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Final Report of the Baltic International Fish Survey Working Group

27-31 March 2017

Riga, Latvia

International Council for the Exploration of the Sea

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Attendees of the WGBIFS 2017 Meeting

Executive summary

The ICES Working Group on Baltic International Fish Survey (WGBIFS) met in the Institute of Food Safety, Animal Health and Environment (BIOR), Fish Resources Research Department, Riga, Latvia, from 27 to 31 March 2017. Overall, 25 participants (including chair invited experts) representing all countries around the Baltic Sea, the ICES Secretariat (Data Centre) and the Norwegian Institute of Marine Research in Bergen attended the meeting (Annex 1). Włodzimierz Grygiel, Poland, chaired the group for the third time. During the meeting was realized the main WGBIFS ToR, i.e. combine and analyse acoustic-trawl-biotic results obtained during the fishery-independent, fish stocks assessment relevant surveys, type BIAS, BASS and BITS, accomplished from May 2016 until March 2017 (Annex 2A). Coordinate the time-schedule of the a.-m. surveys, planning of research vessel/country effort and principal assignments per area and survey, in the period from May 2017 to March 2018 was the next accomplished principal ToR, dedicated to WGBIFS (2017) meeting. New persons from WGBIFS members were chosen to coordinate and plan the above-mentioned surveys as well as to compile and store the acoustic and tows databases. During the meeting, the IBAS and BITS Manuals were updated and finally revised, accordingly to SISP standards and suggestions elaborated by reviewers.

The WGBIFS 2017 Report is composed of two parts, i.e. the basic report, prepared accordingly to the third year activities standard format, and the set of annexes. In the group of annexes can be distinguished the separate lists of recommendations and actions, response of the WGBIFS to inquire from others ICES working groups, including the Baltic Fisheries Assessment Working Group (WGBFAS), the set of presentations, cruise reports and working documents. In the group of additional tasks deliberated at the meeting can be mentioned, e.g.: the fish catches calibration experiments between the Danish old and new RV "Havfisken" and the German RV "Solea", the re-programming of BITS catch-stations allocation from the Tow-Database and the evaluation of possibilities to calculate the Large Fish Indicator (LFI) and Mean Maximum Length (MML) descriptors, based on the BITS surveys results. Moreover, the status of marine litter routine sampling during the BITS surveys and reporting to the ICES DATRAS subdatabase as well as Baltic cod stomachs sampling were also considered. The group intends prolonging coordination of marine litter sampling and reporting within the framework of BITS surveys. Baltic cod stomachs sampling and analysing, among other due to lack of response (interest) from the ICES Working Group on Multispecies Assessment Methods (WGSAM), very limited number of Baltic cod feeding experts, relatively high costs of sampling and not fully developed ICES database for such issue will be continued at local level (depend on possibilities), but not coordinated by WGBIFS.

As the deficiencies of the WGBIFS 2017 meeting can be mentioned – a lack of any information expected from the ICES WGFTFB about the standardization of the IBAS pelagic trawl, and shortage of some input data from the BITS surveys, needed for calculation the LFI and MML ecosystem indicators. The group intends prolonging realization of the both tasks.

The evaluation of a bulk of data from recently realized the BIAS, BITS-Q4/2016 and BITS-Q1/2017 surveys showed that sampling plans and their accomplishment are nearly similar. Fish stocks indices were evaluated based on the a.-m. surveys and reflect possible precision of the current main fish stocks size and distribution in the Baltic. However, the BASS-dataset can be used in the assessment of sprat stock in the Baltic Sea with restriction that the year 2016 (when the survey coverage was very poor) is

excluded from the dataset. The acoustic-hauls-biotic data from the BIAS and BASS surveys will be still stored in newly implemented the StoX programme, managed by the ICES Data Centre.

1 Administrative details

Working Group name - Working Group on Baltic International Fish Survey (WGBIFS)

Year of Appointment - 2014

Reporting year within current cycle - 3

Chair - Włodzimierz Grygiel, Poland

Meetings venue and dates:

- Institute of Coastal Research in Öregrund (SLU), Sweden, 23–27 March 2015 (24 participants)

- Institute of Baltic Sea Fisheries (TI-OF), Rostock, Germany, 30 March – 3 April 2016 (25 participants)

- Institute of Food Safety, Animal Health and Environment (BIOR), Fish Resources Research Department, Riga, Latvia, 27-31 March 2017 (25 participants)

2 WGBIFS Terms of references

ToR a) Combine and analyse the results of spring and autumn acoustic surveys and experiments;

ToR b) Update the BIAS and BASS hydroacoustic databases;

ToR c) Plan and decide on acoustic surveys and experiments to be conducted;

ToR d) Discuss the results BITS surveys and evaluate the characteristics of TVL and TVS standard gears used in BITS;

ToR e) Plan and decide on demersal trawl surveys and experiments to be conducted, and update and correct the Tow Database;

ToR f) Review and update the Baltic International Trawl Survey (BITS) manual according to SISP standards;

ToR g) Review and update the International Baltic Acoustic Surveys (IBAS) manual according to SISP standards;

ToR h) Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty;

ToR i) Coordinate the marine litter sampling programme in the Baltic International Trawl Survey (BITS) and registering the data in the ICES database. The status of Baltic cod stomachs sampling in BITS surveys;

ToR j) Discuss the possibilities to make further standardizations of IBAS. An attempt to standardize the pelagic fishing gear used in BIAS and BASS surveys.

The full list of WGBIFS Multi-annual ToRs is accessible in Annex 2A. The Agenda of WGBIFS 2017 meeting with links to ToRs is presented in Annex 3.

3 Summary of the Work plan for year 3

The seven first ToRs (a-g) of the WGBIFS 2017 meeting are simultaneously ongoing works because these issues are actualized over time. Moreover, they are related to the way of the realization with themselves and the materials obtained from routine research surveys are the input data independent from commercial fishery preferences and can be used for tuning in the main Baltic fish stocks size assessment, realized annually by the Baltic Fisheries Assessment Working Group (WGBFAS). Terms of references from a) to g) and i) - from the list above have been completed successfully in 2017. Results of investigations obtained in the framework of BITS-4q/2016, BITS-1q/2017, BASS/2016 and BIAS/2016 surveys have been analysed and were reported to WGBFAS with the remarks concern the some exclusions from given years. Moreover, the WGBIFS answered on inquires submitted prior the meeting starts, by e.g. the WGBFAS and other working groups/persons (see Annexes 10 and 11 to this year report). During the WGBIFS 2017 meeting the coordination and planning of the time-spatial schedule and numbers of catch-stations have been made for standard surveys in the second half of 2017 and the first half of 2018. However, regarding the next BITS surveys the re-programming of catch-stations allocation from the Tow-Database was initially implemented, without violate of the structure of this database. Some extensions and deficiencies in the Baltic routine research surveys were underlined. Sampling and reporting of the appearances of marine litter in the TV-3 bottom-trawl catches (BITS surveys) were discussed and evaluated as well developing the WGBIFS additional permanent task. Baltic cod stomachs sampling and food spectrum analysing was also discussed, however on the level of metadata because of appearance of a few obstacles mentioned in the description of ToR i) and Annex ToR i) (see also the Executive summary). In the group of additional tasks deliberated at the meeting can be mentioned, e.g.: the fish catches calibration experiments between the Danish old and new RV “Havfisken” and the German RV “Solea” and the evaluation of possibilities to calculate the Large Fish Indicator (LFI) and Mean Maximum Length (MML) descriptors based on the BITS surveys results. The ToR h) was only partly realized because it was decided that WGBIFS should at first move forward and try to evaluate the BIAS and BASS surveys results from the bootstrap method recommended at the Workshop on Sampling Design and Optimization (WKSDO) for calculation the surveys sampling variance. Moreover, the limited time of meeting not allowed on the broad exercises with the acoustic-hauls-biotic data (from BIAS and BASS surveys) under the StoX programme, initially implemented into operation for data storage and fish stocks size assessment in the Baltic. Based on the Estonian’s data from the BIAS 2015 survey common procedures used in the StoX programme were deeply considered. As the deficiencies of the WGBIFS 2017 meeting can be mentioned – a lack of any information expected from the ICES/FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) about the standardization of the IBAS pelagic trawl (ToR j), and shortage of some input data from the BITS surveys, needed for calculation the LFI and MML ecosystem indicators. The group intends prolonging realization of the both tasks.

4 Summary of achievements of the WG during 3-year term

1) Updated the BIAS and BASS acoustic databases, with the acoustic-hauls-biotic data (sprat, herring, cod) from 2014–2016 surveys, according to the BASS_DB.mdb the BIAS_DB.mdb Access-database, and from 2015–2016 surveys according to the StoX programme used in the newly implemented an international acoustic surveys database, managed by the ICES Data Centre.

2) BIAS – sprat (age 1+) from the ICES SD 22-29, herring (age 1+) from the ICES SD 25-29 and separately from the ICES SD 30 - tuning fleet index (area corrected data) for assessment of the Baltic stocks abundance per age groups, for years 1991–2016.

3) BIAS – sprat and herring-CBH (0 age group) recruitment index for the period of 1991–2016.

4) BASS – sprat (age 1+) from the ICES SD 24-28 (without the Gulf of Riga) tuning fleet index (area corrected data) for assessment of the Baltic stock abundance per age groups, for years 2001–2016.

5) Maps reflecting the geographical distribution of sprat, herring and cod stocks abundance (separately for age groups 0 and 1 – 8+) per the ICES-rectangles, in the Baltic areas monitored in May 2014–2016 and September-October 2014–2016.

6) Agreed plan and decide on acoustic-hauls-biotic routine monitoring to be conducted during the BIAS and BASS surveys in sequence of 2015–2018, accordingly to given research vessel/country and area of the Baltic. Maps of the BIAS and BASS surveys area coverage (plans and realization) were attached.

7) Updated and corrected the Database of Trawl Surveys (DATRAS) and the Tow-Database, with the set of data from BITS-Q4 and BITS-Q1 (2014–2017) which allows, e.g. calculating cod and flatfish abundance index per age groups, ICES SDs, depth stratums and planning the spatial distribution of catch-stations in the areas, where the seabed is suitable for safety towing.

8) Set of BITS-Q4, BITS-Q1, BASS and BIAS (2014–2017) surveys standard- and in limited cases – extending-reports, reflecting the comparison between planned and realized fishing-stations by ICES subdivisions, depth layers, and country with overview on the main surveys results.

9) Agreed plan and decide on bottom trawl (TV-3) fish control-catches to be conducted in autumn 2015–2017 and early spring 2016–2018 (successively), during BITS surveys, per depth zones, countries and the ICES SDs.

10) Corrected and finally updated the BITS- and IBAS-Manuals (ver. 2017).

11) The main results of standard research surveys (BITS, BASS and BIAS in 2014–2017) were orally presented country by country during running meetings.

12) The protocols from the annual measurements of the standard technical parameters of the TV-3 bottom trawl used by the Baltic research vessels were presented by some countries (2015–2017).

13) The technical schemes of pelagic trawls used by Poland, Germany, Russia and Finland (list of technical data only) during the BIAS and BASS surveys. An oral presentation (from Poland) summing up the recent knowledge of

the pelagic fishing gears (with the full set of rigging), possible to use during the research surveys (BIAS, BASS) as the standard fishing gear.

14) Revised and updated methodology of marine litter and cod stomach sampling during the BITS surveys and an elaboration of the final structure (format) of marine litter database, systematically supplied with the new data.

15) The set of maps required by the Baltic Fisheries Assessment Working Group (WGBFAS 2015-2016) showing geographical distribution (cpue in numbers/h obtained from control-catches with the TV-3 trawl) of cod, flounder, plaice, turbot, dab, and brill during the BITS-Q1 and BITS-Q4 surveys in 2015 and 2016.

16) The table (required by WGBFAS - 2017) with actualized the status of standard research surveys (per species, age groups, areas, surveys) tuning indices ready to use in the Baltic fish stocks assessment process. Moreover, the overview of various research surveys scope of works realized by the countries surrounding the Baltic, but currently not used for fish stocks assessment.

17) Answers on the WGBFAS inquires (2015–2016) – "How to explain discrepancy between herring ICES SD 30 and Central Baltic Herring stocks size", and "Comparison of methods applied in different institutes for the Baltic fish age reading".

18) Supplementary information for improving quality of data and structure of the DATRAS database (2015–2017), e.g. corrections in the DATRAS HL.CatCatchWgt and fish species codes.

19) The initially implemented re-programming of the next BITS catch-stations allocation (starting from autumn 2017) from the Tow-Database.

20) The results and initial recommendation (2017) to WGBFAS concerns the fish catches calibration experiments between the Danish old and new RV "Havfisken".

21) The evaluation (2016–2017) of possibilities to calculate the Large Fish Indicator (LFI) and Mean Maximum Length (MML) descriptors based on the BITS surveys results.

22) German opinions (2016) regarding "Fish stock indices based on acoustic surveys in the Baltic Sea. Alternative application of results of fishing stations" and "Mixing of the Western Baltic Spring-spawning Herring (WBSSH) and CBH – applicability of the separation function".

23) Recommendations to ICES expert groups and the action list addressed mostly to WGBIFS and in some extent to the ICES Secretariat, and the list of ToRs for the WGBIFS next meetings were prepared in 2015–2017.

5 Final report on ToRs, workplan, Science Implementation Plan

5.1 ToR a) Combine and analyse the results of spring (BASS) and autumn (BIAS) 2016 acoustic surveys and report to WGBFAS

5.1.1 Combined results of the Baltic International Acoustic Survey (BIAS)

In September – October 2016, six research vessels, representing nine national research institutes participated in the accomplishment of autumn acoustic survey (BIAS type), conducted in the ICES Subdivisions 21–32 (excl. ICES SD 31) however, in some subdivisions only in parts. Stock tuning indices of herring, sprat and cod by age groups of the different cruises (1991–2016) are stored in the BIAS-database of WGBIFS. The extended reports from Estonian-Polish, Finnish, German-Danish, Latvian-Polish, Lithuanian, Polish, and Russian BIAS 2016 cruises are presented in Annex 7, and presentations reflecting achieved the main acoustic-trawl results from particular BIAS surveys are accessible in Annex 9. The whole time-series of acoustic surveys data from the period 1991–2016 linked with tuning indices of sprat and herring, are accessible in Annex ToR a).

5.1.1.1 Area under investigation and overlapping areas

The BIAS/2016 survey vs. plan, regarding the area coverage with acoustic-trawl monitoring was completed at 96%. The Figure 5.1.1.1.1 (Annex ToR a) illustrates that the coverage of the Baltic Sea during the BIAS survey in September-October 2016, was slightly less as it was planned during the WGBIFS 2016 meeting. The small areas of the Baltic were omitted from acoustic monitoring, i.e. the ICES SD 32-E (Russian zone) and the northern part of the ICES SD 21 (German/Danish survey). In September-October 2016 overall 102 whole and 6 partly of the ICES rectangles were covered with routine monitoring. Echo integration was recorded at totally of 6981 nautical mile linear distance moreover, 231 and 273 catch and hydrological stations, respectively were inspected too. Totally, eleven statistical ICES rectangles were inspected by more than one country (see Annex ToR a).

5.1.1.2 Total results

Materials concern Baltic sprat and herring stocks and to some extent, cod stocks distribution and abundance in autumn 2016 can be accepted as fully representative for further computation. The fish abundance estimates, which are based on the BIAS surveys in September-October 2016, are presented per the ICES rectangles and age groups and are specified in Tables 5.1.1.2.1, 5.1.1.2.2, and 5.1.1.2.3 (Annex ToR a) for herring, sprat and cod, respectively. In addition, the abundance estimates for herring and sprat aggregated per ICES subdivisions and fish age groups are presented in Tables 5.1.1.2.4 and 5.1.1.2.5 (Annex ToR a). Geographical distribution of herring, sprat and cod abundance in the Baltic Sea, accordingly to the ICES rectangles inspected in September-October 2016 is illustrated in Figures 5.1.1.2.1–5.1.1.2.5 (Annex ToR a).

The highest herring (age 1+) stock abundance was concentrated in eastern part of the ICES Subdivision 29 (nearby the Estonian Hiiumaa Island) and middle part of the Gulf of Finland (Figure 5.1.1.2.1). Somewhat lower herring (age 1+) concentrations were detected in the Åland Islands area. Herring from age group 0 (year class 2016) occurred mostly in the eastern part of ICES Subdivisions 32, precisely on the marine border between Estonia and Russia, and next in the western part of ICES Subdivision 29 and in the western Baltic (Figure 5.1.1.2.2). The highest sprat (age 1+) stock abundance was concentrated in the eastern Baltic, particularly in enter to the Gulf of Finland as well nearby the Estonian and Latvian coasts (Figure 5.1.1.2.3). YOY sprat (year class 2016) highest concentration was detected in a narrow area of the ICES Subdivision 24, i.e. nearby the coast of the Rügen Island and somewhat lower concentration was noticed nearby the coast of the Hiiumaa Island (Figure 5.1.1.2.4). The relatively high cod (age 1+) stock abundance was recognized in a strait area – from western border of the ICES SD 24 via northern part of the Bornholm Basin to the Öland Island (Figure 5.1.1.2.5). Cod stock abundance in northward from the Gotland Island was almost close to zero. It should be underlined that cod stock abundance was several times lower than herring and sprat stocks abundance.

5.1.1.3 Area corrected data

The area corrected abundance estimates for herring and sprat per ICES subdivisions and age groups are summarized in Tables 5.1.1.3.1 and 5.1.1.3.2, respectively (see Annex ToR a). Biomass for herring and sprat per ICES subdivisions and age groups are summarized in Tables 5.1.1.3.3 and 5.1.1.3.4, respectively (see Annex ToR a). The correction factor for each ICES subdivision and year was introduced in 2006 and somewhat widely description of this one is presented in Annex ToR a), chapter 5.1.1.3.

5.1.1.4 Tuning fleets for WGBFAS

5.1.1.4.1 Herring in the ICES Subdivisions 25–29

Following tuning fleets' index was derived from the 1991–2016 BIAS surveys for the herring assessment of the Central Baltic stock (CBH; Figure 5.1.1.4.1.1) and is presented in Annex ToR a:

- the area corrected numbers per age groups from 1 to 8+ of the ICES SDs 25–27, 28.2 and 29 (incl. the existing data of the ICES SD 29-North; Table 1),
- the area corrected recruitment index for age 0 of the ICES SDs 25–27, 28.2 and 29 (including the existing data of the ICES SD 29-North; Table 2).

In the years, 1993, 1995 and 1997 the area coverage was very poor. The results were therefore not recommended to be used. It is recommended that these data should not be used in future. The coverage of the ICES Subdivision 29N was very inconsistent until 2007. Nevertheless, high density of herring has been recorded there very frequently.

Taking into consideration the recent BIAS surveys results should be underlined systematic increase after 2007 of the Central Baltic herring stock abundance acoustic tuning fleet index (age groups 1-8+) (Table 1, Annex ToR a). Spectacular increase of CBH stock abundance index was noticed in 2015, when the very abundant year class 2014 was recruited and this index for all age groups was over 2 times higher than the long-term (1991–2015) average abundance, equal to 43 845.6 x 10^6 individuals. The abundance of YOY herring from year class 2014 was 11 times higher than the abundance of year class 2013 (Table 2, Annex ToR a). In 2016 the above-mentioned abundance index decrease to 58 080.3 x 10^6 individuals, i.e. still was over the long-term average abundance.

5.1.1.4.2 Sprat in the ICES Subdivisions 22–29

The tuning fleet for assessment of sprat from the ICES Subdivisions 22–29 is presented from the September/October 1991–2016 BIAS surveys (Figure 5.1.1.4.2.1) and the area corrected combined results (for age 1+) of the above-mentioned ICES subdivisions are presented in Table 3, Annex ToR a. The recruitment index for YOY sprat (age 0) in the ICES Subdivisions 22–29 is presented in Table 4, Annex ToR a. Older data than for 1991 do not exist in the current BIAS database. In the years, 1993, 1995, and 1997 the area coverage was very poor. The results were therefore not recommended to be used. It is recommended that these data should also not be used in future.

Taking into consideration the recent BIAS surveys results should be emphasized continuously declined after 2009 of the sprat stock (the ICES SDs 22–29) abundance acoustic tuning fleet index (age groups 1-8+), with the exception of year 2015, when the very abundant year class 2014 was recruited (Table 3, Annex ToR a). The abundance of YOY sprat from year class 2014 was 7 times higher than the abundance of year class 2013 (Table 4, Annex ToR a). In 2015 and 2016, sprat (age 1+) abundance index was equal to 158 980.6 x 10^6 and 142 656.2 x 10^6 individuals, respectively what means it was somewhat over and slightly below than the long-term average abundance (146 580.6 x 10^6).

5.1.1.4.3 Herring in the ICES Subdivision 30

Tuning fleet data from the October 1991, 2000, 2007–2016 BIAS surveys are accessible for the assessment of the Gulf of Bothnia herring stock (the ICES SDs 30-31) size, the area corrected combined results are presented in Table 5.1.1.4.3.1 and Figure 5.1.1.4.3.1 (Annex ToR a). The results from 2012 survey are not consistent with the results from other years due to lower area coverage than normally. Not all of the 2014 herring age samples were available at the deadline-time of data delivery for the 2015 WGBIFS meeting and therefore there could be higher uncertainty in the 2014 age composition of the fish hauls. According to the procedure, delayed data cannot be taken into account for evaluation of the tuning data in the current year.

The abundance indices for herring from the ICES SD 30 in age groups 0 and 1 have high variability (Figure 5.1.1.4.3.1) in the BIAS surveys. The abundant and poor year classes are not well traceable in the time-series for younger age groups. This has been caused by the differences in temporal horizontal distribution of young specimens and not fully recruited herring. WGBIFS recommends WGBFAS to handle the abundance indices of herring in the ICES SD 30 for age groups 0 and 1 with caution.

5.1.2 Combined results of the Baltic Acoustic Spring Survey (BASS)

In May-June 2016, two research vessels only participated in the accomplishment of three spring acoustic surveys (Latvian-Polish, Estonian-Polish, Lithuanian BASS type of surveys; Annex ToR a). Stock indices of sprat by age groups of the different BASS cruises are stored in the in the BASS-database of WGBIFS. The extended reports from the above-mentioned BASS cruises are presented in Annex 7, and presentations reflecting achieved the main acoustic-trawl results from particular surveys are accessible in Annex 9. Some of the spring acoustic survey data from 2016 are available in Annex ToR a.

5.1.2.1 Area under investigation and overlapping areas

The BASS-2016 surveys were realized by the above-mentioned countries in the ICES Subdivisions 26 (northern part), 28, 29 (southeast part only) and 32 (in one ICES rectangle) (Figure 5.1.2.1.1; Annex ToR a). The statistical ICES rectangle 45H0 was inspected by both, Estonia and Latvia. As they covered different part of that rectangle, the data from both countries was used in the calculation of the indices. The BASS–2016 survey vs. plan, regarding the area coverage with acoustic-trawl monitoring was completed in 47% and broad „white" areas in the ICES SDs 24, 25 and in parts of the ICES SDs 26 and 29 were omitted from this inspection. Compared with the previous survey, in 2016 the area coverage of the Baltic Sea with the BASS-2016 survey was very poor. The estimated numbers of sprat per age groups and the ICES rectangles are presented in Table 5.1.2.2.1 (Annex ToR a). The geographical distribution of the sprat abundance is demonstrated in Figure 5.1.2.1.2. Because of relatively small portion of herring (<10%) compared with sprat (>90%) in most of areas monitored during the BASS surveys only the distribution of sprat is further examined.

5.1.2.2 Combined results and area corrected data

The Baltic sprat stock abundance estimates per the ICES rectangles and subdivisions according to age groups are presented in Tables 5.1.2.2.1 and 5.1.2.2.2 (Annex ToR a). The geographical distribution of sprat abundance is demonstrated in Figure 5.1.2.2.1.

5.1.2.2.1 Sprat in the ICES Subdivisions 24–28

Tuning fleets for WGBFAS

The area correction factors, calculated for 2016 are included in Tables 5.1.2.2.1.1 and 5.1.2.2.1.2, which summarize abundance and corresponding biomass estimates, respectively for sprat per ICES subdivision. The complete time-series (2001–2016) of the area-corrected sprat abundance in the ICES Subdivisions 24, 25, 26, 27, and 28 (without the Gulf of Riga) is given in Table 5 and Figure 5.1.2.2.1.1 (Annex ToR a).

5.2 ToR b) Update the acoustic databases BIAS_DB and BASS_DB

After validation, the international data from BIAS and BASS surveys curried out in 2016 were added to the BIAS_DB.mdb and the BASS_DB.mdb Access-databases, respectively (Annex ToR b). These databases also include queries with the used algorithms for creation of report tables and calculation of the different tuning fleets. The updated versions of the databases are located in the folder "Data" of the ICES WGBIFS 2017 SharePoint.

The results of the next international acoustic surveys (BIAS, BASS) should be summarized in table format according to the IBAS Manual and uploaded latest one month before the WGBIFS meeting of the next year to the ICES WGBIFS SharePoint (Annex ToR b). Simultaneously the acoustic-trawl data from both types of surveys should be also uploaded to the newly created database, linked with the StoX programme managed by the ICES Data Centre.

5.3 ToR c) Plan and decide on acoustic surveys to be conducted in autumn 2017 and spring 2017–2018

5.3.1 Planned acoustic survey activities

All the Baltic Sea countries (with the exception of Russia – St. Petersburg) intend to take part in the autumn BIAS acoustic surveys and experiments in 2017. Cooperation between Germany and Denmark in the BIAS survey realization is planned. Germany, Lithuania, and the joint Latvian-Polish and Estonian-Polish BASS surveys will be continued in May 2017–2018 too. In May 2017 is planned for the first time the Polish BASS survey in the Polish EEZ. The list of participating research vessels and initially planned periods of particular surveys are given in tables presented in Annex ToR c. The Figures 5.3.1.1–5.3.1.3 reflects areas, which will be covered with investigations during planned BASS and BIAS surveys (2017–2018).

5.4 ToR d) Discuss the results from BITS surveys performed in autumn 2016 and spring 2017

5.4.1 BITS 4th quarter 2016

During the BITS-Q4/2016 surveys the level of realized valid ground trawl hauls represented 94% of the total planned catch-stations (Table 5.4.1.1; Annex ToR d). The above-mentioned surveys were accomplished by Denmark, Germany, Estonia, Poland, Sweden, Russia, Lithuania, and Latvia in the ICES Subdivisions 20–29. As the extension of the BITS-Q4/2016 survey can be admitted participation of Russia (Kaliningrad) in realization of catch-stations designated in a part of the ICES Subdivision 26. As the deficiency of the BITS-Q4/2016 survey can be considered accomplishment of 69% catch-stations from planned in the ICES SD 28, which was because of unfavourable weather conditions.

The differences in numbers of planned and index-valid fishing stations for each monitored ICES subdivision are presented in the Figure 5.4.1.1; Annex ToR d). The coverage with control-hauls by depth stratum is as follow (depth stratum, coverage in %): 1, 98, 2, 89, 3, 98, 4, 95, 5, 89, 6, and 100.

The number of valid hauls was considered by WGBIFS 2017 as appropriate to tuning series and obtained the data could be used for the assessment of Baltic and Kattegat cod and flatfish stocks.

5.4.2 BITS 1st quarter 2017

In the 1st quarter 2017 the areas coverage with designated catch-stations was on the high level, i.e. 98.7% (Figure 5.4.2.1, Table 5.4.2.1; Annex ToR d). The BITS-Q1/2017 surveys were realized by Denmark, Germany, Poland, Sweden, Lithuania, and Latvia in the ICES Subdivisions 22–28. As the deficiency of the above-mentioned survey can be considered an absence of Russia (Kaliningrad) in the realization of control-hauls in a part of the ICES SD 26. In the ICES Subdivision 22, the number of hauls carried out exceeds the number of hauls planned because the extra catch-stations were added by use of the new facility provide. These hauls are selected in accordance with the random stratified strategy and can be included in the index calculations. In the ICES SD 27, the usual problem with the Swedish military, which do not permit the research vessel to carry out any fishing in certain areas, seems to be solved – at least temporarily - as all stations were approved. The coverage with control-hauls by the depth stratum is as follow (depth stratum, coverage in %): 1, 102, 2, 95.6, 3, 97, 4, 95.5, 5, 102.5, 6, and 133. The depth stratum 6 has significantly higher coverage because of incorrect depth information in the Tow-Database. This new depth information is reported in the feedback to the Tow-Database.

The number of valid hauls accomplished during the BITS-Q4/2016 and BITS-Q1/2017 was considered by WGBIFS 2017 as appropriate to tuning series and obtained the data (e.g. cpue indices) could be used for the assessment of Baltic and Kattegat cod and flatfish stocks.

Standard reports giving overviews of the BITS-Q4/2016 and BITS-Q1/2017 results from country involved in surveys realization can be found in Annexes 6, 8 and 9.

5.4.3 Update and the re-programming of BITS catch-stations allocation from the Tow-Database

Feedbacks of the recent BITS surveys realized (November 2016 – February-March 2017) by designated vessels were used to update the Tow-Database and have demonstrated that the structure of the database is suitable for the routine use (see also Annex ToR e; Chapter 5.5.2 in the WGBIFS 2016 Report). Structure of feedback of the BITS surveys was agreed in 2013. This structure should be used for reporting the information from the realized ground trawl hauls. The feedback of realized catch-stations (BITS surveys) should be submitted to Henrik Degel (Denmark) (e-mail: hd@aqua.dtu.dk), using the standard format (see Annex ToR d), not later than 20 December (BITS-Q4) and immediately after spring survey (BITS-Q1). The above-mentioned Danish delegate is responsible for planning the fish control-hauls distribution for the next BITS surveys and managing the Tow-Database. It was agreed that both e-mail and direct phone communication could be used to reach the Tow-Database administrator for requesting additional hauls during the ongoing survey.

During the WGBIFS 2017 meeting, coordinator of the Tow-Database made proposal to do this one less complicated in the assumptions, more compact and modern, what can be realized in effect of the re-programming of the random drawing procedure and allocating of control-hauls for BITS. The program is made in *R*, provides the list of hauls from the Tow-Database to be fished by each participating countries, and replaces the existing procedure consisting of a combination of various software. The program follows the same method as already agreed by the WGBIFS and used in the past, but includes an additional module, which makes it possible to request extra hauls during the ongoing survey. This leads to a minor violation of the stratified random strategy for the survey but was accepted by the group although various solutions were suggested, which would allow to seek permission in due time and avoid the need for communication with the administrator of the Tow-Database during the survey. All these solutions were turned down because they all would increase the complexity of the administration to an unacceptable degree. It was agreed to test the new facility until the next WGBIFS meeting to see if it works as intended. The program is documented in the working paper "Allocation of BITS hauls from TD" (Annexes 8 and ToR d).

5.4.3.1 Reworking of the Database of Trawl Surveys (DATRAS)

The Tow-Database and the Database of Trawl Surveys (DATRAS) are the basis with different structure for storage the BITS survey results. The ICES Data Centre manages DATRAS. During previous WGBIFS meeting it was agreed that in BITS/DATRAS only SpecCodeVal 0, 1, and 4 are accepted according to the Manual and SpecCodeVal of BITS. WGBIFS accepted the recent version of screening procedure for BITS to unify the data check. The submission of the data concerns marine litter findings during the BITS surveys into DATRAS subdatabase is in a good progress; there are many new facilities provided from DATRAS to improve and faster submission process (ToR i). However, regarding the Baltic cod stomachs data, collected during the BITS surveys by some countries, the specialized database linked with DATRAS is initiated only (ToR i). Moreover, some errors in DATRAS regarding misreporting of fish CatCatchWeight data (record type HL.CatCatchWgt) still needs verification by some submitters (see Annex 10).

5.4.4 Technical checking of the standard bottom trawl TV-3

In 2016–2017, the technical parameters of the bottom-trawls type TV-3L and TV-3S, used in BITS surveys as the standard fishing gear were measured and registered by Denmark, Sweden, Poland, and Russia. As Latvia charters the Polish vessel "Baltica" for BITS surveys, Poland checked parameters of trawls applied by both users. Protocols from the recent measurements of the TV-3 trawl are presented in the standard tables form (Tables 6.1.1–6.1.9 in Annex 6.1). The results of measured parameters did not significantly deviate from the standard values of the parameters given in the BITS Manual. The relative errors most often were at a level of a few percent. However, the Danish and Swedish specialists suggested appearance of an error in the number of meshes indicated in the section No. 1 – parts 1C1 and 1C2 of the "Check list for the trawl TV-3-930#" (the BITS Manual). Nevertheless, the results of above-mentioned technical checking of the TV-3 trawls suggest that cpue values presented in the BITS database are not influenced by observed differences between measured and standard technical parameters of the trawls.

WGBIFS recommended that all Baltic countries involved in the BITS surveys realization should check their trawls according to the parameters listed in the tables (see the BITS Manual) once a year and be presented to the next WGBIFS meeting.

5.4.5 Calibration experiments between the Danish old and new RV "Havfisken" and the German RV "Solea"

A preliminary analysis of the cpue calibration between the Danish old and new RV "Havfisken" was presented by H. Degel (DTU-AQUA, Denmark) at the WGBIFS 2016 meeting. The same author at the WGBIFS 2017 meeting presented the final working document describing outcomes from the above-mentioned experiment (for more details see Annexes 6.2, 8, 9 and 10) as well the conclusions were discussed. In the period of 13–19 March 2016, a calibration exercise was carried out in the Skagerrak and the northwestern Kattegat in order to be able to continue the BITS time-series. The set up was simple pair trawling following normal BITS haul procedure and using the small BITS standard trawl. In total, 30 successful pair of hauls were made.

The WGBIFS discussed possibly reason for having significant differences in the control-catches of the two vessels for flounder and cod however, not for plaice, and the potential problem in applying calibration factors for some species. It was argued that it was a result of variability of the data and that the possible inconsistency might be due to insufficient numbers of parallel hauls sets. It was also argued that the significant difference in cod catches (new RV "Havfisken" catch approximately two-times the catch of the old RV "Havfisken") might be a source of significant bias in the time-series if it was not considered.

The WGBIFS members decided to use the conversion factors estimated for cod and flounder within the next 4–5 years, and then reanalyse the data including the additional data obtained (see Annex 4.A).

The recent calibration exercise between the new RV "Havfisken" and the RV "Solea" (27 February – 01 March 2017) include 12 parallel hauls made with the TV-3S, no formal analysis was made, and the result is considered as not fully valid (Annex 9 - A. Velasco *et al.*, 2017). However, the initial conclusion from performed calibration experiment is as follow: "The statistical analyses showed that the hypothesis of same catchability of cod and flatfish by both involved research vessels, which use the same fishing gear, cannot be rejected".

5.5 ToR e) Plan and decide on demersal trawl surveys and experiments to be conducted in autumn 2017 and spring 2018

The most of institutes intend to participate in the BITS-Q4/2017 and BITS-Q1/2018 surveys have nearly the same plans regarding the numbers of control-hauls as in the previous seasons, but location of the catch-stations per country was substantially revised during the WGBIFS 2016 meeting. The planning of catch-stations in the ICES SDs 24, 25 and 26 in the framework of the BITS-Q4/2017 and the BITS-Q1/2018 was partly influenced by the rule introduced in February 2016 by the Polish government concerning the work of international research vessels in the Polish EEZ. The position of Denmark and Germany is still that they will not realize fishing-stations in the Polish zone during the next BITS surveys among-others due to the above-mentioned new procedures (see WGBIFS 2016 report). The total number of catch-stations committed by the countries and ICES subdivisions in the framework of the BITS-Q4/2017 and the BITS-Q1/2018 surveys is listed in Table 5.5.1 (Annex ToR e). Overall, 260 and 299 catch-stations are planned in the ICES Subdivisions 22-28 during particular surveys. Allocated ground trawl hauls by ICES subdivisions and the depth layers for autumn survey in 2017 are presented in Table 5.5.2 and the corresponding allocation for spring 2018 in Table 5.5.3 (Annex ToR e). The planned fishing-stations by country and the ICES subdivision can be considered as not ultimately fixed. It should be emphasized that, according to the recommendations of the WGBIFS 2011 meeting, all countries involved in realization of the BITS catch-stations should upload to DATRAS information related to all fished species.

5.6 ToR f) Review and update the Baltic International Trawl Survey (BITS) Manual according to SISP standards

A small group of WGBIFS members before the WGBIFS 2017 meeting once more corrected the Manual for the Baltic International Trawl Surveys (BITS) however, during the meeting some new supplementary information were inserted into the text of a manual. For example, incorrect information regarding the definition “daylight”, mentioned in the BITS Manual and on the ICES DATRAS website was discussed and for clarifying the problem was suggested that during the BITS-Q4/2017 and the BITS-Q1/2018 surveys will be performed experimental work (Annex 4.B). Practically, will be made observations in the period of sunrise and sunset, where we will try to determine if the light during those 30 minutes (15′ before sunrise/sunset and 15′ after sunrise/sunset) have any impact partly on the light-meter and on the fish aggregation pattern while looking at the echosounder. The calculations procedure of sunrise/sunset time, applied for IBTS surveys is described in Annex 9. In the recently reworked text of the BITS Manual was added information about suggested by WGBIFS the new, lower threshold of the minimum oxygen content in waters nearby a seabed, i.e. from 1.5 to 0.5 ml/l, initially to accept for performing the fish catch-stations (see Annex 4.B). WGBIFS decided that, when the oxygen content on the depth interval from 0 to 10 m over the seabed is 0.5 ml/l, fishing will be not realized. After one year of transition, the final decision about newly proposed the threshold minimum oxygen content in waters nearby a seabed will be taken. Moreover, in the BITS Manual was mentioned that all countries realized the BITS surveys should try to supply own research vessels with additional equipment (sensors) installed on the edge of the TV-3 trawl wings for routine measuring horizontal and vertical opening of the net. The above-mentioned parameters are very needed for calculation the trawl swept-area and further for estimates the Large Fish Indicator (LFI) and the Mean Maximum Length (MML) as descriptors of marine ecosystem status. It should be added that the ICES Data Centre, DATRAS experts elaborated (2014) “DATRAS Procedure Document – NS-IBTS cpue by swept-area calculation algorithms” focused on cpue by swept-area calculation algorithms used by different countries executed the IBTS surveys. The mentioned document can be adapted to the BITS cpue calculation.

5.7 ToR g) Review and update the International Baltic Acoustic Surveys (IBAS) Manual according to SISP standards

The IBAS Manual covers both, Baltic Acoustic Spring Survey (BASS) and Baltic International Acoustic Survey (BIAS) those are carried out yearly in the Baltic Sea. A small group of WGBIFS members once more corrected the IBAS Manual before the WGBIFS 2017 meeting however, during the meeting, a lacking description of fish stocks abundance and biomass calculation method (with formulas) was added.

5.8 ToR h) Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty. Review the progress of the ICES acoustic-trawl survey database design and the development of the StoX software

5.8.1 Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty

At the WGBIFS meeting in 2016, it was decided that a bootstrap method should be used to calculate the IBAS surveys sampling variance. That method was based on recalculations of the survey results by the resampling of acoustic data and trawl hauls. On the "Workshop on Sampling Design and Optimization" (WKSDO) in Lysekil, Sweden, the above-mentioned method was discussed with invited experts, i.e. J.-H. Vølstad and M. Christman and they suggested doing a bootstrap on the BIAS and BASS surveys results from the covered study area. At this year's WGBIFS meeting, two bootstrapping methods was presented by N. Larson (Lysekil, Sweden) and discussed. It was decided that WGBIFS should at first move forward and try to evaluate the BIAS and BASS results from the bootstrap method recommended at WKSDO.

5.8.2 Review the progress of the ICES acoustic-trawl survey database design and the development of the StoX software

One day of the WGBIFS 2017 meeting was devoted special deliberation, connected with exercises, which can be named "Review the progress of the ICES acoustic-trawl survey database design and the development of the StoX software to allow usage of IBAS methodology for the calculation of acoustic estimates based on the WGBIFS data". The StoX programme was elaborated under the "AtlantOS" project and currently is managed by the ICES Data Centre. The ICES acoustic data portal is accessible at *http://ices.dk/marine-data/data-portals/Pages/acoustic.aspx*. The evaluation of status of the StoX programme development, was the additional, however essential task of the WGBIFS 2017 meeting. Because of this, a small group of experts invited by WGBIFS chair and the subgroup of the WGBIFS members deliberated on this matter. O. Kaljuste (Sweden) and H. Parner (the ICES Data Centre) presented a review on the progress of the ICES acoustic-trawl survey database design and the development of the StoX software (Annex 9).

At the WGBIFS 2017 meeting was executed the comparison of fish stocks abundance at the length calculations for each ICES rectangle between the StoX software and the standard IBAS method was done using the test dataset. It resulted by 1–3% difference in fish abundance (Annex ToR h, ch. 5.8.2). The reason behind this difference is the use slightly different approach to split NASC by species. Tests showed that both methods gave the same NASC by species. However, the calculation operation from NASC to fish number by length group by species differs between those two methods.

After the WGBIFS 2017 meeting StoX developers have decided not to add this different IBAS calculation method into the software features. According to the StoX team opinion (May 2017), other acoustic surveys (outside the Baltic) have used the same method as the IBAS calculation method, and the final decision whether the original method should be used in future, as a part of the StoX, should be taken after consultancies, before the BIAS-2017 survey begins. Despite the minor difference in the final result, the StoX team recommends to use the method already implemented in the StoX as this gives users the opportunity to combine different acoustic categories and also retrieve estimated NASC by species by log-distance (nice for mapping).

It should be emphasized that, the ICES workshop WKBIFS-ACOU, held at the ICES HQ (December 2016), was one of the landmark in the process of a new designed acoustic-trawl-biotic database implementation to the IBAS surveys (Annex ToR h, ch. 5.8.2).

5.9 ToR i) Coordinate the marine litter sampling programme in the Baltic International Trawl Survey (BITS) and registering the data in the ICES database. The status of Baltic cod stomachs sampling in BITS surveys

Marine litter sampling and reporting

Submission of the marine litter (mostly anthropogenic origin) data from the current BITS surveys into DATRAS is in a good progress. All countries realized the BITS-Q4/2016 and BITS-Q1/2017 surveys submitted the data (with the exception of Russia) and registered collected materials in the format C-TS-REV of the DATRAS Litter database (Table 5.2.2.1 in the BITS Manual 2017). The status of submission of marine litter data from years 2012–2016 is accessible in Annex ToR i, the WGBIFS 2016 Report. In the above-mentioned database are many new facilities to improve and speed up the submission process (Annex ToR i).

Marine litter data submitters will transfer data using the new DATRAS Trawl litter standard format, implementing ICES vocabulary and classification coding (Tables 5.2.2.2 and 5.2.2.3 in the BITS Manual 2017), described in the suitable manual, or via the Litter Reporting Format (ERF3.2; *vide* Annex 12), downloadable here: http://www.ices.dk/marine-data/data-portals/Pages/DATRAS-Docs.aspx.

Collected and registered information about the marine litter occasionally appeared in the ground trawl fish catches (app. 300 hauls per BITS survey) are additional source of data on present ecological status of marine seabed in investigated areas of the Baltic and this task will be continued by WGBIFS.

Baltic cod stomachs sampling

Baltic cod stomachs collected during the bottom-trawl surveys (BITS) improve the basic knowledge concerning the species interactions in relation to the multispecies approach. Baltic cod stomachs sampling was implemented as the routine procedure by all countries during BITS surveys, starting from autumn 2015, however in some national laboratories this type of sampling was initiated earlier. The above-mentioned additional task of BITS surveys was suggested by WGSAM. Therefore, the WGBIFS prepared a manual on cod stomachs sampling during BITS surveys, in a line with accomplished the MARE project. The WGBIFS has not received any formal request to coordinate programme devoted Baltic cod stomachs sampling and analysing and continue the sampling as well as has not obtained any plan for how future stomach samples should be worked up or intend to be used. Therefore, the WGBIFS members at the meeting in 2016 agreed to stop further international coordination of Baltic cod stomach sampling due to very limited number of Baltic cod feeding experts, relatively high costs of stomachs sampling and analysing, lack of interest from WGSAM and not fully developed ICES database for such issue. The particular national laboratories can continue the Baltic cod stomachs sampling and analysing, based on their experiences, staff, and financial possibilities.

In November 2016 and February-March 2017 totally, 1859 and 1678 Baltic cod stomachs, respectively were sampled by Sweden, Denmark, Poland, Latvia, and Russia. During the same surveys, Sweden collected adequately, 357 and 417 flounder stomachs (Annex ToR i).

5.10 Tor j) Discuss the possibilities to make further standardizations of IBAS. An attempt to standardize the pelagic fishing gear used in the BIAS and BASS surveys

The goals of the proposal to further standardization (see also Annex ToR j) of the pelagic fishing gear used in the BIAS and BASS surveys were:

a) to minimize the differences in efficiency and species composition in pelagic monitoring trips between different vessels by eliminating diversity in the pelagic gear construction and its elements used during production;

b) to make research catches more comparable, e.g. as was made in the case of TV-3 demersal trawl (achieved after standardization process), applied from 2000 in the BITS surveys.

During the WGBIFS 2015 meeting was welcomed an initiative made by K. Stanuch (chair invited expert from Poland) to present an overview of the existing constructions of both commercial and research pelagic trawls used in the Baltic Sea and with expected steps for the standardization (Annex 10 of the WGBIFS 2015 report). At the WGBIFS 2016 meeting, the technical-schemes of national pelagic trawls used in the BIAS and BASS surveys were presented by Poland, Germany, Russia, and Finland and the same expert made a comparison of some gears-detail. No fishing gear experts from other countries were present at the meetings and therefore a constructive and critical discussion on this topic was not possible however, the WGBIFS support the need of standardization of various pelagic trawls for acoustic surveys. The group also admitted that with this initiative only the first step has been done and the practical ways of should be further discussed.

Based on the ICES EG Recommendations 2016 – ID 51 the WGBIFS was expected that the ICES – FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) undertake until/during the WGBIFS 2017 meeting an initiative to advice the specification of the new standard pelagic trawl suitable to the Baltic Sea conditions however, WGFTFB has not replied to WGBIFS request.

The chair of WGBIFS tried inviting a fishing gear expert from Sweden to the meeting in 2017, but requested (December 2016) the ICES Secretariat was not able to cover the travel costs of that expert. As there was no any new information about the standardization of the IBAS trawl gear available during the WGBIFS 2017 meeting, the group was not able to make any progress in this ToR. The group intend prolonging realization of this ToR.

6 Cooperation

Cooperation with other WGs

- Baltic Fisheries Assessment Working Group (WGBFAS) – direct cooperation,
- Working Group on Fisheries Acoustics Science and Technology (WGFAST) – indirect cooperation,
- Atlantic International Bottom Trawl Survey Working Group (IBTSWG) – indirect cooperation,

Cooperation with Advisory structures

- SCICOM Steering Group on Integrated Ecosystem Observation and Monitoring – direct cooperation,
- ICES Data-Centre – direct cooperation,
- PGDATA – indirect cooperation,
- WGCHAIRS – indirect cooperation.

Cooperation with other IGOs

- HELCOM – indirect cooperation.

7 Summary of Working Group self-evaluation and conclusions

The ICES Working Group on Baltic International Fish Survey (WGBIFS), according to the ICES ASC 2014 recommendation No. 2014/MA2/SSGIEOM:02, met at successive three meetings:

- 23–27 March 2015 in Öregrund (SLU), Sweden;
- 30 March – 3 April 2016 in Rostock (TI-OF), Germany;
- 27–31 March 2017 in Riga (BIOR), Latvia;

Overall, 25 experts (including chair invited experts) from research institutes located on the Baltic Sea coasts and from the ICES Data Centre, took part in the WGBIFS annual meetings to works on almost constant ToRs and deliverables. Włodzimierz Grygiel, Poland chaired the group for three years. The text of basic report and the set of annexes were prepared from each WGBIFS annual meeting, accordingly to the format proposed by the ICES Secretariat. Any significant changes in the final version of ToRs dedicated to WGBIFS 2015–2017 meetings have not been done.

During the WGBIFS meetings were successfully realized following main ToRs, i.e.:

- combine and analyse acoustic-trawl-biotic results obtained during the fishery-independent, fish stocks assessment relevant surveys, type BIAS, BASS and BITS, accomplished from May 2014 until March 2017; updated the acoustic-hauls-biotic data (sprat, herring, cod, flatfish) from 2014 - 2016 surveys, were systematically uploaded according to the BASS_DB.mdb and BIAS_DB.mdb Access-database, as well the DATRAS and Tow-Database; the acoustic-trawl data from the BIAS and BASS surveys in 2015 - 2016 are also stored in format of the StoX programme (WGBIFS 2017),
- coordinate the time-schedule of the a.-m. surveys, planning of research vessel/country effort and principal assignments per area and survey, in the period from May 2015 to March 2018, however regarding the next BITS surveys, the re-programming of catch-stations allocation from the Tow-Database was initially implemented (WGBIFS 2017), without violate of the structure of this database,
- finalize the text for IBAS and BITS Manuals, accordingly to the SISP standards and suggestions elaborated by reviewers.

Analyse the status of marine litter sampling during the BITS surveys and reporting to the ICES DATRAS subdatabase as well as Baltic cod stomachs sampling can be treated than the second order of the WGBIFS ToRs. Cod stomachs sampling and analysing, among-other due to lack of response (interest) from the ICES Working Group on Multispecies Assessment Methods (WGSAM), very limited number of Baltic cod feeding experts, relatively high costs of sampling and not fully developed ICES database for such issue will be continued at local level (depend on possibilities), but not coordinated by WGBIFS. To the same group of ToRs importance more two considered tasks can be added, i.e.: "Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty. Evaluation of status of the StoX programme" and "The evaluation of possibilities to calculate the Large Fish Indicator (LFI) and Mean Maximum Length (MML) descriptors, based on the BITS surveys results". The above-mentioned two tasks were only partly realized because it was decided that the WGBIFS should at first move forward and try to evaluate the BIAS and BASS surveys results from the bootstrap method recommended at WKSDO for calculation the surveys sampling variance. Moreover, the limited time of meeting not allowed on the broad exercises with the acoustic-hauls-biotic data (from BIAS and BASS surveys) under the StoX programme, initially implemented into operation for data storage and fish stocks size assessment in the Baltic. Based on the Estonian's data from the BIAS 2015 survey common procedures used in the StoX programme were deeply considered.

Furthermore, a few additional tasks (see examples below), requested mostly by the Baltic Fisheries Assessment Working Group (WGBFAS), were also accomplished during the running WGBIFS meetings (2015-2017):

- elaboration the set of maps showing geographical distribution (cpue in numbers/h obtained from control-catches with the TV-3 trawl) of cod, flounder, plaice, turbot, dab, and brill during the BITS-Q1 and BITS-Q4 surveys in 2015 and 2016,
- actualization of the table reflecting the status of standard research surveys tuning indices (per species, age groups, areas, surveys) ready to use in the Baltic fish stocks assessment process moreover, the overview of various research surveys scope of works, realized by the countries surrounding the Baltic, but currently not used for fish stocks assessment,
- answers on the inquires – "How to explain discrepancy between herring ICES SD 30 and Central Baltic Herring stocks size", and "Comparison of methods applied in different institutes for the Baltic fish age reading",
- German opinions (2016) regarding "Fish stock indices based on acoustic surveys in the Baltic Sea. Alternative application of results of fishing stations" and "Mixing of the Western Baltic Spring-spawning Herring (WBSSH) and CBH – applicability of the separation function",
- Presentation the first results from fish catches calibration experiments between the Danish old and new RV "Havfisken" and the German RV "Solea".

In 2015–2017 were also prepared the recommendations to ICES expert groups and the action list addressed mostly to the WGBIFS and in some extent to the ICES Secretariat, and the list of ToRs for the WGBIFS next meetings.

As the deficiencies of the WGBIFS meetings can be mentioned – a lack of any information expected from the ICES/FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) about the standardization of the IBAS pelagic trawl (ToR j), and shortage of some input data from the BITS surveys, needed for calculation the LFI and MML ecosystem indicators. The WGBIFS intends prolonging realization of the both above tasks based on the new information as well as the coordination of marine litter sampling and reporting within the framework of BITS surveys.

The main outcomes and achievements of the WGBIFS meetings are listed in:

- the chapter 4 - Summary of achievements of the WG during 3-year term (2015–2017),
- the chapter 3 - Summary of the Work plan for year 3 (2017),
- the Executive summary (2017).

The materials obtained from routine research surveys (BIAS, BASS, BITS-Q4, BITS-Q1) are the input data independent from commercial fishery preferences and can be used for tuning in the main Baltic fish stocks size assessment, realized annually by the WGBFAS. Fish stocks abundance indices reflect possible precision of the current main fish stocks size and distribution in the Baltic Sea. The evaluation of a bulk of data from recently realized the surveys showed that sampling plans and their accomplishment are nearly similar. However, the BASS-dataset can be used in the assessment of sprat stock in the Baltic Sea with restriction that the year 2016 (when the survey coverage was very poor) is excluded from the dataset.

The WGBIFS have not directly contributed to the ICES "Advisory needs" however, the group is responsible for systematic realization of the seasonal Baltic research surveys, focused on the monitoring on main species spatial distribution and changes of their abundance, including the YOY. In every year, the WGBIFS prepared the set of input data needed for the Baltic fish stocks size final assessment, made by the WGBFAS.

It is proposed to have the same set of ToRs, as above-mentioned, for 2018–2020 WGBIFS meetings with some modifications, i.e.:

- the intensive review and update of the BITS and IBAS Manuals (ToRs f and g) is not needed however, some current response on the proposed actions (see Annex 4.B) are valuable for further improvement of the a.-m. manuals,
- the present ToR h) should be divided on two separate parts, i.e. "Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty in the BIAS and BASS surveys" and "Review the progress of the ICES acoustic-trawl surveys database design implemented under the StoX programme",
- as separate ToRs should be also considered:
    - "An attempt to make standardization of the pelagic fishing gear used in BIAS and BASS surveys" – close cooperation with the WGFTFB is urgently needed,
    - "Coordinate the marine litter-sampling programme within the BITS surveys and registering the data in the ICES database" – close cooperation with existing (?) or specialized, newly-created the ICES working group is very needed,
    - "Define methods for the appropriate processing of the survey data and output products from the BITS survey to fee the Baltic LFI and MML indicators" – close cooperation with specialized the ICES or HELCOM expert group is very needed,
    - "Compilation of meta-data concerns the Baltic cod stomach sampling during the BITS surveys" – close cooperation with the WGSAM is very needed.

8 Next meeting and proposition of a new WGBIFS chair

There was confirmed proposal for the venue of the next WGBIFS meeting, i.e. the Danish DTU-AQUA in Copenhagen-Lyngby. The WGBIFS members in the re-voting supported the idea to organize the next meeting at the above-mentioned scientific institution, in the period of 24–28 March 2018.

In the result of secret voting (for report see below) with the part of 19 delegates on the new Chair of the WGBIFS in years 2018–2020 it was proposed Olavi Kaljuste (Sweden), only one candidate for this position.

Riga, 31.03.2017 – voting results of a new WGBIFS chair

Candidate on the WGBIFS chairperson	Accepted by Nos. of the WGBIFS members	Against (Nos.) of proposed candidate	Refrained (Nos.) from voting
Olavi Kaljuste	18	0	1

Signature of the *ad hoc* commission members (from WGBIFS):

1. Szymon Smoliński
2. Niklas Larsson

Annex 1: List of participants of the WGBIFS 2017 Meeting

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Annex 2: Terms of references of the WGBIFS 2017 meeting

2014/MA2/SSGIEOM:02 The Baltic International Fish Survey Working Group (WGBIFS), chaired by Włodzimierz Grygiel, Poland, met in Riga, Latvia on 27 – 31 March 2017, to work on ToRs and generate deliverables as listed in the table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2015	23–27 March 2015	Öregrund, Sweden	Interim report by 15 May 2015 to SSGIEOM, SCICOM and ACOM	
Year 2016	30 March – 3 April 2016	Rostock, Germany	Interim report by 16 May 2016 to SSGIEOM, SCICOM and ACOM	
Year 2017	27–31 March	Riga, Latvia	Final report by 15 May 2017 to SSGIEOM, SCICOM and ACOM	

ToR descriptors

ToR	Description	Background	Science plan topics addressed	Duration	Expected deliverables
a	Combine and analyse the results of spring and autumn acoustic surveys and experiments	Acoustic surveys (BASS, BIAS) provide important fishery-independent stock estimates for Baltic herring and sprat stocks and are additional source of information about cod distribution in the pelagic waters zone of the Baltic. Moreover, a.m. surveys are a good source for collecting and developing the knowledge about acoustic parameters and the ichthyofauna biodiversity in midwaters of the Baltic.		Year 1, 2 and 3	Updated acoustic tuning index for WGBFAS
b	Update the BIAS and BASS hydroacoustic databases	The aim of BIAS and BASS databases is to store the aggregated data from acoustic surveys. The newly implemented acoustic-trawl database, developed under AtlantOS project can be a source of a modern, international base of the primary/raw data from acoustic surveys.		Year 1, 2 and 3	Updated databases with both disaggregated and aggregated acoustic data for WGBIFS

TOR	Description	Background	Science plan topics addressed	Duration	Expected deliverables
c	Plan and decide on acoustic surveys and experiments to be conducted	Acoustic surveys (BIAS, BASS) provide important fishery-independent stock estimates for Baltic herring and sprat stocks and are additional source of information about cod distribution in the pelagic waters zone of the Baltic. Moreover, a.m. surveys are a good source for collecting and developing the knowledge about acoustic parameters and the ichthyofauna biodiversity in the Baltic pelagic waters zone.		Year 1, 2 and 3	Finalized planning for the surveys for WGBIFS
d	Discuss the results BITS surveys and evaluate the characteristics of TVL and TVS standard gears used in BITS	Demersal trawl research surveys provide important fishery-independent stock estimates for Baltic cod and flatfish stocks. Moreover, a.m. surveys are a good source for collecting data concerns the ichthyofauna biodiversity in the Baltic bottom waters zone.		Year 1, 2 and 3	Updated BITS data in DATRAS database for ICES Data Centre and WGBFAS
e	Plan and decide on demersal trawl surveys and experiments to be conducted, and update and correct the Tow Database	Demersal trawl research surveys provide important fishery-independent stock estimates for Baltic cod and flatfish stocks		Year 1, 2 and 3	Finalized planning for the surveys for WGBIFS
f	Review and update the Baltic International Trawl Survey (BITS) manual according to SISP standards	Demersal trawl research surveys provide important fishery-independent stock estimates for Baltic cod and flatfish stocks, and should be organized and accomplished based on the common agreed standards.		Year 3	Final updated BITS manual for WGBIFS
g	Review and update the International Baltic Acoustic Surveys (IBAS) manual according to SISP standards	Acoustic research surveys provide important fishery-independent stock estimates for Baltic herring and sprat stocks and are additional source of information about cod distribution in the pelagic waters zone of the Baltic. The BIAS and BASS surveys should be organized and accomplished based on the common agreed standards.		Year 3	Final updated IBAS manual for WGBIFS

TOR	Description	Background	Science plan topics addressed	Duration	Expected deliverables
h	Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty	Acoustic surveys provide important fishery-independent stock estimates for Baltic herring and sprat stocks. Evaluation of status of the StoX programme.		Year 3	Improved quality of acoustic indices with estimates of the uncertainty for WGBFAS
i	Coordinate the marine litter sampling programme in the Baltic International Trawl Survey (BITS) and registering the data in the ICES database. The status of Baltic cod stomachs sampling in BITS surveys.	Collected and registered information about the marine litter (mostly anthropogenic origin), occasionally appeared in the ground trawl fish catches, are additional source of data on present ecological status of marine seabed in investigated areas of the Baltic. Baltic cod stomachs collected during the demersal trawl surveys improve the basic knowledge concerning the species interactions in relation to the multispecies approach.		Year 1, 2 and 3	Coordinated the marine litter sampling programme in the Baltic International Trawl Survey (BITS). The status of Baltic cod stomachs sampling.
j	Discuss the possibilities to make further standardizations of IBAS. An attempt to standardize the pelagic fishing gear used in BIAS and BASS surveys.	Acoustic surveys provide important fishery-independent stock estimates for Baltic herring and sprat stocks and are additional source of information about cod distribution in the pelagic waters zone of the Baltic.		Year 3	Agreements for further standardizations of IBAS for WGBIFS and through the improved data quality for WGBFAS. The 2nd approach to designing the standard pelagic fishing gear used in BIAS and BASS surveys, including an update of the IBAS manual to ensure consistent use.

Summary of the Work Plan

Year 1	Compilation the survey results from 2014 and first half of 2015 and reporting to WGBFAS. Coordination and planning the schedule for surveys in the second half of 2015 and the first half of 2016. Coordinate cod stomachs sampling programme in the Baltic International Trawl Survey. The 1st approach to designing the standard pelagic fishing gear used in BIAS and BASS surveys.
Year 2	Compilation the survey results from 2015 and first half of 2016 and reporting to WGBFAS. Coordination and planning the schedule for surveys in second half of 2016 and first half of 2017. Coordinate cod stomachs and marine litter sampling programmes in the Baltic International Trawl Survey. An attempt to construct the standard pelagic fishing gear, which will be applied to BIAS and BASS surveys.
Year 3	Compilation the survey results from 2016 and first half of 2017 and reporting to WGBFAS. Coordination and planning the schedule for surveys in second half of 2017 and first half of 2018. Coordinate the marine litter sampling programme in the Baltic International Trawl Surveys. Final reviewing and updating the common surveys manuals (IBAS, BITS) according to SISP standards. Proposals for improvement of quality of acoustic indices and for further standardization of Baltic International Acoustic Surveys. An attempt to implement the standard pelagic fishing gear to control-catches in BIAS and BASS surveys.

Supporting information

Priority	The scientific surveys coordinated by this Group provide major fishery-independent tuning information for the assessment of several fish stocks in the Baltic Sea. Consequently, these activities are considered to have a very high priority.
Resource requirements	The research programmes, which provide the main input to this group, are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 20-25 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	The survey data are prime inputs to the assessments of Baltic herring, sprat, cod and flatfish stocks carried out by WGBFAS. Linked to ACOM through the quality of stock assessments and management advice.
Linkages to other committees or groups	There is a very close working relationship with WGBFAS. It is also relevant to the SSGIEOM and WGFAST.
Linkages to other organizations	No direct linkage to other organizations.

Annex 3: Agenda of the WGBIFS 2017 Meeting

Date	Venue	Chair	Local representative of the organizer – host of the meeting
27 – 31 March 2017; working time: 09:00(10:00) – 17:00(17:30) coffee breaks: 10:30–10:50; 15:00–15:20, lunch break: 12:30–13:30.	The BIOR Institute/Fish Resources Research Department. Address: Riga (Latvia), Daugavgrivas Street 8, the conference room No. 24.	Włodzimierz Grygiel, National Marine Fisheries Research Institute, Gdynia (Poland)	Guntars Strods, BIOR/ Fish Resources Research Department. (e-mail: guntars.strods@bior.gov.lv)

ICES ASC 2014 Resolution No. 2014/MA2/SSGIEOM:02, and the WGBIFS Multiannual ToRs 2015-2017.

27.03.2017; 10:00–17:30

10:00 – 10:30; Salutation of the WGBIFS members. Opening of the meeting.

Introduction. Adoption of the agenda and allocation of the WGBIFS/2017 tasks.

- Introducing oneself by participants of the WGBIFS/2017 meeting.
- Info about logistic aspects of the WGBIFS/2017 meeting, a few facts from the history of Riga city (the presentation will be made by chair).
- Household remarks (info from the local organizer and host of the meeting).
- Implementation of proposed agenda and a time schedule of WGBIFS/2017 meeting (the presentation will be made by chair).
- Allocation of the WGBIFS/2017 tasks between participants.

10:30 – 10:50; Coffee break

10:50 – 12:30; Continuation of works

- “What was done between consecutive WGBIFS meetings? The main tasks assigned on the WGBIFS meeting in Riga” - the presentation will be made by chair.
- The BITS-4q/2016, BITS-1q/2017, BASS and BIAS – 2016 surveys status of realization in the Baltic and obtained the main results – one by one the oral presentations will be made by delegates from the national research institutes (max. 10 minutes of single speech). The presentation should include also information about planned the next routine research surveys, as well as information about the status of curried out obligatory measurements of technical parameters of the bottom trawls type TV-3L and TV-3S.

12:30 – 13:30; Lunch break

13:30 – 15:00; Continuation of works

- The BITS-4q/2016, BITS-1q/2017, BASS and BIAS – 2016 surveys status of realization in the Baltic and obtained the main results – cont. of the oral presentations made by delegates from the national research institutes.

15:00 – 15:20; Coffee break and an additional presentation "Vecrīga" will be made by chair

15:20 – 17:15; Continuation of works

Acoustic surveys data compilation and calculations; the sub-group leader - Olavi Kaljuste will coordinate works, during a part of the day, particularly with following ToRs:

- Discuss the quantity and quality of data obtained during spring and autumn 2016 acoustic-trawl surveys and experiments and report to WGBFAS. Combine and analyse the results from routine acoustic-trawl surveys. Updated the acoustic tuning index for clupeids stocks (recommended by WGBFAS; ToR a).
- Status of reports from the BIAS and BASS (2016) surveys.
- Update the BIAS and BASS acoustic databases (ToR b) – the initial works.
- Plan and decide on acoustic surveys and experiments to be conducted in spring and autumn 2017- 2018 (ToR c) – the initial works.

Bottom trawl standard surveys data compilation and evaluation; the sub-group leader - Henrik Degel will coordinate works, during a part of the day, particularly with following ToRs:

- Discuss the quantity and quality of data obtained during BITS surveys performed in autumn 2016 and winter/spring 2017 and evaluate the characteristics of TV-3L and TV-3S standard gears used in BITS (ToR d). Realization of a task is supported by the WGBFAS.
- Status of BITS surveys standard- and extended reports – the initial works.
- Status of WGBIFS standard protocols from measurements of technical parameters of the bottom trawls type TV-3L and TV-3S – the initial works.
- Status of the recent BITS surveys basic data in the DATRAS database.
- An evaluation of progress in the submission of the marine litter data collected by particular institutes during the BITS surveys (works supported by HELCOM and ICES).
- Status of completions and amendments the Tow-Database (part of ToR e) – the initial works.

17:15 – 17:30; a plenary session and summing up of daily works realised by two subgroups

28.03.2017; 09:00 – 17:00 (breaks in work are the same time like planned on 27.03.2017)

9:00; Good morning and continuation of the plenary session, incl.:

Others presentations and discussion:

- "Analysis related to the improvement of quality of acoustic indices and estimation of the uncertainty". Presentation the status of additional study on acoustic data from BIAS surveys - Niklas Larson.
- The results of intercalibration between the research vessels "New Havfisken" and "Old Havfisken" as well as between "Solea" and "New Havfisken" – presentations will be made by Henrik Degel and Andrés Velasco.
- Results of calculation of a survey index (conversion factor), back in time from 2016-Q1, for all relevant species with preferences to cod, for research surveys made by the Danish old and a new RV "Havfisken" in the 1st and the 4th quarters. Presentation and comments – Henrik Degel.
- Other *ad hoc* presentations.

10:00 – 17:00; continuation of works in the sub-groups during the main part of the day, which should be focus on the standard ToRs and additional recommendations from the WGBFAS and others. Moreover:

- Systematically preparation of the text, tables and graphs linked with the WGBIFS final report.
- Update the International Baltic Acoustic Surveys (IBAS) Manual, according to the Series of ICES Survey Protocols (SISP) standards.
- Update the BITS Manual according to the SISP standards. Additional discussion concerns some discrepancies between the BITS surveys manual and mentioned at the ICES DATRAS Website.
- Requests from WGBFAS (2015 & 2016) addressed to WGBIFS: "To produce maps showing the distribution of Baltic cod, flounder, plaice, turbot, dab and brill stocks abundance (all size groups) in the previous two seasons (BITS surveys data)".

16:45 – 17:00; a plenary session and summing up of daily works realised by two sub-groups

29.03.2017; 09:00 – 17:00 (breaks in work are the same time like planned on 27.03.2017)

9:00 – 17:00; Good morning and continuation of works in the sub-groups during the main part of the day, which should be focus on the standard ToRs and additional recommendations from the WGBFAS and others. Moreover:

- Systematically preparation the text of the WGBIFS final report.
- Update the International Baltic Acoustic Surveys (IBAS) Manual, according to the Series of ICES Survey Protocols (SISP) standards.
- Update the BITS Manual according to SISP standards.
- Initial report from the sub-groups works.

16:45 – 17:00; a plenary session and summing up of daily works realised by two sub-groups

30.03.2017; 09:00 – 17:00 (breaks in work are the same time like planned on 27.03.2017)

9:00 – 10:00; Welcome of the WGBIFS 2017 meeting new participants and continuation of the plenary session, incl. others presentations and discussion:

- Review the progress of the ICES acoustic-trawl survey database design elaborated under the AtlantOS project (Optimizing and Enhancing the Integrated Atlantic Ocean Observing System) - the development and widely implementation of the acoustic database, based on the StoX programme. How to facilitate converting the WGBIFS data into the StoX format in order for the WGBIFS to test out using StoX (software) for fish stocks size assessment? Olavi Kaljuste, based on the summary from ICES WKBIFS-ACOU (Dec. 2016), will make presentation.
- "Define methods for the appropriate processing of the survey data and output products from the BITS survey to fee the Baltic LFI (proportion of large fish) and MML (mean maximum length of fishes) indicators" – an attempt of calculation of the a.-m. indicators. A small *ad hoc* sub-group (Scott Large, Szymon Smoliński & Vaishav Soni) was created for initial works and comments concern a topic, which was again suggested by ICES – SSGIEOM, ACOM, the

ICES Data Centre and originally by HELCOM. The revision of the text dedicated to ToR l) in the WGBIFS/2016 Report is needed too.
- An other *ad hoc* sub-group composed from StoX programme and ICES Data Centre experts and a part of WGBIFS members will working during a part of the meeting time on the implementation of the IBAS abundance estimation procedure using StoX programme; this task is indicated in the ICES recommendation ID 250, prepared by the WKBIFS-ACOU/2016, and call "Create a task group to follow implementation of the IBAS abundance estimation procedure using StoX".
- How to improve some incorrect data (CatCatchWgt in HL records from BITS surveys), uploaded to the DATRAS database, and proposals concern logistic aspects of transfer Baltic cod stomachs and marine litter data to ICES Data Centre. Vaishav Soni will make presentation and comments concern the present status of works made by the ICES Data Centre.
- Some uncorrected information regarding the definition "daylight", mentioned in the BITS Manual and on the ICES DATRAS Website.
- The possibilities to make further standardization of the pelagic fishing gear used in BIAS and BASS surveys. Presentation and comments are expected from a co-chairman of the ICES – FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB).

10:00 – 17:00; continuation of works in the sub-groups during the main part of the day, which should be focus on the standard ToRs and additional recommendations from the WGBFAS and others, including:

- Systematically preparation the text of the WGBIFS final report.
- Preparation a draft of the "WGBIFS actions list".
- Preparation a draft of "Recommendations" elaborated under the WGBIFS 2017 meeting.
- The final plans of the BITS, BASS and BIAS research surveys in the Baltic, in May-June 2017, the 4th quarter of 2017 and in the 1st quarter of 2018.

16:45 – 17:00; a plenary session and summing up of daily works realised by two subgroups

31.03.2017; 09:00 – 14:00

9:00 – 10:30; Good morning and continuation of the plenary session, incl. discussion on:

- Inquires from the others ICES Working Groups, e.g. "Revision and update the text-template submitted (Feb. 2017) by the WGBFAS, which is focused on the status of fish research surveys data, collected by WGBIFS for the basic fish stocks size assessment. Comments made by Henrik Degel and Olavi Kaljuste and invited the ICES experts.
- Agreeing on preliminary ToRs for three next years WGBIFS meetings.
- Election of a new chair of the WGBIFS for 2018-2020.
- Selection of the venue and period for the next WGBIFS meeting.
- Preparation of the final "Action list" and "Recommendations", taking into account also a fact that, the IBAS and BITS manuals are already announced by chair to the ICES Secretariat as the category 1 for publication in the ICES Cooperative Research Report series – 2017.

- cont. "Define methods for the appropriate processing of the survey data and output products from the BITS survey to fee the Baltic LFI and MML indicators" – an attempt of calculations of the a.-m. indicators.

10:30 – 10:50; Coffee break

- "It was it passed but …" – presentation and comments will be made by chair.
- Systematically works and finalize the WGBIFS obligatory tasks and verification of parts of the draft text of report from 2017 meeting.
- Other business. The ICES data policy at: http://ices.dk/marine-data/guidelines-and-policy/Pages/ICES-data-policy.aspx.
- Final discussion and closing of the meeting (app. at 13:30-14:00).

Annex 4.A: Recommendations

Recommendations concern the BITS and IBAS surveys	**Responsible**	**Deadline**	**Recipients**	**Section from report this relates to**
WGBIFS regard the spatial coverage of both the 4th quarter 2016 and the 1st quarter 2017 BITS surveys with valid control-catches as to be of sufficiently quality and recommend that the data be used for calculating of the CPUE indices without restrictions. Obtained results (stored in the DATRAS) can be considered as sufficient for tuning series, and are recommended for the assessment of Baltic and Kattegat cod and flatfish stocks.	ICES Data Centre	In due time, principally at WGBFAS 2017 meeting.	WGBFAS	Input data to the Baltic demersal/benthic fish stocks assessment.
WGBIFS recommends that, the BIAS-dataset, including the valid data from 2016 can be used in the assessment of the CBH (herring) and sprat stocks in the Baltic Sea with the restriction that the years 1993, 1995 and 1997 (when the monitored area coverage was poor) are excluded from the index series.	WGBIFS	Before WGBFAS 2017 meeting.	WGBFAS	Input data to the Baltic clupeids stocks assessment.
WGBIFS recommends that, the current BIAS index series can be used in assessment of the Gulf of Bothnia herring stock size with the restriction that the year 1999 is excluded from the dataset. The abundance indices for age groups 0 and 1 should be handled with caution.	WGBIFS	Before WGBFAS 2017 meeting.	WGBFAS	Input data to the Bothnian Sea herring stock assessment.
WGBIFS recommends that, the BASS-dataset can be used in the assessment of sprat stock in the Baltic Sea with restriction that the year 2016 (when the survey coverage was very poor) is excluded from the dataset.	WGBIFS	Before WGBFAS 2017 meeting.	WGBFAS	Input data to the Baltic sprat stock assessment.
Other recommendations	Responsible	Deadline	Recipients	Section from report this relates to
Because WGBIFS has not enough competence for proposing particular type of pelagic trawl, like to ask the ICES - FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) for advice, which type of pelagic trawl, incl. fully rigging, would be the best for BIAS and BASS surveys in the Baltic Sea conditions.	WGFTFB	Before WGBIFS 2020 meeting	WGBIFS	Standardization of pelagic fishing gear in the IBAS surveys.

WGBIFS recommends the research materials originated from the long-term realised national and local fish research surveys (accomplished only by some countries) as potential supplementary sources of the input index for fish stocks size assessment, taking into consideration also others less-abundant species however, important for the complex study of the Baltic ecosystem.	WGBIFS as coordinator and national laboratories after agreements	Before WGBIFS 2020 meeting	WGBFAS and others WGs co-operated with ACOM and SCICOM	Other issues addresses to WGBIFS 2017 meeting by WGBFAS.
The WGBIFS recommends that whenever the BITS surveys data from the Danish research vessel 26 Havfisken is used for CPUE calculations (e.g. in DATRAS) then the catch results for cod and flounder are adjusted with the length and species specific calibration factors given in the 2017 WGBIFS working document: "Results of calibration between the Danish old R/S Havfisken and the new R/S Havfisken II".	WGBIFS in close cooperation with the Danish DTU-AQUA specialists	No limited time	WGBFAS, DATRAS users	WGBIFS 2017 Report, ToR d), Ch. 5.4.5. "Calibration experiments …", Annexes 6.2. and 8.

Annex 4.B: Actions list

1) The feedback of the recent catch-stations realized in the framework of BITS surveys should be submitted to Henrik Degel (Denmark; e-mail: hd@aqua.dtu.dk), using the proposed standard format (Annex ToR e, Ch. 5.5.2.2; WGBIFS 2016 Report) not later than 20 December (autumn survey) and immediately after winter-spring survey. The above-mentioned Danish delegate is a coordinator of the reprogrammed Tow-Database, responsible for storage old control-hauls location with remarks concern realization - and for planning new catch-stations distribution for the next BITS surveys. All problems with realization of designated single control-hauls or part (whole) of survey should be promptly transferred (by e-mail or mobile phone) to H. Degel with c/c to the WGBIFS chair. The version of TD_2017V1.XLS will be made available after submission the full set of data from the current BITS surveys by all countries.

2) Olavi Kaljuste (Sweden) and Juha Lilja (Finland) were assigned acoustic-trawl (IBAS) surveys coordinators, responsible among-others for controlling that the acoustic surveys results are uploaded in the right format (accordingly to the StoX programme). Grzegorz Kruk (Poland; e-mail: gkruk@mir.gdynia.pl) was assigned coordinator of BIAS and BASS national databases aggregated data uploading and compilation to international level, moreover he is responsible also for all kind of input data preparation, before and during the ongoing WGBIFS meeting. The recently collected aggregated acoustic-trawl surveys (BASS, BIAS) data (in already agreed Excel format) should be submitted to G. Kruk at least one month before beginning of the annual WGBIFS meeting. At the same time, the latest disaggregated acoustic and biotic data from national BASS and BIAS surveys should also be uploaded to the new database for acoustic trawl surveys at the ICES Data Centre (http://ices.dk/marine-data/data-portals/Pages/acoustic.aspx), using the ICES acoustic data format.

The WGBIFS members mentioned in this paragraph are responsible also for (June 2017) the final calculation the BIAS survey abundance index for herring inspected in the ICES Subdivision 32, as a part of the CBH stock assessment. M. Bergenius (Sweden, the WGBFAS member and the Central Baltic Herring stock assessor) needs this data for the CBH stock assessment process during the benchmark meeting in December 2017.

3) Directly, after each BITS survey finalization, national submitters of data linked with monitoring of the marine litter appearance at seabed should transfer such data to especially section in the DATRAS database (the ICES Data Centre). Information about proposed format of data submission is described in the suitable manual accessible at the ICES webpage: http://www.ices.dk/marine-data/data-portals/Pages/DATRAS-Docs.aspx.

4) Baltic cod stomachs sampling and analysing the food components will be no longer internationally coordinated by WGBIFS however, the national laboratories can systematically realise the Baltic cod stomachs sampling and analysing, based on their experiences, personal and financial possibilities.

5) The ICES Data Centre coordinated the process of revision for incorrect CatCatchWeights (the mean weight of fish) data in the DATRAS. This work was not finalized, and some national submitters of the BITS surveys results are requested for possibly soon revision of incorrectness in the own historical dataset. The message confirmed finalization of such needs should be send to the ICES Secretariat Data Centre (V. Soni).

6) WGBIFS suggested performing in every year, as obligatory - the technical checking of standard parameters, i.e. measurements of the TV-3 ground trawl elements. The

measurements results should be reported to ongoing WGBIFS meeting, using the agreed format of protocols.

7) The Danish specialists from the DTU-AQUA requested a revision of fish catch-station distribution in the so called ″gray″ zone of the Bornholm (ICES SD 25) during the BITS surveys. The problem was already solved and the Danish vessel RV "Dana" will be operating among-others in that zone and the Polish RV "Baltica" will inspect only the Polish part of the ICES SD 25.

8) The Workshop on the Review of the ICES Acoustic-Trawl Survey Database Design (WKIACTDB) and the ICES Data Centre asked (16.08.2016 and 20.02.2017, respectively) WGBIFS for a description of the surveyed area in the routine acoustic-trawl surveys for the ICES geoportal. The requested information was submitted before the WGBIFS 2017 meeting.

9) The ICES Data Centre mobilised by the ACOM/SCICOM and HELCOM, requested again (27.01.2017) WGBIFS to deliberate the issue – how to calculate the LFI and MML indicators, based on the BITS survey results. The additional task was discussed during the WGBIFS 2017 meeting and will be prolonged at the next annual meetings.

10) The Workshop on Implementation and Use in IBAS of a New Common Acoustic Database (ACOU; 06-08.12.2016) and authors of the StoX programme asked participants of the WGBIFS 2017 meeting for suggestions how to improve the programme and implement it as a routine database linked with IBAS surveys. The additional task was discussed during the WGBIFS 2017 meeting and will be prolonged at the next annual meetings.

11) WGBIFS would like to obtained answers from the ICES Secretariat concerning following questions:

- who is the end-user of the marine litter data reported by WGBIFS during the BITS surveys,
- what is the present quality status of the part of the DATRAS database devoted to storage of the marine debris data,
- why the collected Baltic cod stomach content data during the BITS surveys is not yet the subject of the WGSAM interest?

12) It is suggested that during the BITS-Q4/2017 and the BITS-Q1/2018 national surveys there will be made observations in the period of sunrise and sunset, where we will try to determine if the light during those 30 minutes (15′ before sunrise/sunset and 15′ after sunrise/sunset) have any impact partly on the light-meter and on the fishes aggregation pattern while looking at the echosounder.

13) It is important for precise values of the LFI and MML indicators to inspect that both door and wingspread indices are included in DATRAS uploads. This should be analysed by all WGBIFS members involved in the BITS surveys accomplishment. This information will facilitate the ability calculate the swept area, one of the much needed parameter in calculation of the a.-m. indicators. Therefore, WGBIFS suggest that all vessels involved in the BITS surveys realisation should to have possibly soon suitable equipment (sensors on the trawl wings) for measuring horizontal and vertical trawl opening during fishing.

14) WGBIFS suggested that the Swedish research survey "Sound-survey" results will be included in the DATRAS database in order to be available for potential assessment of fish stocks size and other external use however, such survey should not be included in the BITS type of survey due to different fishing gear used and fishing period. The

Swedish delegates in cooperation with experts from the ICES Data Centre will do the action.

15) For action before the next WGBIFS meeting (March 2018) it was suggested to make regular consistency analyses to the age matrixes of the indices produced by the regular research surveys, for the use of WGBFAS.

16) In connection with the new EU DC-MAP ten-years-planning, Danish specialists from the DTU-AQUA requested (12.09.2016) WGBIFS for acceptance of combining the BITS- and Cod-survey in Kattegat by using the facility on the RV "Havfisken", and because of lack of convincing materials from the experimental catches, the decision was postponed.

17) Danish specialists from the DTU-AQUA requested (16.06.2016) of special attention at the WGBIFS 2017 meeting, focusing on the results of calibration of fish catch data, obtained by the old and the new "Havfisken". The above request was repeated (04.01.2017) by the ICES Secretariat. Because of not sufficient numbers of experimental catches, the decision concerns to insert the calibrated data for the routine assessment process of the western Baltic cod and flounder stocks size (realised by WGBFAS) was postponed, and experiments will be continued in the forthcoming BITS surveys. Moreover, it was decided to use the conversion factors estimated for cod and flounder for the next 4-5 years, and then reanalyse the data including the additional data obtained.

18) The WGBIFS suggested to all countries realised the BITS surveys that until the WGBIFS-2018 meeting, initially to accept the new, lower threshold of the minimum oxygen content in waters nearby a seabed, i.e. from 1.5 to 0.5 ml/l. Observations and reporting of fish distribution near seabed at the above-mentioned oxygen content minimum should be considered as very important. The WG decided that when the oxygen content on the depth interval from 0 to 10 m over the seabed is 0.5 ml/l, fishing will be not realised. After one year of transition, the final decision about newly proposed the threshold minimum oxygen content in waters nearby a seabed will be taken.

Annex 5. Copy of Working Group self-evaluation (Ch. 7)

The ICES Working Group on Baltic International Fish Survey (WGBIFS), according to the ICES ASC 2014 recommendation No. 2014/MA2/SSGIEOM:02, met at successive three meetings:

- 23–27 March 2015 in Öregrund (SLU), Sweden;
- 30 March – 3 April 2016 in Rostock (TI-OF), Germany;
- 27-31 March 2017 in Riga (BIOR), Latvia;

Overall, 25 experts (including chair invited experts) from research institutes located on the Baltic Sea coasts and from the ICES Data Centre, taking part in the WGBIFS annual meetings for works on almost constant ToRs and deliverables. Włodzimierz Grygiel, Poland chaired the group for the a.-m. three years. The text of basic report and the set of annexes were prepared from each WGBIFS annual meeting, accordingly to the format proposed by the ICES Secretariat. Any significant changes in the final version of ToRs dedicated to WGBIFS 2015-2017 meetings have not been done.

During the WGBIFS meetings were successfully realised following main ToRs, i.e.:

- combine and analyse acoustic-trawl-biotic results obtained during the fishery-independent, fish stocks assessment relevant surveys, type BIAS, BASS and BITS, accomplished from May 2014 until March 2017; updated the acoustic-hauls-biotic data (sprat, herring, cod, flatfishes) from 2014 - 2016 surveys, were systematically uploaded according to the BASS_DB.mdb and BIAS_DB.mdb Access-database, as well the DATRAS and Tow-Database; the acoustic-trawl data from the BIAS and BASS surveys in 2015 - 2016 are also stored in format of the StoX programme (WGBIFS-2017),
- coordinate the time-schedule of the a.-m. surveys, planning of research vessel/country effort and principal assignments per area and survey, in the period from May 2015 to March 2018, however regarding the next BITS surveys, the re-programming of catch-stations allocation from the Tow-Database was initially implemented (WGBIFS-2017), without violate of the structure of this database,
- finalise the text for IBAS and BITS Manuals, accordingly to SISP standards and suggestions elaborated by reviewers.

Analyse the status of marine litter sampling during the BITS surveys and reporting to the ICES DATRAS sub-database as well as Baltic cod stomachs sampling can be treated than the second order of the WGBIFS ToRs. Cod stomachs sampling and analysing, among-other due to lack of response (interest) from the ICES Working Group on Multispecies Assessment Methods (WGSAM), very limited number of Baltic cod feeding experts, relatively high costs of sampling and not fully developed ICES database for such issue will be continued at local level (depend on possibilities), but not coordinated by WGBIFS. To the same group of ToRs importance more two considered tasks can be added, i.e.: "Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty. Evaluation of status of the StoX programme" and "The evaluation of possibilities to calculate the Large Fish Indicator (LFI) and Mean Maximum Length (MML) descriptors, based on the BITS surveys results". The above-mentioned two tasks were only partly realised because it was decided that the WGBIFS should at first move forward and try to evaluate the BIAS and BASS surveys results from the bootstrap method recommended at WKSDO for calculation the surveys sampling variance. Moreover, the limited time of meeting not allowed on the broad exercises with the acoustic-hauls-biotic data (from BIAS and BASS surveys) under the StoX programme, initially implemented into operation for data storage and fish stocks size assessment in the Baltic. Based on the Estonian's data from the BIAS 2015 survey common procedures used in the StoX programme were deeply considered.

Furthermore, a few additional tasks (see examples below), requested mostly by the Baltic Fisheries Assessment Working Group (WGBFAS), were also accomplished during the running WGBIFS meetings (2015-2017):

- elaboration the set of maps showing geographical distribution (cpue in numbers/h obtained from control-catches with the TV-3 trawl) of cod, flounder, plaice, turbot, dab and brill during the BITS-Q1 and BITS-Q4 surveys in 2015 and 2016,
- actualization of the table reflecting the status of standard research surveys tuning indices (per species, age groups, areas, surveys) ready to use in the Baltic fish stocks assessment process moreover, the overview of various research surveys scope of works, realised by the countries surrounding the Baltic, but presently not used for fish stocks assessment,
- answers on the inquires – "How to explain discrepancy between herring ICES SD 30 and Central Baltic Herring stocks size", and "Comparison of methods applied in different institutes for the Baltic fishes age reading",
- German opinions (2016) regarding "Fish stock indices based on acoustic surveys in the Baltic Sea. Alternative application of results of fishing stations" and "Mixing of the Western Baltic Spring Spawning Herring (WBSSH) and CBH – applicability of the separation function",
- presentation the first results from fish catches calibration experiments between the Danish old and new r/v "Havfisken" and the German r/v "Solea".

In 2015-2017 were also prepared the recommendations to ICES expert groups and the action list addressed mostly to the WGBIFS and in some extent to the ICES Secretariat, and the list of ToRs for the WGBIFS next meetings.

As the deficiencies of the WGBIFS meetings can be mentioned – a lack of any information expected from the ICES/FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) about the standardization of the IBAS pelagic trawl (ToR j), and shortage of some input data from the BITS surveys, needed for calculation the LFI and MML ecosystem indicators. The WGBIFS intends prolonging realisation of the both above tasks based on the new information as well as the coordination of marine litter sampling and reporting within the framework of BITS surveys.

The main outcomes and achievements of the WGBIFS meetings are listed in the WGBIS-2017 Final Report:

- the chapter 4 - Summary of achievements of the WG during 3-year (2015-2017) term,
- the chapter 3 - Summary of the Work plan for year 3 (2017),
- the Executive summary (2017).

The materials obtained from routine research surveys (BIAS, BASS, BITS-Q4, BITS-Q1) are the input data independent from commercial fishery preferences and can be used for tuning in the main Baltic fish stocks size assessment, realized annually by the WGBFAS. Fish stocks abundance indices reflect possible precision of the current main fish stocks size and distribution in the Baltic Sea. The evaluation of a bulk of data from recently realized the surveys showed that sampling plans and their accomplishment are nearly similar. However, the BASS-dataset can be used in the assessment of sprat stock in the Baltic Sea with restriction that the year 2016 (when the survey coverage was very poor) is excluded from the dataset.

The WGBIFS have not directly contributed to the ICES "Advisory needs" however, the group is responsible for systematic realisation of the seasonal Baltic research surveys, focused on the monitoring on main species spatial distribution and changes of their abundance, including the YOY. In every year, the WGBIFS prepared the set of input data needed for the Baltic fish stocks size final assessment, made by the WGBFAS.

It is proposed to have the same set of ToRs, as above-mentioned, for 2018-2020 WGBIFS meetings with some modifications, i.e.:

- the intensive review and update of the BITS and IBAS Manuals (ToRs f and g) is not needed however, some current response on the proposed actions (see Annex 4.B) are valuable for further improvement of the a.-m. manuals,

- the present ToR h) should be divided on two separate parts, i.e. "Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty in the BIAS and BASS surveys" and "Review the progress of the ICES acoustic-trawl surveys database design implemented under the StoX programme",
- as separate ToRs should be also considered:
  - ¤ "An attempt to make standardization of the pelagic fishing gear used in BIAS and BASS surveys" – close cooperation with the WGFTFB is urgently needed,
  - ¤ "Coordinate the marine litter-sampling programme within the BITS surveys and registering the data in the ICES database" – close cooperation with existing (?) or specialized, newly-created the ICES working group is very needed,
  - ¤ "Define methods for the appropriate processing of the survey data and output products from the BITS survey to fee the Baltic LFI and MML indicators" – close cooperation with specialized the ICES or HELCOM expert group is very needed,
  - ¤ "Compilation of meta-data concerns the Baltic cod stomach sampling during the BITS surveys" – close cooperation with the WGSAM is needed.

Annex: ToR a) Combine and analyse the results of spring (BASS) and autumn (BIAS) 2016 acoustic surveys and report to WGBFAS

5.1.1. Combined results of the Baltic International Acoustic Survey (BIAS)

In September - October 2016, the following acoustic surveys were conducted in the ICES Subdivisions 21-32 (excl. ICES SD 31) however, in some subdivisions only in parts:

Vessel	COUNTRY	ICES SUBDIVISIONS
Aranda	Finland	30, parts of 29 and 32
Atlantniro	Russia	Part of 26
Baltica	Poland	Parts of 24, 25 and 26
Baltica	Latvia/Poland	Parts of 26 and 28
Baltica	Estonia/Poland	Parts of 28, 29 and 32
Dana	Sweden	25, 26, 27, 28, 29,
Darius	Lithuania	Part of 26
Solea	Germany/Denmark	21, 22, 23, 24

5.1.1.1. Area under investigation and overlapping areas

Each the ICES statistical rectangle of the area under investigation was allocated to one country during the WGBIFS meeting in 2005, thus each country has a mandatory responsible area. That means that area by about 60 NM shall be acoustically investigated and at least two fish catch-stations needs to be performed. However, it is allowed for all nations to cover also other areas, the results from the responsible country are used if these data are available.

Totally, eleven statistical ICES rectangles were inspected by more than one country (Fig. 5.1.1.1.1), precisely the following rectangles:

- 38G4 by GER and POL,
- 38G9 by POL and RUS,
- 39G5 by POL and SWE,
- 39G9 by POL and RUS,
- 40G7 by POL and SWE,
- 40G9 by LIT and RUS,
- 43G9 by LAT and SWE,
- 45H0 by EST and LAT,
- 45H1 by EST and LAT,
- 48H4 by EST and FIN,
- 48H5 by EST and FIN.

The Figure 5.1.1.1.1 illustrates that the coverage of the Baltic Sea during the BIAS-2016 survey, was slightly less as it was planned during the WGBIFS 2016 meeting. The following small areas of the Baltic were omitted from acoustic monitoring:

- the northern part of the ICES SD 21 (German/Danish survey),
- the eastern part of the ICES SD 32 (Russian – GosNIORH survey).

Russia (AtlantNIRO) has realized the BIAS survey in the southeastern part of the ICES SD 26 in 2016, which was not planned during the previous WGBIFS meeting. Since 2012, Russia (GosNIORH) has annually planned to conduct the BIAS surveys in the eastern part of the ICES SD 32, but has failed so far to perform any of them.

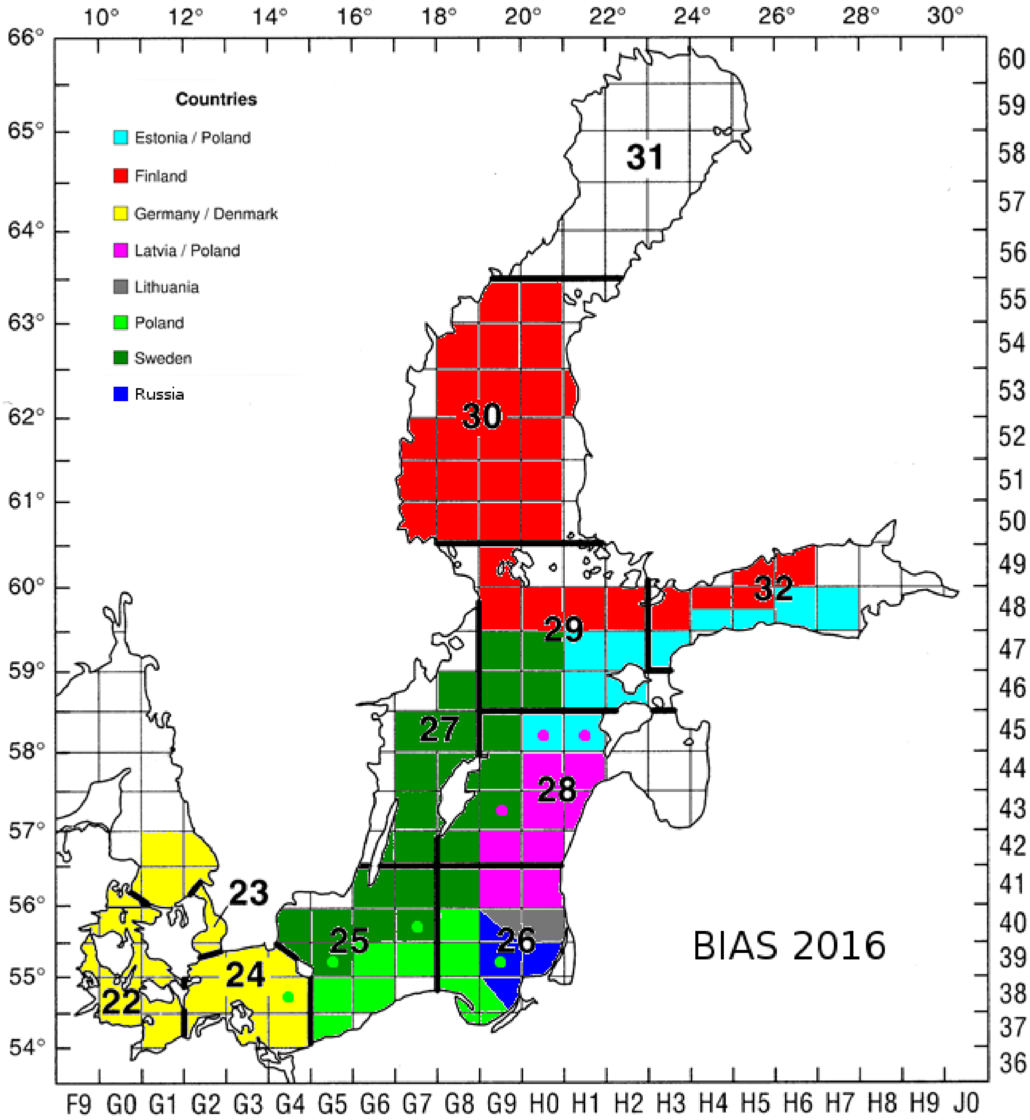


Figure 5.1.1.1.1. Map of the BIAS survey conducted in September-October 2016. Various colours indicate the countries, which covered specific ICES rectangles and delivered data to BIAS-database, thus was responsible for this rectangle. Dot with different colour within a rectangle explain additional data in BIAS-database partly or totally covered by other countries.

Additionally, the Estonian-Latvian acoustic survey in the Gulf of Riga was conducted in July-August 2016, as was planned during WGBIFS 2016 meeting. The survey results from the recent years are accessible at the national level, however, were not uploaded to the WGBIFS database.

5.1.1.2. Total results

Geographical distribution of herring, sprat and cod abundance in the Baltic Sea, accordingly to the ICES rectangles inspected in September-October 2016 is illustrated in Figures 5.1.1.2.1 - 5.1.1.2.5.

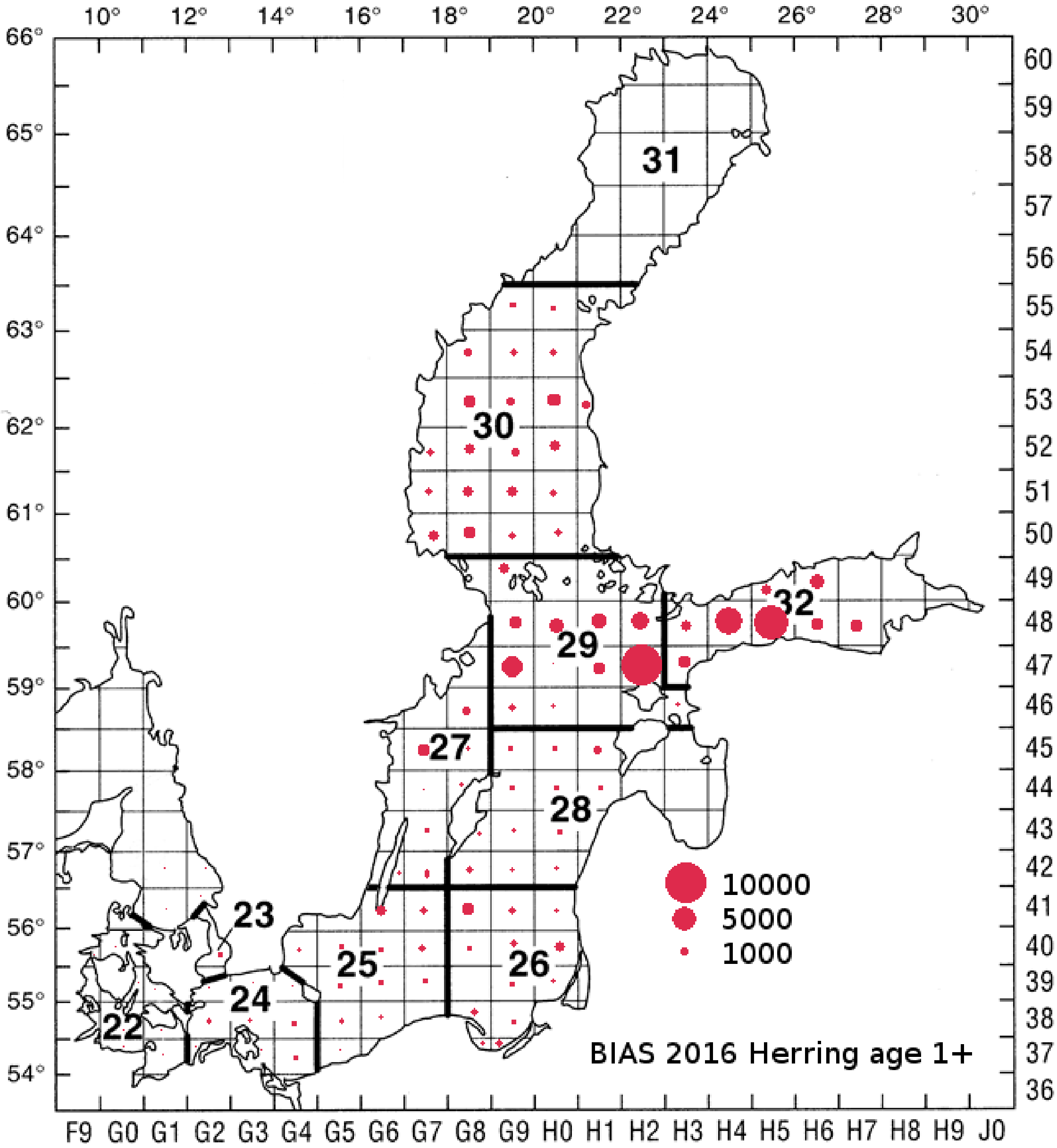


Figure 5.1.1.2.1. The abundance of herring (age 1+) per ICES rectangles monitored in September-October 2016 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

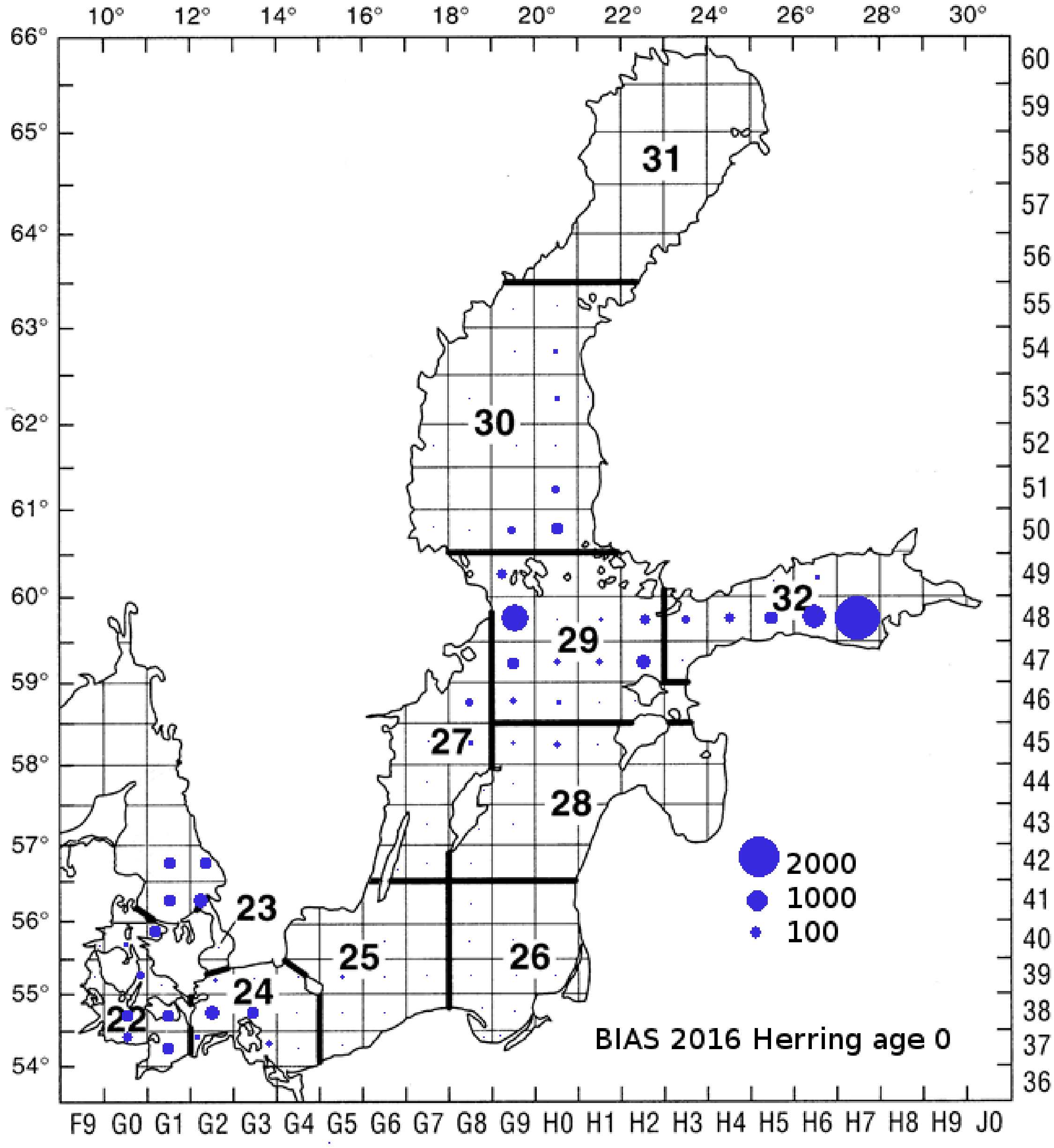


Figure 5.1.1.2.2. The abundance of herring (age 0) per ICES rectangles monitored in September-October 2016 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

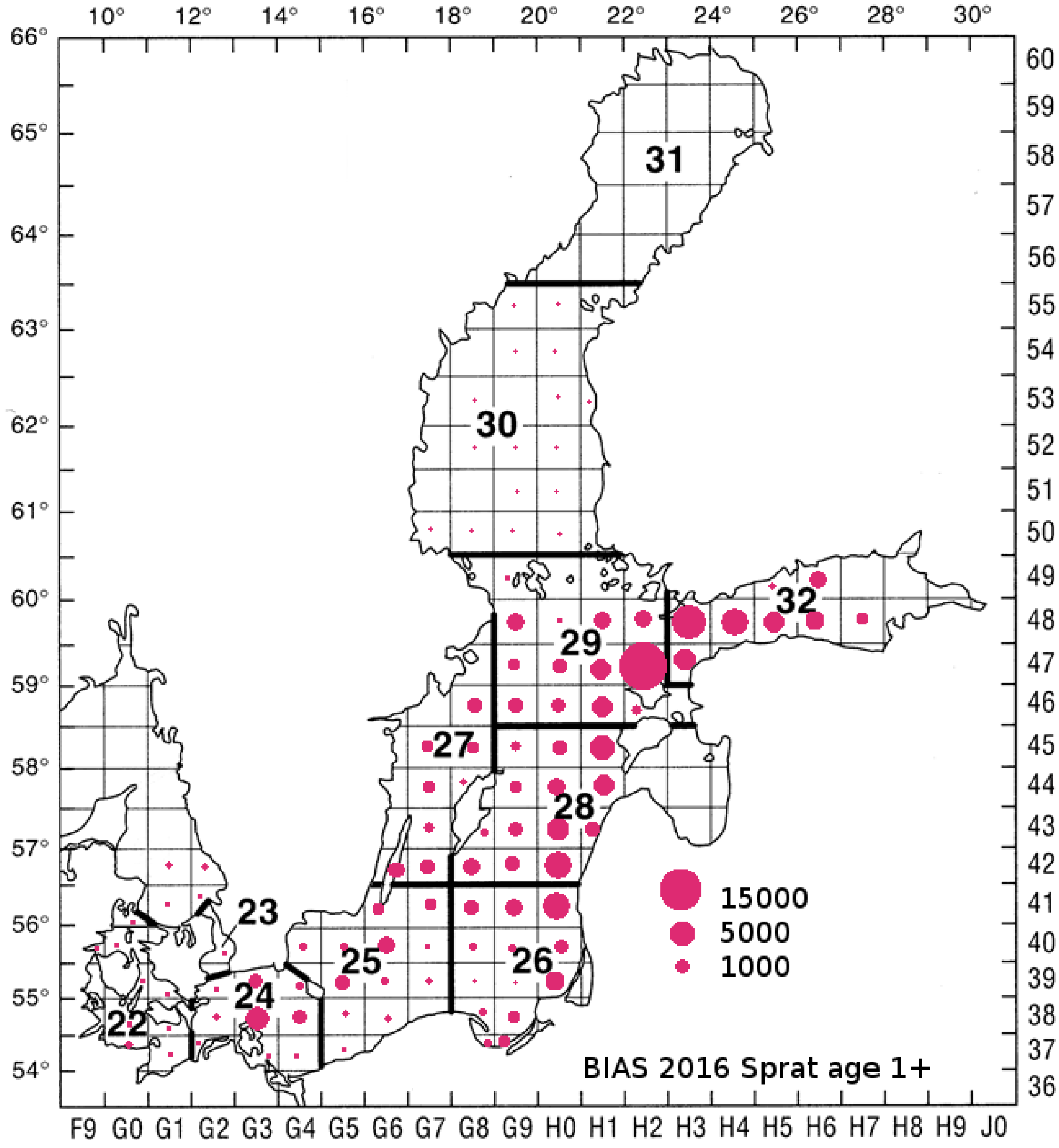


Figure 5.1.1.2.3. The abundance of sprat (age 1+) per ICES rectangles monitored in September-October 2016 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

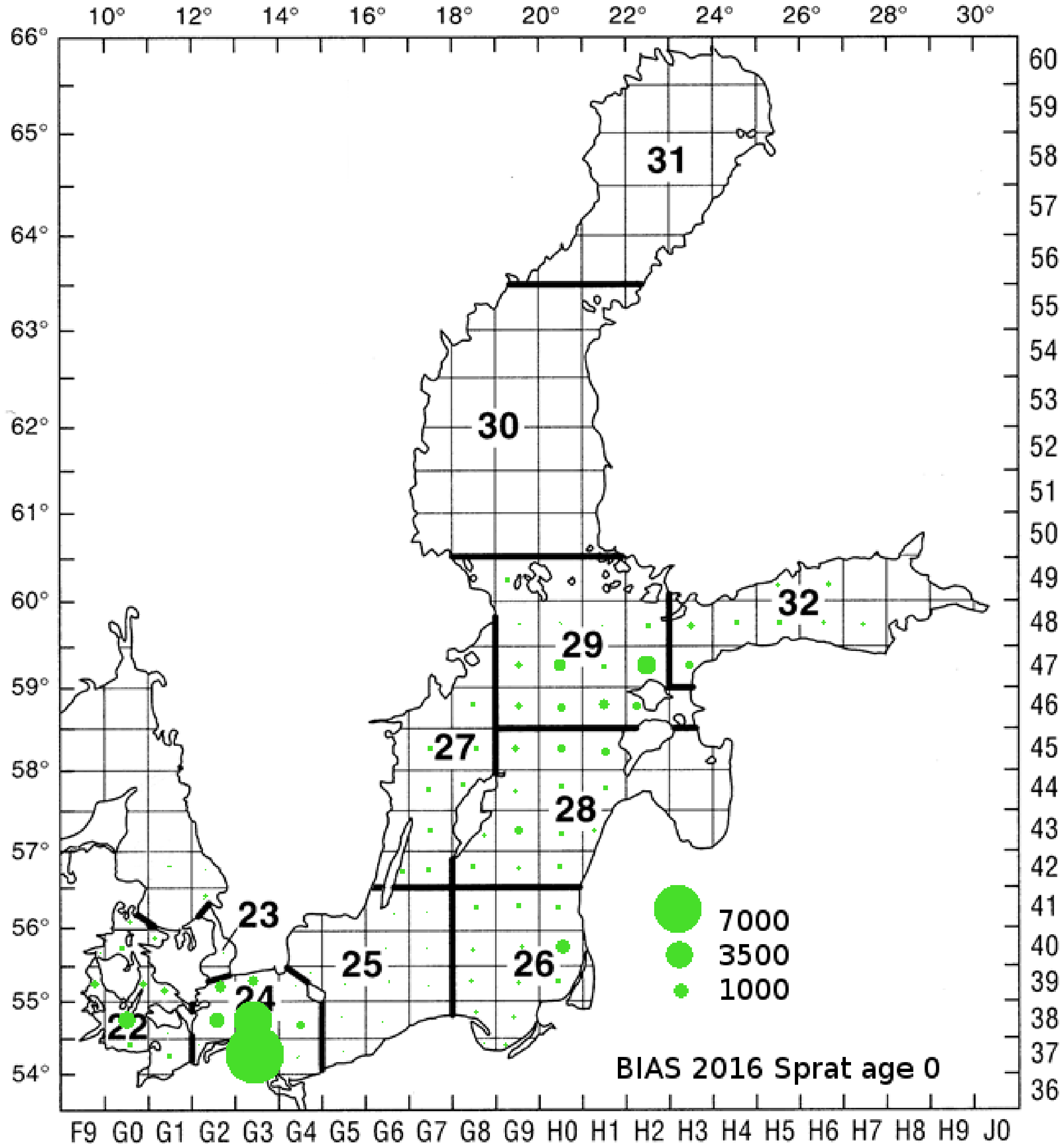


Figure 5.1.1.2.4. The abundance of sprat (age 0) per ICES rectangles monitored in September-October 2016 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

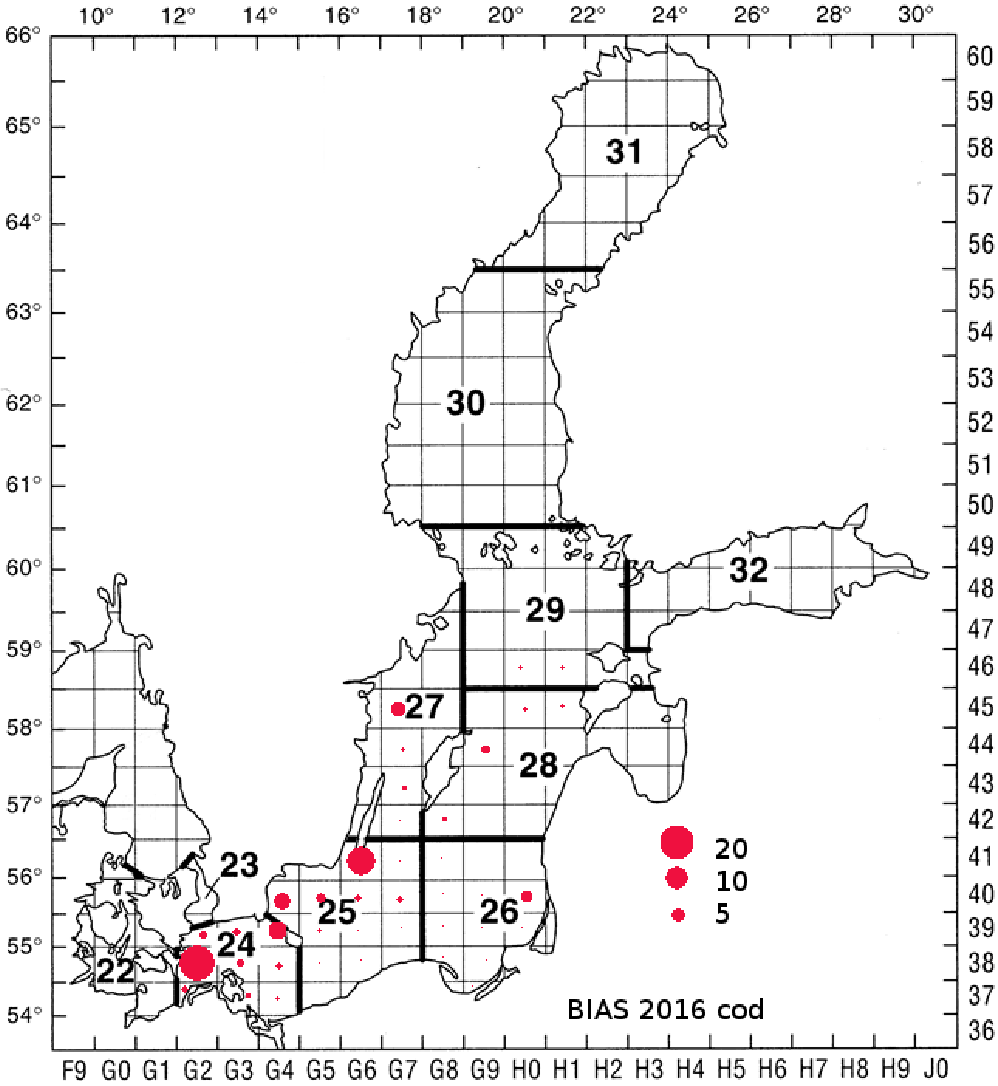


Figure 5.1.1.2.5. The abundance of cod (age 1+) per the ICES rectangles monitored in September-October 2016 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

The fish abundance estimates, which are based on the BIAS surveys in September-October 2016, are presented per the ICES rectangles and age groups and are specified in Tables 5.1.1.2.1, 5.1.1.2.2 and 5.1.1.2.3 for herring, sprat and cod, respectively. In addition, the abundance estimates for herring and sprat aggregated per ICES subdivisions and fish age groups are presented in Tables 5.1.1.2.4 and 5.1.1.2.5.

Table 5.1.1.2.1. Estimated numbers (millions) of herring in September-October 2016, by ICES rectangles, accordingly to age groups.

YEAR	Sub_Div	RECT	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	21	41G0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	21	41G1	125.91	94.95	27.44	2.68	0.57	0.14	0.13	0.00	0.00	0.00
2016	21	41G2	227.35	220.63	5.85	0.77	0.07	0.03	0.00	0.00	0.00	0.00
2016	21	42G1	148.59	132.14	15.52	0.69	0.06	0.08	0.10	0.00	0.00	0.00
2016	21	42G2	156.64	154.58	1.97	0.07	0.00	0.01	0.01	0.00	0.00	0.00
2016	22	37G0	115.36	107.26	3.94	1.50	0.82	0.97	0.52	0.16	0.19	0.00
2016	22	37G1	271.35	234.10	17.42	5.89	1.98	7.39	3.04	0.87	0.66	0.00
2016	22	38G0	254.87	238.58	6.72	4.46	1.09	2.03	0.78	0.38	0.12	0.71
2016	22	38G1	212.36	211.70	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	22	39F9	3.34	3.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	22	39G0	62.44	61.55	0.64	0.02	0.03	0.15	0.02	0.03	0.00	0.00
2016	22	39G1	9.38	9.26	0.09	0.00	0.00	0.02	0.01	0.00	0.00	0.00
2016	22	40F9	0.88	0.77	0.05	0.02	0.03	0.01	0.00	0.00	0.00	0.00
2016	22	40G0	34.60	30.08	1.91	0.89	1.03	0.55	0.00	0.14	0.00	0.00
2016	22	40G1	273.84	273.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	22	41G0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	23	39G2	20.89	16.12	1.19	0.67	0.91	1.35	0.46	0.07	0.11	0.01
2016	23	40G2	290.08	7.76	189.69	55.82	25.32	8.58	2.15	0.56	0.20	0.00
2016	23	41G2	58.60	58.31	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	24	37G2	49.01	43.11	1.70	1.02	0.68	1.73	0.73	0.02	0.02	0.00
2016	24	37G3	150.31	60.72	15.67	13.37	19.09	24.25	10.56	3.62	2.07	0.96
2016	24	37G4	354.21	5.89	55.73	50.52	81.09	93.23	37.75	17.08	9.95	2.97
2016	24	38G2	545.89	367.32	48.05	30.93	33.09	46.02	15.02	2.74	2.48	0.24
2016	24	38G3	457.78	246.67	42.97	31.87	44.48	57.35	21.97	6.19	4.94	1.34
2016	24	38G4	777.34	23.63	94.91	99.65	207.82	185.26	87.83	45.37	23.83	9.04
2016	24	39G2	85.62	66.04	4.89	2.75	3.74	5.53	1.87	0.29	0.45	0.06
2016	24	39G3	95.05	26.14	14.71	10.06	13.78	18.66	7.48	2.11	1.70	0.41
2016	24	39G4	143.27	10.49	18.94	18.59	32.03	35.97	15.08	6.12	4.10	1.95
2016	25	37G5	118.38	0.68	5.36	31.65	24.00	28.26	12.68	4.93	5.01	5.81
2016	25	38G5	392.56	2.25	17.78	104.96	79.59	93.70	42.05	16.34	16.62	19.27
2016	25	38G6	275.69	1.58	12.49	73.71	55.90	65.80	29.53	11.48	11.67	13.53
2016	25	39G4	17.87	0.42	3.29	3.12	2.93	5.80	0.79	1.10	0.28	0.14
2016	25	39G5	248.77	16.28	22.30	51.62	59.54	48.62	24.29	8.13	9.02	8.98
2016	25	39G6	505.23	2.90	22.88	135.08	102.44	120.59	54.12	21.03	21.39	24.80
2016	25	39G7	453.79	2.60	20.55	121.33	92.01	108.31	48.61	18.89	19.21	22.28
2016	25	40G4	155.81	0.00	8.06	21.57	72.86	31.16	16.62	3.21	0.22	2.11
2016	25	40G5	695.16	0.00	10.26	104.73	141.60	264.29	99.65	28.67	21.30	24.66
2016	25	40G6	575.63	0.95	31.35	128.66	163.13	147.58	70.08	15.98	14.19	3.71
2016	25	40G7	773.64	0.00	14.65	275.32	120.31	163.40	71.56	54.72	45.43	28.26
2016	25	41G6	1,178.50	0.00	41.31	287.53	219.43	324.43	138.26	98.16	58.19	11.18
2016	25	41G7	402.82	0.00	6.45	171.80	87.18	45.34	46.30	25.32	15.58	4.83
2016	26	37G8	84.05	0.42	4.21	19.48	13.94	21.60	9.07	5.01	5.42	4.90
2016	26	37G9	621.68	3.11	31.17	144.11	103.10	159.74	67.08	37.05	40.08	36.24
2016	26	38G8	365.77	1.83	18.34	84.79	60.66	93.99	39.47	21.80	23.58	21.32
2016	26	38G9	293.72	0.66	18.31	46.93	45.40	86.06	40.34	21.39	10.39	24.26
2016	26	39G8	346.17	1.73	17.36	80.24	57.41	88.95	37.35	20.63	22.32	20.18
2016	26	39G9	394.85	0.54	9.19	65.37	51.33	103.07	33.51	42.11	35.03	54.70
2016	26	39H0	20.48	1.05	0.35	3.39	4.12	6.40	1.37	0.95	0.98	1.86
2016	26	40G8	341.64	1.71	17.13	79.19	56.66	87.79	36.86	20.36	22.03	19.91
2016	26	40G9	736.65	0.32	30.87	132.16	152.63	182.17	86.32	74.08	45.21	32.91
2016	26	40H0	1,435.86	0.00	11.54	131.88	285.54	333.70	254.01	200.08	114.80	104.30
2016	26	41G8	2,757.52	3.45	30.83	472.05	379.05	870.83	150.18	543.12	228.80	79.21
2016	26	41G9	272.30	0.00	9.72	61.08	46.40	71.98	30.01	12.50	20.57	20.04
2016	26	41H0	80.64	0.00	6.15	41.78	17.42	10.96	3.38	0.41	0.25	0.29
2016	27	42G6	77.92	1.01	3.37	33.12	10.25	10.19	9.04	6.88	3.04	1.01
2016	27	42G7	571.95	1.17	17.56	369.64	53.72	68.86	44.82	8.39	1.66	6.13
2016	27	43G7	352.53	4.78	1.99	82.27	51.27	121.22	61.60	15.50	11.92	1.99
2016	27	44G7	16.97	10.03	0.00	3.79	0.63	1.89	0.63	0.00	0.00	0.00
2016	27	44G8	234.18	5.71	5.20	84.28	47.09	37.82	20.05	15.99	11.93	6.09
2016	27	45G7	1,502.05	6.11	63.63	751.43	279.72	198.82	85.35	110.47	5.00	1.53
2016	27	45G8	137.12	72.65	2.72	29.06	4.54	17.80	4.18	3.45	1.82	0.91
2016	27	46G8	1,068.04	99.87	290.32	614.13	43.49	15.17	5.06	0.00	0.00	0.00
2016	28_2	42G8	524.93	2.07	17.30	301.38	54.79	95.46	31.97	9.53	9.86	2.57
2016	28_2	42G9	25.44	0.00	0.76	12.42	5.72	3.15	1.79	0.62	0.98	0.00
2016	28_2	42H0	54.88	0.00	1.60	25.06	11.64	10.37	3.01	1.60	1.60	0.00
2016	28_2	43G8	29.31	0.95	2.36	18.44	0.47	1.89	0.95	2.36	1.89	0.00
2016	28_2	43G9	22.19	7.01	0.00	7.13	4.12	3.65	0.09	0.09	0.00	0.09
2016	28_2	43H0	666.49	0.00	0.00	372.63	93.95	94.85	69.18	1.53	5.52	28.83
2016	28_2	43H1	423.71	0.00	0.00	199.35	61.32	73.94	59.94	3.67	6.41	19.10
2016	28_2	44G9	225.81	11.88	0.63	82.84	45.61	40.28	25.09	10.85	7.66	0.96
2016	28_2	44H0	238.34	0.00	14.87	156.15	21.84	17.11	9.04	6.23	8.85	4.25
2016	28_2	44H1	670.50	0.00	40.63	315.01	86.23	127.44	60.57	5.01	21.38	14.24
2016	28_2	45G9	284.76	25.89	4.80	110.28	49.93	73.24	14.14	3.02	1.74	1.74
2016	28_2	45H0	279.54	37.94	2.96	150.54	42.01	24.78	10.97	0.99	3.57	5.79
2016	28_2	45H1	1,146.13	4.39	17.57	536.18	205.51	184.87	119.44	8.78	25.91	43.47
2016	29	46G9	562.77	64.57	36.16	309.49	36.98	84.75	10.36	16.36	1.36	2.73
2016	29	46H0	62.63	23.65	5.74	24.66	6.76	1.69	0.00	0.00	0.13	0.00
2016	29	46H1	4.17	4.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	29	46H2	59.69	1.53	4.84	34.44	8.32	6.32	2.98	0.00	0.31	0.95
2016	29	47G9	5,126.97	122.26	635.71	3,364.36	366.88	332.38	172.86	70.15	55.51	6.87
2016	29	47H0	141.82	77.36	9.28	47.45	2.58	2.58	2.58	0.00	0.00	0.00
2016	29	47H1	2,816.09	85.35	109.94	1,654.30	377.64	263.59	227.45	0.00	38.38	59.46
2016	29	47H2	10,638.36	199.44	892.35	5,787.16	1,199.61	929.17	1,196.68	0.00	139.17	294.79
2016	29	48G9	3,436.37	1,594.00	857.35	892.38	59.01	10.42	3.55	7.31	6.52	5.83
2016	29	48H0	3,000.34	7.62	360.88	1,529.72	406.24	220.50	73.34	150.70	121.17	130.17
2016	29	48H1	3,948.42	52.45	882.87	2,305.42	319.49	128.44	43.47	76.44	66.43	73.41
2016	29	48H2	4,494.57	89.80	1,543.06	2,460.08	190.88	84.20	18.21	40.93	25.51	41.90
2016	29	49G9	1,704.05	136.58	237.48	840.32	194.52	87.03	27.27	58.65	45.99	76.21
2016	30	50G7	963.93	7.40	293.17	449.99	127.23	45.39	20.42	5.24	3.74	11.35
2016	30	50G8	1,456.71	1.39	561.48	595.21	161.47	59.68	29.54	11.83	11.18	24.93
2016	30	50G9	683.49	83.16	205.15	247.59	72.31	29.45	15.96	6.25	6.18	17.44
2016	30	50H0	814.84	230.80	297.14	188.47	45.04	18.01	11.23	4.19	4.79	15.17
2016	30	51G7	504.90	0.00	18.13	224.14	100.61	54.53	29.49	12.77	14.83	50.40
2016	30	51G8	2,010.15	0.00	105.84	878.73	398.55	225.84	132.37	57.77	63.34	147.71
2016	30	51G9	1,398.81	0.00	80.75	680.21	285.69	147.56	74.86	32.39	32.88	64.47
2016	30	51H0	625.20	73.86	156.68	241.42	72.64	30.46	16.87	7.17	6.93	19.17
2016	30	52G7	460.51	1.87	7.74	111.29	68.83	53.23	38.04	22.33	29.97	127.21
2016	30	52G8	1,573.11	0.00	52.68	547.19	307.80	203.89	122.93	59.11	65.34	214.17
2016	30	52G9	368.42	1.55	16.88	129.20	66.80	45.46	29.34	14.75	16.81	47.63
2016	30	52H0	834.81	2.81	37.26	291.22	151.25	103.49	67.02	33.79	38.56	109.41
2016	30	53G8	1,445.38	3.35	64.21	512.44	276.88	183.54	112.80	54.97	61.11	176.08
2016	30	53G9	695.18	0.00	8.62	191.88	129.98	105.59	73.40	38.24	42.40	105.07
2016	30	53H0	1,333.82	20.71	70.59	439.82	231.09	158.09	104.11	52.50	64.36	192.55
2016	30	53H1	228.70	3.11	18.30	82.87	39.82	24.98	15.90	7.67	9.17	26.88
2016	30	54G8	753.00	0.00	4.09	122.57	105.63	101.46	82.67	46.16	60.30	230.12
2016	30	54G9	604.36	7.47	41.73	200.12	97.76	65.76	44.37	23.02	29.15	94.98
2016	30	54H0	1,680.21	36.11	11.71	360.61	278.46	246.89	180.75	96.26	114.75	354.67
2016	30	55G9	451.59	3.34	143.57	191.56	54.22	22.58	12.96	5.55	5.77	12.04
2016	30	55H0	794.85	4.57	100.85	331.95	133.43	73.72	43.10	20.20	22.68	64.36
2016	32	47H3	1,332.92	14.04	52.12	498.93	396.56	118.57	139.29	45.62	42.26	25.51
2016	32	48H3	1,069.44	75.14	199.16	663.65	71.87	20.59	10.30	12.57	4.42	11.74
2016	32	48H4	6,949.50	131.17	581.68	3,495.05	1,961.04	304.90	336.81	49.66	44.01	45.17
2016	32	48H5	9,171.65	182.75	852.43	4,787.55	2,282.72	419.24	389.86	93.30	67.24	96.55
2016	32	48H6	3,262.26	1,237.32	256.28	1,108.28	518.81	54.81	65.55	12.00	9.22	0.00
2016	32	48H7	3889.15	2224.89	141.05	494.62	534.77	192.89	183.95	54.71	46.63	15.64
2016	32	49H5	1265.17	5.73	189.42	789.87	141.87	53.97	23.72	20.92	12.98	26.69
2016	32	49H6	2776.93	42.13	315.71	1576.04	420.35	156.67	72.63	69.4	41.07	82.93

Table 5.1.1.2.2. Estimated numbers (millions) of sprat in September-October 2016, by ICES rectangles, accordingly to age groups.

YEAR	Sub_Div	RECT	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	21	41G0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	21	41G1	34.10	0.00	7.53	22.27	3.81	0.49	0.00	0.00	0.00	0.00
2016	21	41G2	19.59	3.61	11.42	4.31	0.24	0.01	0.00	0.00	0.00	0.00
2016	21	42G1	132.75	0.26	52.84	72.75	6.48	0.42	0.00	0.00	0.00	0.00
2016	21	42G2	173.29	9.21	134.66	28.38	1.02	0.02	0.00	0.00	0.00	0.00
2016	22	37G0	246.03	230.74	4.00	10.46	0.81	0.00	0.02	0.00	0.00	0.00
2016	22	37G1	148.53	145.48	1.14	1.53	0.32	0.00	0.06	0.00	0.00	0.00
2016	22	38G0	1,249.83	1,225.07	3.05	17.80	3.41	0.44	0.06	0.00	0.00	0.00
2016	22	38G1	58.27	58.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	22	39F9	595.94	595.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	22	39G0	225.13	168.95	7.73	40.34	4.59	2.68	0.84	0.00	0.00	0.00
2016	22	39G1	167.58	166.61	0.35	0.62	0.00	0.00	0.00	0.00	0.00	0.00
2016	22	40F9	10.46	3.63	1.32	4.98	0.48	0.04	0.01	0.00	0.00	0.00
2016	22	40G0	413.57	143.51	52.14	196.88	19.12	1.58	0.34	0.00	0.00	0.00
2016	22	40G1	19.56	19.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	22	41G0	6.78	1.78	1.08	3.45	0.47	0.00	0.00	0.00	0.00	0.00
2016	23	39G2	183.02	166.28	9.03	6.13	0.73	0.33	0.28	0.24	0.00	0.00
2016	23	40G2	1.90	0.75	0.11	0.49	0.10	0.24	0.21	0.00	0.00	0.00
2016	23	41G2	21.56	21.08	0.23	0.16	0.03	0.06	0.00	0.00	0.00	0.00
2016	24	37G2	51.13	38.88	4.26	5.65	1.22	0.41	0.57	0.14	0.00	0.00
2016	24	37G3	7,377.79	7,292.75	70.05	14.99	0.00	0.00	0.00	0.00	0.00	0.00
2016	24	37G4	191.59	35.21	23.69	69.54	31.13	16.47	12.71	2.84	0.00	0.00
2016	24	38G2	1,393.55	1,031.84	173.54	148.43	21.05	6.19	8.80	3.70	0.00	0.00
2016	24	38G3	10,046.07	5,186.01	2,295.86	1,977.42	298.01	110.41	118.30	60.06	0.00	0.00
2016	24	38G4	833.14	104.02	168.00	326.96	115.08	58.13	47.60	13.35	0.00	0.00
2016	24	39G2	749.63	681.08	36.99	25.09	2.99	1.33	1.16	0.99	0.00	0.00
2016	24	39G3	1,643.12	433.93	467.38	544.18	99.31	36.20	41.70	20.42	0.00	0.00
2016	24	39G4	577.35	29.11	160.23	254.76	64.47	30.76	28.74	9.28	0.00	0.00
2016	25	37G5	175.63	0.62	1.63	73.38	56.53	26.45	8.95	5.20	2.64	0.22
2016	25	38G5	578.18	2.05	5.38	241.56	186.11	87.08	29.46	17.11	8.70	0.73
2016	25	38G6	351.78	1.25	3.27	146.97	113.23	52.98	17.92	10.41	5.29	0.44
2016	25	39G4	303.88	0.93	33.93	93.22	97.50	18.83	45.30	4.85	1.12	8.20
2016	25	39G5	1,119.58	6.09	65.91	460.90	207.68	233.58	90.35	44.99	6.50	3.58
2016	25	39G6	567.81	2.02	5.28	237.23	182.77	85.52	28.93	16.81	8.55	0.71
2016	25	39G7	336.97	1.20	3.14	140.78	108.46	50.75	17.17	9.97	5.07	0.42
2016	25	40G4	518.33	0.00	34.56	192.09	66.06	172.27	38.62	0.00	0.00	14.74
2016	25	40G5	397.07	0.00	28.75	38.72	118.45	134.98	31.75	29.82	5.01	9.59
2016	25	40G6	2,268.03	15.17	49.26	423.03	594.91	705.27	140.48	6.79	58.80	274.33
2016	25	40G7	405.60	0.51	5.34	133.86	75.12	73.56	47.81	17.22	24.63	27.54
2016	25	41G6	1,057.79	5.51	0.00	549.01	330.62	112.65	26.16	5.49	2.19	26.16
2016	25	41G7	1,246.20	6.46	89.73	545.08	268.88	170.33	102.58	5.06	30.32	27.77
2016	26	37G8	251.21	2.90	6.94	152.74	51.44	29.63	1.92	4.89	0.74	0.00
2016	26	37G9	1,397.25	16.15	38.63	849.57	286.09	164.83	10.66	27.19	4.14	0.00
2016	26	38G8	603.86	6.98	16.69	367.16	123.64	71.23	4.61	11.75	1.79	0.00
2016	26	38G9	1,000.56	3.59	20.73	506.38	195.53	181.90	59.32	12.99	0.92	19.20
2016	26	39G8	84.95	0.98	2.35	51.65	17.39	10.02	0.65	1.65	0.25	0.00
2016	26	39G9	138.26	0.65	7.95	68.59	20.54	26.89	7.97	1.39	1.21	3.07
2016	26	39H0	4,162.10	145.48	410.62	2,735.36	439.54	370.11	49.18	5.91	2.95	2.95
2016	26	40G8	430.13	4.97	11.89	261.53	88.07	50.74	3.28	8.37	1.28	0.00
2016	26	40G9	541.04	6.81	21.41	182.65	152.22	92.33	39.75	22.30	15.17	8.40
2016	26	40H0	2,481.99	1,379.46	279.92	592.99	100.24	78.10	30.77	0.00	10.26	10.26
2016	26	41G8	1,628.13	18.92	40.30	723.86	498.77	137.78	122.29	46.56	27.65	12.00
2016	26	41G9	2,827.60	164.20	119.60	1,318.20	705.80	212.40	186.20	38.00	39.00	44.20
2016	26	41H0	8,185.60	132.60	768.00	5,810.40	1,055.80	295.80	33.90	71.90	5.30	11.90
2016	27	42G6	2,213.00	32.54	338.46	963.31	742.01	82.99	14.64	30.92	8.14	0.00
2016	27	42G7	3,536.96	84.84	209.95	1,975.33	500.80	307.96	219.25	30.87	207.96	0.00
2016	27	43G7	837.95	36.58	19.69	357.44	283.16	88.84	24.49	0.00	21.18	6.59
2016	27	44G7	1,246.50	214.31	39.81	476.78	285.47	189.90	11.67	28.56	0.00	0.00
2016	27	44G8	227.07	3.21	7.70	65.47	79.27	63.55	2.09	0.00	0.00	5.78
2016	27	45G7	1,131.39	82.81	8.98	505.53	360.14	97.54	28.81	15.97	6.94	24.68
2016	27	45G8	1,306.48	37.95	73.73	536.69	408.75	136.61	32.53	0.00	31.44	48.79
2016	27	46G8	2,727.35	237.39	237.10	1,388.69	745.23	95.25	10.30	1.55	0.00	11.85
2016	28_2	42G8	3,727.98	215.54	61.50	2,265.33	1,102.10	41.75	0.00	21.49	20.26	0.00
2016	28_2	42G9	2,329.20	34.10	125.90	1,087.60	777.50	202.50	48.70	20.10	2.70	30.10
2016	28_2	42H0	6,364.00	172.90	426.90	3,288.80	1,807.80	407.30	141.80	62.10	14.30	42.10
2016	28_2	43G8	502.69	64.34	31.77	238.08	135.53	16.49	8.45	4.02	4.02	0.00
2016	28_2	43G9	3,060.34	610.54	501.80	974.56	495.71	394.29	0.00	45.97	37.47	0.00
2016	28_2	43H0	5,695.30	121.90	640.40	3,889.90	578.40	336.30	126.20	0.00	0.00	2.20
2016	28_2	43H1	1,935.30	47.20	287.80	1,349.20	98.10	112.90	38.90	0.60	0.00	0.60
2016	28_2	44G9	857.16	62.90	100.48	356.11	225.53	91.72	5.66	5.66	9.09	0.00
2016	28_2	44H0	3,208.90	162.80	158.50	1,744.50	773.20	148.40	138.10	12.50	6.90	64.00
2016	28_2	44H1	5,114.60	264.40	425.20	2,979.70	841.80	300.60	233.20	52.60	0.00	17.10
2016	28_2	45G9	1,155.45	460.20	128.00	261.70	187.83	66.22	13.00	9.30	7.23	21.96
2016	28_2	45H0	3,063.23	753.84	243.67	1,390.88	341.36	117.47	88.14	12.47	31.40	83.99
2016	28_2	45H1	5,168.61	655.53	447.87	2,458.32	601.26	290.07	266.53	79.24	154.88	214.91
2016	29	46G9	1,896.31	307.55	66.14	1,247.17	25.98	136.47	59.99	22.48	14.80	15.72
2016	29	46H0	5,426.67	639.51	1,151.11	2,338.77	617.58	434.86	73.09	135.21	18.27	18.27
2016	29	46H1	6,734.25	838.04	806.66	4,130.30	797.63	38.91	53.87	29.93	38.91	0.00
2016	29	46H2	870.55	51.68	161.92	545.45	89.44	5.37	7.35	3.98	5.37	0.00
2016	29	47G9	1,409.46	73.11	97.00	915.24	194.83	83.34	16.16	5.50	24.28	0.00
2016	29	47H0	2,935.47	998.23	145.50	1,341.69	280.43	120.97	40.18	8.46	0.00	0.00
2016	29	47H1	4,941.72	155.00	767.01	3,170.23	618.57	52.53	68.65	51.81	57.91	0.00
2016	29	47H2	20,396.77	2,622.20	5,788.59	10,117.29	1,448.61	79.12	153.87	107.97	79.12	0.00
2016	29	48G9	1,753.10	34.10	176.90	1,309.00	163.90	33.90	14.80	7.70	5.20	7.60
2016	29	48H0	274.30	16.00	35.20	161.00	26.10	15.20	9.20	4.50	2.90	4.20
2016	29	48H1	1,544.60	33.00	130.60	952.30	202.90	98.90	59.90	27.10	15.20	24.70
2016	29	48H2	3,560.20	384.70	405.50	2,055.80	359.90	189.60	92.20	30.80	13.20	28.50
2016	29	49G9	287.00	4.80	35.00	161.10	36.20	22.40	12.90	5.70	2.90	6.00
2016	30	50G7	11.60	0.00	0.10	4.50	3.20	1.60	0.60	0.30	0.60	0.70
2016	30	50G8	17.20	0.00	1.00	10.80	2.90	1.10	0.40	0.20	0.40	0.40
2016	30	50G9	51.20	0.50	0.60	20.20	11.70	5.90	2.90	1.50	3.00	4.90
2016	30	50H0	31.90	0.00	0.30	15.50	8.20	3.40	1.50	0.50	1.30	1.20
2016	30	51G7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	30	51G8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	30	51G9	3.10	0.00	0.00	0.50	0.40	0.30	0.20	0.20	0.30	1.20
2016	30	51H0	1.00	0.00	0.00	0.10	0.20	0.20	0.10	0.10	0.10	0.20
2016	30	52G7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	30	52G8	5.70	0.00	0.00	1.30	1.20	0.90	0.60	0.40	0.40	0.90
2016	30	52G9	0.80	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.20
2016	30	52H0	0.70	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.20
2016	30	53G8	0.40	0.00	0.00	0.00	0.10	0.10	0.00	0.00	0.10	0.10
2016	30	53G9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	30	53H0	10.10	0.00	0.00	0.80	1.20	1.30	0.90	0.80	1.20	3.90
2016	30	53H1	2.80	0.00	0.00	0.10	0.30	0.40	0.20	0.20	0.40	1.20
2016	30	54G8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	30	54G9	2.20	0.00	0.00	0.40	0.30	0.30	0.20	0.20	0.20	0.60
2016	30	54H0	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.30
2016	30	55G9	31.20	0.00	0.10	6.30	6.40	4.60	2.60	1.80	2.70	6.70
2016	30	55H0	7.60	0.00	0.00	1.80	1.70	1.10	0.70	0.50	0.60	1.20
2016	32	47H3	5,516.49	646.57	1,191.18	3,231.00	206.66	50.13	86.03	55.99	17.72	31.19
2016	32	48H3	13,530.30	252.00	2,828.90	8,533.40	1,260.90	382.20	150.80	65.30	27.20	29.60
2016	32	48H4	8,593.09	68.10	2,101.18	5,213.97	648.07	165.66	190.70	117.64	32.42	55.34
2016	32	48H5	3,981.31	74.90	715.40	2,158.73	412.37	178.61	214.85	129.94	36.66	59.84
2016	32	48H6	3,117.20	3.99	427.51	1,606.85	310.09	143.81	273.55	179.98	50.94	120.48
2016	32	48H7	1135.82	5.38	141.84	591.65	128.32	50.64	90.15	62.36	20.68	44.79
2016	32	49H5	305.50	2.90	53.10	157.00	38.40	24.80	16.30	6.60	3.80	2.60
2016	32	49H6	1573.10	16.80	424.40	987.40	112.40	18.30	6.80	4.30	0.90	1.80

Table 5.1.1.2.3. Estimated numbers (millions) of cod in September-October 2005-2016, by ICES rectangles.

Sub_Div	RECT	Area	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
24	37G2	192.40	2.17	0.00	1.82	0.00	0.00	0.00	0.00	0.00	6.01	0.00	0.00	1.26
24	37G3	167.70	0.00	4.14	0.87	1.18	0.72	4.26	0.00	1.99	1.09	0.91	0.25	2.26
24	37G4	875.10	9.50	0.13	4.27	5.16	1.41	2.60	0.02	0.00	19.73	0.31	3.32	0.88
24	38G2	832.90	10.86	0.00	1.95	0.00	0.00	1.93	1.07	5.97	0.46	0.00	0.00	22.78
24	38G3	865.70	0.28	0.00	1.61	1.07	1.97	3.57	0.40	4.39	0.94	25.85	1.22	2.12
24	38G4	1034.80	3.10	0.27	4.86	6.85	0.48	2.18	0.20	1.03	0.83	0.29	14.08	0.97
24	39G2	406.10	1.49	3.89	1.76	0.41	1.26	3.77	0.05	0.87	0.04	1.69	0.13	2.31
24	39G3	765.00	17.92	3.78	13.93	2.76	0.55	3.80	0.35	2.08	5.09	18.75	2.19	1.12
24	39G4	524.80	2.70	1.82	2.44	1.19	1.58	7.09	0.21	0.38	1.18	4.19	1.07	7.93
25	37G5	642.20	17.83	0.25	1.31	0.00	0.38	0.21	0.00	0.00	0.00	0.03	0.00	0.00
25	38G5	1035.70	57.28	2.06	5.20	0.74	2.92	4.54	18.40	19.88	4.98	3.37	2.95	1.01
25	38G6	940.20	9.54	3.00	17.12	2.52	0.27	0.23	0.00	15.48	0.00	0.00	0.00	0.38
25	38G7	471.70	0.00	0.13	0.04	0.92	0.37	0.85	0.00	0.21	0.00	0.00	0.00	
25	39G4	287.30	2.67	28.46	0.22	4.36	0.35	0.29	0.22	0.57	0.49	2.90	4.21	0.00
25	39G5	979.00	0.75	1.80	0.90	1.57	1.25	3.10	35.67	4.46	2.04	2.88	0.71	2.17
25	39G6	1026.00	0.86	6.50	0.69	4.05	0.48	16.71	3.48	0.04	0.00	0.16	0.12	0.11
25	39G7	1026.00	47.40	0.52	0.44	5.78	0.26	0.18	2.18	0.00	0.00	0.51	0.06	0.04
25	40G4	677.20	1.38	5.54	15.86	0.22	19.19	0.33	25.27	15.24	2.06	31.02	38.33	7.44
25	40G5	1012.90	2.40	7.60	4.89	25.09	1.81	0.81	14.00	5.45	1.24	7.96	31.00	3.14
25	40G6	1013.00	1.13	6.53	0.24	5.94	6.54	7.03	30.84	5.66	0.22	53.62	17.00	1.76
25	40G7	1013.00	2.85	2.89	0.00	3.13	1.75	0.25	9.31	21.37	0.15	3.90	0.00	1.54
25	41G6	764.40	2.69	14.80	0.00	2.53	0.63	0.36	0.00	1.03	0.00	0.84	0.23	18.94
25	41G7	1000.00	0.08	1.90	8.71	0.25	4.40	1.12	61.89	29.81	35.29	0.00	0.53	0.71
26	37G8	86.00	0.46	3.25	0.00	0.23	0.00	0.03	0.00	0.08	0.00	0.54	0.00	0.00
26	37G9	151.60	37.64	0.89	1.59	0.99	0.32	0.21	0.51	0.59	0.00	0.16	0.15	0.10
26	38G8	624.60	37.05	4.97	1.68	3.39	2.01	1.43	1.29	7.19	0.00	1.05	7.11	0.10
26	38G9	918.20	0.00	0.00	0.00	0.00	0.26	0.00	1.31	4.53	49.20	6.52	0.25	0.28
26	39G8	1026.00	32.28	22.10	1.63	0.83	4.33	4.71	19.88	5.18	0.00	0.50	0.42	0.23
26	39G9	1026.00	0.00	0.00	0.00	0.00	0.35	0.00	0.92	0.00	3.12	4.66	7.30	0.17
26	39H0	881.60					0.00	0.00	0.02					0.30
26	40G8	1013.00	17.82	4.57	0.54	0.21	0.55	6.77	3.96	3.18	0.00	0.10	2.75	0.06
26	40G9	1013.00	0.00		0.00	0.00	1.51	0.00	0.21	5.86	9.07	0.79		0.41
26	40H0	1012.10	5.10		0.00	0.71	34.59	51.72	1.12	0.23	0.13	0.14		5.13
26	41G8	1000.00	0.00	2.62		0.04	1.16	1.59	21.93	19.24	0.92	1.30	0.00	1.52
26	41G9	1000.00	10.00	0.07	3.21	0.18	0.00	1.05	0.00	0.00	0.27	195.80	1.59	0.00
26	41H0	953.30	54.47	0.24	3.39	1.92	0.00	0.09	0.00	0.00	0.30	0.00	0.01	0.00
27	42G6	266.00		2.23	0.04	0.00	1.14	0.02	0.00	0.26	0.01	0.00	0.00	0.00
27	42G7	986.90	1.02	1.14	0.49	0.02	0.88	0.00	1.57	0.61	0.69	0.92	0.00	2.68
27	43G6	269.80				0.00								
27	43G7	913.80	0.00	22.02	0.00	0.08	0.00	0.50	0.09	0.00	1.87	2.70	0.00	3.21
27	44G7	960.50	0.00	1.19	1.25	0.42	0.00	0.23	0.00	0.00	0.00	0.07	0.00	0.47
27	44G8	456.60	0.00	0.00	0.00	0.03	0.51	0.23	0.09	0.00	0.19	0.00	0.00	0.00
27	45G7	908.70	0.00	0.00	0.00	1.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.93
27	45G8	947.20	0.00	2.22	0.23	0.00	0.00	0.00	0.00	0.00	1.14	0.32	0.00	0.00
27	46G8	884.80	0.00	0.21	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.37	0.00	0.00
28_2	42G8	945.40	2.35	0.00	3.73	1.65	0.24	1.29	0.00	1.63	4.73	1.79	0.00	0.79
28_2	42G9	986.90	0.00	0.23	0.56	1.33	0.00	0.00	0.00	0.00	4.94	293.83	0.00	0.00
28_2	42H0	968.50	0.00	0.37	10.37	2.89	0.00	0.14	0.00	0.00	0.32	1.23	0.13	0.00
28_2	43G8	296.20	0.32	0.00	0.00	0.19	0.00	0.00	0.00	5.57	0.10	0.40	0.00	0.00
28_2	43G9	973.70	0.00	0.16	12.71	1.04	1.39	0.00	0.00	4.12	5.88	0.00	0.00	0.00
28_2	43H0	973.70	0.00	0.12	3.57	0.00	0.00	0.07	0.00	0.00	0.61	3.59	0.32	0.00
28_2	43H1	412.70	0.00	0.05	0.00	0.00	0.00	0.14	0.00	0.00	0.06	0.00		0.00
28_2	44G9	876.60	0.00	0.00	0.47	0.61	0.00	0.46	2.28	2.60	2.69	2.91	0.00	3.33
28_2	44H0	960.50	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	238.71	11.70	0.00
28_2	44H1	824.60	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.38	0.00	0.00	0.00
28_2	45G9	924.50	0.27	0.00	0.10	0.00	0.36	0.00	0.00	0.63	0.64	0.00	0.00	0.90
28_2	45H0	947.20	0.00	0.00	0.08	0.15	0.00	0.02	0.00	0.00	0.00	0.00	0.04	0.00
28_2	45H1	827.10	0.00	0.00	0.07	0.00	0.00	0.05	0.00	0.00	0.00	0.00	1.67	0.28
29	46G9	933.80	0.03	0.00	0.48	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66
29	46H0	933.80	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.66
29	46H1	921.50	0.00	0.00	0.00	0.00	0.00	0.42	0.00	0.70	0.09	0.00	0.03	0.00
29	46H2	258.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	47G9	876.20	2.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
29	47H0	920.30	0.00	0.00	0.63	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	47H1	920.30	0.00	0.00	0.00	0.00	0.00	0.00	8.77	0.00	0.00	0.00	0.00	0.00
29	47H2	793.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.05	0.00	0.00
29	48G9	772.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	48H0	730.30			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	48H1	544.00			0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	48H2	597.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	49G9	564.20			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5.1.1.2.4. Estimated numbers (millions) of herring by ICES subdivisions, accordingly to age groups; September-October 2016.

YEAR	Sub_Div	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	21	602.30	50.78	4.21	0.70	0.26	0.24	0.00	0.00	0.00
2016	22	1,170.48	31.43	12.78	4.98	11.12	4.37	1.58	0.97	0.71
2016	23	82.19	191.17	56.49	26.23	9.93	2.61	0.63	0.31	0.01
2016	24	850.01	297.57	258.76	435.80	468.00	198.29	83.54	49.54	16.97
2016	25	27.66	216.73	1,511.11	1,220.91	1,447.27	654.53	307.96	238.12	169.56
2016	26	14.83	205.15	1,362.45	1,273.67	2,117.22	788.94	999.48	569.47	420.13
2016	27	201.33	384.80	1,967.72	490.71	471.77	230.73	160.68	35.37	17.65
2016	28_2	90.13	103.48	2,287.41	683.13	751.03	406.18	54.28	95.36	121.04
2016	29	2,458.78	5,575.65	19,249.78	3,168.90	2,151.07	1,778.75	420.54	500.47	692.32
2016	30	481.49	2,296.57	7,018.48	3,205.49	1,999.60	1,258.12	612.16	704.24	2,105.81
2016	32	3,913.17	2,587.85	13,414.00	6,327.99	1,321.65	1,222.10	358.19	267.84	304.24

Table 5.1.1.2.5. Estimated numbers (millions) of sprat by ICES subdivisions, accordingly to age groups; September-October 2016.

YEAR	Sub_Div	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	21	13.08	206.45	127.71	11.55	0.94	0.00	0.00	0.00	0.00
2016	22	2,759.27	71.08	276.06	29.20	4.74	1.33	0.00	0.00	0.00
2016	23	188.11	9.37	6.78	0.86	0.63	0.49	0.24	0.00	0.00
2016	24	14,832.83	3,400.00	3,367.02	633.26	259.90	259.58	110.78	0.00	0.00
2016	25	41.83	326.17	3,275.82	2,406.33	1,924.24	625.47	173.73	158.82	394.44
2016	26	1,883.69	1,745.04	13,621.07	3,735.08	1,721.78	550.48	252.89	110.66	111.99
2016	27	729.61	935.42	6,269.23	3,404.82	1,062.62	343.78	107.88	275.66	97.68
2016	28_2	3,626.20	3,579.80	22,284.66	7,966.12	2,526.01	1,108.69	326.06	288.26	476.96
2016	29	6,157.91	9,767.14	28,445.34	4,862.09	1,311.57	662.17	441.14	278.05	105.00
2016	30	0.50	2.10	62.40	38.00	21.40	11.10	6.90	11.60	23.90
2016	32	1,070.65	7,883.51	22,480.01	3,117.21	1,014.16	1,029.19	622.11	190.32	345.64

5.1.1.3. Area corrected data

During WGBIFS meeting in 2006 possible improvement of presenting the results from acoustic surveys was discussed, and correction factor for each ICES subdivision and year was introduced because of the coverage of the investigated area differed in the years. This factor is the proportion between the total area of the ICES subdivision that are presented in the IBAS Manual (see Addendum 2) and the area of the ICES rectangles, which was covered during the survey. Some disagreements appeared about appropriate area of the ICES Subdivision 28. It was agreed that the Gulf of Riga (ICES Subdivision 28.1) must be excluded from the total area. All other the ICES subdivisions kept their areas from the a.-m. Manual.

The area corrected abundance estimates for herring and sprat per the ICES subdivisions and age groups are summarized in Tables 5.1.1.3.1 and 5.1.1.3.2, respectively. Biomass for herring and sprat per the ICES subdivisions and age groups are summarized in Tables 5.1.1.3.3 and 5.1.1.3.4, respectively.

Table 5.1.1.3.1. Area corrected numbers (millions) of herring by ICES subdivisions and age groups (September-October 2016).

YEAR	Sub_Div	AREA_CORR_FACTOR	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	21	1.55	931.22	78.51	6.51	1.08	0.40	0.37	0.00	0.00	0.00
2016	22	1.02	1,194.62	32.08	13.04	5.08	11.35	4.46	1.61	0.99	0.72
2016	23	1.00	82.19	191.17	56.49	26.23	9.93	2.61	0.63	0.31	0.01
2016	24	1.00	850.01	297.57	258.76	435.80	468.00	198.29	83.54	49.54	16.97
2016	25	1.07	29.72	232.91	1,623.88	1,312.03	1,555.28	703.38	330.95	255.89	182.22
2016	26	1.01	15.00	207.52	1,378.17	1,288.36	2,141.64	798.05	1,011.01	576.04	424.98
2016	27	1.23	247.78	473.58	2,421.75	603.94	580.63	283.97	197.75	43.53	21.73
2016	28_2	1.01	91.31	104.84	2,317.39	692.09	760.88	411.50	54.99	96.61	122.62
2016	29	1.04	2,556.49	5,797.23	20,014.75	3,294.83	2,236.55	1,849.44	437.25	520.36	719.83
2016	30	1.07	516.11	2,461.71	7,523.15	3,435.98	2,143.38	1,348.59	656.18	754.88	2,257.24
2016	32	1.42	5,561.57	3,677.96	19,064.55	8,993.61	1,878.39	1,736.90	509.07	380.67	432.40

Table 5.1.1.3.2. Area corrected numbers (millions) of sprat by ICES subdivisions and age groups (September-October 2016).

YEAR	Sub_Div	AREA_CORR_FACTOR	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	21	1.55	20.22	319.19	197.45	17.86	1.45	0.00	0.00	0.00	0.00
2016	22	1.02	2,816.17	72.55	281.75	29.80	4.84	1.36	0.00	0.00	0.00
2016	23	1.00	188.11	9.37	6.78	0.86	0.63	0.49	0.24	0.00	0.00
2016	24	1.00	14,832.83	3,400.00	3,367.02	633.26	259.90	259.58	110.78	0.00	0.00
2016	25	1.07	44.95	350.52	3,520.29	2,585.91	2,067.84	672.14	186.69	170.68	423.88
2016	26	1.01	1,905.42	1,765.17	13,778.21	3,778.16	1,741.65	556.83	255.81	111.94	113.28
2016	27	1.23	897.96	1,151.26	7,715.78	4,190.44	1,307.81	423.11	132.77	339.26	120.22
2016	28_2	1.01	3,673.72	3,626.72	22,576.75	8,070.54	2,559.12	1,123.22	330.33	292.04	483.21
2016	29	1.04	6,402.62	10,155.28	29,575.74	5,055.31	1,363.69	688.48	458.67	289.10	109.17
2016	30	1.07	0.54	2.25	66.89	40.73	22.94	11.90	7.40	12.43	25.62
2016	32	1.42	1,521.66	11,204.39	31,949.56	4,430.31	1,441.36	1,462.72	884.17	270.49	491.24

Table 5.1.1.3.3. Estimated biomass (in tons) of herring in September-October 2016.

YEAR	Sub_Div	AREA_CORR_FACTOR	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	21	1.55	11,744.00	3,128.46	348.65	58.27	12.80	17.00			
2016	22	1.02	9,035.01	1,071.02	667.85	219.98	460.25	193.75	69.42	45.54	43.48
2016	23	1.00	747.74	8,133.90	3,933.56	2,369.94	734.76	266.21	63.61	32.86	0.46
2016	24	1.00	8,045.93	9,774.86	11,842.75	27,353.06	22,284.89	11,329.91	6,397.28	3,100.37	1,173.60
2016	25	1.07	361.06	5,766.01	39,980.00	57,865.68	63,115.77	34,929.14	17,686.07	13,856.57	10,893.36
2016	26	1.01	99.73	4,994.28	34,205.16	39,585.82	77,485.78	35,798.89	46,923.20	31,065.76	25,930.54
2016	27	1.23	1,055.07	6,276.28	42,073.16	13,914.44	16,801.30	9,191.69	6,313.58	1,668.57	873.29
2016	28_2	1.01	242.52	1,510.49	40,203.45	14,658.72	19,850.73	11,949.26	1,806.20	2,820.91	3,825.25
2016	29	1.04	9,612.68	67,084.70	299,230.07	61,013.24	50,269.98	42,668.92	10,581.69	12,796.63	18,191.54
2016	30	1.07	2,430.35	39,717.14	168,661.27	87,569.23	61,905.64	42,943.69	22,624.56	28,482.93	100,058.19
2016	32	1.42	26,422.99	40,417.30	273,258.27	167,161.62	42,428.68	39,820.60	11,942.98	9,548.00	12,224.22

Table 5.1.1.3.4. Estimated biomass (in tons) of sprat in September-October 2016.

YEAR	Sub_Div	AREA_CORR_FACTOR	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	21	1.55	68.58	3,465.02	2,909.64	310.25	27.10				
2016	22	1.02	9,728.34	843.17	3,681.06	405.73	86.42	23.83			
2016	23	1.00	924.32	116.00	95.06	13.36	10.88	10.34	3.40		
2016	24	1.00	61,488.51	44,048.02	48,996.24	10,292.02	4,323.68	4,278.05	1,642.72	0.00	
2016	25	1.07	172.96	3,623.21	40,060.95	33,069.14	31,033.27	10,608.63	3,126.80	2,587.22	6,240.77
2016	26	1.01	6,625.99	15,517.66	135,539.17	41,983.55	21,042.91	7,260.88	3,426.32	1,467.48	1,581.29
2016	27	1.23	3,173.19	7,879.68	66,047.72	43,867.47	16,078.38	5,548.27	1,711.51	4,313.99	1,488.53
2016	28_2	1.01	13,185.65	27,164.69	191,901.19	78,668.17	27,792.22	12,325.62	3,903.15	3,412.45	5,137.34
2016	29	1.04	18,989.06	62,694.15	221,518.37	45,024.26	14,519.87	7,334.95	4,976.05	3,103.66	1,309.50
2016	30	1.07	2.01	17.07	703.79	480.16	293.41	159.19	106.94	173.87	400.09
2016	32	1.42	4,254.49	71,811.42	220,263.09	35,145.62	13,144.34	14,863.27	9,278.96	2,847.12	5,693.75

5.1.1.4. Tuning fleets for WGBFAS

5.1.1.4.1. Herring in the ICES Subdivisions 25–29

The tuning fleet for assessment of the Central Baltic herring (CBH) abundance in the ICES Subdivisions 25-29 per age groups and years 1991-2016 (BIAS) is presented in Figure 5.1.1.4.1.1, with inclusion of the data from the ICES SD 29N. The area corrected combined results (for age 1+ CBH) of the above-mentioned ICES subdivisions are presented in Table 1. The recruitment index for herring (age 0) in the ICES Subdivisions 25-29 is presented in Table 2.

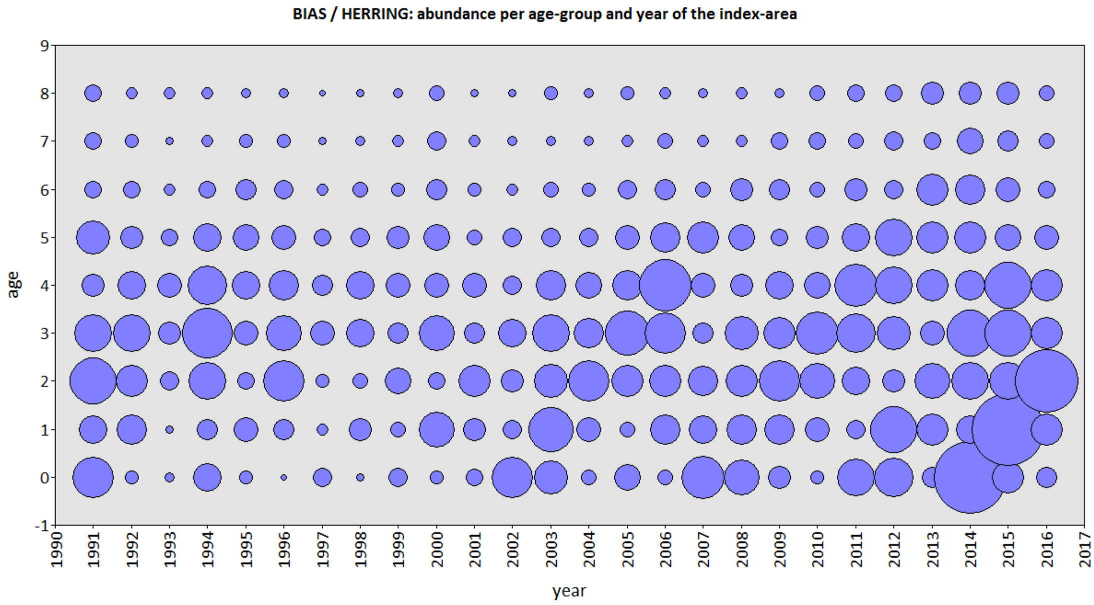


Figure 5.1.1.4.1.1. Autumn (BIAS) tuning fleet index (abundance per age groups and years 1991-2016) for herring in the ICES Subdivisions 25-29.

Table 1. *Whole time-series of tuning indices*. Autumn acoustic (BIAS) tuning fleet index (numbers in millions) for the Central Baltic herring (the ICES Subdivisions 25–27, 28.2 and 29, including the existing data of the ICES SD 29 North).

YEAR	HER_TOTAL_age1_8	HER_AGE1	HER_AGE2	HER_AGE3	HER_AGE4	HER_AGE5	HER_AGE6	HER_AGE	HER_AGE8+
1991	59,944.22	6,942.71	20,002.43	11,963.95	4,148.43	9,642.76	2,511.21	2280.03	2452.71
1992	45,994.83	7,416.92	9,155.99	13,177.55	7,156.18	4,107.91	2,273.74	1539.52	1167.03
1993	28,396.39	709.95	4,539.70	6,809.39	7,830.70	3,619.01	2,054.43	1089.66	1743.56
1994	57,157.97	3,924.41	11,881.25	20,303.84	11,526.53	5,653.24	2,098.90	940.75	829.04
1995	28,048.83	4,663.87	2,235.90	4,464.12	5,908.26	5,286.76	3,156.91	1503.95	829.06
1996	43,944.57	3,985.13	13,761.96	9,989.35	7,360.96	4,532.76	2,358.59	1178.87	776.94
1997	15,438.37	1,447.81	1,544.65	5,182.71	3,237.17	2,156.86	1,091.15	466.71	311.32
1998	24,922.96	4,285.08	2,170.72	6,617.17	6,520.67	2,584.07	1,523.58	791.27	430.41
1999	20,511.86	1,754.15	4,741.92	3,193.65	4,251.46	3,679.73	1,427.81	833.2	629.96
2000	40,924.36	10,151.18	2,560.04	9,873.66	4,837.59	5,200.35	3,234.04	3006.83	2060.67
2001	24,300.57	4,028.51	8,194.34	3,286.15	4,660.79	1,567.36	1,238.05	861.26	464.12
2002	20,672.28	2,686.92	4,242.02	6,508.41	2,842.26	2,326.29	869.78	741.28	455.3
2003	49,161.77	16,704.18	9,115.70	10,643.33	6,689.95	2,319.57	1,777.96	755.07	1156
2004	34,519.87	4,913.56	13,229.49	6,788.89	4,672.24	2,500.08	1,132.10	603.52	679.98
2005	41,760.33	1,920.24	8,250.78	15,344.88	7,123.19	4,355.80	2,540.70	1095.95	1128.8
2006	62,514.29	7,316.60	8,059.84	12,700.27	21,120.77	7,336.31	3,068.12	1700.65	1211.72
2007	29,634.05	5,400.70	6,587.26	2,974.88	4,191.03	7,092.91	1,696.87	882.93	807.46
2008	35,039.19	6,841.54	6,822.40	7,588.80	3,612.67	4,926.52	3,563.14	877.07	807.05
2009	38,653.24	6,408.78	12,141.39	6,820.28	5,551.44	2,058.64	2,969.48	2089.22	614
2010	37,891.76	3,829.47	8,278.75	12,047.60	5,006.24	3,542.80	1,684.71	1901.9	1600.3
2011	44,141.66	2,338.71	5,667.81	10,992.95	12,668.94	5,525.30	3,257.40	1448.43	2242.12
2012	51,695.69	14,947.97	3,630.05	7,544.67	9,345.39	9,199.52	2,684.65	2261.89	2081.55
2013	46,887.63	6,895.68	9,160.08	3,855.08	6,934.01	7,127.08	7,272.45	2154.28	3488.96
2014	59,146.09	5,086.33	10,113.93	15,408.71	5,916.49	7,369.87	6,664.24	4933.46	3653.07
2015	95,183.53	36,179.38	9,812.43	15,272.96	15,548.98	5,486.39	4,873.36	3648.14	4361.89
2016	58,080.31	6,816.07	27,755.94	7,191.25	7,274.97	4,046.34	2,031.95	1,492.42	1,471.37

<u>Note:</u> The coverage of the ICES Subdivision 29N was very inconsistent until 2007. In the years, 1993, 1995 and 1997 the total coverage was very poor. It is recommended that these data should not be used.

Table 2. Autumn acoustic (BIAS) recruitment index (age 0; numbers in millions) for the Central Baltic herring (the ICES Subdivisions 25-27, 28.2 and 29, including the existing data of the ICES SD 29 North).

YEAR	HER_AGE0
1991	13,732.73
1992	1,607.67
1993	1,297.73
1994	6,122.03
1995	1,356.71
1996	336.39
1997	4,050.41
1998	507.52
1999	2,591.05
2000	1,318.96
2001	2,122.76
2002	16,046.38
2003	9,066.54
2004	1,586.72
2005	5,567.63
2006	1,990.13
2007	12,197.22
2008	8,673.16
2009	3,365.99
2010	1,177.97
2011	10,098.28
2012	11,140.63
2013	3,068.44
2014	35,060.67
2015	7,661.72
2016	2,940.31

<u>Note:</u> The coverage of the ICES Subdivision 29N has been very inconsistent until 2007. In the years, 1993, 1995 and 1997 the total coverage was very poor. It is recommended that these data should not be used.

5.1.1.4.2. Sprat in the ICES Subdivisions 22–29

The tuning fleet for assessment of sprat abundance in the ICES Subdivisions 22-29 per age groups and years 1991-2016 (BIAS) is presented in Figure 5.1.1.4.2.1. The area corrected combined results (for age 1+ sprat) of the above-mentioned ICES subdivisions are presented in Table 3. The recruitment index for sprat (age 0) in the ICES Subdivisions 22-29 is presented in Table 4.

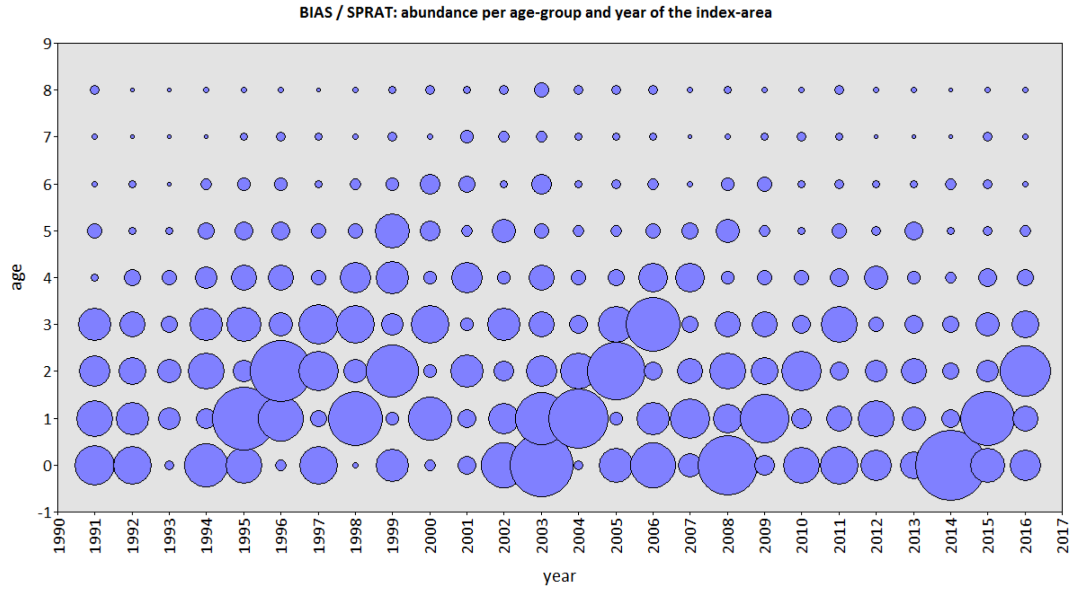


Figure 5.1.1.4.2.1. Autumn (BIAS) tuning fleet index (abundance per age groups and years 1991-2016) for sprat in the ICES Subdivisions 22-29.

Table 3. *Whole time-series of tuning indices*. Autumn acoustic (BIAS) tuning fleet index (numbers in millions) for Baltic sprat (the ICES Subdivisions 22–29).

YEAR	SPR_TOTAL_age 1_8	SPR_AGE1	SPR_AGE2	SPR_AGE3	SPR_AGE4	SPR_AGE5	SPR_AGE6	SPR_AGE7	SPR_AGE8
1991	149,058.78	46,487.55	40,298.51	43,681.07	2,743.40	8,923.78	1,850.70	1,956.55	3117.22
1992	102,482.10	36,519.48	26,991.22	24,050.54	9,289.37	1,920.67	2,436.59	714.03	560.2
1993	98,533.51	30,598.67	30,890.12	16,143.51	12,681.94	4,602.94	989.26	1,451.80	1175.27
1994	137,290.10	12,531.57	44,587.69	43,274.48	17,271.54	11,924.82	5,111.65	1,028.95	1559.41
1995	231,515.93	133,193.30	16,471.15	39,297.74	22,146.93	11,336.09	5,565.78	2,104.11	1400.83
1996	268,983.16	69,994.44	130,760.26	20,797.14	23,240.90	12,777.76	6,405.11	3,696.69	1310.87
1997	143,508.24	9,279.48	57,189.82	56,067.88	8,711.23	7,627.08	2,577.01	1,638.94	416.8
1998	229,727.74	100,615.48	21,975.06	55,422.01	36,291.46	8,055.62	4,734.54	1,623.02	1010.56
1999	195,727.24	4,892.39	90,049.98	15,989.26	35,716.70	38,820.46	5,230.64	3,289.62	1738.19
2000	153,298.39	58,702.70	5,284.94	49,634.73	5,676.06	13,932.76	15,834.60	1,554.39	2678.2
2001	107,308.72	12,047.44	35,686.65	6,927.47	30,236.94	4,028.43	9,605.64	6,369.57	2406.58
2002	118,874.55	31,208.71	14,414.86	36,762.80	5,733.13	18,735.12	2,638.09	5,036.99	4344.84
2003	213,176.57	99,128.90	32,269.59	24,035.40	23,198.49	8,015.62	13,163.37	4,830.62	8534.58
2004	199,357.55	119,497.31	47,026.76	11,638.43	7,928.99	4,875.78	2,449.65	2,388.71	3551.91
2005	204,805.07	7,082.11	125,148.06	48,723.56	10,035.20	5,115.68	3,010.70	2,364.40	3325.36
2006	201,584.17	36,531.26	11,773.53	103,289.44	32,411.85	7,937.24	4,582.91	2,110.57	2947.37
2007	120,744.73	51,888.04	21,665.20	8,174.54	26,102.00	9,800.35	1,066.69	470.39	1577.52
2008	127,064.04	28,804.63	45,117.75	20,134.34	5,350.44	18,819.87	5,678.43	1,241.37	1917.21
2009	145,140.98	77,342.78	25,333.42	20,839.86	6,546.99	4,667.38	7,023.48	2,011.35	1375.72
2010	88,295.36	12,048.42	51,771.79	10,275.01	6,594.51	1,880.19	1,951.11	2,591.36	1182.97
2011	99,587.07	20,620.08	11,656.53	43,356.67	9,989.74	6,746.61	2,614.83	1,794.67	2807.94
2012	90,590.08	40,515.77	16,525.13	7,935.32	18,412.56	3,494.33	1,732.67	606.20	1368.12
2013	71,926.85	19,407.84	20,363.57	11,448.00	5,683.54	11,219.11	1,771.30	759.48	1274.02
2014	40,768.24	10,447.80	8,623.21	9,735.00	4,695.08	2,033.89	3,778.55	681.04	773.67
2015	158,980.65	99,618.14	17,315.45	19,727.94	11,041.13	3,426.39	3,552.12	2,771.69	1527.78
2016	142,656.19	20,530.86	80,822.32	24,344.28	9,305.47	3,725.21	1,475.29	1,203.01	1,249.75

Note: In the years, 1993, 1995 and 1997 the coverage was very poor. It is recommended that these data should not be used.

Table 4. Autumn acoustic (BIAS) recruitment index (age 0; numbers in millions) for sprat (the ICES Subdivisions 22-29).

YEAR	SPR_AGE0
1991	59,472.84
1992	48,035.33
1993	5,173.57
1994	64,092.10
1995	44,364.82
1996	3,841.55
1997	45,947.64
1998	1,279.14
1999	33,320.45
2000	4,601.26
2001	12,000.66
2002	79,550.86
2003	146,334.99
2004	3,562.32
2005	41,862.94
2006	66,125.22
2007	17,821.04
2008	115,698.22
2009	12,798.16
2010	41,158.22
2011	45,186.05
2012	33,653.39
2013	24,694.37
2014	162,714.99
2015	36,900.25
2016	30,761.79

Note: In the years, 1993, 1995 and 1997 the coverage was very poor. It is recommended that these data should not be used.

5.1.1.4.3. Herring in the ICES Subdivision 30

The results from 2012 survey are not consistent with the results from other years due to lower area coverage than normally. In 2012, Sweden could not support the funding for the BIAS survey in the Bothnian Sea and therefore the coverage of the ICES SD 30 was based on the Finnish data only, which resulted in half of the normal effort. In 2013, Finland installed fishing equipment and the Simrad EK-60 echosounder into the R/V "Aranda" and used the vessel in order to cover all required ICES rectangles in the Bothnian Sea. In 2014, the distance of the acoustic transects and the numbers of realized fish control-hauls were done almost as planned. Not all of the 2014 herring age samples were available at the deadline-time of data delivery for the 2015 WGBIFS meeting and therefore there could be higher uncertainty in the 2014 age composition of the fish hauls. According to the procedure, delayed data cannot be taken into account for evaluation of the tuning data in the current year.

Tuning fleet data from the October 1991, 2000, 2007-2016 BIAS surveys are accessible for the assessment of the Gulf of Bothnian herring stock (the ICES Subdivisions 30-31), the area corrected combined results are presented in Table 5.1.1.4.3.1 and Figure 5.1.1.4.3.1.

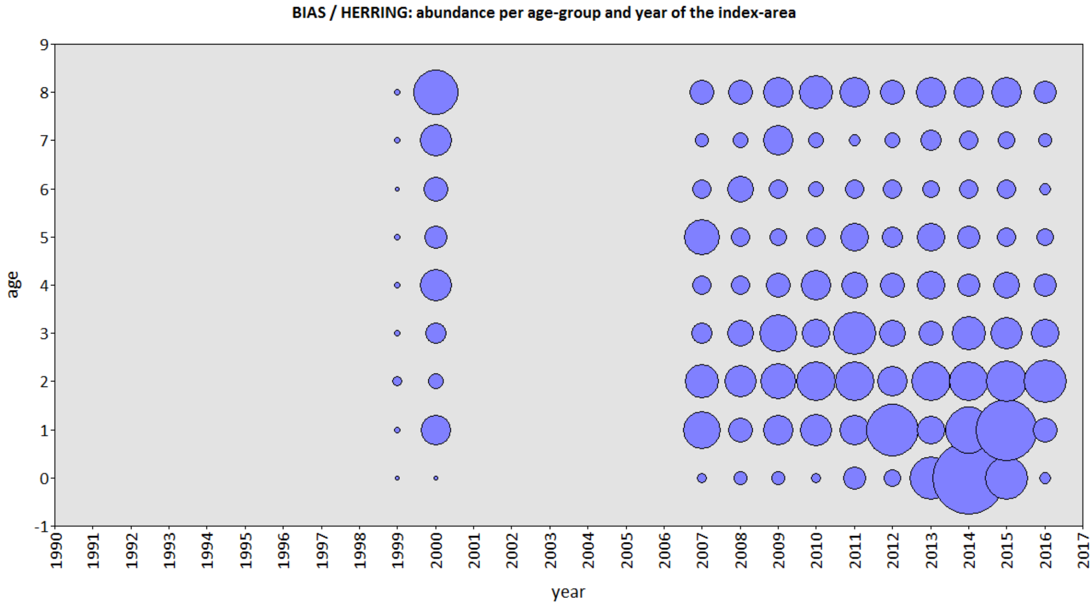


Figure 5.1.1.4.3.1. Autumn (BIAS) tuning fleet index (abundance per age groups and years 1999-2000 and 2007-2016) for herring in the ICES Subdivision 30.

Table 5.1.1.4.3.1. Correction factor and area corrected numbers (millions) of herring per age groups in the ICES Subdivision 30 (1999, 2000, 2007-2016).

YEAR	AREA_CORR_FACTOR	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
1999	1.28	100.45	187.68	561.32	252.25	228.34	252.55	140.65	156.24	188.65
2000	1.06	104.19	3 846.00	928.57	1 794.16	4 429.95	2 048.50	2 704.11	4 361.30	8 552.91
2007	1.06	442.53	5 670.78	4 916.19	1 845.69	1 507.59	5 254.43	1 441.11	826.08	2 347.95
2008	1.2	859.15	2 669.79	4 846.31	3 386.30	1 649.49	1 825.30	3 344.39	1 265.96	3 049.00
2009	1.06	679.46	3 573.39	5 089.63	5 558.51	2 438.03	1 282.91	1 518.46	3 615.98	3 757.41
2010	1.06	452.73	3 989.84	6 534.82	3 500.95	3 535.59	1 576.84	982.35	891.26	4 479.00
2011	1.06	2 041.68	3 699.81	6 100.51	7 384.00	3 086.23	3 133.75	1 442.21	641.73	3 870.69
2012	1.08	1 402.04	11 647.55	3 841.53	3 108.94	2 733.63	1 868.14	1 693.16	987.30	2 494.57
2013	1.11	8 358.81	3 306.48	6 645.52	2 843.18	3 486.22	3 386.11	1 434.66	1 771.46	3 946.95
2014	1.08	22 393.65	9 007.65	6 686.09	4 905.35	2 234.93	2 126.82	1 691.66	1 550.85	3 642.34
2015	1.21	8 949.47	17 996.57	8 079.44	4 637.48	3 507.45	1 844.19	1 681.52	1 331.19	4 362.95
2016	1.07	516.11	2461.71	7523.15	3435.98	2143.38	1348.59	656.18	754.88	2257.24

5.1.2. Combined results of the Baltic Acoustic Spring Survey (BASS)

In May–June 2016, the following acoustic surveys were conducted:

Vessel	Country	ICES Sub-divisions
BALTICA	Latvia-Poland	Parts of 26, 28,
BALTICA	Estonia-Poland	Parts of 28, 29, 32
DARIUS	Lithuania	Part of 26

5.1.2.1. Area under investigation and overlapping areas

The BASS-2016 surveys were realised by the above-mentioned countries in the ICES Subdivisions 26 (northern part), 28, 29 (south-east part only) and 32 (in one ICES rectangle) (Fig. 5.1.2.1.1). The area coverage of the Baltic Sea with the BASS/2016 survey was very poor. Due to the engine problems of the R/V "Walther Herwig III", Germany was unable to conduct the BASS survey. ICES Subdivisions 24, 25 and western parts of SD 26 and 28 remained thus uncovered. One statistical the ICES rectangle 45H0 was inspected by both, Estonia and Latvia however they covered different parts of that rectangle, therefore the data from both countries was used in the calculation of the indices.

During late spring, sprat is concentrated for spawning in the Baltic deeper basins. Herring stays at this time primarily in shallow water areas close to coasts however, small fraction of herring started to migrate to deeper waters for feeding after spawning. The portion of herring is much smaller than 10% in most monitored areas. These numbers should not be used for a real investigation of herring stock abundance.

Because of relatively small portion of herring (<10%) in comparison with sprat (>90%) in most of areas monitored during the BASS surveys only the distribution of sprat is further examined.

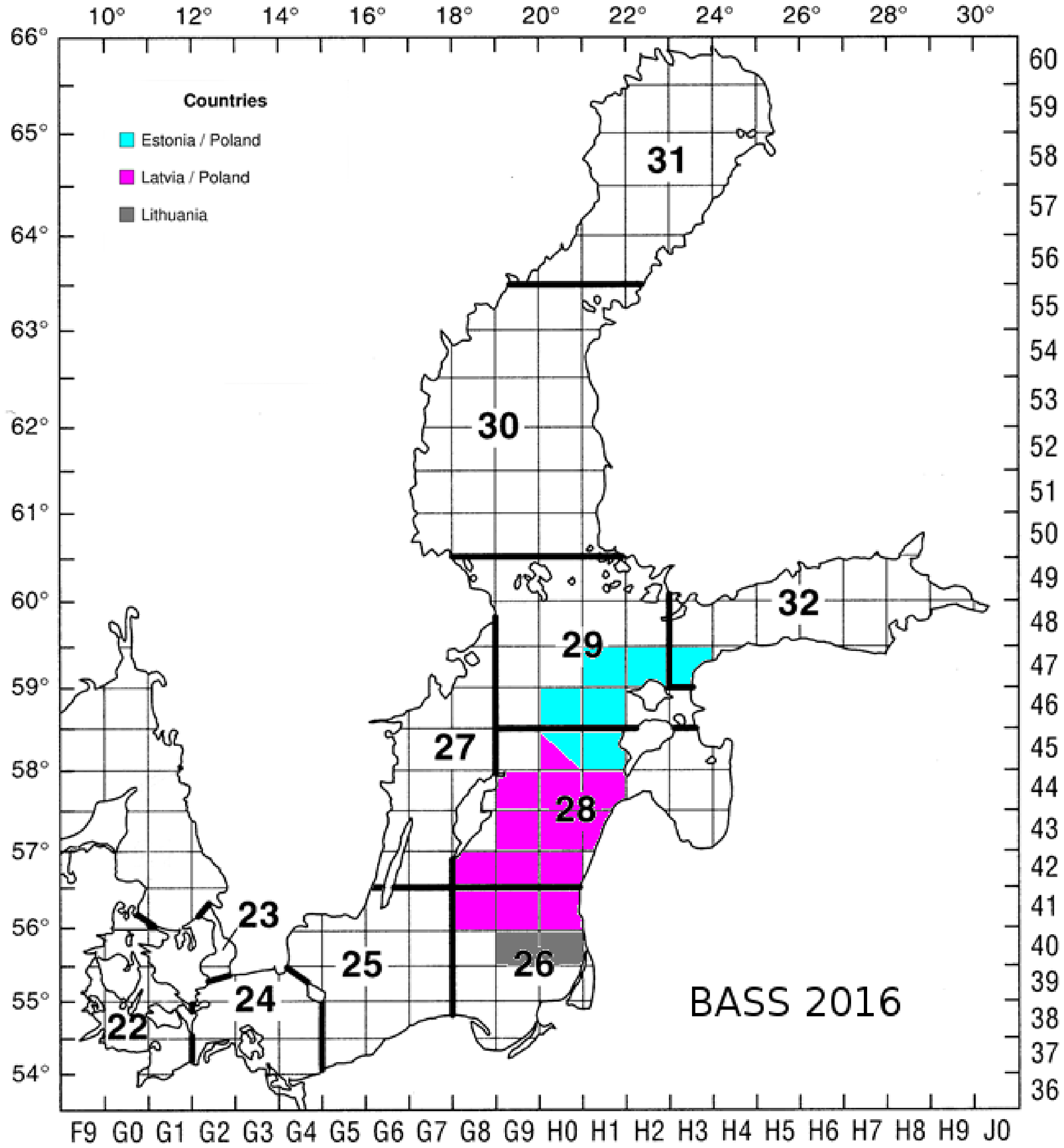


Figure 5.1.2.1.1. Map of the BASS survey conducted in May 2016. Various colours indicate the countries, which covered specific ICES rectangles and delivered data to the BASS-database, thus was responsible for this rectangle. Dot with different colour within a rectangle explain additional data in the BASS-database partly or totally covered by other countries.

5.1.2.2. Combined results and area corrected data

The geographical distribution of the sprat abundance per ICES rectangles monitored in May 2016 is demonstrated in Figure 5.1.2.2.1. The Baltic sprat stock abundance estimates per ICES rectangles and ICES subdivisions according to age groups are presented in Tables 5.1.2.2.1 and 5.1.2.2.2. During the WGBIFS 2006 meeting possible improvement of the results from acoustic surveys was discussed, and a correction factor for each ICES subdivision and year was introduced because of the coverage of the investigated areas differed in the years. This factor is the proportion to the total area of ICES subdivision (see the IBAS Manual) and the area of rectangles covered during the survey. The correction factors, calculated by ICES subdivisions for 2016 are included.

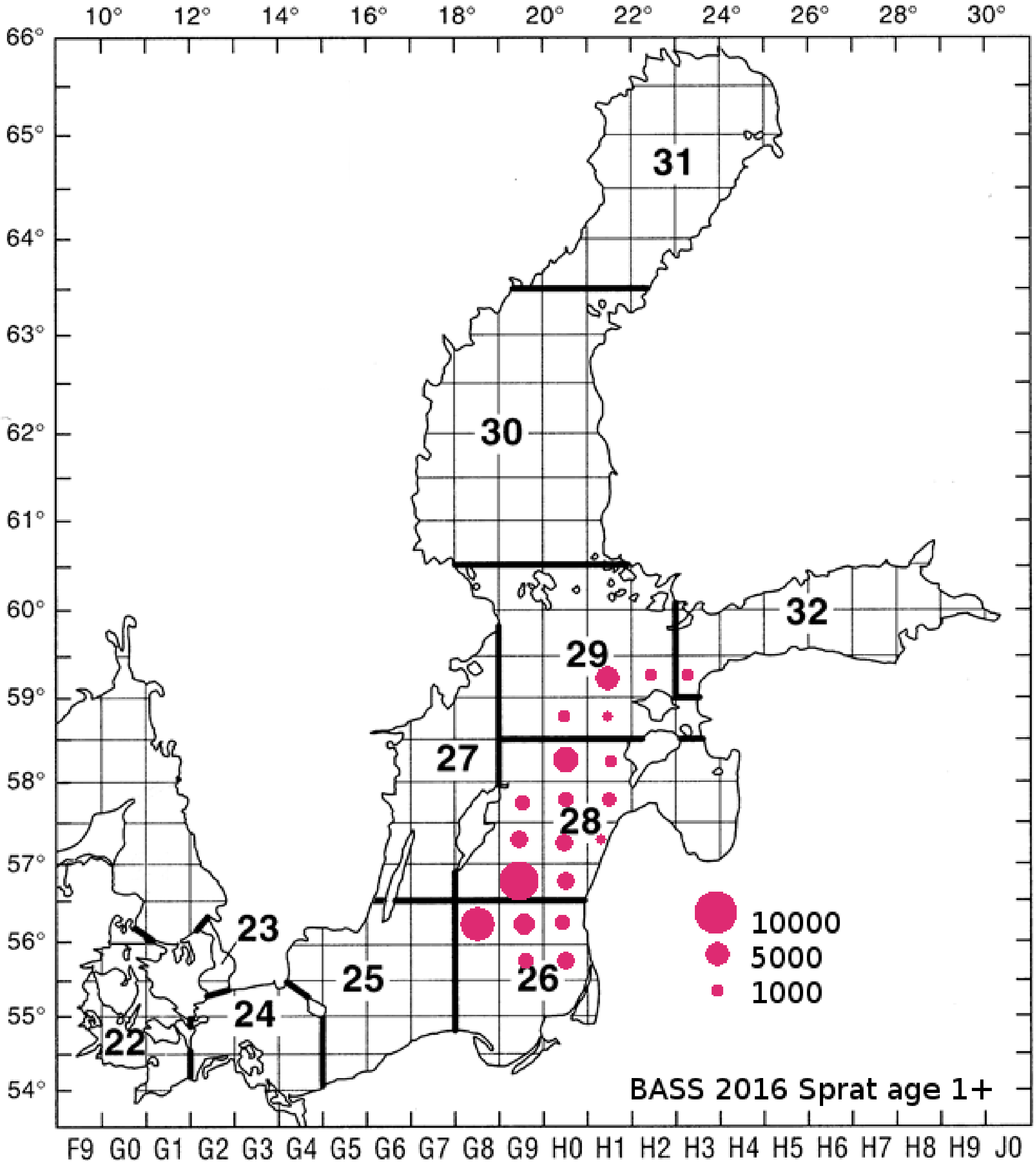


Figure 5.1.2.2.1. The abundance of sprat per ICES rectangles monitored in May 2016 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

Table 5.1.2.2.1. Estimated abundance (millions) of sprat in May 2016 per age groups and the ICES rectangles in given ICES subdivisions.

YEAR	Sub_Div	RECT	total	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	26	40G9	3,183.18	190.48	1,828.40	744.70	220.77	76.12	76.06	20.71	25.95
2016	26	40H0	4,281.74	1,035.24	1,603.79	1,047.48	323.91	134.78	62.11	60.47	13.97
2016	26	41G8	8,737.50	648.95	6,893.56	666.21	245.17	129.92		89.65	64.05
2016	26	41G9	4,794.57	539.32	3,778.31	222.36	151.19	71.70	8.02	16.69	6.98
2016	26	41H0	3,607.94	471.79	2,584.43	279.31	131.88	77.06	4.93	9.87	48.67
2016	28_2	42G9	9,197.97	1,529.58	6,536.54	484.90	309.00	174.18	91.98	34.55	37.23
2016	28_2	42H0	4,376.15	947.07	3,087.61	180.55	74.27	34.05	27.84		24.77
2016	28_2	43G9	4,379.09	322.73	3,345.43	288.45	250.68	98.13	55.70		17.96
2016	28_2	43H0	4,188.60	570.52	3,100.46	256.27	143.27	43.56	41.51	7.35	25.65
2016	28_2	43H1	1,219.58	222.31	818.94	93.48	48.31	18.85	11.78	5.89	
2016	28_2	44G9	3,619.96	423.92	2,868.45	149.34	65.04	65.72	17.89		29.59
2016	28_2	44H0	3,395.97	362.07	2,587.08	215.54	102.95	44.90	24.51		58.93
2016	28_2	44H1	2,967.59	426.28	2,073.78	204.37	135.23	67.15	33.30	10.15	17.34
2016	28_2	45H0	6,410.44	1,626.34	4,368.41	157.55	118.41	60.57	27.27	3.23	48.66
2016	28_2	45H1	3,660.99	909.87	2,485.44	92.29	62.89	49.29	34.06	5.59	21.56
2016	29	46H0	3,387.87	182.57	2,467.08	150.06	245.81	134.56	36.50	60.28	111.01
2016	29	46H1	2,344.49	289.93	1,679.86	67.55	126.81	81.26	19.50	23.95	55.63
2016	29	47H1	6,252.20	510.12	4,948.13	108.83	246.48	185.40	59.45	56.85	136.93
2016	29	47H2	2,340.62	18.08	1,851.88	59.68	156.94	100.59	34.37	35.56	83.52
2016	32	47H3	2,308.64	174.73	1,889.23	34.68	64.15	57.21		13.87	74.78

Table 5.1.2.2.2. Estimated numbers of sprat (millions) by ICES subdivisions, according to age groups (May 2016).

YEAR	Sub_Div	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	26	2,885.78	16,688.48	2,960.06	1,072.92	489.59	151.12	197.38	159.61
2016	28_2	7,340.69	31,272.15	2,122.73	1,310.06	656.40	365.84	66.76	281.69
2016	29	1,000.69	10,946.94	386.13	776.04	501.81	149.83	176.64	387.09
2016	32	174.73	1,889.23	34.68	64.15	57.21		13.87	74.78

5.1.2.2.1. Sprat in the ICES Subdivisions 24 – 28

Tuning Fleets for WGBFAS

The area corrected abundance estimates for sprat per ICES subdivision are summarized in Table 5.1.2.2.1.1. The corresponding biomass estimates of sprat are given in the Table 5.1.2.2.1.2. The complete time-series (2001 - 2016) of the area-corrected sprat abundance in the ICES Subdivisions 24-28 (without the Gulf of Riga) is given in the Table 5.

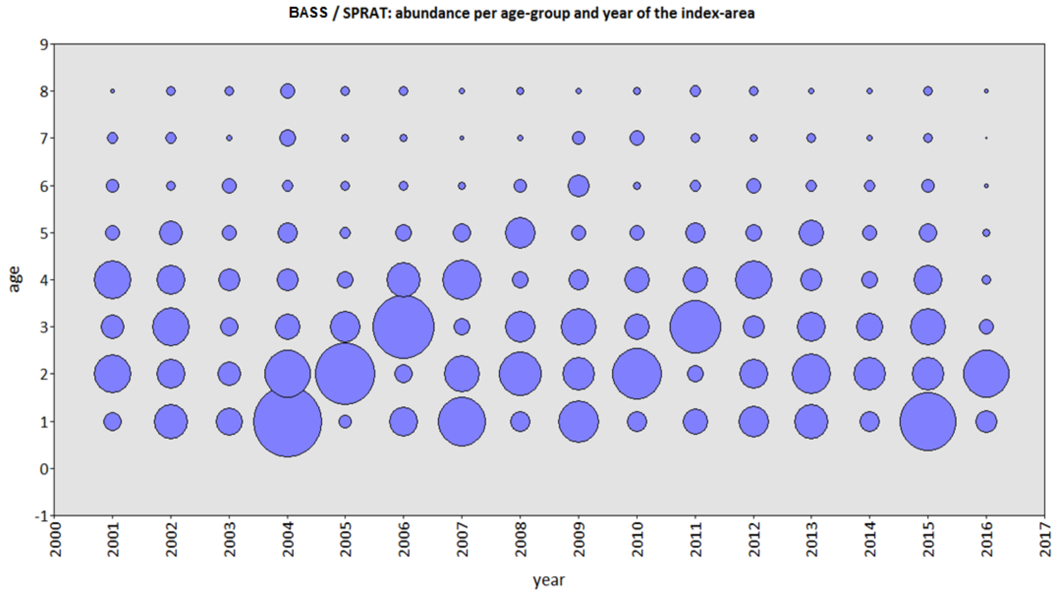


Figure 5.1.2.2.1.1. Spring (BASS) tuning fleet index (abundance per age groups and years 2001-2016) for sprat in the ICES Subdivisions 24-28.

Table 5.1.2.2.1.1. Area corrected numbers (millions) of sprat by ICES subdivisions and age groups (May 2016).

YEAR	Sub_Div	AREA_CORR_FACTOR	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	26	2.175176766	6,277.07	36,300.40	6,438.65	2,333.78	1,064.95	328.71	429.34	347.18
2016	28_2	1.263863342	9,277.64	39,523.72	2,682.84	1,655.74	829.60	462.37	84.38	356.02
2016	29	2.844712138	2,846.68	31,140.91	1,098.42	2,207.62	1,427.50	426.23	502.49	1,101.15
2016	32	13.98209584	2,443.13	26,415.34	484.86	896.90	799.92		193.95	1,045.54

Table 5.1.2.2.1.2. Corrected sprat biomass (in tonnes) according to ICES subdivisions and age groups (May 2016).

YEAR	Sub_Div	AREA_CORR_FACTOR	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2016	26	2.175176766	23,714.35	245,484.34	51,426.47	22,386.11	11,149.03	3,670.64	4,683.31	3,931.22
2016	28_2	1.263863342	31,716.83	241,880.15	22,789.05	16,729.13	8,231.45	4,703.59	900.33	3,759.11
2016	29	2.844712138	8,704.07	165,886.05	7,383.83	17,778.55	12,038.64	4,056.52	4,808.76	10,051.15
2016	32	13.98209584	5,744.33	124,050.32	3,702.75	7,477.98	6,688.73		2,146.29	9,431.21

Table 5. *Whole time-series of tuning indices*. Spring acoustic (BASS) tuning fleet index (numbers in millions) for Baltic sprat (the ICES Subdivisions 24-28 without GoR).

YEAR	SPR_TOTAL	SPR_AGE1	SPR_AGE2	SPR_AGE3	SPR_AGE4	SPR_AGE5	SPR_AGE6	SPR_AGE7	SPR_AGE8
2001	109 404.16	8 225.02	35 734.86	12 970.86	37 327.77	5 384.44	4 635.49	4 526.01	599.71
2002	125 782.95	27 412.12	18 982.00	36 813.57	19 044.89	14 758.59	2 517.12	3 669.81	2 584.85
2003	84 986.61	26 468.98	16 471.45	8 422.95	15 532.70	5 653.45	7 169.73	1 660.01	3 607.34
2004	258 606.73	136 162.06	65 565.92	15 783.74	11 042.29	12 655.24	3 270.65	7 805.79	6 321.05
2005	134 373.52	4 358.61	88 829.99	23 556.64	7 258.25	3 516.63	2 780.51	1 829.96	2 242.94
2006	130 287.13	13 416.63	7 980.49	76 703.20	21 045.81	5 701.71	1 970.41	1 525.76	1 943.11
2007	132 637.19	51 568.74	28 713.21	6 377.16	36 006.21	7 480.56	1 261.14	532.65	697.52
2008	102 722.51	9 029.20	40 269.65	20 164.14	5 627.08	21 187.94	4 209.97	757.16	1 477.38
2009	139 641.22	39 412.17	26 701.03	36 255.42	10 548.51	6 312.12	14 106.27	5 341.22	964.48
2010	112 784.60	9 387.20	58 680.01	15 199.18	15 963.48	5 061.93	1 653.59	5 566.35	1 272.87
2011	128 153.97	18 091.69	6 790.99	66 159.99	16 689.00	10 564.65	4 076.69	2 399.13	3 381.83
2012	107 660.52	22 699.62	22 079.78	11 274.09	35 541.24	7 515.42	5 024.69	1 367.20	2 158.48
2013	111 418.65	24 876.63	35 333.30	18 392.57	11 357.94	14 959.37	3 385.50	2 163.71	949.62
2014	76 549.35	10 144.65	26 906.62	19 857.10	7 457.71	6 098.20	3 810.12	1 217.38	1 057.57
2015	160 548.72	70 752.42	24 659.60	29 744.21	18 934.79	8 080.81	4 074.30	2 581.47	1 721.12
2016	108 392.40	15 554.71	75 824.12	9 121.48	3 989.53	1 894.54	791.08	513.72	703.20

Note: In year 2016, the inspected area coverage was very poor. It is recommended that these data should not be used.

Annex: ToR b) Update the BIAS and BASS acoustic databases

5.2. ToR b) Update the BIAS and BASS acoustic databases

After validation, the international data from the Baltic International Acoustic Survey (BIAS) and the Baltic Acoustic Spring Survey (BASS) curried out in 2016 were added to the BIAS_DB.mdb and the BASS_DB.mdb Access-databases, respectively. These databases also include queries with the used algorithms for creation of report tables and calculation of the different tuning fleets. The updated versions of the databases are located in the folder "Data" of the ICES WGBIFS-2017 SharePoint. A data transmission error was found shortly after WGBIFS-2016 meeting and corrected at checking the database (BIAS 2011, the ICES rectangles 37G8 and 40G7, missing herring datasets in the Tables 6 and 7). The correction caused changes <0.25% of the herring tuning fleets in 2011.

The results of the next international acoustic surveys (BIAS, BASS) should be summarized in table format according the IBAS Manual and latest one month before the next year meeting uploaded to the ICES WGBIFS-SharePoint. Simultaneously the acoustic-trawl data from both types of surveys should be also uploaded to the newly created database, linked with the StoX programme.

O. Kaljuste and N. Larson from Sweden were assigned as the above-mentioned (old-type) acoustic-trawl data coordinators, responsible to control that the acoustic survey results are uploaded in the right format to the ICES WGBIFS-SharePoint. Moreover, G. Kruk from Poland was assigned as the manager of the BIAS and BASS databases for aggregated data (old-type). G. Kruk in cooperation with particular national submitters will check the integrated data for errors and preliminary analysis will be performed in order to present the data to the WGBIFS meeting for further evaluations and discussion. If the countries do not submit the data to database manager in the agreed time, this work cannot be done during the WGBIFS annual meeting with the required quality. Furthermore, O. Kaljuste (Sweden) and J. Lilja (Finland) were assigned as the new-type acoustic-trawl data coordinators; the data from BIAS and BASS surveys should be uploaded before the next WGBIFS meeting to the ICES Data Center database, using the StoX programme software.

Annex: ToR c) Plan and decide on acoustic surveys to be conducted in autumn 2017 and spring 2017-2018

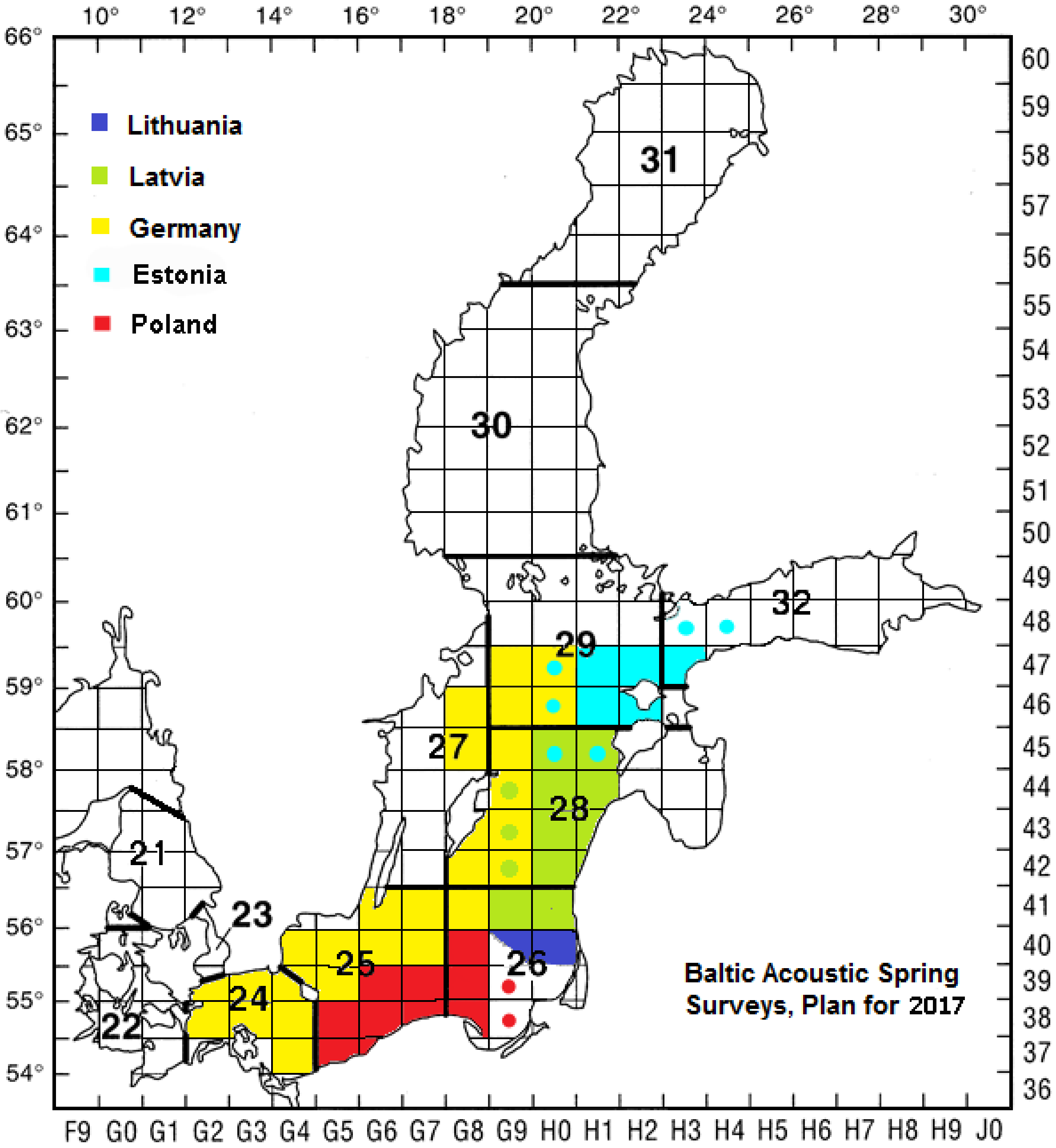
5.3.1. Planned acoustic survey activities

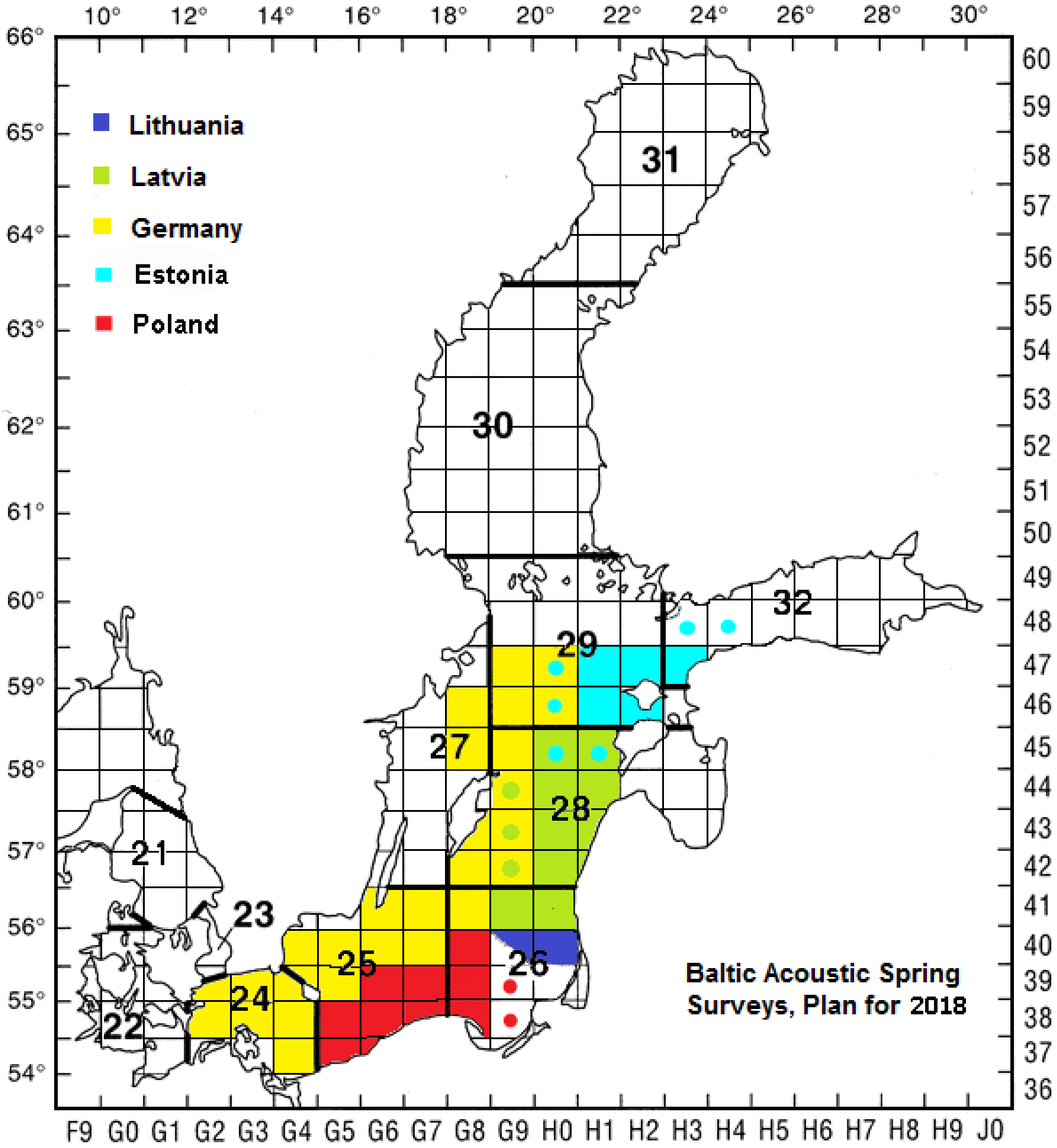
All the Baltic Sea countries (with the exception of Russia – St. Petersburg) intend to take part in the autumn BIAS acoustic surveys and experiments in 2017. There is also an intention to conduct the traditional Latvian/Estonian herring acoustic survey in the Gulf of Riga on July/August 2017 and 2018. Germany, Lithuania, and the joint Latvian-Polish and Estonian-Polish BASS surveys will be continued in May 2017-2018 too. In May 2017 is planned for the first time (after long-time break) the Polish BASS survey in the Polish EEZ. The list of participating research vessels and initially planned periods of particular surveys are given in tables below and the Figures 5.3.1.1-5.3.1.3 reflects areas, which will be covered with acoustic-trawl investigations during planned BASS and BIAS surveys (2017-2018).

Vessel	Country	Area of investigations (ICES subdivisions)	(Preliminary) Period of investigations (**BASS-2017**)	Duration (days)
Walther Hervig III	Germany	24, 25, 26 (part), 28 (part)	03-24.05.2017	21
Baltica	Latvia-Poland	26, 28	18-25.05.2017	8
Baltica	Estonia-Poland	28(part), 29E, 32	26-31.05.2017	5
Darius	Lithuania	26 (the Lithuanian EEZ)	beginning of May 2017	2
Baltica	Poland	24 (part), 25 (part), 26 (part)	02-13.05.2017	12

Vessel	Country	Area of investigation (ICES subdivisions)	(Preliminary) Period of investigations (**BIAS-2017**)	Duration (days)
Solea	Germany	21, 22, 23, 24	04-24.10.2017	21
Darius	Lithuania	26(part)	October 2017	2
Baltica	Latvia-Poland	26, 28	11-20.10.2017	10
Baltica	Poland	24(part), 25, 26	18-30.09.2017	18
Dana	Sweden	27, 25, 26, 28, 29	05-20.10.2017	16
Baltica	Estonia-Poland	28, 29, 32	21-31.10.2017	11
Dana	Finland	29N, 32N, 30	21.10-01.11.2017	12
Atlantniro	Russia	26	October 2017	10

Vessel	Country	Area of investigation (ICES subdivisions)	(Preliminary) Period of investigations (**BASS-2018**)	Duration (Days)
Walther Hervig III	Germany	24, 25N, 26SW, 28W, 29 (part)	May 2018	20
Baltica	Poland	24 (part), 25 (part), 26 (part)	May 2018	10
Baltica	Estonia-Poland	28 (part), 29 (part), 32 (part)	May 2018	5
Baltica	Latvia-Poland	26 (part), 28 (part)	11-19.05.2018	8
Darius	Lithuania	26 (the Lithuanian EEZ)	May 2018	2


Lithuania
Latvia
Germany
Estonia
Poland
Baltic Acoustic Spring
Surveys, Plan for 2017
10° 12° 14° 16° 18° 20° 22° 24° 26° 28° 30°
66° 65° 64° 63° 62° 61° 60° 59° 58° 57° 56° 55° 54°
60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36
F9 G0 G1 G2 G3 G4 G5 G6 G7 G8 G9 H0 H1 H2 H3 H4 H5 H6 H7 H8 H9 J0
21 22 23 24 25 26 27 28 29 30 31 32



Lithuania
Latvia
Germany
Estonia
Poland
Baltic Acoustic Spring Surveys, Plan for 2018
10° 12° 14° 16° 18° 20° 22° 24° 26° 28° 30°
66° 65° 64° 63° 62° 61° 60° 59° 58° 57° 56° 55° 54°
60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36
F9 G0 G1 G2 G3 G4 G5 G6 G7 G8 G9 H0 H1 H2 H3 H4 H5 H6 H7 H8 H9 J0
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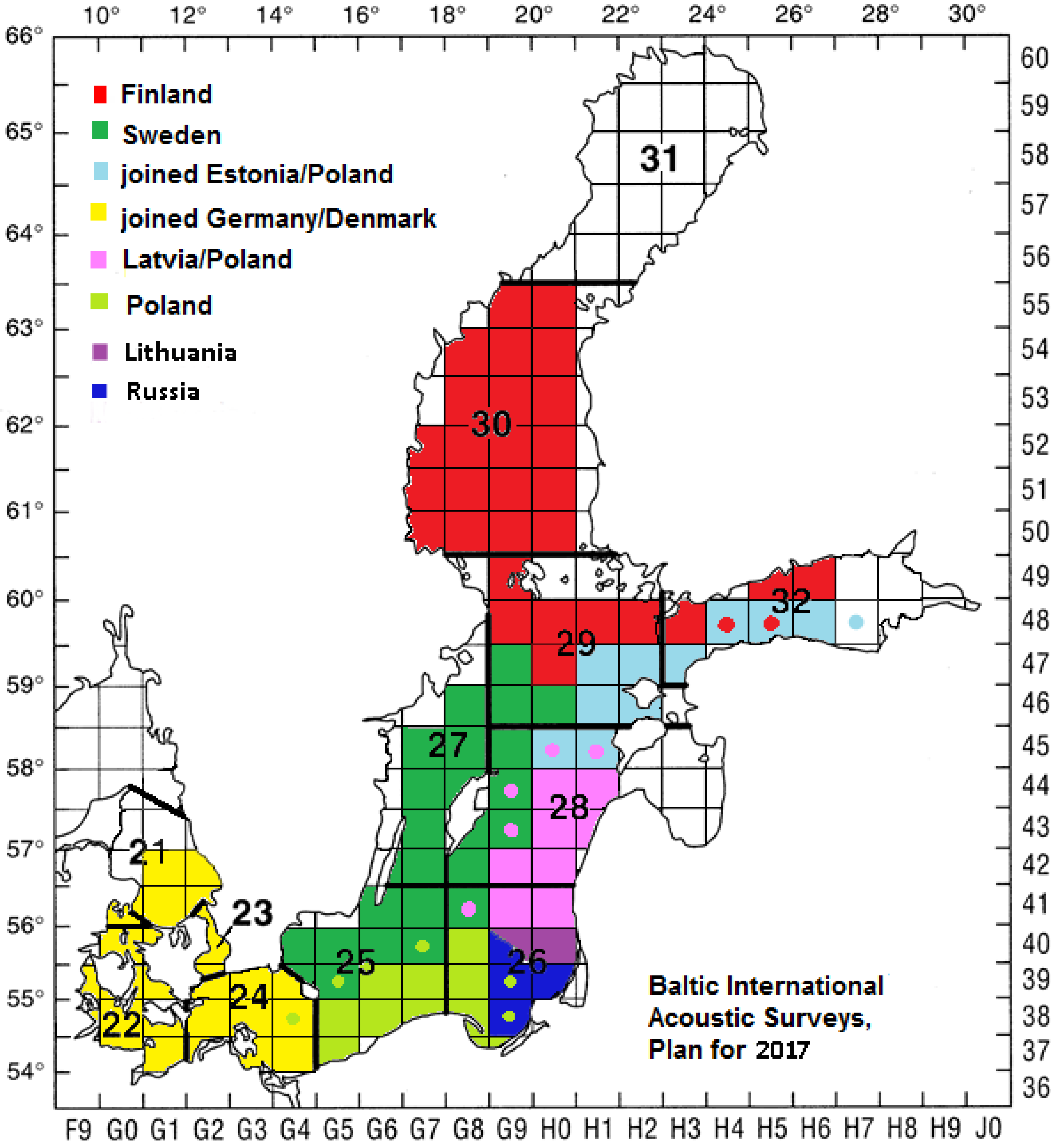


Figures 5.3.1.1–5.3.1.3. The planned coverage of the Baltic Sea and the assignment of the national/joint acoustic surveys to the ICES rectangles during the May 2017 and 2018, and September/October 2017 surveys (from top to bottom). Base colours of rectangles indicate the country or joint survey, which is responsible for this ICES rectangle. Coloured dots indicate overlapping coverage by other countries (sometimes only parts of rectangle are covered).

Annex ToR d) Discuss the results from BITS surveys performed in autumn 2016 and spring 2017

5.4.1. BITS 4th quarter 2016

During the BITS-Q4/2016 surveys the level of realized valid hauls was relatively high (94%) vs. planned and Denmark, Germany, Estonia, Poland, Sweden, Russia, Lithuania and Latvia participated in cruises in the ICES Subdivisions 20-29 (Table 5.4.1.1, Figure 5.4.1.1). Sweden was able to substitute most of the allocated catch-stations, which the Swedish military prohibited to inspect.

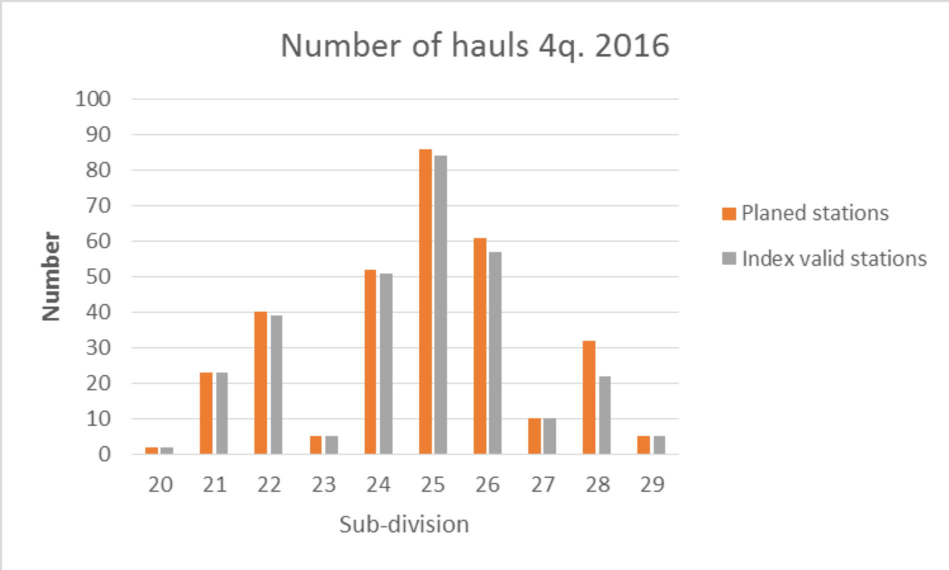


Figure 5.4.1.1. Comparison of the planned (BITS-Q4 2016) and the index-valid catch-stations by ICES subdivisions and depth layers.

Table 5.4.1.1. Comparison of the planned fishing-stations and realized during the BITS-Q4 2016 by ICES subdivisions and depth layers.

ICES subdivi-sions	Gear (TVL,TVS)	Depth strata (1–6)	Number of hauls planed	Number of valid hauls realized using “standard” ground trawl	Number of valid hauls realized using rock-hoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
21	TVS	1	5	5	0	0	0	0	100
21	TVS	2	13	13	0	0	0	0	100
21	TVS	3	1	1	0	0	0	0	100
21	TVS	4	3	3	0	0	0	0	100
21	TVS	5	1	1	0	0	0	0	100
21	TVS	ALL	23	23	0	0	0	0	100
22	TVS	1	30	28	0	0	1	2	97
22	TVS	2	10	10	0	0	0	0	100
22	TVS	ALL	40	38	0	0	1	2	98
23	TVS	1	4	4	0	0	0	0	100
23	TVS	2	1	1	0	0	0	0	100
23	TVS	ALL	5	5	0	0	0	0	100
24	TVS	1	18	17	0	0	1	0	100
24	TVL/TVS	2	30	28	0	0	0	0	93
24	TVL	3	4	5	0	0	0	0	125
24	TVL/TVS	ALL	52	50	0	0	1	0	98
25	TVL	2	14	13	0	0	0	1	93
25	TVL	3	30	28	0	0	2	0	100
25	TVL	4	29	27	0	1	0	0	97
25	TVL	5	13	12	0	0	0	0	92
25	TVL	6	0	1	0	0	0	0	NA
25	TVL	ALL	86	81	0	1	2	1	98
26	TVL/TVS	2	8	7	0	0	0	0	88
26	TVL/TVS	3	11	10	1	0	0	0	100
26	TVL/TVS	4	15	10	1	2	0	0	87
26	TVL/TVS	5	19	15	1	2	1	0	100
26	TVL	6	8	5	1	1	0	0	88
26	TVL/TVS	ALL	61	47	4	5	1	0	93

27	TVL	3	2	0	0	0	0	0	0
27	TVL	4	4	4	0	1	1	0	150
27	TVL	5	1	0	0	1	0	0	100
27	TVL	6	3	0	0	2	1	0	100
27	TVL	ALL	10	4	0	4	2	0	100
28	TVL	2	7	0	2	0	0	1	29
28	TVL/TVS	3	9	5	3	0	1	0	100
28	TVL/TVS	4	11	3	5	1	0	0	82
28	TVL	5	5	0	0	2	0	0	40
28	TVL/TVS	ALL	32	8	10	3	1	1	69
29	TVS	2	2	2	0	0	0	0	100
29	TVS	3	2	2	0	0	0	0	100
29	TVS	4	1	1	0	0	0	0	100
29	TVS	ALL	5	5	0	0	0	0	100
ALL SD		ALL	314	261	14	13	8	4	94.3

5.4.2. BITS 1st quarter 2017

During the BITS-Q1/2017 surveys the level of realized valid hauls was very high (99%) vs. planned. The above-mentioned surveys were realised by Denmark, Germany, Poland, Sweden, Lithuania and Latvia in the ICES Subdivisions 22-28 (Table 5.4.2.1, Figure 5.4.2.1).

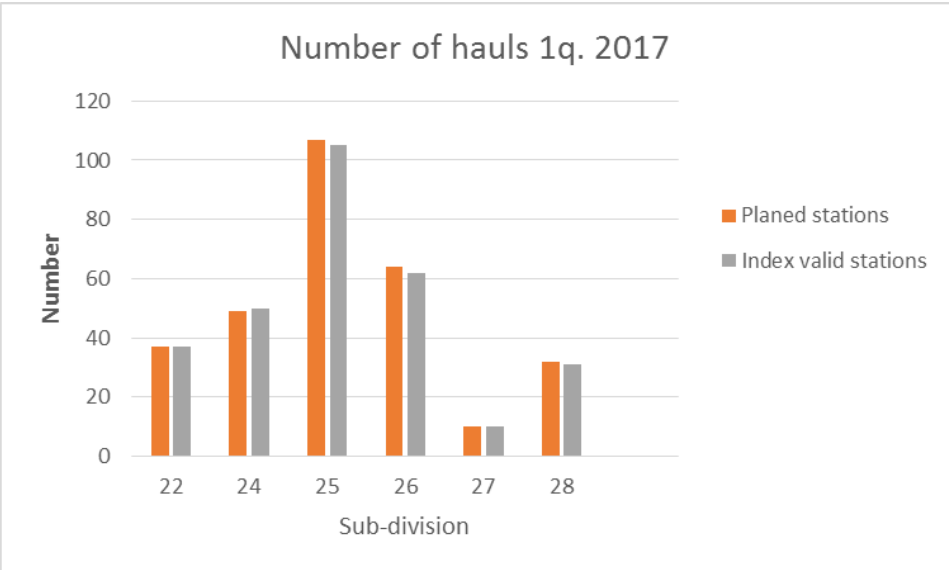


Figure 5.4.2.1. Comparison of the planned and the index-valid fishing-stations by ICES subdivisions and depth layers (the BITS-Q1/2017).

Table 5.4.2.1. Comparison of the planned and realized control-catches by ICES subdivisions and depth layers (the BITS-Q1/2017).

ICES subdivi-sions	Gear (TVL, TVS)	Depth strata (1–6)	Number of hauls planed	Number of valid hauls realized using "standard" ground trawl	Number of valid hauls realized using rock-hoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
22	TVS	1	29	28	0	0	1	0	100
22	TVS	2	8	8	0	0	0	0	100
22	TVS	ALL	37	36	0	0	1	0	100
24	TVS	1	20	20	0	0	1	0	105
24	TVL/TVS	2	26	24	0	0	2	1	100
24	TVL	3	3	3	0	0	0	0	100
24	TVL/TVS	ALL	49	47	0	0	3	1	102
25	TVL	2	18	17	0	0	0	0	94
25	TVL	3	39	35	0	0	2	1	95
25	TVL	4	38	35	0	0	0	0	92
25	TVL	5	12	15	0	0	0	0	125
25	TVL	6	0	1	0	0	0	0	NA
25	TVL	ALL	107	103	0	0	2	1	98
26	TVL/TVS	2	9	8	0	0	0	0	89
26	TVL/TVS	3	14	13	1	0	0	0	100
26	TVL/TVS	4	17	16	1	0	0	0	100
26	TVL/TVS	5	21	18	1	1	0	0	95
26	TVL	6	3	1	1	1	0	0	100
26	TVL/TVS	ALL	64	56	4	2	0	0	97
27	TVL	3	2	2	0	0	0	0	100
27	TVL	4	4	1	0	3	0	0	100
27	TVL	5	1	0	0	1	0	0	100
27	TVL	6	3	0	0	3	0	0	100
27	TVL	ALL	10	3	0	7	0	0	100
28	TVL	2	7	1	4	0	1	0	86
28	TVL	3	9	3	5	0	1	0	100
28	TVL	4	10	1	9	0	0	0	100
28	TVL	5	6	0	4	1	0	0	83
28	TVL	6	0	0	1	0	0	0	NA
28	TVL	ALL	32	5	23	1	2	0	97
ALL SD		ALL	299	250	27	10	8	2	99

5.4.3. Update and the re-programming of BITS catch-stations allocation from the Tow-Database

To speed up the process of preparation the final version of the Tow-Database it is necessary that all countries submit the feedback immediately after the BITS survey accomplishment (see ToR d). Some catch-stations were deleted or were corrected in the Tow-Database dependent on the information of the different countries. More than 90% of the catch-stations, which are stored in the Tow-Database, were already successfully used at least one time. It should be underlined that the standard groundrope of the TV-3 trawl must be used when the catch-station was successfully carried out during earlier surveys with this gear.

The feedbacks from BITS surveys inserted into the Tow-Database should contain information about:

- ICES subdivision,
- start and end position (latitude, longitude) of trawling of particular haul,
- ship course during fishing,
- mean seabed depth,
- bottom depth range,
- codes of the running hauls,

- evaluation the process of realised catch-stations and e.g. explanation of reason for deleting the given haul from the T-D.

Full set of codes for characterizing the different type of realization of hauls was defined and is presented in WGBIFS-2016 Report, Annex ToR e, Ch. 5.5.2.1. Moreover, the current used structure of the Tow-Database was described in the WGBIFS 2005 Report and in the BITS Manual.

The re-programming of BITS catch-stations allocation from the Tow-Database

Discussed and initially agreed during the WGBIFS-2017 meeting a new re-programming of BITS catch-stations allocation from the Tow-Database is summarized in the ToR d and widely described in the working paper "Allocation of BITS hauls from TD" (Annex 8). The program is made in *R*, provides the list of hauls from the Tow-Database to be fished by each participating countries, and replaces the existing procedure consisting of a combination of various software. The program follows the same method as already agreed by the WGBIFS and used in the past, but includes an additional module, which makes it possible to request extra hauls during the ongoing survey. This module allows drawing additional hauls to the regular allocated hauls if excess survey time is available. The additionally catch-stations cannot be made in other countries EEZ without permission and therefore the hauls must be situated in the own EEZ or international zone.

5.4.3.1. Reworking of the Database of Trawl Surveys (DATRAS)

During the WGBIFS-2017, meeting any essential changes in the Database of Trawl Surveys (DATRAS) wasn't made. Hitherto existing changes were described in the WGBIFS-2016 Report (incl. annexes) and some minor incorrectness is listed in Annex 10 to this year report.

Annex ToR e) Plan and decide on demersal trawl surveys and experiments to be conducted in autumn 2017 and spring 2018

The procedure used for allocating ground trawl catch-stations to ICES subdivisions and depth layers was described in Annex ToR e of the WGBIFS-2015 Report (see also Annex 3 "Method used for planning the BITS" of the WGBIFS-2004 Report). The method for allocating catch-stations to the ICES SDs was slightly adapted in 2015, according to the new definition of the stock structure of cod in the Baltic Sea, created during WKBALTCOD in March 2015. The most of institutes intend to participate in the BITS-Q4/2017 and BITS-Q1/2018 surveys have nearly the same plans regarding the numbers of control-hauls as in the previous seasons, but location of the catch-stations per country was significantly revised during the WGBIFS-2016 meeting.

The planning of catch-stations in the ICES SDs 24, 25 and 26 in the framework of the BITS-Q4/2017 and the BITS-Q1/2018 was partly influenced by the rule introduced in February 2016 by the Polish government, concerning the work of international research vessels in the Polish EEZ. Accordingly, to this new rule an administrative observer of the government must be on board of the international research vessels if they work in the Polish EEZ. The position of Denmark and Germany is still that they will not realize fishing stations in the Polish zone (as was previously) during the next BITS surveys among-others due to applied the above-mentioned rule.

The total number of catch-stations committed by the countries and ICES subdivisions in the framework of the BITS-Q4/2017 and the BITS-Q1/2018 is listed in Table 5.5.1. Allocated ground trawl hauls by ICES subdivisions and the depth layers for autumn survey in 2017 are presented in Table 5.5.2 and the corresponding allocation for spring 2018 in Table 5.5.3. According to the recommendations of the WGBIFS-2011 meeting, all countries involved in realization of the BITS catch-stations should upload to DATRAS information related to all fished species.

Table 5.5.1. Total numbers of catch-stations planned by particular countries during the BITS surveys in autumn 2017 and spring 2018.

COUNTRY	VESSEL	NUMBER OF PLANNED STATIONS IN AUTUMN 2017	NUMBER OF PLANNED STATIONS IN SPRING 2018
Germany	Solea	57	60
Denmark	Havfisken	27	27
Poland	Baltica	3	7
	Total 22 + 24	87	94
Denmark	Dana	50	50
Estonia	commercial vessel	5	0
Finland	Aranda	0	0
Latvia	Baltica	25	25
Lithuania	Darius	6	6
Poland	Baltica	57	74
Russia	Atlantniro/Atlantida	0	0
Sweden	Dana	30	50
	Total 25 - 28	173	205
	Total 22, 24 - 28	**260**	**299**

Table 5.5.2. Allocation of planned fishing-stations by ICES subdivisions and depth layers in autumn 2017 (BITS-Q4).

	ICES SUBDIVISION						
DEPTH LAYER [M]	22	24	25	26	27	28	TOTAL
10 – 39	29	24	22	8	0	7	90
40 – 59	5	13	24	9	2	7	60
60 – 79	0	16	24	12	4	9	65
80 – 100	0	0	14	14	4	5	37
100 – 120	0	0	0	8	0	0	8
Total	**34**	**53**	**84**	**51**	**10**	**28**	**260**

Table 5.5.3. Allocation of planned catch-stations by ICES subdivisions and depth layers in spring 2018 (BITS-Q1).

	ICES SUBDIVISION						
DEPTH LAYER [M]	22	24	25	26	27	28	TOTAL
10 – 39	33	25	26	9	0	8	101
40 – 59	5	14	31	10	2	8	70
60 – 79	0	17	29	16	4	11	77
80 – 100	0	0	16	16	4	6	42
100 – 120	0	0	0	9	0	0	9
Total	**38**	**56**	**102**	**60**	**10**	**33**	**299**

Annex ToR h) Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty. Review the progress of the ICES acoustic-trawl survey database design and the development of the StoX software

5.8.2. Review the progress of the ICES acoustic-trawl survey database design and the development of the StoX software

Acoustic surveys provide important fishery-independent estimates for Baltic herring and sprat stocks resource and because of this all analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty are very needed.

The important phase in an improvement of the IBAS surveys acoustic and biotic data storage and utilization is implementation of the StoX software (programme), elaborated under the "AtlantOS" project and managed by the ICES Data-Center. The ICES acoustic data portal is accessible at *http://ices.dk/marine-data/data-portals/Pages/acoustic.aspx*.

One day of the WGBIFS-2017 meeting was devoted special deliberation, connected with exercises, which can be named "Review the progress of the ICES acoustic-trawl survey database design and the development of the StoX software to enable usage of IBAS methodology for the calculation of acoustic estimates based on the WGBIFS data". The evaluation of status of the StoX programme development, was the additional, however essential task of the WGBIFS-2017 meeting. Because of this fact, a small group of experts invited by WGBIFS chair and the sub-group of the WGBIFS members deliberated on this matter. By this opportunity were prepared: acoustic data portal validation rules and the list of various acoustic surveys uploaded to the system (until Feb. 2017) and validated. The files named "Acoustic validation of existing upload Feb2017.xlsx" and "Acoustic Data Portal Validation rules.xlsx" are located in the folder "07. Software" of the ICES WGBIFS-2017 Meeting docs - SharePoint. In the first file are listed various acoustic surveys with evaluated errors in acoustic or biotic data and proposed action to eliminate all incorrectness; some comments are also added. The need of resubmission or information that resubmission is most likely not needed is indicated too. In the second, in turn a file can be found the list with description of validation rules and quality checks in an acoustic database.

At the WGBIFS meeting in March 2017, a review on the progress of the ICES acoustic-trawl survey database design and the development of the StoX software was presented by O. Kaljuste, Sweden with some comments made by H. Parner, from the ICES Data Centre (Annex 9). In the presentation "Review the progress of the ICES acoustic-trawl survey database design elaborated under the AtlantOS project…" can be found information among-others about expected the next stages in development of the ICES acoustic data portal and fully implementation of the StoX programme to the IBAS surveys.

A number of quality control checks have been applied in the acoustic-trawl survey database, which will prevent obviously wrong data from getting into the acoustic database and from there into the indices estimates using StoX. Consequently, some data already within the database needs to be resubmitted. The WGBIFS members having submitted not fully correct data into the acoustic database will be contacted by an acoustic data manager on what's wrong and how to resubmit the data in question. Additionally, ICES Data Centre recreated GIS layer of ICES Subdivisions/Statistical Rectangles/>10 meter depth covered by IBAS and sent the layer of polygons to the StoX developers at the IMR-Bergen.

Comparison of fish stocks abundance at the length calculations for each ICES rectangle between the StoX software and the standard IBAS method was done using the test dataset. It resulted by 1-3% difference in fish abundance. The reason behind this difference is the use slightly different approach to split NASC by species. Tests showed that both methods gave the same NASC by species. However, the calculation operation from NASC to fish number by length group by species differs between those two methods. After the production of NASC values by species, the StoX software estimates a relative length distribution by station for each species and makes a total length distribution for each species for the ICES rectangle. According to the IBAS method, the length distribution used is the same as used for the split NASC operation which means that the total length distribution of one species in a rectangle is affected by the catch of other species (through the weighting of the various stations).

After the WGBIFS 2017 meeting have StoX developers decided not to add this different IBAS calculation method into the software features. Accordingly, to the StoX team very recent opinion (May 2017), other acoustic surveys (outside the Baltic) have used the same method as the IBAS calculation method, and the final decision whether the original method should be used in the future, as a part of the StoX, should be taken after consultancies, before the BIAS-2017 survey begins. Despite the minor difference in the final result, the StoX team recommend to use the method already implemented in the StoX as this gives users the opportunity to combine different acoustic categories and also retrieve estimated NASC by species by log-distance (nice for mapping).

It should be underlined that the above-mentioned additional task, realised at the WGBIFS-2017 meeting, was preceded by the WKBIFS-ACOU workshop organized at the beginning of December 2016 at the ICES headquarters.

The ToRs for the WKBIFS-ACOU workshop were to:
a) evaluate the existing national computational tools used for the acoustic abundance estimations of sprat, herring and cod in the Baltic Sea,
b) test run StoX estimation software using existing data reported into ICES new acoustic database before the workshop,
c) establish baseline parameters within StoX for use during future BIAS/BASS surveys,
d) provide feedback to the ICES Data Centre on the new acoustic trawl data format/database,
e) provide feedback to StoX developers to address outstanding issues.

Hjalte Parner from the ICES Data Centre gave an overview about the status of the ICES Acoustic data portal and new database for acoustic-trawl surveys.

Before the workshop, most of the countries participating in BIAS and BASS surveys have uploaded the acoustic and biotic data from 2015 through the acoustic data portal into this new database for testing out StoX as assessment tool.

Olavi Kaljuste from WGBIFS gave an insight into the existing national computational tools used for the acoustic abundance estimations of sprat, herring and cod in the Baltic Sea. The current national computerization methods follow a very robust abundance estimation protocol, which in addition allows diverse implementation nationally by combining the national survey estimates by the ICES statistical rectangles within the ICES subdivisions into the final annual tuning indices. However, the current computerization method is not transparent and difficult to reproduce centrally even having a central acoustic database.

Espen Johnsen and Atle Totland from IMR-Bergen, presented the StoX software, including the data requirements from the ICES Data Centre. Abundance estimations done using the StoX framework are transparent and reproducible. In addition, StoX is very flexible as new methods can be developed at any time and as a tool, StoX makes it apparent how the national calculations are done and as such facilitate discussions to improve and share methods.

For the period of the WKBIFS-ACOU workshop, Elor Sepp from WGBIFS produced one working input dataset uploaded to the ICES acoustic data portal and downloadable in StoX format for testing purposes. He also provided StoX developers with a list of all log distances, trawl hauls and values for fish target strength-length relationship constants for all species used for the calculation of fish abundances in specific ICES rectangle in order to test StoX split NASC function. During the WKBIFS-ACOU workshop, the ICES Acoustic data format was adjusted in order to cope with the sampling methodology used during BIAS and BASS surveys and the possibilities in using StoX was introduced.

A task force group with Olavi Kaljuste (Sweden) and Juha Lilja (Finland) as contact persons from the Baltic International Fish Survey Working Group (WGBIFS) group was created to carry out the next steps in an implementation of the StoX software to the IBAS surveys. The task force group is the link between WGBIFS, the ICES Data Centre and the StoX team and will assure by testing that the ICES Acoustic data format and the StoX survey estimation software perform as expected in order for WGBIFS to use StoX for calculating their annual tuning indices going forward.

Annex ToR i) Coordinate the marine litter sampling programme in the Baltic International Trawl Survey (BITS) and registering the data in the ICES database. The status of Baltic cod stomachs sampling in BITS surveys

Marine litter sampling and reporting

Based on EC's Marine Strategy Framework Directive, WKMAL requested WGBIFS to discuss at the meeting in 2012, the suggested collection and storage of information about the marine litter (anthropogenic origin) appearances in bottom fish catches during the BITS surveys. Systematically monitoring of the spatial and temporal distribution of marine litter in the Baltic Sea as one parameter of the Marine Strategy Framework Directive – can be source of the Baltic environment status evaluation in time and space (MSFD descriptor; Report of the joint MEDPOL/Black Sea/JRC/ICES Workshop on Marine Litters; WKMAL/2011).

The WGBIFS at the meeting in 2015 agreed that since autumn 2015, the marine litter data will be collected during the BITS-Q1 and BITS-Q4 surveys as regular procedure obeyed by all participated countries. The standard protocol, which was developed for the IBTSWG was adapted for WGBIFS purposes and is used for the exchange of marine litter data sampled in the Baltic Sea. The report from marine litter findings should be prepared in a standard database format. Marine litter data submitters will transfer data using the new DATRAS Trawl litter standard format, implementing ICES vocabulary and classification coding, described in the suitable manual, or via the Litter Reporting Format (ERF3.2; *vide* Annex 12), downloadable here: http://www.ices.dk/marine-data/data-portals/Pages/DATRAS-Docs.aspx. Standard form is accessible also from the WGBIFS-2017 SharePoint. The sheet and description of the marine litter categories that need to be collected at each fish catch-station are attached to the BITS Manual (2017). Each type of marine litter that is collected will be submitted in the format mentioned on the Table 5.2.2.1 and then uploaded to DATRAS. Once collected, these data can be sending by delegate to the WGBIFS or by the marine litter sampling co-coordinator. All data should be uploaded by haul, number, weight and size (Tables 5.2.2.2 and 5.2.2.3 in the BITS Manual 2017).
The about 300 fishing-stations, which are realised during BITS-Q1 and BITS-Q4 surveys can be used to improve the sample intensity related to the marine litter distribution.

Submission of the marine litter data from the current BITS surveys into DATRAS Litter database is in a good progress; there are many new facilities provided from DATRAS to improve and faster submission process, i.e.:

- improved data screening procedures and defined new checks base on position, and new references,
- cross check against submitted Trawl HH record,
- exchange data available on promptly soon after upload,
- HH and LT records are in the same file.

The status of submission of marine litter data from BITS-Q1 and BITS-Q4 per country and years 2012-2016 is accessible in Annex ToR i, the WGBIFS-2016 Report.

Baltic cod stomachs sampling

The Working Group on Multispecies Assessment Methods (WGSAM) in 2010 proposed the realization of stomach sampling of the main predator fish in the North Sea and the Baltic Sea to improve the basic knowledge concerning the species interactions in relation to the multispecies approach. On this basis, the EU project MARE/2012/02 "Study on stomach contents of fish to support the assessment of good environmental status of marine food webs and the prediction of MSY after stock restoration" was funded and realized from December 1, 2012 and lasted for 24 months. The WGBIFS at the meeting in 2014 decided that Baltic cod stomachs sampling procedure (Annex ToR i and the BITS Manual-2017), widely described within the EU project MARE/2012/02 manual, would be adopted for realization during the

BITS-1q and BITS-4q surveys. According to the Manual 10 cod stomachs per 1-cm length class from each the ICES Subdivisions (22-26, 28) in the 1st and the 4th quarter should be collected in the BITS surveys. The set of 10 stomachs may include also empty stomachs; however, stomachs that are obviously regurgitated are discarded. Within each ICES SD, a wide geographical coverage of samples should be obtained whenever possible. Detailed description of cod stomachs sampling procedures was inserted to the WGBIFS-2015 Report and annexes as well to the BITS Manual-2017. The list of Baltic cod and flounder stomachs collected in November 2016 and February-March 2017 for feeding analyses is mentioned below:

	BITS-Q4/2016	BITS-Q1/2017	BITS-Q4/2016	BITS-Q1/2017
Sweden	416	577	357	417
Denmark	-	835	-	-
Finland	-	-	-	-
Germany		-	-	-
Poland	511	662	-	-
Latvia	48	439	-	-
Estonia	-	-	-	-
Lithuania	-	-	-	-
Russia	884		-	-
Total	1859	1678	357	417

Annex ToR j) Discuss the possibilities to make further standardizations of IBAS. An attempt to standardize the pelagic fishing gear used in BIAS and BASS surveys

The WGBIFS in 2005 realized the first phase of the standardization various types of fishing gears applied in the BIAS and BASS surveys, i.e. then was recommended that for fishing in areas westward and eastward from the meridian 18°00'E adequately, 10- and 6-mm mesh bar length in the codend will be used in the pelagic trawl. However, the specification of technical construction of applied fishing gear and a set of rigging to this one was not discussed and not unified.

During the WGBIFS-2015 meeting K. Stanuch (chair invited expert from Poland) presented an own overview of the existing constructions of both commercial and research pelagic trawls used in the Baltic Sea and with expected steps for the standardization (see Annex 10 of the WGBIFS 2015 report). The group admitted that with this initiative only the first step has been done and the practical ways of should be further discussed.

