Author(s): Henrik Degel, Elena Fedotova, Włodzimierz Grygiel, Olavi Kaljuste, Igor Karpushevskiy, Niklas Larson, Juha Lilja, Olof Lövgren, Hjalte Parner, Jukka Pönni, Krzysztof Radtke, Tiit Raid, Paco Rodriguez-Tress, Beata Schmidt, Elor Sepp, Vladimir Severin, Ivo Sics, Vaishav Soni, Marijus Spegys, Daniel Stepputtis, Guntars Strods, Anders Svenson, Andrés Velasco & Yury Zablotski

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

24-28 March 2018

Lyngby, Copenhagen, Denmark

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

H. C. Andersens Boulevard 44–46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

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Contents

Executive summary

The ICES Baltic International Fish Survey Working Group (WGBIFS) met in the National Institute of Aquatic Resources (DTU Aqua) in Lyngby-Copenhagen, Denmark, on 24–28 March 2018, to compile the research surveys (BITS, BASS, BIAS) results from 2017 and the first half of 2018 moreover, to coordinate and plan the schedule for surveys in the second half of 2018 and the first half of 2019. All Baltic fish stocks assessment relevant surveys were internationally coordinated. A total of 24 participants, representing all countries around the Baltic Sea, attended in the meeting (see Annex 1). Olavi Kaljuste, Sweden chaired the group.

The routine standard surveys data compilation was done and can be found under the relevant sections of the report. Each nationally organized survey is described in the standard survey report section (Annexes 6-7) and a short overview of each survey was also orally presented during the meeting (Annex 8). The area coverage and the number of control hauls in the BASS and BIAS surveys in 2017 were considered to be appropriate for the calculation of tuning indices and the data can be used for the assessment of Baltic herring and sprat stocks. The number of valid hauls accomplished during the BITS-Q4/2017 and BITS-Q1/2018 were considered by WGBIFS 2018 as appropriate for tuning series (e.g. CPUE indices) and the data can be used for the assessment of Baltic and Kattegat cod and flatfish stocks.

Time-series of the acoustic tuning fleets are presented in the Annex ToR a. Data from the BITS recent surveys have been uploaded to DATRAS. Tow-Database which allows planning the spatial distribution of hauls in the areas, where the seabed is suitable for safety trawling, was corrected and updated. Access-databases for aggregated acoustic data (BASS_DB.mdb and BIAS_DB.mdb) were updated. ICES database of acoustic-trawl surveys for disaggregated data were updated as well.

Plans for the next BITS and standard acoustic surveys were agreed.

A StoX task subgroup was created for the implementation of the StoX software for the calculation of WGBIFS acoustic stock estimates.

The outlier-rechecking request from ICES Data Centre to DATRAS data submitters was discussed. Since the outliers or extreme values can largely affect the outcomes of the Large Fish Indicator (LFI), should national submitters compare those values with their national database and recommend a decision on every particular outlier.

All countries, who realized the BITS-Q4/2017 and BITS-Q1/2018 surveys, also registered collected litter materials to the DATRAS database. ICES Data Centre suggested a new feature which would enable to upload simultaneously survey data and litter data in order to facilitate the upload process.

During the meeting a WebEX-meeting was held with Haraldur Einarsson (chair of WGFTFB) and Daniel Stepputtis (Thünen-Institute, Germany and member of WGFTFB) to discuss the issues related to the standardization of the pelagic trawl gears used in BIAS and BASS surveys. Based on the discussions, the needs for the possible standard pelagic trawl gear where identified and the next steps in the gear standardisation process were agreed.

The IBAS and BITS manuals were reviewed and several suggestions about the possible changes and corrections were listed.

Inquiries from other ICES expert groups were discussed and addressed.

1 Administrative details

Working Group name – Baltic International Fish Survey Working Group (WGBIFS)
Year of Appointment – 2018
Reporting year within current cycle (1, 2 or 3) – 1
Chair – Olavi Kaljuste, Sweden
Meeting venue – Lyngby-Copenhagen, Denmark
Meeting dates – 24–28 March 2018

2 Terms of references

a) Combine and analyse the results of spring and autumn acoustic surveys and experiments and report to WGBFAS;

b) Update the BIAS and BASS hydroacoustic databases and ICES database for acoustic-trawl surveys;

c) Coordinate and plan acoustic surveys including any experiments to be conducted;

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

e) Coordinate and plan demersal trawl surveys and experiments to be conducted, and update and correct the Tow Database;

f) Conduct analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty in the BIAS and BASS surveys;

g) Update on progress in development of the StoX software and implementation of it for the calculation of WGBIFS acoustic stock estimates, based on the IBAS methodology and data from ICES acoustic-trawl survey database;

h) Define methods for the appropriate processing of the survey data and output products from the BITS survey to deliver input-data for calculation of the Baltic LFI and MML indicators;

i) Coordinate the marine litter-sampling programme within the Baltic International Trawl Survey and registering the data in the ICES database;

j) Agree standard pelagic trawl gear used in BIAS and BASS surveys;

k) Review and update the International Baltic Acoustic Surveys (IBAS) manual and address methodological question raised at the last review of the SISP;

l) Review and update the Baltic International Trawl Survey (BITS) manual and address methodological question raised at the last review of the SISP.

3 Summary of the Work Plan for Year 1

Combined survey results from 2017 and the first quarter of 2018 and updated tuning indices for WGBFAS (ToR a and d).

Updated databases with acoustic and biotic data (ToR b).

Finalized coordination and planning for the BASS, BIAS and BITS surveys in 2018 and first half of 2019, updated and corrected Tow Database (ToR c and e).

Progress in estimation of the uncertainty in the BIAS and BASS surveys (ToR f).

Progress towards a comparison exercise to validate the StoX software in order to allow WGBIFS to use it as a new standard tool for the calculation of annual BIAS and BASS survey estimates (ToR g).

Progress in delivering input-data for the calculation of the Baltic LFI and MML indicators (ToR h).

Coordinated marine litter sampling programme in the BITS surveys and registered data in the ICES database (ToR i).

Progress towards an agreement in the standard pelagic fishing gear to be used in the BIAS and BASS surveys (ToR j).

Progress in review and update procedure of the IBAS and BITS manuals (ToR k and l).

4 List of outcomes and achievements of the WG in this delivery period

Indices for the pelagic and demersal fish stocks in the Baltic Sea from annual surveys as fishery-independent data for analytical assessment purposes in WGBFAS:

- Calculated BASS tuning fleet index for Baltic sprat in SDs 24–26 and 28.2 (abundance per age in the age groups 1-8+).
- Calculated BIAS tuning fleet index for Baltic sprat in SDs 22–29 (abundance per age in the age groups 1-8+).
- Calculated BIAS tuning fleet index for Baltic sprat recruitment in SDs 22–29 (abundance at age 0).
- Calculated BIAS tuning fleet index for Baltic herring in SDs 25–29 (abundance per age in the age groups 1-8+).
- Calculated BIAS tuning fleet index for Baltic herring recruitment in SDs 25–29 (abundance at age 0).
- Calculated BIAS tuning fleet index for Baltic herring in SD 30 (abundance per age in the age groups 0-8+).
- Uploaded data from the 4th quarter 2017 and the 1st quarter 2018 BITS surveys to the DATRAS database to be used for the calculation of survey indices for the relevant cod and flatfish stocks.

Other survey-derived products:

- Working paper to WKPELA 2018 with an evaluation of acoustic time-series for Central Baltic herring stock.
- Maps of BASS and BIAS area coverage in 2017.
- Geographical distribution maps of sprat abundance in the Baltic Sea (May-June 2017; BASS surveys).
- Geographical distribution maps of sprat, herring and cod abundance in the Baltic Sea (September-October 2017; BIAS surveys).
- Updated Access-databases for aggregated acoustic data (BASS_DB.mdb and BIAS_DB.mdb).
- Updated ICES database of acoustic-trawl surveys for disaggregated data.
- Updated and corrected the Tow-Database which allows planning the spatial distribution of hauls in the areas, where the seabed is suitable for safety trawling.

Other outcomes and achievements:

- Agreed plans (time and spatial coverage by countries) for the next standard acoustic surveys.
- Agreed plans (time and number of planned stations by countries) for BITS surveys to be conducted in autumn 2018 and spring 2019.
- 10 recommendations (Annex 4) was made to ICES Data Centre and to other ICES working groups.
- Action list (Annex 5) for WGBIFS members was prepared.
- A StoX task subgroup was created for the implementation of the StoX software for the calculation of WGBIFS acoustic stock estimates.
- A table was filled on request of Sven Kupschus (chair of Ecosystem Observation Steering Group) to assess the risk on the future fisheries surveys (Does risk to future survey implementation present a risk to advice?) and to be presented to ACOM.

5 Progress report on ToRs and workplan

5.1 ToR a) Combine and analyse the results of spring (BASS) and autumn (BIAS) 2017 acoustic surveys and report to WGBFAS

In September – October 2017 five research vessels (representing nine national research institutes) participated in the accomplishment of autumn acoustic survey (BIAS). The survey was conducted in the ICES Subdivisions 21-32 (excl. ICES SD 31) however, some Subdivisions were only partly covered. The BIAS 2017 survey vs. plan, regarding the area coverage with acoustic-trawl monitoring was completed in 98%. Overall, 117 ICES rectangles were covered with standard monitoring. Echointegration was recorded at totally of 6309 NM linear distance moreover, 232 and 279 catch and hydrological stations, respectively were inspected too. Totally, eight statistical ICES-rectangles were controlled by more than one country. The extended reports from BIAS 2017 cruises are available in Annex 7. The whole time-series of the area-corrected BIAS survey data of sprat and herring are presented in Annex ToR a.

In May 2017, four research vessels participated in the accomplishment of five spring acoustic surveys (German, Latvian-Polish, Estonian-Polish, Polish and Lithuanian BASS survey; Annex ToR a). The BASS 2017 survey was realised in the ICES Subdivisions 24-32 (excl. ICES SD 30, 31). It should be underlined that the ICES SD 29 was monitored with acoustic-trawl investigations only in the southern and middle parts. Moreover, only one ICES rectangle (47H3) was inspected in the ICES Subdivision 32. Overall 54 the ICES rectangles were covered with acoustic-biotic monitoring, what is comparable with 95% of area coverage. Six ICES rectangles were inspected by two countries. Echointegration was recorded at totally of 3610 NM linear distance moreover, 124 and 224 catch and hydrological stations, respectively were inspected too. The extended reports from the above-mentioned BASS cruises are presented in Annex 7. The complete time-series of the area-corrected BASS sprat abundance is given in Annex ToR a.

The area coverage and the number of control hauls in the BASS and BIAS surveys in 2017 were considered to be appropriate for the calculation of tuning indices and the data can be used for the assessment of Baltic herring and sprat stocks.

5.2 ToR b) Update the BIAS and BASS hydroacoustic databases and ICES database for acoustic-trawl surveys

An error was discovered shortly after WGBIFS 2016 meeting in the handling of the multiple covered rectangles in BIAS 2016 data. This error was corrected in the database (see Annex ToR b).

After validation, the aggregated data from BIAS and BASS surveys from 2017 were added to the BIAS_DB.mdb and the BASS_DB.mdb Access-databases, respectively. The updated versions of the databases are located in the folder "Data" of the ICES WGBIFS 2018 SharePoint site.

The disaggregated data from BIAS and BASS surveys were also uploaded to the recently created ICES database for acoustic-trawl data (http://ices.dk/marine-data/data-portals/Pages/acoustic.aspx).

5.3 ToR c) Plan and decide on acoustic surveys to be conducted in autumn 2018 and spring 2018-2019

All the Baltic Sea countries (with the exception of Russia) intend to take part in the autumn BIAS acoustic surveys and experiments in 2018. Cooperation between Germany and Denmark, Latvia and Poland and Estonia and Poland in the BIAS survey realisation is planned. Germany, Lithuania, Poland and the joint Latvian-Polish and Estonian-Polish BASS surveys will be continued in May 2018-2019 too. There is also an intention to conduct a Latvian-Estonian survey on the Gulf of Riga in July 2018 and 2019. The list of participating research vessels and initially planned periods of particular surveys are given in Annex ToR c.

5.4 ToR d) Discuss the results from BITS surveys performed in autumn 2017 and spring 2018 and evaluate the characteristics of TVL and TVS standard gears used in BITS

During the BITS-Q4/2017 surveys the level of realized valid ground trawl hauls represented 95.6 % of the total planned catch-stations (see Annex ToR d). The survey was accomplished by Denmark, Germany, Sweden, Poland, Estonia, Latvia, Lithuania and Russia in the ICES Subdivisions 20-29. Russia performed the autumn survey 2017 in the Russian EEZ of the ICES Subdivision 26 earlier than the recommended time period for BITS surveys, which was due to administrative problems with research vessel. It was decided to accept the Russian data to be included in the index calculations and it was arranged with the ICES Data Centre that the Russian data were uploaded to the DATRAS database. The coverage in all Subdivisions and all depth strata is in general quite good. In SD 27, the achieved number of hauls is smaller than planned due to the trawling restrictions enforced by the Swedish military. The differences in numbers of planned and index-valid fishing stations for each monitored ICES subdivision is presented in the Annex ToR d. The coverage by depth stratum is as follows (depth stratum, coverage in %): 1, 100; 2, 94.0; 3, 98.8; 4, 93.2; 5, 92.1 and 6, 100.0). The lower coverage in depth strata 4 and 5 is due to the restrictions enforced by the Swedish military.

In the 1st quarter 2018 the areas coverage with designated catch-stations was on similar level than in 4q 2017, i.e. 96.8 % (Annex ToR d). The BITS Q1 2018 surveys were realized by Denmark, Germany, Sweden, Poland, Latvia, Russia and Lithuania in the ICES Subdivisions 22-28. In the ICES Subdivisions 22 and 24, the number of hauls carried out exceeds the number of hauls planned because extra catch-stations were added during the surveys by use of the new facility provided. These added stations does not violate the principle of stratified random selection of stations and can be included in the index calculations. The coverage with control-hauls by the depth stratum is as follow (depth stratum, coverage in %): 1, 100; 2, 100; 3, 97.1; 4, 100; 5, 84.6; 6, 80.0. The depth stratum 6 has significantly lower coverage because of the restrictions enforced by the Swedish military.

The number of valid hauls accomplished during the BITS-Q4/2017 and BITS-Q1/2018 were considered by WGBIFS 2018 as appropriate for tuning series (e.g. CPUE indices) and the data can be used for the assessment of Baltic and Kattegat cod and flatfish stocks.

Standard reports from participating countries giving overviews of the BITS Q4 2017 and BITS Q1 2018 results can be found in Annex 6.

WGBIFS has implemented a complete and smaller scale measurement of the technical parameters of the exploited demersal trawls (type TV-3L and TV-3S) as a standard procedure. The complete measurement procedure has to be performed at least once a year by each country involved in the BITS surveys realization. The smaller scale measurement procedure should be made prior to each BITS survey. Standard protocols with the results of these measurements from all countries are available in the WGBIFS SharePoint.

5.5 ToR e) Plan and decide on demersal trawl surveys and experiments to be conducted in autumn 2018 and spring 2019, and update, and correct the Tow-Database and DATRAS

The most of the WGBIFS member countries, who intend to participate in the BITS-Q4/2018 and BITS-Q1/2019 surveys, have nearly the same plans regarding the numbers of hauls as in the previous years. The total number of stations committed by the countries and available is given in the Annex ToR e.

According to preliminary information, the participation of Russia in the BITS surveys in autumn 2018 and in spring 2019 cannot be confirmed yet. Since other ICES Member Countries will not be able to get permission to work in the EEZ of Russia, the negative effect on the quality of the survey results based on BITS survey would be eminent.

One haul was deleted from the Tow-Database due to obstruction by a new cable across the haul track and another haul was deleted because of repeated serious damage of the gear. One new haul were added to the database and for 19 hauls the position were adjusted. The Trawl Database manager has started the practice of keeping a logbook of the activities connected to the database.

During the WGBIFS 2018, meeting no any essential changes of the data in the Database of Trawl Surveys (DATRAS) was made.

5.6 ToR f) Conduct analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty in the BIAS and BASS surveys

At the WGBIFS meeting 2016 it was decided that a bootstrap method should be used to present the survey sampling variance. That method was based on recalculations of the survey results by resampling of acoustic data and trawl hauls. On the Workshop on Sampling Design and Optimization (WKSDO) in Lysekil, Sweden in 2016, the method was discussed with Jon Helge Vølstad and Mary Christman and they suggested to do a bootstrap on the survey results from the covered area. At 2017 year's WGBIFS meeting the two bootstrapping methods were discussed and it was decided that WGBIFS should move forward and try to evaluate the results from the bootstrap method recommended at WKSDO. This evaluation will be presented in the final report of the Baltic International Fish Survey Working Group in 2020.

In the Annex ToR f is presented an example about the estimation of the uncertainties in the acoustic survey estimates using the bootstrap method.

5.7 ToR g) Update on progress in development of the StoX software and implementation of it for the calculation of WGBIFS acoustic stock estimates, based on the IBAS methodology and data from ICES acoustic-trawl survey database

A StoX task subgroup was created during the WGBIFS 2018 meeting containing Juha Lilja (Finland), Olavi Kaljuste (Sweden), Elor Sepp (Estonia), Niklas Larson (Sweden), Paco Rodriguez-Tress (Germany) and Beata Schmidt (Poland) as contact persons for the implementation of the StoX software for the calculation of WGBIFS acoustic stock estimates.

- WGBIFS subgroup will control that the acoustic survey results from 2017 are uploaded in the right format to the ICES acoustic data portal in April 2018 as latest.
- WGBIFS subgroup will contact the developers of StoX to solve the problems with installation of the StoX software.
- WGBIFS subgroup will organize a net-meeting together with StoX developers in the end of August/beginning of September 2018 to go through the fish abundance index calculation procedure in the StoX software using the BIAS and BASS data from 2017.
- WGBIFS subgroup will organize a meeting together with StoX developers in January 2019 to set up the final herring and sprat abundance index calculation procedures in the StoX software using the BIAS and BASS data from 2017.

5.8 ToR h) Define methods for the appropriate processing of the survey data and output products from the BITS survey to deliver input-data for calculation of the Baltic LFI and MML indicators.

The large fish indicator (LFI) is an important community indicator that integrates different stocks in a unique regional indicator. The LFI is one of the DCF indicators and is used by OSPAR in the Ecological Quality Objective (EcoQO), by HELCOM as a useful indicator of biodiversity, related to the foodwebs MSFD descriptor D4 and used in ICES Advice. LFIs may also be used in future as a standard product in the ICES Ecosystem Overviews and will be calculated every year.

The outlier-rechecking request from ICES Data Centre to DATRAS Baltic data submitters is the first step in the process of developing Large Fish Indicator (LFI) for the Baltic Sea. Since the outliers or extreme values can largely affect the outcomes of the LFI, national submitters supposed to compare those values with their national database and recommend a decision on every particular outlier. For instance: 1) "NA", if the value is wrong, or not existing, 2) "ok", if the extreme value is identical to the value in the national database / protocols, and 3) report a correct value, if the outlier turns out to be a mistake. Despite of one month of time, provided by the ICES Data Centre for the outliers-check, time turned out to be the main limiting factor for many countries. Therefore, the recent deadline of March 26th was not met.

Adriana Villamor, the LFI-responsible ICES collaborator, proposed an easier way to proceed: the national data-submitters fill out two columns, "Action" and "Comments" (explaining the outlier), in the MS-Excel table, which was send by E-mail to every national data-submitter, and resend it back to ICES Data Centre as soon as possible.

5.9 ToR i) Coordinate the marine litter-sampling programme within the Baltic International Trawl Survey and registering the data in the ICES database

Collected and registered information from marine litter is an important source of knowledge regarding current ecological status of marine seabed in investigated areas of the Baltic. All countries, who realized the BITS-Q4/2017 and BITS-Q1/2018 surveys and submitted the data, also registered collected litter materials in the format C-TS-REV of the DATRAS Litter database.

ICES Data Centre suggested a new feature, which would enable to upload simultaneously survey data and litter data in order to facilitate the upload process. It was discussed within the group and decision was left to the countries if they either want to upload survey and litter data simultaneously or separately.

In order to collect more useful data, WGBIFS recommends additional size category (volume) to be incorporated in the litter size column in DATRAS (see Annex ToR i).

5.10 ToR j) Agree a standard pelagic trawl gear used in BIAS and BASS surveys

In 2016, WGBIFS requested support from WGFTFB to standardize the pelagic trawl for the international Baltic acoustic surveys (BASS and BIAS). During the WGBIFS 2018 meeting a WebEX-meeting was held with Haraldur Einarsson (chair of WGFTFB), Daniel Stepputtis (Thünen-Institute, Germany and member of WGFTFB) to discuss the issues related to survey gear standardization.

The first topic was to briefly summarize the current status of different gears, used in the BASS and BIAS surveys. The rationale for the need of pelagic–net standardization was discussed. In addition to a discussion about the basic trawl-design, it was pointed out that a multisampler could help to identify specific echo targets and layers and hence to improve the survey result. Haraldur Einarsson briefly explained the current process of standardization of mackerel-trawls, used to estimate swapped area-abundances (as typically for bottom trawl surveys).

Based on the discussions, the needs for the possible standard pelagic trawl gear where identified and the next steps in the gear standardisation process were agreed (see Annex ToR j).

5.11 ToR k) Review and update the International Baltic Acoustic Surveys (IBAS) manual and address methodological question raised at the last review of the SISP

The IBAS manual was reviewed during the WGBIFS 2018 meeting and several suggestions about the possible changes and corrections were listed. The updated manual will be presented as an Addendum to the final report of the Baltic International Fish Survey Working Group in 2020.

5.12 ToR l) Review and update the Baltic International Trawl Survey (BITS) manual and address methodological question raised at the last review of the SISP

The BITS manual was reviewed during the WGBIFS 2018 meeting and several suggestions about the possible changes and corrections were listed. The updated manual will be presented as an Addendum to the final report of the Baltic International Fish Survey Working Group in 2020.

6 Other business

6.1 Inquiries from other Expert Groups

6.1.1 Advise to ICES Data Centre regarding the development of automated ALK substitution procedures for DATRAS data products (WGNSSK request)

Current methods in DATRAS for producing survey indices make use of ALK substitution procedures, which creates a bottle-neck for producing such indices, particularly if calculations need to be repeated, e.g. due to new data uploads. WGNSSK recommended that ICES develops automated ALK substitution procedures for Datras data products, following advice from appropriate survey groups on appropriate methodology.

WGBIFS discussed this request with Vaishav Soni from ICES Data Centre. It revealed that ICES Data Centre had already found a solution in this matter.

6.1.2 Participation in planning and development of terms of reference for a joint session of WGFAST and WGFTFB (JFATB) in April/May of 2020 (WGFAST and JFATB request)

JFATB and WGFAST recommended that survey groups WGIPS, WGBIFS, WGACEGG should be included in planning for development of terms of reference for a joint session of WGFAST and WGFTFB in April/May of 2020 as establishing survey trawl selectivity is important for these surveys. The Terms of Reference are to be mutually decided by the Working Group Chairs and new joint session chairs. The joint session should review existing knowledge and recent developments in this area, with a focus on trawls used to sample pelagic organisms, and practical approaches to estimate trawl selectivity.

WGBIFS discussed this request. One recommendation was made to WGFTFB and JFATB to investigate the selectivity in the BITS standard trawls (see chapter 6.1.4).

6.1.3 Suggestions about data collections and compilations (WKQUAD request)

WKQUAD has recommended three survey groups dealing with acoustic surveys (WGIPS, WGBIFS and WGACEGG) to:

1. Collect data during both calm weather and in inclement weather. Use the opportunity of inclement weather to collect data along a transect in opposite headings (i.e. with and against the seas).

2. Compile seabed substrate maps and data for the survey area. These may be useful for decoupling substrate effects from noise or attenuation effects on data quality when the seabed backscatter is used as a diagnostic

3. Compile information on transducer location and vessel trim, and collect vessel motion (pitch, roll, heave) data at a sampling rate of at least twice the frequency of the vessel motion (<1/2 the period), i.e. Nyquist sampling rate. A typical rate is 3 Hz.

4. Collect meteorological data, e.g. windspeed and direction, swell, sea state, wave height during the surveys.

5. Collect passive data during inclement weather. Transient and impulse noise will appear in passive data. Compare noise values between good and bad data.

WGBIFS discussed these requests during the meeting. Some participating countries expressed the opinion that it is possible to collect most of the requested data during the BIAS and BASS surveys. However, it is not possible to provide WKQUAD with seabed substrate maps as our institutions do not perform any seabed substrate mapping exercises. There are separate geological investigation institutions performing these investigations, and the data are usually classified by military. WGBIFS recommends national laboratories to collect, whenever possible, the data requested by WKQUAD (see Annex 5).

6.1.4 Estimation of catch selection curve from the BITS survey (WGBFAS request)

WGBIFS got the following recommendation from WGBFAS: "Estimation of catch selection curve from the BITS survey, to see what size we should base on our stock abundance indices". The background of this recommendation is related to the age groups (and size groups) used in the assessment and this information (catch selection curves) could probably be feed into SS3 model (for example for the eastern Baltic cod stock). Most useful would be the information on the expected shape of the catch selection curves – is it be asymptotic or something else (i.e. are the largest cod fully selected or do we expect the selectivity to decline again for the larger ones). It would be nice to know when a given species by size is fully selected for the trawl. Cod and plaice would be the most important species for catch selection curve information (the flounder, dab, brill and turbot would have a lower priority).

WGBIFS discussed this request but currently were no such catch selection curve estimations available. Henrik Degel (DTU Aqua, Denmark) will investigate after the WGBIFS 2018 meeting whether such information can be derived from the historical BITS standard trawl inter calibration exercises or not. However, the group expressed the opinion that WGBIFS is lacking expertize in trawl selectivity field and would recommend that experts in this field would address this request. Therefore, WGBIFS recommends WGFTFB and JFATB to investigate the selectivity in the BITS standard trawls (TV3L and TV3S).

6.2 Other issues emerged before and during the meeting

6.2.1 Does risk to future survey implementation present a risk to advice? (ACOM request)

During a recent ACOM meeting was Sven Kupschus (chair of Ecosystem Observation Steering Group) requested an assessment of the impact of marine spatial planning on the ability to provide future advice. Sven Kupschus forwarded this request to survey group chairs and asked them to fill a table "Does risk to future survey implementation present a risk to advice?". This Excel table was filled during the WGBIFS 2018 meeting and returned to Sven Kupschus.

7 Revisions to the work plan and justification

No changes in ToRs have been proposed.

No any significant revisions to the work plan were made.

8 Next meeting

There was one proposal for the venue of the next WGBIFS meeting, i.e. Klaipeda, Lithuania. Majority of WGBIFS members supported the idea to organize the next meeting at Klaipeda University in the period of 25-29 March 2019.

Annex: ToRs a) Combine and analyse the results of spring (BASS) and autumn (BIAS) 2017 acoustic surveys and report to WGBFAS

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

In September - October 2017, 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
Dana	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, eight statistical ICES rectangles were inspected by more than one country (Figure 5.1.1.1.1), precisely the following rectangles:

- 38G4 by GER and POL,
- 39G5 by SWE and POL,
- 40G7 by SWE and POL,
- 40G9 by LIT and RUS,
- 38G9 by RUS and POL,
- 39G9 by RUS and POL,
- 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-2017 survey, was only slightly less as it was planned during the WGBIFS 2017 meeting. The small northeastern part of the ICES Subdivision 28-2 (the ICES rct. 44H1 and 43H1) was omitted from the acoustic monitoring during the Latvian-Polish survey. Investigations in the eastern part of the ICES SD 32 (the Russian zone) were not planned and remain not realised.

Additionally, the Estonian-Latvian acoustic survey in the Gulf of Riga was conducted in July-August 2017, as was planned during WGBIFS 2017 meeting. The survey results from the recent years are accessible at the national level, however, were not uploaded to the WGBIFS database.

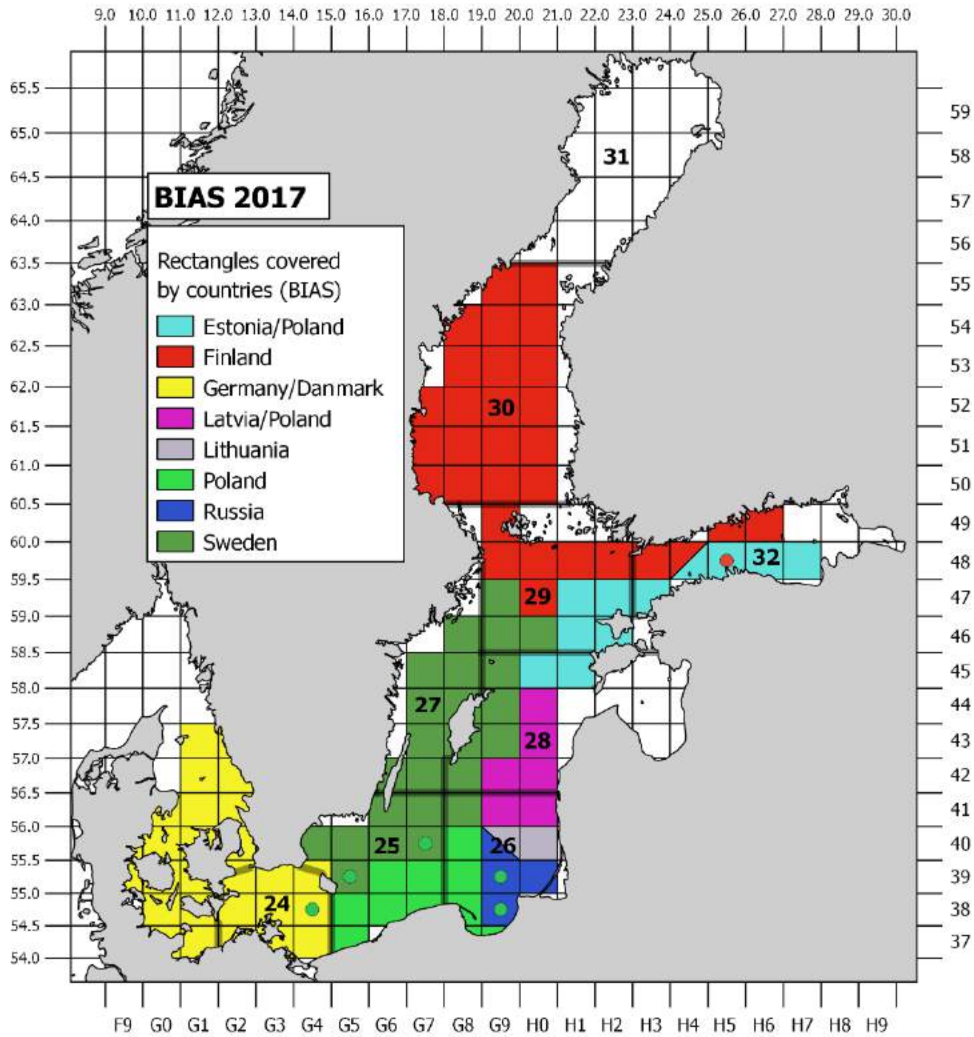


Figure 5.1.1.1.1. Map of the BIAS survey conducted in September-October 2017. Various colours indicate the countries, which covered specific ICES rectangles and delivered data to BIAS-database, thus was responsible for this rectangle. Dot with different colour within a rectangle explain additional data in BIAS-database partly or totally covered by other countries.

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 2017 is illustrated in Figures 5.1.1.2.1 - 5.1.1.2.5.

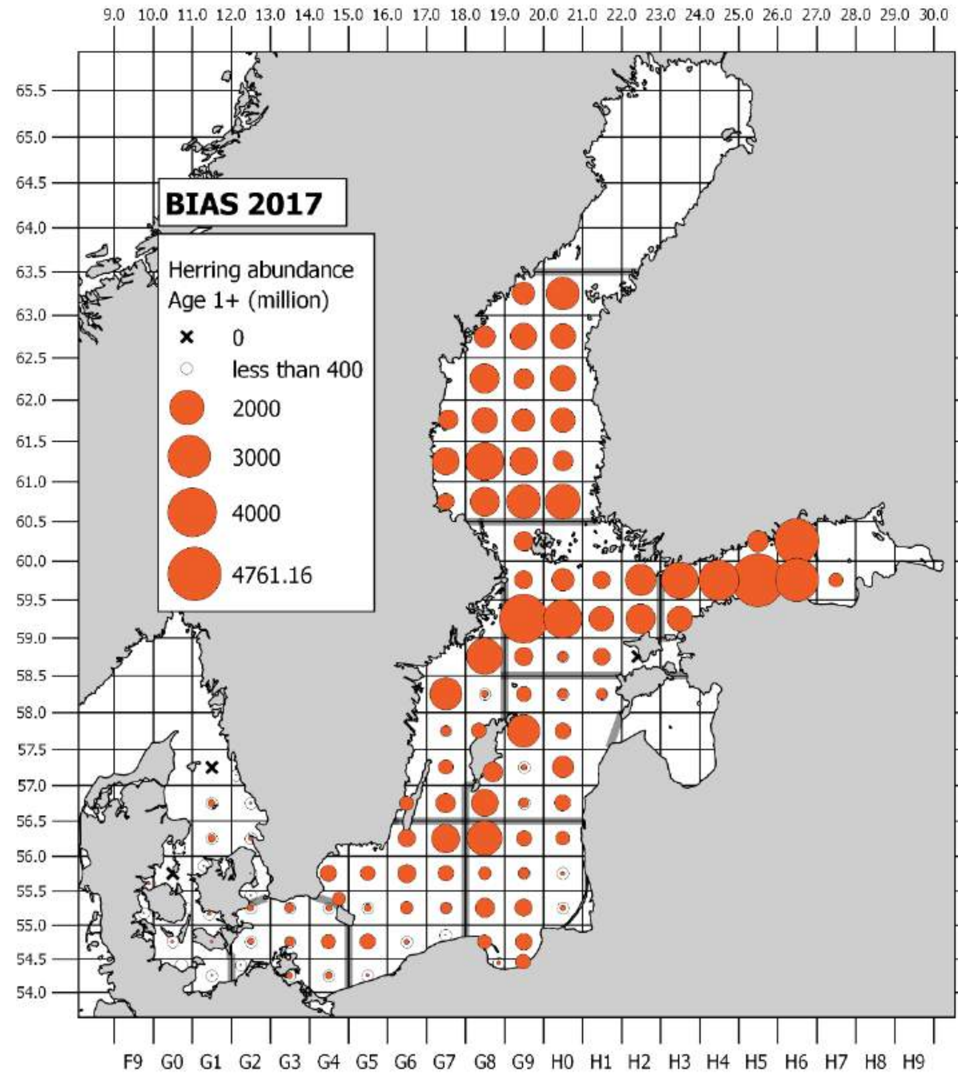


Figure 5.1.1.2.1. The abundance of herring (age 1+) per ICES rectangles monitored in September-October 2017 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

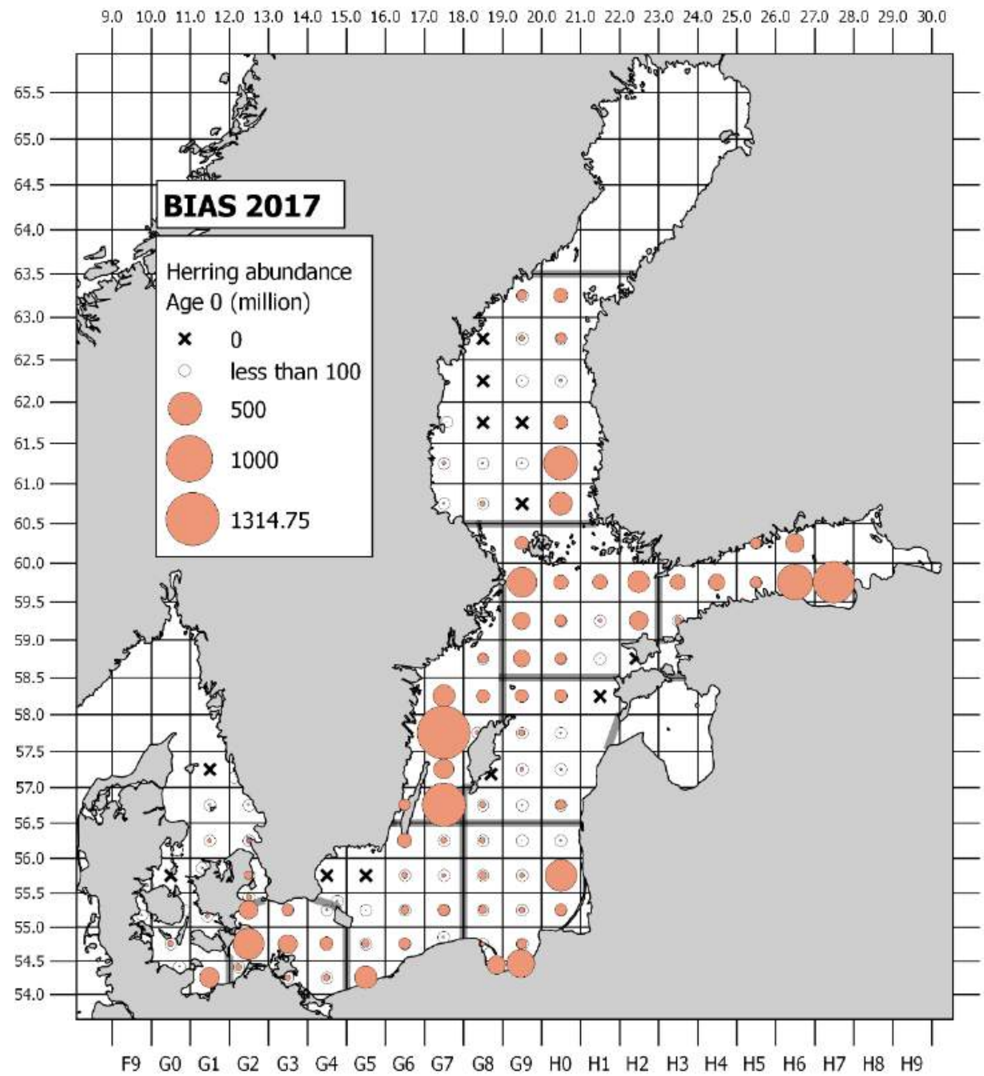


Figure 5.1.1.2.2. The abundance of herring (age 0) per ICES rectangles monitored in September-October 2017 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

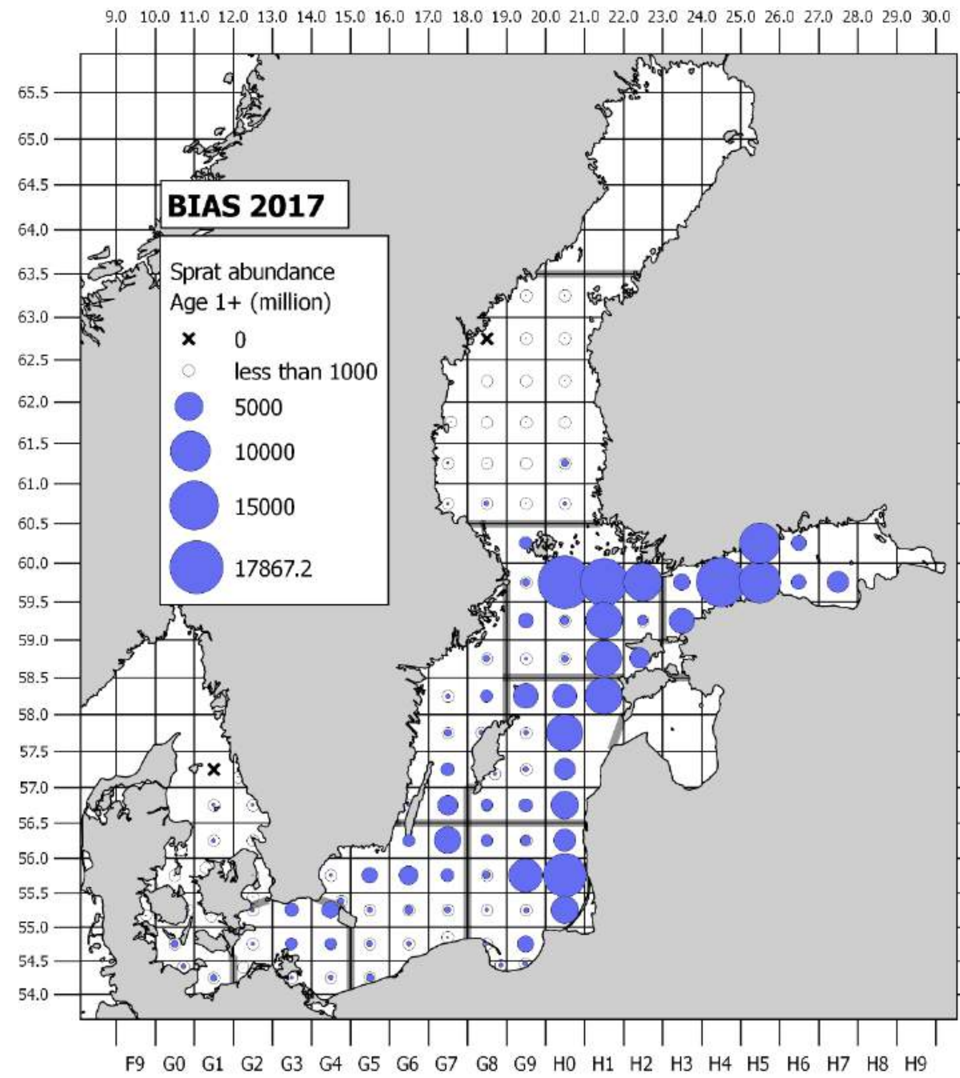


Figure 5.1.1.2.3. The abundance of sprat (age 1+) per ICES rectangles monitored in September-October 2017 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

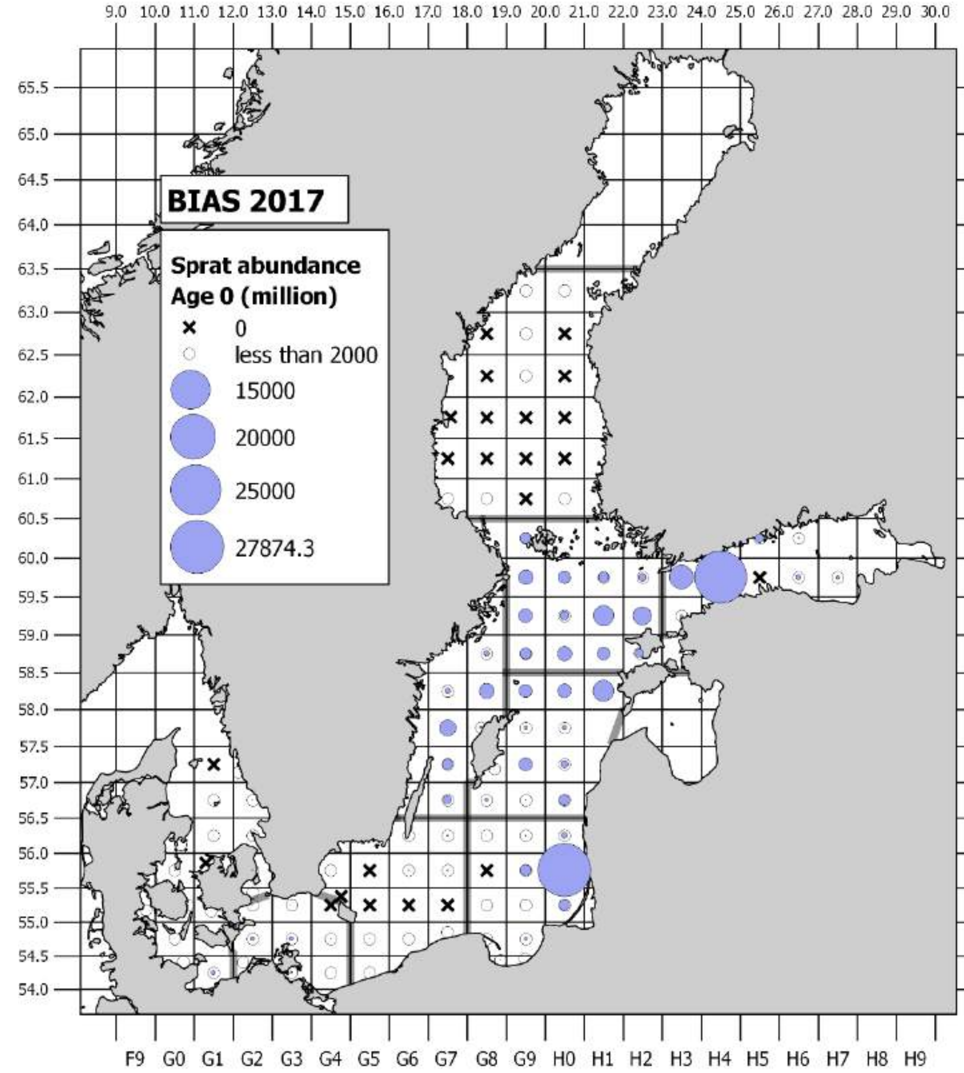


Figure 5.1.1.2.4. The abundance of sprat (age 0) per ICES rectangles monitored in September-October 2017 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

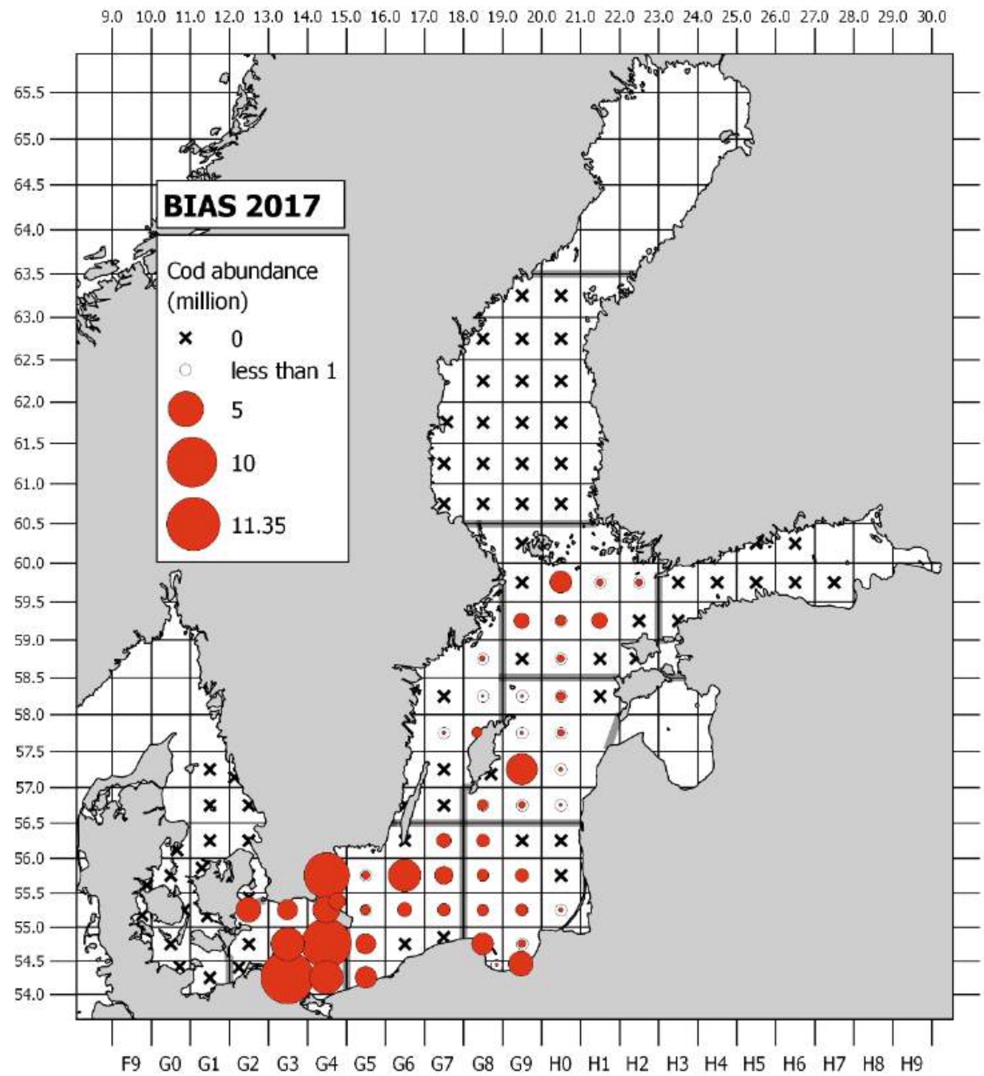


Figure 5.1.1.2.5. The abundance of cod (age 1+) per the ICES rectangles monitored in September-October 2017 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

The fish abundance estimates, which are based on the BIAS survey in September-October 2017, 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.

The highest herring (age 1+) stock abundance was concentrated in the middle and western part of the Gulf of Finland (ICES SD 32), western part of the ICES Subdivision 29 (the Åland Islands area) and the Bothnian Sea (ICES SD 31; Figure 5.1.1.2.1). Somewhat lower, however also significant abundance of herring stock was assessed in the southern parts from the Gotland Island. Herring (age 1+) was distributed in all inspected areas of the Baltic, however with various abundances. Concentrations of YOY herring (age group 0, year-class 2017) occurred mostly in the waters between the Gotland Island and the Öland Island, in the eastern part of the Gulf of Finland, in the southeastern part of the Bothnian Sea, in the western part of the ICES SD 24 and in the southern part of the Gulf of Gdańsk (Figure 5.1.1.2.2).

The highest sprat (age 1+) stock abundance was concentrated in the eastern Baltic, particularly in middle and eastern parts of the Åland Islands area, in the western part of the Gulf of Finland, and along the Latvian and Lithuanian coasts (Figure 5.1.1.2.3). Highest concentration of YOY sprat (year-class 2017) was detected in two ICES rectangles only, i.e. in 40H0 (the Lithuanian inshore waters) and 48H4 (enter to the Gulf of Finland; Figure 5.1.1.2.4). Somewhat smaller 0-age group sprat concentration was detected in the Åland Islands area. YOY sprat was occurred also in others inspected waters of the Baltic, however on the very low level. In the middle part of the southern Baltic and in the Bothnian Sea sprat from 0 age group was absent.

The highest cod stock abundance (age 1+) was assessed in the ICES SD 24 and in north-western part of the ICES SD 25 (Figure 5.1.1.2.5). Cod with low abundance was detected in many others areas of the Baltic, with exception of the ICES SDs 31 and 32. It should be underlined that cod stock abundance was several times lower than herring and sprat stocks abundance.

Table 5.1.1.2.1. Estimated numbers (millions) of herring in September-October 2017, by ICES rectangles, accordingly to age groups.

YEAR	SD	RECT	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2017	21	41G0	1.19	0.24	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	21	41G1	115.41	10.64	103.91	0.65	0.21	0.00	0.00	0.00	0.00	0.00
2017	21	41G2	46.30	14.20	31.73	0.27	0.09	0.01	0.00	0.00	0.00	0.00
2017	21	42G1	94.38	4.10	79.10	9.20	1.68	0.30	0.00	0.00	0.00	0.00
2017	21	42G2	15.47	2.29	13.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	21	43G1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	21	43G2	2.24	0.33	1.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	22	37G0	1.25	1.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	22	37G1	200.10	188.33	11.32	0.22	0.19	0.04	0.00	0.00	0.00	0.00
2017	22	38G0	37.24	18.32	18.61	0.00	0.31	0.00	0.00	0.00	0.00	0.00
2017	22	38G1	19.10	0.00	18.21	0.55	0.34	0.00	0.00	0.00	0.00	0.00
2017	22	39F9	7.06	1.62	5.05	0.22	0.13	0.04	0.00	0.00	0.00	0.00
2017	22	39G0	6.88	4.57	2.11	0.12	0.07	0.01	0.00	0.00	0.00	0.00
2017	22	39G1	38.71	10.47	22.21	4.68	1.13	0.22	0.00	0.00	0.00	0.00
2017	22	40F9	22.81	5.23	16.30	0.72	0.42	0.14	0.00	0.00	0.00	0.00
2017	22	40G0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	22	40G1	13.37	4.47	8.40	0.25	0.21	0.04	0.00	0.00	0.00	0.00
2017	22	41G0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	23	39G2	20.22	13.71	1.59	0.97	1.63	1.01	1.04	0.18	0.07	0.02
2017	23	40G2	38.27	34.16	3.33	0.22	0.31	0.18	0.07	0.00	0.00	0.00
2017	23	41G2	3.57	3.42	0.11	0.03	0.01	0.00	0.00	0.00	0.00	0.00
2017	24	37G2	27.75	22.20	2.48	0.55	0.89	0.89	0.67	0.07	0.00	0.00
2017	24	37G3	91.97	16.62	4.45	13.76	20.01	22.01	9.31	3.32	1.78	0.71
2017	24	37G4	105.48	20.65	5.92	13.08	19.81	26.02	13.01	4.96	1.36	0.67
2017	24	38G2	534.31	459.90	28.42	5.04	16.33	11.68	11.55	1.39	0.00	0.00
2017	24	38G3	326.95	168.28	24.98	30.55	40.44	30.91	23.20	4.83	2.43	1.33
2017	24	38G4	464.09	90.86	26.04	57.55	87.19	114.48	57.24	21.81	5.97	2.95
2017	24	39G2	239.17	162.21	18.77	11.52	19.29	11.94	12.28	2.09	0.83	0.24
2017	24	39G3	210.60	67.57	23.00	23.85	36.93	31.78	19.76	4.85	1.73	1.13
2017	24	39G4	73.04	2.86	3.89	12.82	18.93	19.78	9.35	2.88	1.94	0.59
2017	25	37G5	265.14	245.18	4.62	2.37	3.96	2.77	2.51	1.86	1.09	0.77
2017	25	38G5	447.18	29.98	17.43	53.97	76.92	62.00	99.88	56.08	28.82	22.11
2017	25	38G6	119.04	68.19	3.82	7.10	11.96	8.57	10.52	5.74	2.06	1.07
2017	25	38G7	5.09	3.19	0.12	0.25	0.38	0.28	0.43	0.26	0.12	0.06
2017	25	39G4	307.56	1.68	5.58	14.19	152.83	62.80	53.97	13.96	0.00	2.56
2017	25	39G5	90.56	0.89	3.75	3.37	31.97	15.82	20.99	6.82	5.96	1.00
2017	25	39G6	323.07	35.67	21.36	40.65	70.95	47.09	58.03	30.70	11.24	7.40
2017	25	39G7	265.20	63.42	9.64	25.02	39.74	28.56	46.02	27.81	14.28	10.72
2017	25	40G4	456.13	0.00	5.90	47.49	123.51	107.83	106.65	15.48	37.63	11.64
2017	25	40G5	362.62	0.00	10.42	3.74	162.25	99.35	37.76	22.87	22.02	4.21
2017	25	40G6	605.64	19.93	6.64	53.08	312.40	121.77	56.38	24.22	2.27	8.94
2017	25	40G7	411.74	8.20	7.93	17.38	242.00	41.51	52.64	22.57	16.42	3.09
2017	25	41G6	626.37	98.82	47.50	10.58	394.21	39.39	31.64	4.12	0.00	0.11
2017	25	41G7	1 381.06	16.42	34.94	214.13	917.67	79.10	71.54	41.61	4.77	0.88
2017	26	37G8	190.47	161.89	4.28	2.62	8.54	3.20	4.42	1.51	0.82	3.18
2017	26	37G9	756.30	371.38	45.79	37.63	126.00	51.40	68.75	22.37	9.78	23.20
2017	26	38G8	349.45	10.04	4.88	27.43	69.65	33.56	67.84	39.73	18.57	77.75
2017	26	38G9	542.84	47.11	37.74	27.92	105.37	88.87	120.87	45.57	28.75	40.63
2017	26	39G8	671.29	33.26	21.17	56.78	161.32	73.46	139.47	68.35	28.54	88.95
2017	26	39G9	536.03	17.73	2.51	26.08	145.19	93.89	122.58	53.56	31.26	43.23
2017	26	39H0	118.13	66.76	4.29	5.41	16.26	7.45	9.85	4.00	3.31	0.80
2017	26	40G8	300.12	27.62	15.24	25.32	81.88	35.79	61.28	23.98	7.40	21.62
2017	26	40G9	225.02	11.99	2.15	11.91	40.65	34.87	49.92	28.20	23.02	22.30
2017	26	40H0	496.40	465.31	0.00	0.00	2.44	7.31	14.04	4.87	2.44	0.00
2017	26	41G8	2 090.42	18.56	4.84	127.51	723.08	467.42	586.05	121.07	4.84	37.04
2017	26	41G9	398.99	0.32	0.93	24.11	115.02	16.08	91.41	72.06	15.87	63.19
2017	26	41H0	351.04	2.45	0.00	21.90	104.57	13.18	80.77	61.61	12.82	53.74
2017	27	42G6	423.74	67.41	23.89	9.16	236.24	65.77	19.63	1.64	0.00	0.00
2017	27	42G7	1 546.04	884.70	35.78	111.67	382.18	115.33	9.84	4.65	1.89	0.00
2017	27	43G7	550.45	186.52	77.00	69.89	146.37	37.35	25.67	2.63	2.39	2.63
2017	27	44G7	1 484.85	1 314.75	35.30	20.10	68.53	27.41	8.53	5.78	4.46	0.00
2017	27	44G8	415.43	7.32	25.60	49.70	283.11	43.37	4.82	1.51	0.00	0.00
2017	27	45G7	2 030.59	221.87	425.49	228.17	999.11	143.25	4.92	2.87	4.92	0.00
2017	27	45G8	174.97	81.25	37.08	5.78	30.85	8.88	7.52	3.62	0.00	0.00
2017	27	46G8	2 303.41	50.03	375.28	406.12	1 401.72	34.27	35.99	0.00	0.00	0.00
2017	28_2	42G8	1 285.72	20.30	0.00	182.01	811.02	56.92	132.88	60.93	12.75	8.91
2017	28_2	42G9	158.20	0.89	0.50	8.67	51.78	6.51	34.52	26.97	5.38	22.98
2017	28_2	42H0	516.16	45.81	3.33	20.10	223.78	39.54	82.95	48.04	18.53	34.08
2017	28_2	43G8	676.21	0.00	3.74	57.80	389.08	97.08	63.41	47.14	5.61	12.35
2017	28_2	43G9	68.24	8.91	0.00	5.15	40.17	5.58	8.43	0.00	0.00	0.00
2017	28_2	43H0	815.15	4.20	20.16	55.02	405.17	61.62	139.12	65.61	24.52	39.73
2017	28_2	44G9	1 818.72	19.50	52.46	339.51	1 143.87	132.49	53.38	61.55	10.95	5.01
2017	28_2	44H0	466.33	2.43	5.13	45.87	279.66	23.54	52.62	37.03	7.22	12.84
2017	28_2	45G9	468.65	76.13	48.19	52.31	238.90	34.08	16.11	2.92	0.00	0.00
2017	28_2	45H0	247.25	76.22	1.70	9.01	84.30	23.52	35.68	12.67	0.00	4.14
2017	28_2	45H1	214.72	0.00	0.00	16.57	123.62	23.75	34.80	11.59	0.00	4.40
2017	29	46G9	709.97	131.80	127.22	85.10	316.50	39.22	2.64	7.49	0.00	0.00
2017	29	46H0	240.23	63.82	22.99	33.50	74.79	23.72	16.19	4.05	1.16	0.00
2017	29	46H1	500.69	0.83	30.04	25.90	250.13	43.03	60.13	56.14	0.00	34.49
2017	29	46H2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	29	47G9	4 195.26	144.16	616.69	771.73	2 183.50	268.27	121.04	58.55	19.68	11.64
2017	29	47H0	2 631.19	60.39	197.25	436.31	1 034.11	240.03	199.80	155.34	90.87	217.09
2017	29	47H1	1 082.49	8.40	133.78	81.16	622.85	69.50	60.52	64.49	0.00	41.79
2017	29	47H2	1 697.93	166.10	346.49	136.32	870.23	67.90	42.35	46.28	0.00	22.25
2017	29	48G9	987.90	413.54	205.22	80.77	188.42	27.80	17.45	15.90	8.98	29.81
2017	29	48H0	988.73	97.61	215.53	155.18	350.25	62.42	32.42	24.78	14.96	35.58
2017	29	48H1	655.55	106.55	201.84	90.24	190.50	33.20	11.34	11.06	3.06	7.78
2017	29	48H2	1 908.22	226.98	283.50	348.00	734.82	149.87	59.29	49.73	18.61	37.41
2017	29	49G9	747.24	90.75	210.40	102.76	230.14	38.84	19.57	17.74	9.58	27.46
2017	30	50G7	491.57	3.02	142.83	87.69	141.67	44.43	23.78	13.98	6.53	27.63
2017	30	50G8	1 438.92	14.36	983.45	225.15	149.83	37.68	12.48	5.79	2.45	7.73
2017	30	50G9	1 942.18	0.00	191.74	345.86	738.75	242.74	148.57	92.49	41.62	140.41
2017	30	50H0	2 372.35	253.03	1 452.36	278.46	248.67	67.47	27.72	13.96	5.21	25.48
2017	30	51G7	1 248.99	6.87	281.02	227.37	398.32	126.27	68.71	40.60	19.02	80.80
2017	30	51G8	2 446.22	2.81	240.77	419.96	936.53	300.81	187.09	112.39	51.74	194.11
2017	30	51G9	1 314.08	2.18	199.45	266.68	472.26	151.36	84.37	51.25	21.80	64.73
2017	30	51H0	1 220.27	534.08	372.17	95.07	108.67	33.09	18.43	12.63	7.44	38.68
2017	30	52G7	654.49	0.37	110.43	99.94	199.66	65.84	42.16	29.43	15.75	90.90
2017	30	52G8	1 089.60	0.00	78.96	184.85	411.09	137.24	89.31	59.39	27.72	101.04
2017	30	52G9	879.00	0.00	44.44	78.84	251.35	95.19	83.49	75.76	42.56	207.37
2017	30	52H0	1 091.14	89.24	590.50	155.50	152.82	44.00	20.81	12.65	6.11	19.52
2017	30	53G8	1 488.46	0.00	229.50	296.81	505.15	166.05	95.95	62.82	27.55	104.64
2017	30	53G9	702.83	0.76	76.74	117.33	227.61	76.14	52.53	38.83	19.98	92.92
2017	30	53H0	1 143.51	5.29	336.75	223.49	338.82	106.13	54.88	31.61	12.66	33.88
2017	30	54G8	798.45	0.00	71.36	137.15	295.67	97.29	64.10	43.77	20.27	68.85
2017	30	54G9	1 203.51	15.43	147.39	208.47	385.84	129.71	86.10	66.07	33.28	131.24
2017	30	54H0	1 143.70	48.04	491.10	183.29	222.50	68.79	38.56	26.13	12.69	52.60
2017	30	55G9	932.18	49.54	230.13	180.97	256.61	80.86	42.11	27.81	13.46	50.70
2017	30	55H0	1 966.60	95.07	640.09	353.10	472.99	148.05	79.13	52.76	25.57	99.84
2017	32	47H3	1 104.64	25.51	286.43	169.05	470.65	110.27	34.30	5.64	2.17	0.61
2017	32	48H3	2 444.80	111.49	275.69	215.64	1 127.66	206.43	250.17	103.73	40.81	113.18
2017	32	48H4	2 940.77	126.71	919.28	435.00	1 116.47	210.86	93.58	14.32	9.28	15.28
2017	32	48H5	4 817.80	56.64	776.08	829.54	2 399.14	565.86	155.81	24.39	8.04	2.29
2017	32	48H6	3 828.31	599.57	475.80	559.57	1 612.62	416.79	140.51	18.98	4.47	0.00
2017	32	48H7	1 176.49	834.60	177.31	55.53	90.72	12.63	1.68	2.01	1.01	1.01
2017	32	49H5	823.51	58.11	153.45	75.62	377.23	62.66	52.02	17.03	5.56	21.84
2017	32	49H6	3 582.70	171.69	617.97	341.41	1 723.85	287.77	239.02	74.95	24.03	102.00

Table 5.1.1.2.2. Estimated numbers (millions) of sprat in September-October 2017, by ICES rectangles, accordingly to age groups.

YEAR	SD	RECT	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2017	21	41G0	8.96	0.04	2.80	3.98	2.10	0.04	0.00	0.00	0.00	0.00
2017	21	41G1	150.56	4.96	56.30	56.93	29.92	2.45	0.00	0.00	0.00	0.00
2017	21	41G2	59.41	30.22	4.92	10.79	12.26	1.22	0.00	0.00	0.00	0.00
2017	21	42G1	96.32	0.14	19.26	39.74	34.50	2.68	0.00	0.00	0.00	0.00
2017	21	42G2	74.76	2.34	15.99	26.47	26.54	3.42	0.00	0.00	0.00	0.00
2017	21	43G1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	21	43G2	10.82	0.34	2.32	3.83	3.84	0.49	0.00	0.00	0.00	0.00
2017	22	37G0	168.52	1.60	131.76	13.57	19.22	0.60	1.59	0.18	0.00	0.00
2017	22	37G1	513.85	215.28	213.26	31.73	46.97	2.08	4.01	0.52	0.00	0.00
2017	22	38G0	351.01	2.33	221.40	43.40	73.82	4.08	4.56	1.42	0.00	0.00
2017	22	38G1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	22	39F9	12.24	0.33	6.63	1.93	3.03	0.12	0.19	0.01	0.00	0.00
2017	22	39G0	74.49	8.26	42.59	8.78	12.98	0.61	1.05	0.22	0.00	0.00
2017	22	39G1	13.55	7.57	3.86	0.00	1.15	0.97	0.00	0.00	0.00	0.00
2017	22	40F9	39.47	1.08	21.37	6.22	9.77	0.39	0.62	0.02	0.00	0.00
2017	22	40G0	43.05	16.14	6.83	3.91	15.19	0.98	0.00	0.00	0.00	0.00
2017	22	40G1	3.02	0.00	0.78	0.59	1.50	0.09	0.03	0.03	0.00	0.00
2017	22	41G0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	23	39G2	10.04	0.27	2.73	2.81	2.71	1.05	0.19	0.17	0.02	0.09
2017	23	40G2	18.94	9.15	5.84	1.66	1.55	0.52	0.16	0.05	0.01	0.00
2017	23	41G2	1.37	0.98	0.28	0.07	0.03	0.01	0.00	0.00	0.00	0.00
2017	24	37G2	3.08	1.23	0.73	0.47	0.50	0.06	0.03	0.03	0.00	0.03
2017	24	37G3	128.36	63.72	55.75	4.64	3.42	0.55	0.14	0.11	0.01	0.02
2017	24	37G4	186.39	0.85	70.47	46.06	46.07	15.84	2.83	2.54	0.20	1.53
2017	24	38G2	278.60	183.63	63.40	14.10	13.13	2.65	0.65	0.65	0.00	0.39
2017	24	38G3	1 201.72	198.23	715.35	124.48	123.53	25.97	6.08	5.50	0.29	2.29
2017	24	38G4	820.28	3.73	310.10	202.70	202.73	69.72	12.47	11.20	0.89	6.74
2017	24	39G2	118.89	3.21	32.28	33.30	32.14	12.43	2.28	1.96	0.20	1.09
2017	24	39G3	1 196.55	7.81	588.02	249.17	247.73	63.67	15.74	15.01	0.78	8.62
2017	24	39G4	1 942.95	0.00	1 082.39	364.24	360.24	83.24	21.13	20.77	0.18	10.76
2017	25	37G5	376.83	2.69	51.71	48.00	173.38	71.27	24.57	2.04	3.17	0.00
2017	25	38G5	228.48	2.59	28.23	27.82	102.47	44.77	16.53	3.06	3.00	0.00
2017	25	38G6	170.82	0.82	37.62	26.30	75.76	20.68	7.04	1.58	1.01	0.00
2017	25	38G7	21.62	0.10	3.83	3.06	9.57	3.41	1.19	0.26	0.19	0.00
2017	25	39G4	288.78	0.00	28.38	11.35	140.55	66.77	7.68	20.03	9.35	4.67
2017	25	39G5	198.97	0.00	9.41	13.59	81.39	70.41	18.54	3.50	0.56	1.57
2017	25	39G6	486.31	0.00	74.74	63.20	223.93	86.67	30.42	2.95	4.40	0.00
2017	25	39G7	283.51	0.00	53.58	41.96	132.73	38.62	13.61	1.03	1.98	0.00
2017	25	40G4	76.37	0.37	8.52	0.72	33.81	17.27	5.29	7.34	0.34	2.70
2017	25	40G5	1 513.32	0.00	37.01	130.57	746.98	277.54	267.90	53.32	0.00	0.00
2017	25	40G6	2 327.78	19.40	136.01	121.87	1 746.00	40.33	79.14	97.02	11.83	76.19
2017	25	40G7	1 092.78	18.93	91.17	23.50	571.36	90.00	41.13	109.67	104.64	42.37
2017	25	41G6	1 001.38	60.24	20.61	190.07	452.01	75.40	155.93	14.24	18.63	14.24
2017	25	41G7	4 679.07	40.68	53.83	0.00	3 496.77	683.64	350.15	6.83	33.80	13.37
2017	26	37G8	133.11	3.90	28.89	20.40	69.67	6.84	2.36	0.71	0.28	0.07
2017	26	37G9	160.44	1.39	20.48	25.37	88.89	15.04	5.99	1.83	1.00	0.45
2017	26	38G8	64.44	0.67	15.69	9.86	34.26	2.66	0.96	0.25	0.06	0.04
2017	26	38G9	1 823.67	127.44	165.50	565.26	773.81	89.59	68.97	24.81	3.06	5.23
2017	26	39G8	90.84	0.39	9.86	13.27	49.75	10.06	4.29	1.75	1.23	0.24
2017	26	39G9	186.43	0.58	10.01	31.65	107.45	13.54	13.70	6.39	2.45	0.66
2017	26	39H0	5 967.11	1 140.78	920.46	2 012.32	1 624.01	182.19	32.23	38.11	17.00	0.00
2017	26	40G8	399.86	0.00	25.86	57.61	224.18	54.93	23.77	7.81	3.95	1.75
2017	26	40G9	8 400.20	1 240.78	1 457.87	2 483.24	2 518.26	444.82	135.77	78.55	15.36	25.55
2017	26	40H0	39 842.66	27 874.27	1 703.98	3 839.29	4 330.39	1 342.30	501.95	222.44	0.00	28.03
2017	26	41G8	940.87	7.18	142.93	89.99	480.12	48.78	70.56	0.00	36.65	64.66
2017	26	41G9	662.19	16.61	52.39	20.41	325.74	133.61	47.41	38.72	21.62	5.68
2017	26	41H0	3 471.83	361.42	799.20	221.14	1 145.32	766.79	95.29	35.56	31.97	15.15
2017	27	42G6	83.29	0.50	5.12	4.62	48.97	12.24	1.40	3.11	5.92	1.40
2017	27	42G7	3 234.52	703.39	46.09	293.75	1 638.88	279.72	235.22	30.42	0.00	7.04
2017	27	43G7	2 213.37	1 093.33	247.07	321.30	424.12	95.87	15.87	2.57	2.57	10.65
2017	27	44G7	3 009.87	2 679.09	67.05	85.26	170.74	5.15	0.00	0.00	0.00	2.58
2017	27	44G8	222.17	82.19	4.23	14.65	109.86	5.86	1.63	0.00	0.00	3.74
2017	27	45G7	428.46	296.70	18.13	11.99	89.15	7.88	2.90	0.00	0.86	0.86
2017	27	45G8	3 212.25	2 202.54	170.60	164.33	548.73	77.00	39.95	9.10	0.00	0.00
2017	27	46G8	654.85	347.78	19.19	39.19	216.90	1.23	9.81	13.05	3.24	4.46
2017	28_2	42G8	1 063.59	151.58	45.08	78.46	607.15	101.91	67.66	0.00	6.87	4.89
2017	28_2	42G9	1 186.47	6.52	98.54	127.73	691.46	143.44	49.08	41.80	12.29	15.60
2017	28_2	42H0	6 018.43	1 101.65	733.69	907.14	2 421.94	479.00	207.41	93.63	13.02	60.95
2017	28_2	43G8	94.23	4.16	0.00	10.00	64.87	10.31	3.64	0.73	0.00	0.52
2017	28_2	43G9	1 927.45	1 727.82	48.73	51.89	85.12	1.47	0.00	1.05	11.37	0.00
2017	28_2	43H0	3 518.74	560.31	185.51	320.45	1 645.30	353.83	258.42	137.36	30.36	27.20
2017	28_2	44G9	292.62	132.21	17.31	8.12	116.64	0.93	12.66	3.82	0.00	0.93
2017	28_2	44H0	8 804.42	179.82	386.60	828.53	5 289.13	1 233.01	443.22	211.80	174.01	58.30
2017	28_2	45G9	5 687.39	1 659.98	205.43	403.57	2 189.41	889.88	249.68	47.36	12.62	29.46
2017	28_2	45H0	5 568.66	1 838.28	206.47	640.47	2 217.65	279.73	270.00	63.36	38.78	13.91
2017	28_2	45H1	13 133.36	4 384.62	863.49	1 480.75	5 156.43	527.15	499.76	136.68	47.74	36.74
2017	29	46G9	1 435.85	1 352.31	0.00	16.67	42.81	4.72	5.84	1.87	0.00	11.64
2017	29	46H0	2 464.27	2 114.60	48.60	45.56	210.68	12.30	26.41	0.00	1.35	4.78
2017	29	46H1	9 887.97	1 746.23	847.55	1 379.24	4 531.26	733.35	317.31	301.27	31.75	0.00
2017	29	46H2	3 426.64	747.04	597.99	387.59	1 443.92	86.61	109.35	54.13	0.00	0.00
2017	29	47G9	3 369.38	1 928.21	236.14	45.21	1 088.53	14.62	17.93	5.98	14.62	18.13
2017	29	47H0	1 254.13	783.83	75.32	129.11	185.46	36.26	23.56	9.90	0.00	10.69
2017	29	47H1	12 735.78	4 157.32	785.59	1 485.60	4 742.38	875.42	324.75	323.63	20.25	20.85
2017	29	47H2	4 001.41	3 379.88	113.12	87.43	327.06	39.55	23.32	20.44	2.12	8.49
2017	29	48G9	2 445.80	2 062.52	115.84	106.57	132.67	18.86	8.37	0.00	0.00	0.96
2017	29	48H0	19 404.11	1 536.96	5 474.48	4 778.76	6 494.19	649.20	258.31	76.85	0.00	135.36
2017	29	48H1	15 410.95	1 088.55	4 503.13	3 906.90	5 189.74	463.78	186.30	48.92	0.00	23.63
2017	29	48H2	9 954.01	598.25	2 932.57	2 580.47	3 407.63	292.77	112.38	15.08	0.00	14.85
2017	29	49G9	2 269.71	1 220.34	246.90	302.41	397.57	54.24	27.23	17.69	0.00	3.35
2017	30	50G7	47.59	0.11	3.06	6.57	21.87	6.62	2.81	2.15	1.11	3.28
2017	30	50G8	183.22	1.10	15.13	27.45	85.50	24.38	9.48	7.56	4.09	8.53
2017	30	50G9	7.26	0.00	0.39	0.81	2.78	1.43	0.46	0.42	0.36	0.61
2017	30	50H0	89.69	1.00	6.77	16.03	42.11	12.12	3.68	2.93	1.26	3.80
2017	30	51G7	56.56	0.00	2.98	7.39	25.73	8.09	3.61	2.70	1.35	4.70
2017	30	51G8	6.95	0.00	0.09	0.50	2.95	1.28	0.85	0.42	0.23	0.63
2017	30	51G9	0.78	0.00	0.08	0.16	0.34	0.13	0.03	0.02	0.01	0.01
2017	30	51H0	352.64	0.00	15.99	60.88	184.18	45.00	13.62	12.40	6.67	13.90
2017	30	52G7	6.15	0.00	0.99	0.99	2.44	0.72	0.21	0.24	0.18	0.37
2017	30	52G8	0.39	0.00	0.03	0.08	0.17	0.05	0.02	0.01	0.00	0.02
2017	30	52G9	3.76	0.00	0.03	0.17	0.97	0.37	0.47	0.38	0.18	1.19
2017	30	52H0	3.33	0.00	0.13	0.47	1.50	0.49	0.19	0.17	0.12	0.27
2017	30	53G8	0.53	0.00	0.11	0.20	0.19	0.03	0.00	0.00	0.00	0.00
2017	30	53G9	0.67	0.31	0.01	0.06	0.24	0.02	0.01	0.01	0.01	0.01
2017	30	53H0	7.20	0.00	0.13	0.69	2.87	1.06	0.70	0.46	0.20	1.07
2017	30	54G8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2017	30	54G9	2.91	0.97	0.03	0.17	0.83	0.22	0.26	0.13	0.06	0.23
2017	30	54H0	10.58	0.00	0.77	1.91	4.56	1.14	0.47	0.78	0.16	0.79
2017	30	55G9	4.11	0.82	0.59	0.96	0.91	0.68	0.07	0.04	0.03	0.01
2017	30	55H0	12.77	0.90	1.24	2.54	4.57	1.63	0.44	0.66	0.15	0.64
2017	32	47H3	4 275.83	97.19	934.26	1 053.78	1 761.32	132.16	62.89	83.74	8.53	141.97
2017	32	48H3	7 649.24	5 829.64	849.78	487.01	445.66	29.98	0.00	0.00	7.16	0.00
2017	32	48H4	42 487.13	27 053.93	4 866.91	4 074.71	5 576.74	355.70	146.95	139.83	57.43	214.94
2017	32	48H5	11 236.28	0.00	2 262.00	2 862.49	4 799.11	389.94	195.56	262.22	42.37	422.58
2017	32	48H6	1 742.88	289.11	196.33	334.44	595.26	101.84	74.27	58.98	19.29	73.35
2017	32	48H7	3 011.58	132.86	372.84	653.39	1 181.58	195.45	134.06	125.59	53.30	162.50
2017	32	49H5	11 109.48	743.55	3 211.05	3 324.00	3 276.77	318.19	112.13	25.36	78.10	20.32
2017	32	49H6	1 611.58	36.16	386.84	439.83	540.14	86.15	48.90	19.92	20.44	33.21

Table 5.1.1.2.3. Estimated numbers (millions) of cod in September-October 2005-2017, by ICES rectangles.

Sub_Div	RECT	Area	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
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	0.00
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	11.35
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	4.57
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	0.00
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	4.50
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	10.06
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	2.51
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	1.71
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	3.03
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	1.95
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	1.72
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	0.00
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		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	1.16
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	1.70	0.38
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	0.85
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	0.66
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	8.42
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	0.28
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	4.27
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	1.33
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	0.00
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	0.87
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	0.05
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	2.52
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	2.01
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	0.26
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	0.55
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	0.59
26	39H0	881.60					0.00	0.00	0.02					0.30	0.09
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	0.56
26	40G9	1013.00	0.00		0.00	0.00	1.51	0.00	0.21	5.86	9.07	0.79		0.41	0.71
26	40H0	1012.10	5.10		0.00	0.71	34.59	51.72	1.12	0.23	0.13	0.14		5.13	0.00
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	0.69
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	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	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	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	0.00
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	0.00
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	0.06
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	0.46
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	0.00
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	0.04
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	0.16
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	0.47
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	0.20
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	0.05
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	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	3.90
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	0.08
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	0.06
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	0.22
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	0.05
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	0.33
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	0.00
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	0.00
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	0.24
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	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	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	0.98
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	0.42
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	1.06
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	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	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	1.97
29	48H1	544.00			0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
29	48H2	597.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
29	49G9	564.20			0.00	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 2017.

YEAR	Sub_Div	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2017	21	31.80	230.78	10.12	1.98	0.31	0.00	0.00	0.00	0.00
2017	22	234.01	102.46	6.76	2.80	0.49	0.00	0.00	0.00	0.00
2017	23	51.29	5.03	1.22	1.95	1.19	1.11	0.18	0.07	0.02
2017	24	1 011.15	137.95	168.72	259.82	269.49	156.37	46.20	16.04	7.62
2017	25	591.55	179.65	493.32	2 540.75	716.84	648.96	274.09	146.66	74.58
2017	26	1 234.42	143.82	394.62	1 699.97	926.48	1 417.24	546.90	187.40	475.64
2017	27	2 813.84	1 035.41	900.58	3 548.11	475.63	116.91	22.69	13.67	2.63
2017	28_2	254.38	135.22	792.02	3 791.34	504.64	653.91	374.44	84.97	144.44
2017	29	1 510.94	2 590.95	2 346.96	7 046.25	1 063.81	642.73	511.56	166.90	465.30
2017	30	1 120.09	6 911.19	4 165.98	6 914.81	2 219.13	1 320.29	870.12	413.40	1 633.06
2017	32	1 984.32	3 682.02	2 681.37	8 918.35	1 873.25	967.09	261.04	95.36	256.21

Table 5.1.1.2.5. Estimated numbers (millions) of sprat by ICES subdivisions, accordingly to age groups; September-October 2017.

YEAR	Sub_Div	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2017	21	38.04	101.59	141.74	109.16	10.30	0.00	0.00	0.00	0.00
2017	22	252.59	648.48	110.13	183.63	9.92	12.05	2.40	0.00	0.00
2017	23	10.40	8.85	4.54	4.29	1.58	0.35	0.22	0.03	0.09
2017	24	462.41	2 918.49	1 039.16	1 029.49	274.13	61.35	57.77	2.55	31.47
2017	25	145.83	634.65	702.02	7 986.72	1 586.80	1 019.13	322.88	192.89	155.12
2017	26	30 775.41	5 353.12	9 389.80	11 771.85	3 111.16	1 003.26	456.95	134.61	147.49
2017	27	7 405.51	577.49	935.08	3 247.35	484.95	306.79	58.26	12.59	30.74
2017	28_2	11 746.95	2 790.85	4 857.09	20 485.08	4 020.68	2 061.54	737.60	347.06	248.51
2017	29	22 716.03	15 977.24	15 251.51	28 193.89	3 281.69	1 441.05	875.76	70.11	252.73
2017	30	5.21	48.56	128.06	384.71	105.47	37.37	31.49	16.18	40.05
2017	32	34 182.45	13 080.01	13 229.65	18 176.57	1 609.40	774.76	715.64	286.63	1 068.87

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 2017).

YEAR	Sub_Div	AREA_CORR_FACTOR	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2017	21	1.22	38.694	280.812	12.314	2.409	0.377	0.000	0.000	0.000	0.000
2017	22	1.02	238.836	104.573	6.899	2.858	0.500	0.000	0.000	0.000	0.000
2017	23	1.00	51.290	5.030	1.220	1.950	1.190	1.110	0.180	0.070	0.020
2017	24	1.00	1 011.150	137.950	168.720	259.820	269.490	156.370	46.200	16.040	7.620
2017	25	1.03	610.478	185.400	509.098	2 622.026	739.772	669.717	282.854	151.355	76.964
2017	26	1.01	1 248.660	145.478	399.175	1 719.577	937.171	1 433.594	553.213	189.566	481.128
2017	27	1.23	3 463.104	1 274.319	1 108.380	4 366.795	585.370	143.889	27.930	16.820	3.241
2017	28_2	1.14	290.655	154.502	904.962	4 331.981	576.596	747.153	427.832	97.090	165.042
2017	29	1.04	1 570.986	2 693.913	2 440.224	7 326.267	1 106.082	668.277	531.885	173.534	483.791
2017	30	1.08	1 210.64	7 469.92	4 502.78	7 473.83	2 398.53	1 427.02	940.46	446.82	1 765.08
2017	32	1.42	2 820.207	5 233.052	3 810.880	12 675.145	2 662.348	1 374.471	371.000	135.525	364.131

Table 5.1.1.3.2. Area corrected numbers (millions) of sprat by ICES subdivisions and age groups (September-October 2017).

YEAR	Sub_Div	AREA_CORR_FACTOR	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2017	21	1.22	46.287	123.614	172.469	132.825	12.533	0.000	0.000	0.000	0.000
2017	22	1.02	257.799	661.852	112.401	187.417	10.125	12.298	2.449	0.000	0.000
2017	23	1.00	10.400	8.850	4.540	4.290	1.580	0.350	0.220	0.030	0.090
2017	24	1.00	462.410	2 918.490	1 039.160	1 029.490	274.130	61.350	57.770	2.550	31.470
2017	25	1.03	150.494	654.947	724.472	8 242.207	1 637.554	1 051.727	333.207	199.061	160.083
2017	26	1.01	31 130.440	5 414.877	9 498.127	11 907.653	3 147.053	1 014.829	462.225	136.165	149.187
2017	27	1.23	9 114.244	710.741	1 150.840	3 996.639	596.847	377.573	71.707	15.495	37.830
2017	28_2	1.14	13 422.056	3 188.817	5 549.706	23 406.230	4 594.027	2 355.517	842.780	396.551	283.946
2017	29	1.04	23 618.757	16 612.172	15 857.602	29 314.305	3 412.100	1 498.318	910.564	72.894	262.772
2017	30	1.08	5.633	52.481	138.411	415.809	113.994	40.390	34.032	17.484	43.287
2017	32	1.42	48 581.574	18 589.878	18 802.551	25 833.329	2 287.352	1 101.126	1 017.099	407.367	1 519.125

Table 5.1.1.3.3. Estimated biomass (in tons) of herring in September-October 2017.

YEAR	Sub_Div	AREA_CORR_FACTOR	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2017	21	1.22	686.94	11 349.96	866.32	165.20	25.01				
2017	22	1.02	2 790.39	4 055.57	410.95	141.80	24.17				
2017	23	1.00	692.10	189.46	69.98	89.36	62.56	48.47	9.40	5.49	1.40
2017	24	1.00	10 257.86	5 211.00	11 349.73	18 891.92	26 814.09	12 890.63	5 040.99	1 425.68	598.77
2017	25	1.03	6 329.83	4 375.91	15 895.49	84 997.80	34 294.46	33 146.68	14 562.66	8 803.19	5 200.49
2017	26	1.01	11 125.85	4 336.29	15 218.99	56 899.42	34 546.87	61 874.90	27 386.09	10 553.14	29 441.73
2017	27	1.23	15 771.31	19 632.33	26 704.39	104 702.86	18 073.38	4 662.52	1 001.23	543.98	93.99
2017	28_2	1.14	1 446.50	2 854.31	21 820.07	116 586.36	18 860.25	25 935.54	16 741.04	4 042.07	7 439.82
2017	29	1.04	5 440.53	39 177.50	51 336.35	163 752.49	27 791.21	19 061.89	14 902.16	5 125.69	14 804.50
2017	30	1.08	6 882.05	128 125.11	104 846.37	204 188.82	68 106.51	44 364.55	32 121.12	16 343.57	78 838.95
2017	32	1.42	12 092.57	74 641.48	73 435.15	268 763.45	64 451.37	35 476.54	10 025.90	3 702.75	9 197.82

Table 5.1.1.3.4. Estimated biomass (in tons) of sprat in September-October 2017.

YEAR	Sub_Div	AREA_CORR_FACTOR	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2017	21	1.22	355.45	1702.19	2771.22	2463.78	260.30				
2017	22	1.02	1515.07	9186.59	1836.11	3161.36	194.05	201.50	51.18		
2017	23	1.00	58.81	112.76	70.98	73.15	28.38	6.83	3.86	0.65	1.43
2017	24	1.00	2305.63	36015.95	15970.43	15764.89	4600.98	982.11	913.37	50.16	500.37
2017	25	1.03	501.29	6632.38	7130.62	89447.68	21328.87	14236.37	4793.29	2575.89	2467.15
2017	26	1.01	97398.88	50717.42	95842.35	129508.35	36824.29	12628.48	6081.64	1916.40	2072.98
2017	27	1.23	23315.32	5515.19	10682.02	40242.17	7568.69	4818.33	867.34	187.47	494.58
2017	28_2	1.14	39657.42	27373.87	53128.36	234214.64	49256.23	27271.70	10507.14	5158.44	3644.60
2017	29	1.04	61525.95	134640.57	140902.13	261043.50	33464.97	14738.16	9305.59	801.75	3237.52
2017	30	1.08	17.98	559.90	1599.78	5169.44	1472.06	560.50	472.02	244.62	651.07
2017	32	1.42	106185.16	145782.68	162615.77	226130.94	23153.42	12079.05	10991.13	4452.32	15622.43

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 1991-2017 (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.

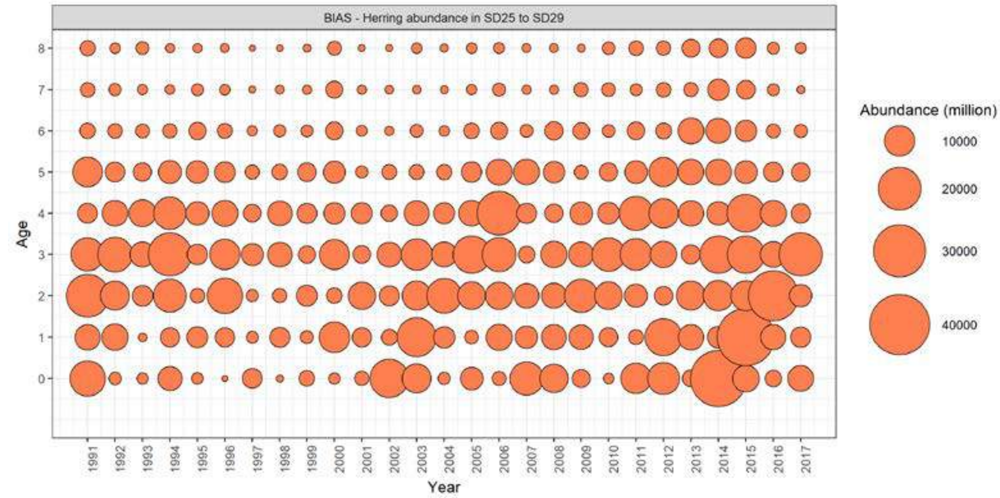


Figure 5.1.1.4.1.1. Autumn (BIAS) tuning fleet index (abundance per age groups and years 1991-2017) for herring in the ICES Subdivisions 25-29.

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	58 119.58	6 830.44	27 754.78	7 212.29	7 276.68	4 049.76	2 031.87	1 493.15	1 470.62
2017	41 451.96	4 453.61	5 361.84	20 366.65	3 944.99	3 662.63	1 823.71	628.36	1 210.17

Note: 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	2 956.58
2017	7 183.88

Note: 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 1991-2017 (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.

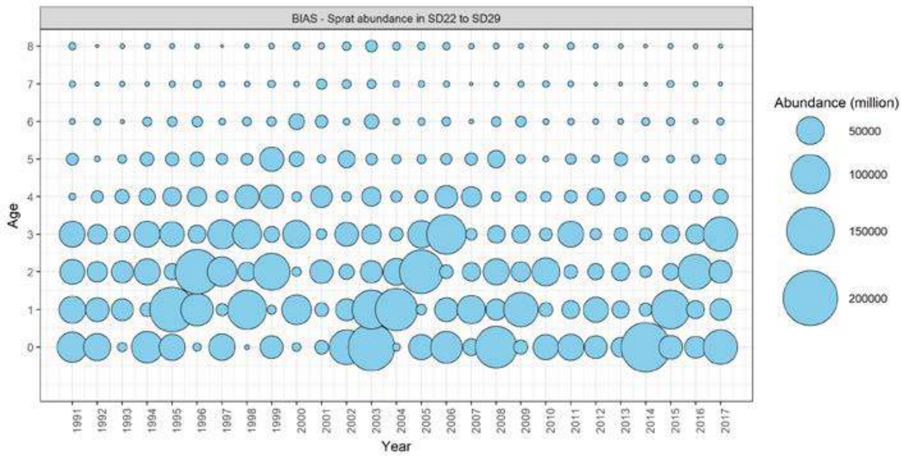


Figure 5.1.1.4.2.1. Autumn (BIAS) tuning fleet index (abundance per age groups and years 1991-2017) for sprat in the ICES Subdivisions 22-29.

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	142 927.58	20 593.04	80 929.70	24 268.59	9 416.64	3 774.99	1 496.16	1 196.02	1 252.44
2017	166 670.25	30 170.75	33 936.85	78 088.23	13 673.42	6 371.96	2 680.92	822.75	925.38

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	30 765.04
2017	78 166.60

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 RV "Aranda" and used the vessel in order to cover all required ICES rectangles in the Bothnian Sea. In 2014-2017, the distance of the acoustic transects and the numbers of realized fish control-hauls were done almost as planned. In 2017, the Finnish BIAS survey was realised on board of the RV "Dana".

Tuning fleet data from the October 1991, 2000, 2007-2017 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.

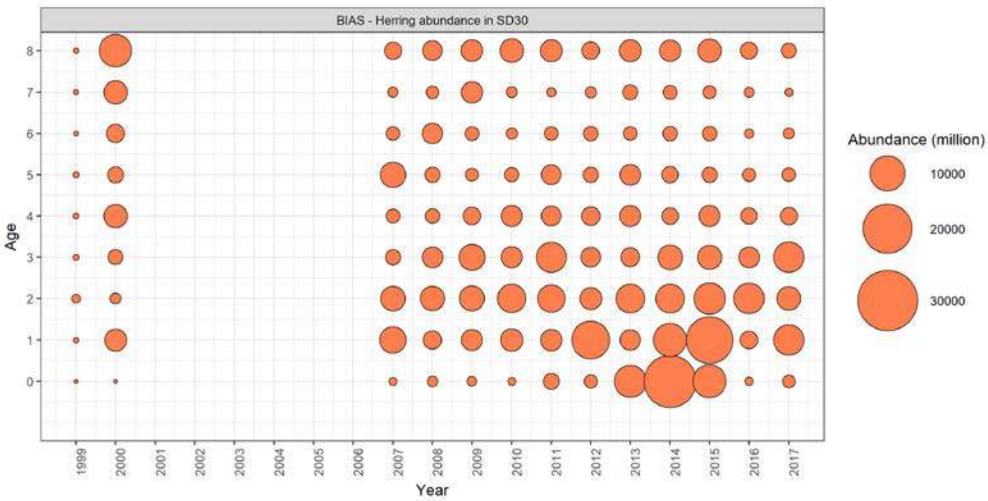


Figure 5.1.1.4.3.1. Autumn (BIAS) tuning fleet index (abundance per age groups and years 1999-2000 and 2007-2017) for herring in the ICES Subdivision 30.

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, 2007-2017).

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
2017	1.08	1210.64	7469.92	4502.78	7473.83	2398.53	1427.02	940.46	446.82	1765.08

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

In May–June 2017, the following acoustic surveys were conducted:

Vessel	Country	ICES Subdivisions
Baltica	Latvia-Poland	Parts of 26, 28,
Baltica	Estonia-Poland	Parts of 28, 29, 32
Darius	Lithuania	Part of 26
Baltica	Poland	Parts of 24, 25, 26
Walther Herwig III	Germany	Part of 24, 25, 26, 27, 28, 29

5.1.2.1. Area under investigation and overlapping areas

The BASS surveys were realised in May 2017 by the above-mentioned five countries in the ICES Subdivisions 24-32 (excl. ICES SD 30, 31) however, in some ICES subdivisions only fragmentary (Figure 5.1.2.1.1). The area coverage of the Baltic Sea with the BASS/2017 survey was very broad and 95% of planned area was monitored with acoustic and trawling. The ICES SD 29 was monitored with acoustic-trawl investigations in the southern and middle parts moreover, only one the ICES rectangle 47H3 was inspected in the ICES Subdivision 32. The statistical ICES rectangles 48H3, 48H4 and 37G4 were omitted from investigations planned during the previous WGBIFS meeting (March 2017). In May 2017, overall 54 the ICES rectangles were covered with acoustic-biotic monitoring. Six ICES rectangles were inspected by two countries. Echointegration was recorded at totally of 3610 NM linear distance moreover, 124 and 224 catch and hydrological stations, respectively were inspected too. The estimated numbers of sprat per age groups and the ICES rectangles are presented in Table 5.1.2.2.1. The geographical distribution of sprat abundance is demonstrated in Figure 5.1.2.1.2. 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.

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, e.g. in May 2017, in the Polish EEZ it was 4%, for cod was 1% and 95% was sprat. These numbers should not be used for a real investigation of herring stock abundance.

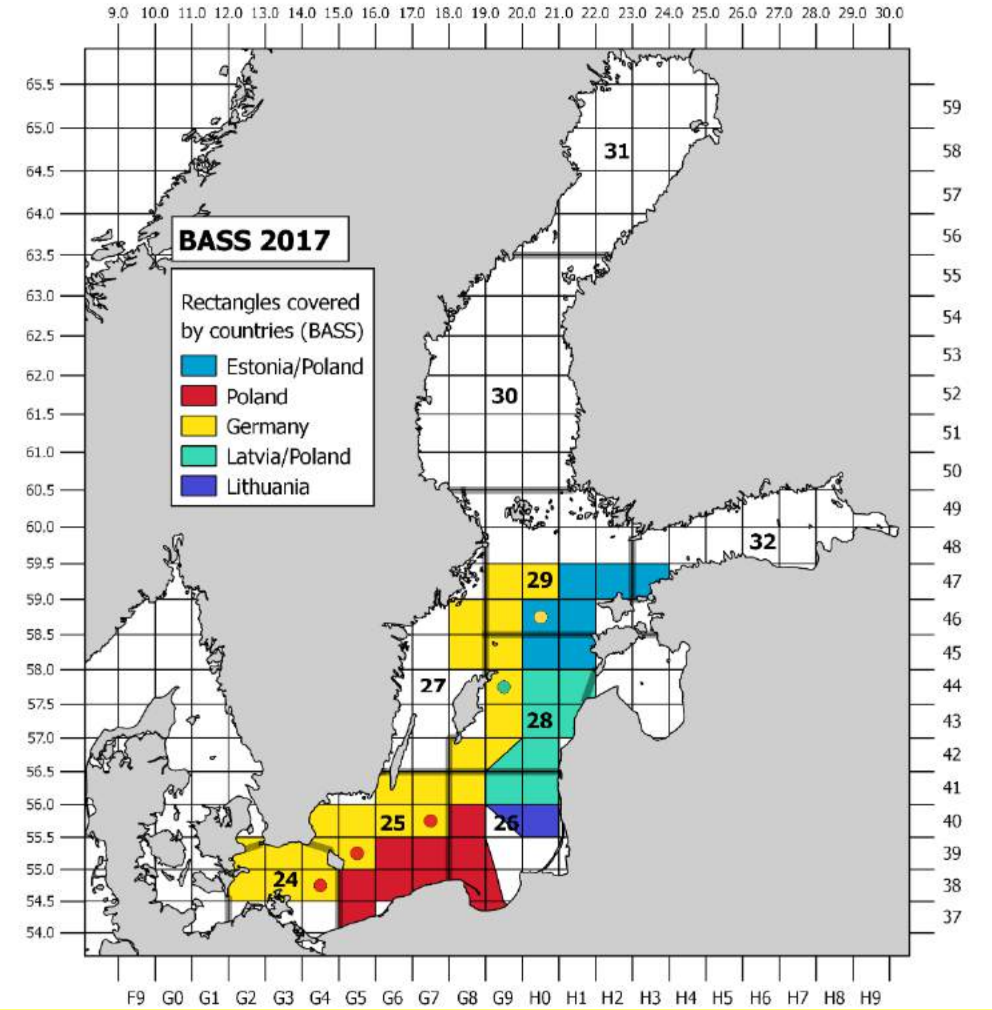


Figure 5.1.2.1.1. Map of the BASS survey conducted in May 2017. Various colours indicate the countries, which covered specific ICES rectangles and delivered data to the BASS-database, thus was responsible for this rectangle. Dot with different colour within a rectangle explain additional data in the 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.

In May 2017 sprat was very widely distributed in the Baltic Sea, was occurred in the each monitored ICES rectangle (Figure 5.1.2.2.1). The highest sprat (age 1+) stock abundance was concentrated in the southeastern part of the Gdańsk Basin.

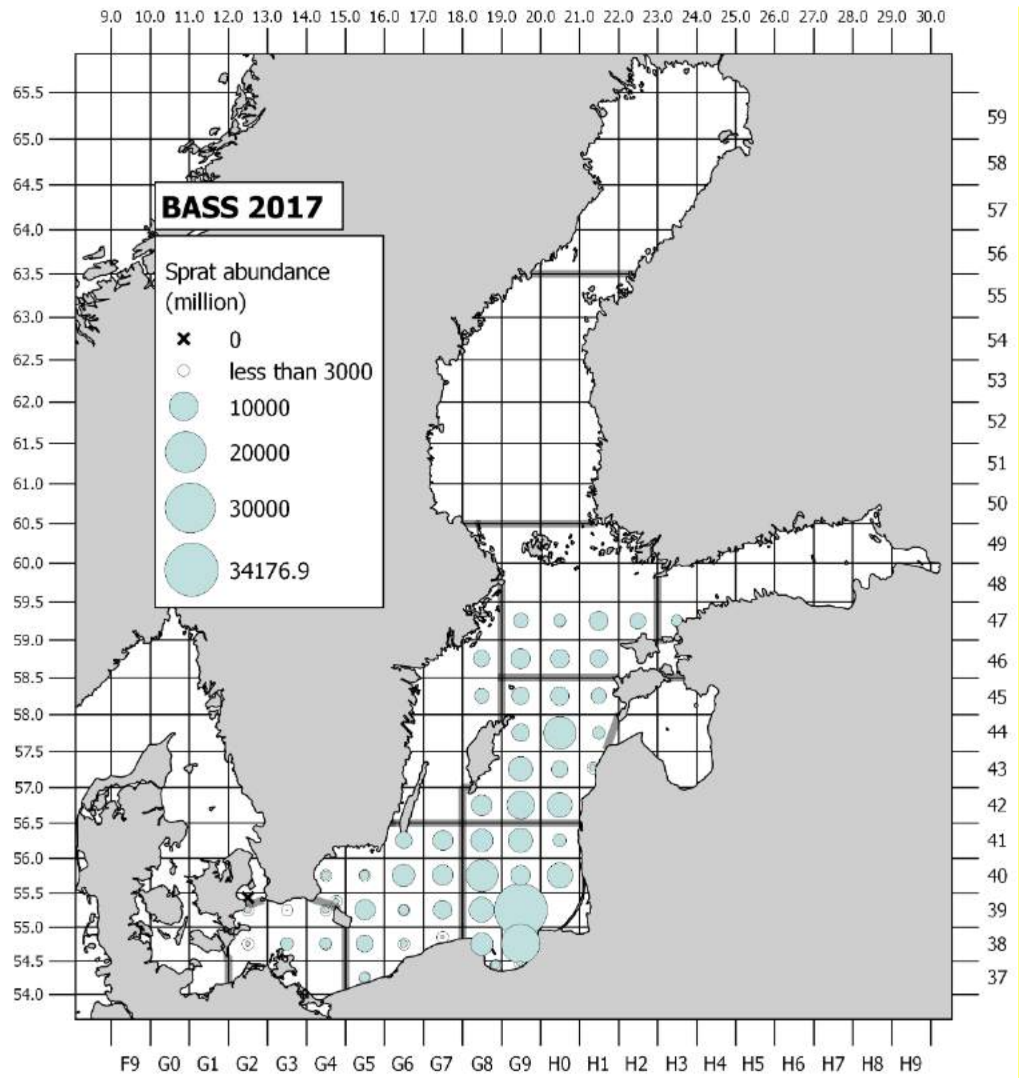


Figure 5.1.2.2.1. The abundance of sprat per ICES rectangles monitored in May 2017 (the area of circles indicates estimated numbers of specimens x10^6 in given rectangle).

Table 5.1.2.2.1. Estimated abundance (millions) of sprat in May 2017 per age groups and the ICES-rectangles in given ICES subdivisions.

YEAR	SD	RECT	total	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
2017	24	38G2	354.56	292.92	16.68	24.61	12.81	5.31	0.64	1.44	0.15
2017	24	38G3	2 078.65	898.68	184.35	641.35	251.80	74.59	4.35	22.35	1.18
2017	24	38G4	1 787.30	226.63	241.28	865.43	325.60	99.02	4.29	24.40	0.65
2017	24	39G2	600.96	496.49	28.27	41.71	21.72	8.99	1.09	2.44	0.25
2017	24	39G3	29.87	0.11	4.30	16.97	6.32	1.60	0.11	0.44	0.02
2017	24	39G4	576.23	5.99	57.75	285.06	147.36	59.75	3.99	15.29	1.04
2017	25	37G5	1 381.74	4.15	45.26	663.07	434.53	153.35	67.68	12.04	1.65
2017	25	38G5	3 719.77	11.96	155.95	2 041.04	1 045.29	306.35	137.86	19.66	1.65
2017	25	38G6	728.53		19.76	352.91	232.71	80.22	35.90	5.65	1.38
2017	25	38G7	179.49	0.14	5.16	84.99	56.48	21.25	9.28	1.85	0.34
2017	25	39G4	444.60	11.70	5.39	183.94	121.32	75.67	21.31	11.12	14.15
2017	25	39G5	4 996.74	176.04	331.96	3 251.40	536.84	535.02	108.60	40.88	16.00
2017	25	39G6	1 404.93	4.62	93.40	862.21	299.66	96.20	40.70	6.15	1.99
2017	25	39G7	4 246.37	154.83	341.49	2 634.03	769.00	226.98	99.30	17.52	3.21
2017	25	40G4	901.59	12.20	15.66	365.28	215.39	177.64	52.23	5.59	57.60
2017	25	40G5	1 154.97	35.69	22.89	664.34	211.47	144.67	39.05	20.58	16.28
2017	25	40G6	6 337.41	500.08	843.64	3 926.10	451.46	478.19	103.83	25.68	8.43
2017	25	40G7	5 137.58	772.44	1 286.61	2 866.52	89.89	75.29	43.55	3.28	
2017	25	41G6	3 446.11	136.52	519.62	2 168.58	263.73	282.98	55.96	12.86	5.86
2017	25	41G7	4 794.47	342.56	956.82	3 238.15	116.06	110.44	27.25	2.54	0.65
2017	26	37G8	1 052.91	392.93	109.70	464.10	65.95	16.12	1.89	2.22	
2017	26	37G9	440.70	34.70	45.53	310.31	41.26	7.61	0.34	0.96	
2017	26	38G8	6 251.49	925.92	630.66	3 855.80	647.60	148.69	19.98	22.84	
2017	26	38G9	18 628.78	1 327.15	2 829.18	13 017.01	1 223.41	213.57		18.46	
2017	26	39G8	7 618.31	339.65	773.48	5 295.79	957.59	193.91	23.70	34.19	
2017	26	39G9	34 176.93	3 018.96	5 322.02	23 194.74	2 254.38	344.36		42.46	
2017	26	40G8	12 510.88	749.85	2 340.66	8 342.55	884.13	161.33	11.26	21.10	
2017	26	40G9	4 940.91	301.05	514.33	1 638.88	1 626.79	387.52	256.59	79.43	136.32
2017	26	40H0	7 861.80	5 715.37	481.15	707.98	506.40	147.69	191.11	38.38	73.72
2017	26	41G8	6 334.75	365.13	1 428.37	4 056.53	438.66	21.97	8.03	8.03	8.03
2017	26	41G9	7 273.20	865.61	922.45	4 471.09	547.47	311.01	54.40	57.32	43.84
2017	26	41H0	2 142.41	310.53	297.71	1 197.02	194.76	102.13	14.36	20.17	5.73
2017	27	45G8	2 580.89	453.01	345.39	1 755.85	20.52	3.06	3.06		
2017	27	46G8	3 551.63	296.04	699.66	2 453.26	89.88	10.23	2.56		
2017	28_2	42G8	5 327.54	1 108.43	1 128.07	2 428.45	565.00	31.69	48.07		17.83
2017	28_2	42G9	9 180.00	674.15	2 033.05	5 349.34	795.72	183.00	86.93	28.79	29.02
2017	28_2	42H0	7 542.11	2 666.90	1 062.80	3 157.95	251.22	232.86	76.67	28.40	65.31
2017	28_2	43G9	7 396.09	738.07	1 714.71	3 986.88	642.81	145.67	106.50	12.97	48.48
2017	28_2	43H0	3 387.66	519.57	598.75	1 918.23	131.52	111.71	57.98	2.17	47.73
2017	28_2	43H1	612.06	124.79	101.81	328.02	14.66	19.21	11.88		11.69
2017	28_2	44G9	3 895.90	304.96	1 151.22	1 850.41	488.18	33.68	49.21		18.24
2017	28_2	44H0	13 106.47	2 073.02	2 201.47	7 771.50	383.17	336.04	127.57	58.74	154.97
2017	28_2	44H1	2 034.61	967.18	336.02	566.69	51.73	60.10	29.03		23.86
2017	28_2	45G9	3 653.17	338.42	1 118.80	1 624.19	467.60	33.82	53.86		16.48
2017	28_2	45H0	4 148.73	1 172.01	930.19	1 705.82	207.58	68.67	25.85	6.71	31.90
2017	28_2	45H1	2 984.29	1 025.76	603.48	1 129.11	132.94	42.46	18.26	8.47	23.82
2017	29	46G9	4 929.05	751.88	1 108.27	2 730.20	224.14	87.50	15.58	11.48	
2017	29	46H0	4 449.25	1 767.37	612.98	1 742.86	123.52	100.86	14.15	37.17	50.33
2017	29	46H1	3 935.38	1 967.66	626.49	1 203.52	50.56	43.24	7.39	18.23	18.27
2017	29	47G9	2 720.53	281.91	559.57	1 518.06	242.66	68.32	28.64	18.51	2.86
2017	29	47H0	1 894.82	259.94	387.40	1 062.69	116.97	37.53	17.49	10.85	1.95
2017	29	47H1	4 375.84	1 302.11	685.64	2 094.23	123.25	88.93	11.86	34.35	35.47
2017	29	47H2	3 030.15	502.41	500.79	1 558.76	163.26	137.70	25.05	47.49	94.69
2017	32	47H3	1 618.33	335.63	312.30	757.00	56.22	52.91	37.36	20.03	46.87

Table 5.1.2.2.2. Estimated numbers of sprat (millions) by ICES subdivisions, according to age groups (May 2017).

YEAR	Sub_Div	AGE1	AGE2	AGE3	AGE4	AGE5	AGE6	AGE7	AGE8
2017	24	1 920.82	532.63	1 875.13	765.61	249.26	14.47	66.36	3.29
2017	25	2 162.93	4 643.61	23 302.56	4 843.84	2 764.25	842.51	185.40	129.19
2017	26	14 346.84	15 695.24	66 551.80	9 388.41	2 055.90	581.67	345.56	267.63
2017	27	749.05	1 045.05	4 209.11	110.40	13.29	5.62		
2017	28_2	11 713.27	12 980.38	31 816.56	4 132.12	1 298.92	691.82	146.24	489.33
2017	29	6 833.28	4 481.14	11 910.32	1 044.36	564.09	120.16	178.09	203.58
2017	32	335.63	312.30	757.00	56.22	52.91	37.36	20.03	46.87

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 - 2017) of the area-corrected sprat abundance in the ICES Subdivisions 24-28 (without the Gulf of Riga) is given in the Table 5.

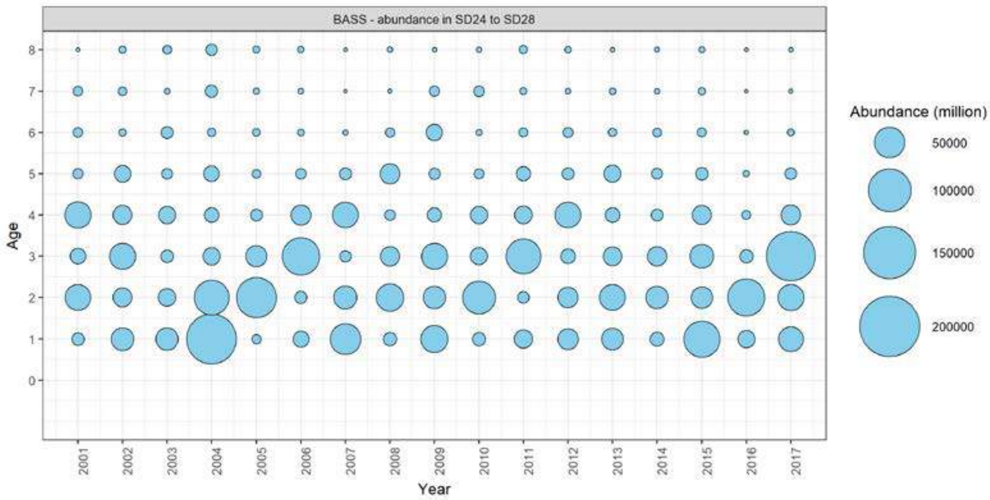


Figure 5.1.2.2.1.1. Spring (BASS) tuning fleet index (abundance per age groups and years 2001-2017) for sprat in the ICES Subdivisions 24-28.

Table 5.1.2.2.1.1. Area corrected numbers (millions) of sprat by ICES subdivisions and age groups (May 2017).

YEAR	Sub_Div	AREA_CORR_FACTOR	AGE1	AGE2	AGE3	AGE4	AGE5	AGE6	AGE7	AGE8+
2017	24	1.28	2 456.48	681.16	2 398.05	979.12	318.77	18.51	84.87	4.21
2017	25	1.03	2 232.12	4 792.15	24 047.98	4 998.79	2 852.68	869.46	191.33	133.32
2017	26	1.10	15 814.71	17 301.06	73 360.90	10 348.97	2 266.24	641.18	380.92	295.01
2017	27	4.25	3 182.56	4 440.21	17 883.66	469.07	56.47	23.88		
2017	28_2	1.04	12 197.73	13 517.25	33 132.49	4 303.02	1 352.64	720.43	152.29	509.57
2017	29	1.61	11 014.07	7 222.84	19 197.40	1 683.33	909.21	193.68	287.04	328.13
2017	32	13.98	4 692.83	4 366.60	10 584.46	786.07	739.77	522.42	280.11	655.37

Table 5.1.2.2.1.2. Corrected sprat biomass (in tonnes) according to ICES subdivisions and age groups (May 2017).

