

REPORT OF THE
BALTIC INTERNATIONAL FISH SURVEY
WORKING GROUP

Tallinn, Estonia
2–6 August 1999

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1 INTRODUCTION

1.1 Participation

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Yvonne Walther	Sweden

1.2 Terms of reference

According to Annual Science Conference Resolution in Portugal last year (C.Res.1998/2:61) the Baltic International Fish Survey Working Group [WGBIFS] (Chair: E. Aro, Finland) will meet in Tallinn, Estonia from 2–6 August 1999 to:

- a) 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) Manual;
- b) compare results from concurrent survey activities by the traditional and the new standard trawls and plan intercalibration programmes;
- c) develop effective and operational sampling procedures for the collection of SMALK information;
- d) plan experiments to evaluate the biological sampling and TS conversion formulas presently applied in the Baltic during hydroacoustic surveys;
- e) evaluate the Manual for Baltic International Acoustic Surveys (BIAS) from practical experiences obtained during the 1998 hydroacoustic surveys;
- f) establish an acoustic database BAD2 (including the information on Elementary Sampling Distance Unit (ESDU) and biological sampling) which should replace the existing database BAD1.

WGBIFS will report to the Baltic Committee and Resource Management Committees at the 1999 Annual Science Conference in Stockholm.

1.3 Overview

The WGBIFS was initiated in 1996 to promote co-ordination and standardisation of national research surveys in the Baltic (ICES CM 1995/J:1). The first Working Group meeting (ICES CM 1996/J:1) considered the design of trawl surveys for cod assessment, established a bottom trawl manual and outlined problems in hydroacoustic surveys. The second meeting (ICES CM 1997/J:4) gave advice on intercalibration between research vessels, described sampling protocols of sprat and flounder and evaluated historical data from hydroacoustic investigations 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 gear workshops (ICES CM 1997/J6; 1998/H:1). The third meeting (ICES CM 1998/H:4) adopted the recommendation on standard trawls for Baltic International Fish Surveys. They also made a plan intercalibration programmes 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 maturity stages and reviewed the effects of biological sampling and TS conversion formulas on the results of acoustic stock levels and biomass estimates. The meeting also finalised and updated the Manual for Baltic International Acoustic Surveys (BIAS) based on a draft made by the Study Group on Baltic Acoustic Data (SGBAD).

In recent years a number of new scientific projects and study projects has been initiated in the Baltic and neighbouring areas (ISDBITS, BITS, BALTDAT and HERSUR for example) and these projects are tackling the same kind of issues as WGBIFS. The TORs of WGBIFS this year were closely linked to these projects funded by European Commission. Thus it was considered appropriate to organise coordination meetings of these projects during the WG meeting to benefit from the progress in these projects.

EU-Study Projects, which had their short coordination meetings in Tallinn were:

1. **ISDBITS**-project: "Implementation and calibration of standard survey trawls and standardisation of survey design of the Baltic international bottom trawl surveys for fishery resource assessment" co-ordinated by J. Rasmus Nielsen (Hirtshals, Denmark)
2. **BITS**-project: "Establishing a Baltic Trawl Survey (BITS) database" co-ordinated by Yvonne Walther (Karlskrona, Sweden).
3. **BALTDAT**-project: "Surveying the pelagic fish resources and establish an acoustic database in the Baltic Sea"-co-ordinated by Fredrik Arrhenius (Lysekil, Sweden)

During the WGBIFS meeting it was noticed that both parties, ICES and EU were benefiting very much from this kind of co-ordination and sharing of duties and tasks. Thus it is recommended that this kind of co-ordination and co-operation should be continued also in the future.

The working group also discussed the future organisation, timing and tasks of the WGBIFS. As mentioned above those new scientific projects/study projects are tackling the same kind of issues as WGBIFS and Study Group on Baltic Acoustic Data (SGBAD). There has been also a clear overlap between the WGBIFS and SGBAD terms of reference and WGBIFS has already taken over of some of the SGBAD activities. SGBAD was set up to combine and analyse acoustic survey data for Baltic Fisheries Assessment Working Group (WGBFAS) and develop further hydroacoustic database and plan and decide on acoustic surveys and experiments to be conducted in the future. These tasks have been set up to provide WGBFAS and ACFM with the information required to respond to requests for advice/information from IBSFC. The results and analysis provided by SGBAD has been used by WGBFAS just after SG meeting.

In this situation, members of SGBAD felt that at the moment there is no need to have Study Group on Baltic Acoustic Data anymore and have an extra three days meeting to cover those TORs, which are allocated to other working group. Thus Study Group members recommended that SGBAD should be dissolved and its tasks should be moved to Baltic International Fish Survey Working Group (WGBIFS). If accepted this eventually means that WGBIFS should then have their next five days meeting in 2000 and it should be scheduled for the first week in April 2000.

WGBIFS discussed this merging issue and after a lengthy discussion WGBIFS endorsed the recommendation of SGBAD. It was also agreed, that WGBIFS should be in the future, at least be responsible on survey design, co-ordinated sampling protocols, reporting of survey results and making proposals of allocation of research vessel

resources for assessment purposes, according to target species and areas. Time and funding constraints experienced in the past and present by individual WG members and laboratories in general strongly suggest that matters relating to Baltic Sea fish resource surveys should be assigned in principal to one working group only and one meeting per year. The proposed terms of reference for WGBIFS are given in Section 4.

2 DEMERSAL TRAWL SURVEYS

2.1 Survey strategies, fishing methods and sampling

2.1.1 Timing of the survey

The new gear has been introduced in 1999. At present several countries conduct biannual surveys in spring and autumn in accordance to the recommendation of ICES in "Report of the Baltic International Fisheries Survey Working Group (ICES CM 1996/J:1).

The working group discussed further the appropriate survey timing and recommend that:

- The spring survey activities are to be carried out in the period 15th February to 25th March
- The autumn survey activities are to be carried out in the period 1st November to 30th November.

This survey timing has been implemented in the 1999 BITS survey.

2.1.2 Survey area covered

Historical records show occurrence of a substantial cod fisheries as far north as the Bothnian Sea (Sub-division 30). At present however the cod stock north of Sub-divisions 27 and 28 is considered to be insignificant. The coverage of the Baltic Sea (Sub-divisions 25–31) of each country are presently constricted to the area south of 58° 00' N. It is recommended that the new survey should cover the area up till 58° 00' N. The option to alter the area surveyed should however be available if the distribution pattern of the cod stocks changes.

2.1.3 Haul allocation/stratification schemes and depth strata information

The Working Group continued the discussion of the various methods available for allocation of trawl hauls.

At present the national bottom trawl surveys are carried out using different haul allocations schemes, e.g., as transects, fixed stations and randomly selected stations, the latter being based either on ICES rectangles and/or by depth strata.

The international trawl surveys are expected carried out in the form of a stratified random survey. As stratification criteria the squares of the ICES Subdivisions or the depth layers are possible. In both cases it is necessary to know the area of the strata. Since different estimates exist for the different areas a comparison of areas of the different depth strata within all relevant ICES rectangles were carried out in Rostock, 11–14 January 1999 (Workshop on Baltic Trawl Experiments, ICES CM 1999/H:7). The working group agreed that these data should be used for the international bottom trawl surveys.

The Working Group discussed the various methods available for allocation of trawl stations. It was agreed that further statistical analyses of the previous surveys are necessary. These analyses are still going on and the preliminary results are expected to be discussed during the Lysekil (ISDBITS EU Study Project) meeting in December 1999. Furthermore, the analyses will be concluded in 2000 after which the results will be presented in WGBIFS meeting in year 2000. Institute for Baltic Sea Fisheries, Rostock, will be responsible for presenting further analyses. Furthermore, the data on fishing positions from the library of clear tow information must be available for the survey design.

The following options of stratification are assessed as possible:

- Estimation of the CPUE for all ICES Subdivisions.
- Stratification of the ICES Subdivisions using depth layers. The number of trawl stations should be chosen dependent on the mean variabilities of the CPUE's.
- Stratification of the ICES Subdivisions using rectangles.

The stations should be fixed prior to the commencement of each year, and are randomly selected from the library of possible haul-tracks.

If the number of possible stations in a strata is too low for a random selection fixed stations can be used every year.

The precision of survey abundance estimates are primarily dependent on the effort applied and may be expected to decline proportional to the square root of the number of hauls. Cost on the other hands is linearly dependent on the effort level implying a diminishing return of the marginal effort. Choosing the number of hauls therefore requires evaluation of cost and benefits. The working groups have not attempted to specify criteria's for any optional effort level.

The benefits associated with the standardisation of the gears and a joint station allocation implies that a lower number of stations are required to reach a precision similar to the present.

2.1.4 Clear tow trawl track library

At the Workshop in Rostock, January 1999 (ICES CM 1999/H:7), it was agreed to establish a library containing computerised track lines useful for future survey work. A number of practical problems were anticipated in this compilation, e.g. some areas have bottom conditions preventing bottom trawling, some countries might have limited use of GPS positioning systems in the commercial fisheries and the different GPS positioning systems might have conversion problems to a common library.

The sampling schemes for the future common survey has not been decided. Moreover, it is possible that the scheme initially chosen may subsequently be changed when information from the new survey is accumulating. For this reason it was decided to establish a collection of track-lines with a broad geographical coverage and reflecting the differences in depth within different ICES quarter squares.

The Workshop agreed on some principles (listed in section 4.1 in ICES CM 1999/H:7) to base the library on, basically selecting 10 track lines per quarter of ICES square preferably with a depth stratification.

Track line information from the relevant countries has been submitted to the Swedish Institute of Marine Research, Lysekil, for conversion and compilation under the ISDBITS EU Study Project. The data were derived from a number of systems; Shipmate, Furuno, QuatFish, Sodema, Maxsea, some also submitted as start and end positions in Excel-files. Some of the systems are compatible, but there is no one capable of handling all the others. The group therefore agreed to initially compile the library as an ASCII file with the track lines described with start and end positions (ca 2 nautical miles apart) and at least two positions in between, to describe the shape of the line, positions of wrecks and other obstacles and depth(s). This preliminary library will, consequently, be an expansion of the existing trawl track database with information about start and end position for each trawl track.

The Danish Institute for Fisheries Research has in relation to establishment of a library of clear tow information made an electronic map with indication of trawlable areas, areas with stones (not trawlable) and areas with unknown trawl bottom, respectively, on ICES quarter square basis for whole Kattegat area and ICES Sub-Division 22.

2.1.5 Standard report formats and BITS Progress Report

Data from all surveys will be entered into the BITS data base hold in the ICES Secretariat as described in the BITS manual. From the data base a number of standard figures and tables will be extracted for each quarter to be used by the Baltic Fisheries Assessment Working Group.

The standard output from the data base will include:

- For each quarter an overview table of number of hauls conducted by each ship and gear will be produced as a standard output from the database.
- Three figures for each of the species herring, sprat and cod will be produced, showing catch in numbers by haul graphically, length frequency histograms per subdivision and depth stratum, and catch in number per hour by haul and by age groups 1,2 and 3+.
- Tables with standard indices as mean catch in numbers at age by subdivision and depth stratum for cod for all age groups up to the +group used in the assessment.
- Export files: "Numbers at length" and "numbers at age"

Appendix II contains BITS Progress Report, which describe the preliminary structure of the data base, the calculation performed by the data base and the final output.

2.1.6 Quality control and quality assurance for BITS

Up to 7 countries and 8 research vessels participate in co-ordinated surveys in the Baltic Sea in order to collect biological data used for the assessment and assessment related activities of cod, sprat and herring in the area. The assurance of consistency between data collected by different vessels and countries is essential for the quality of the data. Therefore, standards for most aspects of the sampling- and reporting procedure has been specified in the BITS manual on the highest possible level of details.