At the WGBIFS/2016 meeting, the technical-schemes of national pelagic trawl gears used in the BIAS and BASS surveys were presented by Poland, Germany, Russia and Finland (available at the WGBIFS/2016 SharePoint; in the folder Background documents - Pelagic gear in BIAS_BASS surveys). It appeared that the construction, shape and size, inlet area as well as the rigging of those trawls is different. Even the trawl doors were very different and some of them in use were actually designed for demersal hauls. Because of the fish unique behaviour, the reaction on these gears can be different. The unlike inlet area and other parameters of trawls, e.g. differences in netting size of the front part of these trawls, different meshes, leads to different catchability properties of the fishing gears and determined various cpue of fish. The trawls from Poland, Germany and Finland have similar size; this is only concerns the circumference, which gives only information about inlet area. If we assume the same mesh-opening factor (0.3) the theoretical inlet area of smallest trawl is app. 150 m^2 and biggest one is 2000 m^2. The Swedish and Finnish delegates informed the WGBIFS that, they have already ordered and use relatively new pelagic fishing gears and do not like to implement for BIAS surveys any new standard gear however, they suggested performing an experiment focused on observations how the fish behaves in the front part of trawl and about the trawl catchability. For this experiment, the underwater cameras will be mounted to the headrope and footrope of trawl. It should be underlined that in 2016, similarly like at the previous meeting, only the Polish expert on fishing gear constructions was attended in a part time the WGBIFS meeting. No fishing gear experts from other countries were present at the meeting and therefore a constructive and critical discussion on this topic was not possible.

Because of lack of the fishing gear specific competence among the WGBIFS members, the group was not able to come up with any proposal regarding the specification of the new standard pelagic trawl gear. WGBIFS asked the ICES – FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) for advice (ICES EG Recommendations 2016 – ID 51 and Annex 4 of the WGBIFS 2016 report), which type of pelagic trawl, incl. rigging (e.g. type of trawl doors), would be the best for BIAS and BASS surveys in the Baltic Sea conditions. WGFTFB has not replied to our request. Despite this temporal problems the WGBIFS/2017 agreeing on the need for standardization of trawl for acoustic surveys in the next years.

Annex 6: Standard and Cruise Reports of BITS surveys presented at the WGBIFS-2017 meeting

Note: Authors are fully responsible for quality of the prepared text and all kind of presented data.

I. List of standard reports:
1. BITS 2016 Quarter 4 Standard Report of Sweden;
2. BITS 2016 Quarter 4 Standard Report of Germany;
3. BITS 2016 Quarter 4 Standard Report of Estonia;
4. BITS 2016 Quarter 4 Standard Report of Poland;
5. BITS 2016 Quarter 4 Standard Report of Latvia;
6. BITS 2016 Quarter 4 Standard Report of Denmark;
7. BITS 2016 Quarter 4 Standard Report of Lithuania;
8. BITS 2016 Quarter 4 Standard Report of Russia;
9. BITS 2017 Quarter 1 Standard Report of Sweden;
10. BITS 2017 Quarter 1 Standard Report of Germany;
11. BITS 2017 Quarter 1 Standard Report of Poland;
12. BITS 2017 Quarter 1 Standard Report of Latvia;
13. BITS 2017 Quarter 1 Standard Report of Denmark;
14. BITS 2017 Quarter 1 Standard Report of Denmark KASU-1;
15. BITS 2017 Quarter 1 Standard Report of Lithuania.

II. List of cruise reports:
1. BITS 2016 Quarter 4 Cruise Report of Germany;
2. BITS 2016 Quarter 4 Cruise Report of Latvia;
3. BITS 2016 Quarter 4 Cruise Report of Russia.

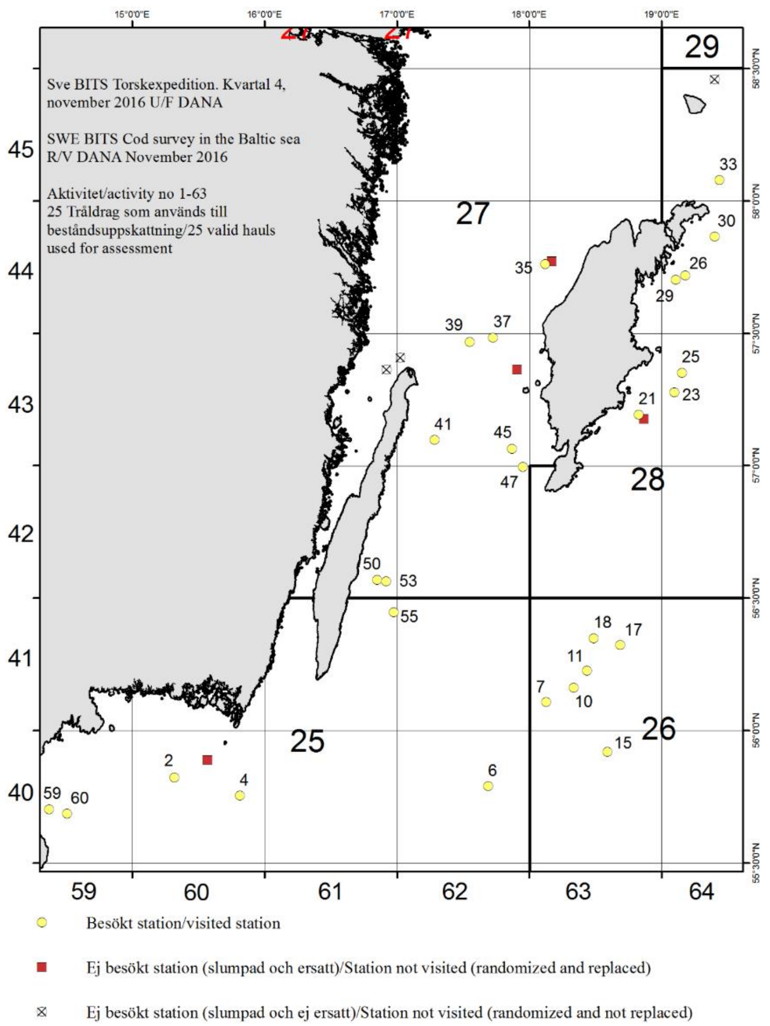
NATION:	SWEDEN	VESSEL:	RV "DANA"
Survey:	BITS Q4 2016	Dates:	19-27 November 2016

Cruise	
Gear details:	The large (930#) standard TV3 trawl was used. No tows are done with the rock hopper ground gear on harder ground stations. The trawl construction is according to the specification in the BITS manual.
Notes from survey (e.g. problems, additional work etc.):	30 stations were allocated, 25 of these were trawled. Two hauls were cancelled in the ICES SD 27 and one in the ICES SD 28 because the Swedish Armed Forces (SAF) did not grant us permission. Two invalid hauls this time. Four complementary hauls, not included here. A total of nine hauls in the ICES SDs 25, 26, 27 and 28 had oxygen deficiency.
Additional comments:	

ICES Sub-divisions	Gear (TVL, TVS)	Depth strata (2–6)	Number of hauls planned	Number of valid hauls realized using "Standard" ground gear	Number of valid hauls realized using Rock hoppers	Number of assumed zero-catch hauls	Number of replace-ment hauls	Number of invalid hauls	Stations fished %	Remarks
25	TVL	21-40 m	1	0	-	0	0	1	0	2
25	TVL	41-60 m	4	4	-	0	2	0	100	
25	TVL	61-80 m	1	0	-	1	0	0	100	
26	TVL	41-60 m	2	2	-	0	0	0	100	
26	TVL	61-80 m	2	1	-	1	0	0	100	
26	TVL	>100 m	2	2	-	0	0	0	100	
27	TVL	41-60m	2	0	-	0	0	0	0	1
27	TVL	61-80 m	4	4	-	1	1	0	125	
27	TVL	81-100 m	1	0	-	1	0	0	100	
27	TVL	>100 m	3	0	-	2	1	0	67	1, 2
28	TVL	21-40 m	1	0	-	0	0	1	0	2
28	TVL	41-60 m	3	3	-	0	1	0	100	
28	TVL	61-80 m	2	0	-	1	0	0	50	1
28	TVL	81-100 m	2	0	-	2	0	0	100	

Remark 1. The % number deviates from 100 because we were prohibited by Swedish Armed Forces to visit some of the stations.
Remark 2. The % number deviates from 100 because we don't have any replacement stations at that depth and area.

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
Gadus morhua	5 307	700
Clupea harengus	467 015	
Sprattus sprattus	641 928	
Cyclopterus lumpus	7	
Enchelyopus cimbrius	25	
Engraulis encrasicolus	2	
Gasterosteus aculeatus	496	
Limanda limanda	7	
Lumpenus lampretaeformis	12	
Merlangius merlangus	8	
Myoxocephalus quadricornis	2 657	
Myoxocephalus scorpius	1 358	
Platichthys flesus	2 808	759
Pleuronectes platessa	90	
Pomatoschistus	3	
Pungitius pungitius	1	
Scophthalmus maximus	15	
Trachurus trachurus	1	
Zoarces viviparus	79	

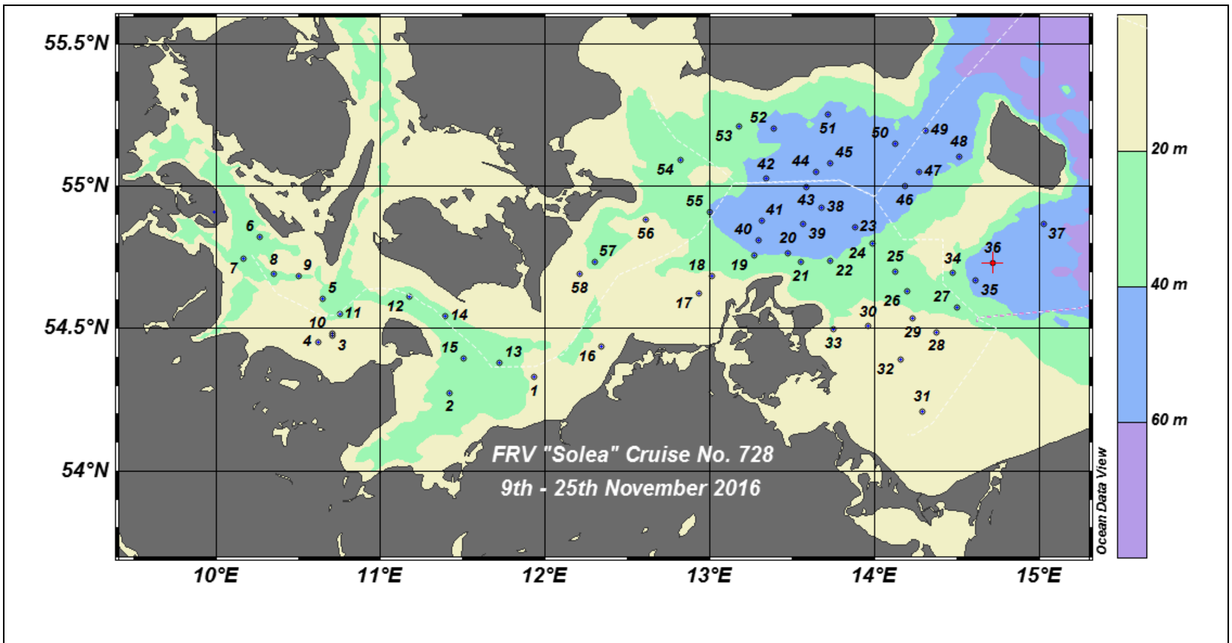


Nation:	**Germany**	**Vessel:**	**FRV "Solea"**
Survey:	BITS 2016, quarter 4	Dates:	9th – 25th November 2016

Cruise	
Gear details:	The small (520#) standard TV3 trawl was used. All Tow Database stations are fished without rock-hoppers. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	Total 54 fishing hauls and 54 hydrographical stations were performed. One station in Swedish territorial waters was not allowed to carry out.
Additional comments:	

ICES Sub-divisions	Gear (TVL, TVS)	Depth strata (2–6)	Number of hauls planed	Number of valid hauls realized using "standard" ground gear	Number of valid hauls realized using Rock hoppers	Number of assumed zero-catch hauls	Number of replace-ment hauls	Number of invalid hauls	% stations fished
22	TVS	1	15	13	-		1	2	87
24	TVS	1	17	16	-		1	-	94
24	TVS	2	26	25	-		-	-	96

Number of biological samples (maturity and age material, *maturity only):		
Species	**Length**	**Age**
Gadus morhua	17560	1026
Platichthys flesus	16670	637
Pleuronectes platessa	8349	920
Limanda limanda	15413	726
Psetta maxima	210	196
Scophthalmus rhombus	6	5
Clupea harengus	19481	-
Sprattus sprattus	72052	-

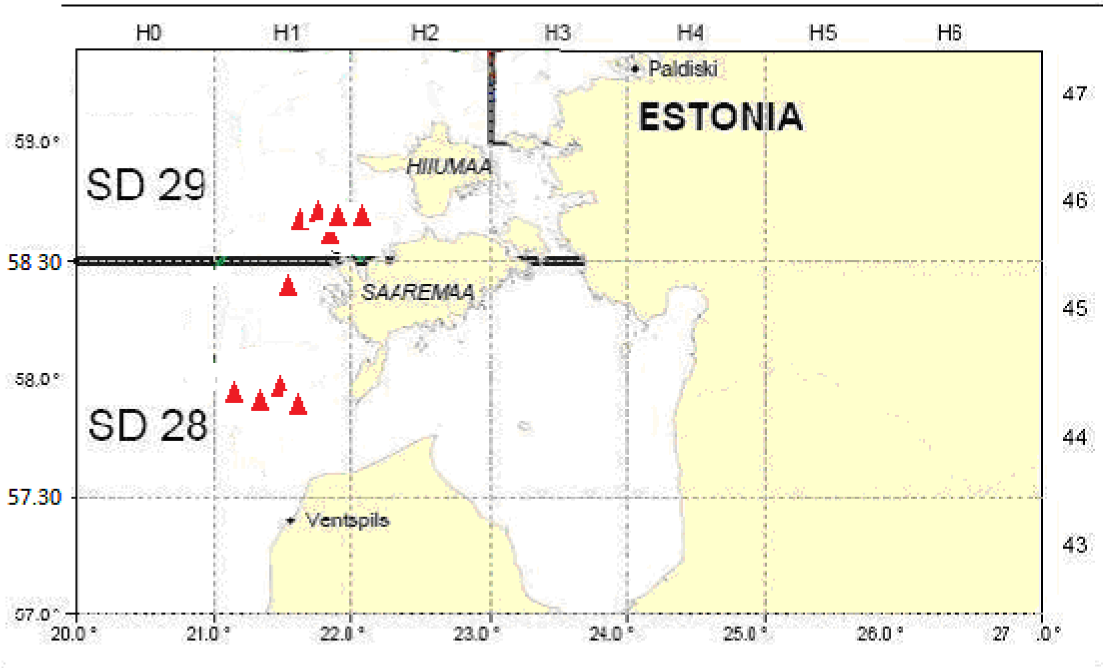


NATION:	ESTONIA	VESSEL:	CEV
Survey:	BITS16IVQRT	Dates:	13-14 November 2016

Cruise	
Gear details:	The small (530) standard TV3 trawl was used. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	The survey was carried out as planned. Survey started from the Port of Dirhamn in the western Gulf of Finland late evening on 13th of November 2016, steaming to the ICES subdivision 28.2. The weather conditions were extremely poor; however it was possible to carry out all 5 trawl hauls on November, 14th, as planned. Since the weather forecast was bad for the coming week, it was decided to continue with the rest of survey in the ICES Subdivision 29. So, after accomplishing the planned work in ICES subdivision 28.2, the vessel steamed to the ICES subdivision 29, where all planned 5 hauls were performed. The survey was finished in late hours of 14 November 2016 in the Port of Veere. No technical problems were observed during the survey this year. All catches were analysed at the field station of the Estonian Marine Institute on Saaremaa Island.

ICES Sub-divisions	Gear (TVL,TVS)	Depth strata (1–6)	Number of hauls planed	Number of valid hauls realized using “Standard” ground gear	Number of valid hauls realized using Rock hoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
28	TVS	40-59	2	2	0	0	0	0	100
28	TVS	60-79m	3	3	0	0	0	0	100
28	TVS	80-99m	0	0	0	0	0	0	n/a
29	TVS	20-39m	2	2	0	0	0	0	100
29	TVS	40-59m	2	2	0	0	0	0	100
29	TVS	60-79m	1	1	0	0	0	0	100

Number of biological samples (maturity and age material, *maturity only):		
Species	Age	Length
Gadus morhua	58	58
Sprattus sprattus	200	701
Clupea harengus	200	1554
Platichthys flesus	391	1554



Approximate positions of realised hauls during Estonian BITS survey in 4 QRT 2016

EST BITS 4 QRT 2016	Catch composition, kg per 30´ haul										
	1	2	3	4	5	6	7	8	9	10	
Haul ID.	28091	28030	28059	28192	28061	2901	2902	2903	2904	2905	
Sd	28	28	28	28	28	29	29	29	29	29	
Depth, m	42	50	65	61	68	45	75	46	38	34	
Date	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	
Coordinates	5756_2138	5755_2133	5754_2127	5759_2115	5828_2139	5835_2151	5837_2133	5837_2150	2835_2152	5833_2200	Total
Clupea harengus	1,1032	7,1104	5,8939	6,1526	2,3227	0,1167	0,8141	0,4127	0,8012	1,9487	**26,6762**
Sprattus sprattus	0,115	1,754	3,022	0,645	0,206	0,137	1,857	0,361	0,03	0,09	**8,217**
Platichthys flesus	11,201	36,334	12,463	5,696	7,558	0,181	0,279	4,337	6,7205	12,587	**97,356**
Gadus morhua	0,0019	0,0024	0,0017	0,0022	0	0	0	0	0	0	**0,0081**
Osmerus eperlanus	1,26	1,95	0,37	0,25	0,53	0,04	0,03	2,20	4,16	3,49	**14,2818**
Scophthalmus maximus	0	0	0,2105	0	0	0	0	0	0	0	**0,2105**
Neogobius melanostomus	1,3229	1,8285	0,6729	0	0,0519	0	0	0	0	0	**3,8762**
Gobius sp.	0,2945	0,0787	0,0009	0,0013	0	0	0	0,039	0,129	0,1565	**0,7001**
Gasterosteus aculeatus	0,0019	0,0051	0,0016	0	0,0023	0,0036	0	0,047	0,032	0,0297	**0,1226**
Pungitius pungitius	0	0	0	0	0	0	0	0,002	0,002	0	**0,0038**
Myoxocephalus scorpius	0,2472	1,4393	0,9466	0	0	0	0	0,440	0,866	1,0674	**5,0067**
Zoarces viviparus	0,0612	0,0625	0	0	0	0	0	0,035	0,162	0,0344	**0,3543**
Cyclopterus lumpus	0,1906	0	0	0	0	0	0	0	0	0	**0,1906**
Myxocephalys quadricornis	0,2528	0	0	0	0	0	0	0	0,687	0,605	**1,5448**
Taurulus bubalis	0	0	0	0	0	0	0	0	0,0323	0	**0,0323**
Lumpenus lampretaeformis	0	0,0218	0	0	0	0	0	0	0	0	**0,0218**
Enchelyopus cimbrius	0	0	0	0	0,076	0	0	0	0	0	**0,0755**
Total	**16,05**	**50,59**	**23,37**	**12,74**	**10,7479**	**0,48**	**2,9842**	**7,8721**	**13,6228**	**20,0068**	**158,68**

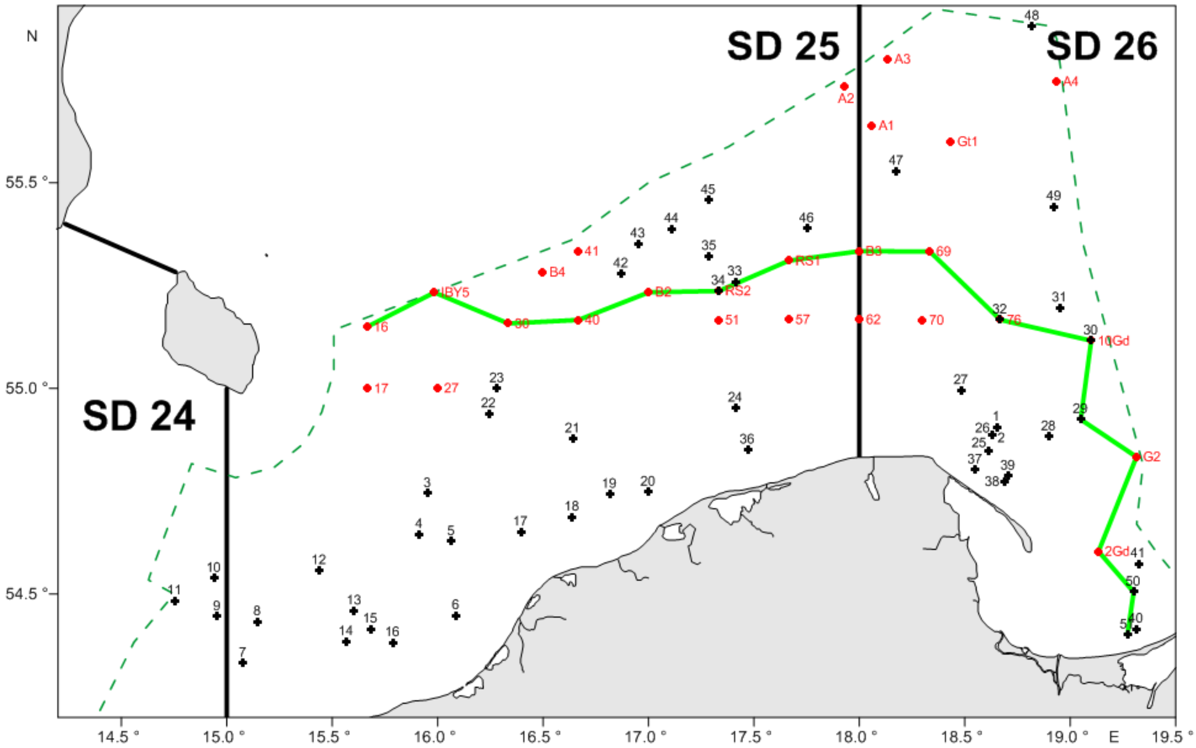
NATION:	**POLAND**	**VESSEL:**	**RV "BALTICA"**
Survey:	BITS-Q4/2016	Dates:	08-29/11/2016

Cruise	No. 18/2016/MIR
Gear details:	The standard rigging cod ground trawl type TV-3#930, with 10-mm mesh bar length in the codend was applied for fish control-catches realisation. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	According to the WGBIFS recent (March/April 2016) recommendations, the vessel "Baltica" was designated to cover parts of the ICES subdivisions 24, 25 and 26 with totally 60 randomly selected fish control-hauls. The catch-stations were located at the seabed depth range of 16-110 m. Totally, 51 fish catch-stations can be accepted as representative. Among the 51 hauls, three planned catch-stations, *i.e.* No. 26087, 26257 and 26091 were only initiated because the oxygen content in the bottom waters was below critical minimum (1.5 ml/l). For the above-mentioned three hauls, zero catch was assumed. In 48 fully realised catch-stations, zero catches were not achieved. Due to a rocky bottom appearance at part of trawling transects connected with hauls Nos. 25006, 25089, 26138 and 26211 fishing was shortened to 15 minutes. Haul No. 26163 was shortened to 15 minutes due to dense fish concentrations near seabed, observed on the EK-60 SIMRAD echosounder. Every control-haul was preceded by the seawater temperature, salinity and oxygen content measurements, made continuously from the sea-surface to a seafloor. Overall, 50 fish catch-stations starting positions and 28 standard hydrographic stations were controlled by the Neil-Brown CTD-probe combined with the rosette sampler (the bathometer rosette). As the standard hydrographic station RS2 was made on the same position as control-haul No. 25339 therefore its results were also attached to control-haul No. 2533.Oxygen content was determined by the standard Winkler's method.
Additional comments:	Due to stormy weather occurred on 21-22.11.2017 and partly on 14.11.2017 the number of realised hauls was reduced vs. planned.

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
24	TVL	10-39 m	3	2	0	0	0	0	66.6
24	TVL	40-59 m	0	1	0	0	0	0	200
25	TVL	10-39 m	13	12	0	0	0	0	92
25	TVL	40-59 m	10	9	0	0	0	0	90
25	TVL	60-79 m	6	5	0	0	0	0	83
25	TVL	80-100 m	2	2	0	0	0	0	100
26	TVL	10-39 m	5	4	0	0	0	0	80
26	TVL	40-59 m	4	4	0	0	0	0	100
26	TVL	60-79 m	6	3	0	0	0	0	50
26	TVL	80-100 m	9	7	0	2	0	0	78
26	TVL	101-120 m	2	2	0	1	0	0	100

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES (LATIN NAME)	**Length**	**Age and maturity**
Gadus morhua	9609	512
Platichthys flesus	3471	788
Clupea harengus	6514	1024
Sprattus sprattus	4714	515
Pleuronectes platessa	821	498
Scophthalmus maximus	25	24
Cyclopterus lumpus	7	4
Enchelyopus cimbrius	616	95
Hyperoplus lanceolatus	128	35
Osmerus eperlanus	114	3
Merlangius merlangus	19	19
Myoxocephalus scorpius	87	80

Lampetra fluviatilis	1	0
Pomatoschistus minutus	12	6
Pungitius pungitius	1	0
Alosa fallax	3	3
Trachurus trachurus	3	2
Engraulis encrasicholus	39	15
Gasterosteus aculeatus	61	0
Neogobius melanostomus	9	7
Perca fluviatilis	1	1
Sander lucioperca	52	15
Agonus cataphractus	3	0
Anguilla anguilla	1	0



Marks used: crosses – fish control stations, red dots – hydrological stations, green line – hydrological profile.

NATION:	LATVIA	VESSEL:	RV “BALTICA”
Survey:	BITS-Q4/2016	Dates:	03-12/12/2016

Cruise	No. 2/2016
Gear details:	The hard bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	The original surveys plan provided that 25 control-hauls will be realised during the survey in the Latvian EEZ (19 trawls in the ICES SD 28, 6 trawls in the ICES SD 26). Five additional hauls, in case, if main control-hauls are made were planned in the Lithuanian EEZ (ICES SD 26). The r.v.“Baltica” realised 14 bottom trawl control-hauls from the 25 planned, incl. the Latvian territorial waters (Fig. 1, Table 1). All trawl catches were performed in the daylight. The hard bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The standard trawling duration was planned 30 minutes. The mean speed of vessel while trawling was 3.0 knots. However, in the case of 14 hauls, their duration was shortened to 15 minutes, due to dense clupeids concentrations observed on the echosounder, bad bottom or bad weather. The length measurements in the 1.0-cm classes were realised for 48 cod and 358 flounder. Length measurements in the 0.5-cm classes were realised for 1379 herring and 1449 sprat. In total, 48 cod and 276 flounder individuals were taken for biological analysis. The details about fish biological sampling are presented in Table 2. Stomachs from the 46 cod were taken for investigation of cod feeding. Acoustic data, i.e. the echo-integration records (SA = NASCs; Nautical Area Scattering (Strength) Coefficient) were collected with the EK-60 scientific echosounder during fishing operations and on the distances between consecutive hauls. Echo-sounding data collected during the BITS survey were delivered to the Latvian researchers for further analysis. Directly before every haul, the seawater temperature, salinity and oxygen content were measured continuously from the sea surface to a bottom. The seawater samples were taken also at the standard HELCOM stations. Totally, 19 hydrological stations were inspected with the Neil-Brown CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler’s method. Meteorological observations of wind velocity and directions and the sea state were realised at the actual geographic position of each control-haul.
Additional comments:	**Due to the very bad weather conditions 5 working days during the survey were lost.**

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING “STANDARD” GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
26	TVL	3	1		1				100
26	TVL	4	1		1				100
26	TVL	5	2		1				50
26	TVL	6	2		1				50
28	TVL	2	6		2				33
28	TVL	3	4		3				75
28	TVL	4	6		5				83
28	TVL	5	3						0

Number of biological samples (maturity and age material, *maturity only):		
Species	Length	Age
Gadus morhua	48	48
Platichthys flesus	358	276
Clupea harengus	1379	
Sprattus sprattus	1449	
Scophthalmus maximus	1	
Zoarces viviparus	1	
Cyclopterus lumpus	1	
Myoxocephalus scorpius	10	
Osmerus eperlanus	32	
Gasterosteus aculeatus	33	
Neogobius melanostomus	4	
Engraulis encrasicholus	1	
Gasterosteus pungitius	4	
Pleuronectes platessa	3	

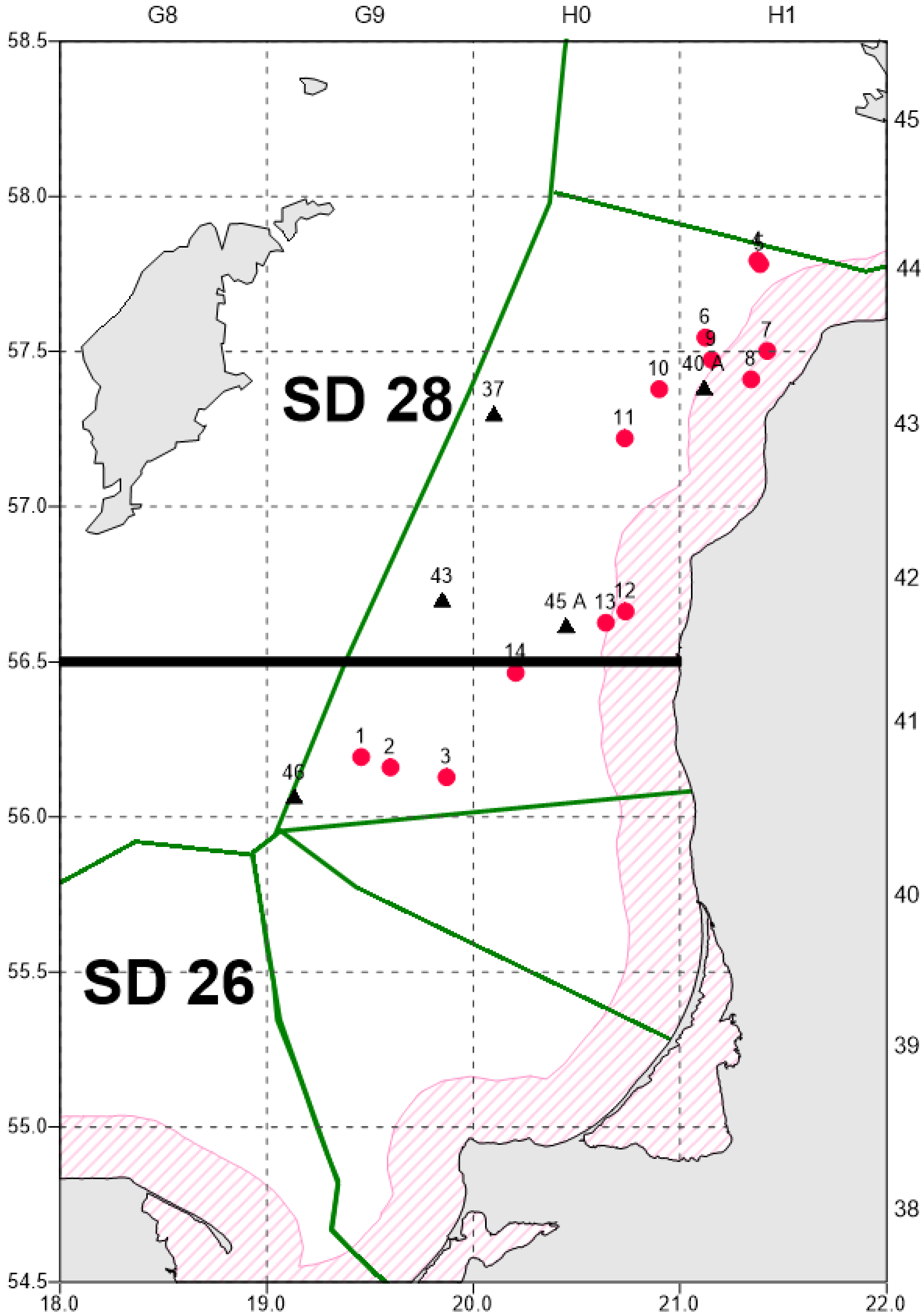


Figure 1. Location of the realized fish control-hauls (marked with red dots) and the HELCOM standard hydrological stations (marked with black triangles), green lines - national fishing zone borders.

Nation:	Denmark	Vessel:	Dana
Survey:	BITS	Dates:	1-18/11 - 2016

Cruise	
Gear details:	The big (#920) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual. No rock hopper was used
Notes from survey (e.g. problems, additional work etc.):	Stomack sampling from cod, plankton fishing during night.

ICES Sub-Divisions and Depth stratum	Gear (TVL,TVS)	Number of hauls planed	Number of valid hauls realized using "Standard" ground gear	Number of valid hauls realized using Rock-hoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
25								
2	TVL	0	1	0	0	0	0	
3	TVL	16	15	0	0	0	0	81,3
4	TVL	22	22	0	0	0	0	86,4
5	TVL	11	10	0	0	0	0	90,9
6	TVL	0	1	0	0	0	0	
26								
3	TVL	1	1	0	0	0	0	100,0
4	TVL	1	1	0	0	0	0	100,0
24								
2	TVL	1	1	0	0	0	0	100,0
3	TVL	4	4	0	0	0	0	100,0

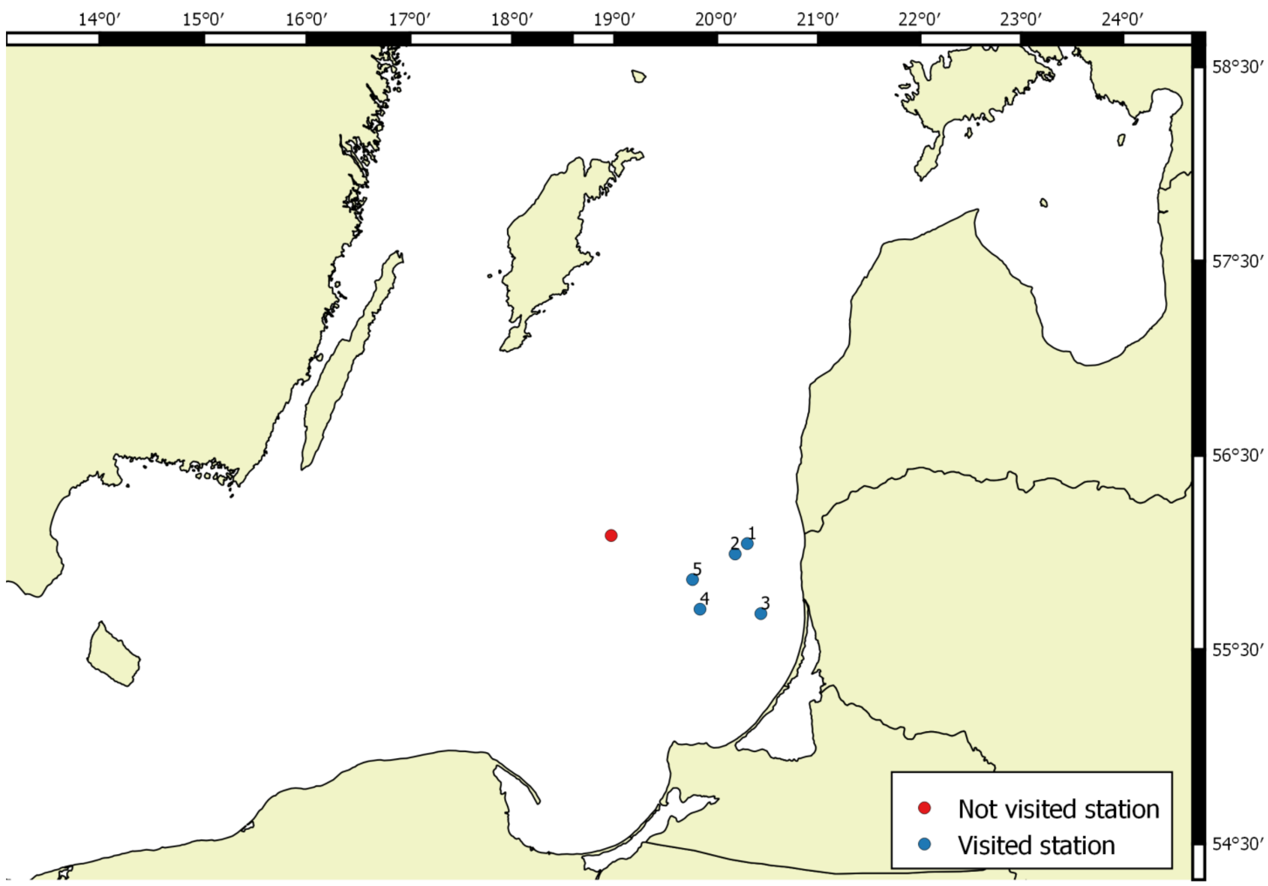
Number of biological samples (maturity and age material, *maturity only):			
Species	Age	Species	Age
Clupea harengus			
Gadus morhua			
Sprattus sprattus			

Nation:	**Lithuania**	**Vessel:**	**RV «Darius»**
Survey:	BITS-Q4/2016	Dates:	24-25 /11/2016

Cruise	
Gear details:	The small (530) standard TV3 trawl was used. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	Total 6 trawls were planned. 5 trawls were made in the ICES SD26, 41H0 and 40H0 rectangles. One station was empty. One trawl was not made during bad weather condition. Due to bad weather conditions only two hydrological stations were made. Cod stomachs were no collected. Litters from the trawls were recorded.
Additional comments:	

ICES Sub-divisions	Gear (TVS)	Depth strata	Number of hauls planed	Number of valid hauls realized using "Standard" ground gear	Number of valid hauls realized using Rock hoppers	Number of assumed zero-catch hauls	Number of replace-ment hauls	Number of invalid hauls	% stations fished
26	TVS	20-39	2	2	0	0	0	0	100
26	TVS	40-59m	1	1	0	0	0	0	100
26	TVS	60-79m	2	2	0	1	0	0	100
26	TVS	80-99m	1	0	0	0	0	0	0

Number of biological samples (maturity and age material, *maturity only):			
Species	Age	Length	Maturity
Gadus morhua	298	545	
Platichthys flesus	323	820	
Pleuronectes platessa	1	1	
Psetta maxima	5	5	
Clupea harengus		648	
Sprattus sprattus		30	
Osmerus eperlanus		24	
Myoxocephalus scorpius		17	
Cyclopterus lumpus		1	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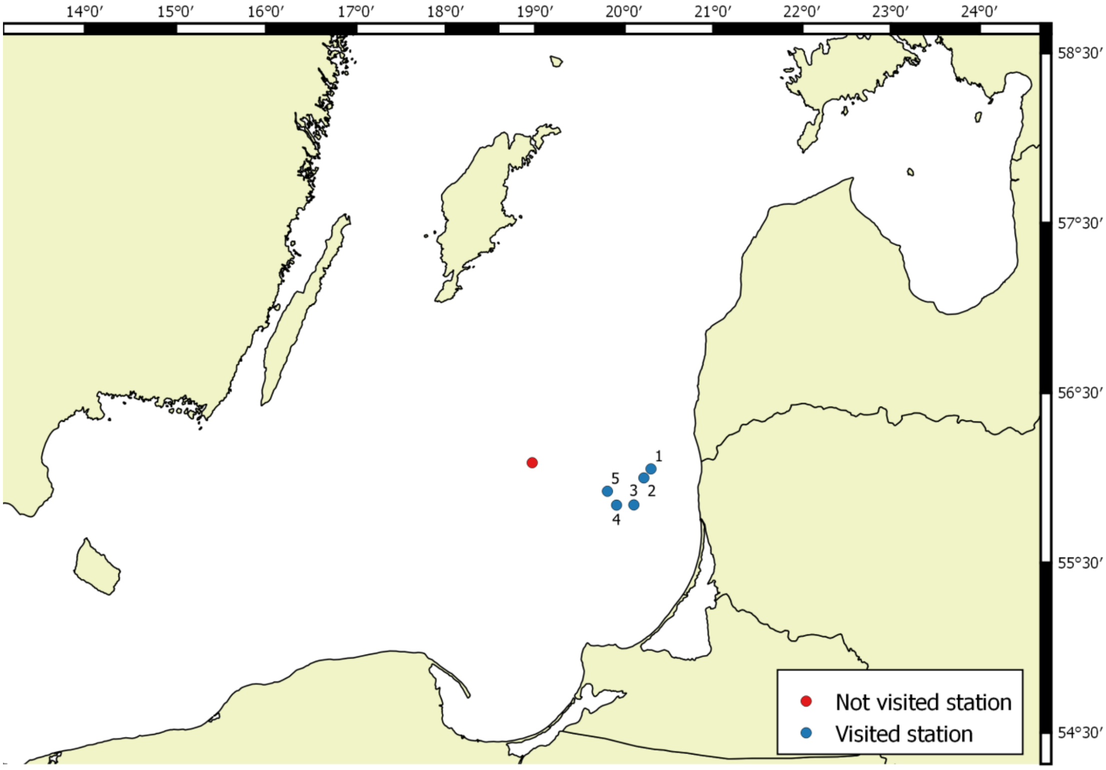
22°0′
23°0′
24°0′
58°30′
57°30′
56°30′
55°30′
54°30′
1
2
3
4
5
Not visited station
Visited station

Nation:	**Lithuania**	**Vessel:**	**RV «Darius»**
Survey:	BITS-Q1/2017	Dates:	15-16 02/2017

Cruise	
Gear details:	The small (530) standard TV3 trawl was used. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	Total 6 trawls were planned. 5 trawls were made. One trawl was not made during bad sea ground. Every control-haul was preceded by the water temperature, salinity and oxygen content measurements, made continuously from the sea-surface to a bottom
Additional comments:	

ICES Sub-divisions	Gear (TVS)	Depth strata	Number of hauls planed	Number of valid hauls realized using "Standard" ground gear	Number of valid hauls realized using Rock hoppers	Number of assumed zero-catch hauls	Number of replace-ment hauls	Number of invalid hauls	% stations fished
26	TVS	20-39	2	1	0	0	0	0	100
26	TVS	40-59m	1	1	0	0	0	0	100
26	TVS	60-79m	2	2	0	0	0	0	100
26	TVS	80-99m	1	0	0	0	0	0	0

Number of biological samples (maturity and age material, *maturity only):			
Species	**Age**	**Length**	**Maturity**
Gadus morhua	60	76	
Platichthys flesus	292	1016	
Psetta maxima	2	2	
Clupea harengus		782	
Sprattus sprattus		1333	
Osmerus eperlanus		435	
Myoxocephalus scorpius		54	
Cyclopterus lumpus		3	
Zoarces viviparus		1	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21°0′
22°0′
23°0′
24°0′
58°30′
57°30′
56°30′
55°30′
54°30′
1
2
3
4
5
Not visited station
Visited station

Draft template for standardised reporting of BITS survey:

Nation:	Russia	Vessel:	Atlantniro
Survey:	65	Dates:	11 – 18 October 2016

Cruise	
Gear details:	The large standard TV3 trawl is used. Following the recommendations in the TOW database stations are fished either without rockhoppers. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	No problems were experienced during the survey. Low content of oxygen in one trawl station 26135 (depth >100 m) – therefore hydrological researches have been made only.
Additional comments:	The national scientific program causes performance of trawl stations 26089, 26097 – Russia. These trawl stations have been made in addition to the planned BITS stations. Trawl station 26112 have been made instead of 26154. Trawl stations 26121 did not carried after 2009 (invalid in March 2009).

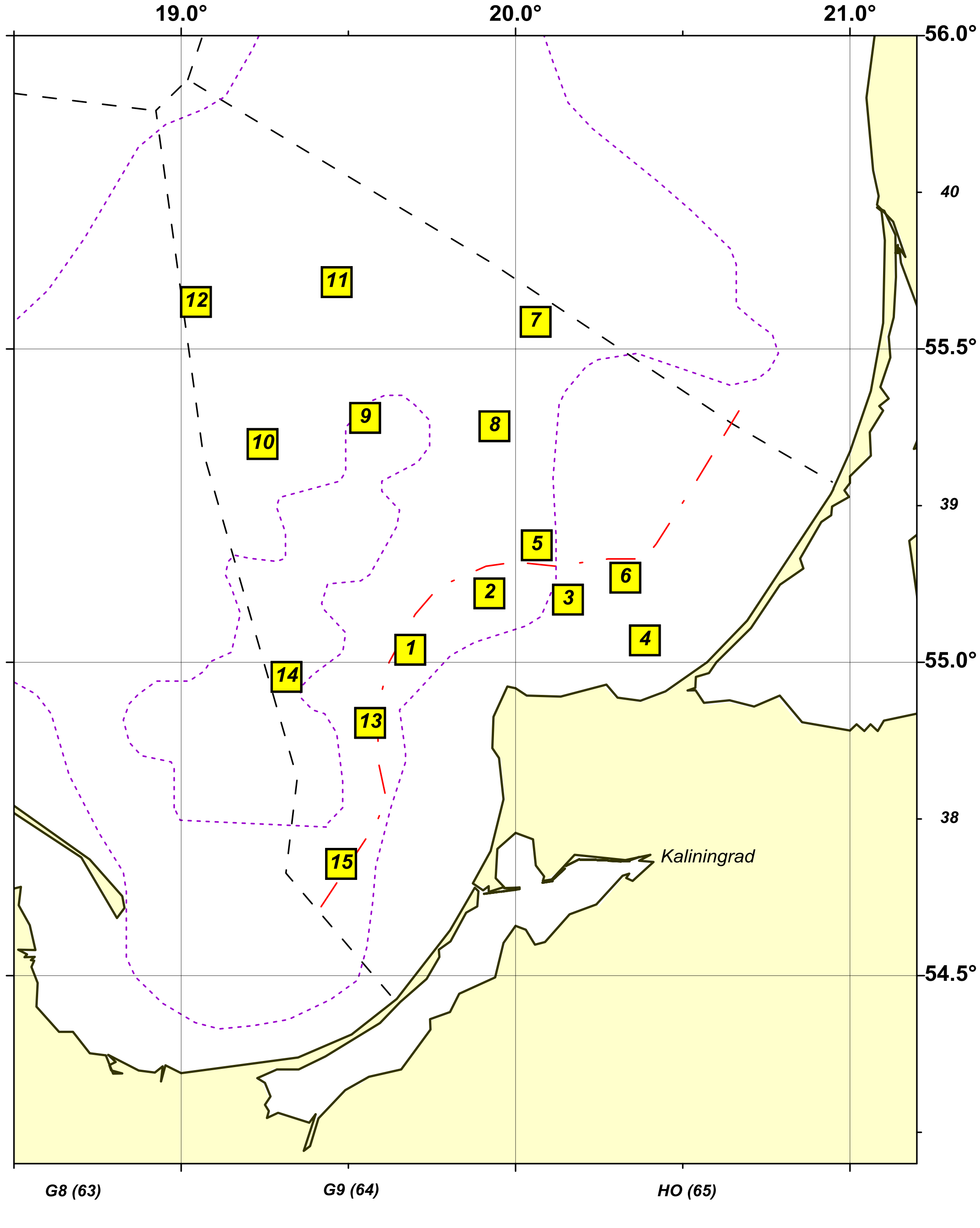
Stations fished

(Please insert line according to your needs)

ICES Sub-divisions	Gear (TVL,TVS)	Depth strata (1 -6)	Number of hauls planed	Number of valid hauls realised using “Standard” ground gear	Number of valid hauls realised using Rockhoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
26	TVL	1	0	0	0	0	0	0	
26	TVL	2	1	1	0	0	0	0	
26	TVL	3	2	2	0	0	0	0	
26	TVL	4	3	3	0	0	0	0	
26	TVL	5	7	8	0	0	1	0	
26	TVL	6	2	1	0	0	0	0	

Number of biological samples (maturity and age material, *maturity only):			
Species	Length	Maturity	Age (otoliths)
Clupea harengus	3526	924	355
Gadus morhua	3789	1026	526
Platichthys flesus	981	512	511
Sprattus sprattus	799	122	122

Other species may need to be added for your survey



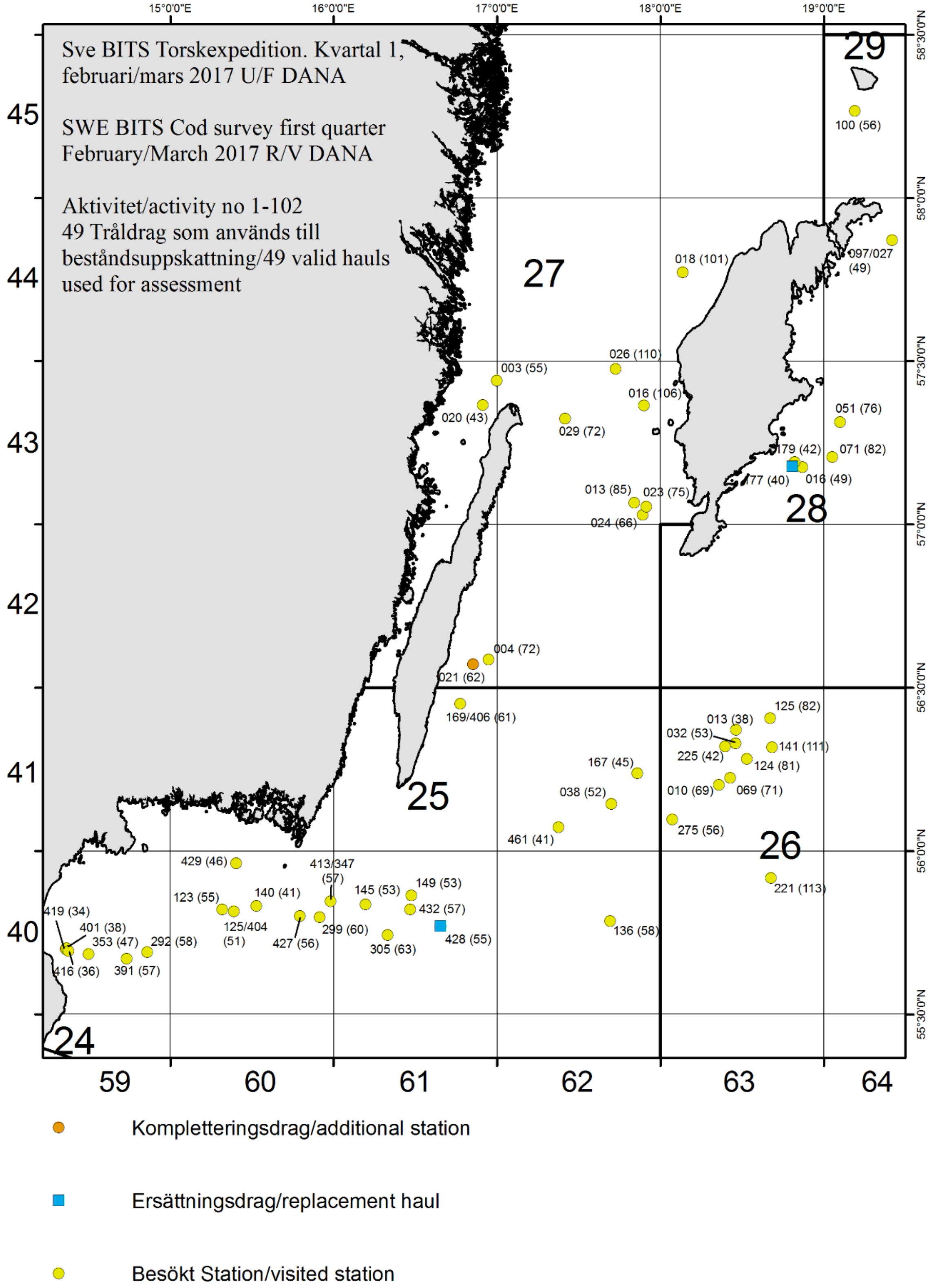
Trawl positions for RV "ATLANTNIRO" in October 2016

NATION:	SWEDEN	VESSEL:	RV "DANA"
Survey:	BITS Q1 2017	Dates:	23 February - 07 Mars 2017

Cruise	
Gear details:	The large (930#) standard TV3 trawl was used. No tows are done with the rock hopper ground gear on harder ground stations. The trawl construction is according to the specification in the BITS manual.
Notes from survey (e.g. problems, additional work etc.):	50 stations were allocated, 49 of these were trawled. One invalid hauls this time. A total of ten hauls in the ICES SDs 25, 26, 27 and 28 had oxygen deficiency.
Aditional comments:	No stations where forbidden by the Swedish Armed Forces

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANNED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	STATIONS FISHED %
25	TVL	21-40 m	3	3	-		0		100
25	TVL	41-60 m	17	16	-		2	1	94
25	TVL	61-80 m	3	3	-		0		100
26	TVL	21-40 m	1	1	-		0		100
26	TVL	41-60 m	3	3	-		0		100
26	TVL	61-80 m	2	2	-		0		100
26	TVL	81-100 m	2	2	-	1	0		100
26	TVL	>100 m	2	2	-	1	0		100
27	TVL	41-60 m	2	2	-		0		100
27	TVL	61-80 m	4	4	-	3	0		100
27	TVL	81-100 m	1	1	-	1	0		100
27	TVL	>100 m	3	3	-	3	0		100
28	TVL	21-40 m	1	1	-		1		100
28	TVL	41-60 m	4	4	-		1		100
28	TVL	61-80 m	1	1	-		0		100
28	TVL	81-100 m	1	1	-	1	0		100

Number of biological samples (maturity and age material, *maturity only):			
Species	Lenght	Age	Stomachs
Alosa fallax	1		
Aphia minuta	1		
Clupea harengus	8 289		
Cyclopteridae	1		
Cyclopterus lumpus	25		
Enchelyopus cimbrius	131		
Gadus morhua	4 770	870	577
Gasterosteus aculeatus	173		
Hyperoplus lanceolatus	2		
Limanda limanda	37		
Liparis liparis	1		
Lumpenus lampretaeformis	7		
Merlangius merlangus	18		
Myoxocephalus quadricornis	330		
Myoxocephalus scorpius	1 604		
Osmerus eperlanus	1		
Pholis gunnellus	1		
Platichthys flesus	3 665	1 079	417
Pleuronectes platessa	580		
Pomatoschistus spp	88		
Pungitius pungitius	1		
Scophthalmus maximus	38		
Spinachia spinachia	2		
Sprattus sprattus	4 510		
Zoarces viviparus	34		


Sve BITS Torskexpedition. Kvartal 1, februari/mars 2017 U/F DANA
SWE BITS Cod survey first quarter February/March 2017 R/V DANA
Aktivitet/activity no 1-102
49 Tråldrag som används till beståndsuppskattning/49 valid hauls used for assessment
15°0'0"E
16°0'0"E
17°0'0"E
18°0'0"E
19°0'0"E
58°30'0"N
58°0'0"N
57°30'0"N
57°0'0"N
56°30'0"N
56°0'0"N
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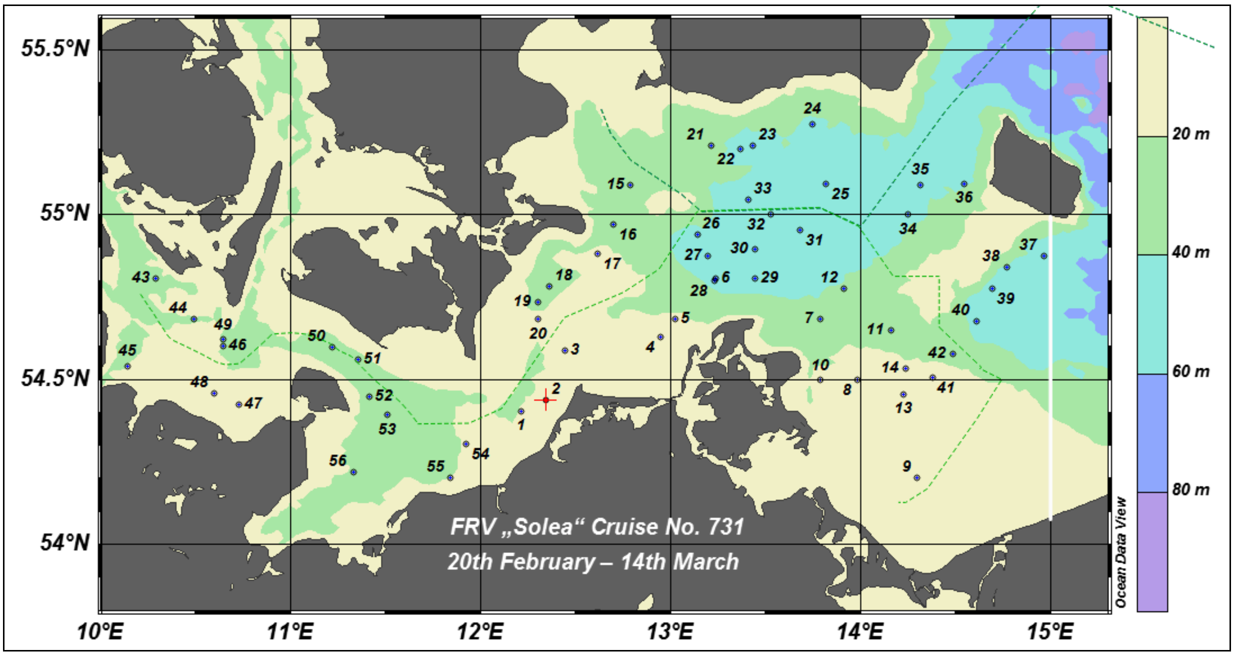
100 (56)
097/027 (49)
018 (101)
026 (110)
003 (55)
016 (106)
020 (43)
029 (72)
051 (76)
179 (42)
071 (82)
177 (40)
016 (49)
013 (85)
023 (75)
024 (66)
004 (72)
021 (62)
169/406 (61)
125 (82)
013 (38)
032 (53)
141 (111)
225 (42)
124 (81)
167 (45)
010 (69)
069 (71)
038 (52)
275 (56)
461 (41)
221 (113)
429 (46)
413/347 (57)
149 (53)
123 (55)
140 (41)
145 (53)
432 (57)
419 (34)
401 (38)
125/404 (51)
299 (60)
428 (55)
136 (58)
353 (47)
292 (58)
427 (56)
305 (63)
416 (36)
391 (57)
Kompletteringsdrag/additional station
Ersättningsdrag/replacement haul
Besökt Station/visited station

NATION:	GERMANY	VESSEL:	FRV "SOLEA"
Survey:	BITS 2017, quarter 1	Dates:	20 th February to 14th March 2016

Cruise	
Gear details:	The small (520#) standard TV3 trawl was used. All Tow Database stations are fished without rock-hoppers. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	Total 55 fishing hauls and 55 hydrographical stations were performed.
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (1–5)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING "STANDARD" GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
22	TVS	1	15	14			1	0	93
24	TVS	1	20	20			1	-	100
24	TVS	2	22	20			2	1	90

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES	LENGTH	AGE
Gadus morhua	10425	1285
Platichthys flesus	4303	682
Limanda limanda	5735	536
Pleuronectes platessa	4476	758
Psetta maxima	136	132
Scophthalmus rhombus	4	3
Clupea harengus	5769	-
Sprattus sprattus	5449	-



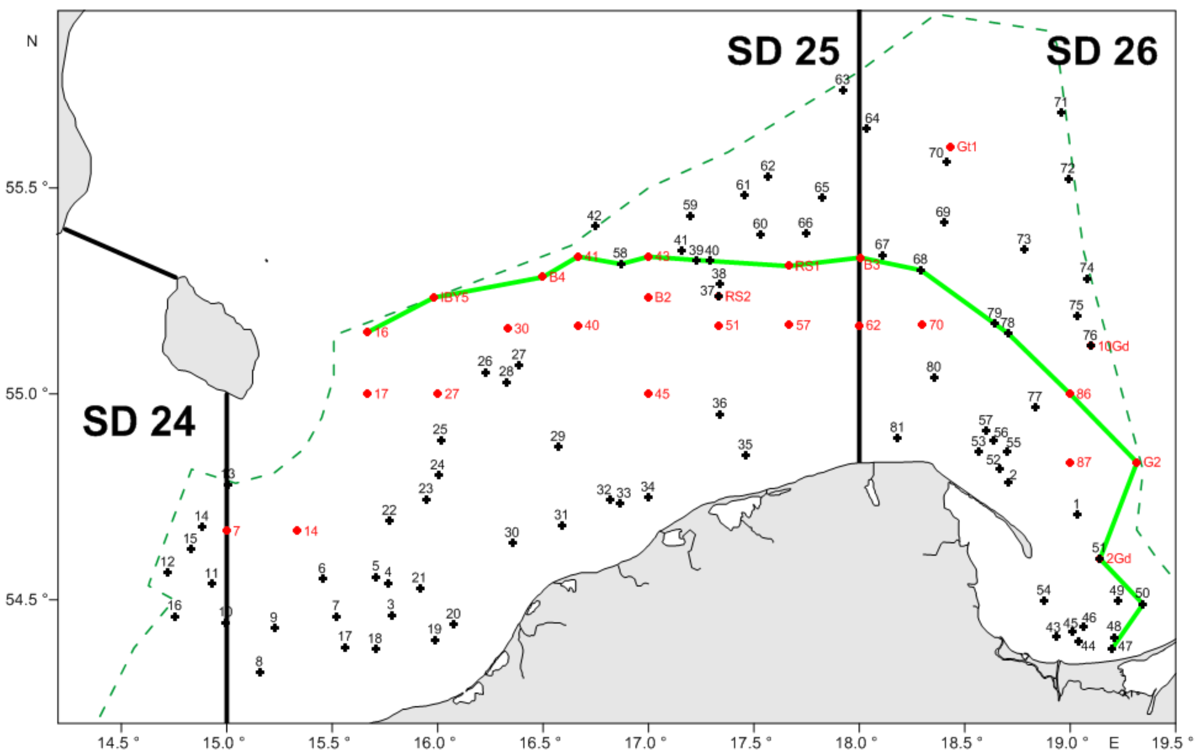
NATION:	**POLAND**	**VESSEL:**	**RV “BALTICA”**
Survey:	BITS-Q1/2017	Dates:	09/02-08/03/2017

Cruise	No. 4/2017/MIR
Gear details:	The standard rigging cod ground trawl type TV-3#930, with 10-mm mesh bar length in the codend was applied for fish control-catches realisation. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	According to the WGBIFS recent (March/April 2016) recommendations, the vessel “Baltica” was designated to cover parts of the ICES subdivisions 24, 25 and 26 with totally 81 randomly selected fish control-hauls. The catch-stations were located at the seabed depth range of 16 - 99 m. Totally, 81 realised fish catch-stations can be accepted as representative. Due to a rocky bottom appearance at part of trawling transects connected with hauls Nos. 25046, 25011, 25014, 25017, 25308, 26050 and 26046 fishing was shortened to 15 or 20 minutes. Hauls Nos. 25046, 24278, 25054, 25056, 25232, 25008, 25290, 26107, 26045, 26094 and 26091 were shortened to 15 or 20 minutes due to dense fish concentrations observed on the EK-60 SIMRAD echosounder. Haul No. 26272 was shortened to 15 minutes due to presence of the salmon drift hooks on the vessel course. Every control-haul was preceded by the seawater temperature, salinity and oxygen content measurements, made continuously from the sea-surface to a seafloor. Overall, 80 fish catch-stations starting positions and 26 standard hydrographic stations were controlled by the Neil-Brown CTD-probe combined with the rosette sampler (the bathometer rosette). As the standard hydrographic station 10Gd was made on the same position as the control-haul No. 26091 therefore its results were also attached to control-haul No. 26091. Oxygen content was determined by the standard Winkler’s method.
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING “STANDARD” GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
24	TVL	10-39 m	4	4	0	0	0	0	100
24	TVL	40-59 m	3	3	0	0	0	0	100
25	TVL	10-39 m	15	14	0	0	0	0	93
25	TVL	40-59 m	13	14	0	0	0	0	108
25	TVL	60-79 m	11	11	0	0	0	0	100
25	TVL	80-100 m	2	2	0	0	0	0	100
26	TVL	10-39 m	6	6	0	0	0	0	100
26	TVL	40-59 m	6	6	0	0	0	0	100
26	TVL	60-79 m	8	8	0	0	0	0	100
26	TVL	80-100 m	13	13	0	0	0	0	100

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES (LATIN NAME)	**Length**	**Age and maturity**
Gadus morhua	13197	661
Platichthys flesus	9752	1045
Clupea harengus	10583	979
Sprattus sprattus	8476	730
Pleuronectes platessa	1819	754
Scophthalmus maximus	53	52
Cyclopterus lumpus	68	4
Enchelyopus cimbrius	583	13
Hyperoplus lanceolatus	11	0
Osmerus eperlanus	287	0
Merlangius merlangus	157	72
Myoxocephalus scorpius	576	8
Zoarces viviparus	27	0
Pomatoschistus minutus	47	0

Alosa fallax	58	2
Trachurus trachurus	15	4
Engraulis encrasicholus	42	6
Gasterosteus aculeatus	5	0
Neogobius melanostomus	109	0
Perca fluviatilis	7	0
Sander lucioperca	9	1
Agonus cataphractus	8	0
Scomber scombrus	8	4
Trisopterus minutus	1	1
Lumpenus lampretaeformis	2	0
Liparis liparis	1	0
Chelidonichthys lucerna	1	0



Marks used: crosses – fish control stations, red dots – hydrological stations, green line – hydrological profile.

NATION:	**LATVIA**	**VESSEL:**	**RV “BALTICA”**
Survey:	BITS-Q1/2017	Dates:	11-19/03/2017

Cruise	No. 1/2017
Gear details:	The hard bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	The original surveys plan provided that 20 control-hauls will be realized in the Latvian EEZ (all trawls in the ICES SD 28) and 5 control-hauls in the Estonian EEZ (/ICES SD 28). Ten additional trawls were planned in the ICES SD 26 (5 trawls in the Latvian EEZ and 5 trawls in the Lithuanian EEZ. Before the trip, we received a request from the Danish colleagues to help with 4 trawls originally allocated for Denmark in Latvian EEZ, in the ICES SD 26. The reason was bad grounds in Latvian EEZ and TV3 with rockhopper which is used during Latvian-Polish BITS survey. The r.v.“Baltica” realized 28 bottom trawl control-hauls from the 25 + 4 planned, incl. the Latvian territorial waters (Fig.1, Table 1). From to Latvia allocated 25 hauls 23 were realized. Weather conditions influenced the realization of all planned tracks. Four originally allocated hauls for Denmark and 1 additional track were realized in Latvian EEZ in the ICES SD 26. In the trawling position (track 28088) the depth did not match the information included into trawling database. Actual depth belongs to the depth zone 6, not depth zone 5. Trawling was performed in this position. Trawl database administrator will be informed about this problem. All trawl catches were performed in the daylight. The hard bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The standard trawling duration was 30 minutes. The mean speed of vessel while trawling was 3.0 knots. However, in the case of 24 hauls, their duration was shortened to 15 minutes, due to dense clupeids concentrations observed on the echosounder, bad weather or bad fishing ground. The length measurements in the 1.0-cm classes were realised for 1340 cod and 1840 flounder. Length measurements in the 0.5-cm classes were realized for 2795 herring and 2350 sprat. In total, 596 cod and 539 flounder individuals were taken for biological analysis. The details about fish biological sampling are presented in Table 2. Stomachs from the 439 cod were taken for investigation of cod feeding. Acoustic data, i.e. the echo-integration records (SA = NASCs; Nautical Area Scattering (Strength) Coefficient) were collected with the EK-60 scientific echosounder during fishing operations and on the distances between consecutive hauls. Echo-sounding data collected during the BITS survey were delivered to the Latvian researchers for further analysis. Directly before every haul, the seawater temperature, salinity and oxygen content were measured continuously from the sea surface to a bottom. The seawater samples were taken also at the standard HELCOM stations. Totally, 33 hydrological stations were inspected with the Neil-Brown CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler’s method. Meteorological observations of wind velocity and directions and the sea state were realized at the actual geographic position of each control-haul.
Additional comments:	

ICES SUB-DIVISIONS	GEAR (TVL, TVS)	DEPTH STRATA (2–6)	NUMBER OF HAULS PLANED	NUMBER OF VALID HAULS REALIZED USING “STANDARD” GROUND GEAR	NUMBER OF VALID HAULS REALIZED USING ROCK HOPPERS	NUMBER OF ASSUMED ZERO-CATCH HAULS	NUMBER OF REPLACE-MENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
26	TVL	3	1*		1				100
26	TVL	4	1*		1				100
26	TVL	5	1*		1				100
26	TVL	6	1*		1				100
28	TVL	2	6		4				67
28	TVL	3	5		5				100
28	TVL	4	9		9				100
28	TVL	5	5		4				80
28	TVL	6			1				

*Trawls originally allocated for Denmark, realized by Latvia

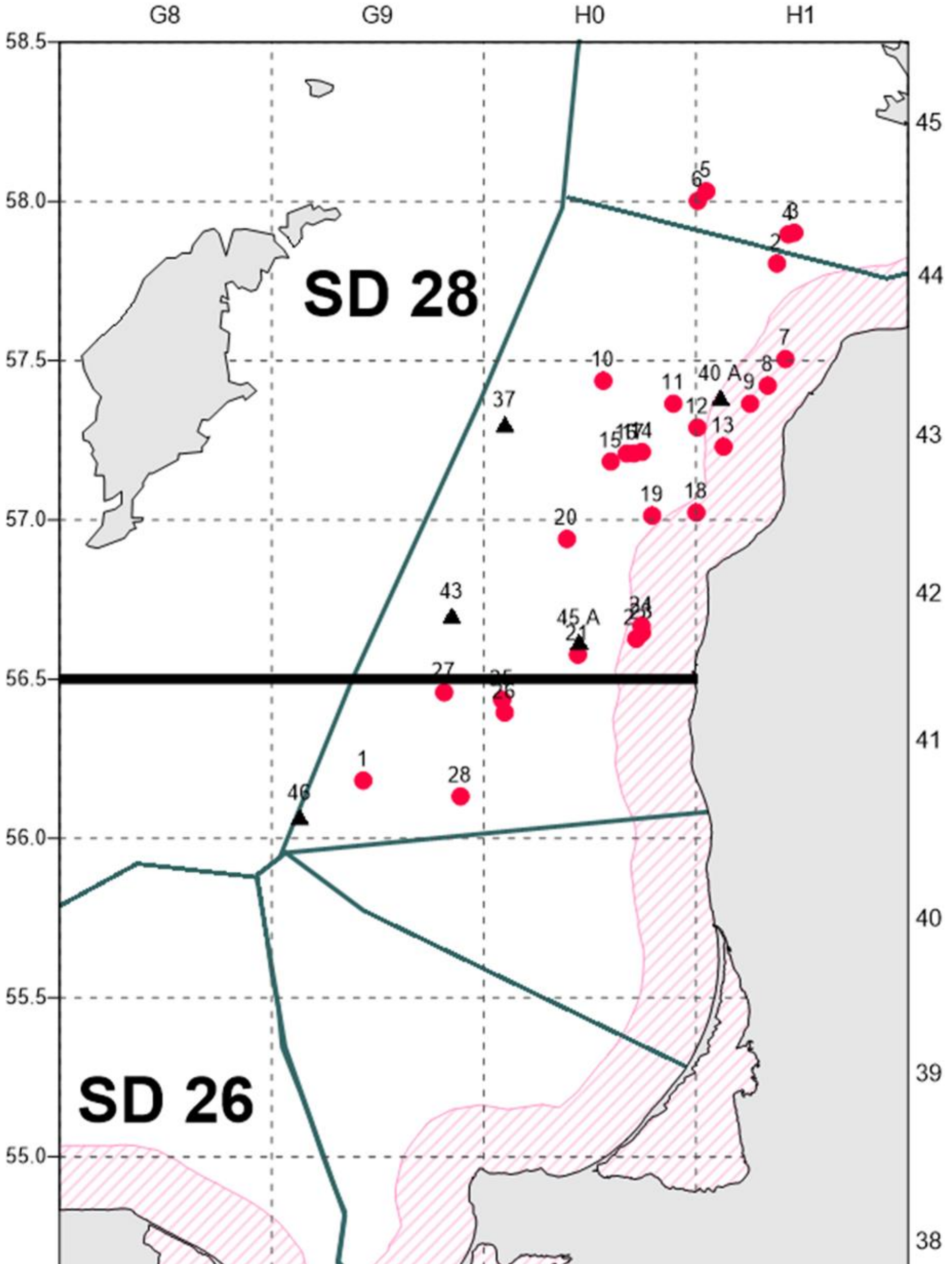


Figure 1. Location of the realized fish control-hauls (marked with red dots) and the HELCOM standard hydrological stations (marked with black triangles), blue lines - national fishing zone borders.

Number of biological samples (maturity and age material, *maturity only):		
Species	**Length**	**Age**
Gadus morhua	1340	596
Platichthys flesus	1840	539
Clupea harengus	2795	
Sprattus sprattus	2350	
Zoarces viviparus	16	
Lumpenus lampretaeformis	1	
Cyclopterus lumpus	2	
Pleuronectes platessa	1	
Myoxocephalus scorpius	41	
Osmerus eperlanus	100	
Gasterosteus aculeatus	14	
Enchelyopus cimbrius	16	
Hyperoplus lanceolatus	1	
Neogobius melanostomus	11	
Scophthalmus maximus	3	

Nation:	Denmark	Vessel:	Dana
Survey:	BITS	Dates:	7-25/3 - 2017

Cruise	
Gear details:	The big (#920) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual. No rock hopper was used
Notes from survey (e.g. problems, additional work etc.):	Stomack sampling from cod, plankton fishing during night.

ICES Sub-divisions and depth stratum	Gear (TVL,TVS)	Number of hauls planed	Number of valid hauls realized using “Standard” ground gear	Number of valid hauls realized using Rock-hoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
25	TVL							
3	TVL	9	7	0	0	0	1	88,9
4	TVL	24	21	0	0	0	0	87,5
5	TVL	10	13	0	0	0	0	130,0
6	TVL	0	1	0	0	0	0	-
26	TVL							
3	TVL	3	3	0	0	0	0	100,0
4	TVL	4	4	0	0	0	0	100,0
5	TVL	4	1	0	0	0	0	25,0

Number of biological samples (maturity and age material, *maturity only):			
Species	Age	Species	Age
Clupea harengus			
Gadus morhua			
Sprattus sprattus			

Nation:	**Denmark**	Vessel:	Havfisken/26HF
Survey:	KASU-1	Dates:	15/2-6/3-2017

Cruise	
Gear details:	The small (#520) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	

ICES Sub-Divisions		Gear (TVL,TVS)	Depth strata (1 -6)	Number of hauls planed	Number of valid hauls realized using "Standard" ground gear	Number of valid hauls realized using Rockhoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
22		TVS	1(0-19m)	14	14					100%
22		TVS	2(20-39m)	9	9					100%
21		TVS	1(0-19m)	6	6					100%
21		TVS	2(20-39m)	11	11					100%
21		TVS	3(40-59m)	3	3					100%
21		TVS	4(60-79m)	1	1					100%
21		TVS	5(80-99m)	1	1					100%
20		TVS	2(20-39m)	3	3					100%
23		TVS	1(0-19m)	3	3					100%
23		TVS	2(20-39m)	2	2					100%
24		TVS	2(20-39m)	1	1					100%

Number of biological samples (maturity and age material, *maturity only):

Species	**Number of otoliths**	**Species**	**Number of otoliths**
Sole	48	Saith	6
Cod	550	Dab	361
Withing	216	Haddok	33
Witch	27	Turbot	38*
Hake	0	Brill	118*
Plaice	799		

Institute of
Baltic Sea Fisheries

Alter Hafen Süd 2, 18069 Rostock Phone: +49 381 8116123 Fax: + 49 381 8116199 Date: 21/12/2016 Mail andres.velasco@thuenen.de

Cruise report
Cruise number 728 FRV „SOLEA“
09/11/ - 25/11/2016

Baltic International Trawl Autumn Survey (BITS) in the Arkona Sea and in the Mecklenburg Bight (ICES SDs 24+22)

Scientist in charge: **Dr. A. Velasco**

1. Summary

The 728th cruise of the FRV “SOLEA” is the 35st November survey since 1981. It was part of the Baltic International Trawl Survey (BITS) which was coordinated by ICES WGBIFS. The main objective of the survey was the estimation of fishery independent stock indices for both Baltic cod stocks, flounder and other flat fish.

In total 58 fishery and 58 hydrography stations were carried out.

A preliminary analysis of the survey results suggests a stronger year class of cod in 2016 as compared with the previous year class 2015 (recruits at length range 10-25 cm). The proportion of recruits between 26-40 cm was lower in all depth layers as compared to the previous year with the exception of the depth layer of 20 – 39 meters in subdivision 24.

The abundance of flounder decreased in all depth layers as compared to the previous year.

The oxygen concentration close to the bottom was above 3.41 ml/l, with exception of two stations.

Verteiler:
BLE, Hamburg
Schiffsführung FFS „Solea“
BMELV, Ref. 614
TI, Präsidialbüro (M. Welling)
TI, OF TI
TI, FOE
TI, SF
TI, FIZ
Fahrtteilnehmer
Eurobaltic Mukran
Verantw. Seeeinsatzplanung, Herr Dr. Rohlf
BFEL Hamburg, FB Fischqualität
IFM-GEOMAR, Kiel
Institut für Fischerei der Landesforschungsanstalt
LA für Landwirtschaft, Lebensmittels. u. Fischerei
BSH, Hamburg
Deutscher Fischerei-Verband e. V., Hamburg
Leibniz-Institut für Ostseeforschung
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Kutter- und Küstenfisch Sassnitz
Landesverband der Kutter- und Küstenfischer
Sassnitzer Seefischer
Deutsche Fischfang Union Cuxhaven

2. Research programme

The cruise took place from 9th until 25th November 2016. Corresponding to the recommendations of the WGBIFS in 2007, the survey of the FRV "SOLEA" covered the ICES subdivisions 22 and 24 (Figure 1).

The following stock assessment objectives were covered during the survey:

- Collecting data for assessing stock indices, the structure and recruitment of the stocks, especially for cod and flatfish
- Monitoring the composition of fish species in the western Baltic Sea
- Collecting samples of cod and flounder for biological investigations (i.e. sex, maturity, fecundity, age)
- Monitoring the actual hydrographical situation in the survey area

3. Narrative

The internationally coordinated trawl survey is planned as a Stratified Random Survey where ICES subdivisions and depth layers are used as strata. A total of 60 stations (45 in the ICES subdivision 24 and 15 in the ICES subdivision 22) were planned for the German part of the survey which covered the southern part of the ICES subdivision 22 and the ICES subdivision 24 in total. The haul positions were selected from the TOW Database by the coordinator of the BITS surveys (ICES 2008, WGBIFS report as reference). 58 fishing stations were realized and can be used for stock assessment. The fishing hauls were carried out between 7:00 and 15:00 UTC (8:00 and 16:00 local time).

The positions of the trawl hauls are shown in Figure 1. 15 fishing hauls and 15 hydrographic stations were done in subdivision 22, and 43 fishing hauls and 43 hydrographical stations were realized in subdivision 24.

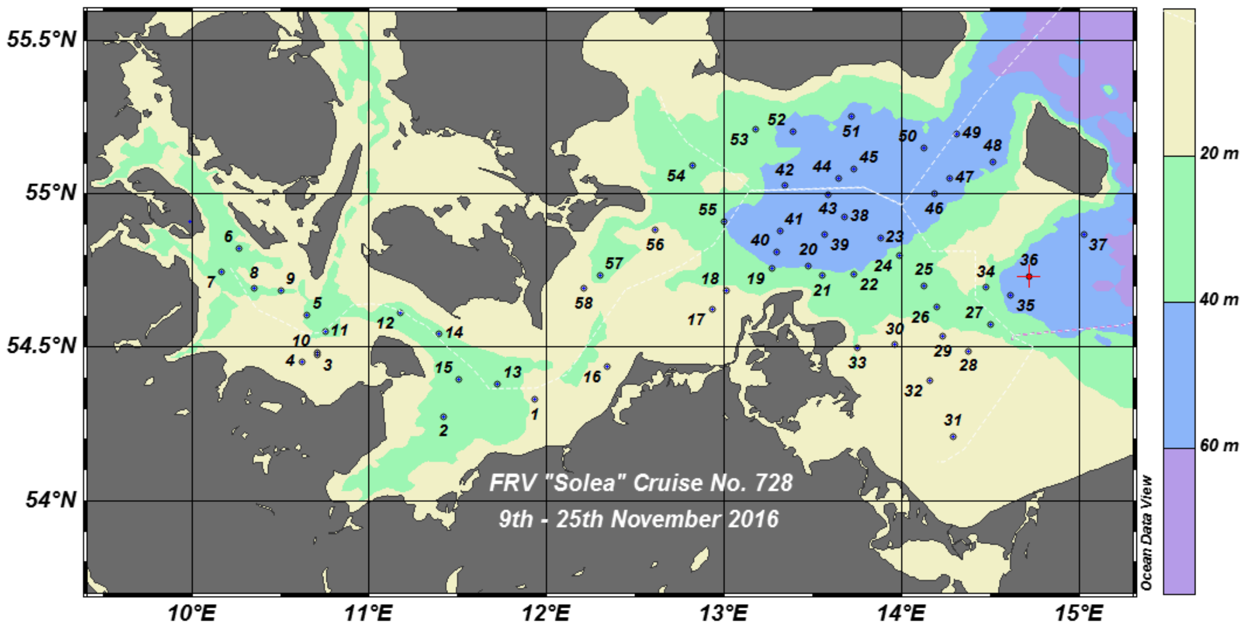


Fig. 1 Stations of the 728th FRV "SOLEA" cruise (Ocean Data View, R. Schlitzer, www.awi-bremerhaven.de/GEO/ODV)

The numbers of fishing hauls and hydrographic stations by subdivision and 10 m depth layers are given in Table 1. All hauls in subdivision 22 were located at depths from 20 m to 29 m and 24 of 43 hauls in subdivision 24 between 40 and 59 m.

Tab. 1 Sampling intensity (evaluated fishing stations)

Area		Stations		
Subdivision	**Stratum Depth [m]**	**Total trawl distance [sm]**	**Fishing [n]**	**Hydrography [n]**
22	**2 [10-19]**	-	-	-
	3 [20-29]	22.4	15	15
24	**2 [10-19]**	8.9	6	6
	3 [20-29]	11.9	8	8
	4 [30-39]	4.2	3	3
	5 [40-49]	35.9	24	24
	6 [50-59]	3.1	2	2

Trawling was done with the standard BITS trawl "TV3 520#". The stretched mesh size in the codend was 20 mm. The duration of each haul was 30 minutes at a velocity of 3 kn as required in the BITS manual. The total catch of a haul was analysed to determine species composition in weight and number as well as the length distribution of all species. Subsamples of cod, flounder, plaice, dab and turbot were investigated concerning sex, maturity and age.
Vertical profiles of the hydrographical parameters temperature, salinity and oxygen were sampled from the surface to the bottom immediately after every fishing haul with a CTDO probe (Sea Bird 19 +).

4. Preliminary results

4.1 Biological data

In total 1026 cod, 637 flounder, 920 plaice, 726 dab, 196 turbot and 5 brill were collected for measuring length, weight, sex, maturity and age. The total catches and numbers of length samples of cod and flounder are given in Table 2 by subdivision and depth stratum.

Tab. 2 Numbers of length measurements of cod and flounder by depth stratum and ICES subdivision

Area		Sample			
		Cod		Flounder	
Subdivision	**Depth [m]**	**Weight [kg]**	**Number [n]**	**Weight [kg]**	**Number [n]**
22	**10-29**	161.6	9086	112.1	374
24	**10-19**	18.5	129	500.6	2185
	20-39	347.4	2200	817.8	3525
	40-59	2355.4	6155	2415.7	10590

Area		Sample			
		Plaice		Dab	
Subdivision	Depth [m]	Weight [kg]	Number [n]	Weight [kg]	Number [n]
22	10-29	423.4	1460	1158.2	13700
24	10-19	38.8	449	14.3	62
	20-39	138.8	746	168.1	1430
	40-59	1258.2	5678	36.3	220

The mean catch per half hour (CPUE) was 33.3 kg of cod and 44.5 kg of flounder. In general the catch composition was dominated by cod and flounder. However, plaice and dab were also abundant in the catches. The mean fraction of cod biomass in the hauls was 23% and mean fraction of flounder, plaice and dab was 30.7%, 14.9 % and 11 %, respectively. Sprat and herring represented 10.8 % of the total biomass in mean.
The highest abundances in weight and number of cod and flounder were observed in subdivision 24 in depths between 40 - 59 m.
Mean CPUE of cod and flounder are given in Table 3 by subdivision and depth stratum.

Tab. 3 Mean CPUE of cod and flounder and average individual weights by sub-division and depth

Area		Catch							
		Cod				Flounder			
Subdivision	Depth [m]	Weight [kg/sm]	Number [n/sm]	Average Weight [g]	Stations [n]	Weight [kg/sm]	Number [n/sm]	Average Weight [g]	Stations [n]
22	10-29	7.2	406	17.8	15	5.0	17	299.7	15
24	10-19	2.1	14	143.7	6	56.0	244	229.1	6
	20-39	21.5	136	157.9	11	50.7	218	232.0	11
	40-59	60.4	158	382.7	26	61.9	272	228.1	26

Area		Catch							
		Plaice				Dab			
Subdivision	Depth [m]	Weight [kg/sm]	Number [n/sm]	Average Weight [g]	Stations [n]	Weight [kg/sm]	Number [n/sm]	Average Weight [g]	Stations [n]
22	10-29	18.9	65	290.0	15	51.8	613	84.5	15
24	10-19	4.3	50	86.3	6	1.6	7	230.5	6
	20-39	8.6	46	186.0	11	10.4	89	117.6	11
	40-59	32.3	146	221.2	26	0.9	6	164.8	26

The frequencies of cod grouped by subdivision and depth strata are presented in Figures 1 to 3.

Noteworthy is the low abundance of cod recruits of the year class 2015 ranging in length from 26 to 40 cm in subdivision 24 and subdivision 22. The length range 10–25 cm of young cod compared to the previous year has increased in all depths layers in the ICES subdivision 24 and the ICES subdivision 22 (Table 4 and Figures 1 to 3).

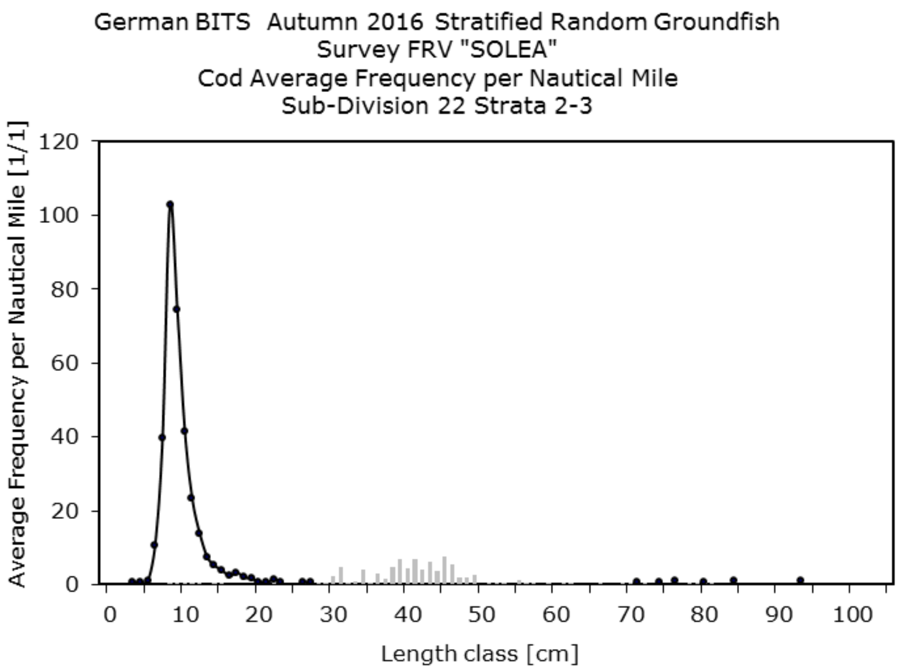


Fig. 1 Length frequencies of cod in number per mile in depth strata 10 m to 29 m in the ICES SD 22 2016 (line) and 2015 (bars), (15 Hauls)

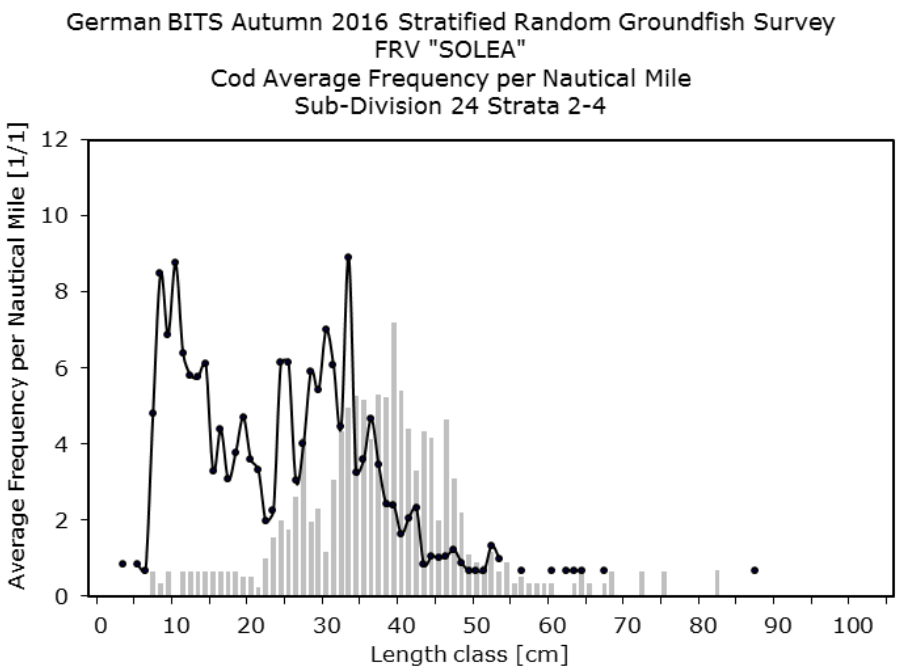


Fig. 2 Length frequencies of cod in number per mile in depth strata 10 m to 39 m in the ICES SD 24 2016 (line) and 2015 (bars), (17 Hauls)

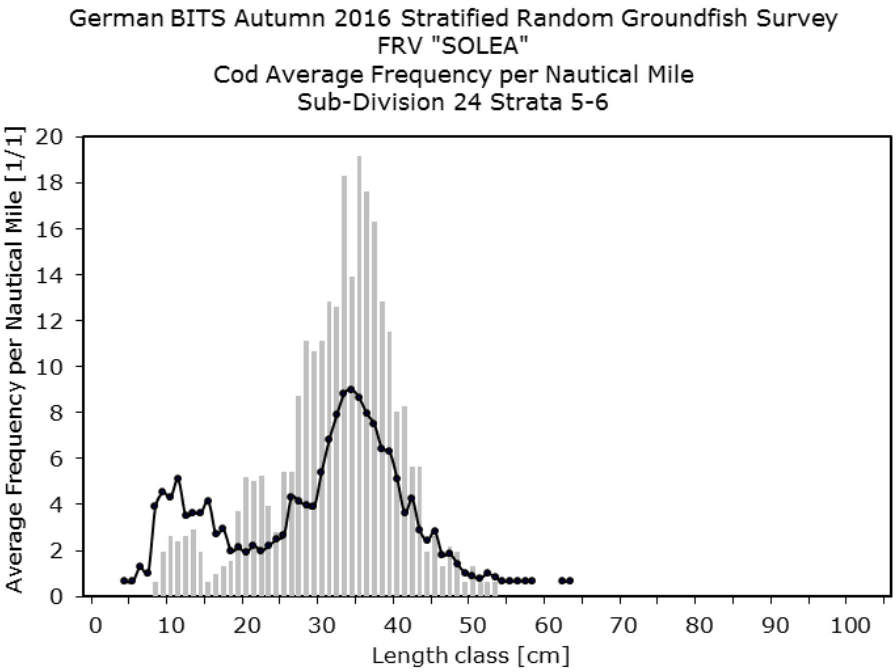


Fig. 3 Length frequencies of cod in number per mile in depth strata 40 m to 59 m in the ICES SD 24 2016 (line) and 2015 (bars), (26 Hauls)

Tab. 4 Recruitment of length groups of the year 2016 in comparison to the previous year

	Area		Catch			
Jahr	**Subdivision**	**Depth [m]**	**Length range [cm]**	**Number [n]**	**Number/ Mile [n/sm]**	**Trawl distance [sm]**
2016	**22**	**10-29**	**10 - 25**	3856	172	22.4
	24	**10-19**		89	10	8.9
		20-39		1049	65	16.1
		40-59		1179	30	39.0
	22 - 24	**10-59**		6173	71	86.4
2015	**22**	**10-29**	**10 - 25**	10	1	15.3
	24	**10-19**		15	2	9.0
		20-39		41	3	13.7
		40-59		324	9	34.6
	22 - 24	**10-59**		390	5	72.6

	Area		Catch			
Jahr	**Subdivision**	**Depth [m]**	**Length range [cm]**	**Number [n]**	**Number/ Mile [n/sm]**	**Trawl distance [sm]**
2016	**22**	**10-29**	**26 - 40**	2	0	22.4
	24	**10-19**		17	2	8.9
		20-39		458	28	16.1
		40-59		2790	72	39.0
	22 - 24	**10-59**		3267	38	86.4
2015	**22**	**10-29**	**26 - 40**	77	5	15.3
	24	**10-19**		215	24	9.0
		20-39		432	28	13.7
		40-59		4516	130	34.6
	22 - 24	**10-59**		5240	72	72.6

Under the assumption that the survey covered all nursery grounds of cod, a stronger year class 2016 (top tables) than the year class 2015 (tables below) can be assumed.

4.2 Hydrographical data

Figure 4 shows the distribution of temperature, salinity and oxygen near the bottom and at the surface in the covered area.
The hydrography was characterised by typical autumn conditions with surface temperatures between 6.9 °C and 9.9 °C. The salinity of the surface water decreased from 15.9 to 7.5 from west to east. The lowest temperature value was found in the area north west of Hiddensee at 6.9 °C. The salinity above the permanent halocline at a water depth of 29 m south of Bornholm was approx. 8.2 The salinity increased below the halocline at a depth of 44 m in the Arkona Sea up to 21.7
The oxygen concentration close to the bottom was between 3.4-9.6 ml/l, with exception of two stations (sts.-nrs. 6 and 7: 0.06 and 0.02 ml/l).

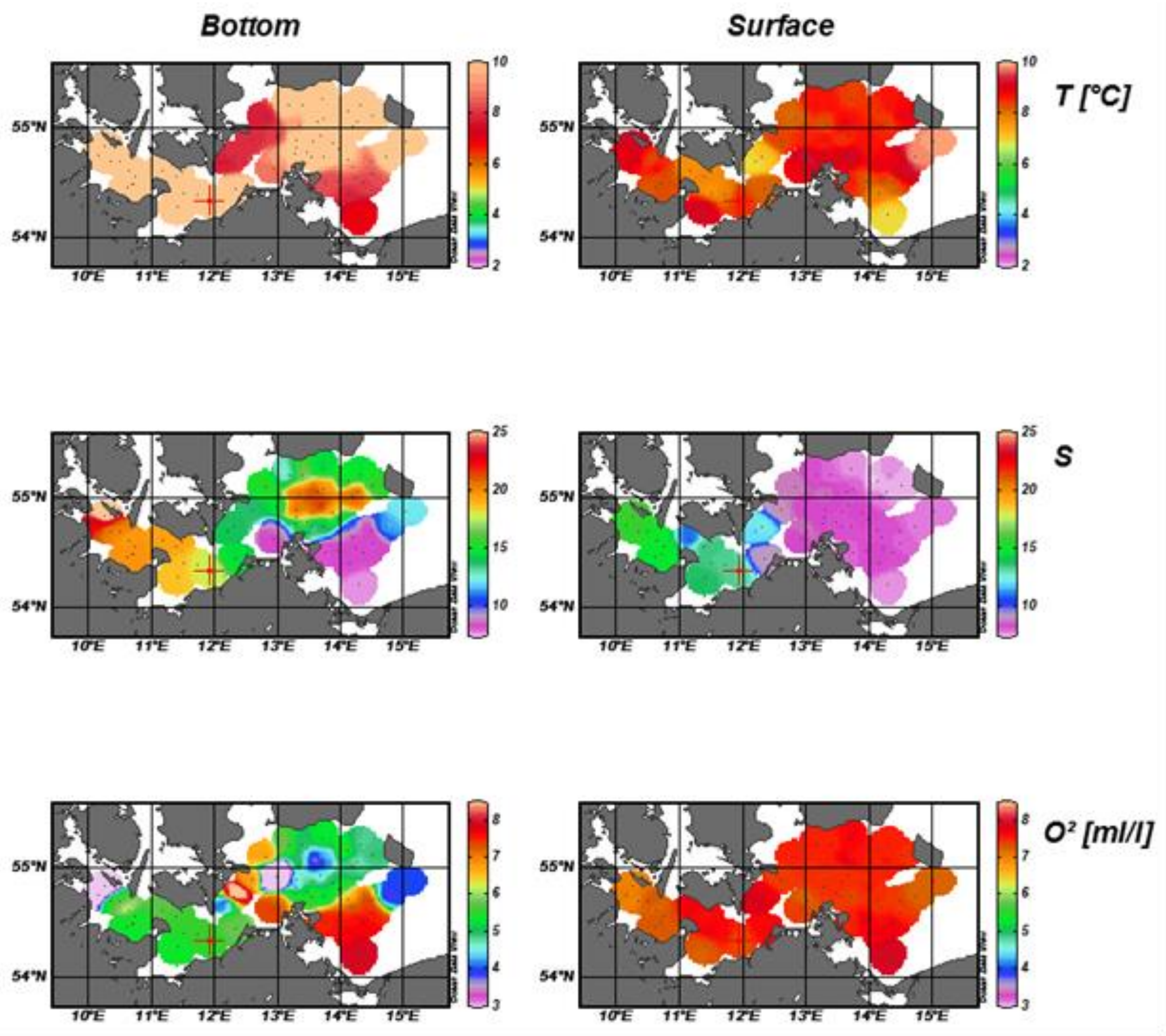


Fig. 4 Hydrography of the survey near the bottom (left) and at the surface (right)

5. Participants

A. Velasco	TI-OF	Scientist in charge
T. Hogh	TI-OF	Chief technician
C. Albrecht	TI-OF	Technician
S. Dressler	TI-OF	Technician
R. Wiechert	TI-OF	Technician
M. Koth	TI-OF	Technician
C. Elwert	University of Rostock	Student helper
A. Bühler	University of Rostock	Student helper

6. Acknowledgements

I would like to express my gratitude to Captain Koops and his crew on the FRV "Solea" for their good cooperation.

Scientist in charge

Institute of Food Safety, Animal Health and Environment "BIOR" Riga (Latvia)
National Marine Fisheries Research Institute, Gdynia (Poland)

THE CRUISE REPORT

FROM THE JOINT LATVIAN-POLISH BITS 4Q SURVEY ON THE POLISH R.V. "BALTICA"
IN THE CENTRAL-EASTERN BALTIC (03-12 December 2016)

by
Ivo Sics*, Radosław Zaporowski** and Lena Szymanek**

* Institute of Food Safety, Animal Health and Environment "BIOR" Riga (Latvia),
** National Marine Fisheries Research Institute, Gdynia (Poland)

Gdynia - Riga, January 2017

INTRODUCTION

The joint Latvian-Polish BITS survey, conducted in the period of 03-12.12.2016 on the r.v. “Baltica” , was based on the agreement between the Institute of Food Safety, Animal Health and Environment “BIOR” in Riga and the National Marine Fisheries Research Institute (NMFRI”) in Gdynia. The joint Latvian-Polish BITS 4Q survey was conducted in the Latvian EEZs (the ICES Sub-divisions 26 and 28). It was part of the Baltic International Trawl Survey (BITS), which was coordinated by the ICES Baltic International Fish Survey Working Group [WGBIFS] (Anon. 2016).

The main aims of reported cruise were:

1. Collecting materials to investigate the distribution, abundance and biological structure of cod stock.
2. Determine distribution and abundance of cod recruits. Estimates of year – class strength of cod.
3. Collecting materials to investigate the distribution abundance and biological structure of Flounder stock.
4. Collect data on cod feeding.
5. Analysis of the hydro-meteorological conditions (seawater temperature, salinity, oxygen content, air temperature, atmospheric pressure, wind velocity and directions) in the ICES Sub-divisions 26N and 28.
6. Acoustical data recording during trawling and on the distance between consecutive catch-stations.
7. A collection of information about marine litter.

MATERIALS AND METHODS

Personnel

The BITS Q4 - 2016 survey scientific staff was composed of nine persons, i.e.:
Radosław Zaporowski, NMFRI, Poland - cruise leader,
Jakub Słembarski, NMFRI, Poland - acoustician,
Anetta Ameryk, NMFRI, Poland - hydrologist,
Władysław Gaweł, NMFRI, Poland - ichthyologist,
Ivo Sics, BIOR, Latvia - scientific staff leader,
Ivars Putnis, BIOR, Latvia - ichthyologist,
Guntars Strods, BIOR, Latvia - ichthyologist,
Laura Briekmane, BIOR, Latvia – ichthyologist,
Janis Gruduls, BIOR, Latvia – ichthyologist.

Narrative

The reported survey research tasks realisation took place during the period of 03-12 December 2016 and overall ten full days was devoted to survey plan accomplishment. The at sea researches were conducted within the Latvian EEZs (the ICES Sub-divisions 26 and 28) moreover, inside the Latvian territorial waters not shallower than 20 m (the ICES Sub-division 28).

The vessel left the Gdynia port (Poland) on 02.12.2016 at 22.00 o’clock and was navigated towards the south-western corner of the Latvian EEZs (Fig. 1). The direct at sea researches begins on 03.12.2016, in the morning and was ended on 11.12.2016. Due to the very bad weather conditions, 5 working days during the survey were lost. On 12.12.2016 r/v “Baltica” returned back to the homeport.

Survey design and realization

The original surveys plan provided that 25 control-hauls will be realised during the survey in the Latvian EEZ (19 trawls in SD 28, 6 trawls in SD 26). Five additional hauls, in case, if main control-hauls are made were planned in the Lithuanian EEZ (SD 26).

The r.v.“Baltica” realised 14 bottom trawl control-hauls from the 25 planned, incl. the Latvian territorial waters (Fig. 1, Table 1).

All trawl catches were performed in the daylight. The hard bottom ground-rope (rockhopper) trawl, type TV-3#930 (with 10-mm mesh bar length in the codend) was applied for fish catches. The standard trawling duration was planned 30 minutes. The mean speed of vessel while trawling was 3.0 knots. However, in the case of 14 hauls, their duration was shortened to 15 minutes, due to dense clupeids concentrations observed on the echosounder, bad bottom or bad weather.

The length measurements in the 1.0-cm classes were realised for 48 cod and 358 flounder. Length measurements in the 0.5-cm classes were realised for 1379 herring and 1449 sprat. In total, 48 cod and 276 flounder individuals were taken for biological analysis. The details about fish biological sampling are presented in Table 2. Stomachs from the 46 cod were taken for investigation of cod feeding.

Acoustic data, i.e. the echo-integration records (SA = NASCs; Nautical Area Scattering (Strength) Coefficient) were collected with the EK-60 scientific echosounder during fishing operations and on the distances between consecutive hauls. Echo-sounding data collected during the BITS survey were delivered to the Latvian researchers for further analysis.

Directly before every haul, the seawater temperature, salinity and oxygen content were measured continuously from the sea surface to a bottom. The seawater samples were taken also at the standard HELCOM stations. Totally, 19 hydrological stations were inspected with the Irdonaut CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler’s method. Meteorological observations of wind velocity and directions and the sea state were realised at the actual geographic position of each control-haul.

RESULTS

Fish catches and biological data

The control-catches basic results collected in December 2016 during the Latvian-Polish BITS-4Q survey are presented in Table 1. Overall, 14 fish species were recognised in hauls performed in the central-eastern Baltic. Sprat dominated by mass in the ICES Sub- division 26 with the average share of 91.9% respectively. Herring was the next species most frequently represented in terms of mass, i.e. 6.3%. The share of flounder and cod in control-catches made out in the ICES SD 26 was 1.1 and 0.7 %, respectively. By-catch of other fishes was insignificant.

Herring dominated by mass in the ICES Sub- division 28 with the average share of 68.7% respectively. Sprat was the next species most frequently represented in terms of mass, i.e. 28.3%. Flounder was the third species most frequently represented in terms of mass in the ICES SD 28 (mean share was 2.6%, respectively). The share of cod in control-catches made out in the ICES SD 28 was 0.2 %, respectively. By-catch of other fishes was insignificant.

The mean CPUE for all species in SD 26 amounted 724 kg/0.5h, and in this 665.0, 4.8, 45.9 and 8 kg/0.5h were for sprat, cod, herring and flounder, respectively.

The mean CPUE for all species in SD 28 amounted 255.9 kg/0.5h, and in this 7.0, 177.1, 0.6 and 70.6 kg/0.5h were for flounder, herring, cod and sprat, respectively.

The length distribution of cod, flounder, herring and sprat, according to the ICES Sub-divisions 26 and 28 and particular hauls is illustrated in Figures 2-5 and Tables 3-6.

Cod

All 48 cod caught during the survey were biologically analysed. The total length of cod in scrutinised samples ranged from 4 to 55 (Fig.2; Table 3).

Flounder

For all flounder caught during the survey biological analyse and length measurement was made. The total length of flounder in samples ranged from 18 to 40 cm in the ICES Sub-division 26, and from 10 to 32 cm with dominating length classes of 18-24 cm in the ICES Sub-division 28 (Fig. 3; Table 4).

Herring

The length range of collected herring was 14-24 cm, and specimens from the length classes of 15-18 cm were most frequently represented in samples from the ICES Sub-divisions 26 (Fig. 4; Table 5).

The length range of collected herring was 12-24 cm, and specimens from the length classes of 14-18 cm were most frequently represented in samples from the ICES Sub-divisions 28 (Fig. 4; Table 5).

Sprat

The length range of collected sprat was 6-15 cm. The length frequency apex of 8-9 and 11-13 was characteristically for sprat samples from the ICES Sub-26, respectively and the length frequency apexes of 7-8cm and 10-12 cm were characteristically for sprat samples from the ICES Sub-28, respectively (Fig. 5; Table 6).

Hydrological situation in December 2016

Graphic illustration of the main hydrological parameters are shown on the figures. Hydrological parameters were measured at each trawling (14) and hydrological stations (7) (Fig. 1). Measurements were conducted with the Idronaut CTD-probe combined with the rosette sampler. Oxygen content was determined by the standard Winkler's method. The STD data were aggregated to the 1-m depth strata. The oxygen probes were taken on every 10 meters. The salinity parameter was presented in Practical Salinity Unit (PSU).
Meteorological parameters were measured by MicroStep-MIS AMS 111 automatic weather station.

The most frequent winds (Fig. 6) were from directions: WNW-WSW and NNW. The average (10 min) wind speed varied from 0.4 m/s to 17.7 m/s. The air temperature ranged from 0.8 °C to 9.1 °C, and average temperature was 3.7°C.

The seawater temperature in the surface layer varied from 4.25 to 7.55 °C. The lowest values were observed at the trawl 7, while the warmest surface water was at the trawl 2. The average value equalled 6.25 °C.

The average surface salinity was 7.15 PSU. The minimum value was 6.80 PSU (hydrological station 5) and maximum 7.40 PSU (trawl 14).

The highest oxygen content in surface layer was 8.67 ml/l (trawl 8) while the lowest one 7.84 ml/l (hydrological station 46). Mean value of dissolved oxygen equalled 8.13 ml/l.

Near - bottom layer conditions are presented in the (Fig.7,8). Water temperature varied from 4.81 °C (trawl 7) to 7.73 °C (trawl 2). The mean value calculated for the whole area covered during the cruise was 6.43 °C.

The average salinity in the close-to-the-bottom water layers was 9.36 PSU. The highest value was measured at the hydrological station 37 (13.38 PSU). The lowest one was 6.98 PSU (trawl 7).

The dissolved oxygen varied from 0.08 ml/l (hydrological station 37) to 8.54 ml/l (trawl 8).The mean value was 4.41 ml/l.

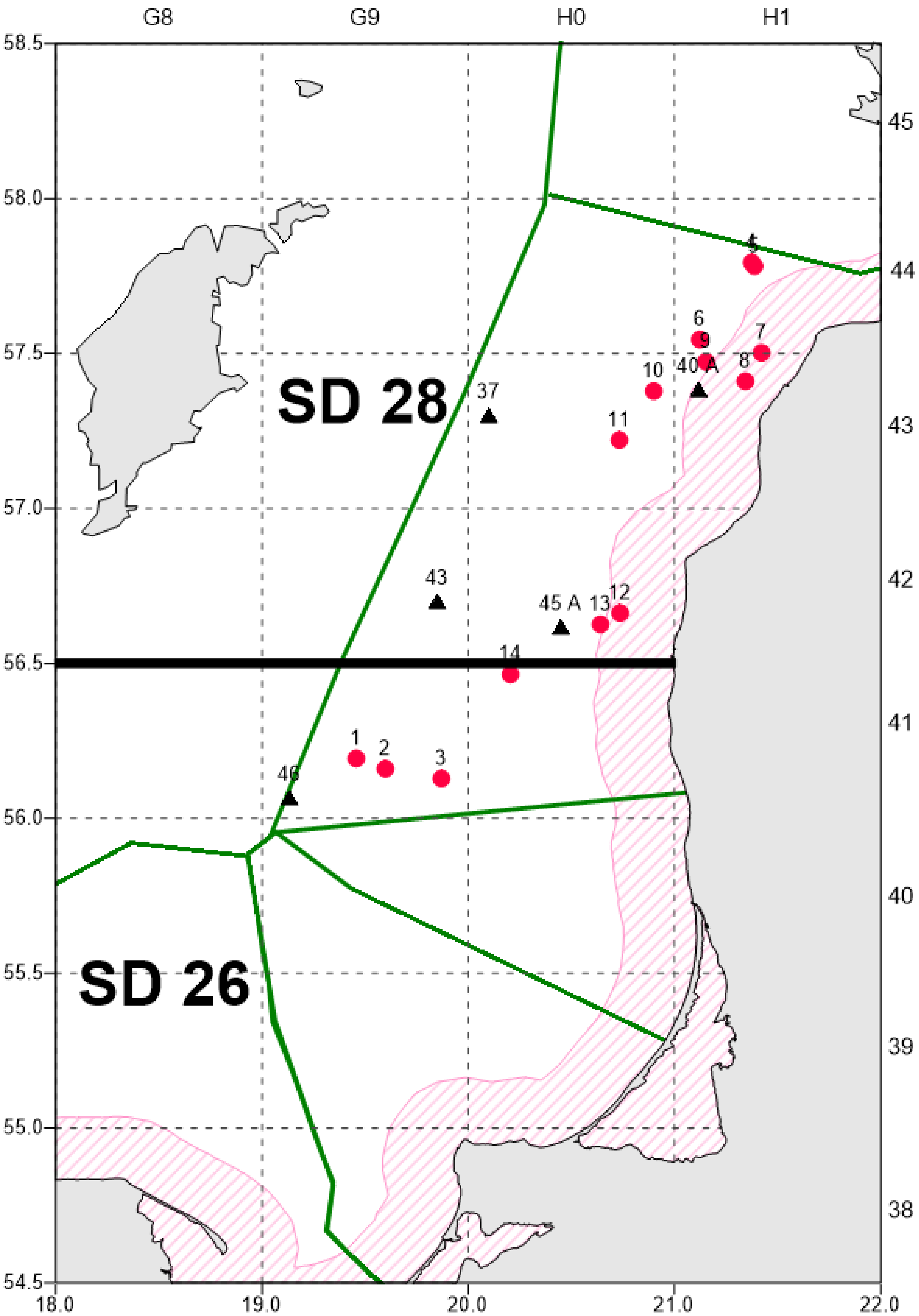


Figure 1. Location of the realized fish control-hauls (marked with red dots) and the HELCOM standard hydrological stations (marked with blue triangles), green lines - national fishing zone borders.

Table 1. Catch results from the Latvian-Polish BITS 4Q survey; r/v "Baltica", 03-12 December 2016

Haul number	Date of catch	EEZ	ICES rectangle	ICES SD	Depth to the bottom [m]	The ship's course during fishing [°]	Geographical position of the catch station: start latitude 00°00' N	start longitude 00°00' E	end latitude 00°00' N	end longitude 00°00'E	Time of: shutting net	pulling up net	Haul duration [min.]	Total catch	all species CPUE [kg/0.5h]	CATCH of particular fish species [kg]: Sprat	Herring	Cod	Flounder	Others
1	04.12.2016	LAT	41G9	26	102	225	56°11"6'	19°27" 4'	56° 11' 1"	19° 26' 7"	08:15	08:30	15	37.618	75.236	7.015	14.455	5.85	9.795	0.503
2	04.12.2016	LAT	41G9	26	65	205	56°09"6'	19°35" 9'	56° 08' 8"	19° 35' 5"	10:15	10:30	15	1037.085	2074.17	1023.838	12.622	0.625		0
3	04.12.2016	LAT	41G9	26	59	80	56°07"7'	19°52" 2'	56° 07' 8"	19° 53' 3"	12:15	12:30	15	348.485	696.97	281.076	58.184	3.2	6.025	0
4	06.12.2016	LAT	44H1	28	73	175	57°47"6'	21°22" 4'	57° 47' 0"	21° 22' 5"	08:15	08:30	15	228.887	457.774	108.978	118.402	0.891	0.587	0.029
5	06.12.2016	LAT	44H1	28	69	165	57°46"9'	21°23" 2'	57° 46' 2"	21° 23' 4"	09:55	10:10	15	198.468	396.936	74.247	121.733	0.714	1.23	0.544
6	06.12.2016	LAT	44H1	28	67	190	57°32"7'	21°07" 3'	57° 31' 4"	21° 06' 7"	13:30	14:00	30	216.16	216.16	79.953	134.547		1.510	0.15
7	07.12.2016	LAT	44H1	28	26	350	57°30"1'	21°25" 3'	57° 30' 8"	21° 25' 3"	08:15	08:30	15	51.029	102.058	2.61	40.58		7.48	0.359
8	10.12.2016	LAT	43H1	28	33	355	57°24"6'	21°20" 6'	57° 25' 3"	21° 20' 4"	08:20	08:35	15	26.421	52.842	3.1	18.04		4.795	0.486
9	10.12.2016	LAT	43H1	28	69	335	57°28"4'	21°09" 1'	57° 29' 0"	21° 08' 6"	09:50	10:05	15	199.215	398.43	29.919	168.961		0.335	0
10	10.12.2016	LAT	43H0	28	61	200	57°22"7'	20°54" 0'	57° 22' 1"	20° 53' 5"	11:45	12:00	15	230.867	461.734	31.134	197.826	1.278	0.505	0.124
11	10.12.2016	LAT	43H0	28	59	185	57°13"2'	20°44" 0'	57° 12' 6"	20° 43' 9"	14:10	14:25	15	46.52	93.04	39.948	6.572			0
12	11.12.2016	LAT	42H0	28	43	35	56°39"7'	20°44" 2'	56° 40' 4"	20° 44' 8"	08:20	08:35	15	99.811	199.622	14.855	71.145		13.15	0.661
13	11.12.2016	LAT	42H0	28	50	40	56°37"5'	20°38" 5'	56° 38' 2"	20° 39' 2"	09:55	10:10	15	90.034	180.068	8.094	74.786	0.25	6.285	0.619
14	11.12.2016	LAT	41H0	26	80	25	56°27"9'	20°12" 3'	56° 28' 8"	20° 12' 6"	13:30	13:45	15	24.752	49.504	18.02	6.58		0.135	0.017

Table 2. Numbers of fish biologically analysed during the BITS-4q survey; r.v. "Baltica" (03-12 December 2016).

Species	ICES SD	Number of samples	Number of fish	
			measured	analyzed
Cod	26	3		34
	28	4		14
	Total	7		48
Flounder	26	3		64
	28	9	82	212
	Total	12	82	276
Turbot	26			
	28	1	1	
	Total	1	1	
Plaice	26	1	3	
	28			
	Total	1	3	
Herring	26	4	342	
	28	10	1037	
	Total	14	1379	
Sprat	26	4	419	
	28	10	1030	
	Total	14	1449	
All other Species	26	2	6	
	28	8	84	
	Total	10	90	
Total	26	17	770	98
	28	42	2234	226
	Total	59	3004	324

Species	ICES SD	Number of samples	Number of stomachs collected
Cod stomach samples	26	3	32
	28	4	14
	Total	7	46

Fig. 2. Length frequency of cod from Sub-Divisions 26 and 28 in the control catches during the r/v "Baltica" BITS survey, 03-12 December 2016

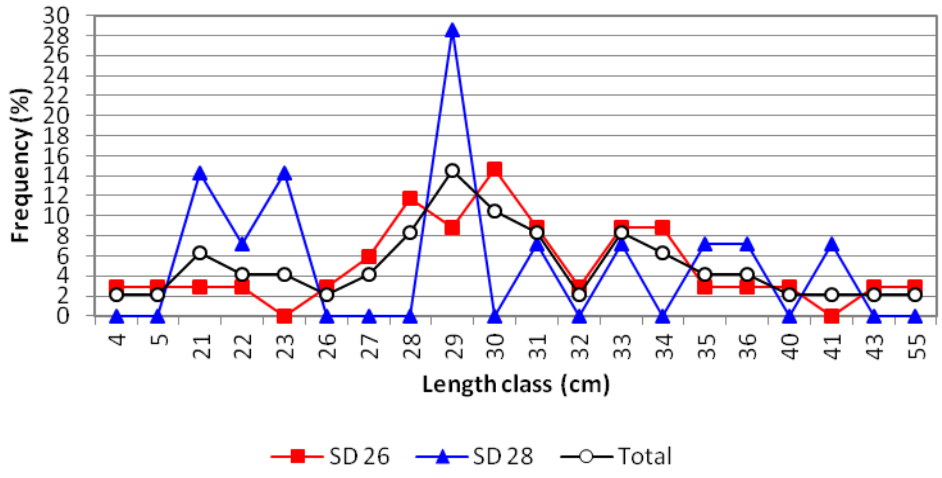


Fig. 3. Length frequency of flounder from Sub-Divisions 26 and 28 in the control catches during the r/v "Baltica" BITS survey, 03-12 December 2016

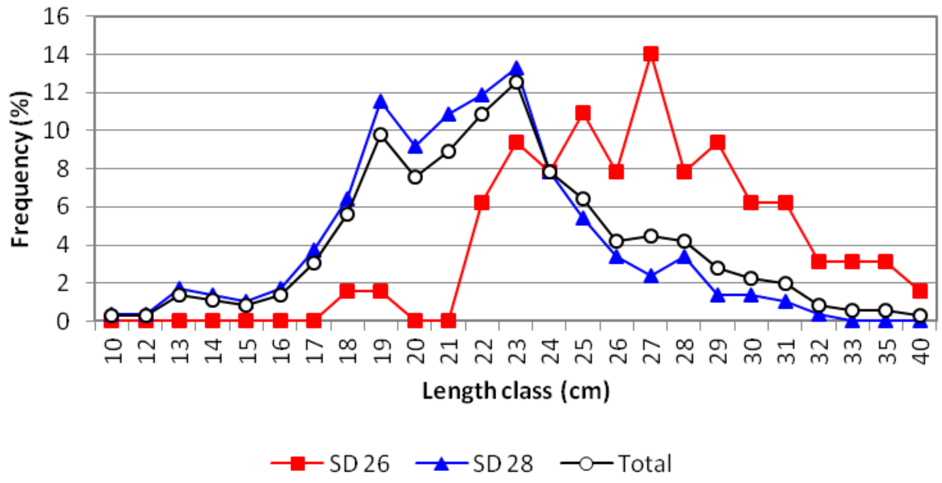


Fig. 4. Length frequency of herring from Sub-Divisions 26 and 28 in the control catches during the r/v "Baltica" BITS survey, 03-12 December 2016

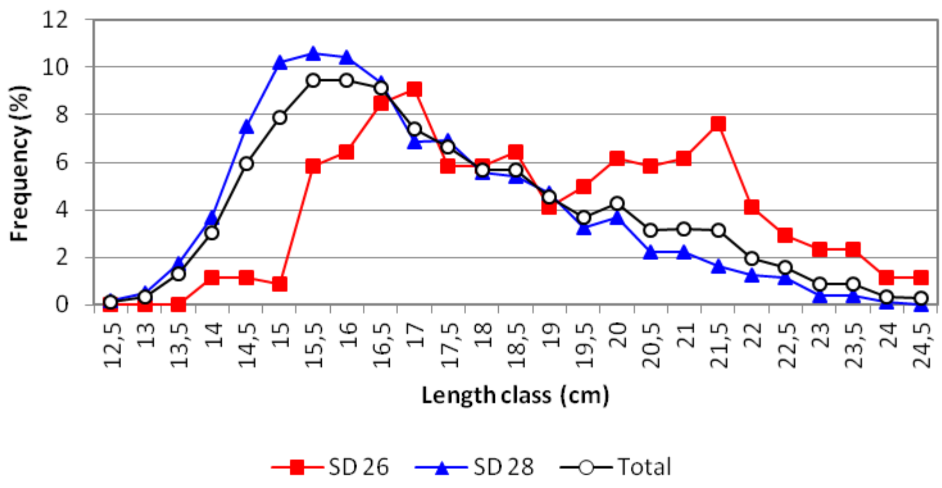


Fig. 5. Length frequency of sprat from Sub-Divisions 26 and 28 in the control catches during the r/v "Baltica" BITS survey, 03-12 December 2016

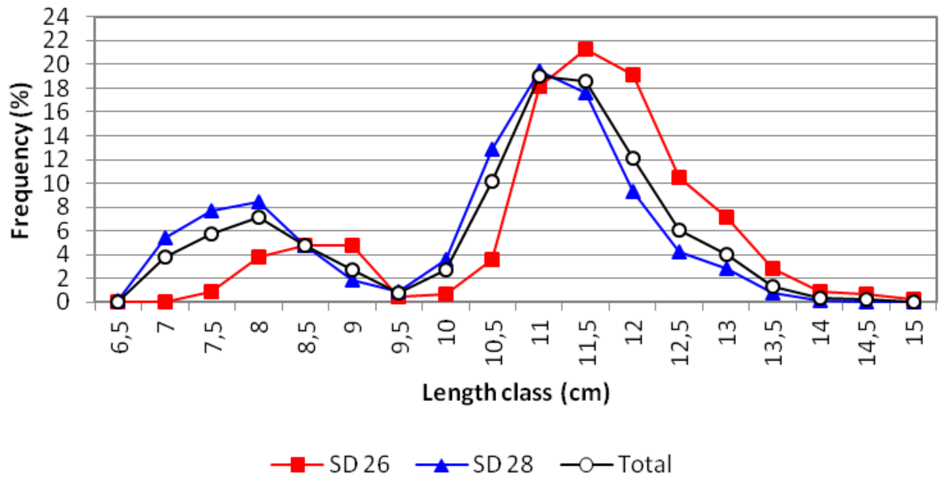


Table 3. Cod length measurements by consecutive hauls in the r/v “Baltica” Latvian - Polish BITS survey (03- 12 December 2016); specimens grouped by 5-cm length classes.

Haul no	SD	cm_groups								Sum
		0-4	5-9	20-24	25-29	30-34	35-39	40-44	55-59	
1	26	1	1	1	7	9	2	2		23
2	26					2				2
3	26			1	3	4			1	9
4	28						1	1		2
5	28				2	1				3
10	28			5	2		1			8
13	28					1				1
SD 26		1	1	2	10	15	2	2	1	34
SD 28				5	4	2	2	1		14
Total		1	1	7	14	17	4	3	1	48

Table 4. Flounder length measurements by consecutive hauls in the r/v “Baltica” Latvian - Polish BITS survey (03- 12 December 2016); specimens grouped by 2-cm length classes.

Haul no	SD	cm_group														Sum
		10-11	12-13	14-15	16-17	18-19	20-21	22-23	24-25	26-27	28-29	30-31	32-33	34-35	38-40	
1	26							3	8	7	8	2	4	2	1	35
3	26							7	4	7	3	6				27
4	28							1	1		1					3
5	28							3	2	1		1				7
6	28				1	3	2	5	2							13
7	28		6	5	7	18	20	17	9							82
8	28	1		1	2	8	9	10	3	4	2					40
9	28							1	1							2
10	28						1	2	1							4
12	28			1	5	16	19	22	16	7	7	4	1			98
13	28				1	8	8	13	4	5	4	2				45
14	26					2										2
SD 26		0	0	0	0	2	0	10	12	14	11	8	4	2	1	64
SD 28		1	6	7	16	53	59	74	39	17	14	7	1	0	0	294
Total		1	6	7	16	55	59	84	51	31	25	15	5	2	1	358

Table 5. Herring length measurements by consecutive hauls in the r/v “Baltica” Latvian-Polish BITS survey (03- 12 December 2016); specimens grouped by 1cm length classes.

Haul no	SD	cm_group 12	13	14	15	16	17	18	19	20	21	22	23	24	Sum
1	26				2	12	12	11	8	15	16	11	7	7	101
2	26				1	4	4	1				1			11
3	26			7	11	19	22	14	14	11	16	8	6	1	129
4	28	1	3	21	31	22	10	11	2	2	1	1			105
5	28		5	17	27	24	14	9	2	2	1		1		102
6	28		2	12	24	25	10	10	11	4	4				102
7	28		1	15	20	24	15	12	7	1	5	2	0		102
8	28		1	6	14	27	14	11	13	9	2	0	3		100
9	28		2	6	26	29	17	8	8	3	2	1	0		102
10	28	1	3	18	24	19	16	4	7	3	4	3	0		102
11	28		6	18	36	12	15	8	2	5	5	0	0		107
12	28			2	8	8	22	22	16	13	7	9	4	1	112
13	28			1	6	15	10	19	15	19	9	9			103
14	26			1	9	16	13	16	9	15	15	4	3		101
SD 26				8	23	51	51	42	31	41	47	24	16	8	342
SD 28		2	23	116	216	205	143	114	83	61	40	25	8	1	1037
Total		2	23	124	239	256	194	156	114	102	87	49	24	9	1379

Table 6. Sprat length measurements by consecutive hauls in the r/v “Baltica” Latvian-Polish BITS survey (03- 12 December 2016); specimens grouped by 0.5 cm length classes.

Haul no	SD	cm_group 6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	Sum
1	26					1					10	14	29	19	15	8	4	3	1	104
2	26							1		1	29	31	26	7	8	1				104
3	26			4	13	15	16		1	9	21	18	5	5	1					108
4	28							2	5	12	38	25	12	5	3	1				103
5	28					1		1	1	15	28	28	14	6	7					101
6	28		2	5	11	10	6	1	16	24	18	7	2	2						104
7	28	1	35	37	13			1	1	1	2	3	3	2	2					101
8	28		10	13	13	2	1	1	1	13	13	24	6	2	1					100
9	28			2	3	3	2		5	14	26	22	13	6	5	3				104
10	28		8	16	17	7	1	2	3	9	4	11	12	6	1	1	2			100
11	28		1	4	18	7	1		1	16	29	15	9	6	4					111
12	28			2	9	17	7	1	3	19	15	17	7	4	3	1				105
13	28				3	2	1		1	10	27	29	18	5	3	2				101
14	26				3	4	4	1	2	5	16	26	20	13	6	3				103
SD 26				4	16	20	20	2	3	15	76	89	80	44	30	12	4	3	1	419
SD 28		1	56	79	87	49	19	9	37	133	200	181	96	44	29	8	2			1030
Total		1	56	83	103	69	39	11	40	148	276	270	176	88	59	20	6	3	1	1449

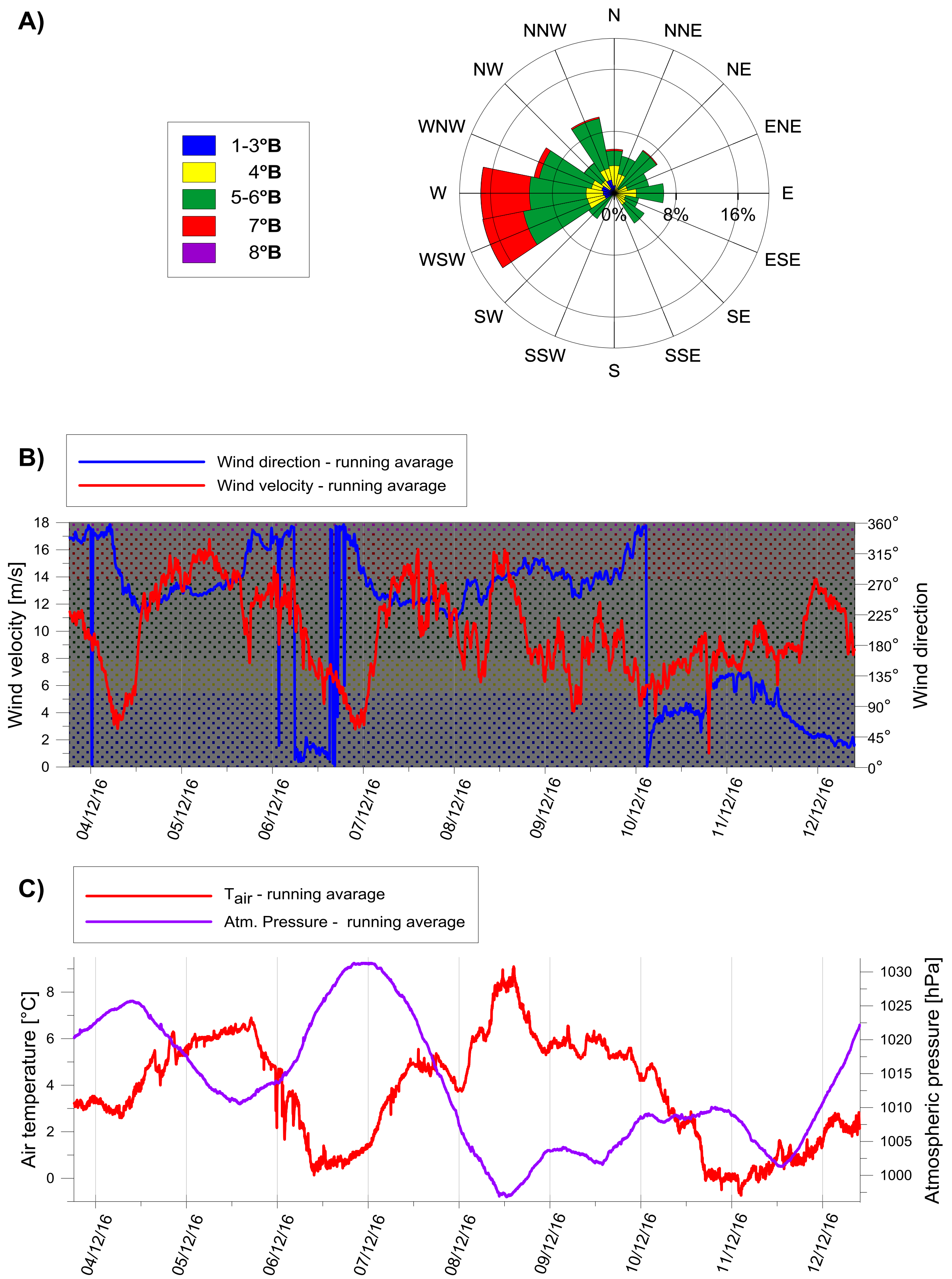


Figure 6. Changes of the main meteorological parameters (December 2016).

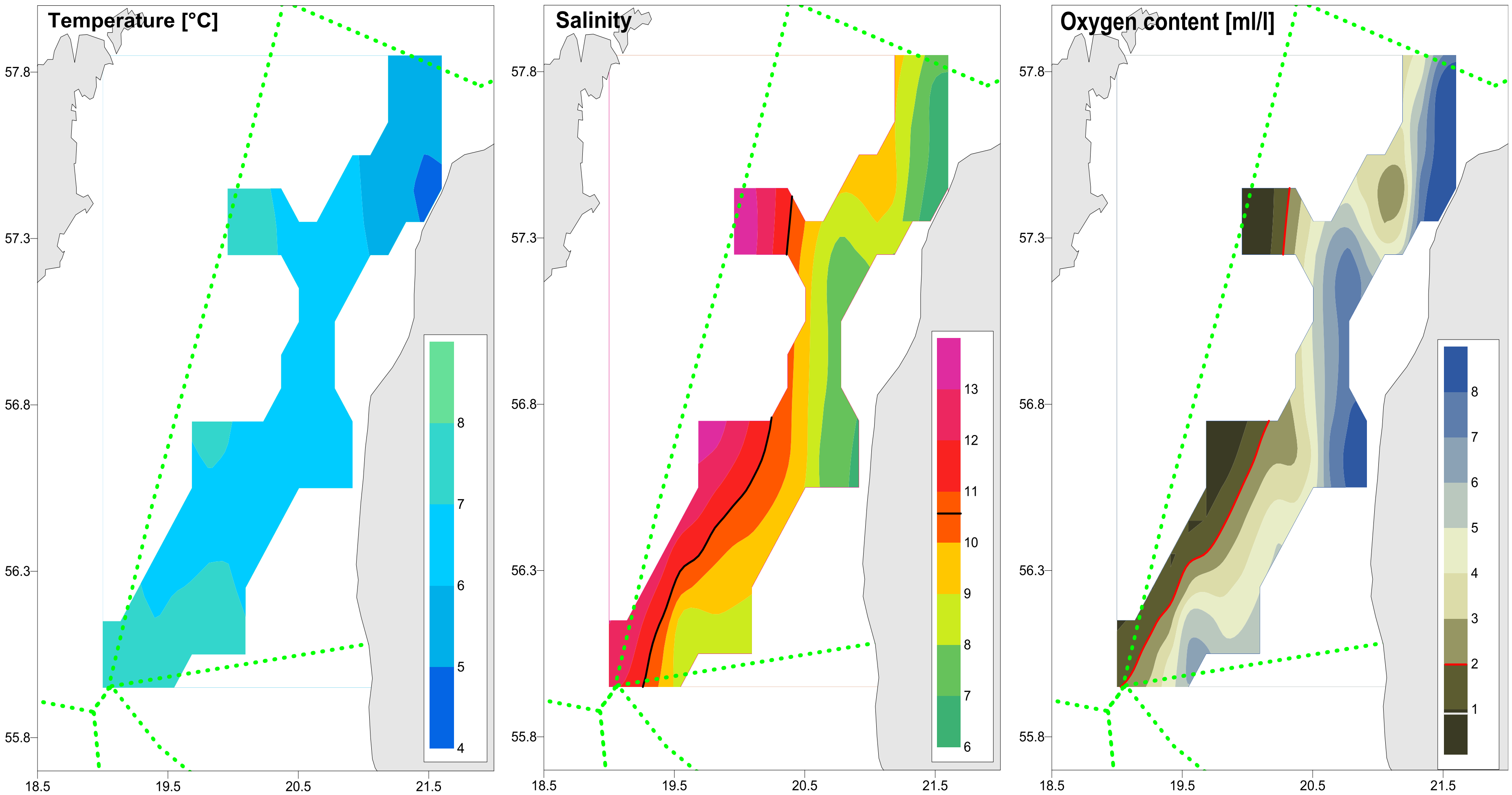


Figure 7. Distribution of the seawater temperature, salinity and oxygen content in the near bottom waters (December 2016).

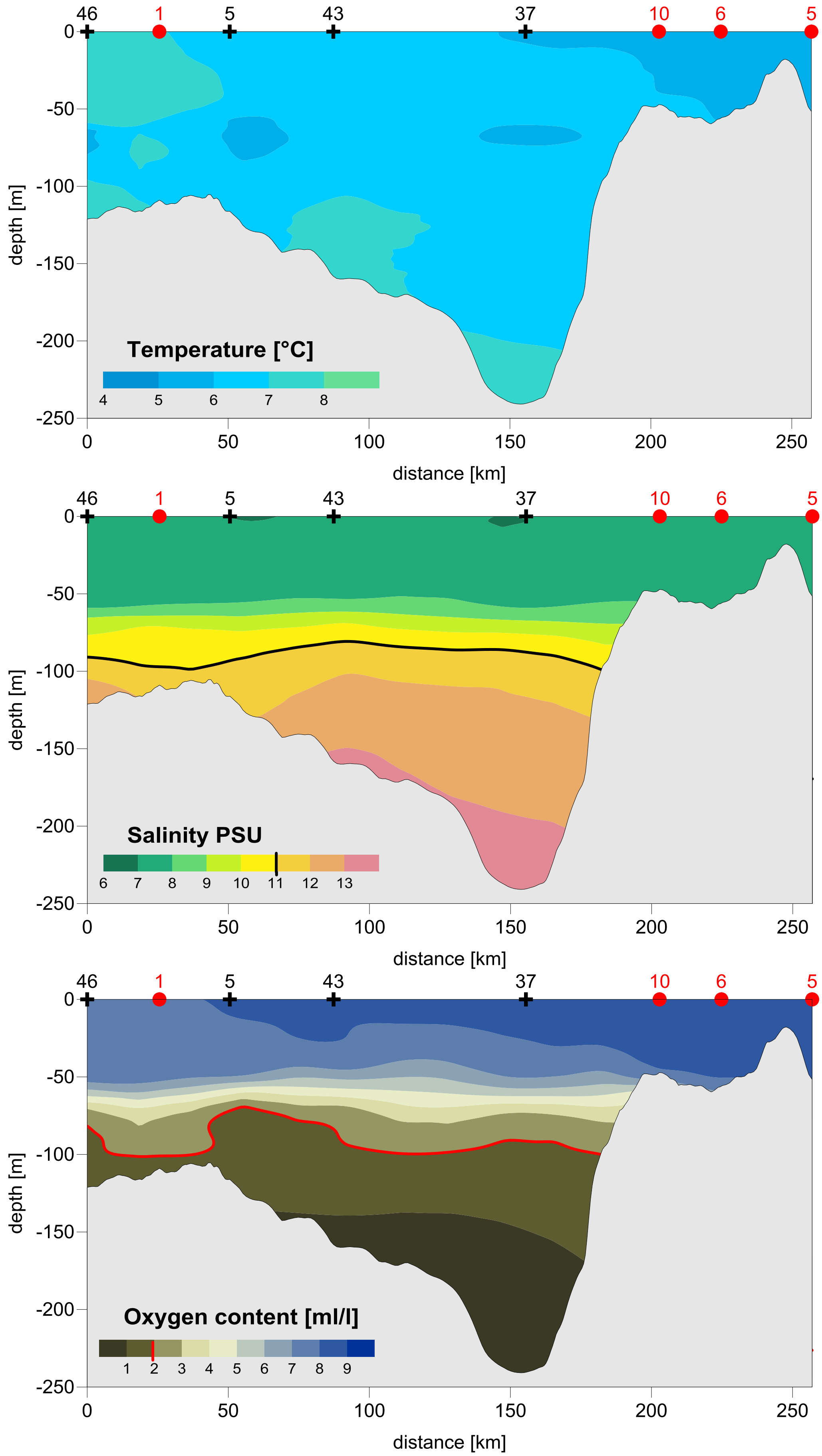


Figure 8.Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological profile (December 2016).

Russian Demersal Trawl Survey Report for RV "ATLANTNIRO" 11-18.10.2016

by A. Karpushevskaia, A. Zezera, I. Karpushevskiy

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

1 INTRODUCTION

The main objective is to assess recruits resources of cod in the Baltic Sea. The demersal trawl survey is conducted two times annually - in the autumn and in the spring to supply the ICES with the data on amount young cod and cod of advanced ages. The present survey data will provide to the ICES Baltic Fisheries Assessment Working Group (WGBFAS). These data are necessary for an estimation of the stock size of cod in East part of the Baltic Sea (ICES subdivisions 25-32).

2 METHODS

2.1 Personnel

A. Zezera	AtlantNIRO, Kaliningrad, Russia - cruise leader
A. Karpushevskaia	AtlantNIRO, Kaliningrad, Russia - scientific leader
A. Malishko	AtlantNIRO, Kaliningrad, Russia – acoustic
M. Sokolov	AtlantNIRO, Kaliningrad, Russia – acoustic
S. Alekseev	AtlantNIRO, Kaliningrad, Russia - hydrologist
S. Ivanov	AtlantNIRO, Kaliningrad, Russia - engineer
N. Kalinina	AtlantNIRO, Kaliningrad, Russia - engineer
I. Trufanova	AtlantNIRO, Kaliningrad, Russia - engineer
N. Dyushkov	AtlantNIRO, Kaliningrad, Russia - engineer

2.2 Narrative

The RV'ATLANTNIRO' cruise number 65 was started from port Kaliningrad 30 September and continued to 19 October of 2016. The demersal trawl survey was carried out from 11 till 18 October, 2016. The demersal trawl survey was intended to cover the waters of Russian zone.

2.3 Survey design

The international bottom trawl survey was carried out in from of a stratified random survey. The depth of demersal trawls is in the range between 27 and 106 m. The number of trawl stations to the depth strata according to recommendations ICES (ICES CM 2002/G:05 Ref. H) and according to solution ICES WGBIFS (ICES CM 2008/LRC:08 Ref. Acom). The survey zone to cover the water area of Russian zone. (fig. 1).

2.4 Biological data – fishing stations

Trawling was done with the standard ground trawl –TV3#930 in a bottom. The mesh size in the codend was 6.5 mm. The trawling depth and the net opening were controlled by a netsonde. Normally a net opening was achieved of about 5 m. The trawling time lasted 30 minutes, the trawling time duration for one fishing station was reduced to 20 minutes. From each haul sub-samples were taken to determine of length and weight of fish. Samples of cod, flounder, herring and sprat were investigated onboard a vessel (i.e. sex, maturity, age). After each trawl haul it was intended to investigate the hydrographic condition by a CTD-probe.

3 RESULTS

3.1 Biological data

It was in total made 15 control ground trawls in the Russian water area. Catches of a fish were from 3.0 kg up to 520.7 kg for 30 minutes of a trawl (cod – 60.4%, flounder – 9.2%, herring – 27.5%, sprat - 2.4%). The average catch for a trawl has made 197.4 kg. The results of the catch composition are presented in Table 1.

Cod catches were insignificant and varied from 1.1 up 334.3 kg (abundance from 2 up to 496) for 30 minutes of a trawl. Flounder catches varied from 0.19 up to 131.2 kg. 1026 cod, 512 flounder, herring and sprat were investigated in lab onboard a vessel. Age samples of cod 565 and age samples of flounder 511 have been researched in the institute.

Landings of cod (kg) and landings of young cod in length up to 30 cm (in numbers) for 30 minutes of a haul in October 2016 are presented in Figures 2 – 3. Landings of flounder (kg) for 30 minutes of a haul in October 2016 are presented in Figure 4.

The length distributions of cod and flounder are presented in Fig. 5-6.

3.2 Hydrographic data

In the period from 02 till 18 October 2016 on the water area of Russian economic region oceanographic survey has been made (40 hydrological stations). The water temperature, salinity and the oxygen concentrations were determined by a sonde SBE-19Plus (Sea Bird Electronic, Ltd., USA).

The water temperature on the surface had been changing from 7.5°C up to 16.5°C. Seasonal thermocline was found at the depth of 35 m.

Salinity of water on the surface had been changing within the narrow range of 6.96‰-7.45‰. High limit of a halocline was found at the depth of 65-75 m. The maximum values of salinity have been fixed in a benthic stratum in the central part of Gdansk Deep (13.4-13.5‰).

The oxygen concentration was high 6.2-6.8 ml/l on the surface, saturation of water 95-98%. In the bottom layer to the main part of the area with depths of more than 80-85 m was observed under hypoxic conditions, and oxygen was absent in the center of the Gdansk Deep. At the end of the second decade of October the inflow of the North Sea waters genesis was noted, that characterized by increased bottom temperature to 8.2°C, significant increase in salinity to 14.5‰ and the improvement of the oxygen regime.

The locations of stations, temperature, salinity distribution and the oxygen concentration at the bottom, vertical distribution are shown on fig. 7-12.

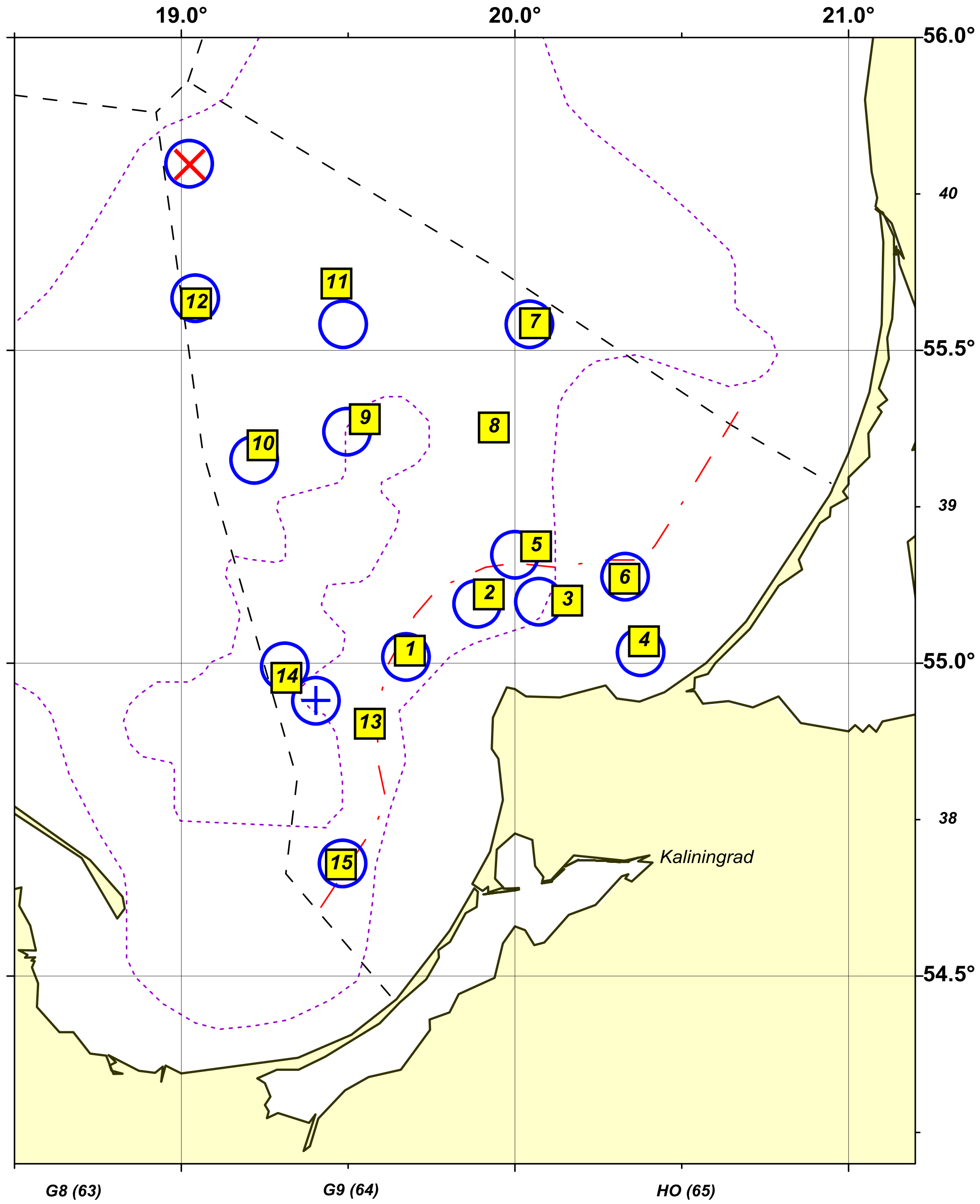
4 DISCUSSION

Structure of catches of demersal trawl survey is shown on table 1.
The total length of the main fish species ranged as follows:

- cod – 15 –70 cm (average length of 36.5 cm, average weight 433 g)
- flounder – 15-41 cm (average length of 26.5 cm, average weight 208 g)
- herring – 11.0 – 29.0 cm (average length of 20.6 cm, average weight 51.1 g)
- sprat – 6.5 – 14.5 cm (average length of 10.7 cm, average weight 8.25 g)

5 REFERENCES

Report of the Baltic International Fish Survey Working Group. ICES CM 2014/SSGESST:13 Ref. SCICOM & ACOM Manual for the Baltic International Trawl Surveys (BITS).



- The executed trawling stations

- The recommended ICES trawling stations

- Only hydrological are executed in exchange to trawling stations

- Did not carried after 2009 (invalid in March 2009)

Fig. 1. Trawl positions for RV "ATLANTNIRO" in 11-18 October 2016

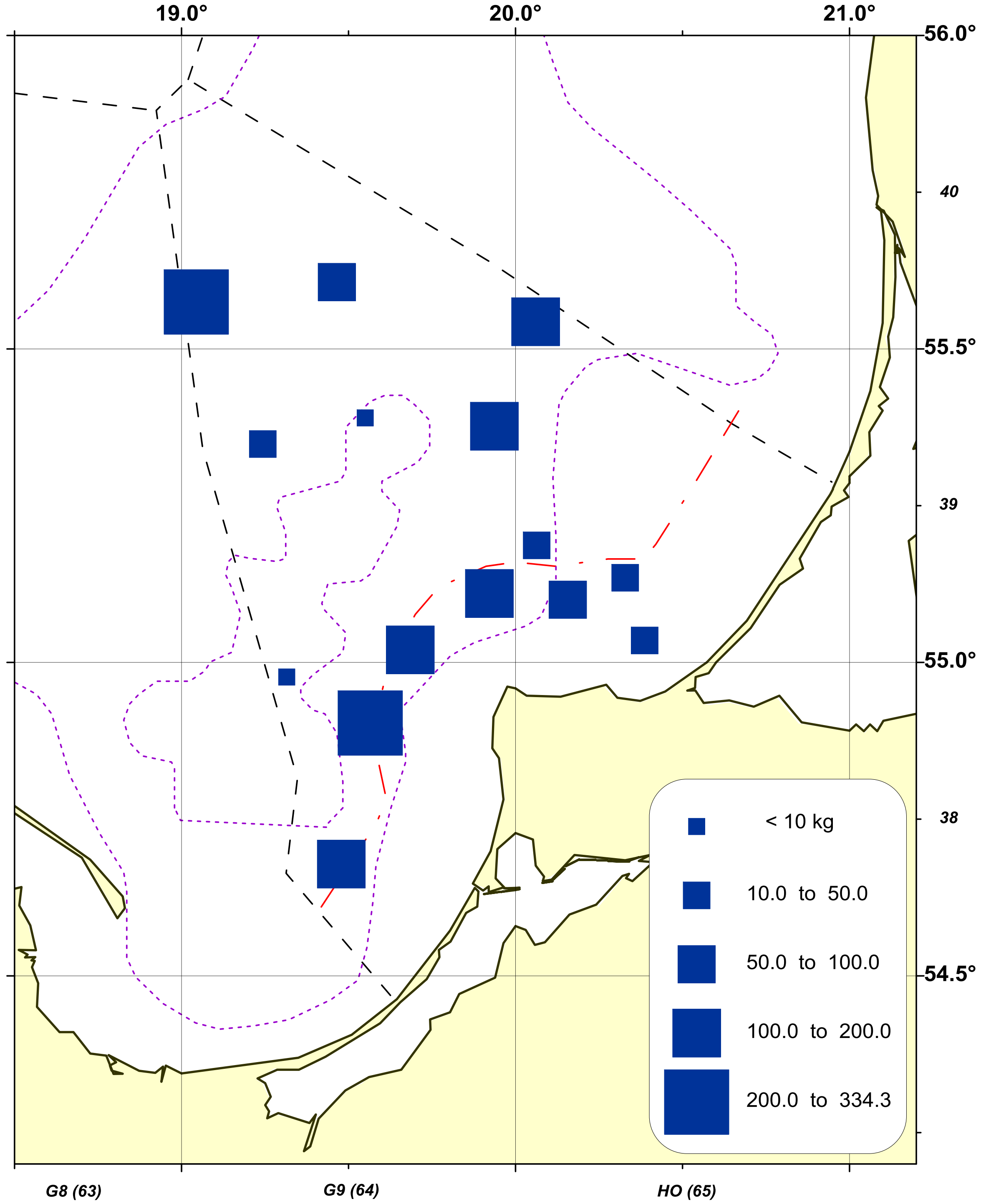


Fig. 2. Landings of cod (kg) for 30 minutes of a haul in 11-18 October 2016

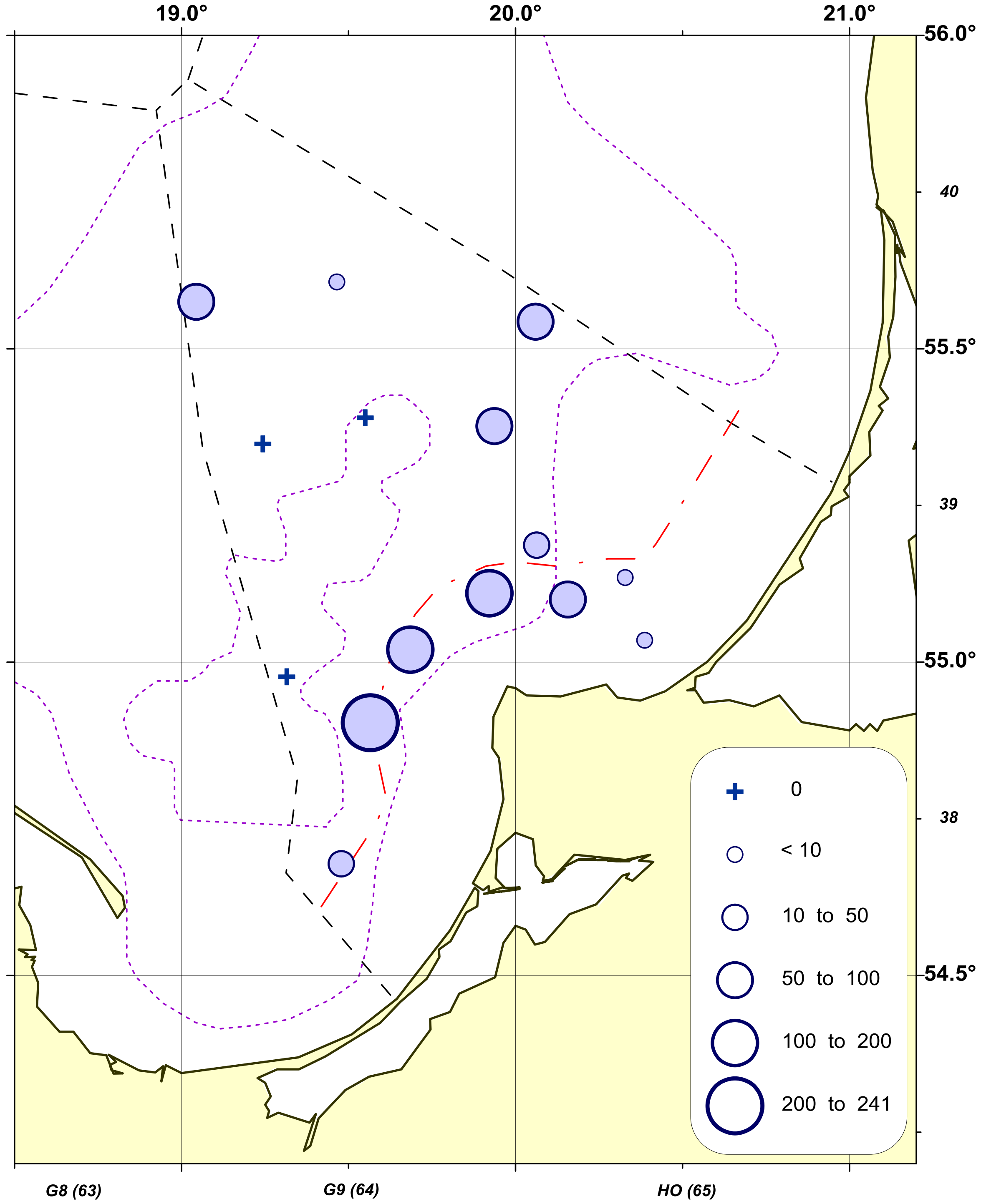


Fig. 3. Landings of young cod in length up to 30 cm (in numbers) for 30 minutes of a haul in 11-18 October 2016

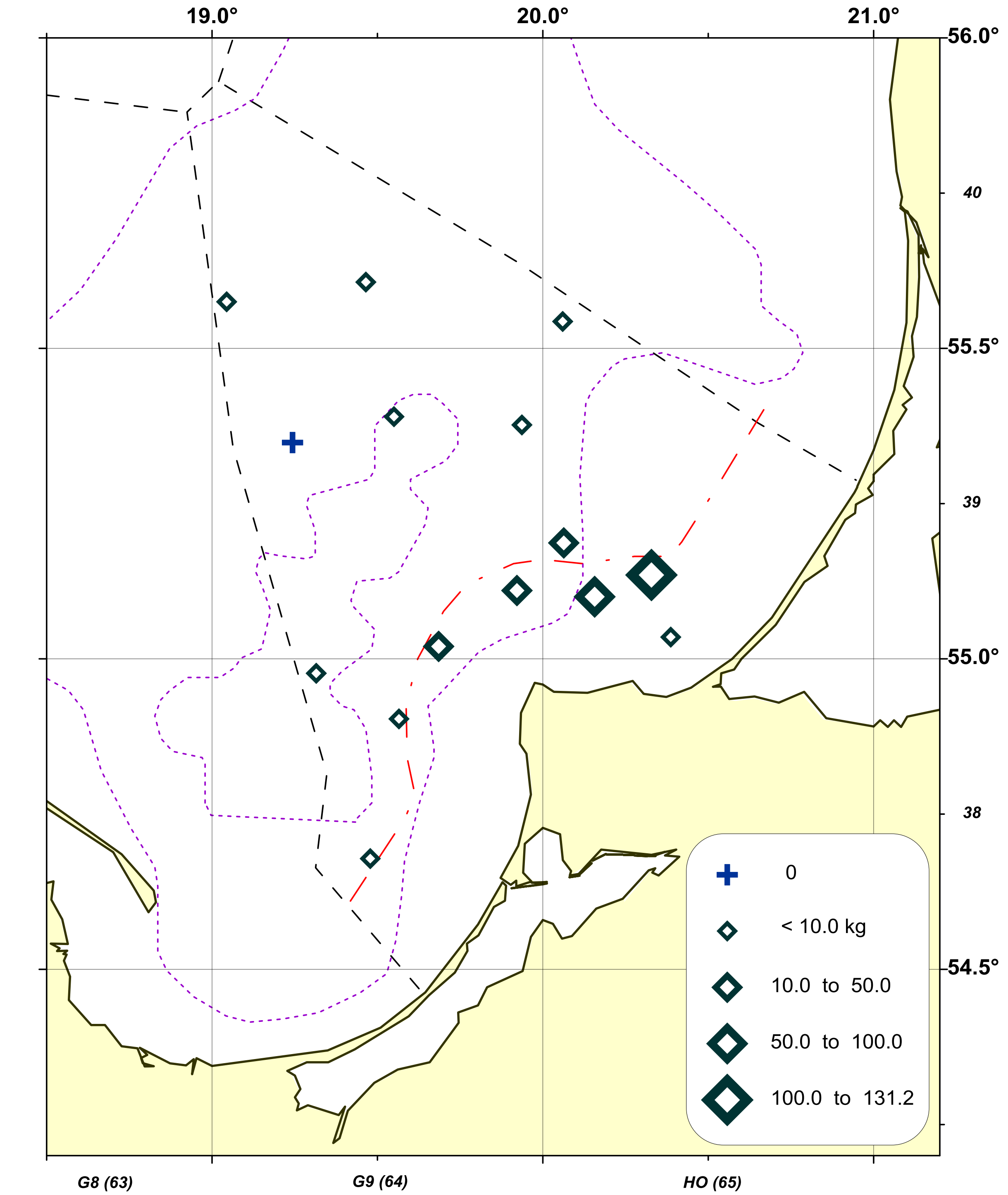


Fig. 4. Landings of flounder (kg) for 30 minutes of a haul in 11-18 October 2016

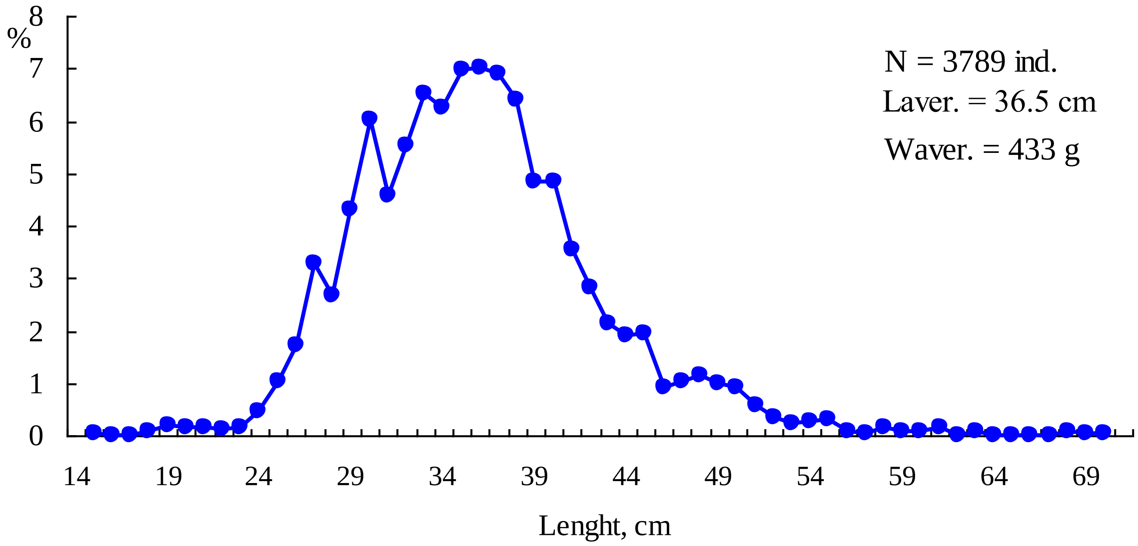


Fig. 5. Length distribution of ***cod*** in Russian water area (Sub-division 26) in 11-18 October 2016 (materials of international bottom trawl survey)

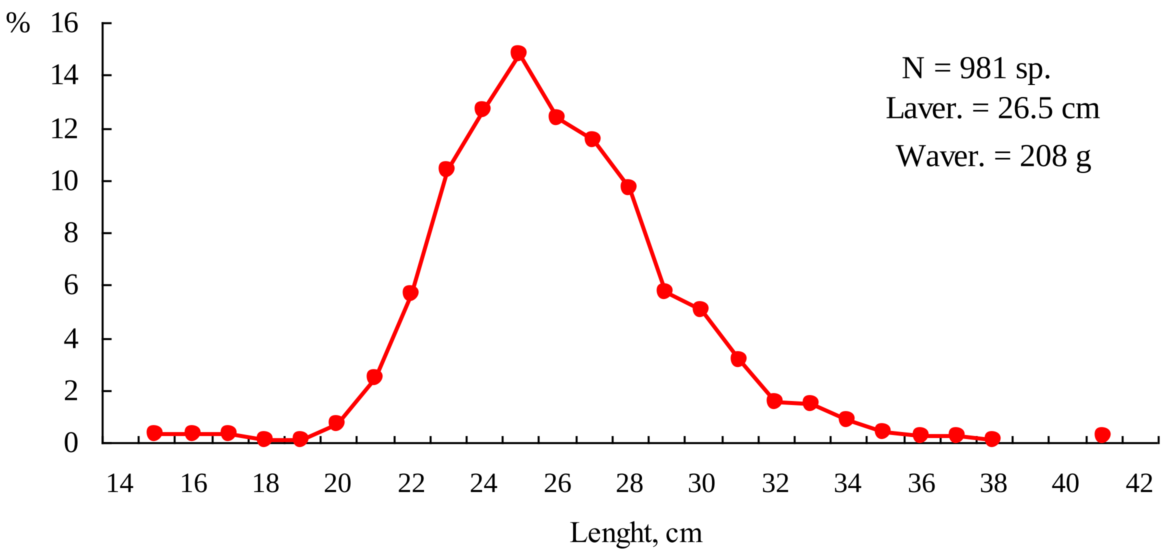


Fig. 6. Length distribution of ***flounder*** in Russian water area (Sub-division 26) in 11-18 October 2016 (materials of international bottom trawl survey)

Table 1

Catch composition on the International demersal trawl survey in 11-18 October 2016

ICES subdivision: 26 Vessel: STM - "Atlantniro" Net type: bottom trawl - TV-3#930
Month/Year: October/2016 Haul duration: 30 minute Mesh bar size: 6.5 mm

Total of hauls	rectangle	depth meter	haul duration	total catch, kg	cod		flounder		herring		sprat	
					kg	%	kg	%	kg	%	kg	%
15	4064, 4065, 3864, 3964, 3965	27-106	30	2890.4	1735.4	60.0	273.1	9.4	797.8	27.6	71.0	2.5

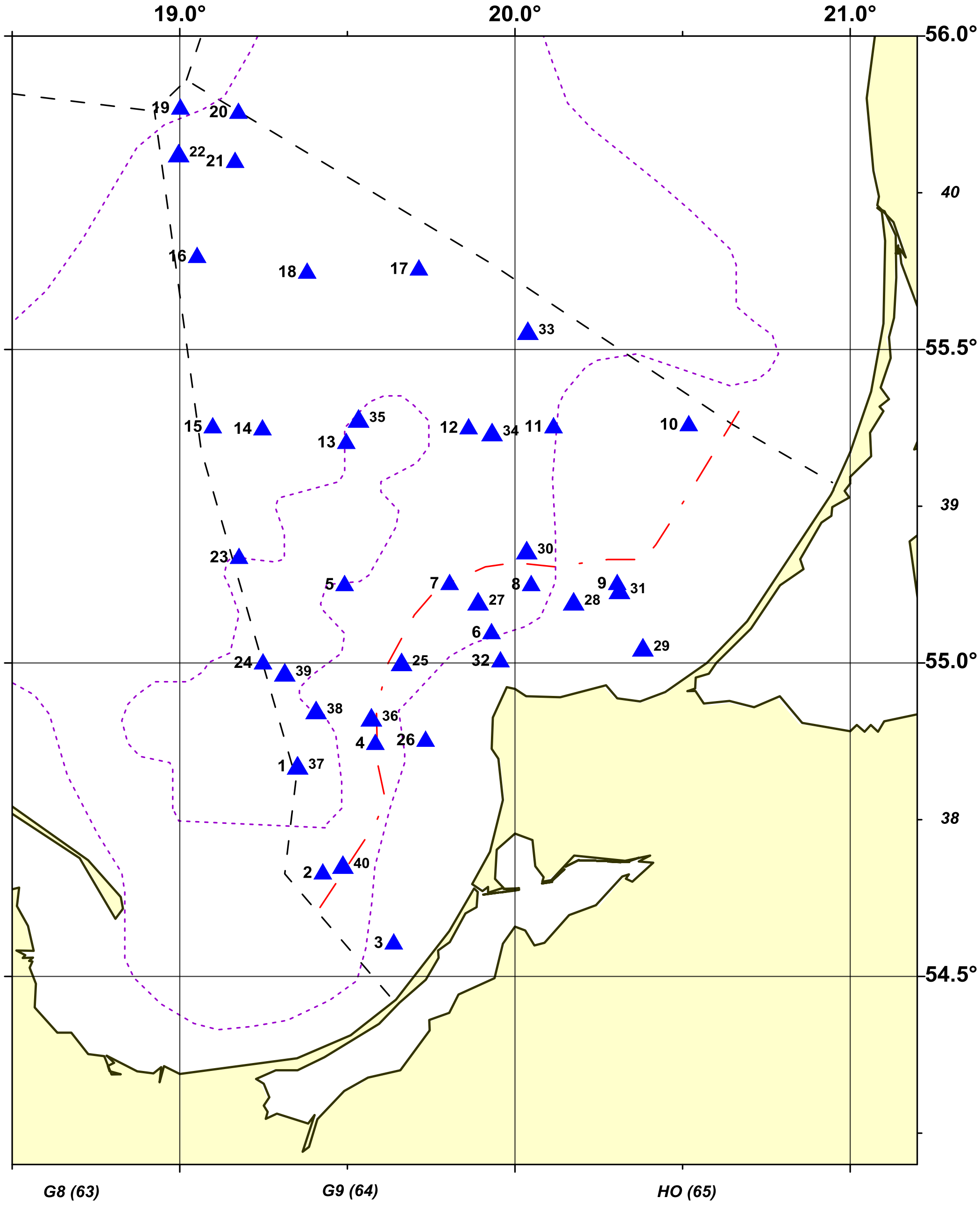


Fig. 7. Location of hydrographic stations in 02-18 October 2016, RV "ATLANTNIRO"

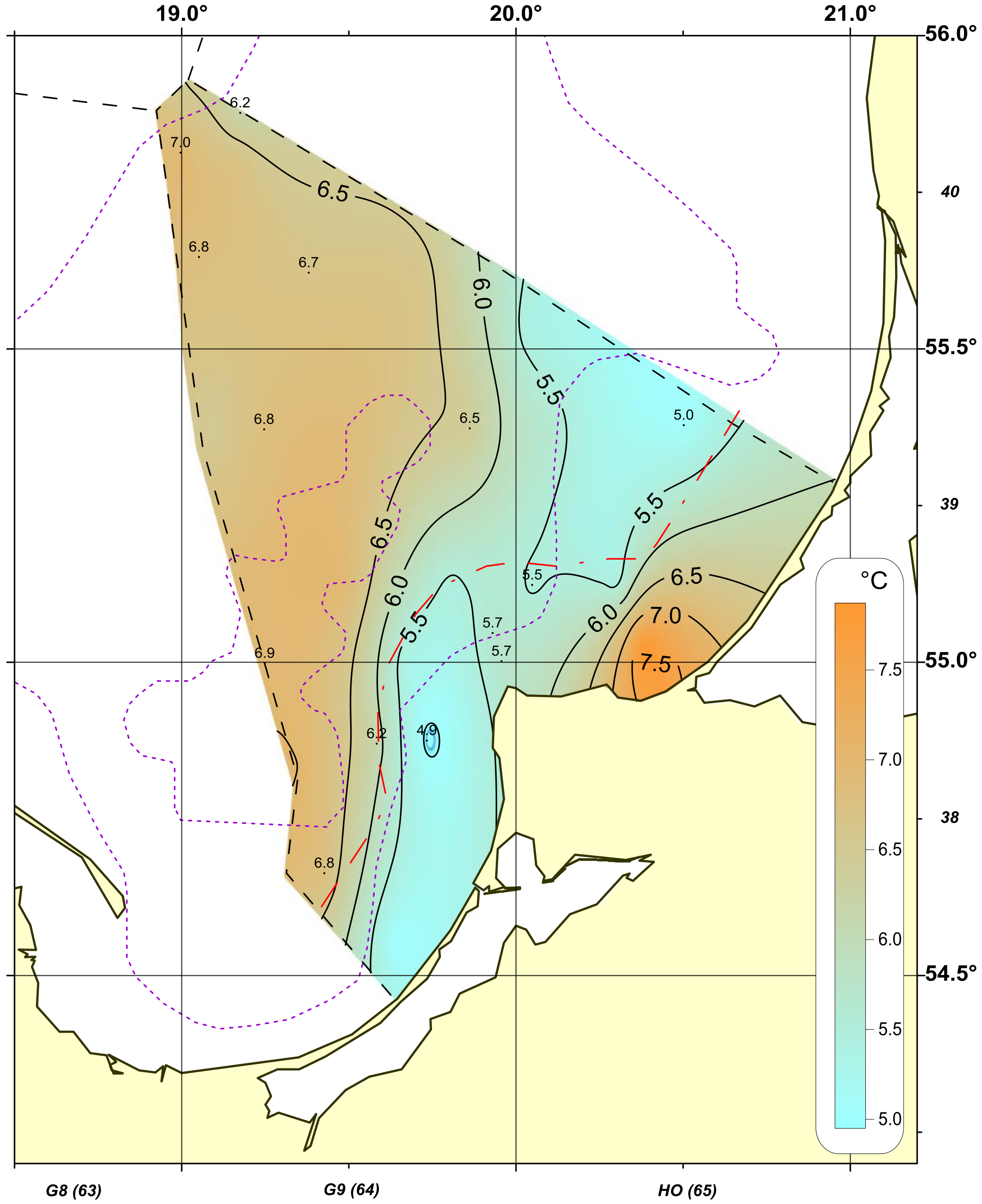


Fig. 8. Bottom water temperature distribution (°C) in 02-13 October 2016, RV "ATLANTNIRO"

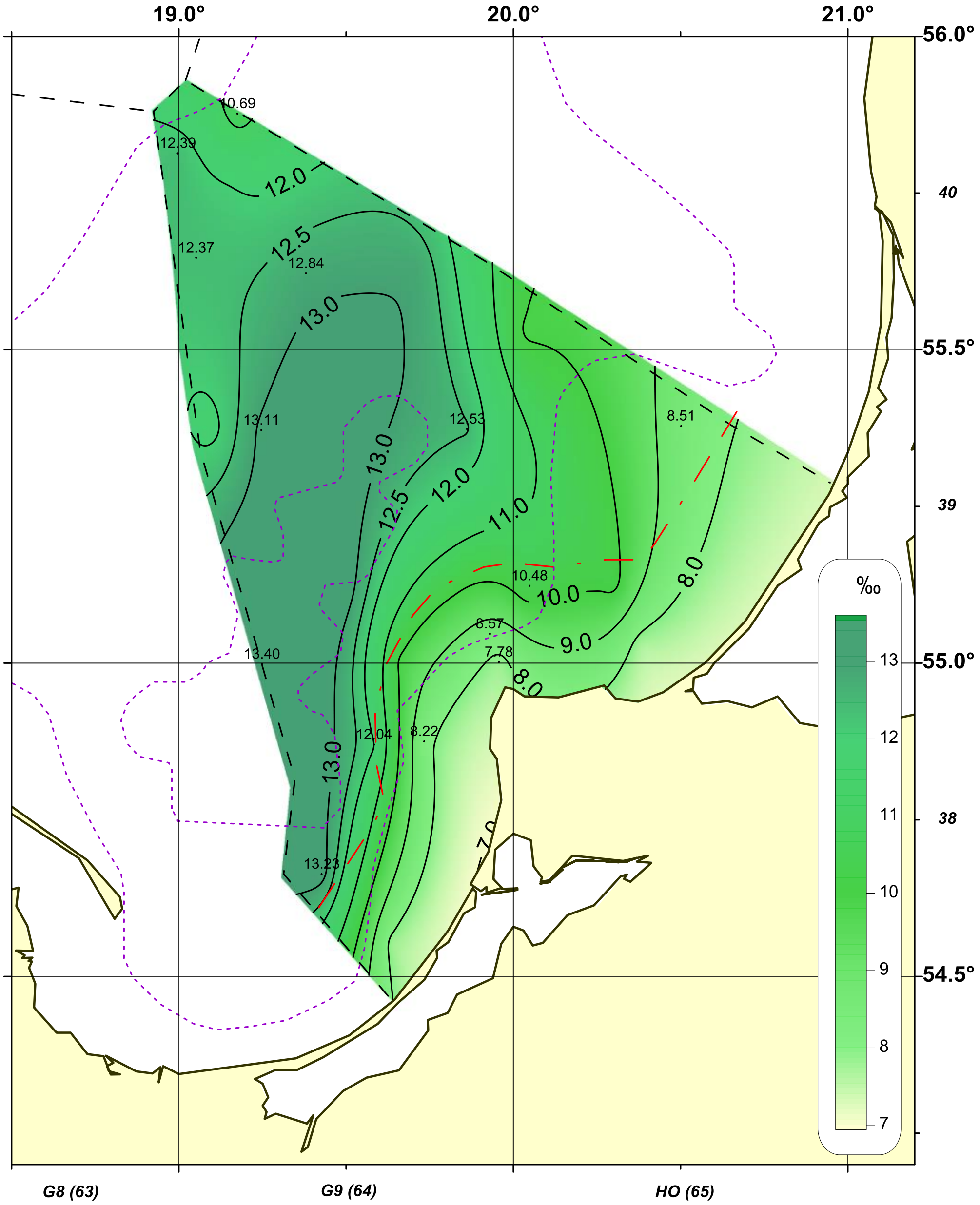


Fig. 9. Bottom water salinity distribution (‰) in 02-13 October 2016, RV "ATLANTNIRO"

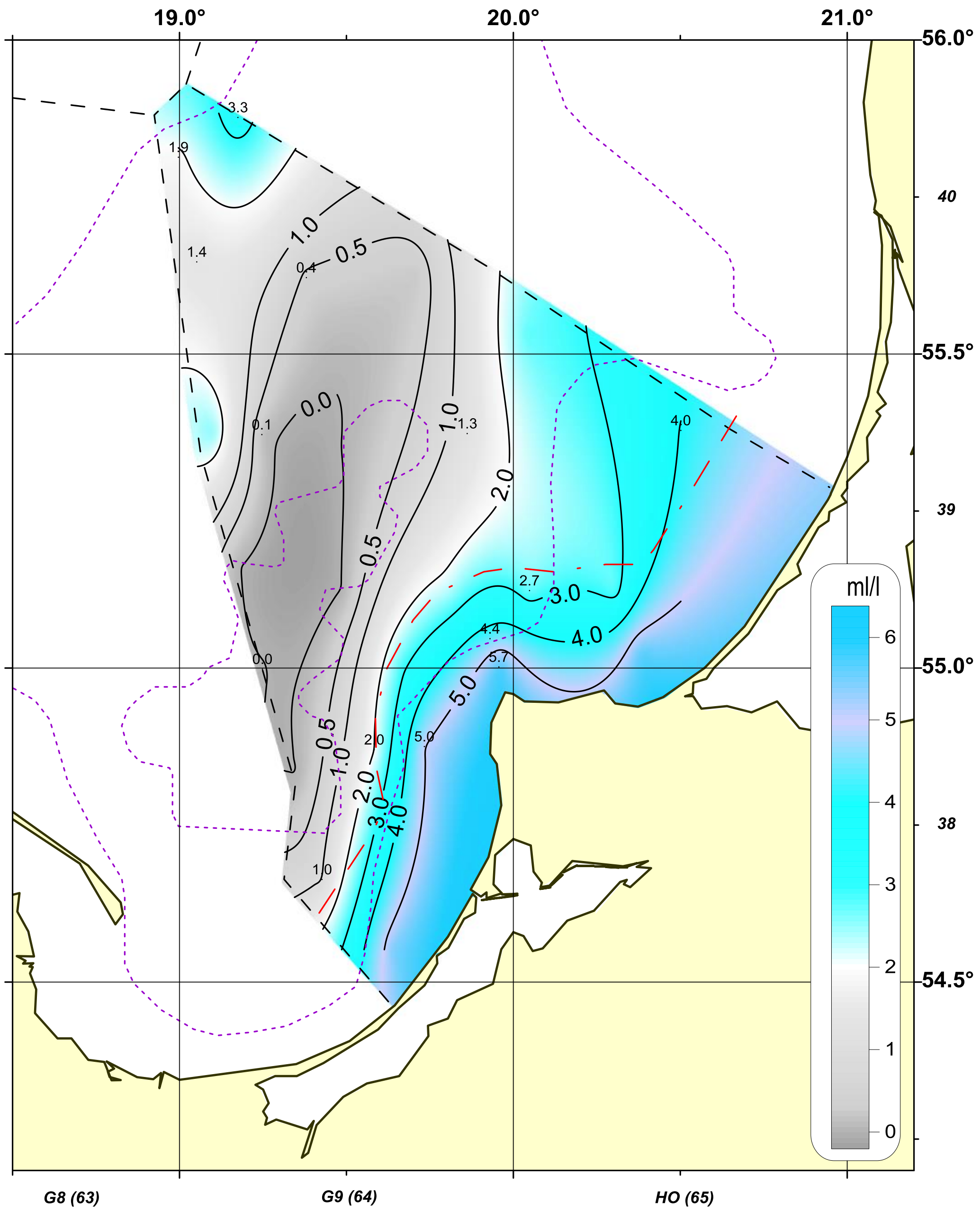


Fig. 10. Bottom water oxygen concentration (ml/l) in 02-13 October 2016, RV "ATLANTNIRO"

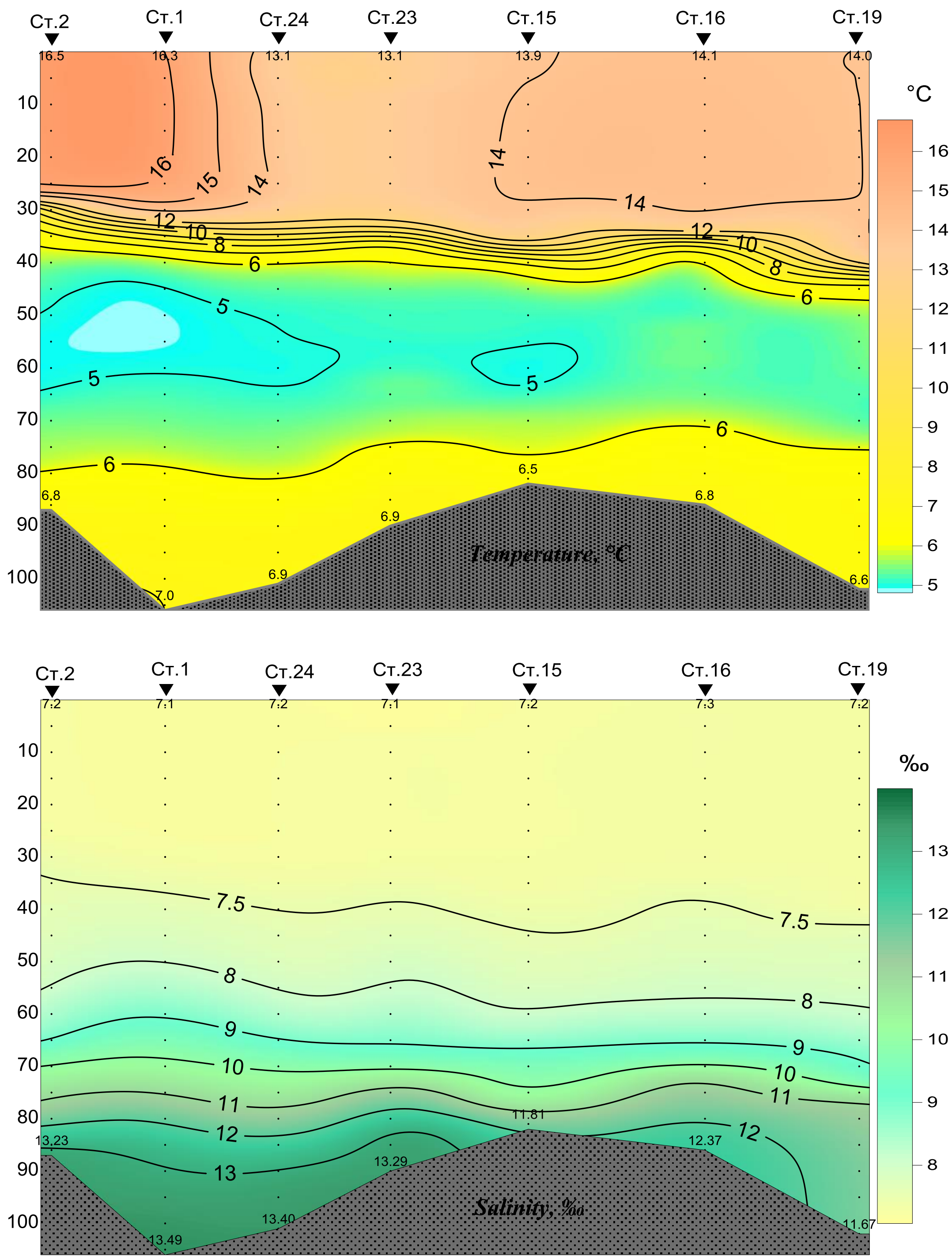


Fig. 11. The vertical distribution of the seawater temperature (°C) and salinity (‰) in October 2016 on the research profile through Gdansk Deep and south part of Gotland Deep, RV “ATLANTNIRO”

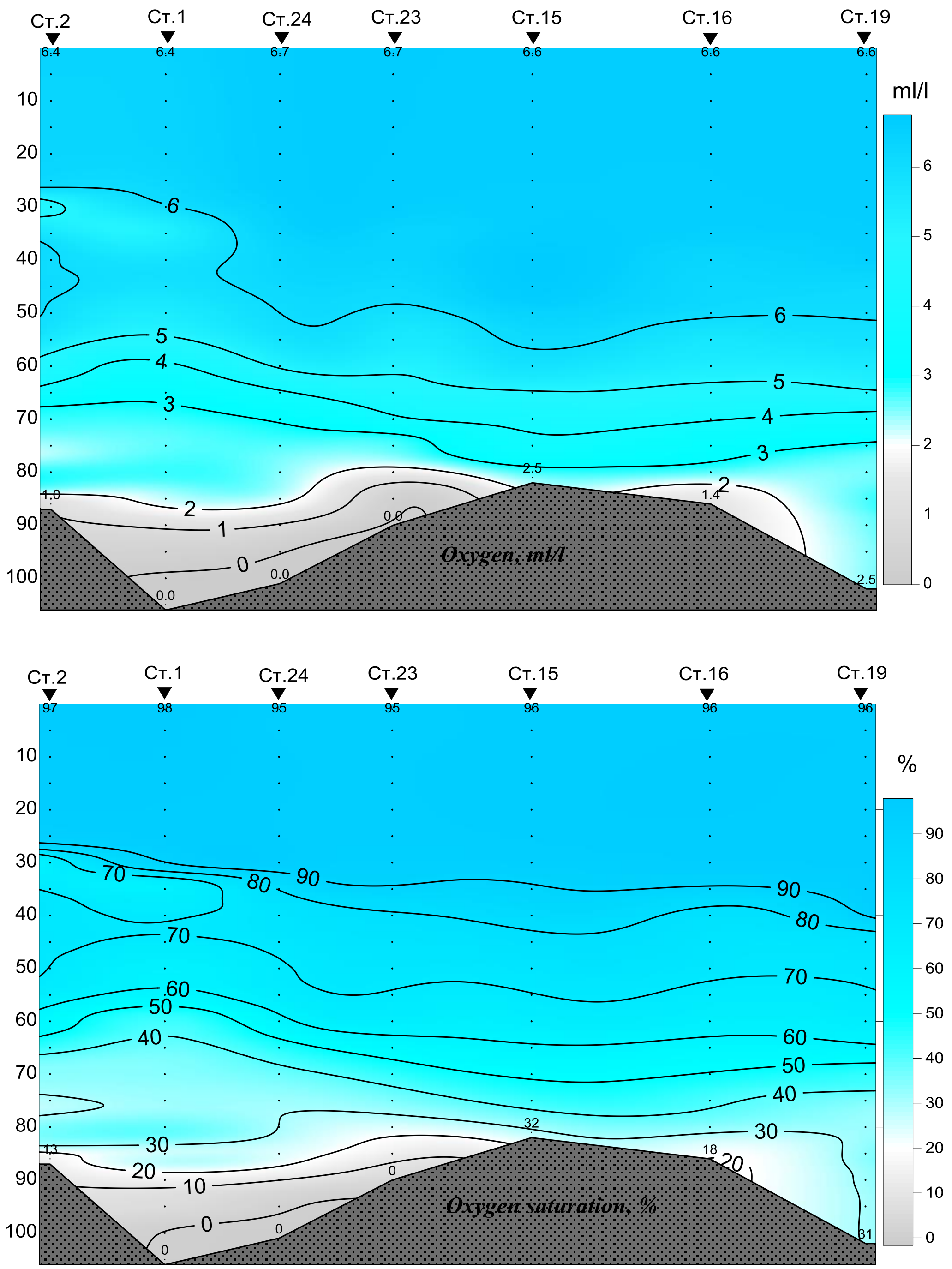


Fig. 12. The vertical distribution of the oxygen concentration (ml/l) and oxygen saturation (%) in October 2016 on the research profile through Gdansk Deep and south part of Gotland Deep, RV "ATLANTNIRO"

Annex 6.1. Protocols from measurements of the standard technical parameters of the TV-3 bottom trawl

Contributions prepared by Denmark, Sweden, Poland and Russia were accessible at the WGBIFS/2017 meeting in Riga, Latvia, 27-31.03.2017. Latvia, during the join BITS surveys with Poland, is using the same fishing gear type as Poland.

WGBIFS recommended that the all Baltic countries involved in the BITS surveys realization should check their trawls according to the parameters listed in the tables (see the BITS Manual) once a year and be presented to the next WGBIFS meeting.

Note: Authors are fully responsible for quality of the prepared text and all kind of presented data.

Table 6.1.1. Results of the Danish fishing gear check-up.

Check list for trawl TV3-930#											
Section	Manual	Standard			Tag no. TV3-930 # -				Relative error [%]		Remarks
	TV3-930 # page 57	Measured distance	Mesh size [mm]	Number of meshes	Measured distance	Mesh size [mm]	Mesh size mean	Number of meshes	Mesh size [mm]	Number of meshes	
1	1B1	22.10	200	111	22.00	200	200	110.0	0.0	-0.5	
	1A1	22.10	200	111	22.05	200	200	110.3	0.0	-0.2	
	1A2	22.10	200	111	21.98	200	200	109.9	0.0	-0.5	
	1B2	22.10	200	111	21.97	200	200	109.9	0.0	-0.6	
	1C1	8.28	120	69	22.37	120	120	186.4	0.0	170.2	Column C cannot be right
	1C2	8.28	120	69	22.36	120	120	186.3	0.0	170.0	Column C cannot be right
2	2B1	2.96	160	19	2.75	160	160	17.2	0.0	-7.1	
	2A	2.96	160	19	2.74	160	160	17.1	0.0	-7.4	
	2B2	2.96	160	19	2.75	160	160	17.2	0.0	-7.1	
	2C1	3.00	120	25	2.75	120	120	22.9	0.0	-8.3	
	2C2	3.00	120	25	2.85	120	120	23.8	0.0	-5.0	
3	3B1	2.94	120	25	2.56	120	120	21.3	0.0	-12.9	
	3A	2.94	120	25	2.57	120	120	21.4	0.0	-12.6	
	3B2	2.94	120	25	2.56	120	120	21.3	0.0	-12.9	
	3C	3.00	120	25	2.72	120	120	22.7	0.0	-9.3	
4	4B1	7.92	80	99	7.66	80	80	95.8	0.0	-3.3	
	4A	7.92	80	99	7.67	80	80	95.9	0.0	-3.2	
	4B2	7.92	80	99	7.68	80	80	96.0	0.0	-3.0	
	4C	8.00	80	100	7.76	80	80	97.0	0.0	-3.0	
5	5B1	5.94	60	99	5.76	60	60	96.0	0.0	-3.0	
	5A	5.94	60	99	5.76	60	60	96.0	0.0	-3.0	
	5B2	5.94	60	99	5.73	60	60	95.5	0.0	-3.5	
	5C	6.00	60	100	8.82	60	60	147.0	0.0	47.0	
6	6B1	11.92	40	298	10.92	40	40	273.0	0.0	-8.4	
	6A	11.92	40	298	10.90	40	40	272.5	0.0	-8.6	
	6B2	11.92	40	298	10.92	40	40	273.0	0.0	-8.4	
	6C	12.00	40	300	11.02	40	40	275.5	0.0	-8.2	
Codend			20			20	20		0.0		
			20			20	20		0.0		
Mean mesh opening in codend (OMEGA mesh gauge): mm (n, n, n, n, n, n, n, n, n, n)											

Check list for frame ropes of trawl TV3-930 #			
Manual TV3-930 # page 59	Measured distance [m]		Remarks
	Standard	TV3-520 # -02	
Head line extension Port.	4.00	4	
Head line wing section Port.	28.50	28.58	
Head line bosom section	2.50	2.6	
Head line wing section Stbd.	28.50	28.58	
Head line extension Stbd.	4.00	4	
Fishing line extension Port.	0.95	0.95	
Fishing line wing section Port.	29.94	0.95	
Fishing line bosom section	1.68	1.68	
Fishing line wing section Stbd.	29.94	29.9	
Fishing line extension Stbd.	0.95	0.95	
Upper wing line Port.	2.70	2.6	
Upper wing line Stbd.	2.70	2.8	
Upper wing side Port.	2.15	2.6	
Upper wing side Stbd.	2.15	2.6	
Lower wing line Port.	2.75	2.85	
Lower wing line Stbd.	2.75	2.8	
Lower wing side Port.	2.20	2.8	
Lower wing side Stbd.	2.20	2.65	

Type of fishing gear:	TV3-930 #	GRØN !
Nation:		Denmark
Date of measurements:		22/3 2017
Name of operators:		Knudsen
Number of realized hauls:		????
Comments concerning the use:		

Table 6.1.2. Results of the Danish fishing gear check-up.

Check list for trawl TV3-930 #												
Section	Manual TV3-930 # page 57	Standard			Tag no. TV3-930 # -				Relative error [%]		Remarks
		Measured distance	Mesh size [mm]	Number of meshes	Measured distance	Mesh size [mm]	Mesh size mean	Number of meshes	Mesh size [mm]	Number of meshes	
1	1B1	**22.10**	**200**	**111**	21.93	200	200	109.7	0.0	-0.8	
	1A1	**22.10**	**200**	**111**	21.98	200	200	109.9	0.0	-0.5	
	1A2	**22.10**	**200**	**111**	21.97	200	200	109.9	0.0	-0.6	
	1B2	**22.10**	**200**	**111**	21.95	200	200	109.8	0.0	-0.7	
	1C1	**8.28**	**120**	**69**	22.35	120	120	186.3	0.0	169.9	Column C cannot be right
	1C2	**8.28**	**120**	**69**	22.38	120	120	186.5	0.0	170.3	Column C cannot be right
2	2B1	**2.96**	**160**	**19**	2.87	160	160	17.9	0.0	-3.0	
	2A	**2.96**	**160**	**19**	2.85	160	160	17.8	0.0	-3.7	
	2B2	**2.96**	**160**	**19**	2.84	160	160	17.8	0.0	-4.1	
	2C1	**3.00**	**120**	**25**	2.98	120	120	24.8	0.0	-0.7	
	2C2	**3.00**	**120**	**25**	3.01	120	120	25.1	0.0	0.3	
3	3B1	**2.94**	**120**	**25**	2.72	120	120	22.7	0.0	-7.5	
	3A	**2.94**	**120**	**25**	2.69	120	120	22.4	0.0	-8.5	
	3B2	**2.94**	**120**	**25**	2.72	120	120	22.7	0.0	-7.5	
	3C	**3.00**	**120**	**25**	2.92	120	120	24.3	0.0	-2.7	
4	4B1	**7.92**	**80**	**99**	7.50	80	80	93.8	0.0	-5.3	
	4A	**7.92**	**80**	**99**	7.49	80	80	93.6	0.0	-5.4	
	4B2	**7.92**	**80**	**99**	7.55	80	80	94.4	0.0	-4.7	
	4C	**8.00**	**80**	**100**	7.65	80	80	95.6	0.0	-4.4	
5	5B1	**5.94**	**60**	**99**	5.40	60	60	90.0	0.0	-9.1	
	5A	**5.94**	**60**	**99**	5.41	60	60	90.2	0.0	-8.9	
	5B2	**5.94**	**60**	**99**	5.42	60	60	90.3	0.0	-8.8	
	5C	**6.00**	**60**	**100**	5.50	60	60	91.7	0.0	-8.3	
6	6B1	**11.92**	**40**	**298**	10.70	40	40	267.5	0.0	-10.2	
	6A	**11.92**	**40**	**298**	10.70	40	40	267.5	0.0	-10.2	
	6B2	**11.92**	**40**	**298**	10.72	40	40	268.0	0.0	-10.1	
	6C	**12.00**	**40**	**300**	10.79	40	40	269.8	0.0	-10.1	
Codend			**20**			20	20		0.0		
			20			20	20		0.0		
Mean mesh opening in codend (OMEGA mesh gauge): mm (n, n, n, n, n, n, n, n, n, n)											

Check list for frame ropes of trawl TV3-930 #			
Manual TV3-930 # page 59	Measured distance [m]		Remarks
	Standard	TV3-520 # -02	
Head line extension Port.	4.00	4.2	
Head line wing section Port.	28.50	28.5	
Head line bosom section	2.50	26	
Head line wing section Stbd.	28.50	28.5	
Head line extension Stbd.	4.00	4.2	
Fishing line extension Port.	0.95	1.25	
Fishing line wing section Port.	29.94	30.1	
Fishing line bosom section	1.68	1.68	
Fishing line wing section Stbd.	29.94	29.94	
Fishing line extension Stbd.	0.95	1.1	
Upper wing line Port.	2.70	2.7	
Upper wing line Stbd.	2.70	2.7	
Upper wing side Port.	2.15	2.2	
Upper wing side Stbd.	2.15	2.25	
Lower wing line Port.	2.75	2.7	
Lower wing line Stbd.	2.75	2.75	
Lower wing side Port.	2.20	2.25	
Lower wing side Stbd.	2.20	2.2	

Type of fishing gear:	TV3-930 #	GUL II
Nation:		Denmark
Date of measurements:		16/3 2017
Name of operators:		Knudsen
Number of realized hauls:		????
Comments concerning the use:		

Table 6.1.3. Results of the Danish fishing gear check-up.

Check list for trawl TV3-930#											
Section	Manual TV3-930 # page 57	Standard			Tag no. TV3-930 # -				Relative error [%]		Remarks
		Measured distance	Mesh size [mm]	Number of meshes	Measured distance	Mesh size [mm]	Mesh size mean	Number of meshes	Mesh size [mm]	Number of meshes	
1	1B1	**22.10**	**200**	**111**	22.95	200	200	114.8	0.0	3.8	
	1A1	**22.10**	**200**	**111**	22.23	200	200	111.2	0.0	0.6	
	1A2	**22.10**	**200**	**111**	22.00	200	200	110.0	0.0	-0.5	
	1B2	**22.10**	**200**	**111**	22.00	200	200	110.0	0.0	-0.5	
	1C1	**8.28**	**120**	**69**	22.53	120	120	187.8	0.0	172.1	Column C cannot be right
	1C2	**8.28**	**120**	**69**	22.30	120	120	185.8	0.0	169.3	Column C cannot be right
2	2B1	**2.96**	**160**	**19**	2.79	160	160	17.4	0.0	-5.7	
	2A	**2.96**	**160**	**19**	2.78	160	160	17.4	0.0	-6.1	
	2B2	**2.96**	**160**	**19**	2.76	160	160	17.3	0.0	-6.8	
	2C1	**3.00**	**120**	**25**	2.91	120	120	24.3	0.0	-3.0	
	2C2	**3.00**	**120**	**25**	2.86	120	120	23.8	0.0	-4.7	
3	3B1	**2.94**	**120**	**25**	2.68	120	120	22.3	0.0	-8.8	
	3A	**2.94**	**120**	**25**	2.66	120	120	22.2	0.0	-9.5	
	3B2	**2.94**	**120**	**25**	2.71	120	120	22.6	0.0	-7.8	
	3C	**3.00**	**120**	**25**	2.80	120	120	23.3	0.0	-6.7	
4	4B1	**7.92**	**80**	**99**	7.91	80	80	98.9	0.0	-0.1	
	4A	**7.92**	**80**	**99**	7.91	80	80	98.9	0.0	-0.1	
	4B2	**7.92**	**80**	**99**	7.91	80	80	98.9	0.0	-0.1	
	4C	**8.00**	**80**	**100**	8.00	80	80	100.0	0.0	0.0	
5	5B1	**5.94**	**60**	**99**	5.58	60	60	93.0	0.0	-6.1	
	5A	**5.94**	**60**	**99**	5.60	60	60	93.3	0.0	-5.7	
	5B2	**5.94**	**60**	**99**	5.62	60	60	93.7	0.0	-5.4	
	5C	**6.00**	**60**	**100**	5.74	60	60	95.7	0.0	-4.3	
6	6B1	**11.92**	**40**	**298**	11.66	40	40	291.5	0.0	-2.2	
	6A	**11.92**	**40**	**298**	11.71	40	40	292.8	0.0	-1.8	
	6B2	**11.92**	**40**	**298**	11.71	40	40	292.8	0.0	-1.8	
	6C	**12.00**	**40**	**300**	11.89	40	40	297.3	0.0	-0.9	
Codend			**20**			20	20		0.0		
			20			20	20		0.0		
Mean mesh opening in codend (OMEGA mesh gauge): mm (n, n, n, n, n, n, n, n, n)											

Check list for frame ropes of trawl TV3-930 #			
Manual TV3-930 # page 59	Measured distance [m]		Remarks
	Standard	TV3-520 # -02	
Head line extension Port.	4.00	4.2	
Head line wing section Port.	28.50	28.5	
Head line bosom section	2.50	26	
Head line wing section Stbd.	28.50	28.5	
Head line extension Stbd.	4.00	4.2	
Fishing line extension Port.	0.95	1.25	
Fishing line wing section Port.	29.94	30.1	
Fishing line bosom section	1.68	1.68	
Fishing line wing section Stbd.	29.94	29.94	
Fishing line extension Stbd.	0.95	1.1	
Upper wing line Port.	2.70	2.7	
Upper wing line Stbd.	2.70	2.7	
Upper wing side Port.	2.15	2.2	
Upper wing side Stbd.	2.15	2.25	
Lower wing line Port.	2.75	2.7	
Lower wing line Stbd.	2.75	2.75	
Lower wing side Port.	2.20	2.25	
Lower wing side Stbd.	2.20	2.2	

Type of fishing gear:	TV3-930 #	GUL II
Nation:		Denmark
Date of measurements:		16/3 2017
Name of operators:		Knudsen
Number of realized hauls:		????
Comments concerning the use:		

Table 6.1.4. Results of the Swedish fishing gear check-up (Trawl No. 1).

Check list for trawl and for frame ropes of trawl Tag no. TV3-930 #	Trawl no./nam 1	Country: Swe	Year: 2016	Quarter: 2	Date: 2016-06-06	Remarks:

Check list for trawl TV3-930#

Section	Manual TV3-930 # page 57	Standard: Measured distance [m]	Standard: Mesh size [mm]	Standard: Number of meshes	Tag no. TV3-930 # -: Measured distance [m]	Tag no. TV3-930 # -: Mesh size [mm]	Tag no. TV3-930 # -: Mesh size mean	Tag no. TV3-930 # -: Number of meshes	Relative error [%]: Mesh size [mm]	Relative error [%]: Number of meshes	Remarks
1	1B1	22.10	200	111	21.90	200	200	109.5	0.0	-0.9	
	1A1	22.10	200	111	20.90	200	200	104.5	0.0	-5.4	
	1A2	22.10	200	111	21.15	200	200	105.8	0.0	-4.3	
	1B2	22.10	200	111	21.90	200	200	109.5	0.0	-0.9	
	1C1	8.28	120	69	22.16	120	120	184.7	0.0	167.6	Most be error in protokoll
	1C2	8.28	120	69	22.35	120	120	186.3	0.0	169.9	Most be error in protokoll
2	2B1	2.96	160	19	2.77	160	160	17.3	0.0	-6.4	
	2A	2.96	160	19	2.73	160	160	17.1	0.0	-7.8	
	2B2	2.96	160	19	2.77	160	160	17.3	0.0	-6.4	
	2C1	3.00	120	25	2.96	120	120	24.7	0.0	-1.3	
	2C2	3.00	120	25	2.94	120	120	24.5	0.0	-2.0	
3	3B1	2.94	120	25	2.82	120	120	23.5	0.0	-4.1	
	3A	2.94	120	25	2.81	120	120	23.4	0.0	-4.4	
	3B2	2.94	120	25	2.82	120	120	23.5	0.0	-4.1	
	3C	3.00	120	25	2.95	120	120	24.6	0.0	-1.7	
4	4B1	7.92	80	99	7.76	80	80	97.0	0.0	-2.0	
	4A	7.92	80	99	7.75	80	80	96.9	0.0	-2.1	
	4B2	7.92	80	99	7.72	80	80	96.5	0.0	-2.5	
	4C	8.00	80	100	7.85	80	80	98.1	0.0	-1.9	
5	5B1	5.94	60	99	5.87	60	60	97.8	0.0	-1.2	
	5A	5.94	60	99	5.80	60	60	96.7	0.0	-2.4	
	5B2	5.94	60	99	5.75	60	60	95.8	0.0	-3.2	
	5C	6.00	60	100	5.85	60	60	97.5	0.0	-2.5	
6	6B1	11.92	40	298	11.61	40	40	290.3	0.0	-2.6	
	6A	11.92	40	298	11.60	40	40	290.0	0.0	-2.7	
	6B2	11.92	40	298	11.65	40	40	291.3	0.0	-2.3	
	6C	12.00	40	300	12.05	40	40	301.3	0.0	0.4	
Codend			20								
			20								

Mean mesh opening in codend (OMEGA mesh gauge): mm (n, n, n, n, n, n, n, n, n, n)

Check list for frame ropes of trawl TV3-930 #

Manual TV3-930 # page 59	Measured distance [m]: Standard	Measured distance [m]: TV3-930 #	Remarks
Head line extension Port.	4.00	3.92	
Head line wing section Port.	28.50	28.47	
Head line bosom section	2.50	2.6	
Head line wing section Stbd.	28.50	28.37	
Head line extension Stbd.	4.00	3.93	
Fishing line extension Port.	0.95	1	
Fishing line wing section Port.	29.94	30.17	
Fishing line bosom section	1.68	1.7	
Fishing line wing section Stbd.	29.94	30.18	
Fishing line extension Stbd.	0.95	1	
Upper wing line Port.	2.70	2.73	
Upper wing line Stbd.	2.70	2.68	
Upper wing side Port.	2.15	2.48	
Upper wing side Stbd.	2.15	2.52	
Lower wing line Port.	2.75	2.65	
Lower wing line Stbd.	2.75	2.68	
Lower wing side Port.	2.20	2.52	
Lower wing side Stbd.	2.20	2.48	

Table 6.1.5. Results of the Swedish fishing gear check-up (Trawl No. 2).

Check list for trawl and for frame ropes of trawl Tag no. TV3-930 #	Country:	Year:	Quarter:	Date:	Remarks:
Trawl no./nam 2	SWE	2016	2	2016-06-06	

Check list for trawl TV3-930 #

Section	Manual TV3-930 # page 57	Standard			Tag no. TV3-930 # -				Relative error [%]		Remarks
		Measured distance [m]	Mesh size [mm]	Number of meshes	Measured distance [m]	Mesh size [mm]	Mesh size mean	Number of meshes	Mesh size [mm]	Number of meshes	
1	1B1	22.10	200	111	22.11	200	200	110.6	0.0	0.0	
	1A1	22.10	200	111	21.56	200	200	107.8	0.0	-2.4	
	1A2	22.10	200	111	21.17	200	200	105.9	0.0	-4.2	
	1B2	22.10	200	111	22.36	200	200	111.8	0.0	1.2	
	1C1	8.28	120	69	22.13	120	120	184.4	0.0	167.3	Wrong length in protokoll
	1C2	8.28	120	69	22.58	120	120	188.2	0.0	172.7	Wrong length in protokoll
2	2B1	2.96	160	19	2.90	160	160	18.1	0.0	-2.0	
	2A	2.96	160	19	2.79	160	160	17.4	0.0	-5.7	
	2B2	2.96	160	19	2.89	160	160	18.1	0.0	-2.4	
	2C1	3.00	120	25	3.02	120	120	25.2	0.0	0.7	
	2C2	3.00	120	25	3.02	120	120	25.2	0.0	0.7	
3	3B1	2.94	120	25	2.84	120	120	23.7	0.0	-3.4	
	3A	2.94	120	25	2.80	120	120	23.3	0.0	-4.8	
	3B2	2.94	120	25	2.80	120	120	23.3	0.0	-4.8	
	3C	3.00	120	25	2.87	120	120	23.9	0.0	-4.3	
4	4B1	7.92	80	99	7.76	80	80	97.0	0.0	-2.0	
	4A	7.92	80	99	7.83	80	80	97.9	0.0	-1.1	
	4B2	7.92	80	99	7.82	80	80	97.8	0.0	-1.3	
	4C	8.00	80	100	7.86	80	80	98.3	0.0	-1.8	
5	5B1	5.94	60	99	5.93	60	60	98.8	0.0	-0.2	
	5A	5.94	60	99	5.87	60	60	97.8	0.0	-1.2	
	5B2	5.94	60	99	5.92	60	60	98.7	0.0	-0.3	
	5C	6.00	60	100	5.92	60	60	98.7	0.0	-1.3	
6	6B1	11.92	40	298	11.64	40	40	291.0	0.0	-2.3	
	6A	11.92	40	298	11.67	40	40	291.8	0.0	-2.1	
	6B2	11.92	40	298	11.64	40	40	291.0	0.0	-2.3	
	6C	12.00	40	300	11.73	40	40	293.3	0.0	-2.3	
Codend			20								
			20								
Mean mesh opening in codend (OMEGA mesh gauge): mm (n, n, n, n, n, n, n, n, n, n)											

Check list for frame ropes of trawl TV3-930 #

Manual TV3-930 # page 59	Measured distance [m]		Remarks
	Standard	TV3-930 #	
Head line extension Port.	4.00	3.96	
Head line wing section Port.	28.50	28.45	
Head line bosom section	2.50	2.6	
Head line wing section Stbd.	28.50	28.64	
Head line extension Stbd.	4.00	3.96	
Fishing line extension Port.	0.95	1	
Fishing line wing section Port.	29.94	30.2	
Fishing line bosom section	1.68	1.7	
Fishing line wing section Stbd.	29.94	30.22	
Fishing line extension Stbd.	0.95	1	
Upper wing line Port.	2.70	2.52	
Upper wing line Stbd.	2.70	2.67	
Upper wing side Port.	2.15	2.53	
Upper wing side Stbd.	2.15	2.56	
Lower wing line Port.	2.75	20.67	
Lower wing line Stbd.	2.75	2.90	
Lower wing side Port.	2.20	2.56	
Lower wing side Stbd.	2.20	2.56	

Table 6.1.6. Results of the Swedish fishing gear check-up (Trawl No. 3).

Check list for trawl and for frame ropes of trawl Tag no. TV3-930 #	Country:	Year:	Quarter:	Date:	Remarks:
Trawl no./nam 3	SWE	2016	2	2016-06-06	

Check list for trawl TV3-930#

Section	Manual TV3-930 # page 57	Standard			Tag no. TV3-930 # -				Relative error [%]		Remarks
		Measured distance [m]	Mesh size [mm]	Number of meshes	Measured distance [m]	Mesh size [mm]	Mesh size mean	Number of meshes	Mesh size [mm]	Number of meshes	
1	1B1	**22.10**	**200**	**111**	22.26	200	200	111.3	0.0	0.7	
	1A1	**22.10**	**200**	**111**	21.66	200	200	108.3	0.0	-2.0	
	1A2	**22.10**	**200**	**111**	21.64	200	200	108.2	0.0	-2.1	
	1B2	**22.10**	**200**	**111**	22.25	200	200	111.3	0.0	0.7	
	1C1	**8.28**	**120**	**69**	22.72	120	120	189.3	0.0	174.4	
	1C2	**8.28**	**120**	**69**	22.50	120	120	187.5	0.0	171.7	
2	2B1	**2.96**	**160**	**19**	2.88	160	160	18.0	0.0	-2.7	
	2A	**2.96**	**160**	**19**	2.82	160	160	17.6	0.0	-4.7	
	2B2	**2.96**	**160**	**19**	2.88	160	160	18.0	0.0	-2.7	
	2C1	**3.00**	**120**	**25**	3.01	120	120	25.1	0.0	0.3	
	2C2	**3.00**	**120**	**25**	3.02	120	120	25.2	0.0	0.7	
3	3B1	**2.94**	**120**	**25**	3.00	120	120	25.0	0.0	2.0	
	3A	**2.94**	**120**	**25**	2.93	120	120	24.4	0.0	-0.3	
	3B2	**2.94**	**120**	**25**	3.00	120	120	25.0	0.0	2.0	
	3C	**3.00**	**120**	**25**	3.04	120	120	25.3	0.0	1.3	
4	4B1	**7.92**	**80**	**99**	7.77	80	80	97.1	0.0	-1.9	
	4A	**7.92**	**80**	**99**	7.79	80	80	97.4	0.0	-1.6	
	4B2	**7.92**	**80**	**99**	7.74	80	80	96.8	0.0	-2.3	
	4C	**8.00**	**80**	**100**	7.85	80	80	98.1	0.0	-1.9	
5	5B1	**5.94**	**60**	**99**	5.85	60	60	97.5	0.0	-1.5	
	5A	**5.94**	**60**	**99**	5.80	60	60	96.7	0.0	-2.4	
	5B2	**5.94**	**60**	**99**	5.80	60	60	96.7	0.0	-2.4	
	5C	**6.00**	**60**	**100**	5.86	60	60	97.7	0.0	-2.3	
6	6B1	**11.92**	**40**	**298**	11.80	40	40	295.0	0.0	-1.0	
	6A	**11.92**	**40**	**298**	11.80	40	40	295.0	0.0	-1.0	
	6B2	**11.92**	**40**	**298**	11.80	40	40	295.0	0.0	-1.0	
	6C	**12.00**	**40**	**300**	11.80	40	40	295.0	0.0	-1.7	
Codend			**20**								
			20								

Mean mesh opening in codend (OMEGA mesh gauge): mm (n, n, n, n, n, n, n, n, n, n)

Check list for frame ropes of trawl TV3-930 #			
Manual TV3-930 # page 59	Measured distance [m]		Remarks
	Standard	TV3-930 #	
Head line extension Port.	4.00	3.97	
Head line wing section Port.	28.50	28.37	
Head line bosom section	2.50	2.6	
Head line wing section Stbd.	28.50	28.49	
Head line extension Stbd.	4.00	3.96	
Fishing line extension Port.	0.95	1.01	
Fishing line wing section Port.	29.94	29.74	
Fishing line bosom section	1.68	2.6	
Fishing line wing section Stbd.	29.94	29.64	
Fishing line extension Stbd.	0.95	0.95	
Upper wing line Port.	2.70	2.64	
Upper wing line Stbd.	2.70	2.75	
Upper wing side Port.	2.15	2.64	
Upper wing side Stbd.	2.15	2.60	
Lower wing line Port.	2.75	2.85	
Lower wing line Stbd.	2.75	2.90	
Lower wing side Port.	2.20	2.60	
Lower wing side Stbd.	2.20	2.64	

Type of fishing gear:	TV3-930 #
Nation:	Sweden
Date of measurements:	6/6/2016
Name of operators:	Olof Lövgren
Number of realized hauls:	
Comments concerning the use: All 3 trawls checked by Olof Lövgren	

Table 6.1.7. Results of the Polish fishing gear check-up (Trawl No. 1). Check of the TV-3#930 STANDARD GEAR used during the BITS since 2000

Table of gear data

Type of fishing gear	TV3#930 No. 1
Nation	Poland
Date of measurements	08.03.2017
Name of operators	
Number of realized hauls	over 400, permanently used
Comments concerning the use	many meshes are overstretched, need to replace in the future

Manual TV3#930 page 11 Parameter	Measured distance [m]	Mesh size [mm]
Section 1 - 1B1	22,28	200
Section 1 - 1A1	22,80	200
Section 1 - 1A2	22,80	200
Section 1 - 1B2	22,32	200
Section 1 – 1C1	22,85	120
Section 1 – 1C2	22,73	120
Section 2 – 2B1	2,91	160
Section 2 - 2A	2,82	160
Section 2 – 2B2	2,91	160
Section 2 – 2C1	2,83	120
Section 2 – 2C2	2,90	120
Section 3 – 3B1	2,89	120
Section 3 – 3A	2,75	120
Section 3 – 3B2	2,91	120
Section 3 – 3C	2,82	120
Section 4 – 4B1	7,90	80
Section 4 – 4A	7,76	80
Section 4 – 4B2	7,88	80
Section 4 – 4C	7,94	80
Section 5 – 5B1	5,87	60
Section 5 – 5A	5,87	60
Section 5 – 5B2	5,87	60
Section 5 – 5C	5,80	60
Section 6 – 6B1	11,64	40
Section 6 – 6A	11,57	40
Section 6 – 6B2	11,57	40
Section 6 – 6C	11,57	40
Section 7	7,48	20
Section 8	7,60	20

*** - mesh opening measured with a ruler, others measured with use of the ICES gauge,**

**** - measured along selvedge's.**

Manual TV3#930 page 13 Parameter	Measured distance [m]	
Head line extension Port.	3,98	
Head line wing section Port.	28,37	
Head line bossom section	2,60	
Head line wing section Stbd.	28,46	
Head line extension Stbd.	4,00	
Fishing line extension Port.	1,30	
Fishing line wing section Port.	29,80	
Fishing line bossom section	1,66	
Fishing line wing section Stbd.	29,35	
Fishing line extension Stbd.	1,34	
Lower wing line Port.	2,70	
Lower wing line Stbd.	2,70	
Upper wing line Port.	2,63	
Upper wing line Stbd.	2,65	
Lower side line Port	2,10	
Lower side line Stbd.	2,08	
Upper side line Port	2,06	
Upper side line Stbd.	2,07	
Side line extension Port	4,00	
Side line Extension Stbd.	4,00	
Manual TV3#930 page 8/12 Parameter	Port	Stbd
Backstrop	8,00	8,00
Sweep	75,00	75,00
Chain sweep	3,01	3,02
Lower bridle	27,50	27,50
Lower extension	4,02	4,03
Chain for adjustment of upper bridle	0,30	0,30
Upper bridle	27,50	27,50
Headline extension	4,00	4,00
Floats 25pcs x 280mm		
Chain for adjustment of foot rope	8links x 0,08m	8links x 0,08m

The cod bottom (ground) trawl type TV-3#930:

- bridles with the top and centre combirope diameter of 18 mm, and the bottom wire with the length of 27,5 m and diameter of 16 mm and with the 50 mm diameter rubber discs,
- sweeps combirope with the length of 75 m and diameter of 40 mm,
- trawl lines with the maximum length of 520 m and the diameter of 18 mm.

Table 6.1.8. Results of the Polish fishing gear check-up (Trawl No. 3). Check of the TV-3#930 STANDARD GEAR used during the BITS since 2000.

Table of gear data

Type of fishing gear	TV3#930 heavy rigged No. 3	
Nation	Poland/used by Latvia during BITS surveys	
Date of measurements	08.03.2017	
Name of operators		
Number of realized hauls	over 400, permanently used	
Comments concerning the use		
Manual TV3#930 page 11 Parameter	Measured distance [m]	Mesh size [mm]
Section 1 - 1B1	22,03	200
Section 1 - 1A1	22,03	200
Section 1 - 1A2	22,06	200
Section 1 - 1B2	22,06	200
Section 1 – 1C1	22,07	120
Section 1 – 1C2	22,06	120
Section 2 – 2B1	2,92	160
Section 2 - 2A	2,72	160
Section 2 – 2B2	2,93	160
Section 2 – 2C1	2,95	120
Section 2 – 2C2	2,94	120
Section 3 – 3B1	2,89	120
Section 3 – 3A	2,86	120
Section 3 – 3B2	2,91	120
Section 3 – 3C	2,95	120
Section 4 – 4B1	7,82	80
Section 4 – 4A	7,92	80
Section 4 – 4B2	7,83	80
Section 4 – 4C	8,13	80
Section 5 – 5B1	5,85	60
Section 5 – 5A	5,93	60
Section 5 – 5B2	5,81	60
Section 5 – 5C	6,02	60
Section 6 – 6B1	11,56	40
Section 6 – 6A	11,66	40
Section 6 – 6B2	11,59	40
Section 6 – 6C	11,57	40
Section 7	7,76	20
Section 8	7,85	20

*** - mesh opening measured with a ruler, others measured with use of the ICES gauge,**

**** - measured along selvedge's.**

Manual TV3#930 page 13 Parameter	Measured distance [m]	
Head line extension Port.	4,03	
Head line wing section Port.	28,49	
Head line bossom section	2,60	
Head line wing section Stbd.	28,42	
Head line extension Stbd.	4,03	
Fishing line extension Port.	0,98	
Fishing line wing section Port.	29,86	
Fishing line bossom section	1,72	
Fishing line wing section Stbd.	29,93	
Fishing line extension Stbd.	0,98	
Lower wing line Port.	2,74	
Lower wing line Stbd.	2,73	
Upper wing line Port.	2,66	
Upper wing line Stbd.	2,69	
Lower side line Port	2,19	
Lower side line Stbd.	2,19	
Upper side line Port	2,19	
Upper side line Stbd.	2,19	
Side line extension Port	3,96	
Side line Extension Stbd.	3,97	
Manual TV3#930 page 8/12 Parameter	Port	Stbd
Backstrop	8,00	8,00
Sweep	75,00	75,00
Chain sweep	3,01	3,02
Lower bridle	27,50	27,50
Lower extension	4,02	4,03
Chain for adjustment of upper bridle	0,30	0,30
Upper bridle	27,50	27,50
Headline extension	4,00	4,00
Floats 25pcs x 280mm		
Chain for adjustment of foot rope	8links x 0,08m	8links x 0,08m

The cod bottom (ground) trawl type TV-3#930:

- bridles with the top and centre combirope diameter of 18 mm, and the bottom wire with the length of 27,5 m and diameter of 16 mm and with the 50 mm diameter rubber discs,
- sweeps combirope with the length of 75 m and diameter of 40 mm,
- trawl lines with the maximum length of 520 m and the diameter of 18 mm.

Table 6.1.9. Results of the Russian fishing gear (TV-3L) check-up (Trawl No. 4).

Check list for trawl and for frame ropes of trawl Tag no. TV3-930 #

Results of the Russian fishing gear check-up (Trawl No. 4).

Check list for trawl TV3-930 #												
Section	Manual TV3-930 # page 57	Standard			Tag no. TV3-930 # -				Relative error [%]		Remarks
		Measured distance [m]	Mesh size [mm]	Number of meshes	Measured distance [m]	Mesh size [mm]	Mesh size mean	Number of meshes	Mesh size [mm]	Number of meshes	
1	1B1	**22.10**	**200**	**111**	22.15	200	200	110.8	0.0	0.2	
	1A1	**22.10**	**200**	**111**	22.15	200	200	110.8	0.0	0.2	
	1A2	**22.10**	**200**	**111**	22.15	200	200	110.8	0.0	0.2	
	1B2	**22.10**	**200**	**111**	22.15	200	200	110.8	0.0	0.2	
	1C1	**22.68**	**120**	**189**	22.70	120	120	189.2	0.0	0.1	
	1C2	**22.68**	**120**	**189**	22.70	120	120	189.2	0.0	0.1	
2	2B1	**2.96**	**160**	**19**	2.90	160	160	18.1	0.0	-2.0	
	2A	**2.96**	**160**	**19**	2.90	160	160	18.1	0.0	-2.0	
	2B2	**2.96**	**160**	**19**	2.90	160	160	18.1	0.0	-2.0	
	2C1	**3.00**	**120**	**25**	2.97	120	120	24.8	0.0	-1.0	
	2C2	**3.00**	**120**	**25**	2.97	120	120	24.8	0.0	-1.0	
3	3B1	**2.94**	**120**	**25**	2.90	120	120	24.2	0.0	-1.4	
	3A	**2.94**	**120**	**25**	2.90	120	120	24.2	0.0	-1.4	
	3B2	**2.94**	**120**	**25**	2.90	120	120	24.2	0.0	-1.4	
	3C	**3.00**	**120**	**25**	3.00	120	120	25.0	0.0	0.0	
4	4B1	**7.92**	**80**	**99**	7.80	80	80	97.5	0.0	-1.5	
	4A	**7.92**	**80**	**99**	7.80	80	80	97.5	0.0	-1.5	
	4B2	**7.92**	**80**	**99**	7.80	80	80	97.5	0.0	-1.5	
	4C	**8.00**	**80**	**100**	7.90	80	80	98.8	0.0	-1.3	
5	5B1	**5.94**	**60**	**99**	5.90	60	60	98.3	0.0	-0.7	
	5A	**5.94**	**60**	**99**	5.90	60	60	98.3	0.0	-0.7	
	5B2	**5.94**	**60**	**99**	5.90	60	60	98.3	0.0	-0.7	
	5C	**6.00**	**60**	**100**	6.00	60	60	100.0	0.0	0.0	
6	6B1	**11.92**	**40**	**298**	11.90	40	40	297.5	0.0	-0.2	
	6A	**11.92**	**40**	**298**	11.90	40	40	297.5	0.0	-0.2	
	6B2	**11.92**	**40**	**298**	11.90	40	40	297.5	0.0	-0.2	
	6C	**12.00**	**40**	**300**	12.00	40	40	300.0	0.0	0.0	
Codend			**20**								
			20								
Mean mesh opening in codend (OMEGA mesh gauge): mm (n, n, n, n, n, n, n, n, n, n, n)											

Check list for frame ropes of trawl TV3-930 #			
Manual TV3-930 # page 59	Measured distance [m]		Remarks
	Standard	TV3-930 # -02	
Head line extension Port.	4.00	3.97	
Head line wing section Port.	28.50	28.50	
Head line bosom section	2.50	2.60	
Head line wing section Stbd.	28.50	28.50	
Head line extension Stbd.	4.00	3.97	
Fishing line extension Port.	0.95	0.90	
Fishing line wing section Port.	29.94	29.90	
Fishing line bosom section	1.68	1.68	
Fishing line wing section Stbd.	29.94	29.90	
Fishing line extension Stbd.	0.95	0.90	
Upper wing line Port.	2.70	2.75	
Upper wing line Stbd.	2.70	2.75	
Upper wing side Port.	2.15	2.20	
Upper wing side Stbd.	2.15	2.20	
Lower wing line Port.	2.75	2.80	
Lower wing line Stbd.	2.75	2.80	
Lower wing side Port.	2.20	2.30	
Lower wing side Stbd.	2.20	2.30	

Type of fishing gear: TV3-930 #
Nation: Russia
Date of measurements: 12.10.2016
Name of operators: Senior trawl master - Lubochonskiy Egor F.
Number of realized hauls: 4
Comments concerning the use: The mesh size in the codend was 6.5 mm. The trawling depth and the net opening were controlled by a netsonde.

Annex 6.2. Results of fish catches calibration experiments between the Danish old and new RV "Havfisken" and the German RV "Solea"

Danish specialists from the DTU-AQUA requested (16.06.2016) special attention at the WGBIFS/2017 meeting, focusing on the results of calibration of fish catch data, obtained by the Danish old and new RV "Havfisken". The request was repeated (04.01.2017) by the ICES Secretariat.

The WGBIFS discussed possibly reason for having significant differences in the control-catches of the two vessels for flounder and cod however, not for plaice, and the potential problem in applying calibration factors for some species. It was argued that it was a result of variability in the data and that the possible inconsistency might be due to insufficient numbers of parallel hauls sets. Based on this it was argued that no calibration factors should be applied to any fish species. On the other hand, it was argued that the significant difference in cod catches (new RV "Havfisken" catch approximately two-times the catch of the old RV "Havfisken") might be a source of significant bias in the time series if it was not considered. The distance between the doors in the new RV "Havfisken" setup is twice the distance in the old RV "Havfisken" setup and the herding effect might explain the difference in quantity of catches. What is more difficult to explain is - why some flatfish show significant differences (flounder) and some not (plaice) even though plaice has been caught in significant amounts.

The conclusion from the WGBIFS discussion was that the estimated calibration factors should be applied for cod and flounder for calculating of the indices for a period of 4-5 years and should then be re-evaluated based on the additional data obtained. Until the final decision is made, the factors should be applied to the data from the new RV "Havfisken" (see also Annex 4.A).

It is recommended that calibration factors as calculated is applied to the BITS catches of the new RV "Havfisken" (26HF) for the following species: cod and flounder. Other species are not affected.

Furthermore, WGBIFS concluded that there is significant difference between catching results obtained by the Danish old and new RV "Havfisken", this leads to inconsistency between the results of the calibration trials (in 2009) between the old RV "Havfisken" and the German RV "Solea", and the recent calibration experiment (in 2017), which both could conclude that there were no significant difference in the catchability. The newest calibration exercise between the new RV "Havfisken" and the RV "Solea" (27 February – 01 March 2017) include 12 parallel hauls made with the TV-3S, no formal analysis was made, and the result is considered as not fully valid (Annex 9 - A. Velasco et al. 2017). However, the initial conclusion from performed intercalibration experiment is as follow: "The statistical analyses showed that the hypothesis of same catchability of cod and flatfish by both involved research vessels, which use the same fishing gear, cannot be rejected".

Annex 7: Cruise reports from the BASS and the BIAS surveys in 2016

Note: Authors are fully responsible for quality of the prepared text and all kind of presented data.

REPORT FROM THE JOINT ESTONIAN-POLISH BASS 2016 CONDUCTED BY THE R.V. "BALTICA" IN THE NORTH-EASTERN BALTIC SEA (22-26 May 2016)

by
Miroslaw Wyszynski*, Tiit Raid**, Ain Lankov** Elor Sepp** and Bartosz Witalis*

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** University of Tartu, Estonian Marine Institute, Tallinn (Estonia)

Introduction

The recent joint Estonian-Polish Baltic Acoustic Spring Survey (BASS), marked with the number 8/2016/NMFRI/TUEMI was based on the procurement contract between the University of Tartu/Estonian Marine Institute in Tallinn and the National Marine Fisheries Research Institute in Gdynia. The survey was conducted in the Estonian EEZ (the ICES Sub-divisions 28.2, 29 and 32).

The Estonian Data Collection Programme for 2016 and the European Union (the Commission regulations Nos. 1639/2001, 1581/2004, 665/2008, 1078/2008, 199/2008) financially supported the EST-POL BASS 2016. Timing, surveying area in the North-eastern Baltic Sea and the principal methods of investigations concerns the above mentioned survey were designed and coordinated by the ICES WGBIFS (ICES 2015[1]).

The main aims of the reported cruise were:

- to provide the echo-integration and to collect the acoustic data along the planned transects in the north-eastern Baltic Sea,
- to conduct the fish pelagic control-catches in the fish concentration locations,
- to collect ichthyological samples specially for herring and sprat,
- to collect plankton samples,
- to provide hydrological monitoring (water temperature, salinity and oxygen content) at the catch locations.

Personnel

The EST-POL BASS 2016 scientific staff was composed of 8 persons:
Miroslaw Wyszynski (NMFRI, Gdynia – Poland) – survey leader
Jakub Slembarski (NMFRI, Gdynia – Poland) – acoustician
Bartosz Witalis (NMFRI, Gdynia – Poland) – hydrologist
Tiit Raid (TUEMI, Tallinn - Estonia) – Estonian scientific staff leader
Ain Lankov (TUEMI, Tallinn - Estonia) – ichthyologist
Andrus Hallang (TUEMI, Tallinn - Estonia) – ichthyologist
Timo Arula (TUEMI, Tallinn - Estonia) – biologist
Elor Sepp (TEMI, Tallinn - Estonia) – acoustician.

Narrative

The reported survey took place during the period of 22-26 May 2016. The at sea researches (echo-integration, fish control catches, hydrological and plankton stations) were conducted aboard r.v. "Baltica" within Estonian EEZ (the ICES Sub-divisions 28.2, 29 and 32 West), moreover inside the territorial waters of this country not shallower than 20 m depth.

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[1]ICES 2015. First Interim Report of the Baltic International Fish Survey Working Group (WGBIFS). ICES CM 2015/SSGIEOM: 07.

The survey started from the Ventspils port (Latvia) on 21.05.2016 after the midday and was navigated in the North-eastern direction to the entering point of planed acoustic transect at the geographical position 59°16.5'N 022°21.3'E on May, 22 (Fig. 1). The at sea researches were ended on 25.05.2016 before the midday in the port of Ventspils (Latvia). Then the r.v. "Baltica" started its journey to the home-port in Gdynia (Poland), reaching it on 26.05.2016 late afternoon.

Survey design and realization

The r.v. "Baltica" realized 251 Nm echo-integration transect and 13 fish control-catches (Fig. 1). All planed ICES rectangles were covered with acoustic transect and control catches. All control catches were performed in the daylight (between 06:50 am. and 20:00 pm.) using the pelagic trawl type WP 53/64x4 (with 6 mm mesh bar length in the codend). The most trawling duration was 30 minutes, however in 4 cases hauls duration was shortened to 10-15 minutes due to high fish density observed on the net-sounder monitor. The mean speed of vessel while providing echo-integration was 8.0 knots, in case of trawling was 3.0 knots. Overall, 3 hauls were conducted in SD 28.2, 8 hauls in SD 29 and 2 hauls in SD 32.

The length measurements (in 0.5 cm classes) were realized for 2979 sprat and 2757 herring individuals. Totally, 397 sprat and 687 herring individuals were taken for biological analysis.

Acoustic data were collected with the EK-60 echo-sounder equipped with "Echo-view V4.10" software for the data analysis. The acoustic equipment was calibrated before the survey according to the methodology described in the IBAS manual (ICES. 2015). The basic acoustic and biological data collected during recently carried out survey will be stored in the BASS_DB.mdb managed by ICES.

Calibration

The hydroacoustic equipment was calibrated before the survey according to the methodology described in the BIAS manual. (Anon. 2014[2])

Acoustic data collection

Acoustic data were collected during the light time with the Simrad EK60 echosounder equipped with "Echo-view V4.10" software for the data analysis. Data from two frequencies (38 and 120 kHz) were recorded simultaneously, but for the standard analyses only the information collected with 38 kHz was used. The specific settings of the equipment were used as described in the BIAS manual. (Anon. 2014[2]) The basic acoustic and biological data collected during recently carried out survey will be stored in the BIAS_DB.mdb managed by ICES.

[2]Anon. 2014. Report of the Baltic International Fish Survey Working Group (WGBIFS). ICES CM 2014/SSGESST: 13.

Data analysis

The MYRIAX "EchoView v.4.10" software was used for the analysis of the acoustic data.

The total number of fish in each the ICES rectangle was estimated as a product of the mean NASCs from scrutinized acoustic data and a rectangle area, divided by corresponding mean acoustic cross-section (σ) which is based on the trawl catch results. The abundance of clupeids was separated into sprat and herring according to the mean catch composition.

Mean target strength (TS) – one of the principal acoustic parameter – of clupeids was calculated according to following formula:

TS = 20 log L – 71.2 (Anon. 1983[3]).

Due to fortunate weather conditions, all transects and planned trawls were conducted according to the plan and no data from colleagues from nearby countries were needed.

Catch results and fish measurements

Overall, 7 fish species were recognized in hauls performed at the North-eastern Baltic Sea in May 2016. Sprat was prevailing species by mass in the total catch with the mean share amounted 63.9 % (especially high in SD 28 – 85.0%). Only in SD 32 the catch mass share of sprat and herring was at the same level – 51.5 and 48.5% respectively. The rest 5 species (with the three spine stickleback) represented only 1.0 % of the total mass in average.

The detailed catch and CPUE results are presented in the Table 1 and Fig. 2. The biological sampling is shown in Table 2.

Mean CPUE for all species in the investigated area in May 2016 amounted 670.0 kg/h. The most valueable CPUEs for sprat was noted in SD 28.2, but for herring – in SD 32. The mean CPUEs of sprat were: 1493.2 kg/h in ICES SD 28.2, 184.9 kg/h in SD 29 and 278.9 kg/h in SD 32. The mean CPUEs in case of herring were as follow: 186.7, 149.3 and 207.9 kg/h in SDs 28.2, 29 and 32 respectively.

The length distributions of sprat and herring according to the ICES Sub-divisions 28.2, 29 and 32 are shown on Fig. 3 and 4 respectively. The sprat length distribution curves represent similar character in three investigated SDs. First frequency pick representing sprat generation born in 2015 take place on 7.5-8.0 cm length class shows a small quantity in all investigated Sub-divisions. The second one representing adult sprat placed on 9.5 cm length class. The length distribution curves by Sub-divisions in case of herring show generally two frequency picks – first one on 11.0-12.5 cm length classes and second one on 15.0-18.0 cm length classes. The first pick shows good quantity of herring generation born in 2015, especially in SD 32.

Acoustic results

The survey statistics concerning the survey area, the mean NASC, the mean sigma, the estimated total number of fish, the percentages of herring and sprat per ICES statistical rectangles are presented in Table 3. Fish concentrations were similar throughout the survey.

Abundance and biomass estimates

The estimated abundances of herring and sprat by age group and Sub-division/ICES statistical rectangle are given in Table 4. The estimated biomass by age group and Sub-division/ICES statistical rectangle is shown in Table 5. Corresponding mean weights by age group and Sub-division/ICES statistical rectangle are summarized in Table 6.

Sprat concentration was found highest in Central Baltic and slightly decreased towards Gulf of Finland. Average weights were similar throughout the survey. Biomass of herring increased heavily towards Gulf of Finland, but sprats biomass remained on more or less stable high level.

Meteorological and hydrological characteristics.

The 13 hydrological stations at the control catch positions (Fig.1) were inspected with the IDRONAUT CTD-probe combined with the rosette sampler. Hydrological parameters were measured at each catch–station location. Oxygen content was determined by the standard Winkler’s method. The CTD row data aggregated to the 1-m depth stratum. The oxygen probes ware taken on every 10 meters, and at the catch depth.

The most frequently wind was ESE (Fig. 5). The wind force varied from 0,6 m/s to 8,4 m/s, and average force was 4,5 m/s. The air temperature ranged from 9,3 °C to 17,1 °C, and average temperature was 12,2 °C.

The seawater temperature in the surface layers varied from10.00 to 14.74°C (the mean was 11.50°C).The lowest surface temperatures were recorded at the haul station 5. The highest ones were noted at the haul 11. The minimum value of salinity in Practical Salinity Unit (PSU) was 5,05 at the haul station 4 in the surface layer. The maximum was 6,78 PSU at the haul station 12. The mean value of salinity was 6,07 PSU. The oxygen content in the surface layers of investigated the research area varied in the range of 6.52 ml/l (haul 10) - 9.87 ml/l (haul 4). The mean value of surface water oxygen content was 8.45 ml/l.

The temperature of near bottom layer was changing in the range of 4.05 (haul 7) to 6.17 °C (haul 9), the mean was 5.54 °C. Salinity of near bottom waters varied from7.47 (haul 7) to 11.61 PSU (haul 9), and the mean was 10.30 PSU. Oxygen content varied from 0.37 ml/l (haul 6) to 6.61 ml/l (haul 7), the mean was 1.77 ml/l.

The depth profiles of three basic hydrological parameters (Fig. 6) measured at the deepest sampling station show a thermocline starting from about 20 m depth and oxycline starting from about 60 m depth with the oxygen value 6 ml/l to below 0,5 ml/l below the depth of 80 m.

The temperature at the trawl towing layer was changing in the range of 4.10 (haul 13)- 5.35 °C (haul 2), the mean value was 4.76 °C. Salinity at the haul depth varied from 6,93 (haul 6) to 9.72 PSU (haul 8), and the mean was 8.44 PSU. Oxygen content varied from 1.21 ml/l (haul 10) to 7.47 ml/l (haul 7), and the mean was 3.68 ml/l (Table 3).

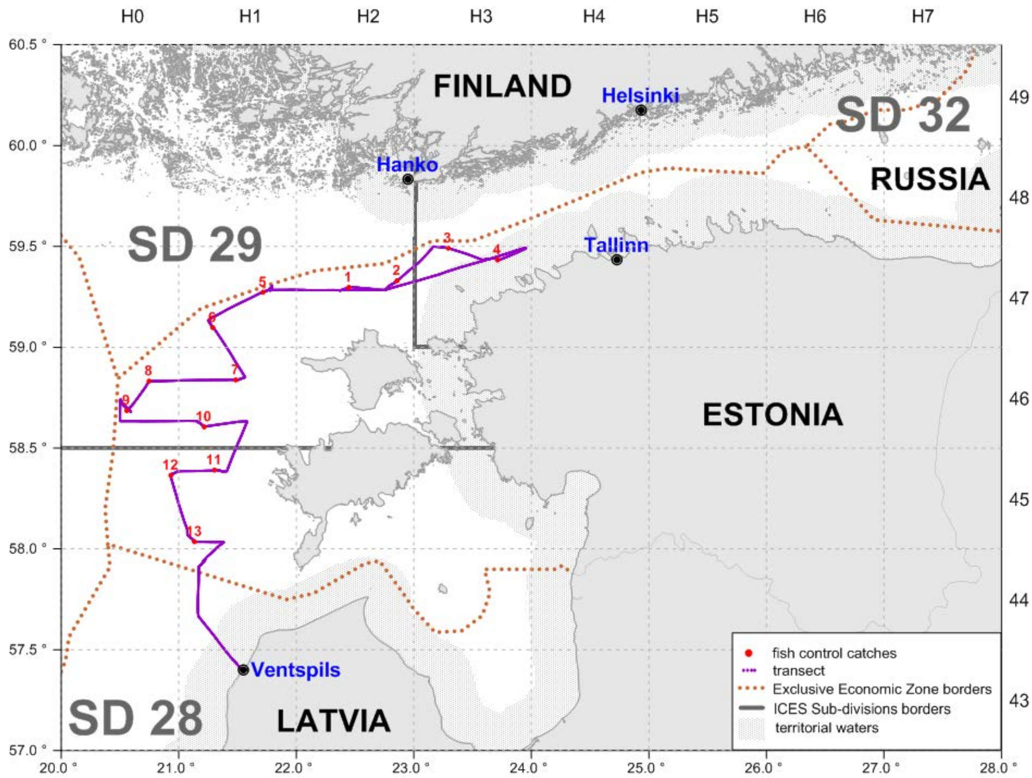


Fig. 1. Acoustic transects and pelagic fish control catches with connected hydrological stations realised during joint EST-POL BASS (May 2016).

Table 1. Catch results during joint Estonian-Polish BASS conducted by r.v. “Baltica” in Estonian EEZ in May 2016.

Gear: pelagic trawl type WP53/64x4 with 6 mm bar length in the codend

Haul no	Date	ICES rectangle	ICES Sub-division (SD)	Geographical position start latitude 00°00.0'N	Geographical position start longitude 00°00.0'E	Geographical position end latitude 00°00.0'N	Geographical position end longitude 00°00.0'E	Time start	Time end	Haul duration [min]	Total catch [kg]	CPUE* [kg/h]	Catch per species [kg] sprat	herring	cod	flounder	lumpfish	eelpout	three-spined stickleback
1	2016-05-22	47H2	29	59°16.9'	22°22.8'	59°17.5'	22°25.5'	06:55	07:25	30	160,740	321,480	74,969	85,562					0,209
2	2016-05-22	47H2	29	59°18.3'	22°47.7'	59°19.1'	22°50.0'	09:55	10:25	30	239,408	478,816	139,380	99,016	0,988				0,024
3	2016-05-22	47H3	32	59°29.7'	23°14.7'	59°29.6'	23°15.9'	13:15	13:30	15	152,990	611,960	113,320	39,640					0,030
4	2016-05-22	47H3	32	59°26.3'	23°38.6'	59°26.4'	23°41.5'	15:50	16:20	30	180,960	361,920	52,243	128,572					0,145
5	2016-05-23	47H1	29	59°17.1'	21°46.2'	59°16.6'	21°44.0'	06:50	07:20	30	399,123	798,246	208,153	189,038	1,658		0,075		0,199
6	2016-05-23	47H1	29	59°07.4'	21°15.6'	59°06.2'	21°17.0'	10:15	10:45	30	23,925	47,850	16,480	6,580					0,865
7	2016-05-23	46H1	29	58°50.8'	21°32.7'	58°50.2'	21°30.2'	13:40	14:10	30	19,084	38,168	15,180	3,040					0,864
8	2016-05-23	46H0	29	58°49.9'	20°49.0'	58°49.8'	20°46.1'	17:15	17:45	30	123,127	246,254	58,584	63,986	0,442	0,115			
9	2016-05-23	46H0	29	58°42.2'	20°35.3'	58°41.5'	20°34.1'	19:35	19:50	15	72,800	291,200	44,300	26,919	1,325	0,171		0,014	0,071
10	2016-05-24	46H1	29	58°37.6'	21°10.1'	58°36.8'	21°12.2'	09:10	09:40	30	235,322	470,643	138,120	96,136	0,767	0,132		0,003	0,164
11	2016-05-24	45H1	28	58°23.2'	21°20.2'	58°23.5'	21°19.4'	13:55	14:10	15	366,580	1466,320	236,297	129,439					0,844
12	2016-05-24	45H0	28	58°22.5'	20°57.6'	58°22.3'	20°56.7'	16:25	16:35	10	559,360	3356,160	555,444	3,804					0,112
13	2016-05-24	45H1	28	58°03.7'	21°05.3'	58°02.8'	21°07.1'	19:30	20:00	30	110,759	221,518	100,893	9,703			0,119		0,044
									Total catch [kg]	28	1036,699	1681,333	892,634	142,946			0,119		1,000
										29	1273,529	336,582	695,166	570,277	5,180	0,418	0,075	0,017	2,396
										32	333,950	486,940	165,563	168,212					0,175
										Sum	2533,419	670,041	1652,470	871,732	5,180	0,418	0,075	0,017	3,527

*mean CPUE for sum haul numbers

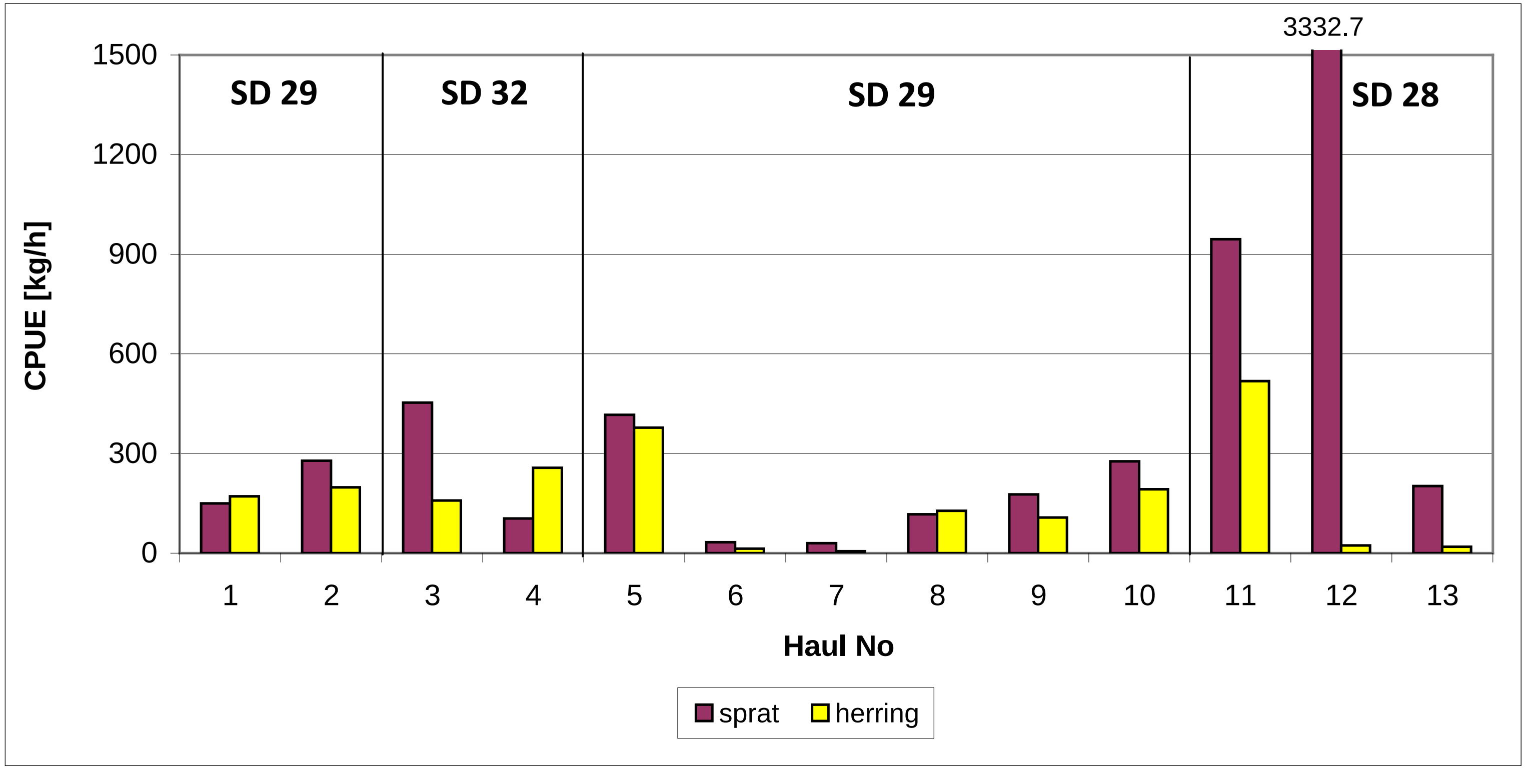


Fig. 2. CPUE values (kg/h) of sprat and herring in particular pelagic fish control catches during joint EST-POL BASS in the North-eastern Baltic Sea (Sub-divisions 28.2, 29 and 32), May 2016.

