Living Resources Committee

ICES CM 2002/G:05
Ref. H

REPORT OF THE

Baltic International Fish Survey Working Group

ICES Headquarters
8–12 April 2002

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

Palægade 2–4 DK–1261 Copenhagen K Denmark

https://doi.org/10.17895/ices.pub.9717

TABLE OF CONTENTS

Section **Page**

Section **Page**

1 INTRODUCTION

1.1 Participation

Henrik Degel	Denmark
Valeri Feldman	Russia
Pavel Gasjukov (part time)	Russia
Eberhard Götze	Germany
Wlodzimierz Grygiel	Poland
Nils Håkansson	Sweden
Holger Hovgaard	Denmark
Igor Karpoushevski	Russia
Per-Olov Larsson (part time)	Sweden
Hildrun Müller	Germany
Rasmus Nielsen	Denmark
Rainer Oeberst (Chairperson)	Germany
Maris Plikshs (part time)	Latvia
Tiit Raid	Estonia
Faust Shvetsov	Latvia

1.2 Terms of Reference

According to Annual Science Conference Resolution (C.Res 2001/2H02) in Oslo last year, the Baltic International Fish Survey Working Group [WGBIFS] (Chair: R. Oeberst, Germany) will meet at Copenhagen, Denmark from 8–12 April 2002 to:

a) combine and analyse the results of the 2001 acoustic surveys and report to WGBFAS;

b) update the hydroacoustic database BAD1 for the years 1991 to 2001;

c) update the established acoustic database BAD2;

d) plan and decide on acoustic surveys and experiments to be conducted in 2002 and 2003;

e) continue the evaluation of the survey design strategies for future BITS surveys;

f) discuss the results from BITS surveys made in 2001 (spring surveys and autumn surveys) and evaluate the usefulness of autumn surveys for cod assessment in Subdivisions 25–32;

g) continue analysis of conversion factors between new and old survey trawls on national level and report the conversion factors;

h) update, if necessary, the Baltic International Trawl Survey (BITS) and Baltic International Acoustic Survey (BIAS) manuals;

i) update and correct the Clear tow database, and allocate the hauls for the Baltic International Trawl Survey (BITS) in November 2001 (intersessional).

WGBIFS will report by 30 April 2002 for the attention of the Living Resources Committee and of the Baltic and Resources 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 include the quality assurance of basic data for stock assessments and management of Baltic herring, sprat and cod stocks. The quality assurance of the primary data will require achievements towards a fully agreed calibration of processes and internationally agreed standards (C.Res.1999/2:61).

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

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

1.3 Overview of WGBIFS activities in 1996-2001

The WGBIFS activities was initiated in 1996 to promote co-ordination and standardisation of national research surveys in the Baltic (ICES CM 1995/J:1). The first Working Group meeting (ICES CM 1996/J:1) considered the design of trawl surveys for cod assessment, established a bottom trawl manual and outlined problems in hydroacoustic surveys. The second meeting (ICES CM 1997/J:4) gave advice on 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 programs for the introduction of new standard gears. They also evaluated the continuation of existing survey practice, optimised the sampling procedures for both cod and other target species including a critical inventory of the current coding procedures for fish maturity stages and reviewed the effects of biological sampling and TS conversion formulas on the results of acoustic stock levels and biomass estimates. During the meeting also updated the Manual for Baltic International Acoustic Surveys (BIAS) based on a draft made by the Study Group on Baltic Acoustic Data (SGBAD).

The fourth meeting (ICES CM 1999/H:2) propose detailed protocols on fishing methods, sampling, report formats, etc. for trawl surveys in the Baltic in order to implement a quality assurance to the Baltic International Trawl Survey (BITS). It also preliminary compared the results from concurrent survey activities by the traditional and the new standard trawls and 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) analysed 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.

2 RESULTS OF THE 2001 BALTIC ACOUSTIC SURVEYS

In 2001 the following acoustic surveys were conducted during the time period September/October:

Vessel	Country	Area
Argos	Sweden	23,27(parts 24,25,26,28,29S)
ATLANTIDA	Russia, Latvia	26,28
BALTICA	Poland	25,26 (parts 24)
SOLEA	Germany, Denmark	22,24 (parts21)
SOLVEIG	Estonia	28,29,32

The results from the individual vessels are found in the database BAD1.

2.1 R/V ARGOS

The Swedish R/V Argos carried out an acoustic survey in ICES Subdivision 27 and parts of Subdivisions 23, 24, 25, 28 and 29S from 8 to 23 October 2001.

The equipment used was an SIMRAD EK500 echo sounder and the BEI (Bergen Echo Integrator) system. A hull mounted 38 kHz split beam transducer was used. Integration and fishing was performed around the clock. Samples of fish were taken from the trawl catches to estimate species composition and length-frequency distribution of target species. For this purpose a Macro 4 midwater trawl or a Fotö midwater trawl was used with a vertical opening of 17-22 m and a stretch mesh size of 21 mm in the codend. As last year Dangren trawl doors were used, with an area of 5.3 m2 and weight of 950 kg. The trawling speed was 3-4.5 knots, and haul duration 30-60 minutes. Totally 44 trawl hauls were made. One haul was excluded in the analysis.

The hydroacoustic equipment was calibrated directly before the survey against a standard copper sphere at a calibration site at Högön, Västervik.

The survey covered 18 160 NM². The survey grid and position of the trawl hauls are shown in Figure 2.1.1.

The acoustic energy was allocated to species based on the catch composition in the hauls and converted to number per length group using following target strength regressions

for clupeoides: TSind.= 20.0 log L(cm) - 71.2 dB

for gadoids: TSind.= 20.0 log L(cm) – 67.5 dB

and for fish without swim bladder TSind.= 20.0 log L(cm) - 77.2 dB
where L is the fish length in cm.

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

2.2 R/V ATLANTIDA

Russian and Latvian scientists carried out an acoustic survey aboard R/V “ATLANTIDA” in Subdivisions 26 and 28 from 5 to 29 of October 2001 year. The integration covered 20464,6 square nautical miles and the integrated track was 1236 nautical miles. The survey grid and position of trawl hauls are shown in Figure 2.2.1.

The hydroacoustic equipment used was SIMRAD EK-500 echosounder, working at the 38 kHz, and Sonar Data Echo View software for postprocessing integrated data. The vessel speed on the survey was 8 – 9 knots, trawling speed was 4.0-4.4 knots and the integrated interval was one nautical mile.

The hydroacoustic equipment was calibrated by SIMRAD specialists, directly before the survey, in September 2001, against with standard copper sphere (Bergen, Norway).

The integrated and hauling were made during the daytime. R/V “ATLANTIDA” used the midwater trawl RT/TM 70/300 with a vertical opening 28 – 32 meters and bar length in the codend of 6.5 mm. Totally 61 sample hauls were made.

The backscattered energy was allocated to species on the basis of the catch and its length composition, using the following target strength regression for clupeoids:

TS = 20.0 log L(cm) - 71.2 [dB]

Fish sampling data: 61 hauls; herring - length samples (12576 sp.), age samples (5699 sp.); sprat - length samples (11668 sp.), age samples (5009 sp.).

2.3 R/V BALTICA

The Polish acoustic survey was carried out by r.v. BALTICA in the Polish EEZ in Subdivisions 24, 25 and 26 from 3-11 and 15-24 October 2001. The three day break was caused by technical problems.

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. Very good weather conditions were found during the most of survey days. Results of the last calibration carried out during the cruise by SIMRAD at 10th October 2001 (Bergen, Norway) were applied into calculations.

Trawl WP53/64x4 with 11 mm bar length in the codend was used to collect biological samples. The trawling speed was 3.0-3.5 knots, and haul duration 30 minutes (120 in one case 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 of the catch. ALKs were made for each Sub-division for sprat and herring.

Data: 1256 ESDU; 32 hauls; herring - length 32 samples (7635 ind.), age 29 samples (1236 ind.); sprat - length 31 samples (6275 ind.), age 10 samples (647 ind.). Quality of data was good due to reasonable weather conditions.

Acoustic track and trawl stations are presented in Figure 2.3.1.

2.4 R/V SOLVEIG (EST)

An acoustic survey was carried out on board of commercial fishing vessel SOLVEIG in the Sub-divisions 28,29 and 32 from 12 to 18 of October 2001.

The length of the cruise track was 317 NM and integrated area covered 6138 NM^2.

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 = 20log L - 71.2 [dB],
where L = total length in cm.

Altogether 10 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 5 mm. A total number of specimens measured and aged were 774 for herring and 1962 for sprat. Additionally, 251 sticklebacks were measured.

Acoustic track and trawl stations are presented in Figure 2.4.1.

2.5 R/V SOLEA

A joint German-Danish acoustic survey was carried out with R/V “SOLEA” from 28 September–18 October 2001 in the Western Baltic. The survey covered ICES Subdivisions 21, 22 and 24. The applied permission to enter the Swedish 12-miles-zone was not given. In consequence the whole Subdivision 23 and parts of Subdivision 21 and 24 could not be covered.

All investigations were performed during night as in previous years. The acoustic equipment used was an EK500 echosounder connected to the BI500 Bergen-Integrator. The specific settings of the hydroacoustic equipment were used as described in the ‘Manual for the Baltic International Acoustic Surveys (BIAS)’ (Annex 4 in ICES 2000). A 38 kHz transducer 38–26 was deployed in a towed body. The towed body had a lateral distance of about 30 m to reduce escape reactions of fish. The transducer was calibrated before this survey in Rostock-Warnemünde. The cruise track (Figure 2.5.1) reached in total a length of 882 nautical miles. 47 trawl hauls were carried out. 1205 herring and 770 sprat were frosted for further age determination in the lab.

In general the catch composition was dominated by herring and to a lower extent by sprat. The herring stock in the survey area was estimated to be 9.8x109 individuals or 299 x 103 tonnes. Last years total abundance and biomass estimates of herring (excluding the northern Kattegat) were extremely low. This years result reached again the level of the years before 2000. As in the years before 2000, the present level is mainly caused by the high fraction of 0-group herring, which was almost missing last year. The high abundance estimate of herring in the northern Subdivision 21 are characterised by a high fraction of young fishes. This result emphasizes the claim to cover the total Kattegat (and possibly the Skagerrak) each year in order to get a total stock index value for the herring in the western Baltic area.

The estimated sprat stock was 8.7 x 109 fish or 90.9 x 103 tonnes in the survey area. The present sprat abundance and biomass estimate (excluding the northern Kattegat) increased compared to last years result. The whole time series is characterised by strong fluctuations from year to year. Nevertheless, the high estimate of sprat in the Kattegat is unusual. As in former years the abundance estimates are dominated by the fraction of young sprat.

Caused by the missing Swedish permission some parts of the planned survey area could not be covered as in the years before. Specially the Sound (Subdivision 23), which is at that time of the year the main distribution area for adult herring in the Western Baltic, could not be investigated by RV “SOLEA” in 2001.

2.6 Combined results

2.6.1 Overlapping areas

During the international acoustic survey 2001, seventeen rectangles were investigated by two or more vessels. The investigations were carried out within the time interval of some days to some weeks. For the further use of these data it was necessary to propose how these data should be used in the estimates for the ICES Subdivisions.

For each rectangle the following data was compared between vessels

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

The differences between the species and length composition were being supposed as stochastic variations. If the whole rectangle was investigated by both vessels and the number of hauls was more than one the arithmetic mean of both data sets were used. If the coverage of the rectangles were quite different or the number of hauls were zero for one vessel the handling of the data were discussed. The Table 2.6.1.1 presents the results of this analysis. In Tables 2.6.1.2 and 2.6.1.3 you will find the abundance in numbers by rectangle for herring and sprat. Overlapping coverage by two or more vessels is indicated by grey shadow.

2.6.2 Total results

As a summary of the results of the international acoustic survey 2001 the Tables 2.6.2.1 to 2.6.2.4 are presented. The overlapping areas are used as described in Table 2.6.1.1.

The Table 2.6.2.1 and 2.6.2.2 give the abundance estimates for herring and sprat for ICES subdivisions and age groups. The biomass estimates are presented in Tables 2.6.2.3 and 2.6.2.4 for herring and sprat. These data are also given by ICES subdivisions and age groups.

The WGBIFS recommends that the data from 2001 can be used for the estimation of the herring and sprat stocks. For a comparison of the estimation 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 overwintering 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 (Sub-divisions 25-32). The young herring and sprat stay partly in the shallow water of the eastern Baltic Sea. These areas cannot be investigated with the used vessels. Therefore the portion of theses groups is unknown.

Table 2.6.1.1 Treatment of data from rectangles with overlapping.

ICES rect.	Vessel A	Sa values	Number hauls	Vessels B (and C)	Sa values	Number of hauls	Suggestion
38G3	Solea	Whole area	3	Argos	N part	1	Solea data
38G4	Solea	Whole area	3	Argos	N part	0	Solea data
38G4				Baltica	Small part in E	1	
39G3	Solea	Whole area	4	Argos	Whole area	3	Arithm. mean
39G4	Solea	Whole area	4	Argos	Whole area	4	Arithm. mean
39G5	Argos	Whole area	3	Baltica	SE part	1	Argos data
40G7	Argos	Whole area	1	Baltica	Small part in S	1	Argos data
38G9	Baltica	SW part	5	Atlantida	NE part	3	Sum of areas
39G8	Baltica	Whole area	3	Atlantida	Whole area	3	Arithm. mean
39G9	Baltica	Small part in W	2	Atlantida	Whole area	3	Atlantida data
40G8	Baltica	Whole area	4	Atlantida	Whole area	3	Arithm. mean
41G8	Argos	Whole area	1	Atlantida	Whole area	3	Atlantida data
42G8	Argos	Whole area	2	Atlantida	E part	2	Argos data
45G9	Argos	Stormy weather	1	Atlantida	E part	2	Atlantida data
45HO	Atlantida	Whole area	3	Solveig	NE part	0	Atlantida data
45H1	Atlantida	W part	2	Solveig	W part	2	Arithm. mean
46H0	Argos	Whole area	1	Solveig	E part	1	Arithm. mean
47H1	Argos	Whole area	2	Solveig	S part	1	Arithm. mean

Table 2.6.1.2 Estimated numbers (millions) of herring October 2001

Ship	SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
SOL	21	41G1	186	182	4							
SOL	21	41G2	80	75	5	1						
SOL	21	42G1	307	302	4	1	1					
SOL	21	42G2	130	124	6	0						
SOL	21	43G1	361	328	23	10						
SOL	21	44G0	278	277	1							
SOL	21	44G1	3636	3635	1							
	21 Total		4979	4922	44	12	1	0	0	0	0	0
SOL	22	37G0	146	114	29	1		1	1			
SOL	22	37G1	291	213	39	19	6	6	3	4		
SOL	22	38G0	107	97	8	1	0	0	0			
SOL	22	38G1	160	157	3	0		0	0			
SOL	22	39F9	4	4								
SOL	22	39G0	0	0								
SOL	22	39G1	4	4								
SOL	22	40F9	1	1								
SOL	22	40G0	1	1								
SOL	22	41G0	11	11	0	0	0					
	22 Total		724	600	78	22	7	8	4	4	0	0
ARG	23	40G2	1213	33	182	638	276	76	7	0	0	0
ARG	23	41G2	396	195	153	36	12	0	0	0	0	0
	23 Total		1609	228	334	674	289	76	7	0	0	0
SOL	24	37G2	147	143	2	1	0	0	0			
SOL	24	38G2	758	315	153	158	85	33	8	5	0	
uSOL	24	38G3	964	192	155	220	236	94	35	29	3	
uSOL	24	38G4	1016	155	279	328	168	64	14	7	0	
SOL	24	39G2	350	27	73	114	94	29	8	5	0	
uARGSOL	24	39G3	356	145	71	74	41	18	5	2	0	0
uARGSOL	24	39G4	412	53	99	132	68	39	15	4	0	1
	24 Total		4003	1031	832	1028	692	277	85	52	5	1
BAL	25	37G5	540	45	47	145	62	120	38	35	37	11
BAL	25	38G5	497	39	44	135	58	111	34	32	33	11
BAL	25	38G6	760	38	72	203	94	188	54	47	49	15
BAL	25	38G7	98	5	8	29	13	21	6	7	7	3
ARG	25	39G4	191	11	25	69	40	28	13	4	1	1
uARG	25	39G5	528	34	87	155	92	127	18	5	9	0
BAL	25	39G6	425	35	38	124	54	98	24	24	23	6
BAL	25	39G7	655	33	54	190	84	142	42	44	46	18
ARG	25	40G4	140	26	16	36	23	24	7	5	2	2
ARG	25	40G5	339	40	54	84	52	54	21	25	9	0
ARG	25	40G6	506	5	35	119	68	160	55	25	37	2
uARGBAL	25	40G7	329	1	30	111	51	85	17	20	12	3
ARG	25	41G6	93	1	23	29	10	17	8	4	1	0
ARG	25	41G7	489	1	12	71	68	154	80	50	42	13
	25 Total		5590	313	543	1501	769	1328	417	325	308	85
BAL	26	37G8	108	81	5	6	3	6	1	1	3	2
BAL	26	37G9	186	112	13	16	9	18	3	3	7	4
BAL	26	38G8	581	345	37	49	28	55	13	12	24	18
uATL+BAL	26	38G9	570	69	72	107	55	102	35	41	54	35
uATLBAL	26	39G8	440	16	40	95	49	105	33	28	48	28
uATL	26	39G9	173	4	10	37	22	44	23	17	12	5
ATL	26	39H0	662	185	119	81	42	75	51	45	41	26
uATLBAL	26	40G8	397	9	34	62	42	107	40	46	41	18
ATL	26	40G9	453	4	31	92	77	135	42	37	23	13
ATL	26	40H0	160	6	26	26	24	30	15	17	8	9

Table 2.6.1.2 (Cont'd)

uATL	26	41G8	157		3	37	18	45	21	11	11	11
ATL	26	41G9	110		5	19	14	32	13	10	7	9
ATL	26	41H0	170	2	14	48	28	35	12	6	13	11
	26 Total		4167	832	409	675	410	787	301	274	290	188
ARG	27	42G6	30	0	16	5	1	4	2	2	1	0
ARG	27	42G7	100	0	22	22	4	34	9	5	2	0
ARG	27	43G7	658	5	143	229	70	132	32	36	10	2
ARG	27	44G7	355	4	80	135	47	46	13	22	6	2
ARG	27	44G8	338	1	106	166	12	49	3	1	1	0
ARG	27	45G7	1827	17	365	756	198	317	98	26	40	10
ARG	27	45G8	130	3	37	34	14	15	20	8	0	0
ARG	27	46G7	1544	30	297	543	207	329	100	15	23	1
ARG	27	46G8	279	31	55	52	38	74	27	0	0	1
	27 Total		5262	91	1121	1942	590	1000	305	114	83	16
uARG	28	42G8	427	2	13	72	41	110	85	80	21	4
ATL	28	42G9	367	0	20	115	43	111	18	17	24	19
ATL	28	42H0	626	2	96	126	85	154	43	35	41	44
ARG	28	43G8	275	0	8	51	23	96	39	56	2	0
ATL	28	43G9	80	0	6	22	11	23	8	5	2	3
ATL	28	43H0	276	0	31	57	41	67	24	18	17	21
ATL	28	43H1	83	8	29	18	11	8	3	1	1	3
ATL	28	44G9	98	0	11	37	13	21	7	1	3	6
ATL	28	44H0	104	1	18	34	9	20	6	11	4	2
ATL	28	44H1	44	3	21	10	4	2	1	1	0	2
uATL	28	45G9	92	0	14	37	6	20	6	5	1	4
uATL	28	45H0	332	0	36	78	41	78	33	19	12	36
uATLSVG	28	45H1	273	0	94	118	26	18	5	5	4	1
	28 Total		3079	16	398	774	356	729	277	252	132	145
ARG	29S	46G9	467	3	36	158	171	77	16	6	0	1
uARGSVG	29S	46H0	418	2	41	124	73	83	35	40	14	4
SVG	29S	46H1	1193	12	76	446	286	198	97	46	9	22
SVG	29S	46H2	75	40	14	18	2	1	1	0	0	0
ARG	29S	47G9	1083	6	55	394	107	193	79	191	58	0
ARG	29S	47H0	1007	354	92	427	81	47	8	0	0	0
uARGSVG	29S	47H1	273	47	54	90	34	33	10	3	1	1
SVG	29S	47H2	113	73	16	13	6	4	1	1	0	0
	29S Total		4630	536	383	1671	760	635	246	288	82	28
SVG	32	47H3	49	2	5	18	14	6	2	1	1	0
	32 Total		49	2	5	18	14	6	2	1	1	0
	Grand Total		34091	8573	4148	8318	3887	4846	1645	1310	901	463

Table 2.6.1.3 Estimated numbers (millions) of sprat October 2001

Ship	SD	rect	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
SOL	21	41G1	42	0	37	3	1	0				
SOL	21	41G2	7	2	5	1	0	0				
SOL	21	42G1	60	0	51	8	1	0				
SOL	21	42G2	25	1	23	1						
SOL	21	43G1	2		1	1						
SOL	21	44G0	796	3	766	27						
SOL	21	44G1	253	2	241	10						
	21 Total		1186	9	1124	51	2	1	0	0	0	0
SOL	22	37G0	323	313	6	2	1	0	0	0		
SOL	22	37G1	324	161	32	56	43	20	8	3		
SOL	22	38G0	174	136	14	11	8	3	1	0		
SOL	22	38G1	47	43	2	1	0	0	0	0		
SOL	22	39F9	466	466								
SOL	22	39G0	4	3	1							
SOL	22	39G1	29	29								
SOL	22	40F9	150	150								
SOL	22	40G0	125	125								
SOL	22	41G0	13	10	2	0	0	0				
	22 Total		1656	1438	58	70	53	23	9	4	0	0
ARG	23	40G2	174	122	4	7	16	16	3	3	1	1
ARG	23	41G2	42	0	27	8	5	1	0	1	0	0
	23 Total		217	122	31	15	21	17	3	4	1	1
SOL	24	37G2	66	63	2	0	0	0	0	0		
SOL	24	38G2	441	289	15	55	44	26	7	4	1	
uSOL	24	38G3	1743	822	123	353	254	135	35	18	2	
uSOL	24	38G4	1434	795	83	244	176	101	21	15		
SOL	24	39G2	19	1	2	7	5	3	1	0		
uARGSOL	24	39G3	461	71	36	121	82	93	26	12	15	6
uARGSOL	24	39G4	1028	459	75	209	100	118	17	30	14	5
	24 Total		5192	2500	337	989	661	477	106	79	32	11
BAL	25	37G5	301	28	16	63	59	76	29	20	7	4
BAL	25	38G5	621	48	32	132	125	160	60	41	14	8
BAL	25	38G6	171	6	15	39	36	44	17	10	3	2
BAL	25	38G7	99	0	9	27	25	24	6	4	3	1
ARG	25	39G4	252	50	4	64	0	77	10	26	16	6
uARG	25	39G5	966	14	8	236	29	272	21	111	204	71
BAL	25	39G6	809	16	83	203	188	193	59	38	19	10
BAL	25	39G7	660	1	61	177	168	160	42	27	17	8
ARG	25	40G4	691	30	3	64	47	296	50	112	49	39
ARG	25	40G5	719	12	0	202	1	294	63	22	71	53
ARG	25	40G6	416	8	0	77	1	139	46	13	102	30
uARGBAL	25	40G7	897	0	37	210	116	243	56	81	75	79
ARG	25	41G6	1023	81	4	388	72	227	33	48	85	85
ARG	25	41G7	479	0	4	77	0	143	45	58	81	71
	25 Total		8103	293	277	1959	866	2346	535	611	747	468
BAL	26	37G8	320	31	93	73	48	45	20	7	1	1
BAL	26	37G9	1179	80	313	301	200	173	77	27	3	4
BAL	26	38G8	1829	125	572	433	289	249	112	41	5	5
uATL+BAL	26	38G9	2267	115	597	673	175	526	69	65	35	13
uATLBAL	26	39G8	996	172	113	194	106	209	66	89	35	13
uATL	26	39G9	2896	19	239	774	192	1250	134	143	145	0
ATL	26	39H0	5222	4471	343	195	2	163	18	28	2	0
uATLBAL	26	40G8	1663	0	124	353	225	545	100	234	68	14
ATL	26	40G9	4691	102	533	1363	224	1595	250	478	90	57
ATL	26	40H0	4417	503	649	1427	500	968	49	221	85	16
uATL	26	41G8	2943		41	623	18	1132	73	391	464	200

Table 2.6.1.3 (Cont'd)

ATL	26	41G9	1678		78	677	9	579	35	120	100	81
ATL	26	41H0	3958	60	260	1569	23	1120	74	396	323	134
	26 Total		34059	5677	3956	8654	2010	8552	1077	2240	1356	537
ARG	27	42G6	335	14	6	76	1	63	23	15	115	23
ARG	27	42G7	2282	11	33	138	138	961	100	290	532	79
ARG	27	43G7	3408	21	45	456	115	1146	182	659	578	207
ARG	27	44G7	1235	0	22	214	27	354	79	274	184	83
ARG	27	44G8	346	0	10	42	18	83	16	120	17	39
ARG	27	45G7	1664	17	54	414	88	554	105	246	133	54
ARG	27	45G8	1009	6	111	382	16	252	57	102	63	21
ARG	27	46G7	2464	20	197	599	72	726	152	403	206	87
ARG	27	46G8	2190	2	325	449	0	617	83	433	186	95
	27 Total		14934	91	803	2770	475	4756	797	2541	2013	688
uARG	28	42G8	4312	27	245	290	101	1938	352	841	461	57
ATL	28	42G9	1514	0	85	398	53	565	35	188	147	42
ATL	28	42H0	2469	34	159	843	150	704	30	163	194	192
ARG	28	43G8	1471	0	161	225	157	525	80	220	61	42
ATL	28	43G9	1214	4	48	396	45	422	49	134	101	14
ATL	28	43H0	2318	63	278	906	43	738	21	101	112	56
ATL	28	43H1	1323	331	183	449	27	255	0	44	35	0
ATL	28	44G9	1125	6	111	499	7	288	41	69	85	18
ATL	28	44H0	2759	23	400	995	10	834	14	212	206	67
ATL	28	44H1	2406	59	261	1467	35	440	6	78	56	6
uATL	28	45G9	1579	0	61	758	10	420	32	168	93	37
uATL	28	45H0	6405	0	561	2961	26	1988	0	419	372	78
uATLSVG	28	45H1	2659	167	300	1091	146	545	56	171	119	64
	28 Total		31555	713	2852	11279	808	9662	716	2808	2043	674
ARG	29S	46G9	1521	1	109	375	25	509	104	174	148	79
uARGSVG	29S	46H0	1525	3	59	432	99	430	51	189	108	154
SVG	29S	46H1	1469	9	117	530	266	197	86	193	65	6
SVG	29S	46H2	313	121	43	77	25	18	9	18	4	0
ARG	29S	47G9	1216	0	115	201	91	212	49	245	235	69
ARG	29S	47H0	2024	0	10	133	304	466	199	498	111	303
uARGSVG	29S	47H1	2652	61	242	828	184	547	100	335	256	98
SVG	29S	47H2	1558	46	273	607	217	150	73	150	41	2
	29S Total		12278	241	968	3183	1211	2527	671	1801	967	710
SVG	32	47H3	418	11	67	174	60	37	20	41	8	0
	32 Total		418	11	67	174	60	37	20	41	8	0
	Grand Total		109598	11095	10473	29144	6168	28398	3933	10129	7168	3090

Table 2.6.2.1 Estimated numbers (millions) of herring October 2001

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	4979	4922	44	12	1	0	0	0	0	0
22	724	600	78	22	7	8	4	4	0	0
23	1609	228	334	674	289	76	7	0	0	0
24	4003	1031	832	1028	692	277	85	52	5	1
25	5590	313	543	1501	769	1328	417	325	308	85
26	4167	832	409	675	410	787	301	274	290	188
27	5262	91	1121	1942	590	1000	305	114	83	16
28	3079	16	398	774	356	729	277	252	132	145
29S	4630	536	383	1671	760	635	246	288	82	28
32	49	2	5	18	14	6	2	1	1	0
TOTAL	34091	8573	4148	8318	3887	4846	1645	1310	901	463

Table 2.6.2.2 Estimated numbers (millions) of sprat October 2001

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	1186	9	1124	51	2	1	0	0	0	0
22	1656	1438	58	70	53	23	9	4	0	0
23	217	122	31	15	21	17	3	4	1	1
24	5192	2500	337	989	661	477	106	79	32	11
25	8103	293	277	1959	866	2346	535	611	747	468
26	34059	5677	3956	8654	2010	8552	1077	2240	1356	537
27	14934	91	803	2770	475	4756	797	2541	2013	688
28	31555	713	2852	11279	808	9662	716	2808	2043	674
29S	12278	241	968	3183	1211	2527	671	1801	967	710
32	418	11	67	174	60	37	20	41	8	0
Total	109598	11095	10473	29144	6168	28398	3933	10129	7168	3090

Table 2.6.2.3 Estimated biomass (in tonnes) of herring October 2001

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	68715	66174	1851	662	38	0	0	0	0	0
22	12663	6486	3337	1276	403	521	265	357	0	0
23	116431	4326	17300	54612	29917	9066	1210	0	0	0
24	208167	11094	34922	59601	59511	24013	10006	7130	885	109
25	227114	4467	17217	56596	34811	53323	20917	17144	16739	5914
26	130739	7686	11933	22169	13994	26968	11801	11987	14089	10560
27	107173	391	12796	38372	14255	25218	8776	3568	2578	1218
28	80191	172	7289	16539	8949	20031	9037	8676	4585	4756
29S	85775	2918	4736	28442	16523	15089	5983	8183	2622	1155
32	824	11	61	283	246	111	49	23	26	13
TOTAL	1037792	103724	111441	278553	178648	174339	68045	57068	41523	23725

Table 2.6.2.4 Estimated biomass (in tonnes) of sprat October 2001

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	16863	53	16039	750	44	19	0	0	0	0
22	9753	5048	1000	1548	1224	608	222	106	0	0
23	2492	672	457	270	442	391	83	115	31	31
24	58303	12347	4900	16371	11320	8237	1926	1341	637	207
25	113858	1496	3435	26333	12395	33865	8186	9457	11447	7261
26	338349	22924	38343	93296	22385	97823	13078	27415	16326	6908
27	159327	328	5747	25332	4981	51889	8810	29123	24386	8732
28	328681	2685	25430	114397	8858	104879	8316	32182	23442	8066
29S	122335	985	8275	32201	13036	27687	7142	20153	11041	9149
32	4217	53	614	1764	634	399	209	432	89	4
Total	1154177	46591	104240	312262	75320	325797	47972	120323	87399	40358

Figure 2.1.1 Survey grid and trawl positions of R/V Argos

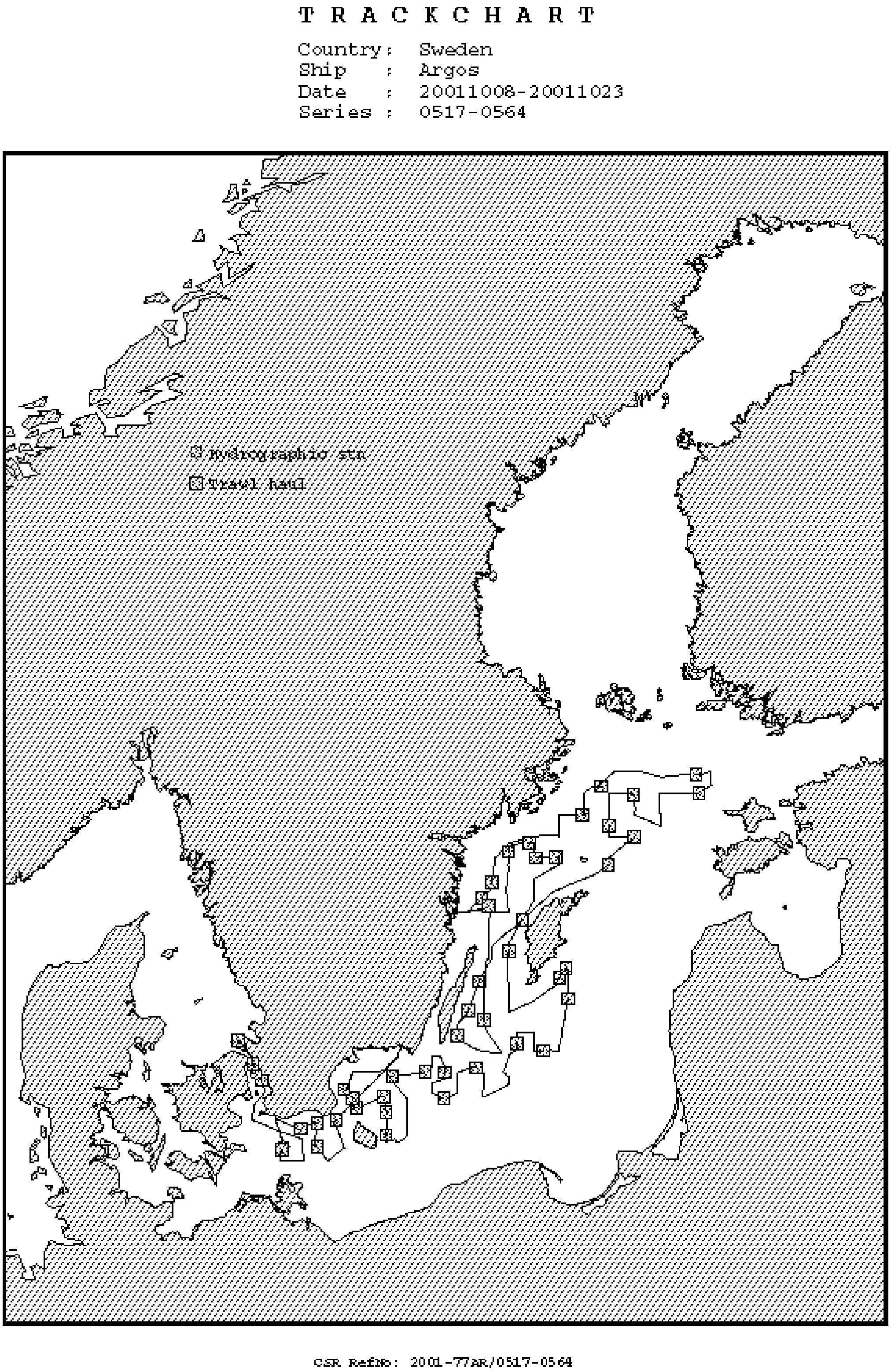


Figure 2.1.1 Survey grid and trawl positions of R/V Argos

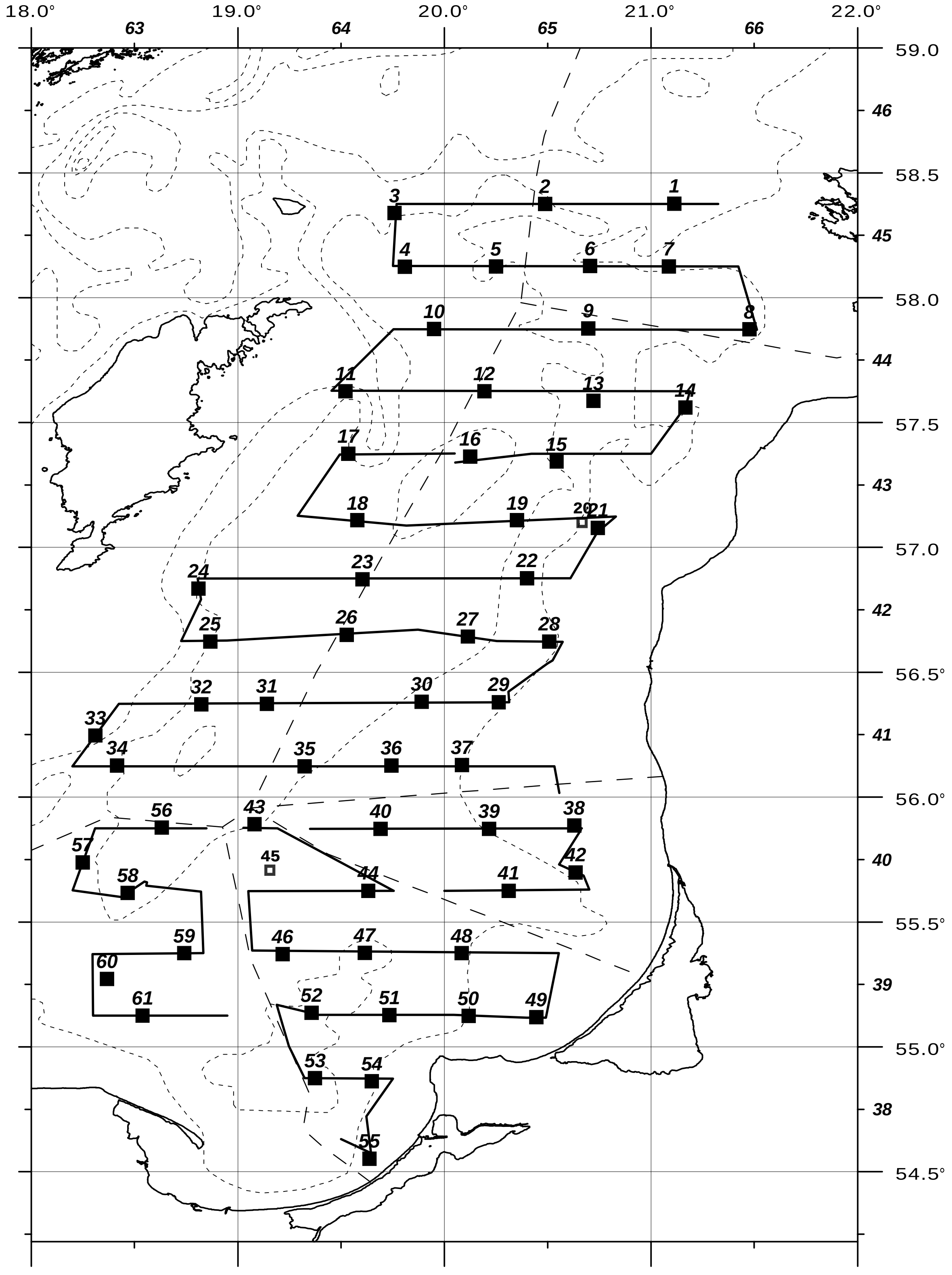


Figure 2.2.1. Hydroacoustic transects and hauling stations of "ATLANTIDA" (05-29.10.2002).

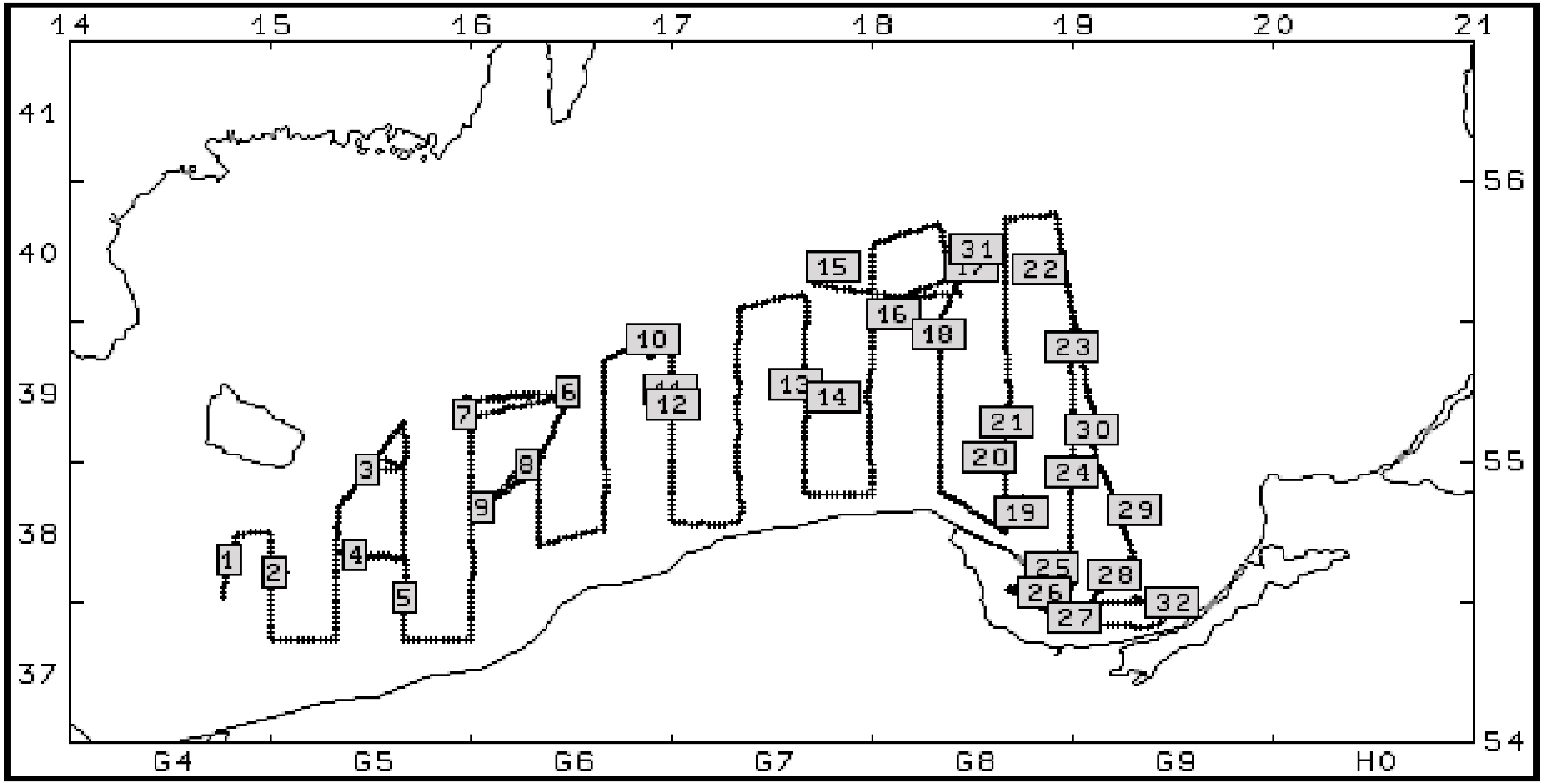


Figure 2.3.1. Cruise track and trawl stations of R/V Baltica October 2001.

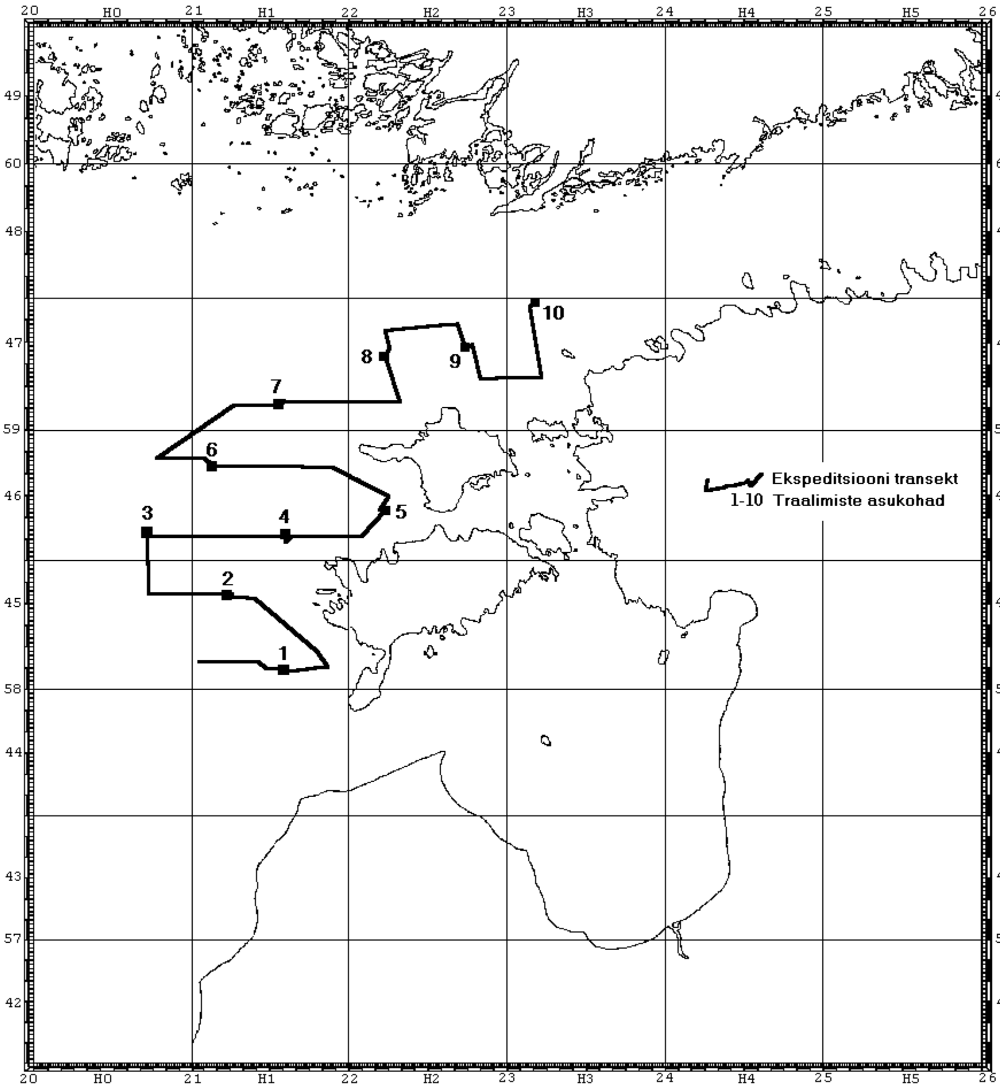


Figure 2.4.1. Survey track and trawl stations of F/V SOLVEIG , 12 -18 October 2001

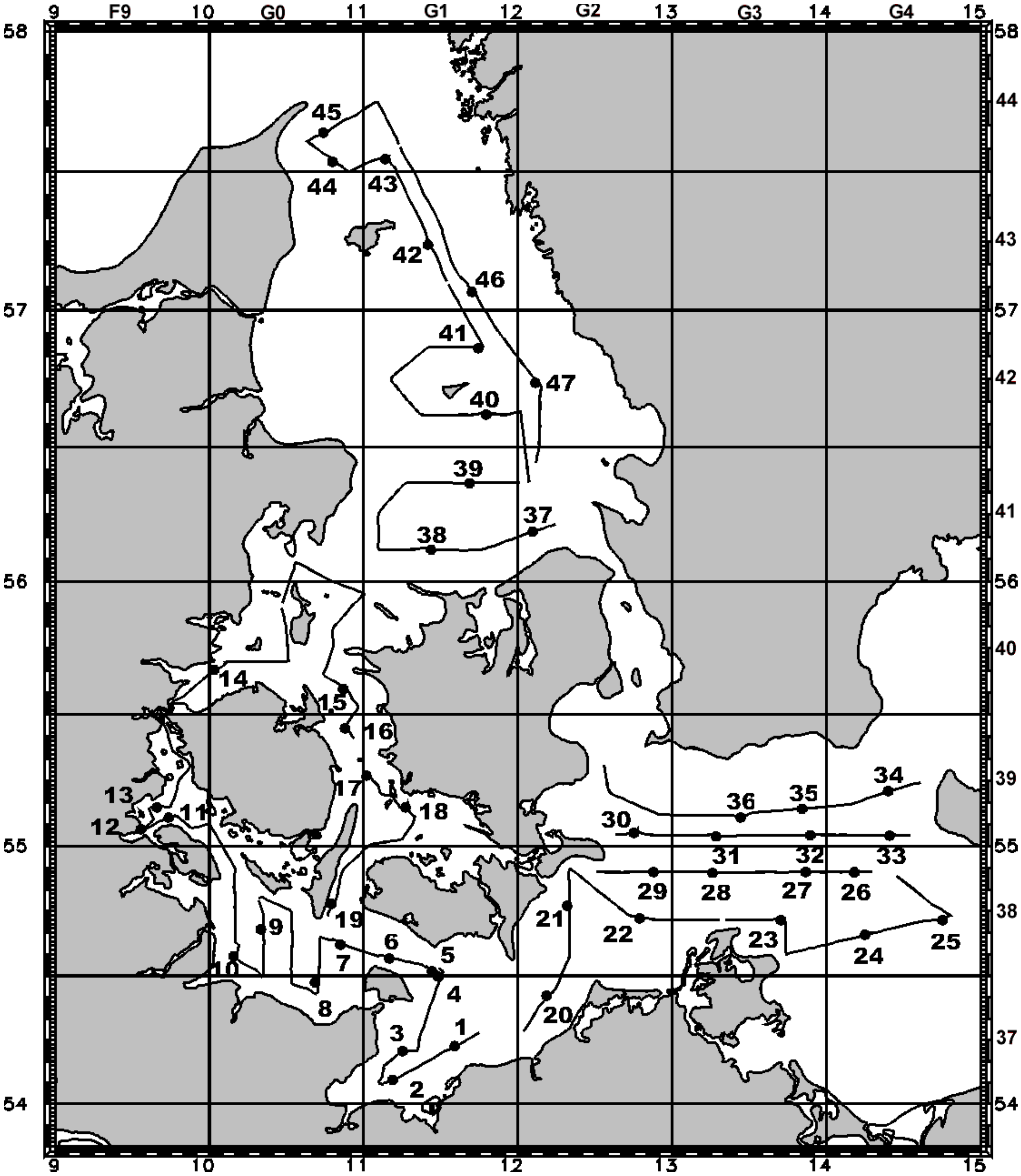


Figure 2.5.1 Cruise track and trawl positions for RV „SOLEA“ in September/October 2001

3 CORRECTIONS AND UPDATE OF THE HYDROACOUSTIC DATABASE BAD1 FOR THE YEARS 1991 TO 2001

The database BAD1 Rev. 5 contains now the revised results of the Baltic acoustic surveys for the years 1991 to 2001. This dataset enables a simple and fast access to the abundance and biomass estimates for herring and sprat per age group and ICES statistical rectangle in the Baltic Sea. The errors in the last revision concerning the unofficial areas of the statistical rectangles are now corrected to get a consistent dataset.

The participation and covering of all ships by Subdivision in the surveys 1991 to 2001 is depicted in Table 3.1.

The WG recommends that this database BAD1 should be continued for the next years.

Table 3.1 Baltic Acoustic Surveys in 1991 - 2001
Participation and number of ICES squares covered

		Sub-division												
YEAR	**SHIP**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**total**
1991	Baltijas Petnieks					10	11	6	10	7				**44**
	Solea		9	3	7	8								**27**
1991			**9**	**3**	**7**	**18**	**11**	**6**	**10**	**7**				**71**
1992	Argos			2	1	8	4	8	2	5				**30**
	Monokristal					2	11		9					**22**
	Solea		10		7									**17**
1992			**10**	**2**	**8**	**10**	**15**	**8**	**11**	**5**				**69**
1993	Baltijas Petnieks						5		7					**12**
	Solea	6	8	2	8									**24**
1993		**6**	**8**	**2**	**8**		**5**		**7**					**36**
1994	Argos					9	1	9	3	6				**28**
	Baltica					8	8							**16**
	Monokristal						8		11					**19**
	Solea	6	10	2	7	2								**27**
1994		**6**	**10**	**2**	**7**	**19**	**17**	**9**	**14**	**6**				**90**
1995	Baltica				1	12	7	5						**25**
	Monokristal						10		12					**22**
	Solea	3	10	2	7									**22**
1995		**3**	**10**	**2**	**8**	**12**	**17**	**5**	**12**					**69**
1996	Argos				2	10	2	9	2	5				**30**
	Atlantniro						9		11					**20**
	Baltica				1	12	7							**20**
	Solea	4	9	2	7	3								**25**
1996		**4**	**9**	**2**	**10**	**25**	**18**	**9**	**13**	**5**				**95**
1997	Atlantniro						9		12					**21**
	Baltica					6	7							**13**
	Solea	4	10	2	7									**23**
1997		**4**	**10**	**2**	**7**	**6**	**16**		**12**					**57**
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		**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		**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		**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		**7**	**10**	**2**	**12**	**16**	**18**	**9**	**17**	**10**			**1**	**102**
total		**44**	**102**	**23**	**95**	**155**	**169**	**71**	**139**	**60**	**41**	**8**	**21**	**928**

4 THE HYDROACOUSTIC DATABASE BAD2: THE STATE OF THE ART

The database BAD2 is planned to contain acoustic results based on nautical mile and the catch results for each fishery station. The contents and the field formats have been discussed and modified repeatedly during several years.

During this years meeting of WGBIFS, a new, until then, unkown revision of the Exchange Format Specification (Rev.XI, January 2002) was distributed by the chair. The new revision contains changes that has not been discussed or approved by the BAD2 group. There are also problems uploading data, eg. Receiving unspecified error messages.

The most severe problem is that the BAD2 and HERSUR projects are finished and nobody seems to be responsible and have fundings for the maintenance, development and user support for the databases.

Thus the WG strongly recommends that:

- The Format Specification must be correct and in accordance with the database schema.
- Uploading data to the BAD2 **must** function without unspecified error messages.
- Development of data extraction applications for the BAD2 must continue.
- A transfer of the BAD2 database to the ICES Headquarter should be considered.

The new exchange format Version I, Revision XI is given as Annex 5 in this report and the Manual for International Acoustic Database is given in Annex 6. Annex 7 contains the BAD2 installation manual.

5 PLAN FOR HYDROACOUSTIC EXPERIMENTS AND SURVEYS IN 2002 AND 2003

In 2002 all the Baltic Sea countries (exc. Lithuania and Finland) intend to take part in acoustic survey and experiments. The list of participating research vessels and period of investigation is as follow:

Vessel	Country	Area of investigation (ICES Sub-divisions)	Period of investigation
R/V Argos	Sweden	27, part of 25, 26, 28 and 29S	2002-10-07 – 2002-10-25
ATLANTNIRO	Russia	Part of 26	2002-05-16 – 2002-05-31
ATLANTNIRO	Russia	26, part of 28	2002-10-10 – 2002-10-31
BALTICA	Poland	24,25,26	2002-10-13 – 2002-10-31
chartered Estonian vessel	Estonia	28,28,32	Early october 2002
Walther Herwig III	Germany	24, 25, parts of 26,27 and 28	2002-05-03 – 2002-05-22
SOLEA	Germany	21, 22, 23 and 24	2002-09-26 – 2002-10-17
chartered commercial vessel	Latvia	Part of 28	2002-05-15 –2002-05-25

The preliminary plan for acoustic surveys and experiments in 2003 for majority of institutes will be taken after verification of budget plans, but for example Latvia, Poland and Russia intend to perform hydroacoustic surveys.

The main results of BIAS should be summarised and reported to the acoustic surveys co-ordinator **(to be assigned during this meeting)** <u>not later than two months before WGBFAS meeting of the next year</u>. These results are intended for the information of the ICES Assessment Working Groups.