The following issues has been taking into account when defining standards:

- The sampling sizes and the procedure for working up the catches are defined under the consideration of sufficient level of precision of key results.
- An optimising of the time/cost efficiency has been taking into account.
- The standards are in all cases operational taking into account the physical conditions met in the field.

The manual should be updated continuously in order to constitute the reference for the surveys and secure consistency in the data.

There is a checking program available in ICES Headquarters and it should be used before the data are submitted.

2.1.7 Baltic International Demersal Survey (BITS) Manual

In general the manual was further elaborated compared to the 1998 version. A new set-up was introduced in the part of the manual concerning working up of the catches and more detailed descriptions of sub-sampling procedures based on general sampling theory was included.

Length distribution

It was agreed to raise the number of individuals measured for length measurement. The new guidelines are based on investigations of Müller (1996). In Figure 2.1 in the manual the relation between the number of length-classes and the necessary number of length measurements is demonstrated for herring and sprat. This relationship can be applied for all fish species.

Cutting of otoliths

The optimum number of otoliths, which should be taken per length class and ICES Sub-division for age reading, 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 interval is dependent on:

- the portion of the length interval within the length frequency and
- the maximum variance of the portions of the age groups within the length intervals.

The number of otoliths necessary to obtain the age distribution per length group was revised as specified below.

If a length class contains only one age group, the age reading necessary will be zero. This situation can be observed for small individuals of many species in the surveys (cod, herring, sprat). For example, herrings with total length less than 9 cm in trawl surveys in November are always in the age group 0.

If the length classes contains more than 1 age group the optimum number of age readings is correlated with the length frequency (ICES CM 1998/H:4). The reason for this relation is the relative equal maximum variance of the portions of age groups within all length intervals.

From the Age-Length-Key of the previous years the length ranges with probably only one age group are well known. These length ranges are different for species and survey times.

In these length intervals only between 2 and 5 age readings must be carried out in each ICES Sub-division independent of the species density. For all other length intervals 10 age readings should be carried out at least.

In the length intervals with more then 5 % of the length frequency it is recommended that 20 age readings is carried out at least.

Exchange format

It was experienced that there had been some confusion regarding haul validity code and species validity code. Considering that, it was decided to simplify the codes.

In the HH records the haul validity code "partly valid" was removed. From now on hauls can only be "valid" (V) or "invalid" (I) or there can be "no oxygen" (N). Since partly valid information is not allowed as haul validity code the species validity code "partly valid information" (2) is not legal either. This species validity code has therefore been removed from Appendix VIII in the manual.

In addition it was decided to remove the species validity code 3. If length composition is incomplete the species now have to be reported as invalid.

A few small changes have been done in the HH records. It is now legal to report historical data (before 1999) with a haul duration of 150 minutes. The maximum weight ground rope has been change from 300 to 800 kg and the maximum door spread from 180 to 200 m.

In the CA records a field with individual/mean weight (in grams) has been added in position 64 to 68.

An Appendix X has been included into the manual containing the maximum length used by the checking program when checking the length of the fish. Furthermore, there have been a few updates of ship and gear codes.

2.2 The new standard trawls for demersal surveys

2.2.1 Evaluation of the new standard trawls and comparison of results obtained from old survey trawls and new standard trawls

Flume tank experiments with model TV3 trawls:

The EU ISDBITS Study Project includes Flume Tank tests and measurements of model TV3 trawls which have been completed in the spring 1999. These tests produced results necessary to adjust the rigging of the full scale trawls and to give a description of the performance of the trawl gear. The trawls to be tested, the trawl design and the actual tests, as well as the preliminary results of these tests are reported in a working document to this working group (ICES WGBIFS 1999) "Report on the initial testings of the new standard trawl for international Baltic bottom trawl surveys in the spring 1999" (Hansen, 1999). Furthermore, the flume tank tests are described in the "Report of the Workshop on Baltic Trawl Experiments", Rostock January 1999 (ICES CM 1999/H:7). The final results of these tests will be available in early 2000 as a trawl construction and operation manual under the ISDBITS project.

Production and procurement of the new full scale standard TV3 trawls

The new standard TV3 trawls were produced and made available in the winter and spring 1999 and delivered to the research vessels R/V DANA (DK), R/V ARGOS (S), R/V SOLEA (D), R/V BALTICA (PL), R/V ATLANTIDA (RUS), and R/V GRIFS (LAT), which used the new trawls during the spring 1999 BITS surveys. The new standard TV3 trawls for the Estonian vessel will follow in late summer 1999 to be used in the 3rd quarter 1999 survey for inter-calibration.

Results on testing of the new full scale TV3 standard trawls at sea:

Fishing gear technologists joined on the first field tests with the full scale TV3 trawls on board R/V DANA, R/V SOLEA and R/V ARGOS during the spring 1999 BITS survey in order to monitor the dimensions, handling and performance of the full scale trawl gear and to compare the results with the flume tank model testing. These tests have been performed using SCANMAR and other similar sensor systems. Information from some countries (Sweden, Poland and Russia) have not been submitted yet. A video recording of the new trawl have been made on board R/V ARGOS. The tape will be made available for the gear technologists as soon as possible. The preliminary results of these tests are reported in the Working Paper "Report on the initial testings of the new standard trawl for international Baltic bottom trawl surveys in the spring 1999" (Hansen, 1999). The final results of these tests will be available in early 2000 as a trawl construction and operation manual under the ISDBITS project. Information on the trawl size used by different vessels is given in Figures 2.2.1.1 - 2.2.1.11.

Based on the obtained preliminary results and the gained experiences from the flume tank tests and the full scale tests at sea topics on fishing gear technology and handling of the gear for the new TV3 trawls were discussed in a group under the ISDBITS EU Study Project.

- Size of the trawl door, especially for the large 930# TV3 and the corresponding angle of attack for the bridles and sweeps,
- The length of the sweeps,
- The weight of the trawl doors.

On the handling and operation the discussion covered:

- Handling difficulties of the large 930# TV3 on board R/V SOLEA
- Performance of the rock-hopper groundgear on very soft bottom
- Difficulties in getting the trawl 4.36 m² doors to work properly on board R/V ARGOS and R/V DANA leading to a discussion of the correct warp-length-to-depth-ratio.
- The trawling speed.

Size of trawl doors for the 930# TV3

During the testing of the trawls in model scale in the flume Tank of The North Sea Centre this net was tested with two different trawl spreads, one giving approximately 110 m between the doors in full scale and one giving a larger spread of 130 m.

It should be emphasised that tank tests do not reveal whether the trawl doors are actually able to provide the specified spread, because they are set at a certain spread before the testing starts by moving in and out the towing masts to which the model towing warps are attached.

The large spread gives an angle of attack on the bridles and sweeps of 17 degrees while the small gives an angle of 13 degrees. This design of trawl is extensively used in commercial fisheries and in some of them - for Nephrops and shrimps - the angle is around 13 degrees, while in the whitefish fishery an angle of up to 17 degrees are often seen.

For the initial tests the large door spread was targeted on the research vessels, but it was not possible to obtain. On both R/V ARGOS and R/V DANA the 100 inch Thyborøn doors (provided by the project) were therefore quickly substituted by larger doors which were found to be present on the vessels.

The group had to reconsider what trawl spread was necessary, or rather whether the large spread was necessary. It was argued that the large angle meant that the fish herded towards the centre of the trawl track had to swim faster than fish subjected to a smaller angle, and that this would most likely have the effect that small fish would not be caught representatively.

A few calculations at towing speed of 3 knots were done showing the swimming speed of the small fish confronted with the large and the small angle of attack of the sweeps and bridles. In order to escape the approaching sweep a fish has to swim with a speed of 0.41 m/s for 1.5 minutes when subjected to a sweep of 75 m at an angle of 17.2 degrees. The swimming speed is 0.32 m/s when the angle is 13.5 degrees.

The conclusion was that there were few arguments in favour of the large door spread but several more in favour of the small spread.

The length of the sweeps

One of the 'complaints' over the new trawl was that it was catching a very high amount of pelagic fish, which took so long time to process that the number of hauls per day was reduced. This led to a discussion of how to reduce the catch. One way was to reduce the distance between the doors. This can be accomplished by not aiming at the large angle of attack by sweeps and bridles. Another way is to reduce the distance between the net and the doors by having shorter sweeps and a third is to reduce towing speed.

The discussion dealt with the need for long sweeps and the conclusion was that although scientific evidence was lacking it would be expected that the shorter sweeps would give a trawl with a more even selection for the different size groups.

In the Rostock meeting report (Jan. 1999, ICES CM 1999/H:7) the question was put forward whether the large cod is caught with same efficiency when using different sweeps length. In that context we must, however, keep in mind that the relative number of large cod is low compared to the smaller size groups of cod in the Baltic Sea. Thus, the largest cod are not the primary target size groups in the BITS.

Recent Danish investigations from R/V HAVFISKEN and R/V HAVKATTEN are testing the effect of different sweep lengths on the TV3 trawl. The results are now being analysed and will in the early autumn of 1999 give an indication of the effect on the selectivity pattern.

R/V DANA will continue the tests with the large trawl and test different sweep lengths in the autumn 1999.

The group agreed that unless the Danish results gave results in favour of long sweeps they would recommend to reduce the length of the sweeps to 75 m.

A 'by-product' of shorter sweeps is that it will be more easy to perform trawling in shallow water and there will be less risk of hitting an obstruction and damaging the trawl – especially on hard bottom localities.

The weight of the trawl doors

The Russian and to some extent also the Swedish experiences with the new trawl doors were in the beginning that they were too light and had difficulties in bringing the net to the sea bed.

The problem could be that there has been used too short trawl warps due to lack of practical experience with this type of design of trawl doors.

It was therefore agreed that a small survey should be made on the warp dimensions used on the various research vessels and for each a guiding table should be calculated giving a warp-length-to-depth-ratio for each vessel. This would assist the vessels in selecting the warp length giving a correct upward pull in the warp at the doors and therefore ensure that the doors are not lifted off the ground. The calculation could be conducted using the Trawl Door software developed in Kaliningrad. Information from each country on the warp dimensions on all research vessels are to be sent to DIFRES, Hirtshals (R. Nielsen), who will forward it to Kaliningrad.

Handling difficulties of the large 930# TV3 on board R/V SOLEA

In the ISDBITS project description it is planned that R/V SOLEA - being of intermediate size - should do the testing work on calibration between the large and the small TV3 trawls and on the testing of the groundgear on the large trawl on hard grounds.

The spring cruise to the Baltic using the large 930# TV3 trawl showed, however, that there are difficulties on board R/V Solea in handling the large trawl. There is limited engine power and limited space on the net drums and it is therefore necessary to take off the floats during hauling and put them on again during shooting. This procedure takes so long time that it is not always possible to make the usual number of hauls per day.

It was agreed that the comparison between the two sizes should be completed on R/V Solea, despite the handling difficulties, and concerning the groundgear tests effort should be made to find another vessel.

Performance of the rock-hopper groundgear on very soft bottom

At the meeting in Rostock in January 1999 the question was raised whether the specified groundgear for the large TV3 trawl had a risk to dig into the bottom at soft bottom localities. The tests on board R/V ARGOS at very soft grounds revealed that there seemed to be no problem with the groundgear digging into the bottom.

Size of the doors specified for the 930# TV3 trawl and the correct warp-length to depth ratio

Both vessels R/V ARGOS and R/V DANA reported difficulties in getting the 4,36 m² doors to work properly. It has been claimed that the doors were flapping, seemed to be unstable and were moving in and out. However, only one attempt (haul) was made on R/V ARGOS and four hauls on R/V DANA before the doors was substituted for another type.