Table. 2. Biological sampling in the r.v."Baltica" joint EST-POL BASS in May 2016.

Fish samples

SD 28		SPRAT	HERRING	COD	FLOUNDER	LUMPFISH	THREE SPINED STICKLEBACK	EELPOUT	TOTAL
Samples taken	measurements	3	3			1	3		10
	analyses	3	3			0	0		6
Fish measured		746	296			1	36		1079
Fish analysed		124	182			0	0		306

SD 29		SPRAT	HERRING	COD	FLOUNDER	LUMPFISH	THREE SPINED STICKLEBACK	EELPOUT	TOTAL
Samples taken	measurements	8	8	5	3	1	7	2	34
	analyses	8	8	0		0	0	0	16
Fish measured		1798	1920	13	4	1	197	2	3935
Fish analysed		177	333	0	0	0	0	0	510

SD 32		SPRAT	HERRING	COD	FLOUNDER	LUMPFISH	THREE SPINED STICKLEBACK	EELPOUT	TOTAL
Samples taken	measurements	2	2				2		6
	analyses	2	2				0		4
Fish measured		435	541				12		988
Fish analysed		96	172				0		268

SUM		SPRAT	HERRING	COD	FLOUNDER	LUMPFISH	THREE SPINED STICKLEBACK	EELPOUT	TOTAL
Samples taken	measurements	13	13	5	3	2	12	2	50
	analyses	13	13	0	0	0	0	0	26
Fish measured		2979	2757	13	4	2	245	2	6002
Fish analysed		397	687	0	0	0	0	0	1084

Type of fishing net used: pelagic trawl WP53/64x4 with 6mm mesh size in the codend

Zooplankton samples

Sub-division	stations	samples
28	3	6
29	6	12
32	1	2
Sum	10	20

Type of plankton net used: Juday net + Bongo net

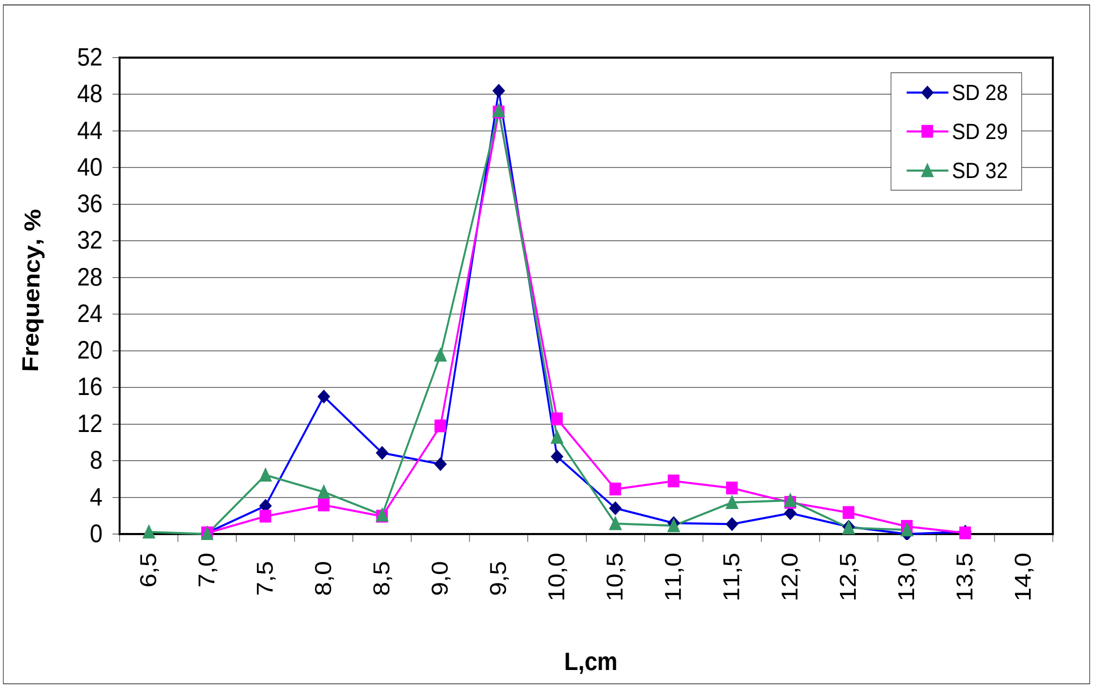


Fig. 3. Sprat length distributions from the control catches conducted by the rv. "Baltica" during joint EST-POL BASS in the SDs 28.2, 29 and 32 (May 2016).

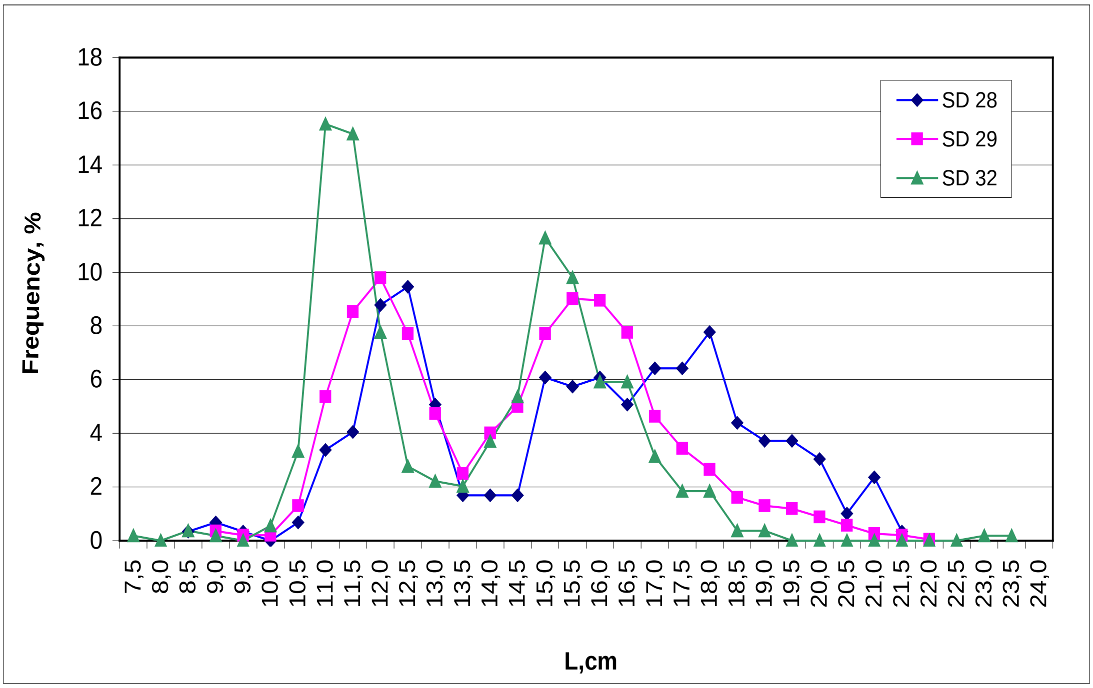


Fig. 4. Herring length distributions from the control catches conducted by the rv. "Baltica" during joint EST-POL BASS in the SDs 28.2, 29 and 32 (May 2016).

Table 3. The BASS survey basic biological and acoustic data concerning the clupeid stocks inhabiting the north- eastern Baltic Sea in May 2016.

ICES Sub-div.	ICES rectangle	Area [NM^2]	Share [%-indiv.]		Total abundance [$x10^6$]	Abundance density [$10^6/NM^2$]	NASC [m^2/NM^2]	σ [cm^2]
			herring	sprat				
28	45H0	947.2	0,3	99,7	8861,17	9,355	785,3	0,839
28	45H1	827.1	6,4	87,5	4184,93	5,060	483,7	0,956
29	46H0	933.8	19,6	80,0	4233,51	4,534	564,2	1,244
29	46H1	921.5	11,4	81,7	2870,94	3,116	325,4	1,044
29	47H1	920.3	17,5	76,3	8196,44	8,906	982,1	1,103
29	47H2	793.9	24,9	74,7	3131,27	3,944	497,1	1,260
32	47H3	536.2	29,0	70,7	3265,36	6,090	722,0	1,186
Average			**15,6**	**81,5**		**5,858**	**622,8**	**1,090**
Total		**5880**			**34743**			

Table 4. Abundance (in 10^6 indiv.) of herring and sprat per age groups according to the ICES rectangles and Sub-divisions of the north-eastern Baltic in May 2016.

ICES Sub-div.	ICES rectangle	HERRING – age groups								
		1	2	3	4	5	6	7	8+	total
28	45H0		21,86	0,36	1,82	1,09	0,36			25,50
28	45H1	4,56	68,16	8,17	43,29	43,48	18,89	25,54	57,13	269,21
total		4,56	90,01	8,53	45,12	44,57	19,25	25,54	57,13	294,71
29	46H0	14,20	239,14	56,67	181,84	112,34	40,36	51,33	134,3	830,17
29	46H1	6,21	112,43	20,04	67,24	42,78	14,38	19,10	45,65	327,83
29	47H1	29,44	591,56	148,97	325,03	140,22	51,72	41,96	104,23	1433,12
29	47H2	15,16	275,36	60,42	200,86	104,25	31,19	28,00	63,94	779,16
total		65,02	1218,49	286,09	774,96	399,58	137,65	140,38	348,12	3370,28
32	47H3	6,39	444,31	135,64	137,04	121,76	39,87	27,74	35,79	948,55
total		6,39	444,31	135,64	137,04	121,76	39,87	27,74	35,79	948,55
Grand total		75,97	1752,81	430,26	957,12	565,91	196,77	193,67	441,04	4613,55

Table 4. Continued

ICES Sub-div.	ICES rectangle	SPRAT – age groups 1	2	3	4	5	6	7	8+	total
28	45H0	2825	5730	109	57	48	26	6	32	8834
28	45H1	910	2485	92	63	49	34	6	22	3661
total		3734	8216	202	119	98	60	12	54	12495
29	46H0	183	2467	150	246	135	37	60	111	3388
29	46H1	290	1680	68	127	81	20	24	56	2344
29	47H1	510	4948	109	246	185	59	57	137	6252
29	47H2	18	1852	60	157	101	34	36	84	2341
total		1001	10947	386	776	502	150	177	387	14325
32	47H3	175	1889	35	64	57	0	14	75	2309
total		175	1889	35	64	57	0	14	75	2309
Grand total		4910	21052	622	960	657	210	203	516	29129

Table 5. Biomass (in tons) of herring and sprat per age groups according to the ICES rectangles and Sub-divisions of the north-eastern Baltic in May 2016.

ICES	ICES rectangle	HERRING – age groups								
Sub-div.		1	2	3	4	5	6	7	8+	total
28	45H0		225	6	30	18	6			285
28	45H1	23	688	118	828	1013	434	651	1806	5563
total		23	913	124	858	1031	440	651	1806	5848
29	46H0	90	2449	836	3275	2563	1314	1620	3085	12148
29	46H1	40	1132	298	1308	962	431	601	900	5672
29	47H1	82	6474	2219	5985	3354	1507	1323	1692	22635
29	47H2	112	2503	876	3717	2041	963	951	749	11913
total		324	12558	4229	14285	8920	4216	4495	6425	52368
32	47H3	256	3566	1018	3607	2143	964	852	464	12870
total		256	3566	1018	3607	2143	964	852	464	12870
Grand total		603	17037	5371	18750	12095	5620	5999	8696	71086

Table 5. Continued

ICES Sub-div.	ICES rectangle	SPRAT – age groups								
		1	2	3	4	5	6	7	8+	total
28	45H0	9215	29898	866	538	469	257	61	347	41650
28	45H1	2866	13345	743	587	518	362	55	225	18701
total		12081	43242	1609	1125	987	618	116	572	60351
29	46H0	546	13408	742	1666	1079	359	496	957	19254
29	46H1	889	9023	553	1126	722	186	245	527	13271
29	47H1	1565	26662	850	2147	1579	565	595	1297	35259
29	47H2	59	9221	450	1311	852	316	354	753	13316
total		3060	58314	2596	6250	4232	1426	1690	3533	81100
32	47H3	411	8872	265	535	478	0	154	675	11389
total		411	8872	265	535	478	0	154	675	11389
Grand total		15551	110428	4469	7910	5697	2044	1960	4780	152841

Table 6. Mean weight (in grams) of herring and sprat per age groups, according to the ICES rectangles of the north-eastern Baltic in May 2016.

ICES Sub-div.	ICES rectangle	HERRING – age groups								
		1	2	3	4	5	6	7	8+	avg.
28	45H0		10,30	16,50	16,50	16,50	16,50			11,19
28	45H1	5,10	10,10	14,42	19,14	23,31	22,99	25,51	31,62	20,66
29	46H0	6,33	10,24	14,75	18,01	22,81	32,57	31,56	22,97	14,63
29	46H1	6,40	10,07	14,88	19,46	22,49	30,00	31,46	19,71	17,30
29	47H1	2,78	10,94	14,90	18,41	23,92	29,13	31,53	16,23	15,79
29	47H2	7,42	9,09	14,50	18,50	19,58	30,89	33,98	11,71	15,29
32	47H3	40,01	8,03	7,50	26,32	17,60	24,18	30,72	12,96	13,57

Table 6. Continue

ICES Sub-div.	ICES rectangle	SPRAT – age groups								
		1	2	3	4	5	6	7	8+	avg.
28	45H0	3,26	5,22	7,91	9,53	9,68	9,78	9,48	10,75	4,71
28	45H1	3,15	5,37	8,05	9,34	10,52	10,62	9,87	10,45	5,11
29	46H0	2,99	5,43	4,95	6,78	8,02	9,84	8,24	8,62	5,68
29	46H1	3,07	5,37	8,18	8,88	8,89	9,52	10,23	9,48	5,66
29	47H1	3,07	5,39	7,81	8,71	8,52	9,50	10,46	9,47	5,64
29	47H2	3,27	4,98	7,54	8,35	8,47	9,19	9,96	9,01	5,69
32	47H3	2,35	4,70	7,64	8,34	8,36		11,07	9,02	4,93

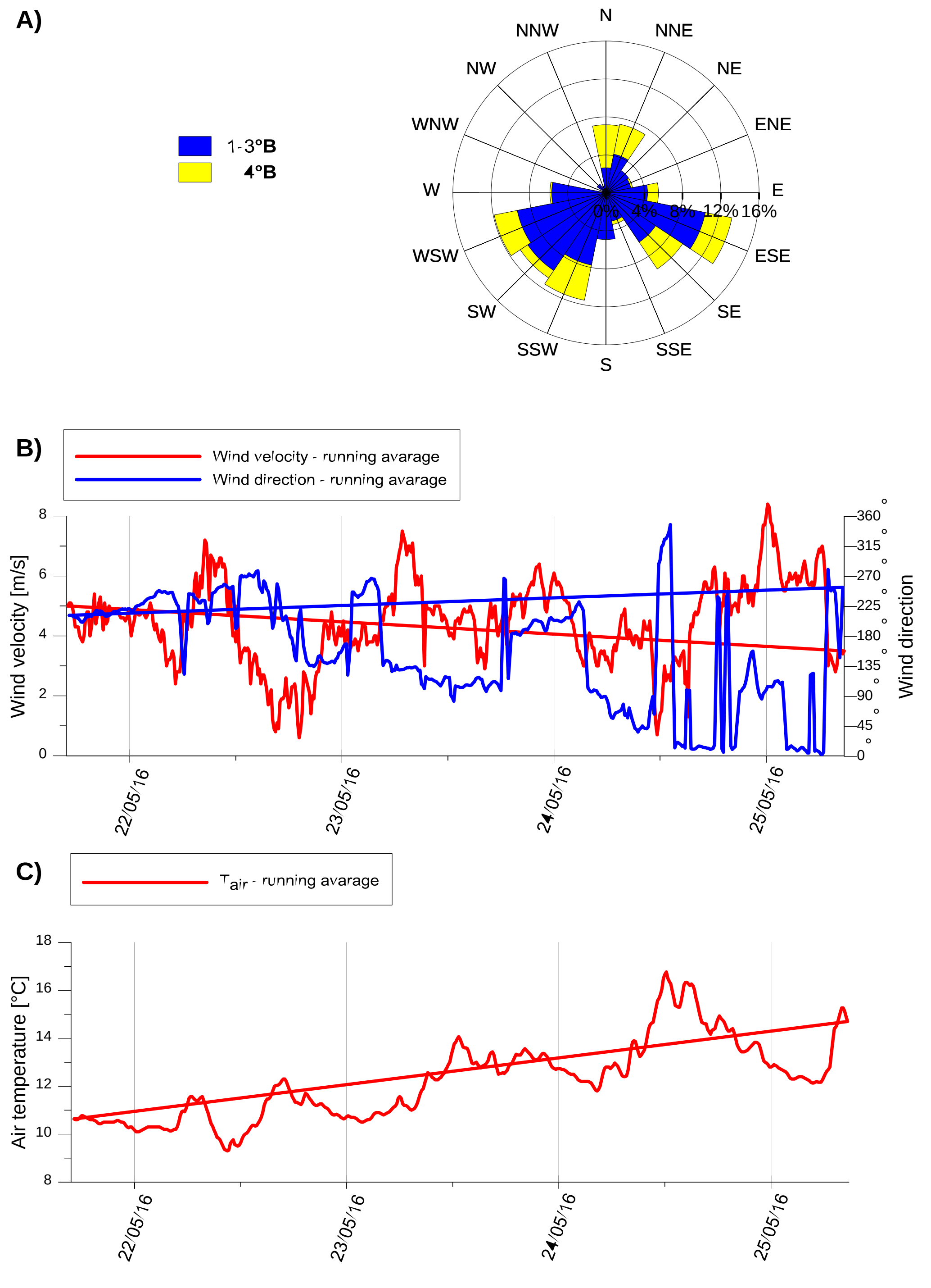


Fig. 5. Changes of the main meteorological parameters during joint EST-POL BASS conducted in May 2016 (A and B – wind direction and velocity, C – air temperature).

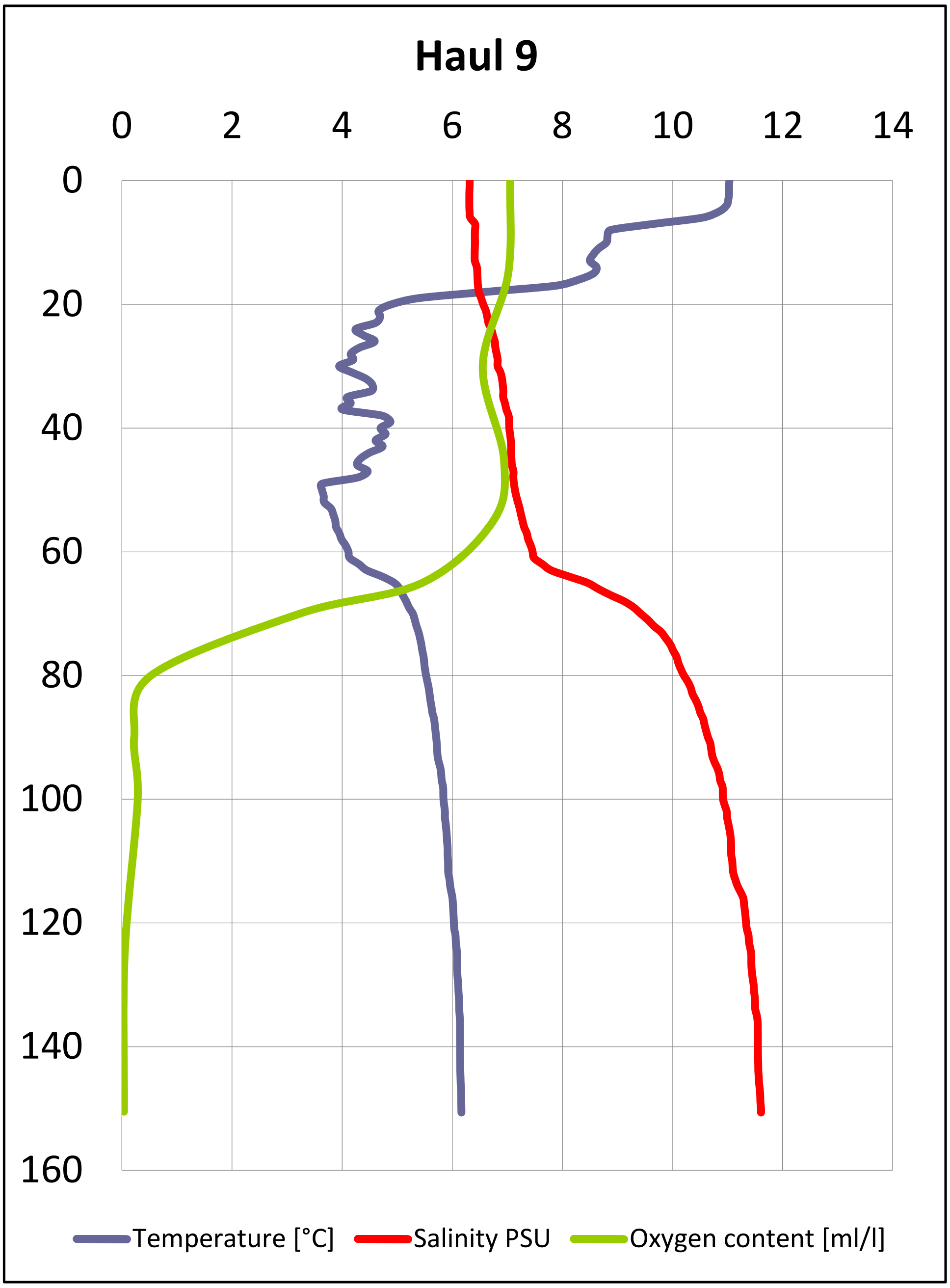


Fig.6. Temperature, salinity and oxygen depth [m] profiles at the deepest sampling station (haul No. 9) during the joint EST-POL BIAS, May 2016.

Table 3. Values of the basic meteorological and hydrological parameters recorded in May 2016 at the positions of the r.v. “Baltica” fish control catches during EST-POL BASS.

Haul number	Date of catch	Meteorological parameters					Hydrological parameters*		
		wind direction	wind force [°B]	sea state	air temper. [°C]	atmospheric pressure [hP]	temperature [°C]	salinity [PSU]	oxygen [ml/l]
1	22-05-2016	W	3	1	8	1015	4,86	8,42	2,92
2	22-05-2016	WSW	3	2	11	1016	5,35	9,66	3,59
3	22-05-2016	W	3	2	9	1019	4,32	7,64	4,44
4	22-05-2016	W	2	1	9	1019	5,11	8,95	2,64
5	23-05-2016	SE	2	1	8	1015	5,19	9,31	1,70
6	23-05-2016	SE	4	2	10	1016	4,16	6,93	7,07
7	23-05-2016	SE	2	1	11	1018	4,13/3,93	6,97/7,05	7,47
8	23-05-2016	SE	2	1	11	1018	5,32	9,72	1,37
9	23-05-2016	SE	2	1	10	1018	5,28	9,42	2,07
10	24-05-2016	SE	3	1	12	1015	5,25	9,49	1,21
11	24-05-2016	changeable	2	1	13	1017	4,98	8,84	3,78
12	24-05-2016	changeable	2	1	14	1017	4,73	8,40	3,06
13	24-05-2016	changeable	2	1	14	1017	4,10	7,30	6,55
						Mean >	4,76	8,44	3,68

* data at the mean depth of the fish control catch

Fisheries Service under the Ministry of Agriculture of Republic of Lithuania,
Fishery Research and Science State

RESEARCH REPORT FROM THE BALTIC INTERNATIONAL ACOUSTIC SURVEY (BASS) IN THE ICES SUBDIVISION 26 (LITHUANIAN ESPECIAL ECONOMIC ZONE) OF THE BALTIC SEA

(R/V "DARIUS"; 03.05 - 04.05.2016)

Working paper on the WGBIFS meeting in Riga, Latvia, 27.03-31.03.2017

Klaipeda, May, 2016
Lithuania

1 INTRODUCTION

The Lithuanian survey is coordinated within the frame of the **Baltic International Sprat Survey (BASS).** The reported acoustic survey is conducted to supply the ICES Baltic Fisheries Assessment Working Group (WGBFAS) and the Fisheries Service under the Ministry of Agriculture of Republic of Lithuania with an index value for the stock size of herring and sprat in parts of the ICES subdivision (SD) 26 (Lithuanian Exclusive Economic Zone). Pelagic research catches carried out during an acoustic survey are the information source, independent from topical preferences in fishery, about quantitative changes in a process of clupeids geographical and bathymetrical distribution in the Baltic. Hydrological parameters measurements are the information source about abiotic factors (seawater temperature, salinity, oxygen content) influencing sprat and herring spatial distribution. Echo integration results along the pre-selected tracks are the basic materials for fish stock biomass calculation.

The main aims were:

- to collect the echo-integration data for the estimation of the clupeids stocks biomass and abundance in the south-central Baltic.

2 METHODS

2.1 Personnel

The scientific staff was composed of four persons:

M. Špegys	Fisheries Service under the Ministry of Agriculture of The Republic of Lithuania; Division of Fishery Research and Science, Klaipeda – cruise leader and acoustics;
J. Fedotova	Fisheries Service under the Ministry of Agriculture of The Republic of Lithuania; Division of Fishery Research and Science, Klaipeda - scientific leader and fish sampling
D. Tarvydiene	Fisheries Service under the Ministry of Agriculture of The Republic of Lithuania; Division of Fishery Research and Science, Klaipeda - fish sampling

2.2 Narrative

The scientist cruise of RV “Darius” took place from 3-th to 4-th of May 2016. The cruise was intended to cover parts of ICES subdivisions (SD) 26, constituting the Lithuanian Exclusive Economic zones.

2.3 Survey design

The statistical rectangles were used as strata (ICES 2003). The area is limited by the 20-m depth line. The scheme of transects is defined as the regular. The average speed of a vessel for the period of acoustic survey was 8 knots. The average speed of the vessel with a trawl was 3 knots. Duration of trawling was 30 minutes. The survey was conducted in the daytime from 08.00 up to 20.00. The survey area was 2025 nm^2 and the distance used for acoustic estimates was 123 nm. The entire cruise track with positions of the trawling is shown in Fig. 1.

2.4 Calibration

The SIMRAD EK60 echo sounder with split beam transducer ES38 - 12 was calibrated (28 of April 2013) at the site of 30 m depth, located 3.5 nm northwest of Klaipeda harbour according to the BIAS manual (ICES 2011). S_v correction after calibration was set to 21.94 dB.

THE RESULTS OF CALIBRATION PROCEDURE FOR EK60 SCIENTIFIC ECHOSOUNDER	
Date: 28.04.2014	Place : near Klaipeda port
Type of transducer	Split – beam for 38 kHz
Gain (38 kHz)	21.94 dB
Athw. Angle Sens	12.5
Along. Angle Sens	12.5
Athw. Beam Angle	12.06
Along. Beam Angle	11.96
Athw. Offset Angle	0.08
Along. Offset Angle	-0.15
SA Correction (38 kHz)	-0.18 dB

2.5 Acoustic data collection

The acoustic sampling was performed around the clock. The main pelagic species of interest were herring and sprat. The SIMRAD EK60 echo sounder with hull mounted 38 kHz transducer ES38-12 was used during the cruise. The specific settings of the hydro acoustic equipment were used as described in the BIAS manual (ICES 2011). The post-processing of the stored echo signals was made using the Sonar4 (Balk & Lindem, 2005). The mean volume back scattering values S_v, were integrated over 1 nm intervals, from 10 m below the surface to the bottom. Contributions from air bubbles, bottom structures and noise scattering layers were removed from the echogram using Sonar4.

2.6 Biological data – fishing stations

All trawling was done with the pelagic gear „OTM“ in the midwater as well as near the bottom. The mesh size in the codend was 10 mm. The intention was to carry out at least two hauls per ICES statistical rectangle. The trawling depth was chosen by the echogram, in accordance to the characteristic of echo records from the fish. Normally, the trawl had vertical opening of about 12 m. The trawling time lasted 30 minutes. From each haul, sub-samples were taken to determine length and weight composition of fish. The samples of sprat and herring were taken from each catch station to determine the species proportion, length-mass relationship, sex, maturity and age-length relationship.

2.7 Data analysis

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

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

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

3 RESULTS

3.1 Biological data

In total 7 trawl hauls (Fig.1) were carried out: 574 herrings and 1634 sprats were measured and 327 herrings and 639 sprats were aged.

The results of the catch composition are presented in Table 1. In all catch compositions sprat dominated (>90%).

The length distributions of herring and sprat of the May 2016 presented in Fig. 2 and Fig. 3. In 40H0 ICES rectangle were almost no herrings and most of its (more than 77%) were 12.0-17.0 cm length, but 62% of these fishes were oldest than 2 years old. The biggest part of catching herring was in the rectangle 40G9 (85.99%). In both rectangles sprats length were from 8cm to 14 cm. In 40H0 ICES rectangle sprat dominated in 8.0 – 11.0 cm length classes (94.5%) and in 40G9 rectangle more than 89% were fishes in 9.0 – 11.5 length classes.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean Sa, the mean scattering cross section **σ**, the estimated total number of fish, the percentages of herring, sprat per rectangle are show in Table 2-14. Nautical area scattering coefficient distribution during survey is show in Figure 2.

3.3 Abundance estimates

R/V "Darius" survey statistics (aggregated data for herring and sprat), included the total abundance of herrings and sprats are presented in Tables 2-4. The estimated age composition of sprat and herring are given in table 5 and table 10. The abundance estimates of sprat were dominated by 1 age fish in both rectangles. The estimated number sprat and herring by age group and rectangle are given in table 6 and table 11. The estimates of sprat and herring biomass by age group and rectangle are summarised in table 7 and table 12. The corresponding mean weights and mean length by age group and rectangle for each species are shown in tables 8-9 and tables 13-14.
The herring stock was estimated to be $364.7 \cdot 10^6$ fishes or about 6829.0 tonnes.
The estimated sprat stock was $12743.2 \cdot 10^6$ fish or 80207 tonnes. Length distribution of herring show in Fig. 3 and sprat length distribution show in Fig. 4.

3.4. Hydrographic data

The basic hydrological parameters (seawater temperature, salinity and oxygen contents) were measured from the surface to the bottom after every haul. The survey hydrographic data by hauls presented in the Figure7. The seawater temperature was 6-7 in the surface layer and and 9 ºC near in the closest coastal zone stations in rectangle 40H0. Temperature near bottom was about 10 ºC. Water temperature in hauls was from 6 to 9 ºC. There was no halocline in 2015 of May. Salinity was about 7.8 ‰ in all hauls and depts. The oxygen-condition was excellent in all hauls and depts.

4 REFERENCES

Balk, H. & Lindem, T. 2005. Sonar4, Sonar5 and Sonar6 post processing systems, operator manual version 5.9.6. Norway: Balk and Lindem. pp. 1-381

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

ICES 2011. Manual for the international acoustic survey (BIFS). CM2003/G:05 Ref.: D, H; Appendix 9, Annex 3

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

Figure 1 The survey grid ant trawl hauls position of R/V “Darius” 03-04 May 2016

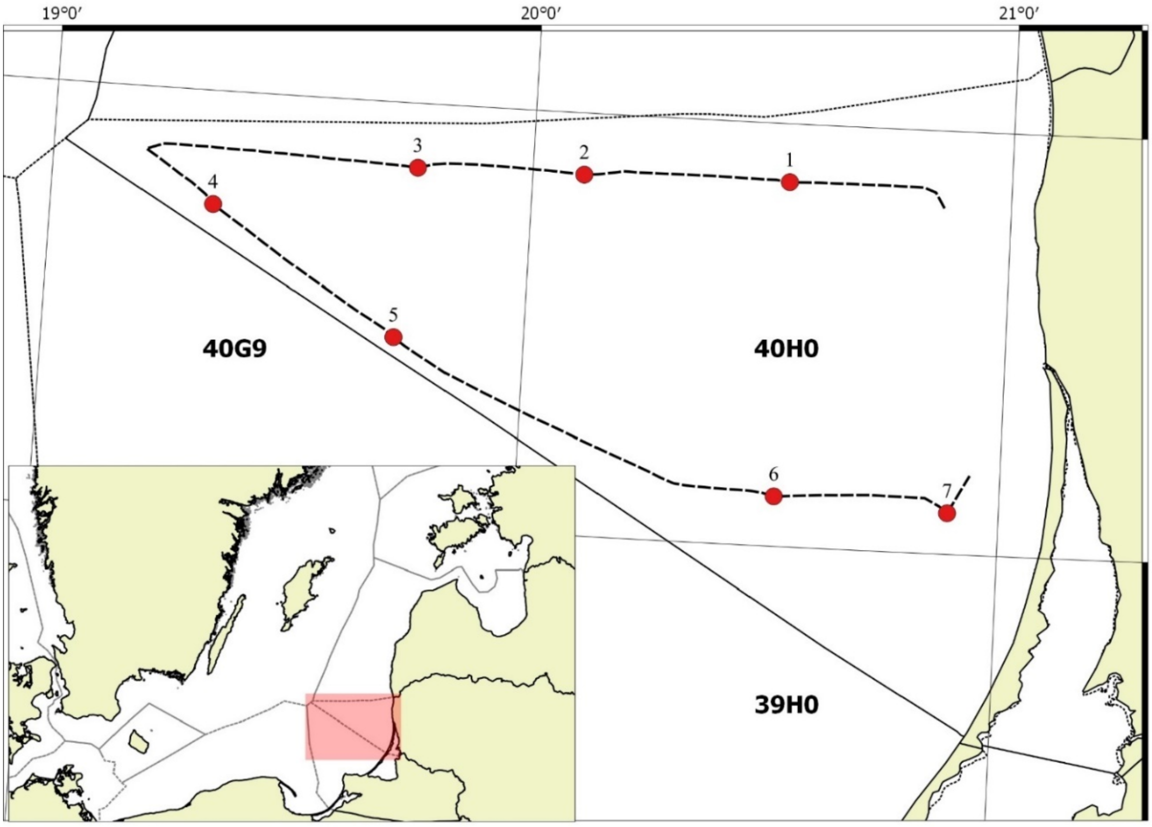


Figure 2. Mean nautical area scattering coefficient (NASC) per 3nmi of R/V “Darius” 03-04 May 2016 BASS survey

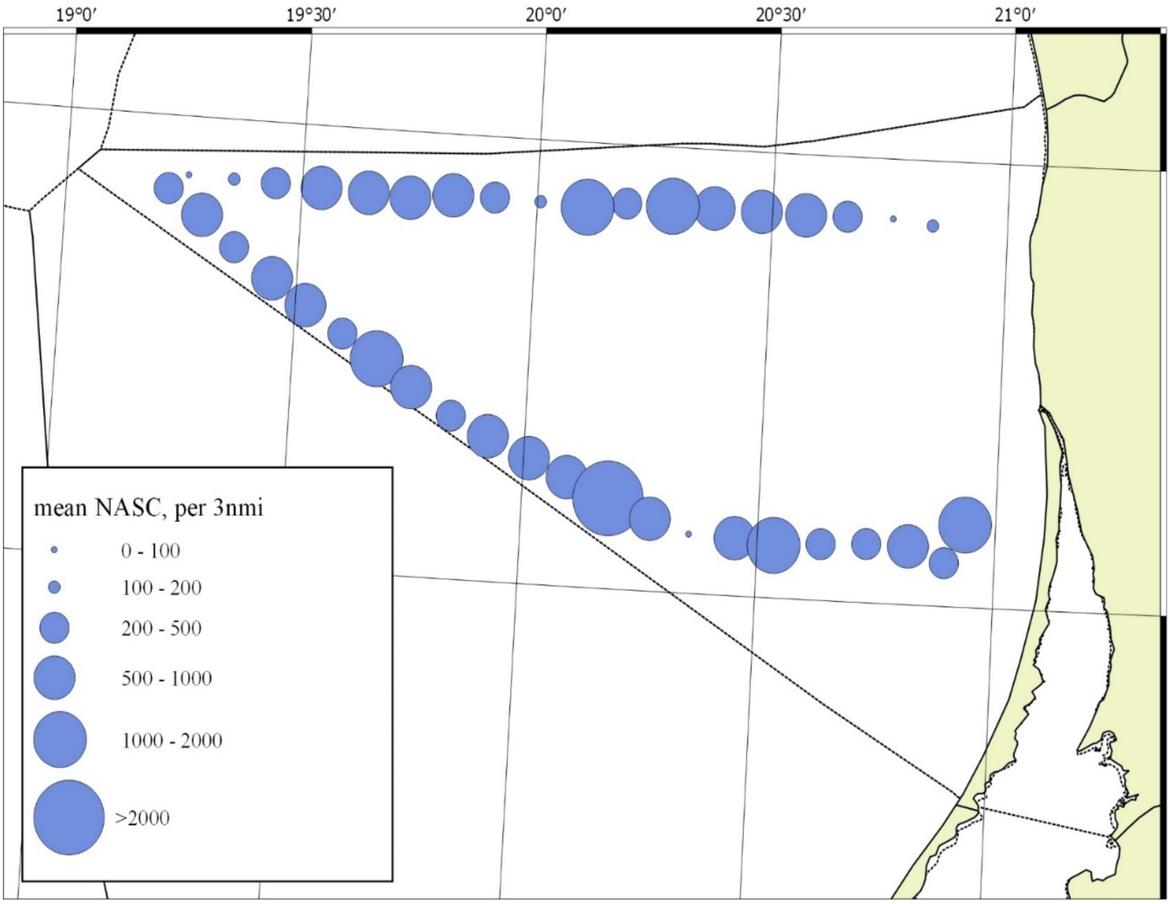


Table 1 Catch composition (kg/1hour) per haul (R/V "Darius", 03-04.05.2016)

ICES subdivision 26							
Haul No	1	2	3	4	5	6	7
Date	2016.05.03	2016.05.03	2016.05.03	201.05.04	2016.05.04	2016.05.04	2016.05.04
Validity	Valid	Valid	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	40H0	40H0	40G9	40G9	40G9	40H0	40H0
Clupea hrengus		0.45	0.42	0.17	85.6	15.96	
Sprattus spratus	60.00	660.00	240.00	100.00	154.40	224.04	500.00
Gadus morhua		1.02		0.88			
Total	60.00	661.47	240.42	101.05	240.00	240.00	500.00

Figure 3. Length composition of herring (%) (R/V "Darius", 03-04.05.2016)

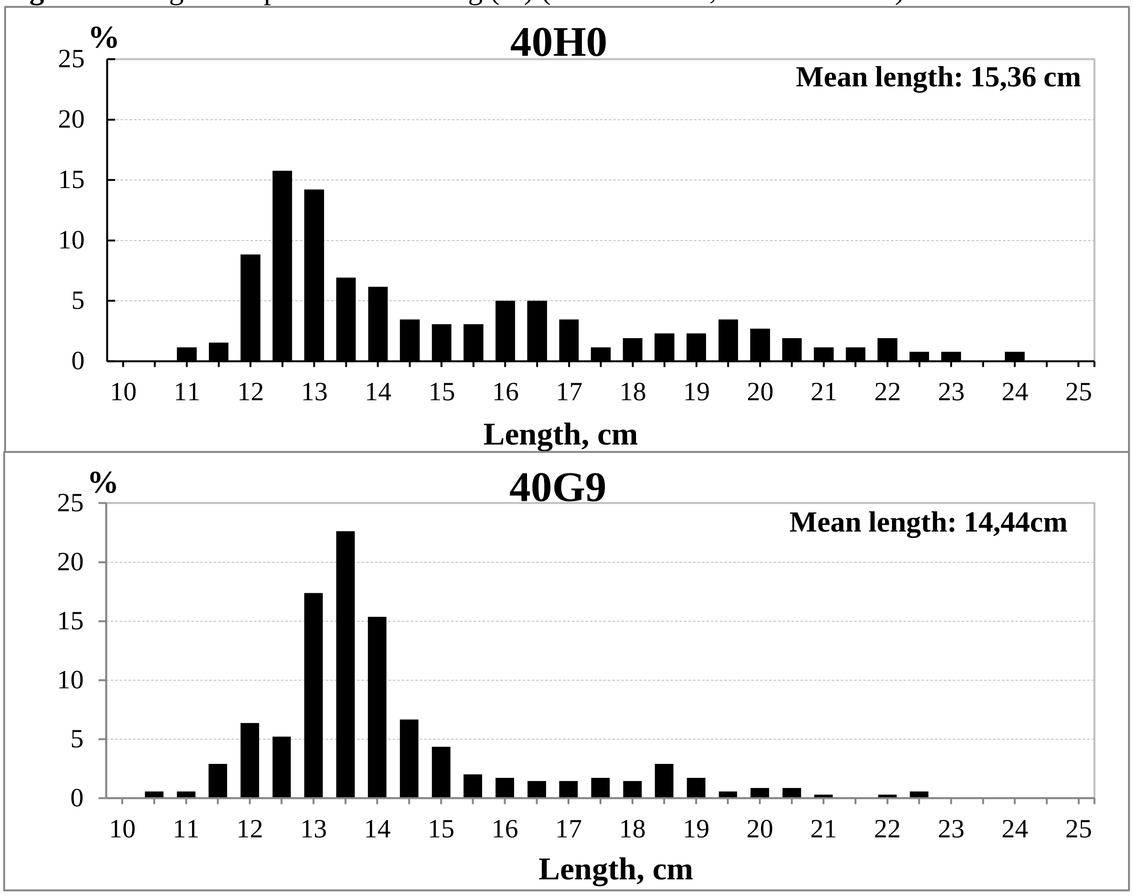


Figure 4. Length distribution of sprat (%) (R/V "Darius", 03-04.05.2016)

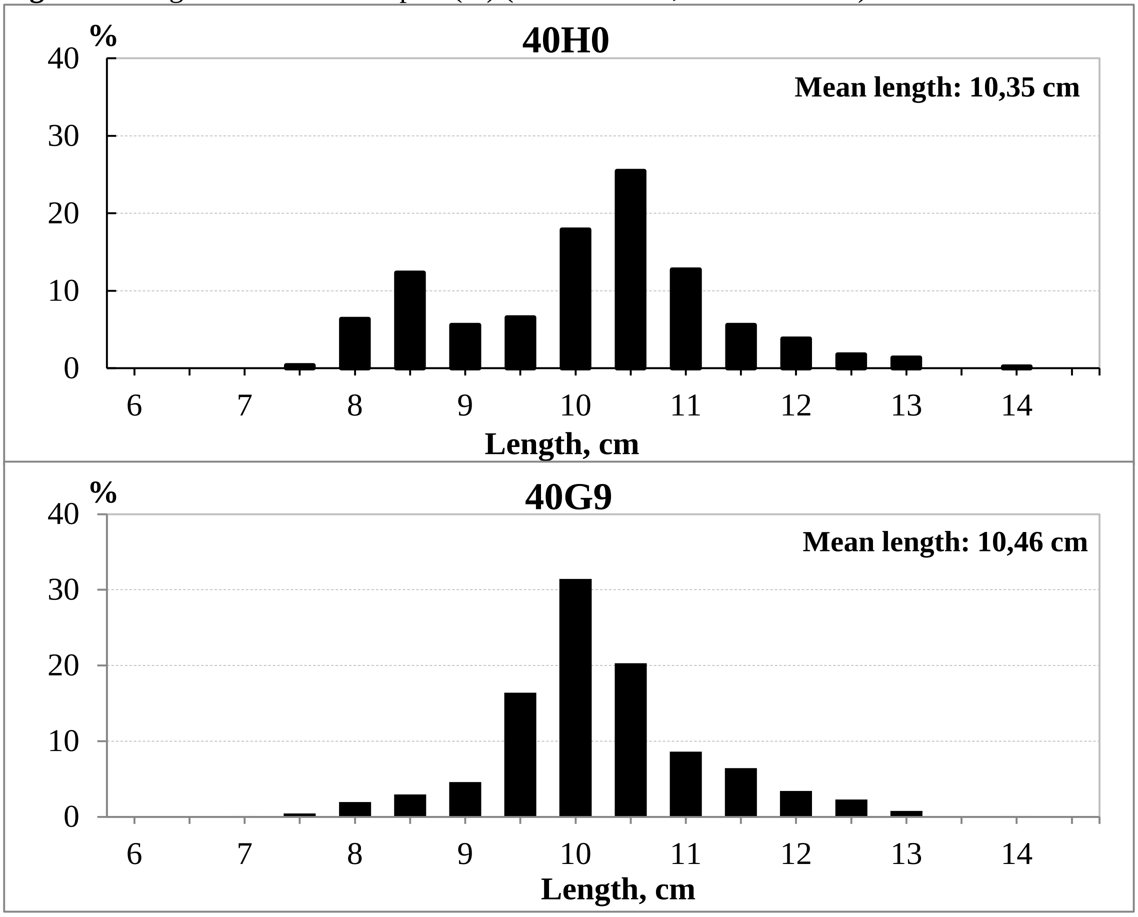


Table 2 R/V "DARIUS" survey statistics (abundance of herring and sprat),), 03-04.05.2016

ICES SD 26	ICES Rect.	Area nm^2	ρ mln/nm^2	Abundance, mln			Biomass, tonn		
				N sum	N her	N spr	W sum	W her	W spr
	40H0	1012.1	5,31	5371,0	1089,3	4281,7	52358	23883	28475
	40G9	1013.0	4,39	4444,1	1260,9	3183,2	45293	22685	22609

Table 3 R/V "DARIUS" survey statistics (aggregated data of herring and sprat),), 03-04.05.2016

ICES SD 26	ICES Rect.	No trawl	Herring			Sprat			SA m^2/nm^2	TS calc. dB
			L, cm	w, g	Numb.,%	L, cm	w, g	Numb.,%		
	40H0	1,2,6,7	15,36	21,93	20,28	10,35	6,65	79,72	688,9	-49,9
	40G9	3,4,5	14,44	17,99	28,37	10,46	7,10	71,63	583,0	-49,8

Table 4 R/V "DARIUS" survey statistics (herring and sprat), 03-04.05.2016

ICES SD 26	ICES Rect.	Area nm^2	SA m^2/nm^2	σ *10^4 nm^2	Abundance, mln	Species composition (%)	
						herring	sprat
	40H0	1012	688,9	1,29806	5371,0	20,28	79,72
	40G9	1013	583,0	1,32896	4444,1	28,37	71,63

Table 5 R/V "Darius" estimated age composition (%) of sprat, 03-04.05.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	100,0		24,2	37,5	24,5	7,6	3,1	1,5	1,4	0,3
	40G9	100,0		6,0	57,4	23,4	6,9	2,4	2,4	0,7	0,8

Table 6 R/V "Darius" estimated number (millions) of sprat, 03-04.05.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	4281,7		1035,2	1603,8	1047,5	323,9	134,8	62,1	60,5	14,0
	40G9	3183,2		190,5	1828,4	744,7	220,8	76,1	76,1	20,7	25,9

Table 7 R/V "Darius" estimated biomass (in tons) of sprat, 03-04.05.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	28475		4164	10899	7853	2783	1240	661	732	142
	40G9	22609		694	12057	5575	2089	814	862	205	311

Table 8 R/V "Darius" estimated mean weights (g) of sprat, -03-04.05.2016

SD	Rect.	Age									
		Mean	0	1	2	3	4	5	6	7	8
26	40H0	6,65		4,0	6,8	7,5	8,6	9,2	10,6	12,1	10,2
	40G9	7,10		3,64	6,59	7,49	9,46	10,70	11,34	9,91	11,98

Table 9 R/V "Darius" estimated mean length (cm) of sprat, 03-04.05.2016

SD	Rect.	Age									
		Mean	0	1	2	3	4	5	6	7	8
26	40H0	10,3		8,5	10,2	10,6	11,4	11,8	12,2	12,7	12,0
	40G9	10,5		8,3	10,0	10,5	11,4	12,0	12,3	11,7	12,5

Table 10 R/V "Darius" estimated age composition (%) of herring, 03-04.05.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	100,0		38,7	29,0	9,9	7,7	4,4	2,4	4,0	3,9
	40G9	100,0		15,3	59,6	5,2	9,4	3,9	3,1	1,3	2,3

Table 11 R/V "Darius" estimated number (millions) of herring, 03-04.05.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	1089,3		421,8	315,6	107,5	84,1	48,2	26,0	43,4	42,6
	40G9	1260,9		192,5	751,6	65,5	118,1	48,7	39,3	16,1	28,9

Table 12 R/V "Darius" estimated biomass (in tons) of herring, 03-04.05.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	23883		5496,3	6038,4	2908,6	3003,9	1933,7	953,9	1842,0	1705,9
	40G9	22685		2537,2	11110,0	1239,8	2923,1	1459,7	1444,1	601,1	1369,8

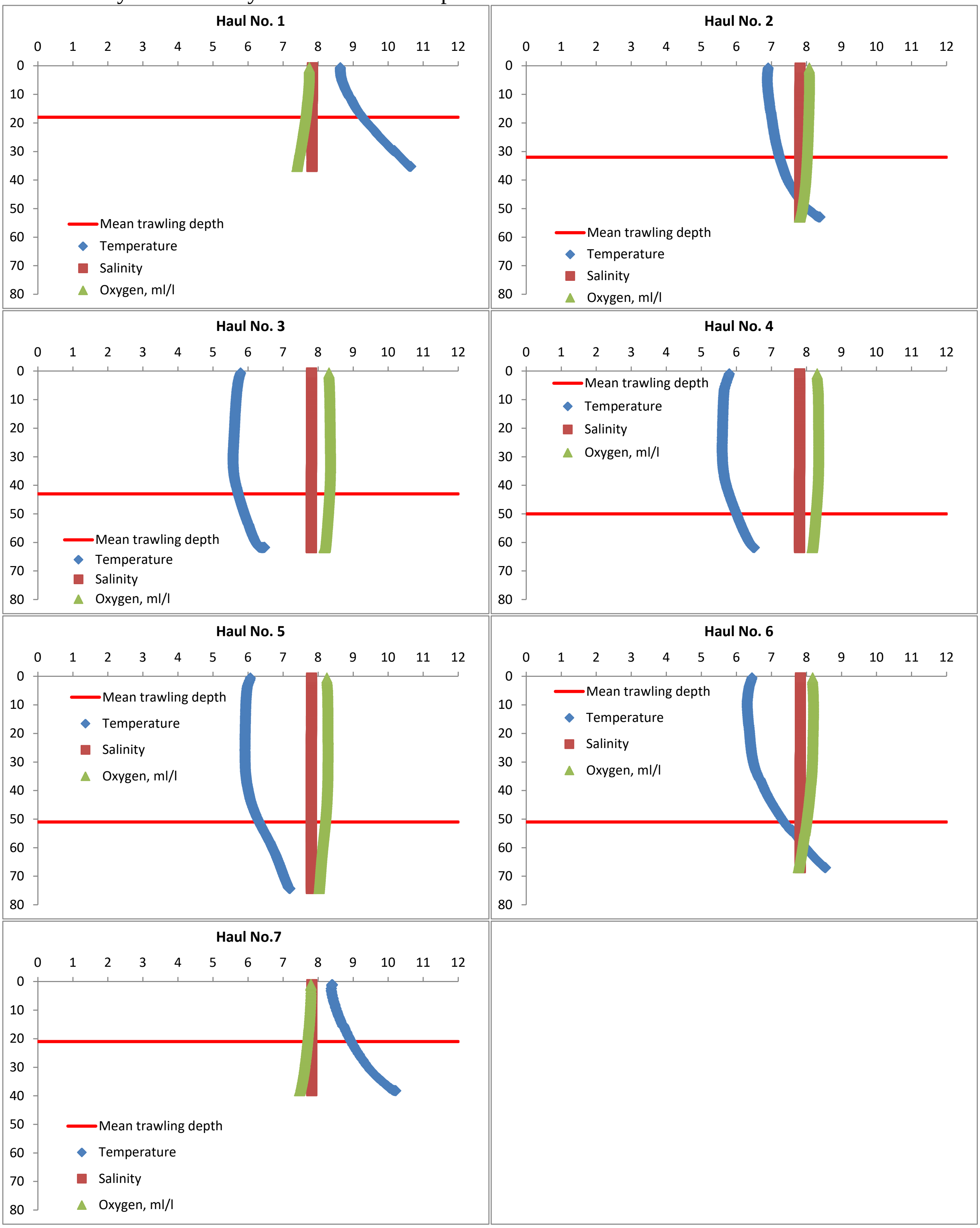
Table 13 R/V "Darius" estimated mean weights (g) of herring, 03-04.05.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	21,9		13,03	19,13	27,05	35,72	40,10	36,72	42,41	40,05
	40G9	18,0		13,18	14,78	18,92	24,75	29,96	36,76	37,24	47,34

Table 14 R/V "Darius" estimated mean length (cm) of herring, 03-04.05.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	15,4	0	12,9	14,6	16,5	18,3	19,0	19,1	19,9	19,0
	40G9	14,4	0	12,8	13,4	14,5	16,1	17,4	18,8	19,0	20,7

Figure 4. Hydrological parameters registered at the hydrological station from the Lithuanian BIAS BASS survey conducted by r/v "Darius" in the period of 03-04.05.2016.



Institute of Food Safety, Animal Health and Environment – BIOR, Riga (Latvia)

National Marine Fisheries Research Institute – NMFRI, Gdynia (Poland)

THE CRUISE REPORT

FROM THE JOINT LATVIAN-POLISH BALTIC ACOUSTIC SPRING SURVEY – BASS 2016 ON THE R/V "BALTICA" IN THE ICES SUBDIVISIONS 26N AND 28.2 OF THE BALTIC SEA (12-21 MAY 2016)

Working paper on the WGBIFS meeting in Riga, Latvia, 27-31.03.2017

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Riga – Gdynia, March 2017

INTRODUCTION

More less regular acoustic estimations of pelagic fish stocks in the Baltic Sea initiated by BaltNIIRH (now BIOR) and Institute für Hochseefischerei in Rostock (GDR) was performed since 1983, but the first scattered surveys was made since 1977 [Shvetsov 1983, Hoziosky et al. 1987, Shvetsov et al. 1988]. Several years in May (2005-2008) BIOR as assignee of BaltNIIRH, LatFRI and LatFRA cooperated with Polish NMFRI (former SFI) in Gdynia, but before – in 2003-2004 with AtlantNIRO in Kaliningrad, Russia. In 2009 due to collapse of Latvian economy the survey was not performed. In 2010 we resumed our international cooperation in the fisheries research, but this time on the Lithuanian r/v “Darius” board. The collaboration lasted for three years till the 2012. In May 2013 The Latvian Baltic Acoustic Spring Survey (BASS) in the ICES Sub-divisions 26N and 28 was conducted on Latvian commercial fishing vessel “Ulrika” with which crew and the owners cooperation in research for pelagic fish distribution and feeding conditions in the recent decade has developed a very close and productive. Due to BONUS EEIG project INSPIRE (INSPIRE) funding historically the first Latvian-Estonian joint BASS in the ICES Sub-divisions 26N, 28 29 and 32W in May 2014 was conducted on the Latvian commercial fishing vessel “Ulrika” and in May 2015 the same survey was performed, too [Svecovs et al., 2015, 2016]. In May 2016 we renew cooperation with Polish NMFRI.

This was the 5th joint Latvian-Polish Baltic Acoustic Spring Survey (BASS) in the ICES Sub-divisions 26N and 28.2 conducted by the r/v “Baltica” in May 2016. The reported cruise was organized on the basis of the agreement between the Institute of Food Safety, Animal Health and Environment (BIOR) from Riga and the National Marine Fisheries Research Institute (NMFRI) from Gdynia. The vessel was operated within the Latvian, Estonian and Swedish EEZs (ICES Sub-divisions 26N and 28.2). The “Latvian National Program for Collection of Fisheries Data 2011-2013” in accordance with the EU Council Regulation No. 199/2008 and EU Commission Regulation No.605/2008, EU Commission Decisions 2008/605/EC, 2009/10121/EC, C (2013) 5568, with European Commission implementing decision of 30.08.2013 that extends the national program for the period 2011-2013 to the period 2014-2016, was partly subsidized this cruise. It was coordinated by the ICES Baltic International Fish Survey Working Group (WGBIFS) [ICES 2015].

Pelagic research catches carried out during an acoustic survey are the information source, independent from topical preferences in fishery, about quantitative changes in a process of clupeids geographical and bathymetrical distribution in the Baltic Sea. The data from hydrological measurements are the information source about abiotic environmental factors (seawater temperature, salinity, oxygen content) influencing sprat and herring spatial distribution. Echo-integration results along the pre-selected tracks are the basic materials for fish stock biomass calculations.

The ICES Baltic Fisheries Assessment Working Group (WGBFAS) applies the BASS data for clupeids (sprat and herring) stock biomass assessment and spatial distribution updating. The basic acoustic and biological data collected during recently carried out survey are stored in the BASS_DB and BIAS_DB in BAD1 format and till the 2012 were stored in FishFrame Acoustic (former BAD2 format) international databases, managed by the ICES Secretariat. In recent years work is underway to create a new useful acoustic database.

The main aims of cruise were:

- to collect the echo-integration data for the estimation of the clupeids stocks biomass and abundance in the central-eastern Baltic;
- to collect materials from the fish control catches for investigations of the Baltic sprat, and in lesser degree herring, spawning stocks spatial distribution in the offshore waters of Latvia, Estonia and Sweden, moreover for analyses of the age-length structure and recruiting year-class strength of these fishes populations;
- to collect sprat and herring stomachs samples for feeding condition and food components analyses;

- to analyze the vertical and horizontal changes of the basic hydrological parameters (temperature, salinity and oxygen content) at the trawling positions and at the standard HELCOM hydrological stations;
- to collect the zooplankton and ichthyoplankton samples at the referring area.

1. MATERIALS AND METHODS

1.1. Personnel assignment

The scientific staff – seven persons:

F. Svecovs, (BIOR, Riga – Latvia) – scientific staff leader, acoustic team;
M. Wyszynski (NMFRI, Gdynia – Poland) – cruise leader, fish sampling team;
B. Witalis (NMFRI, Gdynia – Poland) – hydrologist, hydrology team;
J. Slembarski (NMFRI, Gdynia – Poland) – acoustician, acoustic team;
G. Strods (BIOR, Riga – Latvia) – ichthyologist, acoustic and fish sampling team;
V. Cervoncevs (BIOR, Riga – Latvia) – ichthyologist, fish sampling team;
I. Kazmers (BIOR, Riga – Latvia) – ichthyologist, fish sampling team;
A. Makarcuks (BIOR, Riga – Latvia) – hydrobiologist, hydrobiology and fish sampling team.

1.2. Survey description

The reported BASS survey on the r/v “Baltica” took place during the period of 12-21 May 2016 (10 working days at sea: 8 days in accordance with Latvian-Polish survey plan and additionally 2 days according to German vessel technical problems, which one should operate in the same region simultaneously). The at sea researches were conducted within Latvian, Swedish and Estonian EEZs (the ICES Sub-divisions 26N and 28.2), moreover inside the Latvian territorial waters not shallower than 20 m.

The vessel left the Gdynia port (Poland) on 12.05.2016 at 00:01 o’clock and was navigated in the north direction to the echo-integration start point at the geographical position 56°07’N 019°00’E. The direct at sea researches began on 12.05.2016 after midday. The survey ended on 21.05.2016 before midday in the port Ventspils (Latvia).

1.3. Survey methods and performance

1.3.1. Acoustical and trawling methods

Acoustic data were collected with the SIMRAD EK-60 38 kHz and 120 kHz two frequency split beam scientific echo-sounder equipped with “EchoView Version 7.10” software for the data analysis. These data collected during the described here BASS were delivered to the Latvian researchers for further elaboration. The survey echo-integration tracks were planned in the similar pattern as in the previous years, due to historical comparability of the data. Overall 645 nautical miles long survey tracks was observed and recorded with hydroacoustic equipment. The final pattern of transects was covered with a relatively good density. The area covered in May 2016 was 1953.3 nm^2 in the northern part of the ICES Sub-division 26 and 7874.9 nm^2 in Sub-division 28.2, totally 9828.2 nm^2 (Fig. 1).

The pre-selection of the pelagic fish catches based on the ICES statistical rectangle area (with range of 0.5 degree in latitude and 1 degree in longitude) and the present density pattern of vertical distribution of clupeids along a transect. The intention was to carry out at least two control hauls per the ICES statistical rectangle [ICES 2003]. The water depth range-layer with sufficient for fish oxygen content (minimum 1.0÷2.0 ml/l) were taken into account in the process of the hauls distribution.

Survey was performed in accordance to “SISP Manual of International Baltic Acoustic Surveys (IBAS)” [ICES 2014]. The r/v “Baltica” realized 25 fish control-catches (Tab. 1). All catches were performed in the daylight between 07:00 am and 18:30 pm (GMT+01:00) using the pelagic trawl type WP 53/64x4 (with 6 mm mesh bar length in the codend). The standard trawling duration was 30 minutes. The mean speed of vessel while trawling was 3.0 knots. Overall, 6 hauls were conducted in SD 26N and 19 hauls in SD 28.2. Totally 14 hauls were performed in the Latvian EEZ, 10 hauls in Swedish EEZ and 1 haul in Estonian EEZ (see text-table below).

1.3.2. Biological sampling

The length measurements (in 0.5 cm length classes) were realized for 4083 herring and 5072 sprat individuals. In total, 1987 herring and 2498 sprat individuals were taken for biological analysis. Moreover, 485 individuals of other species such as threespine stickleback, ninespine stickleback, cod, flounder and lumpfish were measured (Tab. 2). Detailed ichthyologic analyses were made according to standard procedures, directly on board of surveying vessel.

Due to herring and sprat normally cannot be distinguished from other species by visual inspection of the echogram species composition and fish length distributions were based on trawl catch results. Mean target strength of fish was calculated according to the following formulas [Foote et al. 1986, ICES 1983, 2014]:

for clupeids: TS = 20logL-71.2;
for gadoids: TS = 20logL-67.5;
cross section $\sigma = 4\pi 10^{a/10} \times L^{b/10}$.

The total number of fish in each ICES rectangle was estimated as a product of the mean area scattering cross-section – NASC (S_A) and the rectangle area, divided by corresponding mean acoustic cross-section. Fish abundance was separated into different species according to the mean catch composition in the given rectangle.

Ichthyoplankton and zooplankton samples were collected at the positions of the hydrological stations or after trawling. Totally 26 ichthyoplankton and zooplankton stations were realized (Fig. 2) and 52 and 41 samples were taken accordingly. Ichthyoplankton was collected with IKS-80 net (mouth opening 0.5 m^2, mesh size 500 μm). This net was towed vertically from the depths 150 or from the bottom in case of lesser depth, to the water surface with speed of 0.4 m/s. Zooplankton was collected with Judday net (mouth opening 0.1 m^2, mesh size 160 μm). This net was towed vertically from the depths 50 and 100, or from the bottom in case of lesser depth, to the water surface with speed of 0.4 m/s. Low speed of lifting allowed preventing all plankton objects from destroying by mechanic forces. All samples were conserved in 2.5% unbuffered formaldehyde solution with sea water and processed during the year.

1.3.2. Hydrological and meteorological observations

The measurements of the basic hydrological parameters were realized in the period of 12-20 May 2015, totally at 26 stations, int. al. at 25 fish catch-station and 1 independent station named Hydro 1 (Fig. 2). Hydrological stations were inspected with the IDRONAUT CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler’s method. The hydrological row data, originated from measuring realized from the sea surface layer up to the bottom, were aggregated to the 1-m depth stratums, were information source about the abiotic factors potentially influencing fishes spatial distribution. The oxygen probes ware taken on every 10 meters. The salinity parameter was presented in Practical Salinity Unit (PSU).

Meteorological observations of air temperature, wind velocity and directions and atmospheric pressure were realized at the actual geographic position of each control-haul and in every 10 minutes interval over the whole survey. The automatic meteorological station type “Milosz” was applied for measurements of the above-mentioned parameters. The values of meteorological and hydrological parameters registered at trawling stations are aggregated in Table 3.

2. RESULTS

2.1. Biological data

2.1.1. Catch statistics

Total number of realized hauls and total catches (in kg) of fish in Latvian, Swedish and Estonian EEZs during reported BASS 2Q 2016 are presented in the Table 4. Overall, 7 fish species were recognized in hauls performed in the Central-eastern Baltic Sea in May 2016. Sprat was dominating species by mass in the both ICES Sub-divisions 26N and 28.2 (88.3 and 71.9% respectively). The rest 5 species represented 0.6 % (in this 0.4% belonging to cod) of the total mass in average for all investigated area. The geographical catch distribution by fish species shown in Figure 3.

Mean CPUE for all species in the investigated area amounted 1404.7 kg/h. The mean CPUEs of sprat were: 4183.7 kg/h in ICES SD 26N, and 9219.8 kg/h in SD 28.2. The mean CPUEs of herring were as follow: in SD 26N – 538.1 kg/h and 3521.0 kg/h in SD 28.2. The CPUE values by particular haul for herring, sprat and others are presented at the Figure 4. The highest CPUE values for sprat were noted from the Northern part of SD 26 do the Southern part of SD 28.2. The good CPUEs for herring were distributed more in Northern part of SD 28.2.

2.1.2. Acoustical and biological estimates

The basic acoustic and biological data (surveyed area statistics, mean NASC, the mean scattering cross-section, the total number of fish, percentages of herring and sprat) per ICES rectangles and the estimated abundance and biomass of sprat and herring per above mentioned rectangles, collected in May 2016, are given in Table 5, for third dominant species – cod in Table 6. The characteristics of the pelagic fish stock are aggregated in Table 7 for sprat and Table 8 for herring. The geographical distributions of NASC, sprat and herring stock densities in the central-eastern Baltic Sea in May 2016 are shown in Figures 6, 7 and 8 respectively.

The pelagic fish stock was represented mostly by sprat – 92.9 %, in comparison – 71.5% in 2013, 86.8 % in 2014 and 88.2 % in 2015. Herring was represented as 7.1 %, 28.5 % in 2013, 13.2 % in 2014 and 11.8 % in 2015. The highest sprat stock density according to acoustic estimates (199.3 $n \times 10^6/nm^2$) were recorded in ICES rectangle 42G9 of the ICES Sub-division 28.2. The highest average abundance per nm^2 and biomass of the sprat stock were recorded in the central and southern part of investigated area in ICES rectangles 42G9 and 41G8. The distribution of the high density sprat concentrations in May 2016 had similar pattern as in May 2010 and 2013, but totally differed comparing with that from May 2005-2008, 2011, 2012, 2014 and 2015, when high density sprat concentrations had found mostly in the central and northern parts of the investigated area. In 2015 sprat distribution pattern more-less was emulating pattern observed in years till 1992 [Hoziosky et al. 1988, Shvetsov et al. 1988, 1989, 1992, 2002], but not so evident as it was in 2010. In 2014 sprat had scattered distribution of concentrations mostly made from specimens of new generation. In 2015 distribution was scattered too, but with relatively high rate of concentrations in separate points and in 2016 sprat made high concentrations in two points and distribution of concentrations was not so scattered as in previous years.

The herring stock density was significantly lower in comparison to sprat stock density. The highest density value was 18.1 $n \times 10^6/nm^2$ and noted in ICES rectangle 42G9 in central part of the investigated area in Sub-division 28.2 in comparison to 2015 were highest density values was not over 10.2 $n \times 10^6/nm^2$ in rectangle 44H0, in 2013 it was 8.8 $n \times 10^6/nm^2$ in rectangle 44H0, but in 2014 values over 10.0 $n \times 10^6/nm^2$ were recorded in two rectangles 43H0 and 45H0.

Comparison of the acoustic results from May of 2005-2016 indicated that investigated sprat stock abundance and biomass had decreasing tendency, but herring stock had a slight increase. In 2016 both of sprat and herring stocks had increased in numbers and biomass. The geographical distribution of main sprat stock shows different pattern as in years 2005-2015 and is less scattered with two concentration points of high abundance [Svecovs et al. 2010, 2011, 2012, 2013, 2014, 2015].

The mean length and mean weight distributions of dominant fish species (sprat and herring) by hauls and rectangles in the ICES Sub-divisions 26 and 28 are shown in Figures 9 and 10 respectively. The total length and mean weight in control hauls of sprat, herring and cod ranged as follows:

- sprat – 7.0÷14.0 cm (average TL = 10.5 cm), 2.4÷16.6 g (average W = 6.4 g);
- herring – 10.0÷24.5 cm (average TL = 16.8 cm), 6.2÷87.3 g (average W = 28.4 g);
- cod – 19.5÷62.0 cm (average TL = 29.8 cm), 59.0÷2315.0 g (average W = 284.2 g).

The sprat length distribution curves have a bimodal character for both Sub-divisions 26 and 28.2. First length frequency pick takes place at 8.5 cm length class and represent very low frequency values 4.8 and 5.4% respectively. The second higher one at length classes 10-10.5 cm represent adult sprat. The fish generation born in 2015 (ranged from 7.0 to 9.0 cm of total length) characterized by low total frequency in both Sub-divisions.

The herring length distribution curves have a similar multimodal character in both Sub-divisions 26N and 28.2. The highest picks of frequency belong to length classes 20.0 and 12.5 cm respectively. The fish representing 10.0-14.0 cm length range belonging to the generation born in 2015 have relatively high frequency in Sub-division 28.2, only.

2.1.3. Ichthyoplankton estimates

Totally 52 ichthyoplankton samples collected at 26 station positions during BASS on RV “Baltica”, including 26 samples collected in vertical hauls with IKS-80 net and 26 samples from horizontal hauls on water surface during 10 minutes. The number of sprat eggs and larvae in ICES SD 26 and 28 are aggregated in Table 9.

Sprat eggs and larvae prevailed in the ichthyoplankton in May 2016. The average numbers of sprat eggs and larvae in the investigated region were above the corresponding average values for the previous years. The number of eggs increased with the depth. Sprat eggs were more abundant in the southern and central parts of the Gotland Basin. Amount of eggs of sprat as usual increased towards the greater depths near the centre of the basin. Sprat larvae also were more numerous over the bigger depths and in the southern part of the Gotland Basin. There amount gradually decreased towards the northern areas.

Sprat eggs in the water surface layer were numerous only in the southern and central parts of the Gotland Basin, but their numbers were low in the northern region. This must be the evidence that the spawning of sprat has started not long time ago.

This year larvae of flounder were more abundant in the central part of the Gotland Basin. In general, the amount of flounder larvae was at the same level as in 2015, but most of them were collected on the water surface.

There was a major inflow from the North Sea in 2015, and the hydrological conditions in the Gotland Basin were favorable for the spawning of cod and four beard rockling also in May 2016. We observed rather sharp increase in the abundance of cod egg in the southern and central parts of the Gotland basin. All the cod eggs were found in the deepest area of the Gotland Basin. Two cod larvae were sampled in the central and southern parts of the Gotland Basin.

Biodiversity in the ichthyoplankton was on the medium level – several eggs of flounder and rockling and also some larvae of sand eel and rockling were found in May, apart from those of sprat, cod and flounder.

2.1.4. Zooplankton estimates

The calculated average number and average biomass of zooplankton organisms in 0-100 m water column per volume unit from 41 samples taken in 26 stations are aggregated in Table 10.

In May 2016 in the Baltic Sea the estimated zooplankton biomass was generally equal to 2013 and 2014. Total zooplankton biomass in 2016 was 164.55 mg/m^3. The most part of the biomass (60.14 %) was made from larger copepods, the residual part was made from small rotatorians (15.96 %), cladocerans (12.20 %) and other planktonic organisms (11.70 %). The dominance of copepods in the spring season in the Baltic Sea creates favorable feeding conditions for pelagic fish species. Amount of them in 2016 on average was 3.01 times higher than in 2014 and 1.30 times higher the long-term average. Overall, the biomass of *Acartia* spp., taking the top rank among copepods, has exceeded biomass more evident – by 7.16 times in comparison with May 2014, but the long-term average only by 1.34 times. Higher biomass of *Pseudocalanus* sp., the next largest group of copepods was detected in the deep stations of the investigated aquatory. The same was detected for *Acartia* spp. and *Temora longicornis*. The biomass of *T. longicornis* has increased for 3.17 times since 2014. In 2016 decreased average biomass of rotatorians *Synchaeta* spp. and *Polychaeta* worms. In 2016 had increased the role of above mentioned copepods in all aquatory. In deep stations has dramatically increased estimated quantity and biomass of *Centropages hamatus* – approximately by 20 times than was stated in 2014. In the upper layer (0-50 m) of water column after copepods the next dominant object of zooplankton was rotatorians *Synchaeta* spp. and cladocerans *Evadne* spp. Biomass of *Evadne* spp. was at higher level than in 2014 and almost higher to the level of long-term average. Overall, the favorable feeding conditions in May 2016 formed in the deepest part of the investigated area.

2.2. Meteorological and hydrological data

2.2.1. Weather conditions

The most frequently wind was SE (Fig. 11). The wind force varied from 16.5 m/s to 0 m/s and average force was 4.7 m/s. The air temperature ranged from 6.6°C to 13.5°C, and average temperature value was 9.3°C.

2.2.2. Hydrology of the Gotland Deep

The seawater temperature in the surface layers varied from 7.86 to 12.14°C (the mean was 9.12°C).The lowest surface temperature was recorded at the haul station 16. The highest one was noted at the haul 25. The minimum value of salinity in Practical Salinity Unit (PSU) was 6.36 at the haul station 24 in the surface layer. The maximum was 8.70 PSU at the haul station 11. The mean value of salinity was 7.10 PSU. The oxygen content in the surface layers of investigated research area varied in the range of 8.05 ml/l (haul 20) – 9.95 ml/l (haul 7). The mean value of surface water oxygen content was 9.22 ml/l.

The temperature of near bottom layer was changing in the range of 4.26 (haul 20) to 7.23°C (haul 14), the mean was 6.14°C (Fig. 12). Salinity of near bottom waters varied from 7.47 (haul 20) to 13.51 PSU (haul 14), and the mean was 6.14 PSU. Oxygen content varied from 0.45 ml/l (haul 6) to 7.42 ml/l (haul 20), the mean value was 2.72 ml/l.

The Figure 13 shows comparison of the values of three main hydrological parameters vertical distributions at the hydrological station H1 situated at the Southern Gotland Deep slope investigated in May 2016. The increasing temperature was observed above 20 m depth to the surface, to the maximum value about 10°C. The cold winter water (about 4°C) was noted in the water layer ranged 20-70 m depth. The surface water layer (0 to about 5 m depth) had a very low salinity – about 5.5 PSU. The salinity values about 11 PSU were noted below 80 m depth. The oxygen content below 2 ml/l (the border value generally recognized as a minimum for fish) started from about 73 m depth to the bottom.

The temperature at the mean depth of trawling layer was changing in the range of 7.92 (haul 20) – 4.24°C (haul 4), the mean value was 5.14°C. Salinity in the haul waters varied from 7.21 (haul 20) to 10.37 PSU (haul 7), and the mean was 8.88 PSU. Oxygen content varied from 1.30 ml/l (haul 7) to 9.71 ml/l (haul 4), the mean was 4.33 ml/l (Table 3).

3. DISCUSSION

The data of the Latvian-Polish BASS in the 2nd quarter of 2016 were considered by the ICES BIFS Working Group (Rostock, Germany, 30.03-03.04.2016) as representative for the central-eastern Baltic for the estimation of abundance and spatial distribution of pelagic fishes (herring and sprat) recruiting year classes and were provided to the Baltic Fisheries Assessment Working Group (WGBFAS) as the input data for fish stocks resources calculation. The acoustic, catch, biological and hydrological data, collected during reported survey were uploaded to the BAD1 and to the emerging international databases managed by the ICES Secretariat.

The collected data shows that sprat population in ICES SD 26N and 28.2 till the 2014 had overall decreasing tendency of abundance, but since 2015 is increasing due to very abundant sprat generation of 2014. The mean length and weight of adult sprat had the same tendency to abundance. The geographical distribution of sprat densities in the May 2016 had different pattern as in 2015 and copy pattern as it was in 2010 and before 1992. The overall estimated better feeding conditions should ensure biomass increasing and young fish surviving of pelagic fish species in future.

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Annex. Tables and Figures

Table 1. Fish control-catch statistics in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016

Haul number	Date	ICES rectangle	ICES SD	Mean bottom depth [m]	Headrope depth [m]	Vertical opening [m]	Trawling speed [knt]	Trawling direction [°]	Geographical position: Start Latitude 00°00.0'N	Start Longitude 00°00.0'E	End Latitude 00°00.0'N	End Longitude 00°00.0'E	Time Start	Haul duration [min]	Total cactch [kg]
1	2016-05-12	41G8	26	98	64	19	3.0	270	56°07.1'	18°45.0'	56°07.2'	18°42.4'	18:00	30	1291.154
2	2016-05-13	41G9	26	124	35/65	20/18	3.0	87	56°07.0'	19°13.0'	56°07.1'	19°16.1'	07:35	30	955.237
3	2016-05-13	41G9	26	62	35	18	3.2	90	56°06.9'	19°52.9'	56°06.8'	19°55.8'	11:50	30	250.620
4	2016-05-13	41H0	26	66	37/43	19/18	3.2	270	56°21.9'	20°10.6'	56°21.9'	20°07.6'	17:30	30	500.672
5	2016-05-14	41G9	26	121	60/66	20/18	3.2	270	56°22.1'	19°39.0'	56°22.1'	19°36.2'	07:10	30	366.779
6	2016-05-14	41G8	26	109	65	18	3.0	6	56°22.7'	18°58.4'	56°24.1'	18°58.7'	10:50	30	1374.457
7	2016-05-14	42G8	28	103	55/70	18	2.9	99	56°36.8'	18°52.9'	56°36.6'	18°55.5'	14:30	30	1793.357
8	2016-05-14	42G9	28	130	65	19	2.9	81	56°36.5'	19°17.8'	56°36.7'	19°20.5'	17:40	30	913.394
9	2016-05-15	42G9/H0	28	134	60	20	3.0	90	56°37.0'	19°58.1'	56°37.0'	20°00.9'	07:15	30	842.007
10	2016-05-15	42H0	28	136	65	19	3.0	270	56°53.0'	20°16.7'	56°53.1'	20°14.1'	14:05	30	1068.872
11	2016-05-15	42G9	28	164	70	20	2.9	265	56°52.8'	19°46.1'	56°52.7'	19°43.1'	17:45	30	96.735
12	2016-05-16	42G8	28	139	65	20	3.0	270	56°53.0'	18°58.6'	56°53.0'	18°56.0'	07:00	30	304.421
13	2016-05-16	43G9	28	135	65	19	3.1	12	57°08.0'	19°10.6'	57°09.4'	19°11.2'	10:55	30	619.365
14	2016-05-16	43G9/H0	28	201	60	18	3.0	90	57°06.9'	19°57.4'	57°06.8'	20°00.2'	15:45	30	1121.974
15	2016-05-17	43H0	28	85	62	19	3.5	360	57°08.2'	20°39.3'	57°10.0'	20°39.4'	07:05	30	513.576
16	2016-05-17	43H0	28	167	65	19	3.3	357	57°22.9'	20°29.4'	57°24.7'	20°29.1'	10:55	30	441.087
17	2016-05-17	43G9	28	179	65	19	2.9	7	57°23.8'	19°50.8'	57°25.2'	19°51.2'	15:20	30	494.920
18	2016-05-18	44G9	28	101	65	19	3.0	93	57°36.9'	19°32.9'	57°36.8'	19°35.7'	07:05	30	1113.621
19	2016-05-18	44H0	28	133	65	18	3.3	11	57°36.9'	20°31.3'	57°38.6'	20°31.9'	12:30	30	742.231
20	2016-05-18	44H1	28	68	40	20	2.9	360	57°47.2'	21°06.1'	57°48.6'	21°06.2'	17:15	30	79.472
21	2016-05-19	44H0	28	102	65	20	3.0	265	57°53.0'	20°29.1'	57°52.9'	20°26.6'	07:00	30	237.929
22	2016-05-19	44/45G9	28	192	65	20	2.9	357	57°59.5'	19°53.8'	58°00.9'	19°53.7'	11:05	30	875.279
23	2016-05-19	45H0	28	160	68	19	3.1	95	58°09.9'	20°02.1'	58°09.7'	20°05.5'	14:15	30	968.869
24	2016-05-20	45H0	28	80	55	20	2.9	193	58°06.5'	20°47.5'	58°05.1'	20°46.9'	07:05	30	413.274
25	2016-05-20	43H1	28	70	45	21	2.9	18	57°27.0'	21°10.8'	57°28.3'	21°11.6'	14:20	30	179.290
													SD26		4738.919
													SD28		12819.672
													SD26+28		17558.591

Table 2. Number of measured and aged fish individuals in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016

Fish species	Number of measured individuals			Number of aged individuals		
	SD 26	SD 28	SD 26+28	SD 26	SD 28	SD 26+28
Sprat (Total)	1220	3852	5072	594	1904	2498
Sprat (Age 1)	126	447	573	83	262	345
Herring (Total)	717	3366	4083	287	1700	1987
Herring (Open sea herring)	632	3024	3656	252	1527	1779
Herring (Gulf herring)	15	293	308	6	144	150
Herring (Southern Baltic herring)	70	49	119	29	29	58
Cod	52	220	272			
Flounder	13	76	89			
Lumpfish	1		1			
Stickleback, threespine		122	122			
Stickleback, ninespine		1	1			
Total	2003	5322	9640	881	3604	4485

Table 3. The values of meteorological and hydrological parameters registered at the trawling position and depth in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016

Haul number	Date of catch	Meteorological parameters					Trawling depth		Hydrological parameters		
		wind direction	wind force [°B]	sea state [Degrees]	air temper. [°C]	atmospheric pressure [hP]	Headrope [m]	Footrope [m]	temperature [°C]	salinity [PSU]	oxygen [ml/l]
1	2016-05-12	NE	5	3	10	1006	64	83	5.26	9.32	5.18
2	2016-05-13	NW	3	2	7	1000	35/65	55/83	4.32/5.45	7.54/9.81	9.56/5.04
3	2016-05-13	N	3	2	10	1000	35	53	4.30	7.57	8.41
4	2016-05-13	N	2	1	10	1000	37/43	56/61	4.24/4.25	7.53/7.38	8.16/9.71
5	2016-05-14	C	2	1	7	996	60/66	80/84	4.87/5.22	8.72/9.35	5.05/2.44
6	2016-05-14	NW	3	2	10	997	65	83	5.55	10.00	2.65
7	2016-05-14	NW	3	2	9	998	55/70	73/88	4.82/5.69	8.64/10.37	5.69/1.30
8	2016-05-14	W	2	1	11	1000	65	84	5.50	9.98	2.12
9	2016-05-15	N	4	2	7	998	60	80	5.00	8.69	4.24
10	2016-05-15	W	3	2	8	1001	65	84	5.42	9.74	3.29
11	2016-05-15	W	3	2	8	1001	70	90	5.30	9.34	2.23
12	2016-05-16	SW	5	3	8	993	65	85	5.12	9.05	5.88
13	2016-05-16	SE	5	3	9	998	65	84	5.26	9.32	2.41
14	2016-05-16	SE	4	2	10	1000	60	78	5.29	9.29	2.26
15	2016-05-17	S	5	3	7	999	62	81	4.39	7.72	7.45
16	2016-05-17	SE	4	2	8	1004	65	84	5.29	9.43	2.73
17	2016-05-17	SE	3	2	10	1007	65	84	5.36	9.72	2.54
18	2016-05-18	S	3	2	7	1006	65	84	5.32	9.48	2.10
19	2016-05-18	S	5	3	8	1011	65	83	5.29	9.46	2.16
20	2016-05-18	S	4	2	7	1011	40	60	7.92	7.21	7.85
21	2016-05-19	SW	4	3	6	1011	65	85	5.17	9.03	2.56
22	2016-05-19	SW	4	2	9	1011	65	85	4.95	8.61	1.58
23	2016-05-19	SW	3	2	9	1011	68	87	5.15	8.97	1.66
24	2016-05-20	C	1	1	7	1014	55	75	5.07	8.96	1.87
25	2016-05-20	C	2	1	9	1016	45	66	4.33	7.25	7.47
						Mean	59	78	5.14	8.88	4.33

Table 4. Fish control-catch results by species in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016

Haul number	Date	ICES rectangle	ICES SD	Total Cactch [kg]	Catch per species [kg]						
					sprat	herring	cod	flounder	lumpfish	threespine stickleback	ninespine stickleback
					161789	161722	164712	172894	167612	166365	166365
1	2016-05-12	41G8	26	1291.154	1280.880	6.440	3.544	0.290			
2	2016-05-13	41G9	26	955.237	643.180	309.680	1.606	0.771			
3	2016-05-13	41G9	26	250.620	250.620						
4	2016-05-13	41H0	26	500.672	488.960	11.000	0.462		0.250		
5	2016-05-14	41G9	26	366.779	245.718	115.102	5.586	0.373			
6	2016-05-14	41G8	26	1374.457	1274.314	95.916	3.869	0.358			
7	2016-05-14	42G8	28	1793.357	1663.570	127.140	2.486	0.161			
8	2016-05-14	42G9	28	913.394	807.090	102.820	1.995	1.489			
9	2016-05-15	42G9/H0	28	842.007	568.042	269.778	3.621	0.566			
10	2016-05-15	42H0	28	1068.872	906.281	157.429	3.925	1.237			
11	2016-05-15	42G9	28	96.735	29.366	64.454	2.242	0.673			
12	2016-05-16	42G8	28	304.421	156.105	141.805	6.245	0.266			
13	2016-05-16	43G9	28	619.365	413.844	196.996	7.857	0.668			
14	2016-05-16	43G9/H0	28	1121.974	685.267	429.602	6.017	0.977		0.111	
15	2016-05-17	43H0	28	513.576	387.601	125.099	0.322	0.554			
16	2016-05-17	43H0	28	441.087	243.756	189.204	6.982	1.145			
17	2016-05-17	43G9	28	494.920	369.252	120.148	4.931	0.552		0.037	
18	2016-05-18	44G9	28	1113.621	714.497	396.940	1.165	0.986		0.033	
19	2016-05-18	44H0	28	742.231	550.464	185.330	5.171	0.160		1.106	
20	2016-05-18	44H1	28	79.472	72.461	4.522				2.487	0.002
21	2016-05-19	44H0	28	237.929	147.751	89.338	0.658	0.111		0.071	
22	2016-05-19	44/45G9	28	875.279	353.237	511.713	8.376	0.913		1.040	
23	2016-05-19	45H0	28	968.869	707.093	261.527	0.249				
24	2016-05-20	45H0	28	413.274	266.275	145.729		0.444		0.826	
25	2016-05-20	43H1	28	179.290	177.874	1.398				0.018	
SD26				4738.919	4183.672	538.138	15.067	1.792	0.250		
SD28				12819.672	9219.826	3520.972	62.241	10.902	0.000	5.729	0.002
SD26+28				17558.591	13403.498	4059.110	77.308	12.694	0.250	5.729	0.002

Table 5. BASS statistics of pelagic fish species from the Latvian-Polish BASS in the Baltic Sea ICES SD 26N and 28.2 conducted by r/v "Baltica" in the period of 12-21.05.2016

Table 5A

ICES	ICES	Trawl		Herring			Sprat		NASC	$\sigma \times 10^4$	TS calc.
SD	Rect.	No	L, cm	w, g	n, %	L, cm	w, g	n, %	m^2/nm^2	m^2	dB
28	45H0	24,23,22	15.32	20.29	17.17	10.40	6.07	82.83	640.17	1.25971	-49.99
	44H1	20,25	12.68	12.30	1.16	10.64	6.77	98.84	399.38	1.09687	-50.59
	44H0	19,20,21,22	15.90	22.41	15.84	10.32	5.99	84.16	527.43	1.25549	-50.00
	44G9	18,22	15.56	21.87	19.23	10.33	6.12	80.77	658.68	1.28836	-49.89
	43H1	25	15.55	20.88	0.25	10.63	6.79	99.75	323.65	1.09243	-50.61
	43H0	14,15,16	15.72	22.75	13.08	10.34	6.06	86.92	599.20	1.21069	-50.16
	43G9	13,14,17	16.24	25.34	11.55	10.57	6.51	88.45	635.35	1.24950	-50.02
	42H0	9,10	16.77	27.50	5.98	10.24	6.04	94.02	536.35	1.11600	-50.52
	42G9	7,8,9,11,12	17.50	31.60	4.25	10.48	6.40	95.75	1110.09	1.14051	-50.42
	42G8	7,12	18.21	35.47	2.65	10.54	6.54	97.35	766.11	1.12625	-50.48
26	41H0	3,4	14.77	19.11	0.54	10.74	7.04	99.46	425.37	1.11780	-50.51
	41G9	2,3,5,6	19.77	44.72	3.11	10.58	6.65	96.89	573.31	1.15855	-50.35
	41G8	1,6	18.47	37.30	0.72	10.76	6.88	99.28	980.38	1.12741	-50.47
26		1-6	19.02	40.65	1.34	10.71	6.85	98.66	659.68	1.13459	-50.44
28		7-25	16.01	23.94	9.20	10.44	6.31	90.79	619.64	1.18358	-50.27
26+28		1-25	16.16	24.78	7.11	10.52	6.46	92.88	628.88	1.17227	-50.31

Table 5B

ICES	ICES	Area	ρ	Abundance, $n \times 10^6$			n, %		Biomass, $kg \times 10^3$		
SD	Rect.	nm^2	$n \times 10^6/nm^2$	ΣN	$N_{HERRING}$	N_{SPRAT}	herring	sprat	ΣW	$W_{HERRING}$	W_{SPRAT}
28	45H0	947.2	5.08186	4813.54	826.61	3986.93	17.17	82.83	40979.28	16770.18	24209.10
	44H1	824.6	3.64109	2997.18	29.60	2967.59	1.16	98.84	20443.11	364.12	20078.99
	44H0	960.5	4.20097	4035.03	639.06	3395.97	15.84	84.16	34668.63	14319.66	20348.96
	44G9	876.6	5.11255	4481.66	861.70	3619.96	19.23	80.77	40990.08	18845.38	22144.70
	43H1	412.7	2.96267	1222.69	3.12	1219.58	0.25	99.75	8347.62	65.10	8282.52
	43H0	973.7	4.94927	4819.11	630.51	4188.60	13.08	86.92	39737.45	14346.26	25391.19
	43G9	973.7	5.08486	4951.13	572.04	4379.09	11.55	88.45	43005.70	14497.86	28507.84
	42H0	968.5	4.80601	4654.62	278.47	4376.15	5.98	94.02	34090.71	7658.98	26431.72
	42G9	986.9	9.73326	9605.75	407.78	9197.97	4.25	95.75	71735.27	12886.18	58849.09
	42G8	945.4	6.80233	6430.92	170.61	6260.30	2.65	97.35	46998.61	6051.86	40946.74
26	41H0	953.3	3.80541	3627.69	19.76	3607.94	0.54	99.46	25764.39	377.59	25386.80
	41G9	1000.0	4.94848	4948.48	153.90	4794.57	3.11	96.89	38788.38	6882.54	31905.83
	41G8	1012.1	8.69588	8797.33	59.83	8737.50	0.72	99.28	62321.84	2231.48	60090.35
26		2965.4	5.85874	17373.50	233.49	17140.01	1.34	98.66	380996.45	9491.61	117382.99
28		8869.8	5.41293	48011.64	4416.38	43592.14	9.20	90.79	126874.60	105740.50	275190.86
26+28		11835.2	5.52463	65385.14	4649.87	60732.16	7.11	92.88	507871.05	115232.11	392573.85

Table 6. BASS statistics of cod from the Latvian-Polish BASS in the Baltic Sea ICES SD 26N and 28.2 conducted by r/v "Baltica" in the period of 12-21.05.2016

ICES	ICES	Trawl	Area	Cod		NAS	TS	$\sigma \times 10^4$	ρ	Abundance	Biomas
SD	Rect.	No	nm^2	L, cm	w, g	L, cm	dB	m^2	$n \times 10^3/nm^2$	$n \times 10^3$	$kg \times 10^3$
28	45H0	24,23,22	947.2	32.50	418.80	1.01	-36.79	26.31414	0.38532	364.98	152.85
	44H0	19,20,21,22	960.5	33.67	451.57	1.58	-36.54	27.89553	0.56550	543.16	245.27
	44G9	18,22	876.6	32.19	366.96	1.58	-36.90	25.65423	0.61515	539.24	197.88
	43H0	14,15,16	973.7	30.32	288.87	1.94	-37.61	21.79493	0.89127	867.83	250.69
	43G9	13,14,17	973.7	29.45	257.60	2.97	-37.90	20.37888	1.45556	1417.27	365.09
	42H0	9,10	968.5	31.91	343.00	0.98	-37.16	24.15405	0.40725	394.42	135.28
	42G9	7,8,9,11,12	986.9	30.27	259.20	2.53	-37.69	21.39120	1.18366	1168.16	302.79
	42G8	7,12	945.4	29.61	242.53	1.74	-37.92	20.29871	0.85687	810.08	196.47
26	41G9	2,3,5,6	1000.0	30.70	276.53	1.16	-37.59	21.90629	0.52872	528.72	146.20
26		2,3,5,6	1000.0	30.70	276.53	1.16	-37.59	21.90629	0.52872	528.72	146.20
28		7-24	7632.5	31.24	328.57	1.79	-37.31	23.48521	0.79989	6105.14	1846.33
26+28		2,3,5-24	8632.5	31.18	322.78	1.72	-37.34	23.30977	0.76847	6633.85	1992.53

Table 7. Sprat stock characteristics in the Baltic Sea ICES SD 26N and 28.2
from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016

Table 7A CANUM		Age group								Σ
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	45H0	23461	164760	11273	9881	3984	1551		3564	218475
	44H1	5315	25855	2548	1686	837	415	127	216	36998
	44H0	19998	142890	11905	5686	2480	1354		3255	187566
	44G9	20440	138306	7201	3136	3169	863		1427	174541
	43H1	4774	17587	2008	1038	405	253	127		26191
	43H0	29583	160770	13288	7429	2259	2152	381	1330	217194
	43G9	16623	172314	14857	12912	5054	2869		925	225555
	42H0	52826	172222	10071	4143	1899	1553		1382	244095
	42G9	83801	358118	26566	16929	9543	5039	1893	2040	503930
	42G8	40665	200129	18318	8686	6314	2507	1253	336	278208
26	41H0	13744	75291	8137	3842	2245	144	288	1418	105108
	41G9	40802	285848	16823	11438	5425	607	1262	528	362733
	41G8	27595	293131	28329	10425	5525		3812	2724	371541
26		82141	654270	53289	25705	13194	750	5362	4669	839382
28		297487	1552952	118034	71526	35944	18556	3781	14475	2112755
26+28		379628	2207222	171323	97232	49139	19306	9143	19145	2952137

Table 7B n × 10^6		Age group								Σ
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	45H0	428.15	3006.69	205.72	180.32	72.71	28.31		65.04	3986.93
	44H1	426.28	2073.78	204.37	135.23	67.15	33.30	10.15	17.34	2967.59
	44H0	362.07	2587.08	215.54	102.95	44.90	24.51		58.93	3395.97
	44G9	423.92	2868.45	149.34	65.04	65.72	17.89		29.59	3619.96
	43H1	222.31	818.94	93.48	48.31	18.85	11.78	5.89		1219.58
	43H0	570.52	3100.46	256.27	143.27	43.56	41.51	7.35	25.65	4188.60
	43G9	322.73	3345.43	288.45	250.68	98.13	55.70		17.96	4379.09
	42H0	947.07	3087.61	180.55	74.27	34.05	27.84		24.77	4376.15
	42G9	1529.58	6536.54	484.90	309.00	174.18	91.98	34.55	37.23	9197.97
	42G8	915.05	4503.35	412.20	195.45	142.08	56.40	28.20	7.57	6260.30
26	41H0	471.79	2584.43	279.31	131.88	77.06	4.93	9.87	48.67	3607.94
	41G9	539.32	3778.31	222.36	151.19	71.70	8.02	16.69	6.98	4794.57
	41G8	648.95	6893.56	666.21	245.17	129.92		89.65	64.05	8737.50
28		1660.06	13256.30	1167.88	528.23	278.69	12.95	116.20	119.70	17140.01
26		6147.68	31928.33	2490.80	1504.54	761.33	389.22	86.15	284.09	43592.14
26+28		7807.74	45184.63	3658.68	2032.77	1040.02	402.18	202.35	403.78	60732.16

Table 7C n, %		Age group								Σ
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	45H0	10.74	75.41	5.16	4.52	1.82	0.71		1.63	100.00
	44H1	14.36	69.88	6.89	4.56	2.26	1.12	0.34	0.58	100.00
	44H0	10.66	76.18	6.35	3.03	1.32	0.72		1.74	100.00
	44G9	11.71	79.24	4.13	1.80	1.82	0.49		0.82	100.00
	43H1	18.23	67.15	7.67	3.96	1.55	0.97	0.48		100.00
	43H0	13.62	74.02	6.12	3.42	1.04	0.99	0.18	0.61	100.00
	43G9	7.37	76.40	6.59	5.72	2.24	1.27		0.41	100.00
	42H0	21.64	70.56	4.13	1.70	0.78	0.64		0.57	100.00
	42G9	16.63	71.07	5.27	3.36	1.89	1.00	0.38	0.40	100.00
	42G8	14.62	71.93	6.58	3.12	2.27	0.90	0.45	0.12	100.00
26	41H0	13.08	71.63	7.74	3.66	2.14	0.14	0.27	1.35	100.00
	41G9	11.25	78.80	4.64	3.15	1.50	0.17	0.35	0.15	100.00
	41G8	7.43	78.90	7.62	2.81	1.49		1.03	0.73	100.00
28		9.69	77.34	6.81	3.08	1.63	0.08	0.68	0.70	100.00
26		14.10	73.24	5.71	3.45	1.75	0.89	0.20	0.65	100.00
26+28		12.86	74.40	6.02	3.35	1.71	0.66	0.33	0.66	100.00

Table 7D W, kg × 10³		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	45H0	1452.64	17678.46	1703.39	1793.91	716.87	178.34		685.49	24209.10
	44H1	1587.01	13822.38	1810.63	1476.11	677.84	388.13	139.04	177.85	20078.99
	44H0	1195.28	15203.95	1644.28	1007.47	437.14	230.90		629.94	20348.96
	44G9	1578.69	17372.17	1354.39	640.83	678.65	186.50		333.47	22144.70
	43H1	823.29	5698.93	811.81	548.48	185.05	134.24	80.72		8282.52
	43H0	1993.38	18870.46	1907.17	1509.03	412.87	379.95	49.06	269.27	25391.19
	43G9	1126.14	20790.38	2382.58	2572.73	926.11	537.18		172.71	28507.84
	42H0	3267.31	19755.88	1736.60	748.28	368.51	310.85		244.27	26431.72
	42G9	5324.53	42734.84	4356.01	2980.35	1715.53	974.72	357.78	405.32	58849.09
	42G8	3231.15	29905.87	3656.53	1831.13	1381.02	567.15	288.59	85.31	40946.74
26	41H0	1674.66	17979.74	2612.08	1430.67	910.22	65.51	143.11	570.81	25386.80
	41G9	1976.60	25310.32	1977.29	1538.84	731.22	98.66	189.13	83.78	31905.83
	41G8	2392.33	46610.66	5624.95	2449.90	1429.52		883.50	699.50	60090.35
28		6043.59	89900.72	10214.32	5419.41	3070.96	164.17	1215.73	1354.09	117382.99
26		21579.44	201833.32	21363.39	15108.31	7499.60	3887.97	915.18	3003.64	275190.86
26+28		27623.04	291734.04	31577.71	20527.73	10570.55	4052.14	2130.92	4357.73	392573.85

Table 7E W, %		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	45H0	6.00	73.02	7.04	7.41	2.96	0.74		2.83	100.00
	44H1	7.90	68.84	9.02	7.35	3.38	1.93	0.69	0.89	100.00
	44H0	5.87	74.72	8.08	4.95	2.15	1.13		3.10	100.00
	44G9	7.13	78.45	6.12	2.89	3.06	0.84		1.51	100.00
	43H1	9.94	68.81	9.80	6.62	2.23	1.62	0.97		100.00
	43H0	7.85	74.32	7.51	5.94	1.63	1.50	0.19	1.06	100.00
	43G9	3.95	72.93	8.36	9.02	3.25	1.88		0.61	100.00
	42H0	12.36	74.74	6.57	2.83	1.39	1.18		0.92	100.00
	42G9	9.05	72.62	7.40	5.06	2.92	1.66	0.61	0.69	100.00
	42G8	7.89	73.04	8.93	4.47	3.37	1.39	0.70	0.21	100.00
26	41H0	6.60	70.82	10.29	5.64	3.59	0.26	0.56	2.25	100.00
	41G9	6.20	79.33	6.20	4.82	2.29	0.31	0.59	0.26	100.00
	41G8	3.98	77.57	9.36	4.08	2.38		1.47	1.16	100.00
28		5.15	76.59	8.70	4.62	2.62	0.14	1.04	1.15	100.00
26		7.84	73.34	7.76	5.49	2.73	1.41	0.33	1.09	100.00
26+28		7.04	74.31	8.04	5.23	2.69	1.03	0.54	1.11	100.00

Table 7F w, g		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	45H0	3.39	5.88	8.28	9.95	9.86	6.30		10.54	6.07
	44H1	3.72	6.67	8.86	10.92	10.09	11.66	13.70	10.26	6.77
	44H0	3.30	5.88	7.63	9.79	9.74	9.42		10.69	5.99
	44G9	3.72	6.06	9.07	9.85	10.33	10.42		11.27	6.12
	43H1	3.70	6.96	8.68	11.35	9.82	11.39	13.70		6.79
	43H0	3.49	6.09	7.44	10.53	9.48	9.15	6.68	10.50	6.06
	43G9	3.49	6.21	8.26	10.26	9.44	9.64		9.61	6.51
	42H0	3.45	6.40	9.62	10.07	10.82	11.17		9.86	6.04
	42G9	3.48	6.54	8.98	9.65	9.85	10.60	10.35	10.89	6.40
	42G8	3.53	6.64	8.87	9.37	9.72	10.06	10.23	11.27	6.54
26	41H0	3.55	6.96	9.35	10.85	11.81	13.28	14.50	11.73	7.04
	41G9	3.66	6.70	8.89	10.18	10.20	12.30	11.33	12.00	6.65
	41G8	3.69	6.76	8.44	9.99	11.00		9.86	10.92	6.88
28		3.64	6.78	8.75	10.26	11.02	12.67	10.46	11.31	6.85
26		3.51	6.32	8.58	10.04	9.85	9.99	10.62	10.57	6.31
26+28		3.54	6.46	8.63	10.10	10.16	10.08	10.53	10.79	6.46

Table 7G L, g		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	45H0	8.63	10.34	11.66	12.47	12.48	10.68		12.75	10.40
	44H1	8.95	10.65	11.61	12.53	12.32	12.73	13.75	12.38	10.64
	44H0	8.60	10.31	11.13	12.36	12.32	12.08		12.69	10.32
	44G9	8.76	10.35	11.81	12.29	12.52	12.76		12.95	10.33
	43H1	8.96	10.80	11.49	12.54	12.06	12.50	13.75		10.63
	43H0	8.73	10.40	11.10	12.49	12.24	12.08	10.75	12.75	10.34
	43G9	8.65	10.45	11.52	12.41	12.19	12.26		12.38	10.57
	42H0	8.68	10.49	12.07	12.35	12.57	12.75		12.25	10.24
	42G9	8.65	10.61	11.91	12.26	12.38	12.73	12.75	12.72	10.48
	42G8	8.62	10.63	11.86	12.18	12.36	12.75	12.75	12.92	10.54
26	41H0	8.78	10.78	11.82	12.42	12.96	13.25	14.00	13.06	10.74
	41G9	8.79	10.65	11.69	12.37	12.33	12.87	13.03	12.89	10.58
	41G8	8.82	10.72	11.64	12.36	12.79		12.36	12.72	10.76
28		8.80	10.71	11.69	12.38	12.72	13.01	12.60	12.87	10.71
26		8.69	10.50	11.65	12.37	12.36	12.40	12.77	12.67	10.44
26+28		8.72	10.56	11.66	12.37	12.46	12.42	12.67	12.73	10.52

Table 8. Herring stock characteristics in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016

Table 8A CANUM		Age group								
ICES SD	ICES Rect.	2	3	4	5	6	7	8	9+	∑
28	45H0	20163.77	3840.80	9163.49	3982.41	3230.53	2268.72	1313.68	1332.94	45296.33
	44H1	323.60	11.99	7.99	4.00	7.99		7.99	4.00	367.54
	44H0	12194.75	3788.56	6354.77	5489.59	3232.52	1475.48	1702.50	1058.48	35296.65
	44G9	17874.13	3880.49	6827.47	5458.98	2523.41	1692.85	2243.34	1047.19	41547.85
	43H0	13842.88	2120.31	5915.43	4327.13	1646.67	2518.45	1483.50	839.79	32694.16
	43G9	10429.32	2481.11	4773.77	4736.32	1686.17	2324.89	2086.11	946.70	29464.38
	42H0	5515.70	640.76	2144.22	2450.76	989.86	1387.32	1182.52	1221.28	15532.41
	42G9	5664.00	1766.57	3719.79	4195.95	1712.30	1249.66	1944.83	2088.18	22341.28
	42G8	1056.87	753.25	1583.11	1569.00	617.87	353.57	885.24	763.23	7582.13
26	41H0	364.49	57.55	19.18	57.55	38.37	19.18	19.18		575.51
	41G9	431.01	1025.94	2085.36	2350.31	676.05	1395.16	1714.29	1965.42	11643.54
	41G8	306.28	259.83	650.28	178.66	246.81	413.34	385.31	131.04	2571.55
28		1101.78	1343.32	2754.82	2586.52	961.23	1827.69	2118.78	2096.47	14790.61
26		87065.02	19283.83	40490.03	32214.12	15647.31	13270.94	12849.70	9301.77	230122.73
26+28		88166.80	20627.15	43244.85	34800.64	16608.54	15098.63	14968.48	11398.24	244913.34

Table 8B n × 10^6		Age group								
ICES SD	ICES Rect.	2	3	4	5	6	7	8	9+	∑
28	45H0	367.97	70.09	167.22	72.67	58.95	41.40	23.97	24.32	826.61
	44H1	26.06	0.97	0.64	0.32	0.64		0.64	0.32	29.60
	44H0	220.79	68.59	115.06	99.39	58.53	26.71	30.82	19.16	639.06
	44G9	370.71	80.48	141.60	113.22	52.34	35.11	46.53	21.72	861.70
	43H0	266.96	40.89	114.08	83.45	31.76	48.57	28.61	16.20	630.51
	43G9	202.48	48.17	92.68	91.95	32.74	45.14	40.50	18.38	572.04
	42H0	98.89	11.49	38.44	43.94	17.75	24.87	21.20	21.90	278.47
	42G9	103.38	32.24	67.90	76.59	31.25	22.81	35.50	38.11	407.78
	42G8	23.78	16.95	35.62	35.31	13.90	7.96	19.92	17.17	170.61
26	41H0	12.51	1.98	0.66	1.98	1.32	0.66	0.66		19.76
	41G9	5.70	13.56	27.56	31.07	8.94	18.44	22.66	25.98	153.90
	41G8	7.13	6.04	15.13	4.16	5.74	9.62	8.96	3.05	59.83
28		25.33	21.58	43.35	37.20	16.00	28.72	32.28	29.03	233.49
26		1681.02	369.87	773.25	616.84	297.85	252.57	247.70	177.29	4416.38
26+28		1706.35	391.45	816.60	654.04	313.85	281.28	279.98	206.32	4649.87

Table 8C n, %		Age group								Σ
ICES SD	ICES Rect.	2	3	4	5	6	7	8	9+	
28	45H0	44.52	8.48	20.23	8.79	7.13	5.01	2.90	2.94	100.00
	44H1	88.04	3.26	2.17	1.09	2.17		2.17	1.09	100.00
	44H0	34.55	10.73	18.00	15.55	9.16	4.18	4.82	3.00	100.00
	44G9	43.02	9.34	16.43	13.14	6.07	4.07	5.40	2.52	100.00
	43H0	42.34	6.49	18.09	13.24	5.04	7.70	4.54	2.57	100.00
	43G9	35.40	8.42	16.20	16.07	5.72	7.89	7.08	3.21	100.00
	42H0	35.51	4.13	13.80	15.78	6.37	8.93	7.61	7.86	100.00
	42G9	25.35	7.91	16.65	18.78	7.66	5.59	8.71	9.35	100.00
	42G8	13.94	9.93	20.88	20.69	8.15	4.66	11.68	10.07	100.00
26	41H0	63.33	10.00	3.33	10.00	6.67	3.33	3.33		100.00
	41G9	3.70	8.81	17.91	20.19	5.81	11.98	14.72	16.88	100.00
	41G8	11.91	10.10	25.29	6.95	9.60	16.07	14.98	5.10	100.00
28		10.85	9.24	18.57	15.93	6.85	12.30	13.83	12.43	100.00
26		38.06	8.38	17.51	13.97	6.74	5.72	5.61	4.01	100.00
26+28		36.70	8.42	17.56	14.07	6.75	6.05	6.02	4.44	100.00

Table 8D W, kg × 10^3		Age group								Σ
ICES SD	ICES Rect.	2	3	4	5	6	7	8	9+	
28	45H0	4173.46	1434.57	4054.97	2039.39	1832.76	1322.52	955.79	956.74	16770.18
	44H1	277.27	17.48	15.01	7.08	13.64		21.42	12.22	364.12
	44H0	2603.06	1436.35	2847.09	2868.28	1773.02	930.18	1132.92	728.77	14319.66
	44G9	4434.36	1695.78	3694.39	3355.65	1640.03	1275.24	1848.62	901.31	18845.38
	43H0	3376.56	852.17	2935.36	2607.15	1097.70	1749.68	1072.92	654.73	14346.26
	43G9	2615.65	1134.81	2442.54	3029.11	1148.70	1772.71	1573.69	780.65	14497.86
	42H0	1398.17	276.19	1041.76	1463.37	623.40	956.73	910.28	989.09	7658.98
	42G9	1570.41	850.76	2103.48	2767.30	1227.63	949.50	1571.09	1846.01	12886.18
	42G8	430.46	470.57	1142.61	1348.35	547.94	354.45	921.35	836.12	6051.86
26	41H0	177.01	38.19	18.96	61.77	42.54	15.15	23.97		377.59
	41G9	129.96	476.56	1072.79	1324.55	401.98	821.58	1132.17	1522.95	6882.54
	41G8	136.92	161.89	539.60	175.37	246.22	372.58	423.70	175.19	2231.48
28		443.89	676.64	1631.35	1561.70	690.73	1209.31	1579.84	1698.15	9491.61
26		20879.40	8168.67	20277.20	19485.67	9904.81	9311.01	10008.08	7705.64	105740.50
26+28		21323.29	8845.31	21908.55	21047.37	10595.55	10520.32	11587.93	9403.79	115232.11

Table 8E W, %		Age group								Σ
ICES SD	ICES Rect.	2	3	4	5	6	7	8	9+	
28	45H0	24.89	8.55	24.18	12.16	10.93	7.89	5.70	5.70	100.00
	44H1	76.15	4.80	4.12	1.94	3.75		5.88	3.36	100.00
	44H0	18.18	10.03	19.88	20.03	12.38	6.50	7.91	5.09	100.00
	44G9	23.53	9.00	19.60	17.81	8.70	6.77	9.81	4.78	100.00
	43H0	23.54	5.94	20.46	18.17	7.65	12.20	7.48	4.56	100.00
	43G9	18.04	7.83	16.85	20.89	7.92	12.23	10.85	5.38	100.00
	42H0	18.26	3.61	13.60	19.11	8.14	12.49	11.89	12.91	100.00
	42G9	12.19	6.60	16.32	21.47	9.53	7.37	12.19	14.33	100.00
	42G8	7.11	7.78	18.88	22.28	9.05	5.86	15.22	13.82	100.00
26	41H0	46.88	10.12	5.02	16.36	11.27	4.01	6.35		100.00
	41G9	1.89	6.92	15.59	19.25	5.84	11.94	16.45	22.13	100.00
	41G8	6.14	7.25	24.18	7.86	11.03	16.70	18.99	7.85	100.00
28		4.68	7.13	17.19	16.45	7.28	12.74	16.64	17.89	100.00
26		19.75	7.73	19.18	18.43	9.37	8.81	9.46	7.29	100.00
26+28		18.50	7.68	19.01	18.27	9.19	9.13	10.06	8.16	100.00

Table 8F w, g		Age group								
ICES SD	ICES Rect.	2	3	4	5	6	7	8	9+	∑
28	45H0	11.34	20.47	24.25	28.06	31.09	31.94	39.87	39.33	20.29
	44H1	10.64	18.11	23.33	22.00	21.20		33.30	38.00	12.30
	44H0	11.79	20.94	24.75	28.86	30.29	34.82	36.75	38.03	22.41
	44G9	11.96	21.07	26.09	29.64	31.34	36.32	39.73	41.50	21.87
	43H0	12.65	20.84	25.73	31.24	34.57	36.02	37.50	40.43	22.75
	43G9	12.92	23.56	26.35	32.94	35.09	39.27	38.86	42.47	25.34
	42H0	14.14	24.04	27.10	33.31	35.13	38.47	42.94	45.17	27.50
	42G9	15.19	26.38	30.98	36.13	39.28	41.63	44.26	48.43	31.60
	42G8	18.10	27.76	32.07	38.19	39.41	44.55	46.25	48.68	35.47
26	41H0	14.15	19.33	28.80	31.27	32.30	23.00	36.40		19.11
	41G9	22.81	35.14	38.92	42.64	44.98	44.55	49.97	58.62	44.72
	41G8	19.22	26.78	35.67	42.19	42.88	38.74	47.27	57.47	37.30
28		17.52	31.35	37.63	41.98	43.18	42.11	48.94	58.50	40.65
26		12.42	22.09	26.22	31.59	33.25	36.87	40.40	43.46	23.94
26+28		12.50	22.60	26.83	32.18	33.76	37.40	41.39	45.58	24.78

Table 8G L, g		Age group								
ICES SD	ICES Rect.	2	3	4	5	6	7	8	9+	∑
28	45H0	12.54	15.84	16.81	17.72	18.37	18.85	20.05	20.24	15.32
	44H1	12.09	14.92	16.25	16.75	16.50		19.75	21.25	12.68
	44H0	12.66	15.94	16.89	17.86	18.14	19.19	19.49	19.83	15.90
	44G9	12.64	15.85	17.06	17.84	18.35	19.34	19.87	20.40	15.56
	43H0	12.89	15.66	16.95	18.07	18.89	18.98	19.23	19.57	15.72
	43G9	12.93	16.12	16.98	18.31	18.78	19.50	19.36	19.65	16.24
	42H0	13.35	16.51	17.14	18.48	18.68	19.27	20.31	20.51	16.77
	42G9	13.62	16.73	17.68	18.78	19.20	19.57	20.14	20.75	17.50
	42G8	14.31	16.90	17.72	18.88	19.12	19.91	20.29	20.58	18.21
26	41H0	13.41	14.75	17.25	17.92	18.25	16.25	20.25		14.77
	41G9	15.46	18.09	18.91	19.51	20.03	19.79	20.73	21.88	19.77
	41G8	14.74	16.68	18.27	19.75	19.74	18.59	20.33	21.82	18.47
28		14.24	17.39	18.66	19.45	19.78	19.31	20.61	21.87	19.02
26		12.81	16.02	17.04	18.15	18.56	19.24	19.79	20.27	16.01
26+28		12.83	16.10	17.13	18.23	18.62	19.24	19.89	20.50	16.16

Table 9. Number of sprat eggs and larvae per 1 m^2 or per 10 minutes of sampling on water surface in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016

Aquatory	Northern part		Central part		Southern part	
Depth strata	>70m	<70m	>70m	<70m	>70m	<70m
Eggs (per $1m^2$)	116	-	416	31	591	31
Larvae (per $1m^2$)	1.2	-	18.2	0	130	11.4
Eggs (per 10 min. of haul on the water surface)	5.3	-	123	51	82	31
Larvae (per 10 min. of haul on the water surface)	0.4	-	3.1	0	1.5	0

Northern part of the Gotland Basin – to the north from 57°30’N
Central part of the Gotland Basin – between 56°30’N and 57°30’N
Southern part of the Gotland Basin – to the south from 56°30’N.

Table 10. The average number and average biomass of zooplankton organisms in 0-100m water column per volume unit in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016

Species or group	Whole aquatory All stations (26) [0-100 layer]		Stations (13) with depth more than 100m [0-50 layer]		Stations (19) with depth more than 100m [0-100 layer]		Stations (7) with depth less than 100m [0-bottom layer]	
	n\m^3	mg\m^3	n\m^3	mg\m^3	n\m^3	mg\m^3	n\m^3	mg\m^3
Acartia spp.	2870	33.43	3524	35.78	3014	35.17	2331	26.95
Eurytemora affinis	3	0.09	5	0.13	1	0.05	7	0.24
Temora longicornis	1330	24.69	1314	16.25	1391	26.10	1100	19.43
Centropages	1658	14.46	2071	15.09	1811	15.59	1088	10.26
Pseudocalanus sp.	2843	26.27	2459	14.05	3354	31.72	937	5.96
Oithona sp.	3	0.02			4	0.02		
Bosmina spp.	3	0.02	5	0.05	3	0.02	3	0.02
Evadne spp.	663	19.59	731	20.68	659	19.21	678	20.98
Podon spp.	47	0.47	69	0.62	44	0.43	58	0.62
Synchaeta spp.	4377	26.26	6028	36.17	3817	22.90	6466	38.80
Polychaeta sp.	99	2.96	28	0.84	94	2.82	116	3.48
Bivalvia larvae	96	0.10	113	0.11	88	0.09	126	0.13
Fritillaria borealis	1619	16.19	1518	15.18	1562	15.62	1831	18.31
Copepoda	8705	98.96	9374	81.29	9576	108.65	5463	62.85
Cladocera	713	20.08	805	21.34	706	19.67	739	21.61
Rotatoria	4377	26.26	6028	36.17	3817	22.90	6466	38.80
Varia	1813	19.25	1659	16.13	1744	18.53	2073	21.91
Total	15609	164.55	17866	154.93	15842	169.75	14741	145.17

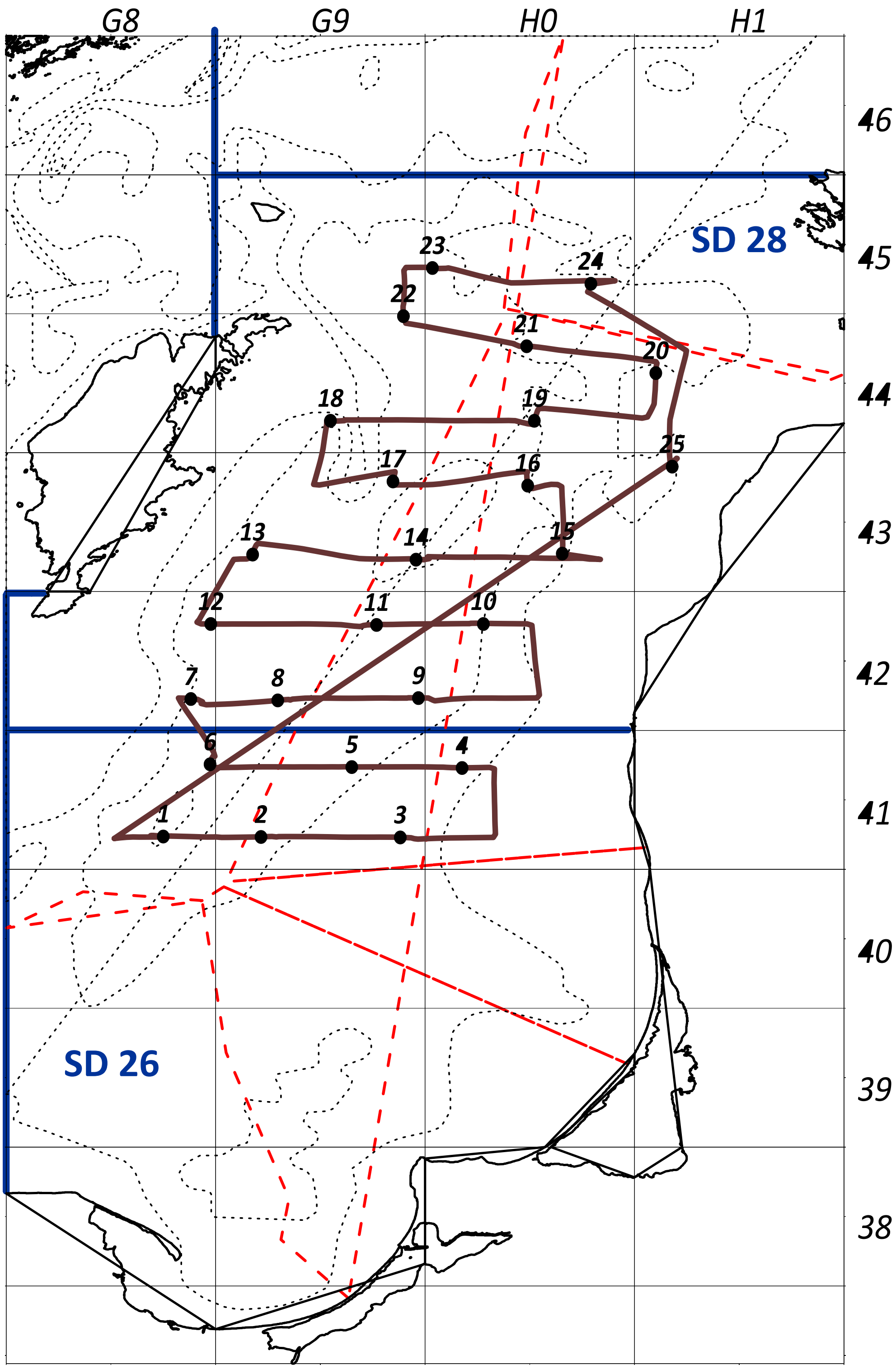

Figure 1: Cruise track design and trawling positions of the Latvian-Polish BASS on the r/v "Baltica" in the period of 12-21.05.2016.

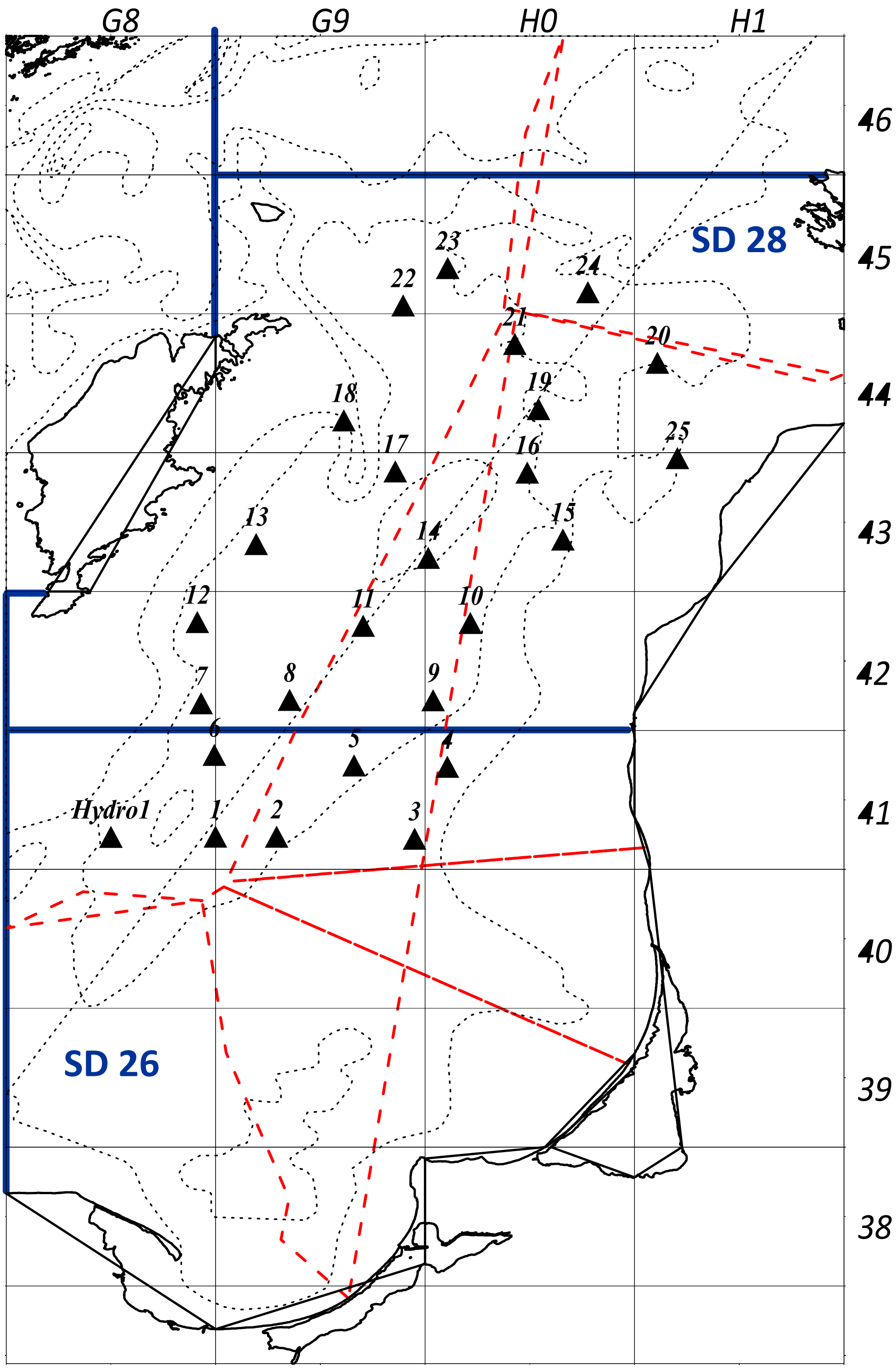

Figure 2: Locations of the hydrological, ichthyoplankton and zooplankton stations performed during the Latvian-Polish BASS on the r/v "Baltica" in the period of 12-21.05.2016.

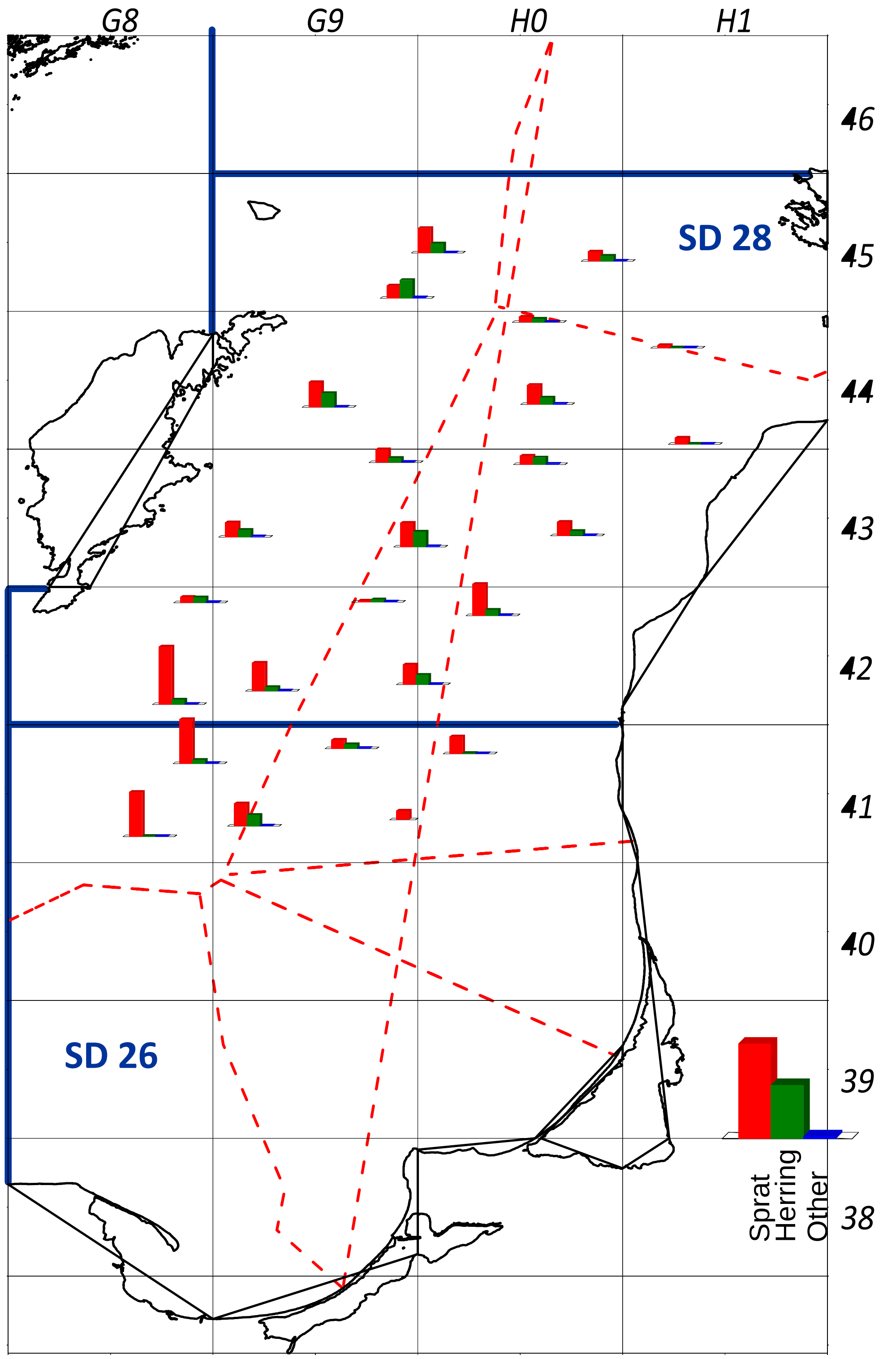

Figure 3: Catch [kg] distribution by fish species in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica"in the period of 12-21.05.2016.

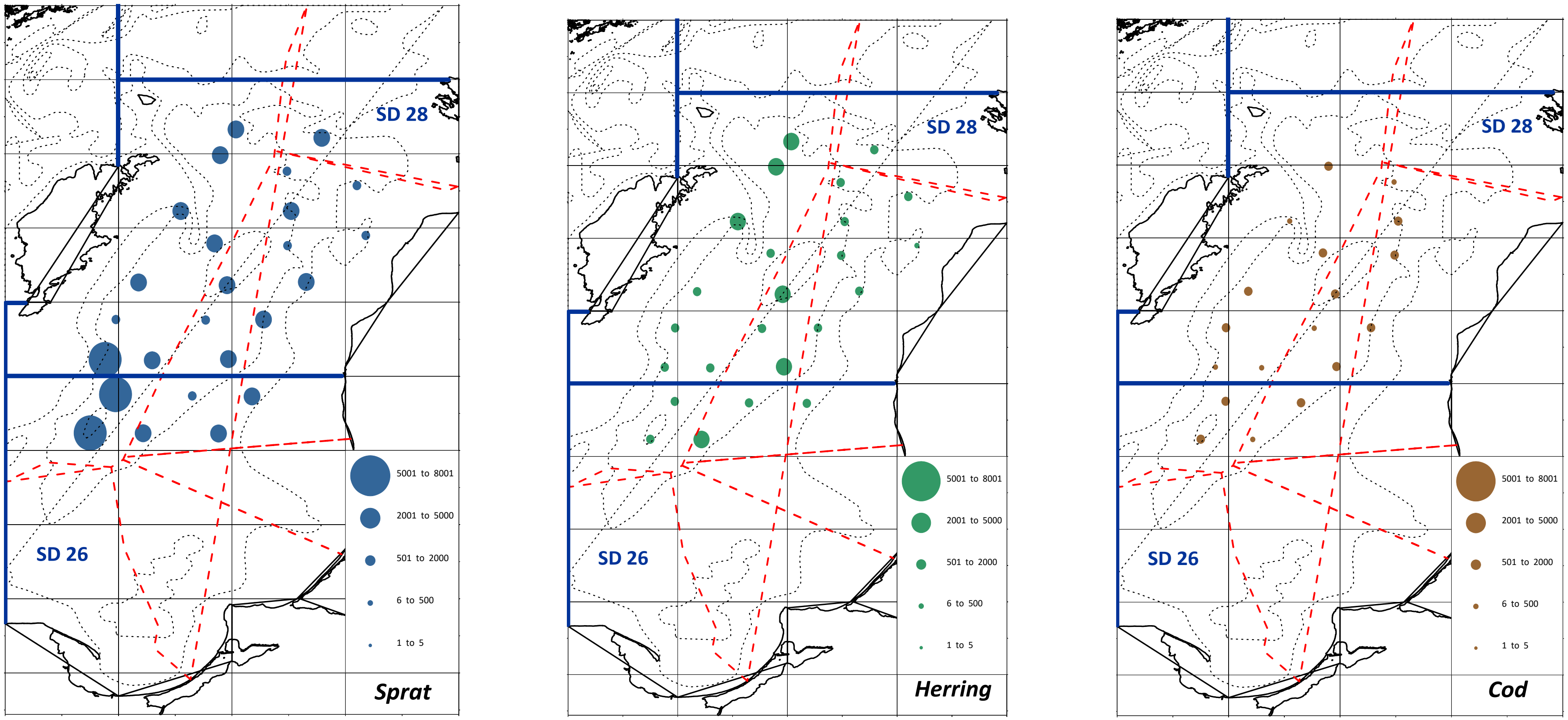

Figure 4: CPUE [kg/h] ranges distribution of dominant fish in the catch hauls in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica"in the period of 12-21.05.2016.

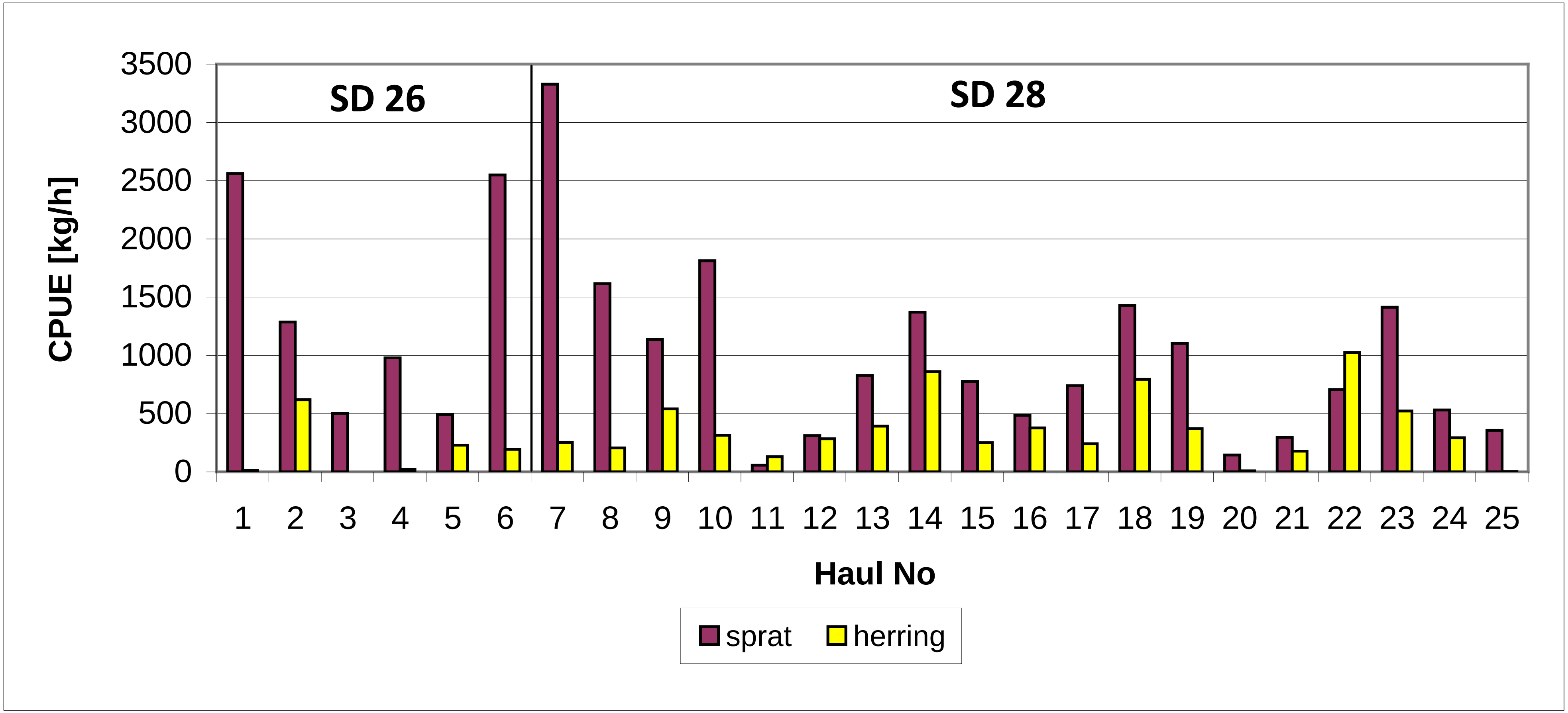

Figure 5: CPUE [kg/h] of dominant pelagic fish in the catch hauls in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica"
in the period of 12-21.05.2016.

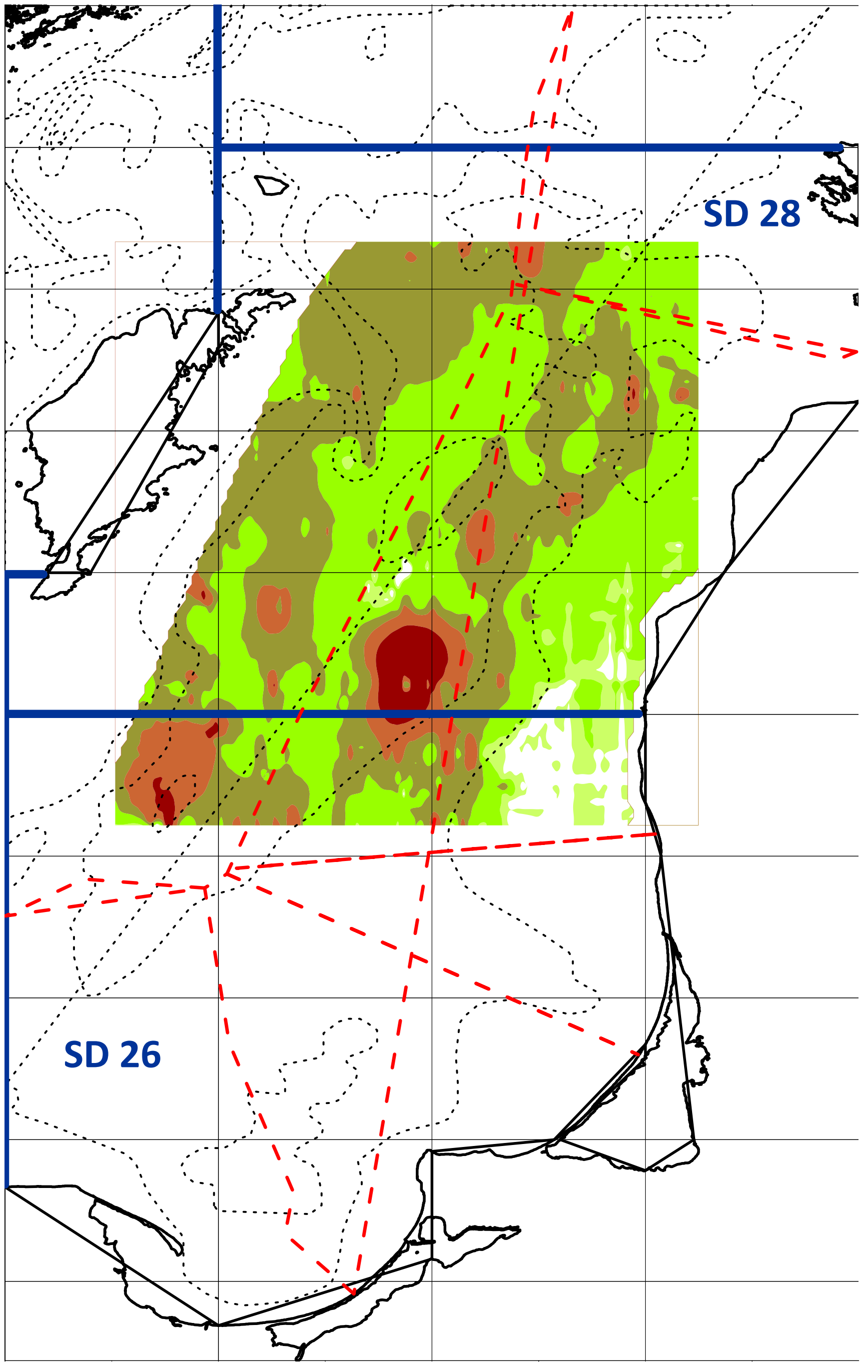

Figure 6: Acoustic parameter NASC distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016.

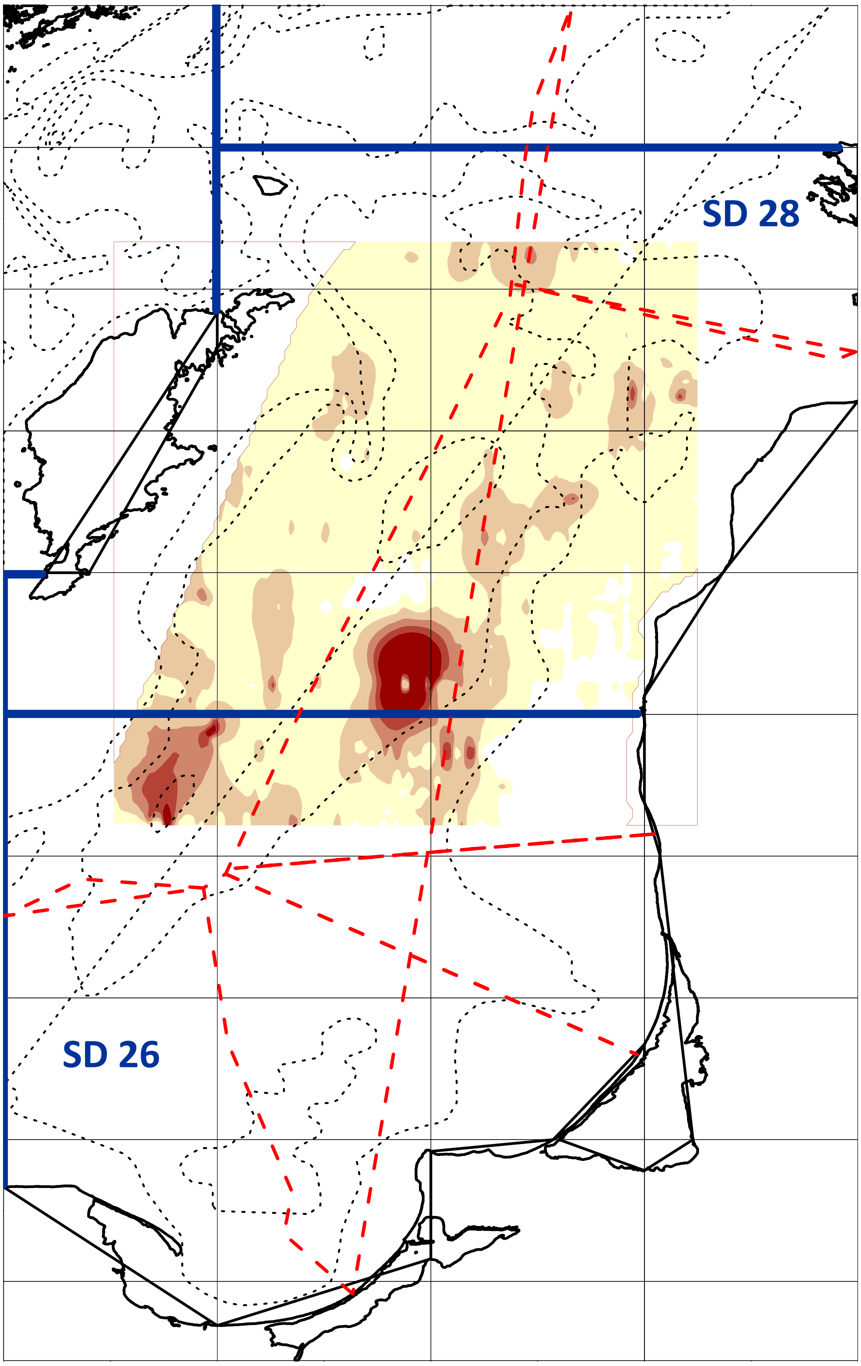

Figure 7: Sprat distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016.

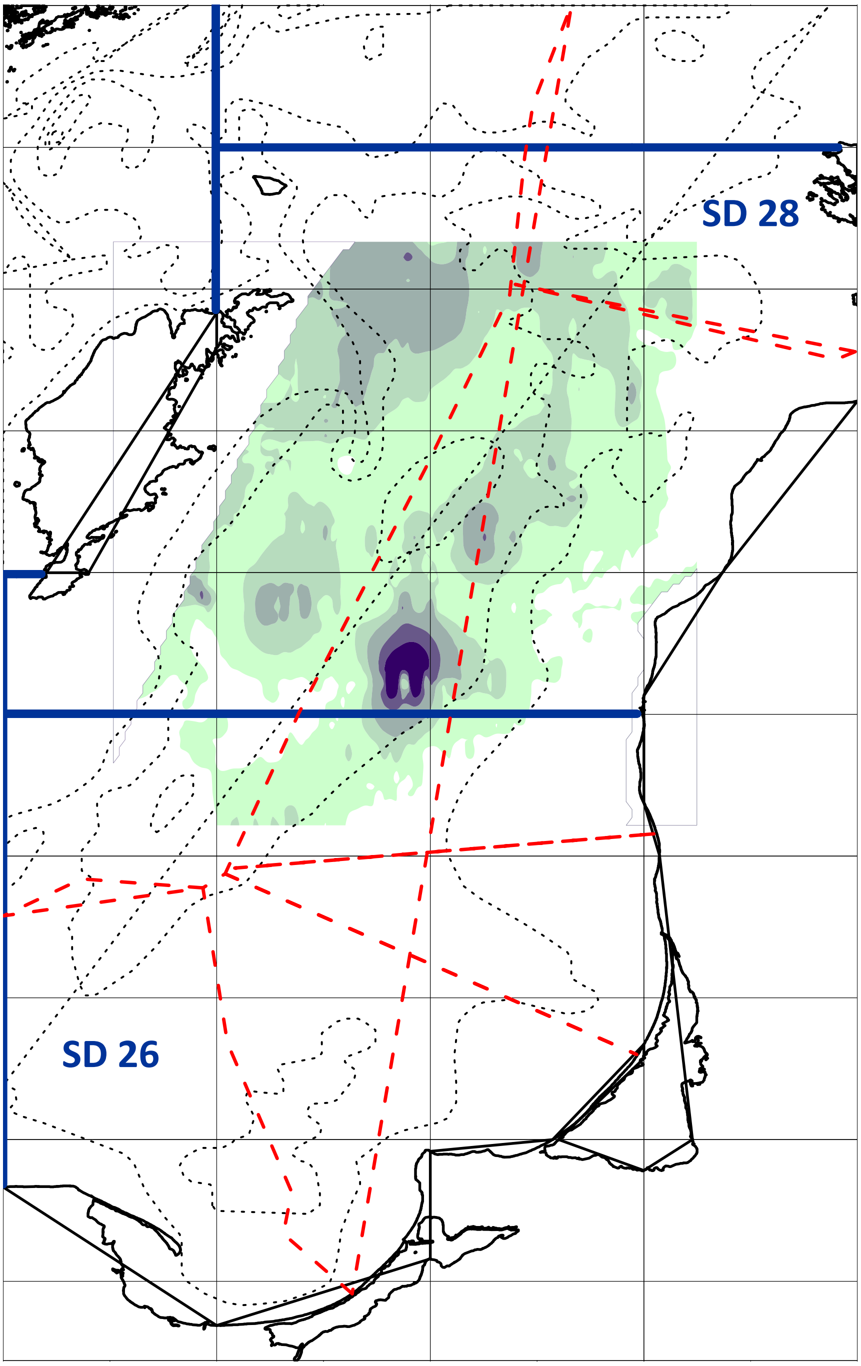

Figure 8: Herring distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016.

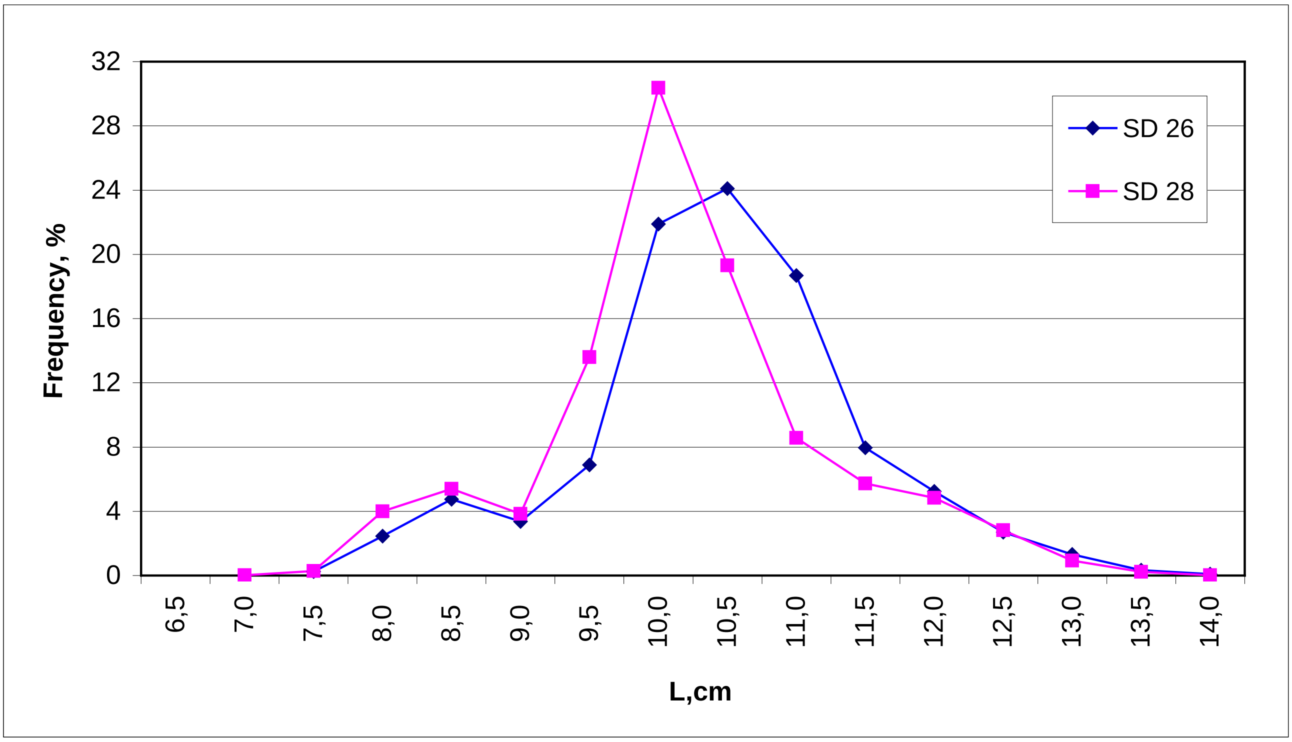

Figure 9: Sprat length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016.

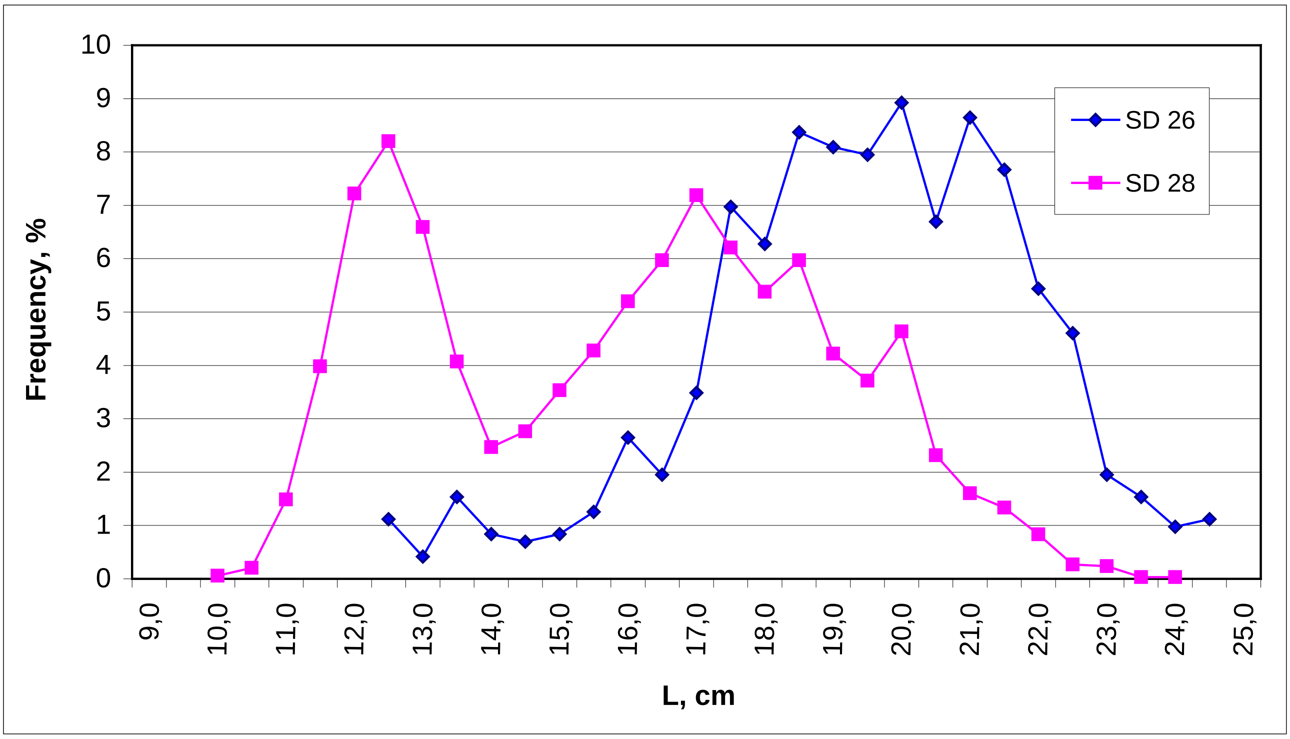

Figure 10: Herring length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016.

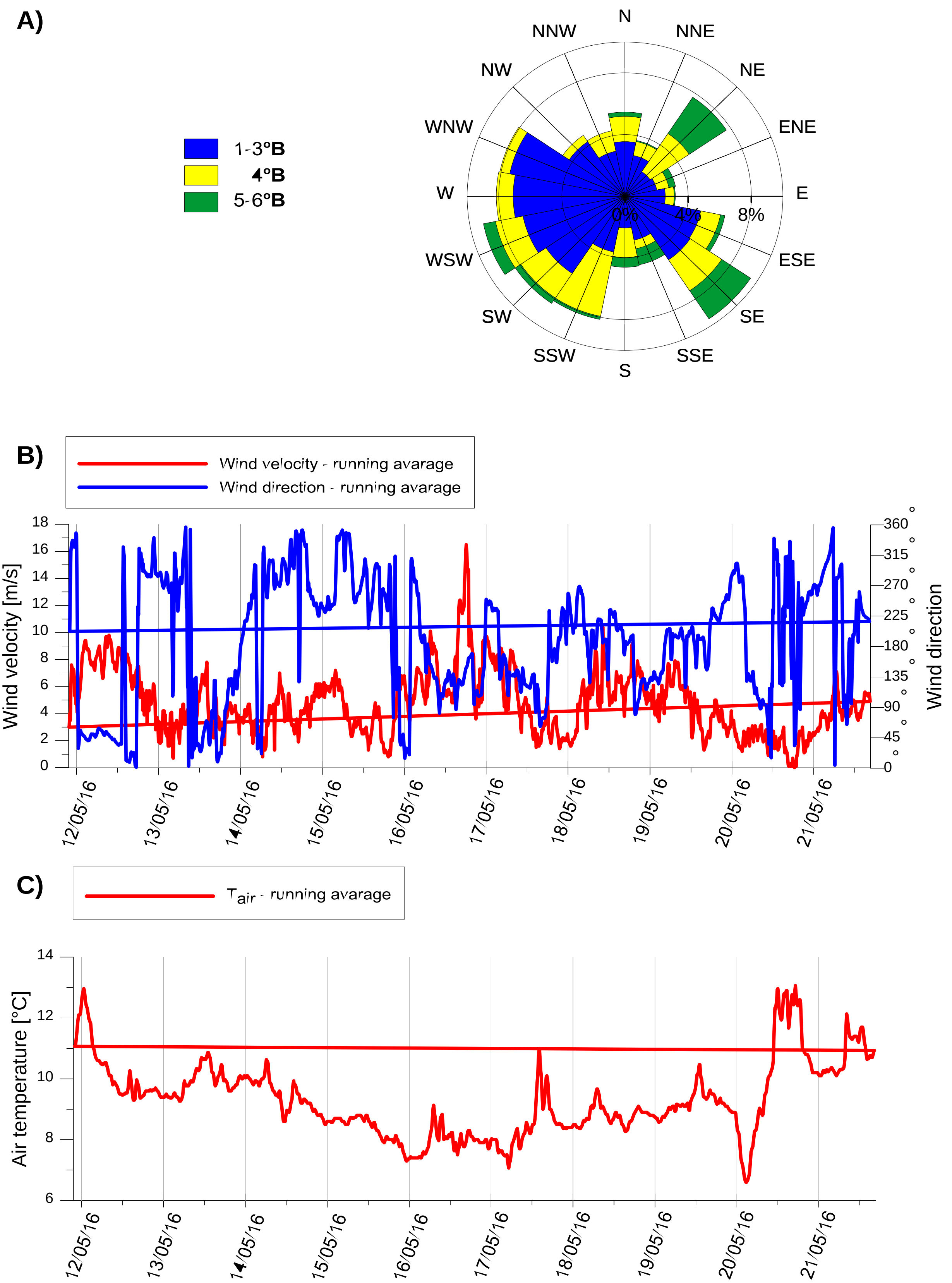

Figure 11: Changes of the main meteorological parameters (wind force, direction and the daily air temperature) during the Latvian-Polish BASS in the Baltic Sea ICES SD 26N and 28.2 conducted by r/v "Baltica" in the period of 12-21.05.2016

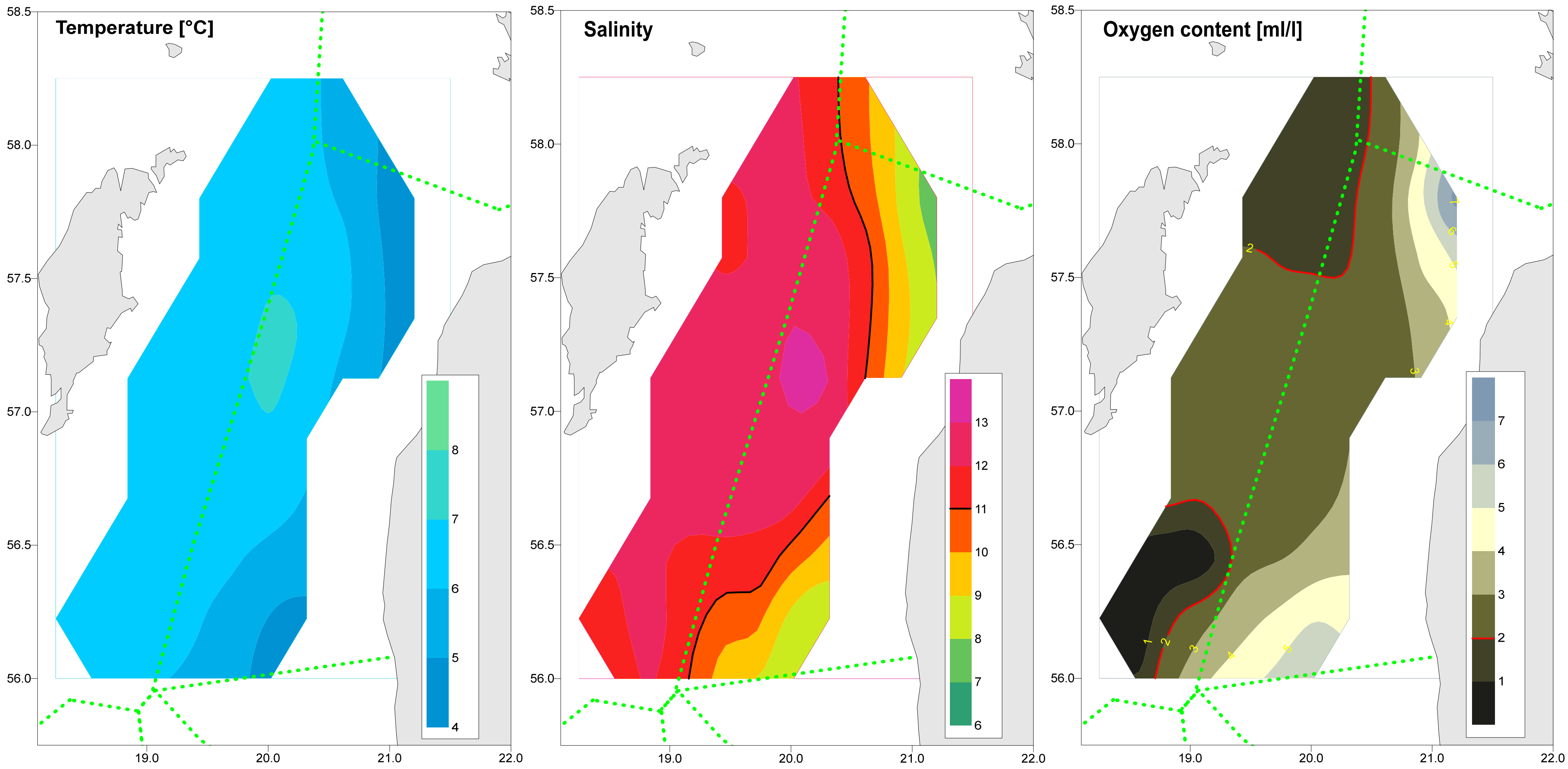

Figure 12: Horizontal distribution of the main hydrological parameters (temperature, salinity, oxygen content) measured in the bottom water layer of the Gotland Deep in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 12-21.05.2016.

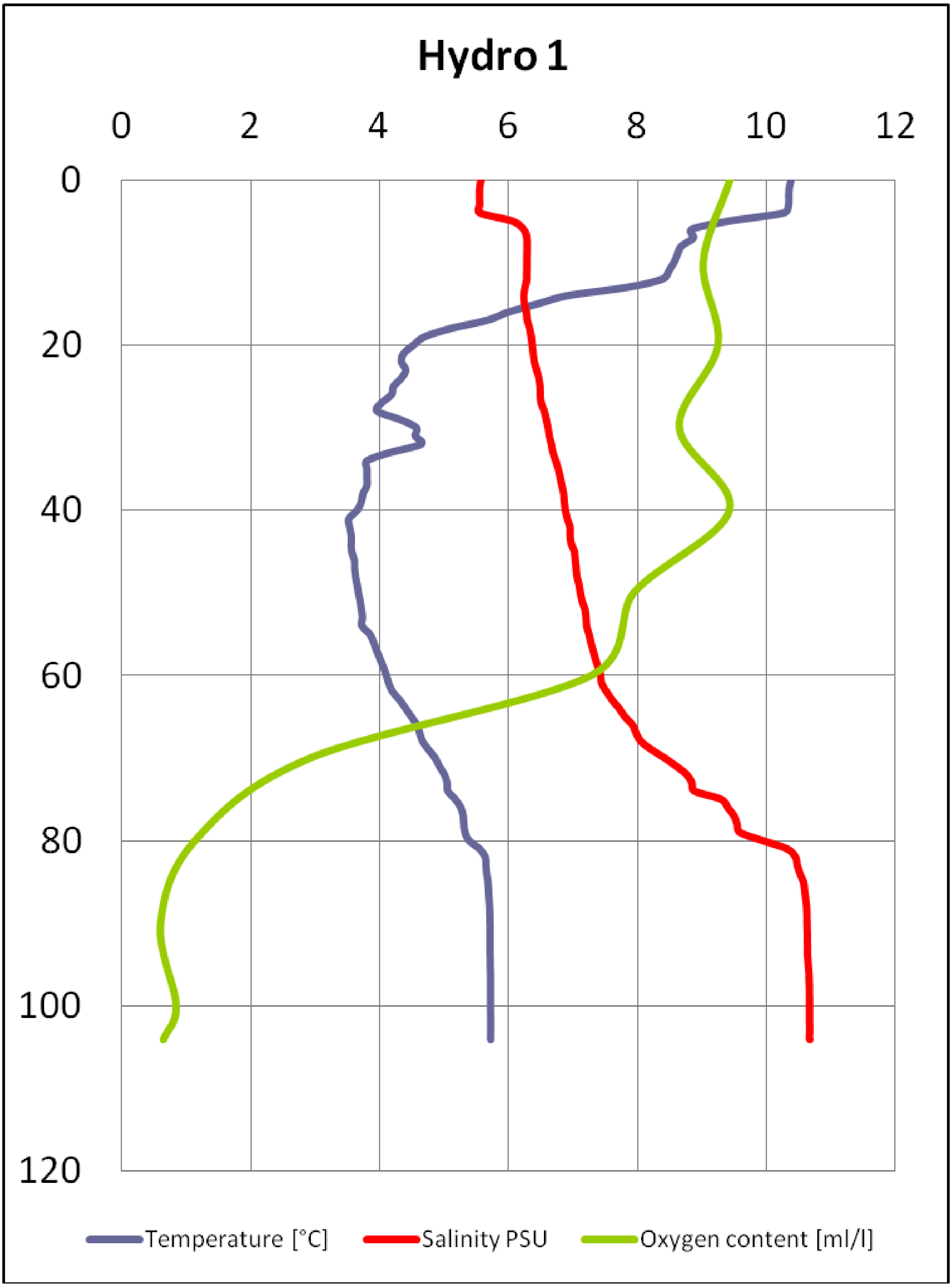

Figure 12: Vertical distribution of the seawater temperature, salinity and oxygen content at the independent hydrological station in the southern part of the Gotland Basin in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in October in the period of 12-21.05.2016.

REPORT
FROM THE JOINT ESTONIAN-POLISH BIAS
CONDUCTED BY THE R.V. “BALTICA” IN THE NORTH-EASTERN BALTIC SEA
(21-28 October 2016)

by
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Introduction

The permanent participation of the Polish r.v. “Baltica” in the autumn Baltic International Acoustic Surveys (BIAS) within the Polish EEZ has taken place since 1994 in the framework of long-term ICES Baltic International Acoustic Surveys Program, coordinated by the ICES Baltic International Fish Survey Working Group [WGBIFS].

The first joint Estonian-Finnish-Polish BIAS survey was conducted on the r.v. “Baltica” in October 2006 in the ICES Sub-divisions 28.2, 29 and 32. The recent joint survey, marked with the number 5/2016/NMFRI/TUEMI based on the procurement contract between the University of Tartu/Estonian Marine Institute in Tallinn and the National Marine Fisheries Research Institute in Gdynia. This Estonian-Polish BIAS 4Q 2016 survey was conducted in the Estonian EEZ only (the ICES Sub-divisions 28.2, 29 and 32).

The Estonian Data Collection Program for 2016 and the European Union (the Commission regulations Nos. 665/2008, 199/2008, 2010/93/EU) financially supported the mentioned above BIAS-2016 survey. Timing, surveying area in the north-eastern Baltic and the principal methods of investigations concerns the survey were designed and coordinated by the WGBIFS (Anon. 2012[1], Anon. 2016[2]).

The main aims of the reported cruise were:

- to provide the echo-integration and to collect the acoustic data along the planned transects in the north-eastern Baltic Sea,
- to conduct the fish pelagic control-catches in the fish concentration locations,
- to collect ichthyological samples specially for herring and sprat,
- to collect plankton samples,
- to provide hydrological monitoring (temperature, salinity and oxygen content) at the catch locations.

Personnel

The BIAS 4Q 2016 scientific staff was composed of 9 persons:
Miroslaw Wyszynski (NMFRI, Gdynia – Poland) – survey leader
Jakub Slembarski (NMFRI, Gdynia – Poland) – acoustician
Tycjan Wodzinowski (NMFRI, Gdynia – Poland) – hydrologist
Grzegorz Kruk (NMFRI, Gdynia – Poland) – acoustician
Ain Lankov (TUEMI, Tallinn - Estonia) – Estonian scientific staff leader
Andrus Hallang (TUEMI, Tallinn - Estonia) – ichthyologist
Timo Arula (TUEMI, Tallinn - Estonia) – ichthyologist
Viktor Kajalainen (TUEMI, Tallinn - Estonia) – ichthyologist
Elor Sepp (TUEMI, Tallinn - Estonia) – acoustician.

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[1]Anon. 2012. Manual For International Balic Acoustic Surveys (IBAS). Version 1.01. Addendum 2: ICES WGBIFS BIAS Manual 2012.

[2]Anon. 2016. Anon. 2016. Second Interim Report of the Baltic International Fish Survey Working Group (WGBIFS). ICES CM 2016/SSGIEOM: 07.

Narrative

The reported survey took place during the period of 21-28 October 2016. The at sea researches (echo-integration, fish control catches, hydrological and plankton stations) were conducted within Estonian EEZ (the ICES Sub-divisions 28.2, 29 and 32), moreover inside the territorial waters of this country not shallower than 20 m.

The vessel left the Ventspils port (Latvia) on 20.10.2016 at 15:40 o'clock and was navigated in the north-western direction to the geographical position 58°05'N 020°27'E in north-western part of Sub-division (SD) 28.2 (Fig. 1) where the vessel started investigations at the acoustic transect. The at sea researches were ended on 26.10.2016 after midday in the Ventspils harbour (Latvia). Then the r.v. "Baltica" started its journey to the home-port in Gdynia (Poland), reaching it on 28.10.2016 morning. The researches were shortened by 2 days at sea (according to contracted time of research) due to vessel technical problems making the catches impossible.

Survey design and realization

The r.v. "Baltica" realized 612 Nm echo-integration tracks and 9 fish control-catches/hauls (Fig. 1). Due to technical problems of the vessel the ICES rectangles 45H0, 47H1, 47H2 and 48H4 were not covered with control catches. Three rectangles (44H1, 45H0 and 45H1) in SD 28.2 were covered with investigations during the gone before Latvian-Polish BIAS in October 2016. All catches were performed in the daylight (between 08:05 am. and 16:30 pm.) using the pelagic trawl type WP 53/64x4 (with 6 mm mesh bar length in the codend). The standard trawling duration (30 minutes) was shortened in 7 cases to 15 or 20 minutes due to high fish density observed on the net-sounder monitor. The mean speed of vessel while trawling was 3.1 knots. Overall, 1 haul was conducted in SD 28.2, 2 hauls in SD 29 and 6 hauls in SD 32.

The length measurements (in 0.5 cm classes) were realized for 1919 sprat and 2259 herring. Totally, 420 sprat and 554 herring individuals were taken for biological analysis.

The acoustic data were collected with the EK-60 echo-sounder equipped with "Echo-view V4.10" software for the data analysis. The acoustic system was calibrated before the survey according to the methodology described in the BIAS manual (Anon. 2012). The basic acoustic and biological data collected during recently carried out survey will be stored in the acoustic database, managed by ICES Secretariat. The acoustic data collected during the survey were delivered to the Estonian Marine Institutes laboratories for further elaboration.

Calibration

The hydroacoustic equipment was calibrated before the survey according to the methodology described in the BIAS manual. (Anon. 2014[2])

Acoustic data collection

Acoustic data were collected during the light time with the Simrad EK60 echosounder equipped with "Echo-view V4.10" software for the data analysis. Data from two frequencies (38 and 120 kHz) were recorded simultaneously, but for the standard analyses only the information collected with 38 kHz was used. The specific settings of the equipment were used as described in the BIAS manual. (Anon. 2014[2]) The basic acoustic and biological data collected during recently carried out survey will be stored in the BIAS_DB.mdb managed by ICES.

Data analysis

The MYRIAX "EchoView v.4.10" software was used for the analysis of the acoustic data.

The total number of fish in each the ICES rectangle was estimated as a product of the mean NASCs from scrutinized acoustic data and a rectangle area, divided by corresponding mean acoustic cross-section (σ) which is based on the trawl catch results. The abundance of clupeids was separated into sprat and herring according to the mean catch composition.

Mean target strength (TS) – one of the principal acoustic parameter – of clupeids was calculated according to following formula:

$TS = 20 \log L - 71.2$ (Anon. 1983[3]).

Due to fortunate weather conditions, all transects and planned trawls were conducted according to the plan and no data from colleagues from nearby countries were needed.

Catch results and fish measurements

Overall, 10 fish species were recognized in hauls performed in the north-eastern Baltic Sea in October 2016. Sprat was prevailing species by mass in each of the ICES Sub-divisions 28.2, 29 and 32 with the mean share amounted 69 % of the total catch (mostly in SD 29 – 97.2%). Herring dominated in 4 from all 9 hauls performed. Its most share in the total catch mass was in the Sub-division 32 with mean share about 38 %. The rest 8 species (with smelt and three-spine stickleback predominance) represented only 1,6 % of the total mass in average.

The detailed catch and CPUE results and distribution are presented in the Table 1 and Fig. 2-3. The biological sampling is shown in Table 4. Mean CPUE for all species in the investigated area in 2016 amounted 729.5 kg/h comparing to 845.5 kg/h in the previous year (2015) – about 14 % decrease has been noted. The mean CPUE value for all species was similar in SD 29 and 32, respectively 729.6 and 772.5 kg/h in the investigated year. It was lower in SD 28.2 – 471.8 kg/h, however 1 haul only was performed in this SD.

The mean CPUEs of sprat in SDs 28.2, 29 and 32 were as follow: 297.5, 708.9 and 469,1 kg/h respectively. The mean CPUEs in case of herring were: 156.3, 10.0 and 292.3 kg/h in above mentioned SDs.

The length distributions of sprat, herring, three-spine stickleback, nine-spine stickleback and smelt according to the ICES Sub-divisions 28.2, 29 and 32 are shown on Fig. 4-8 respectively. Generally, sprat was caught in length range 6.5-14.0 cm. The modal value of sprat length frequency belonged to 10.5 cm length class in all SDs. A little frequency pick only at 8.0 cm length class represented 2016 generation of this species. The length range of herring from all control catches was 6,0-19,5 cm. The modal values of herring length frequency from SDs 28.2, 29 and 32 were 14.5, 13.5 and 13.0 cm respectively. This species generation born in 2016 (with modal frequency value 9.0 cm) was noted numerously only in SD 32. This herring generation was not found in SD 28.2. The total length range of three-spine stickleback was 3-7 cm. Its length frequency curves had bimodal character in all investigated SDs, with small pick at 3.5-4 cm length classes and main one at 5.5-6 cm length classes. The length frequency curves of nine-spine stickleback caught in SDs 29 and 32 had one mode character in length range 4-6 cm and frequency pick at 4.5 cm length class. Smelt was caught in SD 32 only. It existed in catches in wide length range 5-21 cm, with modal value of length frequency at 8 cm length class.

Acoustic results

The survey statistics concerning the survey area, the mean NASC, the mean sigma, the estimated total number of fish, the percentages of herring and sprat per ICES statistical rectangles are presented in Table 3. Fish concentrations were found to be higher in western part of Gulf of Finland as in previous years.

Abundance and biomass estimates

The estimated abundances of herring and sprat by age group and Sub-division/ICES statistical rectangle are given in Table 4. The estimated biomass by age group and Sub-division/ICES statistical rectangle is shown in Table 5. Corresponding mean weights by age group and Sub-division/ICES statistical rectangle are summarized in Table 6.

The spatial distribution of sprat biomass and abundance differed considerably within the investigated area, abundance being highest near island Hiiumaa. The abundance and biomass of herring was highest in the western part of Gulf of Finland and lowest in the Baltic Proper. The average weight of individuals from both species was lower than in the previous survey, but abundance was considerably higher, especially for herring.

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[2]Anon. 2014. Report of the Baltic International Fish Survey Working Group (WGBIFS). ICES CM 2014/SSGESST: 13.

Meteorological and hydrological characteristics.

The 9 hydrological stations connected with the control catch locations (Fig.1) were inspected with CTD-probe combined with the rosette sampler. Hydrological parameters were measured at each catch–station location. Oxygen content was determined by the standard Winkler’s method. The CTD row data aggregated to the 1 m depth stratum. The Oxygen probes were taken on every 10 meters.

The most frequently wind (Fig. 9) were: SE, ESE, E and N. The wind speed varied from 3.8 m/s to 16.6 m/s and average wind speed was 11.1 m/s. The air temperature ranged from 8.0 °C to 1.7 °C, and average temperature was 5.1 °C.

The seawater temperature in the surface layers varied from 7.73 to 10.30°C (the mean was 8.74°C). The lowest surface temperatures were recorded at the haul station 7. The highest ones were noticed at the haul station 5. The minimum value of salinity in Practical Salinity Unit (PSU) was 4.23 at the haul station 6 in the surface layer. The maximum was 6.66 PSU at the hydrological haul station 3. The mean value of salinity was 5.44 PSU. The oxygen content in the surface layers of investigated the research area varied in the range of 7.31 ml/l (haul 9) - 8.26 ml/l (haul 3). The mean value of surface water oxygen content was 7.71 ml/l.

The temperature of near bottom layer was changing in the range of 6.22 - 4.81°C (the mean was 5.58°C). Salinity in the bottom waters varied from 7.73 to 10.57 PSU (the mean was 9.11 PSU). The lowest values of salinity was at the haul station 3. The highest values of salinity were noticed at the haul station 1. Oxygen content varied from 0.00 ml/l to 5.23 ml/l (the mean was 1.69 ml/l). The lowest values of this parameter were noticed at the haul stations 4 and 5. Vertical distribution of the seawater temperature, salinity and oxygen content on the four chosen haul stations are presented at Fig. 10.

Discussion

The estimated total abundance of sprat in the survey regions was almost 10% higher compared to the previous year survey results. Herring abundance in same region was almost 2 times higher. Herring abundance was found low in Baltic Proper, but much higher in Gulf of Finland compared to previous year. Mean weights of individuals from both species were slightly lower than in the previous year and much lower compared to older results.

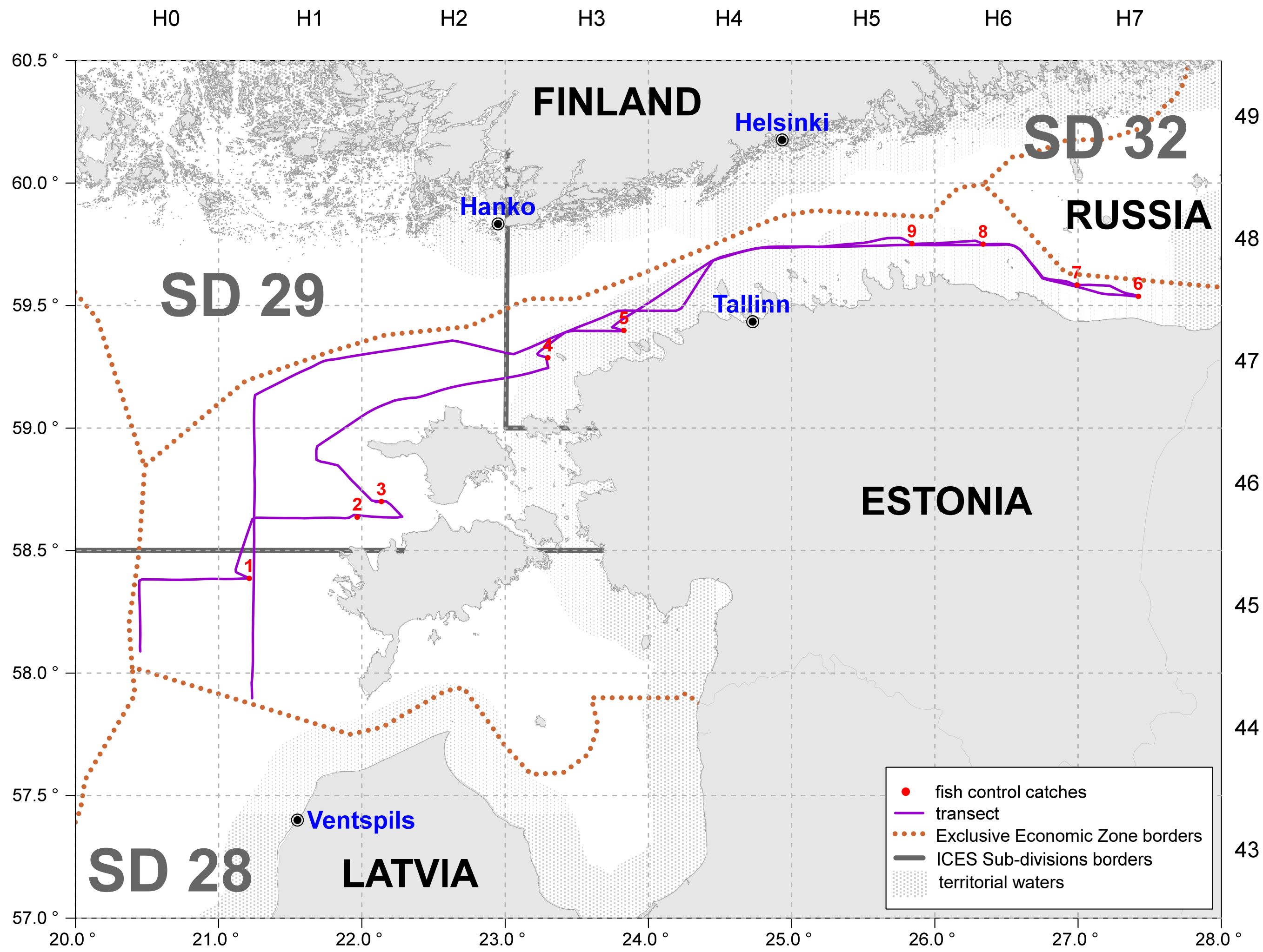


Fig. 1. Acoustic transects and pelagic fish control catches with connected hydrological stations realised during joint EST-POL BIAS 4Q 2016.

Table 1. Catch and CPUE results during joint Estonian-Polish BIAS conducted by r.v. “Baltica” in Estonian EEZ in October 2016.

Haul no	Date	ICES rectangle	ICES Sub-division (SD)	Geographical position				Time		Haul duration [min]	Total catch [kg]	Catch per species [kg]									
				start		end															
				latitude 00°00.0'N	longitude 00°00.0'E	latitude 00°00.0'N	longitude 00°00.0'E	start	end			sprat	herring	cod	flounder	short horn sculpin	eelpout	sand gobby	nine-spined stickleback	three-spined stickleback	smelt
1	2016-10-21	45H1	28.2	58°23.8'	21°10.5'	58°24.5'	21°07.7'	14:10	14:40	30	235,882	148,741	78,136	0,532					0,071	8,237	0,165
2	2016-10-22	46H1	29	58°38.3'	21°55.9'	58°38.6'	21°52.9'	08:05	08:35	30	650,957	643,971	0,260			0,087			0,130	6,509	
3	2016-10-22	46H2	29	58°42.0'	22°06.5'	58°42.1'	22°04.9'	12:30	12:45	15	39,300	32,462	4,873						0,362	1,603	
4	2016-10-23	47H3	32	59°17.5'	23°15.6'	59°17.7'	23°14.3'	09:35	09:50	15	151,200	68,010	81,860						0,015	0,711	0,604
5	2016-10-23	47H3	32	59°24.2'	23°47.5'	59°24.4'	23°46.3'	14:00	14:15	15	580,048	499,363	80,443						0,076	0,116	0,050
6	2016-10-24	48H7	32	59°32.6'	27°23.3'	59°32.8'	27°21.4'	08:05	08:20	15	36,940	6,738	29,792				0,052		0,052	0,218	0,089
7	2016-10-24	48H6	32	59°35.2'	26°58.4'	59°35.5'	26°56.8'	10:15	10:30	15	61,546	16,359	43,087					0,007	0,018	0,620	1,455
8	2016-10-24	48H6	32	59°45.0'	26°18.6'	59°45.7'	26°17.4'	13:45	14:00	15	171,679	93,966	73,753		0,121	0,065			0,103	0,446	3,225
9	2016-10-24	48H5	32	59°45.6'	25°48.7'	59°46.2'	25°46.9'	16:10	16:30	20	209,800	25,616	172,770						0,043	1,280	10,091
									Total catch [kg]	28.2	235,882	148,741	78,136	0,532					0,071	8,237	0,165
										29	690,257	676,433	5,133			0,087			0,492	8,112	
										32	1211,213	710,052	481,705		0,121	0,065	0,052	0,007	0,307	3,391	15,514
										Sum	2137,352	1535,226	564,974	0,532	0,121	0,152	0,052	0,007	0,870	19,740	15,679

Haul no	Date	ICES rectangle	ICES Sub-division (SD)	Haul duration [min.]	Total CPUE [kg/h]	CPUE per species [kg/h]									
						sprat	herring	cod	flounder	short horn sculpin	eelpout	sand gobby	nine-spined stickleback	three-spined stickleback	smelt
1	2016-10-21	45H1	28.2	30	471,764	297,482	156,272	1,064					0,142	16,474	0,330
2	2016-10-22	46H1	29	30	1301,914	1287,942	0,520			0,174			0,260	13,018	
3	2016-10-22	46H2	29	15	157,200	129,848	19,492						1,448	6,412	
4	2016-10-23	47H3	32	15	604,800	272,040	327,440						0,060	2,844	2,416
5	2016-10-23	47H3	32	15	2320,192	1997,452	321,772						0,304	0,464	0,200
6	2016-10-24	48H7	32	15	147,760	26,952	119,168				0,206		0,206	0,872	0,356
7	2016-10-24	48H6	32	15	246,184	65,436	172,348					0,028	0,072	2,480	5,820
8	2016-10-24	48H6	32	15	686,716	375,864	295,012		0,484	0,260			0,412	1,784	12,900
9	2016-10-24	48H5	32	20	629,400	76,848	518,310						0,129	3,840	30,273
		Mean CPUE by SDs [kg/h]		28.2	471,764	297,482	156,272	1,064					0,142	16,474	0,330
				29	729,557	708,895	10,006			0,087			0,854	9,715	
				32	772,509	469,099	292,342		0,081	0,043	0,034	0,005	0,197	2,047	8,661
				Total	729,548	503,318	214,482	0,118	0,054	0,048	0,023	0,003	0,337	5,354	5,811

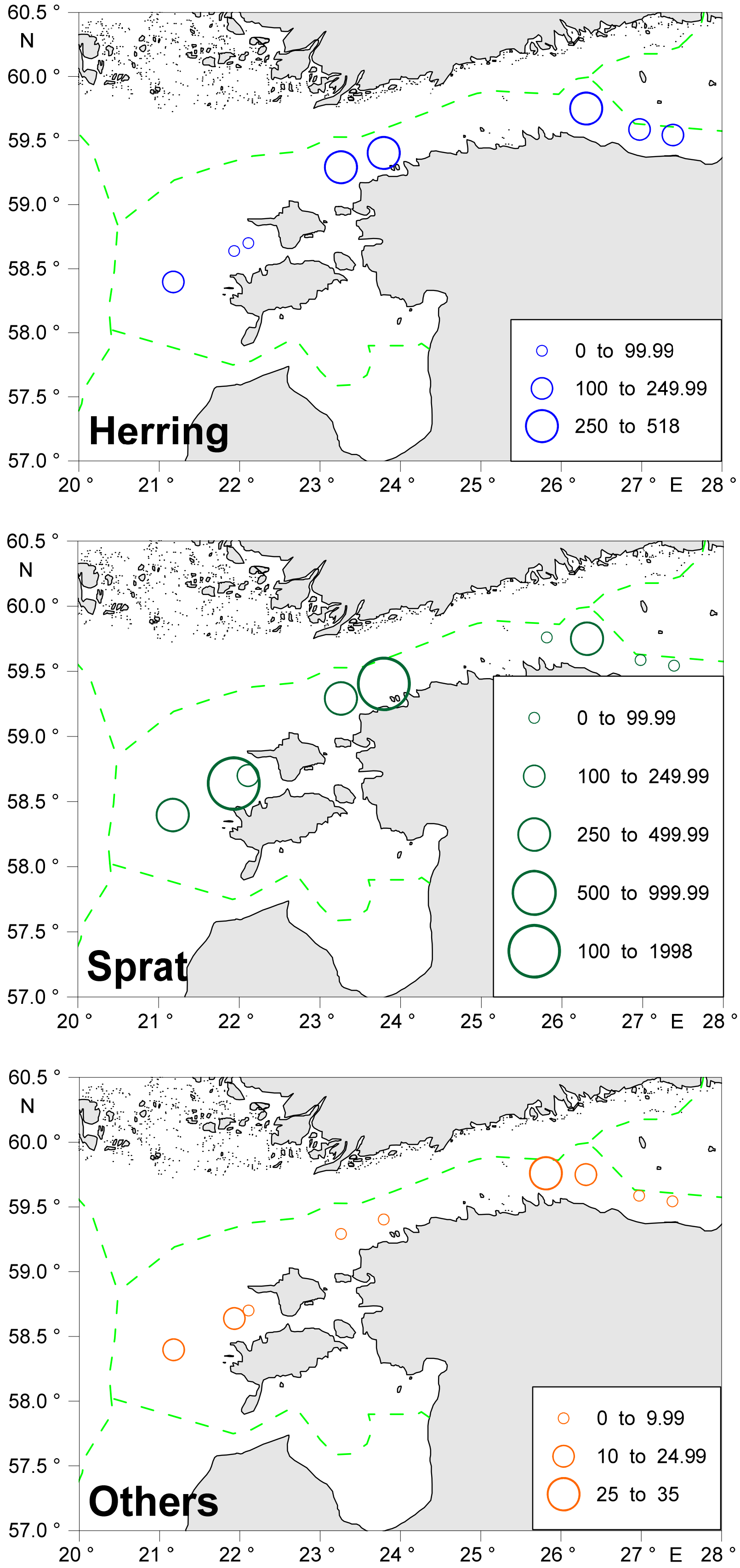


Fig. 2. Distribution of CPUE values (kg/h) for herring, sprat and other species in the pelagic fish control catches during EST-POL BIAS (October 2016).

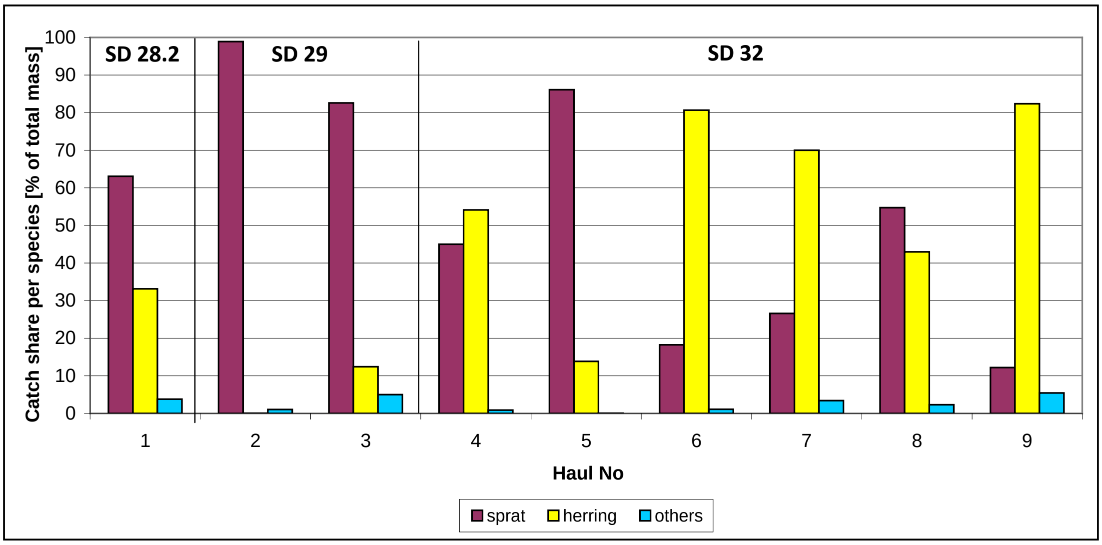


Fig. 3. Catch share per species [% of total mass] in particular control hauls during joint EST-POL BIAS (October 2016).

Table. 2. Biological sampling in the r.v.”Baltica” joint EST-POL BIAS in October 2016.

Fish biological material collected during EST-POL BIAS; r/v "Baltica", October 2016.

SD 28.2		SPRAT	HERRING	THREE SPINED STICKLEBACK	NINE SPINED STICKLEBACK	SMELT	EEL POUT	TOTAL
Samples taken	measurements	1	1	1	1	1	0	5
	analyses	1	1	0	0	0	0	2
Fish measured		205	261	50	10	1	0	527
Fish analysed		117	117	0	0	0	0	234

SD 29		SPRAT	HERRING	THREE SPINED STICKLEBACK	NINE SPINED STICKLEBACK	SMELT	EEL POUT	TOTAL
Samples taken	measurements	2	2	2	2	0	0	8
	analyses	2	2	0	0	0	0	4
Fish measured		444	197	98	46	0	0	785
Fish analysed		123	98	0	0	0	0	221

SD 32		SPRAT	HERRING	THREE SPINED STICKLEBACK	NINE SPINED STICKLEBACK	SMELT	EEL POUT	TOTAL
Samples taken	measurements	6	6	6	6	6	1	31
	analyses	6	6	0	0	0	0	12
Fish measured		1270	1801	301	76	197	10	3655
Fish analysed		180	339	0	0	0	0	519

Sum SDs		SPRAT	HERRING	THREE SPINED STICKLEBACK	NINE SPINED STICKLEBACK	SMELT	EEL POUT	TOTAL
Samples taken	measurements	9	9	9	9	7	1	44
	analyses	9	9	0	0	0	0	18
Fish measured		1919	2259	449	132	198	10	4967
Fish analysed		420	554	0	0	0	0	974

Zooplankton samples collected during EST-POL BIAS; r/v "Baltica", October2016.

Sub-divisi	stations	samples
28.2	1	1
29	2	2
32	6	6
Sum	9	9

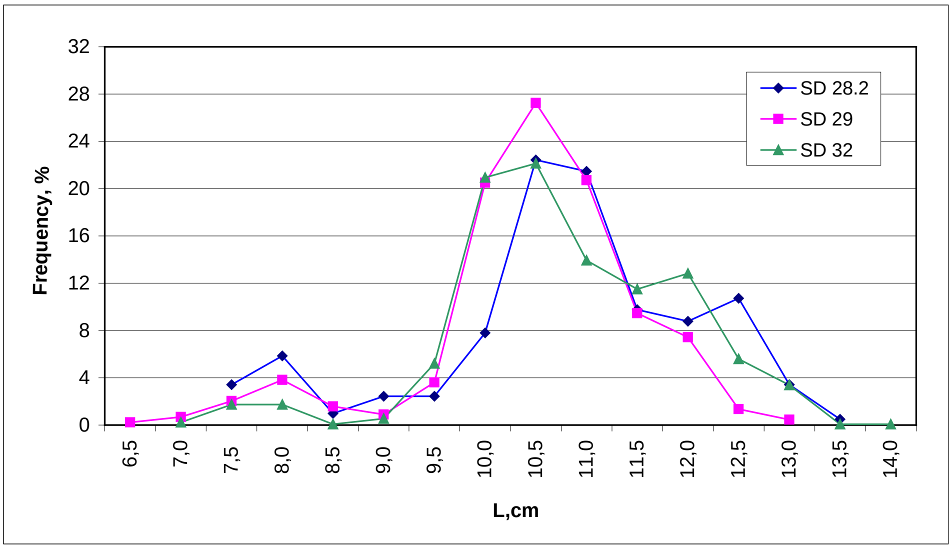


Fig. 4. Sprat length distributions from the control catches conducted by the rv. “Baltica” during joint EST-POL BIAS in the SDs 28.2, 29 and 32 (October 2016).

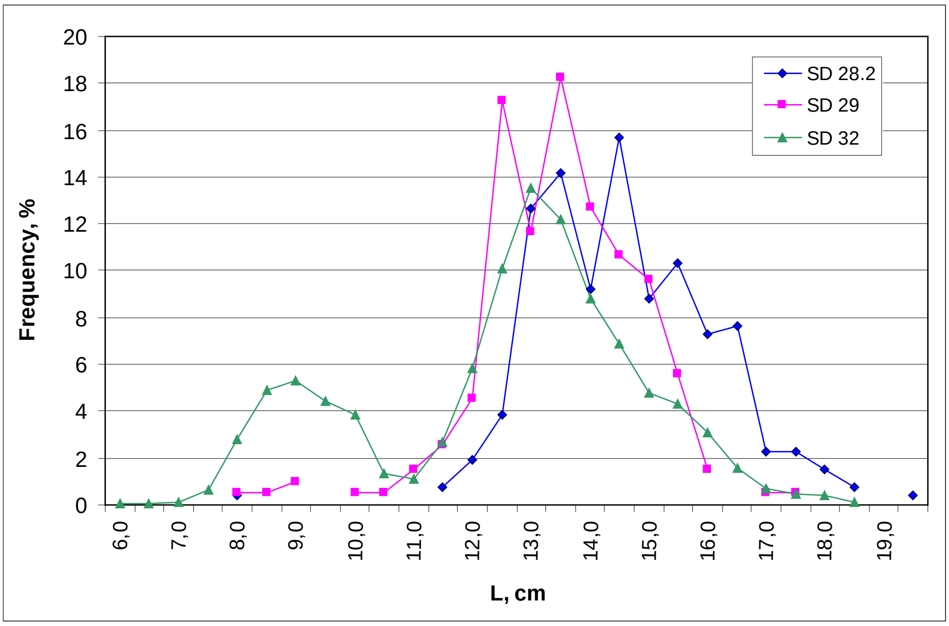


Fig. 5. Herring length distributions from the control catches conducted by the rv. “Baltica” during joint EST-POL BIAS in the SDs 28.2, 29 and 32 (October 2016).

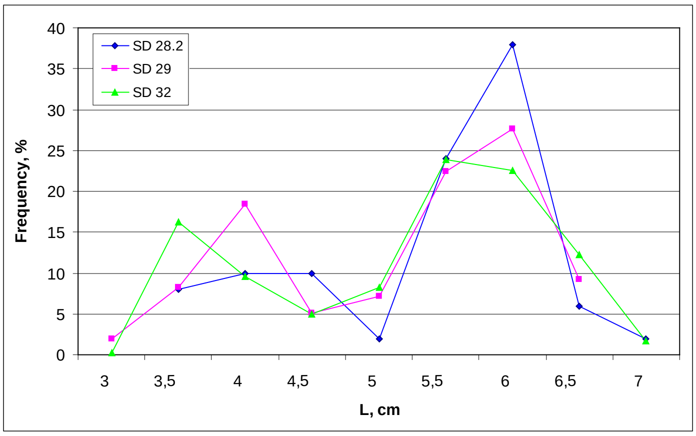


Fig. 6. Three-spined stickleback length distributions from the control catches conducted by the rv. “Baltica” during joint EST-POL BIAS in the SDs 28.2, 29 and 32 (October 2016).

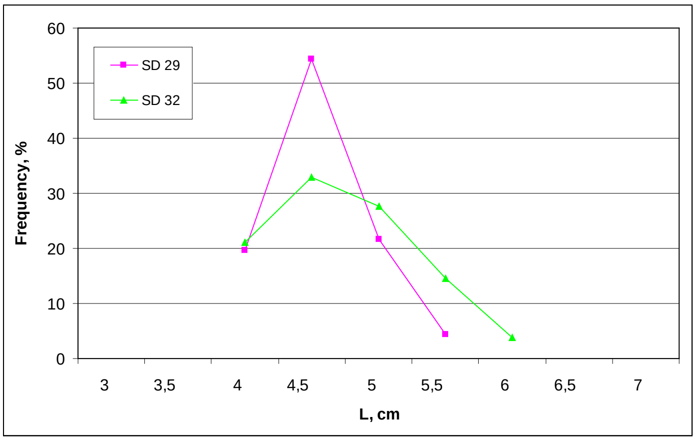


Fig. 7. Nine-spined stickleback length distributions from the control catches conducted by the rv. “Baltica” during joint EST-POL BIAS in the SDs 28.2, 29 and 32 (October 2016).

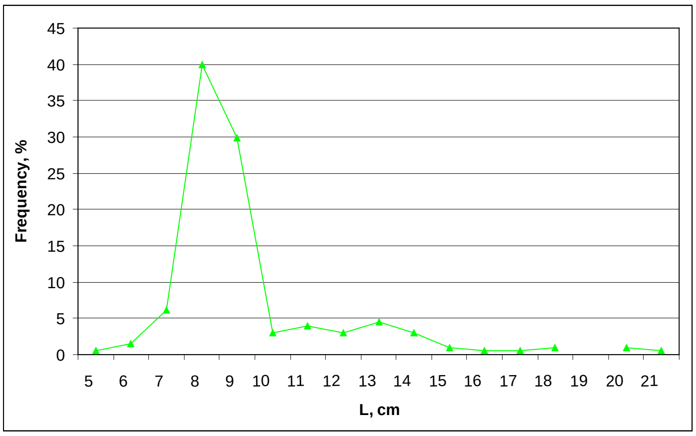


Fig. 8. Smelt length distributions from the control catches conducted by the rv. “Baltica” during joint EST-POL BIAS in the SD 32 (October 2016).

Table 3. The BIAS survey basic biological and acoustic data concerning the clupeid stocks inhabiting the north- eastern Baltic Sea in October 2016.

ICES Sub-div.	ICES rectangle	Area [NM^2]	Share [%-indiv.]		Total abundance [x10^6]	Abundance density [10^6/NM^2]	NASC [m^2/NM^2]	σ [cm²]
			herring	sprat				
28	45H0	947.2	3,1	34,3	8917,93	9,415	618,9	0,657
28	45H1	827.1	14,4	65,0	7950,35	9,612	1082,8	1,127
29	46H1	921.5	0,1	94,2	7145,14	7,754	814,4	1,050
29	46H2	258.0	4,7	67,9	1282,29	4,970	448,7	0,903
29	47H1	920.3	30,6	53,7	9202,00	9,999	1229,2	1,229
29	47H2	793.9	32,6	62,5	32609,50	41,075	5202,4	1,267
32	47H3	536.2	19,0	78,7	7009,79	13,073	1575,0	1,205
32	48H4	835.1	66,1	19,3	19868,09	23,791	3708,8	1,559
32	48H5	767.2	66,1	19,3	20202,23	26,332	4104,9	1,559
32	48H6	776.1	46,2	44,1	7061,84	9,099	1130,5	1,242
32	48H7	851,4	70,7	20,6	5500,64	6,461	785,4	1,216
Average			**32,1**	**50,9**		**14,851**	**1881,9**	**1,183**
Total		**8434**			**126750**			

Table 4. Abundance (in 10^6 indiv.) of herring and sprat per age groups according to the ICES rectangles and Sub-divisions of the north-eastern Baltic in October 2016.

ICES	ICES rectangle	HERRING – age groups									
Sub-div.		0	1	2	3	4	5	6	7	8+	total
28	45H0	37,94	2,96	150,54	42,01	24,78	10,97	0,99	3,57	5,79	279,54
28	45H1	4,39	17,57	536,18	205,51	184,87	119,44	8,78	25,91	43,47	1146,13
total		42,33	20,53	686,71	247,52	209,66	130,41	9,77	29,47	49,26	1425,67
29	46H1	4,17	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	4,17
29	46H2	1,53	4,84	34,44	8,32	6,32	2,98	0,00	0,31	0,95	59,69
29	47H1	85,35	109,94	1654,30	377,64	263,59	227,45	0,00	38,38	59,46	2816,09
29	47H2	199,44	892,35	5787,16	1199,61	929,17	1196,68	0,00	139,17	294,79	10638,36
total		290,49	1007,12	7475,90	1585,57	1199,08	1427,11	0,0	177,85	355,20	13518,31
32	47H3	14,04	52,12	498,93	396,56	118,57	139,29	45,62	42,26	25,51	1332,92
32	48H4	230,99	1045,24	6527,01	3842,52	581,00	660,01	86,84	78,26	75,07	13126,95
32	48H5	234,88	1062,82	6636,78	3907,14	590,77	671,11	88,30	79,58	76,33	13347,72
32	48H6	1237,32	256,28	1108,28	518,81	54,81	65,55	12,00	9,22	0,00	3262,26
32	48H7	2224,89	141,05	494,62	534,77	192,89	183,95	54,71	46,63	15,64	3889,15
total		3942,12	2557,5	15265,62	9199,8	1538,05	1719,91	287,48	255,95	192,56	34959,0
Grand total		4274,94	3585,15	23428,24	11032,89	2946,78	3277,43	297,25	463,28	597,03	49902,98

Table 4. Continued

ICES Sub-div.	ICES rectangle	SPRAT – age groups									
		0	1	2	3	4	5	6	7	8+	Total
28	45H0	753,84	243,67	1390,88	341,36	117,47	88,14	12,47	31,40	83,99	3063,23
28	45H1	655,53	447,87	2458,32	601,26	290,07	266,53	79,24	154,88	214,91	5168,61
total		1409,37	691,54	3849,19	942,63	407,54	354,68	91,71	186,28	298,90	8231,83
29	46H1	838,04	806,66	4130,30	797,63	38,91	53,87	29,93	38,91	0,00	6734,25
29	46H2	51,68	161,92	545,45	89,44	5,37	7,35	3,98	5,37	0,00	870,55
29	47H1	155,00	767,01	3170,23	618,57	52,53	68,65	51,81	57,91	0,00	4941,72
29	47H2	2622,20	5788,59	10117,29	1448,61	79,12	153,87	107,97	79,12	0,00	20396,77
total		3666,91	7524,19	17963,27	2954,26	175,92	283,75	193,69	181,30	0,00	32943,29
32	47H3	646,57	1191,18	3231,00	206,66	50,13	86,03	55,99	17,72	31,19	5516,49
32	48H4	40,91	554,86	1844,54	410,24	219,83	363,59	232,28	63,35	107,67	3837,27
32	48H5	41,60	564,20	1875,57	417,14	223,52	369,71	236,18	64,41	109,48	3901,81
32	48H6	3,99	427,51	1606,85	310,09	143,81	273,55	179,98	50,94	120,48	3117,20
32	48H7	5,38	141,84	591,65	128,32	50,64	90,15	62,36	20,68	44,79	1135,822
total		738,46	2879,59	9149,61	1472,45	687,93	1183,03	766,79	217,10	413,62	17508,59
Grand total		5814,74	11095,32	30962,08	5369,33	1271,39	1821,46	1052,19	584,68	712,52	58683,72

Table 5. Biomass (in tons) of herring and sprat per age groups according to the ICES rectangles and Sub-divisions of the north-eastern Baltic in October 2016.

ICES	ICES rectangle	HERRING – age groups									
Sub-div.		0	1	2	3	4	5	6	7	8+	total
28	45H0	4,74	32,14	2270,86	740,32	505,58	259,94	24,90	95,48	151,95	4085,91
28	45H1	14,05	178,64	8204,58	3706,48	3989,72	2909,24	240,86	660,23	1145,91	21049,70
total		18,80	210,77	10475,43	4446,80	4495,29	3169,17	265,77	755,71	1297,86	25135,61
29	46H1	19,61	0	0	0	0	0	0	0	0	19,61
29	46H2	8,61	53,68	508,20	149,67	132,99	66,22	0	7,35	21,18	947,89
29	47H1	125,99	1240,29	23389,02	6280,75	5207,84	4886,85	0	829,15	1414,68	43374,57
29	47H2	422,25	9808,78	79188,97	20296,74	18541,90	26425,15	0	3006,70	7244,03	164934,52
total		576,47	11102,74	103086,19	26727,15	23882,73	31378,22	0	3843,20	8679,89	209276,59
32	47H3	34,40	553,42	6908,60	6948,45	2515,71	2948,43	1083,74	1013,35	626,53	22632,62
32	48H4	1259,90	10843,92	92405,55	71673,77	13353,98	15172,96	2306,62	1980,59	2531,01	211528,30
32	48H5	1281,09	11026,30	93959,66	72879,20	13578,57	15428,14	2345,41	2013,90	2573,58	215085,90
32	48H6	6161,85	2426,80	15754,96	9390,20	1272,20	1495,33	321,58	252,47	0	37075,39
32	48H7	10431,21	1178,32	7678,26	10762,07	4930,49	4776,47	1619,18	1442,71	568,25	42818,70
total		19168,43	26028,76	216707	171653,70	35650,96	39821,33	7676,53	6703,02	6299,38	529140,90
Grand total		19764	37342	330269	202828	64029	74369	7942	11302	16277	763553

Table 5. Continued

ICES Sub-div.	ICES rectangle	SPRAT – age groups 0	1	2	3	4	5	6	7	8+	total
28	45H0	2834,60	1596,13	10790,11	3019,30	1065,96	895,45	137,04	354,77	686,80	21380,16
28	45H1	2203,59	2986,65	18888,68	5421,54	2833,24	2846,41	870,92	1740,76	2278,77	40070,57
total		5038,19	4582,79	29678,80	8440,84	3899,20	3741,86	1007,96	2095,53	2965,57	61450,72
29	46H1	2621,87	5130,68	32224,53	6881,93	393,88	573,46	341,20	393,88	0,00	48561,43
29	46H2	177,69	1041,50	4090,44	763,57	56,54	80,39	47,83	56,54	0,00	6314,50
29	47H1	577,44	4676,61	23341,75	5256,49	537,53	717,04	557,79	537,53	0,00	36202,19
29	47H2	7472,95	33822,96	71418,28	12154,12	786,06	1618,29	1184,40	786,06	0,00	129243,12
total		10849,94	44671,76	131075,00	25056,11	1774,01	2989,18	2131,22	1774,01	0,00	220321,25
32	47H3	1846,29	7555,25	21838,66	1730,90	478,14	856,32	567,18	176,06	338,22	35387,01
32	48H4	175,64	3508,15	13712,36	3769,29	2150,53	3669,94	2454,12	665,28	1257,25	31362,55
32	48H5	178,59	3567,15	13942,98	3832,69	2186,70	3731,67	2495,39	676,47	1278,40	31890,02
32	48H6	14,78	3125,80	12956,32	2939,42	1466,19	2919,64	1993,66	568,09	1470,41	27454,33
32	48H7	19,38	943,92	4694,44	1222,69	518,31	957,72	683,33	224,58	548,38	9812,75
total		2234,67	18700,26	67144,76	13494,99	6799,86	12135,29	8193,68	2310,49	4892,66	135906,67
Grand total		18123	67955	227899	46992	12473	18866	11333	6180	7858	417679

Table 6. Mean weight (in grams) of herring and sprat per age groups, according to the ICES rectangles of the north-eastern Baltic in October 2016.

ICES Sub-div.	ICES rectangle	HERRING – age groups									
		0	1	2	3	4	5	6	7	8+	avg.
28	45H0	0,13	10,84	15,09	17,62	20,40	23,70	25,20	26,78	26,25	14,62
28	45H1	3,20	10,17	15,30	18,04	21,58	24,36	27,43	25,48	26,36	18,37
29	46H1	4,70									4,70
29	46H2	5,63	11,10	14,76	17,99	21,04	22,20		24,00	22,24	15,88
29	47H1	1,48	11,28	14,14	16,63	19,76	21,49		21,61	23,79	15,40
29	47H2	2,12	10,99	13,68	16,92	19,96	22,08		21,61	24,57	15,50
32	47H3	2,45	10,62	13,85	17,52	21,22	21,17	23,76	23,98	24,56	16,98
32	48H4	5,45	10,37	14,16	18,65	22,98	22,99	26,56	25,31	33,71	16,11
32	48H5	5,45	10,37	14,16	18,65	22,98	22,99	26,56	25,31	33,71	16,11
32	48H6	4,98	9,47	14,22	18,10	23,21	22,81	26,79	27,39		11,36
32	48H7	4,69	8,35	15,52	20,12	25,56	25,97	29,59	30,94	36,33	11,01

Table 6. Continue

ICES Sub-div.	ICES rectangle	SPRAT – age groups									
		0	1	2	3	4	5	6	7	8+	avg.
28	45H0	3,76	6,55	7,76	8,84	9,07	10,16	10,99	11,30	8,18	6,98
28	45H1	3,36	6,67	7,68	9,02	9,77	10,68	10,99	11,24	10,60	7,75
29	46H1	3,13	6,36	7,80	8,63	10,12	10,64	11,40	10,12		7,21
29	46H2	3,44	6,43	7,50	8,54	10,54	10,93	12,03	10,54		7,25
29	47H1	3,73	6,10	7,36	8,50	10,23	10,44	10,77	9,28		7,33
29	47H2	2,85	5,84	7,06	8,39	9,94	10,52	10,97	9,94		6,34
32	47H3	2,86	6,34	6,76	8,38	9,54	9,95	10,13	9,94	10,84	6,41
32	48H4	4,29	6,32	7,43	9,19	9,78	10,09	10,57	10,50	11,68	8,17
32	48H5	4,29	6,32	7,43	9,19	9,78	10,09	10,57	10,50	11,68	8,17
32	48H6	3,70	7,31	8,06	9,48	10,20	10,67	11,08	11,15	12,20	8,81

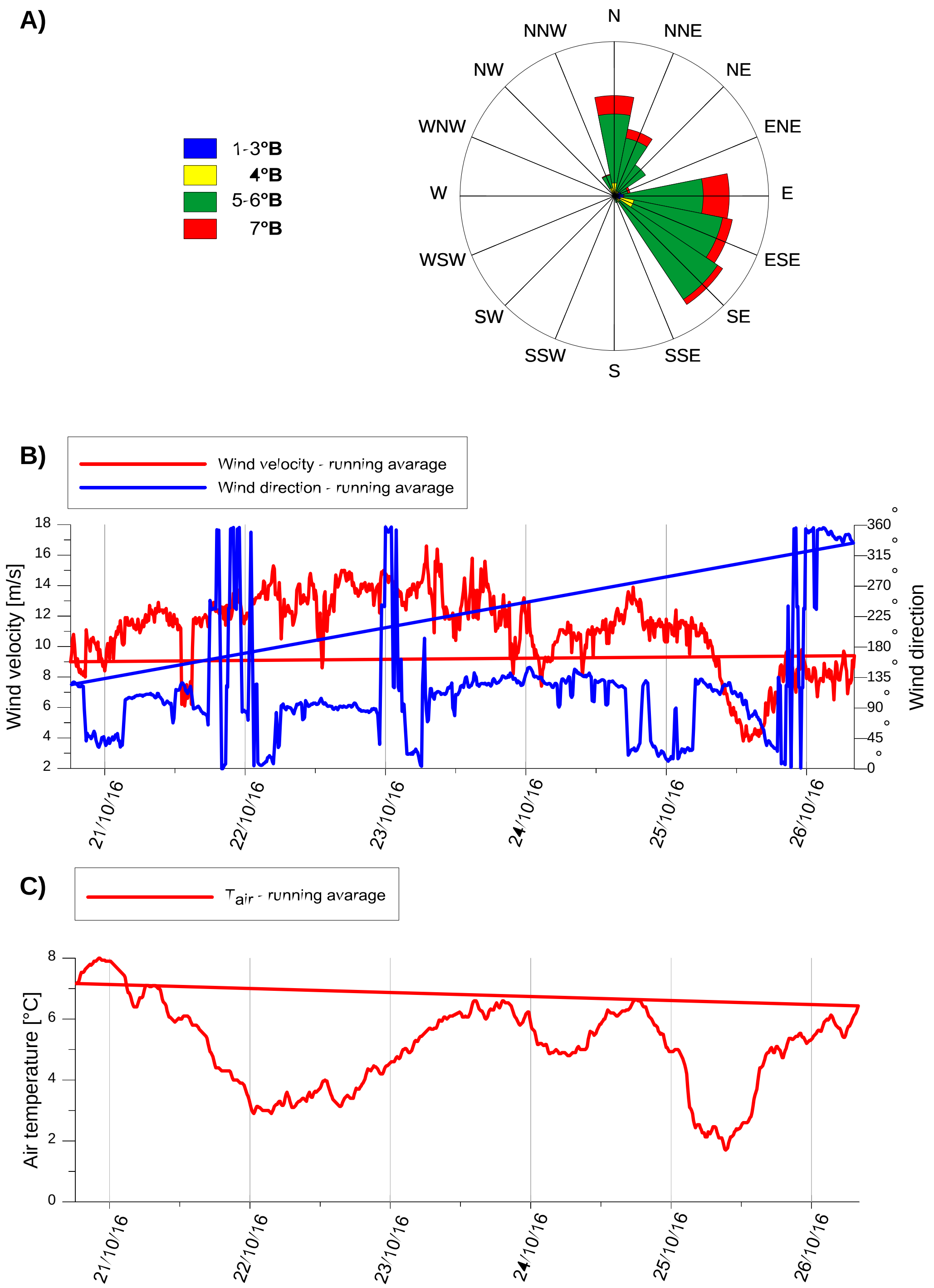


Fig. 9. Changes of the main meteorological parameters during EST-POL BIAS in October 2016.

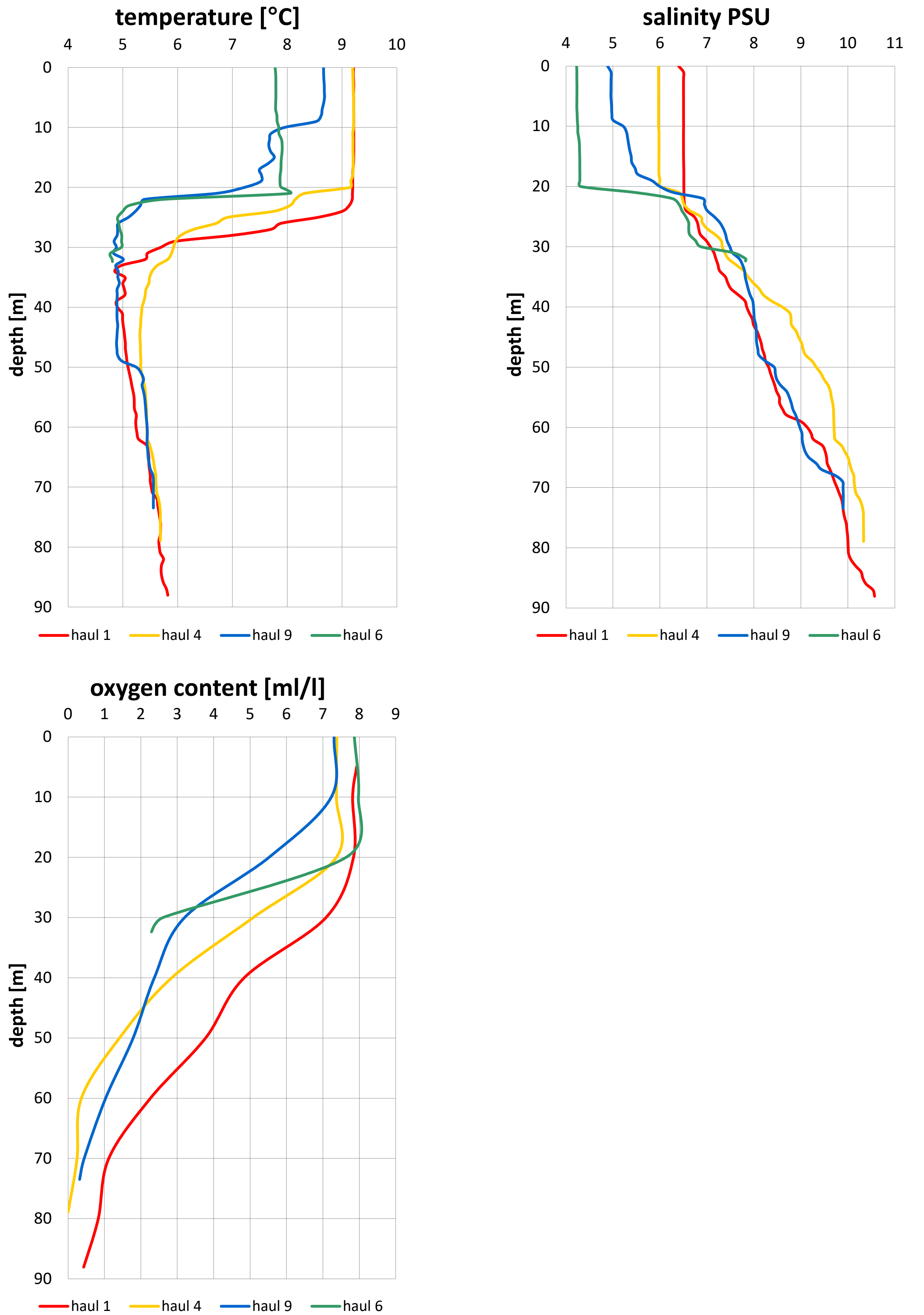


Fig. 10. Vertical distribution of the seawater temperature, salinity and oxygen content on the four chosen haul stations sampled during EST-POL BIAS (October 2016).

Fisheries Service under the Ministry of Agriculture of Republic of Lithuania,
Fishery Research and Science State

RESEARCH REPORT FROM THE BALTIC INTERNATIONAL ACOUSTIC SURVEY (BIAS) IN THE ICES SUBDIVISION 26 (LITHUANIAN ESPECIAL ECONOMIC ZONE) OF THE BALTIC SEA

(R/V "DARIUS"; 13.10. - 14.10.2016)

Working paper on the WGBIFS meeting in Riga, Latvia, 27.03-31.03.2017

Klaipeda, October, 2016
Lithuania

1 INTRODUCTION

The main objective is to assess clupeid resources in the Baltic Sea. The international acoustic survey in October is traditionally coordinated within the frame of the **Baltic International Acoustic Survey (BIAS).** The reported acoustic survey is conducted every year to supply the ICES: 'Baltic Fisheries Assessment Working Group (WGBFAS)' and Fisheries Service under the Ministry of Agriculture of The Republic of Lithuania (FS) with an index value for the stock size of herring, sprat and other species in the Subdivision 26 of the Baltic area.

The principal aims of the Lithuanian BIAS surveys organized and realized by the Division of Fishery research and science delegates on board of the R/V "Darius" were:

- annual verification of herring, sprat and cod stocks size and their spatial distribution in the pelagic zone of the Lithuanian Especial Economic Zone (LEEZ) waters with applied an acoustic method, along preselected transects on the distance of 124 nautical miles (NM),
- determination of herring, sprat and cod (usually dominants in catches) proportion by numbers and by mass in pelagic control-catches and an evaluation of their fishing efficiency, i.e. catch per unit effort (CPUE) in the investigated area,
- characteristics of dominants age-length-mass structure, sex, sexual maturation, feeding intensity,
- a preliminary evaluation of herring and sprat new recruiting year-class strength,
- analysis of the vertical and horizontal changes of the basic hydrological parameters (seawater temperature, salinity, oxygen content) in areas inspected by the R/V "Darius".

2 MATERIALS AND METHODS

2.1 Personnel

The main research tasks of the BIAS survey on board of the R/V "Darius" were realized by the Fishery Research and Science State (FS FRSS) two members of the scientific team. The group of researchers was composed of:

M. Spegys, FS FRSS, Klaipeda - cruise leader and acoustics;
J. Fedotova, FS FRSS, Klaipeda – scientific staff and fish sampling.
G. Macernius, FS FRSS, Klaipeda – fish sampling

2.2 Narrative

The reported BIAS survey of the R/V "Darius" took place during the period of 13-14 October in 2016. The vessel left the port of Klaipeda on 13.10.2016 early morning. On next day 14.10.2016 evening, the research activity had been stopped and the vessel returned back to the homeport. During research time was intended to cover parts of ICES subdivision (SD) 26, constituting the LEEZ.

2.3 Survey design

The area of international acoustic survey is limited by the 20 m depth line. The statistical rectangles of Subdivision 26 were used as strata (BIAS, ver. 0.82, ICES CM 2010/j: 1 Ref. Assess). The scheme of transects has been defined as the regular, of rectangular form, with the distance between transects of 15 nm. The average speed of a vessel for the all period of acoustic survey was 8.0 knots. The average speed of the vessel with a trawl was 3 knots; the trawling duration was standard 30 minutes. The survey was conducted in the daytime from 08:00 up to 17.00 of local time. All investigated area of survey constitutes the 2015 nm^2. The full cruise track with positions of the trawling is shown on Figure 1.

2.4 Calibration

The SIMRAD EK60 echo sounder with split beam transducer ES38 - 12 were calibrated in 28th of April in the Baltic Sea shore area The calibration procedure was carried out with a standard calibrated copper sphere, in accordance with the 'Manual for the Baltic International Acoustic

Surveys (BIAS) ("Manual for the Baltic International Acoustic Survey", Version 0.3-0.82, WGBIFS 2011 ICES CM 2011/ SSGESST:07).

THE RESULTS OF CALIBRATION PROCEDURE FOR EK60 SCIENTIFIC ECHOSOUNDER	
Date: 28.04.2014	Place : near Klaipeda port
Type of transducer	Split – beam for 38 kHz
Gain (38 kHz)	21.94 dB
Athw. Angle Sens	12.5
Along. Angle Sens	12.5
Athw. Beam Angle	12.06
Along. Beam Angle	11.96
Athw. Offset Angle	0.08
Along. Offset Angle	-0.15
SA Correction (38 kHz)	-0.18 dB

2.5 Acoustic data collection

The acoustic sampling was performed around the clock. The main pelagic species of interest were herring and sprat. The SIMRAD EK60 echo sounder with hull mounted 38 kHz transducer ES38-12 was used during the cruise. The specific settings of the hydro acoustic equipment were used as described in the BIAS manual (ICES 2011). The post-processing of the stored echo signals was made using the Sonar4 (Balk & Lindem, 2005). The mean volume back scattering values Sv, were integrated over 1 nm intervals, from 10 m below the surface to the bottom. Contributions from air bubbles, bottom structures and noise scattering layers were removed from the echogram using Sonar4.

2.6 Biological data – fishing stations

All trawling were done with the pelagic gear "OTM" in the midwater as well as near the bottom. The mesh size in the codend was 20 mm. The intention was to carry out at least two hauls per ICES statistical rectangle. The trawling depth was chosen by the echogram, in accordance to the characteristic of echo records from the fish. Normally, the trawl had vertical opening of about 12 m. The trawling time of the single haul lasted for 30 minutes. On the whole, 6 catch samples were taken in the Lithuanian EEZ. From each haul sub-samples were taken to determine length and weight composition of fish. Samples of herring and sprat were analyzed for further investigations on the board of vessel (i.e. sex, maturity, age).

2.7 Data analysis

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

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

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

The total number of fish (total N) in each rectangle was estimated as the product of the mean NASCs scrutinized acoustic data and a rectangle area, divided by corresponded the mean acoustic cross-section. Clupeids abundance was separated into herring and sprat according to the mean catch composition.

After finalization of each trawling, a hydrographic measurement was executed. The vertical profiles of hydrographical parameters, (temperature, salinity of water and the oxygen dissolved in water) were taken with a "SBE-19 plus" probe.

3. RESULTS

3.1 Biological data

Caught fishes, before the length measurements, were separated by species and weighed, and the species composition, the mean share in mass (proportion) as well as the CPUE was determined for given species from each control-haul. The sample of fish dominants from each catch-station was taken for the length-mass structure analyses. Fish sampling the total length distribution and the mean mass at the 0.5 cm classes - in the case of clupeids and 1 cm classes in the case of cod were determined. Overall, in 6 trawl hauls was measured for 843 herring, 1140 sprat, 2 cods, 2 shorthorn sculpins, and 1 smelt. Totally, 422 individuals of sprat, 510 of herring and 2 of cod were biologically analyzed (age, sex, maturity, stomach fullness). The results of the catch composition are presented in Table 1. Ichthyological analyses were performed directly on board of surveying vessel, according to the ICES WGBIFS standard procedures. The numerical share of juvenile, undersized (below minimum landing/protective size) sprat, herring and cod in samples was determined based on fish length distribution results. For sprat, the minimum commercial size (the separate length) is equal to 10.0 cm, for herring is equal to 16.0 cm and for cod is 35.0 cm.

The length distributions of herring and sprat of the October 2016 presented in Fig. 3 and 4. Both rectangles were represented practically by sprat. In the coastal rectangle (40H0) herring was only 37%. Most of its was fish of 15.5–21.5 cm length class. There were no young (0+ age class) fish and a little herring recruitment (age 1) – 0.8%. In 40G9 rectangle herring stock was represented 15.5–20.5 cm length class without young herring too.

Sprat was represented by two size groups in the rectangle 40H0: 7.0–8.5 cm and 10.0–12.0 cm. And more than 55% of sprat was fish of this year generation. (age 0+). In the western part of LEEZ (40G9 rectangle ICES) sprat was represented practically of adult fish 10.5-13.5 cm length classes.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean S_a , the mean scattering cross-section σ, the estimated total number of fish, the percentages of herring, sprat per rectangle are shown in Table 2-12. Nautical area scattering coefficient distribution during survey is show in Figure 2.

3.3 Abundance estimates

R/V "Darius" survey statistics (aggregated data for herring and sprat), included the total abundance of herrings and sprats are presented in tables 2-4. The estimated age composition of sprat and herring are given in Table 5 and Table 10. The estimated number sprat and herring by age group and rectangle are given in Table 6 and Table 11. The estimates of sprat and herring biomass by age group and rectangle are summarised in Table 7 and Table 12. The corresponding mean weights and mean length by age group and rectangle for each species are shown in tables 8-9 and tables 13-14.

The herring stock was estimated to be $2269.8*10^6$ fish or about 102696.2 tones. The abundance estimates were dominated by 3 - 6 ages herring in rectangle 40H0 and by 2-6 ages herring in rectangle 40G9 (Fig. 2 and Table 8).

The sprat stock was estimated to be $3457.1*10^6$ fish or about 25456.9 tones. More than 55% of all aged sprats were young (0+ age class) fish in rectangle 40H0 and by ages 2-5 fish (86%) in the rectangle 40G9 (Fig. 3 and Table 5).

Comparison of the acoustic results from last five years (2010-2014) indicated that investigated herring stock abundance have decreasing tendency in ICES rectangle 40H0. In 2016 was recorded the highest average parameters of the herring stock densities in this rectangle (Fig.5). At the same time investigated sprat stock have decreasing tendency in this rectangle in 2013-2014 The distribution of the high density sprat concentrations were indicated in the northern part of the ICES rectangle 40H0 (Fig.6).

3.4 Hydrologic data

The basic hydrological parameters (seawater temperature, salinity and oxygen contents) were measured from the surface to the bottom after every haul. Totally, 6 hydrological stations were inspected during survey. The hydrological research profiles location is presented in Figure 7.
The seawater temperature varied from 7 ºC to 10 ºC in the surface layer in 40H0 and 40G9 ICES rectangles. The lowest temperature (about 2 ºC lower then in surface) was in 30 -40 m depth. Deeper temperate equable grow. The salinity is 7.5 -8 ‰ in all area and strata. There was no oxygen deficit in this survey.

4.0 REFERENCES

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

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

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

ICES. 2011. Report of the Baltic International Fish Survey Working Group (WGBIFS), March 2011, Kaliningrad, Russia. ICES CM 2011/SSGESST:07. 102 p.

Figure 1. The survey grid and trawl hauls position of R/V "DARIUS" (13-14 October 2016)

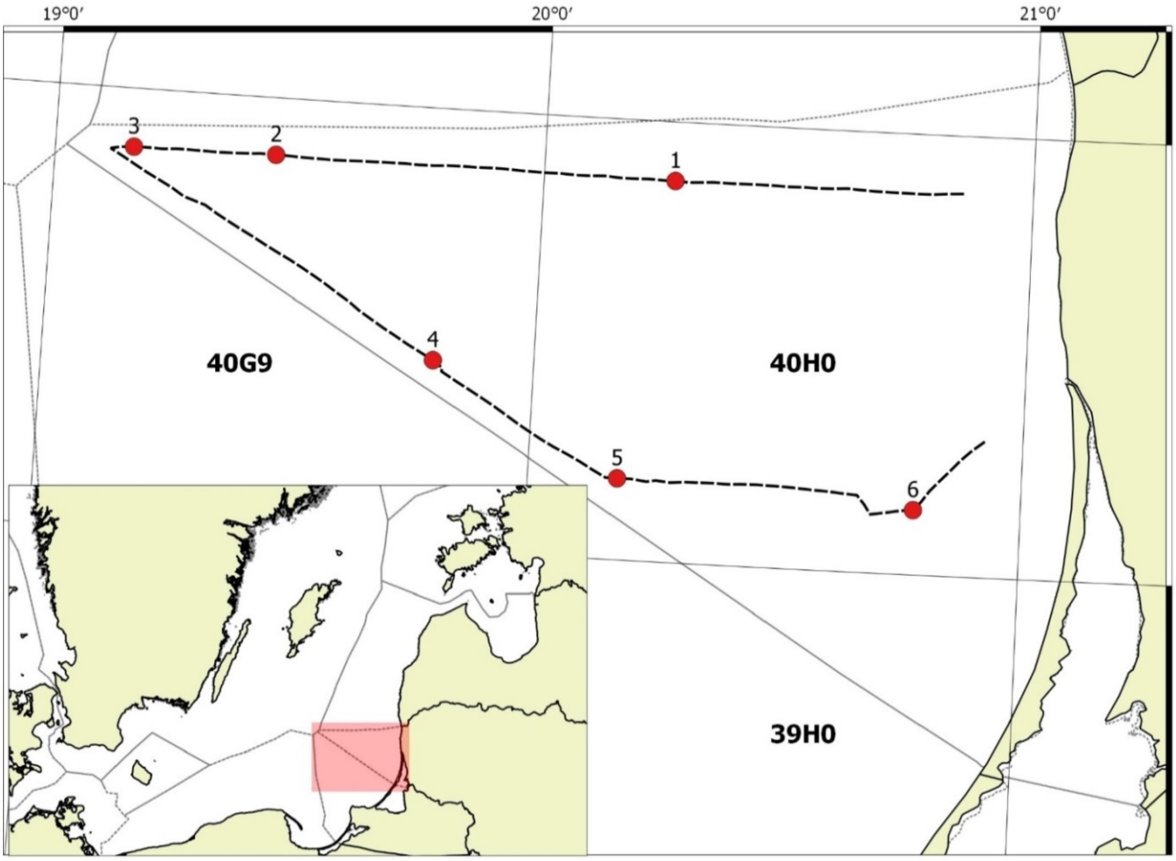


Figure 2. Mean nautical area scattering coefficient (NASC) per 3nmi of R/V "DARIUS" (13-14 October 2016)

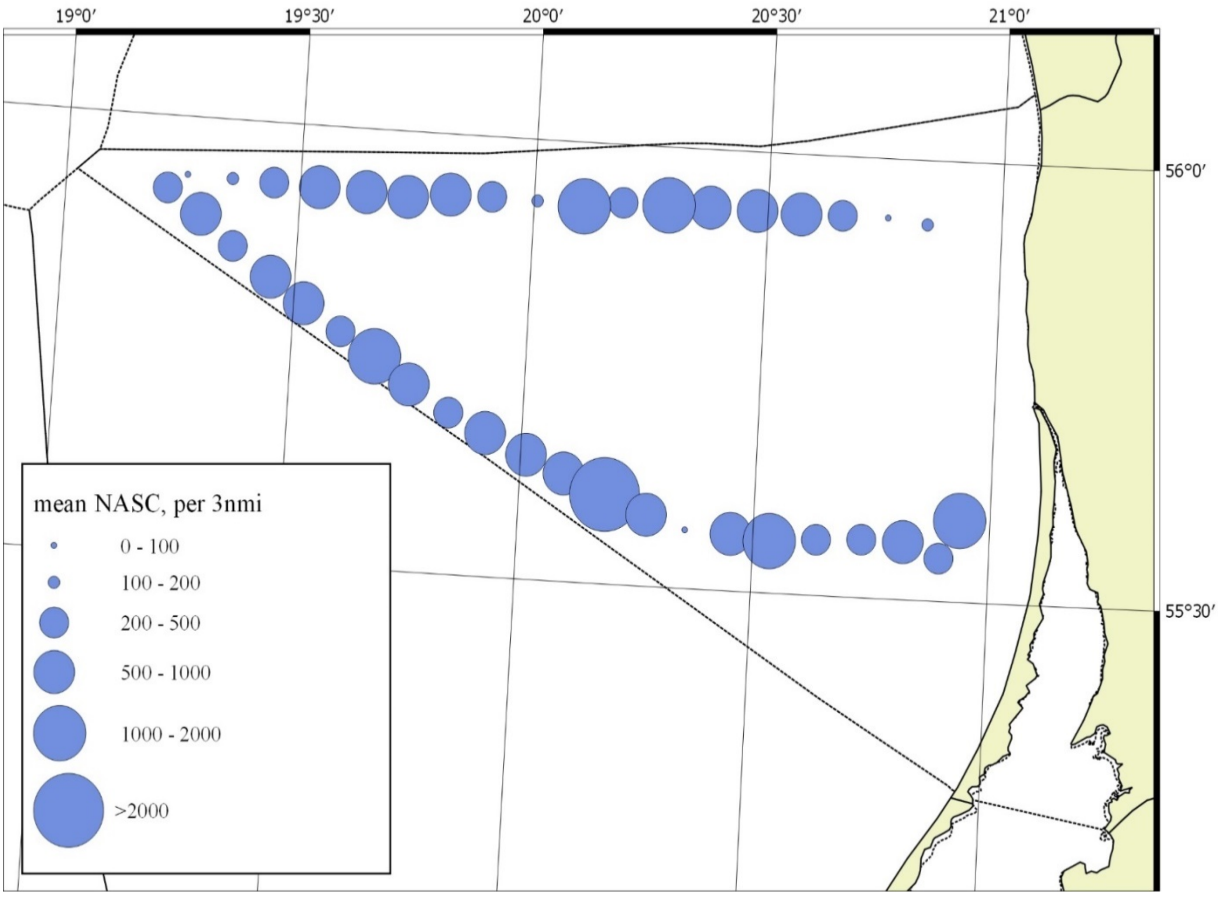
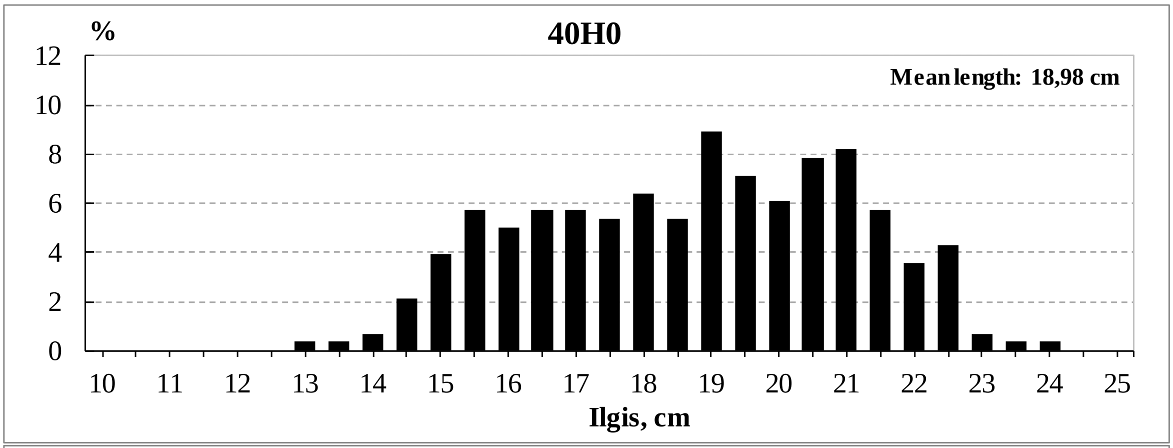


Table 1. Catch composition (kg/1hour) per haul (R/V "Darius", 13.10- 14.10.2016)

ICES subdivision 26						
Haul No	1	2	3	4	5	6
Date	13.10.2016	13.10.2016	13.10.2013	14.10.2016	14.10.2016	14.10.2016
Validity	Valid	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	40H0	40H0	40G9	40G9	40G9	40H0
CLUPEA HARENGUS		1.75	31.944	77.3	180.00	191.056
SPRATTUS SPRATTUS	2	30	9.5	342.7		5,808.94
GADUS MORHUA				0.96		2.688
SHORTHORN SCULPIN	0.472					
SMELT	0.024					
Total	2.496	31.75	41.444	420.96	180	6002.688

Figure 3. Length composition of herring (%) (R/V "Darius", 13.10- 14.10.2016



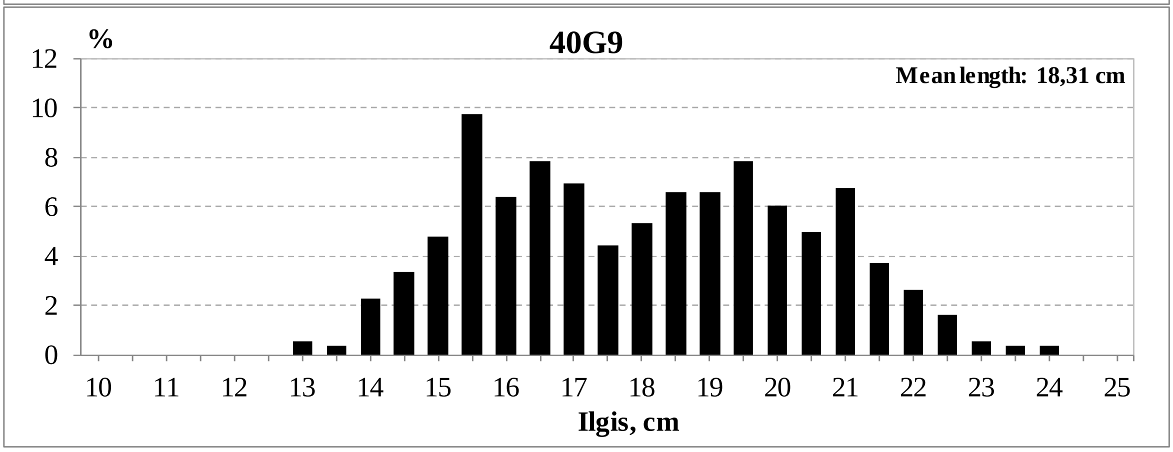
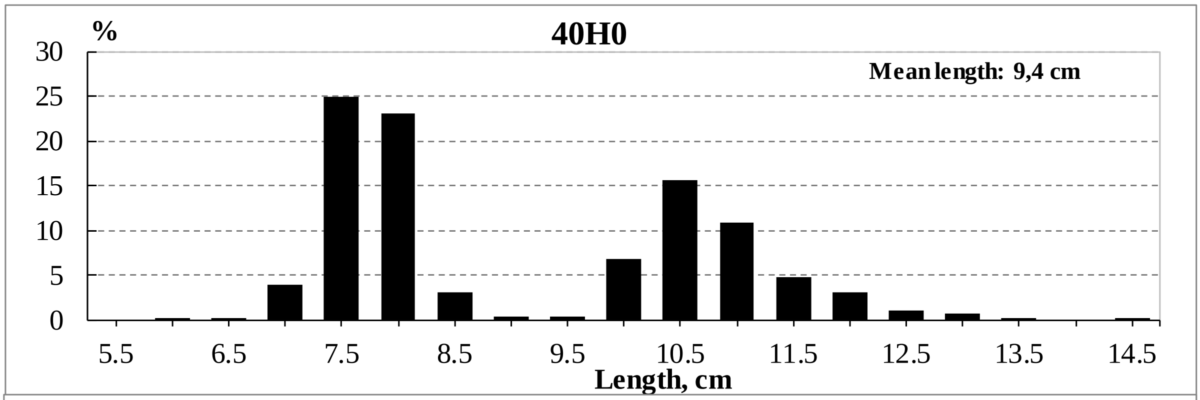


Figure 4 Length distribution of sprat (%) (R/V "Darius", 13.10- 14.10.2016)



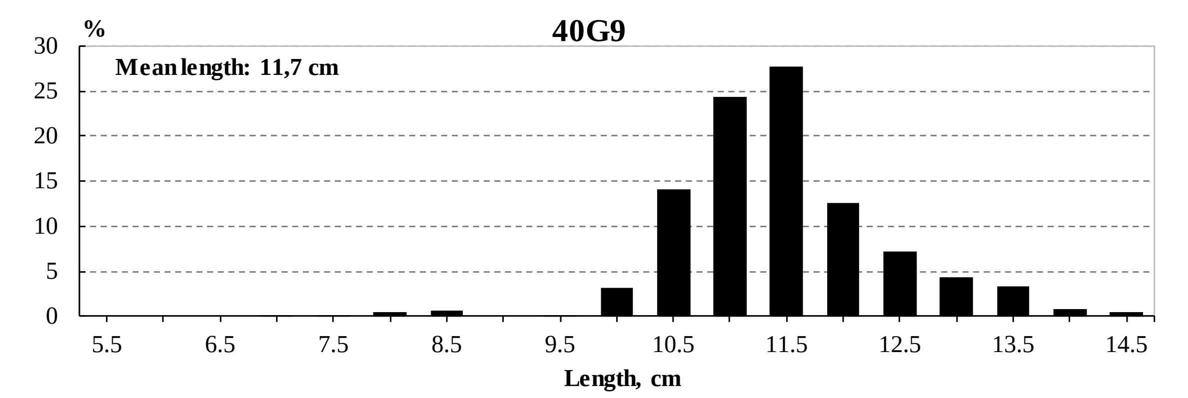


Table 2 R/V "DARIUS" survey statistics (abundance of herring and sprat), 13.10- 14.10.2016

ICES SD	ICES Rect.	Area nm^2	ρ mln/nm^2	Abundance, mln			Biomass, tonn		
				N sum	N her	N spr	W sum	W her	W spr
26	40H0	1012,1	3.87	3917.9	1435.9	2482.0	77703	62525.7	15177.6
	40G9	1013,0	1.79	1810.0	833.9	976.1	50450	40170.5	10279.3

Table 3 R/V "DARIUS" survey statistics (aggregated data of herring and sprat), 13.10- 14.10.2016

ICES SD	ICES Rect.	No trawl	Herring			Sprat			SA m^2/nm^2	TS calc. dB
			L, cm	w, g	Numb.,%	L, cm	w, g	Numb.,%		
26	40H0	1,5,6	18.98	43.55	36.65	9.36	6.12	63.35	706.1	-48.4
	40G9	2,3,4	18.31	48.17	46.07	11.69	10.53	53.93	393.9	-47.6

Table 4 R/V "DARIUS" survey statistics (herring and sprat), 13.10- 14.10.2016

ICES SD	ICES Rect.	Area nm^2	SA m^2/nm^2	σ *10^4 nm^2	Abundance mln.	Species composition (%)	
						herring	sprat
26	40H0	1012	706.1	1.82407	3917.9	36.65	63.35
	40G9	1013	393.9	2.20452	1810.0	46.07	53.93

Table 5 R/V "Darius" estimated age composition (%) of sprat, 13.10- 14.10.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	100,0	55.6	11.3	23.9	4.0	3.1	1.2	0.0	0.4	0.4
	40G9	100,0	1.4	3.9	33.4	29.6	16.2	6.8	4.4	2.9	1.4

Table 6 R/V "Darius" estimated number (millions) of sprat, 13.10- 14.10.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	2482.0	1379.5	279.9	593.0	100.2	78.1	30.8	0.0	10.3	10.3
	40G9	976.1	13.3	37.8	326.0	289.1	157.9	66.6	42.9	28.6	13.9

Table 7 R/V "Darius" estimated biomass (in tons) of sprat, 13.10- 14.10.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	15178	4534	2408	5558	1032	889	415	0	154	188
	40G9	10279	45	336	3134	2952	1770	855	578	412	197

Table 8 R/V "Darius" estimated mean weights (g) of sprat, 13.10- 14.10.2016

SD	Rect.	Age									
		Mean	0	1	2	3	4	5	6	7	8
26	40H0	6.12	3.3	8.6	9.4	10.3	11.4	13.5		15.0	18.4
	40G9	10.53	3.4	8.9	9.6	10.2	11.2	12.8	13.5	14.4	14.1

Table 9 R/V "Darius" estimated mean length (cm) of sprat, 13.10- 14.10.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	9.4	7.7	10.3	10.7	11.3	11.9	12.7		13.0	13.8
	40G9	11.7	8.1	10.6	11.0	11.4	11.8	12.5	12.7	13.1	13.0

Table 10 R/V "Darius" estimates age composition (%) of herring, 13.10- 14.10.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	100,0		0.8	9.2	19.9	23.2	17.7	13.9	8.0	7.3
	40G9	100,0		2.9	16.2	22.4	26.1	13.1	12.2	5.4	1.7

Table 11 R/V "Darius" estimated number (millions) of herring, 13.10- 14.10.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	1435.9		11.5	131.9	285.5	333.7	254.0	200.1	114.8	104.3
	40G9	833.9		24.1	135.1	186.4	217.8	109.5	101.9	44.9	14.2

Table 12 R/V "Darius" estimated biomass (in tons) of herring, 13.10- 14.10.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	62526		227	4117	8990	13465	12007	10657	6570	6492
	40G9	40170		612	4933	9087	10177	6203	5670	2667	822

Table 13 R/V "Darius" estimated mean weights (g) of herring, 13.10- 14.10.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	43.5		19.7	31.2	31.5	40.3	47.3	53.3	57.2	62.2
	40G9	48.2		25.5	36.5	48.7	46.7	56.7	55.7	59.3	57.9

Table 14 R/V "Darius" estimated mean length (cm) of herring, 13.10- 14.10.2016

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	18.98		14.3	16.6	16.8	18.4	19.5	20.2	20.7	21.4
	40G9	18.31		16	15.7	17.1	18.2	18.9	20.6	20.6	21.0

Figure 5. Biomass and abundance of herring by acoustic survey results from October of 2010 – 2016 in ICES rectangles 40HO and 40G9

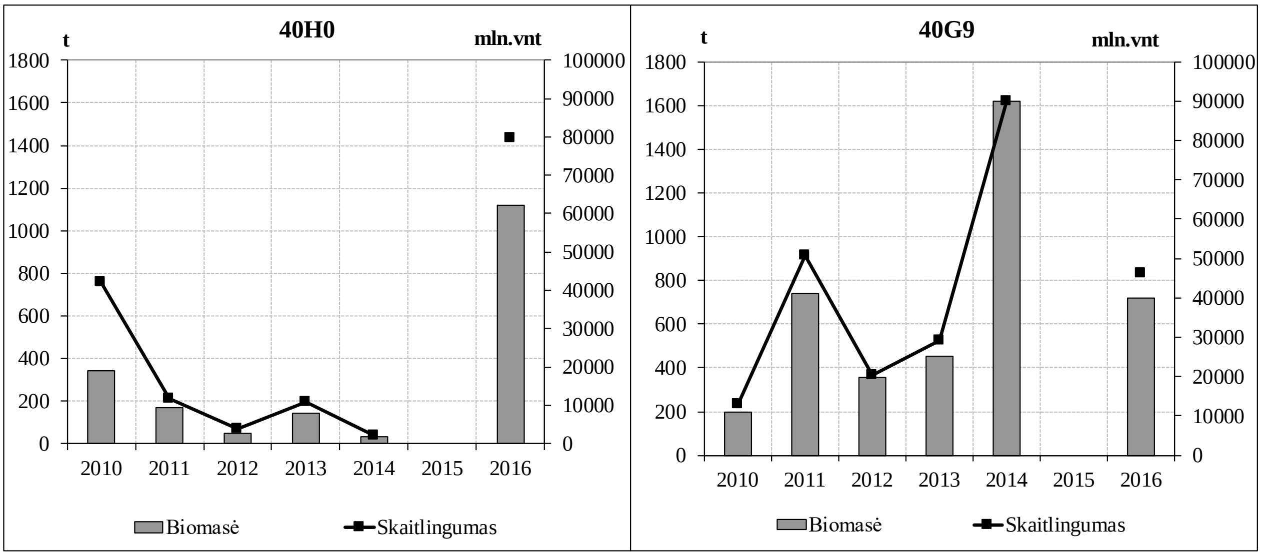


Figure 6. Biomass and abundance of sprat by acoustic survey results from October of 2010 – 2016 in ICES rectangles 40HO and 40G9

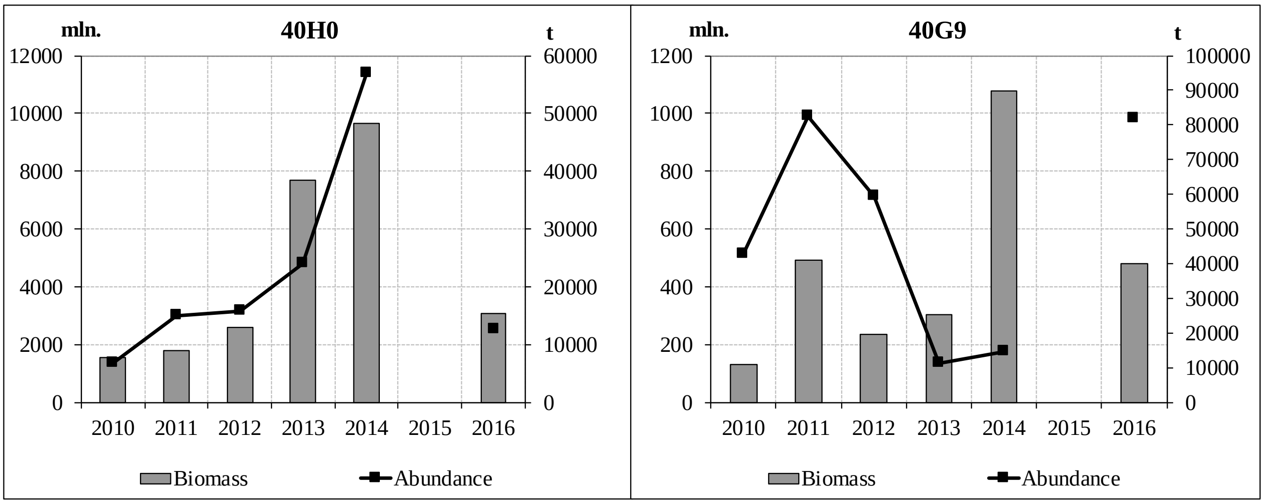
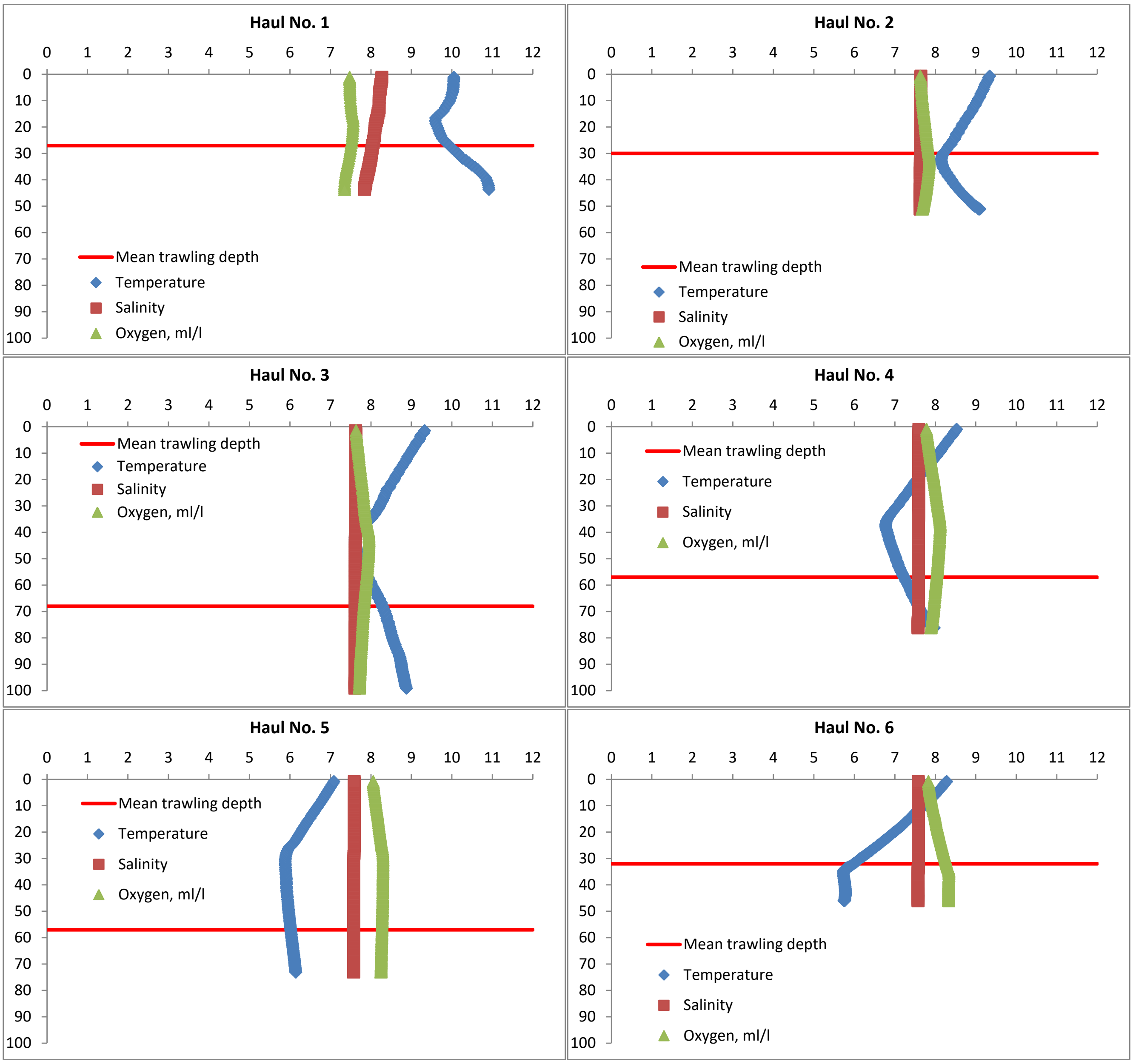


Figure 7. Hydrological parameters registered at the hydrological station from the Lithuanian BIAS survey conducted by r/v "Darius" in the period of 13.10-14.10.2016.