The Study Group on Target Strength Estimation in the Baltic Sea (SGTSEB) has been established. The first meeting has taken place in Seattle - USA, April 21-22, 2001. The main tasks of the mentioned SGTSEB are as follow:

♦ prepare and disseminate as soon as possible a protocol for TS measurements on the Baltic herring, based upon the state of the art and especially the recommendations of the CRR on TS measurements, adapting these recommendations to the special case of the Baltic Sea;

- establish a list of the main factors affecting the herring TS and study the effects through comparative analysis and measurements on various herring stocks (e.g. Baltic and Norwegian spring spawning herring);

- collate the existing information and measurements on herring TS;

- apply modelling methods on the case of the herring and compare their results to the existing information;

- measure the variability of TS in situ under various conditions (day-night, winter-summer, etc.) using databases available from WGBFAS members;

- encourage experimental measurements through conventional and non-conventional methods.

The next meeting of this SGTSEB will take place in Sète, France 2002-06-07 – 2002-06-08.

6 MANUALS FOR THE BALTIC INTERNATIONAL ACOUSTIC SURVEY (BIAS)

6.1 Modifications made during the WGBIFS meeting

No modifications were made during the working group meeting. The Manual for Baltic International Acoustic Survey is found in Annex 2 in ICES. 2000.

6.2 Problems to be solved between meetings and to agree in the next meeting

The following problems are still to be solved:

Section 2: Survey design

<u>Basic aspects/requirements of survey design</u>
The objective of acoustic surveys is to get an unbiased estimates of herring and sprat abundance in the area sampled. In order to achieve this, a clearly defined sampling strategy is necessary. Each specimen should have the same probability to be sampled. For any future sampling design for acoustic surveys it is a prerequisite to define optimal sample sizes (number and length of transects), measures of abundance (estimation method) and errors (variance, and bias in the data collections). Aspects of randomisation, sequential sampling and quality assurance and quality control should be also taken into account.

Section 4: Fish sampling

<u>Gear</u>
A significant problem within acoustic surveys is the ability to obtain representative trawl samples to be associated with allocated acoustic information. The problem is related to this specific selectivity of the applied trawl gear which may bias (1) the species composition and (2) the length distribution of target fish species and (3) the age distribution.

<u>Length, weight and age distributions</u>
Sample sizes for a representative length distribution per haul have to be evaluated. Sample sizes for a representative weight/age distribution per rectangle/sub-division have also to be evaluated. At the Swedish Institute of Marine Research it has also been suggested that random fish sampling should be used for age and length. A working paper on this matter will be presented at the next meeting.

Section 5: Data analysis

<u>Species composition and length distribution</u>
Currently an unweighted mean is used for estimating the species composition and the length distribution. In cases where catches are not representative it might be more appropriate to give those catches a minor weight. In order to clarify whether equally or unequally weighted means should be used, it seems necessary to define the representativeness and how to derive plausible calculation methods and weighting criteria from this definition.

Target strength of an individual fish

Target Strength (TS) is the keystone of fisheries acoustics and needs further work for the Baltic Sea fish stocks. The Study Group on Target Strength Estimation in the Baltic Sea (SGTSEB) has started its work to provide better estimates of the TS but the results are still pending.

Lack of sample hauls

The interpolation method must be evaluated.

7 RESULTS OF BITS SURVEYS IN 2001 (SPRING SURVEY AND AUTUMN SURVEY) AND EVALUATION OF THE USEFULLNESS OF AUTUMN SURVEYS FOR COD ASSESSMENT IN SD 25 – 32

7.1 Results of BITS surveys in 2001 and 2002 (spring survey and autumn survey)

The following countries participate in the spring survey in 2001:

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

A summary is given below of each national contribution:

Denmark

In the period from 1/3-2002 to 22/3-2002 R/V DANA took 72 hauls using large TW3 trawl. 10 of these hauls were double hauls for calibration purposes and 8 were invalid due to damage of the gear. Furthermore, 57 CTD samples were obtained. The fishing areas were Subdivisions 24, 25 and 26.

In the period from 1/3-2002 to 22/3-2003 R/V DANA took 44 hauls using large TW3 trawl. In 39 of these Seacat was mounted in the trawl. Furthermore, 58 CTD samples were obtained. The fishing areas were primary Subdivision 25 and 26, but 3 hauls were done in Subdivision 24.

From 16/10-2001 to 10/11-2001 Havfisken did 18 hauls in SD 21, 16 stations in Subdivision 22 and 3 stations in Subdivision 23. The small TW3 trawl was used on all stations.

In the period from 23/2-2001 to 13/3-2001 R/V DANA took 67 hauls using large TW3 trawl. 10 of these hauls were dedicated stomach investigations Furthermore, 70 CTD samples were obtained. The fishing areas were Subdivision 24, 25 and 26. 2 stations were dropped due to the lack of permission to enter Polish territory within the 12 miles zone.

From 26/2-2001 to 17/3-2001 Havfisken did in total 45 hauls in SD 21, 22 and 23. The small TW3 trawl was used on all stations.

Poland

During second period 18/2-2002 to 21/3 R.V. BALTICA participated in the BITS. In total 36 hauls were made. 23 of those were made using the standard gear TV3#930 and 13 hauls were made using the former national gear (P20/25). No difficulties were anticipated.

During second period 16/2-2001 to 8/3-2001 R.V. BALTICA participated in the BITS. In total 77 hauls were made. 62 of those were made using the standard gear TV3#930 and 15 hauls were made using the former national gear (P20/25). No difficulties were anticipated.

Germany

Three BITS surveys were carried out with R/V SOLEA using TV3#520. The survey periods as well as the number of realized stations are presented in the tables. After each hauls a CTD profile was sampled. Additional experiments were not carried out.

Periods of the surveys and number of realized hauls

	Sub-division		
Periods	22	24	25
24 February - 3 March	13	53	
17 November - 2 December	9	51	3
16 February - 5 March	15	45	

Sweden

Totally 43 hauls were made in Subdivisions 25, 27 and 28 from 5 - 20 March 2001. In all three basins oxygen deficit appeared. Several of the selected hauls were not clear tows.

Subdivision 25

In SD 25 four selected stations had so low O2 levels (<2 ml/l up to 10 m from the bottom) that they were not fished. Another four tracks were not clear. At one station a bottom structure, known to fishermen as “the church tower”, appeared in the very track line. The positions for that “clear tow” is obviously wrong, and another haul close by was chosen instead. At one station, previously fished many times with the GOV-trawl, the bottom of the trawl was lost, so it had to be delivered to a trawl binder for mending to a large cost. In the same area, named “the forest” by fishermen, the other trawl was damaged in another two hauls, but not as severely (codend filled with timber and stumps but also fish).

Subdivision 27

In SD 27 10 hauls were made out of 17 available. The other 7 hauls had a depth of >80 m where the O2 level was well below 2 ml/l (limit at ca 75 m).

Subdivision 28

In Subdivision 28 Sweden had 26 stations selected. In two cases two tracks had the same position coordinates, obviously the haul has been entered to the HDB from two sources. In one case three tracks and in one case four tracks had the same position. Some hauls had O2 deficiency in the bottom waters. At one station the second TV3 trawl was ripped. The whole catch was lost but all the netting was still there and the trawl could be mended on board during the next days. The first trawl was onboard again and could be used the remaining time. Totally only 13 valid hauls were made in Subdivision 28.

Also in the November survey (19 – 30 November 2001) a number of tracks allocated to Sweden were situated on bottoms not possible to trawl with the TV3 trawl with the light rock-hopper gear, totally 8 hauls. On 9 stations the oxygen content was insufficient for cod so they were not trawled. Four stations were in the Polish zone. The permission to enter Polish zone had not arrived in time for the survey so those stations also had to be omitted.

For a number of the omitted stations replacement stations in the same depth stratum could be found, and totally 33 valid hauls were made, 20 in Subdivision 25, 9 in Subdivision 27 and 4 in Subdivision 28.

Latvia

During the 2001 and 2002 LATFRI has conducted 3 demersal trawl surveys. All surveys were carried out by TV3 520 and using Latvian commercial vessel (CLV). The hired vessels for all 3 surveys were similar type vessels – MRTK (medium size trawlers). Although from haul allocation Latvia has to perform survey in Subdivision 26 and Subdivision 28 (Latvian zone), however trawling on selected tracks was not available in SD 26 due to non-suitable grounds for TV3 520 trawl. Therefore, all hauls were re-allocated to Subdivision 28. Additionally new trawling tracks were selected in Subdivision 28 and implemented in Clear Tow Database.

Date and realized haul number during Latvian surveys in 2001 and 2002:

Survey	Vessel	Date	Number of hauls in SD 28
Spring 2001	CLV AGNESE	10-14 of March	30
Autumn 2001	CLV GRIFS	25-27 of November	25
Spring 2002	CLV HOGLANDE	10-14 of March	25

Russia

The Russian R/V AtlantNIRO carried out a bottom trawl survey in ICES Subdivision 26 and part of Subdivision 28 from 17.02 – 10.03.2001. Totally 54 sample hauls by large TV3#930, equipped standard ground rope, were made. From this amount 47 hauls were made in Subdivision 26 and 7 hauls in Subdivision 28.

The Russian chartered commercial vessel “Voskhod” carried out a bottom trawl survey in ICES Subdivision 26 from 26.02 – 12.03.2001. Totally 44 sample hauls by large TV3#930, equipped standard ground rope, were made.

It should be mentioned that during the both surveys at a haul position $56^0 28' 3''$N; $20^0 06' 6''$E the gear was damaged.

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

Depth strata	R/V AtlantNIRO, 2001	“Voskhod”, 2002
0-20	1	-
21-40	3	1
41-60	10	7
61-80	15	11
81-100	21	23
>100	4	2
Total	54	44

7.2 Evaluation of the usefulness of autumn surveys for cod assessment in Subdivisions 25 – 32

It was discussed whether or not a second coordinated trawl survey in the Baltic Sea is useful beside the national trawl surveys during the first quarter of the year for the first time during the BIFS working group meeting in 1995 (ICES 1995), and it was pointed out that “there is a need for two surveys and more trawl hauls and it is therefore proposed that each nation should attempt to do two BITS cruises each year.” The second survey should be carried out in the 4th quarter of the year since previous German studies indicated that surveys in the 2nd and 3rd quarter are unsuitable for abundance estimates. It was again agreed that a second survey should be carried out in November during the BIFS working group meeting in 1996 (ICES 1996).

Three years later the BIFS WG (ICES 1999) recommended that international coordinated surveys should be planned between 15 February and 30 March as well as between 1 November and 30 November. The first international co-ordinated surveys were realized in spring and autumn 2001 using the new standard gears TV3#520 and TV3#930.

Cook (ICES 1995) showed the usefulness of having at least two independent surveys to detect errors of commercial catch data. Pennington and Strømme (1998) indicated that surveys are more suitable to analyse the temporal developments of fish stocks than VPA estimates since survey data give information on the entire population. They have furthermore shown that the use of smoothing algorithm and time series techniques are suitable tools to reduce the white noise of the stock indices that are based on trawl surveys and to improve the description of the temporal development of fish stocks.

The advantage of second BITS survey in November is that two VPA independent estimates of both the Baltic cod stocks are available and additional data exist to analyse important stock parameter like the migration structures of different stock components between pre-spawning and feeding periods and the growth. Furthermore, the results of the two surveys can be used to estimate the proportions of Belt Sea cod in the eastern Baltic Sea and vice versa (Oeberst 2001). These results are very important for different aspects of cod stock assessment.

The November surveys produce first unbiased estimates of 1-years-old of the Baltic cod stocks because during the March surveys of the same year this age group is not completely represented in the catch. The subsequent survey in spring of next year estimates this year class again. These two independent estimates of the same year class produce a more realistic estimate of the year class abundance and the reproduction success. That is especially important since the largest individuals of this year class reach a total length of 35 cm, the minimum commercial landing size, in the same year.

Looking at the distribution of CPUE values obtained by statistical rectangle (Figure 7.1) it can be verified that the distribution pattern of cod does change from 1st quarter to 4th quarter. In 1999 the distribution of age class 1 in 1st quarter seems to be concentrated primary around Bornholm with only few hauls having high numbers of young cod in the area of Hanö bay (40G5). In 4th quarter there seems to be high concentration of age class 1 in both the area around Bornholm and in the Hanö bay. Furthermore, high concentrations of 1-year cod have been discovered in the Liepaja area (41H0). The Situation is rather similar for year class 2 except that the concentration around Bornhols seems to be smaller in 4th quarter that 1st quarter. For the 3+ age group low densities are seen around Bornholm in 4th quarter. The distribution in 2000 seems to support the distribution pattern seen in 1999. The combination the existence of areas was trawling is difficult (impossibly) and the significant difference in distribution pattern by season implies that two surveys a year will have better chance to give a reliable survey results.

A second survey is also important if during one of the two surveys the total distribution area of both the Baltic cod stocks is not completely covered due to breakdown of one or more research vessels.

It is well known that the hydrographic conditions influence the distribution patterns of cod in the Baltic Sea. This influence is the reason why stratified random surveys are carried out using depth layers as stratification parameter. Oeberst (2000) has shown that thermocline influence the distribution pattern of cod less than 40 cm as well as of cod larger than 60 cm). Matthäus *et al*. (1997, 1998, 1999) and Nehring et al. (1994, 1995, 1996) have shown the temporary high dynamics of the hydrographic conditions especially during major inflow events. Hinrichsen *et al*. (2001) Indicated that by wind driven water transport processes within the upper layer cod eggs can be transported from the Belt Sea into the Bornholm Basin within 25 days. If this high dynamics of hydrographical conditions is taken into account in combination with the relative long survey periods of 45 days in spring and 30 days in November it is possible that the different periods of the national cruises can influence the stock indices. In order to reduce the influence of the changing hydrographical conditions concerning the accuracy of the estimates of stock abundance a second survey is useful as additional independent estimate.

The WG BIFS recommends that two demersal trawl surveys should be carried out in the Baltic Sea to get more than one VPA independent estimates of Baltic cod and flatfish stocks.

It is proposed that each country before next WG meeting prepare a description of the national contribution of the BITS survey. The template given in Annex 5 should be used for such description (similar template for acoustic- and trawl survey).

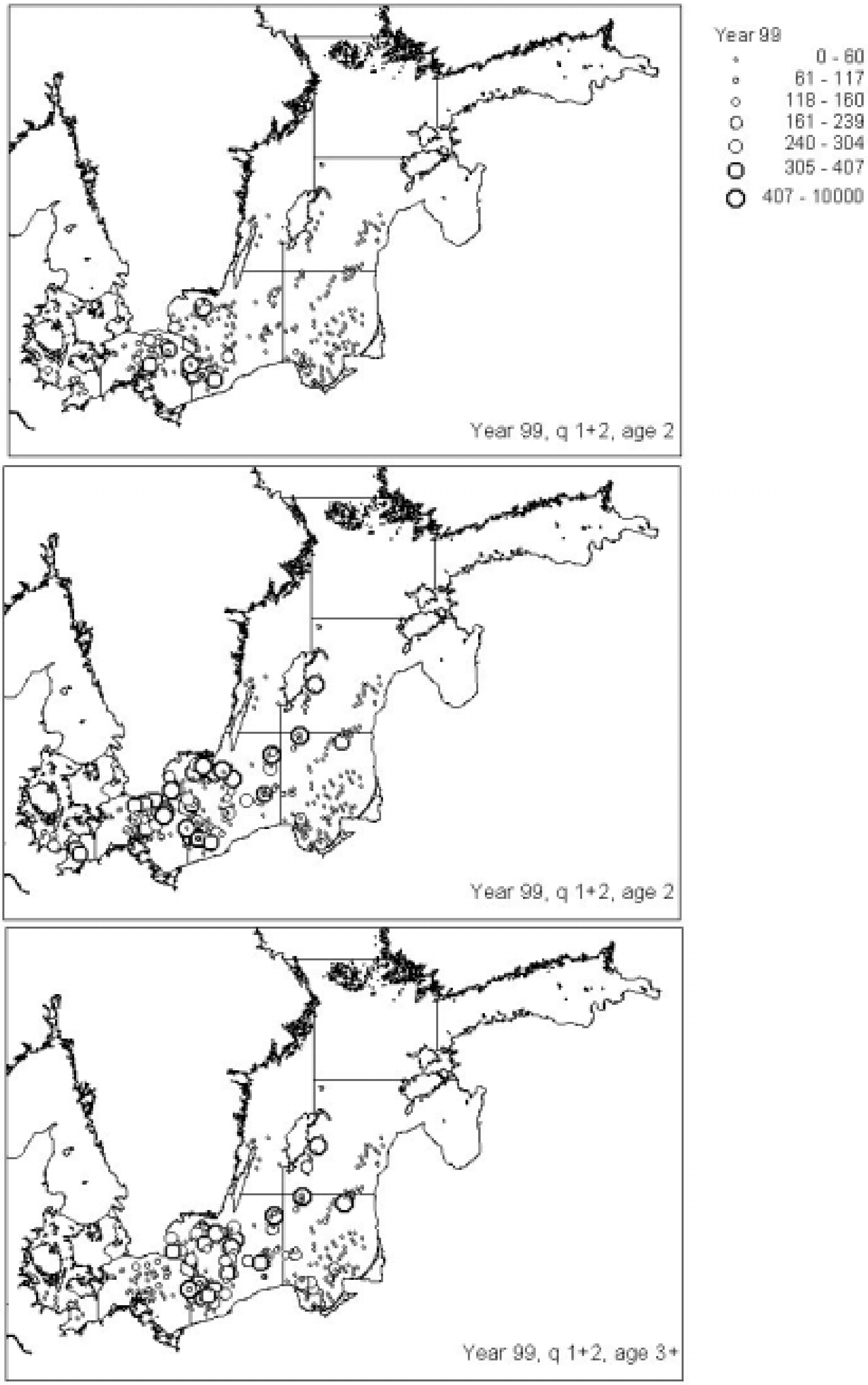
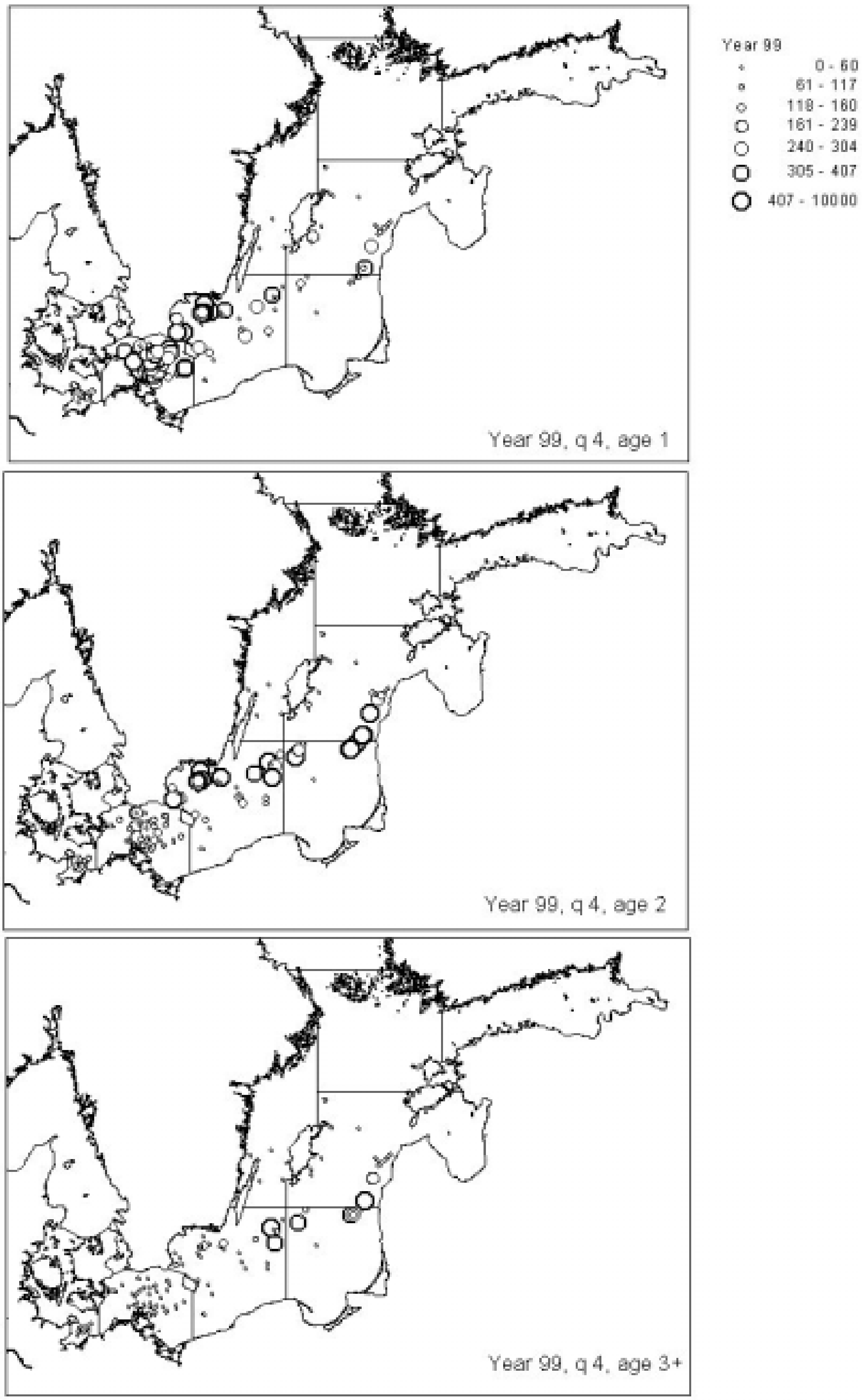


Figure 7.1. The catch in numbers by age group (I, II and III+) by statistical rectangle as obtained during BITS survey in 1999.

Figure 7.1 (Cont'd)



8 EVALUATION OF THE SURVEY DESIGN STRATEGIES FOR FUTURE BITS SURVEYS

The group discussed a number of proposals for necessary amendments to the survey design in order to achieve further improvement of the quality of BITS results. Most of the problems, discussed by the group were connected with timing of surveys and to allocation scheme of control hauls.

8.1 Timing of the BITS survey

Need for autumn surveys. The group came to the conclusion that the autumn survey carried out in November is needed in coming years. At least a short time series is needed to judge whether to skip the November survey. There was general agreement, that two surveys allow higher accuracy in estimates of cod of age group 1 because of better area coverage. Insufficient data from the shallow waters, particularly in the Subdivisions 25 and 26 (mostly from Polish zone) do not allow elaborating the accurate abundance indices. Also, the length distribution and the CPUE of cod during the spring and autumn surveys are different. The Working Group recommend carrying out the inter-calibration experiment type 3 with TV3 trawl (see Nielsen *et al*., 2002) in November 2002. At least 10 pairs of control hauls should be conducted in different depth strata in the area, where the cod length distribution is assumed to be normal. Each pair of hauls should be started from the same position and performed in the same depth strata (see also Chapter 7).

The coverage of the Polish zone during the autumn survey. The group discussed the possibilities of moving a part of Polish survey effort from spring to autumn in 2003. The possible solutions for 2002 would be either using the RV DANA with Polish scientific observer onboard to cover the Polish zone or shifting one week of Polish spring survey to autumn covering the shallow coastal areas of Polish zone, while RV DANA covers the more distant areas.

8.2 Allocation scheme

During the discussions on allocation scheme it was found that the overall allocation is very heterogeneous at present and there is a problem that in many cases hauls are concentrated into small areas (e.g. in Mecklenburg area) whereas some strata lack the hauls. It was found, that the present depth stratification of hauls should be continued since no data for the evaluation of appropriateness of present stratification scheme is available. The optimal distance between control hauls should be 3 nm (not less than 1.5 nm and not more than 10 nm).

The available hydrological data on oxygen conditions from the hydrographical surveys should be extensively used in haul allocation and better communication between vessels during the survey is needed in order to modify the haul location, according to the current oxygen conditions, e.g. shifting the control hauls out of the oxygen-depleted areas. However, since the acoustical investigations have indicated, that cod may occur in significant amounts in the pelagic zone above the oxygen depleted areas, it would be necessary to explore the available information on vertical distribution of cod. In that respect one possibility would be the using the information from control hauls of the autumn acoustic surveys in final allocation of the control trawl tracks in bottom trawl survey.

Three different gears (small TV3, large TV3 with standard rope and large TV3 with rock-hopper) are in use in the western areas (Subdivisions 22-24) at present. However, only the limited number of the trawl hauls with small TV3 has been carried out in this area. In order to increase the accuracy of the conversion factor between small and large TV3 trawls**,** it was proposed that in future trawl surveys of German research vessel with small TV3 will be carried out in Sub division 22-24, while the vessels with large TV3 will be operating in the eastern areas. The group came to the conclusion that no rock-hopper should be used in control hauls on the tracks listed in the CTD. The rock-hopper should be used only in the areas, which are well known by the heavy grounds.

For the cases, when trawl survey on pre-allocated tracks is impossible (e.g. track is occupied by the gillnets), it was agreed, that a new trawl station in the same depth strata should be selected as close to the pre-allocated station as possible.

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

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

Under the EU ISDBITS Study Project (Nielsen *et al*. 2001) 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. 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 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 in the 1999 and 2000 inter-calibrations (as well as in the type 3 additional inter-calibrations performed in 1995 with the small TV3-520-trawl and in 2002 with the large TV3-930-trawl as described below).

An overview of the inter-calibration activities performed in 1999 and 2000 is given 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 Subdivision, 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.

Detailed descriptions of all the above are given in the Final ISDBITS EU Study Report (Nielsen *et al*. 2001) accepted by the EU Commission in October 2001 as well as in Nielsen *et al*. (2002a).

9.2 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.

Besides from the field tests and between gear inter-calibrations on national level described above, additional Danish field tests have been performed with repeated hauls with the new standard TV3-trawls in 1st quarter 2002 with the large TV3-930 trawl on board R/V Dana, and in 1st quarter of 1995 with the small TV3-520 trawl on board R/V Havfisken. The design of these (type 3 – see below) field tests is identical with the design of the field tests performed in 1999 and 2000. Data from the additional field tests have been included into the inter-calibration database as well.

Consequently, the database contain 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. Several 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 1999-2002.

In the ISDBITS Report (Nielsen et al. 2001) two analysis methods were presented which are identical to what has been presented in Nielsen (2001) for method 1 and in Oeberst *et al*., 2000 (extended to data for all countries in the ISDBITS report) for method 2. Later on, modified methods have been evolved which have been presented in form of working documents to the present working group. These methods are described in the working documents partly by Oeberst and Grygiel (2002) and partly by Nielsen et al. (2002a,b) attached in full form to the present working group report.

Furthermore, the two first methods presented in Nielsen *et al*. 2001, Nielsen 2001 and in Oeberst *et al.* 2000 have been evaluated and discussed in a working document by Gasyukov (2002) to the present working group.

The three working documents and the newly developed methods were presented to the working group and discussed by the working group both in plenum and in sub-group. Details of the methods are given in the working documents as appendices to the present working group report.

The discussion of the working document by Oeberst and Grygiel (2002) focussed on the assumptions of the model presented in this working document where it was discussed whether the assumption of equal efficiency of the traditional Swedish GOV-trawl and the new standard TV3-930 trawl (i.e. the inter-calibration factor between these are 1) hold, and whether the assumption of equal disturbance effects of the new standard TV3-trawls and the traditional, national trawls on national basis hold and, finally, whether the assumption of constant conversion factors for all cod larger above 24 cm in length for all nations inter-calibration data hold.

The discussion of the working document(s) by Nielsen *et al*. (2002a,b) focussed on the variability in the estimates of the conversion factors and the disturbance effects of the different trawls in relation to the ability of the used model to estimate these factors and effects. Furthermore, the problems in using only Danish type 3 experiments applied to all nations inter-calibration data in the used model were discussed. In this context also the relatively low sample size (number of inter-calibration hauls) of available type 3 experiments was discussed in relation to the uncertainty in the estimates. When going through the results of the method the relatively high disturbance effect of the Swedish traditional GOV trawl was discussed. The constancy in the estimates of the disturbance effect by the new TV3-trawls for each nation was evaluated when only Danish type 3 data was applied for all nations inter-calibration data.

The general conclusion of the analyses of Gasyukov (2002), which introduced a cross validation method, was that according to the criteria proposed in the cross validation method that the method of Nielsen *et al*. 2001, Nielsen 2001 was more appropriate to estimate conversion factors based on total reference pair trawlings compared to the method of Oeberst *et al*. (2000), and that the results of the first method described the inter-calibration data best. However, in light of the introduction of a modified and further developed Danish method (Nielsen *et al*. 2002a,b) to the present working group meeting the latter was by the ICES BIFS Working Group recommended to be used by the WGBFAS working group in the assessments of Baltic cod stocks (see below).

Conclusions:

One general conclusion of all working documents and of the discussion in the working group is that it is necessary to perform further inter-calibration experiments in order to reduce variation in data and in the estimates of the conversion factors (as well as of the disturbance effects). It is recommended that all countries participating in BITS shall perform at least 10 inter-calibration experiments of type 3 during the autumn 2002 and spring 2003 surveys 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 type 0 followed by type 1 and type 2 experiments based on the estimates of variation in inter-calibration data and the precision of estimates of the conversion factors when national type 3 experiments have been introduced and included in the analyses.

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.

In overall, it was agreed that the ICES BIFS Working Group recommend that the estimates of conversion factors given by the method of Nielsen *et al*. 2002a,b is used by the ICES WGBFAS working group in the assessments of Baltic cod stocks. It should be noted that the estimates from the method is based only on Danish type 3 experiments and that the available sample size of the type 3 data so far is limited (for example only 8 pairs for large TV3-930). Some members of the working group noted that the disturbance effects for some of the traditional, national trawls (Poland, Sweden, Latvia) was significantly more than 1. In this context it should be noted that the estimates for Sweden should be treated with caution as the disturbance effect of the traditional Swedish GOV trawl is relatively high. Based on the estimates and the un-certainty of the estimates of the conversion factors from the method of Nielsen *et al.* (2002) the working group noted that it is not possible to use the same conversion factors for all length groups for all countries. In relation to the above agreement it is noted that when developing the method of Oeberst and Grygiel (2002) the new, additional information from the type 3 inter-calibration experiments was not available.

Finally, it was recommended by the working group that the working documents of Nielsen *et al*. (2002a,b) should present results for conversion factors and disturbance effects from the full model on national basis and not only for the reduced models as initially was done for Denmark and Poland. The attached working documents have been up-dated in that respect.

The working group noted that inter-calibration analyses and estimates of conversion factors for flounder applying the method of Nielsen *et al*. (2002a,b) was not yet available and recommended that these should be provided at latest to the next meeting of the working group.

9.3 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 WGBFAS to decide how the conversion factor should be used in the assessment.

Adding conversion factors to the 'fishing power' model previously used

Last year the assessment group noted that the GOV trawl used by Sweden were about as efficient as the new (large) TV3-trawl according to analysis then available. As the GOV trawl were used as the standard in the previous assessments it was hereby possible to fit the 2000 survey catches into the fishing power framework (Sparholt and Tomkiewicz, 2000) that has been used for the Eastern cod stock. The working group acknowledged that this was an ad hoc solution and that more analysis was needed to achieve final conversion factors.

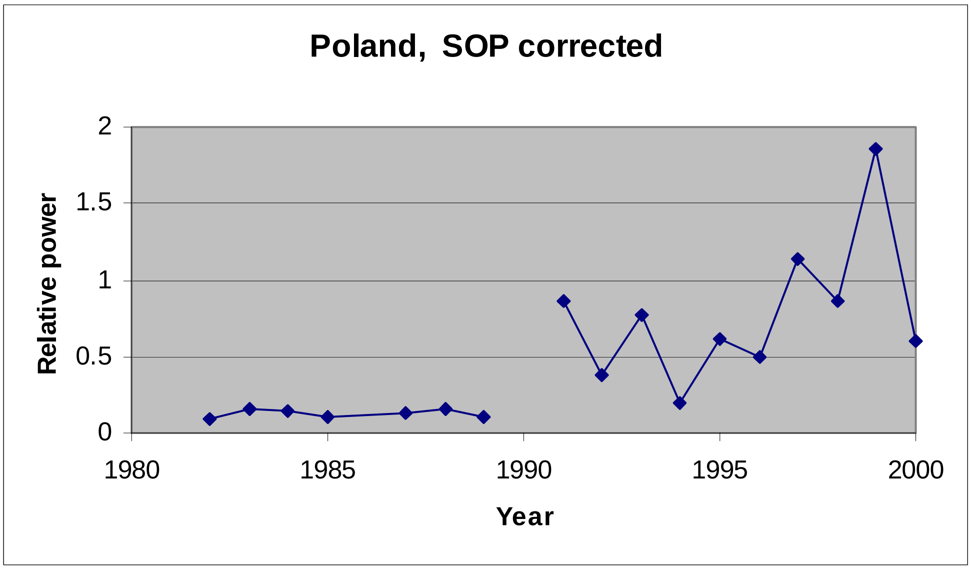
Intercessional work has pointed at several weaknesses in the fishing power framework. A fundamental problem is the quality of the data available. Catch in numbers at age are available by hauls but weight at age and maturity at age is only available as overall Baltic values (taken from the VPA input tables). Due to the rather marked age reading differences between countries this implies that the survey SSB's, that are used to derive the powers, are not comparable between countries. These problems are evident when the observed survey catch weight is compared to the survey weight that are derived by an SOP, which show that for a number of countries the SOP significant exceeds the observed catch weight, text below. It is possible to do a rough correction of the weight irregularities by SOP correcting the SSB. This however, does only account for part of the SSB problem as age reading differences both includes a weight and a maturity term.

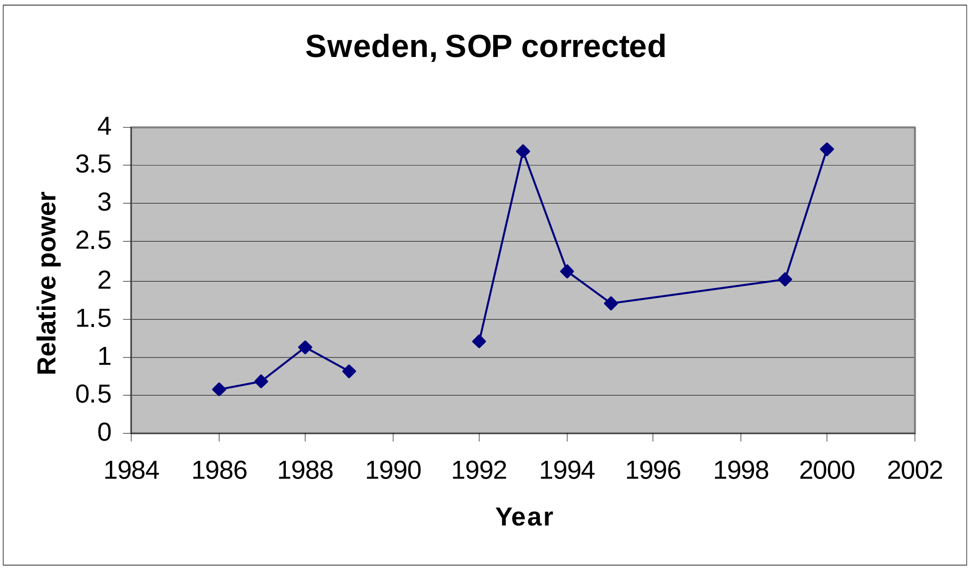
Average SOP deviations by country:

Vessel	# Years	SOP deviation
ATLANTNIRO	4	144%
DENMARK	18	95%
FORMERFR	11	95%
GERMANY	9	104%
LATVIA	16	121%
LATVIA2	2	197%
POLAND	10	153%
RUSSIA	4	133%
SWEDEN	11	128%
SWEDENF	10	114%

The power analysis is based on an assumption that the vessel (=country) effects are stable over the time period analysed (1982-1996), whish appears questionable. Performing analysis by separate years using the model;

log(SSB)= vessel (v) + depth (d) +subdiv (s)*depth (d) + noise show very considerable trends in the relative vessel estimates (the vessel estimates are termed fishing powers). The analysis only provides relative power estimates that may be expressed by using any vessel as the standard. In this analysis Denmark is chosen as the standard as Denmark have fished over the whole period. Sweden and notable Poland show very remarkable trends in their relative powers (see text tables below). The Polish power is thus less than 20% of that of Demark in the early years whereas Poland is as efficient (SOP corrected run) or more efficient (un-corrected run) than Denmark in the 1990's. Similar trends also occurs when catch in numbers are analysed.





As both the SSB derivation problem and the trends in the relative fishing powers will significantly affect the CPUE indices WGBIFS is of the opinion that the fishing power approach should only be used with great care, if used at all.

An ad hoc validation of the conversion factors

As the conversion factors derived by the generalized linear model are new and because of the importance of the CPUE calibrations for tunings it is useful to try to evaluate whether they provide estimates that are found in a range generally expected. The only measuring rod for such an evaluation is comparing the generalized linear model to the results from the power analysis. The estimates of the fishing power of the traditional gears are based on Sparholt and Tomkiewicz (2000) final model and only uses the most recent information (here chosen as 1997-2000) to match the years when the calibrations experiments were conducted. For this period the power are very similar between Germany, Denmark and Poland (text table, below) and not statistical different (irrespectively of using uncorrected or SOP corrected SSB's).

Sweden's power is the highest and Russia's power is somewhat between Sweden and the group consisting of Germany, Denmark and Poland.

Power estimates by the model of Sparholt and Tomkiewicz (2000).

	Power SSB not cotrected	Power SSB SOP cotrected
RUSSIA	0.72	0.59
DENMARK	0.28	0.35
GERMANY	0.31	0.41
LATVIA	0.64	0.51
LATVIA2	0.30	0.20
POLAND	0.42	0.34
SWEDEN GOV	1.00	1.00
SWEDEN Fotø	0.94	1.01

As the power is estimated from the mature fish only this estimate must be compared to the conversion factors derived from the mature part of the population only, which is here approximated by cod above 35 cm. The resultS are shown in table below where the row q-TV3/q-old is the mean conversion factor of fish above 35 cm. The row 'q-old/q-TV3 express how efficient the old gear is relative to the large TV3 trawl. These values are finally indexed to Sweden which is by this attributed the 'power´ of 1.0. The results are seen as roughly similar to that derived by the power analysis.

Relative fishing power difference for mature fish as derived from the conversions factors from the generalized linear model.

Length	Denmark	Poland	Russia	Sweden
35-40	1.94	0.7	0.59	0.3
40-45	1.91	1.48	0.52	0.46
45-50	1.37	1.34	0.45	0.48
>50	0.99	1.43	0.49	0.32
q-TV3/q-old	1.55	1.24	0.51	0.39
q-old/q-TV3	0.64	0.81	1.95	2.56
Indexed	0.25	0.32	0.76	1.00

It is stressed that this comparison do not imply that the generalized linear model and the fishing power approach will result in similar results. E.g. the generalised linear model provides estimates over the total length span whereas the power analysis measures gear efficiency only for the SSB and assumes this to reflect power difference over all ages. Also the generalised linear model allows national weight and maturity at age values to be applied as these data are available in the ICES BITS database.

<u>Possible ways of using the conversion information.</u>

The assessment working group have several options available if they wish to use the conversion factors from the generalised linear model. It can be chosen only to use conversion factors if these are statistically different from '1' and otherwise set the old gear equal to the TV3 gear as the hypothesis old-gear equals TV3 trawl can not be rejected. The alternative option is to use all estimated conversion factors face value, as significance is basically a function on effort that has been low for some countries.

The assessment working group also have the option of not including all the historically available trawl information. A reason for omitting some data is to avoid the double conversion, which is necessary for the Eastern cod where some research vessels uses the small TV3 trawl. Concrete, this will imply omitting the data from Germany and Latvia in the eastern area hereby reducing the number of hauls by ca. 15%. The data from these countries may be included when the conversion factors between the two sizes of the TV3 trawls are determined more reliable. This conversion problem is not found for the Western Baltic that is covered by Denmark and Germany using only the small TV3 trawl.

10 UDATE AND CORRECTION OF THE CLEAR TOW DATABASE, AND ALLOCATION OF THE HAULS FOR THE BALTIC INTERNATIONAL TRAWL SURVEYS IN AUTUMN 2002 AND IN SPRING 2003

10.1 Update and correction of the Clear Tow Database

The version of the Clear Tow Database submitted by Sweden in February 2002 was analysed. This version includes besides the Clear Tow Database version of the WGBIFS meeting in Kaliningrad 2001 also the data of the Danish vessel “Havfisken”. Table 10.1.1 summarizes the number of available hauls in the Clear Tow Database, version February 2002.

The aim of the analyses was to calculate and to study values which were calculated from the data of the Clear Tow Database because only the data of the Clear Tow Database were available without additional information of the tracks (e.g. hard copies of the screen picture of the hauls). The haul data were copied in a new EXCEL file and were separately stored in different spreadsheets concerning the assignment to subdivisions) using Subdivision 22, as notation of the spreadsheets. The data of the Subdivisions 20, 21, 23, 29 and 32 were not analysed. Using special equations, follow up values of the different Clear Tow Database data were calculated like the assignment of subdivision, the distance of the different haul sections, the number of latitude and longitude positions, the distance between two hauls. These follow up data were used for detecting hauls that probably contain problems. Only hauls with problems were checked **and consequently it is possible that further problems exist which were not found.** All changes are described in the “ReadMe” sheet of the new version of Clear Tow Database “CTD_Vers2002.XLS”.

Assignment to subdivisions

The true assignment of haul to a subdivision is important since the parameter subdivision is used as the first level of stratification. A incorrect assignment of Subdivision can produce different problems. At first the number of planned and realized stations in the subdivisions can be different. Furthermore, it is possible that a station with incorrect assignment to a Subdivision must be realized by a vessel that works faraway from the selected station.

An additional estimate of Subdivision was calculated using the first haul position. If both the values of Subdivision were different the positions of the haul were checked. Furthermore, the first position of all hauls of the same subdivision were plotted in digitised sea maps. If hauls were drawn outside of the expected area the positions were also checked. Altogether 16 hauls were assigned to another subdivision. The changed assignments to a Subdivision were marked using bold figures.

Haul positions

Hauls exist where latitude and longitude positions were different. In these cases it was assumed that typing errors are the reason (unnecessary data were deleted).

The main parameters to check the different positions of a haul were the total distance and the distances between the different section of the haul. It was assumed that typing errors are possible if the total distance of a haul was very long and/or the distances of the subsequent sections of the haul were very different. The data of the positions were corrected and were marked with bold figures if changes were carried out. Hauls were deleted if a realistic interpretation of the typing errors was not possible. The numbers of the deleted hauls were separately stored by subdivision in the spreadsheet “ReadMe”. Hauls were not changed (the haul number was stored in the “ReadMe”) if the total distance of the hauls was large, but the distances of the subsequent sections were relatively constant and the position of the hauls was not outside of the Baltic Sea.

Deleted hauls

All hauls with a distance of less than 1.5 nm were deleted since a standard haul of BITS is defined by a velocity of 3 knots and a duration of 30 minutes. That means that a standard haul covers a distance of about 1.5 nm. If the total distance of the selected hauls is shorter than 1.5 nm it is possible that problems occurred with the bottom since it is difficult to see the danger. The total distance of the haul is not included in the analysed database. The haul number and the total distance of the deleted hauls are summarized in “ReadMe” by subdivision. As consequence the total distance of the hauls is added in the revised database “CTD_Vers2002.XLS”. Hauls dependent on Swedish information were also deleted.

A further problem is the fact that some hauls are stored twice or more times in the Clear Tow Database and that many hauls are very close together, especially in Subdivisions 22, 24 and 25.

The sum of the absolute distance of all positions of two hauls were calculated to detect hauls that are very close together using

SUM = abs[P(1,Lati(1))-P(2,Lati(1))]+abs[P(1,Long(1))-P(2,Long(1))]+abs[P(1,Lati(2)-P(2,Lati(2))]+ ….

where

P(1,Lati(1))	first latitude value of the first haul
P(2,Lati(1))	first latitude value of the second haul
P(1,Long(1))	first longitude value of the first haul.

If SUM was less than 4 minutes, the haul with the higher number was deleted since it was assumed that both hauls cover the same area. The haul numbers that present the "same haul" are given in "ReadMe" by subdivision. The described procedure can be also used to detect hauls with a defined absolute distance.

Checking of the depth layer

Since the planning process of the surveys is based on the stratification by subdivision **and** by depth layer, it is important that the assignments to the depth layer is also correct. For checking the depth layer the first position of the hauls was plotted in digitised sea maps. It was assumed that the assignment to the depth layer is true when the depth layer of the haul corresponds with the depth layer in the map. If both the depth layers differed, the position and the depth of the haul were checked in official sea maps and the **mean** depth was changed if necessary. The mean depth of these hauls was marked by bold figures. Additionally, all haul numbers were marked with green colour where the depth was compared with official sea maps independent of whether the mean depth was changed. That means that the depth of all hauls with a black haul number was not checked. The data of hauls that were realized during the surveys in 2001 and later on can be also used to compare the depth data of the Clear Tow Database with the field data.

All these checking procedures make not sure that all data of the current database are correct. It must be a continuous process to improve the database by the feedback of all realized hauls. The start and the end position as well as the mean depth should be send to Germany that is responsible fore the care of the Clear Tow Database.

Feedback from the realized surveys

During the November survey 2001 a further problem became clear. The hauls of the Clear Tow Database come from different sources, not only from different countries, but also from different vessel – gear combinations. As example, the haul with the number 131 (Subdivision 24, Swedish zone) is from a commercial vessel (SIN18 Vingarö Aug 98). The covered area is stony and rough and probably a rock hopper gear was used. However, in the database information concerning the used ground rope are not available. If this station is assigned to a country which can only use the gear TV3#520 with a standard ground rope the probability is high that the gear will be damaged. However, it is necessary to use such stations during the surveys since positions with soft bottom are not available in some areas. As consequence the haul with the number 131 must be assigned to a vessel that can use a rock hopper ground rope. Therefore, additional information are necessary in the Clear Tow Database (ground rope type – column TV3 is added). Using the feedback of the realized surveys this new data field can be filled in, step by step.

However, there are further consequences. It follows that it is not possible, as it was planed for the survey in November 2001, that RV "Solea" (using TV3#520 with standard ground rope) realizes all stations in this subdivision. It is necessary that at least some stations must be realized by other vessels which can work with the rock hopper equipment.

The following data of all realized stations of BITS should be submitted to Germany not later than 20 December (autumn survey) and 5 April (spring survey).

- Haul number of Clear 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

Additional hauls

The analysis of the spatial distribution of the available hauls has shown that “white areas” exist in the different subdivisions where hauls are not available (see: Spatial distribution of the hauls). Therefore, additional hauls are necessary to cover the total distribution area of the target species. One way to get additional hauls is the splitting of hauls with a total distance longer than 2 nm into separate sections. On the other hand additional hauls should be make available.

Latvia prepared new hauls in Subdivisions 26 and 28, and Germany made available new stations in Subdivisions 22, 24 and 25. These stations are included in the revised version of the Clear Tow Database and were used during the analyses. These hauls are marked with special haul numbers, e.g. 28001 for the first new haul in Subdivision 28. Table 10.1.2 presents the additional hauls by subdivision and depth layer. All countries are called upon to submit additional hauls for “white areas”.

New numbering of the stations

Up to now the hauls got a number independent of their position in the Baltic Sea. The numbers were given dependent of the sequence of the availability of the data. As example the lowest haul number in Subdivision 26 is 718. The next number is 943. It is very difficult to find a haul number in the revised database since all hauls with the same assignment to the Subdivisions are stored in one spreadsheet. From the number of the realized haul it cannot be concluded in which spreadsheet the data are stored. Therefore, it is proposed that the hauls get a new numbering. Each haul number has 5 figures. The first two figures are the subdivision like it is used for the additional hauls. Then the hauls are numbered on the sequence of the hauls. These new numbers should be added as new column besides the current number.

Present state of the Clear Tow Database

Table 10.1.3 summarizes the available hauls of the revised Clear Tow Database (CTD_Vers2002.XLS) by subdivision and depth layer. In most cases enough hauls are available to carry out random selections of hauls for future surveys if about 300 stations are planned like in spring 2001. Problems exist in Subdivision 27 and in areas with a water depth of less than 40 m in the Subdivisions 25, 26, 27 and 28. However, not only the low number of the available stations is difficult in some depth layers, but the spatial distribution of the available stations produce also problems during the selection procedure. Figure 10.1 shows the first position of the available hauls by subdivisions.

The figures illustrate that regions exist in all subdivisions where a very high number of hauls exist. In contrast to that, large regions exist where hauls are not available. For example, all 35 hauls of Subdivision 24 with a water depth of less than 20 meters are located southern of 55°N, and a large proportion is concentrated in a small area eastern of Rügen. That means that a large part of this depth layer is not covered by the surveys.

To illustrate the heterogeneous distribution of the available hauls, units of 5’N x 10’E were defined and the number of hauls were counted which have the first position in these units. Table 10.1.4 presents the maximum number of hauls per unit by subdivision. The minimum value of all subdivisions was zero in all subdivisions.

This heterogeneous distribution of the available hauls produce a biased coverage of the depth layers when an equal distributed random number generator is used for selecting hauls for a planned survey.

Allocation of hauls by subdivision and depth layer

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 WG BIFS in Kaliningrad in February 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 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.

It was agreed during this meeting that this scheme of the allocation of hauls should be modified. During the future surveys RV "Solea" should only cover the ICES Subdivisions 22 and 24. This arrangement was chosen to improve the stock indices in the ICES Sub-divisions 25 - 28/32 since from the studies of the conversion factors it can be concluded that the accuracy of the stock indices increases when only the same type of TV3 is used in a sub-division.

Using the agreed arrangement only the small TV3#520 is used in the western Baltic Sea (Subdivisions 22, 24) and in a large part of the eastern Baltic Sea (Subdivisions 25 - 28/32) only the larger version TV3#930 is applied. As consequence the algorithm of the haul allocation was modified. The above described method which use the areas of the ICES subdivisions and a running 5 years mean of the CPUE values is used for the western Baltic Sea (Subdivisions 22, 24) and the eastern Baltic Sea (Subdivisions 25 - 28/32). In both the cases the areas are weighted with the factor 0.6 and the running mean of the distribution pattern is weighted with the factor 0.4.

Table 10.1.5 presents the adapted basic data for allocating the hauls according to subdivisions for the survey in autumn 2002.

The same procedure is used for allocating the number of stations according to the depth layers in the different subdivisions. Table 10.1.6 shows the basic data of the different subdivisions for the autumn survey in 2002). The depth layer 10 to 39 m was used as one unit because no CPUE data were available for water depth of less than 20 m in some subdivisions.

<u>Selection of hauls</u>

The aim of the random selection of hauls in the different depth layers 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 be sampled. However, from the spatial heterogeneous distribution of the available hauls it can be concluded that a random number generator can not be used to select hauls from the Clear Tow Database since such algorithm produces a biased selection due to the different probability (number of hauls within small units, see Table 10.4) of areas/units to come into the selected pool of hauls. To reduce the influence of the heterogeneous distribution of the available hauls the following algorithm is used.

The area of depth layers is separated into small units of the same size of 2’Nx4’E or 5’Nx10’E. Using a random number generator one unit is selected, and in a subsequent step one of the hauls that have the first position in the unit is selected. This algorithm is repeated until the total number of planed stations is achieved.

The advantage of this algorithm is that the probability of a unit to come into the sample as well as the coverage of the depth layer are independent of the distribution pattern of the available hauls of the Clear Tow Database. The use of 5’Nx10’E units is proposed for the Baltic trawl surveys.

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

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

- It is not allowed to use the rock hopper ground rope in the following areas:

  - Southern part of Subdivision 24
  - SD25
  - South western part of Subdivision 26

- The standard ground rope must be used when the station was successfully carried out during earlier surveys by standard ground rope (see the columns TV3 and ground rope in the CTD).

- The number of hauls that are close together should be reduced. Hauls should be deleted if SUM, the absolute distance between all positions (see equation in the text part), is less than 25 minutes.

- Additional hauls should be submitted to Germany. Especially hauls in the "white areas" of Figure 10.1 are necessary to cover to 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 distance of more than 5 nm should be splitted up in different hauls. The total distance of each of the new hauls should not be less than 2.5 nm.

- Additional columns should be added. 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.

- The proposed algorithm to select hauls for a planned survey was intensively discussed. It was pointed out that the use of to small and to large units during the selection process can produce a biased coverage of the total area since the available hauls are very heterogeneous distributed in many depth layers. 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 the units.

10.2 Allocation of the hauls for the Baltic international trawl surveys in autumn 2002, spring 2003 and autumn 2003

It was agreed during this meeting that the scheme of the allocation of hauls should be modified (see chapter Update and correction of the Clear Tow Database). Tables 10.1.5 and 10.1.6 present the basic data for allocating the hauls for the planned surveys.

The available total number of planned stations is given by countries in Table 10.2.1 for the autumn survey in 2002, in Table 10.2.2 for the survey in spring 2003 and in Table 10.2.3 for the survey in autumn 2003.

The total number of available stations of Tables 10.2.1 - 10.2.3 were used in combination with the results of Table 10.1.5 and 10.1.6 to allocate the number of stations by subdivision and depth layer for the different surveys. Table 10.2.4 and 10.2.5 present the allocation of the hauls by subdivision and depth layer for the autumn survey in 2002. Furthermore, the number of hauls that the different countries have to be carried out in the different subdivisions are given. Tables 10.2.6 and 10.2.7 show the corresponding data for the survey in spring 2003, and Table 10.2.8 and 10.2.9 show the data for the surveys in autumn 2003. These data are the basis for the selection of the hauls for the different surveys.

Table 10.1.1 Number of available hauls of Clear Tow Database version February 2002 by subdivision and depth layer.

Sub-division	Depth layer in meter 0 – 20	21 – 40	41 – 60	61 – 80	81 – 100	> 100	Total
20	1	8	3	10	5	11	38
21	57	194	57	10	2	0	320
22	57	114	0	0	0	0	172
23	8	7	0	0	0	0	15
24	35	292	239	6	0	0	572
25	10	57	206	253	36	1	562
26	4	15	27	82	75	17	220
27	0	0	2	10	3	4	19
28	0	18	42	57	33	210	171
29	0	6	4	1	2	0	13
32	0	1	2	1	0	0	4
Total	171	712	583	430	156	53	2106

Table10.1.2 Number of additional stations by subdivision and depth layer.