The exact nature and cause of these observations could not be revealed, but it was suggested that it could be explained by an too high uplift from the trawl warp caused by a wrong trawl-warp length to depth.

It was reported that the different research vessels are using very different dimensions of trawl warp and it would therefore not be possible to make one table covering all vessels. It was agreed that a table should be made for each individual vessel based on calculations, which could be made by means of the above mentioned computer software.

The trawling speed

Various reports give ranges for the trawling speed between 3 and 4 knots. This was regarded as problem for the standardisation of the sampling. A trawling speed of not less than 3 knots have been recommended in the report of the Workshop on Standard Trawls for Baltic International Fish Surveys, Gdynia, 1997. In the Rostock January 1999 report it was recommended to use a trawl speed around 3.5 knots. In order to avoid too large by-catch of pelagic species (clupeids) and to minimize the required towing power of the ship to tow the gear the question was put forward whether a trawl speed of 3.0 knots was not sufficient. This question should be addressed in relation to the selected smaller angle of attack and the shorter sweep lengths selected as standard settings.

Based on the knowledge and experience of the most important target species the most acceptable compromise was a trawling speed of about 3.0 knots.

Results of the inter-calibration experiments

To allow for a concurrent use of new and historic survey information for assessment purposes it is necessary to calibrate the catch information from the new standard trawls against those hitherto used. As noted in the ISDBITS EU-study project, the 1999 BITS activities include both a survey, conducted with the historically used trawls, and between trawl inter-calibrations experiments. When all results from the calibrations are available all existing survey information will be expressed in units corresponding to the large TV3-trawl.

The inter-calibration requires and has in the spring 1999 included that each country carry out comparative fishing with its historical used gear and the new TV3-trawl. It was in the "Report of the workshop on Baltic trawl experiments", Rostock January 1999 (ICES CM 1999/H:7), recommended that the comparative trawling with the new and old gear should be made on the same trawl track lines, which are covered by trawling in the same direction. The second haul should be made immediately after the first. In order to balance out any possible effects of 1st and 2nd trawl coverage's the order of the gears should alternate between stations, i.e. following the sequence shown in the table below.

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

This recommendation has in general been followed during the spring 1999 surveys. However, on board some vessels it has been impossible to shift trawls 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 trawlings with the two different trawls.

Length distribution plots by species (cod and flounder) are shown for the paired, comparative trawlings with both types of gears made for each country (DK, RUS, LAT, POL, SWE) during the spring 1999 survey in Figures 2.2.1-1–2.2.1-11. The inter-calibration data from Germany have not yet been finally processed.

Appropriate areas for the inter-calibration studies were generally selected during the spring 1999 BITS survey with respect to occurrence of relative high abundance of a broad size range of both cod and flatfish. The inter-calibrations have accordingly covered all important size classes of the two species in the spring 1999 BITS survey.

It is evident for the inter-calibrations made by DK, RUS, LAT, PL and SWE during the spring 1999 BITS survey that the new TV3-trawl caught the smallest size groups of cod more efficiently than the respective traditional trawls. The TV3 trawl caught a high number of 5-10 cm cod during the survey. Also for larger size groups of cod the TV3 trawl in general is more efficient than the national, traditional trawls which also accounts for all size groups of flounders. Also, it is evident that the TV3 trawl caught all size groups of cod and flounder that occurred in the corresponding catches with traditional trawls. However, the results from the inter-calibration trawlings have not yet been finally analysed and the above observations are, consequently, only preliminary conclusions.

The EU ISDBITS Study Project group has not decided on the exact procedure for deriving the conversion factors but it appears evident that the conversion factors will be size dependent. Also the statistical methods to be used in comparing the size distributions by species in the different trawl catches have not yet been selected. Literature studies are going on concerning that methodology.

2.2.2 Plan for intercalibration activities

With the establishment of the EU-project by January 1999 it will be possible to arrange a co-ordinated survey for the year 2000. A detailed survey planing, including a more comprehensive area and depth coverage as well as the timing of the surveys has been discussed during this working group meeting.

The survey planning for the autumn 1999 surveys has been agreed according to the working plan for the ISDBITS EU-Study project. In November 1999 R/V DANA, R/V ARGOS, R/V SOLEA and the Estonian vessel (and maybe R/V BALTICA for a few days) will operate in the autumn BITS survey. All vessels will continue the trawl intercalibration and also perform standard surveying in order to continue the time series necessary for assessment purposes. R/V SOLEA will in the autumn 1999 start on the intercalibration between the small TV3-trawl and the traditional HG20/25 trawl as R/V SOLEA will operate with the small TV3-trawl as standard survey gear instead of the large TV3-trawl, which is a very heavy gear for this research vessel.

R/V DANA will also during the autumn 1999 survey perform experiments with different sweep lengths of the large TV3-trawl and start on performing intercalibration between the hard bottom ground gear (rock-hopper) and the normal ground gear for the large TV3-trawl.

National intercalibration between the new and the existing trawls are, thus, carried out in 1999 and 2000 under the ISDBITS EU Study Project. The existing national survey time series are converted to the units of the new trawl during

the surveys. The between gear intercalibrations are carried out in the form of an experimental surveys designed specifically to derive conversion factors between the new and the old gears. This method will assure continuation of the time series to be used in the assessment of demersal species in the Baltic Sea.

The survey planning for year 2000 will be finally planned at the ISDBITS EU-meeting in Lysekil in December 1999.

The use of two different size of trawls also requires that intercalibrations are carried out between these. Also intercalibrations between different ground gear riggings for soft and hard bottom localities, respectively, are required. Both types of intercalibration will be finalised under the EU ISDBITS project in year 2000 during the spring and autumn BITS surveys according to the EU-project work plan.

2.3 Sampling procedures for the collection of SMALK information

2.3.1 Considerations on maturity stages and best sampling periods for maturity data

For solving the confusions in the classification of the maturity stages into 'mature' and 'immature' a small Working document was presented by H. Müller and discussed by the group. The main results are as follows:

The word 'mature' can have different meanings:

1. Mainly 'mature' is used in the sense of adult (sexually mature), i.e. a fish is about to spawn or spawned already at least once.
2. When the term 'proportion mature' is used in connection with the calculation of the spawning stock size, 'mature' has the meaning 'spawner'.
3. 'mature' can be also found as synonym for the maturity stage 'ripe'.

The terms 'proportion mature' or 'maturity ogive' are used

- when the sexual maturity/maturation pattern of a species in the sense of adult is described and also
- when the reproductive condition is meant and it is intended to estimate the spawning stock size.

The following text table gives an overview of the 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

Misclassifications into spawners and nonspawners caused by the difficulties in distinguishing the stages VIRGIN and RESTING can't occur.

The Group also discussed the best time of sampling and came to the following conclusions:

For assessment purposes the appropriate time of sampling is when it can be decided whether a fish will contribute in the current year to the spawning stock or not (fish in the resting stage will not spawn in the given year). At present for cod it would be in ICES Subdivision 22 in March and in ICES Subdivisions 24 and 25 in April/June (Bleil & Oeberst, 1997; Müller 1999, Oeberst & Bleil 1999).

Because timing of the surveys is dependent on many other reasons the surveys are carried out in February and March. That means that the proportion mature will be underestimated for cod in ICES Subdivisions 24 and 25 and subsequently the spawning stock size, too.

3 ACOUSTIC SURVEYS

3.1 Experiments for evaluation of biological sampling

For the estimation of the stock biomass measured during hydroacoustic surveys it is necessary to take fish samples. These samples should represent the length distribution and species composition of the fish estimated by the acoustic information. Therefore, the trawl has to catch every fish in the volume of water sampled. To approximate this, the selectivity of the used trawl should be low. However, specially designed trawls are rarely available. Usually modified commercial trawls are used. In 1997, two research vessels Argos from Sweden and Solea from Germany carried out a co-ordinated survey in the Baltic Sea, to investigate trawl catch composition of herring and sprat occurring in high densities in scattered layers (Bedtke *et al.*, in press). The analysis indicated that the selectivity for young fish was different between trawls mainly due to different mesh sizes in the codend. Thus, there was a need to estimate the real size distribution. A correction function was designed by applying selectivity data obtained from commercial trawls. However, these corrections are only possible for data obtained with mesh sizes not much larger than the optimum size. Results of Bedtke *et al.* (in press) also indicated that the larger the trawl is, the larger the proportion of larger fishes in the length distribution. Thus further research is necessary.

It was agreed to design future field experiments in order to investigate the fishing performance of different gears with the aim to identify and quantify sampling errors due to selectivity problems. These experiments should include intercalibration for the different trawl types used in the Baltic. One important aspect is that all trawls will use the same mesh sizes in the codend as stated in the BIAS manual (Appendix IV). The trawl investigations will be further discussed in the proposed workshop in January 2000. Results from these investigations will be used for standardisation of a pelagic trawls.

3.2 Target strength conversion formulas

In the application of acoustic fish abundance estimation, the target strength of the fish is one of the keystone parameter for the conversion of integrated acoustic energy to relative or absolute fish abundance. One of the most important factors influencing the final results is related to target strength conversion formulas. The target strength conversion is usually expressed as the averaged function of fish length. The actual target strength constants applied since 1983 for the Baltic Sea acoustic surveys are in reality estimates obtained for North Sea herring, sprat and cod.

In recent years several authors have expressed their concern that applying North Sea TS values as such directly to Baltic Sea may contain extra systematic error and that present TS values used are not accurate enough to be used for various seasons. Therefore, a rather critical approach has been practised for all target strength calculations and should be practised until target detection methods have improved. The WGBIFS recommended few years ago that an extensive review on the target strength conversion formulas and their application for acoustic fish stock abundance and biomass estimations should be made. One review on herring TS values was presented to WGBIFS last year and the main conclusion from that review was that the observed hydrographical and biological variability in back-scattering strength might obscure the use of fixed target strength constants. In addition, it has been assumed that two different ongoing review work on TS values, their estimation and usage will somehow clear and elucidate the pitfalls in the estimation of target strength constants. However, ICES Cooperative Research Report Series edited by Egil Ona, Bergen, Norway is not available yet and the WGFASST did not cover this issue in such manner that their findings would have been directly applicable for WGBIFS and Baltic International Acoustic Survey. Thus WGBIFS was not in the position to update and advice on new conversion formulas for Baltic Clupeoid fish. So the actual target strength constants applied since 1983 for the Baltic Sea acoustic surveys are still those estimates obtained for North Sea herring, sprat and cod. In order to solve this problem WGBIFS and BALTDAT EU Study Project together recommend that that a Workshop on Target Strength Estimation should be organised and the Workshop should take place in January 2000 (time and venue to be decided at the ICES Annual Science Conference 1999) in order to discuss and organise experiments with the objective to find and verify a new Target Strength (TS) conversion formulas for the target species.

3.3 Evaluation of The Baltic International Acoustic Survey (BIAS) Manual

3.3.1 Modifications made during the BIFS meeting

During the meeting the working group members evaluated the manual and agreed upon the following major changes:

- (1) The total area of observation was extended to the whole division III in order to include the western Baltic spring spawners.
- (2) The procedure of the intercalibration was added to the manual.
- (3) The methods of biological sampling were described in more detail.
- (4) The description of the identification of species compositions was extended.
- (5) The sampling of the length distribution was specified.
- (6) The weight and age distribution sampling and calculation sections were modified considering two different alternatives, which can be applied depending on the available manpower.
- (7) The oldest age-group for herring was reduced from 10+ to 8+ (tables 6.1 and 6.2)
- (8) The following tables were added:
 - ship and country codes (table 6.3)
 - species names (table 4.3.1)
 - areas per rectangles (table 2.2)
 - trawl gear specification (table 4.1)
- (9) An Appendix II was added containing calibration procedures.