Research report from the Polish part of the Baltic International Acoustic Survey on board of the r.v. “Baltica” (13-30.09.2016)

Grzegorz Kruk, Mirosław Wyszyński, Bartosz Witalis and Włodzimierz Grygiel
National Marine Fisheries Research Institute, Gdynia (Poland)

INTRODUCTION

In October 1982, the Sea Fisheries Institute (SFI) in Gdynia (currently named National Marine Fisheries Research Institute – NMFRI) began the international acoustic investigations of herring and sprat stocks size and distribution, mostly in the Polish marine waters of the southern Baltic. In the 1980s, the SFI contribution to those surveys was limited to chartering of commercial stern cutter the m/t “HEL-100”, which was designated for fish control-hauls realization. Moreover, the SFI delegates participated in several acoustic surveys on board of the Swedish r.v. “Argos”. Sporadically, also the Polish r.v. “Profesor Siedlecki” participated in the Baltic acoustic surveys (May 1983 and 1985, October 1989 and 1990). Since 1994, the permanent participation of the Polish r.v. "Baltica", managed by the NMFRI in Gdynia, has took place in the framework of the ICES Baltic International Acoustic Surveys (BIAS) long-term programme, which is coordinated by the ICES Baltic International Fish Survey Working Group (WGBIFS). The WGBIFS coordinated methods of investigations and designed timing of the BIAS survey, the scheme of acoustic monitoring spatial allocation, and general pattern of pelagic control-hauls distribution in the Baltic.

The reported 23rd consecutive (1994-2016) acoustic survey in the Polish EEZ was conducted on-board of the r.v. “Baltica” between 13th and 30th of September 2016. The research was focused on monitoring of clupeids and cod spatial-temporal distribution in pelagic zone of the southern Baltic (parts of the ICES Sub-Divisions 24, 25, 26) moreover, on assessment of stocks size of the above-mentioned fishes. The BIAS survey was carried out in the season of herring and sprat an ending phase of intensive feeding and at the beginning of a new year-class, recruiting to the stocks exploited in the Polish waters of the southern Baltic.

The acoustic system EK-60 SIMRAD with the new determined calibration parameters were applied to completing the BIAS survey tasks. The Polish Fisheries Data Collection Programme for 2016 and the European Union (the Commission Regulations Nos. 665/2008 1078/2008, 2008/949/EC, 2010/93/EU) financially and logistically supported the Polish BIAS survey marked with internal No. 14/2016/MIR-PIB.

The ICES Baltic Fisheries Assessment Working Group [WGBFAS] will use the BIAS data for tuning clupeids (sprat and herring) stock biomass assessment and spatial distribution based on the data from commercial catches.

The main goal of current paper is a brief description of sprat, herring and cod stocks size changes and their spatial distribution as well as analysis of the CPUE variation within the Polish waters of the southern Baltic at autumn 2016. Moreover, the paper contains description of sprat, herring and cod some biological parameters variation. The principal hydrological parameters fluctuation in the water column of the southern Baltic is also described.

MATERIAL AND METHODS

Research team personnel

The main research tasks of September 2016 the BIAS survey on board of the r.v. "Baltica" were realized by the NMFRI (Gdynia) nine members of the scientific team, with Mirosław Wyszyński as a cruise leader. The group of researchers was composed of:
Grzegorz Kruk – hydroacoustician,
Jakub Słembarski – hydroacoustician, electronics specialist,
Zuzanna Celmer - specialist, herring analyses,
Joanna Pawlak - specialist, sprat analyses,

Krzysztof Radtke – ichthyologist, cod analyses,
Wojciech Deluga – technician, herring analyses,
Ireneusz Wybierala – technician, sprat analyses,
Bartosz Witalis – hydrologist.

The course of the cruise

The r.v. “Baltica” left the Gdynia port on 13th of September 2016 at 00:05 o’clock and was navigated in the south-eastern direction, where at the mouth of the Vistula River a successful calibration of the acoustic system, installed on the vessel, was carried out. On the same day in the evening, the ship was directed to the start point of a planned acoustic transects above the Gdansk Deep (Fig. 3). The acoustic integration started on 14th of September 2016 at 7 a.m. The researches at sea ended on 27.09.2016 in the evening at the western part of Polish EEZ, in the ICES rectangle 38G4. The r.v. “Baltica” returned to the Gdynia port on 30th of September at 08:10 a.m. One of the fish-catches planned in the vicinity of the Ustka port was impossible to realise because of stormy weather.

Survey design and realization

The SIMRAD EK-60 version 2.2.0, a split beam scientific echosounder, with the GPT transceivers operating at 38 and 120 kHz frequencies, as in the previous years, was used in the recent Polish BIAS. New values (from the above-mentioned calibration) of acoustic parameter *Sv* (transducer gain) for the transducers type ES38-B (ser. Nº 30867) and ES120-7C (ser. Nº 566) were applied:
38 kHz – 23,87 dB (reference: 23,85 dB, Fig. 1),
120 kHz – 26,45 dB (reference: 26,50 dB).

Calibration was performed at location:
Lat. 54°27.7'N, Lon. 019°07.1'E.

The depth of dropped calibration spheres: 15-24 m, as it can be seen in Figure 2 (a screenshot from the Echoview programme showing a fragment of the calibration of the 38 kHz transducer).

The integration of acoustic data was carried out between 14th and 27th of September 2016, along transects shown in Figure 3. The recorded data were analysed in the Echoview programme according to the recommendations of the recent "Manual for Baltic International Acoustic Surveys (IBAS)". Only 38 kHz transmitter’s data were taken into further processing because that frequency is recommended for fish trace recording. According to the ICES advice calculation of parameter S_A [m^2/NM^2] (hereinafter called NASC) was carried out in the range from -60 dB to -24 dB by first removing noise and other wrong data type recorded. Then the average NASC for each nautical mile within overall 876 miles of integration by 10-m depth layers was calculated from exported to a CSV file data from the Echoview. After that, the average coordinates for miles were calculated and the NASC average values were assigned to the corresponding ICES statistical rectangles and Sub-divisions (SD).

The acoustic and ichthyologic sampling procedure is stratified by the ICES statistical rectangles, with the range of 0.5 degree in latitude and 1 degree in longitude in the ICES Sub-divisions 24, 25 and 26. The intention was to carry out at least minimum two control-hauls per the ICES statistical rectangle. Overall 36 catch-stations were inspected by the r.v. “Baltica” in autumn of 2016, using the herring small-meshed pelagic trawl type WP53/64x4 with 6 mm mesh bar length in the codend (Table 3). The trawling time for most hauls was 30 minutes, however duration of 16 of them was 15 and 60 minutes. The time of trawling depended on the density of fish concentration coming into the trawl mouth, observed at the net-sounder monitor. In the cases of two-layer fish concentrations appearing, the net was 15 minutes in each layer. The mean speed of vessel during trawling was slightly over 3.0 knots.

Fish catches were localized on the depth ranged from 25 to 82 m (position of the headrope from the sea surface). Depth to the bottom at trawling positions varied from 40 to 106 m. The trawl vertical opening during fishing was ranged from 15 to 20 m. The 35th and 36th hauls were localized in the Polish part of the ICES Sub-division 24, 10 hauls were realised in the ICES SD 25 and 14 hauls in the ICES SD 26 (Fig. 3, Table 3). Each haul can be accepted as representative (valid from technical point of view).

Fish caught in each control-haul was separated by species and weighted. The samples for sprat, herring and cod were taken for length and mass measurements and ageing. Detailed ichthyologic analyses were made according to standard procedures (Anon., 2012), directly on board of surveying vessel. Overall, 35, 36 and 18 samples were taken for the length and mass determination of sprat, herring and cod, respectively. Totally, the length and mass were measured for 6902 sprat, 7645 herring and 253 cod individuals. Respectively, 554, 1328 and 121 individuals of the above-mentioned species were biologically analysed (sex, maturity, stomach fullness and age).

After each haul as well as at the standard hydrological stations located within the Polish EEZ, the seawater temperature, salinity and oxygen content were measured continuously from the sea surface to the seabed. Totally, 48 hydrological stations were inspected using the CTD IDRONAUT probe combined with the rosette sampler. One additional hydrological station was realized at the place selected for the acoustic system calibration. Oxygen content was determined by the standard Winkler's method. The basic meteorological parameters i.e. air temperature, air pressure, wind direction and force, and sea state were registered at the each catch-station location with the automatic station MILOS 500.

RESULTS

Acoustic results

The newest calibration results were satisfactory and comparable to those obtained in the previous year (Łączkowski and Witalis 2016); (Figures 1 and 2). Because the registered NASC values in the ICES rectangles have a direct impact on the estimation of abundance and biomass of fish, hence from the data for the ICES SDs 24, 25 and 26 (Tables 1 and 2), one can already pre-conclude, that in 2016 the total amount of clupeids in the Polish economic zone decreased, whilst comparing with 2015. In particular, a big change - about three-times decrease of the NASC appeared in the area placed to the north from the Peninsula of Hel (the ICES rectangle 38G8), and more than five-times decrease in the adjacent rectangle 38G7, located in shallow waters. Minor changes and remaining very high value integration of the clupeids can be seen in ICES rectangles 37G8 and 37G9 (the southern part of the Gulf of Gdansk). There the average NASC remained still about 3500 m^2/NM^2 in a relatively small area of 237.6 square miles. The highest value of the NASC per 1-mile reached there was 17265 m^2/NM^2 (Figs. 4 and 5).

A slight increase of the NASC was observed in the ICES rectangle 39G6 near the Danish and Swedish EEZs. In contrast, a more significant increase of the NASC was observed between the Island of Bornholm and the Kołobrzeg port (the ICES rectangle 38G5). In shallow waters, about 20 m deep, the NASC recorded for 444th mile assumed a value of 0.00 (Fig. 6).

The calculations of following parameters (the cruise statistics) have been performed according to the recent ICES IBAS Manual: mean S_A , EDSU, σ, fish species composition and abundance in millions of individuals per ICES rectangles and ICES SDs. Values of the above-mentioned parameters are listed in Table 5, while graphical distribution of fish stocks abundance is shown in Figure 14.

The changes of sprat, herring and cod total biomass surface density in the ICES sub-divisions is shown in Figure 13. Additionally, the biomass of sprat, herring and cod is presented in a form of the ArcGIS plot in Figures 15, 16 and 17.

Control catches and fish length distribution

The fish control-catches statistics and mean CPUEs by species are presented in Table 3 and Figure 7. Totally, 8354.2 kg of fish in 36 hauls were caught. The herring average share in mass was 56.5%, sprat 42.4%, cod 0.9% and other species 0.2%. Among the other eight species, the following ones were noted: flounder, salmon, sea-trout, lumpfish, lampreys, sand- eels, sticklebacks and mackerel. The herring domination in research catches was noticed in the 2010-2011 and 2013-2015. In 2009 sprat dominated (56%). In the period of 2006-2008, as well as in 2012, herring and sprat share in the total catches was similar (Grygiel et. al, 2007, 2009, 2010, 2011; Łączkowski et. al, 2012, 2013, 2014; Łączkowski and Witalis 2016).

In September 2016 the mean CPUE of all fish species for entire investigated area was 385.8 kg/h and it was lower comparing to the same period of 2015 (427.4 kg/h). The highest CPUE was noticed in the ICES SD 25 (441.7 kg/h), and it was much higher whilst comparing to this one from the ICES SDs 24 and 26 (320.4 and 323.6 kg/h, respectively). Mean CPUEs for main species in 2016 were as follow: herring – 217.9, sprat – 163.5, cod 3.5 and others – 0.9 kg/h. After Łączkowski et. al (2016), mean CPUEs for these three species in 2015 were: 318.0, 97.0 and 10.7 kg/h, respectively. Concluding, we had lower mean CPUEs of herring and cod, and higher of sprat in 2016, whilst comparing to CPUE values from 2015 in the pelagic waters of the Polish EEZ. In the early autumn of the analysed year, the mean herring CPUE in the ICES Sub-divisions 24, 25 and 26 is comparable and was as follow: 249.7, 228.1 and 200.8 kg/h, respectively (Fig. 8). The highest fishing efficiency of sprat was obtained in the ICES SD 25, i.e. 206.6 kg/h on average, while in the ICES SDs 26 and 24 was 121.4 and 69.2 kg/h, respectively.

The mean share of sprat, herring and cod in mass of catches realised in September 2016, by inspected ICES sub-divisions is presented in Figure 9. Herring was prevailed in catches performed in the ICES SDs 24, 25 and 26, where the mean share amounted, adequately: 77.9; 51.6 and 62.1%. Sprat was played the second role in realised catches with the mean share of 21.6; 46.8 and 37.5%. The share of cod in pelagic catches was marginal.

Sprat, herring and cod length distribution in samples originated from catches in the ICES SDs 24,25 and 26 in recent acoustic survey is presented in Figures 10, 11 and 12. The mean numerical share of young, undersized fishes, it is below minimum landing size (<10.0 cm for sprat, <16.0 cm for herring, <35 cm for cod) is listed in Table 4.

Sprat

The sprat length distribution in all control-catches covered the range of 7.0-16.0 cm, with the mean length of 12.7 cm and the mean weight 13.0 g. The length distribution curves had a one mode shape in each controlled ICES sub-divisions, with frequency peaks on 13.0 cm (ICES SDs 24 and 25) and 12.0 cm (ICES SD 26). In September 2016, the mean numerical share of young (undersized) sprat in analysed samples, with comparison to the data from previous years, was very low and amounted 1.7; 0.3; 1.3 and 0.8% in ICES SDs 24, 25, 26 and entire scrutinized areas, respectively (Table 4). The mean share of sprat from year-class 2016 was negligible.

Herring

The herring length distribution in all control-catches covered the range of 9.5-27.0 cm, with the mean length of 17.9 cm and the mean weight 36.0 g. The herring length frequency curve shapes were similar (with the mono modal character at length-class 16.5 cm) in the particular ICES sub-divisions. The mean numerical share of young herring (<16 cm) in entire study area was 19.2% (Table 4). The lowest and highest mean share of herring was recorded in samples originated from the ICES SDs 24 (10.8%) and 26 (21.7%). The mean share of herring below <13 cm of total length, i.e. from year-class 2016 was negligible and amounted 0.2 and 0.5% in the ICES SDs 25 and 26, respectively. Those were the lowest values in the history of Polish research surveys.

Cod

There was a small amount of cod in the ICES SD 26, where only 17 individuals were found in all catches, and only one cod with 36 cm length in the ICES SD 24. In the ICES SD 25 - 235 of cod specimens were found in all catches. The length range of cod caught in September 2016 was 21-49 cm and only one individual had length of 8 cm (Fig. 12). The mean length of sampled cod was 31.6 cm and the mean weight was 268 g. Undersized specimens (<35 cm) established average up to 68.8% of total cod catch by numbers (Table 4).

Meteorological and hydrological characteristics of the southern Baltic

Meteorological and hydrological data at the start positions of the control-catches are presented in Table 15. The control-catches took place at the various weather conditions. The atmospheric pressure ranged from 1017 to 1027 hP. The air temperature fluctuated from 13 to 19°C, and prevailing winds were from various directions with the force from 2 to 5°B, which generated 1-3 sea state.

The seawater temperature on mean fishing depth varied from 4.81 to 13.72°C, salinity changed from 7.13 to 15.45 PSU, and oxygen content from 2.83 to 7.81 ml/l. The highest water salinity value was noticed at the position of haul No. 32, i.e. in the Bornholm Deep, on the 79 m depth. The lowest value of the oxygen content was recorded at the position of haul No. 27. In the second half of September 2016, cod spawning concentrations were recognized in the deep pelagic waters of the Bornholm Basin. In the Gdansk Deep, the hydrological conditions for cod reproduction did not appear because of salinity values were below 10 PSU, despite of quite good oxygen content.

The mean air temperature during surveying time amounted 16.8°C (ranging between 13 and 20.5°C). The dominating wind direction was from the north-east. The weak and moderate winds (below 4°B) appeared in most of the time of observation. The maximal wind speed was 12.8 m/s and minimal 0.9 m/s. Very strong winds from SW and W directions, with noticed maximum speed of 21.8 m/s, were observed in 2.3% of time of fishing operations. Fluctuation of values of meteorological parameters is shown in the Figure 18.

The horizontal distribution of hydrological parameters in the near seabed layer of the southern Baltic is presented in Figure 19, whilst vertical distribution in Figure 20.

The seawater temperature in the surface layer fluctuated from 16.68 to19.7°C. The lowest values were observed at the haul No. 25 and the highest at the haul No. 3 (Table 15). The average salinity of surface water was 7.04 PSU. A minimum salinity value (6.49 PSU) was measured at the haul No. 36 and the maximum (7.48 PSU) at the haul No. 31. The mean oxygen content in the sea upper layer was equal to 6.78 ml/l. The lowest value was 5.56 ml/l, recorded at the haul No. 35.

The seawater temperature recorded near the seabed (Fig. 19) was ranging from 5.01 to 8.75°C. The lowest temperature was recorded at position of the haul No. 4. The highest temperature was recorded at the haul No. 24. The average temperature of the water near the seabed was 6.64°C. The salinity of the water at the seabed varied in the range of 7.79 PSU at the station No. 61 to 18.38 PSU at position of the haul No. 27. The average salinity of water near the seabed was 12.75 PSU. The oxygen content in the deep-sea zone varied from 0.68 to 6.39 ml/l. The lowest values of oxygen concentration were recorded at position of the haul No. 27, the highest content of oxygen in water was recorded at the haul No. 29. The average content of oxygen near the seabed was 3.64 ml/l. During the survey period, a thermocline was observed at a depth of approx. 30 m. To the north from the Slupsk Furrow and near the Gdansk Deep at the depth of the thermocline appearance, there was a sudden decrease in the content of oxygen dissolved in water, because of the elevation to a higher layer of the "old" winter water supply through refilling at the seabed with the heavier, more saline ocean water. Salinity in the Bornholm Deep (below depth of 75 m) exceeded 18 PSU, and below 58 m of depth, there were favourable conditions for occurrence of cod eggs, at the oxygenation of 3-4 ml/l, which guaranteed the efficiency of reproduction of the cod. In the Gdansk Deep constraint on the effectiveness of spawning could be salinity and oxygen content below the threshold value of 2 ml/l, taken as a barrier to determine the thickness of the so-called "cod waters", but on the western slopes of the depth the conditions for the development of eggs were convenient. Similar conditions also existed throughout the Slupsk Furrow. Oxygen content at the seabed of the depths was not reduced below 1 ml/l (Fig. 20).

DISCUSSION

The ICES Baltic International Fish Survey Working Group and the Baltic Fisheries Assessment Working Group for the Baltic clupeids and cod stocks size analysis and their spatial distribution characteristics can apply the Polish BIAS-2016 survey data obtained by the r.v. “Baltica” scientific team. Results presented in this paper can be considered as representative for the Polish part of the southern Baltic, namely for the ICES Sub-divisions 24, 25 and 26. The basic acoustic, fisheries, biological and hydrological data collected during reported survey will be stored in the ICES Data-Center international databases, managed by the ICES Secretariat and designated experts from WGBIFS.

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TABLES AND FIGURES

Table 1. Average NASC values for the three ICES SDs in Polish EEZ in 2015 and 2016.

ICES SD	Average NASC 2016	Average NASC 2015
24	89,2	96,9
25	160,0	226,4
26	556,8	926,8

Table 2. Average NASC values for the covered ICES rectangles in Polish EEZ in 2015 and 2016.

SD	ICES Rectangles	Area [NM^2]	Average NASC 2016	Average NASC 2015
24	38G4	1034,8	89,2	96,9
25	37G5	642,2	100,7	158,2
25	38G5	1035,7	209,5	129,0
25	38G6	940,2	151,8	175,8
25	38G7	471,7	41,2	255,7
25	39G5	979,0	220,2	301,0
25	39G6	1026,0	241,1	215,8
25	39G7	1026,0	189,6	297,0
25	40G7	1013,0	125,9	279,1
26	37G8	86,0	767,5	2894,6
26	37G9	151,6	2739,7	914,1
26	38G8	624,6	336,0	997,1
26	38G9	918,2	170,9	750,9
26	39G8	1026,0	118,7	285,0
26	39G9	1026,0	57,6	393,2
26	40G8	1013,0	172,4	252,9

Table 3. Fish control-catches data from the Polish BIAS survey conducted on-board of the r.v. "Baltica" in September 2016.

Haul no	Date	ICES rectangle	ICES Sub-division (SD)	Mean bottom depth [m]	Headrope depth [m]	Vertical opening [m]	Trawling speed [w]	Trawling direction [°]	Geographical position start latitude 00°00.0'N	Geographical position start longitude 00°00.0'E	Geographical position end latitude 00°00.0'N	Geographical position end longitude 00°00.0'E	Time start	Time end	Haul duration [min.]	Total catch [kg]	CPUE [kg/h]	Catch per species [kg] sprat	herring	cod	flounder	salmon	trout	lumpfish	mackerel	lamprey	great sand eel	three spined stickleback
1	14-09-2016	38G9	26	106	30	18	3.1	160	54°54.2'	19°08.0'	54°52.6'	19°08.8'	09:50	10:20	30	335.600	671.200	274.425	58.615	2.560								
2	14-09-2016	38G9	26	80	60	18	3.0	90	54°34.8'	19°13.8'	54°34.7'	19°16.6'	13:40	14:10	30	317.107	634.214	83.662	233.238	0.207								
3	14-09-2016	37G9	26	68	40	18	3.0	97	54°29.8'	19°22.2'	54°29.7'	19°23.6'	16:55	17:10	15	234.506	938.024	43.259	190.571	0.485						0.191		
4	15-09-2016	37G9	26	50	24	18	3.0	77	54°26.0'	19°04.5'	54°26.2'	19°07.1'	06:35	07:05	30	60.837	121.674	60.499	0.061		0.241						0.036	
5	15-09-2016	37G8	26	60	42	16	3.1	320	54°27.3'	18°56.1'	54°28.8'	18°54.3'	09:00	09:30	30	141.931	283.862	34.477	107.403		0.051							
6	15-09-2016	38G8	26	66	28	19	3.0	82	54°33.1'	18°55.0'	54°33.4'	18°57.4'	11:00	11:30	30	114.543	229.086	113.068	0.912	0.467	0.096							
7	15-09-2016	38G8	26	95	45	19	3.3	355	54°45.3'	18°59.8'	54°47.1'	18°59.6'	14:00	14:30	30	144.915	289.830	11.563	132.977	0.375								
8	16-09-2016	39G8	26	84	42	18	3.2	359	55°19.9'	18°59.9'	55°23.3'	18°59.8'	07:40	08:40	60	67.697	67.697		66.540	0.803				0.354				
9	16-09-2016	40G8	26	84	61	19	2.8	342	55°41.9'	18°56.9'	55°44.6'	18°55.6'	11:45	12:45	60	48.040	48.040	16.041	31.995									0.004
10	16-09-2016	40G8	26	84	32	19	3.1	181	55°34.9'	18°39.8'	55°31.8'	18°39.7'	17:40	18:40	60	163.700	163.700	25.046	138.654									
11	17-09-2016	39G8	26	80	44	18	2.9	185	55°17.6'	18°39.8'	55°16.2'	18°39.5'	07:25	07:55	30	100.279	200.558	15.717	81.903	2.590						0.069		
12	17-09-2016	38G8	26	77	58	18	3.2	336	54°53.5'	18°40.0'	54°56.6'	18°38.6'	11:55	12:55	60	157.952	157.952	63.803	93.347		0.442			0.360				
13	18-09-2016	39G8	26	85	46	18	3.2	252	55°23.7'	18°20.2'	55°23.2'	18°17.2'	08:15	08:45	30	87.130	174.260	10.368	76.762									
14	18-09-2016	40G8	26	94	63	18	3.2	322	55°36.0'	18°25.9'	55°38.0'	18°24.2'	11:45	12:15	30	325.380	650.760	157.749	166.171	1.460								
15	18-09-2016	40G7	25	68	45	17	3.1	265	55°35.7'	17°59.9'	55°35.5'	17°56.9'	17:35	18:05	30	450.180	900.360	290.816	159.364									
16	19-09-2016	39G7	25	71	37	15	3.1	236	55°26.0'	17°59.7'	55°25.3'	17°57.6'	07:20	07:50	30	117.080	234.160	18.147	98.933									
17	19-09-2016	39G8	26	75	50	20	3.1	178	55°19.4'	18°00.4'	55°16.3'	18°01.1'	10:00	11:00	60	223.140	223.140	19.860	203.280									
18	19-09-2016	39G7	25	63	30	18	3.1	341	55°12.2'	17°39.7'	55°15.1'	17°37.9'	16:55	17:55	60	191.655	191.655	13.940	174.430			3.170		0.115				
19	20-09-2016	39G7	25	77	30	19	3.1	1	55°22.7'	17°40.0'	55°25.7'	17°40.1'	08:05	09:05	60	378.770	378.770	94.883	283.137	0.491	0.140			0.119				
20	20-09-2016	39G7	25	68	50	17	3.2	181	55°22.4'	17°20.0'	55°20.6'	17°19.9'	13:25	13:55	30	291.100	582.200	104.214	186.886									
21	20-09-2016	39G7	25	81	57	18	3.0	284	55°11.7'	17°18.8'	55°12.2'	17°13.9'	16:10	17:10	60	142.843	142.843	48.267	94.113	0.223				0.240				
22	21-09-2016	39G6	25	80	50	19	3.2	342	55°14.6'	16°59.7'	55°16.1'	16°58.8'	11:40	12:10	30	502.954	1005.908	177.820	323.080	0.603				1.451				
23	21-09-2016	39G6	25	66	46	18	2.9	74	55°20.0'	16°41.0'	55°20.5'	16°43.8'	16:20	16:50	30	223.276	446.552	63.088	159.052	1.136								
24	22-09-2016	39G6	25	77	45	20	3.3	61	55°10.2'	16°40.8'	55°12.0'	16°45.9'	09:40	10:40	60	414.695	414.695	134.143	279.877		0.299			0.376				
25	23-09-2016	38G6	25	40	15	20	3.2	272	54°44.2'	16°16.3'	54°44.3'	16°13.6'	09:55	10:25	30	413.959	827.918	407.547	2.873						3.433	0.106		
26	23-09-2016	39G6	25	57	37	18	3.0	42	55°02.1'	16°20.8'	55°04.5'	16°24.5'	14:00	15:00	60	191.389	191.389	64.350	126.600					0.439				
27	24-09-2016	39G5	25	87	55	17	3.1	128	55°12.3'	15°57.8'	55°11.8'	15°59.0'	07:30	07:45	15	191.465	765.860	150.495	39.765	1.205								
28	24-09-2016	38G6	25	73	50	20	3.1	148	54°59.1'	16°00.8'	54°57.9'	16°01.7'	10:40	11:10	30	174.711	349.422	11.145	160.315	2.890				0.361				
29	24-09-2016	37G5	25	45	15	20	3.3	280	54°27.3'	15°51.5'	54°27.6'	15°46.2'	16:25	17:25	60	88.097	88.097	13.696	70.844			0.336	1.795	1.248		0.178		
30	25-09-2016	38G5	25	57	28/39	18/17	3.1	348	54°30.7'	15°39.8'	54°33.6'	15°39.0'	08:30	09:30	60	386.933	386.933	244.920	140.780					1.233				
31	25-09-2016	38/39G5	25	80	30/53	17	3.0	357	54°58.0'	15°39.9'	55°01.0'	15°39.6'	13:05	14:05	60	294.942	294.942	128.237	154.223	11.643				0.839				
32	25-09-2016	39G5	25	79	54	18	3.1	206	55°06.7'	15°37.9'	55°05.4'	15°37.2'	16:10	16:40	30	489.494	978.988	190.164	259.396	39.660	0.154			0.120				
33	26-09-2016	38G5	25	66	49	16	3.1	355	54°42.0'	15°19.7'	54°43.5'	15°19.4'	08:05	08:35	30	93.141	186.282	18.195	74.165	0.565	0.152			0.064				
34	26-09-2016	37G5	25	44	21	19	2.9	122	54°29.5'	15°20.4'	54°28.6'	15°25.3'	11:40	12:40	60	25.807	25.807	18.850	2.650				0.788	3.519				
35	26-09-2016	38G4	24	50	25	18	3.3	334	54°37.1'	14°59,3'	54°38.6'	14°58,5'	17:25	17:55	30	91.925	183.850	57.433	34.167					0.325				
36	27-09-2016	38G4	24	57	31	18	3.2	262	54°44.9'	14°55,8'	54°44.6'	14°53,1'	07:30	08:00	30	228.448	456.896	11.823	215.537	0.449				0.639				
														Total	24	320.373		69.256	249.704	0.449				0.964				
														catch	25	5062.491		2192.917	2790.483	58.416	0.745	3.506	2.583	10.124	3.433	0.284		
														by SDs	26	2522.757		929.537	1582.429	8.947	0.830			0.714		0.260	0.036	0.004
														[kg]	Sum	7905.621		3191.710	4622.616	67.812	1.575	3.506	2.583	11.802	3.433	0.544	0.036	0.004

Table 4. The mean numerical share of young, undersized fishes per ICES SDs.

Species	Fish length	Mean share in % of numbers SD 24	SD 25	SD 26	Mean
sprat	< 10 cm	1.7	0.3	1.3	0.8
herring	< 16 cm	10.8	18.5	21.7	19.2
cod	< 35 cm	0.0	72.3	23.5	68.8

Table 5. Cruise statistics of the Polish BIAS survey on-board of the r.v. "Baltica", 13.09.-30.09.2016.

SD	ICES Rectangle	EDSU [NM]	<σ> [m² * 10⁻⁴]	<S_A> [m²/NM²]	Area [NM²]	species composition [%] sprat	herring	cod	Abundance *(10⁶) total	sprat	herring	cod
24	38G4	33	2.4	89.2	1034.8	44.4	55.6	0.008	379.3	168.5	210.8	0.030
Sum SD24		33		89.2	1034.8				379.3	168.5	210.8	0.030
25	37G5	61	2.2	100.7	642.2	59.7	40.3	0.000	294.0	175.6	118.4	0.000
25	38G5	73	2.2	209.5	1035.7	59.5	40.4	0.104	971.8	578.2	392.6	1.015
25	38G6	72	2.3	151.8	940.2	56.0	43.9	0.061	627.9	351.8	275.7	0.383
25	39G5	27	2.0	220.2	979.0	81.0	18.5	0.495	1066.4	864.0	197.1	5.280
25	39G6	89	2.3	241.1	1026.0	52.9	47.1	0.010	1073.1	567.8	505.2	0.107
25	39G7	112	2.5	189.6	1026.0	42.6	57.4	0.005	790.8	337.0	453.8	0.039
25	40G7	23	2.2	125.9	1013.0	57.8	42.2	0.000	572.4	330.8	241.6	0.000
Sum SD25		457		177.0	6662.1				5396.4	3205.2	2184.4	6.822
26	37G8	7	2.0	767.5	86.0	74.9	25.1	0.000	335.3	251.2	84.1	0.000
26	37G9	35	2.1	2739.7	151.6	69.2	30.8	0.005	2019.3	1397.2	621.9	0.104
26	38G8	48	2.2	336.0	624.6	62.3	37.7	0.011	969.9	603.9	365.9	0.102
26	38G9	50	1.9	170.9	918.2	76.9	23.1	0.011	808.4	621.7	186.6	0.090
26	39G8	95	2.8	118.7	1026.0	19.7	80.3	0.053	431.5	84.9	346.3	0.229
26	39G9	29	2.4	57.6	1026.0	47.1	52.8	0.075	245.0	115.4	129.4	0.185
26	40G8	101	2.3	172.4	1013.0	55.7	44.3	0.008	772.0	430.1	341.8	0.063
Sum SD26		365		623.3	4845.4				5581.2	3504.5	2075.9	0.772

Table 6. Abundance of sprat (in millions individuals) per age groups, ICES rectangles and SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13.09-30.09.2016.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum sprat
24	38G4	3.3	7.7	57.2	45.9	35.6	5.6	6.5	6.7	0.0	168.49
Sum SD24		3.3	7.7	57.2	45.9	35.6	5.6	6.5	6.7	0.0	168.49
25	37G5	0.62	1.63	73.38	56.53	26.45	8.95	5.20	2.64	0.22	175.63
25	38G5	2.05	5.38	241.56	186.11	87.08	29.46	17.11	8.70	0.73	578.18
25	38G6	1.25	3.27	146.97	113.23	52.98	17.92	10.41	5.29	0.44	351.78
25	39G5	3.07	8.04	360.98	278.11	130.12	44.02	25.57	13.00	1.09	864.01
25	39G6	2.02	5.28	237.23	182.77	85.52	28.93	16.81	8.55	0.71	567.81
25	39G7	1.20	3.14	140.78	108.46	50.75	17.17	9.97	5.07	0.42	336.97
25	40G7	1.18	3.08	138.20	106.47	49.82	16.85	9.79	4.98	0.42	330.78
Sum SD25		11.39	29.83	1339.10	1031.68	482.71	163.30	94.87	48.24	4.03	3205.15
26	37G8	2.90	6.94	152.74	51.44	29.63	1.92	4.89	0.74	0	251.21
26	37G9	16.15	38.63	849.57	286.09	164.83	10.66	27.19	4.14	0	1397.25
26	38G8	6.98	16.69	367.16	123.64	71.23	4.61	11.75	1.79	0	603.86
26	38G9	7.18	17.19	378.00	127.29	73.34	4.74	12.10	1.84	0	621.68
26	39G8	0.98	2.35	51.65	17.39	10.02	0.65	1.65	0.25	0	84.95
26	39G9	1.33	3.19	70.18	23.63	13.61	0.88	2.25	0.34	0	115.41
26	40G8	4.97	11.89	261.53	88.07	50.74	3.28	8.37	1.28	0	430.13
Sum SD26		40.50	96.88	2130.82	717.56	413.41	26.74	68.19	10.39	0	3504.48

Table 7. Biomass of sprat (in tons) per age groups, ICES rectangles and SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13.09-30.09.2016.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum sprat [t]
24	38G4	19.4	110.4	835.0	713.7	600.5	108.4	124.8	109.7	0.0	2621.9
Sum SD24		19.4	110.4	835.0	713.7	600.5	108.4	124.8	109.7	0.0	2621.9
25	37G5	3.0	18.0	988.9	826.3	421.3	142.3	87.9	43.6	4.2	2535.6
25	38G5	10.0	59.4	3255.7	2720.3	1387.0	468.5	289.4	143.6	13.7	8347.5
25	38G6	6.1	36.1	1980.8	1655.1	843.9	285.0	176.1	87.4	8.3	5078.8
25	39G5	15.0	88.8	4865.1	4065.1	2072.6	700.1	432.4	214.6	20.4	12474.1
25	39G6	9.9	58.3	3197.3	2671.5	1362.1	460.1	284.2	141.0	13.4	8197.7
25	39G7	5.8	34.6	1897.4	1585.4	808.3	273.0	168.6	83.7	8.0	4865.0
25	40G7	5.7	34.0	1862.6	1556.3	793.5	268.0	165.5	82.2	7.8	4775.6
Sum SD25		55.6	329.2	18047.8	15079.9	7688.7	2597.0	1604.1	796.1	75.8	46274.2
26	37G8	9.3	56.0	1612.9	658.6	400.5	30.1	70.1	12.2	0.0	2849.8
26	37G9	51.8	311.7	8971.1	3663.0	2227.8	167.7	389.8	67.8	0.0	15850.7
26	38G8	22.4	134.7	3877.1	1583.0	962.8	72.5	168.4	29.3	0.0	6850.3
26	38G9	23.0	138.7	3991.5	1629.8	991.2	74.6	173.4	30.2	0.0	7052.5
26	39G8	3.1	19.0	545.4	222.7	135.4	10.2	23.7	4.1	0.0	963.7
26	39G9	4.3	25.7	741.0	302.6	184.0	13.8	32.2	5.6	0.0	1309.3
26	40G8	15.9	96.0	2761.7	1127.6	685.8	51.6	120.0	20.9	0.0	4879.4
Sum SD26		129.8	781.9	22500.8	9187.2	5587.7	420.5	977.6	170.1	0.0	39755.5

Table 8. Mean weight of sprat (in grams) per age groups, ICES rectangles and SDs based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13.09-30.09.2016.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Mean W sprat [g]
24	38G4	5.80	14.39	14.59	15.56	16.87	19.30	19.18	16.43		15.27
MW SD24		5.80	14.39	14.59	15.56	16.87	19.30	19.18	16.43		15.27
25	37G5	6.20	13.75	15.48	15.98	17.06	17.59	17.74	17.56	19.35	15.64
25	38G5	5.69	12.79	14.03	14.92	15.97	16.26	17.14	16.45	18.79	14.67
25	38G6	5.07	10.42	14.16	14.79	16.95	16.86	20.60	16.61		14.43
25	39G5	5.40	9.89	13.49	14.65	15.63	16.50	17.10			13.24
25	39G6	8.20	11.79	13.33	14.46	15.60	15.64	16.60	16.32	17.96	14.43
25	39G7		9.03	12.36	14.02	14.86	14.37	16.45	17.22	17.95	14.53
25	40G7		10.79	12.27	13.41	14.49	13.88	15.56	15.09	17.70	14.15
MW SD25		6.11	11.21	13.59	14.60	15.79	15.87	17.31	16.54	18.35	14.38
26	37G8	3.08	5.67	9.69	12.45	12.28	16.60	16.60			10.91
26	37G9	3.08	8.19	10.21	11.91	13.17	15.00	17.35			11.27
26	38G8	3.45	8.06	10.14	12.44	13.20	15.45	14.27	15.33		11.54
26	38G9	4.00	8.16	10.31	12.79	12.85	15.35	12.53			10.85
26	39G8		7.75	12.18	13.40	13.85	15.99	15.04	15.44		13.38
26	39G9	3.40	8.46	10.41	12.48	13.47	16.52	13.54	16.40		11.84
26	40G8		7.85	11.08	12.81	13.38	15.49	14.19	15.11		12.84
MW SD26		3.40	7.73	10.57	12.61	13.17	15.77	14.79	15.57		11.70

Table 9. Abundance of herring (in millions individuals) per age groups, ICES rectangles and SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13.09-30.09.2016.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum herring
24	38G4	1.3	21.9	28.4	41.7	71.9	30.0	3.4	9.3	3.0	210.8
Sum SD24		1.3	21.9	28.4	41.7	71.9	30.0	3.4	9.3	3.0	210.8
25	37G5	0.68	5.36	31.65	24.00	28.26	12.68	4.93	5.01	5.81	118.4
25	38G5	2.25	17.78	104.96	79.59	93.70	42.05	16.34	16.62	19.27	392.6
25	38G6	1.58	12.49	73.71	55.90	65.80	29.53	11.48	11.67	13.53	275.7
25	39G5	1.13	8.93	52.69	39.96	47.04	21.11	8.20	8.34	9.68	197.1
25	39G6	2.90	22.88	135.08	102.44	120.59	54.12	21.03	21.39	24.80	505.2
25	39G7	2.60	20.55	121.33	92.01	108.31	48.61	18.89	19.21	22.28	453.8
25	40G7	1.38	10.94	64.61	48.99	57.67	25.88	10.06	10.23	11.86	241.6
Sum SD25		12.52	98.93	584.04	442.89	521.36	233.97	90.94	92.49	107.24	2184.4
26	37G8	0.42	4.21	19.48	13.94	21.60	9.07	5.01	5.42	4.90	84.1
26	37G9	3.11	31.17	144.11	103.10	159.74	67.08	37.05	40.08	36.24	621.9
26	38G8	1.83	18.34	84.79	60.66	93.99	39.47	21.80	23.58	21.32	365.9
26	38G9	0.93	9.35	43.24	30.93	47.93	20.13	11.11	12.03	10.87	186.6
26	39G8	1.73	17.36	80.24	57.41	88.95	37.35	20.63	22.32	20.18	346.3
26	39G9	0.65	6.49	29.99	21.45	33.24	13.96	7.71	8.34	7.54	129.4
26	40G8	1.71	17.13	79.19	56.66	87.79	36.86	20.36	22.03	19.91	341.8
Sum SD26		10.39	104.04	481.03	344.16	533.23	223.92	123.66	133.80	120.96	2075.9

Table 10. Biomass of herring (in tons) per age groups, ICES rectangles and SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13.09-30.09.2016.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum herring [t]
24	38G4	18.0	661.4	973.6	1318.2	2558.2	1041.7	162.8	459.8	200.1	7393.9
Sum SD24		18.0	661.4	973.6	1318.2	2558.2	1041.7	162.8	459.8	200.1	7393.9
25	37G5	9.7	152.1	904.9	783.0	973.1	529.4	216.0	266.3	369.3	4203.8
25	38G5	32.1	504.2	3000.7	2596.4	3226.6	1755.4	716.4	883.2	1224.6	13939.6
25	38G6	22.6	354.1	2107.4	1823.4	2266.1	1232.8	503.1	620.3	860.0	9789.7
25	39G5	16.1	253.1	1506.5	1303.5	1619.9	881.3	359.7	443.4	614.8	6998.2
25	39G6	41.3	649.0	3861.9	3341.5	4152.7	2259.2	922.0	1136.7	1576.1	17940.4
25	39G7	37.1	582.9	3468.8	3001.4	3730.0	2029.2	828.1	1020.9	1415.6	16114.0
25	40G7	19.8	310.4	1847.1	1598.2	1986.1	1080.5	441.0	543.6	753.8	8580.5
Sum SD25		178.7	2805.8	16697.3	14447.3	17954.4	9767.9	3986.4	4914.4	6814.2	77566.3
26	37G8	4.0	101.5	519.7	443.1	755.2	359.3	225.1	290.4	358.2	3056.5
26	37G9	29.5	750.5	3844.2	3277.7	5585.6	2657.6	1664.7	2147.6	2649.7	22607.0
26	38G8	17.3	441.6	2261.8	1928.4	3286.3	1563.6	979.4	1263.6	1559.0	13301.1
26	38G9	8.8	225.2	1153.4	983.4	1675.8	797.3	499.4	644.3	795.0	6782.7
26	39G8	16.4	417.9	2140.6	1825.1	3110.3	1479.9	927.0	1195.9	1475.5	12588.4
26	39G9	6.1	156.2	799.9	682.1	1162.3	553.0	346.4	446.9	551.4	4704.3
26	40G8	16.2	412.4	2112.6	1801.2	3069.5	1460.5	914.8	1180.2	1456.1	12423.6
Sum SD26		98.3	2505.2	12832.3	10941.0	18645.0	8871.3	5556.8	7168.8	8844.9	75463.5

Table 11. Mean weight of herring (in grams) per age groups, ICES rectangles and SDs, based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13.09-30.09.2016.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Mean W herring [g]
24	38G4	14.3	30.2	34.3	31.6	35.6	34.7	48.5	49.3	66.2	38.3
MW SD24		14.3	30.2	34.3	31.6	35.6	34.7	48.5	49.3	66.2	38.3
25	37G5	11.6	29.2	28.9	47.2	30.6	28.3	33.4		56.5	33.2
25	38G5	13.7	30.1	30.3	30.2	33.5	43.1	59.2	53.3	64.0	39.7
25	38G6		27.0	29.1	30.4	33.9	41.4	46.7	45.6	52.6	38.3
25	39G5	14.8	30.7	28.5	40.6	42.1	49.9	54.3	59.8	64.7	42.8
25	39G6	12.2	23.3	28.3	34.8	32.2	38.3	37.0	60.9	65.3	36.9
25	39G7	14.8	25.1	31.3	35.7	40.1	43.7	47.8	47.2	58.8	38.3
25	40G7			23.7	26.4	31.3	41.7	38.6	47.4	55.3	37.8
MW SD25		13.4	27.6	28.6	35.0	34.8	40.9	45.3	52.4	59.6	38.1
26	37G8	7.0	23.3	23.5	30.1	35.8	30.5	40.5	47.4	47.9	31.8
26	37G9	10.5	27.8	25.5	28.6	32.8	41.1	43.0	67.1	58.8	37.2
26	38G8	10.2	19.3	25.6	34.1	34.6	45.8	39.7	52.7	77.1	37.7
26	38G9		23.1	31.9	30.2	38.4	44.2	47.5	60.0	83.6	44.9
26	39G8		25.9	29.6	38.7	34.4	45.0	45.9	66.3	65.6	43.9
26	39G9		24.2	33.1	39.0	37.9	44.1	46.1	57.8	71.4	44.2
26	40G8		26.5	25.7	29.7	35.0	38.2	44.3	52.7	65.1	39.7
MW SD26		9.2	24.3	27.8	32.9	35.6	41.3	43.9	57.7	67.1	39.9

Table 12. Abundance of cod (in millions individuals) per age groups, ICES rectangles and SDs, estimated using acoustic method, based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13.09-30.09.2016.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum cod
24	38G4	0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.000	0.000	0.030
Sum SD24		0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.000	0.000	0.030
25	37G5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	38G5	0.004	0.000	0.151	0.272	0.371	0.164	0.033	0.004	0.014	1.015
25	38G6	0.002	0.000	0.057	0.103	0.140	0.062	0.013	0.002	0.005	0.383
25	39G5	0.021	0.000	0.787	1.415	1.932	0.855	0.174	0.021	0.074	5.280
25	39G6	0.000	0.000	0.016	0.029	0.039	0.017	0.004	0.000	0.001	0.107
25	39G7	0.000	0.000	0.006	0.010	0.014	0.006	0.001	0.000	0.001	0.039
25	40G7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sum SD25		0.027	0.000	1.016	1.828	2.497	1.105	0.225	0.027	0.096	6.822
26	37G8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	37G9	0.000	0.000	0.013	0.013	0.026	0.026	0.026	0.000	0.000	0.104
26	38G8	0.000	0.000	0.013	0.013	0.025	0.025	0.025	0.000	0.000	0.102
26	38G9	0.000	0.000	0.011	0.011	0.022	0.022	0.022	0.000	0.000	0.090
26	39G8	0.000	0.000	0.029	0.029	0.057	0.057	0.057	0.000	0.000	0.229
26	39G9	0.000	0.000	0.023	0.023	0.046	0.046	0.046	0.000	0.000	0.185
26	40G8	0.000	0.000	0.008	0.008	0.016	0.016	0.016	0.000	0.000	0.063
Sum SD26		0.000	0.000	0.096	0.096	0.193	0.193	0.193	0.000	0.000	0.772

Table 13. Biomass of cod (in tons) per age groups, ICES rectangles and SDs, estimated using acoustic method, based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13.09-30.09.2016.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum cod [t]
24	38G4	0.00	0.00	0.00	13.39	0.00	0.00	0.00	0.00	0.00	13.39
Sum SD24		0.00	0.00	0.00	13.39	0.00	0.00	0.00	0.00	0.00	13.39
25	37G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	38G5	0.01	0.00	19.41	42.88	101.78	65.31	17.38	2.14	3.57	252.48
25	38G6	0.00	0.00	7.32	16.17	38.37	24.63	6.55	0.81	1.35	95.19
25	39G5	0.07	0.00	101.01	223.15	529.68	339.91	90.46	11.12	18.61	1314.01
25	39G6	0.00	0.00	2.04	4.50	10.69	6.86	1.83	0.22	0.38	26.52
25	39G7	0.00	0.00	0.74	1.63	3.88	2.49	0.66	0.08	0.14	9.62
25	40G7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum SD25		0.09	0.00	130.52	288.33	684.40	439.20	116.89	14.37	24.04	1697.83
26	37G8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	37G9	0.00	0.00	2.68	6.09	13.05	11.81	19.19	0.00	0.00	52.81
26	38G8	0.00	0.00	2.64	5.98	12.83	11.62	18.87	0.00	0.00	51.93
26	38G9	0.00	0.00	2.33	5.28	11.32	10.25	16.65	0.00	0.00	45.82
26	39G8	0.00	0.00	5.91	13.43	28.79	26.07	42.35	0.00	0.00	116.55
26	39G9	0.00	0.00	4.79	10.87	23.29	21.10	34.26	0.00	0.00	94.30
26	40G8	0.00	0.00	1.63	3.69	7.92	7.17	11.64	0.00	0.00	32.05
Sum SD26		0.00	0.00	19.97	45.34	97.19	88.02	142.96	0.00	0.00	393.47

Table 14. Mean weight of cod (in grams) per age groups and SDs, based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13.09-30.09.2016 .

SD	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Mean W cod [g]
24				449.00						449.00
25	3.20		128.40	157.70	274.10	397.40	519.20	526.50	251.70	282.28
26			207.00	470.00	503.75	456.25	741.00			475.60

Table 15. Values of the basic meteorological and hydrological parameters recorded in September 2016 at the positions of the r.v. "Baltica" fish control catches.

Haul	Date	Haul	Mean	Meteorological parameters					Hydrological parameters*		
No	of catch	start time	haedrope	atmospheric	air	wind	wind force	sea state	temperature	salinity	oxygen
		[hh:mm]	depth [m]	preasure [hP]	temperature [°C]	direction	[°B]		[°C]	[PSU]	[ml/l]
1	14-09-2016	09:50	30	1020	18	NE	3	2	6.06	9.40	6.46
2	14-09'2016	13:40	60	1024	19	NNE	3	2	5.60	10.30	4.17
3	14-09'2016	16:55	40	1021	18	N	4	2	5.07	9.00	4.00
4	15-09'2016	06:35	24	1020	16	S	2	1	6.15	7.27	6.47
5	15-09'2016	09:00	42	1021	16	SSE	2	1	5.10	9.07	3.89
6	15-09'2016	11:00	28	1024	19	SE	2	1	5.24	7.37	6.39
7	15-09'2016	14:00	45	1024	19	SE	2	1	5.07	7.50	6.48
8	16-09'2016	07:40	42	1018	17	NE	3	2	5.26	9.93	6.76
9	16-09'2016	11:45	61	1019	17	NE	4	2	5.16	9.34	3.23
10	16-09'2016	17:40	32	1020	17	NE	4/5	2/3	5.57	9.16	7.81
11	17-09'2016	07:25	44	1018	16	E	5	3	5.45	7.55	5.88
12	17-09'2016	11:55	58	1018	17	ENE	5	3	5.76	10.57	3.59
13	18-09'2016	08:15	46	1021	15	E	5	3	4.99	7.40	6.67
14	18-09'2016	11:45	63	1022	13	E	5	3	4.81	7.82	6.38
15	18-09'2016	17:35	45	1023	15	E	5	3	5.86	8.33	5.58
16	19-09'2016	07:20	37	1020	14	SE	3	1	6.12	7.26	6.95
17	19-09'2016	10:00	50	1020	14	ESE	2	1	5.01	7.59	6.73
18	19-09'2016	16:55	30	1020	13	N	3	1/2	5.72	7.34	6.90
19	20-09'2016	08:05	60	1017	15	N	3	2	13.72	7.13	5.20
20	20-09'2016	13:25	30	1018	16	NNW	3	2	6.47	8.96	5.98
21	20-09'2016	16:10	60	1018	16	NNW	4	2	8.41	12.54	4.45
22	21-09'2016	11:40	50	1024	16	NE	2	1	8.13	13.06	4.92
23	21-09'2016	16:10	46	1024	16	NE	3	2	6.32	8.23	6.46
24	22-09'2016	09:40	45	1023	15	NNW	4	2	6.79	6.69	4.37
25	23-09'2016	09:55	15	1022	15	W	3	2	10.88	7.46	5.88
26	23-09'2016	14:00	37	1023	16	WSW	4	3	6.51	8.93	5.24
27	24-09'2016	07:30	55	1021	16	NW	5	3	8.39	14.74	2.83
28	24-09'2016	10:40	50	1024	16	WNW	5	3	7.42	12.39	4.55
29	24-09'2016	16:25	15	1027	16	WNW	4	2	16.61	7.47	6.36
30	25-09'2016	08:30	28/39	1023	13	S	3	2	6,80/6,29	7,55/10,30	5,97/4,91
31	25-09'2016	13:05	30/53	1027	16	S	2	2	8,46/6,66	13,68/7,81	4,16/6,06
32	25-09'2016	16:10	54	1025	16	SE	3	2	11.61	15.45	4.29
33	26-09'2016	08:05	49	1023	15	SSE	4	2	8.46	12.80	3.70
34	26-09'2016	11:40	21	1025	15	SSE	4	2	7.39	7.56	6.10
35	26-09'2016	17:25	25	1027	16	E	4	2	7.98	7.58	5.57
36	27-09'2016	07:30	31	1025	14	S	4	2	6.37	8.71	5.70
37											

* data at the mean depth of the fish control catch (in the middle of trawl vertical oppening)

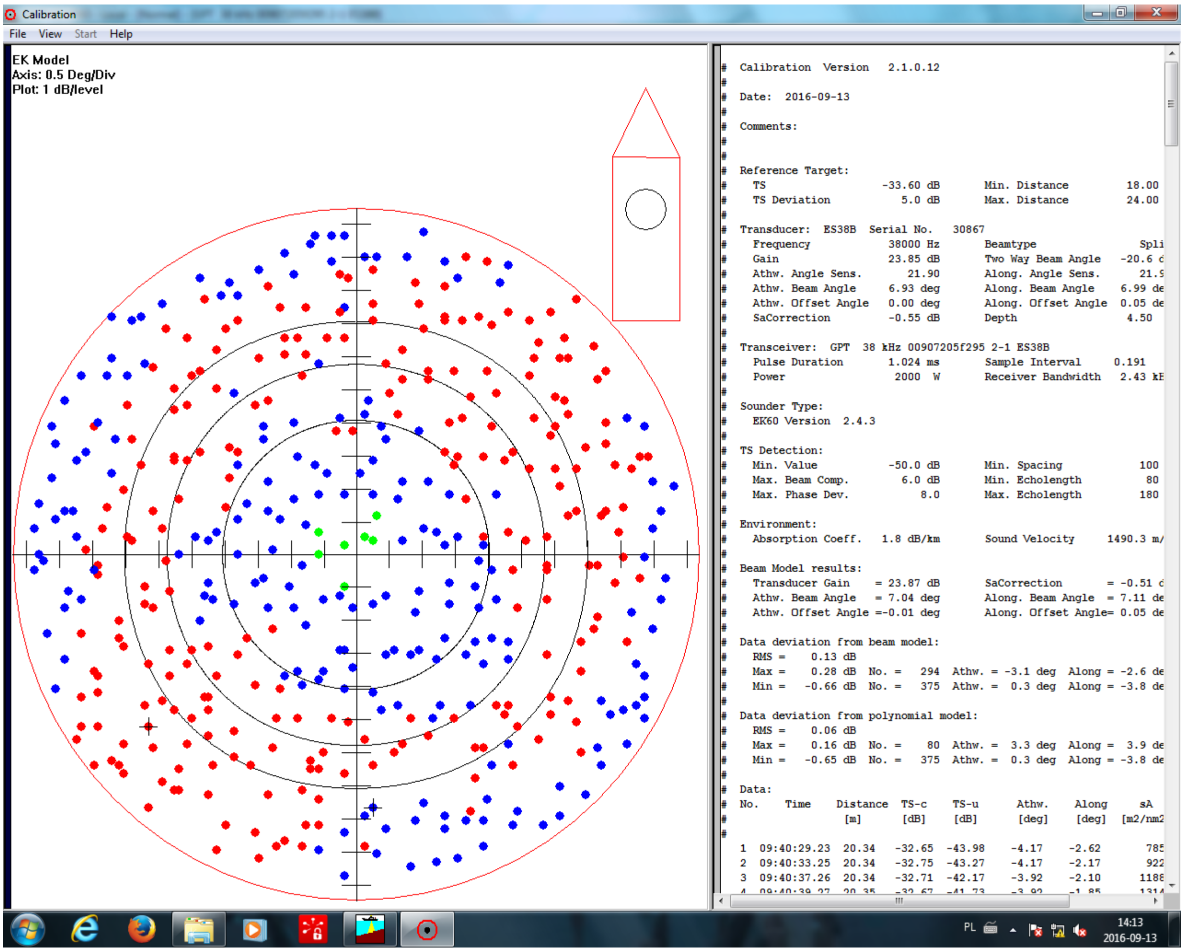

Fig.1. A screenshot after finishing calibration of the 38 kHz transducer.

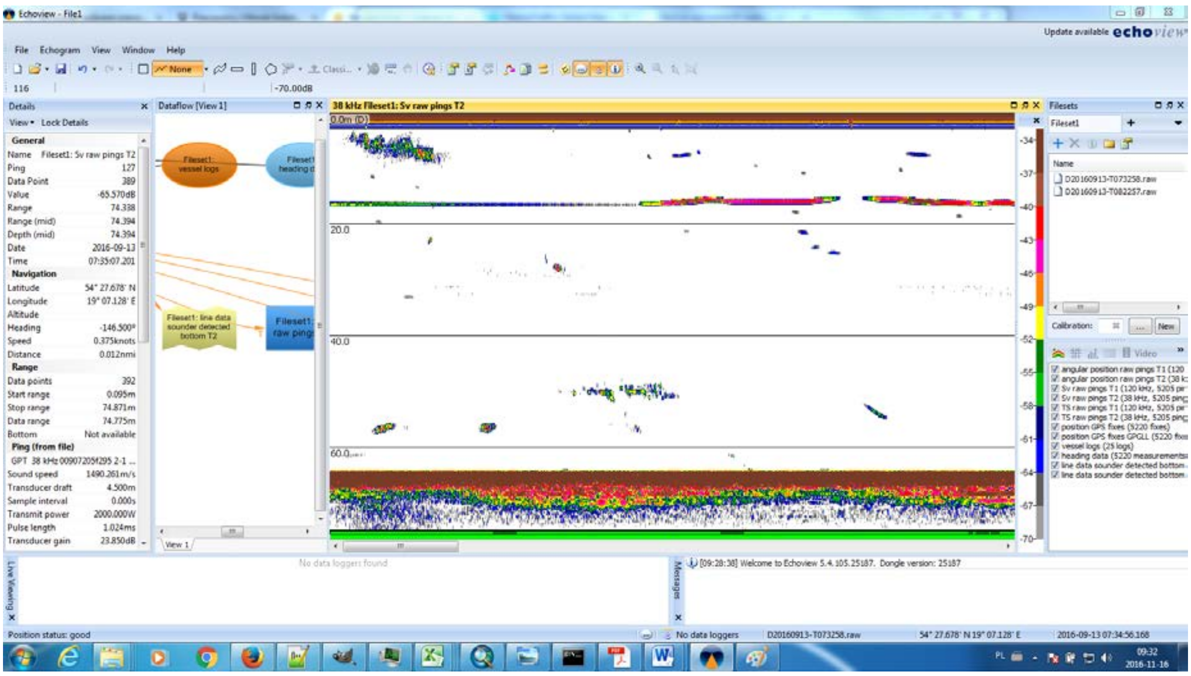

Fig. 2. Observed position of the calibration sphere for the 38 kHz transducer.

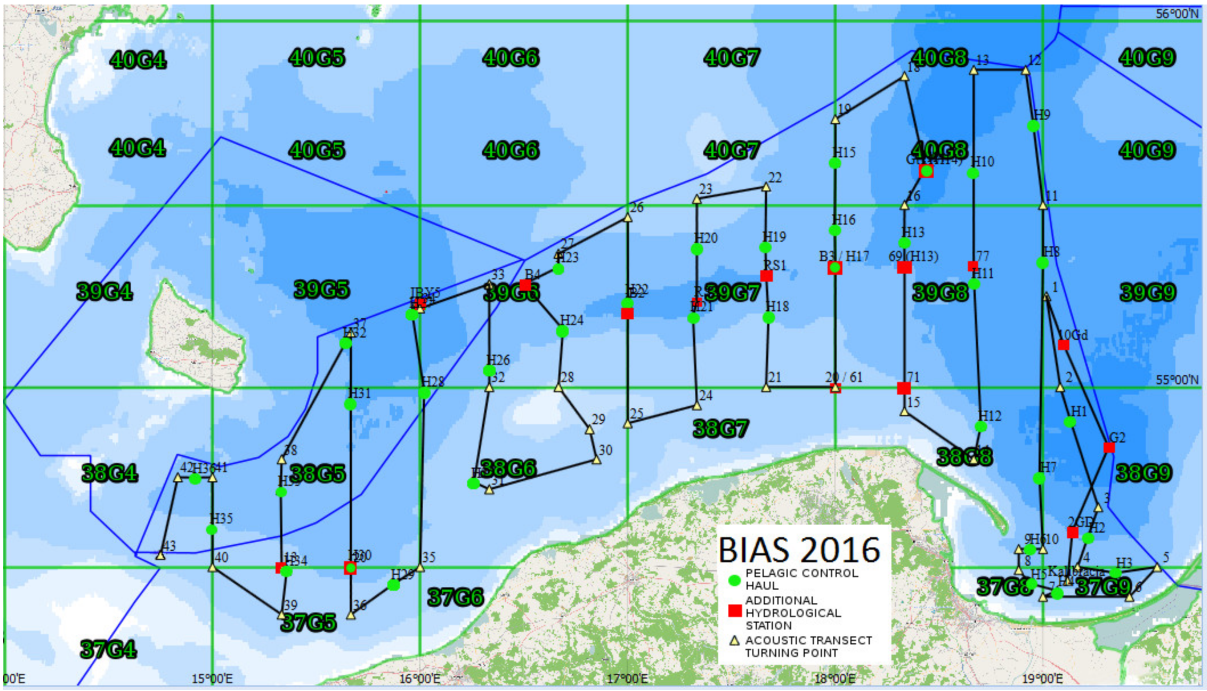

Fig. 3. A map showing realised cruise tracks.

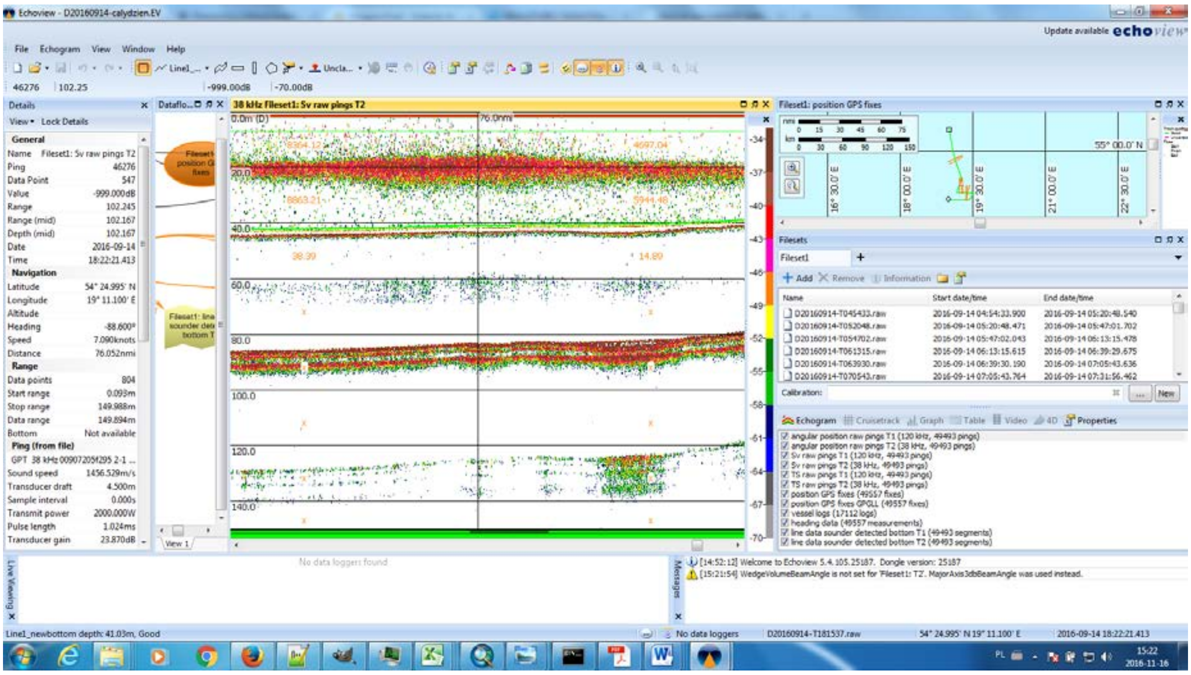

Fig. 4. An example of an echogram analysis for 76th mile of the integration NASC = 17265 (bottom depth about 40 m).

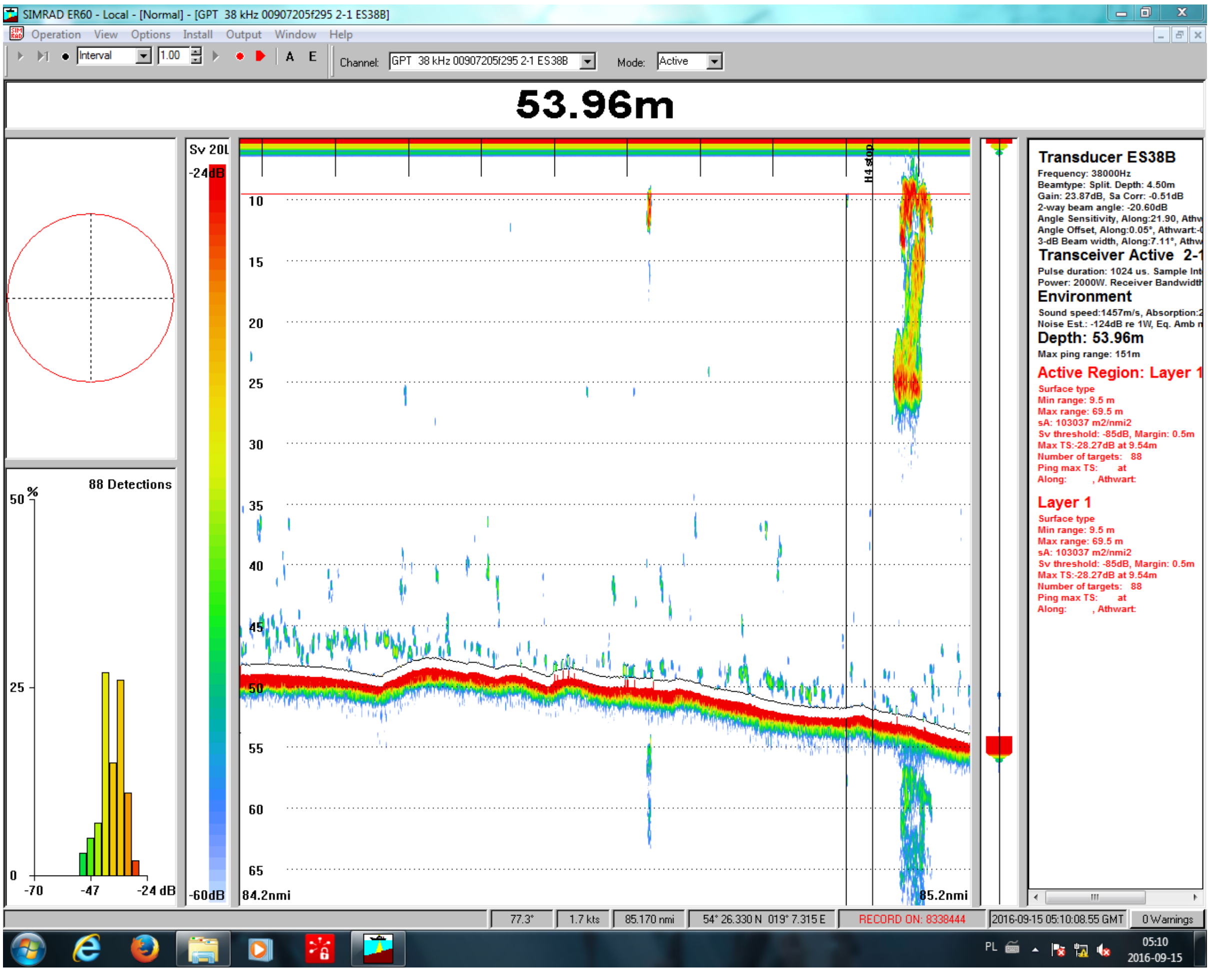

Fig. 5. A screenshot from the SIMRAD EK60 software showing a large school of clupeids with the NASC over 103000 in the ICES rectangle 37G9 near Krynica Morska (south-eastern part of the Gulf of Gdansk).

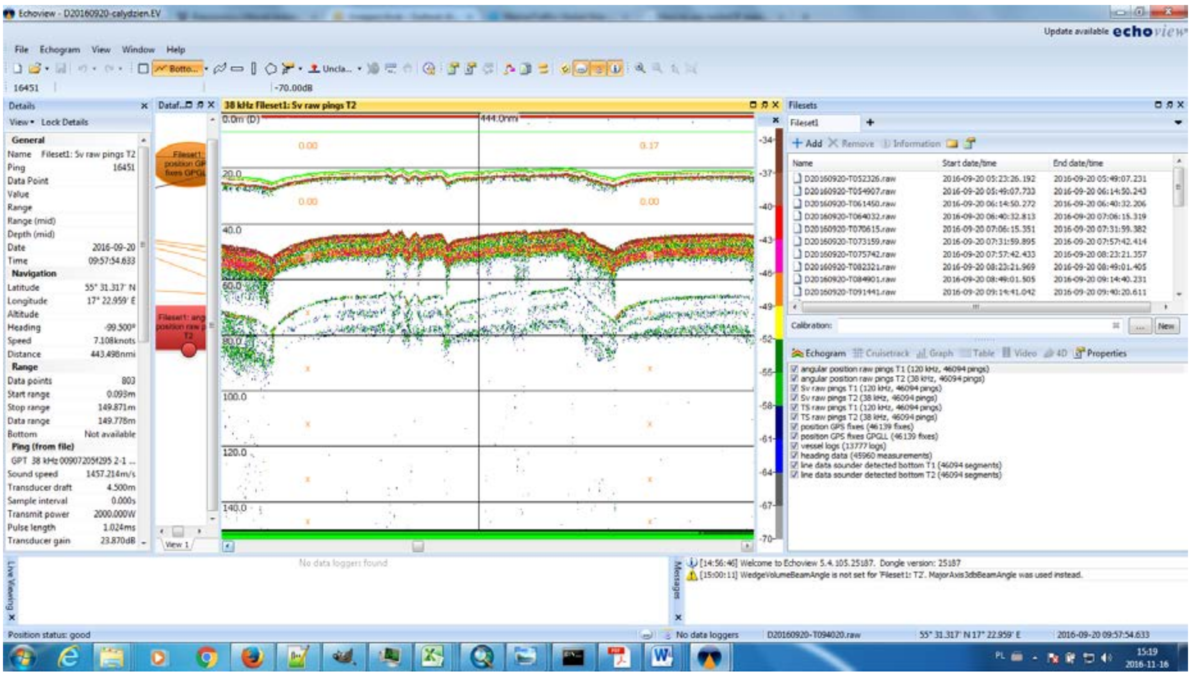

Fig. 6. An example of an echogram analysis for 444th mile of the integration NASC = 0 (bottom depth about 20 m).

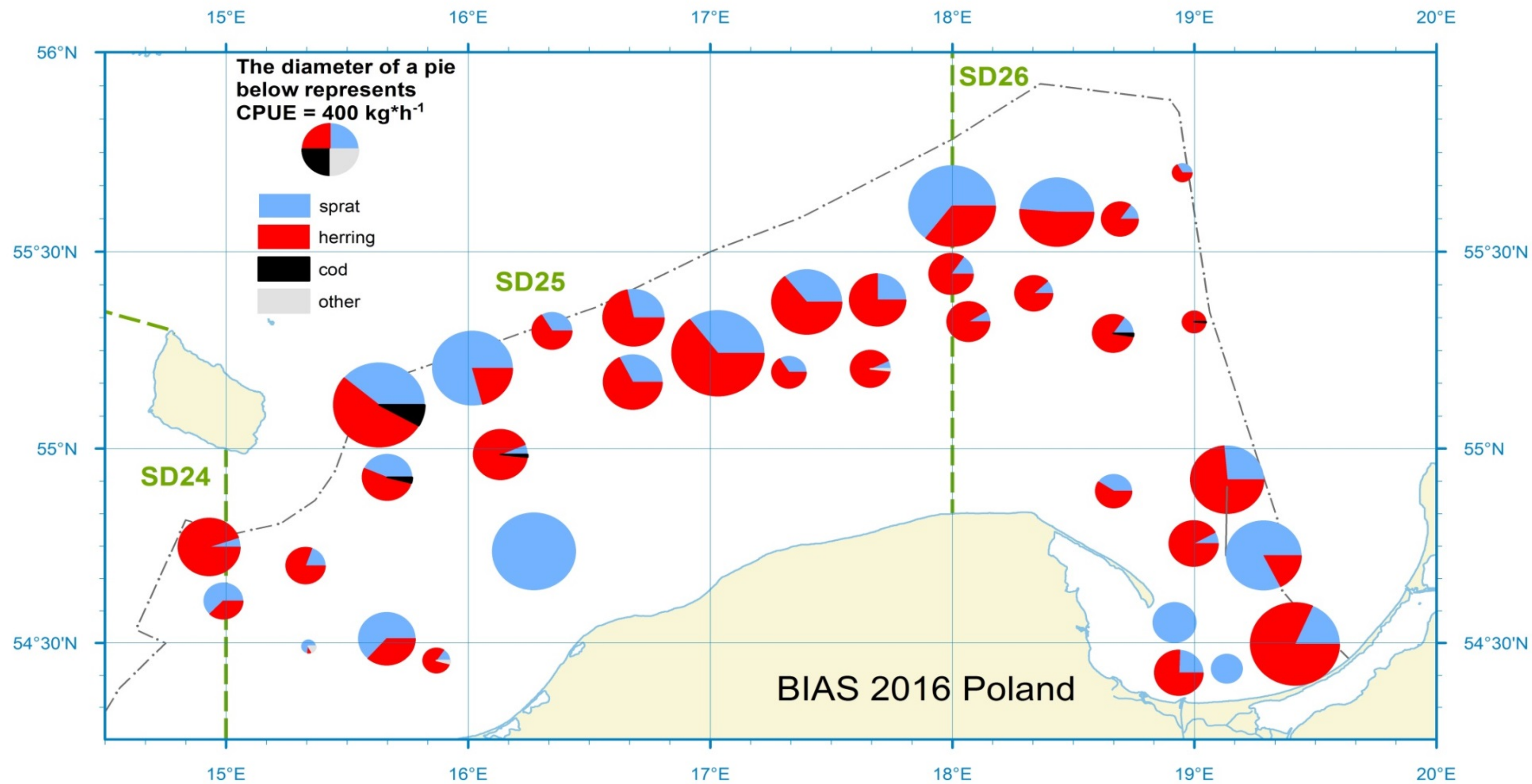

Fig. 7. Mean CPUE [kg h^{-1}] per species in Polish EEZ per single pelagic haul.

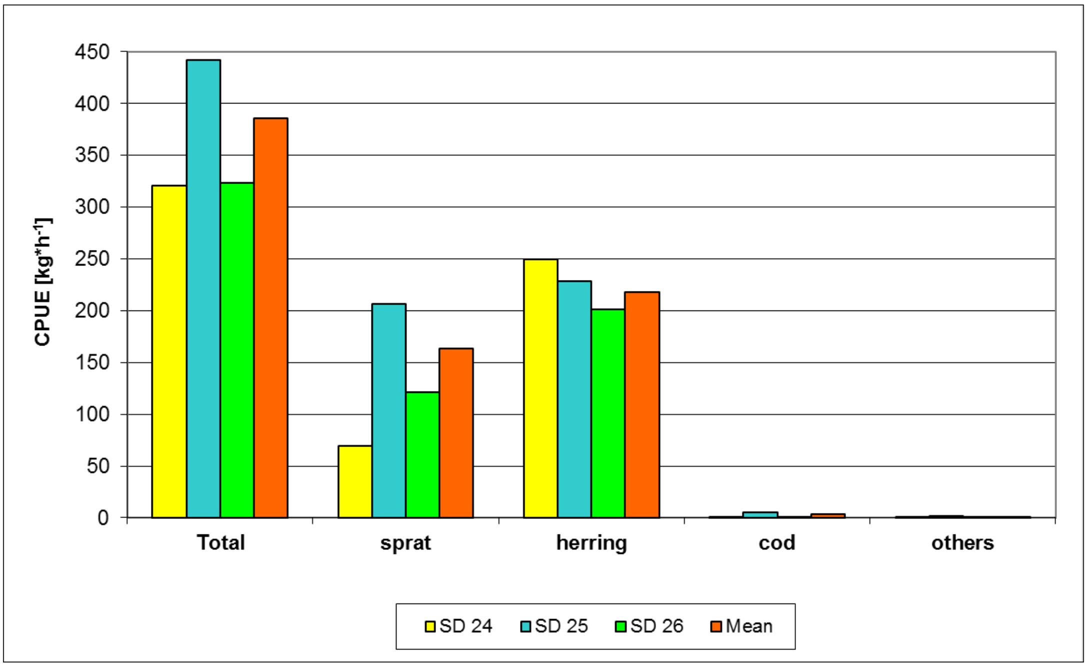

Fig. 8. Mean CPUE [kg h^{-1}] per fish species and the ICES SDs.

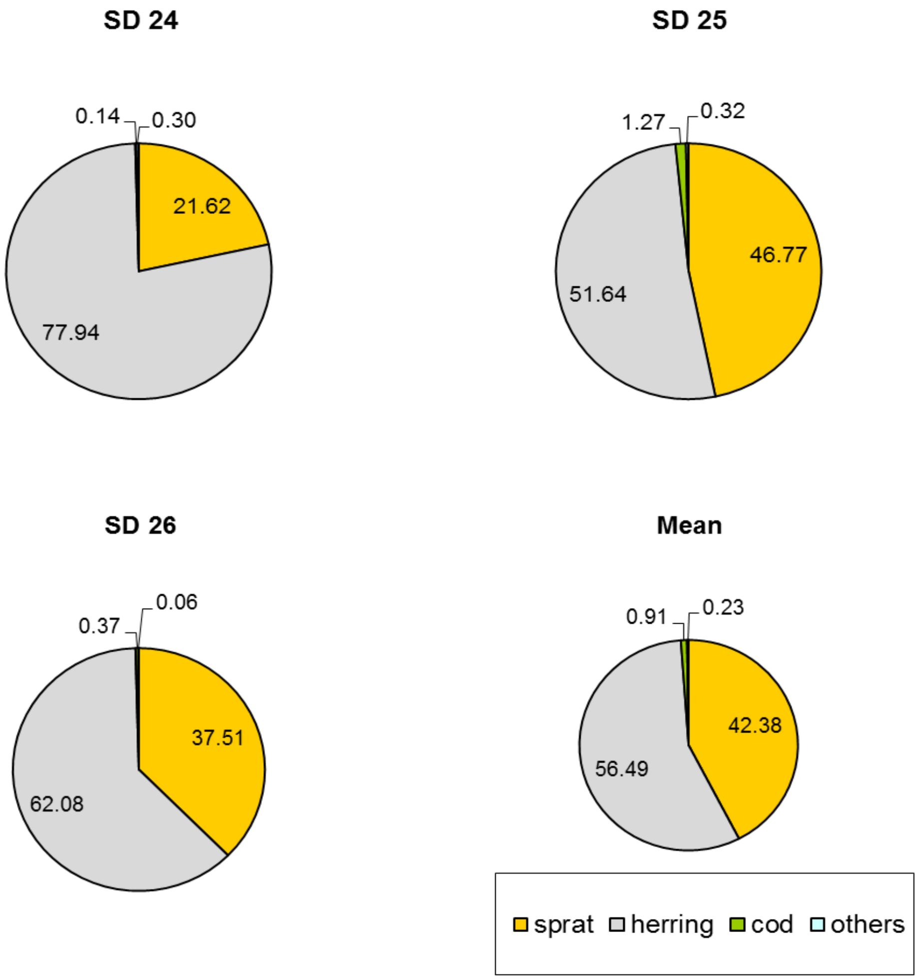

Fig. 9. Mean share (%) of sprat, herring, cod and other fishes in the mass of total catches per the ICES SDs.

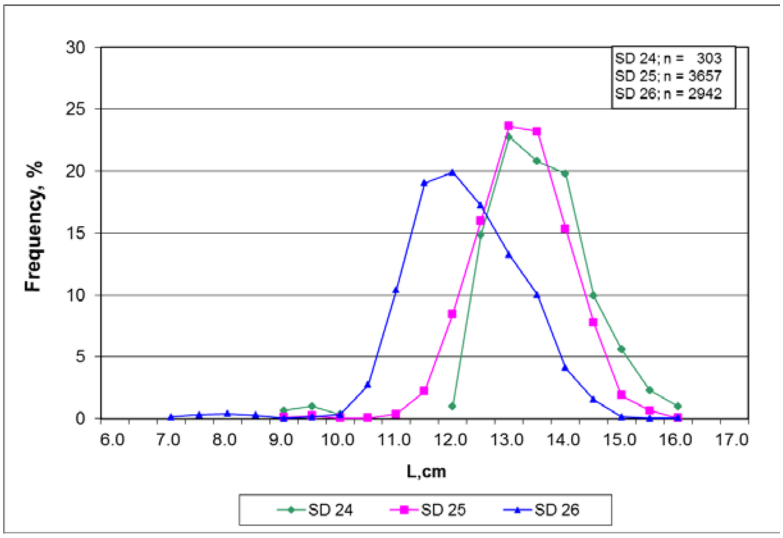

Fig. 10. Length distribution of sprat in samples taken from the control catches.

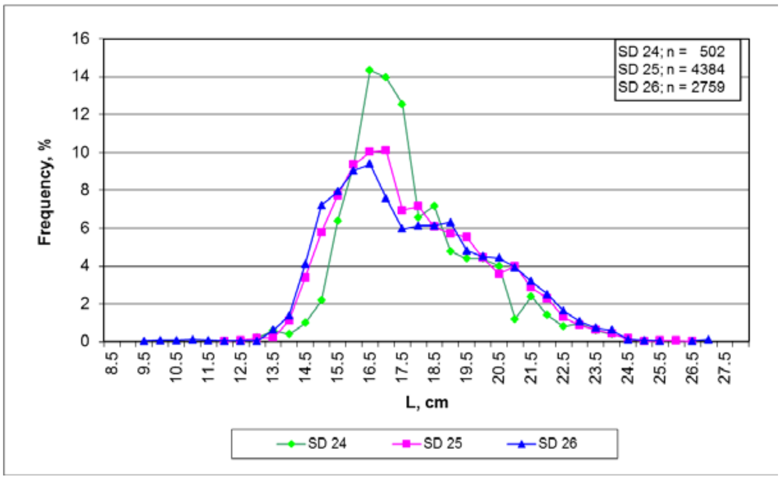

Fig. 11. Length distribution of herring in samples taken from the control catches.

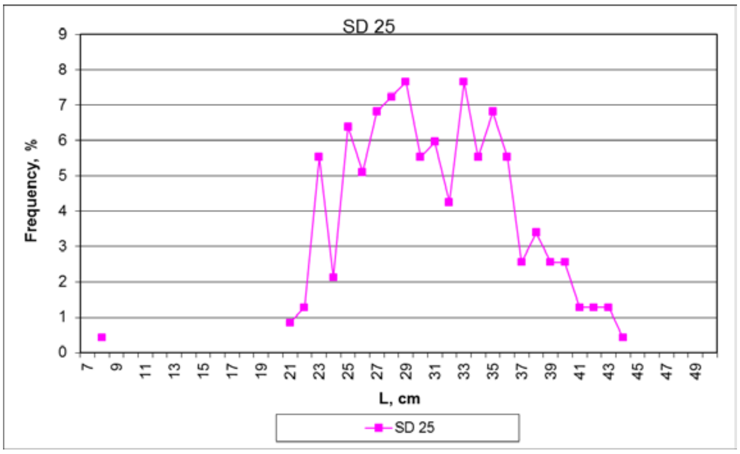

Fig. 12. Length distribution of cod in samples taken from the control catches in SD 25. The data from SDs 24 and 26 were not representative.

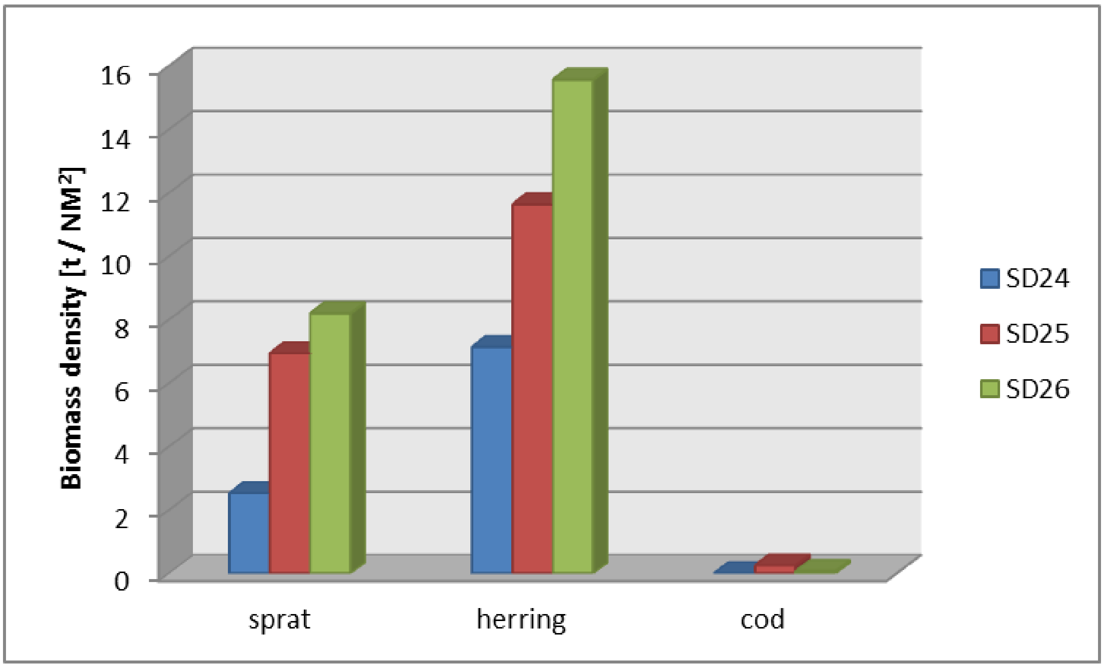

Fig. 13. Total biomass density in the ICES Sub-divisions for the three major species.

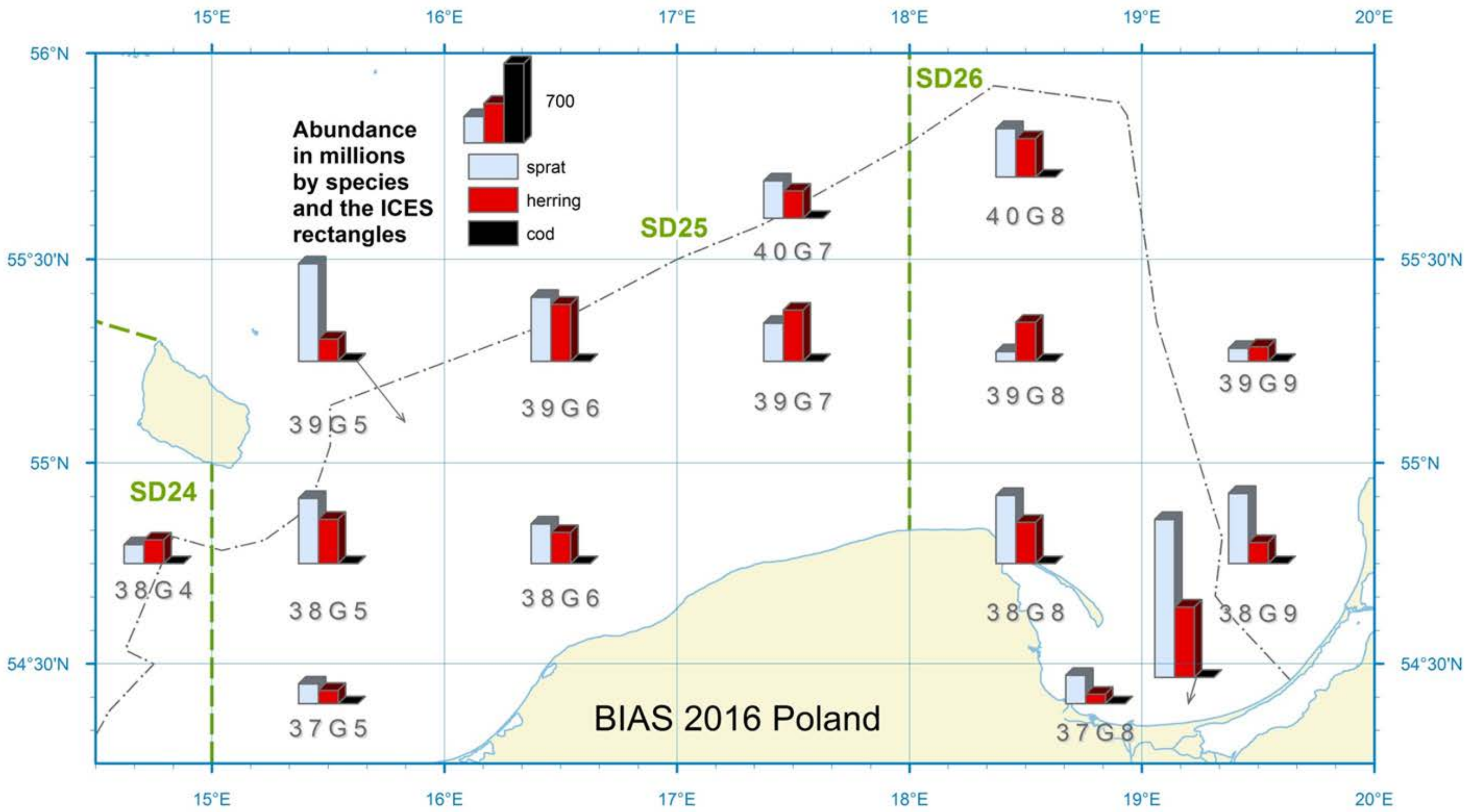

*Fig. 14. Cruise statistics (the black bar's size in a legend represents 700*10^6 of indiv.).*

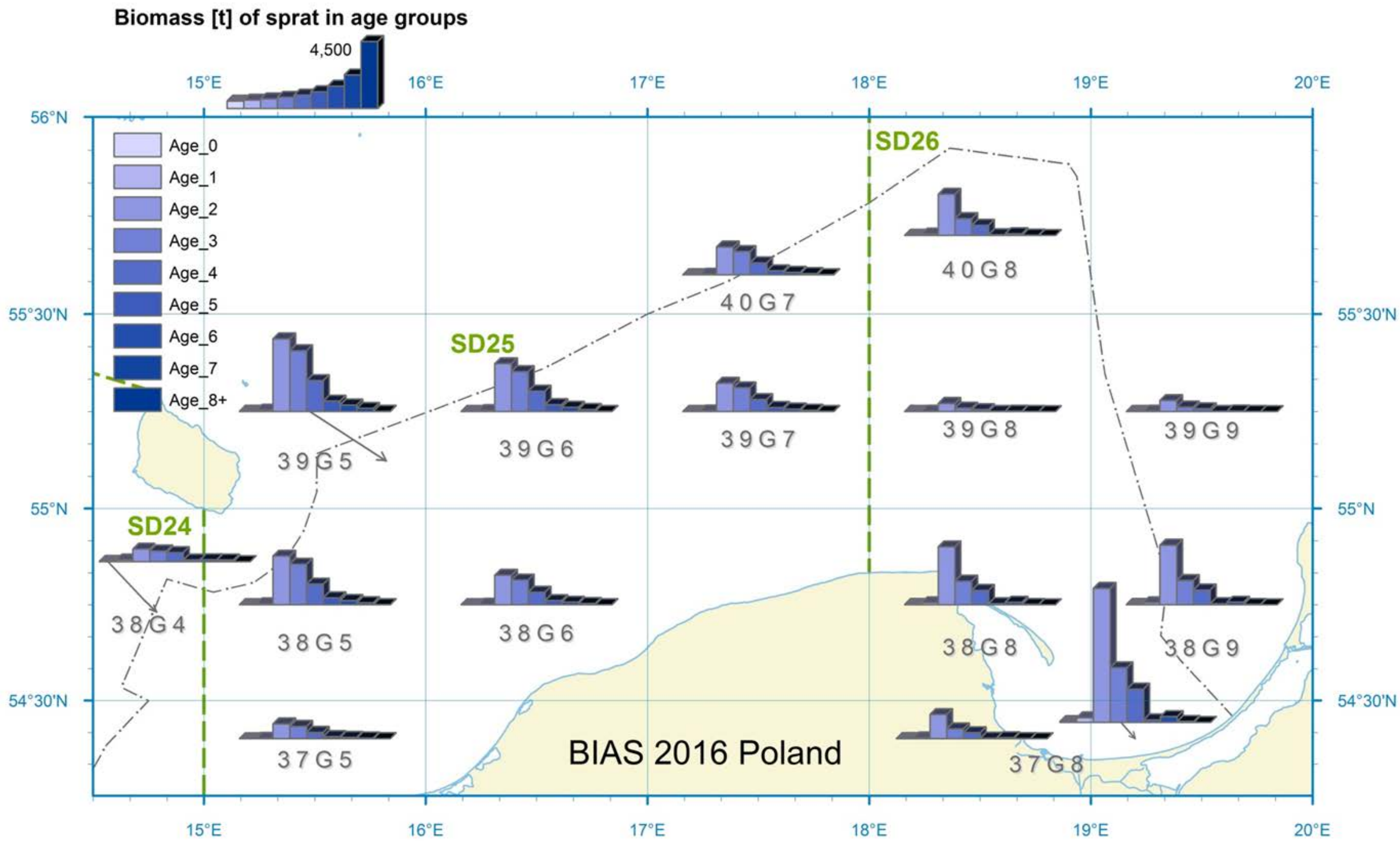

Fig. 15. Biomass of sprat (in tons) per age groups, ICES rectangles and ICES SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13-30.09.2016. The largest bar's size in the legend represents 4500 t.

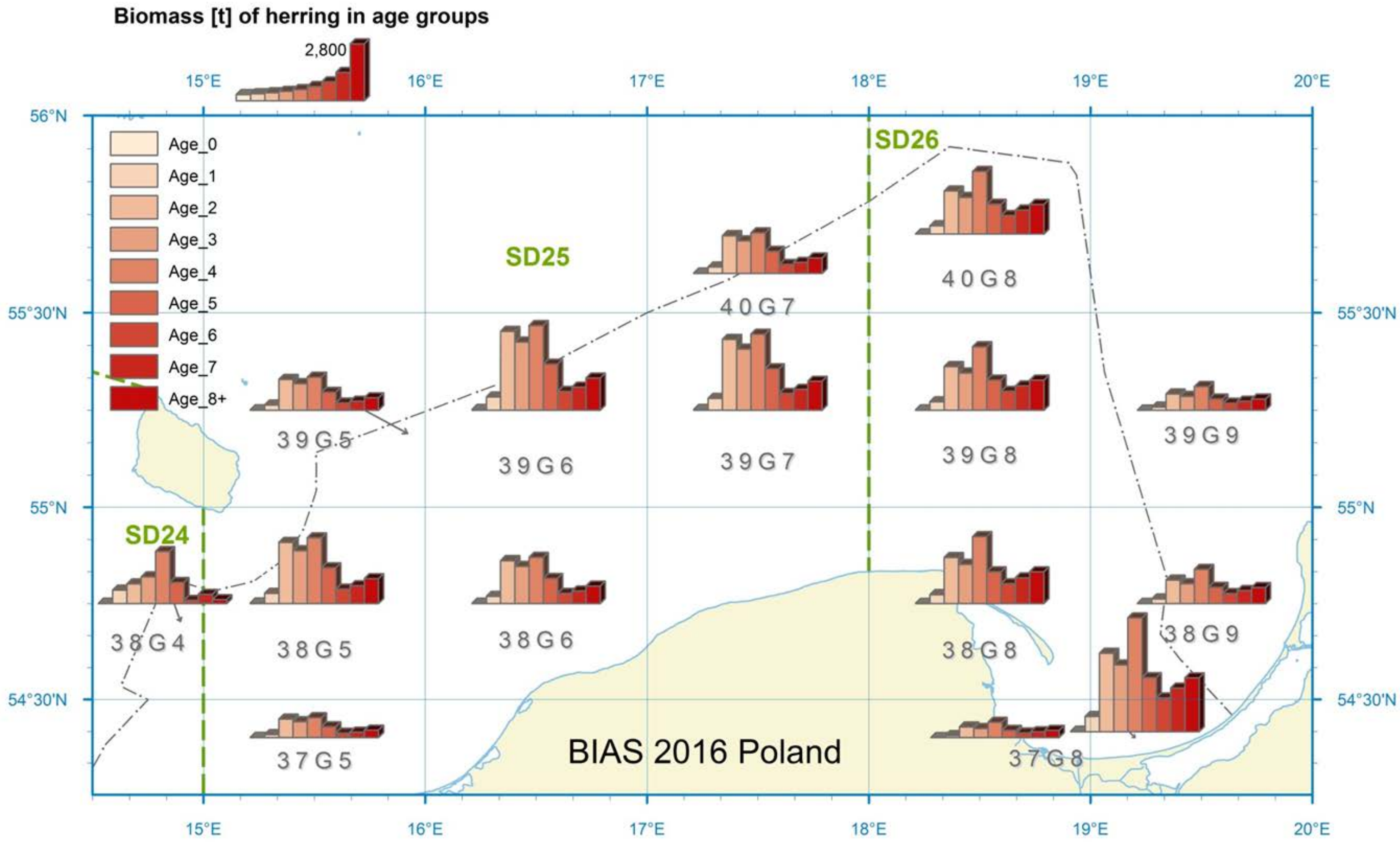

Fig. 16. Biomass of herring (in tons) per age groups, ICES rectangles and ICES SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13-30.09.2016. The largest bar's size in the legend represents 2800 t.

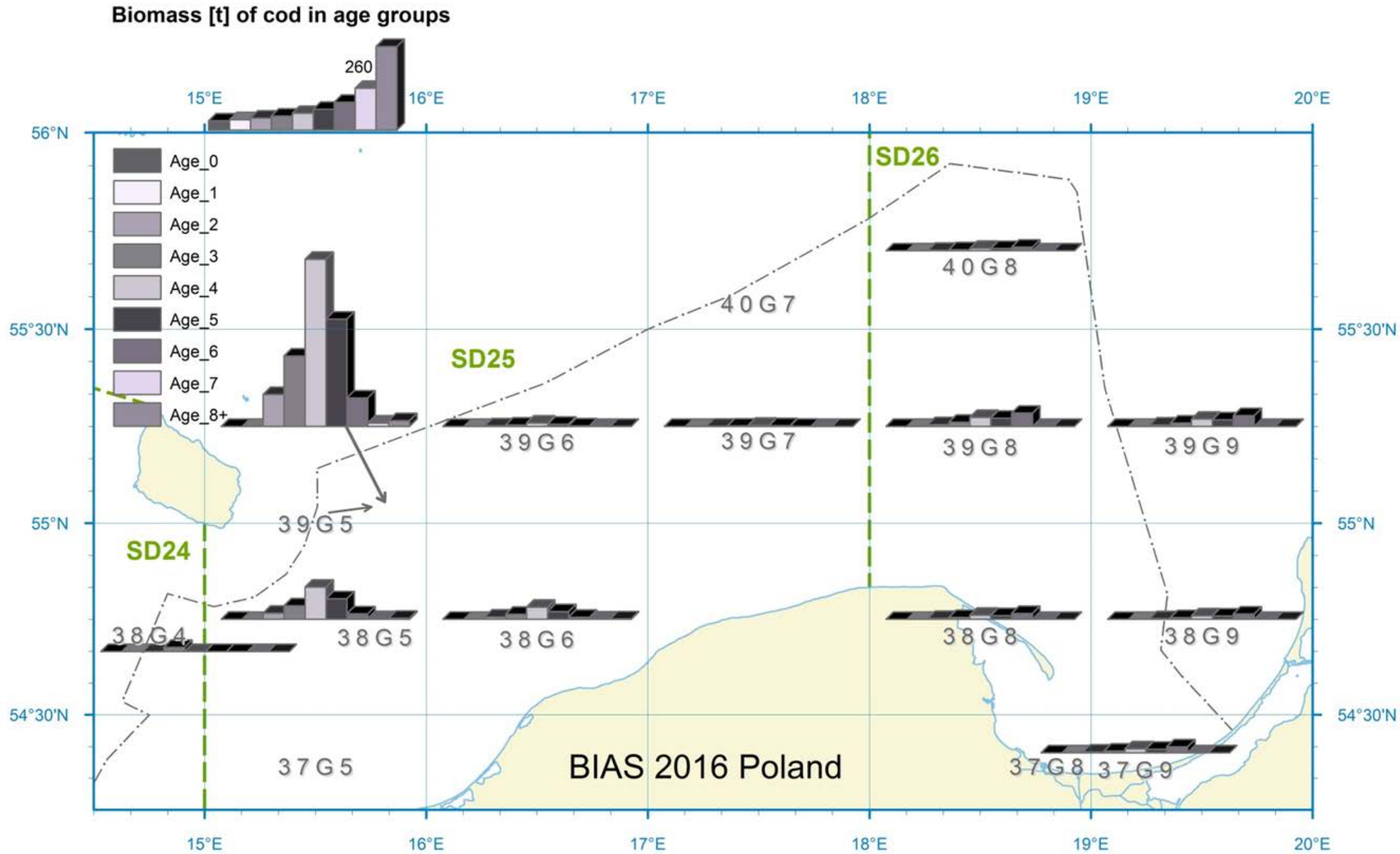

Fig. 17. Biomass of cod in tons per age groups, ICES rectangles and ICES SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13-30.09.2016. The largest bar's size in the legend represents 260 t.

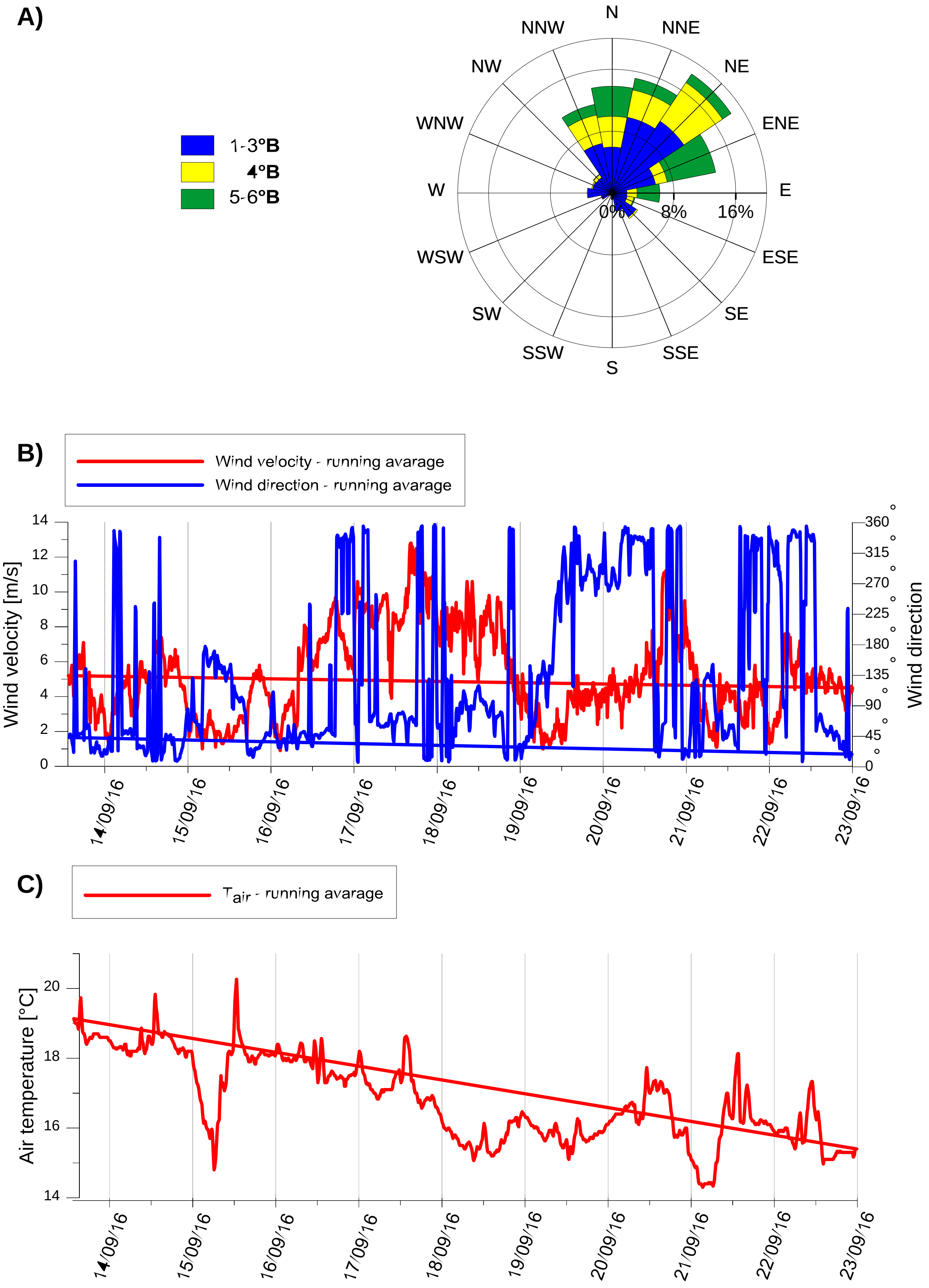

Fig. 18. Changes of meteorological parameters during consecutive days of the Polish BIAS survey (September 2016).

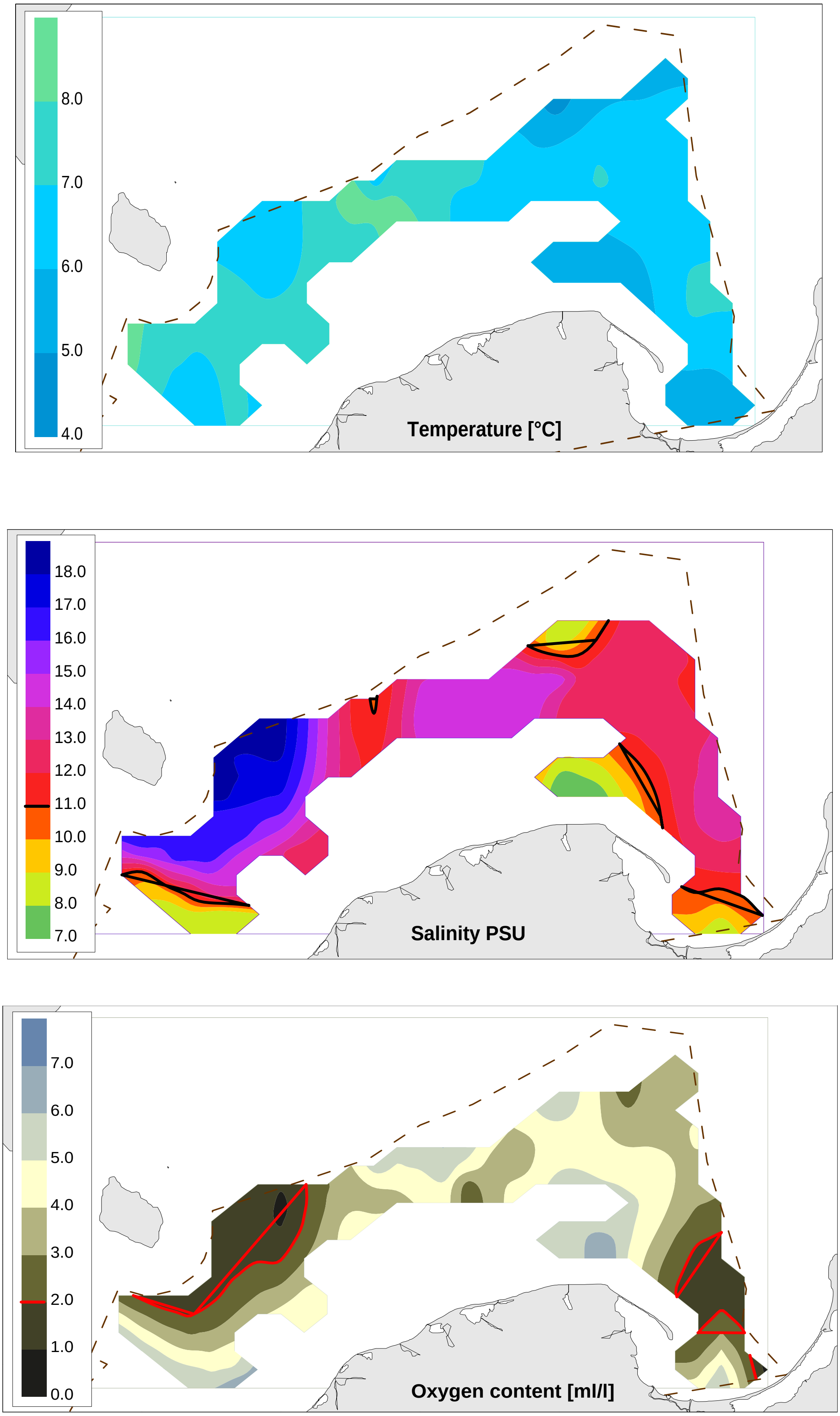

Fig. 19. Horizontal distribution of the seawater temperature, salinity and oxygen content in near the seabed layer of the southern Baltic (September 2016).

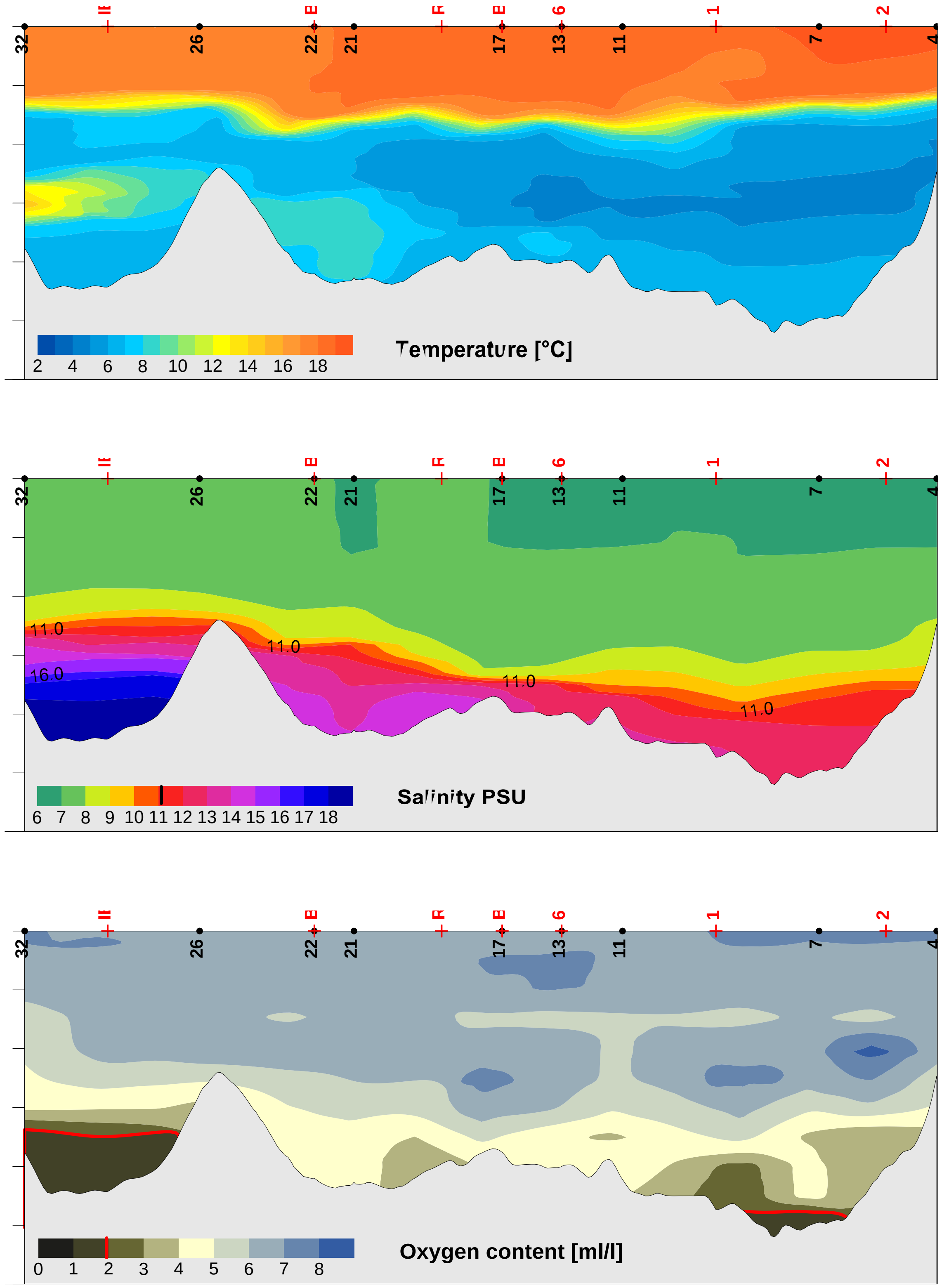

Fig. 20. Vertical distribution of the seawater temperature, salinity and oxygen content, along the research profile determined in the southern Baltic (September 2016); X- and Y-axes reflects distance (in kilometers) and depth (in meters) from the sea surface to the seabed, respectively.

Institute of Food Safety, Animal Health and Environment – BIOR, Riga (Latvia)

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THE CRUISE REPORT

FROM THE JOINT LATVIAN-POLISH BALTIC INTERNATIONAL ACOUSTIC SURVEY – BIAS 2016 ON THE R/V "BALTICA" IN THE ICES SUBDIVISIONS 26N AND 28.2 OF THE BALTIC SEA (11-20 OCTOBER 2016)

Working paper on the WGBIFS meeting in Riga, Latvia, 27-31.03.2017

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Riga – Gdynia, March 2017

INTRODUCTION

More less regular acoustic estimations of pelagic fish stocks in the Baltic Sea initiated by BaltNIIRH (now BIOR) and Institute für Hochseefischerei in Rostock (DDR) was performed since 1983, but the first scattered surveys was made since 1977 [Hoziosky et al. 1987, Shvetsov 1983, Shvetsov et al. 1988]. The first joint Latvian-Polish acoustic survey on the research vessel “Issledovatel Baltiki” (renamed on the r/v "Baltijas Petnieks") of former BaltNIRH was realised in October 1991 and was performed for the estimations of the biomas of Baltic clupeid stocks in the pelagic offshore zone of the ICES Sub-divisions 25-29 [Shvetsov et al. 1992]. The next joint acoustic survey in cooperation of scientists from Poland, Latvia and Estonia were performed on the Polish r/v "Baltica" in October 1996 [Grygiel 2006, Orłowski et al. 1997]. The permanent participation of the Polish r/v “Baltica” in the autumn Baltic International Acoustic Surveys (BIAS) within the Polish EEZ has taken place since 1994 in the framework of long-term ICES Baltic International Acoustic Surveys program, coordinated by the ICES Baltic International Fish Survey Working Group (WGBIFS). Several years in October (1994-2004) and May (2003-2004) BIOR as assignee of BaltNIIRH, LatFRI (in noted period) and LatFRA cooperated with Russian AtlantNIRO in Kaliningrad, but since 2005 the superb regular collaboration has been formed with Polish SFI (since June 2011 named as National Marine Fisheries Research Institute – NMFRI) in Gdynia and as a result we have made 5 BASS and 12 BIAS on pelagic fish stocks and 20 BITS on demersal fish stocks.

This was the 12th joint Latvian-Polish Baltic International Acoustic Survey (BIAS) in the ICES Sub-divisions 26N and 28.2 conducted by the r/v “Baltica” in October 2016. The reported cruise was organized on the basis of the agreement between the Institute of Food Safety, Animal Health and Environment (BIOR) from Riga and the National Marine Fisheries Research Institute (NMFRI) from Gdynia. The vessel was operated within the Latvian, Estonian and Swedish EEZs (ICES Sub-divisions 26N and 28.2). The “Latvian National Program for Collection of Fisheries Data 2011-2013” in accordance with the EU Council Regulation No. 199/2008 and EU Commission Regulation No.605/2008, EU Commission Decisions 2008/605/EC, 2009/10121/EC, C (2013) 5568, with European Commission implementing decision of 30.08.2013 that extends the national program for the period 2011-2013 to the period 2014-2016, was partly subsidized this cruise. It was coordinated by the ICES Baltic International Fish Survey Working Group (WGBIFS) [ICES 2016].

Pelagic research catches carried out during an acoustic survey are the information source, independent from topical preferences in fishery, about quantitative changes in a process of clupeids geographical and bathymetrical distribution in the Baltic Sea. The data from hydrological measurements are the information source about abiotic environmental factors (seawater temperature, salinity, oxygen content) influencing sprat and herring spatial distribution. Echo-integration results along the pre-selected tracks are the basic materials for fish stock biomass calculations.

The ICES Baltic Fisheries Assessment Working Group (WGBFAS) applies the BIAS data for clupeids (sprat and herring) stock biomass assessment and spatial distribution updating. The basic acoustic and biological data collected during recently carried out survey are stored in the BASS_DB and BIAS_DB in BAD1 format and till the 2012 were stored in FishFrame Acoustic (former BAD2 format) international databases, managed by the ICES Secretariat. In recent years work is underway to create a new useful acoustic database.

The main aims of cruise were:

- to collect the echo-integration data for the estimation of the clupeids stocks biomass and abundance in the central-eastern Baltic;
- to collect materials from the fish control catches for investigations of the Baltic sprat, and in lesser degree herring, spawning stocks spatial distribution in the offshore waters of Latvia, Estonia and Sweden, moreover for analyses of the age-length structure and recruiting year-class strength of these fishes populations;

- to collect sprat and herring stomachs samples for feeding condition and food components analyses;
- to analyze the vertical and horizontal changes of the basic hydrological parameters (temperature, salinity and oxygen content) at the trawling positions and at the standard HELCOM hydrological stations;
- to collect the zooplankton and ichthyoplankton samples at the referring area.

1. MATERIALS AND METHODS

1.1. Personnel assignment

The scientific staff – seven persons:

F. Svecovs, (BIOR, Riga – Latvia) – scientific staff leader, acoustic team;
M. Wyszynski (NMFRI, Gdynia – Poland) – cruise leader, fish sampling team;
T. Wodzinowski (NMFRI, Gdynia – Poland) – hydrologist, hydrology team;
J. Slembarski (NMFRI, Gdynia – Poland) – acoustician, acoustic team;
G. Kruk (NMFRI, Gdynia – Poland) – acoustician, acoustic team;
G. Strods (BIOR, Riga – Latvia) – ichthyologist, acoustic and fish sampling team, hydrobiology;
V. Cervoncevs (BIOR, Riga – Latvia) – ichthyologist, fish sampling team;
J. Aizups (BIOR, Riga – Latvia) – ichthyologist, fish sampling team;
J. Gruduls (BIOR, Riga – Latvia) – ichthyologist, fish sampling team.

1.2. Survey description

The reported survey took place during the period of 11-20 October 2016 (10 working days at sea). The at sea researches were conducted within Latvian, Swedish and Estonian EEZs (the ICES Sub-divisions 26N and 28.2), moreover inside the Latvian territorial waters not shallower than 20 m.

The vessel left the Gdynia port (Poland) on 11.10.2016 at 15:55 o’clock and was navigated in the north direction to the echo-integration start point at the geographical position 56°06’N 020°10’E. The direct at sea researches began on 12.10.2016 at the midday. The survey ended on 20.10.2016 at 11:55 o’clock in the Ventspils harbor (Latvia).

1.3. Survey methods and performance

1.3.1. Acoustical and trawling methods

Acoustic data were collected with the SIMRAD EK-60 38 kHz and 120 kHz two frequency split beam scientific echo-sounder equipped with “EchoView Version 7.10” software for the data analysis. These data collected during the described here BIAS were delivered to the Latvian researchers for further elaboration. The survey echo-integration tracks were planned in the similar pattern as in the previous years, due to historical comparability of the data. Overall 628 nautical miles long survey tracks was observed and recorded with hydroacoustic equipment. The final pattern of transects was covered with a relatively good density. The area covered in October 2014 was 1953.3 nm^2 in the northern part of the ICES Sub-division 26 and 7874.9 nm^2 in Sub-division 28.2, totally 9828.2 nm^2 (Fig. 1).

The pre-selection of the pelagic fish catches based on the ICES statistical rectangle area (with range of 0.5 degree in latitude and 1 degree in longitude) and the present density pattern of vertical distribution of clupeids along a transect. The intention was to carry out at least two control hauls per the ICES statistical rectangle [ICES 2003]. The water depth range-layer with sufficient for fish oxygen content (minimum 1.0÷2.0 ml/l) were taken into account in the process of the hauls distribution.

The r/v “Baltica” realized 23 fish control-catches (Tab. 1). All catches were performed in the daylight (between 07:05 am and 16:55 pm) using the pelagic trawl type WP 53/64x4 (with 6 mm mesh bar length in the codend). The standard trawling duration was 30 minutes, however 5 hauls duration were shortened to 15 minutes (due to very dense fish concentrations observed). The mean speed of vessel while trawling was 3.0 knots. Overall, 5 hauls were conducted in SD 26N and 18 hauls in SD 28.2. Totally 15 hauls were performed in the Latvian, 5 hauls in Swedish and 3 hauls in Estonian EEZs (see text-table below).

1.3.2. Biological sampling

The length measurements (in 0.5 cm length classes) were realized for 4590 sprat and 2271 herring individuals. In total, 2161 sprat and 1248 herring individuals were taken for biological analysis. Moreover, all 755 individuals of other species (683 threespine stickleback, 46 ninespine stickleback, 18 cod, 4 flounder, 2 lumpfish, 1 short horn scorpion and 1 salmon) were measured (Tab. 2). Detailed ichthyologic analyses were made according to standard procedures, directly on board of surveying vessel.

Due to herring and sprat normally cannot be distinguished from other species by visual inspection of the echogram species composition and fish length distributions were based on trawl catch results. Mean target strength of fish was calculated according to the following formulas [Foote et al. 1986, ICES 1983, 2014]:

for clupeids: TS = 20logL-71.2;
for gadoids: TS = 20logL-67.5;
cross section $\sigma = 4\pi 10^{a/10} \times L^{b/10}$.

The total number of fish in each ICES rectangle was estimated as a product of the mean area scattering cross-section – NASC (S_A) and the rectangle area, divided by corresponding mean acoustic cross-section. Fish abundance was separated into different species according to the mean catch composition in the given rectangle.

1.3.2. Hydrological and meteorological observations

The measurements of the basic hydrological parameters were realized in the period of 11-20 October 2016, totally at 25 stations, int. al. at 23 fish catch-station and 5 HELCOM stations located in the central-eastern part of the Baltic Sea (Fig. 2). Positions of the haul stations 6, 7, 13 and 14 overlapped with HELCOM stations 45, 43, 37 and 40A respectively. Results presented in this paper are linked with sites of the standard HELCOM stations and locations of the catch-stations during pelagic trawl hauling up. Hydrological stations were inspected with the IDRONAUT CTD-probe combined with the rosette sampler (the bathometer rosette). Oxygen content was determined by the standard Winkler’s method. The hydrological row data, originated from measuring realized from the sea surface layer up to the bottom, were aggregated to the 1-m depth stratums, were information source about the abiotic factors potentially influencing fishes spatial distribution. The oxygen probes ware taken on every 10 meters. The salinity parameter was presented in Practical Salinity Unit (PSU).

Meteorological observations of air temperature, wind velocity and directions and atmospheric pressure were realized at the actual geographic position of each control-haul and in every 10 minutes interval over the whole survey. The automatic meteorological station type “Milosz” was applied for measurements of the above-mentioned parameters. The values of meteorological and hydrological parameters registered at trawling stations are aggregated in Table 3.

2. RESULTS

2.1. Biological data

2.1.1. Catch statistics

Total number of realized hauls and total catches in kg of fish in Latvian and Swedish EEZs during reported BIAS 4Q 2016 are presented in the Table 4. Overall, 9 fish species were recognized in hauls performed in the Central-eastern Baltic Sea. Sprat was dominating species by mass in the both ICES Sub-divisions 26N and 28.2 (92.7 and 83.3% respectively). The rest 7 species represented as 1.9 % (in this 1.7% belonging to threespine stickleback) of the total mass in average for all investigated area.

Mean CPUE for all species in the investigated area in 2016 amounted 1387.3 kg/h and was higher comparing to the previous years (504.5 kg/h in 2013 and 751.2 kg/h in 2014, 832.6 in 2015). The mean CPUEs of sprat were: 2036.8 kg/h in ICES SD 26N, and 968.4 kg/h in SD 28.2. The mean CPUEs of herring were as follow: in SD 26N – 155.2 kg/h and 162.0 kg/h in SD 28.2. Taking into advice all investigated area, about two time increase of mean CPUE value for sprat and a little of herring was noted in 2016, comparing to previous year. The CPUE values and distributions by particular haul for herring, sprat and others are presented at the Fig. 3 and 4. Highest CPUE values for herring were noted in the North-eastern part of SD 28.2, as well as very good CPUEs for sprat were distributed more equally in all investigated area.

2.1.2. Acoustical and biological estimates

The basic acoustic and biological data (surveyed area statistics, mean NASC, the mean scattering cross-section, the total number of fish, percentages of herring and sprat) per ICES rectangles and the estimated abundance and biomass of sprat and herring per above mentioned rectangles, collected in October 2016, are given in Table. 5, for third dominant species – threespine stickleback in Table 6. The characteristics of the pelagic fish stock are aggregated in Table 7 for sprat and Table 8 for herring. The geographical distributions of NASC and pelagic fish stock densities in the central-eastern Baltic Sea in October 2016 are shown in Fig. 5, 6 and 7.

The pelagic fish stock was represented mostly by sprat – 94.4 %, in comparison – 71.5% in 2013 86.8 %, in 2014 and 88.2 % in 2015. Herring was represented as only 5.6 %, 28.5 % in 2013, 13.2 % in 2014 and 11.8 % in 2015. Tendency shows that sprat stock grows faster than herring stock. The highest sprat stock density (126.4 n×10^6/nm^2, 72.6 n×10^6/nm^2 in 2015) were recorded in ICES rectangle 42H0 of the ICES Sub-division 28.2. The highest average abundance per nm^2 and biomass of the sprat stock were recorded in the central and southern part of investigated area in ICES rectangles 42H0 and 41H0. The distribution of the high density sprat concentrations in October 2016 totally differed comparing with that from October of the years previous 2010-2015, when high density sprat concentrations had found mostly in the central and northern parts of the investigated area. In 2013 sprat distribution pattern more-less was emulating pattern observed in years till 1992 [Hoziosky et al. 1988, Shvetsov et al. 1988, 1989, 1992, 2002], but not so evident as it was in 2010. In 2014 sprat had scattered distribution of concentrations mostly made from specimens of new generation and in 2015 distribution was scattered too, but with relatively high rate of concentrations in separate points. In 2016 the main sprat stock resides between 50 and 100 m depth isolines and the geographical distribution shows different pattern as it was recent two years before when it was very scattered with several concentration points of high abundance [Svecovs et al. 2010, 2011, 2012, 2013, 2014, 2015]. In October 2016 sprat stock had three centers of aggregations in investigated aquatory.

The herring stock density was significantly lower in comparison to sprat stock density and densities in previous recent years. The highest density values were 5.0 and 5.2 n×10^6/nm^2 and noted in ICES rectangles 43H1 and 43H0 respectively in Sub-division 28.2 in comparison to 2013 were highest density values was not over 8.8 n×10^6/nm^2 in rectangle 44H0, in 2014 values over 10.0 n×10^6/nm^2 were recorded in two rectangles 43H0 and 45H0, but in 2015 highest density values was 10.2 n×10^6/nm^2 and noted in ICES rectangle 44H0.

Comparison of the acoustic results from October of 2005-2015 indicated that investigated sprat stock abundance and biomass had decreasing tendency, but herring stock had a slight increase. In 2016 sprat stock has increased significantly due to very abundant generation of 2014. Herring stock remains at the same level as previous year.

The mean length and mean weight distributions of dominant fish species (sprat, herring and sticklebacks) by hauls and rectangles in the ICES Sub-divisions 26 and 28 are shown in Figures 8, 9 and 10 respectively. The total length and mean weight in control hauls of sprat, herring and stickleback ranged as follows:

- sprat – 6.5÷14.5 cm (average TL = 11.36 cm), 1.7÷18.4 g (average W = 8.71 g)
- herring – 8.0÷23.0 cm (average TL = 15.38 cm), 4.0÷84.0 g (average W = 23.07 g)
- stickleback – 4.0÷7.5 cm (average TL = 6.23 cm), 0.7÷3.5 g (average W = 1.85 g)

The sprat length distribution curves have a bimodal character for both Sub-divisions 26 and 28.2. The first small length frequency pick takes place at 8.5-9 cm length classes and the second higher one at length classes 11-11.5 cm represented adult sprat. The frequency of sprat generation born in 2016 (ranged from 6.5 to 9.5 cm total length), like as 2015 generation, was scarcely notice comparing to high frequency of sprat generation born in 2014.

The modal frequency representing adult herring corresponded to 14.5 and 15.5 cm length classes in SDs 28.2 and 26 respectively. The fish representing 8.0-9.5 cm length range belonging to the generation born in 2016 had a very low frequency and was noted in SD 28.2 only.

Three and ninespine sticklebacks length distributions from SD 28.2 showed a one mode character with frequency picks at 6 and 4.5 cm length classes respectively.

Sprat at the smallest length classes had even composition of mean weights and lengths in whole area, but by increasing age the differences of mean weights appears in the investigated area – towards the south-southwest sprat became heavier, the same tendency was observed in previous years. Herring had more evident differences at length classes than it was observed at sprat. Sprat stock was composed dominantly of year class 2 specimens – 67.64 % in SD 26N, 56.82 % in SD 28.2 and 60.22 % overall. Herring stock although was composed mainly of year class 2 specimens – 33.93 % in SD 26N, 51.44 % in SD 28.2 and 49.18 % overall. The year-class 0 of sprat was represented by length-classes 8.0÷9.5 cm in SD 26N, 6.5÷10.0 cm in SD 28.2 and 8.35 cm on average with mean weights 3.3÷5.5 g, 1.7÷7.2 g and 4.27 g respectively.

2.2. Meteorological and hydrological data

2.2.1. Weather conditions

The most frequently winds (Fig. 11.) were: E and ESE. The wind speed varied from 2.8 m/s to 14.8 m/s and average wind speed was 8.1 m/s. The air temperature ranged from 9.8 °C to 2.6 °C, and average temperature was 6.6 °C.

2.2.2. Hydrology of the Gotland Deep

Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological research profile of the central-eastern Baltic for October 2016 is shown in Figure 12. The seawater temperature in the surface layers varied from 8.15 to 13.54°C (the mean was 10.81°C). The lowest surface temperatures were recorded at the haul station 23. The highest ones were noticed at the station 46. The minimum value of salinity in Practical Salinity Unit (PSU) was 6.30 at the haul station 22 in the surface layer. The maximum was 7.03 PSU at the hydrological station 46. The mean value of salinity was 6.65 PSU. The oxygen content in the surface layers of investigated the research area varied in the range of 7.06 ml/l (station 46) – 7.96 ml/l (haul 11). The mean value of surface water oxygen content was 7.61 ml/l.

The temperature of near bottom (Fig. 13) layer was changing in the range of 7.30 - 4.82°C (the mean was 6.01°C). Salinity in the bottom waters varied from 7.56 to 13.39 PSU (the mean was 10.99 PSU). The lowest values of salinity were at the haul station 2. The highest values of salinity were noticed at the haul station 13. Oxygen content varied from 0.17 ml/l to 6.96 ml/l (the mean was 1.86 ml/l). The lowest values of this parameter were noticed at the haul station 13.

3. DISCUSSION

The data of the Latvian-Polish BIAS in the 4th quarter of 2016 were considered by the ICES BIFS Working Group (Rostock, Germany, 30.03-03.04.2016) as representative for the central-eastern

Baltic for the estimation of abundance and spatial distribution of pelagic fishes (herring and sprat) recruiting year classes and were provided to the Baltic Fisheries Assessment Working Group (WGBFAS) as the input data for fish stocks resources calculation. The acoustic, catch, biological and hydrological data, collected during reported survey were uploaded to the BAD1 and to the emerging international databases managed by the ICES Secretariat.

The collected data shows that sprat population in ICES SD 26N and 28.2 in the period of 2005-2015 had overall decreasing tendency of abundance with evident increasing in 2016 due to very abundant sprat generation of 2014. The mean length and weight of adult sprat had the same tendency to abundance. The geographical distribution of sprat densities in the October 2016 had different pattern as in 2015 due to recruits of 2014 integrated in adult fish stock. The main sprat stock laid over the 50-100 m depths.

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Annex. Tables and Figures

Table 1. Fish control-catch statistics in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016

Haul number	Date	ICES rectangle	ICES SD	Mean bottom depth [m]	Headrope depth [m]	Vertical opening [m]	Trawling speed [knt]	Trawling direction [°]	Geographical position: Start		Geographical position: End		Time Start	Haul duration [min]	Total catch [kg]
									Latitude 00°00.0'N	Longitude 00°00.0'E	Latitude 00°00.0'N	Longitude 00°00.0'E			
1	2016-10-12	41H0/G9	26	60	37	20	3.1	277	56°06.5'	20°00.1'	56°06.7'	19°57.3'	11:45	30	239.337
2	2016-10-12	41G9	26	51	22	20	3.1	268	56°06.3'	19°37.9'	56°06.3'	19°35.1'	14:10	30	198.320
3	2016-10-13	41G9	26	128	25	20	2.9	105	56°23.0'	19°08.8'	56°22.7'	19°12.1'	07:40	30	439.608
4	2016-10-13	41G9	26	102	55	20	3.0	280	56°23.1'	19°47.0'	56°23.3'	19°44.7'	11:45	30	283.410
5	2016-10-13	41H0	26	76	50	20	3.0	280	56°23.2'	20°03.2'	56°23.3'	20°01.7'	14:50	15	2166.149
6	2016-10-14	42H0	28.2	56	27/38	20	3.0	267	56°36.9'	20°35.8'	56°36.8'	20°33.1'	07:05	30	716.380
7	2016-10-14	42G9	28.2	145	65	19	3.0	276	56°37.0'	19°53.3'	56°37.1'	19°52.1'	10:55	15	861.191
8	2016-10-14	42G9	28.2	151	70	18	3.0	18	56°40.0'	19°06.0'	56°41.4'	19°06.7'	15:25	30	379.628
9	2016-10-15	42H0/G9	28.2	160	30	20	3.1	275	56°53.1'	20°02.2'	56°53.2'	19°59.2'	08:10	30	176.630
10	2016-10-15	42H0	28.2	126	58	20	2.9	275	56°53.0'	20°17.0'	56°53.1'	20°14.1'	11:05	30	1462.576
11	2016-10-15	43H0	28.2	69	45	20	3.0	308	57°05.7'	20°44.7'	57°06.6'	20°42.8'	16:00	30	421.665
12	2016-10-16	43G9	28.2	154	35	18	2.9	304	57°23.3'	19°44.3'	57°23.7'	19°43.2'	13:35	15	338.085
13	2016-10-16	43H0	28.2	232	40/60	20	2.8	280	57°20.7'	20°04.5'	57°20.9'	20°02.0'	16:25	30	203.150
14	2016-10-17	43H1	28.2	67	46	20	3.2	26	57°23.7'	21°00.5'	57°24.6'	21°01.3'	08:25	15	946.110
15	2016-10-17	44H1	28.2	64	43	20	3.0	10	57°34.6'	21°08.4'	57°36.2'	21°09.2'	10:40	30	277.920
16	2016-10-17	44H0	28.2	103	70/40	19/20	2.9	342	57°37.3'	20°43.7'	57°38.6'	20°42.8'	14:55	30	197.671
17	2016-10-18	44G9	28.2	121	52	20	3.0	350	57°42.0'	19°59.8'	57°42.7'	19°59.6'	08:20	15	282.600
18	2016-10-18	44H0	28.2	123	56	20	2.9	346	57°54.5'	20°12.7'	57°55.8'	20°12.2'	11:55	30	306.960
19	2016-10-18	44H0	28.2	101	50/30	20/23	3.1	312	57°54.4'	20°41.9'	57°55.2'	20°40.3'	15:35	30	137.940
20	2016-10-19	44H1	28.2	67	45	20	3.1	338	57°55.5'	21°21.2'	57°56.8'	21°20.2'	07:40	30	807.460
21	2016-10-19	45H0	28.2	59	30	18	3.2	295	58°04.9'	20°57.7'	58°05.5'	20°54.8'	11:25	30	87.251
22	2016-10-19	45H0	28.2	98	41	20	2.8	309	58°07.5'	20°28.7'	58°08.4'	20°26.6'	14:30	30	99.991
23	2016-10-20	43H1	28.2	68	40	20	3.0	323	57°23.0'	21°09.2'	57°24.2'	21°08.1'	07:30	30	329.343
												SD26			3326.824
												SD28			8032.551
												SD26+28			11359.375

Table 2. Number of measured and aged fish individuals in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016

Fish species	Number of measured individuals			Number of aged individuals		
	SD 26	SD 28	SD 26+28	SD 26	SD 28	SD 26+28
Sprat (all)	1014	3576	4590	466	1695	2161
Sprat (yearclass 0)	43	381	424	43	201	244
Herring (all)	421	1850	2271	200	1048	1248
Herring (Open sea herring)	359	1460	1819	169	824	993
Spring spawners	359	1459	1818	169	823	992
Autumn spawners		1	1		1	1
Herring (Gulf herring)	4	381	385	2	219	221
Herring (Southern Baltic herring)	58	9	67	29	5	34
Cod	11	8	19			
Flounder		4	4			
Lumpfish	2		2			
Salmon	1	1	2			
Stickleback, threespine	15	668	683			
Stickleback, ninespine		46	46			
Shorthorn sculpin	1		1			
Total	1465	6153	7618	666	2743	3409

Table 3. The values of meteorological and hydrological parameters registered at the trawling depth in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016

Haul numbe r	Date of catch	Mean headrop e depth [m]	Meteorological parameters wind directio n	wind force [°B]	sea state	air temper [°C]	atmospheric pressure [hP]	Hydrological parameters temperatur e [°C]	salinity [PSU]	oxygen [ml/l]
1	12-10-	37	E	4	3	6	1027	5.29	7.28	6.53
2	12-10-	22	E	4	2	6	1027	13.38	7	7.27
3	13-10-	25	E	4	2	6	1027	11.6	6.7	7.36
4	13-10-	55	E	4	3	6	1029	5.07	8.58	4.65
5	13-10-	50	E	3	2	7	1030	5.04	8.6	4.11
6	14-10-	27/38	E	4	2	4	1025	4.85/4.64	7.13/7.6	6.75/4.7
7	14-10-	65	E	4	2	4	1028	5.08	8.92	2.69
8	14-10-	70	E	4	2	5	1029	5.36	9.45	2.83
9	15-10-	30	ESE	5	3	3	1027	9.15	6.81	7.31
10	15-10-	58	E	4	3	3	1028	5.08	8.83	2.18
11	15-10-	45	E	6	3	3	1031	5.26	9.25	2.59
12	16-10-	35	SE	5	3/4	5	1035	5.05	7.17	6.79
13	16-10-	40/60	SE	5	3	5	1035	5.11/5.01	8.93/7.2	2.07/6.3
14	17-10-	46	SE	4	3	5	1035	5.45	9.18	2.04
15	17-10-	43	SE	5	3	6	1037	5.85	9.58	1.75
16	17-10-	70/40	S	5	3	7	1034	4.62/4.82	7.46/8.3	5.95/3.3
17	18-10-	52	SSE	5	3	6	1026	4.67	8.04	3.96
18	18-10-	56	SSE	4	3	7	1026	5.31	9.43	1.84
19	18-10-	50/30	SE	4	3	7	1026	5.37/6.53	9.76/7.4	1.01/6.5
20	19-10-	45	SE	5	3	5	1022	5.23	8.96	2.18
21	19-10-	30	SE	5	3	7	1023	5.55	7.33	5.43
22	19-10-	41	SE	5	3	7	1023	4.59	7.54	4.6
23	20-10-	40	ESE	5	3	3	1020	5.43	9.09	2.15

Table 4. Fish control-catch results by species in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016

Haul number	Date	ICES rectangle	ICES SD	Total cactch [kg]	Catch per species [kg] sprat	herring	cod	flounder	shorthorn sculpin	lumpfish	threespine stickleback	ninespine stickleback	salmon
					161789	161722	164712	172894	167318	167612	166365	166387	161996
1	2016-10-	41H0/G9	26	239.337	198.320	40.620				0.397			
2	2016-10-	41G9	26	198.320	197.328	0.992							
3	2016-10-	41G9	26	439.608	430.011	7.890	1.103		0.165		0.439		
4	2016-10-	41G9	26	283.410	28.310	251.990	3.110						
5	2016-10-	41H0	26	2166.149	2119.034	43.246	0.354						3.515
6	2016-10-	42H0	28.2	716.380	703.127	8.167					5.086		
7	2016-10-	42G9	28.2	861.191	841.569	18.070	0.691				0.861		
8	2016-10-	42G9	28.2	379.628	356.128	21.595	0.768				1.137		
9	2016-10-	42H0/G9	28.2	176.630	9.715	0.530					166.385		
10	2016-10-	42H0	28.2	1462.576	1422.233	39.775	0.276				0.292		
11	2016-10-	43H0	28.2	421.665	413.197	5.054	0.465				2.949		
12	2016-10-	43G9	28.2	338.085	332.340	1.005					1.675		3.065
13	2016-10-	43H0	28.2	203.150	173.490	18.890					10.770		
14	2016-10-	43H1	28.2	946.110	664.169	281.752					0.189		
15	2016-10-	44H1	28.2	277.920	154.690	123.146					0.084		
16	2016-10-	44H0	28.2	197.671	183.403	12.200		0.251			1.797	0.020	
17	2016-10-	44G9	28.2	282.600	243.036	33.347					6.217		
18	2016-10-	44H0	28.2	306.960	240.657	63.541					2.762		
19	2016-10-	44H0	28.2	137.940	102.972	20.001					14.911	0.056	
20	2016-10-	44H1	28.2	807.460	647.583	158.827					0.969	0.081	
21	2016-10-	45H0	28.2	87.251	58.981	1.160	0.001				26.969	0.140	
22	2016-10-	45H0	28.2	99.991	55.790	20.936					23.235	0.030	
23	2016-10-	43H1	28.2	329.343	31.508	295.958	0.549	0.244			1.051	0.033	
SD26				3326.824	9607.591	1468.692	4.567		0.165	0.397	0.439		3.515
SD28				8032.551	6634.588	1123.954	2.750	0.495			267.339	0.360	3.065
SD26+28				11359.375	9607.591	1468.692	7.317	0.495	0.165	0.397	267.778	0.360	6.580

Table 5. Hydroacoustic survey statistics of pelagic fish species from the Latvian-Polish BIAS survey in the Baltic Sea ICES SD 26N and 28.2 conducted by r/v "Baltica" in the period of 11.-20.10.2016

Table 5A

ICES	ICES	Trawl	Herring			Sprat			NASC	$\sigma \times 10^4$	TS calc.
SD	Rect.	No	L, cm	w, g	n, %	L, cm	w, g	n, %	m^2/nm^2	m^2	dB
28	45H1	21	13.50	15.15	0.96	10.72	7.44	99.04	633.83	1.11377	-50.52
	45H0	21,22	13.69	16.13	8.03	10.66	7.32	91.97	520.53	1.15788	-50.36
	44H1	15,20	15.43	22.78	11.59	11.38	8.50	88.41	958.71	1.36654	-49.64
	44H0	16,17,18,19	14.70	19.09	6.91	11.47	8.84	93.09	473.35	1.31892	-49.79
	43H1	14,23	15.64	24.09	17.96	11.28	8.34	82.04	814.53	1.42494	-49.45
	43H0	11,13,14	15.28	22.35	10.48	11.34	8.53	89.52	874.06	1.33780	-49.73
	43G9	12,13	16.08	24.50	0.80	11.29	8.78	99.20	470.97	1.23865	-50.06
	42H0	6,7,9,10	15.65	23.07	0.85	11.57	9.03	99.15	856.76	1.29271	-49.88
	42G9	7,8,9	15.76	23.62	1.08	11.67	9.16	98.92	313.68	1.31471	-49.80
26	41H0	1,5,6	15.75	25.49	0.98	11.64	9.54	99.02	1134.30	1.30811	-49.83
	41G9	1,2,3,4	17.89	36.55	8.78	11.86	9.97	91.22	466.38	1.50449	-49.22
26		1-6	17.40	34.02	3.11	11.70	9.65	96.89	800.34	1.40630	-49.52
28		6-23	15.10	21.52	6.34	11.26	8.43	93.66	657.38	1.28510	-49.91
26+28		1-23	15.38	23.07	5.61	11.36	8.71	94.39	683.37	1.30714	-49.84

Table 5B

ICES	ICES	Area	ρ	Abundance, $n \times 10^6$			n, %		Biomass, $kg \times 10^3$		
SD	Rect.	nm^2	$n \times 10^6/nm^2$	ΣN	$N_{HERRING}$	N_{SPRAT}	herring	sprat	ΣW	$W_{HERRING}$	W_{SPRAT}
28	45H1	827.1	5.69086	4706.91	45.03	4661.88	0.96	99.04	35372.54	682.27	34690.27
	45H0	947.2	4.49551	4258.15	341.92	3916.23	8.03	91.97	34167.85	5516.10	28651.74
	44H1	824.6	7.01564	5785.10	670.50	5114.60	11.59	88.41	58723.58	15271.87	43451.71
	44H0	960.5	3.58894	3447.17	238.34	3208.83	6.91	93.09	32926.49	4549.78	28376.71
	43H1	412.7	5.71623	2359.09	423.71	1935.37	17.96	82.04	26354.59	10206.23	16148.36
	43H0	973.7	6.53353	6361.70	666.49	5695.20	10.48	89.52	63454.08	14895.65	48558.43
	43G9	973.7	3.80230	3702.30	29.65	3672.64	0.80	99.20	32967.93	726.63	32241.30
	42H0	968.5	6.62761	6418.84	54.88	6363.97	0.85	99.15	58753.02	1265.94	57487.08
	42G9	986.9	2.38591	2354.65	25.44	2329.21	1.08	98.92	21926.25	600.89	21325.36
26	41H0	953.3	8.67126	8266.32	80.64	8185.67	0.98	99.02	80144.70	2055.42	78089.28
	41G9	1000.0	3.09990	3099.90	272.30	2827.60	8.78	91.22	38140.86	9952.01	28188.84
26		1953.3	5.88558	11366.22	352.95	11013.27	3.11	96.89	118285.56	12007.43	106278.13
28		7874.9	5.09517	39393.92	2495.98	36897.94	6.34	93.66	364646.32	53715.36	310930.96
26+28		9828.2	5.23888	50760.14	2848.92	47911.21	5.61	94.39	482931.88	65722.79	417209.09

Table 6. Hydroacoustic survey statistics of threespine stickleback from the Latvian-Polish BIAS survey
in the Baltic Sea ICES SD 26N and 28.2 conducted by r/v "Baltica" in the period of 11.-20.10.2016

ICES	ICES	Trawl	Threespine stickleback		NASC	TS calc.	$\sigma \times 10^4$	ρ	Abundance	Biomass
SD	Rect.	No	L, cm	w, g	m^2/nm^2	dB	m^2	$n \times 10^6/nm^2$	$n \times 10^6$	$kg \times 10^3$
28	45H1	16,19,20	6.29	1.99	3.55	-51.51	0.88806	0.04000	33.08	65.69
	45H0	18,19,21,22	6.45	1.94	216.61	-51.29	0.93321	2.32110	2198.55	4267.34
	44H1	16								
	44H0	15,16,17	6.66	2.07	24.79	-51.00	0.99758	0.24852	238.71	495.17
	43H1	13,14								
	43H0	12,13,14	6.38	1.95	0.34	-51.41	0.90922	0.00369	3.59	7.00
	43G9	10,11	6.52	2.20	22.82	-51.17	0.95942	0.23781	231.55	508.74
	42H0	7,8,9	6.15	1.99	0.11	-51.69	0.85232	0.00127	1.23	2.46
	42G9	6,10	6.31	2.07	26.73	-51.46	0.89787	0.29773	293.83	609.60
26	41H0	3,4								
	41G9	1,2,5	6.28	2.23	17.42	-51.50	0.88977	0.19580	195.80	436.73
26		1-5	6.28	2.23	17.42	-51.50	0.88977	0.19580	195.80	436.73
28		6-22	6.39	2.03	42.14	-51.36	0.91967	0.45002	3000.55	5955.99
26+28		1-22	6.38	2.06	39.05	-51.38	0.91593	0.41824	3196.35	6392.72

Table 7. Sprat stock characteristics in the Baltic Sea ICES SD 26N and 28.2
from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016

Table 7A CANUM		Age group									Σ
ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	1347	1503	3963	669	115	251		38	38	7926
	45H0	3809	2136	7111	1136	587	523	200	38	147	15687
	44H1	4882	7850	55016	15543	5549	4306	971		316	94434
	44H0	5811	5659	62284	27604	5297	4930	447	245	2285	114562
	43H1	3973	24234	113613	8263	9511	3279	52		52	162977
	43H0	4806	25257	153407	22810	13261	4976			88	224605
	43G9	15066	2563	55582	9600	6246	4618		724	1078	95477
	42H0	11485	28356	218435	120074	27050	9417	4126	948	2794	422686
	42G9	3281	12095	104499	74704	19458	4681	1930	258	2889	223795
26	41H0	8728	50547	382418	69487	19467	2232	4735	348	785	538747
	41G9	4973	3625	39934	21382	6436	5640	1150	1182	1340	85661
26		13702	54171	422352	90868	25903	7872	5885	1530	2125	624408
28		54460	109654	773908	280404	87075	36982	7726	2253	9687	1362148
26+28		68162	163825	1196260	371272	112978	44854	13611	3783	11812	1986557

Table 7B n × 10^6		Age group									Σ
ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	792.07	884.10	2330.94	393.77	67.89	147.85		22.63	22.63	4661.88
	45H0	950.79	533.26	1775.18	283.69	146.57	130.64	49.86	9.61	36.64	3916.23
	44H1	264.44	425.17	2979.71	841.80	300.56	233.23	52.58		17.12	5114.60
	44H0	162.78	158.52	1744.54	773.19	148.36	138.08	12.51	6.86	63.99	3208.83
	43H1	47.18	287.78	1349.17	98.12	112.95	38.94	0.62		0.62	1935.37
	43H0	121.86	640.43	3889.87	578.38	336.26	126.18			2.23	5695.20
	43G9	579.54	98.57	2138.02	369.29	240.26	177.65		27.86	41.45	3672.64
	42H0	172.92	426.93	3288.76	1807.84	407.27	141.78	62.12	14.28	42.07	6363.97
	42G9	34.14	125.88	1087.60	777.50	202.52	48.72	20.09	2.69	30.07	2329.21
26	41H0	132.62	768.00	5810.42	1055.78	295.78	33.91	71.94	5.29	11.93	8185.67
	41G9	164.17	119.64	1318.17	705.79	212.45	186.18	37.97	39.01	44.22	2827.60
26		296.79	887.65	7128.60	1761.56	508.22	220.09	109.91	44.30	56.16	11013.27
28		3125.72	3580.64	20583.78	5923.58	1962.63	1183.07	197.78	83.92	256.82	36897.94
26+28		3422.50	4468.29	27712.38	7685.14	2470.85	1403.16	307.69	128.22	312.98	47911.21

Table 7C n, %		Age group									Σ
ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	16.99	18.96	50.00	8.45	1.46	3.17		0.49	0.49	100.00
	45H0	24.28	13.62	45.33	7.24	3.74	3.34	1.27	0.25	0.94	100.00
	44H1	5.17	8.31	58.26	16.46	5.88	4.56	1.03		0.33	100.00
	44H0	5.07	4.94	54.37	24.10	4.62	4.30	0.39	0.21	1.99	100.00
	43H1	2.44	14.87	69.71	5.07	5.84	2.01	0.03		0.03	100.00
	43H0	2.14	11.25	68.30	10.16	5.90	2.22			0.04	100.00
	43G9	15.78	2.68	58.21	10.06	6.54	4.84		0.76	1.13	100.00
	42H0	2.72	6.71	51.68	28.41	6.40	2.23	0.98	0.22	0.66	100.00
	42G9	1.47	5.40	46.69	33.38	8.69	2.09	0.86	0.12	1.29	100.00
26	41H0	1.62	9.38	70.98	12.90	3.61	0.41	0.88	0.06	0.15	100.00
	41G9	5.81	4.23	46.62	24.96	7.51	6.58	1.34	1.38	1.56	100.00
26		2.19	8.68	67.64	14.55	4.15	1.26	0.94	0.25	0.34	100.00
28		4.00	8.05	56.82	20.59	6.39	2.71	0.57	0.17	0.71	100.00
26+28		3.43	8.25	60.22	18.69	5.69	2.26	0.69	0.19	0.59	100.00

Table 7D W, kg × 10^3	Age group	Σ

ICES	ICES	0	1	2	3	4	5	6	7	8+	
28	45H1	3043.80	6063.76	19573.56	3440.89	705.47	1398.71		222.68	241.39	34690.27
	45H0	3684.53	3578.94	14889.44	2545.54	1512.05	1367.60	546.83	94.52	432.29	28651.74
	44H1	946.38	3036.88	25066.50	7882.16	3202.36	2518.43	614.85		184.16	43451.71
	44H0	598.48	1212.86	15320.30	7101.97	1663.92	1500.86	151.81	81.11	745.41	28376.71
	43H1	131.87	2081.67	11254.27	969.01	1245.26	452.96	6.37		6.95	16148.36
	43H0	446.35	4657.12	32846.95	5520.46	3586.31	1473.39			27.84	48558.43
	43G9	2463.55	832.24	19738.78	3699.79	2588.85	2106.38		345.45	466.26	32241.30
	42H0	626.21	3422.11	29242.33	16802.9	4399.42	1567.62	772.15	159.70	494.62	57487.08
	42G9	135.88	1022.80	9642.54	7133.95	2133.98	586.11	271.57	30.67	367.85	21325.36
26	41H0	517.37	6567.77	55117.44	11137.8	3296.74	432.14	779.34	72.76	167.87	78089.28
	41G9	733.33	1063.21	12881.86	7256.01	2519.83	2177.77	516.98	452.51	587.34	28188.84
26		1250.70	7630.98	67999.31	18393.8	5816.56	2609.91	1296.3	525.27	755.21	106278.1
28		12077.0	25908.3	177574.6	55096.6	21037.6	12972.0	2363.5	934.13	2966.7	310930.9
26+28		13327.7	33539.3	245573.9	73490.5	26854.1	15581.9	3659.8	1459.4	3721.9	417209.0

Table 7E W, %					Age group						Σ
ICES	ICES	0	1	2	3	4	5	6	7	8+	
28	45H1	8.77	17.48	56.42	9.92	2.03	4.03		0.64	0.70	100.00
	45H0	12.86	12.49	51.97	8.88	5.28	4.77	1.91	0.33	1.51	100.00
	44H1	2.18	6.99	57.69	18.14	7.37	5.80	1.42		0.42	100.00
	44H0	2.11	4.27	53.99	25.03	5.86	5.29	0.53	0.29	2.63	100.00
	43H1	0.82	12.89	69.69	6.00	7.71	2.80	0.04		0.04	100.00
	43H0	0.92	9.59	67.64	11.37	7.39	3.03			0.06	100.00
	43G9	7.64	2.58	61.22	11.48	8.03	6.53		1.07	1.45	100.00
	42H0	1.09	5.95	50.87	29.23	7.65	2.73	1.34	0.28	0.86	100.00
	42G9	0.64	4.80	45.22	33.45	10.01	2.75	1.27	0.14	1.72	100.00
26	41H0	0.66	8.41	70.58	14.26	4.22	0.55	1.00	0.09	0.21	100.00
	41G9	2.60	3.77	45.70	25.74	8.94	7.73	1.83	1.61	2.08	100.00
26		1.18	7.18	63.98	17.31	5.47	2.46	1.22	0.49	0.71	100.00
28		3.88	8.33	57.11	17.72	6.77	4.17	0.76	0.30	0.95	100.00
26+28		3.19	8.04	58.86	17.61	6.44	3.73	0.88	0.35	0.89	100.00

Table 7F w, g					Age group						Total
ICES	ICES	0	1	2	3	4	5	6	7	8+	
28	45H1	3.84	6.86	8.40	8.74	10.39	9.46		9.84	10.67	7.44
	45H0	3.88	6.71	8.39	8.97	10.32	10.47	10.97	9.84	11.80	7.32
	44H1	3.58	7.14	8.41	9.36	10.65	10.80	11.69		10.76	8.50
	44H0	3.68	7.65	8.78	9.19	11.22	10.87	12.13	11.82	11.65	8.84
	43H1	2.79	7.23	8.34	9.88	11.03	11.63	10.31		11.26	8.34
	43H0	3.66	7.27	8.44	9.54	10.67	11.68			12.51	8.53
	43G9	4.25	8.44	9.23	10.02	10.78	11.86		12.40	11.25	8.78
	42H0	3.62	8.02	8.89	9.29	10.80	11.06	12.43	11.19	11.76	9.03
	42G9	3.98	8.13	8.87	9.18	10.54	12.03	13.52	11.41	12.23	9.16
26	41H0	3.90	8.55	9.49	10.55	11.15	12.74	10.83	13.75	14.07	9.54
	41G9	4.47	8.89	9.77	10.28	11.86	11.70	13.62	11.60	13.28	9.97
26		4.21	8.60	9.54	10.44	11.44	11.86	11.79	11.86	13.45	9.65
28		3.86	7.24	8.63	9.30	10.72	10.96	11.95	11.13	11.55	8.43
26+28		3.89	7.51	8.86	9.56	10.87	11.10	11.89	11.38	11.89	8.71

Table 7G L, cm	Age group	Total

ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	8.72	10.37	11.23	11.46	12.58	11.94		12.25	12.75	10.72
	45H0	8.73	10.34	11.25	11.59	12.38	12.34	12.70	12.25	13.36	10.66
	44H1	8.47	10.66	11.34	11.86	12.64	12.68	13.13		12.70	11.38
	44H0	8.59	10.85	11.43	11.64	12.78	12.64	13.31	13.25	12.97	11.47
	43H1	7.92	10.69	11.29	12.12	12.73	13.06	12.75		13.00	11.28
	43H0	8.45	10.69	11.30	11.85	12.49	12.99			13.25	11.34
	43G9	8.91	11.10	11.52	11.95	12.38	12.84		13.25	12.67	11.29
	42H0	8.48	11.03	11.50	11.73	12.54	12.68	13.13	12.76	13.08	11.57
	42G9	8.80	11.13	11.50	11.71	12.43	13.15	13.34	12.78	13.23	11.67
26	41H0	8.44	11.17	11.63	12.11	12.49	13.17	12.41	13.63	13.76	11.64
	41G9	8.99	11.34	11.76	12.05	12.77	12.75	13.49	12.75	13.51	11.86
26		8.75	11.19	11.65	12.08	12.61	12.81	12.78	12.86	13.57	11.70
28		8.70	10.63	11.37	11.74	12.54	12.63	13.05	12.77	12.99	11.26
26+28		8.70	10.74	11.44	11.82	12.55	12.66	12.96	12.80	13.09	11.36

Table 8. Herring stock characteristics in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016

Table 8A CANUM		Age group									Σ
ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	29		10		19		10		10	77
	45H0	188	55	862	123	76		10	5	52	1370
	44H1		750	5816	1592	2353	1118	93	395	263	12380
	44H0		531	5575	780	611	323	222	316	152	8509
	43H1			16787	5163	6226	5047	309	540	1608	35681
	43H0			14696	3705	3741	2728	60	218	1137	26285
	43G9			294	131	189	58	45	38	16	771
	42H0		106	1664	773	689	200	106	106		3645
	42G9		73	1193	550	303	172	59	94		2444
26	41H0		405	2750	1146	721	222	27	17	19	5308
	41G9		295	1850	1406	2181	909	379	623	607	8249
26			699	4600	2552	2902	1131	406	640	626	13557
28		216	1516	46897	12818	14206	9647	914	1711	3237	91161
26+28		216	2215	51497	15370	17107	10778	1320	2351	3863	104718

Table 8B n × 10^6		Age group									Σ
ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	16.89		5.63		11.26		5.63		5.63	45.03
	45H0	46.84	13.76	215.20	30.68	18.93		2.39	1.20	12.91	341.92
	44H1		40.63	315.01	86.23	127.44	60.57	5.01	21.38	14.24	670.50
	44H0		14.87	156.15	21.84	17.11	9.04	6.23	8.85	4.25	238.34
	43H1			199.35	61.32	73.94	59.94	3.67	6.41	19.10	423.71
	43H0			372.63	93.95	94.85	69.18	1.53	5.52	28.83	666.49
	43G9			11.29	5.06	7.26	2.24	1.75	1.46	0.61	29.65
	42H0		1.60	25.06	11.64	10.37	3.01	1.60	1.60		54.88
	42G9		0.76	12.42	5.72	3.15	1.79	0.62	0.98		25.44
26	41H0		6.15	41.78	17.42	10.96	3.38	0.41	0.25	0.29	80.64
	41G9		9.72	61.08	46.40	71.98	30.01	12.50	20.57	20.04	272.30
26			15.87	102.86	63.82	82.94	33.38	12.92	20.82	20.33	352.95
28		63.73	71.62	1312.74	316.43	364.30	205.77	28.42	47.40	85.56	2495.98
26+28		63.73	87.50	1415.60	380.26	447.24	239.16	41.34	68.22	105.89	2848.92

Table 8C n, %	Age group	Σ

ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	37.50		12.50		25.00		12.50		12.50	100.00
	45H0	13.70	4.03	62.94	8.97	5.54		0.70	0.35	3.78	100.00
	44H1		6.06	46.98	12.86	19.01	9.03	0.75	3.19	2.12	100.00
	44H0		6.24	65.52	9.16	7.18	3.79	2.61	3.71	1.78	100.00
	43H1			47.05	14.47	17.45	14.15	0.87	1.51	4.51	100.00
	43H0			55.91	14.10	14.23	10.38	0.23	0.83	4.33	100.00
	43G9			38.08	17.05	24.47	7.56	5.89	4.91	2.05	100.00
	42H0		2.91	45.67	21.21	18.89	5.49	2.91	2.91		100.00
	42G9		2.99	48.82	22.50	12.38	7.03	2.42	3.85		100.00
26	41H0		7.63	51.81	21.60	13.59	4.19	0.51	0.31	0.36	100.00
	41G9		3.57	22.43	17.04	26.43	11.02	4.59	7.56	7.36	100.00
26			5.16	33.93	18.83	21.40	8.34	2.99	4.72	4.62	100.00
28		0.24	1.66	51.44	14.06	15.58	10.58	1.00	1.88	3.55	100.00
26+28		0.21	2.12	49.18	14.68	16.34	10.29	1.26	2.25	3.69	100.00

Table 8D W, kg × 10^3						Age group					Σ
ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	79.94		95.70		213.91		146.36		146.36	682.27
	45H0	236.27	193.92	3572.21	645.24	418.11		62.12	29.46	358.78	5516.10
	44H1		687.60	6153.13	2013.22	3360.43	1833.12	181.16	568.41	474.80	15271.87
	44H0		214.92	2693.35	468.10	418.90	230.81	164.27	232.09	127.33	4549.78
	43H1			3720.74	1496.69	2100.28	1890.30	129.55	198.44	670.23	10206.23
	43H0			6847.05	2107.04	2643.59	2115.88	44.18	161.83	976.08	14895.65
	43G9			218.26	122.61	200.06	68.80	51.94	44.48	20.48	726.63
	42H0		33.25	475.50	295.07	252.73	98.68	55.96	54.75		1265.94
	42G9		14.29	235.04	144.80	73.54	70.51	22.78	39.94		600.89
26	41H0		141.67	908.27	481.10	307.47	161.99	19.29	14.49	21.15	2055.42
	41G9		232.16	1438.22	1433.71	2731.60	1391.88	568.78	1053.19	1102.48	9952.01
26			373.83	2346.49	1914.81	3039.07	1553.86	588.07	1067.67	1123.63	12007.43
28		316.20	1143.98	24010.98	7292.78	9681.54	6308.10	858.31	1329.40	2774.06	53715.36
26+28		316.20	1517.81	26357.47	9207.58	12720.62	7861.97	1446.38	2397.07	3897.69	65722.79

Table 8E W, %						Age group					Σ
ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	11.72		14.03		31.35		21.45		21.45	100.00
	45H0	4.28	3.52	64.76	11.70	7.58		1.13	0.53	6.50	100.00
	44H1		4.50	40.29	13.18	22.00	12.00	1.19	3.72	3.11	100.00
	44H0		4.72	59.20	10.29	9.21	5.07	3.61	5.10	2.80	100.00
	43H1			36.46	14.66	20.58	18.52	1.27	1.94	6.57	100.00
	43H0			45.97	14.15	17.75	14.20	0.30	1.09	6.55	100.00
	43G9			30.04	16.87	27.53	9.47	7.15	6.12	2.82	100.00
	42H0		2.63	37.56	23.31	19.96	7.80	4.42	4.32		100.00
	42G9		2.38	39.12	24.10	12.24	11.73	3.79	6.65		100.00
26	41H0		6.89	44.19	23.41	14.96	7.88	0.94	0.70	1.03	100.00
	41G9		2.33	14.45	14.41	27.45	13.99	5.72	10.58	11.08	100.00
26			3.11	19.54	15.95	25.31	12.94	4.90	8.89	9.36	100.00
28		0.59	2.13	44.70	13.58	18.02	11.74	1.60	2.47	5.16	100.00
26+28		0.48	2.31	40.10	14.01	19.35	11.96	2.20	3.65	5.93	100.00

Table 8F w, g	Age group	Total

ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	4.73		17.00		19.00		26.00		26.00	15.15
	45H0	5.04	14.09	16.60	21.03	22.08		26.00	24.50	27.79	16.13
	44H1		16.92	19.53	23.35	26.37	30.27	36.15	26.59	33.34	22.78
	44H0		14.45	17.25	21.43	24.48	25.53	26.37	26.22	29.98	19.09
	43H1			18.66	24.41	28.41	31.54	35.34	30.94	35.10	24.09
	43H0			18.37	22.43	27.87	30.58	28.80	29.34	33.85	22.35
	43G9			19.33	24.25	27.57	30.70	29.73	30.57	33.71	24.50
	42H0		20.80	18.97	25.35	24.38	32.74	35.01	34.25		23.07
	42G9		18.77	18.92	25.29	23.34	39.41	37.00	40.77		23.62
26	41H0		23.03	21.74	27.62	28.07	47.99	46.53	57.75	72.29	25.49
	41G9		23.88	23.55	30.90	37.95	46.39	45.50	51.19	55.03	36.55
26			23.55	22.81	30.00	36.64	46.55	45.53	51.27	55.27	34.02
28		4.96	15.97	18.29	23.05	26.58	30.66	30.20	28.05	32.42	21.52
26+28		4.96	17.35	18.62	24.21	28.44	32.87	34.99	35.14	36.81	23.07

Table 8G L, cm						Age group					Total
ICES SD	ICES Rect.	0	1	2	3	4	5	6	7	8+	
28	45H1	9.25		14.25		15.25		18.75		16.75	13.50
	45H0	9.27	13.13	13.95	15.48	15.88		18.75	16.75	17.19	13.69
	44H1		13.93	14.67	15.52	16.30	17.15	18.78	16.35	18.43	15.43
	44H0		13.18	14.13	15.51	16.38	16.74	16.87	17.06	17.87	14.70
	43H1			14.44	15.76	16.64	17.22	17.87	17.13	17.93	15.64
	43H0			14.38	15.35	16.63	17.03	17.79	16.93	17.57	15.28
	43G9			14.65	16.09	17.00	17.53	17.63	17.81	17.72	16.08
	42H0		15.25	14.66	16.22	16.03	17.84	18.25	18.26		15.65
	42G9		14.77	14.68	16.19	15.86	18.97	18.25	19.92		15.76
26	41H0		15.39	14.94	16.30	16.38	20.24	19.42	21.00	22.32	15.75
	41G9		15.58	15.48	16.95	18.22	19.71	19.56	20.50	20.93	17.89
26			15.51	15.26	16.77	17.98	19.77	19.55	20.50	20.95	17.40
28		9.26	13.66	14.37	15.56	16.41	17.14	18.07	16.85	17.70	15.10
26+28		9.26	13.99	14.43	15.76	16.70	17.51	18.53	17.97	18.32	15.38

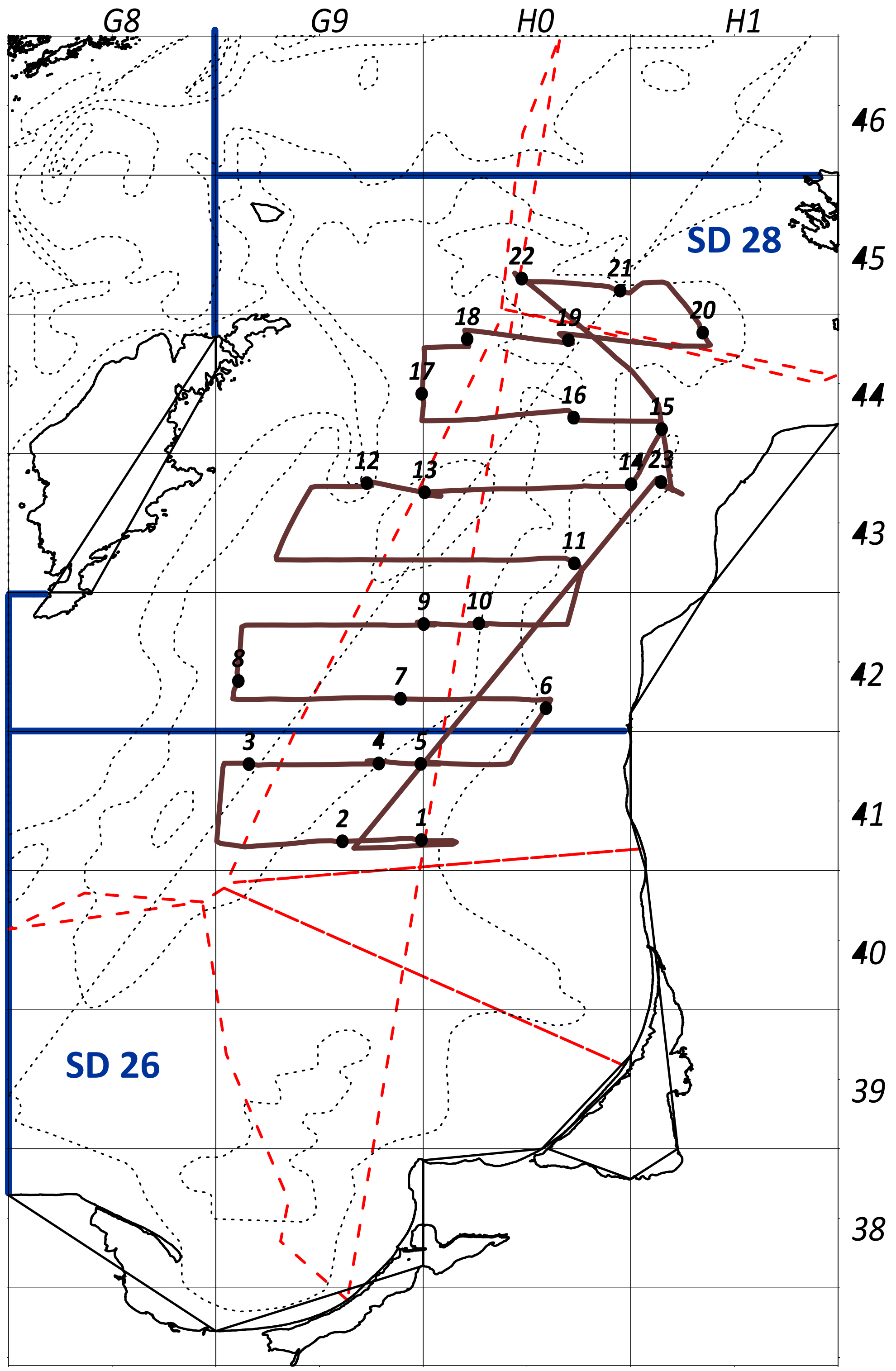


Figure 1: Cruise track design and trawling positions of the Latvian-Polish hydroacoustic survey on the r/v "Baltica" in the period of 11.-20.10.2016.

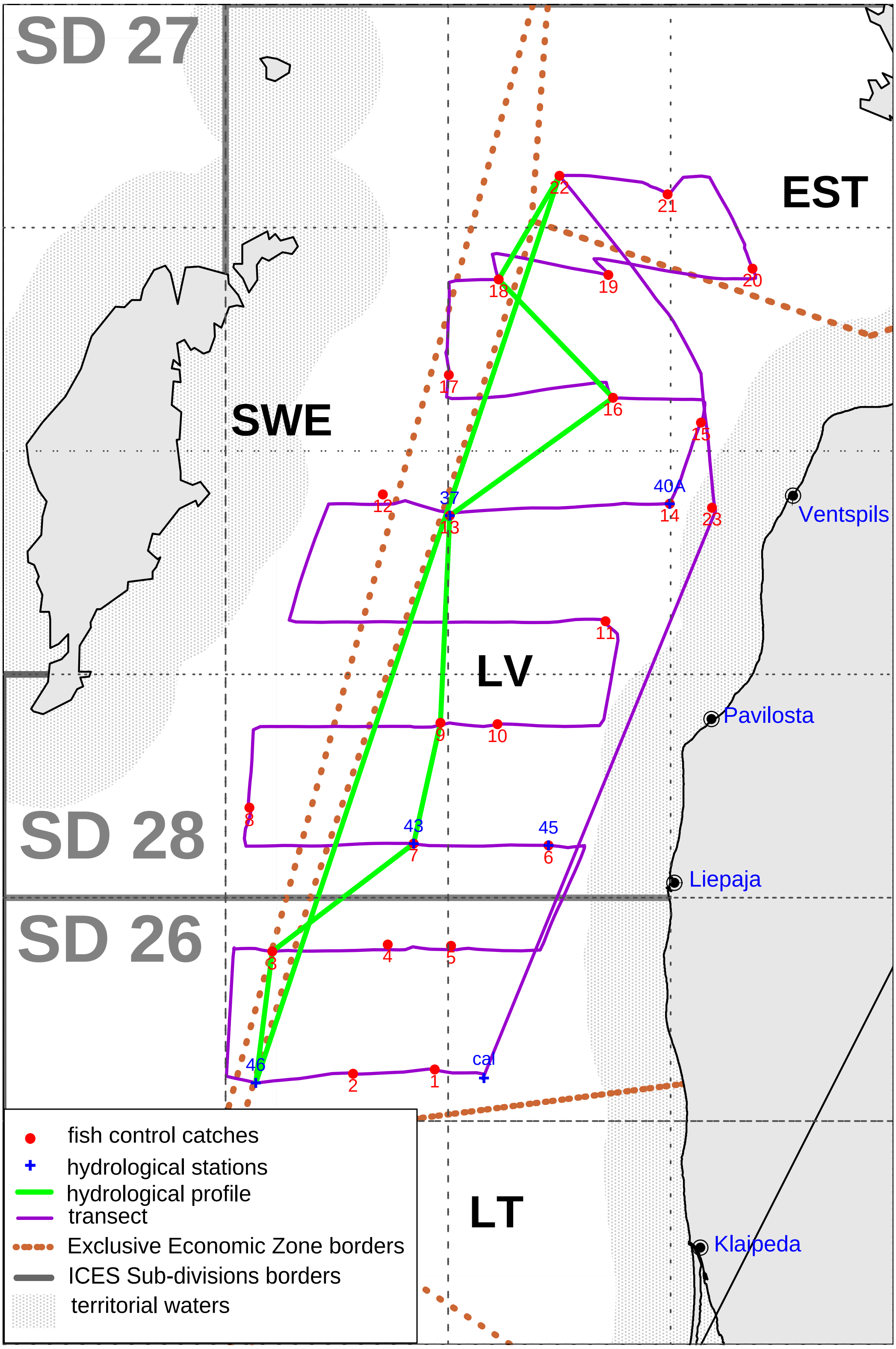


Figure 2: Locations of the hydrological stations and hydrological profile performed during the Latvian-Polish hydroacoustic survey on the r/v "Baltica" in the period of 11.-20.10.2016.

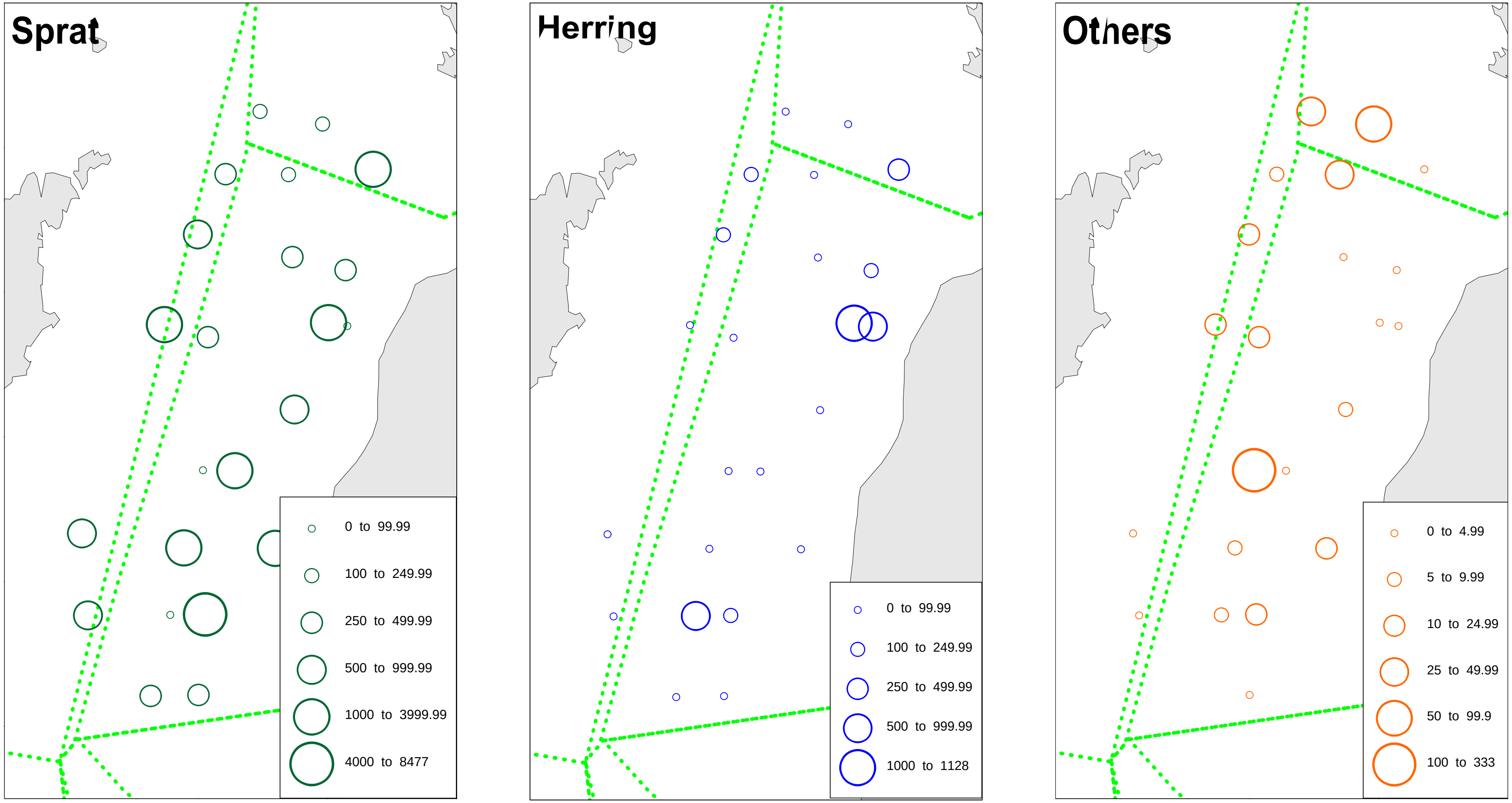


Figure 3: CPUE [kg/h] ranges distribution of fish in the catch hauls in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica"in the period of 11.-20.10.2016.

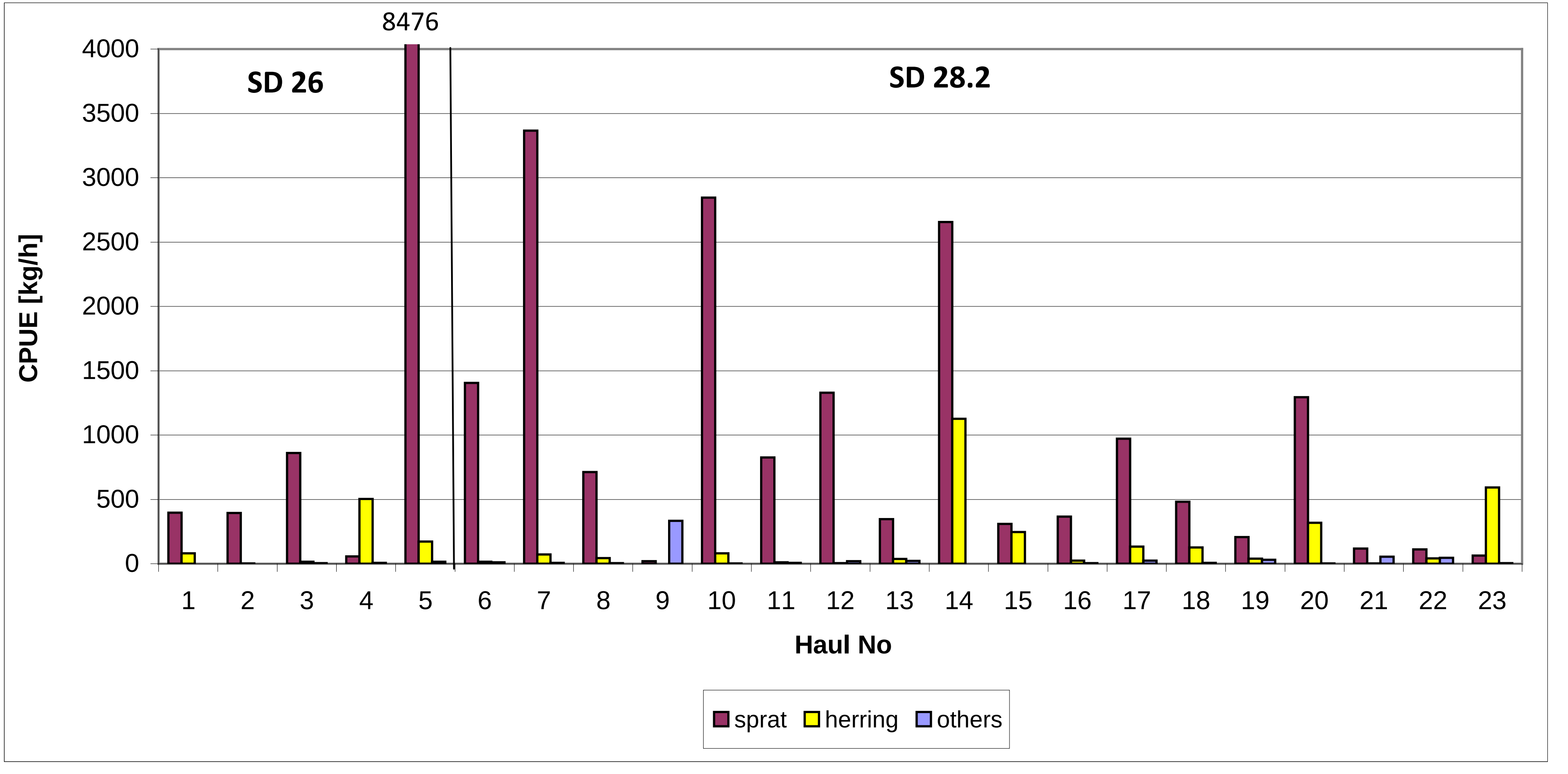


*Figure 4: CPUE [kg/h] of dominant pelagic fish in the catch hauls in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica"
in the period of 11.-20.10.2016.*

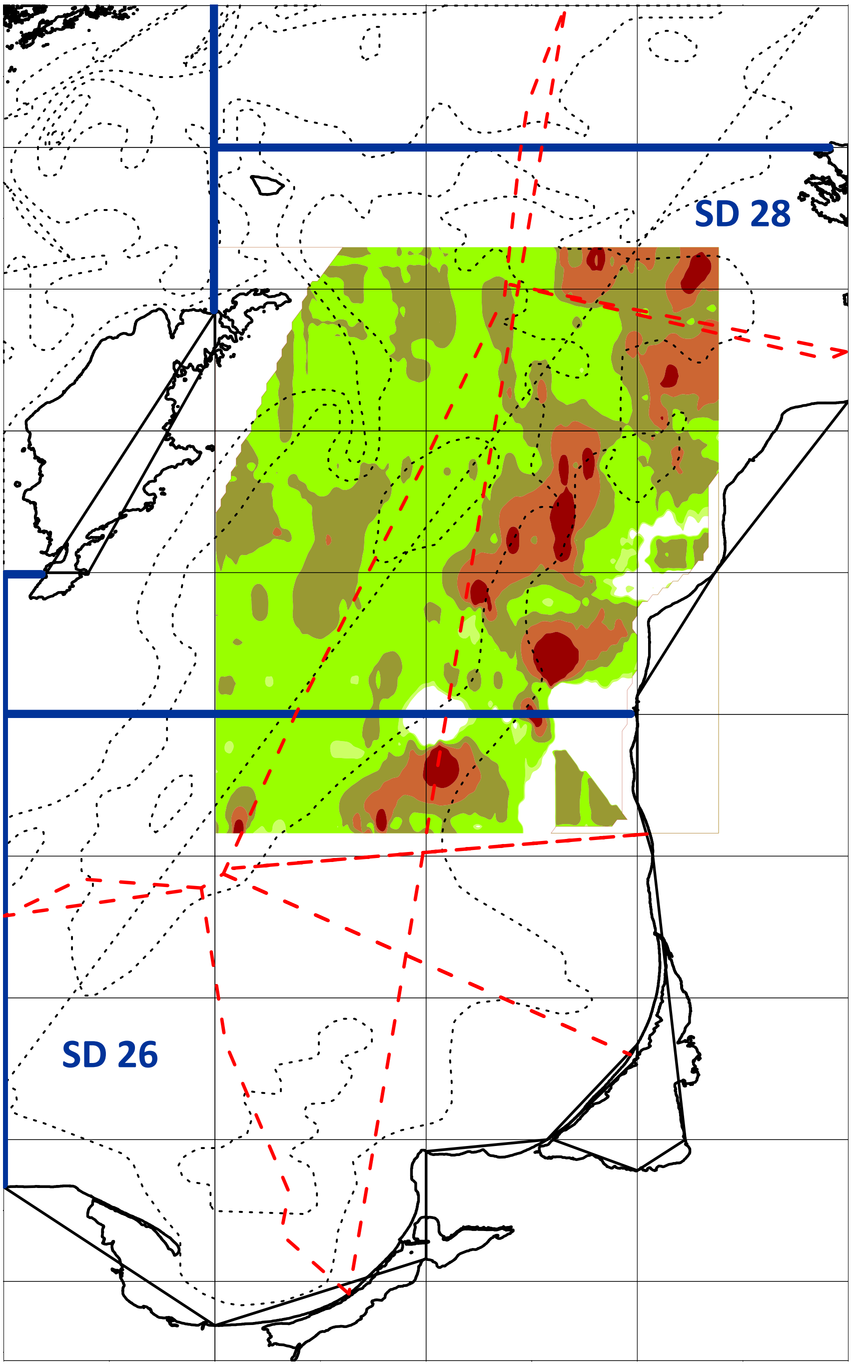


Figure 5: Acoustic parameter NASC distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016.

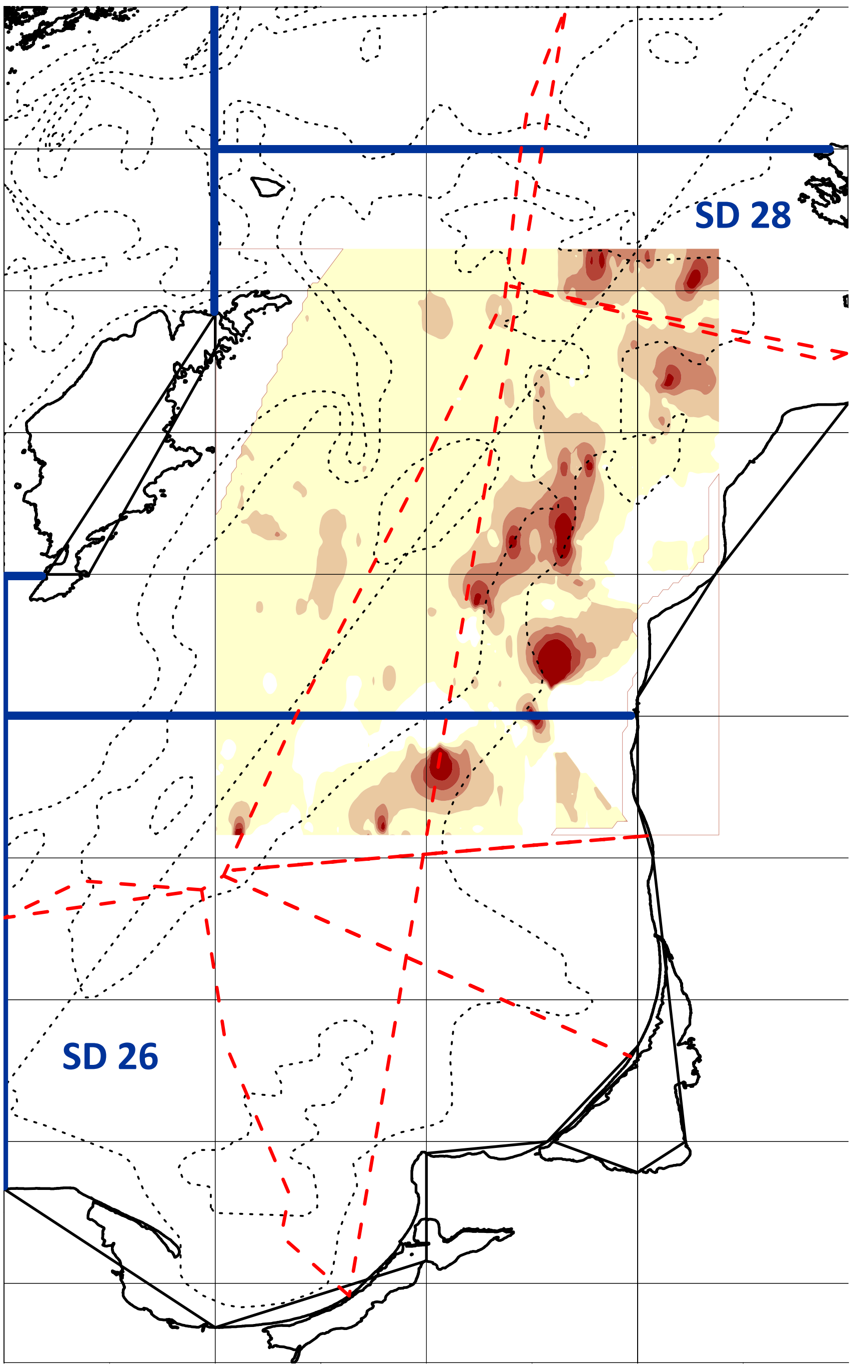


Figure 6: Sprat distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016.

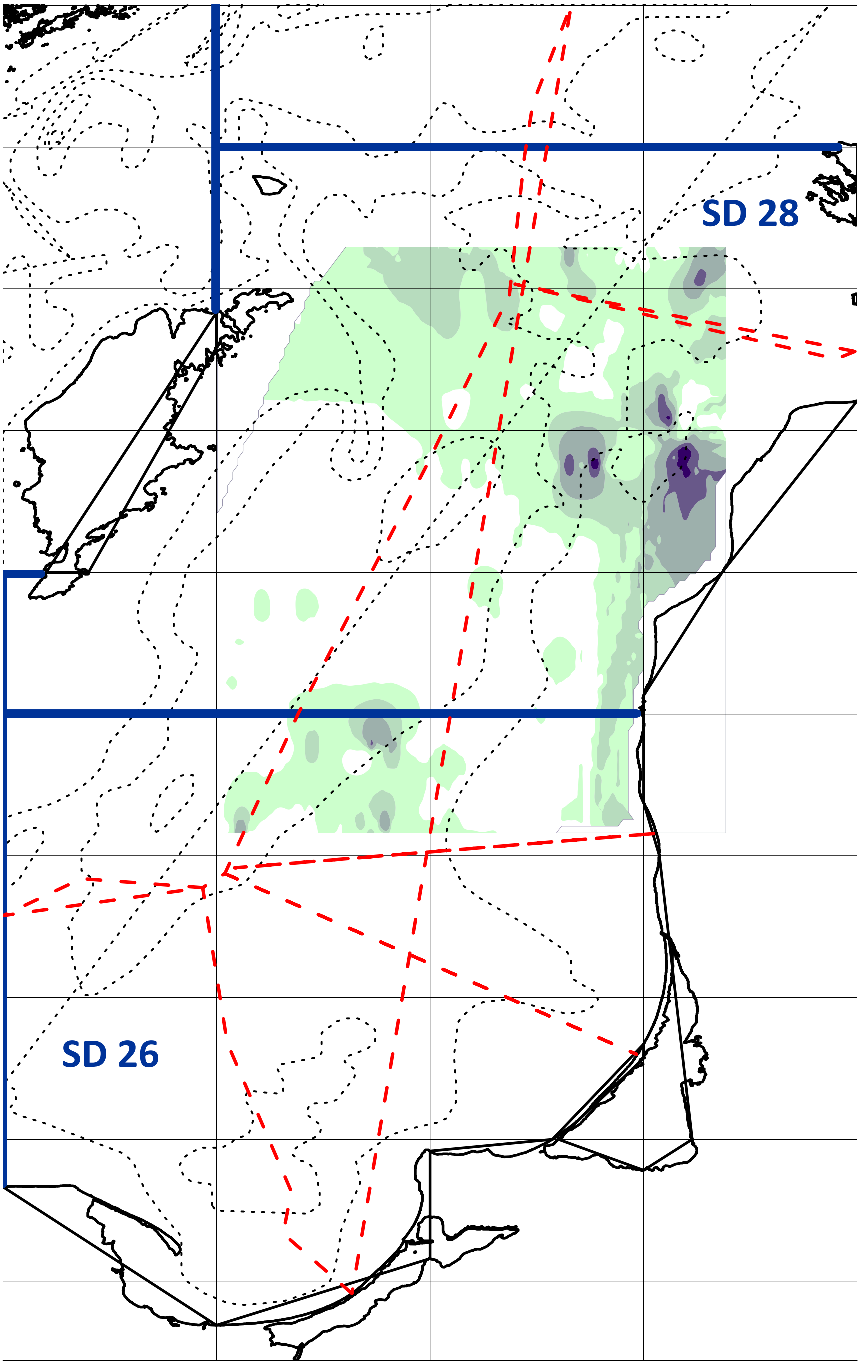


Figure 7: Herring distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016.

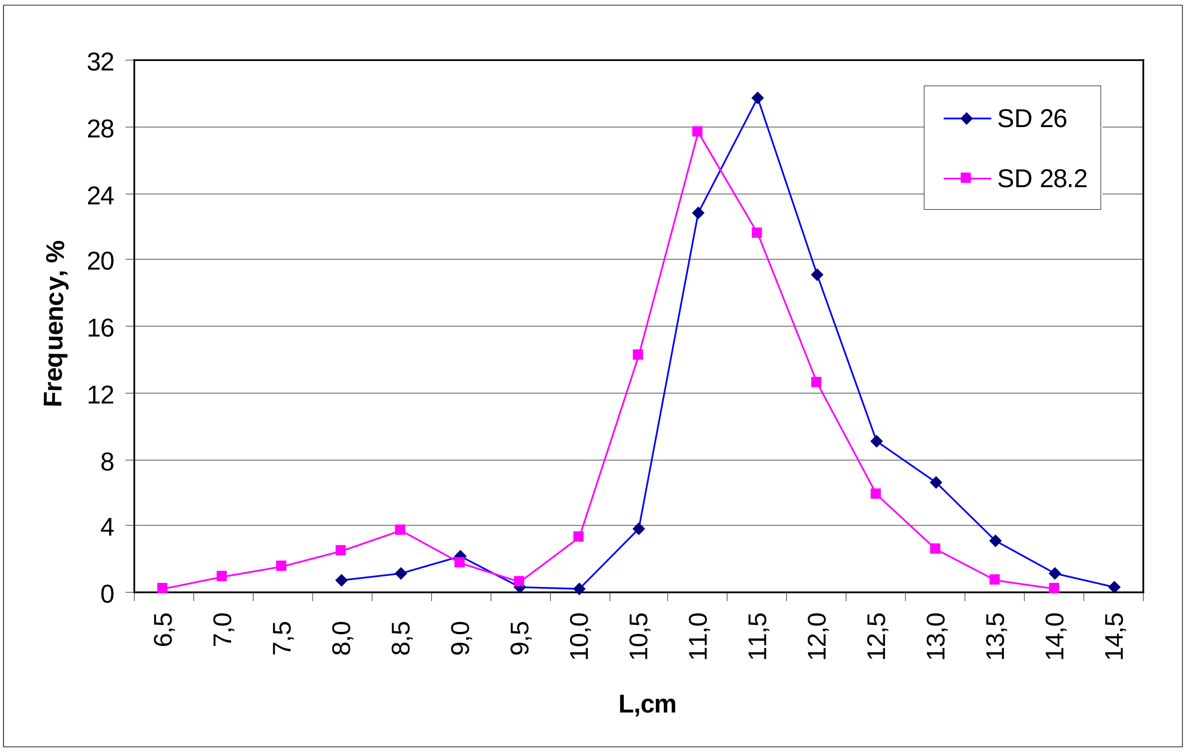


Figure 8: Sprat length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016.

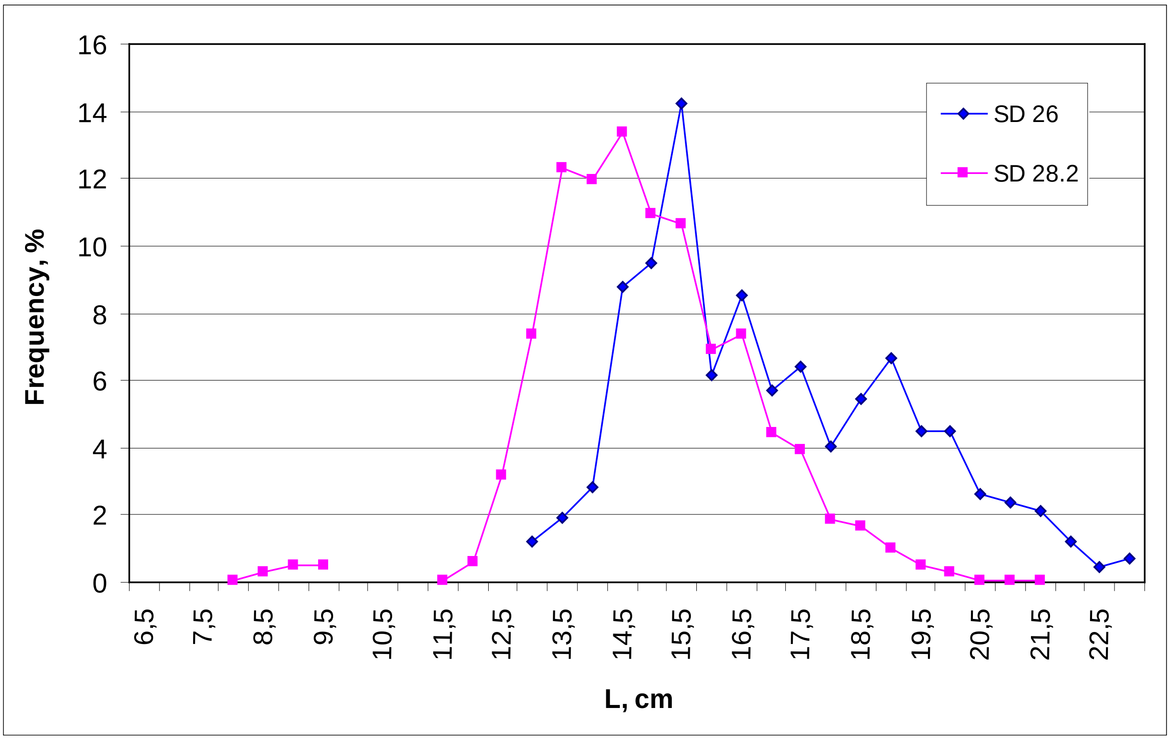


Figure 9: Herring length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016.

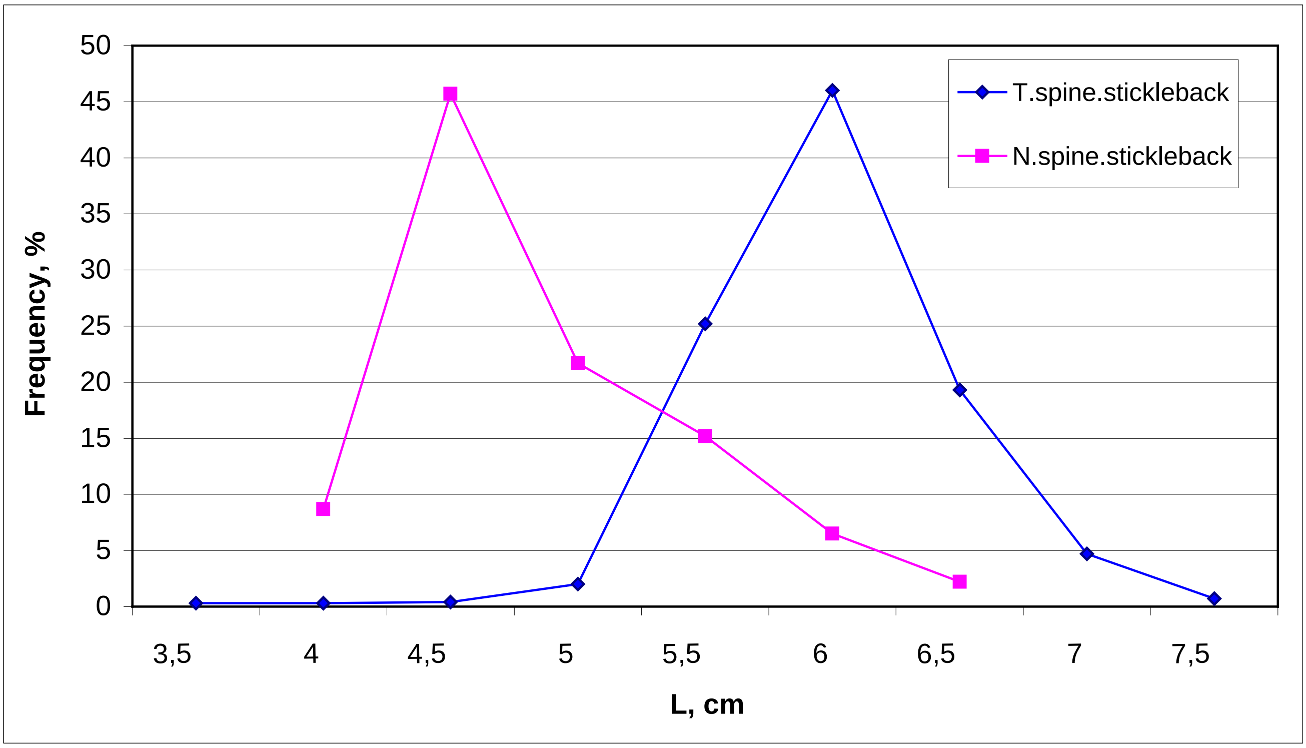
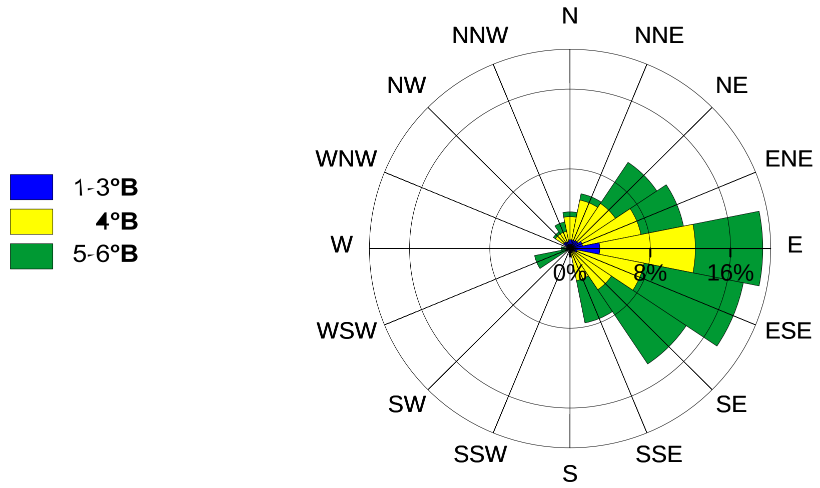


Figure 10: Stickleback length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016.

A)



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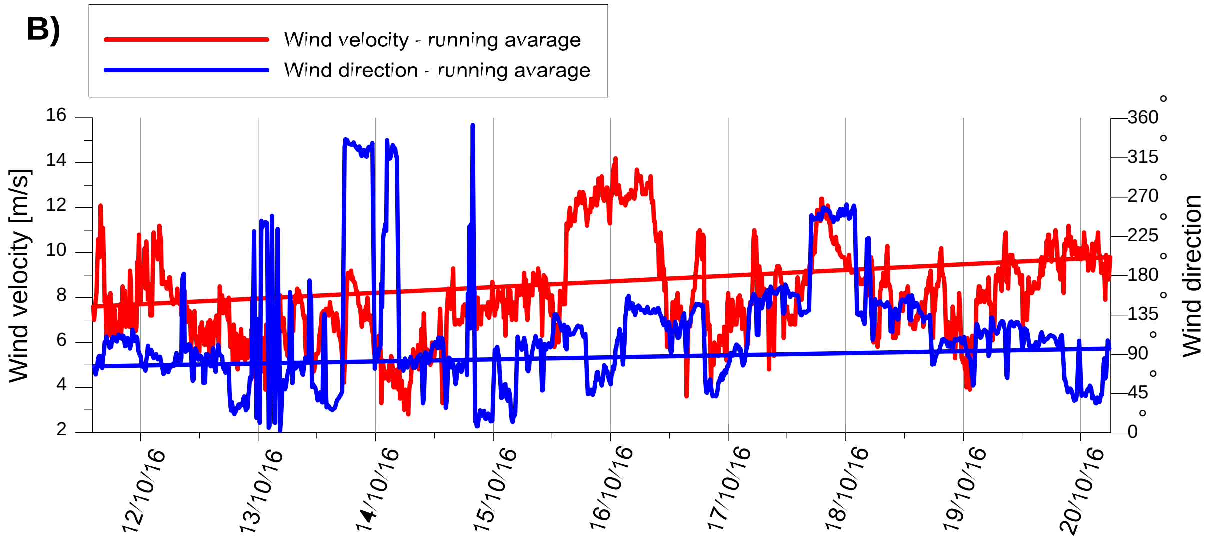

C)

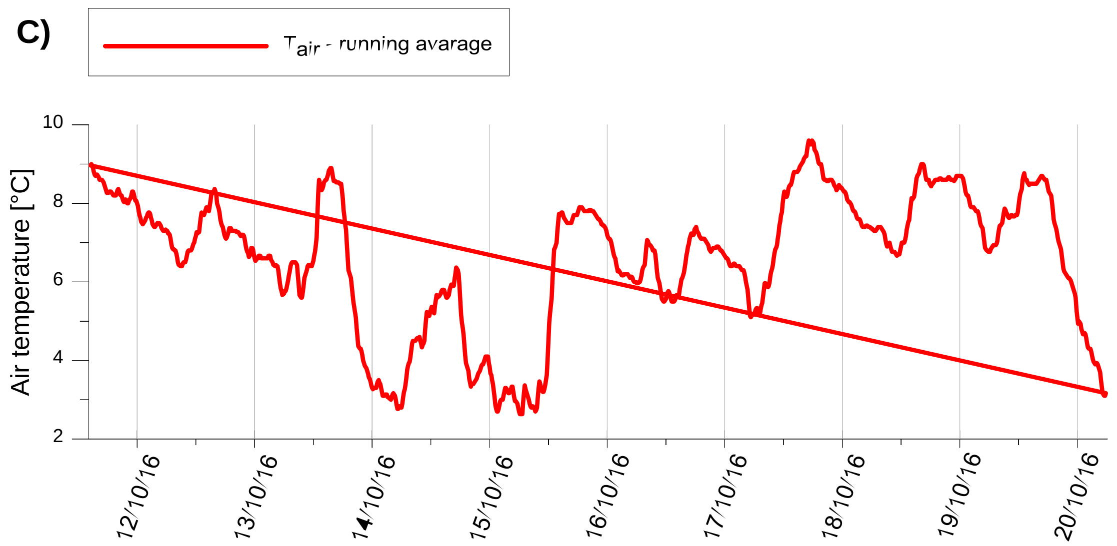

Figure 11: Changes of the main meteorological parameters (wind force, direction and the daily air temperature) during the Latvian-Polish BIAS survey in the Baltic Sea ICES SD 26N and 28.2 conducted by r/v "Baltica" in the period of 11.-20.10.2016

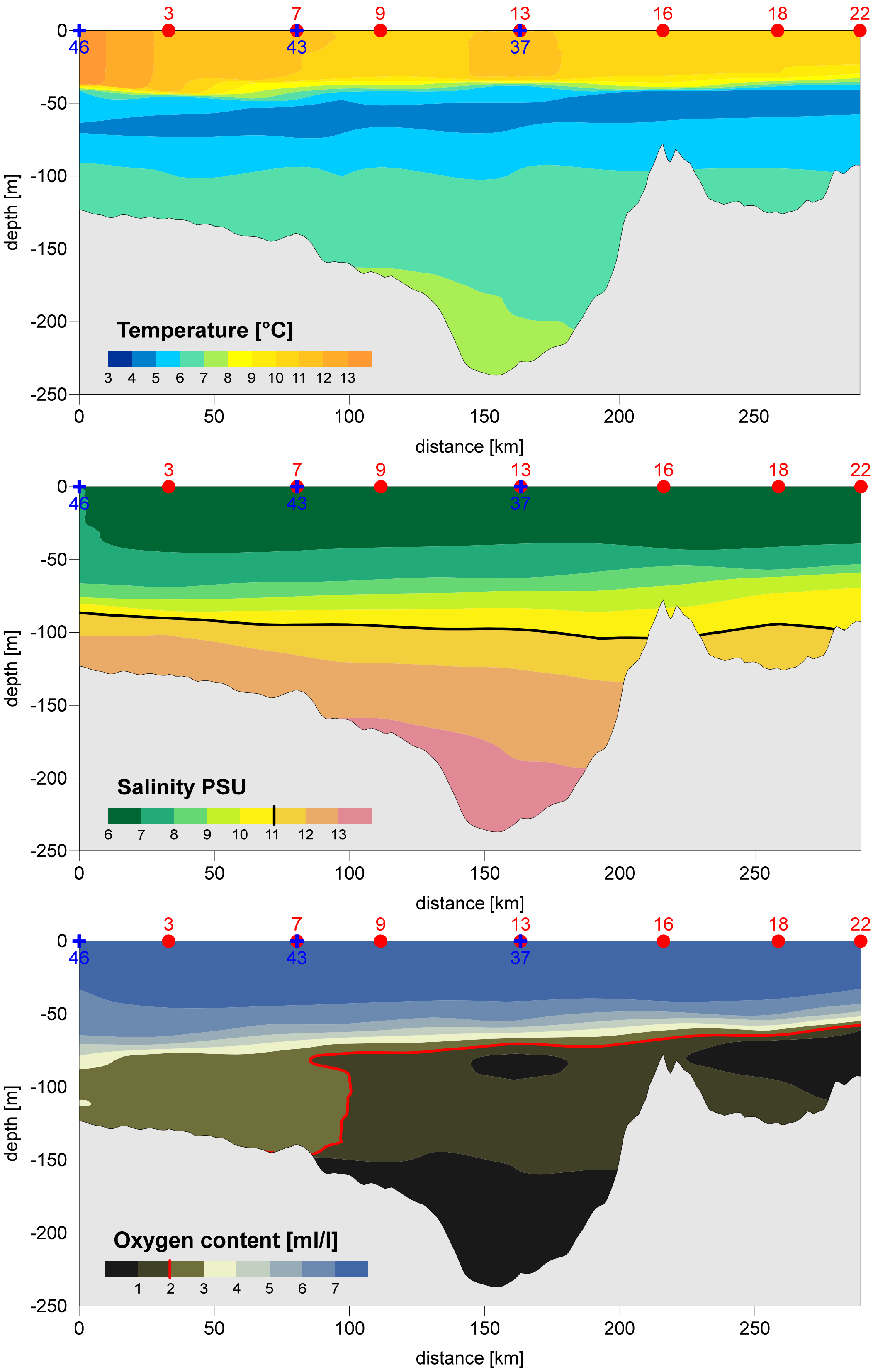

Figure 12: Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological profile in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in October in the period of 11.-20.10.2016.

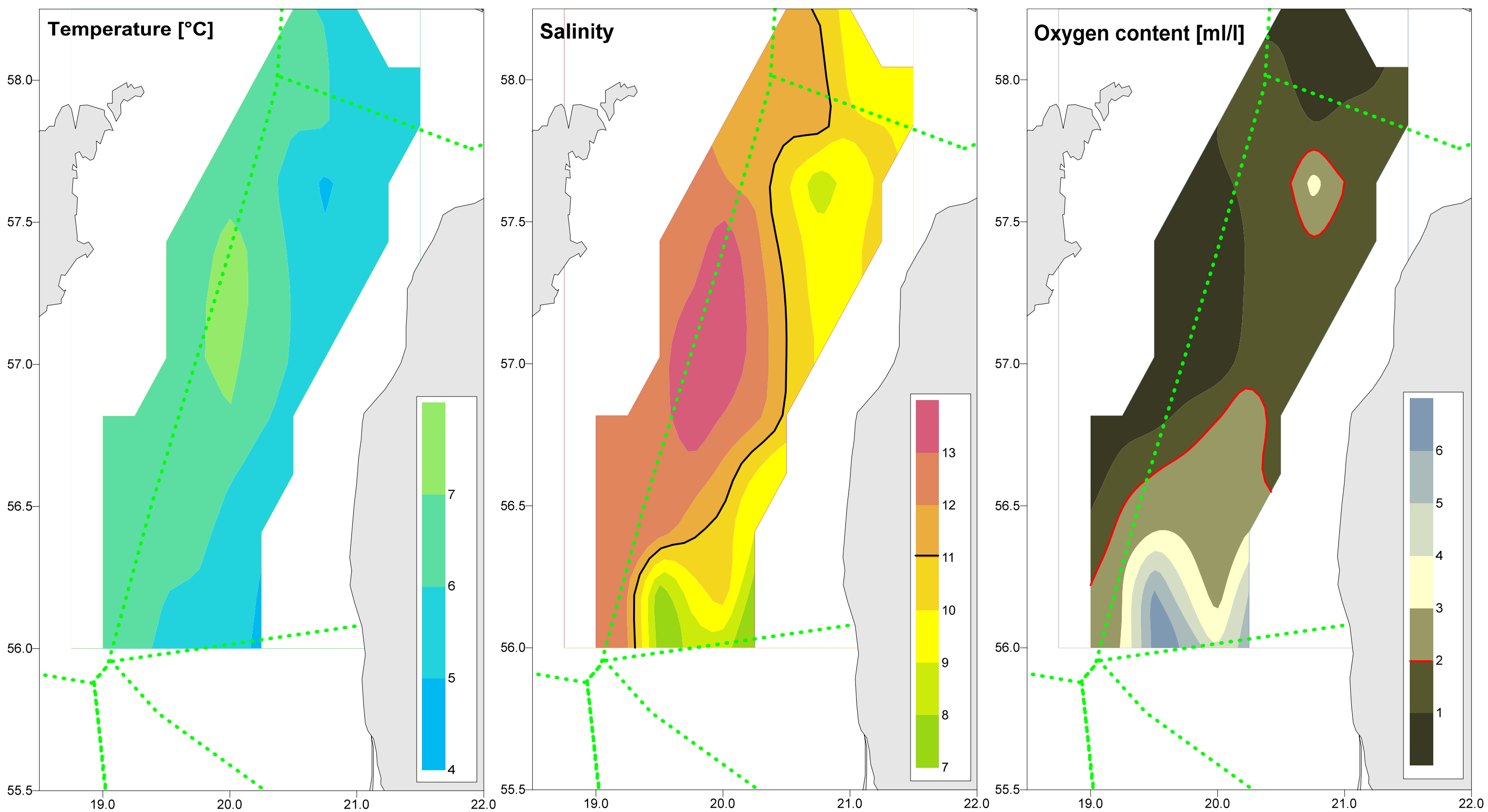

Figure 13: Horizontal distribution of the main hydrological parameters (temperature, salinity, oxygen content) measured in the bottom water layer of the Gotland Deep in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11.-20.10.2016.

RUSSIAN ACOUSTIC AUTUMN SURVEY REPORT FOR THE R/V "ATLANTNIRO"

30.09-10.10.2016

by A. Karpushevskaia, A. Zezera, I. Karpushevskiy

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1 INTRODUCTION

The main objective is to assess clupeoid resources in the Baltic Sea. The autumn international acoustic survey is traditionally coordinated within the frame of the International Baltic Acoustic Survey (IBAS). The reported acoustic survey is conducted every year to estimate abundance and biomass of herring and sprat for assessment purposes of Baltic Fisheries Assessment Working Group (WGBFAS).

2 METHODS

2.2 Personnel

A. Zezera	AtlantNIRO, Kaliningrad, Russia - cruise leader
A. Karpushevskaia	AtlantNIRO, Kaliningrad, Russia - scientific leader
A. Malishko	AtlantNIRO, Kaliningrad, Russia – acoustic
M. Sokolov	AtlantNIRO, Kaliningrad, Russia – acoustic
S. Alekseev	AtlantNIRO, Kaliningrad, Russia - hydrologist
S. Ivanov	AtlantNIRO, Kaliningrad, Russia - engineer
N. Kalinina	AtlantNIRO, Kaliningrad, Russia - engineer
I. Trufanova	AtlantNIRO, Kaliningrad, Russia - engineer
N. Dyushkov	AtlantNIRO, Kaliningrad, Russia - engineer

2.2 Narrative

The RV "ATLANTNIRO" cruise number 65, 2016, was started from port Kaliningrad, the 30 September and continued to 19 October of 2016. The cruise covered the ICES Subdivision 26 and included only Russia economic zone. Calibration of acoustic equipment was carried out in 01 October 2016. Acoustic investigations were carried out from 2 October to 10 October.

2.3 Survey design

The area of international acoustic survey is limited by the 10 m depth line. The statistical rectangles of Subdivision 26 (zone of Russia), were used as strata (IBAS, ver. 0.82, ICES CM 2015/ SSGIEOM:07 Ref. Assess). The scheme of transects has been defined as the regular, of rectangular form, with the distance between transects of 15 nm. The average speed of a vessel for the all period of acoustic survey was 7.9-8.2 knots. The average speed of the vessel with a trawl was 4.0 knots; the trawling duration was standard 30 minutes. The survey was conducted in the daytime from 7.00 up to 18.00 of local time. All investigated area of survey constitutes the 3838.8 nm^2. The full cruise track with positions of the trawling is shown on Figure 1.

2.4 Calibration

The Simrad EK60 echosounder with transducers ES38B and ES120–7 were calibrated in the Baltic Sea shore area, near the port Pionerskiy (Russia), the 01.10.2016, in 55°05.31'N; 20°22.03'E. The ship was fixed on the two anchors and one trawl door on the 36.0 meters of depth. The calibration procedure was carried out with a standard calibrated copper sphere, in accordance with the 'SISP Manual of International Baltic Acoustic Surveys (IBAS) (“Manual of International Baltic Acoustic Surveys (IBAS)”, Version 0.82, WGBIFS 2015 ICES CM 2015/ SSGIEOM:07).

THE RESULTS OF CALIBRATION PROCEDURE FOR EK60 SCIENTIFIC ECHOSOUNDER	
Date: 01.10.2016	Place : port Pionerskiy (Russia)
Type of transducer	Split – beam for 38 and 120 kHz
Gain (38 kHz)	26.25 dB
SA Correction (38 kHz)	-0.68 dB
Gain (120 kHz)	25.90 dB
Sa Correction (120 kHz)	-0.35 dB

2.5 Acoustic data collection

The acoustic investigations have been performed during daytime only. The acoustic equipment was an echosounder EK60 with the 38/120 kHz working frequencies. Both transducers are stationary installed in the bottom of the ship, in special blister, for air bubbles noise level decreasing. The specific settings of the hydroacoustic equipment were as described in the “Manual of International Baltic Acoustic Surveys (IBAS)”, (WGBIFS 2014 ICES CM 2014/ SSGIEOM:13). The post-processing of the stored echodata was done with the SonarData Echoview ver. 4.80.48.16239, Surfer 8.0 and Excel software’s. Data sampling and echogram formation were implemented by SonarData Echolog_60 ver. 3.50.1.2922. The mean volume backscattering values Sv, were integrated over 1 nm intervals, from 5 m below the surface to the bottom. Contributions from air bubbles, trawlings and on oceanology stations maneuvers, bottom structures and scattering layers were removed from the echograms by using the SonarData Echoview software. The map of fish density distribution was built on base NASC values with Surfer 8.0 software.

2.6 Biological data – fishing stations

All trawlings were done with the pelagic gear “RT/TM 70/300” in the midwater as well as near the bottom. The mesh size in the codend was 6.5 mm. The intention was to carry out at least two hauls per ICES statistical rectangle. The trawling depth and the trawl opening were defined with a trawl sonar monitoring system SI-110. The trawling depth was chosen on base the echogram, in accordance to echorecords from the fish. Normally, the trawl had vertical opening of about 28 m. The trawling time lasted 30 minutes. Samples were taken from each haul in order to determine length and weight composition of fish. Sub-samples of herring and sprat were taken for further investigations in the laboratory (i.e. sex, maturity, age). In addition, stomachs of sprat and herring were sampled for further biological investigations. The positions of trawlings are shown on Figure 1. Fish control-catch results from the Russian RV‘Atlantniro’ IBAS survey are shown on Table 1.

2.7 Data analysis

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

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

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

2.8 Hydrographic data

After finalization of each trawling, a hydrographic measurement was executed. The vertical profiles of hydrographical parameters, (temperature, salinity of water and the oxygen dissolved in water) were taken with a "SBE-19 plus" probe.

Samples of water on different depth were selected with the complex “SBE19+V2/SBE32/33”. Concentration of the dissolved oxygen in samples was defined on method Winkler, by means of the stand for titration "Dosimat 715" (Hydrobios, Germany).

3. RESULTS

3.1 Biological data

In total 10 trawl hauls were carried out in subdivision 26 (Russia zone). During the survey the 2006 sprat and 2381 herring were measured, 772 herring and 1000 sprat were aged. The results of the catch composition by ICES Subdivision are presented in Table 2. The average catch amounted to 260.3 kg per half hour of trawling. The average biomass fraction was 40.0% for sprat, 58.8% for herring and less than 1.0% for cod. In four trawling stations the fraction of a sprat reached more than 70%, in the remaining trawling it was from 4 to 23%. The cod catches were extremely small.

The length compositions of sprat and herring in subdivision 26 (Russia zone) of the year 2016, are presented in Figure 2.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean NASC, the mean scattering cross section σ, the estimated total number of fish, the percentages of herring and sprat per Sub-division/rectangle are shown in Table 3. The maps of surface density distribution in NASC [m^2/nm^2] – values, are shown in Figure 3.

3.3 Abundance estimates

The survey statistics concerning the survey area, the mean NASC, the mean scattering cross section σ, the estimated total number of fish, the percentages of herring and sprat per Sub-division/rectangle are shown in Table 3. The total abundance of herring and sprat are presented in Table 4. The estimated summary acoustic survey of sprat and herring (mean length and weights) by Sub-division/rectangle are given in Table 5. The estimates of sprat and herring number, mean weights and biomass by Sub-division/rectangle are shown in Table 6-11.

4.0 DISCUSSION

The indices of young sprat and herring (the generation of 2016) had minimal values that indicated on low recruitment of clupeids in 2016.

During trawl acoustic survey in October 2016 significant distraction of the fish accumulations on the researching water area was noted. It was caused by anomalous hydrometeorological unfavorable conditions both for the formation of dense concentrations of pelagic fish (especially sprat and its young), and, respectively, for their catching.

5.0 REFERENCES

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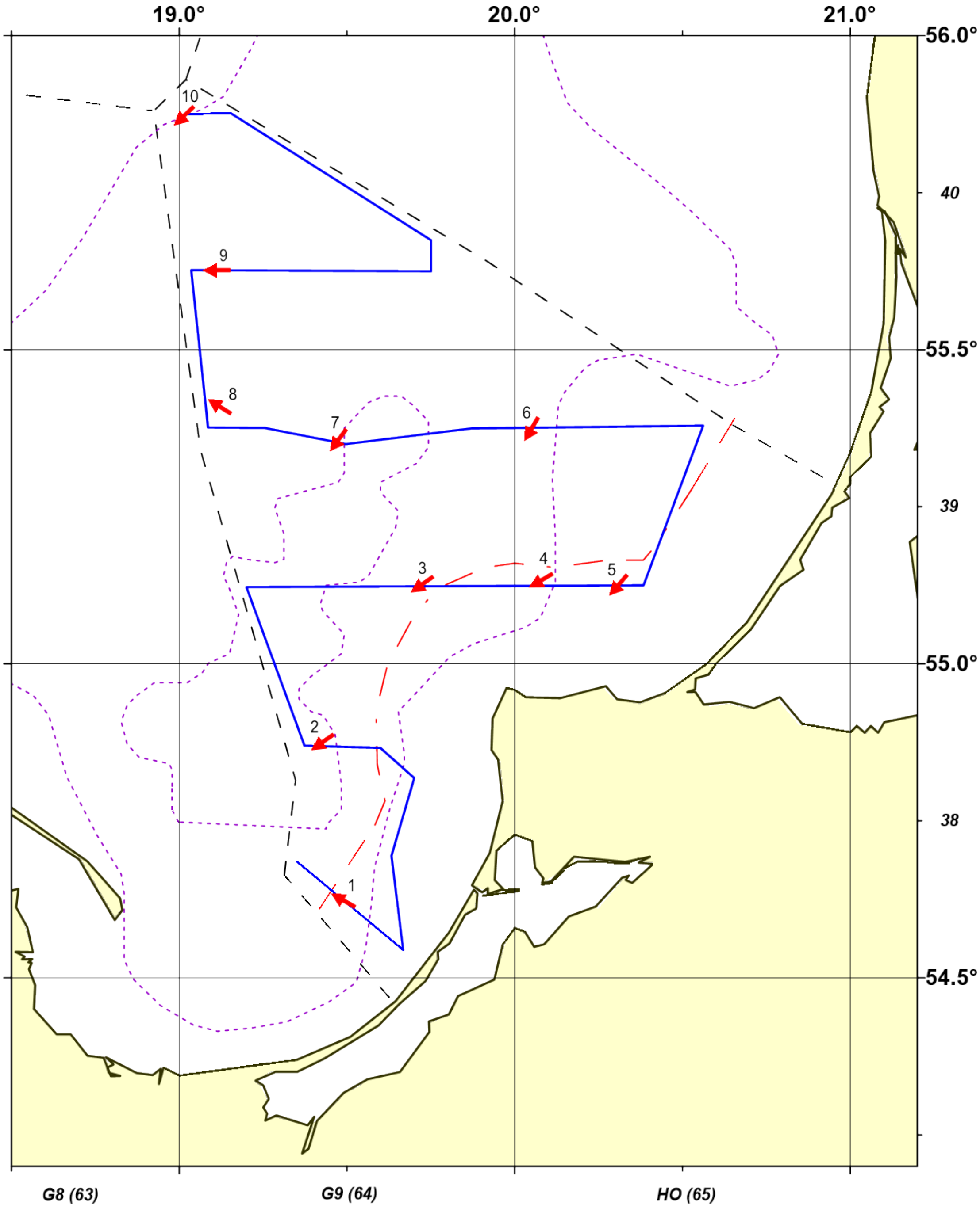


Figure 1. The scheme of cruise track and trawl stations for Russian part of survey (RV "ATLANTNIRO", 02-10.10. 2016)

Table 1. Fish control-catch results in the Baltic Sea ICES SD 26 from Russian BASS survey (RV “ATLANTNIRO”, 02–10.10.2016)

Haul number	Date	ICES rect.	ICES SD	Mean bottom depth [m]	Head-rope depth [m]	Hor. open [m]	Ver. open [m]	Trawl. speed [knt]	Trawl. direct [°]	Geographical position				Time Start	Haul dur. [min]	Total catch [kg]
										Start		End				
										Latitude 00° 00.0'N	Longitude 00° 00.0'E	Latitude 00° 00.0'N	Longitude 00° 00.0'E			
1	02.10.2016	38G9	26	80	20	97	26	4,0	300	54 37.1	19 30.1	54 37.7	19 28.2	18:08	20	345,5
2	04.10.2016	38G9	26	105	52	92	26	4,0	230	54 53.3	19 27.7	54 52.0	19 24.3	7:40	30	353,5
3	06.10.2016	39G9	26	76	37	98	28	4,1	237	55 08.2	19 45.1	55 07.0	19 42.0	12:31	30	219,5
4	07.10.2016	39HO	26	56	13	98	29	4,1	241	55 08.6	20 06.6	55 07.5	20 03.1	7:31	30	336,1
5	07.10.2016	39HO	26	43	10	91	31	4,0	220	55 08.4	20 19.8	55 06.7	20 17.3	14:42	30	149,5
6	08.10.2016	39HO	26	59	17	90	25	4,0	213	55 23.7	20 04.4	55 21.8	20 02.5	10:04	30	99,8
7	08.10.2016	39G9	26	96	43	89	28	4,0	221	55 22.3	19 29.9	55 20.5	19 27.2	15:18	30	237,1
8	09.10.2016	39G9	26	81	34	90	28	4,0	300	55 23.8	19 09.3	55 25.1	19 05.6	9:05	30	63,3
9	09.10.2016	40G9	26	87	55	95	29	3,9	270	55 37.5	19 09.0	55 37.5	19 05.3	13:39	30	419,2
10	10.10.2016	40G9	26	104	50	97	26	3,9	224	55 53.3	19 02.5	55 51.6	18 59.6	11:32	30	207,0
SD26				79	33	94	28	4,0	246							2430

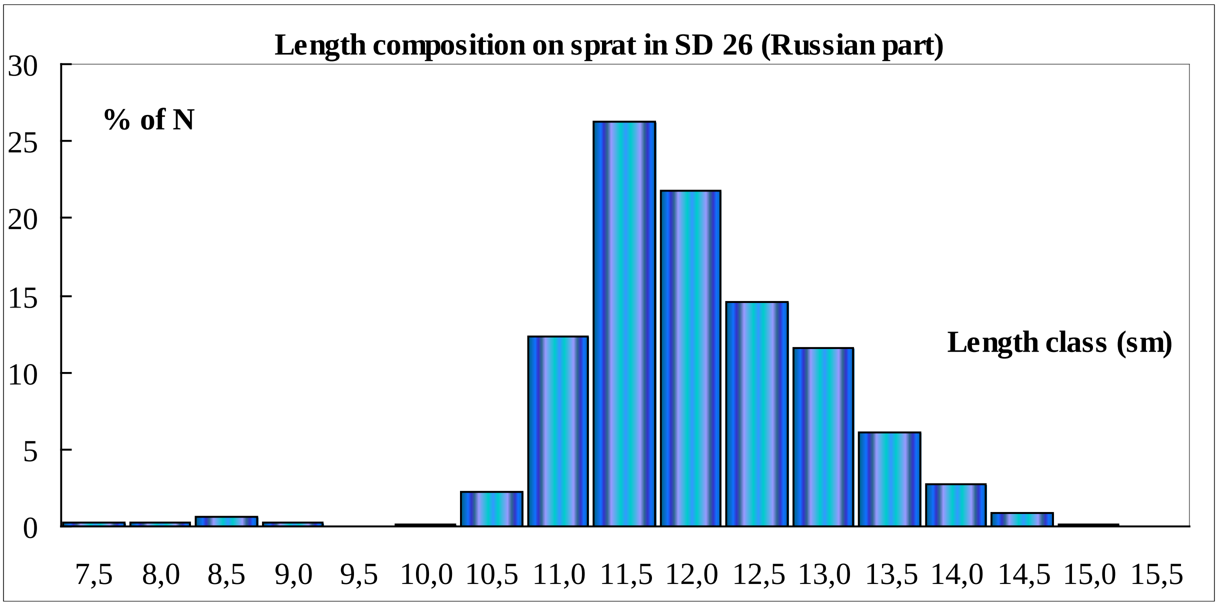
Table 2. Catch composition (kg/1hour) per haul by ICES Subdivision and ICES rectangles (RV “ATLANTNIRO”, 02–10.10.2016)

ICES_subdivision	**26**	**26**	**26**	**26**	**26**	**26**	**26**
Haul_No	***1***	***2***	***3***	***4***	***5***	***6***	***7***
Date	02.10.2016	04.10.2016	06.10.2016	07.10.2016	07.10.2016	08.10.2016	08.10.2016
Validity	Valid	Valid	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	38G9(64)	38G9(64)	39G9(64)	39HO(65)	39HO(65)	39HO(65)	39G9(64)
CLUPEA HARENGUS	282,9	523,2	386,6	8,0	1,4	11,9	431,8
SPRATTUS SPRATTUS	732,9	160,6	50,1	660,0	295,2	186,8	33,6
GADUS MORHUA	6,0	18,5	1,4	2,3	0,0	0,8	8,1
ANOTHER	14,7	4,7	0,9	1,9	2,3	0,2	0,7
Total	1036,5	707,0	439,0	672,1	298,9	199,7	474,3

ICES_subdivision	**26**	**26**	**26**
Haul_No	***8***	***9***	***10***
Date	09.10.2016	09.10.2016	10.10.2016
Validity	Valid	Valid	Valid
Species/ICES rectangle	39G9(64)	40G9(64)	40G9(64)
CLUPEA HARENGUS	119,6	803,0	385,0
SPRATTUS SPRATTUS	6,8	32,6	28,4
GADUS MORHUA	0,0	2,8	0,5
ANOTHER	0,2	0,0	0,0
Total	126,6	838,4	413,9

Table 3. Survey statistics (RV “ATLANTNIRO”, 02–10.10.2016)

ICES SD	ICES Rect.	AREA NM^2	SA M^2/NM^2	$\sigma*10^4$ M^2	N TOTAL MLN	SPECIES COMPOSITION (%)	
						HERRING	SPRAT
26	40G9	1013,0	229,3	3,12	745,4	85,78	14,22
26	39H0	881,6	630,8	1,33	4182,6	0,49	99,51
26	39G9	1026,0	154,2	2,97	533,1	74,07	25,93
26	38G9	918,2	378,3	1,95	1780,4	22,52	77,48



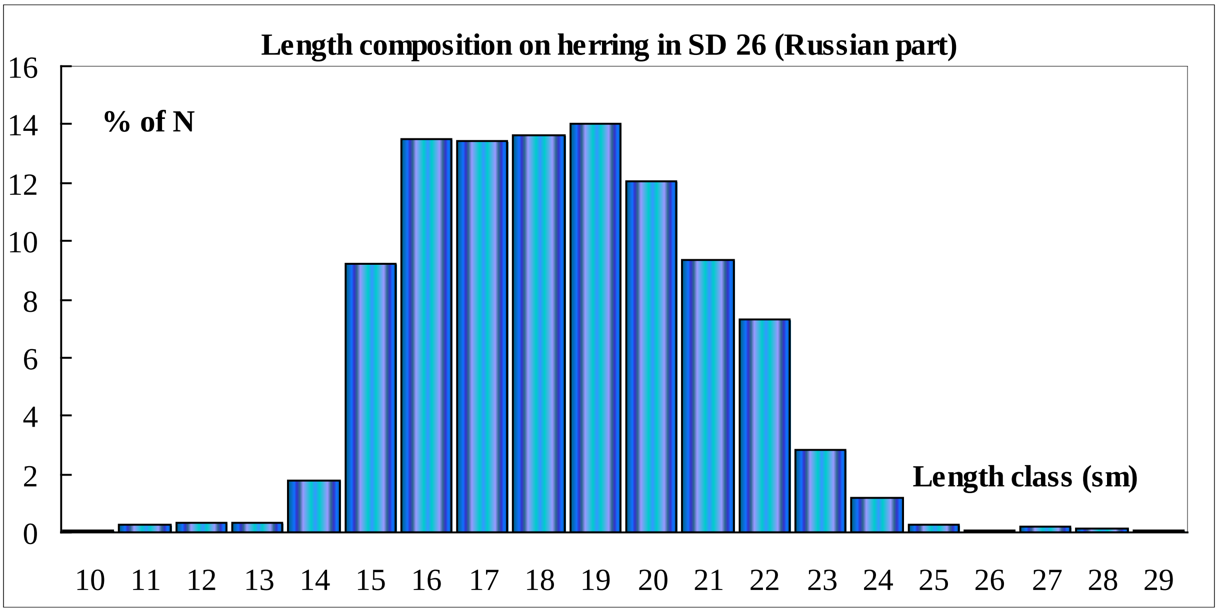


Figure 2. Length composition of sprat and herring (%) (RV "ATLANTNIRO", 02–10.10.2016)

Table 4. Characteristics of the stock of sprat and herring acoustic survey data (RV "ATLANTNIRO", 02–10.10.2016)

ICES	**ICES**	**Area**	**ρ**	**Quantity, mln**			**Biomass, tonn**		
SD	**Rect.**	**nm^2**	**mln/nm^2**	**N sum**	**N her**	**N spr**	**W sum**	**W her**	**W spr**
26	40G9	1013,0	0,74	745,4	639,4	106,0	26316,9	25031,6	1285,3
26	39H0	881,6	4,74	4182,6	20,5	4162,1	43786,6	799,7	42986,8
26	39G9	1026,0	0,52	533,1	394,9	138,3	17948,3	16368,6	1579,7
26	38G9	918,2	1,94	1780,4	400,9	1379,4	33058,3	17289,4	15768,9

SD26		**3 838,8**		**7 241**	**1 456**	**5 786**	**121 110**	**59 489**	**61 621**

Table 5. Summary acoustic survey of sprat and herring (RV "ATLANTNIRO", 02–10.10.2016)

ICES SD	ICES Rect.	No trawl	HERRING			SPRAT			SA	TS CALC.
			L, cm	W, g	Numb.,%	L, cm	W, g	Numb.,%	M^2/NM^2	DB
26	40G9	9,10	18,69	39,15	85,78	12,65	12,13	14,22	229,3	-46,1
26	39H0	4,5,6	18,53	39,06	0,49	11,74	10,33	99,51	630,8	-49,8
26	39G9	3,7,8	19,01	41,45	74,07	12,29	11,43	25,93	154,2	-46,3
26	38G9	1,2	19,30	43,12	22,52	12,39	11,43	77,48	378,3	-48,1

Table 6. Estimated number (millions) of sprat (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	NSTOT	1	2	3	4	5	6	7	8+
26	40G9	105,99	0,29	4,98	39,33	15,38	26,76	12,91	1,73	1,75
26	39H0	4162,10	145,48	410,62	2735,36	439,54	370,11	49,18	5,91	2,95
26	39G9	138,26	0,65	7,95	68,59	20,54	26,89	7,97	1,39	1,21
26	38G9	1379,45	0,00	24,27	634,76	263,78	290,47	113,89	13,88	0,00
	Sum	5785,79	146,42	447,82	3478,05	739,23	714,22	183,95	22,91	5,91

Table 7. Estimated mean weights (g) of sprat (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	WSTOT	1	2	3	4	5	6	7	8+
26	40G9	12,13	3,93	8,99	10,79	11,93	13,20	14,13	16,70	15,21
26	39H0	10,33	3,90	9,04	10,32	11,58	12,14	14,36	17,24	16,79
26	39G9	11,43	4,54	8,66	10,54	12,16	12,68	14,27	16,22	12,61
26	38G9	11,43	0,00	8,02	10,39	12,36	12,19	13,61	12,90	0,00

Table 8. Estimated biomass (in tonnes) of sprat (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	WSTOT	1	2	3	4	5	6	7	8+
26	40G9	1285,29	1,13	44,72	424,24	183,45	353,07	182,49	28,96	26,65
26	39H0	42986,84	567,49	3712,45	28223,08	5090,96	4492,47	706,15	101,84	49,59
26	39G9	1579,69	2,97	68,89	723,03	249,85	340,82	113,73	22,55	15,24
26	38G9	15768,87	0,00	194,67	6596,11	3261,34	3541,31	1550,19	178,95	0,00
	Sum	**61620,70**	571,59	4020,73	35966,46	8785,60	8727,67	2552,56	332,30	91,48

Table 9. Estimated number (millions) of herring (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	NHTOT	0	1	2	3	4	5	6	7	8+
26	40G9	639,40	0,63	37,67	129,21	118,85	146,48	63,17	46,29	45,46	51,63
26	39HO	20,48	1,05	0,35	3,39	4,12	6,40	1,37	0,95	0,98	1,86
26	39G9	394,85	0,54	9,19	65,37	51,33	103,07	33,51	42,11	35,03	54,70
26	38G9	400,93	0,38	27,26	50,61	59,86	124,19	60,55	31,67	8,75	37,65
	Sum	1455,66	2,61	74,48	248,58	234,16	380,14	158,60	121,01	90,23	145,85

Table 10. Estimated mean weights (g) of herring (RV “ATLANTNIRO”, 02–10.10.2016)

SD	RECT	WHTOT	0	1	2	3	4	5	6	7	8+
26	40G9	39,15	12,05	28,76	30,89	35,29	37,35	47,14	46,52	47,72	57,76
26	39HO	39,06	11,18	18,96	30,92	33,31	38,26	43,12	61,77	46,69	70,37
26	39G9	41,45	13,96	29,16	29,65	31,86	39,19	43,74	45,74	52,24	59,57
26	38G9	43,12	9,85	26,21	29,30	42,10	41,21	45,51	53,53	60,70	65,56

Table 11. Estimated biomass (in tonnes) of herring (RV “ATLANTNIRO”, 02–10.10.2016)

SD	RECT	WHTOT	0	1	2	3	4	5	6	7	8+
26	40G9	25031,62	7,620206	1083,381	3991,107	4194,366	5471,059	2978,299	2153,536	2169,751	2982,498
26	39HO	799,7359	11,78513	6,727076	104,8264	137,3403	244,6947	59,0191	58,41273	45,84818	131,0823
26	39G9	16368,62	7,587676	267,8705	1938,146	1635,283	4039,425	1465,752	1925,884	1829,931	3258,742
26	38G9	17289,41	3,709085	714,4161	1483,027	2519,931	5117,677	2755,268	1695,348	531,3136	2468,716
	Sum	**59489,38**	30,7021	2072,394	7517,107	8486,92	14872,86	7258,338	5833,18	4576,844	8841,039

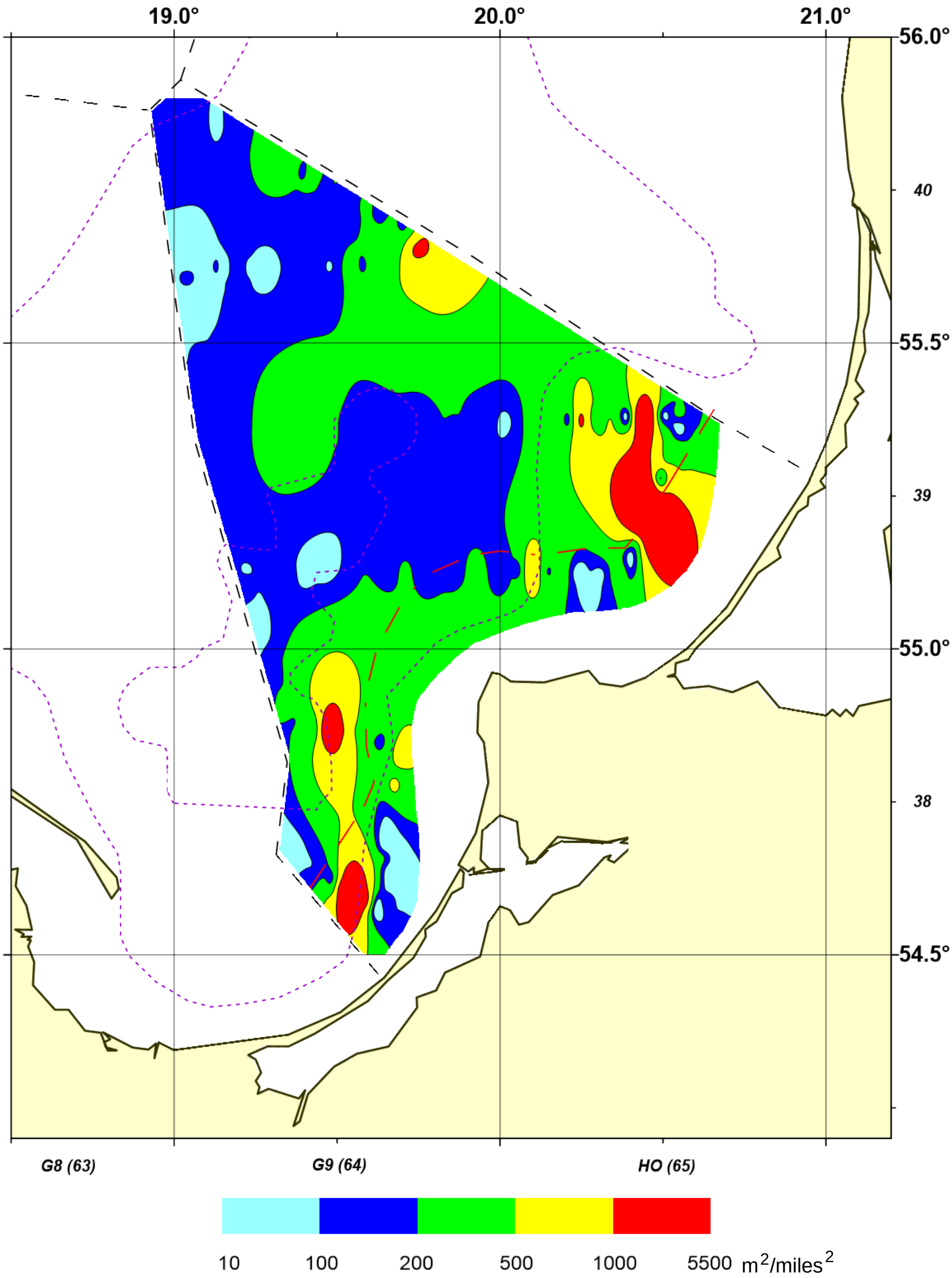


Figure 3. The map of NASC values distribution on the Russian area of international acoustic survey (RV “ATLANTNIRO”, 02-10.10.2016)

Baltic International Acoustic Survey

Report for R/V Aranda

R/V Aranda

Cruise 17/2016

ICES_BIAS2016

22th September – 4th October 2016

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INTRODUCTION

International hydroacoustic surveys have been conducted in the Baltic Sea since 1978 (Håkansson et al. 1979). The initial Finnish-Estonian (FIN-EST) research survey on the R/V Baltica was realised in October 2006 (Grygiel et al. 2007), in the framework of the long-term ICES Baltic International Acoustic Surveys (BIAS) programme. The FIN-EST BIAS surveys on the R/V Baltica were continued until 2012. Since 2007, Finland and Sweden joined together to additionally cover Bothnian Sea (ICES Subdivision 30). In 2012 Sweden could not support the funding of the survey in the Bothnian Sea due to economic difficulties within the DCF program and therefore the coverage of the SD30 had to be based on Finnish funding which resulted in half the normal effort (ICES 2013). In 2013, Finland installed fishing equipment and a Simrad EK60 echo sounder into the R/V Aranda and used the vessel in order to cover ICES SDs 29N, 30, and 32N.