Sub-division	Depth layer in meter 0 – 20	21 – 40	41 – 60	61 – 80	81 – 100	> 100	Total
22	4	19					23
24	9	15	16	2			42
25		2	6	6	2		16
26		2		8	3	1	13
27							
28		20	42	46	6	16	130

Table 10.1.3 Number of available hauls of the Clear Tow Database (CTD_Vers2002.XLS) by subdivision and depth layer

Sub-division	Depth layer in meter 0 – 20	21 – 40	41 – 60	61 – 80	81 – 100	> 100	Total
22	57	114					172
24	35	292	239	6			572
25	10	57	206	253	36		562
26	4	15	27	82	75	17	220
27			2	10	3	4	19
28		18	42	57	33	21	171

Table 10.1.4 Maximum number of hauls which have the first position in units of 5’N x 10’E by subdivision

Sub-division	22	24	25	26	27	28
Maximum value	7	34	14	10	3	10

Table 10.1.5 Basic data for allocating the hauls of the survey in autumn 2002 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+ (1997 - 2001)	Proportion of the index values (weight=0.4)	Proportion of the stations	Special Decisions (additional stations9
SD	[nm²]	[%]		[%]	[%]	
22	3673	39	1142	20	31	
23	0	0	0	0	0	3
24	5724	61	4680	80	69	
Total 22 + 24	9397	100	5822	100	100	
25	13762	43	7683	64	51	
26	9879	31	3003	25	28	
27	0	0	0.0	0	0	10
28	8516	26	1381	11	20	
Total 25 - 28	32156	100	12067	100	100	

Table 10.1.6 Basic data for allocating the hauls according to the depth layer for the survey in autumn 2002 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+ (1997 - 2001)	Proportion of the depth layer (0.4) [%]	Proportion of the depth layer [%]
24	10 - 39	4174	73	2175	46	62
	40 -	1550	27	2505	54	38
	Total	5724	100	4680	100	100
25	10 - 39	4532	37	1029	13	27
	40 - 59	3254	26	4072	53	37
	60 - 79	3037	25	2122	28	26
	80 -	1461	12	460	6	10
	Total	12284	100	7683	100	100
26	10 - 39	2379	23	186	6	16
	40 - 59	1519	15	440	15	15
	60 - 79	1911	19	1092	36	26
	80 - 100	2872	28	1285	43	34
	100 - 120	1504	15			9
	Total	10185	100	3003	100	100
27	10 - 39	1642	31			18
	40 - 59	1101	21			12
	60 - 79	996	19	24	7	14
	80 -	1596	30	318	93	55
	Total	5335	100	3003413	100	100
28	10 - 39	2589	39			23
	40 - 59	1598	24	116	8	18
	60 - 79	1101	16	264	19	18
	80 - 100	1389	21	1001	73	41
	Total	6677	100	1380	100	100

Table 10.2.1 Total number of the stations planned for the BITS in autumn 2002.

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*	15
	Russia	
Argos	Sweden	35
Total 25 - 28		**135**

* also on board of "DANA"

Table 10.2.2 Total number of the stations planned for the BITS in spring 2003.

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
Voskhod	Russia	44
Argos	Sweden	45
Total 25 - 28		**199**

Table 10.2.3 Total number of the stations planned for the BITS in autumn 2003.

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 10.2.4 Allocation of the planned stations by country and subdivision in autumn 2002.

Sub-division Country	Total	22	23	24	25	26	27	28
Denmark	**65**	12	3		30	20		
Estonia	**10**							10
Finnland	**0**							
Germany	**57**	10		47				
Latvia	**25**							25
Poland	**15**				10	5		
Russia	**0**							
Sweden	**40**				25		10	
Total	**207**	22	3	47	65	25	10	35

Table 10.2.5 Allocation of the planned stations by subdivision and depth layer in autumn 2002.

Sub-division Depth layer	22	23	24	25	26	27	28
10 - 39	22	3	29	18	5	3	8
40 - 59			18	24	4	2	6
60 - 79				17	6	2	6
80 - 100				6	8	3	14
100 - 120					2		
Total	22	3	47	65	25	10	34

Table 10.26 Allocation of the planned stations by country and subdivision in spring 2003.

Sub-division Country	Total	22	23	24	25	26	27	28
Denmark	**65**	12	3		44	6		
Estonia	**0**							
Finnland	**0**							
Germany	**62**	11		49				
Latvia	**25**							25
Poland	**35**				35			
Russia	**44**					44		
Sweden	**45**				18	4	10	13
Total	**279**	23	3	49	97	54	10	38

Table 10.2.7 Allocation of the planned stations by subdivision and depth layer in spring 2003.

Sub-division Depth layer	22	23	24	25	26	27	28
10 - 39	23	3	31	27	9	3	9
40 - 59			18	36	8	2	7
60 - 79				25	14	2	7
80 - 100				9	18	3	16
100 - 120					5		
Total	23	3	49	97	54	10	38

Table 10.2.8 Allocation of the planned stations by country and subdivision in autumn 2003.

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

Table 10.2.9 Allocation of the planned stations by subdivision and depth layer in autumn 2003.

Sub-division Depth layer	22	23	24	25	26	27	28
10 - 39	22	3	29	20	6	3	8
40 - 59			18	27	5	2	7
60 - 79				19	8	2	7
80 - 100				7	12	3	13
100 - 120					2		
Total	22	3	49	72	33	10	35

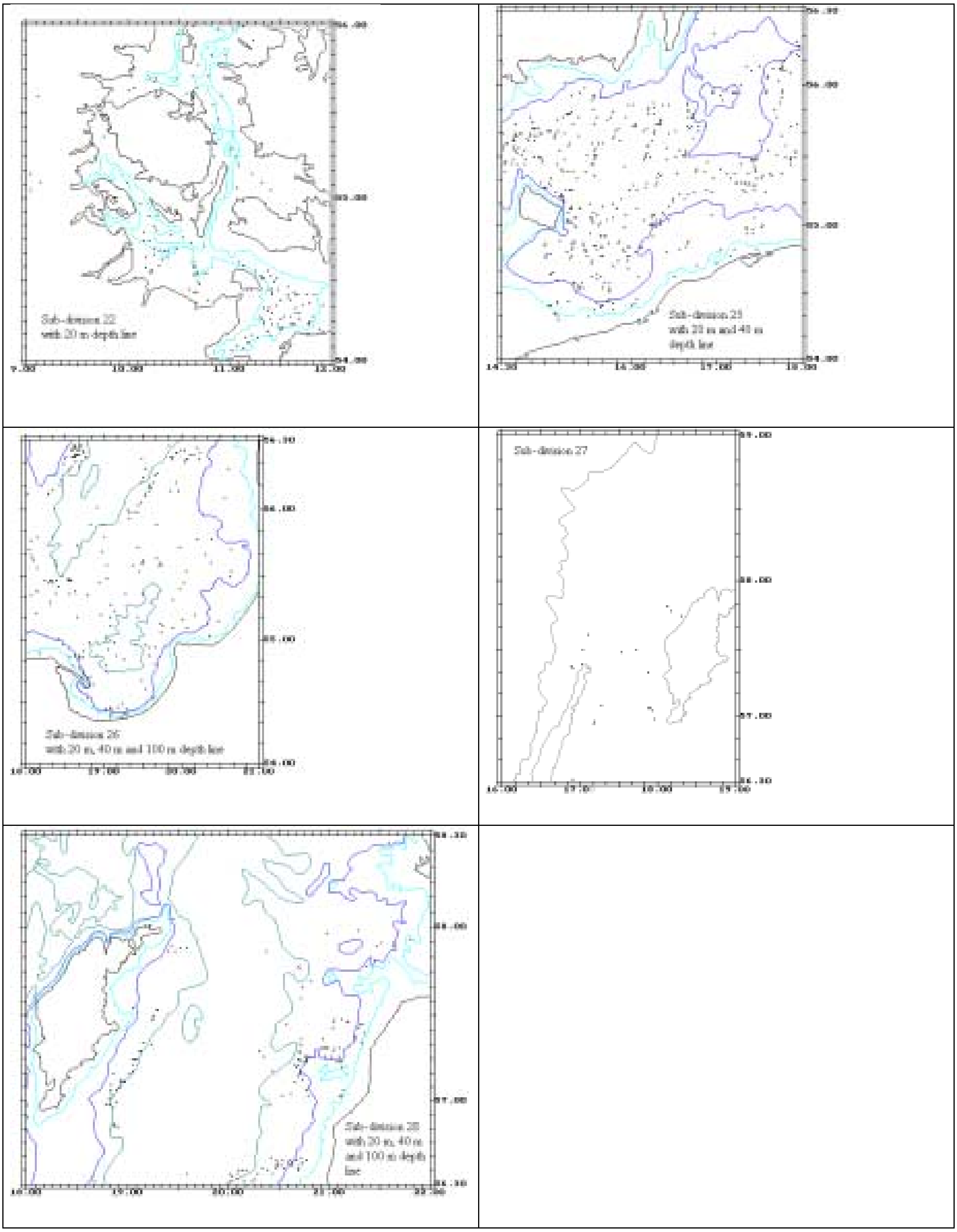


Figure 10.1 First position of the available stations by subdivision.

11 BALTIC INTERNATIONAL TRAWL SURVEY DATABASES

11.1 BITS Manual

The "Manual for the Baltic International Demersal Trawl Surveys" Version 3.01 (Annex 1 to ICES CM 2001/H:02) was revised. Mainly the chapters of the fishing methods were changed taking into consideration the latest results concerning standard gears, fishing positions, and standard fishing operations. The description and use of the international standard trawls are added as Appendix XIII for TV3 520 meshes and Appendix XIV for TV3 930 meshes. They are taken from Annex 2 of the Final and Consolidated Report of the EU Study Project ISDBITS (No 98/099). For Appendix XIII the “Parts List” in the position “Trawl doors” was changed, and the “Check list for rigg” was exchanged. In Appendix XIV a drawing of the Danish stone panel is added.

The BIFSWG was of the opinion that the new revised version of the Manual could be taken as a final one. Therefore it was agreed to take it as Addendum to this WG report.

If in future important changes of the Manual will be necessary a Corrigendum should be prepared during a BIFS meeting and distributed to all participants of the Baltic international trawl surveys.

11.2 DATRAS exchange format

The working group discussed changes to the exchange format suggested by the International Bottom Trawl Survey Working Group and decided to adapt all of them to ensure one common standard for all trawl surveys, which deliver data to ICES. Some of the changes are small adjustments, however, others will require data to be delivered in a new way and will affect the way the national institute extract their data. The major changes to the format will be described in ANNEX 4.

The changes will first be implemented in 2004 when the DATRAS project ends and the checking program and the ICES database can handle the format.

12 RECOMMENDATIONS

12.1 Hydroacoustic surveys

Two databases are established now to store the data of the hydroacoustic surveys in the Baltic Sea. BAD1 contains the following aggregated results:

- the stock in number of herring and sprat by age group, ICES sub-division and rectangle
- the mean weight of both target species by age group, ICES sub-division and rectangle

Data of the year from 1991 to 2001 are available now. The database BAD2 summarizes the disaggregated acoustic and biological data of the surveys. The first data are stored in this database, but it is necessary to put in the data from 1991 to 2001 as fast as possible. However, different test during the meeting showed that the uploading of national data into the database does not work.

Both the databases (BAD1, BAD2) should be used for special analyses and should be enable to utilize the acoustic data for time series analyses and a number of other studies apart from direct stock estimation.

The following important working items, must be considered for the future:

- The actual yearly input of biological and hydroacoustic data to the database BAD2 should be intensively continued.

- The responsibility of the maintenance of the database BAD2 should be devoted to the ICES headquarters to make sure that an uploading of data is always possible and that the database is available for studies during the assessment working groups.

- The coverage of the autumn hydroacoustic survey by different nations in the Baltic Sea should be maintained at the actual high level. Additionally Subdivisions 29N, 30, 31 and 32 should be covered during the future surveys.

- In order to get a complete picture of herring and sprat distribution in the Western Baltic area (Skagerrak, Kattegat, Subdivisions 22-24) the whole area should be covered at the same time. At present the Western Baltic area is covered by two separate surveys in different time of the year. One is carried out in July (Skagerrak, northern Kattegat) and the other in September/October (southern Kattegat, Subdivisions 22 to 24). The July survey is connected to the North Sea acoustic summer surveys whereas the October survey is linked to the Baltic Sea acoustic surveys.

- The main results and the cruise reports from future acoustic surveys as well as cruise descriptions from all participating vessels should devote to N. Håkanson, Lysekil, Sweden until the 1st of February 2003. The data of BAD1 should be submitted in the proposed exchange format at least two months before the WGBIFS meeting to E. Götze. Hamburg, Germany and the data of BAD2 to P. Faber, Hirtshals, Denmark.

- An evaluation must be made on how to average several hauls in a rectangle and on how to treat rectangles without hauls.

- A relevant way to publish the data from the hydroacoustic surveys should be considered and evaluated to keep record of survey results. The format used in the ICES Planning Group for Herring Surveys (PGHERS) is suggested to use for the next meeting, see Annex 5.

- 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 2001 and 2002 should be reported to the next meeting of the WGBIFS.

12.2 BITS surveys

The following important working items, must be considered for the future:

- A new model was proposed to estimate the conversion factors between the national gears and the new standard gears. The analyses of the available data sets showed that additional inter-calibration experiments are necessary. Such experiments should be carried out during the next surveys.

- The analyses of the Clear Tow Database showed that the feedback from the realized station is necessary to improve the quality of the database. Therefore, the data of all realized stations should be submitted to Germany until 20 December (autumn surveys) and 4 April (spring surveys). Furthermore, the databases should be revised according to the proposals of the working group.

- Preliminary studies of available hydroacoustic data have shown that cod can be observed in pelagic layers in areas with low oxygen content in the bottom layer. These analyses should be continued and the results should be presented during the next meeting.

12.3 Next meeting in year 2002

12.3.1 Time and venue

The Working Group discussed its next meeting (to be decided at the Annual Science Conference in Copenhagen, Denmark) and WGBIFS recommends that it will meet five days from 7-11 April 2003 (Chair: Rainer Oeberst), at ICES Headquarters to assist WGBFAS and ACFM.

12.3.2 Terms of reference

According to Annual Science Conference Resolution in Copenhagen, Denmark (C.Res.2002/x:xx) The Baltic International Fish Survey Working Group [WGBIFS] (Chair: Rainer Oeberst) will meet in ICES Headquarters from 7-11 April 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 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.

g) Update and correct the Clear Tow Database

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

i) Update, if necessary Baltic International Trawl Survey manual (BITS).

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 2002 Annual Science Conference in Copenhagen.

Justifications

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

The most important future activities are to combine and analyze acoustic survey data for Baltic Fisheries Assessment Working Group, develop disaggregated hydroacoustic database, plan and decide on acoustic surveys and experiments to be conducted. The quality assurance of ICES will require achievements towards a fully agreed calibration of processes and internationally agreed standards.

13 REFERENCES

Gasyukov, P.S. 2002. Selection of model to estimate conversion factors based on comparative tests of trawls used in the bottom survey of the Baltic fishes. Working Document, ICES WGBIFS, Copenhagen 8-12 April 2002: 1-17.

Hinrichsen, H.-H., Böttcher, U., Oeberst, R., Voss, R., Lehmann, A. 2001. The potential for advective exchange of the early life stages between the western and eastern Baltic cod (*Gadus morhua* L.) stocks. Fisheries Oceanography 10 (3), 249-258.

ICES. 1992. Report from FTFB subgroup: evaluation of sources of variability in the bfishing power of the GOV trawl. ICES C.M. 1992/B:39

ICES 1994b. Report of the Working Group on the Assessment of Pelagic Stocks in the Baltic. CM 1994/Assess:16.

ICES 1995. Report of the Study Group on Data Preparation for the Assessments of Demersal and Pelagic Stocks in the Baltic. CM 1995/Assess:17Ref:J. 104 p.

ICES. 1996: Report of the Baltic International Fish Survey Working Group. ICES Counc. Meet. Pap./ J 1:46pp.

ICES, 1996: Addendum to Report of the Baltic Fish Survey Working group – Manual for the Baltic International Trawl surveys. ICES Counc. Meet. Pap./ J 1:27pp.

ICES, 1997: Addendum to Report of the Baltic Fish Survey Working group – Manual for the Baltic International Trawl surveys. ICES Counc. Meet. Pap./ J 4:25pp.

ICES, 1997: Addendum to Report of the Baltic Fish Survey Working group – Manual for the Baltic International Trawl surveys. ICES Counc. Meet. Pap./ J 4:25pp.

ICES, 1997: Report of the Workshop on Standard Trawl for Baltic International Fish Surveys. ICES Counc. Meet. Pap./ J 6:18pp.

ICES 1997. Report of the Baltic Fisheries Assessment Working Group. CM 1997/Assess:12. 506 pp.

ICES, 1998: Report of the Baltic Fish Survey Working group. ICES Counc. Meet. Pap./ H 4:70pp.

ICES, 1998: Appendix 2 to Report of the Baltic Fish Survey Working group – Manual for the Baltic International Trawl surveys. ICES Counc. Meet. Pap./ J 4:70pp.

ICES, 1998: . Report of the 2nd Workshop on standard Trawls for Baltic international Fish Surveys. ICES Counc. Meet. Pap./ H 1:11pp.

ICES 1998. Report of the Baltic Fisheries Assessment Working Group. CM 1998/ACFM:16. 391 pp.

ICES, 1999: Workshop on Baltic Trawl Experiments. . ICES Counc. Meet. Pap./ H 7:15pp.

ICES. 1999: Report of the Baltic International Fish Survey Working Group. ICES Counc. Meet. Pap./ H 1:113pp.

ICES 1999b. Report of the Baltic Fisheries Assessment Working Group. CM 1999/ACFM:16. 505 p.

ICES 1999a. Report of the Workshop of the Baltic Trawl Experiments. ICES CM 1999/H:7, 16 pp.

ICES. 2000: Report of the Baltic International Fish Survey Working Group. ICES Counc. Meet. Pap./ H 2:237pp.

ICES 2001: Report of the Baltic International Fish Survey Working Group. ICES Counc. Meet. Pap./ H 2.

Matthäus, W.; Nehring, D.; Lass, H.-U.; Nausch, G.; Nagel, K.; Siegel, H., 1997: Hydrographisch-chemische Zustandseinschätzung der Ostsee 1996. Meereswiss. Ber., Warnemünde, 24: 1-49.

Matthäus, W.; Nausch, G.; Lass, H.-U.; Nagel, K.; Siegel, H., 1998: Hydrographisch-chemische Zustandseinschätzung der Ostsee 1997. Meereswiss. Ber., Warnemünde, 29: 1-65.

Matthäus, W.; Nausch, G.; Lass, H.-U.; Nagel, K.; Siegel, H., 1999: Hydrographisch-chemische Zustandseinschätzung der Ostsee 1998. Meereswiss. Ber., Warnemünde, 29: 1-69.

Nehring, D.; Matthäus, W.; Lass, H.-U.; Nausch, G., 1994: Hydrographisch-chemische Zustandseinschätzung der Ostsee 1993. Meereswiss. Ber., Warnemünde, 7: 1-68.

Nehring, D.; Matthäus, W.; Lass, H.-U.; Nausch, G.; Nagel, K., 1995: Hydrographisch-chemische Zustandseinschätzung der Ostsee 1994. Meereswiss. Ber., Warnemünde, 9: 1-71.

Nehring, D.; Matthäus, W.; Lass, H.-U.; Nausch, G.; Nagel, K., 1996: Hydrographisch-chemische Zustandseinschätzung der Ostsee 1995. Meereswiss. Ber., Warnemünde, 16: 1-43.

Nielsen, J.R, Hansen, U.J., Ernst, P., Oberst, R., Rehme, W, .Larsson, P.-O., Aro, E., Feldman, V., Karpouchevski, I., Gasyukov, P., Netzel, J., Järvik, A., Raid, T., Sics, I., and Plikshs, M. 2001 (a). Final and Consolidated Report of the EU Study Project No. 98/099 ISDBITS: Improvement of stock assessment and data collection by continuation, standardisation and design improvement of the Baltic International Bottom Trawl Surveys for fishery resource management. EU Report, 2001: 143 pp + VI + 10 Annexes (349 pp.).

Nielsen, J.R. 2001. Inter-calibration experiments: Linking new and old data time series on national level by performing inter-calibration. Note to the ICES WGBFAS, Gdynia Poland 18-27 April 2001: 1-16.

Nielsen, J.R., Lewy, P., and Hovgård, H. 2002 (a, version 2). Comparison of size selection of monitoring survey trawls applying generalized linear models to CPUE-data. Part 1. Working Document, ICES WGBIFS, Copenhagen 8-12 April 2002: 1-44.

Nielsen, J.R., Lewy, P., and Hovgård, H. 2002 (b). Comparison of size selection of monitoring survey trawls applying generalized linear models to CPUE-data. Part 2. Working Document, ICES WGBIFS, Copenhagen 8-12 April 2002: 1-xx.

Oeberst, R. 2000. Proposal of the stratification of the Baltic Sea for the Baltic international trawl survey. ICES C.M. 2000/K:21

Oeberst, R.; Ernst, P.; Frieß, C.C.2000. Inter-calibrations between German demersal gears HG 20/25 and TV3/520 as well as between the gears TV3/520 and TV3/930. ICES Counc. Meet. Pap. Incorporation of External Factors in Marine Recource Surveys K 20: 27 pp., 2000

Oeberst, R. 2001. The importance of the Belt Sea cod for the eastern Baltic cod stock. Arch. Fish. Mar. Res. 49(2), 2001, 83-102.

Pennington, M., Strømme, T. 1998. Surveys as a research tool for managing dynamic stocks. Fisheries Research 37 (1998) 97-106

ANNEX 1

Working Paper

Selection of model to estimate conversion factors based on comparative tests of trawls used in the bottom survey of the Baltic fishes

Selection of model to estimate conversion factors based on comparative tests of trawls used in the bottom survey of the Baltic fishes

P.S. Gasyukov
Atlantic Scientific Research |Institute of Marine Fisheries
And Oceanography (AtlantNIRO)
5, Dm. Donskoy St., Kaliningrad, 236000, Russia
E-mail:pg@atlant.baltnet.ru

For many years the bottom trawling surveys of the Baltic fishes were carried out by research vessels (R/V) of various countries, equipped with traditional fishing gear with different fishing capacity. The decision to standardise fishing gears adopted in 1997 by the Working group (ICES, 1997) required special experiments, which should provide transition from traditional trawls to a standard one. This transition assumes recalculation of abundance indices obtained in the previous years (from 1982 up to the moment of a new fishing gear use in 2001), into respective data of the standard trawl to ensure possibility of the whole time series of abundance indices application in stocks assessment procedures. At the first stages of a new fishing gear operation the opposite problem appeared, when the new fishing gear data should be converted into the data of traditional fishing gear. This particular problem had arisen at ICES Baltic fish assessment working group in 2001 (ICES, 2001a). Recalculation of old indices into new ones is still necessary.

The specialized experiment mentioned above was carried out by the Baltic countries (Denmark, Sweden, Poland, Germany, Latvia and Russia) in 1999 and in 2000 during fulfilment of spring and autumn trawling surveys. During this experiment pair trawlings were carried out along one track with fishing gear change. Two patterns were used: according to one of them the first trawling was carried out by a new standard fishing gear, while the second trawling was made with a traditional fishing gear; according to the second pattern trawlings were carried out in reverse order. The series of similar pair trawlings was carried out by each country.

The material obtained during this experiment was processed with the purpose of the data reduction to a standard trawling duration, and on the basis of this material a database was compiled.

At present a number of researches is known aimed at estimation of conversion factors. Thus, in 2000 German scientists have presented a work (Oeberst et. al., 2000) with theoretical substantiation of the method applied to estimate a conversion factors and results of assessments for fishing gears used at German R/V. The methodical part of this work has been updated (ICES, 2001 b) and the results of assessments (cod and flounder) made by all countries are presented. In 2001 the similar work was carried out by Danish scientists (ICES, 2001) within the framework of European Union project. In the letter sent by R. Nielsen to the Working group on the Baltic fish stocks assessment (WGBFAS), other model of conversion factors estimation was proposed and the results of cod assessments by each country were presented.

Taking into account, that the latter model has not been analysed by the experts, WGBFAS (ICES, 2001a) decided to apply the first model in conversion of abundance indices obtained in spring survey 2001 with the standard trawl TV3 into appropriate data of traditional fishing gears, and to use the resulted values in estimation of standartized abundance indices by age structure according to the procedure adopted by WGBFAS (ICES, 1998), (Sparholt H., Tomkiewicz J., 1998).

Meanwhile, the comparative analysis of these two models shows, that they are based on different theoretical principles and apparently result in different estimates of conversion factors. The direct comparison of results is complicated, since the authors used different length grouping. Besides, in the first model the factors are estimated for the conversion pattern “a traditional trawl into a standard trawl ”, and in second model “ a standard trawl into a traditional trawl”.

The purpose of this work is to propose the method of models comparative analysis for estimating conversion factors applied in recalculation of one fishing gear data into another fishing gear data on the basis special pair trawlings. All calculations were carried out using materials on the Baltic cod.

Existing models of conversion factors estimation

At least two models of conversion factors estimation were proposed (Oeberst et. al., 2000), (Anon, 2001b), (Nielsen R., 2001).

The first model (Oeberst *et. al*., 2000) uses the linear regression dependence between catch per effort (standard trawling) obtained with a traditional fishing gear and catch per effort obtained with a new fishing gear. The regression equations is:

$$Cpue(stand) = a + b \cdot Cpue(trad) \qquad (1)$$

where *stand* means a new trawl TV3, and *trad* means a traditional trawl used by countries in the trawling surveys in the previous years. For example, *trad=Granton* for Denmark, *trad=Gov* – for Sweden, etc. Another modification of the model includes additional term accounting for catch per effort dependence on fish length *L*:

$$Cpue(stand) = a + b \cdot Cpue(trad) + c \cdot L \qquad (2)$$

These models parameters are estimated based on experimental pair trawlings data. This allows to recalculate the available series of abundance indices into estimates corresponding to observations made with the new standard trawl.

It is necessary to note, that with this model the dependence of results on the sequence of pair trawlings fulfilment has been revealed (the first pattern implies the first trawling fulfilment with the new fishing gear and the second one with the traditional trawl; the second pattern implies trawlings fulfilment in reverse order). Therefore in the work the transition is substantiated from conversion factors obtained for a certain sequence of pair trawlings fulfilment to the estimates not depending on this sequence.

Another modification of this model presented in the report of the Working group (Anon, 2001b) applied logarithmic transformation of equations for updated factors and their statistical characteristics.

The model for conversion factors estimation proposed by Danish scientists (Nielsen R., 2001, letter to the Working group WGBFAS) is based on the generalized linear models method (GLM) (McGullagh P, Nelder J.A., 1989). The model is formulated as follows

$$Z_{l,s} \sim \alpha_L + \beta_s + \gamma_{l,s} + \varepsilon_{l,s} \qquad (3)$$

where α_L - terms dependent on fish length represented by the factor variable in contrast to the first model ;

β_S - terms dependent on pair trawlings sequence ;

$\gamma_{L,S}$ - terms dependent on interaction of variables related to fish length and trawling sequence,

$$Z = \operatorname{logit}(p) = \ln(p/(1-p)),$$

and

$$p = Cpue(trad) / [Cpue(trad) + Cpue(stand)].$$

Then

$$p = \frac{C}{1+C},$$

where *C* notate a conversion factor ,

$$C = \frac{Cpue(trad)}{Cpue(stand)} \text{ and } Z=\ln(C).$$

In the latter equation both *Z* and *C* are functions of fish length *L* and trawlings sequence *S*.

The proposed model provides determination of statistical characteristics of unknown parameters according to the generalized linear models method and then statistical characteristics of conversion factors.

The authors of both models carried out appropriate calculations of conversion factors. The direct comparison of these results is complicated, since different data grouping by length classes was applied (in the first model the data, grouped by two-cm classes are used, in the second model - by five-cm classes). Besides the results of the first model are relevant to the version of recalculation of the data obtained with the traditional fishing gear into the data corresponding to the new standard fishing gear, while in the second model the estimation is carried out for recalculation of the fishing gear data into the data of the traditional trawl.

Nevertheless, a rough comparison shows, that the estimations of conversion factors significantly differ. But even if the difference is insignificant, it is necessary to choose the model for practical use. The same conclusion is confirmed by the comparison of mean catches per trawling by different length classes obtained on the basis of samples of the experimental trawling carried out with one trawl and the estimates obtained by means of recalculation of the other trawl data applying respective factors.

The results of such comparison based on materials of experimental pair trawlings carried out by Denmark, Sweden, Germany are shown in Fig. 1 for the first model and in Figure 2 for the second model. It is obvious, that the second model (Danish) provides more precise estimates of mean catch per trawling than first model.

But this conclusion should not be considered as the final one. The point is that the Danish model (Nielsen R., 2001) essentially uses a hypothesis of binomial distribution family in the model (3). According to this model variance of $Z_{e,s}$ is the function of the mean value and parameter ϕ (dispersion), which is equal to 1 in binomial family. However, the results of calculations show, that this multiplier significantly differs from 1: for Sweden it is equal to 3.6, for Denmark - 1.83, for Germany - 2.81, etc. The deviation of ϕ values from 1 results in the phenomenon, known as "overdispersion". One of its indications may be too optimistic estimates of the model parameters standard error. (Indeed, standard errors of conversion factors in the second model are significantly lower than in the first model). However, it seems impossible to estimate the extent of the "overdispersion" problem solution in assessment of the model (3) parameters, though R.Nielsen has mentioned it.

One of probable explanations of the first model results application in calculation of mean estimates based on the pair trawlings material is a small size of the samples used for parameters assessment. Apparently, the fact that pair trawlings data not used in parameters estimation have been included into these calculations essentially affected the accuracy of mean estimates. Another explanation is possible, if the method of lognormal distribution parameters was used in conversion factors estimation, as mentioned in the work by Oeberst R. *et.al*. (2000). This method is described, for example, in the papers by Atchison (1969), Pennington (1983) and others. The fact is, that this method is acceptable in the case if the hypothesis of lognormal distribution is true. Otherwise this method can give unsatisfactory results (Syrjala S.E., 2000).

In Figure 3 the results of comparison of theoretical (lognormal distribution) and empirical distribution functions are presented by individual length-classes based on materials of trawlings carried out by R/V of Denmark, Sweden and Germany. In addition the results of the test by Shapiro-Wilkes (S-Plus, 2001) are also shown. Obviously, that the assumption of lognormal distribution is not always true, and the essential differences between theoretical and empirical functions are especially appreciable in trawlings carried out by R/V of Denmark.

It is apparent that the problem of choosing a model for conversion factors estimation based on pair trawlings data deserves serious attention.

Crossvalidation method applied to the problem of conversion factors estimation

The results verification with independent material not used in the model parameters assessment is one of the most important requirements to the method of selecting models for a particular problem solution. If a large sample of data is available this approach is realized by means of the sample division into two parts - one to tune the model and another – to check of its efficiency.

In the case of small samples it is hardly possible to allocation a representative part of data for checking the model efficiency. In such cases the problem should be settled at the expense of increasing of calculations volume. The problem is solved many times and each time one element is excluded from the sample to be used later in the independent check. The rest part of the sample is used to estimate unknown parameters. After parameters estimation the calculations are carried out corresponding to the model application to the element removed from the sample. The result is compared to the observed value. The set of such comparisons carried out in all sample elements, is a basis of the criterion formation to compare different models.

The procedure described is known under the name of "crossvalidation" (Efron B.,1982), or "moving check" (Vapnik B.N., 1979). Under the name of "jackknife" (Efron B., Tibshirani R.J., 1993) the basic part of this procedure is used for determination of statistical characteristics (variance, standard error, coefficient of variation) and bias of other parameters used in the models.

Let us indicate:

T_1 – index of the fishing gear with the data to be reconstructed using the second fishing gear data ;
T_2 – index of the fishing gear with the data used to reconstruct the data of the first fishing gear;
l – index of the length-class which can include several length-groups;
L – total number of length-classes ;
s– sequence of trawlings in the pair. *s*=1, if the first trawl is used . *s*=2, if the second trawl is used in the pair;
K – total number of pair trawlings ;
k – index of *k-th* pair trawling k =1,2,…, K ;
$CPUE(l,s,T_i,P_k)$ – catch per standard trawling with a trawl $T_i, i = 1,2,$ fish of *l* length-group in P_k pair with S - th sequence of trawlings;
$f(l,s,T_i)$ – conversion factor of $CPUE(l,s,T_j,P_k)$ j ≠ i recalculation into $CPUE(l,s,T_i,P_k)$ for each P_k, k =1,2,…, K pair.

Then, for example, if in the equation

$$\overline{CPUE}\ (20,1,T_1,4) = f(20,1,TV3) \cdot CPUE(20,2,T_2,4)$$

T_1 indicates the trawl $TV3$ used at R/V of Denmark, then T_2 will correspond to the trawl "Granton" in the fourth trawling pair where $TV3$ trawl is used as the first one.

The error of one trawl data conversion into the other one can be estimated by each length-class l as follows:

$$R(l,s,T,P_k) = CPUE(l,s,T_1,P_k) - \overline{CPUE}\ (l,s,T_1,P_k) \qquad (4)$$

where $\overline{CPUE}$ is determined by means of the conversion factor f_m estimated with the model *m*.

If in the equation (4) we indicate (P_k) trawling pair excluded from the sample, then the total error of the crossvalidation method for a particular model *m* is estimated as follows :

$$SSE(m) = \sum_{k=1}^{K} R(l,s,T,(P_k))^2 \ .$$

Statistic characteristics and parameters bias are estimated as follows. Let us assume that excluding the pair trawling *k* from the sample the conversion factor $f(l,s,T_i,(P_k))$ has been obtained. Then the equation by Efron B. (1982)

$$\sigma_f = \left(\frac{K-1}{K} \cdot \sum_{k=1}^{K} \left(f(l,s,T_i,(P_k)) - f(l,s,T_i,(\bullet)) \right)^2 \right)^{1/2}$$

will determine the error of parameter *f*, where $f(l,s,T_i,(\bullet))$ is mean *f* estimated based on all $f(l,s,T_i,(P_k))$, *k=1,2,…,K*, while bias corrected *f* value is estimated by the equation:

$$f_{BC} = K \cdot f(l,s,T_i) - (K-1) \cdot f(l,s,T_i,(\bullet)).$$

In this equation $f(l,s,T_i)$ is the estimate based on the whole sample of pair trawlings.

Example of application

As a practical example of the proposed selection method application we compare two models – Danish model (Nielsen R, 2001) and a model based on Δ-distribution parameters estimation (Pennington, 1983).

The latter method is formulated as follows: A sample $(X_1, X_2,..., X_n)$ of *n* elements including *m* positive ones assumed to be of Δ-distribution, is given. Therefore, the mean estimate of this distribution $\bar{X}$ is determined as follows :

$$\bar{X} = {}^{m}\!/_{n} \cdot \exp(y) \cdot G_m \cdot (1/2 \cdot S^2), \qquad m>1,$$

$$\bar{X} = {}^{X_1}\!/_{n}, \qquad m = 1, X_1 > 0 \qquad (5)$$

$$\bar{X} = 0 \qquad m = 0$$

where

$$G_m(t) = 1 + \frac{m-1}{m} + \sum_{r=2}^{\infty} \frac{(m-1)^{2\cdot r-1}}{m^r \cdot (m+1)\cdot(m+3)...(m+2\cdot r-3)} \cdot \frac{t^r}{r!},$$

$\bar{y}$ and S^2 - estimates of the mean value and variance based on the sample of positive elements logarithms.

Variance of the mean value can be estimated with equations presented in Pennington (1983):

In spite of the facts mentioned above we assume that conversion factors *f* for each length-class have Δ-distribution. Thus, conversion factors can be estimated with the above equations. Since *f* value for specific sample element uses two *Cpue* estimates (for standard and traditional trawls) we assume that *f* = 0, when either of these values or both are equal to zero.

In Tables 1-3 the conversion factors are presented by different length-classes based on Δ-distribution model and Danish model. For the first model factors of variance and estimates bias have been calculated with the “jack-knife” method, while for the second model – with bootstrap method.

It is hardly possible to make a final conclusion concerning accuracy of any model by means of variance factors comparison. In some cases variance factors were obtained mainly for Δ-distribution model (data of Germany), in other cases – for the model by R. Nielsen (data of Denmark and Sweden). In all cases bias of estimates was low.

Calculations confirmed the assumption that in model (3) the “overdispersion” sometimes reduced the standard error value by 2-3 times. Therefore, the true accuracy corresponds to the coefficient of variance of 0.10 – 0.20 in middle length-classes (25-40 cm), While the highest variance factors occur in length-classes of 10 – 25 cm and 40 – 55 cm.

The crossvalidation carried out with the first and the second models in the same sample provides the following mean-root-square error (SSE):

	Model by R. Nielsen			Δ - distribution model		
	Denmark	Germany	Sweden	Denmark	Germany	Sweden
SSE	69.9	147.9	153.8	53.8	151.1	194.0

It should be noted that the Danish sample reduction by 1% gives the following SSE estimates: 19.1 and 21.8 respectively.

Thus, according to the criterion proposed Nielsen's model is more appropriate to estimate conversion factors based on total reference pair trawlings. This is most evident in Figures 4 and 5 where mean catch per trawling is presented by different length-classes as calculated in the sample independent on parameters estimation. It is evident that deviations of mean values based on observations as compared to those based on conversion factors are lower in the Danish model than in Δ - distribution model. It should be also noted that estimates of the Danish model are less accurate than the results based on the total sample of pair trawlings. (Figures 1 and 2).

The results of the Danish model application in conversion factors estimation for TV3-520 (a small standard trawl) data converted into the data of TV3-930 and the data of TV3-930 converted into the data of a traditional trawl used by Sweden, corrected for trawlings sequence, are presented in Table 7. The estimates of standard errors of log-transformed conversion factors were calculated by bootstrap method (Efron B., Tibshirani R.J., 1993). It should be recalled, that in 2001, when all countries used new standard trawls for the first time, prior to the Baltic stocks assessment working group meeting the estimation of cod abundance indices consistent with the data of traditional trawls had been made. In the process of this estimation the value 1.2 was used for TV3-520 and 1.0 for TV3-930. As it is seen from the Table this resulted in underestimation of the younger year classes abundance indices as compared to all countries observations and to data of the countries used the small standard trawl.

References

1998/ACFM: 14.

2000/ACFM: 14.

2000/H: 2.

Aitchison J. 1955. On the distribution of a positive random variable having a discrete probability mass at the origin. J. Am. Stat. Assoc., 50: 901:908.

Вапник В.Н. 1979. Восстановление зависимостей по эмпирическим данным. Москва, «Наука». 447 стр.

Efron B. 1982. The jackknife, the Bootstrap and Other Resampling Plans. Philadelphia, Pa: SIAM. 102 p.

Efron B., Tibshirani R.J. 1993. An Introduction to the Bootstrap. Chapman & Hall. 436 p.

ICES 2001a. Report of the Baltic international fish survey working group. ICES C.M.

ICES. 1997.Report of the workshop on standard trawls for Baltic international fish surveys. ICES C.M. 1997 / J:7.

ICES. 1998. Report of the Baltic Fisheries assessment working group. ICES CM.

ICES. 2001b. Report of the Baltic Fisheries assessment working group. ICES CM.

McCullagh P. Nelder J.A. 1989. Generalized Linear Models. Second Edition. Chapman & Hall. 477 p.

Oeberst R, P. Ernst, C.C. Fried. 2000. Inter-calibrations between German demersal gears HG 20/25 and TV3 520 as well as between the gears TV3 520 and TV3 930. ICES C. M. 2OOO/K:20. 27 p.

Pennington M. 1983. Efficient estimators of abundance for fish and plankton surveys. Biometrics, 39:281-286.

Sparholt H., Tomkiewicz J. 1998. A robust way of compiling trawl survey data for the use in the Central Baltic cod stock assessment. ICES 06/01/9809:27.

Syrjala S. E. 2000. Critique on the use of the delta distribution for the analysis of trawl survey data. ICES Journal of Marine Science, 57:831:842.

Table 1. Estimates of conversion factors for cod on the base of Δ-distribution model for Germany

Length midpoint	Length interval		Seq.First C	Seq.First CV	Seq.First C bias Corrected	Seq. Second C	Seq. Second CV	Seq. Second C bias Corrected
12.5	10	14	0.124	0.3755	0.122	0.112	0.456	0.111
17.5	15	19	0.376	0.3145	0.370	0.180	0.284	0.179
22.5	20	24	0.569	0.2844	0.567	0.163	0.153	0.163
27.5	25	29	0.497	0.1731	0.496	0.220	0.169	0.220
32.5	30	34	0.570	0.1522	0.569	0.248	0.146	0.248
37.5	35	39	0.469	0.1333	0.470	0.410	0.269	0.406
42.5	40	44	0.624	0.2176	0.624	0.281	0.240	0.279
47.5	45	49	0.802	0.2868	0.786	0.244	0.259	0.245
52.5	50	54	0.986	0.2716	0.978	0.323	0.310	0.321

Table 2. Estimates of conversion factors for cod on the base of R. Nielsen's model for Denmark

Length midpoint	Length interval		Seq.First C	Seq.First CV	Seq.First C bias Corrected	Seq.Second C	Seq.Second CV	Seq.Second C bias Corrected
12.5	10	14	0.110	0.235	0.109	0.042	0.257	0.042
17.5	15	19	0.248	0.225	0.261	0.095	0.248	0.101
22.5	20	24	0.454	0.270	0.420	0.175	0.290	0.163
27.5	25	29	0.570	0.184	0.551	0.219	0.212	0.214
32.5	30	34	0.571	0.083	0.562	0.219	0.134	0.218
37.5	35	39	0.520	0.118	0.517	0.200	0.158	0.201
42.5	40	44	0.564	0.132	0.560	0.217	0.168	0.218
47.5	45	49	0.705	0.189	0.684	0.271	0.216	0.266
52.5	50	54	0.958	0.134	0.953	0.369	0.170	0.370

Table 3. Estimates of conversion factors for cod on the base of Δ-distribution model for Sweden

Length midpoint	Length interval		Seq. First C	Seq. First CV	Seq. First C bias Corrected	Seq. Second C	Seq. Second CV	Seq. Second C bias Corrected
12.5	10	14	0.404	0.327	0.400	1.247	0.231	1.247
17.5	15	19	1.814	0.456	1.716	2.674	0.422	2.628
22.5	20	24	1.539	0.342	1.509	1.892	0.414	1.780
27.5	25	29	1.591	0.279	1.582	1.400	0.233	1.400
32.5	30	34	1.797	0.344	1.755	1.408	0.258	1.405
37.5	35	39	1.334	0.187	1.330	2.412	0.378	2.413
42.5	40	44	1.537	0.314	1.539	1.241	0.215	1.272
47.5	45	49	1.241	0.276	1.234	1.176	0.223	1.198
52.5	50	54	1.770	0.434	1.859	1.389	0.472	1.354

Table 4. Estimates of conversion factors for cod on the base of R. Nielsen's model for Sweden

Length midpoint	Length interval		Seq. First C	Seq. First CV	Seq. First C bias Corrected	Seq. Second C	Seq. Second CV	Seq. Second C bias Corrected
12.5	10	14	0.716	0.260	0.724	0.801	0.322	0.806
17.5	15	19	1.073	0.197	1.078	1.200	0.274	1.201
22.5	20	24	1.316	0.268	1.317	1.472	0.328	1.467
27.5	25	29	1.414	0.261	1.384	1.581	0.323	1.542
32.5	30	34	0.952	0.210	0.978	1.064	0.283	1.089
37.5	35	39	1.001	0.193	1.012	1.119	0.271	1.127
42.5	40	44	1.023	0.195	1.029	1.144	0.273	1.146
47.5	45	49	1.030	0.304	0.985	1.152	0.359	1.098
52.5	50	54	1.626	0.429	1.506	1.818	0.470	1.678

Table 5. Estimates of conversion factors for cod on the base of Δ-distribution model for Germany

Length midpoint	Length interval		Seq.First C	Seq.First CV	Seq.First C bias Corrected	Seq.Second C	Seq.Second CV	Seq.Second C bias Corrected
12.5	10	14	1.724	0.183	1.741	0.811	0.142	0.815
17.5	15	19	1.431	0.163	1.430	0.962	0.200	0.967
22.5	20	24	1.602	0.119	1.615	1.065	0.188	1.064
27.5	25	29	1.265	0.095	1.270	1.281	0.163	1.280
32.5	30	34	1.144	0.138	1.146	1.508	0.180	1.505
37.5	35	39	1.543	0.179	1.539	1.787	0.208	1.784
42.5	40	44	1.394	0.242	1.417	1.424	0.142	1.422
47.5	45	49	1.450	0.329	1.432	1.020	0.229	1.023
52.5	50	54	0.667	1.571	1.583	0.931	0.364	0.915

Table 6. Estimates of conversion factors for cod on the base of R. Nielsen's model for Germany

Length midpoint	Length interval		Seq.First C	Seq.First CV	Seq.First C bias Corrected	Seq.Second C	Seq.Second CV	Seq.Second C bias Corrected
12.5	10	14	1.138	0.175	1.149	1.124	0.224	1.128
17.5	15	19	1.213	0.180	1.201	1.198	0.228	1.180
22.5	20	24	1.242	0.175	1.252	1.227	0.224	1.229
27.5	25	29	1.058	0.193	1.066	1.045	0.239	1.046
32.5	30	34	1.144	0.170	1.137	1.130	0.221	1.116
37.5	35	39	1.383	0.173	1.379	1.366	0.223	1.354
42.5	40	44	1.185	0.150	1.178	1.171	0.206	1.157
47.5	45	49	1.294	0.165	1.280	1.278	0.217	1.256
52.5	50	54	1.227	0.372	1.246	1.212	0.398	1.223

Table 7. Conversion factors between the gears TV3-520 and TV3-930 and between the gears TV3-930 and traditional gear used by Sweden for cod on the base of R. Nielsen's model corrected for sequence of trawling. (Standard errors were calculated by bootstrap)

Length midpoint	Length interval		Gov <- TV3-930 C Seq. corrected	CV	TV3-930 <- TV3-520 C Seq. corrected	CV
12.5	10	-14	0.764	0.391	0.933	0.324
17.5	15	-19	1.138	0.310	1.070	0.232
22.5	20	-24	1.390	0.402	1.282	0.285
27.5	25	-29	1.461	0.393	1.385	0.281
32.5	30	-34	1.032	0.326	1.560	0.331
37.5	35	-39	1.068	0.304	1.445	0.229
42.5	40	-44	1.086	0.307	1.446	0.186
47.5	45	-49	1.040	0.451	1.353	0.190
52.5	50	-54	1.590	0.622	1.404	0.306

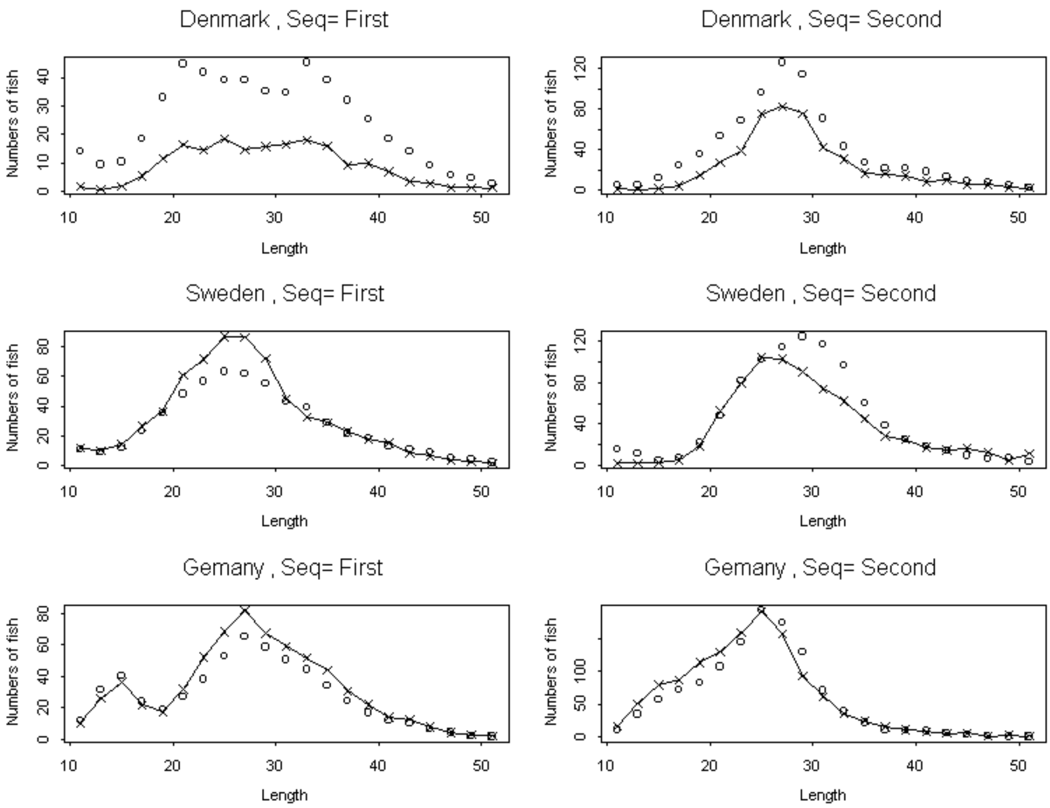


Figure 1. Mean *cpue* values observed (°) and calculated (×) by the model (Oeberst R. et al, 2000) on the base of dependent (full) sample of pair trawlings

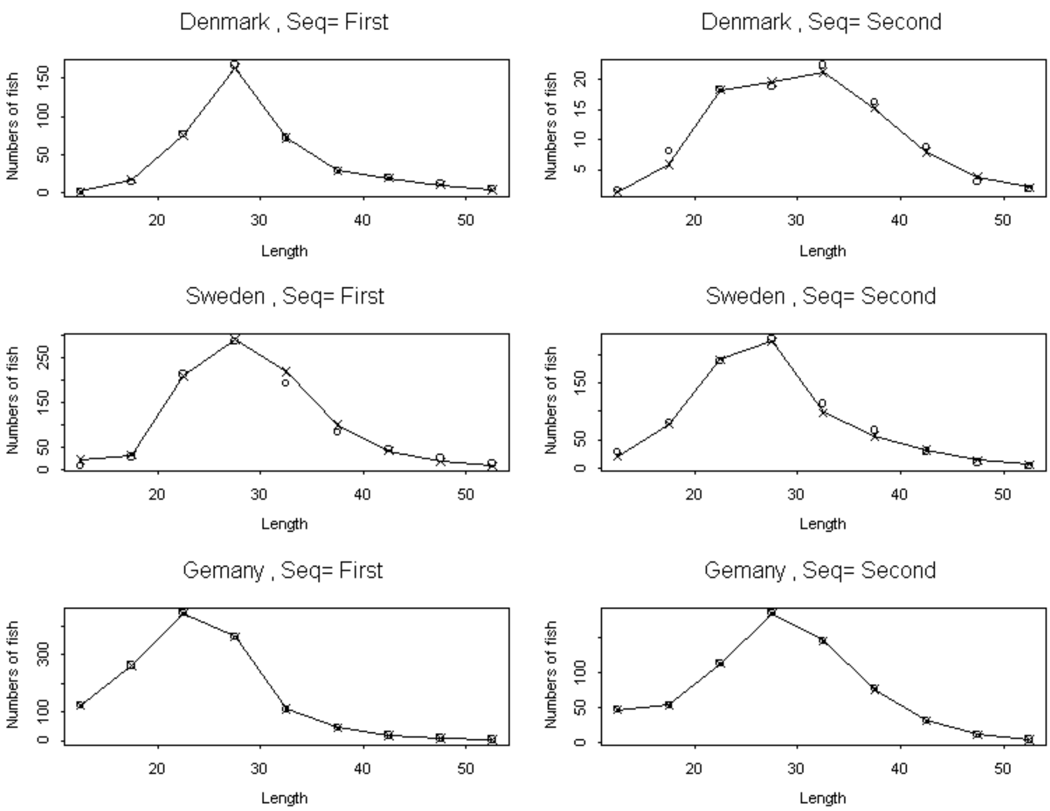


Figure 2. Mean *cpue* values observed (°) and calculated (×) by the model (Nielsen R., 2001) on the base of dependent (full) sample of pair trawlings

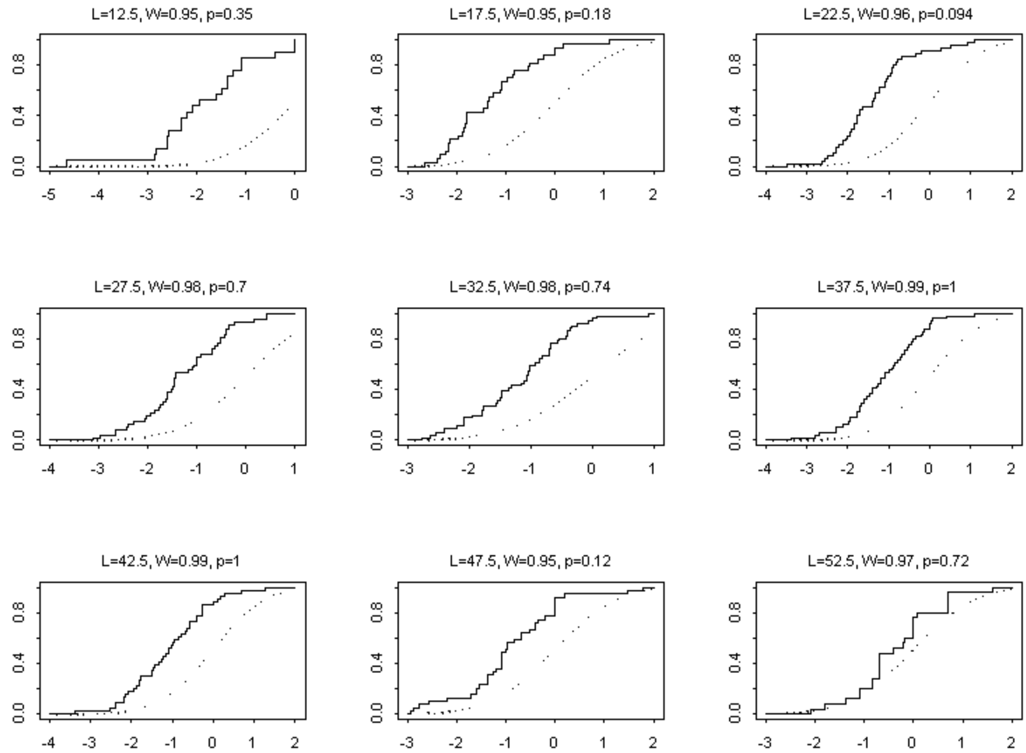


Figure 3. Theoretical lognormal and empirical distribution functions of the *cpue* values for separate length groups of cod on the base of pair trawlings (Denmark) (L-midpoing of the length interval in sm, W-statistic of the Shapiro-Wilks test for normality, *p – p-values)*