YEAR	Sub_Div	AREA_CORR_FACTOR	AGE1	AGE2	AGE3	AGE4	AGE5	AGE6	AGE7	AGE8+
2017	24	1.28	18251.08	9177.25	37516.99	17236.82	6132.28	410.45	1636.58	102.12
2017	25	1.03	13118.74	36789.94	242872.53	69101.99	40221.31	12267.04	3128.57	2480.84
2017	26	1.10	62040.51	125769.97	617631.04	101064.87	23373.64	7326.90	4487.95	3728.02
2017	27	4.25	13015.92	37315.81	137371.97	5740.39	823.13	334.30		
2017	28_2	1.04	46899.26	92954.12	248331.44	39499.65	13661.82	7696.06	1520.94	5438.14
2017	29	1.61	40715.86	46947.77	140111.55	16784.57	9209.81	2147.17	2859.95	3365.50
2017	32	13.98	15076.13	27980.93	71289.67	7108.12	7111.20	5055.76	2856.42	6422.81

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
2017	233 353.41	32 701.04	36 291.63	132 939.42	20 629.89	6 790.33	2 249.57	809.40	942.12

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

Annex: ToR b) Update the BIAS and BASS hydroacoustic databases and ICES database for acoustic-trawl surveys

5.2 ToR b) Update the BIAS and BASS hydroacoustic databases and ICES database for acoustic-trawl surveys

After validation, the international data from the Baltic International Acoustic Survey (BIAS) and the Baltic Acoustic Spring Survey (BASS) curried out in 2017 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-2018 SharePoint.

An error was discovered shortly after WGBIFS 2016 meeting in the handling of the multiple covered rectangles in 2016 data. This error was corrected in the database. Updated BIAS indices for Central Baltic herring in the SD 25–27, 28.2 and 29 in 2016 are as average 0.07% higher and updated BIAS index for Central Baltic herring recruitment (age 0) is 0.55% higher. Updated BIAS indices for Baltic sprat and Baltic sprat recruitment (age 0) in the SD 22–27, 28.2 and 29 in 2016 are as average 0.19% and 0.01% higher respectively.

The disaggregated data from recent BIAS and BASS surveys were also uploaded to the recently created ICES database for acoustic-trawl data (http://ices.dk/marine-data/data-portals/Pages/acoustic.aspx).

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. O. Kaljuste and N. Larson from Sweden were assigned as the above-mentioned (BAD1) acoustic-trawl data coordinators, responsible to control that the acoustic survey results are uploaded in the right format to the SharePoint of WGBIFS. Moreover, B. Schmidt from Poland was assigned as the manager of the BIAS and BASS databases for aggregated data (BIAS_DB.mdb and BASS_DB.mdb). B. Schmidt 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.

Additionally, before the next WGBIFS meeting the acoustic-trawl data from BIAS and BASS surveys should be uploaded also to the database for Acoustic trawl surveys in the ICES data portal (http://ices.dk/marine-data/data-portals/Pages/acoustic.aspx). Furthermore, O. Kaljuste (Sweden) and J. Lilja (Finland) were assigned as the data coordinators of the acoustic-trawl data in the ICES data portal.

Annex: ToR c) Plan and decide on acoustic surveys to be conducted in autumn 2018 and spring 2018-2019

5.3.1. Planned acoustic survey activities

All the Baltic Sea countries except of Russia intend to take part in the BASS and BIAS acoustic surveys and experiments in 2018 and 2019 (Figures 5.1.1, 5.1.2 and 5.1.3). There is also an intention to conduct a Latvian/Estonian survey on the Gulf of Riga in July 2018 and 2019. The list of participating research vessels and initially planned periods of particular surveys are given in the following tables:

BASS/2018 surveys

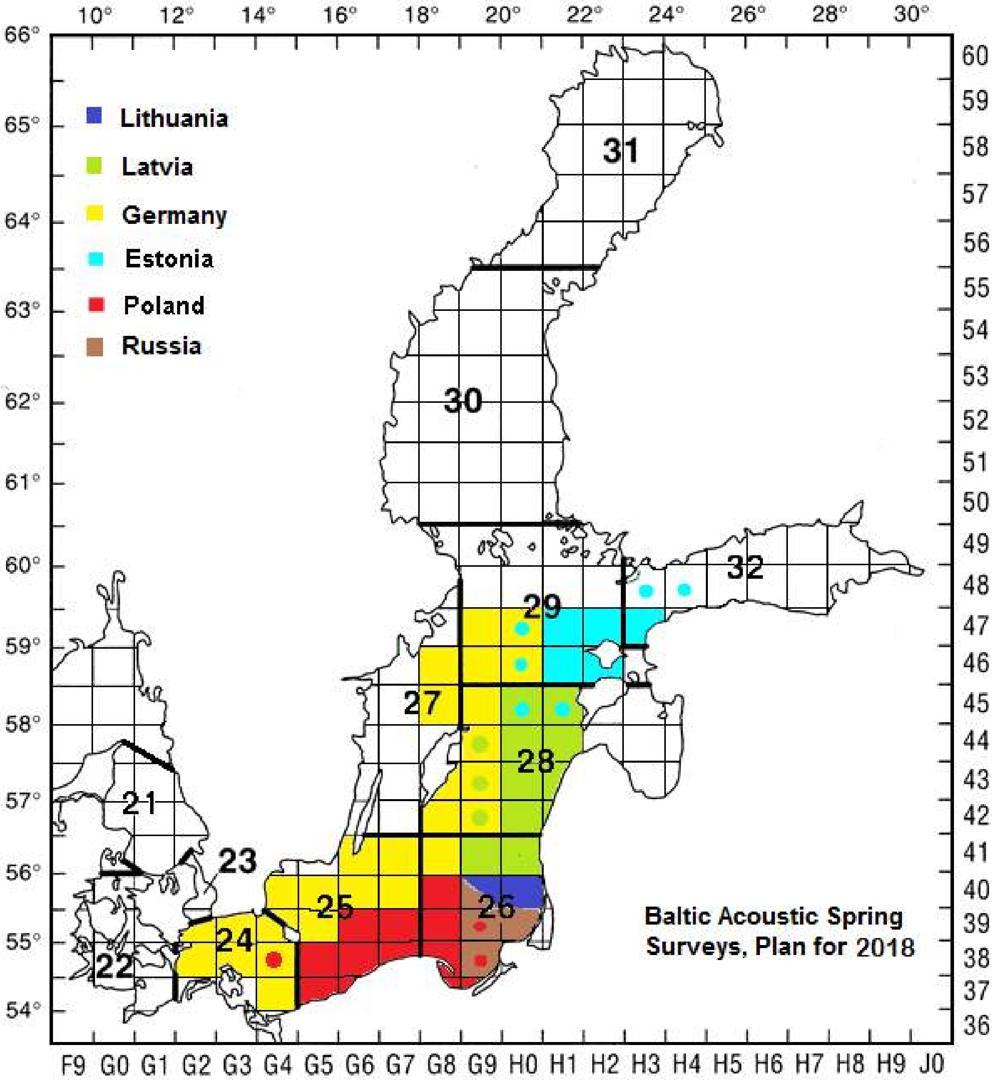
Vessel	Country	Area of Investigation (ICES Sub-divisions)	(Preliminary) Period of Investigations	Duration (Days)
Solea	Germany	24, 25, 26 (part), 28 (part)	30.04.-25.05.2018	24
Baltica	Latvia/Poland	26, 28	18-25.05.2018	8
Baltica	Estonia/Poland	28(part), 29E, 32	26-31.05.2018	5
unknown	Lithuania	26 (the Lithuanian EEZ)	May 2018	2
Baltica	Poland	24 (part), 25, 26 (in the Polish EEZ)	02-13.05.2018	12

BIAS/2018 surveys

Vessel	Country	Area of Investigation (ICES Sub-divisions)	(Preliminary) Period of Investigations	Duration (Days)
Solea	Germany	21, 22, 23, 24	01-21.10.2018	21
unknown	Lithuania	26(part)	November 2018	2
Baltica	Latvia/Poland	26, 28	11-20.10.2018	10
Baltica	Poland	24(part), 25, 26 (in the Polish EEZ)	22.09.-09.10.2018	18
Dana	Sweden	27, 25, 26, 28, 29	02-18.10.2018	17
Baltica	Estonia/Poland	28N, 29E, 32S	21-31.10.2018	11
Aranda	Finland	29N, 32N, 30	25.09.- 09.10.2018	14
unknown	Russia	Not decided		

BASS/2019 surveys

Vessel	Country	Area of Investigation (ICES Subdivisions)	(Preliminary) Period of Investigations	Duration (Days)
Solea	Germany	24, 25N, 26SW, 28W, 29(part)	May 2019	20
Baltica	Poland	24(part), 25, 26 (in the Polish EEZ)	May 2019	12
Baltica	Estonia/Poland	28N, 29E, 32W	May 2019	5
Baltica	Latvia/Poland	26(part), 28(part)	May 2019	9
unknown	Lithuania	26 (the Lithuanian EEZ)	May 2019	2
unknown	Russia	Not decided		


Lithuania
Latvia
Germany
Estonia
Poland
Russia
Baltic Acoustic Spring
Surveys, Plan for 2018
21
22
23
24
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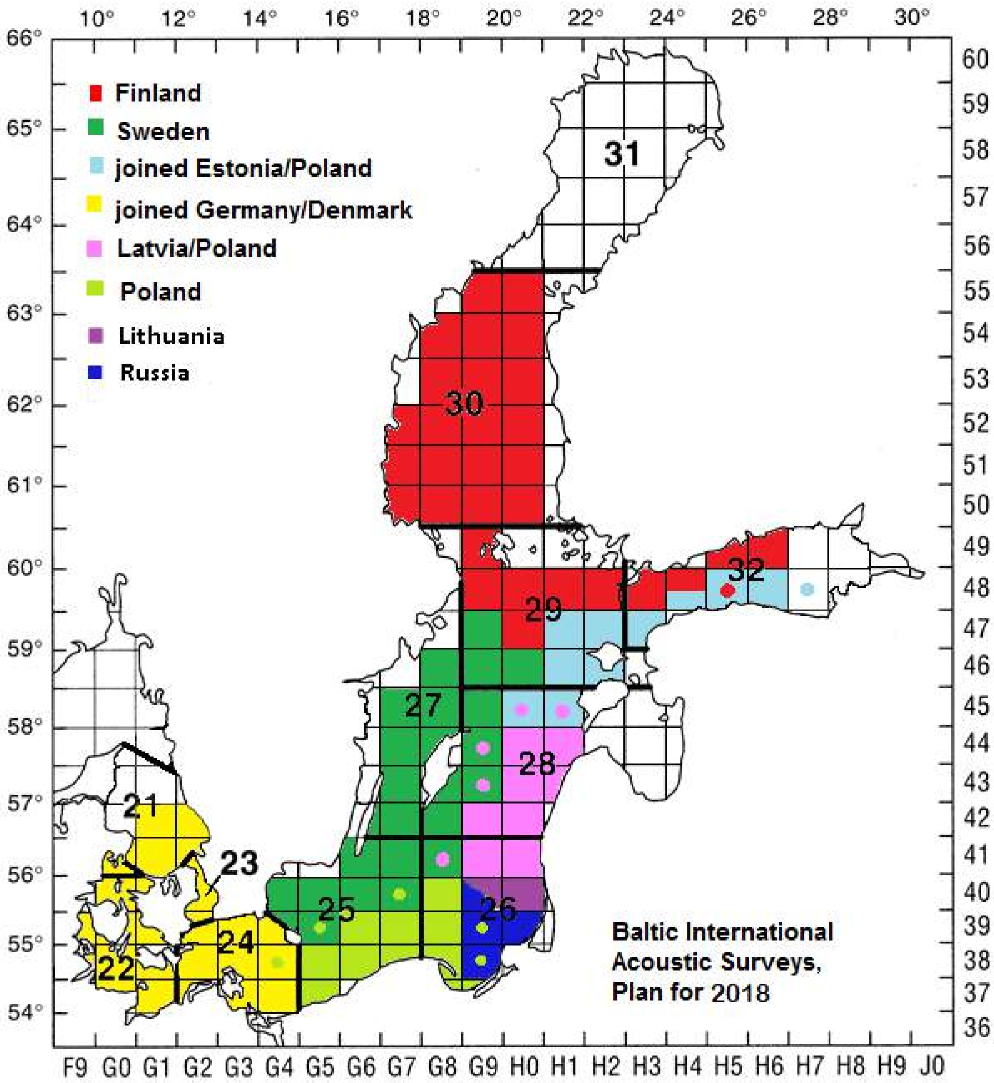
27
28
29
30
31
32
10° 12° 14° 16° 18° 20° 22° 24° 26° 28° 30°
66° 65° 64° 63° 62° 61° 60° 59° 58° 57° 56° 55° 54°
60 59 58 57 56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36
F9 G0 G1 G2 G3 G4 G5 G6 G7 G8 G9 H0 H1 H2 H3 H4 H5 H6 H7 H8 H9 J0


Finland
Sweden
joined Estonia/Poland
joined Germany/Denmark
Latvia/Poland
Poland
Lithuania
Russia
Baltic International
Acoustic Surveys,
Plan for 2018
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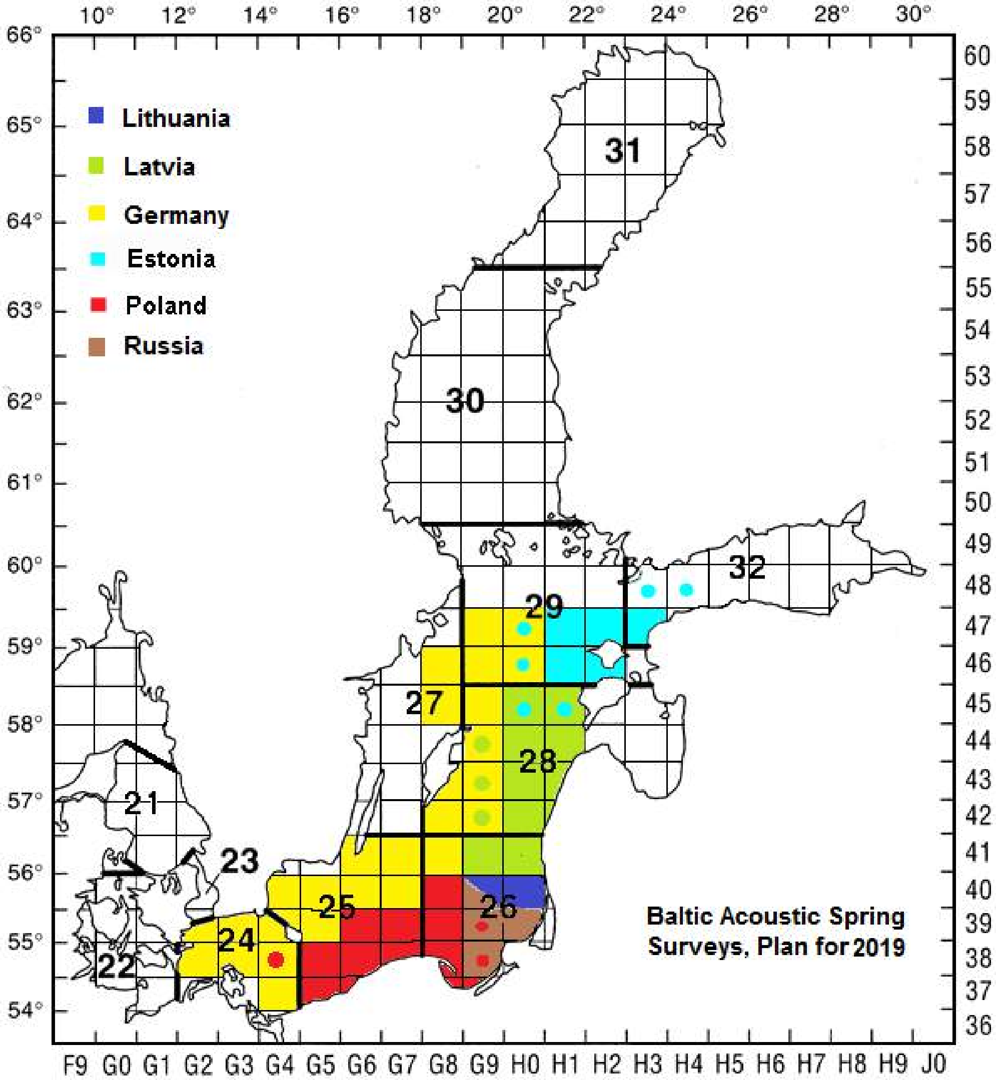


Figures 5.1.1–5.1.3. The planned coverage of the Baltic Sea and the assignment of the national/joint acoustic surveys to the ICES rectangles during the May 2018, September/October-2018 and May 2019 surveys (from top to bottom). Base colours of rectangles indicate the country or joint survey, which is responsible for given 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 2017 and spring 2018 and evaluate the characteristics of TVL and TVS standard gears used in BITS

5.4.1 BITS 4th quarter 2017

During quarter 4th BITS in 2017, the level of realized valid hauls represented 95.6 % of the total planned stations. The level is above the mean historical level. In SD 25 and SD 27 the sampling was influenced by the restrictions enforced by the Swedish military. The smaller number of stations carried out in the Swedish EEZ in SD 25 was counter-balanced by the extra hauls carried out in the Danish EEZ.

The coverage by depth stratum is as follow (depth stratum, coverage in %): 1, 100; 2, 94.0; 3, 98.8; 4, 93.2; 5, 92.1 and 6, 100.0). Again, the lower coverage in depth strata 4 and 5 were induced by the restrictions by the Swedish military preventing sampling in part of the areas around Gotland.

Russia performed the autumn survey 2017 in the Russian EEZ of the ICES Subdivision 26 earlier than the recommended time period for BITS surveys, which was due to administrative problems with research vessel. It was decided to accept the Russian data to be included in the index calculations and it was arranged with the ICES data centre that the Russian data were uploaded to the DATRAS database.

The number of valid hauls was considered by WGBIFS as appropriate for tuning series and it is recommended that the data are used for the assessment of Baltic and Kattegat cod and flatfish stocks.

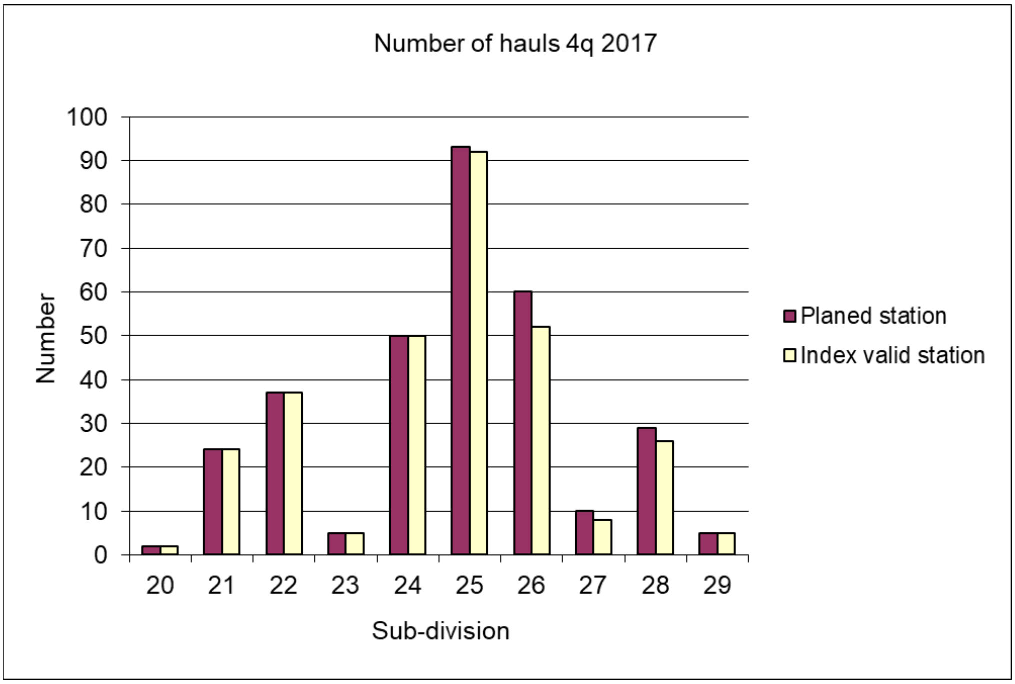


Figure 5.4.1 Comparison of the planned and the index-valid fishing stations by ICES Subdivisions and depth layers during BITS 4th quarter 2017.

Table 5.4.1 Comparison of the planned and the index-valid fishing stations by ICES Subdivisions and depth layers during BITS 4th quarter 2017.

ICES Sub-Divisions	Gear (TVL, TVS)	Depth strata (1-6)	Number of hauls planed	Number of valid hauls realised using "standard" ground trawl	Number of valid hauls realised using rock-hoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
20	TVS	2	2	2	0	0	0	0	100
20	TVS	ALL	2	2	0	0	0	0	100
21	TVS	1	5	5	0	0	0	0	100
21	TVS	2	12	12	0	0	0	0	100
21	TVS	3	3	3	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	24	24	0	0	0	0	100
22	TVS	1	9	9	0	0	0	0	100
22	TVS	2	28	27	0	0	1	0	100
22	TVS	ALL	37	36	0	0	1	0	100
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	TVL	1	3	3	0	0	0	0	100
24	TVS	1	9	9	0	0	0	0	100
24	TVS	2	13	11	0	0	2	0	100
24	TVS	3	25	24	1	0	0	0	100
24	TVL/TVS	ALL	50	47	1	0	2	0	100
25	TVL	2	17	15	0	0	0	0	88
25	TVL	3	29	26	0	0	2	1	97
25	TVL	4	36	32	0	2	0	0	94
25	TVL	5	11	14	0	0	0	0	127
25	TVL	6	0	1	0	0	0	0	NA
25	TVL	ALL	93	88	0	2	2	1	99
26	TVL	2	5	5	0	0	0	0	100
26	TVL	3	8	8	0	0	0	0	100
26	TVL	4	18	11	5	0	0	0	89
26	TVL	5	17	11	1	0	0	1	71
26	TVL	6	6	1	3	0	1	0	83
26	TVS	2	1	1	0	0	0	0	100
26	TVS	3	3	3	0	0	0	0	100
26	TVS	4	2	2	0	0	0	0	100
26	TVL/TVS	ALL	60	42	9	0	1	1	87
27	TVL	3	2	0	0	0	0	0	0
27	TVL	4	5	2	0	2	1	0	100
27	TVL	5	2	1	0	1	0	0	100
27	TVL	6	1	0	0	1	0	0	100
27	TVL	ALL	10	3	0	4	1	0	80
28	TVL	2	4	0	1	0	0	0	25
28	TVL	3	8	3	7	0	0	0	125
28	TVL	4	6	1	2	1	1	1	83
28	TVL	5	6	1	2	2	0	0	83
28	TVS	3	2	2	0	0	0	0	100
28	TVS	4	3	3	0	0	0	0	100
28	TVL/TVS	ALL	29	10	12	3	1	1	90
29	TVS	2	1	1	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	5	1	1	0	0	0	0	100
29	TVS	ALL	5	5	0	0	0	0	100
ALL SD		ALL	315	262	22	9	8	3	95,6

5.4.2 BITS 1st quarter 2018

In general, the coverage is in this quarter very good (96.8%). In SD 22 and 24, the number of hauls carried out exceeds the number of hauls planned because extra stations were added by use of the new facility provided to request additional hauls during the survey if excess time is available. These hauls are selected in accordance with the random stratified strategy and can be included in the index calculations without bias. In certain areas of the ICES SD 25 and 27, fishing investigations were forbidden by the Swedish military. As was the case for the 4th quarter 2017, the smaller number of stations carried out in the Swedish EEZ in SD 25 was counterbalanced by the extra hauls carried out in the Danish EEZ.
The coverage by depth stratum is (depth stratum, coverage %): 1, 100; 2, 100; 3, 97.1; 4, 100; 5, 84.6; 6, 80.0.). The depth stratum 5 and 6 has significantly lover coverage because of the restrictions enforced by the Swedish military particularly in the area around Gotland.

The number of valid hauls accomplished during the BITS-Q1/2018 were considered by WGBIFS 2018 as appropriate for tuning series (e.g. CPUE indices) and the data can be used for the assessment of Baltic and Kattegat cod and flatfish stocks.

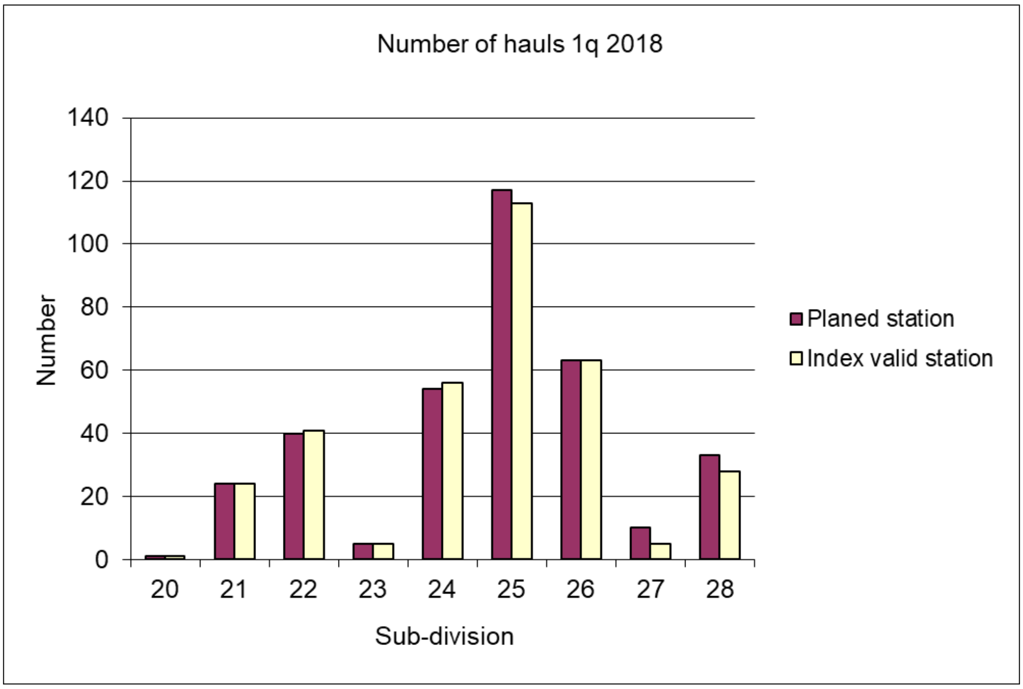


Figure 5.4.2 Comparison of the planned and the index-valid fishing stations by ICES Subdivisions and depth layers during BITS 1q 2018.

Table 5.4.2 Comparison of the planned and the index-valid fishing stations by ICES Subdivisions and depth layers during BITS 1th quarter 2018.

ICES Sub-	Gear (TVL,	Depth strata	Number of hauls	Number of valid hauls	Number of valid	Number of	Number of replacement	Number of invalid	% stations fished
20	TVS	3	1	1	0	0	0	0	100
20	TVS	ALL	1	1	0	0	0	0	100
21	TVS	1	5	5	0	0	0	0	100
21	TVS	2	13	13	0	0	0	0	100
21	TVS	3	4	4	0	0	0	0	100
21	TVS	4	2	2	0	0	0	0	100
21	TVS	ALL	24	24	0	0	0	0	100
22	TVS	1	5	5	0	0	0	0	100
22	TVS	2	35	34	0	0	2	0	103
22	TVS	ALL	40	39	0	0	2	0	103
23	TVS	1	3	3	0	0	0	0	100
23	TVS	2	2	2	0	0	0	0	100
23	TVS	ALL	5	5	0	0	0	0	100
24	TVL	2	6	6	0	0	0	0	100
24	TVL	3	5	4	0	0	0	1	80
24	TVS	1	5	5	0	0	0	0	100
24	TVS	2	10	10	0	0	1	0	110
24	TVS	3	28	28	0	0	2	0	107
24	TVL/TVS	ALL	54	53	0	0	3	1	104
25	TVL	2	17	16	0	0	0	0	94
25	TVL	3	44	39	0	2	0	1	93
25	TVL	4	40	32	0	7	1	1	100
25	TVL	5	16	3	0	12	0	0	94
25	TVL	6	0	1	0	0	0	0	NA
25	TVL	ALL	117	91	0	21	1	2	97
26	TVL	2	9	7	0	0	1	1	89
26	TVL	3	9	11	0	0	0	0	122
26	TVL	4	14	17	0	0	0	1	121
26	TVL	5	16	10	2	0	2	0	88
26	TVL	6	9	5	1	1	0	0	78
26	TVS	3	1	1	0	0	0	0	100
26	TVS	4	5	5	0	0	0	0	100
26	TVL/TVS	ALL	63	56	3	1	3	2	100
27	TVL	3	2	0	0	0	0	0	0
27	TVL	4	5	4	0	0	0	0	80
27	TVL	5	2	1	0	0	0	0	50
27	TVL	6	1	0	0	0	0	0	0
27	TVL	ALL	10	5	0	0	0	0	50
28	TVL	2	6	0	6	0	0	0	100
28	TVL	3	10	2	7	0	0	1	90
28	TVL	4	12	4	6	0	0	0	83
28	TVL	5	5	1	2	0	0	0	60
28	TVL	ALL	33	7	21	0	0	1	85
ALL SD		ALL	347	281	24	22	9	6	96,8

5.4.3 Standard fishing-gear checking

WGBIFS has implemented a complete and accurate measurement of technical parameters (the geometry, mesh sizes, rope lengths of the trawl, etc.) of the exploited demersal trawls (type TV-3L and TV-3S) as a standard procedure. This procedure has to be performed at least once a year by each country involved in the BITS surveys realization. In addition, prior to each BITS survey, also a smaller scale measurement of the trawl should be made. All the measurements should follow the Manual of the construction and use of the International Standard Trawl for the Baltic Demersal Surveys. It is recommended that the measurements of TV-3L and TV-3S trawl technical parameters is done by professional experts in fishing gear technology or experienced crewmembers. Results of the measurements from all countries must be uploaded to the WGBIFS SharePoint using the standard protocols.

Eight reports, covering in total ten different trawls, were submitted by national laboratories to WGBIFS 2018. None of the reports showed any values, which was outside an acceptable percentage deviation from the standard reference values of the two trawls. All reports can be found in WGBIFS SharePoint. One example from the standard bottom fishing gear-checking report is given here below.

Table 5.4.3.1. Results of the Polish (RV "Baltica") bottom, standard fishing gear-checking exercise.

Table 2. Check list for trawl and for frame ropes of trawl Tag no. TV3-930 #	Country:	Year:	Quarter:	Date:	Remarks:
Trawl no./nan No 1	POL	2018	1	20180315	

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	22.27	200	200	111.4	0.0	0.8	
	1A1	22.10	200	111	22.87	200	200	114.4	0.0	3.5	
	1A2	22.10	200	111	23.26	200	200	116.3	0.0	5.2	
	1B2	22.10	200	111	22.38	200	200	111.9	0.0	1.3	
	1C1	22.10	120	184	22.84	120	120	190.3	0.0	3.3	
	1C2	22.10	120	184	22.75	120	120	189.6	0.0	2.9	
2	2B1	2.96	160	19	3	160	160	18.8	0.0	1.4	
	2A	2.96	160	19	2.75	160	160	17.2	0.0	-7.1	
	2B2	2.96	160	19	3	160	160	18.8	0.0	1.4	
	2C1	3.00	120	25	2.91	120	120	24.3	0.0	-3.0	
	2C2	3.00	120	25	2.95	120	120	24.6	0.0	-1.7	
3	3B1	2.94	120	25	2.94	120	120	24.5	0.0	0.0	
	3A	2.94	120	25	2.76	120	120	23.0	0.0	-6.1	
	3B2	2.94	120	25	2.95	120	120	24.6	0.0	0.3	
	3C	3.00	120	25	2.78	120	120	23.2	0.0	-7.3	
4	4B1	7.92	80	99	7.91	80	80	98.9	0.0	-0.1	
	4A	7.92	80	99	7.73	80	80	96.6	0.0	-2.4	
	4B2	7.92	80	99	7.89	80	80	98.6	0.0	-0.4	
	4C	8.00	80	100	7.88	80	80	98.5	0.0	-1.5	
5	5B1	5.94	60	99	5.86	60	60	97.7	0.0	-1.3	
	5A	5.94	60	99	5.96	60	60	99.3	0.0	0.3	
	5B2	5.94	60	99	5.85	60	60	97.5	0.0	-1.5	
	5C	6.00	60	100	5.83	60	60	97.2	0.0	-2.8	
6	6B1	11.92	40	298	11.47	40	40	286.8	0.0	-3.8	
	6A	11.92	40	298	11.56	40	40	289.0	0.0	-3.0	
	6B2	11.92	40	298	11.49	40	40	287.3	0.0	-3.6	
	6C	12.00	40	300	11.96	40	40	299.0	0.0	-0.3	
Codend			20			20					
			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	4	
Head line wing section Port.	28.50	28.44	
Head line bosom section	2.50	2.57	
Head line wing section Stbd.	28.50	28.44	
Head line extension Stbd.	4.00	4	
Fishing line extension Port.	0.95	1.33	
Fishing line wing section Port.	29.94	29.77	
Fishing line bosom section	1.68	1.78	
Fishing line wing section Stbd.	29.94	29.82	
Fishing line extension Stbd.	0.95	1.33	
Upper wing line Port.	2.70	2.67	
Upper wing line Stbd.	2.70	2.7	
Upper wing side Port.	2.15	2.62	
Upper wing side Stbd.	2.15	2.65	
Lower wing line Port.	2.75	2.11	
Lower wing line Stbd.	2.75	2.07	
Lower wing side Port.	2.20	2.13	
Lower wing side Stbd.	2.20	2.1	

Type of fishing gear:	TV3-930 #
Nation:	POL
Date of measurements	2018-03-15
Name of operators:	Krzysztof Radtke
Number of realized hauls:	150
Comments concerning the use:	

Annex: ToR e) Plan and decide on demersal trawl surveys and experiments to be conducted in autumn 2018 and spring 2019, and update, and correct the Tow-Database and DATRAS

5.5.1. Plan and decide on demersal trawl surveys and experiments

WGBIFS 2018 notes that planning of the BITS in quarter 4 in 2018 and in quarter 1 in 2019 was influenced by the existing rule for foreign research vessels working in the Polish EEZ implying stationing of a governmental administrative observer on board. WGBIFS notes that allowing the scientific observer on-board instead of an administrative one would be the decent solution for that problem.

The most of the participating institutes plan the same numbers of hauls during BITS surveys in autumn 2018 and spring 2019 as in the year before.

The total number of stations committed by the countries and available is given in Table 5.5.1.1,

Table 5.5.1.1. Total numbers of catch-stations planned by particular country during BITS in autumn 2018 and spring 2019.

COUNTRY	VESSEL	NUMBER OF PLANNED STATIONS IN AUTUMN	NUMBER OF PLANNED STATIONS IN SPRING
		2018	2019
Germany	Solea	57	60
Denmark	Havfisken	27	27
Poland	Baltica	3	5
	Total 22 + 24	87	92
Denmark	Dana	55	55
Estonia	Commercial vessel	5	0
Finland	Aranda	0	0
Latvia	Chartered vessel	25	25
Lithuania	Chartered vessel	6	6
Poland	Baltica	57	64
Russia	Atlantniro/Atlantida	0	0
Sweden	Dana	30	50
	Total 25 - 28	178	200
	Total 22 - 28	265	292

WGBIFS acknowledges that Russia re-established its participation in BITS surveys in 2017. However, according to preliminary information from the Member Country, the participation of Russia in the BITS surveys in autumn 2018 and in spring 2019 cannot be confirmed yet. Since other ICES Member Countries will not be able to get permission to work in the EEZ of Russia, the negative effect on the quality of the survey results based on BITS survey would be eminent. According to the recommendations of WGBIFS, all countries should upload to DATRAS information related to all fished species.

5.5.2. Update and correct the Tow-Database

One haul was deleted from the database due to obstruction by a new cable across the haul track and another haul was deleted because of repeated serious damage of the gear. One new haul were added to the database and for 19 hauls the position were adjusted. The Trawl Database manager has started the practice of keeping a logbook of the activities connected to the database.

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

During the WGBIFS 2018, meeting no any essential changes of the data in the Database of Trawl Surveys (DATRAS) was made.

Annex: ToR f) Conduct analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty in the BIAS and BASS surveys

At the WGBIFS meeting 2016 it was decided that a bootstrap method should be used to present the survey sampling variance. That method was based on recalculations of the survey results by resampling of acoustic data and trawl hauls. On the Workshop on Sampling Design and Optimization (WKSDO) in Lysekil, Sweden in 2016, the method was discussed with Jon Helge Vølstad and Mary Christman and they suggested to do a bootstrap on the survey results from the covered area.

At 2017 year's WGBIFS meeting the two bootstrapping methods were discussed and it was decided that WGBIFS should move forward and try to evaluate the results from the bootstrap method recommended at WKSDO.

In the following figures (6.1-6.8) are presented the results of bootstrapping (using method recommended at WKSDO) of the BIAS and BASS 2017 survey data.

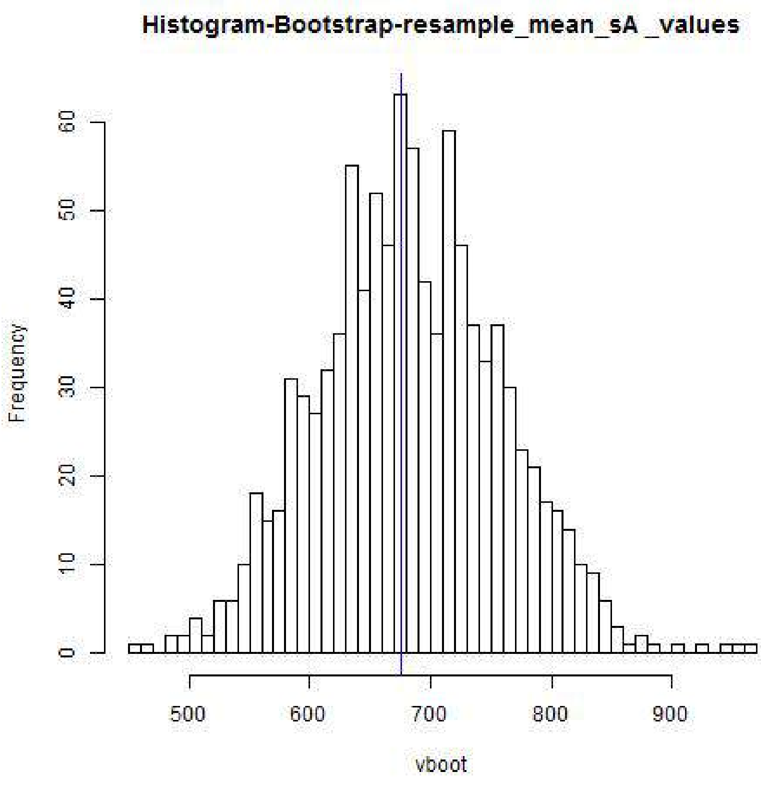


Figure 6.1 Bootstrapped mean of sA from the BIAS survey. Blue line is the survey result mean.

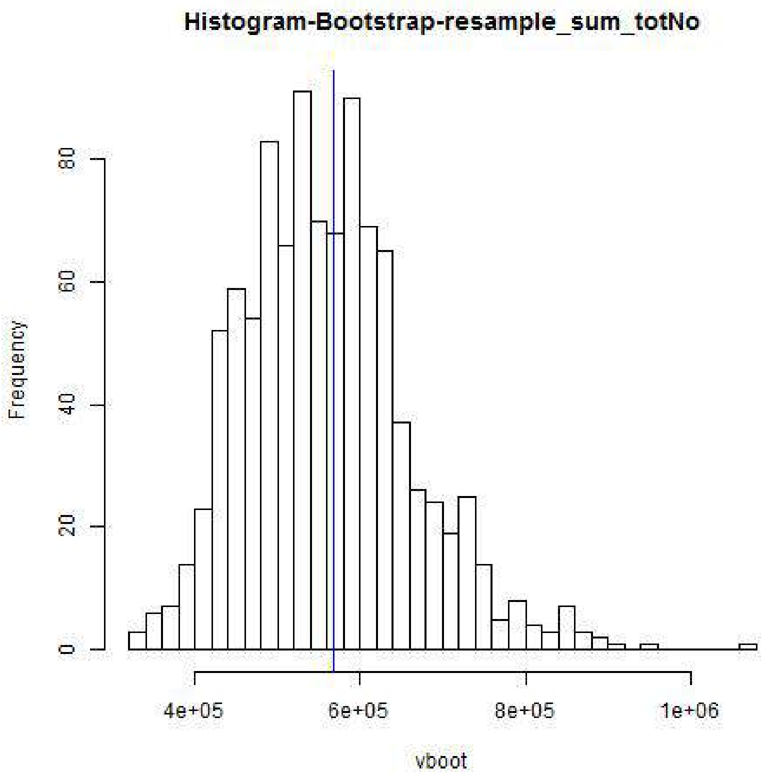


Figure 6.2 Bootstrapped sum of total number of fish from the BIAS survey. Blue line is the survey result sum.

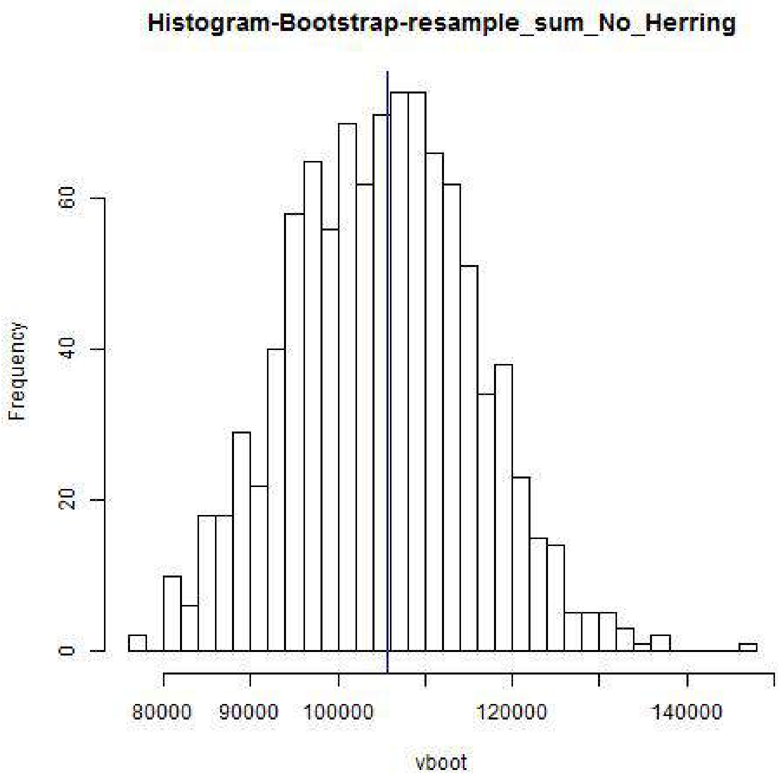


Figure 6.3 Bootstrapped sum of herring from the BIAS survey. Blue line is the survey result sum.

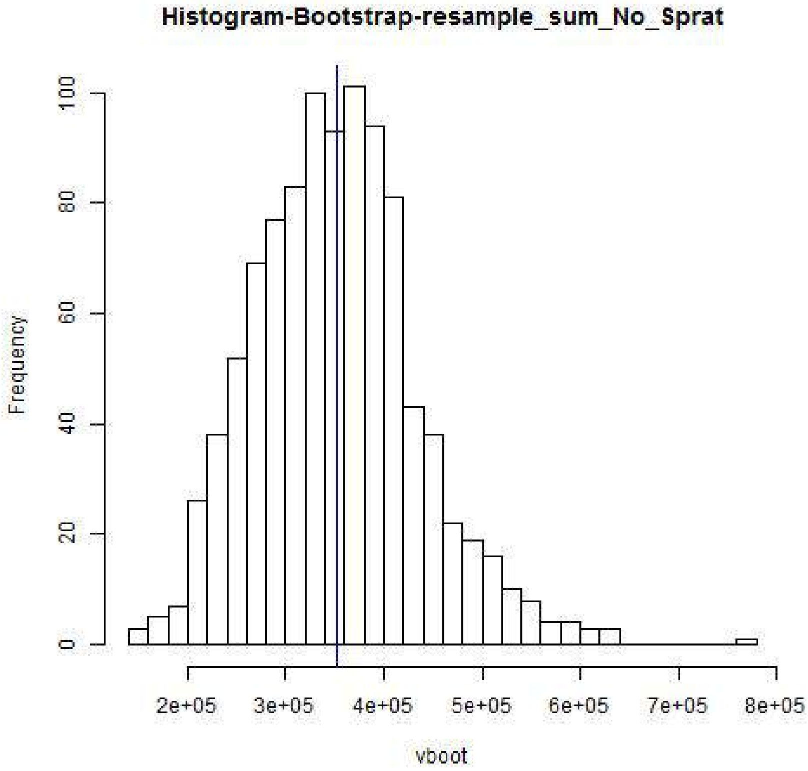


Figure 6.4 Bootstrapped sum of sprat from the BIAS survey. Blue line is the survey result sum.

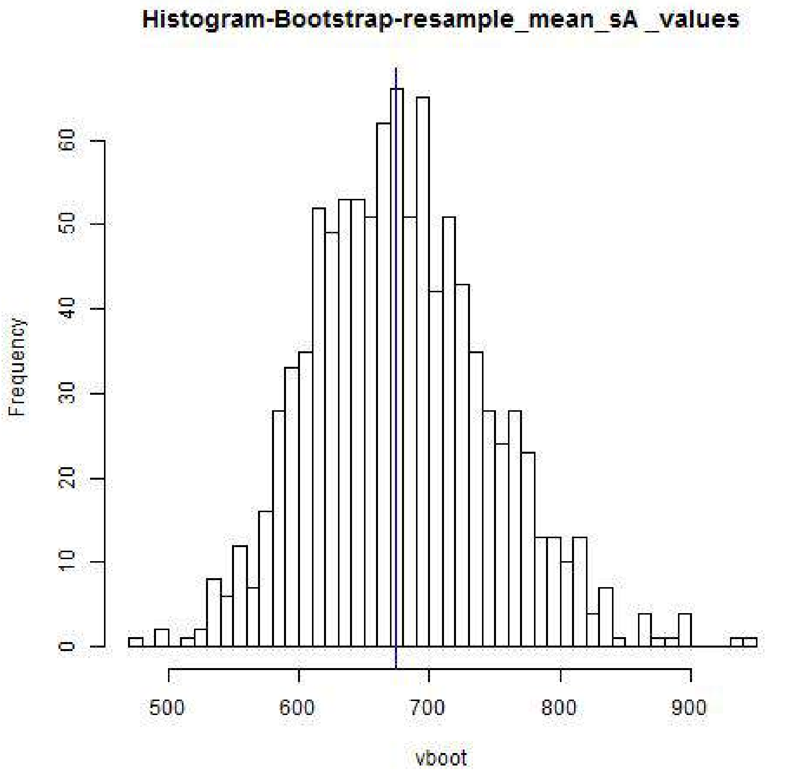


Figure 6.5 Bootstrapped mean of sA from the BASS survey. Blue line is the survey result mean.

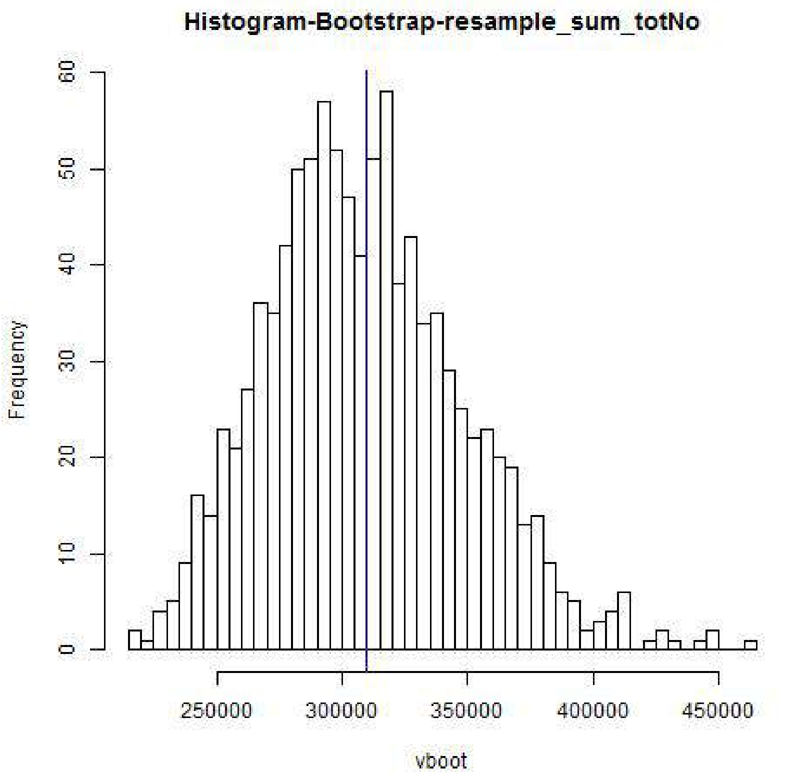


Figure 6.6 Bootstrapped sum of total number of fish from the BASS survey. Blue line is the survey result sum.

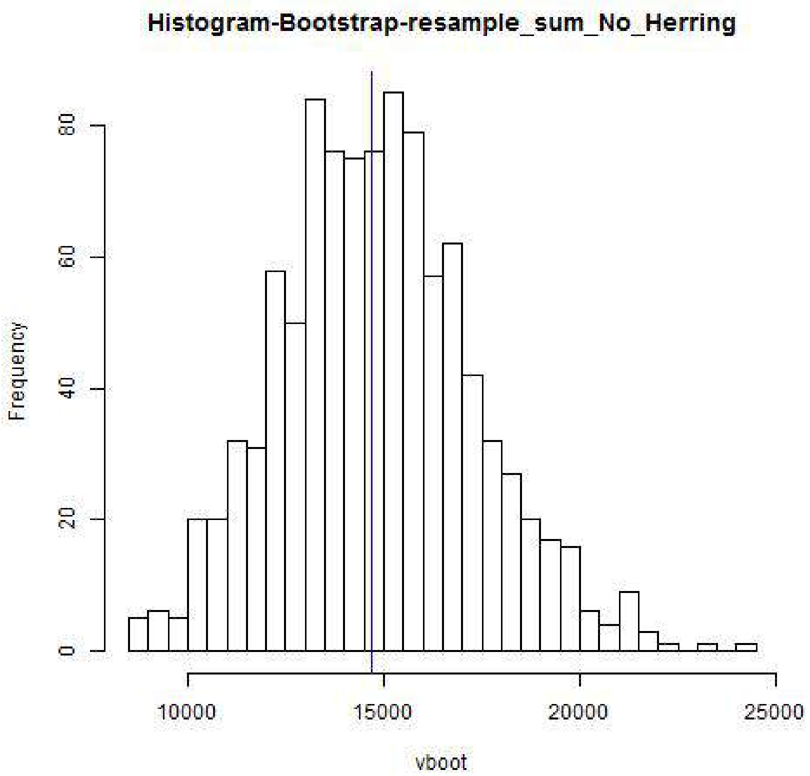


Figure 6.7 Bootstrapped sum of herring from the BASS survey. Blue line is the survey result sum.

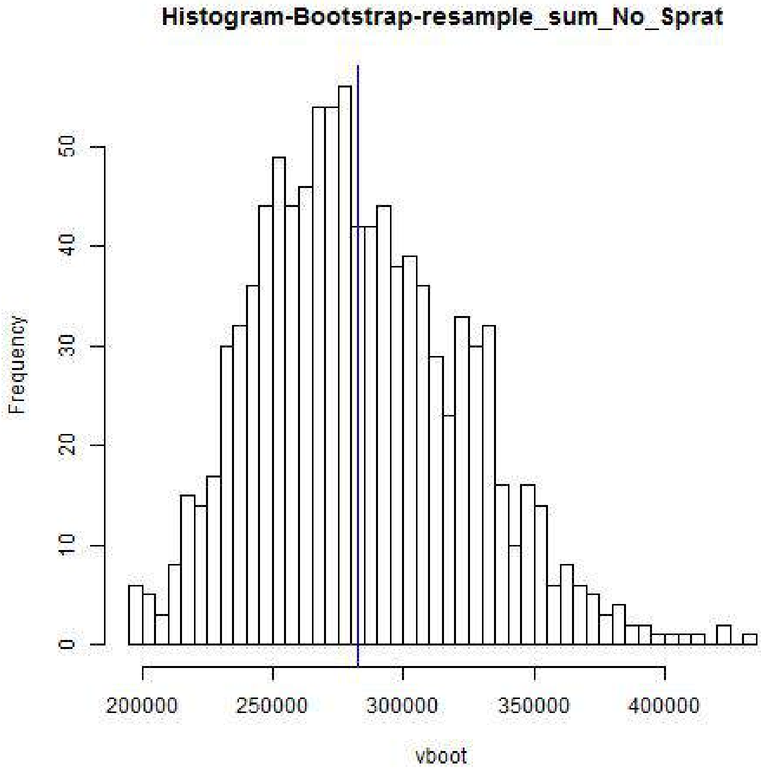


Figure 6.8 Bootstrapped sum of sprat from the BASS survey. Blue line is the survey result sum.

Annex: ToR i) Coordinate the marine litter-sampling programme within the Baltic International Trawl Survey and registering the data in the ICES database

Submission of the marine litter (mostly anthropogenic origin) data from the current BITS surveys into DATRAS is uploaded and fully functional. All countries realized the BITS-Q4/2017 and BITS-Q1/2018 surveys and submitted the data 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).

Marine litter data submitters will transfer data using the DATRAS Trawl litter standard format, implementing ICES vocabulary and classification coding (Tables 5.2.2.2 and 5.2.2.3 in the Manual for the Baltic International Trawl Surveys (BITS). Series of ICES Survey Protocols SISP 7 - BITS. 95 pp. http://doi.org/10.17895/ices.pub.2883), 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.

ICES Data Centre suggested a new feature which would enable to upload simultaneously survey data and litter data in order to facilitate the upload process. It was discussed within the group and decision was left to the countries if they either want to upload survey and litter data simultaneously or separately.

One-dimensional (length) and two-dimensional (area) measurements sometimes do not describe the shape and size of marine litter correct. Therefore we would need to implement a three-dimensional measurement unit (volume) for litter in order to describe the shape and size of marine litter. For example, a bottle, a rock, or a box described with only one or two dimensions doesn't provide enough information in order to be used scientifically. In order to collect more useful data, WGBIFS recommends additional size category (volume) to be incorporated in the litter size column in DATRAS.

Collected and registered information from marine litter is an important source of knowledge regarding current ecological status of marine seabed in investigated areas of the Baltic. BITS will continue this task.

Annex: ToR j) Agree a standard pelagic trawl gear used in BIAS and BASS surveys

In 2016, WGBIFS requested support from WGFTFB to standardize the pelagic trawl for the international Baltic acoustic surveys (BASS and BIAS). A first discussion was held during WGBIFS 2016. Prior to the current discussion, there were two meetings between Olavi Kaljuste (chair WGBIFS), Haraldur Einarsson (chair WGFTFB) and Daniel Stepputtis (Thünen-Institute, Germany and member of WGFTFB) to discuss the basic needs. During the last meeting (25.01.2018 in Copenhagen) of these three above mentioned persons, it was agreed to have a wider discussion during the WGBIFS 2018 meeting. Haraldur Einarsson and Daniel Stepputtis joined the WGBIFS meeting using the WebEx-meeting application at 27.03.2018 between 11:00 and 12:30.

The first topic was to briefly summarize the current status of different gears, used in the acoustic surveys. Apart from different codend mesh sizes, which are also specified in the BIAS manual, the different countries use quite different gears (an overview was presented in the WGBIFS 2015 meeting). Additionally, some of the countries (e.g. Germany) use two different size classes of gears. The reasons for the use of different gears are historic, based on the usage of different vessels and their possibilities, but also the different survey needs in shallow and deep waters.

The main reason for conducting fishery hauls during an acoustic survey is the need to identify the species and length composition and to obtain biological samples for maturity and age estimation. This sampling/survey approach usually does not require a standardised gear design, which is typically used in swept-area surveys.

Therefore, the rationale for the need of pelagic trawlnet standardization was discussed. Some members of WGBIFS raised the wish to have a comparable catchability for all countries during the acoustic surveys. It was also pointed out that – in contrast to a bottom-trawl survey – the fishing strategy and fishing behaviour of the captain is at least as important for the catch result as the trawl. Additionally, Henrik Degel (DTU-Aqua) pointed out that during the BITS a pelagic net is needed to obtain an abundance estimate for cod using swept-area method when cod is not at the ground due to oxygen depletion and hence not catchable with the standard BITS-trawl.

In addition to a discussion about the design of the basic trawl-design, it was pointed out (Germany, Estonia, Sweden) that a multisampler could help to identify specific echo targets and layers and hence to improve the survey result. Daniel Stepputtis highlighted that different multisamplers with remote control are available and offered to present the possibilities.

Haraldur Einarsson briefly explained the current process of standardization of mackerel-trawls. Whereas, the mackerel surveys are pelagic surveys using pelagic trawls, the general requirement is different from the Baltic approach. Mackerel are mostly found in the surface layer and hence potentially scared by the vessel. Due to this aggregation in the surface layer, the mackerel hauls potentially can be used to estimate swapped area-abundances (as typically for bottom-trawl surveys). Two trawls with different size (30m vertical opening and 10m vertical opening) were designed by Hampedjan, whereas the design is not owned by the company – and hence could be used as template for standardized Baltic trawls.

Based on the discussion following needs where identified:

- standardization of technical specification of the gear
    - basic gear
        - **two sizes** needed (e.g. 30m and 10-15m) due to different vessel size and fishing areas
        - **possibility to fish close to or even at the bottom** (especially in shallow western Baltic and slope areas in Baltic basins)
        - **standardized trawl doors**
    - codends
        - currently two sizes, discussion needed whether it is possible to harmonize
    - multisampler
- re-evaluation of BIAS-manual related to fishing operation and vertical stratification (e.g. in relation to vertical opening and the use of multisamplers)
- standardization of trawl-geometry monitoring/net monitoring
- standardization of regular documentation of net specifications for each used net

The following next steps were agreed

- Share of Information regarding existing trawls
    - Haraldur Einarsson distribute information about the mackerel trawls
- Search for experts for further discussions (task force)
    - WGBIFS members should volunteer to be part of a task force group
    - WGBIFS members should find gear experts in their countries
    - Haraldur Einarsson and Daniel Stepputtis will present the topic briefly at WGFTFB (June 2018) to ask gear technologists for their participation

Annex 1: List of participants

Name	Address	Telephone	E-mail
Degel Henrik	Danish Technical University, National Institute of Aquatic Resources, Section for Fisheries Advice, Copenhagen, Denmark	+45 33963386 or +45 21314880	hd@aqua.dtu.dk
Fedotova Elena	Fisheries Service under the Ministry of Agriculture of Republic of Lithuania; Smiltynes st. 1, LT-91001 Klaipeda, Lithuania	+370 46 391122	Jelena.Fedotova@zuv.lt
Grygiel Włodzimierz	National Marine Fisheries Research Institute, ul. Kollataja 1, 81-332 Gdynia, Poland	+48 58 7356 270	wgrygiel@mir.gdynia.pl
Kaljuste Olavi (chair)	Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Coastal Research, Skolgatan 6, SE-74242 Öregrund, Sweden	+46 761 268 071	olavi.kaljuste@slu.se
Karpushevskiy Igor	AtlantNIRO, 5 Dmitry Donskogo Street, RU-236000 Kaliningrad, Russian Federation	+7 4012 925 568	karpushevskiy@atlantniro.ru
Larson Niklas	Swedish University of Agricultural Sciences,Department of Aquatic Resources, Institute of Marine Research, Turistgatan 5, SE- 453 30 Lysekil, Sweden	+46 70 3034773	niklas.larson@slu.se
Lilja Juha	Natural Resources Institute Finland (Luke) Natural Resources and Bioproduction Survontie 9A, FI-40500 Jyväskylä, Finland	+358 295 327 525	juha.lilja@luke.fi
Lövgren Olof	Swedish University of Agricultural Sciences, Department of Aquatic Resources,	+46 10 4784055	olof.lovgren@slu.se

	Institute of Marine Research, Turistgatan 5, SE- 453 30 Lysekil, Sweden	+46 730 323 426	
Parner Hjalte (part time as ICES staff)	International Council for the Exploration of the Sea, Data Center; H.C. Andersens Boulevard 44-46, 1553 Copenhagen V, Denmark	+45 33386737	hjalte.parner@ices.dk
Pönni Jukka	Natural Resources Institute Finland (Luke), Natural Resources and Bioproduction; Latokartanonkaari 9, FI-00790 Helsinki, Finland	+358 29 532 7894	jukka.ponni@luke.fi
Radtke Krzysztof	National Marine Fisheries Research Institute, ul. Kollataja 1, 81-332 Gdynia, Poland		radtke@mir.gdynia.pl
Raid Tiit	Estonian Marine Institute, University of Tartu 14 Mäealuse Street EE-126 18 Tallinn, Estonia	+37258339340	tiit.raid@ut.ee
Rodriguez-Tress Paco	Thünen-Institute of Baltic Sea Fisheries, Alter Hafen Süd 2, D-18069 Rostock, Germany		paco.rodriguez-tress@thuenen.de
Schmidt Beata	National Marine Fisheries Research Institute, ul. Kollataja 1, 81-332 Gdynia, Poland		bschmidt@mir.gdynia.pl
Sepp Elor	Estonian Marine Institute, University of Tartu 14 Mäealuse Street EE-126 18 Tallinn, Estonia Center of Lake Peipsi Fisheries	+372 521 7789	elor.sepp@ut.ee
Severin Vladimir	AtlantNIRO, 5 Dmitry Donskogo Street, RU-236000 Kaliningrad, Russian Federation		vseverin@gmail.com
Sics Ivo	Institute of Food Safety, Animal Health and Environment (BIOR), Fish Resources Research Department; Daugavgrivas Str. 8, LV-1048 Riga, Latvia	+371 7610 776	ivo.sics@bior.lv
Soni Vaishav (part time as ICES staff)	International Council for the Exploration of the Sea, Data Center, H.C. Andersens Boulevard 44-46, 1553 Copenhagen V, Denmark	+45 33386737	vaishav.soni@ices.dk

Spegys Marijus	Fisheries Service under the Ministry of Agriculture of Republic of Lithuania; Smiltynes st. 1, LT-91001 Klaipeda, Lithuania	+370 46 391122	marijus.spegys@zuv.lt
Stepputtis Daniel (chair-invited expert)	Thünen-Institute of Baltic Sea Fisheries, Alter Hafen Süd 2, D-18069 Rostock, Germany		daniel.stepputtis@thuenen.de
Strods Guntars	Institute of Food Safety, Animal Health and Environment (BIOR), Fish Resources Research Department; Daugavgrivas Str. 8, LV-1048 Riga, Latvia	+371 7613 775	guntars.strods@bior.lv
Svenson Anders	Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Marine Research, Turistgatan 5, SE- 453 30 Lysekil, Sweden	+46 10 4784047	andres.svenson@slu.se
Velasco Andrés	Thünen-Institute of Baltic Sea Fisheries, Alter Hafen Süd 2, D-18069 Rostock, Germany	+49 381 811 6123	andres.velasco@thuenen.de
Zablotski Yury	Thünen-Institute of Baltic Sea Fisheries, Alter Hafen Süd 2, D-18069 Rostock, Germany	+493818116137	yury.zablotski@thuenen.de

Annex 2: Terms of references for the next meeting

The Baltic International Fish Survey Working Group (WGBIFS), chaired by Olavi Kaljuste, Sweden, will meet to work on ToRs and generate deliverables as listed in the table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2018	24–28 March 2018	Lyngby-Copenhagen, Denmark	The first interim report by 15 May 2018 to, SCICOM and ACOM	Olavi Kaljuste appointed as chair
Year 2019	25–29 March 2019	Klaipeda, Lithuania	The second interim report by 15 May 2019 to SCICOM and ACOM	
Year 2020			Final report by 15 May 2020 to 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 provide important fishery-independent stock estimates for Baltic herring and sprat stocks	1	Year 1, 2 and 3	Updated acoustic tuning index for WGBFAS
b	Update the BIAS and BASS hydroacoustic databases and ICES database for acoustic-trawl surveys	The aim of BIAS and BASS databases is to store the aggregated data. The aim of ICES database is to ensure that the standardized and quality-controlled scrutinized data from the acoustic-trawl surveys will be stored centrally in a	31	Year 1, 2 and 3	Updated databases with acoustic and biotic data for WGBIFS

		safe way and allows easy access to the data, which will facilitate usage for many different analyses by a wider range of users.			
c	Plan and decide on acoustic surveys and experiments to be conducted	Acoustic surveys provide important fishery-independent stock estimates for Baltic herring and sprat stocks	27	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 surveys provide important fishery-independent stock estimates for Baltic cod and flatfish stocks	1	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 surveys provide important fishery-independent stock estimates for Baltic cod and flatfish stocks	27	Year 1, 2 and 3	Finalized planning for the surveys for WGBIFS, updated and corrected Tow Database
f	Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty in the BIAS and BASS surveys	Acoustic surveys provide important fishery-independent stock estimates for Baltic herring and sprat stocks	31	Year 1, 2 and 3	Improved quality of acoustic indices with estimates of the uncertainty for WGBFAS
g	Review the progress in development	StoX software produces fish	31	Year 1, 2 and 3	Improved transparency

	of the StoX software and implementation of it for the calculation of WGBIFS acoustic stock estimates, based on the IBAS methodology and data from ICES acoustic-trawl survey database	abundance estimations in a transparent and reproducible way. Planned development of the StoX post-processing program should allow implication this software by WGBIFS using the acoustic and biotic data from ICES database for acoustic-trawl surveys. Exercises will be performed to validate whether the StoX software provides us similar results as the current IBAS calculation method in order to allow WGBIFS to use it as a new standard tool for the calculation of annual BIAS and BASS survey estimates.			and reproducibility of acoustic indices, improved pace of work on the level of national data compilation and verification
h	Define methods for the appropriate processing of the survey data and output products from	The ground trawl surveys provide important fishery-independent stock estimates for	9, 31	Year 1, 2 and 3	Improvement the scientific knowledge about the demersal/benthic components (mostly fish) in the Baltic Sea

	the BITS survey to deliver input-data for calculation of the Baltic LFI and MML indicators.	Baltic cod and flatfish stocks and can be a source of the ecosystem indicators, recently requested by different scientific organizations			
i	Coordinate the marine litter-sampling programme within the Baltic International Trawl Survey and registering the data in the ICES database.	Collected and registered information about the marine litter (mostly anthropogenic origin), occasionally appeared in the ground trawl fish control-catches, are additional source of data on present ecological status of marine seabed in investigated areas of the Baltic.	1	Year 1, 2 and 3	Coordinated the marine litter sampling programme in the Baltic International Trawl Survey (BITS).
j	An attempt to make standardization of the pelagic fishing gear used in BIAS and BASS surveys	Acoustic surveys provide important fishery-independent estimates for Baltic herring and sprat stocks size and possible uncertainties, which result from, e.g. different type of fishing gears applied for fish control-catches,	31	Year 1, 2 and 3	Agreement on the standard pelagic fishing gear which will be used in the BIAS and BASS surveys

		should be eliminated			
k	Review and update the International Baltic Acoustic Surveys (IBAS) manual and address methodological question raised at the last review of the SISP	Acoustic surveys provide important fishery-independent stock estimates for Baltic herring and sprat stocks	31	Year 3	Updated IBAS manual for WGBIFS (SISP 8)
l	Review and update the Baltic International Trawl Survey (BITS) manual and address methodological question raised at the last review of the SISP	Demersal trawl surveys provide important fishery-independent stock estimates for Baltic cod and flatfish stocks	31	Year 3	Updated BITS manual for WGBIFS (SISP 7)

Summary of the Work Plan

Year 1	Compilation the survey results from 2017 and the first quarter of 2018 and reporting to WGBFAS. Coordination and planning the schedule for surveys in 2018 and first half of 2019. Review the development and validation progress of the StoX software. Coordinate the marine litter-sampling programme in the BITS surveys and registering the data in the ICES database. Define methods for the appropriate processing of the survey data and output products from the BITS survey to deliver input-data for calculation of the Baltic LFI and MML indicators. The approach to designing the standard pelagic fishing gear used in BIAS and BASS surveys.
Year 2	Compilation the survey results from 2018 and first quarter of 2019 and reporting to WGBFAS. Coordination and planning the schedule for surveys in 2019 and first half of 2020. Review the development and validation progress of the StoX software. Coordinate the marine litter-sampling programme in the BITS surveys and registering the data in the ICES database. Define methods for the appropriate processing of the survey data and output products from the BITS survey to deliver input-data for calculation of the Baltic LFI and MML indicators. The approach to designing the standard pelagic fishing gear used in BIAS and BASS surveys.

Year 3	Compilation the survey results from 2019 and first quarter of 2020 and reporting to WGBFAS. Coordination and planning the schedule for surveys 2020 and first half of 2021. Implementation of the StoX software linked with the ICES acoustic-trawl survey database for the calculation of stock estimates for Baltic herring and sprat. Coordinate the marine litter-sampling programme in the BITS surveys and registering the data in the ICES database. An attempt to calculate the LFI and MML indicators based on the Baltic research surveys (e.g. BITS). Reviewing and updating the BITS and IBAS survey manuals according to SISP standards. Final decision concerning the possible implementation of the standard pelagic fishing gear for control-catches in BIAS and BASS surveys and assignment of the intercalibration exercises between the new and old fishing gears.

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 about 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 SSGESST and WGFAST.
Linkages to other organi zations	No direct linkage to other organizations.

Annex 3: Agenda of WGBIFS 2018

Introduction

1. Opening of the meeting (24.03 2018 at 10:15)

- Welcome and introduction (presentation made by chair)
- Households remarks (info from local organizer of the meeting, Henrik Degel)

2. Adoption of the agenda and organization of the meeting

- Discussion and adoption of the agenda
- Allocation of tasks between participants
- Presentation of time schedule

Acoustic surveys and data

3. Combine and analyse the results of spring and autumn 2017 acoustic surveys and experiments and report to WGBFAS. (ToR a)

- Status of BIAS and BASS standard survey reports.

4. Update the BIAS and BASS hydroacoustic databases and ICES database for acoustic-trawl surveys. (ToR b)

5. Plan and decide on acoustic surveys and experiments to be conducted in autumn 2018 and spring 2019. (ToR c)

6. Analyses related to the improvement of quality of acoustic indices and estimation of the uncertainty in the BIAS and BASS surveys. (ToR f)

7. Review the progress in development of the StoX software and implementation of it for the calculation of WGBIFS acoustic stock estimates, based on the IBAS methodology and data from ICES acoustic-trawl survey database. (ToR g)

8. An attempt to make standardization of the pelagic fishing gear used in BIAS and BASS surveys. (ToR j)

9. Review and update the International Baltic Acoustic Surveys (IBAS) manual and address methodological question raised at the last review of the SISP. (ToR k)

Bottom trawl surveys and data

10. Discuss the results from BITS surveys performed in autumn 2017 and spring 2018 and evaluate the characteristics of TVL and TVS standard gears used in BITS. (ToR d)

10.1. Recommendation regarding the Russian BITS Q4 survey in 3rd quarter of 2017.

- Status of BITS standard and extended survey reports.

11. Plan and decide on demersal trawl surveys and experiments to be conducted in autumn 2018 and spring 2019, and update and correct the Tow Database. (ToR e)

12. Define methods for the appropriate processing of the survey data and output products from the BITS survey to deliver input-data for calculation of the Baltic LFI and MML indicators. (ToR h)

13. Coordinate the marine litter-sampling programme within the Baltic International Trawl Survey and registering the data in the ICES database. (ToR i)

14. Review and update the Baltic International Trawl Survey (BITS) manual and address methodological question raised at the last review of the SISP. (ToR l)

Joint acoustic and bottom trawl survey issues

15. Inquiries from other Expert Groups

15.1. Does risk to future survey implementation present a risk to advice?. (Request from ACOM)

15.2. Advise to ICES data cetre regarding the development of automated ALK substitution procedures for Datras data products. (Rec. by WGNSSK)

15.3. Participation in planning and development of terms of reference for a joint session of WGFAST and WGFTFB (JFATB) in April/May of 2020. (Rec. by WGFAST and JFATB)

15.4. Suggestions about data collections and compilations. (Rec. by WKQUAD)

15.5. Estimation of catch selection curve from the BITS survey. (Rec. by WGFBAS)

Final issues

16. Going through the recommendations

17. Going through the action plan

18. Selection of time and venue for the next meeting

Closing of the meeting (28.03.2018 at 13:30).

Annex 4: Recommendations

WGBIFS recommends 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.	WGBIFS	As fast as possible	ICES Data Centre	
WGBIFS Recommends that trawling should only take place during day-light, (15 minutes after sunrise and until 15 minutes before sunset) and that the checking program in DATRAS needs to be changed accordingly.	WGBIFS	Before BITS survey 2018 Q4	ICES Data Centre	
WGBIFS recommends to include species validity codes 6 and 7 in DATRAS to allow recording weight of the following marine organisms: cnidaria (i.e. jelly fish, corals, sea anemones etc.) and molluscs (octopus, bivalves etc.).	WGBIFS	Before BITS survey 2018 Q4 end of November	ICES Data Centre	
WGBIFS recommends additional size categories (volume) to be incorporated in the litter size column in DATRAS.	WGBIFS	Before BITS survey 2018 Q4 end of October	WGML and ICES Data Centre	Annex ToR i)
The WGBIFS recommends that the WGFTFB and JFATB investigate the selectivity in the BITS standard trawls (TV3L and TV3S).	WGBIFS	As soon as possible	WGFTFB and JFATB	Chapter 6.1.4

Annex 5: Action 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 as coordinators of acoustic-trawl (IBAS) surveys, responsible among-others for controlling that the acoustic surveys results are uploaded in the right format. Beata Schmidt (Poland; e-mail: bschmidt@mir.gdynia.pl) was assigned as the coordinator of BIAS and BASS national databases aggregated data uploading and compilation to international level, moreover she 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 uploaded to the latest WGBIFS SharePoint site 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.

3) Directly, after each BITS survey finalization, national submitters of data linked with monitoring of the marine litter from seabed should be uploaded to the DATRAS database (the ICES Data Center). The upload data format is described in the manual accessible at the ICES web page: http://www.ices.dk/marine-data/data-portals/Pages/DATRAS-Docs.aspx.

4) 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 next WGBIFS meeting, using the agreed format of protocols.

5) It's important for precise values of the LFI and MML indicators to inspect that both doors 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 realization should to have possibly soon suitable equipment (sensors on the trawl wings) for measuring horizontal and vertical trawl opening during fishing.

6) For action before the next WGBIFS meeting (March 2019) 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.

7) WGBIFS StoX task subgroup [including Juha Lilja (Finland), Olavi Kaljuste (Sweden), Elor Sepp (Estonia), Niklas Larson (Sweden), Paco Rodriguez-Tress (Germany) and Beata Schmidt (Poland)] will:

- control that the acoustic survey results from 2017 are uploaded in the right format to the ICES acoustic data portal in April 2018 as latest;
- contact the developers of StoX to solve the problems with installation of the StoX software;
- organize a net-meeting together with StoX developers in the end of August/beginning of September 2018 to go through the fish abundance index calculation procedure in the StoX software using the BIAS and BASS data from 2017;
- organize a meeting together with StoX developers in January 2019 to set up the final herring and sprat abundance index calculation procedures in the StoX software using the BIAS and BASS data from 2017;

8) All countries participating in the BIAS and BASS surveys should provide WGBIFS chair with the pulling power or propeller specifications of the vessel(s) they are using.

9) WGBIFS recommends national laboratories to collect, whenever possible, the data requested by WKQUAD:

1. Collect data during both calm weather and in inclement weather. Use the opportunity of inclement weather to collect data along a transect in opposite headings (i.e. with and against the seas).

The objectives of collecting data along a transect in inclement weather are to:

a) characterize the vessel motion,

b) characterize the seabed backscatter, and

c) characterize the backscatter by your target species.

One can characterize the vessel motion in a fairly short time, but to characterize the seabed and fish backscatter with enough data to compare to the same stretch of transect in good weather will take longer - i.e. in good weather you can cover 10 nautical mile in an hour, but in inclement weather one may only be able to cover 2-3 nautical mile. The safety of the vessel and comfort of crew/scientist should also be taken into consideration.

It is recommended that the data in inclement weather are collected at least during one hour in one heading of the transect. If there is a need to steam longer along a transect, then one should do that.

2. Compile seabed substrate maps and data for the survey area. These may be useful for decoupling substrate effects from noise or attenuation effects on data quality when the seabed backscatter is used as a diagnostic.

Any quality information is useful. Even publicly-available seabed classification data are useful.

3. Compile information on transducer location and vessel trim, and collect vessel motion (pitch, roll, heave) data at a sampling rate of at least twice the frequency of the vessel motion (<1/2 the period), i.e. Nyquist sampling rate. A typical rate is 3 Hz.

4. Collect meteorological data, e.g. windspeed and direction, swell, sea state, wave height during the surveys.

5. Collect passive data during inclement weather. Transient and impulse noise will appear in passive data. Compare noise values between good and bad data.

> The objective is to measure and monitor the background, transient, and impulse noise as weather conditions deteriorate. Ideally this should be done at survey speed, but if that is not possible, then slower speeds can be informative. If the survey protocols specify a minimum speed, then speeds below that are not as useful.
>
> It is recommended that the passive data in inclement weather are collected at least during one hour per one data sample. If there is a need to steam longer along a transect, then one should do that.

Annex 6: Standard and Cruise Reports of BITS surveys at the WGBIFS 2018 annual 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 2017 Quarter 4 Standard Report of Sweden;
- 2. BITS 2017 Quarter 4 Standard Report of Germany;
- 3. BITS 2017 Quarter 4 Standard Report of Estonia;
- 4. BITS 2017 Quarter 4 Standard Report of Poland;
- 5. BITS 2017 Quarter 4 Standard Report of Latvia;
- 6. BITS 2017 Quarter 4 Standard Report of Denmark;
- 7. BITS 2017 Quarter 4 Standard Report of Lithuania;
- 8. BITS 2017 Quarter 4 Standard Report of Russia;
- 9. BITS 2018 Quarter 1 Standard Report of Sweden;
- 10. BITS 2018 Quarter 1 Standard Report of Germany;
- 11. BITS 2018 Quarter 1 Standard Report of Poland;
- 12. BITS 2018 Quarter 1 Standard Report of Latvia;
- 13. BITS 2018 Quarter 1 Standard Report of Russia;
- 14. BITS 2018 Quarter 1 Standard Report of Denmark;
- 15. BITS 2018 Quarter 1 Standard Report of Denmark KASU-1.

II List of cruise reports:

- 1. BITS 2017 Quarter 4 Cruise Report of Latvia.

NATION:	SWEDEN	VESSEL:	RV "DANA"
Survey:	BITS Q4 2018	Dates:	21-29 November 2018

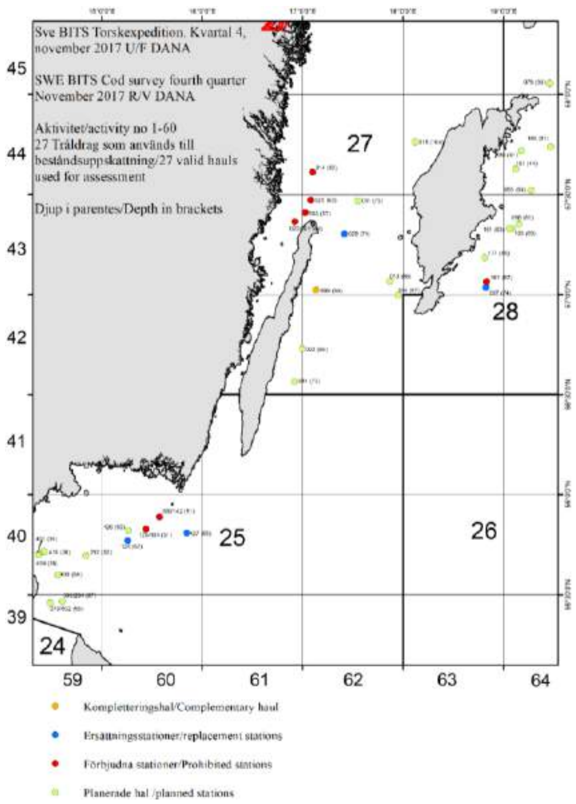
Cruise	
Gear details:	The large (930#) standard TV3 trawl was used. No tows are done with the rock hopper ground gear on harder ground stations. The trawl construction is according to the specification in the BITS manual.
Notes from survey (e.g. problems, additional work etc.):	30 stations were allocated, 27 of these were trawled. Four hauls were cancelled in SD 27 and one in SD 28 because the Swedish Armed Forces (SAF) did not grant us permission. One invalid hauls this time. One complementary haul, not included here. A total of seven hauls in SD 25, 26, 27 and 28 had oxygen deficiency.
Additional comments:	Depthstrata 2 sd25 where planned 3 hauls but only two where made due to close proximity to next haul, (clusterhaul), 1 additional haul where made in depthstrata 3.

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 replacement hauls	Number of invalid hauls	Stations fished %	Remarks
25	TVL	2	3	2	-	0	0	0	66	
25	TVL	3	5	6	-	0	2	0	100	
25	TVL	4	2	2	-	1	0	0	100	
27	TVL	3	2	0	-	0	0	0	0	1
27	TVL	4	5	5	-	2	1	0	100	
27	TVL	5	2	1	-	1	0	0	50	1
27	TVL	6	1	1	-	1	0	0	100	
28	TVL	3	3	3	-	0	0	0	100	
28	TVL	4	4	4	-	1	1	1	100	
28	TVL	5	3	3	-	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):			
Specname sci.	Lenght	Age	Stomachs
Agonus cataphractus	2		
Anguilla anguilla	2		
Clupea harengus	4828		
Cyclopterus lumpus	21		
Enchelyopus cimbrius	130		
Gadus morhua	3589	355	355
Gasterosteus aculeatus	301		
Gobiidae	1		
Limanda limanda	11		
Lumpenus lampretaeformis	4		
Melanogrammus aeglefinus	2		
Merlangius merlangus	454		
Myoxocephalus quadricornis	639		
Myoxocephalus scorpius	259		
Perca fluviatilis	1		
Platichthys flesus	2675	601	229
Pleuronectes platessa	944		
Pomatoschistus	2		
Pungitius pungitius	3		
Scophthalmus maximus	39		
Sprattus sprattus	2754		
Trisopterus minutus	2		
Zoarces viviparus	26		

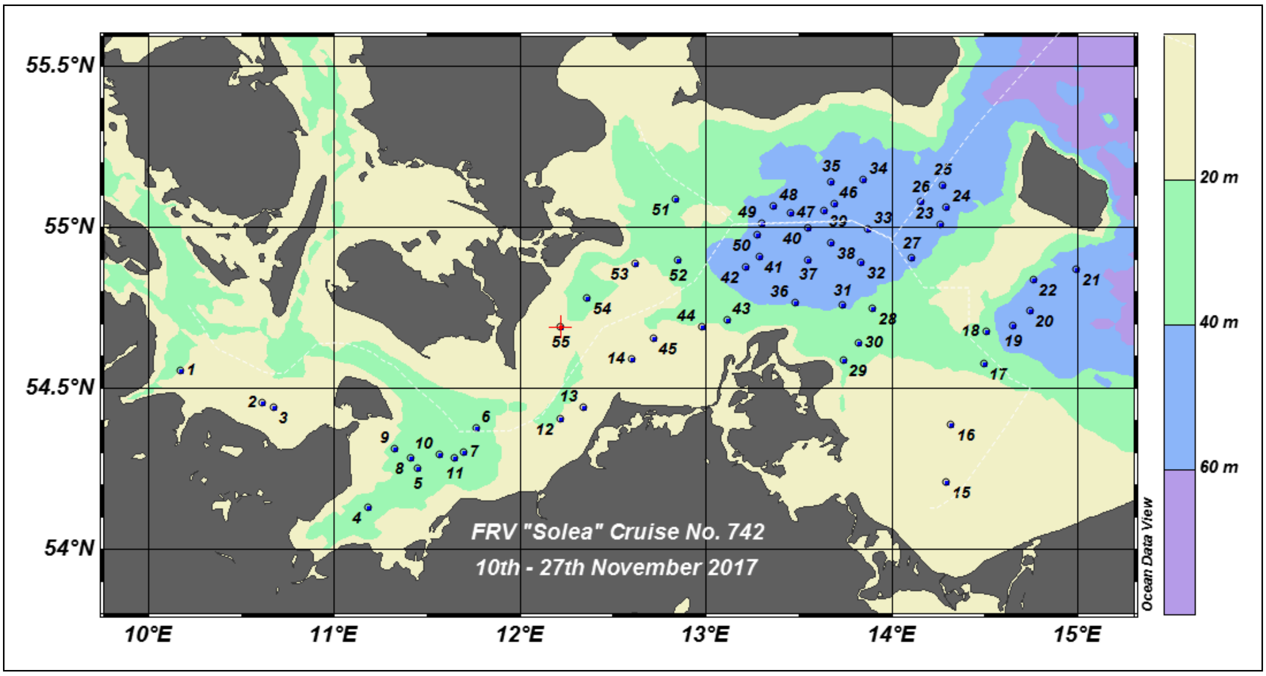


Nation:	**Germany**	**Vessel:**	**FRV "Solea"**
Survey:	BITS 2018, quarter 4	Dates:	10th – 27th November 2018

Cruise	
Gear details:	The small (520#) standard TV3 trawl was used. The stations south of Sweden were fished with 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. Two stations 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 replacement hauls	Number of invalid hauls	% stations fished
22	TVS	1	2	2	-		-	-	100
22	TVS	2	9	9	-		1	-	100
24	TVS	1	8	8	-		-	-	90
24	TVS	2	13	11	-		2	-	90
24	TVS	3	25	24	1			-	100

Number of biological samples (maturity and age material, *maturity only):		
Species	**Length**	**Age**
Gadus morhua	7115	801
Platichthys flesus	6018	717
Pleuronectes platessa	7650	942
Limanda limanda	5268	666
Psetta maxima	230	230
Scophthalmus rhombus	20	20
Clupea harengus	2085	-
Sprattus sprattus	4531	-



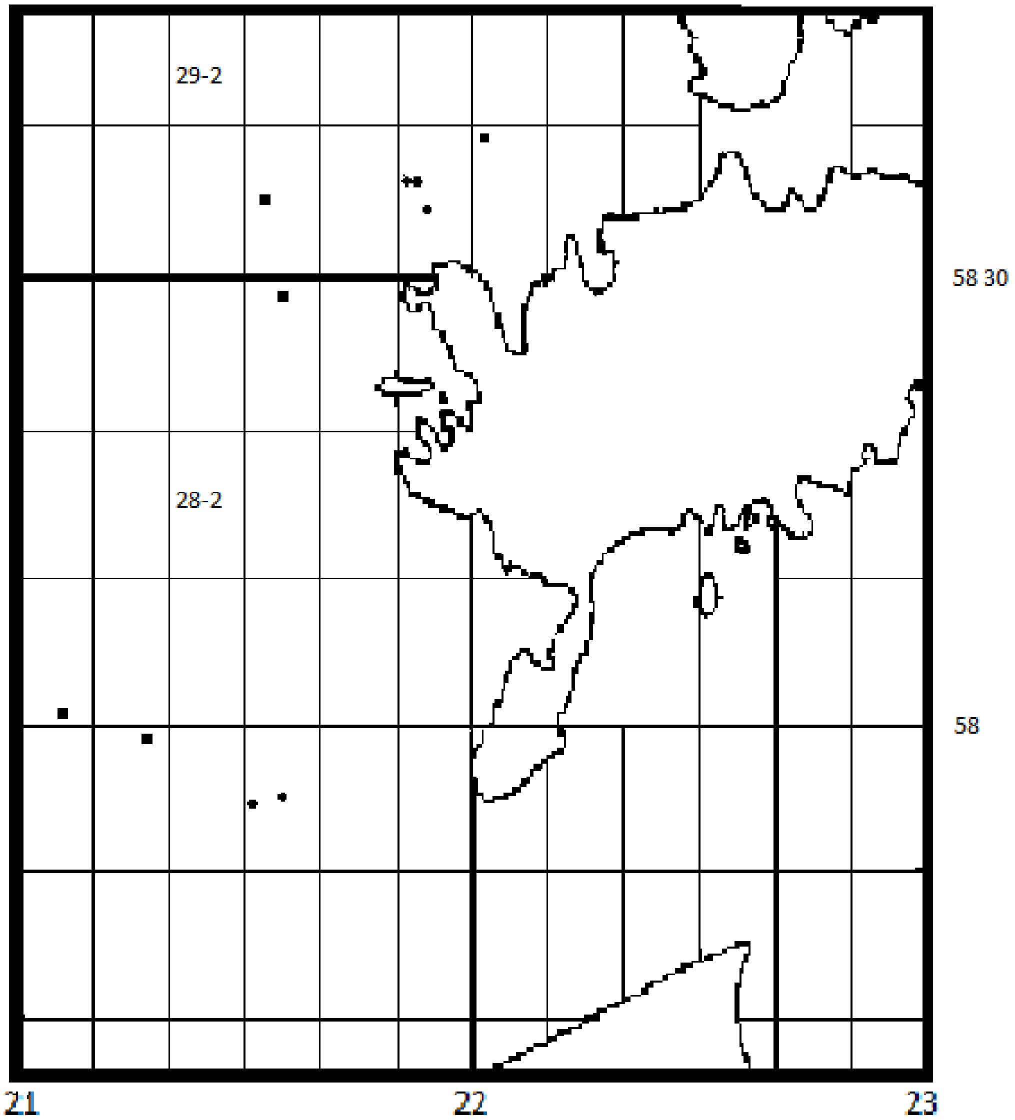
FRV "Solea" Cruise No. 742
10th - 27th November 2017
55.5°N
55°N
54.5°N
54°N
10°E
11°E
12°E
13°E
14°E
15°E
20 m
40 m
60 m
Ocean Data View

NATION:	ESTONIA	VESSEL:	CEV
Survey:	BITS17IVQRT	Dates:	19-21 November

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 late evening of 19 November 2018 from the Port of Haapsalu , steaming to the Sub-division 28-2. The weather conditions were extremely poor; however it was possible to carry out all 5 trawl hauls on November, 20th, as planned. Since the weather forecast was bad for the coming week, it was decided to continue with the rest of survey in the Sub-division 29. So, after accomplishing the planned work in Sub-division 28-2, the vessel steamed to Sub-division 29 where all planned additional 5 hauls were performed. The survey was finished in late hours of 20 November 2018 in the Port of Virtsu. No technical problems were observed during the survey this year. All catches were analysed at the field station of the Estonian Marine Institute in Pärnu.

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	na
29	TVS	20-39m	1		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
29	TVS	>80	1	1	0	0	0	0	100

Number of biological samples (maturity and age material, *maturity only):		
Species	Age	Length
Gadus morhua	196	638
Sprattus sprattus	0	179
Clupea harengus	0	104
Platichthys flesus	499	1228



Approximate positions of realised hauls during Estonian BITS survey in 4 QRT 2018

Estonian BITS IV Quarter 2018: Overview of catches.

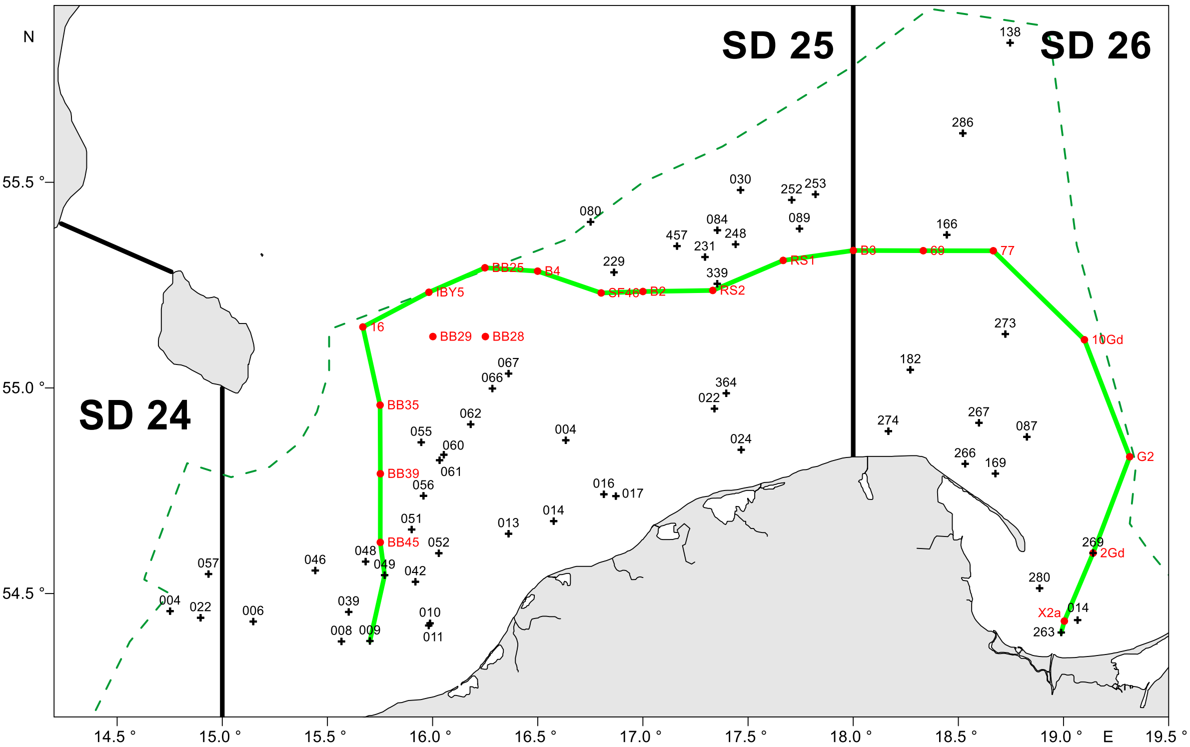
2017				Catch, kg							
	1	2	3	4	5	6	7	8	9	10	
Haul ID.	28030	28029	28192	28191	28061	290X	2902	2903	2904	2905	
Sd	28	28	28	28	28	29	29	29	29	29	
Depth, m	50	56	67	70	71	87	70	45	37	42	
Date	20.11.2017	20.11.2017	20.11.2017	20.11.2017	20.11.2017	20.11.2017	20.11.2017	20.11.2017	20.11.2017	20.11.2017	
Coordinates	5755_2135	5755_2131	5759_2117	5802_2106	5828_2135	5836_2125	5835_2133	5837_2152	2834_2154	5839_2201	Total
Clupea harengus		0.04	0.38	0.69	0.72	0.78	0.13	0.07	0.10	0.37	3.26
Sprattus sprattus	0.42	0.59	0.01	0.19	0.09	0.29	0.13	0.03	0.01	0.05	1.82
Platichthys flesus	35.73	38.89	10.75	4.50	19.82	2.11	0.84	10.37	10.17	25.71	158.9
Gadus morhua	38.79	2.11	6.25	4.20	8.32	0.52	1.61	0.31	0.71	1.75	65
Osmerus eperlanus	0.71	0.32	0.17	0.08	0.15		0.05	1.58	0.53	1.35	5
Scophthalmus maximus											0
Neogobius melanostomu	0.5343	0.06		0.03	0.13	0.04		0.20	0.74	0.05	1.78
Gobius sp.	0.0143	0.01	0.05	0.03	0.00	0.00	0.10		0.13	0.10	0.44
Gasterosteus aculeatus						0.01	0.04	0.00	0.01		0.06
Pungitius pungitius											0
Myoxocephalus scorpius	1.1648	0.07	0.99	0.51	0.36			0.05	0.54		3.68
Zoarces viviparus	0.1911	0.05						0.33	0.05	0.19	0.82
Cyclopterus lumpus			0.25	0.27				0.38			0.90
Myxocephalys quadricornis										0.49	0.49
Taurulus bubalis											0
Lumpenus lampretaeformis											0
Enchelyopus cimbrius											0
	77.56	42.13	18.85	10.49	29.58	3.75	2.90	13.32	12.98	30.05	241.6

Nation:	**Poland**	**Vessel:**	**RV "Baltica"**
Survey:	BITS-Q4/2018	Dates:	11/11-03/12/2018

Cruise	No. 22/2018/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 2018) recommendations, the vessel "Baltica" was designated to cover parts of the ICES Sub-divisions 24, 25 and 26 with totally 60 randomly selected fish control-hauls. The catch-stations were located at the bottom depth range of 16 - 110 m. Totally, 56 fish catch-stations can be accepted as representative. Among the 56 hauls, one planned *i.e.* No. 25248 was omitted, as the oxygen content was below critical minimum (0.5 ml/l) in the bottom waters and zero catch was assumed. Four planned hauls (No. 25455, 26050, 26055 and 26106) was not realized due to stormy weather. In none of the control-hauls conducted, zero catches were achieved. Due to stormy weather haul No. 24022 was shortened due to stormy weather. Hauls No 26266, 25080, 25231, 25250, 25253 were shortened to 20 min due to rocky bottom appearance at the part of trawling. Haul No. 25457 was shortened to 20 minutes due to large fish concentrations observed in echosounder. Every control-haul was preceded by the seawater temperature, salinity and oxygen content measurements, made continuously from the sea-surface to a bottom. Overall, 53 fish catch-stations starting positions and 20 standard hydrographic stations were controlled by the SeaBird SBE 911 CTD-probe combined with the rosette sampler (the bathometer rosette). 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 replacement hauls	Number of invalid hauls	% stations fished
24	TVL	10-39 m (1)	3	3	0	0	0	0	100
25	TVL	20-39 m (2)	14	13	0	0	0	0	93
25	TVL	40-59 m (3)	15	15	0	0	0	0	100
25	TVL	60-79 m (4)	10	10	0	1	0	0	100
25	TVL	80-99 m (5)	1	1	0	0	0	0	100
26	TVL	20-39 m (2)	4	4	0	0	0	0	100
26	TVL	40-59 m (3)	2	2	0	0	0	0	100
26	TVL	60-79 m (4)	4	2	0	0	0	0	50
26	TVL	80-100 (5)	6	5	0	0	0	0	83
26	TVL	100-120 m (6)	1	1	0	0	0	0	100

Number of biological samples (maturity and age material, *maturity only):		
Species (Latin name)	**Length**	**Age and maturity**
Gadus morhua	12214	545
Clupea harengus	8772	1066
Sprattus sprattus	6507	632
Platichthys flesus	3953	798
Pleuronectes platessa	1107	478
Scophthalmus maximus	30	30
Limanda limanda	1	1
Zoarces viviparus	7	
Enchelyopus cimbrius	282	102
Sander lucioperca	1	1
Gasterosteus aculeatus	6	
Agonus cataphractus	4	3
Cyclopterus lumpus	2	2
Myoxocephalus scorpius	251	89
Neogobius melanostomus	7	2
Pomatoschistus minutus	19	
Osmerus eperlanus	248	
Merlangius merlangus	205	52
Hyperoplus lanceolatus	150	33



Crosses – fish control stations, red dots – hydrological stations, green line – hydrological profile.

NATION:	**LATVIA**	**VESSEL:**	**RV "BALTICA"**
Survey:	BITS-Q4/2018	Dates:	08-18/12/2018

Cruise	No. 2/2018
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 (14 trawls in SD 28, 11 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 21 bottom trawl control-hauls from the 25 planned, incl. the Latvian territorial waters (Fig. 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 18 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 1575 cod and 1458 flounder. Length measurements in the 0.5-cm classes were realised for 1670 herring and 2145 sprat. In total, 489 cod and 413 flounder individuals were taken for biological analysis. Stomachs from the 406 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, 26 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, 4 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 replacement hauls	Number of invalid hauls	% stations fished
26	TVL	3	1						
26	TVL	4	6		5				83.3
26	TVL	5	1		1				100
26	TVL	6	3		2				66.7
28	TVL	2	4		1				25
28	TVL	3	5		7				140
28	TVL	4	2		2				100
28	TVL	5	3		2				66.7

Number of biological samples (maturity and age material, *maturity only):		
Species	**Length**	**Age**
Anguilla anguilla	1	
Agonus cataphractus	1	
Gadus morhua	2064	489
Platichthys flesus	1872	
Clupea harengus	1670	
Sprattus sprattus	2145	
Scophthalmus maximus	8	
Pleuronectes platessa	2	
Zoarces viviparus	21	
Pomatoschistus minutus	88	
Myoxocephalus scorpius	113	
Osmerus eperlanus	244	
Gasterosteus aculeatus	15	
Enchelyopus cimbrius	7	
Neogobius melanostomus	397	

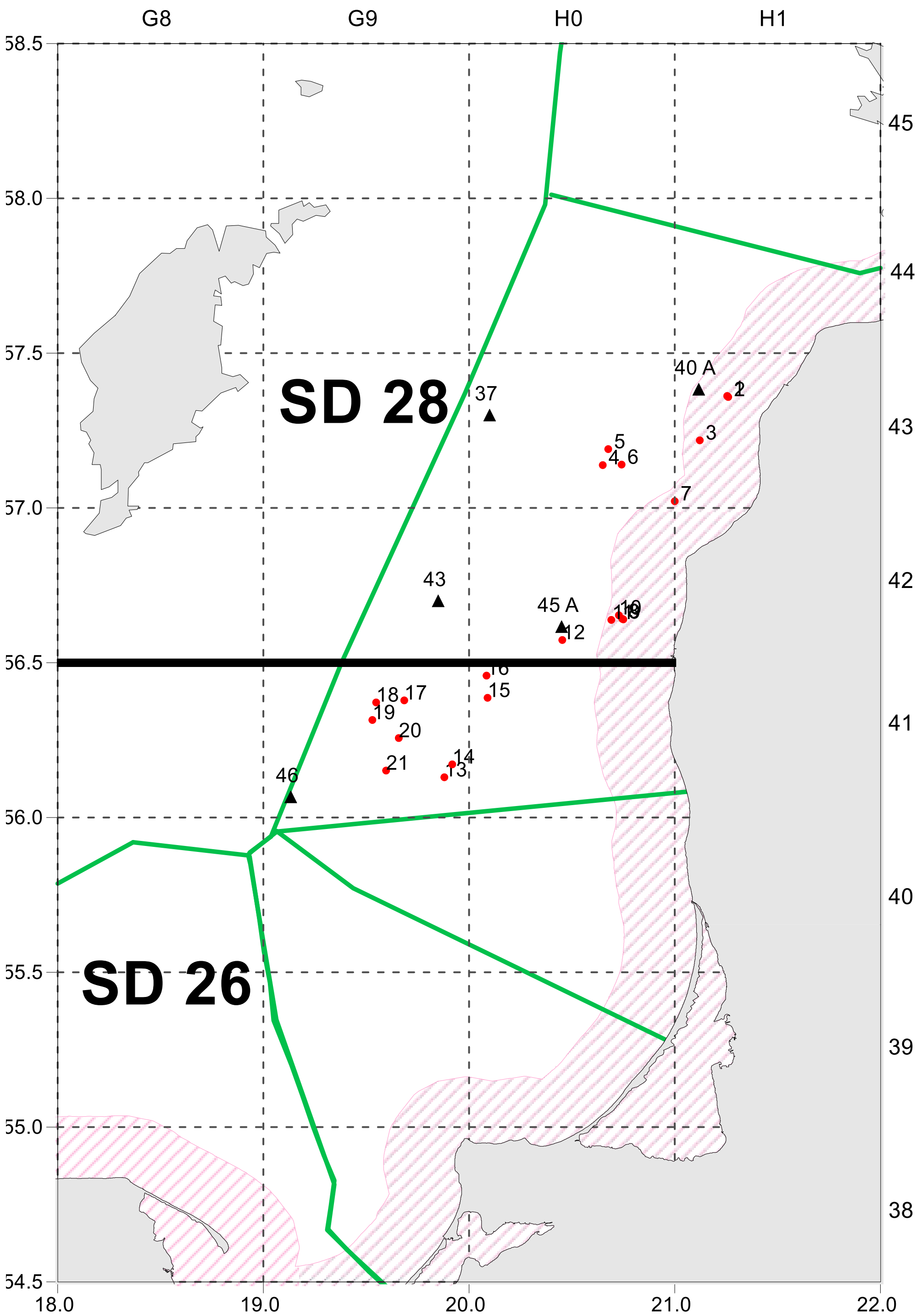


Figure 1. Location of the realized fish control-hauls (marked with red dots) and the HELCOM standard hydrological stations (marked with black triangles), green lines - national fishing zone borders.

Nation:	Denmark	Vessel:	Dana
Survey:	BITS	Dates:	4/11-20/11 - 2018

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

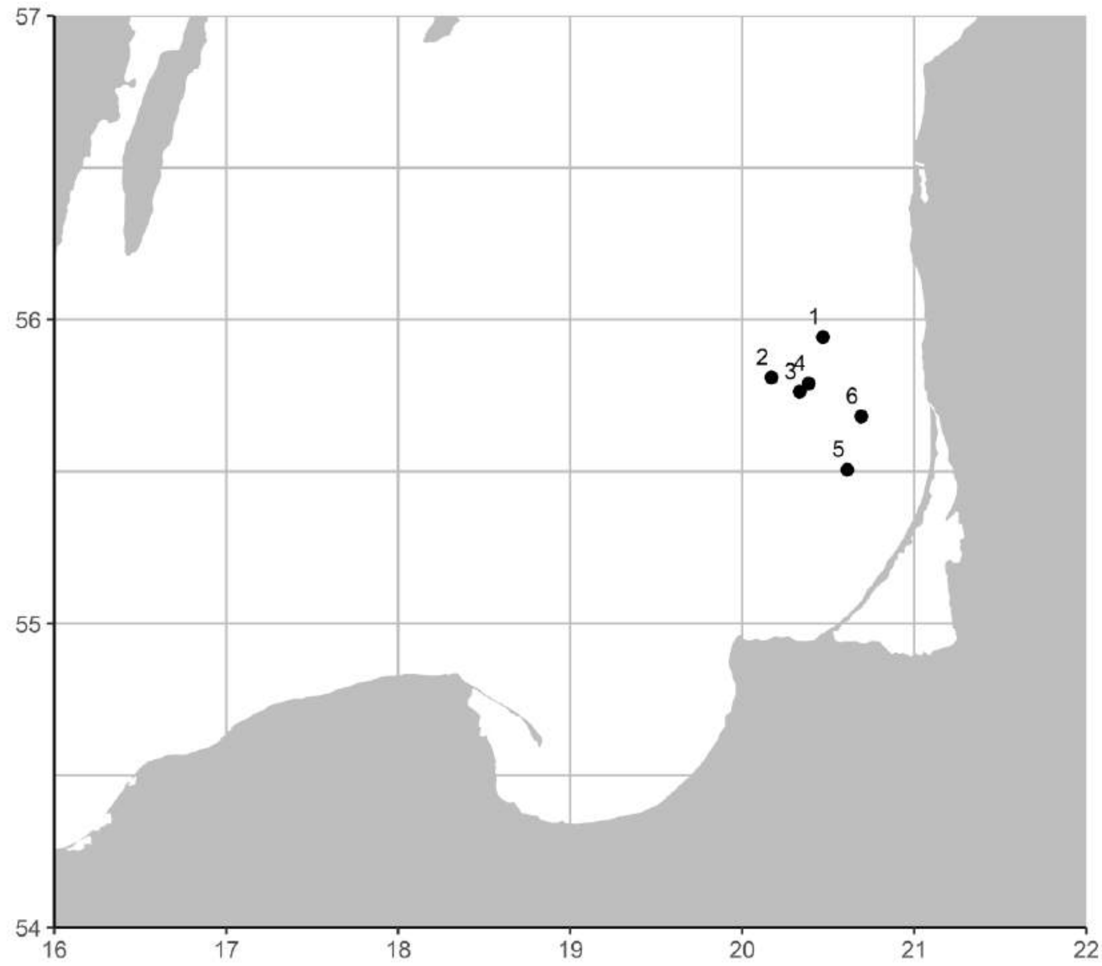
Number of biological samples (maturity and age material, *maturity only):			
Species	Age	Species	Age
Clupea harengus			
Gadus morhua			
Sprattus sprattus			

NATION:	**LITHUANIA**	**VESSEL:**	**DARIUS**
Survey:	BITS2018Q4	Dates:	07th – 08 th November 2018

Cruise	
Gear details:	The small (520#) standard TV3 trawl was used.
Notes from survey (e.g. problems, additional work etc.):	Total 6 fishing hauls and 4 hydrographical stations were performed.
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 REPLACEMENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
26	TVS	2	1	1	-		-	-	100
26	TVS	3	3	3	-		-	-	100
26	TVS	4	2	2	-		-	-	100

NUMBER OF BIOLOGICAL SAMPLES (MATURITY AND AGE MATERIAL, *MATURITY ONLY):		
SPECIES	**LENGTH**	**AGE**
Alosa fallax	2	
Clupea harengus	1240	
Gadus morhua	2410	426
Hyperoplus lanceolatus	1	
Myoxocephalus scorpius	95	
Neogobius melanostomus	14	
Osmerus eperlanus	2293	
Platichthys flesus	2034	407
Pleuronectes platessa	26	26
Pomatoschistus minutus	60	
Psetta maxima	8	8
Sprattus sprattus	110	


57
56
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6

Nation:	Russia	Vessel:	Atlantniro
Survey:	66	Dates:	24 – 30 September 2018

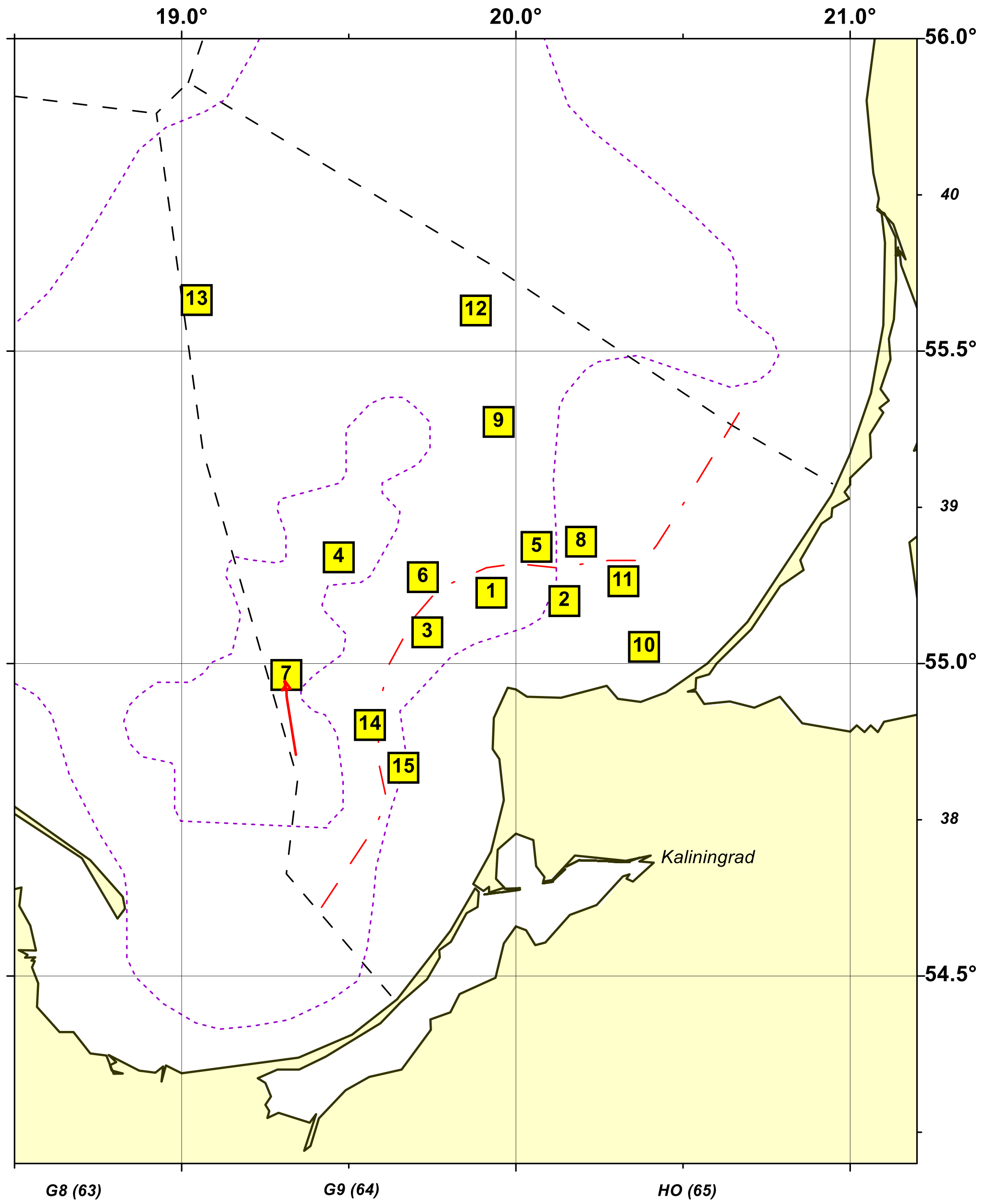
Cruise	
Gear details:	The large standard TV3 trawl is used. Following the recommendations in the TOW database stations are fished either without rockhoppers. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	No problems were experienced during the survey. Low content of oxygen in two trawl stations 26147, 26130 (depth > 95 m and > 100 m) – therefore hydrological researches have been made only.
Additional comments:	The national scientific program causes performance of trawl stations 26023, 26042, 26092 – Russia. These trawl stations have been made in addition to the planned BITS stations. Trawl station 26129 have been made instead of 26291 (in Polish EEZ). Trawl stations 26084 is invalid.