The Baltic International Acoustic Survey (BIAS), is mandatory for the countries that have exclusive economic zone (EEZ) in the Baltic Sea, and is a part of the Data Collection Framework. The BIAS survey in September/October are co-ordinated and managed by the ICES working group WGBIFS. The main objective of BIAS is to assess clupeoid resources in the Baltic Sea. The survey will provide data to the ICES Baltic Fisheries Assessment Working Group (WGBFAS). The aim of the cruise was to carry out Baltic International Acoustic Survey on herring and sprat covering SDs 29N, 30, and 32N during the autumn 2016, within the remit of the Natural Resources Institute Finland (Luke).

MATERIALS AND METHODS

Narrative

The cruise was completed in two legs, the first covering most of the Bothnian Sea (BS) and the second leg covering the Northern Baltic Sea and the Gulf of Finland (GoF). Altogether 44 stations were visited during both legs. The research area, cruise track and trawl stations are shown in Figure 1 and 2. At every station also a CTD cast was made. At one additional station the calibration of the echo sounder system was performed.

The R/V Aranda departed from HELSINKI on Thursday 28.09.2015 at 23:00 (UTC 20:00) and the direct at sea researches begun. Investigations were continued in the northern direction in to SD 30. All at sea researches were finalised on 8.10.2015 morning. The r/v Aranda arrived back to HELSINKI on Tuesday 08.10.2015 at 11:00. The harbour of Kaskinen was visited during the cruise at 01.10.2014 for change of scientific crew and repair the trawl. In addition, the harbour of Pori was visited at 03.10.2015 for fixing the vessel.

The Finnish BIAS 2015 survey had two interruptions due to technical faults and the fishing had to be stopped. The first fault was at 01.10.2015 in SD 39 when the trawl was damaged due to bottom contact. The second interruption was at between 2.-3.10.2015 due to a stormy weather, which damaged the vessel. Therefore, several fishing stations could not be realized and rectangles 55G9, 55H0, and 54H0 were not covered during the survey.

Survey design and hydrographical data

During the cruise, echo-integration was performed along the survey track from ICES Sub-Divisions 29N, 30, and 32N. The conductivity, temperature, and depth (CTD) were measured using a "RBR

XR-620" instrument. The CTD cast was done when whenever a trawl haul was conducted and also when calibrating the acoustic instrument.

Calibration

The SIMRAD EK60 echo sounder with the transducer ES38B was calibrated on 30.09.2015 at the sea, according to the IBAS manual (ICES 2013, Addendum 2). Values from the calibration were within required accuracy.

Acoustic data collection

The acoustic sampling was performed around the clock. SIMRAD EK60 echo sounder with the 38 kHz transducer (ES38B) mounted on a hull was used for the acoustic data collection. The settings of the hydroacoustic equipment were as described in the BIAS manual (ICES 2013, Addendum 2). The post processing of the stored raw data was done using the Echoview software (www.echoview.com). The mean volume back scattering values (Sv) were integrated over 1 nautical mile elementary distance sampling units (ESDUs) from 10 m below the surface to the bottom at 10 m intervals.

Data analysis

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

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

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

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

PERSONNEL

Cruise leader during the survey was Juha Lilja from Natural Resources Institute Finland (Luke). The acoustic measurements and fishing trawls were performed by Natural Resources Institute Finland (Luke) and fish sampling together by Luke and Swedish University of Agricultural Sciences (SLU). The participating scientist crew can be seen in the list below.

Juha Lilja	Luke	Cruise Leader, Acoustics
Ari Leskelä	Luke	Fishing
Jukka Pönni	Luke	Fish sampling
Tero Saari	Luke	Fish sampling
Hannu Harjunpää	Luke	Fish sampling
Timo Myllylä	Luke	Fish sampling
Markku Vaajala	Luke	Fish sampling
Esa Lehtonen	Luke	Fishing
Arto Koskinen	Luke	Fish sampling
Jari Raitaniemi	Luke	Fish sampling
Erkki Jaala	Luke	Acoustics
Mikko Leminen	Luke	Acoustics
Katja Ikonen	Luke	Fish sampling
Perttu Rantanen	Luke	Database maintenance
Otto Kiukkonen	Fisherman	Fishing
Peter Koskinen	Fisherman	Fishing
Jari Johansson	Fisherman	Fishing
Markku Gavrilov	Luke	Fishing
Sami Vesala	Luke	Fishing/ Fish sampling
Yvette Heimbrand	SLU	Fish sampling
Anne Odelström	SLU	Fish sampling
Harri Vehviläinen	Luke	Fish sampling
Anu Lastumäki	SYKE	Fish sampling
Tanja Kinnunen	SYKE	Fish sampling

Luke: Luonnonvarakeskus / Natural Resources Institute Finland
SLU: Sveriges lantbruksuniversitet / Swedish University of Agricultural Sciences
SYKE: Suomen ympäristökeskus / Finnish Environment Institute

RESULTS

Fish catches, biological and hydro-meteorological data

The number of planned trawling stations was 46. From these, 44 trawling stations were accomplished, and from those 40 were counted as "valid" (technically sound hauls and sufficient catch for a sample) (Table 1 & 4). The total number of trawling stations in Bothnian Sea (ICES SD 30) was 30, in northern Baltic proper (SD 29) 7, and 7 in the northern Gulf of Finland (SD 32). Only 2 trawling stations was reduced due to stormy weather.

The 8488 kg combined catches (Table 1) consisted of 17 fish species (8349 kg) and mostly unidentified organic matter categorized as "waist" (139 kg), but also including identified common jellyfish (*Aurelia aurita*), large number of mysids and small amounts of the isopod *Saduria entomon*. The unsorted "invalid" trawlcatches add up to 115 kg, and they are also included in the total catch. The most common and abundant species were herring (*Clupea harengus*) (5134 kg) and sprat (*Sprattus sprattus*) (1870 kg) followed by three-spined stickleback (*Gasterosteus aculeatus*) (1315 kg). All observed species are presented in Table 2. From the sub-samples of the 40 fish catches a total of 18326 measurements for species-specific length distributions (0,5 cm interval for herring and sprat, and 1 cm interval for other species) were performed according to Table 3.

Ten individual samples per statistical rectangle for age determination and maturity definitions by length-class were collected from herring and sprat, 3786 and 1183 samples respectively (Table 5). The mean weights for each length-class were also derived from these individual fish samples. Additionally, from 10 statistical rectangles in SD 30 and 2 rectangles in SD 29 close to the Swedish coast, a 2 kg sample of herring from 17 cm to 20 cm of length was collected and frozen for dioxin analyses to be performed by Livsmedelsverket (SLV) of Sweden.

Also, in SD30, 17 dioxin samples of 25 herring individuals from the same size-category as in previous sampling were collected and frozen for Naturhistoriska Riksmuséet (NRM) of Sweden.

Hydrographical data: temperature (°C), salinity (psu), sound speed (m/s), special conductivity (µS/cm), conductivity (mS/cm) and sound speed (m/s) were measured and results are showed in Figures 5 - 8. Total of 44 CTD casts were done during the entire cruise. Here only a part of the CTD casts is presented.

Abundance estimates

The total area covered by the Finnish BIAS survey was 21629 square nautical miles (nmi^2) and after the scrutinizing, the distance used for acoustic estimates was 1703 nautical miles (nmi). The cruise track and positions of trawl hauls are shown in Figure 1. Length distributions for herring and sprat by ICES subdivision are shown in fgures 2 and 3, respectively. The total abundance of herring and sprat is presented in Table 6. Estimated numbers of herring and sprat by age group and Subdivision/rectangle are given in Table 7 and Table 10, respectively. Corresponding mean weights by age group and Subdivision/rectangle are shown in Table 8 and Table 11, respectively. Estimates of herring and sprat biomass by age group and Subdivision/rectangle are summarized in Table 9 and Table 12, respectively.

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TABLES, MAP, AND FIGURES

Table 1.Trawl catches (kg) by species/category during the Finnish BIAS-survey in 2016.

Haul no	Haul name	ICES SD	Aurelia aurita	Clupea harengus	Cyclopterus lumpus	Gasterosteus aculeatus	Hyperoplus lanceolatus	Lampetra fluviatilis	Liparis liparis	Nerophis ophidion	Osmerus eperlanus	Platichthys flesus	Pomatoschistus [illegible]	Pomatoschistus [illegible]	Pungitius pungitius	[illegible]	Salmo salar	Sprattus sprattus	Zoarces viviparus	Waste*	Total (kg)
1	4844-1	32		24.80		4.32					9.94			0.01	0.06			654.29		0.01	654.29
2	4843-1	32		18.48		2.82					0.88				0.06	0.00		51.80		4.96	51.80
4	4841-1	29	0.91	3.63		2.12					0.15				0.08	0.00		61.51		1.65	61.51
5	4969-1	29		81.00		10.87	0.12							0.00	0.02			15.62		3.88	81.00
6	5068-1	30		186.45		20.31	0.01								0.01	0.01		3.04		6.14	186.45
7	5068-2	30		39.80		26.28									0.00	0.01		0.13		1.79	39.80
8	5067-1	30		508.94		7.20	0.02								0.00	0.00		8.16		3.68	508.94
9	5168-1	30		1.24		419.25	0.08								0.06		0.14	1.16		26.89	419.25
10	5169-1	30		54.17		14.02									0.00			0.15		0.15	54.17
11	5168-2	30		188.94		84.05										0.01					188.94
12	5167-1	30		77.48		80.26	0.01									0.00				0.25	77.48
13	5267-1	30		85.88		4.45	0.01								0.01					2.65	85.88
14	5268-1	30		180.98		13.95				0.00						0.08		0.61		0.88	180.98
15	5468-1	30		217.74		11.72			0.01						0.08	0.14		0.08		0.29	217.74
16	5468-2	30		67.84		10.10									0.02	0.03				0.06	67.84
17	5469-1	30		76.60		6.08	0.01		0.37						0.01	0.04					76.60
18	5468-1	30		57.15		0.52	0.08		0.32					0.00	0.00	0.01				2.12	57.15
19	5469-1	30		107.22		5.52	0.15		0.05						0.01	0.03		0.81		1.22	107.22
20	5569-1	30		127.17		8.27	0.01			0.00	0.05			0.00		0.04		9.95		6.49	127.17
21	5540-1	30		158.56		0.69	0.00		0.11		1.10		0.00		0.00	0.04	0.28	2.04	0.02	1.15	158.56
22	5469-2	30		105.25		0.13			0.34	0.00	0.47					0.05				1.96	105.25
23	5640-1	30		285.24		19.27	0.02			0.02					0.06	0.03		0.08		2.38	285.24
24	5640-2	30		109.17		20.80		0.04			0.57				0.01	0.01		0.22		5.18	109.17
25	5840-1	30		71.53		18.95				0.00	0.07					0.00		0.89		1.56	71.53
26	5840-2	30		78.98		21.79	0.00		0.08									0.24		4.96	78.98
28	5240-1	30		811.78		2.45	0.00			0.00					0.02			0.29		1.45	811.78
29	5269-1	30		10.55		182.78	0.01			0.00								0.42			182.78
31	5140-1	30		27.47		18.42				0.00					0.08	0.00		0.02	0.04	1.02	27.47
32	5140-2	30		71.24		100.14									0.01			0.18		0.46	100.14
33	5040-1	30		109.93		85.49	0.00			0.00					0.00		0.41	6.78	0.02	2.37	109.93
34	5069-1	30		140.93		41.23										0.01		11.58		1.25	140.93
35	5069-2	30		20.08		129.80				0.00	0.00					0.00		0.44		0.17	129.80
36	4869-1	29		159.04		14.53	0.03				0.22				0.01			186.01		1.17	159.04
37	4840-1	29		248.11		12.74									0.01			25.58		14.55	248.11
38	4841-2	29	3.48	397.47	0.06	9.25												94.28		7.45	397.47
39	4842-1	29	3.09	93.91		1.10	0.02				0.09				0.02	0.03		105.52	0.04	9.19	105.52
40	4843-2	32	0.06	2.35		0.15				2.35					0.01			846.07		1.99	846.07
41	4946-1	32		100.97		0.97				0.00	4.76				0.01			61.88		7.91	100.97
43	4845-1	32		165.43		3.07				0.00	1.80	0.14			0.06			159.52			165.43
44	4945-1	32		460.46		1.13					1.91				0.01	0.00		108.17		1.32	460.46
Total			3.48	508.94	0.06	419.25	0.15	0.04	0.37	2.35	9.94	0.14	0.00	0.01	0.08	0.14	0.41	654.29	0.04	26.89	654.29

Table 2.English, scientific, and Finnish names of observed species in Finnish BIAS-survey.

Fishnames		
English	**Scientific**	**Finnish**
snake blenny	Lumpenus lampretaeformis	Elaska
sand goby	Pomatoschistus minutus	Hietatokko
striped seasnail	Liparis liparis	Imukala
greater sandeel	Hyperoplus lanceolatus	Isotuulenkala
sarduria	Sarduria entomon	Kilkki
sprat	Sprattus sprattus	Kilohaili
eelpout	Zoarces viviparus	Kivinilkka
three-spined stckleback	Gasterosteus aculeatus	Kolmipiikki
jellyfish	Aurelia aurita	Korvameduusa
smelt	Osmerus eperlanus	Kuore
nine-spined stickleback	Pungitius pungitius	Kymmenpiikki
Atlantic salmon	Salmo salar	Lohi
sea lamprey	Petromyzon marinus	Meritaimen
turbot	Scophtalmus maximus	Piikkikampela
small sandeel	Ammodytes tobianus	Pikkutuulenkala
lumpsucker	Cyclopterus lumpus	Rasvakala
Baltic herring	Clupea harengus membras	Silakka
straightnose pipefish	Nerophis ophidion	Siloneula

Table 3. Number of length measurements /species and Sub-Division.

Species	ICES SD			Total
	29	30	32	
Clupea harengus	1753	8167	1408	11328
Cyclopterus lumpus	1			1
Gasterosteus aculeatus	441	1617	413	2471
Hyperoplus lanceolatus	6	96		102
Lampetra fluviatilis		1		1
Liparis liparis		51		51
Nerophis ophidion		18	5	23
Osmerus eperlanus	15	81	457	553
Platichthys flesus			1	1
Pomatoschistus minutus	1	2	1	4
Pungitius pungitius	28	65	135	228
Salmo salar		3		3
Sprattus sprattus	1382	809	1359	3550
Zoarces viviparus	2	8		10
Total	**3629**	**10918**	**3779**	**18326**

Table 4.Numbers and locations of fishing stations (WGS-84) during Finnish BIAS-survey in 2016.

Haul no	Haul name	Date	ICES SD	Start latitude	Start longitude	End latitude	End longitude	Haul duration (min)	Haul speed (knot)	Haul distance (nmi)	Catch (kg)	Sample weight (kg)	Headrope depth (m)	Bottom depth (m)	Doors spread (m)	Trawl height (m)
1	48H4-1	22.09.2016	32	594993N	0242245E	595010N	0242375E	16	2.7	0.72	695	68.8	20	53	62.5	16
2	48H3-1	23.09.2016	32	593889N	0231304E	593895N	0231386E	10	2.5	0.42	80	26.4	25	56	62	16
3	48H2-0(INVALID)	23.09.2016	29	593520N	0234326E	593560N	0234570E	30	3	1.5	36		22	62	65	16
4	48H1-1	23.09.2016	29	593265N	0212500E	593399N	0212138E	90	2.5	3.75	70	20.75	12	120	58	16
5	49G9-1	23.09.2016	29	600630N	0192466E	600882N	0192327E	58	2.8	2.71	111.5	41.89	17	170	66.1	17
6	50G8-1	24.09.2016	30	603181N	0185593E	603461N	0185518E	62	2.6	2.69	216	39.5	17	90	64.6	17
7	50G8-2	24.09.2016	30	605193N	0184735E	605580N	0184660E	85	2.8	3.97	68	31	16	75	64.4	16
8	50G7-1	24.09.2016	30	604640N	0175180E	604648N	0175774E	75	2.4	3	528	66.6	25	55	66.2	20
9	51G8-1	24.09.2016	30	610662N	0181999E	610778N	0181738E	30	2.8	1.4	449	10.97	14	68	65.4	20
10	51G9-1	24.09.2016	30	610987N	0190919E	611131N	0190962E	30	2.9	1.45	68.5	32.16	15	70	64.2	20
11	51G8-2	25.09.2016	30	612001N	0185788E	611794N	0185447E	60	2.5	2.5	173	34.44	16	68	63.3	20
12	51G7-1	25.09.2016	30	611871N	0175889E	611581N	0175790E	69	2.8	3.22	108	31.12	15	70	66.2	20
13	52G7-1	25.09.2016	30	615911N	0175901E	615612N	0175600E	73	2.8	3.41	93	37.35	17	80	64.1	20
14	52G8-1	26.09.2016	30	615500N	0181234E	615220N	0180985E	65	2.9	3.14	196	51.64	13	85	63.2	20
15	53G8-1	26.09.2016	30	620284N	0181348E	620053N	0181031E	60	2.8	2.8	230	39.38	13	83	64.6	20
16	53G8-2	26.09.2016	30	620615N	0182969E	620647N	0183440E	49	2.8	2.29	78	35.94	13	90	65	20
17	53G9-1	26.09.2016	30	622887N	0191939E	622522N	0191988E	90	2.4	3.6	84	35.34	80	140	86.6	20
18	54G8-1	26.09.2016	30	624069N	0185473E	623719N	0185566E	93	2.3	3.57	61	61	90	210	90	17
19	54G9-1	26.09.2016	30	623680N	0192070E	623962N	0192355E	68	2.8	3.17	115	35.9	13	125	64.7	17
20	55G9-1	27.09.2016	30	630592N	0191760E	630848N	0192538E	100	2.8	4.67	152	42.94	15	185	64.3	20
21	55H0-1	27.09.2016	30	632101N	0202091E	631868N	0201742E	72	2.4	2.88	164	40.08	68	100	89.6	20
22	54G9-2	27.09.2016	30	624059N	0193205E	623698N	0192984E	90	2.4	3.6	108	48.93	80	135	98.6	20
23	54H0-1	27.09.2016	30	623543N	0200688E	623403N	0200715E	31	2.9	1.5	257	48.67	8	90	63.6	20
24	54H0-2	28.09.2016	30	623300N	0202093E	623173N	0202034E	29	2.8	1.35	136	49.24	10	70	65.2	20
25	53H0-1	28.09.2016	30	622167N	0203981E	621980N	0204128E	47	2.5	1.96	93	35.32	14	65	67	20
26	53H0-2	28.09.2016	30	621556N	0201988E	621403N	0201743E	40	2.7	1.8	106	38.32	16	120	64.7	20
27	53G9-2(INVALID)	29.09.2016	30	621944N	0195121E	621941N	0194761E	37	2.8	1.73	38.32		17	110	66.8	20
28	52H0-1	29.09.2016	30	615517N	0202220E	615673N	0201774E	60	2.7	2.7	316	65.44	15	110	62.1	20
29	52G9-1	29.09.2016	30	615018N	0195442E	615017N	0195999E	60	2.6	2.6	194	194	40	100	75	20
30	52H0-2(INVALID)	29.09.2016	30	613562N	0200027E	613441N	0200003E	32	2.4	1.28			85	120	85	20
31	51H0-1	01.10.2016	30	611487N	0202350E	611548N	0201806E	70	2.5	2.92	51	51	35	120	90	20
32	51H0-2	01.10.2016	30	610736N	0200421E	610635N	0202464E	48	2.5	2	172	47.32	17	103	62.3	24
33	50H0-1	02.10.2016	30	605528N	0201207E	605458N	0202675E	62	2.6	2.69	205	52.44	16	70	63	20
34	50G9-1	02.10.2016	30	605413N	0192804E	605278N	0195310E	68	2.4	2.72	195	46.91	22	93	62.6	22
35	50G9-2	02.10.2016	30	605251N	0192088E	605545N	0192124E	47	2.5	1.96	150	150	20	108	62.8	20
36	48G9-1	02.10.2016	29	594751N	0195515E	594750N	0200049E	87	2.6	3.77	310	59.16	37	190	95.4	20
37	48H0-1	02.10.2016	29	593000N	0203001E	592980N	0203175E	21	2.8	0.98	301	60.54	12	90	66.3	20
38	48H1-2	03.10.2016	29	593246N	0210210E	593310N	0210094E	17	2.8	0.79	512	69.54	12	105	65	20
39	48H2-1	03.10.2016	29	593340N	0221711E	593312N	0221632E	13	2.4	0.52	213	39.8	24	66	62.1	20
40	48H3-2	03.10.2016	32	593328N	0233027E	593354N	0233189E	20	2.5	0.83	353	54.58	30	84	77	20
41	49H6-1	03.10.2016	32	600319N	0262278E	600389N	0262247E	17	2.6	0.74	178	48.91	19	75	64.2	20
42	49H5-1(INVALID)	04.10.2016	32	595380N	0253169E	595426N	0253222E	12	2.6	0.52	41		21	73	66.1	20
43	48H5-1	04.10.2016	32	595528N	0253359E	595606N	0253450E	20	2.5	0.83	330	50.06	21	68	61.3	20
44	49H5-1	04.10.2016	32	600051N	0252093E	600138N	0252009E	22	2.4	0.88	573	46.6	23	60	61.3	20

Table 5.Individual samples of herring and sprat (for age-determination) per SD.

Lenght	Sprat			Sprat	Herring			Herring
class	29	30	32	total	29	30	32	total
60	2			2		1		1
65	3		3	6	1			1
70	10		6	16	3	3	4	10
75	10	1	10	21	14	6	5	25
80	11		3	14	12	11	12	35
85	6	1	1	8	13	19	2	34
90	8	1	20	29	13	28	4	45
95	47	2	50	99	10	18	4	32
100	50	10	50	110	23	11	1	35
105	50	28	50	128	3	4	5	12
110	50	33	41	124	3	1	13	17
115	45	51	36	132	19	1	43	63
120	46	72	32	150	35	9	45	89
125	41	68	15	124	47	54	50	151
130	13	62	7	82	40	85	50	175
135	3	66	1	70	40	125	50	215
140	1	38		39	40	144	50	234
145		17		17	47	181	48	276
150		12		12	41	194	48	283
155					44	199	42	285
160					35	199	24	258
165					36	195	14	245
170					17	182	2	201
175					14	179	2	195
180					5	170		175
185					4	147	1	152
190					1	127		128
195					2	123		125
200						104		104
205					1	68		69
210					1	46		47
215					1	28	1	30
220					1	20		21
225						9		9
230						3		3
235						2		2
240					1			1
250						1		1
255						1		1
265							1	1

Table 6. Survey statistics by area r/v Aranda 2015.

ICES SD	ICES Rect.	NM	N (million/nm²)	Area (nm²)	Sa (m²/nm²)	σ (cm²)	N total (million)	Herring (%)	Sprat (%)	Cod (%)
29	48G9	65	7.551482	772.8	789	1.045365	5836	58.9	30.0	0
29	48H0	61	5.550355	730.3	952	1.714755	4053	74.0	6.8	0
29	48H1	57	11.258670	544	1491	1.324108	6125	64.5	25.2	0
29	48H2	71	14.014105	597	1944	1.387496	8366	53.7	42.6	0
32	48H3	55	25.449869	615.7	2572	1.010686	15669	6.8	86.3	0
32	48H4	44	18.391186	835.1	1813	0.985664	15358	5.0	86.9	0
32	48H5	60	12.667041	767.2	1776	1.401875	9718	51.4	42.1	0
29	49G9	76	5.050568	564.2	706	1.397885	2850	59.8	10.1	0
32	49H5	19	5.190208	306.9	864	1.665052	1593	79.4	19.2	0
32	49H6	53	7.792386	586.5	1186	1.521502	4570	60.8	34.5	0
30	50G7	27	2.550247	403.1	522	2.046998	1028	93.8	1.1	0
30	50G8	61	3.104480	833.4	383	1.232636	2587	56.3	0.7	0
30	50G9	72	5.478775	879.5	381	0.695841	4819	14.2	1.1	0
30	50H0	37	3.818359	795.1	277	0.724586	3036	26.8	1.0	0
30	51G7	36	3.485320	614.5	309	0.887547	2142	23.6	0.0	0
30	51G8	61	5.656325	863.7	741	1.310854	4885	41.1	0.0	0
30	51G9	57	3.544268	865.8	483	1.361671	3069	45.6	0.1	0
30	51H0	113	4.214350	865.7	312	0.740196	3648	17.1	0.0	0
30	52G7	29	1.220099	482.6	305	2.496667	589	78.2	0.0	0
30	52G8	80	2.784527	852	553	1.986211	2372	66.3	0.2	0
30	52G9	60	1.702613	852	261	1.534196	1451	25.4	0.0	0
30	52H0	77	1.023037	852	271	2.653370	872	95.8	0.1	0
30	53G8	61	2.325741	838.1	475	2.043236	1949	74.2	0.0	0
30	53G9	61	1.129408	838.1	251	2.220022	947	73.4	0.0	0
30	53H0	62	5.492220	838.1	558	1.016509	4603	29.0	0.2	0
30	53H1	9	6.593151	126.6	621	0.942162	835	27.4	0.3	0
30	54G8	33	1.241488	642.2	381	3.071477	797	94.4	0.0	0
30	54G9	91	0.855443	824.2	220	2.569571	705	85.7	0.3	0
30	54H0	47	3.564550	727.9	722	2.024741	2595	64.8	0.0	0
30	55G9	29	1.023572	625.6	175	1.710784	640	70.5	4.9	0
30	55H0	39	1.195182	688.6	294	2.463472	823	96.6	0.9	0

Table 7.Numbers (millions) of herring by age and area (r/v Aranda 2016).

SD	Rect	0	1	2	3	4	5	6	7	8+	Total
29	48G9	1594.0	857.4	892.4	59.0	10.4	3.6	7.3	6.5	5.8	3436.4
29	48H0	7.6	360.9	1529.7	406.2	220.5	73.3	150.7	121.2	130.2	3000.3
29	48H1	52.4	882.9	2305.4	319.5	128.4	43.5	76.4	66.4	73.4	3948.4
29	48H2	89.8	1543.1	2460.1	190.9	84.2	18.2	40.9	25.5	41.9	4494.6
32	48H3	75.1	199.2	663.6	71.9	20.6	10.3	12.6	4.4	11.7	1069.4
32	48H4	31.3	118.1	463.1	79.6	28.8	13.6	12.5	9.8	15.3	772.1
32	48H5	130.6	642.0	2938.3	658.3	247.7	108.6	98.3	54.9	116.8	4995.6
29	49G9	136.6	237.5	840.3	194.5	87.0	27.3	58.7	46.0	76.2	1704.1
32	49H5	5.7	189.4	789.9	141.9	54.0	23.7	20.9	13.0	26.7	1265.2
32	49H6	42.1	315.7	1576.0	420.4	156.7	72.6	69.4	41.1	82.9	2776.9
30	50G7	7.4	293.2	450.0	127.2	45.4	20.4	5.2	3.7	11.3	963.9
30	50G8	1.4	561.5	595.2	161.5	59.7	29.5	11.8	11.2	24.9	1456.7
30	50G9	83.2	205.1	247.6	72.3	29.4	16.0	6.3	6.2	17.4	683.5
30	50H0	230.8	297.1	188.5	45.0	18.0	11.2	4.2	4.8	15.2	814.8
30	51G7	0.0	18.1	224.1	100.6	54.5	29.5	12.8	14.8	50.4	504.9
30	51G8	0.0	105.8	878.7	398.5	225.8	132.4	57.8	63.3	147.7	2010.2
30	51G9	0.0	80.8	680.2	285.7	147.6	74.9	32.4	32.9	64.5	1398.8
30	51H0	73.9	156.7	241.4	72.6	30.5	16.9	7.2	6.9	19.2	625.2
30	52G7	1.9	7.7	111.3	68.8	53.2	38.0	22.3	30.0	127.2	460.5
30	52G8	0.0	52.7	547.2	307.8	203.9	122.9	59.1	65.3	214.2	1573.1
30	52G9	1.5	16.9	129.2	66.8	45.5	29.3	14.7	16.8	47.6	368.4
30	52H0	2.8	37.3	291.2	151.3	103.5	67.0	33.8	38.6	109.4	834.8
30	53G8	3.4	64.2	512.4	276.9	183.5	112.8	55.0	61.1	176.1	1445.4
30	53G9	0.0	8.6	191.9	130.0	105.6	73.4	38.2	42.4	105.1	695.2
30	53H0	20.7	70.6	439.8	231.1	158.1	104.1	52.5	64.4	192.5	1333.8
30	53H1	3.1	18.3	82.9	39.8	25.0	15.9	7.7	9.2	26.9	228.7
30	54G8	0.0	4.1	122.6	105.6	101.5	82.7	46.2	60.3	230.1	753.0
30	54G9	7.5	41.7	200.1	97.8	65.8	44.4	23.0	29.2	95.0	604.4
30	54H0	36.1	11.7	360.6	278.5	246.9	180.8	96.3	114.8	354.7	1680.2
30	55G9	3.3	143.6	191.6	54.2	22.6	13.0	5.6	5.8	12.0	451.6
30	55H0	4.6	100.8	332.0	133.4	73.7	43.1	20.2	22.7	64.4	794.8

Table 8.Mean weight (g) of herring by age and area (r/v Aranda 2016).

SD	Rect.	0	1	2	3	4	5	6	7	8+
29	48G9	4.1	8.0	13.4	18.4	21.6	22.1	21.9	21.7	21.1
29	48H0	3.9	14.3	17.1	20.5	23.4	23.9	24.5	25.1	24.6
29	48H1	3.9	13.4	15.7	19.6	22.9	24.0	23.4	25.0	23.3
29	48H2	3.7	12.2	14.3	19.4	29.8	23.2	24.1	22.7	25.0
32	48H3	3.6	11.4	13.5	17.1	20.7	20.8	19.1	21.8	23.4
32	48H4	2.8	11.7	14.3	17.4	20.6	21.2	18.3	22.7	23.0
32	48H5	2.8	12.5	14.6	19.2	20.7	20.6	19.3	21.8	23.3
29	49G9	3.4	12.5	16.8	19.9	23.2	23.6	24.3	24.4	31.5
32	49H5	4.2	12.2	14.2	17.6	21.4	20.7	19.0	22.1	41.7
32	49H6	4.1	12.9	15.1	17.8	20.6	21.0	19.5	22.4	23.3
30	50G7	5.2	15.9	20.6	22.5	24.2	23.9	26.3	30.6	37.7
30	50G8	12.2	15.6	19.9	22.3	25.7	27.3	30.2	33.5	37.2
30	50G9	4.8	15.7	20.3	22.8	26.1	28.2	31.5	35.4	42.1
30	50H0	4.8	15.2	19.0	22.0	26.0	28.3	32.8	38.3	43.6
30	51G7	0.0	18.4	23.1	25.1	27.4	30.4	33.3	37.9	47.3
30	51G8	0.0	17.7	22.9	25.2	28.0	30.7	33.0	36.1	39.3
30	51G9	0.0	17.8	22.6	24.7	27.3	29.8	31.5	33.7	36.3
30	51H0	4.5	15.9	20.5	23.0	26.6	28.9	32.3	36.3	40.8
30	52G7	6.6	18.1	23.9	26.9	30.3	34.5	37.8	41.2	49.1
30	52G8	0.0	17.6	23.7	26.3	29.0	31.8	34.5	37.7	45.5
30	52G9	4.9	17.5	23.2	26.1	29.4	32.3	34.8	37.4	43.1
30	52H0	5.0	17.5	23.3	26.1	29.5	32.3	34.8	37.4	43.1
30	53G8	4.9	17.0	23.5	26.2	29.0	31.8	34.3	37.6	44.6
30	53G9	0.0	19.3	24.3	27.3	30.4	32.9	34.7	37.0	40.4
30	53H0	4.6	17.2	23.1	26.1	29.4	32.7	35.1	38.6	44.3
30	53H1	3.7	17.0	22.6	25.7	28.8	32.0	34.7	38.8	44.3
30	54G8	0.0	19.2	25.2	28.4	31.5	34.3	36.6	40.4	48.9
30	54G9	4.9	17.0	22.8	25.9	29.4	32.8	35.9	39.4	45.8
30	54H0	3.6	19.1	25.0	27.9	30.9	33.6	35.5	38.1	44.6
30	55G9	5.5	15.9	20.2	22.8	26.7	29.0	31.7	35.0	37.2
30	55H0	4.7	16.5	22.1	24.8	28.0	30.8	33.9	37.1	44.0

Table 9.Total biomass (ton) of herring by age and area (r/v Aranda 2016).

SD	Rect.	0	1	2	3	4	5	6	7	8+	Total
29	48G9	6520.9	6859.2	11970.8	1085.1	225.0	78.5	159.8	141.3	123.3	27163.9
29	48H0	29.5	5165.8	26101.0	8346.2	5156.6	1752.3	3688.3	3038.8	3201.1	56479.6
29	48H1	206.0	11820.5	36084.0	6263.2	2943.2	1043.6	1789.2	1660.0	1709.5	63519.3
29	48H2	330.7	18826.1	35154.3	3701.3	2510.2	421.7	985.4	578.6	1048.0	63556.2
32	48H3	268.2	2271.5	8944.2	1228.4	425.9	214.4	240.3	96.3	275.0	13964.3
32	48H4	87.8	1385.4	6636.7	1386.1	593.6	287.9	228.4	221.2	350.4	11177.6
32	48H5	366.5	8005.5	42792.5	12654.6	5137.3	2238.7	1899.2	1196.5	2725.6	77016.3
29	49G9	459.9	2964.8	14144.9	3879.7	2018.2	644.7	1423.9	1122.2	2400.9	29059.0
32	49H5	24.2	2317.7	11250.8	2497.8	1155.5	490.8	397.0	286.3	1112.9	19533.0
32	49H6	174.0	4059.6	23833.1	7492.8	3221.6	1528.8	1351.6	920.7	1928.2	44510.3
30	50G7	38.4	4674.0	9288.8	2861.5	1097.3	488.3	137.6	114.3	427.9	19128.1
30	50G8	17.0	8736.0	11840.5	3600.7	1533.4	806.9	357.6	375.0	928.1	28195.2
30	50G9	399.0	3222.4	5031.7	1651.1	769.6	450.9	196.6	218.9	734.7	12674.8
30	50H0	1117.7	4521.0	3573.1	988.6	467.3	318.1	137.7	183.4	661.8	11968.7
30	51G7	0.0	332.8	5169.2	2521.6	1493.0	895.5	425.2	561.6	2381.3	13780.2
30	51G8	0.0	1869.2	20122.6	10028.2	6327.0	4067.2	1905.5	2289.2	5808.3	52417.2
30	51G9	0.0	1440.7	15385.8	7050.6	4035.7	2229.5	1019.4	1106.8	2340.8	34609.3
30	51H0	331.3	2496.6	4952.6	1672.5	810.8	487.4	231.8	251.5	783.0	12017.5
30	52G7	12.3	140.4	2662.7	1852.7	1613.5	1313.1	845.0	1235.6	6250.4	15925.7
30	52G8	0.0	926.7	12973.3	8080.6	5902.7	3911.5	2039.3	2462.4	9735.1	46031.8
30	52G9	7.6	295.1	3003.1	1741.7	1337.1	946.8	513.2	628.0	2051.2	10523.8
30	52H0	14.0	653.4	6772.2	3947.4	3048.5	2166.1	1177.1	1441.3	4716.1	23936.1
30	53G8	16.3	1088.7	12020.3	7240.6	5327.0	3588.4	1887.5	2295.4	7850.0	41314.3
30	53G9	0.0	166.7	4662.7	3553.0	3212.1	2414.1	1326.1	1567.9	4248.0	21150.8
30	53H0	94.5	1217.0	10171.4	6042.4	4646.6	3404.6	1845.0	2482.5	8534.0	38437.9
30	53H1	11.6	310.3	1874.0	1024.0	719.7	508.7	265.7	355.5	1192.0	6261.6
30	54G8	0.0	78.5	3086.2	3004.6	3192.0	2833.2	1689.7	2439.1	11248.7	27572.0
30	54G9	36.6	711.1	4560.5	2533.7	1932.7	1456.9	826.1	1147.3	4350.2	17555.1
30	54H0	131.2	223.3	9006.5	7755.7	7618.3	6074.3	3419.1	4372.6	15823.5	54424.6
30	55G9	18.4	2284.5	3865.8	1235.4	602.8	376.1	176.2	202.1	447.5	9208.8
30	55H0	21.6	1664.4	7323.8	3308.1	2065.0	1325.6	685.4	841.6	2832.7	20068.3

Table 10.Numbers (millions) of sprat by age and area (r/v Aranda 2016).

SD	Rect	0	1	2	3	4	5	6	7	8+	Total
29	48G9	34.1	176.9	1309.0	163.9	33.9	14.8	7.7	5.2	7.6	1753.1
29	48H0	16.0	35.2	161.0	26.1	15.2	9.2	4.5	2.9	4.2	274.4
29	48H1	33.0	130.6	952.3	202.9	98.9	59.9	27.1	15.2	24.7	1544.6
29	48H2	384.7	405.5	2055.8	359.9	189.6	92.2	30.8	13.2	28.5	3560.3
32	48H3	252.0	2828.9	8533.4	1260.9	382.2	150.8	65.3	27.2	29.6	13530.3
32	48H4	95.3	3647.5	8583.4	885.9	111.5	17.8	3.0	1.5	3.0	13348.8
32	48H5	108.2	866.6	2441.9	407.6	133.7	60.0	23.7	8.9	10.2	4060.8
29	49G9	4.8	35.0	161.1	36.2	22.4	12.9	5.7	2.9	6.0	287.0
32	49H5	2.9	53.1	157.0	38.4	24.8	16.3	6.6	3.8	2.6	305.5
32	49H6	16.8	424.4	987.4	112.4	18.3	6.8	4.3	0.9	1.8	1573.1
30	50G7	0.0	0.1	4.5	3.2	1.6	0.6	0.3	0.6	0.7	11.5
30	50G8	0.0	1.0	10.8	2.9	1.1	0.4	0.2	0.4	0.4	17.2
30	50G9	0.5	0.6	20.2	11.7	5.9	2.9	1.5	3.0	4.9	51.3
30	50H0	0.0	0.3	15.5	8.2	3.4	1.5	0.5	1.3	1.2	31.8
30	51G7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	51G8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	51G9	0.0	0.0	0.5	0.4	0.3	0.2	0.2	0.3	1.2	3.1
30	51H0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.9
30	52G7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	52G8	0.0	0.0	1.3	1.2	0.9	0.6	0.4	0.4	0.9	5.7
30	52G9	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.6
30	52H0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.7
30	53G8	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.3
30	53G9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	53H0	0.0	0.0	0.8	1.2	1.3	0.9	0.8	1.2	3.9	10.1
30	53H1	0.0	0.0	0.1	0.3	0.4	0.2	0.2	0.4	1.2	2.8
30	54G8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	54G9	0.0	0.0	0.4	0.3	0.3	0.2	0.2	0.2	0.6	2.1
30	54H0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5
30	55G9	0.0	0.1	6.3	6.4	4.6	2.6	1.8	2.7	6.7	31.2
30	55H0	0.0	0.0	1.8	1.7	1.1	0.7	0.5	0.6	1.2	7.6

Table 11.Mean weight (g) of sprat by age and area (r/v Adanda 2016).

SD	Rect.	0	1	2	3	4	5	6	7	8+
29	48G9	3.0	7.0	7.9	8.6	10.1	10.5	11.6	12.1	11.5
29	48H0	2.6	6.6	7.6	9.2	10.5	10.6	11.2	11.5	11.1
29	48H1	3.1	6.8	8.0	9.2	10.3	10.4	11.2	11.5	10.9
29	48H2	2.5	6.4	7.7	9.1	10.3	10.3	10.7	11.1	10.6
32	48H3	2.5	6.4	6.8	7.4	8.5	9.6	9.0	9.8	9.4
32	48H4	2.4	6.2	6.5	6.8	7.5	8.7	9.3	9.3	9.3
32	48H5	2.7	6.5	6.9	7.6	8.6	9.3	8.8	9.7	9.3
29	49G9	3.0	6.6	7.7	9.4	10.4	10.4	11.0	11.3	11.5
32	49H5	2.6	6.6	7.0	8.2	9.5	9.9	9.6	10.1	9.8
32	49H6	2.5	6.2	6.5	7.0	8.1	9.1	8.8	9.3	9.3
30	50G7	0.0	8.3	11.0	11.8	12.2	12.5	13.8	13.0	15.1
30	50G8	0.0	7.8	9.0	10.4	11.6	12.8	14.0	12.9	14.2
30	50G9	3.8	6.8	10.6	11.7	12.6	13.1	14.2	13.8	15.4
30	50H0	0.0	8.6	10.4	11.3	12.1	12.2	13.6	12.7	14.5
30	51G7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	51G8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	51G9	0.0	0.0	12.0	12.4	13.1	14.2	15.8	15.0	16.9
30	51H0	0.0	0.0	12.7	13.0	13.5	13.9	14.1	13.7	14.4
30	52G7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	52G8	0.0	0.0	11.8	12.2	12.9	14.1	14.6	13.7	14.7
30	52G9	0.0	0.0	12.4	12.9	13.8	14.3	14.7	14.8	15.2
30	52H0	0.0	0.0	12.7	13.2	14.2	14.6	14.9	15.2	15.3
30	53G8	0.0	0.0	13.5	13.5	13.5	13.5	13.5	13.5	13.5
30	53G9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	53H0	0.0	0.0	12.1	12.9	14.2	14.4	15.0	15.1	16.2
30	53H1	0.0	0.0	12.2	13.3	14.6	14.6	15.1	15.3	16.3
30	54G8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	54G9	0.0	0.0	11.5	12.2	13.8	14.2	15.0	14.7	15.9
30	54H0	0.0	0.0	0.0	16.1	16.1	16.1	16.1	16.1	16.1
30	55G9	0.0	6.4	11.7	12.4	13.2	13.7	14.5	14.2	15.8
30	55H0	0.0	0.0	11.6	12.2	12.9	13.8	14.4	13.9	14.8

Table 12.Total biomass (ton) of sprat by age and area (r/v Aranda 2016).

SD	Rect.	0	1	2	3	4	5	6	7	8+	Total
29	48G9	101.0	1229.5	10351.4	1403.0	341.2	155.3	88.8	63.3	87.0	13820.5
29	48H0	41.8	232.8	1224.8	240.2	159.7	97.4	50.7	32.9	46.7	2126.9
29	48H1	101.7	883.1	7665.7	1870.4	1022.9	622.5	303.7	174.3	269.8	12914.1
29	48H2	947.9	2593.3	15911.4	3283.8	1946.8	950.1	329.4	146.8	302.0	26411.6
32	48H3	624.5	18163.1	57890.5	9373.8	3238.4	1442.9	590.0	266.2	278.0	91867.4
32	48H4	225.6	22760.7	55777.3	5997.8	838.5	155.2	27.7	13.8	27.7	85824.3
32	48H5	297.5	5658.4	16764.2	3108.9	1150.4	560.9	208.9	86.9	94.3	27930.3
29	49G9	14.8	229.7	1244.3	340.1	231.8	134.4	62.6	32.7	69.4	2359.7
32	49H5	7.5	352.3	1101.3	316.3	234.8	160.7	63.9	38.5	25.9	2301.2
32	49H6	42.5	2639.6	6399.8	791.4	149.1	62.6	37.4	8.1	16.3	10146.8
30	50G7	0.0	0.5	49.9	37.7	19.1	8.0	3.8	8.2	10.2	137.4
30	50G8	0.0	8.1	96.6	30.0	12.7	5.4	2.9	4.7	6.1	166.5
30	50G9	1.9	4.1	214.6	137.5	73.9	37.6	21.7	41.3	75.8	608.5
30	50H0	0.0	2.9	161.4	92.5	40.5	18.6	7.2	16.3	16.9	356.4
30	51G7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	51G8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	51G9	0.0	0.0	5.4	5.4	3.9	3.3	3.3	3.8	19.8	45.0
30	51H0	0.0	0.0	1.5	2.7	2.1	1.7	1.1	1.2	2.5	12.8
30	52G7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	52G8	0.0	0.0	15.8	14.4	12.0	8.1	5.5	5.2	13.4	74.5
30	52G9	0.0	0.0	0.8	1.2	1.1	1.1	0.8	1.0	2.7	8.6
30	52H0	0.0	0.0	0.6	0.9	1.1	1.4	1.1	1.2	3.6	9.8
30	53G8	0.0	0.0	0.1	1.1	1.1	0.4	0.5	0.8	0.8	4.7
30	53G9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	53H0	0.0	0.0	10.1	15.5	18.8	13.4	12.2	17.4	62.4	149.7
30	53H1	0.0	0.0	1.4	3.4	5.1	3.6	3.6	5.5	20.2	42.8
30	54G8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	54G9	0.0	0.0	4.3	3.8	3.6	3.4	2.5	2.4	10.0	30.0
30	54H0	0.0	0.0	0.0	0.2	0.2	0.4	0.6	1.7	4.2	7.2
30	55G9	0.0	0.7	73.6	80.1	60.3	35.6	26.2	38.8	105.1	420.5
30	55H0	0.0	0.0	21.5	20.9	14.8	9.7	6.5	8.4	17.5	99.3

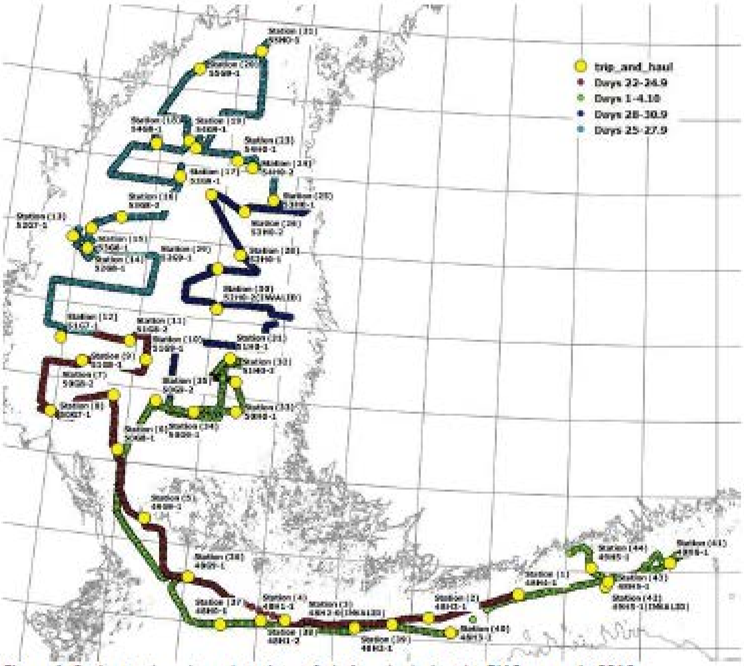

Figure 1. Cruise track and trawl stations of r/v Aranda during the BIAS-survey in 2016.

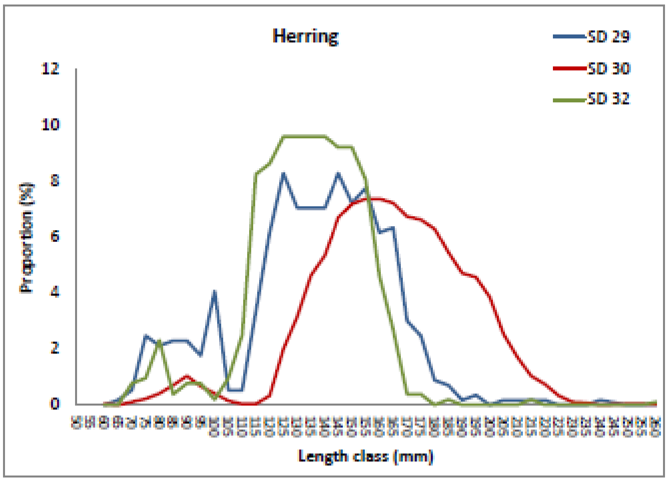

Figure 2. Length distributions of measured herring in three different Sub-Division.

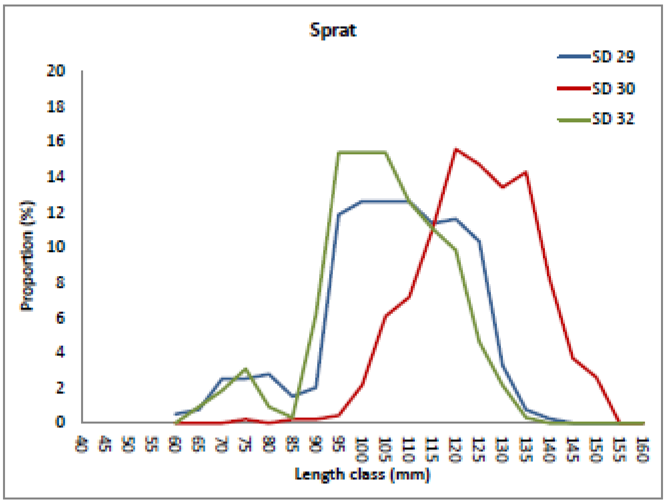

Figure 3. Length distributions of measured sprat in three different Sub-Division.

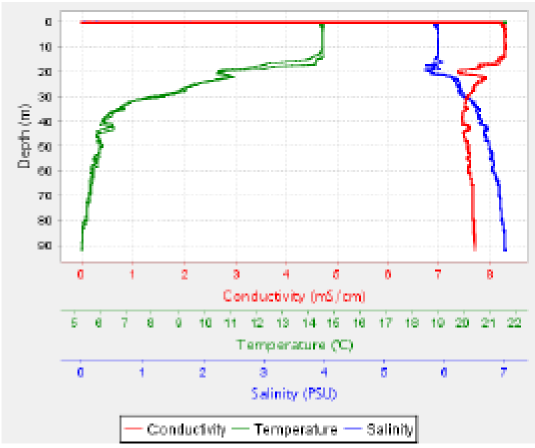

Figure 5. Vertical distribution of the connectivity, water temperature, and salinity at the trawling station 49G9-1 in SD 29.

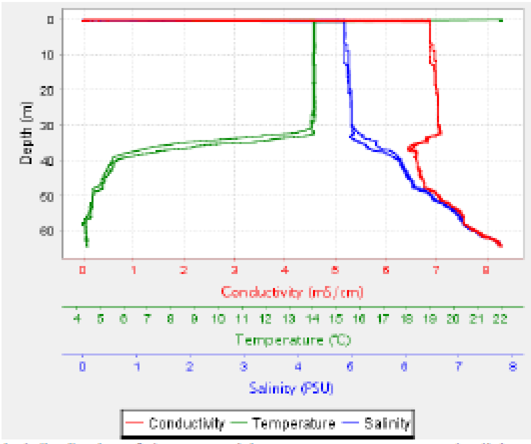

Figure 6. Vertical distribution of the connectivity, water temperature, and salinity at the trawling station 49H6-1 in SD 32.

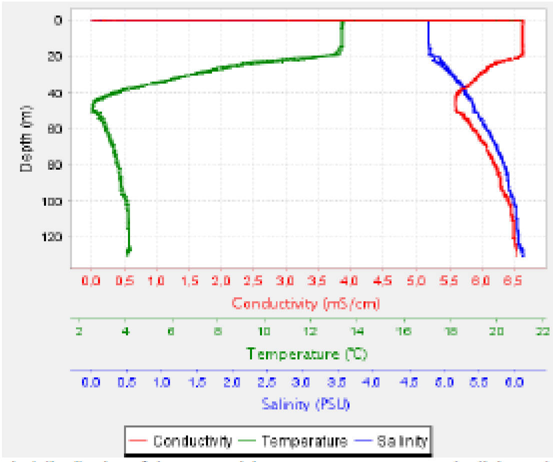

Figure 7. Vertical distribution of the connectivity, water temperature, and salinity at the trawling station 54G9-1 in SD 30.

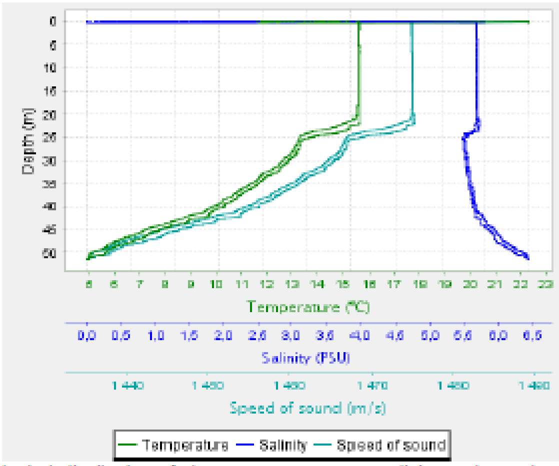

Figure 8. Vertical distribution of the water temperature, salinity, and sound speed at the calibration station of echo sounder in SD 32 (EK60 38 kHz).

Survey report for FRV "Solea"

German Acoustic Autumn Survey (GERAS)
30 September – 20 October 2016

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1 INTRODUCTION

Background: The joint German/Danish GERAS survey is part of the Baltic International Acoustic Survey (BIAS), which is co-ordinated by the Baltic International Fish Survey Working Group (WGBIFS) and is conducted within the scope of the ICES Working Group for International Pelagic Surveys (WGIPS). Further WGBIFS contributors to the Baltic survey are national fisheries research institutes of Sweden, Poland, Finland, Latvia, Estonia, Lithuania and Russia. FRV "Solea" participated for the 29th time. The survey area covered the western Baltic Sea including Kattegat, Belt Sea, Sound and Arkona Sea (ICES Subdivisions 21, 22, 23 and 24). The survey effort was comparable to former years.

Objectives: The survey has the main objective to annually assess the clupeoid resources of herring and sprat in the Baltic Sea in autumn. The reported acoustic survey is conducted every year to supply the ICES

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

with an index value for the stock size of herring and sprat in the Western Baltic area (Kattegat/Subdivisions 21 and Subdivisions 22, 23 and 24).

2 SURVEY DESCRIPTION & METHODS

2.1 Personnel

Name	**Function**	**Institute**
30.09.-01.10.2016/Calibration of hydroacoustic equipment		
Dr. M. Schaber	Hydroacoustics, Cruise leader	TI-SF
M. Drenckow	Hydroacoustics	TI-SF
S.-E. Levinsky	Fishery biology	DTU Aqua, Charlottenlund, (DK)
B. Stefanowitsch	Student assistant	TI-SF
S. Wieser	Student assistant	TI-SF
01.-20.10.2016/Survey		
Dr. M. Schaber	Hydroacoustics, Cruise leader	TI-SF
Dr. T. Gröhsler	Hydroacoustics, Cruise leader	TI-OF (01.-08.10.)
A. Bühler	Fishery biology, Student assistant	TI-OF (09.-20.10.)
M. Koth	Fishery biology	TI-OF (01.-09.10.)
S.-E. Levinsky	Fishery biology	DTU Aqua, Charlottenlund, (DK)
B. Stefanowitsch	Student assistant	TI-SF
S. Wieser	Student assistant	TI-SF

2.2 Narrative

The 726th cruise of FRV "SOLEA" represents the 30th subsequent GERAS survey. FRV "SOLEA" left the port of Kiel harbor on 30 September 2016. The acoustic survey covered the southern part of Subdivision (SD) 21 and the whole area of SD 22, 23 and 24. The northern part of SD 21 could not be covered because of a loss of survey time due to unfavorable weather conditions. Due to varying weather conditions in the survey area the following survey schedule was accomplished:

- Arkona Sea (SD 24) 01. - 03.10.
- Belt Sea (SD 22) 03. - 07.10.
- Arkona Sea (SD 24) 09. -10.10.
- Sound (SD 23) 10. -11.10.
- Kattegat (SD 21) 11. - 13.10.
- Arkona Sea (SD 24) 16. - 17.10.
- Sound (SD 23) 18. - 19.10.

The survey ended on 20 October 2016 in Rostock/Marienehe.

2.3 Survey design

ICES statistical rectangles were used as strata for all Subdivisions (ICES, 2014). The area was limited by the 10 m depth line. The survey area in the Western Baltic Sea is characterised by a number of islands and sounds. Consequently, parallel transects would lead to an unsuitable coverage of the survey area. Therefore a zig-zag track was adopted to cover all depth strata regularly and sufficiently. Overall regular cruise track length was 1 179 nmi covering a survey area of 12 400 nmi^2 (Figure 1).

2.4 Calibration

Both transducers (38 kHz and 120 kHz) were calibrated prior to the beginning of the survey in initially inclement but increasingly improving weather conditions from a drifting vessel in Strande Bay/Kiel Bight. Overall calibration results were considered good based on calculated RMS values. Resulting transducer parameters were applied for consecutive data-collection and post-processing of hydroacoustic survey data.
The calibration procedure was carried out as described in the "Manual for the Baltic International Acoustic Surveys (BIAS)" (ICES, 2014). Calibration results for the 38 kHz transducer are given in Table 1.

2.5 Acoustic data collection

All acoustic investigations were performed during night time to account for the more pelagic distribution of clupeids during that time. The main pelagic species of interest were herring and sprat. The acoustic equipment used was a Simrad scientific echosounder EK80 operated in continuous wave mode at 38 kHz (120 kHz). Specific settings of the hydroacoustic equipment were used as described in the "Manual for the Baltic International Acoustic Survey (BIAS)" (ICES, 2014). Corresponding settings are listed in Table 1. Echo-integration, i.e. the integration and allocation of NASC values to species abundance and biomass was accomplished using EchoView 7 post-processing software Echoview Software Pty Ltd (2016). Mean volume back scattering values (s_v) were integrated over 1 nmi intervals from 10 m below the surface (or depending on surface turbulence) to ca. 0.5 m over the seafloor. Interferences from surface turbulence, bottom structures and scattering layers were removed from the echogram.

2.6 Biological data – fishing trawls

Trawl hauls were conducted with a pelagic gear "PSN388" in midwater layers as well as near the seafloor. Mesh size in the codend was 10 mm. It was planned to carry out at least two hauls per ICES statistical rectangle. Both trawling depth and net opening were continuously controlled by a netsonde during fishing operations. Trawl depth was chosen in accordance with echo distributions on the echogram. Normally, a vertical net opening of about 7-9 m was achieved. The trawling time usually lasted 30 minutes but was shortened when echograms and netsounder indicated large catches. From each haul sub-samples were taken to determine length and weight of fish. Samples of herring and sprat were frozen for additional investigations (e.g. determining sex, maturity, age).

2.7 Hydrographic data

Hydrographic conditions were measured after each trawl haul and in regular distances on the survey transect. On each corresponding station, vertical profiles of temperature, salinity and oxygen concentration were measured using a "Seabird SBE 19 plus" CTD. Water samples for calibration purposes (salinity) were taken on every station, while water samples for Winkler titration and calibration of oxygen measurements were taken and processed at least once per day. Altogether, 81 CTD-profiles were measured (Fig. 5).

2.8 Data analysis

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

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

The total number of fish (total N) in one rectangle was estimated as the product of the mean area scattering cross section (s_A) and the rectangle area, divided by the corresponding mean cross section. The total number was separated into herring and sprat according to the mean catch composition.
In accordance with the guidelines in the "Manual for the Baltic International Acoustic Surveys (BIAS)" (ICES, 2014) further calculations were performed as follows:

Fish species considered:

Clupea harengus
Engraulis encrasicolus
Gadus morhua
Gasterosteus aculeatus
Melanogrammus aeglefinus
Merlangius merlangus
Pollachuis pollachius
Pollachius virens
Sprattus sprattus
Trisopterus esmarkii

Exclusion of trawl hauls with very low catch level:

Haul No.	Rectangle	Subdivision (SD)
19, 22	40G0	22
32	41G2	23
52	39G2	24
53	40G2	23

Despite low catch levels of both herring and sprat the following hauls were not excluded from the analysis as they were the only trawl hauls conducted in the corresponding rectangles and thus provided the only available information on species composition in these rectangles:

Haul No.	Rectangle	Subdivision (SD)
20	41G0	22
42	41G0	21

Usage of neighbouring trawl information for rectangles which contain only acoustic investigations:

Rectangle/SD to be filled	with Haul No.	of Rectangle/SD
40F9/22	18	40G0/22
39G2/23	45	39G2/24
37G4/24	5, 8	38G4/24

3 RESULTS

3.1 Acoustic data

Statistics on survey area, mean S_A (NASC), mean scattering cross section σ, estimated total number of fish, as well as proportion of herring and sprat per SD/rectangle are shown in Table 6.

During the survey, hydroacoustic data were recorded at a standard ship speed of 10 kn leading to daily transect lengths of roughly 90 to 100 nmi. Figure 2 depicts the spatial distribution of mean NASC values (5 nmi intervals) measured on the hydroacoustic transects covered in 2016. In almost all rectangles surveyed, mean NASC values were significantly higher than those recorded in 2015, often also higher than those recorded in 2014, and –in SD24- also above the long-time survey average. On ICES subdivision scale, mean NASC values were higher than in the previous year in SD 21, 22 and 24 while in SD 23 mean NASC values were significantly lower than in preceding years.

In SD 21, overall NASC values measured were comparatively low, but mean NASC per 1 nmi EDSU was – occasionally significantly- higher in almost all rectangles observed than in the previous year, but mostly lower than the long-time survey average in all rectangles surveyed. Rectangles with increased aggregations of clupeids (43G1 and 43G2) in the northern part could not be covered due to adverse weather conditions. Increased aggregations were instead measured in the southwestern part of SD 21.

In SD 22, mean NASC values recorded were higher than the previous year in all but one rectangles surveyed. In comparison to the long-term survey mean of rectangles in SD 22, the NASC measured was lower in the majority of rectangles. No clear aggregations of clupeids were measured, but overall NASC values were increased compared to previous years almost along the whole survey transect covered. However, in the short transect section covering rectangle 40G1, NASC values were many times higher than the values observed in the years before and also than the long-term survey mean.

The large aggregations of big herring that can be observed annually in SD 23 in the Öre Sound were not present in autumn 2016. NASC values in rectangle 40G2 covering the aggregation hotspot in this area were significantly lower than the high levels measured in 2015 (only 13% of the measured values in 2015) and also only ca. 40% of the long-time survey average. Measurements were made in inclement weather conditions with strong currents in the Sound. A replicate measurement of the transect in SD 23 in good weather conditions a few days later corroborated these findings.

3.2 Biological data

In total 55 trawl hauls were conducted:

Subdivision	No. of Hauls
21	12
22	17
23	6
24	20

Altogether, 1 501 individual herring, 749 sprat, 535 European anchovies and 42 sardines were frozen for further investigations (e.g. determining sex, maturity, age). Results of catch compositions by Subdivision are presented in Tables 2-5. Altogether, 49 different species were recorded. Herring were caught in 52, sprat in 51 hauls. SD 23, which is typically characterized by the highest mean catch rates per station (kg 0.5 h^{-1}), showed the lowest values ever recorded. In contrast to the last year where sardines (*Sardina pilchardus*) were not caught at all, this species did appear in 2016 catches in SDs 22-24. As in previous years, anchovy (*Engraulis encrasicolus*) were present in most catches. Anchovies were caught throughout the survey area in 41 out of 55 hauls, including the majority of hauls in SD 21 and SD 22.

Figures 3 and 4 show relative length-frequency distributions of herring and sprat in ICES subdivisions 21, 22, 23 and 24 for the years 2015 and 2016. Compared to results from the previous survey in 2015, the following conclusions for herring can be drawn (Fig. 3):

- As in 2015, catches in SD 21 showed a bimodal distribution characterized by the presence of the incoming year class (≤15 cm) and older herring (>15 cm). In contrast to 2015, the fraction of the incoming year class was higher in 2016.
- SD 22 showed the incoming year class with a mode at 9.75 cm while in 2015 this mode had been observed at 10.75 cm. A rather low fraction of older fishes showed in both years another comparable mode (17.25 cm in 2016 and at 16.75 cm in 2015).
- In SD 23, smaller herring (< 20 cm) dominated catches. This was in contrast to the dominant contribution of larger herring (>20 cm) in previous years.
- In SD 24, the herring length-frequency distribution was characterized by a similar contribution of the incoming year class (≤15.00 cm) and older herring (>15 cm) in both years.
- Altogether, the present contribution of the incoming year class (ca. <15 cm) seemed to be quite similar in the last two years.

Relative length-frequency distributions of **sprat** in the years 2015 and 2016 (Fig. 4) can be characterized as follows:

- In SD 21 catch numbers of the incoming year class (≤10 cm) were virtually absent in both years. The catches were dominated by the contribution of larger sprat (ca. >10 cm).
- In SD 22 and 23 catch numbers of the incoming year class (≤10 cm) dominated in 2016, whereas they were almost virtually absent in 2015. The dominant high contribution of larger sprat (ca. >10 cm) in 2015 disappeared in 2016.
- In SD 24, the sprat length-frequency distribution was rather similar compared to 2015 with a bimodal distribution of both incoming year class (< 10 cm) and older sprat.
- Altogether, the present contribution of the incoming year class (ca. <10 cm) increased compared to last year’s very low value.

3.3 Biomass and abundance estimates

In the western Baltic, the distribution areas of two stocks, the Western Baltic Spring Spawning herring (WBSSH) and the Central Baltic herring (CBH) overlap. Survey results from recent years indicated that in SD 24, which is part of the WBSSH management area, a considerable fraction of CBH is present and correspondingly erroneously allocated to WBSSH stock indices (ICES, 2013). Accordingly, a stock separation function (SF) based on growth parameters derived from 2005 to 2010 has been developed to quantify the proportion of CBH and WBSSH in the area (Gröhsler et al., 2013; Gröhsler et al., 2016). The estimates of the growth parameters based on baseline samples of WBSSH and CBH in 2011-2015 and in 2016 support the applicability of SF (Oeberst et al., 2013, WD Oeberst et al., 2014; WD Oeberst et al., 2015; WD Oeberst et al., 2016; WD Oeberst et al., 2017). Beside in SD 24, the SF was finally also applied to ICES rectangle 39G2 (SD 23 area) since biological samples of 39G2 (SD 24 area) were used to raise the corresponding recorded Sa values.

The age-length distribution of herring in SD 22 in 2015 for the second time indicated a higher contribution of older fish of CBH origin. Thus, the SF was also applied in SD 22.

The ICES Herring Assessment Working Group for the area south of 62° N (HAWG)) is yearly supplied with an index for this survey (GERAS), which now excludes CBH in 2005-2016 and in general covers the total standard survey area, excluding ICES rectangles 43G1 and 43G2 in SD 21 and 37G3 and 37G4 in SD 24, which were not covered in 1994-2004.

3.3.1 Estimates incl. Central Baltic herring (CBH)

The total abundance of herring and sprat is presented in Table 6. Estimated numbers of herring and sprat by age group and SD/rectangle are given in Table 7 and Table 10. Corresponding mean weights by age group and SD/rectangle are shown in Table 8 and Table 11. Estimates of herring and sprat biomass by age group and SD/rectangle are summarised in Table 9 and Table 12.

The **herring** stock in Subdivisions 21-24 was estimated to be 4.9 x 10^9 fish (Table 7) or 139.1 x 10^3 tonnes (Table 9). For the included area of Subdivisions 22-24 the number of herring was calculated to be 4.3 x 10^9 fish or 129.1 x 10^3 tonnes. Last year's higher contribution of age 2, was now recorded at age 3 (Figure 3 and Table 7).

The estimated **sprat** stock in Subdivisions 21-24 was 26.6 x 10^9 fish (Table 10) or 195.1 x 10^3 tonnes (Table 12). For the included area of Subdivisions 22-24 the number of sprat was calculated to be 22.9 x 10^9 fish or 175.1 x 10^3 tonnes. As in 2015, the overall abundance estimate was dominated by the incoming year class (Figure 4 and Table 10).

3.3.2 Estimates excl. Central Baltic herring in SDs 22&24

Estimated numbers of **herring excluding CBH** in SDs 22-24 by age group and SD/rectangle for 2016 are given in Table 13. Corresponding herring mean weights by age group and SD/rectangle are shown in Table 14. Estimates of herring biomass excluding CBH by age group and SD/rectangle are summarised in Table 15. Removal of the CBH fraction in SDs 22 and 24 from herring GERAS index in 2016 resulted in biomass reductions of 29.4 % with corresponding reductions in numbers of 18.7 % (-35.7 % and -25.6 %, respectively in 2015; Figure 5).

3.4 Hydrographic data

In addition to the trawl hauls, vertical profiles of temperature, salinity and oxygen concentration were measured on a station grid covering the whole survey area. Altogether, hydrography profiles were measured on 81 stations. CTD stations as well as horizontal gradients of temperature, salinity and oxygen concentration both at the surface and at the seafloor are displayed in Figure 6.

Surface temperatures ranged from ca. 12°C in the Kattegat, Sound and northern Arkona Sea to almost 18°C in the southern Arkona Sea and the Kiel Bight. Bottom temperatures were also comparatively and similarly high in the southern part of the survey area but decreased to less than 8 °C in the deep parts of the southeastern Arkona Sea/western Bornholm Basin.

Surface salinities showed a large gradient from ca. 7 PSU in the eastern Arkona Sea to ca. 16 PSU in the Kiel Bight and over 20 PSU in the Kattegat. Salinity near the seafloor ranged from 8 PSU in the Arkona Sea to ca. 33 PSU in the Kattegat. Especially in the Sound, a very strong stratification with steep salinity gradients was observed.

Surface waters were well oxygenated throughout the survey area, while especially in the northern parts of the Sound as well as in the inner, southeastern Mecklenburg Bight and the norther Kiel Bight as well as in eastern parts of the Kattegat low levels, as well as in comparatively large areas anoxic conditions were observed.

4 DISCUSSION

Compared to 2015, the present estimates of **herring (incl. CBH)** show an increase in stock numbers, whereas stock biomass notably decreases:

Herring	Difference compared to 2015	
Area	Numbers (%)	Biomass (%)
Subdivisions 22-24	15	-40
Subdivisions 21-24	33	-42

The significant increase in numbers in 2016 was mainly caused by some higher numbers of the incoming year class, whereas the decrease in biomass was mainly driven by lower biomass estimates of age groups 1+ in SD 23. However, the strength of the new incoming year class in 2016, which is even assumed not to deliver an quantitative adequate index of the 0-group due to the survey design (mesh size of the gear in the codend; not covering possible inshore shallow water areas), was still far below the long-term average (2016: 2.7 x 10^9 million; average 1994-2015: 4.4 x 10^6 million).

Only very few older and bigger herring were recorded in SD 23 and SD 24 in 2016. The application of SF and the exclusion of CBH (Gröhsler et al., 2013; Gröhsler et al., 2016) in turn lead to the further decrease of older and bigger herring in 2016.

The large herring usually observed and dominant in SD 23 (the Sound), which is seen as an important transition and aggregation area for the WBSSH stock during its spawning migration (Nielsen, 1996), were in 2016 virtually absent for the first time in many years. This complete absence could be explained by delayed immigration of WBSSH from the feeding areas in the Skagerrak in 2016 (however, no large herring were observed there). The exceptionally low numbers of large and older herring could also be explained by the very low recruitment, which was recorded by the N20 during the last years. The sustained downward trend in recruitment could explain the disappearance of older herring in time. A strong correlation of N20 with the 1-age group (Annex: RHLS-Report) of GERAS supports this assumption.

As in the year before, some few older and bigger herring were detected in SD 24. However, exclusion of CBH in SD 24 led to almost elimination of older and bigger herring in this area. This was in contrast to the 2015 results, where some older and bigger herring already had started to migrate out of the Sound (SD 23) into SD 24.

In SDs 21 and 23 an increasing number of herring were observed that according to their age and length (e.g. age 3, total length 15 cm) could be allocated to CBH with a high degree of probability. Hence, CBH seem to have migrated into SD 21 and SD 23 in low numbers for the first time observed. This immigration has been observed in past years, albeit only in single individuals. Analysis of 2016 data validating the SF indicates that a further reduction of big herring together with immigration of CBH in SD 21 and SD 23, when being used as basis sample for WBSSH, can lead to problems with estimating SF parameters and their utilization.

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6 FIGURES AND TABLES

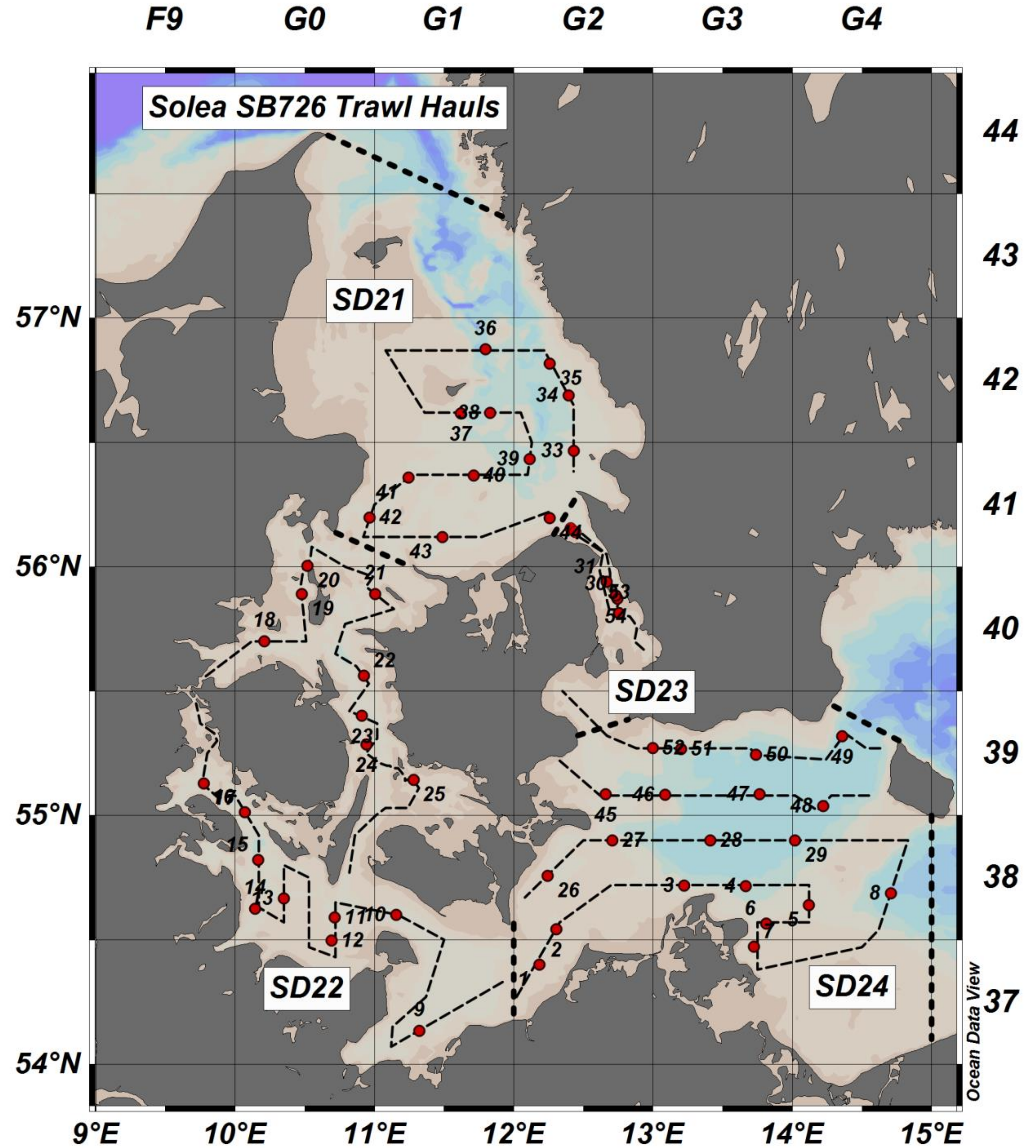


Figure 1: **FRV "Solea" cruise 726/2016. Cruisetrack (thin dashed lines) and fishery hauls (red dots). ICES statistical rectangles are indicated in the top and right axis. Thick dashed lines separate ICES subdivisions (SD).**

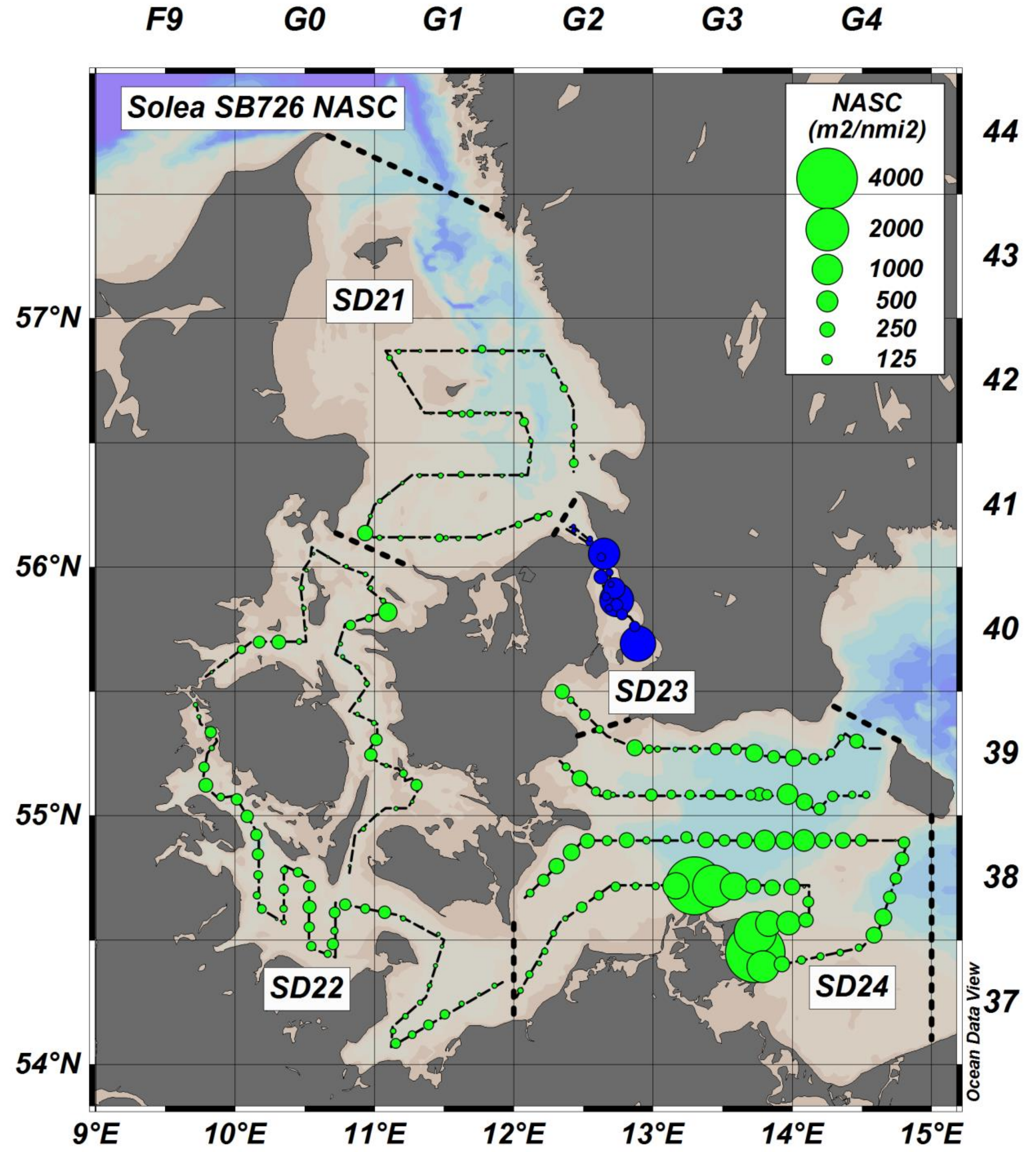


Figure 2: FRV "Solea" cruise 726/2016. Cruisetrack (thin dashed lines) and mean NASC (5 nmi intervals, dots). ICES statistical rectangles are indicated in the top and right axis. Thick dashed lines separate ICES subdivisions (SD). Blue NASC values in Subdivision 23 (Sound) represent mean of two recordings.

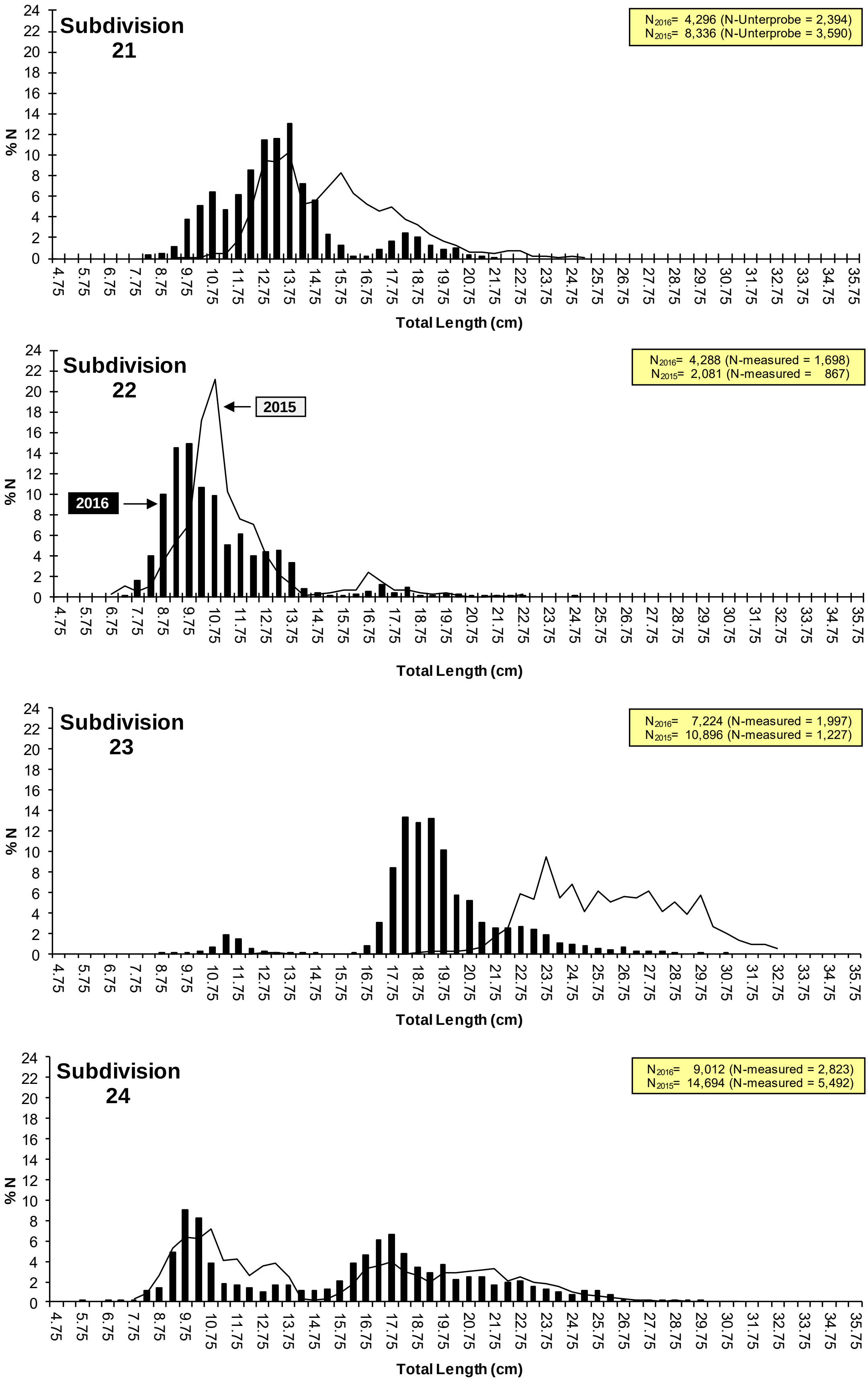


Figure 3: **FRV "Solea," cruise 726/2016: Herring (*Clupea harengus*) length-frequency distribution compared to previous year (cruise 710/2015).**

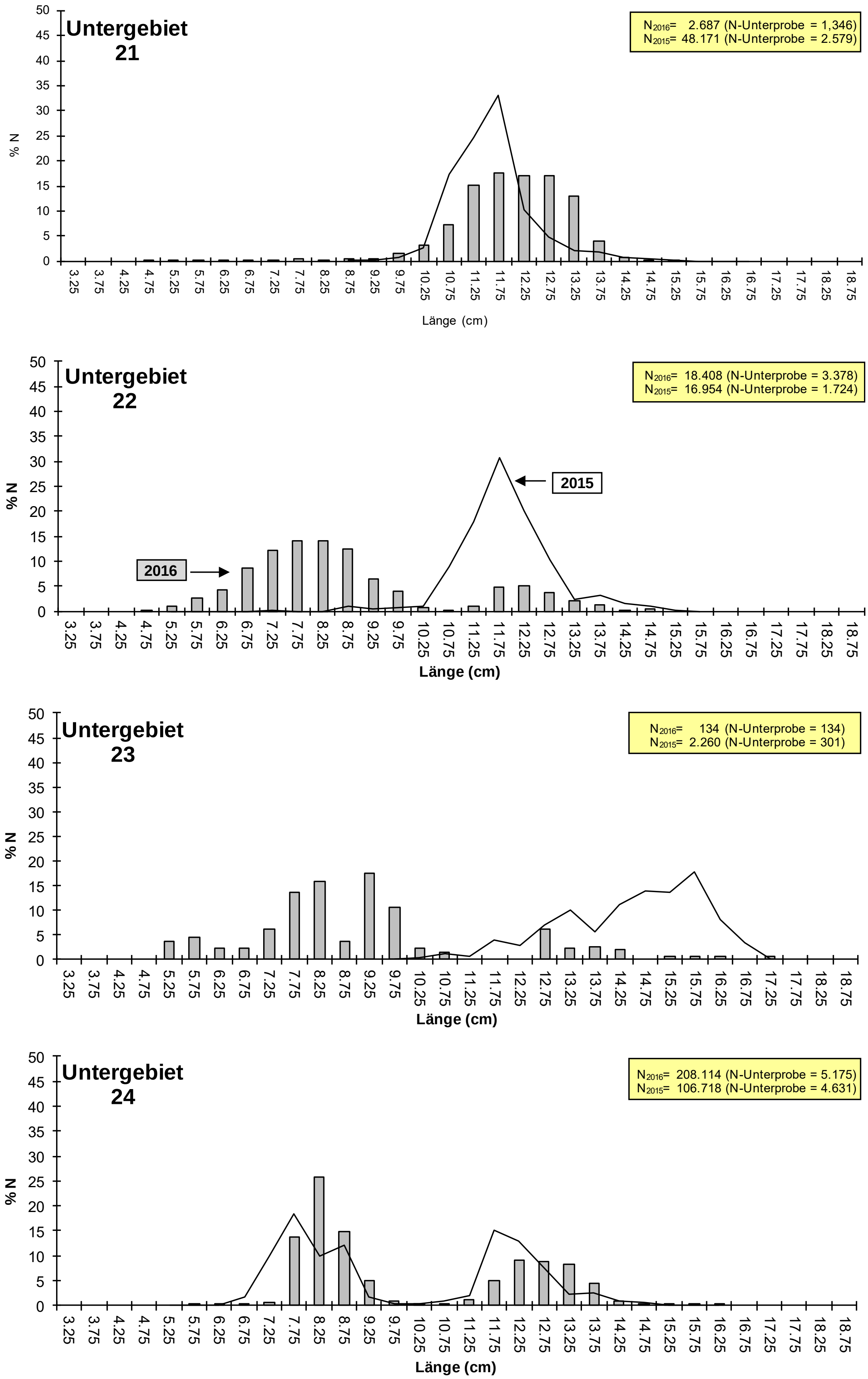


Figure 4: FRV "Solea", cruise 726/2016: Sprat (*Sprattus sprattus*) length-frequency distribution compared to previous year (cruise 710/2015).

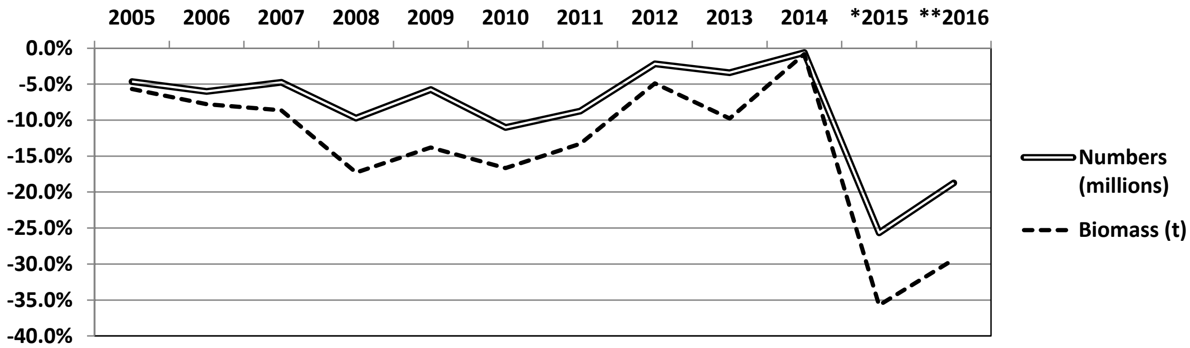


Figure 5 **Relative changes in abundance and biomass of Western Baltic Spring Spawning herring in ICES Subdivisions 21-24 (2005-2016) after application of the stock separation function (SF, Gröhsler et al., 2013) to the abundance and biomass index generated from German acoustic survey data (GERAS).**
***2015 = excl. CBH also in SD 22 and mature herring (stages ≥6) in SD 23; ** = . excl. CBH also in SD 22**

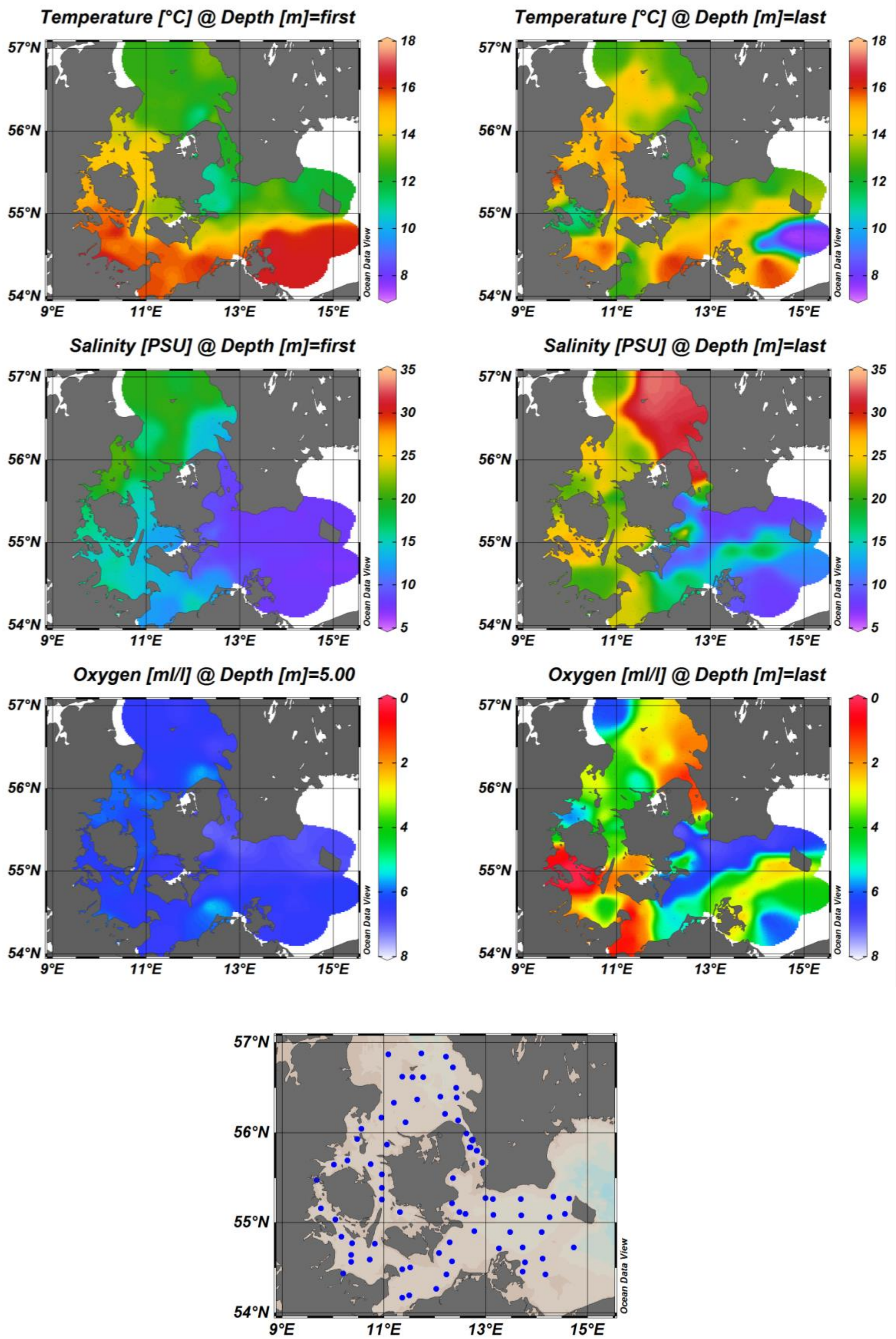


Figure 6: **FRV "Solea" cruise 726/2016: Hydrography. CTD stations are depicted as blue dots in the area map (lower panel). Temperature (°C, top panels), salinity (PSU, middle panels and oxygen concentration (ml/l, lower panels) at the surface (left) and near the seafloor (right). Surface oxygen concentration levels are displayed at 5 m depth.**

Table 1: FRV "Solea", cruise 726/2016. Simrad EK80 calibration report.

Date:	30.09.2016		
Transceiver Type:	WBT		
Software Version:	EK80 1.8.3.0		
Reference Target:	Tungsten (WC-Co) 38.1 mm		
Transducer:	ES38B Serial No. 30545		
Frequency:	38000 Hz	Beamtype:	Split
Gain:	26.04 dB	Two Way Beam Angle:	-20.6 dB
Athw. Beam Angle:	6.91 deg	Along. Beam Angle:	7.35 deg
Athw. Offset Angle:	0.10 deg	Along. Offset Angle:	-0.21 deg
Depth:	4.20 m		

Pulse Duration:	1.024 ms
Power:	1000 W

TS Detection:

Min. Value:	-53.0 dB	Min. Spacing:	0.0
Max. Gain Comp.:	3.0 dB	Min. Echolength:	0.8
		Max. Echolength:	1.8

Environment:

Absorption Coeff.:	0.005372	Sound Velocity:	1494.38 m/s

Calibration results:

Transducer Gain:	26.21 dB	SaCorrection:	0.33 dB
Athw. Beam Angle:	7.29 deg	Along. Beam Angle:	7.32 deg
Athw. Offset Angle:	-0.11 deg	Along. Offset Angle:	0.02 deg

Ts RMS-Error:	0.0399

Table 2: FRV "Solea", cruise 726/2016. Catch composition (kg 0.5h^{-1}) by trawl haul in SD 21.

Haul No.	33	34	35	36	37	38	39	40	41	42	43	44	Total
Species/ICES Rectangle	**41G2**	**42G2**	**42G2**	**42G1**	**42G1**	**42G1**	**41G2**	**41G1**	**41G1**	**41G0**	**41G1**	**41G2**	
BELONE BELONE											0.02		0.02
CLUPEA HARENGUS	1.67	3.53	3.19	2.66	2.26	10.86	1.46	1.84	1.08		20.29	19.23	68.07
CRANGON CRANGON				+									+
CRYSTALLOGOBIUS LINEARIS	+	0.01		+		+		+				+	0.01
CTENOLABRUS RUPESTRIS						+							+
CYCLOPTERUS LUMPUS											0.160		0.16
ENGRAULIS ENCRASICOLUS	0.01	0.01	0.09	0.11	0.10	0.92	2.19	1.05	2.42	0.43	0.110	0.060	7.50
EUTRIGLA GURNARDUS	+	0.02	0.01	0.04	0.05				1.06	0.15		+	1.33
GADUS MORHUA		6.84	2.12				5.36	2.94	2.67			0.010	19.94
GASTEROSTEUS ACULEATUS	+					+		0.01	+	+	0.08	0.01	0.10
HIPPOGLOSSOIDES PLATESSOIDES					+								+
LEANDER				+									+
LIMANDA LIMANDA		0.81	0.09	0.11	0.07			0.1	1.05	0.2		0.01	2.44
LOLIGO FORBESI	0.01	0.01	0.06	0.12	0.05	0.73	0.05	+	0.02			0.37	1.42
MELANOGRAMMUS AEGLEFINUS	0.99												0.99
MERLANGIUS MERLANGUS	0.01	1.03	0.53	0.05	0.1	0.09	0.06	0.03	0.03	0.02	0.06	0.05	2.06
MERLUCCIUS MERLUCCIUS		0.18	0.27										0.45
MYSIDACEA				0.01									0.01
PLEURONECTES PLATESSA		0.95	0.41	0.49									1.85
POMATOSCHISTUS MINUTUS		+	+	+									+
SARDINA PILCHARDUS	0.01				0.06	0.01		0.03		0.06	0.25		0.42
SCOMBER SCOMBRUS					0.68	0.43	0.43						1.54
SEPIOLA			0.01	0.03		0.01							0.05
SPRATTUS SPRATTUS	0.13	4.8	3.66		11.93	8.05	0.34	0.12	0.16		4.82	0.29	34.30
SQUALUS ACANTHIAS		0.96											0.96
SYNGNATHUS ROSTELLATUS				+									+
TRACHINUS DRACO		0.23	0.21	0.19	2.28	3.39	0.39	0.67	0.38	0.14	0.34	0.22	8.44
TRACHURUS TRACHURUS	0.01	0.02	+				0.03	0.03	0.02	0.01	0.03	0.03	0.18
TRISOPTERUS ESMARKI			0.01	0.02									0.03
Total	**2.84**	**19.40**	**10.66**	**3.83**	**17.58**	**24.49**	**10.31**	**6.82**	**8.89**	**1.01**	**26.16**	**20.28**	**152.27**
Medusae	4.16	0.02	1.86	1.95	0.27	0.23	1.77	15.18	11.05	4.12	13.67	1.99	56.26

+ = < 0.01 kg

Table 3: FRV "Solea", cruise 726/2016. Catch composition (kg 0.5h^{-1}) by trawl haul in SD 22.

Haul No.	9	10	11	12	13	14	15	16	17	18	19	20	21
Species/ICES Rectangle	37G1	38G1	38G0	37G0	38G0	38G0	38G0	39G0	39F9	40G0	40G0	41G0	40G1
AGONUS CATAPHRACTUS							+						
ANGUILLA ANGUILLA									0.05				
CALLIONYMUS LYRA			0.03										
CLUPEA HARENGUS	1.54	2.08	2.72	4.20	3.48	0.17	0.37	0.28	0.08	0.26	0.04		0.13
CRANGON CRANGON											+		+
CRYSTALLOGOBIUS LINEARIS			+								+		+
CTENOLABRUS RUPESTRIS			+						+	0.01			0.01
CYCLOPTERUS LUMPUS						0.16	1.05						
ENGRAULIS ENCRASICOLUS	0.09	0.01	0.02	0.08	0.46	0.69	1.70	0.18	0.04	0.05	3.32	0.84	0.06
EUTRIGLA GURNARDUS													
GADUS MORHUA	0.19	0.01	5.01	9.44	0.04		0.02	0.01	0.02			0.08	0.01
GASTEROSTEUS ACULEATUS	0.01	0.01	0.01		0.09		0.15	0.19	0.51	0.01	+	0.02	0.02
GOBIUS			0.01										
GOBIUS NIGER			+						0.01		+		
LIMANDA LIMANDA	0.05	0.04	20.74	3.69	1.91		0.08		0.22		0.12	0.09	0.12
LOLIGO FORBESI											0.01	+	
LUMPENUS LAMPRETAEFORMIS			0.02										
MERLANGIUS MERLANGUS	0.24	0.01	0.93	0.22	0.06	0.01	0.04	0.10	0.04		0.06	0.06	0.03
MULLUS SURMULETUS			0.03								0.02	0.08	0.03
PHOLIS GUNNELLUS													
PLATICHTHYS FLESUS			2.43	0.22	0.50								
PLEURONECTES PLATESSA			2.90					0.15	0.10				
POMATOSCHISTUS MINUTUS	+		+	+							+		+
PSETTA MAXIMA									1.78				
SARDINA PILCHARDUS											0.01	0.01	0.02
SCOMBER SCOMBRUS						0.02						0.23	
SPINACHIA SPINACHIA				+									
SPRATTUS SPRATTUS	0.39	0.31	4.56	6.03	11.11	0.33	3.74	4.62	7.17	2.55		0.19	+
SYNGNATHUS ROSTELLATUS	+		+										
SYNGNATHUS TYPHLE		+					+			+	+	+	+
TRACHINUS DRACO	0.10		0.21	0.06							0.02	0.19	0.22
TRACHURUS TRACHURUS				0.04	0.03	0.03		+			0.01	0.12	0.05
TRISOPTERUS ESMARKI												+	+
TRISOPTERUS MINUTUS													
Total	**2.61**	**2.47**	**39.62**	**23.98**	**17.68**	**1.41**	**7.15**	**5.53**	**10.02**	**2.88**	**3.61**	**1.91**	**0.70**
Medusae	37.76	6.99	4.71	4.53	33.10	53.80	48.38	47.70	7.37	11.59	32.86	9.08	6.37

Haul No.	22	23	24	25	Total
Species/ICES Rectangle	40G0	39G0	39G0	39G1	
AGONUS CATAPHRACTUS			0.01		**0.01**
ANGUILLA ANGUILLA					**0.05**
CALLIONYMUS LYRA					**0.03**
CLUPEA HARENGUS	0.12	0.96	20.93	0.74	**38.10**
CRANGON CRANGON				+	+
CRYSTALLOGOBIUS LINEARIS	0.02	0.01		0.01	**0.04**
CTENOLABRUS RUPESTRIS	+		+		**0.02**
CYCLOPTERUS LUMPUS			0.21		**1.42**
ENGRAULIS ENCRASICOLUS	+	0.02	0.03		**7.59**
EUTRIGLA GURNARDUS			+		+
GADUS MORHUA			8.48	0.05	**23.36**
GASTEROSTEUS ACULEATUS	+	0.06	0.01	5.50	**6.59**
GOBIUS					**0.01**
GOBIUS NIGER				+	**0.01**
LIMANDA LIMANDA	0.03		0.21	0.01	**27.31**
LOLIGO FORBESI			0.01		**0.02**
LUMPENUS LAMPRETAEFORMIS					**0.02**
MERLANGIUS MERLANGUS	0.01	0.19	0.14	0.10	**2.24**
MULLUS SURMULETUS					**0.16**
PHOLIS GUNNELLUS				0.02	**0.02**
PLATICHTHYS FLESUS	0.18				**3.33**
PLEURONECTES PLATESSA			0.07		**3.22**
POMATOSCHISTUS MINUTUS	+	+		0.01	**0.01**
PSETTA MAXIMA					**1.78**
SARDINA PILCHARDUS				0.02	**0.06**
SCOMBER SCOMBRUS			0.05		**0.30**
SPINACHIA SPINACHIA					+
SPRATTUS SPRATTUS	0.31	1.19	50.12	5.55	**98.17**
SYNGNATHUS ROSTELLATUS					+
SYNGNATHUS TYPHLE	+	+		+	+
TRACHINUS DRACO		0.02			**0.82**
TRACHURUS TRACHURUS	+	0.11	0.16		**0.55**
TRISOPTERUS ESMARKI				+	+
TRISOPTERUS MINUTUS	+				+
Total	**0.67**	**2.56**	**80.43**	**12.01**	**215.24**
Medusae	8.31	23.15	8.46	2.78	**346.94**

+ = < 0.01 kg

Table 4: **FRV "Solea", cruise 726/2016. Catch composition (kg 0.5h^{-1}) by trawl haul in SD 23.**

Haul No.	30	31	32	53	54	55	Total
Species/ICES Rectangle	40G2	40G2	41G2	40G2	40G2	41G2	
CARCINUS	0.03						0.03
CLUPEA HARENGUS	97.33	153.30		0.91	122.72	1.77	376.03
CRYSTALLOGOBIUS LINEARIS						+	+
ENGRAULIS ENCRASICOLUS			0.01	0.03		0.03	0.07
EUTRIGLA GURNARDUS	+		0.01				0.01
GADUS MORHUA	90.86	25.38	2.67	13.22	11.03		143.16
GASTEROSTEUS ACULEATUS	+	+	0.01	+	+	0.01	0.02
LIMANDA LIMANDA			0.36	0.25	0.06		0.67
LOLIGO FORBESI			0.01		+	0.05	0.06
MELANOGRAMMUS AEGLEFINUS				1.09	1.23		2.32
MERLANGIUS MERLANGUS	0.03		0.01		0.05	+	0.09
PLATICHTHYS FLESUS						0.35	0.35
PLEURONECTES PLATESSA	0.18				0.44		0.62
POLLACHIUS VIRENS	3.33			3.17			6.50
SARDINA PILCHARDUS					+		+
SPRATTUS SPRATTUS	0.13		0.01	0.07	0.32	0.28	0.81
SYNGNATHUS TYPHLE	+						+
TRACHINUS DRACO						0.02	0.02
TRACHURUS TRACHURUS			+			+	+
Total	**191.89**	**178.68**	**3.09**	**18.74**	**135.85**	**2.51**	**530.76**
Medusae	2.93	2.56	3.96	4.17	1.00	3.33	**17.96**

+ = < 0.01 kg

Table 5: **FRV "Solea", cruise 726/2016. Catch composition (kg 0.5h^{-1}) by trawl haul in SD 24.**

Haul No.	1	2	3	4	5	6	7	8	26	27	28	29	45
Species/ICES Rectangle	37G2	38G2	38G3	38G3	38G4	38G3	37G3	38G4	38G2	38G2	38G3	38G4	39G2
AMMODYTES TOBIANUS							0.04						
BELONE BELONE			0.10							0.39			
CLUPEA HARENGUS	1.47	3.23	11.57	13.75	12.20	9.56	53.66	53.96	25.05	2.41	5.29	92.66	3.11
CRANGON CRANGON											+	+	+
CRYSTALLOGOBIUS LINEARIS	+	+								+			0.01
CTENOLABRUS RUPESTRIS	+												
CYCLOPTERUS LUMPUS		0.16	0.24									0.11	
ENGRAULIS ENCRASICOLUS	0.45	0.12							0.08	0.01	0.01		0.09
GADUS MORHUA	0.02	0.10		0.02		0.81	3.84	0.54	0.01	+	1.27	0.84	0.06
GASTEROSTEUS ACULEATUS	0.01	+		0.12			0.01		0.01	0.08	0.02	+	3.44
GOBIUS NIGER				0.01						0.01			+
LEANDER													+
LIMANDA LIMANDA	+	1.99	1.02							0.03			+
MERLANGIUS MERLANGUS	0.34	1.13	0.03	0.98			0.07	0.20	0.02	0.04	4.03	2.56	
MYOXOCEPHALUS SCORPIUS		0.03											
OSMERUS EPERLANUS							0.08						
PLATICHTHYS FLESUS		1.48	0.50	0.44	0.44	1.68	0.31		0.20	0.68	0.23		
PLEURONECTES PLATESSA		0.17		0.22						0.52	0.21	0.16	
POLLACHIUS POLLACHIUS													
POMATOSCHISTUS MINUTUS	+	+	+	0.01		0.01	0.01			0.04	+	+	+
SARDINA PILCHARDUS										0.01			+
SPRATTUS SPRATTUS	0.87	1.08	753.9	24.84	2.48	59.74	324.25	6.99	22.89	12.12	61.78	81.97	9.85
STIZOSTEDION LUCIOPERCA							0.26						
SYNGNATHUS TYPHLE	+												+
TRACHURUS TRACHURUS			0.01								+	0.02	
Total	**3.16**	**9.49**	**767.37**	**40.39**	**15.12**	**71.80**	**382.53**	**61.69**	**48.26**	**16.34**	**72.84**	**178.32**	**16.56**
Medusae	2.39	13.20	0.84	5.99	42.20	18.60	4.12	9.70	11.40	3.01	3.20	7.62	1.64

Haul No.	46	47	48	49	50	51	52	Total
Species/ICES Rectangle	39G3	39G3	39G4	39G4	39G3	39G3	39G2	
AMMODYTES TOBIANUS								0.04
BELONE BELONE								0.49
CLUPEA HARENGUS	0.93	1.80	4.16	2.67	5.24	1.26	0.95	304.93
CRANGON CRANGON								+
CRYSTALLOGOBIUS LINEARIS								0.01
CTENOLABRUS RUPESTRIS								+
CYCLOPTERUS LUMPUS							0.18	0.69
ENGRAULIS ENCRASICOLUS	0.01	0.19	0.04			0.02		1.02
GADUS MORHUA	0.01	0.36	3.78	1.35	2.45		0.36	15.82
GASTEROSTEUS ACULEATUS	0.24	0.01		+	+	+		3.94
GOBIUS NIGER								0.02
LEANDER								+
LIMANDA LIMANDA								3.04
MERLANGIUS MERLANGUS	+	0.25	3.61		2.20			15.46
MYOXOCEPHALUS SCORPIUS								0.03
OSMERUS EPERLANUS								0.08
PLATICHTHYS FLESUS	0.20		0.19	0.37	0.32			7.04
PLEURONECTES PLATESSA				0.23				1.51
POLLACHIUS POLLACHIUS					1.60			1.60
POMATOSCHISTUS MINUTUS	+	+	+		+			0.07
SARDINA PILCHARDUS								0.01
SPRATTUS SPRATTUS	2.25	126.52	12.71	2.22	85.84	4.72	1.22	1598.24
STIZOSTEDION LUCIOPERCA								0.26
SYNGNATHUS TYPHLE								+
TRACHURUS TRACHURUS	0.04	0.04	0.05		0.11	+		0.27
Total	**3.68**	**129.17**	**24.54**	**6.84**	**97.76**	**6.00**	**2.71**	**1954.57**
Medusae	5.54	1.50	5.25	5.20	3.24	23.29	15.96	**183.89**

+ = < 0.01 kg

Table 6: **FRV "Solea", cruise 726/2016. Survey statistics by area.**

Sub-division	ICES Rectangle	Area (nm²)	Sa (m²/NM²)	Sigma (cm²)	N total (million)	Herring (%)	Sprat (%)	NHerring (million)	NSprat (million)
21	41G0	108.1	319.5	1.254	275.42	0.00	0.00	0.00	0.00
21	41G1	946.8	59.5	2.032	277.24	45.42	12.30	125.92	34.10
21	41G2	432.3	132.9	1.752	327.93	69.33	5.97	227.35	19.58
21	42G1	884.2	56.5	1.680	297.36	49.97	44.64	148.60	132.75
21	42G2	606.8	91.3	1.557	355.82	44.02	48.70	156.64	173.30
21	Total	2,978.2			1533.77			658.51	359.73
22	37G0	209.9	198.0	1.100	377.82	30.53	65.12	115.35	246.03
22	37G1	723.3	104.2	1.290	584.25	46.44	25.42	271.33	148.54
22	38G0	735.3	192.3	0.805	1756.50	14.51	71.15	254.87	1249.83
22	38G1	173.2	191.5	1.166	284.46	74.65	20.49	212.36	58.27
22	39F9	159.3	194.7	0.460	674.25	0.49	88.39	3.34	595.94
22	39G0	201.7	143.0	0.905	318.71	19.59	70.64	62.44	225.12
22	39G1	250.0	110.0	0.341	806.45	1.16	20.78	9.38	167.58
22	40F9	51.3	25.6	1.102	11.92	7.35	87.86	0.88	10.47
22	40G0	538.1	96.4	1.102	470.72	7.35	87.86	34.59	413.57
22	40G1	174.5	511.7	0.830	1075.80	25.45	1.82	273.84	19.56
22	41G0	173.1	36.4	1.453	43.36	0.00	15.65	0.00	6.79
22	Total	3,389.7			6404.24			1238.38	3141.70
23	39G2	130.9	208.6	0.580	470.79	4.44	38.88	20.90	183.02
23	40G2	164.0	825.0	4.530	298.68	97.12	0.64	290.08	1.91
23	41G2	72.3	123.6	1.068	83.67	70.03	25.78	58.60	21.57
23	Total	367.2			853.14			369.58	206.50
24	37G2	192.4	97.8	1.325	142.01	34.52	36.01	49.03	51.14
24	37G3	167.7	3085.4	0.687	7531.61	2.00	97.96	150.31	7377.79
24	37G4	875.1	186.5	2.984	546.94	64.76	35.03	354.20	191.60
24	38G2	832.9	322.7	1.239	2169.30	25.16	64.24	545.88	1393.56
24	38G3	865.7	1440.8	1.179	10579.31	4.33	94.96	457.78	10046.07
24	38G4	1034.8	441.8	2.832	1614.32	48.15	51.61	777.34	833.14
24	39G2	406.1	275.4	0.580	1928.27	4.44	38.88	85.62	749.64
24	39G3	765.0	348.1	1.426	1867.44	5.09	87.99	95.05	1643.12
24	39G4	524.8	349.9	2.455	747.97	19.15	77.19	143.26	577.35
24	Total	5,664.5			27,127.17			2658.47	22863.41
22-24	Total	9,421.4			34,384.55			4266.43	26211.61
21-24	Total	12,399.6			35,918.32			4924.94	26571.34

Table 7: FRV "Solea", cruise 726/2016. Numbers (millions) of herring incl. CBH by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G0										0.00
21	41G1	94.95	27.44	2.68	0.57	0.14	0.13				125.91
21	41G2	220.63	5.85	0.77	0.07	0.03					227.35
21	42G1	132.14	15.52	0.69	0.06	0.08	0.10				148.59
21	42G2	154.58	1.97	0.07		0.01	0.01				156.64
21	Total	602.30	50.78	4.21	0.70	0.26	0.24	0.00	0.00	0.00	658.49
22	37G0	107.26	3.94	1.50	0.82	0.97	0.52	0.16	0.19		115.36
22	37G1	234.10	17.42	5.89	1.98	7.39	3.04	0.87	0.66		271.35
22	38G0	238.58	6.72	4.46	1.09	2.03	0.78	0.38	0.12	0.71	254.87
22	38G1	211.70	0.66								212.36
22	39F9	3.34									3.34
22	39G0	61.55	0.64	0.02	0.03	0.15	0.02	0.03			62.44
22	39G1	9.26	0.09			0.02	0.01				9.38
22	40F9	0.77	0.05	0.02	0.03	0.01					0.88
22	40G0	30.08	1.91	0.89	1.03	0.55		0.14			34.60
22	40G1	273.84									273.84
22	41G0										0.00
22	Total	1,170.48	31.43	12.78	4.98	11.12	4.37	1.58	0.97	0.71	1,238.42
23	39G2	16.12	1.19	0.67	0.91	1.35	0.46	0.07	0.11	0.01	20.89
23	40G2	7.76	189.69	55.82	25.32	8.58	2.15	0.56	0.2		290.08
23	41G2	58.31	0.29								58.60
23	Total	82.19	191.17	56.49	26.23	9.93	2.61	0.63	0.31	0.01	369.57
24	37G2	43.11	1.70	1.02	0.68	1.73	0.73	0.02	0.02		49.01
24	37G3	60.72	15.67	13.37	19.09	24.25	10.56	3.62	2.07	0.96	150.31
24	37G4	5.89	55.73	50.52	81.09	93.23	37.75	17.08	9.95	2.97	354.21
24	38G2	367.32	48.05	30.93	33.09	46.02	15.02	2.74	2.48	0.24	545.89
24	38G3	246.67	42.97	31.87	44.48	57.35	21.97	6.19	4.94	1.34	457.78
24	38G4	23.63	94.91	99.65	207.82	185.26	87.83	45.37	23.83	9.04	777.34
24	39G2	66.04	4.89	2.75	3.74	5.53	1.87	0.29	0.45	0.06	85.62
24	39G3	26.14	14.71	10.06	13.78	18.66	7.48	2.11	1.70	0.41	95.05
24	39G4	10.49	18.94	18.59	32.03	35.97	15.08	6.12	4.10	1.95	143.27
24	Total	850.01	297.57	258.76	435.80	468.00	198.29	83.54	49.54	16.97	2,658.48
22-24	Total	2,102.68	520.17	328.03	467.01	489.05	205.27	85.75	50.82	17.69	4,266.47
21-24	Total	2,704.98	570.95	332.24	467.71	489.31	205.51	85.75	50.82	17.69	4,924.96

Table 8: FRV "Solea", cruise 726/2016. Mean weight (g) of herring incl. CBH by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G0										
21	41G1	14.18	40.93	55.33	54.39	31.85	45.82				21.12
21	41G2	13.18	39.69	60.19	53.48	31.85					14.04
21	42G1	14.83	38.26	40.30	49.00	31.85	45.82				17.44
21	42G2	8.94	37.74	43.82		31.85	45.82				9.32
21	Total	12.61	39.85	53.56	53.84	31.85	45.82				15.04
22	37G0	5.86	32.57	47.70	52.02	39.10	46.97	46.39	46.00		8.23
22	37G1	6.94	33.97	43.40	35.37	38.20	42.08	41.44	46.00		11.12
22	38G0	5.25	33.86	62.49	45.39	51.92	46.85	48.11	46.00	60.00	7.91
22	38G1	9.52	21.33								9.56
22	39F9	4.93									4.93
22	39G0	7.26	32.08	27.87	30.80	34.67	31.38	36.82			7.62
22	39G1	8.92	31.38			31.37	31.37				9.21
22	40F9	7.56	32.82	52.66	49.48	34.82		36.82			11.76
22	40G0	7.56	32.82	52.66	49.48	34.82		36.82			11.91
22	40G1	9.32									9.32
22	41G0										0.00
22	Total	7.56	33.39	51.20	43.28	40.55	43.44	43.05	46.00	60.00	9.34
23	39G2	9.48	32.70	34.88	40.33	36.71	39.30	49.63	45.23	45.98	15.72
23	40G2	9.94	42.63	70.05	92.15	79.86	115.41	107.38	139.40		53.19
23	41G2	8.88	29.33								8.98
23	Total	9.10	42.55	69.63	90.35	73.99	102.00	100.96	105.98	45.98	44.06
24	37G2	10.17	31.38	26.51	36.28	34.23	36.28	50.30	50.30		12.88
24	37G3	9.01	33.52	43.74	49.42	43.06	46.55	57.94	56.47	54.76	30.04
24	37G4	21.01	33.38	46.62	56.99	46.65	54.41	76.64	57.32	65.76	49.23
24	38G2	9.67	30.76	29.83	33.38	34.66	37.94	49.73	46.61	45.98	17.38
24	38G3	7.81	32.53	38.96	46.95	41.26	45.14	61.34	52.12	62.05	23.44
24	38G4	16.79	33.49	53.10	76.82	55.34	68.43	84.40	70.75	73.82	60.82
24	39G2	9.48	32.70	34.88	40.33	36.71	39.30	49.63	45.23	45.98	15.73
24	39G3	11.74	32.71	38.59	43.31	40.40	45.32	59.64	52.50	67.46	32.71
24	39G4	12.25	33.82	50.34	58.02	46.20	51.30	64.07	59.39	68.61	47.24
24	Total	9.47	32.85	45.77	62.77	47.62	57.14	76.58	62.58	69.16	38.11
22-24	Total	8.39	36.45	50.09	64.11	47.99	57.42	76.14	62.53	68.78	30.27
21-24	Total	9.33	36.75	50.13	64.09	47.98	57.40	76.14	62.53	68.78	28.23

Table 9: FRV "Solea", cruise 726/2016. Total biomass (t) of herring incl. CBH by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total
21	41G0										0.0
21	41G1	1,346.4	1,123.1	148.3	31.0	4.5	6.0				2,659.2
21	41G2	2,907.9	232.2	46.4	3.7	1.0					3,191.1
21	42G1	1,959.6	593.8	27.8	2.9	2.6	4.6				2,591.3
21	42G2	1,382.0	74.4	3.1		0.3	0.5				1,460.2
21	Total	7,595.9	2,023.5	225.5	37.7	8.3	11.0	0.0	0.0	0.0	9,901.8
22	37G0	628.5	128.3	71.6	42.7	37.9	24.4	7.4	8.7		949.6
22	37G1	1,624.7	591.8	255.6	70.0	282.3	127.9	36.1	30.4		3,018.7
22	38G0	1,252.6	227.5	278.7	49.5	105.4	36.5	18.3	5.5	42.6	2,016.6
22	38G1	2,015.4	14.1								2,029.5
22	39F9	16.5									16.5
22	39G0	446.9	20.5	0.6	0.9	5.2	0.6	1.1			475.8
22	39G1	82.6	2.8			0.6	0.3				86.4
22	40F9	5.8	1.6	1.1	1.5	0.4					10.3
22	40G0	227.4	62.7	46.9	51.0	19.2		5.2			412.2
22	40G1	2,552.2									2,552.2
22	41G0										0.0
22	Total	8,852.5	1,049.4	654.4	215.53	451.0	189.8	68.00	44.62	42.6	11,567.7
23	39G2	152.8	38.9	23.4	36.70	49.6	18.1	3.47	4.98	0.5	328.4
23	40G2	77.1	8,086.5	3,910.2	2,333.2	685.2	248.1	60.1	27.9		15,428.4
23	41G2	517.8	8.5								526.3
23	Total	747.7	8,133.9	3,933.6	2,369.9	734.8	266.2	63.6	32.9	0.5	16,283.0
24	37G2	438.4	53.4	27.0	24.7	59.2	26.5	1.0	1.0		631.2
24	37G3	547.1	525.3	584.8	943.4	1,044.2	491.6	209.7	116.9	52.6	4,515.6
24	37G4	123.8	1,860.3	2,355.2	4,621.3	4,349.2	2,054.0	1,309.0	570.3	195.3	17,438.4
24	38G2	3,552.0	1,478.0	922.6	1,104.5	1,595.1	569.9	136.3	115.6	11.0	9,485.0
24	38G3	1,926.5	1,397.8	1,241.7	2,088.3	2,366.3	991.7	379.7	257.5	83.2	10,732.6
24	38G4	396.8	3,178.5	5,291.4	15,964.7	10,252.3	6,010.2	3,829.2	1,686.0	667.3	47,276.5
24	39G2	626.1	159.9	95.9	150.8	203.0	73.5	14.4	20.4	2.8	1,346.7
24	39G3	306.9	481.2	388.2	596.8	753.9	339.0	125.8	89.3	27.7	3,108.7
24	39G4	128.5	640.6	935.8	1,858.4	1,661.8	773.6	392.1	243.5	133.8	6,768.1
24	Total	8,045.9	9,774.9	11,842.8	27,353.1	22,284.9	11,329.9	6,397.3	3,100.4	1,173.6	101,302.7
22-24	Total	17,646.1	18,958.2	16,430.7	29,938.5	23,470.6	11,785.9	6,528.9	3,177.8	1,216.7	129,153.4
21-24	Total	25,242.0	20,981.6	16,656.2	29,976.2	23,478.9	11,796.9	6,528.9	3,177.8	1,216.7	139,055.2

Table 10: FRV "Solea", cruise 726/2016. Numbers (millions) of sprat by age and area.

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
21	41G0										0.00
21	41G1		7.53	22.27	3.81	0.49					34.10
21	41G2	3.61	11.42	4.31	0.24	0.01					19.59
21	42G1	0.26	52.84	72.75	6.48	0.42					132.75
21	42G2	9.21	134.66	28.38	1.02	0.02					173.29
21	Total	13.08	206.45	127.71	11.55	0.94	0.00	0.00	0.00	0.00	359.73
22	37G0	230.74	4.00	10.46	0.81		0.02				246.03
22	37G1	145.48	1.14	1.53	0.32		0.06				148.53
22	38G0	1,225.07	3.05	17.80	3.41	0.44	0.06				1,249.83
22	38G1	58.00	0.27								58.27
22	39F9	595.94									595.94
22	39G0	168.95	7.73	40.34	4.59	2.68	0.84				225.13
22	39G1	166.61	0.35	0.62							167.58
22	40F9	3.63	1.32	4.98	0.48	0.04	0.01				10.46
22	40G0	143.51	52.14	196.88	19.12	1.58	0.34				413.57
22	40G1	19.56									19.56
22	41G0	1.78	1.08	3.45	0.47						6.78
22	Total	2,759.27	71.08	276.06	29.20	4.74	1.33	0.00	0.00	0.00	3,141.68
23	39G2	166.28	9.03	6.13	0.73	0.33	0.28	0.24			183.02
23	40G2	0.75	0.11	0.49	0.10	0.24	0.21				1.90
23	41G2	21.08	0.23	0.16	0.03	0.06					21.56
23	Total	188.11	9.37	6.78	0.86	0.63	0.49	0.24	0.00	0.00	206.48
24	37G2	38.88	4.26	5.65	1.22	0.41	0.57	0.14			51.13
24	37G3	7,292.75	70.05	14.99							7,377.79
24	37G4	35.21	23.69	69.54	31.13	16.47	12.71	2.84			191.59
24	38G2	1,031.84	173.54	148.43	21.05	6.19	8.80	3.70			1,393.55
24	38G3	5,186.01	2,295.86	1,977.42	298.01	110.41	118.30	60.06			10,046.07
24	38G4	104.02	168.00	326.96	115.08	58.13	47.60	13.35			833.14
24	39G2	681.08	36.99	25.09	2.99	1.33	1.16	0.99			749.63
24	39G3	433.93	467.38	544.18	99.31	36.20	41.70	20.42			1,643.12
24	39G4	29.11	160.23	254.76	64.47	30.76	28.74	9.28			577.35
24	Total	14,832.83	3,400.00	3,367.02	633.26	259.90	259.58	110.78	0.00	0.00	22,863.37
22-24	Total	17,780.21	3,480.45	3,649.86	663.32	265.27	261.40	111.02	0.00	0.00	26,211.53
21-24	Total	17,793.29	3,686.90	3,777.57	674.87	266.21	261.40	111.02	0.00	0.00	26,571.26

Table 11: FRV "Solea", cruise 726/2016. Mean weight (g) of sprat by age and area.

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
21	41G0										
21	41G1	0.00	12.56	16.15	18.11	18.66					15.62
21	41G2	3.05	10.84	13.75	15.43	18.07					10.11
21	42G1	8.52	11.93	15.14	17.50	18.68					13.97
21	42G2	3.38	10.34	12.74	14.28	18.07					10.39
21	Total	3.39	10.86	14.74	17.37	18.65					12.19
22	37G0	4.96	10.07	13.24	13.61		15.94				5.43
22	37G1	4.92	7.73	15.94	15.94		15.94				5.08
22	38G0	3.49	10.48	13.86	15.28	19.50	15.94				3.69
22	38G1	5.14	7.24								5.15
22	39F9	2.26									2.26
22	39G0	3.34	11.84	13.69	14.40	17.82	18.50				5.94
22	39G1	3.80	9.72	13.27							3.85
22	40F9	3.12	11.90	12.85	13.13	17.49	15.94				9.39
22	40G0	3.12	11.90	12.85	13.13	17.49	15.94				9.39
22	40G1	4.45									4.45
22	41G0	4.26	11.13	12.38	12.46						10.05
22	Total	3.45	11.62	13.06	13.61	17.86	17.56				4.61
23	39G2	5.09	12.46	13.87	15.51	15.28	16.29	14.18			5.84
23	40G2	5.01	15	15.99	16.23	20.87	27.5				13.55
23	41G2	3.52	7.97	13.78	13.78	13.78					3.69
23	Total	4.91	12.38	14.02	15.53	17.27	21.09	14.18			5.69
24	37G2	4.56	13.58	14.92	16.24	17.52	16.47	16.17			7.00
24	37G3	3.71	9.87	10.31							3.78
24	37G4	4.85	13.97	16.10	17.75	18.69	17.85	18.29			14.41
24	38G2	4.68	12.78	14.25	15.37	14.79	15.57	13.69			7.00
24	38G3	4.41	12.88	14.28	15.58	15.17	15.89	13.92			8.93
24	38G4	4.88	13.67	15.58	17.49	18.45	17.61	17.07			14.46
24	39G2	5.09	12.46	13.87	15.51	15.28	16.29	14.18			5.84
24	39G3	5.20	13.35	14.68	16.13	16.32	16.20	15.41			11.97
24	39G4	5.30	13.62	15.13	16.94	18.16	17.13	15.65			14.69
24	Total	4.15	12.96	14.55	16.25	16.64	16.48	14.83			7.66
22-24	Total	4.05	12.93	14.44	16.14	16.66	16.49	14.83			7.28
21-24	Total	4.04	12.81	14.45	16.16	16.67	16.49	14.83			7.34

Table 12: FRV "Solea", cruise 726/2016. Total biomass (t) of sprat by age and area.

Sub-division	Rectangle/ Age group	0	1	2	3	4	5	6	7	8+	Total
21	41G0										0.0
21	41G1	0.0	94.6	359.8	69.1	9.1					532.5
21	41G2	11.0	123.8	59.2	3.7	0.3					197.9
21	42G1	2.2	630.4	1,101.2	113.3	7.9					1,855.0
21	42G2	31.1	1,392.2	361.5	14.6	0.4					1,799.8
21	Total	44.3	2,241.0	1,881.6	200.7	17.6	0.0	0.0	0.0	0.0	4,385.2
22	37G0	1,145.6	40.3	138.5	11.0		0.4				1,335.7
22	37G1	715.9	8.8	24.4	5.1		1.0				755.3
22	38G0	4,270.6	31.9	246.6	52.2	8.7	0.9				4,610.9
22	38G1	298.4	2.0								300.3
22	39F9	1,345.8									1,345.8
22	39G0	564.3	91.5	552.1	66.1	47.7	15.5				1,337.1
22	39G1	633.9	3.4	8.2							645.5
22	40F9	11.3	15.7	64.0	6.4	0.7	0.1				98.3
22	40G0	447.3	620.6	2,529.8	251.1	27.6	5.4				3,881.8
22	40G1	87.0									87.0
22	41G0	7.6	12.1	42.7	5.9						68.3
22	Total	9,527.5	826.3	3,606.4	397.7	84.7	23.3	0.0	0.0	0.0	14,465.9
23	39G2	846.5	112.5	85.0	11.3	5.0	4.6	3.4			1,068.3
23	40G2	3.8	1.7	7.9	1.6	5.1	5.8				25.9
23	41G2	74.3	1.8	2.2	0.5	0.9					79.7
23	Total	924.5	116.0	95.1	13.4	11.0	10.5	3.4	0.0	0.0	1,173.9
24	37G2	177.2	57.9	84.4	19.8	7.2	9.4	2.2			358.1
24	37G3	27,042.2	691.7	154.4							27,888.3
24	37G4	170.7	330.8	1,119.7	552.6	307.9	226.9	52.0			2,760.5
24	38G2	4,824.1	2,217.2	2,115.4	323.5	91.5	137.1	50.7			9,759.4
24	38G3	22,877.5	29,575.6	28,246.1	4,643.0	1,675.1	1,879.6	835.9			89,732.7
24	38G4	507.3	2,297.0	5,093.4	2,013.2	1,072.5	838.2	227.9			12,049.4
24	39G2	3,467.1	460.9	348.1	46.3	20.3	18.9	14.1			4,375.6
24	39G3	2,256.4	6,239.3	7,988.0	1,602.2	590.8	675.4	314.7			19,666.6
24	39G4	154.2	2,182.5	3,854.6	1,092.2	558.7	492.3	145.2			8,479.7
24	Total	61,476.7	44,052.9	49,003.9	10,292.6	4,323.9	4,277.7	1,642.6	0.0	0.0	175,070.4
22-24	Total	71,928.8	44,995.2	52,705.4	10,703.7	4,419.5	4,311.5	1,646.1	0.0	0.0	190,710.1
21-24	Total	71,973.1	47,236.1	54,587.0	10,904.4	4,437.2	4,311.5	1,646.1	0.0	0.0	195,095.3

Table 13: **FRV "Solea", cruise 726/2016. Numbers (m) of herring excl. CBH by age/W-rings and area.**

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total	
21	41G0										0.00	
21	41G1	94.95	27.44	2.68	0.57	0.14	0.13				125.91	
21	41G2	220.63	5.85	0.77	0.07	0.03					227.35	
21	42G1	132.14	15.52	0.69	0.06	0.08	0.10				148.59	
21	42G2	154.58	1.97	0.07		0.01	0.01				156.64	
21	Total	602.30	50.78	4.21	0.70	0.26	0.24	0.00	0.00	0.00	658.49	
22	37G0	107.25	3.69	1.19	0.38						112.51	
22	37G1	234.10	17.42	2.97							254.48	
22	38G0	238.51	6.74	4.15		0.71					250.12	
22	38G1	211.69									211.69	
22	39F9	3.34									3.34	
22	39G0	61.55	0.59								62.14	excl. CBH
22	39G1	9.26	0.09								9.36	
22	40F9	0.77	0.05	0.02							0.83	
22	40G0	30.08	1.91	0.75							32.74	
22	40G1	273.84									273.84	
22	41G0										0.00	
22	Total	1,170.39	30.50	9.09	0.38	0.71	0.00	0.00	0.00	0.00	1,211.06	
23	39G2	16.12	1.17	0.14	0.16						17.59	excl. CBH
23	40G2	7.76	189.69	55.82	25.32	8.58	2.15	0.56	0.2		290.08	
23	41G2	58.31	0.29								58.60	
23	Total	82.19	191.15	55.96	25.48	8.58	2.15	0.56	0.20	0.00	366.27	
24	37G2	43.11	1.45	0.02							44.58	
24	37G3	60.72	15.45	7.00	7.31	1.24	0.42	0.14			92.28	
24	37G4	5.89	54.55	25.83	39.23	12.20	4.21	2.90	0.18		144.99	
24	38G2	367.32	46.76	2.39	1.88						418.35	
24	38G3	246.67	42.01	10.53	13.43	3.23	0.79	0.46			317.12	excl. CBH
24	38G4	23.63	92.93	57.80	134.41	42.43	25.58	13.38	2.98		393.14	
24	39G2	66.04	4.80	0.59	0.65						72.08	
24	39G3	26.14	14.65	3.29	2.95	0.50	0.31	0.10			47.94	
24	39G4	10.49	18.34	11.54	16.18	5.24	1.42	0.48	0.12		63.81	
24	Total	850.01	290.94	118.99	216.04	64.84	32.73	17.46	3.28	0.00	1,594.29	
22-24	Total	2,102.59	512.59	184.04	241.90	74.13	34.88	18.02	3.48	0.00	3,171.62	
21-24	Total	2,704.89	563.37	188.25	242.60	74.39	35.12	18.02	3.48	0.00	3,830.11	

Table 14: **FRV "Solea", cruise 726/2016. Mean weight (g) of herring excl. CBH by age/W-rings and area.**

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total	
21	41G0											
21	41G1	14.18	40.93	55.33	54.39	31.85	45.82				21.12	
21	41G2	13.18	39.69	60.19	53.48	31.85					14.04	
21	42G1	14.83	38.26	40.30	49.00	31.85	45.82				17.44	
21	42G2	8.94	37.74	43.82		31.85	45.82				9.32	
21	Total	12.61	39.85	53.56	53.84	31.85	45.82				15.04	
22	37G0	5.72	33.09	51.22	64.00						7.30	
22	37G1	6.73	33.85	49.51							9.08	
22	38G0	5.11	33.79	66.19		80.00					7.11	
22	38G1	9.16									9.16	
22	39F9	4.74									4.74	
22	39G0	7.01	32.69								7.25	excl. CBH
22	39G1	8.59	30.83								8.81	
22	40F9	7.28	32.93	63.00							10.06	
22	40G0	7.28	32.93	63.00							10.06	
22	40G1	8.93									8.93	
22	41G0											
22	Total	7.30	33.65	58.50	64.00	80.00					8.41	
23	39G2	9.17	32.99	56.41	62.82						11.62	excl. CBH
23	40G2	9.94	42.63	70.05	92.15	79.86	115.41	107.38	139.40		53.19	
23	41G2	8.88	29.33								8.98	
23	Total	9.04	42.55	70.02	91.97	79.86	115.41	107.38	139.40		44.12	
24	37G2	9.95	33.54	48.00							12.88	
24	37G3	8.89	34.24	60.37	69.21	80.98	88.62	87.80			30.04	
24	37G4	20.42	34.20	65.23	78.33	86.53	119.52	138.94	136.25		49.23	
24	38G2	9.42	31.03	53.93	69.05						17.38	
24	38G3	7.63	33.15	61.35	73.66	85.78	96.09	103.39			23.44	excl. CBH
24	38G4	16.39	34.36	71.71	97.14	102.97	114.02	116.70	136.25		60.82	
24	39G2	9.17	32.99	56.41	62.82						15.73	
24	39G3	11.50	33.15	60.74	71.99	88.62	88.74	87.80			32.71	
24	39G4	11.95	34.93	64.99	76.26	79.70	97.18	94.82	136.25		47.24	
24	Total	9.24	33.56	67.33	89.06	96.61	113.00	119.04	136.25		34.38	
22-24	Total	8.15	36.92	67.71	89.33	94.51	113.15	118.68	136.43		26.39	
21-24	Total	9.14	37.18	67.39	89.23	94.29	112.69	118.68	136.43		24.44	

Table 15: **FRV "Solea", cruise 726/2016. Total biomass (t) of herring excl. CBH and mature herring by age/W-rings and area.**

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total	
21	41G0										0.0	
21	41G1	1,346.4	1,123.1	148.3	31.0	4.5	6.0				2,659.2	
21	41G2	2,907.9	232.2	46.4	3.7	1.0					3,191.1	
21	42G1	1,959.6	593.8	27.8	2.9	2.6	4.6				2,591.3	
21	42G2	1,382.0	74.4	3.1		0.3	0.5				1,460.2	
21	Total	7,595.9	2,023.5	225.5	37.7	8.3	11.0	0.0	0.0	0.0	9,901.8	
22	37G0	613.8	122.0	61.1	24.4						821.2	
22	37G1	1,575.0	589.6	147.1							2,311.7	
22	38G0	1,219.7	227.8	274.9		57.1					1,779.5	
22	38G1	1,939.1									1,939.1	
22	39F9	15.8									15.8	
22	39G0	431.2	19.4								450.5	excl. CBH
22	39G1	79.5	2.9								82.4	
22	40F9	5.6	1.6	1.2							8.4	
22	40G0	219.0	63.0	47.4							329.4	
22	40G1	2,445.1									2,445.1	
22	41G0										0.0	
22	Total	8,543.8	1,026.3	531.6	24.4	57.1	0.0	0.00	0.00	0.0	10,183.1	
23	39G2	147.8	38.6	7.9	10.1						204.4	excl. CBH
23	40G2	77.1	8,086.5	3,910.2	2,333.2	685.2	248.1	60.1	27.9		15,428.4	
23	41G2	517.8	8.5								526.3	
23	Total	742.7	8,133.6	3,918.1	2,343.3	685.2	248.1	60.1	27.9	0.0	16,159.1	
24	37G2	428.9	48.6	1.0							478.5	
24	37G3	539.8	529.0	422.6	505.9	100.4	37.2	12.3			2,147.3	
24	37G4	120.3	1,865.6	1,684.9	3,072.9	1,055.7	503.2	402.9	24.5		8,730.0	
24	38G2	3,460.2	1,451.0	128.9	129.8						5,169.8	
24	38G3	1,882.1	1,392.6	646.0	989.3	277.1	75.9	47.6			5,310.5	excl. CBH
24	38G4	387.3	3,193.1	4,144.8	13,056.6	4,369.0	2,916.6	1,561.5	406.0		30,034.9	
24	39G2	605.6	158.4	33.3	40.8						838.1	
24	39G3	300.6	485.7	199.8	212.4	44.3	27.5	8.8			1,279.1	
24	39G4	125.4	640.6	750.0	1,233.9	417.6	138.0	45.5	16.4		3,367.3	
24	Total	7,850.1	9,764.5	8,011.3	19,241.6	6,264.1	3,698.5	2,078.5	446.9	0.0	57,355.5	
22-24	Total	17,136.6	18,924.4	12,461.0	21,609.2	7,006.4	3,946.6	2,138.7	474.8	0.0	83,697.7	
21-24	Total	24,732.5	20,947.9	12,686.5	21,646.9	7,014.7	3,957.6	2,138.7	474.8	0.0	93,599.5	

Annex 8: Working papers presented at the WGBIFS-2017 meeting

Note: Authors are fully responsible for quality of the prepared text and all kind of presented data.

List of working papers:

1. Allocation of BITS hauls from TD;
2. Calibration between new and old the r/v Havfisken.

DTU Aqua
National Institute of Aquatic Resources

DTU

WGBIFS 2017 working document

Allocation of BITS hauls from TD

by Henrik Degel (DTU Aqua)

Introduction

Every year during the Baltic International Survey Working Group in March (WGBIFS) a number countries commit themselves to carry out a number of trawl hauls in the Kattegat and Baltic Sea twice a year. The hauls constitute the internationally coordinated "Baltic International Trawl Survey" (BITS).
The survey is designed as a stratified random survey, which distribute the hauls stratified on Sub-division and depth strata. The allocation of hails positions to each country is a several-step procedure (fig. 1) and this document describes in details how hauls are distributed between strata and randomly drawn from a closed list of haul tracks in the Trawl Database. The software used for selecting the hauls has recently been updated using R as the programming language. Previously, the selection was a mixture of several types of software including EXCEL spreadsheets and was not documented except as program codes and a brief description in the WGBIFS report.

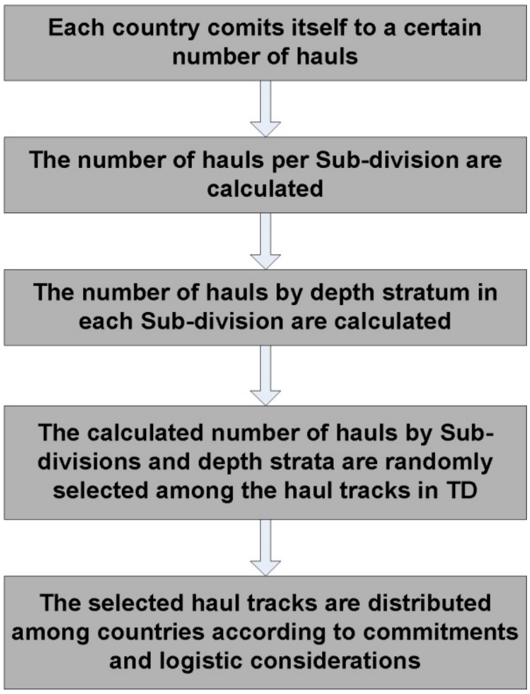


Figure 1. Main steps in allocating BITS haul tracks.

The number of hauls, which each country commits themselves to carry out during the following autumn and the next year spring, is announced during the WGBIFS meeting in March. The total number hauls vary a little but is around 300 in the spring and 270 in the autumn. The total spatial area for the survey falls into two separate sea areas: Sea area 21-24 covering Subdivisions 21, 22, 23 and 24 and sea area 25-28, which covers Sub-divisions 25, 26, 27 and 28.

Description of the Trawl Database

The Trawl Database (TD) consists of a closed list of tracks suitable for demersal trawling. The database covers the Sub-divisions from 22 in the western Baltic Sea to sub-division 28 in the central Baltic Sea. The tracks are sourced from commercial fishing boats as well as from research vessels track libraries. Each haul track is given by start position, end position and a number of waypoints in between. To each position is given the depth and auxiliary information such as origin, recommended gear version to be used, distance of the track and EEZ. Each haul track is identified by a TD Haul number consisting of a combination of the sub-division in which it is situated and a consecutive number. The database is continuously updated based on feed-back from the users concerning change in track statuses due to e.g. new gas and power cables and updated or canceled if serious gear damage is experienced. Errors are of cause also corrected and new haul tracks can be included in the database as well. At present (March 2017) the database holds information about 795 tracks. The format is a plain CSV file, which can be read in e.g. EXCEL.

Allocating the total available hauls to Sub-division and depth interval
(Part 1 in the R-program)

The total numbers of hauls by sea area (SD 21-24 and SD 25-28) are distributed between sub-divisions based on a weighting which consists of a combination of the area (km^2) of the sub-divisions and the running mean of the previous 5 years BITS abundance index by Sub-division of cod of age 1+ in 1st quarter. The weighting between area and Cpue is 60% and 40% respectively. The number of hauls in a given Sub-division is given by:

$$N_{SD} = \frac{N_{Total} \times \left[(0.6 \times A_{SD}) + 0.4 \times Cpue_{RM(SDy_{py-6,py-1})}\right]}{\sum_{SD=s}^{t} \left[(0.6 \times A_{SD}) + 0.4 \times Cpue_{RM(SDy_{py-6,py-1})}\right]}$$

where N is the number of hauls, NTotal is the total number of hauls for which the countries has committed itself, SD is the Sub-division, s and t are the start and end of the Sub-division assemble in question. A is the area (km2), Cpue is the Catch per unit effort, RM is the running mean, and the py is the present year. The present year is the year for the autumn survey for which the allocation is made. For the spring survey the present year is the year before for which the allocation is made.

The area of each subdivision can be downloaded from the DATRAS homepage. The abundance index of age 1+ cod in the 1st quarter survey can be downloaded on the same homepage (see annex 1 for details in calculation of the CPUE input values). The Subarea codes in DATRAS output is not the same as used in the haul allocation program. The key between DATRAS and the haul allocation program is given below.

Depth interval	Layer	DATRAS subarea code
0-10	1	8
10-40	2	9
40-60	3	10
60-80	4	11
80-100	5	12
< 100	6	13

Depth interval	Layer	DATRAS subarea code
0-20	1	8
20-40	2	9
40-60	3	10
60-80	4	11
80-100	5	12
< 100	6	13

Remark that the shallow water intervals are different for the two sea areas.

DATRAS subarea (=depth interval) code key for SD 22-24 DATRAS subarea (=depth interval) code key for SD 25-32

Several countries have area restrictions on the distribution of the hauls, which prevent the hauls to be distributed following strict standardized principles. These restrictions can be incorporated in the program and integrated in the outcome.

The allocation by depth interval (Layer) follows the same principles as for the allocation to Sub-division and is given by the equation below.

$$N_{SD,DL} = \frac{N_{SD,Total} \times \left[\left(0.6 \times A_{SD,DL}\right) + 0.4 \times Cpue_{RM(SD,DLy_{py-6,py-1})}\right]}{\sum_{SD,DL=n}^{m} \left[\left(0.6 \times A_{SD,DL}\right) + 0.4 \times Cpue_{RM(SD,DLy_{py-6,py-1})}\right]}$$

where DL is Depth Layer and n and m are the smallest and largest depth layer interval.

If the allocated number of hauls in total does not exactly match the total number of the planed hauls, the numbers can be fine-tuned individually in each stratum to match the total planned hauls.

The allocation of hauls is done by separate runs for each quarter by indicating the quarter in the program.

Random drawing of haul tracks in the Trawl Database

(Part 2 in the R-program)

The next step in the haul allocation process is to decide on which tracks in the Trawl Database (TD) should be realized for the given survey. First, every depth interval area is divided into a number of 10′ N x 20′ E area subunits. If a given subunit covers more than one depth interval, the unit is then used in both subunits. The selection is a two-step process: First are subunits randomly selected among the subunits, which have one or more TD hauls included. This is done in order to assure that the selected hauls are dispersed throughout the whole stratum. Secondly, one haul in each of the selected subunits are selected. Both selections are done without replacements.

For each stratum (Sub-division, depth interval), the number of selected hauls might exceed the number of track available in the TD. Depending on the circumstances, one of three types of haul selection strategies is used:

Type I haul selection strategy is used when the number of hauls selected in a given stratum does not exceeds the number of sub-units for that stratum with one or more tracks included. A number of sub-units, which equal to the selected number of selected hauls, are randomly selected. The selection is made without replacement. For those sub-units where more than one track are identified, one of those tracks is selected randomly.

Type II haul selection strategy is used when the number of hauls selected in a given stratum does exceeds the number of sub-units for that stratum with one or more tracks included, but the number of hauls selected does not exceeds the number of tracks available. In this case, one track is selected in each sub-unit and the rest of the hauls are randomly selected among the remaining tracks available in the given stratum.

Type III haul selection strategy is used when type II does not provide sufficient available tracks to fulfil the number of hauls selected. In this case, the type II selection strategy is used for as many hauls as possible (equals the number of tracks available) and the remaining hauls are selected by use of so called “Strata adjustments”. Strata adjustments are manually reallocation of hauls in the TB from strata where there are tracks available, which have not yet been selected in the haul allocation procedure. The choice of which strata shall be used for the strata adjustment is a subjective decision based on an idea about the degrees of similarity between the original stratum and the substituted stratum.

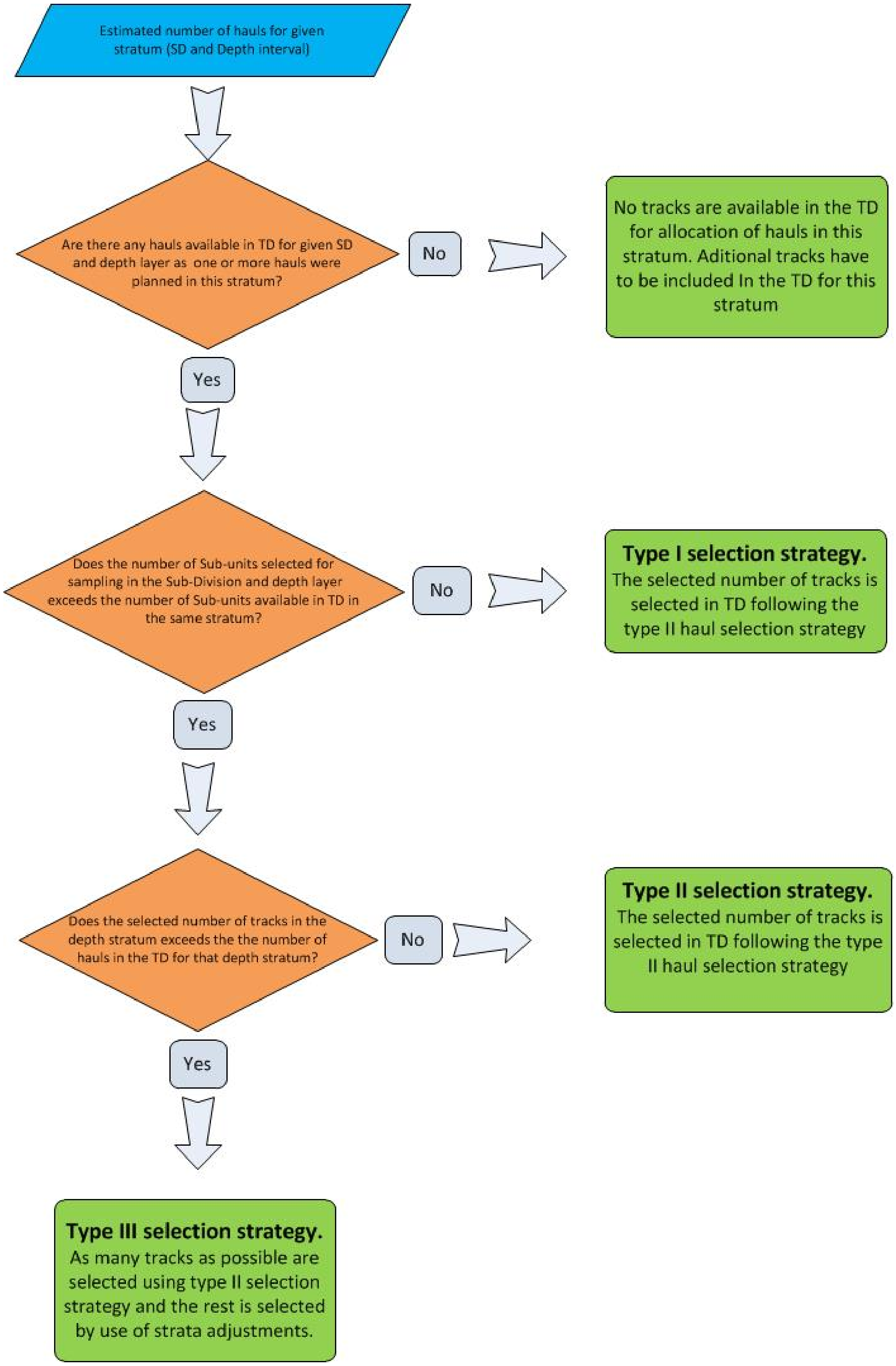


Figure 2. Decision diagram leading to selection of tracks from the Trawl Database (TD). See text for description of Type I, II and III selection strategy.

Distribution of the selected hauls between the countries involved
(Part 3 in the R-program)
When the total agreed tracks are selected in the database, the next step is to distribute these between the countries involved in the BITS according to the numbers of hauls committed by each country.
The distribution is based on logistic considerations about distances between hauls, the necessity for permissions to enter foreign national EEZs and some countries demand of only to operate in own national EEZ. The program considers these issues but do not take into account the numbers of hauls committed by each country. Based on the initial allocation between countries done by the program, the distribution has to be fine-tuned according to the numbers of hauls committed by each country. This is done manually…..
Finally, the program maps the hauls by country and print the list of allocated hauls in various formats specially designed to be used by the cruise leader, the research vessel skipper, the cruise report writer etc.

The possibility to requesting extra hauls during the survey
(Part 4 in the R-program)
This part of the program is a new feature and it has to be discussed and agreed during the WGBIFS meeting in March 2017 before it can be launched.
Many countries include a certain margin when planning the number of days needed for carrying out the number of hauls they have committed themselves for. This is because the experience tells that the weather not always allows fishing in the whole period. This means, that if the weather is fine during the whole cruise and nothing else happens which prevent fishing, one or two days might be in excess at the end of the cruise. In order to fully utilize the ship time allocated to the cruise, a 4th part of the r-program has been developed, which select additionally hauls without violating the random condition of the survey design.
The conditions, which must be obeyed if not to violate the random condition of the survey design is:

- The original hauls allocated must be fished before any extra hauls are fished
- The extra hauls must be requested for a certain Sub-division and Depth interval.
- All the requested extra hauls have to be carried out.
- The fishing of the extra hauls has to follow the instructions in the BITS manual

The extra hauls must be requested by mailing the TD administrator hd@aqua.dtu.dk and XXXXXXXXX as backup.
The extra hauls will be drawn in the TD among the remaining hauls not already used for the initial standard haul allocation and **only hauls within the EEZ of the requesting country will be considered**.

Time wheel for the administration of the BITS haul allocation procedure
The delivery from the Trawl Database is linked to various external events. Therefore, it is necessary to keep some deadlines for input to the TD. The most significant is the Baltic Fish Assessment Working Group in April and the fixed BITS survey in March (1st quarter) and October/November (4th quarter). These events determine the time schedule for the other activities in connection with the database. Previous to a survey the hauls must be assigned to each country and this allocation should be based on the

most resent possible update of the database. Therefore, the feedback from previous survey must be submitted in due time before the survey. Because some countries require up to 6 month to handle the access of foreign vessel into the EZZ and because the exact positions have to be stated in the application, the haul allocation has to be done already soon after the WGBITS meeting in order to be ready for the 4th quarter survey. The haul allocation is normally made at the same time for the following 1st quarter survey because there is not sufficient time between 4th quarter survey and 1st quarter survey to include the TD feedback from the 4th quarter survey in the following years 1st quarter survey. The time schedule wheel for the TD including the haul allocation procedure is given in figure 3.

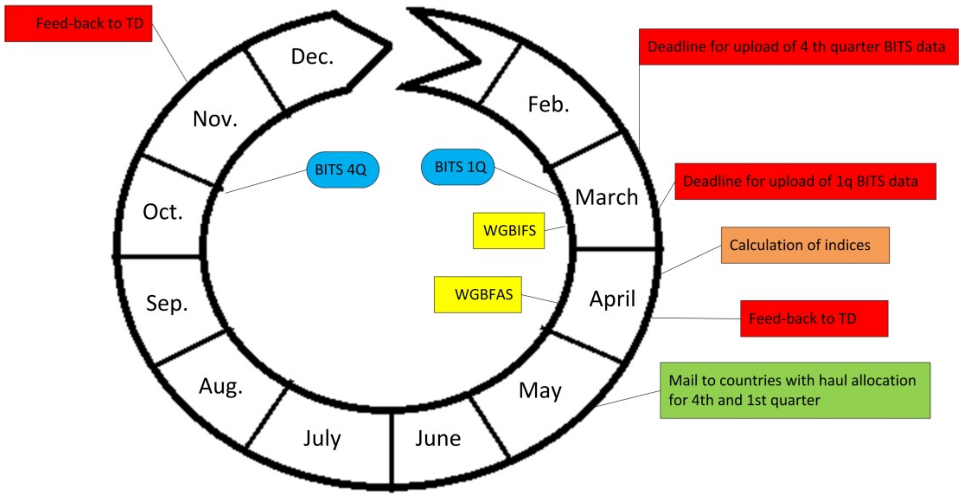


Figure 3. The time schedule wheel for the TD.

Annex 1

Detailed description of calculating of CPUE input values
From the DATRAS homepage:
(https://datras.ices.dk/Data_products/Download/Download_Data_public.aspx)
are the following data tables downloaded:

CPUE per age per area (present year-6 to present year-1, 1st quarter, all subdivisions)

CPUE per age per subarea (present year-6 to present year-1, 1st quarter, all subdivisions)

The CPUE(age1+) is calculated by summing all ages >0 (i.e. Age1 to Age10) for each age and subdivision or for each age, subdivision and depth stratum (=subarea in DATRAS). Finally, the mean of the five years are calculated for all sub-divisions or depth strata by sub-division. The results are saved as csv-files in the formats of the examples below.
Example of the "CpueDepthDist.csv" and "CpueSDDist.csv" input files

SD	DepthInterval	Layer	Cpue
22	10 - 39	2	158.1
22	40 - 59	3	0
22	60 - 79	4	0
22	80 - 99	5	0
22	100 - 119	6	0
24	10 - 39	2	93
24	40 - 59	3	297.4
24	60 - 79	4	1619.5
24	80 - 99	5	0
24	100 - 119	6	0
25	20 - 39	2	252.1
25	40 - 59	3	2144.7
25	60 - 79	4	2134.2
25	80 - 99	5	1083.7
25	100 - 119	6	0
26	20 - 39	2	102.8
26	40 - 59	3	699.3
26	60 - 79	4	1106.1
26	80 - 99	5	846.8
26	100 - 119	6	87
27	10 - 39	2	0
27	40 - 59	3	6.1
27	60 - 79	4	164.8
27	80 - 99	5	101.2
27	100 - 119	6	0
28	10 - 39	2	3.3
28	40 - 59	3	37.6
28	60 - 79	4	82.8
28	80 - 99	5	28.4
28	100 - 119	6	0

SD	AreaSection	Cpue
22	2224	158.1
23	2224	1469.9
24	2224	562.2
25	2528	1424.4
26	2528	608.9
27	2528	90
28	2528	46.7

Headings: “SD”= Sub-division,
“DepthInterval”= Depth interval for the corresponding “Layer”,”Cpue”= catch per unit effort, “AreaSection”= Sub-division assemble (Kattegat and Western Baltic Sea=”2224” and Eastern Baltic Sea= “2528”.
BITS depth layer SD 21-24

Annex 2

The R program

The complete program consists of 3 parts:

Part 1 Compilation of the number of hauls in each Sub-division and depth layer

Part 2 Drawing of the identified number of hauls in the Trawl database

Part 3 Allocation of the drawn tracks to the individual countries

The program is attempted to be self-explaining with extended use of comments and guidance both in the log window and in the code.

The following input files have to be prepared before the program can be executed:

AreaDepthLayerDist.csv (Areas of depth layers, no update needed)

AreaSDDist.csv (areas of sub-divisions, no update needed)

CpueDepthDist.csv (CPUE by Sub-division and depth strata of the most resent 5 years)

CpueSDDist.csv (CPUE by depth strata of the most resent 5 years)

PlannedStations.csv (Number of hauls by country as agreed during WGBIFS)

The input and output directories stated has to be changed according to the file structure on the executing PC.

R source codes

Part 1

```
###############################################################################################
###########################
#Part 1 of Haul allocation program for BITS (stratified random sampling)

#Calculates the number of hauls to be allocated to each depth layer in each Sub-division

# 1.  Update the assigned number of hauls by country by quarter (file:PlannedStations) from the
WGBIFS report
# 2.  Update the running mean of CPUE of 1+ cod (5 resent years) by            1) Subdivision
#                                                                              2) Sub-division, Depth
layer
# 3.  Select the Quarter in line 33
# 4.  Assure that the rounding adjustments (line 128-131) are all "0"
# 4.  Compare total number of planned stations (file:PlannedStations) with the file: NHaulPlanned and
adjust the numbers in lines 128-131 if needed
# 4.  Rerun line 128 and out
# 4.  RUN the PROGRAM "Allocation of BITS stations Part 2" and "Allocation of BITS stations Part 3"

#output: CSV-file stating the number of hauls to be allocated to each depth layer in each Sub-division
###############################################################################################
###########################
install.packages("plyr")
library(plyr)
#READ INPUT FILES
#Area per SD (Fixed, WGBFAS-report):
AreaSDDist<-read.table("H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS
stations/AreaSDDist.csv",header=TRUE,sep=";")
#Area per SD (Fixed, WGBFAS-report):
AreaDepthLayerDist<-read.table("H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of
BITS stations/AreaDepthLayerDist.csv",header=TRUE,sep=";")
#Runnin mean of 5 previous yers CPUE(cod) per SD (DATRAS):
CpueSDDist<-read.table("H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS
stations/CpueSDDist.csv",header=TRUE,sep=";")
#Runnin mean of 5 previous yers CPUE(cod) per depth strata (DATRAS):
```

```
CpueDepthDist<-read.table("H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS
stations/CpueDepthDist.csv",header=TRUE,sep=";")
#Number of planed stations (WGBFAS-report):
PlannedStations<-read.table("H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS
stations/PlannedStations.csv",header=TRUE,sep=";")

##################################################################
#  QUARTER IS SELECTED:
   Quarter<-1
##################################################################

#        SPECIAL RULES AGREED BY THE WGBIFS
#  Denmark takes always 5 hauls in SD 23:
   FixedNHaulsDK23<-5
   FixedCPUEDK23<-0

#  Sweden takes always 10 hauls in SD 27:
   FixedNHaulsSWE27<-10
   FixedCPUESWE27<-0

#  Germany always takes 45 hauls in SD 24. All other planned hauls in AreaSection 2124 minus hauls
of Havfisken in SD 21 are allocated to SD 22
   FixedNhaulsGER24<-45

#  Number of fixed stations taken in Kattegat (sd21) by Denmark:
   FixedNHaulsDK21<-0

#################################################################
#Abowe adjustments are implemented:
PlannedStations<-PlannedStations[PlannedStations$Quarter==Quarter,]
CpueSDDist$CpueAdj <- CpueSDDist$Cpue
CpueSDDist[CpueSDDist$SD==23,"CpueAdj"] <- FixedCPUEDK23
CpueSDDist[CpueSDDist$SD==27,"CpueAdj"] <- FixedCPUESWE27
PlannedStations[PlannedStations$Vessel=="Havfisken","PlannedNumberOfHauls"] <-
PlannedStations[PlannedStations$Vessel=="Havfisken","PlannedNumberOfHauls"]-
FixedNHaulsDK21


require(stats)

#The number of hauls by Sub-division (including abowe adjustments) is calculated based on the
relative distributions calculated
#based on a weighted input of area (0.6) and CPUE (0.4)
#Area per AreaSection is calculated:
temp<-(tapply(AreaSDDist$Area,AreaSDDist$AreaSection, FUN=sum))
temp = data.frame( AreaSection = names(temp), SumArea=temp)
distSDArea<- merge(AreaSDDist, temp, all.x=TRUE)
#Relative area distribution per SD is calculated:
distSDArea$RelArea<-distSDArea$Area/distSDArea$SumArea*100

#CPUE per AreaSection is calculated:
temp<-(tapply(CpueSDDist$CpueAdj,CpueSDDist$AreaSection, FUN=sum))
temp = data.frame( AreaSection = names(temp), SumCpue=temp)
```

```
distSDCpue<- merge(CpueSDDist, temp, all.x=TRUE)

#Relative CPUE distribution per SD is calculated:
distSDCpue$RelCpue<-distSDCpue$CpueAdj/distSDCpue$SumCpue*100
SDHaulDist<-merge(distSDArea,distSDCpue)

temp <- ddply(PlannedStations, c("Quarter","AreaSection"),summarize,
SumPlannedStations=sum(PlannedNumberOfHauls))

SDStationAlocation<- merge(SDHaulDist, temp, all.x=TRUE)
#Fixed number of stations in Kattegat is deducted:



SDStationAlocation$NHaulsRel<-
((0.6*SDStationAlocation$RelArea)+(0.4*SDStationAlocation$RelCpue))/100

SDStationAlocation$SumPlannedStationsAdj<-SDStationAlocation$SumPlannedStations
SDStationAlocation[SDStationAlocation$AreaSection==2224,"SumPlannedStationsAdj"] <-
SDStationAlocation[SDStationAlocation$AreaSection==2224,"SumPlannedStations"]-
FixedNHaulsDK23
SDStationAlocation[SDStationAlocation$AreaSection==2528,"SumPlannedStationsAdj"] <-
SDStationAlocation[SDStationAlocation$AreaSection==2528,"SumPlannedStations"]-
FixedNHaulsSWE27

SDStationAlocation$NHaulsPrim<-
SDStationAlocation$NHaulsRel*SDStationAlocation$SumPlannedStationsAdj
SDStationAlocation$NHaulsSD<-SDStationAlocation$NHaulsPrim

#The number per SD is adjusted with the SPECIAL RULES AGREED BY THE WGBIFS:
SDStationAlocation[SDStationAlocation$SD==24,"NHaulsSD"] <-
PlannedStations[(PlannedStations$Country=="Poland") &
(PlannedStations$AreaSection==2224),"PlannedNumberOfHauls"]+FixedNhaulsGER24
SDStationAlocation[SDStationAlocation$SD==23,"NHaulsSD"] <- FixedNHaulsDK23
SDStationAlocation[SDStationAlocation$SD==22,"NHaulsSD"] <-
SDStationAlocation[SDStationAlocation$SD==22,"SumPlannedStations"] -
SDStationAlocation[SDStationAlocation$SD==23,"NHaulsSD"] -
SDStationAlocation[SDStationAlocation$SD==24,"NHaulsSD"]
SDStationAlocation[SDStationAlocation$SD==27,"NHaulsSD"] <- FixedNHaulsSWE27

SDStationAlocation$NHaulsSD<-round(SDStationAlocation$NHaulsSD,0) #(This file can be used for
check of haul distribution by SD)
SDStatAlocation<-SDStationAlocation [,c("SD", "AreaSection", "Quarter", "NHaulsSD")]

#The number of hauls by Sub-division and depth stratum is calculated based on the number of hauls
by SD calculated above:
temp<-(tapply(AreaDepthLayerDist$Area,AreaDepthLayerDist$SD, FUN=sum))
temp = data.frame( SD = names(temp), SumArea=temp)
distDepth<- merge(AreaDepthLayerDist, temp, all.x=TRUE)
distDepth$RelDepth<-distDepth$Area/distDepth$SumArea

temp<-(tapply(CpueDepthDist$Cpue,CpueDepthDist$SD, FUN=sum))
temp = data.frame( SD = names(temp), SumCpue=temp)
```

```
distCpue<- merge(CpueDepthDist, temp, all.x=TRUE)
distCpue$RelCpue<-distCpue$Cpue/distCpue$SumCpue
DepthStationAlocation<-merge(distDepth,distCpue)

DepthStationAlocation$NHaulsDepthRel<-
((0.6*DepthStationAlocation$RelDepth)+(0.4*DepthStationAlocation$RelCpue)) #(This file can be used
for check of haul distribution by depth strata)
DepthStatAlocation<-DepthStationAlocation [,c("SD", "DepthInterval", "Layer", "NHaulsDepthRel")]

NHaulPlanned<-merge(SDStatAlocation, DepthStatAlocation)
NHaulPlanned$NHauls<-round(NHaulPlanned$NHaulsDepthRel*NHaulPlanned$NHaulsSD,0)
NHaulPlanned<-NHaulPlanned [,c("AreaSection","SD", "Quarter","DepthInterval", "Layer",
"NHauls")]
##################################################################
#Final adjustment due to rounding errors.
#   Initialy no adjustments should be made (all set to "0")
##################################################################
NHaulPlanned[NHaulPlanned$SD==25 & NHaulPlanned$Layer==2,"NHauls"] <-
NHaulPlanned[NHaulPlanned$SD==25 & NHaulPlanned$Layer==2,"NHauls"]-0
NHaulPlanned[NHaulPlanned$SD==26 & NHaulPlanned$Layer==4,"NHauls"] <-
NHaulPlanned[NHaulPlanned$SD==26 & NHaulPlanned$Layer==4,"NHauls"]-0

#Add as many strata as needed
##################################################################

write.table(NHaulPlanned, "H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS
stations/NHaulPlanned.csv", sep=";")

Part 2
##########################################################################################
######################################
#Part 2 of Haul allocation program for BITS (stratified random sampling)

#The program selects the hauls to be allocated to each depth layer in each Sub-division from the Trawl
Database (TD)

# Part 1 of Haul allocation program for BITS has to be run previous to this

# 1.  RUN FIRST STEP TO LINE 194
# 2.  ADJUST THE STRATA FOR THE ADDITIONAL SELECTION BY USE OF "STRATA
ADJUSTMENTS" (step 2) BASED ON COMMENTS IN LOG
#     AND BY INSPECTION OF "AdditionalSelect" and "MSamplePopulation"
# 3.  RUN SECOND STEP FROM LINE 196 AND OUT.
# 4.  RUN the PROGRAM "Allocation of BITS stations Part 3"

#output: CSV-file listing the haul numbers in TD to be distributed among participating countries
##########################################################################################
######################################
NHaulPlanned <- read.table("H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS
stations/NHaulPlanned.csv", sep=";")
NHaulPlanned <- NHaulPlanned [NHaulPlanned$NHauls>0,]
#TD data  from all Sub-Division is read
```

```
TD<-read.table("H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS
stations/TD_2016_V1 HD version.csv",header=TRUE,sep=";")

TD <-TD [,c("NrHaul", "RectangleAlpha", "ICES.SD", "Latitude1_deg", "Latitude1_dec_min",
"Longitude1_deg", "Longitude1_dec_min", "Layer", "EEZ")]
#Each haul is allocated to a Rec9 (=sub split of each ICES Statistical Rectangle into 9 sub-rectangles):
TD$latGr<- floor(floor(TD$Latitude1_dec_min)/10)+1
TD$latGr1<- ifelse(TD$latGr>3, TD$latGr -3, TD$latGr)
TD$lonGr<- (floor(floor(TD$Longitude1_dec_min)/20)+1)
TD$Rec9<- ifelse(TD$latGr1>1, TD$lonGr +3, TD$lonGr)
TD$Rec9<- ifelse(TD$latGr1>2, TD$Rec9 +3, TD$Rec9)
TD$Rec9<-paste(TD$RectangleAlpha, TD$Rec9)
TD <-TD [,c("NrHaul", "RectangleAlpha", "ICES.SD", "Latitude1_deg", "Latitude1_dec_min",
"Longitude1_deg", "Longitude1_dec_min", "Layer", "EEZ", "Rec9")]

#...and the list for random selection of SubRec9 is made:
Rec9List<-unique(TD [,c("RectangleAlpha","Rec9", "ICES.SD", "Layer")])

Allocated1<- NULL
Allocated2<- NULL
Allocated3<- NULL
census<-NULL
census1<-NULL
Type2add<-NULL
Type3add<-NULL
Selectedhauls1<-NULL
ManualSelec1<-NULL
ManualSelec2<-NULL
AdditionalSelect1<-NULL
AdditionalSelect2<-NULL
AddHaulsToBeSelected<-NULL

subNHaulPlannedSD<-unique(NHaulPlanned ["SD"])


for (i in subNHaulPlannedSD$SD)  #SubDiv
 {
 subNHaulPlanned<-NHaulPlanned[NHaulPlanned$SD==i,]
 Allocated2<- NULL
 for (j in subNHaulPlanned$Layer) #DepthInterval

   {

   SubRec9TotalList <- Rec9List[Rec9List$ICES.SD==i & Rec9List$Layer==j,]

   if (nrow(SubRec9TotalList)==0)
   {
     SubNHaulspl<-NHaulPlanned[NHaulPlanned$SD==i & NHaulPlanned$Layer==j,]

     p<-SubNHaulspl$NHauls

     tekst1<-paste("...
```

```
Information:No hauls availble in TD for SD ",i," and depth layer",j,"even though",p,"hauls were
planned in this stratum
                .........................................................................")
    cat(tekst1)

    tekst2<-paste("...
GUIDENCE:",p,"hauls have to be selected by use of strata adjustments for SD ",i," and depth
layer",j,"(",p,",0 hauls)
                .........................................................................")
    cat(tekst2)

   ManualSelec1$SD<-i
   ManualSelec1$Layer<-j
   ManualSelec1$N<-p
   remain1 <- data.frame(ManualSelec1)
   AdditionalSelect1<-rbind(AdditionalSelect1, remain1)

   }else{
    SubRec9TotalList <- SubRec9TotalList[,c("RectangleAlpha","Rec9", "ICES.SD", "Layer")]
    SubRec9TotalList$ID <- 1:nrow(SubRec9TotalList)
    SubAntHauls<-NHaulPlanned[NHaulPlanned$SD==i & NHaulPlanned$Layer==j,]     #Number of
hauls to be drawn in SD, Layer
    SubRec9TotalList$Count<-1
    temp1<-(tapply(SubRec9TotalList$Count,SubRec9TotalList$Count, FUN=sum))
    availRec9 = data.frame(TDcheck = names(temp1), SumRec9=temp1)

   if (SubAntHauls$NHauls> availRec9$SumRec9) {
    m<-SubAntHauls$NHauls
    n<-availRec9$SumRec9

    tekst3<-paste("...
Information: (-> Type II or Type III) The number of different Sub-rectangles selected for sampling in
Sub-Div",i,"depth layer",j,"
is larger than the number of Sub-rectangles available in the same stratum in TD. (",m,"hauls,",n,"sub-
rec.)
.........................................................................")
    cat(tekst3)

    censusHauls<-TD[TD$ICES.SD==i & TD$Layer==j,]
    censusHauls$Count<-1
    censusHauls$ID <- 1:nrow(censusHauls)
    temp2<-(tapply(censusHauls$Count,censusHauls$Count, FUN=sum))
    availHauls = data.frame(TDcheck1 = names(temp2), SumHauls=temp2)

      if (SubAntHauls$NHauls> availHauls$SumHauls) {
       #Type III. inkluder alle tilgængelige træk (i,j) i selected hauls (resten trækkes manuelt fra andre
strata)
       a<-availHauls$SumHauls
       Nmissing2<-m-a
       tekst4<-paste("...
GUIDENCE: (Type III)" ,Nmissing2,"hauls have to be selected by use of strata adjustments from
another stratum because of insuficient number
of hauls in the TD in Sub-Div",i,"depth layer",j,". (",m,",",a,"hauls.)
```

```
........................................................................")
          cat(tekst4)
          censusHauls$Type<-3
          Type3ad<-censusHauls[,c("NrHaul","Type")]
          Type3add<-rbind(Type3add, Type3ad)
          Type3ad<-NULL
          ManualSelec2$SD<-i
          ManualSelec2$Layer<-j
          ManualSelec2$N<-Nmissing2
          remain2 <- data.frame(ManualSelec2)
          AdditionalSelect2<-rbind(AdditionalSelect2, remain2)

        } else{
          #Type II. træk det planlagte antal træk fra tilgængelige træk i stratum (i,j,k)
          b<-availHauls$SumHauls
          Nmissing3<-m
          ID<-sample(1:nrow(censusHauls), SubAntHauls$NHauls, replace=FALSE)

          SubSelectedIDRec9 <- data.frame(ID)                              #Selected hauls in SD, Layer
          Type2ad<- merge(censusHauls, SubSelectedIDRec9, by="ID", all.selected=FALSE)
          Type2ad$Type<-2
          Type2ad<-Type2ad[,c("NrHaul", "Type")]
          Type2add<-rbind(Type2add, Type2ad)
          Type2ad<-NULL

          tekst5<-paste("...
Information: (Type II.)" ,Nmissing3,"hauls has been selected for sampling in Sub-Div",i,"depth
layer",j,"
where the number of hauls planned is bigger than the number of Rec9 available
but the number of hauls available in TD is sufficient.(",m,",",b,"hauls.)
........................................................................")
          cat(tekst5)
          }

      } else  {
        #Type I. træk det planlagte antal Rec9 fra tilgængelige Rec9 i stratum (i,j)
        ID<-sample(1:nrow(SubRec9TotalList), SubAntHauls$NHauls, replace=FALSE)
        SubSelectedIDRec9 <- data.frame(ID)                              #Selected hauls in SD, Layer
        SubSelecRec9ad<- merge(SubRec9TotalList, SubSelectedIDRec9, by="ID", all.selected=FALSE)
        SubSelecRec9ad$Count<-1
        temp<-tapply(SubSelecRec9ad$Count, SubSelecRec9ad$Rec9, FUN=sum)
        SubNumberRec9 = data.frame(Rec9 = names(temp), SumHauls=temp)

      for (k in SubNumberRec9$Rec9)  #Sub-Rectangle
        {
        #Type I. træk det planlagte antal træk fra tilgængelige træk i stratum (i,j,k)

        Type1HaulAvail<-TD[TD$ICES.SD==i & TD$Layer==j & TD$Rec9==k,]
        Type1HaulAvail$ID <- 1:nrow(Type1HaulAvail)
        Type1HaulAvail<-Type1HaulAvail[,c("NrHaul", "ID")]
        Type1HaulAvail <- data.frame(Type1HaulAvail)
        Type1SubNumberHauls<- SubNumberRec9[SubNumberRec9$Rec9==k,]
        ID<-sample(1:nrow(Type1HaulAvail), Type1SubNumberHauls$SumHauls, replace=FALSE)
```

```
        Type1add <- data.frame(ID)
        Type1add<- merge(Type1add, Type1HaulAvail, by="ID", all.selected=FALSE)
        Type1add$Type<-1
        Allocated1<-rbind(Allocated1, Type1add)
        }
      Allocated2<-rbind(Allocated2, Allocated1)
      Allocated1<-NULL
       }
      }}
    Allocated3<-rbind(Allocated3, Allocated2)

    }

Allocated3<-Allocated3[,c("NrHaul","Type")]
Selectedhauls1<-rbind(Allocated3,Type3add,Type2add)
Selectedhauls1$sekvens<-order(Selectedhauls1$NrHaul)
Selectedhauls1<-Selectedhauls1[Selectedhauls1$sekvens,]
Selectedhauls<- merge(Selectedhauls1, TD, by="NrHaul", all.selected=FALSE)
NHaulSelected<-nrow(Selectedhauls)
NHaulPlannedTotal<-sum(NHaulPlanned$NHauls)
Missing<-NHaulPlannedTotal-NHaulSelected
tekst6<-paste("...
Information: In all areas a total of",Missing,"hauls have to be selected by use of strata adjustments.
......................................................................")
cat(tekst6)
write.table(Selectedhauls, "H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS
stations/list of allocated hauls.csv", sep=";")

# SECOND STEP:  Selection the remaining planned hauls by use of strata adjustments

NrHaul<-(TD [,c("NrHaul")])
TDIndex<-data.frame(NrHaul)
NrHaul<-(Selectedhauls [,c("NrHaul")])
IndexSelected <- data.frame(NrHaul)
IndexSelected$Marker<-1
MSamplePop<-merge(TDIndex,IndexSelected, by= "NrHaul", all=TRUE)
MSamplePop$Marker[is.na(MSamplePop$Marker)] <- 0
MSamplePop<-MSamplePop[MSamplePop$Marker==0,]
MSamplePopulation<-merge(TD,MSamplePop, by= "NrHaul", all.selected=FALSE)

#options(error = utils::recover)

AdditionalSelect<-rbind(AdditionalSelect1, AdditionalSelect2)
ModAdditionalSelect<-AdditionalSelect
ModAdditionalSelect$cond<-paste(ModAdditionalSelect$SD, ModAdditionalSelect$Layer, sep="")

#   implementation of strata adjustment of not succesful haul allocations
#   Based on inspection of "AdditionalSelect" and "MSamplePopulation" the substituting Layer is
defined below
#   ModAdditionalSelect$cond defined as concatenating of "SD" and "Layer"

ModAdditionalSelect$Layer[ModAdditionalSelect$cond==244] <- 3
ModAdditionalSelect$Layer[ModAdditionalSelect$cond==252] <- 3
```

```
ModAdditionalSelect$Layer[ModAdditionalSelect$cond==275] <- 6
ModAdditionalSelect$Layer[ModAdditionalSelect$cond==282] <- 3

ModAdditionalSelect$cond<-paste(ModAdditionalSelect$SD, ModAdditionalSelect$Layer, sep="")

for (l in ModAdditionalSelect$cond)  #SubDivLayer
{
  AddHaulsToBeSelectedadd<-NULL
  i<-substr(l,1,2)
  j<-substr(l,3,3)

  SubMSamplePopulation<-MSamplePopulation[MSamplePopulation$ICES.SD==i &
MSamplePopulation$Layer==j,]
  Nrhaul1<- SubMSamplePopulation[,c("NrHaul")]
  SubMSamplePopulation <- data.frame(Nrhaul1)
  SubMSamplePopulation$ID <- 1:nrow(SubMSamplePopulation)
  SubAdditionalSelect<-ModAdditionalSelect[ModAdditionalSelect$SD==i &
ModAdditionalSelect$Layer==j,]
  ID<-sample(1:nrow(SubMSamplePopulation), SubAdditionalSelect$N, replace=FALSE)
  AddHaulsToBeSelectedadd <- data.frame(ID)
  AddHaulsToBeSelectedadd<-merge(AddHaulsToBeSelectedadd, SubMSamplePopulation, by= "ID",
all.selected=FALSE)
  AddHaulsToBeSelectedadd$NrHaul<-AddHaulsToBeSelectedadd$Nrhaul1
  AddHaulsToBeSelectedadd<-merge(AddHaulsToBeSelectedadd, MSamplePopulation, by=
"NrHaul", all.selected=FALSE)
  AddHaulsToBeSelected<-rbind(AddHaulsToBeSelected, AddHaulsToBeSelectedadd)
}
check<-AddHaulsToBeSelected
check$count<-1
z<-(tapply(check$count,check$Marker, FUN=sum))

tekst7<-paste("...
Check: In all areas a total of",z,"hauls have been selected by use of strata adjustments out
of",Missing,"requested.
              .....................................................................")


HaulsToBeFished1<-Selectedhauls[,c("NrHaul", "RectangleAlpha", "ICES.SD", "Latitude1_deg",
"Latitude1_dec_min", "Longitude1_deg", "Longitude1_dec_min", "Layer", "EEZ")]
HaulsToBeFished2<-AddHaulsToBeSelected[,c("NrHaul", "RectangleAlpha", "ICES.SD",
"Latitude1_deg", "Latitude1_dec_min", "Longitude1_deg", "Longitude1_dec_min", "Layer", "EEZ")]
TotalHaulsToBeFished<-rbind(HaulsToBeFished1, HaulsToBeFished2)


write.table(TotalHaulsToBeFished, "H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of
BITS stations/list of totalallocated hauls.csv", sep=";")
cat(tekst7)

TD$Latitude1_deg_dec<-(TD$Latitude1_dec_min/60*100/100)+TD$Latitude1_deg
TD$Longitude1_deg_dec<-(TD$Longitude1_dec_min/60*100/100)+TD$Longitude1_deg

write.table(TD, "H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS stations/TD for
plotting.csv", sep=";")
```

Part 3
The final output file is called “list of totalallocated hauls processed.csv” and lists the selected tracks in the Trawl database to be carried out by the participants of the BITS. The file can be imported to EXCEL and the tracks can subsequently be distributed between the countries according to the commitments list (PlannedStations.csv).

```
#Processes the output from Part2
################################################################################
##################################################
#Part 3 of Haul allocation program for BITS (stratified random sampling)

#The program allocate a priori the hauls selected by "Haul allocation program for BITS Part 2".

#Haul allocation program for BITS Part 1 and Haul allocation program for BITS Part 2 have to be run previous to this.

# 1.  RUN FIRST STEP TO LINE 46.
# 2.  MANUALLY SHIFT AROUND AND ADJUST THE DISTRIBUTION BETWEEN COUNTRIES SO IT FITS THE NATIONAL PLANNED NUMBER OF HAULS
#     BY INSPECTION OF "PlannedStations" and "NHaulPlanned".
# 3.  RUN SECOND STEP FROM LINE 52 AND OUT.


#output: CSV-file listing the haul numbers in TD to be distributed among participating countries and maps by country of hauls distributed
################################################################################
#####################################################

#STEP 1
TotalHaulsToBeFished <- read.table("H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS stations/list of totalallocated hauls.csv", sep=";")
TotalHaulsToBeFished$Latitude1_deg_dec<-(TotalHaulsToBeFished$Latitude1_dec_min/60*100/100)+TotalHaulsToBeFished$Latitude1_deg
TotalHaulsToBeFished$Longitude1_deg_dec<-(TotalHaulsToBeFished$Longitude1_dec_min/60*100/100)+TotalHaulsToBeFished$Longitude1_deg
TotalHaulsToBeFished[TotalHaulsToBeFished$ICES.SD<25,"codstock"]<-"21-24"
TotalHaulsToBeFished[TotalHaulsToBeFished$ICES.SD>24,"codstock"]<-"25-32"
TotalHaulsToBeFished$country<-"notassigned"
TotalHaulsToBeFished[TotalHaulsToBeFished$codstock=="21-24" & TotalHaulsToBeFished$EEZ=="DEN","country"]<-"DEN (SD 21-24)"
TotalHaulsToBeFished[TotalHaulsToBeFished$ICES.SD==27 & TotalHaulsToBeFished$codstock=="25-32","country"]<-"SWE (SD 25-32)"
TotalHaulsToBeFished[TotalHaulsToBeFished$ICES.SD==24,"country"]<-"GFR (SD 21-24)"
TotalHaulsToBeFished[TotalHaulsToBeFished$EEZ=="grey","country"]<-"DEN (SD 25-32)"
TotalHaulsToBeFished[TotalHaulsToBeFished$codstock=="21-24" & TotalHaulsToBeFished$EEZ=="POL","country"]<-"POL (SD 21-24)"
```

```
TotalHaulsToBeFished[TotalHaulsToBeFished$codstock=="25-32" &
TotalHaulsToBeFished$EEZ=="POL","country"]<-"POL (SD 25-32)"
TotalHaulsToBeFished[TotalHaulsToBeFished$EEZ=="LTU","country"]<-"LTU (SD
25-32)"
TotalHaulsToBeFished[TotalHaulsToBeFished$EEZ=="RUS","country"]<-"RUS (SD
25-32)"
TotalHaulsToBeFished[TotalHaulsToBeFished$EEZ=="EST" |
TotalHaulsToBeFished$EEZ=="LAT","country"]<-"LAT (SD 25-32)"

TotalHaulsToBeFished[TotalHaulsToBeFished$EEZ=="DEN" &
TotalHaulsToBeFished$ICES.SD>24,"country"]<-"DEN (SD 25-32)"
TotalHaulsToBeFished[TotalHaulsToBeFished$EEZ=="GFR" &
TotalHaulsToBeFished$codstock=="21-24","country"]<-"GFR (SD 21-24)"
TotalHaulsToBeFished[TotalHaulsToBeFished$EEZ=="SWE" &
TotalHaulsToBeFished$codstock=="25-32","country"]<-"SWE (SD 25-32)"
TotalHaulsToBeFished[TotalHaulsToBeFished$RectangleAlpha=="37G0"|TotalHauls
ToBeFished$RectangleAlpha=="37G1"|TotalHaulsToBeFished$RectangleAlpha=="37
G2","country"]<-"GFR (SD 21-24)"
TotalHaulsToBeFished[TotalHaulsToBeFished$RectangleAlpha=="39G5"|TotalHauls
ToBeFished$RectangleAlpha=="40G6"|TotalHaulsToBeFished$RectangleAlpha=="40
G7"|

TotalHaulsToBeFished$RectangleAlpha=="41G8"|TotalHaulsToBeFished$RectangleA
lpha=="41G7","country"]<-"DEN (SD 25-32)"
TotalHaulsToBeFished[TotalHaulsToBeFished$RectangleAlpha=="43G8"|TotalHauls
ToBeFished$RectangleAlpha=="43G9"|TotalHaulsToBeFished$RectangleAlpha=="44
G9"|

TotalHaulsToBeFished$RectangleAlpha=="45G7"|TotalHaulsToBeFished$RectangleA
lpha=="42G8"|

TotalHaulsToBeFished$RectangleAlpha=="45G9"|TotalHaulsToBeFished$RectangleA
lpha=="45G8","country"]<-"SWE (SD 25-32)"

TotalHaulsToBeFished[TotalHaulsToBeFished$RectangleAlpha=="40G5" &
TotalHaulsToBeFished$EEZ=="DEN","country"]<-"DEN (SD 25-32)"
write.table(TotalHaulsToBeFished, "H:/Active nonsystem/ICES
WG/WGBIFS/Surveys/Allocating of BITS stations/list of totalallocated hauls
processed.csv", sep=";")
#library(dismo)
#library(raster)
#library(marmap)
library(rgdal)
library("RODBC")
#library(maptools)
#library(rasterVis)
#library(grid)
library(mapplots)
library(shapefiles)
setwd("H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Allocating of BITS stations")
```

```
coast <-
read.shapefile('Y:/Dynamisk/GEOdata/BasicLayers/CoastLines/Europe/europe')
latlon <- CRS("+proj=longlat +datum=WGS84")
test2 <- TotalHaulsToBeFished
test2<-test2[,c("country")]
test2<-unique(test2)

for (countr in test2)
{
  CountryTotalHaulsToBeFished<-
TotalHaulsToBeFished[TotalHaulsToBeFished$country==countr,]

  test <- CountryTotalHaulsToBeFished
  test1<-test[,c("country")]
  test1<-unique(test1)

  coordinates(test) <- c("Longitude1_deg_dec", "Latitude1_deg_dec")
  proj4string(test) <- latlon

  #Set the limit of the plot to +/- 10% of the extent of the points
  xfactor <- (bbox(test)[1,2]-bbox(test)[1,1])/20
  yfactor <- (bbox(test)[2,2]-bbox(test)[2,1])/20
  xlim <- c(bbox(test)[1,1]-xfactor, bbox(test)[1,2]+xfactor)
  ylim <- c(bbox(test)[2,1]-yfactor, bbox(test)[2,2]+yfactor)

  ########
  #col <- terrain.colors(12)

########################################################################
#####################
  ##  Draw the maps

########################################################################
#####################
  basemap(xlim=xlim, ylim=ylim, main = "Haul position map",test1) #, bg="white")
  draw.shape(coast, col="cornsilk", border="transparent", xlim=xlim, ylim=ylim)
  draw.rect()

points(CountryTotalHaulsToBeFished$Longitude1_deg_dec,CountryTotalHaulsToBe
Fished$Latitude1_deg_dec, pch=20, cex=1.0, col="black")
  CountryTotalHaulsToBeFished$NrHaulalpha<-
as.character(CountryTotalHaulsToBeFished$NrHaul)
text(CountryTotalHaulsToBeFished$Longitude1_deg_dec,CountryTotalHaulsToBeFi
shed$Latitude1_deg_dec,CountryTotalHaulsToBeFished$NrHaulalpha,cex=0.5,adj=0,
pos=2,col="black")

  }
```

Part 4

This part is used when participants in the BITS are requesting extra hauls to the hauls already allocated by the normal standard haul allocation procedure.

```
##################################################################################
######################################################
#Part 5 of Haul allocation program for BITS (stratified random sampling)

#The program select extra hauls for given Sub-dicision and depth interval.

#Haul allocation program for BITS Part 1 and Haul allocation program for BITS Part 2
have to be run previous to this.

# 1.  Chose the Sub-division, depth interval and EZZ to allocate more hauls.
# 2.  Chose the number of extra hauls to be selected.
# 3.  Run the rest of the program.
##############################
# Depth interval            Layer     #
#   0-10/20          1       #
#   10/20-40             2       #
#   40-60                    3       #
#   60-80                    4       #
#   80-100                 5       #
#   < 100          6       #
##############################
# Country             Code #
# Poland              POL #
# Denmark (incl. grey)  DEN #
# Germany              GFR #
# Sweden               SWE #
# Latvia              LAT #
# Lithuania            LTU #
# Estonia             EST #
# Finland             FIN #
# Rusia               RUS #
##############################

#output: CSV-file listing the extra haul numbers in TD to and maps the positions
##################################################################################
######################################################
library(plyr)
library(mapplots)
library(shapefiles)
library(rgdal)
################################################################################
################################################################################
Sub_div<-25
DepthInterval<-4
NHaulstoDraw<-6
NationalZone<-"DEN"
################################################################################
################################################################################
```

```
TD<-read.table("C:/Arbejdsting der skal tilbage på H-drev/BITS 2017
spring/Allocating of BITS stations/TD_2016_V1 HD
version.csv",header=TRUE,sep=";")
#TotalHaulsToBeFished <- read.table("H:/Active nonsystem/ICES
WG/WGBIFS/Surveys/Allocating of BITS stations/list of totalallocated hauls.csv",
sep=";")
TotalHaulsToBeFished <- read.table("C:/Arbejdsting der skal tilbage på H-drev/BITS
2017 spring/2017/2017 spring/Planned hauls for Q1 2017.csv", header=TRUE,sep=";")
TotalHaulsToBeFished <-TotalHaulsToBeFished [,c("NrHaul", "SD")]
TotalHaulsToBeFished$id<-1
haulRemaining<- merge(TotalHaulsToBeFished,TD, all=TRUE)
haulRemaining$id[is.na(haulRemaining$id)] <- 2
haulRemaining<-haulRemaining[haulRemaining$id==2,]
haulRemaining$EEZ1<-haulRemaining$EEZ
haulRemaining$EEZ1[haulRemaining$EEZ=="grey"]<-"DEN"
haulRemaining<-haulRemaining[haulRemaining$ICES.SD==Sub_div &
haulRemaining$Layer==DepthInterval & haulRemaining$EEZ1==NationalZone,]
haulRemaining$ID <- 1:nrow(haulRemaining)
haulRemaining1<-haulRemaining[,c("NrHaul", "ID")]
haulRemaining1 <- data.frame(haulRemaining)
ID<-sample(1:nrow(haulRemaining1), NHaulstoDraw, replace=FALSE)
addtionalHauls <- data.frame(ID)
extrahauls<- merge(addtionalHauls, haulRemaining, by="ID", all.selected=FALSE)
extrahauls <-extrahauls [,c("NrHaul", "ICES.SD", "RectangleAlpha", "Layer",
"Latitude1_deg", "Latitude1_dec_min", "Longitude1_deg", "Longitude1_dec_min",
"Mean_Depth", "Distance", "EEZ", "Source")]
#write.table(extrahauls, "H:/Active nonsystem/ICES WG/WGBIFS/Surveys/Extra
hauls.csv", sep=";")
write.table(extrahauls, "C:/Arbejdsting der skal tilbage på H-drev/BITS 2017
spring/Allocating of BITS stations/Extra hauls.csv", sep=";")

extrahauls$Latitude1_deg_dec<-
(extrahauls$Latitude1_dec_min/60*100/100)+extrahauls$Latitude1_deg
extrahauls$Longitude1_deg_dec<-
(extrahauls$Longitude1_dec_min/60*100/100)+extrahauls$Longitude1_deg

coast <- read.shapefile('C:/Arbejdsting der skal tilbage på H-drev/BITS 2017
spring/Allocating of BITS stations/Shapefiles/europe')
latlon <- CRS("+proj=longlat +datum=WGS84")

  coordinates(extrahauls) <- c("Longitude1_deg_dec", "Latitude1_deg_dec")
  proj4string(extrahauls) <- latlon

  #Set the limit of the plot to +/- 10% of the extent of the points
  xfactor <- (bbox(extrahauls)[1,2]-bbox(extrahauls)[1,1])/20
  yfactor <- (bbox(extrahauls)[2,2]-bbox(extrahauls)[2,1])/20
  xlim <- c(bbox(extrahauls)[1,1]-xfactor, bbox(extrahauls)[1,2]+xfactor)
  ylim <- c(bbox(extrahauls)[2,1]-yfactor, bbox(extrahauls)[2,2]+yfactor)
  ########
  #col <- terrain.colors(12)
```

```
##############################################################################
#####################
 ##
 ##  Draw the maps
 #
 ##

##############################################################################
#####################

  basemap(xlim=xlim, ylim=ylim, main = "Haul position map","Extra hauls") #,
bg="white")
  draw.shape(coast, col="cornsilk", border="transparent", xlim=xlim, ylim=ylim)
  draw.rect()
  points(extrahauls$Longitude1_deg_dec,extrahauls$Latitude1_deg_dec, pch=20,
cex=1.0, col="black")
  extrahauls$NrHaulalpha<- as.character(extrahauls$NrHaul)

text(extrahauls$Longitude1_deg_dec,extrahauls$Latitude1_deg_dec,extrahauls$NrH
aulalpha,cex=0.5,adj=0,pos=2,col="black")
```

Results of calibration between the Danish old R/S Havfisken and new R/S Havfisken II

by Henrik Degel, DTU Aqua

Introduction

The Danish research vessel "Havfisken" (code in DATRAS: HAF) has for more than 50 years been used for research. It was built in wood in 1962 as a side trawler weighting 20 BRT and is outdated. Among many other tasks, the vessel has carried out the BITS survey in Kattegat and western Baltic. Therefore, it has been replaced by the newly built "Havfisken II" (code in DATRAS: 26HF). It was decided to establish a calibration exercise between the old Havfisken and the new Havfisken II in order to be able to continue already established BITS survey time series

Trawling procedure and material

The exercise was carried out in the period from 13-19/3 – 2016 in the area of Skagerrak and the north-western part of Kattegat. The method used was parallel hauling between the two vessels. Figure 1 shows the sets of parallel hauls.

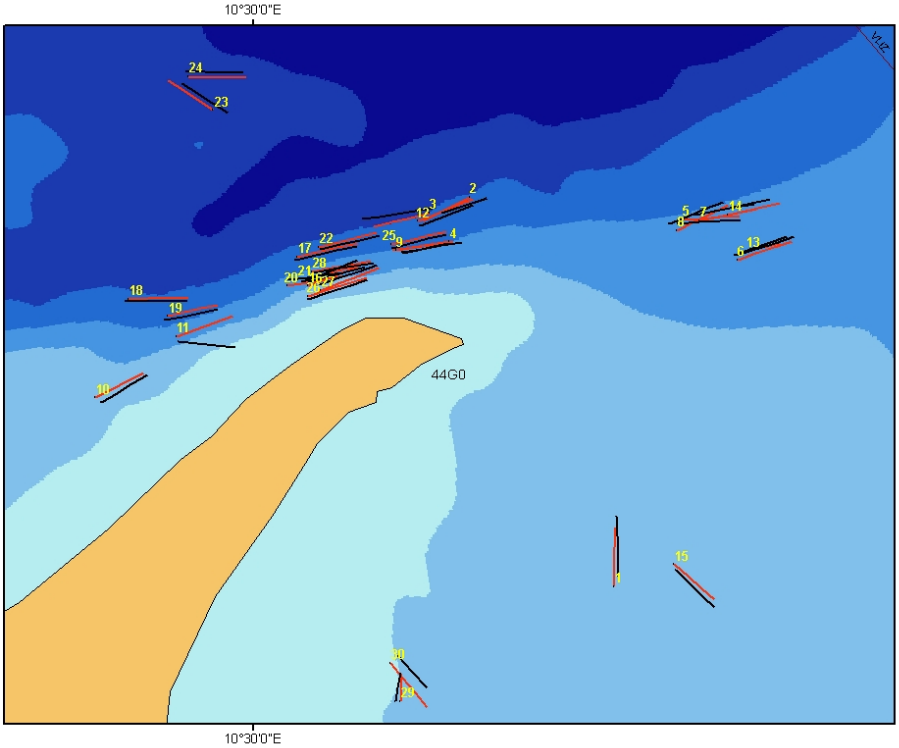


Figure 1. Map showing the parallel hauls with indication of pair haul number (red lines indicate tracks of the new Havfisken. Black lines indicate tracks of the old Havfisken.

The criteria for selecting this area were that it could be expected to exhibit reasonable abundance of cod and flatfish and that each species could be expected to exist in length span comparable to the length span observed during BITS and finally that trawling could be carried out on depth comparable to the depth observed during the BITS. In addition the selected area was in a convenient distance from the home port of the vessels, Strandby, on the east coast of Jutland.

The trawl used was the small standard BITS trawl (TV3 #520) with standard ground gear. Because the old Havfisken is a side trawler, it has not been possible to use the normal standard trawl doors. Instead a set of "Munkebo" trawl doors have been used for the whole time series and during this calibration exercise. The new Havfisken uses "Thyborøn" trawl doors (1.78 m^2 (63 inch), Weight 205 kg), which is the BITS standard trawl doors for TV3 #520.

The trawling procedure follows the standard BITS trawling procedure, which dictates 30 minutes of haul duration, trawling speed of 3 knots and trawling only during day-time. Parallel trawling was used where the two vessels conduct to parallel tracks simultaneous few hundred meters from each other. The engine power of the old Havfisken is not always sufficient to keep up this speed if the current is strong and against the trawling direction. This has the consequence that the trawling distance in these cases differs between the two vessels.

30 haul pairs were conducted, but only 28 hauls can be included in the analysis because two hauls of the old Havfisken were invalid (Haul pair 9 and haul pair 28) due to significant catches of peat, which completely blocked the cod end. The trawl and haul parameters of the 30 haul pairs are shown in table 1 together with the catches of the most important flatfish species and cod.

Haul pair	Validity	Vessel	Fishing duration	Mean depth	OtterBoard Distance	Wire Length	Distance (Bottom)	Catch of most important species				
								Dab	Turbot	Plaice	Flounder	Cod
			Minutes	Meters	Meters	Meters	Nautic miles	Kg	Kg	Kg	Kg	Kg
1	V	New	30	22	65.3	136	1.5	37.7	0.72	49	0.7	3.37
	V	Old	30				1.45	33.6	0.7	37.1	1.0	0.2
2	V	New	30	78	74.3	250	1.5	0.89	0.0	6.88	0.0	69.2
	V	Old	30				1.25	1.7	0.0	5.4	0.3	21.1
3	V	New	30	77	69	225	1.5	0.0	0.0	19.4	0.0	118.5
	V	Old	30	80.3		232	1.15	0.5	0.0	12.5	0.0	27
4	V	New	30	54		188	1.5	6.07	1.53	31.3	1.2	94.4
	V	Old	30	53.2		186	1.2	10.9	0.0	54.5	0.9	32.8
5	V	New	30	52	69.3		1.5	33.8	0.0	24.9	0.0	222
	V	Old	30	51.1		186	1.5	10.4	0.0	16	0.0	41.6
6	V	New	30	42	73.3	168	1.5	4.25	0.36	16.8	1.1	28.1
	V	Old	30	44.5	43.7	186	1.5	6.6	0.0	9.3	0.6	5.9
7	V	New	30	51	72.6	188	1.5	0.12	0.0	27.6	2.0	133
	V	Old	30	52.9	39	186	1.5	3.6	0.0	16	0.6	43.4
8	V	New	30	50	71.6	188	1.5	8.42	0.0	20.4	0.0	19.45
	V	Old	30	53.6	36	232	1.5	12.4	0.0	10.6	0.0	144.5
9	V	New	30	75.8	78	232	1.5	0.0	0.0	0.0	0.0	0.0
	I	Old	30	52		232	1.5	0.0	0.0	0.0	0.0	0.0
10	V	New	30	55	70.4	182	1.5	10.2	0.49	36.5	0.9	2.51
	V	Old	30	27		186	1.45	9.2	0.0	24.2	0.4	0.1
11	V	New	30	32	66.6	136	1.5	75.7	0.0	164	2.4	112
	V	Old	30	50		232	1.5	73.3	0.0	379	0.7	3.1
12	V	New	30	54.8	72.8	182	1.5	2.8	0.0	31.6	0.5	83
	V	Old	30	71		277	1.5	7.5	0.0	21.4	0.3	40.8
13	V	New	30	44.9	74.5	182	1.5	2.79	0.0	14.6	2.1	40.4
	V	Old	30	44		232	1.5	2.12	0.0	7.4	1.0	36.9
14	V	New	30	69	75.3	235	1.5	4.97	0.0	16.4	1.4	130.6
	V	Old	30	53		277	1.5	13.5	0.0	11.5	0.2	74.4

15	V	New	30	50.8	73.1	182	1.5	3.24	0.0	72.3	1.0	8.9296
	V	Old	30	25		186	1.4	20.4	0.0	43.1	0.4	1.6
16	V	New	30	23	68	136	1.5	48.8	2.2	50.9	1.2	105.9
	V	Old	30	57		232	1.5	0.0	0.0	27.6	0.0	40.8
17	V	New	30	53	72.3	200	1.5	1.68	0.0	42.8	0.0	136.5
	V	Old	30	74		277	1.5	10.1	0.0	29.6	0.0	71.7
18	V	New	30	75	76	240	1.5	1.49	0.0	39.5	0.3	260.01
	V	Old	30	78		277	1.5	1.7	0.0	22.7	0.2	93.1
19	V	New	30	80	75.5	250	1.5	4.79	0.0	52.6	0.4	16.24
	V	Old	30	67		277	1.45	1.95	0.0	24.8	1.0	2
20	V	New	30	56	74.3	235	1.5	43.5	1.7	67.4	0.7	63.3
	V	Old	30	58.5	28	277	1.4	22.4	0.0	47.8	0.7	22.6
21	V	New	30	56	73.6	216	1.5	5.18	1.53	15.2	0.7	42.1
	V	Old	30	52.5	31	236	1.5	7.5	0.0	10.2	0.3	11.9
22	V	New	30	77	73.3	240	1.5	5.35	0.0	61.5	0.7	32.2
	V	Old	30	75	23.5	277	1.5	15.4	0.0	51	0.0	7.3
23	V	New	30	93	74.6	312	1.5	0.0	0.0	0.0	0.0	3.9
	V	Old	30	95	25	315	1.35	0.1	0.0	0.6	0.0	0.2
24	V	New	30	98	77	312	1.5	0.43	0.0	0.41	0.0	7.2
	V	Old	30	100.5	34	315	1.45	0.2	0.0	0.0	0.0	0.0
25	V	New	30	62	71	215	1.5	26.5	0.0	76.4	0.4	47.7
	V	Old	30	59.9	37	236	1.35	10.7	0.7	71.7	0.0	16.2
26	V	New	30	36	64.6	150	1.5	33.6	1.63	146	0.6	14.3
	V	Old	30	31.2	37	136	1.5	46.1	0.4	195	1.5	2.3
27	V	New	30	46	72.7	200	1.5	45	1.31	98.2	2.1	4.1
	V	Old	30	48.4	35	186	1.5	14.5	0.5	59.7	0.0	6.5
28	V	New	30	60	69.7	215	1.5	0.0	0.0	0.0	0.6	0.0
	I	Old	30	56.9		186	1.5	0.0	0.0	0.0	0.3	0.0
29	V	New	15	17	62.5	136	0.75	23.9	0.0	74.6	0.0	8.5
	V	Old	15	17.6	37	136	0.75	19	0.0	42.8	0.0	4.8
30	V	New	30	17	63.3	136	1.5	39.4	0.0	86.3	1.8	18.5
	V	Old	30	17.8	43	136	1.4	27.3	0.0	43	0.4	13.5

Analyzing method

The comparison of the species specific catches of the new Havfisken versus the old Havfisken were done based on a statistical method for inter-calibration of surveys, i.e. determining the relative selectivity of two gear types or two vessels described in the draft paper "Intercalibration of survey trawl gear using paired hauls" prepared by Thygesen et al. 2015. The method relies on data from paired trawl hauls performed with the two gear types.

The relative selectivity for each gear is modelled by use of the length distribution of the catches of the actual species and includes the swept area and three sets of random size dependent variables expressing:

1) The local background size distribution (The true length distribution at the bottom at the spot for the haul. This will not be estimated but is only linking the relative selectivity of the two gears);
2) The haul specific fluctuations in the length distribution in the catch (This express the fact that the catch in one haul is different than the catch in another haul due to local variations of the abundance of the fish);
3) The relative selectivity of the two gears by length group (This is the component we are looking for in order to identify the any significant differences, which prevent us from directly comparing the catches of one gear with the catches of another gear and to convert the result from one gear to the other.

The catches are assumed to be Poisson distributed. Poisson distributions is used when it is assumed that the observations are independent (the catch in one haul is independent of the catch in another haul).

Trawling results

The total number of the potential relevant species in relation to index calculation in Kattegat and the Baltic Sea are given in table 2.

Vessel	**Species**									
	Long rough dab	Dab	Turbot	Plaice	Lemon sole	Wich flounder	Flounder	Brill	Sole	Cod
New Havfisken	7119	**7597**	17	8195	2608	7	68	19	11	1561
Old Havfisken	4053	5656	4	8831	1444	9	37	14	32	796
Total	11172	13253	21	17027	4052	16	105	33	43	2357

Table 2. Total number of flatfish species and cod caught by the two vessels.

The amount of the catches by haul are given in table 1 for the most index-relevant and frequently caught flatfish (dab, turbot, plaice, flounder) and cod. The catch of other species are too sparse to allow the establishment of conversion factors.

The length distributions of the four index-relevant and sufficient frequently caught species are shown in figure 2.

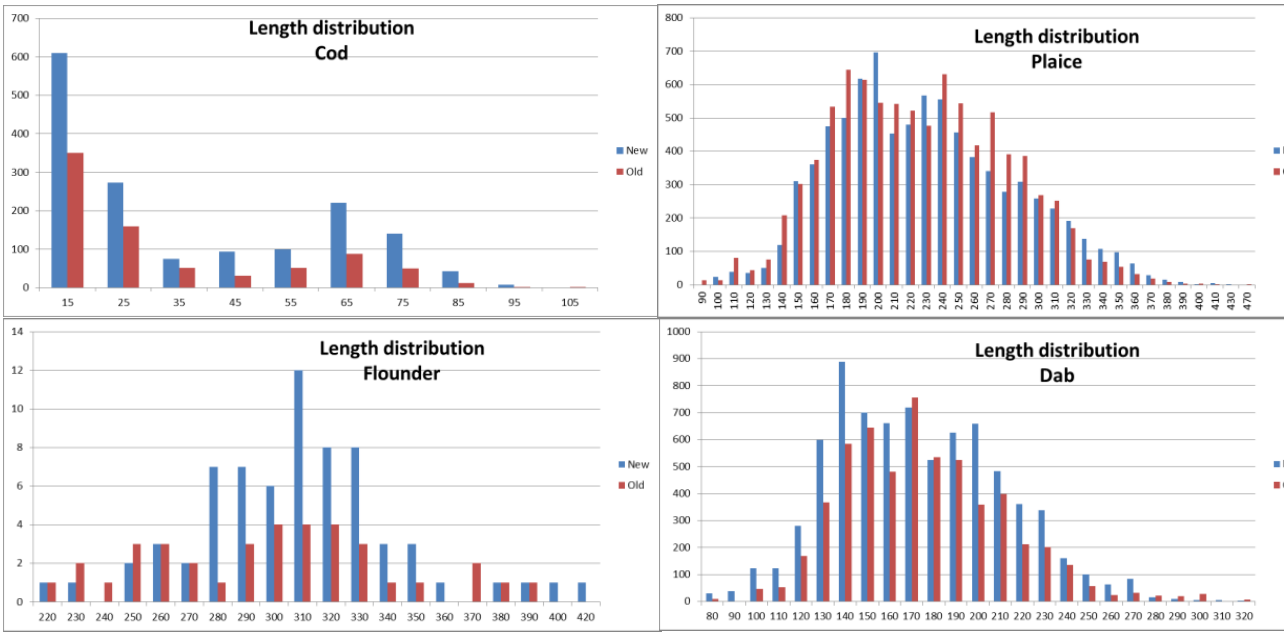


Figure 2. Compare of length distribution for the two vessels for the four most frequently caught species.

Results of calibration factors modelling

Figure 3 shows the relative selectivity for the new Havfisken compared with the old Havfisken for each of the most frequent caught species. The circles indicate the individual observations (hauls) and the solid lines indicate the estimated conversion factor. The grey area indicates the 95% significant intervals. The conversion factor (y-axis) expresses the factor which the catches of the new Havfisken must be multiplied with in order to be comparable to the time series of the old Havfisken. The exact calibration factors by length group are given in table 3.

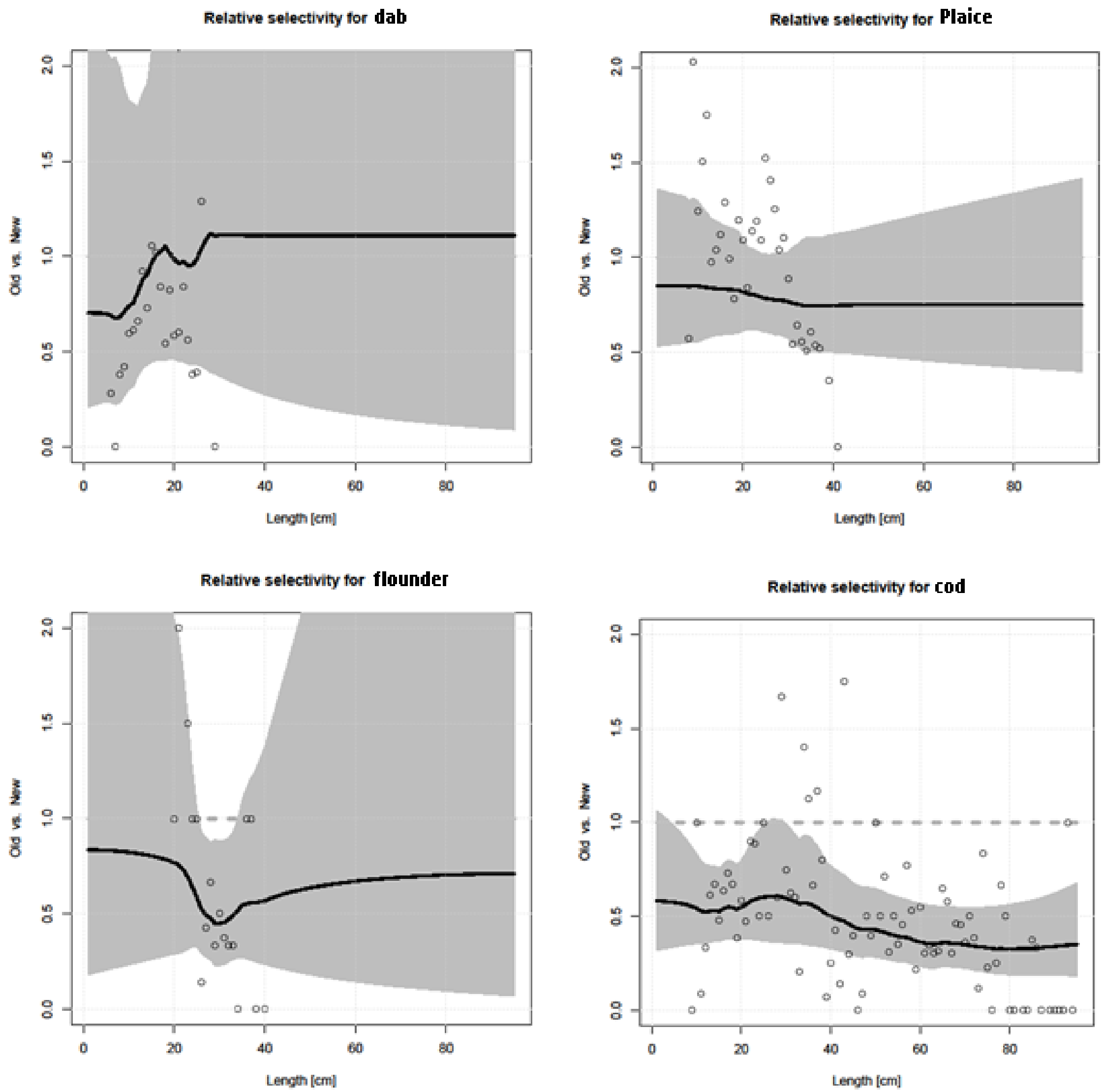


Figure 3. Graphs showing the estimated calibration factors (solid line) for dab plaice, flounder and cod by cm length group for converting CPUE values from new Havfisken to old Havfisken time series. Grey area indicates significant intervals for the estimate. Open circles indicate observations. The conversion factor expresses the conversion from the new Havfisken to the old Havfisken

Discussion

Because the vessels use different rigging due to different trawl doors, the distance between the doors is more than double as large for the new Havfisken that for the old Havfisken (mean distance for new and old Havfisken is 71.5 meters and 34.6 meters respectively). Looking at the compare of length distribution (figure 1) there seems to be a difference in the selection of all length groups between the flatfish and the cod. The difference in the number in all length groups of cod is significant larger (largest for the new Havfisken) than is the case for the flatfish species. This might be explained by the difference in response to herding effect by the doors where cod is likely to respond by aggregating close to the median line of the trawl and then after a while to fall back into the belly of the trawl while flatfish is less likely to seek towards

the median of the trawl and will be able to escape under the bridles. As a consequence the catch of cod represents individuals from the water mass defined by the opening of the net and the distance between the doors while the catch of flatfish represent the water mass defined by the opening and the distance between the wings. The difference in trawling distance might influence on the catch as well. In 12 cases out of the 30 hauls the old Havfisken was not capable of keeping up the 3 knots and consequently has a shorter trawl distance than the new Havfisken. The difference was in average for the 12 hauls 0.14 knots and 0.06 knots including all hauls.
The difference in hauling procedure of the trawls might influence the catch of round fish as large individuals might escape when the wire are coiled up and the net is floating in the surface before it is pulled onboard the side trawler. The hauling process onboard the aft trawler is a more continuous movement, which does not allow the fish to escape.
The number of long rough dab and lemon sole (table 2) is probably sufficient to calculate if the catches of these two species are significantly different and would justify if conversion factors should be established for these two species as well.

Conclusions

The estimated conversion factors for cod and flounder are at a level, which means that they are significantly different from 1 for all size groups found and it is recommended to converting BITS CPUE estimates obtained with the new Havfisken to the BITS CPUE estimates obtained with the old Havfisken. This means that BITS surveys results acquired with the new Havfisken can be included in the existing time series for cod and flounder if the species specific conversion factors are applied.

The conversion factors estimated for plaice and dab are not significant different from 1, which indicates that no conversion factors should be applied and that the estimated obtained by the new Havfisken can be directly compared with the estimate obtained with the old Havfisken. It should be noted that the conversion factor estimates particularly for dab are very uncertain and not very well estimated. This has to do with high variability and **not** due to small catches of dab during the exercise.
The conversion factors which should be used are given in table 3.

It is suggested that the corrected indices are introduces already this for this year assessment for cod and flounder by converting the new Havfisken input to old Havfisken standard followed by a conversion of the complete time series for the old Havfisken to new Havfisken standard. As the change is relatively large for especially cod but also for flounders, it is recommended that the new time series is implemented in connection with a future benchmark process.

References

Thygesen et al. Intercalibration of survey trawl gear using paired hauls. Draft prepared by Uffe Høgsbro Thygesen, Kasper Kristensen, Teunis Jansen, Jan E. Beyer. Additional authors to be included. DTU-Aqua, Danish Technical University. Compiled September 1, 2015.

Table 3. The estimated conversion factors by 1 cm length group for cod and flounder.

Cod	
Length gr. Cm	**Conversion factor**
<13	0.54
14	0.53
15	0.52
16	0.53
17	0.53
18	0.53
19	0.54
20	0.55
21	0.55
22	0.54
23	0.55
24	0.56
25	0.58
26	0.59
27	0.60
28	0.60
29	0.61
30	0.61
31	0.61
32	0.60
33	0.60
34	0.59
35	0.58
36	0.57
37	0.57
38	0.57
39	0.56
40	0.55
41	0.53
42	0.51
43	0.50
44	0.49
45	0.48
46	0.48
47	0.46
48	0.45
49	0.44
50	0.43
51	0.43
52	0.43
53	0.43
54	0.42
55	0.42
56	0.41
57	0.40
58	0.40
59	0.39
60	0.39
61	0.38
62	0.37
63	0.37
64	0.36
65	0.36
66	0.35
67	0.36
68	0.36
69	0.36

70	0.36
71	0.36
72	0.35
73	0.35
74	0.35
75	0.34
76	0.34
77	0.34
78	0.33
79	0.33
80	0.33
81	0.33
82	0.33
83	0.33
84	0.33
85	0.33
86	0.33
87	0.33
88	0.33
89	0.33
90	0.33
91	0.34
92	0.34
>93	0.34

Flounder	
Length gr. (Cm)	Conversion factor
<=20	0.77
21	0.76
22	0.73
23	0.69
24	0.64
25	0.59
26	0.53
27	0.50
28	0.48
29	0.45
30	0.45
31	0.46
32	0.47
33	0.49
34	0.52
35	0.55
36	0.56
37	0.56
38	0.56
39	0.57
>=40	0.57

Presentations contributed to the WGBIFS/2017 meeting in Riga, Latvia

Annex 9: Presentations accessible at the WGBIFS 2017 meeting

Notes: Authors are fully responsible for quality of the prepared text and all kind of presented data.

List of presentations:
1. Presentation of logistic information
2. Presentation of done works between WGBIFS 2016 and WGBIFS 2017
3. BITS presentation of Russia;
4. BITS presentation of Germany;
5. BITS presentation of Lithuania;
6. BITS presentation of Poland;
7. BITS presentation of Denmark;
8. BITS presentation of Sweden;
9. BITS presentation of Latvia;
10. BASS, BIAS and BITS presentation of Estonia;
11. BASS and BIAS presentation of Lithuania;
12. BIAS presentation of Russia;
13. BIAS presentation of Poland;
14. BIAS presentation of Finland;
15. BASS and BIAS presentation of Latvia;
16. Gulf of Riga Herring Survey presentation of Latvia;
17. Presentation of intercalibration exercise between new Havfisken and Solea;
18. Presentation of sunrise and sunset calculations;
19. Presentation of LFI and LMI development;
20. Presentation of outcomes of ICES WKBIFS-ACOU;
21. Allocation of BITS hauls from the Tow-Database;
22. Calibration between new and old r/v “Havfisken”.

ICES - WGBIFS meeting in Riga/Latvia; 27-31.03.2017

The logistic aspects of the WGBIFS-2017 meeting.

A few facts from the history of Riga city

Włodzimierz Grygiel (NMFRI, Gdynia – Poland)

Timing of the WGBIFS meeting: 27 – 31.03.2017

Time-schedule of the meeting:

- starts on 27.03.2017, from 10:00 to 17:30 o'clock,
- on 28 - 30.03.2017, from 9:00 to 17:00 o'clock,
- meeting will be finalised on 31.03.2017 at about 14:00 o'clock,
- coffee breaks: the 1st at 10:30-10:50 and the 2nd at 15:00-15:20,
- lunch break at 12:30-13:30.

The meeting venue: the BIOR Institute/Fish Resources Research Department - the local organizer and host of the meeting, with Guntars Strods as POC.
Address: Riga – Latvia, Daugavgrivas Street 8 (Daugavgrivas iela 8), the conference room No. 24, on the 2nd floor.

Participants of the meeting: 27 persons, incl. 4 attendees for a part-time only.

- The BITS surveys sub-group – coordinated by Henrik Degel,
- The IBAS surveys sub-group – coordinated by Olavi Kaljuste,
- The Baltic LFI (proportion of large fish) and MML (mean maximum length of fishes) indicators sub-group – coordinated by Scott Large,
- The StoX programme and a new acoustic-trawl database sub-group – coordinated by Hjalte Parner and Espen Johnsen.

The main tasks of the WGBIFS/2017 meeting:

– to work on standard ToRs and response on the additional tasks requested by the WGBFAS, ICES Data Center & others.
– preparation of draft text of the final report,
– deliberation on the ToRs for next 3 years works of WGBIFS and selection of the 2018 venue,
– election of candidate on the position of WGBIFS chairperson for 2018-2020.

Please obey following rules during the meeting:

1) punctuality,
2) do not use mobile phone inside the conference room,
3) if you really needs smoking cigarettes, that outside.

WGBIFS meetings venue in 2000-2017:

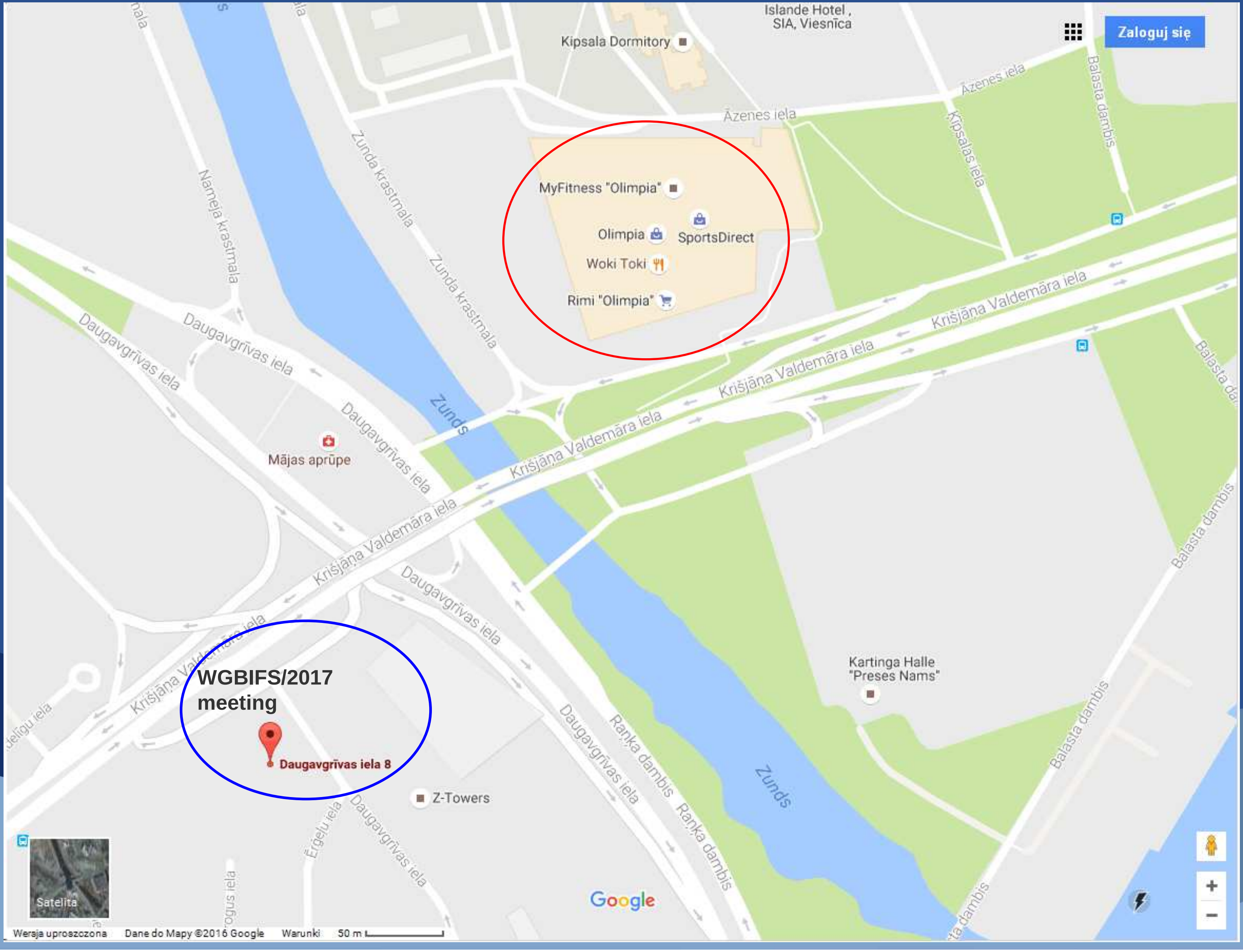
Year	Location
2000	Copenhagen ICES HQ
2001	Kaliningrad (Russia)
2002	Copenhagen ICES HQ
2003	Copenhagen ICES HQ
2004	Rostock (Germany)
2005	Rostock (Germany)
2006	Copenhagen ICES HQ
2007	Rostock (Germany)
2008	Gdynia (Poland)
2009	Lysekil (Sweden)
2010	Klaipeda (Lithuania)
2011	Kaliningrad (Russia)
2012	Helsinki (Finland)
2013	Tartu (Estonia)
2014	Gdynia (Poland)
2015	Öregrund (Sweden)
2016	Rostock (Germany)
2017	Riga (Latvia)

MIR

www.nmfri.gdynia.pl

Where we are

Riga, the capital city of Latvia is located at the Daugava River mouth, on the shores of the Gulf of Riga.



Riga from the historical point of view

Riga officially founded in 1201 by Bishop Albert, became one of the most developed seaports in the Hanseatic League during the Middle Ages and has traditionally served as a crossroads for trade between east and west. When an independent Latvian Republic formed in 1918, Riga became the capital.

Above: Riga in the 16th century. Below: the flag and coat of arms of the city.

Historical affiliations

- Terra Mariana (condominium of Archbishops of Riga and Livonian Order) 1201–1561
- Imperial Free City 1561–1582
- Polish–Lithuanian Commonwealth 1582–1629
- Swedish Empire 1629–1721
- Russian Empire 1721–1917
- German Empire 1917–1918
- Republic of Latvia 1918–1940
- Soviet Union 1940–1941
- Nazi Germany 1941–1944
- Soviet Union 1944–1991
- Republic of Latvia 1991–present

after: https://en.wikipedia.org/wiki/Riga

https://pl.wikipedia.org/wiki/Ryga

Riga at present time

Riga is the largest city of Latvia, is also known as the "Heart of the Baltic's". Riga: area (in 2002) - 304 km^2, population (2015) – 696,6 x 10^3 inhabitants.

Today, you can see the entire history of the city reflected in its architecture (Old Town). Due to rich historical and cultural heritage, the city was chosen as the European Capital of Culture 2014.

The building of the Brotherhood of Blackheads is one of the most iconic buildings of Old Riga (Vecriga).

Thank you for your attention!

MIR

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WGBIFS meeting in Riga - Latvia; 27 – 31.03.2017
What was done between consecutive WGBIFS meetings?
The main tasks assigned on the WGBIFS-2017 meeting
MIR
Włodzimierz Grygiel - National Marine Fisheries Research Institute, Gdynia - Poland
The aim of presentation:
a) what was done between consecutive WGBIFS meetings - an overview,
b) requests addressed to WGBIFS chair about accessibility to international and national data and submission of various information/resume,
c) the basic administrative information about BASS and BIAS surveys accomplishment in the Baltic Sea in 2016 with confrontation to WGBIFS plans,
d) summary of the WGBIFS/2017 workplan.

What was done at the WGBIFS/2016 meeting?

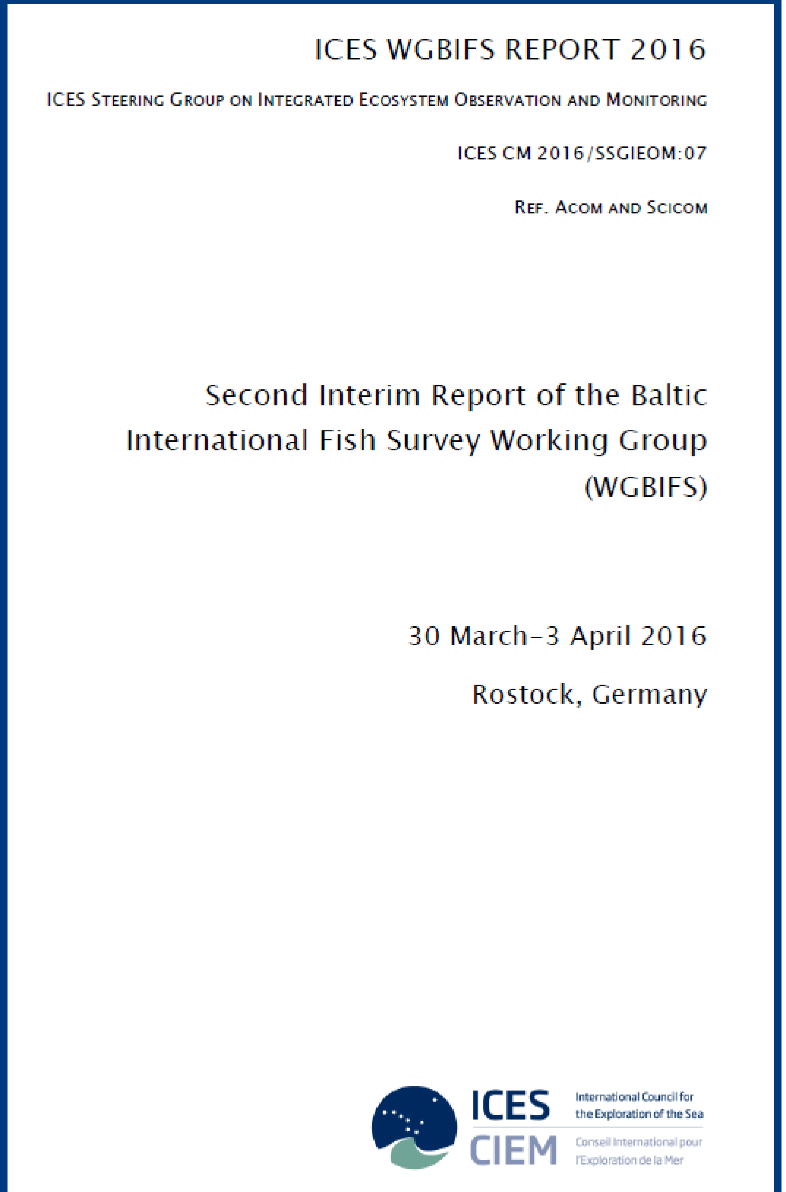
The Second Interim Report of the WGBIFS-2016 prepared at the meeting and delivered on time to the ICES SCICOM/ACOM, composed from:

- 597 pages of the text, incl. 23 Annexes,
- description of 12 Terms of References (ToRs),
- discussion and reply on 3 additional, non-routine tasks, i.e. inquires from the WGBFAS and ICES Secretariat Data-Center.

All the input data linked with the WGBIFS annual report are accessible, and a new one should be systematically uploaded at the ICES WGBIFS Share-Point Website: *https://community.ices.dk/ExpertGroups/wgbifs/SitePages/HomePage.aspx*

About the present ICES data policy you can read at: *http://ices.dk/marine-data/guidelines-and-policy/Pages/ICES-data-policy.aspx*

After WGBIFS/2016 meeting some significant personnel changes in a group of permanent members of the WGBIFS was noticed. Successors of works realised so far by three colleagues have been founded.


ICES WGBIFS REPORT 2016

ICES STEERING GROUP ON INTEGRATED ECOSYSTEM OBSERVATION AND MONITORING

ICES CM 2016/SSGIEOM:07

REF. ACOM AND SCICOM

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

30 March–3 April 2016

Rostock, Germany

ICES CIEM International Council for the Exploration of the Sea Conseil International pour l'Exploration de la Mer

cont. What was done between consecutive WGBIFS meetings?

The presentation made by chair of WGBIFS at the WGBFAS annual meeting in April 2016 with overview concern results from the BITS, BASS and BIAS surveys conducted in 2015 and the 1st quarter of 2016.

Outcomes from the Baltic fishery independent research surveys in 2016-2017 were uploaded to ICES databases (DATRAS, Tow-Database, the BIAS_DB.mdb, the BASS_DB.mdb Access-databases and StoX) and evaluated by WGBIFS will be used as the input data in Baltic fish stocks size assessment, made by WGBFAS.

No change in the submission procedure of the marine litter, occasionally appeared in the BITS survey fish catches, and info about zero-litter hauls must be submitted by the national submitters. The above-mentioned ICES Data Center advice was transferred on 24.05.2016 to all WGBIFS members involved in the BITS surveys realisation.

The national laboratories can continue the Baltic cod stomachs sampling and analysing, based on their experiences, personal and financial possibilities.

The ICES Data-Center coordinated the process of revision incorrect CatCatchWeights data in the DATRAS. This work was expected to be finalized on the 21st of July 2016. Some national delegates to WGBIFS (but not all) respond on the e-mail sent on 21.06.2016 by Anna Osypchuk (ICES Data-Center) however, a final response from the a.m. is expected.

cont. What was done between consecutive WGBIFS meetings?

Danish specialists from the DTU-AQUA requested (April 2016) about revision of fish catch-station distribution in the „gray” zone of the Bornholm (ICES SD 25) during forthcoming the BITS surveys. The problem was solved and the Danish vessel „Dana” will be operated among-others, in the above-mentioned zone and the Polish r/v „Baltica” will inspected the Polish part of the ICES SD 25.