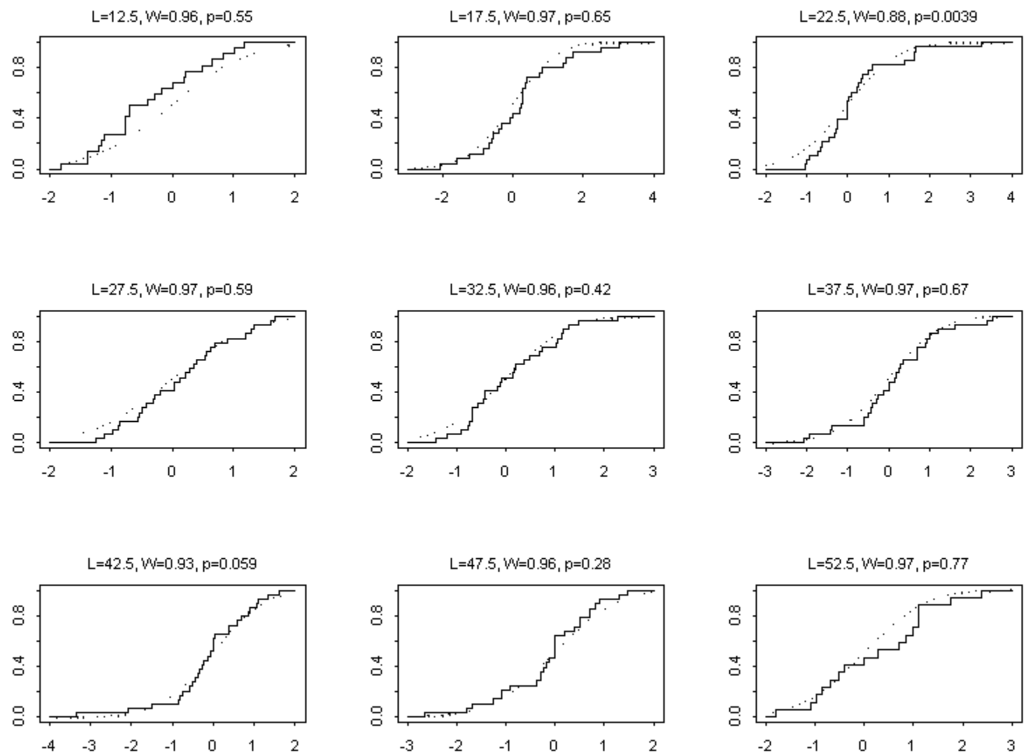


Figure 4. Theoretical lognormal and empirical distribution functions of the *cpue* values for separate length groups of cod on the base of pair trawlings (Sweden) (L-midpoing of the length interval in sm, W-statistic of the Shapiro-Wilks test for normality, *p – p-values)*

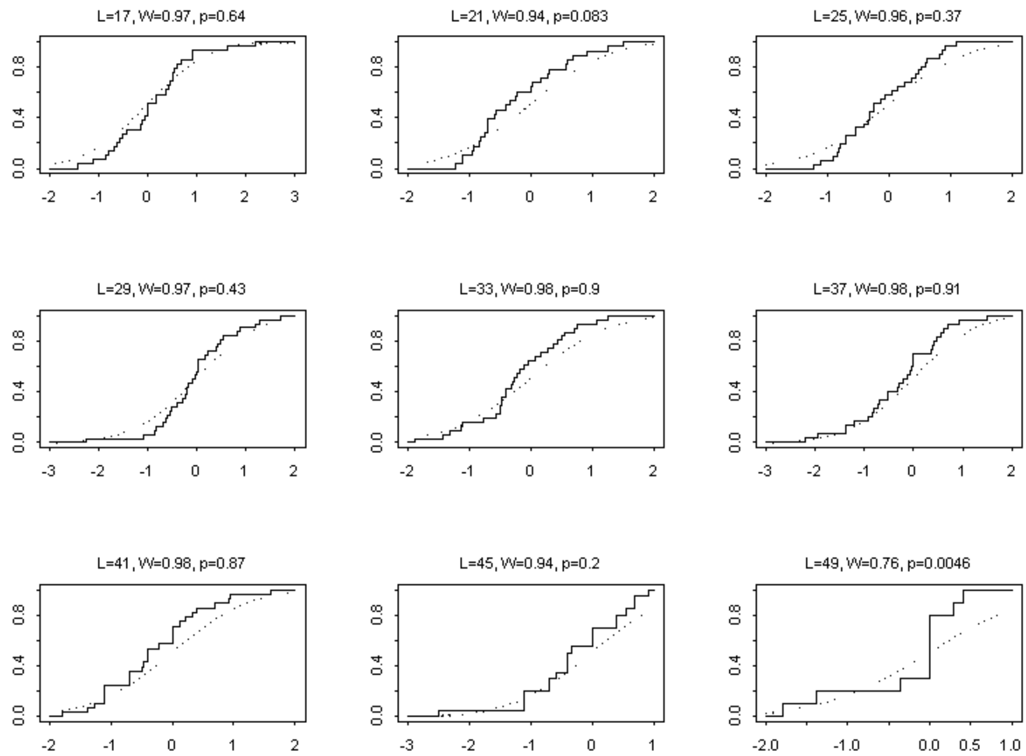


Figure 5. Theoretical lognormal and empirical distribution functions of the *cpue* values for separate length groups of cod on the base of pair trawlings (Germany) (L-midpoing of the length interval in sm, W-statistic of the Shapiro-Wilks test for normality, *p – p-values)*

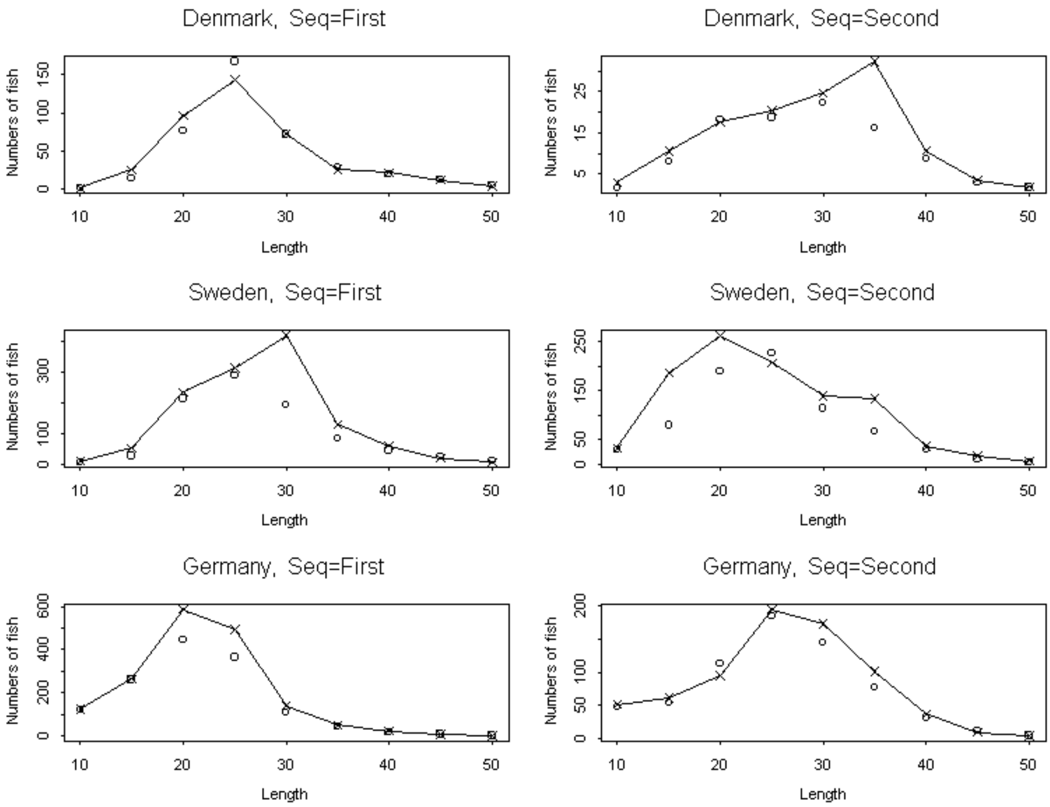


Figure 6. Mean *cpue* values observed (°) and calculated (×) by the Δ-distribution model on the base of independent sample of pair trawlings

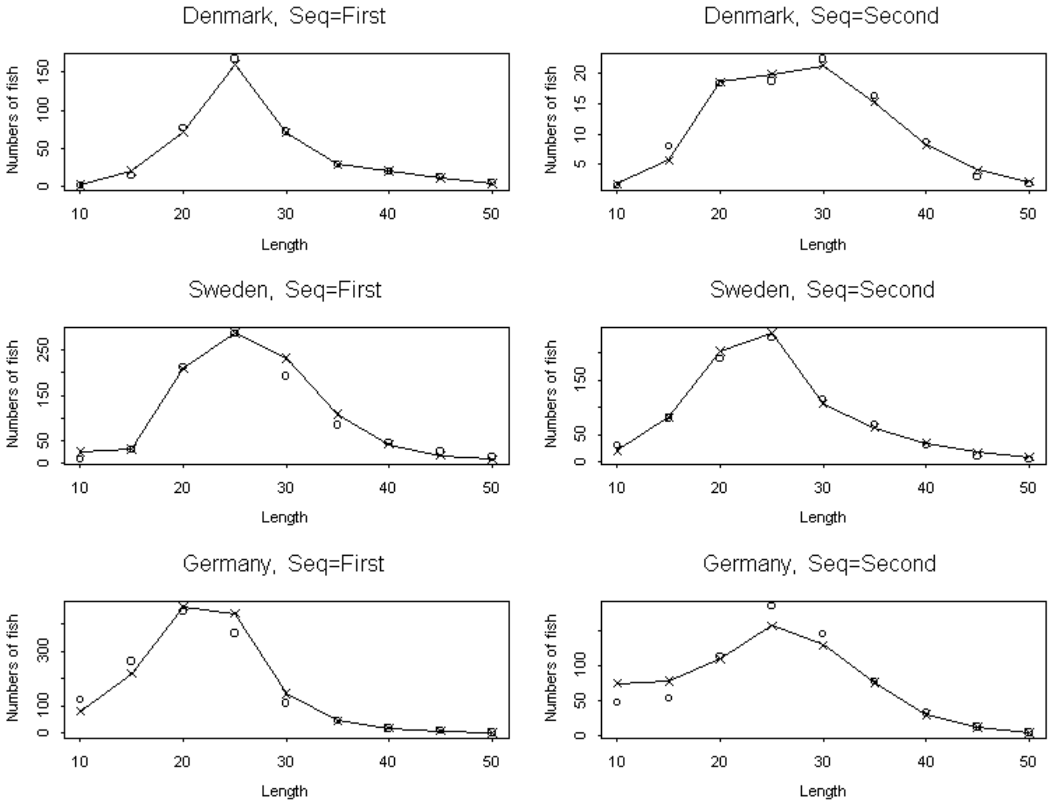


Figure 7. Mean *cpue* values observed (°) and calculated (×) by the model (Nielsen R., 2001) on the base of independent sample of pair trawlings

ANNEX 2

Working Paper:

Comparison of size selection of monitoring survey trawl applying generalized linear models to CPUE data

ICES Baltic International Fish Survey Working Group, 8-12 April 2002

Comparison of size selection of monitoring survey trawls applying generalized linear models to CPUE data

(Part 1)

J. Rasmus Nielsen
Peter Lewy
Holger Hovgård

Danish Institute for Fisheries Research (DIFRES), Department of Sea Fishery, Charlottenlund Castle, DK-2920 Charlottenlund, Denmark

Introduction

The implementation of the EU Common Fisheries Policy (CFP) is dependent on regular stock assessments. In order to achieve sustainable exploitation of fisheries resources improved data quality and methods of fish stock assessment techniques are required. The currently used assessment methods for demersal fishery resources, especially the cod stocks in the Baltic Sea, are mainly fishery based, but they also depends heavily on the use of fishery independent survey stock abundance estimates for calibrating the stock assessments in order to determine the recent levels of stock sizes and fishing mortality. The data from the fisheries have proven unreliable in periods where the need for reliable assessments was most pertinent. For example the official catch statistics of eastern Baltic cod is of rather poor quality. In view of the deteriorating landing statistics and problems in the biological sampling of landings there is an ever increasingly demand for high quality and reliable long time series of data from fishery independent sources such as resource surveys in the Baltic. In the assessment of Baltic cod stocks the data time series of the Baltic International (bottom) Trawl Survey (BITS) is very important.

The increasing reliance on surveys was, however, not previously matched by an improvement in the survey methodology and survey design standardisation in the Baltic. Regular bottom trawl surveys have so far been carried out by Denmark, Germany, Latvia, Poland, Russia and Sweden covering ICES (International Council for Exploration of the Sea) Subdivisions 21-28. Previously, BITS was not implemented according to a co-ordinated and standardised common survey stratification scheme and survey design, i.e. were not using a standardised gear and were covering different areas that were surveyed in different periods of the year. The traditional national gears used varied significantly both with regard to their overall efficiency as well as their selection properties towards various age groups of Baltic cod and towards other demersal fishery resources (e.g. flounder). Previously, only the methods and data analyses were standardised while sampling was carried out with very different vessels and trawls, and only a few (insufficient) attempts have been made to inter-calibrate the existing trawls. BITS has traditionally been carried out using different haul allocation schemes, e.g. as transects, fixed stations and random stratification, the latter being based either on ICES squares or by depth strata. These lacks in survey standardisation and randomised haul stratification has also resulted in poor quality estimations of fishing power differences between different national research vessels in order to obtain combined survey data time series in the eastern Baltic cod assessment. Recruitment indices were not available for the 1-age-group of cod, but only for the 2-age-group with a large part of the catch prediction being based on average recruitment, because of the traditional use of trawls selective to the 1-age-group for many of these trawls. One of the main problems in the utility of the biological advice for management is that the most recent index for prognoses is 2-year olds, introducing a large uncertainty in the catch forecast due to the contribution of an unknown year class. (Anon. 1987; 1996a; 1997a; 1997c; 1998a; 1998e; Engås and Godö 1989; Hovgård 1997; Larsson 1993; Oeberst and Friess 1994; Schultz and Grygiel 1984; Sparholt and Tomkiewicz 1998; 2000; Walsh 1991). Consequently, it was considered necessary to establish a well co-ordinated BITS survey using the same, common standard trawls and standardised operational procedures that also would provide better cost-benefit for this resource survey (Anon. 1995; 1996a; 1996b; 1997a; 1997b; 1998a; 1998b; 1998d; 1998e).

New BITS trawls were recommended by ICES in 1998 (Anon. 1998a) to achieve better quality data for calibration and strengthen the stock assessment of demersal fishery resources in the Baltic, and to enable a shift of the recruitment index used in stock assessments of Baltic cod from an age of 2 years to 1 year by introduction of a trawl with better selectivity for the 1-age-group and through modification of survey design to also fully cover this age group, i.e. in order to get better estimates of year class strength for all age groups. Besides the need to obtain efficient estimation indices of abundance and distribution of both pre-recruiting year classes of cod to the fishery as well as of adult cod abundance (SSB) and distribution, also good quality estimates of abundance, distribution and SSB-level of flatfishes, notably flounder, were needed as well as of reasonable catch efficiency for non-commercial species with the aim of detecting large-scale changes in populations. (Anon. 1996a; 1997a; 1998a; 1998e). ICES anticipated that unless determined action were taken within near future the establishment of a new survey could well take several years. This pessimism was based on the fact that only few Baltic Fisheries Institutes were able to procure a new standard gear within the near future (Anon. 1996a; 1997a; 1998a; 1998e), and the new survey would not be of use for assessment purposes before a time series of at least five years was available. This period and the transition phase could be shortened considerable if experiments with comparative fishing trials were carried out to calibrate new standard gear catch efficiencies to those of the existing gears when ship resources were specifically allocated to this task.

One main purpose of the EU ISDBITS Project, 1999-2001, (Nielsen *et al*. 2001) was to introduce a standardisation and optimisation of design, gear rigging and operation of a standard trawl gear, as well as by making an evaluation of and a suggested revision of a standardised survey design and haul stratification. Other main objectives of the project were to carry out between gear inter-calibration experiments on national basis to obtain direct, national inter-calibration estimates between the existing gears and the new standardised gear in full scale for each of the relevant research vessels in relation to BITS in 1st and 4th quarter of the year. Furthermore, the aim was to inter-calibrate two different sizes of the new standard TV3-trawl and, additionally, to test 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. Finally, in order to obtain inter-calibration estimates a major aim and task 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. The purpose of the present paper is to develop a robust statistical analysis model to be used for analysis of inter-calibration data. The method used provide statistical estimates of the conversion factors as well as estimates of the certainty and reliability of the estimated conversion factors, i.e. the variance and confidence limits of the estimates of the conversion factors, as well as the disturbance effect of the different types of trawls.

Based on this method the existing national survey data time series could be converted to the units of the new standard trawl (or the opposite way around) and could 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, were 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.

Materials and methods

Field tests and between gear inter-calibrations on national level between the currently used trawl gears and the new standardised full scale TV3-trawls gears in relation to the current BITS survey were carried out in 1st and 4th quarter of both 1999 and 2000. Additionally, Danish field tests were performed with repeated hauls with the new standard TV3-trawls in 1st quarter 2002 with the large TV3-930 trawl on board R/V Dana, and in 1st quarter of 1995 with the small TV3-520 trawl on board R/V Havfisken.

Materials and Experimental design

Three types of inter-calibration experiments were 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.
Type = 2: The experiment for which a haul of the new gear is followed by a haul of the old gear.
Type = 3: The experiment for which a haul of the new gear is followed by a haul of the new gear.

For all types of inter-calibrations repeated parallel (overlapping) hauls at the same locality with the two different gears or with the same gear have been carried out on selected localities in relation to the BITS survey. The inter-calibrations have been carried out in form of experimental surveys designed specifically to derive conversion factors on a national level. This approach is considered optimal, as it was possible to select appropriate areas and periods where good concentrations of fish most probably were available covering all important size groups and species in the Baltic. Thus, occurrence of a relatively high abundance of a broad size range of both cod and flatfish was assured. Furthermore, such inter-calibration experiments on national level made it more easy to assure that the fishery with the different gears or with the same gear for inter-calibration was overlapping in time and space, i.e. assuring that fishery to a high degree was performed on the same underlying fish population. The inter-calibration stations were selected based on recent catch rates obtained during the BITS survey.

The comparative fishing with the new standard TV3-gear and the (old) traditional, national trawl gear, or with the new gear twice, were made on the same trawl track lines, which were covered by trawling in the same direction. The second haul was made immediately after the first. The duration of the two comparative trawl hauls was set at 0.5 hours each, with the same trawling speed. In order to reduce bias from possible effects of 1st hauling on 2nd hauling such as disturbance effects in form of a depletion effect or an attraction effect or other effects, the order of the gears was alternated between stations, i.e. following the sequence shown in the table below. Furthermore, the sequence of each gear was recorded in the data.

Station	1	2	3	Etc
Gear used	New-Old	Old-New	New-Old	Etc.

This experimental design was in general followed during the spring and autumn 1999 and 2000 inter-calibrations. However, on board some vessels it was impossible to shift trawls and trawl doors as often as on every second fishing station. This has resulted in larger sequences of hauls with the same trawl, but, still with good overlap in time and space of the paired hauls with the two different trawl types, and with the possibility of analyzing the sequence effect of which trawl was used first or next in the fishing trial. This was the case for the performed Russian and the Latvian inter-calibration experiments.

Field tests and inter-calibration were also made for the new standard, full scale TV3 trawls of two different sizes, i.e. large (TV3#930) and small (TV3#520) TV3 trawls in 1999-2000. The national research vessels available in the Baltic differ considerably with regard to size and engine power. To make use of the vessel potential two different gear sizes were introduced – one for vessels below 500 HP and one for vessels above 500 HP. The use of two different gear sizes determined by vessel size required inter-calibration between them which was performed on a medium sized vessels capable of operating both sizes of gears for reasons of minimizing causes of variability, i.e. the German R/V Solea. The inter-calibrations were performed with light (standard) ground gear rigged on both the large and small TV3 trawl as this bottom gear construction is used as standard on the small trawls always. Furthermore, field tests and inter-calibration of two different types of ground gear rigging were performed, i.e. light-ground-gear (standard) and intermediate ground-gear in form of a light rock-hopper bottom gear, respectively, for soft and hard (rocky) bottom types for the large TV3#930 trawls. The catchability of small cod and flatfish are known to be very dependent on a good bottom contact of the gear that is associated with using light ground rope arrangement in the trawls. The bottom conditions are, however, rough in some Baltic Sea areas and varies a lot from soft mud over stony seabed to hard rock, this implying a need for also using relatively heavy ground rope arrangements (large bobbins / rock hopper discs) where needed in order to obtain sufficient coverage of the Baltic Sea. In order to avoid damage to the trawl the ground-gear of the net has to reflect the bottom conditions. On rough bottom a large diameter ground-gear should be used which can lift the footrope and the netting in the lower belly clear of stones and rocks. On sandy bottom the surveys are to be conducted all over the area, and the standard trawl gear, therefore, has to be very flexible. Therefore, it is recognised that the choice of ground gear is a trade off between efficiency and the versatility in the areas that may be covered.

The method used for calculation of conversion factors between the two trawl sizes (and between trawls mounted with the two ground gear types) were the same as used for the national trawl inter-calibrations.

Data selection: criteria and processes

The inter-calibration analyses were primarily targeting cod. The need for calculating conversion factors between traditional national trawls and the new standard TV3 trawls for the Baltic cod is obvious because the BITS survey data are used directly in tuning of the analytical stock assessments made by ICES for both the eastern Baltic and western Baltic cod stocks. Among the flatfish covered by BITS there are only made analytical stock assessment for flounder in the central Baltic Sea (ICES) where BITS data is also used for tuning of the assessment while no analytical assessment is made for plaice, turbot, dab and brill in the Baltic Sea. The abundances of these other flatfish species are in general relatively low in the Baltic Sea area. The BITS survey is only directed towards demersal fish species and, consequently, the Baltic stocks of pelagic species (e.g. herring and sprat) were not taken into consideration in the present context.

The results of all trawl inter-calibration experiments were put into a database including data from all involved Baltic countries, and for both inter-calibration years (1999-2000) and both seasons (spring, autumn) as well as data from type 3 experiments from 1995 and 2002. The database contains the following information for each haul performed within a paired inter-calibration haul with two different trawl types or with the same trawl type on national basis: Country, Year, Season, Pair no., Pair no.2, Trawl type, Sequence of the haul with the given trawl type (first or second), Length of fish, CPUE per 1 cm fish length group (per 1 hour trawling). The analyses and estimation of conversion factors between different trawl types were based on extraction of data from this database.

The inter-calibration analyses have been made for the fish length ranges where there are some observations and where the fish are recruited to the trawls. The new standard TV3-trawls (both TV3#930 and TV3#520) do catch cod down to 3 cm in length with relatively high efficiency. The various traditionally used national trawls, except for the Granton-trawl traditionally used by Denmark, do also catch the smaller size group of cod with some efficiency. In general, the smallest size groups of cod (e.g. 2-7 cm) are probably not fully recruited to any of the trawls used. However, conversion factors have been calculated between the different types of trawls on national level also for smaller cod down to 5 cm length and larger fish because the 1-group cod in the first quarter of the year in the eastern Baltic Sea include length classes down to 5 cm (and even smaller fish some years dependent of the timing of the late spawning of the eastern Baltic cod as well as dependent on the biological and hydrographic conditions the 0-groups experience during the 3rd and 4th quarter of the year). On board R/V Dana, cod size classes down to 3-4 cm in length have been caught in trawls in both December (0-group) and in January (early 1-group) surveys targeting juvenile cod since 1995 and onwards in the eastern Baltic Sea (see e.g. EU CORE Project Report: Anon. 1998c; J. Rasmus Nielsen, DIFRES, pers. comm.). However, for some countries the smallest fish size groups have been excluded from the analyses if the average CPUE for these length groups were less than 5 for some trawls (see results). The largest cod, i.e. the cod size groups above 55 cm in length, have been excluded from the analyses because there was only very few individuals caught in these size groups for all trawls and all countries. (The flounders caught in the present inter-calibration experiments mainly covered the length classes (5-) 10 cm to 45 cm for all trawl types and countries. Consequently, flounders within this length interval were included in the analyses.). Generalized Linear Models analyses have been made on summed CPUE data for fish within 5 cm length groups, where the numbers have been rounded within each 5 cm length group because the statistical binomial distribution model applied demands integer values.

The inter-calibration haul pairs included in the analyses were selected by scrutinizing the raw data (CPUE by length, trawl type and country). By plotting the data on a haul-to-haul basis for the paired hauls it was obvious that a few paired hauls should be excluded from the analyses for both fish species. The exclusion of these data has been based on the following objective criteria:

1. Where the sum of CPUE for all fish length groups together of a given species (either cod or flounder) in a given haul was less than 20 individuals in total for each of both hauls in a paired trawling the data from this haul pair have been excluded from the analyses.

2. Where the sum of CPUE for all length groups together of a given fish species (either cod or flounder) was 0 individuals in a given haul pair, i.e. was 0 in both trawls in a haul pair, the data have been excluded from the analyses. These pairs where that was the case did not contribute with any information.

The catch rate data was in the first place standardized to catch per 60 minutes hauling time on haul-to-haul basis, i.e. to CPUE as number caught per 1 hour hauling per fish length group, in the inter-calibration database. However, the inter-calibration hauls actually had the duration of typical 30 minutes, i.e. the actual haul time by trawl type varied typically between 28 and 32 minutes. Because of the relatively high efficiency of the used trawls it was decided that ½ hour hauls were adequate for inter-calibration purposes. Consequently, in the statistical model shown below the CPUE analysed was on ½ hour basis, i.e. on standardized raw data.

Methods

If you like statistics you should skip the section on basic idea and go directly to the section on statistical formulation of the model.

Basic idea and model

The purpose of the model developed is to estimate conversion factors linking the CPUE's of old and new gears. Furthermore, the short-term disturbance effect (see definition below) of disturbance of the old and new gears will be estimated as well.

For a given length group and trawl station Let U_{old} and U_{new} denote the CPUE's of the old and new gears for the type of experiment for which a haul of the old gear is followed by a haul of the new gear. This type of experiment is defined as type = 1. Correspondingly, V_{old} and V_{new} are CPUE's for type = 2 where a haul of the new gear is followed by a haul of the old gear on another station.

The model applied assumes that the fish density is affected by a gear specific factor each time the gear operates. This factor, called the disturbance effect (short time trawling / hauling effect), includes that fish are being removed and fish behaviour is affected. The fish behaviour is not specified, but the fish inside and outside the area tracked may be mixed in any way. The basic assumption is that in average the disturbance effect of a given trawl is unchanged under different conditions and therefore independent of for instance fish density and habitat.

The model further assumes that CPUE for a gear is catchability times the fish density, i.e. the standard catch model. According to this the following model can be formulated:

Type = 1	type = 2
$U_{old} = q_{old} D_1$	$V_{old} = q_{old} \beta D_2$
$U_{new} = q_{new} \alpha D_1$	$V_{new} = q_{new} D_2$

where q_{old} and q_{new} are the catchabilities of the two gears, α is the short term disturbance effect of the old gear, β is the short term disturbance effect of the new gear, and where D_1 and D_2 are the fish density (of the fish species in question) at two different stations. The catchability parameters, q_{old} and q_{new} , expresses the total effect on the catch of all different gear characteristics. The parameters α and β may be less or greater than one as no assumption is made on the total resulting trawling effect that might be the sum of several trawling / hauling effects.

It should be noted that the conversion factors to be estimated are the relationships between catchabilities, $\gamma = q_{new} / q_{old}$. To inter-calibrate the catches for two different gears it is not necessary to know the absolute values of the catchabilities. Further, the conversion factors cannot be estimated without estimating the disturbance effects parameters, α and β .

It will be shown below that the information obtained from an experimental design including experiments of type 1 and 2 only is not sufficient to obtain estimates of the conversion factors. Further information is needed.

The parameters in the model is estimated by assuming that
U_{new} given the sum $U = U_{old} + U_{new}$ is binomially distributed $B(U, p_U)$
V_{new} given the sum $V = V_{old} + V_{new}$ is binomially distributed $B(V, p_V)$
where

$$p_U = \frac{U_{new}}{U_{old} + U_{new}} = \frac{q_{new} D_1}{q_{old} D_1 + q_{new} \alpha D_1} = \frac{\gamma}{\gamma + 1/\alpha}$$

and

$$p_V = \frac{V_{new}}{V_{old} + V_{new}} = \frac{q_{new} D_2}{q_{new} D_2 + q_{old} \beta D_2} = \frac{\gamma}{\gamma + \beta}$$

When only the two types of experiments mentioned are available we only can estimate P_U and P_V . Intuitively, this means that we have two equations to estimate three parameters, α, β and γ , which is not possible. It can be shown that only relative estimates of conversion factors and the disturbance effects can be obtained in this case.

To obtain absolute estimates of the conversion factors further information is required. Therefore, additional hauls with R/V Dana, Denmark, have been conducted, where the new standard TV3-trawl (large TV3-930) has been applied twice at each station. This has been defined as an experiment of type = 3. For vessels using the small standard TV3 trawl (TV3-520) as the new gear the additional type 3 information already are available from previous surveys performed in spring 1995 with the Danish vessel, R/V Havfisken.

Statistical formulation of the model including 3 types of experiments

The purpose of the model developed is to estimate conversion factors linking the CPUE's of old and new gears. Furthermore, the short term disturbance effect of the old and new gears will be estimated as well.

The model applied assumes that the fish density is affected by a gear specific factor each time the gear operates. This factor, called the disturbance effect, includes that fish are being removed and fish behaviour is affected. The fish behaviour is not specified, but the fish inside and outside the area tracked may be mixed in any way. The model is based on the basic assumption that in average the disturbance effect is unchanged under different conditions and therefore independent of for instance fish density and habitat. The three types of experiments implemented 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.

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

Type = 3: The experiment for which a haul of the new gear is followed by a haul of the new gear.

For a given length group *l* and station *s* let $U_{old,l,s}$ and $U_{new,l,s}$ denote the CPUE's of the old and new gears for the type = 1. Correspondingly, $V_{old,l,s}$ and $V_{new,l,s}$ are CPUE's for type = 2 whereas $X_{new,l,s}^{first}$ and $X_{new,l,s}^{second}$ are CPUE's for type =3.

The model further assumes that CPUE for a gear is catchability times the fish density. It is furthermore assumed that all CPUE's are poisson distributed with the means:

type = 1	type= 2	type= 3
$E(U_{old,l,s}) = q_{old,l} D_{1,l,s}$	$E(V_{old,l,s}) = q_{old,l} \beta_l D_{2,l,s}$	$E(X_{new,l,s}^{first}) = q_{new,l} D_{3,l,s}$
$E(U_{new,l,s}) = q_{new,l} \alpha_l D_{1,l,s}$	$E(V_{newl,s}) = q_{new,l} D_{2,l,s}$	$E(X_{new,l,s}^{second}) = q_{new,l} \beta_l D_{3,l,s}$

where *E* denotes the expected value, where $q_{old,l}$ and $q_{new,l}$ are the catchabilities of the two gears, α_l is the short term disturbance effect of the old gear, β_l is the short term disturbance effect of the new gear, S is station, and where *D* is the fish density at different trawl stations (hauling localities). The catchability parameters, $q_{old,l}$ and $q_{new,l}$, expresses the total effect on the catch of all gear characteristics. The parameters α_l and β_l may be less or greater than one as no assumption is made on the net effect. The catchabilities as well as the disturbance effects may depend on the length. The length dependence may be different for α_l and β_l.

It should be noted that the conversion factors to be estimated are the relationships between catchabilities, $\gamma_l = q_{new,l} / q_{old,l}$. To inter-calibrate the catches for two different gears it is not necessary to know the absolute values of the catchabilities. Further, the conversion factors cannot be estimated without estimating the disturbance parameters, α_l and β_l.

Now, let

$$C_{new,1,l,s} = U_{new,l,s}$$
$$C_{new,2,l,s} = V_{new,l,s}$$
$$C_{new,3,l,s} = X_{new,l,s}^{first}$$
$$n_{1,l,s} = U_{new,l,s} + U_{old,l,s}$$
$$n_{2,l,s} = V_{new,l,s} + V_{old,l,s}$$
$$n_{3,l,s} = X_{new,l,s}^{first} + X_{new,l,s}^{second}$$

As the CPUE's are assumed poisson distributed we have that:

$C_{new,t,l,s}$ given the sum $n_{t,l,s}$ is binomially distributed $B(n_{t,l,s}, p_{t,l})$

where

$$p_{1,l} = \frac{E(U_{new,l,s})}{E(U_{new,l,s}) + E(U_{old,l,s})} = \frac{q_{new,l}\alpha_l D_{1,l,s}}{q_{new,l}\alpha_l D_{1,l,s} + q_{old,l} D_{1,l,s}} = \frac{\gamma_l}{\gamma_l + 1/\alpha_l} \qquad (1)$$

$$p_{2,l} = \frac{E(V_{new,l,s})}{E(V_{new,l,s}) + E(V_{old,l,s})} = \frac{\gamma_l}{\gamma_l + \beta_l} \qquad (2)$$

$$p_{3,l} = \frac{E(X^{first}_{new,l,s})}{E(X^{first}_{new,l,s}) + E(X^{second}_{new,l,s})} = \frac{1}{1 + \beta_l} \qquad (3)$$

The canonical link function for the binomial distribution, the logit function, has been applied for the analysis:

The logit's for the three probabilities are:

$$r_{1,l} = \text{logit}(p_{1,l}) = \ln(\frac{p_{1,l}}{1 - p_{1,l}}) = \ln(\gamma_l) + \ln(\alpha_l) = \pi_l + \theta_l \qquad (4)$$

$$r_{2,l} = \text{logit}(p_{2,l}) = \ln(\gamma_l) - \ln(\beta_l) = \pi_l + \tau_l \qquad (5)$$

$$r_{3,l} = \text{logit}(p_{3,l}) = -\ln(\beta_l) = \tau_l \qquad (6)$$

where

$$\pi_l = \ln(\gamma_l) = \ln(\frac{q_{new,l}}{q_{old,l}}) \qquad (7)$$

$$\theta_l = \ln(\alpha_l) \qquad (8)$$

$$\tau_l = -\ln(\beta_l) \qquad (9)$$

The logits, (4)-(6) can be combined to one linear equation:

$$r_{t,l} = \pi_l x_t + \theta_l y_t + \tau_l z_t \qquad (10)$$

where

$$x_t = \begin{cases} 1 & \text{if } t = 1 \\ 1 & \text{if } t = 2 \\ 0 & \text{if } t = 3 \end{cases} \qquad (11)$$

$$y_t = \begin{cases} 1 & \text{if } t = 1 \\ 0 & \text{if } t = 2 \\ 0 & \text{if } t = 3 \end{cases} \qquad (12)$$

$$z_t = \begin{cases} 0 & \text{if } t=1 \\ 1 & \text{if } t=2 \\ 1 & \text{if } t=3 \end{cases} \qquad (13)$$

As equation (7) is a linear function of the parameters the theory of generalized linear models (McCullagh and Nelder 1989) has been used to in the analysis applying the binomial distribution with the logit as link function. The equation may be regarded as multiple linear regression with heterogeneous slopes and with *x*, *y*, and *z* as known covariates.

If the assumption of binomial distributed variables do not hold an over-dispersion parameter will be estimated (McCullagh and Nelder 1989).

The model, (10), can be used to test if the conversions factors, γ_l, and the disturbance effects, α_l and β_l depend on the length by applying the standard technique of analysis of variance. This is done by reformulation of (10):

$$r_{t,l} = \pi x_t + \pi_l x_t + \theta y_t + \theta_l y_t + \tau z_t + \tau_l z_t \qquad (14)$$

and by testing the hypotheses

$$H : \begin{cases} \tau_l = 0 \\ \theta_l = 0 \\ \pi_l = 0 \end{cases} \qquad (15)$$

The GENMOD, SAS procedure (SAS 1996) has been used to estimate parameters and testing hypotheses. The p-scale option and Wald's statistics in connection with Type3 contrasts have been used as test in order to include over-dispersion.

Results

Denmark

The number of stations and the average CPUE per station, $\overline{C}_{new,t,l}$, is shown in Table 1. The tests applied requires that the expected value of $C_{new,t,l}$ is larger than 5. This is the case for all length groups except for the largest fish larger than 50 cm and the smallest fish less than 10 cm. For the latter group the results of the χ^2 test should be treated with caution.

The basic model, (10), including all three sets of parameters has been run and the parameters estimated. The results of the tests of significance for over-dispersion and the parameters are given in Table 2, which shows that the estimated over-dispersion of 1.89 is significantly larger than one. The table further shows that the conversion factors, γ_l and the disturbance parameter for TV3-930, β_l, are significant different from one whereas the hypothesis that the disturbance parameter for the traditional national Danish Granton trawl, α_l equals 1 for all length groups is accepted. The model, (10), therefore can be reduced to

$$r_{t,l} = \pi_l x_t + \tau_l z_t \qquad (16a)$$

For this model both effects are significant. However, in order to include estimates of the disturbance factors, α_l, as well, it is chosen to present the results from the full model (10). For this full model the estimated parameters and the 95% confidence limits are given in Figures 1-3 and the Tables 3-5. The conversion factor is decreasing with increasing length: It is between 4 and 10 for fish less than 20 cm, about 2 for fish in the interval 20 - 50 cm and about 1 for fish larger than 50 cm. The Disturbance parameters for TV3-930 are weakly decreasing with length from about 0.5 for the small fish to about 0.3 for the large ones. The Disturbance parameters for the traditional, national Granton trawl shows no trends and are fluctuating around 1 in the interval between 0.7 to 1.3

Germany

The data available for the German experiments are summarized in Table 6. The table shows that the average number of fish caught in general is smaller than 5 for the fish less than 10 cm and for fish larger than 40 cm. This implies that χ^2-approximations probably do not hold and the test results accordingly doubtful. As no data are available for type 3 experiments for length group 7.5 this length group has been left out of the analysis because it is not possible to estimate the corresponding parameters in absolute terms.

The parameters in the basic model, (10), have been estimated, and the tests quantities of the tests $H_1 - H_4$ assuming that the other effects are significant, are shown in Table 7. H_1 indicates that the binomial model is significantly over-dispersed with a dispersion of 2.79.

The tests $H_1 - H_3$ indicate that γ_l and α_l both are equal to one whereas β_l is different from one. With respect to γ_l and α_l we have the following problem: If we assume that γ_l equals one the new estimates of α_l are significantly different from one and conversely. This problem makes it difficult to decide on how the model can be reduced. We therefore have chosen not to eliminate any effects but keeping them both into the model. The estimated parameters and their 95% confidence limits are given in Tables 8-10 and the Figures 4-6. For fish less than 40 cm the conversion is about 0.8. For the larger fish the factor may increase to about one. The uncertainty, however, is great for these fish. The hypotheses that the conversion factor is one cannot be rejected implying that efficiency of the TV3-520 and the HG20/25 is the same. Furthermore, the disturbance of TV3-520 is about 0.6 for fish less than 20 cm indicating that fish density is reduced whereas there is no effect for the larger fish. The HG20/25 trawl apparently has no effect for the succeeding fishery.

The reason for the relatively high uncertainty for the largest length group is that very few fish was caught in this length group.

It should be noted that the results for Germany might be influenced by the origination of the type 3 data used here. The type 3 data for Germany was obtained from fishing with another research vessel than where the type 1 and 2 data originate from, i.e. from the Danish R/V Havfisken, which is a smaller vessel than the German R/V Solea and with much less engine power than R/V Solea. There might be differences in fishing power between the two vessels fishing with the same TV3-520 trawl. This can for example be in relation to different engine effects of the two vessels, and this might influence the results. For example, if type 3 hauls had been made with R/V Solea instead of with R/V Havfisken then catch rates of type 3 probably would have been higher than what is observed now, which consequently would give model results showing less efficiency of the traditional German national trawl compared to the new standard TV3-520 trawl seen in relation to what the results show in the present analyses.

Poland

The number of stations and the average CPUE per station, $\overline{C}_{new,t,l}$, is shown in Table 11. From here it appears that the average number of fish caught is only smaller than 5 for the largest cod larger than 45 cm but not for the smallest fish. Consequently, the results of the χ^2 test for the largest fish groups should be treated with caution as the χ^2 approximations probably do not hold for these.

The basic model, (10), including all three sets of parameters has been run and the parameters estimated. The results of the tests of significance for over-dispersion and the parameters are given in Table 12, which shows that the estimated over-dispersion of 2.45 is significantly larger than one. The table further shows that the disturbance parameter for the traditional national Polish P20/25 trawl, α_l and the disturbance parameter for TV3-930, β_l, are significant different from one whereas the hypothesis that the conversion factors, γ_l, equals 1 for all length groups is accepted. The model, (10), therefore can be reduced to:

$$r_{t,l} = \theta_l y_t + \tau_l z_t \qquad (16b)$$

For this model both effects are significant. However, in order to include estimates of the conversion factors, γ_l, also for Poland, it is chosen to present the results from the full model (10). For this full model the estimated parameters and the 95% confidence limits are given in Figs. 7-9 and the Tables 13-15. The hypotheses that the conversion factor is one cannot be rejected implying that efficiency of the TV3-930 and the P20/25 is the same. No trends can be seen in the Polish conversion factors, however, they have been estimated to below 1 for fish in the size group 20-40 cm and above one for fish smaller and larger than that. The Disturbance parameters for TV3-930 are approximately below 0.3-0.5 for all length groups except for the smallest fish (5-10 cm in length) where it is around 0.7. Consequently, fish density is reduced by this trawl and it seems that the trawl is distracting fish of all size groups. The disturbance of P20/25 has a maximum above 2 in the estimates of the full model (it is very much lower in the estimates of the reduced model). There seems to be a slight tendency to decreasing disturbance with increasing length here. For fish less than 40 cm in length it is larger than 1, and it is less than 1 for fish above 40 cm in length. Thus, fish density seems to be increased for smaller fish (attraction effect) and decreased for lager fish (distraction effect).

Russia

The number of stations and the average CPUE per station, $\overline{C}_{new,t,l}$, is shown in Table 16. From here it appears that the average number of fish caught is smaller than 5 for the smallest cod smaller than 20-25 cm and for the largest ones larger than 50 cm. Consequently, the results of the χ^2 test for these fish size groups should be treated with caution as the χ^2 approximations probably do not hold for these.

The basic model, (10), including all three sets of parameters has been run and the parameters estimated. The results of the tests of significance for over-dispersion and the parameters are given in Table 17, which shows that the estimated over-dispersion of 2.83 is significantly larger than one. The tests $H_1 - H_3$ indicate that γ_l and α_l both are equal to one whereas β_l is different from one. With respect to γ_l and α_l we like for Germany have the following problem: If we assume that γ_l equals one the new estimates of α_l are significantly different from one and conversely. This problem makes it difficult to decide on how the model can be reduced. We therefore again have chosen not to eliminate any effects but keeping them both into the model.

The estimated parameters and their 95% confidence limits are given in Tables 18-20 and the Figures 10-12. For fish larger than 20 cm the conversion factor is 1 and is then decreasing with increasing length down to around 0.5 for larger fish. The Disturbance parameters for TV3-930 trawl are decreasing with length from a level about 0.5 for fish around 20 cm to about 0.3 for the largest fish indicating that fish density is reduced. The disturbance of the HAKE-4M trawl have a tendency to increase with length for fish from 25-50 cm from 0.3 to 1.30 indicating that fish density for large fish is increased, i.e. the large fish are maybe attracted by the trawl and the hauling process.

Sweden

The number of stations and the average CPUE per station, $\overline{C}_{new,t,l}$, is shown in Table 21. From here it appears that the average number of fish caught is only smaller than 5 for the largest cod larger than 50 cm but not for fish smaller than that including the 5-10 cm length group. Consequently, the results of the χ^2 test for only the largest fish above 50 cm should be treated with caution as the χ^2 approximations probably do not hold for these.

The basic model, (10), including all three sets of parameters has been run and the parameters estimated. The results of the tests of significance for over-dispersion and the parameters are given in Table 22, which shows that the estimated over-dispersion of 3.39 is significantly larger than one. The table further shows that the conversion factors, γ_l, the disturbance parameter for the traditional national Swedish GOV trawl, α_l, and the disturbance parameter for the TV3-930 trawl, β_l, all are significant different from one. Therefore the full model (10) cannot be reduced for Russia, where all effects are significant.

The estimated parameters and the 95% confidence limits are given in Figures 13-15 and the Tables 23-25. For fish smaller than 20 cm the conversion factor is around 0.5. It is then decreasing to around 0.3 for fish in the length interval 20-40 cm, and is then increasing to around 0,5 again for fish between 40-50 cm in length. The Disturbance parameters for TV3-930 trawl are for all length groups within the interval 0.3-0.5 and only for the smallest fish between 5-10 cm in length it is higher around 0.7. This indicates that for all fish length groups fish density is reduced. The disturbance of the GOV trawl is for all length groups relatively high above 1 with a tendency to be largest for the smallest size groups of fish (up to around 5-8). This disturbance effect is notably high. This indicates that density for all size groups of fish is increased, which is particularly pronounced for the small fish, i.e. it seems that the GOV trawl and the hauling process with this trawl has a rather high attraction effect. Such high attraction effect cannot immediately be explained from the available data.

Latvia

The number of stations and the average CPUE per station, $\overline{C}_{new,t,l}$, is shown in Table 26. From here it appears that the average number of fish caught is smaller than 5 for the smallest cod smaller than 20 cm and for the largest ones larger than 45 cm. Consequently, the results of the χ^2 test for these fish length groups should be treated with caution as the χ^2 approximations probably do not hold for these.

The basic model, (10), including all three sets of parameters has been run and the parameters estimated. The results of the tests of significance for over-dispersion and the parameters are given in Table 27, which shows that the estimated over-dispersion of 2.87 is significantly larger than one. The table further shows that the conversion factors, γ_l, the disturbance parameter for the traditional national Latvian LBT trawl, α_l, and the disturbance parameter for the TV3-520 trawl, β_l, all are significant different from one. Therefore the full model (10) cannot be reduced for Latvia, where all effects are significant.

The estimated parameters and the 95% confidence limits are given in Figures 16-18 and the Tables 28-30. For fish smaller than 25 cm the conversion factor is above 1 (1.5-2.5) and then continuously decreasing with fish length to around 0.1 for the largest fish up to 50 cm in length. The Disturbance parameters for TV3-520 trawl are less than 1 for the smallest fish up to 25 cm in length and then increasing to above 1 to around 1-1.5 for larger fish. This indicates that for the small fish length groups, fish density is reduced while it is increased for larger fish. The disturbance of the LBT trawl shows a similar tendency where it is less than 1 for the smallest fish up to 30 cm in length and then increasing to above 1 for larger fish with an increasing tendency for increasing fish length. For the largest fish it is very high up to more than 15. This again indicates that for the small fish length groups, fish density is reduced while it is increased for larger fish and, consequently, it seems that the GOV trawl and the hauling process with this trawl has a rather high attraction effect on larger effect but a distraction effect on smaller fish.

Discussion

For the basic model including all parameters and for a given length group the likelihood function is a product of binomial distributions:

$$L_l = \prod_{t,s} \binom{n_{t,l,s}}{C_{new,t,l,s}} p_{t,l}^{C_{new,t,l,s}} (1 - p_{t,l})^{n_{t,l,s} - C_{new,t,l,s}}$$

where $p_{t,l}$ is defined by equation (1) - (3).

It can be shown that the maximum likelihood estimates of the parameters are:

$$\hat{\beta}_l = \frac{1 - \hat{p}_{3,l}}{\hat{p}_{3,l}} \tag{17}$$

$$\hat{\gamma}_l = \hat{\beta}_l \frac{1 - \hat{p}_{2,l}}{\hat{p}_{2,l}} \tag{18}$$

$$\hat{\alpha}_l = \frac{1}{\hat{\gamma}_l} \frac{1 - \hat{p}_{1,l}}{\hat{p}_{1,l}} \tag{19}$$

where $\hat{p}_{t,l} = \frac{\sum_s C_{new,t,l,s}}{\sum_s n_{t,l,s}}$.

Equation (17) and (18) shows that the estimated disturbance parameter, $\hat{\beta}_l$, solely depends on the type 3 experiments whereas, the estimated conversion factor, $\hat{\gamma}_l$, solely depends on the type 2 and 3 experiments (and not on type 1). This means that when type 1, 2 and 3 experiments are available the type 1 experiments do not contain information on the conversion factor, but only information on the disturbance parameter, α_l. However, if type 0 experiments were available where the old gear is used twice at each station, data from all four types of experiments would contribute to the estimation of all three parameters.

It should be emphasized that the estimated conversion factors is based on only a relatively few intercalibration experiments for three types of experiments. In order to obtain more certain, precise and robust estimates of the conversion factors it is strongly recommended to carry out more inter-calibration experiments within future BITS surveys. First of all, type 3 experiments should be performed for all nations on national basis because there now only exist a limited number of type 3 paired hauls and because they are only Danish. Then also type 0 experiments should be conducted. In that context it should be noted that there is no purpose in conducting any more type 1 experiments if no type 0 experiments are carried out. The conversion factors, actually, can be estimated based on type 2 and type 3 experiments alone.

In situations where some effects are tested to be insignificant the equations (17)-(19) do not hold. For instance if $\hat{\alpha}_l$ are tested to be zero and left out of the model the estimates of γ_l depends on all observations from all three types of experiments.

When analysing the Generalized Linear Model using the relationship between the respective catches of the different trawl types on a given station the time and space effects (i.e. the geographical locality effect and the year, season, day, time effect between stations) were eliminated and there was only analysed on the gear selection, the specific gear disturbance effects and fishing power differences by length group. The method used takes account for different underlying population structures, distributions and densities between different trawl stations as a result of time and space factors, i.e. it takes into account that the observations per station and length group might not be identically distributed and independent and having the same variance in the estimation of the variance of the estimated conversion factors. The method weighs with the number of observations in the individual length groups. It is a fact that the individual observations by station and length group have not the same statistical variance partly because the variance is dependent on the number of fish caught which off course varies by station and length group.

In general, the inter-calibration data showed a very high degree of variability for all countries. This was mostly due to the variability in the distribution (by fish species and fish size) of the underlying fish stock the trawls met in different areas and seasons of year (and days), i.e. due to spatial and temporal factors in relation to stock distribution and migration patterns. This variability makes it complicated to obtain an optimal and very robust statistical model to analyze the data, and which can be used in the relative precise estimation of the conversion factors needed for stock assessment purposes taking statistical significant factors influencing the conversion factors into consideration.

However, when pooling data for cod in e.g. 5 cm length groups the variability in data is reduced and the overall trends in the data appears more distinctively.

In general no consistent functional relationship was found between fish length and the catch rate relationships for the various inter-calibration experiments, i.e. no uniform curvature existed between the individual inter-calibration experiments that could indicate a specific distribution pattern and specific functional relationship. Therefore, fish length is included as a discrete variable (effect) in the model. Consequently, the dependence between the length groups of the conversion factor cannot be utilized in the statistical model by performing smoothing with a consistent functional relationship over different length groups because such consistency did not exist.

The analyses have been made country by country because the primary purpose was to compare the traditional national gears with the new standardized TV3 trawl gear on board the respective national research vessels in order to continue national data time series. Consequently, the experiments have not been used for comparison between countries because the experimental design and the data are not fit for the latter type of analyses. Comparison between vessels (and countries) would have demanded full overlap in time and space between the national inter-calibrations in order to estimate fishing power differences between national research vessels.

Usefulness and catch efficiency of the new standard TV3 trawl in relation to stock assessments

The new standard TV3 trawl did in general catch all size groups of cod and flatfish (flounder) that were present in the corresponding (paired / comparative) catches of the traditional national trawls for all nationalities. The TV3-trawl caught the smallest size groups of cod and flatfish (flounder) either more efficiently or just as efficiently as the respective traditional national trawls. The results indicate that the TV3 trawl in general do catch all size groups of cod present in the sea from size 3 cm, however, L50 for the TV3 trawl is higher than 3 cm fish. Consequently, the TV3 trawl at least to some extent catch all size groups of 1-group cod. The trawl, thus, seems to be fit for introducing a good quality prediction of year class index for 1-group cod in the Baltic Sea in the recruitment indices from the BITS survey. This accounted both for the large TV3#930 trawl and the small TV3#520 trawl. The smallest size groups of cod and flatfish sometimes were only to a limited extent present in the catches of the traditional national trawls. This was especially the case for the Danish Granton trawl.

Also for larger size groups of cod (older age groups) the TV3 trawl was in general either more efficient or just as efficient as the national, traditional trawls with respect to catch rates. This also accounts for the larger size groups of flatfish species (e.g. flounder). Consequently, the catch rate data for the new TV3 trawl seems also to be fit to be used in the tuning fleet data time series used in fish stock assessment with respect to the older age groups of cod (that are recruited to the fishery), as well as fit for prediction of year class strengths for older age groups of cod and flatfishes (stock index by age and year, and spawning stock biomass index).

References

Anonymous. 1987. Report of the Study Group on Young Fish Surveys in the Baltic. ICES CM 1987/J:22.

Anonymous. 1995. Report of the Study Group on Assessment-Related Research Activities relevant to the Baltic Fish Resource. ICES CM 1995/J:1.

Anonymous. 1996a. Report of Baltic International Fisheries Survey Working Group. ICES CM 1996/J:1, 49 pp.

Anonymous. 1996b. Report of the Baltic Fisheries Assessment Working Group. ICES CM 1996/Assess:13.

Anonymous. 1997a. Report of the Workshop on Standard Trawls for Baltic International Fish Surveys. Gdynia, Poland, 8-10 January 1997. ICES CM 1997/J:6, 19 pp.

Anonymous. 1997b. Report of the Baltic International Fish Survey Working Group. ICES C.M. 1997/J:4, 52 pp.

Anonymous. 1997c. Report of the Working Group on Fishing Technology and Fish Behaviour. ICES C.M. 1997/B:2

Anonymous. 1998a. Report of the 2nd Workshop on Standard Trawls for Baltic International Fish Surveys. Gdynia, Poland, 23-24 February 1998. ICES CM 1998/H:1, xx pp.

Anonymous. 1998b. Baltic Fish Committee. In: ICES Annual Report for 1996/1997: 164-165.

Anonymous. 1998c. Mechanisms influencing long term trends in reproductive success and recruitment of Baltic cod: Implications f or fisheries management. CORE AIR2-CT94-1226 CEC Project. Final Report, Vol. 1-2.

Anonymous. 1998d. ICES Annual Report for 1996/1997. ICES, January 1998, Copenhagen, Denmark, 306 pp. ISSN 0906-0596.

Anonymous. 1998e. Report of the Baltic International Fish Survey Working Group. Karlskrona 8-13 June 1998. ICES CM 1998/H:4, 72 pp.