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

Several issues concerning the BIAS Manual were discussed during the WGBIFS meeting and the following summarises those discussions:

Section 2: Survey design

Basic aspects/requirements of survey design

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 control should be also taken into account. First results shall be presented during the next WGBIFS meeting by Joachim Gröger, Rostock, Germany.

Stratification

ICES statistical rectangles limited by the 10m depth line should be used as strata. The areas of the strata are partly not exactly determined up to now. Therefore, these areas must be recalculated. The revised data set will be delivered to all members before the next WGBIFS meeting by Eberhard Götze, Hamburg, Germany.

Observation time

Concerning the survey time, at present the western Baltic area is covered by two separate surveys in different times of the year. One is carried out in July (Skagerrak, northern Kattegat) and the other in September/October (southern Kattegat, Sub-divisions 22 to 24). The July survey is connected to the North Sea acoustic summer surveys whereas the October survey is linked to the Baltic Sea acoustic surveys. In order to get a more complete picture of the herring and sprat distribution in the western Baltic area, in the future, it is required to cover the whole area at the same time.

Section 4: Fishery

Gear

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 species and (3) the age distribution.

A new table containing information of the trawl used in the acoustic surveys was added to the manual. The table must be filled by the following information until the next meeting by the national members:

- Type (pelagic, bottom trawl - 2-seams, 4-seams)
- Headline length between wing ends (m)
- Total length without codend (m)
- Circumference (m)
- Mesh sizes in all sections
- Height of headline at centre while trawling (m)

A schematic draft of the relevant specification to be filled in for the above information will be prepared by Wolfgang Rehme, Hamburg, Germany and distributed to the working group members by Eberhard Götze, Hamburg, Germany, during the autumn.

Length distribution, weight distribution, age distribution

Sample sizes for a representative length distribution per trawl haul have to be evaluated. Sample sizes for a representative weight/age distribution per rectangle/sub-division have also to be evaluated. First approaches to solve the problem will be presented during the next WGBIFS meeting by Joachim Gröger, Rostock, Germany.

Section 5: Data analysis

Species composition and length distribution

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. First results shall be presented during the next WGBIFS meeting by Joachim Gröger, Rostock, Germany.

Lack of sample hauls

The interpolation method must be evaluated. First approaches to investigate the problem will be presented during the next WGBIFS meeting by Fredrik Arrhenius, Lysekil, Sweden.

Target strength of an individual fish

See section 3.2 of the report. Target Strength is the keystone of fisheries acoustics and needs further work for the clupeoids stocks in the Baltic Sea. A workshop is recommended to be held in January 2000 to deal with this matter.

3.4 Establishing a new acoustic database (BAD2)

The present BAD1 database contains age-aggregated data on abundance and biomass for Baltic herring and sprat as estimated from 1991 to 1998. Due to differences in instrumentation and unavailability of data the WGBIFS decided that this database should not be extended further backwards in time than to 1991. It was also agreed that the BAD1 should be updated continuously. Some obvious errors have been found in the present data set and therefore the WGBIFS stresses the need for checking and corrections by contributing parties.

A new detailed database for acoustic data and biological sampling for the Baltic International Acoustic Survey (BAD2) is under construction. This database will contain acoustic data expressed as S_a -values at the level of Elementary Sampling Distance Unit (ESDU). The database will handle S_a -values for herring, sprat and mixed layers, respectively. The biological information from trawl hauls will be stored in a database structure similar to the BITS database format (Appendix III). The acoustic database project is coordinated by Fredrik Arrhenius, Lysekil, in the EU project BALTDAT "Surveying the pelagic fish resources and establish an acoustic database in the Baltic Sea". One of the main task of that project is to create an international database for acoustic and biological sampling data (BAD2) in close connection with the WGBIFS group.

A comparable database (EU study project "(CFP 97/008)." acronym HERSUR) is also currently under construction to manage the results from the international co-ordinated acoustic survey for the North Sea and West of Scotland. The WGBIFS in 1998 has recognised that the database specified for the North Sea is suitable for the Baltic Sea. The structure and status of this database was presented by the HERSUR-coordinator, Karl-Johan Stæhr during the meeting. The two databases HERSUR and BALTDAT have similar goals and data structures and will be merged to contain a common HERSUR/BALTDAT database kept in Hirtshals, Denmark. The database format that will be used for input to the common database is named BAD2 by the WGBIFS group. The creation and availability of all acoustic survey and biological data in a joint international database will make historical survey data accessible for studies on development of the herring and sprat stocks over a number of years, their interactions with other fish stocks in the Baltic Sea and also in the North Sea, effects of exploitation pattern and the possible effects of environmental changes on the stocks.

3.5 HERSUR/BALTDAT data exchange format

3.5.1 Background

The HERSUR/BALTDAT database exchange format (Appendix 1 in ICES 1999/H:3) for the combined database is prior to the project defined by the IBTS exchange format description. This format description is transformed into an XML definition document with the purpose of making the database in principle platform independent and easy to transfer on the World Wide Web. XML is actually a specially designed subset of Standard Generalised Markup Language (SGML) simplified and targeted at the Web.

A three-way construction has been made in order to create a loose connection between the acoustic data and the fishing data. For example, this might enable use of acoustic data without direct corresponding fishing data by using relevant fishing data. Another feature of this construction is that the database can be used as an international fish database if on a special purpose acoustic data is not needed.

Both acoustic and fishing data will be analysed prior to the processes of the international acoustic database. Execution of a JAVA/VB script by an Internet browser will perform the checking for validity, consistency and completeness.

3.5.2 Status of the specification of exchange format

There has been progress in the specification of exchange format and SGBAD in April included into their report a HERSUR/BALTDAT Exchange Format Specification (Rev. Ia April 1999) to fulfil this task. However, during the present WGBIFS meeting several inconsistencies were discussed and the WGBIFS recommended that the specification of the exchange format needs to be updated before the data can actually be delivered to the common database. The HERSUR-coordinator promised that an updated version will be delivered within four week after the closure of the present WGBIFS meeting. There were also guaranties that the database system for logging data will be up and running by 1 November 1999. Therefore WGBIFS recommended that all involved countries should prepare and deliver at least one complete dataset with acoustic and biological data by that date. However, participating fishery institutes will be requested to further compile and prepare data in agreed exchange format for as many years as possible to be delivered to the database until the next WGBIFS meeting as agreed in the EU BALTDAT-project. The status and progress of the data processing will be further evaluated a project meeting for BALTDAT in January 2000.

3.5.3 Future plans

A new EU-project (HERSUR-II) is applied from the EU DGXIV to secure a continuation of the database administration and further development of the common database HERSUR/BALTDAT in Hirtshals. At present, national data collected by the participants in the international coordinated acoustic survey from the North Sea and Division VIa(N) are worked up at the respective national institutes. The historical data will now be transferred to this database both from the Baltic and the North Sea. In the new project data reports from the database for national use shall be identified and developed. Furthermore, the possibility for an international abundance estimation program based on the all the international data stored in the in database will be investigated. This will be essential for the possibility of reanalysing time series of acoustic survey data.

4 RECOMMENDATIONS

4.1 Dissolving SGBAD

In the past the tasks of The Study Group on Baltic Acoustic Data (SGBAD) was to combine and analyse acoustic survey data for Baltic Fisheries Assessment Working Group and develop further hydroacoustic database and plan and decide on acoustic surveys and experiments to be conducted in the future. These tasks were set up to provide WGBFAS and ACFM with the information required responding to requests for advice/information from IBSFC. The results and analysis provided by SGBAD has been used by WGBFAS just after SG meeting. In recent years a number of new scientific projects and study projects has been initiated in the Baltic and neighbouring areas (BALTDAT and HERSUR for example) and these projects are tackling the same kind of issues than SGBAD. There is also a clear overlap between the Baltic International Fish Survey Working Group (WGBIFS) and SGBAD terms of reference and WGBIFS has already taken over of some of the SGBAD activities. SGBAD has recommended that it should be dissolved and the **WGBIFS do agree with SGBAD and also recommends that Study Group on Baltic Acoustic Data should be dissolved and its tasks should be moved to Baltic International Fish Survey Working Group (WGBIFS).**

4.2 Specific recommendations for future work

The following gives specific recommendations for future work of WGBIFS and hopefully the list eases out to keep track on work to be completed and completed in the future.

1. The WGBIFS recommends that the main results and the cruise reports from acoustic surveys in 1999 as well as cruise descriptions from all participating vessels should be delivered to the co-ordinator of the BALTDAT project (Dr. F. Arrhenius, Lysekil, Sweden) in the proposed exchange format (BAD1, BAD2) two months before the meeting for preparing a summary of the survey results. The summary is needed for WGBFAS. The corrected and updated database BAD1 for years 1991 to 1999 should be sent to E. Götze, Hamburg, Germany, about two months in advance to WGBIFS meeting in year 2000.
2. The WGBIFS recommends that each laboratory shall submit information about the dimension of the towing warps used with the TV3 trawls for each vessel. The information will be used to produce a table of warp length to fishing depth for all the research vessels. Preferred information is weight per metre in water and diameter should be submitted. If this is not available then diameter and construction. The information should be sent to R. Nielsen, Hirtshals, Denmark.
3. The WGBIFS recommends that two TV3 trawls should be tested in the flume tank to produce a series of measurements with the most recent decided changes in the rigging. The measurements will be used to monitor the trawls during the autumn 1999 surveys.
4. The WGBIFS recommends that scientists are urged to participate on foreign vessels with the aim of harmonising and standardising sampling procedures and facilitating implementation among the participating countries.
5. The WGBIFS recommends that a first track-line collection should be made available not later than December 1999. The track line library should be presented at the ISDBITS EU-Study Project meeting held in Lysekil in December 1999.
6. The WGBIFS recommends that the Manual for Baltic International Acoustic Surveys (BIAS) should be evaluated from practical experiences obtained during the 1999 hydroacoustic surveys.
7. The WGBIFS recommends that the exchange format between national laboratories and the new detailed acoustic database BAD2 (including the information on ESDU and biological sampling) should be evaluated.
8. The WGBIFS recommends that an evaluation is necessary to use a weighting factor when several pelagic trawl hauls are averaged in one rectangle.
9. The WGBIFS recommends that a relevant way to publish the data from the hydroacoustic surveys should be considered and evaluated to keep record of survey results.
10. The WGBIFS recommends that a Workshop on Target Strength estimation (Chair: Dr. Fredrik Arrhenius, Lysekil, Sweden) should be organised and the workshop should take place in January 2000 (time and venue to be decided at the ICES Annual Science Conference 1999) in order to discuss and organise experiments with the objective to find and verify a new Target Strength (TS) conversion formulas for the target species.
11. The WGBIFS recommends that the variability in the results of the acoustic surveys used for the assessment should be analysed. For this work the BAD1 must be continued and updated.
12. The WGBIFS recommend that as many as possible complete datasets of acoustic values and biological data should be used as a test for the exchange of data from the individual national acoustic surveys to the forthcoming database.
13. The WGBIFS recommends that statistical analyses of historical demersal trawl survey data in order to be able to evaluate the survey design with respect to area and depth coverage should be presented in year 2000. Preliminary analyses should be presented at the ISDBITS EU-Study Project meeting in Lysekil December 1999.
14. The WGBIFS recommends that for BITS-database a new format agreed and presented in the BITS manual should be used already for 1999 surveys and that the old data should be updated accordingly by national laboratories.