German specialists from the Institut für Ostseefischerei in Rostock requested (end of April 2016) about support by others vessels in realisation of the BASS (2016) survey in the ICES SD 28. The Polish r/v „Baltica” with the Latvian-Polish team on board, in two additional days at sea, realised the above request.

Danish specialists from the DTU-AQUA requested (16.06.2016) about special attention at the WGBIFS/2017 meeting, focused on the results of calibration fish catch data, obtained by old and new the r/v „Havfisken”. The above-mentioned request was repeated on 04.01.2017 by the ICES Secretariat. Calibrated data will be used in April 2017 by the WGBFAS for estimation the Baltic cod stock abundance index.

In connection with the new DC-map ten-years-planning, Danish specialists from the DTU-AQUA requested (12.09.2016) about acceptance of combining the BITS- and Cod-survey in Kattegat by using the facility on the r/v „Havfisken”.

cont. What was done between consecutive WGBIFS meetings?

Working Group on Fisheries Acoustics Science and Technology (WGFAST) on 25.10.2016 submitted recommendation with ID No. 81, suggested to include in the IBAS Manual details on minimum data quality for acoustic (e.g. the list of echosounder frequencies) and trawl data (e.g. the type of trawl and the auxiliary) collection on vessels participating in the BIAS and BASS surveys.

In the period of 06-08.12.2016 at the ICES Secretariat in Copenhagen (based on the ICES Res. 2016/2/SSGIEOM08), held the Workshop on Implementation and Use in IBAS of a New Common Acoustic Database (WKBIFS-ACOU). The StoX programme is proposed as a tool for the IBAS data submission however, the StoX program does not allow us yet to produce the acoustic indices in the same way as they have been calculated so far.

On 19.12.2016 chairman of the WGBIFS submitted to the ICES Secretariat a request concerns financial covering of Mr. Pehr Eriksson's, two days duty trip to Riga on the WGBIFS/2017 meeting. Mr. Eriksson from the Swedish Fishermen's Federation has the long-term experiences in constricting and using in practice as fisherman the pelagic fishing gears in the Baltic, and he initially agree to elaborate independent opinion about standardization of the small-meshed pelagic trawl applied for fish catching during the Baltic routine acoustic surveys. However, the above-mentioned request was not supported (20.12.2016) by the ICES Secretariat because of lack of the budget available to hold-up the suggested duty travel.

cont. What was done between consecutive WGBIFS meetings?

At the WGCHAIRS meeting (23-25.01.2017), WGBIFS chairman expressed opinion about a weak communication between the ICES expert groups and a real advice expected by WGBIFS in following matters:

a) A new co-chair (Haraldur Einarsson) of the ICES - FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) was requested to participate at the WGBIFS/2017 meeting with presentation focused on standardisation of the pelagic fishing gear, which will be applied by all the Baltic countries during the BIAS and BASS surveys. Because WGBIFS has not enough competence for proposing particular type of pelagic trawl as standard one, the ICES Secretariat confirmed (24.10.2016) and sent to co-chairs of the WGFTFB recommendation No. 51, concerns the above-mentioned matter.

b) Who is end-user of the marine litter data reported by WGBIFS during the BITS surveys and what is a present quality status of a part of the DATRAS database devoted storage of the marine debris data?

c) Why the collected Baltic cod stomachs content data are not yet the subject of the WGSAM interest.

What was done between consecutive WGBIFS meetings?

Requests sent to the WGBIFS chair concerns submission of various information and data

1) Henna Rinne from HELCOM (Helsinki) asked (13.04.2016) about aggregated data on herring and sprat from acoustic surveys for produce the maps connected with the Baltic Sea Impact Assessment in 2011-2015, as a part of the of HELCOM holistic assessment of the Baltic Sea Ecosystem Health.

2) Jessica Tengvallone, a master student on the Aarhus University (Denmark) asked (23.05.2016) via ICES Secretariat, about description of the procedure of computation and practical use the CPUE data conversion factor, obtained with the national fishing gears and both versions of the TV-3 trawls, during the BITS surveys.

3) Jörn Schmidt from the Kiel University (FRG), supported by ICES, asked (15.06.2016) about fulfilling the questionnaire concerns interest of extending the WGBIFS scientific expertises into disciplines from social sciences and humanities.

4) The chair of PGDATA and COSTBENWK asked (16.06.2016) about fulfilling the questionnaires related to logistic and technical matters of the Baltic acoustic surveys, what was needed for the ICES workshop.

5) Jane Behrens from DTU-Aqua asked (16.06.2016) information about round goby occurrence in the southern Baltic, based on the BITS surveys results.

6) Workshop on the Review of the ICES Acoustic-Trawl Survey Database Design (WKIACTDB) asked (16.08.2016) about description of the surveyed area in the routine acoustic-trawl surveys for the ICES geoportal. The same inquire was sent on 20.02.2017 by the ICES Data Center (A. Osypchuk).

What was done between consecutive WGBIFS meetings? cont. Requests sent to the WGBIFS chair concerns submission of various information and data

7a) Previous chairman of the Steering Group on Integrated Ecosystem Observation and Monitoring (SSGIEOM) asked (September 2016) about an overview of the WGBIFS 2015-2016 outcomes, needed for presentation at a special session during the ICES- ASC/2016.

7b) A new chairman of the SSGIEOM asked (27.02.2017) about provide him with:

- some science highlights the WGBIFS have achieved or are working on,
- ideas you (WGBIFS) have that would make interactions with the assessment groups (both, stock and integrated ecosystem) more productive; should we provide more documentation or should we look to some joint meetings?,
- opinion on how we could support more regionalisation of the SSGIEOM groups to draw out regionally common themes from our data collection programs.

8) The ICES Publishing Department asked (02.09.2016) for submission of the description of Category 1 Resolutions, i.e. the SISP Manuals for publication in 2017.

9) The ICES Science Department asked (06.09.2016) for revision the recommendations and action lists, indicated in the WGBIFS/2016 Report, strictly as is advised in the „Guidelines to ICES Expert Groups".

10) Francois Bastardie from the DTU-Aqua asked (03.10.2016) the ICES Secretariat and WGBIFS chair, for the full access to the WGBIFS SharePoint and intensively demanded submission of the non-aggregated data from BIAS and BASS surveys and shape-files for characterizing Baltic sprat and herring spatial distribution in monitored areas during several recent years; the requested data were planned to be used to inform ongoing Marine Spatial Planning-related projects with relevant ecosystems components; access of the a.m. recipient to the WGBIFS SharePoint, with a list of restrictions indicated by WGBIFS chair, was granted by the ICES Secretariat and raw data from the Baltic acoustic surveys were not transferred by WGBIFS chair.

What was done between consecutive WGBIFS meetings?

cont. Requests sent to the WGBIFS chair concerns submission of various information and data

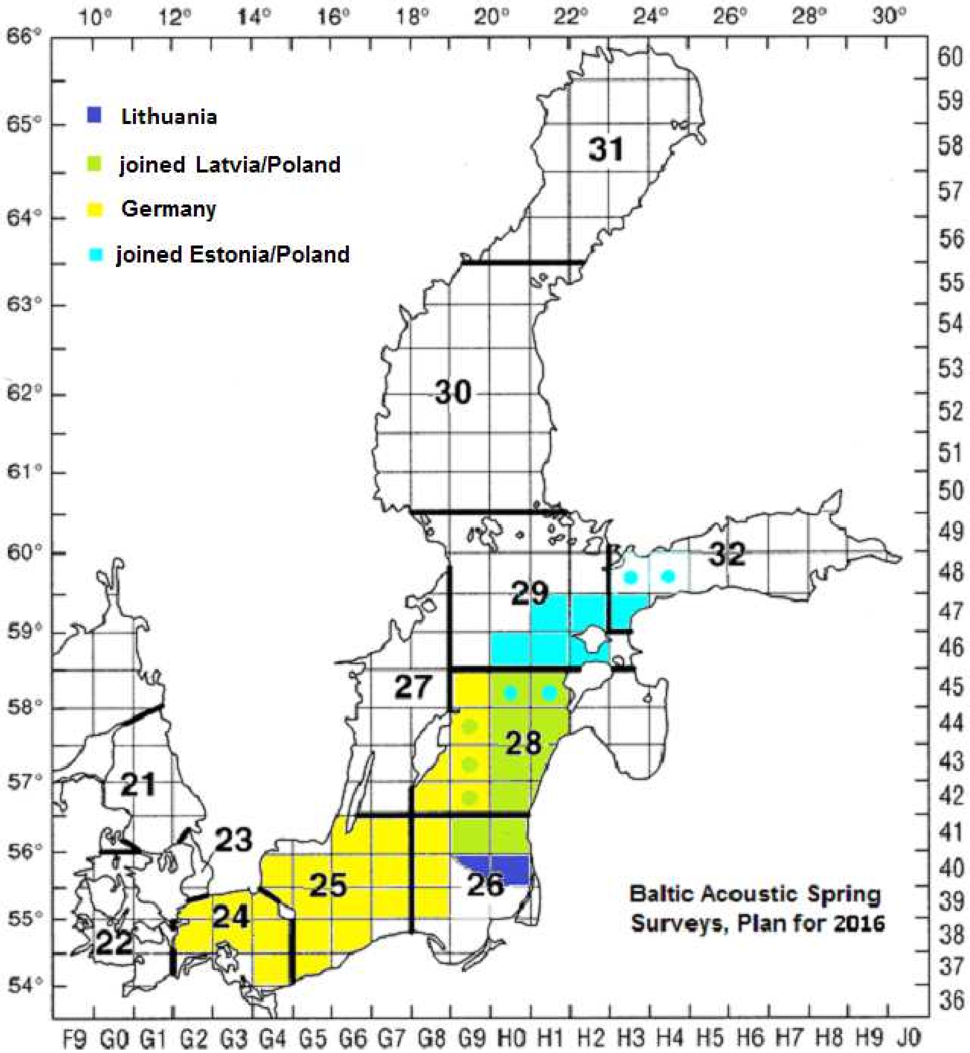
11) In the last days of November 2016, the ICES Secretariat asked for revision of the list of ToRs dedicated on the WGBIFS/2017 meeting; the amended set of ToRs was presented to the ACOM-SCICOM Forum.

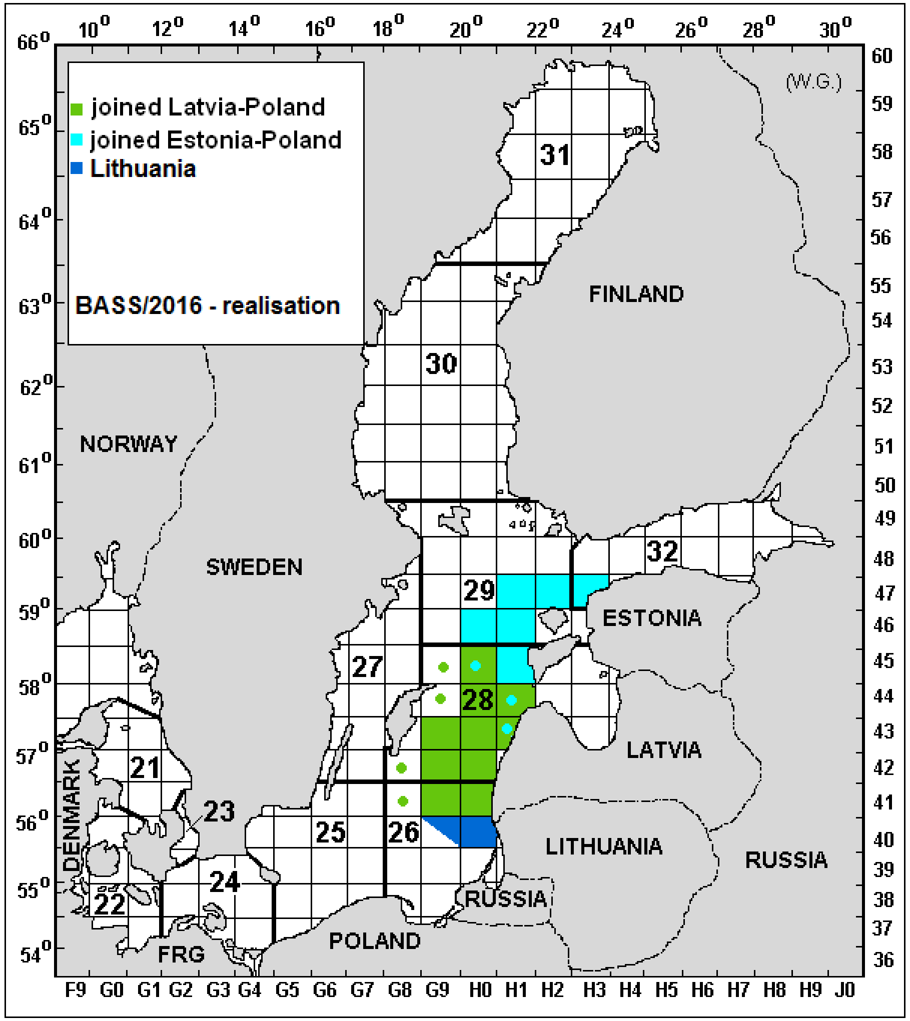
12) The ICES Data Center (27.01.2017), mobilised by the ACOM/SCICOM, again requested WGBIFS/2017 meeting participants about an attempt to calculate the LFI and MML indicators, based on the BITS survey results.

13) In the 1st half of Feb. 2017, the former and the present WGBFAS chairs asked the WGBIFS for continuation works on preparation maps showing demersal fish species distribution in the Baltic, based on the BITS surveys results moreover, about fulfilment a newly prepared table with the status of input data collected during the BITS, BASS and BIAS surveys and directly linked with Baltic fish stocks size assessments realised by the WGBFAS.

14) M. Bergenius - the Central Baltic Herring stock assessor asked (22.03.2017) about preparation the BIAS index for the ICES SD 32, so far not considered within the WGBIFS meetings. Such data are needed for the CBH stock assessment process during the benchmark meeting in December 2017.

BASS/2016 (spring) plans vs. realization





The BASS – 2016 survey vs. plan was completed in 47% by coverage of the ICES statistical rectangles however, broad „white" areas in the ICES SDs 24, 25 and parts of ICES SDs 26 and 28 wasn't covered with acoustic-trawl investigations. Materials concerns monitoring of the Baltic sprat stock distribution and abundance in spring 2016 are not completed.

BASS/2016 (spring) realization in details

Executing the survey	Period of investigations	Number of the ICES statistical rectangles covered with acoustic-trawl monitoring	Echointegration tracks on the distance (NM)	Number of fish catch-stations	Number of hydrological stations
LAT-POL	12-20.05.2016	8 whole + 6 partly	645	25	26
EST-POL	22-26.05.2016	6 whole + 3 partly	251	13	13
GER	02-22.05.2016*)	not performed			
LIT	03-04.05.2016	1 whole + 1 partly	126	7	7
RUS	-	not performed			

*) planned period; survey was not realized because of technical problems with the vessel

Summary	Coverage with acoustic-trawl investigations	Linear distance of echointegration tracks (NM)	Number of fish catch-stations	Number of hydrological stations
Plans BASS - 2016	47 of the ICES statistical rectangles			
Realization BASS - 2016	18 whole + 4 partly the ICES rectangles	1022	45	46

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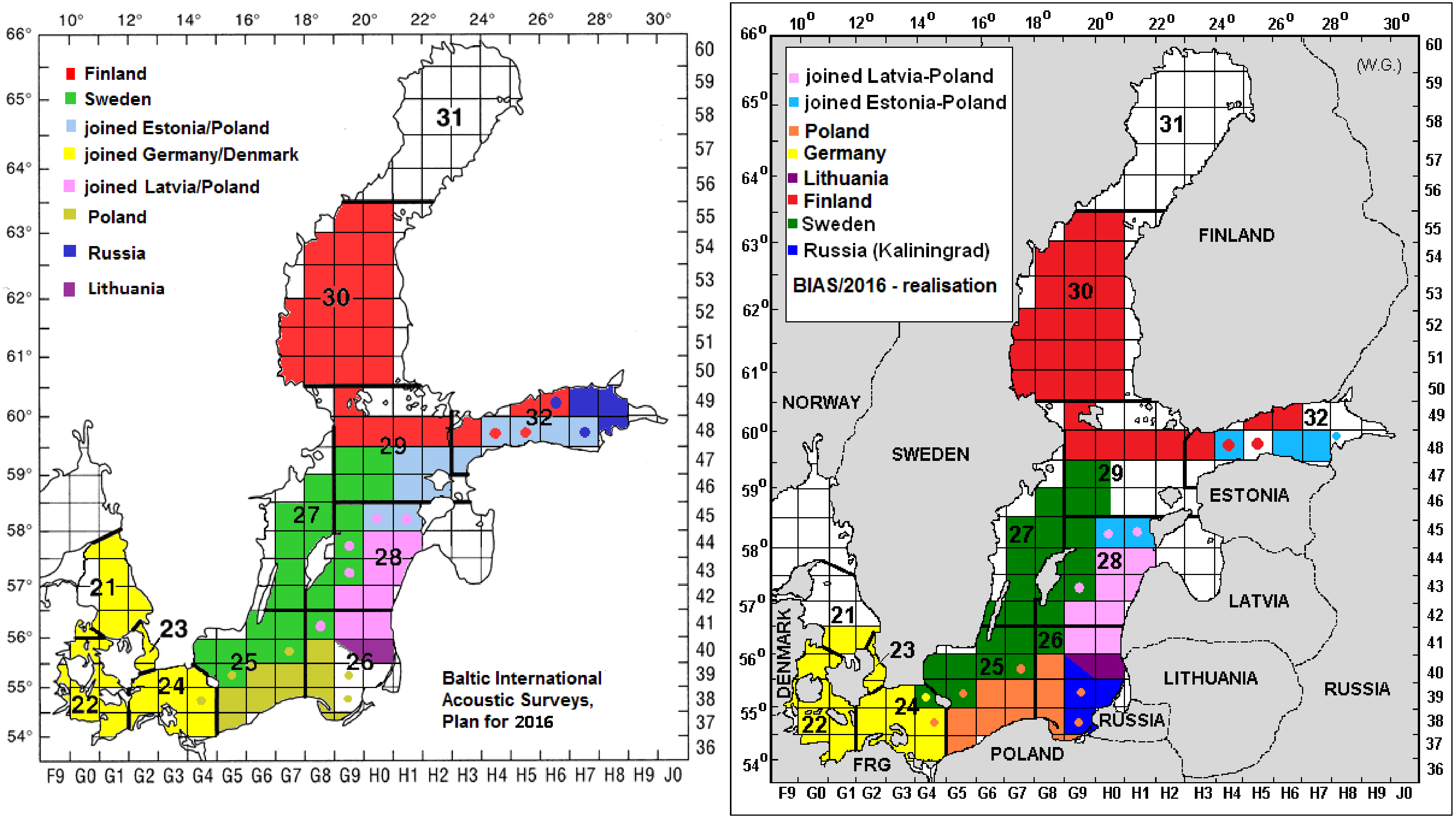
BIAS/2016 (autumn) plans vs. realization



The BIAS/2016 survey vs. plan was completed in 96% however, some „white" areas in the ICES SDs 29-S and 32-E are indicated. Materials concern Baltic sprat, herring and cod stocks distribution and abundance in autumn 2016 can be accepted as completed.

BIAS/2016 (autumn) realization in details

Executing the survey	Period of investigations	Number of the ICES statistical rectangles covered with acoustic-trawl monitoring	Echointegration tracks on the distance (NM)	Number of fish catch-stations	Number of hydrological stations
LAT-POL	11-20.10.2016	9 whole + 2 partly	638	23	25
EST-POL*)	21-28.10.2016	5 whole + 1 partly	612	9	9
FIN	22.09.-04.10.2016	28 whole + 2 partly	1760	43	44
GER/DEN	30.09.-20.10.2016	20 whole + 2 partly	1179+178	55	81
LIT	13-14.10.2016	1 whole + 1 partly	124	6	6
POL	13-30.09.2016	11 whole +5 partly	875	36	40
RUS**) - Kaliningrad	01-10.10.2016	3 whole + 1 partly	234	10	20
SWE	01-15.10.2016	24 whole + 2 partly	1381	49	48

*) survey shortened because of technical problems with the vessel,
**) RUS – St. Petersburg, BIAS-2016 survey not performed due to unfortunate coincidence.

Summary	Coverage with acoustic-trawl investigations	Linear distance of echointegration tracks (NM)	Number of fish catch-stations	Number of hydrological stations
Plans BIAS - 2016	112 of the ICES statistical rectangles			
Realization BIAS - 2016	102 whole + 6 partly the ICES rectangles	6981	231	273

The main tasks of the WGBIFS/2017 meeting - Summary of the Workplan - Year 3rd

- Compilation the survey results from 2016 and the first half of 2017 and reporting to WGBFAS.
- Coordination and planning the schedule for routine research surveys in the second half of 2017 and the first half of 2018.
- Coordinate the marine litter sampling programme in the BITS.
- Final reviewing and updating the common surveys manuals (IBAS, BITS) according to SISP standards.
- Proposals for improvement of quality of acoustic indices and for further standardization of the BIAS surveys.
- An attempt to implement the standard pelagic fishing gear to control-catches in BIAS and BASS surveys.
- Deliberation on the ToRs for next 3 years work of WGBIFS and selection of the 2018 venue.
- Election of candidate on the position of WGBIFS chairperson for 2018-2020.
- Final report, by 15 May 2017 to SSGIEOM, SCICOM and ACOM – based on 10 standard ToRs and 2 additional tasks requested by other WGs with resume from recent 3 years activities of the WGBIFS.

Thank you for your attention!

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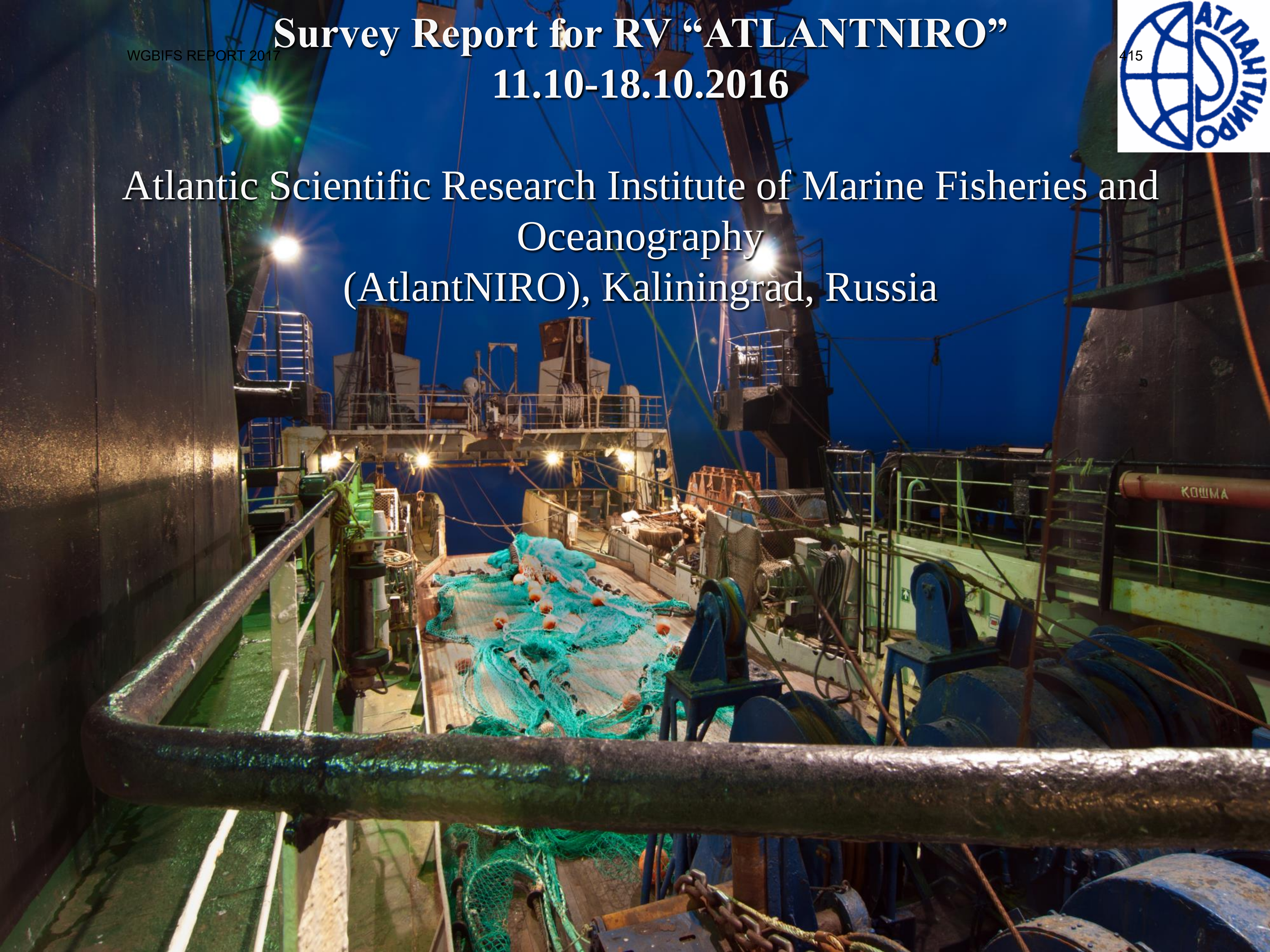
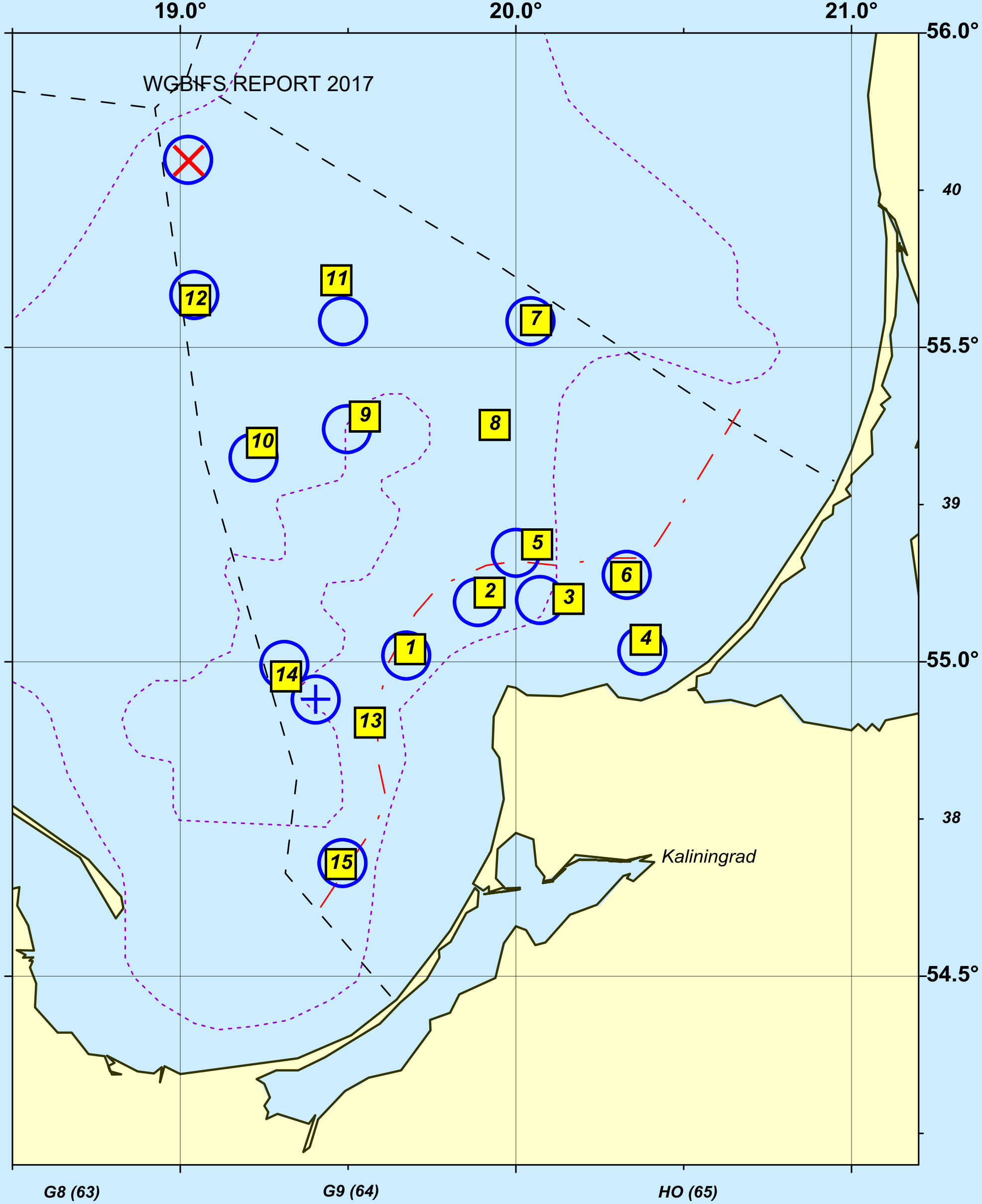
Survey Report for RV "ATLANTNIRO"
11.10-18.10.2016

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





- The executed trawling stations

- The recommended ICES trawling stations

- Only hydrological are executed in exchange to trawling stations

- Did not carried after 2009 (invalid in March 2009)

Figure 1. Trawl positions for RV "ATLANTNIRO" in 11-18 October 2016

Table 1. Fish control-catch results in the Baltic Sea ICES SD 26 from Russian BITS survey (RV "ATLANTNIRO", 11–18.10.2016)

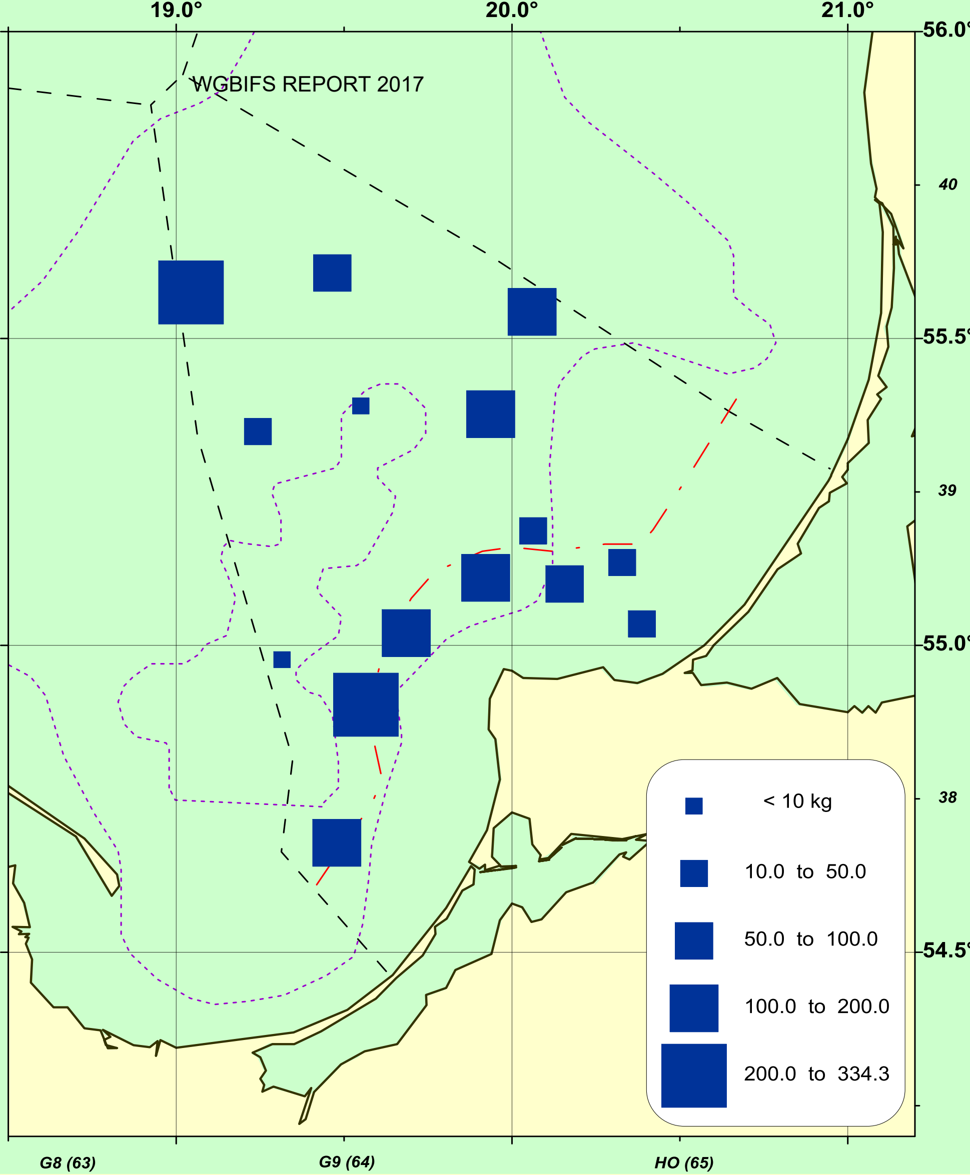
Haul number	Date	ICES rect.	ICES SD	Mean bottom depth [m]	Head-rope depth [m]	Hor. open [m]	Ver. open [m]	Trawl. speed [knt]	Trawl. direct [°]	Geographical position				Time Start	Haul dur. [min]	Total catch [kg]
										Start		End				
										Latitude 00° 00.0'N	Longitude 00° 00.0'E	Latitude 00° 00.0'N	Longitude 00° 00.0'E			
1	11.10.2016	39G9	26	74	74	97	5	3,0	220	55 01.2	19 41.1	55 00.0	19 39.6	17:40	30	262,6
2	12.10.2016	39G9	26	66	66	92	5	3,0	238	55 06.6	19 55.3	55 05.7	19 53.1	8:39	30	520,7
3	12.10.2016	39HO	26	55	55	98	5	3,1	270	55 06.0	20 09.4	55 06.0	20 06.7	13:10	30	297,3
4	12.10.2016	39HO	26	27	27	98	5	2,9	200	55 02.1	20 23.2	55 00.8	20 22.2	17:10	30	62,7
5	13.10.2016	39HO	26	60	60	91	5	2,9	250	55 11.2	20 03.8	55 10.7	20 01.5	10:40	30	177,1
6	13.10.2016	39HO	26	43	43	90	5	3,0	206	55 08.1	20 19.7	55 06.8	20 18.5	14:27	30	159,6
7	14.10.2016	40HO	26	80	80	89	5	3,0	226	55 32.6	20 03.6	55 31.5	20 01.7	8:35	30	225,1
8	14.10.2016	39G9	26	82	82	90	5	3,0	201	55 22.6	19 56.2	55 21.7	19 55.6	13:28	20	141,3
9	14.10.2016	39G9	26	97	97	95	5	2,9	235	55 23.4	19 33.0	55 22.6	19 30.9	17:20	30	3,0
10	15.10.2016	39G9	26	86	86	97	5	3,1	215	55 20.9	19 14.6	55 19.7	19 13.0	8:52	30	43,9
11	15.10.2016	40G9	26	85	85	92	5	3,0	250	55 36.4	19 27.9	55 35.9	19 25.5	14:08	30	108,8
12	17.10.2016	40G9	26	88	88	93	5	3,0	0	55 34.5	19 02.6	55 36.0	19 02.7	7:27	30	333,5
13	17.10.2016	38G9	26	86	86	96	5	3,0	4	54 54.2	19 33.9	54 55.7	19 34.2	15:55	30	344,2
14	18.10.2016	38G9	26	106	106	94	5	2,9	350	54 58.6	19 18.9	55 00.1	19 18.5	7:30	30	9,9
15	18.10.2016	38G9	26	87	87	92	5	2,9	51	54 40.7	19 28.7	54 41.5	19 30.9	11:12	30	200,8
SD26				75	75	94	5	3,0	194							2890

Table 2. Catch composition on the bottom trawl survey in 11-18 October 2016

Sub-Division: 26 **Vessel: STM - "Atlantniro"** **Net type: bottom trawl - TV-3#930**
Month/Year: October/2016 **Haul duration: 30 minute** **Mesh bar size: 6.5 mm**

Total of hauls	rectangle	depth meter	haul duration	total catch, kg	cod		flounder		herring		sprat	
					kg	%	kg	%	kg	%	kg	%
15	4064, 4065, 3864, 3964, 3965	27-106	30	2890.4	1735.4	60.0	273.1	9.4	797.8	27.6	71.0	2.5

Number of biological samples (maturity and age material, *maturity only):			
Species	Length	Maturity	Age (otoliths)
Clupea harengus	3526	924	355
Gadus morhua	3789	1026	526
Platichthys flesus	981	512	511
Sprattus sprattus	799	122	122



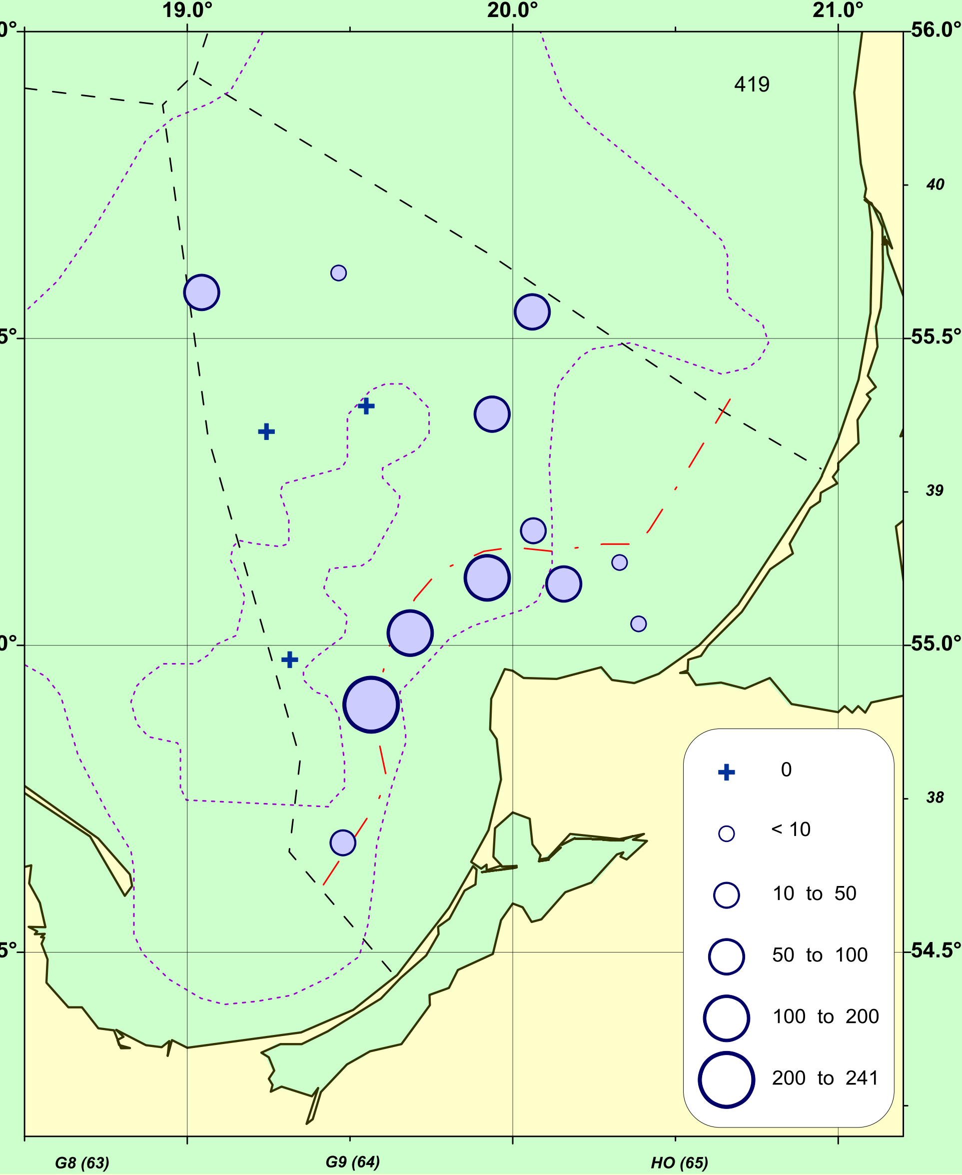


Fig. 2. Landings of cod (kg) for 30 minutes of a haul in 11-18 October 2016

Fig. 3. Landings of young cod in length up to 30 cm (in numbers) for 30 minutes of a haul in 11-18 October 2016

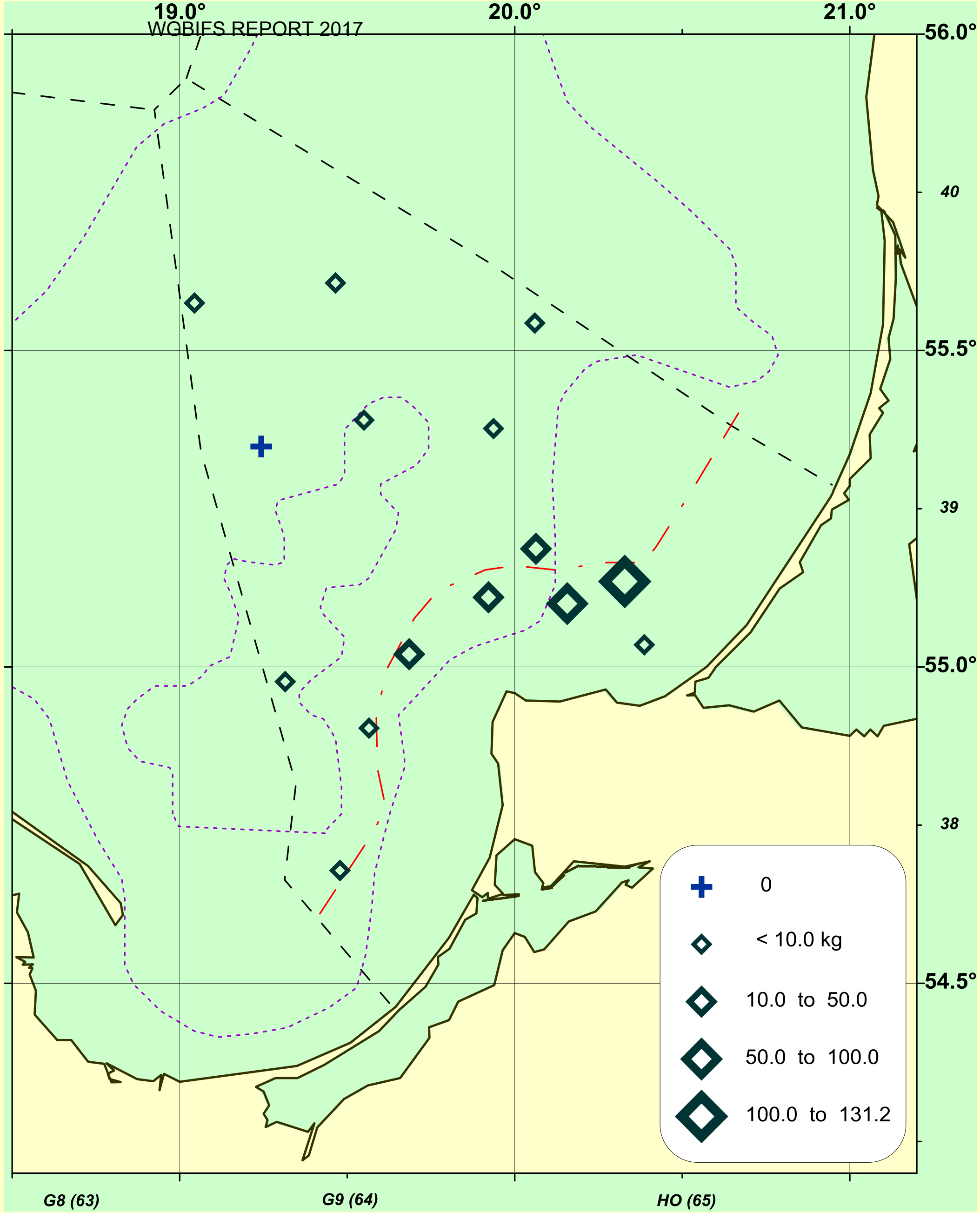


Fig. 4. Landings of flounder (kg) for 30 minutes of a haul in 11-18 October 2016

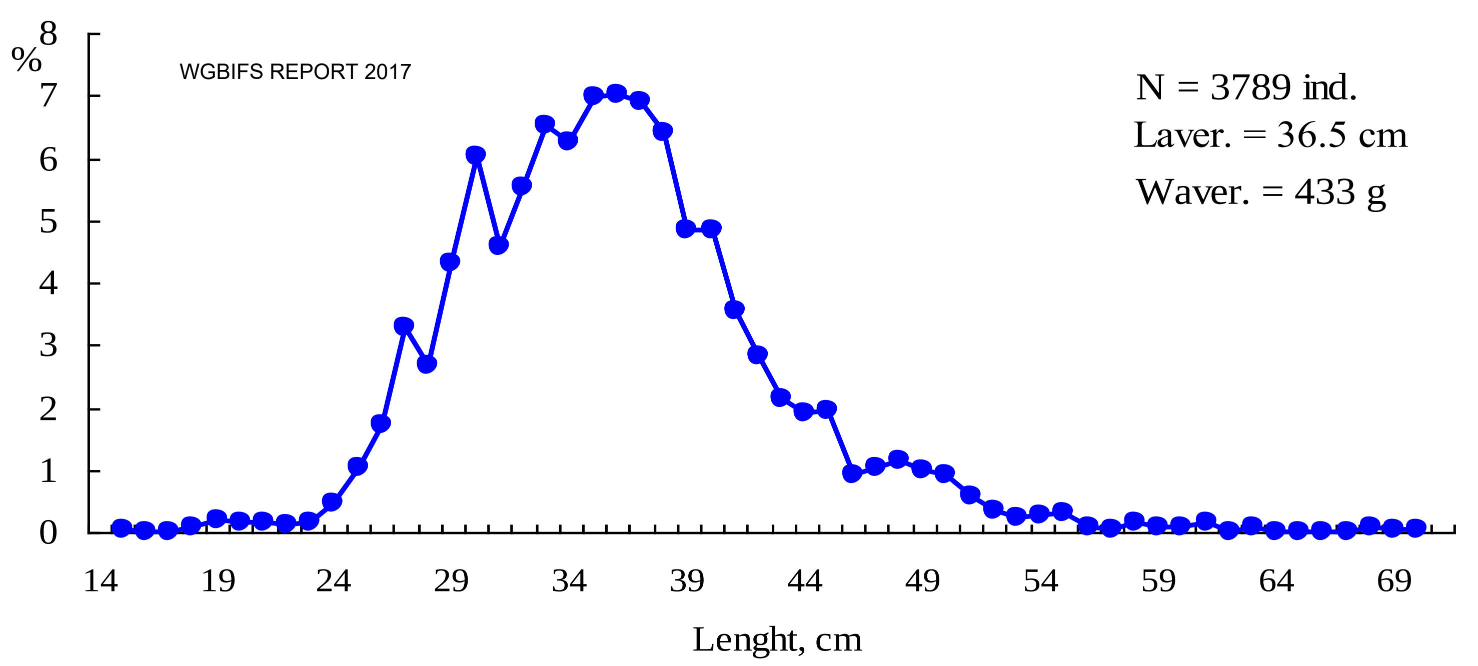


Fig. 5. Length distribution of cod in Russian water area (Sub-division 26) in 11-18 October 2016 (materials of international bottom trawl survey)

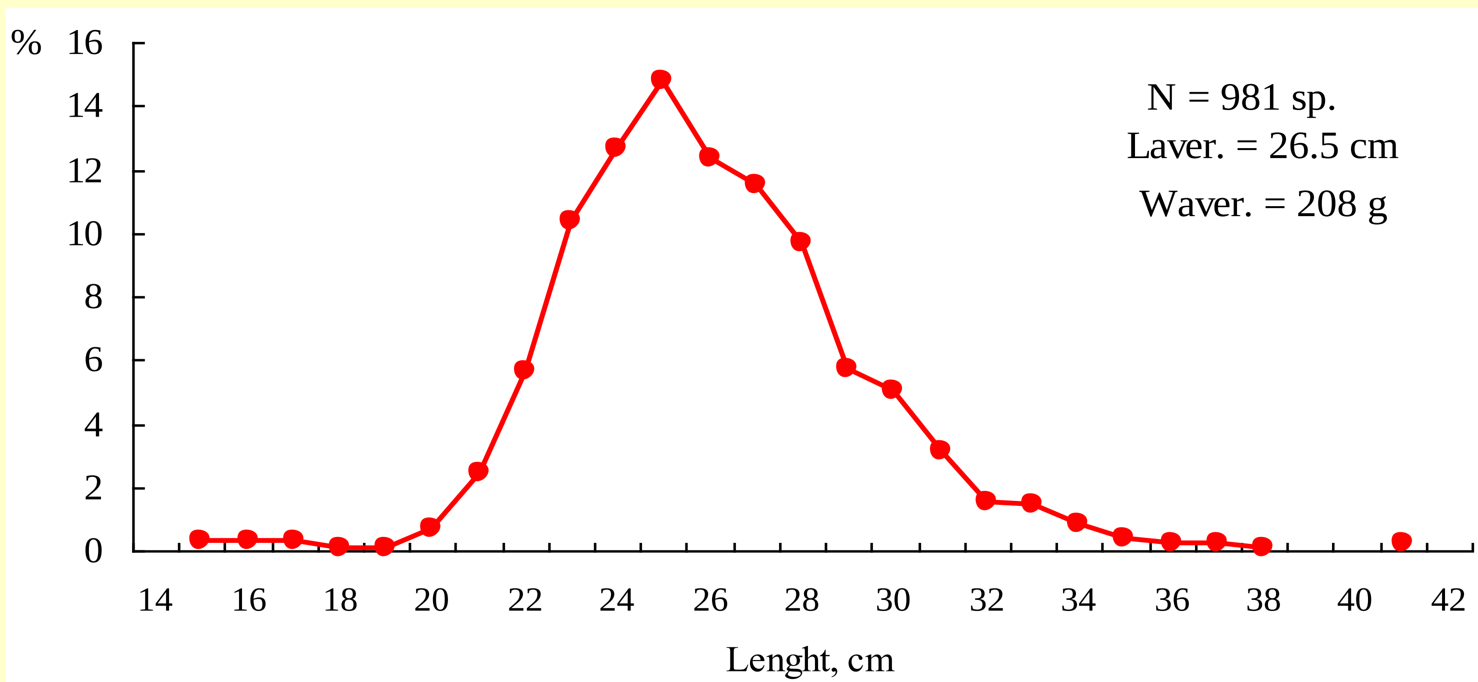


Fig. 6. Length distribution of flounder in Russian water area (Sub-division 26) in 11-18 October 2016 (materials of international bottom trawl survey)

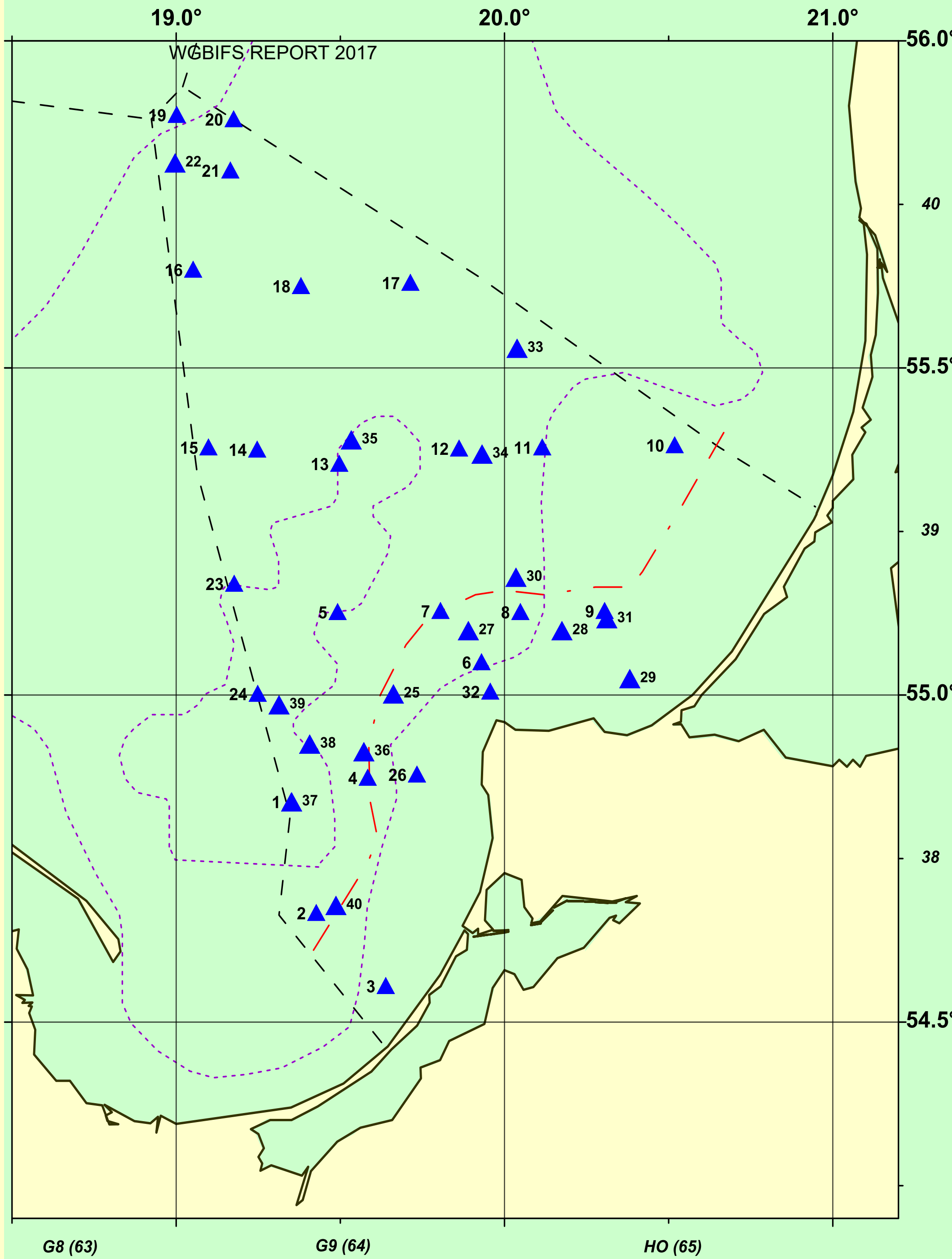


Fig. 7. Location of hydrographic stations in 02-18 October 2016, RV "ATLANTNIRO"

Hydrological stations
40

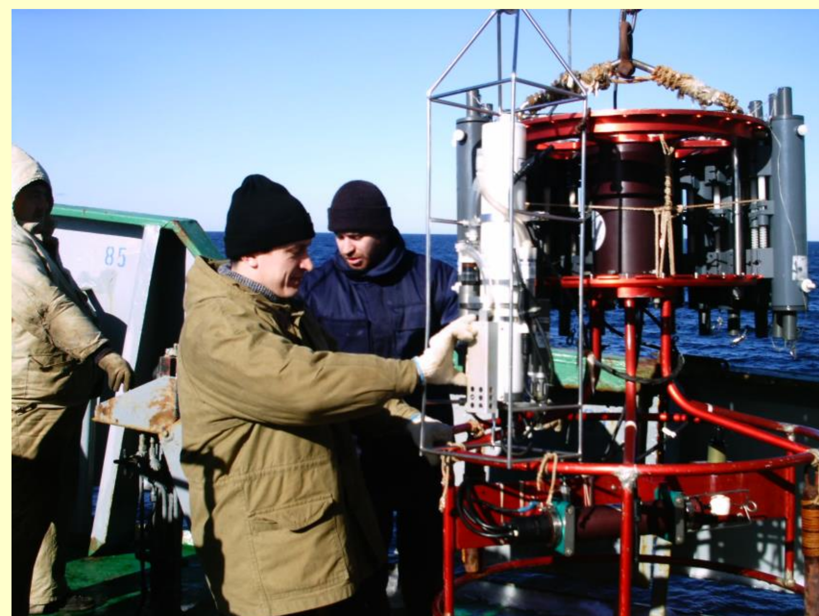
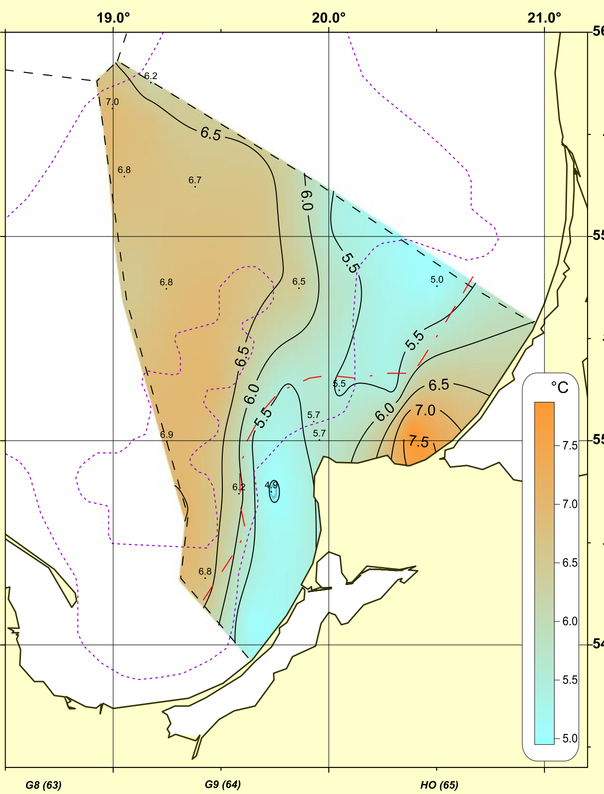
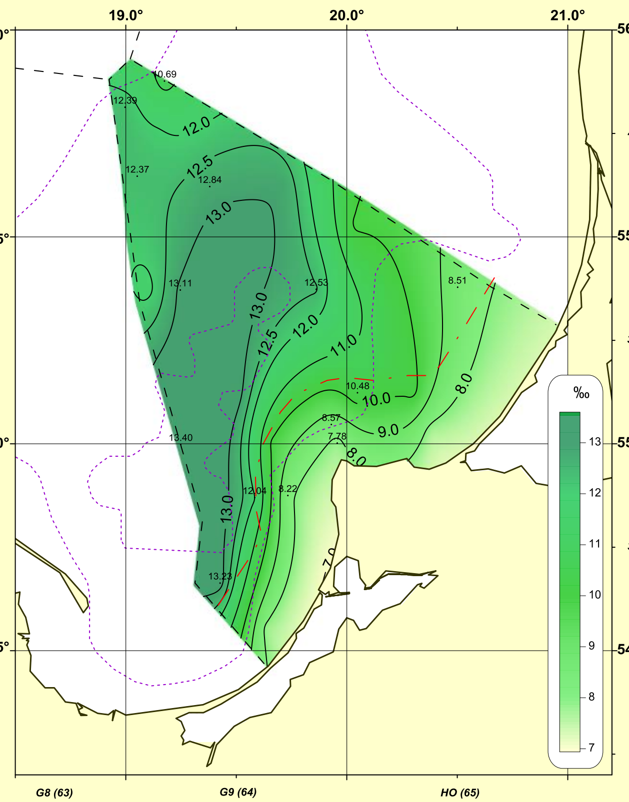


Fig. 8. Bottom water temperature distribution (°C) in 02-13 October 2016, RV "ATLANTNIRO"

Fig. 9. Bottom water salinity distribution (‰) in 02-13 October 2016, RV "ATLANTNIRO"

Fig. 10. Bottom water oxygen concentration (ml/l) in 02-13 October 2016, RV "ATLANTNIRO"





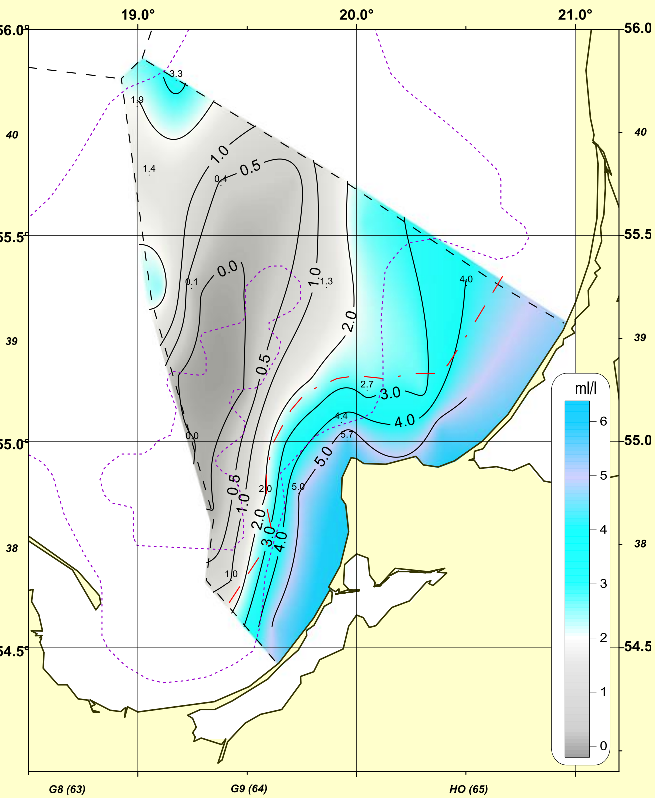


Table 3.The some biological parameters of the main fish species

Species	Length range, cm	Length aver., cm	Weight aver., g
GADUS MORHUA 	15 - 70	36,5	433
PLATICHTHYS FLESUS 	15 - 41	26,5	208
CLUPEA HARENGUS 	11,0 - 29,0	20,6	51,1
SPRATTUS SPRATTUS 	6,5 - 14,5	10,7	8,25


THANK YOU!

THÜNEN

German BITS in Q4 2016 & Q1 2017

Martina Bleil & Andrés Velasco

Thünen Institute of Baltic Sea Fisheries, Rostock

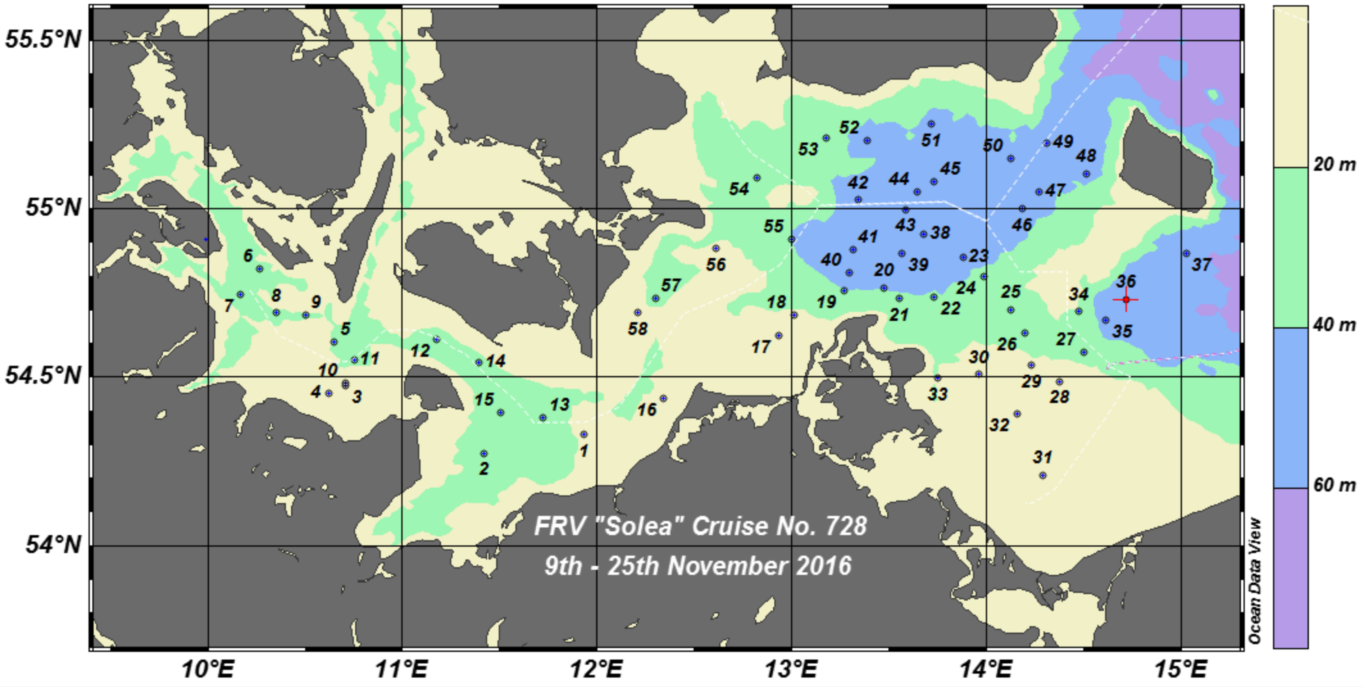
Riga,
27.03.2017

Introduction

- The autumn survey 2016 and the spring survey 2017 are the 35th autumn and the 36th spring German trawl surveys since 1981
- They took place from 9th - 25th November 2016 and from 20th February to 14th March 2017
- The German BITS covers Danish, Swedish, Polish and German territorial waters in the Belt Sea (Mecklenburg- and Kiel Bight and Belts) in ICES SD22 and the Baltic West from Bornholm in ICES SD24 (Arkona Sea)
- In total 114 fishery hauls and 114 hydrography stations (95 % of planned) in ICES SD22 and SD24 were carried out

German BITS Q4 2016

- 58 fishery hauls and 58 hydrography stations (97 % of planned due bad weather) were carried out in ICES SD22 and SD 24
- In total 1026 COD, 637 FLE, 920 PLE, 726 DAB, 196 TUR & 5 BLL were collected for measuring length, weight, sex, maturity and age



- The mean catch per half hour (CPUE) was 66.7 kg of COD and 89.0 kg of FLE

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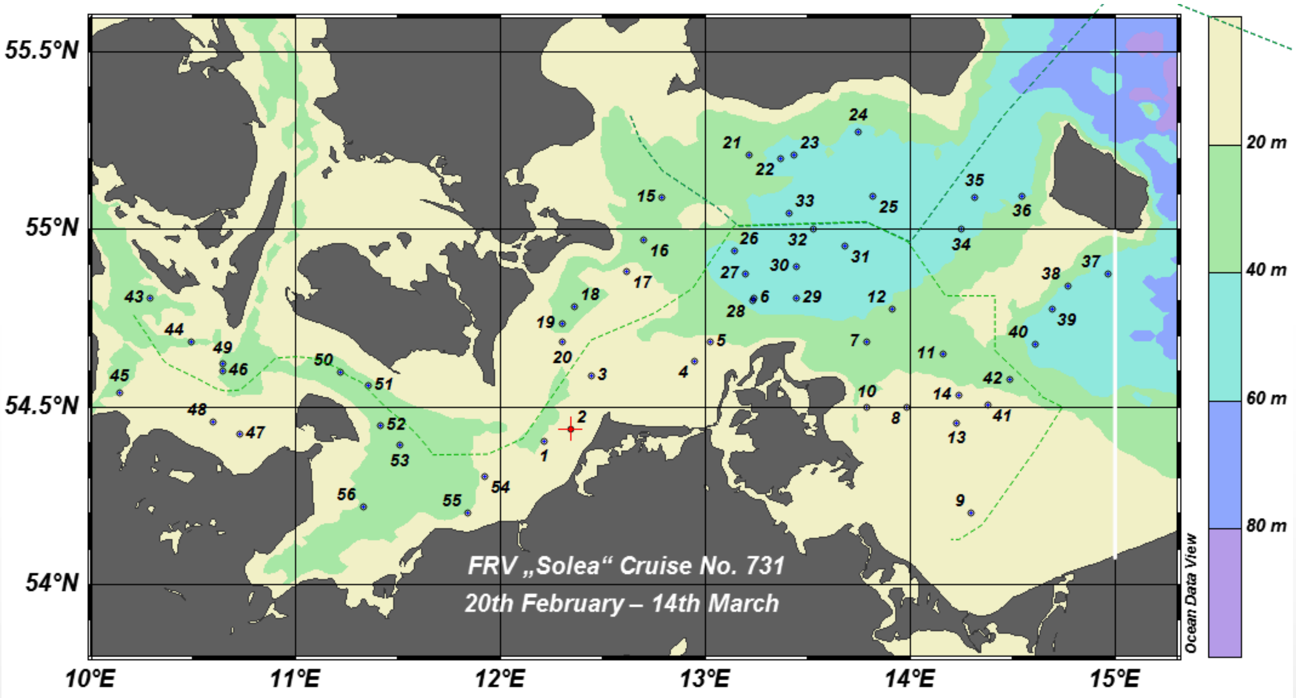
German BITS Q1 2017

- 58 fishery hauls and 61 hydrography stations (100 % of planned) were carried out in ICES SD 22 and SD24
- In total 1285 COD, 682 FLE, 758 PLE, 536 DAB, 132 TUR & 3 BLL were collected for measuring length, weight, sex, maturity and age



- The mean catch per half hour (CPUE) was 105.7 kg of COD and 25.4 kg of FLE

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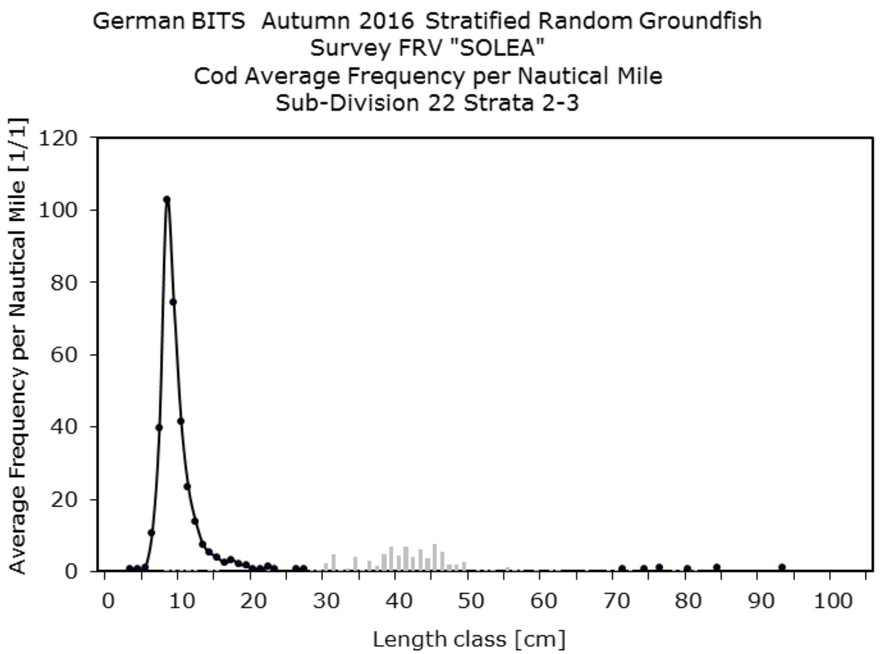
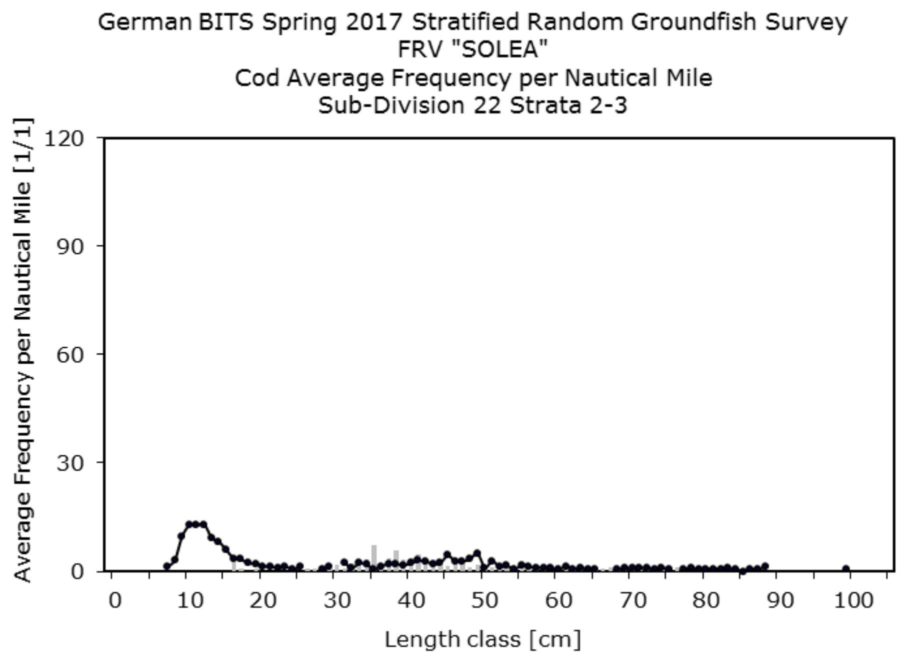
Length frequencies of Cod by depth strata (ICES SD 22, 10-29 m, Q4 2016 & Q1 2017)





- the length range 10–25 cm of young cod in the depth layer 10-29 m in SD 22 in autumn 2016 and spring 2017 compared to the previous year is increased

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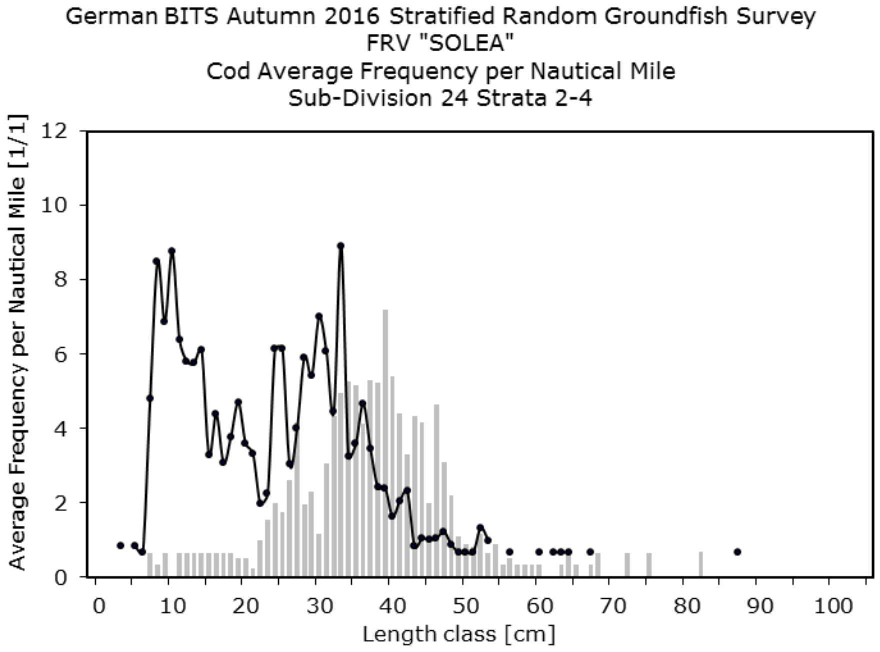
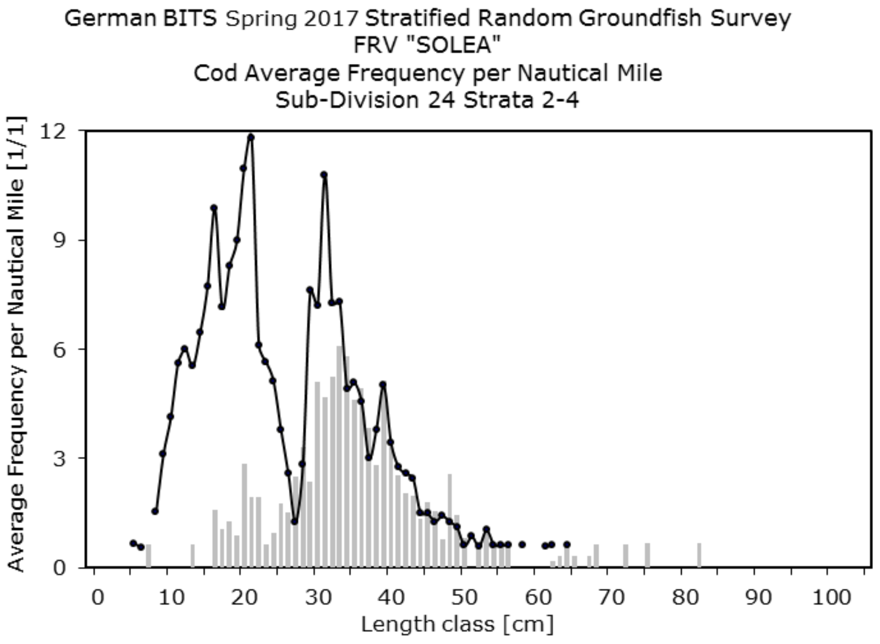
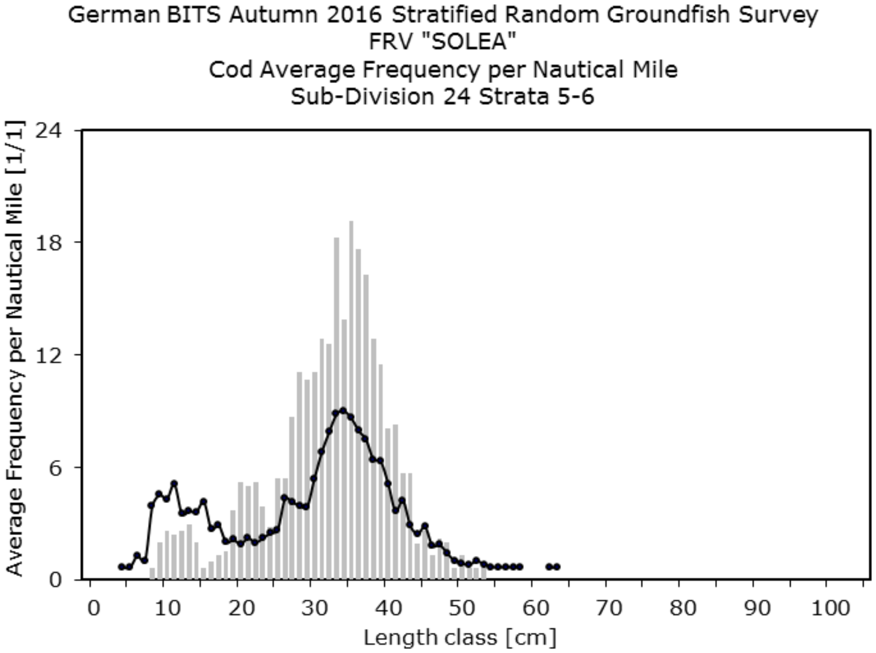
Length frequencies of Cod by depth strata (ICES SD 24, 10-39 m, Q4 2016 & Q1 2017)

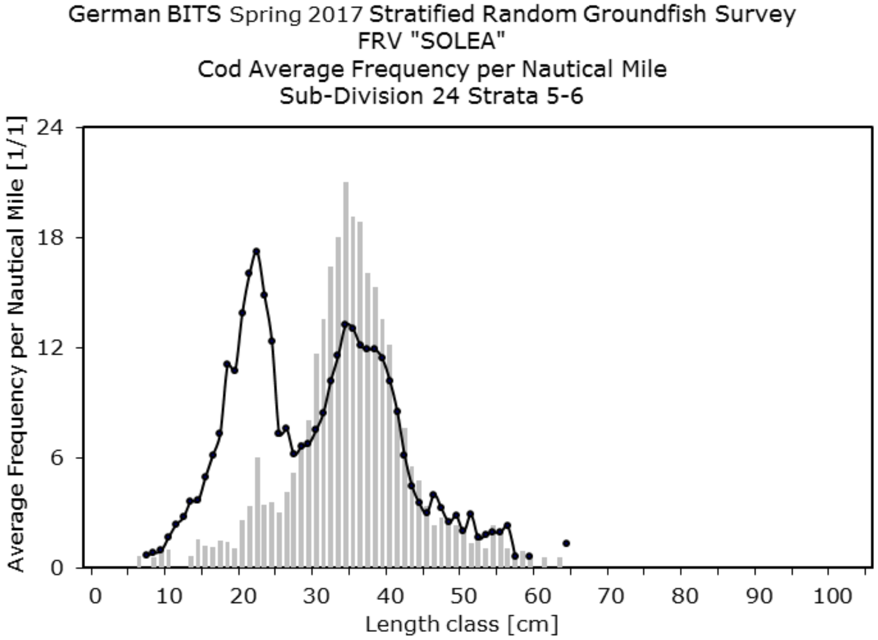




- the number per mile of length range 25–40 cm of young cod in the depth layer 10-39 m in SD 24 in autumn 2016 and spring 2017 compared to the previous year is increased

Length frequencies of Cod by depth strata (ICES SD 24, 40-59 m, Q4 2016 & Q1 2017)





- the number per mile of length range 25–40 cm of young cod in the depth layer 40-59 m in SD 24 in autumn 2016 and spring 2017 compared to the previous year is in autumn decreased and in spring similar

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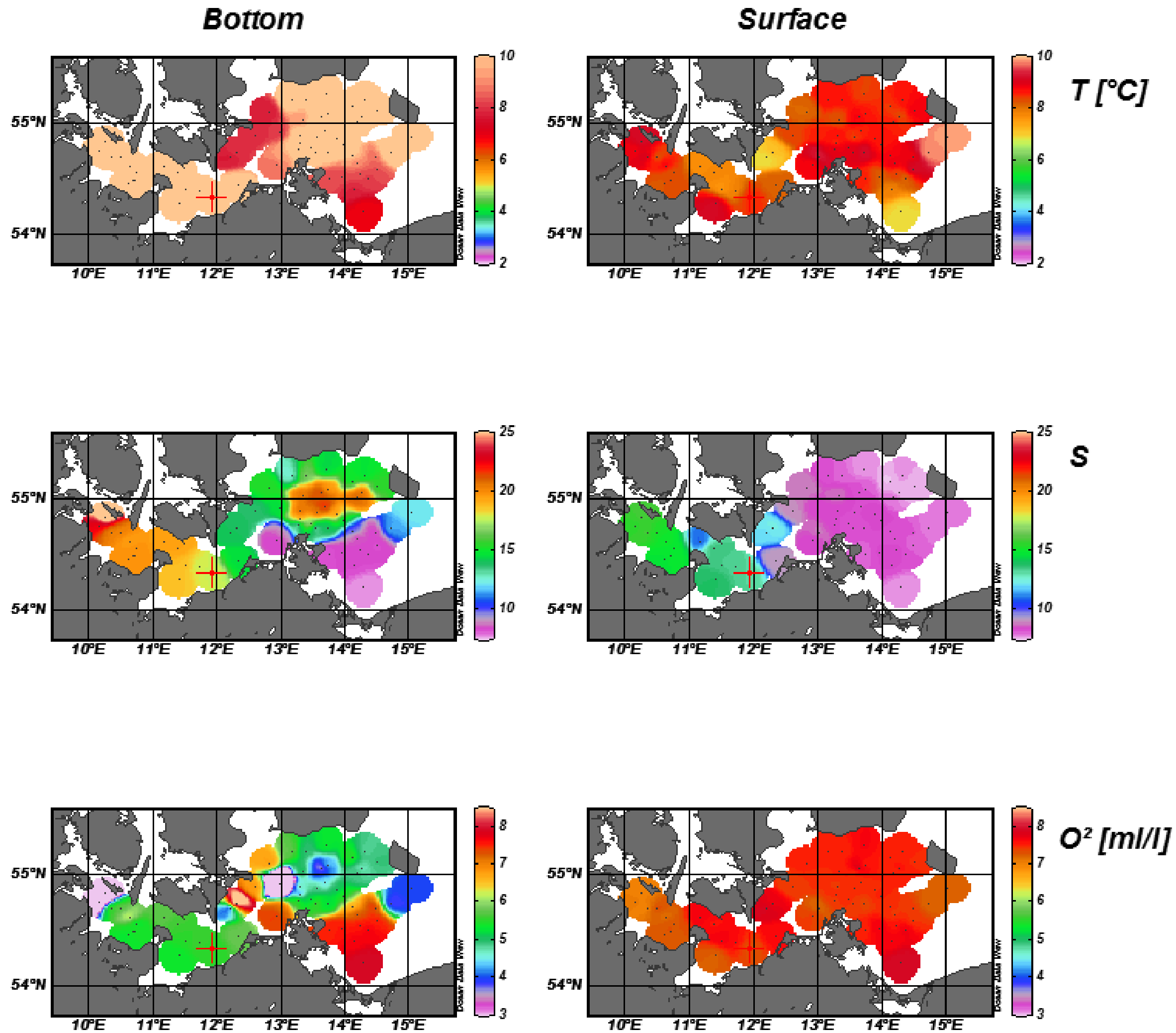
Hydrography in Q4 2016

- typical autumn conditions with surface temperatures between 6.9 - 9.9 °C
- salinity of the surface water decreased from 15.9 - 7.5 from west to east
- lowest temperature value was found in the area south of Bornholm at 6.9 °C
- salinity above the permanent halocline at a water depth of 29 m south of Bornholm was 8.2
- salinity increased below the halocline at a depth of 44 m in the Arkona Sea up to 21.7 at 10.9 °C
- oxygen concentration close to the bottom was between 3.4-9.6 ml/l



Andrés Velasco & Martina Bleil
WGBIFS
THÜNEN

Hydrography in Q1 2017

- typical spring conditions with surface temperatures between 2.0 - 3.8 °C
- salinity of the surface water decreased from 16.3 - 7.8 from west to east
- lowest temperature value was found in the area East of island Rügen at 2.0 °C
- salinity above the permanent halocline at a water depth of 20.8 m in the Arkona Basin was 8.4
- salinity increased below the halocline at a depth of 42 m in the Arkona Basin up to 20.8 at 3.6 °C
- oxygen concentration close to the bottom was between 5.9-9.2 ml/l

Thank you!

Andrés Velasco & Martina Bleil
WGBIFS

THÜNEN

Fisheries Service under the Ministry of Agriculture of Republic of Lithuania, Fishery Research and Science State

BALTIC INTERNATIONAL TRAWL SURVEY (BITS) IN THE LITHUANIAN ESPECIAL ECONOMIC ZONE OF THE BALTIC SEA

WGBIFS, 2017

BITS 2016 Q4

(R/V ”DARIUS” 2016-11-24-25)

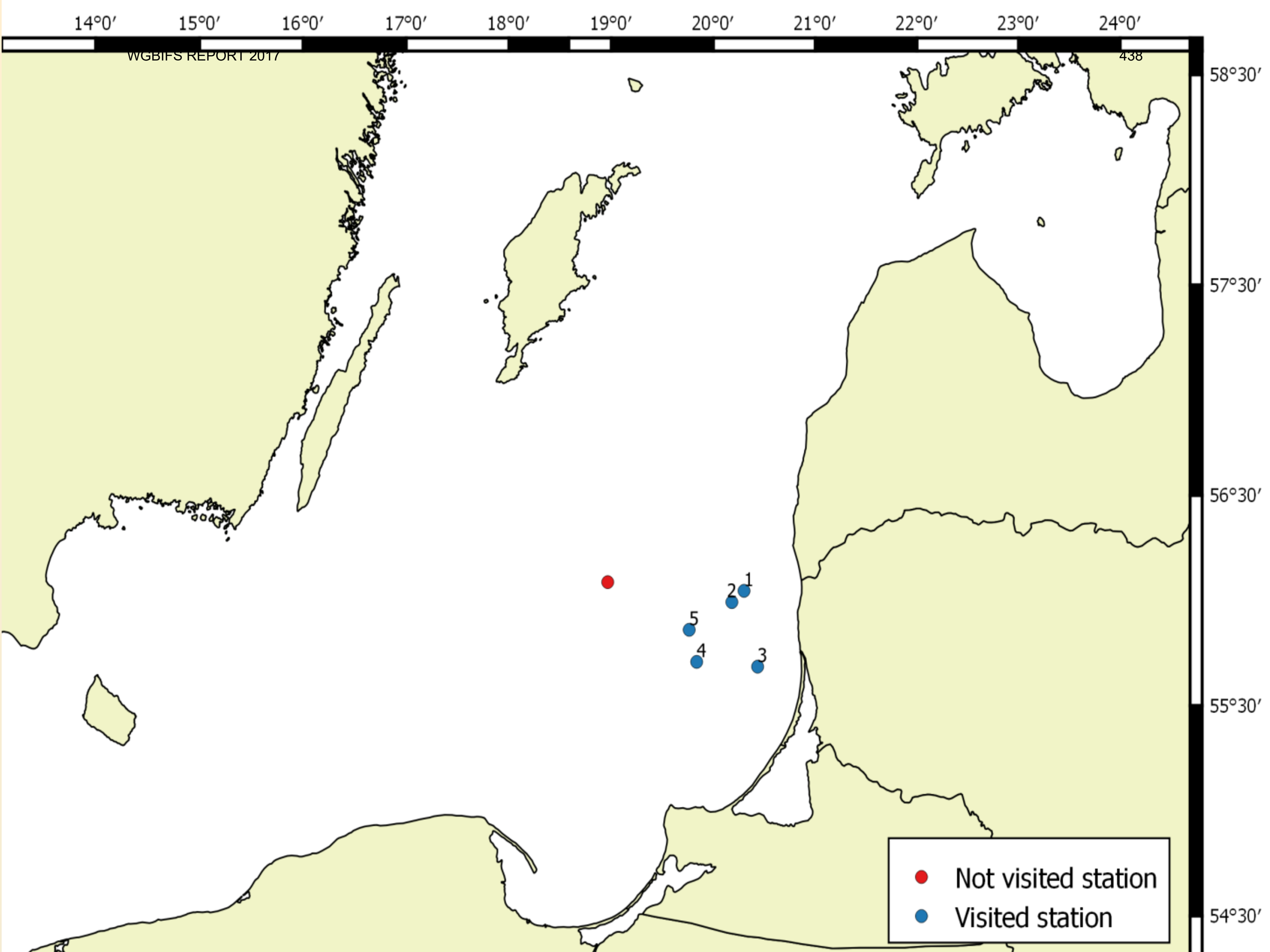
During survey was made 5 trawls and 2 hydrological station (planed 6 trawls).

Trawling was done with the standard trawl TV3/520.

Seabird SBE 19plus v2 was used for hydrological data

The duration of the hauls was 30 minutes and the velocity was 3 knots. The total catch of each haul was analyzed to determine the species composition in weight and number as well as the distribution of length among all species.

Sub-samples of cod, flatfishes were investigated concerning sex, maturity and age.

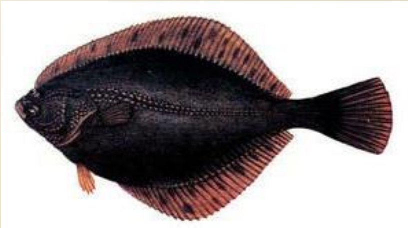

14°0′
15°0′
16°0′
17°0′
18°0′
19°0′
20°0′
21°0′
22°0′
23°0′
24°0′
58°30′
57°30′
56°30′
55°30′
54°30′
1
2
3
4
5
Not visited station
Visited station

BITS (2016 Q4) RESULTS

Fish catches

Haul number	Catch date	The ICES rectangle and subdivision	Trawling depth (m)	Total CPUE (kg/h)	CPUE per species (kg/h)				
					Cod	Flounder	Place	Turbot	Others
1	2016-11-24	40H0 (26)	32	395.9	25.4	166.0	0	2.1	202.4
2	2016-11-24	40H0 (26)	37	509.1	41.3	360.0	0	0	107.8
3	2016-11-25	40H0 (26)	48	224.4	137.7	86.3	0	0	0.3
4	2016-11-25	40H0 (26)	74	174.5	235.7	33	0.1	0.3	80.0
5	2016-11-25	40H0 (26)	81	0					
Mean					110.0	161.3	0.03	0.6	97.6

29,8%

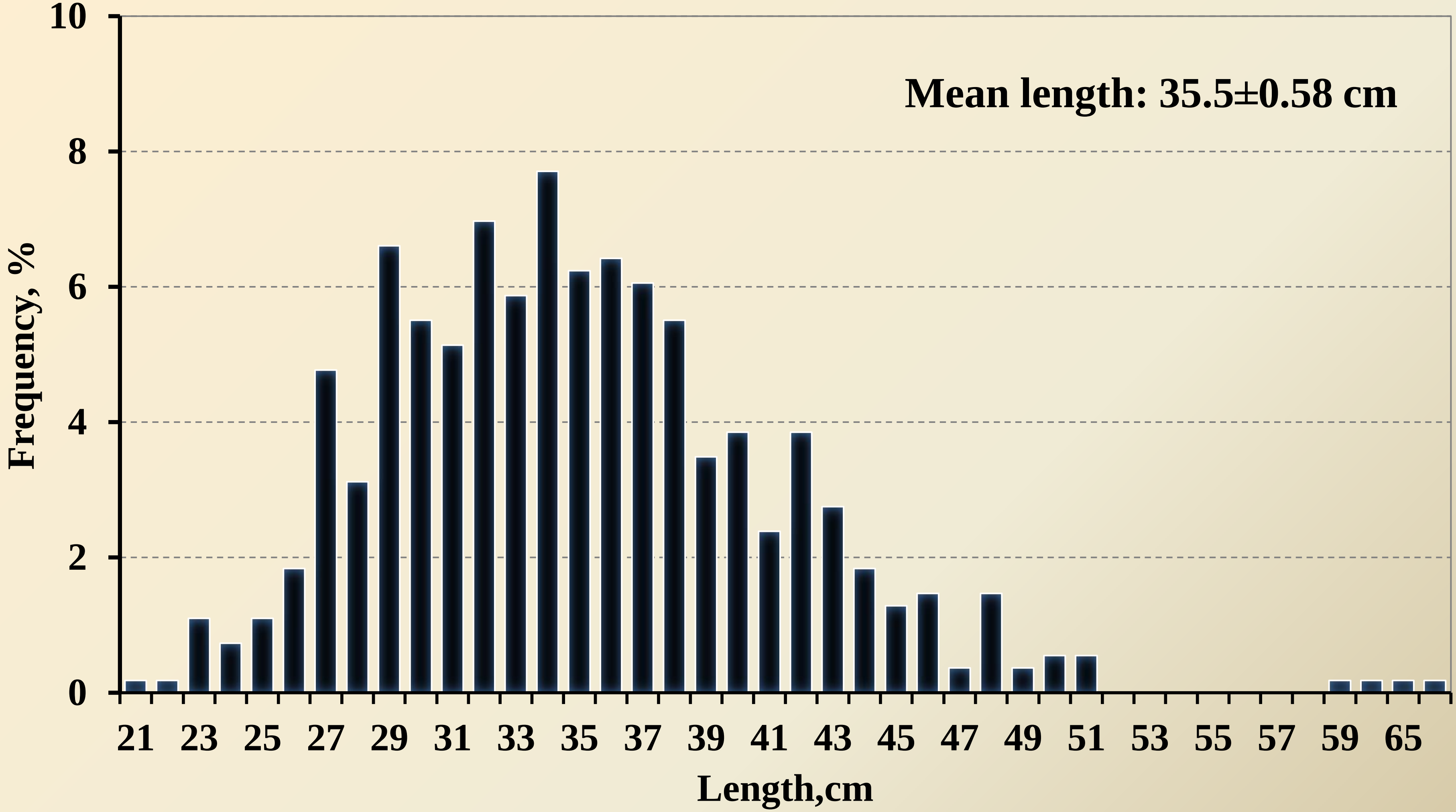


43,7%

BITS (2016 Q4) RESULTS

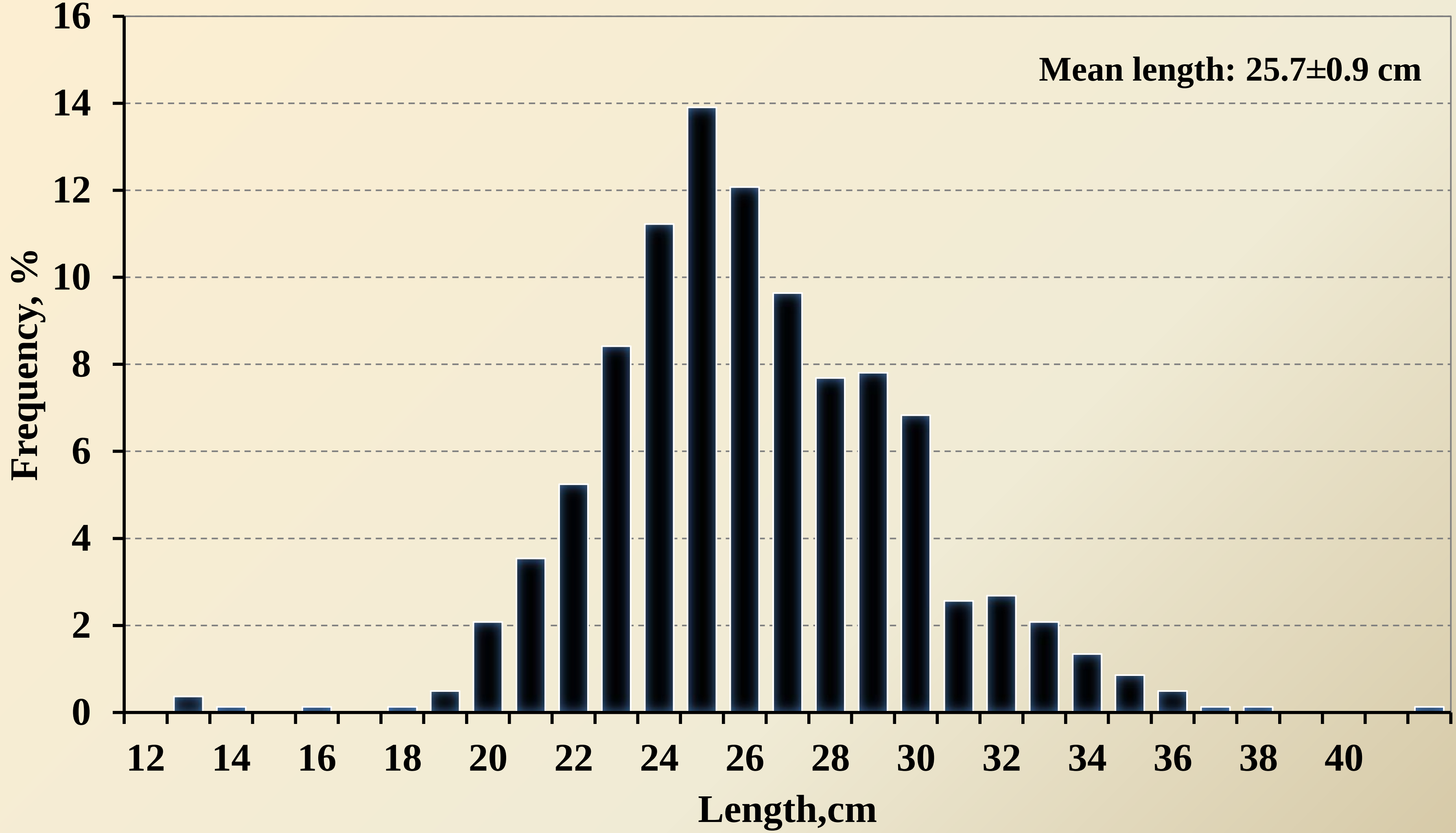
	Haul Nr.	Cod	Flounder	Place	Turbot	Other
Length data	1	32	169		4	302
	2	64	353			233
	3	179	231			2
	4	270	64	1	1	183
Age data		298	323	1	5	0
Stomach data		0	0	0	0	0

Baltic cod length distribution

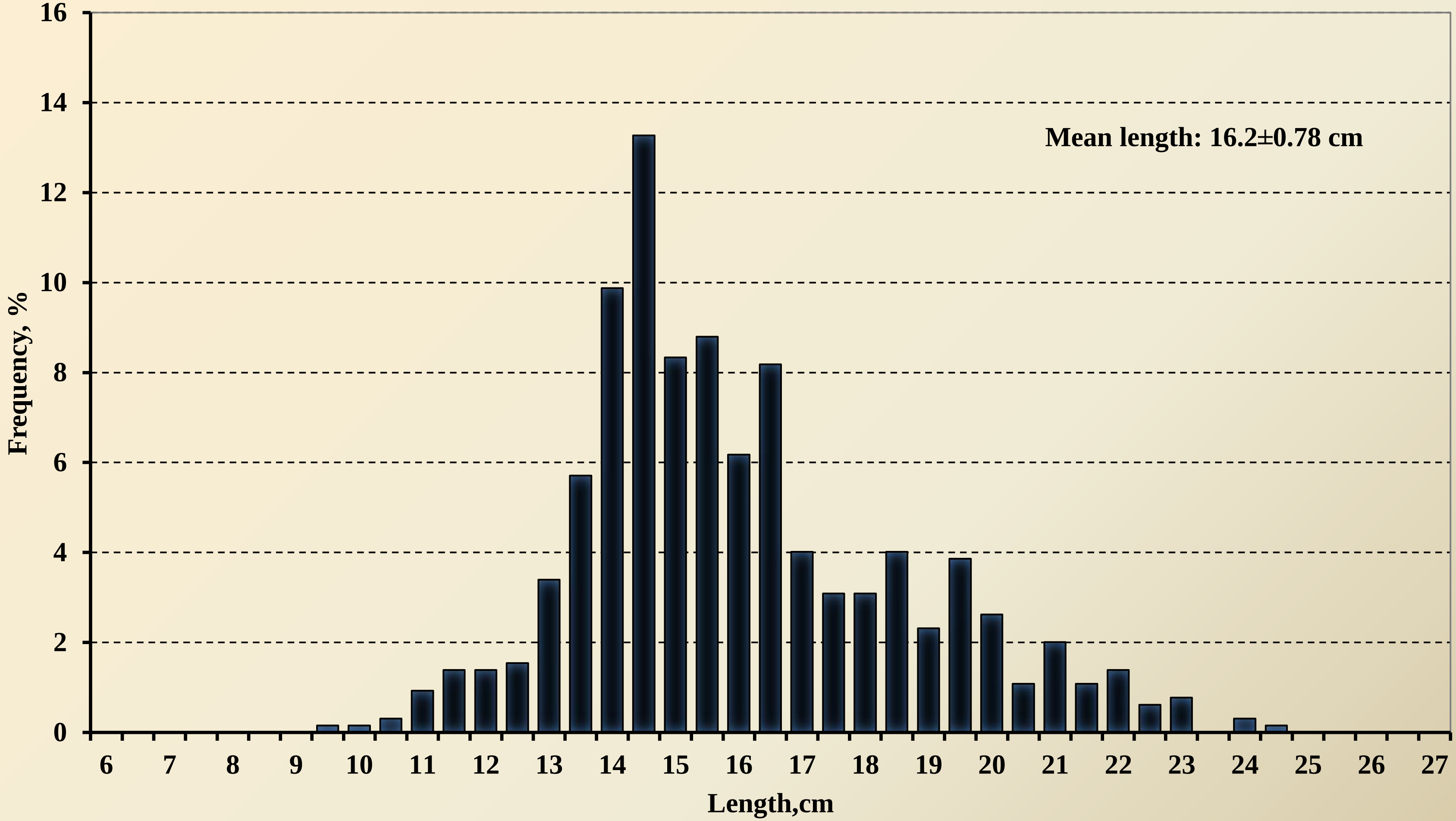


WGBIFS 2017

Flounder length distribution



Herring length distribution



WGBIFS 2017

BITS 2017 Q1

(R/V ”DARIUS” 15-16. 02.2017)

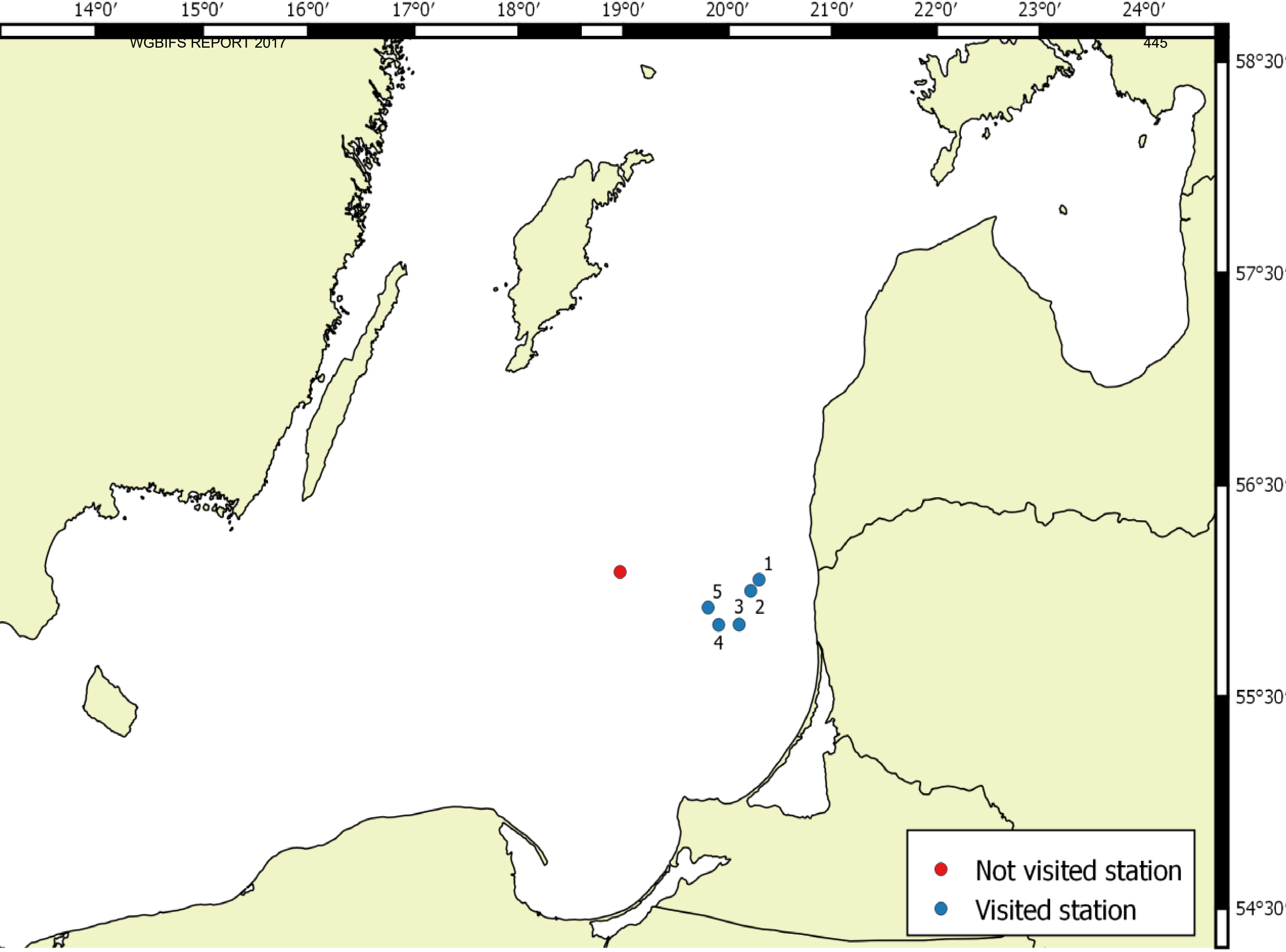
During survey was made five trawls and five hydrological station.

Trawling was done with the standard trawl TV3/520.

Seabird SBE 19plus v2 was used for hydrological data

The duration of the hauls was 30 minutes and the velocity was 3 knots. The total catch of each haul was analyzed to determine the species composition in weight and number as well as the distribution of length among all species.

Sub-samples of cod, flatfishes were investigated concerning sex, maturity and age.


14°0′
15°0′
16°0′
17°0′
18°0′
19°0′
20°0′
21°0′
22°0′
23°0′
24°0′
58°30′
57°30′
56°30′
55°30′
54°30′
1
2
3
4
5
Not visited station
Visited station

BITS (2017 Q1) RESULTS:

Fish catches and biological data

Haul number	Catch date	The ICES rectangle	Trawling depth (m)	Total CPUE (kg/h)	CPUE per species (kg/h)					
					Cod	Flounder	Place	Turbot	Herring	Others
1	2017-02-14	40H0	38	270.976	45,932	215,712		1,024	0,14	8,168
2	2017-02-14	40H0	34,5	39,496	1,196	25,408			7,732	5,16
3	2017-02-15	40H0	51	68,082	11,34	30,9			8,874	16,978
4	2017-02-15	40H0	54	176,146	2,576	78,632			9,696	85,242
5	2017-02-15	40H0	32	260,098	6,05	95,78			96,64	61,628
Mean					13,509	89,286		1,024	24,616	35,435

54.76%

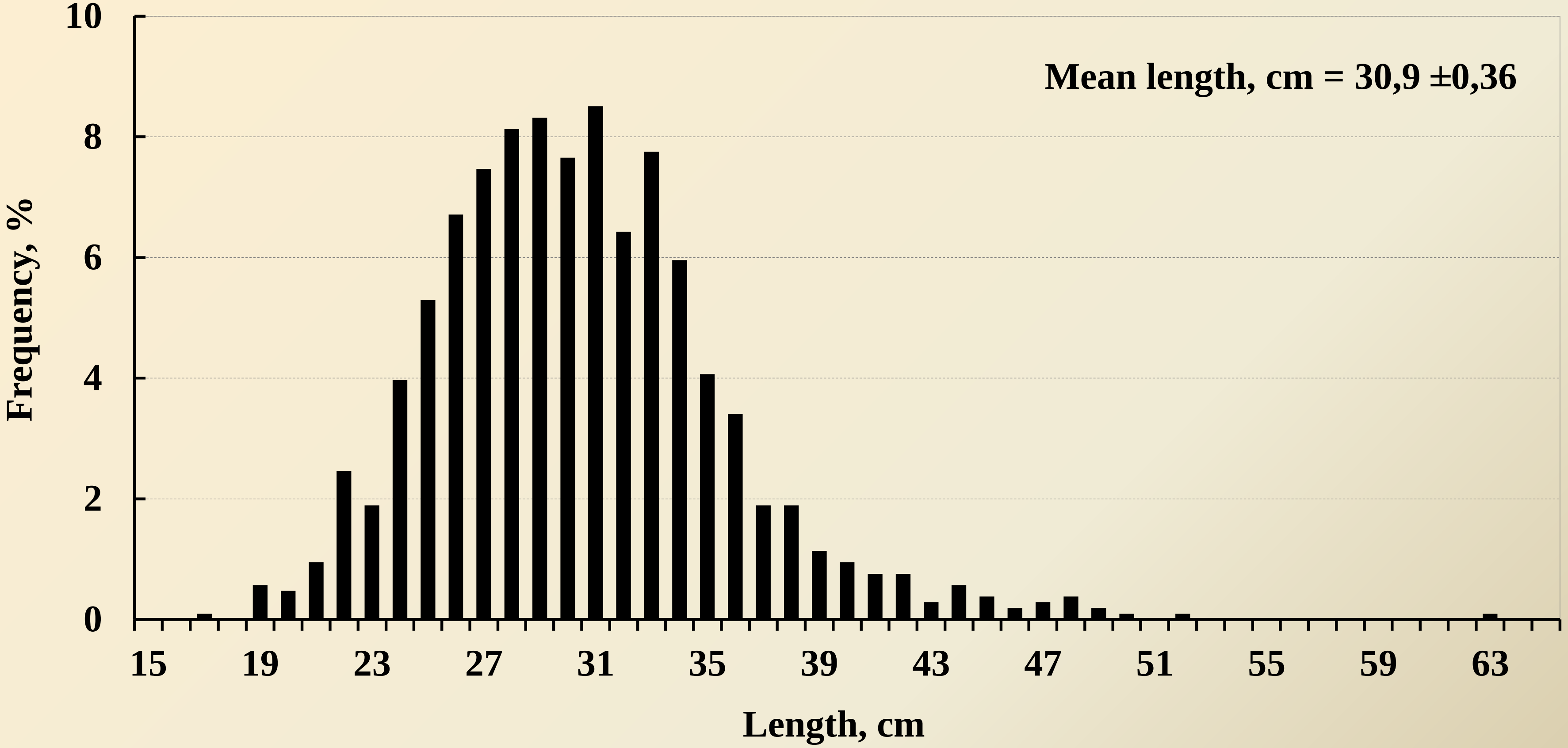
15.1%

8.28%

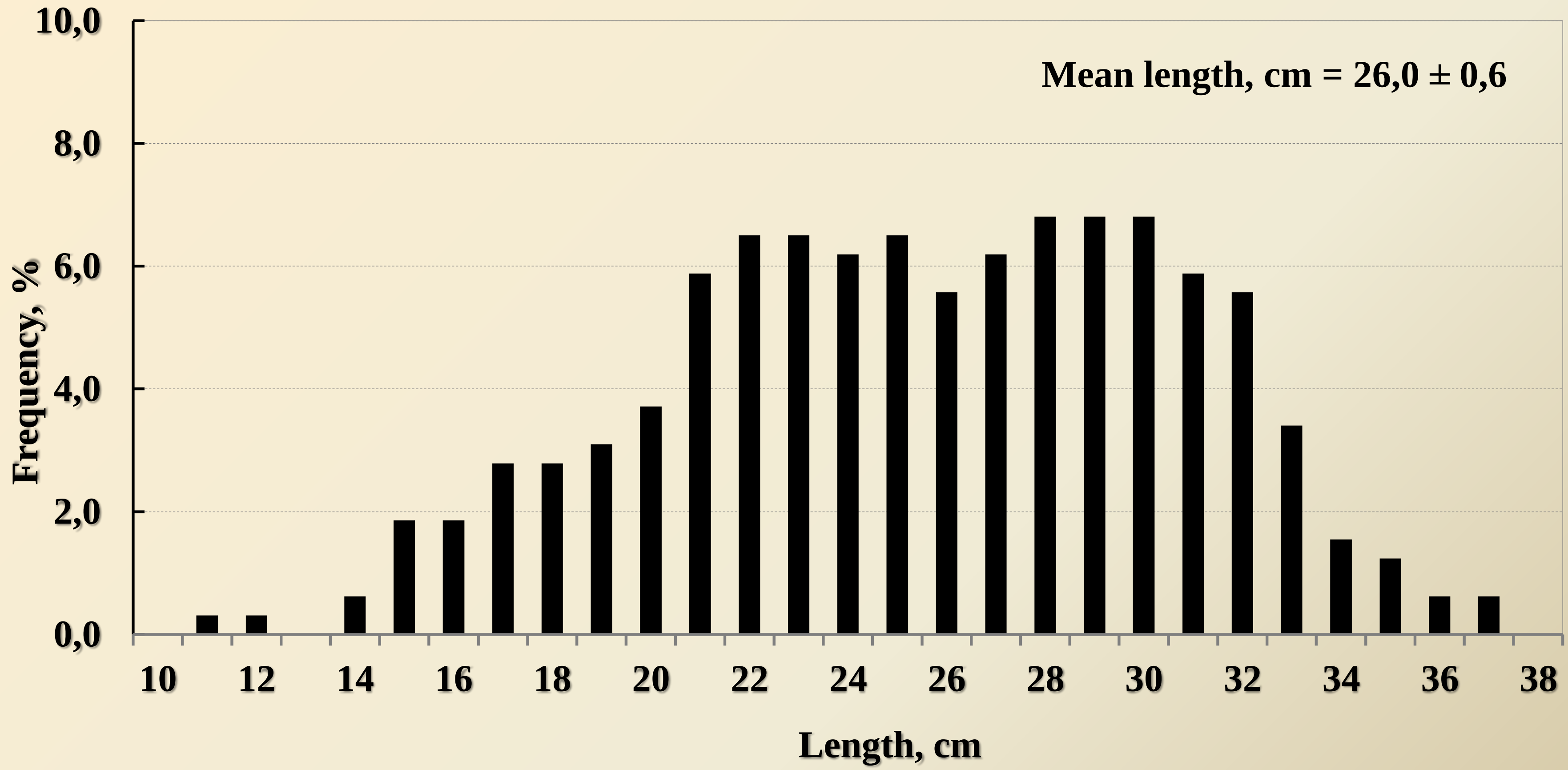
BITS (2017 Q1) RESULTS

	Haul Nr.	Cod	Flounder	Place	Turbot	Other
Length data	1	41	384		2	36
	2	1	79			803
	3	13	90			701
	4	4	215			417
	5	17	248			655
Age data		60	292		2	0

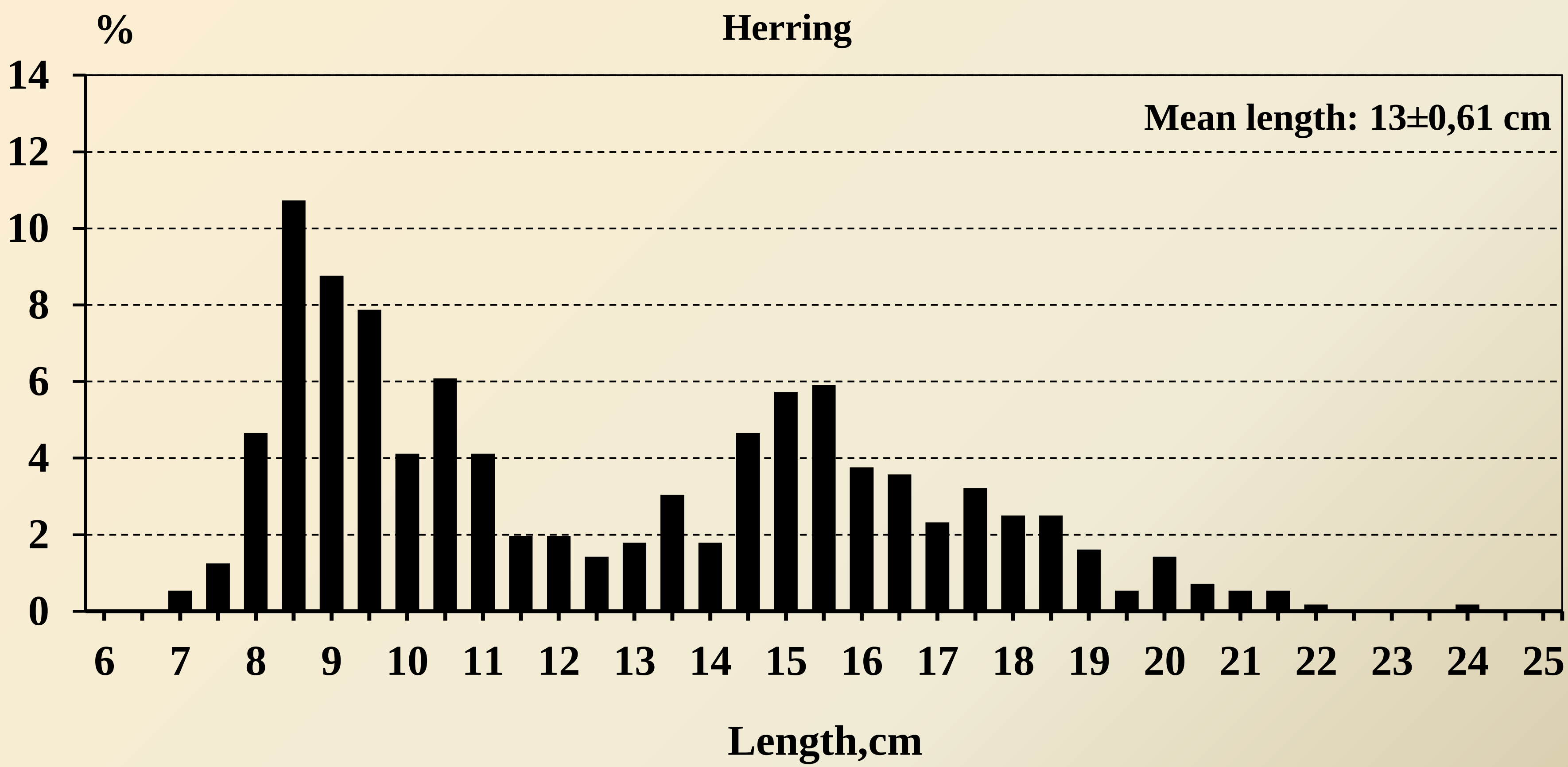
Baltic cod length distribution

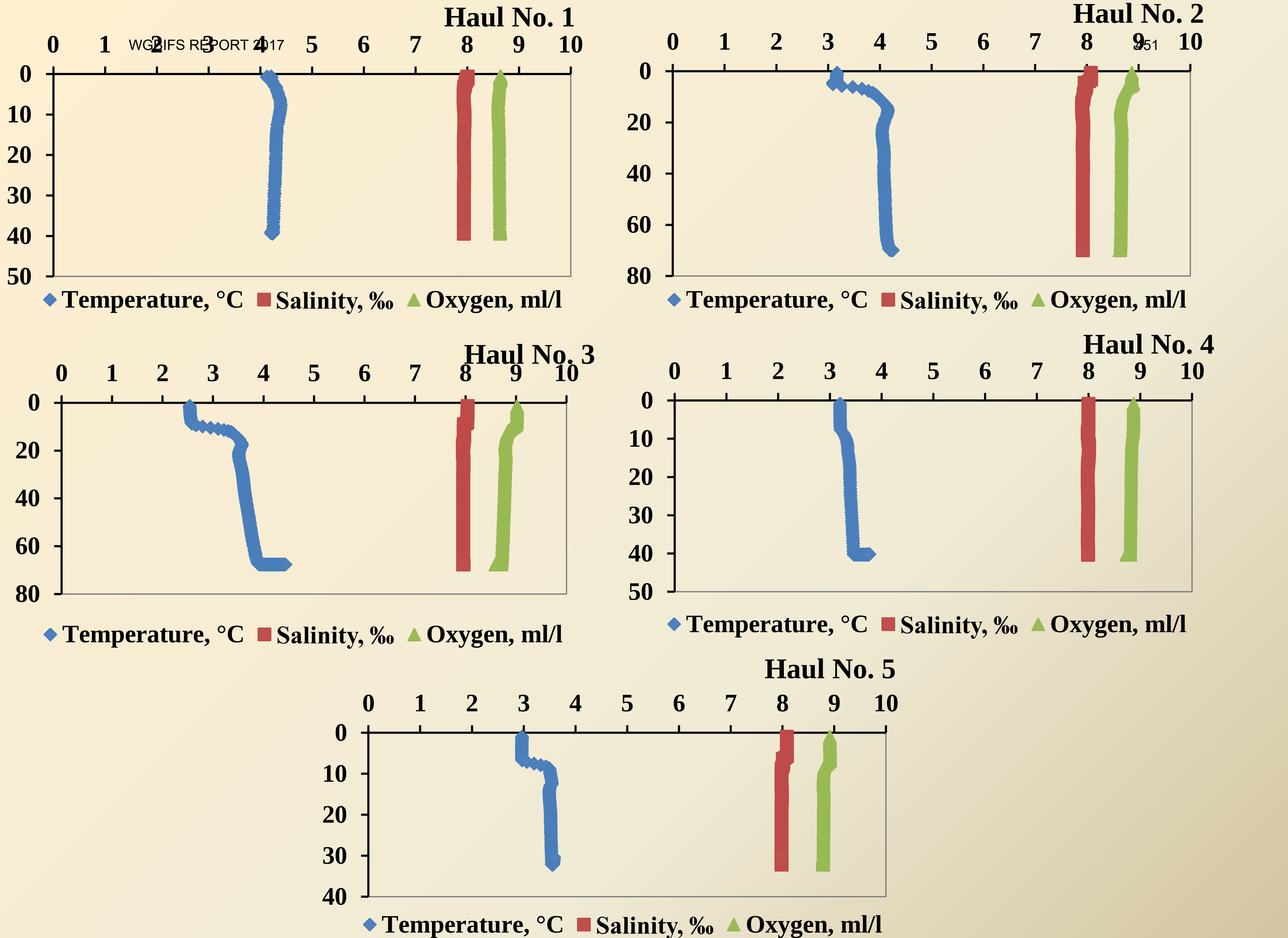


Flounder length distribution



Herring length distribution




Haul No. 1
0 1 2 3 4 5 6 7 8 9 10
0 10 20 30 40 50
Temperature, °C
Salinity, ‰
Oxygen, ml/l
Haul No. 2
0 1 2 3 4 5 6 7 8 9 10
0 20 40 60 80
Temperature, °C
Salinity, ‰
Oxygen, ml/l
Haul No. 3
0 1 2 3 4 5 6 7 8 9 10
0 20 40 60 80
Temperature, °C
Salinity, ‰
Oxygen, ml/l
Haul No. 4
0 1 2 3 4 5 6 7 8 9 10
0 10 20 30 40 50
Temperature, °C
Salinity, ‰
Oxygen, ml/l
Haul No. 5
0 1 2 3 4 5 6 7 8 9 10
0 10 20 30 40
Temperature, °C
Salinity, ‰
Oxygen, ml/l

WGBIFS meeting in Riga - Latvia; 27 – 31.03.2017

The BITS-4q/2016 and BITS-1q/2017 surveys in the Polish marine waters

Włodzimierz Grygiel, Krzysztof Radtke and Tycjan Wodzinowski
National Marine Fisheries Research Institute, Gdynia - Poland

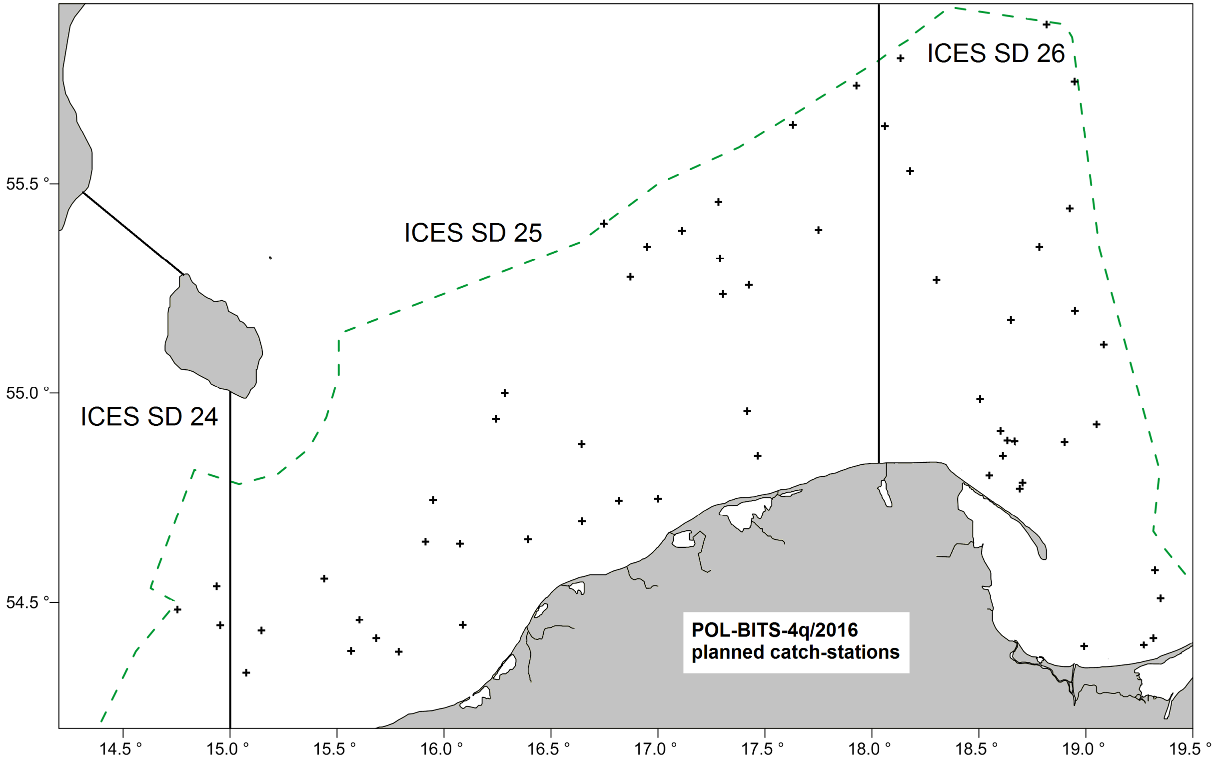
The main topics of presentation:

- accomplishment and main results of investigations linked with the Polish part of the BITS-4q/2016 and BITS-1q/2017 surveys in the southern Baltic,
- plans vs. realisation of the BITS surveys on board of the Polish r.v. „Baltica”.

95 YEARS MIR
1921 - 2016

www.nmfri.gdynia.pl

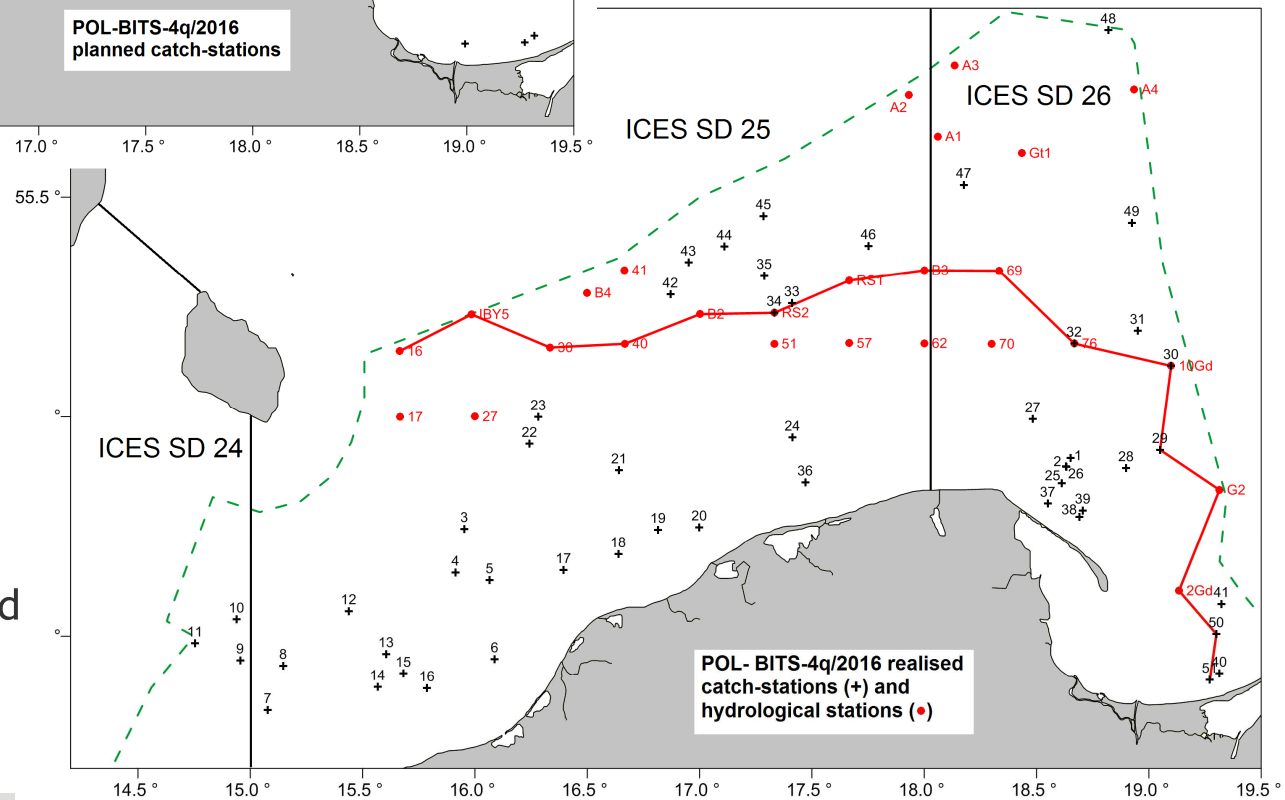
POL-BITS-4q; plans vs. realization (08-29.11.2016)



Location of the bottom trawl control-hauls planned to realise (60) and inspected (51) by the r.v. “Baltica” in the Polish part of the southern Baltic.

85% of planned hauls was realised, incl.:

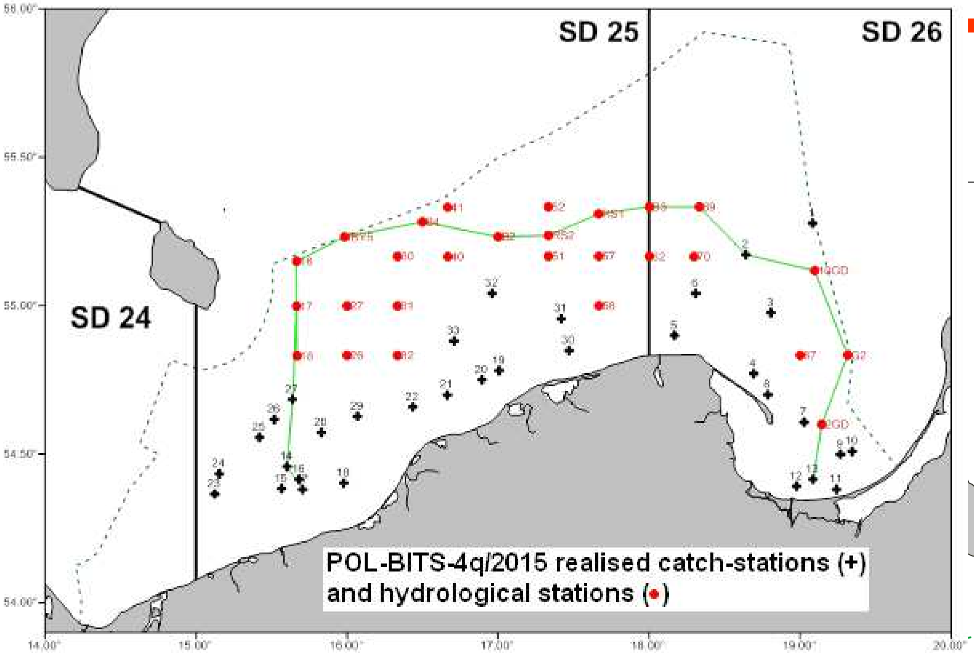
- 3 hauls in ICES SD 24,
- 28 hauls in ICES SD 25,
- 20 hauls in ICES SD 26,
- 72 hydrological stations,
- due to stormy weather occurred on 21-22.11.2017 and partly on 14.11.2017 the number of realised hauls was reduced vs. planned.



Scope of surveys

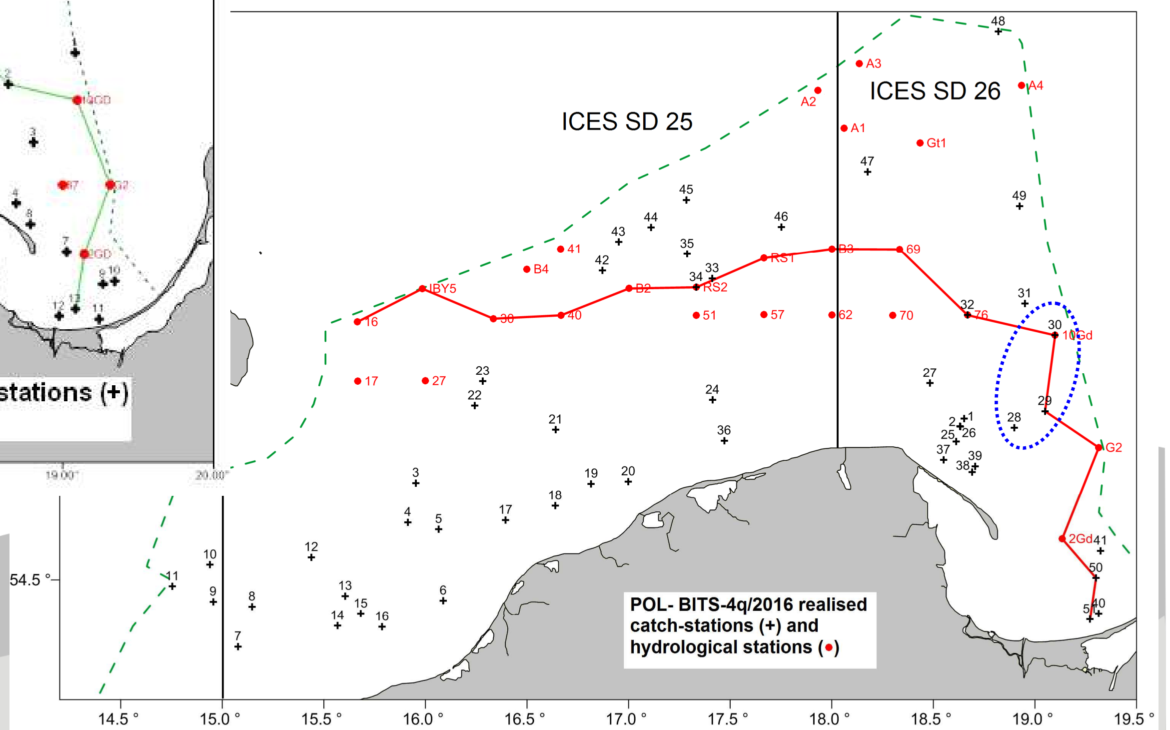
POL-BITS-4q (Nov. 2015)

- period of survey: 15-27.11.2015,
- 12 days at sea,
- number of successfully realised hauls: 32 out of 33,
- zero catches not achieved,
- number of recognised fish-like species: 19,
- area of investigations:



POL-BITS-4q (Nov. 2016)

- period of survey: 08-29.11.2016,
- 22 days at sea,
- number of successfully realised hauls: 48 out of 60,
- zero catches achieved (no sufficient O_2) at more three hauls out of 48 catch-stations,
- number of recognised fish-like species: 24,
- area of investigations:

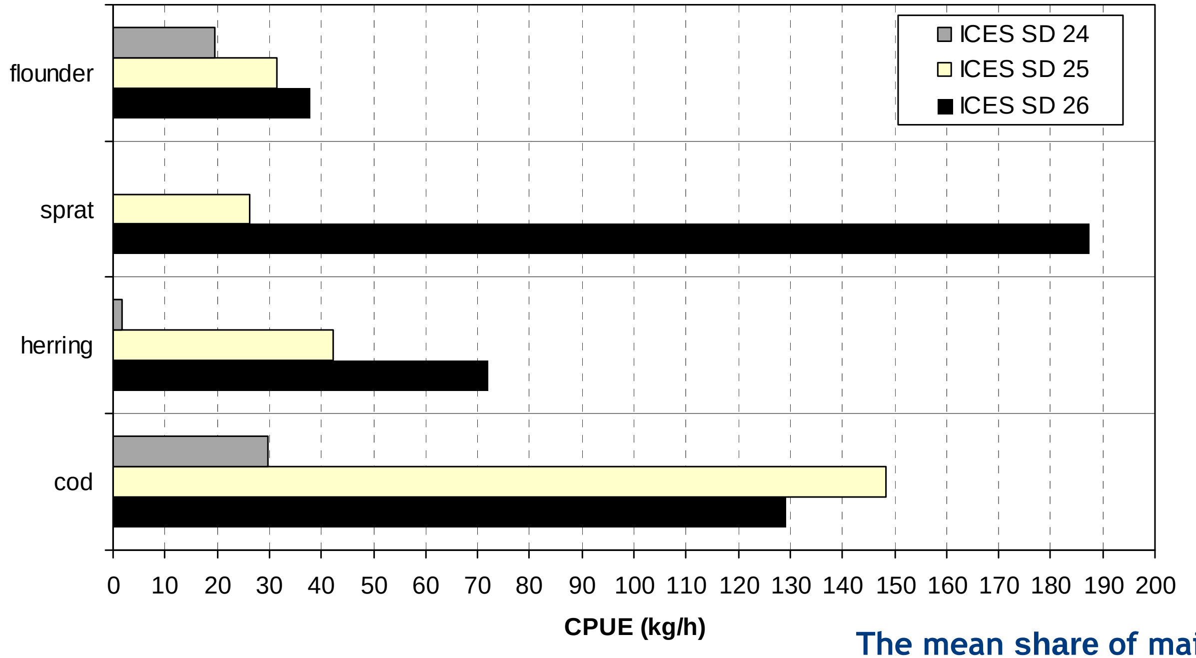


95 YEARS MIR
1 9 2 1 - 2 0 1 6

COLLECTED MATERIALS - POL-BITS-4q/2016

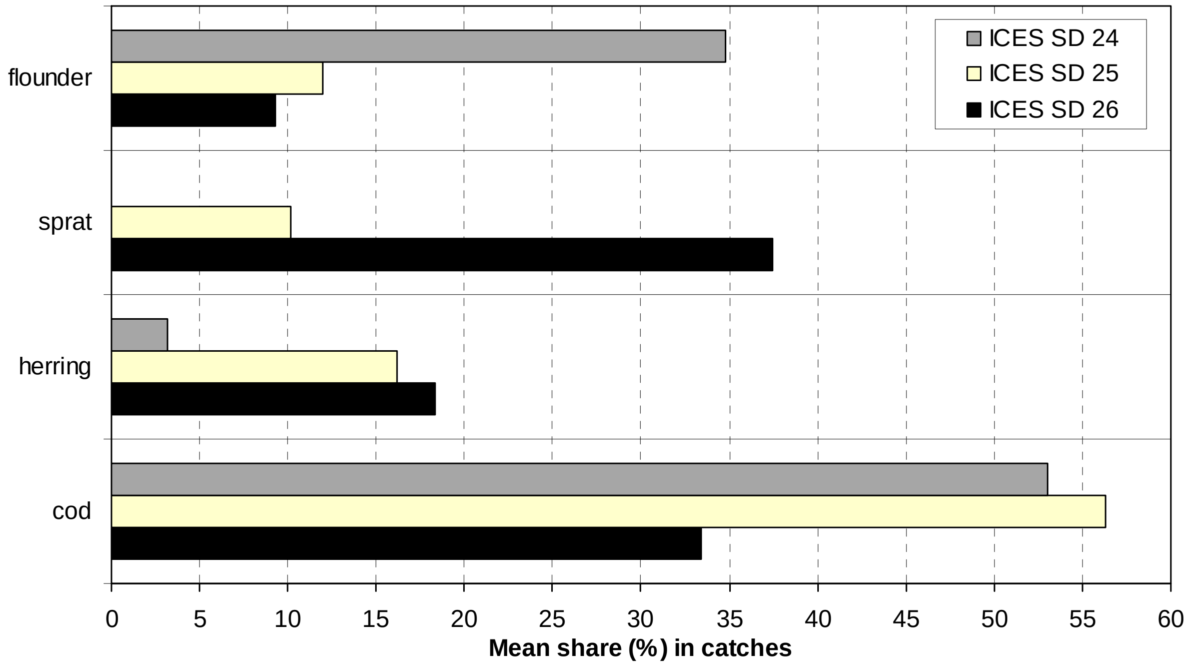
Name of fish species	No. of fish with	
	measured length	determined age
cod - *Gadus morhua* Linnaeus, 1758	9609	512
whiting - *Merlangius merlangus* (Linnaeus, 1758)	19	19
European flounder - *Platichthys flesus* (Linnaeus, 1758)	3471	788
European plaice - *Pleuronectes platessa* Linnaeus, 1758	821	498
turbot - *Scophthalmus* maximus (Linnaeus, 1758)	25	24
sprat - *Sprattus sprattus* (Linnaeus, 1758)	4714	515
herring - *Clupea harengus* Linnaeus, 1758	6514	1024
round goby - *Neogobius melanostomus* (Pallas, 1814)	9	7
sand goby - *Pomatoschistus minutus* (Pallas, 1770)	12	6
threespine stickleback - *Gasterosteus aculeatus* Linnaeus, 1758	61	0
ninespine stickleback - *Pungitius pungitius* (Linnaeus, 1758)	1	0
greater sand eel - *Hyperoplus lanceolatus* (Le Sauvage, 1824)	128	35
sea scorpion/shorthorn sculpin - *Myoxocephalus scorpius* (Linnaeus, 1758)	87	80
hooknose, armed bullhead, pogge - *Agonus* cataphractus (Linnaeus, 1758)	3	0
four-bearded rockling - *Enchelyopus cimbrius* (Linnaeus, 1766)	616	95
perch - *Perca fluviatilis* Linnaeus, 1758	1	1
Atlantic horse mackerel/scad - *Trachurus trachurus* (Linnaeus, 1758)	3	2
twaite shad - *Alosa fallax* (de Lacépède, 1803)	3	3
zander/pikeperch - *Sander lucioperca* (Linnaeus, 1758)	52	15
European anchovy - *Engraulis encrasicolus* (Linnaeus,1758)	39	15
European smelt - *Osmerus eperlanus* (Linnaeus, 1758)	114	3
lumpfish - *Cyclopterus lumpus* Linnaeus, 1758	7	4
European eel - *Anguilla anguilla* (Linnaeus, 1758)	1	0
river (brook) lamprey - *Lampetra fluviatilis* (Linnaeus, 1758)	1	0
total (24 species)	26311	3646

The mean CPUE of main fish species per the ICES SDs.



RESULTS
POL-BITS-4q/2016

The mean share of main fish species in catches per the ICES SDs.



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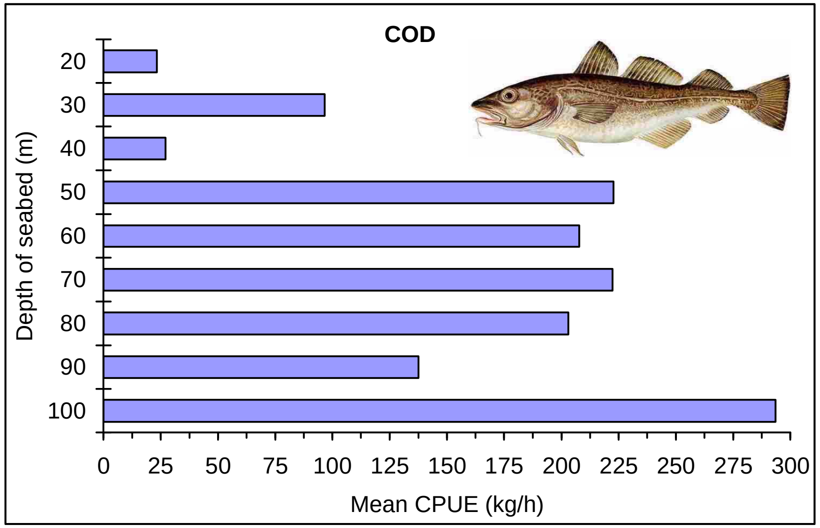
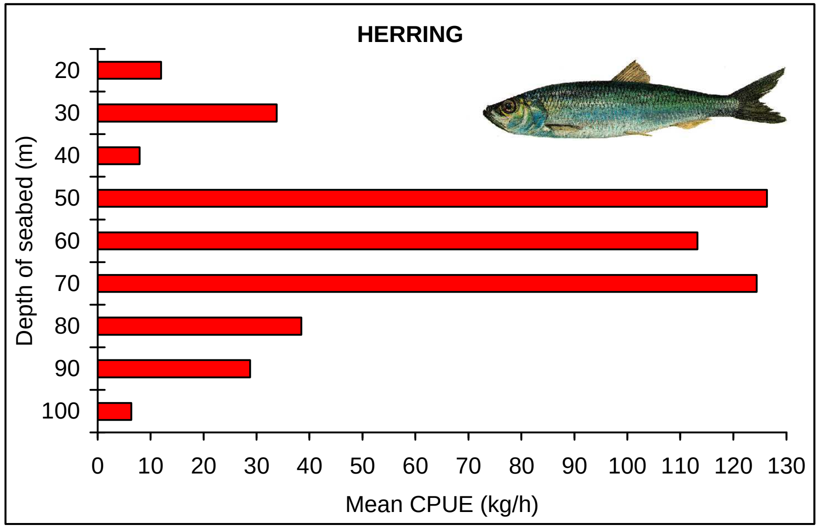
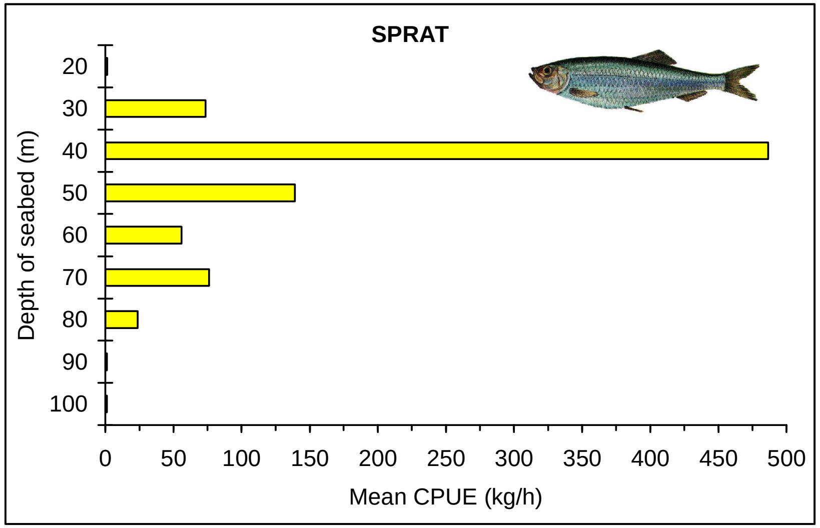
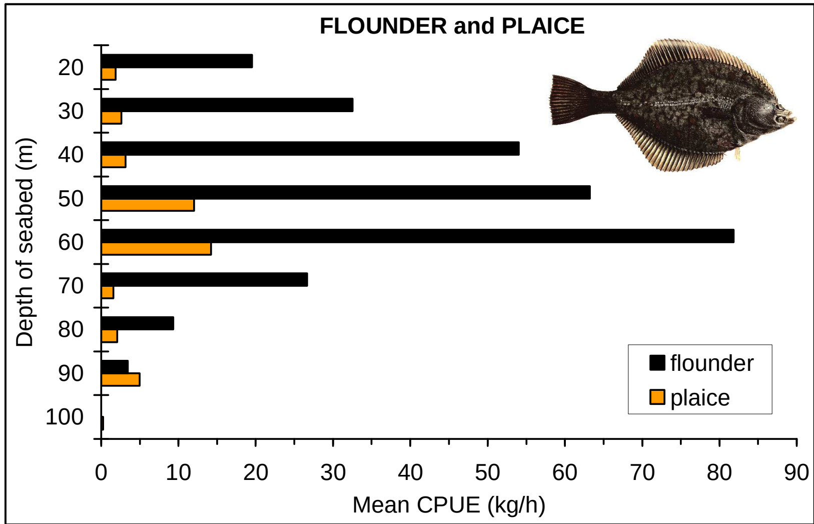
RESULTS POL-BITS-4q/2016





Seabed depth (m)	Number of hauls
20	7
30	11
40	4
50	8
60	4
70	3
80	5
90	5
100	1
total	48





The mean CPUE of fishes dominated in the control-catches per depth of trawling.

1921 - 2016

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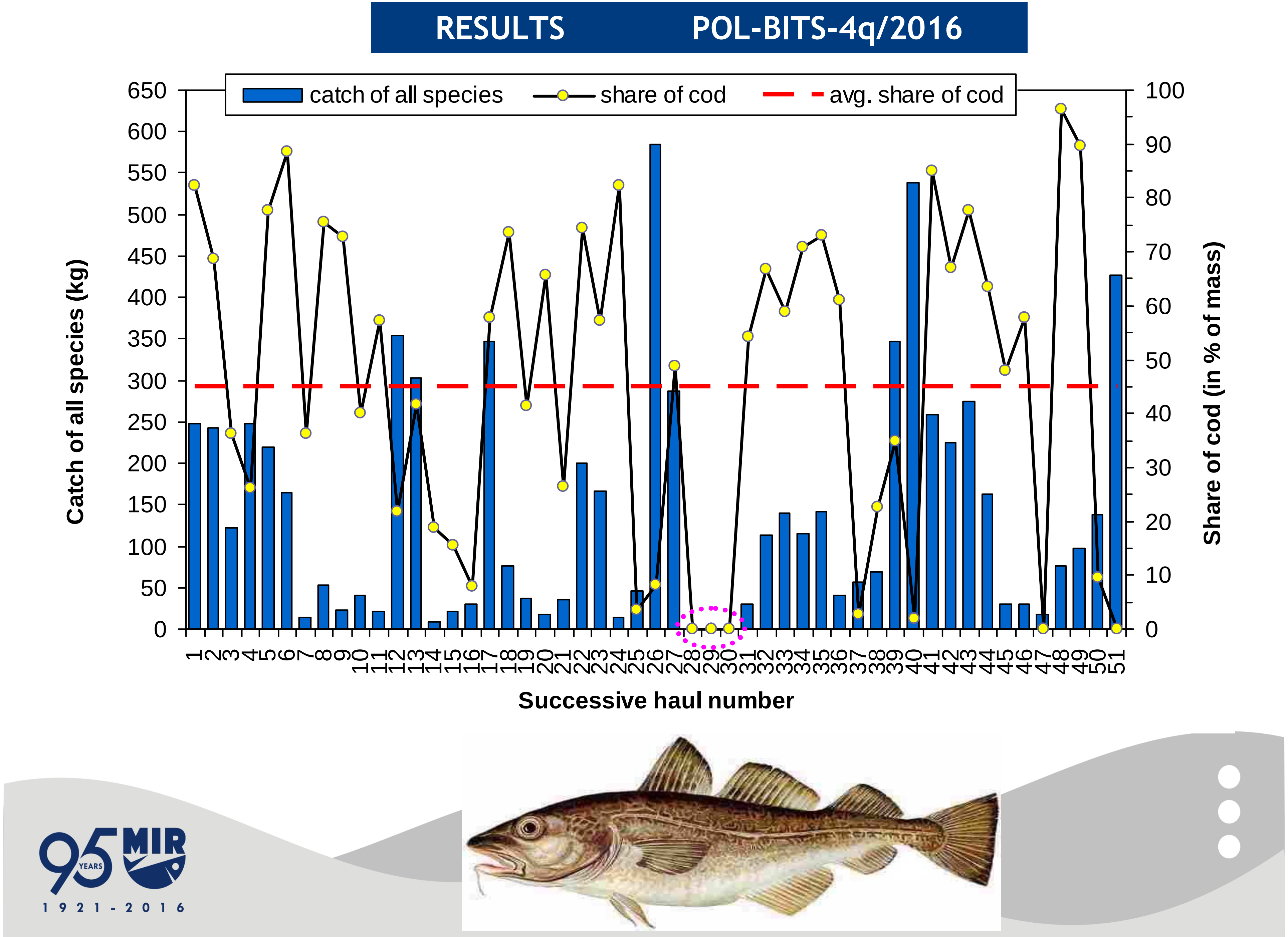
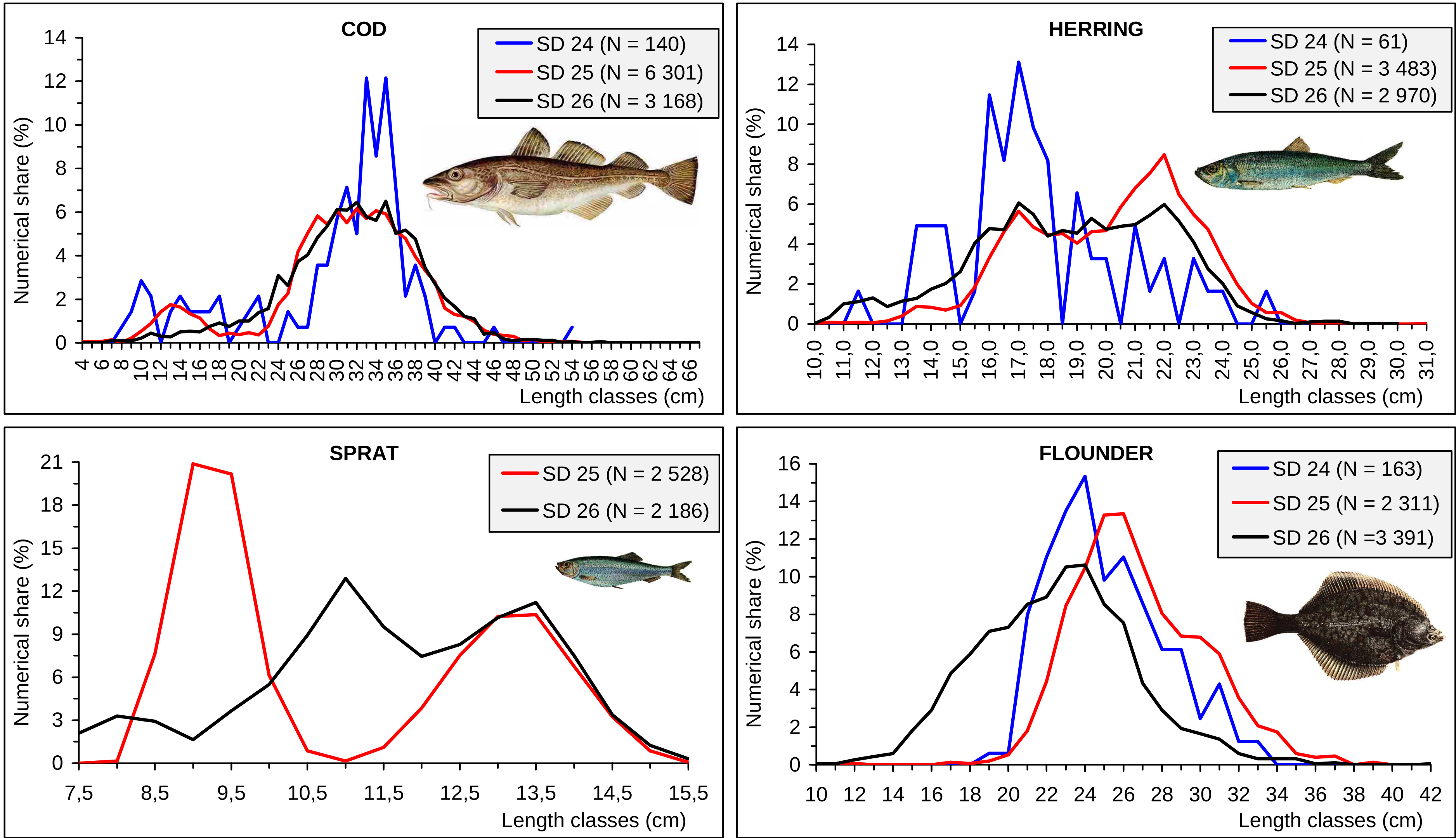

RESULTS
POL-BITS-4q/2016
catch of all species
share of cod
avg. share of cod
Catch of all species (kg)
Share of cod (in % of mass)
Successive haul number
650
600
550
500
450
400
350
300
250
200
150
100
50
0
100
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51
95 YEARS
MIR
1921 - 2016

RESULTS POL-BITS-4q/2016



The main fish species length distribution in samples originated from research catches acc. to the ICES SDs.

95 YEARS MIR 1921 - 2016

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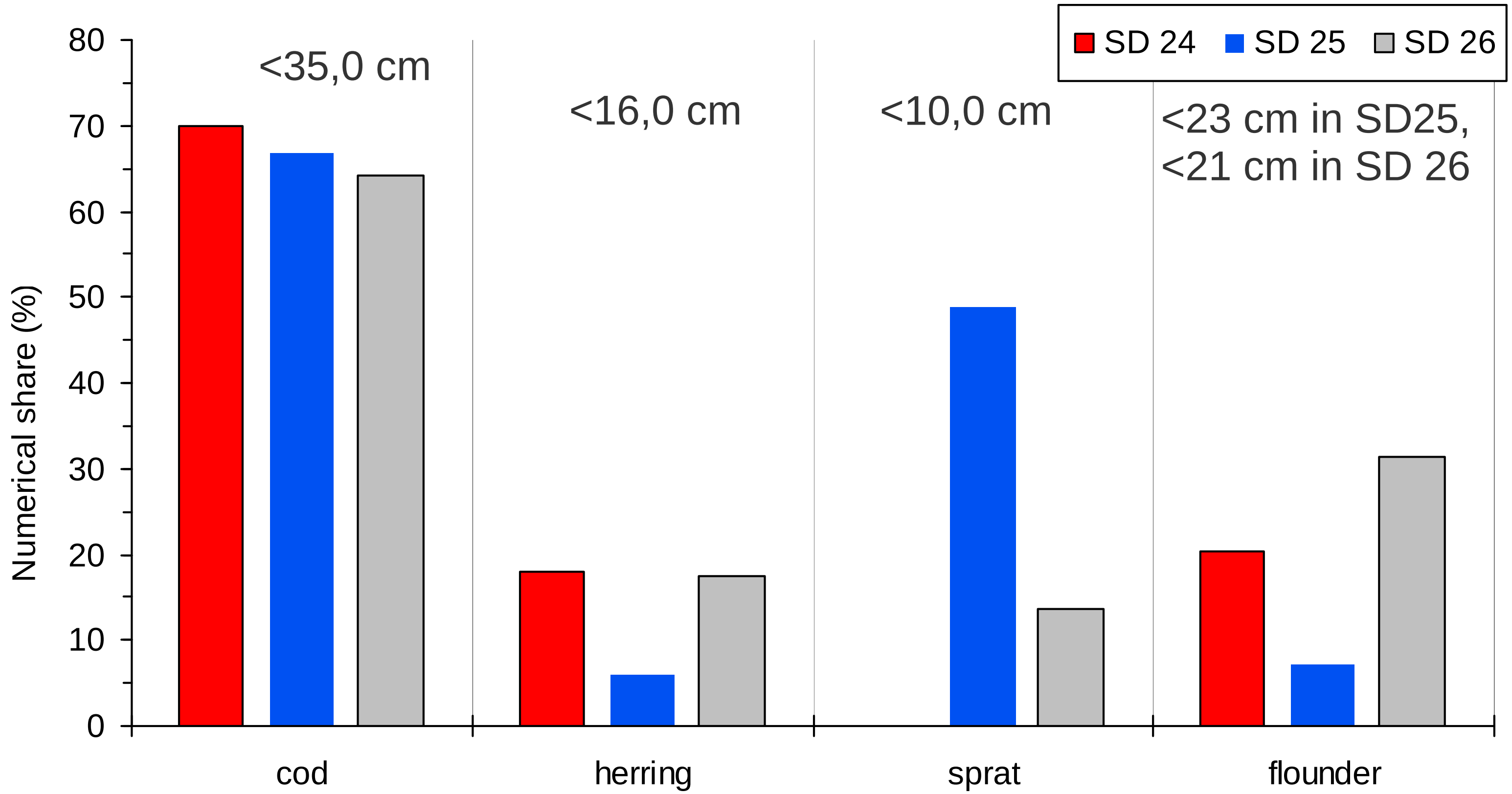
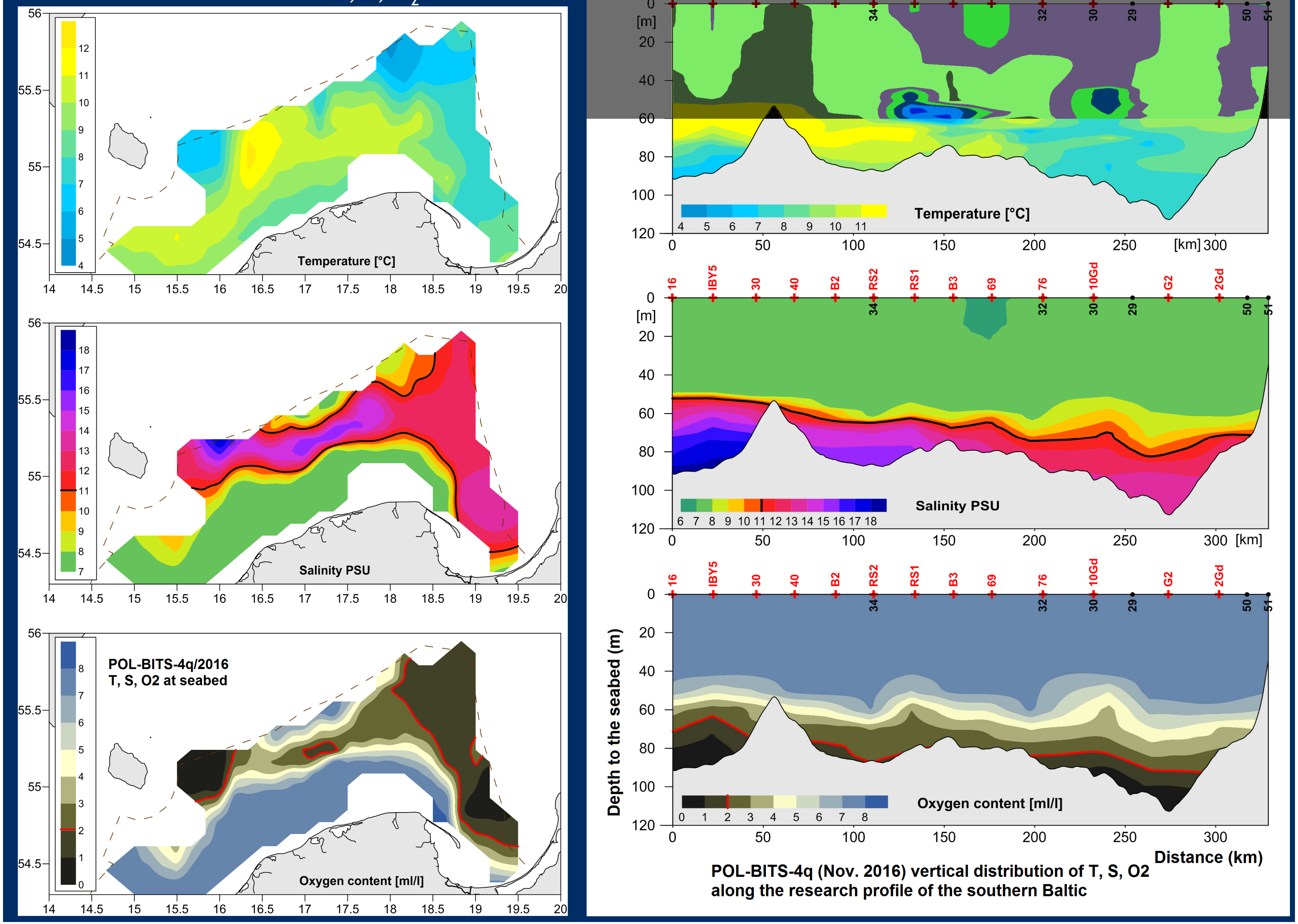
RESULTS POL-BITS-4q/2016



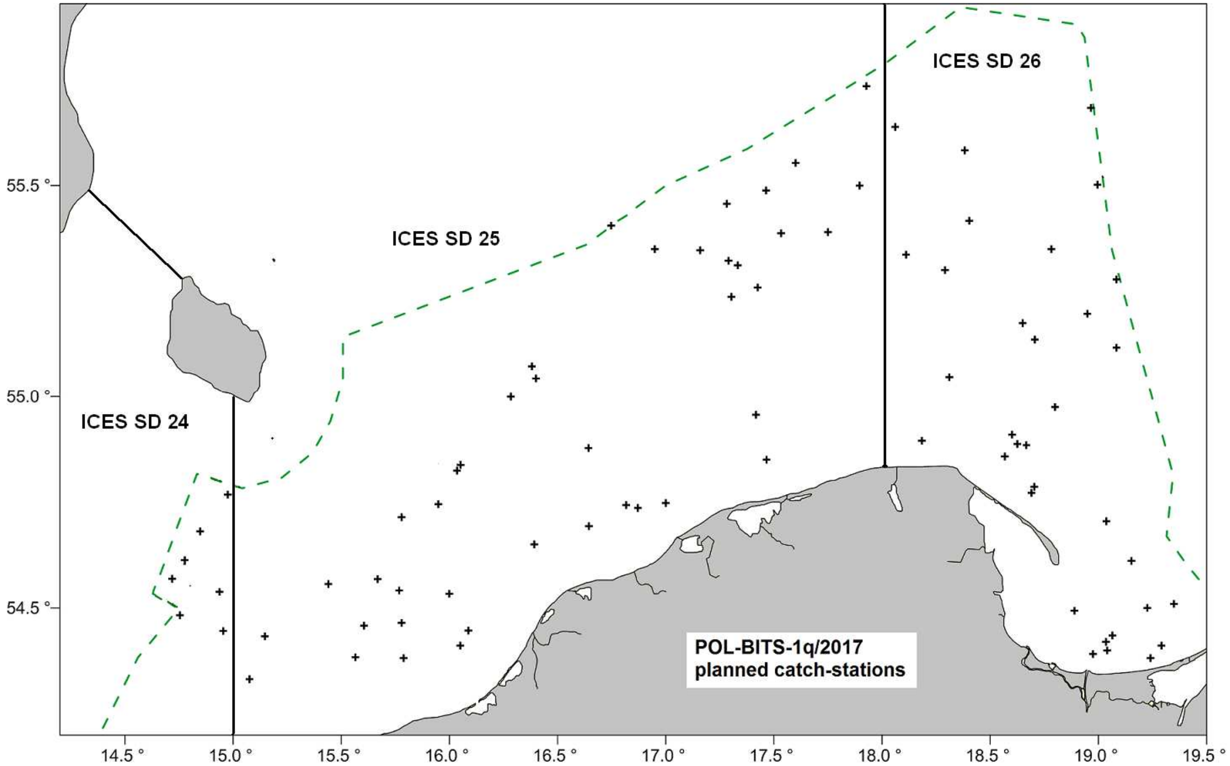
The average numerical share of young, undersized fish species in samples originated from research catches acc. to the ICES SDs.

Horizontal distribution of T, S, O_2 near seabed



POL-BITS-4q (Nov. 2016) vertical distribution of T, S, O2 along the research profile of the southern Baltic

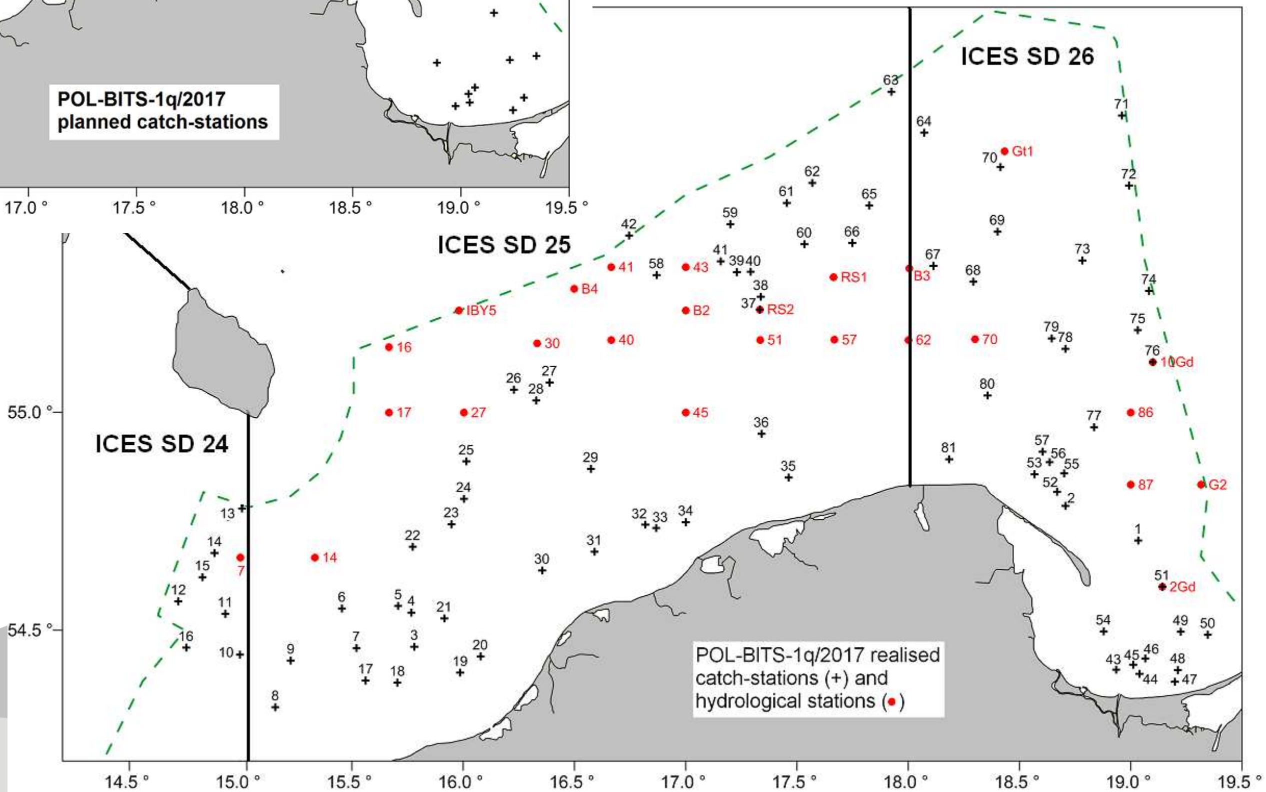
POL-BITS-1q; plans vs. realization (09.02.-08.03.2017)



Location of the bottom trawl control-hauls planned to realise (81) and inspected (81) by the r.v. “Baltica” in the Polish part of the southern Baltic.

100% of planned hauls was realised, incl.:

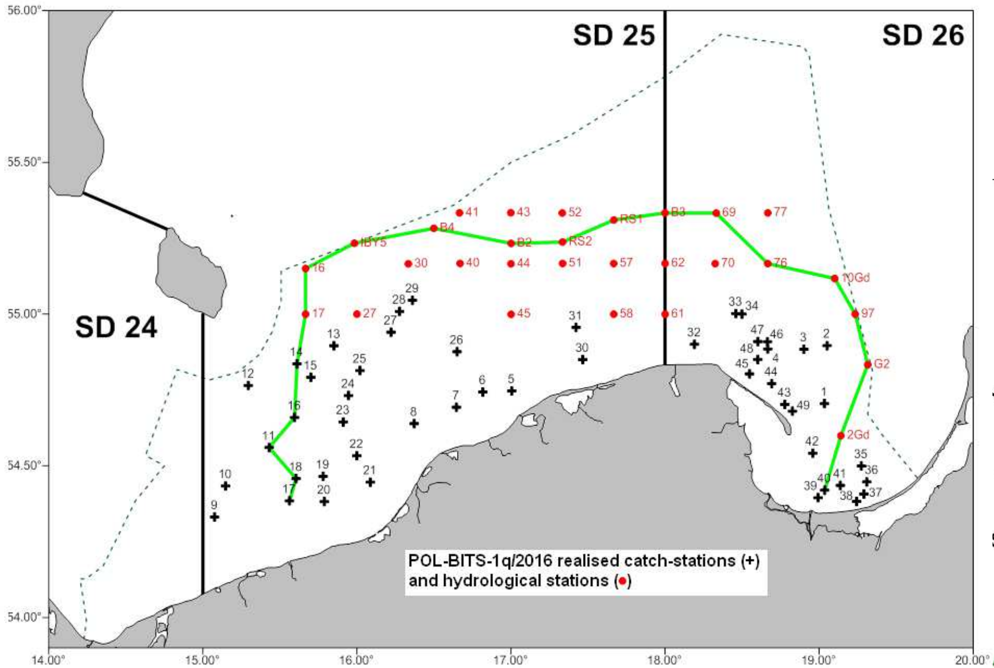
- 7 hauls in ICES SD 24,
- 41 hauls in ICES SD 25,
- 33 hauls in ICES SD 26,
- 101 hydrological stations.



Scope of surveys

POL-BITS-1q (Feb. 2016)

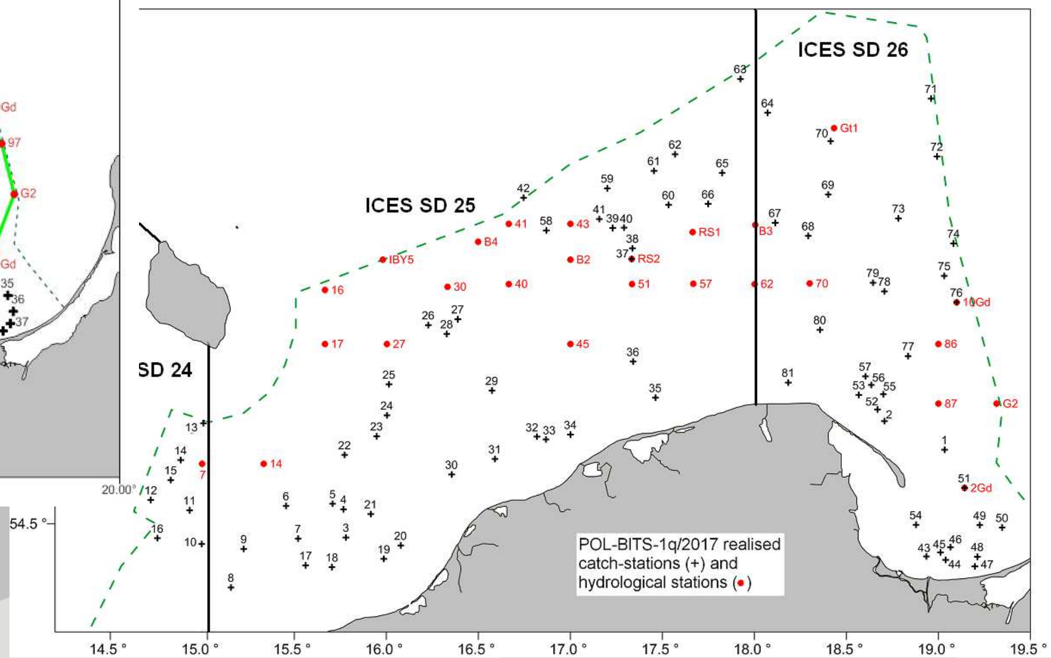
- period of survey: 11-26.02.2016,
- 16 days at sea,
- number of successfully realised hauls: 47 out of 49,
- zero catches achieved at more two hauls (no sufficient O_2) out of 47 catch-stations,
- number of recognised fish-like species: 24,
- area of investigations:



POL-BITS-1q/2016 realised catch-stations (+) and hydrological stations (•)

POL-BITS-1q (Feb.-March 2017)

- period of survey: 09.02.-08.03.2017,
- 27 days at sea,
- number of successfully realised hauls: 81 out of 81,
- zero catches not achieved,
- number of recognised fish-like species: 27,
- area of investigations:



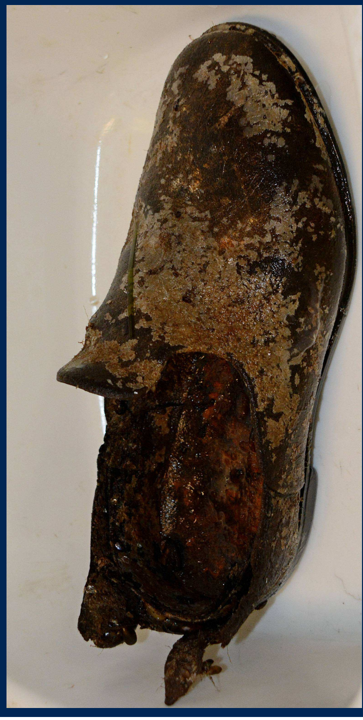
POL-BITS-1q/2017 realised catch-stations (+) and hydrological stations (•)

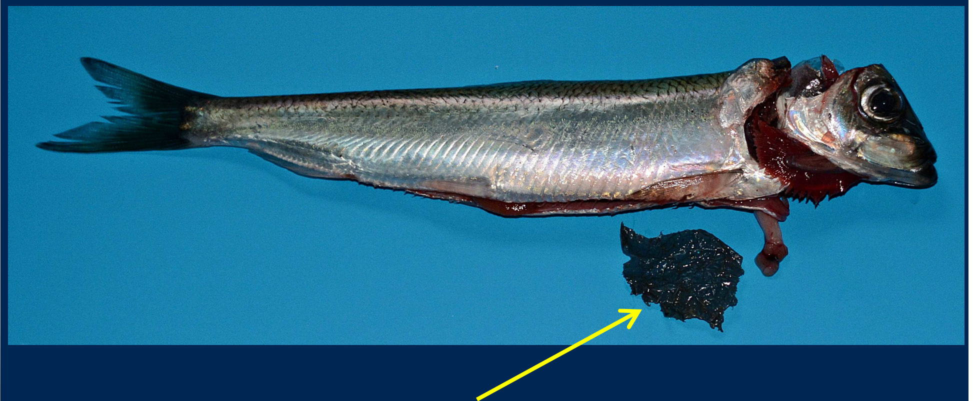
COLLECTED MATERIALS - POL-BITS-1q/2017

Name of fish species	No. of fish with	
	measured length	determined age
cod - *Gadus morhua* Linnaeus, 1758	13197	661
whiting - *Merlangius merlangus* (Linnaeus, 1758)	157	72
European flounder - *Platichthys flesus* (Linnaeus, 1758)	9752	1047
European plaice - *Pleuronectes platessa* Linnaeus, 1758	1819	754
turbot - *Scophthalmus maximus* (Linnaeus, 1758)	53	52
herring - *Clupea harengus* Linnaeus, 1758	10583	979
sprat - *Sprattus sprattus* (Linnaeus, 1758)	8476	730
four-bearded rockling - *Enchelyopus cimbrius* (Linnaeus, 1766)	583	13
sea scorpion/shorthorn sculpin - *Myoxocephalus scorpius* (Linnaeus, 1758)	576	8
Atlantic horse mackerel/scad - *Trachurus trachurus* (Linnaeus, 1758)	15	4
eelpout - *Zoarces viviparus* Linnaeus, 1758	27	0
European anchovy - *Engraulis encrasicolus* (Linnaeus,1758)	42	6
European smelt - *Osmerus eperlanus* (Linnaeus, 1758)	287	0
greater sand eel - *Hyperoplus lanceolatus* (Le Sauvage, 1824)	11	0
hooknose, armed bullhead, pogge - *Agonus cataphractus* (Linnaeus, 1758)	8	0
lumpfish - *Cyclopterus lumpus* Linnaeus, 1758	68	4
Atlantic mackerel - *Scomber scombrus* Linnaeus, 1758	8	4
perch - *Perca fluviatilis* Linnaeus, 1758	7	0
poor cod - *Trisopterus minutus* Linnaeus, 1758	1	1
round goby - *Neogobius melanostomus* (Pallas, 1814)	109	0
sand goby - *Pomatoschistus minutus* (Pallas, 1770)	47	0
snakeblenny - *Lumpenus lampretaeformis* (Walbaum, 1792)	2	0
striped seasnail - *Liparis liparis* (Linnaeus, 1766)	1	0
threespine stickleback - *Gasterosteus aculeatus* Linnaeus, 1758	5	0
tub gurnard - *Chelidonichthys lucerna* (Linnaeus, 1758)	1	0
twaite shad - *Alosa fallax* (de Lacépède, 1803)	58	2
zander/pikeperch - *Sander lucioperca* (Linnaeus, 1758)	9	1
total (27 species)	45902	4338

cont. COLLECTED MATERIALS

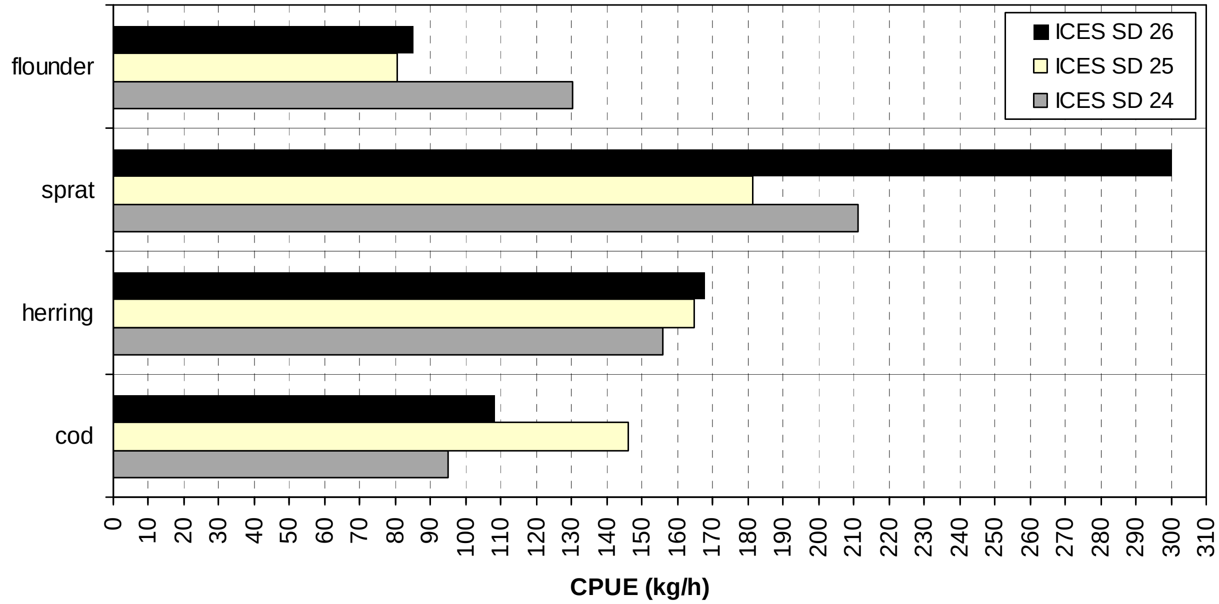
	POL-BITS-4q/2016	POL-BITS-1q/2017
number of sampled cod stomachs	511	SD 24 - 183; SD 25 - 212; SD 26 - 267; total = 662
number of stations with monitored marine litter	48	81





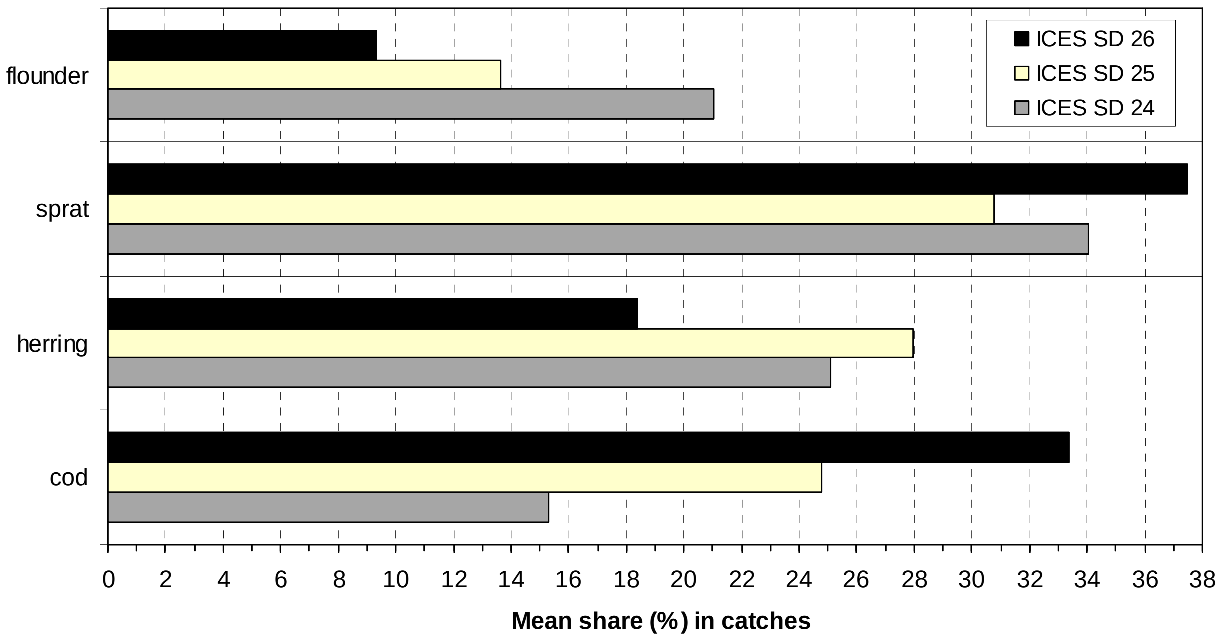
photos: M. Wyszyński (NMFRI), Gdynia

The mean CPUE of main fish species per the ICES SDs.

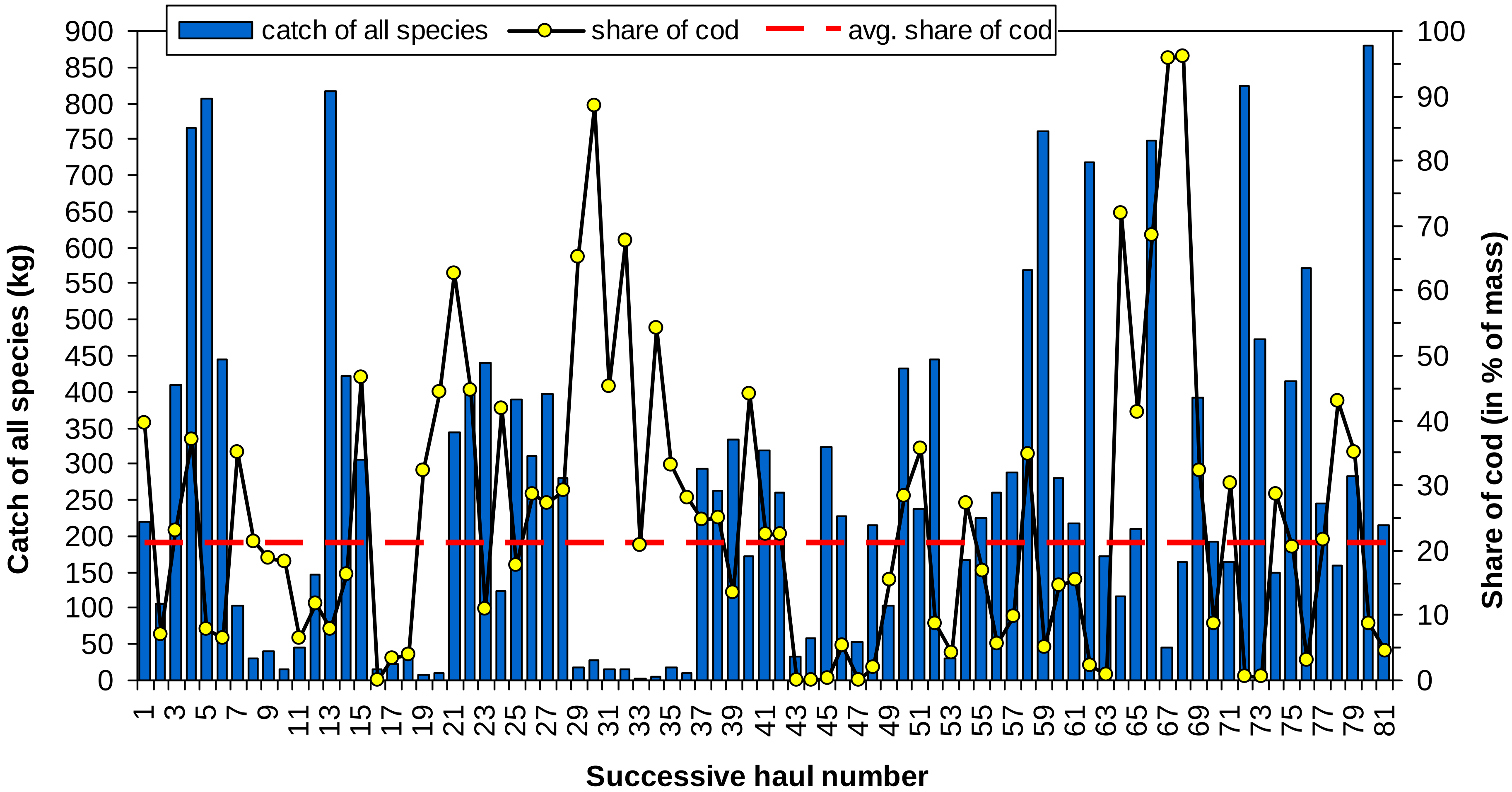


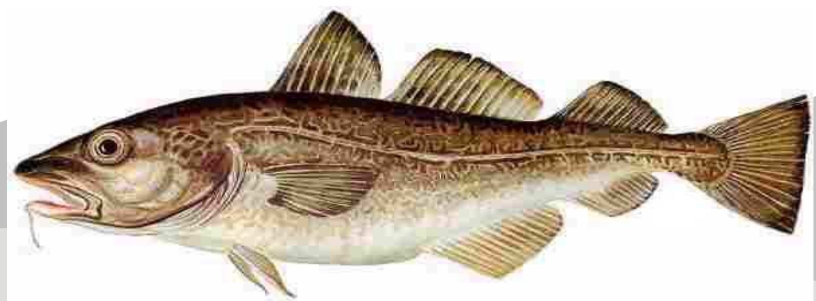
RESULTS POL-BITS-1q/2017

The mean share of main fish species in catches per the ICES SDs.

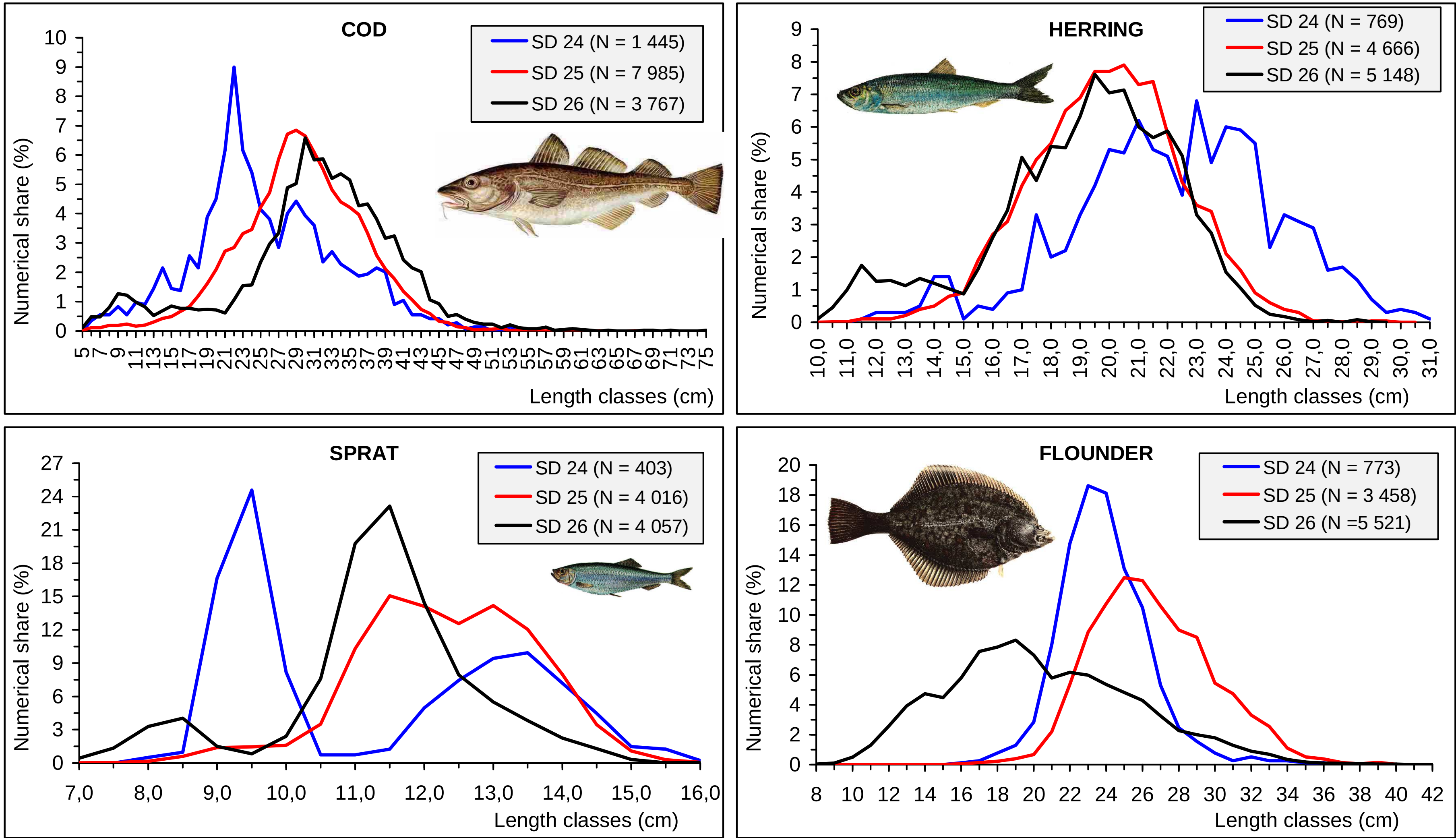


RESULTS POL-BITS-1q/2017





RESULTS POL-BITS-1q/2017

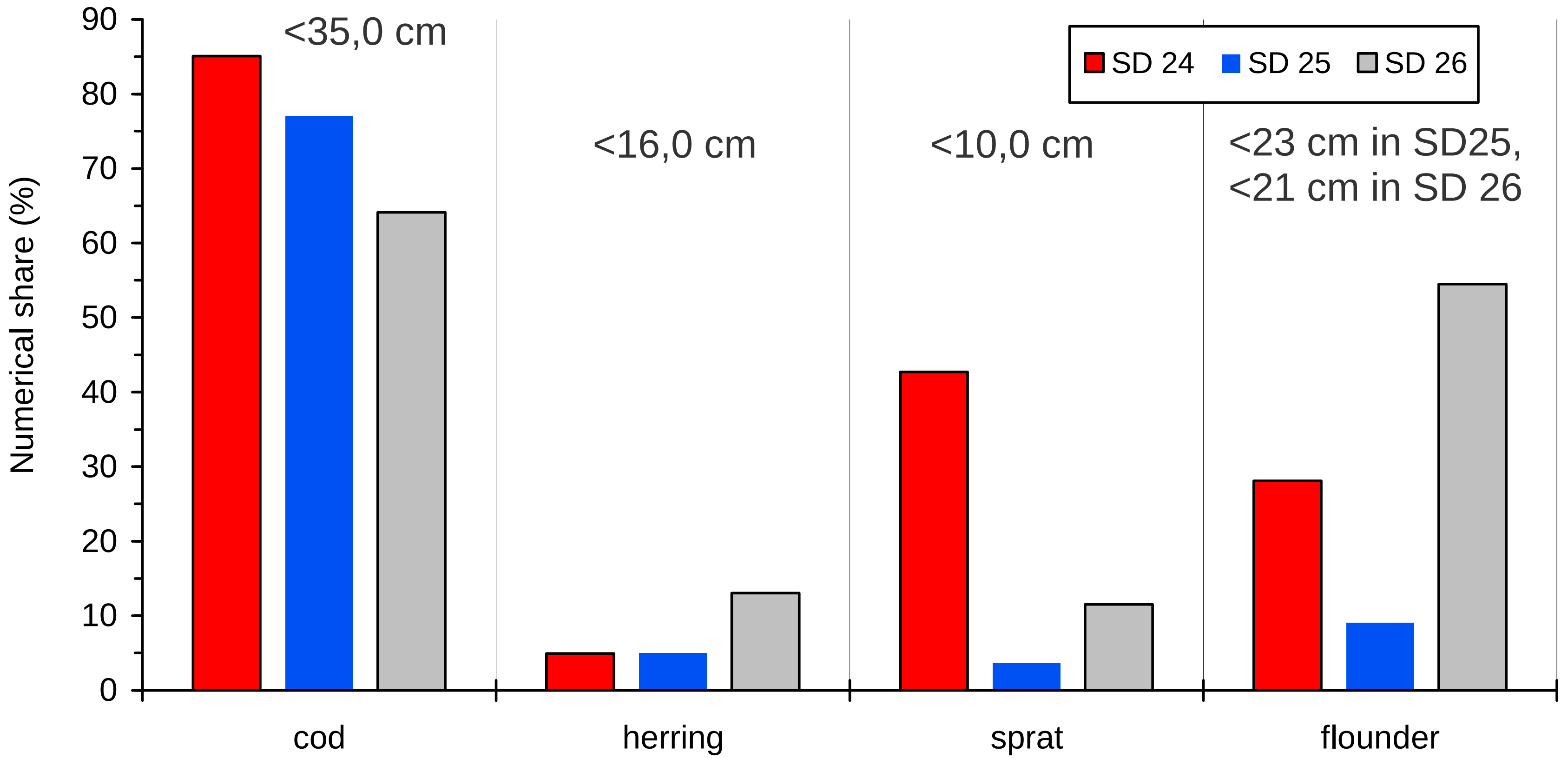


The main fish species length distribution in samples originated from research catches acc. to the ICES SDs.

95 YEARS MIR 1921 - 2016

www.nmfri.gdynia.pl

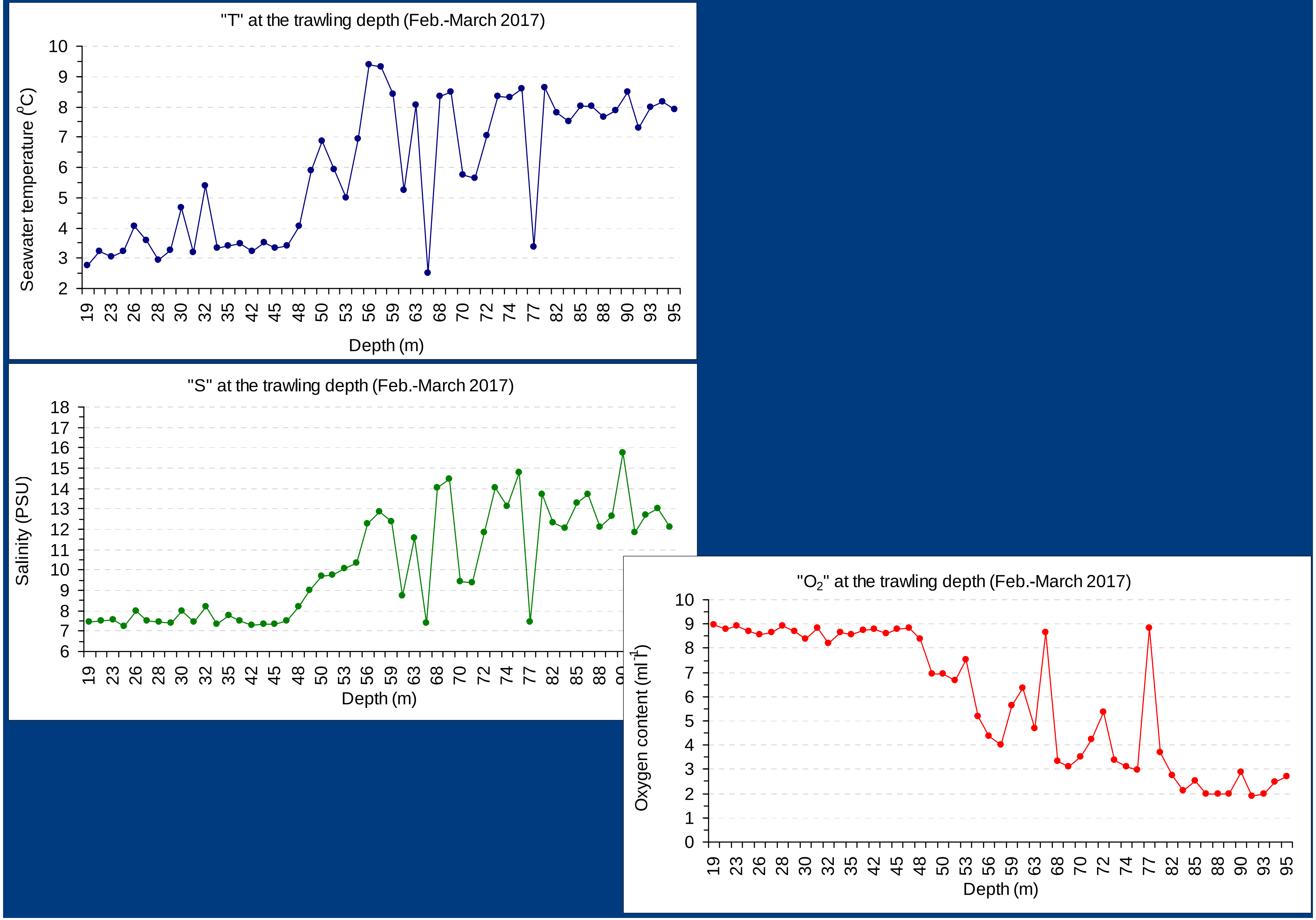
RESULTS POL-BITS-1q/2017



The average numerical share of young, undersized fish species in samples originated from research catches acc. to the ICES SDs.

www.nmfri.gdynia.pl

The mean T, S, O_2 near seabed at particular isobaths (POL-BITS 1q/2017)



Poland - planned activities at sea during the BITS-4q/2017 and BITS-1q/2018 surveys

BITS 4q/2017 period of survey: 11 Nov. – 03 Dec. 2017,
22 days at sea,
60 fish control-hauls is planned,

BITS 1q/2018 period of survey: app. 09 Feb. – 08 March 2018,
27 days at sea,
81 fish control-hauls is planned,

Thank you for your attention!

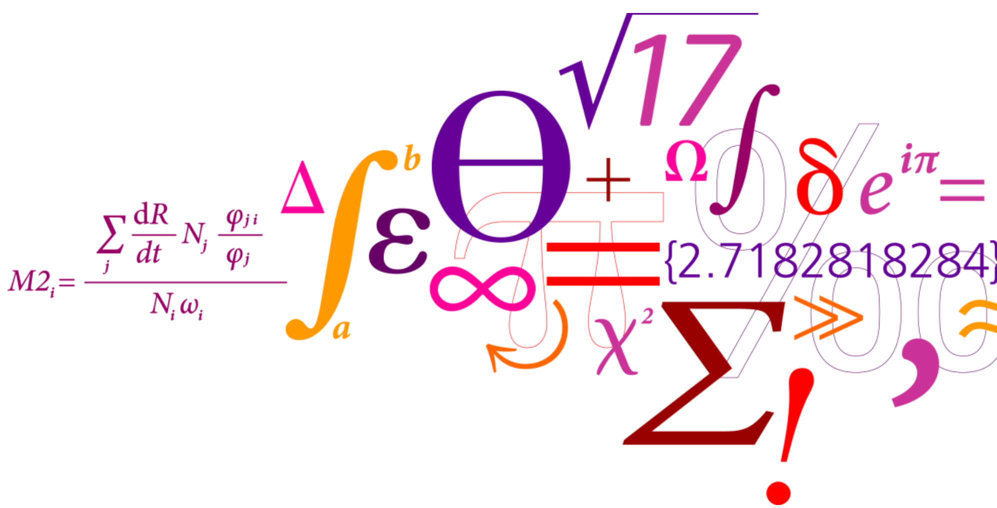
95 YEARS MIR
1921 - 2016

www.nmfri.gdynia.pl

BITS survey status and main results for Dana and Havfisken

By: Henrik Degel
DTU Aqua

BIFS meeting
27/3 – 31/3, 2016
Riga



DTU Aqua
National Institute of Aquatic Resources

BITS Dana 4q 2016

Nation:	Denmark	Vessel:	Dana
Survey:	BITS	Dates:	1-18/11 - 2016

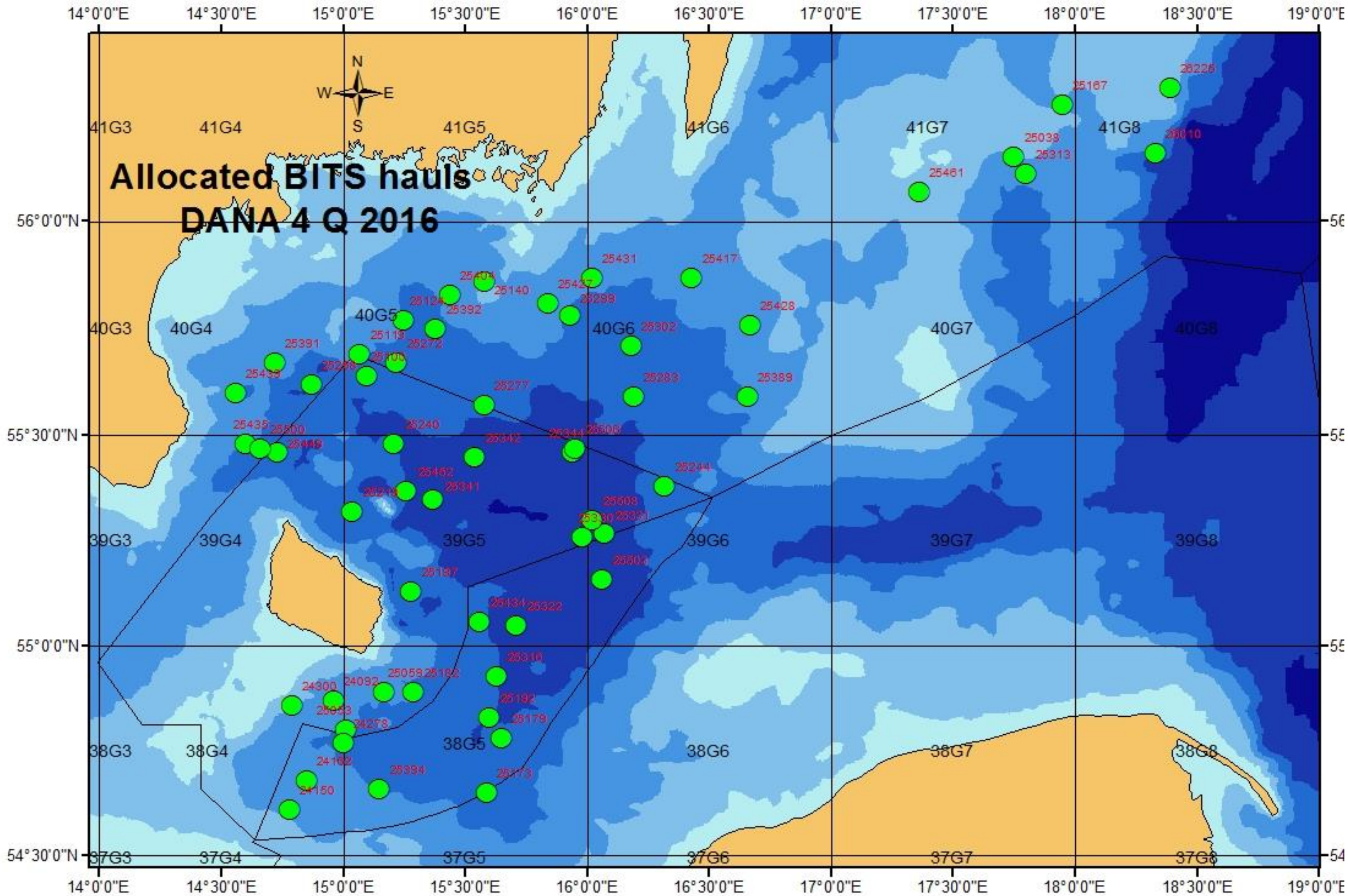
Cruise	
Gear details:	The big (#920) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual. No rock
Notes from survey (e.g. problems, additional work etc.):	Stomack sampling from cod, plankton fishing during night.

ICES Sub-Divisions and Depth stratum	Gear (TVL,TVS)	Number of hauls planed	Number of valid hauls realized using "Standard" ground gear	Number of valid hauls realized using Rock-hoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
25								
2	TVL	0	1	0	0	0	0	#DIV/0!
3	TVL	16	15	0	0	0	0	81,3
4	TVL	22	22	0	0	0	0	86,4
5	TVL	11	10	0	0	0	0	90,9
6	TVL	0	1	0	0	0	0	#DIV/0!
26								
3	TVL	1	1	0	0	0	0	100,0
4	TVL	1	1	0	0	0	0	100,0
24								
2	TVL	1	1	0	0	0	0	100,0
3	TVL	4	4	0	0	0	0	100,0

Number of biological samples (maturity and age material, *maturity only):

Species	Age	Species	Age
Clupea harengus			
Gadus morhua			
Sprattus sprattus			

BITS Dana 4q 2016



Henrik Degel
BIFS meeting Riga 27/3-31/3 -2017

Dana 4th quarter 2016. Dana (SD 25, 26)

Cruise summary

Cruise:	BITS
Cruise number	11
Quarter:	4
Year:	2016
Periode:	1-18/11
Country	Denmark

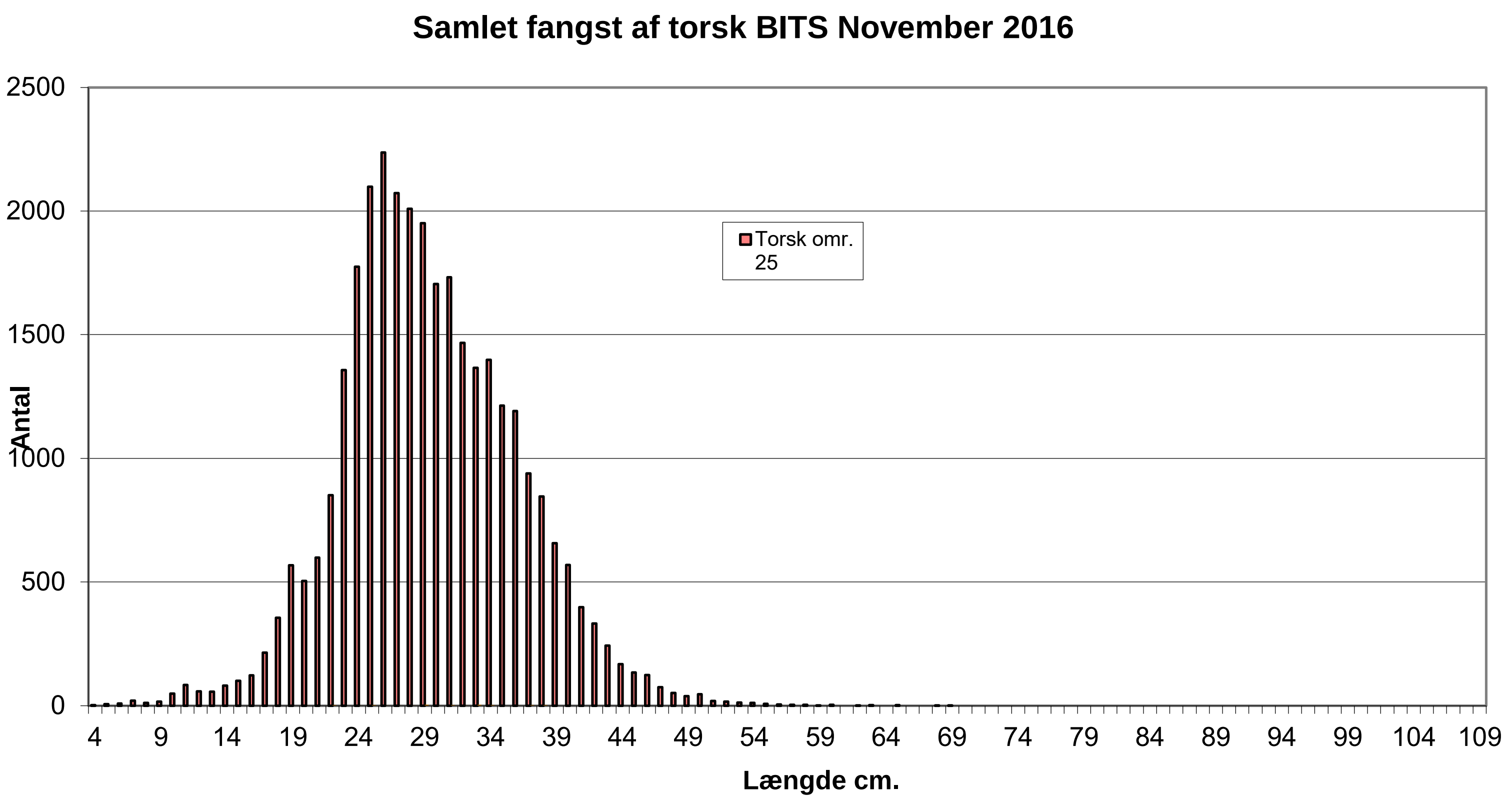
Number of hauls planed: 56

	Index qualified	Non-index qualified
Number of succesful trawl hauls carried out in total:	43	
Number of invalid trawl hauls carried out:		0
Number of "No oxygen trawl hauls" carried out (assumed zero-catch):	13	
SUM	56	0

Number of trawl related CTD stations performed:	0
Number of NON-trawl related CTD stations performed:	89
Number of succesful BONGO hauls carried out:	61
Number of succesful IKMT hauls carried out:	0
Number of succesful Appi hauls carried out:	0
Number of succesful WP2 hauls carried out:	4
Number of succesful BOM hauls carried out:	0
Number of succesful Multi-NET hauls carried out:	0

Total kgs of cod cached	1345,3
Total number of cod measured	24019,909
Total number of cod otoliths collected	0

BITS Dana 4q 2016



Havfisken BITS 4 q 2016

Nation:	**Denmark**	Vessel:	Havfisken/26HF
Survey:	KASU-2	Dates:	18/10-5/11

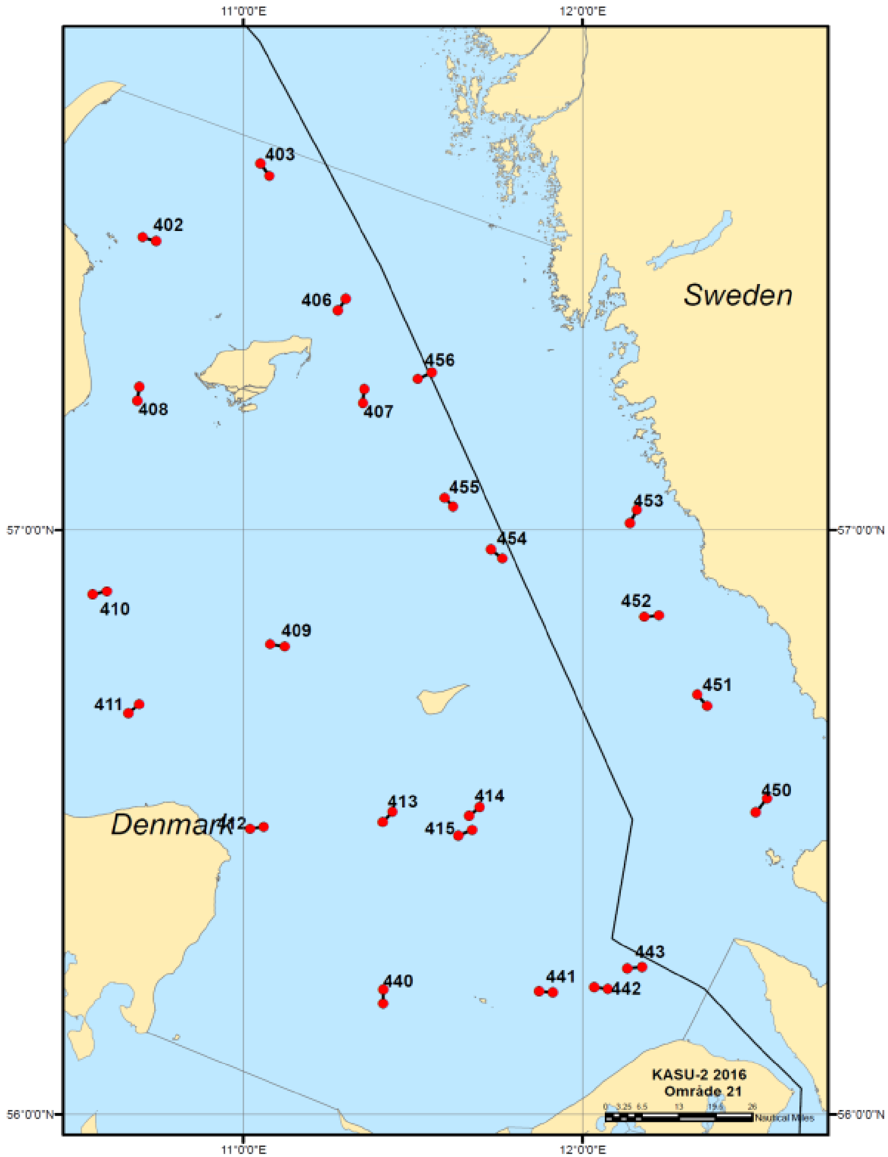
Cruise	
Gear details:	The small (#520) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	

CES Sub-Divisions		Gear (TVL,TVS)	Depth strata (1 -6)	Number of hauls planed	Number of valid hauls realized using "Standard" ground gear	Number of valid hauls realized using Rockhoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
22		TVS	1(0-19m)		15					100%
22		TVS	2(20-39m)		10					100%
21		TVS	1(0-19m)		5					100%
21		TVS	2(20-39m)		13					100%
21		TVS	3(40-59m)		1					100%
21		TVS	4(60-79m)		3					100%
21		TVS	5(80-99m)		1					100%
20		TVS	2(20-39m)		2					100%
23		TVS	1(0-19m)		4					100%
23		TVS	2(20-39m)		1					100%
24		TVS	1(0-19m)		1					100%

Number of biological samples (maturity and age material, *maturity only):

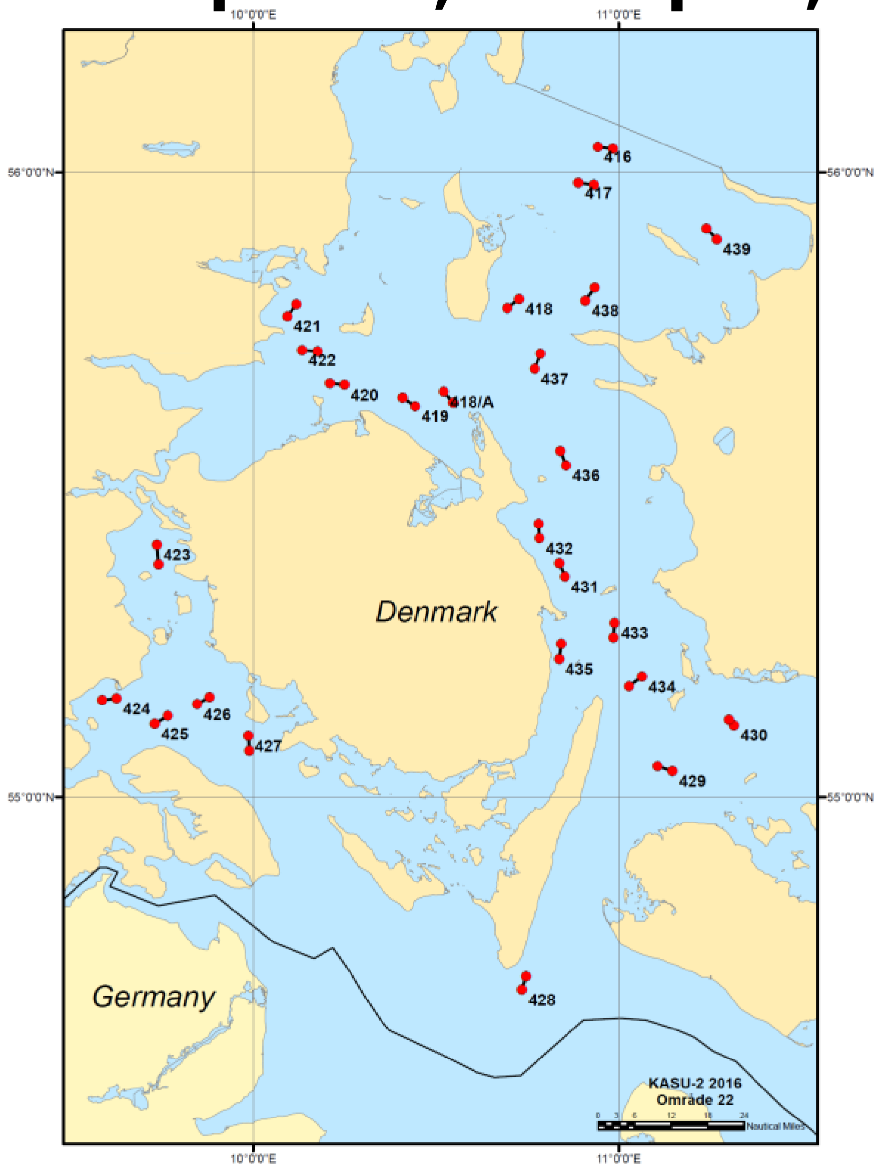
Species	**Number of otoliths**	**Species**	**Number of otoliths**
Sole	182	Saith	10
Cod	941	Dab	331
Withing	227	Haddok	10
Witch	23	Turbot	81*
Hake	23	Brill	118*
Plaice	729		

Havfisken BITS 4 q 2016, Haul plot, Kattegat



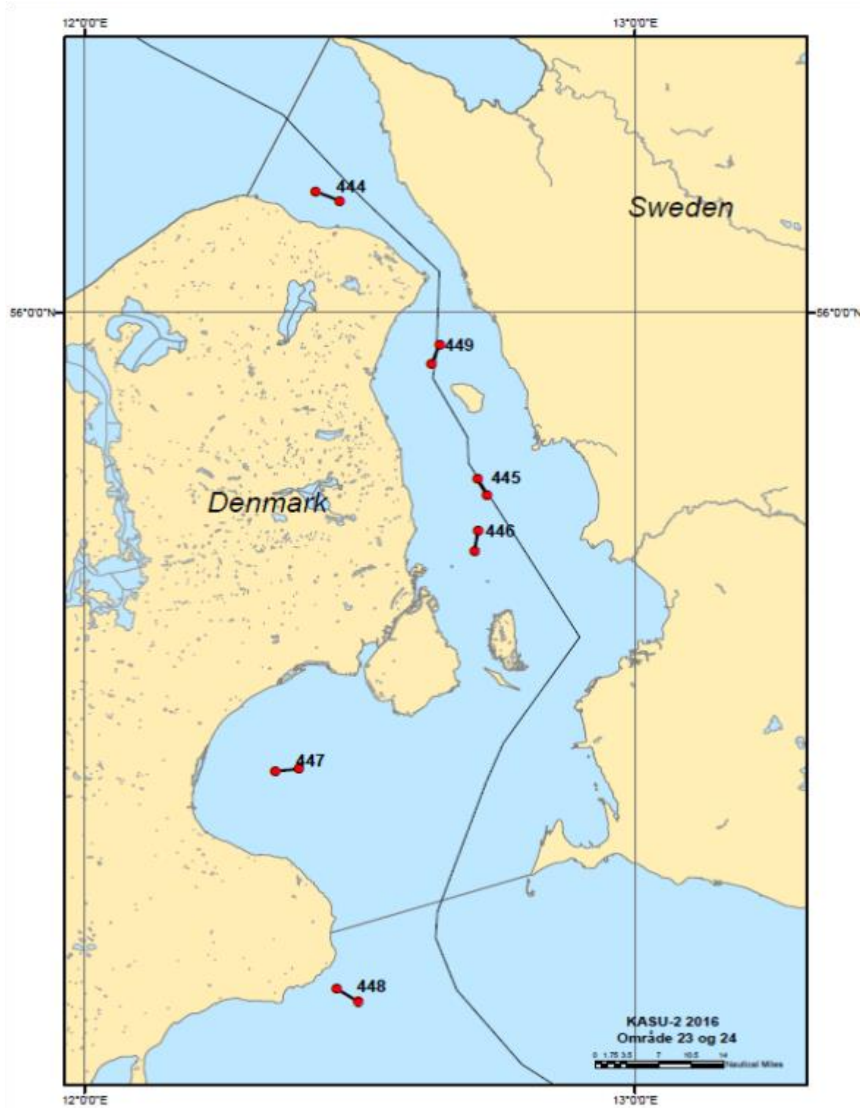
Henrik Degel
BIFS meeting Riga 27/3-31/3 -2017

Havfisken BITS 4 q 2016, Haul plot, Belt area



Henrik Degel
BIFS meeting Riga 27/3-31/3 -2017

Havfisken BITS 4 q 2016, Haul plot, Øresund



Henrik Degel
BIFS meeting Riga 27/3-31/3 -2017

Havfisken BITS 4 q 2016, Species list

uk Name	dk Name	latin	Number Subsamp	SumOfNumberTo	SumOfWeightTo
Squids, octopuses	*Blæksprutter	Cephalopoda	0	0	9,313
Dragonets	*Fløjfisk (ubest.)	Callionymidae	719	1519	19,087
Wrasses	*Gylter	Labridae sp	1	1	0,004
True gobies	*Kutling	Gobiidae	1	1	0,020
Pipe-fishes&seahorses	*Tangnål	Syngnathidae sp	3	3	0,036
Eel	Ål	Anguilla anguilla	2	2	0,908
Eelpout	Ålekvabbe	Zoarces viviparus	40	40	1,030
Anchovy	Ansjos	Engraulis encrasicolus	88	194	2,591
	Berggylt	Labrus bergylta	5	5	0,138
Sprat	Brisling	Sprattus sprattus	2749	102818	1328,509
Northern prawn	Dybvandsreje	Pandalus borealis	0	0	53,197
Four-bearded rockling	Firtrådet havkvabbe	Enchelyopus cimbrius	31	31	0,922
Greater weever fish	Fjæsing	Trachinus draco	1177	11032	671,410
Solenette	Glastunge	Buglossidium luteum	11	15	0,145
Poor-cod	Glyse	Trisopterus minutus	12	28	0,294
Grey gurnard	Grå knurhane	Eutrigla gurnardus	607	948	71,785
American plaice	Håising	Hippoglossoides platessoides	1425	5324	217,183
Bass	Havbars	Dicentrarchus labrax	3	3	1,206
Goldsinny	Havkarudse	Ctenolabrus rupestris	10	10	0,108
Horse mackerel	Hestemakrel	Trachurus trachurus	1472	4943	80,572
Whiting	Hvilling	Merlangius merlangus	4867	103784	2530,672
Invertebrates	Invertebrater	Invertebrata	0	0	353,009
Common dab	Ising	Limanda limanda	4425	100392	4684,708
Norway lobster	Jomfruhummer	Nephrops norvegicus	330	338	21,807
Queen scallop	Kammusling	Aequipecten opercularis	0	0	1,547
Haddock	Kuller	Melanogrammus aeglefinus	82	86	13,755
Hake	Kulmule	Merluccius merluccius	79	79	18,334
Black goby	Kutling-sort	Gobius niger	236	3118	39,802
Sheppy argentine / Pearlside	Laksesild	Maurolicus muelleri	2	6	0,030
Pollack	Lyssej	Pollachius pollachius	1	1	1,810
Mackerel	Makrel	Scomber scombrus	29	29	4,988
Metal	Metal		0	0	0,108
Pogge	Panserulk	Agonus cataphractus	31	31	0,598
Picked dogfish	Pighaj	Squalus acanthias	63	63	142,526
Turbot	Pighvarre	Scophthalmus maximus	82	82	49,475
plastic	Plastik		0	0	9,263
Spotted dragonet	Plettet fløjfisk	Callionymus maculatus	6	6	0,107
Tub gurnard	Rød knurhane	Chelidonichthys lucerna	7	7	2,132
Plaice	Rødspætte	Pleuronectes platessa	3100	13686	2153,229
Lemon sole	Rødtunge	Microstomus kitt	144	185	23,614
Sand gobies	Sand kutling	Pomatoschistus spp	27	43	0,179
Corkwing	Savgylte	Symphodus melops	4	4	0,088
Saithe	Sej	Pollachius virens	15	15	5,727
Herring	Sild	Clupea harengus	3287	45392	502,623
Witch	Skærising	Glyptocephalus cynoglossus	39	39	4,882
Flounder	Skrubbe	Platichthys flesus	1350	2670	626,266
	Skrubbe Rødspætte hybrid	Platichthys flesus x Pleuronectes platessa	1	1	0,526
Brill	Slethvarre	Scophthalmus rhombus	124	124	47,671
	Snippe	Entelurus aequoreus	2	2	0,050
Norway pout	Sperling	Trisopterus esmarkii	586	7802	76,938
Snake blenny	Spidshalet langebarn	Lumpenus lampretaeformis	46	51	0,736
Twaite shad	Stavsild	Alosa fallax	3	3	1,376
Stone and wood	Sten og ler		0	0	0,300
Striped red mullet	Stribet (rød) Mulle	Mullus surmuletus	94	100	2,403
Common dragonet	Stribet fløjfisk	Callionymus lyra	232	696	7,813
Blue-legs swimming crab	Svømmekrabbe	Liocarcinus depurator	0	0	16,970
Starry ray	Tærbe	Amblyraja radiata	6	10	4,505
Seaweed	Tang		0	0	325,031
Butterfish	Tangspræl	Pholis gunnellus	6	6	0,095
Edible crab	Taskekrabbe	Cancer pagurus	8	8	6,990
Sandeel	Tobis-hav	Ammodytes marinus	11	11	0,188
Greater sandeel	Tobiskonge	Hyperoplus lanceolatus	36	36	0,564
Sandeel	Tobis-kys (sand)	Ammodytes tobianus	1	1	0,020
Cod	Torsk	Gadus morhua	2915	9322	911,770
Three-bearded rockling	Tretrådet havkvabbe	Gaidropsarus vulgaris	75	75	1,788
Sole	Tunge	Solea solea	492	492	74,150
Scaldfish	Tungehvarre	Arnoglossus laterna	128	135	2,092
Sculpin	Ulk	Myoxocephalus scorpius	162	162	18,600
			31450	415950	15219,386

Dana BITS 1q 2017

Nation:	Denmark	Vessel:	Dana
Survey:	BITS	Dates:	7-25/3 - 2017

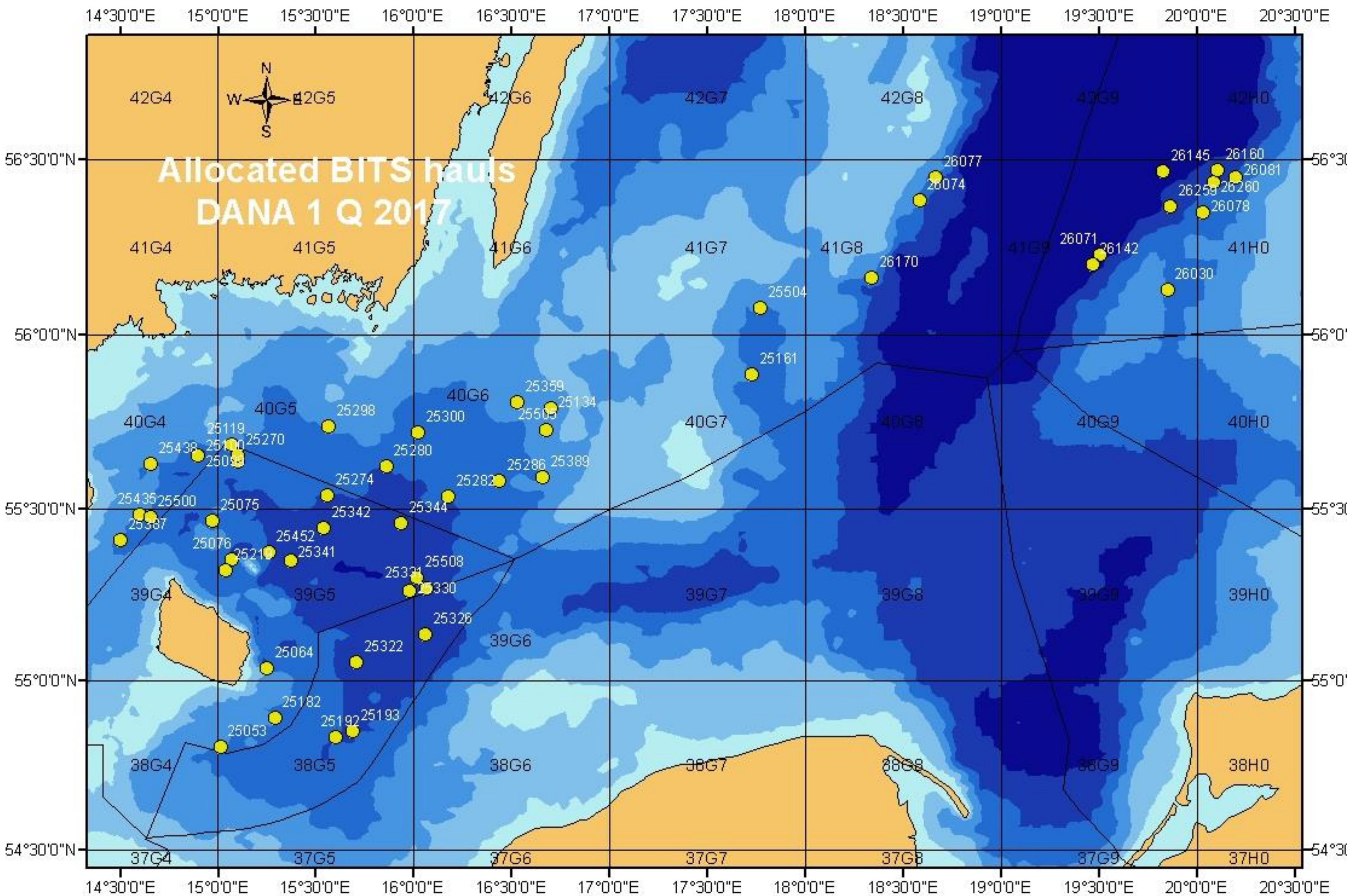
Cruise	
Gear details:	The big (#920) standard TV3 trawl is used. The construction of the trawl follows the specifications in the manual. No rock hopper was used
Notes from survey (e.g. problems, additional work	Stomack sampling from cod, plankton fishing during night.

ICES Sub-Divisions and Depth stratum	Gear (TVL,TVS)	Number of hauls planed	Number of valid hauls realized using "Standard" ground gear	Number of valid hauls realized using Rock-hoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
25	TVL							
3	TVL	9	7	0	0	0	1	88,9
4	TVL	24	21	0	0	0	0	87,5
5	TVL	10	13	0	0	0	0	130,0
6	TVL	0	1	0	0	0	0	-
26	TVL							
3	TVL	3	3	0	0	0	0	100,0
4	TVL	4	4	0	0	0	0	100,0
5	TVL	4	1	0	0	0	0	25,0

Number of biological samples (maturity and age material, *maturity only):

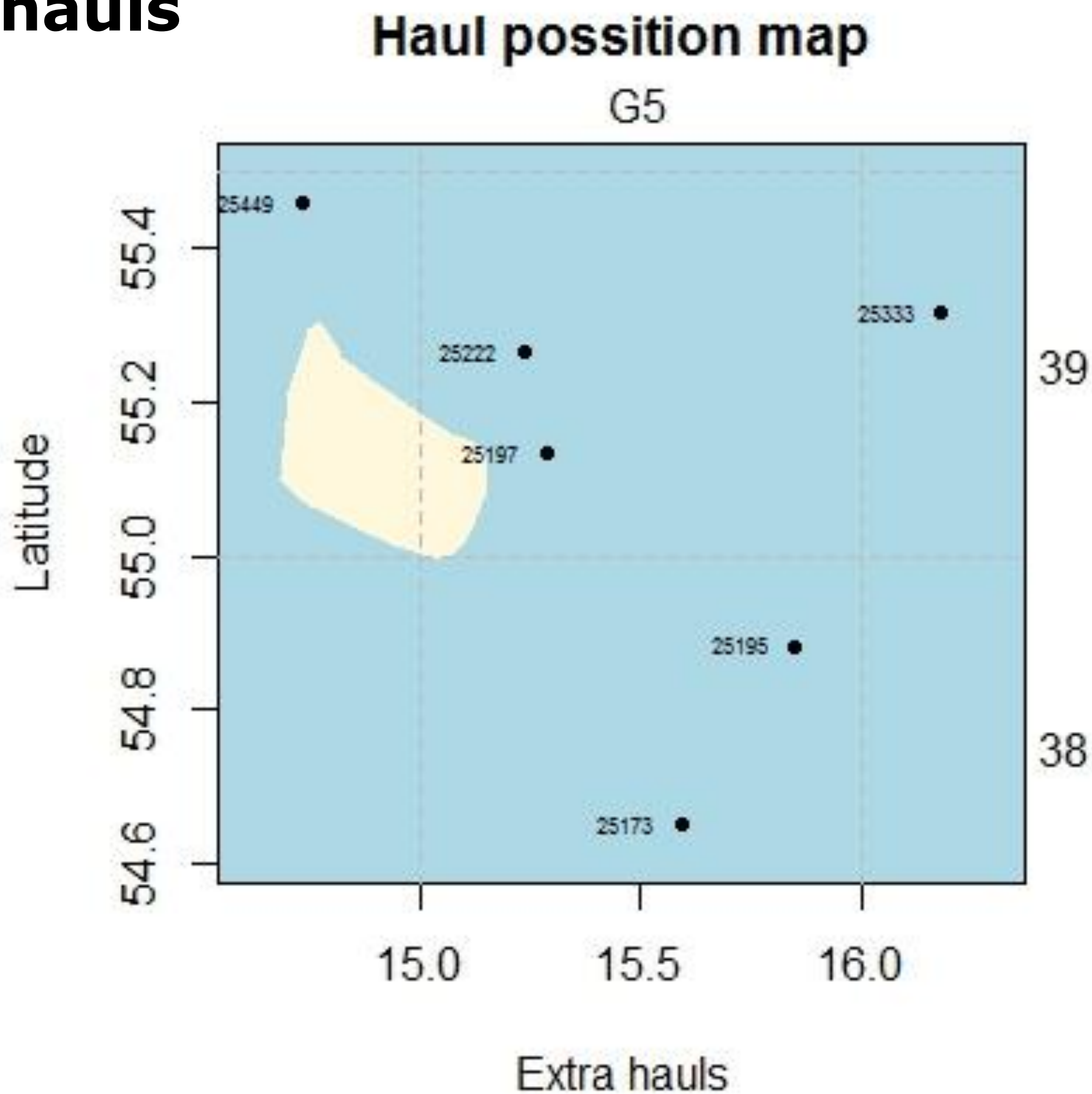
Species	Age	Species	Age
Clupea harengus			
Gadus morhua			
Sprattus sprattus			

Dana BITS 1q 2017



Henrik Degel
BIFS meeting Riga 27/3-31/3 -2017

Dana BITS 1q 2017
Extra hauls



Dana BITS 1q 2017

Cruise summary

Cruise:	BITS
Cruise number	4
Quarter:	1
Year:	2017
Periode:	7-25/3
Country	Denmark

Number of hauls planed: 47

	Index qualified	Non-index qualified
Number of succesful trawl hauls carried out in total:	50	
Number of invalid trawl hauls carried out:		1
Number of "No oxygen trawl hauls" carried out (assumed zero-catch):	0	
SUM	50	1

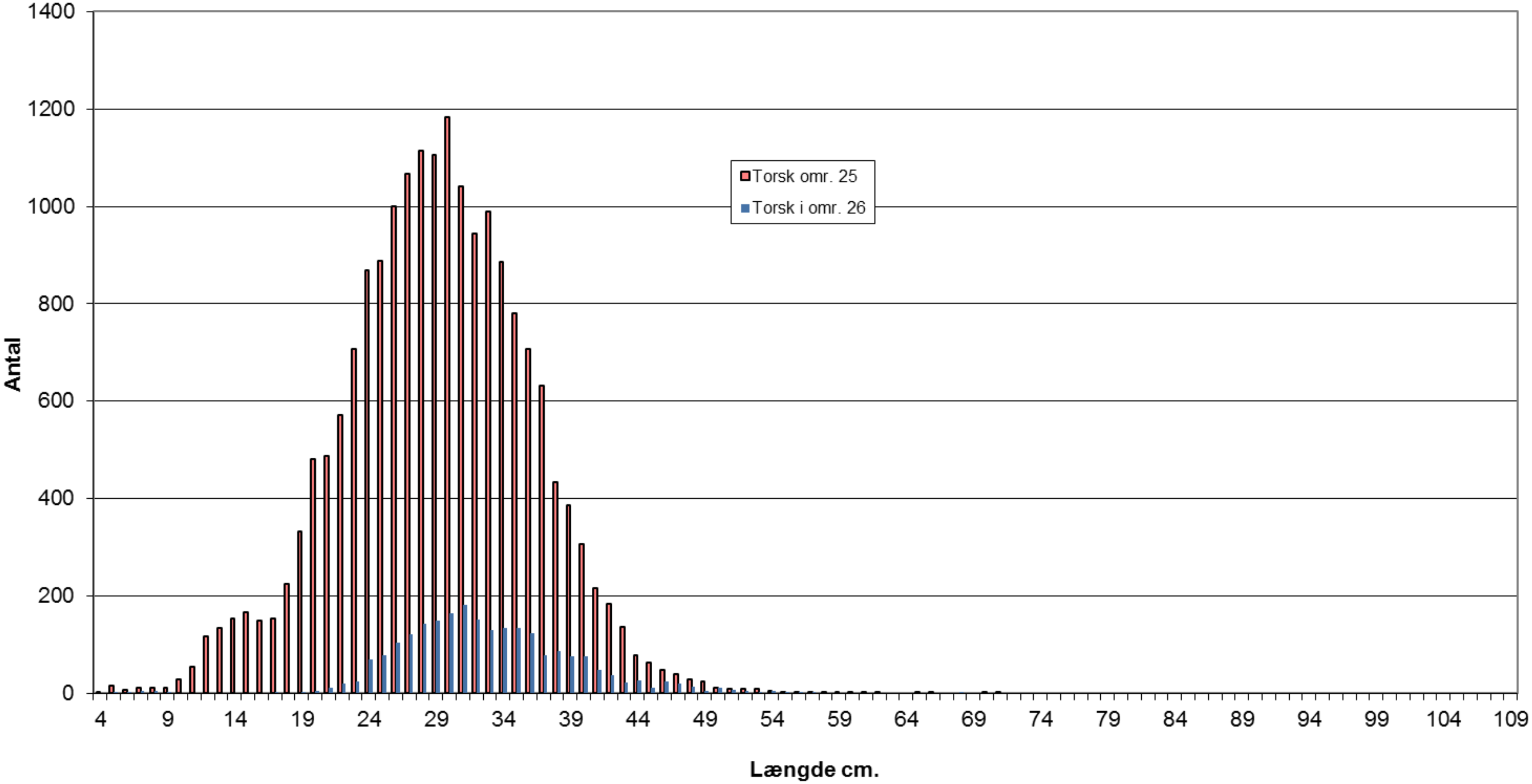
Number of trawl related CTD stations performed:	0
Number of NON-trawl related CTD stations performed:	77
Number of succesful BONGO hauls carried out:	43
Number of succesful IKMT hauls carried out:	0
Number of succesful Appi hauls carried out:	0
Number of succesful WP2 hauls carried out:	0
Number of succesful BOM hauls carried out:	0
Number of succesful Multi-NET hauls carried out:	0

Total kgs of cod cached	6776
Total number of cod measured	21353
Total number of cod otoliths collected	0

Henrik Degel
BIFS meeting Riga 27/3-31/3 -2017

Dana BITS 1q 2017

Length distribution for cod



Henrik Degel
BIFS meeting Riga 27/3-31/3 -2017

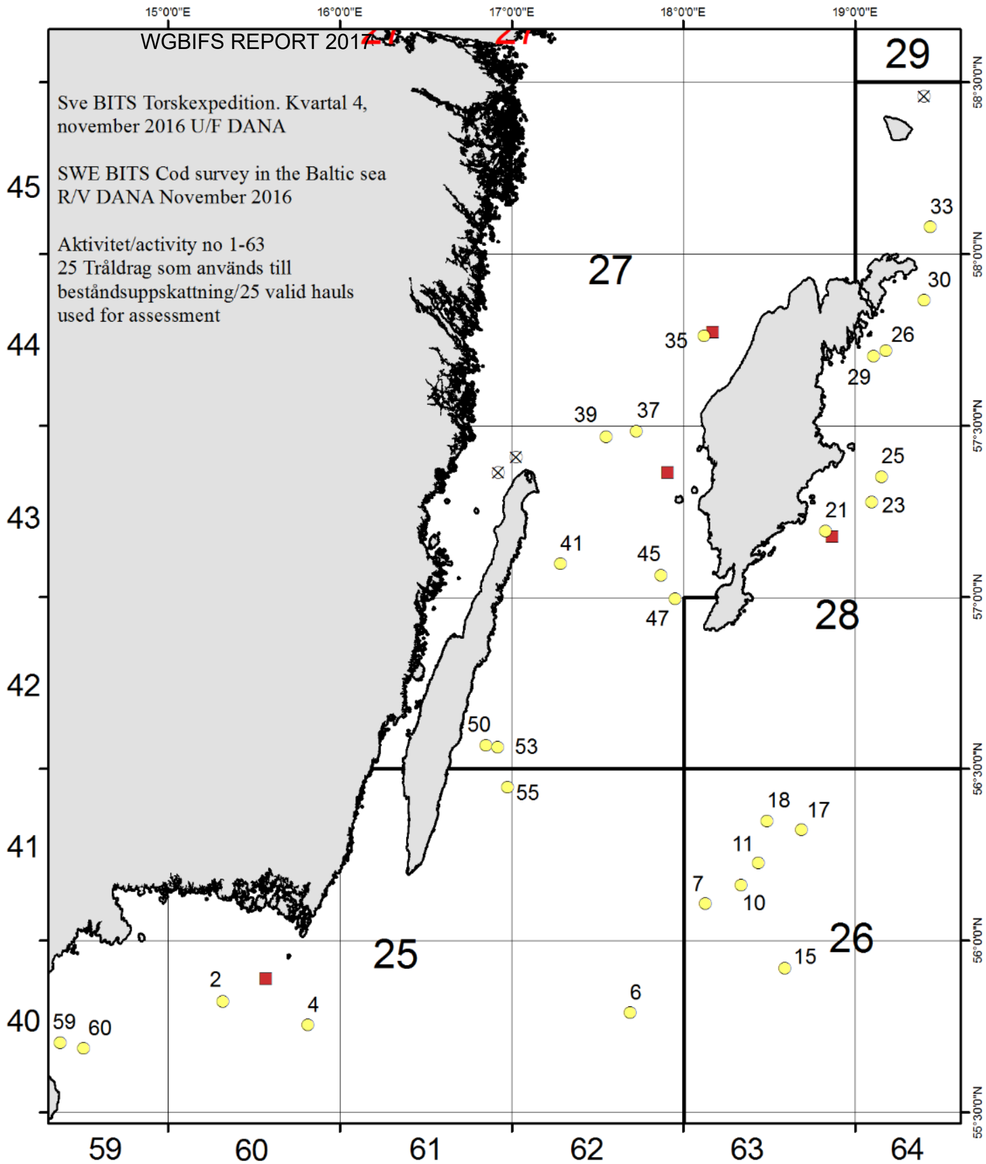
WGBIFS Riga 27/3– 31/03-17

BITS 2016 Q4 and 2017 Q1
R/V Dana

BITS 2016 Q4

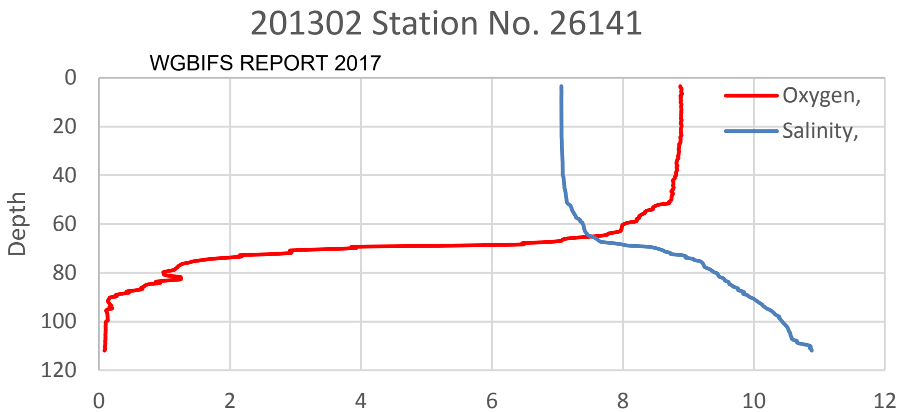
- Nov 18– nov 28
- Nine days survey (30 stations)
- Stomach sampling cod and flounder
- Additional sampling, Saduria entomon Lenght distribution

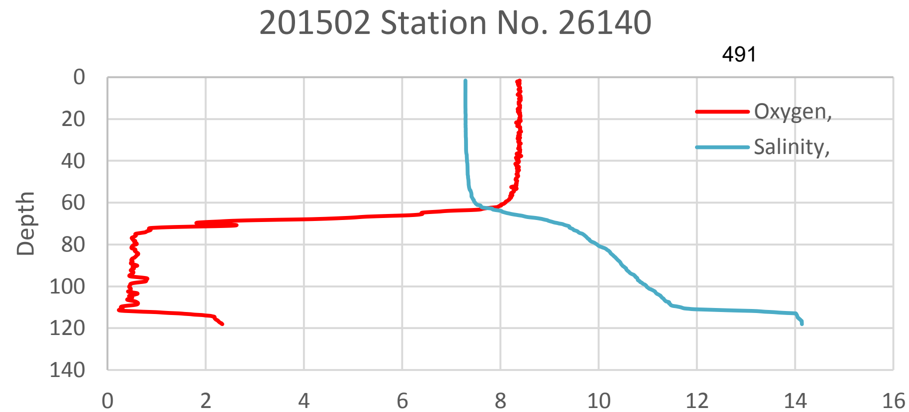
2016 Q4 Stations

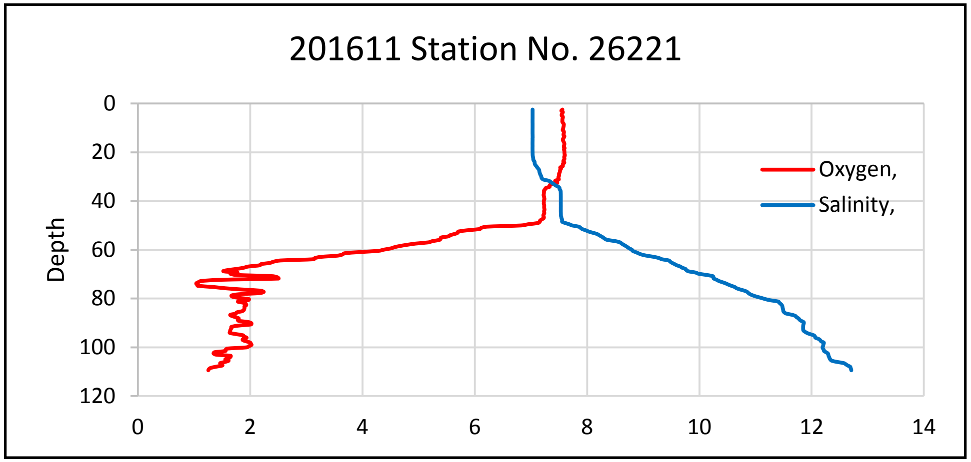


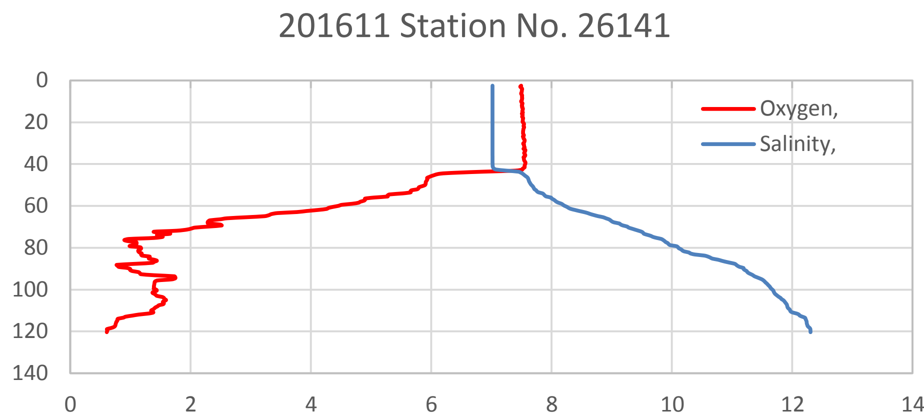
- Crossed circles. Forbidden stations
- Red squares. Replaced stations
- Yellow circles. Planned and executed stations
- On this survey some of the old prohibited stations were allowed.