Bergh, M. O., Pikitch, E. K., Skalski, J. R, Wallace, J. R. 1990. The statistical design of comparitive fishing experiments. Fish. Res. 9: 143 – 163.

Engås and Godö. 1989.

Hovgård, H. 1997.

Larsson, P.-O. 1993. Preliminär rapport från expedition med U/F Argos, 8. - 19. augusti 1993, (In Swedish). Institute of Marine Research, Lysekil. Mimeographed, 6 pp

McGullagh, P., and J.A. Nelder. 1989. Generalized Linear Models. Chapman & Hall, London, xiii+478 pp.

Millar, R.B. 1991. Estimation of asymmetric selectio curves for trawls. ICES CM 1991/B:56.

Millar, R.B. 1992. Analysis of trawl selectivity studies: Implementation in SAS. ICES CM 1992/B:28, 4 pp.

Millar, R. B., Walsh, S. J. 1990. Analysis of trawl selectivity studies with an application to trouser trawls. ICES C. M. 1990 / B:14

Millar, R. B., Walsh, S. J. 1992. Analysis of trawl selectivity studies with an application to trouser trawls. Fish. Res., 13: 205 – 220.

Nielsen, J.R, Hansen, U.J., Ernst, P., Oberst, R., Rehme, W, .Larsson, P.-O., Aro, E., Feldman, V., Karpouchevski, I., Gasyukov, P., Netzel, J., Järvik, A., Raid, T., Sics, I., and Plics, M. 2001. Final and Consolidated Report of the EU Study Project No. 98/099 ISDBITS: Improvement of stock assessment and data collection by continuation, standardisation and design improvement of the Baltic International Bottom Trawl Surveys for fishery resource management. EU Report, 2001: 143 pp + VI + 10 Annexes (349 pp.).

Oeberst, R. and C.C. Friess. 1994. Vergleich der Fängigket der netze HG 20/25 und Sonderburger Trawl für de im Institut für Ostseefischerei durchgefürten Jungfischaufnahmen. Infn. Fischw. 41 (2): 75-81.

Pennington, M. and T. Strømme. 1998. Surveys as a research tool for managing dynamic stocks. Fisheries Research 37: 97-106.

Rindorf, A., and Lewy, P. 2001. Analyses of length and age distributions using continuation-ratio logits. Can. J. Fish. Aquat. Sci. 58 (6): 1141-1152.

SAS/STAT Software: Changes and Enhancements. 1996. SAS Institute Inc. Cary, NC.

Schultz, N. and W. Grygiel. 1984. First results of intercalibration of young fish trawl used in the Baltic Sea by GDR and Poland. ICES C.M. 1984/J:6 Baltic Fish Committee.

Smith, S. 1997. Analysis of data from bottom trawl surveys. NAFO, Scientific council studies nr. 28, pp. 26 – 55.

Sparholt, H. and J. Tomkiewicz. 1998. A robust way of compiling trawl survey data for the use in the Central Baltic cod stock assessment. ICES CM 1998/BB:1, 33 pp.

Sparholt, H. and J. Tomkiewicz. 2000. A robust method for compiling trawl survey data used in the assessment of central Baltic cod (*Gadus morhua* L.). Arch. Fish. Mar. Res. 48(2): 125-151.

Stefansson, G. 1996. Analysis of groundfish survey abundance data: combining the GLM and delta approaches. ICES J. Mar. Sci. 53: 577-588.

Walsh, S. 1991.

Wantiez, L. 1996. Comparison of fish assemblages sampled by a shrimp trawl and a fish trawl in St. Vincent Bay, New Caledonia. J. mar. Biol. Ass. U.K. nr. 76, pp. 759 – 775.

Warren, W.G. 1997. Report on the Comparative fishing trial between the Gadus Atlantica and Teleost. NAFO Sci. Coun. Studies 29: 81-92.

Tables

Denmark

Table 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	.	.	.	.	4	7,8
12,5	19	9,8	25	15,7	6	12,2
17,5	22	39,5	28	30,1	8	15,8
22,5	24	90,6	28	55,7	8	161,9
27,5	24	157,3	28	47,8	8	299,4
32,5	24	68,6	28	51,5	8	137,1
37,5	24	30,5	27	41,3	8	47,6
42,5	23	20,0	28	19,5	8	43,0
47,5	23	8,6	28	7,5	8	23,8
52,5	22	2,7	23	3,5	7	6,6

Table 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	493	1752	<0.001
$H_2 : \gamma_l = 1$	9	129.46	<0.001
$H_3 : \alpha_l = 1$	9	5.98	0.7423
$H_4 : \beta_l = 1$	10	378.21	<0.001

Table 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	7,81	2,53	24,10
17,5	3,74	1,91	7,34
22,5	2,88	2,12	3,92
27,5	2,21	1,65	2,96
32,5	1,73	1,26	2,37
37,5	1,84	1,17	2,88
42,5	1,99	1,19	3,32
47,5	1,85	0,82	4,19
52,5	1,10	0,27	4,44

Table 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	0,44	0,20	0,96
17,5	0,52	0,29	0,91
22,5	0,47	0,40	0,57
27,5	0,41	0,36	0,47
32,5	0,37	0,30	0,46
37,5	0,38	0,27	0,55
42,5	0,46	0,32	0,65
47,5	0,36	0,22	0,61
52,5	0,33	0,11	0,98

Table 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	1,32	0,31	5,64
17,5	1,19	0,57	2,48
22,5	0,76	0,54	1,07
27,5	0,79	0,58	1,07
32,5	1,02	0,72	1,45
37,5	1,07	0,65	1,78
42,5	0,95	0,53	1,71
47,5	0,69	0,28	1,70
52,5	0,88	0,19	4,14

Germany

Table 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 centimeter	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	-	-
12.5	12	36.2	20	31.6	11	92.7
17.5	12	92.2	20	31.8	11	182
22.5	12	180	20	45.1	11	97.0
27.5	12	192	20	76.0	11	15.9
32.5	12	60.1	20	57.0	11	23.2
37.5	12	16.5	20	28.0	11	36.9
42.5	12	8.2	20	13.1	11	13.3
47.5	12	3.0	19	4.9	11	4.3
52.5	8	0.4	18	2.2	11	3.5

Table 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	377	2951	<0.001
$H_2 : \gamma_l = 1$	9	7.1	0.6268
$H_3 : \alpha_l = 1$	9	2.6	0.9773
$H_4 : \beta_l = 1$	9	34.9	<0.001

Table 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
12,5	0,77	0,49	1,20
17,5	0,77	0,52	1,13
22,5	0,75	0,53	1,07
27,5	0,85	0,45	1,58
32,5	0,96	0,57	1,61
37,5	0,78	0,48	1,28
42,5	0,91	0,41	2,01
47,5	0,95	0,25	3,61
52,5	1,43	0,25	7,98

Table 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
12,5	0,58	0,43	0,77
17,5	0,65	0,53	0,79
22,5	0,94	0,74	1,21
27,5	1,03	0,57	1,87
32,5	1,23	0,77	1,96
37,5	1,08	0,73	1,58
42,5	1,12	0,59	2,11
47,5	1,21	0,41	3,58
52,5	1,47	0,46	4,75

Table 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
12,5	0,76	0,44	1,34
17,5	0,91	0,59	1,42
22,5	1,07	0,73	1,57
27,5	1,24	0,65	2,36
32,5	1,14	0,62	2,07
37,5	0,94	0,46	1,92
42,5	1,04	0,34	3,16
47,5	0,79	0,13	4,82
52,5	0,19	0,00	10,50

Poland

Table 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	6	12,2
17,5	9	65,4	13	36,6	8	15,8
22,5	11	69,2	13	64,6	8	161,9
27,5	11	66,5	13	59,8	8	299,4
32,5	11	24,2	15	25,8	8	137,1
37,5	11	10,9	15	7,9	8	47,6
42,5	10	4,4	15	14,7	8	43,0
47,5	9	1,6	12	17,2	8	23,8
52,5	6	0,2	12	5,8	7	6,6

Table 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	262	1580	<0.001
$H_2 : \gamma_l = 1$	10	6,52	0.7700
$H_3 : \alpha_l = 1$	10	29,32	0,0011
$H_4 : \beta_l = 1$	10	222,98	<0.001

Table 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	0,84	0,18	3,94
12,5	1,76	0,57	5,40
17,5	1,08	0,47	2,47
22,5	0,72	0,51	1,03
27,5	0,99	0,68	1,43
32,5	0,90	0,53	1,53
37,5	0,70	0,29	1,68
42,5	1,48	0,65	3,33
47,5	1,34	0,50	3,60
52,5	1,43	0,20	10,09

Table 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	0,71	0,19	2,71
12,5	0,44	0,16	1,22
17,5	0,52	0,25	1,08
22,5	0,47	0,38	0,60
27,5	0,41	0,34	0,49
32,5	0,37	0,28	0,49
37,5	0,38	0,24	0,61
42,5	0,46	0,29	0,73
47,5	0,36	0,18	0,71
52,5	0,33	0,08	1,36

Table 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	2,27	0,46	11,18
12,5	0,83	0,27	2,58
17,5	1,62	0,66	3,95
22,5	2,62	1,65	4,16
27,5	1,83	1,14	2,94
32,5	1,29	0,65	2,56
37,5	1,58	0,53	4,68
42,5	0,53	0,15	1,89
47,5	0,36	0,06	2,31
52,5	0,10	0,00	24,60

Russia

Table 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	.	4	7,8
12,5	1	1,0	1	2,0	6	12,2
17,5	3	1,3	2	0,5	8	15,8
22,5	4	4,5	6	3,5	8	161,9
27,5	4	49,8	6	30,2	8	299,4
32,5	4	65,5	6	36,7	8	137,1
37,5	4	11,5	6	14,2	8	47,6
42,5	4	10,3	6	13,2	8	43,0
47,5	4	5,3	6	8,7	8	23,8
52,5	4	1,0	6	2,5	7	6,6

Table 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	119	954	<0.001
$H_2 : \gamma_l = 1$	9	7,34	0,6018
$H_3 : \alpha_l = 1$	9	10,91	0,2822
$H_4 : \beta_l = 1$	9	167,58	<0.001

Table 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	0,88	0,0009	866,66
17,5	0,26	0,0003	242,92
22,5	1,00	0,12	8,55
27,5	0,93	0,43	2,01
32,5	0,54	0,28	1,05
37,5	0,59	0,20	1,77
42,5	0,52	0,18	1,51
47,5	0,45	0,11	1,81
52,5	0,49	0,03	8,06

Table 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	0,44	0,14	1,42
17,5	0,52	0,22	1,20
22,5	0,47	0,36	0,62
27,5	0,41	0,33	0,51
32,5	0,37	0,27	0,51
37,5	0,38	0,22	0,65
42,5	0,46	0,27	0,78
47,5	0,36	0,17	0,79
52,5	0,33	0,06	1,70

Table 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	1,14	0,00003	39253,83
17,5	5,17	0,00164	16246,01
22,5	0,78	0,05	12,51
27,5	0,32	0,13	0,78
32,5	0,48	0,22	1,03
37,5	0,54	0,13	2,29
42,5	0,84	0,19	3,72
47,5	1,30	0,16	10,20
52,5	0,68	0,01	48,06

Sweden

Table 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	4	7,8
12,5	12	16,7	16	16,4	6	12,2
17,5	13	16,5	16	41,3	8	15,8
22,5	13	95,7	19	71,4	8	161,9
27,5	13	158,2	19	78,2	8	299,4
32,5	13	133,1	18	54,1	8	137,1
37,5	13	48,0	18	29,4	8	47,6
42,5	13	19,9	19	15,5	8	43,0
47,5	13	9,1	18	7,5	8	23,8
52,5	13	2,7	17	2,4	7	6,6

Table 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	329	3782	<0.001
$H_2 : \gamma_l = 1$	10	127,30	<0.001
$H_3 : \alpha_l = 1$	10	66,95	<0.001
$H_4 : \beta_l = 1$	10	116,94	<0.001

Table 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	0,57	0,08	4,09
12,5	0,40	0,09	1,81
17,5	0,43	0,15	1,25
22,5	0,34	0,23	0,51
27,5	0,27	0,19	0,38
32,5	0,32	0,19	0,51
37,5	0,30	0,14	0,65
42,5	0,46	0,20	1,06
47,5	0,48	0,13	1,72
52,5	0,32	0,03	3,71

Table 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	0,71	0,11	4,52
12,5	0,44	0,11	1,79
17,5	0,52	0,19	1,42
22,5	0,47	0,34	0,66
27,5	0,41	0,32	0,53
32,5	0,37	0,25	0,54
37,5	0,38	0,20	0,73
42,5	0,46	0,24	0,87
47,5	0,36	0,14	0,92
52,5	0,33	0,05	2,35

Table 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	5,09	0,63	41,04
12,5	8,59	1,37	54,04
17,5	2,26	0,62	8,22
22,5	2,05	1,25	3,37
27,5	2,52	1,65	3,83
32,5	3,61	2,07	6,27
37,5	3,70	1,57	8,73
42,5	1,82	0,65	5,10
47,5	1,41	0,30	6,50
52,5	1,24	0,07	20,84

Latvia

Table 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
7,5	.	.	2	4,0	8	8,0
12,5	5	10,8	3	1,7	11	92,7
17,5	6	24,3	3	1,7	11	181,9
22,5	7	38,3	4	6,3	11	97,0
27,5	8	77,4	4	7,8	11	15,9
32,5	7	52,6	3	10,7	11	23,2
37,5	9	37,3	3	25,7	11	36,9
42,5	8	28,8	4	10,8	11	13,3
47,5	9	4,9	3	1,3	11	4,4
52,5	5	1,2	4	1,3	11	3,5

Table 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	167	1379	<0.001
$H_2 : \gamma_l = 1$	9	31,29	0,0003
$H_3 : \alpha_l = 1$	9	17,97	0,0356
$H_4 : \beta_l = 1$	9	33,06	0,0001

Table 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	2,88	0,006	1387,52
17,5	1,63	0,015	181,83
22,5	2,36	0,283	19,71
27,5	1,69	0,294	9,67
32,5	0,76	0,195	2,92
37,5	0,23	0,101	0,51
42,5	0,14	0,046	0,43
47,5	0,04	0,002	0,90
52,5	0,23	0,012	4,43

Table 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	0,58	0,43	0,77
17,5	0,65	0,53	0,80
22,5	0,94	0,74	1,21
27,5	1,03	0,57	1,88
32,5	1,23	0,76	1,97
37,5	1,08	0,73	1,59
42,5	1,12	0,59	2,12
47,5	1,21	0,40	3,63
52,5	1,47	0,45	4,81

Table 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	1,04	0,002	604,28
17,5	0,57	0,005	66,36
22,5	0,21	0,024	1,80
27,5	0,44	0,074	2,56
32,5	1,36	0,332	5,62
37,5	3,09	1,258	7,60
42,5	4,58	1,362	15,38
47,5	15,17	0,585	393,25
52,5	1,74	0,031	96,50

Figures

Denmark

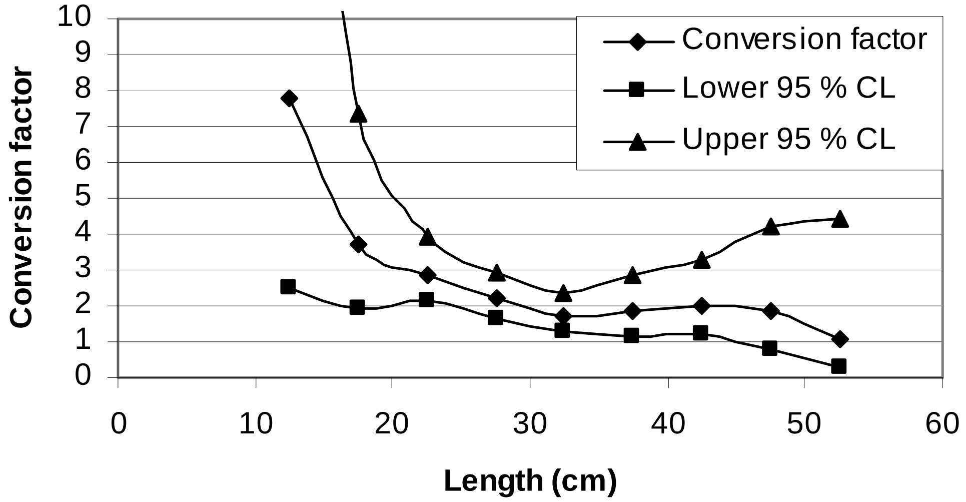


Figure 1 Conversion factors, γ_l, and 95% confidence limits by length for Granton converted to TV3-930. Denmark.

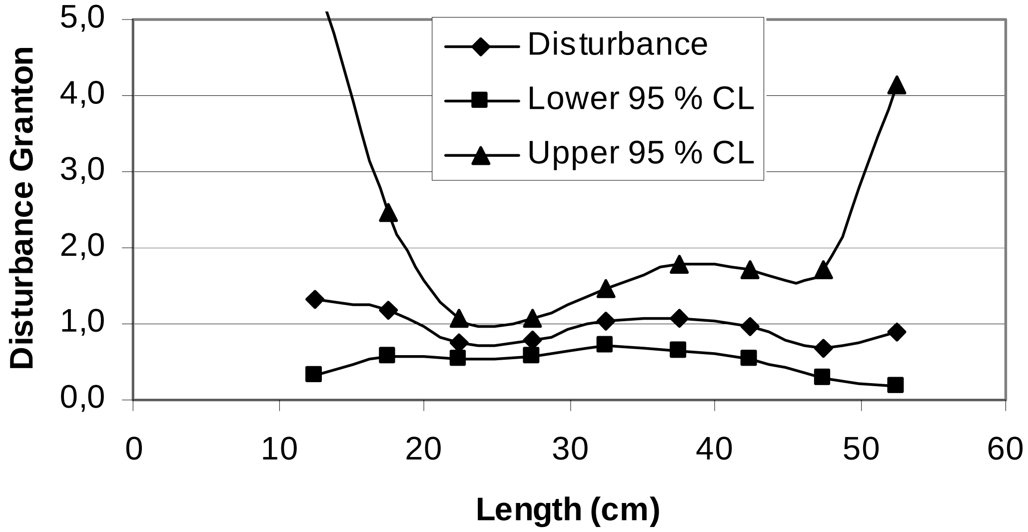


Figure 2. Disturbance parameters, α_l, and 95% confidence limits by length for Granton. Denmark

.

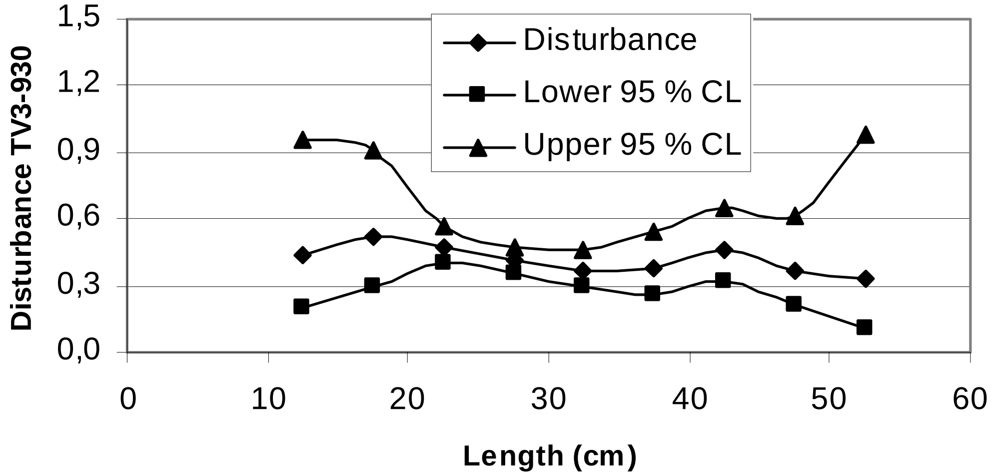


Figure 3. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-930. Denmark.

Germany

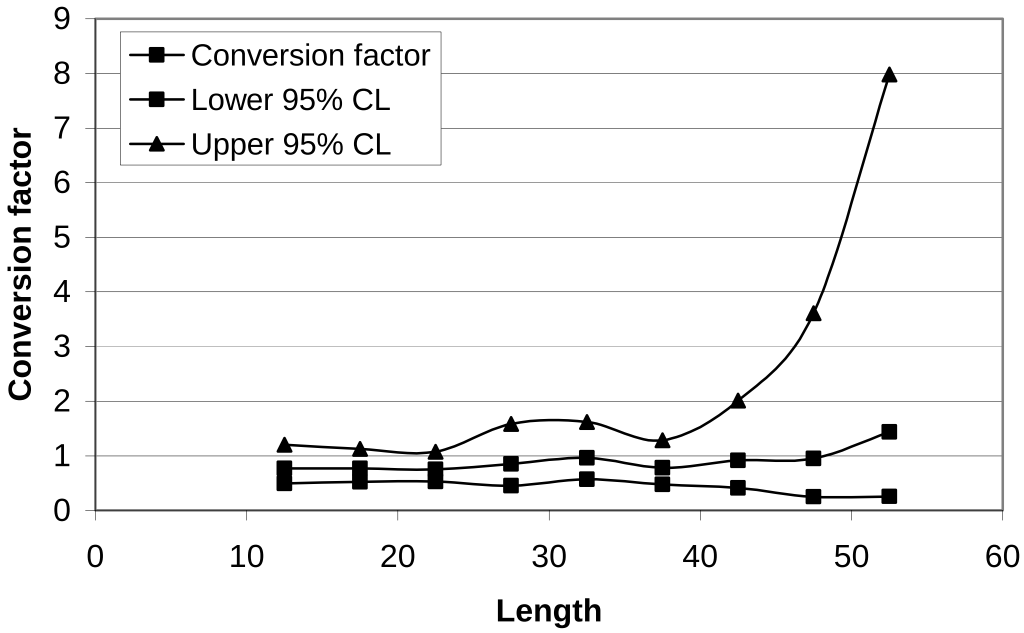


Figure 4 Conversion factors, γ_l, and 95% confidence limits by length for HG20/25 converted to TV3-520. Germany.

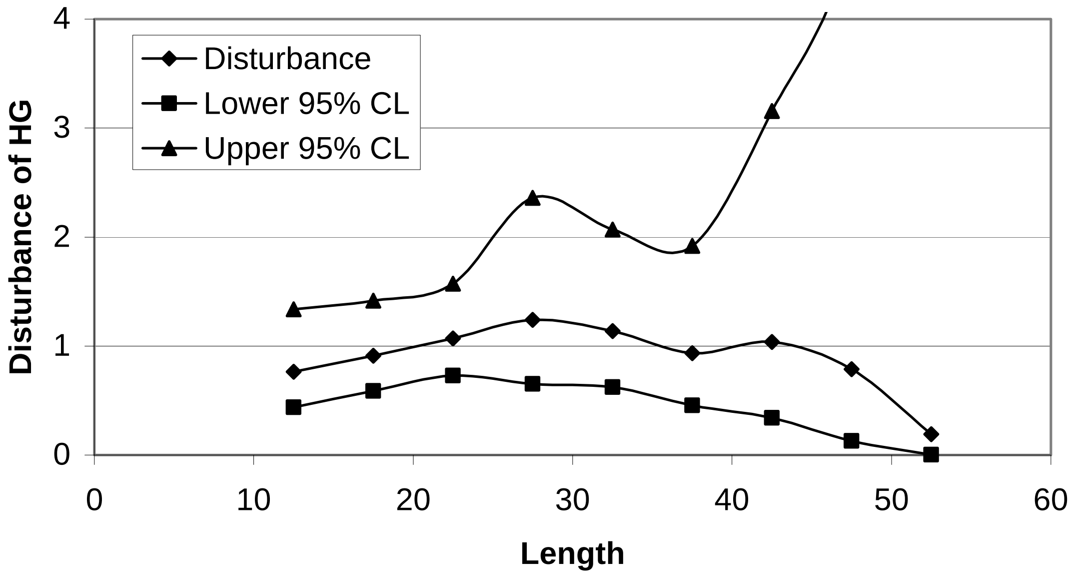


Figure 5 Disturbance parameters, α_l, and 95% confidence limits by length for HG20/25. Germany.

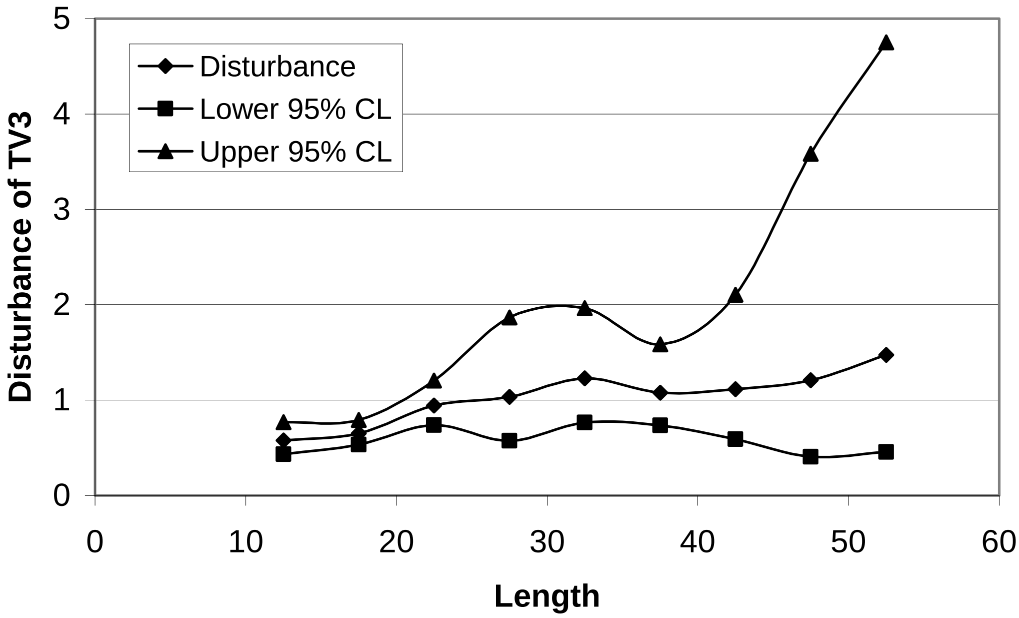


Figure 6. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-520. Germany.

Poland

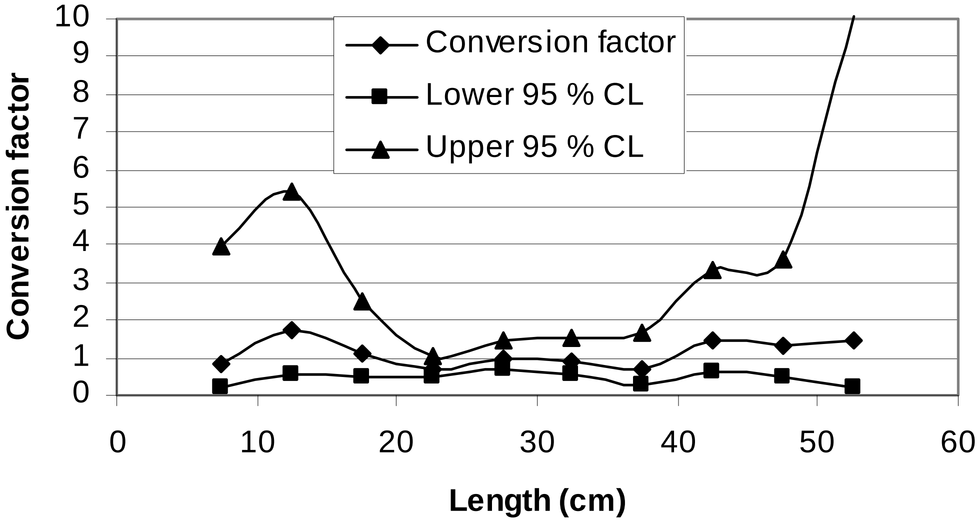


Figure 7. Conversion factors, γ_l , and 95% confidence limits by length for P20/25 converted to TV3-930. Poland.

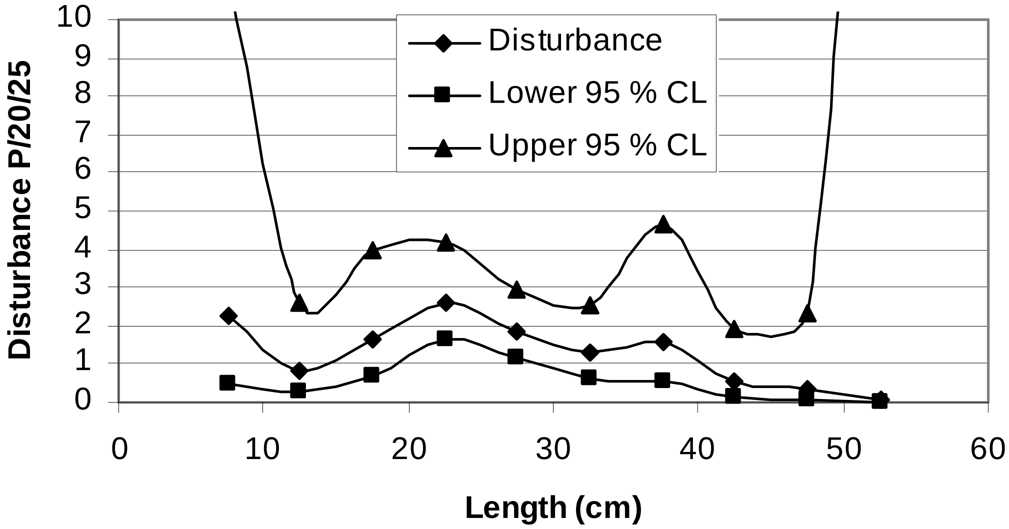


Figure 8. Disturbance parameters, α_l , and 95% confidence limits by length for P20/25. Poland.

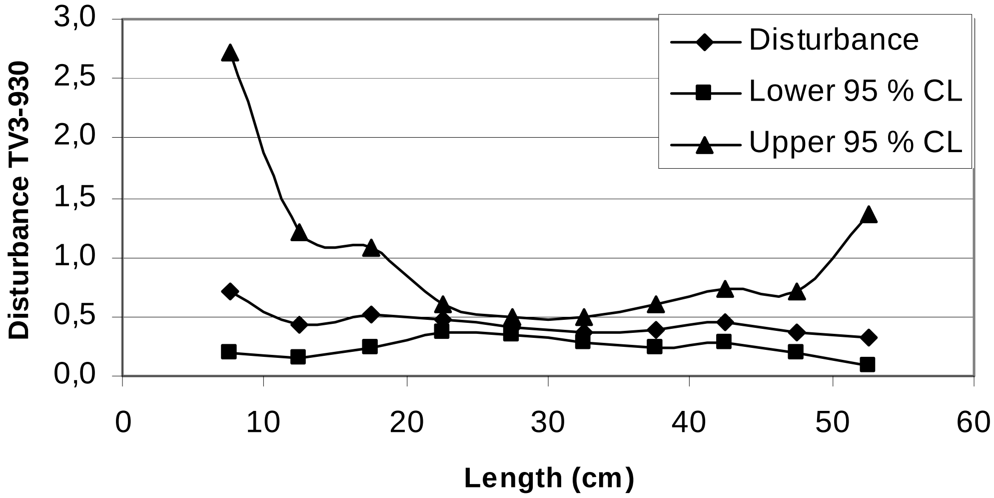


Figure 9. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-930. Poland.

Russia

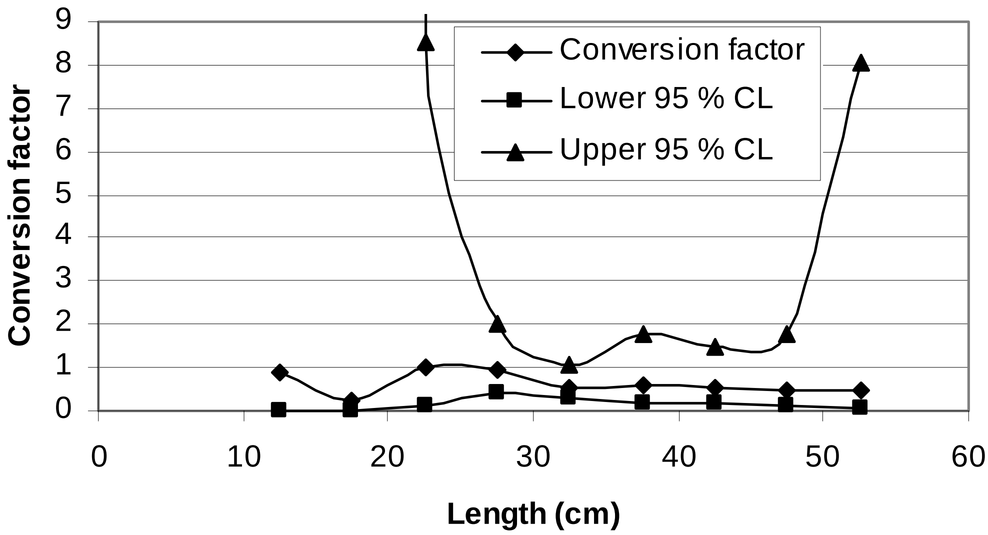


Figure 10. Conversion factors, γ_l, and 95% confidence limits by length for HAKE-4M converted to TV3-930. Russia.

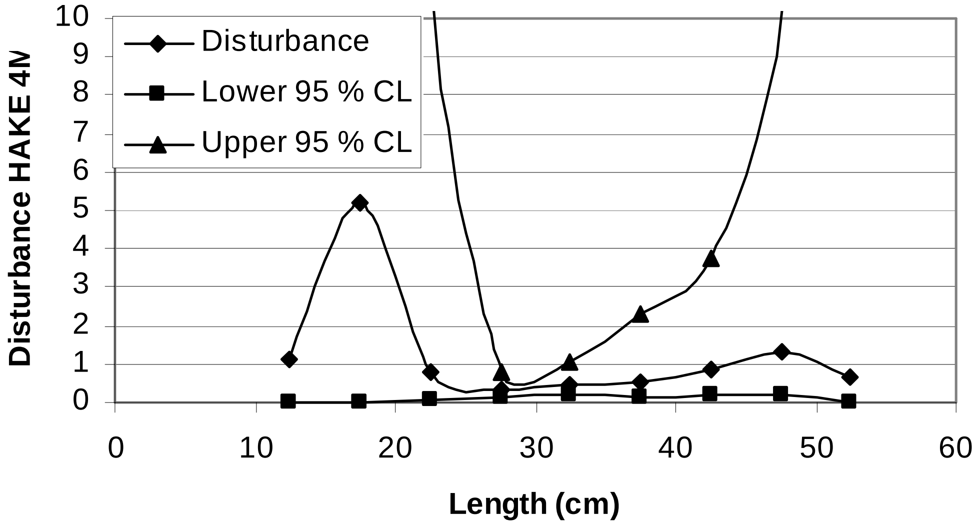


Figure 11. Disturbance parameters, α_l, and 95% confidence limits by length for HAKE-4M. Russia.

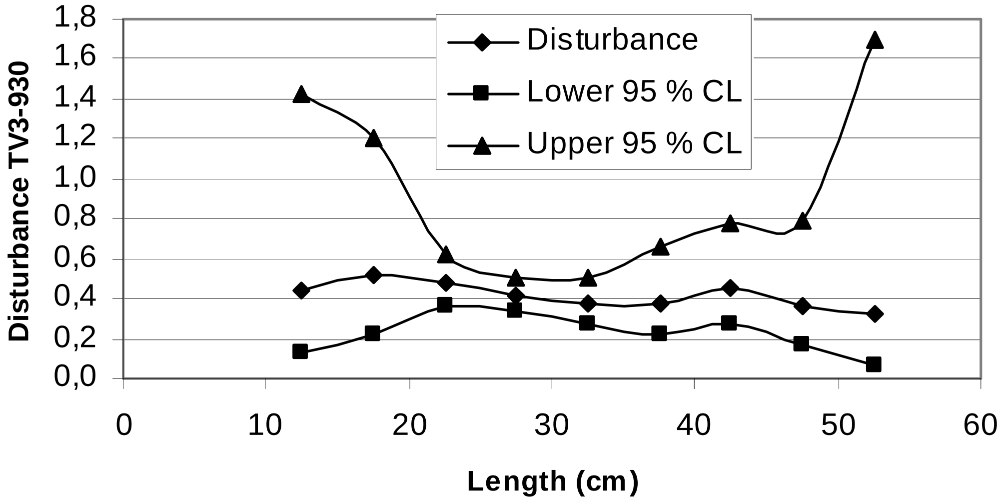


Figure 12. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-930. Russia.

Sweden

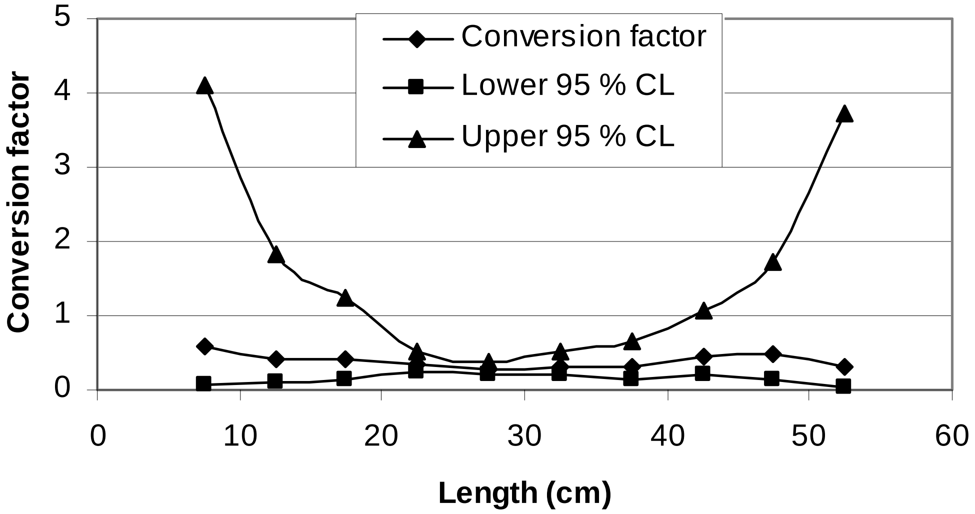


Figure 13 Conversion factors, γ_l, and 95% confidence limits by length for GOV converted to TV3-930. Sweden.

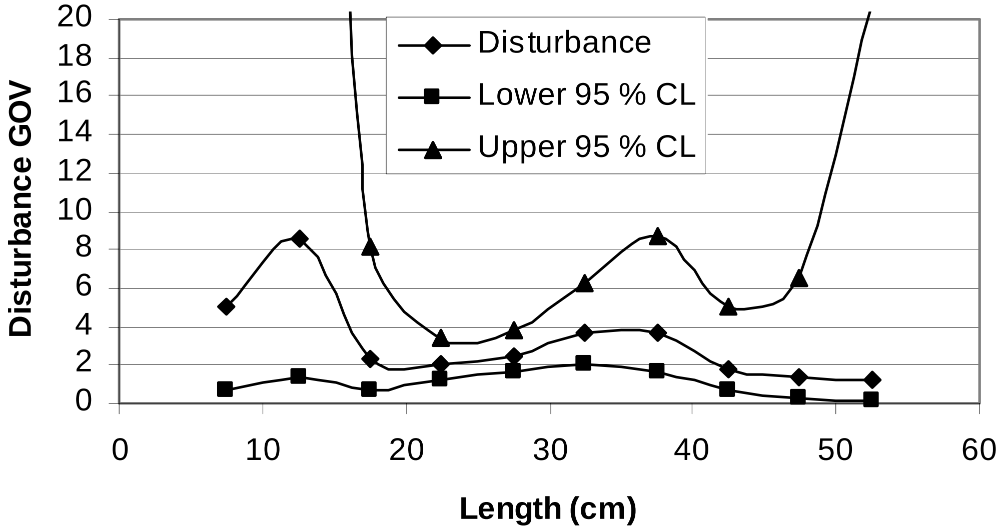


Figure 14. Disturbance parameters, α_l, and 95% confidence limits by length for GOV. Sweden.

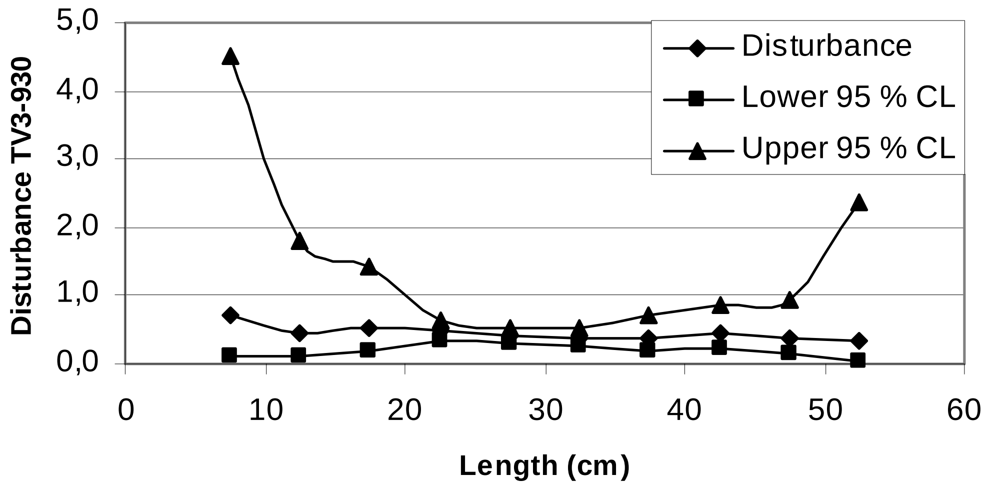


Figure 15. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-930. Sweden.

Latvia

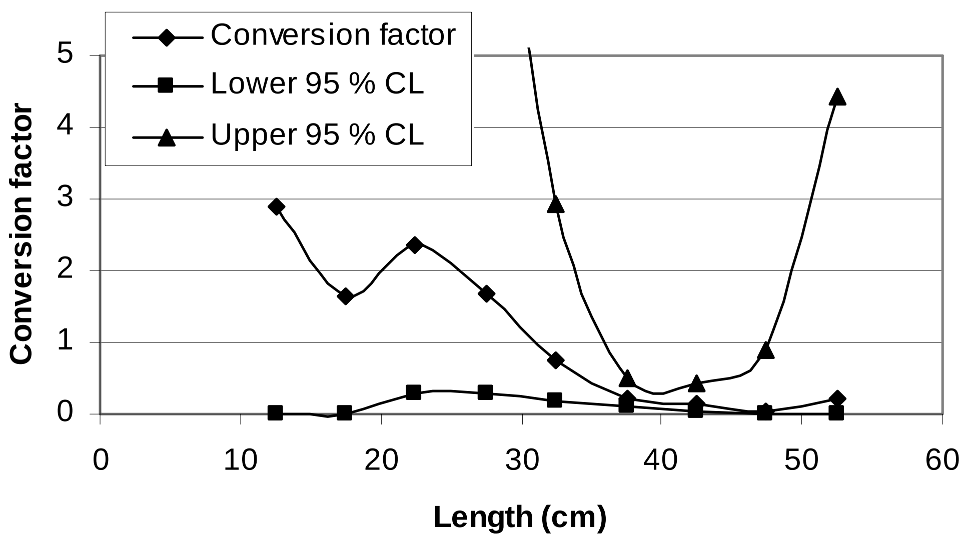


Figure 16. Conversion factors, γ_l , and 95% confidence limits by length for LBT converted to TV3-520. Latvia.

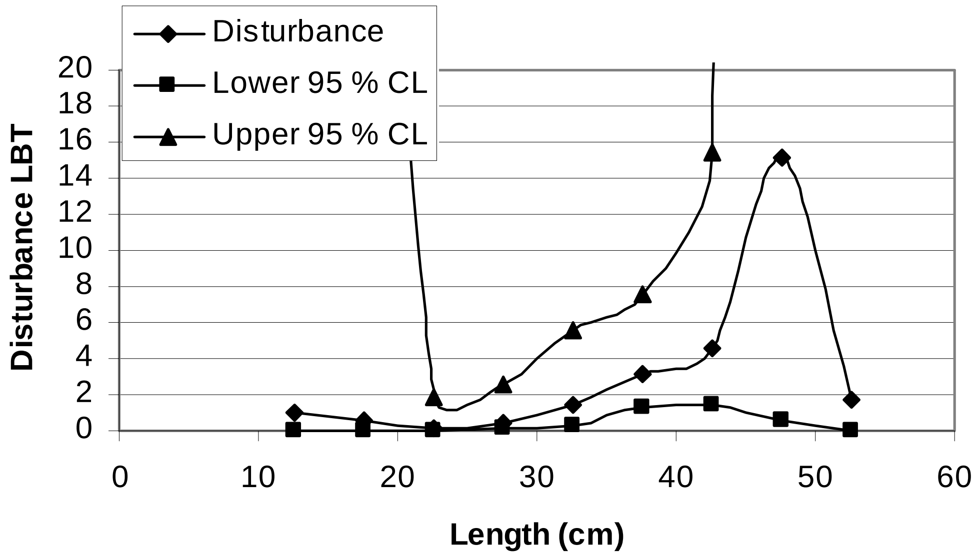


Figure 17. Disturbance parameters, α_l, and 95% confidence limits by length for LBT. Latvia.

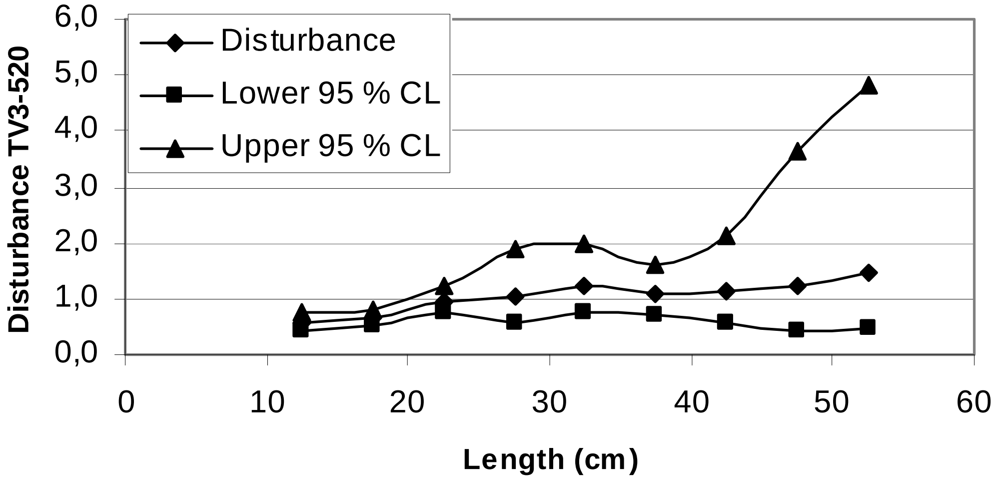


Figure 18. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-520. Latvia.

Comparison of size selection of monitoring survey trawls applying generalized linear models to CPUE data

(Part 2)

J. Rasmus Nielsen

Peter Lewy

Holger Hovgård

Danish Institute for Fisheries Research (DIFRES), Department of Sea Fishery,

Charlottenlund Castle, DK-2920 Charlottenlund, Denmark

Introduction

In the present part 2 of the working document the method described in part 1 of the working document is used to analyse inter-calibration experiments between the large TV3-930 and the small TV3-520 standard trawl. In order to do that the method developed in part 1 of the working document is here in part 2 further developed to include inter-calibration experiments of type 0 experiments where a haul of the old gear is followed by a haul of the old gear where the old gear in the present context is defined as the small TV3-520 trawl and the new gear is defined as the large TV3-930 trawl.

Materials and Methods

Four types of inter-calibration experiments are used here:

Type = 0: The experiment for which a haul of the old gear is followed by a haul of the old gear on national basis, i.e. the old gear is applied twice.

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, i.e. where the new gear is applied twice.

In this context type 0 experiments are only available from Danish experiments (as described in part 1 of the working document). These data are based on additional hauls conducted by R/V Dana, Denmark, where the new standard TV3-trawl (large TV3-930) has been applied twice at each station. Additional information where the new standard TV3 trawl (small TV3-520) has been applied twice at each station is available from previous surveys performed in spring 1995 with the Danish vessel, R/V Havfisken. These type 0 data for Denmark have been applied for all nations inter-calibration experiments on national basis.

With reference to the method described in part 1 of the working document the method is now modified to the following:

For a given length group l and station s let $T^{first}_{new,l,s}$ and $T^{second}_{new,l,s}$ denote the CPUE's of first and second haul of the old gear for the type = 0. Correspondingly, $U_{old,l,s}$, $U_{new,l,s}$ are CPUE's for type 1, $V_{old,l,s}$ and $V_{new,l,s}$ are CPUE's for type = 2 whereas $X^{first}_{new,l,s}$ and $X^{second}_{new,l,s}$ are CPUEs's for type =3.

The model further assumes that CPUE for a gear is catchability times the fish density. It is further assumed that all CPUE's are poisson distributed with the means:

Type	First haul	Second haul
0	$E(T^{first}_{old}) = q_{old,l} D_{0,l,s}$	$E(T^{second}_{old,l,s}) = q_{old,l} \alpha_l D_{0,l,s}$
1	$E(U_{old,l,s}) = q_{old,l} D_{1,l,s}$	$E(U_{new,l,s}) = q_{new,l} \alpha_l D_{1,l,s}$
2	$E(V_{new,l,s}) = q_{new,l} D_{2,l,s}$	$E(V_{old,l,s}) = q_{old,l} \beta_l D_{2,l,s}$
3	$E(X^{first}_{new,l,s}) = q_{new,l} D_{3,l,s}$	$E(X^{second}_{new,l,s}) = q_{new,l} \beta_l D_{3,l,s}$

where E denotes the expected value, where $q_{old,l}$ and $q_{new,l}$ are the catchabilities of the two gears, α_l is the short term disturbance effect of the old gear, β_l is the short term disturbance effect of the new gear and where D is the fish density at different stations, S. The catchability parameters, $q_{old,l}$ and $q_{new,l}$, expresses the total effect on the catch of all gear characteristics. The parameters α_l and β_l may be less or greater than one as no assumption is made on the net effect. The catchabilities as well as the disturbance effects may depend on the length.

It should be noted that the conversion factors to be estimated are the relationships between catchabilities, $\gamma_l = q_{new,l} / q_{old,l}$. To inter-calibrate the catches for two different gears it is not necessary to know the absolute values of the catchabilities. Further, the conversion factors cannot be estimated without estimating the disturbance parameters, α_l and β_l .

Now, let

$$C_{0,l,s} = T^{second}_{old,l,s}$$
$$C_{1,l,s} = U_{new,l,s}$$
$$C_{2,l,s} = V_{new,l,s}$$
$$C_{3,l,s} = X^{first}_{new,l,s}$$
$$n_{0,l,s} = T^{first}_{old,l,s} + T^{second}_{old,l,s}$$
$$n_{1,l,s} = U_{new,l,s} + U_{old,l,s}$$
$$n_{2,l,s} = V_{new,l,s} + V_{old,l,s}$$
$$n_{3,l,s} = X^{first}_{new,l,s} + X^{second}_{new,l,s}$$

As the CPUE's are assumed poisson distributed we have that $C_{t,l,s}$ given the sum $n_{t,l,s}$ is binomially distributed $B(n_{t,l,s}, p_{t,l})$

Where:

$$p_{0,l} = \frac{E(T^{second}_{old,l,s})}{E(T^{second}_{old,l,s}) + E(T^{first}_{old,l,s})} = \frac{q_{old,l}\alpha_l D_{0,l,s}}{q_{old,l}\alpha_l D_{0,l,s} + q_{old,l} D_{0,l,s}} = \frac{1}{1+1/\alpha_l} \qquad (1)$$

$$p_{1,l} = \frac{E(U_{new,l,s})}{E(U_{new,l,s}) + E(U_{old,l,s})} = \frac{\gamma_l}{\gamma_l + 1/\alpha_l} \tag{2}$$

$$p_{2,l} = \frac{E(V_{new,l,s})}{E(V_{new,l,s}) + E(V_{old,l,s})} = \frac{\gamma_l}{\gamma_l + \beta_l} \tag{3}$$

$$p_{3,l} = \frac{E(X_{new,l,s}^{first})}{E(X_{new,l,s}^{first}) + E(X_{new,l,s}^{second})} = \frac{1}{1+\beta_l} \tag{4}$$

The canonical link function for the binomial distribution, the logit function, has been applied for the analysis. The logits for the three probabilities are:

$$r_{0l} = \text{logit}(p_{0,l}) = \ln(\frac{p_{0,l}}{1-p_{0,l}}) = \ln(\alpha_l) = \theta_l \tag{5}$$

$$r_{1,l} = \text{logit}(p_{1,l}) = \ln(\gamma_l) + \ln(\alpha_l) = \pi_l + \theta_l \tag{6}$$

$$r_{2,l} = \text{logit}(p_{2,l}) = \ln(\gamma_l) - \ln(\beta_l) = \pi_l + \tau_l \tag{7}$$

$$r_{3,l} = \text{logit}(p_{3,l}) = -\ln(\beta_l) = \tau_l \tag{8}$$

where

$$\pi_l = \ln(\gamma_l) = \ln(\frac{q_{new,l}}{q_{old,l}}) \tag{9}$$

$$\theta_l = \ln(\alpha_l) \tag{10}$$

$$\tau_l = -\ln(\beta_l) \tag{11}$$

The logits, (5)-(8) can be combined to one linear equation:

$$r_{t,l} = \pi_l x_t + \theta_l y_t + \tau_l z_t \tag{12}$$

where

$$x_t = \begin{cases} 0 & \text{if } t = 0 \\ 1 & \text{if } t = 1 \\ 1 & \text{if } t = 2 \\ 0 & \text{if } t = 3 \end{cases} \tag{13}$$

$$y_t = \begin{cases} 1 & \text{if } t = 0 \\ 1 & \text{if } t = 1 \\ 0 & \text{if } t = 2 \\ 0 & \text{if } t = 3 \end{cases} \tag{14}$$

$$z_t = \begin{cases} 0 & \text{if } t = 0 \\ 0 & \text{if } t = 1 \\ 1 & \text{if } t = 2 \\ 1 & \text{if } t = 3 \end{cases} \qquad (13)$$

As equation (12) is a linear function of the parameters the theory of generalized linear models (McCullagh and Nelder 1989) has been used to in the analysis applying the binomial distribution with the logit as link function. The equation may be regarded as multiple linear regression with heterogeneous slopes and with x, y, and z as known covariates.

If the assumption of binomial distributed variables do not hold an over-dispersion parameter will be estimated (McCullagh and Nelder 1989).