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	100
26	TVL	3	2	3	0	0	0	0	150
26	TVL	4	4	5	0	0	0	0	125
26	TVL	5	6	5	0	0	0	1	83
26	TVL	6	2	1	0	0	1	0	100

Number of biological samples (maturity and age material, *maturity only):			
Species	Length	Maturity	Age (otoliths)
Clupea harengus	3717	731	289
Gadus morhua	3357	1045	647
Platichthys flesus	837	433	429
Sprattus sprattus	904	175	175

Other species may need to be added for your survey



Trawl positions for RV "ATLANTNIRO" in September 2018

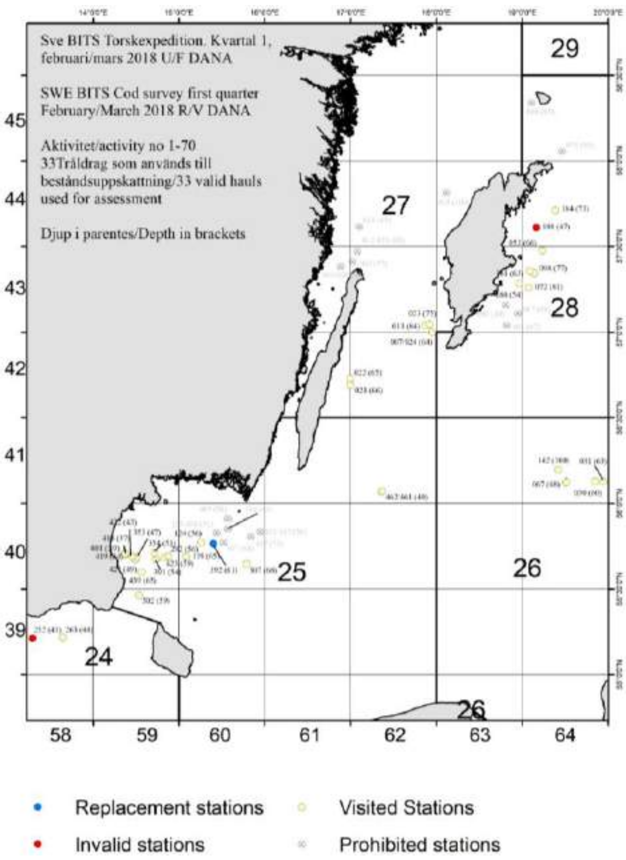
NATION:	**SWEDEN**	**VESSEL:**	**RV “DANA”**
Survey:	BITS Q1 2018	Dates:	25 February - 05 March 2018

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 randomly allocated, whereof 33 were trawled. Two invalid hauls this time. One haul in SD 26, had oxygen deficiency.
Additional comments:	The Swedish Armed Forces forbade 18 stations. There was no opportunity to replace any stations this year. The military pointed out four areas within which we were allowed to fish. However, we were not allowed to fish outside these areas.

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 replacement hauls	Number of invalid hauls	Stations fished %
24	TVL	3	2	1	-	0	0	1	50
25	TVL	2	3	3	-	0	0	0	100
25	TVL	3	17	10	-	0	0	0	59
25	TVL	4	5	4	-	0	1	0	80
26	TVL	3	1	1	-	0	0	0	100
26	TVL	4	2	2	-	0	0	0	100
26	TVL	6	1	1	-	1	0	0	100
27	TVL	3	2	0	-	0	0	0	0
27	TVL	4	5	4	-	0	0	0	80
27	TVL	5	2	1	-	0	0	0	50
27	TVL	6	1	0	-	0	0	0	0
28	TVL	3	3	2	-	0	0	1	67
28	TVL	4	6	4	-	0	0	0	67
28	TVL	5	3	1	-	0	0	0	33

Remark. Stations fished shows a low percentage mostly because of the Swedish armed forces prohibition.

Number of biological samples (maturity and age material, *maturity only):			
Specname sci.	*Lenght*	*Age*	*Stomach*
Agonus cataphractus	4		
Clupea harengus	7447		
Cyclopterus lumpus	19		
Enchelyopus cimbrius	32		
Gadus morhua	5850	722	666
Gasterosteus aculeatus	67		
Limanda limanda	102		
Lumpenus lampretaeformis	1		
Merlangius merlangus	79		
Myoxocephalus quadricornis	36		
Myoxocephalus scorpius	699		
Osmerus eperlanus	1		
Platichthys flesus	3472	1124	491
Pleuronectes platessa	1428		
Pollachius virens	9		
Pomatoschistus	16		
Scophthalmus maximus	44		
Sprattus sprattus	4035		
Syngnathus typhle	1		
Zoarces viviparus	30		

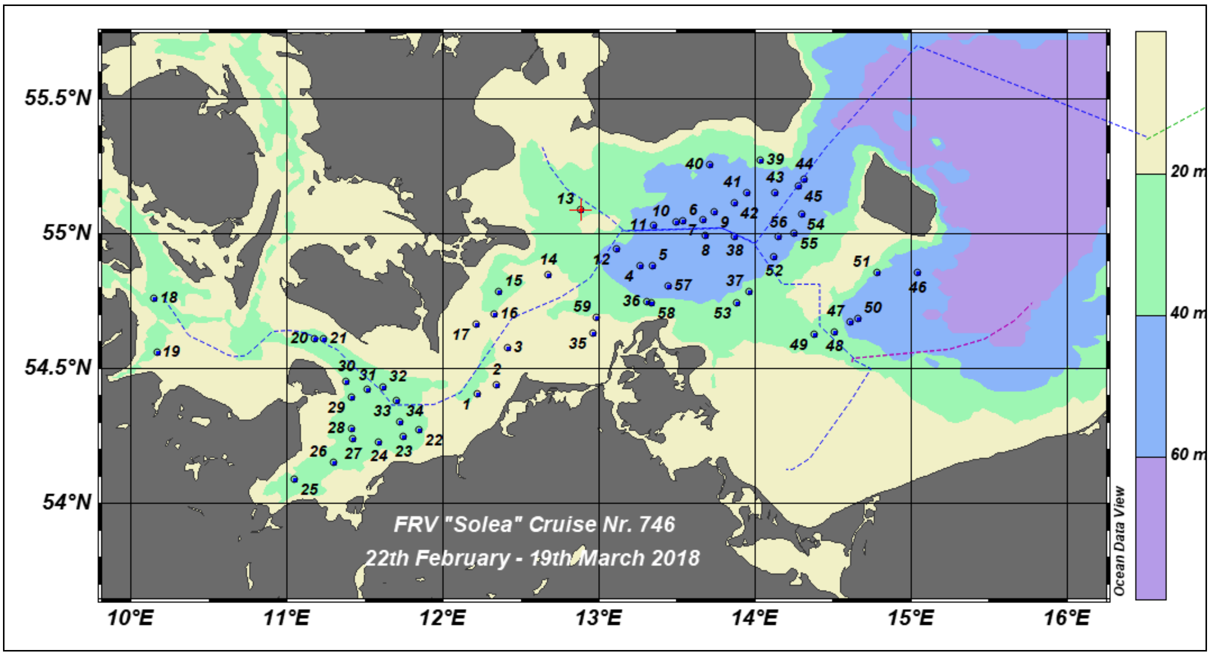


NATION:	**GERMANY**	**VESSEL:**	**FRV "SOLEA"**
Survey:	BITS 2018, quarter 1	Dates:	22 th February to 19th March 2016

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 59 fishing hauls and 59 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 replacement hauls**	**Number of invalid hauls**	**% stations fished**
22	TVS	1	-	-	-		-	-	100
22	TVS	2	17	17	-		2	-	100
24	TVS	1	4	4	-		-	-	100
24	TVS	2	10	10	-		1	-	100
24	TVS	3	28	28	-		2	-	100

Number of biological samples (maturity and age material, *maturity only):		
Species	**Length**	**Age**
Gadus morhua	18246	1476
Platichthys flesus	5718	801
Limanda limanda	6162	727
Pleuronectes platessa	11137	985
Psetta maxima	200	198
Scophthalmus rhombus	14	14
Clupea harengus	3354	-
Sprattus sprattus	7586	-


55.5°N
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54.5°N
54°N
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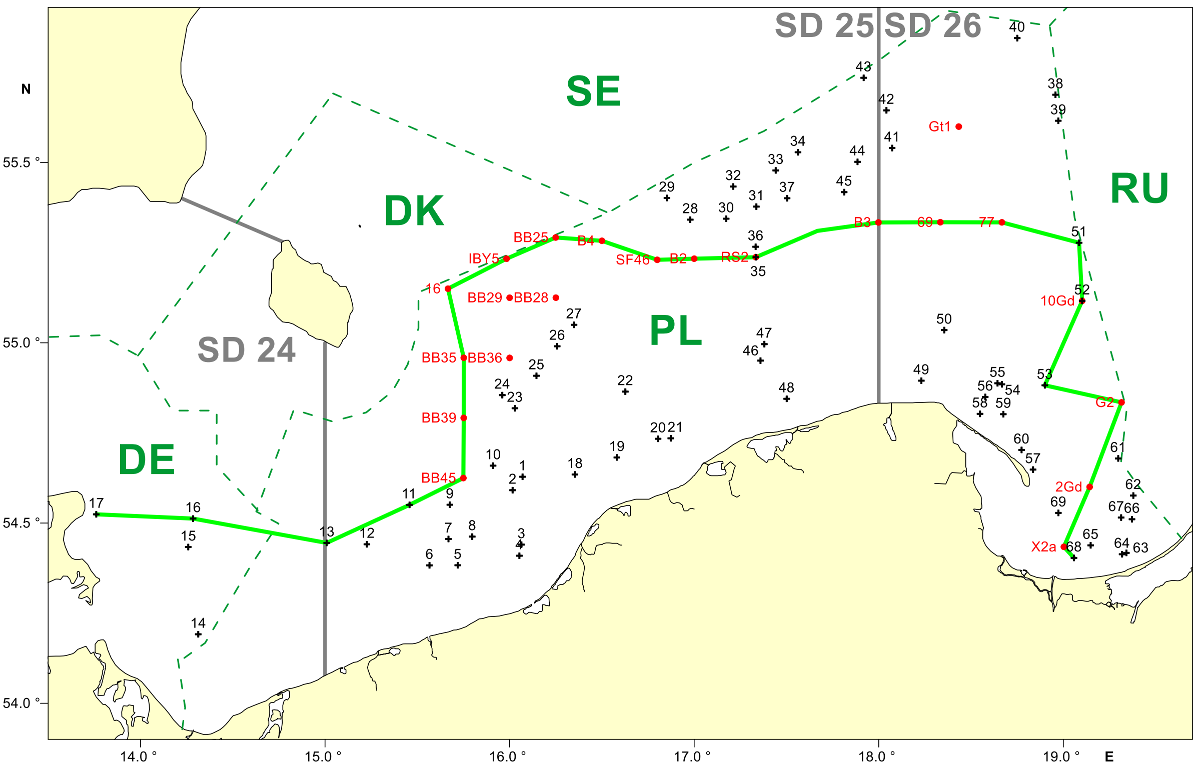
11°E
12°E
13°E
14°E
15°E
16°E
20 m
40 m
60 m
Ocean Data View
FRV "Solea" Cruise Nr. 746
22th February - 19th March 2018

Nation:	**Poland**	**Vessel:**	**RV "Baltica"**
Survey:	BITS-Q1/2018	Dates:	07/02-02/03/2018

Cruise	No. 4/2018/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 2017) recommendations, the vessel "Baltica" was designated to cover parts of the ICES Sub-divisions 24, 25 and 26 with totally 69 randomly selected fish control-hauls. The catch-stations were located at the bottom depth range of 12 - 110 m. Totally, all the 69 fish catch-stations can be accepted as representative. Haul No. 26172 considered as invalid. Hauls No. 26014 and 25055 were shortened to 20 minutes due to large fish concentrations observed in echosounder and conflicting situation with commercial vessel, respectively. Haul No. 26172 was considered. Haul No. 26285, 26191, 26087 and 26091 were classified as "no oxygen". Every control-haul was preceded by the seawater temperature, salinity and oxygen content measurements, made continuously from the sea-surface to a bottom. Overall, 69 fish catch-stations starting positions and 18 standard hydrographic stations were controlled by the SeaBird SBE 911 CTD-probe combined with the rosette sampler (the bathometer rosette). As the standard hydrographic station 10Gd was made on the same position as 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 replacement hauls**	**Number of invalid hauls**	**% stations fished**
24	TVL	10-39 m (2)	5	5	0	0	0	0	100
25	TVL	20-39 m (2)	14	13	0	0	0	0	93
25	TVL	40-59 m (3)	13	14	0	2	0	0	108
25	TVL	60-79 m (4)	9	9	0	2	0	0	100
25	TVL	80-99 m (5)	2	2	0	0	0	0	100
26	TVL	20-39 m (2)	6	6	0	0	0	0	100
26	TVL	40-59 m (3)	4	5	0	0	0	0	125
26	TVL	60-79 m (4)	8	8	0	0	0	1	100
26	TVL	80-100 (5)	7	6	0	0	0	0	86
26	TVL	100-120 (6)	1	1	0	0	0	0	100

Number of biological samples (maturity and age material, *maturity only):		
Species (Latin name)	Length	Age and maturity
Gadus morhua	12389	513
Clupea harengus	8577	1067
Sprattus sprattus	5232	389
Platichthys flesus	6755	966
Pleuronectes platessa	1688	716
Scophthalmus maximus	32	32
Limanda limanda	1	1
Zoarces viviparus	35	
Enchelyopus cimbrius	976	5
Perca fluviatilis	65	12
Sander lucioperca	9	9
Pungitius pungitius	1	
Gasterosteus aculeatus	2	
Agonus cataphractus	5	
Cyclopterus lumpus	33	5
Scomber scombrus	2	2
Myoxocephalus scorpius	582	44
Neogobius melanostomus	2	
Pomatoschistus minutus	1	
Trisopterus minutus	1	1
Osmerus eperlanus	45	1
Alosa fallax	6	6
Merlangius merlangus	118	25
Hyperoplus lanceolatus	43	513



Crosses – fish control stations, red dots – hydrological stations, green line – hydrological profile.

NATION:	**LATVIA**	**VESSEL:**	**RV "BALTICA"**
Survey:	BITS-Q1/2018	Dates:	10-18/03/2018

Cruise	No. 1/2018
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 22 control-hauls will be realized in the Latvian EEZ (4 trawls in SD 26, 18 trawls in SD 28) and 3 control-hauls in the Estonian EEZ (SD 28). Five additional trawls were planned in the SD 26 (5 trawls in the Lithuanian EEZ). The r.v."Baltica" realized 25 bottom trawl control-hauls including the Latvian territorial waters (Fig.1). Weather conditions influenced the realization of all planned additional tracks. 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 3 hauls, their duration was shortened to 20 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 all 253 cod and 2625 flounder. Length measurements in the 0.5-cm classes were realized for 2226 herring and 1976 sprat. In total, 247 cod and 463 flounder individuals were taken for biological analysis. Stomachs from the 210 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, 30 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:	**Due to the unfortunate coincidence during the survey, one trawl was totally destroyed. Reason - trawl metal details fracture.**

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 REPLACEMENT HAULS	NUMBER OF INVALID HAULS	% STATIONS FISHED
26	TVL	2	1				1		100
26	TVL	5	2		2				100
26	TVL	6	1		1				100
28	TVL	2	6		6				100
28	TVL	3	7		7				100
28	TVL	4	6		6				100
28	TVL	5	2		2				100

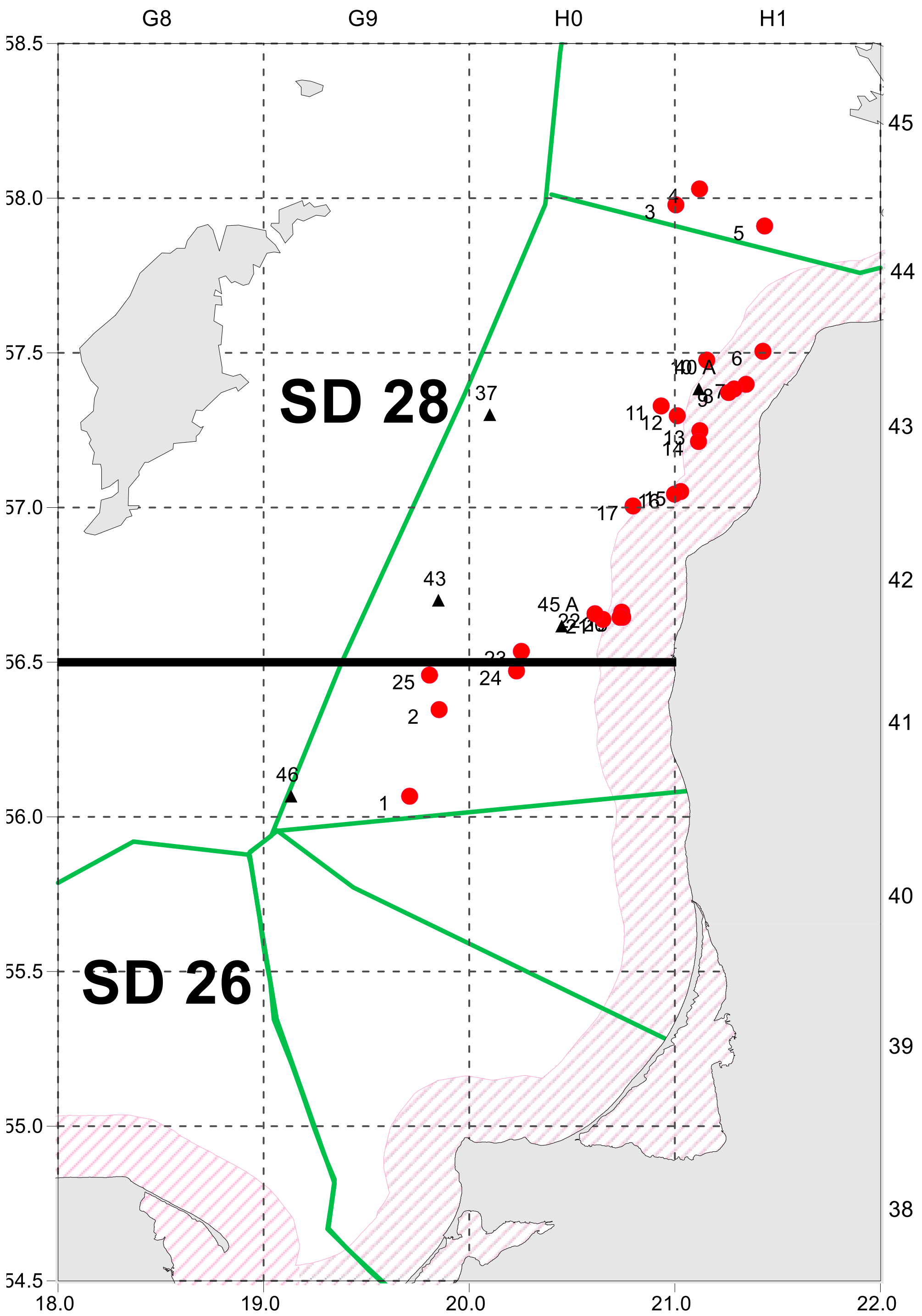


Figure 1. Location of the realized fish control-hauls (marked with red dots) and the HELCOM standard hydrological stations (marked with black triangles), green lines - national fishing zone borders.

Number of biological samples (maturity and age material, *maturity only):		
Species	**Length**	**Age**
Agonus cataphractus	**1**	
Gadus morhua	**253**	**247**
Platichthys flesus	**2625**	**463**
Clupea harengus	**2226**	
Sprattus sprattus	**1976**	
Scophthalmus maximus	**5**	
Zoarces viviparus	**106**	
Triglopsis quadricornis	**1**	
Cyclopterus lumpus	**9**	
Pomatoschistus minutus	**13**	
Myoxocephalus scorpius	**35**	
Myoxocephalus scorpius	**352**	
Osmerus eperlanus	**699**	
Gasterosteus aculeatus	**41**	
Enchelyopus cimbrius	**1**	
Neogobius melanostomus	**41**	
Lumpenus lampretaeformis	**2**	

Nation:	Russia	Vessel:	Atlantniro
Survey:	67	Dates:	19 – 26 March 2018

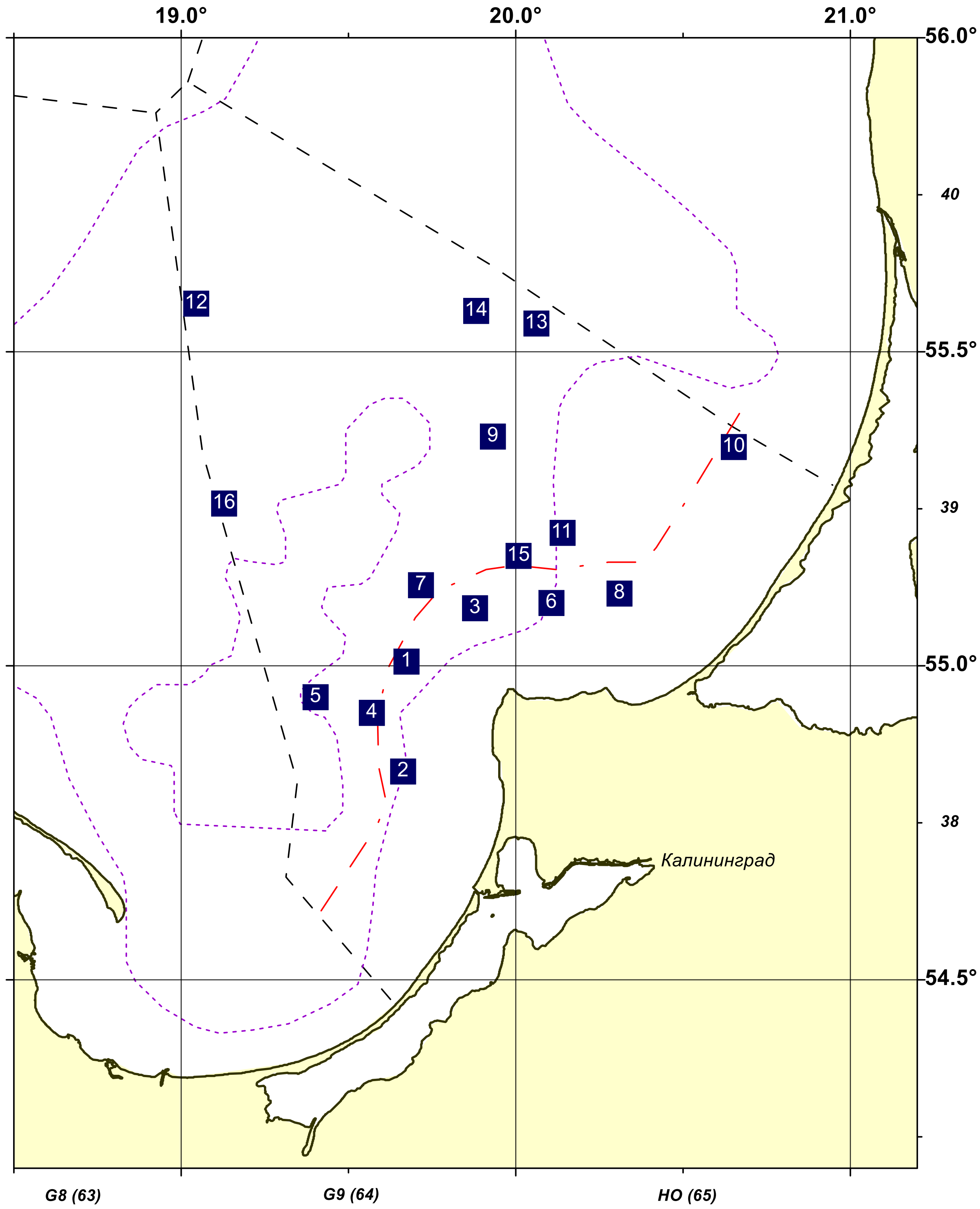
Cruise	
Gear details:	The large standard TV3 trawl is used. Following the recommendations in the TOW database stations are fished either without rockhoppers. The construction of the trawl follows the specifications in the manual.
Notes from survey (e.g. problems, additional work etc.):	No problems were experienced during the survey. Low content of oxygen in three trawl stations 26096, 26129 and 26130 (depth 97-104 m) – therefore hydrological researches have been made only.
Additional comments:	The national scientific program causes performance of trawl stations 26039, 26042, 26023 and 26024 – Russia. These trawl stations have been made in addition to the planned BITS stations. Trawl station 26092 has been made instead of 26148 and 26095 has been made instead of 26096. Trawl stations 26084 is not carried (invalid in September 2017).

Stations fished
(Please insert line according to your needs)

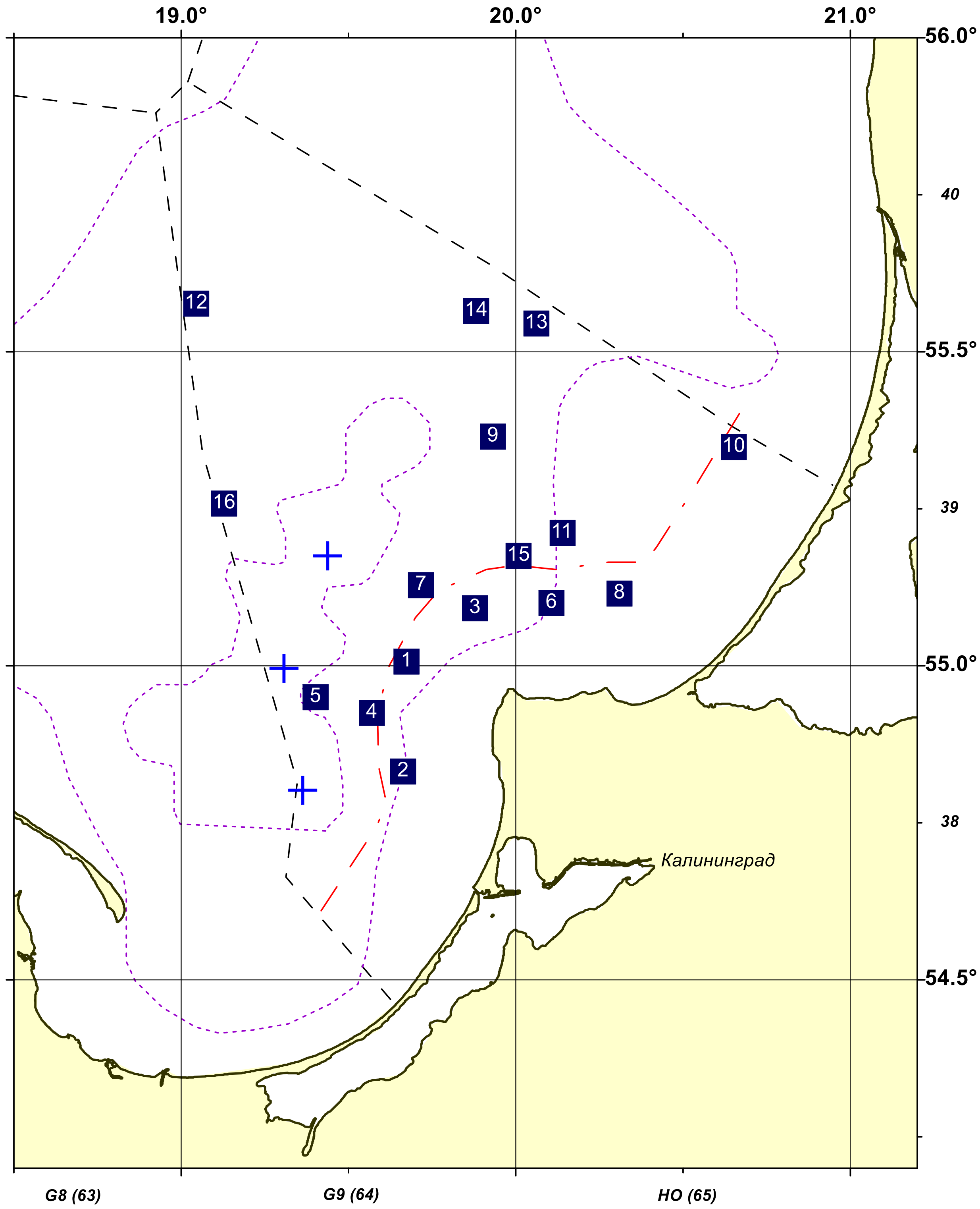
ICES Sub-Divisions	Gear (TVL,TVS)	Depth strata (1 -6)	Number of hauls planed	Number of valid hauls realised using "Standard" ground gear	Number of valid hauls realised using Rockhoppers	Number of assumed zero-catch hauls	Number of replacement hauls	Number of invalid hauls	% stations fished
26	TVL	1	0	0	0	0	0	0	
26	TVL	2	1	1	0	0	0	0	100
26	TVL	3	2	3	0	0	0	0	150
26	TVL	4	2	5	0	0	0	0	250
26	TVL	5	7	4	0	0	2	0	88
26	TVL	6	3	1	0	0	0	0	33

Number of biological samples (maturity and age material, *maturity only):			
Species	Length	Maturity	Age (otoliths)
Clupea harengus	3157	812	481
Gadus morhua	3600	825	570
Platichthys flesus	1411	616	518
Sprattus sprattus	1960	473	250

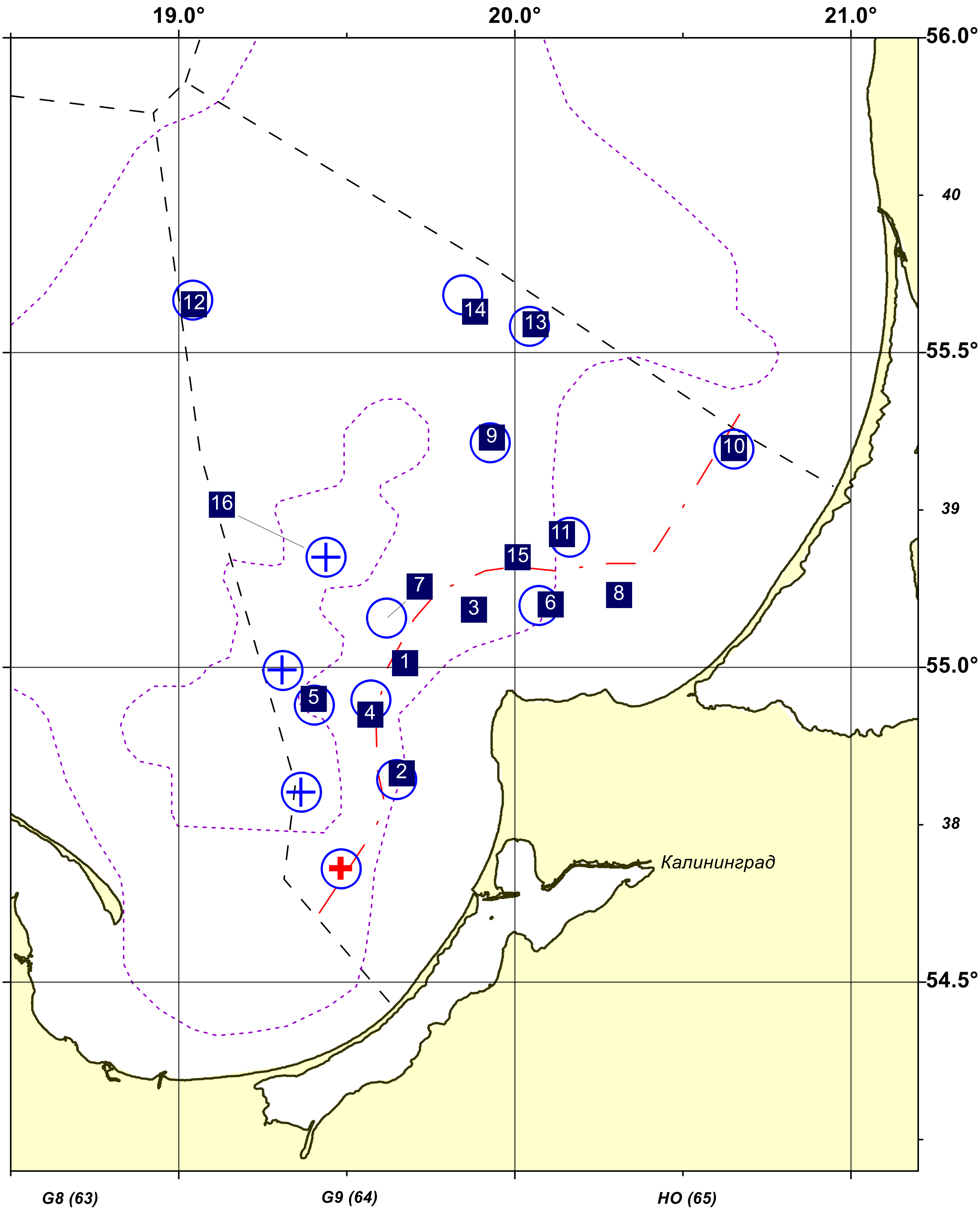
Other species may need to be added for your survey



Trawl positions for RV "ATLANTNIRO" in March 2018



Trawl positions for RV "ATLANTNIRO" in March 2018



Trawl positions for RV "ATLANTNIRO" in March 2018

Nation:	Denmark	Vessel:	Dana
Survey:	BITS	Dates:	06/3-24/3 - 2018

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	Coverage (%)
25	TVL							
3	TVL	14	15	0	0	0	1	107.1
4	TVL	26	19	0	5	0	1	92.3
5	TVL	14	1	0	12	0	0	92.9
6	TVL	0	1	0	0	0	0	#DIV/0!
26	TVL							
2	TVL	1	0	0	0	0	1	0.0
3	TVL	2	2	0	0	0	0	100.0
4	TVL	2	2	0	0	0	0	100.0
6	TVL	3	3	0	0	0	0	100.0
24	TVL							
2	TVL	1	1	0	0	0	0	100.0
3	TVL	3	3	0	0	0	0	100.0
		66	47	0	17	0	3	97.0

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

Nation:	**Denmark**	Vessel:	Havfisken
Survey:	KASU 2	Dates:	

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)		7					100%
22		TVS	2(20-39m)		18					92%
21		TVS	1(0-19m)		5					100%
21		TVS	2(20-39m)		12					100%
21		TVS	3(40-59m)		3					100%
21		TVS	4(60-89m)		3					100%
21		TVS	5(90-109m)		1					
20		TVS	2(20-39m)		2					100%
23		TVS	1(0-19m)		4					100%
23		TVS	1(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	247	Saith	14
Cod	612	Dab	353
Withing	245	Haddok	29
Witch	37	Turbot	105*
Hake	46	Brill	75*
Plaice	826		

Annex 7: Cruise reports of BASS and BIAS surveys at the WGBIFS 2018 meeting

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

List of cruise reports:

1. Cruise Report of Estonia-Poland joint BASS 2017;
2. Cruise Report of Latvia-Poland joint BASS 2017;
3. Cruise Report of Lithuania BASS 2017;
4. Cruise Report of Poland BASS 2017;
5. Cruise Report of Germany BASS 2017;
6. Cruise Report of Finland BIAS 2017;
7. Cruise Report of Sweden BIAS 2017;
8. Cruise Report of Estonia-Poland joint BIAS 2017;
9. Cruise Report of Latvia-Poland joint BIAS 2017;
10. Cruise Report of Lithuania BIAS 2017;
11. Cruise Report of Russia BIAS 2017;
12. Cruise Report of Poland BIAS 2017;
13. Cruise Report of Germany BIAS 2017.

REPORT

**FROM THE JOINT ESTONIAN-POLISH BASS 2017
CONDUCTED BY THE R.V. "BALTICA" IN THE NORTH-EASTERN BALTIC SEA
(26-31 May 2017)**

by
Miroslaw Wyszynski*, Ain Lankov**, Andrus Hallang**, Elor Sepp** and Tycjan Wodzinowski*

* National Marine Fisheries Research Institute, Gdynia (Poland)
** University of Tartu, Estonian Marine Institute, Tallinn (Estonia)

Introduction

The recent joint Estonian-Polish Baltic Acoustic Spring Survey (BASS), marked with the number 8/2017/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 Program for 2017 and the European Union (the Commission Regulations Nos. 1639/2001, 1581/2004, 665/2008, 1078/2008, 199/2008) financially supported the EST-POL BASS 2017. 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 2017[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
Bartlomiej Nurek (NMFRI, Gdynia – Poland) – acoustician
Tycjan Wodzinowski (NMFRI, Gdynia – Poland) – hydrologist
Ain Lankov (TUEMI, Tallinn - Estonia) – Estonian scientific staff leader
Andrus Hallang (TUEMI, Tallinn - Estonia) – ichthyologist
Viktor Kajalainen (TUEMI, Tallinn - Estonia) – ichthyologist
Elor Sepp (TEMI, Tallinn - Estonia) – acoustician
Timo Arula (TUEMI, Tallinn - Estonia) – biologist

[1]ICES 2017. Final Report of the Baltic International Fish Survey Working Group (WGBIFS). ICES CM 2017/SSGIEOM: 07.

Narrative

The reported survey took place during the period of 26-31 May 2017. 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.

The survey started from the Ventspils port (Latvia) on 25.05.2017 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°00.0’E on May 26 (Fig. 1). The at sea researches were ended on 30.05.2017 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 31.05.2017 afternoon.

1.1 Survey design and realization

The r.v. “Baltica” realized 502 Nm echo-integration transect and 14 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 07:15 am. and 19:15 pm.) using the pelagic trawl type WP 53/64x4 (with 6 mm mesh bar length in the codend). In the most of hauls trawling duration was 15 minutes due to high fish density observed on the net-sounder monitor, however in 5 cases hauls duration was prolonged to 20 minutes. The mean speed of vessel while providing echo-integration was 8.0 knots, in case of trawling was 3.0 knots. Overall, 4 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 3193 sprats and 3593 herring individuals. Totally, 465 sprats and 982 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). 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 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.

1.2 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:

$$TS = 20 \log L - 71.2$$

Due to fortunate weather conditions, all transects and planned trawls were conducted according to the plan.

Catch results and fish measurements

Overall, 8 fish species were recognized in hauls performed at the North-eastern Baltic Sea in May 2017. Sprat was prevailing species by mass in the total catch with the mean share amounted 75.1 % (especially high in SD 28.2 – 78.3%, but lowest in SD 32 – 69.4%). The rest 6 species (cod, three spine stickleback, flounder, smelt, lumpfish and eelpout) represented only about 0.3% 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 2017 amounted 630.6 kg/h (comparing to 670.0 kg/h in the same period in 2016). The most valuable CPUEs for sprat was noted in SD 28.2, but for herring – in SDs 28.2 and 29. The mean CPUEs of sprat were as follow: 615.3 kg/h in ICES SD 28.2, 483.7 kg/h in SD 29 and 147.9 kg/h in SD 32. The mean CPUEs in case of herring were: 169.6, 170.6 and 64.8 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 2016 take place on 8.0-8.5 cm length class shows a medium quantity in all investigated Sub-divisions. The second one representing adult sprat placed on 10.5 cm length class. The length distribution curves by Sub-divisions in case of herring show generally three frequency picks – first one at 9.5-10 cm length classes, second one at 13-13.5 cm length classes and third one at 15-16 cm length classes. The first pick shows low quantity of herring generation born in 2016 in SDs 28.2 and 29, except slightly better quantity 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 abundances were about 20% lower than in 2016, with highest differences in open sea areas.

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 abundance was slightly lower than on previous year, and concentrations were evenly distributed through survey area. Average weights were similar throughout the survey, but lower than in 2016. Biomass of herring was very high in southern areas compared to previous survey, but sprat biomass remained on more or less stable high level.

Meteorological and hydrological characteristics.

The 14 control catches and connected hydrological stations (Fig.1.) were inspected with the CTD-probe combined with the rosette sampler. 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 the catch depth.

The most frequently wind (Fig. 5) were: SW and NNW. The wind speed varied from 0.7 m/s to 13.5 m/s and average wind speed was 7.0 m/s. The air temperature ranged from 7.9 °C to 13.7 °C, and average temperature was 10.1 °C.

The seawater temperature in the surface layers varied from 7.26 to 9.92°C (the mean was 8.75°C). The lowest surface temperatures were recorded at the haul 1. The highest ones were noticed at the haul 11. The minimum value of salinity in Practical Salinity Unit (PSU) was 6.00 at the haul 4 in the surface layer. The maximum was 6.79 PSU at the haul 14. The mean value of salinity was 6.44 PSU. The oxygen content in the surface layers of investigated the research area varied in the range of 9.16ml/l (haul 13) - 9.76 ml/l (haul 4). The mean value of surface water oxygen content was 9.36 ml/l.

The temperature of near bottom layer was changing in the range of 5.18 (haul 14) to 6.70 °C (haul 13), the mean was 6.10 °C. Salinity in the bottom waters varied from 9.27 to 11.75 PSU, and the mean was 10.92 PSU. The low values of salinity were at the haul 14. The highest values of salinity were noticed at the haul 13. Oxygen content varied from 0.00 ml/l to 1.31 ml/l (the mean was 0.36 ml/l). The zero values of this parameter were noticed at the hauls 2, 3, 4 (Fig. 6 and 7).

The temperature at the mean depth of the control catches was changing in the range from 4.32 (haul 7) to 5.65 °C (haul 3), the mean was 5.07 °C. Salinity haul water varied from 8.25 (haul 7) to 10.29 PSU (haul 3), and the mean was 9.26 PSU. Oxygen content varied from 0.30 ml/l (haul 5) to 3.86 ml/l (haul 7), the mean was 1.64 ml/l (Tab. 7).

The final report from the LAT-POL BASS 2017 will be presented at the meeting of the ICES Baltic International Fish Survey Working Group (WGBIFS) at March 24-28, 2018 in Copenhagen (Denmark).

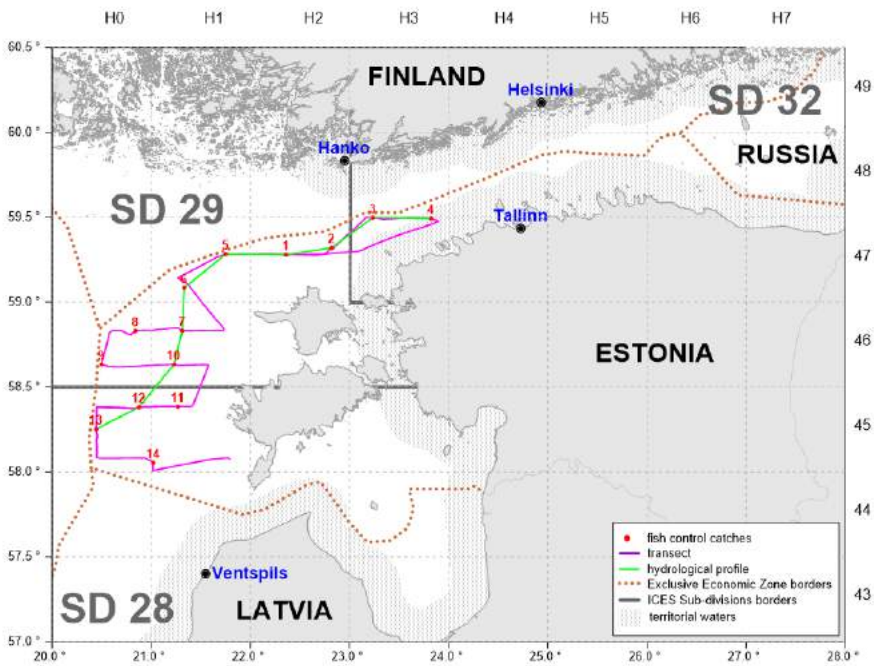


Fig. 1. Acoustic transects and pelagic fish control catches with connected hydrological and plankton stations realised during joint EST-POL BASS (May 2017).

Table 1. Catch results during joint Estonian-Polish BASS conducted by r.v. "Baltica" in Estonian EEZ in May 2017.

Haul no	Date	ICES rectangle	ICES Sub-division (SD)	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	Time end	Haul duration [min]	Total catch [kg]	CPUE [kg/h]	Catch per species [kg] sprat	herring	cod	flounder	lumpfish	eelpout	three-spined stickleback	smelt
1	2017-05-26	47H2	29	59°16.6'	22°23.6'	59°16.8'	22°24.7'	07:15	07:30	15	199,832	799,328	139,018	59,273	1,462				0,059	0,020
2	2017-05-26	47H2	29	59°18.8'	22°50.5'	59°18.6'	22°52.0'	10:00	10:15	15	91,730	366,920	47,452	43,966					0,101	0,211
3	2017-05-26	47H3	32	59°29.7'	23°16.0'	59°29.6'	23°17.4'	13:15	13:30	15	60,300	241,200	42,089	18,030					0,030	0,151
4	2017-05-26	47H3	32	59°29.2'	23°50.9'	59°28.9'	23°52.6'	16:10	16:30	20	61,646	184,938	42,470	19,145				0,006	0,013	0,012
5	2017-05-27	47H1	29	59°16.7'	21°43.5'	59°16.2'	21°41.9'	09:20	09:40	20	103,400	310,200	79,411	23,265					0,724	
6	2017-05-27	47H1	29	59°06.0'	21°19.8'	59°07.1'	21°19.8'	13:00	13:20	20	162,242	486,726	125,983	35,833		0,102			0,324	
7	2017-05-27	46H1	29	58°50.2'	21°18.8'	58°50.7'	21°16.9'	18:30	18:45	15	228,440	913,760	210,530	17,818					0,092	
8	2017-05-28	46H0	29	58°49.3'	20°49.4'	58°48.8'	20°48.0'	07:40	07:55	15	73,393	293,572	30,183	42,714	0,005	0,448			0,043	
9	2017-05-28	46H0	29	58°37.8'	20°31.2'	58°37.8'	20°32.4'	11:00	11:15	15	138,349	553,396	111,165	25,353	1,441	0,308			0,082	
10	2017-05-28	46H1	29	58°37.8'	21°15.6'	58°37.6'	21°16.8'	14:30	14:45	15	383,586	1534,344	275,049	107,819		0,172	0,117	0,007	0,422	
11	2017-05-28	45H1	28.2	58°23.9'	21°17.5'	58°24.7'	21°18.6'	19:15	19:35	20	103,084	309,252	68,723	33,304	0,924				0,133	
12	2017-05-29	45H0	28.2	58°22.5'	20°54.0'	58°22.1'	20°55.3'	08:00	08:15	15	258,040	1032,160	176,474	81,515					0,051	
13	2017-05-29	45H0	28.2	58°13.8'	20°27.0'	58°13.2'	20°27.2'	12:00	12:15	15	182,260	729,040	141,798	40,279					0,183	
14	2017-05-29	45H1	28.2	58°02.0'	21°01.0'	58°01.0'	21°01.0'	16:20	16:40	20	357,980	1073,940	327,337	30,428					0,215	
									Total catch [kg]	28.2	901,364		714,332	185,526	0,924				0,582	
										29	1380,972		1018,791	356,041	2,908	1,030	0,117	0,007	1,847	0,231
										32	121,946		84,559	37,175				0,006	0,043	0,163
										Sum	2404,282		1817,682	578,742	3,832	1,030	0,117	0,013	2,472	0,394

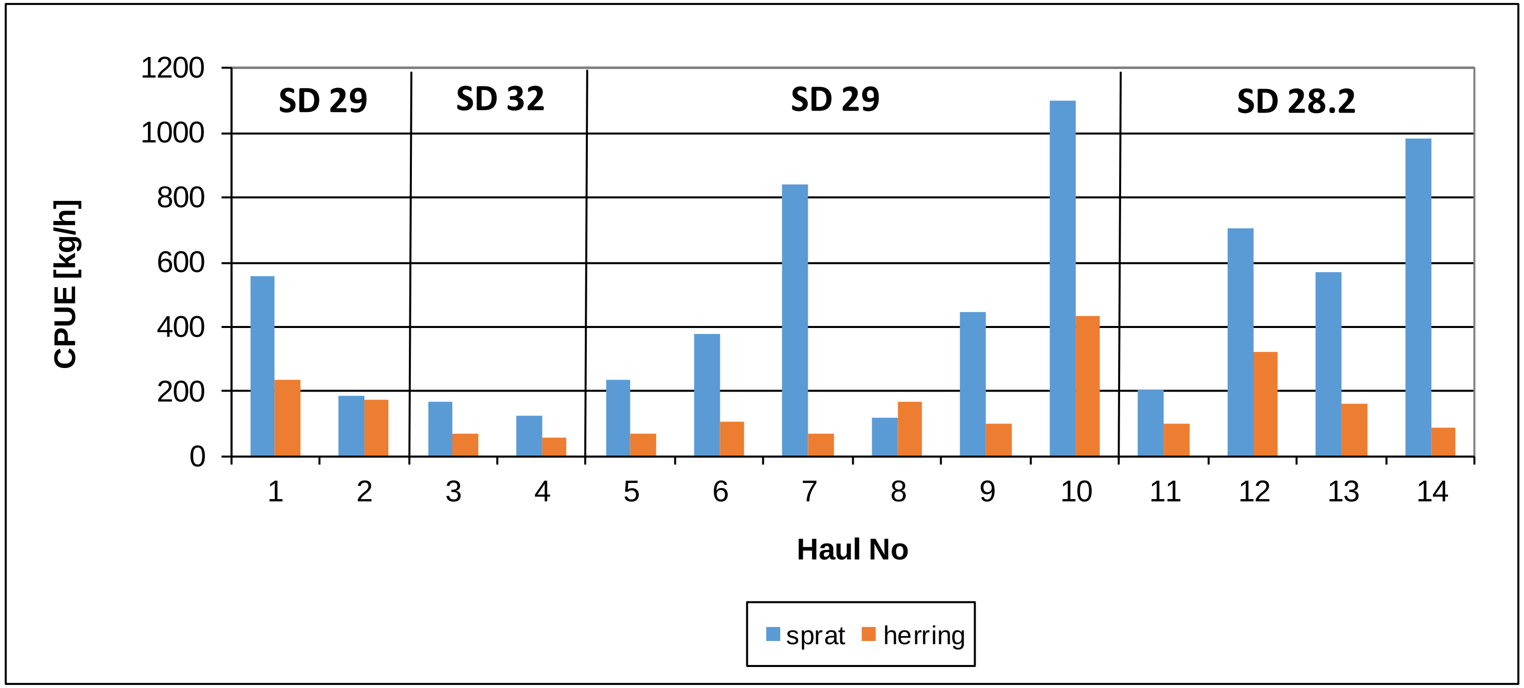


Fig. 2. CPUE values (kg/h) of sprat and herring in particular pelagic fish control catches during joint EST-POL BASS in the North-eastern Baltic Sea (Sub-divisions 28.2, 29 and 32), May 2017.

Table. 2. Biological sampling in the r.v."Baltica" joint EST-POL BASS in May 2017.

Fish samples

SD 28		SPRAT	HERRING	COD	FLOUNDER	LUMPFISH	THREE SPINED STICKLEBACK	SMELT	EELPOUT	TOTAL
Samples	measurements	4	4	1			4			13
taken	analyses	4	4							8
Fish measured		924	852	2			33			1811
Fish analysed		154	280							434

SD 29		SPRAT	HERRING	COD	FLOUNDER	LUMPFISH	THREE SPINED STICKLEBACK	SMELT	EELPOUT	TOTAL
Samples	measurements	8	8	3	4	1	8	2	1	35
taken	analyses	8	8							16
Fish measured		1808	2098	5	7	1	146	4	1	4070
Fish analysed		173	393							566

SD 32		SPRAT	HERRING	COD	FLOUNDER	LUMPFISH	THREE SPINED STICKLEBACK	SMELT	EELPOUT	TOTAL
Samples	measurements	2	2				2	2	1	9
taken	analyses	2	2							4
Fish measured		461	643				7	5	1	1117
Fish analysed		138	309							447

SUM		SPRAT	HERRING	COD	FLOUNDER	LUMPFISH	THREE SPINED STICKLEBACK	SMELT	EELPOUT	TOTAL
Samples	measurements	14	14	4	4	1	14	4	2	57
taken	analyses	14	14							28
Fish measured		3193	3593	7	7	1	186	9	2	6998
Fish analysed		465	982							1447

Zooplankton samples

Sub-divis	stations	samples
28	2	2
29	8	8
32	2	2
Sum	12	12

Type of plankton net used: Bongo

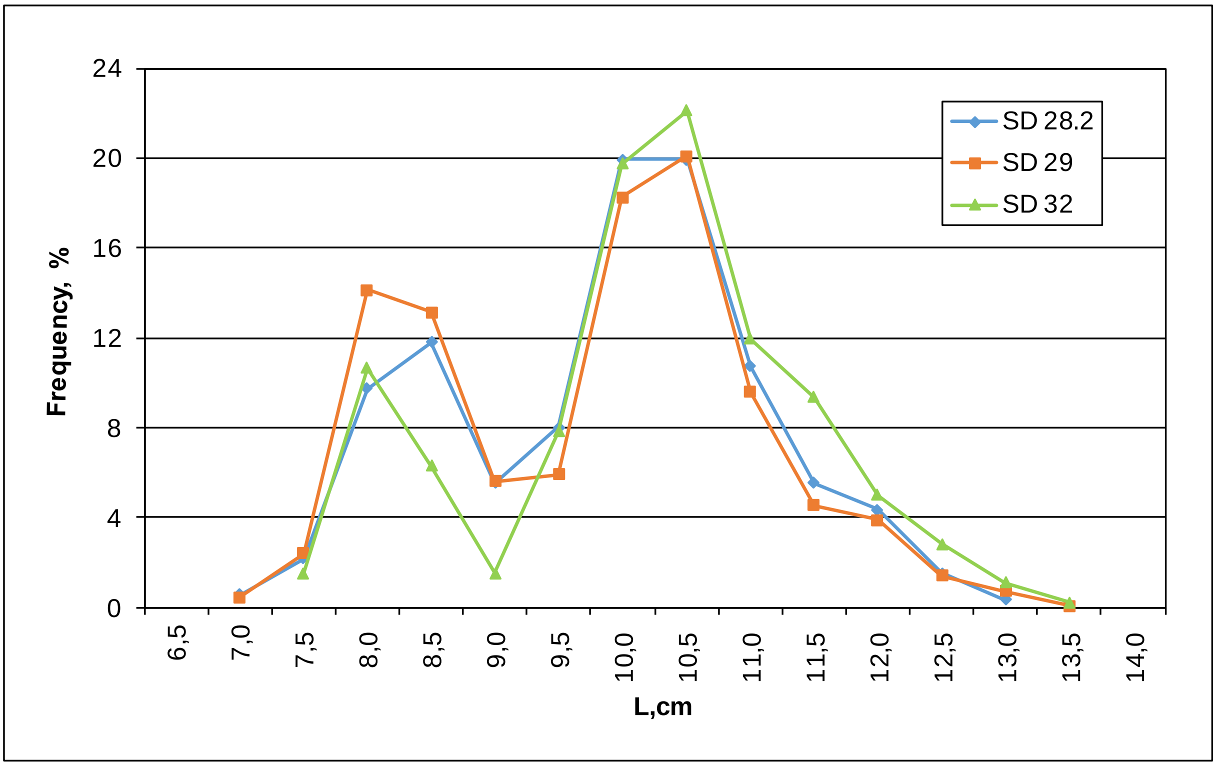


Fig. 3. Sprat length distributions from the control catches conducted by the rv. "Baltica" during joint EST-POL BASS in the SDs 28.2, 29 and 32 (May 2017).

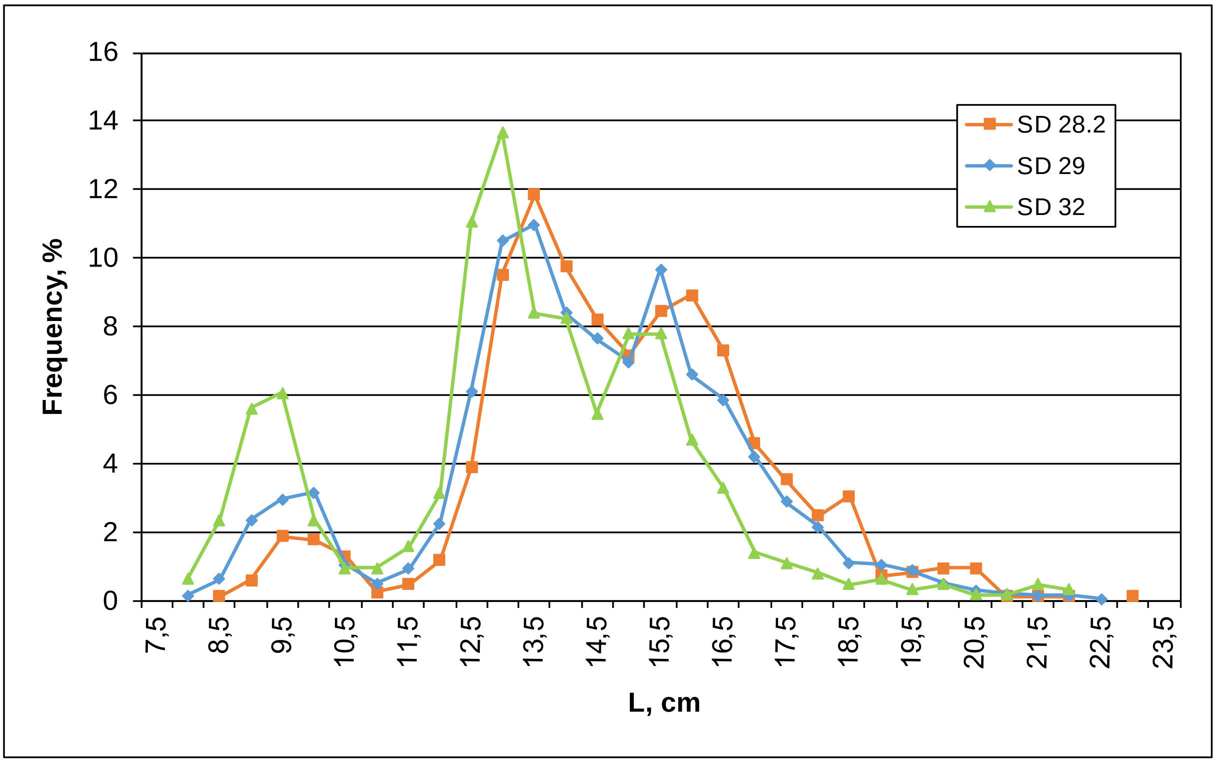


Fig. 4. Herring length distributions from the control catches conducted by the rv. "Baltica" during joint EST-POL BASS in the SDs 28.2, 29 and 32 (May 2017).

Table 3. The BASS survey basic biological and acoustic data concerning the clupeid stocks inhabiting the north- eastern Baltic Sea in May 2017.

ICES Sub-div.	ICES rec-tangle	Area [NM²]	Share [%-indiv.]		Total abun-dance [x10⁶]	Abundance density [10⁶/NM²]	NASC [m²/NM²]	σ [cm²]
			herring	sprat				
28	45H0	947.2	11.2	88.6	4682.77	4.944	557.3	1.127
28	45H1	827.1	9.0	90.7	3292.08	3.980	430.3	1.081
29	46H0	933.8	17.8	81.9	5430.06	5.815	692.9	1.192
29	46H1	921.5	8.0	91.8	4288.64	4.654	437.8	0.941
29	47H1	920.3	9.5	89.2	4907.71	5.333	571.9	1.072
29	47H2	793.9	21.1	78.5	3861.58	4.864	617.6	1.270
32	47H3	536.2	16.5	83.2	1945.28	3.628	424.4	1.170
Average			**13,3**	**86,3**		**4,745**	**522,2**	**1,122**
Total		**5880**			**28408**			

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 2017.

ICES Sub-div.	ICES rectangle	HERRING – age groups								
		1	2	3	4	5	6	7	8+	total
28	45H0	41	25	248	52	78	42	7	30	524
28	45H1	11	9	140	36	53	23	7	16	295
total		52	34	388	88	131	65	15	47	820
29	46H0	15	34	381	91	239	84	21	102	967
29	46H1	52	20	153	27	52	14	3	21	342
29	47H1	66	24	211	36	73	23	5	26	465
29	47H2	42	60	435	69	126	35	7	42	816
total		175	139	1181	224	489	156	36	191	2590
32	47H3	60	16	150	36	34	8	6	12	322
total		60	16	150	36	34	8	6	12	322
Grand total		286	189	1719	347	654	229	57	250	3732

Table 4. Continued

ICES	ICES rectangle	SPRAT – age groups								
Sub-div.		1	2	3	4	5	6	7	8+	total
28	45H0	1172	930	1706	208	69	26	7	32	4149
28	45H1	1026	603	1129	133	42	18	8	24	2984
total		2198	1534	2835	341	111	44	15	56	7133
29	46H0	1767	613	1743	124	101	14	37	50	4449
29	46H1	1968	626	1204	51	43	7	18	18	3935
29	47H1	1302	686	2094	123	89	12	34	35	4376
29	47H2	502	501	1559	163	138	25	47	95	3030
total		5540	2426	6599	461	371	58	137	199	15791
32	47H3	336	312	757	56	53	37	20	47	1618
total		336	312	757	56	53	37	20	47	1618
Grand total		8073	4272	10191	857	535	140	172	301	24542

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 2017.

ICES	ICES rectangle	HERRING – age groups								
Sub-div.		1	2	3	4	5	6	7	8+	total
28	45H0	245	306	3873	1061	1874	1158	195	1052	9764
28	45H1	59	99	2413	837	1498	736	249	602	6492
total		304	405	6286	1898	3372	1894	444	1654	16256
29	46H0	87	407	6590	2424	4810	2778	620	2167	19884
29	46H1	294	232	2497	664	992	428	117	393	5617
29	47H1	360	277	3319	909	1458	614	171	498	7607
29	47H2	201	653	6468	1649	2495	888	229	806	13389
total		942	1568	18874	5646	9756	4709	1137	3864	46496
32	47H3	293	274	2233	467	632	204	70	320	4494
total		293	274	2233	467	632	204	70	320	4494
Grand total		1539	2247	27393	8012	13759	6807	1652	5838	67246

Table 5. Continued

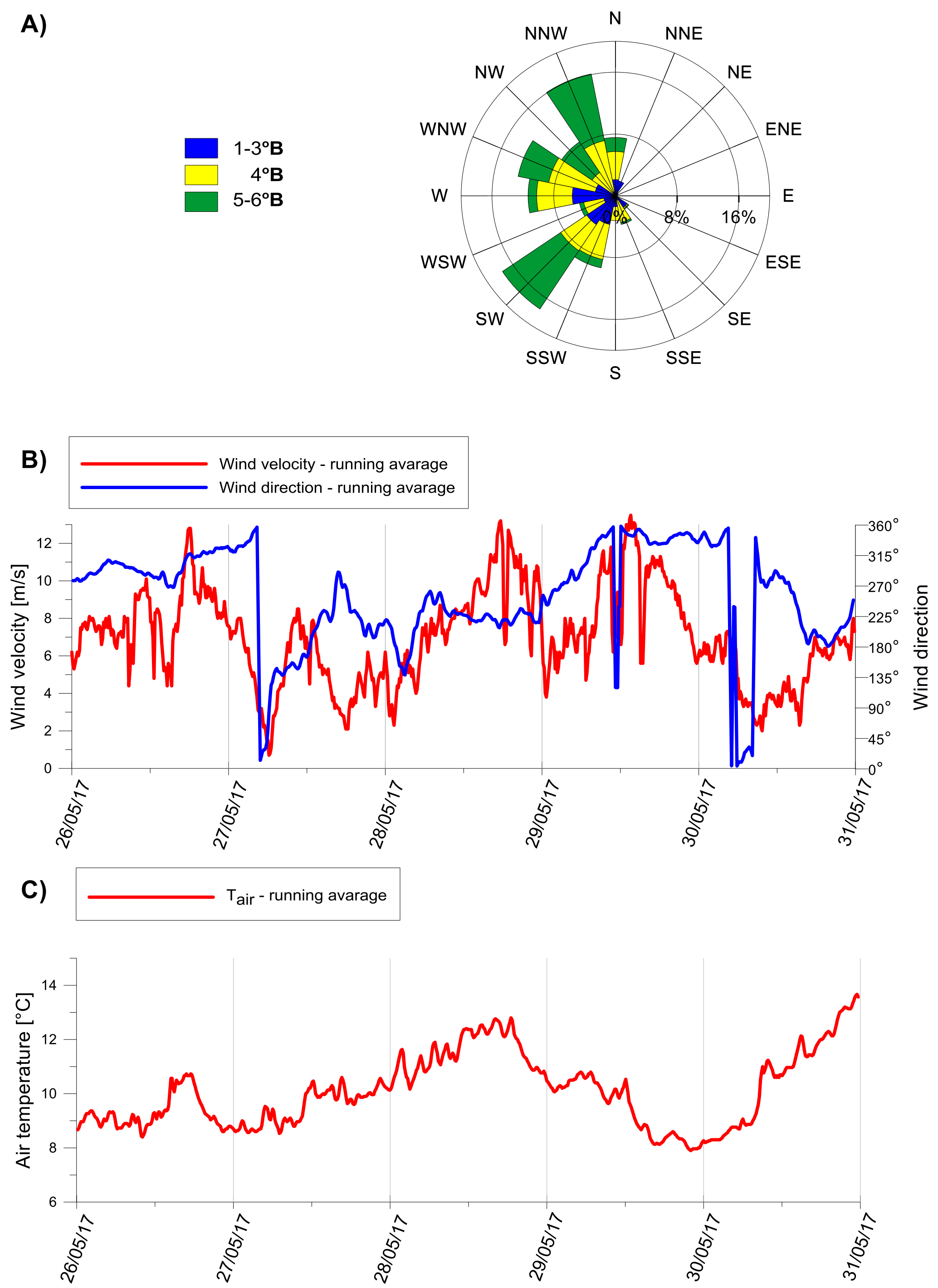
ICES	ICES rectangle	SPRAT – age groups								
Sub-div.		1	2	3	4	5	6	7	8+	total
28	45H0	4346	6520	11917	1865	646	237	74	310	25915
28	45H1	4127	4441	8255	1349	454	193	98	268	19185
total		8473	10961	20172	3213	1099	430	173	578	45100
29	46H0	6966	3970	12339	1181	1015	142	359	525	26498
29	46H1	7461	3856	8515	511	421	69	181	191	21204
29	47H1	4582	4430	14682	1146	862	110	320	363	26495
29	47H2	1617	3118	10371	1480	1327	255	427	945	19540
total		20626	15374	45907	4318	3625	576	1286	2023	93737
32	47H3	1078	2001	5099	508	509	362	204	459	10220
total		1078	2001	5099	508	509	362	204	459	10220
Grand total		30178	28336	71177	8040	5233	1368	1664	3061	149057

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 2017.

ICES Sub-div.	ICES rectangle	HERRING – age groups								
		1	2	3	4	5	6	7	8+	avg.
28	45H0	5,91	12,03	15,62	20,36	24,04	27,72	26,34	34,72	18,62
28	45H1	5,59	11,06	17,24	23,57	28,25	31,55	33,75	36,56	22,00
29	46H0	5,88	11,86	17,29	26,50	20,16	33,16	29,45	21,25	20,56
29	46H1	5,61	11,69	16,27	24,68	19,05	30,92	37,16	18,96	16,40
29	47H1	5,47	11,47	15,72	25,12	19,97	26,33	34,72	18,86	16,36
29	47H2	4,83	10,79	14,87	23,86	19,87	25,51	32,46	19,06	16,41
32	47H3	4,91	17,10	14,87	13,13	18,67	24,27	11,04	27,11	13,96

Table 6, Continue

ICES Sub-div,	ICES rectangle	SPRAT – age groups								
		1	2	3	4	5	6	7	8+	avg,
28	45H0	3,71	7,01	6,99	8,98	9,41	9,17	11,10	9,71	6,25
28	45H1	4,02	7,36	7,31	10,15	10,68	10,56	11,62	11,25	6,43
29	46H0	3,94	6,48	7,08	9,56	10,06	10,01	9,66	10,43	5,96
29	46H1	3,79	6,16	7,07	10,10	9,74	9,35	9,90	10,45	5,39
29	47H1	3,52	6,46	7,01	9,29	9,69	9,30	9,31	10,22	6,05
29	47H2	3,22	6,23	6,65	9,07	9,64	10,18	8,98	9,98	6,45
32	47H3	3,21	6,41	6,74	9,04	9,61	9,68	10,20	9,80	6,32



Fig, 5, Changes of the main meteorological parameters during joint EST-POL BASS conducted in May 2017 (A and B – wind direction and velocity, C – air temperature).

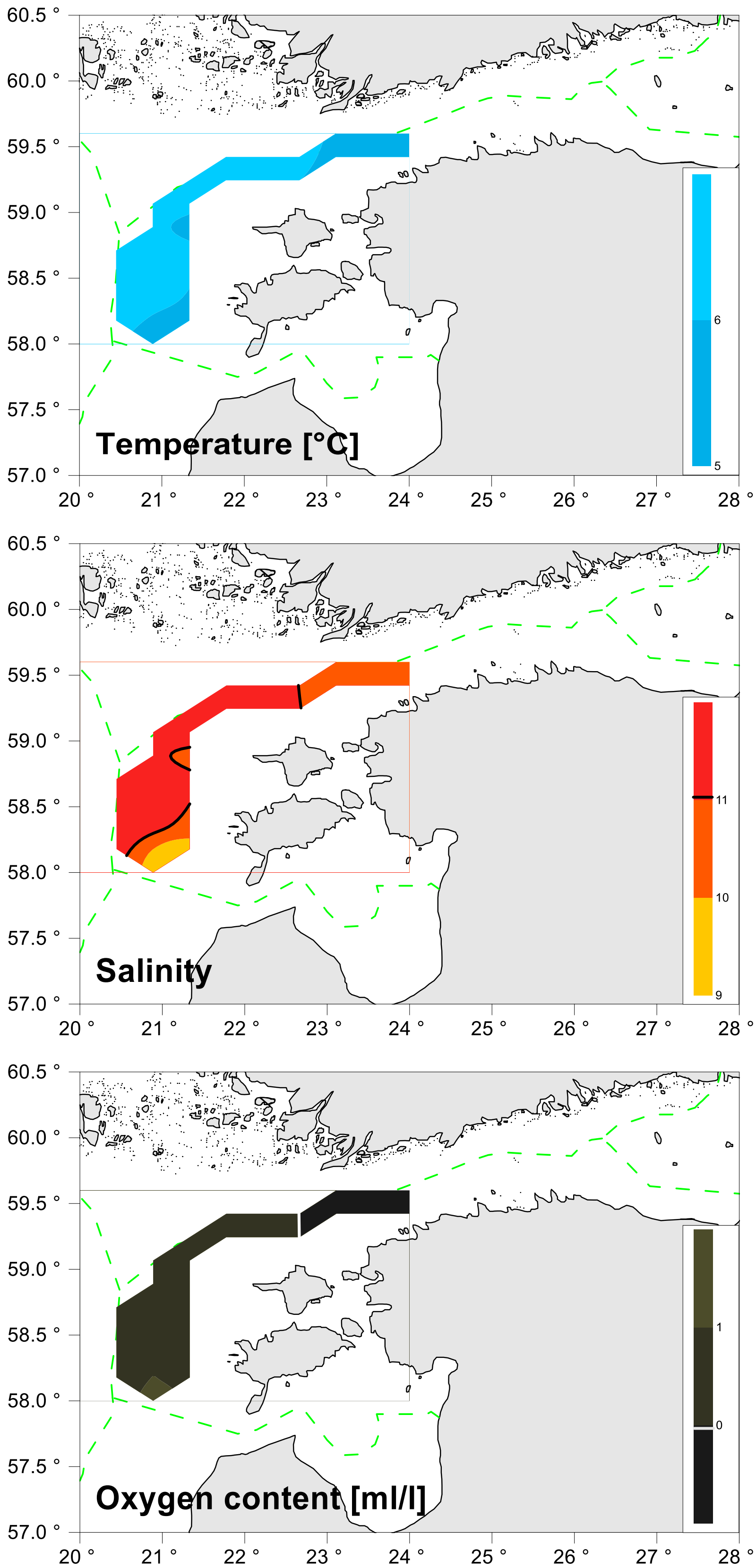


Figure 6. Distribution of the seawater temperature, salinity and oxygen content in the near bottom waters (EST-POL BASS, May 2017).

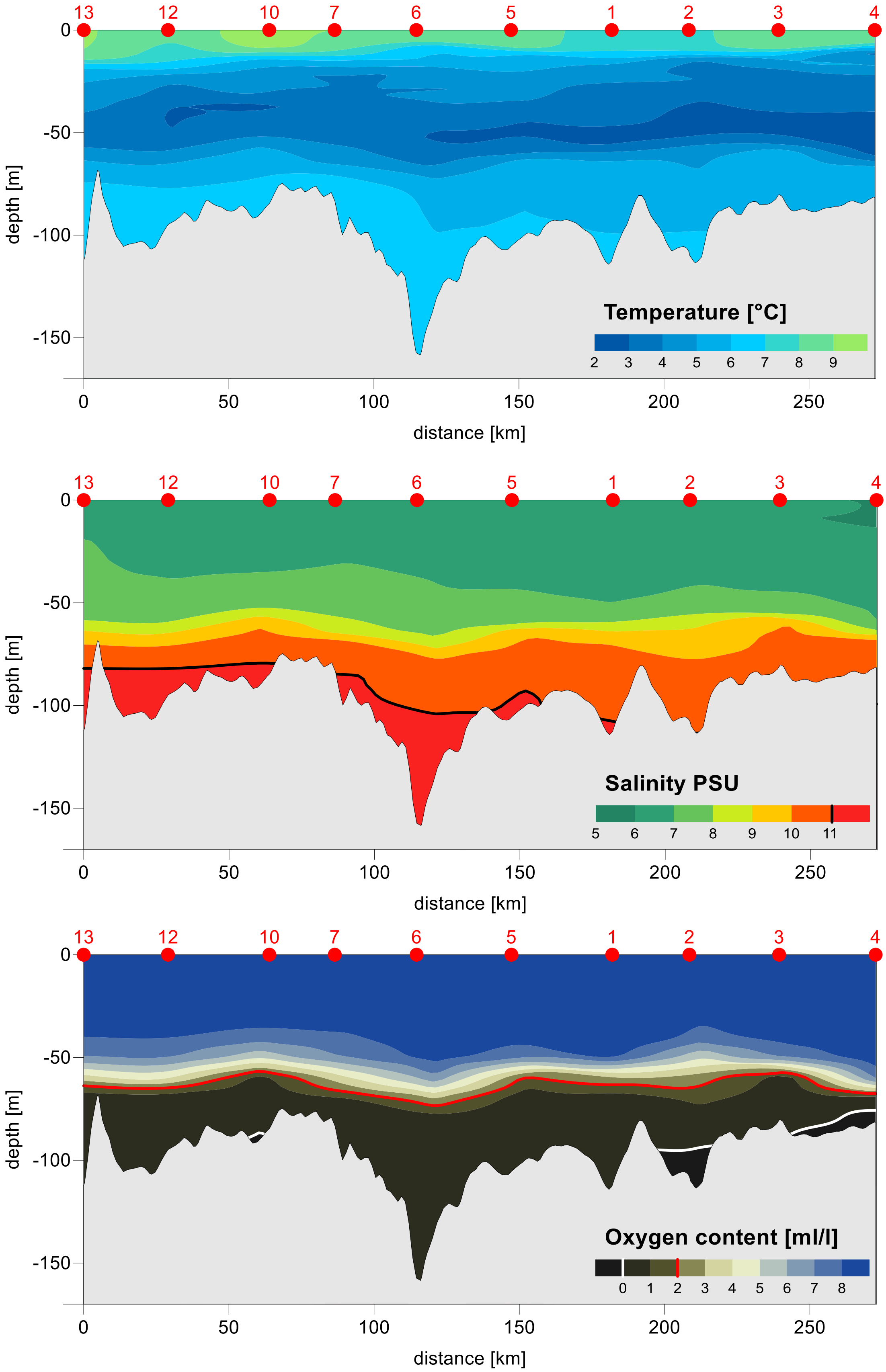


Figure 7. Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological profile (EST-POL BASS, May 2017).

Table 7, Values of the basic meteorological and hydrological parameters recorded in May 2017 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	26-05-2017	WNW	4	2	10	1014	5,67	9,97	0,34
2	26-05-2017	NW	4	2	10	1014	5,09	9,36	1,24
3	26-05-2017	WNW	5	3	10	1014	5,65	10,29	0,43
4	26-05-2017	W	4	2	11	1014	4,43	8,61	3,69
5	27-05-2017	SE	3	1	9	1021	5,65	10,15	0,30
6	27-05-2017	SE	4	2	10	1019	4,73	8,56	2,88
7	27-05-2017	WSW	3	2	10	1019	4,32	8,25	3,86
8	28-05-2017	W	4	2	11	1015	5,11	9,25	0,83
9	28-05-2017	WSW	4	2	12	1014	5,12	9,25	0,66
10	28-05-2017	WSW	5	3	12	1014	5,31	9,65	0,58
11	28-05-2017	SW	6	3	12	1014	4,69	8,65	2,81
12	29-05-2017	W	4	2	11	1003	5,55	9,92	0,39
13	29-05-2017	N	5	3	10	1007	5,24	9,25	1,24
14	29-05-2017	N	6	3-4	11	1007	4,54	8,40	3,65
		Mean >	4,4	2,1	10,6	1013,5	5,08	9,25	1,64

* data at the mean depth of the fish control catch

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 2017 ON THE R/V "BALTICA" IN THE ICES SUBDIVISIONS 26N AND 28.2 OF THE BALTIC SEA (18-25 MAY 2017)

Working paper on the WGBIFS meeting in Lyngby, Copenhagen, Denmark, 24-28.03.2018

•FAUSTS SVECOVS•MIROSLAW WYSZYNSKI•TYCJAN WODZINOWSKI•BARTLOMIEJ NUREK•
•GUNTARS STRODS•ANDREJS MAKARCUKS•ALLA VINGOVATOVA•GUNTA RUBENE•
•JANIS AIZUPS•VADIMS CERVONCEVS•

BIOR: Fausts Svecovs, Guntars Strods, Andrejs Makarcuks, Alla Vingovatova,
Gunta Rubene, Ivars Putnis, Vadims Cervoncevs
Fausts.Svecovs@bior.lv; Guntars.Strods@bior.lv
NMFRI: Miroslaw Wyszynski, Tycjan Wodzinowski, Bartlomiej Nurek
mwyszynski@mir.gdynia.pl; twodzinowski@mir.gdynia.pl

Riga – Gdynia, March 2018

CONTENTS

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 6th 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 2017. The reported survey was organized on the basis of the public procurement contract No. BIOR 2017/56/EJZF from 10 February 2017 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, Swedish and Estonian EEZs (ICES Sub-divisions 26N and 28.2). The "Latvian National Fisheries Data Collection Program, 2017" in accordance with the EU Commission Regulations No. 1639/2001, 1581/2004, 665/2008, 1078/2008 and 199/2008 was partly subsidized this survey. These investigations were coordinated by the ICES Baltic International Fish Survey Working Group (WGBIFS) [ICES 2017].

Pelagic research catches carried out during the 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;
T. Wodzinowski (NMFRI, Gdynia – Poland) – hydrologist, hydrology team;
B. Nurek (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;
J. Aizups (BIOR, Riga – Latvia) – ichthyologist, fish sampling team;
A. Makarcuks (BIOR, Riga – Latvia) – hydrobiologist, hydrobiology and fish sampling team.

1.2. SURVEY DESCRIPTION

The reported survey took place during the period of 18-25 May 2017, totally 8 working days at sea in accordance with Latvian-Polish survey plan. At-the-sea researches were conducted within Latvian and Swedish 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 18.05.2017 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 18.05.2017 after midday. The survey ended on 25.05.2017 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 580 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 2017 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 22 fish control-catches (Tab. 1). All catches were performed in the daylight between 07:10 and 19:20 (GMT+01:00; UTC+02:00) using the pelagic trawl type WP 53/64x4 (with 6 mm mesh bar length in the codend). The standard trawling duration was 30 minutes, but eight hauls was shortened to 20 minutes and three hauls to 15 minutes, according to higher power of the echo-integration. The mean speed of vessel while trawling was 2.9 knots. Overall, 5 hauls were conducted in SD 26N and 17 hauls in SD 28.2. Totally 16 hauls were performed in the Latvian EEZ and 6 hauls in Swedish EEZ.

1.3.2. BIOLOGICAL SAMPLING

All biological material of fish collected in the survey is presented in Table 2.

The length measurements (in 0.5 cm length classes) were realized for 2474 herring and 4548 sprat individuals. In total, 1449 herring and 2288 sprat individuals were taken for biological analysis. Moreover, 193 individuals of other species (three spine stickleback, cod and flounder) were measured. 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 22 ichthyoplankton and zooplankton stations were realized (Fig. 2) and 44 and 37 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 18-25 May 2017, totally at 23 stations, int. al. at 22 fish catch-station and 1 independent station named t3 (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 2017 are presented in the Table 4. Overall, 5 fish species were recognized in hauls performed in the Central-eastern Baltic Sea in May 2017. Sprat was dominating species by mass in the both ICES Sub-divisions 26N and 28.2 (94.9 and 77.8% respectively). The share of the herring constitutes 5.0 and 21.8% respectively. The rest 3 species represented 0.36 % (in this 0.34% belonging to cod) of the total mass in average for all investigated area.

Mean CPUE in BASS 2017 for all species in the investigated area amounted 1436.4 kg/h (comparing to 1404.7 kg/h in previous year (2016). The mean CPUEs of sprat were: 1579.0 kg/h in ICES SD 26N, and 1065.3 kg/h in SD 28.2. The mean CPUEs of herring were as follow: in SD 26N – 83.1 kg/h and 298.1 kg/h in SD 28.2. The CPUE values by particular haul for herring, sprat and others are presented at the Fig. 3 and 4. The highest CPUE values for sprat were noted from the North-eastern part of SD 26 to the Southern part of SD 28.2. The good CPUEs for herring were distributed more in Central 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 2017, are given in Table 5. The characteristics of the pelagic fish stock are aggregated in Table 6 for sprat and Table 7 for herring. The geographical distributions of NASC, sprat and herring stock densities in the central-eastern Baltic Sea in May 2017 are shown in Figures 5, 6 and 7 respectively.

The pelagic fish stock was represented mostly by sprat – 94.1 %, in comparison – 71.5% in 2013, 86.8 % in 2014, 88.2 % in 2015 and 92.9 % in 2016. Herring was represented as 5.9 %, 28.5 % in 2013, 13.2 % in 2014, 11.8 % in 2015 and 7.1 % in 2016. The highest sprat stock density 277.4 n×10^6/nm^2 according to acoustic estimates were recorded in ICES rectangle 44H0 of the ICES Sub-division 28.2. The highest average abundance 13.7 n×10^6/nm^2 and biomass of the sprat stock were recorded in the northern part of investigated area in ICES rectangle 44H0. The distribution of the high density sprat concentrations in May 2017 had different pattern as in May in previous years [Hoziosky et al. 1988, Shvetsov et al. 1988, 1989, 1992, 2002, Svecovs 2016], and versus mostly two scenarios of aggregation formations in May 2017 sprat has very large and dense concentrations in central and northern part of investigated area.

The herring stock density was significantly lower in comparison to sprat stock density. The highest density value was 21.5 n×10^6/nm^2 and noted in the same ICES rectangle 44H0 in northern part of the investigated area in Sub-division 28.2 in comparison to 2015 were highest density values was not over 10.2 n×10^6/nm^2 in rectangle 44H0, in 2013 it was 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, in 2016 the highest density 18.1 n×10^6/nm^2 was recorded in rectangle 42G9 in central part of estimated aquatory.

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 2017 both of sprat and herring stocks had decreased in numbers, but in biomass herring stock had significantly increased. The geographical distribution of main sprat stock shows different pattern as in years 2005-2016 and is less scattered with two large and dense concentrations of high abundance [Svecovs et al. 2010, 2011, 2012, 2013, 2014, 2015, 2016].

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 8 and 9 respectively. The total length and mean weight in control hauls of sprat, herring and cod ranged as follows:

- sprat – 7.5÷14.5 cm (average TL = 10.9 cm), 2.1÷16.2 g (average W = 7.2 g);
- herring – 9.0÷24.5 cm (average TL = 16.2 cm), 4.6÷72.6 g (average W = 25.3 g);

The length distributions of sprat and herring according to the ICES Sub-divisions 26N and 28.2 are shown at the Fig. 3 and 4 respectively. The sprat length distribution curves have a bimodal character for both above mentioned Sub-divisions. First length frequency pick takes place at 9 and 8.5 cm length class with low frequency values 4.8 and 7.0% respectively. It represents sprat generation born in 2016, characterized by low total frequency in both Sub-divisions. The second higher one at length classes 11 and 10.5 cm represents adult sprat.

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 14.5 and 13.5 cm respectively. The fish representing 9.0-11.0 cm length range belonging to the herring generation born in 2016 was found in SD 28.2 only and characterized by very low total frequency.

2.1.3. ICHTHYOPLANKTON ESTIMATES

Totally 44 ichthyoplankton samples collected at 22 station positions during BASS on RV “Baltica”, including 22 samples collected in vertical hauls with IKS-80 net and 22 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 8.

Sprat eggs and larvae prevailed in the ichthyoplankton in May 2017. The average numbers of sprat eggs and larvae in the investigated region were above the corresponding average values for the previous years. 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 center 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 larvae in the water surface layer were numerous in all parts of the Gotland Basin with maximal abundance in the central part of the Gotland Basin. This must be the evidence that the spawning of sprat this year has started very early.

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 and 2016, and also most of them were collected on the water surface.

The hydrological conditions in the Gotland Basin in 2017 were less favorable for the spawning of cod and four-bearded rockling compared with previous year. Number of cod egg was on rather low level. All the cod eggs were found in the deepest area of the southern and central parts 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 rockling and also some larvae of sand eel, shorthorn sculpin, plaice 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 37 samples taken in 22 stations are aggregated in Table 9.

In May 2017 in the Baltic Sea the estimated zooplankton biomass was in the same level that it was in 2013 and 2014, but lower for 32.5 % in comparison to 2016. Total zooplankton biomass in 2017 was 243.72 mg/m^3. The most part of the biomass (56.5 %) was made from small rotatories, the residual part was made from copepods (25.6 %), cladocers (5.8 %) and other planktonic organisms (12.2 %). The dominance of rotatorians in the spring season in the Baltic Sea creates favorable feeding conditions for larvae and smaller groups of pelagic fish species. Amount of them in 2017 on average was significantly higher than in 2014 and the long-term average. Overall, the biomass of *Temora longicornis*, taking the top rank among copepods, has the same biomass as in May 2016. *Pseudocalanus* sp. and *Acartia* spp. biomass had decreased in comparison to 2016, but is higher than in 2014. In 2017 increased average biomass of rotatorians *Synchaeta* spp. and *Polychaeta* worms. In 2017 had increased the role of above mentioned copepods in all aquatory. In deep stations has dramatically decreased estimated quantity and biomass of *Centropages hamatus* – approximately by 3 times than was stated in 2016. In the upper layer (0-50 m) of water column the dominant object of zooplankton was rotatorians *Synchaeta* spp. and cladocerans *Evadne* spp. Biomass of *Evadne* spp. was at lower level than in 2016 and almost close to the level of long-term average. Overall, the favorable feeding conditions in May 2017 formed in the upper water column of the investigated area.

2.2. METEOROLOGICAL AND HYDROLOGICAL DATA

2.2.1. WEATHER CONDITIONS

Changes of the main meteorological parameters during joint LAT-POL BASS in May 2017 are shown at the Figure 10. The wind speed varied from 1.0 m/s to 9.0 m/s and average speed was 5.7 m/s. The wind direction was changing. The air temperature ranged from 8.3 °C to 15.2 °C, and average temperature was 10.6 °C.

2.2.2. HYDROLOGY OF THE GOTLAND DEEP

The seawater temperature in the surface layers varied from 7.36 to 10.13°C (the mean was 8.51°C). The lowest surface temperatures were recorded at the haul 3. The highest ones were noticed at the haul 21. The minimum value of salinity in Practical Salinity Unit (PSU) was 6.69 at the haul 22 in the surface layer. The maximum was 7.31 PSU at the haul 1/station 46. The mean value of salinity was 7.08 PSU. The oxygen content in the surface layers of investigated the research area varied in the range of 8.89 ml/l (haul 3) – 10.34 ml/l (haul 11). The mean value of surface water oxygen content was 9.74 ml/l.

The temperature of near bottom (Fig. 11 and 13) layer changed in the range of 4.86 (haul 3) – 7.19 °C (haul 12), the mean was 6.38 °C. Salinity in the bottom waters varied from 8.46 to 13.23 PSU, and the mean was 11.53 PSU. The low values of salinity were at the haul 3. The highest values of salinity were noticed at the haul 15/station 37. Oxygen content varied from 0.00 ml/l to 4.64 ml/l (the mean was 1.41 ml/l). The zero values of this parameter were noticed at the haul 15/station 37.

The vertical profiles of the basic hydrological parameters (temperature, salinity and oxygen) at the most distant stations (H1 and H22) at the Gotland Deep are shown at the Figure 12.

The temperature at the hauls layer was changing in the range from 3.93 (haul 19) to 6.81 °C (haul 7/ station 43), the mean was 5.18 °C. Salinity of the haul waters varied from 7.29 (haul 10) to 12.99 PSU (haul 1/station 46), and the mean was 9.22 PSU. Oxygen content varied from 0.73 ml/l (haul 12) to 6.95 ml/l (haul 10), the mean was 2.76 ml/l (Table 3).

3. DISCUSSION

The data of the Latvian-Polish BASS in the 2nd quarter of 2017 were considered by the ICES BIFS Working Group (Riga, Latvia, 27-31.03.2017) 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 2017 had different pattern as in 2016 and shows larger aggregations with higher densities. 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 18-25.05.2017

Haul number	Date	ICES rectangle	ICES SD	Mean bottom depth [m]	Headrope depth [m]	Vertical opening [m]	Trawling speed [knt]	Trawling direction [°]	Geographical position				Time Start	Haul duration [min]	Total cactch [kg]
									Start		End				
									Latitude 00°00.0'N	Longitude 00°00.0'E	Latitude 00°00.0'N	Longitude 00°00.0'E			
1	2017-05-18	41G9	26	120	96	19	3.1	89	56°04.0'	19°05.5'	56°04.1'	19°07.9'	14:15	30	445.920
2	2017-05-18	41G9	26	79	53	20	3.1	277	56°05.1'	19°22.0'	56°05.2'	19°19.5'	17:25	30	268.136
3	2017-05-19	41H0	26	57	37	19	2.9	17	56°10.3'	20°04.0'	56°11.7'	20°04.8'	07:40	30	191.174
4	2017-05-19	41G9	26	77	56	19	2.9	274	56°23.4'	19°59.3'	56°23.6'	19°57.6'	11:45	20	1311.947
5	2017-05-19	41G9	26	113	65	20	2.9	273	56°23.4'	19°03.8'	56°23.4'	19°02.6'	16:55	15	643.303
6	2017-05-20	42G9	28	132	60	20	2.8	90	56°37.0'	19°18.3'	56°37.1'	19°19.7'	07:10	15	385.361
7	2017-05-20	42G9	28	154	70/90	20	2.8	42	56°40.5'	19°49.0'	56°41.5'	19°50.8'	10:00	30	397.472
8	2017-05-20	42H0	28	74	49	20	3.0	10	56°37.7'	20°26.8'	56°39.2'	20°27.3'	14:30	30	607.884
9	2017-05-20	42H0	28	127	60	20	3.0	270	56°53.1'	20°16.6'	56°53.1'	20°14.7'	19:00	20	405.516
10	2017-05-21	42G9	28	167	55	20	2.8	240	56°52.5'	19°51.7'	56°52.1'	19°50.3'	07:45	20	1004.239
11	2017-05-21	43G9	28	176	65	20	2.8	33	57°03.7'	19°20.2'	57°04.9'	19°21.3'	13:45	30	383.188
12	2017-05-21	43H0	28	197	70	20	2.8	86	57°07.0'	20°03.3'	57°07.0'	20°05.0'	18:10	20	566.710
13	2017-05-22	43H0	28	90	60	20	2.8	93	57°06.6'	20°34.5'	57°06.5'	20°36.5'	07:25	20	416.562
14	2017-05-22	43H1	28	68	47	18	2.8	26	57°23.1'	21°07.7'	57°23.9'	21°08.3'	11:50	15	1496.580
15	2017-05-22	43H0	28	237	60	19	2.7	277	57°20.5'	20°05.8'	57°20.6'	20°04.3'	17:25	20	147.991
16	2017-05-23	44G9	28	102	60	20	3.0	0	57°29.4'	19°30.0'	57°30.7'	19°30.1'	07:40	30	423.020
17	2017-05-23	44H0	28	140	60	20	3.0	90	57°36.8'	20°31.3'	57°36.8'	20°33.8'	13:55	30	380.641
18	2017-05-23	44H1	28	63	42	20	3.0	185	57°36.2'	21°09.9'	57°34.9'	21°09.8'	17:40	30	144.340
19	2017-05-24	44H1/44H0	28	75	50	20	2.8	274	57°52.9'	21°01.6'	57°53.0'	20°58.7'	07:55	30	127.660
20	2017-05-24	44H0	28	103	65	18	3.0	275	57°52.8'	20°28.8'	57°52.9'	20°27.2'	11:15	20	375.858
21	2017-05-24	44G9	28	147	60	20	2.9	2	57°53.6'	19°54.4'	57°54.5'	19°54.5'	14:40	20	518.578
22	2017-05-24	45G9	28	185	65	20	2.8	140	58°03.3'	19°55.3'	58°02.1'	19°56.7'	17:10	30	261.898
												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 18-25.05.2017

SD 26		Sprat	Herring	Cod	Flounder	Three spined stickleback	Total
Samples taken	measurements	5	5	3	2		15
	analyses	5	2				7
Fish measured		1038	238	5	3		1284
Fish analysed		550	174				724
SD 28		Sprat	Herring	Cod	Flounder	Three spined stickleback	Total
Samples taken	measurements	17	17	14	6	5	59
	analyses	17	13				30
Fish measured		3510	2236	91	9	87	5933
Fish analysed		1738	1275				3013
SUM		Sprat	Herring	Cod	Flounder	Three spined stickleback	Total
Samples taken	measurements	22	22	17	8	5	74
	analyses	22	15	0	0	0	37
Fish measured		4548	2474	96	12	87	7217
Fish analysed		2288	1449	0	0	0	3737

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 18-25.05.2017

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	18-05-2017	SE	4	2	11	1020	96	115	5.79	12.99	3.69
2	18-05-2017	SE	4	2	12	1020	53	73	5.86	10.00	2.20
3	19-05-2017	SSE	4	2	12	1015	37	56	4.68	7.73	5.84
4	19-05-2017	SSE	4	2	11	1016	56	75	4.34	8.00	5.36
5	19-05-2017	SSE	4	2	11	1016	65	85	5.84	9.94	0.92
6	20-05-2017	SE	4	2	11	1014	60	80	5.46	9.34	2.88
7	20-05-2017	SSE	3	1	11	1014	70/90	90/110	6,12/6,81	10,40/12,06	1,29/2,21
8	20-05-2017	changable	1	1	13	1014	49	69	5.06	8.87	1.70
9	20-05-2017	changable	1	1	13	1015	60	80	5.78	9.82	1.26
10	21-05-2017	N	4	2	10	1018	55	75	4.54	7.29	6.95
11	21-05-2017	NNW	3	1	10	1020	65	85	5.05	8.89	1.42
12	21-05-2017	W	2	1	10	1020	70	90	5.65	9.90	0.73
13	22-05-2017	WNW	4	2	10	1019	60	80	5.13	9.06	1.93
14	22-05-2017	W	4	2	10	1018	47	65	4.50	8.14	5.11
15	22-05-2017	W	4	2	10	1017	60	79	4.33	8.02	4.26
16	23-05-2017	W	3	1	9	1013	60	80	5.00	8.86	1.24
17	23-05-2017	W	3	1	9	1013	60	80	5.39	9.38	1.01
18	23-05-2017	W	3	1	11	1013	42	62	4.21	7.47	4.87
19	24-05-2017	NNW	3	2	9	1012	50	70	3.93	7.96	3.66
20	24-05-2017	NW	3	2	10	1012	65	83	5.90	10.08	1.30
21	24-05-2017	NW	4	2	10	1012	60	80	4.70	8.73	1.82
22	24-05-2017	NW	4	2	10	1012	65	85	5.17	9.04	1.94
						Mean	60	79	5.18	9.22	2.76

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 18-25.05.2017

Haul number	Date	ICES rectangle	ICES SD	Total Cactch [kg]	Catch per species [kg]				
					sprat	herring	cod	flounder	threespine stickleback
					161789	161722	164712	172894	166365
1	2017-05-18	41G9	26	445.920	395.085	50.835			
2	2017-05-18	41G9	26	268.136	264.804	3.216		0.116	
3	2017-05-19	41H0	26	191.174	188.760	2.100	0.314		
4	2017-05-19	41G9	26	1311.947	1234.835	75.845	1.001	0.266	
5	2017-05-19	41G9	26	643.303	623.260	19.940	0.103		
6	2017-05-20	42G9	28	385.361	372.172	10.213	2.732	0.129	0.115
7	2017-05-20	42G9	28	397.472	346.773	47.287	2.966	0.446	
8	2017-05-20	42H0	28	607.884	514.922	92.298	0.491	0.173	
9	2017-05-20	42H0	28	405.516	352.255	51.245	1.784	0.230	0.002
10	2017-05-21	42G9	28	1004.239	984.407	18.453	1.379		
11	2017-05-21	43G9	28	383.188	300.839	81.421	0.928		
12	2017-05-21	43H0	28	566.710	496.330	63.230	7.150		
13	2017-05-22	43H0	28	416.562	370.228	38.412	7.536	0.386	
14	2017-05-22	43H1	28	1496.580	691.180	804.880	0.520		
15	2017-05-22	43H0	28	147.991	138.086	7.574	2.331		
16	2017-05-23	44G9	28	423.020	212.787	208.573	1.660		
17	2017-05-23	44H0	28	380.641	298.871	78.969	2.628	0.173	
18	2017-05-23	44H1	28	144.340	127.885	16.455			
19	2017-05-24	44H1/44H0	28	127.660	106.085	20.936			0.639
20	2017-05-24	44H0	28	375.858	342.517	32.728	0.538		0.075
21	2017-05-24	44G9	28	518.578	501.044	15.496	2.038		
22	2017-05-24	45G9	28	261.898	242.642	17.092	2.020	0.118	0.026
SD26					2706.744	151.936	1.418	0.382	0.000
SD28					6399.023	1605.262	36.701	1.655	0.857
SD26+28					9105.767	1757.198	38.119	2.037	0.857

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 18-25.05.2017

Table 5A

ICES	ICES	Trawl	Herring			Sprat			NASC	σ × 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	44H1	18,19	14.07	16.94	5.53	10.20	6.21	94.47	276.8	1.05963	-50.7
	44H0	17,19,20,21	15.22	21.34	3.06	10.65	6.54	96.94	1586.8	1.12728	-50.5
	44G9	16,21,22	17.27	28.68	4.92	10.74	6.81	95.08	553.6	1.19660	-50.2
	43H1	14	16.44	25.62	27.02	11.07	8.14	72.98	317.9	1.56428	-49.0
	43H0	12,13,14,15	16.40	25.51	15.10	10.96	7.39	84.90	562.6	1.37274	-49.6
	43G9	11,12,16,15	17.19	28.75	6.28	10.90	7.13	93.72	463.2	1.25075	-50.0
	42H0	8,9	16.23	25.22	3.95	10.49	6.39	96.05	911.8	1.12473	-50.5
	42G9	6,7,10,11	15.92	111.16	8.81	11.09	7.37	91.19	1525.2	1.29106	-49.9
26	41H0	3,4	16.19	49.47	1.63	11.10	7.53	98.37	272.6	1.19336	-50.2
	41G9	1,2,4,5	17.92	33.76	3.15	11.12	7.47	96.85	939.2	1.25070	-50.0

Table 5B

ICES	ICES	Area	ρ	Abundance, n × 10^6			n, %		Biomass, kg × 10^3		
SD	Rect.	nm^2	n × $10^6/nm^2$	ΣN	$N_{HERRING}$	N_{SPRAT}	herring	sprat	ΣW	$W_{HERRING}$	W_{SPRAT}
28	44H1	824.6	2.61	2153.7	119.1	2034.6	5.5	94.5	14645	2018	12627
	44H0	960.5	14.08	13520.4	414.0	13106.5	3.1	96.9	94498	8834	85665
	44G9	876.6	4.63	4055.6	199.7	3855.9	4.9	95.1	31986	5728	26258
	43H1	412.7	2.03	838.6	226.6	612.1	27.0	73.0	10788	5804	4984
	43H0	973.7	4.10	3990.3	602.6	3387.7	15.1	84.9	40421	15375	25047
	43G9	973.7	3.70	3606.3	226.6	3379.7	6.3	93.7	30607	6515	24092
	42H0	968.5	8.11	7851.9	309.8	7542.1	3.9	96.1	55994	7812	48182
	42G9	986.9	11.81	11658.7	1026.6	10632.1	8.8	91.2	192501	114114	78387
26	41H0	953.3	2.28	2178.0	35.4	2142.6	1.6	98.4	17880	1753	16127
	41G9	1000.0	7.51	7509.6	236.4	7273.2	3.1	96.9	62343	7983	54361

Table 6. 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 18-25.05.2017

Table 6A CANUM		Age group								Σ
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	44H1	35841.16	12452.18	20999.84	1916.85	2227.30	1075.85		884.24	75397.42
	44H0	80839.77	85848.92	303058.69	14942.02	13104.27	4974.64	2290.63	6043.26	511102.20
	44G9	41310.80	56129.44	210004.82	11249.16	7803.03	2451.79	1622.06	4524.32	335095.41
	43H1	69221.01	56475.55	181952.36	8130.72	10657.84	6592.48		6482.60	339512.56
	43H0	119874.18	138141.83	442567.01	30343.15	25773.66	13377.60	499.81	11013.23	781590.47
	43G9	49799.97	63061.34	263705.84	20193.65	14449.65	7291.89	1619.78	3907.13	424029.23
	42H0	115495.84	46026.81	136761.46	10879.52	10084.36	3320.27	1229.85	2828.55	326626.67
	42G9	52736.26	139740.05	519626.00	44229.15	22427.37	5692.61	4271.55	2379.96	791102.95
26	41H0	78607.52	75363.59	303016.50	49301.63	25853.03	3636.18	5105.73	1450.49	542334.66
	41G9	119701.92	127562.67	618289.01	75707.69	43008.68	7523.43	7926.49	6061.83	1005781.74

Table 6B n × 10^6		Age group								Σ
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	44H1	967.18	336.02	566.69	51.73	60.10	29.03		23.86	2034.61
	44H0	2073.02	2201.47	7771.50	383.17	336.04	127.57	58.74	154.97	13106.47
	44G9	475.35	645.87	2416.48	129.44	89.79	28.21	18.66	52.06	3855.86
	43H1	124.79	101.81	328.02	14.66	19.21	11.88		11.69	612.06
	43H0	519.57	598.75	1918.23	131.52	111.71	57.98	2.17	47.73	3387.66
	43G9	398.62	504.78	2110.84	161.64	115.66	58.37	12.97	31.27	3394.15
	42H0	2666.90	1062.80	3157.95	251.22	232.86	76.67	28.40	65.31	7542.11
	42G9	710.96	1883.88	7005.26	596.27	302.35	76.74	57.59	32.09	10665.14
26	41H0	310.53	297.71	1197.02	194.76	102.13	14.36	20.17	5.73	2142.41
	41G9	865.61	922.45	4471.09	547.47	311.01	54.40	57.32	43.84	7273.20

Table 6C n, %		Age group								Σ
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	44H1	47.54	16.52	27.85	2.54	2.95	1.43		1.17	100.00
	44H0	15.82	16.80	59.30	2.92	2.56	0.97	0.45	1.18	100.00
	44G9	12.33	16.75	62.67	3.36	2.33	0.73	0.48	1.35	100.00
	43H1	20.39	16.63	53.59	2.39	3.14	1.94		1.91	100.00
	43H0	15.34	17.67	56.62	3.88	3.30	1.71	0.06	1.41	100.00
	43G9	11.74	14.87	62.19	4.76	3.41	1.72	0.38	0.92	100.00
	42H0	35.36	14.09	41.87	3.33	3.09	1.02	0.38	0.87	100.00
	42G9	6.67	17.66	65.68	5.59	2.83	0.72	0.54	0.30	100.00
26	41H0	14.49	13.90	55.87	9.09	4.77	0.67	0.94	0.27	100.00
	41G9	11.90	12.68	61.47	7.53	4.28	0.75	0.79	0.60	100.00

Table 6D W, kg × 10^3		Age group								Σ
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	44H1	3758.82	2434.97	4659.55	531.76	631.70	339.65		271.00	12627.46
	44H0	7523.52	14189.51	54118.68	3405.92	3079.87	1281.01	566.97	1499.20	85664.67
	44G9	1807.27	4185.82	17261.13	1154.63	858.60	286.94	193.08	510.30	26257.78
	43H1	564.07	837.95	2888.84	170.43	233.80	147.61		141.46	4984.15
	43H0	2163.37	4247.59	14975.50	1233.46	1202.08	642.58	20.28	561.67	25046.53
	43G9	1488.50	3232.70	15174.95	1371.73	1128.67	583.33	132.45	344.91	23457.23
	42H0	10592.28	7187.85	24006.93	2140.94	2459.01	828.13	271.49	695.09	48181.72
	42G9	2504.37	12462.81	51938.90	5727.99	2846.49	889.67	592.88	381.19	77344.30
26	41H0	1167.73	2066.00	9634.78	1764.10	1030.38	147.96	240.39	74.06	16125.39
	41G9	3302.57	6183.91	34910.78	5042.88	3123.76	593.87	656.61	546.31	54360.67

Table 6E W, %		Age group								∑
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	44H1	29.77	19.28	36.90	4.21	5.00	2.69		2.15	100.00
	44H0	8.78	16.56	63.18	3.98	3.60	1.50	0.66	1.75	100.00
	44G9	6.88	15.94	65.74	4.40	3.27	1.09	0.74	1.94	100.00
	43H1	11.32	16.81	57.96	3.42	4.69	2.96		2.84	100.00
	43H0	8.64	16.96	59.79	4.92	4.80	2.57	0.08	2.24	100.00
	43G9	6.35	13.78	64.69	5.85	4.81	2.49	0.56	1.47	100.00
	42H0	21.98	14.92	49.83	4.44	5.10	1.72	0.56	1.44	100.00
	42G9	3.24	16.11	67.15	7.41	3.68	1.15	0.77	0.49	100.00
26	41H0	7.24	12.81	59.75	10.94	6.39	0.92	1.49	0.46	100.00
	41G9	6.08	11.38	64.22	9.28	5.75	1.09	1.21	1.00	100.00

Table 6F w, g		Age group								∑
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	44H1	3.89	7.25	8.22	10.28	10.51	11.70		11.36	6.21
	44H0	3.63	6.45	6.96	8.89	9.17	10.04	9.65	9.67	6.54
	44G9	3.80	6.48	7.14	8.92	9.56	10.17	10.34	9.80	6.81
	43H1	4.52	8.23	8.81	11.63	12.17	12.42		12.10	8.14
	43H0	4.16	7.09	7.81	9.38	10.76	11.08	9.36	11.77	7.39
	43G9	3.73	6.40	7.19	8.49	9.76	9.99	10.22	11.03	6.91
	42H0	3.97	6.76	7.60	8.52	10.56	10.80	9.56	10.64	6.39
	42G9	3.52	6.62	7.41	9.61	9.41	11.59	10.30	11.88	7.25
26	41H0	3.76	6.94	8.05	9.06	10.09	10.30	11.92	12.92	7.53
	41G9	3.82	6.70	7.81	9.21	10.04	10.92	11.46	12.46	7.47

Table 6G L, g		Age group								∑
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	
28	44H1	8.91	10.86	11.33	12.26	12.36	12.91		12.74	10.20
	44H0	8.87	10.66	10.92	12.01	12.10	12.53	12.68	12.36	10.65
	44G9	8.98	10.61	10.93	11.95	12.27	12.54	12.92	12.38	10.74
	43H1	9.19	11.15	11.43	12.66	13.02	13.25		12.76	11.07
	43H0	9.08	10.87	11.23	12.00	12.62	12.76	12.25	12.88	10.96
	43G9	8.93	10.67	11.10	11.76	12.39	12.46	12.81	12.93	10.90
	42H0	8.99	10.82	11.28	11.77	12.68	12.75	12.25	12.68	10.49
	42G9	8.81	10.79	11.20	12.28	12.22	13.10	12.50	13.56	11.08
26	41H0	9.02	10.79	11.42	11.93	12.35	12.36	13.25	13.54	11.10
	41G9	9.03	10.72	11.35	12.01	12.37	12.72	13.18	13.56	11.12

Table 7. 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 18-25.05.2017

Table 7A CANUM		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	44H1	217.20	566.79	2963.98	133.73	160.61	269.68		101.52	4413.51
	44H0	520.14	1219.21	8427.21	525.41	2369.28	1206.06	180.42	1694.94	16142.66
	44G9	337.47	436.39	4101.69	941.30	3803.47	2538.41	1244.64	3953.09	17356.47
	43H1		854.48	42824.54	11994.63	35877.48	23804.30	842.10	9486.02	125683.55
	43H0		1682.66	48473.08	12934.63	37970.84	25766.10	1287.53	10919.60	139034.44
	43G9		742.85	7828.49	1708.97	5833.57	4317.83	1787.78	5345.90	27565.40
	42H0		1557.70	5605.76	250.05	1956.81	1818.77	442.49	1783.86	13415.43
	42G9		12895.92	27811.34	4366.32	13513.89	8243.13	1202.64	7103.41	75136.65
26	41H0		796.97	4995.05	173.24	1024.77	772.31		1222.80	8985.14
	41G9		1336.86	10482.96	1042.04	5321.24	5379.57	1040.96	8090.95	32694.58

Table 7B n × 10^6		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	44H1	5.9	15.3	80.0	3.6	4.3	7.3		2.74	119.1
	44H0	13.3	31.3	216.1	13.5	60.8	30.9	4.6	43.46	414.0
	44G9	3.9	5.0	47.2	10.8	43.8	29.2	14.3	45.49	199.7
	43H1		1.5	77.2	21.6	64.7	42.9	1.5	17.10	226.6
	43H0		7.3	210.1	56.1	164.6	111.7	5.6	47.33	602.6
	43G9		5.9	62.7	13.7	46.7	34.6	14.3	42.79	220.6
	42H0		36.0	129.4	5.8	45.2	42.0	10.2	41.19	309.8
	42G9		173.9	374.9	58.9	182.2	111.1	16.2	95.76	1012.9
26	41H0		3.1	19.7	0.7	4.0	3.1		4.83	35.5
	41G9		9.7	75.8	7.5	38.5	38.9	7.5	58.51	236.4

Table 7C n, %		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	44H1	4.92	12.84	67.16	3.03	3.64	6.11		2.30	100.00
	44H0	3.22	7.55	52.20	3.25	14.68	7.47	1.12	10.50	100.00
	44G9	1.94	2.51	23.63	5.42	21.91	14.63	7.17	22.78	100.00
	43H1		0.68	34.07	9.54	28.55	18.94	0.67	7.55	100.00
	43H0		1.21	34.86	9.30	27.31	18.53	0.93	7.85	100.00
	43G9		2.69	28.40	6.20	21.16	15.66	6.49	19.39	100.00
	42H0		11.61	41.79	1.86	14.59	13.56	3.30	13.30	100.00
	42G9		17.16	37.01	5.81	17.99	10.97	1.60	9.45	100.00
26	41H0		8.87	55.59	1.93	11.41	8.60		13.61	100.00
	41G9		4.09	32.06	3.19	16.28	16.45	3.18	24.75	100.00

Table 7D W, kg × 10^3		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	44H1	39.26	218.41	1275.41	87.33	105.84	210.76		81.01	2018.01
	44H0	85.50	464.33	3640.76	301.12	1574.94	893.70	128.53	1744.85	8833.74
	44G9	24.37	71.08	952.73	289.86	1282.48	900.11	515.50	1692.14	5728.27
	43H1		37.51	1641.71	516.02	1684.53	1242.40	57.01	624.88	5804.05
	43H0		145.39	4380.35	1340.50	4299.96	3251.81	198.14	1758.42	15374.56
	43G9		91.07	1277.70	352.94	1373.71	1097.04	523.00	1627.29	6342.76
	42H0		657.98	2485.00	141.82	1303.78	1238.08	426.34	1559.38	7812.37
	42G9		3413.79	7071.95	1293.50	4873.59	3494.05	511.00	3628.23	24286.12
26	41H0		53.22	379.12	18.89	131.41	112.39		220.40	915.43
	41G9		193.86	1582.97	199.15	1343.58	1481.33	298.84	2882.97	7982.71

Table 7E W, %		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	44H1	1.95	10.82	63.20	4.33	5.24	10.44		4.01	100.00
	44H0	0.97	5.26	41.21	3.41	17.83	10.12	1.45	19.75	100.00
	44G9	0.43	1.24	16.63	5.06	22.39	15.71	9.00	29.54	100.00
	43H1		0.65	28.29	8.89	29.02	21.41	0.98	10.77	100.00
	43H0		0.95	28.49	8.72	27.97	21.15	1.29	11.44	100.00
	43G9		1.44	20.14	5.56	21.66	17.30	8.25	25.66	100.00
	42H0		8.42	31.81	1.82	16.69	15.85	5.46	19.96	100.00
	42G9		14.06	29.12	5.33	20.07	14.39	2.10	14.94	100.00
26	41H0		5.81	41.41	2.06	14.35	12.28		24.08	100.00
	41G9		2.43	19.83	2.49	16.83	18.56	3.74	36.12	100.00

Table 7F w, g		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	44H1	6.70	14.28	15.95	24.20	24.42	28.96		29.57	16.94
	44H0	6.41	14.85	16.85	22.35	25.92	28.90	27.78	40.14	21.34
	44G9	6.28	14.16	20.19	26.76	29.30	30.82	35.99	37.20	28.68
	43H1		24.35	21.26	23.86	26.04	28.95	37.55	36.54	25.62
	43H0		19.94	20.85	23.91	26.13	29.12	35.50	37.15	25.51
	43G9		15.32	20.39	25.80	29.42	31.74	36.55	38.03	28.75
	42H0		18.29	19.20	24.56	28.85	29.48	41.73	37.86	25.22
	42G9		19.64	18.86	21.97	26.75	31.44	31.52	37.89	23.98
26	41H0		16.91	19.21	27.61	32.46	36.84		45.63	25.79
	41G9		20.05	20.88	26.43	34.92	38.08	39.70	49.27	33.76

Table 7G L, g		Age group								
ICES SD	ICES Rect.	1	2	3	4	5	6	7	8+	∑
28	44H1	10.20	13.25	13.85	16.28	16.32	17.51		17.65	14.07
	44H0	10.19	13.44	14.10	15.83	16.57	17.53	17.27	19.73	15.22
	44G9	10.13	13.21	15.08	17.01	17.53	17.91	19.13	19.40	17.27
	43H1		16.25	15.21	16.05	16.63	17.38	19.25	19.18	16.44
	43H0		14.96	15.11	16.07	16.64	17.41	18.68	19.24	16.40
	43G9		13.59	15.11	16.65	17.42	17.93	19.04	19.44	17.19
	42H0		14.44	14.69	16.22	17.38	17.52	19.87	19.15	16.23
	42G9		15.05	14.55	15.76	16.91	17.81	17.91	18.58	15.92
26	41H0		14.16	14.79	16.85	17.82	18.90		20.15	16.20
	41G9		14.87	15.16	16.51	18.25	19.07	19.34	21.00	17.92

Table 8. 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 18-25.05.2017

Aquatory	Northern part		Central part		Southern part	
Depth strata	>70m	<70m	>70m	<70m	>70m	<70m
Eggs (per $1m^2$)	217	86	618	20	439	22.9
Larvae (per $1m^2$)	28	5.7	166	0	46	0
Eggs (per 10 min. of haul on the water surface)	0	0	0.6	0	1.8	20
Larvae (per 10 min. of haul on the water surface)	27	4	167	11	54	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 9. 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 18-25.05.2017

Species	Biomass (mg/m^3)
Acartia spp.	20.42
Pseudocalanus sp.	12.21
Temora longicornis	24.51
Centropages hamatus	4.39
Eurytemora affinis	0.86
Limnocalanus macrurus	
Oithona sp.	0.04
Bosmina coregoni	0.03
Evadne nordmanni	13.83
Podon spp.	0.19
Synchaeta spp.	137.61
Keratella spp.	
Bivalvia larvae	0.02
Fritillaria borealis	25.19
Pleurobrachia pileus	
Polychaeta larvae	4.42
Copepoda	**62.43**
Cladocera	**14.05**
Eurotatoria	**137.61**
Varia	**29.63**
Total	**243.72**

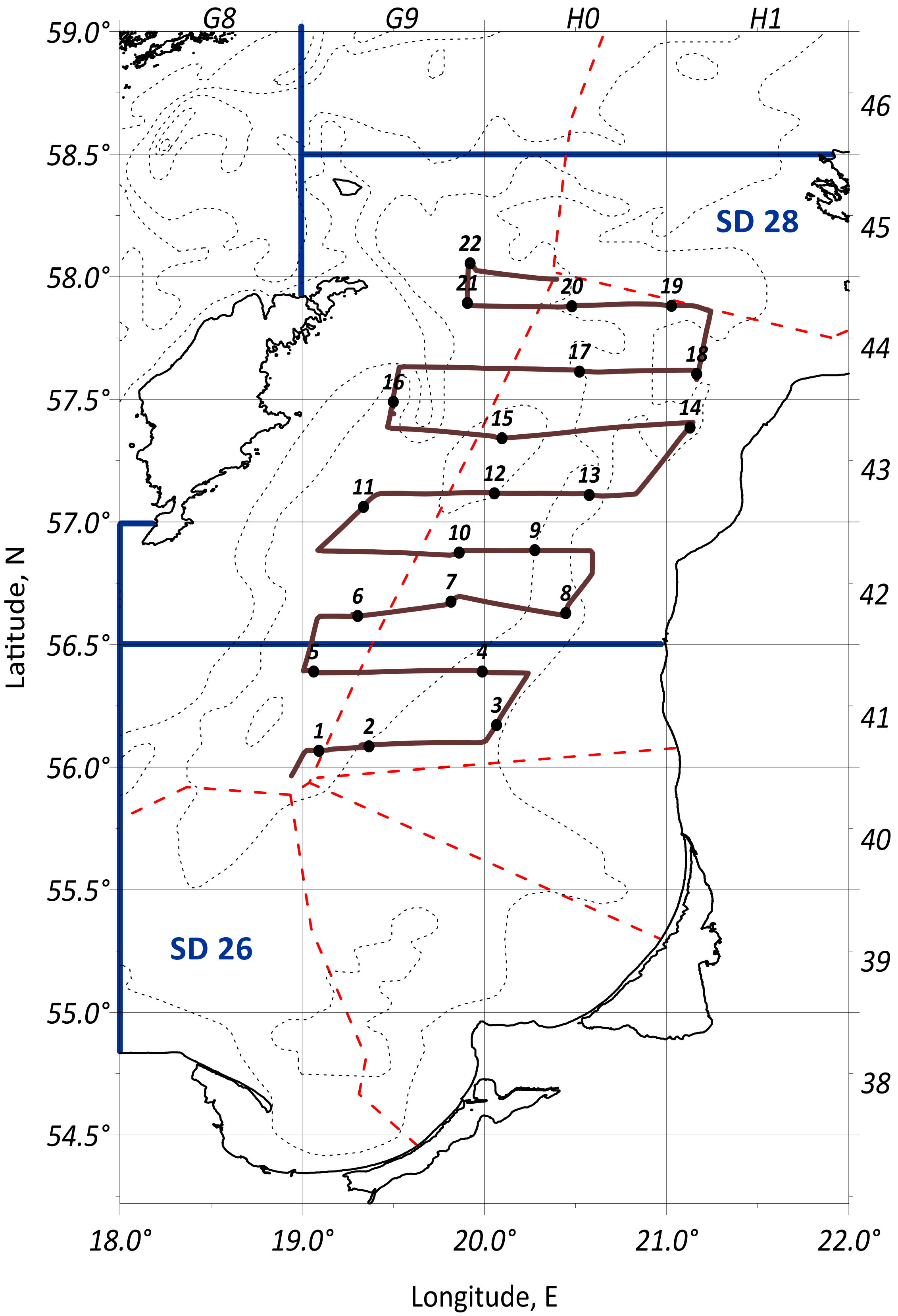


Figure 1: Cruise track design and trawling positions of the Latvian-Polish BASS on the r/v "Baltica" in the period of 18-25.05.2017.