4.3 Next meeting in year 2000

4.3.1 Time and venue

The Working Group discussed its next meeting (to be decided at the Annual Science Conference in Stockholm). WGBIFS recommends that it will meet five days in April (from 3-7 April 2000, Chairperson: E. Aro, Finland) either in Kaliningrad, Russia or Gdynia, Poland in order to assist WGBFAS and ACFM.

4.3.2 Terms of reference

According to Annual Science Conference Resolution in Stockholm, Sweden (C.Res.1999/x:xx) The Baltic International Fish Survey Working Group [WGBIFS] (Chair: E. Aro, Finland) will meet in (to be decided in ASC, Stockholm, Sweden), from 3–7 April 2000 to:

- a) combine and analyse the results of the 1999 acoustic surveys and report to WGBFAS;
- b) correct errors in and update the hydroacoustic database BAD1 for the years 1991 to 1999 (E. Götze);
- c) plan and decide on acoustic surveys and experiments to be conducted in 2000 and 2001.
- d) update, if necessary both Baltic International Trawl Survey (BITS) and Baltic International Acoustic Survey (BIAS) manuals;
- e) continue the comparison and analysis of results from concurrent survey activities by the traditional and the new standard trawls;
- f) plan experiments to evaluate the biological sampling and TS conversion formulas presently applied in the Baltic during hydroacoustic surveys;
- g) continue to establish a new acoustic database BAD2;

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 2000 Annual Science Conference in Belgium.

5 ACKNOWLEDGEMENTS

The members of the working group gratefully acknowledge the organisation of the meeting and the excellent working facilities to the staff of Estonian Marine Institute and especially to Dr. Tiit Raid for his kind hospitality both during the working hours and leisure time. Without their effort the Working Group would not have such good possibilities to fulfil its duties.

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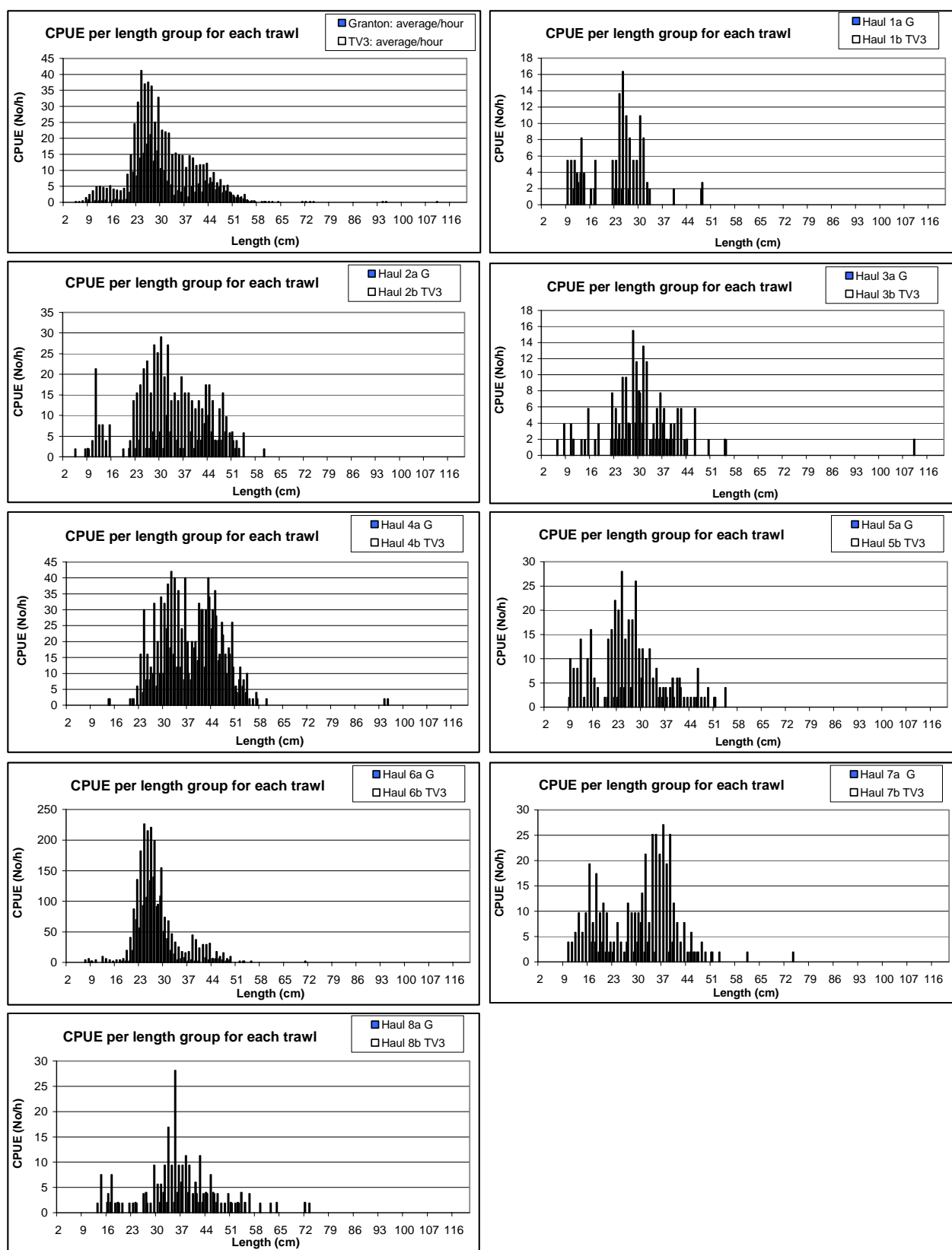


Figure 2.2.1.1 CPUE of cod from paired inter-calibration trawl hauls performed with the new, standard TV3 trawl (large 930) and the traditional Granton trawl (both with 16 mm mesh size in the cod-end). DK: R/V Dana survey 0499, spring (March) 1999, ICES SD 25.

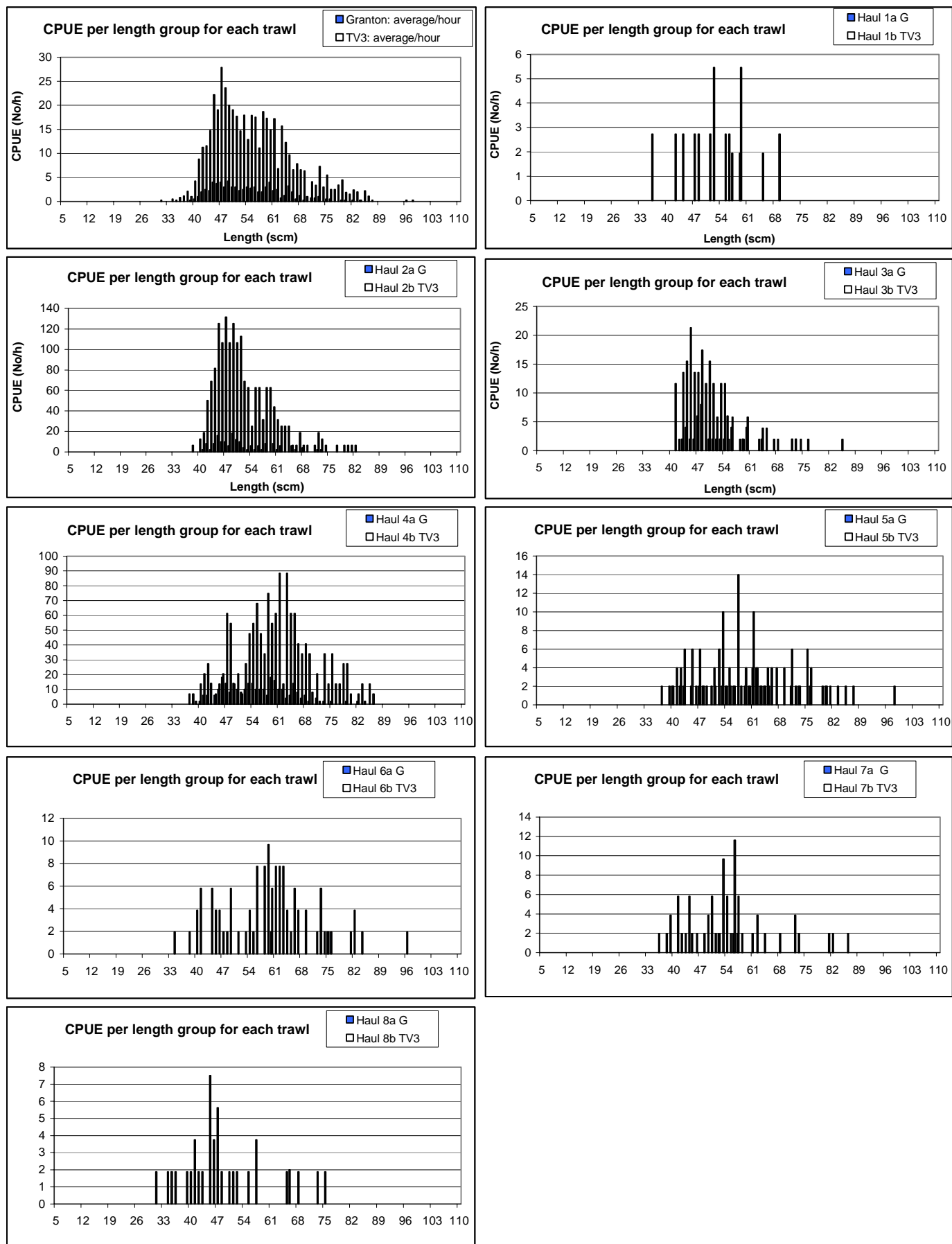


Figure 2.2.1.2 CPUE of flounder from paired inter-calibration trawl hauls performed with the new, standard TV3 trawl (large 930) and the traditional Granton trawl (both with 16 mm mesh size in the cod-end). DK: R/V Dana survey 0499, spring (March) 1999, ICES SD 25.