The model, (10), can be used to test if the conversions factors, γ_l, and the disturbance effects, α_l and β_l depend on the length by applying the standard technique of analysis of variance. This is done by reformulation of (10):

$$r_{t,l} = \pi x_t + \pi_l x_t + \theta y_t + \theta_l y_t + \tau z_t + \tau_l z_t \qquad (14)$$

and by testing the hypotheses

$$H : \begin{cases} \tau_l = 0 \\ \theta_l = 0 \\ \pi_l = 0 \end{cases} \qquad (15)$$

The GENMOD, SAS procedure (SAS 1996) has been used to estimate parameters and testing hypotheses. The Pscale option and Wald's statistics in connection with Type3 contrasts have been used as test in order to include over-dispersion.

Results

Large TV3-930 Trawl versus Small TV3-520 Trawl, Germany / (Denmark)

Type 1 and type 2 data originate from German experiments on board R/V Solea during 1999 and 2000 testing the small TV3-520 versus the large TV3-930 trawl. The type 0 data originates from Danish experiments with R/V Havfisken in 1995. Type 3 data originate from Danish experiments with R/V Dana in 2002. These experiments are further described in part 1 of the present paper.

Only a limited amount of data from relatively few experiments are available for all types of experiments to calculate the conversion factors between the small TV3-520 trawl and the large TV3-930 trawl (Table 1).

The number of stations and the average CPUE per station, $\overline{C}_{new,t,l}$, is shown in Table 1. From here it appears that the average number of fish caught is only smaller than 5 for the smallest cod smaller than 10 cm in length and the largest cod larger than 50 cm in length. Consequently, the results of the χ^2 test for these size groups should be treated with caution as the χ^2 approximations probably do not hold for these.

The basic model, (10), including all three sets of parameters has been run and the parameters estimated. The results of the tests of significance for over-dispersion and the parameters are given in Table 2, which shows that the estimated over-dispersion of 2.33 is significantly larger than one. The table further shows that the disturbance parameter for the small TV3-520, α_l, and the disturbance parameter for TV3-930, β_l, are significant different from one whereas the hypothesis that the conversion factors, γ_l, equals 1 for all length groups is accepted. The model, (10), therefore can be reduced to

$$r_{t,l} = \theta_l y_t + \tau_l z_t \qquad (16c)$$

For this model both effects are significant. However, in order to include estimates of the conversion factors, γ_l, also for conversion between the small TV3-520 trawl and the large TV3-930 trawl, it is chosen to present the results from the full model (10). For this full model the estimated parameters and the 95% confidence limits are given in Figs. 1-3 and the Tables 3-5. The hypotheses that the conversion factor is one cannot be rejected implying that efficiency of the TV3-520 and the TV3-930 is the same. No trends can be seen in the conversion factors, however, they have been estimated below 1 for all size groups of fish within the range 0.5-1.0. The Disturbance parameters for TV3-930 are below 1 (0.3-0.9) for all length groups except for the smallest fish (5-10 cm in length) where it is around 1.4. Consequently, fish density is reduced by this trawl and it seems that the trawl is distracting fish of all size groups except for the smallest fish. For fish larger than 10 cm in length there seems to be a decreasing tendency with increasing length. The disturbance of TV3-520 is below 1 for the smaller fish up to the length group 20-25 cm, and above 1 (1.0-1.5) for larger fish. Consequently, there seems to be a tendency towards an effect of decreasing fish density for smaller fish (distraction effect) and increasing fish density for larger fish (attraction effect).

Discussion

As only a limited amount of data from relatively few experiments are available for all types of experiments to calculate the conversion factors between the large TV3-930 trawl and the small TV3-520 trawl the present results should be treated with caution. It is highly recommended that more paired hauls of type 0, 1, 2 and 3 are carried out in order to give more certain estimates of the conversion factors and the disturbance effects. However, as all types of experiments are included here (and not only type 1-3 experiments) the method is more robust compared to the situation with only 3 types of experiments.

The calculated conversion factors do not significantly differ from 1 between the two sizes of the new standard TV3-trawl. However, the small TV3-520 trawl do very often catch more than the large TV3-930 trawl. This is against our expectations. The reason for that cannot immediately be explained. Also in light of this result it is recommended that further paired hauls are carried out in future surveys order to further explore this result.

Tables

Small TV3-520 versus large TV3-930.

Table 1. Number of stations and average number of fish per station, $C_{new,t,l}$ by length and type of experiment. Small TV3-520 versus large TV3-930.

Length	Type 0		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	Number of stations	Average number of fish
7,5	8	1,4	4	5,8	5	5,6	4	7,8
12,5	11	53,5	8	10,9	9	9,4	6	12,2
17,5	11	118,4	9	22,7	9	26,1	8	15,8
22,5	11	91,6	9	16,4	9	15,6	8	161,9
27,5	11	16,5	9	16,7	9	21,9	8	299,4
32,5	11	28,5	9	25,7	9	32,9	8	137,1
37,5	11	39,8	9	17,4	9	29,0	8	47,6
42,5	11	14,8	9	18,3	9	33,2	8	43,0
47,5	11	5,3	8	9,4	8	25,5	8	23,8
52,5	11	5,1	8	3,3	8	9,8	7	6,6

Table 2. Type 3 test results of the hypotheses $H_1 - H_4$. Small TV3-520 versus large TV3-930.

Test	df	χ^2 (Type3)	$P > \chi^2$
H_1 : Over-dispersion > 1	316	1716	<0.001
$H_2 : \gamma_l = 1$	10	12.79	0.2358
$H_3 : \alpha_l = 1$	10	53.08	<0.0001
$H_4 : \beta_l = 1$	10	251.47	<0.0001

Table 3. Conversion factors, γ_l, and lower and upper confidence limits by length for the conversion of small TV3-520 to large TV3-930. Small TV3-520 versus large TV3-930.

Length	Conversion factor	Lower 95 % CL	Upper 95 % CL
7,5	0,57	0,18	1,83
12,5	0,67	0,38	1,21
17,5	0,82	0,55	1,20
22,5	0,76	0,50	1,15
27,5	0,73	0,47	1,13
32,5	0,80	0,54	1,19
37,5	0,83	0,53	1,30
42,5	0,87	0,54	1,40
47,5	0,64	0,33	1,25
52,5	0,50	0,16	1,53

Table 4. Disturbance parameters, β_l, and lower and upper confidence limits by length for TV3–930. Small TV3-520 versus large TV3-930.

Length	Disturbance	Lower 95 %CL	Upper 95 %CL
7,5	1,42	0,48	4,16
12,5	0,93	0,49	1,76
17,5	0,78	0,49	1,21
22,5	0,50	0,40	0,62
27,5	0,42	0,35	0,50
32,5	0,39	0,30	0,50
37,5	0,42	0,29	0,61
42,5	0,49	0,34	0,73
47,5	0,36	0,21	0,64
52,5	0,22	0,07	0,69

Table 5. Disturbance parameters, α_l, and lower and upper confidence limits by length for small TV3-520-trawl. Small TV3-520 versus large TV3-930.

Length	Disturbance	Lower 95 %CL	Upper 95 %CL
7,5	0,37	0,13	1,03
12,5	0,61	0,48	0,76
17,5	0,67	0,57	0,78
22,5	0,99	0,81	1,20
27,5	1,21	0,80	1,83
32,5	1,37	0,98	1,92
37,5	1,13	0,84	1,52
42,5	1,25	0,81	1,94
47,5	1,21	0,61	2,41
52,5	1,24	0,52	2,95

Figures

Small TV3-520 versus large TV3-930

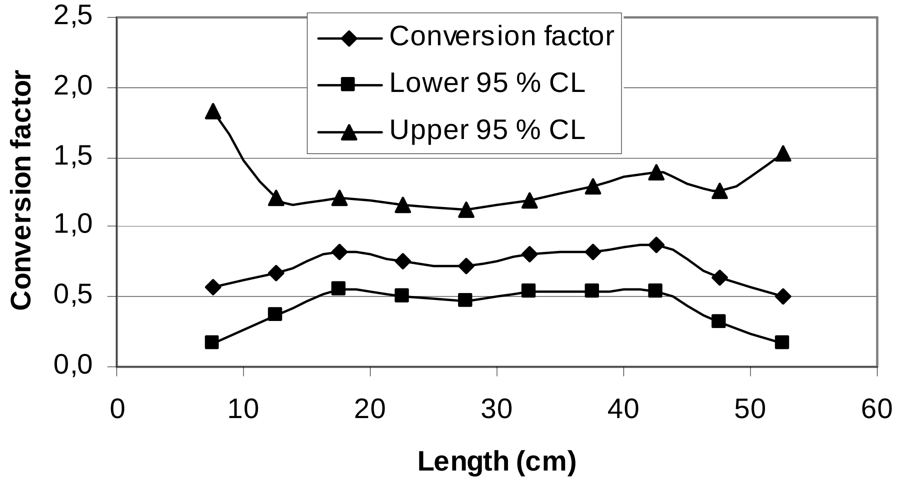


Figure 1 Conversion factors, γ_l , and 95% confidence limits by length for small TV3-520 converted to large TV3-930. Small TV3-520 versus large TV3-930.

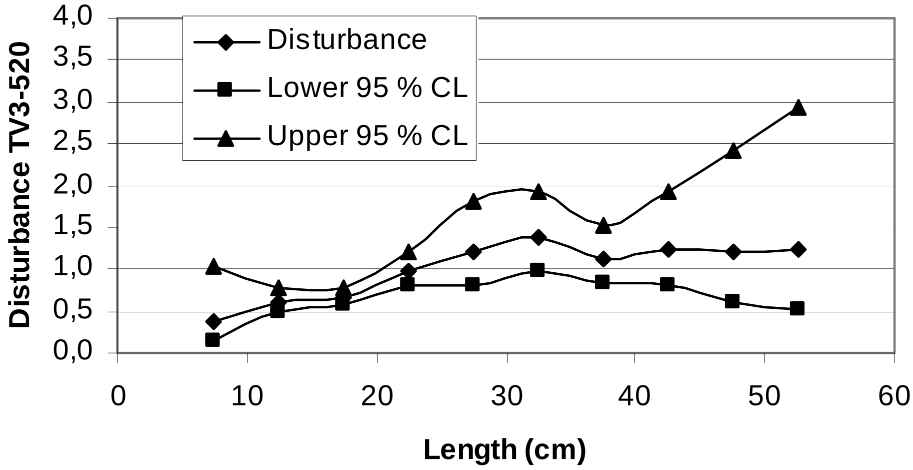


Figure 2. Disturbance parameters, α_l , and 95% confidence limits by length for small TV3-520. Small TV3-520 versus large TV3-930.

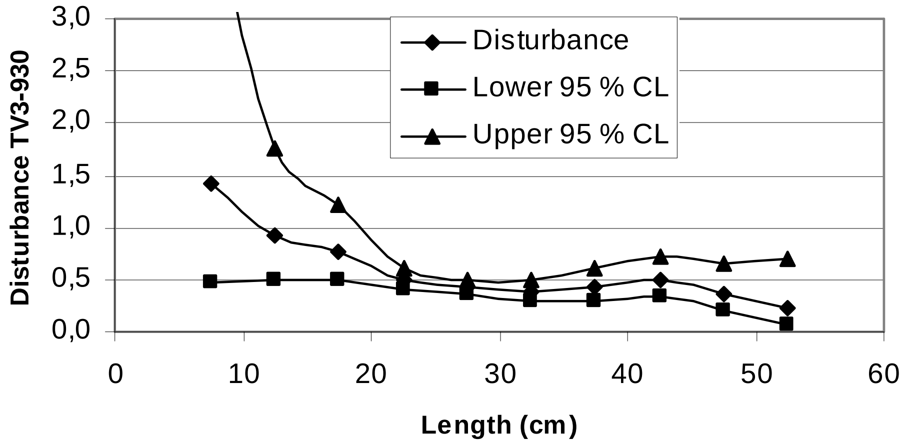


Figure 3. Disturbance parameters, β_l, and 95% confidence limits by length for TV3-930. Small TV3-520 versus large TV3-930.

ANNEX 3

Working Paper:

Analyses of conversion factors

Analyses of conversion factors

by Rainer Oeberst[1] and Włodimierz Grygiel[2]

[1] Institute of Baltic Fisheries, Rostock, Germany
[2] Sea Fisheries Institute, Gdynia, Poland

Two analyses of the inter-calibration experiments exist. The methods and the results are presented in WGBIFS 2001, Final and Consolidated Report of EU-Study Project No. 98/009 and Oeberst et all. (2000) Both the analyses used the same data, however, different methods. One analysis used GENMOD – models to estimate the conversion factors CF = CPUE(national gear)/CPUE(TV3#xxx) depending on the gear sequence during the inter-calibration experiments. The second method estimated special correction factors to eliminate the influence of the gear sequence and estimated C_f = CPUE(TV3#xxx)/CPUE(national gear). In most cases the estimates CF and $1/C_f$ differ.

The aim of these analyses was to estimate new variables based on the conversion factors and to compare these estimates with the results that are based on other independent data sets. That means that follow-up values of the conversion factors were compared with independent estimates. The statistical analyses (Anon. 2001, ICES 2001, Oeberst et al. 2000) have shown that the mean conversion factors are relatively constant for cod larger than 24 cm, especially, if it is taken into account that the number of available data is low in some cases.

Table 1 presents estimates of mean conversion factors of Polish and German national trawls for cod of the length range from 16 to 48 cm to illustrate the variability of C_f based on 2 cm intervals (ICES 2001b). In addition, the numbers of available data sets are given. The Polish fishing gear type P 20/25 was compared with the large version of the standard gears TV3#930, and the German gear type HG 20/25 was compared with the small version TV3#520. The mean conversion factors of cod larger than 24 cm were used to estimate the fishing power of the national gears in ration to the new standard gear TV3#930.

The CPUE value of the fishing gear type GOV, applied by Sweden, was defined as standard unit of historical survey results, and the CPUE value of the large new standard gear TV3#930 was defined as standard unit of the current surveys. The inter-calibration experiments have shown that the conversion factors C_f(TV3#930,GOV) of these gears equals one in the length range defined above (ICES 2001b).

In many cases the results of inter-calibration experiments can be directly used, since the national gears were calibrated with trawl type TV3#930. However, in some cases inter-calibration experiments were conducted between the national fishing gears and the small version of the new standard gear TV3#520, and a direct estimation of the conversion factors C_f(TV3#930, national gear) was not possible. In these cases the conversion factor C_f(TV3#930, TV3#520) was used as described below.

$$C_f(\text{TV3\#930, national gear}) = C_f(\text{TV3\#930, TV3\#520}) \times C_f(\text{TV3\#520, national gear}) \qquad (1)$$

The conversion factors were used to assess the parameter "fishing power II" (F_{p2}) of fishing gears by equation (2) although the accuracy of some conversion factors are relative limited due to the number of carried out inter-calibration experiments was rather low.

$$F_{p2}(\text{national gear}) \quad = \quad 1 / C_f(\text{TV3\#930, national gear}) \qquad (2)$$

The estimatedcoefficient F_{p2} is comparable with F_{p1} estimated by Sparholt and Tomkiewicz (1998, 2000) since C_f(TV3#930, GOV) equals one.

The parameter fishing power F_{p2} was estimated using mean conversion factors (equation 2). The estimates C_f, F_{p1} and F_{p2} by gear are summarized in Table 2. Ranges of F_{p2} are presented if the number if inter-calibration experiments is low. Estimates of F_{p1} and F_{p2} are comparable in some cases, but estimates of the fishing gears LBT (Latvia) and P 20/25 (Poland) significantly differed. These differences cannot be explained by the data of the inter-calibration experiments. F_{p2} of the Polish gear P 20/25 agrees with the estimate of the German gear HG 20/25 as it can be expected because the two gears have almost the same construction with only small variations (Schulz and Grygiel 1984, 1987).

The CPUE values of national surveys stored in the BITS database were applied to decide which of the estimates of "fishing power" is more suitable for describing the catchability of the Polish gear in relation to the new standard unit (Anon. 2001b).

The database mentioned above is the same one as Sparholt and Tomkiewicz (2000) used for their analyses. However, in contrast to the application of GLM analyses the CPUE-values of paired stations were compared. Hauls of different national fishing gears were defined as paired stations that fulfil the following conditions:

- both the hauls were carried out within a depth range of 10 m,
- the distance between both stations was less than 00º15'N and 00º15'E,
- both the hauls were carried out within a period of less than 15 days.

These conditions were chosen in order to make sure that the probability is high that the paired hauls observed comparable fish densities and their length distributions. In some cases if two or more hauls were carried out very closely together with the same type of gear the mean values of the hauls were compared with the results of trawling of the other gear.

The Polish and the German institutes carried out trawl surveys in the ICES Sub-division 25 in spring from 1993 - 1999, but the spatial and temporal distribution of the hauls was not co-ordinated, and therefore, the number of stations that can be used during the analyses are rather low.

Tables 3 and 4 present available paired hauls to compare fishing power. **Table 3** shows data of hauls with a mean water depth of more than 60 m. **Table 4** presents stations where the mean water depth was less than 60 m. These two depth layers were applied since the fish density patterns of the smaller (<30 cm in total length) and larger (>50 cm) cod is different and the differences are probably influenced by the thermocline (Oeberst 1999). The thermocline was mostly observed in a water depth of about 60 m in the ICES Subdivisions 25 (Nehring et al. 1995, 1996, Matthäus *et al.* 1997, 1998, 1999, 2000, HELCOM, 1996). Higher CPUE-values of large cod were observed in water depth deeper than 60 m with a relative low variance, and small cod are heterogeneous distributed in areas above the thermocline with partly high densities.

Figure 1 reflects the comparison of the mean CPUE values of Polish and German fishing gears using all stations that are given in Table 3. The length distributions of cod are given for 2 and 5 cm intervals. The results suggest a comparable mean catchability of the two gears, although the mean CPUE-values of the Polish gear were higher in the length range from 27 to 34 cm, and the German gear captured more cod with total lengths of 37 - 49 cm.

Figure 2 compares mean CPUE values of those paired stations which are presented in Table 4. The length distributions of cod are given also for 2 and 5 cm intervals. The German gear HG 20/25 captured more effectively that specimens smaller than 31 cm and less cod within the length range from 31 to 45 cm than the Polish gear P 20/25. From the investigations of all paired stations it can be concluded that the two fishing gears have a comparable catchability.

The quotient CPUE(P 20/25) / CPUE(HG 20/25) were analysed using the data of 2 cm length intervals to check whether the mean log transformed quotient is significantly different from zero. Log transformation was use because it can be assumed that the quotient is lognormal distributed. **Table 5** summarizes the analysis results separated by paired stations of Tables 3 and 4. T-tests have shown that the mean values were never significantly different from zero.

From all results it can be concluded that the Polish fishing gear type P 20/25 and the German gear type HG 20/25 have the same "fishing power", and that F_{p2} is a suitable estimate to transform CPUE-values of the Polish gear into units of standard gear.

The effects of coefficients F_{p1} and F_{p2} regarding the estimation of cod stock indices were analysed in the subsequent part because the estimates of the Polish gear P 20/25 were essentially different. Two versions of cod length distributions were estimated for the ICES Subdivisions 25 and 26 applying F_{p1} and F_{p2}.

Figure 3 presents the two versions of cod length distributions of the ICES Subdivision 25 in 1999, and **Figure 4** shows estimates of the ICES Subdivision 26 in 1995 as example.

Fp(1) marks the length distribution which is based on F_{p1}, and Fp(2) the alternative version. The two versions of cod stock length distributions differ in comparable ranges in the two mentioned subdivisions from 1993 – 1999. The graphs of the other years are not presented due to similarity of the graphs with Figures 3 and 4. The estimates based on F_{p1} were always significantly higher. **Figure 5** presents cod length distribution using F_{p2} in relation to estimates, which are based on F_{p1} (ICES Subdivision 25 in 1999). The estimate of F_{p1} is used as 100%. Comparable estimates are presented in **Figure 6** for ICES Subdivision 26 in 1995 as examples. The relative difference between the compared length distributions varied from year to year. Reasons of these differences are various proportions of Polish hauls in relation to the total number of realized stations in ICES Subdivisions.

From the results of the inter-calibration experiments and the comparisons of F_{p1} and F_{p2} the conclusion can be drawn that those small differences between F_{p1} and F_{p2} of gear types Granton, GOV and HG 20/25 do not significantly influence the stock indices as it is illustrated in **Figure 7**. This figure shows the two length distributions of cod in ICES Subdivision 26 in 1996 if the Polish hauls were not included.

Different reasons are possible for the different estimates of fishing power of the Polish gear. Various data sets and different methods were applied during analyses. Sparholt and Tomkiewicz (1998, 2000) used GLM methods which estimate F_{p1} in one step and in relation to all other gears which were involved in the analyses. That means that interactions between the other gears also influence the estimate of the Polish gear. In contrast to this, direct comparisons of national fishing gears and standard gears were carried out, and paired stations of the Polish and the German gears were analysed. These estimates are independent of the results of other gears which are also used during the trawl surveys by other laboratories.

A second reason that F_{p1} and F_{p2} differ in some cases can be that Sparholt and Tomkiewicz (2000) used CPUE-values by age groups by and in the studies presented above CPUE-values by length group were used. It is well known and once again documented during the ICES BFASWG meeting in Gdynia 2001 (ICES 2001a) that different schools exist for reading the age of Baltic cod otoliths.

However, the different interpretations of the "annual rings" on otolith were not important for the presented analyses. It is possible that both the estimates of the fishing power are good descriptions of the reality and that the different units explain the differences.

It seems to be useful first to combine the length distributions of the stations of the surveys of cod to reduce the influence of the different interpretations of age readings. The indices by age groups can be estimated in the subsequent step using the different interpretations of the otolith to carry out sensitivity analyses and to check the consequence of the different interpretations of the “otolith rings” for the stock indices. The possibility to analyse the influence of the different interpretations of age readings is very important since the stock indices which are basd on the trawl surveys are the one and only VPA independent estimates of the eastern Baltic cod stock.

Conclusions

- Inter-calibration experiments are suitable tools to estimate reliable conversion factors.
- In most cases additional inter-calibration experiments are necessary to receive conversion factors with realible accuracy.
- Estimates of fishing power (F_{p2}) which are based on the conversion factors correspond well with estimates of F_{p1} by Sparholt and Tomkiewicz (1998, 2000) in many cases, but the estimates of LBT (Latvia) and P 20/25 (Poland) differed.
- The studies show that Fp2 of the Polish gear type P 20/25 presents a realistic description of the catchability.
- The use of Fp2 of the Polish gear type P 20/25 results in a significant reduction of the eastern Baltic cod stock indices in Sub-divisions 25 and 26.
- The length distribution of the cod stock based on the CPUE values of length intervals should be carried out to reduce the influence of the different interpretations of the age readings.

References

Anon., 2001: EU Study Project No. 98/099: Improvement of stock assessment and data collection by continuation, standardisation and design improvement of the Baltic International Bottom Trawl Survey for fishery resource assessment. Final and consolidated report. March-April 2001: 512 pp.

ICES, 2001: Report of the Baltic International Fish Survey Working Group. ICES Counc. Meet. Pap./ H 2:252pp.

Oeberst, R.; Ernst, P.; Frieß, C.C., 2000: Inter-calibrations between German demersal gears HG 20/25 and TV3 520 as well as between the gears TV3 520 and TV3 930. ICES Counc. Meet. Pap./ K 20: 27 pp.

Tables

Table 1. Mean conversion factors (C_f) of cod and the number of inter-calibrations experiments (N) of the national gear types P 20/25 (Poland) and HG 20/25 (Germany) by 2 cm length intervals.

Length classes [cm]	TV3 #930 – P 20/25		TV3 #520 – HG 20/25	
	N	Conversion factor C_f	N	Conversion factor C_f
16	12	1.10	25	1.02
18	13	1.17	23	1.03
20	15	1.01	25	0.96
22	16	1.05	30	1.02
24	15	1.04	31	0.99
26	16	1.13	31	0.99
28	14	1.19	31	1.05
30	17	1.18	32	1.04
32	11	1.37	31	0.98
34	12	1.26	30	0.92
36	14	1.21	26	1.00
38	8	0.97	27	1.03
40	15	1.47	19	0.98
42	7	1.35	17	1.12
44	3	1.22	14	1.03
46	6	1.23	8	0.91
48	2		4	1.08

Table 2. Estimates of the fishing power F_{p1} and F_{p2} as well as the conversion factors C_f by national gears.

Country	Gear	F_{p1}	C_f(TV3#520, national gear)	C_f(TV3#930, national gear)	F_{p2}
Denmark	Granton	0.57		1.2 – 1.8	0.83 – 0.56
FRG + GDR	HG 20/25	0.87	1.0	1.2	0.83
Latvia	LBT	0.44	0.8 – 1.3	1.0 – 1.6	1.0 – 0.64
Poland	P 20/25	0.34		1.1 – 1.2	0.83 – 0.91
Russia	Hake 4M	0.93		1.1 – 1.3	0.77 – 1.00
Sweden [1]	GOV	1.00		1.0	1.00
Germany	TV3#520			1.2	0.83

Table 3. Data of paired stations with water depth deeper than 60 m in the ICES Subdivision 25.

Poland						Germany						Differences			
Lati. 00°00'N	Long. 00°00'E	Depth [m]	Station	Gear type	Date	Lati. 00°00'N	Long. 00°00'E	Depth [m]	Station	Gear type	Date	Lati. 00'N	Long. 00'E	Depth [m]	Days
55°16'	17°21'	90	47	P20/25	15.02.93	55°16'	17°21'	85	79	HG20/25	13.02.93	0	0	5	2
55°20'	17°31'	80	46	P20/25	15.02.93	55°15'	17°33'	90	82	HG20/25	13.02.93	5	2	10	2
55°20'	17°31'	80	46	P20/25	15.02.93	55°16'	17°21'	85	79	HG20/25	13.02.93	4	10	5	2
55°17'	17°10'	90	37	P20/25	14.02.95	55°18'	17°21'	85	79	HG20/25	16.02.95	1	11	5	2
55°19'	17°23'	80	63	P20/25	19.03.98	55°18'	17°25'	89	79	HG20/25	5.03.98	1	2	9	14
55°14'	17°25'	90	52	P20/25	4.03.99	55°17'	16°10'	85	80	HG20/25	2.03.99	3	75	5	2
55°19'	17°20'	80	53	P20/25	4.03.99	55°18'	17°21'	85	79	HG20/25	3.03.99	1	1	5	1
55°19'	17°20'	80	53	P20/25	4.03.99	55°15'	17°19'	90	82	HG20/25	3.03.99	4	1	10	1
55°14'	17°25'	90	52	P20/25	4.03.99	55°18'	17°21'	85	79	HG20/25	3.03.99	4	4	5	1
54°45'	15°44'	70	44	P20/25	15.02.95	54°46'	15°39'	78	74	HG20/25	23.02.95	1	5	8	8
54°47'	15°36'	70	51	P20/25	13.03.98	54°47'	15°40'	76	74	HG20/25	26.02.98	0	4	6	15
54°49'	15°21'	70	28	P20/25	26.02.99	54°46'	15°39'	76	74	HG20/25	28.02.99	3	18	6	2
54°53'	15°43'	80	16	P20/25	25.02.00	54°47'	15°39'	77	74	HG20/25	2.03.00	6	4	3	5
54°32'	15°39'	60	48	P20/25	16.02.95	54°38'	15°38'	67	68	HG20/25	23.02.95	6	1	7	7
54°34'	15°39'	60	50	P20/25	13.03.98	54°38'	15°38'	65	68	HG20/25	1.03.98	4	1	5	12
54°47'	15°36'	70	51	P20/25	13.03.98	54°38'	15°38'	65	68	HG20/25	1.03.98	9	2	5	12
54°49'	15°57'	60	39	P20/25	10.02.93	54°47'	15°57'	58	65	HG20/25	12.02.93	2	0	2	2
54°34'	15°39'	60	50	P20/25	13.03.98	54°31'	15°45'	53	65	HG20/25	1.03.98	3	6	7	12
54°43'	15°48'	60	54	P20/25	15.03.98	54°31'	15°45'	53	65	HG20/25	1.03.98	12	3	7	14
54°49'	15°57'	60	39	P20/25	10.02.93	54°47'	15°57'	58	65	HG20/25	12.02.93	2	0	2	2

Table 4 Data of paired stations with water depth of less than 60 m in the ICES Subdivision 25.

Poland						Germany						Differences			
Lati. 00°00'N	Long. 00°00'E	Depth [m]	Station	Gear type	Date	Lati. 00°00'N	Long. 00°00'E	Depth [m]	Station	Gear type	Date	Lati. 00'N	Long. 00'E	Depth [m]	Days
54°28'	15°29'	50	47	P20/25	16.02.95	54°26'	15°42'	48	62	HG20/25	23.02.95	2	13	2	7
54°26'	15°36'	50	40	P20/25	28.02.99	54°25'	15°41'	46	62	HG20/25	1.03.99	1	5	4	1
54°40'	16°10'	40	48	P20/25	1.03.99	54°55'	16°13'	47	63	HG20/25	2.03.99	15	3	7	1
55°00'	17°27'	30	62	P20/25	6.03.99	55°00'	17°27'	37	60	HG20/25	3.03.99	0	0	7	3
54°59'	17°20'	30	27	P20/25	28.02.00	55°00'	17°31'	39	60	HG20/25	1.03.00	41	11	9	1
54°46'	16°50'	30	51	P20/25	17.02.95	54°50'	16°35'	24	56	HG20/25	19.02.95	4	15	6	2
54°38'	16°21'	30	40	P20/25	11.03.98	54°49'	16°25'	27	54	HG20/25	1.03.98	11	4	3	10
54°46'	16°53'	30	39	P20/25	11.03.98	54°51'	16°38'	23	56	HG20/25	5.03.98	5	15	7	6

Table 5. Number of available data sets (N), mean values (Mean) and standard deviations (Std) of the log-transformed quotient CPUE(P20/25) / CPUE(HG 20/25) by paired stations presented in Tables 3 and 4.

Length	Hauls of Table 3			Hauls of Table 4		
[cm]	N	Mean	Std	N	Mean	Std
19	7	0.36	0.22	1	0.39	
21	10	0.05	0.31	1	0.74	
23	14	0.19	0.52	2	0.18	0.67
25	17	-0.03	0.63	2	-0.12	1.02
27	17	0.11	0.36	4	-0.63	0.71
29	19	-0.04	0.46	3	-0.38	0.55
31	17	-0.03	0.61	5	-0.19	0.25
33	19	-0.11	0.43	3	0.07	0.38
35	16	-0.10	0.37	4	0.24	0.76
37	16	-0.30	0.42	4	0.41	0.54
39	10	-0.15	0.63	3	0.31	1.01
41	10	-0.38	0.56	3	0.79	0.42
43	9	-0.09	0.67	3	0.61	0.04
45	6	-0.17	0.74	1	-0.70	
47	6	-0.05	0.54	2	-0.39	0.80
49	7	-0.31	0.55	1	-1.04	
51	4	-0.16	1.01	1	-0.30	
53	4	0.20	0.48			

Figures

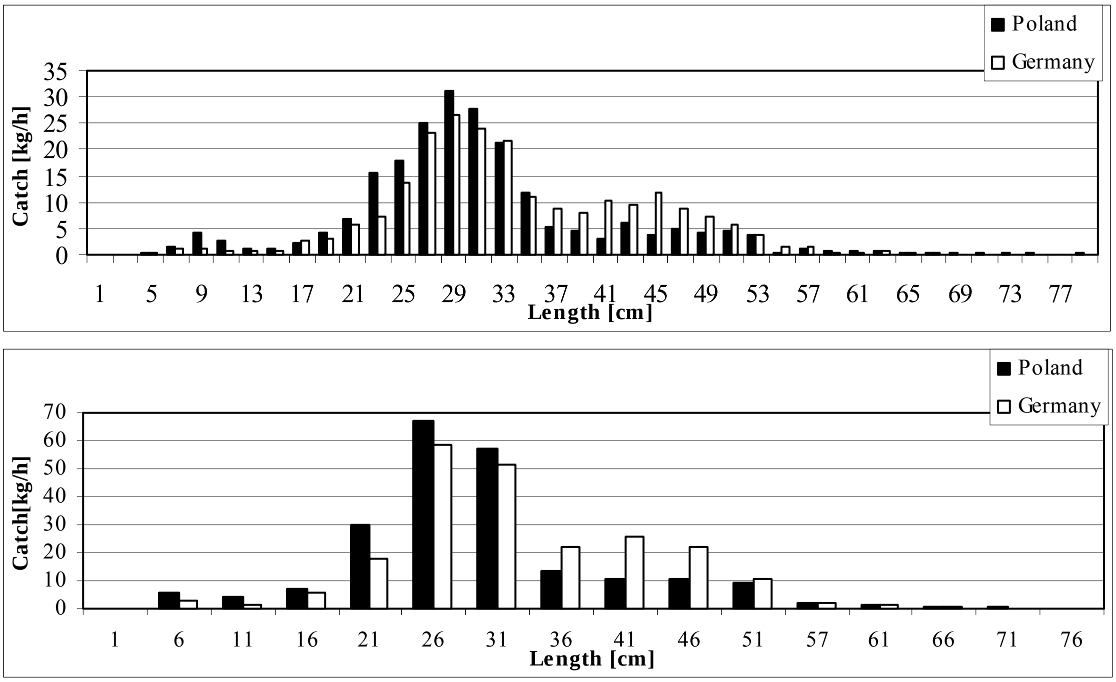


Figure 1. Mean CPUE-values of cod by 2 cm (upper part) and 5 cm (bottom part) length intervals based on 20 trawl stations in water layers deeper than 60 m (a/c. to Table 3).

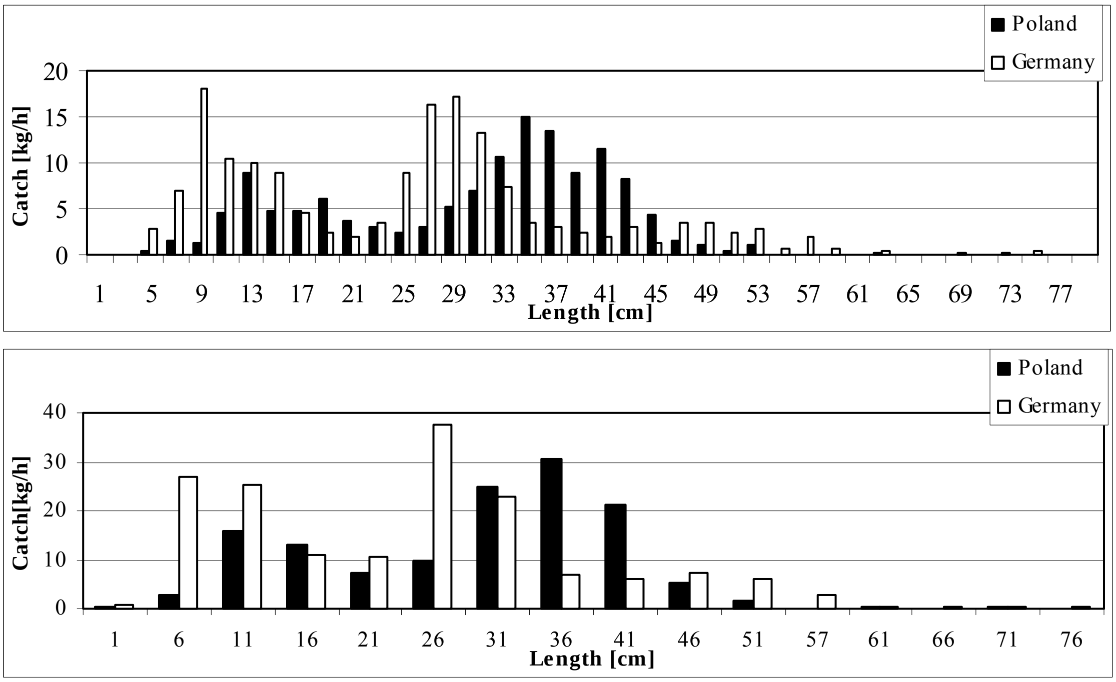


Figure 2. Mean CPUE-values of cod by 2 cm (upper part) and 5 cm (bottom part) length intervals based on 8 trawl stations water layers less than 60 m (a/c. to Table 4).

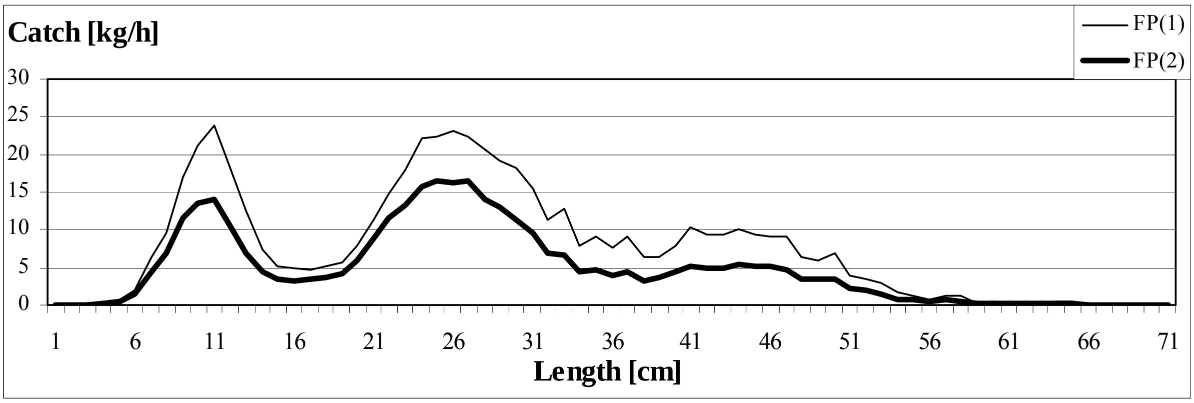


Figure 3. Length distributions based on the coefficients F_{p1} and F_{p2} of the cod stock in ICES Sub-division 25 in 1999.

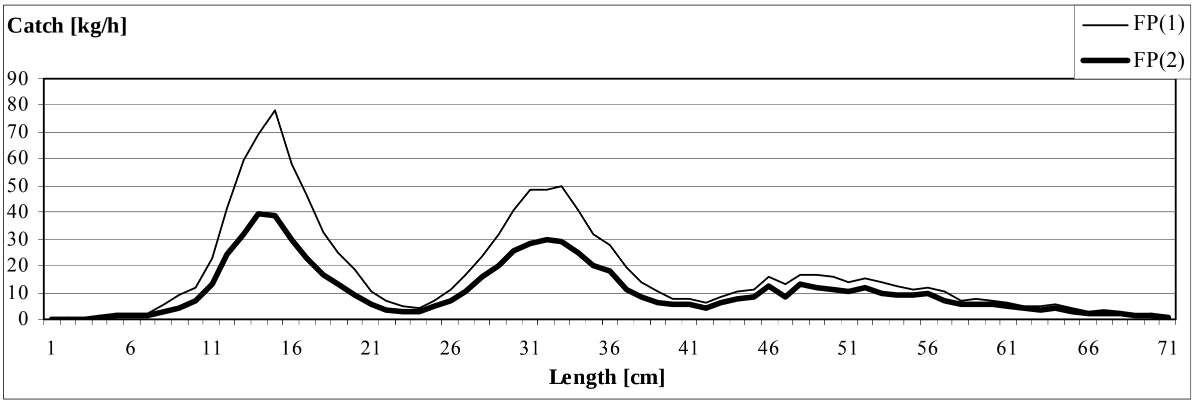


Figure 4. Length distributions based on coefficients F_{p1} and F_{p2} of the cod stock in ICES Sub-division 26 in 1995.

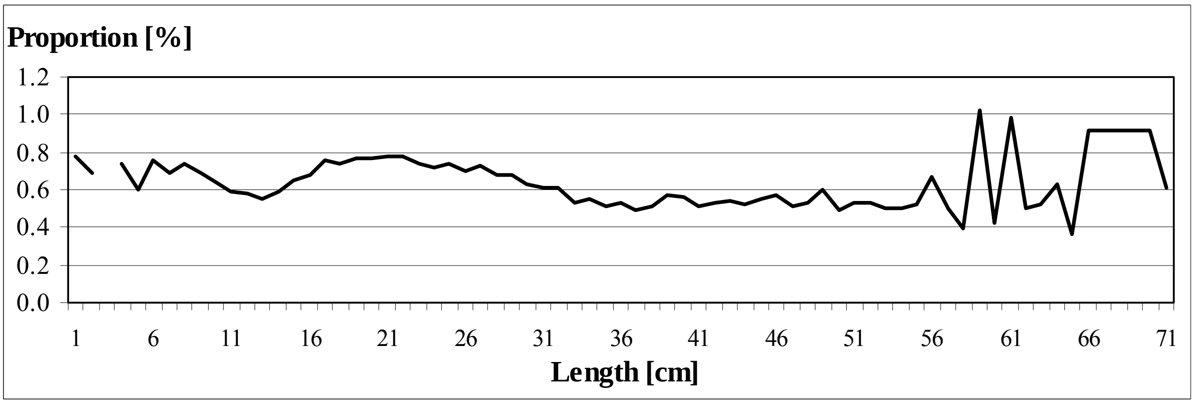


Figure 5. The proportion the indices based on F_{p2} to the estimates based on F_{p1} for the cod stock in ICES Sub-division 25 in 1999.

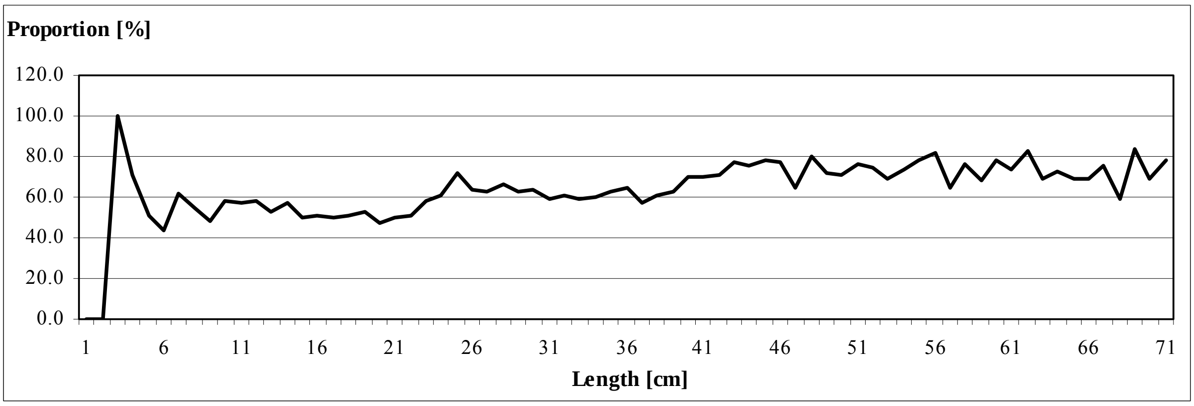


Figure 6. The proportion of the indices based on F_{p2} to the estimates based on F_{p1} for the cod stock in ICES Subdivision 26 in 1995.

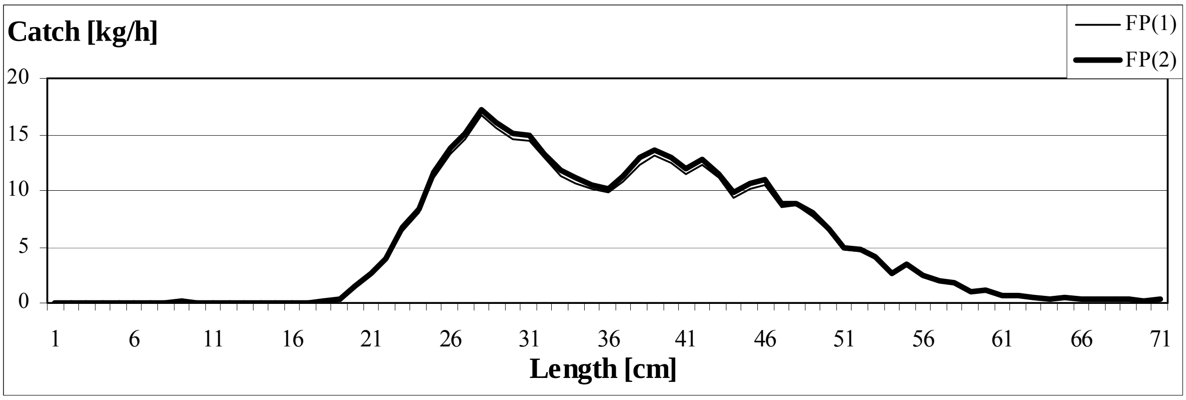


Figure 7. Length distributions based on the coefficients F_{p1} and F_{p2} for the cod stock in ICES Subdivision 25 in 1996 excluding the Polish hauls

ANNEX 4

NEW EXCHANGE FORMAT FOR THE DATRAS DATABASE

NEW EXCHANGE FORMAT FOR THE DATRAS DATABASE

The present exchange format (BITS) is a fix width text file. However, CSV files are more flexible with regard to the size of the fields and to accommodate all surveys in the exchange format data will in the future be deliver as CSV files.

In the future additional environmental data have to be provided. These data are provided in the HE record in the present format. The data have been provide in its own record instead of being included in the HH record because it was decided to be delivered them long time after the exchange format was created and the checking program was not able to handle these data. The working group decided to reduce the redundant data included in the HE records by combining the record with the HH record.

It seems that most national databases store longitude and latitude as degree decimals. This will also be the case for the DATRAS database. Furthermore, the position is often used for mapping of data and for this the position has to be in degree decimals. Therefore, the most logical, and also most precise, way of exchange the position would be as degree decimals. Thus, the working group decided that position should be delivered as degree decimals in the format +/-180 degrees.

To improve and standardise CPUE data in the database it will in future be possible to deliver data on one of three levels:

- Sub sample
- Raw data by haul
- Calculated data by haul and hour

The database will calculate the raising factor from ‘category catch number’ and ‘no measure’ within the category. From the raising factor, ‘No at length’ and haul duration the CPUE per haul and hour will be calculated.

The working group finds that combining IBTS data with the oceanographic data in ICES are impossible. To overcome this problem the working group will include surface and bottom temperature, surface and bottom salinity and whatever there has been observed a thermo cline and the depth of it. The working group are aware that this will duplicate data in ICES, however, they find that problems with combining data are so great that they have to include the data in the fishery database as well as in the oceanographic database.

A thermo cline is defined as a temperature change on 2 degrees Celsius within 10 meters.

The COBOL checking program is not able to deal with commas and data have therefore been delivered as e.g. metres per seconds * 10 instead of meters per seconds with one decimal. Commas will not be a problem in the new checking program and in the new format data will be delivered with decimals.

Unknown data have earlier been delivered as e.g. 9999 or space. To standardise how data are reported unknown values will be reported as –9, except for sex where unknown are stored as U in most national database as well as in the DATRAS database.

The species codes have so fare been the NODC codes. However, the NODC codes are not updated any longer and ICES will in the future use the Taxonomic Serial Numbers (TSN) in order to standardise the codes used within the different departments in ICES. Some of the national institutes might also in the future change the code system they use for storing species and it is therefore made possible to provide data in either code system.

In order to accommodate the surveys at the southern and western areas the HH record will contain an optional field for the fishing strata where a code combined by of the geographical area and the depth stratum can be included. This field will not apply to the BITS data.

RECORD TYPE 1 (Haul information - HH)

NAME		M/O**				RANGE				COMMENTS			
		BITS	IBTS	EVHOE	BTS	BITS	IBTS	EVHOE	BTS	BITS	IBTS	EVHOE	BTS
Record type	2A	M	M			HH				Fixed value: HH	Fixed value: HH		
Quarter	1N	M	M			1 to 4	1 to 4						
Country	3A	M	M			See Appendix III	See Appendix III			ICES alpha codes for countries	ICES alpha codes for countries		
Ship	4AN	M	M			See Appendix III	See Appendix III						
Gear	10AN	M	M			See Appendix IV	See Appendix IV			Preliminary code 1)	Preliminary code 1)		
Standard station number	6AN	**M**	**M**							National coding system	National coding system		
Haul no	3N	M	M			1 to 999	1 to 999			Sequential numbering by cruise	Sequential numbering by cruise		
Year	4N	M	M			1900-2099	1900-2099						
Month	2N	M	M			1 to 12	1 to 12						
Day	2N	M	M			1 to 28/29/30/31	1 to 28/29/30/31						
Time shot	4N	M	M			1 to 2400, 9999	1 to 2400, 9999			In UTC	In UTC		
Stratum	**4A**	**O**	**O**			**See Appendix (to be created)**	**See Appendix (to be created)**						
Haul duration	3N	M	M			5 to 150	5 to 90			In minutes 2)	In minutes 2)		
Day/night	1A	M	M			D, N, space	D, N			Not known = space filled			
Shooting latitude decimal	**3N. 4D**	**M**	**M**			**53.0000 to 66.0000**	**50.0000 to 64.0000**			**Shooting position: latitude decimals**	**Shooting position: latitude decimals**		
Shooting longitude decimal	**+/-3N. 4D**	**M**	**M**			**0.0000 to 59.0000**	**0.0000 to 59.0000**			**Shooting position: longitude decimals**	**Shooting position: longitude decimals**		
Hauling latitude decimal	**3N. 4D**	**M**	**M**			**53.0000 to 66.0000**	**50.0000 to 64.0000**			**Hauling position: latitude decimals**	**Hauling position: latitude decimals**		
Hauling longitude decimal	**+/-3N. 4D**	**M**	**M**			**0.0000 to 59.0000**	**0.0000 to 59.0000**			**Hauling position: longitude decimals**	**Hauling position: longitude decimals**		
Depth	**4N**	M	M			10 to 150, space5 to 150 in Sub-div. 22 + 24, **-9**	**10 to 300, -9**			Depth from surface in metres **Unknown = -9**	Depth from surface in metres, **Unknown = -9**		
Haul validity	1A	M	M			I, V, N	I, P, V			Invalid =I, Valid =V or no oxygen = N, C = calibrated	Invalid=I. Partly valid=P **(only historical data)**.		
Hydrographic station number	8AN	**M**	**M**							Station no as reported to the ICES hydrographer	Station no as reported to the ICES hydrographer		
Species Recording Code	2N	M	M			See Appendix V	See Appendix V			Use position 65 for standard and 66 for bycatch codes	Use position 65 for standard and 66 for bycatch codes		
Data type	**1A**	**M**	**M**			**R, C, S**	**R, C, S**			**R = raw data by haul, C = calculated no/hour, S = Sub sample**	**R = raw data by haul, C = calculated no/hour, S = Sub sample**		
Netopening	**2N. 1D**	**O**	**O**			**1.5 to 10.0, -9**	**2.5 to 10.0, -9**			**In metres**	**In metres**		
Distance	4N	O	O			1850 to 9999**, -9**	1850 to 9999**, -9**			Distance towed over ground (m)	Distance towed over ground (m)		
Warp lenght	**4N**	O	O			100 to 999**, -9**	100 to 999**, -9**			in metres	in metres		
Warp diameter	2N	O	O			10 to 60**, -9**	10 to 60**, -9**			In millimetres	In millimetres		
Door surface	**2N. 1D**	**O**	**O**			**1.0 to 10.0, -9**	**3.0 to 10.0, -9**			**In squaremetres**	**In squaremetres**		

Door weight	4N	O	O	50 to 2000, -9	500 to 2000, -9	In kilogrammes	In kilogrammes
Door spread	3N	O	O	25 to 200, -9	48 to 180, -9	In metres	In metres
Wing spread	2N	O	O	12 to 30, -9	12 to 30, -9	Metres	In metres
Buoyancy	4N	O	O	50 to 200, -9	50 to 200, -9	In kilogrammes	In kilogrammes
Kite dimensions	**1N. 1D**	**O**	**O**	**0.5 to 2.0, -9**	**0.5 to 2.0, -9**	**In squaremetres**	**In squaremetres**
Weight ground rope	4N	O	O	0 to 800, -9	0 to 300, -9	In kilogrammes	In kilogrammes
Towing direction	3N	O	O	1 to 360, -9	1 to 360, -9		
Ground speed	**1N.1D**	**O**	**O**	**2.0 to 6.0, -9**	**2.0 to 6.0, -9**	**Ground speed of trawl. Knots**	**Ground speed of trawl. Knots**
Speed through water	**1N.1D**	**O**	**O**	**1.0 to 9.9, -9**	**1.0 to 9.9, -9**	**Trawl speed through. Knots**	**Trawl speed through. Knots**
Surface current direction	3N	O	O	0 to 360, -9	0 to 360, -9	Slack water =0	0 slack water
Surface current speed	**2N.1D**	**O**	**O**	**0 to 10.0, -9**	**0 to 10.0, -9**	**Metres per sec**	**Metres per sec**
Bottom current direction	3N	O	O	0 to 360, -9	0 to 360, -9	Slack water =0	0 slack water
Bottom current speed	**2N.1D**	**O**	**O**	**0 to 10.0, -9**	**0 to 10.0, -9**	**Metres per sec**	**Metres per sec**
Wind direction	3N	O	O	0 to 360, -9	0 to 360, -9	0 = calm	360=north, 0=variable
Wind speed	3N	O	O	0 to 100, -9	0 to 100, -9	Metres per sec	Metres per sec
Swell direction	3N	O	O	0 to 360, -9	0 to 360, -9		360=north, 0=variable
Swell height	**2N.1D**	**O**	**O**	**0 to 25.0, -9**	**0 to 25.0, -9**	**Metres**	**Metres**
Surface temperature	**2N.1D**	**O**	**O**	**-1.0 to 30.0, -9**	**-1.0 to 30.0, -9**	**Degree Celsius**	**Degree Celsius**
Bottom temperature	**2N.1D**	**O**	**O**	**1.0 to 20.0, -9**	**1.0 to 20.0, -9**	**Degree Celsius**	**Degree Celsius**
Surface salinity	**2N.2D**	**O**	**O**	**10.00-38.00, -9**	**10.00-38.00, -9**		
Bottom salinity	**2N.2D**	**O**	**O**	**20.00-38.00, -9**	**20.00-38.00, -9**		
Thermo cline	**1A**	**O**	**O**	**y=yes, n=no, -9**	**y=yes, n=no, -9**		
Depth of thermo	**4N**	**O**	**O**	**5 to 100, -9**	**5 to 100, -9**	**Depth from surface in metres**	**Depth from surface in metres**

RECORD TYPE 2 (Length frequency distribution)

NAME	TYPE*	M/O**				RANGE				COMMENTS			
		BITS	IBTS	EVHOE	BTS	BITS	IBTS	EVHOE	BTS	BITS	IBTS	EVHOE	BTS
Record type	2A	M	M			HL	HL			Fixed value: HL	Fixed value: HL		
Quarter	1N	M	M			1 to 4	1 to 4			See Record Type 1	See Record Type 1		
Country	3A	M	M			See Appendix III	See Appendix III			See Record Type 1	See Record Type 1		
Ship	4AN	M	M			See Appendix III	See Appendix III			See Record Type 1	See Record Type 1		
Gear	10AN	M	M			See Appendix IV	See Appendix IV			See Record Type 1	See Record Type 1		
Standard station number	6AN	**M**	**M**							See Record Type 1	See Record Type 1		
Haul no	3N	M	M			1 to 999	1 to 999			See Record Type 1	See Record Type 1		
Year	**4N**	M	M			1900 to 2099	1900 to 2099			See Record Type 1	See Record Type 1		
Species code type	**1A**	**M**	**M**			**N, T**	**N, T**			**N = NODC or T = TSN**	**N = NODC or T = TSN**		
Species code	10A	M	M			See Appendix VII	See Appendix VII			Official NODC code or TSN code	Official NODC code or TSN code		
Validity code	2N	M	M			See Appendix VIII	See Appendix VIII						
Category number	**1N**	**M**	**M**			**1 to 5**	**1 to 5**			**If DataType = C then category number = 1, else 1 to 5**	**If DataType = C then category number = 1, else 1 to 5**		
Category catch number	**7N**	**M**	**M**			**0 to 9999999**	**0 to 9999999**			**No specimen caught per category or per haul per hour (if data type = C)**	**No specimen caught per category or haul per hour (if data type = C)**		
Category catch weight	**8N**	**M**	**M**			**0 to 10000000, -9**	**0 to 10000000, -9**			**Catch weight per category or weight per haul per hour, In g. Not known = -9**	**Catch weight per category or weight per haul per hour, In g. Not known = -9**		
Sample catch weight	5N	O	O			0 to 40000**, -9**	0 to 40000**, -9**			**In g. Not known = -9**	**In g. Not known = -9**		
No measured	3N	M	M			0 to 999, -9	0 to 999, -9			Not known = -9	Not known = -9		
Length class code	1AN	M	M			., 0, 1, 2, 5, 9	., 0, 1, 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	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		
Min. length class	3N	M	M			1 to 999, -9	1 to 999, -9			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	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		
No at length	6N	M	M			1 to 999999, -9	1 to 999999, -9			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).	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).		
Sex	1A	O	O			**M, F, U, -9**	**M, F, U**			Male = M, Female =F, **measured but** u**nknown = U, -9 not measured**	Male = M, Female =F, **U = Unknown**		

RECORD TYPE 4 (SMALK's)

NAME		TYPE*	M/O**				RANGE				COMMENTS			
			BITS	IBTS	EVHOE	BTS	BITS	IBTS	EVHOE	BTS	BITS	IBTS	EVHOE	BTS
Record type		2A	M	M			CA	CA			Fixed value: CA	Fixed value CA		
Quarter		1N	M	M			1 to 4	1 to 4			See Record Type 1	Identical to Record Type 1		
Country		3A	M	M			See Appendix III	See Appendix III			See Record Type 1	Idem		
Ship		4AN	M	M			See Appendix III	See Appendix III			See Record Type 1	Idem 1)		
Gear		10AN	M	M			See Appendix IV	See Appendix IV			See Record Type 1	Idem 1)		
Station number		6AN	**M**	**M**							See Record Type 1	Idem 1)		
Haul no		3N	M	M			1 to 999	1 to 999			See Record Type 1	Idem 1)		
Year		4N	M	M			1900 to 2099	1900 to 2099			See Record Type 1	Idem		
Species code type		**1A**	**M**	**M**			**N, T**	**N, T**			**N = NODC or T = TSN**	**N = NODC or T = TSN**		
Species code		10A	M	M			See Appendix VII	See Appendix VII			**Official NODC code or TSN code**	**Official NODC code or TSN code**		
Sub-Division area	Area type	2N	M	M			22 to 32, see Appendix IX	0 to 3			ICES Baltic Sub-Division code 7)	ICES Statistical rectangles=0, Four Statistical rectangles=1, Standard NS Roundfish areas=2, Herring Sampling areas=3		
Rectangle area	Area code	4 AN	M	M			See Appendix IX	See Appendix IX			ICES Statistical Rectangles			
Length class code		1AN	M	M			., 0, 1, 2, 5, 9	., 0, 1, 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	Identical to Record Type 2 (+group not allowed). 2)		
Min. length class		3N	M	M			1 to 999, -9	1 to 999, -9			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	Idem		
Sex		1A	M	M			**M, F, U, -9**	**M, F, U**			Male = M, Female = F, **measured but unknown = U, -9 not measured**	Male=M, Female=F, **Unknown=U**		
Maturity		1AN	M	M			1 to 5, space	1 to 4, space			See Appendix I 3)	See Appendix II 3)		
+group identifier		1A	M	M			+, space	+, space			Plus group = +, else space 4)	Plus group=+ else space 4)		
Age		2N	M	M			0 to 99, spaces	0 to 99, -9			Unknown age = -9 5)	Unknown age/rings= -9 5)		
Number		3N	M	M			1 to 999	1 to 999			6)	6)		
Individual weight (g)	**Individual weight (g)**	5N	O	**O**			0 to 99999, spaces	**0 to 99999, -9**			**The individual weight of the fish in the record (in gram).**	**The individual weight of the fish in the record (in gram).**		
Liver weight?	**Liver weight?**													

ANNEX 5

STUCTURE OF THE CRUISE REPORTS OF THE ACOUSTIC SURVEYS

Survey report for RV "Fantasy"
Date start of survey – date end of survey

Author, Institute.