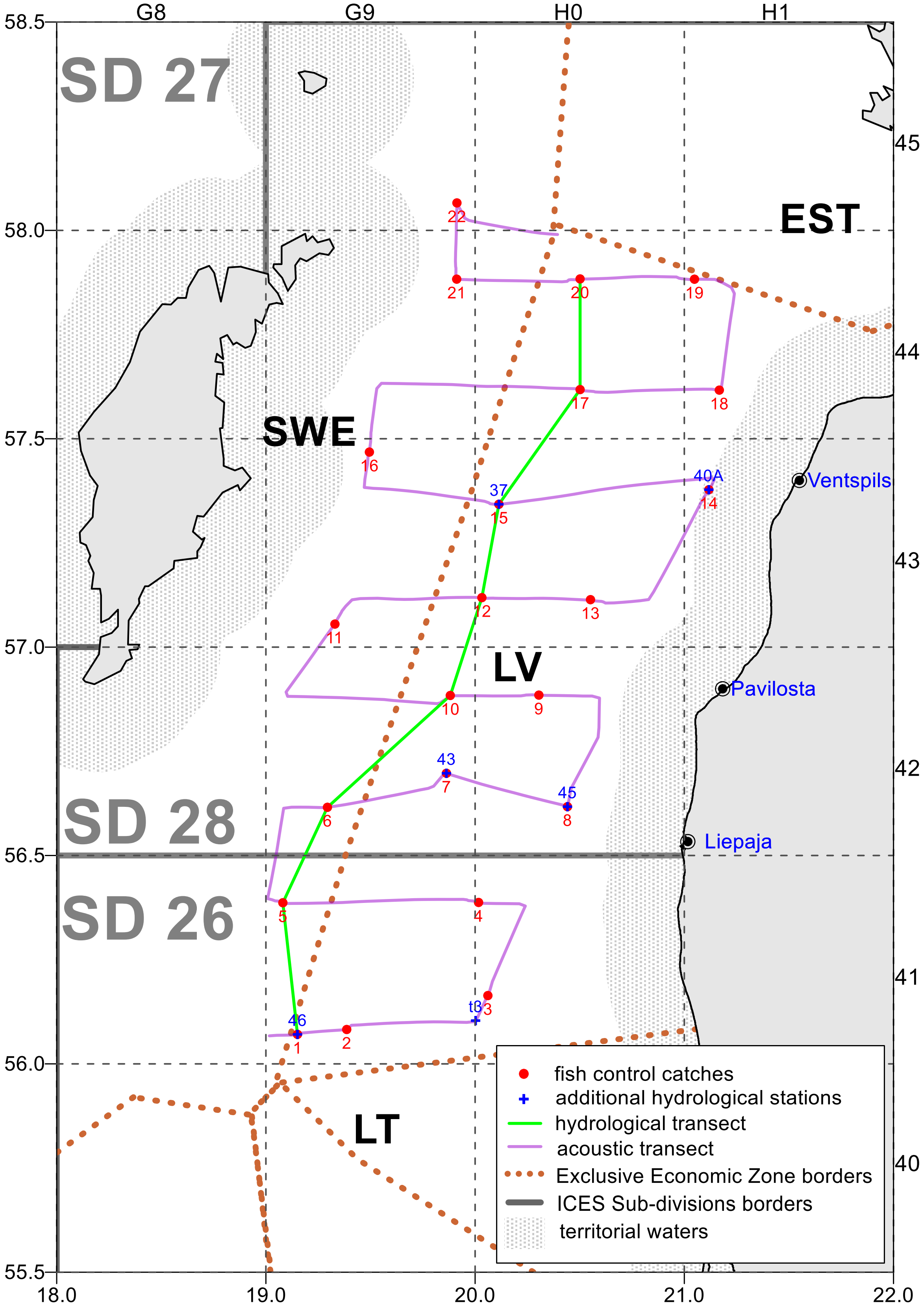


Figure 2: Locations of the hydrological, ichthyoplankton and zooplankton stations performed during the Latvian-Polish BASS on the r/v "Baltica" in the period of 18-25.05.2017.

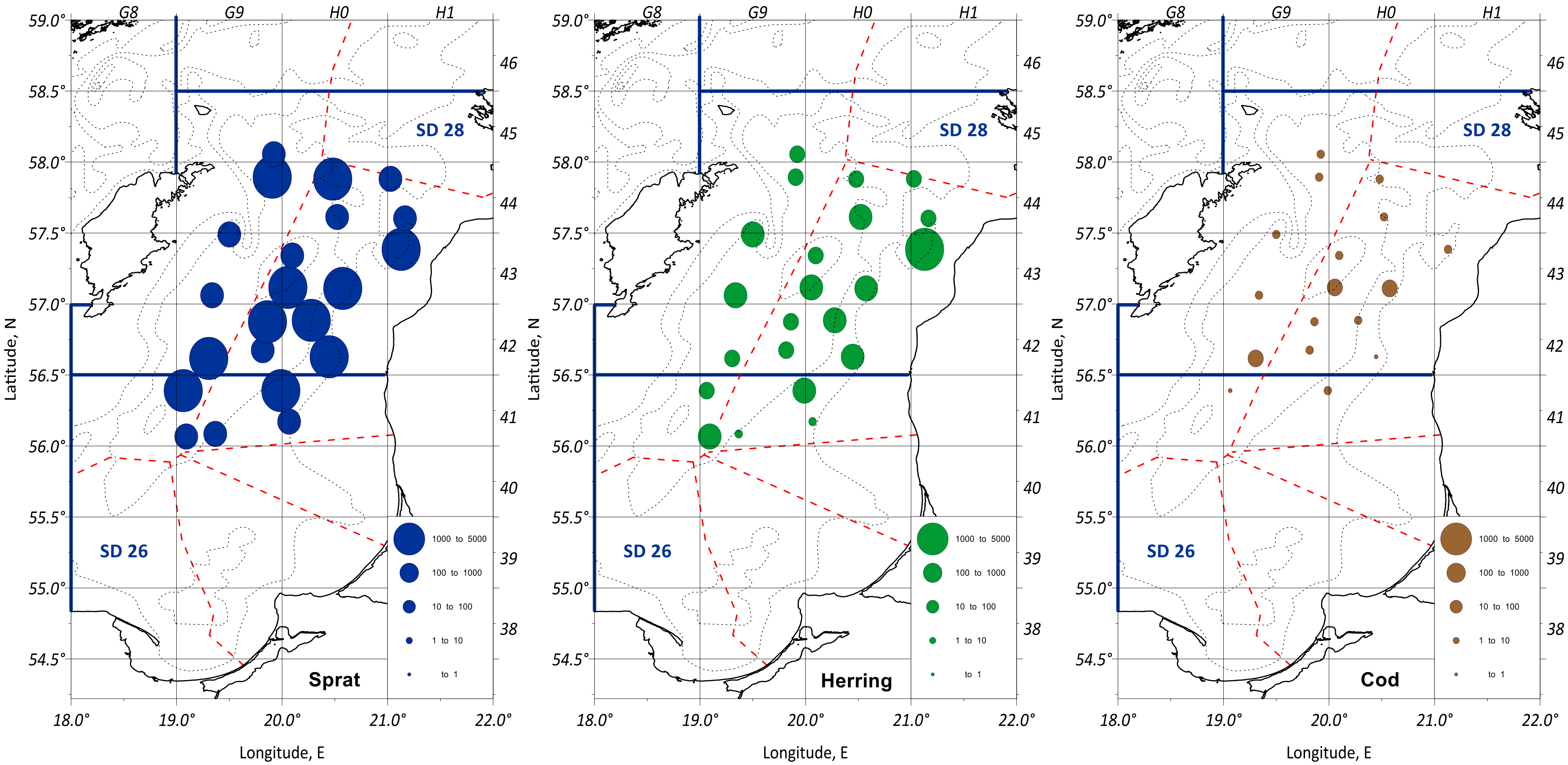


Figure 3: CPUE [kg/h] ranges distribution of dominant fish in the catch hauls in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 18-25.05.2017.

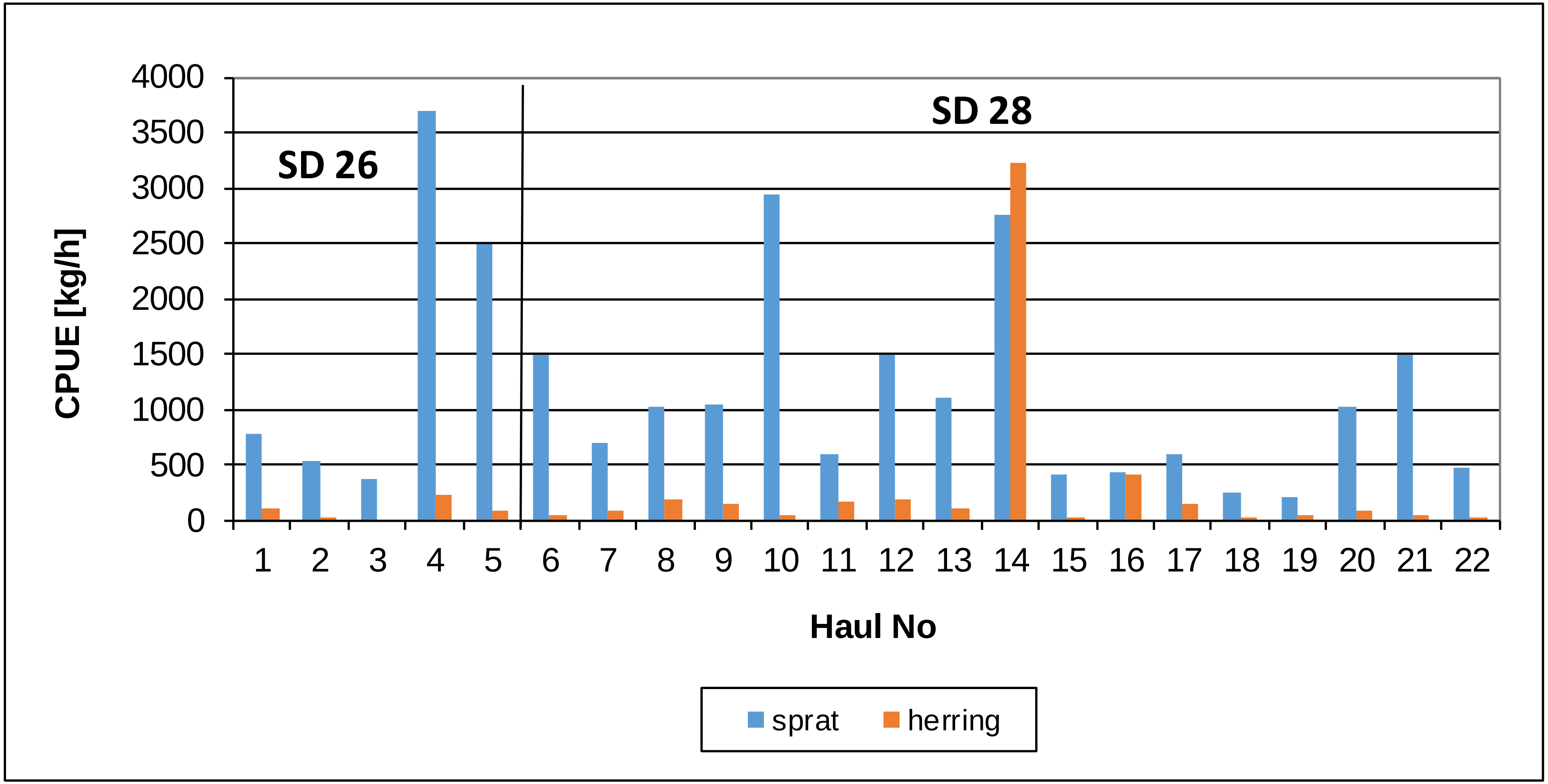


Figure 4: CPUE [kg/h] of dominant pelagic fish in the catch hauls in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 18-25.05.2017.

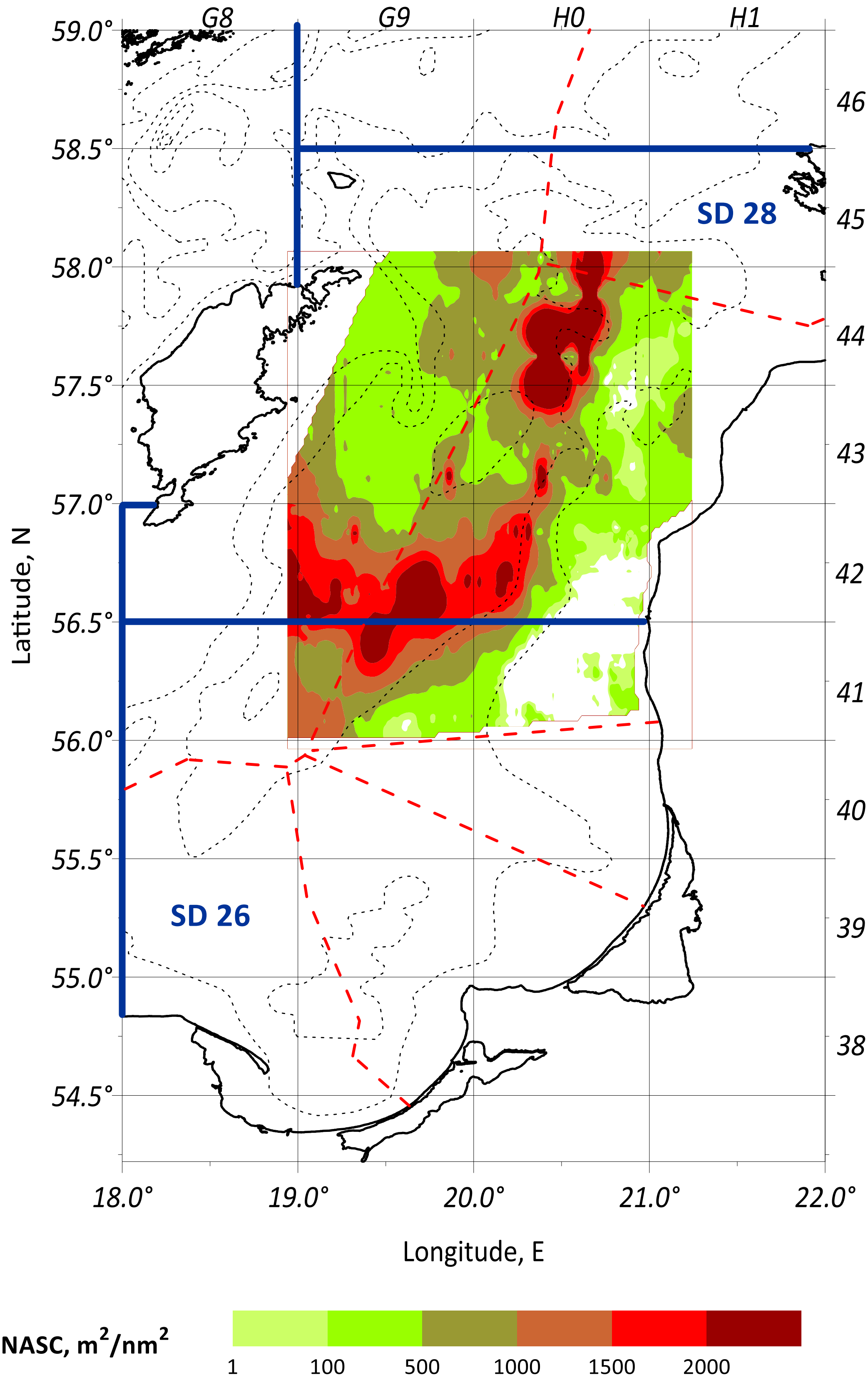


Figure 5: Acoustic parameter NASC distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 18-25.05.2017.

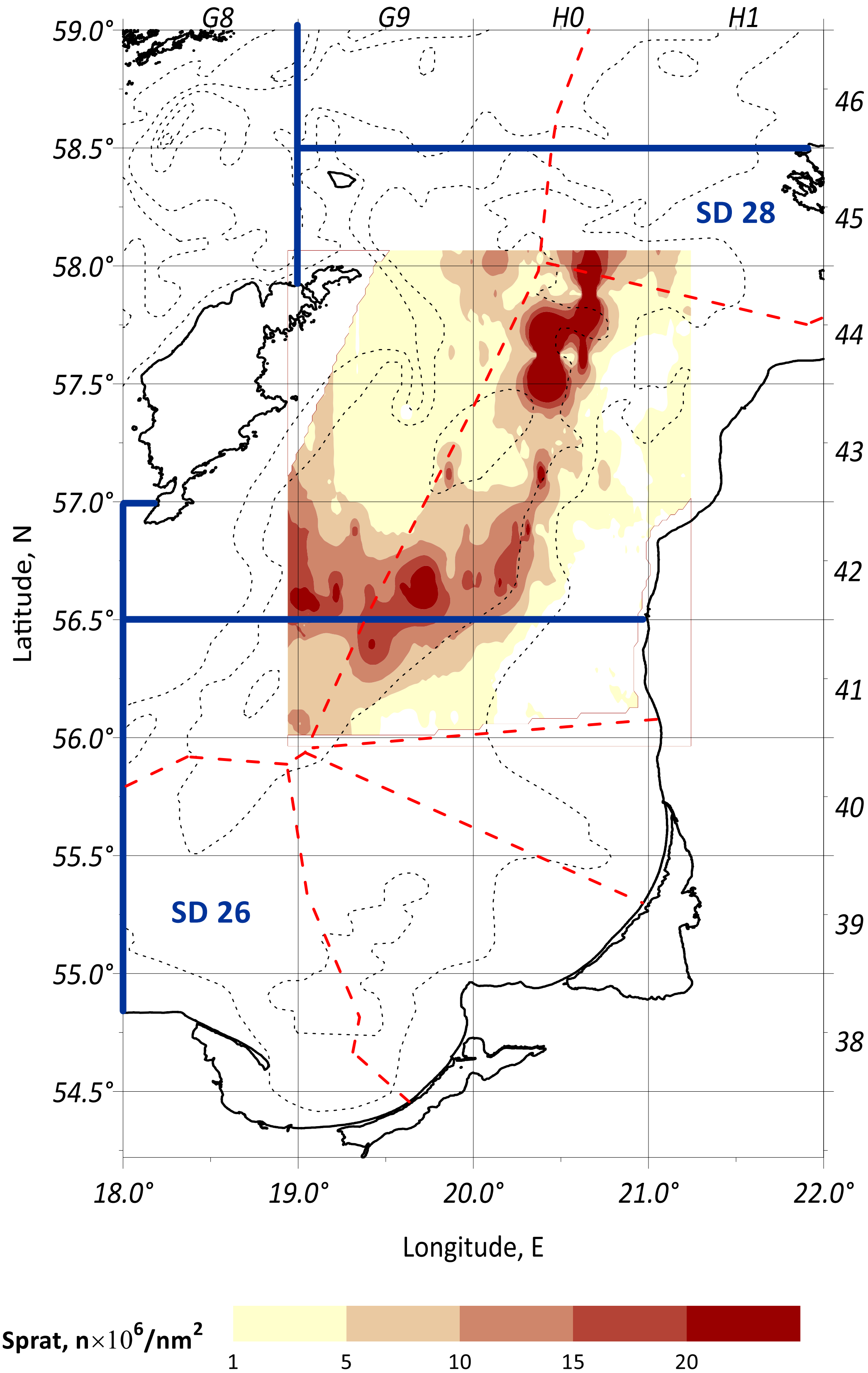


Figure 6: Sprat distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 18-25.05.2017.

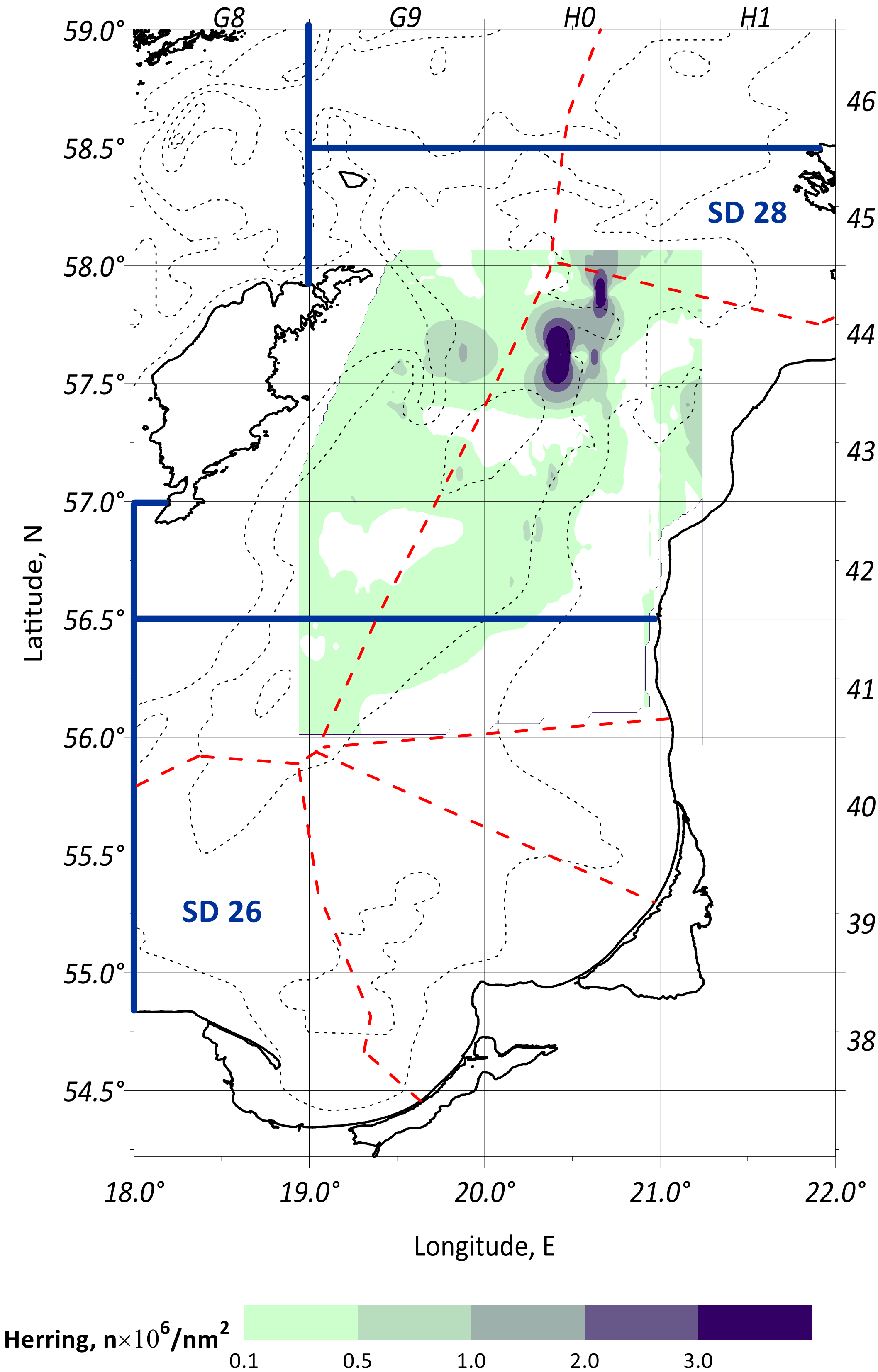


Figure 7: Herring distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 18-25.05.2017.

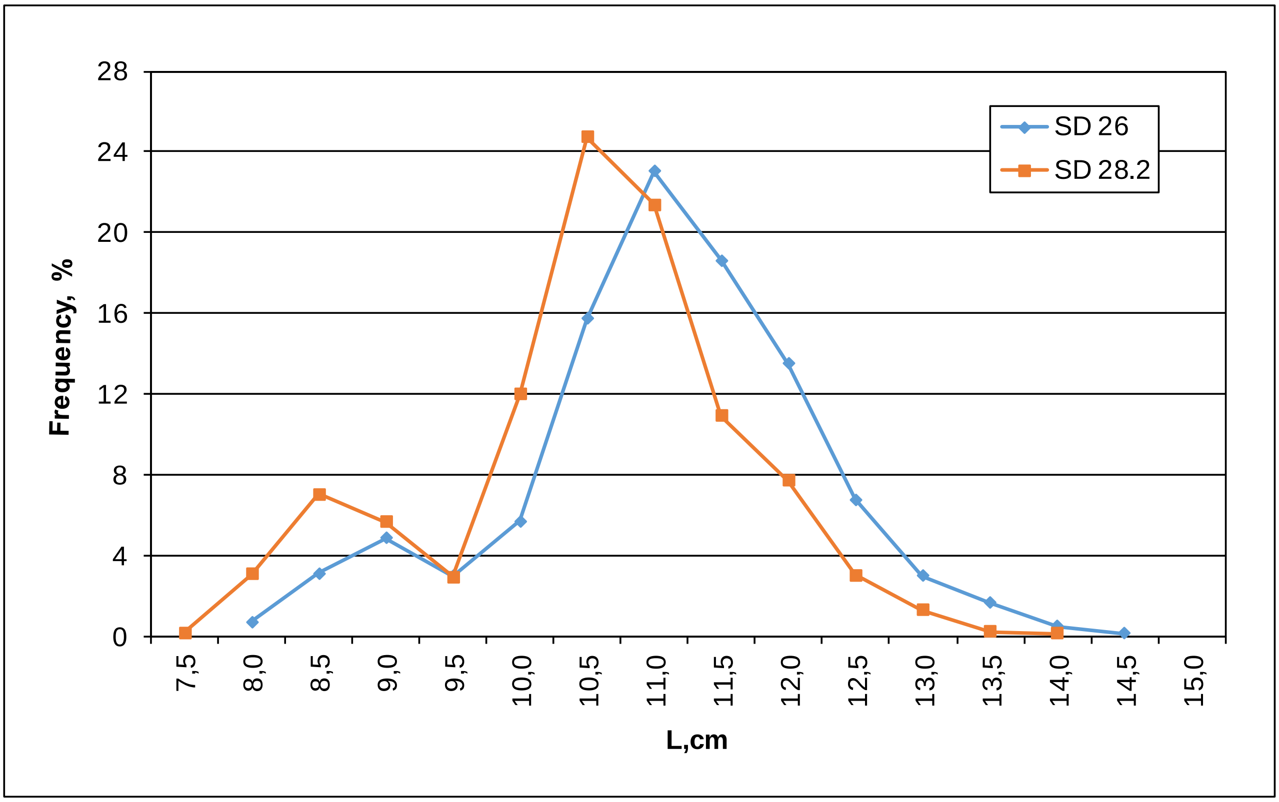


Figure 8: Sprat length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 18-25.05.2017.

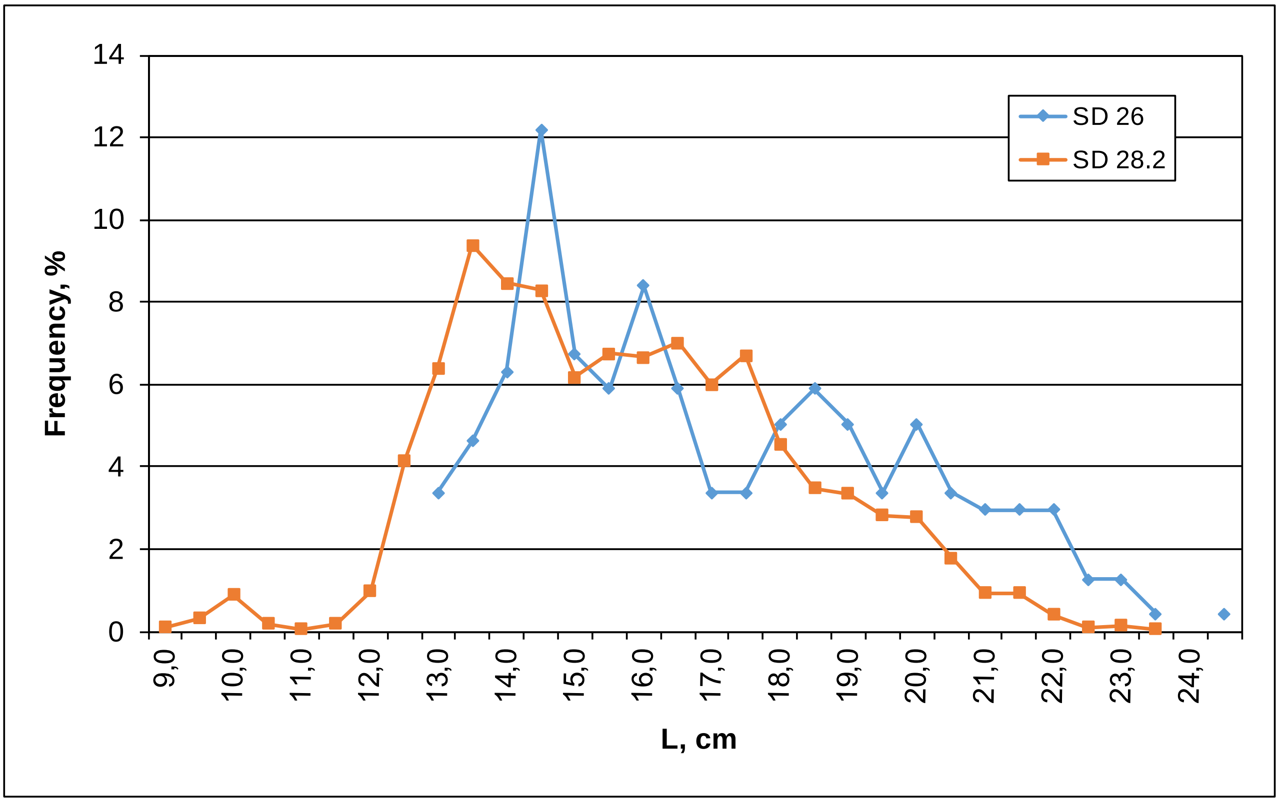


Figure 9: Herring length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 18-25.05.2017.

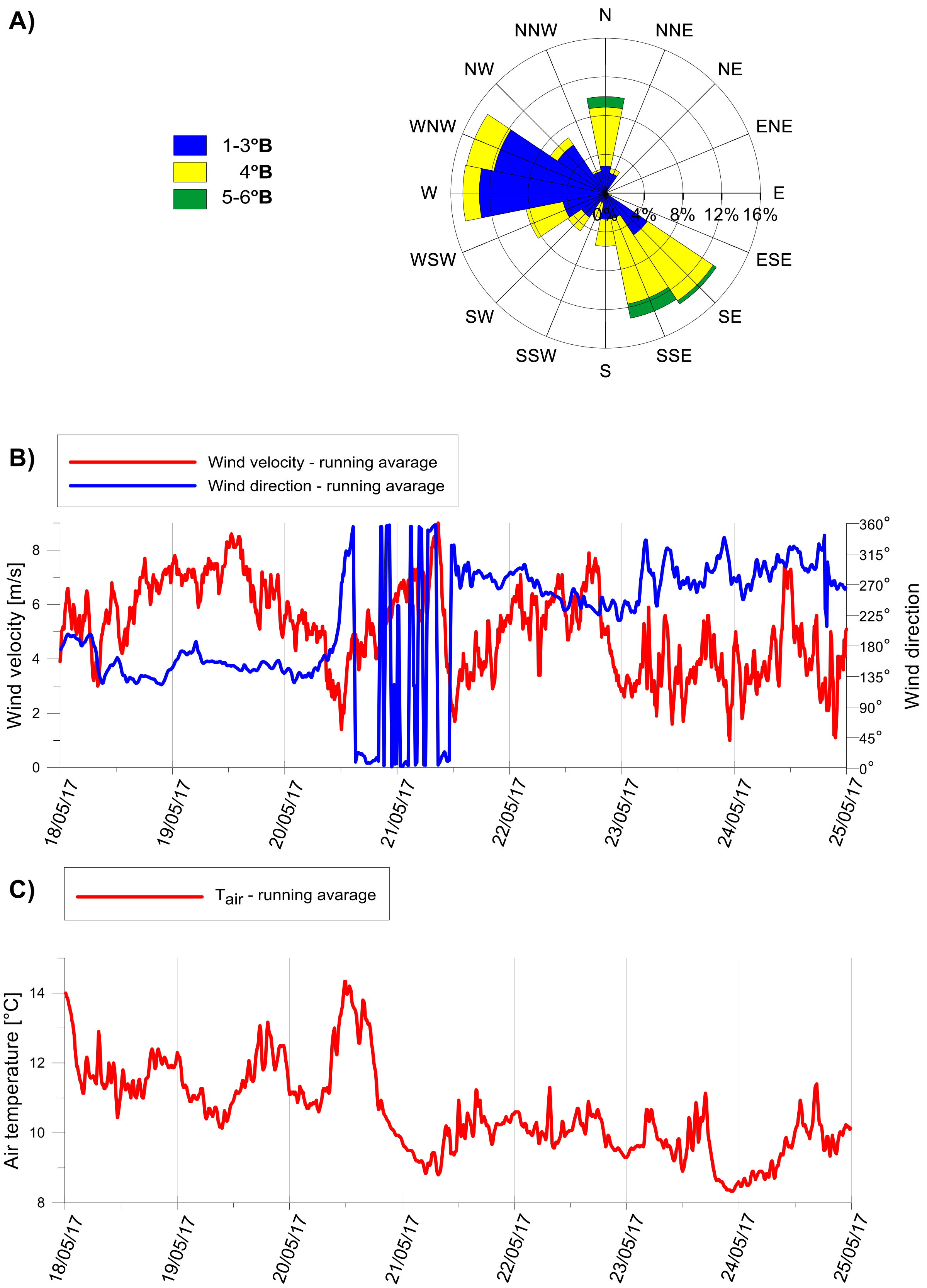


Figure 10: Changes of the main meteorological parameters (wind force, direction and the daily air temperature) during the Latvian-Polish BASS in the Baltic Sea ICES SD 26N and 28.2 conducted by r/v "Baltica" in the period of 18-25.05.2017

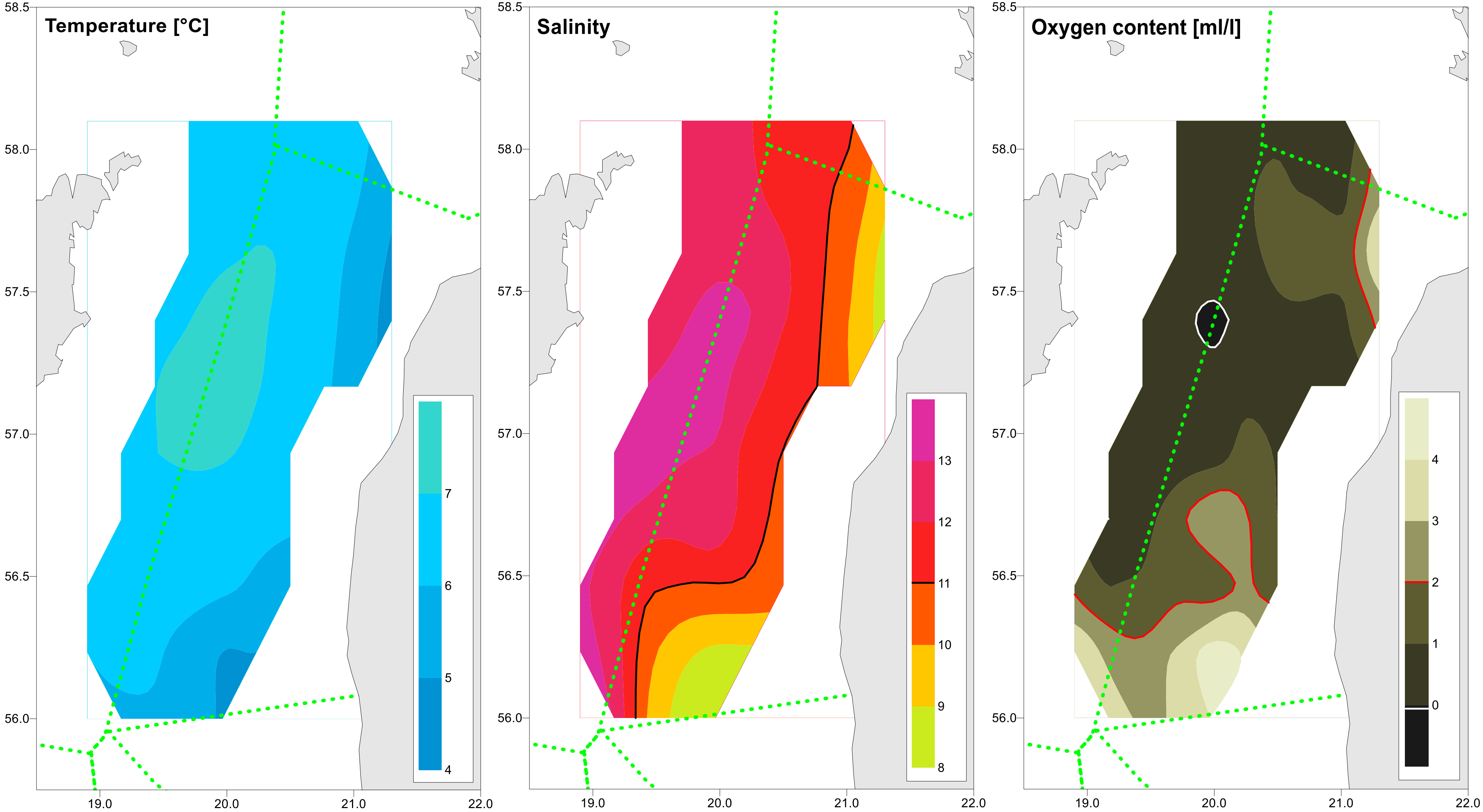
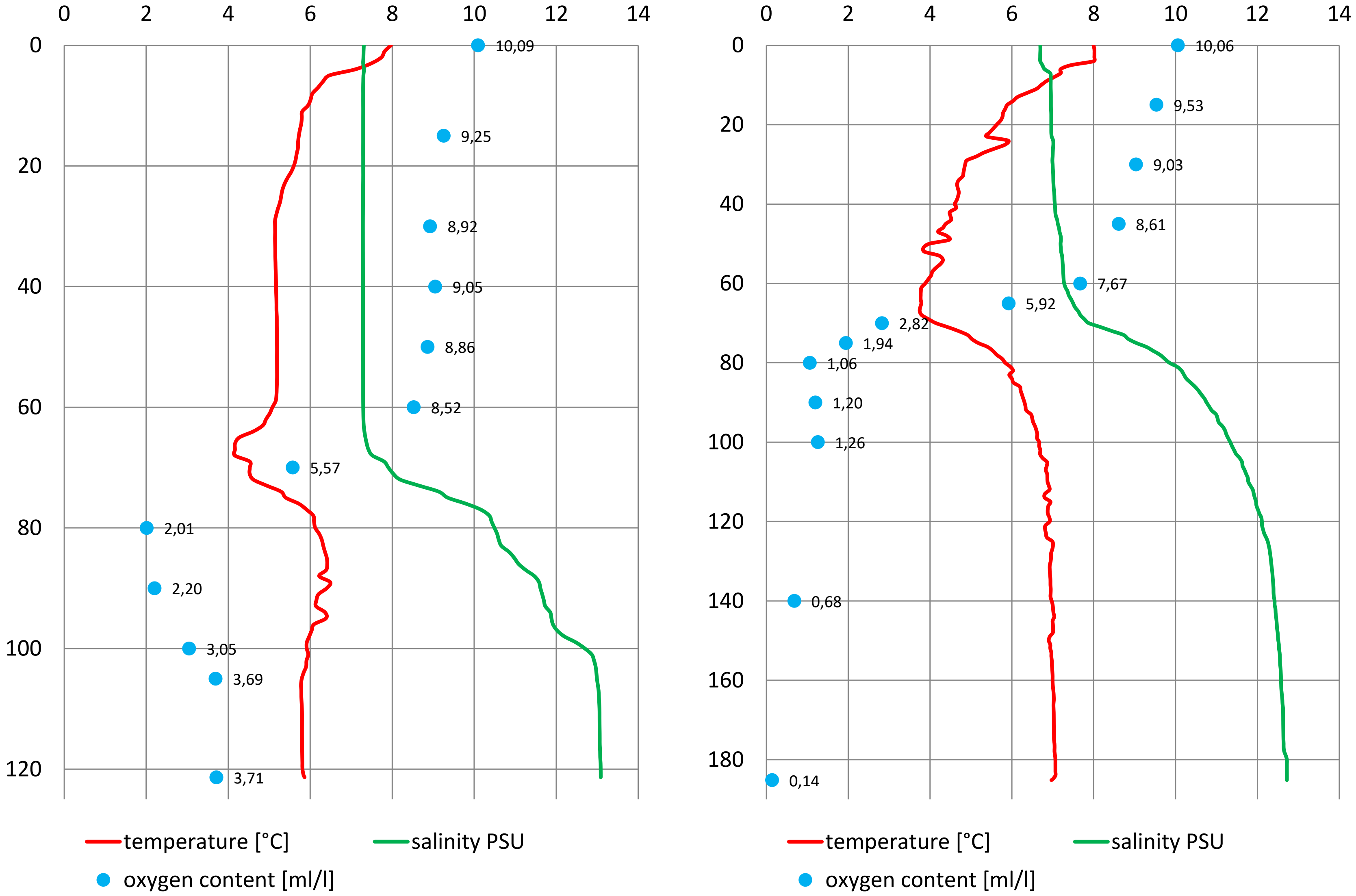


Figure 11: Horizontal distribution of the main hydrological parameters (temperature, salinity, oxygen content) measured in the bottom water layer of the Gotland Deep in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS conducted by r/v "Baltica" in the period of 18-25.05.2017.



Station H1 **Station H22**

Figure 12: Vertical distribution of the seawater temperature, salinity and oxygen content at the independent hydrological stations in the southern part (Station H1) and the northern part (Station H22) 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 the period of 18-25.05.2017.

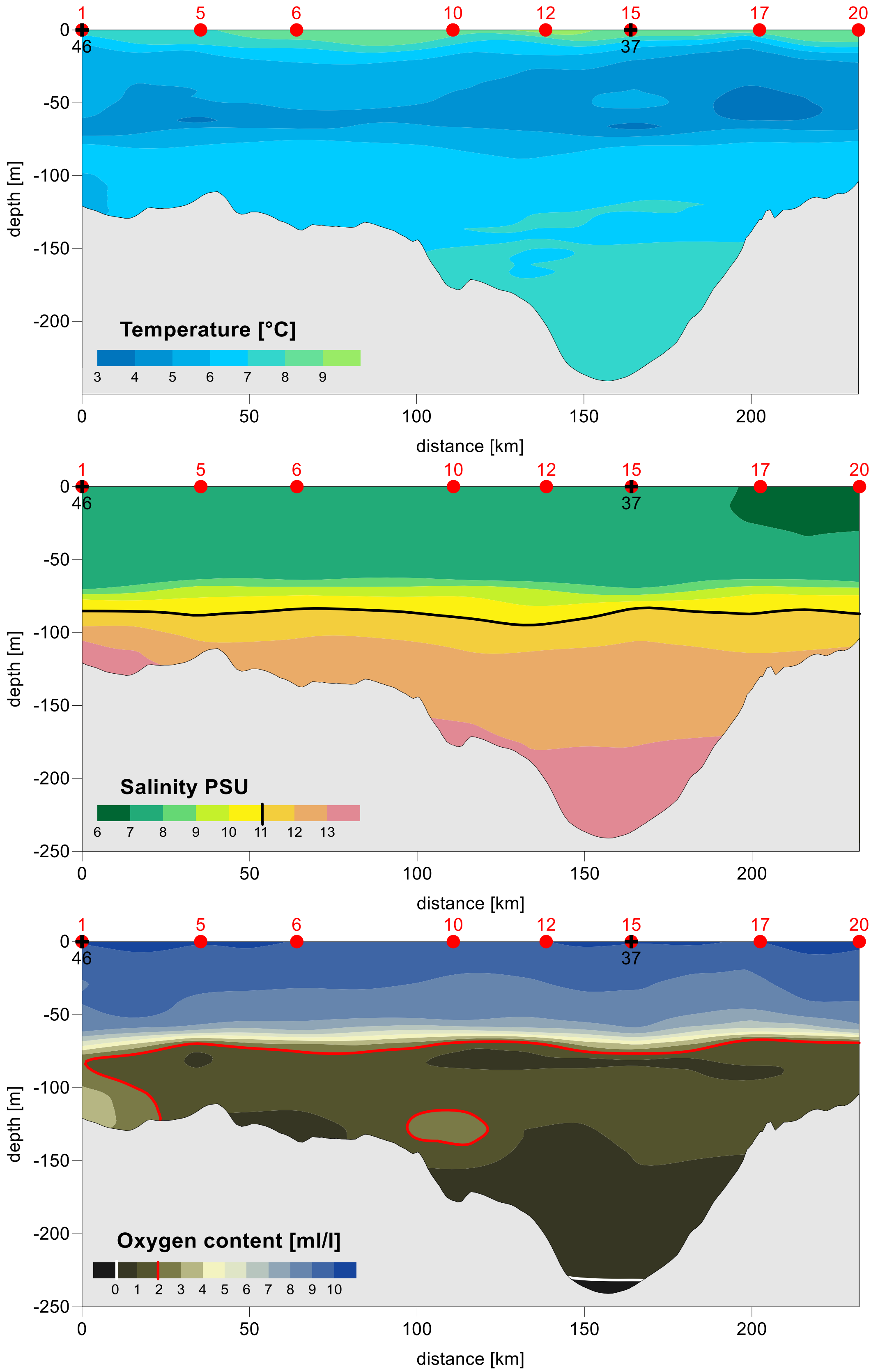


Figure 13: Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological profile in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BASS survey conducted by r/v "Baltica" in the period of 18-25.05.2017

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

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

(Vessel “DARIUS”; 10.05 - 11.05.2017)

Klaipeda, May, 2017
Lithuania

1 INTRODUCTION

The main objective is to assess clupeids resources in the Baltic Sea. The Lithuanian survey is coordinated within the frame of the **Baltic International Spring 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).

2 METHODS

2.1 Participants

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 cruise of BASS survey took place from 10-th to 11-th of May 2017. The cruise was intended to cover parts of ICES subdivisions (SD) 26, constituting the Lithuanian Exclusive Economic zone in 40H0 and 40G9 rectangles.

2.3 Survey design

The statistical rectangles were used as strata (ICES 2016). 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 2.8 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 1520 nm^2 and the distance used for acoustic estimates was 125 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 (10 of May 2017) at the site of 30 m depth, located 3.5 nm northwest of Klaipeda harbour according to the BIAS manual (ICES 2016). 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 2016). 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 1 m 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 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. 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 σ was calculated according to the following target strength-length (TS) relationships:

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

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

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

3 RESULTS

3.1 Biological data

969 herrings and 1532 sprats and 503 herrings were measured and 483 sprats were aged in 7 trawl hauls (Fig. 1)

The results of the catch composition are presented in Table 1. In all catches composition was dominated by sprat (from 65% to 100%).

The length distributions of herring and sprat of the May 2017 were presented in Fig.2 and Fig.3. Herring catches were dominated by 13-14 cm length classes (79%) and 14.1% of them 2016 herring generation. It both rectangles dominated 3 year fish (Table 10, 12).

Sprat dominated by 8.0 cm length class in 40H0 ICES rectangle (72.7%). And 66% of sprats dominated by 10.0 – 11.0 cm length classes in 40G 9 rectangle witch age were 3-4 years old fishes.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean S_a, the mean scattering cross section$\boldsymbol{\sigma}$, the estimated total number of fish, the percentages of herring, sprat per rectangle are shown in Table 2-14.

3.3 Abundance estimates

Vessel “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 Tables 5, 10. The estimated number sprat and herring by age group and rectangle are given in Table 6, 11. The estimates of sprat and herring biomass by age group and rectangle are summarised in Table 7, 12. The corresponding mean weights and mean length by age group and rectangle for each species are shown in Table 8-9 and 13-14.

The herring stock was estimated to be $408.5 \cdot 10^6$ fishes or about 11014 tonnes.

The estimated sprat stock was $12802.7 \cdot 10^6$ fish or 86674 tonnes.

3.4. Hydrographic data

Hydrographic data by hauls presented in the Table 15. The seawater temperature was 6.9 ºC in the surface layer in the first haul. Water temperature in others hauls was from 5 to 9 ºC. The first haul was difference to others caused by wind direction. Wind direction was south-east in the first half cruise. Later wind direction changed to the east. There was no thermocline in 2017 of May

(Table.15). Salinity was from 7 to 8 ‰ in all hauls and depts. The oxygen-condition was excellent in all hauls and depts.

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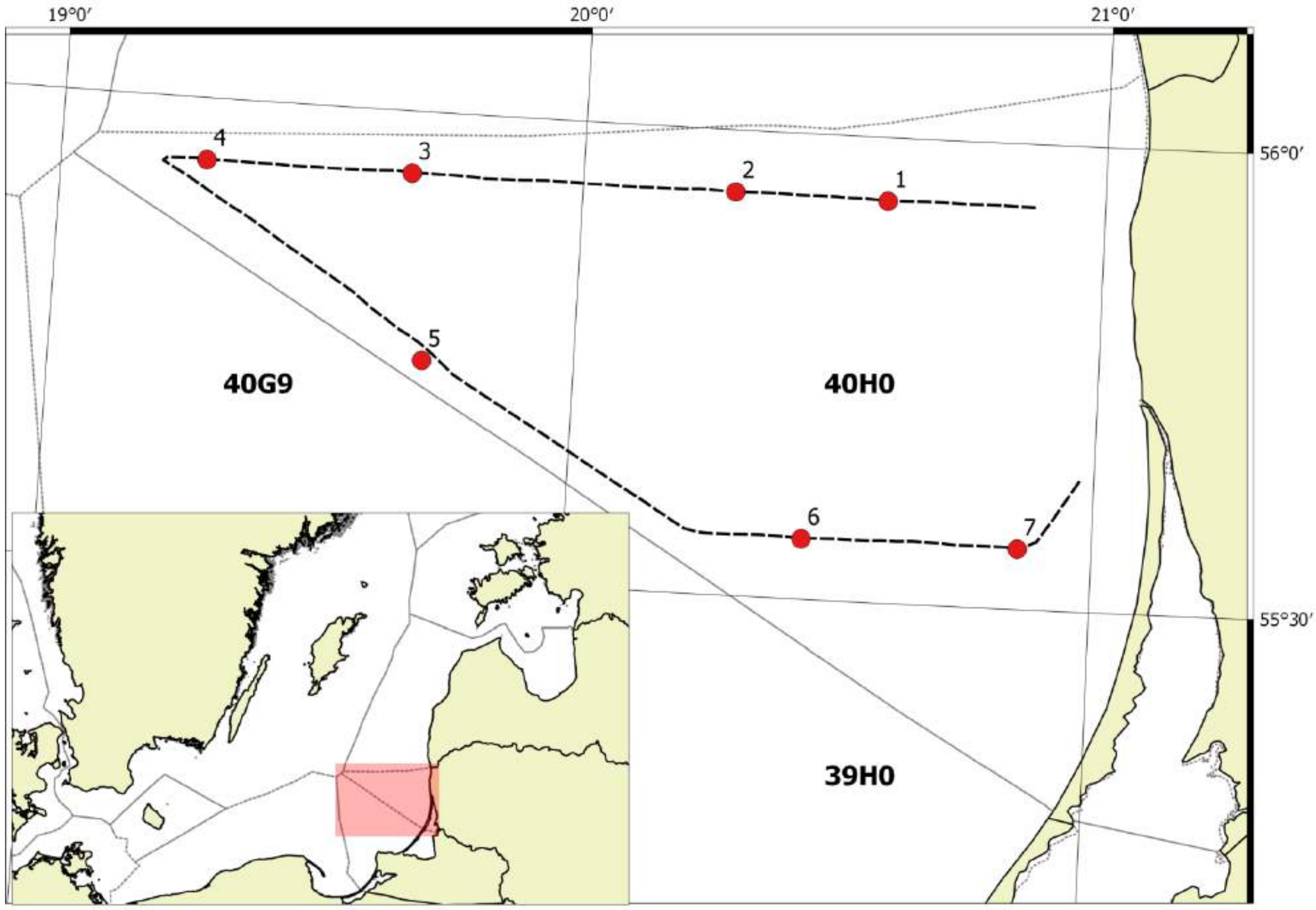

Figure1 The survey grid ant trawl hauls position of R/V “Darius” 10-11 May 2017

Table 1 Catch composition (kg/1hour) per haul (R/V "Darius", 10-11.05.2017)

ICES subdivision 26							
Haul No	1	2	3	4	5	6	7
Date	2017.05.10	2017.05.10	2017.05.10	2017.05.10	2017.05.11	2017.05.11	2017.05.11
Validity	Valid	Valid	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	40H0	40H0	40G9	40G9	40G9	40H0	40H0
Clupea hrengus		28.5	4.6		85.6	45.72	182.22
Sprattus spratus		151.5	673.4	100.00	154.4	194.28	617.78
Gasterosteus aculeatus		0.001		0.004			
Total		180.001	678.0	100.004	240.0	240.0	800.0

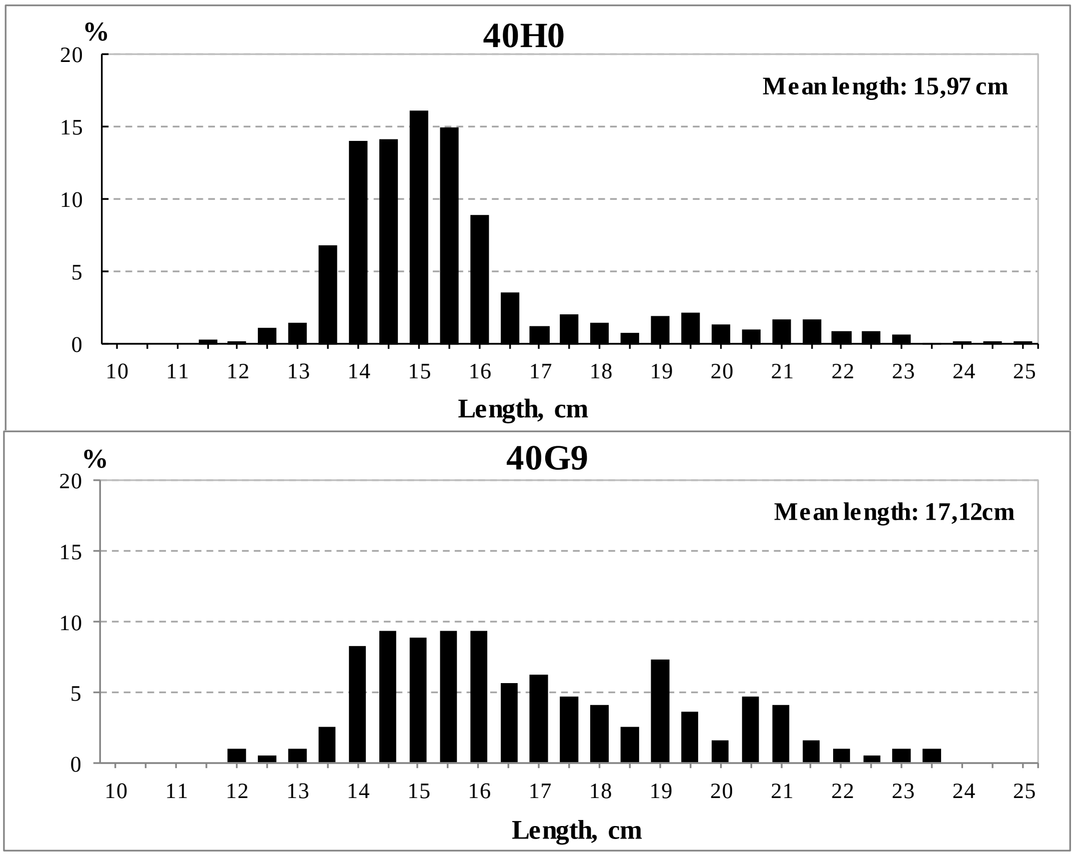

Figure 3 Length distribution of sprat (%) (R/V "Darius", 10-11.05.2017)

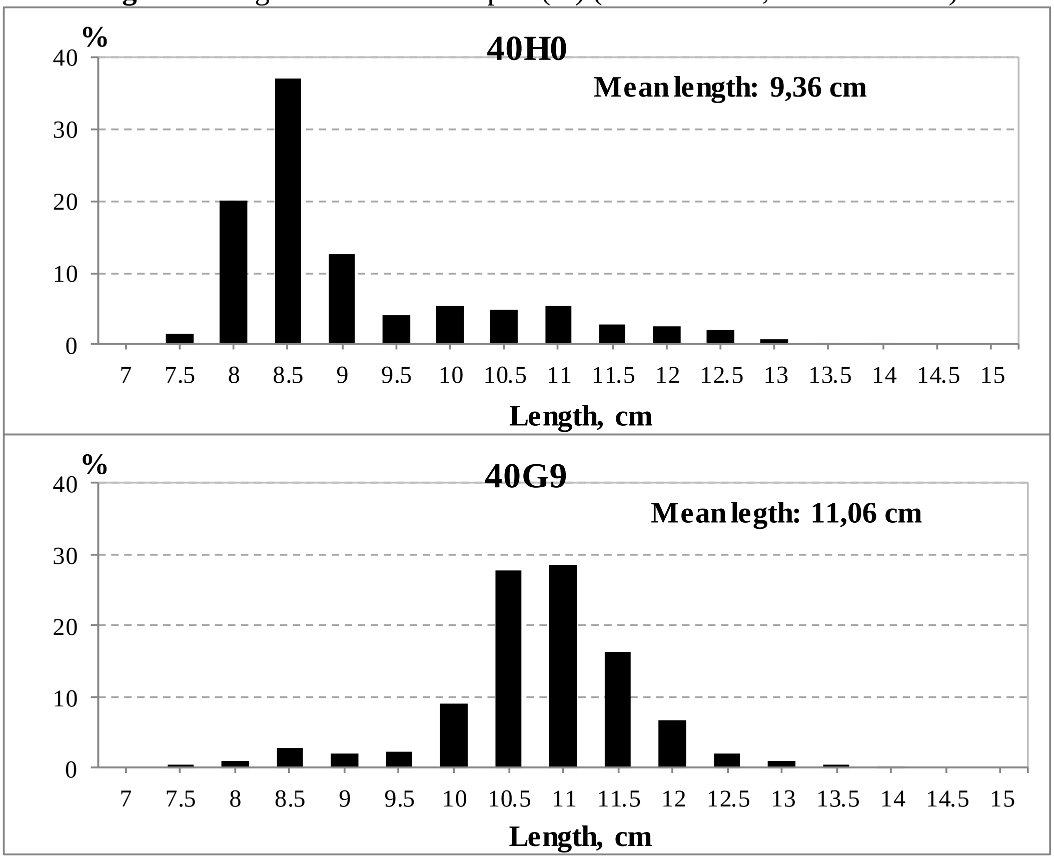

Figure 2. Length composition of herring (%) (R/V "Darius", 10-11.05.2017)

Table 2 R/V "DARIUS" survey statistics (abundance of herring and sprat),), 10-11.05.2017

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	8.15	8251.6	389.8	7861.8	51515	10418	41098
	40G9	1013.0	4.90	4959.5	18.6	4940.9	46173	596	45577

Table 3 R/V "DARIUS" survey statistics (aggregated data of herring and sprat),), 10-11.05.2017

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	1,2,6,7	15.81	26.72	4.72	9.36	5.23	95.28	754.3	-51.3
	40G9	3,4,5	17.12	32.05	0.38	11.06	9.22	99.62	577.4	-50.3

Table 4 R/V "DARIUS" survey statistics (herring and sprat), 10-11.05.2017

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	754.3	0.92522	8251.6	4.72	95.28
	40G9	1013	577.4	1.17934	4959.5	0.38	99.62

Table 5 R/V "Darius" estimated age composition (%) of sprat, 10-11.05.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	100,0	0.0	72.7	6.1	9.0	6.4	1.9	2.4	0.5	0.9
	40G9	100,0	0.0	6.1	10.4	33.2	32.9	7.8	5.2	1.6	2.8

Table 6 R/V "Darius" estimated number (millions) of sprat, 10-11.05.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	7861.8	0.0	5715.4	481.2	708.0	506.4	147.7	191.1	38.4	73.7
	40G9	4940.9	0.0	301.0	514.3	1638.9	1626.8	387.5	256.6	79.4	136.3

Table 7 R/V "Darius" estimated biomass (in tons) of sprat, 10-11.05.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	41098		22317	2954	5663	4532	1733	2368	520	1012
	40G9	45577		1310	4655	15242	15213	3965	2685	861	1646

Table 8 R/V "Darius" estimated mean weights (g) of sprat, -10-11.05.2017

SD	Rect.	Age									
		Mean	0	1	2	3	4	5	6	7	8
26	40H0	5.23		3.9	6.1	8.0	8.9	11.7	12.4	13.6	13.7
	40G9	9.22		4.35	9.05	9.30	9.35	10.23	10.46	10.84	12.08

Table 9 R/V "Darius" estimated mean length (cm) of sprat, 10-11.05.2017

SD	Rect.	Age									
		Mean	0	1	2	3	4	5	6	7	8
26	40H0	9.4		8.4	9.9	10.6	11.0	12.0	12.2	12.7	12.8
	40G9	11.1		8.6	10.4	10.6	11.1	11.6	11.7	11.8	12.7

Table 10 R/V "Darius" estimated age composition (%) of herring, 10-11.05.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	100,0		14.1	1.4	64.9	5.8	6.6	3.3	2.0	1.8
	40G9	100,0		0.5	4.5	41.6	12.2	18.5	7.5	8.7	6.5

Table 11 R/V "Darius" estimated number (millions) of herring, 10-11.05.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	389.8		54.8	5.6	253.2	22.7	25.8	12.8	7.8	7.1
	40G9	18.6		0.1	0.8	7.7	2.3	3.4	1.4	1.6	1.2

Table 12 R/V "Darius" estimated biomass (in tons) of herring, 10-11.05.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	10418		991.5	151.9	5799.0	818.2	1172.4	640.7	427.3	416.7
	40G9	596		1.8	19.2	175.0	78.5	139.5	53.3	67.9	61.2

Table 13 R/V "Darius" estimated mean weights (g) of herring, 10-11.05.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	26.7		18.1	26.9	22.9	36.1	45.5	49.9	54.5	58.4
	40G9	32.1		18.3	23.0	22.6	34.5	40.6	38.2	42.1	50.5

Table 14 R/V "Darius" estimated mean length (cm) of herring, 10-11.05.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	15.8	0	13.6	16.0	14.9	17.7	19.2	20.1	20.8	21.4
	40G9	17.1	0	13.5	15.0	14.9	17.6	18.6	18.3	18.9	20.7

Table 15. The values of hydrological parameters registered at the catching depth in the Baltic Sea ICES SD from the Lithuanian BISS survey conducted by r/v "Darius" in the period of 10-11.05.2017

Haul number	Date of catch	Mean trawling depth, m	Hydrological parameters		
			Temperature, °C	Salinity, ‰	Oxygen, ml/l
1	2017.05.10	16	6,97	7,98	8,06
2	2017.05.10	18	9,89	7,96	7,53
3	2017.05.10	17	5,36	7,96	8,39
4	2017.05.10	18	5,58	7,98	8,35
5	2017.05.11	18	5,49	8,01	8,36
6	2017.05.11	17	6.23	8.01	8.21
7	2017.05.11	15	5.59	8.03	8.34
Average		17			

Working paper for the WGBIFS meeting in Copenhagen (Denmark) 24-28.03.2018

Research report from the Polish part of the Baltic Acoustic Spring Survey on board of the r.v. "Baltica" (02-13.05.2017)

Grzegorz Kruk, Beata Schmidt, Tycjan Wodzinowski
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 1st after a long break inPoland spring acoustic survey in the Polish EEZ was conducted on-board of the r.v. "Baltica" between 02nd and 13th of May 2017. 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 BASS survey was carried out in the season of herring and sprat initial phase of intensive feeding at about spawning time for clupeids there were no new year-classes, 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 2017 and the European Union (the Commission Regulations Nos. 1639/2001, 1581/2005, 665/2008, 1078/2008, 2008/949/EC, 2010/93/EU) financially and logistically supported the Polish BASS survey marked with internal No. 8/2017/MIR-PIB.

The ICES Baltic Fisheries Assessment Working Group [WGBFAS] will use the BASS 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 spring 2017. 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 are also described.

MATERIAL AND METHODS

Research team personnel

The main research tasks of May 2017 the BASS survey on board of the r.v. "Baltica" were realized by the NMFRI (Gdynia) nine members of the scientific team, with Grzegorz Kruk as a cruise leader. The group of researchers was composed of:
Grzegorz Kruk – hydroacoustician,
Bartłomiej Nurek – hydroacoustician, electronics specialist,

Zuzanna Celmer - specialist, herring analyses,
Grzegorz Modrzejewski - specialist, sprat analyses,
Krzysztof Radtke – ichthyologist, cod analyses,
Wojciech Deluga – technician, herring analyses,
Ireneusz Wybierala – technician, sprat analyses,
Anetta Ameryk – hydrologist.

The course of the cruise

The r.v. “Baltica” left the Gdynia port on 02nd of May 2017 at 06:45 o’clock and was navigated in the north-eastern direction to the integration starting point No.1 From the morning of the next day we started collecting acoustic transects data above the Gdansk Deep (Fig. 3). The acoustic integration started on 3rd of May 2017 at about 7 a.m. The researches at sea ended on 12.05.2017 in the late afternoon at the RS1 hydro-station, where on 08.05 the vessel had to stop integration and hauls for one day due to serious engine failure, at the middle part of Polish EEZ, in the ICES rectangle 39G7. The r.v. “Baltica” returned to the Gdynia port on 13th of May before noon. The total number of 32 catches were performed, and the integration was carried out on the way of 858 Nm.

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 BASS.

The integration of acoustic data was carried out between03rd and 12th of May 2017, 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 858 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 32 catch-stations were inspected by the r.v. “Baltica” in spring of 2017, 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 15 to 70 m (position of the headrope from the sea surface). Depth to the bottom at trawling positions varied from 35 to 108 m. The trawl vertical opening during fishing was ranged from 15 to 20 m. The 2 hauls were assigned to the Polish part of the ICES Sub-division 24, 15 hauls were realised in the ICES SD 25 and 17 hauls were assigned to 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, 32, 31 and 7 samples were taken for the length and mass determination of sprat, herring and cod, respectively. Totally, the length and mass were measured for 6424 sprat, 2322 herring and 444 cod individuals. Respectively, 672, 709 and 96 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, 44 hydrological stations were inspected using the CTD IDRONAUT probe combined with the rosette sampler. 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 Sepetmber's BIAS 2016 calibration results were satisfactory and comparable to those obtained in the previous year (Łączkowski and Witalis 2016); (Figures 1 and 2). The next calibration was performed during the BIAS 2017 cruise also with similar results. 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 2017 the total amount of clupeids in SD 25 and SD26 increased, whilst decreased in the SD24, comparing with 2016. In particular, a big change of the NASC appeared in the ICES rectangles 39G9 and 37G9. Minor changes and remaining very high value integration of the clupeids can be seen in ICES rectangles 38G7. There the average NASC remained still about 60 m^2/NM^2 (41 in BIAS 2016). The highest value of the NASC per 1-mile reached there was 17000 m^2/NM^2 (Figs. 4 and 5).

The calculations of the 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 13.

The changes of sprat, herring and cod total biomass surface density in the ICES sub-divisions is shown in Figure 12. Additionally, the biomass of sprat, herring and cod is presented in a form of the ArcGIS plot in Figures 14, 15 and 16.

Control catches and fish length distribution

The fish control-catches statistics and mean CPUEs by species are presented in Table 3 and Figure 6. Totally, 12,474.83 kg of fish in 32 hauls were caught. The herring average share in mass was 3.85%, sprat 95.14%, cod 0.98% and other species 0.02% which is less than 1% hence the other species are excluded from analyses (Fig. 8). Among the other eight species, the following ones were noted: flounder, whiting, lumpfish, sticklebacks. 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, Kruk et.al. 2017).

In May 2017 the mean CPUE of all fish species for entire investigated area was 1200 kg/h and it was higher comparing to the BIAS of 2016 (385.8 kg/h). The highest CPUE was noticed in the ICES SD 25 (over 1400 kg/h), and it was higher whilst comparing to this one from the ICES SDs 24 and 26 (almost 1400 and almost 1000 kg/h, respectively). Mean CPUEs for main species in May 2017 were as follow: herring – 200, sprat – 1150, cod 10 and others – 1 kg/h. After Kruk et. al (2017), mean CPUEs for these three species in September 2016 were: 217.9, 163.5, 3.5, 0.9 kg/h, respectively. Concluding, we had lower mean CPUEs of herring, and higher of sprat and cod in May 2017, whilst comparing to CPUE values from 2016 in the pelagic waters of the Polish EEZ. In May of the analysed year, the mean herring CPUE in the ICES Sub-divisions 24, 25 and 26 is comparable and was as follow: 1380, 1420 and 950 kg/h, respectively (Fig. 7). The highest fishing efficiency of sprat was obtained in the ICES SD 24 and 25, i.e. about 1350 kg/h on average, while in the ICES SDs 26 was less than 1000.

The mean share of sprat, herring and cod in mass of catches realised in May 2017, by inspected ICES sub-divisions is presented in Figure 8. Sprat was prevailed in catches performed in the ICES SDs 24, 25 and 26, where the mean share amounted, adequately: 99.12; 92.74 and 98.73%. Herring was played the second role in realised catches with the mean share of 0.88; 5.61 and 1.23%. 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 9, 10 and 11. 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 7.5-15.5 cm, with the mean length of 11.5 cm and the mean weight 12.65 g (Table 8). The length distribution curves had a multimodal shape in SD 24 and single mode shapes in SD 25 and SD 26 controlled ICES sub-divisions, with frequency peaks on 12.5 cm and 14 cm (ICES SD 24) and 11.5 cm (ICES SD 25, 26). In May 2017, the mean numerical share of young (undersized) sprat in analysed samples, with comparison to the data from previous years, was very low and amounted 0.49; 1.39; 10.55 % in ICES SDs 24, 25, 26 and entire scrutinized areas, respectively (Table 4). The sprat from year-class 2017 was not existing.

Herring

The herring length distribution in all control-catches covered the range of 10.5-27.5 cm, with the mean length of 19.0 cm and the mean weight 41.03 g. The herring length frequency curve shapes were similar (with the mono modal character at length-class 16 cm in SD 26) and multimodal shape in the ICES sub-division 25. The mean numerical share of young herring (<16 cm) in entire study area was 19.78% (Table 4). The lowest and highest mean share of herring was recorded in samples originated from the ICES SDs 25 (11.29%) and 26 (26.62%). The mean share of herring below <13 cm of total length, i.e. from year-class 2017 was not existing.

Cod

There was a small amount of cod in the ICES SD 24, 26 where only 4 and 3 individuals were found in all catches, and only one cod with 49 cm length in the ICES SD 25. In the ICES SD 25 - 89 of cod specimens were found in all catches. The length range of cod caught in May 2017 was 24-49 cm and only two individuals had length of 24 cm (Fig. 11). The mean length of sampled cod was 36.5 cm and the mean weight was 539.73 g. Undersized specimens (<35 cm) established average up to 43.76% 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 1007 to 1028 hP. The air temperature fluctuated from 2.2

to 9.2°C, and prevailing winds were from various directions with the force from 2 to 6°B, which generated 2-4 sea state.

The seawater temperature on mean fishing depth varied from 4.4 to 6.5°C, salinity changed from 5 to 16 PSU, and oxygen content from 1.03 to 8.95 ml/l. The highest water salinity value was noticed at the position of haul No. 19, i.e. in the Bornholm Deep, on the 65 m depth. The lowest value of the oxygen content was recorded at the position of haul No. 10. In the first half of May 2017, 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 6.3°C (ranging between 2.2 and 9.2°C). The dominating wind direction was from the north-east. The weak and moderate winds (below 5°B) appeared in most of the time of observation. The maximal wind speed was 16,7 m/s and minimal 0.6 m/s. Very strong winds from N direction, with noticed maximum speed of 16,7 m/s, were observed in 1% of time of fishing operations. Fluctuation of values of meteorological parameters is shown in the Figure 17.

The horizontal distribution of hydrological parameters in the near seabed layer of the southern Baltic is presented in Figure 18, whilst vertical distribution in Figure 19.

The seawater temperature in the surface layer fluctuated from 5.05 to 7.55°C. The lowest values were observed at the haul No. 11 and the highest at the haul No. 4 (Table 15). The average salinity of surface water was 6.5 PSU. A minimum salinity value (5 PSU) was measured at the haul No. 16 and the maximum (16 PSU) at the haul No. 19. The mean oxygen content in the sea upper layer was equal to 9 ml/l. The lowest value was 1.03 ml/l, recorded at the haul No. 10.

The seawater temperature recorded near the seabed (Fig. 18) was ranging from 4.17 to 7.76°C. The lowest temperature was recorded at position of the haul No. 16. The highest temperature was recorded at the haul No.1. The average temperature of the water near the seabed was 5.88°C. The salinity of the water at the seabed varied in the range of 7.79 PSU at the station No. 61 to 17.79 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 1.04 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 not observed. Salinity in the Bornholm Deep (below depth of 50 m) exceeded 17.7 PSU, and below 58 m of depth, there were favourable conditions for occurrence of cod eggs, at the oxygenation of 2-3 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. 19).

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 BASS-2017 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 (m^2/NM^2) for the three ICES SDs in Polish EEZ in 2015 - 2017.

SD	Average NASC BIAS 2015	Average NASC BIAS 2016	Average NASC BASS 2017
24	96,9	89,2	33,5
25	226,4	160,0	472,9
26	926,8	556,8	1554,3

Table 2. Average NASC (m^2/NM^2) values for the covered ICES rectangles in Polish EEZ in 2015 - 2017.

SD	Rectangles ICES	Area Nm^2	Average NASC BIAS 2015	Average NASC BIAS 2016	Average NASC BASS 2017
24	38G4	1034,8	96,9	89,2	33,5
25	37G5	642,2	158,2	100,7	329,8
25	38G5	1035,7	129,0	209,5	531,1
25	38G6	940,2	175,8	151,8	148,1
25	38G7	471,7	255,7	41,2	61,1
25	39G5	979,0	301,0	220,2	1088,1
25	39G6	1026,0	215,8	241,1	407,3
25	39G7	1026,0	297,0	189,6	569,0
25	40G7	1013,0	279,1	125,9	649,0
26	37G8	86,0	2894,6	767,5	1229,5
26	37G9	151,6	914,1	2739,7	368,3
26	38G8	624,6	997,1	336,0	1145,4
26	38G9	918,2	750,9	170,9	2246,4
26	39G8	1026,0	285,0	118,7	895,9
26	39G9	1026,0	393,2	57,6	3633,7
26	40G8	1013,0	252,9	172,4	1360,8

Table 3. Fish control-catches data from the Polish BASS survey conducted on-board of the r.v. "Baltica" in May 2017.

Haul number	Date of catch	ICES recta-ngle	ICES Sub-div.	Depth to the bottom [m]	Headrope depth - from the surface [m]	Vertical net opening [m]	The ship's course during fishing [°]	Geographical position of the catch-station: start latitude	start longitude	end latitude	end longitude	Local time of: shutting net	hauling up net	Trawling dura-tion [min]	CPUE of all species [kg/h]	CPUE of particular fish species [kg/h]: sprat	herring	cod	flounder	whiting	lumpfish	threespine stickleback
1	02/05/2017	39G9	26	89	55	19	165	55°10.2'	19°06.6'	55°09.0'	19°06.0'	15:40	16:10	30	1638.03	1633.47	3.29	1.270				
2	03/05/2017	38G9	26	102	60	19	160	54°58.6'	19°05.6'	54°57.2'	19°06.5'	09:45	10:15	30	2169.98	2151.69	18.29					
3	03/05/2017	38G9	26	87	50	18	200	54°38.6'	19°14.7'	54°37.5'	19°13.8'	15:25	15:40	15	2946.92	2946.92						
4	03/05/2017	37G9	26	70	45	18	190	54°29.3'	19°13.0'	54°28.5'	19°12.5'	18:45	19:05	20	261.42	225.95	35.47					
5	04/05/2017	37G9	26	48	30	19	240	54°25.7'	19°16.7'	54°24.8'	19°14.1'	07:25	07:55	30	344.16	300.29	42.29	1.580				
6	04/05/2017	37G8	26	65	38	18	206	54°29.5'	18°56.6'	54°28.6'	18°55.7'	12:25	12:45	20	1039.20	1032.54	6.66					
7	04/05/2017	38G8	26	65	35	18	210	54°32.0'	18°54.6'	54°31.7'	18°53.6'	14:40	15:00	20	196.86	194.00	2.86					
8	04/05/2017	38G8	26	85	40	19	216	54°39.4'	18°59.1'	54°38.6'	18°58.5'	17:20	17:40	20	268.77	264.64	4.13					
9	05/05/2017	40G8	26	86	65	17	240	55°37.9'	18°55.8'	55°37.3'	18°54.3'	12:10	12:30	20	620.40	614.62	5.78					
10	05/05/2017	40G8	26	108	70	18	180	55°50.9'	18°39.8'	55°50.1'	18°39.8'	16:25	16:40	15	1217.60	1211.07	6.53					
11	06/05/2017	37G8	26	81	58	18	324	55°20.6	18°39.1'	55°21.3'	18°38.2'	07:15	07:35	20	467.35	464.85	2.49					0.007
12	06/05/2017	38G8	26	78	50	20	157	54°54.0'	18°40.3'	54°53.0'	18°41.0'	11:30	11:50	20	402.12	396.13	5.99					
13	06/05/2017	39G8	26	60	20	20	10	55°01.7'	18°19.5'	55°03.4'	18°19.5'	15:25	15:55	30	297.66	293.61	4.05					
14	06/05/2017	39G8	26	73	45	19	0	55°15.5'	18°19.9'	55°16.4'	18°19.9'	17:40	18:00	20	253.70	241.50	12.20					
15	07/05/2017	40G8	26	92	60	18	195	55°34.2'	18°25.0'	55°34.0'	18°24.7'	07:50	08:05	15	1969.41	1943.05	23.51	2.370	0.480			
16	07/05/2017	40G7	25	63	35	20	190	55°42.8'	17°58.0'	55°41.9'	17°57.8'	13:10	13:25	15	689.92	685.48	4.44					
17	07/05/2017	39G7	25	76	50	20	190	55°19.2'	17°59.5'	55°18.5'	17°59.2'	16:45	17:00	15	1102.04	1099.22	2.82					
18	08/05/2017	39G7	25	82	55	20	190	55°17.8'	17°39.5'	55°17.2'	17°39.3'	10:20	10:35	15	3838.84	3830.74	8.10					
19	09/05/2017	39G5	25	88	65	20	245	55°13.2'	15°58.2'	55°12.5'	15°55.9'	06:55	07:25	30	1482.36	1259.99	87.69	133.400			1.282	
20	09/05/2017	39G5	25	91	67	20	80	55°08.3'	15°40.2'	55°08.7'	15°42.6'	09:40	10:10	30	930.69	639.39	56.57	233.100	1.460	0.170		
21	09/05/2017	38G5	25	71	50	19	220	54°48.9'	15°22.7'	54°47.9'	15°20.7'	13:50	14:20	30	1603.09	1556.38	43.02	3.390		0.300		
22	09/05/2017	38G4	24	60	36	19	210	54°45.3'	14°58.9'	54°44.6'	14°58.1'	16:30	16:45	15	1367.60	1355.54	12.06					
23	10/05/2017	37G5	25	48	25	19	100	54°29.7'	15°26.3'	54°29.6'	15°27.4'	07:50	08:05	15	646.84	637.26	9.58					
24	10/05/2017	38G5	25	61	37	20	360	54°37.4'	15°44.3'	54°38.4'	15°44.6	10:45	11:05	20	916.20	878.47	37.73					
25	10/05/2017	38G6	25	68	45	20	40	54°54.4'	16°00.4'	54°54.9'	16°01.2'	14:00	14:15	15	1905.48	1494.18	403.66	5.920			1.720	
26	10/05/2017	39G6	25	83	55	19	270	55°10.7'	16°11.1'	55°10.7'	16°09.5'	17:50	18:10	20	195.78	177.66	16.80				1.290	0.036
27	11/05/2017	38G6	25	57	30	20	265	54°59.5'	16°16.1'	54°59.6'	16°14.5'	07:20	07:40	20	308.64	221.42	87.22					
28	11/05/2017	39G6	25	69	40	20	280	55°12.5'	16°38.6'	55°12.8'	16°36.2'	10:50	11:20	30	151.77	7.12	143.86				0.790	
29	11/05/2017	39G6	25	85	58	20	273	55°14.3'	16°58.5'	55°14.4'	16°57.3'	15:15	15:30	15	7904.81	7583.44	320.32				1.052	
30	12/05/2017	38G7	25	36	14	18	260	54°59.8'	17°37.6'	54°59.6'	17°35.6'	07:10	07:30	20	62.55	51.33	11.21					0.010
31	12/05/2017	39G7	25	57	25	18	5	55°08.6'	17°19.7'	55°09.6'	17°19.5'	09:30	09:50	20	780.66	777.33	3.33					
32	12/05/2017	40G7	25	56	30	18	245	55°31.1'	17°41.3'	55°32.8'	17°40.1'	15:20	15:35	15	734.00	665.94	67.26				0.784	0.016

Table 4. The mean numerical share of young, undersized fishes per ICES SDs.

Species	Fish length	Mean share in % of numbers: SD24	SD25	SD26	Mean
sprat	< 10 cm	0.49	1.39	10.55	4.14
herring	< 16 cm	21.43	11.29	26.62	19.78
cod	< 35 cm	no data	43.76	no data	

Table 5. Cruise statistics of the Polish BASS survey on-board of the r.v. "Baltica", 02.05.-13.05.2017.

SD	ICES	EDSU	$\langle \sigma \rangle$	$\langle S_A \rangle$	Area	species composition [%]			Abundance *(10^6)			
	Rectangle	[NM]	[$m^2 * 10^{-4}$]	[m^2/NM^2]	[NM^2]	sprat	herring	cod	total	sprat	herring	cod
24	38G4	8	1.51	33.5	1034.8	99.5	0.5	0.003	229.1	228.0	1.1	0.007
Sum SD24		8		33.5	1034.8				229.1	228.0	1.1	0.007
25	37G5	30	1.52	329.8	642.2	99.2	0.8	0.000	1393.2	1381.7	11.5	0.000
25	38G5	65	1.47	531.1	1035.7	99.1	0.9	0.003	3753.5	3719.8	33.7	0.120
25	38G6	16	1.73	148.1	940.2	90.6	9.4	0.003	804.3	728.5	75.7	0.027
25	38G7	23	1.60	61.1	471.7	99.8	0.2	0.000	179.8	179.5	0.3	0.000
25	39G5	25	1.53	1088.1	979.0	97.5	1.9	0.591	6973.8	6797.5	135.1	41.215
25	39G6	145	2.08	407.3	1026.0	70.0	30.0	0.000	2006.0	1404.9	601.1	0.000
25	39G7	119	1.35	569.0	1026.0	98.1	1.9	0.000	4328.6	4246.4	82.3	0.000
25	40G7	33	1.19	649.0	1013.0	98.4	1.6	0.000	5506.6	5416.5	90.1	0.000
Sum SD25		456		472.9	7133.8				24945.8	23874.9	1029.7	41.361
26	37G8	18	1.00	1229.5	86.0	99.6	0.4	0.000	1056.7	1052.9	3.8	0.000
26	37G9	35	1.22	368.3	151.6	96.4	3.6	0.003	457.3	440.7	16.6	0.012
26	38G8	58	1.14	1145.4	624.6	99.6	0.4	0.000	6278.2	6251.5	26.7	0.000
26	38G9	75	1.11	2246.4	918.2	99.9	0.1	0.000	18643.2	18628.8	14.4	0.000
26	39G8	84	1.20	895.9	1026.0	99.5	0.5	0.000	7655.4	7618.3	37.1	0.000
26	39G9	26	1.09	3633.7	1026.0	99.9	0.1	0.000	34212.6	34176.9	35.5	0.157
26	40G8	98	1.10	1360.8	1013.0	99.8	0.2	0.000	12538.4	12510.9	27.4	0.038
Sum SD26		394		1554.3	4845.4				80841.8	80680.0	161.5	0.208

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 BASS survey on board of the r.v. Baltica, 02.05-13.05.2017.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum sprat [mln indiv.]
24	38G4	0.0	4.2	3.1	141.7	57.1	14.1	6.7	0.6	0.6	228.00
Sum SD24		0.0	4.2	3.1	141.7	57.1	14.1	6.7	0.6	0.6	228.00
25	37G5	0.00	4.15	45.26	663.07	434.53	153.35	67.68	12.04	1.65	1381.74
25	38G5	0.00	11.96	155.95	2041.04	1045.29	306.35	137.86	19.66	1.65	3719.77
25	38G6	0.00	0.00	19.76	352.91	232.71	80.22	35.90	5.65	1.38	728.53
25	38G7	0.00	0.14	5.16	84.99	56.48	21.25	9.28	1.85	0.34	179.49
25	39G5	0.00	150.39	537.09	4373.44	1315.23	279.52	126.16	13.33	2.37	6797.53
25	39G6	0.00	4.62	93.40	862.21	299.66	96.20	40.70	6.15	1.99	1404.93
25	39G7	0.00	154.83	341.49	2634.03	769.00	226.98	99.30	17.52	3.21	4246.37
25	40G7	0.00	227.07	687.12	4037.70	414.85	33.18	15.87	0.72	0.00	5416.51
Sum SD25		0.00	553.16	1885.23	15049.40	4567.76	1197.05	532.76	76.92	12.59	23874.87
26	37G8	0.00	392.93	109.70	464.10	65.95	16.12	1.89	2.22	0.00	1052.91
26	37G9	0.00	34.70	45.53	310.31	41.26	7.61	0.34	0.96	0.00	440.70
26	38G8	0.00	925.92	630.66	3855.80	647.60	148.69	19.98	22.84	0.00	6251.49
26	38G9	0.00	1327.15	2829.18	13017.01	1223.41	213.57	0.00	18.46	0.00	18628.78
26	39G8	0.00	339.65	773.48	5295.79	957.59	193.91	23.70	34.19	0.00	7618.31
26	39G9	0.00	3018.96	5322.02	23194.74	2254.38	344.36	0.00	42.46	0.00	34176.93
26	40G8	0.00	749.85	2340.66	8342.55	884.13	161.33	11.26	21.10	0.00	12510.88
Sum SD26		0.00	6789.16	12051.23	54480.31	6074.32	1085.58	57.16	142.24	0	80680.00

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 BASS survey on board of the r.v. Baltica, 02.05-13.05.2017.

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	0.0	33.2	24.6	1881.5	778.8	253.4	126.4	12.1	12.1	3121.9
Sum SD24		0.0	33.2	24.6	1881.5	778.8	253.4	126.4	12.1	12.1	3121.9
25	37G5	0.0	27.1	462.9	8117.5	6246.5	2431.9	1081.4	219.1	31.3	18617.8
25	38G5	0.0	78.7	1568.2	23984.2	14299.1	4733.6	2145.9	368.0	31.3	47209.1
25	38G6	0.0	0.0	220.4	4390.1	3306.6	1276.7	578.9	104.4	27.9	9905.0
25	38G7	0.0	0.9	55.7	1045.7	814.6	343.9	151.5	33.5	6.7	2452.5
25	39G5	0.0	826.3	4920.6	46492.2	17177.8	4202.8	1896.1	240.4	45.0	75801.2
25	39G6	0.0	33.6	881.9	9276.0	4113.5	1546.3	655.8	108.8	41.5	16657.4
25	39G7	0.0	755.5	3036.9	27122.4	10466.6	3616.3	1592.2	316.9	63.6	46970.4
25	40G7	0.0	1270.0	5823.6	37419.3	4596.1	462.7	218.8	12.5	0.0	49803.2
Sum SD25		0.0	2992.1	16970.3	157847.4	61020.8	18614.2	8320.8	1403.7	247.3	267416.5
26	37G8	0.0	1628.5	757.8	4065.3	692.6	175.8	24.7	27.4	0.0	7372.1
26	37G9	0.0	144.1	349.1	2742.3	420.6	76.4	4.3	11.2	0.0	3747.9
26	38G8	0.0	3858.2	4666.0	34668.0	6921.6	1654.7	259.6	281.7	0.0	52309.7
26	38G9	0.0	5125.0	20893.5	109737.4	11733.8	2024.3	0.0	210.4	0.0	149724.5
26	39G8	0.0	1346.8	5851.3	47976.4	10276.5	2188.3	314.9	424.7	0.0	68378.9
26	39G9	0.0	11540.7	39132.9	193508.1	21826.6	3323.0	0.0	484.1	0.0	269815.4
26	40G8	0.0	3026.3	16546.3	69298.8	8808.2	1666.8	144.7	250.3	0.0	99741.3
Sum SD26		0.0	26669.6	88196.8	461996.3	60679.8	11109.2	748.1	1689.8	0.0	651089.7

Table 8. Mean weight of sprat (in grams) per age groups, and SDs based on data collected during the Polish BASS survey on board of the r.v. Baltica, 02.05-13.05.2017.

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		7.87	8.02	13.28	13.63	18.03	18.74	21.67	21.67	13.69
MW SD24			7.87	8.02	13.28	13.63	18.03	18.74	21.67	21.67	13.69
25	37G5		6.53	10.23	12.24	14.38	15.86	15.98	18.20	18.99	13.47
25	38G5		6.58	10.06	11.75	13.68	15.45	15.57	18.72	18.99	12.69
25	38G6			11.15	12.44	14.21	15.92	16.12	18.47	20.24	13.60
25	38G7		6.32	10.79	12.30	14.42	16.18	16.33	18.09	19.79	13.66
25	39G5		5.49	9.16	10.63	13.06	15.04	15.03	18.03	18.99	11.15
25	39G6		7.26	9.44	10.76	13.73	16.07	16.11	17.70	20.83	11.86
25	39G7		4.88	8.89	10.30	13.61	15.93	16.03	18.09	19.79	11.06
25	40G7		5.59	8.48	9.27	11.08	13.95	13.78	17.50		9.19
MW SD25			5.41	9.00	10.49	13.36	15.55	15.62	18.25	19.65	11.20
26	37G8		4.14	6.91	8.76	10.50	10.91	13.03	12.34		7.00
26	37G9		4.15	7.67	8.84	10.19	10.04	12.70	11.63		8.50
26	38G8		4.17	7.40	8.99	10.69	11.13	12.99	12.33		8.37
26	38G9		3.86	7.39	8.43	9.59	9.48		11.40		8.04
26	39G8		3.97	7.56	9.06	10.73	11.29	13.29	12.42		8.98
26	39G9		3.82	7.35	8.34	9.68	9.65		11.40		7.89
26	40G8		4.04	7.07	8.31	9.96	10.33	12.85	11.86		7.97
MW SD26			3.93	7.32	8.48	9.99	10.23	13.09	11.88		8.07

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 BASS survey on board of the r.v. Baltica, 02.05-13.05.2017.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum herring [mln indiv.]
24	38G4	0.00	0.08	0.08	0.18	0.22	0.20	0.22	0.05	0.07	1.10
Sum SD24		0.00	0.08	0.08	0.18	0.22	0.20	0.22	0.05	0.07	1.10
25	37G5	0.00	0.35	0.99	2.68	1.10	1.87	1.98	0.63	1.89	11.5
25	38G5	0.00	0.91	2.00	5.87	3.48	5.87	6.25	1.89	7.39	33.7
25	38G6	0.00	0.82	5.65	13.88	7.87	16.24	15.94	4.29	11.01	75.7
25	38G7	0.00	0.03	0.03	0.08	0.03	0.06	0.05	0.01	0.05	0.3
25	39G5	0.00	3.25	12.96	27.73	13.16	29.18	26.17	5.36	17.28	135.1
25	39G6	0.00	10.75	45.60	127.61	57.28	125.40	127.26	32.35	74.84	601.1
25	39G7	0.00	6.89	9.93	21.31	6.90	14.89	11.23	2.61	8.53	82.3
25	40G7	0.00	7.44	14.09	38.39	4.91	11.67	9.98	1.18	2.41	90.1
Sum SD25		0.00	30.44	91.25	237.55	94.71	205.18	198.85	48.32	123.41	1029.7
26	37G8	0.00	1.77	0.14	0.89	0.30	0.28	0.17	0.05	0.18	3.8
26	37G9	0.00	1.86	0.82	3.95	2.23	2.60	1.98	0.85	2.29	16.6
26	38G8	0.00	4.19	1.19	6.17	2.84	3.90	3.67	1.38	3.37	26.7
26	38G9	0.00	0.17	0.82	2.57	1.77	2.77	2.22	0.83	3.24	14.4
26	39G8	0.00	3.35	3.02	7.21	4.84	4.63	4.14	3.23	6.71	37.1
26	39G9	0.00	0.21	1.65	7.66	6.08	8.10	5.42	1.70	4.68	35.5
26	40G8	0.00	1.57	1.27	10.21	4.27	3.62	3.32	0.65	2.53	27.4
Sum SD26		0.00	13.13	8.90	38.66	22.33	25.91	20.91	8.70	23.00	161.5

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 BASS survey on board of the r.v. Baltica, 02.05-13.05.2017.

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	0.0	1.6	1.9	7.2	11.3	10.9	12.1	3.1	4.6	52.9
Sum SD24		0.0	1.6	1.9	7.2	11.3	10.9	12.1	3.1	4.6	52.9
25	37G5	0.0	5.9	23.2	64.2	52.7	77.9	92.7	35.2	111.0	462.8
25	38G5	0.0	14.3	45.5	162.4	175.4	270.9	301.9	108.2	444.7	1523.3
25	38G6	0.0	14.3	146.1	419.8	351.7	654.1	709.9	229.1	643.1	3168.1
25	38G7	0.0	0.4	0.5	1.8	1.2	2.8	2.3	0.7	3.3	13.0
25	39G5	0.0	50.8	323.0	788.5	547.7	1125.2	1117.0	280.9	1078.3	5311.4
25	39G6	0.0	179.2	1135.3	3716.9	2509.3	4961.5	5570.4	1697.9	4451.2	24221.7
25	39G7	0.0	98.6	218.4	433.9	289.3	560.9	475.4	148.2	522.8	2747.6
25	40G7	0.0	114.8	306.5	818.3	167.1	387.8	384.0	51.8	114.8	2345.1
Sum SD25		0.0	478.3	2198.4	6405.9	4094.5	8041.0	8653.6	2552.1	7369.3	39792.9
26	37G8	0.0	20.6	2.9	19.5	9.7	11.2	7.4	2.9	9.7	83.8
26	37G9	0.0	24.0	22.2	97.3	75.9	98.0	77.9	42.9	130.1	568.3
26	38G8	0.0	45.6	33.4	159.6	91.5	144.3	138.9	72.0	179.1	864.4
26	38G9	0.0	3.1	22.9	62.3	60.2	128.9	92.8	45.3	215.7	631.3
26	39G8	0.0	36.6	90.5	183.7	172.3	181.2	166.7	154.2	341.6	1326.8
26	39G9	0.0	3.9	45.0	204.0	194.9	326.7	211.7	82.8	293.1	1362.1
26	40G8	0.0	25.1	29.6	236.2	142.8	129.5	128.8	30.8	126.9	849.9
Sum SD26		0.0	158.9	246.6	962.6	747.4	1019.8	824.2	430.8	1296.4	5686.6

Table 11. Mean weight of herring (in grams) per age groups, and SDs, based on data collected during the Polish BASS survey on board of the r.v. Baltica, 02.05-13.05.2017.

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		18.9	24.2	41.2	52.1	54.5	54.7	58.7	66.3	48.0
MW SD24			18.9	24.2	41.2	52.1	54.5	54.7	58.7	66.3	48.0
25	37G5		16.8	23.3	24.0	48.0	41.7	46.9	56.2	58.8	40.3
25	38G5		15.6	22.8	27.7	50.5	46.2	48.3	57.2	60.2	45.3
25	38G6		17.5	25.9	30.2	44.7	40.3	44.5	53.4	58.4	41.9
25	38G7		13.8	19.2	22.2	45.7	43.8	44.2	60.4	62.0	38.1
25	39G5		15.6	24.9	28.4	41.6	38.6	42.7	52.4	62.4	39.3
25	39G6		16.7	24.9	29.1	43.8	39.6	43.8	52.5	59.5	40.3
25	39G7		14.3	22.0	20.4	41.9	37.7	42.4	56.8	61.3	33.4
25	40G7		15.4	21.8	21.3	34.0	33.2	38.5	43.8	47.6	26.0
MW SD25			15.7	24.1	27.0	43.2	39.2	43.5	52.8	59.7	38.6
26	37G8		11.6	20.6	21.9	32.2	39.6	42.6	53.0	55.0	22.1
26	37G9		12.9	27.2	24.6	34.1	37.7	39.4	50.2	56.7	34.3
26	38G8		10.9	28.1	25.9	32.2	37.0	37.8	52.0	53.2	32.4
26	38G9		18.4	28.0	24.2	34.1	46.5	41.9	54.9	66.6	43.9
26	39G8		10.9	29.9	25.5	35.6	39.1	40.3	47.8	50.9	35.7
26	39G9		18.4	27.4	26.6	32.0	40.3	39.1	48.6	62.6	38.4
26	40G8		16.0	23.4	23.1	33.4	35.8	38.9	47.4	50.2	31.0
MW SD26			12.1	27.7	24.9	33.5	39.4	39.4	49.5	56.4	35.2

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 BASS survey on board of the r.v. Baltica, 02.05-13.05.2017.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum cod [mln indiv.]
24	38G4	0.000	0.000	0.000	0.002	0.005	0.000	0.000	0.000	0.000	0.007
Sum SD24		0.000	0.000	0.000	0.002	0.005	0.000	0.000	0.000	0.000	0.007
25	37G5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	38G5	0.000	0.000	0.000	0.030	0.058	0.032	0.000	0.000	0.000	0.120
25	38G6	0.000	0.000	0.000	0.000	0.008	0.019	0.000	0.000	0.000	0.027
25	38G7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	39G5	0.000	0.000	0.679	8.610	20.694	8.863	2.229	0.140	0.000	41.215
25	39G6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	39G7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	40G7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sum SD25		0.000	0.000	0.679	8.640	20.760	8.913	2.229	0.140	0.000	41.361
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	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.012
26	38G8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	38G9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	39G8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	39G9	0.000	0.000	0.000	0.000	0.000	0.157	0.000	0.000	0.000	0.157
26	40G8	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.000	0.000	0.038
Sum SD26		0.000	0.000	0.000	0.000	0.000	0.169	0.038	0.000	0.000	0.208

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 BASS survey on board of the r.v. Baltica, 02.05-13.05.2017.

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	0.60	2.49	0.00	0.00	0.00	0.00	3.10
Sum SD24		0.00	0.00	0.00	0.60	2.49	0.00	0.00	0.00	0.00	3.10
25	37G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	38G5	0.00	0.00	0.00	9.03	26.66	15.68	0.00	0.00	0.00	51.37
25	38G6	0.00	0.00	0.00	0.00	3.92	15.12	0.00	0.00	0.00	19.03
25	38G7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	39G5	0.00	0.00	126.69	2462.15	8170.26	4541.36	1473.30	114.13	0.00	16887.88
25	39G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	39G7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	40G7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum SD25		0.00	0.00	126.69	2471.18	8200.84	4572.15	1473.30	114.13	0.00	16958.28
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	0.00	0.00	0.00	9.84	0.00	0.00	0.00	9.84
26	38G8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	38G9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	39G8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	39G9	0.00	0.00	0.00	0.00	0.00	99.72	0.00	0.00	0.00	99.72
26	40G8	0.00	0.00	0.00	0.00	0.00	0.00	30.14	0.00	0.00	30.14
Sum SD26		0.00	0.00	0.00	0.00	0.00	109.56	30.14	0.00	0.00	139.70

Table 14. Mean weight of cod (in grams) per age groups and SDs, based on data collected during the Polish BASS survey on board of the r.v. Baltica, 02.05-13.05.2017 .

SD	ICES rectangule	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Mean W cod [g]
24	**38G4**				330	455					423.75
MW SD24		0.00	0.00	0.00	330.00	455.00	0.00	0.00	0.00	0.00	423.75
25	37G5										
25	38G5				301.6	458.4	495.5				429.00
25	38G6					515.0	795.0				715.00
25	38G7										
25	39G5			186.5	286.0	394.8	512.4	661.0	817.5		409.75
25	39G6										
25	39G7										
25	40G7										
MW SD25				186.5	286.0	395.0	513.0	661.0	817.5		410.01
26	37G8										
26	37G9						790.0				790.00
26	38G8										
26	38G9										
26	39G8										
26	39G9						635.0				635.00
26	40G8							790.0			790.00
MW SD26							646.4	790.0			672.78

Table 15. Values of the basic meteorological and hydrological parameters recorded in May2017 at the positions of the r.v. "Baltica" fish control catches.

Haul No	Date of catch	Haul start time [hh:mm]	Mean haedrope depth [m]	Meteorological parameters: atmospheric preasure [hP]	air temperature [°C]	wind direction	wind force [°B]	sea state	Hydrological parameters*: temperature [°C]	salinity [PSU]	oxygen [ml/l]
1	02-05-2017	15:40	55	1027	4	NE	5	3	5.6	7.36	8.26
2	03-05-2017	9:45	60	1028	4	NE	5	3	5.50	10.20	6.1
3	03-05-2017	15:25	50	1028	5	NE	4	2	4.8	7.90	7.20
4	03-05-2017	18:45	46	1026	6	NE	5	3	5.4	9.26	5.88
5	04-05-2017	7:25	15	1025	5	NE	2	2	4.98	7.21	8.95
6	04-05-2017	12:25	38	1025	8	NE	4	3	5.4	10	8.66
7	04-05-2017	14:40	37	1021	8	NE	5	3	5.4	7.50	8.35
8	04-05-2017	17:20	40	1021	8	NE	3	3	5.5	8	8.29
9	05-05-2017	12:10	65	1023	8	ENE	5	3	6.5	13.50	3.87
10	05-05-2017	16:25	70	1023	7	NE	5	3	6	10.5	1.03
11	06-05-2017	7:15	58	1019	6	NW	3	2	4.6	8.5	4
12	06-05-2017	11:30	50	1017	7	NW	3	2	4.75	9	4.92
13	06-05-2017	15:25	20	1015	7	NE	2	2	5.5	7.25	9.11
14	06-05-2017	17:40	45	1015	7	NW	2	2	4.6	7.3	8.02
15	07-05-2017	7:50	60	1010	6	NE	6	3	4.5	9.50	3.50
16	07-05-2017	13:10	35	1012	6	N	4	3	4.50	5.00	8.80
17	07-05-2017	16:45	50	1011	6	ENE	5	3	4.40	10.00	7.00
18	08-05-2017	10:20	55	1014	6	NE	6	4	5.50	10.14	5.50
19	09-05-2017	6:55	65	1017	5	NNW	5	2	6.00	16.00	3.00
20	09-05-2017	9:40	67	1018	3	E	4	2	6.00	15.00	4.00
21	09-05-2017	13:50	50	1018	4	E	3	2	5.20	13.00	5.00
22	09-05-2017	16:30	36	1016	5	S	3	2	5.50	10.00	8.00
23	10-05-2017	7:50	25	1007	6	W	5	3	5.50	7.80	8.05
24	10-05-2017	10:45	37	1007	6	W	4	3	4.25	8.50	8.20
25	10-05-2017	14:00	45	1007	5	E	4	2	5.00	12.00	5.60
26	10-05-2017	17:50	55	1008	4	E	4	4	5.50	14.80	5.50
27	11-05-2017	7:20	30	1008	5	SE	6	3	5.50	8.50	7.60
28	11-05-2017	10:50	40	1010	5	SE	5	3	5.00	12.50	6.50
29	11-05-2017	15:15	58	1011	5	E	4	3	5.40	12.90	5.50
30	12-05-2017	7:10	14	1010	6	ESE	4	2	5.20	7.40	8.00
31	12-05-2017	9:30	25	1011	7	E	4	2	5.70	7.30	8.60
32	12-05-2017	15:20	30	1013	7	E	5	2	5.40	7.20	8.60

* data at the mean depth of the fish control catch (in the middle of trawl vertical oppening)

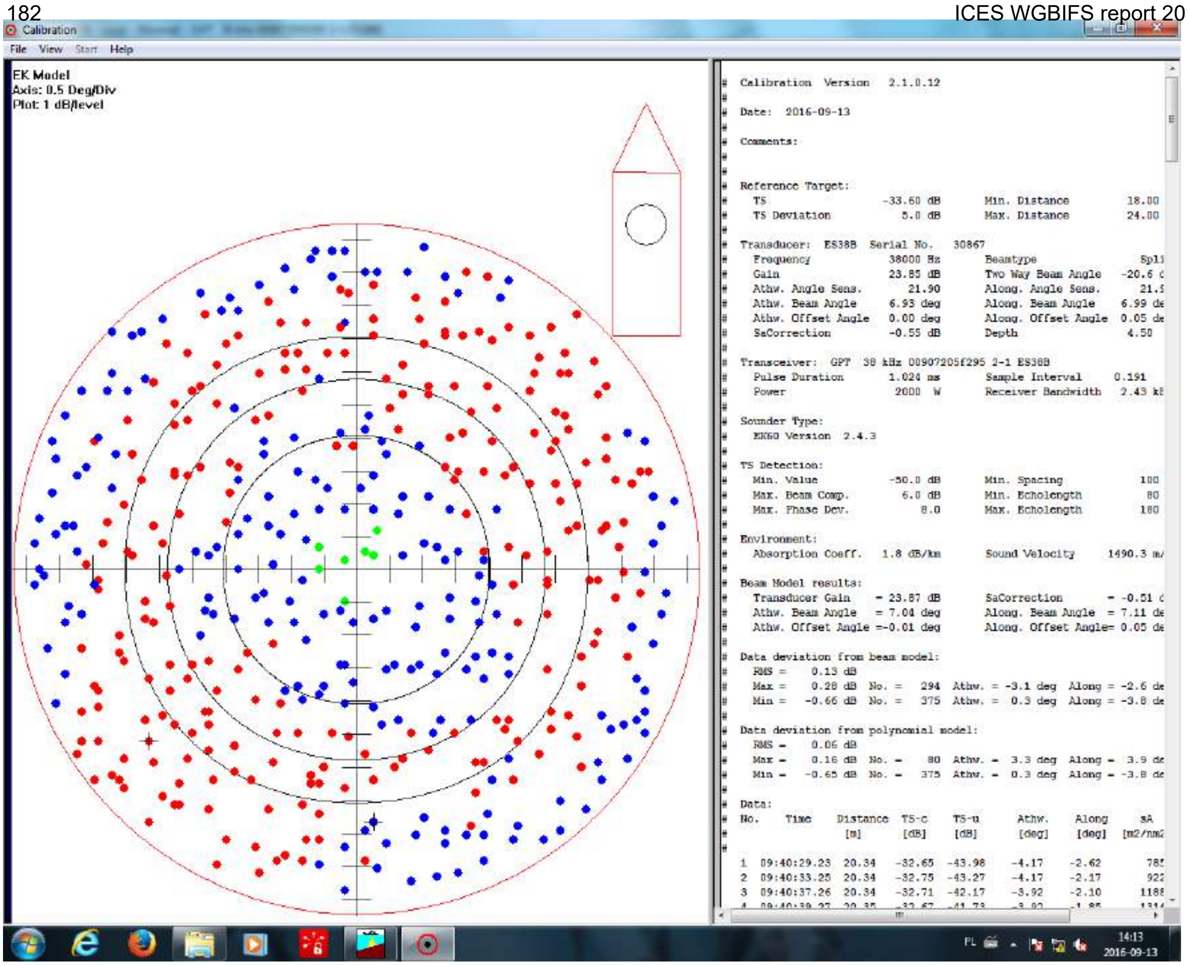

Fig.1. A screenshot after finishing calibration of the 38 kHz transducer during Polish BIAS 2016.