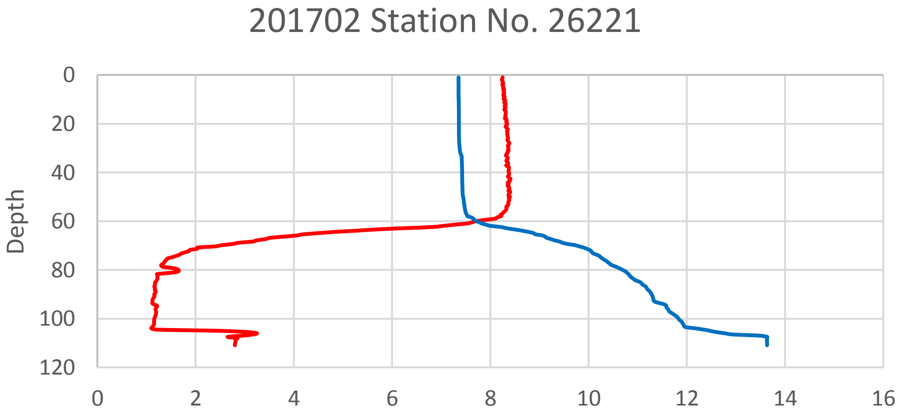
- Continuesly rising levels of salinity and oxygene, (ml/L) in some areas, particularly in Bornholm basin and parts of SD 26

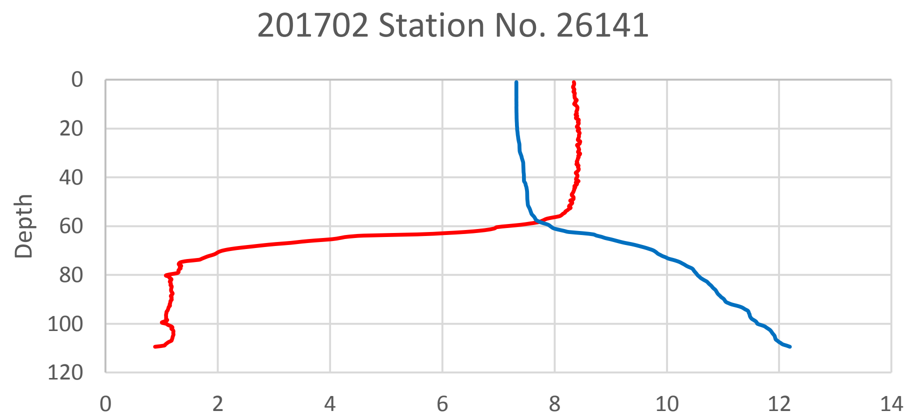

201302 Station No. 26141
Depth
Oxygen,
Salinity,
0
20
40
60
80
100
120
0
2
4
6
8
10
12

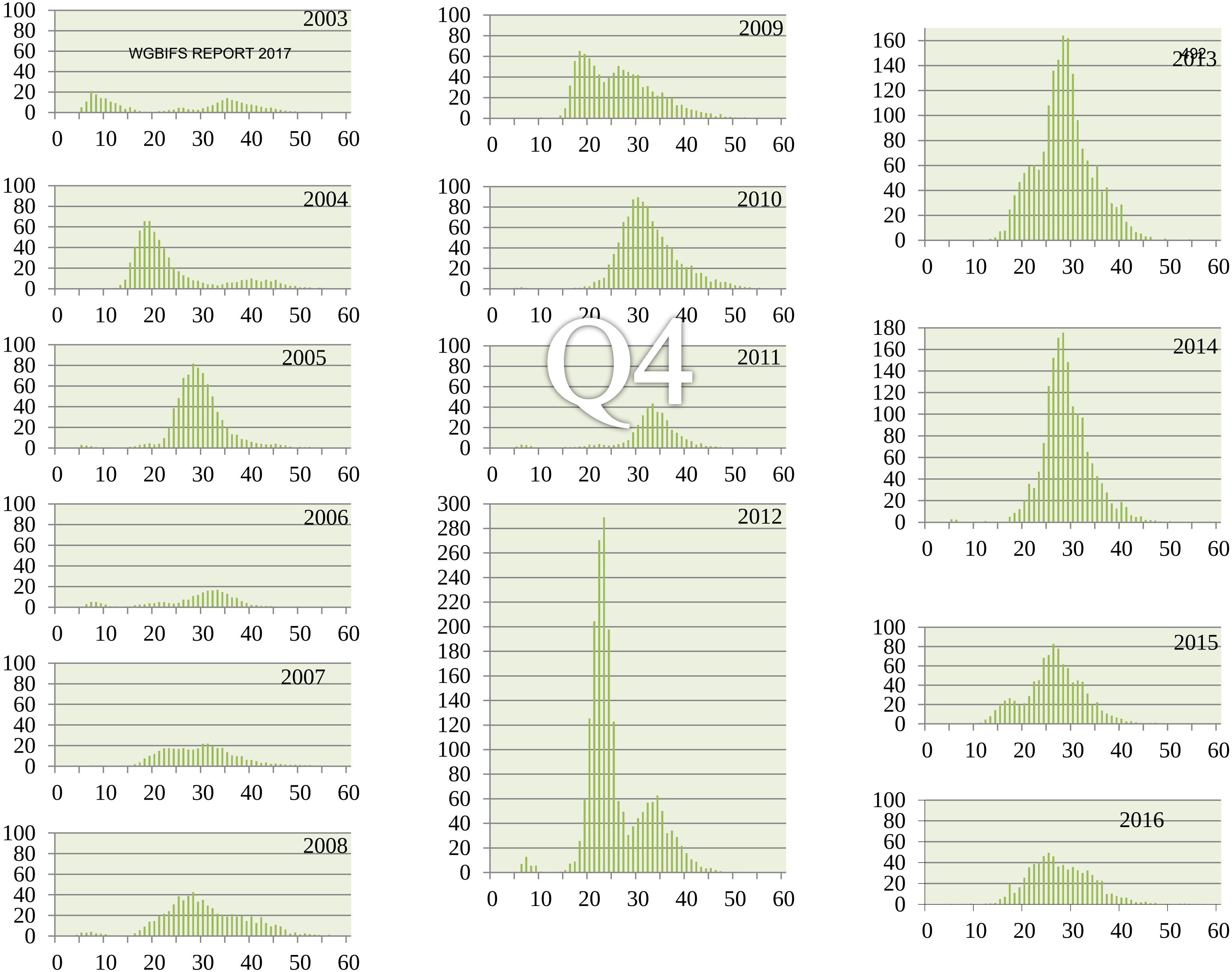

201502 Station No. 26140
Depth
Oxygen,
Salinity,
0
20
40
60
80
100
120
140
0
2
4
6
8
10
12
14
16

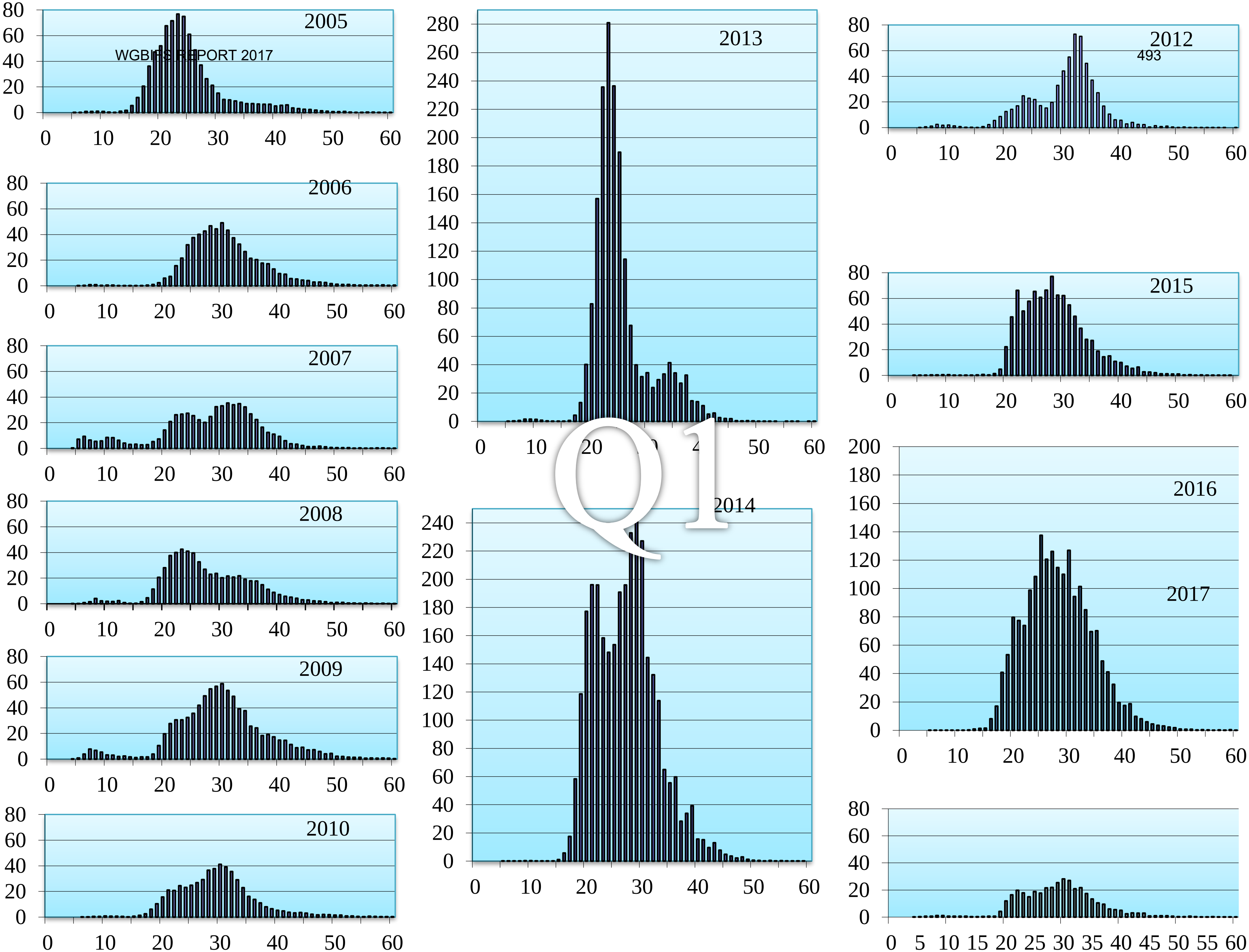

201611 Station No. 26221
Depth
Oxygen,
Salinity,
0
20
40
60
80
100
120
0
2
4
6
8
10
12
14


201611 Station No. 26141
Oxygen,
Salinity,
0
20
40
60
80
100
120
140
0
2
4
6
8
10
12
14


201702 Station No. 26221
Depth
0
20
40
60
80
100
120
0
2
4
6
8
10
12
14
16

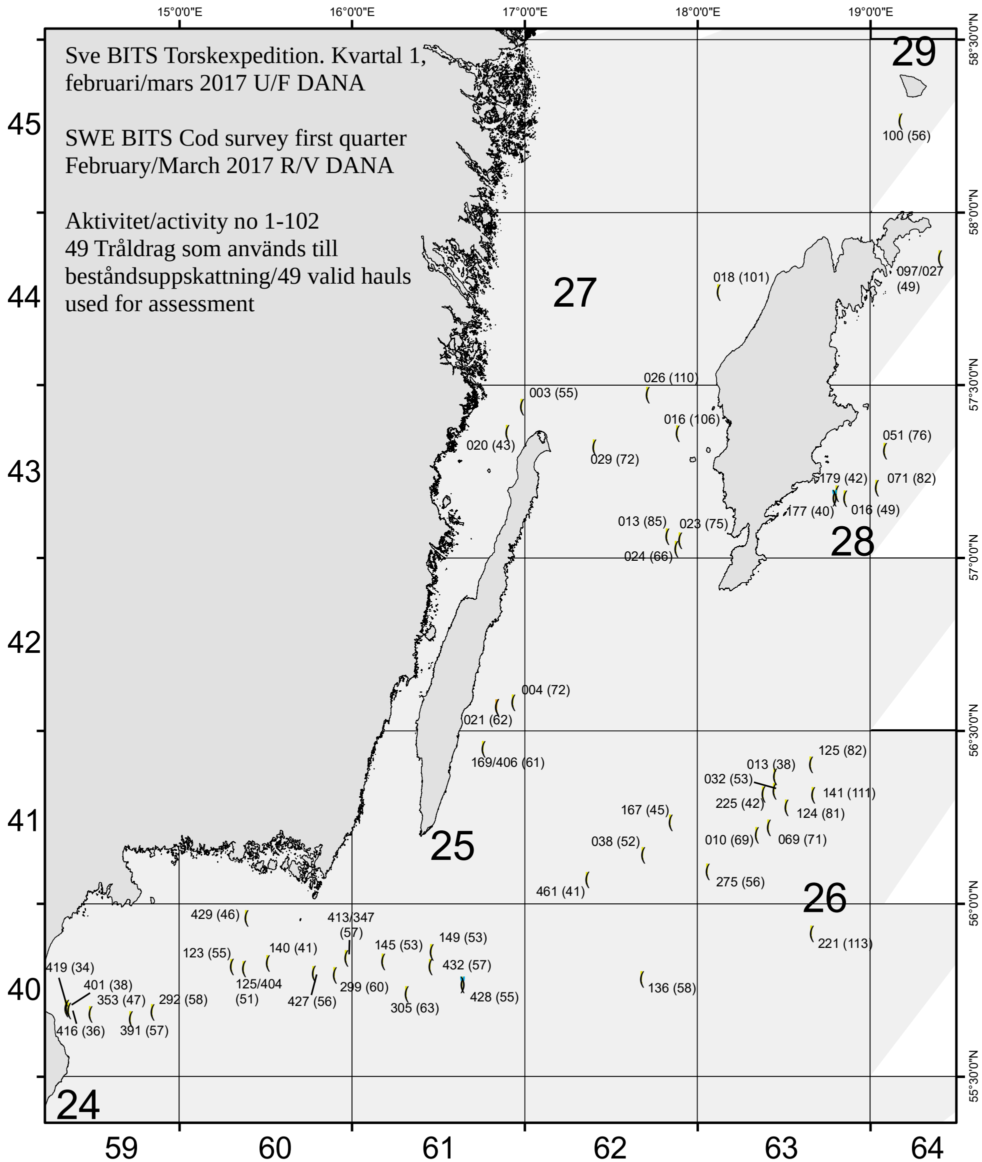

201702 Station No. 26141
Depth
0
20
40
60
80
100
120
0
2
4
6
8
10
12
14


2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Q4


2005
2006
2007
2008
2009
2010
2013
2014
Q1
2012
2015
2016
2017

BITS 2017 Q1

- February 23– March 07
- 13 days survey (50 stations)
- Stomach sampling cod and flounder
- Additional sampling, Saduria entomon Lenght distribution
- Genetic sampling on cod



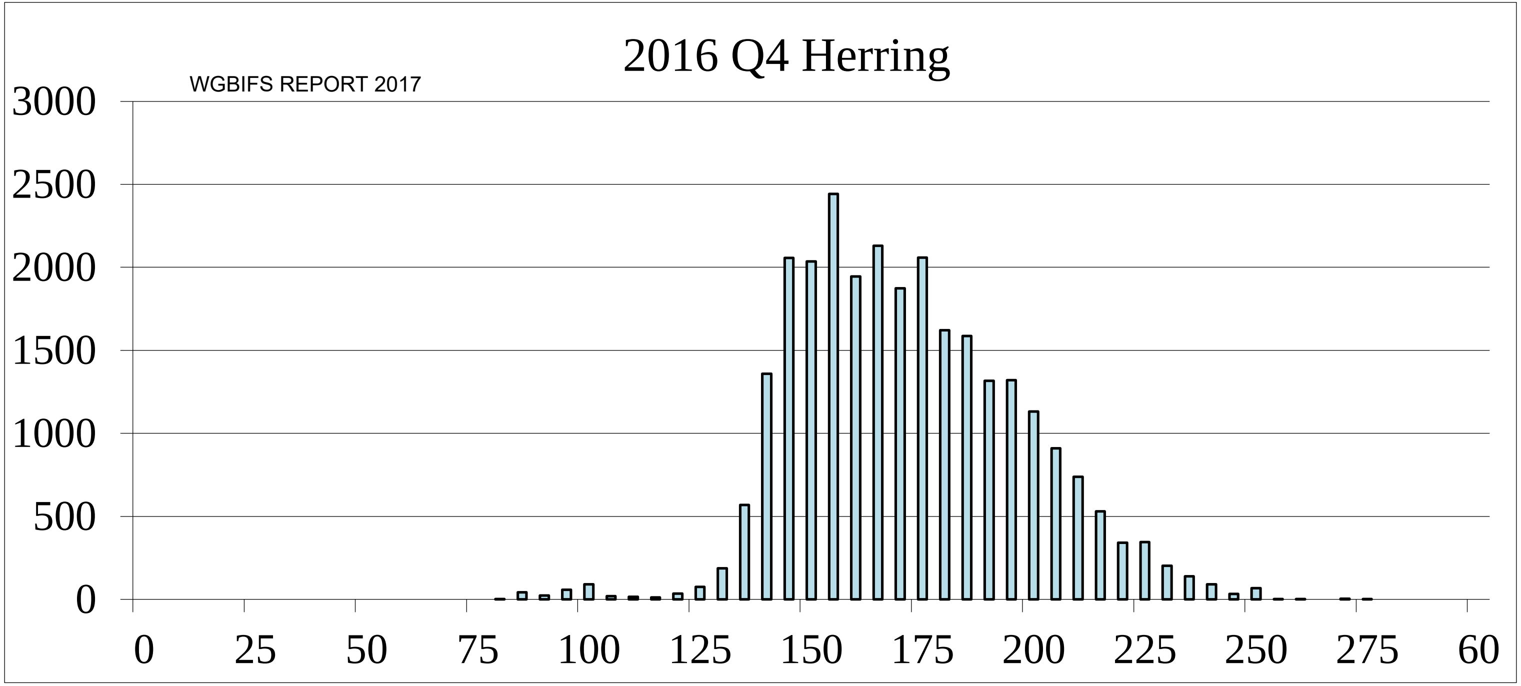
Stations BITS 2017 Q1

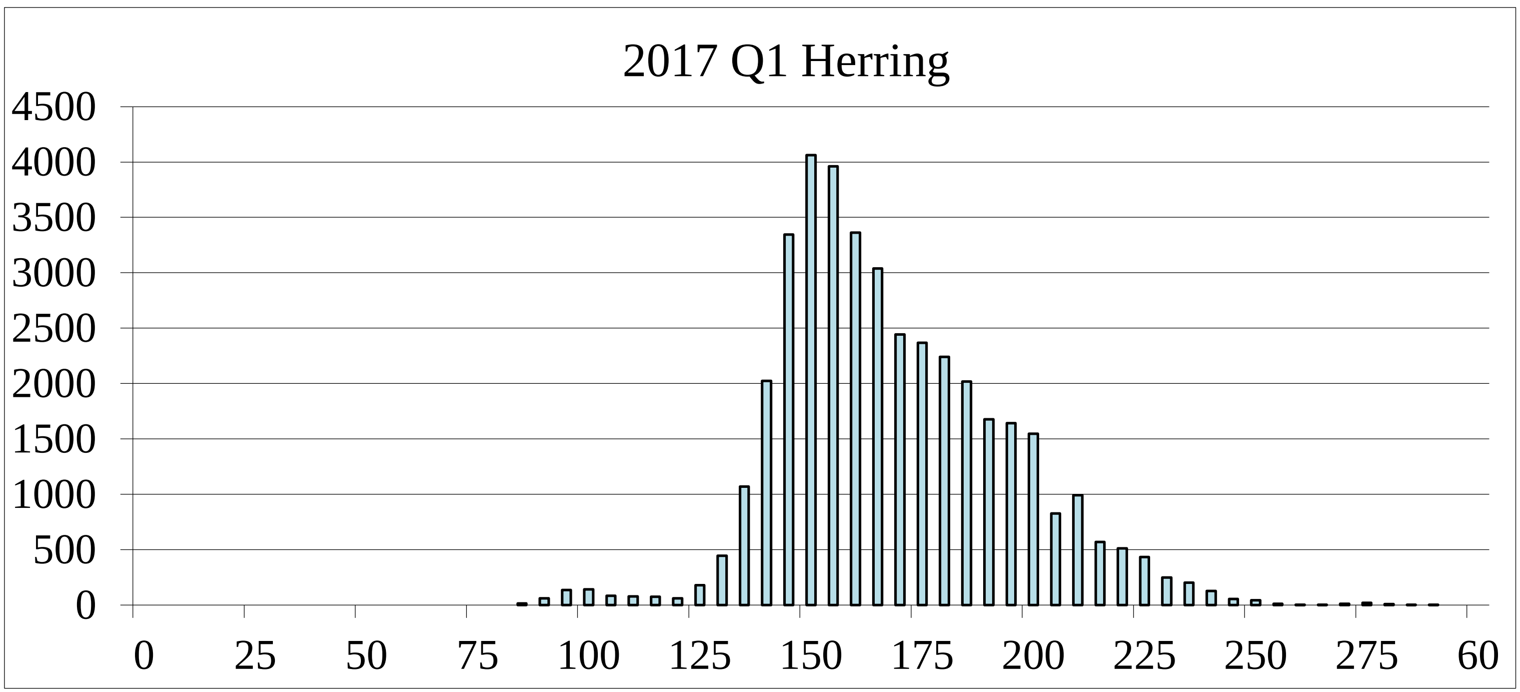
- Squares. Replaced stations
- Orange circles. Additional stations
- Yellow circles. Planned and executed stations

- No stations forbidden by the military this year

Oxygenated water mainly in areas bornholm basin and SD 26 but also in some place east of gotland SD 28

Herring No/h
Baltic basin





Swe BITS 2014 Q1

Total weight Kg 45 185
Cod weight Kg 11 155
Number of Cod 55 031

Swe BITS 2014 Q4

Total weight Kg 20 343
Cod weight Kg 3 693
Number of Cod 16 484

Swe BITS 2015 Q1

Total weight Kg 38 837
Cod weight Kg 4 631
Number of Cod 18 565

Swe BITS 2015 Q4

Total weight Kg 21000
Cod weight Kg 1 792
Number of Cod 7 191

Swe BITS 2016 Q1

Total weight Kg 38 754
Cod weight Kg 10 485
Number of Cod 37 420

Swe BITS 2016 Q4

Total weight Kg 22 804
Cod weight Kg 1 699
Number of Cod 5 307

Swe BITS 2017 Q1

Total weight Kg 45 538
Cod weight Kg 2 114
Number of Cod 8 196

The Sound
Öresund

Two Stations in the sound to be included in the west baltic stock

HÅLABBEN

Swe BITS 2016 Q4	
Total weight Kg	927
Cod weight Kg	679
Number of cod	513

Swe BITS 2017 Q1	
Total weight Kg	204
Cod weight Kg	142
Number of Cod	163

BIOR

PĀRTIKAS DROŠĪBAS, DZĪVNIEKU VESELĪBAS
UN VIDES ZINĀTNISKAIS INSTITŪTS

LATVIA
2016 BITS Q4 AND 2017 BITS Q1 SURVEYS

IVO ŠICS
GUNTARS STRODS

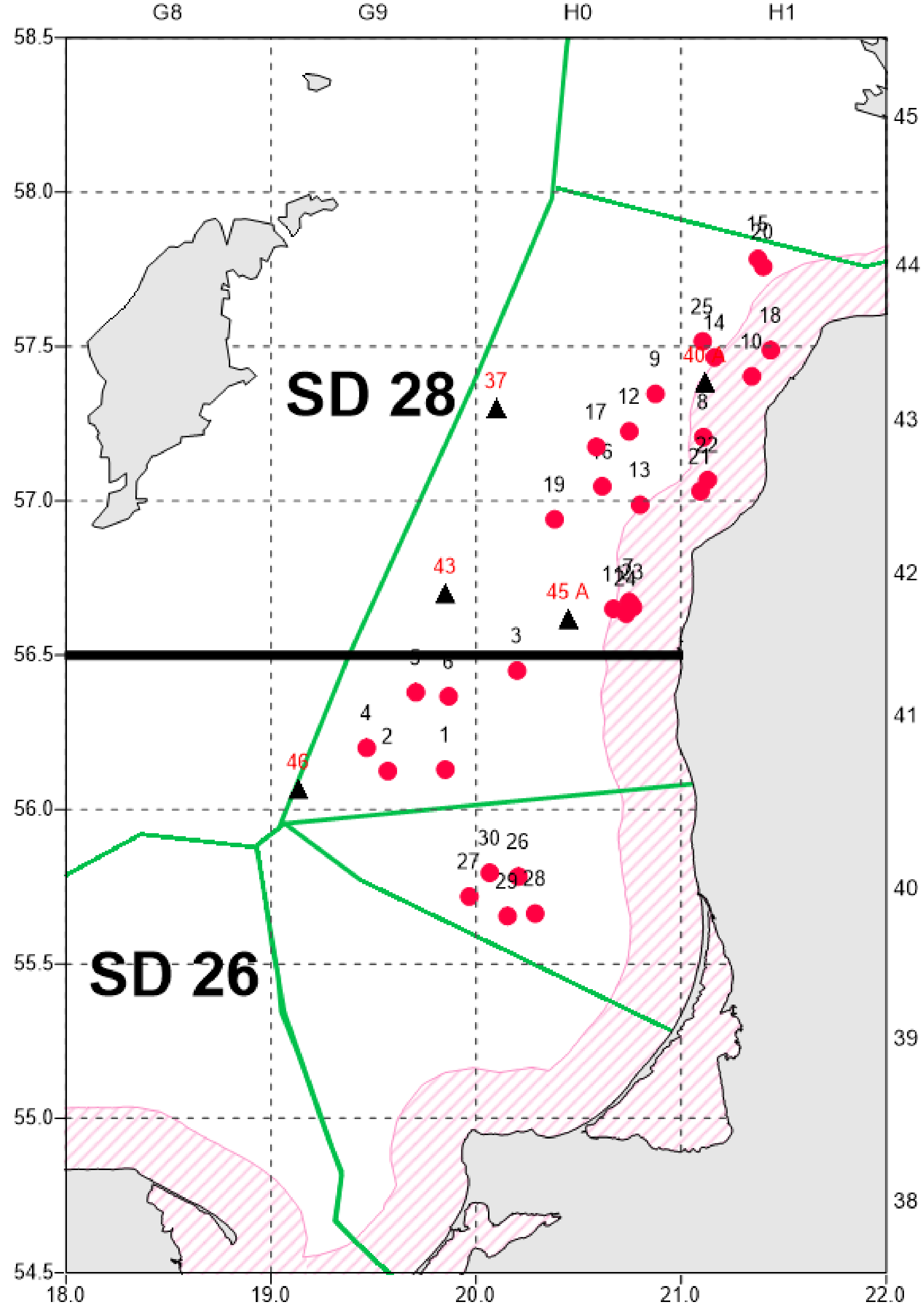
Both surveys were performed in cooperation with Polish colleagues on the Polish r.v. “Baltica”

During these surveys big TV3 with rochopper were used

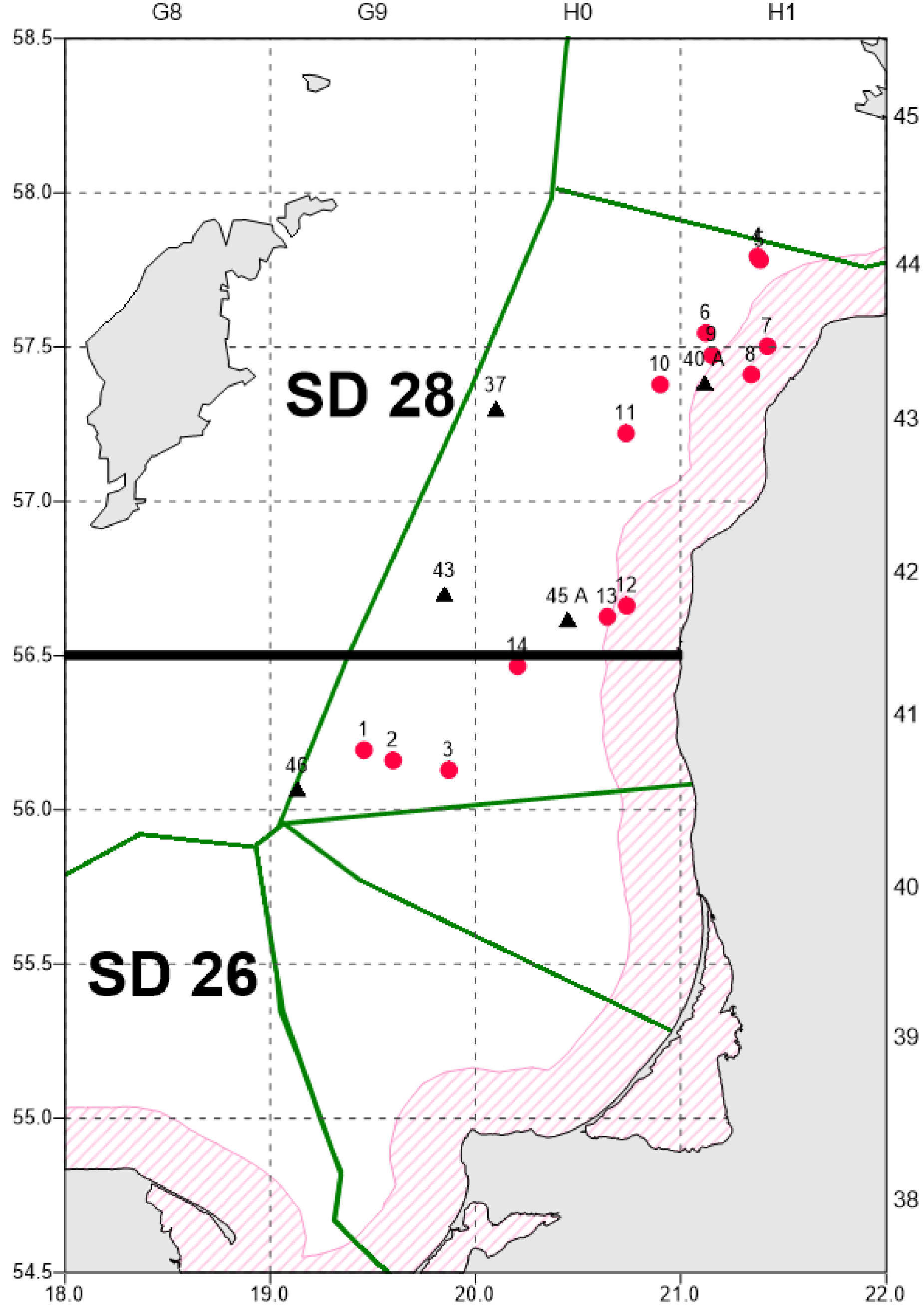
2016. BITS Q4 survey

The joint Latvian-Polish BITS survey, conducted in the period of 03-12.12.2016 on the r.v. “Baltica” , in the Latvian EEZs (the ICES Sub-divisions 26 and 28).

PLANNED TRAWLING STATIONS



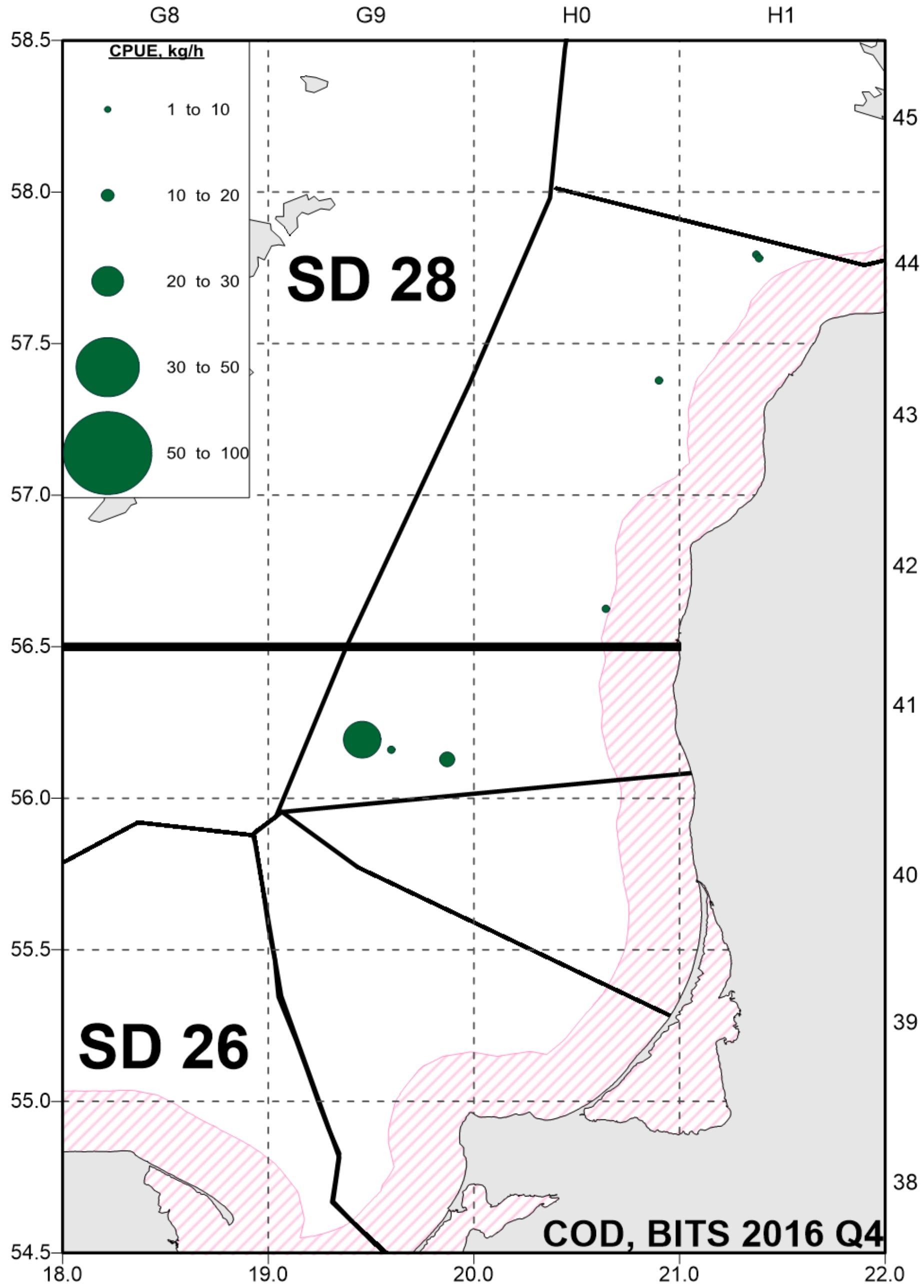
REALIZED TRAWLING STATIONS



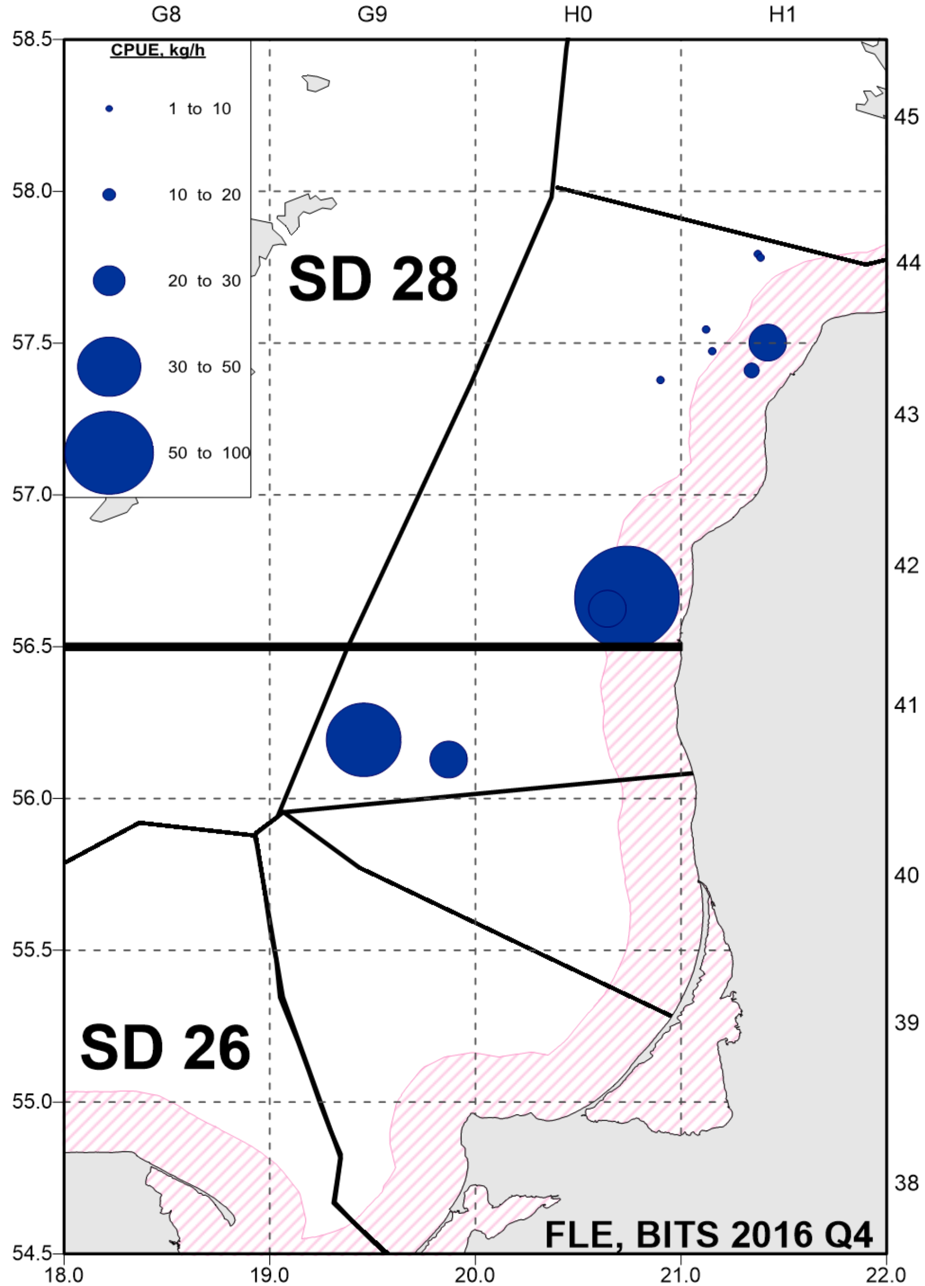
NUMBERS OF FISH BIOLOGICALLY ANALYSED DURING THE BITS-4Q SURVEY (OVERALL, 13 FISH SPECIES)

Species	ICES SD	Number of samples	Number of fish measured	Number of fish analyzed	Number of fish stomach samples
Cod	26	3		34	34
	28	4		14	14
	Total	7		48	48
Flounder	26	3		64	
	28	9	82	212	
	Total	12	82	276	
Turbot	26				
	28	1	1		
	Total	1	1		
Plaice	26	1	3		
	28				
	Total	1	3		
Herring	26	4	342		
	28	10	1037		
	Total	14	1379		
Sprat	26	4	419		
	28	10	1030		
	Total	14	1449		
All other species	26	2	6		
	28	8	84		
	Total	10	90		
Total	26	17	770	98	34
	28	42	2234	226	14
	Total	59	3004	324	48

DISTRIBUTION OF COD DURING THE BITS 2016 Q4 SURVEY



DISTRIBUTION OF FLOUNDER DURING THE BITS 2016 Q4 SURVEY

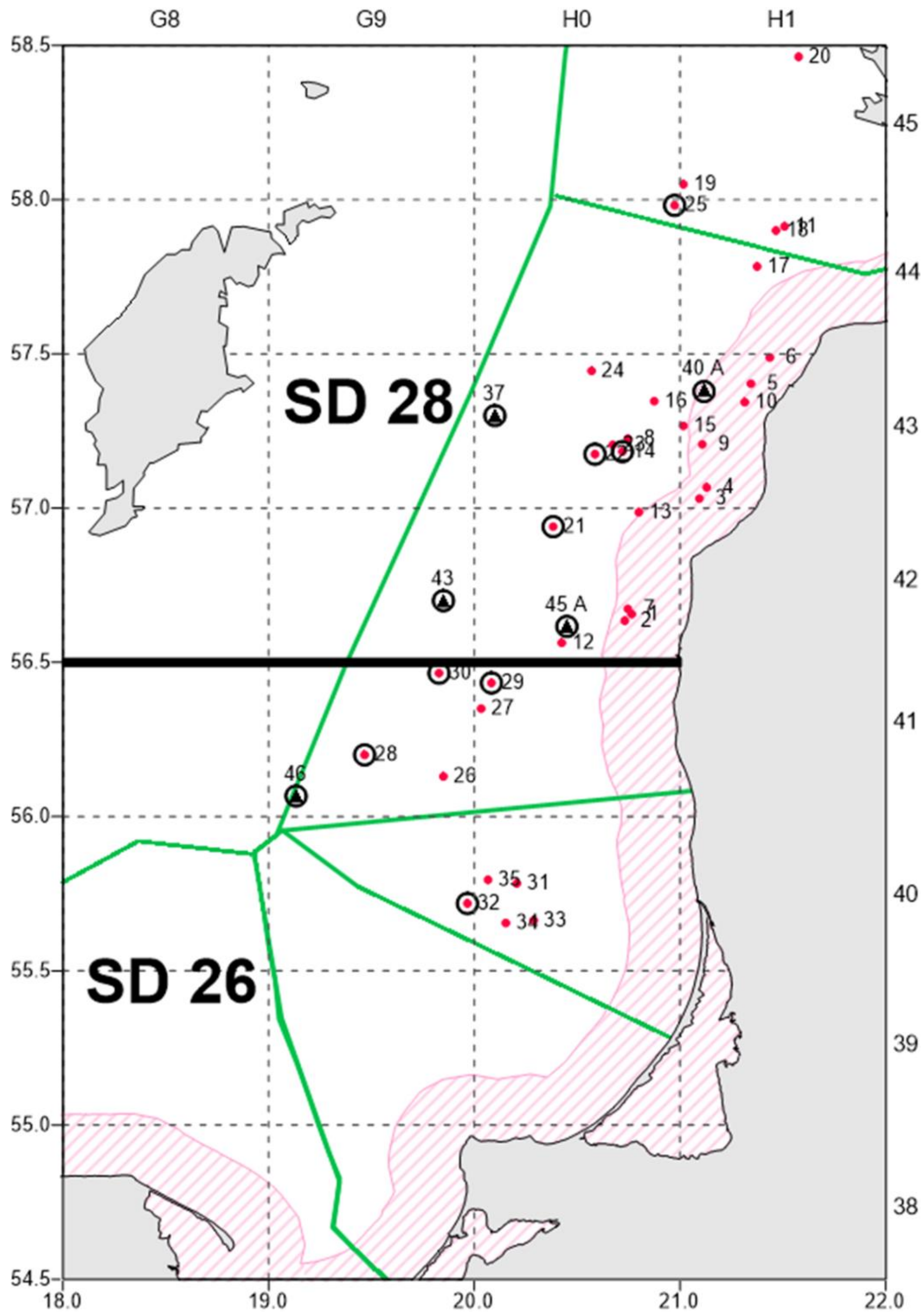


8

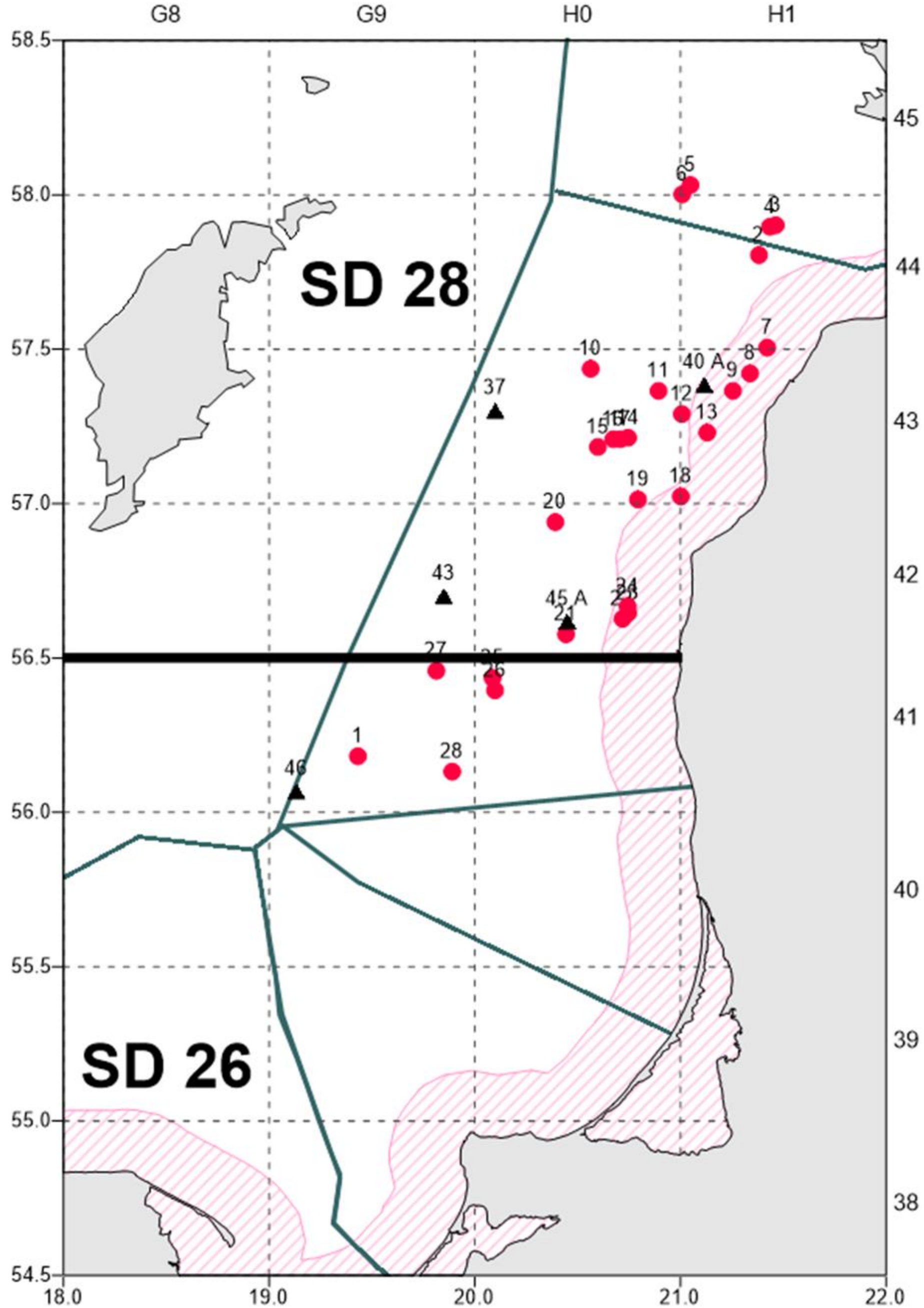
2017. BITS Q1 survey

The joint Latvian-Polish BITS survey, conducted in the period of 11-19.03.2017 on the r.v. “Baltica” , in the Latvian and Estonian EEZs (the ICES Sub-divisions 26 and 28).

PLANNED TRAWLING STATIONS



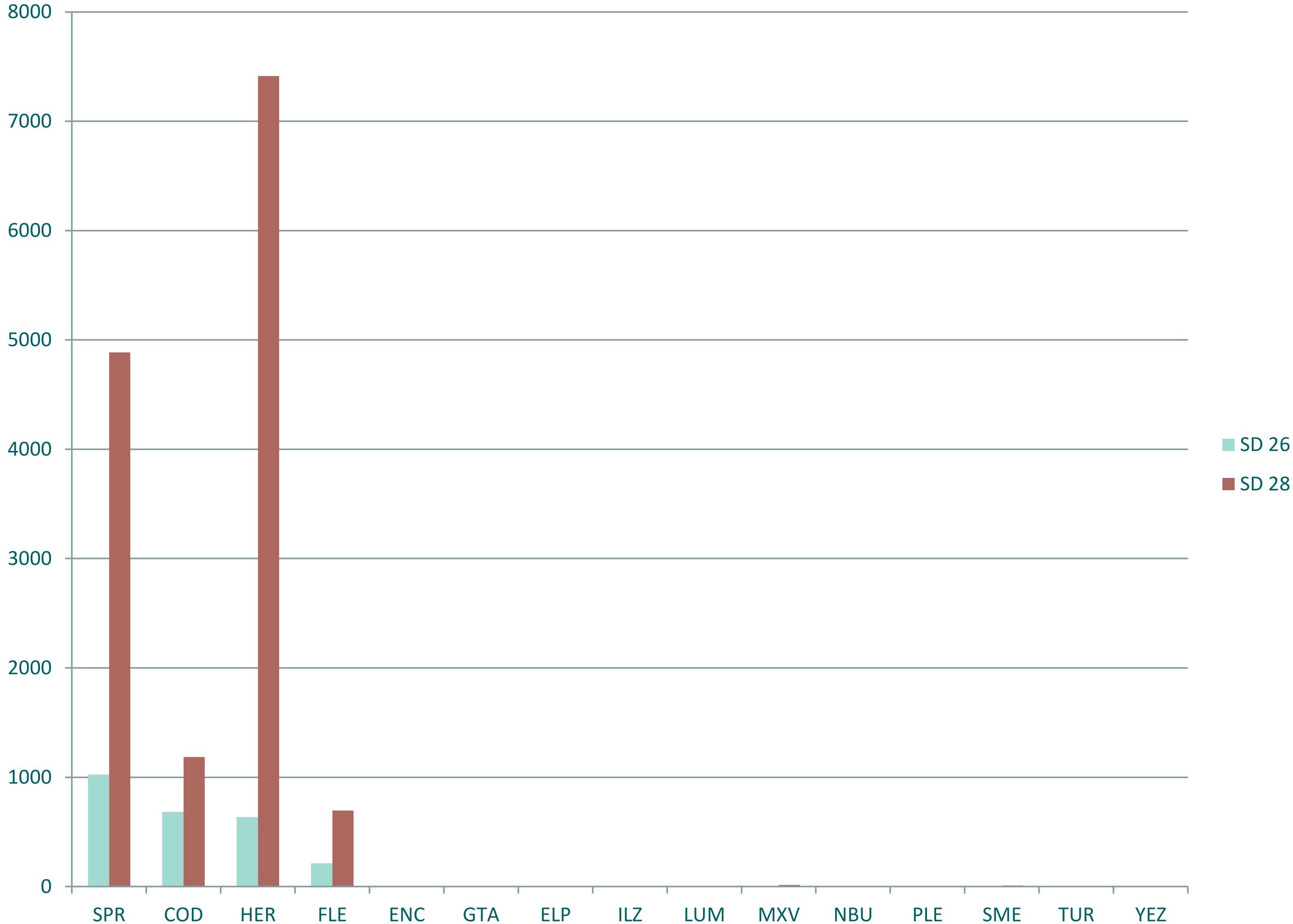
REALIZED TRAWLING STATIONS



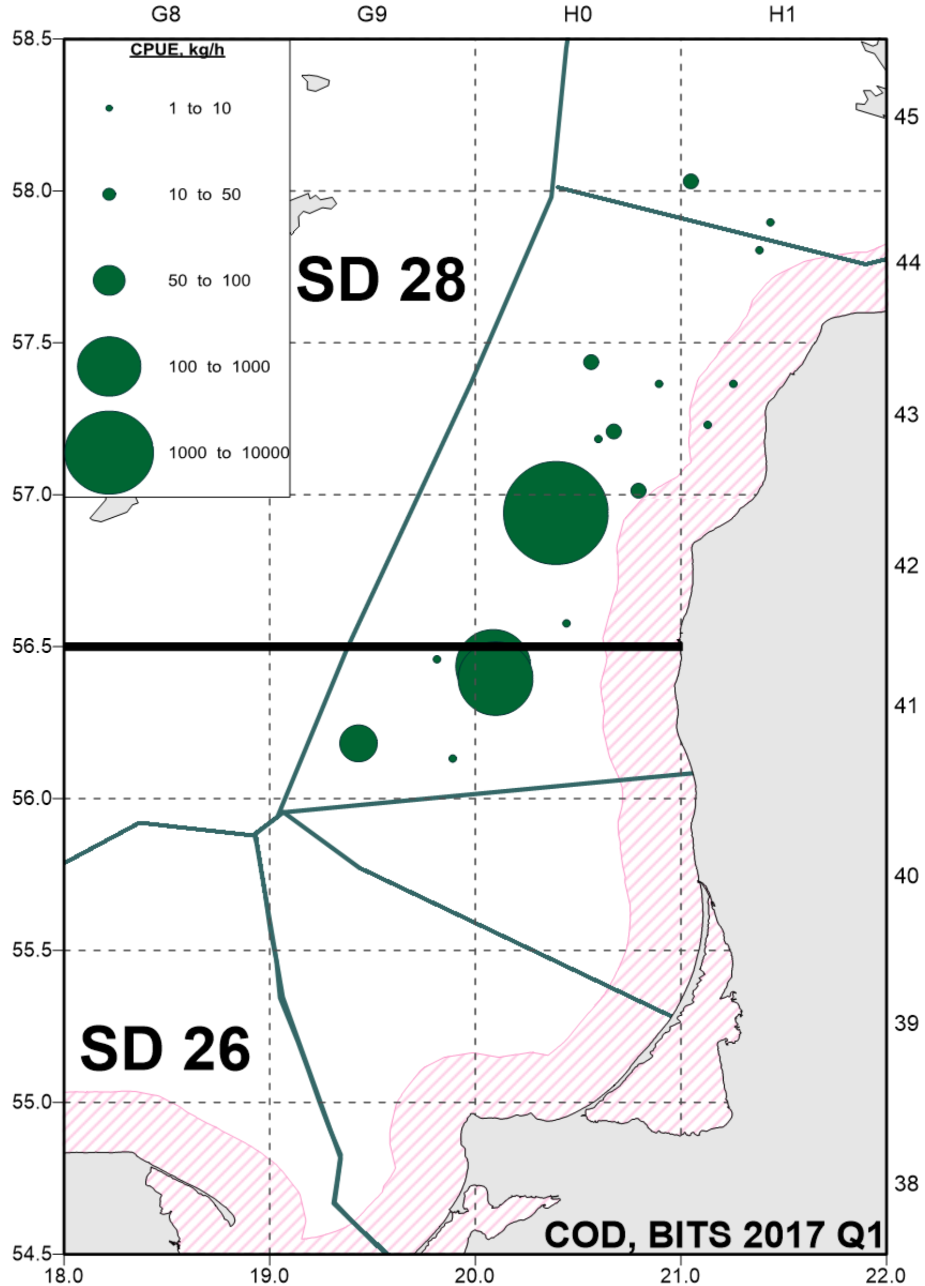
NUMBERS OF FISH BIOLOGICALLY ANALYSED DURING THE BITS-1Q SURVEY (OVERALL, 15 FISH SPECIES)

Species	Number of samples			Number of fish								
				measured			analyzed			Stomach samples		
	SD 26	SD 28	Total	SD 26	SD 28	Total	SD 26	SD 28	Total	SD 26	SD 28	Total
Cod	5	13	18	154	590	744	302	294	596	206	233	439
Flounder	4	22	26	67	1234	1301	206	333	539			
Herring	5	22	27	506	2289	2795						
Sprat	5	21	26	454	1896	2350						
Four bearded rockling	1	1	2	10	7	17						
Round goby		5	5		11	11						
Turbot		1	1		3	3						
Greater sandeel		1	1		1	1						
Plaice		1	1		1	1						
Eelpout		6	6		16	16						
Smelt		10	10		100	100						
Three-spined stickleback	1	6	7	1	13	14						
Lumpfish		2	2		2	2						
Snake blenny		1	1		1	1						
Sea scorpion		11	11		41	41						
Total	21	123	144	1192	6205	7397	508	627	1135	206	233	439

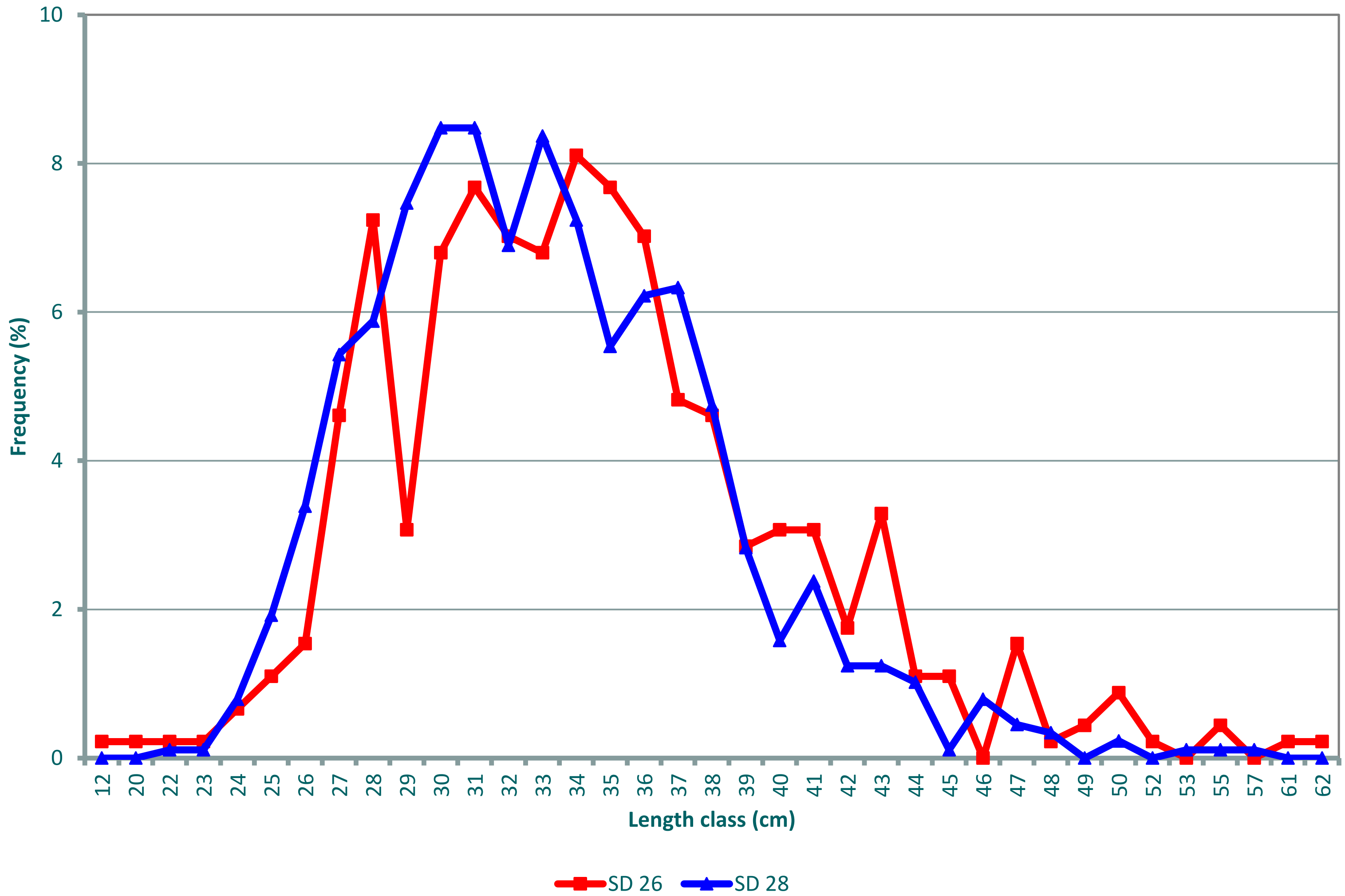
FISHES DOMINATED BY MASS KG PER 1 HOUR TRAWLING IN SD 26 AND 28



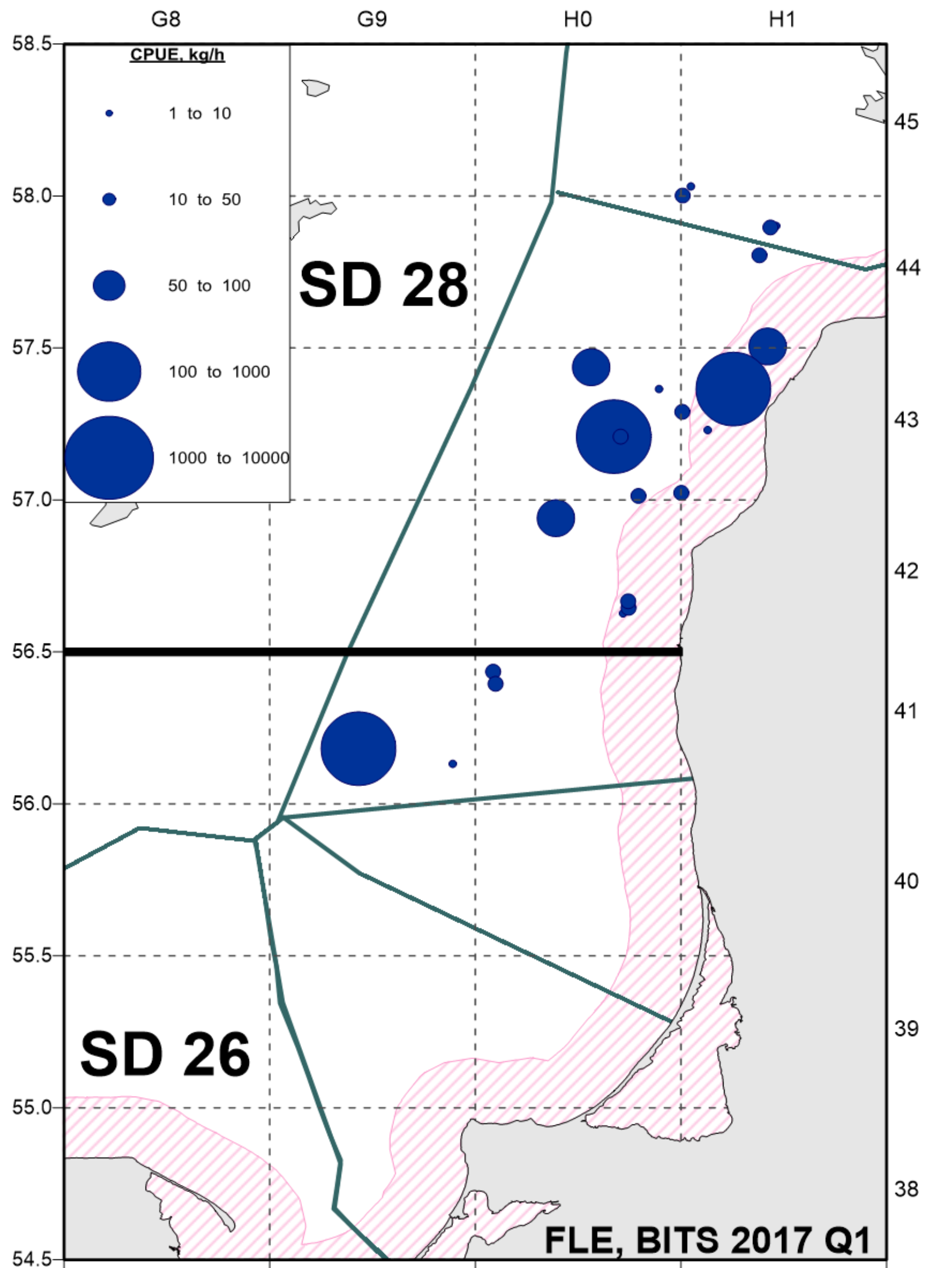
DISTRIBUTION OF COD DURING THE BITS 2017 Q1 SURVEY



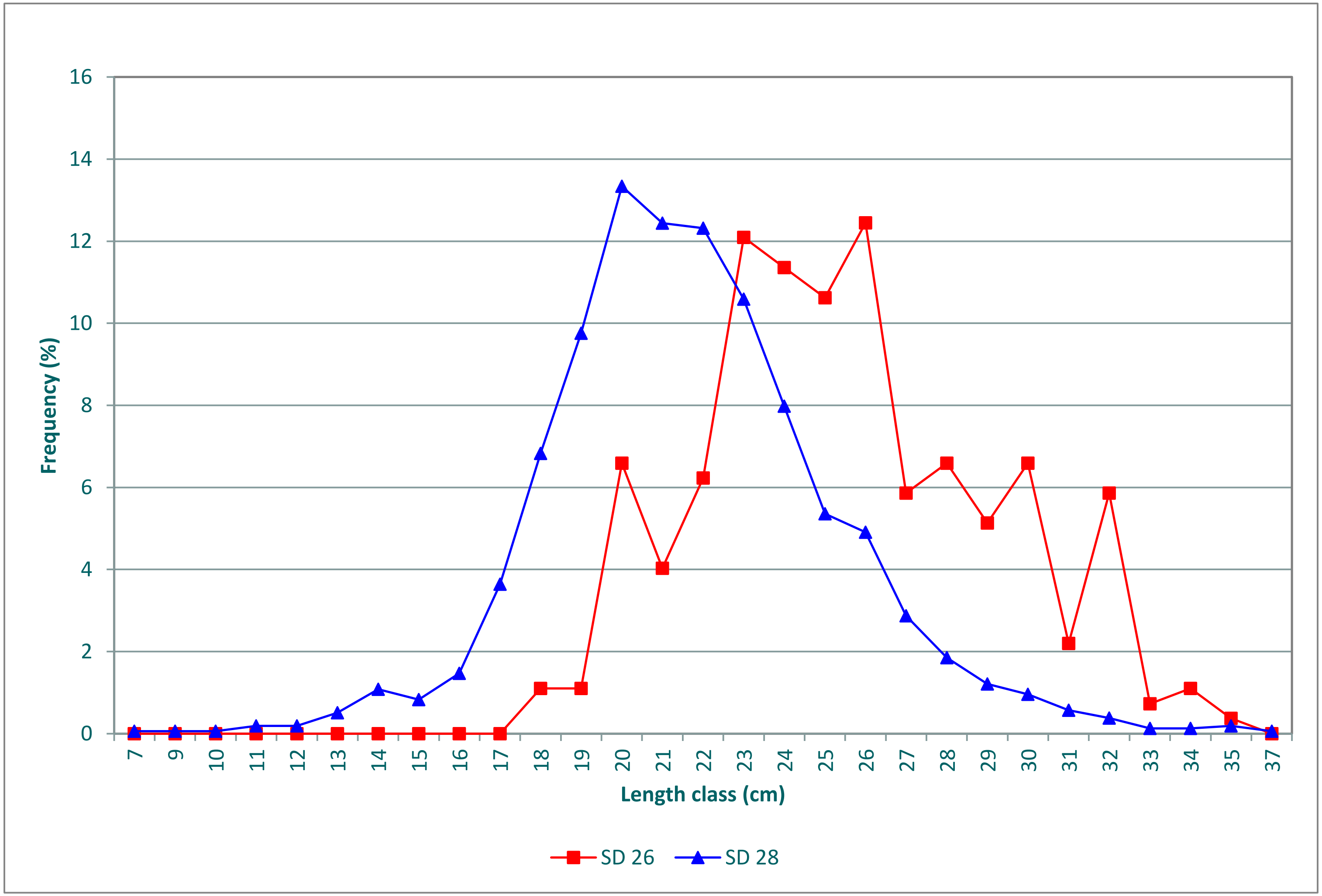
LENGTH FREQUENCY OF COD FROM SUB-DIVISIONS 26 AND 28 IN THE CONTROL CATCHES DURING THE R/V "BALTICA" BITS SURVEY, 11-19 MARCH 2017



DISTRIBUTION OF FLOUNDER DURING THE BITS 2017 Q1 SURVEY



LENGTH FREQUENCY OF FLOUNDER FROM SUB-DIVISIONS 26 AND 28 IN THE CONTROL CATCHES DURING THE R/V "BALTICA" BITS SURVEY, 11-19 MARCH 2017



Thank you for your attention!

www.bior.lv

Daugavgrīvas ielā 8, Riga, Latvija, LV-1048

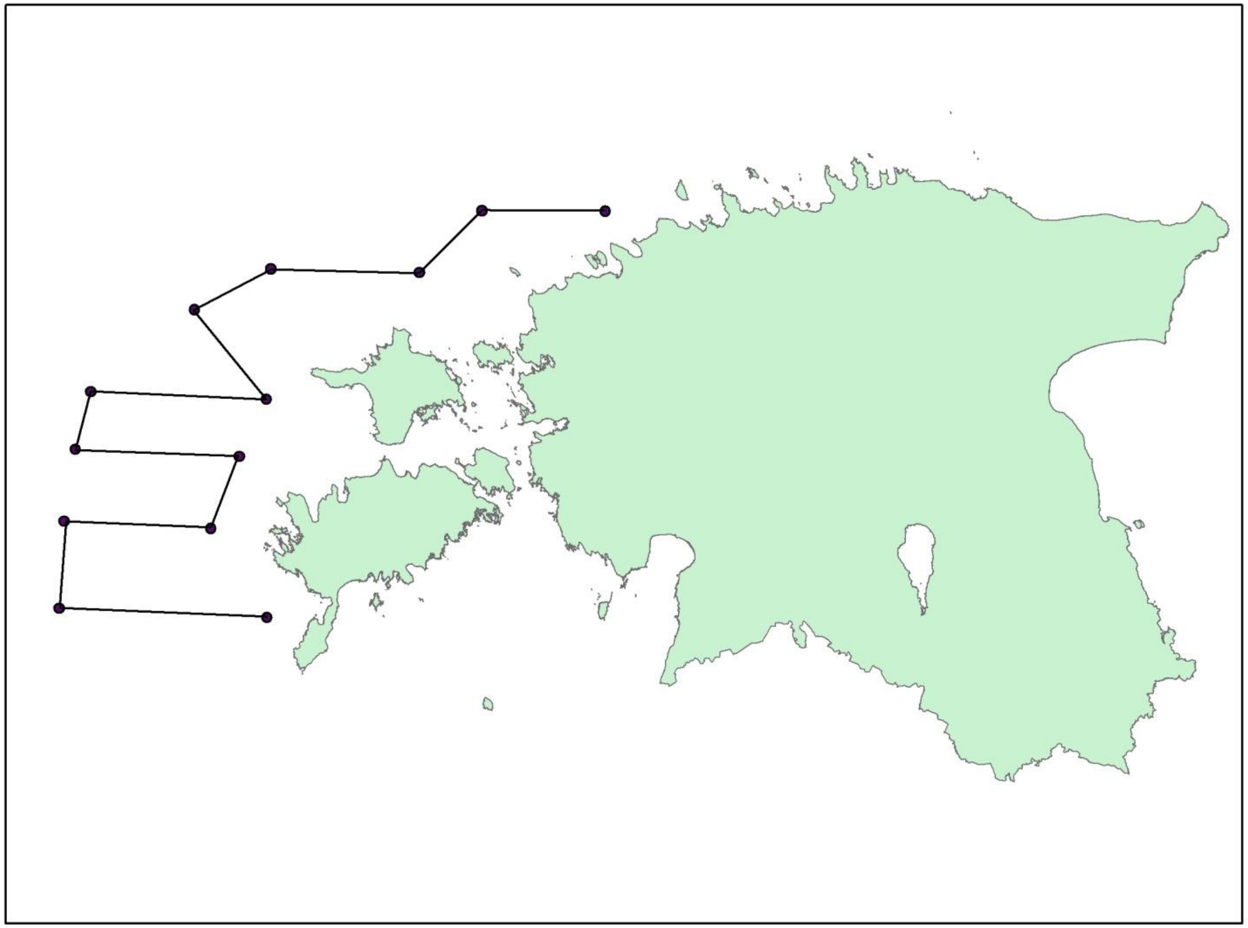
BIOR
PĀRTIKAS DROŠĪBAS, DZĪVNIEKU VESELĪBAS
UN VIDES ZINĀTNISKAIS INSTITŪTS

Estonian
BASS, BIAS 2016
BITS 2016 4qt.

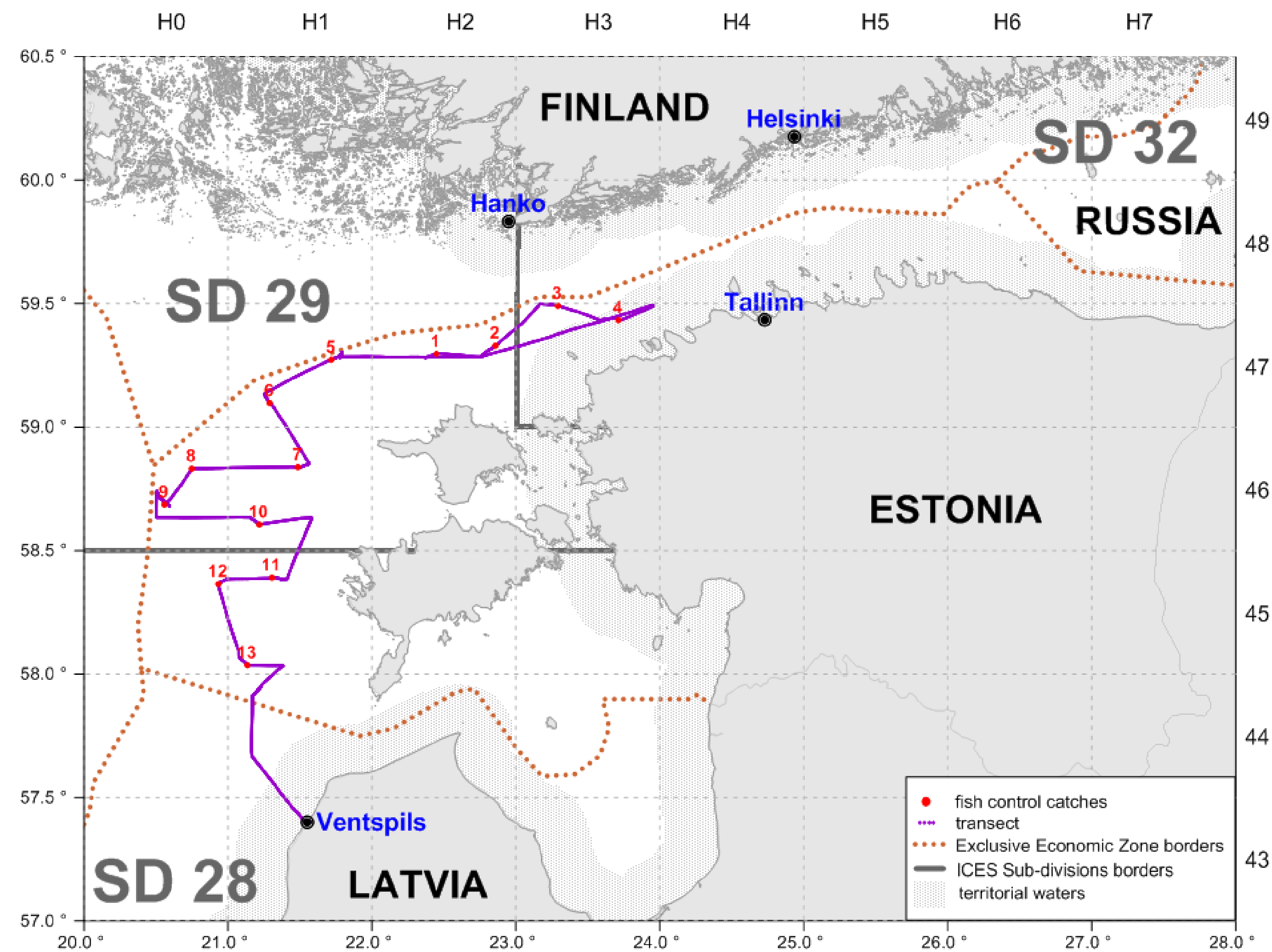
Elor Sepp, Tiit Raid
Estonian Marine Institute

BASS/BIAS 2016

BASS Design 2016



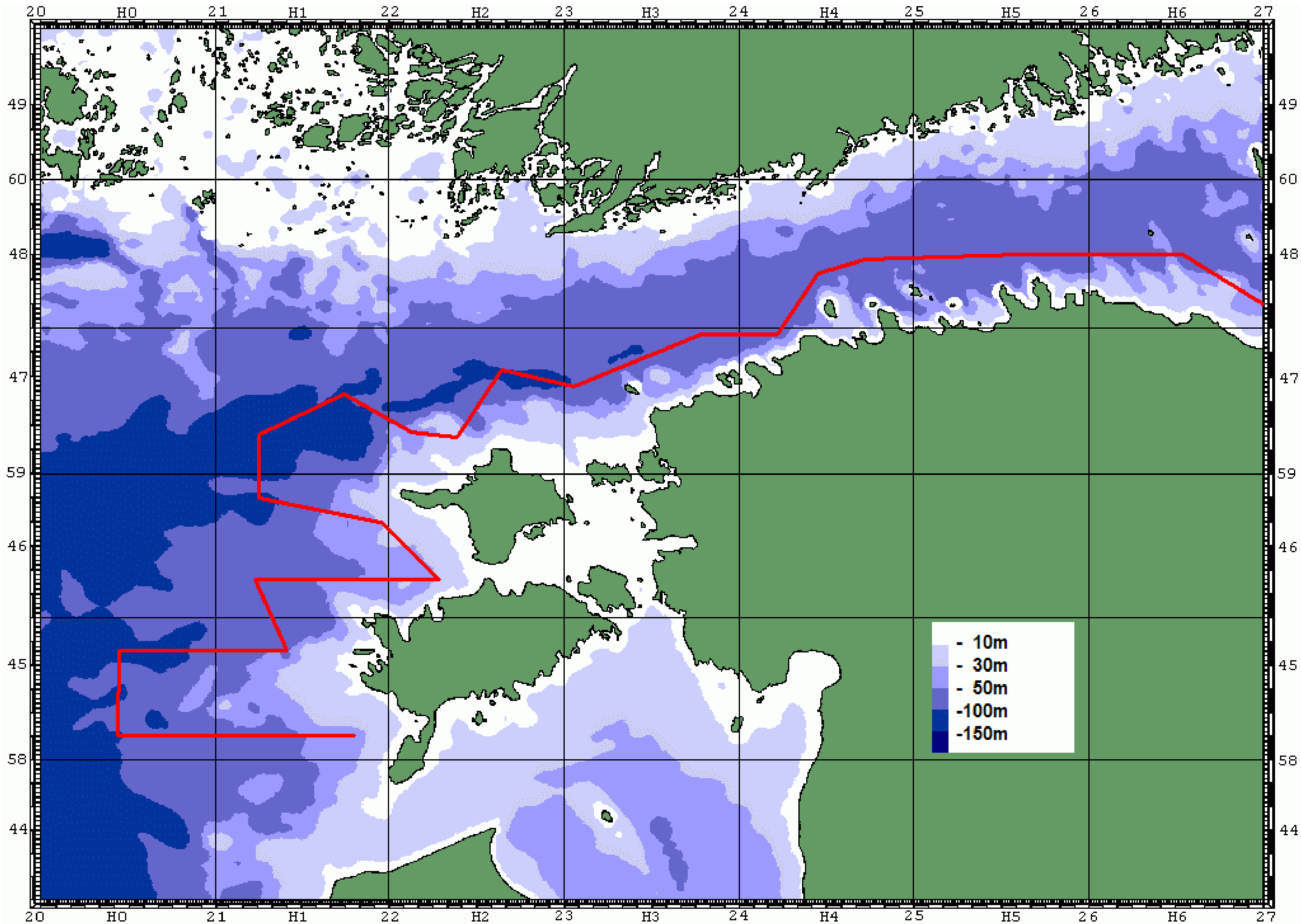
BASS realization



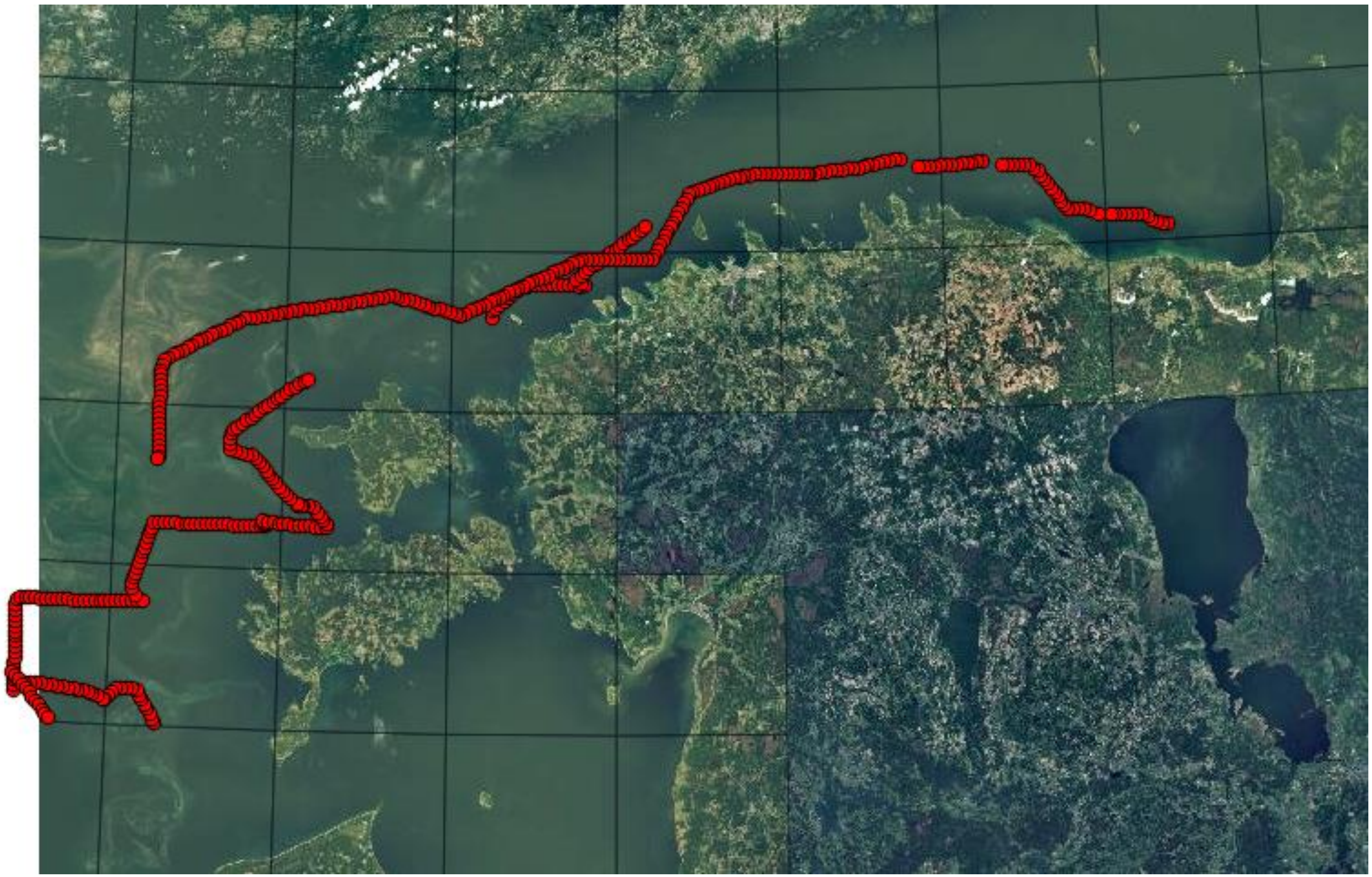
Results

- According to survey plan
- 251 NM
- 13 trawl hauls
- Abundances were higher (sprat +10%, herring +50%)
- Mean weights were lower
- Too little time!

BIAS Design


20
H0
21
H1
22
H2
23
H3
24
H4
25
H5
26
H6
27
49
60
48
47
59
46
45
58
44
- 10m
- 30m
- 50m
-100m
-150m

Realization

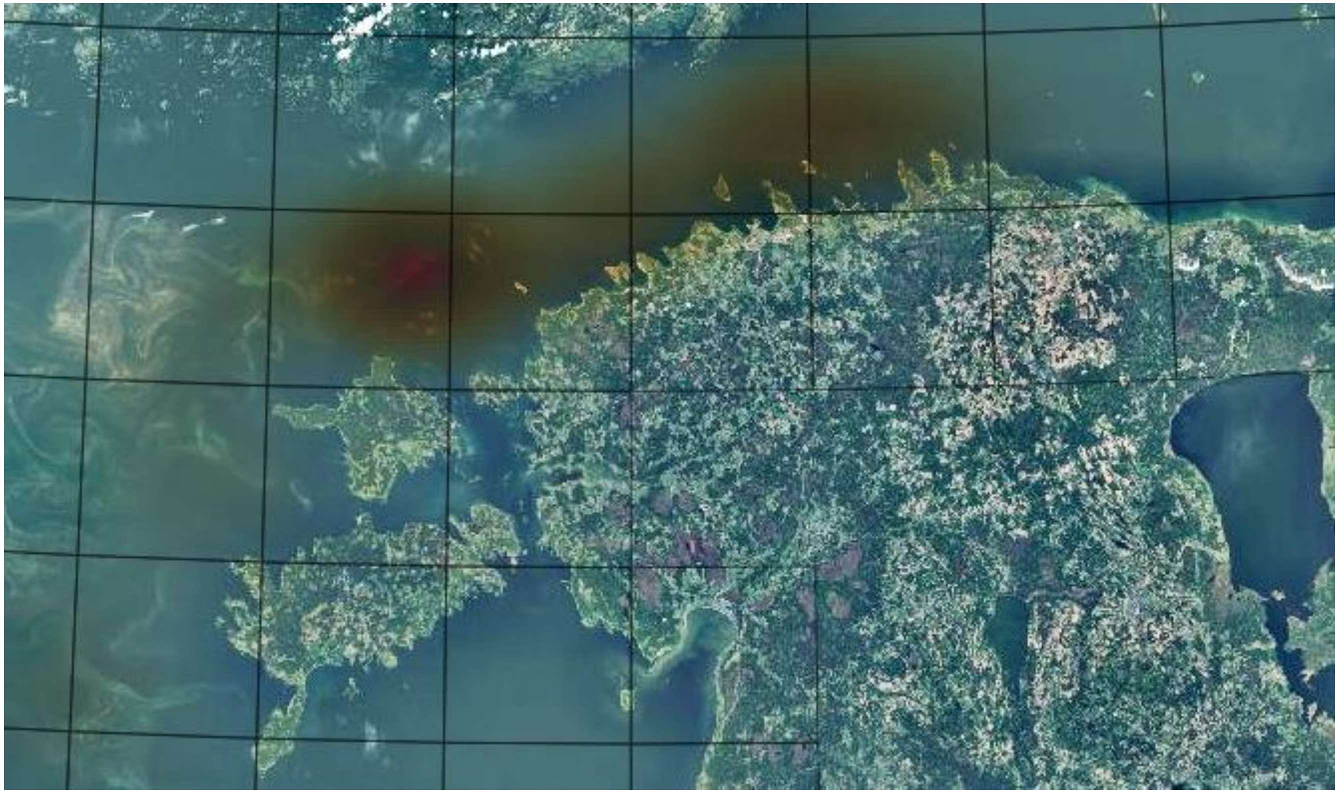


Haul realization

BIAS Realization

- Only 9 hauls (plus some data from Latvia and Finland).
- 444 nm of integration
- Problems with weather and „Baltica“
- After help from colleagues, we still got acceptable results

Main results



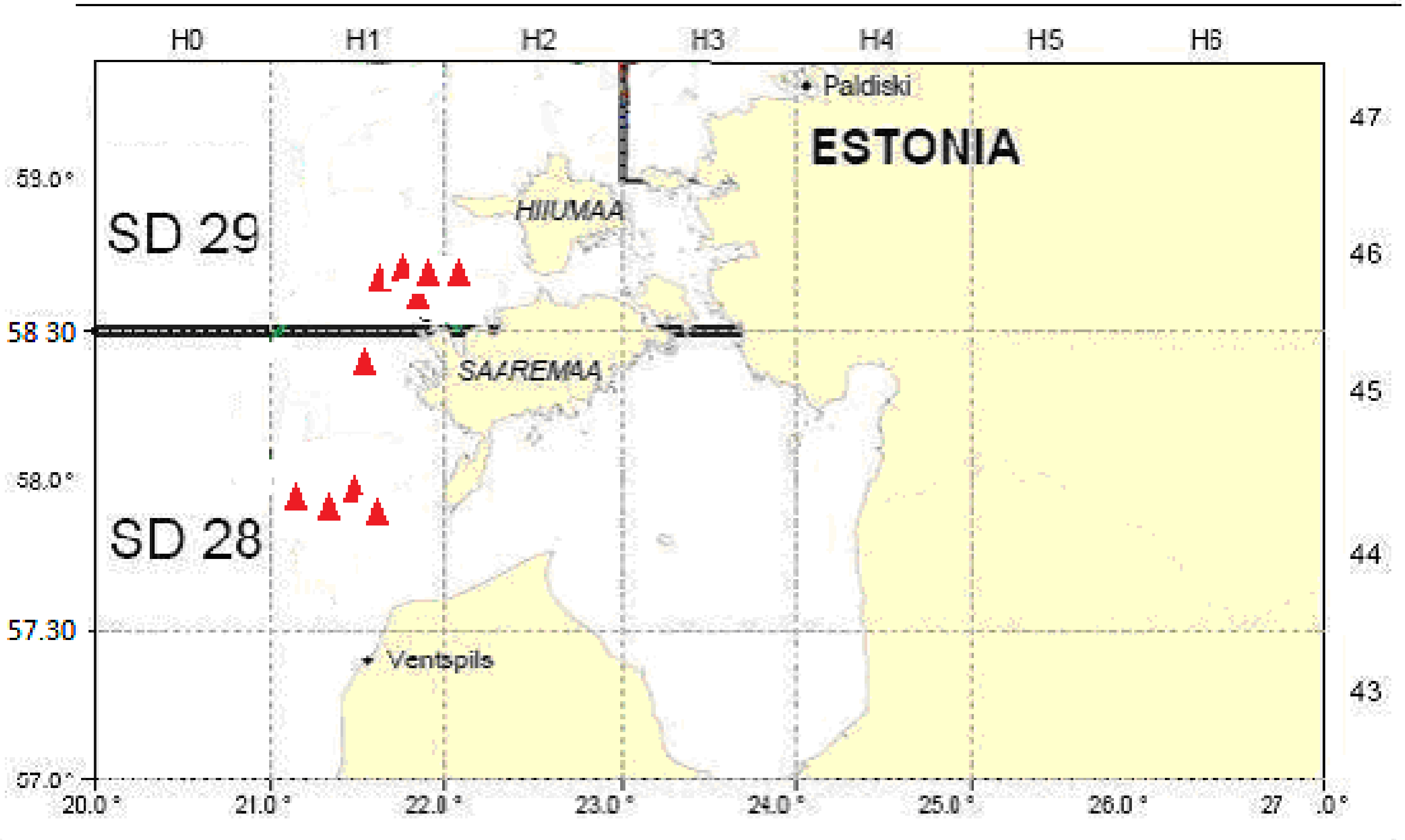
- Herring estimates were 25% higher.
- Sprat estimates were similar.
- Average weight of both species was higher.

Plans for next survey

- Similar dates
- Same design
- Better weather!

BITS EST 2016 4 QRT

13-14. November 2016



Distribution of hauls by depth

EST BITS 4 QRT 2016				Catch composition, kg per 30´ haul							
	1	2	3	4	5	6	7	8	9	10	
Haul ID.	28091	28030	28059	28192	28061	2901	2902	2903	2904	2905	
Sd	28	28	28	28	28	29	29	29	29	29	
Depth, m	42	50	65	61	68	45	75	46	38	34	
Date	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	14.11.2016	
Coordinates	5756_2138	5755_2133	5754_2127	5759_2115	5828_2139	5835_2151	5837_2133	5837_2150	2835_2152	5833_2200	Total
Clupea harengus	1,1032	7,1104	5,8939	6,1526	2,3227	0,1167	0,8141	0,4127	0,8012	1,9487	**26,6762**
Sprattus sprattus	0,115	1,754	3,022	0,645	0,206	0,137	1,857	0,361	0,03	0,09	**8,217**
Platichthys flesus	11,201	36,334	12,463	5,696	7,558	0,181	0,279	4,337	6,7205	12,587	**97,356**
Gadus morhua	0,0019	0,0024	0,0017	0,0022	0	0	0	0	0	0	**0,0081**
Osmerus eperlanus	1,26	1,95	0,37	0,25	0,53	0,04	0,03	2,20	4,16	3,49	**14,2818**
Scophthalmus maximus	0	0	0,2105	0	0	0	0	0	0	0	**0,2105**
Neogobius melanostomus	1,3229	1,8285	0,6729	0	0,0519	0	0	0	0	0	**3,8762**
Gobius sp.	0,2945	0,0787	0,0009	0,0013	0	0	0	0,039	0,129	0,1565	**0,7001**
Gasterosteus aculeatus	0,0019	0,0051	0,0016	0	0,0023	0,0036	0	0,047	0,032	0,0297	**0,1226**
Pungitius pungitius	0	0	0	0	0	0	0	0,002	0,002	0	**0,0038**
Myoxocephalus scorpius	0,2472	1,4393	0,9466	0	0	0	0	0,440	0,866	1,0674	**5,0067**
Zoarces viviparus	0,0612	0,0625	0	0	0	0	0	0,035	0,162	0,0344	**0,3543**
Cyclopterus lumpus	0,1906	0	0	0	0	0	0	0	0	0	**0,1906**
Myxocephalys quadricornis	0,2528	0	0	0	0	0	0	0	0,687	0,605	**1,5448**
Taurulus bubalis	0	0	0	0	0	0	0	0	0,0323	0	**0,0323**
Lumpenus lampretaeformis	0	0,0218	0	0	0	0	0	0	0	0	**0,0218**
Enchelyopus cimbrius	0	0	0	0	0,076	0	0	0	0	0	**0,0755**
Total	**16,05**	**50,59**	**23,37**	**12,74**	**10,7479**	**0,48**	**2,9842**	**7,8721**	**13,6228**	**20,0068**	**158,68**

EST_BITS 4 QRT 2015
Number of fish analysed

Number of biological samples (maturity and age material, *maturity only):				
Species	Age	Length		
Gadus morhua	58	58		
Sprattus sprattus	200	701		
Clupea harengus	200	1554		
Platichthys flesus	391	1554		

Fisheries Service under the Ministry of Agriculture of Republic of Lithuania,
Fishery Research and Science State

BALTIC INTERNATIONAL ACOUSTIC SURVEYS (BASS, BIAS) IN THE LITHUANIAN ESPECIAL ECONOMIC ZONE OF THE BALTIC SEA

WGBIFS, 2017

Baltic Acoustic Sprat Survey

R/V"DARIUS"

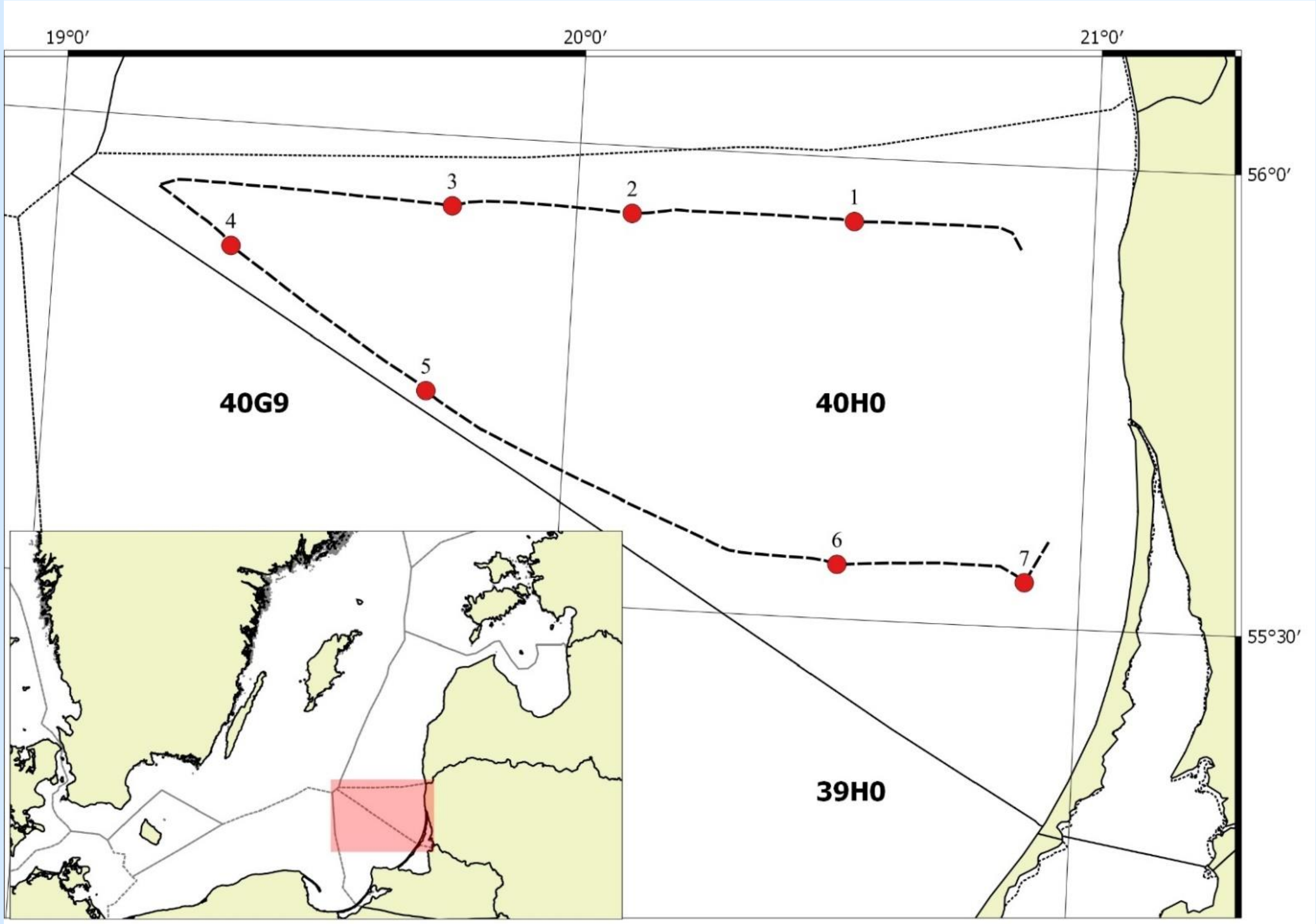
03-04.05.2016

Survey area:

ICES SD.26,

40H0 rect.:1012,1 nm^2

40G9 rect.: 1013,0 nm^2



Hauls (+CTD casts):

40H0 - 4 (4)

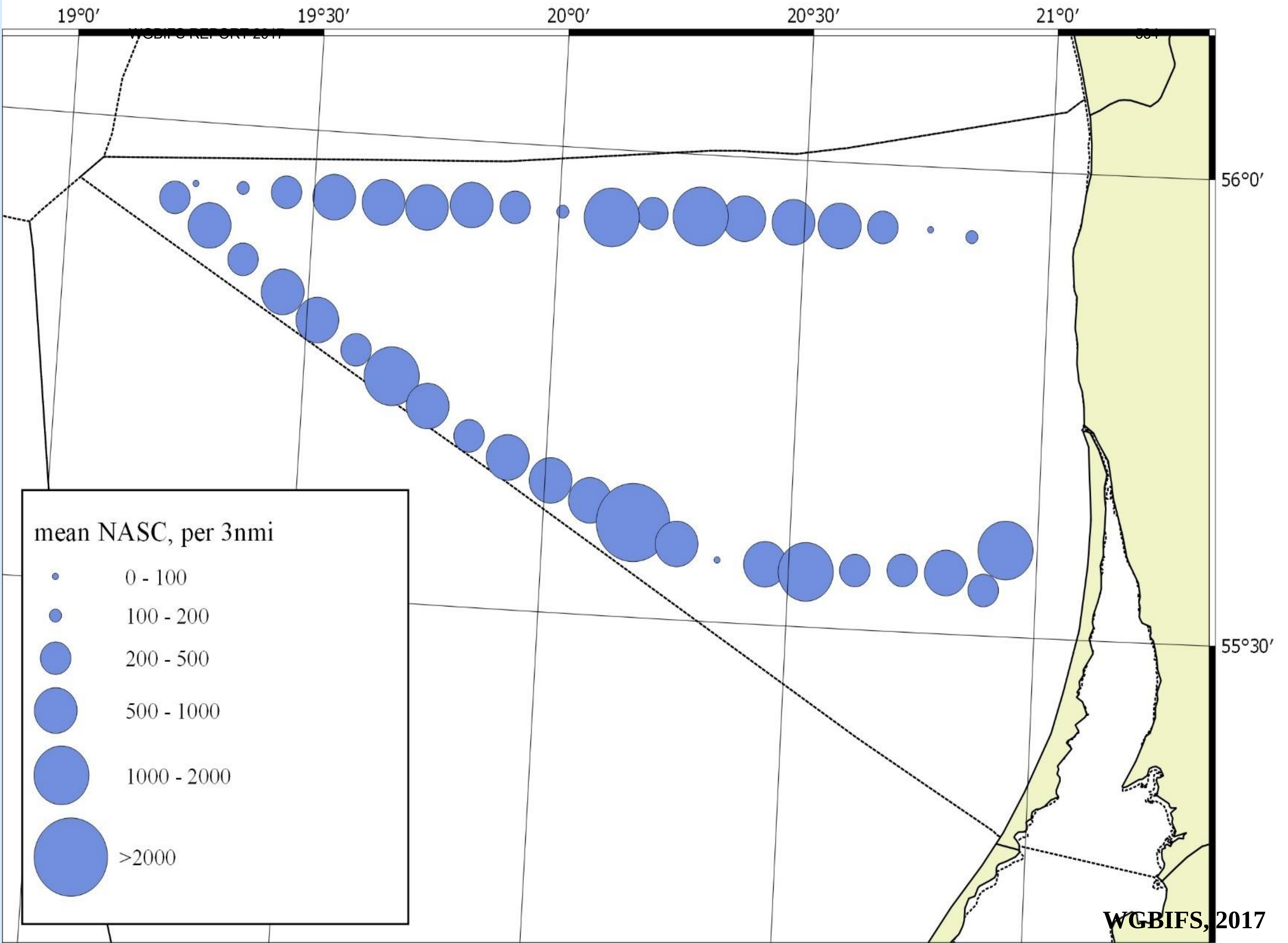
40G9 - 3 (3)

Total: 7 (7)

Personnel:

M. Špegys – cruise leader and acoustics;

J. Fedotova – scientific leader and fish sampling; D. Tarvydiene- fish sampling


19°0′
19°30′
20°0′
20°30′
21°0′
56°0′
55°30′
mean NASC, per 3nmi
0 - 100
100 - 200
200 - 500
500 - 1000
1000 - 2000
>2000
WGBIFS, 2017

BASS RESULTS:

Fish catches and biological data

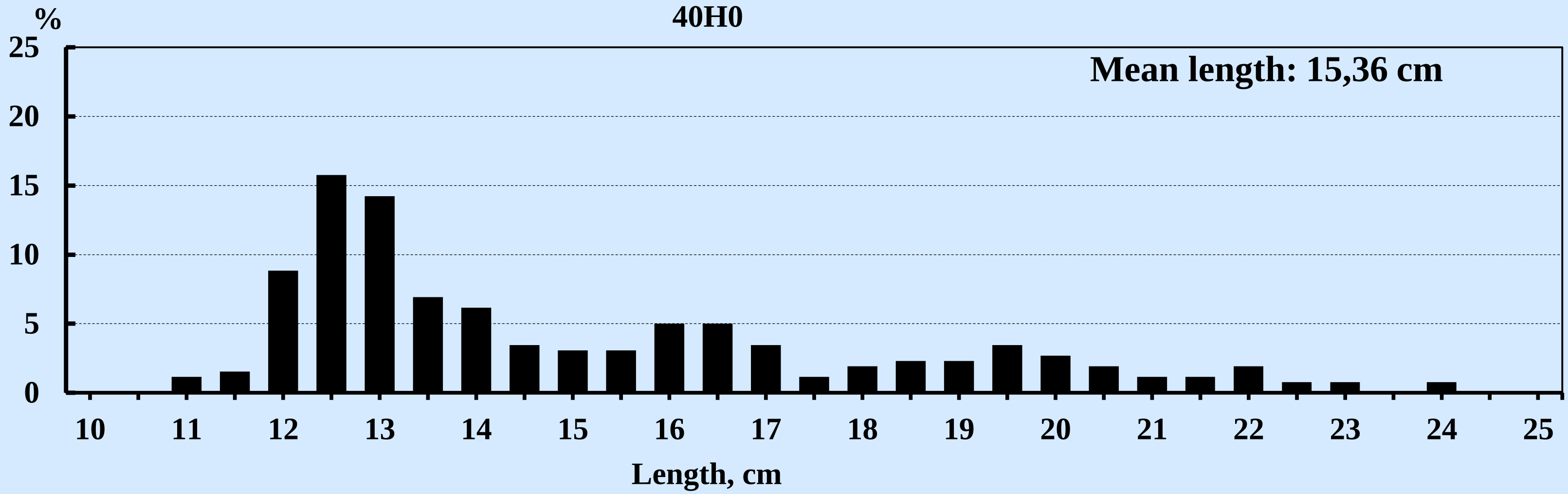
- **CPUE (kg/1hour)**

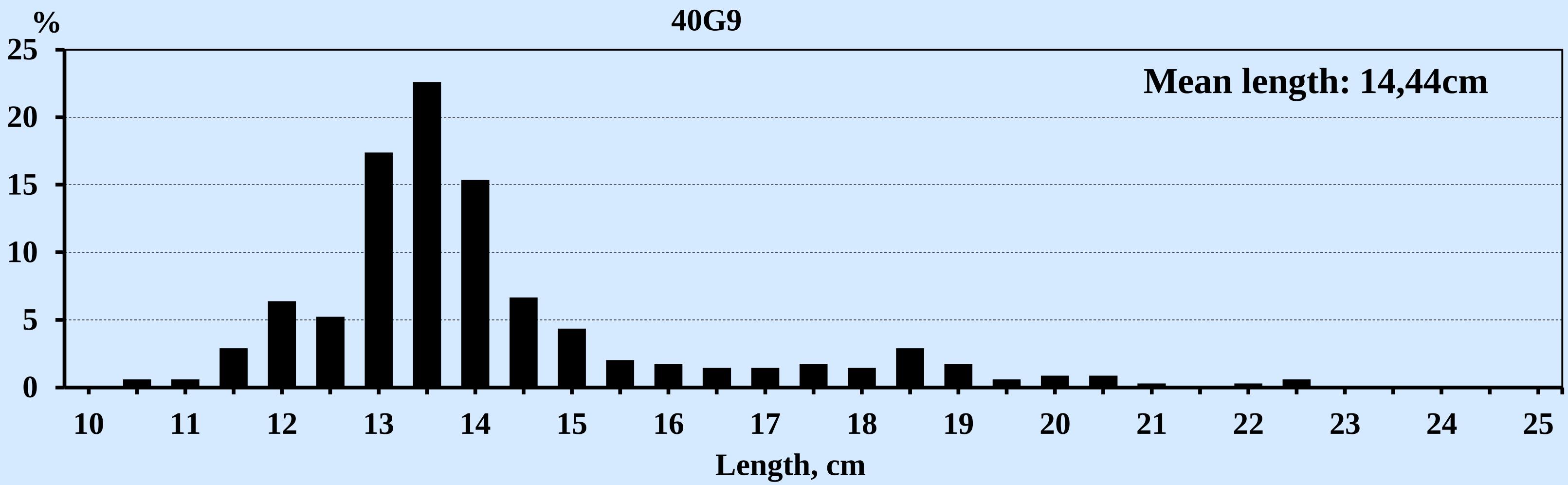
Haul No	1	2	3	4	5	6	7
Date	2015.05.21	2015.05.21	2015.05.21	2015.05.21	2015.05.22	2015.05.22	2015.05.22
Validity	Valid	Valid	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	40H0	40H0	40G9	40G9	40G9	40H0	40H0
Mean trawling depth	18	32	43	50	51	51	21
Clupea hrengus		0.45	0.42	0.17	85.6	15.96	
Sprattus spratus	60.00	660.00	240.00	100.00	154.40	224.04	500.00
Gadus morhua		1.02		0.88			
Total	60.00	661.47	240.42	101.05	240.00	240.00	500.00

94,88%

5,02%

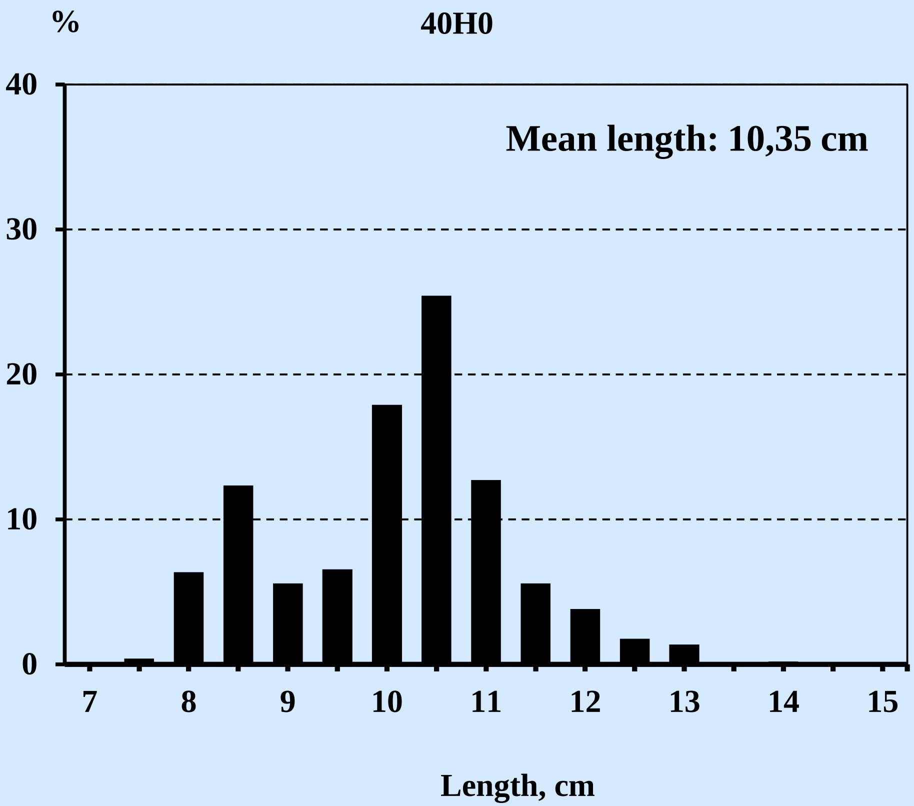
Herring length frequency distribution according to the 40HO and 40G9 rectangles

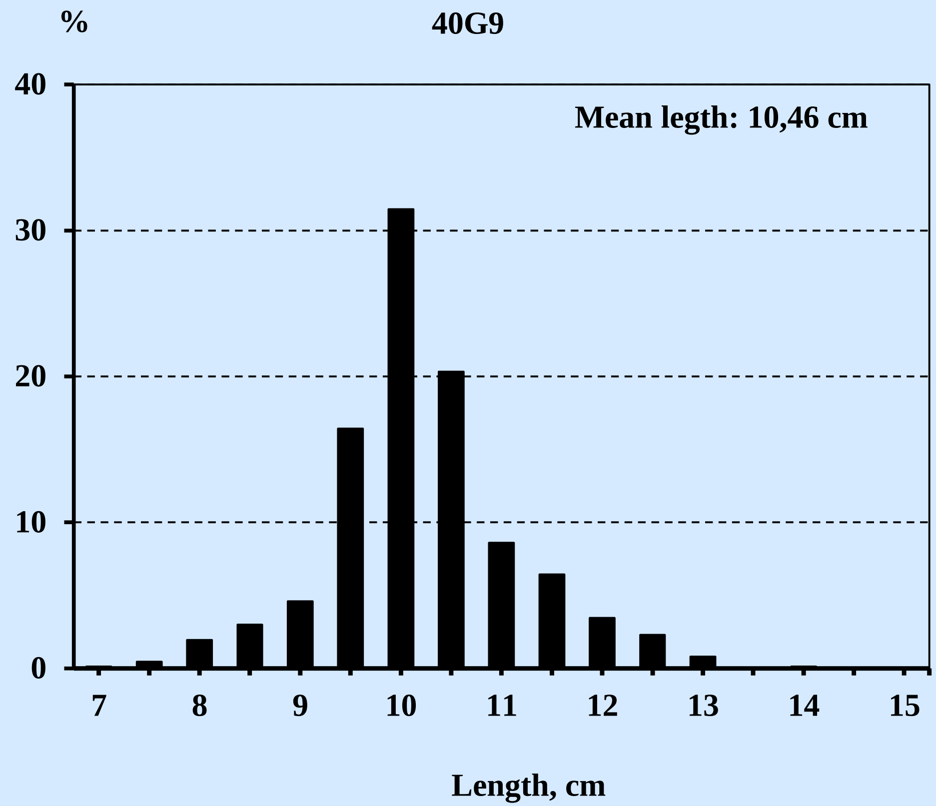




WGBIFS, 2017

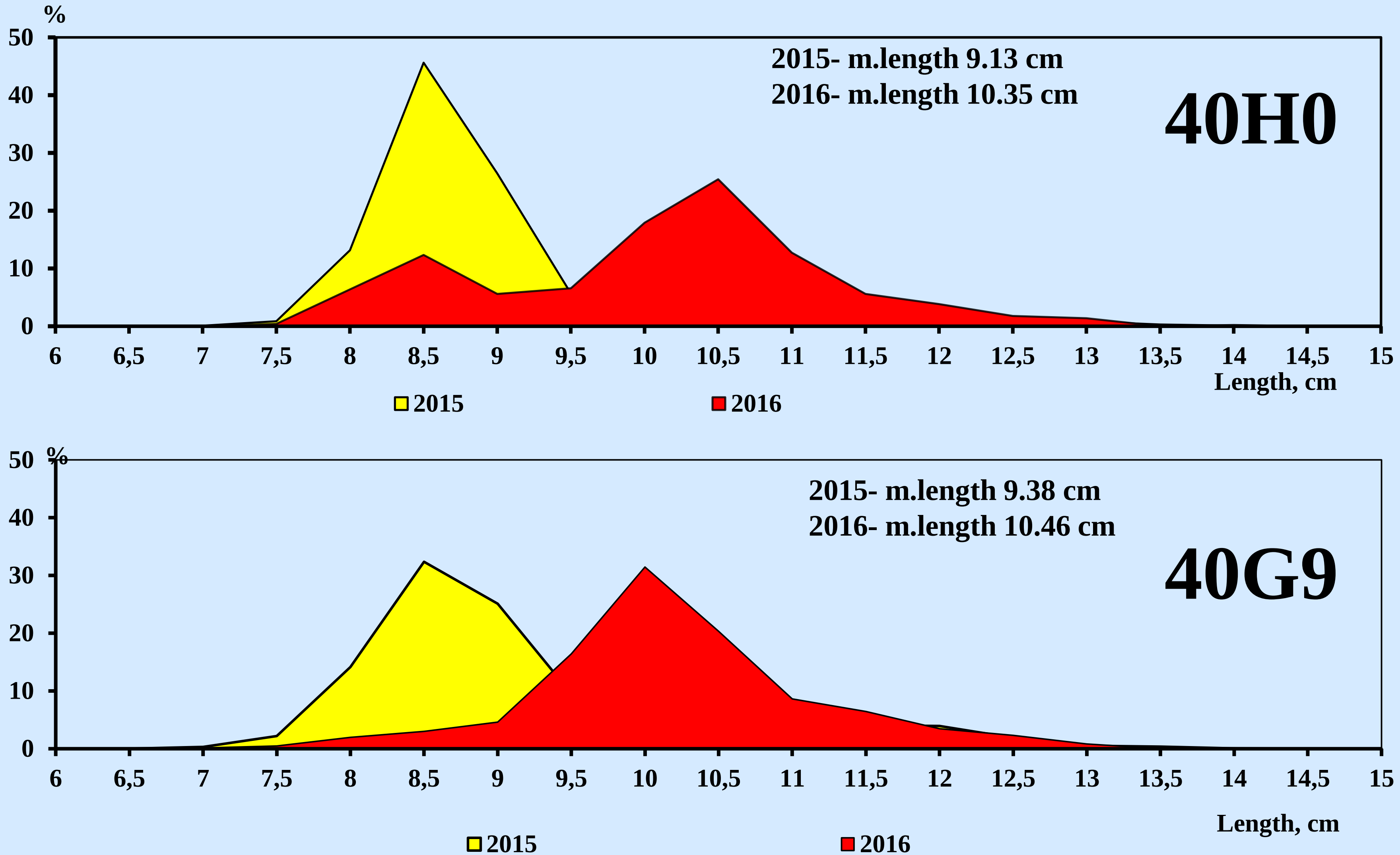
Sprat length frequency distribution by BASS results in the ICES rectangles 40HO and 40G9





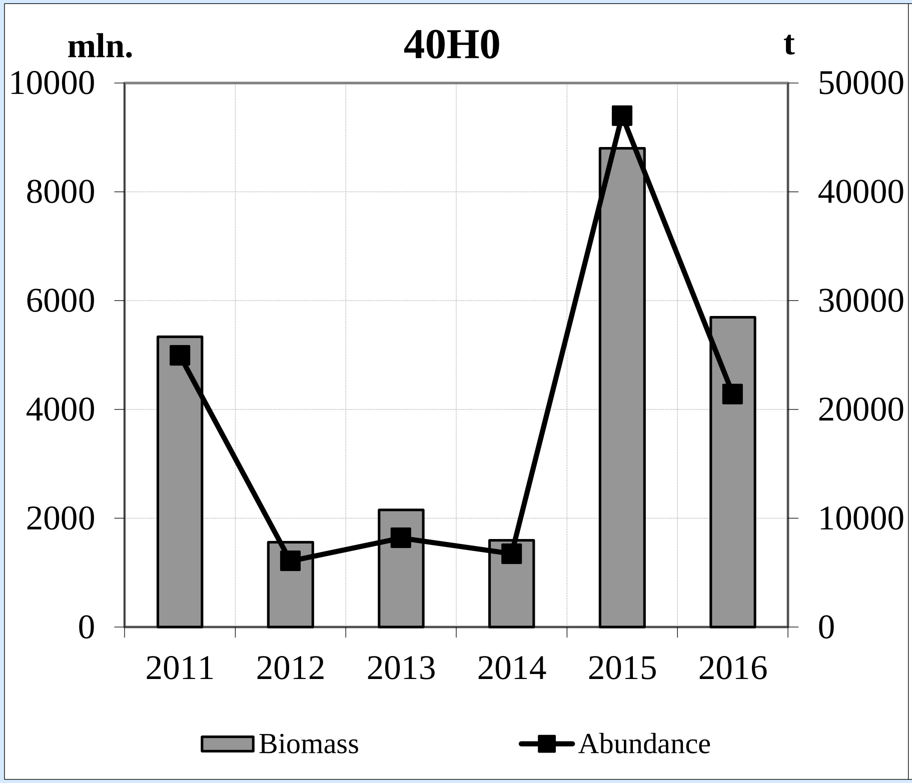
WGBIFS, 2017

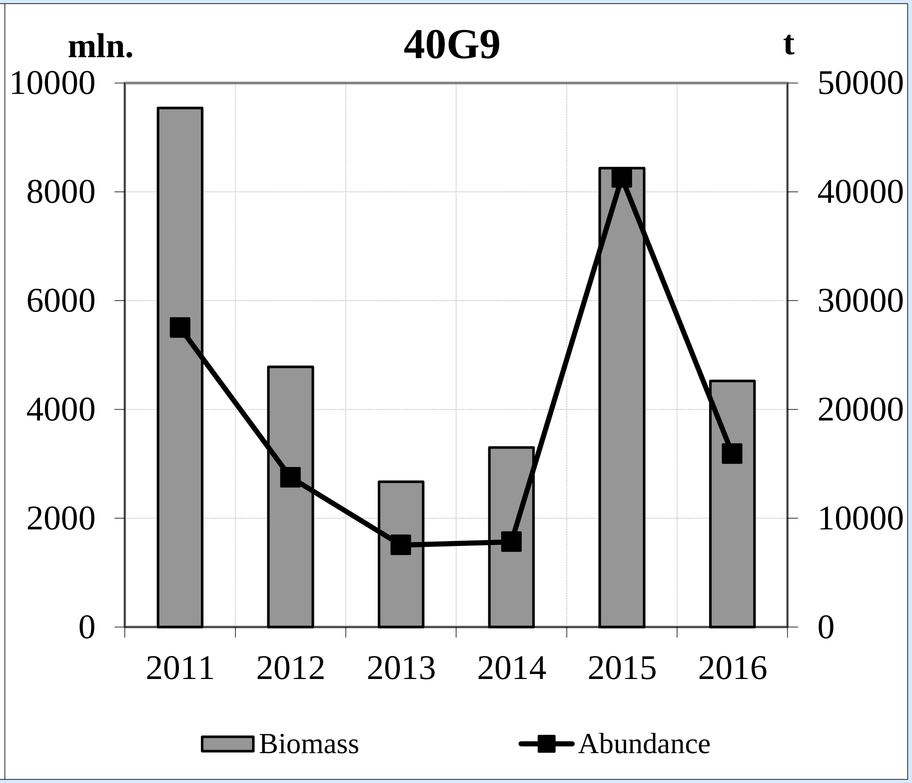
Sprat length frequency distribution in the ICES rectangles 40HO and 40G9 in 2015-2016



WGBIFS, 2017

Sprat abundance and biomass by BASS results in rectangles 40H0 and 40G9 in 2011-2016





TOTAL	Abundance	Biomass
2011	10488,9	74367
2012	3969,6	31703
2013	3146,2	24140
2014	2914,2	33010
2015	17655,6	86157
2016	7464,9	46568

	Abundance	Biomass
2015-2016	-57,7%	-40,7%

WGBIFS, 2017

Baltic International Acoustic Survey

R/V"DARIUS"

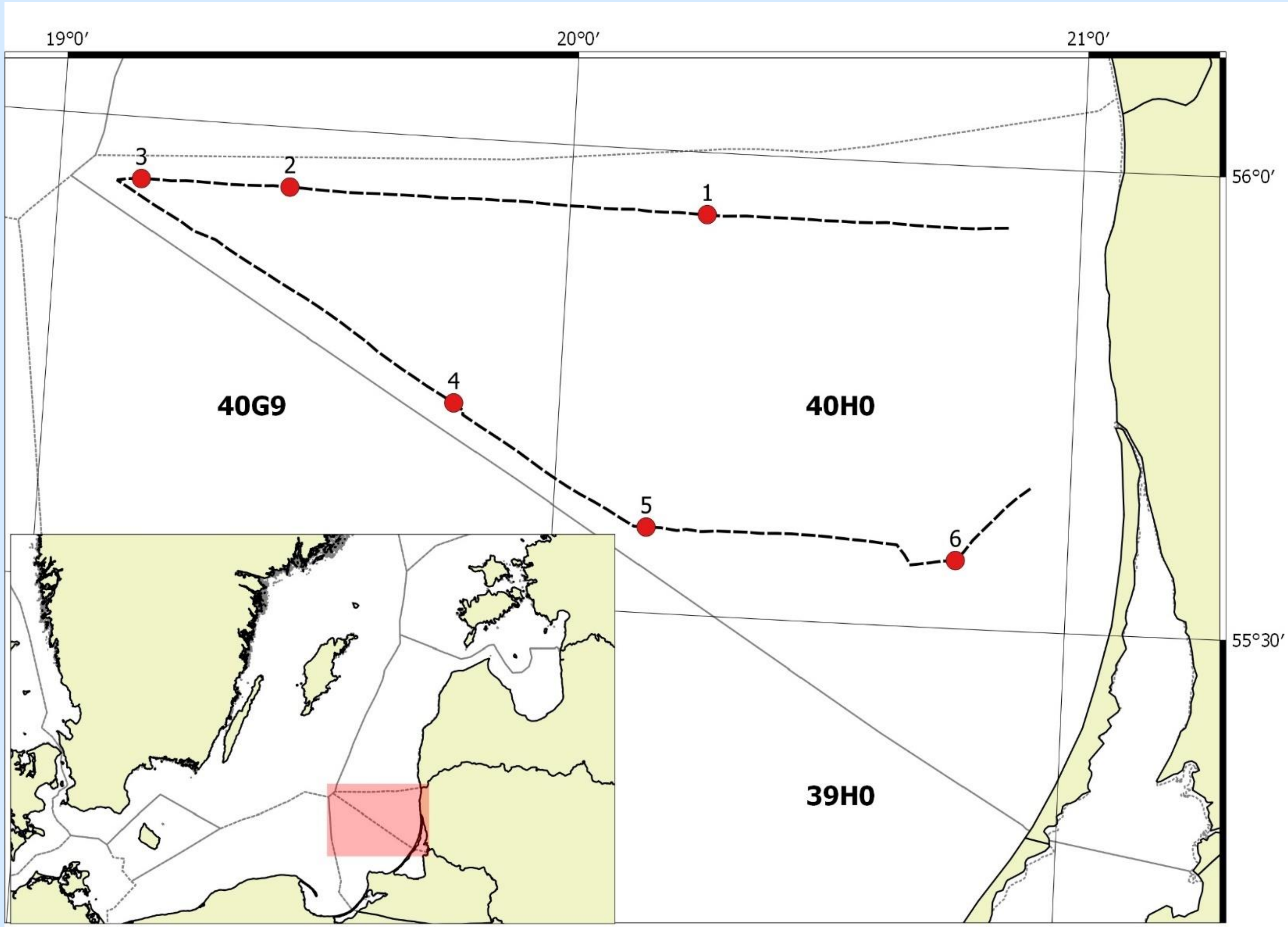
13-14.10.2016

Survey area:

ICES SD.26,

40H0 rect.:1012,1 nm^2

40G9 rect.: 1013,0 nm^2



Hauls (CTD casts):

40H0 - 3 (3)

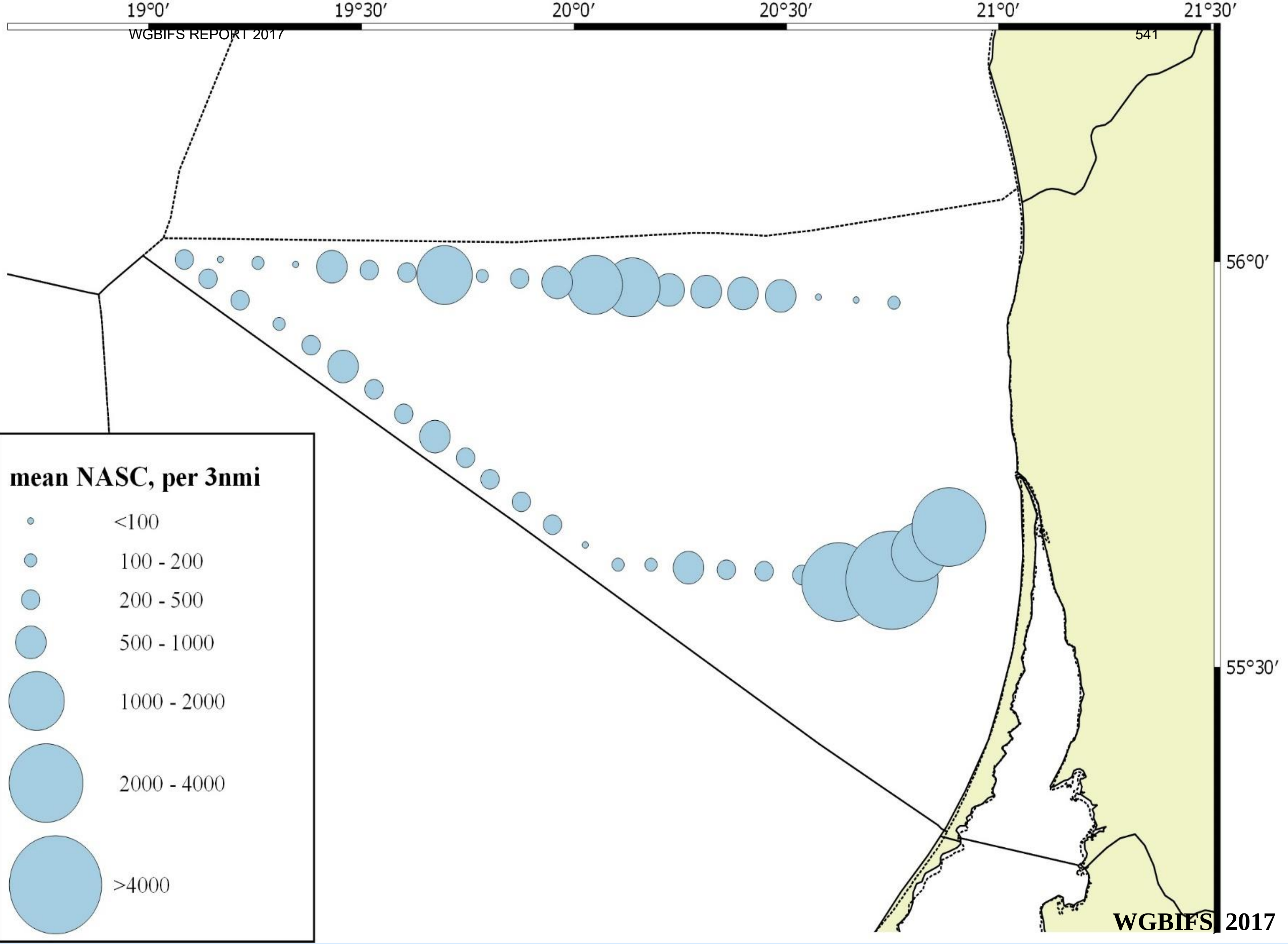
40G9 - 3 (3)

Total: 6 (6)

Personnel:

M. Špegys – cruise leader and acoustics;

J. Fedotova – scientific leader and fish sampling; G. Macernis- fish sampling


19°0′
19°30′
20°0′
20°30′
21°0′
21°30′
56°0′
55°30′
mean NASC, per 3nmi
<100
100 - 200
200 - 500
500 - 1000
1000 - 2000
2000 - 4000
>4000
WGBIFS 2017

BIAS RESULTS: Fish catches and biological data

- CPUE (kg/ 1hour)

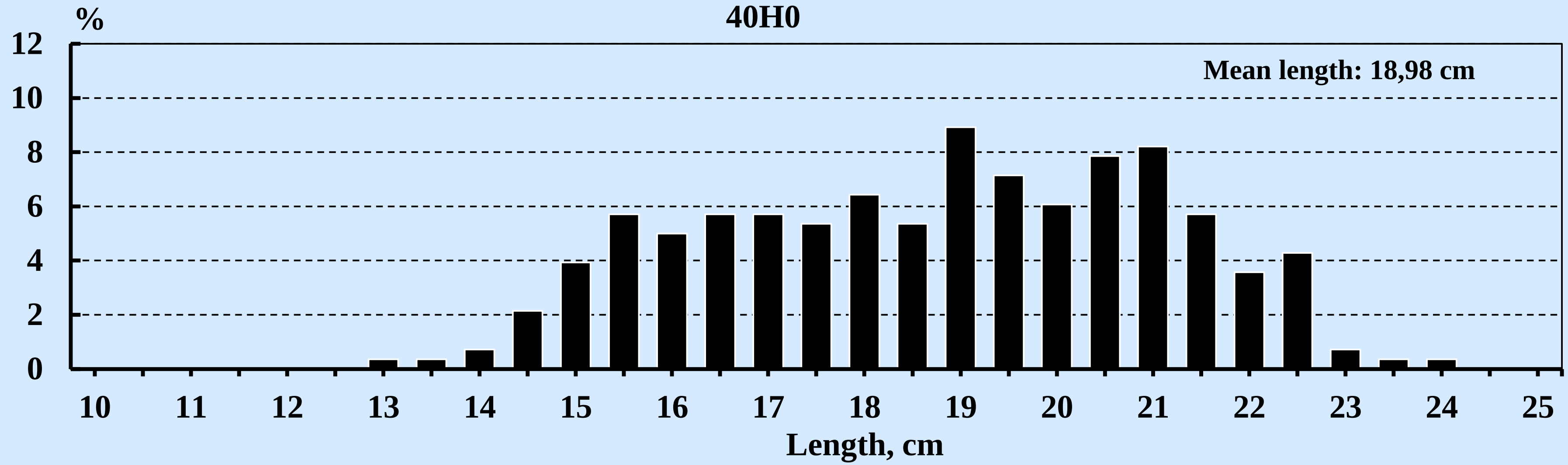
Haul No	1	2	3	4	5	6
Date	13.10.2016	13.10.2016	13.10.2013	14.10.2016	14.10.2016	14.10.2016
Validity	Valid	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	40H0	40H0	40G9	40G9	40G9	40H0
Mean trawling depth	27	30	66	57	56	31
Clupea harengus		1.75	31.944	77.3	180.00	191.056
Sprattus sprattus	2.0	30.0	9.5	342.7		5,808.94
Gadus morhua				0.96		2.688
Osmerus eperlanus	0.024					
Total	2.496	31.75	41.444	420.96	180	6002.688

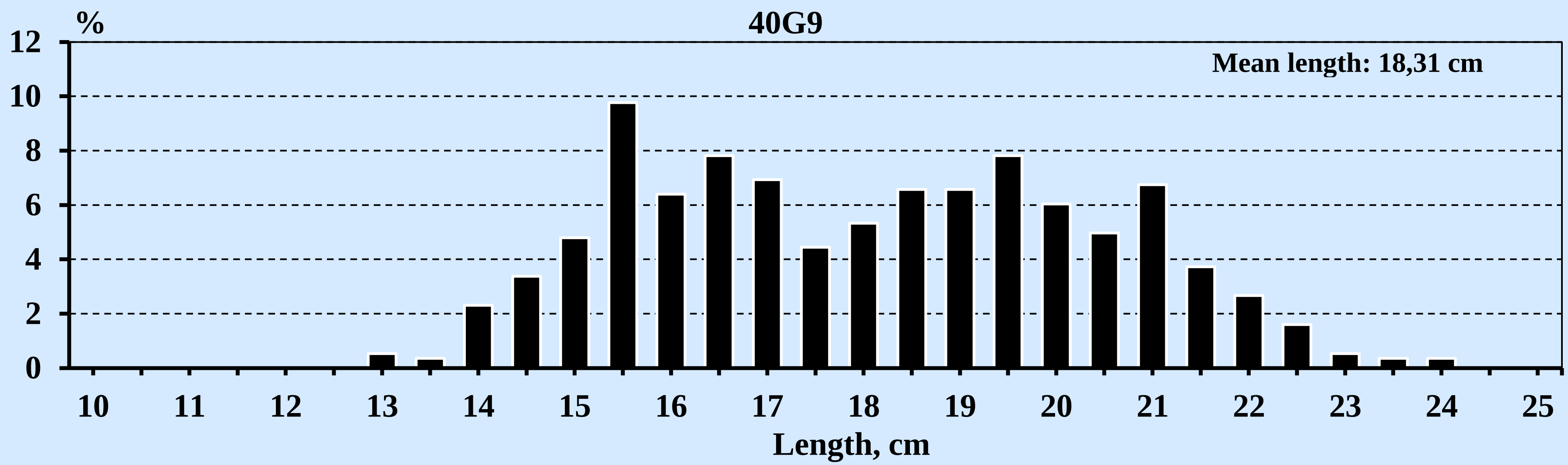
92,77%

7,22%

WGBIFS, 2017

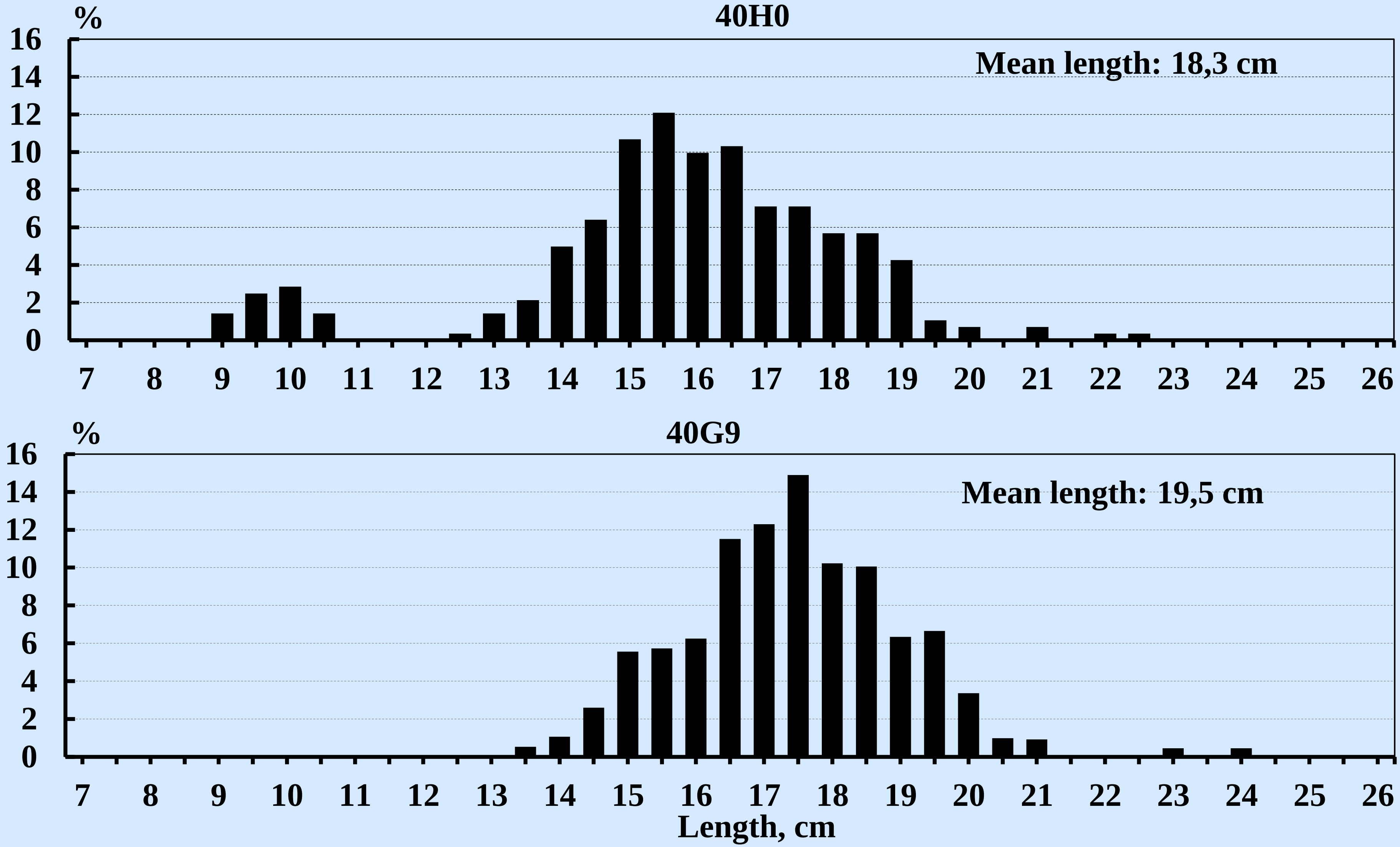
Herring length frequency distribution according to the 40HO and 40G9 rectangles





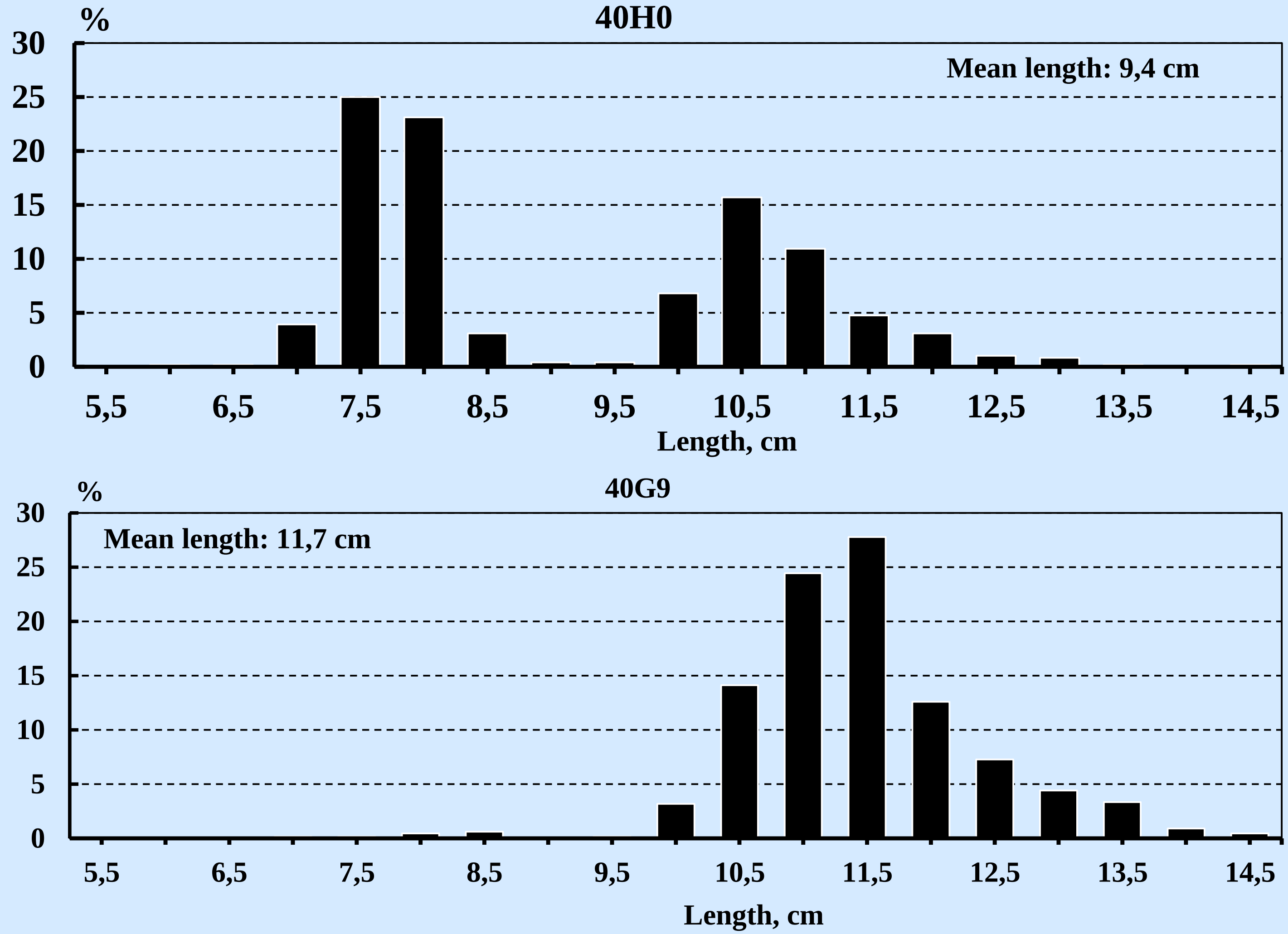
WGBIFS, 2017

Herring length frequency distribution according to the 40HO and 40G9 rectangles



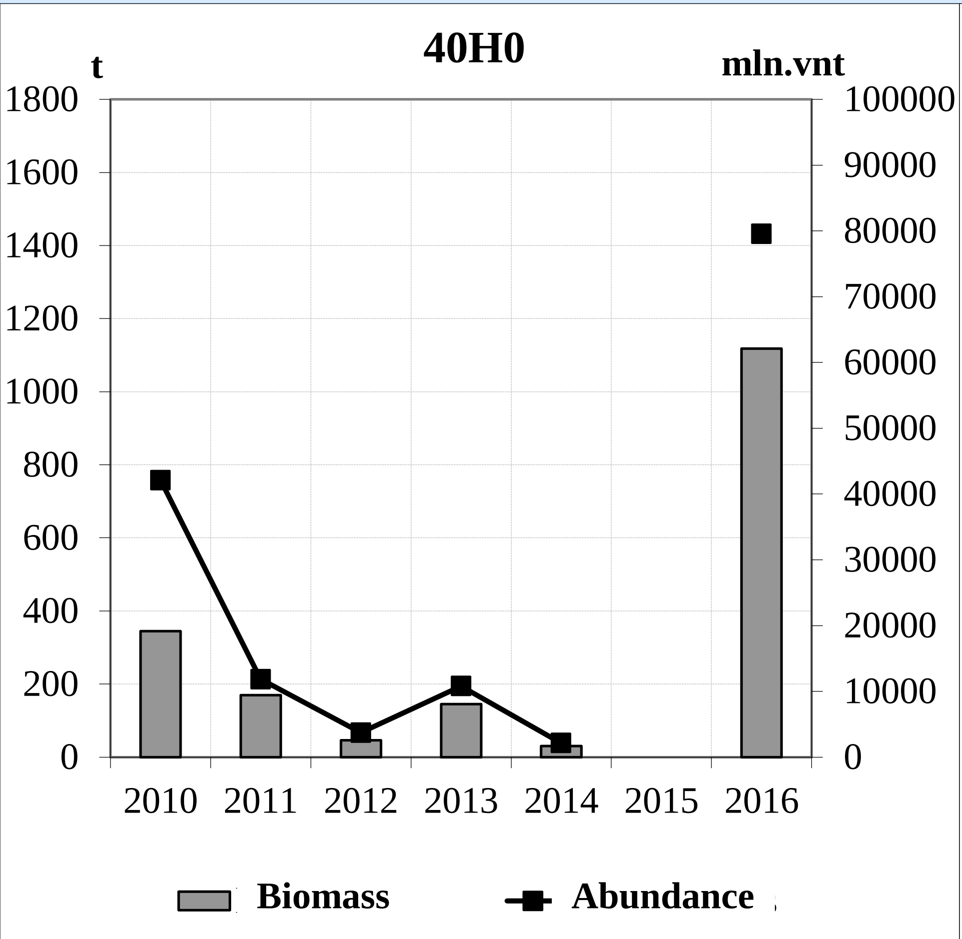
WGBIFS, 2017

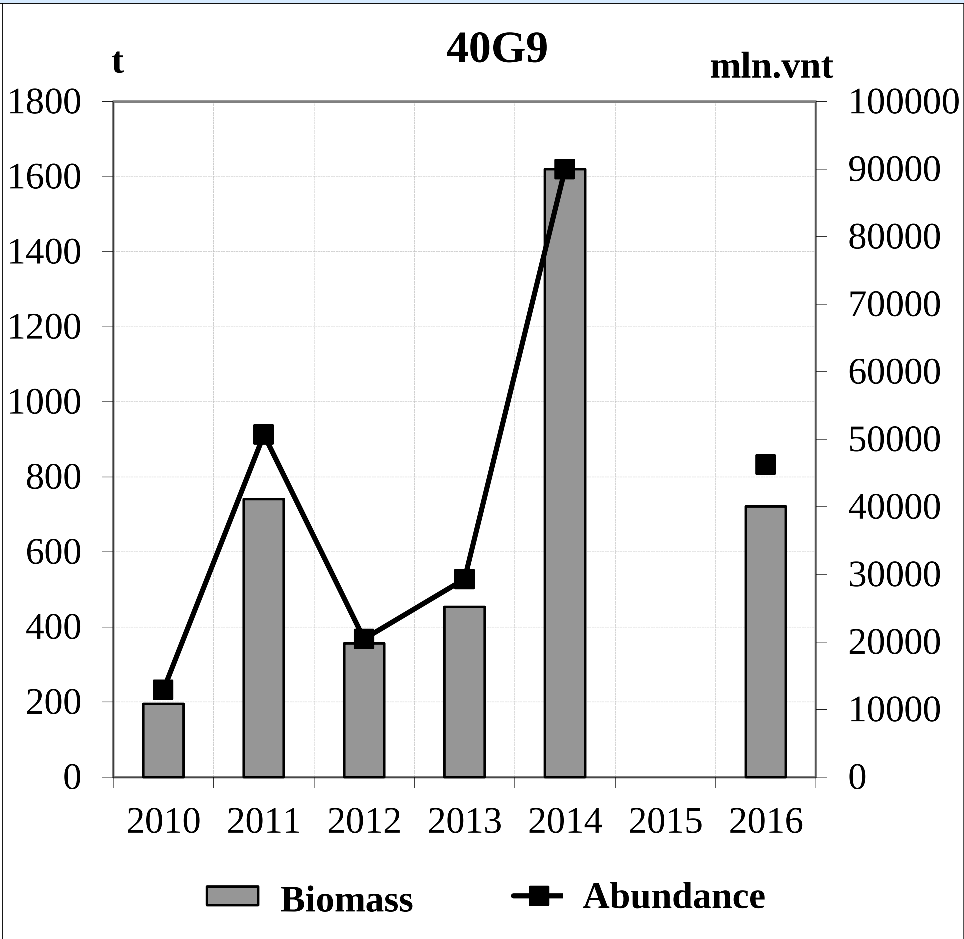
Sprat length frequency distribution by BIAS results in the ICES rectangles 40HO and 40G9



WGBIFS, 2017

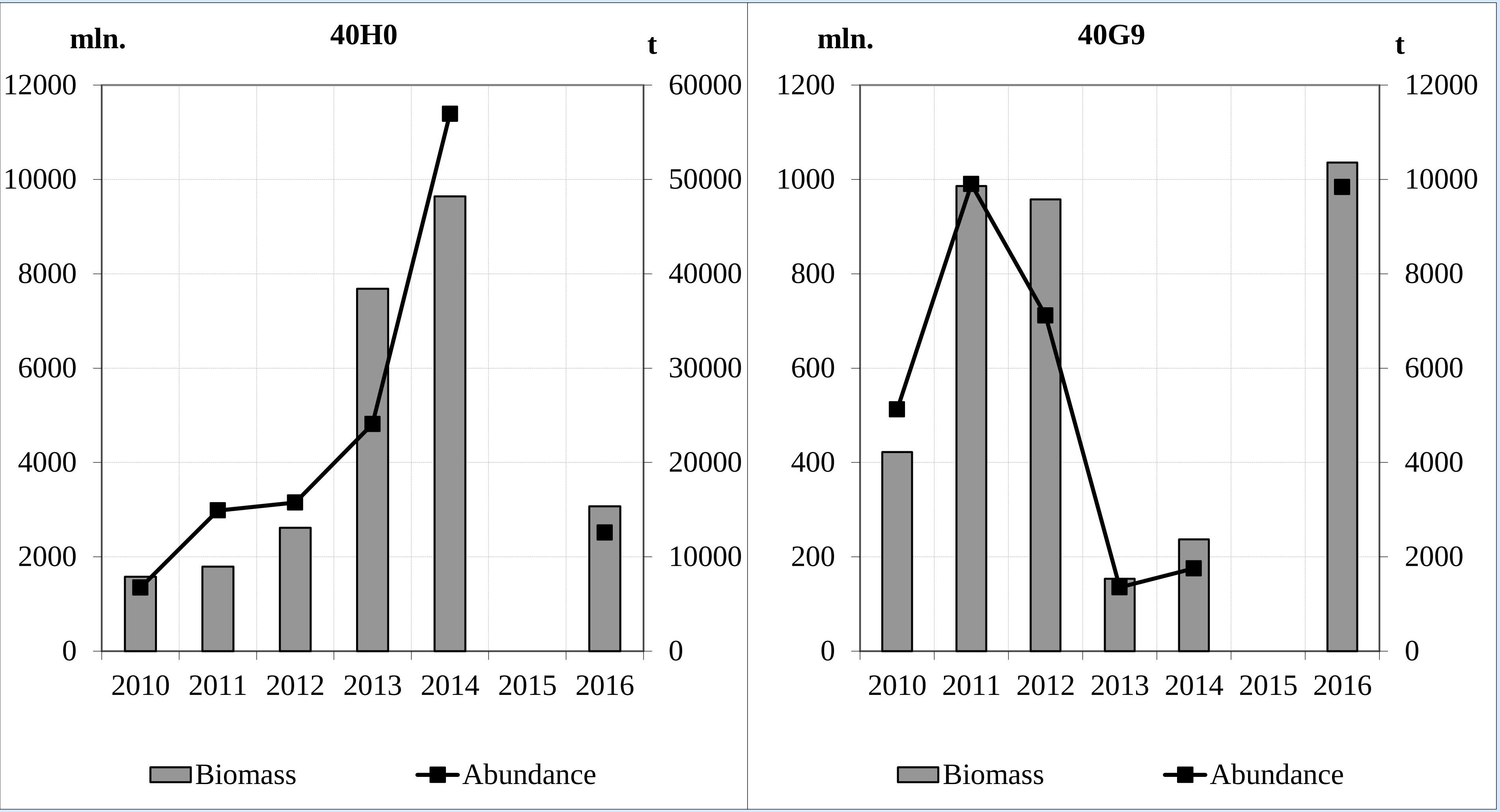
Herring biomass and abundance by BIAS results in ICES rectangles 40H0 and 40G9 from 2010 to 2016





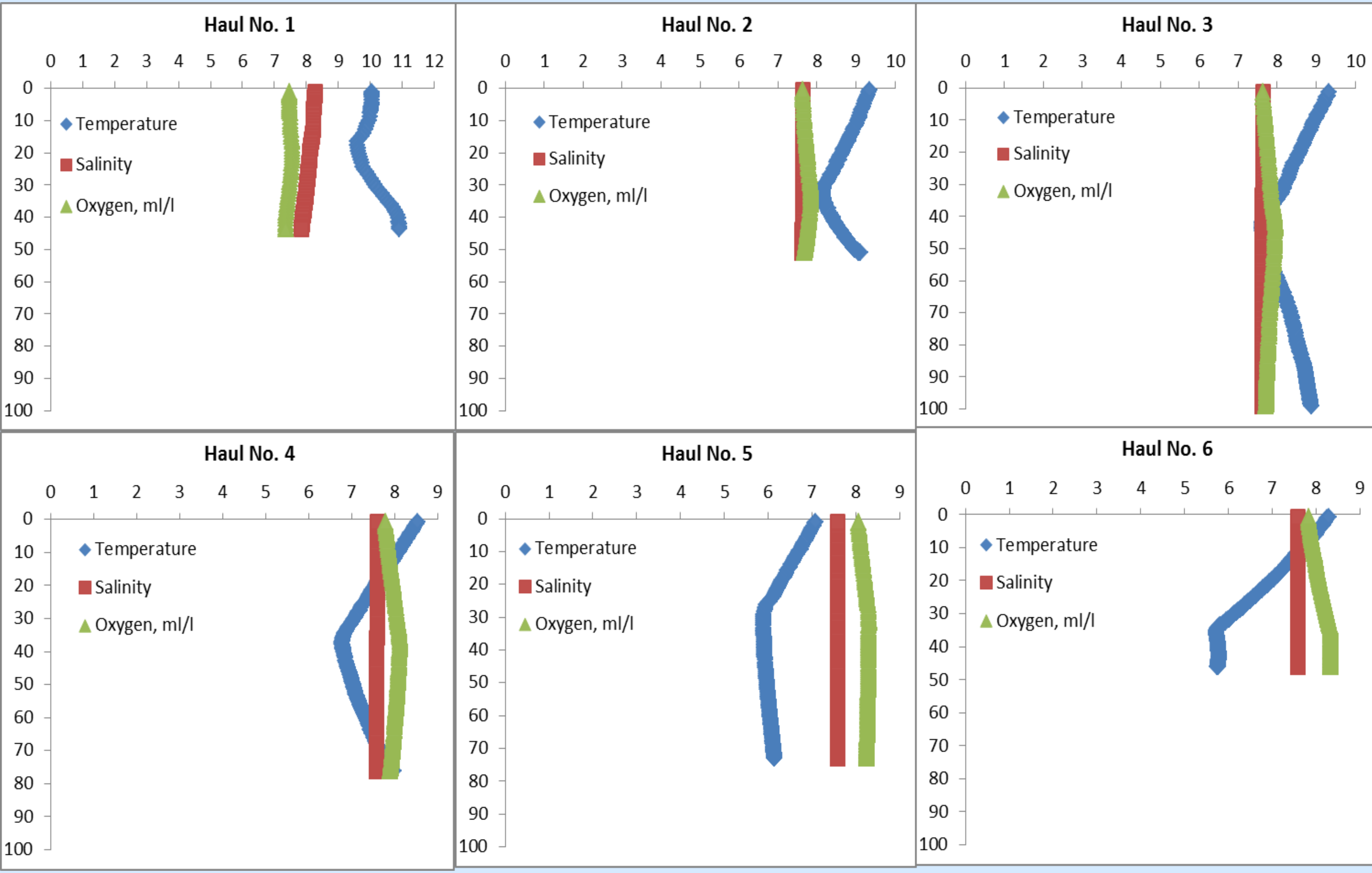
WGBIFS, 2017

Sprat biomass and abundance by BIAS results in ICES rectangles 40H0 and 40G9 from 2010 to 2016



WGBIFS, 2017

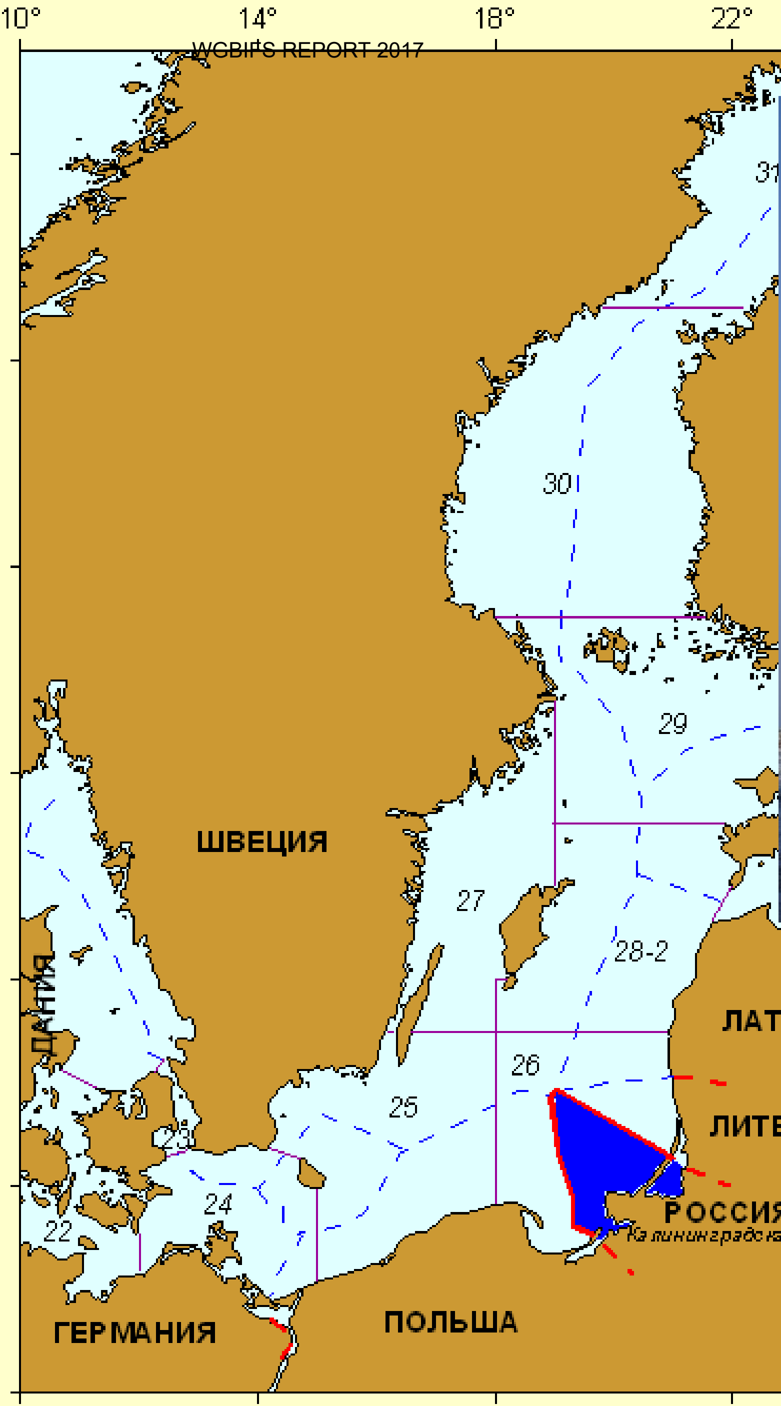
Hydrology

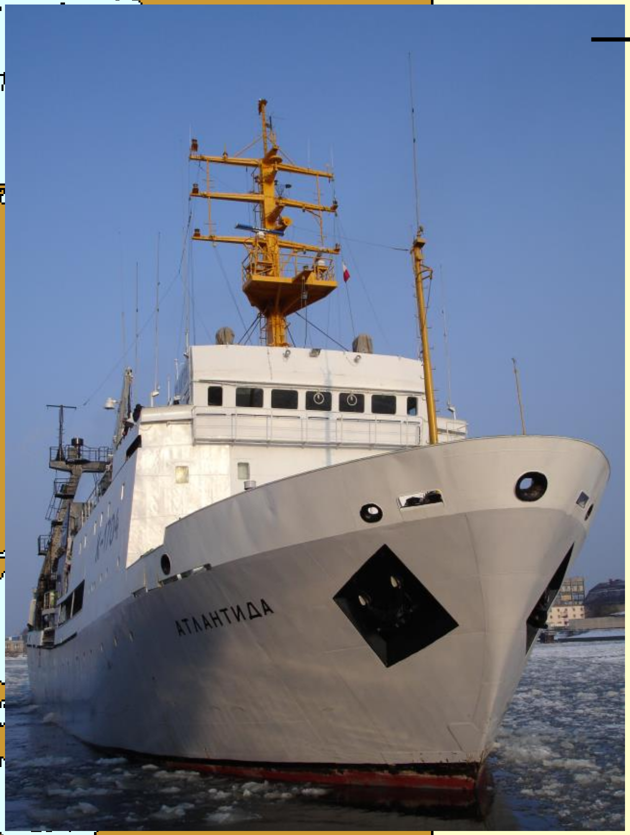

Haul No. 1
Temperature
Salinity
Oxygen, ml/l
Haul No. 2
Temperature
Salinity
Oxygen, ml/l
Haul No. 3
Temperature
Salinity
Oxygen, ml/l
Haul No. 4
Temperature
Salinity
Oxygen, ml/l
Haul No. 5
Temperature
Salinity
Oxygen, ml/l
Haul No. 6
Temperature
Salinity
Oxygen, ml/l

Survey Report for RV "ATLANTNIRO" 02-10.10.2016

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography

(AtlantNIRO), Kaliningrad, Russia





***A. Zezera* – cruise leader**

***A. Karpushevskaia* – scientific leader**

***A. Malishko* – acoustic**

***M. Sokolov* – acoustic**

***S. Alekseev* – hydrologist**

***I. Truphanova* – engineer**

***N. Kalinina* – engineer**

***S. Ivanov* – engineer**

***N. Dyushkov* - engineer**

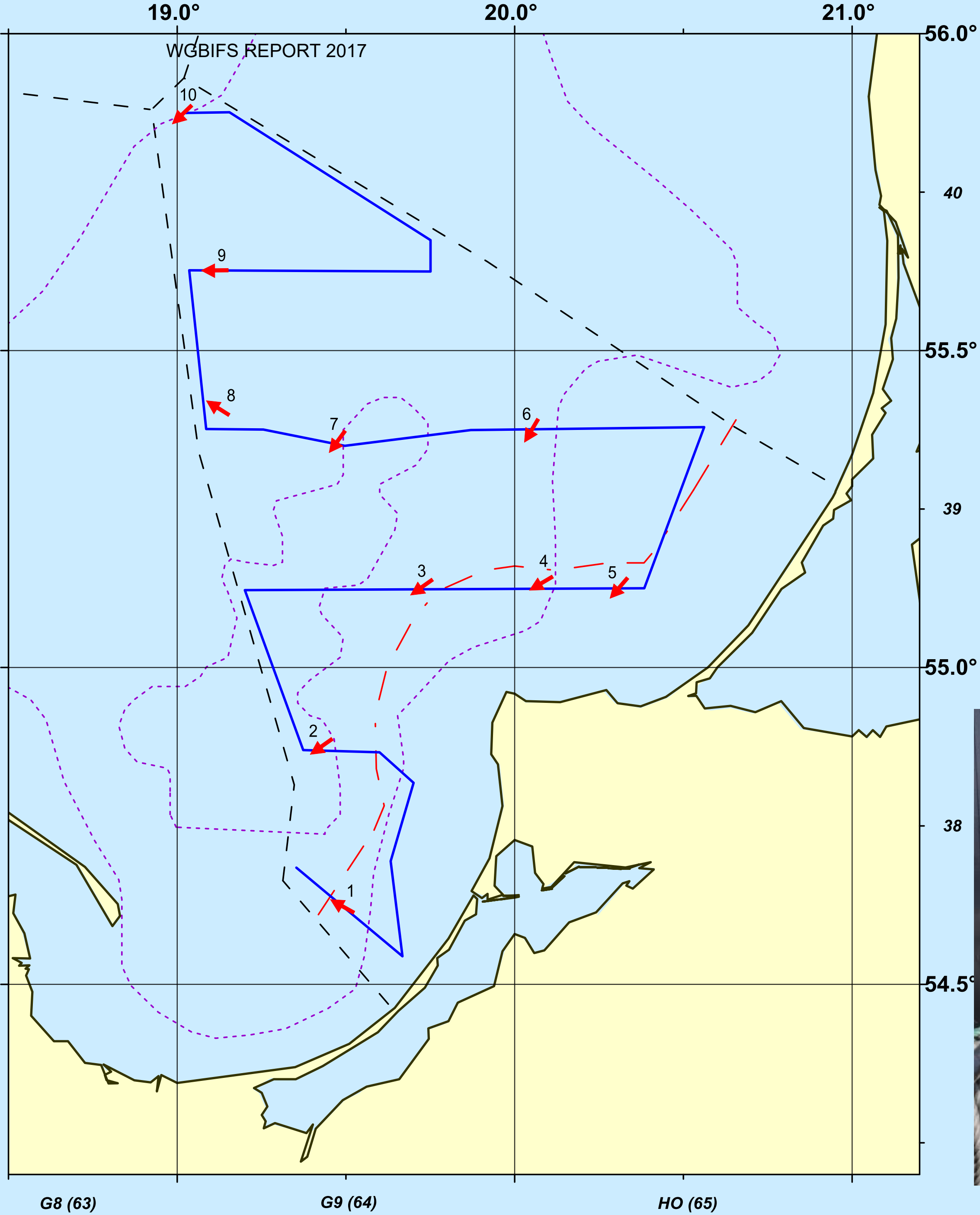


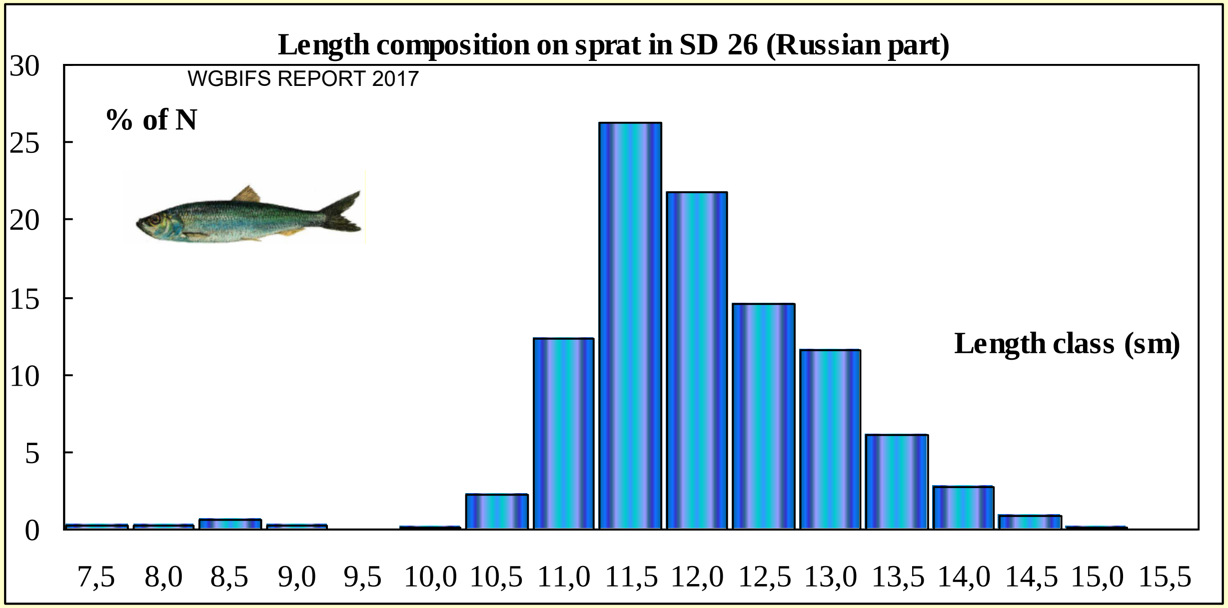
Figure 1. The scheme of cruise track and trawl stations for Russian part of survey (RV "ATLANTNIRO", 02-10.10. 2016)

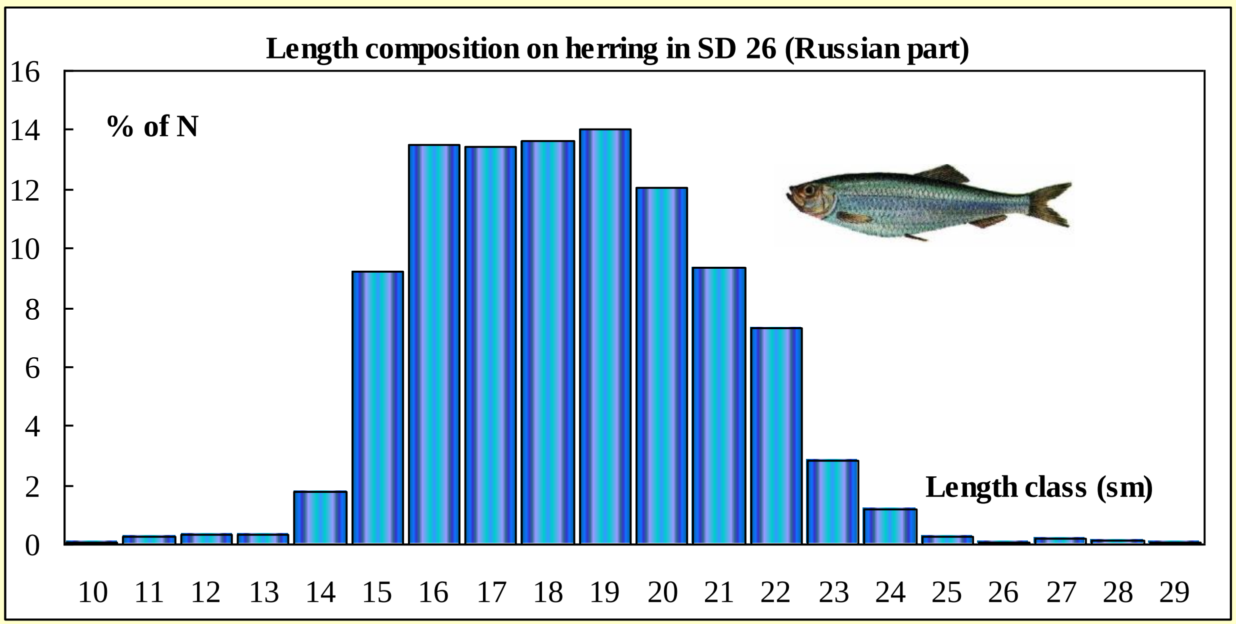
Table 1. Fish control-catch results in the Baltic Sea ICES SD 26 from Russian BIAS survey (RV "ATLANTNIRO", 02–10.10.2016)

Haul number	Date	ICES rect.	ICES SD	Mean bottom depth [m]	Head-rope depth [m]	Hor. open [m]	Ver. open [m]	Trawl. speed [knt]	Trawl. direct [°]	Geographical position				Time Start	Haul dur. [min]	Total catch [kg]
										Start		End				
										Latitude 00° 00.0'N	Longitude 00° 00.0'E	Latitude 00° 00.0'N	Longitude 00° 00.0'E			
1	02.10.2016	38G9	26	80	20	97	26	4,0	300	54 37.1	19 30.1	54 37.7	19 28.2	18:08	20	345,5
2	04.10.2016	38G9	26	105	52	92	26	4,0	230	54 53.3	19 27.7	54 52.0	19 24.3	7:40	30	353,5
3	06.10.2016	39G9	26	76	37	98	28	4,1	237	55 08.2	19 45.1	55 07.0	19 42.0	12:31	30	219,5
4	07.10.2016	39HO	26	56	13	98	29	4,1	241	55 08.6	20 06.6	55 07.5	20 03.1	7:31	30	336,1
5	07.10.2016	39HO	26	43	10	91	31	4,0	220	55 08.4	20 19.8	55 06.7	20 17.3	14:42	30	149,5
6	08.10.2016	39HO	26	59	17	90	25	4,0	213	55 23.7	20 04.4	55 21.8	20 02.5	10:04	30	99,8
7	08.10.2016	39G9	26	96	43	89	28	4,0	221	55 22.3	19 29.9	55 20.5	19 27.2	15:18	30	237,1
8	09.10.2016	39G9	26	81	34	90	28	4,0	300	55 23.8	19 09.3	55 25.1	19 05.6	9:05	30	63,3
9	09.10.2016	40G9	26	87	55	95	29	3,9	270	55 37.5	19 09.0	55 37.5	19 05.3	13:39	30	419,2
10	10.10.2016	40G9	26	104	50	97	26	3,9	224	55 53.3	19 02.5	55 51.6	18 59.6	11:32	30	207,0
SD26				79	33	94	28	4,0	246							2430

ICES_subdivision	26	26	26	26	26
Haul_No	***1***	***2***	***3***	***4***	***5***
Date	02.10.2016	04.10.2016	06.10.2016	07.10.2016	07.10.2016
Validity	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	38G9(64)	38G9(64)	39G9(64)	39HO(65)	39HO(65)
CLUPEA HARENGUS 	282,9	523,2	386,6	8,0	1,4
SPRATTUS SPRATTUS 	732,9	160,6	50,1	660,0	295,2
GADUS MORHUA 	6,0	18,5	1,4	2,3	0,0
ANOTHER	14,7	4,7	0,9	1,9	2,3
Total	1036,5	707,0	439,0	672,1	298,9
ICES_subdivision	**26**	**26**	**26**	**26**	**26**
Haul_No	***6***	***7***	***8***	***9***	***10***
Date	08.10.2016	08.10.2016	09.10.2016	09.10.2016	10.10.2016
Validity	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	39HO(65)	39G9(64)	39G9(64)	40G9(64)	40G9(64)
CLUPEA HARENGUS 	11,9	431,8	119,6	803,0	385,0
SPRATTUS SPRATTUS 	186,8	33,6	6,8	32,6	28,4
GADUS MORHUA 	0,8	8,1	0,0	2,8	0,5
ANOTHER	0,2	0,7	0,2	0,0	0,0
Total	199,7	474,3	126,6	838,4	413,9

Table 2. Catch composition (kg/1hour) per haul by ICES Subdivision and ICES rectangles (RV "ATLANTNIRO", 02–10.10.2016)





The cod catches were extremely small

39 ind.

Figure 2. Length composition of sprat and herring (%) (RV "ATLANTNIRO", 02–10.10.2016)

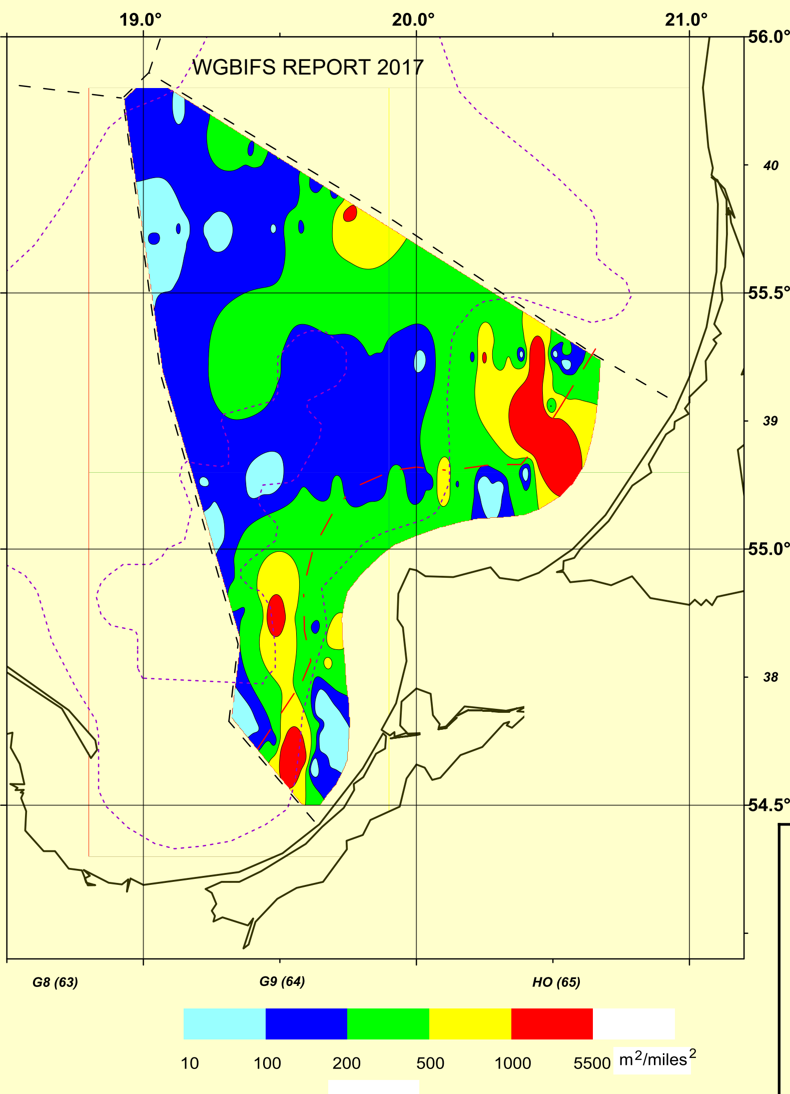


Figure 3. The map of NASC values distribution on the Russian area of international acoustic survey (RV "ATLANTNIRO", 02-10.10.2016)

Table 3. Survey statistics (RV "ATLANTNIRO", 02–10.10.2016)

ICES SD	ICES Rect.	Area nm^2	SA m^2/nm^2	$\sigma*10^4$ m^2	N total mln	Species composition (%)	
						herring	sprat
26	40G9	1013,0	229,3	3,12	745,4	85,78	14,22
26	39H0	881,6	630,8	1,33	4182,6	0,49	99,51
26	39G9	1026,0	154,2	2,97	533,1	74,07	25,93
26	38G9	918,2	378,3	1,95	1780,4	22,52	77,48

Table 4. Characteristics of the stock of sprat and herring acoustic survey data (RV "ATLANTNIRO", 02–10.10.2016)

ICES	ICES	Area	p	Quantity, mln			Biomass, tonn		
SD	Rect.	nm^2	mln/nm^2	N sum	N her	N spr	W sum	W her	W spr
26	40G9	1013,0	0,74	745,4	639,4	106,0	26316,9	25031,6	1285,3
26	39H0	881,6	4,74	4182,6	20,5	4162,1	43786,6	799,7	42986,8
26	39G9	1026,0	0,52	533,1	394,9	138,3	17948,3	16368,6	1579,7
26	38G9	918,2	1,94	1780,4	400,9	1379,4	33058,3	17289,4	15768,9
SD26		3 838,8		7 241	1 456	5 786	121 110	59 489	61 621

Table 5. Summary acoustic survey of sprat and herring (RV "ATLANTNIRO", 02–10.10.2016)

ICES	ICES	No	HERRING			SPRAT			SA	TS CALC.
SD	Rect.	trawl	L, cm	W, g	Numb.,%	L, cm	W, g	Numb.,%	M^2/NM^2	DB
26	40G9	9,10	18,69	39,15	85,78	12,65	12,13	14,22	229,3	-46,1
26	39H0	4,5,6	18,53	39,06	0,49	11,74	10,33	99,51	630,8	-49,8
26	39G9	3,7,8	19,01	41,45	74,07	12,29	11,43	25,93	154,2	-46,3
26	38G9	1,2	19,30	43,12	22,52	12,39	11,43	77,48	378,3	-48,1

Table 6. Estimated number (millions) of sprat (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	NSTOT	1	2	3	4	5	6	7	8+
26	40G9	105,99	0,29	4,98	39,33	15,38	26,76	12,91	1,73	1,75
26	39H0	4162,10	145,48	410,62	2735,36	439,54	370,11	49,18	5,91	2,95
26	39G9	138,26	0,65	7,95	68,59	20,54	26,89	7,97	1,39	1,21
26	38G9	1379,45	0,00	24,27	634,76	263,78	290,47	113,89	13,88	0,00
	Sum	5785,79	146,42	447,82	3478,05	739,23	714,22	183,95	22,91	5,91

Table 7. Estimated mean weights (g) of sprat (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	WSTOT	1	2	3	4	5	6	7	8+
26	40G9	12,13	3,93	8,99	10,79	11,93	13,20	14,13	16,70	15,21
26	39H0	10,33	3,90	9,04	10,32	11,58	12,14	14,36	17,24	16,79
26	39G9	11,43	4,54	8,66	10,54	12,16	12,68	14,27	16,22	12,61
26	38G9	11,43	0,00	8,02	10,39	12,36	12,19	13,61	12,90	0,00

Table 8. Estimated biomass (in tonnes) of sprat (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	WSTOT	1	2	3	4	5	6	7	8+
26	40G9	1285,29	1,13	44,72	424,24	183,45	353,07	182,49	28,96	26,65
26	39H0	42986,84	567,49	3712,45	28223,08	5090,96	4492,47	706,15	101,84	49,59
26	39G9	1579,69	2,97	68,89	723,03	249,85	340,82	113,73	22,55	15,24
26	38G9	15768,87	0,00	194,67	6596,11	3261,34	3541,31	1550,19	178,95	0,00
	Sum	61620,70	571,59	4020,73	35966,46	8785,60	8727,67	2552,56	332,30	91,48

Table 9. Estimated number (millions) of herring (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	NHTOT	0	1	2	3	4	5	6	7	8+
26	40G9	639,40	0,63	37,67	129,21	118,85	146,48	63,17	46,29	45,46	51,63
26	39HO	20,48	1,05	0,35	3,39	4,12	6,40	1,37	0,95	0,98	1,86
26	39G9	394,85	0,54	9,19	65,37	51,33	103,07	33,51	42,11	35,03	54,70
26	38G9	400,93	0,38	27,26	50,61	59,86	124,19	60,55	31,67	8,75	37,65
	Sum	1455,66	2,61	74,48	248,58	234,16	380,14	158,60	121,01	90,23	145,85

Table 10. Estimated mean weights (g) of herring (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	WHTOT	0	1	2	3	4	5	6	7	8+
26	40G9	39,15	12,05	28,76	30,89	35,29	37,35	47,14	46,52	47,72	57,76
26	39HO	39,06	11,18	18,96	30,92	33,31	38,26	43,12	61,77	46,69	70,37
26	39G9	41,45	13,96	29,16	29,65	31,86	39,19	43,74	45,74	52,24	59,57
26	38G9	43,12	9,85	26,21	29,30	42,10	41,21	45,51	53,53	60,70	65,56

Table 11. Estimated biomass (in tonnes) of herring (RV "ATLANTNIRO", 02–10.10.2016)

SD	RECT	WHTOT	0	1	2	3	4	5	6	7	8+
26	40G9	25031,62	7,620206	1083,381	3991,107	4194,366	5471,059	2978,299	2153,536	2169,751	2982,498
26	39HO	799,7359	11,78513	6,727076	104,8264	137,3403	244,6947	59,0191	58,41273	45,84818	131,0823
26	39G9	16368,62	7,587676	267,8705	1938,146	1635,283	4039,425	1465,752	1925,884	1829,931	3258,742
26	38G9	17289,41	3,709085	714,4161	1483,027	2519,931	5117,677	2755,268	1695,348	531,3136	2468,716
	Sum	59489,38	30,7021	2072,394	7517,107	8486,92	14872,86	7258,338	5833,18	4576,844	8841,039


THANK YOU!

WGBIFS meeting in Riga; 27-31.03.2017

Polish BIAS 2016 survey

by Grzegorz Kruk – gkruk@mir.gdynia.pl
National Marine Fisheries Research Institute in Gdynia (Poland)

The aim of presentation:

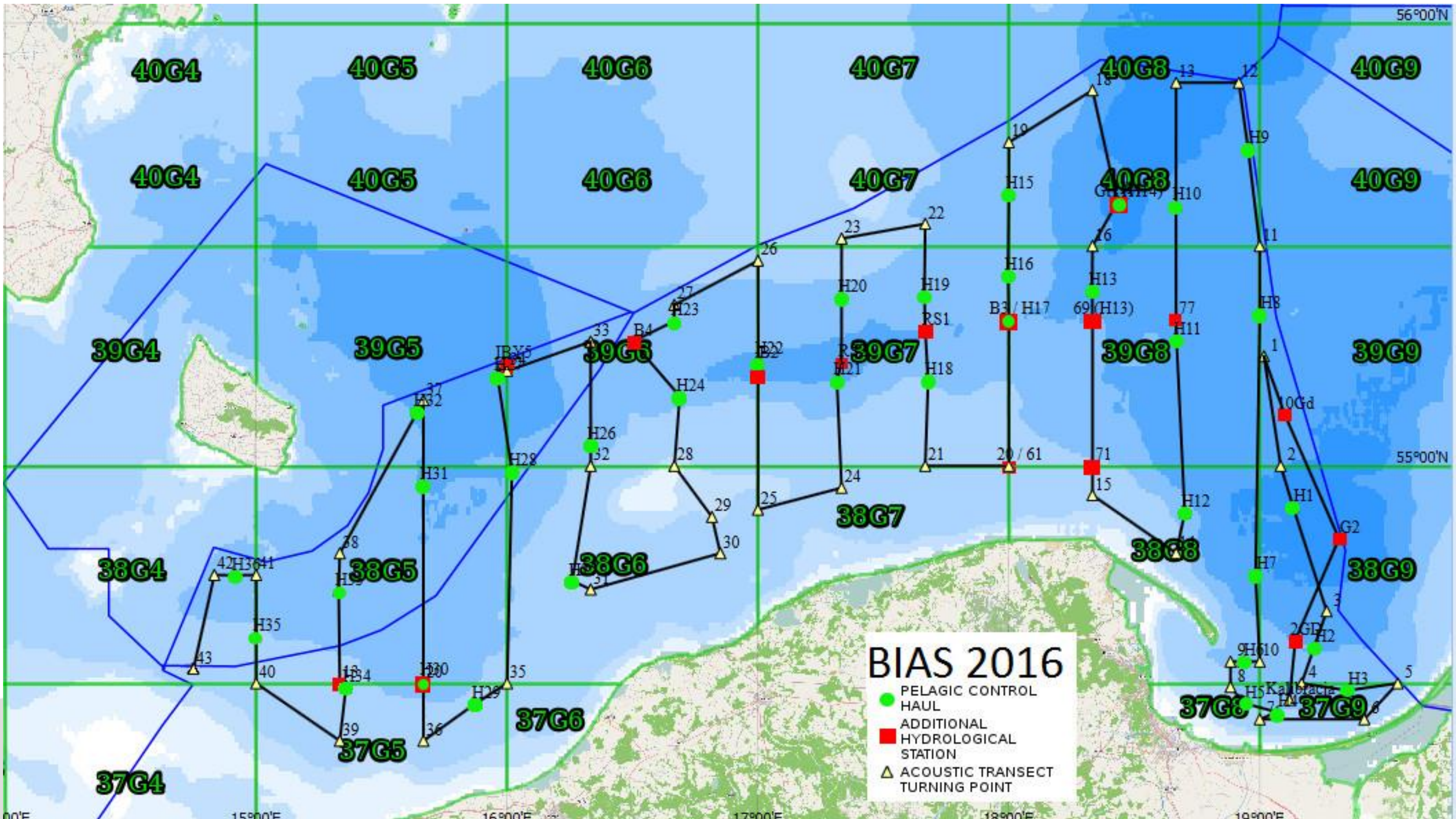
- Brief summary of the acoustic survey (type BIAS) realisation.
- Showing acoustic, biotic and hydrological data .

Based on „Research report from the Polish part of the Baltic International Acoustic Survey (BIAS) onboard of the r.v. Baltica”
by G.Kruk, M. Wyszyński, B. Witalis

95 YEARS MIR
1921 - 2016

Materials

The 2016 Polish BIAS survey was conducted on board of the R/V „Baltica" in the period from 13th to 30th of September within the Polish EEZ.



Materials

The R/V „Baltica” realised :
876 NM echo-integration transect

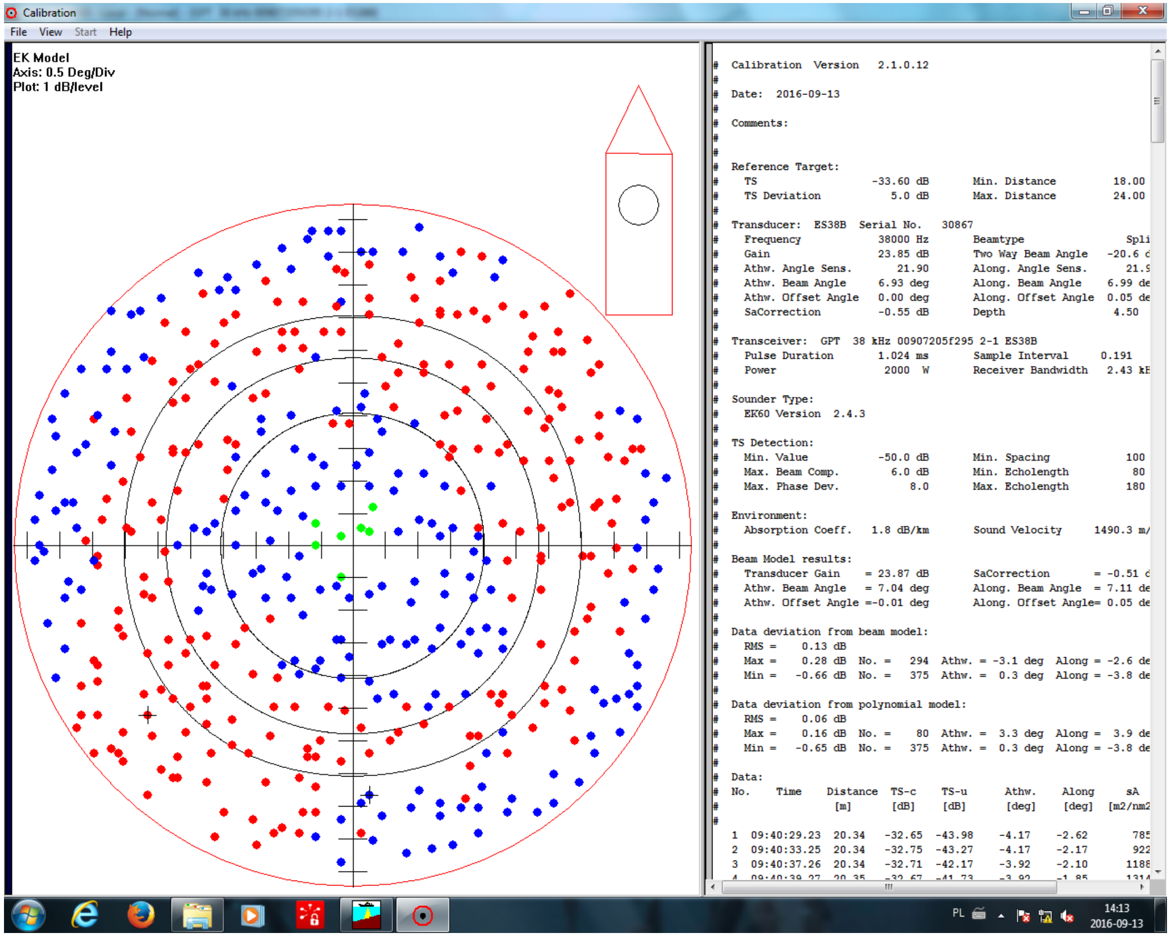
covering ICES rectangles :
- partly 38G4, 38G5, 39G5, 39G6, 40G7, 40G8, 38G9, 39G9
- fully 37G5, 38G6, 38G7, 39G7, 37G8, 38G8 ,39G8, 37G9

36 valid fish control hauls during the daylight with the WP 53/64x4 small meshed herring pelagic trawl applied

48 hydrological stations (36 after each haul and 12 additional)

Materials

Calibration of the EK-60 SIMRAD scientific split beam echosounder, with the frequencies of 38 and 120 kHz



- Performed on 13.09.2016
- Lat. 54º 27.6’ N
- Lon.19º 07.1’ E
- Calibration Accuracy Estimate for 38 kHz: 0.13 dB (RMS) – very good

Materials

Average NASC

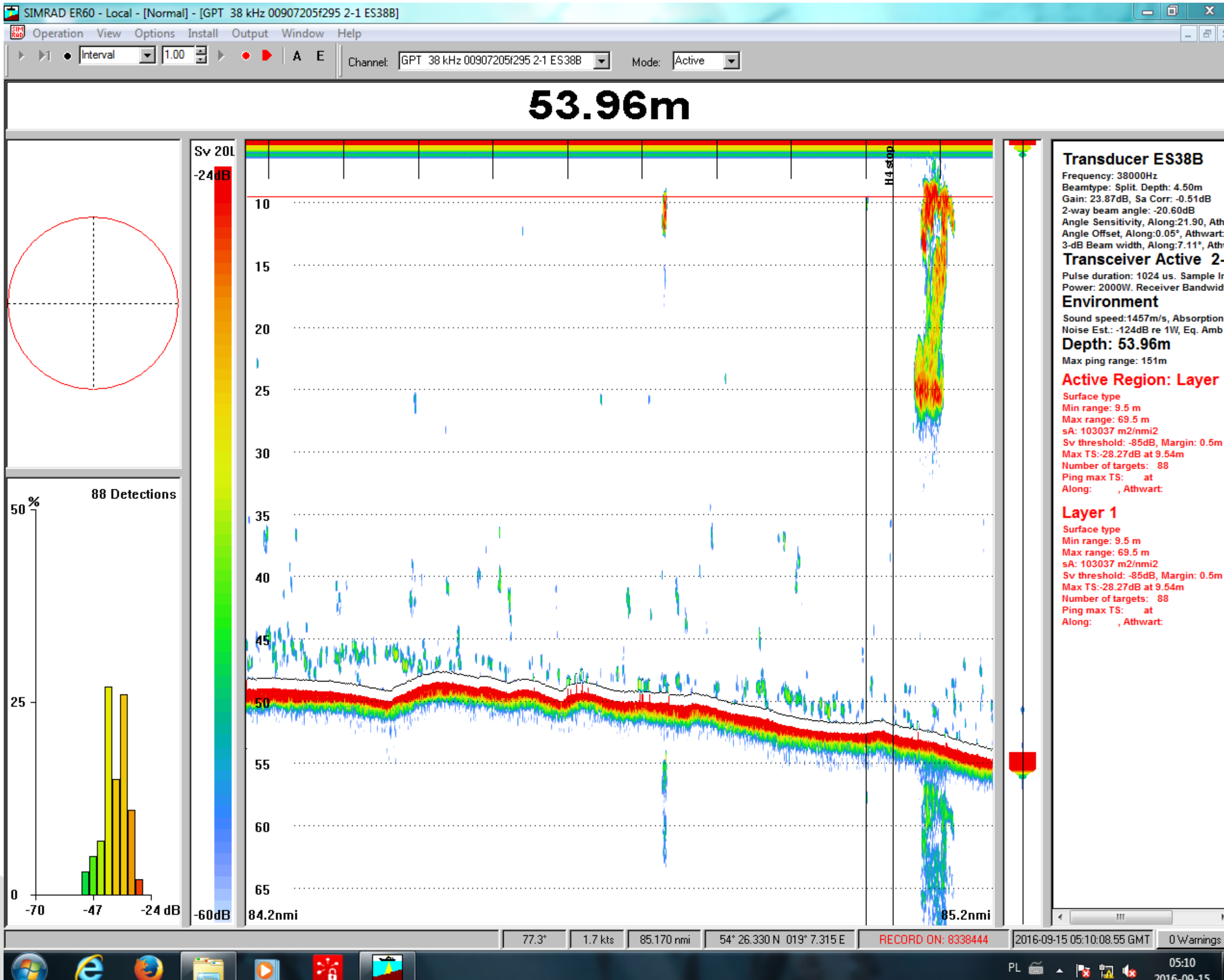
SD	Average NASC 2016	Average NASC 2015
24	89,2	96,9
25	160,0	226,4
26	556,8	926,8

SD	ICES Rectangle	Surface Nm^2	Average NASC 2016	Average NASC 2015
26	37G8	86,0	767,5	2894,6
26	37G9	151,6	2739,7	914,1

Interesting that the largest values of the NASC appear every year at the mouth of the Vistula river.

Results

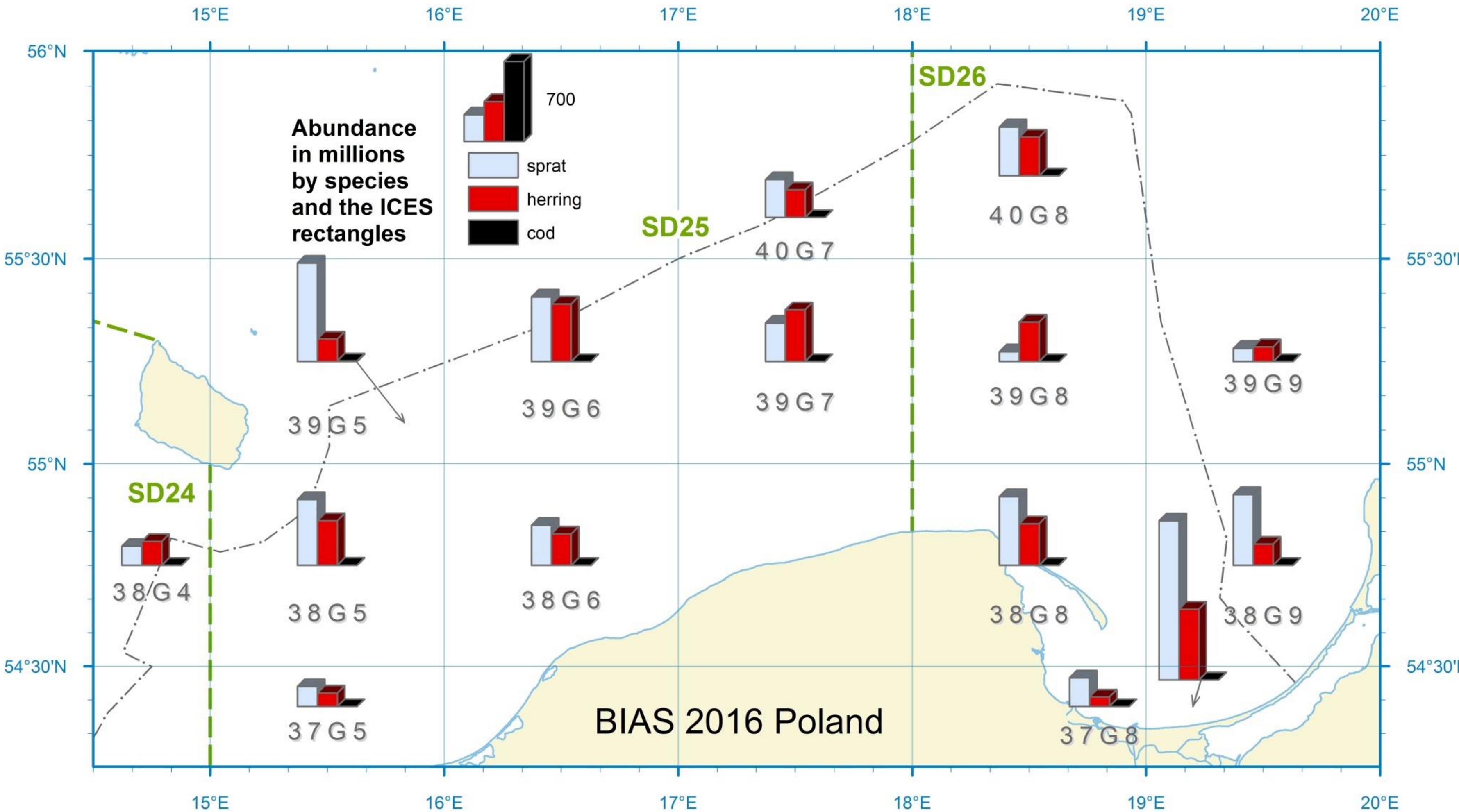
Huge concentration of clupeids at the mouth of the Vistula river in the 37G9 ICES rectangle - a screenshot from the Simrad EK60 software during hydroacoustic integration.



Results

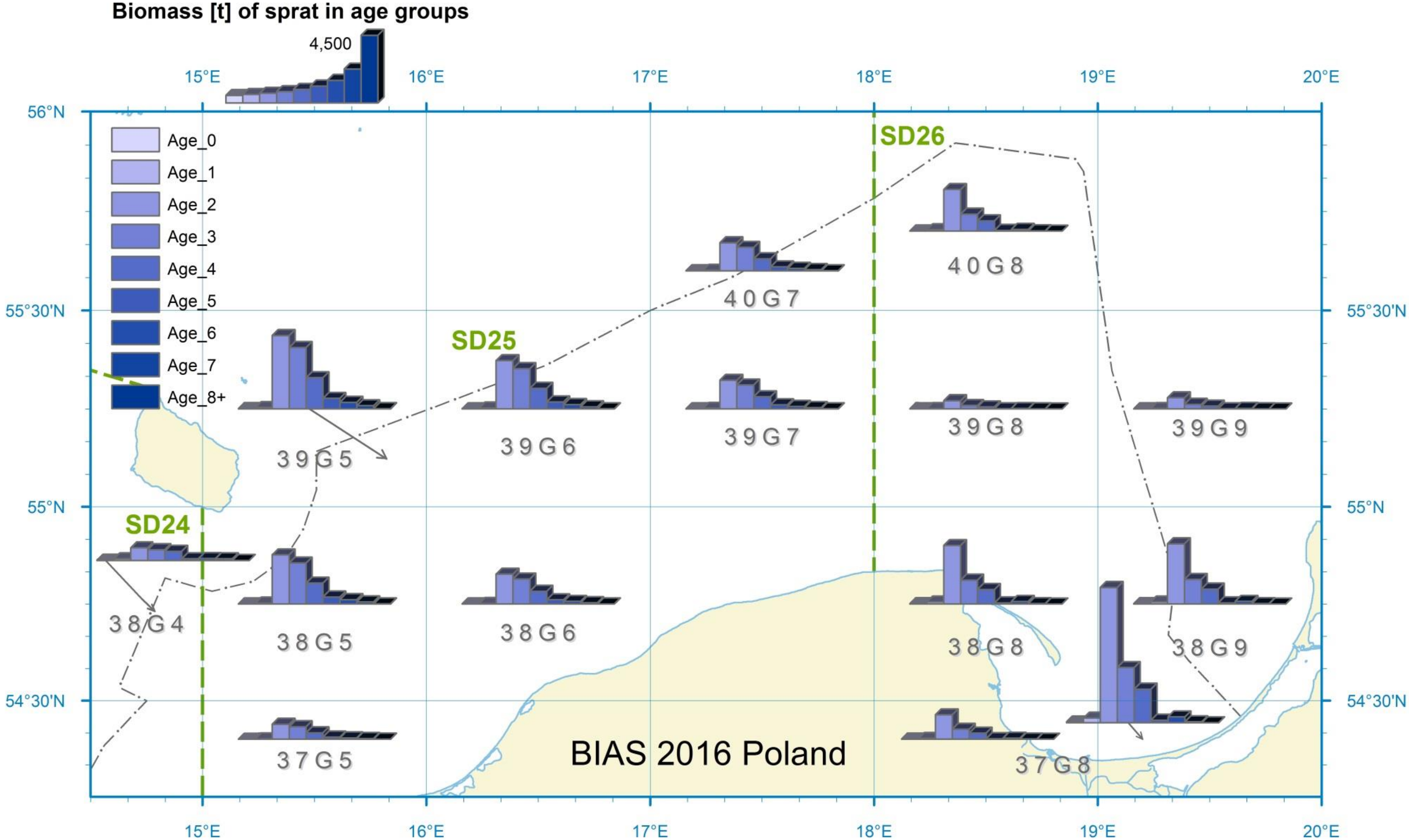
Cruise statistics

(the black bar’s size in a legend represents 700*10^6 of indiv.)



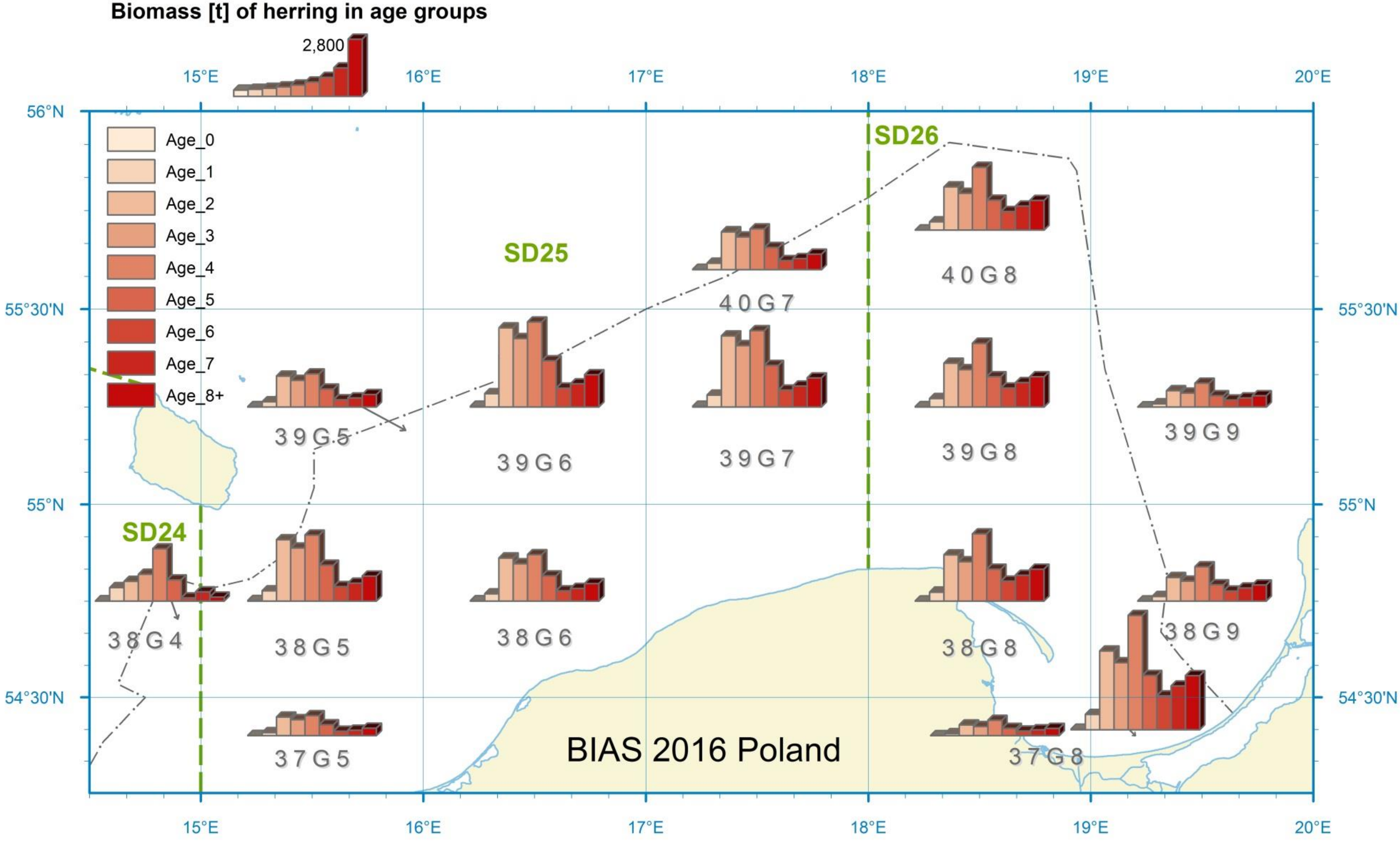
Results

Sprat biomass estimated using acoustic method
(the largest blue bar's size in a legend represents 4500 t of sprat)



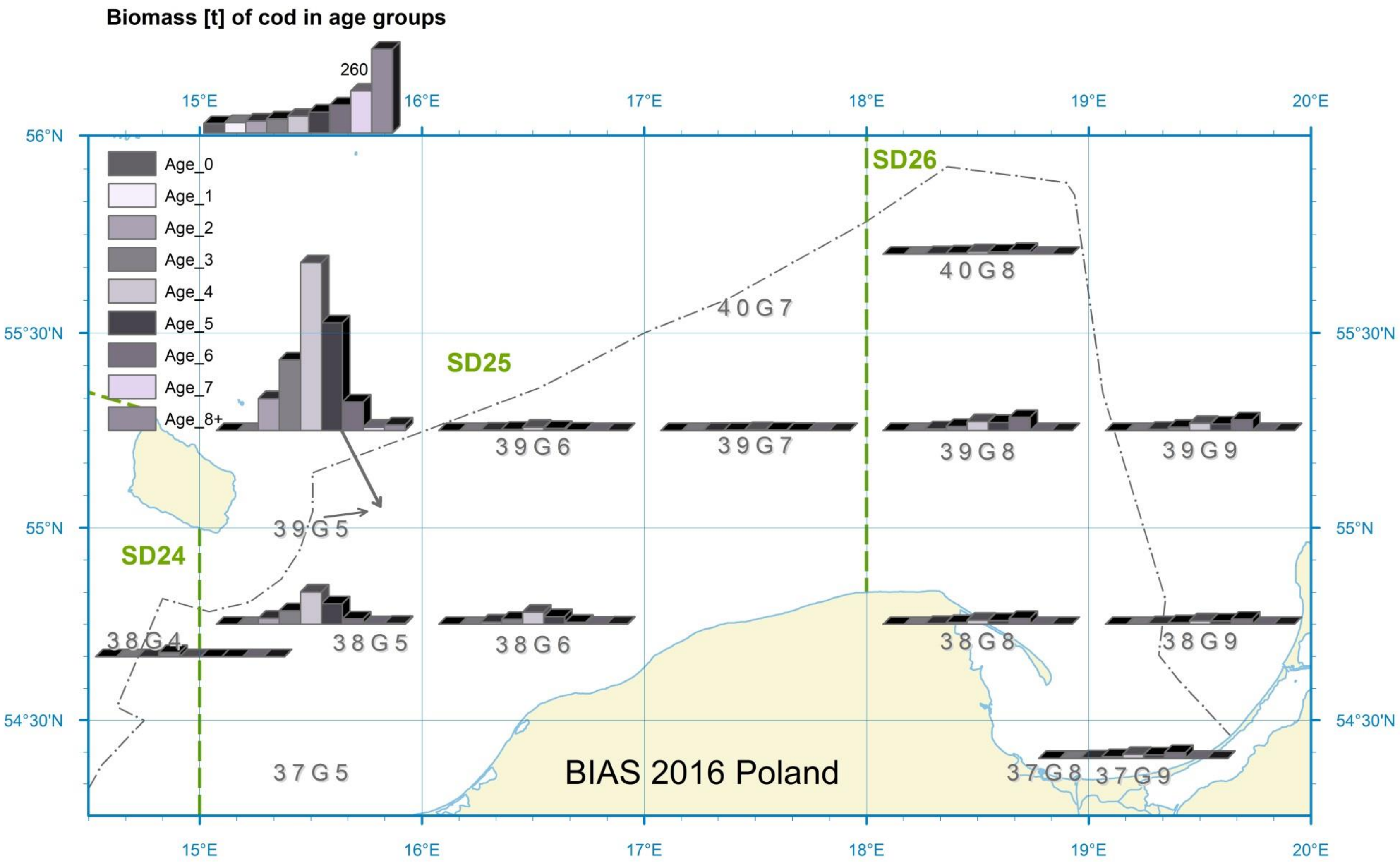
Results

Herring biomass estimated using acoustic method
(the largest red bar's size in a legend represents 2800 t of herring)



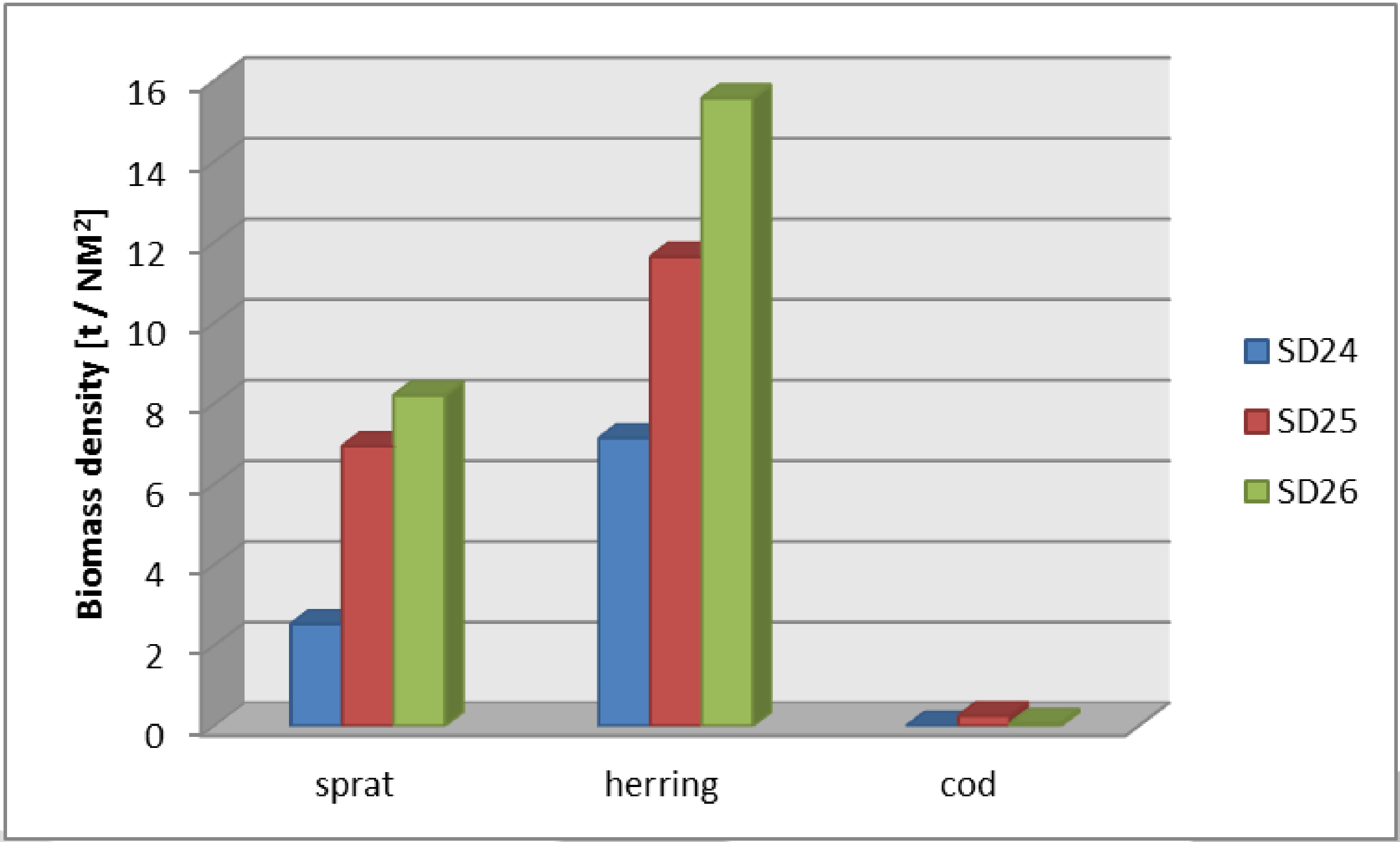
Results

Cod biomass estimated using acoustic method (the largest grey bar's size in a legend represents 260 t of cod)



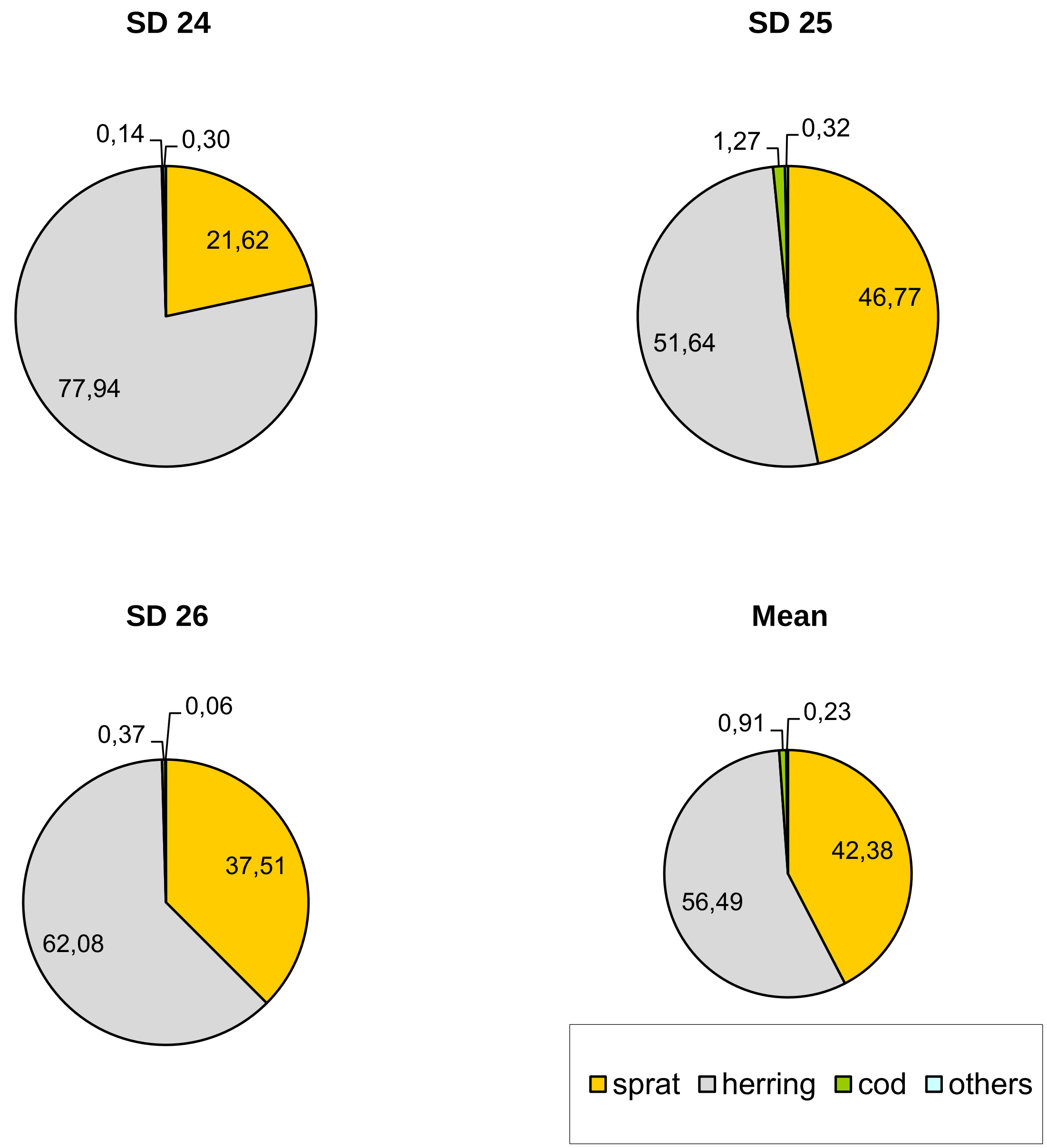
Results

Total biomass density in the ICES Subdivisions for the three major species



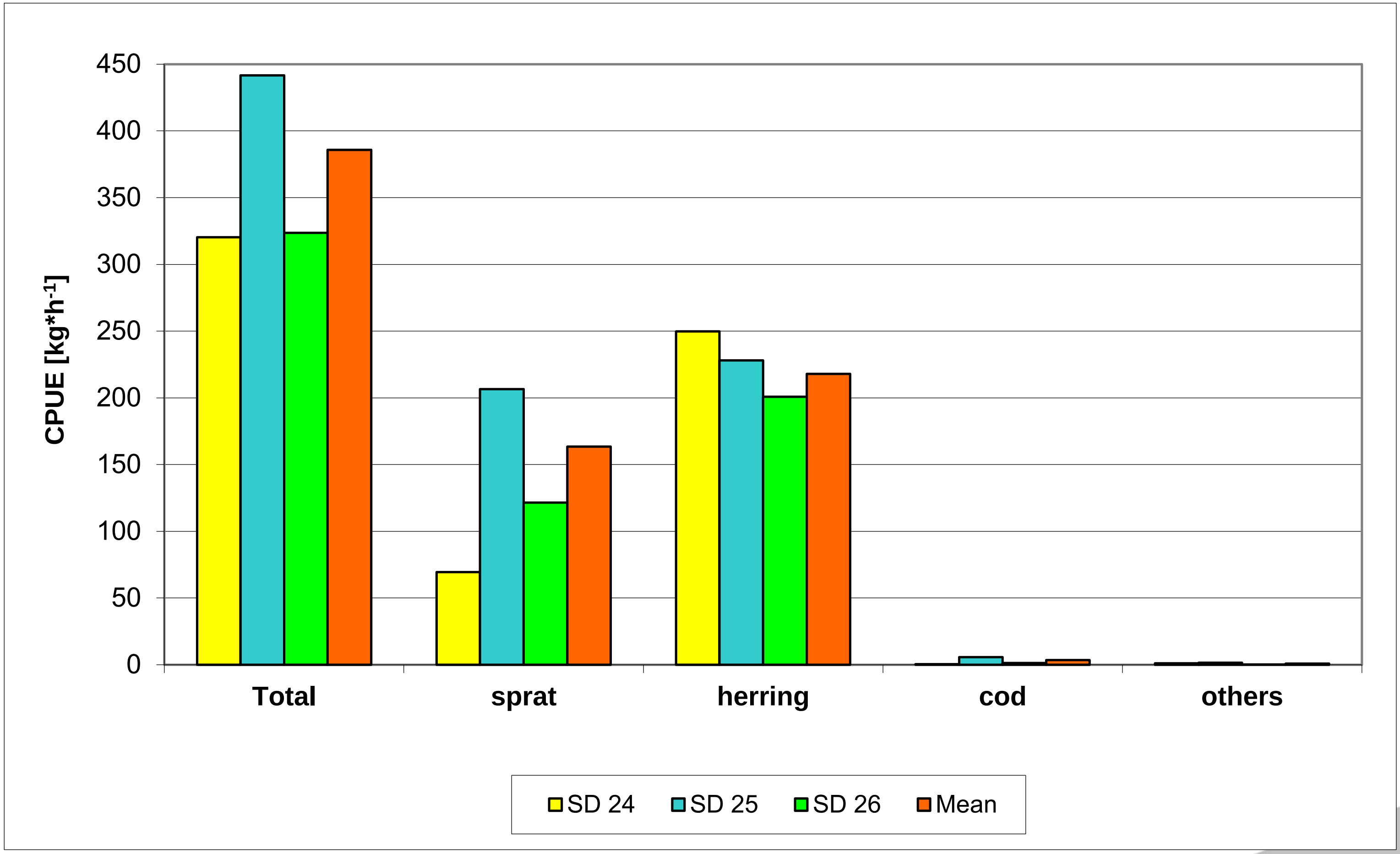
Results

Mean share (%)
of sprat, herring, cod
in the mass of
total catches
per the ICES SDs



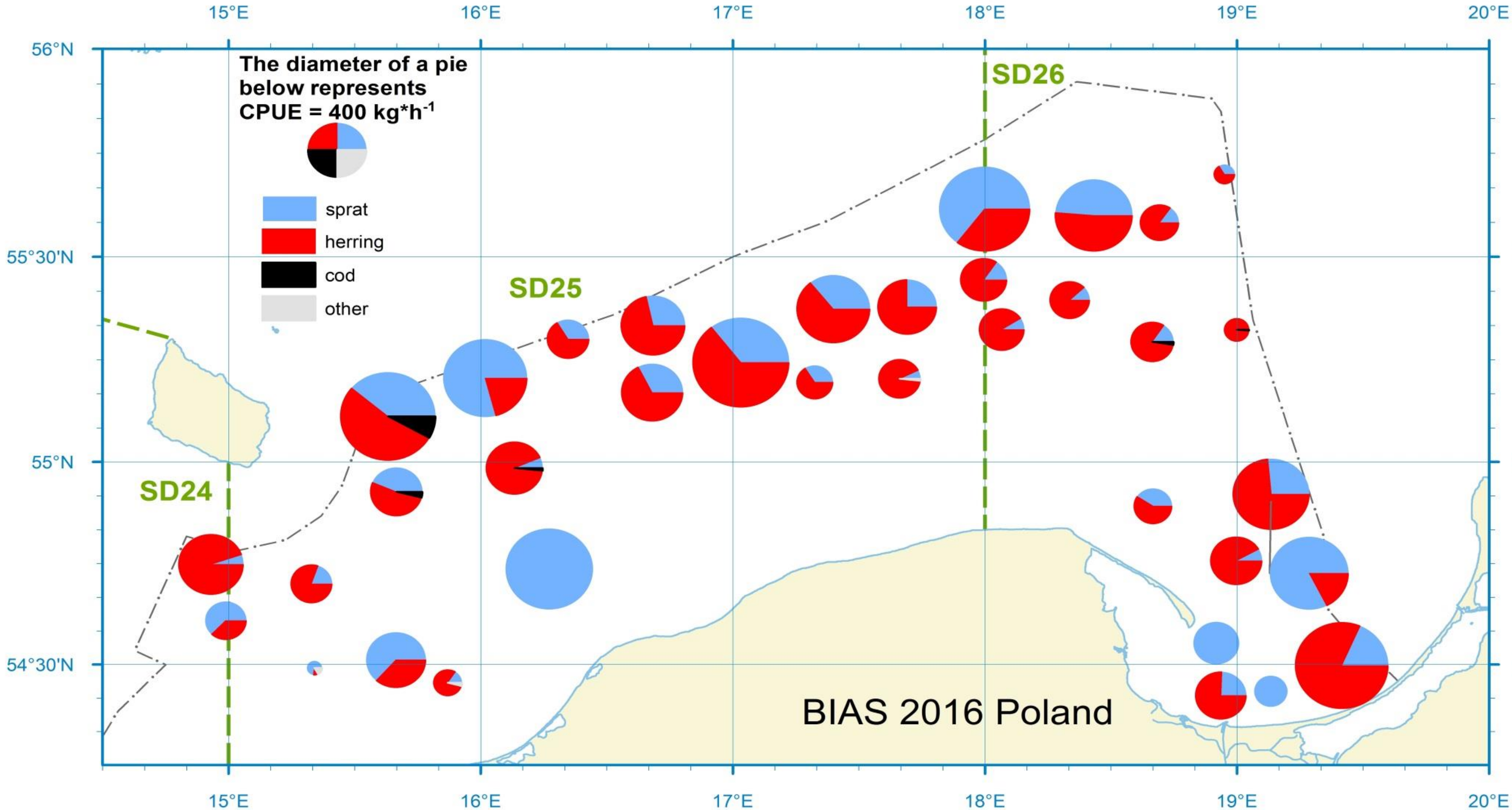
Results

Mean CPUE [kg h^{-1}] per species and the ICES SDs



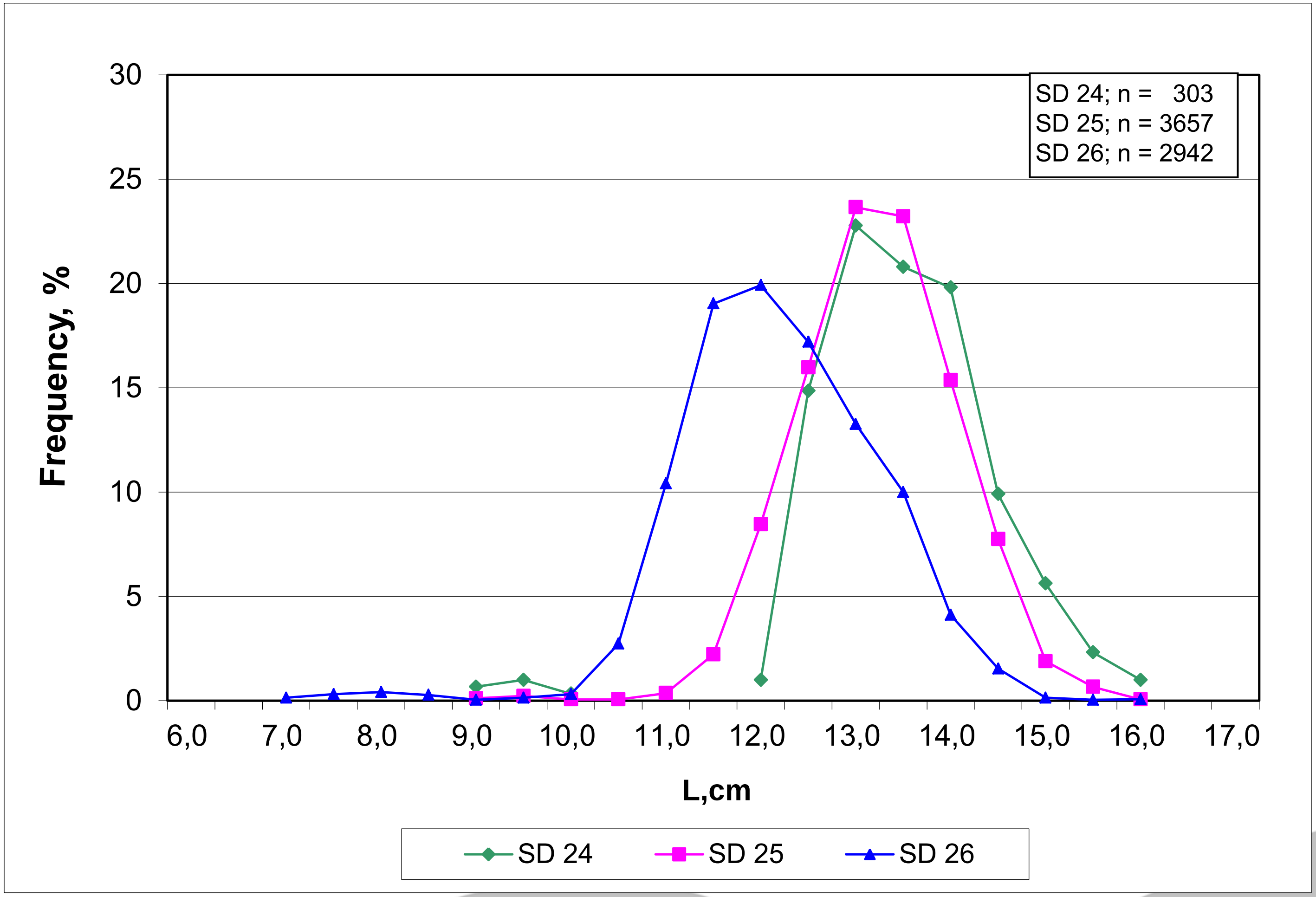
Results

Mean CPUE [kg h^{-1}] per species in Polish EEZ per single pelagic haul



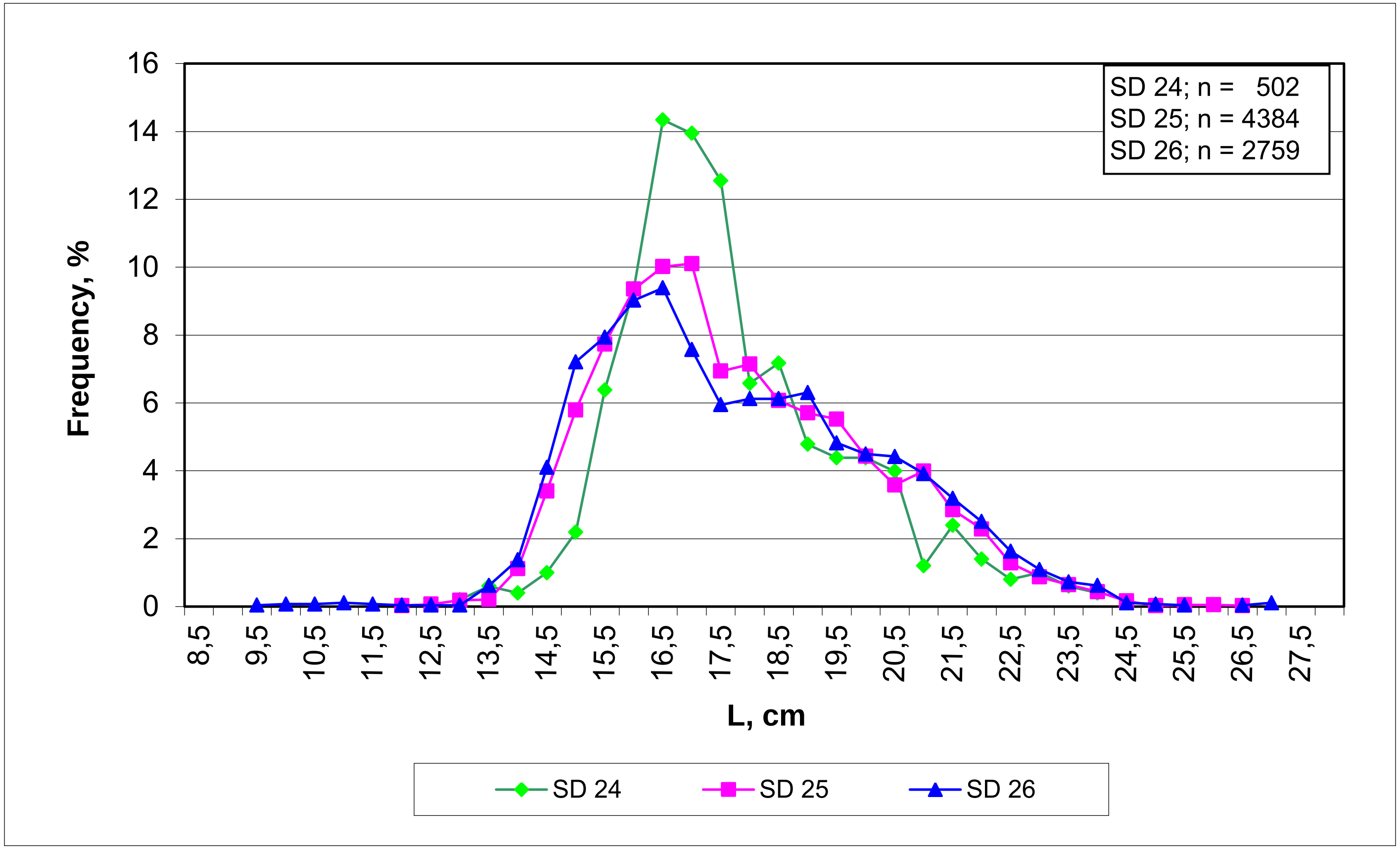
Results

Length distributions of sprat in samples taken from the control catches



Results

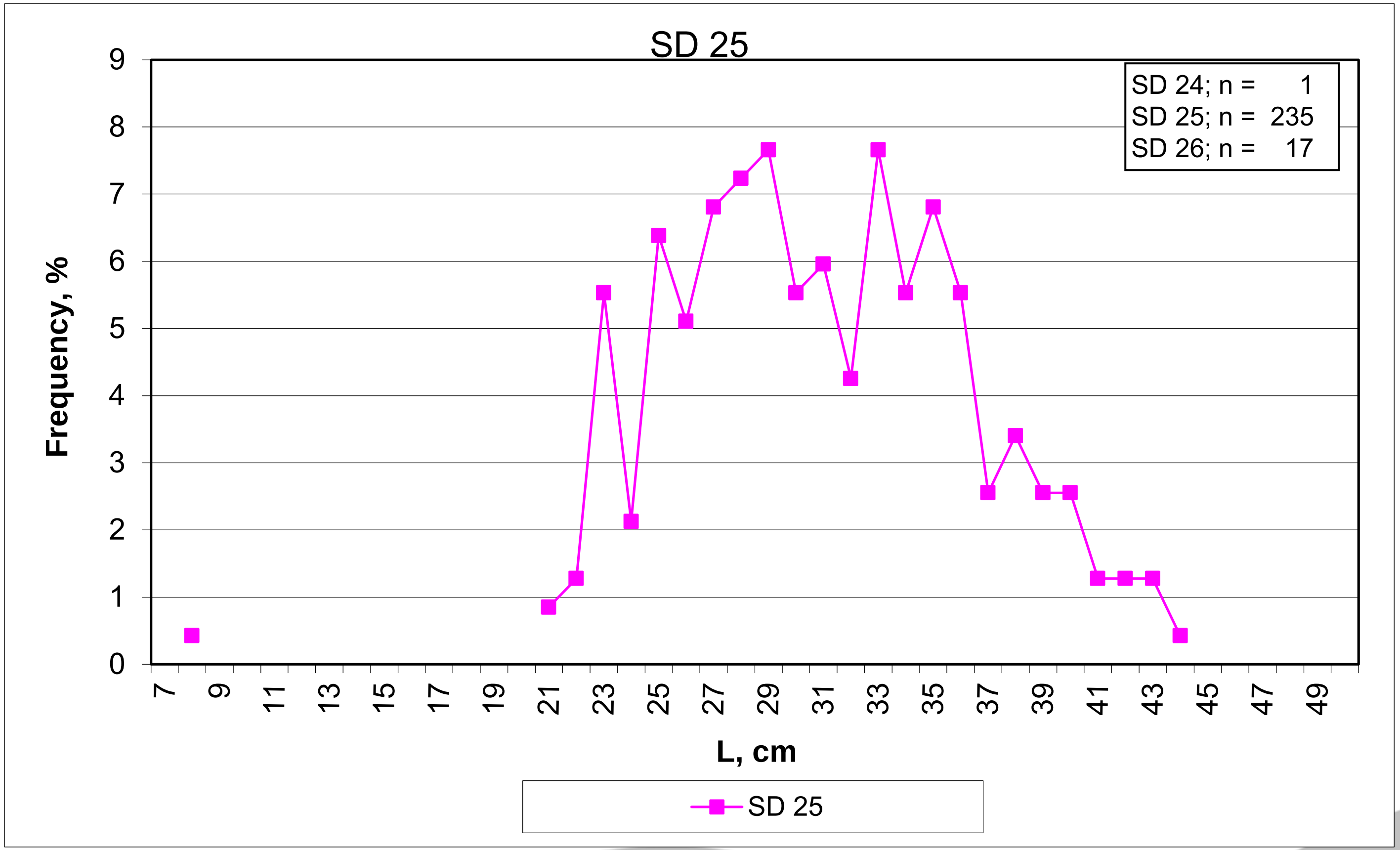
Length distributions of herring in samples taken from the control catches



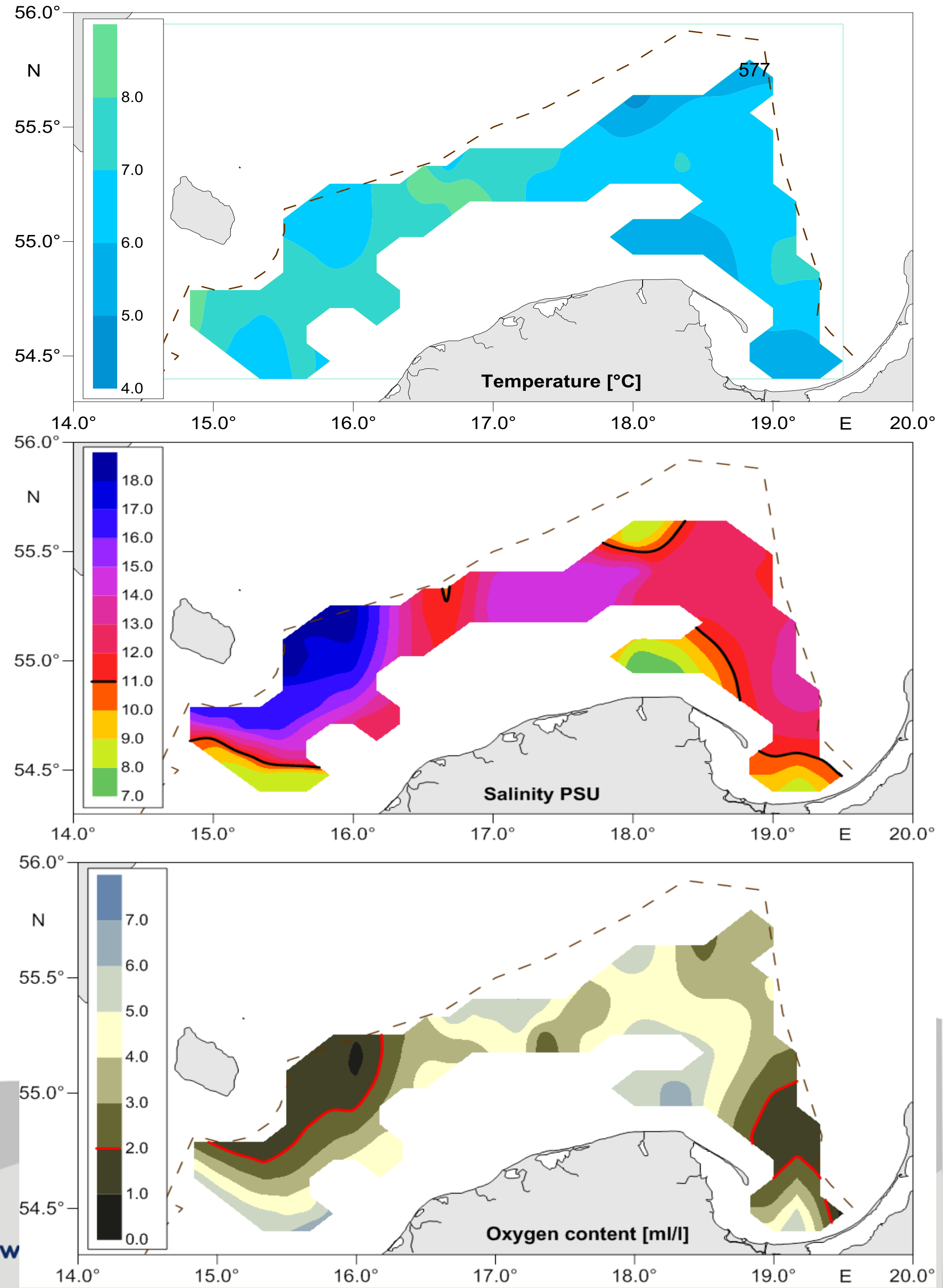
1921 - 2016

Results

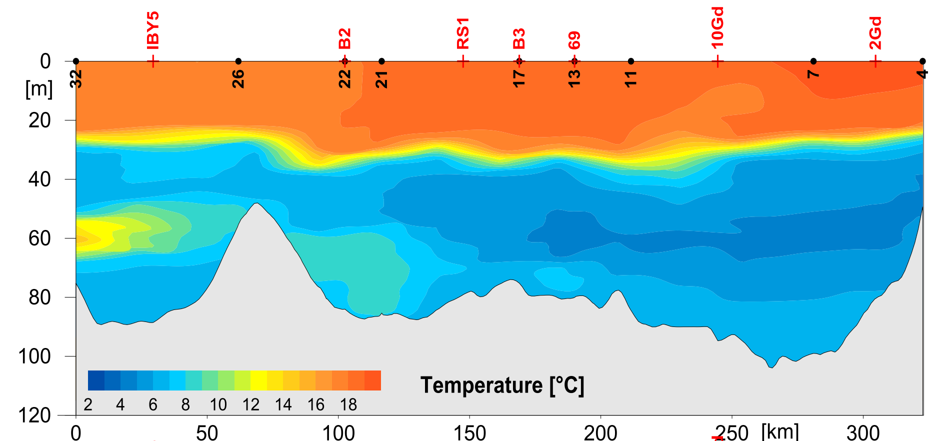
Length distribution of cod in samples taken from the control catches. The amout of fish in SD 24 and SD 26 was not representative to be shown on the plot.