1. INTRODUCTION

Brief background
Objectives

2. SURVEY DESCRIPTION & 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, randomisation ?) and limits of area. Refer to cruise track Figure 1.

2.4 Calibration

Some indication of quality of calibration, comparison to previous values. Dates and location of calibration(s). Reference to table detailing calibration results. Refer to manual.

2.5 Acoustic data collection

Total mileage covered. 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 trawls

Rationale for fishing, opportunistic, standard tow periods, bottom trawls, exclusion trawls. General methods. Description of gear (name of trawl, mesh size in cod end, and reference for further information). Additional equipment (netsondes, scanmar). Sampling procedure. Type of maturity scale used.

2.7 Hydrographic data

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

2.8 Data analysis

EDSU size. Description of echogram scrutiny. Software used and methods employed. Calculation resolution (stat rect., quarter rect, analysis strata). TS/length relationships used were those recommended by the acoustic survey planning group (Anon, 1994). Stock splitting procedure. Raising factors used. Method for combining trawl information and definition of strata.

3. RESULTS & DISCUSSION

3.1 Acoustic data

Geographical distribution of NASCs assigned to whatever species. Reference to figures.

3.2 Biological data

No. of trawl hauls. Ref to Figure 1 and Tables. Herring was present in ?? the trawl hauls; it was the most abundant species caught by weight in ?? trawls. The remaining species were dominated by ??, ?? and ??.

Reference to table of length frequencies. Length-weight relationship used. Remarks on quality of ground truthing data. Geographic distribution of herring. Discussion of biological parameters.

3.3 Biomass estimates

The total biomass estimates for the survey:

Category 1 herring	?? tonnes	%
Category 2 herring	?? tonnes	%
Total herring	**?? tonnes**	
Spawning stock biomass	?? tonnes	%
Other	?? tonnes	

As above for total abundance (numbers).
Age composition. Comparison to previous years.

3.4 Hydrological data

No. of CTD/XBT casts. Reference to Figure 1 (or 2).

Figures

1. Cruise track, trawl stations (herring filled; no herring unfilled; pelagic =triangles, demersal = squares), hydrographic (CTD) stations (crosses).

2. [Optional]. Post plot of acoustic values by EDSU (circle area proportional to square root of Nautical Area Scattering Coefficient, zero values to be included either as crosses or dots).

3. [Optional] Post plot of trawl mean length (square size proportional to mean length in cm) with strata/area subdivisions (if used), symbols to be labelled with actual value of mean length.

4. Label plot of numbers (millions of fish) and biomass (thousands of tonnes) by calculation resolution cell (strata / statistical rectangle / quarter statistical rectangle).

Tables

1. Calibration parameters and EK500 important settings.
2. Trawl haul information
3. Trawl haul species composition (numbers).
4. Trawl length frequency composition (by trawl number or strata).
5. Age-length key of sampled fish with total number of otoliths by age and length class.
6. Summary results table: Total number, biomass, mean length and mean weight by age. Totals are required; division by strata is optional.

Figures

Figure 1. Map of the west of Scotland showing cruise track and positions of fishing trawls undertaken during the July 1998 west coast acoustic survey on MFV Kings Cross. Filled circles indicate trawls in which herring were caught, whilst open squares indicate trawls with no herring.

Figure 2. Post plot showing the distribution of total herring NASC values (on a proportional square root scale relative to the largest value of 10,424) obtained during the July 1998 west coast acoustic survey on MFV Kings Cross. Crosses indicate zero values.

International Council for the
Exploration of the Sea

Addendum to ICES CM 2002/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

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
.

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:			

6 REFERENCES

Alekseev, F.E. and Alekseeva, E.I., 1996. Assessment of gonad maturity stages and study of sex cycles, fecundity, eggs production and maturity rate of marine commercial fishes. AtlantNIRO, Kaliningrad. Mimeo, 75 pp. (In Russian).

Berner, M., 1960. Untersuchungen über den Dorschbestand (*Gadus morhua* L.)der Bornholm- und Arkonasee in den Jahren 1953–1955. Zeitschrift für Fischerei IX (7–10):481–602.

Chrzan, F., 1951. Studies on the biology of cod in the Gulf of Gdansk (in Polish). Rep. Sea Fish. Inst. 6:1–28.

Elwertowski, J., 1957. Biologiczna charakterystyka polskich polowow szprota w Baltyku Poludniowym w latach 1950–1954. [Biological characteristic of Polish sprat catches in the southern Baltic in 1950–1954]. Prace Mor. Inst. Ryb. 9:175–220.

Heincke, F., 1898. Naturgeschichte des Herings. Abhandl. des Seefischverb. 2:1–223.

ICES 2001. Report of the Baltic International Fish Survey Working Group. ICES CM 2001/H:02.

ICES 2002. Report of the Baltic International Fish Survey Working Group. ICES CM 2002/H:0 ?.

Kiselevich, K., 1923. Instructions for biological observations. (In Russian). Referred in Pravdin (1966).

Maier, N.N., 1908. Beiträge zur Altersbestimmung der Fische. I.Allgemeines. Die Altersbestimmung nach Otolithen bei Scholle und Kabeljau. Wissensch. Meeresunters. 8:60–115.

Müller , H. 1996. Minimum sample sizes for length distributions of catch estimated by an empirical approach. ICES CM 1996/J:12, 18pp.

Oeberst, R. 1999. A universal cost function for the optimization of the number of age readings and length measurements for Age-Length-Key-Tables. Arch. Mar. Res. 48 (1): 43-60.

Popiel, J., 1955. Z biologii sledzi baltyckich. [Biology of Baltic herring]. Prace Mor. Inst. Ryb. 8:5–68.

Pravdin, I., 1966. Guidlines for fisheries investigations. Pischevaja Promyshlenost Publ., Moscow. Mimeo: 376 pp. (In Russian).

Sorokin, V.P., 1957. The oogenesis and reproduction cycle of cod (*Gadus morhua L.*). Trudy PINRO 10:125–144.(In Russian). (English translation No. 72F49, Ministry of Agriculture, Fisheries and Food, United Kingdom 1961.)

Strzyzewska, K., 1969. Studium porownawcze populacji sledzi tracych sie u polskich wybrzezy Baltyku. Prace Mor. Inst. Ryb 15 (seria A): 211–278.

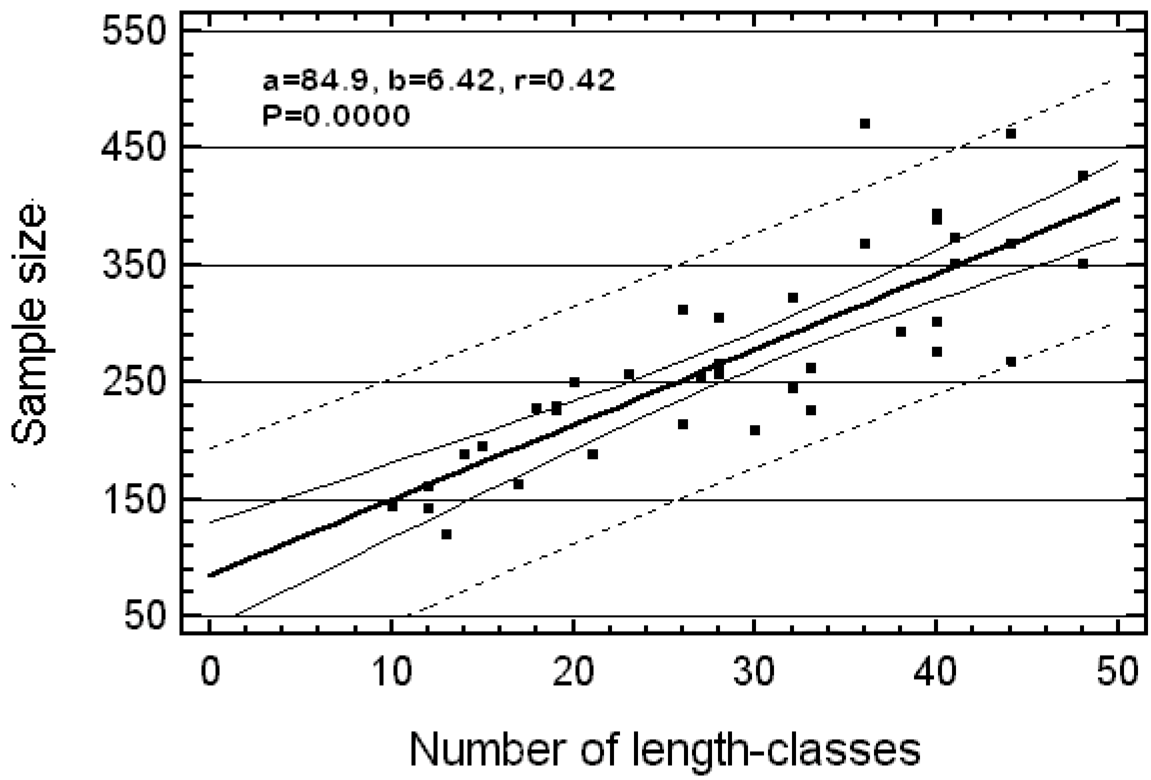


Figure 1. Relationship between the number to be measured and the number of length groups of the total length range in the sample of the catch (after Müller, 1996).

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	 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
<u>Maturity stage</u> ([1])	<u>Code</u>								
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
<u>Maturity stage</u> ([1])	<u>Code</u>								
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		

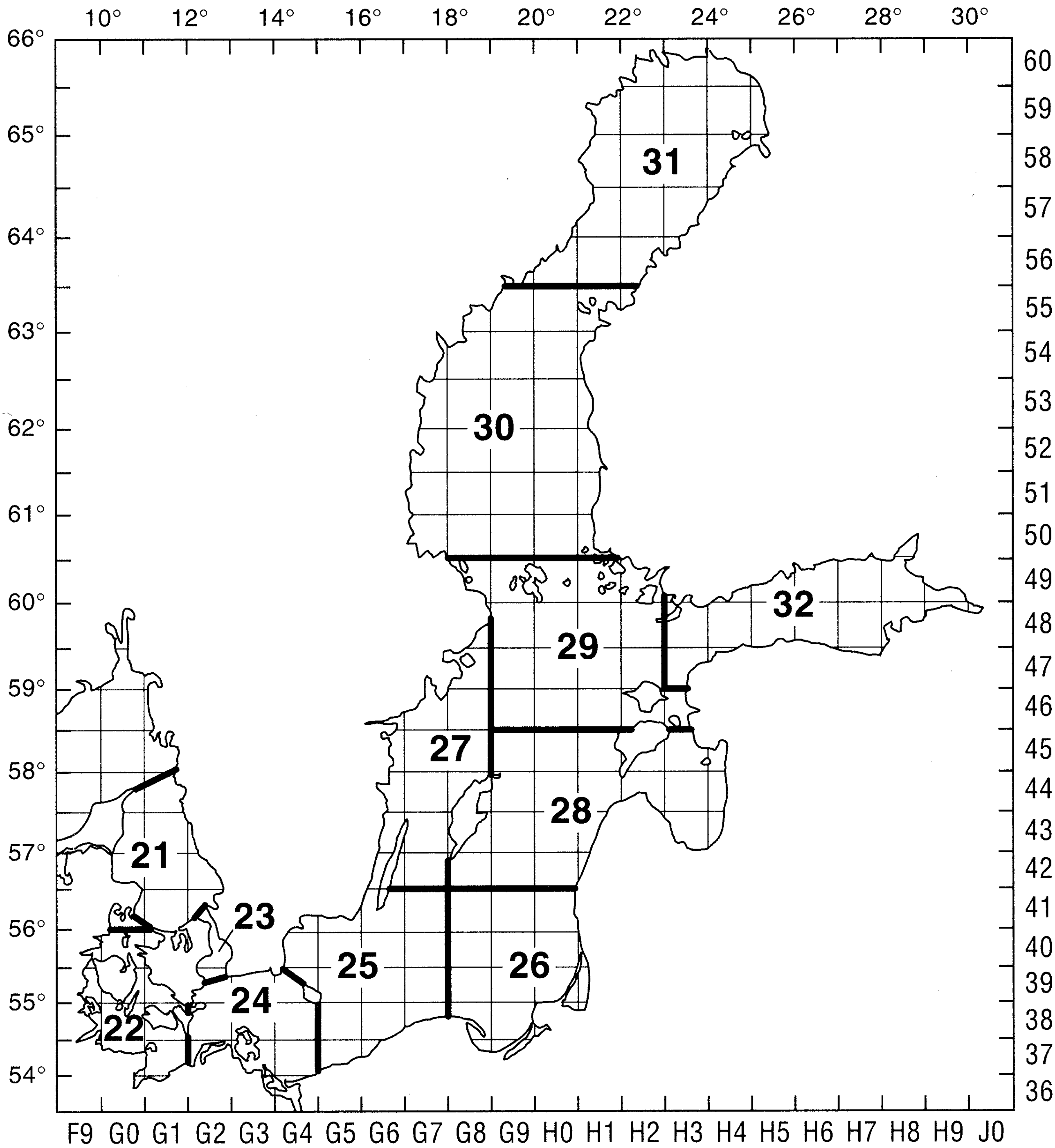
8842020100	Anarhichas	8842020102	Anarhichas denticulatus
		8842020103	Anarhichas lupus
		8842020104	Anarhichas minor
8842120000	Stichaeidae		
8842120500	Chirolophis	8842120505	Chirolophis ascanii
8842120900	Lumpenus	8842120905	Lumpenus lampretaeformis
8842121800	Leptoclinus	8842121801	Leptoclinus maculatus
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	**SD 21**	44G0	44G1	43G0	43G1	43G2	42G0	42G1	42G2	41G0	41G1	39G0
Depth interval												
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	**SD 22**	41G0	40F9	40G0	40G1	39F9	39G0	39G1	38F9	38G0	38G1	37G0	37G1	36G0
Depth interval														
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	**SD 23**	41g2	40g2	39g2
Depth interval				
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	**SD 24**	39G2	39G3	39G4	38G2	38G3	38G4	37G2	37G3	37G4
Depth interval										
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	**SD 25**	41G4	41G5	41G6	41G7	40G4	40G5	40G6	40G7	39G4	39G5	39G6	39G7	38G5	38G6	38G7	37G5	37G6
Depth interval																		
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	**SD 26**	41G8	41G9	41H0	41H1	40G8	40G9	40H0	40H1	39G8	39G9	39H0	39H1	38G8	38G9	38H0	37G8	37G9
Depth interval																		
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

APPENDIX XIII

Manual for the construction and use of the International Standard Trawls for Baltic Demersal Surveys

TV3 520 meshes

References

Anonymous 1998: Report of the Baltic International Fish Survey Working Group. Karlskrona, 8–13 June 1998. ICES CM 1998/H:4.

Contents

Two trawls are specified as International Standard Trawls for Baltic Demersal Surveys:

- TV3 520 meshes in the circumference for vessels less than 600 KW (This manual)
- TV3 930 meshes in the circumference for vessels of more than 600 KW (Separate manual)

This manual consists of 10 pages: Page

Notes to the construction

The nets should be made from good quality polyethylene netting, except the codend, which is made from polyamide. It will however not be possible for the net manufacturer always to obtain sheet netting of exactly the same length as specified in this manual. Thorough care must be taken to obtain materials with properties as close as possible to the ones specified here. The denomination of the sheet netting differs from manufacturer to manufacturer, but the following table should give the most common 'translations'.

	Chemical Composition	Construction	Diameter	International denomination	Trade 'name'
Front part and font belly	PE	Twisted	2.17	500/36	3/12
Rear belly	PE	Twisted	1.71	500/24	3/8
Codend	PA	Twisted	1.32	210/30	no. 10

IMPORTANT: It is very important to maintain the original relationship (hanging ratio, difference in length) between the netting lengths and the framing ropes along the headline and footrope. So if the headline in a section shall be 10% longer than the net according to this manual, it must be so, also if the dimensions of the net differ from the present specification.

Operation of the standard trawls

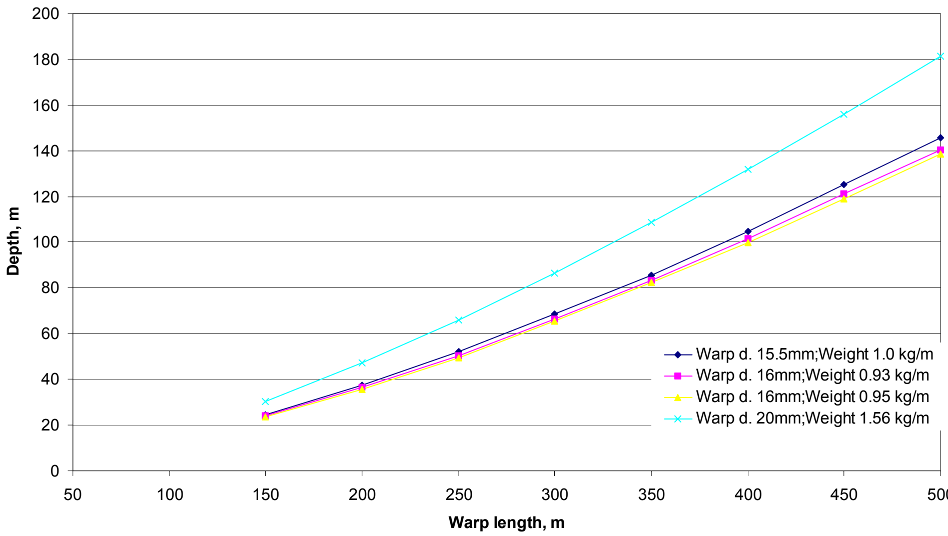
Towing speed

The towing speed should be 3.0 knots.

Warp length

It is recommended to use the following table for finding the correct warp length to be used at various fishing depths. The table gives different warp lengths for a range of warp constructions given by diameter and weight per metre.

It is recommended according to practical experience that the warps length should not less than 125 metre as it will decrease the door spread too much.



(The figures have been obtained using software developed at Kaliningrad State Technical University, by professor Rosenstein).

The recommended warp length in the upper figure for warp diameter 15/16 mm should be taken as maximum. When using warps 15/16 mm their length could be less the results from the figure, but not less than the results from the curve of 20 mm.

Trawl geometry

The shape of the trawl is depending on many parameters of which some are being standardized here by using the same procedures. Nevertheless, when working on different depths and using different lengths of towing warp the door spread will change, and therefore also the height of the net. Below table 2 shows the relationship between the basic geometric parameters for the standard trawl using the specified 97.2 m distance between trawl door and the net (8 + 75 + 2.1 + 9.1 + 3 m). They are based on model measurements and full scale measurements at sea using acoustic measuring devices.

Door spread, m	50	55	60	65
Trawl vertical opening, m	2,3	2,1	1,8	1,7
Headline spread, m	13	14,5	16	17,5
Angle of sweeps, degrees	11	12	13	14

If trawl monitoring instruments (like SCANMAR) are used on the trawl the table can be used to check if the trawl is working properly. Care should be taken that the instruments are neutrally buoyant in water.

Maintenance

The net should be regularly checked for wear and tear and all damages shall be repaired upon discovery.

The net will eventually stretch under normal fishing conditions. It is important for its fishing performance and for maintaining a constant fishing efficiency at regularly intervals to check the length of the bridles, sweeps, extensions, netting sections etc.

The overall status for the net should be checked at the beginning of every cruise. Every year a detailed check should be made of all net and rope dimensions. (The interval between checks is depending on the time the net is in use. An annual check is regarded sufficient if the net is used for one or two normal surveys a year). The special check guide attached to this manual can be used.

IMPORTANT: Special attention should be given to ensure that the relationship (difference) between the length of the netting sections in the top and bottom panels are maintained. Most lower sections are a half mesh or a full mesh longer than the corresponding top section. These differences have to be maintained by monitoring the net at regular intervals.

In the case that the difference is larger than 1 mesh size the bottom section must be shortened to the proper size.

Also the relationship between the length of the framing ropes and the nets in the wings and arms must be retained. The percentage the net is stretched on the headline and footrope is given in the specification. When the netting after a period of use loose its stretch, the headline and footrope must be cut off, the net in the wings and arms shortened and remounted on the ropes again.

TV3 520#

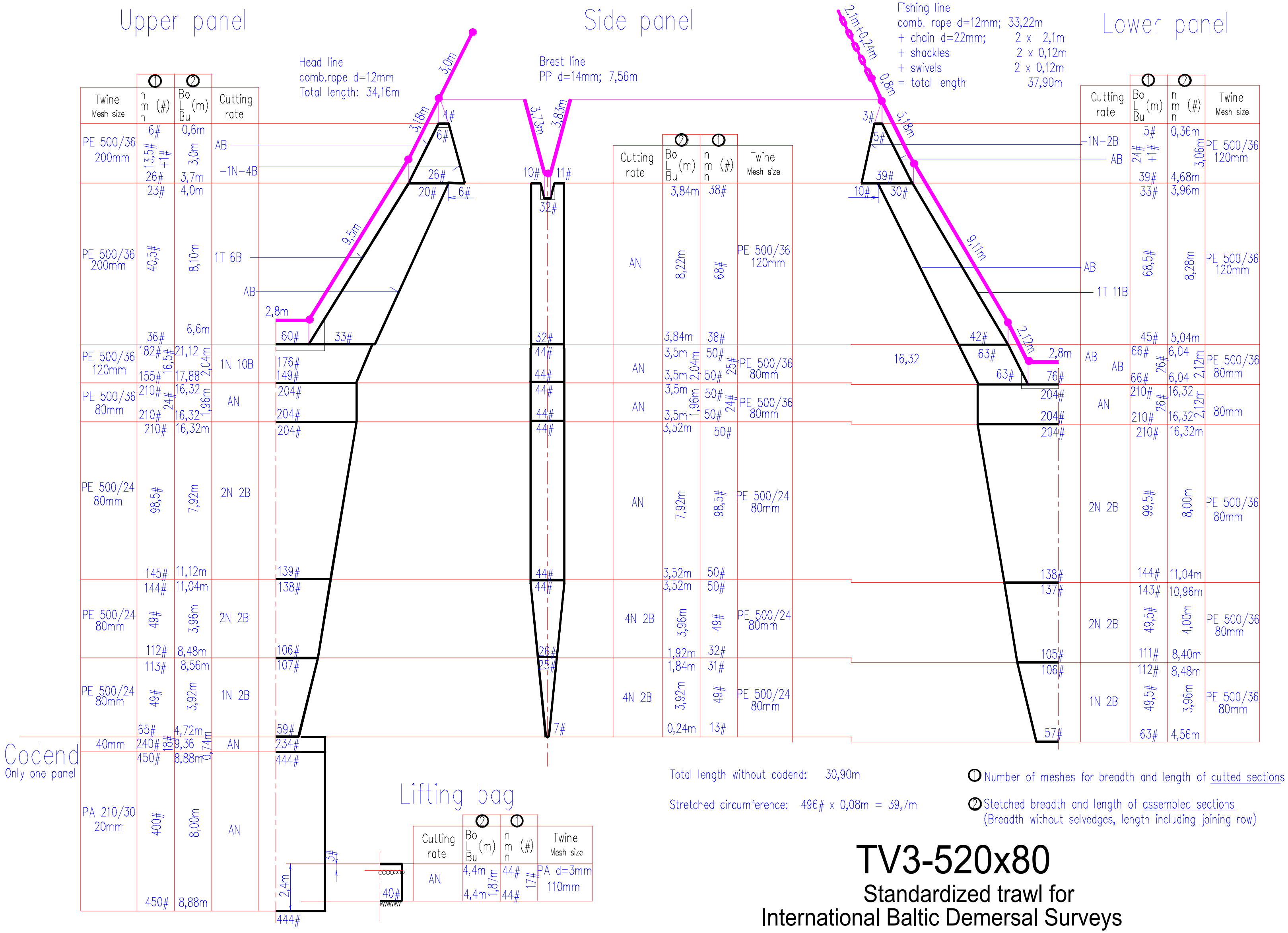
Parts List

International Standard Trawl for
Baltic Demersal Surveys

Note: In this list the term weight is used for mass and the unit is kg.

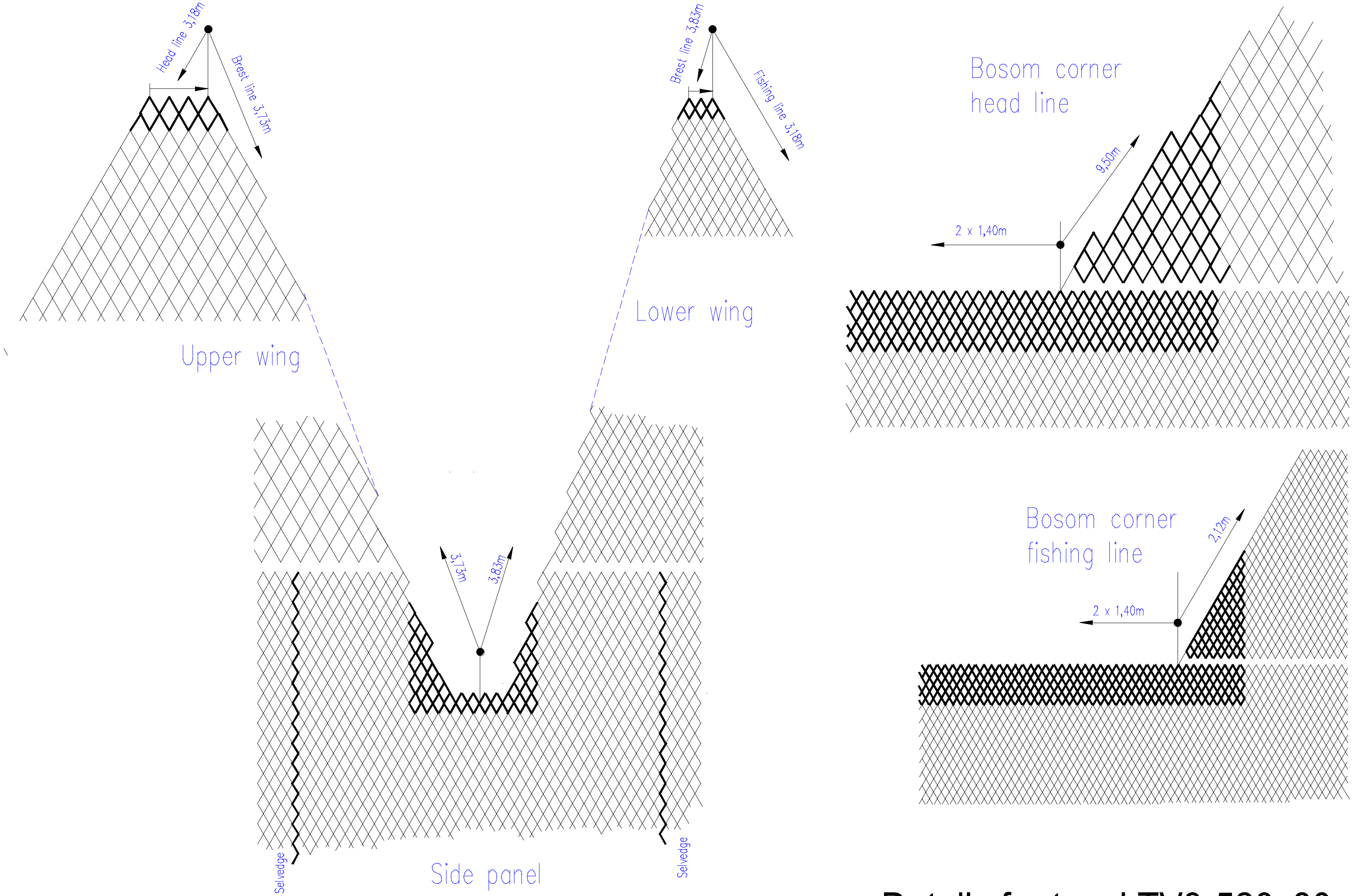
	No	Item	Description	Size
Trawl doors				
	2	Doors	Cambered V-doors, Type: Thyborøn Trawl Doors Type 2	1.78 m² (63 inch) Weight 235 kg
		Front Chain	Recommended setting: 18 links using link 3 for warp attachment	Inside length of link 80 mm
		Back Chain	Recommended setting Top chain: 7 links Horizontal chain: 18 links Bottom chain: 5 links	Inside length of link: 63 mm
	2	Back strop	Combination rope	Ø = no standard Length 8 m
Sweeps				
	2	Sweep	Wire Rubber disks	Ø = 10 mm Length 75 metre Weight per metre 0.36 kg Ø = 35 mm
Chain between sweeps and bridles				
	2	Chain	Iron	Length 2.1 m Weight: 20 kg
Bridles				
	4	Upper bridle	Combination rope	Ø = 12 mm Length: 9.1 m Weight per metre 0.2 kg
	2	Lower bridle	Wire Rubber discs Lead weights with centre hole distributed evenly, every 40 cm	Ø = 10 mm Length 9.1 m Weight per metre 0.36 Ø = 35 mm 22 pieces of 250 g each on each lower bridle
Floats				
	(11)	Floats	(4 litre (same as 200 mm, 8 inch) plastic floats)	Total lifting force: 38.5 kg (equivalent to 11 pcs. of 200 mm plastic floats)

Headline and Fishing line				
	1	Headline	Combination rope, stainless	Ø = 12 mm Length 34.16 m incl. Extension Weight per metre 0.2 kg
	1	Fishing line	Combination rope, stainless Chain weight	Ø = 12 mm Length 37.66 m incl. extension and weight Weight per metre 0.2 kg Length 2.1 m Weight 20 kg
Footrope				
		Centre Wire	Stainless steel wire	Ø = 9.5 mm Weight per metre 0.34 kg
	108	Rubber discs	Rubber discs with side hole	100 mm
		Filling the space between rubber discs	Plastic or rubber tube Rubber discs on each side of rubber disc 28 pcs. of lead, (1 every 3rd space)	Ø = 12 mm/14 mm Ø = 35 mm 250 g each piece
		Rope to mount the gear	Danline mounted in bights on the fishing line and through the rubber discs.	Ø = 12 mm The size of the bights makes the footrope disc periphery hang 4 cm below the fishing line
Attachments				
		Lazy deckie	No standard	
		Tackle strop	No standard	

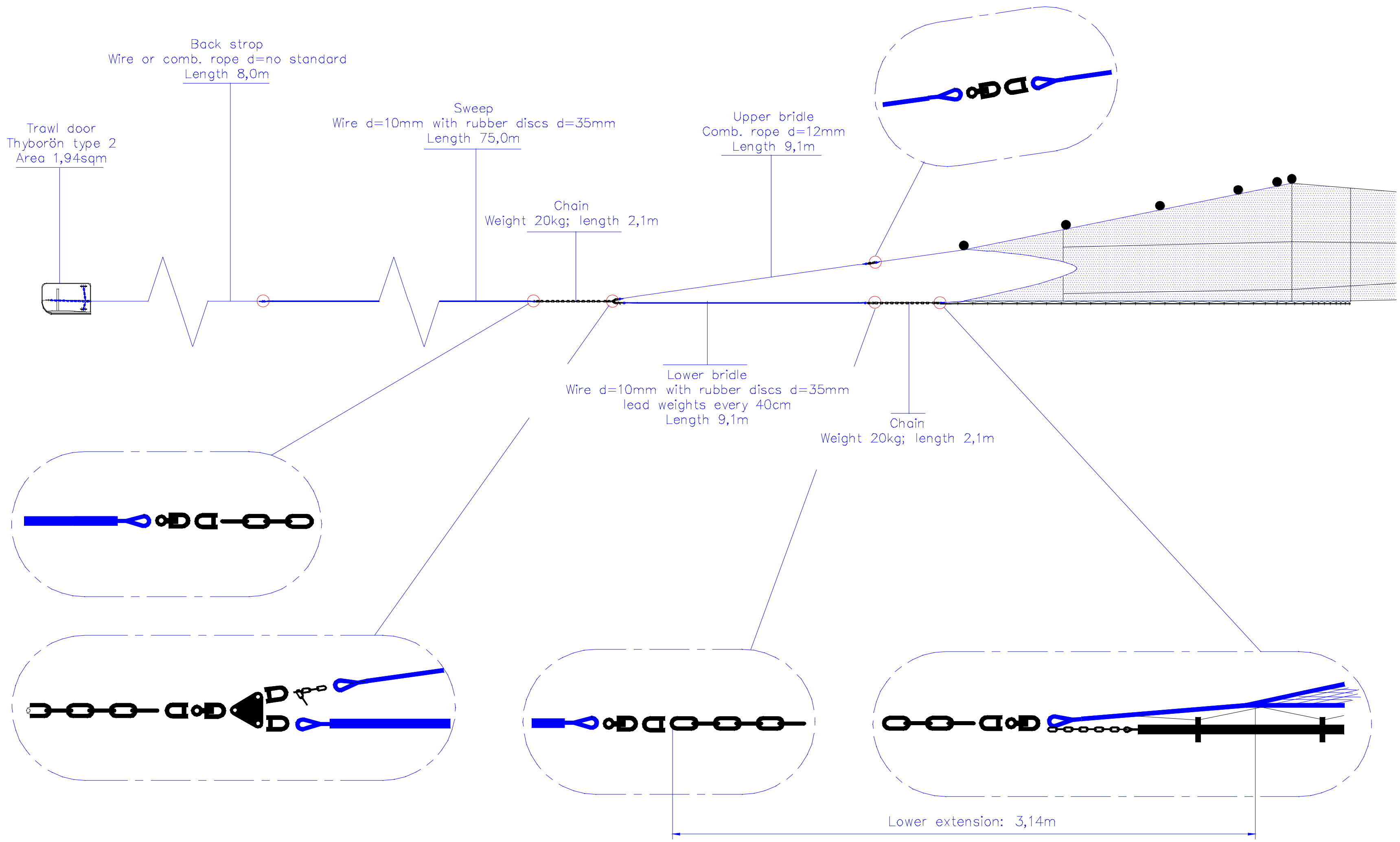


TV3-520x80

Standardized trawl for
International Baltic Demersal Surveys

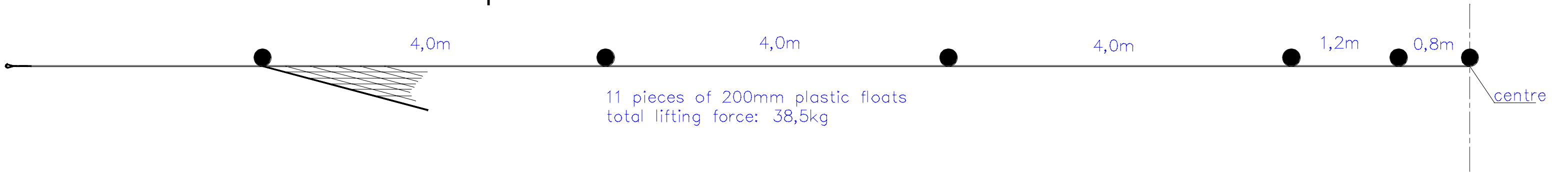


Details for trawl TV3-520x80



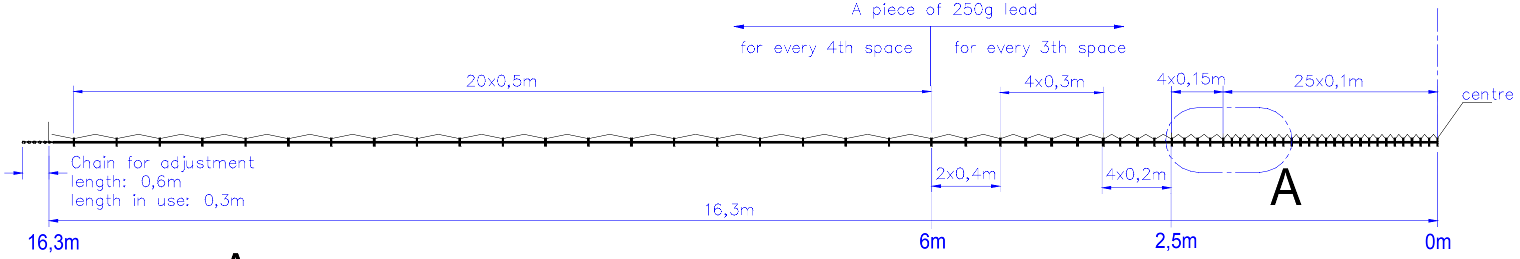
Rigg details (1) for trawl TV3- 520x80

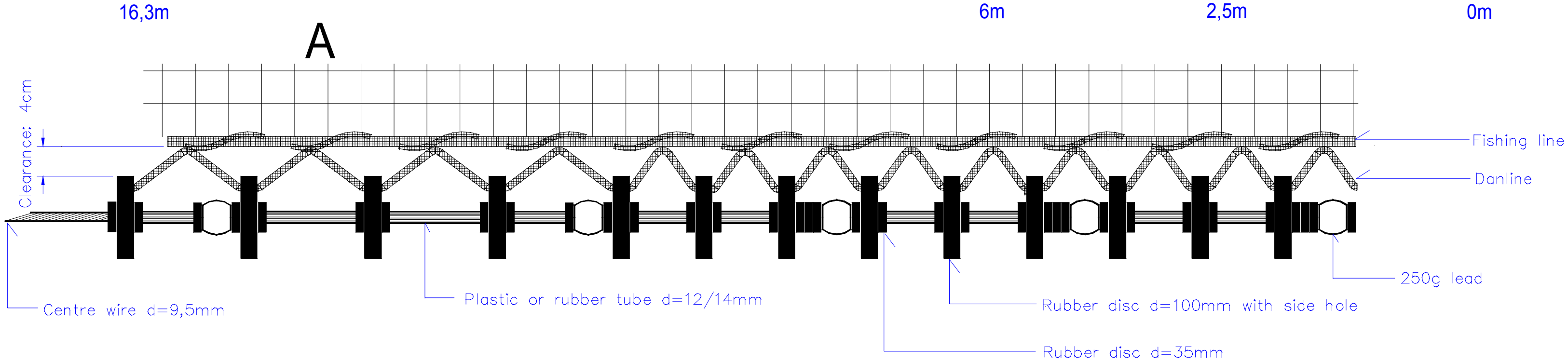
Float positions



Footrope

0 – 2,5m:	100mm rubber discs with side hole, 100mm distance
2,5 – 6m:	100mm rubber discs with side hole, distance increasing from 100 to 500mm
6 – 16,3m:	100mm rubber discs with side hole, 500mm distance
0 – 16,3:	12/14mmrubber or plastic tube and 45mm rubber discs filling all the space between the large discs





Rigg details (2) for trawl TV3- 520x80

Section 1

1B1	1A1	1A2	1B2	1C1	1C2
8,22m	8,10m	8,10m	8,22m	8,28m	8,28m

Section 2

2B1	2A	2B2	2C1	2C2
2,04m	2,04m	2,04m	2,12m	2,12m

Section 3

3B1	3A	3B2	3C
1,96m	1,96m	1,96m	2,12m

Section 4

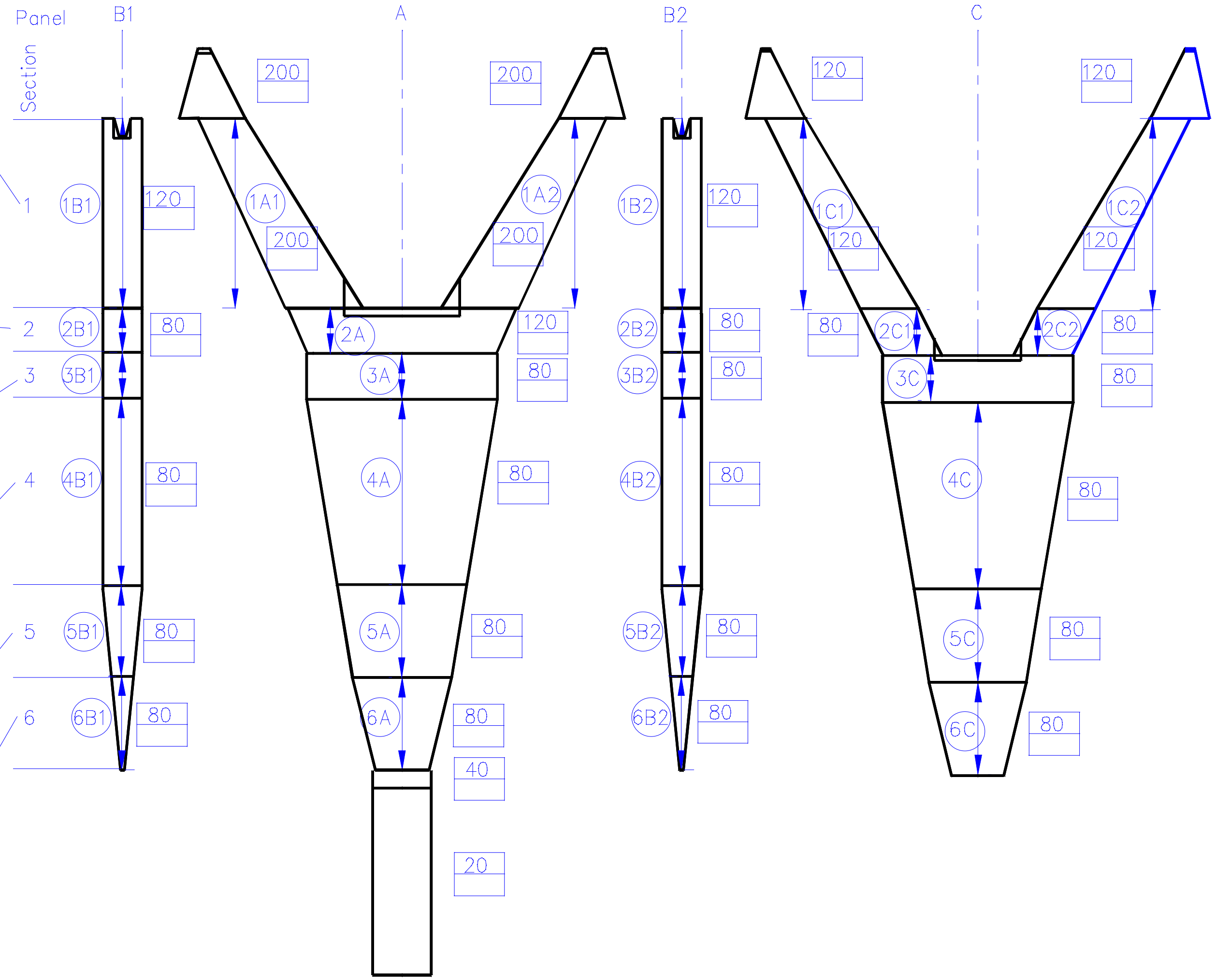
4B1	4A	4B2	4C
7,92m	7,92m	7,92m	8,00m

Section 5

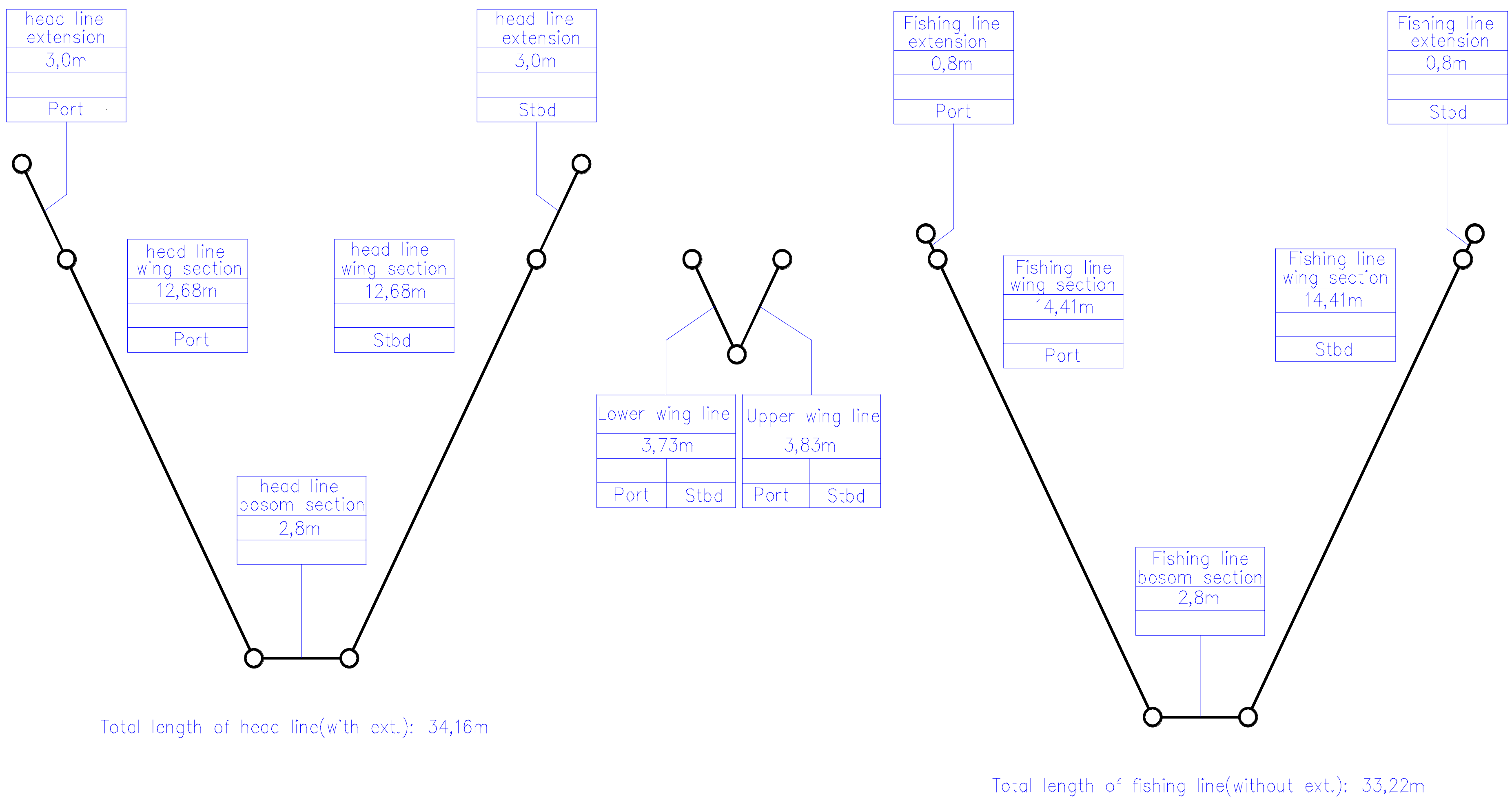
5B1	5A	5B2	5C
3,96m	3,96m	3,96m	4,00m

Section 6

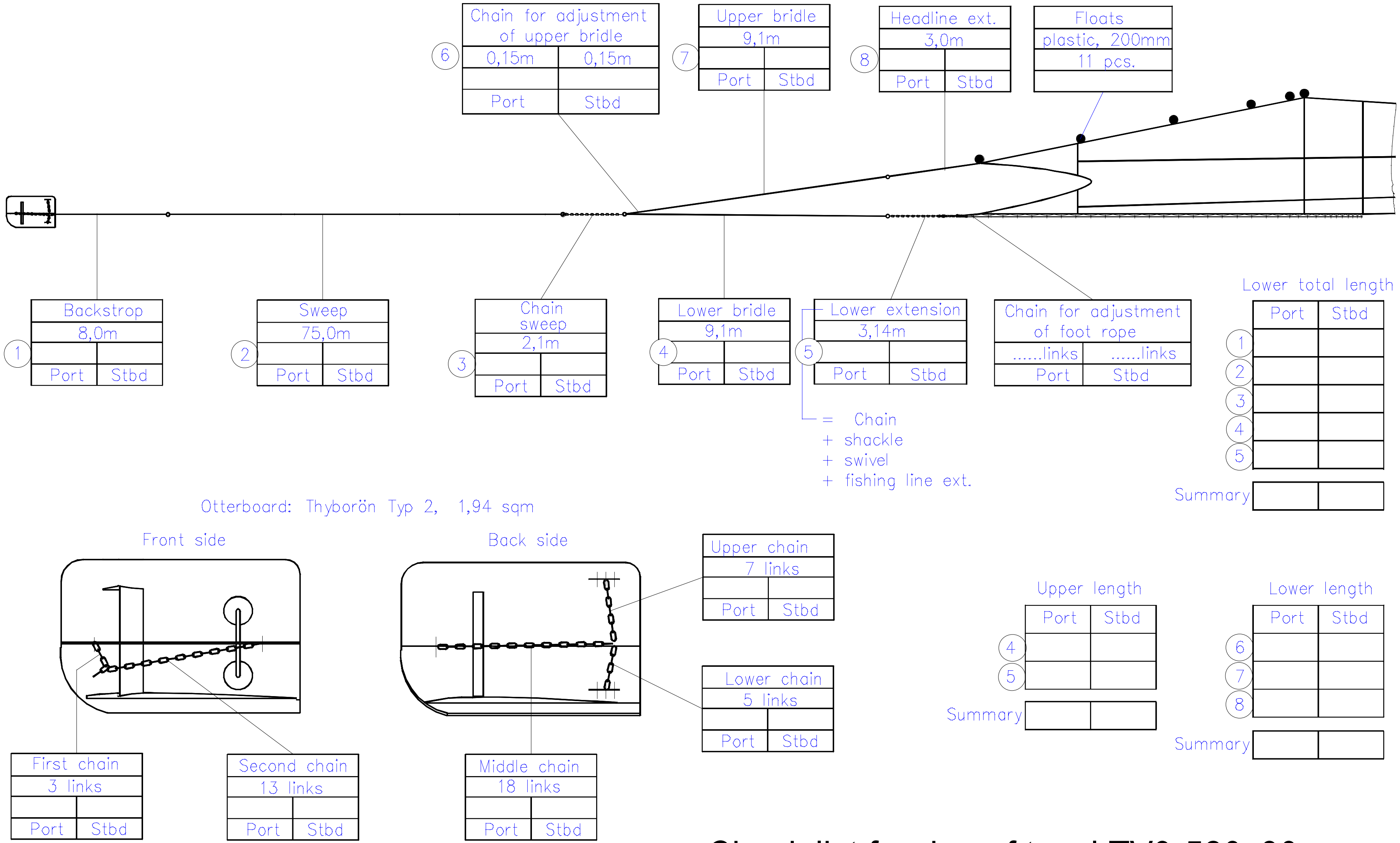
6B1	6A	6B2	6C
3,92m	3,92m	3,92m	3,96m



Check list for trawl TV3-520x80



Check list for frame ropes of trawl TV3-520x80



Check list for rigg of trawl TV3-520x80

TV3 520#

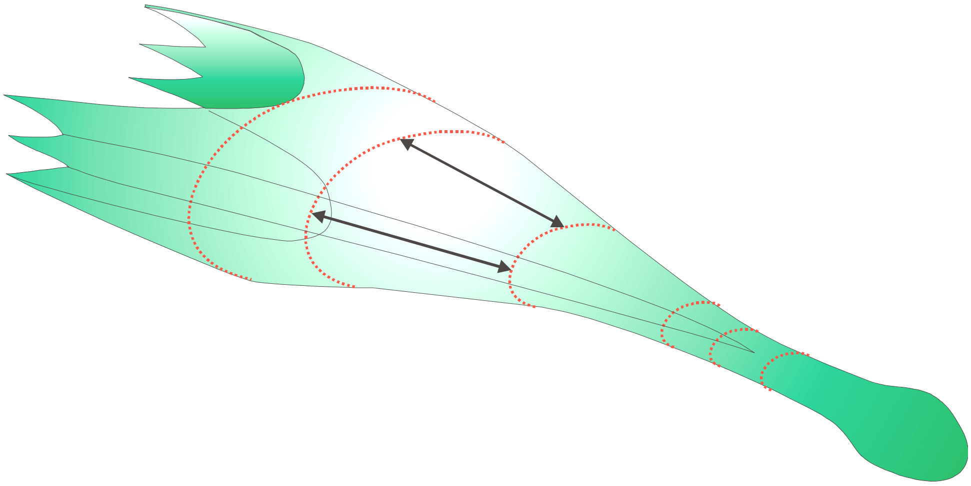
Check Guide

International Standard Trawl for Baltic Demersal Surveys

In order to maintain the properties and performance of the net it must be checked at regular intervals.