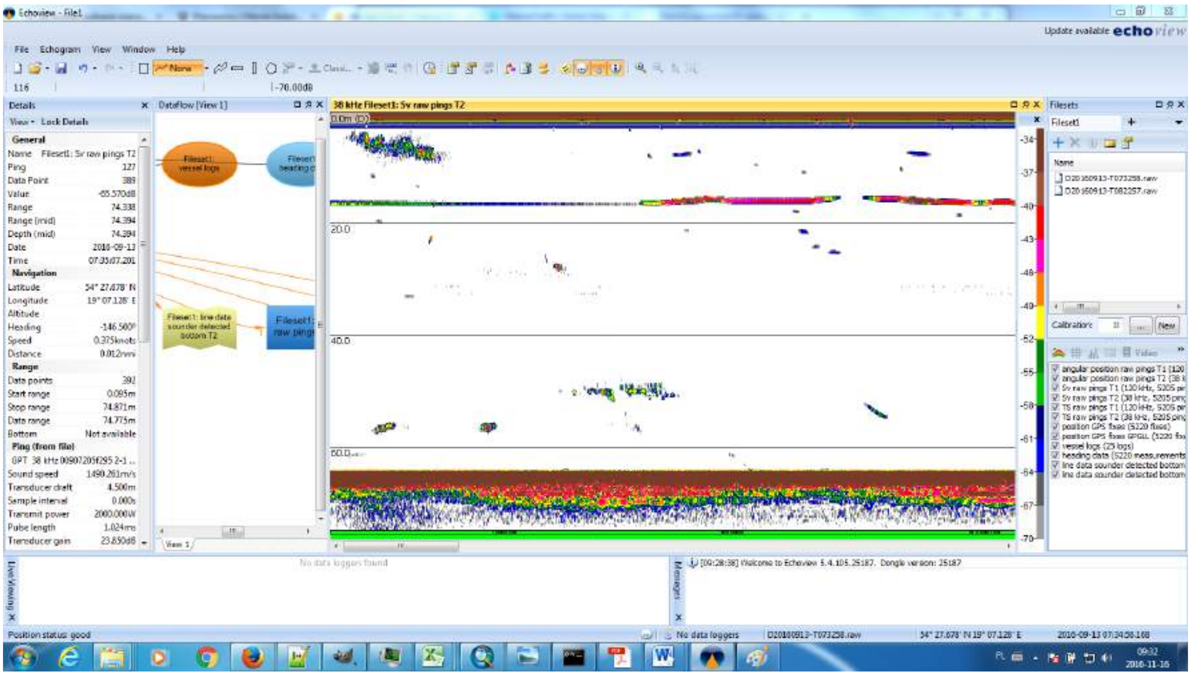

Fig. 2. Observed position of the calibration sphere for the 38 kHz transducer during Polish BIAS 2016.

Fig. 3. A map showing realised cruise tracks (black lines).

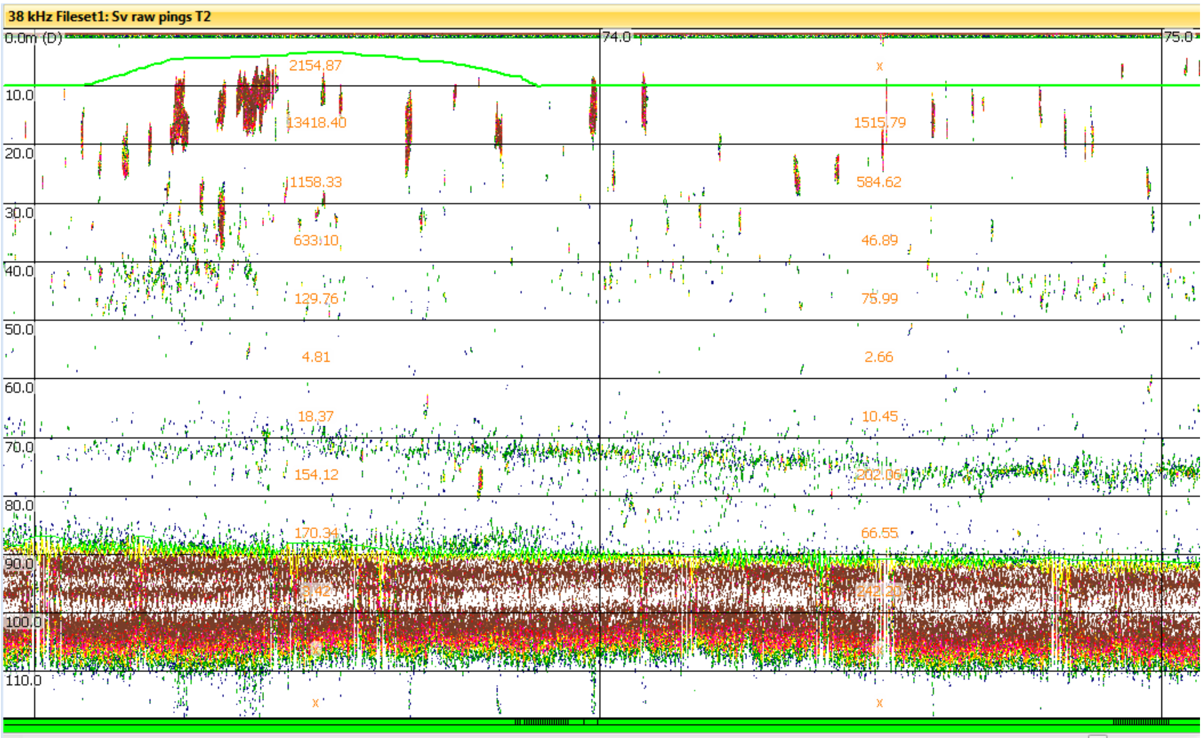

Fig. 4. An example of an echogram analysis for 156th mile of the integration NASC = 17000, north from the Gdansk bay. (bottom depth about 90 m).

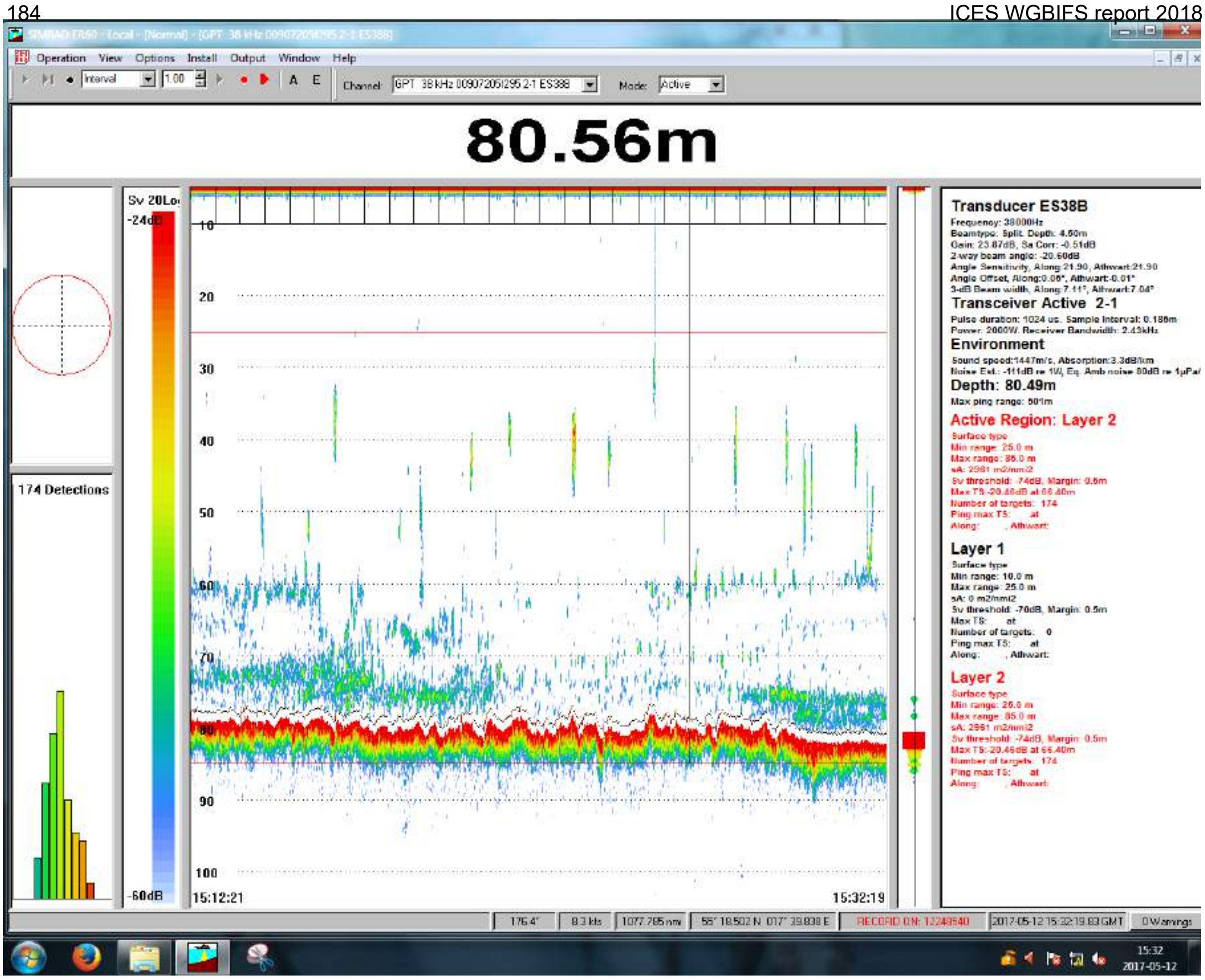

Fig. 5. A screenshot from the SIMRAD EK60 software showing a large concentration of clupeids with the NASC almost 3000 near the RS1 hydrological station.

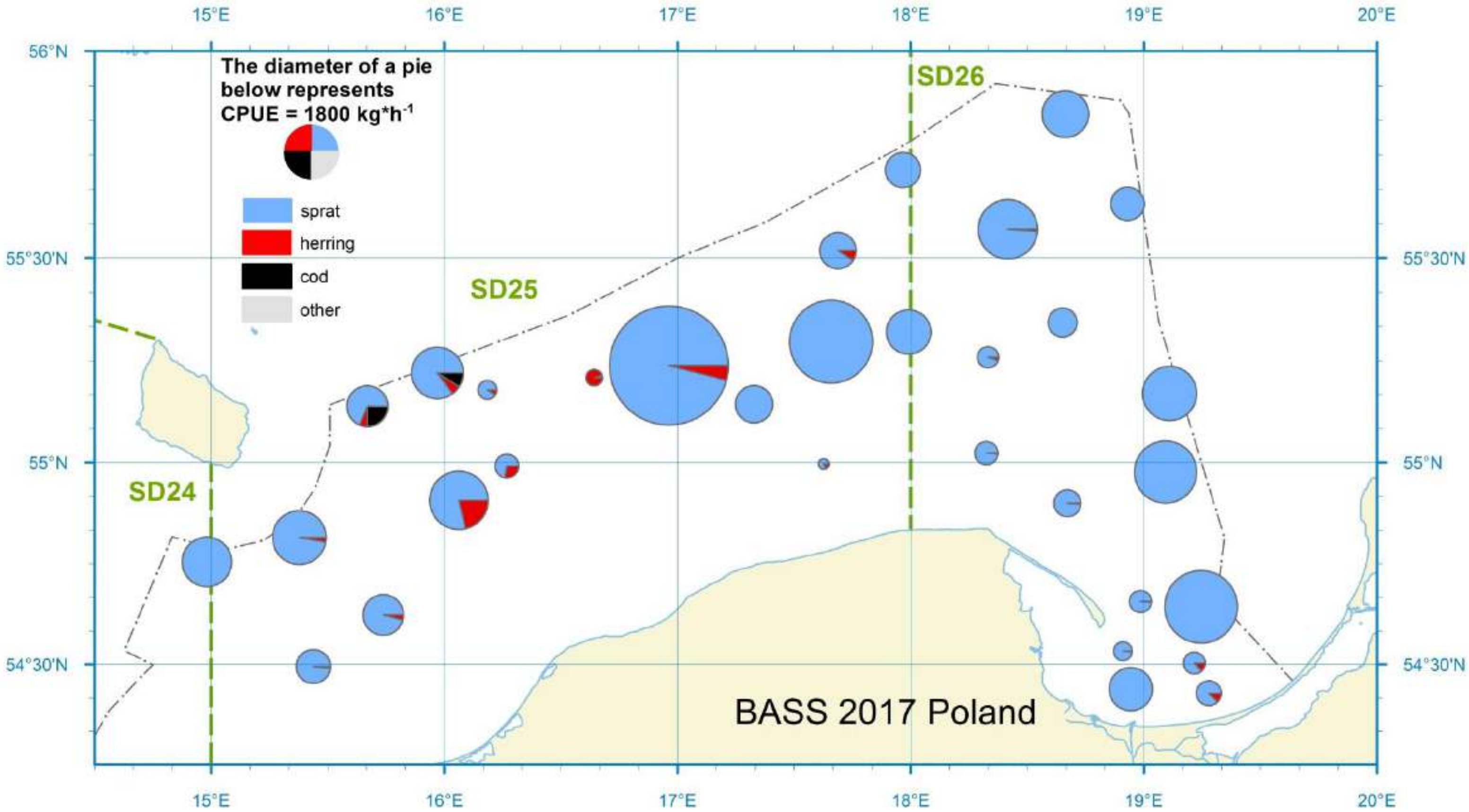

Fig. 6. Mean CPUE [kg h^{-1}] per species in Polish EEZ per single pelagic haul.

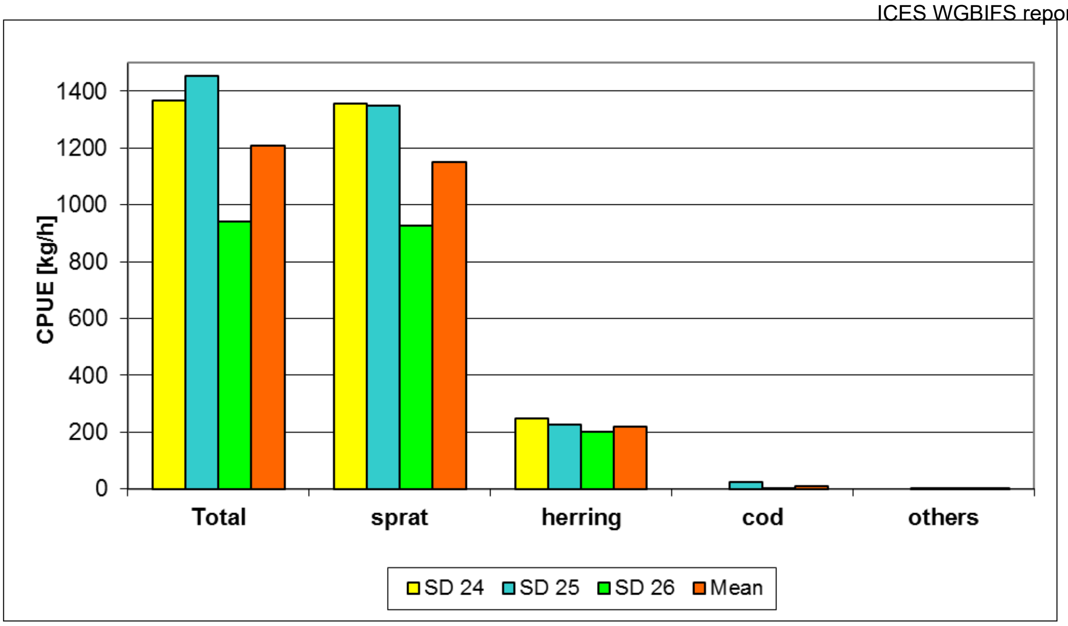

Fig. 7. Mean CPUE [kg h^{-1}] per fish species and the ICES SDs.

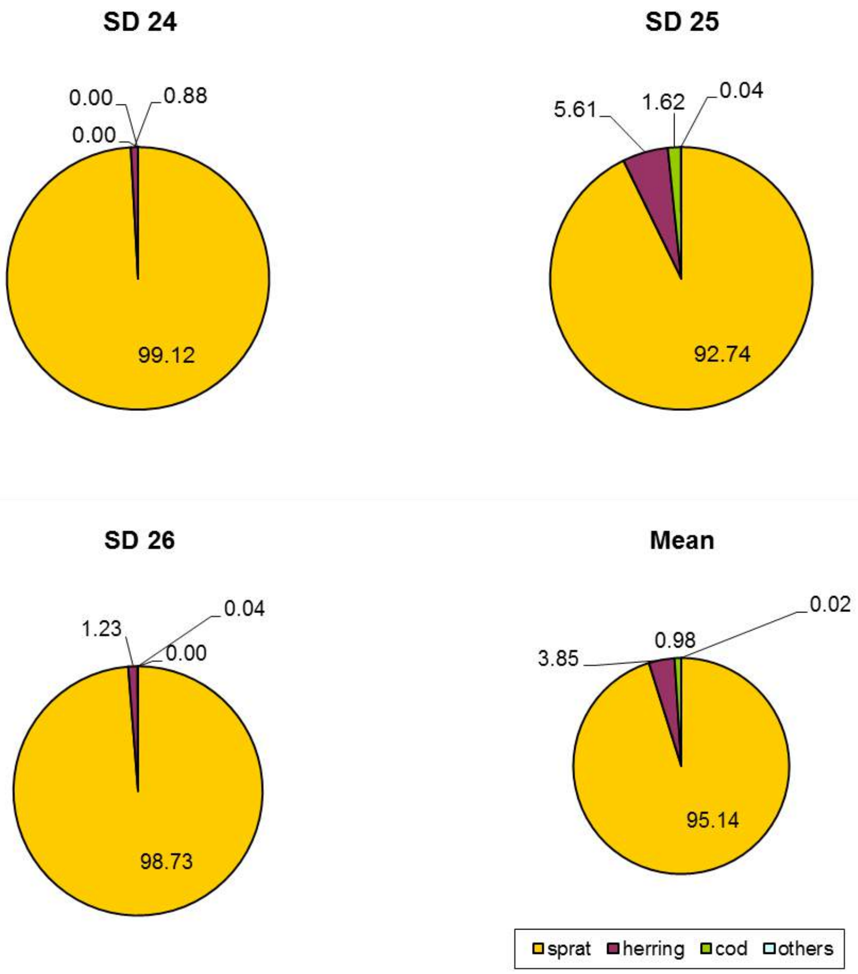

Fig. 8. Mean share (%) of sprat, herring, cod and other fishes in the mass of total catches per the ICES SDs.

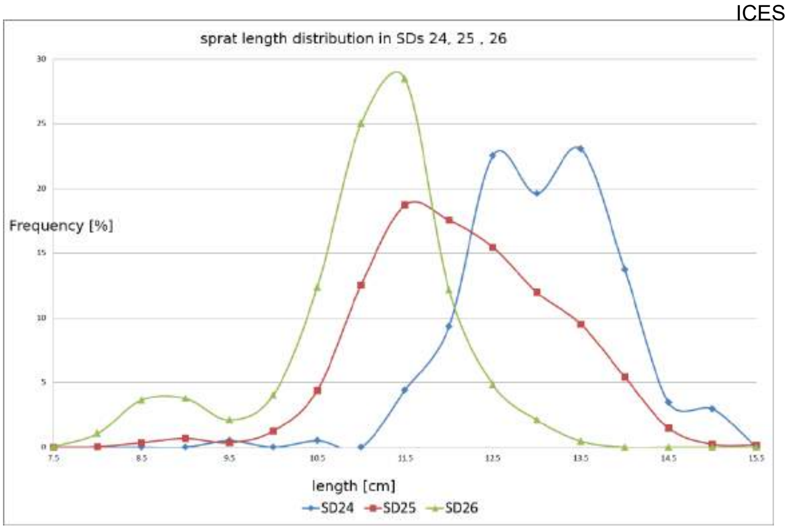

Fig. 9. Length distribution of sprat in samples taken from the control catches.

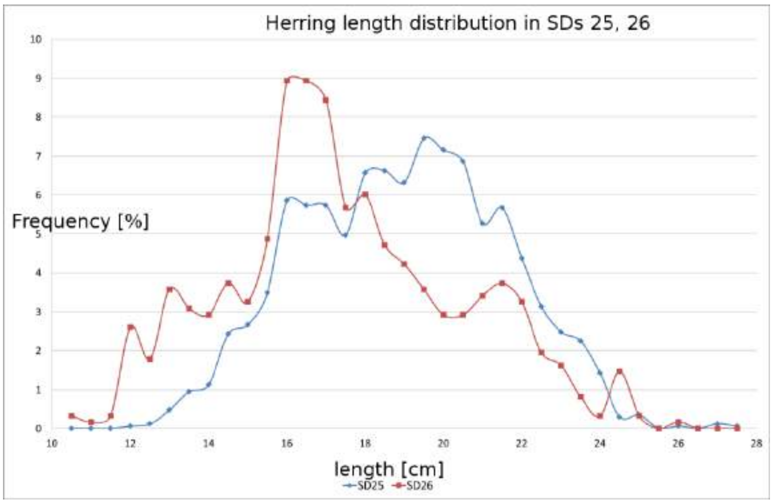

Fig. 10. Length distribution of herring in samples taken from the control catches.

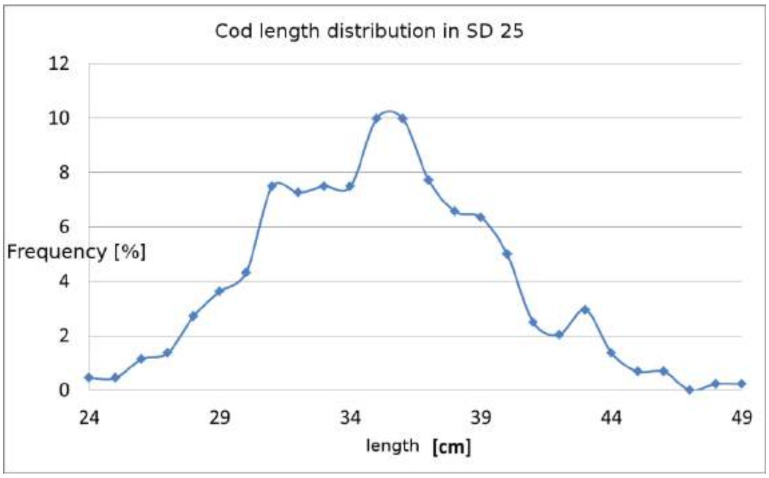

Fig. 11. Length distribution of cod in samples taken from the control catches in SD 25. The data from SDs 24 and 26 were not representative.

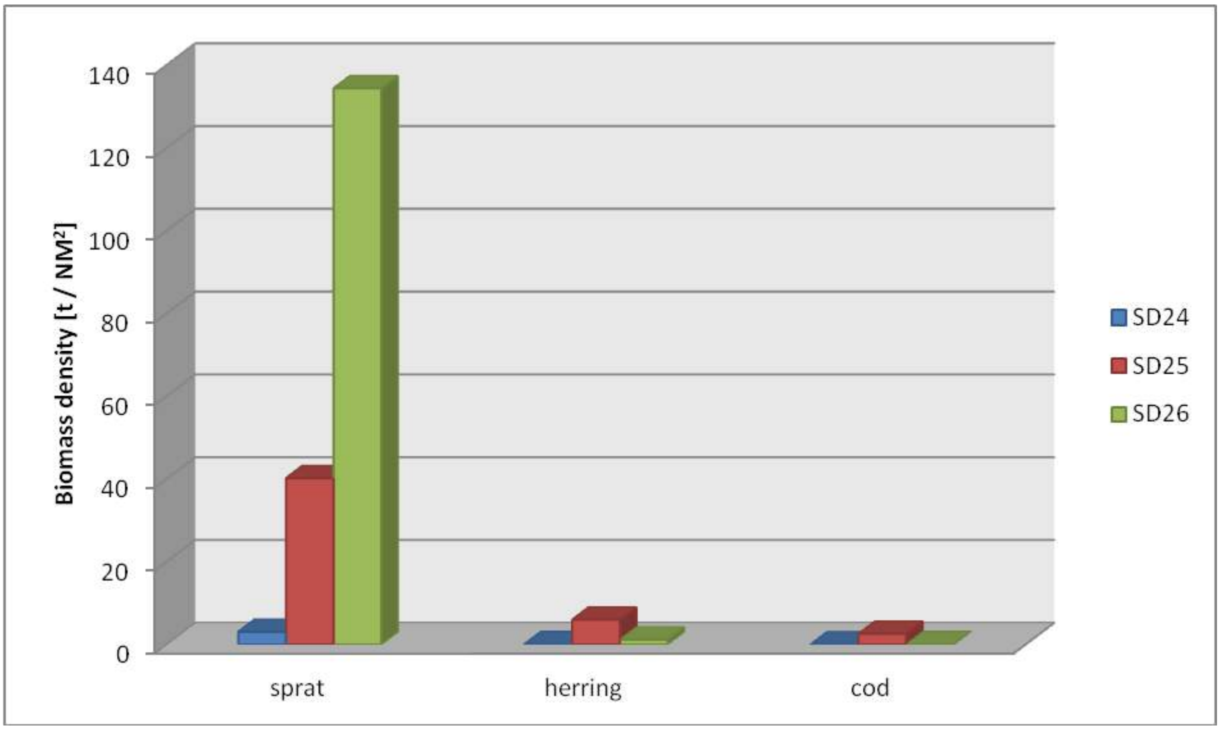

Fig. 12. Total biomass density in the ICES Sub-divisions for the three major species.

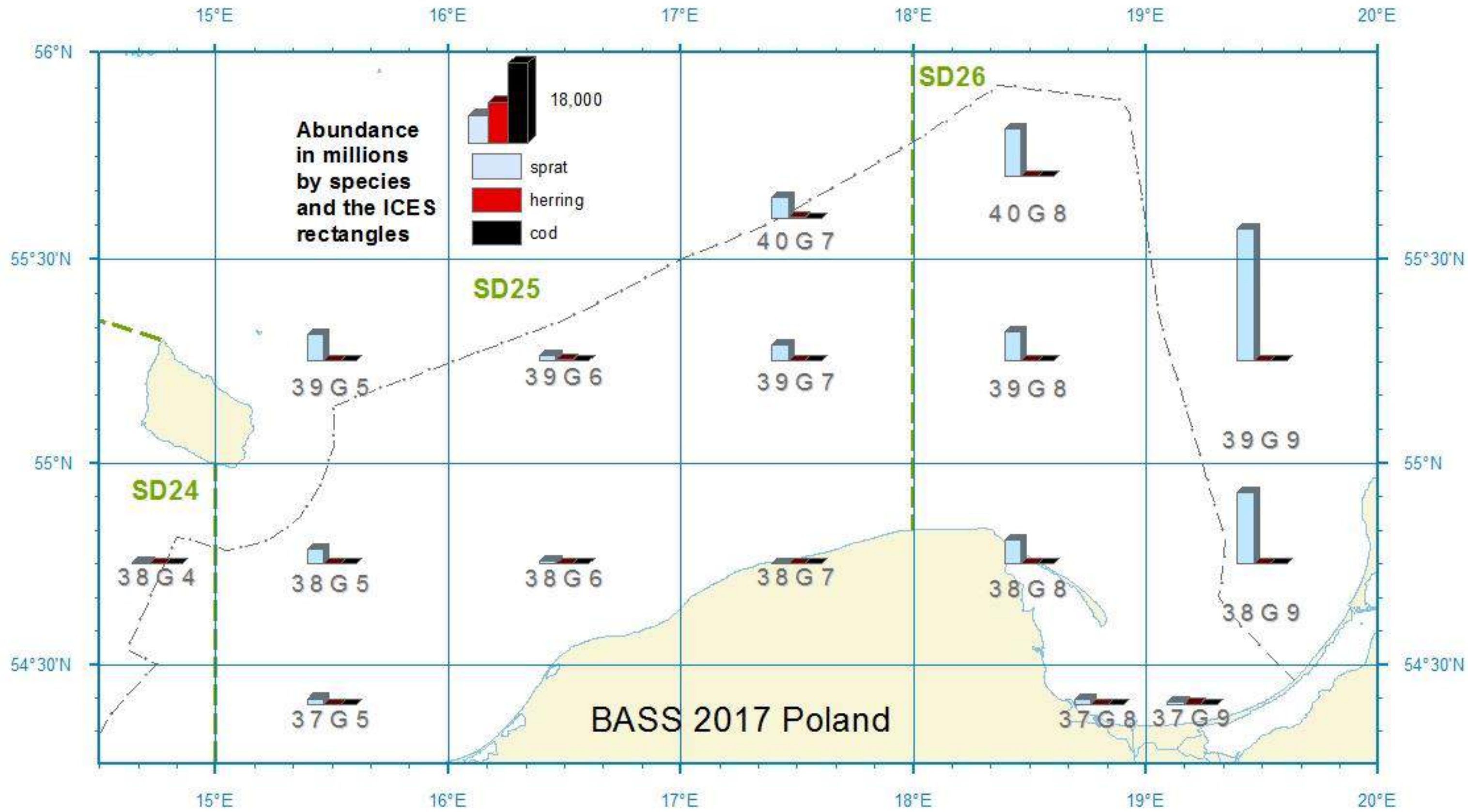

*Fig. 13. Cruise statistics (the black bar's size in a legend represents 18,000*10⁶ of indiv.).*

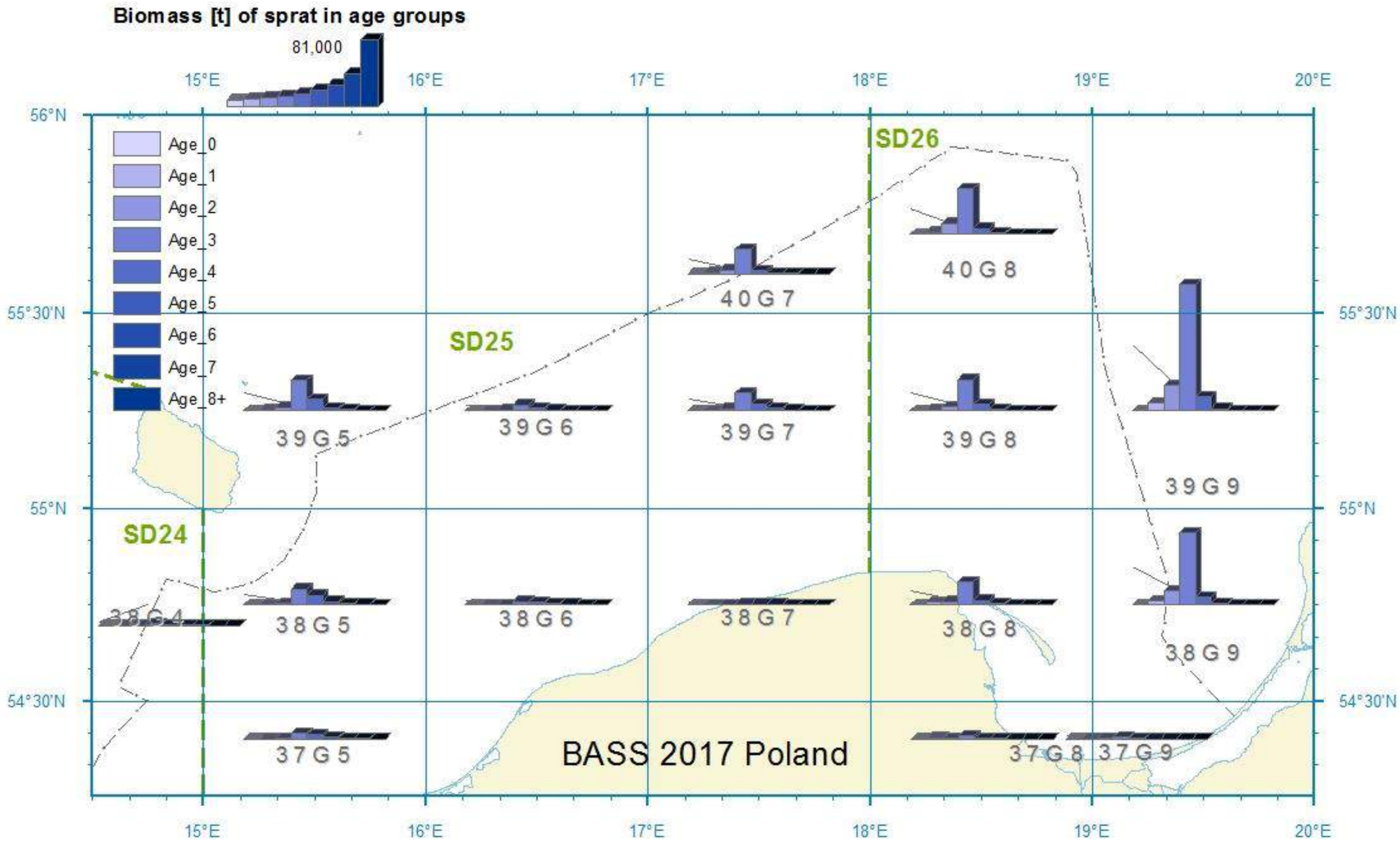

Fig. 14. Biomass of sprat (in tons) per age groups, ICES rectangles and ICES SDs, estimated using acoustic method based on data collected during the Polish BASS survey on board of the r.v. Baltica, 02-13.05.2017. The largest bar's size in the legend represents 81,000 t.

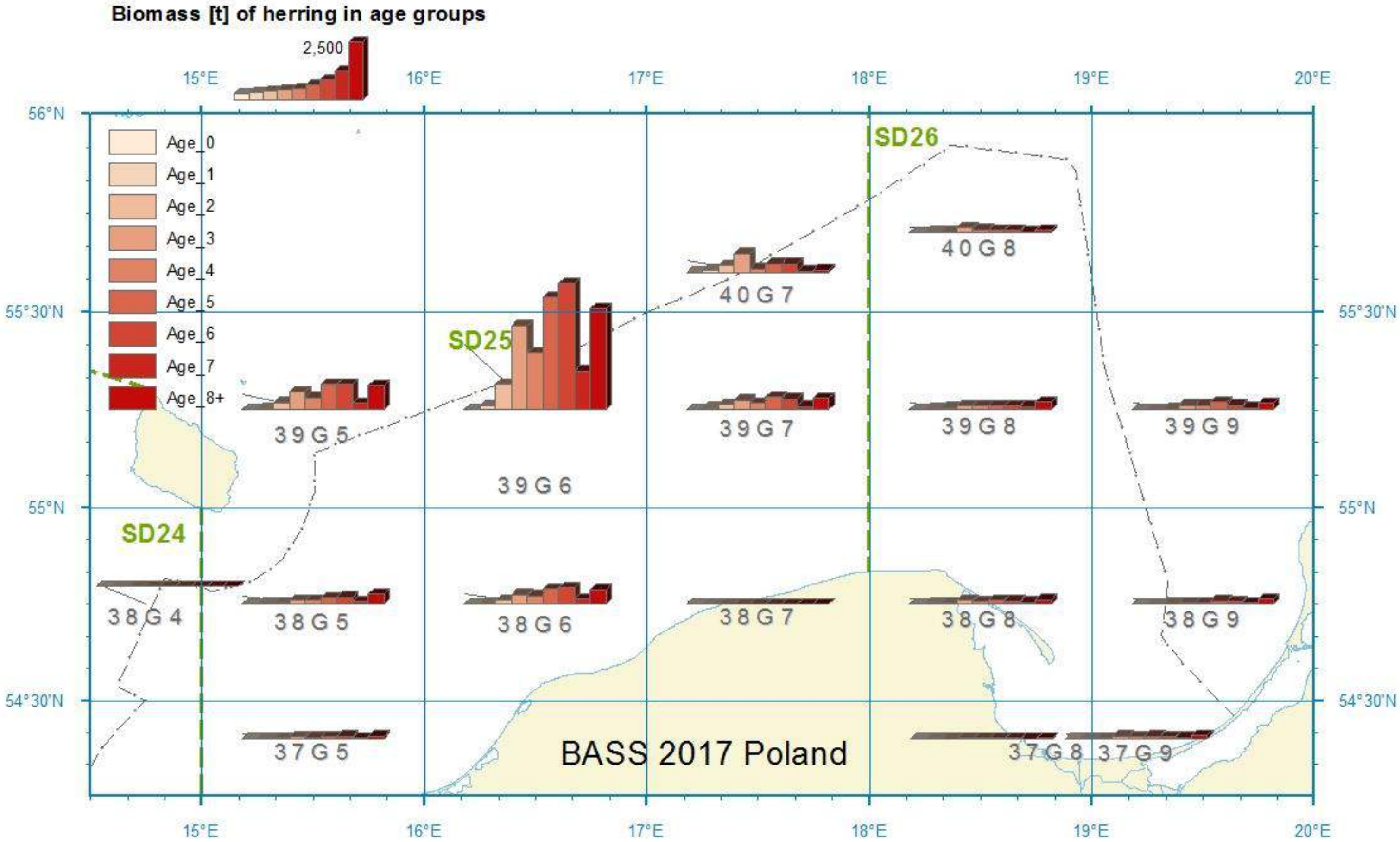

Fig. 15. Biomass of herring (in tons) per age groups, ICES rectangles and ICES SDs, estimated using acoustic method based on data collected during the Polish BASS survey on board of the r.v. Baltica,02--13.05.2017. The largest bar's size in the legend represents 2500 t.

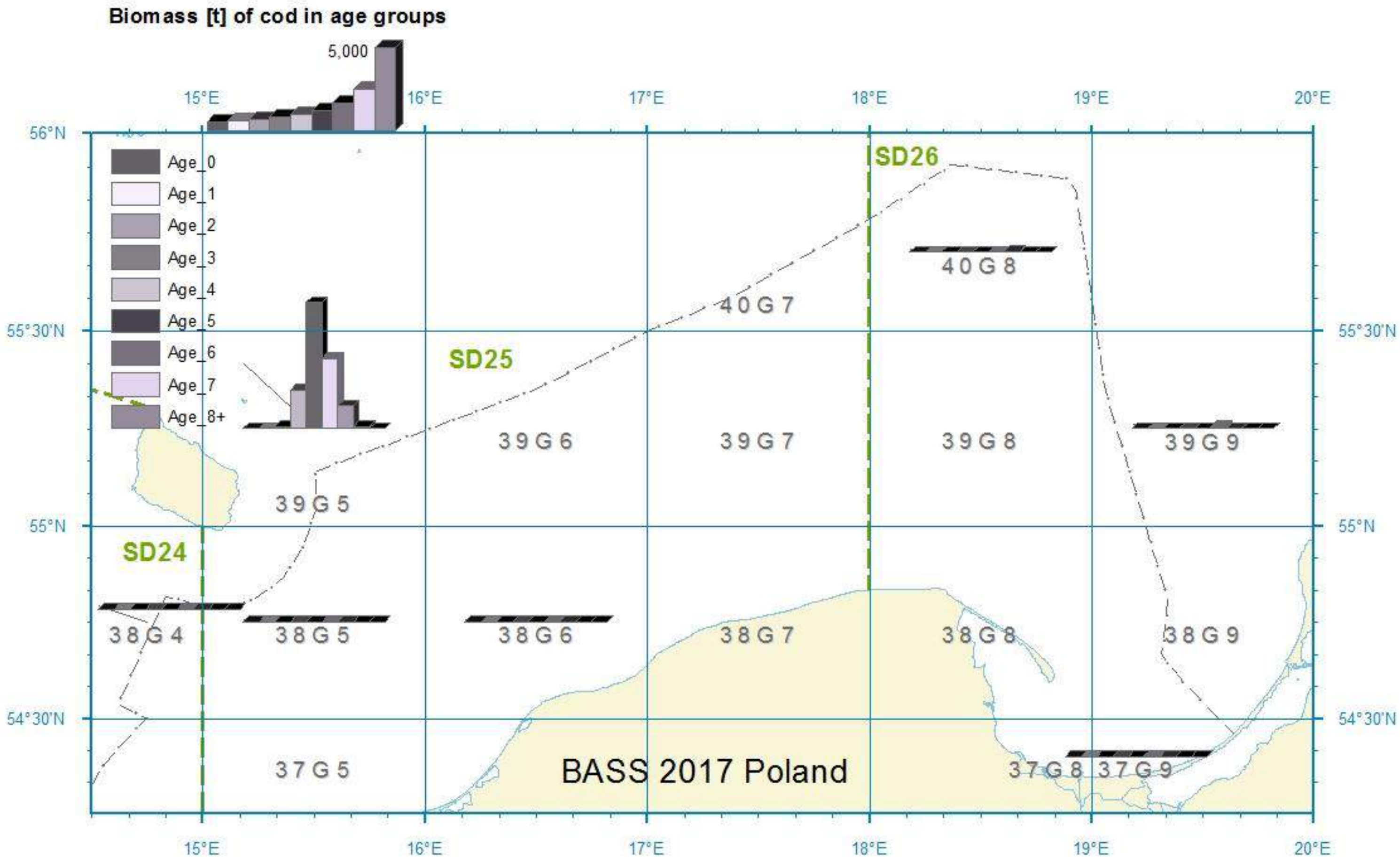

Fig. 16. Biomass of cod in tons per age groups, ICES rectangles and ICES SDs, estimated using acoustic method based on data collected during the Polish BASS survey on board of the r.v. Baltica, 02-13.05.2017. The largest bar's size in the legend represents 5,000 t.

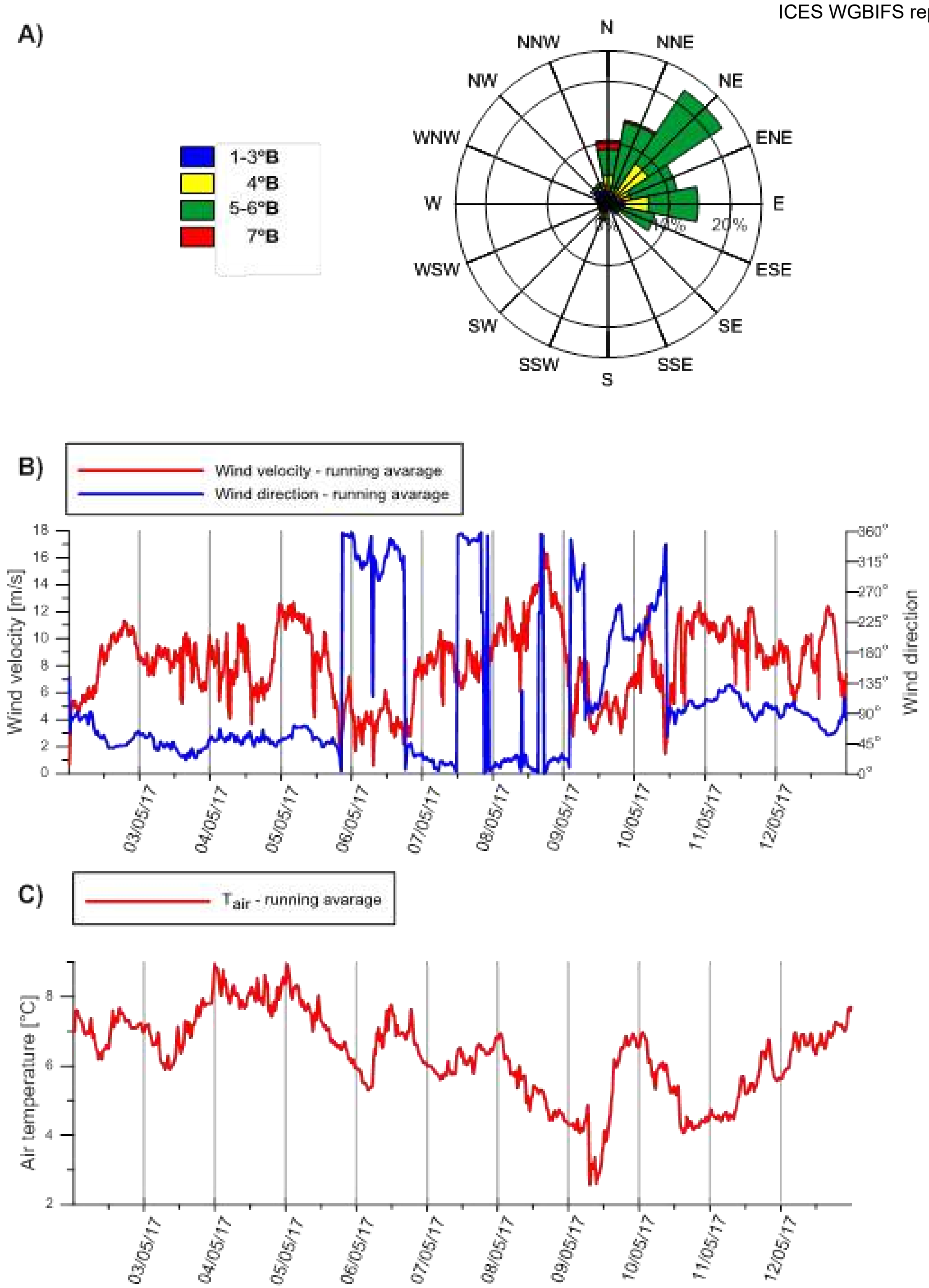

Fig. 17. Changes of meteorological parameters during consecutive days of the Polish BASS survey (May 2017).

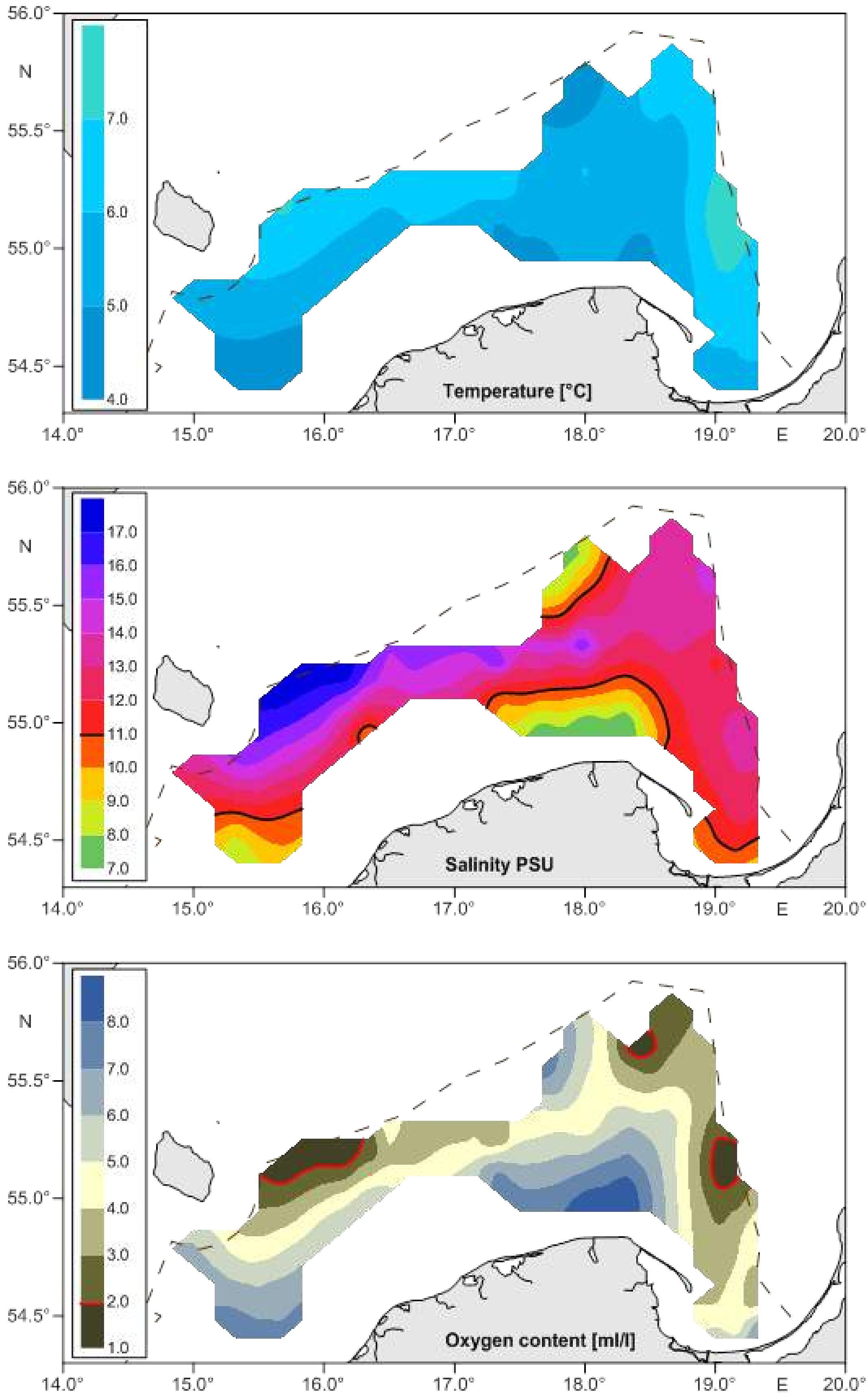

Fig. 18. Horizontal distribution of the seawater temperature, salinity and oxygen content in near the seabed layer of the southern Baltic (May 2017).

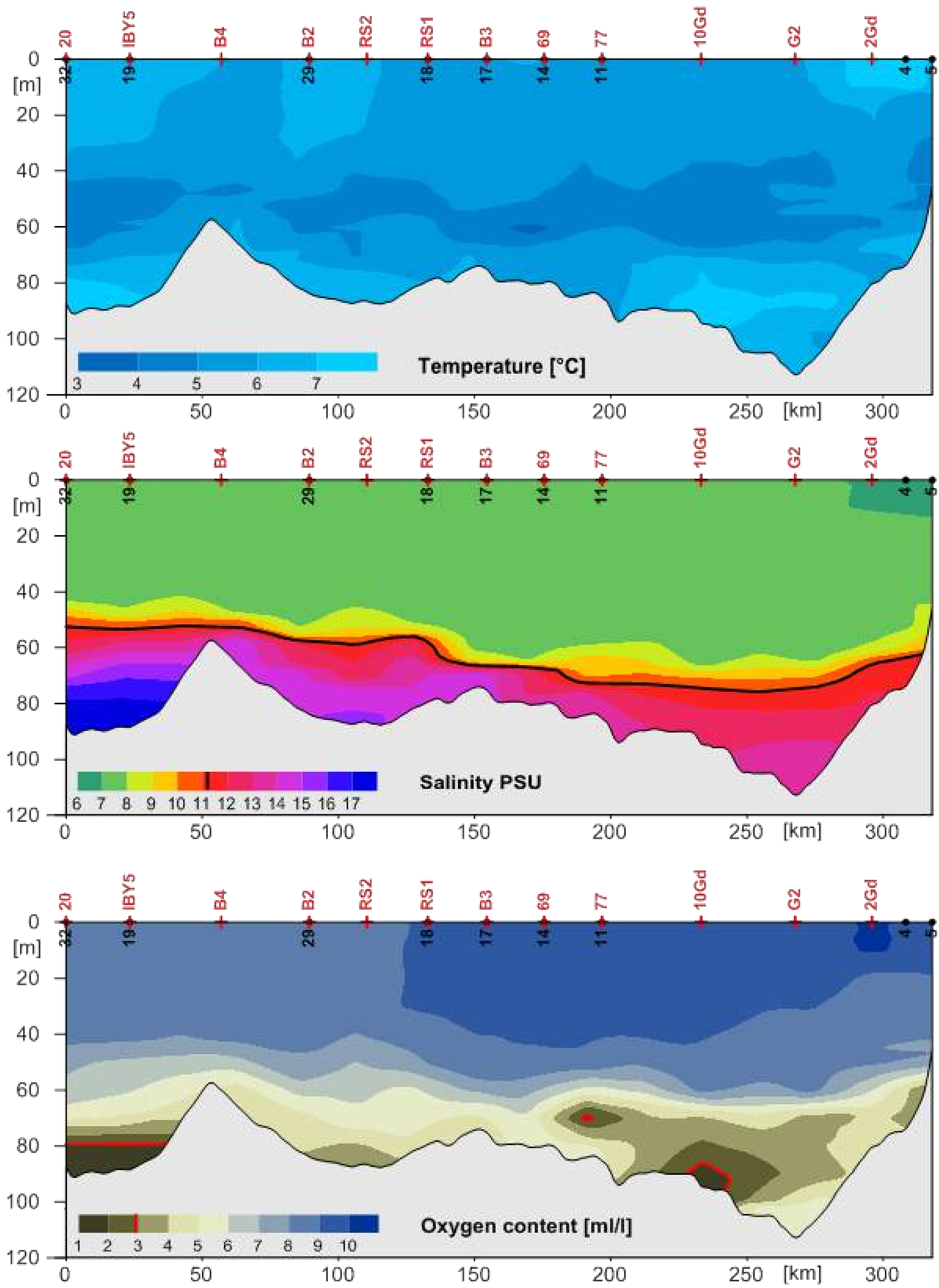

Fig. 19. Vertical distribution of the seawater temperature, salinity and oxygen content, along the research profile determined in the southern Baltic (May 2017); X- and Y-axes reflects distance (in kilometres) and depth (in meters) from the sea surface to the seabed, respectively.

Federal Research Institute for Rural Areas, Forestry and Fisheries

Thünen-Institute of Baltic Sea Fisheries
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Survey Report FRV "Walther Herwig III" Cruise 405
03. – 22.05.2017

Hydroacoustic survey for the assessment of small pelagics in the Baltic Sea

Paco Rodriguez-Tress

Summary

1. Introduction

Cruise no. 405 of the FRV “Walther Herwig III” in 2017 was conducted as part of the annual ICES Baltic International Acoustic Spring Survey (BASS). The main objective of this hydroacoustic survey is the yearly assessment of small pelagic fishes stock, especially sprat, in the Baltic proper. BASS is co-ordinated at the international level by the ICES Baltic International Fish Survey Working Group (WGBIFS) where timing, surveying area and the principal methods of investigations are discussed and decided.

German investigation area in 2017 covered ICES subdivisions 24, 25, 26, 27, 28 and 29. Other areas in the Baltic Sea were covered by Lithuania, Latvia, Estonia and Poland.

This cruise followed a one year interruption in the usual annual survey cycle as technical problems with FRV “Walther Herwig III” previous year didn’t allow monitoring this area during the BASS 2016.

2. Survey participants

Name	Function	Institution
P. Rodriguez-Tress	Scientist in charge	TI-OF
Dr. D. Stepputtis	Acoustics	TI-OF (03.-10.05)
Dr. E Bethke	Acoustics	TI-SF (10.-22.05)
Dr. A. Hermann	Fishery biology	TI-OF (03.-10.05)
M. Koth	Fishery biology	TI-OF
D. Stephan	Fishery biology	TI-OF
A. Müller	Fishery biology	TI-OF
M. Wolfram	Fishery biology	TI-OF (03.-10.05)
D. Enkelmann	Fishery biology	TI-OF (student assistant)
H. Heidemann	Fishery biology	TI-OF (student assistant)

3. Methods

3.1. Narrative

Scientific team and biological gear were embarked on FRV “Walther Herwig III” the 2nd May in Bremerhaven. Cruise started the 3rd May after the ship left Bremerhaven in the morning. Acoustic survey started in the morning of the 5th May after reaching the area of investigation and ended the 21th May in the afternoon. Due to optimal weather conditions the 6th May was used to calibrate the Echosounder in the Tromper Wiek. Part of the scientific staff was replaced the 10th May in the morning at the harbour of Sassnitz.
The cruise ended the 22th May after a total of 16 days of hydroacoustic monitoring when scientists disembarked in the afternoon in the harbour of Warnemünde. Good weather conditions allowed fulfilling the main objectives of the cruise.

3.2. Survey design

The acoustic and ichthyologic sampling stratification was based on ICES statistical rectangles (0.5 degree in latitude and 1 degree in longitude). The daily surveyed distance amounted to approximately 90-100 nautical miles with an objective of 60 nautical miles per statistical rectangle. In general each ICES-rectangle was covered with two parallel transects spaced by a maximum of 15-18 nm whenever possible. Survey speed remained close to 10 knots through the cruise. The standard acoustic investigations and the fishing hauls were carried out at daylight from 4:00 - 16:00 UTC (6:00 and 18:00 local time).

The survey covered the whole subdivision 24 except the rectangle 37G4 where time constraint, shallow depth restricting fishing operation and partial cover by the Polish EEZ didn't allow any investigation. With the exception of rectangle 43G8 (SD 28) -overlapping mostly land- all rectangles assigned to German investigation in subdivisions 25 to 29 were covered by hydroacoustic transects. For some rectangles, due to time or spatial constrain the total hydroacoustic track length was however lower than the recommended 60 nautical miles (see Table 1). Absence of licence delivery for some specific planned station in the Swedish EEZ by authorities forced also some track changes, especially in rectangle 42G8 (SD 28) were transect was reduced.

Most hydroacoustic recording and all fishing hauls were carried at daylight from ~4:00 to ~19:00 UTC (6:00 and 21:00 local time). One notable exception occurred on the 10th May where crew change in Sassnitz forced to extend the survey to night-time period (see Table 2). During the survey, hydroacoustic data were recorded at a standard ship speed of 10 knots and hauls done at a speed of about 3 knots.

3.3. Hydrography

A Seabird-CTD-probe with a carousel water sampler and oxygen sensor was used for hydrographical measurements. Vertical profiles were taken on a fixed station grid along the track. Additional CTD casts were done after or before each trawl if distance from the planned station was high enough (ca. 5 nmi). The profiles covered the entire water column to about 2 m above the sea bottom. Additionally, water samples were taken once per day from different depths to check the oxygen data by Winkler titration and to collect reference salinity samples. The hydrological raw data were aggregated to 1 m depth strata. Additional meteorological observations of air temperature, atmospheric pressure, wind speed and direction were recorded during all hydrographical investigations. Altogether 136 CTD casts were performed during the cruise following this methodology.

3.4. Calibration

Calibration of the hull mounted echosounder took place the 6th May in the coastal area of Rügen Island, the Tromper Wiek. Walther Herwig III was recently equipped with a multifrequency Simrad EK60 echosounder (18, 38, 120 and 200 kHz). Although the survey was done with a 38 kHz frequency (pulse length = 1024 µs; pingrate = 500 ms) each transducer were calibrated at pulse length of 1024, 512 and 256 µs. Calibration procedure itself was carried out as described in the "Manual for International Baltic Acoustic Surveys (IBAS)" (ICES 2015).

3.5. Acoustic data collection

The acoustic equipment used was a Simrad scientific echosounder EK60 operated at 38 kHz. Specific settings of the hydroacoustic equipment were used as described in the "Manual for the Baltic International Acoustic Survey (BIAS)" (ICES, 2015). Echo-integration, i.e. the integration and allocation of NASC values to species abundance and biomass was accomplished using Echoview 8.0 post-processing software. Mean volume back scattering values (sv) were integrated over 1 nm intervals from 10 m below the surface (or depending on surface turbulence) to ca. 0.5 m over the seafloor. Visible interferences from surface turbulence, bottom structures and scattering layers were also removed from the echogram.

3.6. Biological data – fishing stations

Trawling was done with the pelagic gear “PSN205” in the midwater as well as near the bottom to identify the echo signals. The intention was to conduct at least two hauls per ICES statistical rectangle. The trawling time lasted usually 30 minutes by using a trawling speed of about 3 knots. The trawling time was however decreased in case of abundant catch observed with the Scanmar-net-probe. In accordance to the IBAS-manual the following cod end inlets with stretched mesh sizes were used:

- 20 mm in Subdivision 24 and
- 12 mm in Subdivision 25 to 28.

The trawling depth and the net opening were controlled by a Scanmar-net-probe. Generally the net opening was of ca 12 m under usual operation. The trawl depth (headrope below the surface) was chosen regarding highest density of fish on the echogram and ranged from 5 m to 76 m. The bottom depth at the trawling positions varied from 28 m to 443 m.

Samples were taken from each haul in order to determine the length and weight distribution of fish. Sub-samples of cod, herring and sprat were investigated concerning sex, maturity and age. Samples of whole fishes and parts of different organs/tissues were taken for later investigations in the lab. Detailed biological analyses were made according to the standard procedure (i.e. sex, maturity, otolith dissection).

Totally 49 standard hauls were carried out on the cruise (Figure 1). One haul was conducted with a multinet gear (station 7) to sample different fish layer in the water column but the system failed to open properly, resulting in no-catch at this station. Haul 6 was carried out specifically to investigate weak echo close to the surface (consisting of sticklebacks), resulting in supposed non-representative fish composition through the water column. Finally, haul 1, 10, 18, 19, 20 resulted in low catch weight, number and non-representative species composition.

Length of hydroacoustic transects	1.545 nmi
Number of pelagic trawl hauls valid/invalid	49/1
Number of CTD vertical profiles	136

3.7. Data analysis

The pelagic target species sprat and herring are usually distributed in mixed layers and in combination with other species so that the integrator readings cannot be allocated directly to a single species. Therefore, the species composition used for the conversion of echo integrals into fish abundance, was based on trawl catch results accordingly. For each rectangle the species composition and length distribution was determined as the unweighted mean of all trawl results in this rectangle. In case of missing hauls within an individual ICES rectangle (due to gear problems or other limitations), hauls results from neighbouring rectangles was used.
From these distributions, the mean acoustic cross section σ was calculated according to the following target strength-length (TS) relations:

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

The total number of fish (total N) in one rectangle was estimated as the product of the mean nautical area backscattering coefficient (i.e. echo integral, Sa in m²) and the rectangle area (nm²), divided by the corresponding mean cross section. The total number of fish was separated into herring, sprat and cod according to the mean catch composition. In accordance with the guidelines in the 'Manual for the Baltic International Acoustic Surveys (ICES 2015)', the further calculation was performed in the following way:

With the exception of cod, species with an overall mean contribution to all sampled hauls of less than one percent are excluded from further total species frequency calculation for abundance estimation.

Fish species considered in this report are thus (see results for catch statistics):

- *Clupea harengus*
- *Gadus morhua*
- *Gasterosteus aculeatus*
- *Hyperoplus Lanceolatus*
- *Sprattus sprattus*

Hauls with low level of catch and/or non-representative species compositions were excluded from analysis. This includes the following hauls:

- haul 1; 39G3/SD24
- haul 6; 40G5/SD25 : specifically targeting sticklebacks close to the surface
- haul 7; 39G5/SD25 (gear problem)
- haul 10; 40G5/SD25
- haul 18; 40G6/SD25
- haul 19; 40G6/SD25
- haul 20; 40G7/SD25

Usage of neighbouring trawl information for rectangles, which contain only acoustic investigations:

- haul 2; 38G3/SD24 for 38G2/SD24
- haul 2; 38G3/SD24 for 39G2/SD24
- haul 23; 40G7/SD25 for 40G6/SD25
- haul 49; 41G6/SD25 for 40G6/SD25

As no data is available in the German assigned area for the BASS 2016, results will be compared to those of the BASS 2015 or other previous surveys when relevant.

4. Results

4.1. Hydrographic data

Temperature, Salinity and Oxygen profile along the survey are represented in Figure 2. Seawater temperature ranged from 17.8 °C on the surface to 2.6°C (recorded at 48 m depth). At the deepest CTD cast of the survey (438.5 m) temperature was measured at 6.0°C. Only intermediate water in the Gotland Basin presented temperature below 4°C, which could be a temperature threshold limiting sprat distribution in the water column. In this regard it is noteworthy that echo density was relatively low in this water layer (see Figure 3).

Measured salinity ranged from 5 psu at the surface layer to 19 psu at the bottom of the Bornholm Basin and didn't exceed 15 psu at the bottom of the Gotland Basin.

Regarding oxygen, concentration ranged from 5 to 10 $mL.L^{-1}$ above halocline and dropped below 1 $mL.L^{-1}$ under this layer. Overall hypoxic conditions (<1.4 $mL.L^{-1}$, ~30% atmospheric saturation) were observed below 70-80 m depth all along the survey. No fish echo is observed under these conditions (see Figure 3).

4.2. Acoustic data

The basic results are given in Table 3 (survey area, mean s_A, mean scattering cross section σ, estimated total number of fish and percentage of herring and sprat per rectangle).

The valid measured cruise track reached a distance of 1306 nautical miles. On an ICES subdivision scale the mean NASC values in SD 24, 25 and 28 were comparable to those recorded in 2015 (Figure 4). More fluctuation are observed for these 2 years in the SD 26, 27 and 29 with, for 2017, a higher recorded mean NASC in SD 26 and lower one in SD 27 and 29. Overall mean NASC appear above average in 2017 with a mean NASC of 597.6 m^2/nm^2 compared to a mean NASC of 431.0 m^2/nm^2 for all years polled together. However, due to survey track changing from one year to the other, direct comparison is not possible as fish density may well be spatially correlated to landscape.

Echo distributions along the hydroacoustic track (Figure 5) shows heterogeneous fish concentration in SD 24, and to a lesser extend in SD 25. Mean NASC recorded in SD 26, 27, 28, 29 appear to be more homogeneous along the transects. As noted in 2015, mean NASC is lower in SD 24 than in other Subdivisions (Figure 4).

4.3. Biological data

Catch statistics per fishing hauls are presented in Table 4 and per species in Table 5. Overall 9 fish species were recorded in 49 pelagic trawl hauls. Dismissing the haul with low catch level, the CPUE ranged from 2.4 to 1429.3 kg/0.5h. The mean catch reached with 286.7 kg/0.5h.
In terms of weight, catch was dominated by sprat (91.1%) followed by herring (6.7%) and stickleback (1.6%). Those three species were caught on the majority of the trawls through the survey. The numbers and biomass of species other than herring, sprat and stickleback was negligible. CPUE of sprat seems to be increasing since the last 5 years with the exception of SD 25 were catches were relatively low compared to those recorded in 2013 and 2014 (203.7 vs 688.3 and 642.0 kg / 0.5 h respectively). This trend is not observed for herring with relatively average to low catches observed this year, especially in SD 24 to 26. Regarding cod, catches per subdivision were also low compared to previous years. The total CPUE calculated for cod is 1.1 kg / 0.5 h which represent, with 2012 (0.8 kg / 0.5 h) the lowest level of catch recorded during this type of survey.

Figure 6 show the length frequency distribution for sprat and herring per subdivision in 2015 and 2017. Age distribution per length class is presented in Figure 7. Missing length class for the age distribution were reconstructed by calculating a weighted mean of adjacent upper and lower classes. Final age distribution by subdivision for 2015 and 2017 (Figure 8 and Figure 9 respectively) was calculated according to the minimum effort method by multiplying the length frequency distribution with the age distribution per length class as recommended in the IBAS Manual (2015: eq 5.3.1).

As shown by the last figures, proportion of incoming year class in both herring and sprat population was notably lower in 2017 compared to 2015 in almost all subdivision (the exception being SD 24 for sprat). The large incoming year class observed in 2015 for both sprat and herring can still been seen as the well represented 3 year old class in Figure 9. Two years age class was also relatively low compared to the 3 years age class, especially for herring. Overall proportion of 1 year old sprat and herring was lower in SD 25 and 26 compared to other subdivisions in 2017.

4.4. Abundance estimates

The calculated abundance in number and weight of sprat and herring per rectangle and subdivision is presented in Table 6.

As the covered area is not exactly the same between the cruise of 2015 and 2017, following comparison of estimated biomass of sprat and herring for the two year is done only for statistical rectangles monitored both years.

Estimated abundances in all overlapping rectangle for herring and sprat are lower in 2017 compared to 2015 with respectively $5.6*10^9$ versus $18.2*10^9$ herrings (- 69%) and $92.5*10^9$ versus $77.3*10^9$ sprats (- 19%). Estimated biomass is also lower in 2017 for herring with $146.7*10^3$ tonnes versus 264.2 $*10^3$ tonnes estimated in 2015 (- 44%) for the same rectangles. Despite lower calculated number of sprat in 2017, estimated biomass was slightly higher in 2017 with $669.6*10^3$ tonnes versus $656.8*10^3$ tonnes in 2015 (+ 2%). This result is explained by a higher proportion of the larger sprat compared to 2015 (see section 4.3).

Year	Species	n total (million)	total biomass (tonne)
2015	*Clupea harengus*	18165.6	264159.9
2017		5584.8	146653.8
2015	*Sprattus sprattus*	92477.0	656751.9
2017		77331.3	669594.4

5. Discussion

Although this cruise can be considered a success regarding assigned objectives, absence of data for 2016 doesn't allow evaluation the abundance index evolution between 2016 and 2017. Proportion of incoming year class in 2017 however point toward a lower recruitment process for both herring and sprat relatively to 2015. Low proportion of 2 years old class in 2017 for herring would also suggest a similar pattern in 2016. Although estimated biomass of herring was lower (- 44%) biomass of sprats was however slightly higher than in 2015 in similar area due to the higher proportion of larger sprat in the population.

6. Acknowledgements

We are grateful to Captain Jürgen Vandrei and to the vessel's crew for their continuous support during the cruise

7. References

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8. Tables

Table 1: FRV “W. Herwig” cruise 405/2017. Hydroacoustic track length per ICES rectangle.

ICES rectangle	hydroacoustic track length (nmi)	ICES rectangle	hydroacoustic track length (nmi)
37G4	0	41G7	82
38G2	21	41G8	88
38G3	90	42G7*	14
38G4	59	42G8	28
38G5*	12	42G9	56
39G2	20	43G8	0
39G3	80	43G9	77
39G4	61	44G9	69
39G5	88	45G8	45
39G6*	34	45G9	72
40G4	54	46G8	54
40G5	69	46G9	61
40G6	69	46H0	41
40G7	65	47G9	30
40G8*	22	47H0	12
41G6	72		

* ICES rectangle not assigned to German investigation

Table 2: FRV “W. Herwig” cruise 405/2017. Start and end time of hydroacoustic recording during the cruise.

day	start time (UTC)	end time (UTC)	day	start time (UTC)	end time (UTC)
05.05.2017	04:03	17:48	14.05.2017	04:02	15:28
07.05.2017	03:40	16:52	15.05.2017	04:05	16:10
08.05.2017	03:38	18:46	16.05.2017	03:53	17:14
09.05.2017	03:48	15:36	17.05.2017	04:04	16:11
10.05.2017	08:59	21:26	18.05.2017	04:03	16:18
11.05.2017	04:03	14:48	19.05.2017	04:02	16:59
12.05.2017	04:02	17:42	20.05.2017	04:05	15:17
13.05.2017	03:58	16:40	21.05.2017	04:01	15:02

Table 3: FRV “W. Herwig” cruise 405/2017. Survey statistics of the Cruise.

subdivision	rectangle	area (nm²)	sa (m²/nm²)	sigma (m²) (*10e-4)	n total (million)	*Clupea harengus* (%)	*Sprattus sprattus* (%)	*Gadus morhua* (%)
24	38G2	832,9	50,6	1,177	358,07	0,97	99,02	0
24	38G3	865,7	402,4	1,583	2200,62	5,53	94,46	0
24	38G4	1034,8	290,1	1,671	1796,5	0,5	99,49	0
24	39G2	406,1	175,9	1,177	606,91	0,97	99,02	0
24	39G3	765	133,1	3,873	262,9	88,54	11,36	0,1
24	39G4	524,8	213,6	1,899	590,3	2,38	97,62	0
25	39G4	287,3	446,4	2,192	585,09	24,01	75,99	0
25	39G5	979	753,9	1,462	5048,35	0,96	98,98	0,06
25	40G4	677,2	471,8	1,738	1838,34	26,58	49,04	0
25	40G5	1012,9	630,8	2,309	2767,16	56,88	41,74	0
25	40G6	1013	834,9	1,332	6349,5	0,14	99,81	0
25	40G7	1013	598,5	1,178	5146,69	0,17	99,82	0
25	41G6	764,4	626,9	1,317	3638,59	0,78	94,71	0
25	41G7	1000	599,2	1,24	4832,26	0,27	99,22	0
26	41G8	1000	762,4	1,199	6358,63	0,34	99,62	0
27	45G8	947,2	322,4	1,018	2999,78	3,03	86,83	0
27	46G8	884,8	694,6	0,772	7960,91	4,04	44,71	0
28	42G8	945,4	636,2	1,113	5403,98	0,24	98,59	0
28	42G9	986,9	930,1	1,176	7805,41	1,1	98,58	0
28	43G9	973,7	548,8	1,087	4915,98	3,27	81,41	0,01
28	44G9	876,6	554,6	1,15	4227,5	2,8	92,16	0,01
28	45G9	924,5	746	0,875	7882,02	9,39	46,35	0
29	46G9	933,8	647,8	1,097	5514,27	6,69	89,39	0,01
29	46H0	933,8	835,1	1,123	6944,05	9,99	88,66	0,01
29	47G9	876,2	656,4	1,016	5660,8	17,07	48,06	0
29	47H0	920,3	422,4	1,25	3109,88	26,64	60,93	0

Table 4: FRV "W. Herwig" cruise 405/2017. Catch statistics per fishing haul.

Station	Catch weight (kg)	Fish number (n)	Station	Catch weight (kg)	Fish number (n)
1	0.899	22	26	255.864	34942
2	114.267	12514	27	235.497	39122
3	13.62	809	28	295.521	39064
4	150.328	12133	29	141.071	16763
5	20.476	962	30	95.876	11806
6	44.9	27662	31	110.471	16355
7	0	0	32	21.941	5721
8	570.641	52333	33	154.206	16941
9	791.854	74326	34	77.375	8647
10	0.112	12	35	4.685	897
11	25.781	1162	36	137.085	18700
12	436.425	39529	37	221.555	29309
13	10.336	496	38	182.564	25280
14	50.166	995	39	127.234	17269
15	60.268	3358	40	133.465	16927
16	355.786	21756	41	147.022	19055
17	1429.321	101415	42	60.539	23048
18	0.854	185	43	46.028	7365
19	2.25	105	44	150.479	23125
20	1.435	104	45	165.15	19164
21	207.364	22702	46	2.402	337
22	338.259	41045	47	173.298	22326
23	162.53	20376	48	156.384	17751
24	170.721	19744	49	216.146	18095
25	175.19	22866	50	57.671	7576

Table 5: FRV "W. Herwig" cruise 405/2017. Catch statistics per species.

Species	No. of trawl hauls with the species	No. of length measurements	No. of individual measurements	Total catch (kg)	Percent of total catch	Overall mean contribution to all sampled haul (%)
CLUPEA HARENGUS	47	8842	880	571.8	6.72	11.3
ENGRAULIS ENCRASICOLUS	1	3	0	0.1	< 0.001	< 0.01
GADUS MORHUA	14	112	74	44.4	0.52	< 0.01
GASTEROSTEUS ACULEATUS	41	2838	0	139.9	1.64	16.2
HYPEROPLUS LANCEOLATUS	4	57	0	0.8	0.01	1.0
MERLANGIUS MERLANGUS	2	2	0	0.6	0.01	< 0.01
MYOXOCEPHALUS SCORPIUS	1	1	0	0.1	< 0.001	< 0.01
PLATICHTHYS FLESUS	9	14	0	2.7	0.03	< 0.01
SPRATTUS SPRATTUS	46	11845	615	7743	91.06	71.5

Table 6: FRV “W. Herwig” cruise 405/2017. Total number and biomass of sprat and herring per rectangle.

Subdivision	Rectangle	n herring (million)	herring biomass (tonne)	n sprat (million)	sprat biomass (tonne)
24	38G2	3.45	147.6437	354.56	3088.7206
24	38G3	121.78	6257.9422	2078.65	25507.5286
24	38G4	9.04	484.0019	1787.3	26571.4468
24	39G2	5.86	250.496	600.96	5235.1492
24	39G3	232.79	12573.6617	29.87	478.6845
24	39G4	14.07	874.0534	576.23	9855.5534
25	39G4	140.49	6165.2192	444.6	6257.1305
25	39G5	48.54	2003.4787	4996.74	53562.1104
25	40G4	488.55	15887.1892	901.59	13027.3551
25	40G5	1574.1	48436.2735	1154.97	14108.171
25	40G6	8.81	242.1932	6337.41	61310.4714
25	40G7	8.59	249.4287	5137.58	41229.1429
25	41G6	28.43	654.6467	3446.11	34250.4451
25	41G7	12.94	371.4864	4794.47	41405.8296
26	41G8	21.88	573.3439	6334.75	49421.9127
27	45G8	90.47	1318.0367	2580.89	18001.3491
27	46G8	321.96	5329.0389	3551.63	27800.1869
28	42G8	12.92	364.0113	5327.54	38416.7613
28	42G9	85.95	2254.9033	7694.87	58493.5867
28	43G9	160.22	4507.3296	4001.94	29934.6145
28	44G9	118.43	2650.9928	3895.9	29376.6653
28	45G9	739.95	13348.9748	3653.17	27181.806
29	46G9	369.17	5309.1549	4929.05	34438.614
29	46H0	693.57	9546.5108	6156.56	42496.4549
29	47G9	966.38	16400.29	2720.53	20641.1636
29	47H0	828.47	13977.7886	1894.82	13820.1106

9. Figures

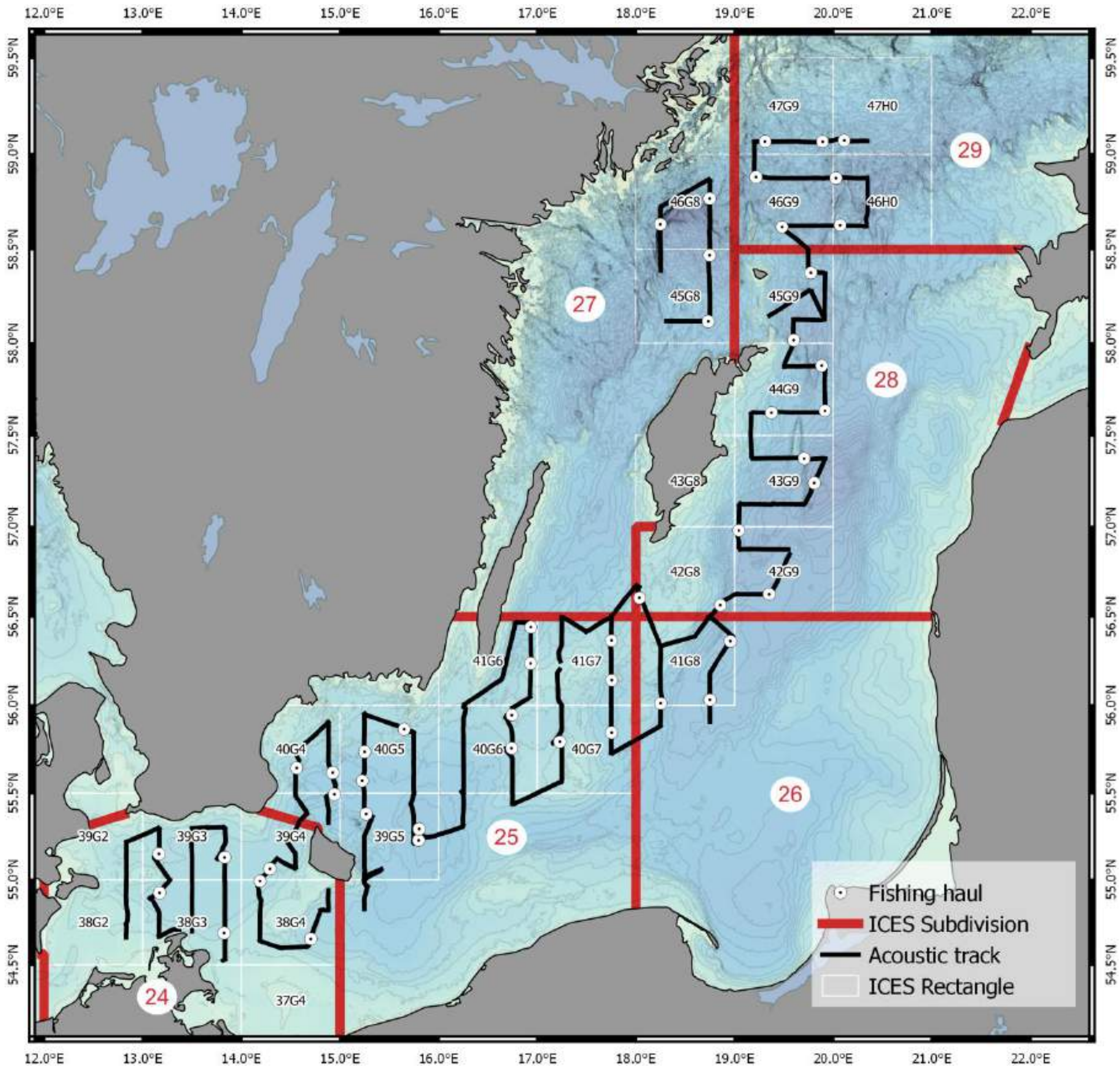

Figure 1: FRV "W. Herwig" cruise 405/2017. Hydroacoustic transect and fishing hauls.

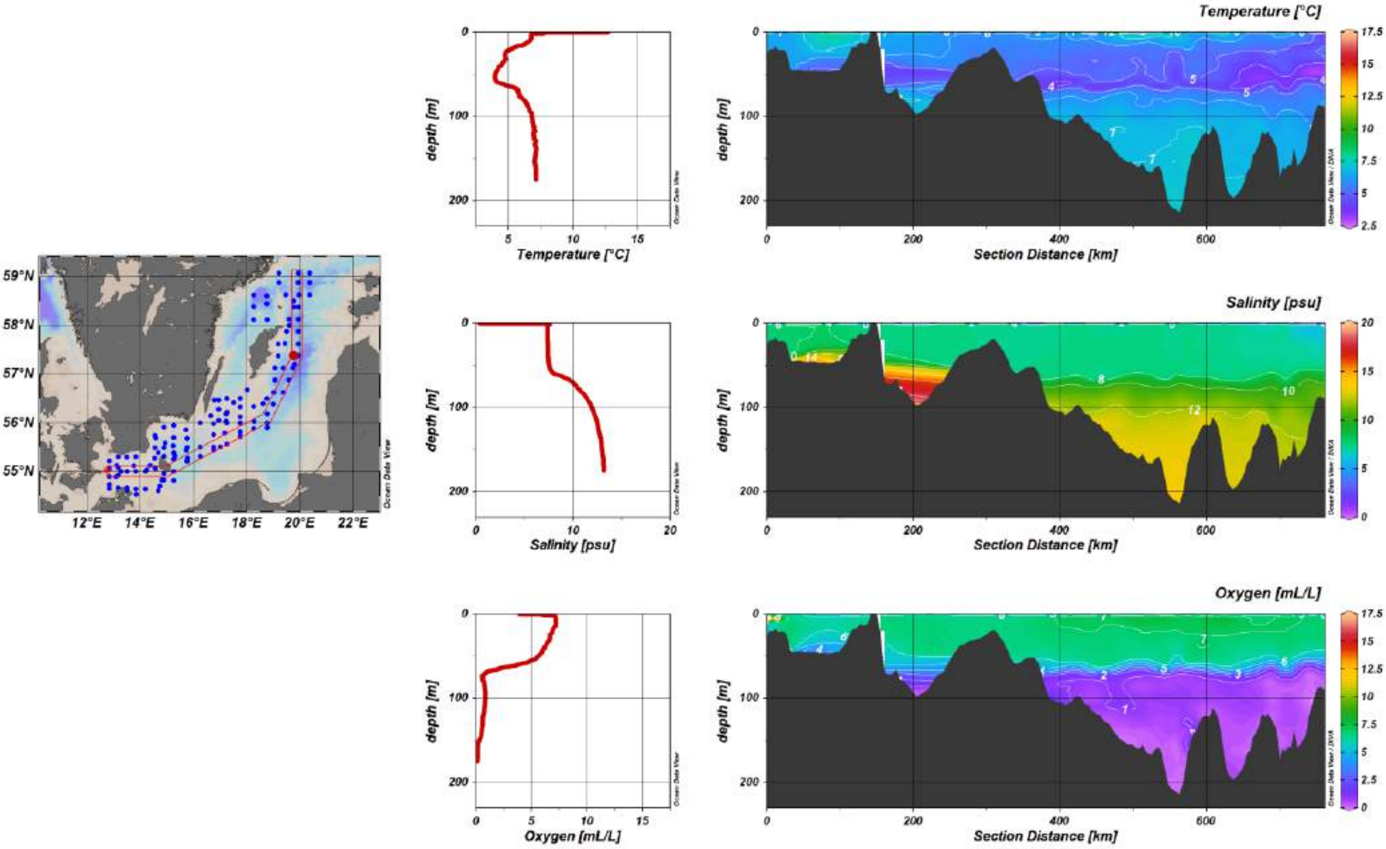

Figure 2: FRV “W. Herwig” cruise 405/2017. Water temperature, salinity and oxygen interpolated from CTD casts along a SW-NE section shown on the left map.

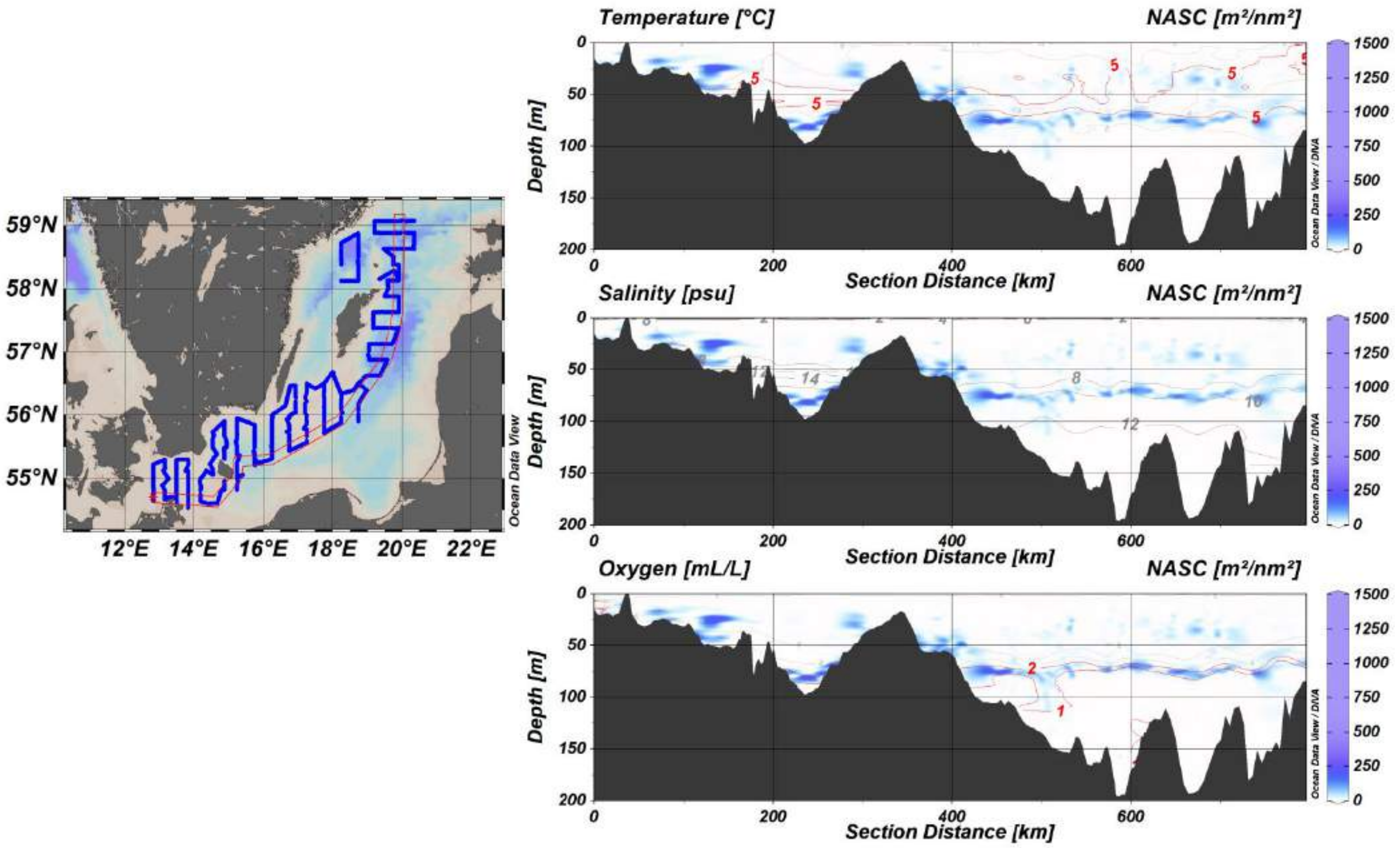

Figure 3: FRV "W. Herwig" cruise 405/2017. Vertical distribution of salinity, temperature and oxygen related to the echogram of fish (blue clouds).

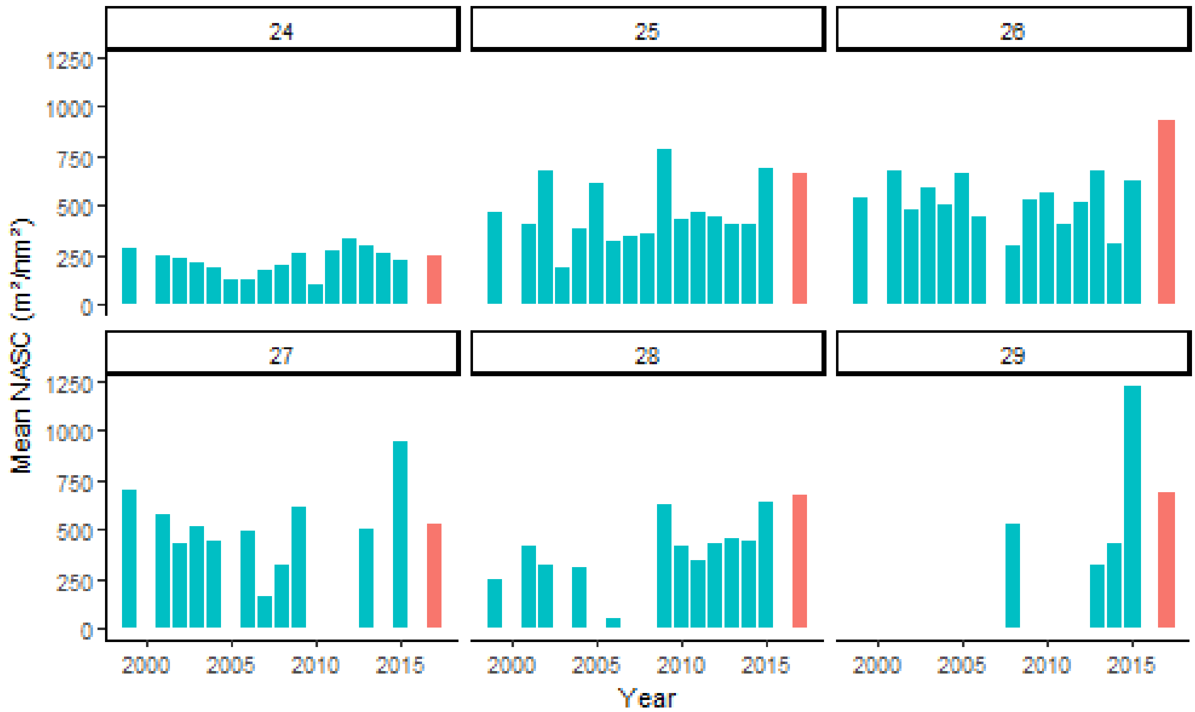

Figure 4: FRV "W. Herwig" cruise 405/2017. Mean NASC calculated per year and per subdivision.

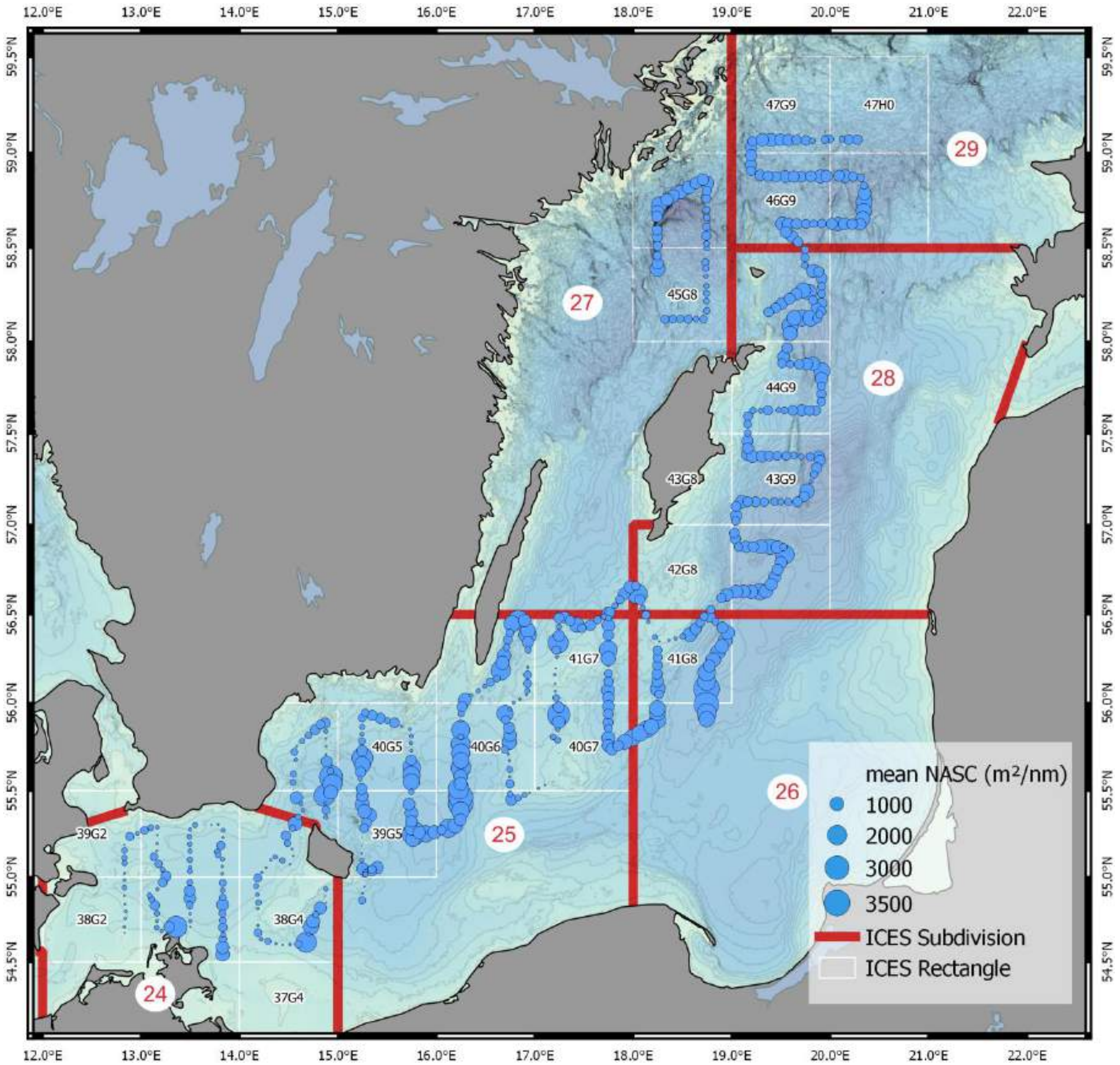

Figure 5: FRV “W. Herwig” cruise 405/2017. Mean NASC calculated per 5nm of transect.

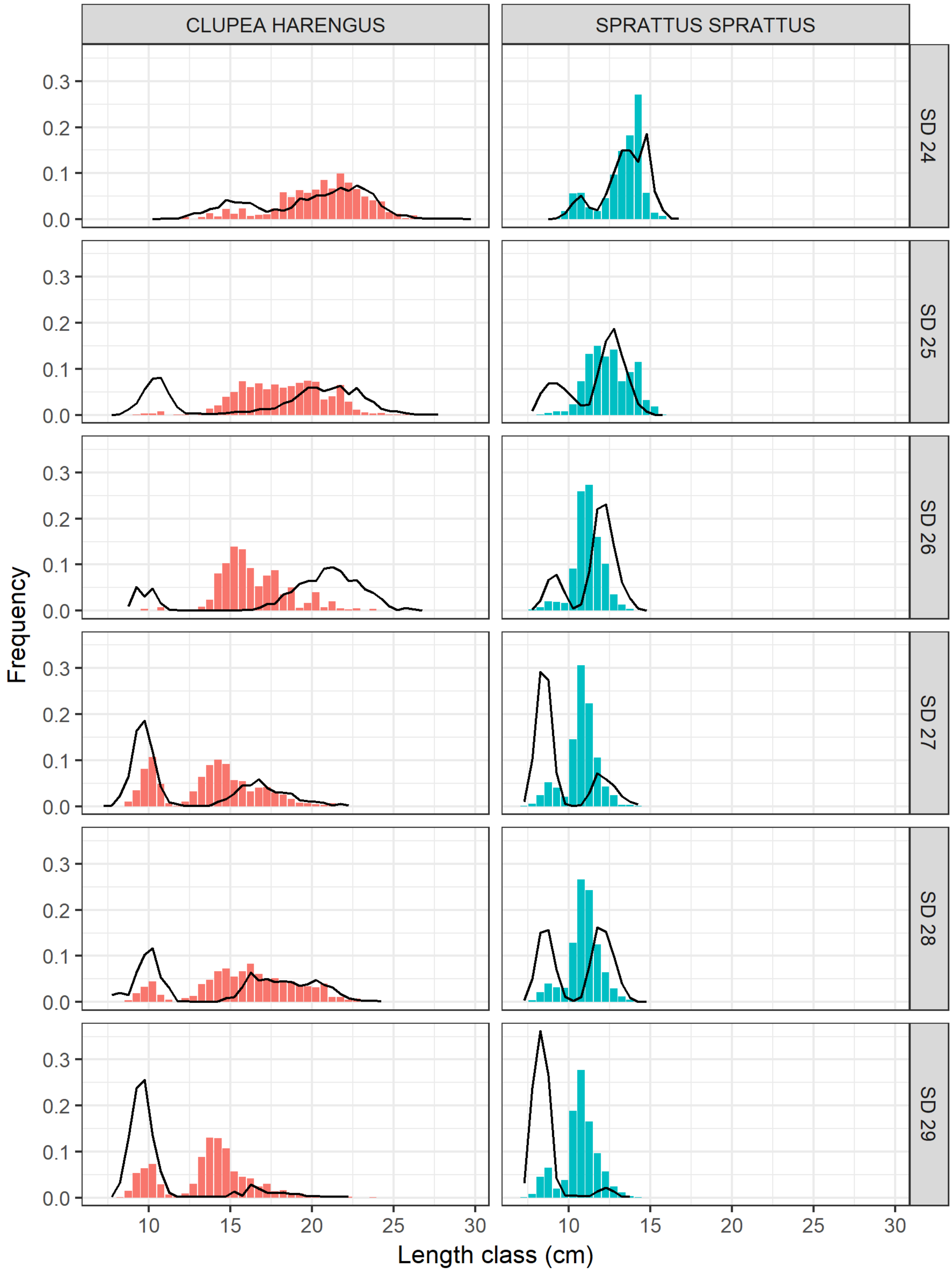

Figure 6: FRV "W. Herwig" cruise 405/2017. Length distribution per species and subdivision for 2015 (black line) and 2017 (bar).

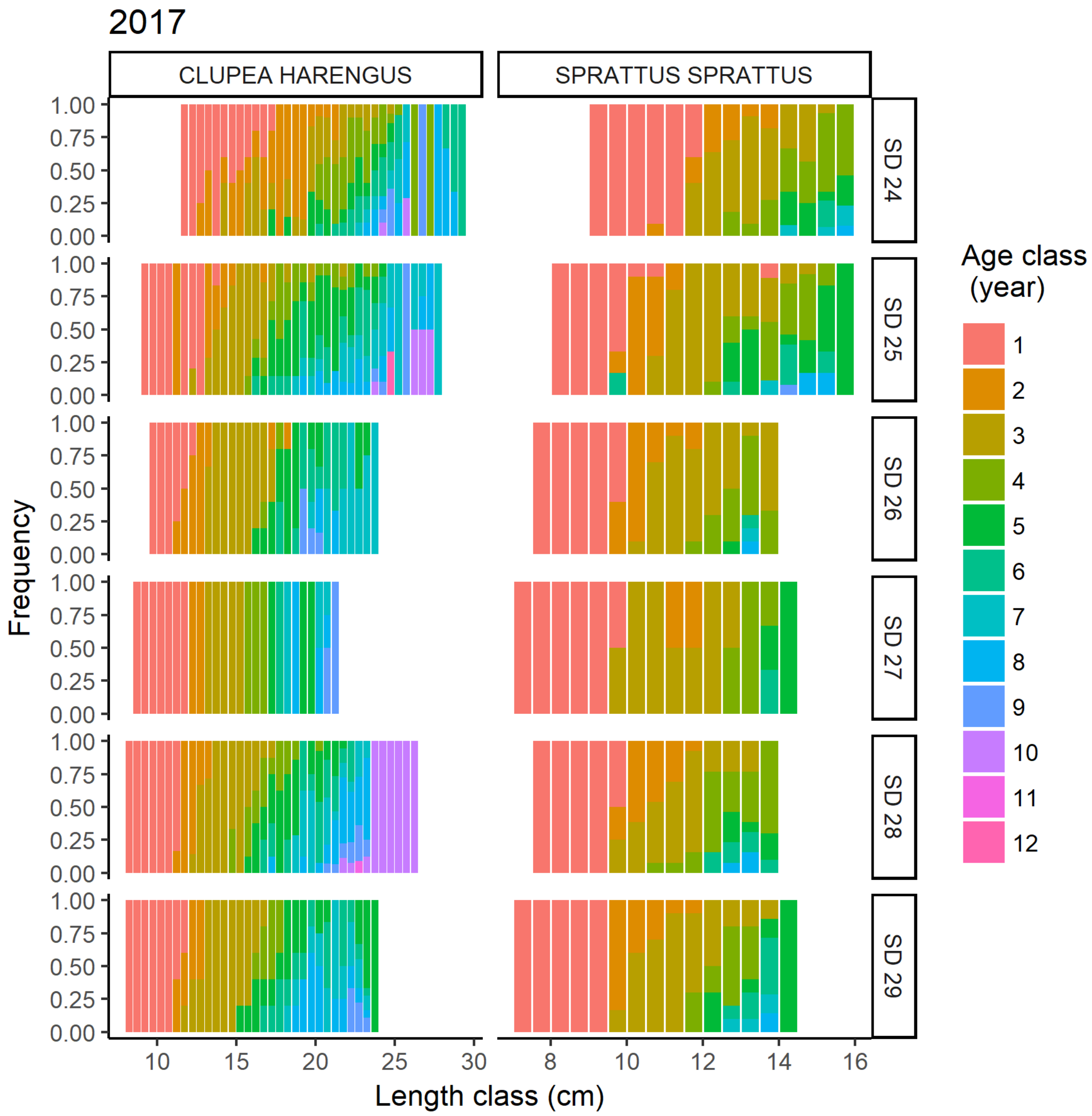

Figure 7: FRV "W. Herwig" cruise 405/2017. Age distribution per length class, species and subdivision for 2017.

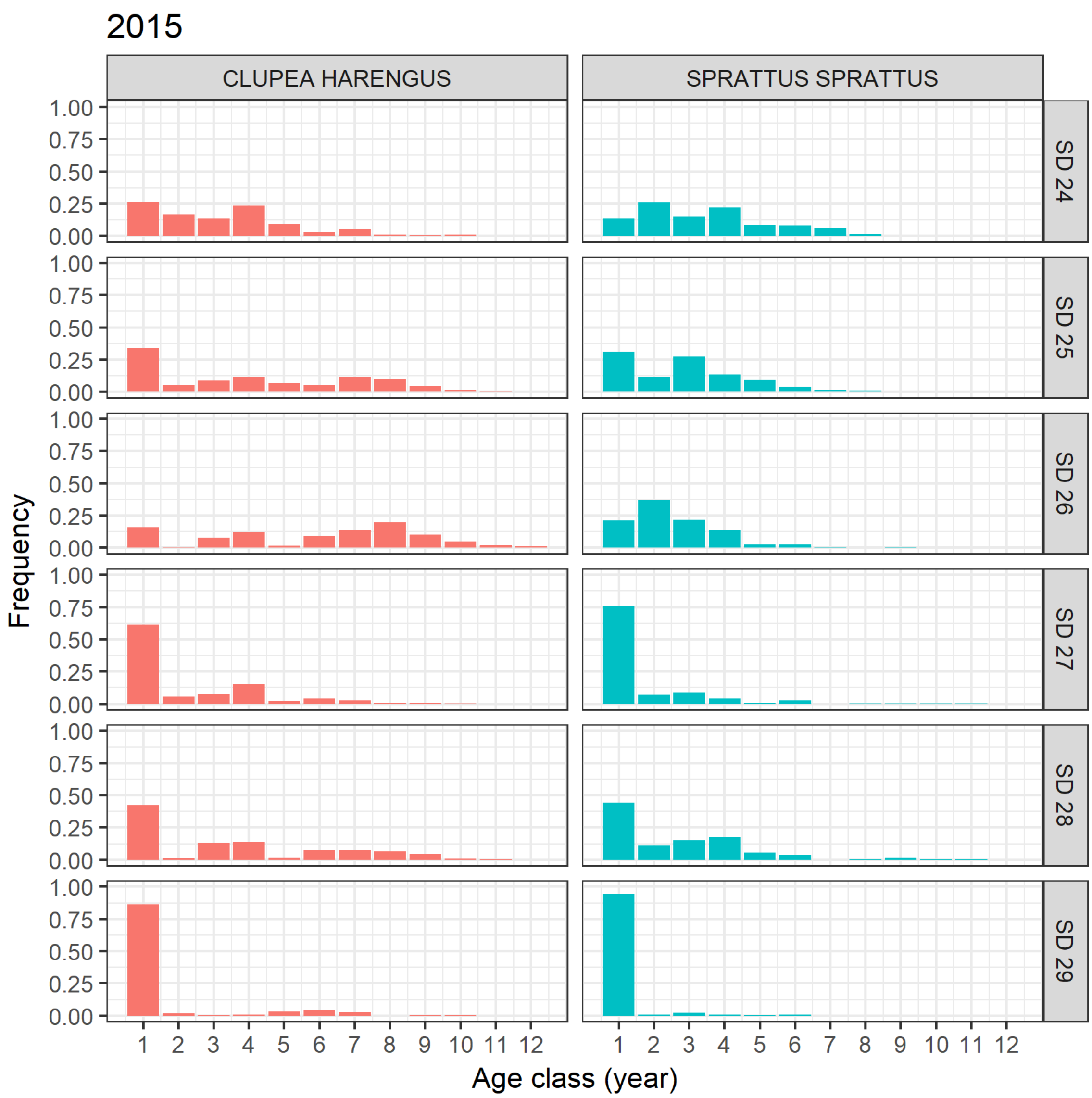

Figure 8: FRV “W. Herwig” cruise 384/2015. Calculated age class distribution per species and subdivision in 2015.

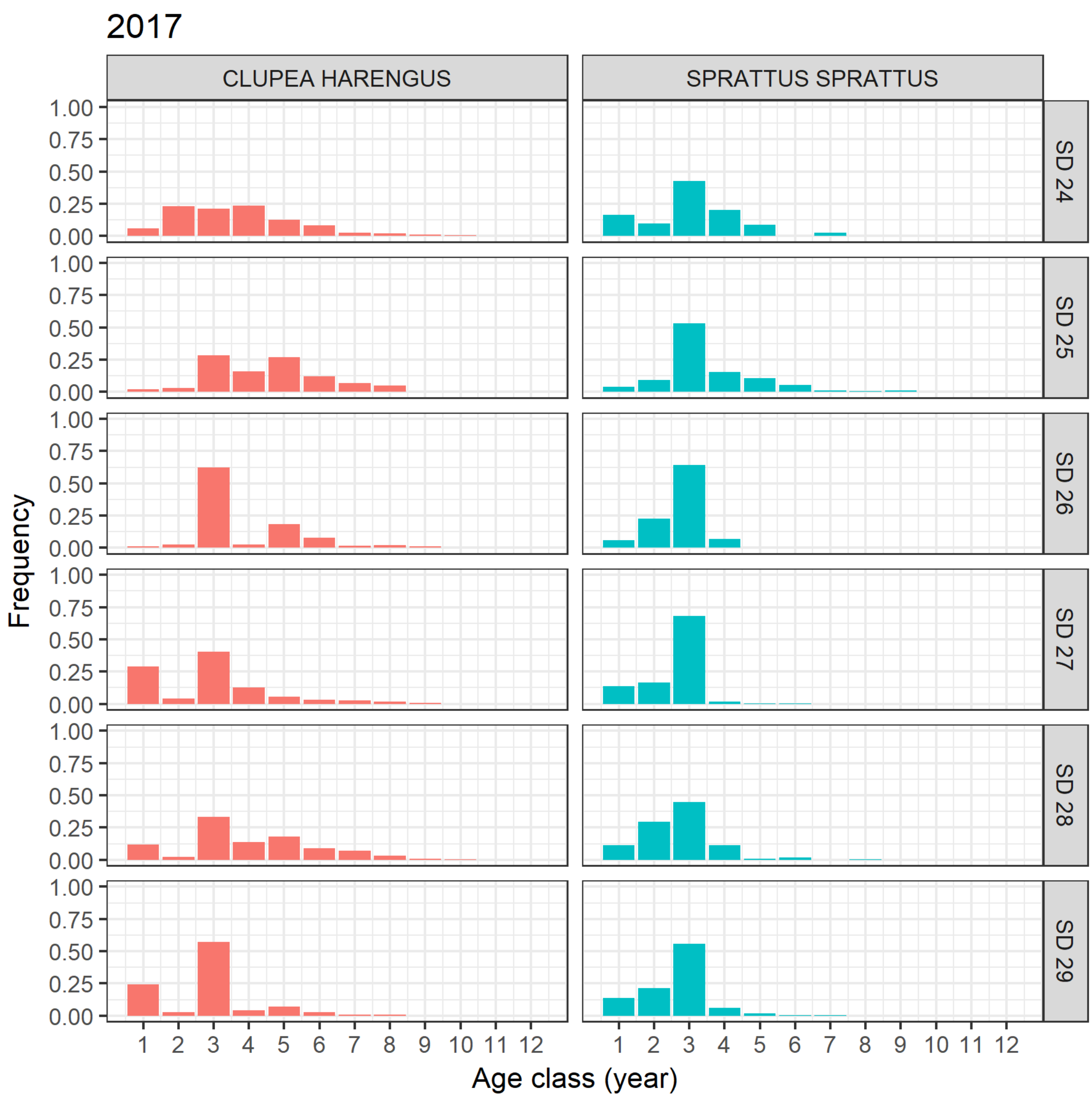

Figure 9: FRV “W. Herwig” cruise 405/2017. Calculated age class distribution per species and subdivision in 2017.

Baltic International Acoustic Survey

Report for R/V Dana

Cruise 12/2017

ICES_BIAS2017

21th October – 1st November 2017

Juha Lilja, Jukka Pönni and Tero Saari

Natural Resources Institute Finland
Viikinkaari 4
FI-00790 HELSINKI, FINLAND
Tel. +358 29 532 6000
kirjaamo@luke.fi

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. In 2017, the R/V Aranda was in dry dock for major renovation and therefore Danish R/V Dana was hired for Finnish BIAS2017 survey.

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 2017, within the remit of the Natural Resources Institute Finland (Luke).

MATERIALS AND METHODS

NARRATIVE

The cruise was completed in one leg covering most of the Bothnian Sea (BS), the Northern Baltic Sea and the Gulf of Finland (GoF). Altogether 37 stations were visited during the survey. The research area, cruise track and trawl stations are shown in Figure 1 and 2. At every station also a CTD (Conductivity Temperature Depth) cast was made.

The R/V Dana departed from the harbour of Södertelje (Sweden) on Fr 21.10.2017 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 the morning 31.10.2017 and the vessel was navigated in the port of Hanko.

The Finnish BIAS 2017 survey had an interruption due to stormy weather and the fishing had to be stopped. Therefore, several fishing stations could not be realized.

SURVEY DESIGN AND HYDROGRAPHICAL DATA

During the cruise, echo-integration was performed along the survey track from ICES Sub-Divisions 29N, 30, and 32N. A dual system SeaBird SBE911 CTD instrument was used with state-of-the-art sensors for fluorescence, oxygen, PAR and distance to seabed.

CALIBRATION

The SIMRAD EK60 echo sounder with all transducers was calibrated on 6.10.2017, according to the IBAS manual (ICES 2017). 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 towed body is used for the acoustic transect data collection, additionally a hull mounted 38 kHz transducer (ES38B) was used during the fishing stations (the towed body is taken aboard when fishing). The settings of the hydroacoustic equipment were as described in the IBAS manual (ICES 2017). 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: $TS = 20 \log L \text{ (cm)} - 71.2$ (ICES 1983/H:12)
Gadoids: $TS = 20 \log L \text{ (cm)} - 67.5$ (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 were performed by Natural Resources Institute Finland (Luke) and fish sampling together by Luke and Swedish University of Agricultural Sciences (SLU). The participating scientific crew can be seen in the list below.