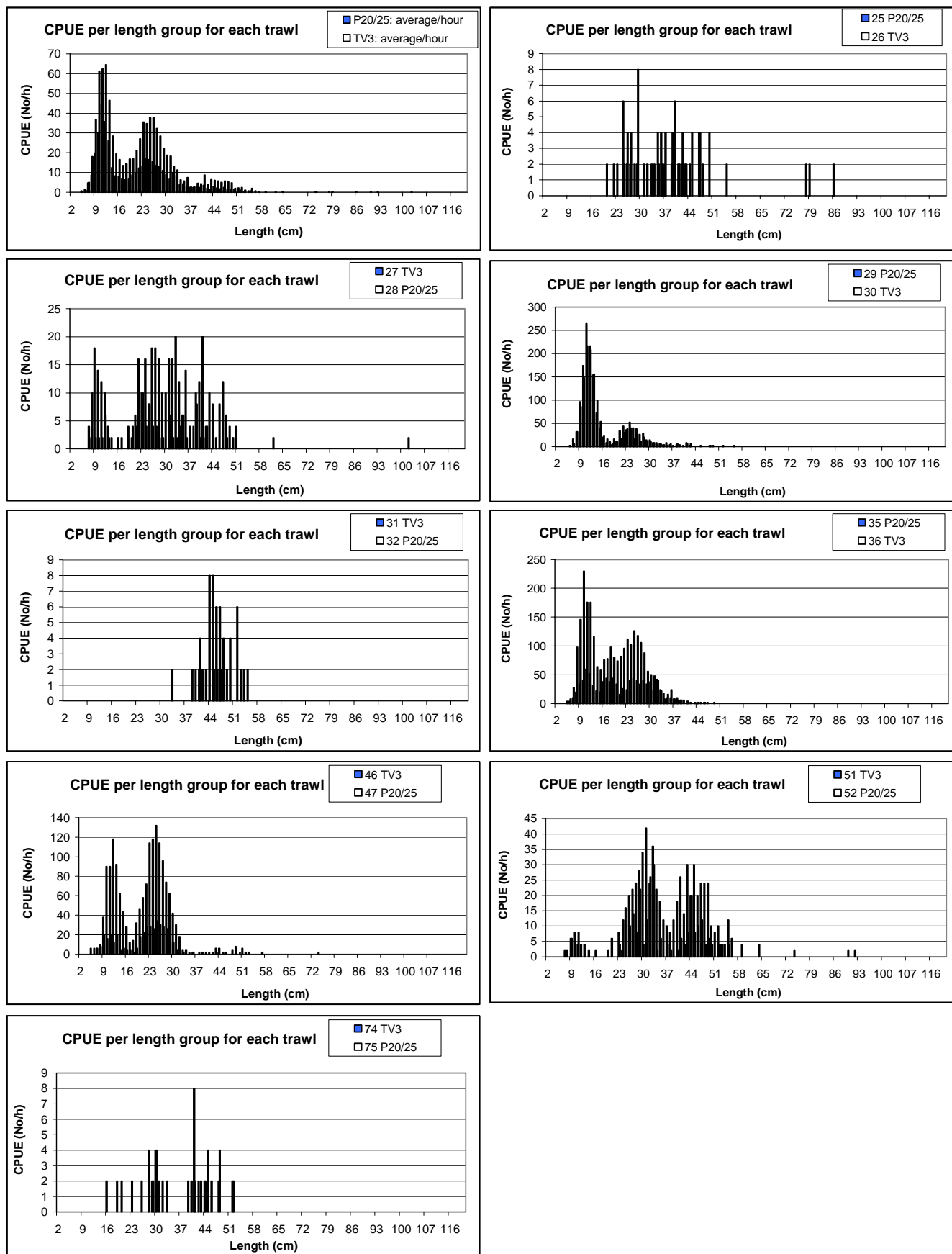


Figure 2.2.1.3 CPUE of cod from paired inter-calibration trawl hauls performed with the new, standard TV3 trawl (large 930) and the traditional P20/25 trawl (both with 16 mm mesh size in the cod-end). POL: R/V Baltica, spring (February-March) 1999.

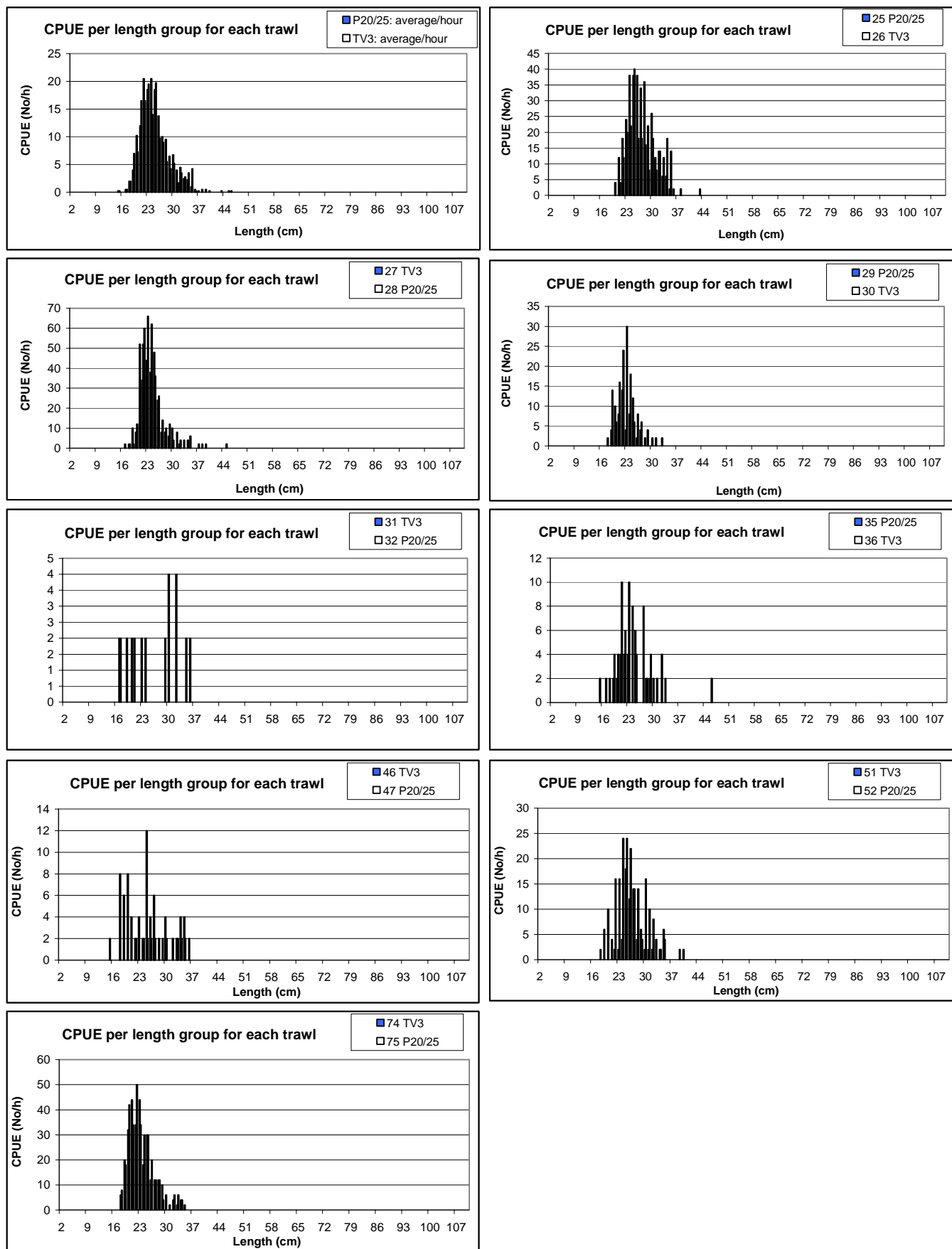


Figure 2.2.1.4 CPUE of flounder from paired inter-calibration trawl hauls performed with the new, standard TV3 trawl (large 930) and the traditional P20/25 trawl (both with 16 mm mesh size in the cod-end). POL: R/V Baltica, spring (February-March) 1999.

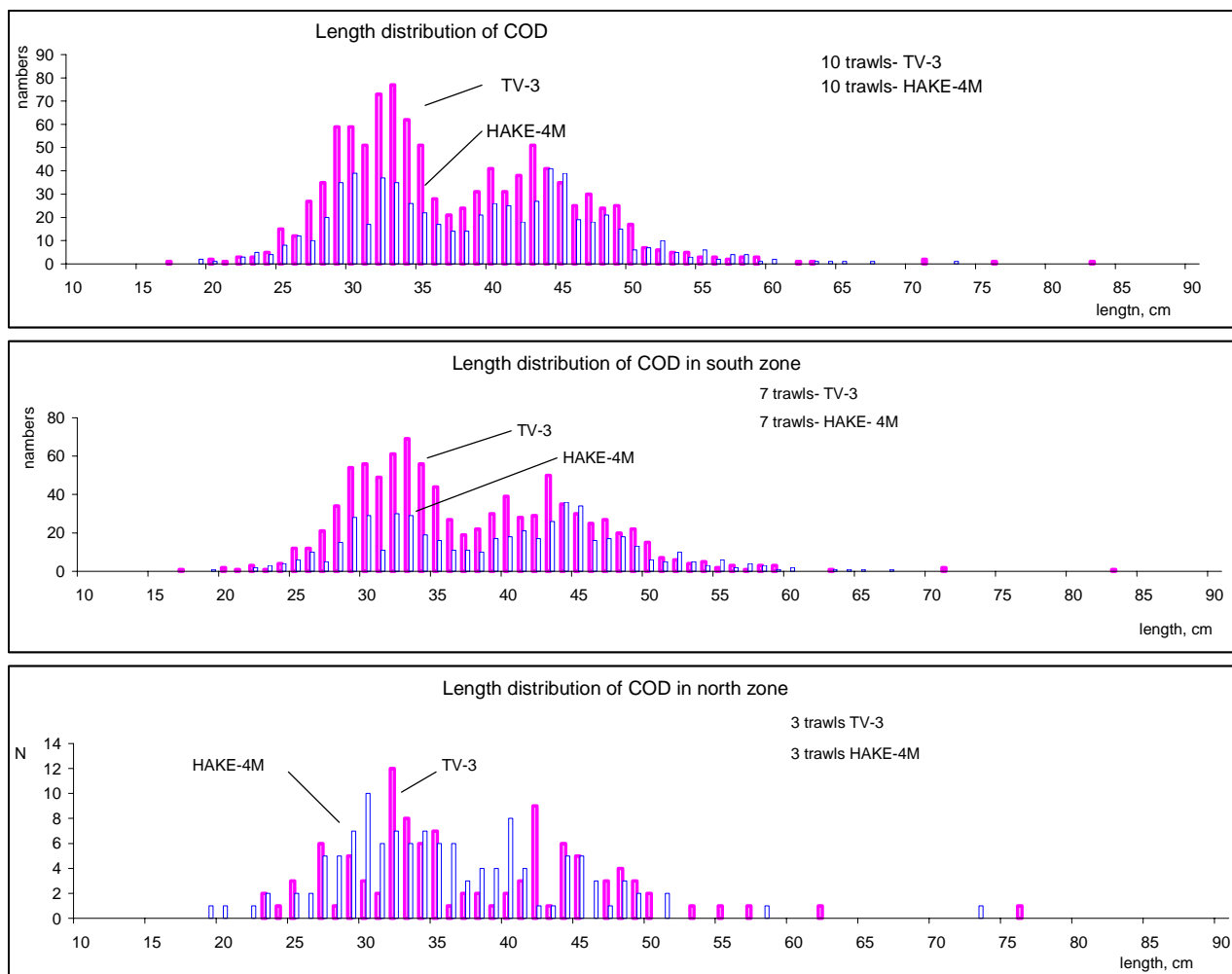


Figure 2.2.1.5 CPUE of cod from paired inter-calibration trawl hauls performed with the new, standard TV3 trawl (large 930) and the traditional HAKE-4M (both with 16 mm mesh size in the cod-end). RUS: R/V Atlantida, spring (March) 1999.