Before every cruise
Length of net sections

The trawl consists of four panels: top, bottom and side panels. Each panel has several sections. It is necessary to check the relative length of each netting section. They are all compared with the corresponding sections in the other panels in the way that the top and bottom panel sections are checked against the side panel sections.



Comparison of the lengths of two sections from the top and side panels – indicated by arrows: Approx 10 meshes from around the centre line of the top panel is hold against approx. 10 meshes from around the centre line of the side panel.

The best method to compare two sections is to let two persons – one in each end of the section – take around 10 meshes from the centre line of one section in one hand and hold it against 10 meshes from the centre line of the other section in the other hand. The sections must then be stretched and the difference in length observed.

- Length of side and top panel sections must be equal;
- Length of bottom panel sections must be about 1 mesh longer than corresponding side panel sections.

The procedure is repeated for each section. In case the difference differs more than 4 cm (or half a mesh) from the specified difference, a skilled netmaker should be consulted to evaluate a possible shortening

Length of wings

The specified shortening of the side wing shall be measured from the joining round between the wing and arms to the eye at the end of the headline, footrope and breastline extensions respectively.

- The length of side wing must be 0,65 meter shorter than the top wing and bottom wing.

Length of ground rope

The length of the ground rope and fishing line must be compared by holding the two together. The length is adjusted by means of the adjustment chain on the ground rope.

- The ground rope must be two links shorter than the fishing line (equal to shortening the groundrope one link in each side).

Original: 7 January 2000
Last revision: April 24, 2002

APPENDIX XIV

Manual for the construction and use of the International Standard Trawls for Baltic Demersal Surveys

---

TV3 930 meshes

References

Anonymous 1998: Report of the Baltic International Fish Survey Working Group. Karlskrona, 8–13 June 1998. ICES CM 1998/H:4.

Contents

Two trawls are specified as International Standard Trawls for Baltic Demersal Surveys:

- TV3 930 meshes in the circumference for vessels more than 600 KW (This manual)
- TV3 520 meshes in the circumference for vessels of less than 600 KW (Separate manual)

This manual consists of 15 pages:

Notes to the construction

The nets should be made from good quality polyethylene netting, except the codend that is made from polyamide. It will however not be possible for the net manufacturer always to obtain sheet netting of exactly the same length as specified in this manual. Thorough care must be taken to obtain materials with properties as close as possible to the ones specified here. The denomination of the sheet netting differs from manufacturer to manufacturer, but the following table should give the most common 'translations'.

	Chemical composition	Construction	Diameter	International denomination	Trade 'name'
Front part and front belly	PE	Braided	3.0	500/36	3/12
Central belly	PE	Twisted	1.71	500/24	3/8
Rear belly and codend	PA	Twisted	1.32	210/30	no. 10

IMPORTANT: It is very important to maintain the original relationship (hanging ratio, difference) between the netting lengths and the framing ropes along the headline and footrope. So if the headline in a section shall be 10% longer than the net according to this manual, it must be so, also if the dimensions of the net differ from the present specification.

Operation of the standard trawls

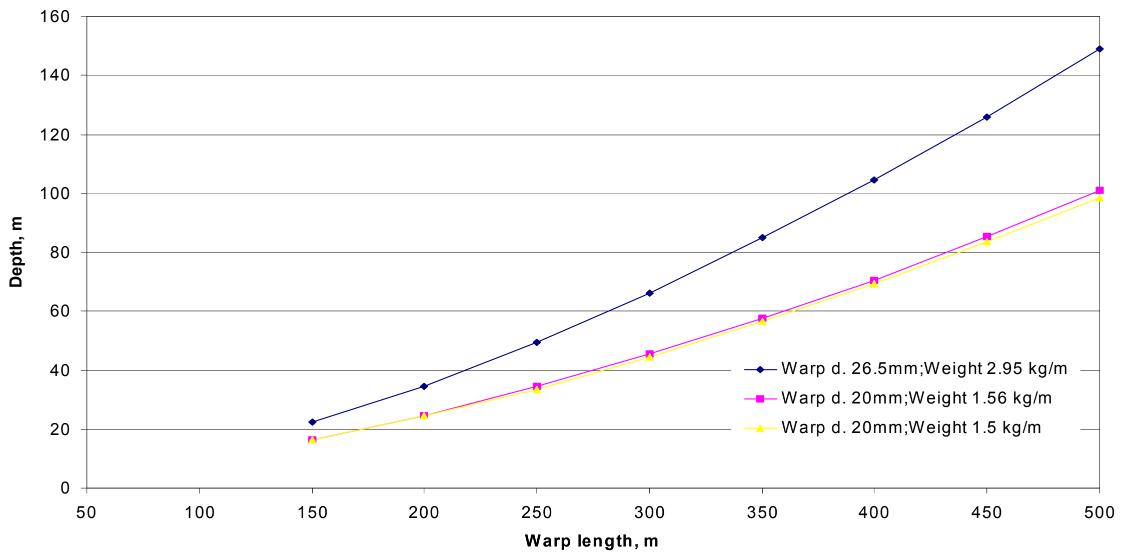
Towing speed

The towing speed should be 3.0 knots.

Warp length

It is recommended to use the following table for finding the correct warp length to be used at various fishing depths. The table gives different warp lengths for a range of warp constructions given by diameter and weight per metre.

The tables are calculated based on the specifications of the net and doors. They should be taken as a starting point. Preliminary tests during the year 2000 suggest that the warp length should be 50 metres more than the table specifies. Also it is recommended that the warps length should not less than 200 metres as it will decrease the door spread too much.



(The figures have been obtained using software developed at Kaliningrad State Technical University, by professor Rosenstein).

Trawl geometry

The shape of the trawl is depending on many parameters of which some are being standardized here by using the same procedures. Nevertheless, when working on different depths and using different lengths of towing warp the door spread will change, and therefore also the height of the net. Below table 2 shows the relationship between the basic geometric parameters for the standard trawl using the specified 118,1 m distance between trawl door and the net (8 + 75 + 3.6 + 27.5 + 4 m). They are based on model measurements and full-scale measurements at sea using acoustic measuring devices.

Door spread, m	60	70	80	90
Trawl vertical opening, m	7.3	6.7	6.1	5.6
Headline spread, m	no data	22.5	26	no data
Angle of sweeps, degrees	11	12	14	16

If trawl monitoring instruments (like SCANMAR) are used on the trawl the table can be used to check if the trawl is working properly. Care should be taken that the instruments are neutrally buoyant in water.

Maintenance

The net should be regularly checked for wear and tear and all damages shall be repaired upon discovery.

The net will eventually stretch under normal fishing conditions. It is important for its fishing performance and for maintaining a constant fishing efficiency at regularly intervals to check the length of the bridles, sweeps, extensions, netting sections etc.

The overall status for the net should be checked at the beginning of every cruise. Every year a detailed check should be made of all net and rope dimensions. (The interval between checks is depending on the time the net is in use. An annual check is regarded sufficient if the net is used for one or two normal surveys a year). The special checklists attached to this manual can be used.

IMPORTANT: Special attention should be given to ensure that the relationship (difference) between the length of the netting sections in the top and bottom panels are maintained. Most lower sections are a half mesh or a full mesh longer than the corresponding top section. These differences have to be maintained by monitoring the net at regular intervals. In the case that the difference is found to be too small the particular bottom section must be shortened be cutting up the joining round and cut away half a mesh or a full mesh from the length.

Also the relationship between the length of the framing ropes and the nets in the wings and arms must be retained. The percentage the net is stretched on the headline and footrope is given in the specification. When the netting after a period of use loose its stretch, the headline and footrope must be cut off, the net in the wings and arms shortened and remounted on the ropes again.

TV3 930#

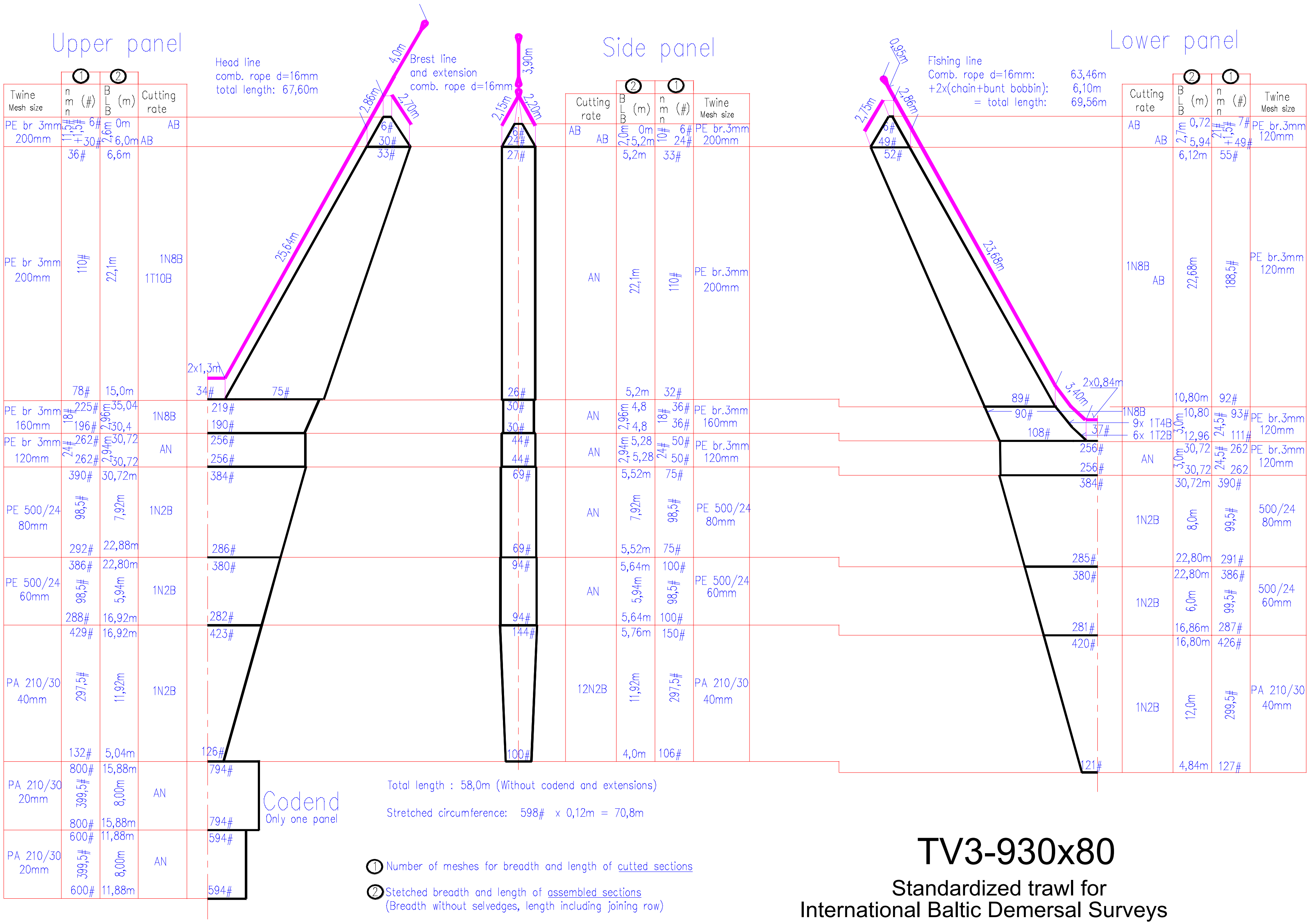
Parts List

International Standard Trawl for
Baltic Demersal Surveys

Note: In this list the term weight is used for mass and the unit is kg.

	No	Item	Description	Size
Trawl doors				
	2	Doors	Cambered V-doors, Type: Thyborøn Trawl Doors Type 2	4.35 m² Weight 520 kg
		Front Chain	Recommended setting: 23 links using link 6 for warp attachment	Inside length of link 100 mm
		Back Chain	Top chain: 10 links Horizontal chain: 24 links Bottom chain: 9 links	Inside length of link: 80 mm
	2	Back strop	Wire or combination rope	Ø = no standard Length 8 m
Sweeps				
	2	Sweep	Combination rope (light)	Ø = 40 mm Length 75 metre Weight per metre 1.60 kg
Chain between sweeps and bridles				
	2	Chain	Iron	Length 3.02 m Weight: 50 kg
Bridles				
	4	Upper and centre bridles	Combination rope	Ø = 18 mm Length: 27.5 m Weight per metre 0.46 kg
	2	Lower bridle	Wire Rubber discs	Ø = 16 mm Length 27,5 m Weight per metre 0.95 kg Ø = 50 mm
Floats				
	(25)	Floats	(11 litre (same as 280 mm, 11 inch) plastic floats)	Total lifting force: 212.5 kg (equivalent to 25 pcs. of 280 mm plastic floats)

Headline and Fishing line				
	1	Headline	Combination rope, stainless	Ø = 16 mm Length 67.60 m incl. extension Weight per metre 0.39 kg
	1 2 2 2 2	Fishing line	Combination rope, stainless Chain weight at bosom corner Chain weight at mid-arm Chain weight at wingend Semi-spherical rubber bunt bobbins	Ø = 16 mm Length 69.64 m incl extension and weight Weight per metre 0.39 kg 14 kg each side 14 kg each arm Length 3.02 m Weight: 50 kg each wingend Ø = 230 mm
Footrope				
		Centre Wire	Wire, stainless steel	Ø = 13 mm Weight per metre 0.66 kg
		Large rubber discs		Ø = 200 mm
		Small rubber discs		Ø = 150 mm
		Filling	rubber discs	Ø = 45 mm
		Rope to mount the gear	Combination rope mounted in bights on the fishing line and through the rubber discs	Ø = 12 mm Weight per metre 0.20 kg The length of the bights shall make the disc periphery hang 4 cm from the fishing line
		Wire lockers	To mount the wire to the fishing line	
Attachments				
		Lazy deckie	No standard	
		Tackle strop	No standard	



Total length : 58,0m (Without codend and extensions)

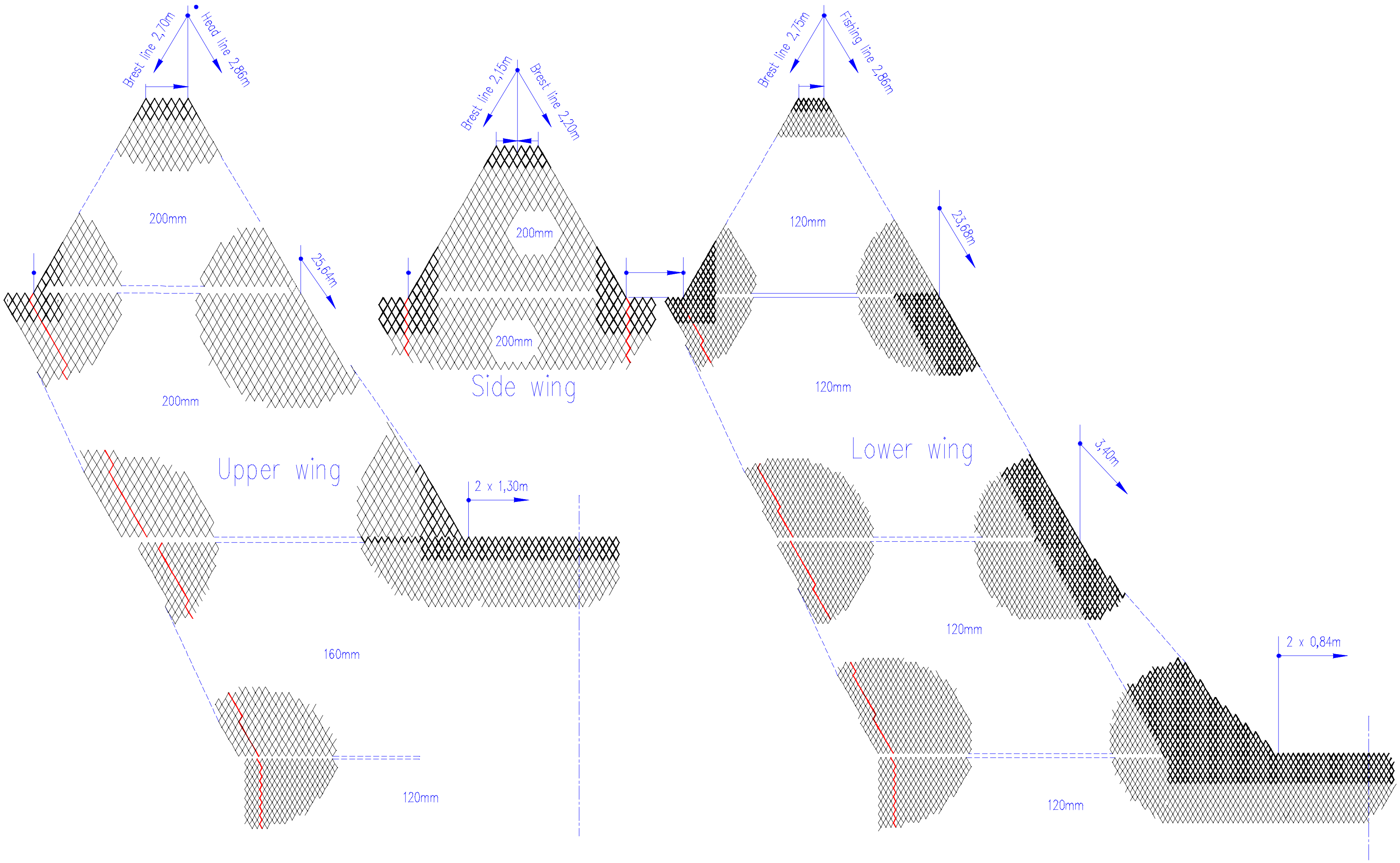
Stretched circumference: 598# x 0,12m = 70,8m

1 Number of meshes for breadth and length of cutted sections

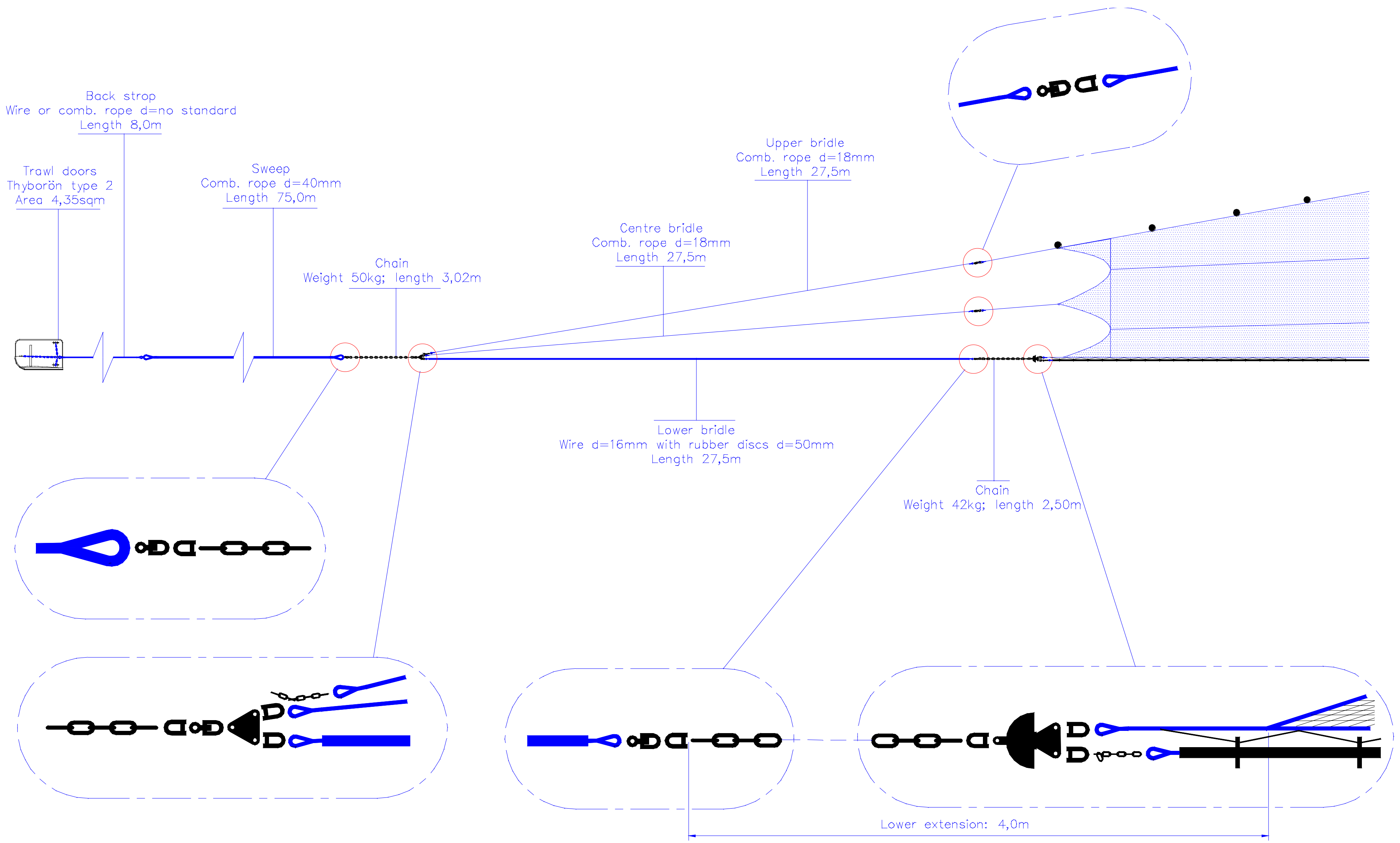
2 Stetched breadth and length of assembled sections
(Breadth without selvedges, length including joining row)

TV3-930x80

Standardized trawl for
International Baltic Demersal Surveys

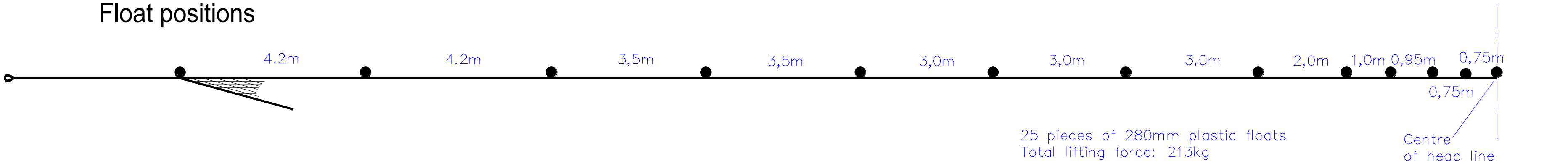


Details for trawl TV3-930x80



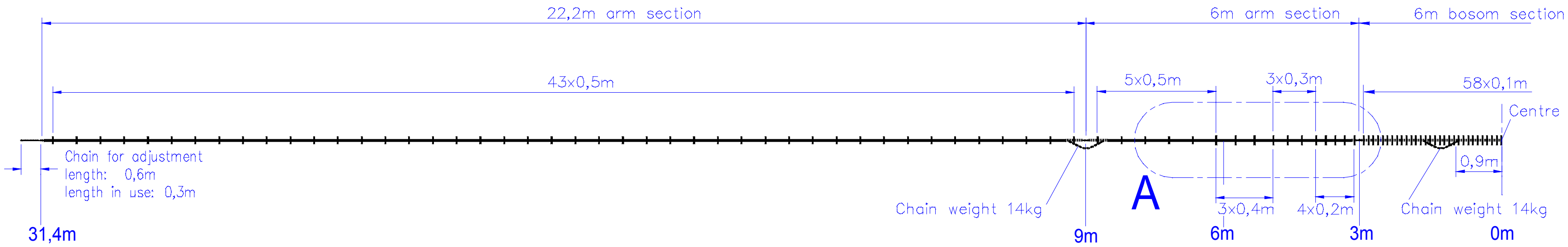
Rigg details (1) for trawl TV3- 930x80

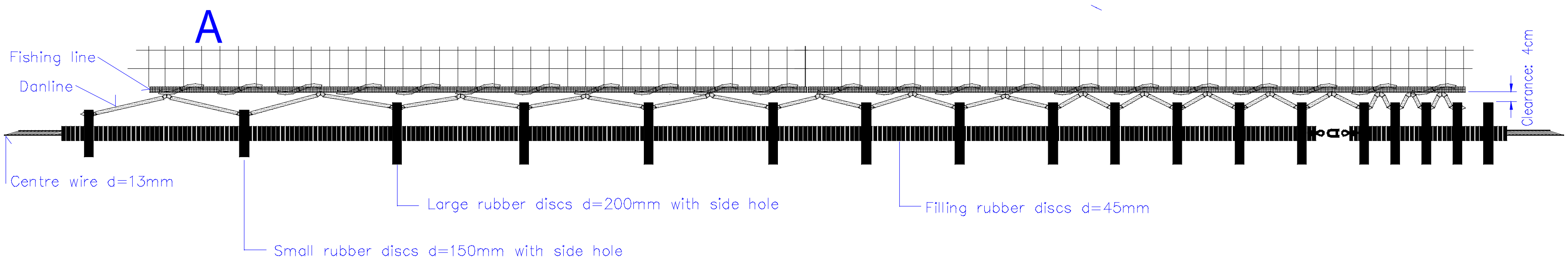
Float positions



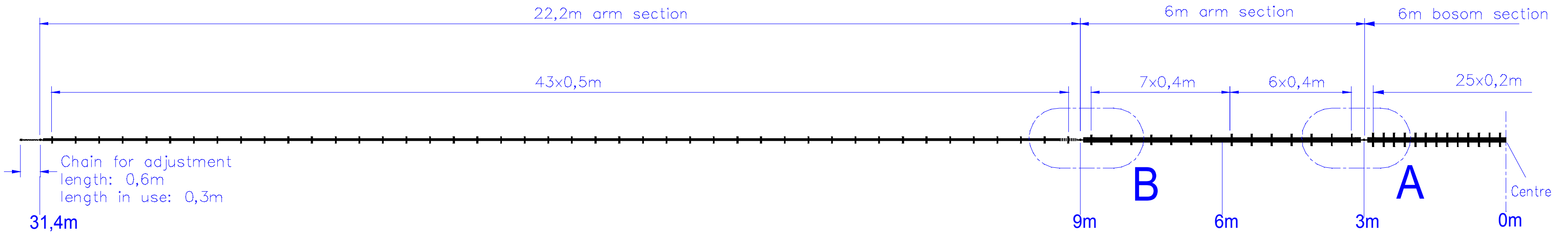
Normal standard footrope

0 – 3m:	200mm rubber discs with side hole, 100mm distance
3– 6m:	200mm rubber discs with side hole, distance increasing from100mm to 500mm
6 – 31,4m:	150mm rubber discs with side hole, 500mm distance
0 – 31,4m:	45mm rubber discs filling all the space between the large discs

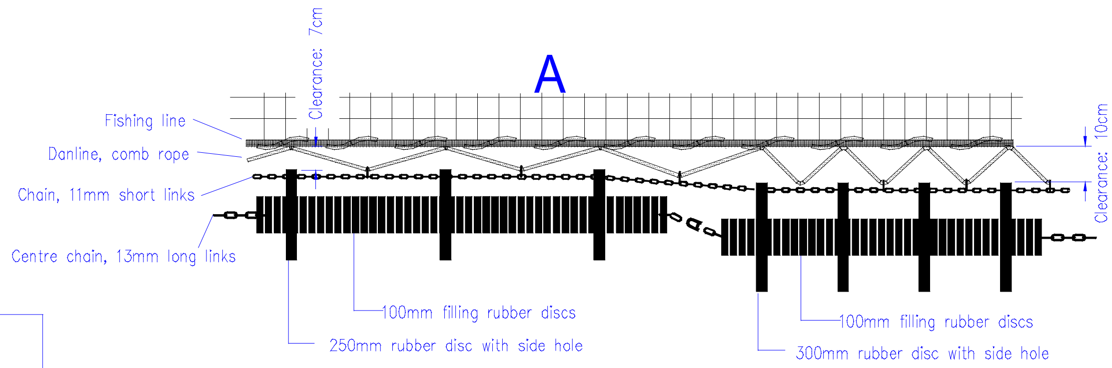




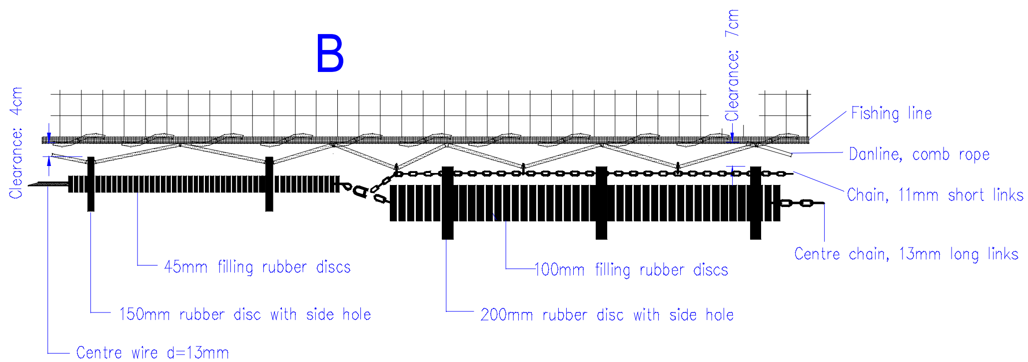
Rigg details (2) for trawl TV3- 930x80



Hard bottom footrope



0 – 3m:		300mm rubber discs with side hole, 200mm distance
3 – 6m:		250mm rubber discs with side hole, 400mm distance
6 – 9m:		200mm rubber diiscs with side hole, 400mm distance
0 – 9m:		100mm rubber discs filling all the spaces between the large discs
9 – 31,4m:		150mm rubber discs with side hole, 500mm distance
9 – 31,4m:		45 mm rubber discs filling all the spaces between the large discs



Rigg details (3) for trawl TV3- 930x80

Section 1

1B1	1A1	1A2	1B2	1C1	1C2
22,10m	22,10m	22,10m	22,10m	8,28m	8,28

Section 2

2B1	2A	2B2	2C1	2C2
2,96m	2,96m	2,96m	3,00m	3,00m

Section 3

3B1	3A	3B2	3C
2,94m	2,94m	2,94m	3,00m

Section 4

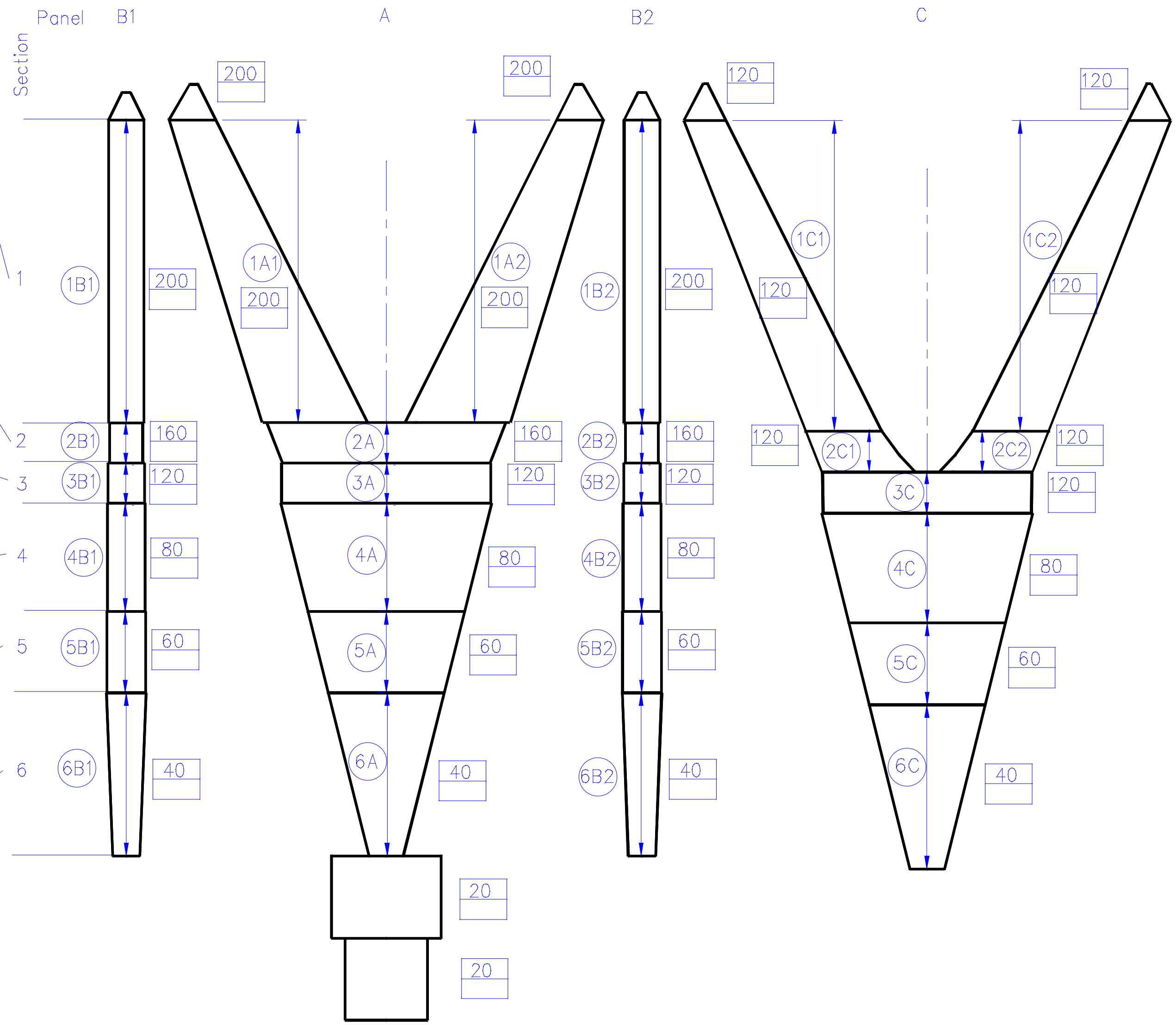
4B1	4A	4B2	4C
7,92m	7,92m	7,92m	8,00m

Section 5

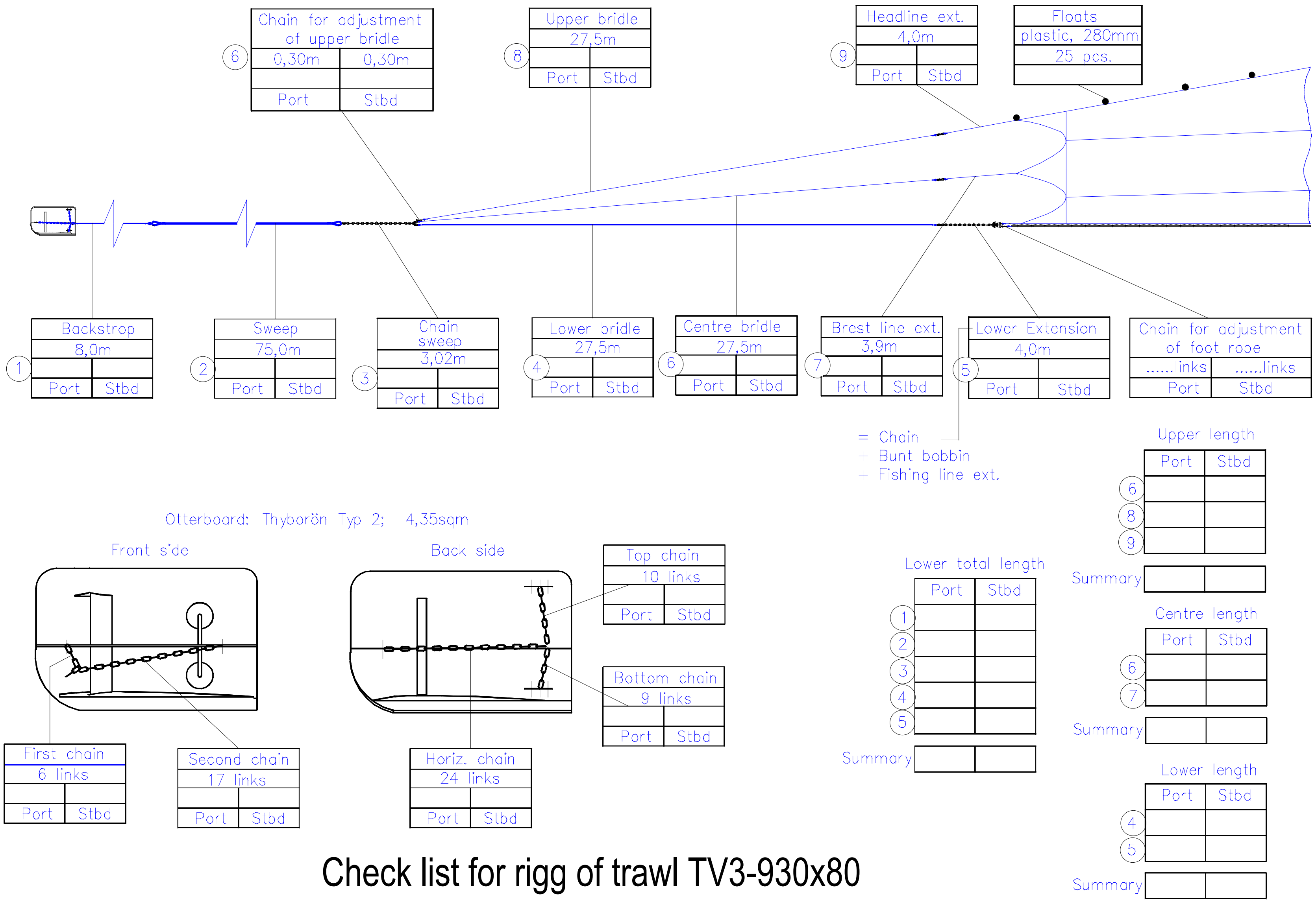
5B1	5A	5B2	5C
5,94m	5,94m	5,94m	6,00m

Section 6

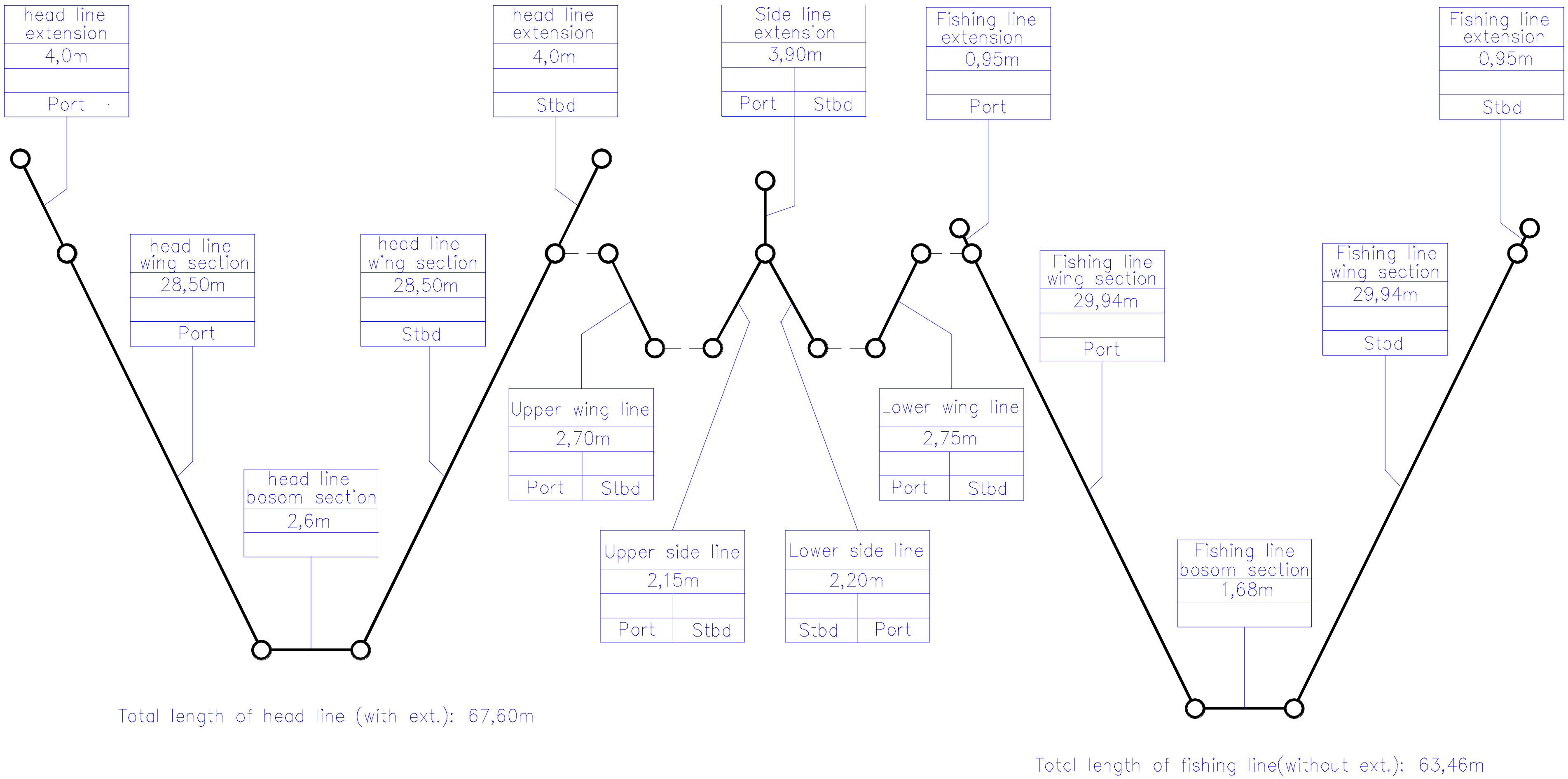
6B1	6A	6B2	6C
11,92m	11,92m	11,92m	12,00m



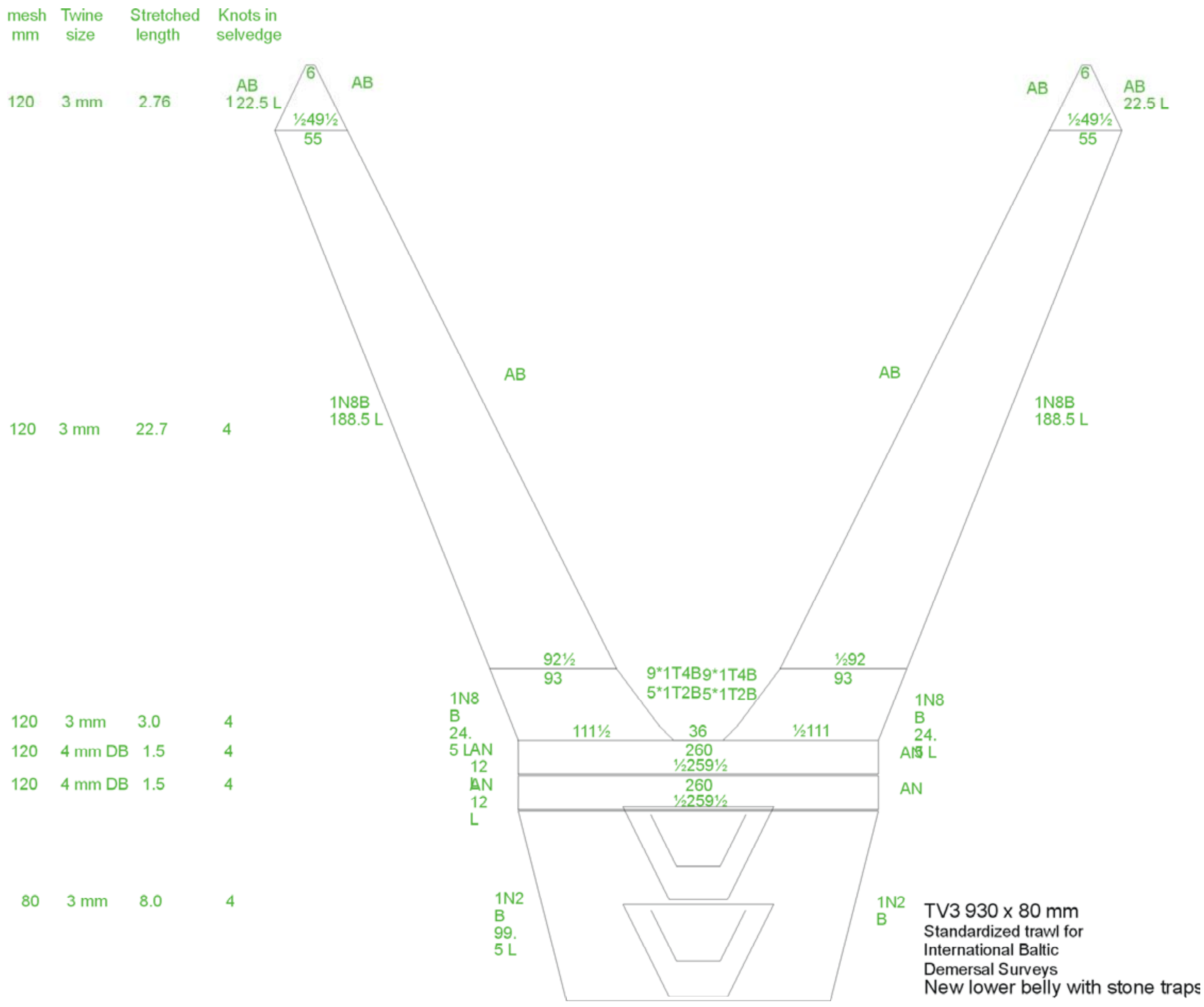
Check list for trawl TV3-930x80



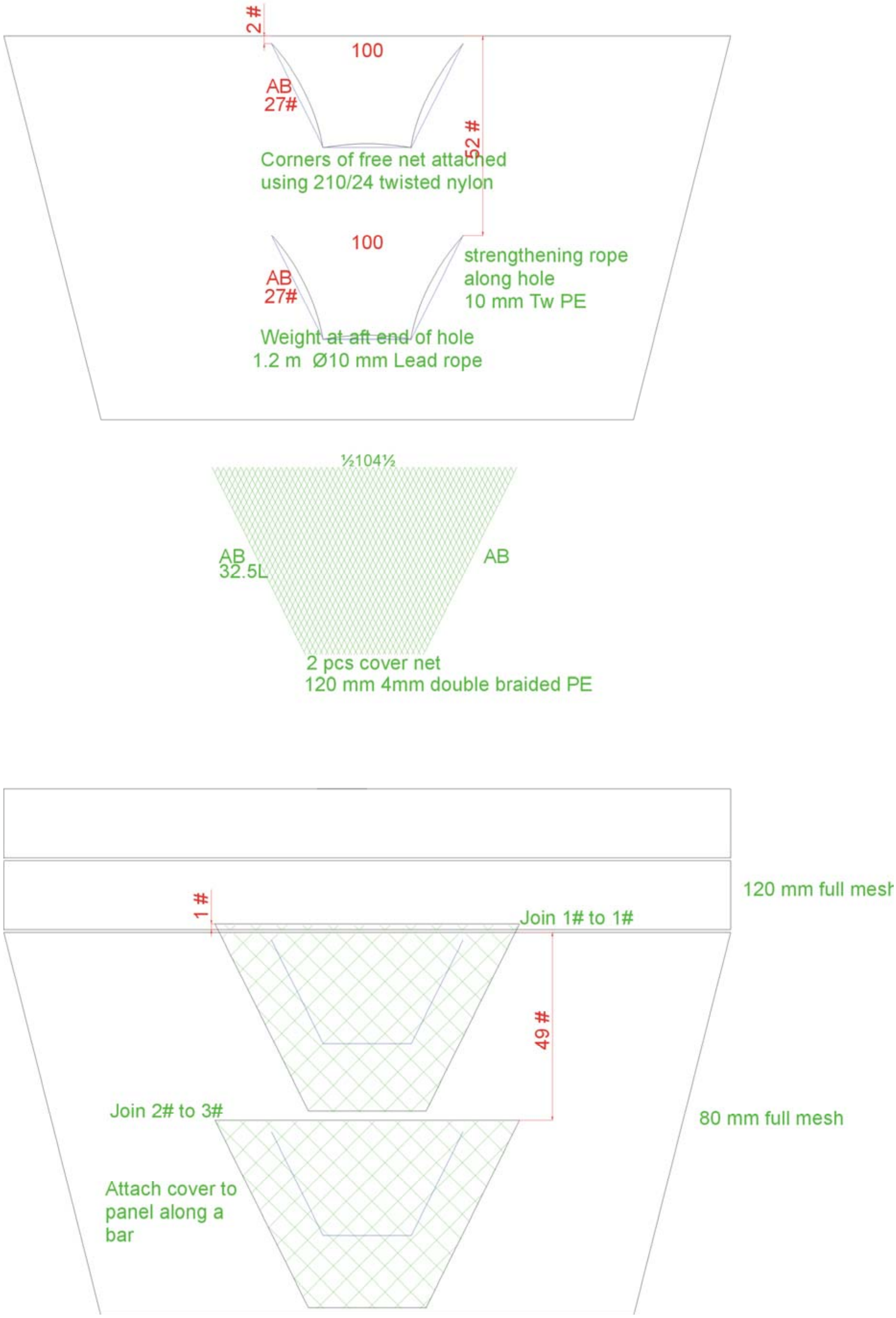
Check list for rigg of trawl TV3-930x80



Check list for frame ropes of trawl TV3-930x80


mesh mm
Twine size
Stretched length
Knots in selvedge
120 3 mm 2.76
120 3 mm 22.7 4
120 3 mm 3.0 4
120 4 mm DB 1.5 4
120 4 mm DB 1.5 4
80 3 mm 8.0 4
AB
1 22.5 L
6
½49½
55
AB
22.5 L
AB
1N8B
188.5 L
92½
93
½92
9*1T4B
5*1T2B
1N8
B
24.
5 L
111½
36
½111
260
½259½
AN
12
L
1N2
B
99.
5 L
TV3 930 x 80 mm
Standardized trawl for
International Baltic
Demersal Surveys
New lower belly with stone traps

Detail for construction of stone traps



TV3 930#

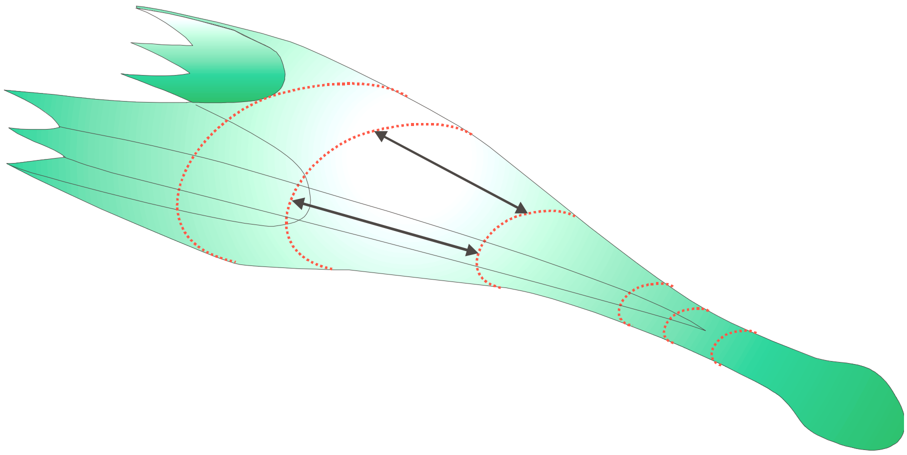
Check Guide

International Standard Trawl for Baltic Demersal Surveys

In order to maintain the properties and performance of the net it must be checked at regular intervals.

Before every cruise
Length of net sections

The trawl consists of four panels: top, bottom and side panels. Each panel has several sections. It is necessary to check the relative length of each netting section. They are all compared with the corresponding sections in the other panels in the way that the top and bottom panel sections are checked against the side panel sections.



Comparison of the lengths of two sections from the top and side panels – indicated by arrows: Approx 10 meshes from around the centre line of the top panel is hold against approx. 10 meshes from around the centre line of the side panel.

The best method to compare two sections is to let two persons – one in each end of the section – take around 10 meshes from the centre line of one section in one hand and hold it against 10 meshes from the centre line of the other section in the other hand. The sections must then be stretched and the difference in length observed.

- Length of side and top panel sections must be equal;
- Length of bottom panel sections must be about 1 mesh longer than corresponding side panel sections.

The procedure is repeated for each section. In case the difference differs more than 4 cm (or half a mesh) from the specified difference, a skilled netmaker should be consulted to evaluate a possible shortening.

Length of wings
The specified shortening of the side wing shall be measured from the joining round between the wing and arms to the eye at the end of the headline, footrope and breastline extensions respectively.

- The length of side wing must be 0,65 meter shorter than the top wing and bottom wing.

Length of ground rope
The length of the ground rope and fishing line must be compared by holding the two together. The length is adjusted by means of the adjustment chain on the ground rope.

- The ground rope must be two links shorter than the fishing line (equal to shortening the groundrope one link in each side).