Juha Lilja	Luke	Cruise Leader, Acoustics & CTD
Jukka Pönni	Luke	Fish sampling
Tero Saari	Luke	Fish sampling
Hannu Harjunpää	Luke	Fish sampling
Markku Vaajala	Luke	Fish sampling
Arto Koskinen	Luke	Fish sampling
Jari Raitaniemi	Luke	Fish sampling
Erkki Jaala	Luke	Acoustics
Mikko Leminen	Luke	Acoustics
Perttu Rantanen	Luke	Database maintenance
Sami Vesala	Luke	Fish sampling
Yvette Heimbrand	SLU	Fish sampling
Harri Vehviläinen	Luke	Fish sampling
Rickard Yngwe	SLU	Fish sampling

Luke: Luonnonvarakeskus / Natural Resources Institute Finland
SLU: Sveriges lantbruksuniversitet / Swedish University of Agricultural Sciences

RESULTS

FISH CATCHES, BIOLOGICAL AND HYDRO-METEOROLOGICAL DATA

The number of planned trawling stations was 49. From these, 37 trawling stations were accomplished, and from those 34 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 24, in northern Baltic proper (SD 29) 6, and 4 in the northern Gulf of Finland (SD 32). Several trawling stations were skipped due to stormy weather.

The 9037 kg combined catches (Table 1) consisted of 20 fish species (8921 kg) and mostly unidentified organic matter categorized as “waist” (116 kg), but also including identified common jellyfish (*Aurelia aurita*), large number of mysids and small amounts of the isopod *Saduria entomon*. The most common and abundant species were herring (*Clupea harengus*) (6406 kg) and sprat (*Sprattus sprattus*) (1994 kg) followed by three-spined stickleback (*Gasterosteus aculeatus*) (449 kg). All observed species are presented in Table 2. From the sub-samples of the 37 fish catches a total of 17453 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, 3679 and 870 samples respectively (Table 5). The mean weights for each length-class were also derived from these individual fish samples.
In addition, 17 dioxin samples (SD30) 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 shown in Figures 5 - 8. Total of 37 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 22422 square nautical miles (nmi^2), 31 rectangles, and after the scrutinizing, the distance used for acoustic estimates was 1450 nautical miles (nmi). The cruise track and positions of trawl hauls are shown in Figure 1. In Figure 2, the abundance of herring and sprat per age groups are shown according to the ICES Sub-divisions during Finnish BIAS surveys 2016 and 2017. Length distributions for herring and sprat by ICES subdivision are shown in Figure 3. 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 2017.

Haul nro	Haul name	ICES SD	Ammodytes tobianus	Aurelia aurita	Clupea harengus	Cyclopterus lumpus	Gadus morhua	Gasterosteus aculeatus	Hyperoplus lanceolatus	Liparis liparis	Lumpenus lampretaeformis	Myoxocephalus scorpius	Neogobius melanostomus	Nerophis ophidion	Osmerus eperlanus	Platichthys flesus	Pomatoschistus microps	Pomatoschistus minutus	Pungitius pungitius	Saduria entomon	Sprattus sprattus	Triglopsis quadricornis	Zoarces viviparus	"waste"	Fish catch (kg)	Catch all (kg)
1	47H0-1	29		0.77	487.40		1.11	0.76													39.79			9.17	529.8	539.0
2	48G9-1	29			105.29			6.79	0.21						0.09			0.00	0.00		65.62				178.0	178.0
3	49G9-1	29			154.23			4.91	0.01						0.02			0.00	0.02		95.70			5.12	254.9	260.0
5	50G8-2	30			42.92			1.41	0.01											0.00	2.17			0.72	46.5	47.2
6	51G8-1	30			419.70			0.25						0.00							0.05				420.0	420.0
7	51G9-1	30	0.12		202.53			28.58		3.74										0.04				0.50	235.0	235.5
8	51G8-2	30			235.58			1.36	0.01	0.24	0.00								0.01		0.80				238.0	238.0
9	51G7-1	30			255.05			2.84		0.03		0.10								0.02	3.63			2.33	261.6	264.0
10	52G8-1	30			211.66			5.60		0.11		0.10								0.01	0.52			12.00	218.0	230.0
11	52G7-1	30			237.09			9.00													0.50			3.41	246.6	250.0
12	53G8-1	30			87.53			3.97											0.01	0.00	0.01			0.48	91.5	92.0
14	54G8-1	30			184.05			11.15		0.14										0.04				1.61	195.3	197.0
15	54G9-1	30	0.00		165.99			6.45		0.13					1.16				0.04		0.13			1.11	173.9	175.0
16	55G9-1	30	0.05		261.01			16.13		0.03				0.00	0.26					0.01	0.23	0.04	0.04	2.21	277.8	280.0
17	54H0-1	30			177.05			37.67	0.01	0.81					0.24				0.01	0.09	0.56			3.57	216.3	220.0
18	53H0-1	30			302.86			5.35		0.03				0.01	0.03					0.01	1.15			0.58	309.4	310.0
19	53G9-2	30			355.39			7.12		2.64										0.04	0.10			4.71	365.2	370.0
20	53G9-3	30			163.00			80.65		0.37				0.00						0.04	0.03			2.91	244.0	247.0
21	53H0-2	30			180.68			47.39												0.01	0.31			1.62	228.4	230.0
22	52H0-1	30			48.98			67.22	0.01						1.56				0.00		0.29			0.95	118.1	119.0
23	52H0-2	30			149.55			37.72												0.01	0.06			0.67	187.3	188.0
24	52G9-1	30			305.65			7.83		4.10											0.51			1.91	318.1	320.0
25	51H0-1	30			57.55			5.29													0.02			2.14	62.9	65.0
26	51H0-2	30			58.00			7.67		0.02					22.43			0.00	0.00	0.00	28.18			0.70	116.3	117.0
27	50H0-1	30	0.01		260.54			3.72		0.02					0.85		0.00				5.79		0.04	4.03	271.0	275.0
28	51G9-2	30			175.58			18.79		0.03					0.01		0.00				0.10				194.5	194.5
29	50G9-1	30			344.79			5.72		0.01										0.00	0.55			1.93	351.1	353.0
30	48H0-1	29			37.77		0.37	0.01	0.02	0.00				0.00	1.66	0.34		0.01	0.01	0.01	413.14		0.00	12.66	453.3	466.0
31	48H1-1	29		0.09	50.34		0.10	8.97	0.02						0.10			0.00	0.01		352.37				412.0	412.0
33	48H3-2	32			137.76	1.64		0.31	0.01						1.09				0.04		54.62			2.55	195.4	198.0
34	48H4-1	32			7.47			5.78	0.09				0.13	0.01	6.70				0.08		95.73			4.01	116.0	120.0
35	48H5-1	32			79.06			0.79							1.64				0.01		533.51			12.00	615.0	627.0
36	49H6-1	32			286.83			0.33							13.70				0.05		30.86			8.23	331.8	340.0
37	48H2-1	29			177.50		0.18	1.91	0.03						0.98				0.00		267.16			12.24	447.8	460.0
Total (kg)			**0.2**	**0.9**	**6406.4**	**1.6**	**1.8**	**449.4**	**0.4**	**12.4**	**0.0**	**0.2**	**0.1**	**0.0**	**52.5**	**0.3**	**0.0**	**0.0**	**0.3**	**0.3**	**1994.1**	**0.0**	**0.1**	**116.1**	**8920.9**	**9037.3**

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.

	ICES SD			
Species	**29**	**30**	**32**	**Total**
Ammodytes tobianus		10		**10**
Clupea harengus	2059	7725	1001	**10785**
Cyclopterus lumpus			2	**2**
Gadus morhua	9			**9**
Gasterosteus aculeatus	636	1765	422	**2823**
Hyperoplus lanceolatus	6	7	2	**15**
Liparis liparis	2	239		**241**
Lumpenus lampretaeformis		1		**1**
Myoxocephalus scorpius		2		**2**
Neogobius melanostomus			1	**1**
Nerophis ophidion	1	7	1	**9**
Osmerus eperlanus	195	280	470	**945**
Platichthys flesus	1			**1**
Pomatoschistus microps		3		**3**
Pomatoschistus minutus	9	1		**10**
Pungitius pungitius	15	17	40	**72**
Sprattus sprattus	993	604	923	**2520**
Triglopsis quadricornis		1		**1**
Zoarces viviparus	1	2		**3**
Total	**3927**	**10664**	**2862**	**17453**

Table 4.Numbers and locations of fishing stations (WGS-84) during Finnish BIAS-survey in 2017.

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	47H0-1	21.10.2017	29	591013N	0202760E	591030N	0203445E	60	3.6	3.6	539	58.54	45	100	78	11
2	48G9-1	21.10.2017	29	595140N	0194433E	595315N	0194543E	30	3.5	1.75	178	27.62	22	90	56	17
3	49G9-1	21.10.2017	29	600279N	0192205E	600416N	0191981E	30	3.7	1.85	260	29.30	20	160	53	16
4	50G8-1(INV.)	22.10.2017	30	603306N	0185478E	603576N	0185528E	46	3.5	2.68	39		20	90	55	16
5	50G8-2	22.10.2017	30	604767N	0184953E	605134N	0184904E	60	3.6	3.6	48	47.96	20	67	62	17
6	51G8-1	22.10.2017	30	610651N	0180645E	610653N	0175718E	75	3.6	4.5	420	56.18	40	70	75	12
7	51G9-1	22.10.2017	30	610838N	0190909E	611015N	0190929E	30	3.6	1.8	236	32.78	20	65	56	16
8	51G8-2	22.10.2017	30	611896N	0185860E	611557N	0185626E	60	3.7	3.7	238	47.28	20	70	56	19
9	51G7-1	23.10.2017	30	611910N	0175830E	611486N	0175848E	70	3.8	4.43	264	50.75	29	69	60	19
10	52G8-1	23.10.2017	30	615166N	0182848E	615034N	0182586E	30	3.4	1.7	230	34.00	21	80	61	18
11	52G7-1	23.10.2017	30	615304N	0175738E	615231N	0175210E	45	3.3	2.48	250	38.46	15	78	51	19
12	53G8-1	24.10.2017	30	620851N	0182160E	620859N	0182550E	30	3.8	1.9	90	90.00	15	88	47	14
13	53G9-1(INV.)	24.10.2017	30	621061N	0190964E	621350N	0191004E	45	3.9	2.93	30		15	75	48	14
14	54G8-1	24.10.2017	30	623620N	0185588E	623610N	0184825E	60	3.7	3.7	197	33.02	80	200	98	11
15	54G9-1	24.10.2017	30	624631N	0192144E	624261N	0192231E	60	3.3	3.3	175	39.06	16	160	50	13
16	55G9-1	25.10.2017	30	630653N	0192110E	630831N	0192741E	60	3.3	3.3	280	53.13	20	165	61	18
17	54H0-1	26.10.2017	30	623581N	0200502E	623304N	0200965E	60	3.9	3.9	220	50.55	30	90	70	17
18	53H0-1	26.10.2017	30	622136N	020272E	622121N	0201215E	75	3.6	4.5	310	52.76	60	125	80	13
19	53G9-2	26.10.2017	30	621802N	0193455E	621523N	0193608E	45	3.8	2.85	370	44.44	81	130	91	13
20	53G9-3	26.10.2017	30	620694N	0194438E	620666N	0194812E	30	3.4	1.7	247	35.00	20	107	48	18
21	53H0-2	26.10.2017	30	620705N	0202556E	620671N	0203100E	45	3.5	2.63	230	37.34	20	100	52	20
22	52H0-1	27.10.2017	30	615969N	0204590E	615792N	0204600E	30	3.2	1.6	110	110.00	12	68	50	15
23	52H0-2	27.10.2017	30	615019N	0201854E	615013N	0201477E	30	3.5	1.75	188	53.41	20	120	51	19
24	52G9-1	27.10.2017	30	613471N	0195959E	613112N	0195972E	60	3.6	3.6	320	35.92	80	115	98	11
25	51H0-1	27.10.2017	30	612484N	0204549E	612304N	0204575E	30	3.5	1.75	65	38.10	23	80	59	17
26	51H0-2	27.10.2017	30	610847N	0204808E	610658N	0204506E	40	3.6	2.4	117	32.34	23	60	59	17
27	50H0-1	28.10.2017	30	604943N	0203192E	605050N	0202898E	35	3.3	1.92	275	52.01	22	80	55	18
28	51G9-2	28.10.2017	30	610689N	0195700E	610695N	0194965E	60	3.2	3.2	195	50.55	38	112	67	17
29	50G9-1	28.10.2017	30	605787N	0193955E	605727N	0193054E	75	3.4	4.25	353	66.22	75	110	94	11
30	48H0-1	29.10.2017	29	593801N	0204011E	593724N	0203945E	15	3.6	0.9	466	73.20	30	100	60	19
31	48H1-1	29.10.2017	29	593226N	0210226E	593335N	0210319E	20	3.5	1.17	412	70.75	33	100	72	13
32	48H3-1(INV.)	29.10.2017	32	593340N	0231800E	593328N	0232093E	25	3.5	1.46	19		47	80	70	13
33	48H3-2	29.10.2017	32	593324N	0232239E	593395N	0232542E	30	3.5	1.75	198	34.14	38	90	61	12
34	48H4-1	29.10.2017	32	593949N	0240061E	594421N	0240057E	30	3.2	1.6	120	20.62	29	65	56	16
35	48H5-1	30.10.2017	32	595525N	0250750E	595585N	0250762E	12	3.2	0.64	627	73.22	29	70	53	18
36	49H6-1	30.10.2017	32	600048N	0261838E	600163N	0261884E	20	3.1	1.03	340	54.50	30	80	55	17
37	48H2-1	30.10.2017	29	593137N	0225744E	593198N	0225447E	30	3.3	1.65	460	40.74	40	90	71	13

Table 5.Individual samples of herring and sprat (for age-determination) per SD.

Length class	Sprat 29	Sprat 30	Sprat 32	Sprat total	Herring 29	Herring 30	Herring 32	Herring total
55			3	3		1		1
60	3		5	8				
65	13		6	19	6			6
70	11	1	9	21	13	2	5	20
75	12		10	22	16	4	8	28
80	9	3	9	21	14	11	9	34
85	12	1	2	15	14	15	10	39
90			4	4	15	18	10	43
95	3		3	6	13	14	7	34
100	22		39	61	5	28	1	34
105	40	8	40	88	5	24	1	30
110	50	15	40	105		17	1	18
115	50	44	35	129	9	19		28
120	44	54	22	120	16	35	10	61
125	20	63	14	97	44	57	27	128
130	5	61	5	71	54	92	32	178
135	2	40	2	44	58	129	36	223
140	2	23		25	60	160	38	258
145		8		8	60	176	40	276
150		2		2	60	177	40	277
155		1		1	60	180	35	275
160					57	180	37	274
165					53	178	25	256
170					48	173	8	229
175					28	160	5	193
180					16	150	1	167
185					7	142		149
190					3	101		104
195					1	86		87
200					2	79		81
205					1	52		53
210					1	40		41
215						22		22
220						18		18
225						4		4
230						5		5
235						1		1
240						3		3
275						1		1

Table 6. Survey statistics by area r/v Dana 2017.

ICES SD	ICES Rect.	NM	N (million/nm²)	Area (nm²)	Sa (m²/nm²)	σ (cm²)	N total (million)	Herring (%)	Sprat (%)	Cod (%)	3-spinn. (%)
29	47H0	62	4.556987	920.3	852.1	1.869876	4194	66.75	31.81	0.010	1.43
29	48G9	31	7.960369	772.8	658.2	0.826888	6152	26.73	55.56	0.000	17.66
29	48H0	49	22.942335	730.3	2758.0	1.202153	16755	5.90	91.90	0.012	1.74
29	48H1	42	20.657053	544.0	2244.5	1.086565	11237	5.83	81.06	0.002	13.08
29	48H2	44	14.755752	597.0	1925.6	1.304967	8809	21.66	73.30	0.002	4.90
32	48H3	67	12.529401	615.7	1394.2	1.112721	7714	31.69	66.34	0.000	1.26
32	48H4	71	103.002191	835.1	5685.7	0.551994	86017	1.12	71.82	0.000	25.68
32	48H5	42	25.570981	767.2	3065.0	1.198635	19618	5.48	93.12	0.000	1.12
29	49G9	32	5.754531	564.2	685.4	1.191081	3247	31.46	59.35	0.000	9.15
32	49H5	21	15.792273	306.9	2189.6	1.386505	4847	16.99	76.44	0.000	1.14
32	49H6	46	10.492194	586.5	1651.9	1.574375	6154	58.22	16.69	0.000	1.21
30	50G7	18	1.518150	403.1	288.4	1.899884	612	81.60	3.46	0.000	14.91
30	50G8	56	2.814758	833.4	425.6	1.512011	2346	63.71	7.35	0.000	28.90
30	50G9	57	2.686690	879.5	619.6	2.306017	2363	82.19	0.29	0.000	17.51
30	50H0	33	3.484665	795.1	596.2	1.710978	2771	85.62	2.80	0.000	11.34
30	51G7	33	2.376046	614.5	543.6	2.287757	1460	85.61	2.59	0.000	11.78
30	51G8	70	2.929170	863.7	769.8	2.628033	2530	96.67	0.26	0.000	2.99
30	51G9	32	3.992174	865.8	493.2	1.235467	3456	38.02	0.02	0.000	61.38
30	51H0	45	3.378451	865.7	400.4	1.185188	2925	41.72	11.34	0.000	40.99
30	52G7	29	2.056473	482.6	406.5	1.976612	992	65.99	0.33	0.000	33.69
30	52G8	58	2.426638	852.0	538.1	2.217513	2067	52.72	0.02	0.000	47.22
30	52G9	66	1.447398	852.0	341.7	2.361072	1233	71.28	0.28	0.000	27.10
30	52H0	55	7.005680	852.0	494.3	0.705521	5969	18.28	0.05	0.000	81.47
30	53G8	58	3.369302	838.1	516.9	1.534254	2824	52.72	0.02	0.000	47.22
30	53G9	61	3.118503	838.1	455.9	1.461920	2614	26.89	0.02	0.000	72.88
30	53H0	59	2.967628	838.1	462.3	1.557896	2487	45.98	0.26	0.000	53.75
30	54G8	38	2.773944	642.2	383.1	1.381075	1781	44.82	0.00	0.000	55.13
30	54G9	75	2.263003	824.2	430.9	1.903894	1865	64.53	0.14	0.000	34.17
30	54H0	47	5.720250	727.9	526.2	0.919863	4164	27.47	0.20	0.000	72.04
30	55G9	30	3.727810	625.6	417.1	1.118754	2332	39.97	0.12	0.000	59.83
30	55H0	23	8.545704	688.6	871.1	1.019308	5885	33.42	0.16	0.000	66.23

Table 7.Numbers (millions) of herring by age and area (r/v Dana 2017).

SD	Rect	0	1	2	3	4	5	6	7	8+	Total
29	47H0	60.4	197.2	436.3	1034.1	240.0	199.8	155.3	90.9	217.1	2631.2
29	48G9	413.5	205.2	80.8	188.4	27.8	17.4	15.9	9.0	29.8	987.9
29	48H0	97.6	215.5	155.2	350.2	62.4	32.4	24.8	15.0	35.6	988.7
29	48H1	106.5	201.8	90.2	190.5	33.2	11.3	11.1	3.1	7.8	655.6
29	48H2	227.0	283.5	348.0	734.8	149.9	59.3	49.7	18.6	37.4	1908.2
32	48H3	111.5	275.7	215.6	1127.7	206.4	250.2	103.7	40.8	113.2	2444.8
32	48H4	164.6	187.5	75.7	358.1	59.3	59.5	19.3	9.2	29.0	962.2
32	48H5	148.0	244.5	87.7	418.8	68.3	56.6	21.4	7.4	22.3	1075.0
29	49G9	90.8	210.4	102.8	230.1	38.8	19.6	17.7	9.6	27.5	747.2
32	49H5	58.1	153.5	75.6	377.2	62.7	52.0	17.0	5.6	21.8	823.5
32	49H6	171.7	618.0	341.4	1723.9	287.8	239.0	75.0	24.0	102.0	3582.7
30	50G7	4.0	144.8	81.8	143.8	46.5	22.5	15.1	6.0	27.0	491.6
30	50G8	19.4	990.0	209.0	153.4	38.7	12.0	6.5	2.5	7.5	1438.9
30	50G9	0.8	195.7	327.0	745.2	256.0	142.1	98.8	39.0	137.7	1942.2
30	50H0	279.0	1438.7	260.0	254.4	69.6	25.9	15.6	4.8	24.3	2372.3
30	51G7	9.2	286.0	212.3	404.1	132.1	64.9	43.9	17.4	79.1	1249.0
30	51G8	3.3	248.2	396.0	946.1	316.2	178.0	120.2	48.1	190.1	2446.2
30	51G9	2.6	204.5	251.2	478.6	158.7	80.2	54.8	20.6	62.9	1314.1
30	51H0	544.7	364.7	89.5	110.1	34.8	17.7	13.3	7.3	38.1	1220.3
30	52G7	0.9	112.8	94.1	201.5	69.2	40.6	31.1	14.8	89.4	654.5
30	52G8	0.0	82.5	173.9	414.7	144.4	86.0	62.4	26.2	99.4	1089.6
30	52G9	0.1	46.1	74.1	253.4	99.1	82.9	76.7	41.4	205.2	879.0
30	52H0	96.2	589.2	146.0	155.6	45.8	19.8	13.5	6.0	19.0	1091.1
30	53G8	0.6	234.0	281.7	508.9	175.9	91.8	67.2	26.1	102.4	1488.5
30	53G9	0.9	79.4	110.8	229.3	80.0	51.2	40.3	19.2	91.9	702.8
30	53H0	7.7	340.3	209.9	343.3	111.6	52.2	34.1	11.6	33.0	1143.5
30	54G8	0.1	73.9	129.4	299.0	101.6	61.7	45.7	19.4	67.7	798.5
30	54G9	15.6	152.6	194.8	390.8	135.4	84.6	67.5	32.0	130.1	1203.5
30	54H0	53.4	490.8	173.8	224.1	72.8	37.1	27.9	12.2	51.6	1143.7
30	55G9	50.9	233.3	170.0	260.9	84.7	40.3	29.3	12.8	50.0	932.2
30	55H0	100.7	643.7	332.9	479.3	155.7	75.9	55.8	24.5	98.2	1966.6

Table 8.Mean weight (g) of herring by age and area (r/v Dana 2017).

SD	Rect.	0	1	2	3	4	5	6	7	8+
29	47H0	3.6	15.8	22.5	23.2	24.3	27.2	27.4	28.6	29.5
29	48G9	3.3	15.0	19.2	19.9	22.5	27.5	29.2	30.0	33.8
29	48H0	2.4	14.9	20.4	20.7	22.3	26.9	25.8	30.2	30.3
29	48H1	3.9	14.0	20.1	20.1	22.0	24.3	24.0	25.8	27.4
29	48H2	3.6	14.7	21.1	21.2	22.3	24.8	24.3	26.5	27.9
32	48H3	3.0	14.8	20.8	21.5	22.5	24.7	27.1	26.7	25.5
32	48H4	3.3	13.9	19.6	20.5	21.7	24.4	25.1	26.0	25.4
32	48H5	3.6	14.2	19.4	20.2	21.6	23.6	25.8	27.1	24.3
29	49G9	3.6	14.8	20.0	20.4	22.4	26.3	26.7	30.9	35.1
32	49H5	3.9	14.9	19.6	20.4	21.6	23.9	24.8	26.4	24.5
32	49H6	4.2	15.2	19.6	20.4	21.6	24.0	24.4	26.1	24.6
30	50G7	9.2	17.9	23.3	27.0	27.9	30.3	33.3	36.0	46.0
30	50G8	7.8	17.3	20.6	23.4	25.1	26.7	30.0	34.5	44.0
30	50G9	15.3	18.4	24.5	27.9	28.7	31.1	32.9	35.7	42.7
30	50H0	7.1	16.0	21.0	24.7	26.3	28.4	31.1	30.6	48.8
30	51G7	9.7	18.2	23.7	27.2	28.0	30.4	33.4	36.0	46.0
30	51G8	5.9	18.8	24.5	27.9	28.7	30.9	33.0	36.1	44.0
30	51G9	6.9	18.6	24.1	27.3	28.1	30.8	32.6	34.6	39.0
30	51H0	5.7	16.0	21.8	26.0	27.8	31.6	34.5	38.9	50.4
30	52G7	12.6	18.3	23.9	27.8	28.9	31.7	35.2	38.9	50.7
30	52G8	0.0	20.0	24.4	28.1	29.0	31.7	33.6	36.6	44.0
30	52G9	16.0	19.0	25.1	29.6	31.3	34.3	37.1	39.8	47.0
30	52H0	5.7	16.5	21.4	25.3	26.8	30.5	32.7	36.3	41.8
30	53G8	15.1	18.7	23.8	27.3	28.4	31.2	33.3	35.4	43.2
30	53G9	5.9	19.2	23.9	28.0	29.2	32.4	35.1	38.4	48.3
30	53H0	8.8	17.4	23.2	26.9	27.6	30.2	31.8	33.2	38.4
30	54G8	14.4	19.4	24.3	28.0	29.1	31.9	33.8	36.6	41.5
30	54G9	4.4	19.2	23.8	27.9	28.9	32.5	34.9	38.5	44.4
30	54H0	6.0	16.8	22.3	26.3	28.0	31.2	33.5	36.4	45.0
30	55G9	5.3	18.0	23.3	26.6	27.6	31.0	33.9	37.2	44.5
30	55H0	5.6	17.3	22.9	26.5	27.7	31.1	33.7	36.9	44.7

Table 9.Total biomass (ton) of herring by age and area (r/v Dana 2017).

SD	Rect.	0	1	2	3	4	5	6	7	8+	Total
29	47H0	219.6	3114.1	9837.9	24024.7	5825.1	5432.9	4251.3	2601.0	6410.6	61717.0
29	48G9	1347.1	3086.6	1553.0	3757.8	624.2	479.5	463.7	269.2	1007.0	12588.0
29	48H0	236.2	3201.2	3159.9	7252.1	1391.9	870.9	639.3	451.6	1079.2	18282.2
29	48H1	418.7	2832.8	1812.3	3836.1	731.0	275.9	265.3	79.0	212.9	10464.0
29	48H2	823.8	4154.4	7357.2	15579.5	3336.7	1468.0	1209.9	492.8	1042.0	35464.3
32	48H3	337.3	4075.1	4490.8	24269.9	4637.7	6180.9	2812.9	1091.1	2881.8	50777.5
32	48H4	543.5	2614.6	1486.4	7347.5	1286.2	1452.0	484.6	239.2	736.2	16190.2
32	48H5	532.4	3463.3	1697.0	8476.6	1477.7	1333.1	553.0	200.5	541.3	18275.0
29	49G9	330.5	3107.2	2050.1	4684.8	868.4	515.6	473.0	295.6	964.4	13289.6
32	49H5	226.1	2287.4	1479.0	7686.9	1352.2	1244.0	421.8	146.6	536.1	15380.0
32	49H6	716.8	9415.4	6697.0	35192.6	6205.7	5738.8	1832.5	627.7	2510.1	68936.6
30	50G7	37.4	2594.9	1905.6	3877.2	1296.6	681.2	504.2	216.1	1243.6	12356.9
30	50G8	150.3	17120.2	4306.9	3581.5	969.6	319.7	195.8	85.8	328.3	27058.0
30	50G9	11.6	3591.4	7995.8	20783.8	7346.6	4418.0	3253.0	1394.3	5877.7	54672.3
30	50H0	1982.3	22974.9	5453.7	6291.1	1830.5	736.4	487.0	148.2	1182.5	41086.7
30	51G7	89.1	5213.6	5026.0	10976.4	3703.6	1973.3	1466.6	628.3	3639.5	32716.4
30	51G8	19.6	4676.6	9701.1	26412.1	9071.0	5506.2	3959.5	1738.3	8362.0	69446.4
30	51G9	17.7	3807.2	6044.8	13056.6	4468.0	2467.1	1786.4	714.3	2454.3	34816.5
30	51H0	3094.8	5845.0	1955.1	2862.3	968.7	561.0	457.9	285.7	1918.8	17949.3
30	52G7	10.9	2063.0	2244.1	5609.7	1997.1	1288.7	1093.9	578.1	4537.1	19422.6
30	52G8	0.0	1647.8	4240.4	11646.3	4193.1	2725.1	2096.8	957.9	4371.2	31878.7
30	52G9	1.2	876.7	1858.7	7498.1	3102.2	2842.0	2844.3	1646.0	9652.1	30321.2
30	52H0	544.9	9738.4	3129.4	3939.0	1228.8	604.0	441.0	217.6	795.3	20638.4
30	53G8	8.5	4371.9	6699.8	13900.3	4995.7	2859.3	2237.4	924.9	4422.0	40419.8
30	53G9	5.1	1521.7	2650.5	6419.6	2335.0	1658.6	1413.8	737.7	4433.9	21175.9
30	53H0	67.1	5937.1	4876.4	9218.0	3080.0	1575.5	1082.4	383.2	1264.9	27484.7
30	54G8	0.9	1437.6	3146.2	8385.3	2952.1	1965.8	1548.3	708.2	2806.7	22951.1
30	54G9	68.1	2928.4	4636.1	10893.2	3911.3	2748.7	2355.2	1234.1	5773.7	34548.8
30	54H0	322.1	8226.8	3868.1	5892.7	2037.3	1156.5	935.2	444.2	2320.6	25203.6
30	55G9	271.9	4190.7	3966.7	6941.4	2337.5	1250.9	991.8	477.0	2223.5	22651.3
30	55H0	565.1	11125.8	7628.8	12701.1	4316.2	2358.9	1883.8	901.8	4389.2	45870.7

Table 10.Numbers (millions) of sprat by age and area (r/v Dana 2017).

SD	Rect	0	1	2	3	4	5	6	7	8+	Total
29	47H0	783.83	75.32	129.11	185.46	36.26	23.56	9.90	0.00	10.69	1254.13
29	48G9	2062.52	115.84	106.57	132.67	18.86	8.37	0.00	0.00	0.96	2445.80
29	48H0	1536.96	5474.48	4778.76	6494.19	649.20	258.31	76.85	0.00	135.36	19404.11
29	48H1	1088.55	4503.13	3906.90	5189.74	463.78	186.30	48.92	0.00	23.63	15410.95
29	48H2	598.25	2932.57	2580.47	3407.63	292.77	112.38	15.08	0.00	14.85	9954.01
32	48H3	5829.64	849.78	487.01	445.66	29.98	0.00	0.00	7.16	0.00	7649.24
32	48H4	53514.35	5528.51	4146.69	4316.27	325.07	106.16	38.29	82.21	19.14	68076.68
32	48H5	1515.52	6387.83	6585.71	6419.64	600.44	198.99	38.97	147.86	19.49	21914.45
29	49G9	1220.34	246.90	302.41	397.57	54.24	27.23	17.69	0.00	3.35	2269.71
32	49H5	743.55	3211.05	3324.00	3276.77	318.19	112.13	25.36	78.10	20.32	11109.48
32	49H6	36.16	386.84	439.83	540.14	86.15	48.90	19.92	20.44	33.21	1611.58
30	50G7	0.11	3.06	6.57	21.87	6.62	2.81	2.15	1.11	3.28	47.59
30	50G8	1.10	15.13	27.45	85.50	24.38	9.48	7.56	4.09	8.53	183.22
30	50G9	0.00	0.39	0.81	2.78	1.43	0.46	0.42	0.36	0.61	7.26
30	50H0	1.00	6.77	16.03	42.11	12.12	3.68	2.93	1.26	3.80	89.69
30	51G7	0.00	2.98	7.39	25.73	8.09	3.61	2.70	1.35	4.70	56.56
30	51G8	0.00	0.09	0.50	2.95	1.28	0.85	0.42	0.23	0.63	6.95
30	51G9	0.00	0.08	0.16	0.34	0.13	0.03	0.02	0.01	0.01	0.78
30	51H0	0.00	15.99	60.88	184.18	45.00	13.62	12.40	6.67	13.90	352.64
30	52G7	0.00	0.99	0.99	2.44	0.72	0.21	0.24	0.18	0.37	6.15
30	52G8	0.00	0.03	0.08	0.17	0.05	0.02	0.01	0.00	0.02	0.39
30	52G9	0.00	0.03	0.17	0.97	0.37	0.47	0.38	0.18	1.19	3.76
30	52H0	0.00	0.13	0.47	1.50	0.49	0.19	0.17	0.12	0.27	3.33
30	53G8	0.00	0.11	0.20	0.19	0.03	0.00	0.00	0.00	0.00	0.53
30	53G9	0.31	0.01	0.06	0.24	0.02	0.01	0.01	0.01	0.01	0.67
30	53H0	0.00	0.13	0.69	2.87	1.06	0.70	0.46	0.20	1.07	7.20
30	54G8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	54G9	0.97	0.03	0.17	0.83	0.22	0.26	0.13	0.06	0.23	2.91
30	54H0	0.00	0.77	1.91	4.56	1.14	0.47	0.78	0.16	0.79	10.58
30	55G9	0.82	0.59	0.96	0.91	0.68	0.07	0.04	0.03	0.01	4.11
30	55H0	0.90	1.24	2.54	4.57	1.63	0.44	0.66	0.15	0.64	12.77

Table 11.Mean weight (g) of sprat by age and area (r/v Dana 2017).

SD	Rect.	0	1	2	3	4	5	6	7	8+
29	47H0	2.29	8.74	9.57	9.74	10.63	11.26	11.37	0.00	13.16
29	48G9	2.52	7.67	9.14	9.10	10.69	11.78	0.00	0.00	10.32
29	48H0	2.29	8.16	8.86	8.85	9.75	9.94	11.48	0.00	12.93
29	48H1	2.41	8.19	8.80	8.77	9.63	9.79	11.48	0.00	10.32
29	48H2	2.34	8.24	8.80	8.76	9.55	9.62	11.14	0.00	10.32
32	48H3	2.08	7.27	8.18	8.12	8.18	0.00	0.00	9.55	0.00
32	48H4	2.17	7.77	8.35	8.45	9.09	11.15	11.49	10.00	11.49
32	48H5	2.67	8.24	8.78	8.92	9.61	10.97	11.49	9.80	11.49
29	49G9	2.84	8.29	9.26	9.36	10.13	10.65	11.59	0.00	10.32
32	49H5	2.68	8.24	8.79	8.95	9.76	11.01	11.49	9.86	12.49
32	49H6	3.10	8.28	8.94	9.54	11.24	11.21	11.49	10.49	13.34
30	50G7	3.50	10.53	11.57	12.60	13.28	14.19	14.21	14.04	15.48
30	50G8	3.50	10.35	11.49	12.49	13.11	13.91	14.00	14.06	14.61
30	50G9	0.00	10.42	10.90	13.14	13.93	14.38	14.85	15.05	15.56
30	50H0	3.50	10.39	11.32	12.24	12.42	13.78	13.52	13.65	14.92
30	51G7	0.00	10.71	11.63	12.68	13.38	14.34	14.33	14.02	15.78
30	51G8	0.00	12.03	12.33	13.17	13.70	14.19	13.94	13.99	14.29
30	51G9	0.00	10.42	10.68	12.31	13.19	13.66	13.66	13.66	13.66
30	51H0	0.00	11.29	11.76	12.39	12.80	13.55	13.29	13.87	14.69
30	52G7	0.00	10.08	11.09	12.23	13.43	14.26	14.51	15.08	15.30
30	52G8	0.00	11.04	11.35	11.85	12.25	13.87	13.26	13.98	13.82
30	52G9	0.00	12.45	12.45	13.40	14.80	15.41	15.67	15.17	16.27
30	52H0	0.00	11.30	11.70	12.59	13.39	14.20	14.30	14.94	15.01
30	53G8	0.00	10.42	10.42	10.42	10.42	0.00	0.00	0.00	0.00
30	53G9	3.00	12.45	12.45	12.45	12.45	12.45	12.45	12.45	12.45
30	53H0	0.00	11.89	12.06	12.83	13.47	14.61	14.70	14.34	15.80
30	54G8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	54G9	2.00	12.45	12.45	12.92	14.04	14.36	13.98	13.98	14.34
30	54H0	0.00	10.75	11.21	12.24	12.97	13.88	16.38	13.55	16.54
30	55G9	3.50	8.44	8.69	11.24	9.82	13.66	13.66	13.66	13.66
30	55H0	3.50	9.55	10.17	12.02	11.53	13.84	16.20	13.57	16.48

Table 12.Total biomass (ton) of sprat by age and area (r/v Dana 2017).

SD	Rect.	0	1	2	3	4	5	6	7	8+	Total
29	47H0	1791.9	658.2	1235.6	1806.6	385.6	265.2	112.5	0.0	140.7	6396.3
29	48G9	5199.5	889.0	974.2	1207.2	201.6	98.7	0.0	0.0	9.9	8580.1
29	48H0	3526.8	44699.0	42340.5	57471.8	6327.3	2568.2	882.2	0.0	1750.3	159566.1
29	48H1	2628.4	36897.3	34395.9	45522.8	4467.1	1824.7	561.6	0.0	243.8	126541.6
29	48H2	1397.4	24168.6	22704.6	29835.3	2796.5	1080.8	168.0	0.0	153.3	82304.4
32	48H3	12139.1	6174.5	3985.2	3618.1	245.3	0.0	0.0	68.3	0.0	26230.6
32	48H4	116209.8	42954.5	34621.4	36476.4	2954.6	1184.1	440.0	822.0	220.0	235882.9
32	48H5	4045.0	52609.1	57823.7	57268.1	5771.7	2183.2	447.9	1449.4	223.9	181821.9
29	49G9	3464.5	2047.5	2801.8	3721.1	549.3	289.9	205.0	0.0	34.6	13113.7
32	49H5	1989.7	26451.2	29208.7	29340.5	3104.5	1234.0	291.5	770.2	253.7	92644.0
32	49H6	112.1	3202.8	3933.2	5150.7	968.0	548.0	229.0	214.6	443.0	14801.2
30	50G7	0.4	32.2	76.1	275.6	88.0	39.9	30.6	15.6	50.7	609.0
30	50G8	3.9	156.6	315.5	1067.7	319.6	131.8	105.8	57.5	124.6	2282.9
30	50G9	0.0	4.1	8.9	36.5	19.9	6.6	6.2	5.4	9.5	97.1
30	50H0	3.5	70.3	181.5	515.2	150.5	50.6	39.6	17.2	56.7	1085.2
30	51G7	0.0	31.9	85.9	326.3	108.3	51.8	38.7	19.0	74.2	736.0
30	51G8	0.0	1.0	6.2	38.9	17.5	12.1	5.9	3.2	9.0	93.8
30	51G9	0.0	0.9	1.7	4.1	1.7	0.4	0.3	0.2	0.1	9.4
30	51H0	0.0	180.6	715.8	2281.1	576.0	184.6	164.8	92.5	204.1	4399.6
30	52G7	0.0	10.0	11.0	29.9	9.7	3.0	3.4	2.8	5.6	75.4
30	52G8	0.0	0.3	0.9	2.0	0.6	0.3	0.2	0.1	0.3	4.6
30	52G9	0.0	0.4	2.1	13.0	5.5	7.2	6.0	2.8	19.3	56.3
30	52H0	0.0	1.4	5.5	18.8	6.6	2.6	2.4	1.8	4.0	43.2
30	53G8	0.0	1.2	2.1	2.0	0.3	0.0	0.0	0.0	0.0	5.6
30	53G9	0.9	0.1	0.8	2.9	0.2	0.1	0.1	0.1	0.1	5.4
30	53H0	0.0	1.6	8.3	36.8	14.3	10.3	6.8	2.9	17.0	98.0
30	54G8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	54G9	1.9	0.4	2.1	10.8	3.0	3.7	1.8	0.9	3.4	28.0
30	54H0	0.0	8.2	21.4	55.9	14.7	6.5	12.8	2.2	13.1	134.8
30	55G9	2.9	5.0	8.3	10.2	6.7	0.9	0.6	0.4	0.2	35.1
30	55H0	3.1	11.8	25.8	54.9	18.8	6.1	10.7	2.1	10.5	143.9

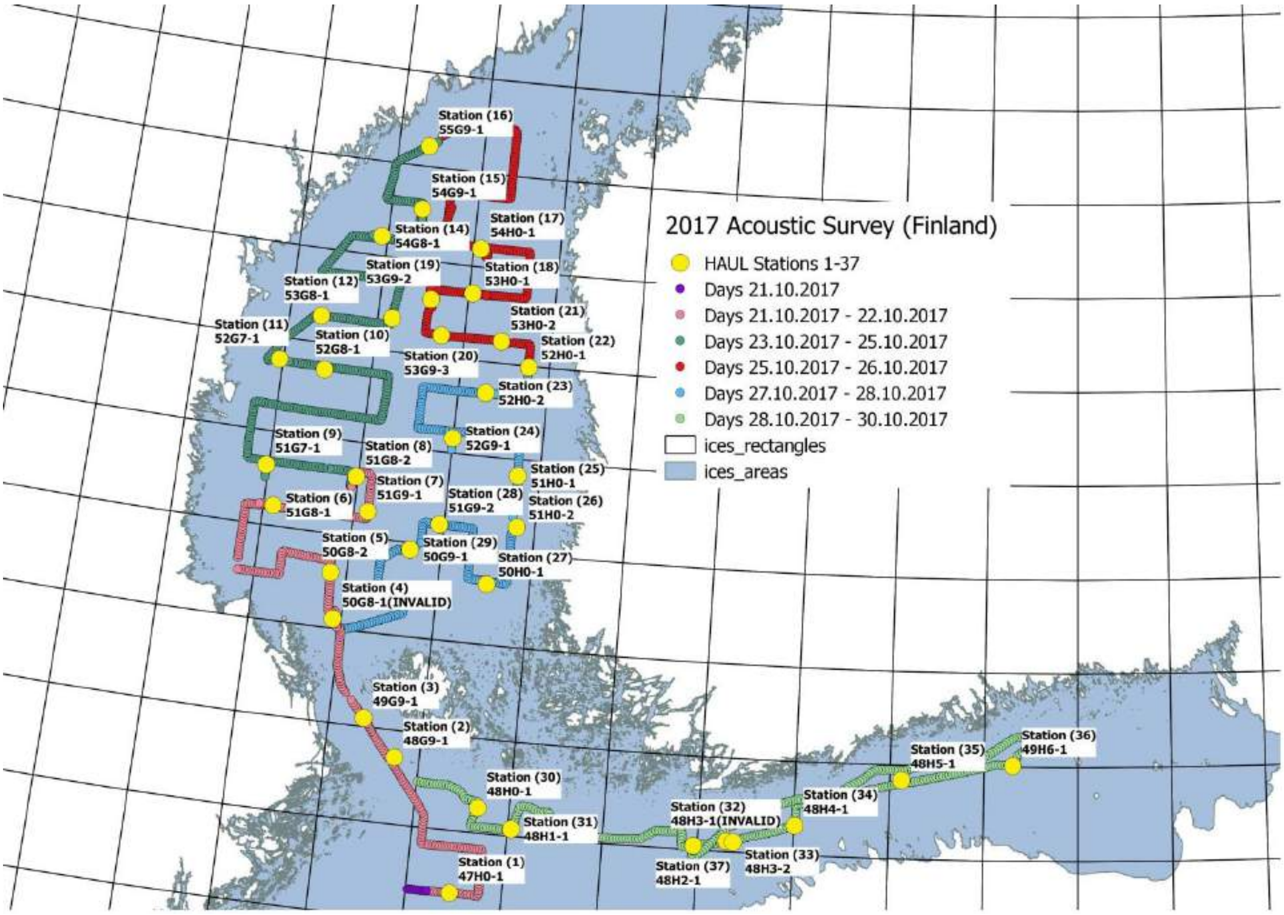


Figure 1. Cruise track and trawl stations of r/v Dana during the Finnish BIAS-survey in 2017.

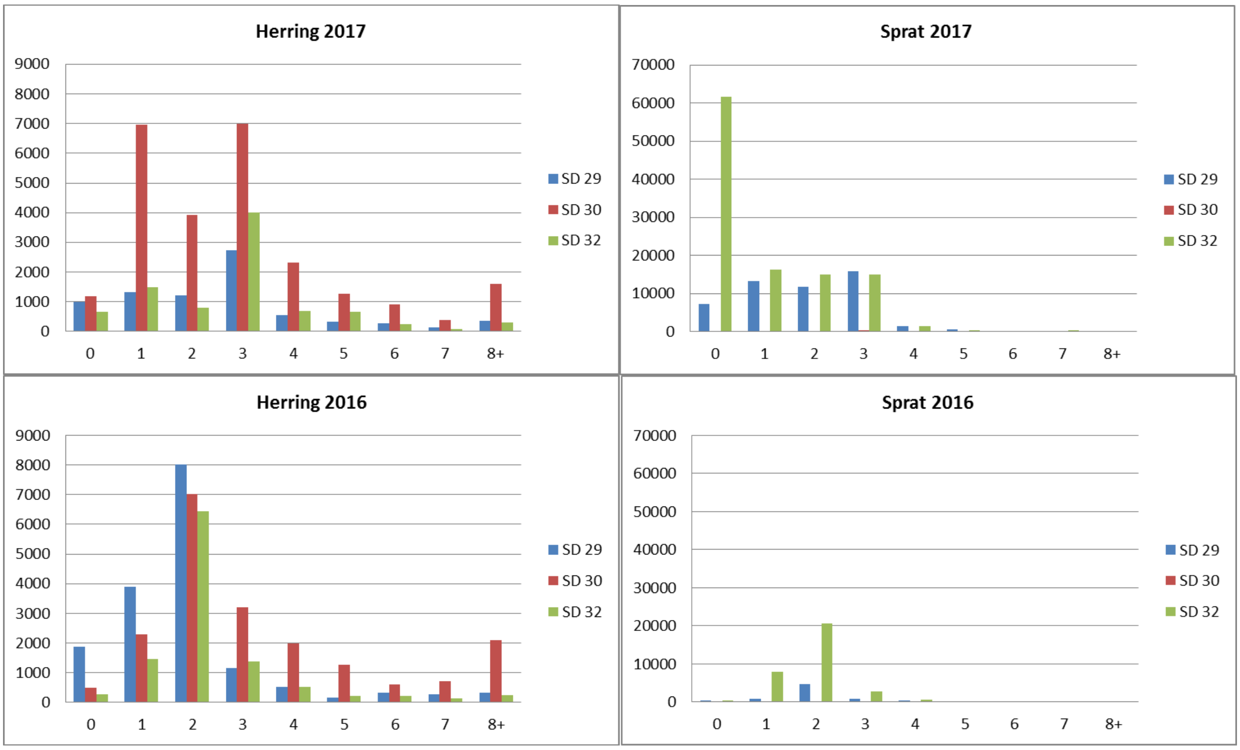
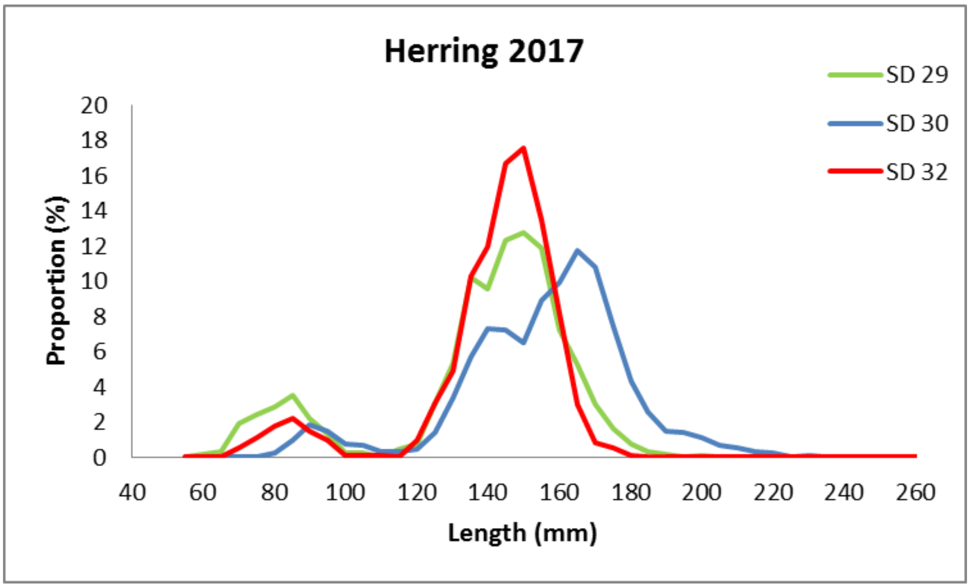


Figure 2. Abundance of herring and sprat per age groups according to the ICES Sub-divisions in Finnish BIAS surveys 2016 and 2017.



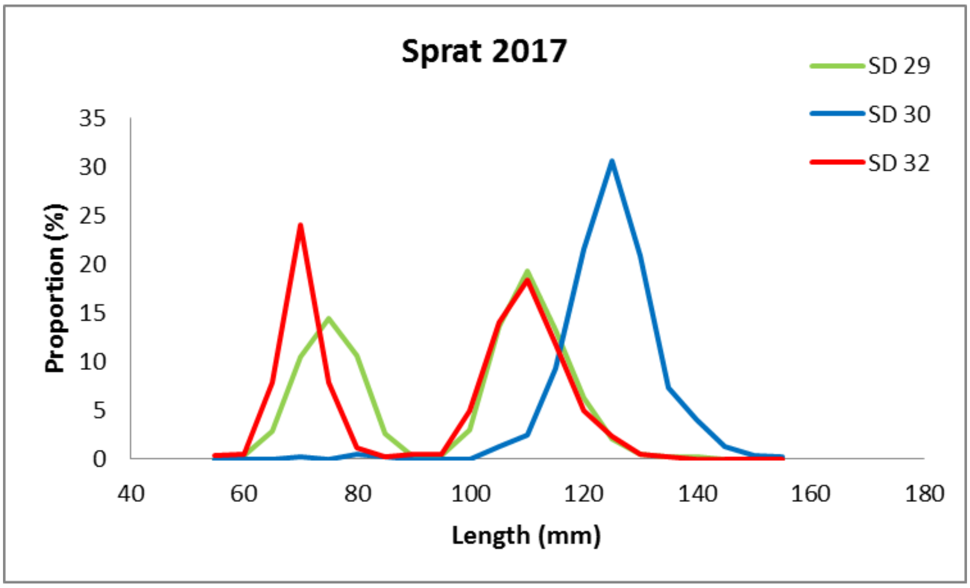


Figure 3. Length distributions of measured herring and sprat in different Sub-Division.

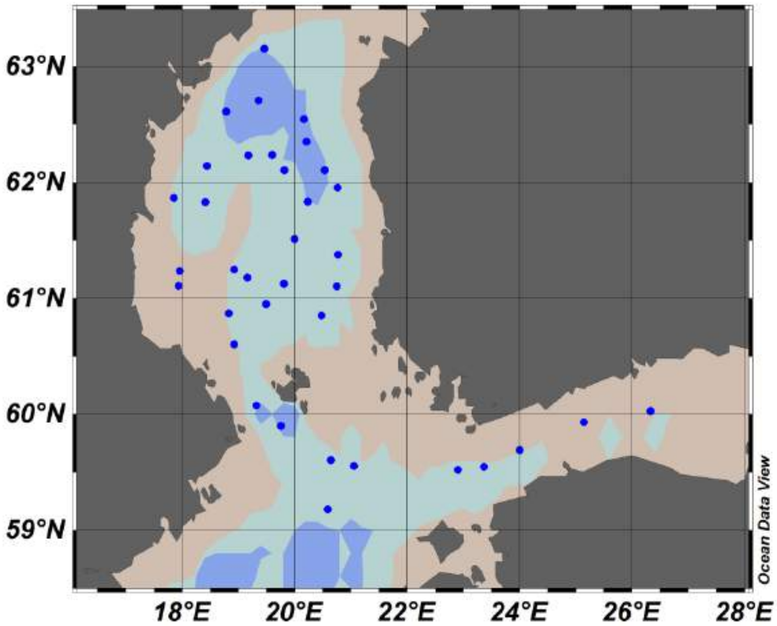


Figure 4. Map of the CTD stations (blue dots) during the Finnish BIAS-survey in 2017.

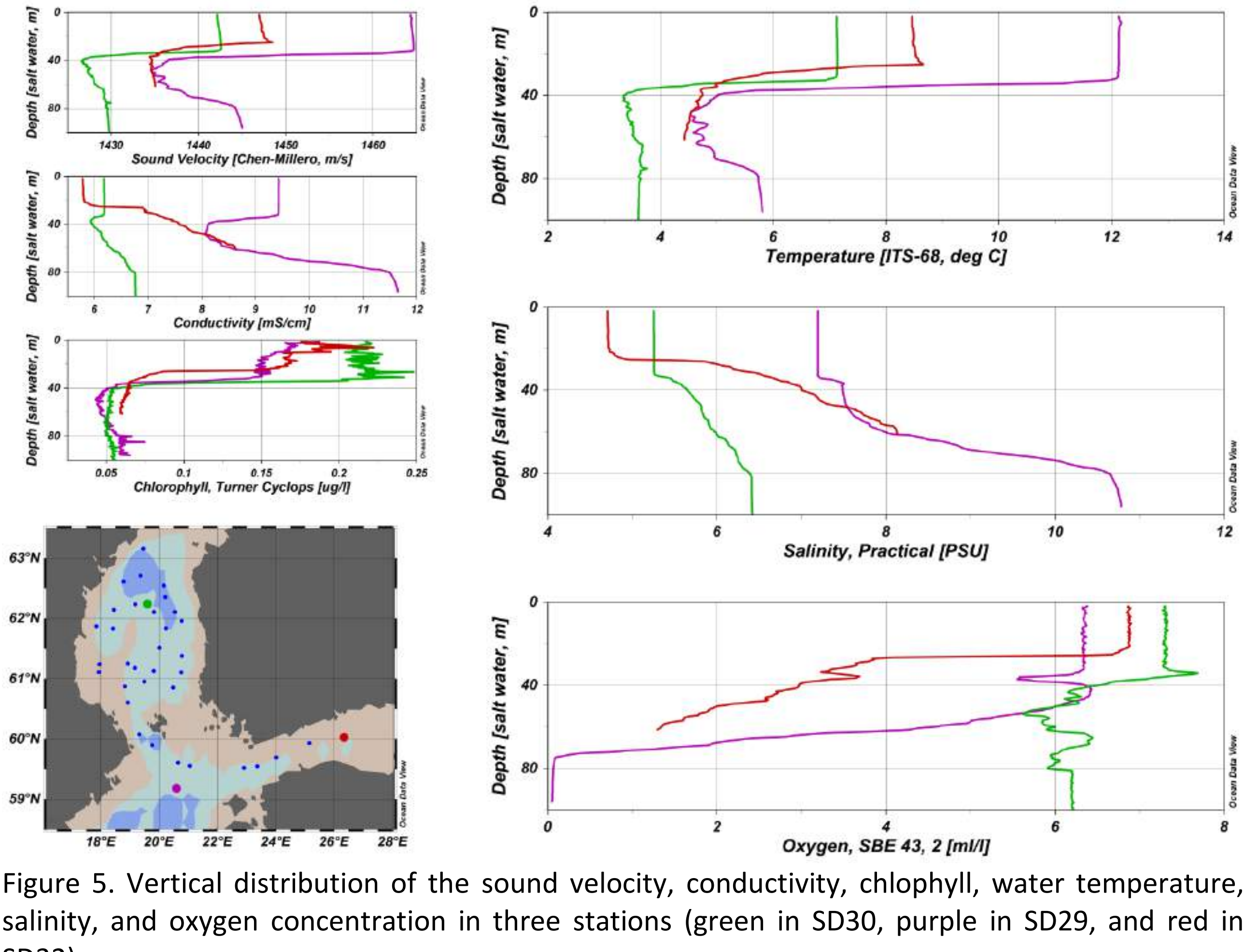


Figure 5. Vertical distribution of the sound velocity, conductivity, chlophyll, water temperature, salinity, and oxygen concentration in three stations (green in SD30, purple in SD29, and red in SD32).

Baltic International Acoustic Survey Report for R/V Dana

Survey 2017-10-05 - 2017-10-19

Niklas Larson
SLU - Institute of Marine Research, Lysekil, Sweden

Contents

1 Introduction

International hydroacoustic surveys have been conducted in the Baltic Sea since 1978. The starting point was the cooperation between Institute of Marine Research (IMR) in Lysekil, Sweden and the Institute für Hochseefisherei und Fishverarbeitung in Rostock, German Democratic Republic in October 1978, which produced the first acoustic estimates of total biomass of herring and sprat in the Baltic Main basin (Håkansson et al., 1979). Since then there has been at least one annual hydroacoustic survey for herring and sprat stocks and results have been reported to ICES.

The 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 as stipulated by the European Council and the Commission (Council Regulation (EC) No 199/2008 and the Commission DCF web page[1]).

IMR in Lysekil is part of the Department of Aquatic Resources within Swedish University of Agricultural Sciences and is responsible for the Swedish part of the EU Data Collection Framework and surveys in the marine environment. The Institute assesses the status of the marine ecosystems, develops and provides biological advices for managers for the sustainable use of aquatic resources.

The BIAS survey are co-ordinated and managed by the ICES working group WGBIFS. The main objective of BIAS is to assess herring and sprat resources in the Baltic Sea. The survey will provide data to the ICES Baltic Fisheries Assessment Working Group (WGBFAS).

[1] https://datacollection.jrc.ec.europa.eu/dcf-legislation

2 Methods

2.1 Narrative

Since R/V Argos was taken out of service in 2011, Sweden has chartered R/V Dana for the BIAS survey. The scientific staff was Swedish and the ship crew was Danish. This year's calibration of the SIMRAD EK60 sounder was made at Gullmarsfjorden on the Swedish west coast, the location change occurred 2011 because the normal calibration site at Högön is inaccessible for Dana due to deeper draft. The first part of the cruise started 2017-10-05 inbetween Sweden and Bornholm at the border between ICES subdivision (SD) 24 and SD 25, and ended 2017-10-19 east of Nynäshamn. The total cruise covered SD 27 and parts of 25, 26, 28 and 29.

2.2 Survey design

The stratification is based on ICES statistical rectangles with a range of 0.5 degrees in latitude and 1 degree in longitude (figure 1). The areas of all strata are limited by the 10 m depth line[2]. The aim is to use parallel transects spaced on regular rectangle basis normally at a maximum distance of 15 nautical miles and with a transect density of about 60 nautical miles per 1000 square nautical miles. The irregular shape of the survey area assigned to Sweden and the weather conditions makes it difficult to fulfill this. The total area covered was 20832 square nautical miles and the distance used for acoustic estimates was 1367 nautical miles. The cruise track and positions of trawl hauls are shown in figure 2.

2.3 Calibration

The SIMRAD EK60 echo sounder with the transducer ES38B was calibrated at Bornö in Gullmarssfjorden 2017-10-05 and 2017-10-06 according to the BIAS manual.[3] Values from the calibration were within required accuracy. The change of calibration site was decided after correspondance with Simrad. Due to the distance between the calibration site and the survey area the gain was recalculated using the equation: $\mathrm{G} = \mathrm{G}_0 + 10 * log10(c_0^2/c^2)$ (Bodholt 2002)

2.4 Acoustic data collection

The acoustic sampling was performed around the clock. SIMRAD EK60[4] echo sounder with the 38 kHz transducer (ES38b) mounted on a towed body is used for the acoustic transect data collection, additionally a hull mounted 38 kHz transducer (ES38B) was used during the fishing stations (the towed body is taken aboard when fishing). The settings of the hydroacoustic equipment were as described in the BIAS manual[5]. The post processing of the stored raw data was made using the software LSSS[6]. The mean volume back scattering values (Sv) were integrated over 1 nautical mile elementary sampling distance units (ESDUs) from 10 m below the surface to the bottom. Contributions from air bubbles, bottom structures and scattering layers were removed from the echogram using LSSS.

2.5 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

[2]ICES CM 2011/SSGESST:05 Addendum 2
[3]See footnote 5
[4]http://www.simrad.com/ek60
[5]See footnote 5
[6]www.marec.no/english/products.htm

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 in table 1.

Clupeoids	TS = 20 log L (cm) - 71.2	(ICES 1983/H:12)
Gadoids	TS = 20 log L (cm) - 67.5	(Foote et al. 1986)
Trachurus trachurus	TS = 20 log L (cm) - 73.0	(Misund, 1997 in Peña, 2007)
Fish without swim bladder	TS = 20 log L (cm) - 84.9	ICES CM2011/SSGESST:02,Addendum 2
Salmonids and 3-spined stickleback were assumed to have the same acoustic properties as herring.		

Table 1: Target strength-length (TS) relationships

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 number was separated into different fish species according to the mean catch composition in the rectangle.

2.6 Hydrographic data

CTD casts were made with a "Seabird 9+" CTD when calibrating the acoustic instruments and whenever a haul was conducted, additional hydrographic data was collected on a selection of these stations.

2.7 Personnel

The participating scientific crew can be seen in table 2

Eliasson, Rebecca	IMR, Lysekil, Sweden	Fish sampling
Jernberg, Carina	IMR, Lysekil, Sweden	Fish sampling
Johannesson, Per	IMR, Lysekil, Sweden	Technician
Larson, Niklas	IMR, Lysekil, Sweden	Scientific & Expedition leader, Acoustics
Lövgren, Olof	IMR, Lysekil, Sweden	Acoustics
Motyka, Roman	IMR, Lysekil, Sweden	Fish sampling
Palmen-Bratt, Anne-Marie	IMR, Lysekil, Sweden	Fish sampling
Sjöberg, Rajlie	IMR, Lysekil, Sweden	Fish sampling
Svenson, Anders	IMR, Lysekil, Sweden	Expedition leader, Acoustics
Tell, Anna-Kerstin	SMHI, Gothenburg	Oceanography

Table 2: Participating scientific crew

3 Results

3.1 Biological data

In total 46 trawl hauls were carried out, 15 in SD 25, 2 in SD 26, 14 in SD 27, 9 in SD 28 and 6 hauls in SD 29. 2044 herrings and 1294 sprats were aged. Catch compositions by trawl haul is presented in Table 8. Length distributions for herring and sprat by ICES subdivision are shown in figures 3 to 12.

3.2 Acoustic data

The survey statistics concerning the survey area, the mean backscatter [s_A], the mean scattering cross section [σ], the estimated total number of fish, the percentages of herring, sprat and cod per Sub-division/rectangle are shown in Table 3.

3.3 Abundance estimates

The total abundances of herring and sprat by age group per rectangle are presented in Table 4 and 6. The corresponding mean weights by age group per rectangle are shown in Tables 5 and 7.

4 Discussion

The data collected during the survey should be considered as representative for the abundance of the pelagic species during the BIAS in 2015 for SD25 to 29 and thus can be used in the assessment work done by WGBFAS.

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Commission DCF web page:
http://datacollection.jrc.ec.europa.eu/dcf-legislation

6 Tables, map and figures

SD	RECT	AREA	SA	SIGMA	NTOT	HHer	HSpr	HCod
25	39G4	287.3	573.8	2.746	600.29	51.24	48.11	0.193
25	39G5	979.0	64.5	2.118	298.20	30.37	66.72	0.252
25	40G4	677.2	332.1	4.062	553.61	82.39	13.79	1.521
25	40G5	1012.9	356.8	1.606	2249.42	16.12	67.28	0.012
25	40G6	1013.0	542.4	1.413	3889.96	15.98	59.84	0.110
25	40G7	1013.0	332.9	1.095	3081.10	13.36	35.47	0.086
25	41G6	764.4	466.9	0.944	3781.77	16.56	26.48	0.000
25	41G7	1000.0	1039.3	1.545	6726.96	20.53	69.56	0.013
26	41G8	1000.0	745.0	2.285	3260.41	64.12	28.86	0.021
27	42G6	266.0	456.4	1.347	901.60	47.00	9.24	0.000
27	42G7	986.9	646.4	1.180	5407.80	28.59	59.81	0.000
27	43G7	913.8	479.1	0.688	6366.15	8.65	34.77	0.000
27	44G7	960.5	448.5	0.561	7685.90	19.32	39.16	0.001
27	44G8	456.6	284.3	1.684	770.71	53.90	28.83	0.059
27	45G7	908.7	537.7	1.365	3578.83	56.74	11.97	0.000
27	45G8	947.2	394.9	0.613	6107.18	2.87	52.60	0.001
27	46G8	884.8	715.9	1.182	5358.34	42.99	12.22	0.003
28	42G8	945.4	742.5	0.862	8141.03	15.79	13.06	0.006
28	43G8	296.2	664.9	2.121	928.63	72.82	10.15	0.000
28	43G9	973.7	360.9	0.455	7720.08	0.88	24.97	0.051
28	44G9	876.6	640.6	1.402	4006.07	45.40	7.30	0.002
28	45G9	924.5	917.0	0.882	9609.30	4.88	59.19	0.001
29	46G9	933.8	433.5	0.551	7346.44	9.66	19.54	0.000
29	46H0	933.8	322.4	0.585	5148.96	4.67	47.86	0.005
29	47G9	876.2	1405.1	1.465	8405.73	49.91	40.08	0.012

Table 3: Survey statistics

SD	RECT	NSprTOT	NSpr0	NSpr1	NSpr2	NSpr3	NSpr4	NSpr5	NSpr6	NSpr7	NSpr8
25	39G4	288.78	0.00	28.38	11.35	140.55	66.77	7.68	20.03	9.35	4.67
25	39G5	198.97	0.00	9.41	13.59	81.39	70.41	18.54	3.50	0.56	1.57
25	40G4	76.37	0.37	8.52	0.72	33.81	17.27	5.29	7.34	0.34	2.70
25	40G5	1513.32	0.00	37.01	130.57	746.98	277.54	267.90	53.32	0.00	0.00
25	40G6	2327.78	19.40	136.01	121.87	1746.00	40.33	79.14	97.02	11.83	76.19
25	40G7	1092.78	18.93	91.17	23.50	571.36	90.00	41.13	109.67	104.64	42.37
25	41G6	1001.38	60.24	20.61	190.07	452.01	75.40	155.93	14.24	18.63	14.24
25	41G7	4679.07	40.68	53.83	0.00	3496.77	683.64	350.15	6.83	33.80	13.37
26	41G8	940.87	7.18	142.93	89.99	480.12	48.78	70.56	0.00	36.65	64.66
27	42G6	83.29	0.50	5.12	4.62	48.97	12.24	1.40	3.11	5.92	1.40
27	42G7	3234.52	703.39	46.09	293.75	1638.88	279.72	235.22	30.42	0.00	7.04
28	42G8	1063.59	151.58	45.08	78.46	607.15	101.91	67.66	0.00	6.87	4.89
27	43G7	2213.37	1093.33	247.07	321.30	424.12	95.87	15.87	2.57	2.57	10.65
28	43G8	94.23	4.16	0.00	10.00	64.87	10.31	3.64	0.73	0.00	0.52
28	43G9	1927.45	1727.82	48.73	51.89	85.12	1.47	0.00	1.05	11.37	0.00
27	44G7	3009.87	2679.09	67.05	85.26	170.74	5.15	0.00	0.00	0.00	2.58
27	44G8	222.17	82.19	4.23	14.65	109.86	5.86	1.63	0.00	0.00	3.74
28	44G9	292.62	132.21	17.31	8.12	116.64	0.93	12.66	3.82	0.00	0.93
27	45G7	428.46	296.70	18.13	11.99	89.15	7.88	2.90	0.00	0.86	0.86
27	45G8	3212.25	2202.54	170.60	164.33	548.73	77.00	39.95	9.10	0.00	0.00
28	45G9	5687.39	1659.98	205.43	403.57	2189.41	889.88	249.68	47.36	12.62	29.46
27	46G8	654.85	347.78	19.19	39.19	216.90	1.23	9.81	13.05	3.24	4.46
29	46G9	1435.85	1352.31	0.00	16.67	42.81	4.72	5.84	1.87	0.00	11.64
29	46H0	2464.27	2114.60	48.60	45.56	210.68	12.30	26.41	0.00	1.35	4.78
29	47G9	3369.38	1928.21	236.14	45.21	1088.53	14.62	17.93	5.98	14.62	18.13

Table 4: Estimated number (millions) of sprat

SD	RECT	WSpr0	WSpr1	WSpr2	WSpr3	WSpr4	WSpr5	WSpr6	WSpr7	WSpr8
25	39G4		12.75	11.50	13.60	16.78	18.00	15.50	12.00	20.50
25	39G5		11.50	12.00	12.50	14.67	15.86	17.75	16.00	18.00
25	40G4	2.00	13.33	10.00	12.29	14.78	16.00	16.25	17.00	18.00
25	40G5		8.67	8.57	11.69	13.43	13.57	14.50		
25	40G6	3.25	8.00	8.50	10.25	14.50	13.75	14.40	15.00	15.86
25	40G7	3.29	9.50	9.50	11.45	13.75	14.80	13.75	12.00	14.75
25	41G6	3.03	6.57	7.75	8.87	12.67	13.50	11.00	12.00	12.00
25	41G7	3.40	8.00		10.33	11.14	12.50	15.00	14.50	16.00
26	41G8	2.67	8.33	9.67	10.47	13.40	13.40		12.50	13.67
27	42G6	3.00	9.00	8.00	9.68	12.00	16.00	11.00	12.50	13.50
27	42G7	2.90	7.67	8.67	10.13	13.00	13.00	12.50		13.00
28	42G8	2.81	9.00	9.00	9.33	12.67	13.00		16.00	13.00
27	43G7	2.55	8.00	9.60	10.71	12.33	11.50	12.00	11.00	13.50
28	43G8	3.12		8.60	10.00	12.20	12.75	13.00		14.00
28	43G9	2.45	8.14	9.50	10.08	11.00		11.00	13.00	
27	44G7	2.33	8.00	9.50	9.57	12.50				14.00
27	44G8	2.59	8.00	10.75	9.70	11.50	13.00			12.50
28	44G9	2.87	8.40	7.50	9.71	12.00	11.60	13.00		15.00
27	45G7	2.69	7.50	9.67	9.25	10.50	11.67		13.00	13.00
27	45G8	2.75	7.38	9.75	10.00	12.40	12.00	12.00		
28	45G9	2.74	8.00	10.00	9.43	10.80	12.83	14.00	12.00	13.00
27	46G8	2.30	7.33	8.33	9.50	12.00	12.00	11.50	12.00	12.00
29	46G9	2.50		7.60	8.85	9.00	11.33	11.00		10.33
29	46H0	2.75	7.12	9.00	9.27	10.00	12.14		13.00	11.50
29	47G9	2.26	7.50	8.00	9.33	10.00	11.67	10.00	10.00	10.50

Table 5: Estimated mean weights (g) of sprat

SD	RECT	NHerTOT	NHer0	NHer1	NHer2	NHer3	NHer4	NHer5	NHer6	NHer7	NHer8
25	39G4	307.56	1.68	5.58	14.19	152.83	62.80	53.97	13.96	0.00	2.56
25	39G5	90.56	0.89	3.75	3.37	31.97	15.82	20.99	6.82	5.96	1.00
25	40G4	456.13	0.00	5.90	47.49	123.51	107.83	106.65	15.48	37.63	11.64
25	40G5	362.62	0.00	10.42	3.74	162.25	99.35	37.76	22.87	22.02	4.21
25	40G6	605.64	19.93	6.64	53.08	312.40	121.77	56.38	24.22	2.27	8.94
25	40G7	411.74	8.20	7.93	17.38	242.00	41.51	52.64	22.57	16.42	3.09
25	41G6	626.37	98.82	47.50	10.58	394.21	39.39	31.64	4.12	0.00	0.11
25	41G7	1381.06	16.42	34.94	214.13	917.67	79.10	71.54	41.61	4.77	0.88
26	41G8	2090.42	18.56	4.84	127.51	723.08	467.42	586.05	121.07	4.84	37.04
27	42G6	423.74	67.41	23.89	9.16	236.24	65.77	19.63	1.64	0.00	0.00
27	42G7	1546.04	884.70	35.78	111.67	382.18	115.33	9.84	4.65	1.89	0.00
28	42G8	1285.72	20.30	0.00	182.01	811.02	56.92	132.88	60.93	12.75	8.91
27	43G7	550.45	186.52	77.00	69.89	146.37	37.35	25.67	2.63	2.39	2.63
28	43G8	676.21	0.00	3.74	57.80	389.08	97.08	63.41	47.14	5.61	12.35
28	43G9	68.24	8.91	0.00	5.15	40.17	5.58	8.43	0.00	0.00	0.00
27	44G7	1484.85	1314.75	35.30	20.10	68.53	27.41	8.53	5.78	4.46	0.00
27	44G8	415.43	7.32	25.60	49.70	283.11	43.37	4.82	1.51	0.00	0.00
28	44G9	1818.72	19.50	52.46	339.51	1143.87	132.49	53.38	61.55	10.95	5.01
27	45G7	2030.59	221.87	425.49	228.17	999.11	143.25	4.92	2.87	4.92	0.00
27	45G8	174.97	81.25	37.08	5.78	30.85	8.88	7.52	3.62	0.00	0.00
28	45G9	468.65	76.13	48.19	52.31	238.90	34.08	16.11	2.92	0.00	0.00
27	46G8	2303.41	50.03	375.28	406.12	1401.72	34.27	35.99	0.00	0.00	0.00
29	46G9	709.97	131.80	127.22	85.10	316.50	39.22	2.64	7.49	0.00	0.00
29	46H0	240.23	63.82	22.99	33.50	74.79	23.72	16.19	4.05	1.16	0.00
29	47G9	4195.26	144.16	616.69	771.73	2183.50	268.27	121.04	58.55	19.68	11.64

Table 6: Estimated number (millions) of herring

SD	RECT	WHer0	WHer1	WHer2	WHer3	WHer4	WHer5	WHer6	WHer7	WHer8
25	39G4	3.50	18.50	36.00	48.67	59.19	51.25	50.40		65.00
25	39G5	13.00	23.80	41.50	38.21	46.11	45.41	51.38	52.82	67.00
25	40G4		25.50	47.33	46.52	70.75	68.61	89.50	66.50	92.67
25	40G5		25.50	42.50	31.59	41.81	49.46	59.23	50.17	58.00
25	40G6	7.94	17.00	28.25	30.21	40.86	47.10	50.14	70.00	48.75
25	40G7	9.25	27.00	27.25	32.75	50.30	46.60	48.38	57.25	60.67
25	41G6	6.04	20.50	32.75	28.94	32.75	38.60	42.50		81.00
25	41G7	5.89	19.50	23.25	28.81	37.00	41.67	43.71	49.33	54.00
26	41G8	4.33	51.00	29.50	26.05	31.73	40.21	45.71	47.00	50.80
27	42G6	5.60	19.33	19.00	26.27	32.45	36.62	44.00		
27	42G7	5.15	17.00	24.88	25.33	32.40	32.33	37.00	49.00	
28	42G8	4.00		23.83	27.32	36.50	38.22	41.83	47.33	43.00
27	43G7	4.49	16.85	23.00	25.53	30.20	36.33	30.00	44.00	29.00
28	43G8		16.00	22.00	24.92	33.50	36.90	40.88	47.00	45.33
28	43G9	3.91		22.33	26.08	29.00	32.75			
27	44G7	4.29	15.89	21.80	23.47	26.14	27.17	31.00	26.00	
27	44G8	3.89	17.43	27.25	26.35	30.60	37.50	58.00		
28	44G9	5.20	17.80	24.60	26.90	37.25	39.17	37.57	53.33	44.00
27	45G7	3.97	15.40	24.00	24.00	30.22	29.00	44.00	26.00	
27	45G8	4.18	15.73	21.33	23.43	27.25	29.25	27.00		
28	45G9	3.46	15.67	18.80	24.36	26.80	30.60	33.00		
27	46G8	3.17	14.50	24.00	22.60	31.25	29.00			
29	46G9	3.28	12.77	20.67	21.09	28.70	32.00	34.33		
29	46H0	3.41	15.17	21.17	24.11	28.62	31.44	39.67	39.00	
29	47G9	3.03	13.62	21.00	23.57	27.83	31.40	24.00	35.33	26.00

Table 7: Estimated mean weights (g) of herring

	Species	3	5	7	9	11	13	15	17
1	Anguilla anguilla								
2	Clupea harengus	58.47	74.89	32.70	25.95	31.82	19.48	72.25	1.16
3	Cyclopterus lumpus				0.24	0.12			1.56
4	Enchelyopus cimbrius								
5	Gadus morhua	2.38	18.61	0.00	0.23	0.15	2.02	0.28	
6	Gasterosteus aculeatus		0.01	0.01	0.00		0.14	5.18	29.69
7	Hyperoplus lanceolatus								
8	Leptoclinus maculatus								
9	Merlangius merlangus	0.94	0.84						
10	Myoxocephalus quadricornis								
11	Myoxocephalus scorpius								0.22
12	Nerophis ophidion								0.00
13	Osmerus eperlanus								
14	Platichthys flesus	0.12							
15	Pleuronectes platessa					0.09			
16	Pomatoschistus			0.00					
17	Pungitius pungitius		0.00				0.00	0.03	0.25
18	Scomber scombrus								
19	Scophthalmus maximus								
20	Sprattus sprattus	18.57	4.13	0.93	89.18	23.48	16.82	42.04	3.27
21	Zoarces viviparus								

Table 8: Catch composition per haul.

	Species	19	21	23	25	27	29	31	33
1	Anguilla anguilla								0.08
2	Clupea harengus	122.28	75.97	151.25	24.12	27.93	272.06	518.15	513.25
3	Cyclopterus lumpus	0.35	0.98	0.23					0.64
4	Enchelyopus cimbrius								
5	Gadus morhua		7.99	6.33	0.10			0.80	0.15
6	Gasterosteus aculeatus	28.95	0.71	4.12	7.23	3.81	9.94	14.22	6.43
7	Hyperoplus lanceolatus			0.21					
8	Leptoclinus maculatus								
9	Merlangius merlangus		0.18						
10	Myoxocephalus quadricornis								
11	Myoxocephalus scorpius								
12	Nerophis ophidion								
13	Osmerus eperlanus								
14	Platichthys flesus				0.31				
15	Pleuronectes platessa								
16	Pomatoschistus			1.62	0.09				
17	Pungitius pungitius	0.04		0.04	0.01	0.01	0.05	0.03	0.03
18	Scomber scombrus				0.29				
19	Scophthalmus maximus								
20	Sprattus sprattus	150.84	100.73	219.49	7.42	387.27	195.07	232.26	117.61
21	Zoarces viviparus								

Table 8 (continued): Catch composition per haul

	Species	35	37	39	41	43	45	47	49
1	Anguilla anguilla								
2	Clupea harengus	216.30	0.39	77.42	971.46	701.49	52.87	0.05	23.08
3	Cyclopterus lumpus				0.73		0.50	0.11	
4	Enchelyopus cimbrius			0.03					
5	Gadus morhua	0.68		0.39		0.00		0.02	0.04
6	Gasterosteus aculeatus	0.43	69.39	8.06	15.01	4.48	36.38	116.61	66.39
7	Hyperoplus lanceolatus								0.04
8	Leptoclinus maculatus								
9	Merlangius merlangus								
10	Myoxocephalus quadricornis					0.37			
11	Myoxocephalus scorpius				0.17	0.18			
12	Nerophis ophidion								
13	Osmerus eperlanus								
14	Platichthys flesus				0.67	0.24			0.15
15	Pleuronectes platessa								
16	Pomatoschistus					0.02			
17	Pungitius pungitius		0.06		0.03				0.01
18	Scomber scombrus								
19	Scophthalmus maximus								
20	Sprattus sprattus	19.80	0.27	20.91	48.19	15.28	10.91	29.47	76.24
21	Zoarces viviparus				0.03				

Table 8 (continued): Catch composition per haul

	Species	51	53	55	57	59	61	63	65
1	Anguilla anguilla								
2	Clupea harengus	189.40	241.38	32.88	34.22	57.01	67.50	46.17	70.17
3	Cyclopterus lumpus					0.14			
4	Enchelyopus cimbrius								
5	Gadus morhua						0.07		0.27
6	Gasterosteus aculeatus	11.15	18.96	1.51	44.26	30.57	49.80	23.76	1.88
7	Hyperoplus lanceolatus						0.12		
8	Leptoclinus maculatus								
9	Merlangius merlangus								
10	Myoxocephalus quadricornis								
11	Myoxocephalus scorpius					0.16			
12	Nerophis ophidion				0.02				
13	Osmerus eperlanus								
14	Platichthys flesus								
15	Pleuronectes platessa								
16	Pomatoschistus								
17	Pungitius pungitius					0.03			
18	Scomber scombrus								
19	Scophthalmus maximus								
20	Sprattus sprattus	192.09	22.10	80.94	127.35	23.52	64.22	56.52	10.98
21	Zoarces viviparus			0.04					

Table 8 (continued): Catch composition per haul

	Species	67	69	71	73	75	77	79	81
1	Anguilla anguilla								
2	Clupea harengus	25.78	170.08	455.47	38.89	74.57	56.87	142.99	24.80
3	Cyclopterus lumpus	0.67	0.20	0.03	0.18		0.46	0.13	0.16
4	Enchelyopus cimbrius								
5	Gadus morhua	0.07					0.01		0.45
6	Gasterosteus aculeatus	54.55	9.70	18.59	94.76	8.60	103.94	61.11	56.14
7	Hyperoplus lanceolatus		0.05				0.04	0.03	
8	Leptoclinus maculatus								
9	Merlangius merlangus								
10	Myoxocephalus quadricornis								
11	Myoxocephalus scorpius	0.35						0.24	
12	Nerophis ophidion								
13	Osmerus eperlanus			0.02					
14	Platichthys flesus								
15	Pleuronectes platessa								
16	Pomatoschistus								
17	Pungitius pungitius	0.04		0.02		0.02		0.06	
18	Scomber scombrus								
19	Scophthalmus maximus		0.31						
20	Sprattus sprattus	253.77	7.42	25.91	161.54	482.35	72.43	224.27	68.07
21	Zoarces viviparus								

Table 8 (continued): Catch composition per haul

	Species	83	85	87	89	91
1	Anguilla anguilla					
2	Clupea harengus	1.25	300.64	537.01	99.98	0.64
3	Cyclopterus lumpus	0.26	0.63		0.14	0.24
4	Enchelyopus cimbrius					
5	Gadus morhua			0.68		
6	Gasterosteus aculeatus	55.69	31.04	0.36	33.83	94.54
7	Hyperoplus lanceolatus					
8	Leptoclinus maculatus			0.00		
9	Merlangius merlangus					
10	Myoxocephalus quadricornis			0.17		
11	Myoxocephalus scorpius					
12	Nerophis ophidion					0.02
13	Osmerus eperlanus					
14	Platichthys flesus			0.40	0.13	
15	Pleuronectes platessa					
16	Pomatoschistus					
17	Pungitius pungitius		0.06		0.02	0.06
18	Scomber scombrus					
19	Scophthalmus maximus					
20	Sprattus sprattus	19.75	280.13	45.25	18.57	18.15
21	Zoarces viviparus					

Table 8 (continued): Catch composition per haul

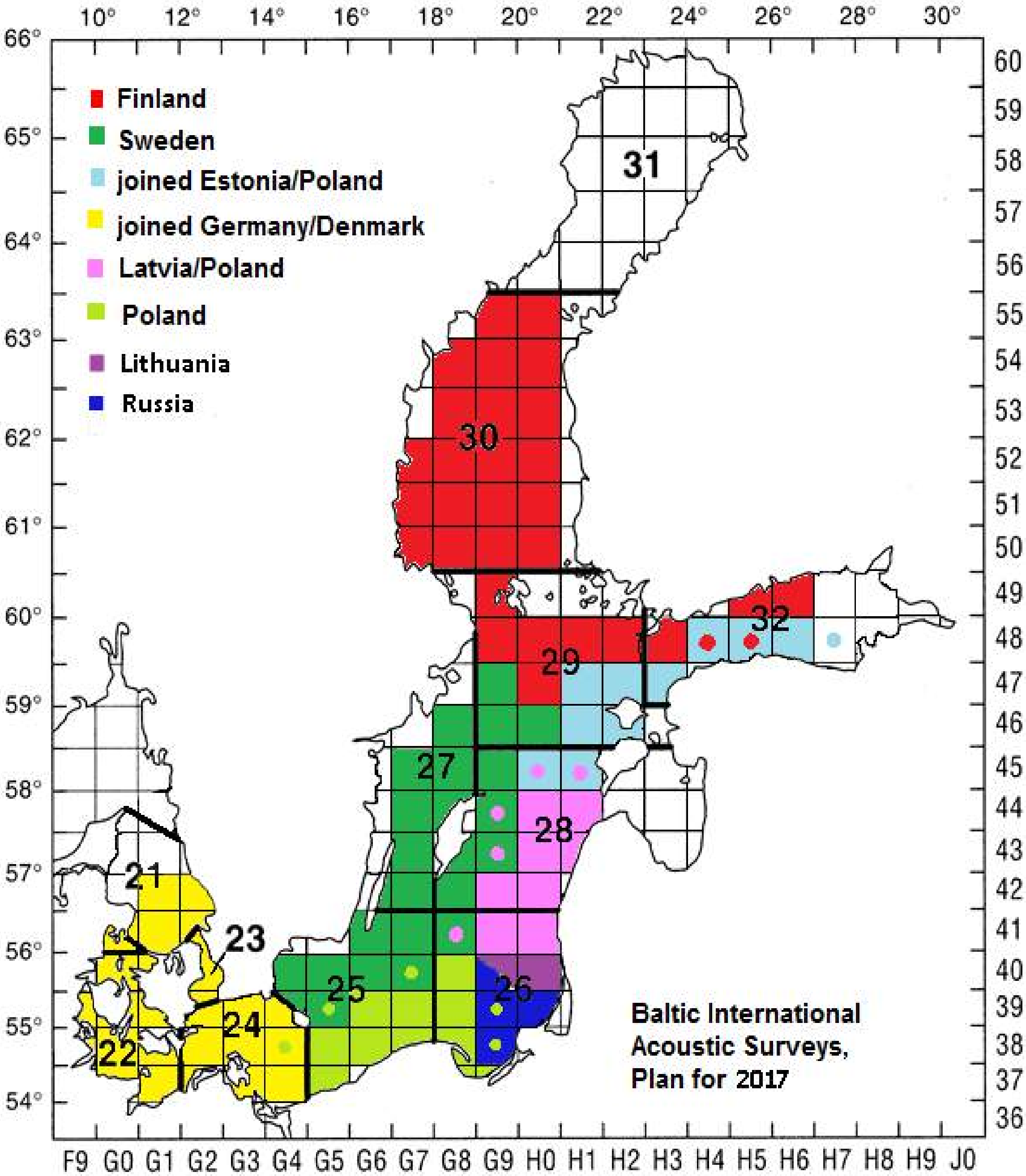

Figure 1: Map over which ICES square are allocated to each country (On axes: longitude, latitude and ICES name of square eg:41G8)

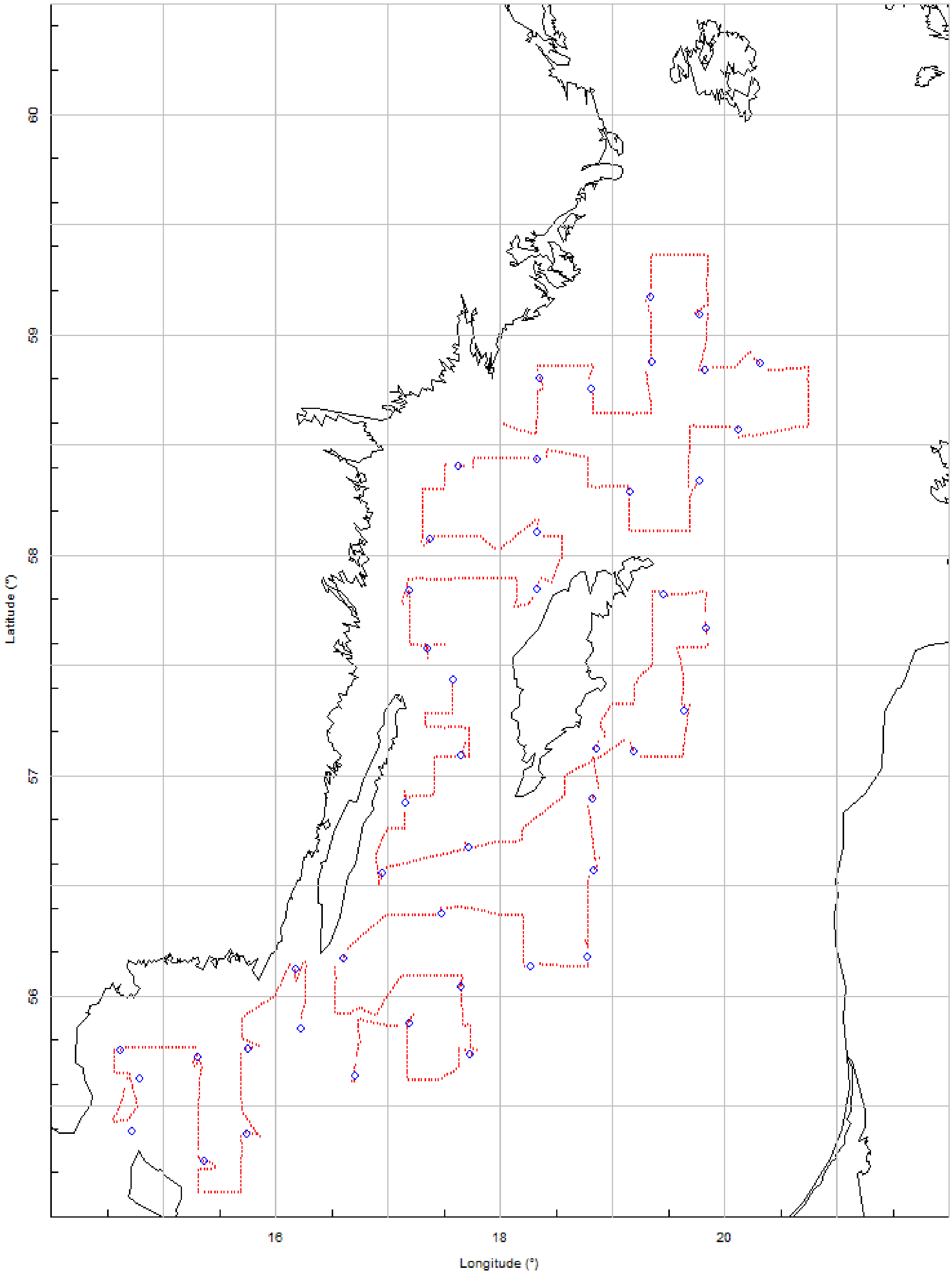

Figure 2: cruise track(red), positions of trawl hauls (blue) and survey grid (ICES squares)(grey)

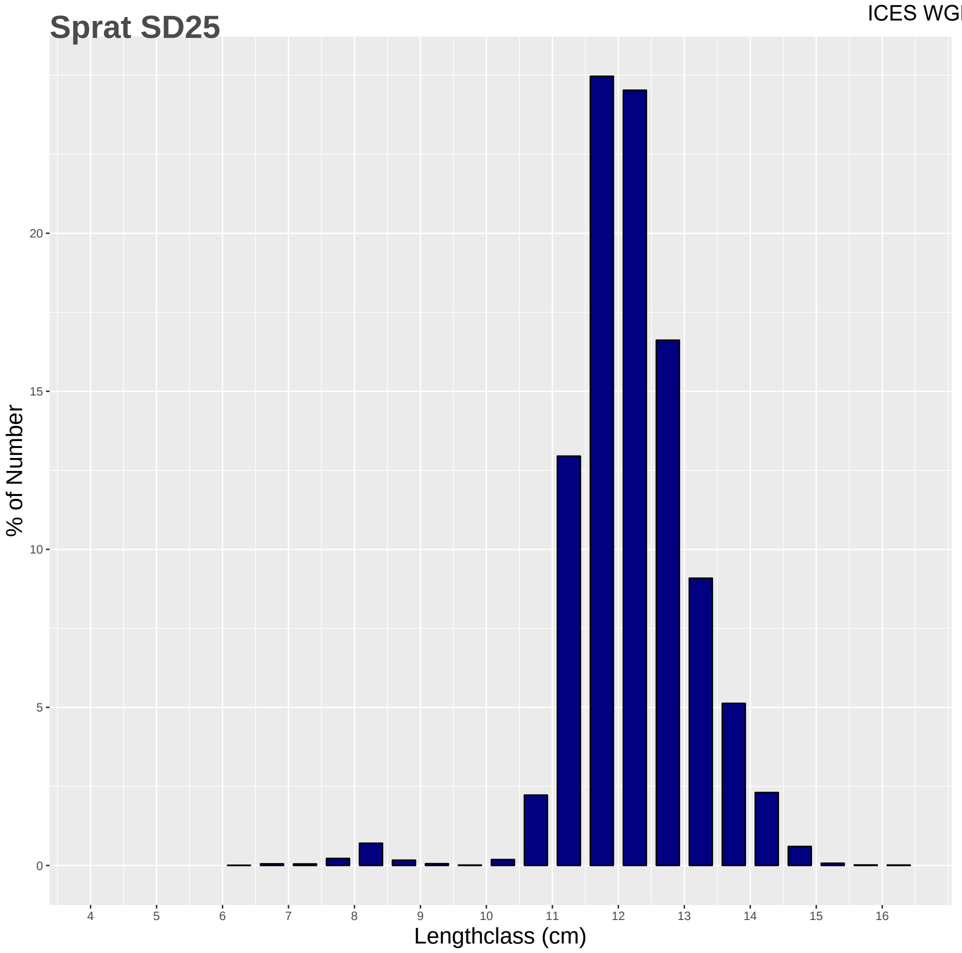

Figure 3: Length distribution of sprat from subdivision 25

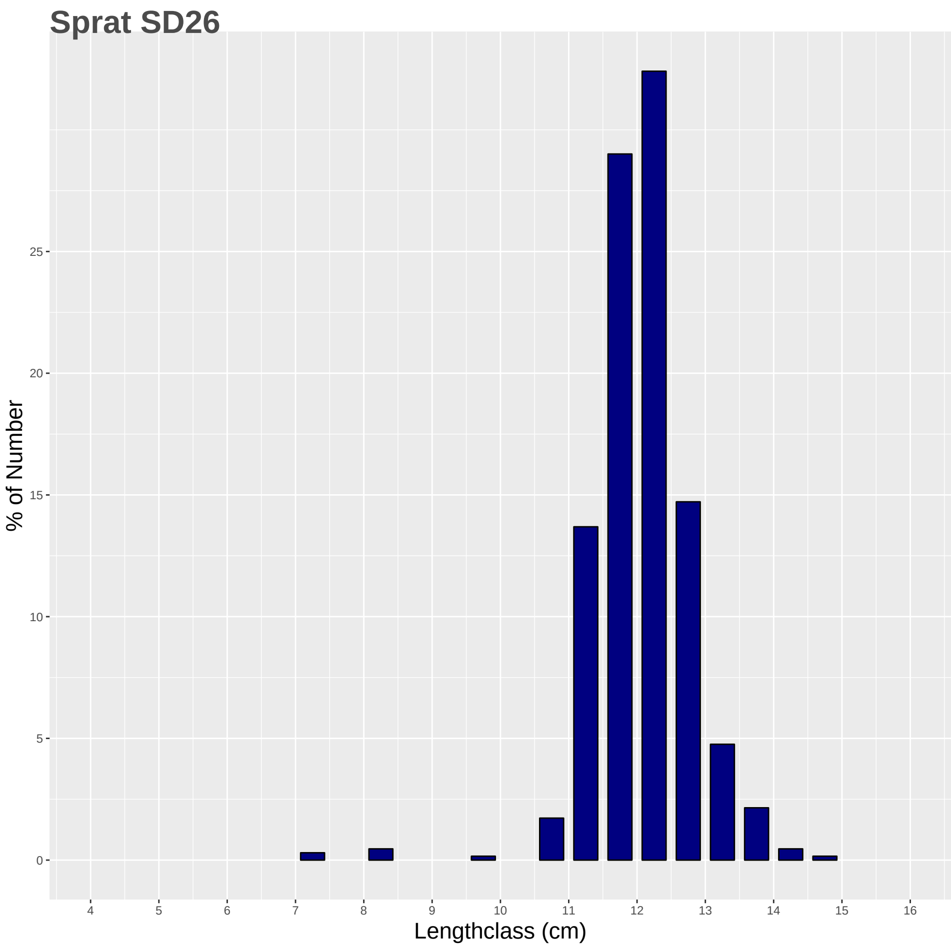

Figure 4: Length distribution of sprat from subdivision 26

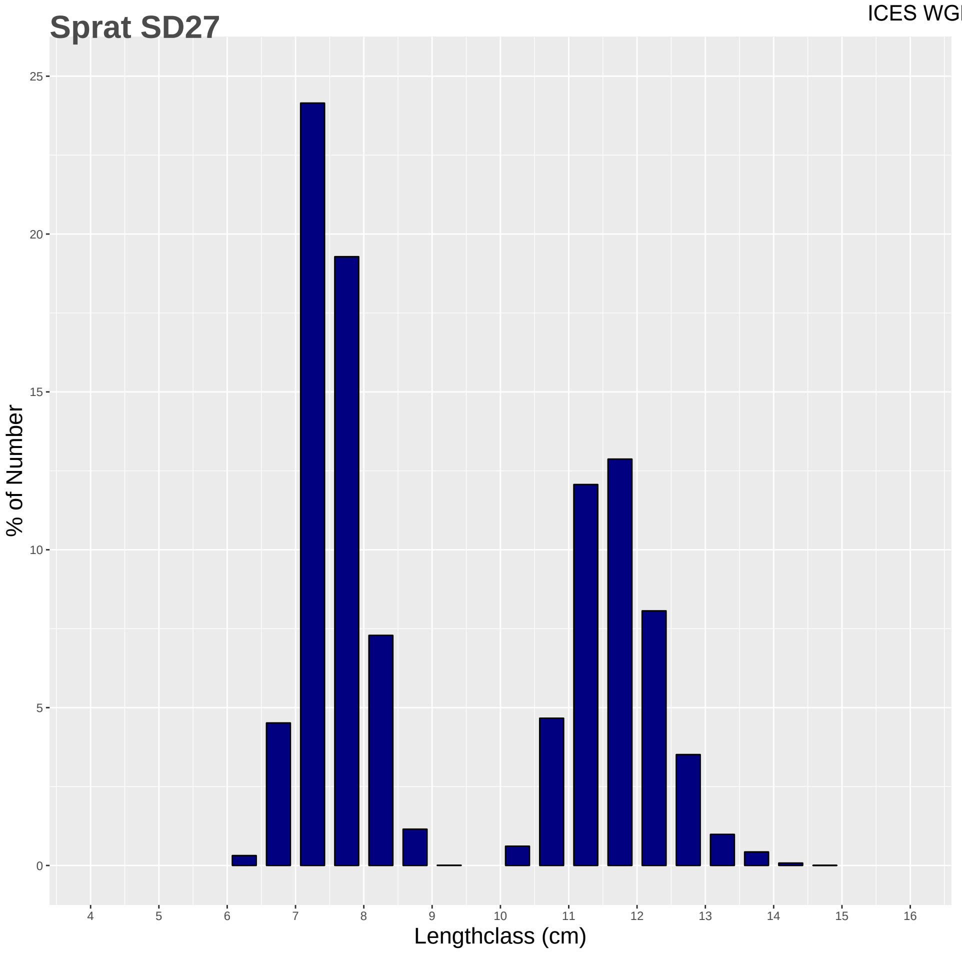

Figure 5: Length distribution of sprat from subdivision 27

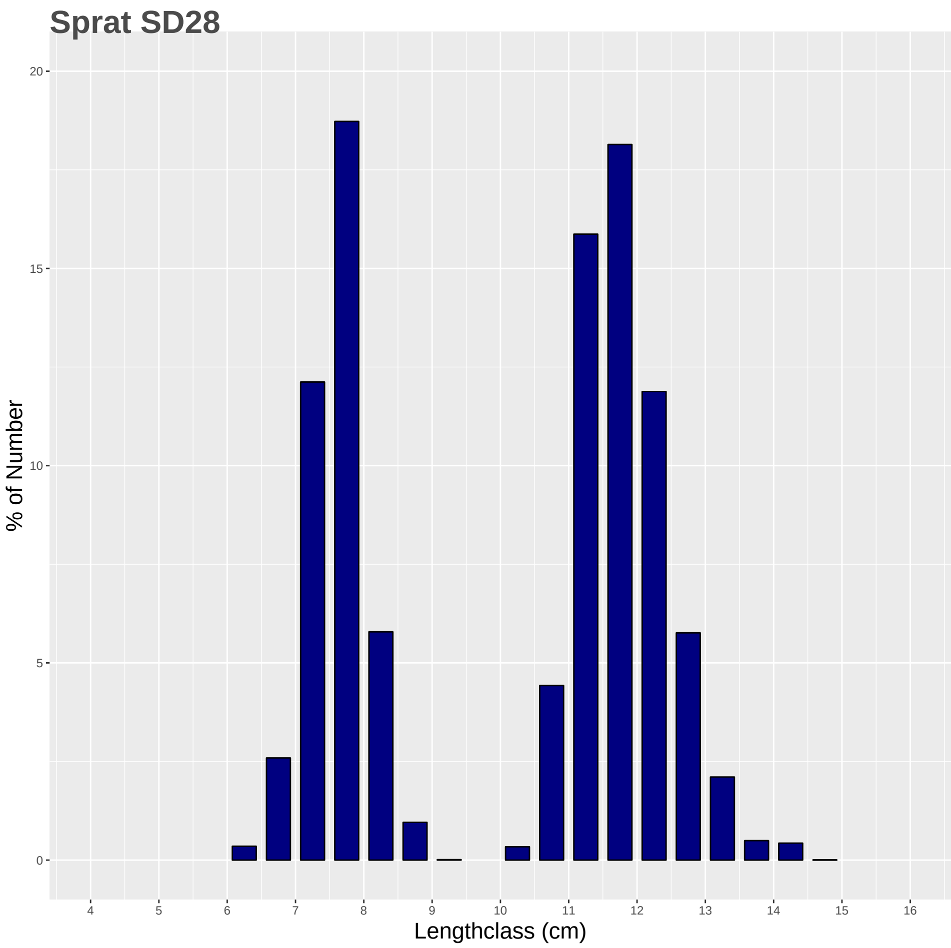

Figure 6: Length distribution of sprat from subdivision 28

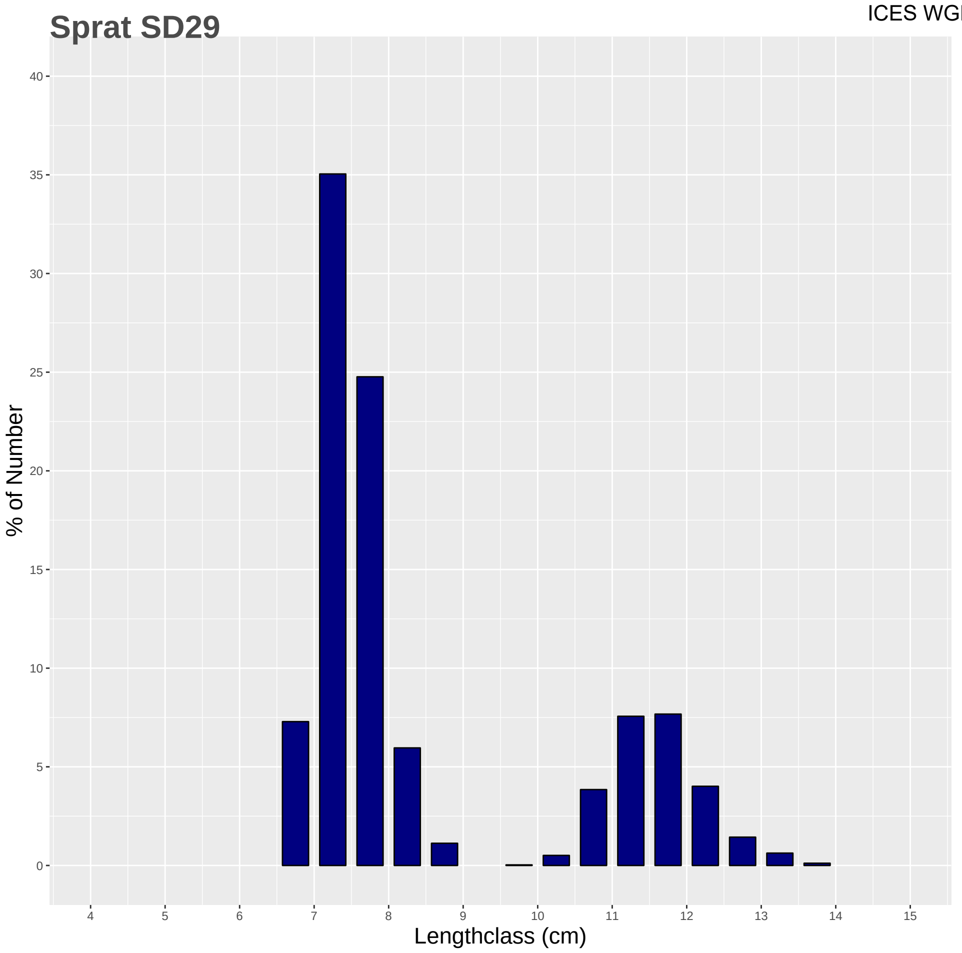

Figure 7: Length distribution of sprat from subdivision 29

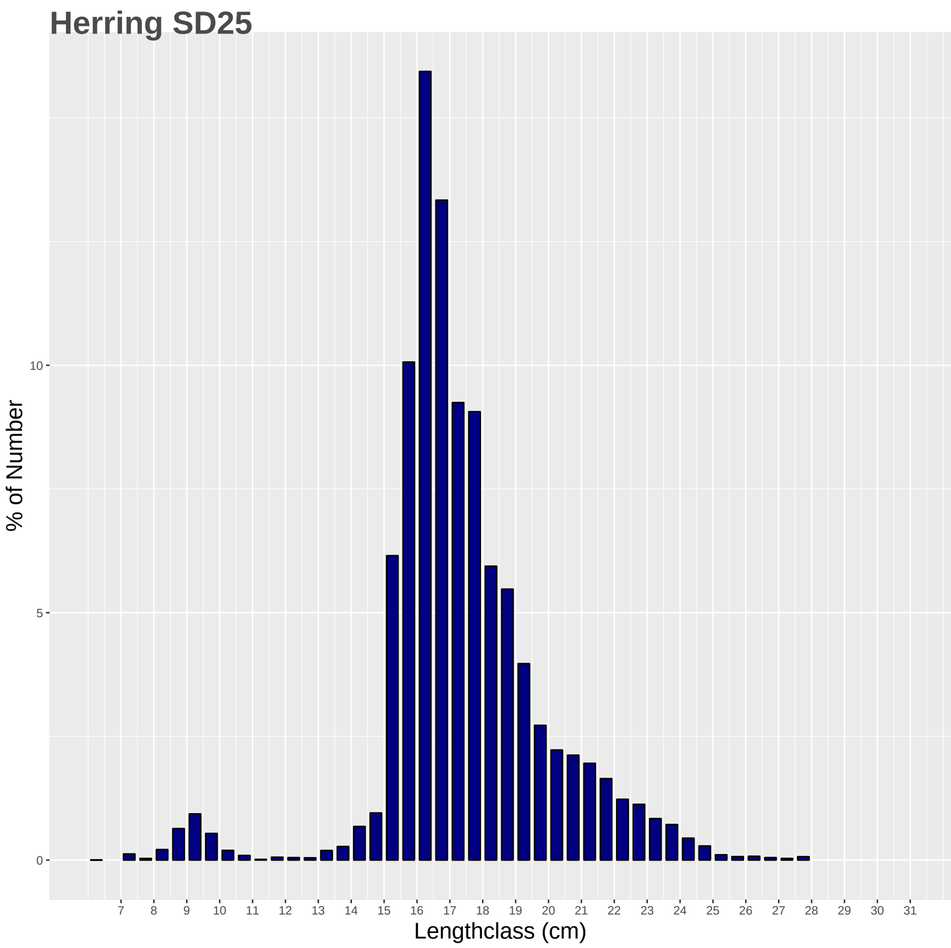

Figure 8: Length distribution of herring from subdivision 25

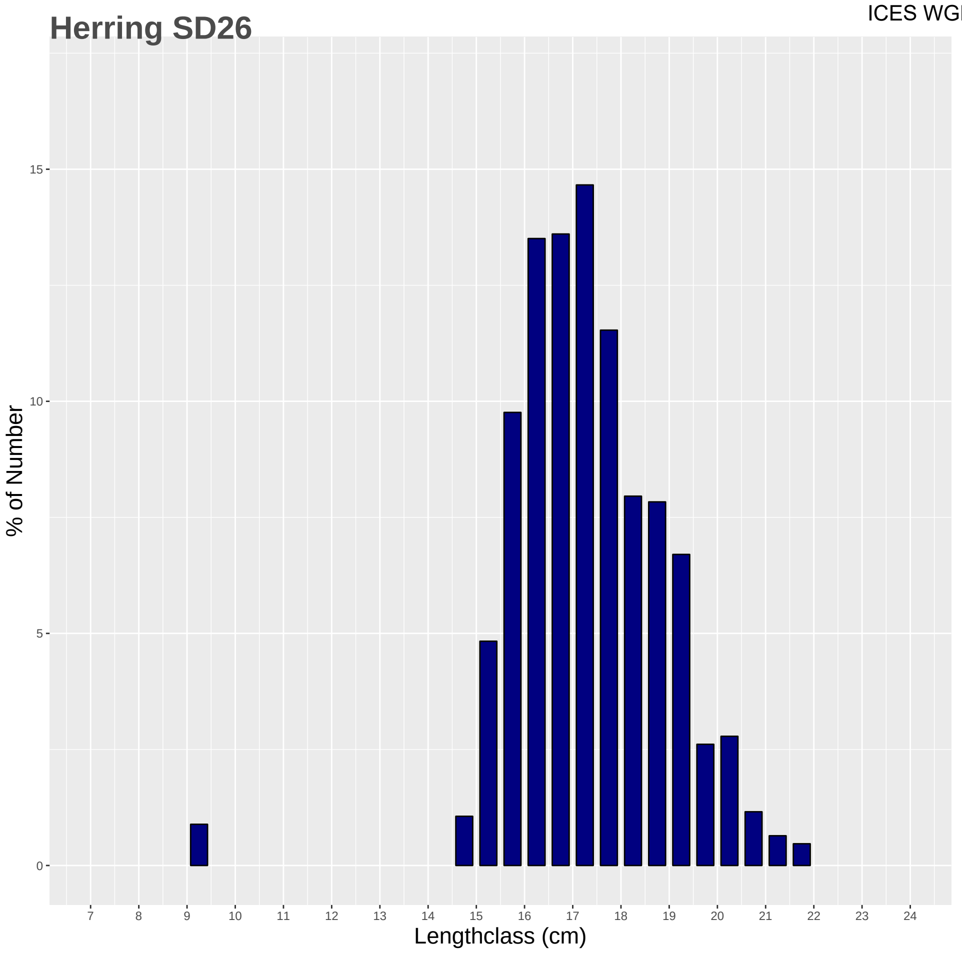

Figure 9: Length distribution of herring from subdivision 26

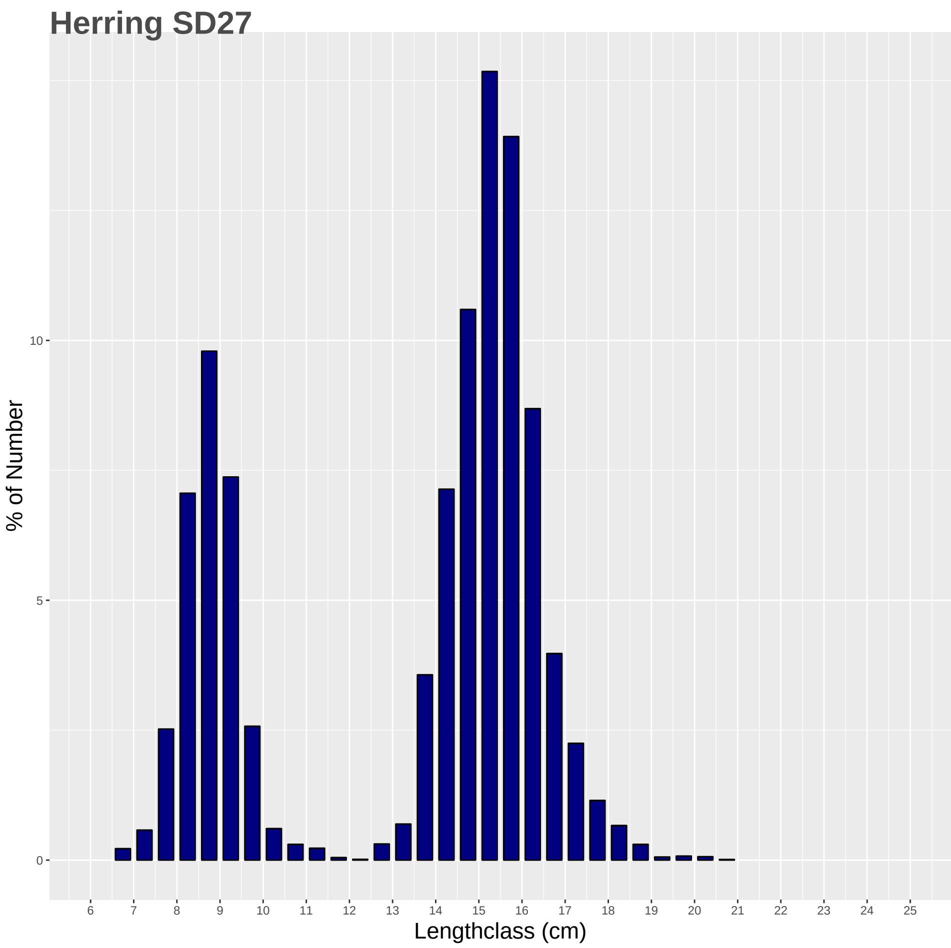

Figure 10: Length distribution of herring from subdivision 27

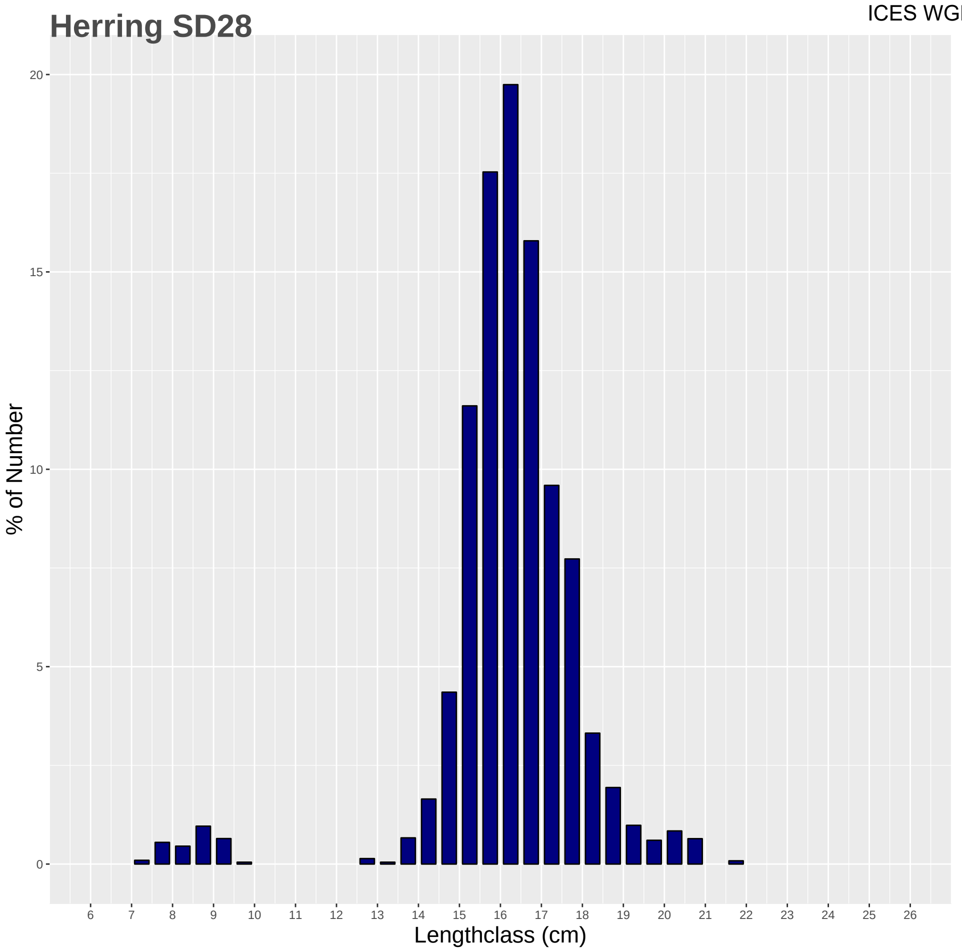

Figure 11: Length distribution of herring from subdivision 28

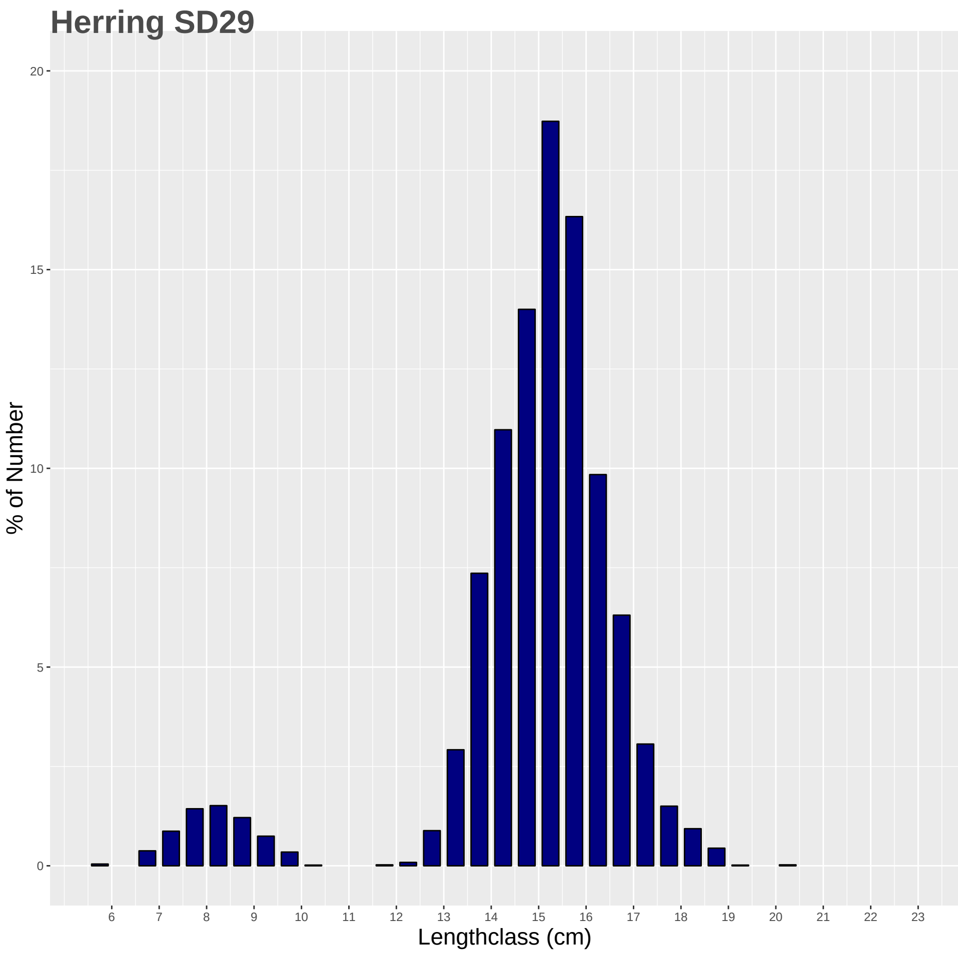

Figure 12: Length distribution of herring from subdivision 29

REPORT

FROM THE JOINT ESTONIAN-POLISH BIAS 2017 CONDUCTED BY THE R.V. "BALTICA" IN THE NORTH-EASTERN BALTIC SEA (21-31 October 2017)

by
Miroslaw Wyszynski*, Ain Lankov**, Andrus Hallang**, Elor Sepp**, Tycjan Wodzinowski* and Beata Schmidt*
* National Marine Fisheries Research Institute, Gdynia (Poland)
** University of Tartu, Estonian Marine Institute, Tallinn (Estonia)

Introduction

The recent joint Estonian-Polish Baltic International Acoustic Survey (BIAS), marked with the number 5/2017/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 Program for 2017 and the European Union (the Commission regulations Nos. 665/2008, 199/2008 and 2010/93/EU) financially supported the EST-POL BIAS 2017. 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 2017[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 at the fish concentration locations,
- to collect ichthyological samples specially for herring and sprat,
- to provide hydrological monitoring (water temperature, salinity and oxygen content) at the catch locations.