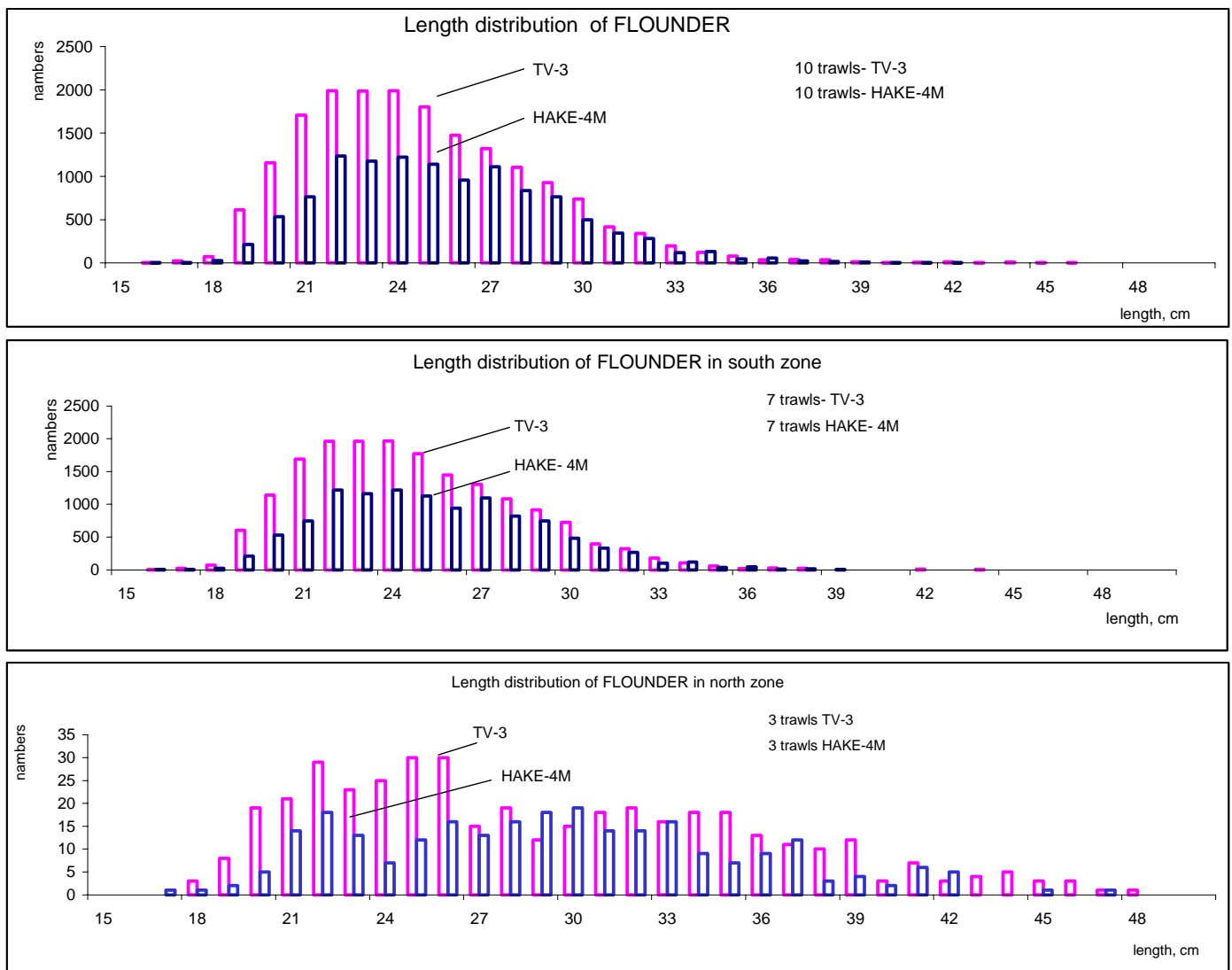


Figure 2.2.1.6 CPUE of flounder from paired inter-calibration trawl hauls performed with the new, standard TV3 trawl (large 930) and the traditional HAKE-4M trawl (both with 16 mm mesh in the cod-end). RUS: R/V Atlantida, spring (March) 1999.

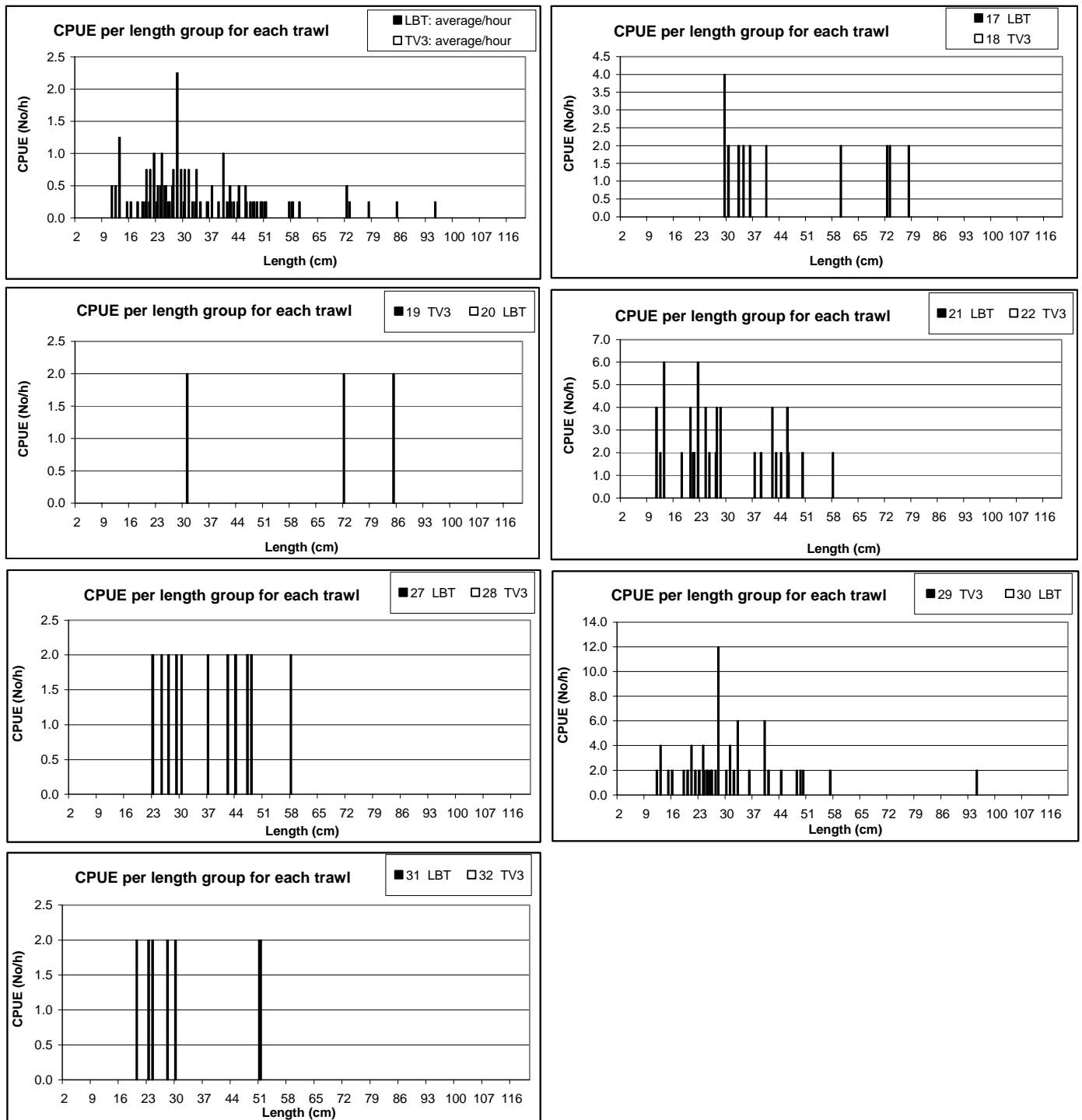


Figure 2.2.1.7 CPUE of cod from paired inter-calibration trawl hauls performed with the new, standard TV3 trawl (small 520) and the traditional LBT trawl (with 10 mm mesh size in the cod-end). Lat: F/V Grifs, spring (March-April) 1999.

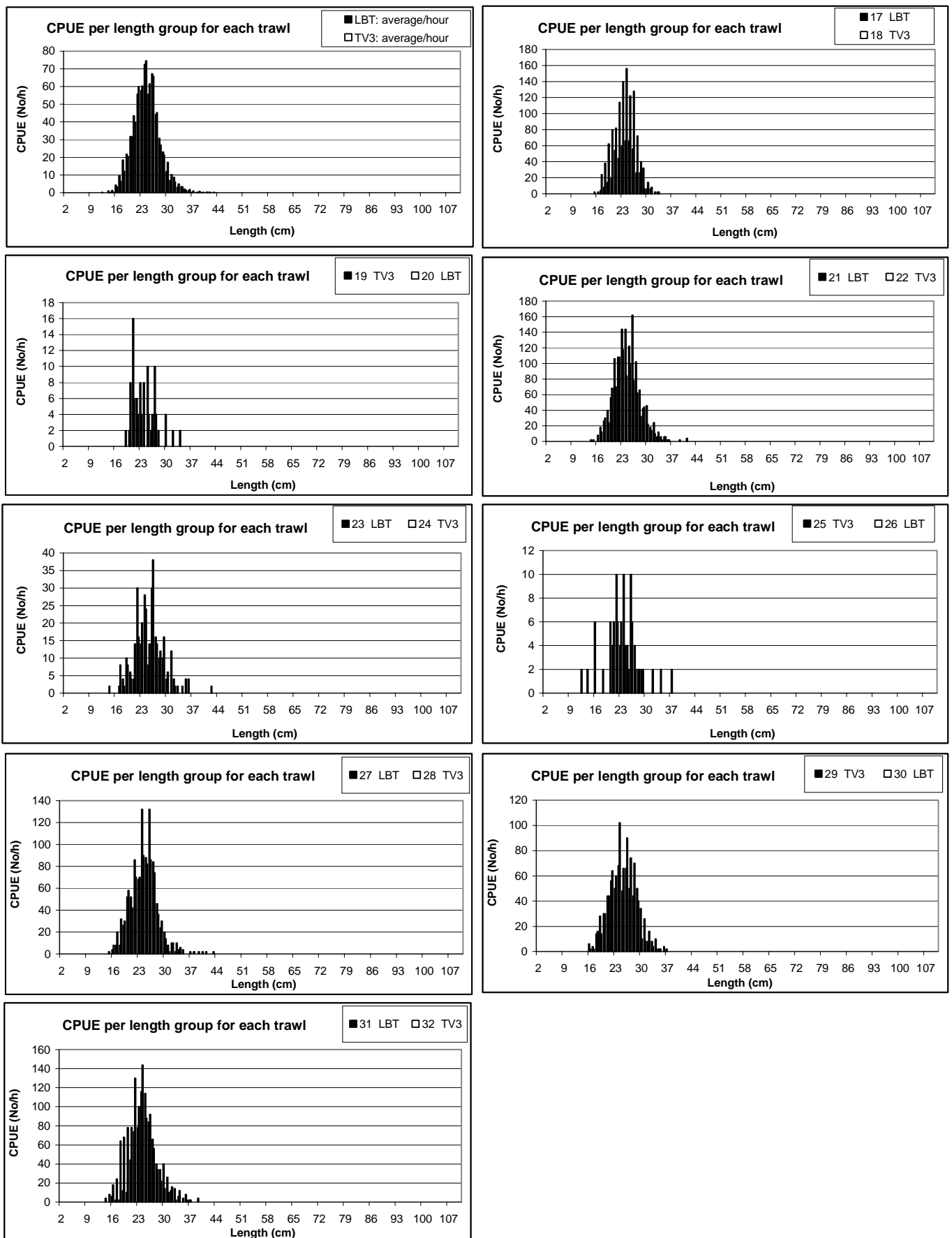


Figure 2.2.1.8 CPUE of flounder from paired inter-calibration trawl hauls performed with the new standard TV3 trawl (small 520) and the LBT trawl (with 10 mm mesh size in the cod-end). Lat: F/V Grifs, spring (March-April) 1999.