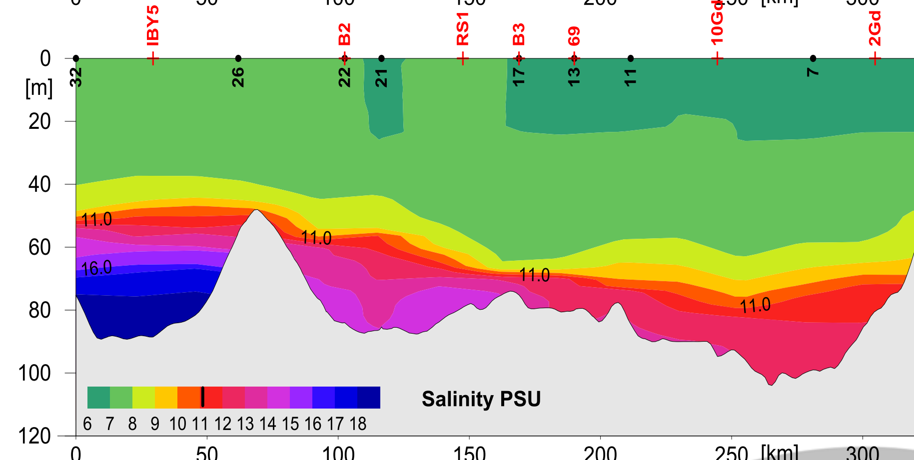


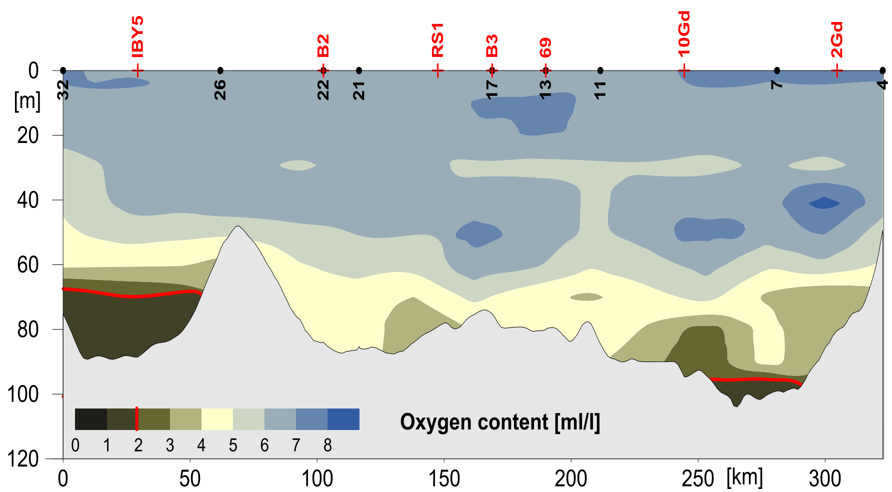
Horizontal distribution of seawater temperature, salinity and oxygen content - near seabed



Vertical distribution of seawater temperature, salinity and oxygen content on the research profile of the southern Baltic







1921 - 2016

SUMMARY

Our plans for 2017 surveys:

Polish BASS: 02 May - 13 May
Polish BIAS: 13 September – 30 September

LAT-POL BASS: 18 May – 25 May
EST-POL BASS: 26 May – 31 May
LAT-POL BIAS: 11 October – 20 October
EST-POL BIAS: 21 October – 31 October

ACKNOWLEDGEMENTS

I would like to thank very much our colleagues for help in collecting and elaborating of biotic as well as acoustic data and for helping me with first steps of preparing data for reports, also this presentation, especially: **Włodzimierz Grygiel, Mirosław Wyszyński, Krzysztof Radtke, Jakub Słembarski, Fausts Svecovs, Elor Sepp, Lena Szymanek, Wojciech Deluga, Ireneusz Wybierała, Bartosz Witalis, Joanna Pawlak, Zuzanna Celmer and Beata Schmidt.**

Thank you for your attention!

95 YEARS MIR 1921 - 2016

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Finnish Baltic International Acoustic Survey in 2016
R/V Aranda

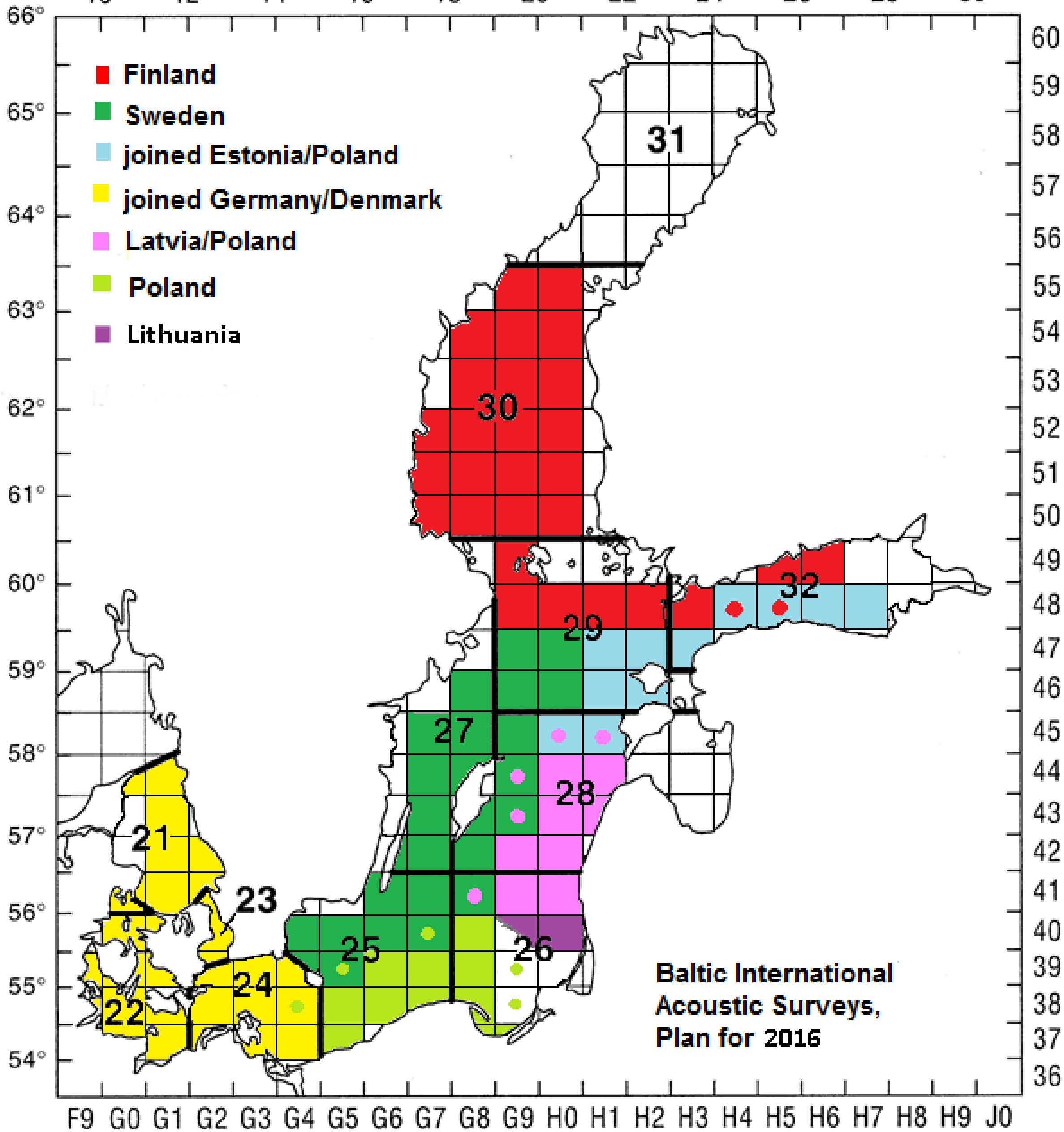
Cruise 17/2016

ICES_BIAS2016

22th September – 4th October 2016

PERSONNEL

Juha Lilja	Luke	Cruise Leader, Acoustics
Ari Leskelä	Luke	Fishing
Jukka Pönni	Luke	Fish sampling
Tero Saari	Luke	Fish sampling
Hannu Harjunpää	Luke	Fish sampling
Timo Myllylä	Luke	Fish sampling
Markku Vaajala	Luke	Fish sampling
Esa Lehtonen	Luke	Fishing
Arto Koskinen	Luke	Fish sampling
Jari Raitaniemi	Luke	Fish sampling
Erkki Jaala	Luke	Acoustics
Mikko Leminen	Luke	Acoustics
Katja Ikonen	Luke	Fish sampling
Perttu Rantanen	Luke	Database maintenance
Otto Kiukkonen	Pro fisherman	Fishing
Peter Koskinen	Pro fisherman	Fishing
Jari Johansson	Pro fisherman	Fishing
Markku Gavrilov	Luke	Fishing
Sami Vesala	Luke	Fishing/ Fish sampling
Yvette Heimbrand	SLU	Fish sampling
Anne Odelström	SLU	Fish sampling
Harri Vehviläinen	Luke	Fish sampling
Anu Lastumäki	SYKE	Fish sampling
Tanja Kinnunen	SYKE	Fish sampling


10° 12° 14° 16° 18° 20° 22° 24° 26° 28° 30°
66° 65° 64° 63° 62° 61° 60° 59° 58° 57° 56° 55° 54°
60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36
F9 G0 G1 G2 G3 G4 G5 G6 G7 G8 G9 H0 H1 H2 H3 H4 H5 H6 H7 H8 H9 J0
Finland
Sweden
joined Estonia/Poland
joined Germany/Denmark
Latvia/Poland
Poland
Lithuania
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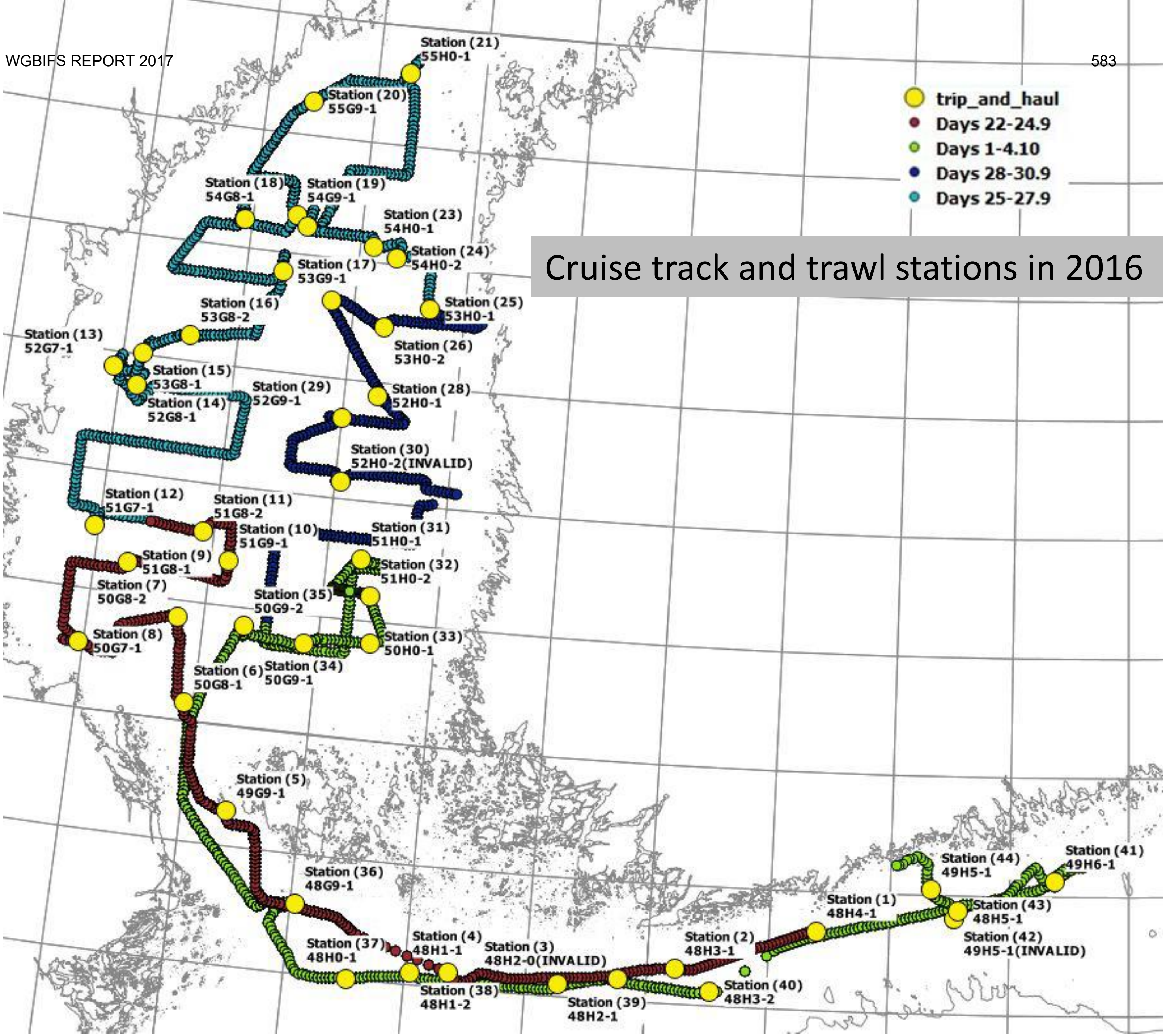
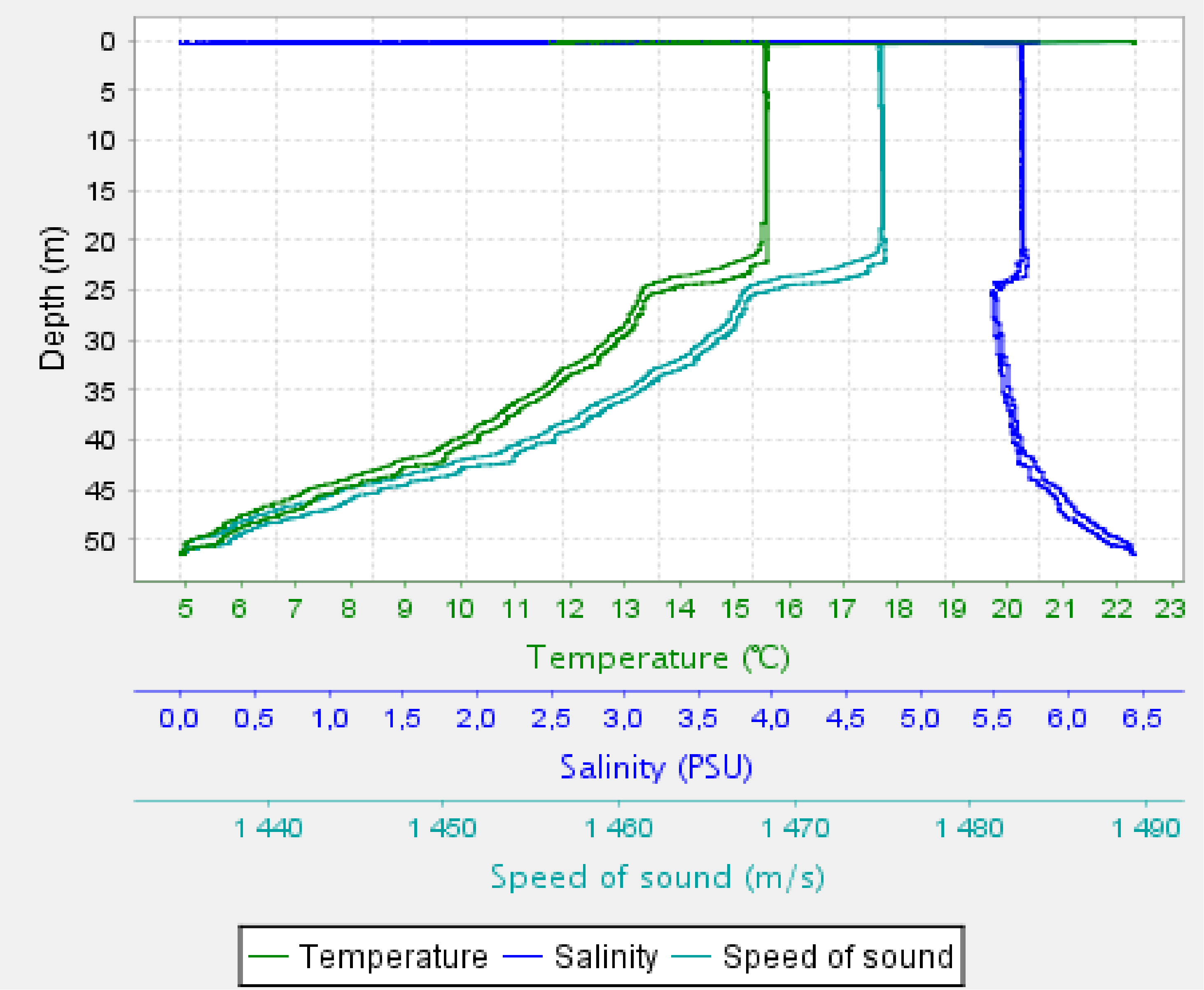
Baltic International
Acoustic Surveys,
Plan for 2016


Cruise track and trawl stations in 2016
trip_and_haul
Days 22-24.9
Days 1-4.10
Days 28-30.9
Days 25-27.9
Station (21) 55H0-1
Station (20) 55G9-1
Station (18) 54G8-1
Station (19) 54G9-1
Station (23) 54H0-1
Station (24) 54H0-2
Station (17) 53G9-1
Station (16) 53G8-2
Station (25) 53H0-1
Station (26) 53H0-2
Station (13) 52G7-1
Station (15) 53G8-1
Station (14) 52G8-1
Station (29) 52G9-1
Station (28) 52H0-1
Station (30) 52H0-2(INVALID)
Station (12) 51G7-1
Station (11) 51G8-2
Station (10) 51G9-1
Station (31) 51H0-1
Station (9) 51G8-1
Station (32) 51H0-2
Station (7) 50G8-2
Station (35) 50G9-2
Station (8) 50G7-1
Station (33) 50H0-1
Station (6) 50G8-1
Station (34) 50G9-1
Station (5) 49G9-1
Station (36) 48G9-1
Station (37) 48H0-1
Station (4) 48H1-1
Station (3) 48H2-0(INVALID)
Station (38) 48H1-2
Station (39) 48H2-1
Station (2) 48H3-1
Station (40) 48H3-2
Station (1) 48H4-1
Station (44) 49H5-1
Station (41) 49H6-1
Station (43) 48H5-1
Station (42) 49H5-1(INVALID)

CTD-calibration EK60



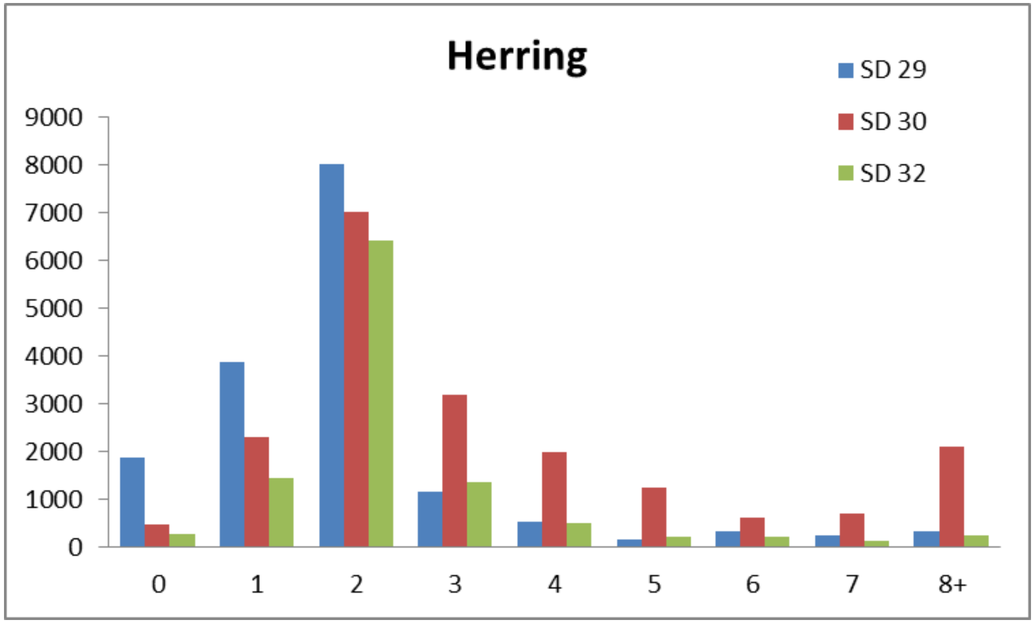

TCIU 453482 0
22G1

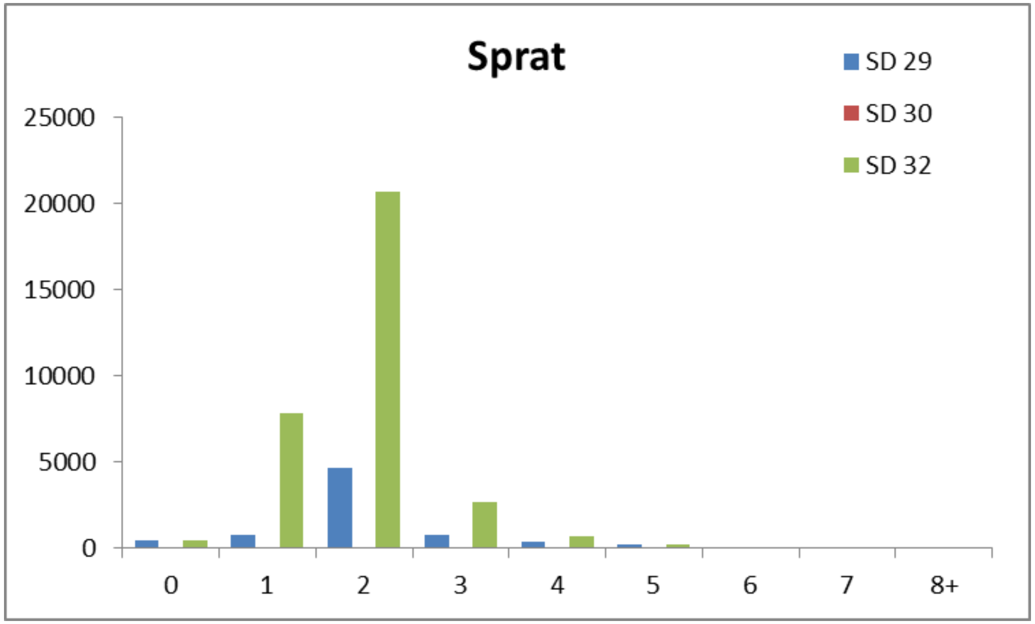
Haul nro	Haul name	Date	ICES SD	Start latitude	Start longitude	End latitude	End longitude	Haul duaration (min)	Haul speed (knot)	Haul distance (nmi)	Catch (kg)	Sample weight (kg)	Headrope depth (m)	Bottom depth (m)	Doors spread (m)	Trawl height (m)
1	48H4-1	22.09.2016	32	594993N	0242245E	595010N	0242375E	16	2.7	0.72	695	68.8	20	53	62.5	16
2	48H3-1	23.09.2016	32	593889N	0231304E	593895N	0231386E	10	2.5	0.42	80	26.4	25	56	62	16
3	48H2-0(INVALID)	23.09.2016	29	593520N	0224326E	593560N	0224570E	30	3	1.5	36		22	62	65	16
4	48H1-1	23.09.2016	29	593265N	0212500E	593399N	0212138E	90	2.5	3.75	70	20.75	12	120	58	16
5	49G9-1	23.09.2016	29	600630N	0192466E	600882N	0192327E	58	2.8	2.71	111.5	41.89	17	170	66.1	17
6	50G8-1	24.09.2016	30	603181N	0185593E	603461N	0185518E	62	2.6	2.69	216	39.5	17	90	64.9	17
7	50G8-2	24.09.2016	30	605193N	0184735E	605580N	0184660E	85	2.8	3.97	68	31	16	75	64.4	16
8	50G7-1	24.09.2016	30	604640N	0175180E	604648N	0175774E	75	2.4	3	528	66.6	25	55	66.2	20
9	51G8-1	24.09.2016	30	610662N	0181999E	610778N	0181738E	30	2.8	1.4	449	10.97	14	68	65.4	20
10	51G9-1	24.09.2016	30	610987N	0190919E	611131N	0190962E	30	2.9	1.45	68.5	32.16	15	70	64.2	20
11	51G8-2	25.09.2016	30	612001N	0185788E	611794N	0185447E	60	2.5	2.5	173	34.44	16	68	63.3	20
12	51G7-1	25.09.2016	30	611871N	0175889E	611581N	0175790E	69	2.8	3.22	108	31.12	15	70	66.2	20
13	52G7-1	25.09.2016	30	615911N	0175921E	615612N	0175600E	73	2.8	3.41	93	37.35	17	80	64.1	20
14	52G8-1	26.09.2016	30	615500N	0181234E	615220N	0180985E	65	2.9	3.14	196	51.64	13	85	63.2	20
15	53G8-1	26.09.2016	30	620284N	0181348E	620053N	0181031E	60	2.8	2.8	230	39.38	13	83	64.6	20
16	53G8-2	26.09.2016	30	620615N	0182969E	620647N	0183440E	49	2.8	2.29	78	35.94	13	90	65	20
17	53G9-1	26.09.2016	30	622887N	0191939E	622522N	0191988E	90	2.4	3.6	84	35.34	80	140	86.6	20
18	54G8-1	26.09.2016	30	624069N	0185473E	623719N	0185566E	93	2.3	3.57	61	61	90	210	90	17
19	54G9-1	26.09.2016	30	623680N	0192070E	623962N	0192355E	68	2.8	3.17	115	35.9	13	125	64.7	17
20	55G9-1	27.09.2016	30	630592N	0191760E	630848N	0192538E	100	2.8	4.67	152	42.94	15	185	64.3	20
21	55H0-1	27.09.2016	30	632101N	0202091E	631868N	0201742E	72	2.4	2.88	164	40.08	68	100	89.6	20
22	54G9-2	27.09.2016	30	624059N	0193205E	623698N	0192984E	90	2.4	3.6	108	48.93	80	135	98.9	20
23	54H0-1	27.09.2016	30	623543N	0200688E	623403N	0200715E	31	2.9	1.5	257	48.67	8	90	63.6	20
24	54H0-2	28.09.2016	30	623300N	0302093E	623173N	0202034E	29	2.8	1.35	136	49.24	10	70	65.2	20
25	53H0-1	28.09.2016	30	622167N	0203981E	621980N	0204128E	47	2.5	1.96	93	35.32	14	65	67	20
26	53H0-2	28.09.2016	30	621556N	0201988E	621403N	0201743E	40	2.7	1.8	106	38.32	19	120	64.7	20
27	53G9-2(INVALID)	29.09.2016	30	621944N	0195121E	621941N	0194761E	37	2.8	1.73	38.32		17	110	66.8	20
28	52H0-1	29.09.2016	30	615517N	0202220E	615673N	0201774E	60	2.7	2.7	316	65.44	15	110	62.1	20
29	52G9-1	29.09.2016	30	615018N	0195442E	615017N	0195999E	60	2.6	2.6	194	194	40	100	75	20
30	52H0-2(INVALID)	29.09.2016	30	613562N	0200027E	613441N	0200003E	32	2.4	1.28			85	120	85	20
31	51H0-1	01.10.2016	30	611487N	0202350E	611548N	0201806E	70	2.5	2.92	51	51	35	120	90	20
32	51H0-2	01.10.2016	30	610736N	0200421E	610635N	0202464E	48	2.5	2	172	47.32	17	103	62.2	24
33	50H0-1	02.10.2016	30	605528N	0203207E	605458N	0202675E	62	2.6	2.69	205	52.44	16	70	62	20
34	50G9-1	02.10.2016	30	605413N	0195804E	605278N	0195310E	68	2.4	2.72	195	46.91	22	93	62.6	22
35	50G9-2	02.10.2016	30	605351N	0192088E	605545N	0192124E	47	2.5	1.96	150	150	20	108	62.8	20
36	48G9-1	02.10.2016	29	594751N	0195515E	594756N	0200249E	87	2.6	3.77	310	59.16	37	190	95.4	20
37	48H0-1	02.10.2016	29	593000N	0203001E	592986N	0203175E	21	2.8	0.98	301	60.54	12	90	66.3	20
38	48H1-2	03.10.2016	29	593246N	0210210E	593310N	0210293E	17	2.8	0.79	512	69.54	12	105	65	20
39	48H2-1	03.10.2016	29	593340N	0221711E	593312N	0221632E	13	2.4	0.52	213	39.8	24	66	62.1	20
40	48H3-2	03.10.2016	32	593328N	0233027E	593354N	0233189E	20	2.5	0.83	353	54.58	30	84	77	20
41	49H6-1	03.10.2016	32	600319N	0262278E	600389N	0262297E	17	2.6	0.74	178	48.91	19	75	64.2	20
42	49H5-1(INVALID)	04.10.2016	32	595380N	0253169E	595426N	0253222E	12	2.6	0.52	41		21	73	66.1	20
43	48H5-1	04.10.2016	32	595539N	0253359E	595606N	0253450E	20	2.5	0.83	330	50.06	21	68	61.3	20
44	49H5-1	04.10.2016	32	600051N	0252093E	600138N	0252069E	22	2.4	0.88	573	46.6	23	60	61.2	20

Haul nro	Haul name	ICES SD	Aurelia aurita	Clupea harengus	Cyclopterus lumpus	Gasterosteus aculeatus	Hyperoplus lanceolatus	Lampetra fluviatilis	Liparis liparis	Nerophis ophidion	Osmerus eperlanus	Platichthys flesus	Pomatoschistus microps	Pomatoschistus minutus	Pungitius pungitius	Saduria entomon	Salmo salar	Sprattus sprattus	Zoarces viviparus	"Waste"	Total (kg)
1	48H4-1	32		24.80		4.32					9.94			0.81	0.04			654.29		0.81	654.3
2	48H3-1	32		18.48		2.82					0.38				0.06	0.00		53.30		4.96	53.3
4	48H1-1	29	0.91	3.63		2.12					0.15				0.03	0.00		61.51		1.65	61.5
5	49G9-1	29		81.00		10.87	0.12							0.00	0.02			15.62		3.88	81.0
6	50G8-1	30		186.45		20.31	0.01								0.01	0.01		3.04		6.13	186.4
7	50G8-2	30		39.80		26.28									0.00	0.01		0.13		1.78	39.8
8	50G7-1	30		508.94		7.20	0.02								0.00	0.00		8.16		3.68	508.9
9	51G8-1	30		1.24		419.25	0.08								0.04		0.34	1.16		26.89	419.2
10	51G9-1	30		54.17		14.02									0.00			0.15		0.15	54.2
11	51G8-2	30		138.94		34.05										0.01					138.9
12	51G7-1	30		77.48		30.26	0.01									0.00				0.25	77.5
13	52G7-1	30		85.88		4.45	0.01								0.01					2.65	85.9
14	52G8-1	30		180.98		13.95				0.00						0.08		0.61		0.38	181.0
15	53G8-1	30		217.74		11.72			0.01						0.03	0.14		0.08		0.29	217.7
16	53G8-2	30		67.84		10.10									0.02	0.02				0.04	67.8
17	53G9-1	30		76.60		6.08	0.01		0.37						0.01	0.04					76.6
18	54G8-1	30		57.15		0.52	0.03		0.32					0.00	0.00	0.01				2.12	57.2
19	54G9-1	30		107.22		5.52	0.15		0.05						0.01	0.02		0.81		1.22	107.2
20	55G9-1	30		127.17		8.27	0.01			0.00	0.05			0.00		0.04		9.95		6.49	127.2
21	55H0-1	30		158.56		0.69	0.00		0.11		1.10		0.00		0.00	0.04	0.28	2.04	0.02	1.15	158.6
22	54G9-2	30		105.25		0.13			0.24	0.00	0.37					0.05				1.96	105.2
23	54H0-1	30		235.24		19.27	0.02			0.02					0.06	0.03		0.08		2.28	235.2
24	54H0-2	30		109.17		20.80		0.04			0.57				0.01	0.01		0.22		5.18	109.2
25	53H0-1	30		71.53		18.95				0.00	0.07					0.00		0.89		1.56	71.5
26	53H0-2	30		78.98		21.79	0.00		0.03									0.24		4.96	79.0
28	52H0-1	30		311.78		2.45	0.00			0.00					0.02			0.29		1.45	311.8
29	52G9-1	30		10.55		182.78	0.01			0.00								0.32			182.8
31	51H0-1	30		27.47		18.42				0.00					0.03	0.00		0.02	0.04	1.02	27.5
32	51H0-2	30		71.24		100.14									0.01			0.18		0.43	100.1
33	50H0-1	30		109.93		85.49	0.00			0.00					0.00		0.41	6.78	0.02	2.37	109.9
34	50G9-1	30		140.93		41.23										0.01		11.58		1.25	140.9
35	50G9-2	30		20.08		129.30				0.00	0.00					0.00		0.44		0.17	129.3
36	48G9-1	29		159.04		13.53	0.03				0.22				0.01			136.01		1.17	159.0
37	48H0-1	29		248.11		12.74									0.01			25.58		14.55	248.1
38	48H1-2	29	3.48	397.47	0.06	9.25												94.28		7.45	397.5
39	48H2-1	29	3.09	93.91		1.10	0.02				0.09				0.02	0.02		105.52	0.04	9.19	105.5
40	48H3-2	32	0.06	2.35		0.15				2.35					0.01			346.07		1.99	346.1
41	49H6-1	32		100.97		0.97				0.00	4.76				0.01			63.38		7.91	101.0
43	48H5-1	32		165.43		3.07				0.00	1.80	0.14			0.04			159.52			165.4
44	49H5-1	32		460.46		1.13					1.91				0.01	0.00		108.17		1.32	460.5
Total			**7.55**	**5133.98**	**0.06**	**1315.45**	**0.53**	**0.04**	**1.13**	**2.39**	**21.43**	**0.14**	**0.00**	**0.81**	**0.53**	**0.54**	**1.03**	**1870.40**	**0.13**	**130.72**	**6939.8**

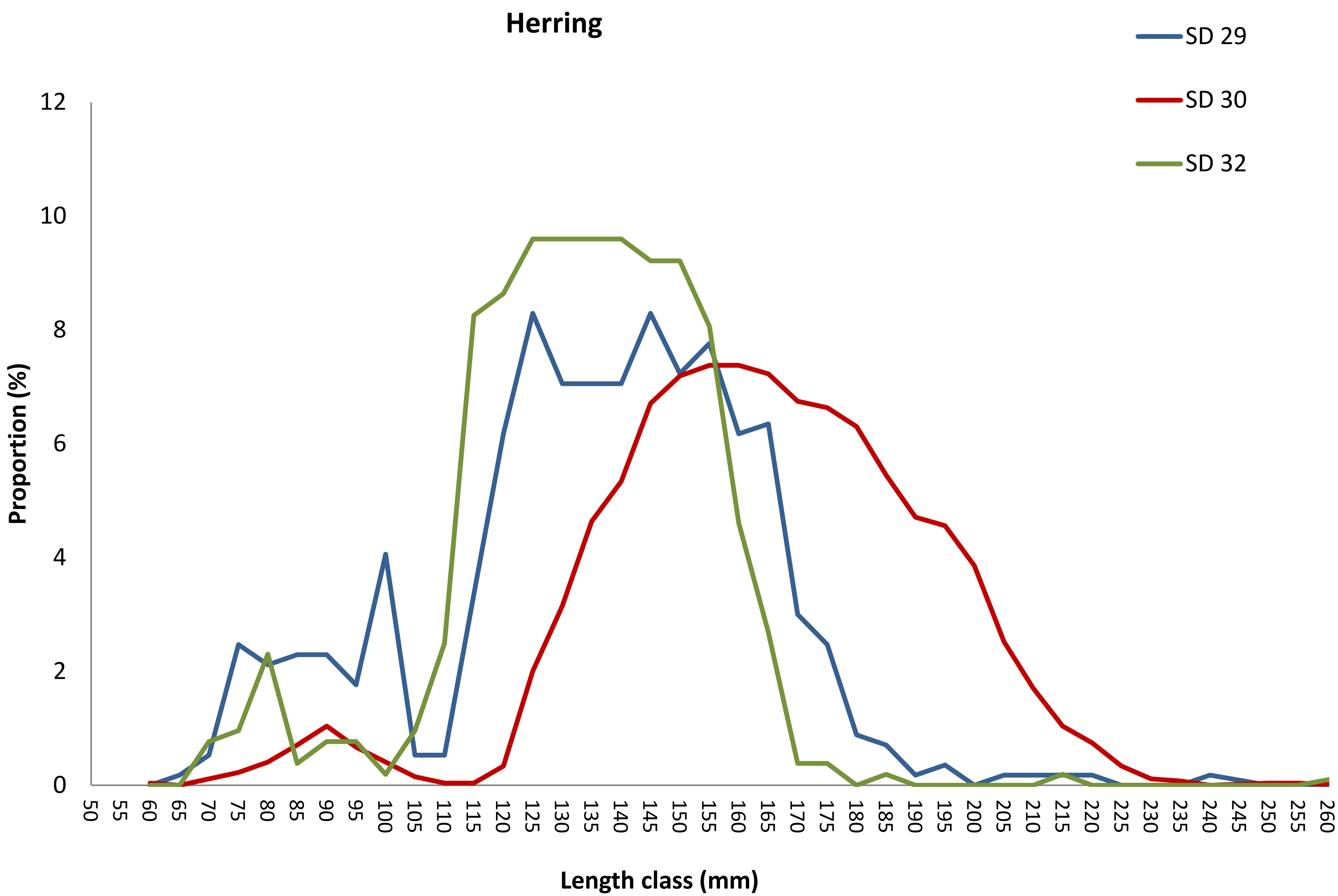
Results

ICES SD	ICES Rect.	NM	N (million/nm²)	Area (nm²)	Sa (m²/nm²)	σ (cm²)	N total (million)	Herring (%)	Sprat (%)	Cod (%)
29	48G9	65	7.551482	772.8	789	1.045365	5836	58.9	30.0	0
29	48H0	61	5.550355	730.3	952	1.714755	4053	74.0	6.8	0
29	48H1	57	11.258670	544	1491	1.324108	6125	64.5	25.2	0
29	48H2	71	14.014105	597	1944	1.387496	8366	53.7	42.6	0
32	48H3	55	25.449869	615.7	2572	1.010686	15669	6.8	86.3	0
32	48H4	44	18.391186	835.1	1813	0.985664	15358	5.0	86.9	0
32	48H5	60	12.667041	767.2	1776	1.401875	9718	51.4	42.1	0
29	49G9	76	5.050568	564.2	706	1.397885	2850	59.8	10.1	0
32	49H5	19	5.190208	306.9	864	1.665052	1593	79.4	19.2	0
32	49H6	53	7.792386	586.5	1186	1.521502	4570	60.8	34.5	0
30	50G7	27	2.550247	403.1	522	2.046998	1028	93.8	1.1	0
30	50G8	61	3.104480	833.4	383	1.232636	2587	56.3	0.7	0
30	50G9	72	5.478775	879.5	381	0.695841	4819	14.2	1.1	0
30	50H0	37	3.818359	795.1	277	0.724586	3036	26.8	1.0	0
30	51G7	36	3.485320	614.5	309	0.887547	2142	23.6	0.0	0
30	51G8	61	5.656325	863.7	741	1.310854	4885	41.1	0.0	0
30	51G9	57	3.544268	865.8	483	1.361671	3069	45.6	0.1	0
30	51H0	113	4.214350	865.7	312	0.740196	3648	17.1	0.0	0
30	52G7	29	1.220099	482.6	305	2.496667	589	78.2	0.0	0
30	52G8	80	2.784527	852	553	1.986211	2372	66.3	0.2	0
30	52G9	60	1.702613	852	261	1.534196	1451	25.4	0.0	0
30	52H0	77	1.023037	852	271	2.653370	872	95.8	0.1	0
30	53G8	61	2.325741	838.1	475	2.043236	1949	74.2	0.0	0
30	53G9	61	1.129408	838.1	251	2.220022	947	73.4	0.0	0
30	53H0	62	5.492220	838.1	558	1.016509	4603	29.0	0.2	0
30	53H1	9	6.593151	126.6	621	0.942162	835	27.4	0.3	0
30	54G8	33	1.241488	642.2	381	3.071477	797	94.4	0.0	0
30	54G9	91	0.855443	824.2	220	2.569571	705	85.7	0.3	0
30	54H0	47	3.564550	727.9	722	2.024741	2595	64.8	0.0	0
30	55G9	29	1.023572	625.6	175	1.710784	640	70.5	4.9	0
30	55H0	39	1.195182	688.6	294	2.463472	823	96.6	0.9	0
		1703								

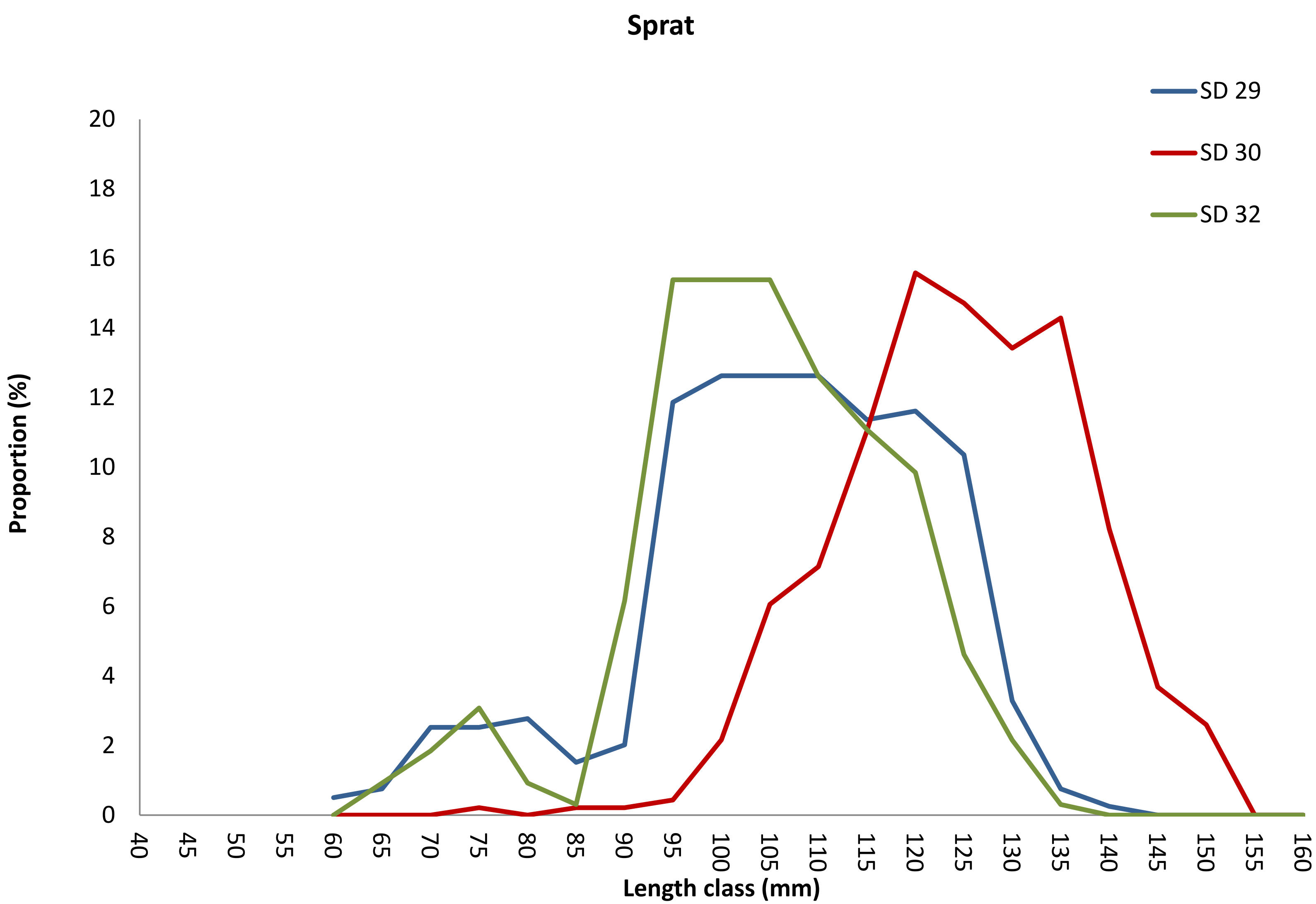

Herring
SD 29
SD 30
SD 32
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
1
2
3
4
5
6
7
8+


Sprat
SD 29
SD 30
SD 32
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
7
8+

Length distributions of measured herring in three different Sub-Division.



Length distributions of measured sprat in three different Sub-Division



THE JOINT LATVIAN-POLISH
BALTIC ACOUSTIC SPRING SURVEY – BASS 2016
ON THE R/V “BALTICA”
IN THE ICES SUBDIVISIONS 26N AND 28.2 OF THE BALTIC SEA
(12 – 21 MAY 2016)

BIOR
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MIR NATIONAL MARINE FISHERIES RESEARCH INSTITUTE

WGBIFS - Riga, Latvia, 27-31.03.2017

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MIR
NATIONAL MARINE FISHERIES RESEARCH INSTITUTE

Equipment:

Echosounder – SIMRAD EK-60 38 & 120 kHz

Trawl – WP53/64×4:

- **Vertical opening – 20 m**
- **Horizontal opening – 70 m**
- **Mesh size at codend – 6 mm (bar)**

IDRONAUT CTD & bathometer rosette sampler

Automatic meteorological station – “Milosz”

Judday net 160 μm mesh, 0.1 m^2 mouth opening

IKS-80 net 500 μm mesh , 0.5 m^2 mouth opening

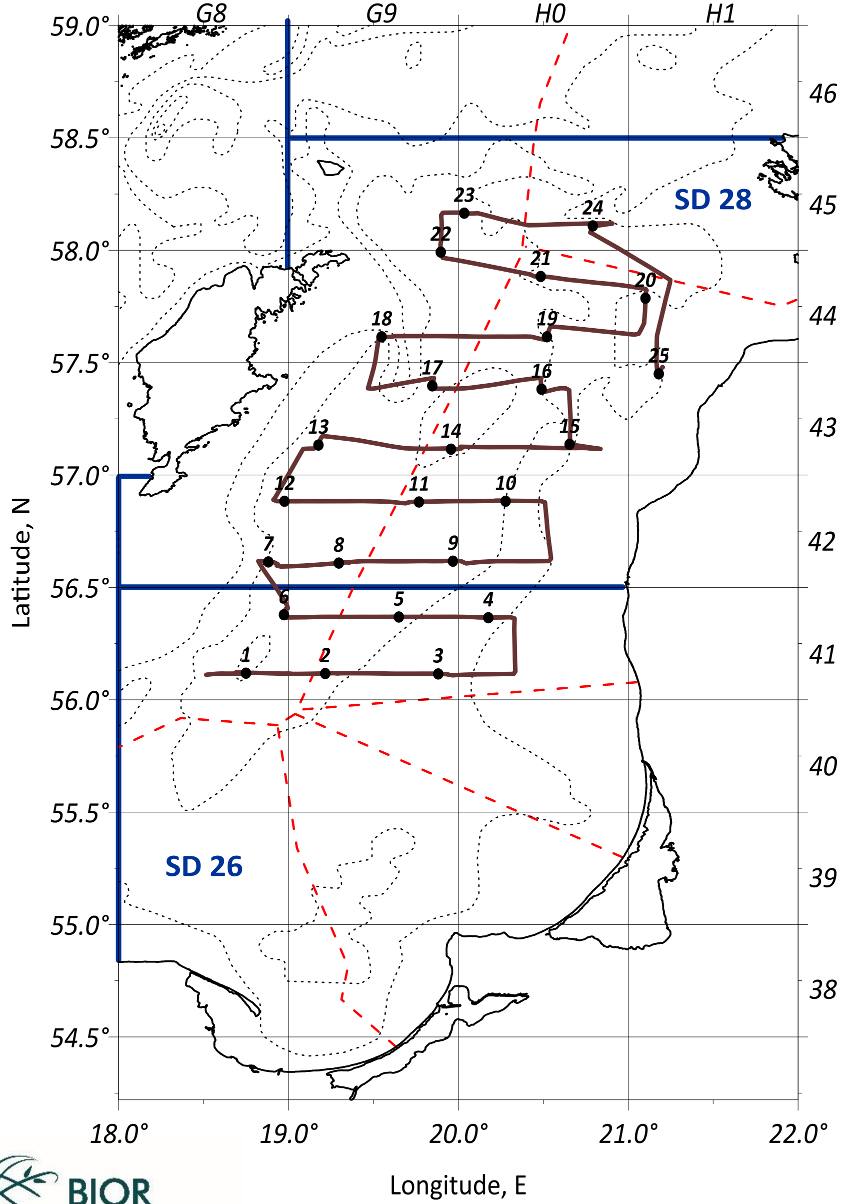
WGBIFS - Riga, Latvia, 27-31.03.2017

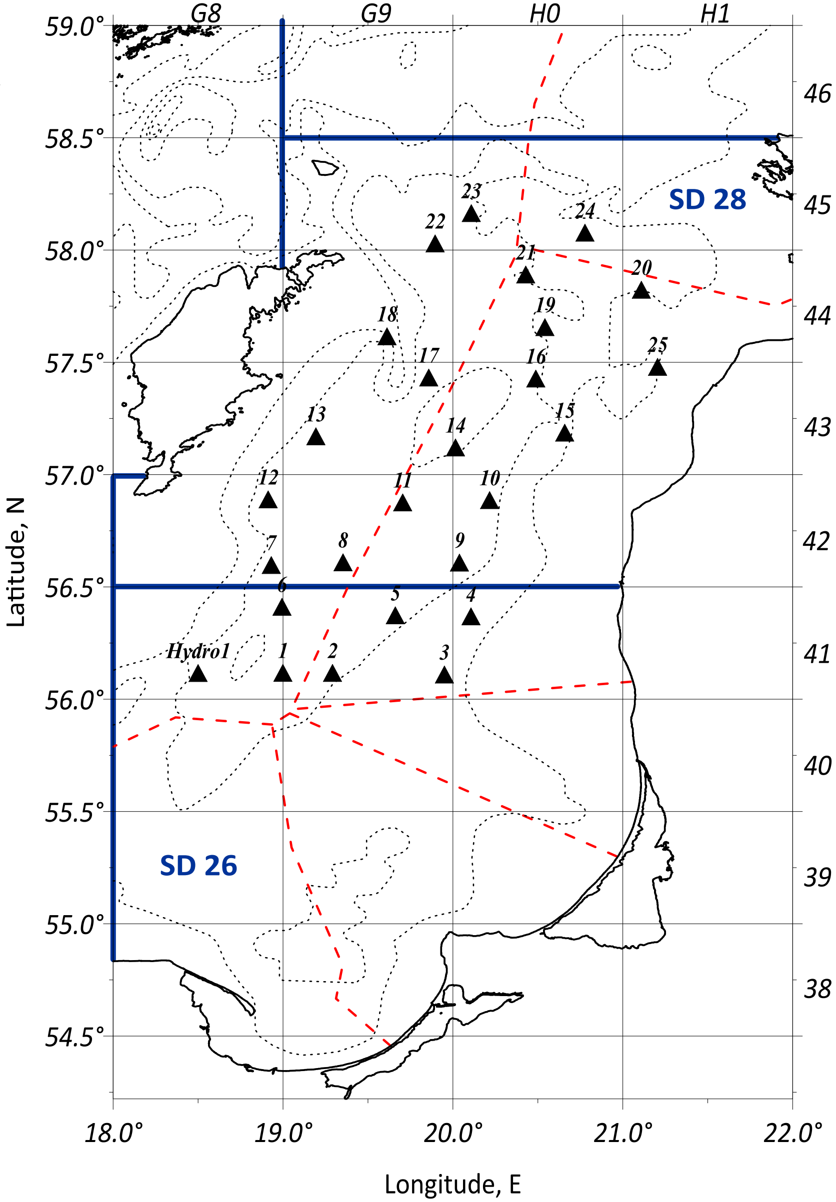
Scope of work

- **Days at sea – 10**
- **Survey tracks – 645 nm**
- **Control trawlings - 25**
- **Hydrological and hydrobiological stations - 26**
- **Ichthyoplankton samples – 52**
- **Zooplankton samples - 41**

WGBIFS - Riga, Latvia, 27-31.03.2017

Survey tracks and stations

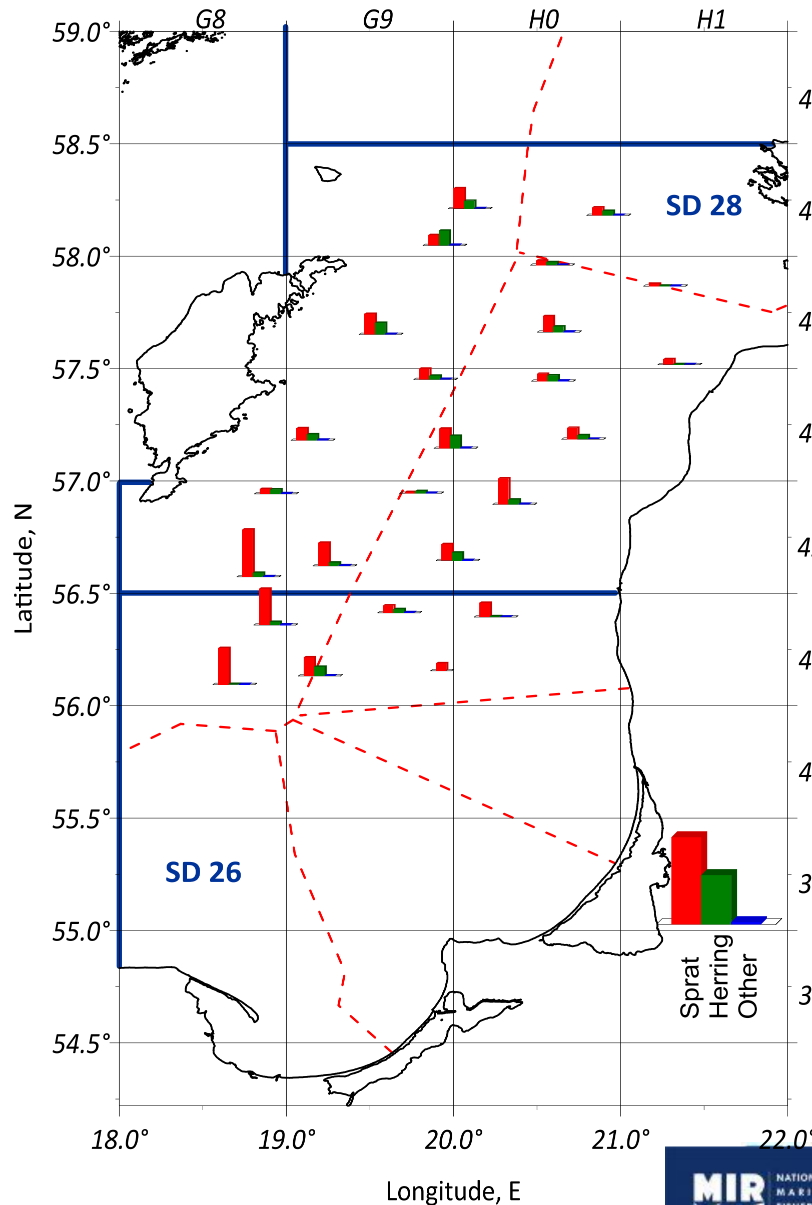




WGBIFS - Riga, Latvia, 27-31.03.2017

Catch, kg

Species	SD26	SD28	SD26+28
Sprat	4183.672	9219.826	13403.500
Herring	538.138	3520.972	4059.110
Cod	15.067	62.241	77.308
Flounder	1.792	10.902	12.694
Lumpfish	0.250		0.250
Threespine stickleback		5.729	5.729
Ninespine stickleback		0.002	0.002
Total	4738.919	12819.670	17558.590

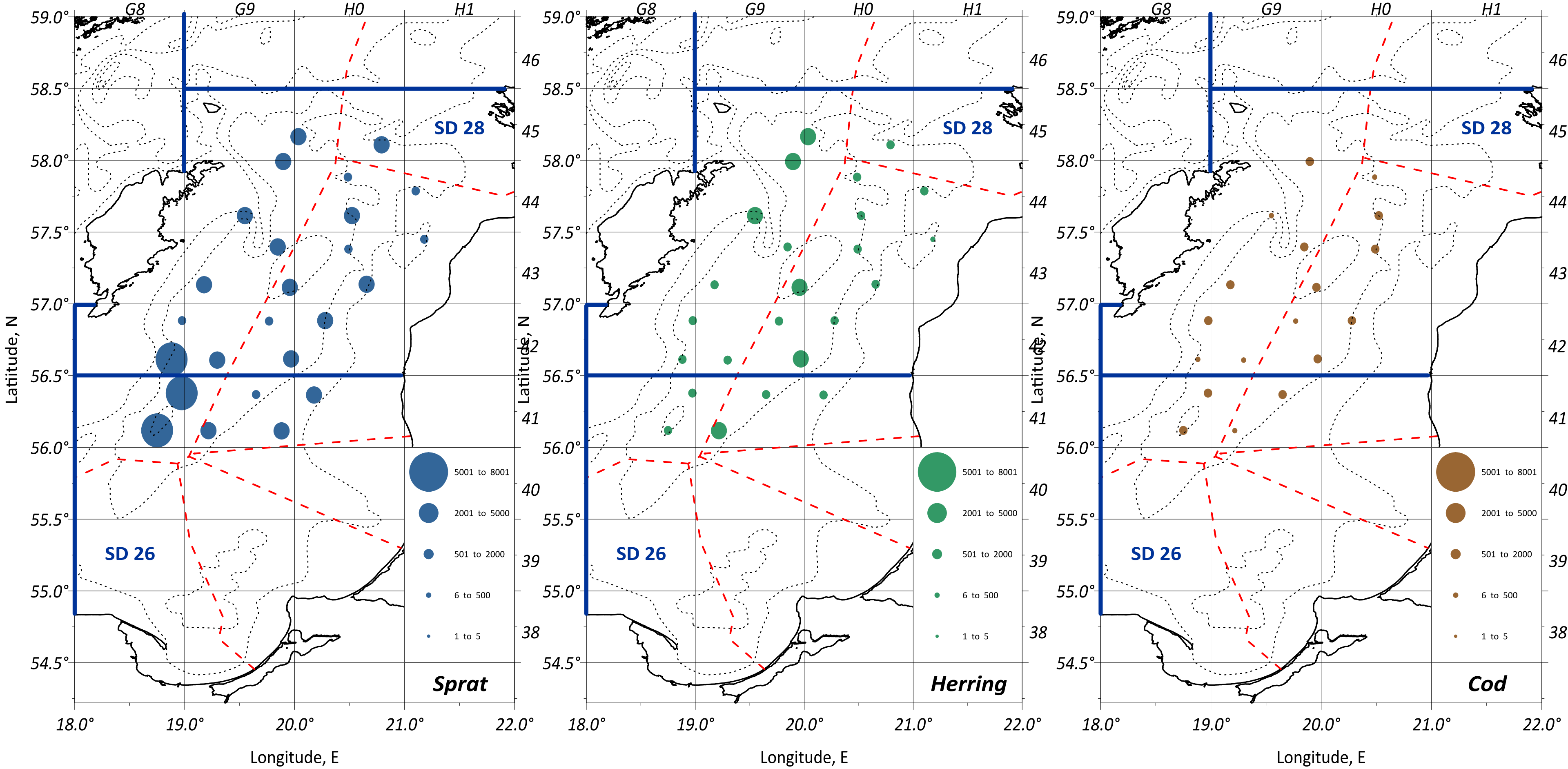


Measured and analyzed fish

Fish species	Number of measured individuals			Number of aged individuals		
	SD 26	SD 28	SD 26+28	SD 26	SD 28	SD 26+28
Sprat (Total)	1220	3852	5072	594	1904	2498
Sprat (Age 1)	126	447	573	83	262	345
Herring (Total)	717	3366	4083	287	1700	1987
Open sea herring	632	3024	3656	252	1527	1779
Gulf herring	15	293	308	6	144	150
Southern Baltic herring	70	49	119	29	29	58
Cod	52	220	272			
Flounder	13	76	89			
Lumpfish	1		1			
Stickleback, threespine		122	122			
Stickleback, ninespine		1	1			
Total	**2003**	**5322**	**9640**	**881**	**3604**	**4485**

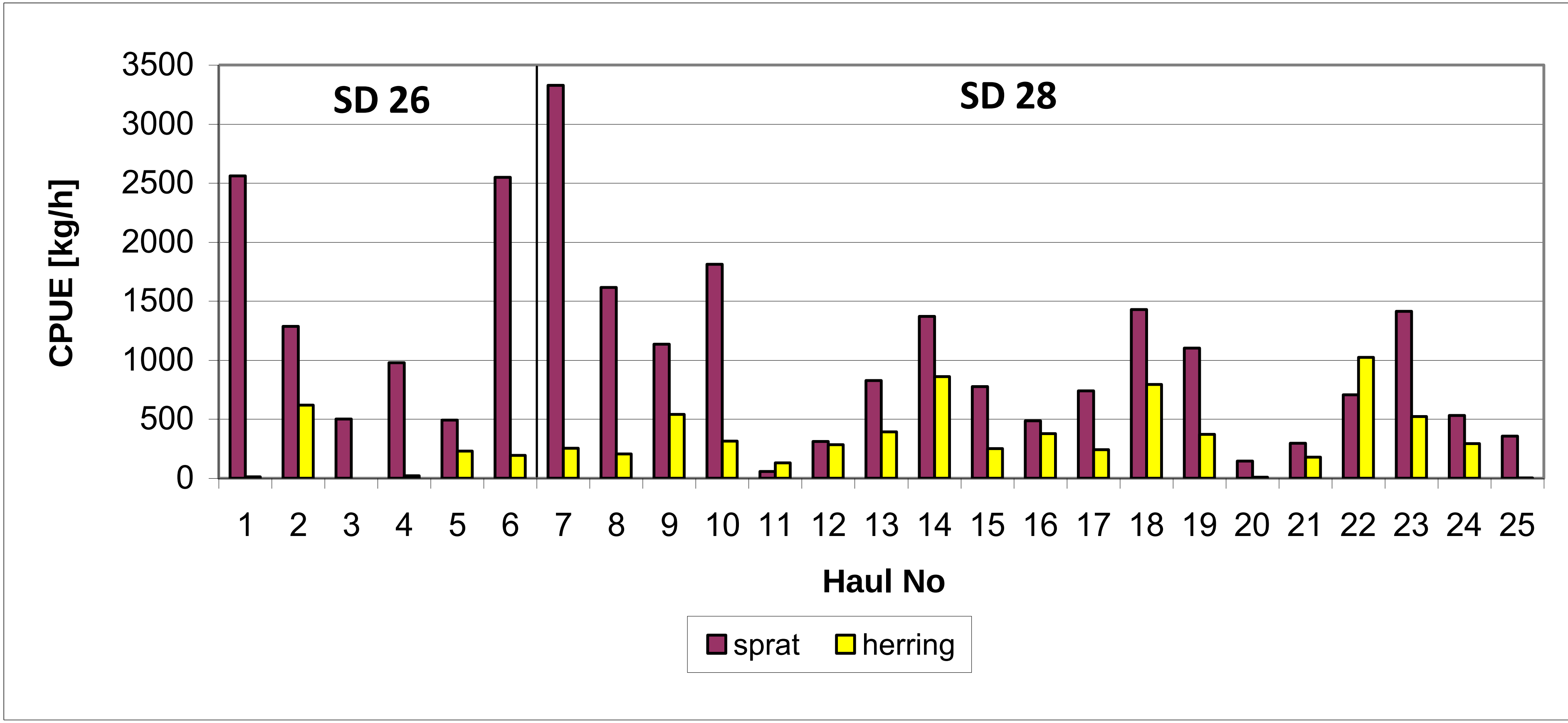
WGBIFS - Riga, Latvia, 27-31.03.2017

CPUE, kg/h



WGBIFS - Riga, Latvia, 27-31.03.2017

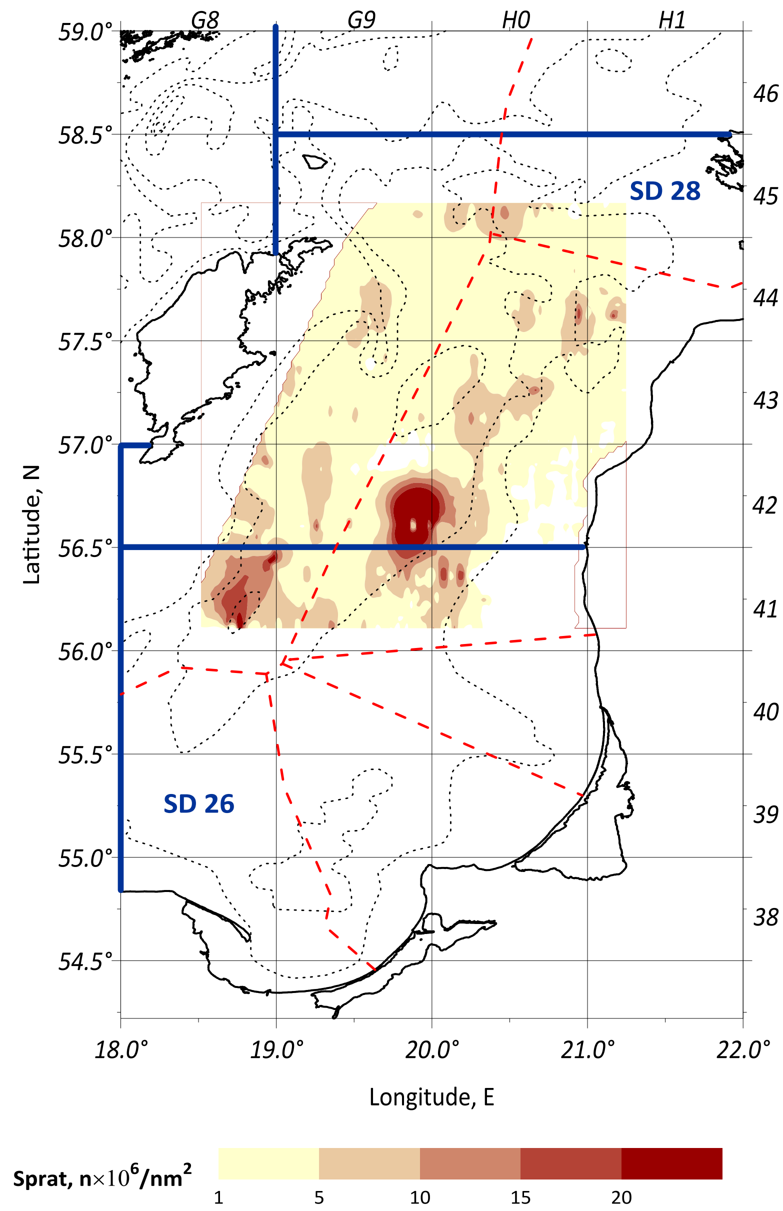
CPUE, kg/h



WGBIFS - Riga, Latvia, 27-31.03.2017

Sprat in May 2016

ICES SD	Abundance $[n\times10^6]$	Biomass $[kg\times10^3]$
26	17140.01	117382.99
28	43592.14	275190.86
∑	60732.16	392573.85



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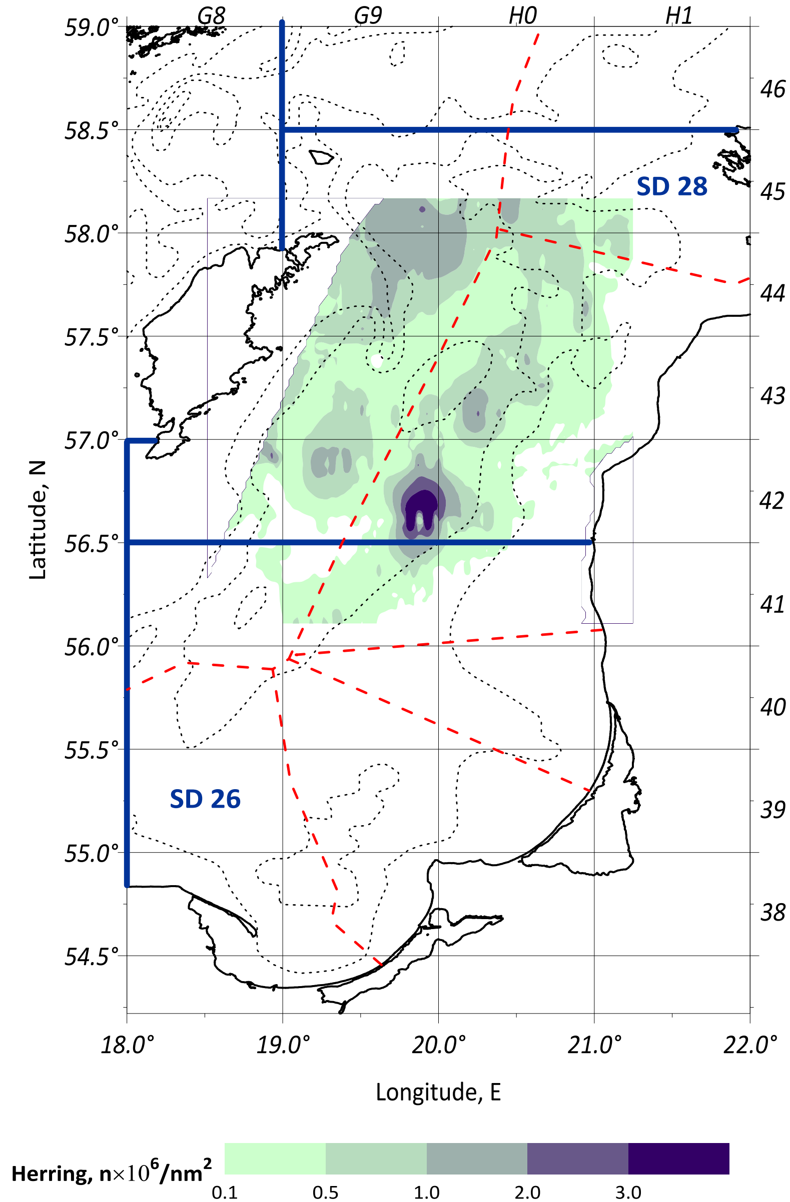
WGBIFS - Riga, Latvia, 27-31.03.2017

Herring in May 2016

ICES SD	Abundance [n×10⁶]	Biomass [kg×10³]
26	233.49	9491.61
28	4416.38	105740.50
∑	4649.87	115232.11

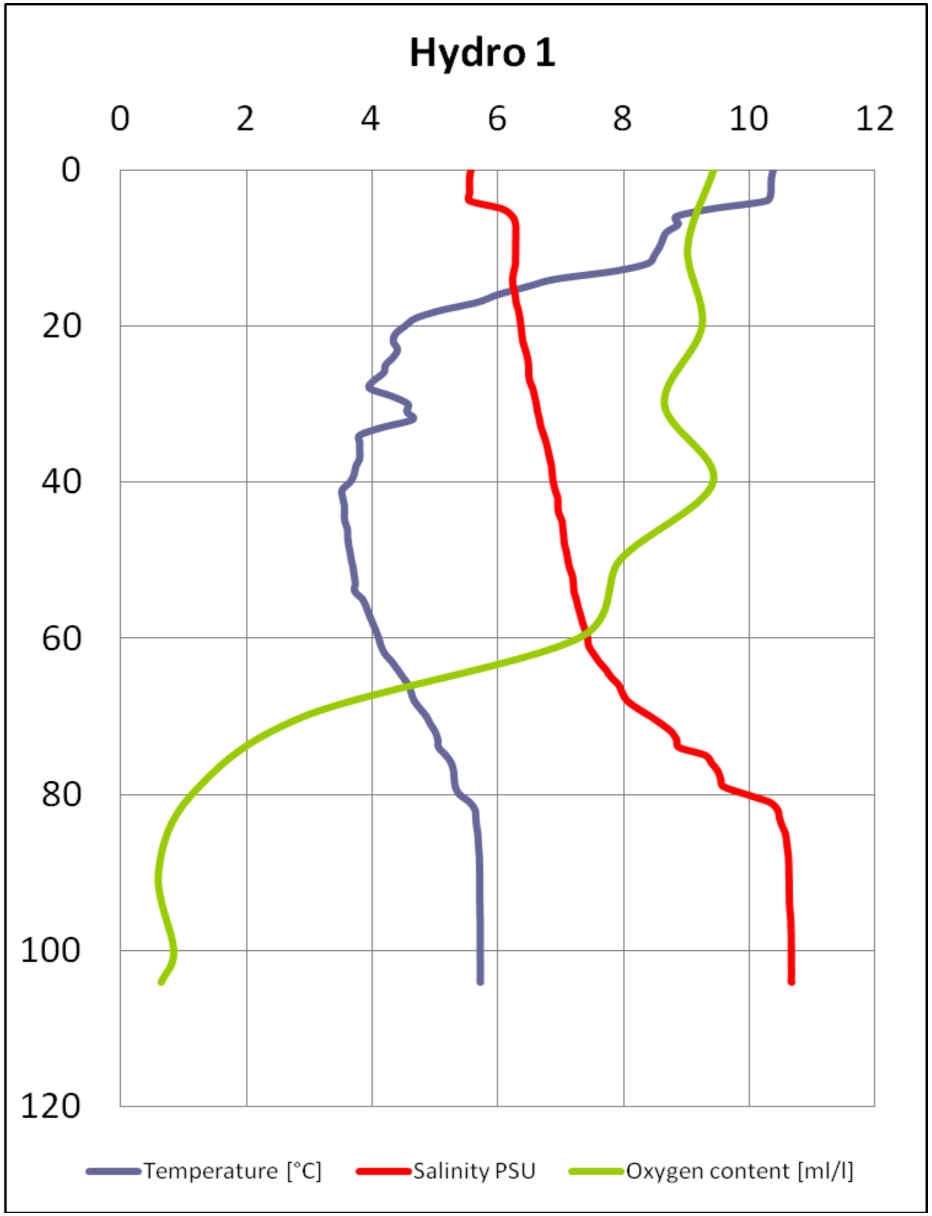


WGBIFS - Riga, Latvia, 27-31.03.2017

Zooplankton in May 2016

Species or group	Whole aquatory All stations (26) [0-100 layer]		Stations (13) with depth more than 100m [0-50 layer]		Stations (19) with depth more than 100m [0-100 layer]		Stations (7) with depth less than 100m [0-bottom layer]	
	n\m³	mg\m³	n\m³	mg\m³	n\m³	mg\m³	n\m³	mg\m³
Acartia spp.	2870	33.43	3524	35.78	3014	35.17	2331	26.95
Eurytemora affinis	3	0.09	5	0.13	1	0.05	7	0.24
Temora longicornis	1330	24.69	1314	16.25	1391	26.10	1100	19.43
Centropages hamatus	1658	14.46	2071	15.09	1811	15.59	1088	10.26
Pseudocalanus sp.	2843	26.27	2459	14.05	3354	31.72	937	5.96
Oithona sp.	3	0.02			4	0.02		
Bosmina spp.	3	0.02	5	0.05	3	0.02	3	0.02
Evadne spp.	663	19.59	731	20.68	659	19.21	678	20.98
Podon spp.	47	0.47	69	0.62	44	0.43	58	0.62
Synchaeta spp.	4377	26.26	6028	36.17	3817	22.90	6466	38.80
Polychaeta sp.	99	2.96	28	0.84	94	2.82	116	3.48
Bivalvia larvae	96	0.10	113	0.11	88	0.09	126	0.13
Fritillaria borealis	1619	16.19	1518	15.18	1562	15.62	1831	18.31
Copepoda	8705	98.96	9374	81.29	9576	108.65	5463	62.85
Cladocera	713	20.08	805	21.34	706	19.67	739	21.61
Rotatoria	4377	26.26	6028	36.17	3817	22.90	6466	38.80
Varia	1813	19.25	1659	16.13	1744	18.53	2073	21.91
Total	15609	164.55	17866	154.93	15842	169.75	14741	145.17

Hydrology in May 2016



THE JOINT LATVIAN-POLISH
BALTIC INTERNATIONAL ACOUSTIC SURVEY – BIAS 2016
ON THE R/V “BALTICA”
IN THE ICES SUBDIVISIONS 26N AND 28.2 OF THE BALTIC SEA
(11-20 October 2016)

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MIR NATIONAL MARINE FISHERIES RESEARCH INSTITUTE

WGBIFS - Riga, Latvia, 27-31.03.2017

WGBIFS - Riga, Latvia, 27-31.03.2017

Equipment:

Echosounder – SIMRAD EK-60 38 & 120 kHz

Trawl – WP53/64×4:

- Vertical opening – 20 m
- Horizontal opening – 70 m
- Mesh size at codend – 6 mm (bar)

IDRONAUT CTD & bathometer rosette sampler

Automatic meteorological station – “Milosz”

WGBIFS - Riga, Latvia, 27-31.03.2017

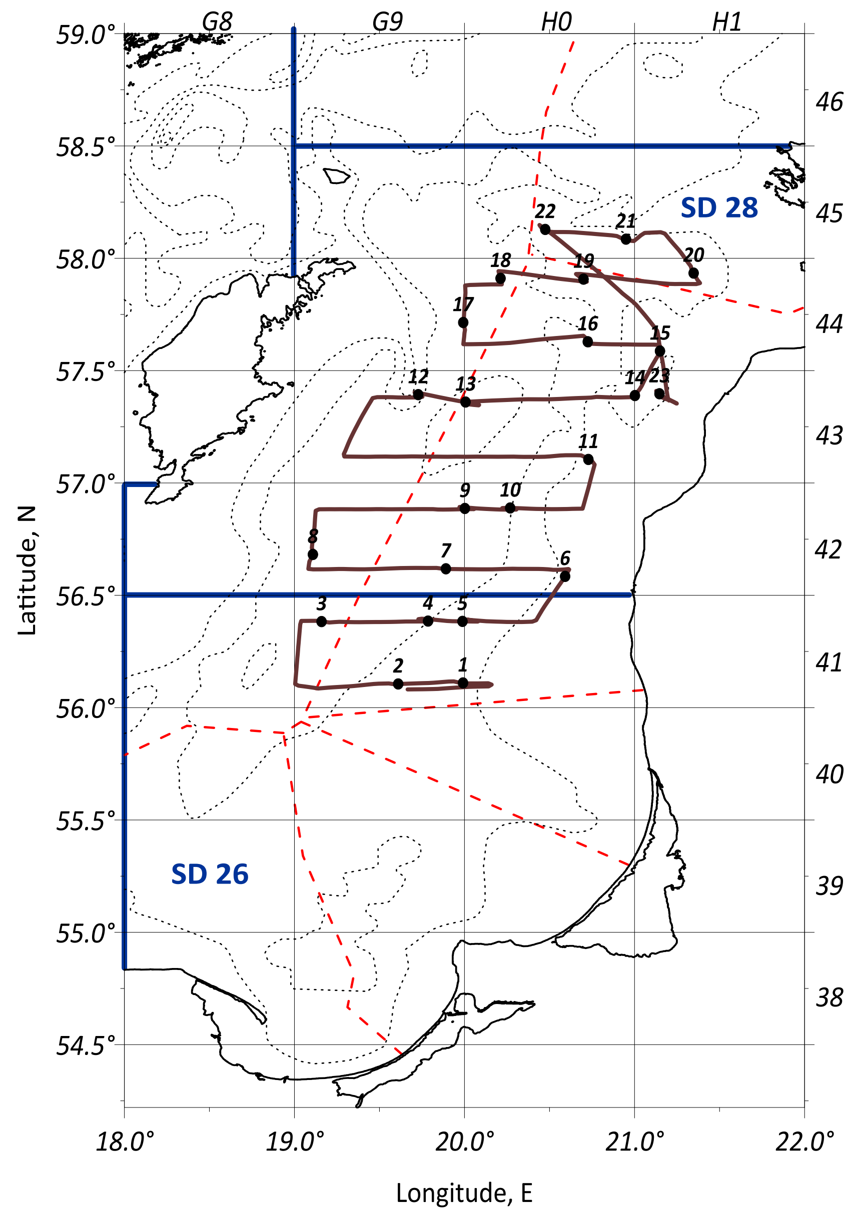
Scope of work

- Days at sea – 10
- Survey tracks – 628 nm
- Control trawlings - 23
- Hydrological stations – 25

ICES CIEM

WGBIFS - Riga, Latvia, 27-31.03.2017

Survey tracks and control trawl positions



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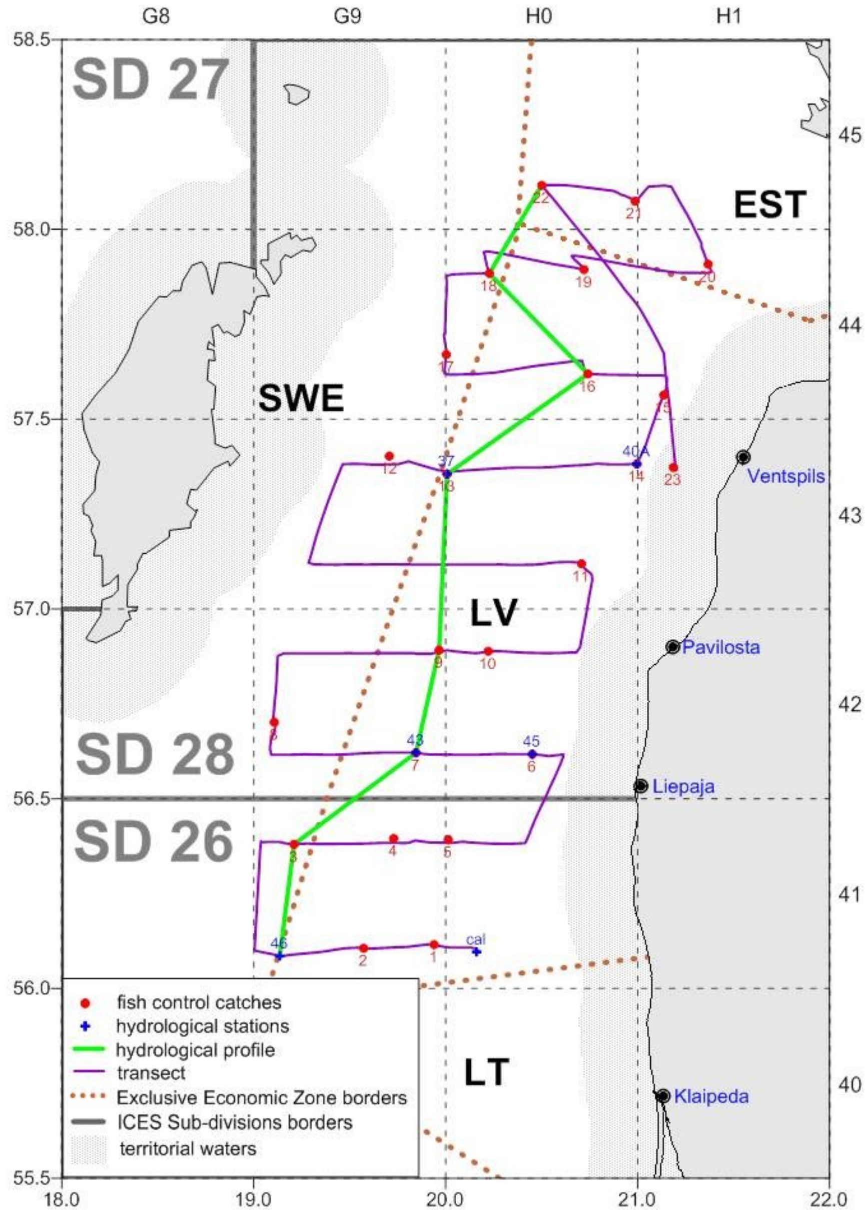
WGBIFS - Riga, Latvia, 27-31.03.2017

Survey stations and hydrological profile



ICES CIEM

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WGBIFS - Riga, Latvia, 27-31.03.2017

Catch, kg

Species	SD26	SD28	SD26+28
Sprat	9607.591	6634.588	9607.591
Herring	1468.692	1123.954	1468.692
Cod	4.567	2.750	7.317
Flounder		0.495	0.495
Shorthorn sculpin	0.165		0.165
Lumpfish	0.397		0.397
Threespine stickleback	0.439	267.339	267.778
Ninespine stickleback		0.360	0.360
Salmon	3.515	3.065	6.580
Total	**3326.824**	**8032.551**	**11359.375**

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Measured and analyzed fish

Fish species	Number of measured individuals			Number of aged individuals		
	SD 26	SD 28	SD 26+28	SD 26	SD 28	SD 26+28
Sprat (all)	1014	3576	4590	466	1695	2161
Sprat (yearclass 0)	43	381	424	43	201	244
Herring (all)	421	1850	2271	200	1048	1248
Open sea herring	359	1460	1819	169	824	993
Spring spawners	359	1459	1818	169	823	992
Autumn spawners		1	1		1	1
Gulf herring	4	381	385	2	219	221
Southern Baltic herring	58	9	67	29	5	34
Cod	11	8	19			
Flounder		4	4			
Lumpfish	2		2			
Salmon	1	1	2			
Stickleback, threespine	15	668	683			
Stickleback, ninespine		46	46			
Shorthorn sculpin	1		1			
Total	**1465**	**6153**	**7618**	**666**	**2743**	**3409**

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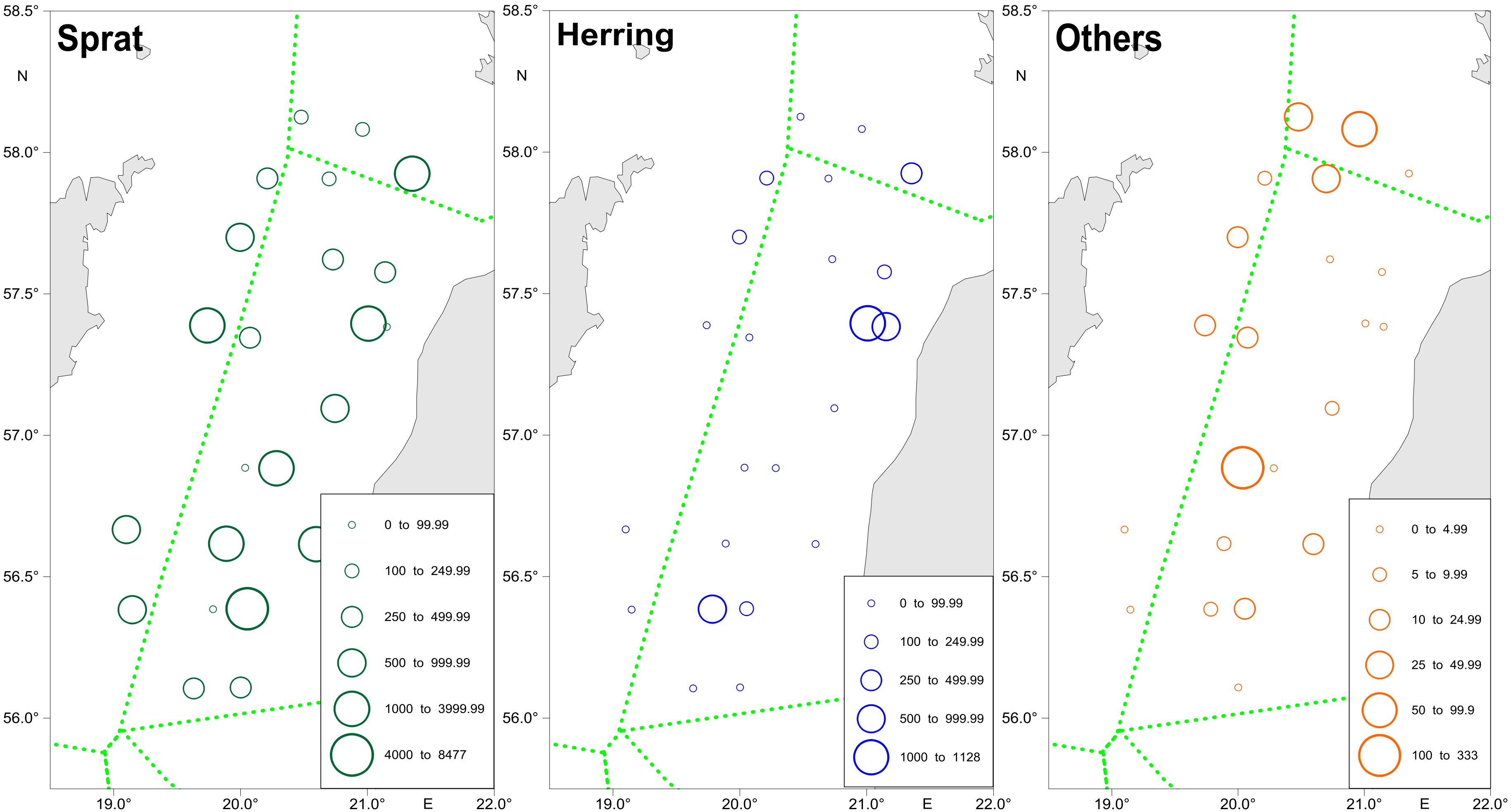
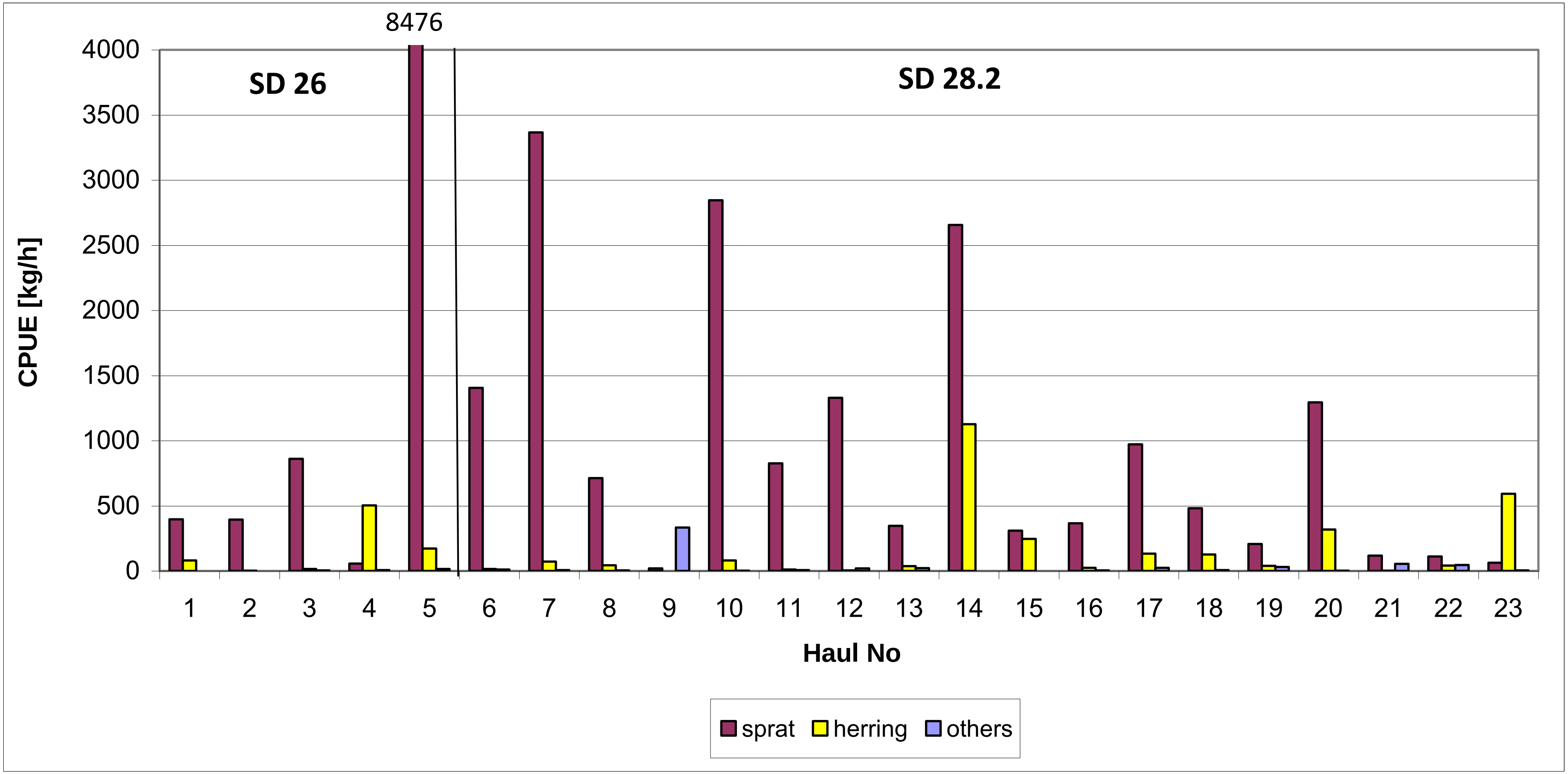
WGBIFS - Riga, Latvia, 27-31.03.2017

CPUE, kg/h



WGBIFS - Riga, Latvia, 27-31.03.2017

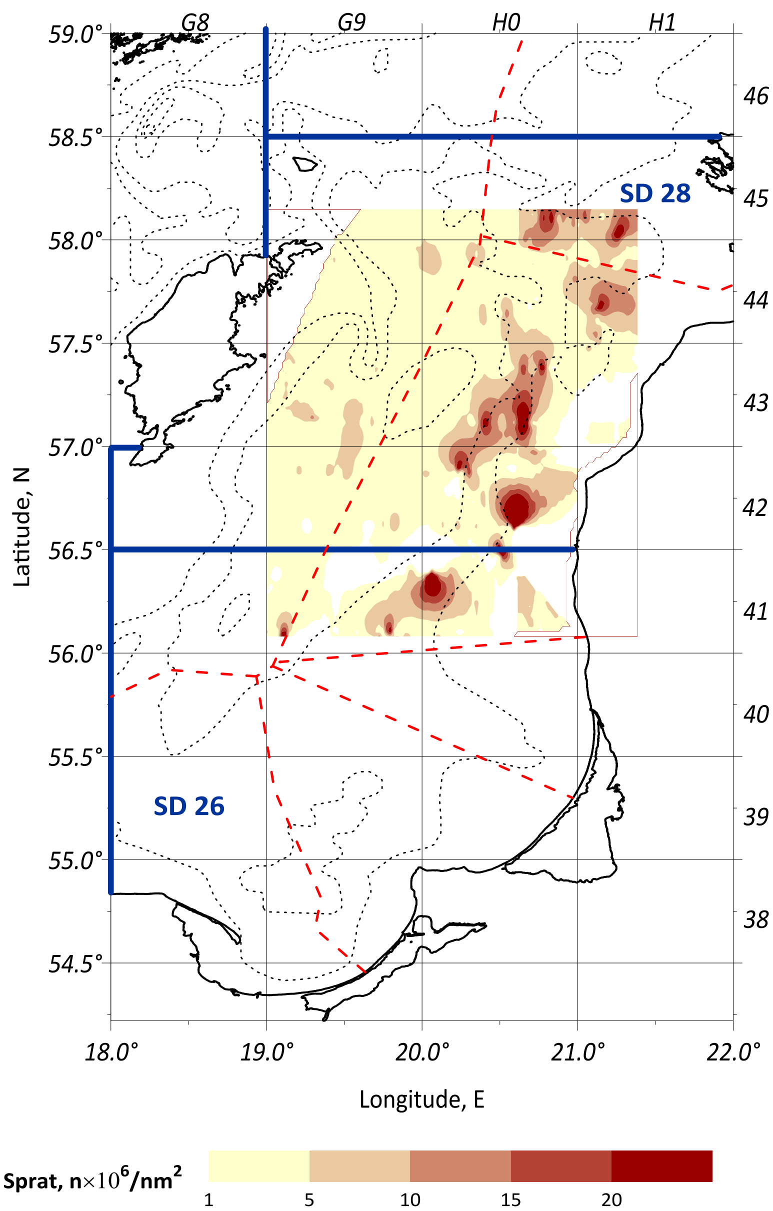
CPUE, kg/h



WGBIFS - Riga, Latvia, 27-31.03.2017

Sprat in October 2016

ICES SD	Abundance [n×10^6]	Biomass [kg×10^3]
26	16123	130609
28	5330	44216
∑	21453	174825

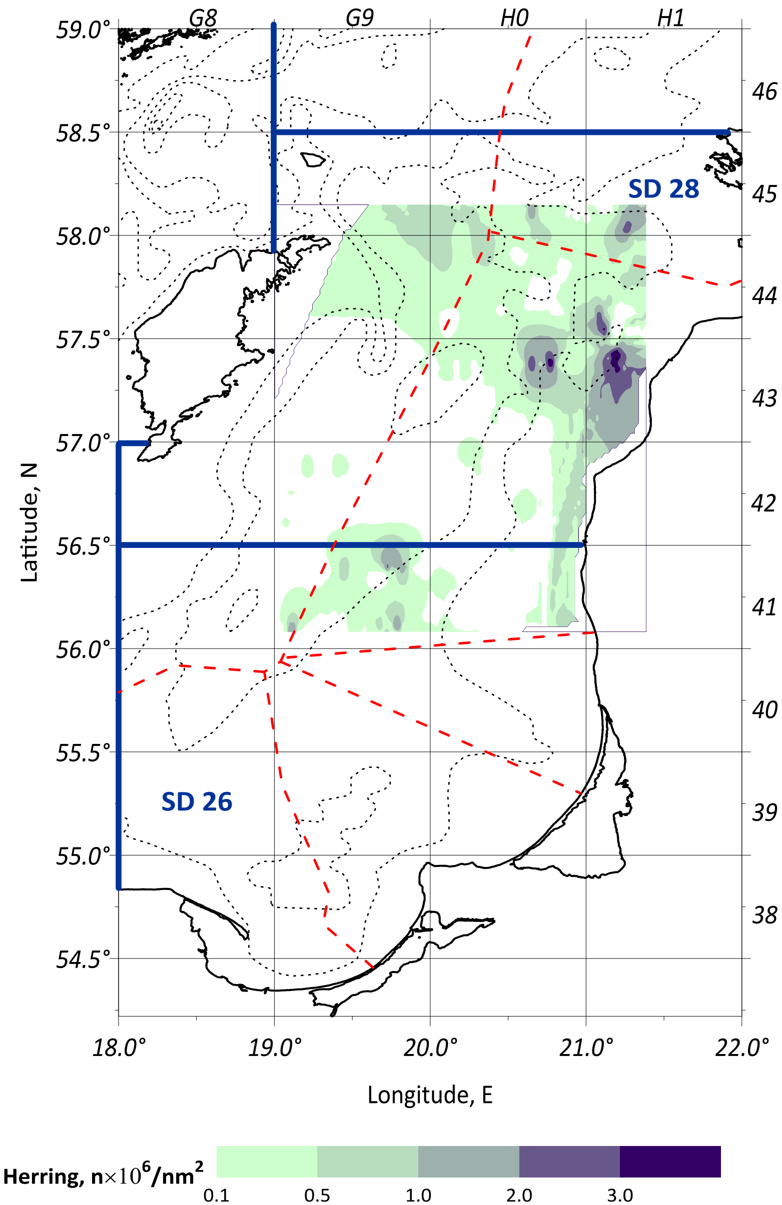


ICES CIEM

WGBIFS - Riga, Latvia, 27-31.03.2017

Herring in October 2016

ICES SD	Abundance [n×10⁶]	Biomass [kg×10³]
26	2648	51928
28	215	6014
∑	2863	57942



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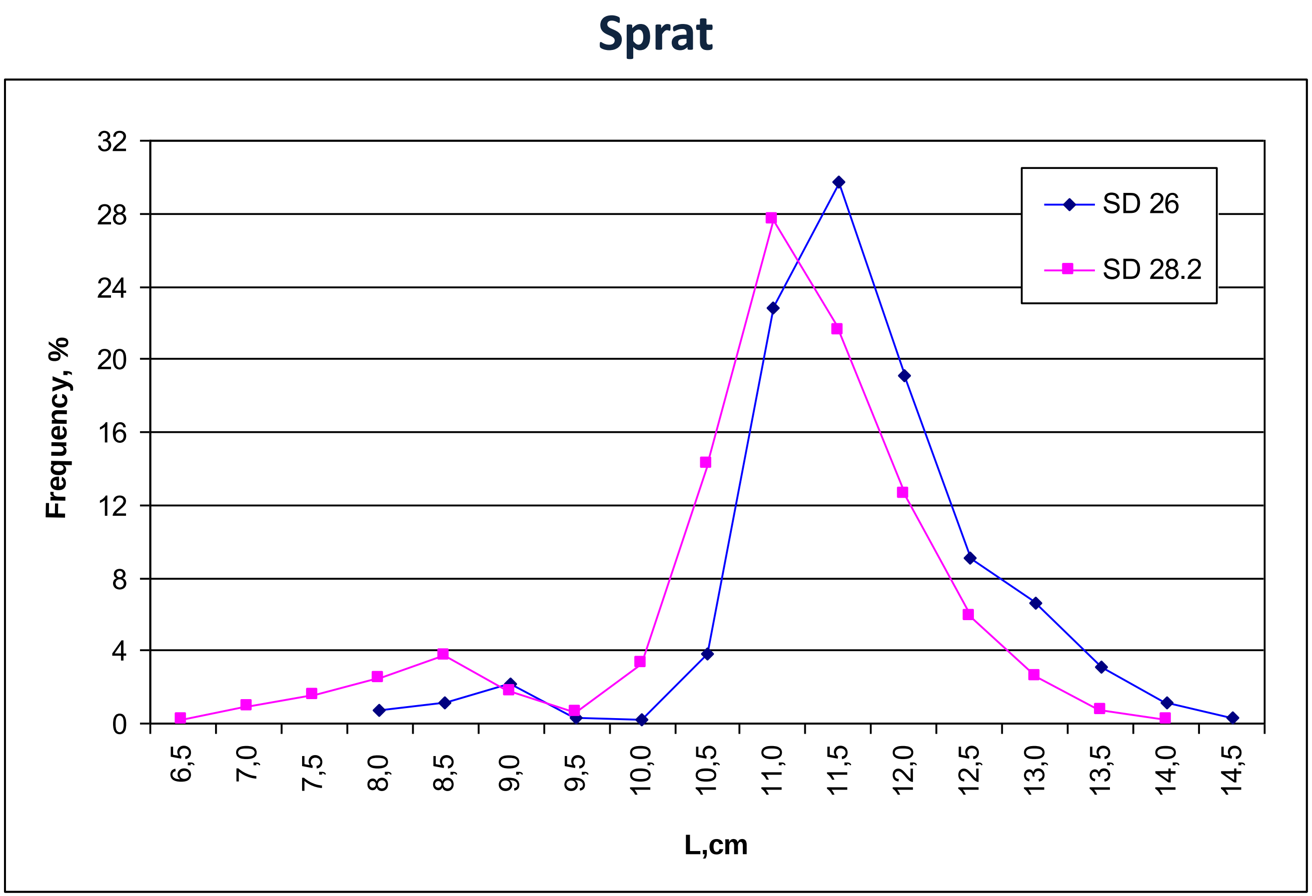
WGBIFS - Riga, Latvia, 27-31.03.2017

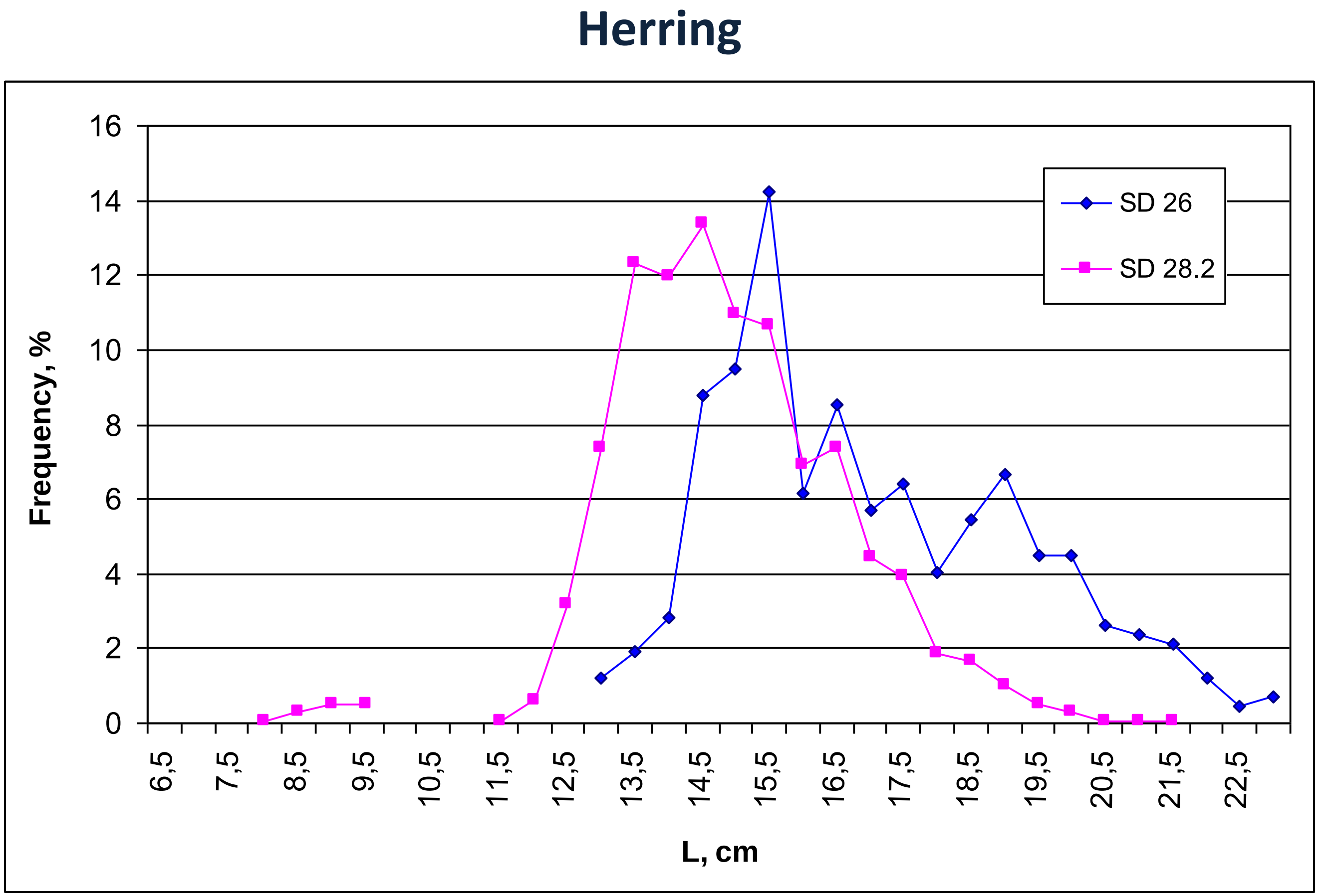
Length distribution



ICES CIEM

WGBIFS - Riga, Latvia, 27-31.03.2017

Length distribution



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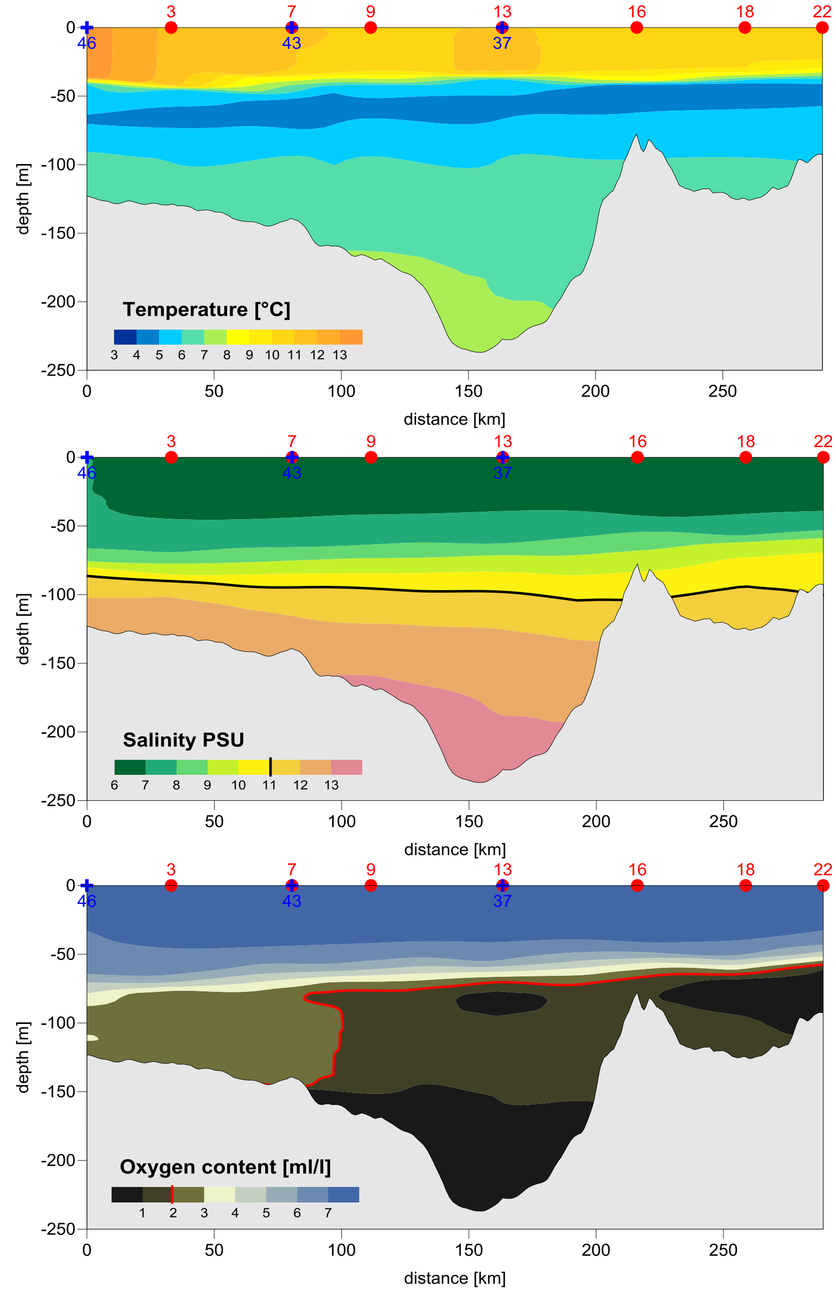
WGBIFS - Riga, Latvia, 27-31.03.2017

Hydrology in October 2016



Thank You!

THE JOINT LATVIAN-ESTONIAN HERRING ACOUSTIC SURVEY IN THE GULF OF RIGA ON THE F/V "ULRIKA" (26.07 – 01.08.2016)

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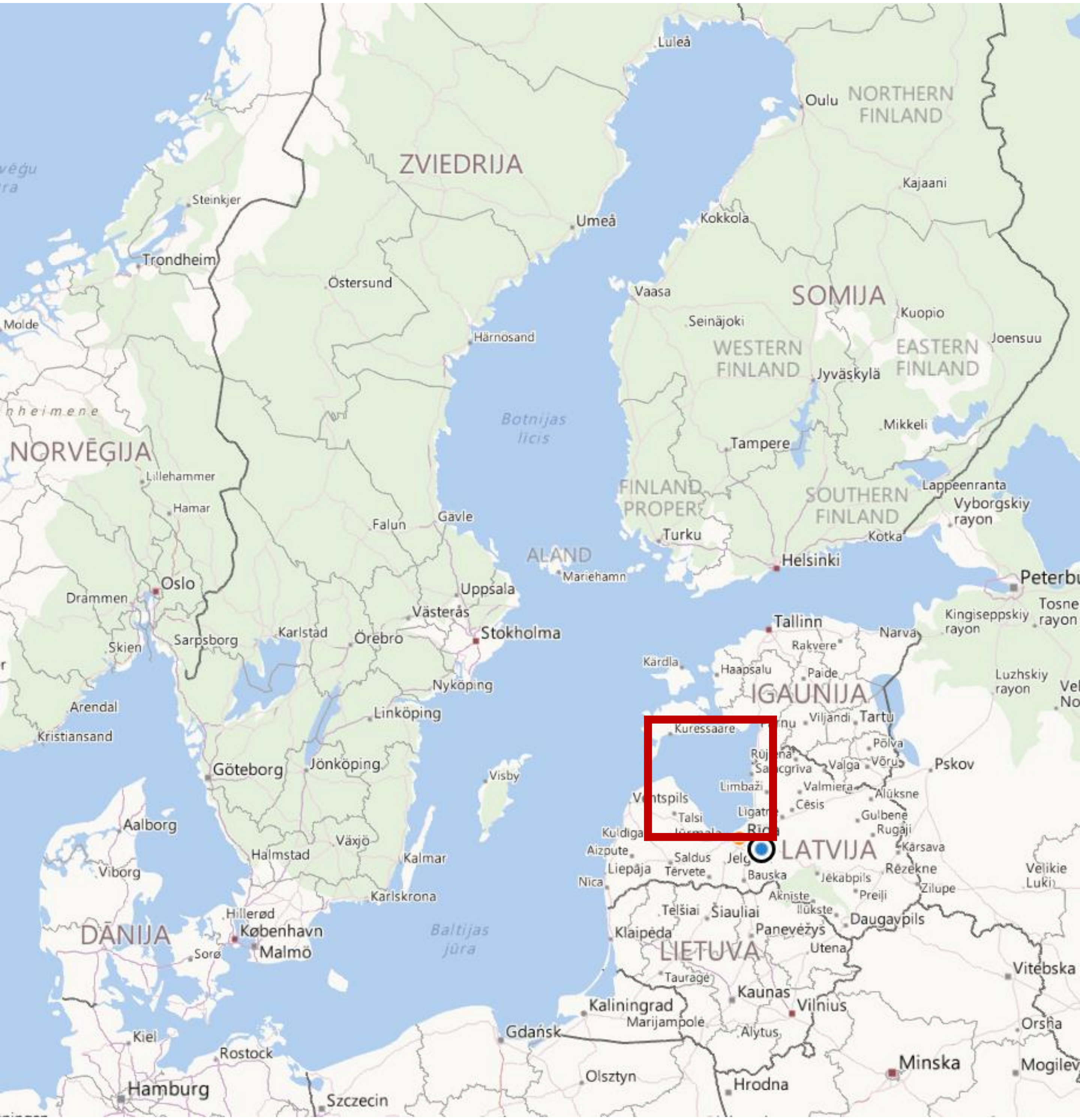
EMI
ESTONIAN MARINE INSTITUTE

ICES CIEM WGBIFS - Riga, Latvia, 27-31.03.2017

Survey area – ICES SD 28.1



ICES CIEM

WGBIFS - Riga, Latvia, 27-31.03.2017

Equipment:

BioSonics D-TX echo-sounder 38 kHz

Trawl:

–Vertical opening – 22 m

–Horizontal opening – 83 m

–Mesh size at codend – 10 mm (bar)

Seabird SBE 19plus

Judday net 100 µm mesh

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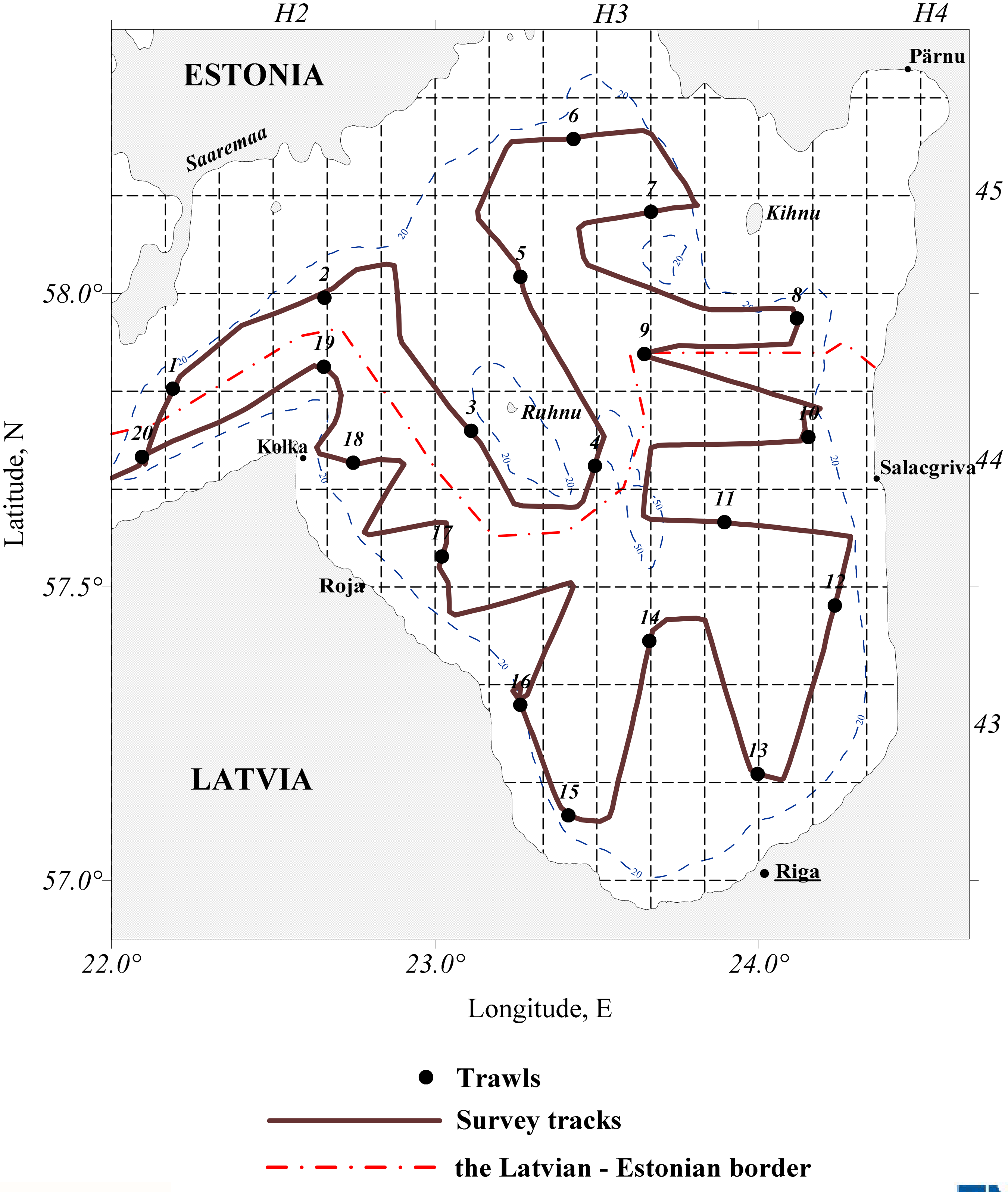
EMI ESTONIAN MARINE INSTITUTE

WGBIFS - Riga, Latvia, 27-31.03.2017

Position of trawls and survey tracks of joint Latvian-Estonian hidroacoustic survey in the Gulf of Riga

(Latvian - Estonian hydroacoustic survey, F/V "Ulrika", 26.07. - 01.08.2016)



WGBIFS - Riga, Latvia, 27-31.03.2017

Scope of work:

- Days at sea – 7
- Survey tracks – 453 nm
  - Latvian EEZ – 253 nm
  - Estonian EEZ – 200 nm
- Control trawlings – 20
  - Latvian EEZ – 12
  - Estonian EEZ – 8
- Hydrological and hydrobiological stations
- Zooplankton samples

Zivju suga	Measured Fish			Analyzed Fish		
	EST	LAT	∑	EST	LAT	∑
Herring	1689	2338	4027	797	1084	1881
Sprat	601	206	807			
Threespine stickleback	269	414	683			
Smelt	150	294	444			
Straitnose pipefish	19	84	103			
Flounder	35	29	64			
River lamprey	11	20	31			
Ninespine stickleback	11	1	12			
Sea trout	4	6	10			
Eelpout	3	3	6			
Great sandeel	2	1	3			
Fourhorn sculpin	1	1	2			
Shorthorn sculpin		1	1			
Pearch	1		1			
Whitefish		1	1			
Σn	2796	3399	6195			1881

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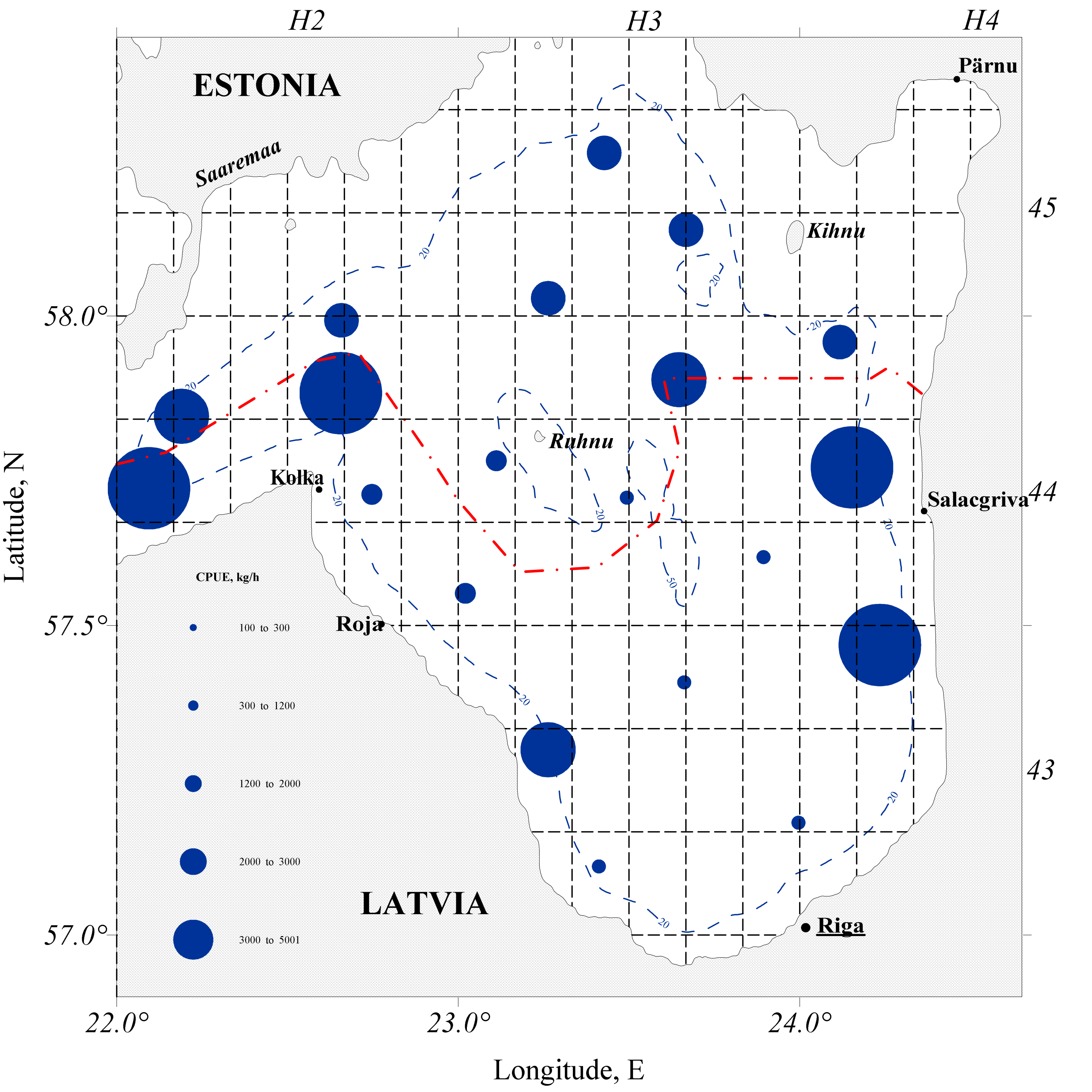
ESTONIAN MARINE INSTITUTE

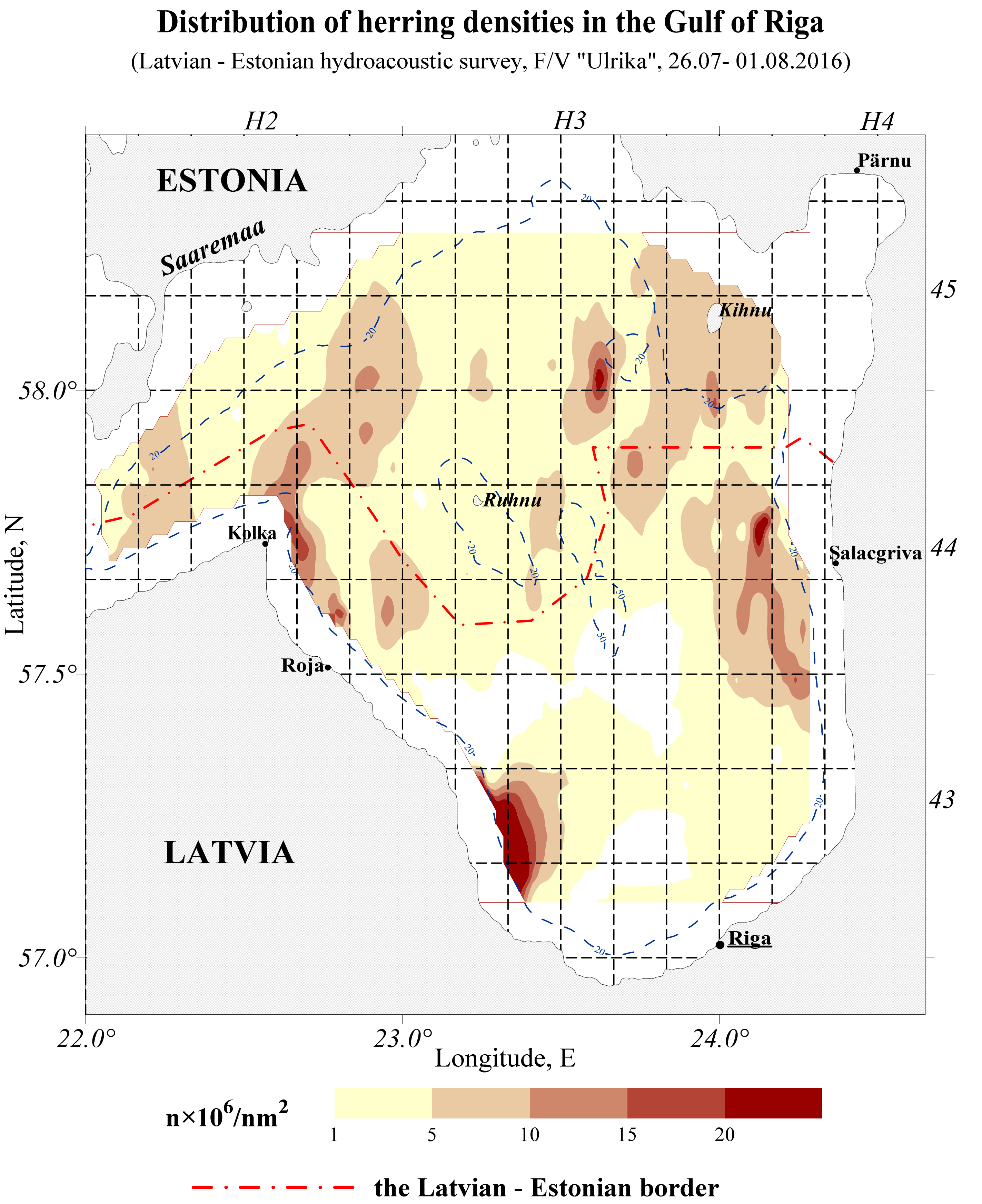
WGBIFS - Riga, Latvia, 27-31.03.2017

CPUE [kg/h] of hauls during joint Latvian-Estonian hidroacoustic survey in the Gulf of Riga

(Latvian - Estonian hydroacoustic survey, F/V "Ulrika", 26.07. - 01.08.2016)



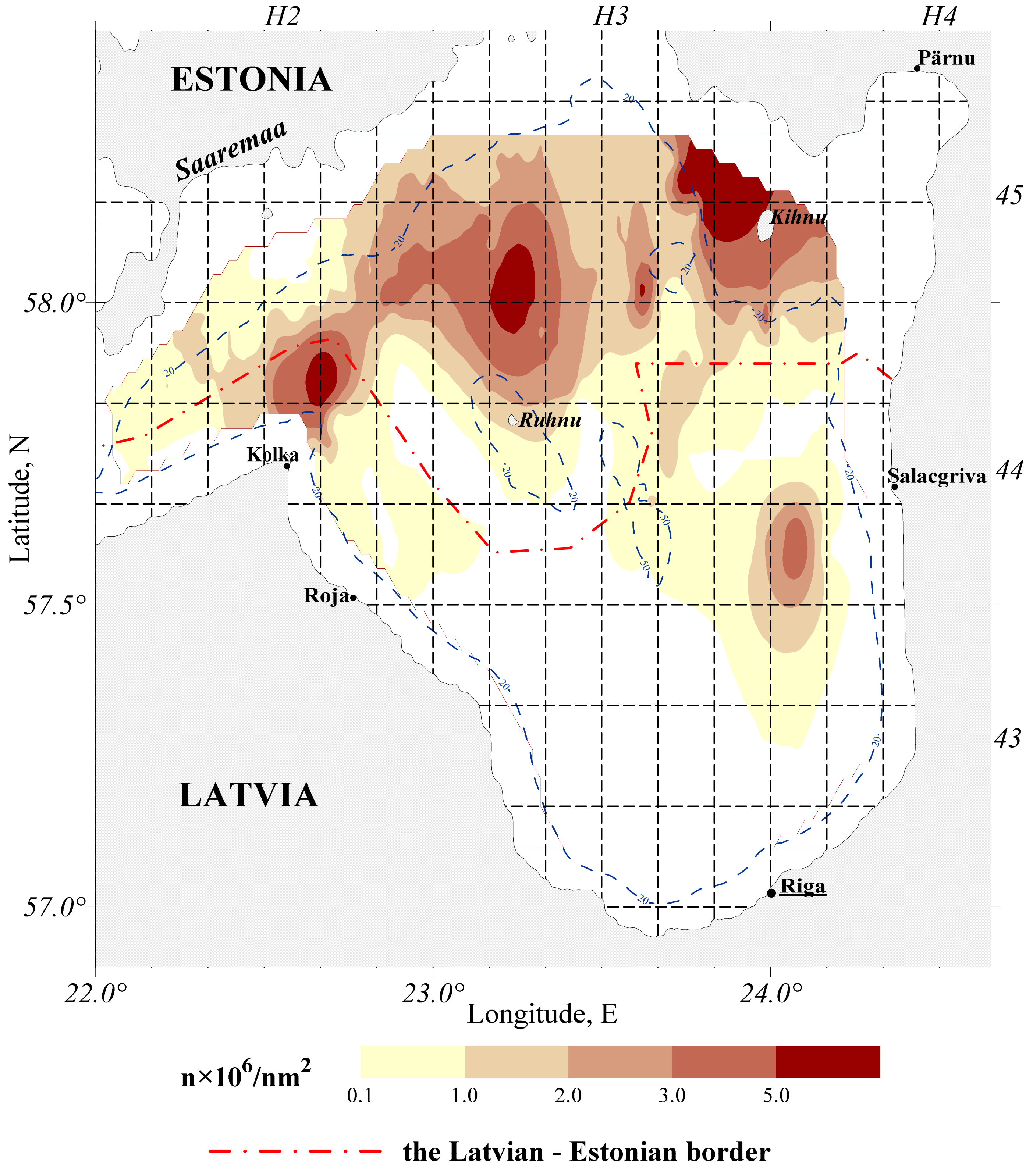
WGBIFS - Riga, Latvia, 27-31.03.2017



WGBIFS - Riga, Latvia, 27-31.03.2017

Distribution of sprat densities in the Gulf of Riga

(Latvian - Estonian hydroacoustic survey, F/V "Ulrika", 26.07- 01.08.2016)




Thank You!

Intercalibration exercise between the new “Havfisken” and “Solea”

A. Velasco / M Bleil, H. Degel /A. Thaarup, R. Oeberst

Thünen Institute of Baltic Sea Fisheries, Rostock

Riga,
28.03.2017

Intercalibration exercise between new “Havfisken” & “Solea

- Background

– Intercalibration experiments between old and new Havfisken suggested large differences of catchability of old and new “Havfisken”

– Intercalibration exercise between the new “Havfisken” and “Solea” was done during the BITS to evaluate the results of intercalibration experiment between old and new “Havfisken”

– Thirteen intercalibration hauls were carried out between February 27 and March 1, 2017. One haul was invalid because the fishing gear of “Havfisken” was unclear

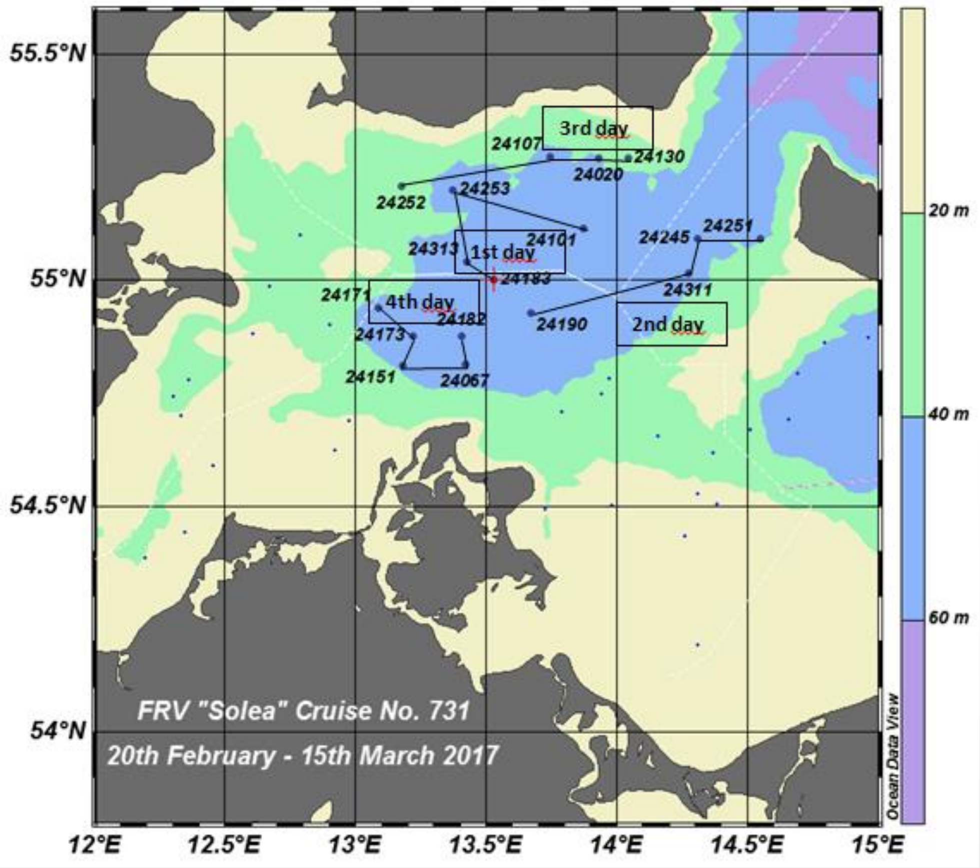
Intercalibration exercise between new “Havfisken” & “Solea

– new “Havfisken” und “Solea” met in Arkona Sea for three days

– Both vessels realized parallel 12 BITS standard hauls

– Catch of “Havfisken” was not influenced by the gear of “Solea” because the distance between vessels was two times more than maximum door spread of used TVS

– It was assumed that both vessels have fished the same population based on the used design



Intercalibration exercise between new “Havfisken” & “Solea

– The relation between total catch in weight by species of both vessels were described by the linear regression Catch(SOL2) = a + b * Catch(HAF2)

– In addition, the regressions Catch(SOL2) = 0 + b * Catch(HAF2) were determined

– It was hypothized that the intercept of the linear regression does not significantly differ from zero and that the slope did not significantly differ from 1

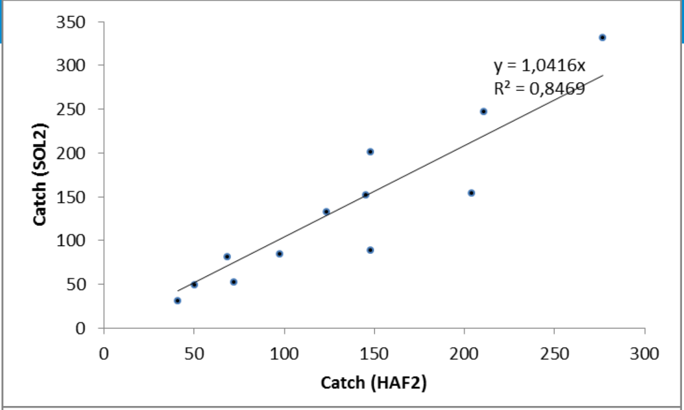
–The hypothesis was tested with t-test with the kind of first error of α = 0.05 (Rasch, 1968)

THÜNEN

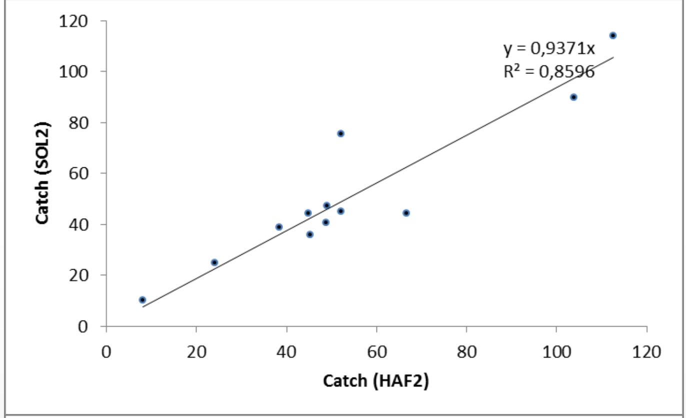
Intercalibration exercise between new "Havfisken" & "Solea

- The t-test showed that the intercepts of the regressions did not significantly differed from zero and that the slopes of the regressions did not significantly differed from 1
- The slopes of the regressions Catch(SOL2) = 0 + b * Catch(HAF2) were close to 1 with 1.04, 0.94 and 1.00 for cod, flounder and the combination of plaice, dab and turbot, respectively
- The hypothesis of similar catchability of both vessels can not be rejected based on the statistical test

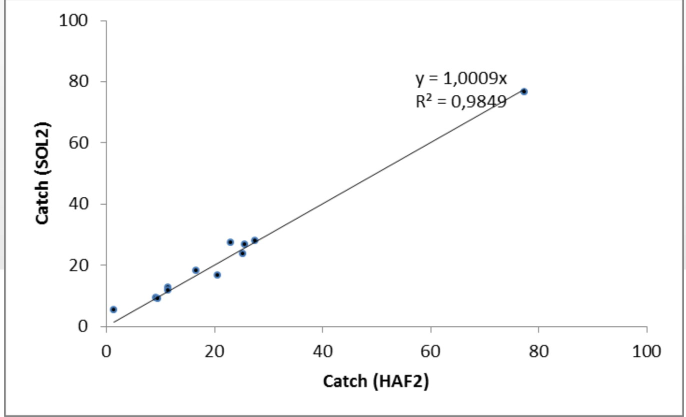
Cod



Flounder



Plaice, Dab and Turbot



Intercalibration exercise between new “Havfisken” & “Solea

– In addition, it was tested that the length frequencies of 5 cm length intervals of both vessels were taken from the same population by means of the χ^2-test of homogeneity (Lozan, 1992)

– Length frequencies of 5 cm length intervals of both vessels of each paired hauls were tested

– The hypothesis of similar catchability of both vessels can not be rejected based on the statistical test

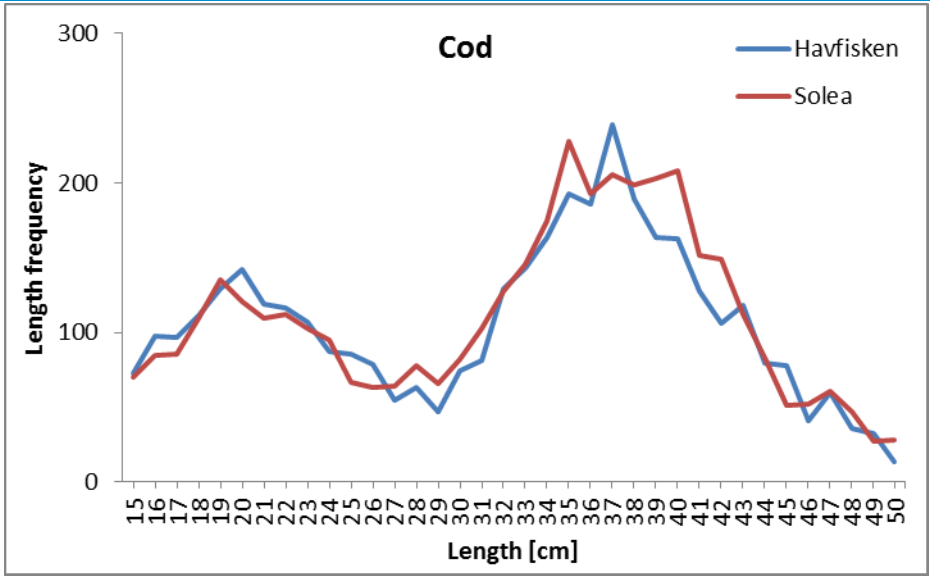
– In addition, the sum of the length frequencies over all hauls of both vessels was analysed for cod and flounder

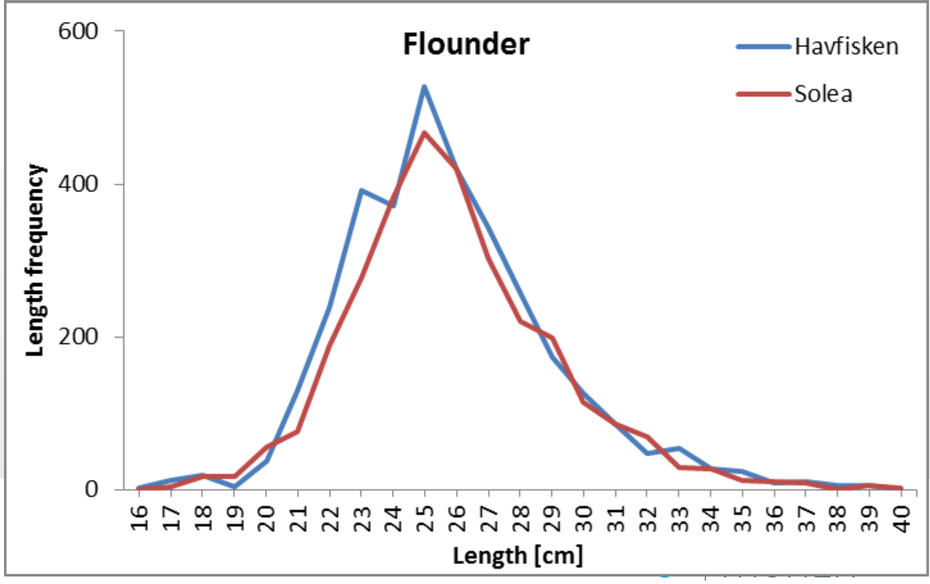
Intercalibration exercise between new “Havfisken” & “Solea

– The total length frequencies of all catches of cod and flounder for 5 cm length intervals by vessel were close together

– The results of the χ^2-test of homogeneity did not reject the hypothesis that the samples were taken from the same population because the length frequencies did not significantly differed

– This statement is supported by the comparison of the length frequencies of each paired haul, separately





Intercalibration exercise between new “Havfisken” & “Solea

Conclusion

The statistical analyses showed that the hypothesis of same catchability of cod and flatfish by both vessels which use the same gear cannot be rejected

Sunrise/Sunset Calculations

For the special case of sunrise or sunset, the zenith is set to 90.833° (the approximate correction for atmospheric refraction at sunrise and sunset), and the hour angle becomes:

$$ha = \pm \arccos\left(\frac{\cos(90.833)}{\cos(lat)\cos(decl)} - \tan(lat)\tan(decl)\right)$$

where the positive number corresponds to sunrise, negative to sunset.

Then the UTC time of sunrise (or sunset) in minutes is:

$$sunrise = 720 + 4(longitude - ha) - eqtime$$

where longitude and hour angle are in degrees and the equation of time is in minutes.

Solar noon for a given location is found from the longitude (in degrees) and the equation of time (in minutes):

$$snoon = 720 + 4 * longitude - eqtime$$

General Solar Position Calculations

First, the fractional year (γ) is calculated, in radians.

$$\gamma = \frac{2\pi}{365} * (day\_of\_year - 1 + \frac{hour - 12}{24})$$

From γ, we can estimate the equation of time (in minutes) and the solar declination angle (in radians).

$$eqtime = 229.18 * (0.000075 + 0.001868\cos\gamma - 0.032077\sin\gamma - 0.014615\cos 2\gamma - 0.040849\sin 2\gamma)$$

$$decl = 0.006918 - 0.399912\cos\gamma + 0.070257\sin\gamma - 0.006758\cos 2\gamma + 0.000907\sin 2\gamma - 0.002697\cos 3\gamma + 0.00148\sin 3\gamma$$

Next, the true solar time is calculated in the following two equations. First the time offset is found, in minutes, and then the true solar time, in minutes.

$$time\_offset = eqtime - 4 * \text{longitude} + 60 * \text{timezone}$$

where eqtime is in minutes, longitude is in degrees, timezone is in hours from UTC (Mountain Standard Time = +7 hours).

$$tst = hr * 60 + mn + sc / 60 + time\_offset$$

where hr is the hour (0 - 23), mn is the minute (0 - 60), sc is the second (0 - 60).

The solar hour angle, in degrees, is:

$$ha = (tst / 4) - 180$$

The solar zenith angle (ϕ) can then be found from the following equation:

$$\cos\phi = \sin(lat)\sin(decl) + \cos(lat)\cos(decl)\cos(ha)$$

And the solar azimuth (θ, clockwise from north) is:

$$\cos(180 - \theta) = -\frac{\sin(lat)\cos\phi - \sin(decl)}{\cos(lat)\sin\phi}$$

LFI & MMI Development

Translating fish and bits into ecological indicators

ICES
CIEM

Science for sustainable seas

Why

- Trophic structure linked to fish size
- LFI responds to targeting large fish
- GES, MSFD, OSPAR Intermediate Assessment, ICES Ecosystem Overviews, etc.

Quick background

- LFI:
  - Measures the fish community that is larger than some length threshold (40 cm for the North Sea; Greenstreet et al., 2011), so expresses a well-understood community response to exploitation—the curtailment of age and size structure (Haedrich and Barnes, 1997; Shin et al., 2005)—by quantifying change in the biomass contribution to the community of the larger individuals/species that are typically removed by fishing.
  - Robust to environmental changes
- LFI + Baltic
  - HELCOM reports (2011, 2013):

Plan of action:

- Swept area:
  - Check that BITS >2001 can be expressed as swept area
- Spatially explicit:
  - NS examples show spatial heterogeneity might be high (Sunderlof, 2013)
  - Baltic basins should be unique (HELCOM 2011)
  - Shoot for swept area by statistical rectangle
- Establish reference period:
  - When were most stocks above precautionary spawning-stock biomass reference limit B_{pa}?

Outcomes of ICES WKBIFS-ACOU

Review the progress of the ICES acoustic-trawl survey database design elaborated under the AtlantOS project…

WKBIFS-ACOU ToRs

a) Evaluate the existing national computational tools used for the acoustic abundance estimations of sprat, herring and cod in the Baltic Sea.

b) Test run StoX estimation software using existing data reported into ICES new acoustic database before the workshop.

c) Establish baseline parameters within StoX for use during future BIAS/BASS surveys.

d) Provide feedback to the ICES Data Centre on the new acoustic trawl data format/database.

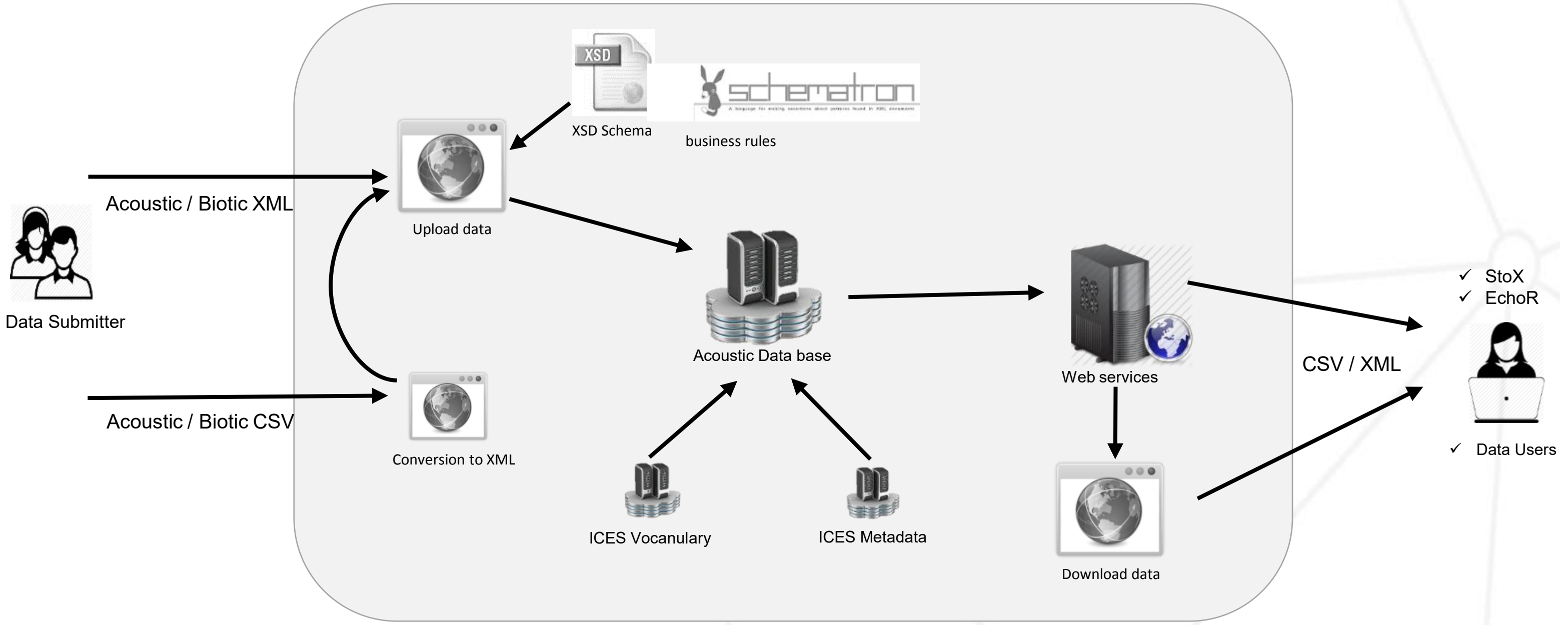
e) Provide feedback to StoX developers to address outstanding issues.

AtlantOS WP 2.4

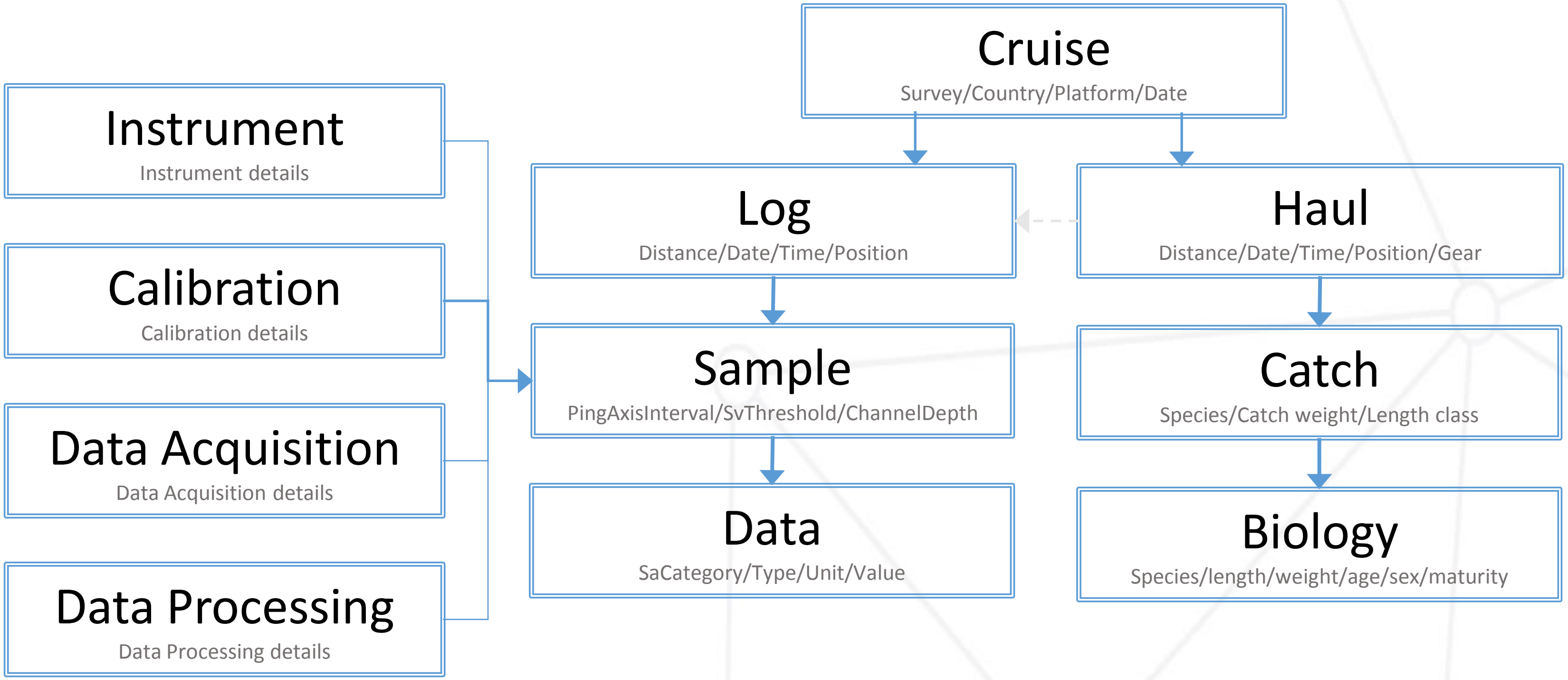
1) to improve the fish survey data availability through the ICES data center
2) to prepare the ICES data center to host these data in accordance with ICES and international data standards
3) to modify current processing and analysis software to fit into the new system.

1. WKEVAL
2. WKIACTDB
3. WGIPS, WGBIFS, WGACEGG and WGIDEEPS

ICES Acoustic Data Portal



Acoustic data model



Science for sustainable seas

ICES Acoustic data portal - progress

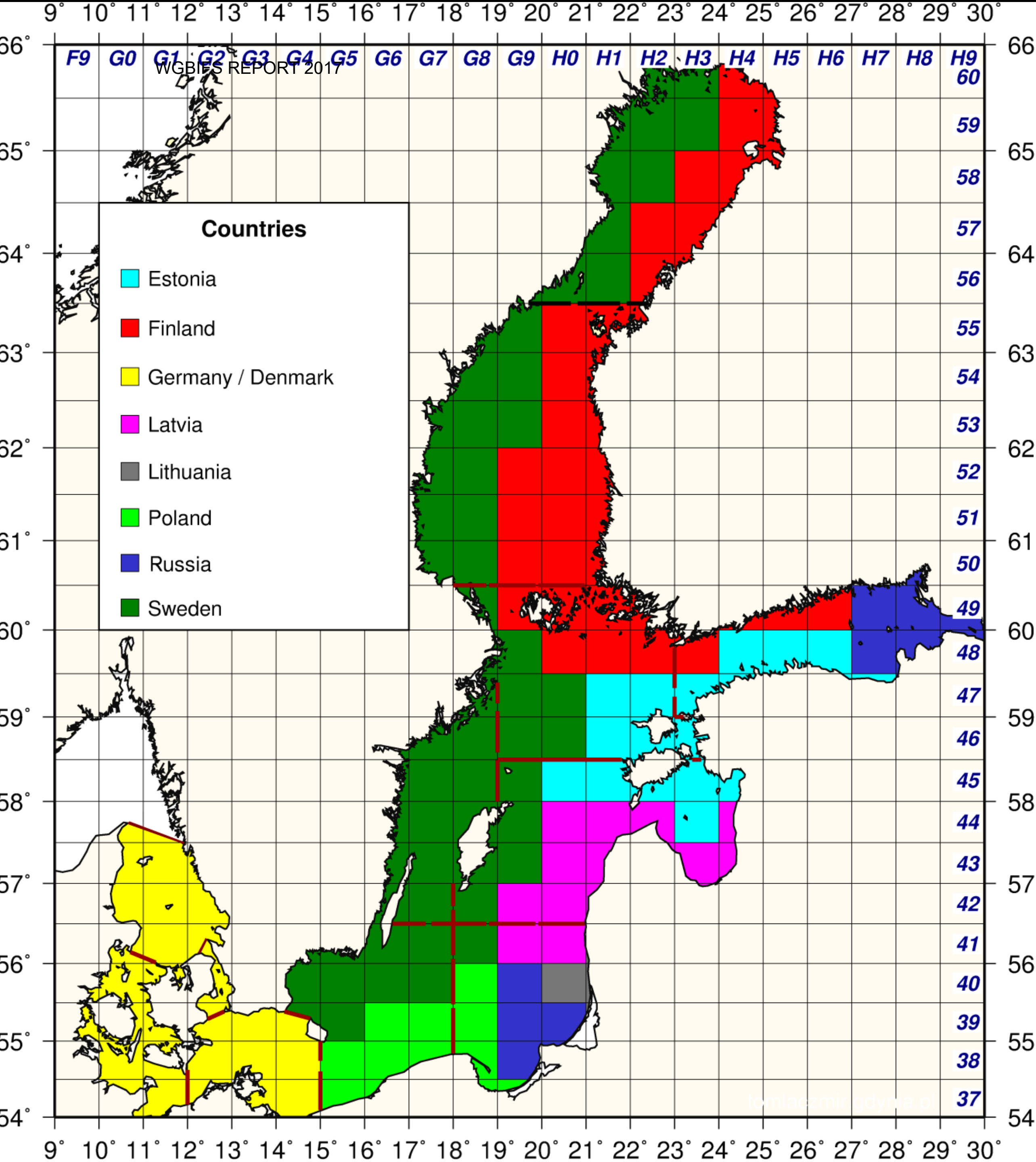
ICES Acoustic data portal at http://acoustic.ices.dk is now operational.

1. WGIPS HERAS survey assessment by StoX
2. WGHANSA PELGAS survey by EchoR
3. WGBIFS BIAS / BASS surveys assessment by StoX?

ICES Acoustic data portal - next

ICES
CIEM

1. Implement user management of data within the database.
2. Make additional quality control checks (using schematron) on data uploaded through the portal.
3. Implement map in order for the users to view data within the database in addition to the grid currently shown at the portal.
4. Host supporting information necessary for the different assessment software's like StoX and EchoR in order to being able to reproduce the assessments done.



ICES statistical rectangles are used as strata for IBAS calculations

National survey estimates

↓

BIAS/BASS MS Access data bases

General assignment scheme of the ICES statistical rectangles (within standard acoustic surveys) to the countries in the Baltic Sea.

National survey estimates

BIAS/BASS MS Access data bases

SU

Code, Ship, Year

AH/AS (Values per ICES statistical rectangle)

Herring/Sprat Total N, N_0-N_8

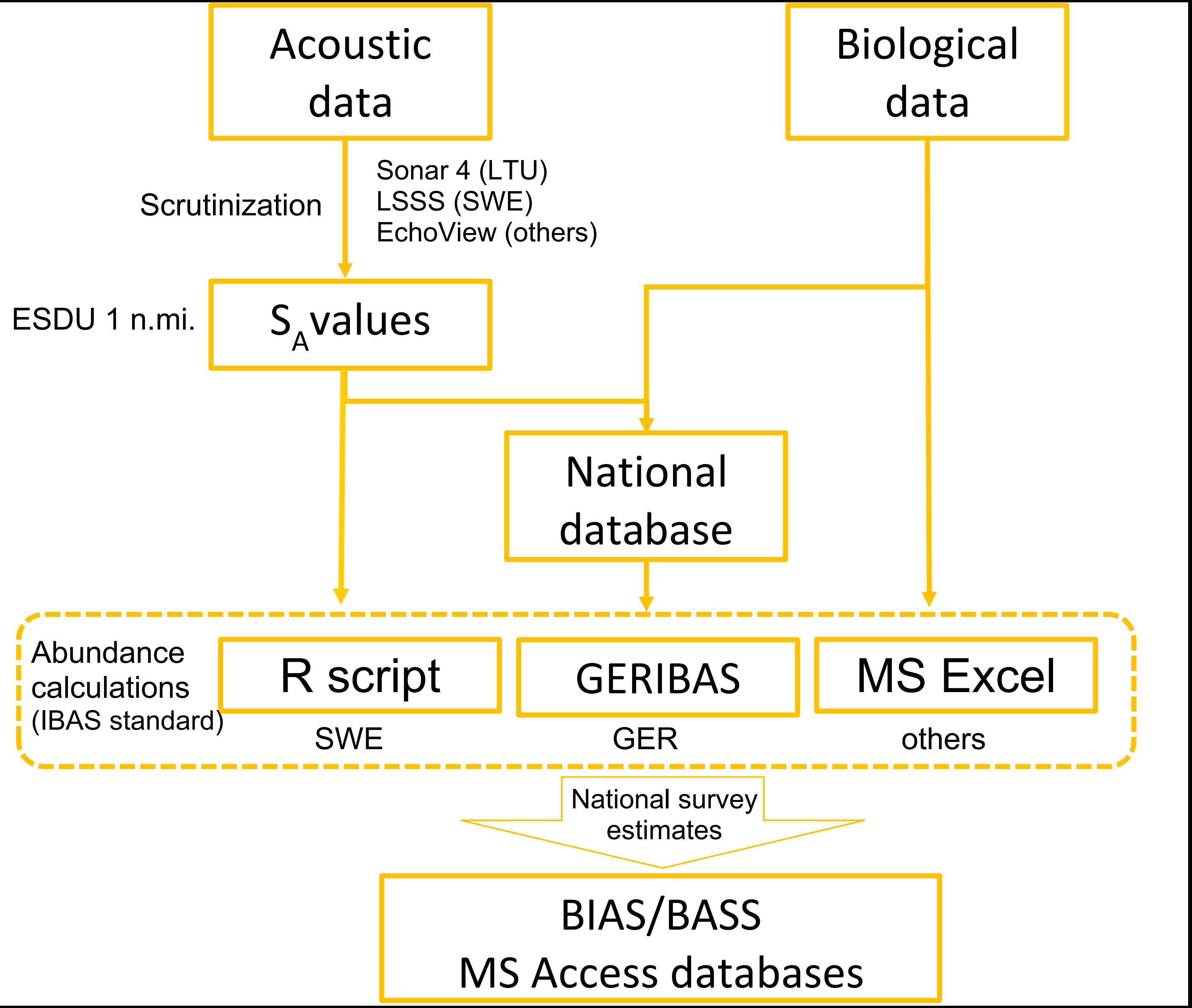
WH/WS (Values per ICES statistical rectangle)

Herring/Sprat Mean W, W_0-W_8

ST (Values per ICES statistical rectangle)

Area, S_A, Sigma, Total N, % herring, % sprat, % cod

IBAS data flow



Deviations from IBAS standard calculation procedure

Layers are used in abundance calculations.

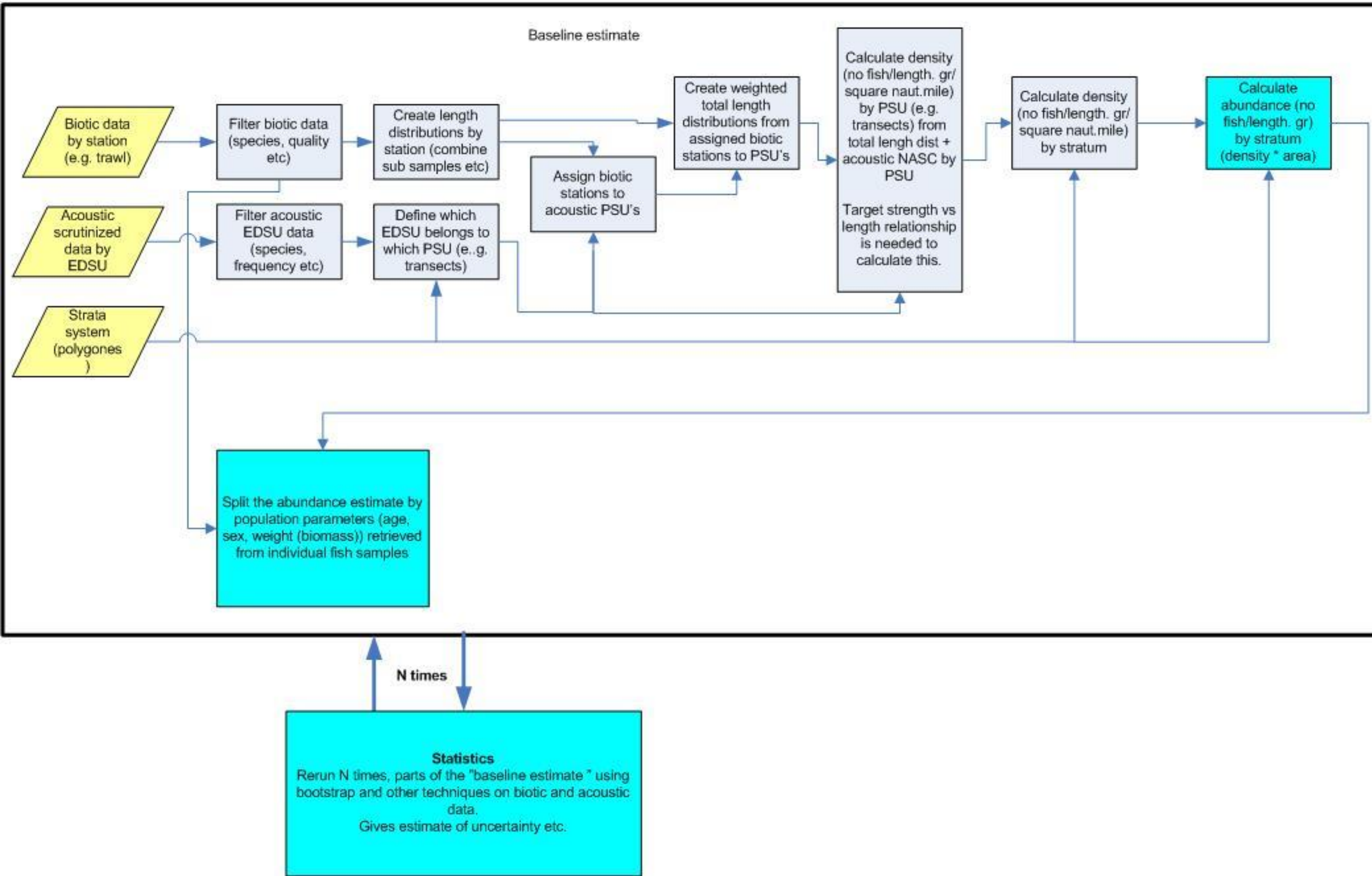
Using weighted average values of species composition and length distribution in abundance calculations.

Nearest haul method is used for combining the S_A values and trawl catches.

Random sampling is used instead of length-stratified random sampling in length and age distribution calculations.

StoX

Simple flow chart of the principals behind acoustic abundance estimation



WKBIFS-ACOU ToRs

- a) Evaluate the existing national computational tools used for the acoustic abundance estimations of sprat, herring and cod in the Baltic Sea.
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- d) Provide feedback to the ICES Data Centre on the new acoustic trawl data format/database.
- e) Provide feedback to StoX developers to address outstanding issues.

Next steps

A WGBIFS task force group was created during the workshop with Olavi Kaljuste (Sweden) and Juha Lilja (Finland) as contact persons from WGBIFS towards the ICES Data Centre and the StoX team.

- 1) WGBIFS task force group to produce one working input dataset uploaded to the ICES acoustic data portal and downloadable in StoX format for testing purposes.

- 2) WGBIFS task force group to provide StoX with list of all log distances, trawl hauls and values for fish target strength-length relationship constants for all species used for the calculation of fish abundances in specific ICES rectangle in order to test StoX split NASC function.

- 3) WGBIFS task force group should provide StoX developers with short description about the methodology used e.g. average in each rectangle with a minimum of at least two trawl stations or else manual assignment function to increase the flexibility of StoX software.

SLU

Next steps

4) Abundance at length calculations for each ICES rectangle in StoX software should be done based on the same trawl hauls as in the split NASC function.

5) Age distributions should be calculated in StoX based on age length keys on the ICES subdivision level.

Action 1-5 to be done before the next WGBIFS meeting on 27–31 March 2017.

6) IMR to document the StoX xml schema on order to make a correct mapping from the ICES acoustic database for both the acoustic and biotic part.

7) IMR to use ICES platform code instead of call sign within the StoX xml files.

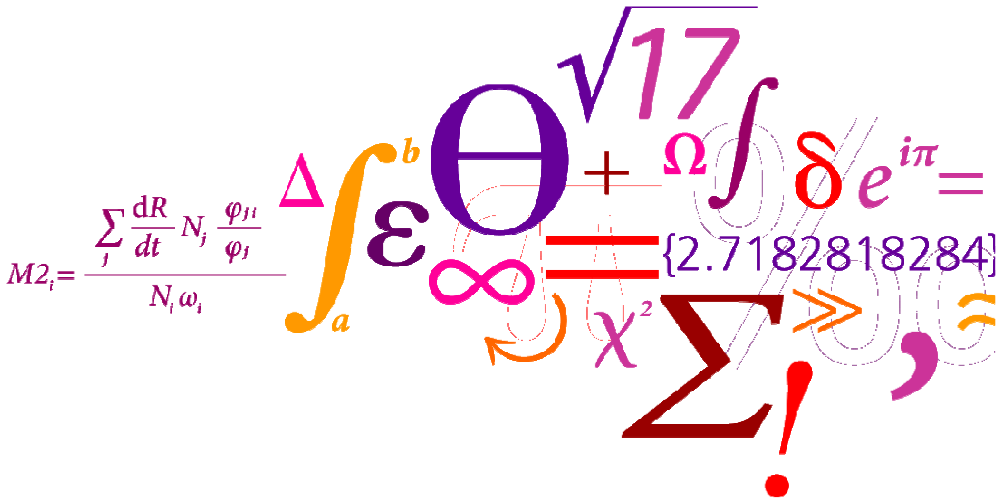
Action 6-7 to be done As soon as possible in order to prevent misunderstandings.

SLU

Allocation of BITS hauls from TD

Henrik Degel
DTU Aqua

BIFS meeting
27/3 –31/3, 2017
Riga



DTU Aqua
National Institute of Aquatic Resources

Why re-programming the procedure?

- The old procedure was based on combination of more than one types of software and not very self-explaining.
- It was not sufficient documented
- The procedure could not be externally reviewed

DTU

Overview of allocation procedure

Each country comits itself to a certain number of hauls

↓

The number of hauls per Sub-division are calculated

↓

The number of hauls by depth stratum in each Sub-division are calculated

↓

The calculated number of hauls by Sub-divisions and depth strata are randomly selected among the haul tracks in TD

↓

The selected haul tracks are distributed among countries according to commitments and logistic considerations

40% ave.catch (running 5 previous years), 60% area

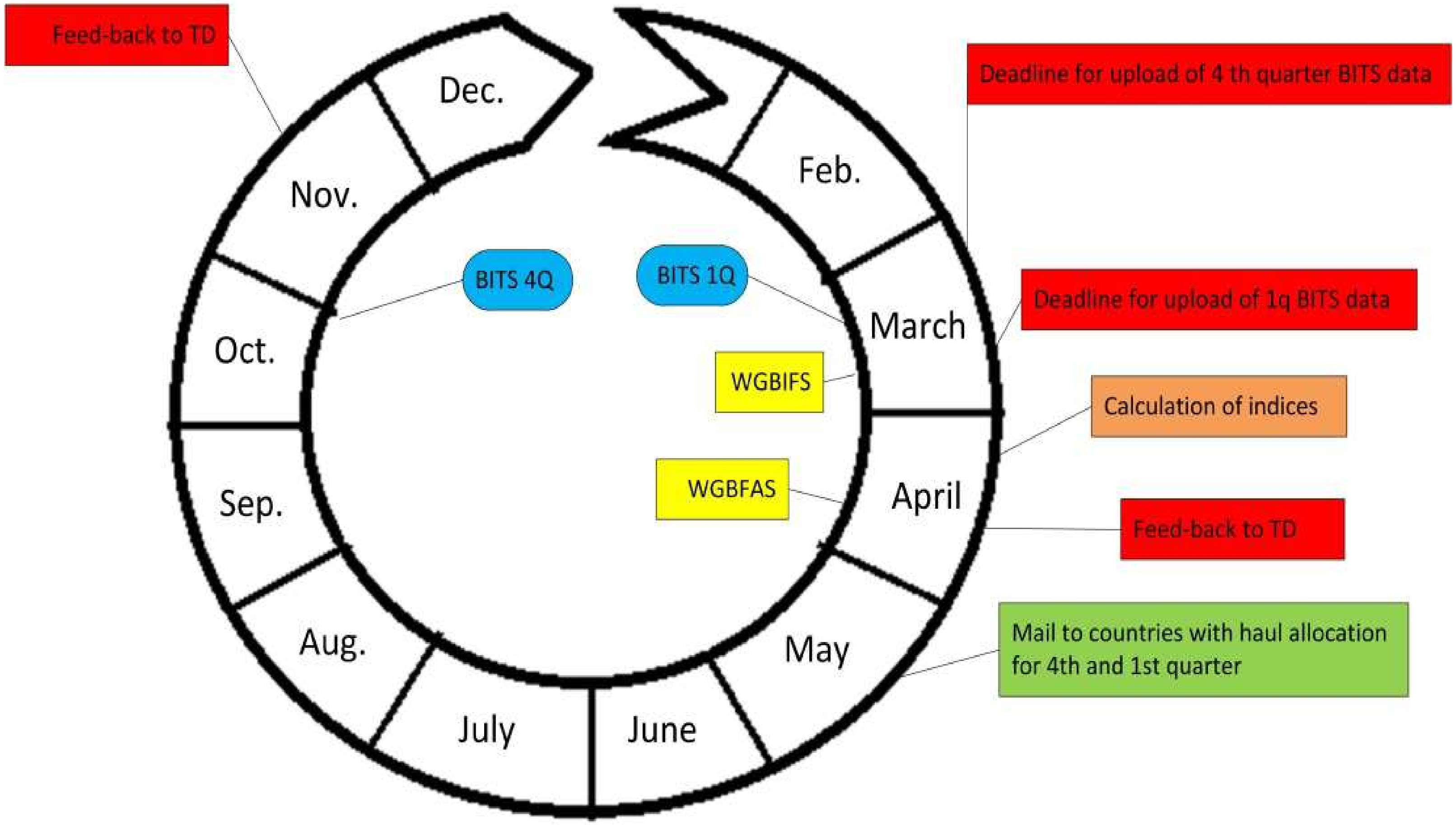
The R program

- Four sections:
  - Calculation of the number of hauls to be allocated to each depth layer in each Sub-division based on the commitment from each country
  - Drawing of the allocated hauls in the Trawl Database
  - Distribution of the drawn hauls between countries and mapping and output files
  - Drawing of extra hauls (to be agreed).

The program is not written in a condensed form and should be readable for persons with only minor experience with R

Many comments in the code and guidance in the log file guide the user through the program and the whole procedure.

Time schedule wheel

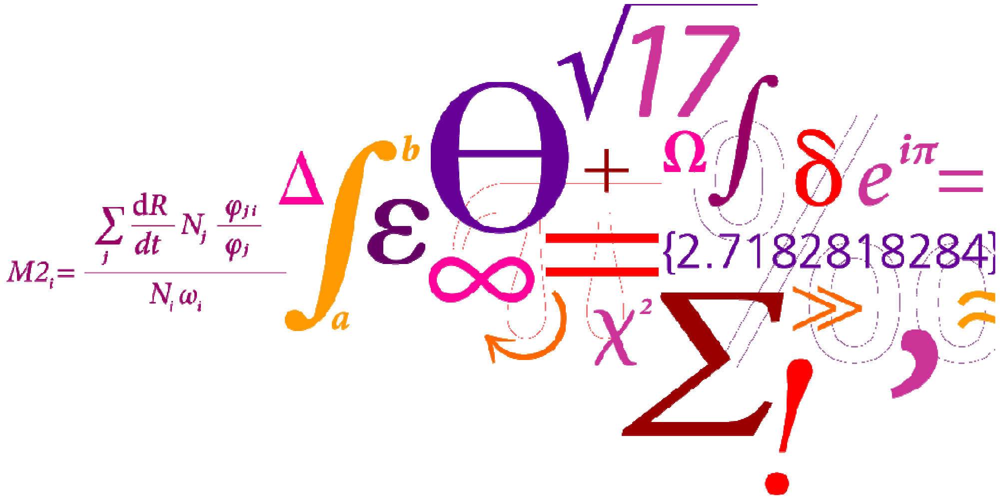


Henrik Degel
BIFS meeting Riga 327/3-31/3 -2017

Calibration between old and new "Havfisken" and the introduction of calibration factors

Henrik Degel
DTU Aqua

BIFS meeting
27/3 –31/3, 2017
Riga



DTU Aqua
National Institute of Aquatic Resources

DTU

Old and new Havfisken

New Havfisken

Traditional stern trawler build in steel

Loa: 17 meter long

BRT: 105 tons

Old Havfisken

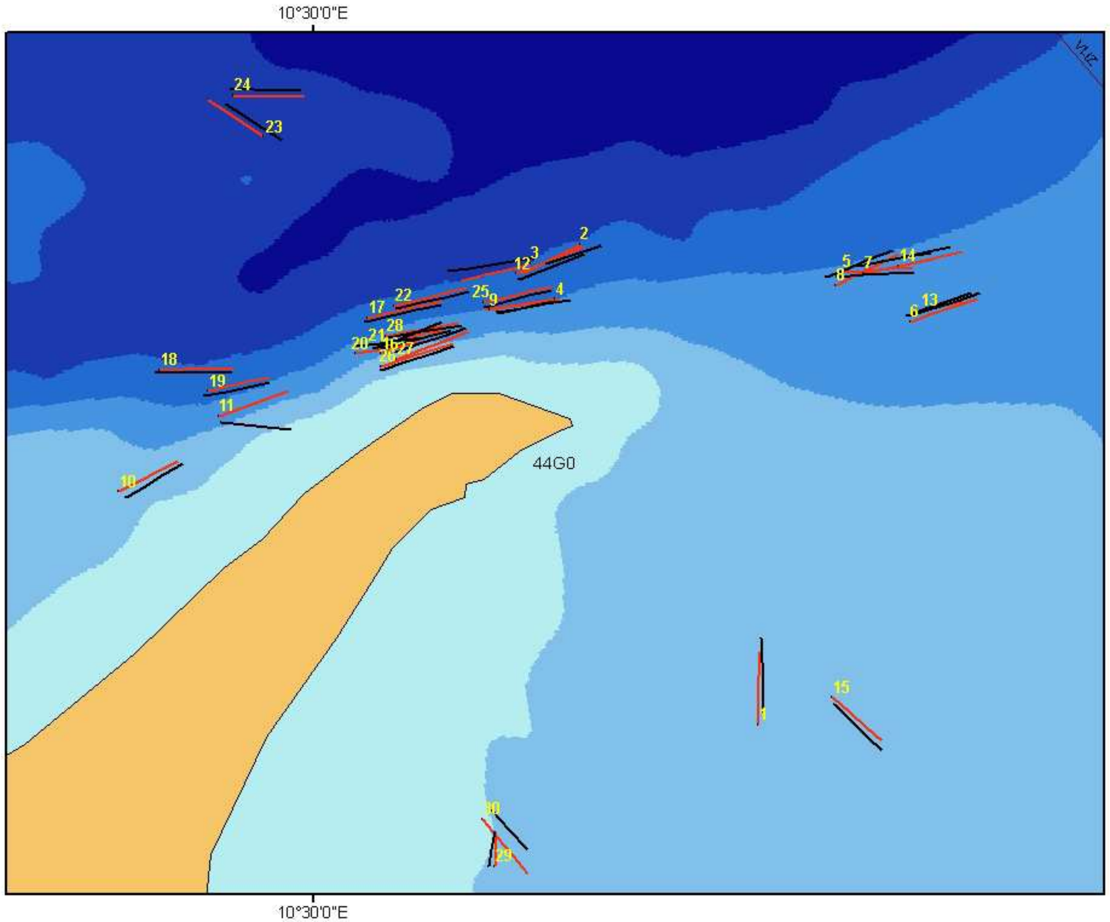
Traditional side trawler build in wood

Loa: 13 m long

BRT: 20 tons.

Calibration set-up

- Method: Parallel hauling following normal BITS haul procedure (in daylight, ½ hour)
- Period: 13-19/3 -2016
- Area: Skagerrak and North-western Kattegat
- Criteria
  - Reasonable abundance of cod and flatfish
  - The length rage of each species should be as wide as possible
  - The depth range should be comparable to the depth range in Kattegat and Western Baltic.
- Gear: Small TV3 (TV3S, #520)
- 30 successful pair of hauls were made.

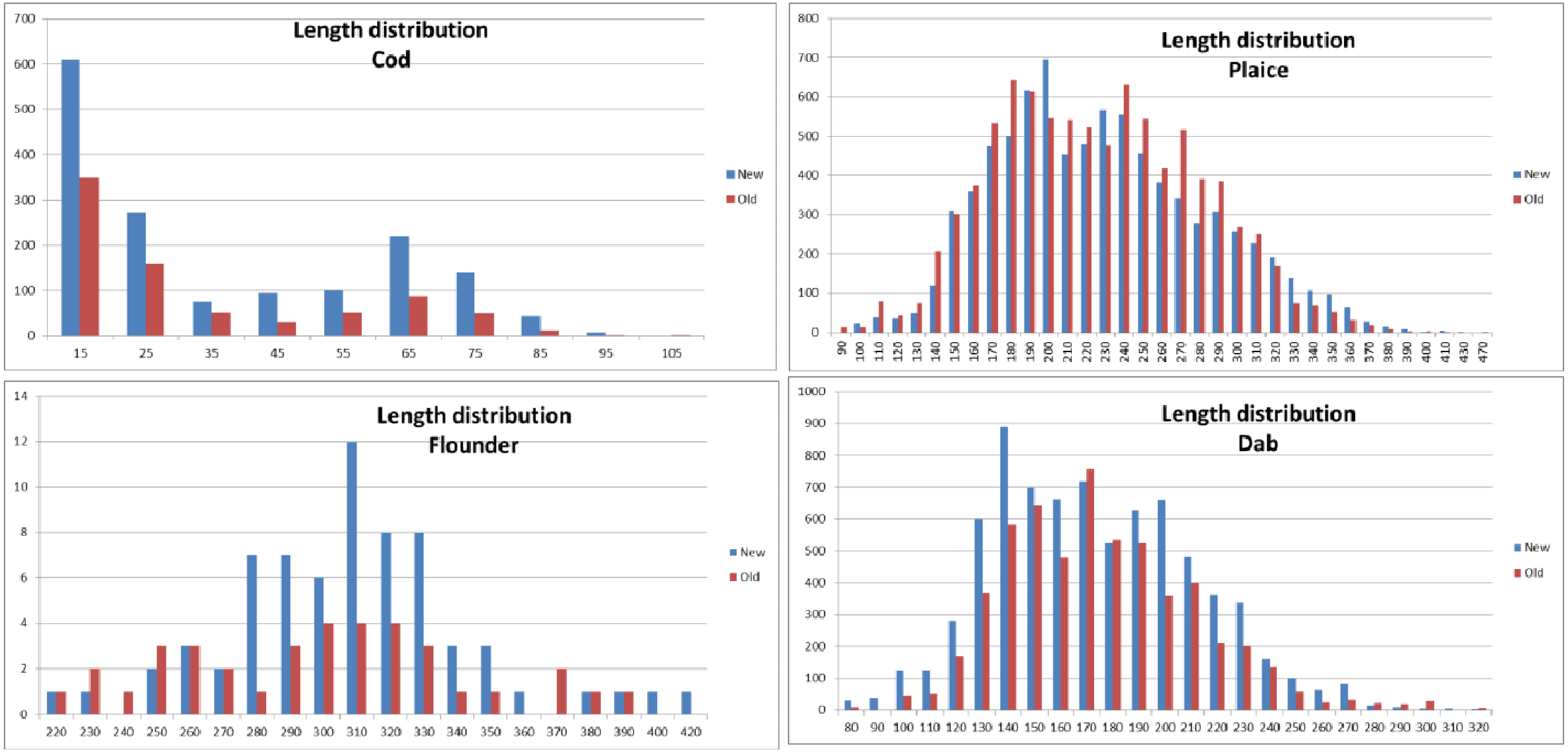

10°30'0"E
24
23
2
3
12
22
25
9
4
17
28
21
20
16
27
26
18
19
11
10
5
7
14
8
13
6
44G0
15
30
29
10°30'0"E

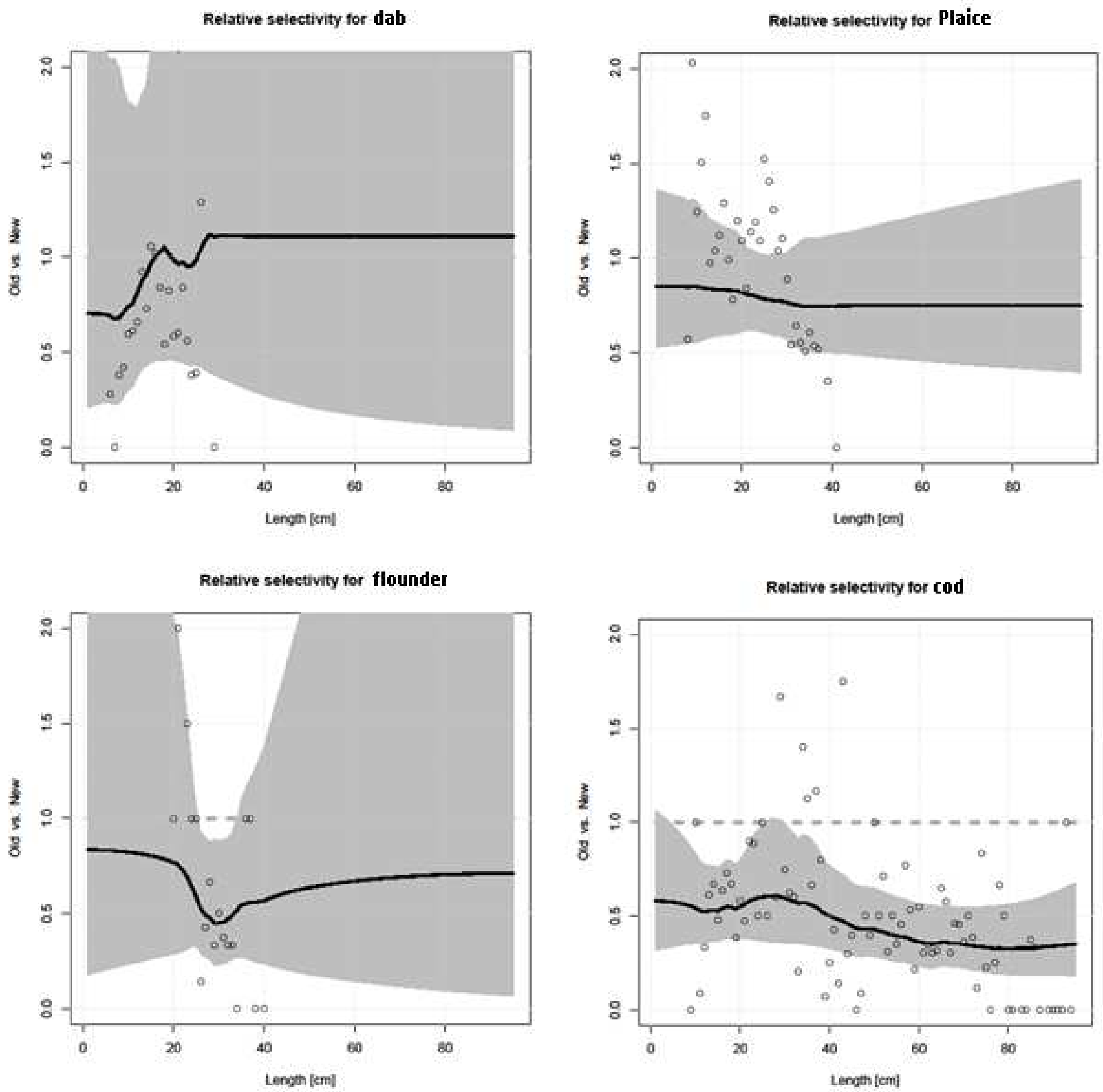
Catches

Vessel	Species									
	Long rough dab	Dab	Turbot	Plaice	Lemon sole	Wich flounder	Flounder	Brill	Sole	Cod
New Havfisken	7119	**7597**	17	8195	2608	7	68	19	11	1561
Old Havfisken	4053	5656	4	8831	1444	9	37	14	32	796
Total	11172	13253	21	17027	4052	16	105	33	43	2357

Catch in numbers of most important species

Length distributions



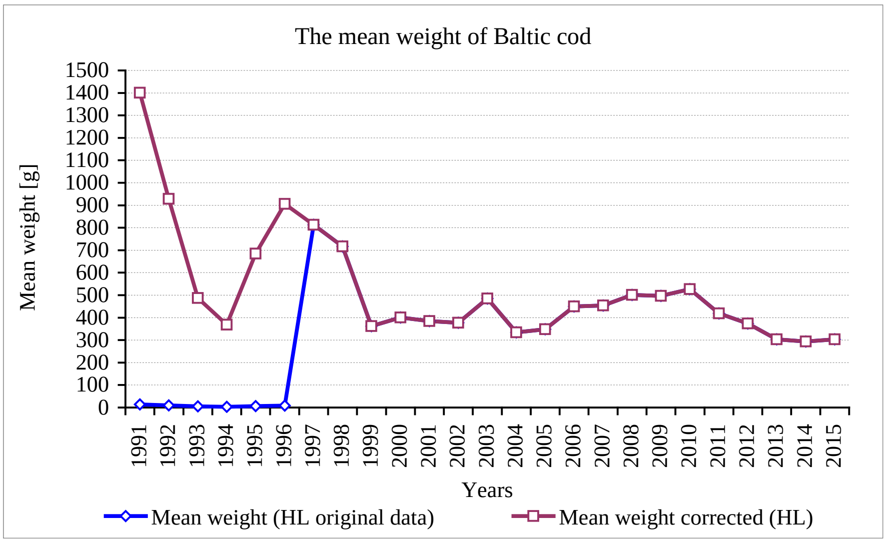

Relative selectivity for dab
Relative selectivity for Plaice
Relative selectivity for flounder
Relative selectivity for cod
Old vs. New
Length [cm]
0.0
0.5
1.0
1.5
2.0
0
20
40
60
80

Preliminary conclusions

- Only conversion factors significant different from 1 were found for only cod and flounders for catches obtains
- Length dependent conversion factors should be applied to these species when data from DATRAS is used for index calculations
- When conversion factors for cod and flounder are applied the existing time series can be regarded as sufficiently undisturbed and can be used as tuning series input for assessment. Other species can be used without any applying of conversion factors.

Annex 10. Other issues emerged before and during the annual meeting

1) On the end of 2015, scientist from the DTU-Aqua (Charlottenlund) requested WGBIFS about verification the set of data concerns the mean weight of fishes (HL records) originated from the BITS surveys and uploaded in the period of 1991-2015 to DATRAS (ICES) database. The ICES Data-Center supported an effort in correction the above-mentioned parameter and prepared the Excel table, which indicate particular reasons needed to be corrected. Before the WGBIFS-2016 meeting the list of such errors was submitted by Denmark, Germany, Poland, Russia, Lithuania and Latvia. The individual action regarding amendments for fish weight misreporting in the DATRAS HL.CatCatchWgt was undertaken before the WGBIFS-2017 meeting however, still some national data should be verified and the final corrections are expected soon as possible. Table below shows the status, and green rows are checked and approved, while white rows need to check by national submitters and report to DATRAS administration e-mail: DatrasAdministration@ices.dk. The discrepancy in CatCatchWeights data from years before 1997 and after resulted from various weight units of fishes used historically and presently in the DATRAS. The effect of various (incorrect) weight units used for cod data is presented in figure below.



country	ship	quarter	year	species	to-do action for CatCatchWgt
POL	GDY	all	1991-93	all	none
POL	BAL	all	1994, 96, 99	all	none
POL	BAL	1	1995	172894 (TSN)-127141 (WoRMS)	in hauls 39,48,49 raise by 10
POL	BAL	1	1997	164712 (TSN)-126436(WoRMS)	in haul 73,74 raise by 0.1
POL	BAL	1	1998	172894 (TSN)-127141 (WoRMS)	in hauls 20,59,62 raise by 10
POL	BAL	1	1999	161789(TSN)	in haul 60 raise by 10
POL	BAL	1	2000	all	raise by 100
POL	BAL	1	2001	164712 (TSN)	raise by 10
POL	BAL	1	2001	164712 (TSN) 126436(WoRMS)	raise by 100

POL	BAL	1	2001	172894 (TSN) 127141 (WoRMS)	haul 34 raise by 1000, all other hauls raise by 100
POL	BAL	1	2002	126436(WoRMS)	haul 11 raised by 10, all other hauls raise by 1000
POL	BAL	1	2002	127141(WoRMS)	raise by 1000
POL	BAL	4	2002	all	raise by 10
POL	BAL	1	2003	all	haul 20 no changes, all other hauls raise by 10
POL	BAL	4	2003	all	raise by 10
POL	BAL	1	2004	all	raise by 100
POL	BAL	4	2004	164712 (TSN)-126436(WoRMS)	raise by 100
POL	BAL	4	2004	172894 (TSN)-127141 (WoRMS)	haul 9 raise by 0.1
POL	BAL	1	2005	164712 (TSN)-126436(WoRMS)	in hauls 4,18 raise by 1000
POL	BAL	1	2006	127141(WoRMS)	haul 36 raise by 100
POL	BAL	all	2007-2015	all	none
GFR	SOL	1	1991-2002	all	raise by 100
GFR	SOL	4	1991-2002	all	raise by 100
GFR	CLP	1	1992-1998	all	raise by 100
GFR	CLP	2	1992-1998	all	raise by 100
GFR	SOL	all	2003-2004	all	none
GFR	SOL2	all	2004-2015	all	none
DEN	DAN2	1+4	1991-1996	all	?
DEN	DAN3	1+4	1997-2015	all	none
DEN	HAF	1	1996	all	?
DEN	HAF	1+4	1997-2015	all	none
LAT	ZBA	1+2+3	1991	126436(WoRMS)-127141(WoRMS)	raise by 100
LAT	BPE	1+2	1993	126436(WoRMS)-127141(WoRMS)	raise by 100
LAT	MONL	2	1994	all	raise by 100, unless -9
LAT	MONL	1	1995	126436(WoRMS) -127141(WoRMS)	raise by 100
LAT	MONL	1	1996	all	raise by 100, unless -9
LAT	CLV	1	1997	all	stno 1 raise by 100
LAT	CLV	2	1998	126436(WoRMS)- 127141(WoRMS)	raise by 100
LAT	CLV	1+2	1999	all	stno 1 raise by 100
LAT	CLV	1+4	2000	all	raise by 100
LAT	CLV	1	2001-2003	spec. with ValCode 4	StNo1 Raise by 1000, CatCatch 0 replace by -9
LAT	CLV	4	2001-2003	all	StNo2 raise by 100
LAT	CLV	1	2004	all	StNo1 Raise by 100, CatCatch 0 replace by -9
LAT	CLV	4	2004	spec. with ValCode 4	StNo2 raise by 1000
LAT		1+4	2005-2009	spec. with ValCode 4	StNo1 and 2 Raise by 1000, CatCatch 0 replace by -9
LAT		1	2010	spec. with ValCode 4	StNo1 Raise by 1000, CatCatch 0 replace by -9
SWE	ARG	all	1991-2010	All	none
SWE	DANS	1+4	2011-2015	All	none
SWE	MIM	1	2011	All	none

RUS	MON	1	1993,94	all	?
RUS	MON	1+2	1995-96	all	?
RUS	ATL	1+2	1997-2011	all	?
RUS	ATL	q4	2003-2008, 2010-2011	all	?
RUS	ATLD	1+2	1998-2011,13	all	?
RUS	ATLD	q4	2003-2013	all	?
RUS	VSH	1	2002	all	?
EST	KOH	2to4	1995-96	all	?
EST	KOOT	2+4	1999-2000	all	?
EST	CEV	4	2005-2014	all	none?
LTU	DAR	4	2005	127141(WoRMS)	haul 4 CatCatchWgt = 75
LTU	DAR	4	2005	126436(WoRMS)	haul 4 CatCatchWgt = 918
LTU	DAR	1	2006	161789(TSN) -126425(WoRMS)	haul 5 CatCatchWgt = 31341
LTU	DAR	4	2007	171978(TSN) -126928(WoRMS)	haul 5 CatCatchWgt = 14

2) Before the beginning of WGBIFS-2017 meeting was detected some incorrect information regarding the definition “daylight”, mentioned in the BITS Manual and on the ICES DATRAS Website and this matter was discussed during the reporting meeting. Proposed action, leading to solving the problem is mentioned in Annex 4.B and the sunrise/sunset calculations procedure is described in Annex 9.

3) Danish specialists from the DTU-AQUA requested (16.06.2016) special attention at the WGBIFS/2017 meeting, focusing on the results of calibration of fish catch data, obtained by the Danish old and new r/v “Havfisken”. The request was repeated (04.01.2017) by the ICES Secretariat. The WGBIFS members decided to use the conversion factors estimated for cod and flounder within the next 4-5 years, and then reanalyse the data including the additional data obtained. More widely, description of this topic is in Annex 6.2.

4) The Workshop on Implementation and Use in IBAS of a New Common Acoustic Database (ACOU; 06-08.12.2016) and authors of the StoX programme asked participants of the WGBIFS-2017 meeting for suggestions how to improve the programme and implement it as a routine database linked with IBAS surveys. The additional task was discussed during the WGBIFS-2017 meeting and will be prolonged at the next annual meetings.

5) Shortly after WKBIFS-ACOU (Dec. 2016) WGBIFS was asked to create a task-group to follow implementation of the IBAS abundance estimation procedure using StoX programme. Such task-group works during the reporting meeting and the example from the Estonian BIAS survey in 2015 was detailed discussed, taking into consideration input and output data (acoustic, biotic, catches) as well the process of fish stock size assessment using the StoX programme.

6) The ICES Data Center mobilised by the ACOM/SCICOM and HELCOM, requested again (27.01.2017) WGBIFS to deliberate the issue – how to calculate the LFI and MML indicators, based on the BITS survey results. The additional task was discussed during the WGBIFS-2017 meeting and will be prolonged at the next annual meetings (see also Annex 4.B). The present status and some needs refer to calculations of the LFI and MML indicators are described below:

<u>The Large Fish Indicator (LFI)</u> initially was developed by Greenstreet et al. (2011) and is defined as the proportion by biomass of large fish in demersal trawl surveys, where

fish are considered as large if they exceed a length threshold, for example, 40 cm. The indicators LFI and Mean Maximum Length (MML) are intended to reflect the status of the fish community. Houle et al. (2012) stated that the LFI is sensitive and specific to fishing pressure that truncates the upper end of the fish size spectrum (Sheldon et al., 1972). LFI quantifies a characteristic of marine food-webs that are slow to recover and often under intense pressure (WKGMSFDD4_II, 2015) and depends on community of species taken into account, defined length limit. Area, which is taken into account (different spatial distribution pattern of species taken into account), the variability of the abundance of new year-classes and human activities (change in the fishing activity can results in changing LFI). MML is calculated as the average maximum potential length of individuals making up a community and takes no account of length of individuals at the time of sampling although it is a community indicator it does reflect a shift in species composition (WKGMSFDD3 Final Report). The method needs unbiased estimates of L_∞ for all species taken into account, which requires unbiased and validated age-length data. Validated age data are not available for species sampled during BITS. LFI defined for the North Sea was adapted to the Baltic Sea by Oesterwind et al. (2013), due to mainly lower diversity of marine fish species and lower mean length of marine commercial fish species in the Baltic Sea. Furthermore, strong environmental gradients from west to east, e.g. salinity, and of the fish communities occur in the Baltic Sea. The authors used the data of BITS between 2001 and 2011. They combined the data of cod, dab, flounder, whiting, plaice, turbot, brill and sole in a species community, which represented more than 98% of the total biomass. It must be pointed out, that the spatial distribution of incorporated species is quite different. Brill and dab are concentrated in the ICES SD 22. Cod is dominating species and makes up 71% (± 5%) of the biomass of individuals larger 20 cm, 86% (± 3%) of biomass larger 30 cm and 96% (± 1%) of biomass larger 40 cm (Oesterwind et al., 2016). Other data sampled during the international coordinated surveys in the Baltic Sea were used to define LFI (HELCOM 2015. HELCOM core indicator report. Online).

The group assumed that inconsistencies in gears used in acoustic surveys made the calculation of a pelagic MML for the entire Baltic Sea unreasonable. Therefore, effort was devoted to define LFI using the BITS demersal trawl data. The subgroup attempted to calculate the index to identify potential problems in the data and in the application of the method (according to Fung et al. 2012 and Oesterwind et al. 2016).

The subgroup extracted BITS data from DATRAS and chose to use the first quarter survey since 2001. The species list used to calculate the LFI in the Baltic Sea is limited to the demersal species that account for the majority of the biomass (cod, dab, flounder, whiting, plaice, turbot, brill, and sole). Compared with efforts in the North Sea (Fung et al. 2012), the identification of non-fish and non-demersal species is minimal for such a limited species list. Length weight relationships are used to estimate total biomass and differences in this relationship vary over time and between regions of the Baltic Sea. Therefore, length weight relationships should be obtained on a reduced spatial and temporal scale. Length-weight relationships for some species are not available for all trawls and interpolating should be made with caution. Swept area is a more robust estimate of effort used for CPUE (Adlerstein and Ehrich, 2002) and is generally used LFI literature (e.g., Greenstreet 2011, Fung et al 2012). Swept area is the distance trawled (m) multiplied by wing spread (m) / 1000 to result in km^2. The subgroup identified some problems with data availability. Several countries do not report trawl wings and door spread to DATRAS. Some countries have this information available while others do not have access to net measuring equipment.

In considering the LFI for the Baltic Sea, the subgroup has some thoughts. Environmental conditions vary across the Baltic Sea (e.g., salinity gradients, etc.) and species distributions vary accordingly. Therefore, species compositions used in the index may influence the index so the coverage of the survey should be taken into account. One potential limitation for the LFI is that it is limited to the areas where the BITS are regularly conducted, i.e. the central and southern Baltic Sea.

Identification of length threshold to define "large fish" and the final species list used for index calculation should be carefully investigated. Finally, the index should be tested against fishing pressure to ensure that it is a useful indicator of ecosystem response to anthropogenic perturbation.

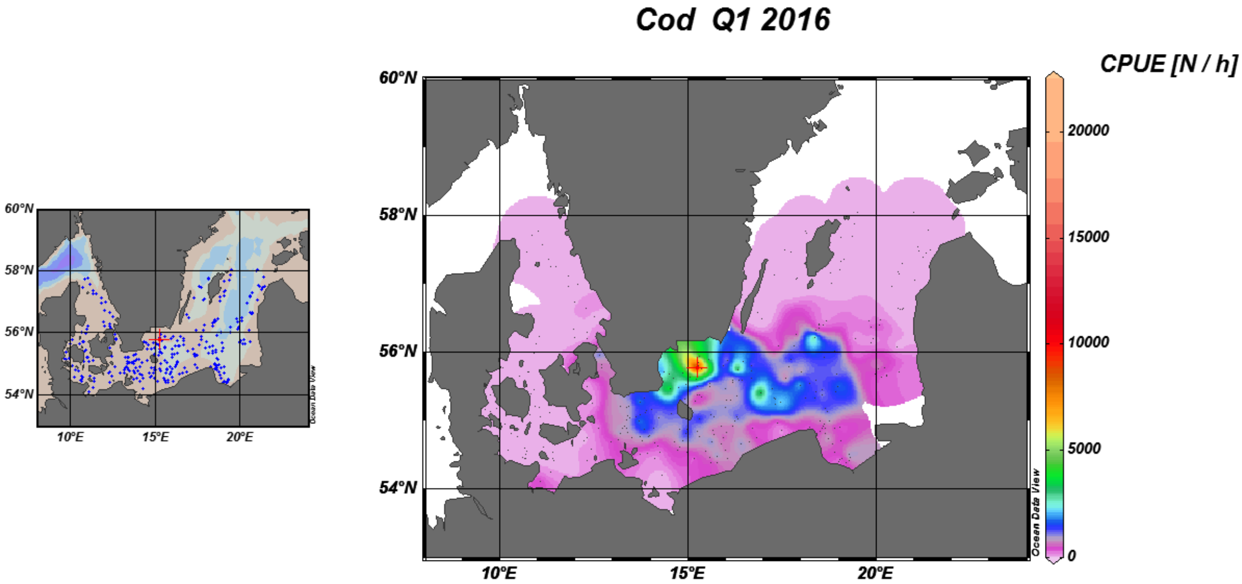
In conclusion, there currently is not sufficient information in DATRAS to create a robust estimation of catch per unit effort using swept area. There is sufficient information to compute catch per unit effort using time as the effort parameter. However, it is assumed that such a CPUE is biased and not suitable for calculating the LFI.

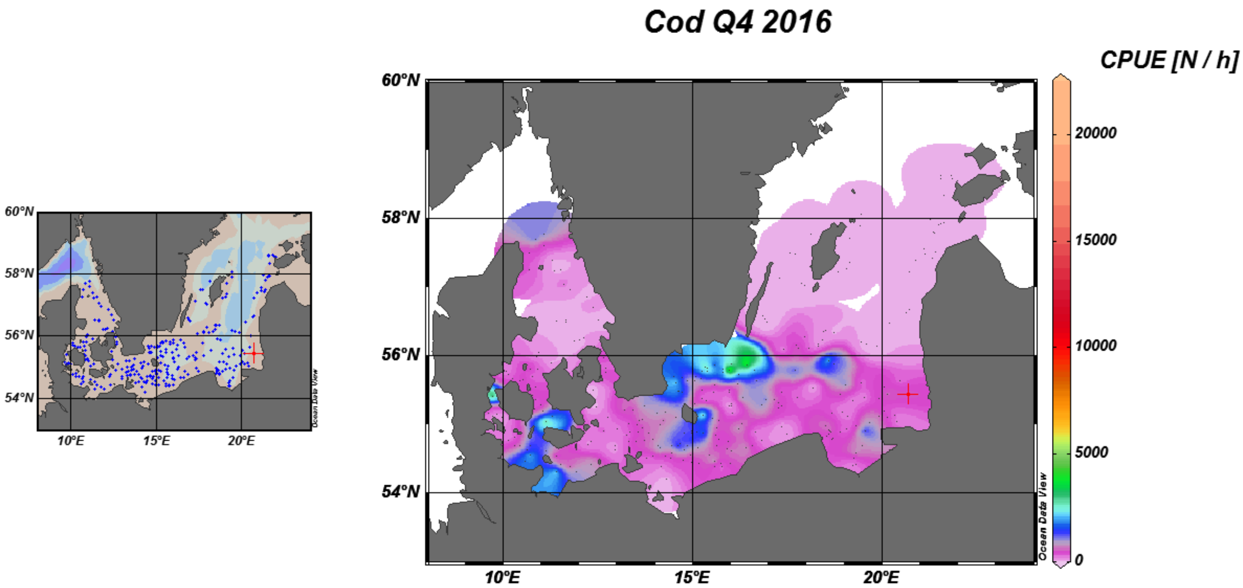
WGBIFS suggest that all vessels involved in the BITS surveys realisation should to have possibly soon suitable equipment (sensors on the trawl wings) for measuring horizontal and vertical trawl opening during fishing. Such data are very needed for calculation the swept area. In the ICES Data Centre, DATRAS experts elaborated (2014) "DATRAS Procedure Document – NS-IBTS CPUE by swept area calculation algorithms" focused on CPUE by swept area calculation algorithms used by different countries executed the IBTS surveys. The mentioned document can be adapted to the BITS CPUE calculation.

Adlerstein, S., Ehrich, S. (2002). Effect of deviations from target speed and of time of day on catch rates of some abundant species under North Sea International Bottom Trawl Survey protocol conditions. ICES J Mar. Sci.; 59, 594–603, doi: 10.1006/jmsc.2002.1193.

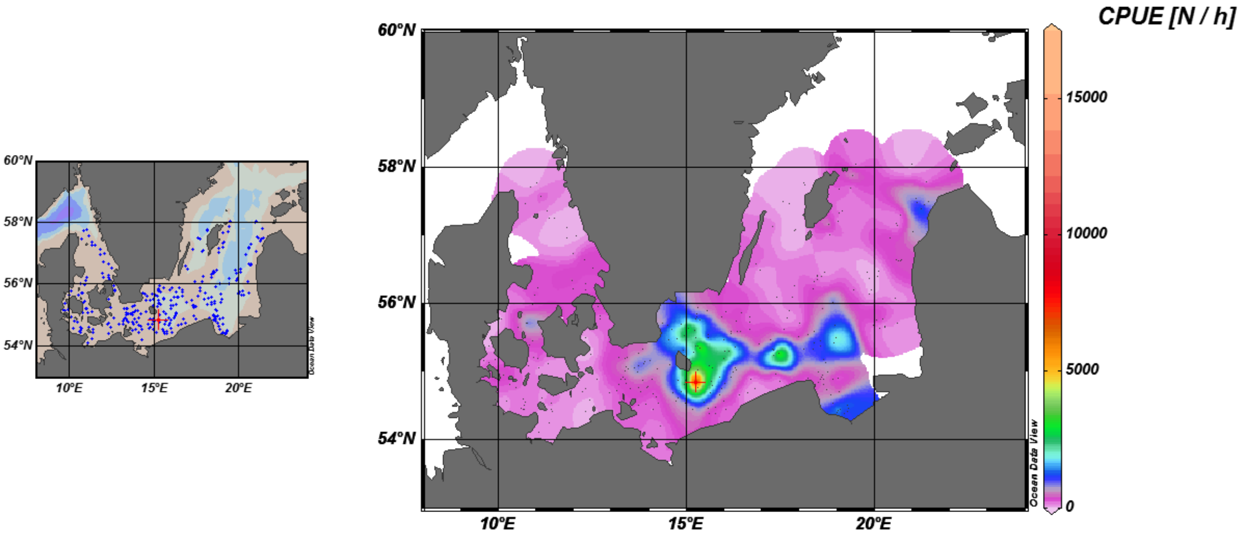
Annex 11. Inquires from the WGBFAS

1) The Baltic Fisheries Assessment Working Group (WGBFAS) at the meetings in 2015 and 2016 requested WGBIFS about preparation the set of maps showing abundance distribution (CPUE in numbers/h) of cod, flounder, plaice, turbot, dab and brill in the bottom zone of the Baltic, during the previous year in the BITS-Q1 and BITS-Q4 surveys. Below are shown distribution maps for the above-mentioned fish species (all ages). The maps are based on download of the CPUE data from DATRAS (March 2017) but before all data from the 1st quarter, 2017 were available. CPUE of cod by catch-stations is given in units of TVL and CPUE of flatfish by stations is given in units of used gear, as no conversion factors are available for standardization for other species than cod. It should be mentioned that, for relatively rare species in the Baltic, like brill and dab, the attached maps shows distribution of this species in very limited areas of the western Baltic only.

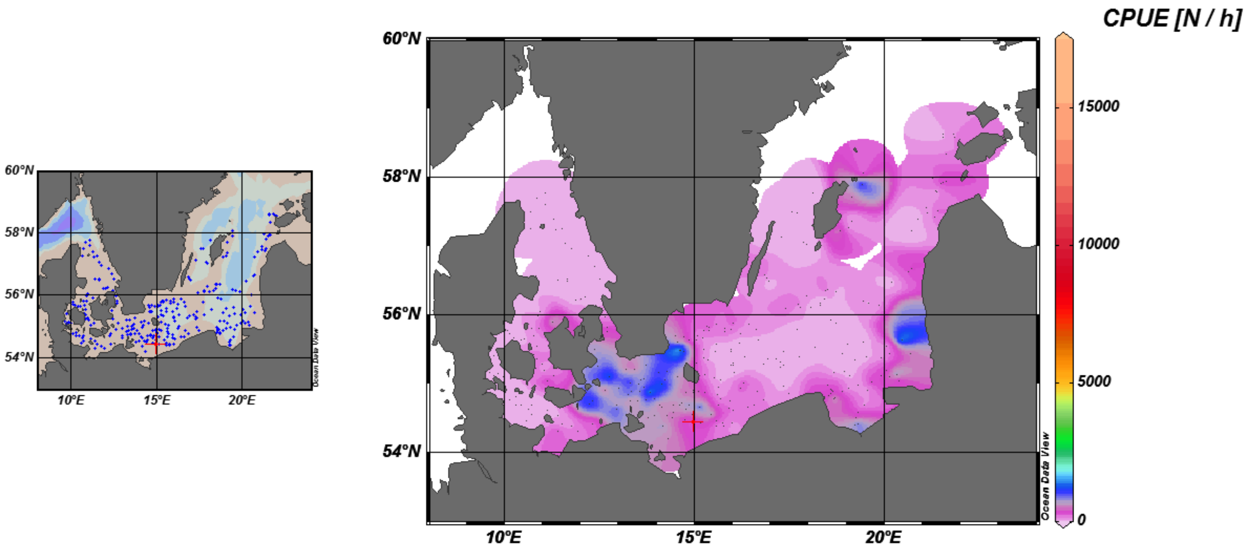




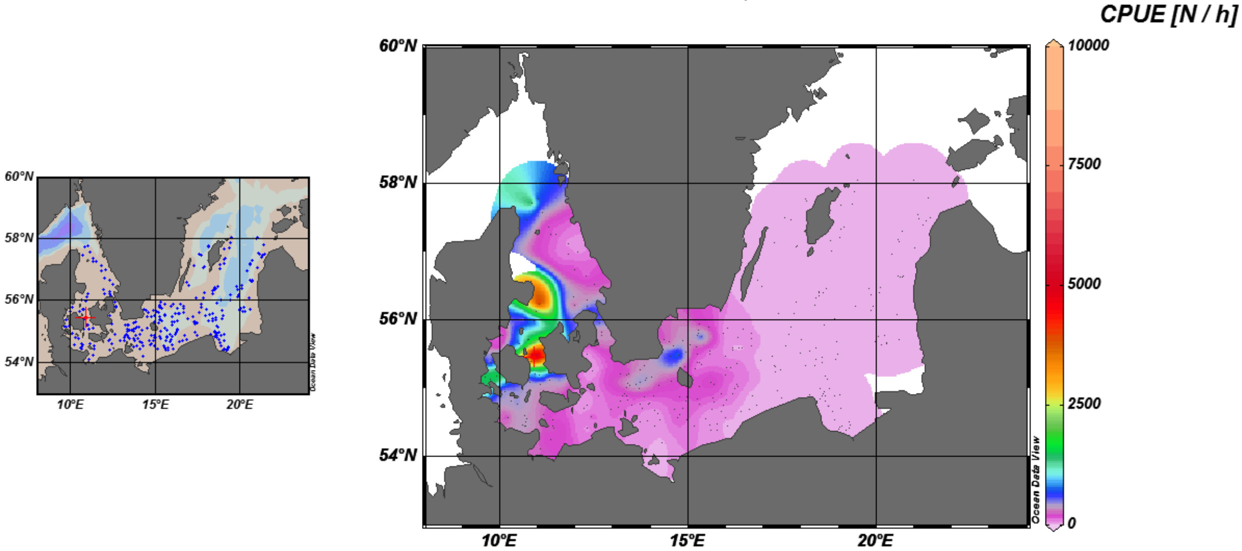
Flounder Q1 2016

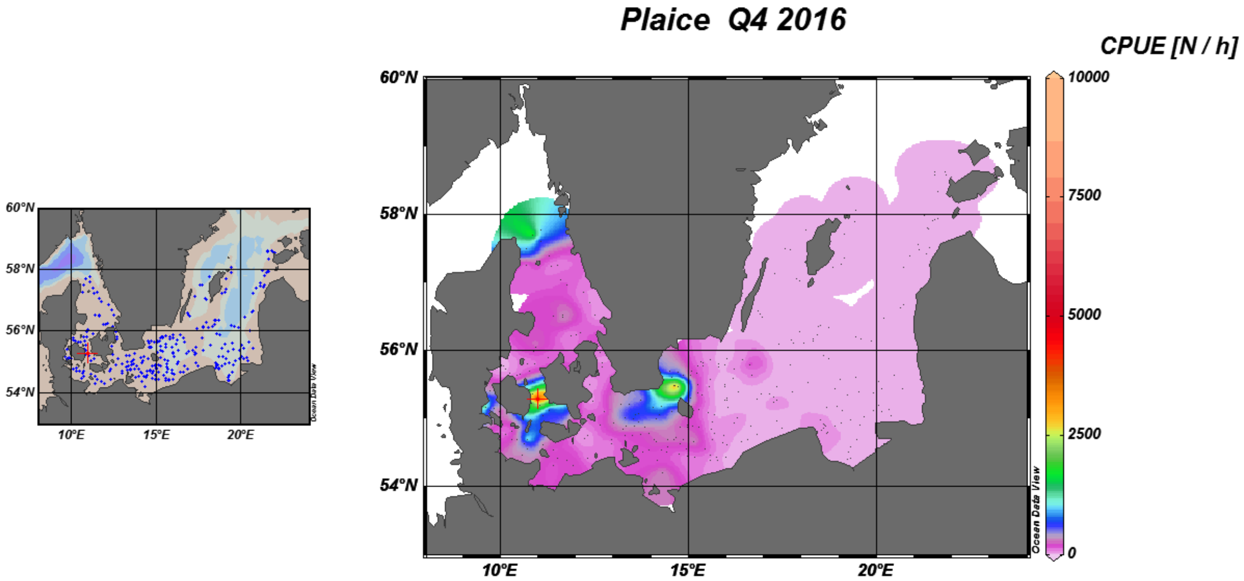


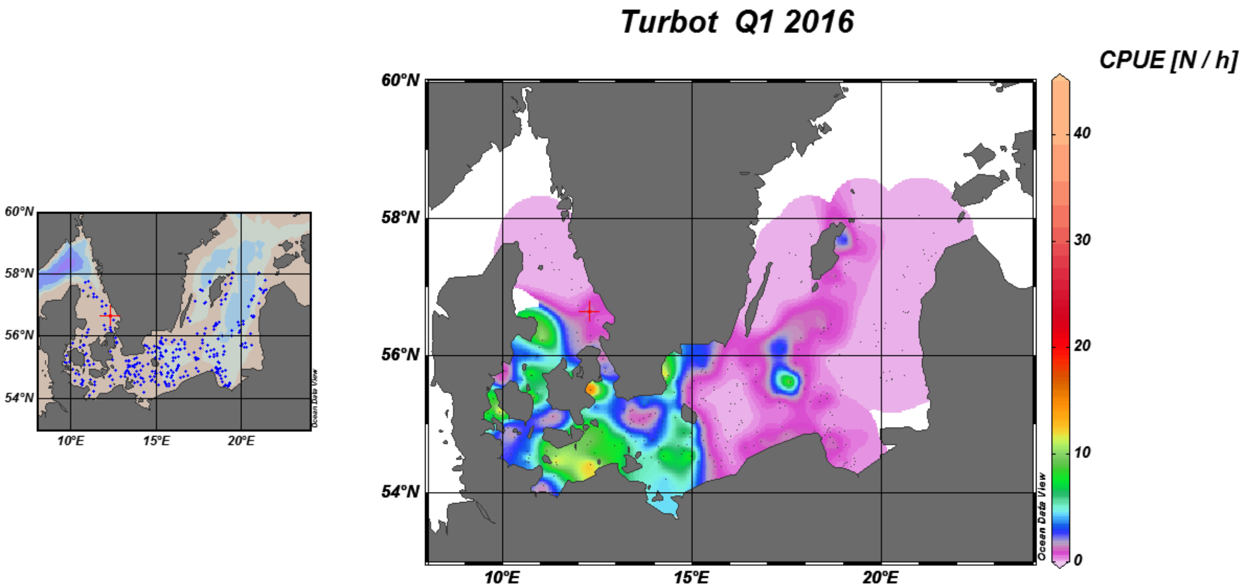
Flounder Q4 2016

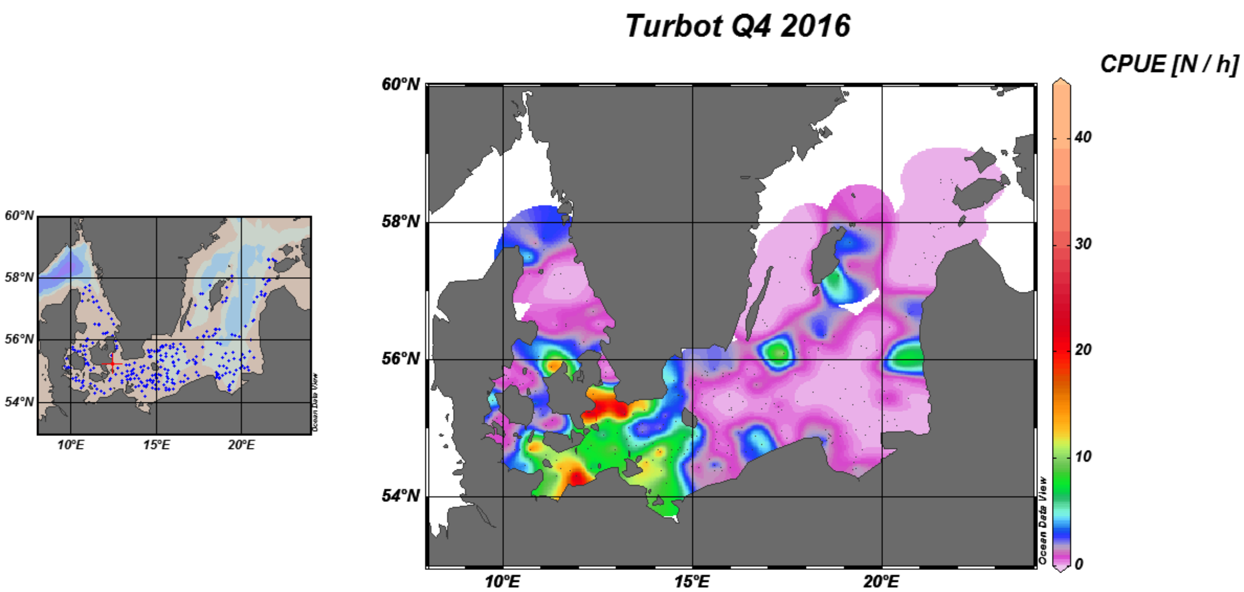


Plaice Q1 2016

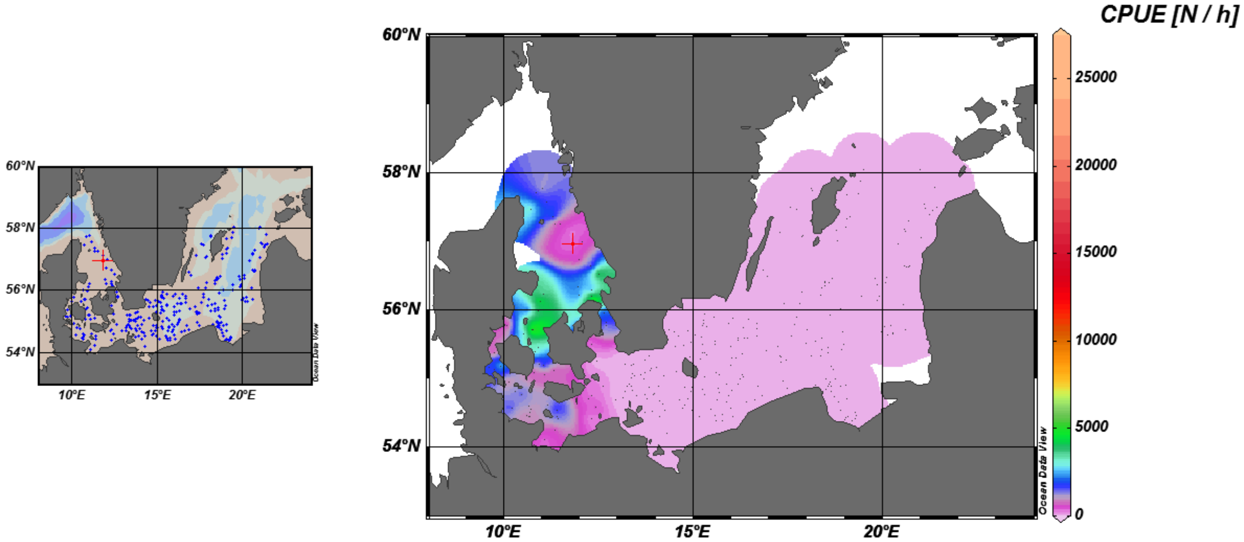



Plaice Q4 2016
CPUE [N / h]
60°N
58°N
56°N
54°N
10°E
15°E
20°E
10000
7500
5000
2500
0
Ocean Data View

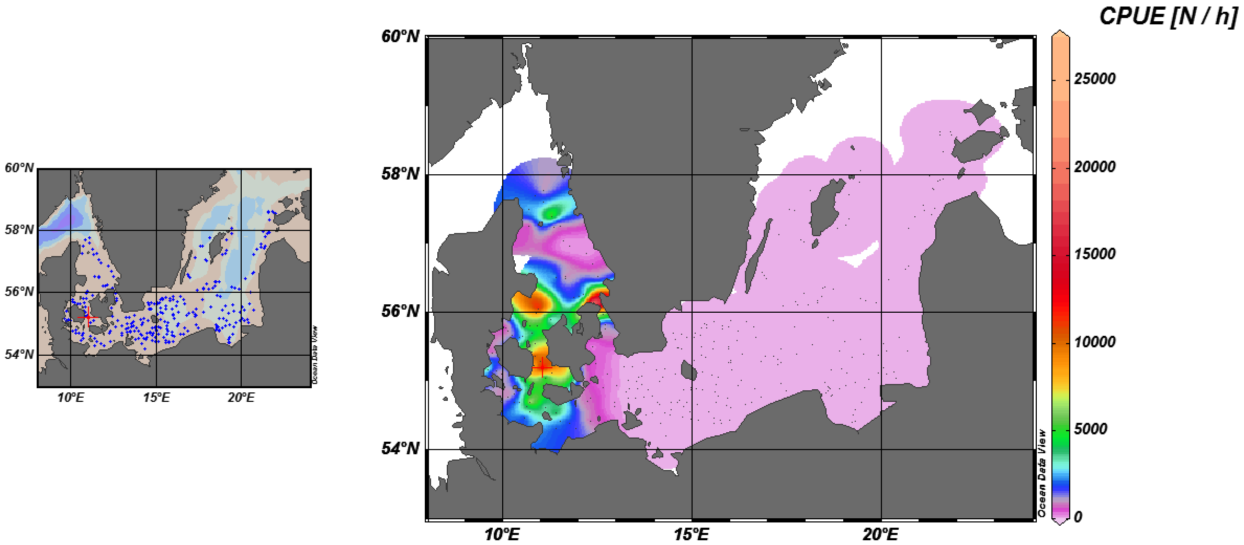

Turbot Q1 2016
CPUE [N / h]
60°N
58°N
56°N
54°N
10°E
15°E
20°E
40
30
20
10
0
Ocean Data View


Turbot Q4 2016
CPUE [N / h]
60°N
58°N
56°N
54°N
10°E
15°E
20°E
40
30
20
10
0
Ocean Data View

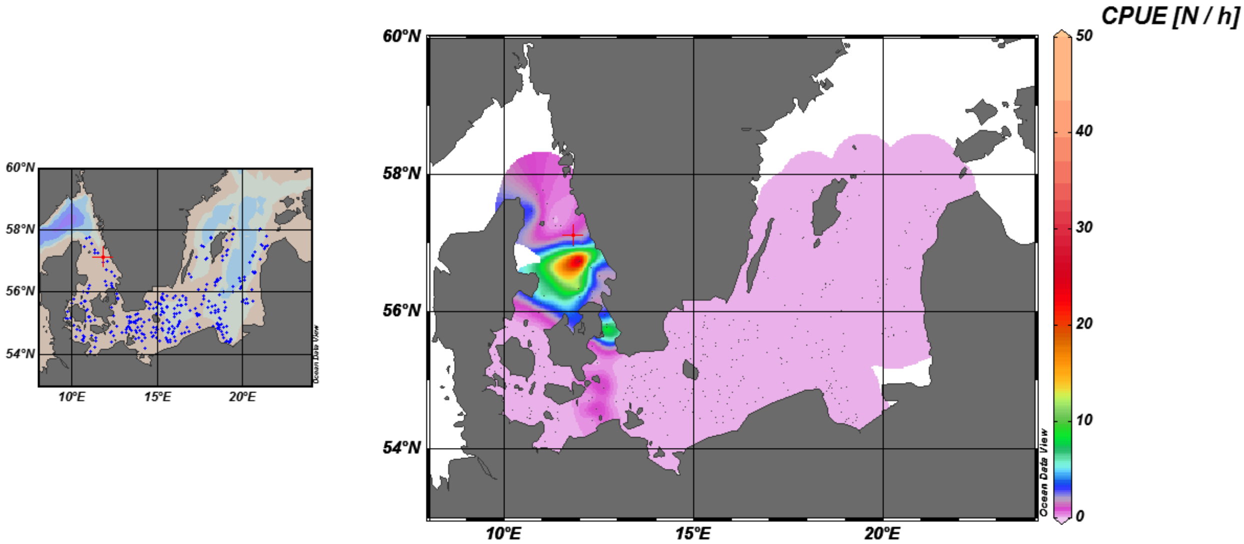
Dab Q1 2016

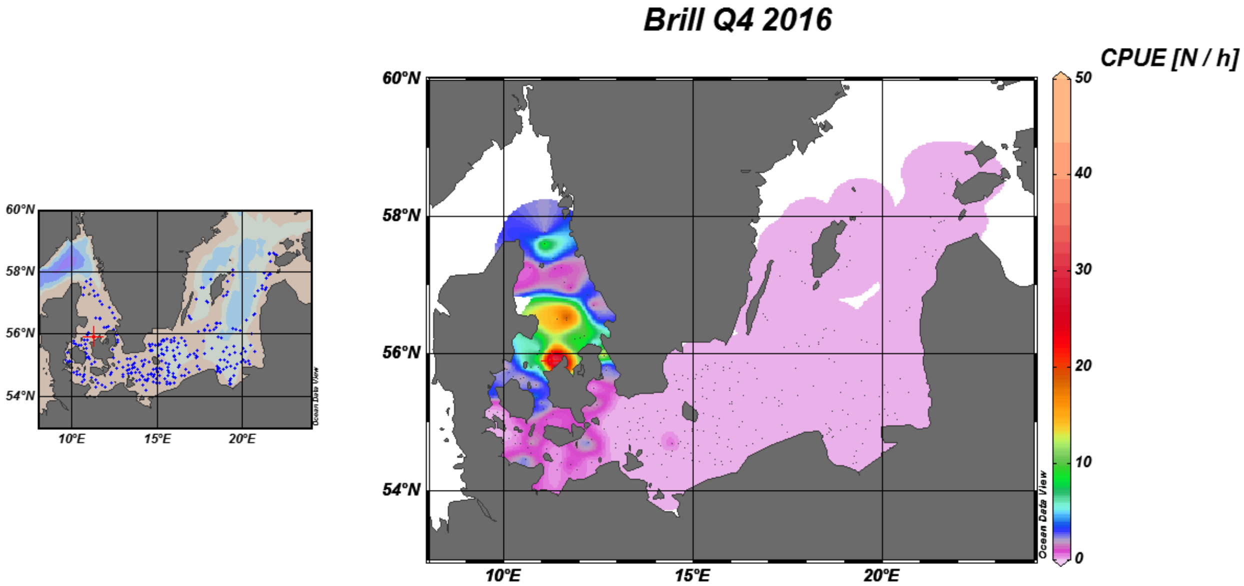


Dab Q4 2016



Brill Q1 2016





1.1) WGBFAS (2015-2016) also requested maps showing the distribution of one-year-old cod, flounder, plaice, turbot, dab and brill. This request is more difficult to fulfil, as the lack of age readings of cod (from the BITS surveys in some countries). For flatfish the maps can be made for flounder and plaice (age readings exists) but the usefulness of the maps can be discussed as the survey do not covers the coastal areas with shallow waters, where the YOY are supposed to be abundant. This probably counts for cod as well.

2) On February 06, 2017 was sent the feedback from WGBFAS with request about annually actualization at the WGBIFS ongoing meeting a table with the WGBFAS surveys indices used in the Baltic fish stocks assessment process. This request was made due to ensure the survey data quality as well as the knowledge of the data quality. This table (see below at the end of a point 2 of this annex) is thought as a dynamic document and if other information is wanted, it can be changed/expanded. First column "stock" indicate which stock the information has been used for, column "survey" indicates the survey used for the stock assessment, if more than one survey has been used surveys are listed one row at the time, column "ages" shows the age span used from the surveys in the assessment and the area column shows the areas used from the survey, the last column indicate were the data is stored. The following questionnaire was attached to the above-mentioned request:

<u>Questions to the WGBIFS, addressed by WGBFAS (Feb. 2017)</u>

Do you consider that the research surveys are appropriate for the Baltic fish stocks assessment – see the list in Table 1?

The routine surveys (BITS, BIAS, BASS) area coverage is sufficient to reflect the spatial distribution of fish from age groups 1+ and applied the fishing gears (TV3-L, TV3-S, small meshed pelagic trawl) are considered to provide representative catches for cod-like and flatfishes (BITS) and clupeids (BIAS, BASS) species. The WGBIFS consider that the BITS surveys results are appropriate as the input data for assessment of the demersal/benthic fish stocks, listed in the table mentioned below. The hydroacoustic surveys can be considered as appropriate for the assessment of Baltic herring and sprat stocks. In addition, the age groups used for the assessment of Baltic herring and sprat stocks are appropriate.

Are the age groups used by stocks appropriate?

Juveniles (0 and 1 age groups) of flatfish and to some extent cod are under-represented in the control-catches because they stay predominately in more shallow waters, than covered by the BITS surveys. The catches of juveniles are not consistent across years. This means that the use of the 0-group of cod in the western Baltic for assessment can be questioned and should be deeply investigated.

The age groups used for the assessment of Baltic herring and sprat stocks (from acoustic estimates) are enough appropriate. The abundance of herring and sprat from age 0 in the central Baltic and from age 0-1 of herring in ICES SD 30 are underestimated in the BIAS surveys, but the time series can be used for the estimation of recruitment index in the stock assessment as it is considered as consistent across years.

Do you have any other fish species for which you collect information (age, length and maturity) during your survey that could be used for stock assessment?

No additional age and maturity international data are available for other fish species/stocks than the stocks listed in the table. However, in some countries (Lithuania, Poland) mentioned biological parameters are determined for a few other, less-numerous fishes (see table below).

Country	Survey	Species	Age	Maturity	Data available	Data can be find
Lithuania	BITS	*Osmerus eperlanus*	yes	yes	2010-2016	Personal age reader Excel tables
Lithuania	BITS	*Myoxocephalus scorpius*	yes	yes	2013-2016	Personal age reader Excel tables
Lithuania	BITS	*Neogobius melanostomus*	yes	yes	2013-2016	Personal age reader Excel tables
Lithuania	BITS	*Cyclopterus lumpus*		yes	2013-2016	Personal age reader Excel tables
Lithuania	BITS	*Alosa fallax*	yes	yes	2010-2016	Personal age reader Excel tables
Poland	BITS	*Merlangius merlangus*	yes	yes	2015-2016	National database
Poland	BITS	*Enchelyopus cimbrius*	yes	yes	2015-2016	National database
Poland	BITS	*Myoxocephalus scorpius*	yes	yes	2015-2016	National database
Poland	BITS	*Engraulis encrasicolus*	yes	yes	2015-2016	National database
Poland	BITS	*Cyclopterus lumpus*	yes	yes	2015-2016	National database
Poland	BITS	*Scomber scombrus*	yes	yes	2015-2016	National database
Poland	BITS	*Alosa fallax*	yes	yes	2015-2016	National database
Poland	BITS	*Sander lucioperca*	yes	yes	2015-2016	National database
Poland	BIAS	*Salmonidae*	yes	yes	2011-2016	National database

Do you have knowledge of any other surveys that we are presently not using for Baltic fish stock assessment that you find appropriate for any of the stocks listed.

The list of additional research surveys that can be potentially used for the assessment of Baltic fish stocks is as follows:

- Germany; two research surveys conducted in summer with applied the TV-3 trawl, i.e. a standard fishing gear in the BITS surveys,
- Lithuania; two surveys per month, with an exception of winter, realised in coastal zone from 2005 are focused on monitoring of all fish species length distribution; gillnets with the mesh size from 20 to 140 mm and in May-June with additional mesh size of 180-240 mm are applied for fish sampling; set of collected materials is stored in the national database,
- Lithuania; every quarter (from 2005) the all fish length distribution monitoring in the Lithuanian marine waters at fixed location of four catch-stations; fish age determination is realised in the case of cod and flounder, and in lesser extent for sprat, herring, smelt, sea-scorpion, round goby; the standard TV-3 trawl is applied for fish sampling, set of collected materials is stored in the national database,
- Lithuania; monitoring of young flatfishes (flounder, turbot), smelt and sprat spatial distribution, feeding and length frequency in coastal areas; investigations realised from 2000 are aimed on the estimation of fish stocks abundance and biomass; beach seine and dragnet are used for fish sampling, set of collected materials is stored in the national database,
- Latvia; *Latvian Flatfishes Juvenile Survey* is performed from May-October 1986, in app. 4000 m^2 sampling area located in the Latvian coastal zone (on app. 130 m distance from the coastline at fixed profiles inside and outside of the Gulf of Riga), and survey is aimed on the juvenile flounder and turbot abundance estimates; data about flounder and turbot length, weight, sex and age are collected however, other fishes and nektobenthos are also intensively investigated to support ecosystem analyses, moreover during the surveys the basic hydrological parameters are measured too; as the basic fishing gear the beach seine (with the mesh size in codend of 8 mm) is applied on the main nursery area of flatfishes, set of collected materials is stored in the national database,
- Latvia; demersal fish survey in the Gulf of Riga since 1977, with the bottom trawl applied for catching demersal/benthic species in May, August and October, with preference to eelpout (viviparous

blenny), to which data concerns length, weight, maturity and age are systematically collected, set of collected materials is stored in the national database,

- Latvia; surveys realised from 1995 are focused on turbot spawning stock investigations, the large gillnets with mesh >=220 mm are used for fish catching, set of collected materials is stored in the national database,
- Sweden; in 2011 was started a survey (no name yet), which results might be useful for future assessment of fish stocks, which distribution area include the Øresund (the Sound).

Summary from the above: four Baltic countries, since about 30 years realised overall 12 research surveys in the own the estuarine, coastal marine waters and to some extent in the open sea too, with various frequency within a year, mostly at fixed research profiles, with different types of fishing gears applied (commercial bottom trawls, TV-3S, gillnets and beach-seine with various mesh size, dragnet), aimed on monitoring of juveniles and adult fishes; set of collected materials is stored in the national database.

Table 1. Surveys presently used in the Baltic fish stocks size assessment. Information on area used, age group included, years used and information on where data is stored is a part of the table.

STOCK	SURVEY	QUARTER	AREA/SD	YEARS	YEARS EXCLUDED	BASIS	Database
Cod SDs 22—24	BITS	1	22, 23, partly 24	2001-2017	-	Ages 1-4	DATRAS
		4	22, 23, partly 24	2001-2016	-	Ages 0-4	DATRAS
Cod SD 21 (Kattegat)	IBTS	1	21	1997-2017	-	Ages 1-6	DATRAS
		3	21	1997-2016	-	Ages 1-4	DATRAS
	BITS	1	21	1997-2017	-	Ages 1-3	DATRAS
		4	21	1997-2016	-	Ages 1-3	DATRAS
	CODS	4	21	2008-2016	Not conducted in 2012	Ages 1-6	National database SLU Aqua, DTU Aqua
Cod SDs 25-32	BITS	1	25-28	2001-2017	-	CPUE (kg/h), ≥ 30 cm	DATRAS
		4	25-28	2001-2016	-	CPUE (kg/h), ≥ 30 cm	DATRAS
Sole 3a (SDs 20-21) & SDs 22-24	SOLES	4	20-21	2004-2016	2012-2013	Ages 1-9	National database DTU Aqua
Plaice SDs 21-23	combined IBTS	1	21-23	1992-2017	-	Ages 1-5	DATRAS
	BITS	1	21-23	1992-2017	-	Ages 1-5	DATRAS
	combined IBTS	3	21-23	1998-2016	-	Ages 1-5	DATRAS
	BITS	4	21-23	1998-2016	-	Ages 1-5	DATRAS
Plaice SDs 24-32	BITS	1	24-26	2002-2017	-	CPUE (N/h), ≥ 20 cm	DATRAS
		4	24-26	2002-2016	-	CPUE (N/h), ≥ 20 cm	DATRAS
Herring SDs 25-27, 28.2, 29+32	BIAS	4	25—27, 28.2, 29	1991-2016	1993, 1995, 1997	Age 0	BIAS database (WGBIFS sharepoint)
		4	25—27, 28.2, 29	1991-2016	1993, 1995, 1997	Ages 1-8+	BIAS database (WGBIFS sharepoint)
Herring SD 28.1	AS	3	28.1	1999-2016	-	Ages 1-8+	National database Latvia\Estonia
Herring SD 30	BIAS	4	30	2007-2016	-	Ages 2-8	BIAS database (WGBIFS sharepoint)
Herring SD 31	TRAPNET	1-4?	31	1994-2006	-	Ages 3-8+ (incl. effort)	National database Finland
	TRAWL	1-4?	31	2000-2006	-	Ages 2-8+ (incl. effort)	National database Finland
Sprat SDs 22-32	BIAS	4	22-29	1991-2016	1993, 1995, 1997	Age 0	BIAS database (WGBIFS sharepoint)
		4	22-29	1991-2016	1993, 1995, 1997	Ages 1-8+	BIAS database (WGBIFS sharepoint)

	BASS		2	24-26, 28	2001-2016	-	Ages 1-8+	BASS database (WGBIFS sharepoint)
Flounder SDs 22-23	combined	BITS	1	22-23	2001-2017	-	CPUE (kg/h), ≥ 20 cm	DATRAS
			4	22-23	2001-2016	-	CPUE (kg/h), ≥ 20 cm	DATRAS
Flounder SDs 24-25	combined	BITS	1	24-25	2001-2017	-	CPUE (kg/h), ≥ 20 cm	DATRAS
			4	24-25	2001-2016	-	CPUE (kg/h), ≥ 20 cm	DATRAS
Flounder SDs 26-28	combined	BITS	1	26, 28	2001-2017	-	CPUE (kg/h), ≥ 20 cm	DATRAS
			4	26, 28	2001-2016	-	CPUE (kg/h), ≥ 20 cm	DATRAS
Flounder SDs 27, 29-32	combined	Muuga	4	32	1993-2016		CPUE (kg/day)	National database SLU Aqua
		Küdema	4	29	2000-2016		CPUE (kg/day)	National database SLU Aqua
		Muskö	4	27	1992-2016		CPUE (kg/day)	National database SLU Aqua
		Kvädö-fjärden	4	27	1989-2016		CPUE (kg/day)	National database SLU Aqua
Turbot SDs 22-32	combined	BITS	1	22-28	2001-2017	-	CPUE (N/h), ≥ 20 cm	DATRAS
			4	22-28	2001-2016	-	CPUE (N/h), ≥ 20 cm	DATRAS
Dab SDs 22-32	combined	BITS	1	22-28	2001-2017	-	CPUE (kg/h), ≥ 15 cm	DATRAS
			4	22-28	2001-2016	-	CPUE (kg/h) ,≥ 15 cm	DATRAS
Brill SDs 22-32	combined	BITS	1	22-24	2001-2017	-	CPUE (N/h), ≥ 20 cm	DATRAS
			4	22-24	2001-2016	-	CPUE (N/h), ≥ 20 cm	DATRAS