Personnel

The EST-POL BIAS 2017 scientific staff was composed of 8 persons:
Miroslaw Wyszynski (NMFRI, Gdynia – Poland) – survey leader
Bartlomiej Nurek (NMFRI, Gdynia – Poland) – acoustician
Beata Schmidt (NMFRI, Gdynia – Poland) – hydrologist
Ain Lankov (TUEMI, Tallinn - Estonia) – Estonian scientific staff leader
Tiit Raid (TUEMI, Tallinn – Estonia) - ichthyologist
Andrus Hallang (TUEMI, Tallinn - Estonia) – ichthyologist
Elor Sepp (TEMI, Tallinn - Estonia) – acoustician
Timo Arula (TUEMI, Tallinn - Estonia) – biologist

[1]ICES 2017. Final Report of the Baltic International Fish Survey Working Group (WGBIFS). ICES CM 2017/SSGIEOM: 07.

Narrative

The reported survey took place during the period of 21-31 October 2017 (according to the survey research plan). 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), moreover inside the territorial waters of this country not shallower than 20 m depth.

The survey started from the Ventspils port (Latvia) on 20.10.2017 after the midday and was navigated in the North-eastern direction to the entering point of planned acoustic transect at the geographical position 58°05’N 021°48’E on October 21 (Fig. 1). The at sea researches were ended on 28.10.2017 about the midday in the port of Ventspils (Latvia), due to very stormy weather forecast. Above mentioned seaport was closed for any navigational activities from the midday October 28 to the midday October 31 according to stormy weather conditions. Then the r.v. “Baltica” started its journey to the home-port in Gdynia (Poland), reaching it on 01.11.2017 afternoon.

Survey design and realization

The r.v. “Baltica” realized 534 Nm echo-integration transect and 20 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 07:55 a.m. and 06:00 p.m.) using the pelagic trawl type WP 53/64x4 (with 6 mm mesh bar length in the codend). Trawling duration was from 10 to 20 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 it was 2,94 knots. Overall, 4 hauls were conducted in SD 28.2, 7 hauls in SD 29 and 9 hauls in SD 32.

The length measurements (in 0.5 cm classes) were realized for 4232 sprat and 3388 herring individuals. Totally, 427 sprat and 611 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 “SISP Manual of International Baltic Acoustic Surveys (IBAS)”, Version 1.04 (ICES, 2016). 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. The basic acoustic and biological data collected during recently carried out survey will be stored in the BIAS_DB.mdb and the new acoustic data base WKBIFS-ACOU in the accepted CSV or XML formats, 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

Due to fortunate weather conditions, all transects and planned trawls were conducted according to the plan.

Catch results and fish measurements

Overall, 10 fish species were recognized in hauls performed at the North-eastern Baltic Sea in October 2017. Sprat was prevailing species by mass in the total catch with the mean share amounted 74.9 % (especially high in SD 28.2 – 90.5%, but lowest in SD 32 – 55.3%). The rest 8 species (cod, three and nine spine sticklebacks, shorthorn sculpin, smelt, lumpfish, round goby and lamprey) represented only about 0.7% 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 October 2017 amounted 1085,4 kg/h (comparing to 729.5 kg/h in the same period in 2016 and 845.5 kg/h in 2015). The most valuable CPUEs for sprat were noted in SDs 28.2 and 29, but for herring – in SDs 29 and 32. The mean CPUEs of sprat were as follow: 1254.0 kg/h in ICES SD 28.2, 975.0 kg/h in SD 29 and 492.1 kg/h in SD 32. The mean CPUEs in case of herring were: 128.9, 190.4 and 381.5 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 2017 take place on 7.5-8 cm length classes and shows a more quantity in sub-divisions 28.2 and 29. The second one representing adult sprat placed on 11-11.5 cm length classes. The length distribution curves by Sub-divisions in case of herring show generally two frequency picks – first one at 8-8.5 cm length classes and second one at 14.5-15.5 cm length classes. The first pick shows relatively high quantity of herring generation born in 2017 in SD 28.2, comparing to the medium quantity of this generation in SDs 29 and 32. Three-spine stickleback was the most frequently species in bycatch in all Sub-divisions, moreover smelt and nine-spine stickleback in SD 32. Their length distributions are presented at Fig. 5-7.

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 was more stable than in previous year within the investigated area, abundance being highest in Gulf of Finland and west of islands Hiiumaa and Saaremaa. 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 herring was considerably higher than during the previous survey, abundance of herring was more than two times lower and abundance of sprat about 40% higher.

Meteorological and hydrological characteristics.

The 20 control catches and hydrological stations were inspected with the CTD-probe combined with the rosette sampler. 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 wind speed varied from 0.6 m/s to 17.8 m/s and average speed was 8.9 m/s. The most often wind direction was SE. The air temperature ranged from -0.1 °C to 9.7 °C, and average temperature was 4.7 °C – Fig. 8.

The seawater temperature in the surface layers varied from 8,85 to 12.64°C (the mean was 11.02°C).The lowest surface temperatures were recorded at the haul 15. The highest ones were noticed at the start position of haul 1. The minimum value of salinity in Practical Salinity Unit (PSU) was 4,85 at the haul 15 in the surface layer. The maximum was 7,20 PSU at the hauls 4 and 5. The mean value of salinity was 6,42 PSU. The oxygen content in the surface layers of investigated the research area varied in the range of 6.79 ml/l (haul 6) - 7.70 ml/l (haul 12). The mean value of surface water oxygen content was 7.10 ml/l.

The temperature of near bottom (Fig.3.) layer was changing in the range of 4.04 (haul 16) - 12.58 °C (haul 6), the mean was 6.05 °C. Salinity in the bottom waters varied from 6.22 to 11.70 PSU, and the mean was 9.38 PSU. The lowest values of salinity were at the haul 15 start position. The highest values of salinity were noticed at the haul 3. Oxygen content varied from 0.00 ml/l to 6.46 ml/l (the mean was 1.83 ml/l). The zero values of this parameter were noticed at the hauls: 8, 11, 12, 13. The distribution of the seawater temperature, salinity and oxygen content in the near bottom waters is shown at Fig. 9. The vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological profile is shown at Fig. 10. The thermocline was established on the depth *ca* 30 m on whole examined area. The surface water salinity was increasing from the eastern part of Gulf of Finland open sea to the west. The same situation was in case of the surface water temperature. The border of the sea water with oxygen content below 2 ml/l (uncomfortable for fish) was at about 70-75 m depth in open sea regions (SDs 28.2 and 29) and about 50 m depth in the eastern part of the Gulf of Finland. The temperature, salinity and oxygen content profiles in the water column at the deepest stations in the SD 29 and 32 (hauls No 8 and 17 respectively) are presented at Fig. 11.

The water temperature at the trawling layer was changing in the range from 4.30 (haul 17) to 12.59 °C (haul 6), the mean was 6.36 °C. Salinity in this layer varied from 4.86 (haul 15) to 9.14 PSU (haul 3 - depth 70 m), and the mean was 7.76 PSU. Oxygen content varied from 1.37 ml/l (haul 12) to 6.82 ml/l (haul 1 – depth 40 m), the mean was 3.94 ml/l – Tab. 7.

The final report from the EST-POL BIAS 2017 will be presented at the meeting of the ICES Baltic International Fish Survey Working Group (WGBIFS) at March 24-28, 2018 in Copenhagen (Denmark).

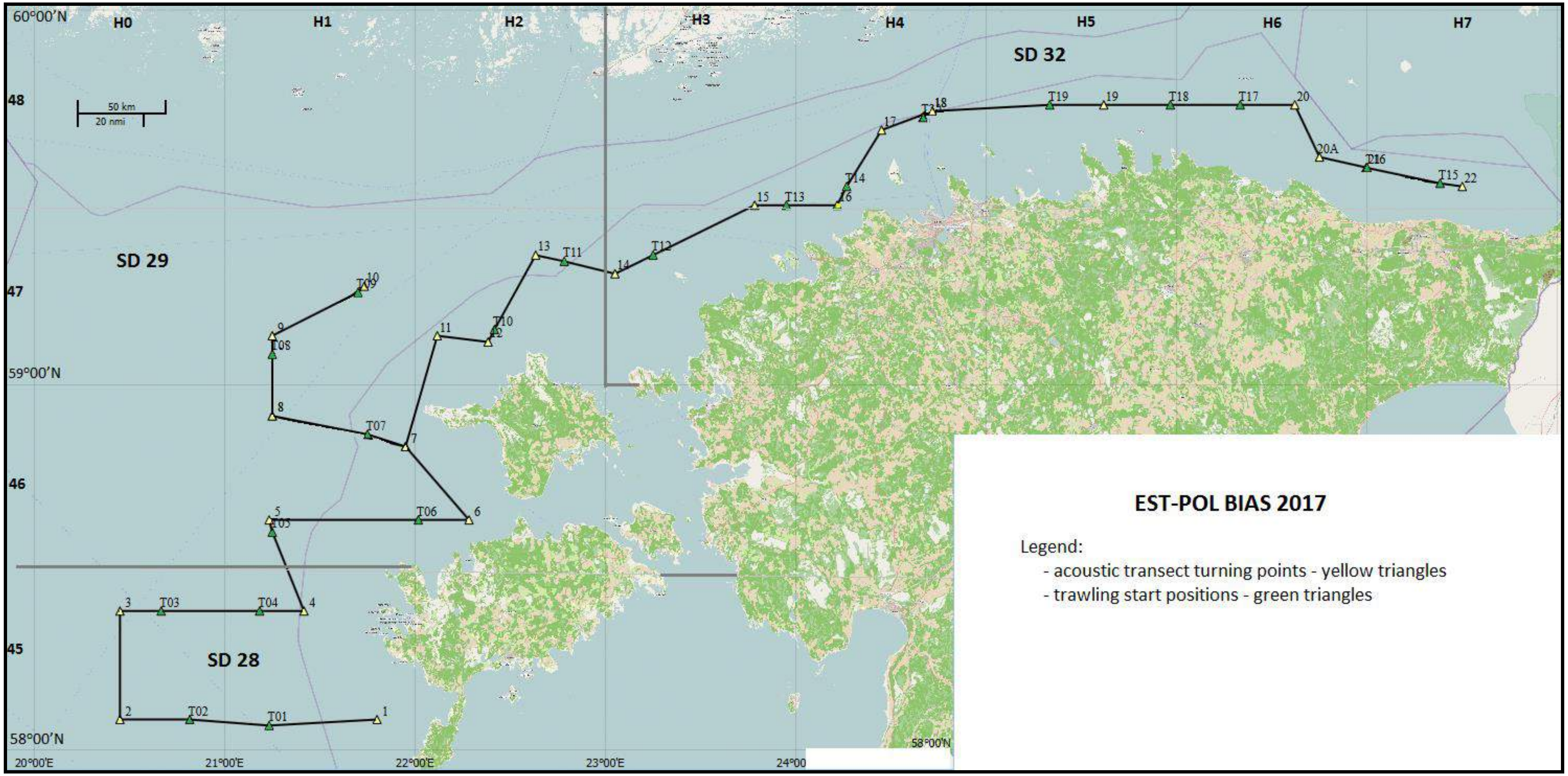

Fig. 1. Acoustic transects and pelagic fish control catches (trawling start positions) with connected hydrological stations realized during the joint EST-POL BIAS (October, 2017).

Table 1. Catch [kg] and CPUE [kg/h] results during the joint Estonian-Polish BIAS conducted by r.v. “Baltica” in Estonian EEZ in October 2017.

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]	Catch per species [kg] sprat	herring	cod	lamprey	shorthorn sculpin	nine-spined stickleback	three-spined stickleback	smelt	lumpfish	round goby
1	2017-10-21	45H1	28.2	58°05.1'	21°11.9'	58°05.2'	21°10.5'	09:50	10:05	15	88,937	88,720				0,215		0,002			
2	2017-10-21	45H0	28.2	58°05.4'	20°47.4'	58°05.6'	20°45.9'	12:15	12:30	15	61,781	59,865	1,872	0,001				0,043			
3	2017-10-21	45H0	28.2	58°23.4'	20°38.5'	58°23.5'	20°37.5'	17:45	18:00	15	427,236	366,273	59,294	0,046				1,623			
4	2017-10-22	45H1	28.2	58°23.1'	21°10.8'	58°23.1'	21°09.8'	08:10	08:20	10	537,980	492,736	45,136					0,108			
5	2017-10-22	46H1	29	58°36.2'	21°15.6'	58°36.6'	21°15.4'	11:50	12:00	10	482,640	361,739	120,756					0,145			
6	2017-10-22	46H2	29	58°38.6'	22°01.5'	58°39.4'	22°01.6'	16:05	16:20	15	140,160	140,160									
7	2017-10-23	46H1	29	58°51.7'	21°43.7'	58°51.8'	21°42.4'	08:20	08:30	10	490,983	490,840								0,143	
8	2017-10-23	47H1	29	59°05.4'	21°12.2'	59°05.6'	21°10.8'	12:35	12:50	15	128,529	100,724	27,482	0,169				0,154			
9	2017-10-23	47H1	29	59°16.3'	21°42.2'	59°16.0'	21°40.6'	16:15	16:35	20	187,690	146,323	41,348					0,019			
10	2017-10-24	47H2	29	59°10.1'	22°27.7'	59°10.7'	22°27.0'	08:55	09:10	15	61,611	58,546	2,689			0,081		0,295			
11	2017-10-24	47H2	29	59°20.9'	22°44.4'	59°21.1'	22°42.4'	12:00	12:20	20	145,814	24,233	121,237				0,013	0,147	0,184		
12	2017-10-24	47H3	32	59°22.1'	23°14.2'	59°21.3'	23°12.7'	15:45	16:00	15	432,870	315,519	116,355						0,996		
13	2017-10-25	47H3	32	59°29.5'	23°55.2'	59°29.8'	23°54.6'	09:35	09:45	10	308,500	166,127	139,936					0,185	2,252		
14	2017-10-25	48H4	32	59°32.6'	24°15.5'	59°33.1'	24°14.9'	12:10	12:25	15	125,202	85,896	38,040				0,004	0,248	0,862	0,138	0,014
15	2017-10-26	48H7	32	59°32.7'	27°23.4'	59°32.8'	27°22.3'	08:15	08:25	10	65,650	45,495	15,631				0,100	3,210	1,214		
16	2017-10-26	48H6	32	59°35.1'	26°29.1'	59°35.3'	26°27.2'	10:25	10:45	20	29,493	9,455	15,228		0,083		0,033	1,091	3,603		
17	2017-10-26	48H6	32	59°45.3'	26°18.6'	59°45.4'	26°17.0'	14:05	14:25	20	168,060	17,428	142,515					0,487	7,630		
18	2017-10-26	48H5	32	59°45.5'	25°56.8'	59°45.7'	25°55.8'	16:15	16:25	10	223,410	111,236	106,611					0,380	5,183		
19	2017-10-27	48H5	32	59°44.7'	25°22.1'	59°44.6'	25°21.2'	07:55	08:05	10	117,360	55,922	58,985					0,681	1,772		
20	2017-10-27	48H4	32	59°42.8'	24°37.4'	59°42.6'	24°35.7'	11:50	12:10	20	297,017	156,611	138,586					0,298	1,455	0,067	
									Total	28.2	1115,934	1007,594	106,302	0,047		0,215		1,776			
									catch	29	1637,427	1322,565	313,512	0,169		0,081	0,013	0,760	0,184	0,143	
										32	1767,562	963,689	771,887		0,083		0,137	6,580	24,967	0,205	0,014
									[kg]	Sum	4520,924	3293,848	1191,701	0,216	0,083	0,296	0,150	9,116	25,151	0,348	0,014

Haul no	Date	ICES rectangle	ICES Sub-division (SD)	Haul duration [min]	Total CPUE [kg/h]	CPUE per species [kg/h] sprat	herring	cod	lamprey	shorthorn sculpin	nine-spined stickleback	three-spined stickleback	smelt	lumpfish	round goby
1	2017-10-21	45H1	28.2	15	355,750	354,880				0,860		0,010			
2	2017-10-21	45H0	28.2	15	247,124	239,460	7,488	0,004				0,172			
3	2017-10-21	45H0	28.2	15	1708,944	1465,092	237,176	0,184				6,492			
4	2017-10-22	45H1	28.2	10	3227,880	2956,416	270,816					0,648			
5	2017-10-22	46H1	29	10	2895,840	2170,434	724,536					0,870			
6	2017-10-22	46H2	29	15	560,640	560,640									
7	2017-10-23	46H1	29	10	2945,898	2945,040								0,858	
8	2017-10-23	47H1	29	15	514,116	402,896	109,928	0,676				0,616			
9	2017-10-23	47H1	29	20	563,070	438,969	124,044					0,057			
10	2017-10-24	47H2	29	15	246,444	234,184	10,756			0,324		1,180			
11	2017-10-24	47H2	29	20	437,443	72,699	363,711				0,039	0,441	0,553		
12	2017-10-24	47H3	32	15	1731,480	1262,076	465,420						3,984		
13	2017-10-25	47H3	32	10	1851,000	996,762	839,616					1,110	13,512		
14	2017-10-25	48H4	32	15	500,808	343,584	152,160				0,016	0,992	3,448	0,552	0,056
15	2017-10-26	48H7	32	10	393,900	272,970	93,786				0,600	19,260	7,284		
16	2017-10-26	48H6	32	20	88,479	28,365	45,684		0,249		0,099	3,273	10,809		
17	2017-10-26	48H6	32	20	504,180	52,284	427,545					1,461	22,890		
18	2017-10-26	48H5	32	10	1340,460	667,416	639,666					2,280	31,098		
19	2017-10-27	48H5	32	10	704,160	335,532	353,910					4,086	10,632		
20	2017-10-27	48H4	32	20	891,051	469,833	415,758					0,894	4,365	0,201	
			Mean CPUE	28.2	1384,924	1253,962	128,870	0,047		0,215		1,830			
			by SDs	29	1166,207	974,980	190,425	0,097		0,046	0,006	0,452	0,079	0,123	
				32	889,502	492,091	381,505		0,028		0,079	3,706	12,002	0,084	0,006
			[kg/h]	Sum	1085,433	813,477	264,100	0,043	0,012	0,059	0,038	2,192	5,429	0,081	0,003

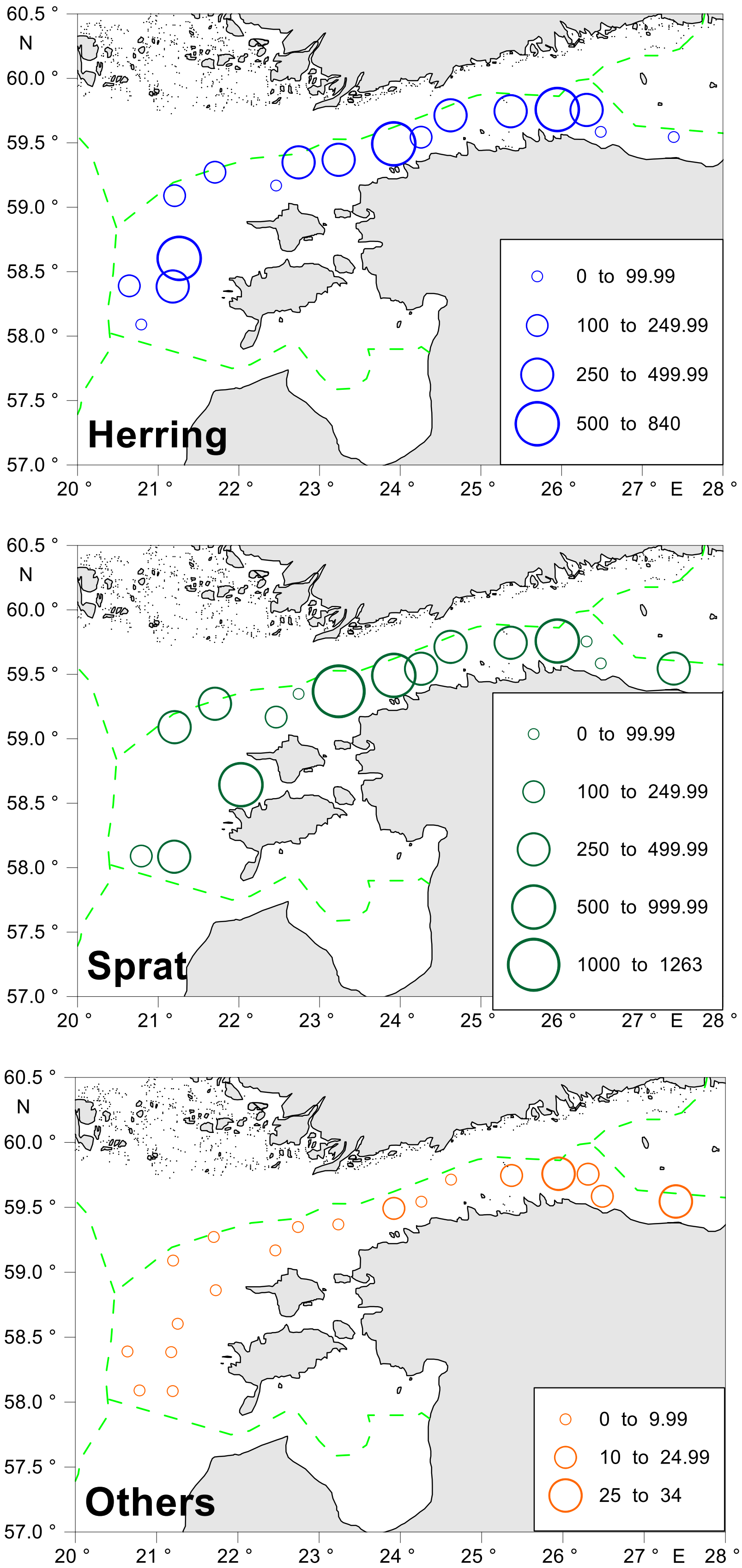

Fig. 2. Distribution of CPUE values (kg/h) for herring, sprat and other species in the pelagic fish control catches during the joint EST-POL BIAS in the North-eastern Baltic Sea, October 2017.

Table. 2. Biological sampling in the r.v.”Baltica” joint EST-POL BIAS in October 2017.

SD 28		SPRAT	HERRING	COD	LUMPFISH	THREE SPINED STICKLEBACK	NINE SPINED STICKLEBACK	SMELT	SHORTHORN SCULPIN	ROUND GOBY	LAMPREY	TOTAL
Samples	measurements	4	3	2		4		1	1			15
taken	analyses	4	3									7
Fish measured		906	251	2		45		13	1			1218
Fish analysed		136	139									275

SD 29		SPRAT	HERRING	COD	LUMPFISH	THREE SPINED STICKLEBACK		SMELT				TOTAL
Samples	measurements	7	5	1	1	5	1	9	1			30
taken	analyses	7	5									12
Fish measured		1492	975	2	1	67	2	395	1			2935
Fish analysed		146	243									389

SD 32		SPRAT	HERRING	COD	LUMPFISH	THREE SPINED STICKLEBACK		SMELT				TOTAL
Samples	measurements	9	9		2	8	3			1	1	33
taken	analyses	9	7									16
Fish measured		1834	2162		2	294	41			1	1	4335
Fish analysed		145	229									374

SUM		SPRAT	HERRING	COD	LUMPFISH	THREE SPINED STICKLEBACK		SMELT				TOTAL
Samples	measurements	20	17	3	3	17	4	10	2	1	1	78
taken	analyses	20	15									35
Fish measured		4232	3388	4	3	406	43	408	2	1	1	8488
Fish analysed		427	611									1038

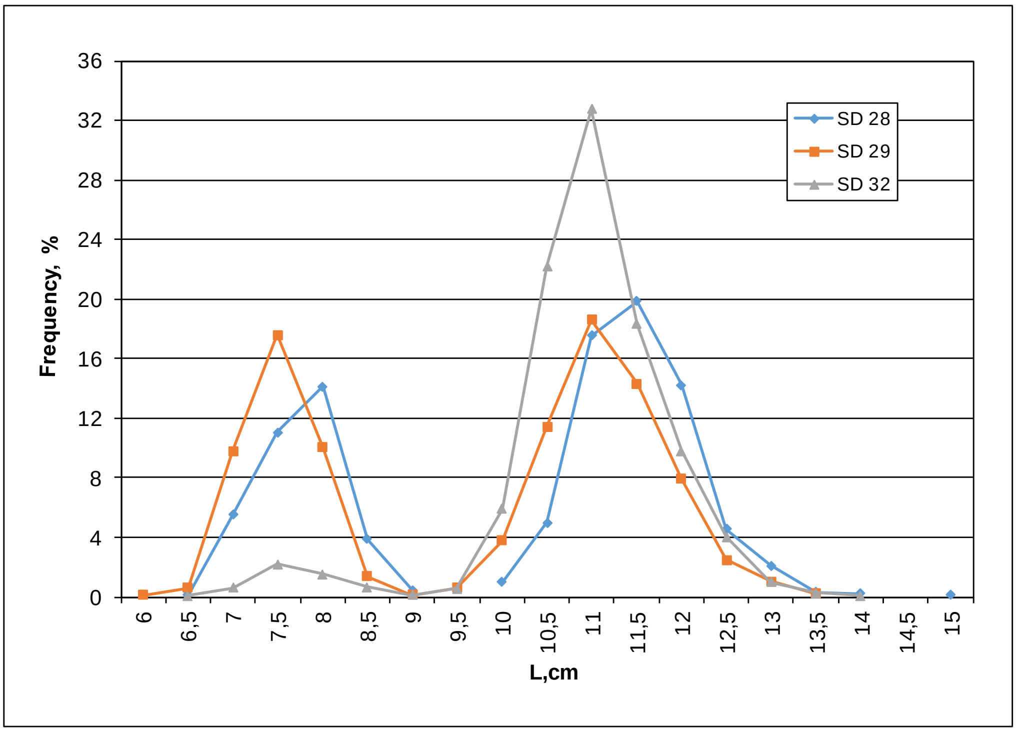

Fig. 3. Sprat length distributions from the control catches conducted by the r.v. "Baltica" during the joint EST-POL BIAS in the SDs 28.2, 29 and 32 (October, 2017).

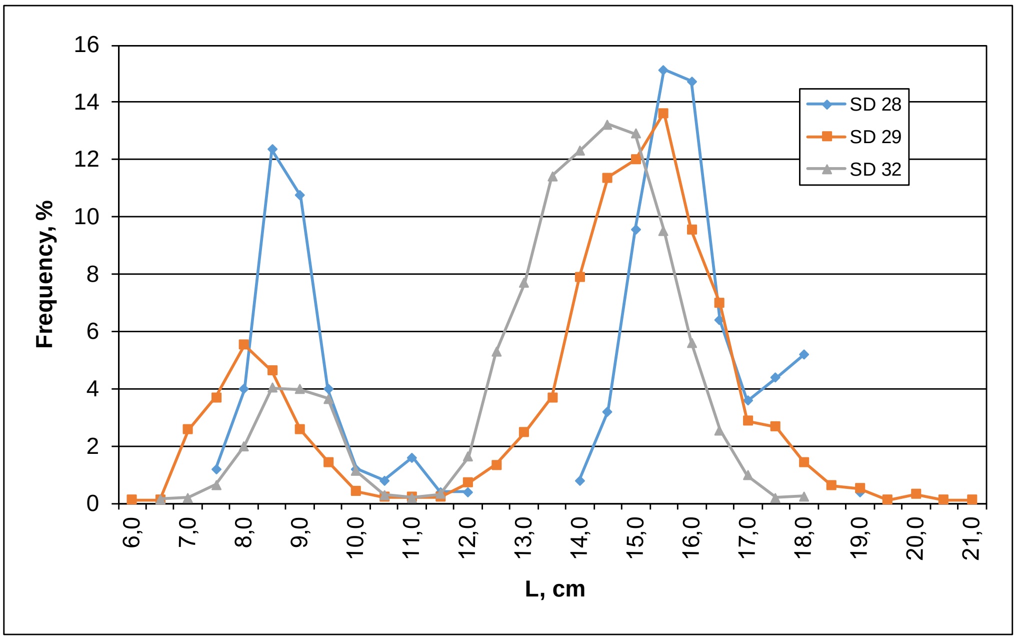

Fig. 4. Herring length distributions from the control catches conducted by the r.v. "Baltica" during the joint EST-POL BIAS in the SDs 28.2, 29 and 32 (October, 2017).

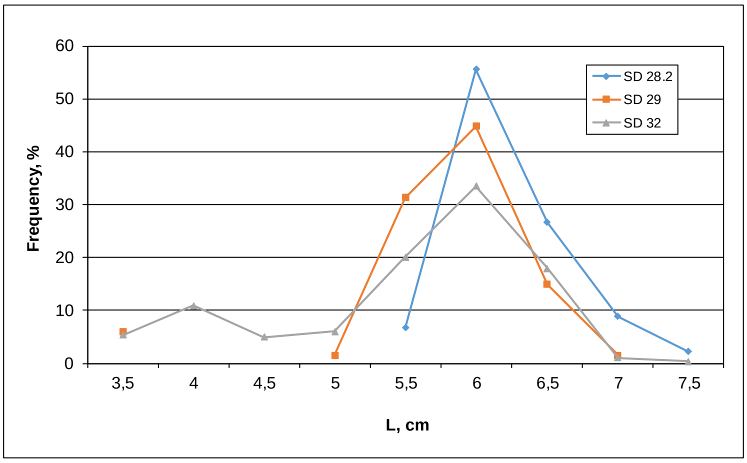

Fig. 5. Three-spined stickleback length distributions from the control catches conducted by the r.v. "Baltica" during the joint EST-POL BIAS in the SDs 28.2, 29 and 32 (October, 2017).

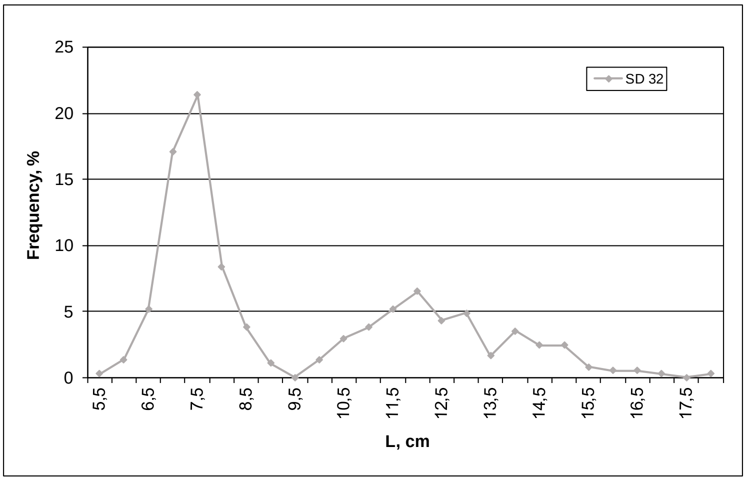

Fig. 6. Smelt length distribution from the control catches conducted by the r.v. "Baltica" during the joint EST-POL BIAS in the SD 32 (October, 2017).

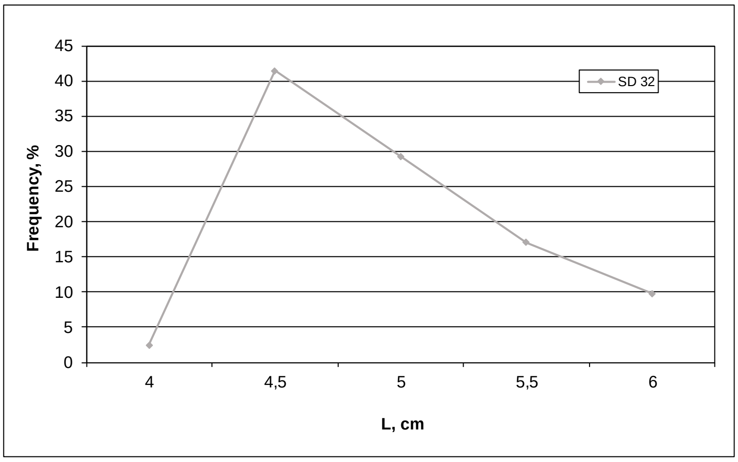

Fig. 7. Nine-spined stickleback length distribution from the control catches conducted by the r.v. "Baltica" during the joint EST-POL BIAS in the SD 32 (October, 2017).

Table 3. The BIAS survey basic biological and acoustic data concerning the clupeid stocks inhabiting the north- eastern Baltic Sea in October 2017.

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	4.2	94.7	5880.23	6.208	698.0	1.12
28	45H1	827.1	1.6	98.3	13354.55	16.146	1752.6	1.09
29	46H1	921.5	4.8	95.1	10398.95	11.285	1362.7	1.21
29	46H2	258.0	0.0	100.0	3426.64	13.282	1325.9	1.00
29	47H1	920.3	7.8	91.9	13862.26	15.063	1728.2	1.15
29	47H2	793.9	29.5	69.5	5754.56	7.248	769.3	1.06
32	47H3	536.2	20.4	79.0	5414.26	10.097	1366.2	1.35
32	48H4	835.1	22.2	76.2	22163.84	26.540	3511.8	1.32
32	48H5	767.2	28.1	65.7	17115.28	22.309	3199.9	1.43
32	48H6	776.1	48.0	21.9	7970.06	10.269	1410.3	1.37
32	48H7	851,4	20.0	51.2	5880.73	6.907	667.3	0.97
Average			**17.0**	**76.7**		**13.214**	**1617.5**	**1.189**
Total		**8434**			**111221**			

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 2017.

ICES Sub-div.	ICES rectangle	HERRING – age groups									
		0	1	2	3	4	5	6	7	8+	total
28	45H0	76.22	1.70	9.01	84.30	23.52	35.68	12.67		4.14	247.25
28	45H1			16.57	123.62	23.75	34.80	11.59		4.40	214.72
total		76.22	1.70	25.58	207.92	47.27	70.48	24.26		8.54	461.98
29	46H1	0.83	30.04	25.90	250.13	43.03	60.13	56.14		34.49	500.69
29	46H2										
29	47H1	8.40	133.78	81.16	622.85	69.50	60.52	64.49		41.79	1082.49
29	47H2	166.10	346.49	136.32	870.23	67.90	42.35	46.28		22.25	1697.93
total		175.33	510.31	243.39	1743.22	180.43	163.00	166.91		98.53	3281.11
32	47H3	25.51	286.43	169.05	470.65	110.27	34.30	5.64	2.17	0.61	1104.64
32	48H4	88.83	1651.04	794.27	1874.82	362.45	127.67	9.36	9.35	1.59	4919.38
32	48H5	56.64	776.08	829.54	2399.14	565.86	155.81	24.39	8.04	2.29	4817.80
32	48H6	599.57	475.80	559.57	1612.62	416.79	140.51	18.98	4.47		3828.31
32	48H7	834.60	177.31	55.53	90.72	12.63	1.68	2.01	1.01	1.01	1176.49
total		1605.16	3366.68	2407.96	6447.96	1467.99	459.97	60.38	25.03	5.50	15846.62
Grand total		1856.70	3878.69	2676.93	8399.10	1695.70	693.45	251.55	25.03	112.57	19589.71

Table 4. Continued

ICES Sub-div.	ICES rectangle	SPRAT – age groups									
		0	1	2	3	4	5	6	7	8+	Total
28	45H0	1838.28	206.47	640.47	2217.65	279.73	270.00	63.36	38.78	13.91	5568.66
28	45H1	4384.62	863.49	1480.75	5156.43	527.15	499.76	136.68	47.74	36.74	13133.36
total		6222.91	1069.96	2121.22	7374.08	806.88	769.76	200.04	86.53	50.65	18702.02
29	46H1	1746.23	847.55	1379.24	4531.26	733.35	317.31	301.27	31.75		9887.97
29	46H2	747.04	597.99	387.59	1443.92	86.61	109.35	54.13			3426.64
29	47H1	4157.32	785.59	1485.60	4742.38	875.42	324.75	323.63	20.25	20.85	12735.78
29	47H2	3379.88	113.12	87.43	327.06	39.55	23.32	20.44	2.12	8.49	4001.41
total		10030.47	2344.26	3339.86	11044.62	1734.94	774.72	699.47	54.13	29.34	30051.80
32	47H3	97.19	934.26	1053.78	1761.32	132.16	62.89	83.74	8.53	141.97	4275.83
32	48H4	593.51	4205.31	4002.74	6837.20	386.33	187.74	241.37	32.65	410.73	16897.58
32	48H5	0.00	2262.00	2862.49	4799.11	389.94	195.56	262.22	42.37	422.58	11236.28
32	48H6	289.11	196.33	334.44	595.26	101.84	74.27	58.98	19.29	73.35	1742.88
32	48H7	132.86	372.84	653.39	1181.58	195.45	134.06	125.59	53.30	162.50	3011.58
total		1112.67	7970.74	8906.84	15174.47	1205.72	654.51	771.90	156.15	1211.14	37164.14
Grand total		17366.05	11384.95	14367.92	33593.16	3747.53	2199.00	1671.41	296.80	1291.14	85917.96

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 2017.

ICES	ICES rectangle	HERRING – age groups									
Sub-div.		0	1	2	3	4	5	6	7	8+	total
28	45H0	337.37	18.07	192.91	2068.79	670.80	1102.83	446.68		140.64	4978.09
28	45H1			348.16	2980.09	669.10	999.68	420.58		150.64	5568.24
total		337.37	18.07	541.06	5048.88	1339.90	2102.52	867.26		291.28	10546.33
29	46H1	10.10	461.87	550.29	5981.28	1192.55	1897.10	1905.62		1179.56	13178.36
29	46H2										
29	47H1	46.88	2168.90	1688.85	14169.66	1835.37	1841.64	2062.72		1433.67	25247.70
29	47H2	712.81	5177.46	2690.79	18274.54	1652.35	1157.55	1238.79		606.69	31510.97
total		769.80	7808.23	4929.93	38425.47	4680.27	4896.29	5207.13		3219.91	69937.04
32	47H3	106.50	3762.02	3103.80	9674.63	2664.31	952.23	169.05	65.69	21.84	20520.08
32	48H4	356.31	21685.49	14481.86	38686.92	9259.55	3440.12	284.15	262.61	50.63	88507.64
32	48H5	323.32	11155.34	16148.38	52676.93	14410.15	4371.77	797.13	253.45	87.61	100224.07
32	48H6	2561.68	7150.67	10776.63	34733.92	10455.78	3977.20	554.84	128.99		70339.71
32	48H7	3786.88	2522.51	989.90	1852.46	349.91	50.61	81.65	40.83	40.83	9715.58
total		7134.71	46276.03	45500.57	137624.86	37139.70	12791.93	1886.82	751.56	200.91	289307.08
Grand total		8241.87	54102.34	50971.57	181099.20	43159.86	19790.73	7961.20	751.56	3712.10	369790.44

Table 5. Continued

ICES Sub-div.	ICES rectangle	SPRAT – age groups									
		0	1	2	3	4	5	6	7	8+	total
28	45H0	5649.81	1688.94	6095.06	21534.13	2974.19	3064.11	809.12	578.19	186.47	42580.04
28	45H1	13220.98	6829.85	13667.61	48506.36	5527.64	5585.47	1736.90	624.35	485.69	96184.85
total		18870.80	8518.79	19762.68	70040.49	8501.83	8649.58	2546.03	1202.54	672.15	138764.89
29	46H1	5108.67	6610.54	12584.63	41159.93	7275.57	3130.63	2988.05	364.94		79222.98
29	46H2	1575.28	4262.53	3241.67	11655.60	760.68	835.87	454.72			22786.36
29	47H1	11997.75	6348.09	13607.25	43461.40	8739.58	3289.78	3296.67	219.43	304.42	91264.36
29	47H2	8924.45	796.44	732.33	2733.79	371.09	195.07	200.65	22.93	111.25	14088.01
total		27606.15	18017.60	30165.89	99010.72	17146.92	7451.36	6940.10	607.30	415.67	207361.71
32	47H3	252.70	7262.73	8873.98	14793.87	1287.41	647.36	852.24	95.96	1361.63	35427.88
32	48H4	1580.50	31434.45	33417.74	56731.86	3798.73	1936.76	2459.91	350.82	3975.18	135685.96
32	48H5	0.00	17841.55	25340.61	42715.30	4025.62	2122.33	2806.35	479.31	4294.54	99625.61
32	48H6	884.17	1554.76	3061.94	5585.34	1092.55	821.09	667.08	221.70	780.67	14669.31
32	48H7	439.93	2892.03	5994.79	11299.90	2190.92	1565.66	1437.38	696.21	1760.99	28277.80
total		3157.30	60985.52	76689.06	131126.27	12395.22	7093.22	8222.96	1844.00	12173.01	313686.57
Grand total		49634.25	87521.91	126617.63	300177.48	38043.98	23194.16	17709.09	3653.84	13260.84	659813.16

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 2017.

ICES Sub-div.	ICES rectangle	HERRING – age groups									
		0	1	2	3	4	5	6	7	8+	avg.
28	45H0	4.43	10.60	21.40	24.54	28.52	30.91	35.26		33.95	20.13
28	45H1			21.01	24.11	28.17	28.73	36.29		34.23	25.93
29	46H1	12.20	15.38	21.25	23.91	27.71	31.55	33.94		34.20	26.32
29	46H2										
29	47H1	5.58	16.21	20.81	22.75	26.41	30.43	31.99		34.30	23.32
29	47H2	4.29	14.94	19.74	21.00	24.33	27.33	26.77		27.27	18.56
32	47H3	4.18	13.13	18.36	20.56	24.16	27.76	29.99	30.29	36.00	18.58
32	48H4	4.01	13.13	18.23	20.63	25.55	26.95	30.35	28.10	31.80	17.99
32	48H5	5.71	14.37	19.47	21.96	25.47	28.06	32.68	31.54	38.20	20.80
32	48H6	4.27	15.03	19.26	21.54	25.09	28.31	29.24	28.85		18.37
32	48H7	4.54	14.23	17.83	20.42	27.72	30.20	40.60	40.60	40.60	8.26

Table 6. Continue

ICES Sub-div.	ICES rectangle	SPRAT – age groups									
		0	1	2	3	4	5	6	7	8+	avg.
28	45H0	3.07	8.18	9.52	9.71	10.63	11.35	12.77	14.91	13.41	7.65
28	45H1	3.02	7.91	9.23	9.41	10.49	11.18	12.71	13.08	13.22	7.32
29	46H1	2.93	7.80	9.12	9.08	9.92	9.87	9.92	11.49		8.01
29	46H2	2.11	7.13	8.36	8.07	8.78	7.64	8.40			6.65
29	47H1	2.89	8.08	9.16	9.16	9.98	10.13	10.19	10.83	14.60	7.17
29	47H2	2.64	7.04	8.38	8.36	9.38	8.37	9.82	10.80	13.10	3.52
32	47H3	2.60	7.77	8.42	8.40	9.74	10.29	10.18	11.25	9.59	8.29
32	48H4	2.66	7.47	8.35	8.30	9.83	10.32	10.19	10.74	9.68	8.03
32	48H5		7.89	8.85	8.90	10.32	10.85	10.70	11.31	10.16	8.87
32	48H6	3.06	7.92	9.16	9.38	10.73	11.06	11.31	11.49	10.64	8.42

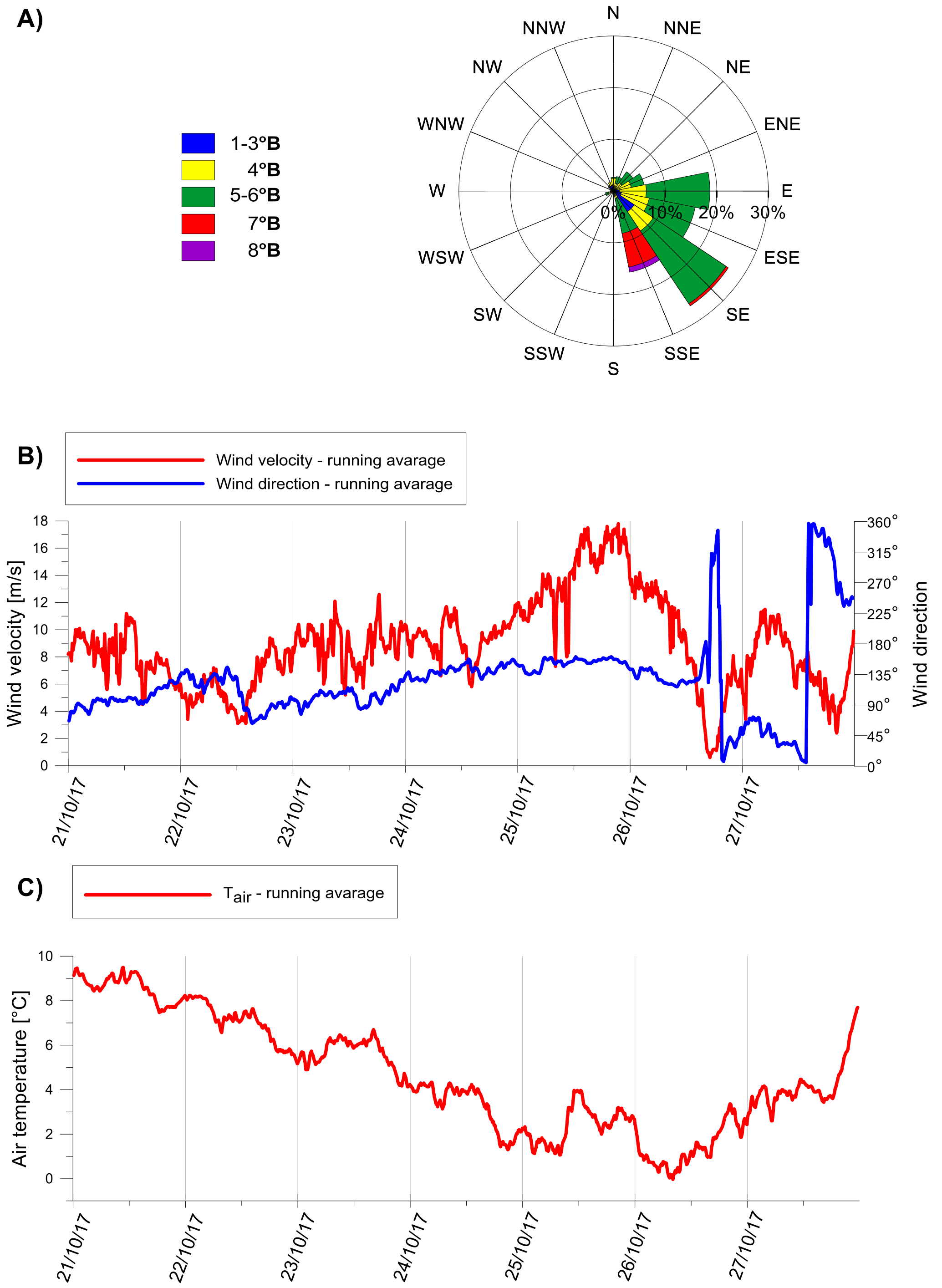

Fig. 8. Changes of the main meteorological parameters during joint EST-POL BIAS conducted in October 2017 (A and B – wind direction and velocity, C – air temperature).

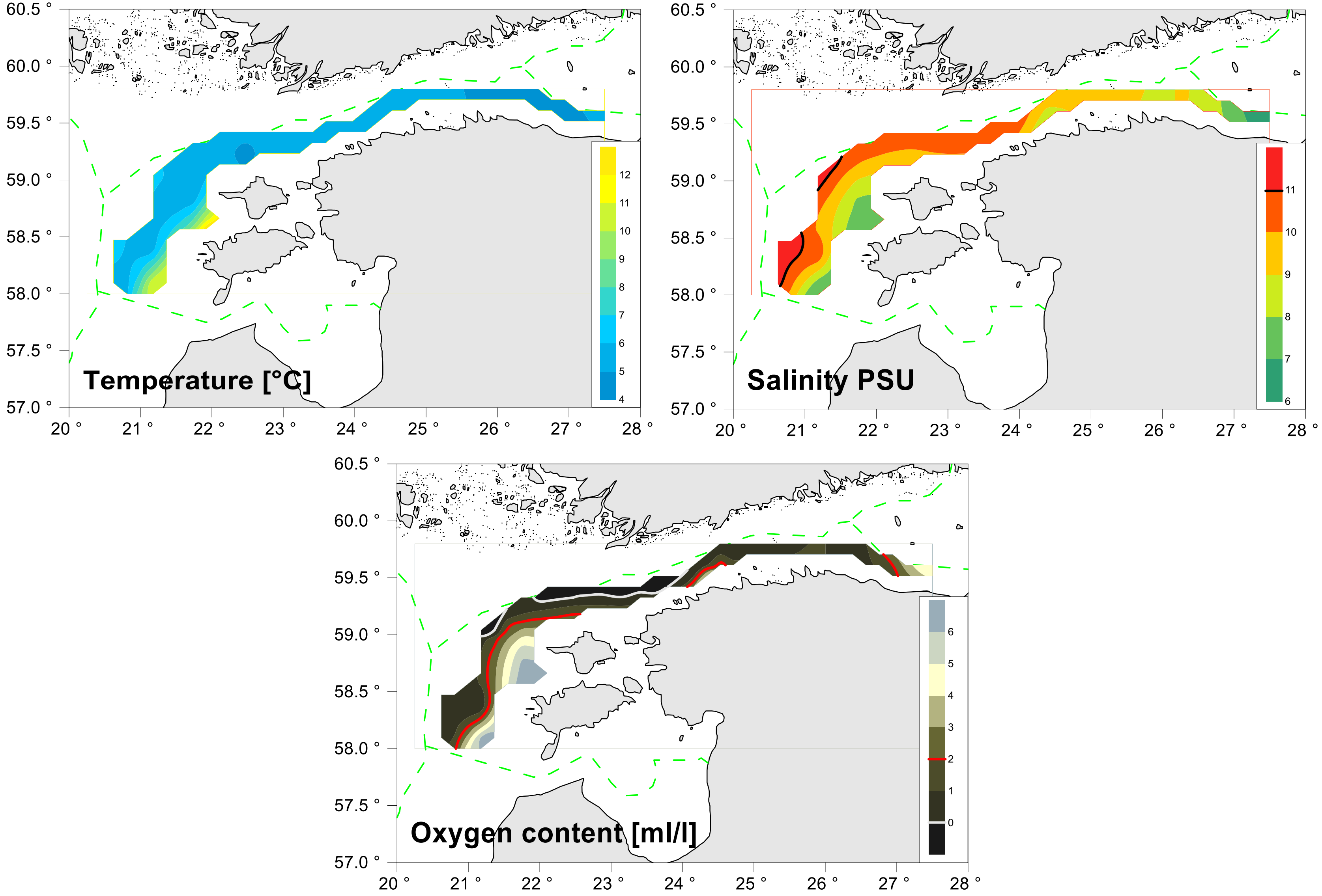

Fig. 9. Distribution of the seawater temperature, salinity and oxygen content in the near bottom waters (EST-POL BIAS, October 2017).

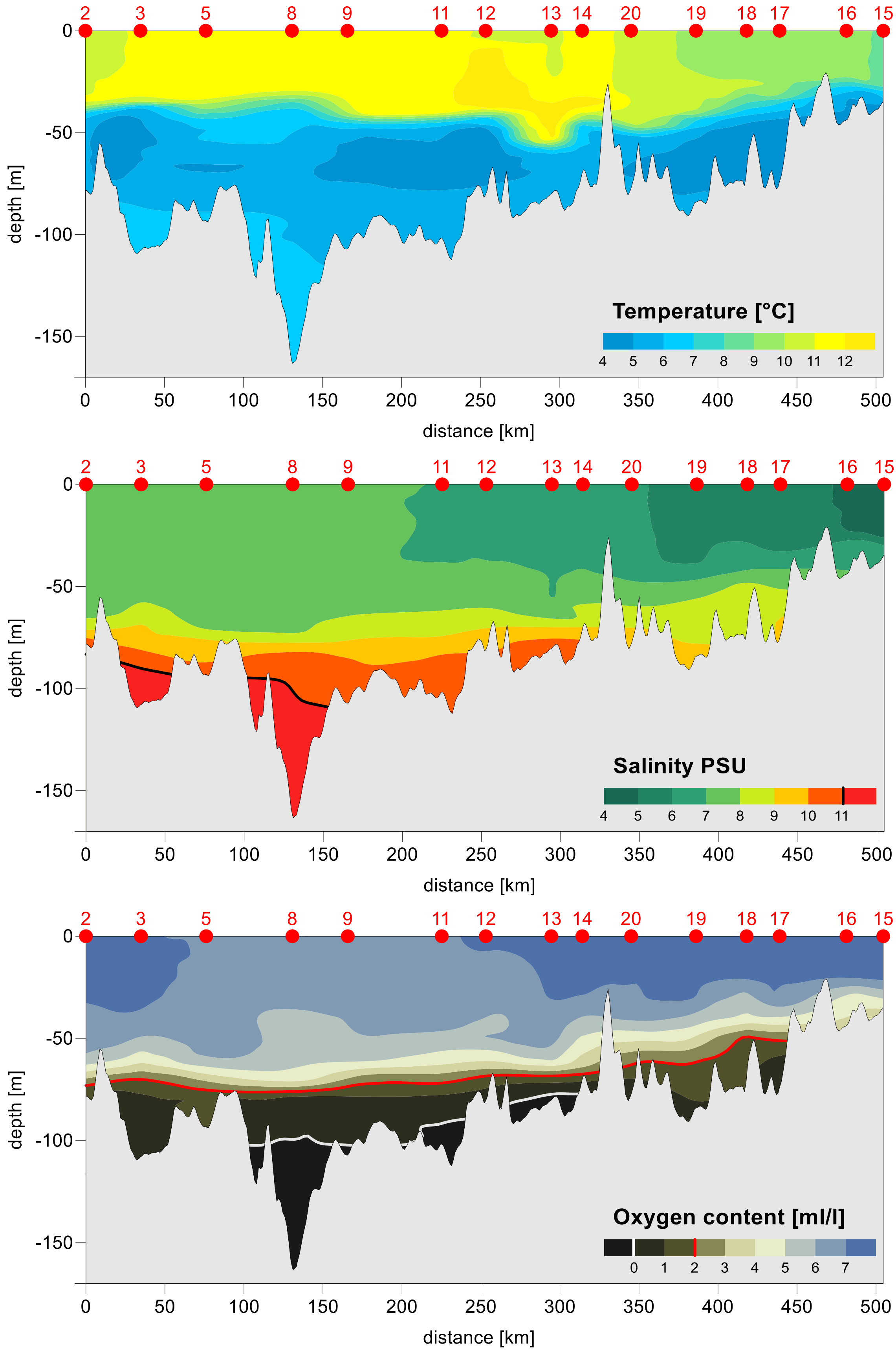

Fig. 10. Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological profile (EST-POL BIAS, October 2017).

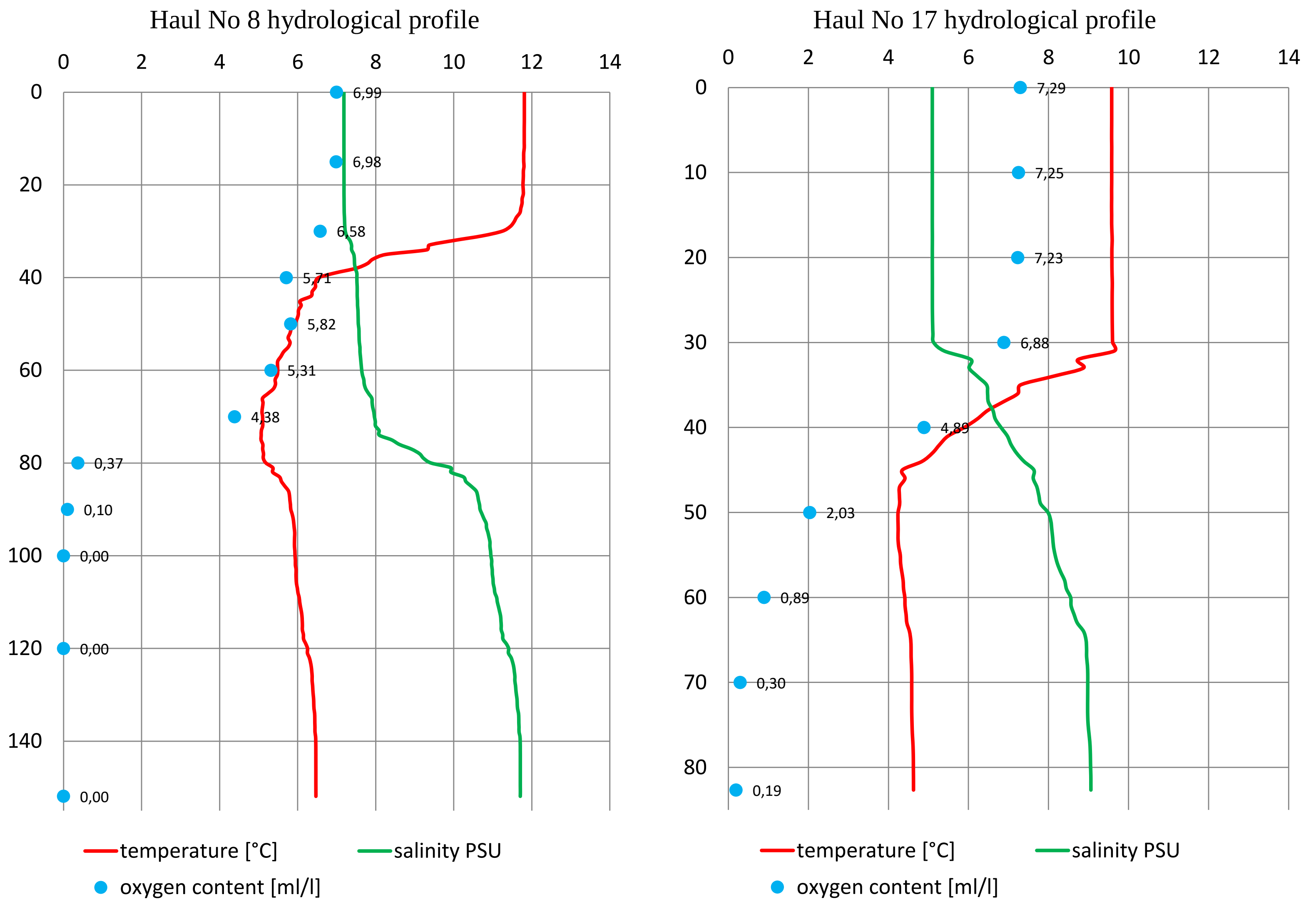

Fig. 11. Temperature, salinity and oxygen depth [m] profiles at the two haul start positions located at the deepest open sea of SD 29 (haul No 8) and SD 32 (haul No 17), during EST-POL BIAS 2017.

Table 7. Values of the basic meteorological and hydrological parameters recorded in October 2017 at the positions of the r.v. “Baltica” fish control catches during EST-POL BIAS.

Haul number	Date of catch	Mean headrope depth [m]	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	21-10-2017	30	E	5	3	8	1021	12,52	7,23	6,82
2	21-10-2017	55	E	5	3	8	1022	5,06	7,88	4,31
3	21-10-2017	60-35	E	5	3	8	1022	5,20/4,94	9,14/7,52	1,91/6,40
4	22-10-2017	65	E	4	2	7	1021	5,10	8,47	2,98
5	22-10-2017	62	ESE	3	1-2	7	1020	5,04	8,02	2,89
6	22-10-2017	16	E	3	1	7	1019	12,59	7,00	6,75
7	23-10-2017	33	E	4	2-3	5	1020	12,28	7,17	6,41
8	23-10-2017	65	E	5	3	6	1023	5,06	8,41	2,37
9	23-10-2017	55	E	5	3	6	1023	4,60	8,10	3,90
10	24-10-2017	40	SE	5	2-3	3	1031	7,31	7,39	5,80
11	24-10-2017	65	SE	5	3	4	1031	4,81	9,03	1,46
12	24-10-2017	60	SE	5	3	4	1031	4,80	9,02	1,37
13	25-10-2017	52	SE	6	3-4	1	1024	6,12	7,32	5,26
14	25-10-2017	50	SE	4-5	3	2	1023	5,33	8,10	3,81
15	26-10-2017	18	SE	5-6	3	0	1005	8,85	4,86	6,27
16	26-10-2017	30	ESE	5	3	0	1005	4,51	6,85	3,83
17	26-10-2017	47	ESE	5	3	0	1003	4,30	8,16	1,46
18	26-10-2017	33	E	5	3	1	1003	4,93	7,30	3,23
19	27-10-2017	40	NE	5	2-3	4	1003	5,26	7,47	3,98
20	27-10-2017	55	NE	5	3	3	1006	4,92	8,54	1,62

* data at the mean depth of the fish control catch

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 INTERNATIONAL ACOUSTIC SURVEY – BIAS 2017 ON THE R/V “BALTICA” IN THE ICES SUBDIVISIONS 26N AND 28.2 OF THE BALTIC SEA (11-20 OCTOBER 2017)

Working paper on the WGBIFS meeting in Lyngby, Copenhagen, Denmark, 24-28.03.2018

•FAUSTS SVECOVS•MIROSLAW WYSZYNSKI•TYCJAN WODZINOWSKI•BARTLOMIEJ NUREK•
•BEATA SCMIDT•GUNTARS STRODS•ALLA VINGOVATOVA•IVARS PUTNIS•
•VADIMS CERVONCEVS•JANIS AIZUPS

BIOR: Fausts Svecovs, Guntars Strods, Alla Vingovatova, Ivars Putnis, Vadims Cervoncevs, Janis Aizups
Fausts.Svecovs@bior.gov.lv; Guntars.Strods@bior.gov.lv
NMFRI: Miroslaw Wyszynski, Tycjan Wodzinowski, Bartlomiej Nurek, Beata Smidt
mwyszynski@mir.gdynia.pl; twodzinowski@mir.gdynia.pl

Riga – Gdynia, March 2018

CONTENTS

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 13th joint Latvian-Polish Baltic International Acoustic Survey (BIAS) in the ICES Sub-divisions 26N and 28.2 signed as No. 4/2017/NMFRI/BIOR conducted by the r/v "Baltica" in October 2017. The reported cruise was organized on the basis of the agreement No. BIOR 2017/25/AK/EJZF 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 was partly subsidized this cruise. It was coordinated by the ICES Baltic International Fish Survey Working Group (WGBIFS) [ICES 2017].

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 BIAS 4Q 2017 survey scientific staff was composed of 7 persons:

M. Wyszynski (NMFRI, Gdynia – Poland) – survey leader,
B. Nurek (NMFRI, Gdynia – Poland) – acoustician,
B. Schmidt (NMFRI, Gdynia – Poland) – hydrologist,
F. Svecovs (BIOR, Riga - Latvia) – Latvian scientific staff leader, acoustician
G. Strods (BIOR, Riga - Latvia) – ichthyologist,
V. Cervoncevs (BIOR, Riga - Latvia) – ichthyologist,
J. Aizups (BIOR, Riga - Latvia) – ichthyologist.

1.2. SURVEY DESCRIPTION

The reported survey took place during the period of 11-20 October 2017 (10 working days at sea). The at sea researches were conducted within Latvian and Swedish 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 11.10.2017 at 00:05 a.m. o'clock and was navigated in the north direction to the echo-integration start point at the geographical position 56°06'N 019°00'E. The direct at sea researches began on 12.10.2017 at the midday. The survey ended on 20.10.2017 at 10:00 a.m. 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 535 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 2017 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 16 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 and 1 haul in Swedish EEZs.

1.3.2. BIOLOGICAL SAMPLING

The length measurements (in 0.5 cm length classes) were realized for 3229 sprats and 2031 herring individuals. In total, 1362 sprat and 1100 herring individuals were taken for biological analysis. Moreover, all 167 individuals of other species (149 three-spine sticklebacks, 2 nine-spine sticklebacks, 10 cods, 5 lumpfish and 1 smelt) 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 2017, totally at 20 stations, int. al. at 16 fish catch-station, 5 HELCOM stations and one additional station named "kal" located in the central-eastern part of the Baltic Sea (Fig. 2). Positions of the haul stations 1 and 7 overlapped with HELCOM stations 46 and 43 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 2017 are presented in the Table 4. Overall, 7 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 (66.0 and 81.3 % respectively). The rest 5 species represented 0.13 % (in this 0.07% belonging to three-spine stickleback) of the total mass in average for all investigated area.

Mean CPUE for all species in the investigated area in 2017 amounted 1276 kg/h and it was a little lower value comparing to the previous year (1387.3 kg/h in 2016) . The mean CPUEs of sprat were: 340.9 kg/h in ICES SD 26N, and 1319 kg/h in SD 28.2. The mean CPUEs of herring were as follow: 175.3 kg/h in SD 26N and 299.9 kg/h in SD 28.2. Taking into advice all investigated area, about 16 % decrease of mean CPUE value for sprat and about 63 % increase for herring was noted in 2017, comparing to previous year. The CPUE values by particular haul and distributions for herring, sprat and others are presented at the Fig. 2 and 3. Highest CPUE values for herring were noted more-less equally in the all investigated area but for sprat in the 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 October 2017, 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 6 for sprat and Table 7 for herring. The geographical distributions of NASC and pelagic fish stock densities in the central-eastern Baltic Sea in October 2017 are shown in Fig. 5, 6 and 7.

The pelagic fish stock was represented mostly by sprat – 89.7 %, in comparison – 71.5% in 2013 86.8 %, in 2014, 88.2 % in 2015 and 94.4 % in 2016. Herring was represented as 10.3 %, 28.5 % in 2013, 13.2 % in 2014, 11.8 % in 2015 and only 5.6 % in 2016. The highest sprat stock density 55.5 n×10^6/nm^2 (126.4 n×10^6/nm^2 in 2016 and 72.6 n×10^6/nm^2 in 2015) were recorded in ICES rectangle 43H1 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 northern part of investigated area in ICES rectangles 44H0. The distribution of the high density sprat concentrations in October 2017 totally differed comparing with that from October of the years previous 2010-2015 and 2016, 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, 2016]. In October 2017 sprat stock had three centers of aggregations in investigated aquatory as in 2016, but in 2017 sprat aggregates over different depths in northern part - <40m, over 70m and over 100m.

The herring stock density was significantly lower in comparison to sprat stock density, but evidently higher than herring densities in previous recent years. The highest density value in 2017 was 17.5 n×10^6/nm^2 in ICES rectangle 42H0 in Sub-division 28.2. 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 2013 highest density values were not over 8.8 n×10^6/nm^2 and observed 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 2005-2016 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. In October 2017 sprat stock decreased, but herring stock significantly decreased, especially biomass.

The mean length distributions of dominant fish species (sprat, herring and sticklebacks) by hauls 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 = 11.69 cm), 1.8÷18.0 g (average W = 9.72 g)
- herring – 8.5÷24.0 cm (average TL = 17.26 cm), 3.8÷82.0 g (average W = 34.26 g)
- stickleback – 5.0÷8.0 cm (average TL = 6.41 cm), 1.2÷3.8 g (average W = 2.19 g)

The sprat length distribution curves for Sub-division 28.2 have a bimodal character. The first small length frequency pick takes place at 8 cm length class and represents young fish (generation born in 2017). The second higher one at length classes 11.5-12 cm represents adult sprat. No young sprat were observed in SD 26, but the adult one have a pick at 12 cm length class.

The modal frequency representing adult herring corresponded to 16 and 17 cm length classes in SDs 28.2 and 26 respectively. The fish representing 8.5-12 cm length range belonging to the herring generation born in 2017 had a very low frequency and mainly were noted in SD 28.2.

Three-spine stickleback length distributions show a one mode character with frequency picks at 6 cm length class for both SDs 26 and 28.2.

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 3 specimens from very abundant generation of 2014 – 35.6 % in SD 26N, 51.5 % in SD 28.2 and 48.7 % overall. Herring stock although was composed mainly of year class 3 specimens – 29.3 % in SD 26N, 49.1 % in SD 28.2 and 43.6 % overall.

The year-class 0 of sprat was represented by length-classes 6.5÷9.5 cm in SD 26N, 6.5÷9.0 cm in SD 28.2 and 8.4 cm on average with mean weights 1.8÷5.0 g, 1.8÷4.6 g and 3.4 g on average respectively.

2.2. METEOROLOGICAL AND HYDROLOGICAL DATA

2.2.1. WEATHER CONDITIONS

The wind speed varied from 1.6 m/s to 18.9 m/s and average speed was 10.1 m/s. The often wind directions were W and WSW. The air temperature ranged from 9.8 °C to 14.1 °C, and average temperature was 11.8 °C (Fig. 11).

2.2.2. HYDROLOGY OF THE GOTLAND DEEP

The seawater temperature in the surface layers varied from 10,60 to 14.32°C (the mean was 12.42°C). The lowest surface temperatures were recorded at the haul 6. The highest ones were noticed at the haul 3. The minimum value of salinity in Practical Salinity Unit (PSU) was 6,77 at the haul 12 in the surface layer. The maximum was 7,36 PSU at the haul 5. The mean value of salinity was 7,20 PSU. The oxygen content in the surface layers of investigated the research area varied in the range of 6.51 ml/l (haul 3) - 7.23 ml/l (station 37). The mean value of surface water oxygen content was 6.89 ml/l (Fig. 12).

The temperature of near bottom layer (Fig. 14) was changing in the range of 4.93 (haul 2) - 14.34 °C (haul 3), the mean was 5.58 °C . Salinity in the bottom waters varied from 7.30 to 13.39 PSU, and the mean was 10.43 PSU. The low values of salinity was at the haul 3. The highest values of salinity were noticed at the station 37. Oxygen content varied from 0.00 ml/l to 6.49 ml/l (the mean was 2.74 ml/l). The zero values of this parameter were noticed at the station 37. The very sharp gradient of water oxygenation comfortable for fish (minimum 2 ml/l O2) was observed in almost all investigated area bellow 55-60 m depth. The temperature, salinity and oxygen content vertical profiles at the two distant stations located in the southern and northern part of Gotland Deep are presented at Fig. 13.

The temperature at the hauls (trawling) layer changed in the range from 4.96 (haul 6) to 14.32 °C (haul 3), the mean was 6.74 °C. Salinity at this layer varied from 7.28 (haul 3) to 10.47 PSU (haul 7/station 43), and the mean was 8.70 PSU. Oxygen content varied from 0.18 ml/l (haul 7/station 43) to 6.64 ml/l (haul 2), the mean was 3.67 ml/l (Tab. 3).

3. DISCUSSION

The data of the Latvian-Polish BIAS in the 4th quarter of 2017 were considered by the ICES BIFS Working Group (Riga, Latvia, 27-31.03.2017) 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. In 2017 sprat stock had decreased but mean length and weights had slightly increased. The geographical distribution of sprat densities in the October 2017 had different pattern as in 2016 due to very different environmental conditions. The main sprat stock laid over the 40 m and 70-130 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 11-20.10.2017

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	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	Haul duration [min]	Total catch [kg]
1	2016-10-11	41G9	26	124	70	20	3.1	85	56°05.0'	19°10.5'	56°05.9'	19°12.9'	17:20	30	48.760
2	2016-10-12	41G9	26	62	40	20	3.1	82	56°06.4'	19°55.1'	56°06.7'	19°58.2'	08:15	30	39.253
3	2016-10-12	41H0	26	49	27	20	3.3	90	56°06.4'	19°55.1'	56°06.4'	19°55.1'	10:55	20	54.100
4	2016-10-14	41H0	26	51	28	20	3.0	90	56°22.3'	20°13.9'	56°22.5'	20°16.4'	09:05	30	587.932
5	2016-10-14	41G9	26	85	65	19	3.2	85	56°22.4'	19°50.7'	56°22.5'	19°53.5'	13:45	30	533.700
6	2016-10-15	41/42G9	26/28.2	120	20	20	3.0	55	56°29.8'	19°06.9'	56°30.7'	19°09.4'	07:15	30	7.987
7	2016-10-15	42G9/H0	28.2	143	65	20	2.8	100	56°39.3'	19°58.2'	56°39.2'	20°00.3'	13:10	30	157.416
8	2016-10-15	42H0	28.2	102	70	20	2.8	198	56°37.5'	20°18.5'	56°36.7'	20°18.2'	15:35	15	347.410
9	2016-10-16	42H0	28.2	62	36	20	3.2	31	56°53.8'	20°40.6'	56°55.3'	20°42.2'	08:20	30	698.420
10	2016-10-17	43G9/H0	28.2	203	50	20	2.9	93	57°07.3'	19°58.4'	57°07.2'	20°01.2'	09:55	30	334.206
11	2016-10-17	43H0	28.2	95	70	17	3.2	30	57°08.4'	20°28.4'	57°09.7'	20°29.9'	13:00	30	159.093
12	2016-10-18	43H0	28.2	67	38	20	2.9	84	57°23.0'	20°40.6'	57°23.1'	20°43.1'	12:50	30	501.978
13	2016-10-18	43H0	28.2	158	60	20	3.1	80	57°23.3'	20°29.9'	57°23.5'	20°30.8'	15:40	20	442.108
14	2016-10-19	44H0	28.2	135	60	20	2.9	28	57°42.6'	20°17.0'	57°43.2'	20°17.5'	07:55	15	1718.090
15	2016-10-19	44H0	28.2	103	60	20	2.8	274	57°53.2'	20°45.4'	57°53.2'	20°43.1'	11:30	30	398.835
16	2016-10-19	44H0	28.2	122	70	20	3.1	318	57°41.1'	20°44.7'	57°42.0'	20°43.3'	15:55	20	1243.400
												SD26			1271.732
												SD28.2			6000.956
												SD26+28.2			7272.688

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 11-20.10.2017

SD 26		Sprat	Herring	Cod	Smelt	Three spine stickleback	Nine spine stickleback	Lumpfish	Total
Samples taken	measurements	5	4			2		2	13
	analyses	5	3						8
Fish measured		1024	604			12		2	1642
Fish analysed		456	300						756
SD 28.2		Sprat	Herring	Cod	Smelt	Three spine stickleback	Nine spine stickleback	Lumpfish	Total
Samples taken	measurements	11	11	5	1	2	1	3	34
	analyses	11	9						20
Fish measured		2205	1427	10	1	137	2	3	3785
Fish analysed		906	800						1706
SUM		Sprat	Herring	Cod	Smelt	Three spine stickleback	Nine spine stickleback	Lumpfish	Total
Samples taken	measurements	16	15	5	1	4	1	5	47
	analyses	16	12						28
Fish measured		3229	2031	10	1	149	2	5	5427
Fish analysed		1362	1100						2462

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 11-20.10.2017

Haul number	Date of catch	Mean headrope depth, m	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	11-10-2017	70	W	5	3	11	1004	5.73	10.36	2.13
2	12-10-2017	40	WSW	3	3	13	1004	5.02	7.97	6.64
3	12-10-2017	27	SW	6	3/4	13	1004	14.32	7.28	6.51
4	14-10-2017	28	W	5	3	12	1014	13.22	7.33	6.59
5	14-10-2017	65	W	6	3/4	12	1013	5.26	8.87	3.25
6	15-10-2017	20	NNW	5	3	11	1017	4.96	7.44	6.49
7	15-10-2017	65	NW	5	3	12	1020	5.79	10.47	0.18
8	15-10-2017	70	NW	4	3	12	1020	5.21	9.31	1.84
9	16-10-2017	36	SW	6	3	13	1015	11.28	7.35	6.16
10	17-10-2017	50	SW	4	2	11	1017	5.26	9.37	0.94
11	17-10-2017	70	SW	6	3/4	12	1017	5.21	8.95	2.68
12	18-10-2017	38	N	5	3	11	1010	5.47	7.57	6.19
13	18-10-2017	60	N	5	3	10	1011	5.09	9.32	1.55
14	19-10-2017	60	NW	4	2	10	1018	5.58	9.93	1.45
15	19-10-2017	60	NW	5	2	10	1019	5.14	8.52	3.31
16	19-10-2017	70	NW	4	2	10	1020	5.31	9.09	2.79

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 11-20.10.2017

					Catch per species [kg]						
Haul number	Date	ICES rectangle	ICES SD	Total cactch [kg]	sprat	herring	cod	smelt	lumpfish	threespine stickleback	ninespine stickleback
					161789	161722	164712	162039	167612	166365	166387
1	2016-10-11	41G9	26	48.760	10.556	38.150				0.054	
2	2016-10-12	41G9	26	39.253	13.781	25.335			0.113	0.024	
3	2016-10-12	41H0	26	54.100	54.100						
4	2016-10-14	41H0	26	587.932	584.861	2.939			0.132		
5	2016-10-14	41G9	26	533.700	161.925	371.775					
6	2016-10-15	41/42G9	26/28.2	7.987	1.373	0.032				6.580	0.002
7	2016-10-15	42G9/H0	28.2	157.416	24.694	132.196	0.526				
8	2016-10-15	42H0	28.2	347.410	322.396	25.014					
9	2016-10-16	42H0	28.2	698.420	669.785	28.635					
10	2016-10-17	43G9/H0	28.2	334.206	31.073	301.953	0.446			0.734	
11	2016-10-17	43H0	28.2	159.093	129.610	29.460		0.023			
12	2016-10-18	43H0	28.2	501.978	326.131	175.609			0.238		
13	2016-10-18	43H0	28.2	442.108	307.783	134.057			0.268		
14	2016-10-19	44H0	28.2	1718.090	1533.295	184.105	0.690				
15	2016-10-19	44H0	28.2	398.835	370.741	26.879	1.215				
16	2016-10-19	44H0	28.2	1243.400	1018.686	223.614	0.861		0.239		
SD26				1271.732	826.596	438.231			0.245	6.658	0.002
SD28.2				6000.956	4734.194	1261.522	3.738	0.023	0.745	0.734	
SD26+28.2				7272.688	5560.790	1699.753	3.738	0.023	0.990	7.392	0.002

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 11-20.10.2017

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
28.2	44H0	14,15,16	16.42	28.99	5.03	12.13	10.44	94.97	1418.2	1.46931	-49.3
	43H0	10,11,12,13	16.79	30.66	18.81	11.65	9.51	81.19	702.8	1.57899	-49.0
	42H0	8,9,10	16.50	29.39	7.90	11.29	8.91	92.10	909.1	1.34739	-49.7
	42G9	5,6,8	18.50	42.24	11.77	12.22	10.79	88.23	224.4	1.64708	-48.8
26	41H0	3,4,5	18.63	43.23	9.18	11.60	9.66	90.82	595.0	1.48368	-49.3
	41G9	1,2,5,6	18.77	44.01	37.60	12.39	11.43	62.40	232.7	2.19247	-47.6

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}
28.2	44H0	960.5	9.7	9270.8	466.3	8804.4	5.0	95.0	105412.9	13519.7	91893.1
	43H0	973.7	4.5	4333.9	815.1	3518.7	18.8	81.2	58468.1	24992.0	33476.1
	42H0	968.5	6.7	6534.6	516.2	6018.4	7.9	92.1	68798.5	15169.0	53629.5
	42G9	986.9	1.4	1344.7	158.2	1186.5	11.8	88.2	19484.4	6682.7	12801.7
26	41H0	953.3	4.0	3822.9	351.0	3471.8	9.2	90.8	48700.4	15173.8	33526.6
	41G9	1000.0	1.1	1061.2	399.0	662.2	37.6	62.4	25128.9	17559.7	7569.2

Table 6. 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 11-20.10.2017

Table 6A CANUM		Age group									
ICES SD	ICES	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	19433	41778	89536	571575	133247	47897	22888	18804	6301	951458
	43H0	31751	10512	18159	93233	20050	14644	7784	1720	1541	199395
	42H0	55284	36819	45523	121541	24038	10408	4699	653	3059	302024
	42G9	823	12441	16125	87295	18109	6197	5277	1551	1969	149788
26	41H0	17850	39472	10922	56567	37872	4706	1757	1579	748	171473
	41G9	823	2597	1012	16150	6624	2351	1920	1072	281	32831

Table 6B n × 10^6		Age group									
ICES SD	ICES	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	179.82	386.60	828.53	5289.13	1233.01	443.22	211.80	174.01	58.30	8804.42
	43H0	560.31	185.51	320.45	1645.30	353.83	258.42	137.36	30.36	27.20	3518.74
	42H0	1101.65	733.69	907.14	2421.94	479.00	207.41	93.63	13.02	60.95	6018.43
	42G9	6.52	98.54	127.73	691.46	143.44	49.08	41.80	12.29	15.60	1186.47
26	41H0	361.42	799.20	221.14	1145.32	766.79	95.29	35.56	31.97	15.15	3471.83
	41G9	16.61	52.39	20.41	325.74	133.61	47.41	38.72	21.62	5.68	662.19

Table 6C n, %		Age group									
ICES SD	ICES	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	2.04	4.39	9.41	60.07	14.00	5.03	2.41	1.98	0.66	100.00
	43H0	15.92	5.27	9.11	46.76	10.06	7.34	3.90	0.86	0.77	100.00
	42H0	18.30	12.19	15.07	40.24	7.96	3.45	1.56	0.22	1.01	100.00
	42G9	0.55	8.31	10.77	58.28	12.09	4.14	3.52	1.04	1.31	100.00
26	41H0	10.41	23.02	6.37	32.99	22.09	2.74	1.02	0.92	0.44	100.00
	41G9	2.51	7.91	3.08	49.19	20.18	7.16	5.85	3.27	0.86	100.00

Table 6D W, kg × 10^3		Age group									
ICES SD	ICES	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	595.33	3536.68	8180.05	56323.9	12924.0	4945.08	2519.80	2121.10	747.12	91893.15
	43H0	1886.96	1743.57	3130.72	17387.5	3873.71	2993.32	1712.32	414.01	333.93	33476.05
	42H0	3741.20	6663.47	8791.13	24828.6	5123.57	2360.72	1161.21	197.81	761.71	53629.46
	42G9	18.02	903.72	1251.64	7455.33	1631.01	642.37	522.61	170.06	206.97	12801.72
26	41H0	1284.95	7531.06	2014.23	12289.8	8114.82	1242.56	448.23	406.53	194.37	33526.62
	41G9	45.88	497.01	198.12	3770.47	1566.81	640.79	488.25	279.05	82.82	7569.19

Table 6E W, %		Age group									
ICES SD	ICES	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	0.65	3.85	8.90	61.29	14.06	5.38	2.74	2.31	0.81	100.00
	43H0	5.64	5.21	9.35	51.94	11.57	8.94	5.12	1.24	1.00	100.00
	42H0	6.98	12.43	16.39	46.30	9.55	4.40	2.17	0.37	1.42	100.00
	42G9	0.14	7.06	9.78	58.24	12.74	5.02	4.08	1.33	1.62	100.00
26	41H0	3.83	22.46	6.01	36.66	24.20	3.71	1.34	1.21	0.58	100.00
	41G9	0.61	6.57	2.62	49.81	20.70	8.47	6.45	3.69	1.09	100.00

Table 6F w, g		Age group									
ICES SD	ICES	0	1	2	3	4	5	6	7	8+	Total
28.2	44H0	3.31	9.15	9.87	10.65	10.48	11.16	11.90	12.19	12.81	10.44
	43H0	3.37	9.40	9.77	10.57	10.95	11.58	12.47	13.64	12.28	9.51
	42H0	3.40	9.08	9.69	10.25	10.70	11.38	12.40	15.19	12.50	8.91
	42G9	2.76	9.17	9.80	10.78	11.37	13.09	12.50	13.84	13.27	10.79
26	41H0	3.56	9.42	9.11	10.73	10.58	13.04	12.60	12.72	12.83	9.66
	41G9	2.76	9.49	9.71	11.58	11.73	13.52	12.61	12.91	14.59	11.43

Table 6G L, cm		Age group									
ICES SD	ICES	0	1	2	3	4	5	6	7	8+	Total
28.2	44H0	8.24	11.47	11.88	12.24	12.17	12.51	12.94	12.97	13.45	12.13
	43H0	8.34	11.57	11.81	12.23	12.43	12.72	13.19	13.68	13.20	11.65
	42H0	8.44	11.37	11.71	11.99	12.21	12.60	13.06	14.20	13.28	11.29
	42G9	7.89	11.47	11.77	12.22	12.48	13.26	12.97	13.48	13.58	12.22
26	41H0	8.49	11.50	11.33	12.13	12.07	13.22	12.91	13.11	13.34	11.60
	41G9	7.89	11.55	11.66	12.47	12.55	13.34	12.93	13.04	13.86	12.39

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 11-20.10.2017

Table 7A CANUM		Age group									
ICES	ICES Rect.	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	263	554	4957	30221	2544	5687	4001	780	1388	50395
	43H0	238	1142	3118	22960	3492	7884	3718	1389	2251	46192
	42H0	2299	167	1009	11230	1984	4163	2411	930	1710	25903
	42G9	112	63	1095	6538	822	4358	3405	679	2902	19973
26	41H0	121	0	1081	5165	651	3989	3043	633	2654	17338
	41G9	16	46	1195	5703	797	4532	3573	787	3133	19781

Table 7B n × 10^6		Age group									
ICES	ICES Rect.	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	2.43	5.13	45.87	279.66	23.54	52.62	37.03	7.22	12.84	466.33
	43H0	4.20	20.16	55.02	405.17	61.62	139.12	65.61	24.52	39.73	815.15
	42H0	45.81	3.33	20.10	223.78	39.54	82.95	48.04	18.53	34.08	516.16
	42G9	0.89	0.50	8.67	51.78	6.51	34.52	26.97	5.38	22.98	158.20
26	41H0	2.45	0.00	21.90	104.57	13.18	80.77	61.61	12.82	53.74	351.04
	41G9	0.32	0.93	24.11	115.02	16.08	91.41	72.06	15.87	63.19	398.99

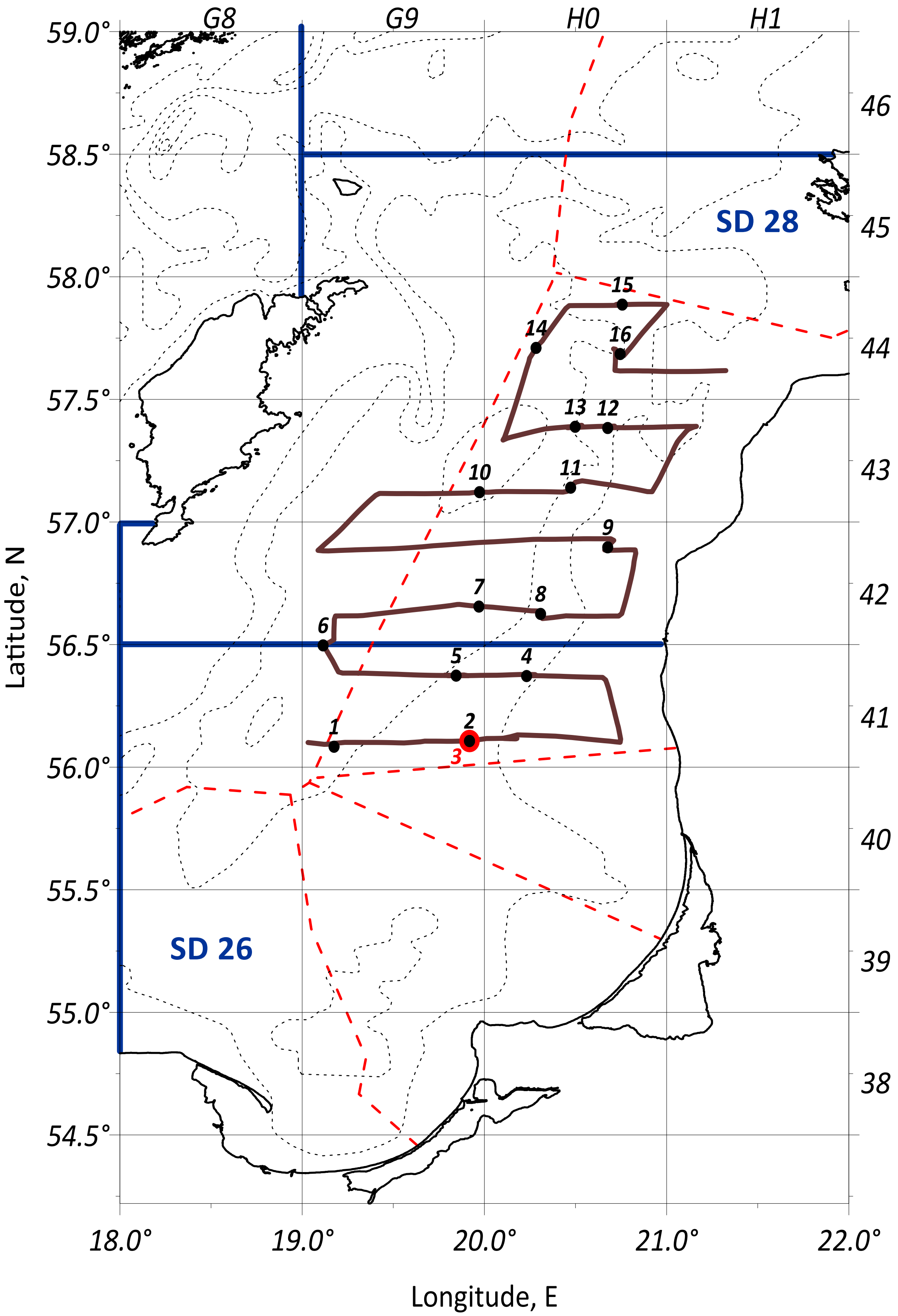
Table 7C n, %		Age group									
ICES	ICES Rect.	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	0.52	1.10	9.84	59.97	5.05	11.28	7.94	1.55	2.75	100.00
	43H0	0.52	2.47	6.75	49.70	7.56	17.07	8.05	3.01	4.87	100.00
	42H0	8.88	0.65	3.89	43.35	7.66	16.07	9.31	3.59	6.60	100.00
	42G9	0.56	0.31	5.48	32.73	4.11	21.82	17.05	3.40	14.53	100.00
26	41H0	0.70	0.00	6.24	29.79	3.75	23.01	17.55	3.65	15.31	100.00
	41G9	0.08	0.23	6.04	28.83	4.03	22.91	18.06	3.98	15.84	100.00

Table 7D W, kg × 10^3		Age group									
ICES	ICES	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	30.13	116.05	1170.62	7676.19	692.56	1707.96	1312.29	263.24	550.67	13519.71
	43H0	40.39	505.67	1458.45	11813.8	1750.57	4464.63	2395.24	879.28	1683.93	24992.02
	42H0	369.89	92.46	522.65	6232.77	1146.32	2614.96	1940.07	690.39	1559.54	15169.05
	42G9	7.98	17.14	344.25	1778.51	236.65	1529.91	1252.44	253.12	1262.68	6682.69
26	41H0	24.03	0.00	865.71	3738.90	494.16	3616.22	2879.04	610.77	2944.91	15173.75
	41G9	3.18	29.43	960.13	4137.46	626.09	4080.94	3417.46	794.16	3510.82	17559.67

Table 7E W, %		Age group									
ICES	ICES	0	1	2	3	4	5	6	7	8+	Σ
28.2	44H0	0.22	0.86	8.66	56.78	5.12	12.63	9.71	1.95	4.07	100.00
	43H0	0.16	2.02	5.84	47.27	7.00	17.86	9.58	3.52	6.74	100.00
	42H0	2.44	0.61	3.45	41.09	7.56	17.24	12.79	4.55	10.28	100.00
	42G9	0.12	0.26	5.15	26.61	3.54	22.89	18.74	3.79	18.89	100.00
26	41H0	0.16	0.00	5.71	24.64	3.26	23.83	18.97	4.03	19.41	100.00
	41G9	0.02	0.17	5.47	23.56	3.57	23.24	19.46	4.52	19.99	100.00

Table 7F w, g		Age group									
ICES	ICES	0	1	2	3	4	5	6	7	8+	Total
28.2	44H0	12.40	22.63	25.52	27.45	29.42	32.46	35.44	36.47	42.88	28.99
	43H0	9.62	25.08	26.51	29.16	28.41	32.09	36.51	35.86	42.38	30.66
	42H0	8.07	27.75	26.00	27.85	28.99	31.52	40.39	37.25	45.76	29.39
	42G9	9.00	34.40	39.69	34.35	36.37	44.32	46.44	47.03	54.94	42.24
26	41H0	9.80	0.00	39.54	35.75	37.50	44.77	46.73	47.64	54.80	43.23
	41G9	9.91	31.76	39.82	35.97	38.93	44.65	47.42	50.05	55.56	44.01

Table 7G L, cm		Age group									
ICES	ICES Rect.	0	1	2	3	4	5	6	7	8+	Total
28.2	44H0	12.75	15.13	15.76	16.15	16.50	17.14	17.56	17.80	18.88	16.42
	43H0	11.54	15.60	15.91	16.52	16.38	17.11	17.96	17.86	18.94	16.79
	42H0	11.00	16.35	15.94	16.36	16.55	17.10	18.69	18.30	19.50	16.50
	42G9	11.40	17.75	18.09	17.33	17.70	18.84	19.12	19.49	20.36	18.50
26	41H0	11.58	0.00	18.07	17.54	17.82	18.90	19.12	19.58	20.28	18.63
	41G9	11.73	16.82	18.14	17.58	18.04	18.89	19.25	19.88	20.43	18.77



3 - broken net - haul invalid for CPUE calculations, but it was separated by species and biological sample was taken.

Figure 1: Cruise track design and trawling positions of the Latvian-Polish hydroacoustic survey on the r/v "Baltica" in the period of 11-20.10.2017.

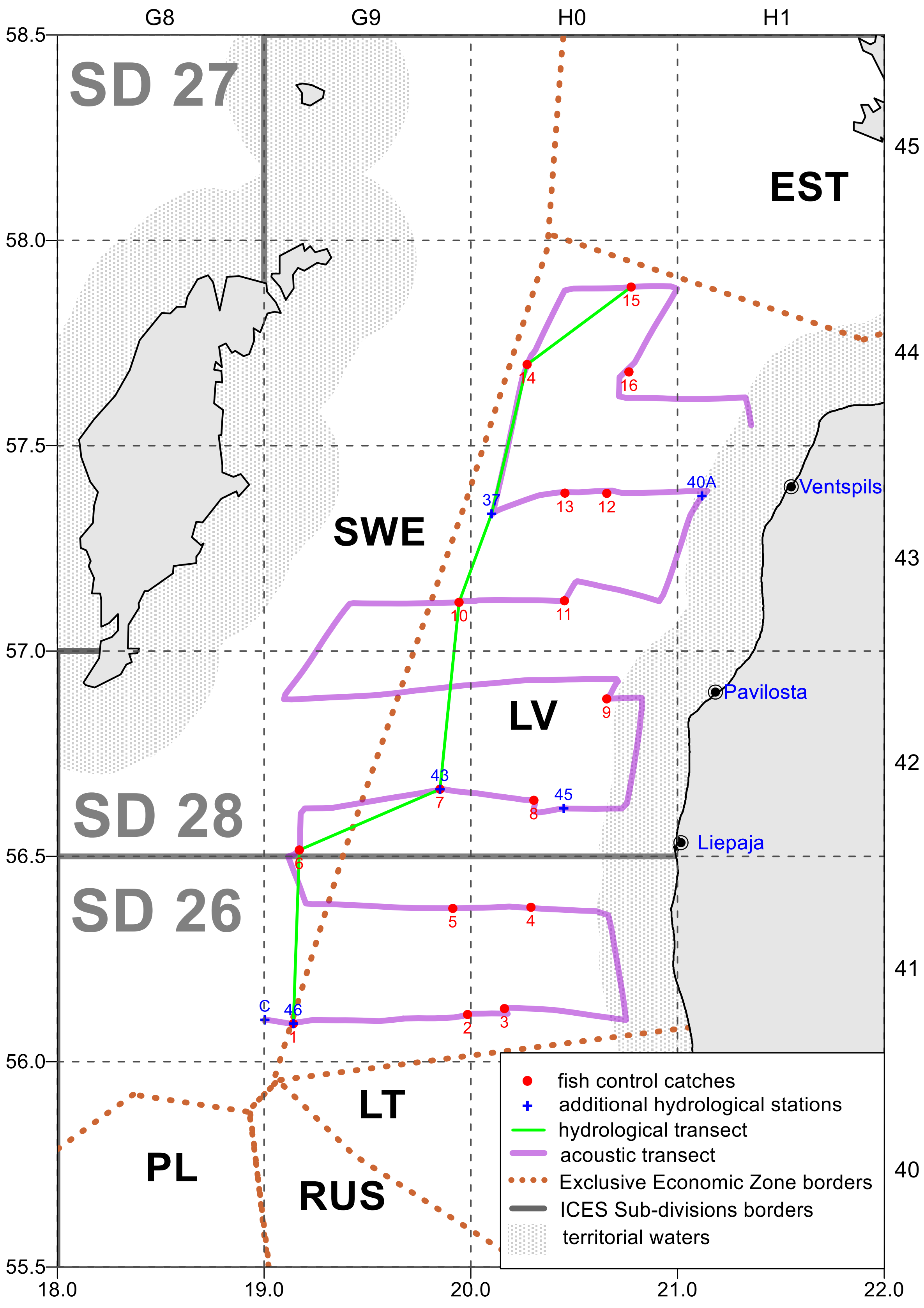


Figure 2: Locations of the hydrological stations and hydrological profile performed during the Latvian-Polish hydroacoustic survey on the r/v "Baltica" in the period of 11-20.10.2017.

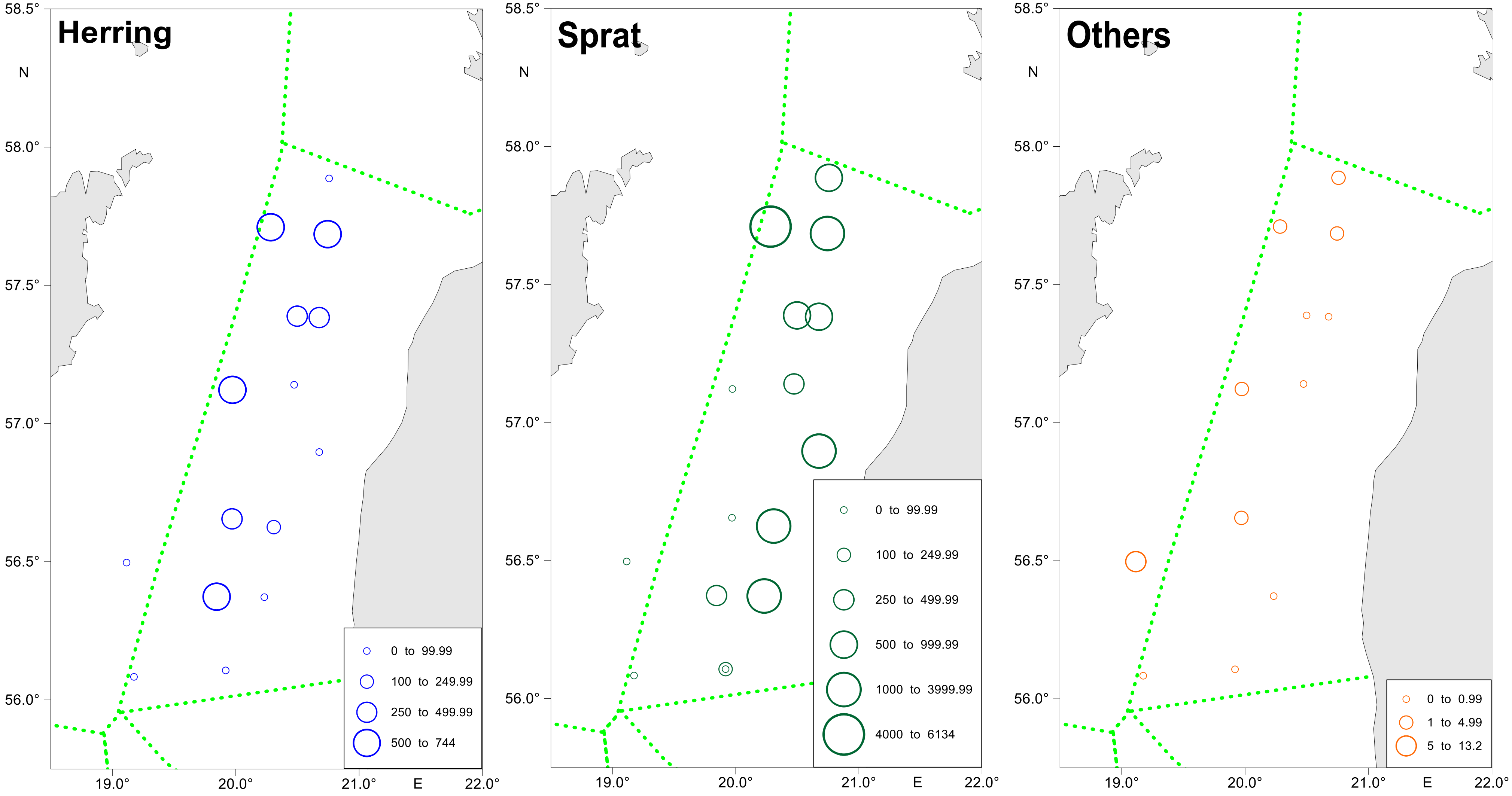


Figure 3: CPUE [kg/h] ranges distribution of fish in the catch hauls in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11-20.10.2017.

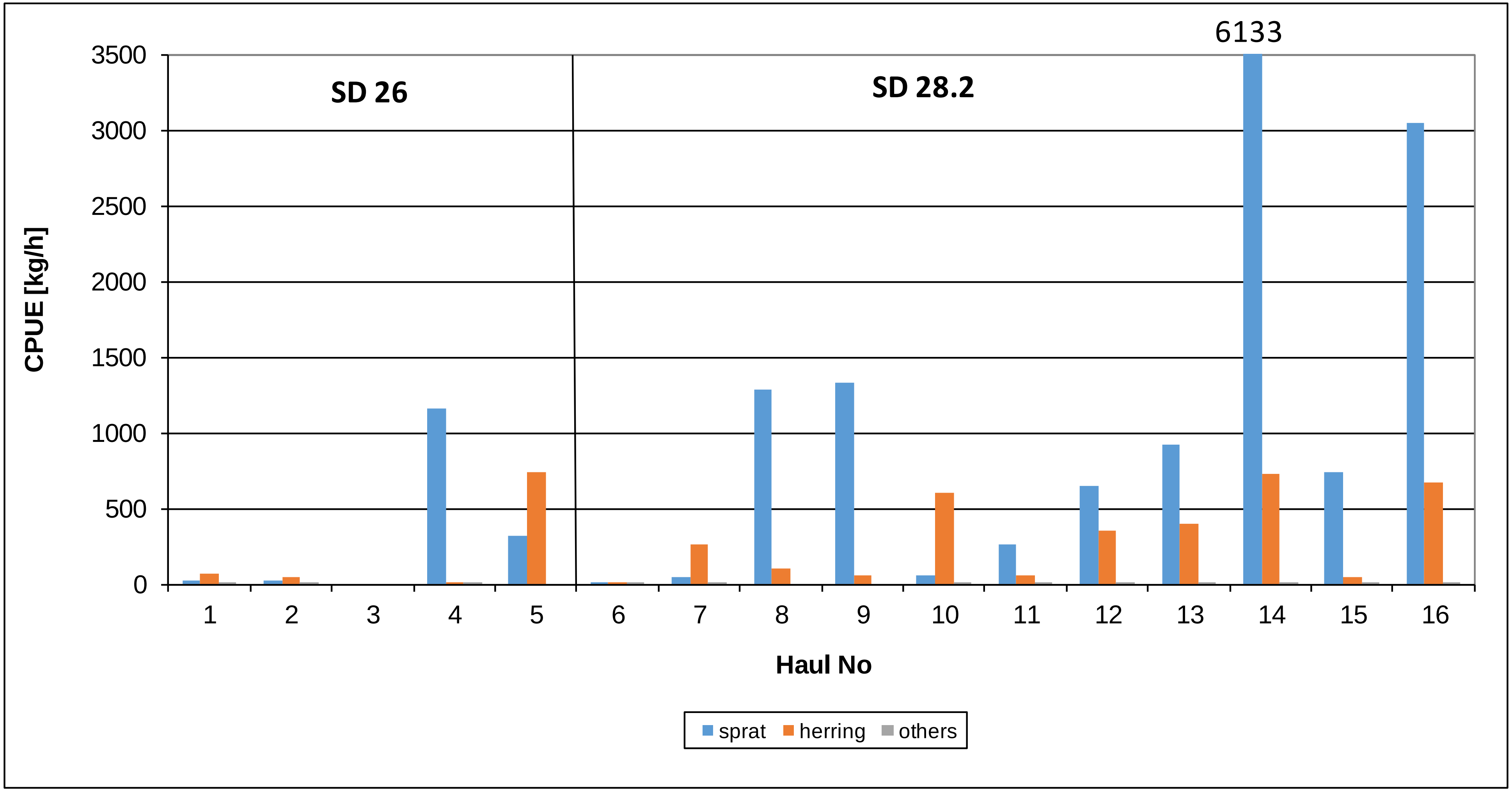


Figure 4: CPUE [kg/h] of dominant pelagic fish in the catch hauls in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11-20.10.2017.