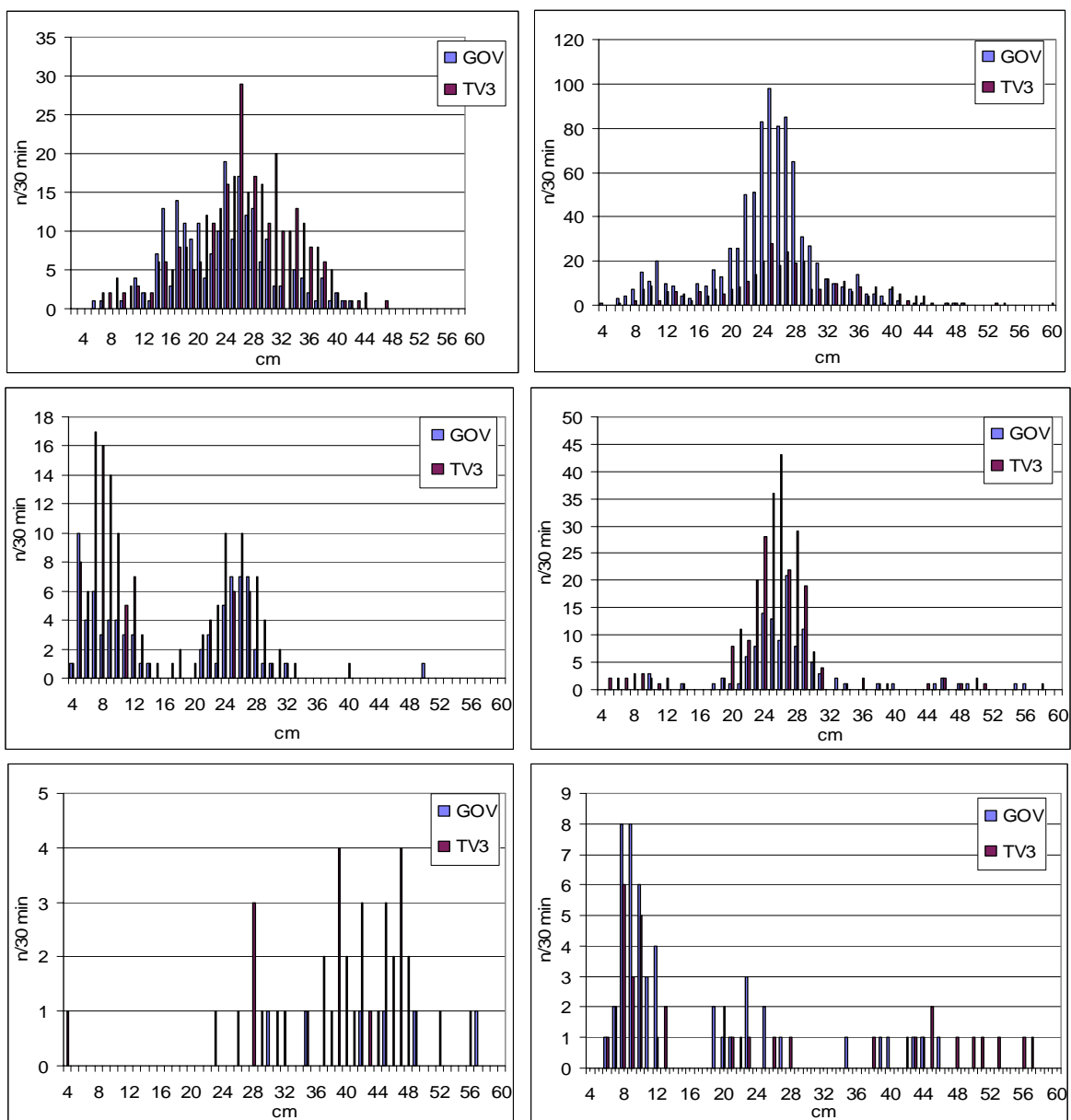


Figure 2.2.1.9 Catch of cod per haul in paired inter-calibration trawl hauls performed with the new, standard TV3 trawl (large 930) and the traditional GOV trawl; both with 16 mm mesh size in the codend). First hauls with TV3, second with GOV. SE: R/V Argos survey 9903.

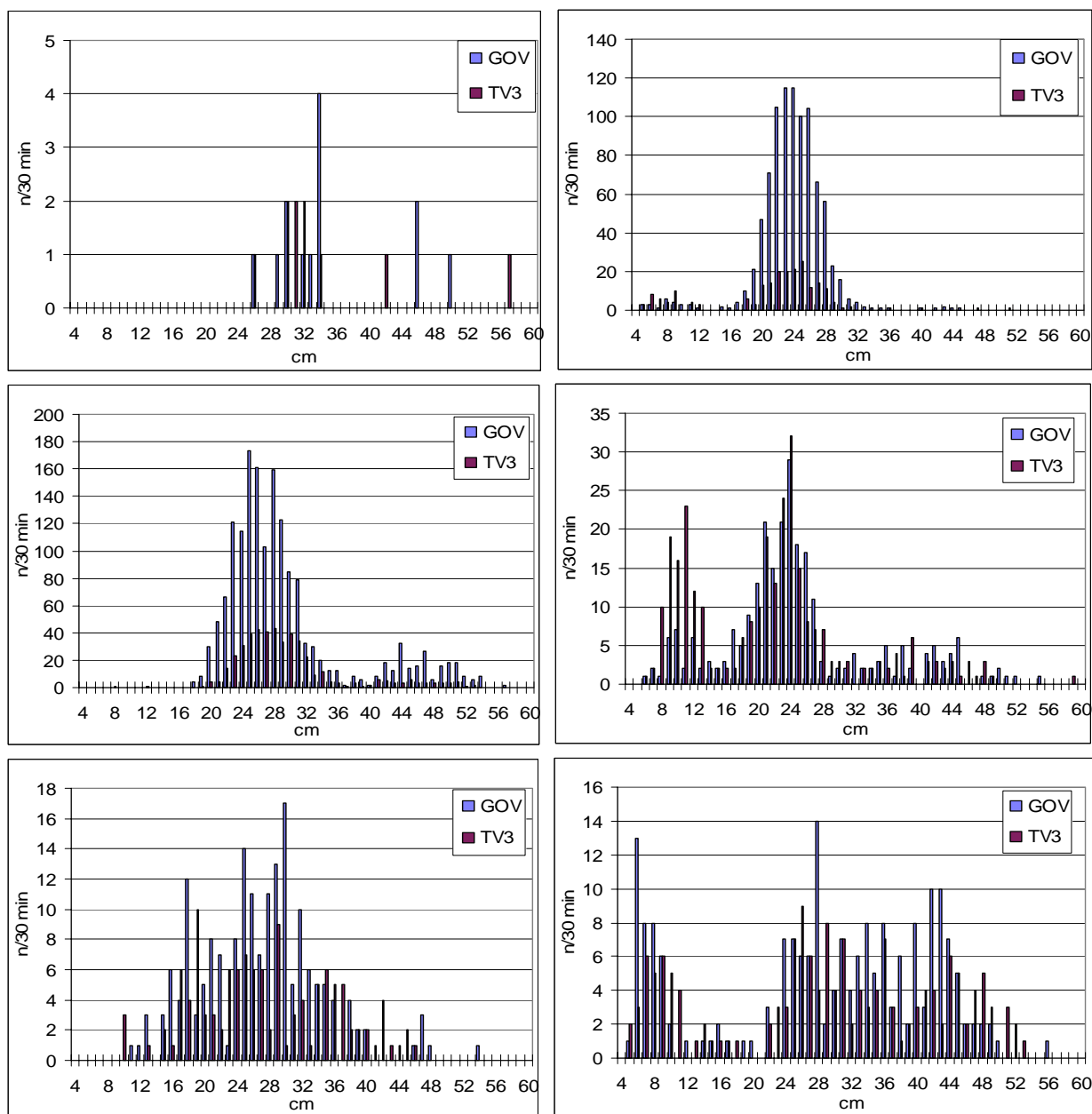


Figure 2.2.1.10 Catch of cod per haul in paired inter-calibration trawl hauls performed with the new standard TV3 trawl (large 930) and the traditional GOV trawl; both with 16 mm mesh size in the codend). First hauls with GOV, second with TV3. SE: R/V Argos survey 9903.

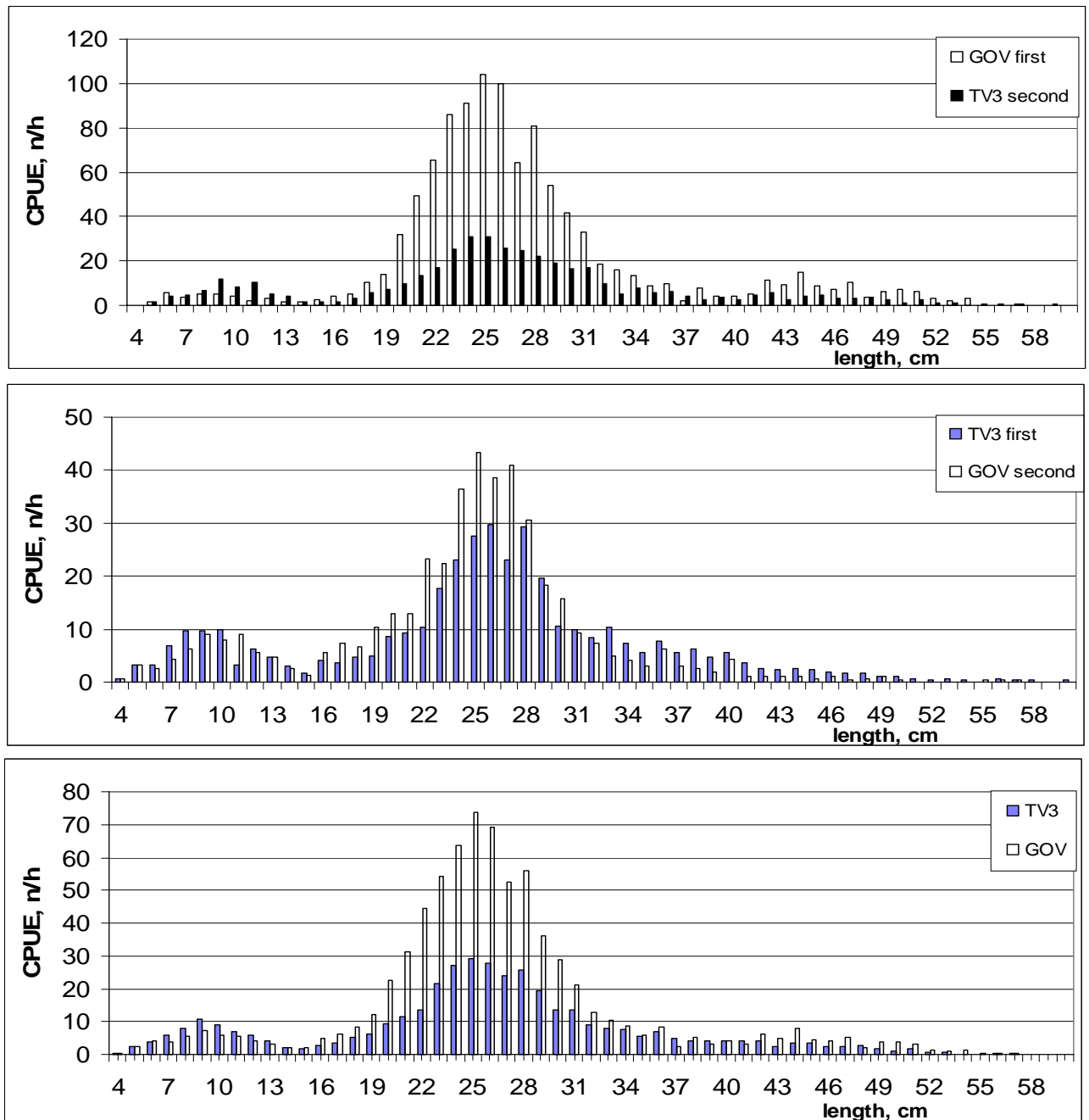


Figure 2.2.1.11 Average CPUE of cod from paired inter-calibration hauls performed with the TV3 trawl and the traditional GOV trawl. GOV hauls first (top), TV3 hauls first (middle) and totally (below). SE: R/V Argos survey 9903.

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