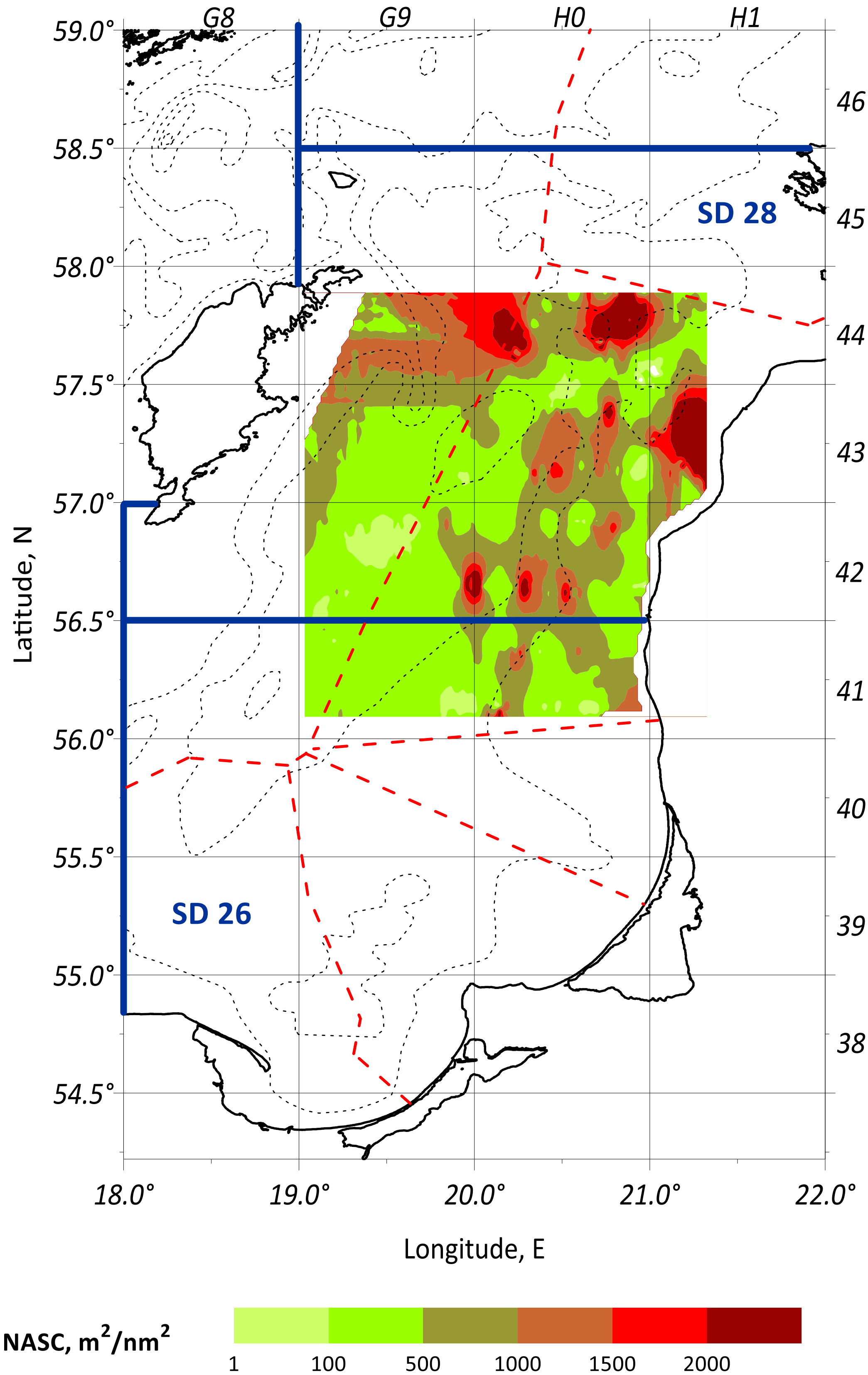


Figure 5: Acoustic parameter NASC distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11-20.10.2017.

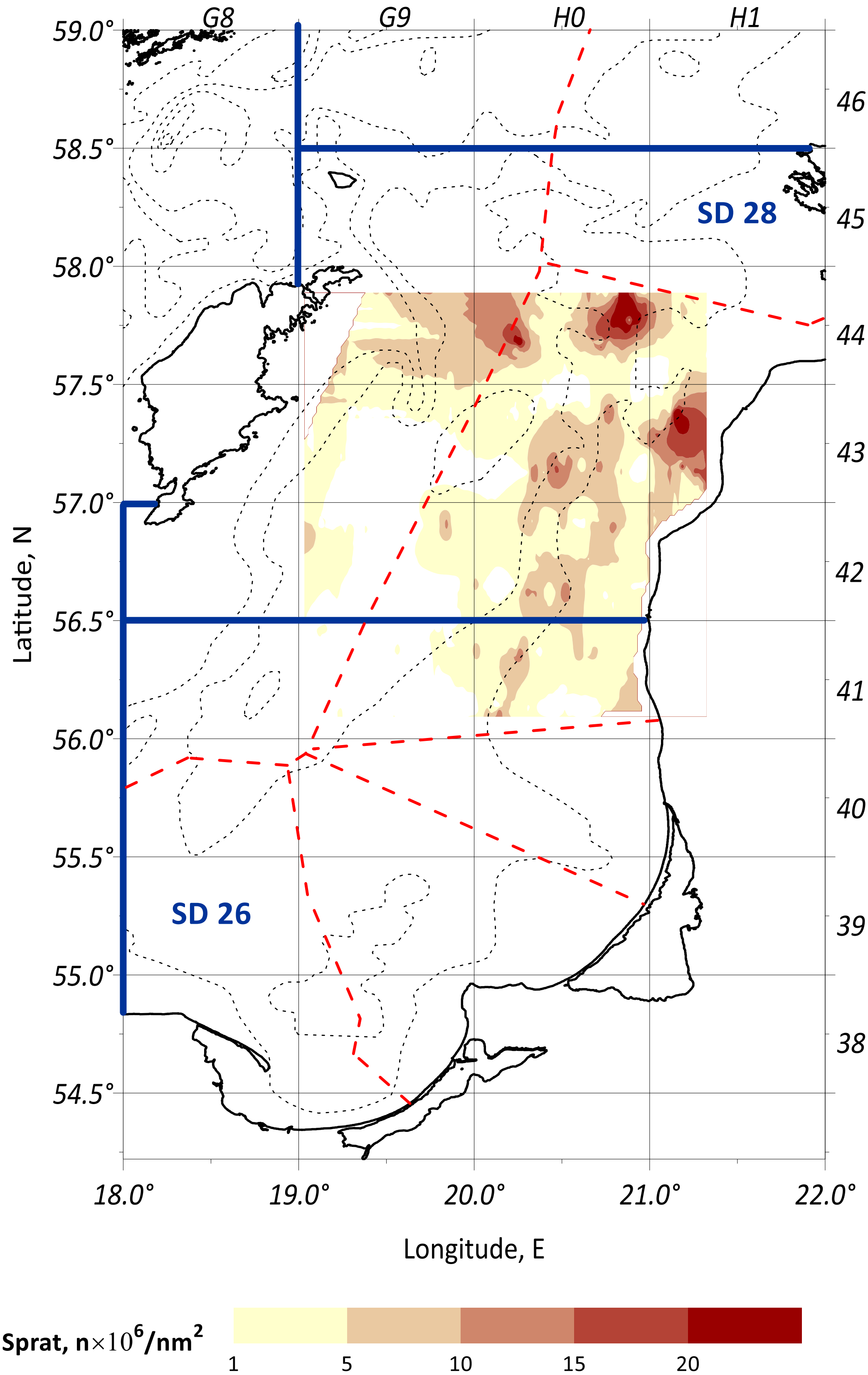


Figure 6: Sprat distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11-20.10.2017.

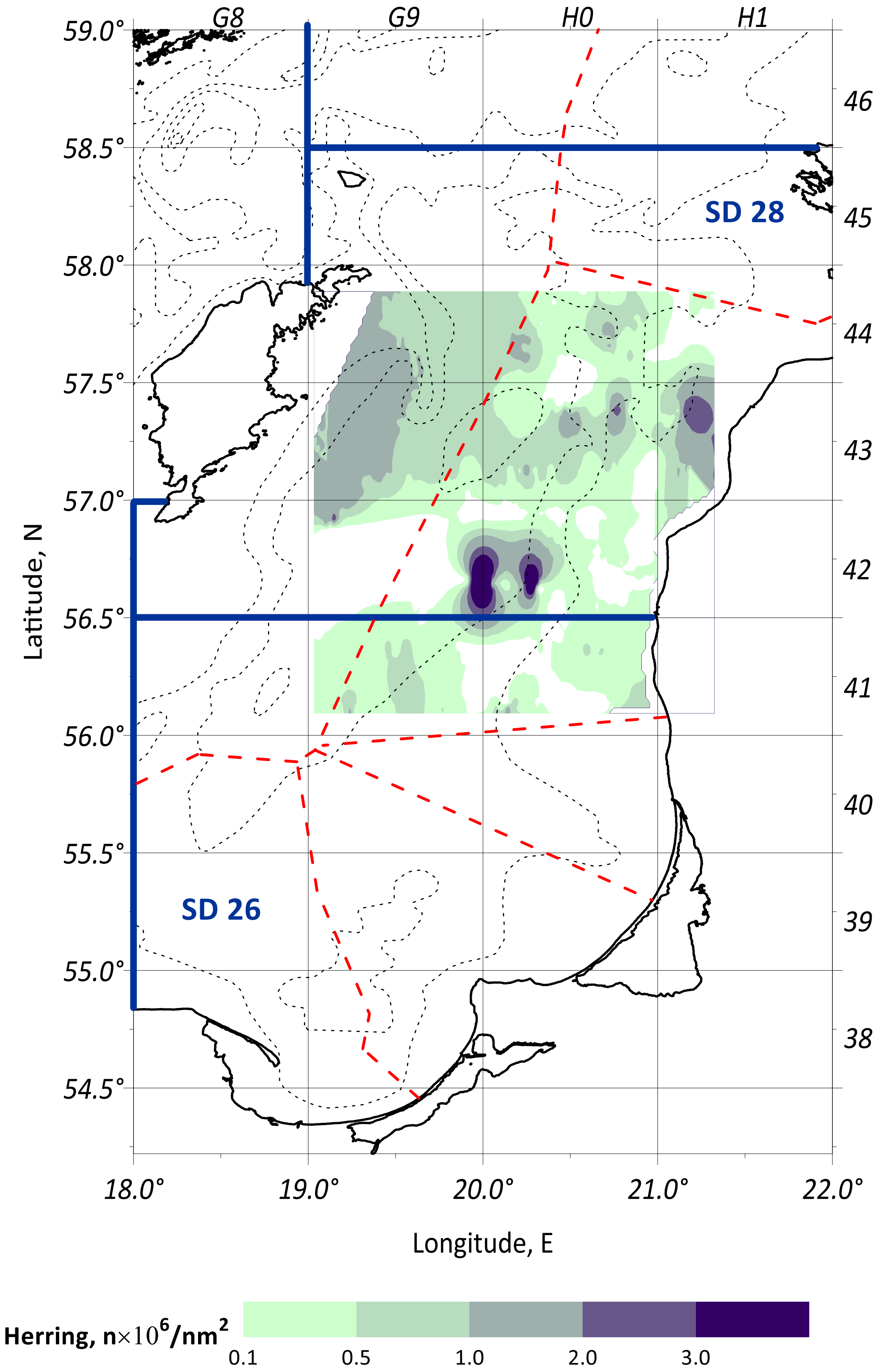


Figure 7: Herring distribution in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11-20.10.2017.

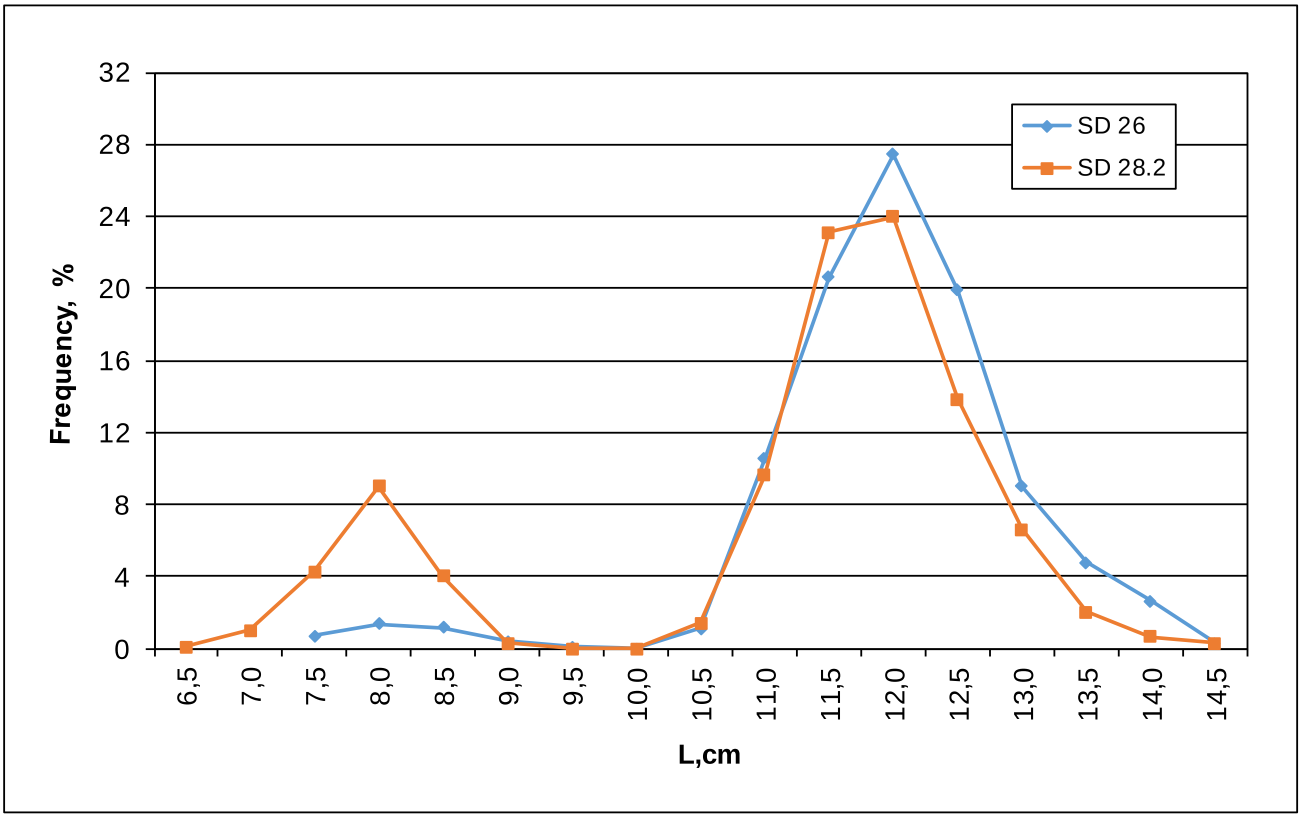


Figure 8: Sprat length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11-20.10.2017.

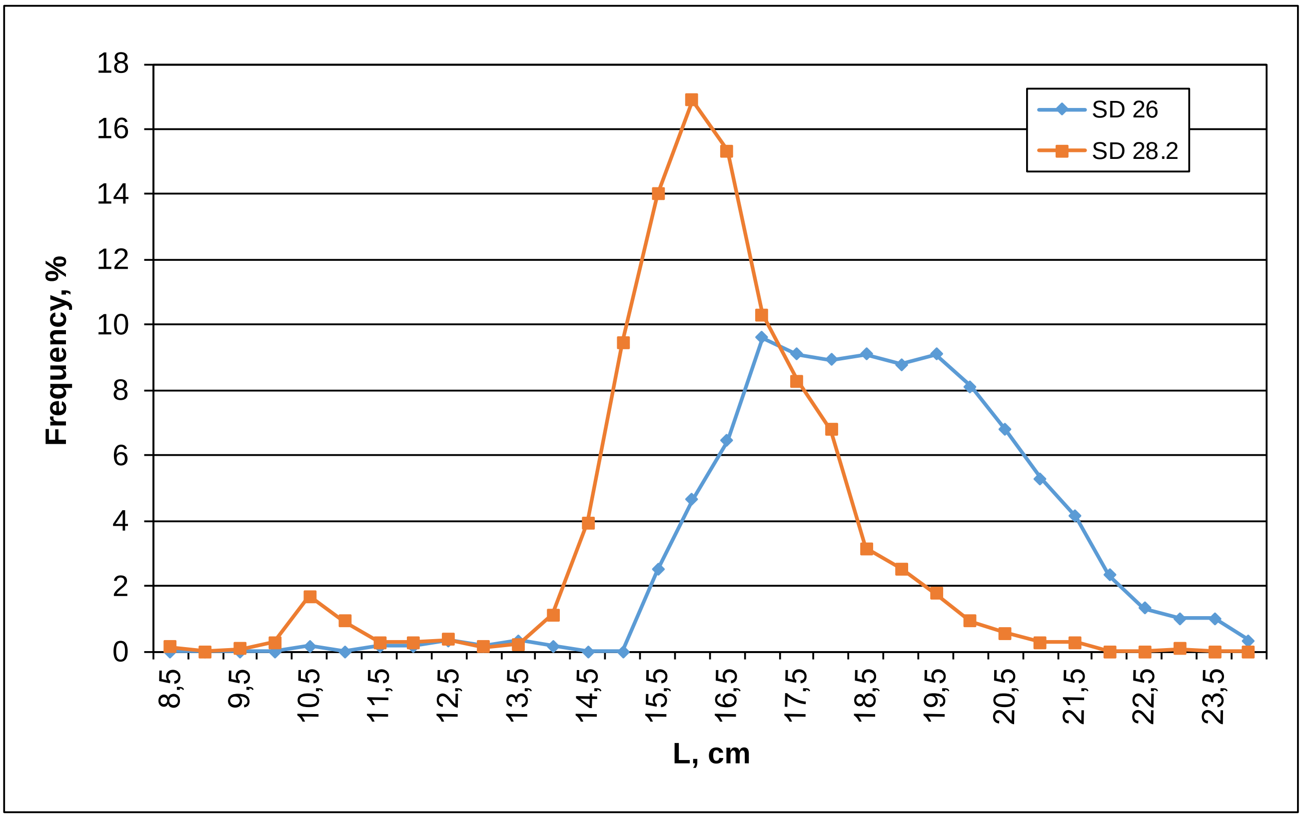


Figure 9: Herring length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11-20.10.2017.

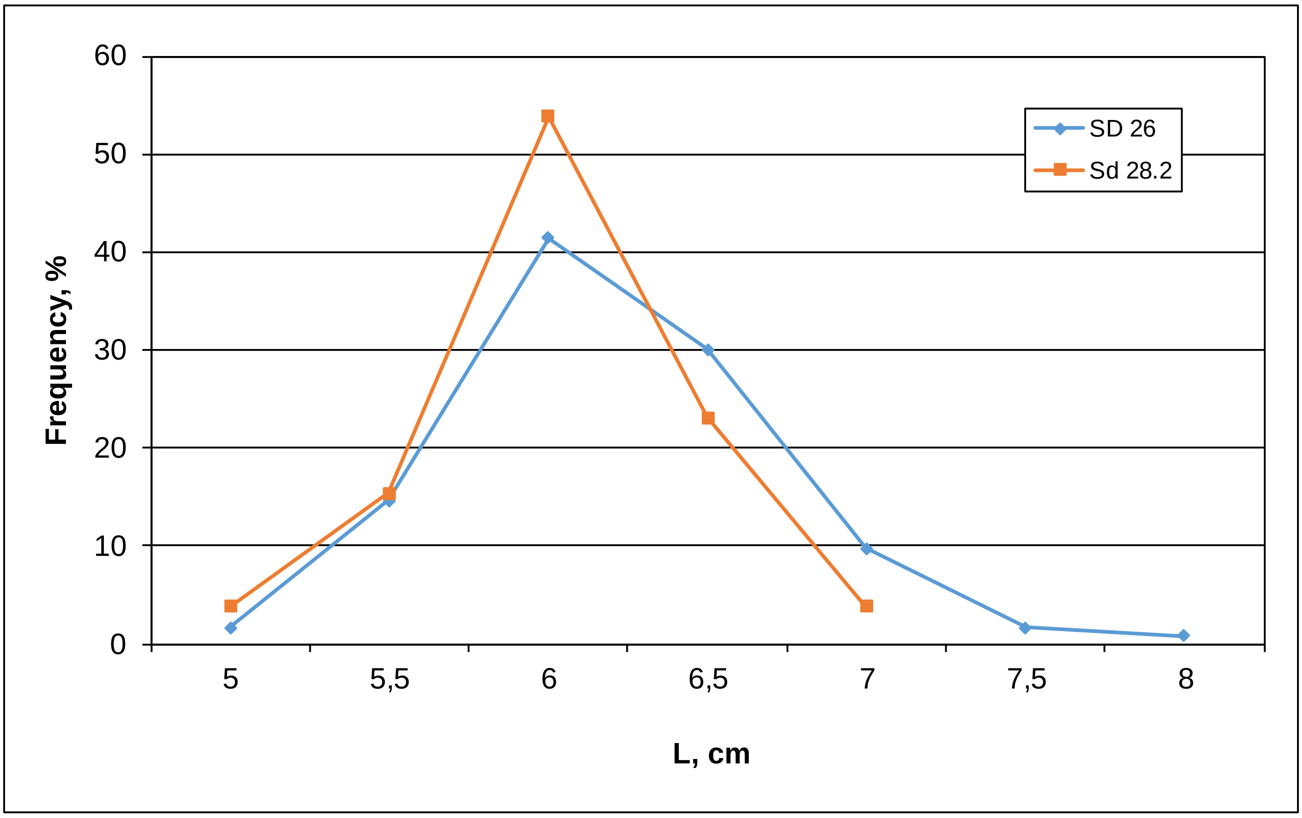


Figure 10: Stickleback length distributions in control catches in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11-20.10.2017.

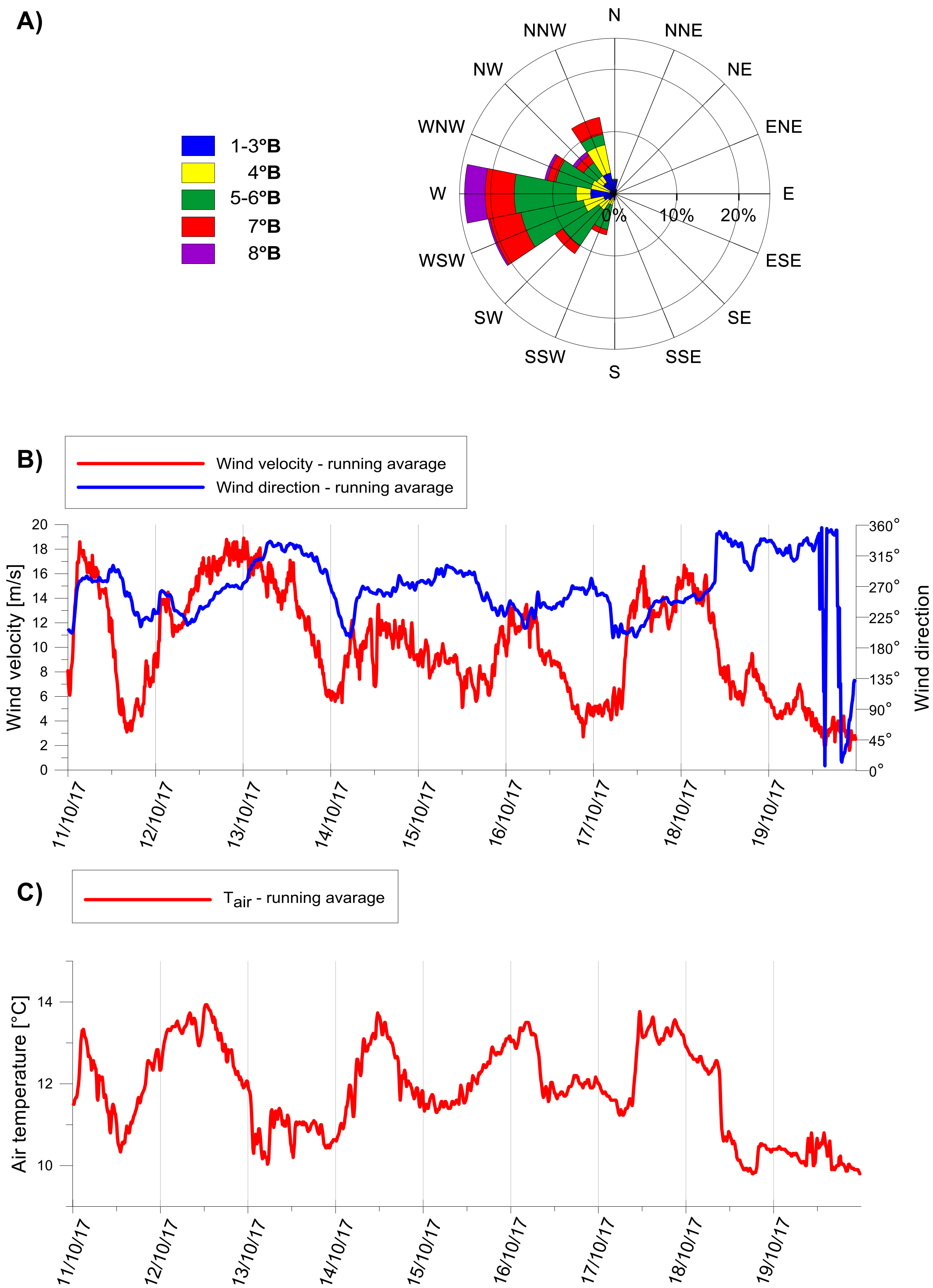


Figure 11: Changes of the main meteorological parameters (wind force, direction and the daily air temperature) during the Latvian-Polish BIAS survey in the Baltic Sea ICES SD 26N and 28.2 conducted by r/v "Baltica" in the period of 11-20.10.2017

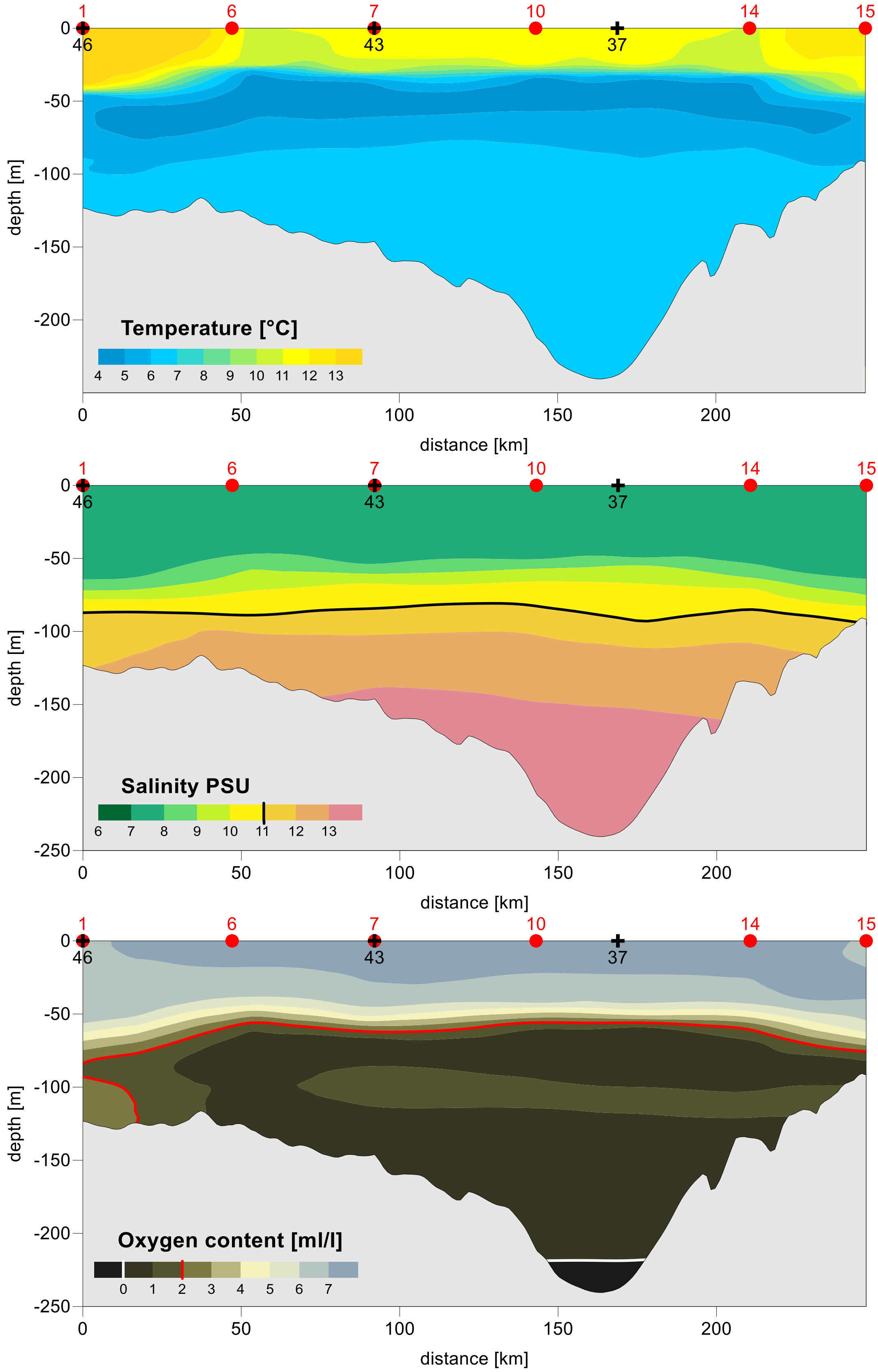


Figure 12: Vertical distribution of the seawater temperature, salinity and oxygen content along the hydrological profile in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in October in the period of 11-20.10.2017.

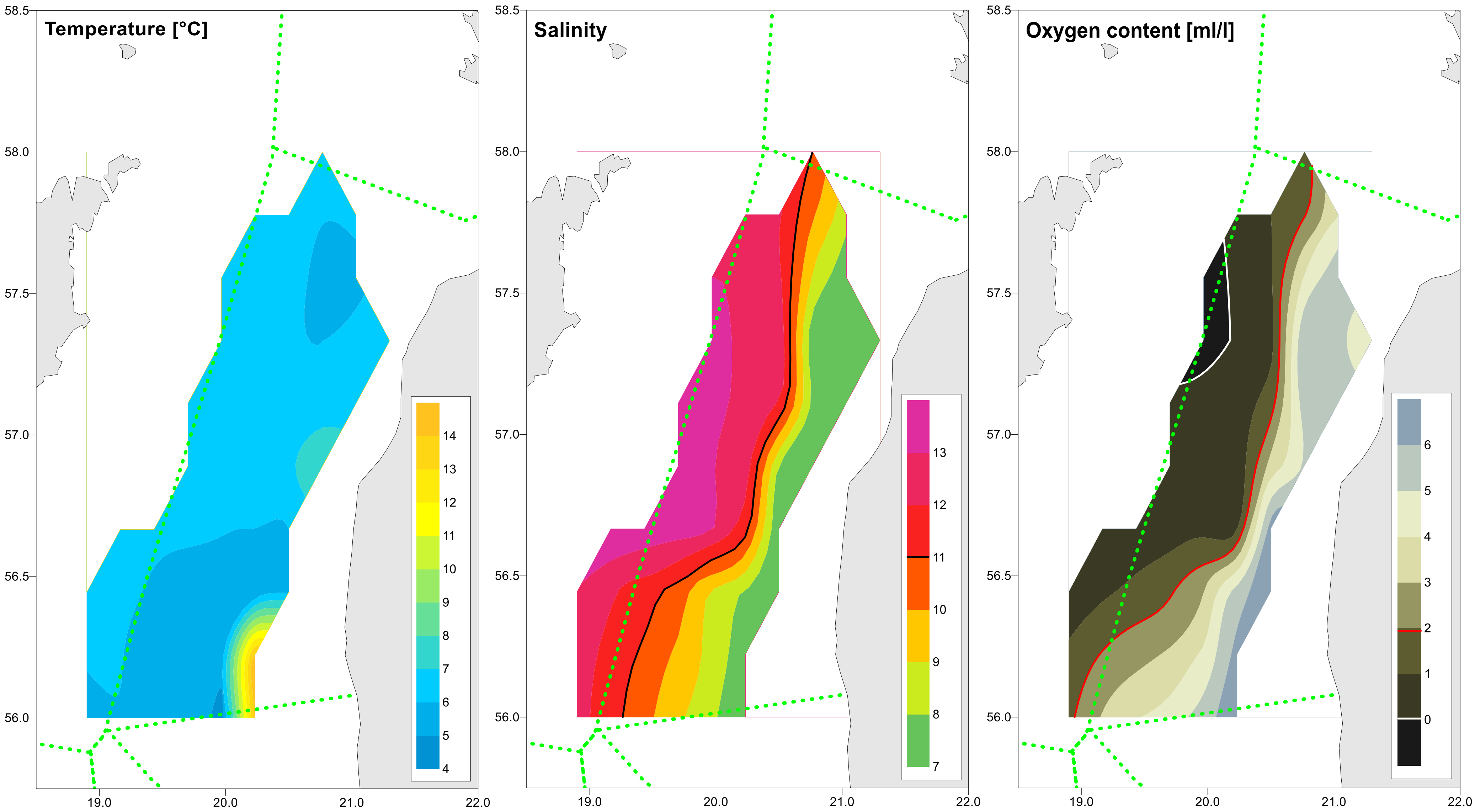
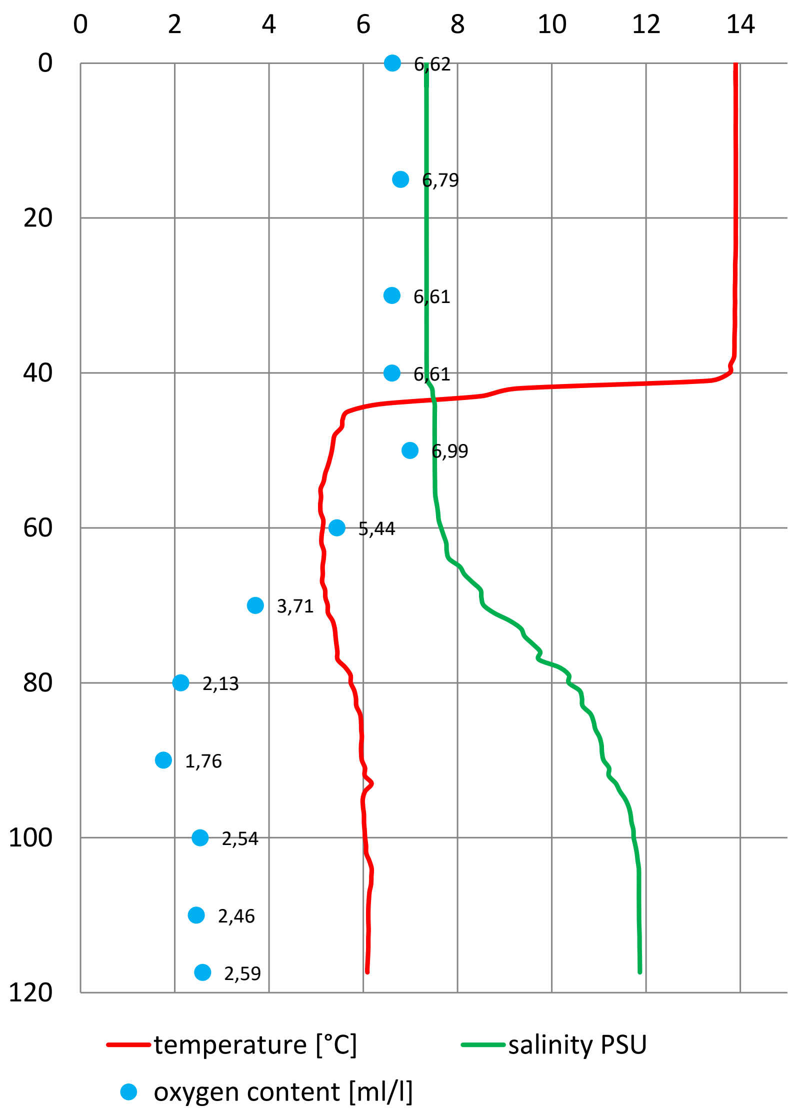
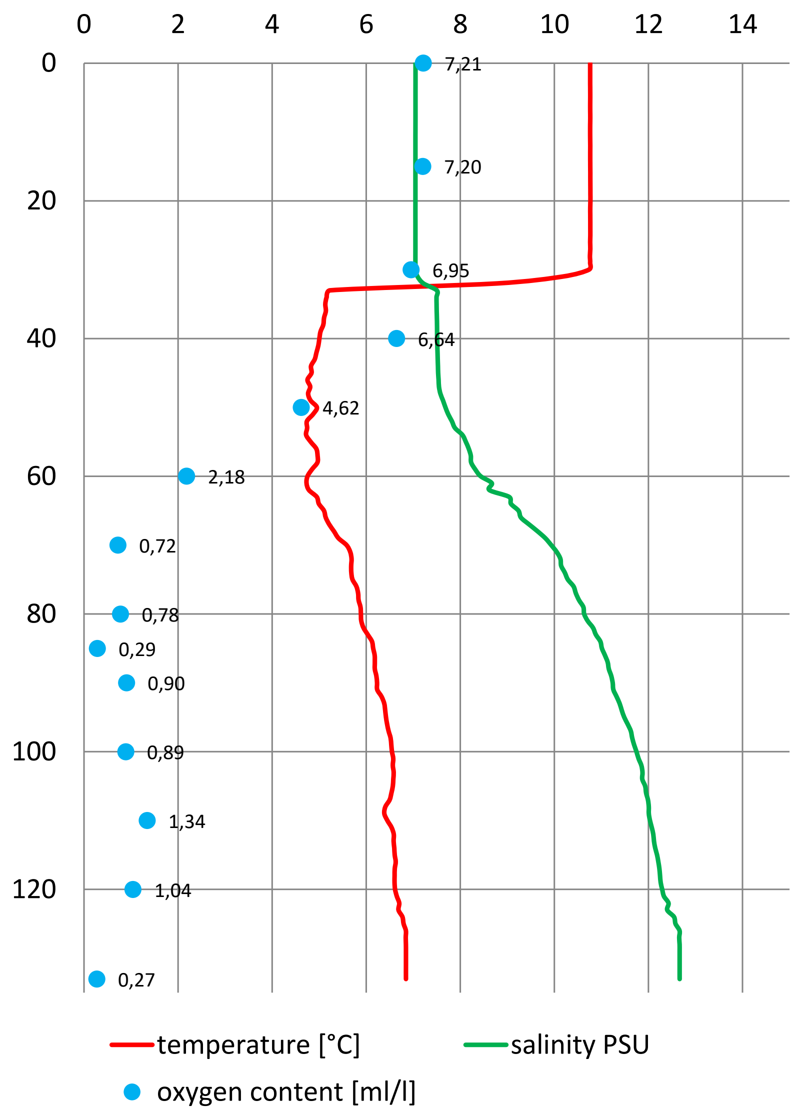


Figure 13: Horizontal distribution of the main hydrological parameters (temperature, salinity, oxygen content) measured in the bottom water layer of the Gotland Deep in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS survey conducted by r/v "Baltica" in the period of 11-20.10.2017.



Station H1



Station H14

Figure 14: : Vertical distribution of the seawater temperature, salinity and oxygen content at the independent hydrological stations in the southern part (Station H1) and the northern part (Station H14) of the Gotland Basin in the Baltic Sea ICES SD 26N and 28.2 from the Latvian-Polish BIAS conducted by r/v "Baltica" in the period of 11-20.10.2017.

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 EXCLUSIVE ECONOMIC ZONE) OF THE BALTIC SEA

(Vessel "DARIUS"; 19.10. - 20.10.2017)

Working paper on the WGBIFS meeting in Lyngby-Copenhagen, Denmark,
24.03-28.03.2018

Klaipeda, October, 2017
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.

Lithuanian BIAS surveys organized and realized by the Fishery Research and Science State delegates on board of the vessel “Darius”. Annual verification of herring, sprat and cod stocks size and their spatial distribution in the pelagic zone of the Lithuanian Exclusive Economic Zone (LEEZ) waters with applied an acoustic method, along preselected:

- 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 vessel “Darius”.

2. MATERIALS AND METHODS

2.1. Personnel

The main research tasks of the BIAS survey on board of the vessel "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. Špėgys, FS FRSS, Klaipeda - cruise leader and acoustics;

D. Tarvidienė and Ž. Kregždys FS FRSS, Klaipeda – scientific staff and fish sampling.

2.2. Narrative

The cruise of BIAS survey took place from 19-th to 20-th of May 2017. The cruise was intended to cover parts of ICES subdivisions (SD) 26, constituting the Lithuanian Exclusive Economic zone in 40H0 and 40G9 rectangles.

2.3. Survey design

The statistical rectangles were used as strata (ICES 2016). 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 2.8 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 1520 nm2 and the distance used for acoustic estimates was 111 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 (10 of May 2017) at the site of 30 m depth, located 3.5 nm northwest of Klaipeda harbour according to the BIAS manual (ICES 2016). Sv 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 2016). 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 1 m 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 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. Caught fishes, before the length measurements, were separated by species and weighed, and the species catches proportion as well as the CPUE was determined for given species from each haul. The sample of fish from each catch-station was taken for the length-mass structure analyses. Fish sampling of 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. 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 one rectangle was estimated as the product of the mean area scattering cross section (Sa) and the rectangle area, divided by the corresponding mean cross section (σ). The total numbers were separated into herring and sprat according to the mean catch composition.

3. RESULTS

3.1. Biological data

217 herrings, 1799 sprats and 1 sand eel were measured in 5 hauls. Totally 375 individuals of sprat, 217 of herring and 1 sand eel were biologically analyzed (age, sex, maturity, stomach fullness). The results of the catch composition are presented in Table 1. Ichthyologic 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 and herring in the 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.

The length distributions of herring and sprat in BASS survey show in Fig. 2 and 3. Both rectangles were represented practically by sprat. In the coastal rectangle (40H0) herring was only 1.23%. Most of it was fish of 10.5 cm length (0 + age) class. In 40G9 rectangle more than 80% herring stock was 11.5 cm length class 0+ age.

Sprat was represented by two size groups in the rectangle 40H0: 7.5 cm and 10.5 cm. 70% of sprat was this year generation (age 0+). In the western part of LEEZ (40G9 rectangle ICES) 59.5% of sprat was adult fish 11.5 cm length and 2-3ages. This year generation sprat was only 14.9% in this rectangle.

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 shown in Table 2-12.

3.3. Abundance estimates

BIAS survey statistics (aggregated data for herring and sprat) of total abundance herrings and sprats are presented in Tables 2-4. The estimated age composition of sprat and herring are given in Tables 5, 10. The estimated number sprat and herring by age group and rectangle are given in Table 6, 11. The estimates of sprat and herring biomass by age group and rectangle are summarised in Table 7, 12. The corresponding mean weights and mean length by age group and rectangle for each species are shown in Table 8-9 and 13-14.

The herring stock was estimated to be $514.7*10^6$ fish or about 5540 tones. In the both rectangles dominated 0+ age class herring. Most of them were in the rectangle 40H0 (Fig. 2 and Table 8).

The sprat stock was estimated $56531.1*10^6$ fish or about 359426.5 tones. 0 - 4 age classes fish were more than 98% of all aged sprats in rectangle 40H0 and 97% in the rectangle 40G9 (Fig. 3 and Table 5).

Comparison of the acoustic results from last seven years (2010-2017) indicated that investigated herring stock abundance have decreasing tendency in the both ICES rectangles. Although in 2016 was recorded the highest average parameters of the herring stock densities in the rectangle 40H0 (Fig.4).

As in 2016 the high-density sprat concentrations were indicated in the northern part of the ICES rectangle 40H0.

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 if weather conditions were favorable.

Totally, 5 hydrological stations were making. The hydrological and hydro biological research profiles location is presented in Table.15.

The seawater temperature varied from 12 ºC to 14 ºC in the surface layer in 40H0 ICES rectangle and about 10 ºC in 40G9 ICES rectangle. The salinity is 8.3 ‰ in all area and strata. There was no oxygen deficit in this survey.

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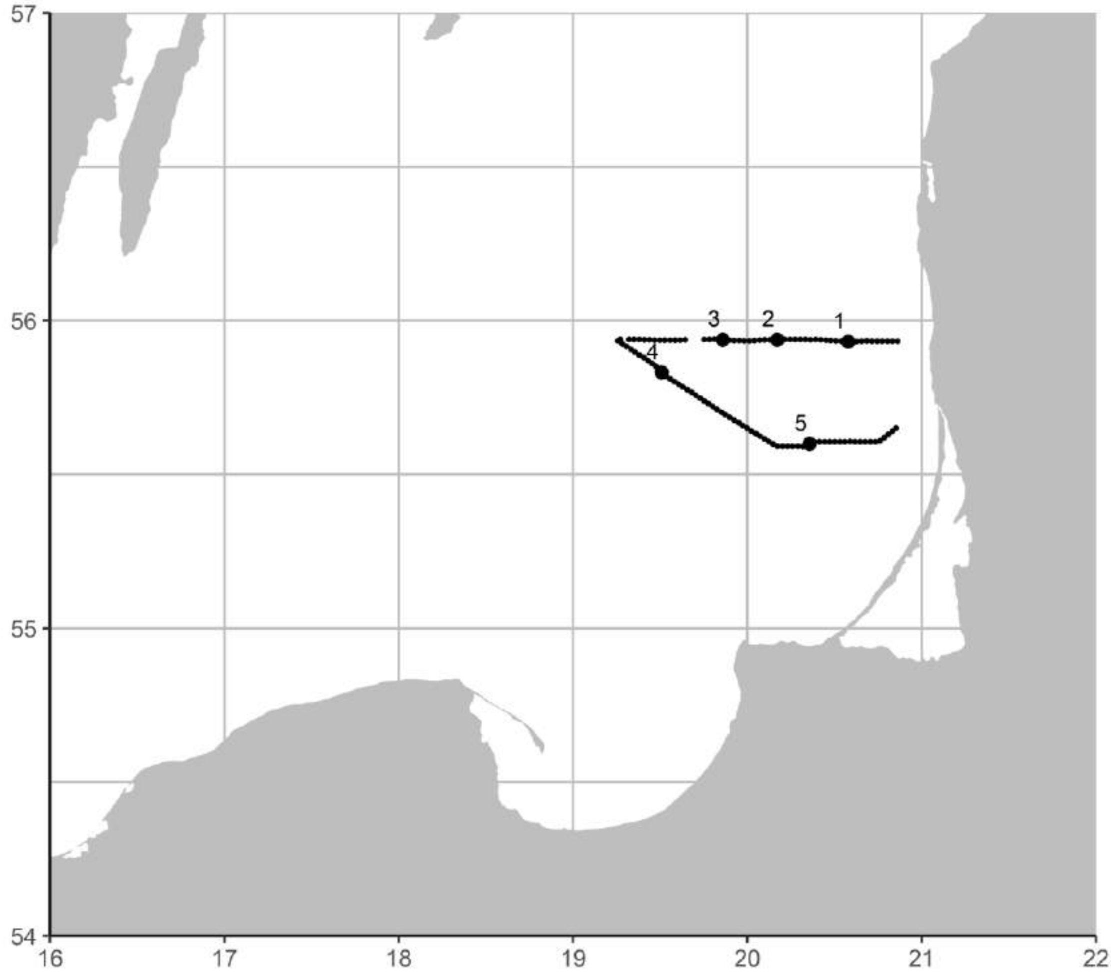

Figure 1. The survey grid and trawl hauls position of R/V “DARIUS” (19-20 October 2017)

Table 1 Catch composition (kg/1hour) per haul (R/V "Darius", 19.10- 20.10.2017)

ICES subdivision 26					
Haul No	1	2	3	4	5
Date	19.10.2017	19.10.2017	19.10.2017	20.10.2017	14.10.2016
Validity	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	40H0	40H0	40G9	40G9	40H0
CLUPEA HARENGUS		3.61	0.93	2.05	10.44
SPRATTUS SPRATTUS	60.0	166.39	1400	180.00	229.56
HYPEROPLUS LANCEOLATUS	0.08				
Total	60.08	170.0	1400.93	182.05	240.0

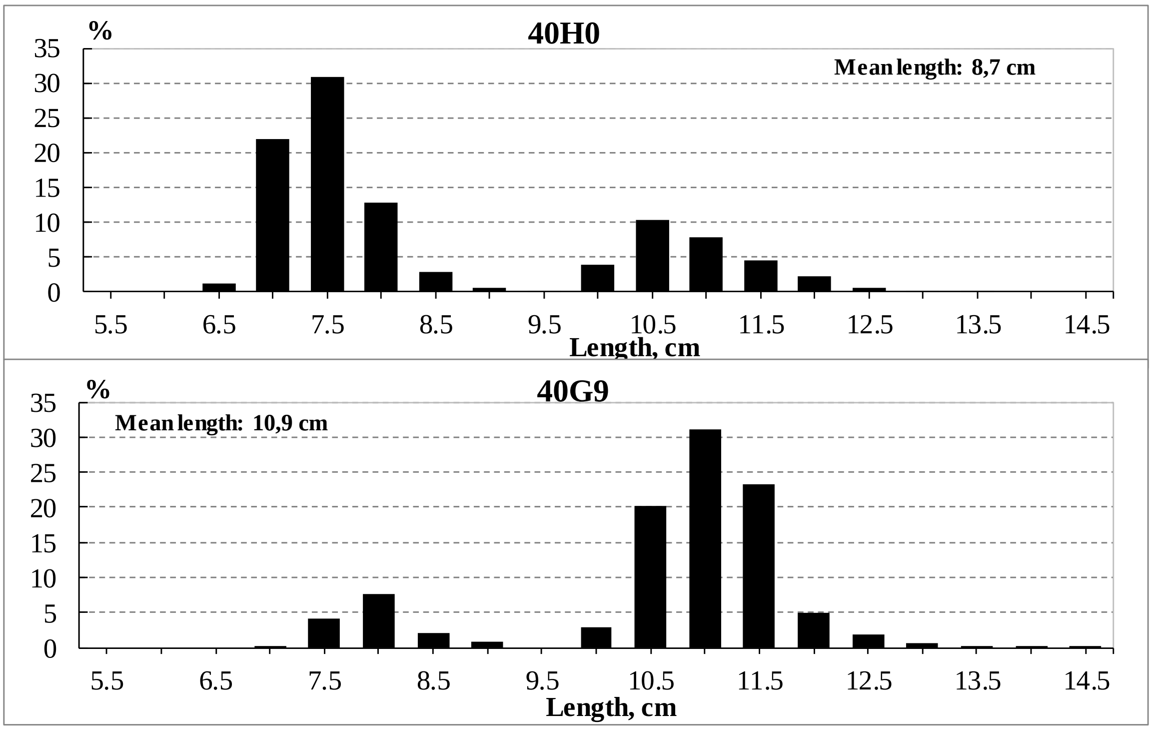

Figure 2 Length distribution of herring (%) (BIAS, 19.10- 20.10.2017)

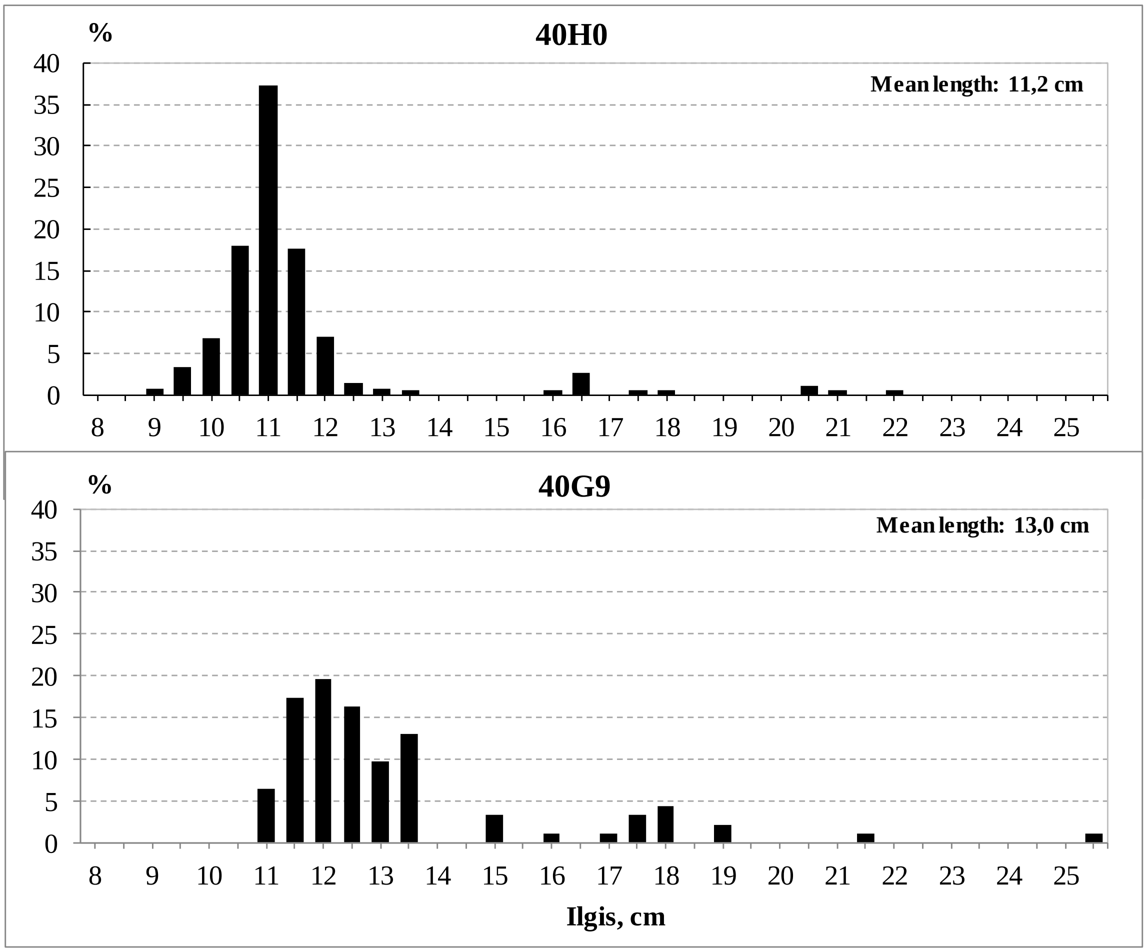

Figure 3 Length distribution of sprat (%) (BIAS, 19.10- 20.10.2017)

Table 2 BIAS survey statistics (abundance of herring and sprat), 19.10- 20.10.2017

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	39.86	40339.1	496.4	39842.7	207783	5243.9	202539.5
	40G9	1013,0	16.49	16706.7	18.3	16688.4	157183	296.1	156887.1

Table 3 BIAS survey statistics (aggregated data of herring and sprat), 19.10- 20.10.2017

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	1,2,5	11.18	10.56	1.23	8.74	5.08	98.77	3027.9	-52.2
	40G9	3,4	13.01	16.22	0.11	10.88	9.40	99.89	1884.9	-50.4

Table 4 BIAS survey statistics (herring and sprat), 19.10- 20.10.2017

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	3027.9	0.75969	40339.1	1.23	98.77
	40G9	1013	1884.9	1.14293	16706.7	0.11	99.89

Table 5 BIAS survey estimated age composition (%) of sprat, 19.10- 20.10.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	100,0	70.0	4.3	9.6	10.9	3.4	1.3	0.6		0.1
	40G9	100,0	14.9	17.5	29.6	29.9	5.2	1.6	0.9	0.2	0.3

Table 6 BIAS survey estimated number (millions) of sprat, 19.10- 20.10.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	39842.7	27874.3	1704.0	3839.3	4330.4	1342.3	501.9	222.4		28.0
	40G9	16688.4	2481.6	2913.3	4945.3	4982.3	873.3	262.2	154.3	29.8	46.4

Table 7 BIAS survey estimated biomass (in tons) of sprat, 19.10- 20.10.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	202539	86224	14424	34978	42588	15462	5699	2786		378
	40G9	156887	9313	28560	50416	52079	10103	3220	2068	428	700

Table 8 BIAS estimated mean weights (g) of sprat, 19.10- 20.10.2017

SD	Rect.	Age									
		Mean	0	1	2	3	4	5	6	7	8
26	40H0	5.08	3.1	8.5	9.1	9.8	11.5	11.4	12.5		13.5
	40G9	9.40	3.8	9.8	10.2	10.5	11.6	12.3	13.4	14.4	15.1

Table 9 BIAS estimated mean length (cm) of sprat, 19.10- 20.10.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	8.7	7.5	10.3	10.6	10.9	11.7	11.6	12.2		12.5
	40G9	10.9	8.0	10.8	11.0	11.1	11.7	12.1	12.7	12.9	13.2

Table 10 BIAS estimated age composition (%) of herring, 19.10- 20.10.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	100,0	93.7	0.0	0.0	0.5	1.5	2.8	1.0	0.5	0.0
	40G9	100,0	82.6	4.3	2.2	2.2	4.3	1.1	1.1	2.2	0.0

Table 11 BIAS survey estimated number (millions) of herring, 19.10- 20.10.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	496.4	465.3			2.4	7.3	14.0	4.9	2.4	
	40G9	18.3	15.1	0.8	0.4	0.4	0.8	0.2	0.2	0.4	

Table 12 BIAS survey estimated biomass (in tons) of herring, 19.10- 20.10.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	5244	3957.7	0.0	0.0	68.2	237.5	600.4	231.4	148.6	0.0
	40G9	296	11.8	12.4	38.9	36.3	38.0	38.9	39.3	81.4	

Table 13 BIAS survey estimated mean weights (g) of herring, 19.10- 20.10.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	10.6	8.5			28.0	32.5	42.8	47.5	61.0	
	40G9	16.2	11.8	12.4	38.9	36.3	38.0	38.9	39.3	81.4	

Table 14 BIAS survey estimated mean length (cm) of herring, 19.10- 20.10.2017

SD	Rect.	Age									
		Total	0	1	2	3	4	5	6	7	8
26	40H0	11.18	10.5			15.5	16.3	17.7	18.8	21.5	
	40G9	13.01	11.9	11.8	17.5	17.0	17.4	17.5	18.5	23.0	

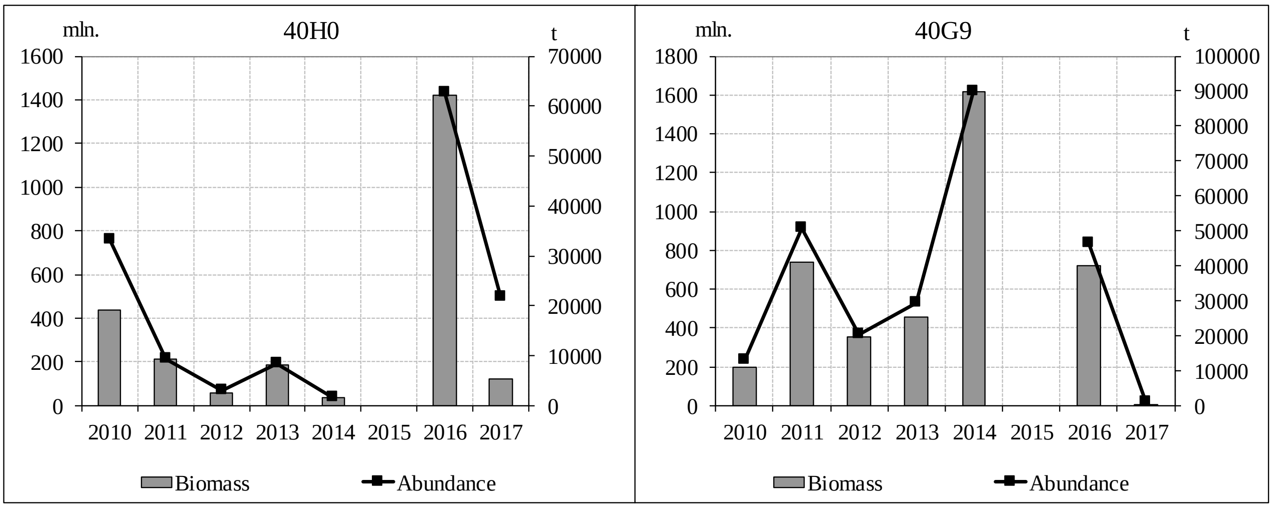

Figure 4 Biomass and abundance of herring by acoustic survey results from October of 2010 – 2017 in ICES rectangles 40H0 and 40G9

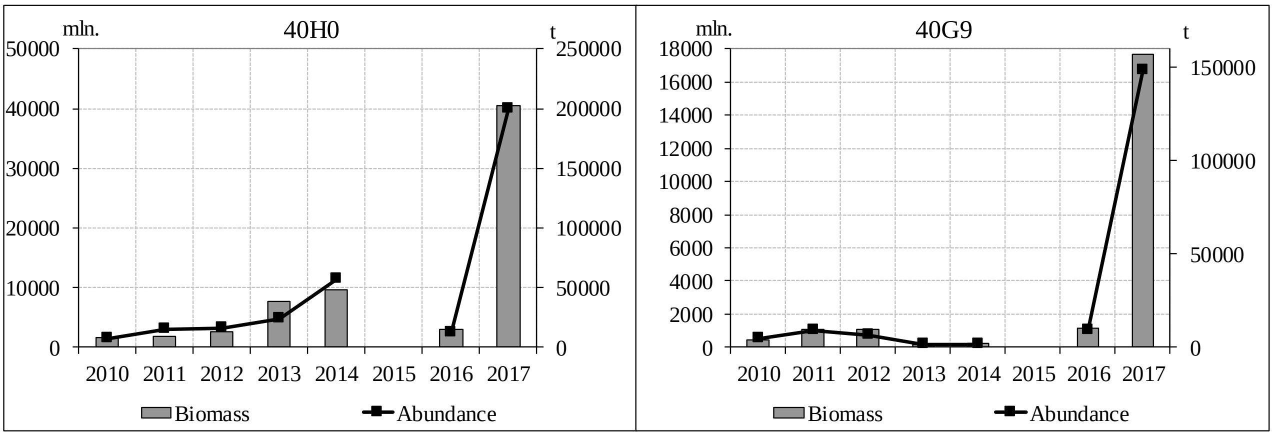

Figure 5. Biomass and abundance of sprat by acoustic survey results from October of 2010 – 2017 in ICES rectangles 40H0 and 40G9

Table 15. The values of hydrological parameters registered at the catching depth in the Baltic Sea ICES SD from the Lithuanian BIASS survey conducted by r/v "Darius" in the period of 19.10-20.10.2017.

Haul number	Date of catch	Min-Max trawling depth, m	Hydrological parameters		
			Temperature, °C	Salinity, ‰	Oxygen, ml/l
1	2017-10-19	10-10	14,4	8,3	6,8
2	2017-10-19	17-19	12.9	8.3	7.0
3	2017-10-19	18-17	10.5	8.3	7.4
4	2017-10-20	18-20	10.0	8.3	7.5
5	2017-10-20	16-20	12.0	8.3	7.2
Average			12.0	8.3	7.2

Survey Report for RV "ATLANTNIRO" 12.09-23.09.2017

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

1 INTRODUCTION

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

2.1 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
D. Churin	AtlantNIRO, Kaliningrad, Russia - hydrologist
S. Ivanov	AtlantNIRO, Kaliningrad, Russia - engineer
N. Kalinina	AtlantNIRO, Kaliningrad, Russia - engineer
I. Trufanova	AtlantNIRO, Kaliningrad, Russia - engineer
A. Gusev	AtlantNIRO, Kaliningrad, Russia – engineer
V. Shopov	AtlantNIRO, Kaliningrad, Russia – engineer
A. Golub	AtlantNIRO, Kaliningrad, Russia – engineer

2.2 Narrative

The RV "ATLANTNIRO" cruise number 66, 2017, was started from port Kaliningrad, the 12 of September and continued to 01 October of 2017. The cruise covered the ICES Subdivision 26 and included only Russia economic zone. Calibration of acoustic equipment was carried out in 13 September 2017. Acoustic investigations were carried out from 15 September to 23 September.

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 3.8 knots; the trawling duration was standard 30 minutes. The survey was conducted in the daytime from 7.00 up to 19.00 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 13.09.2017, in 55°04.97'N; 20°24.99'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)", Series of ICES Survey Protocols SISP 8 – IBAS, Version 2.0, WGBIFS 2017).

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)	26.43 dB
SA Correction (38 kHz)	-0.69 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)", (Series of ICES Survey Protocols SISP 8 – IBAS, Version 2.0, WGBIFS 2017. ICES CM 2017). The post-processing of the stored echodata was done with the SonarData Echoview ver. 3.50.59.4151, 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. 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 33 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 13 trawl hauls were carried out in subdivision 26 (Russia zone). During the survey the 2640 sprat and 3701 herring were measured, 1093 herring and 1018 sprat were aged. The results of the catch composition by ICES Subdivision are presented in Table 2. The average catch amounted to 243.9 kg per half hour of trawling. The average biomass fraction was 41.3% for sprat, 56.3% for herring and less than 2.0% for cod. In five trawling stations the fraction of a sprat reached more than 50%, in the remaining trawling it was less than 13%. The cod catches were small.

The length compositions of sprat and herring in subdivision 26 (Russian zone) of the year 2017, 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 2017) had values that indicated on lower recruitment of clupeids in 2017 than level of medium-yielding generation.

During trawl acoustic survey in September 2017 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.

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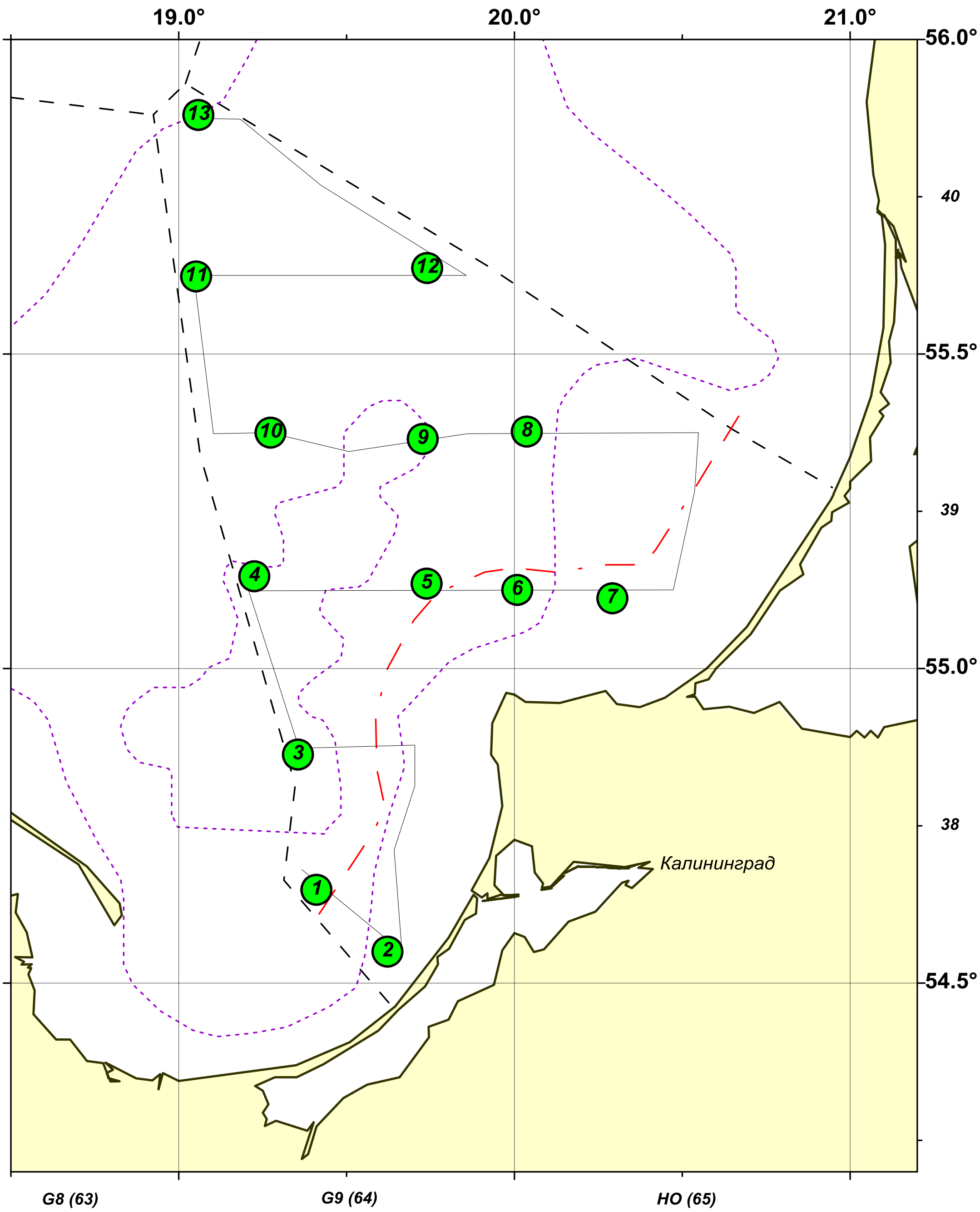

Figure 1. The scheme of cruise track and trawl stations for Russian part of survey (RV "ATLANTNIRO", 15-23.09. 2017)

Table 1. Fish control-catch results in the Baltic Sea ICES SD 26 from Russian BASS survey (RV "ATLANTNIRO", 15–23.09.2017)

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	15.09.2017	38G9	26	88	35	97	31	4,1	68	54 38.9	19 24.6	54 39.6	19 28.0	13:37	30	650,5
2	16.09.2017	38G9	26	47	12	92	32	4,1	23	54 33.0	19 37.3	54 34.9	19 38.6	10:05	30	27,7
3	16.09.2017	38G9	26	110	33	98	30	3,7	350	54 51.8	19 21.3	54 53.6	19 20.9	17:22	30	309,0
4	17.09.2017	39G9	26	102	50	98	35	3,5	180	55 08.8	19 13.5	55 06.7	19 13.6	10:52	30	222,4
5	17.09.2017	39G9	26	81	31	91	33	3,8	232	55 08.1	19 44.3	55 06.9	19 41.8	17:20	30	557,5
6	19.09.2017	39HO	26	60	21	90	34	3,8	90	55 07.5	20 00.5	55 07.4	20 03.7	8:29	30	492,7
7	19.09.2017	39HO	26	42	4	89	36	3,7	70	55 06.7	20 17.5	55 07.4	20 20.6	13:58	30	22,1
8	20.09.2017	39HO	26	59	17	90	34	3,8	90	55 22.6	20 02.2	55 22.6	20 05.6	13:16	30	247,1
9	20.09.2017	39G9	26	99	48	95	32	3,7	261	55 21.9	19 43.6	55 21.5	19 39.8	16:58	30	118,2
10	21.09.2017	39G9	26	84	35	97	33	3,7	270	55 22.5	19 16.4	55 22.5	19 13.1	9:39	30	137,9
11	21.09.2017	40G9	26	88	45	98	33	3,9	195	55 37.4	19 03.1	55 35.3	19 02.0	16:29	30	178,9
12	22.09.2017	40G9	26	82	32	97	34	3,7	225	55 38.2	19 44.4	55 36.9	19 42.1	10:54	30	99,5
13	23.09.2017	40G9	26	98	45	98	30	3,7	231	55 52.8	19 03.5	55 51.5	19 00.4	10:00	30	106,8
SD26				80	31	95	33	3,8	176							3170

Table 2. Catch composition (kg/1hour) per haul by ICES Subdivision and ICES rectangles (RV "ATLANTNIRO", 15–23.09.2017)

ICES_subdivision	**26**	**26**	**26**	**26**	**26**	**26**	**26**
Haul_No	***1***	***2***	***3***	***4***	***5***	***6***	***7***
Date	15.09.2017	16.09.2017	16.09.2017	17.09.2017	17.09.2017	19.09.2017	19.09.2017
Validity	Valid	Valid	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	38G9(64)	38G9(64)	38G9(64)	39G9(64)	39G9(64)	39HO(65)	39HO(65)
CLUPEA HARENGUS	204,6	8,0	288,1	186,2	496,9	28,6	0,8
SPRATTUS SPRATTUS	440,8	13,9	16,7	18,7	56,9	463,3	19,2
GADUS MORHUA	4,6	0,0	3,6	10,0	3,3	0,6	0,0
ANOTHER	0,5	5,8	0,7	7,5	0,4	0,2	2,1
Total	650,5	27,7	309,0	222,4	557,5	492,7	22,1

ICES_subdivision	**26**	**26**	**26**	**26**	**26**	**26**
Haul_No	***8***	***9***	***10***	***11***	***12***	***13***
Date	20.09.2017	20.09.2017	21.09.2017	21.09.2017	22.09.2017	23.09.2017
Validity	Valid	Valid	Valid	Valid	Valid	Valid
Species/ICES rectangle	39HO(65)	39G9(64)	39G9(64)	40G9(64)	40G9(64)	40G9(64)
CLUPEA HARENGUS	5,9	97,2	132,5	152,8	93,5	90,8
SPRATTUS SPRATTUS	239,6	11,6	3,5	6,0	4,6	13,6
GADUS MORHUA	0,0	9,0	1,7	19,6	0,6	2,1
ANOTHER	1,6	0,3	0,2	0,5	0,9	0,3
Total	247,1	118,2	137,9	178,9	99,5	106,8

Table 3. Survey statistics (RV "ATLANTNIRO", 15–23.09.2017)

ICES SD	ICES Rect.	AREA NM^2	SA M^2/ NM^2	σ*10^4 M^2	N TOTAL MLN	SPECIES COMPOSITION (%)	
						HERRING	SPRAT
26	40G9	1013,0	169,2	3,15	543,8	79,41	20,59
26	39H0	881,6	833,7	1,21	6085,2	1,94	98,06
26	39G9	1026,0	203,0	2,88	722,5	74,20	25,80
26	38G9	918,2	462,8	1,80	2366,5	22,94	77,06

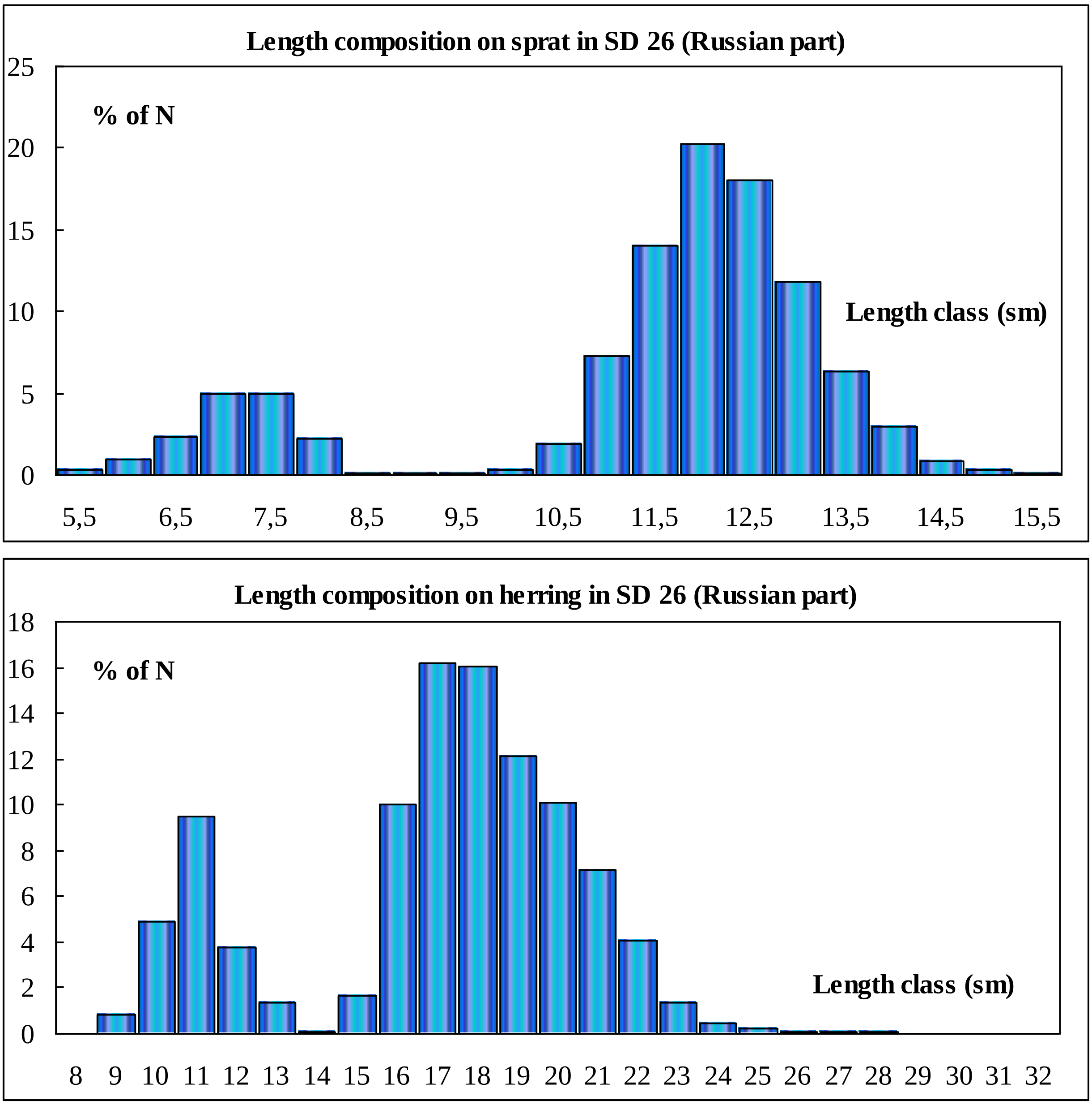

Figure 2. Length composition of sprat and herring (%) (RV "ATLANTNIRO", 15–23.09.2017)

Table 4. Characteristics of the stock of sprat and herring acoustic survey data (RV "ATLANTNIRO", 15-23.09.2017)

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	0,54	543,8	431,8	112,0	20502,8	19131,2	1371,7
26	39H0	881,6	6,90	6085,2	118,1	5967,1	65401,4	3046,8	62354,6
26	39G9	1026,0	0,70	722,5	536,0	186,4	28711,8	26117,1	2594,7
26	38G9	918,2	2,58	2366,5	542,8	1823,7	41533,4	21392,4	20141,0
SD26		**3 838,8**		**9 718**	**1 629**	**8 089**	**156 149**	**69 687**	**86 462**

Table 5. Summary acoustic survey of sprat and herring (RV "ATLANTNIRO", 15-23.09.2017)

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	11,12,13	19,21	44,31	79,41	12,84	12,25	20,59	169,2	-46,0
26	39H0	6,7,8	14,46	25,79	1,94	11,01	10,45	98,06	833,7	-50,2
26	39G9	4,5,9,10	18,65	48,72	74,20	12,52	13,92	25,80	203,0	-46,4
26	38G9	1,2,3	18,28	39,41	22,94	11,87	11,04	77,06	462,8	-48,4

Table 6. Estimated number (millions) of sprat (RV "ATLANTNIRO", 15–23.09.2017)

SD	RECT	NSTOT	1	2	3	4	5	6	7	8+
26	40G9	111,98	0,00	2,48	21,16	54,25	16,31	9,35	2,82	0,92
26	39H0	5967,11	1140,78	920,46	2012,32	1624,01	182,19	32,23	38,11	17,00
26	39G9	186,43	0,58	10,01	31,65	107,45	13,54	13,70	6,39	2,45
26	38G9	1823,67	127,44	165,50	565,26	773,81	89,59	68,97	24,81	3,06
	Sum	8089,19	1268,80	1098,46	2630,39	2559,53	301,63	124,26	72,13	23,43

Table 7. Estimated mean weights (g) of sprat (RV "ATLANTNIRO", 15-23.09.2017)

SD	RECT	WSTOT	1	2	3	4	5	6	7	8+
26	40G9	12,25	0,00	8,87	10,65	11,90	13,34	14,45	15,66	15,58
26	39H0	10,45	3,16	10,40	11,64	13,27	14,89	17,11	15,81	19,65
26	39G9	13,92	3,06	10,81	12,24	13,96	15,92	16,44	16,26	16,66
26	38G9	11,04	3,29	9,23	10,78	12,13	14,40	13,96	13,77	14,99

Table 8. Estimated biomass (in tonnes) of sprat (RV "ATLANTNIRO", 15-23.09.2017)

SD	RECT	WSTOT	1	2	3	4	5	6	7	8+
26	40G9	1371,65	0,00	22,05	225,40	645,51	217,51	135,17	44,12	14,39
26	39H0	62354,63	3608,90	9574,25	23415,74	21554,47	2713,24	551,50	602,52	334,01
26	39G9	2594,73	1,77	108,19	387,47	1499,93	215,49	225,21	103,94	40,83
26	38G9	20141,02	419,69	1527,11	6094,63	9382,93	1289,91	963,04	341,65	45,86
	Sum	86462,04	4030,35	11231,60	30123,24	33082,83	4436,15	1874,93	1092,23	435,08

Table 9. Estimated number (millions) of herring (RV "ATLANTNIRO", 15-23.09.2017)

SD	RECT	NHTOT	0	1	2	3	4	5	6	7	8+
26	40G9	431,77	8,90	3,51	23,43	80,90	68,95	99,63	56,21	45,64	44,60
26	39HO	118,13	66,76	4,29	5,41	16,26	7,45	9,85	4,00	3,31	0,80
26	39G9	536,03	17,73	2,51	26,08	145,19	93,89	122,58	53,56	31,26	43,23
26	38G9	542,84	47,11	37,74	27,92	105,37	88,87	120,87	45,57	28,75	40,63
	Sum	1628,77	8,90	3,51	23,43	80,90	68,95	99,63	56,21	45,64	44,60

Table 10. Estimated mean weights (g) of herring (RV "ATLANTNIRO", 15-23.09.2017)

SD	RECT	WHTOT	0	1	2	3	4	5	6	7	8+
26	40G9	44,31	12,82	33,26	34,77	35,25	40,65	46,23	49,21	55,11	57,02
26	39HO	25,79	10,38	30,74	48,88	41,82	43,86	50,82	50,91	52,27	91,51
26	39G9	48,72	13,70	31,44	44,46	40,07	45,50	51,07	58,66	65,17	71,85
26	38G9	39,41	9,61	31,97	46,77	34,86	41,39	41,62	47,77	50,06	59,79

Table 11. Estimated biomass (in tonnes) of herring (RV "ATLANTNIRO", 15-23.09.2017)

SD	RECT	WHTOT	0	1	2	3	4	5	6	7	8+
26	40G9	19131,17	114,05	116,68	814,58	2852,09	2803,23	4606,09	2765,93	2515,02	2543,51
26	39HO	3046,80	693,04	131,82	264,37	680,13	326,87	500,43	203,85	173,00	73,29
26	39G9	26117,05	243,02	78,96	1159,46	5817,62	4272,24	6260,54	3141,83	2036,96	3106,41
26	38G9	21392,40	452,89	1206,56	1305,86	3673,05	3677,94	5030,38	2177,02	1439,24	2429,46
	Sum	69687,41	1502,99	1534,02	3544,27	13022,89	11080,28	16397,44	8288,63	6164,22	8152,67

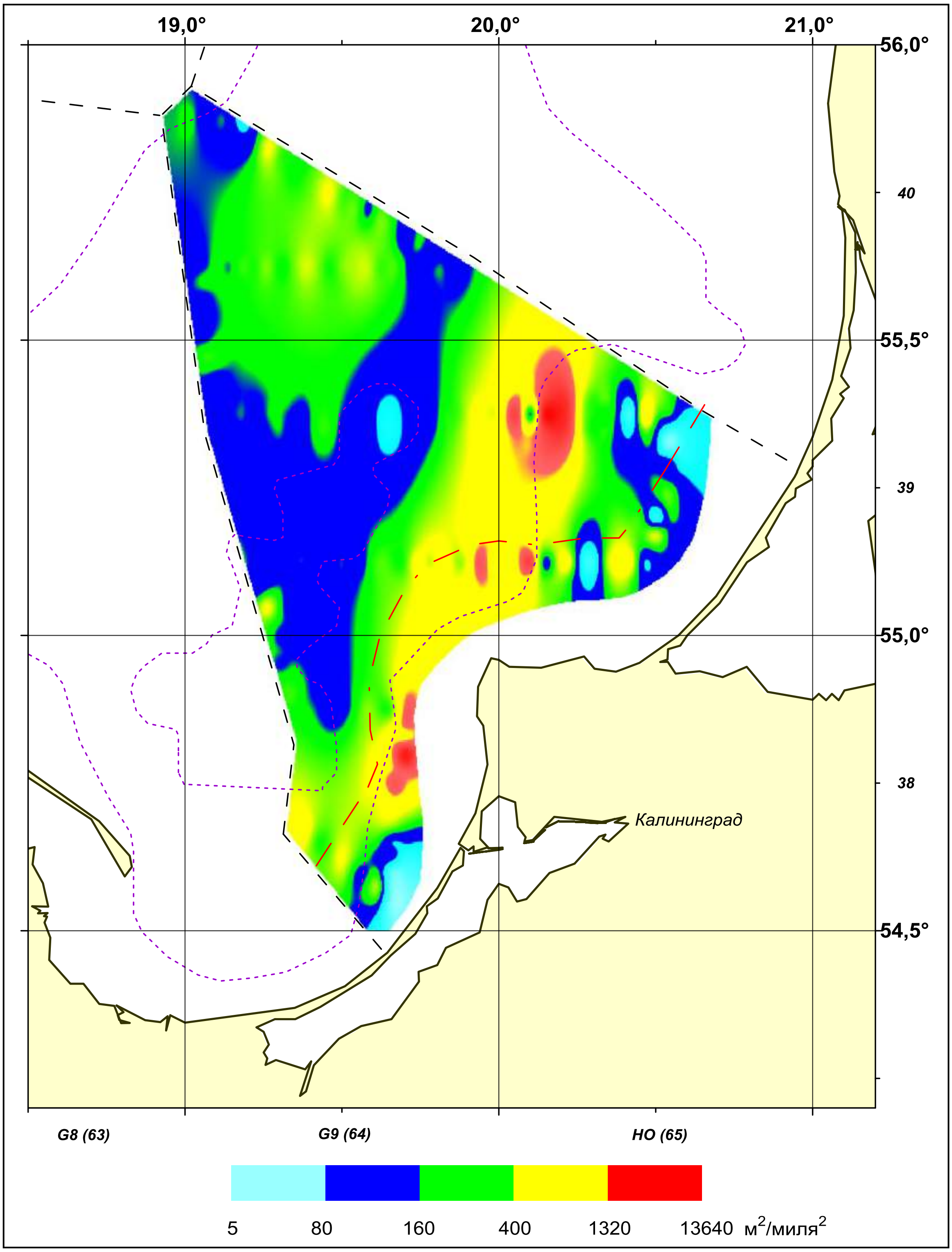

Figure 3. The map of NASC values distribution on the Russian area of international acoustic survey (RV "ATLANTNIRO", 15-23.09.2017)

Working paper for the WGBIFS meeting in Copenhagen (Denmark) 24-28.03.2018

Research report from the Polish part of the Baltic International Acoustic Survey on board of the r.v. "Baltica" (13-30.09.2017)

Grzegorz Kruk, Szymon Smoliński, Beata Schmidt and Tycjan Wodzinowski
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 24th consecutive (1994-2017) acoustic survey in the Polish EEZ was conducted on-board of the r.v. "Baltica" between 13th and 30th of September 2017. 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 fish. 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 2017 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 2017. 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 2017 the BIAS survey on board of the r.v. "Baltica" were realized by the NMFRI (Gdynia) nine members of the scientific team, with Szymon Smoliński as a cruise leader. The group of researchers was composed of:
Grzegorz Kruk – hydroacoustician,
Bartłomiej Nurek – hydroacoustician, electronics specialist,
Zuzanna Celmer - specialist, herring analyses,

Grzegorz Modrzejewski - specialist, sprat analyses,
Krzysztof Radtke – ichthyologist, cod analyses,
Wojciech Deluga – technician, herring analyses,
Ireneusz Wybierala – technician, sprat analyses,
Anetta Ameryk – hydrologist.

The course of the cruise

The r.v. “Baltica” left the Gdynia port on 13th of September 2017 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 because bad weather conditions 14-15.09 started on 16th of September 2017 at 8:50 a.m from SD24. The researches at sea ended on 28.09.2016 in the noon at the eastern part of Polish EEZ. The r.v. “Baltica” returned to the Gdynia port on 30th of September at 07:05 a.m.

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 2017. New values (from the above-mentioned calibration) of acoustic parameter *Sv* (transducer gain) for the transducers type ES38-B (ser. N^{o} 30867) and ES120-7C (ser. N^{o} 566) were applied:

38 kHz – 23,87 dB (reference: 23,85 dB, Fig. 1),
120 kHz – did not work properly but it has not been used anyway.

Calibration was performed at location:
Lat. 54° 26.32' N, Lon 019° 09.61' E.

The depth of dropped calibration spheres: 10-25 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 16th and 28th of September 2017, 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 853 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 39 catch-stations were inspected by the r.v. “Baltica” in autumn of 2017, 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 some of them was 15. 20 and 45 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 about 3.0 knots.

Fish catches were localized on the depth ranged from 20 to 80 m (position of the headrope from the sea surface). Depth to the bottom at trawling positions varied from 27 to 111 m. The trawl vertical opening during fishing was ranged from 14 to 20 m. The catch-station No. 1 should be considered as invalid, because the technical problems appeared during the fishing process. The 2nd and 3rd hauls were localized in the Polish part of the ICES Sub-division 24, 19 hauls were realised in the ICES SD 25 and 16 hauls in the ICES SD 26 (Fig. 3, Table 3). Each haul, beside the first one, 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, 38, 38 and 23 samples were taken for the length and mass determination of sprat, herring and cod, respectively. Totally, the length and mass were measured for 6268 sprat, 8342 herring and 253 cod individuals. Respectively, 571, 911 and 206 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, 39 after hauls and 17 additionally planned 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 (Kruk et.al. 2017); (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 2017 the total amount of clupeids in the Polish economic zone decreased in SD26 and increased in SD24 and SD25, whilst comparing with 2016. An interesting school of clupeids is shown in Fig. 4 with the NASC over 4300 m^2/NM^2 also near that place after the sunset dispersed clupeids are shown in Fig. 5.

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 11.

The changes of sprat, herring and cod total biomass surface density in the ICES sub-divisions is shown in Figure 8. Additionally, the biomass of sprat, herring and cod is presented in a form of the ArcGIS plot in Figures 12, 13 and 14.

Control catches and fish length distribution

The fish control-catches statistics and mean CPUEs by species are presented in Table 3 and Figure 6. Totally, 8612 kg of fish in 39 hauls were caught. The herring average share in mass was 43.6%, dominating in all hauls sprat 55.07%, cod 1.14% and other species 0.19%. 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, 2013-2016. 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, Kruk et.al. 2017).

In September 2017 the mean CPUE of all fish species for entire investigated area was 570.4 kg/h and it was higher comparing to the same period of 2016 (385.8 kg/h). The highest CPUE was noticed in the ICES SD 26 (688.5 kg/h), and it was much higher whilst comparing to this one from the ICES SDs 24 and 26 (356.09 and 491.45 kg/h, respectively). Mean CPUEs for main species in 2017 were as follow: herring – 209.01, sprat – 355.56, cod 4.94 and others – 0.88 kg/h. After Kruk et. al (2017), mean CPUEs for these three species in 2016 were: 217.9, 163.5 and 3.5 kg/h, respectively. Concluding, we had lower mean CPUEs of herring, and higher of sprat and cod in 2017, whilst comparing to CPUE values from 2016 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: 356.09, 491.45 and 688.48 kg/h, respectively (Fig. 7). The highest fishing efficiency of sprat was obtained in the ICES SD 26, i.e. 434.38 kg/h on average, while in the ICES SDs 24 and 25 was 342.52 and 289.87 kg/h, respectively.

The mean share of sprat, herring and cod in mass of catches realised in September 2017, by inspected ICES sub-divisions is presented in Figure 8. Sprat was prevailed in catches performed in the ICES SDs 24, 25 and 26, where the mean share amounted, adequately: 96.19; 58.98 and 63.09%. Herring played the second role in realised catches. 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 Figure 9. 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 7.0-15.5 cm, with the mean length of 12.5 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 11.0 cm (ICES SD 26). In September 2017, the mean numerical share of young (undersized) sprat in analysed samples, with comparison to the data from previous years, was very low and amounted 0; 0.25; 2.86 and 1.16% in ICES SDs 24, 25, 26 and entire scrutinized areas, respectively (Table 4). The mean share of sprat from year-class 2017 was negligible.

Herring

The herring length distribution in all control-catches covered the range of 9.0-29.0 cm, with the mean length of 17.4 cm and the mean weight 37.2 g. The herring length frequency curve shapes were similar (with the bimodal character) in the particular ICES sub-divisions. The mean numerical share of young herring (<16 cm) in entire study area was 23.83% (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 2017 was amounted 20.11% and 17.02% in the ICES SDs 25 and 26, respectively. Those were the lowest values in the history of Polish research surveys.

Cod

There was no cod in catches in SD24. In the ICES SD 25 and 26 there was 148 and 105 individuals respectively. The length range of cod caught in September 2017 was 5-53 cm (Fig. 9). The mean length of sampled cod was 35.3 cm and the mean weight was 388 g. Undersized specimens (<35 cm) established average up to 46.64% 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 998.1 to 1034.8 hPa. The air temperature fluctuated from 12.4 to 17.3°C, and prevailing winds were from various directions with the force from 2 to 8°B, which generated 1-3 sea state.

The seawater temperature on mean fishing depth varied from 4.90 to 16.39°C, salinity changed from 7.25 to 15.59 PSU, and oxygen content from 0.96 to 7.31 ml/l. The highest water salinity value 15.59 was noticed at the position of haul No. 11, i.e. in the Bornholm Deep, on the 67.5 m depth. Cod spawning concentrations were recognized in the deep pelagic waters of the Bornholm Basin. In the Gdansk Deep, the salinity values increased to 13,3 PSU from 10 in 2016.

The mean air temperature during surveying time amounted 14.9°C (ranging between 11.4 and 17.8°C). The dominating wind direction was from the SW, ESE and E. The weak and moderate winds (below 4°B) appeared in most of the time of observation. The maximal wind speed was 27.8 m/s. Fluctuation of values of meteorological parameters is shown in the Figure 15.

The horizontal distribution of hydrological parameters in the near seabed layer of the southern Baltic is presented in Figure 16, whilst vertical distribution in Figure 17.

The seawater temperature in the surface layer fluctuated from 13.28 to 17.57°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. 17) was ranging from 5.01 to 8.75°C. The lowest temperature was recorded at position of the haul No. 38. The highest temperature was recorded at the calibration site. The temperature of the water near the seabed was 7.14°C to 16.43. The salinity of the water at the seabed was 17.24 PSU at the station IBY5, 13.14 PSU at the station B2 and 13.30 at the G2 station. The lowest oxygen concentration were recorded at position of the G2 station 0.23,ml/l almost the same low content of oxygen in water was recorded at the IBY5 station 0.3 ml/l, and at B2 station 3.48 ml/l. 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 to 40 m. The halocline's upper border varied from 40 m at the Bornholm deep to about 60 m at the Gdansk deep.

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-2017 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(m^2/NM^2) for the three ICES SDs in Polish EEZ in 2016 and 2017 (BIAS).

ICES SD	Average NASC 2016	Average NASC 2017
24	89.2	253.5
25	160.0	182.4
26	556.8	431.7

Table 2. Average NASC values (m^2/NM^2) for the covered ICES rectangles in Polish EEZ in 2016 and 2017 (BIAS).

SD	ICES Rectangles	Area [NM^2]	Average NASC 2016	Average NASC 2017
24	38G4	1034,8	89,2	253.5
25	37G5	642,2	100,7	178.6
25	38G5	1035,7	209,5	191.1
25	38G6	940,2	151,8	56.9
25	38G7	471,7	41,2	9.8
25	39G5	979,0	220,2	334.5
25	39G6	1026,0	241,1	178.7
25	39G7	1026,0	189,6	125.9
25	40G7	1013,0	125,9	383.8
26	37G8	86,0	767,5	549.2
26	37G9	151,6	2739,7	1333.1
26	38G8	624,6	336,0	248.9
26	38G9	918,2	170,9	381.9
26	39G8	1026,0	118,7	251.8
26	39G9	1026,0	57,6	99.1
26	40G8	1013,0	172,4	157.5

Table 3. Fish control-catches data from the Polish BIAS survey conducted on-board of the r.v. "Baltica" in September 2017.

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

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	other
1	13-09-2017	37G8	26	61	21	18	3.2	50	54°25.3'	19°10.9'	54°25.9'	19°11.9'	15:25	15:40	15	0.325	1.302	0.037								0.279	0.009		
2	16-09-2017	38G4	24	49	26	20	3.3	10	54°37.5'	14°47.2'	54°38.9'	14°47.6'	11:35	12:05	30	327.935	655.870	319.263	7.897					0.775					
3	16-09-2017	38G4	24	60	37	20	3.3	270	54°44.9'	14°58.4'	54°44.8'	14°55.8'	14:30	15:00	30	28.159	56.318	23.260	4.268		0.631								
4	17-09-2017	37G5	25	44	20.5	20	3.2	0	54°28.2'	15°20.0'	54°29.8'	15°20.0'	7:35	8:05	30	47.570	95.140	35.940	11.630										
5	17-09-2017	38G5	25	65	43	19.5	3.1	0	54°40.0'	15°19.9'	54°41.6'	15°19.8'	10:00	10:30	30	420.580	841.160	220.603	198.917	0.245	0.200				0.535				0.080
6	17-09-2017	39G5	25	77.5	54	20	3.1	30	55°00.5'	15°31.8'	55°01.7'	15°33.2'	13:45	14:15	30	400.385	800.770	134.834	257.706	7.845									
7	17-09-2017	38G5	25	77.5	54	20	3.0	180	54°54.9'	15°39.9'	54°53.9'	15°39.9'	17:45	18:05	20	124.576	373.728	3.612	116.464	4.500									
8	18-09-2017	38G5	25	57.5	35	20	3.1	180	54°32.3'	15°39.8'	54°31.0'	15°39.7'	7:55	8:25	30	136.630	273.260	9.975	126.105	0.550									
9	18-09-2017	37G5	25	46	23	20	3.2	140	54°28.5'	15°49.1'	54°27.3'	15°50.6'	11:50	12:20	30	3.401	6.802	1.078	1.188	1.135									
10	18-09-2017	38G6	25	50	38	20	3.2	165	54°40.4'	16°00.5'	54°38.9'	16°01.3'	15:30	16:00	30	26.575	53.150	2.740	23.300					0.385					0.150
11	19-09-2017	39G5	25	85.5	57.5	20	2.9	90	55°04.6'	15°55.6'	55°04.7'	15°58.2'	6:50	7:20	30	211.820	423.640	93.859	102.201	15.650									0.110
12	19-09-2017	39G6	25	61.5	39	19	3.0	90	55°17.0'	16°21.2'	55°17.1'	16°22.9'	11:30	11:50	20	948.905	2846.715	801.028	147.142	0.735									
13	19-09-2017	38G6	25	47	25.5	18	3.1	50	54°57.8'	16°16.8'	54°58.6'	16°19.0'	16:35	17:05	30	755.884	1511.768	713.755	40.804						1.325				
14	20-09-2017	39G6	25	63	40.5	19.5	3.2	355	55°08.1'	16°40.1'	55°10.6'	16°40.4'	11:50	12:35	45	207.675	276.900	33.802	173.178					0.695					
15	20-09-2017	39G6	25	62	38.5	19.5	2.9	60	55°22.3'	16°41.0'	55°22.9'	16°42.9'	14:45	15:15	30	66.265	132.530	44.180	21.140					0.945					
16	20-09-2017	39G6	25	68.5	47	20	3.1	60	55°20.0'	16°58.0'	55°20.6'	17°00.0'	18:20	18:50	30	88.850	177.700	10.320	73.120	5.410									
17	21-09-2017	38G7	25	27.5	10	14	3.3	0	54°57.5'	17°20.0'	54°59.0'	17°20.0'	10:50	11:20	30	1.271	2.542	1.087	0.184										
18	21-09-2017	39G7	25	83	53	18	3.0	5	55°11.7'	17°20.0'	55°12.7'	17°00.0'	13:30	13:50	20	291.325	873.975	176.603	113.937	0.400				0.385					
19	21-09-2017	39G7	25	70.5	46	20	3.2	210	55°21.6'	17°19.4'	55°20.3'	17°18.0'	15:50	16:20	30	235.790	471.580	32.786	193.944	9.060									
20	22-09-2017	39G7	25	67.5	42	20	3.2	180	55°27.5'	17°40.0'	55°26.0'	17°39.6'	6:45	7:15	30	42.864	85.728	0.164	40.610	1.770				0.320					
21	22-09-2017	39G7	25	83.5	53.5	20	3.0	180	55°17.9'	17°39.8'	55°16.5'	17°39.9'	9:10	09:40	30	173.645	347.290	64.660	108.110	0.740				0.135					
22	22-09-2017	39G7	25	43	21	18	3.0	200	55°09.6'	17°53.5'	55°08.3'	17°58.4'	15:00	15:30	30	44.500	89.000	32.700	11.800										
23	22-09-2017	39G8	26	78	46.5	20	3.2	190	55°21.5'	18°02.2'	55°20.0'	18°01.8'	18:15	18:45	30	71.458	142.916	0.278	70.250	0.650					0.280				
24	23-09-2017	40G7	25	69.5	45	20	3.3	235	55°35.4'	17°58.9'	55°34.6'	17°56.5'	8:40	9:10	30	72.768	145.535	5.625	67.140									0.003	
25	23-09-2017	40G8	26	71.5	43.5	20	3.1	230	55°48.0'	18°11.3'	55°47.5'	18°10.3'	12:25	12:40	15	1997.524	7990.096	1725.348	271.930										0.246
26	23-09-2017	39G8	26	86	46	20	3.2	225	55°26.6'	18°18.9'	55°25.7'	18°17.2'	17:40	18:10	30	205.590	411.180		204.900	0.690									
27	24-09-2017	38G8	26	91.5	50	18	3.1	290	54°55.2'	18°43.6'	54°55.8'	18°41.2'	14:50	15:20	30	196.433	392.866	23.666	172.444					0.118		0.205			
28	24-09-2017	39G8	26	89	57.5	19.5	3.2	285	55°04.4'	18°38.4'	55°04.9'	18°36.0'	17:40	18:10	30	95.327	190.654	5.881	87.801	1.645									
29	25-09-2017	40G8	26	85.5	56	16	3.0	270	55°32.3'	18°38.6'	55°32.4'	18°36.2'	08:30	09:00	30	62.005	124.010	29.520	31.560	0.925									
30	25-09-2017	40G8	26	111	40	20	3.3	250	55°49.5'	18°37.2'	55°50.2'	18°33.6'	12:50	13:35	45	98.315	131.087	25.580	69.780	2.955									
31	25-09-2017	40G8	26	92	46	20	3.2	295	55°46.9'	18°53.7'	55°47.5'	18°49.9'	17:40	18:25	45	39.471	52.628	0.811	38.660										
32	26-09-2017	39G8	26	81	46	19	3.1	285	55°14.0'	18°58.5'	55°14.4'	18°54.9'	8:45	9:30	45	116.080	154.773	9.972	106.108										
33	26-09-2017	39G8	26	100.5	80	19	3	285	54°54.7'	18°58.5'	54°55.1'	18°56.1'	13:30	14:00	30	88.221	176.442	0.281	77.300	10.640									
34	26-09-2017	39G8	26	81.5	60	19.5	3	180	54°38.2'	19°00.0'	54°36.7'	19°00.0'	17:10	17:40	30	82.760	165.520	0.540	82.220										
35	27-09-2017	39G9	26	70.5	45	20	3.1	270	54°30.0'	19°22.0'	54°30.0'	19°19.5'	8:15	8:45	30	152.323	304.646	0.865	140.333	11.125									
36	27-09-2017	39G9	26	79	57	20	3.2	275	54°34.0'	19°12.8'	54°34.1'	19°10.1'	10:45	11:15	30	541.600	1083.200	98.932	433.448	8.32	0.115	0.785							
37	27-09-2017	38G9	26	108	60	20	3.3	270	54°50.0'	19°17.4'	54°50.0'	19°13.7'	15:25	16:10	45	47.306	63.075	4.44	31.84	11.026									
38	28-09-2017	37G9	26	48.5	26.5	20	3.4	270	54°25.0'	19°15.1'	54°25.0'	19°12.4'	8:35	9:05	30	74.361	148.722	18.952	46.178	1.531	0.21	7.37				0.12			
39	28-09-2017	37G8	26	65	40	20	3.2	310	54°50.0'	19°17.4'	54°50.0'	19°13.7'	12:20	12:50	30	85.485	170.970	35.371	49.349	0.540	0.225								

Note: the catch-station No. 1 should be considered as invalid, because the technical problems appeared during the fishing process.

Table 4. The mean numerical share of young, undersized fishes per ICES SDs.

Spieces	Length	Average share (% of number indiv.) SD 24	SD 25	SD 26	Average
Sprat	<10 cm	0	0,25	2,86	1,16
Herring	<16 cm	41,15	25,96	20,54	23,83
Cod	<35 cm	-	60,81	26,67	46,64

Table 5. Cruise statistics of the Polish BIAS survey on-board of the r.v. "Baltica", 13.09.-30.09.2017.

SD	ICES Rectangle	EDSU [NM]	<σ> [$m^2 * 10^{-4}$]	<S_A> [m^2/NM^2]	Area [NM^2]	species composition [%] sprat	herring	cod	Abundance *(10^6) total	sprat	herring	cod
24	38G4	24	1.71	253.5	1034.8	96.2	3.8	0.000	1533.5	1474.5	59.0	0.000
Sum SD24		24		253.5	1034.8				1533.5	1474.5	59.0	0.000
25	37G5	47	1.78	178.6	642.2	58.5	41.2	0.303	643.9	376.8	265.1	1.951
25	38G5	81	2.92	191.1	1035.7	33.7	66.0	0.254	677.4	228.5	447.2	1.719
25	38G6	75	1.85	56.9	940.2	58.9	41.1	0.000	289.9	170.8	119.0	0.000
25	38G7	24	1.73	9.8	471.7	80.9	19.1	0.003	26.7	21.6	5.1	0.001
25	39G5	30	2.36	334.5	979.0	68.4	31.2	0.439	1385.8	948.0	431.8	6.084
25	39G6	85	2.26	178.7	1026.0	60.0	39.9	0.105	810.2	486.3	323.1	0.855
25	39G7	103	2.35	125.9	1026.0	51.6	48.3	0.120	549.4	283.5	265.2	0.659
25	40G7	23	3.44	383.8	1013.0	11.6	88.2	0.175	1129.3	130.8	996.6	1.974
Sum SD25		468		182.0	7133.8				5512.6	2646.3	2853.1	13.244
26	37G8	9	1.46	549.2	86.0	41.1	58.9	0.016	323.6	133.1	190.5	0.053
26	37G9	22	2.20	1333.1	151.6	17.5	82.3	0.274	919.3	160.4	756.3	2.519
26	38G8	49	3.74	248.9	624.6	15.5	84.0	0.482	415.9	64.4	349.4	2.006
26	38G9	65	3.13	381.9	918.2	22.6	76.8	0.603	1120.0	253.2	860.0	6.749
26	39G8	92	3.39	251.8	1026.0	11.9	88.0	0.073	762.7	90.8	671.3	0.554
26	39G9	25	2.95	99.1	1026.0	28.6	70.5	0.889	344.8	98.5	243.2	3.067
26	40G8	99	2.28	157.1	1013.0	57.1	42.8	0.080	700.6	399.9	300.1	0.563
Sum SD26		361		431.7	4845.4				4586.8	1200.4	3370.9	15.511

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, 13.09-30.09.2017.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum sprat [mln indivi.]
24	38G4	0.00	271.86	276.26	631.81	195.98	98.57	0.00	0.00	0.00	1474.49
Sum SD24		0.00	271.86	276.26	631.81	195.98	98.57	0.00	0.00	0.00	1474.49
25	37G5	2.69	51.71	48.00	173.38	71.27	24.57	2.04	3.17	0.00	376.83
25	38G5	2.59	28.23	27.82	102.47	44.77	16.53	3.06	3.00	0.00	228.48
25	38G6	0.82	37.62	26.30	75.76	20.68	7.04	1.58	1.01	0.00	170.82
25	38G7	0.10	3.83	3.06	9.57	3.41	1.19	0.26	0.19	0.00	21.62
25	39G5	0.00	129.03	120.23	442.21	178.02	65.31	2.73	10.43	0.00	947.96
25	39G6	0.00	74.74	63.20	223.93	86.67	30.42	2.95	4.40	0.00	486.31
25	39G7	0.00	53.58	41.96	132.73	38.62	13.61	1.03	1.98	0.00	283.51
25	40G7	0.00	28.02	19.81	61.65	14.91	5.36	0.18	0.86	0.00	130.79
Sum SD25		6.20	406.76	350.38	1221.70	458.35	164.04	13.84	25.05	0.00	2646.33
26	37G8	3.90	28.89	20.40	69.67	6.84	2.36	0.71	0.28	0.07	133.11
26	37G9	1.39	20.48	25.37	88.89	15.04	5.99	1.83	1.00	0.45	160.44
26	38G8	0.67	15.69	9.86	34.26	2.66	0.96	0.25	0.06	0.04	64.44
26	38G9	10.99	46.99	38.15	130.34	16.38	6.64	2.00	1.22	0.46	253.19
26	39G8	0.39	9.86	13.27	49.75	10.06	4.29	1.75	1.23	0.24	90.84
26	39G9	4.65	13.98	15.17	52.37	7.68	3.05	0.93	0.55	0.16	98.54
26	40G8	0.00	25.86	57.61	224.18	54.93	23.77	7.81	3.95	1.75	399.86
Sum SD26		21.99	161.74	179.82	649.48	113.59	47.07	15.29	8.28	3.16	1200.42

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, 13.09-30.09.2017.

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	0.00	3282.86	3873.55	9354.99	3263.28	1705.89	0.00	0.00	0.00	21480.58
Sum SD24		0.00	3282.86	3873.55	9354.99	3263.28	1705.89	0.00	0.00	0.00	21480.58
25	37G5	16.87	615.29	636.72	2473.47	1134.39	392.72	40.40	50.96	0.00	5360.82
25	38G5	16.61	341.34	372.76	1469.95	705.11	263.14	60.43	49.63	0.00	3278.97
25	38G6	4.71	441.96	328.17	1001.85	317.30	108.57	31.14	16.85	0.00	2250.54
25	38G7	0.60	44.98	39.01	131.47	53.30	18.68	5.16	3.17	0.00	296.37
25	39G5	0.00	1588.98	1615.74	6279.35	2750.40	1017.68	54.69	165.58	0.00	13472.42
25	39G6	0.00	909.01	837.23	3152.95	1351.59	474.83	58.02	70.06	0.00	6853.70
25	39G7	0.00	649.59	543.45	1788.44	575.78	205.71	20.46	31.81	0.00	3815.24
25	40G7	0.00	335.73	252.49	809.85	217.08	78.95	3.47	13.42	0.00	1710.98
Sum SD25		38.78	4926.89	4625.57	17107.33	7104.95	2560.27	273.77	401.48	0.00	37039.04
26	37G8	16.24	270.95	220.27	765.07	89.08	31.98	10.14	4.73	0.99	1409.44
26	37G9	5.84	203.53	290.87	1041.34	203.34	84.57	27.14	16.65	6.75	1880.03
26	38G8	3.36	147.25	105.05	366.88	34.10	12.56	3.35	0.93	0.54	674.03
26	38G9	43.99	446.74	422.73	1458.12	220.57	94.40	30.21	20.49	6.97	2744.23
26	39G8	1.65	98.70	155.79	600.90	140.59	63.96	27.87	21.26	3.55	1114.28
26	39G9	17.77	138.11	170.47	601.87	104.17	43.65	14.00	9.33	2.46	1101.84
26	40G8	0.00	275.06	698.97	2783.86	760.83	345.89	117.20	65.45	26.29	5073.54
Sum SD26		88.85	1580.34	2064.15	7618.05	1552.67	677.01	229.91	138.85	47.57	13997.39

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, 13.09-30.09.2017.

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		12.08	14.02	14.81	16.65	17.31				14.57
MW SD24			12.08	14.02	14.81	16.65	17.31				14.57
25	37G5	6.27	11.90	13.27	14.27	15.92	15.98	19.76	16.10		14.23
25	38G5	6.42	12.09	13.40	14.34	15.75	15.91	19.77	16.52		14.35
25	38G6	5.73	11.75	12.48	13.22	15.34	15.41	19.66	16.62		13.17
25	38G7	5.73	11.74	12.75	13.74	15.63	15.67	19.66	16.46		13.71
25	39G5		12.31	13.44	14.20	15.45	15.58	20.00	15.87		14.21
25	39G6		12.16	13.25	14.08	15.59	15.61	19.66	15.93		14.09
25	39G7		12.12	12.95	13.47	14.91	15.12	19.84	16.09		13.46
25	40G7		11.98	12.75	13.14	14.56	14.72	19.66	15.57		13.08
MW SD25		6.2507	12.1125	13.2015	14.0029	15.5011	15.6077	19.7780	16.0285		14.00
26	37G8	4.16	9.38	10.80	10.98	13.03	13.52	14.34	17.17	15.04	10.59
26	37G9	4.21	9.94	11.47	11.71	13.52	14.12	14.79	16.60	15.04	11.72
26	38G8	5.05	9.38	10.66	10.71	12.81	13.13	13.40	16.07	15.04	10.46
26	38G9	4.00	9.51	11.08	11.19	13.46	14.21	15.13	16.79	15.04	10.84
26	39G8	4.27	10.01	11.74	12.08	13.97	14.90	15.90	17.32	15.04	12.27
26	39G9	3.82	9.88	11.24	11.49	13.56	14.33	15.02	17.00	15.04	11.18
26	40G8		10.63	12.13	12.42	13.85	14.55	15.00	16.58	15.04	12.69
MW SD26		4.04	9.77	11.48	11.73	13.67	14.38	15.04	16.77	15.04	11.66

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, 13.09-30.09.2017.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum herring [mln indivi.]
24	38G4	24.77	0.00	2.54	16.29	3.47	5.56	4.18	1.93	0.30	59.03
Sum SD24		24.77	0.00	2.54	16.29	3.47	5.56	4.18	1.93	0.30	59.03
25	37G5	245.18	4.62	2.37	3.96	2.77	2.51	1.86	1.09	0.77	265.14
25	38G5	29.98	17.43	53.97	76.92	62.00	99.88	56.08	28.82	22.11	447.18
25	38G6	68.19	3.82	7.10	11.96	8.57	10.52	5.74	2.06	1.07	119.04
25	38G7	3.19	0.12	0.25	0.38	0.28	0.43	0.26	0.12	0.06	5.09
25	39G5	10.54	21.89	50.29	85.55	54.61	87.99	58.68	32.40	29.84	431.78
25	39G6	35.67	21.36	40.65	70.95	47.09	58.03	30.70	11.24	7.40	323.07
25	39G7	63.42	9.64	25.02	39.74	28.56	46.02	27.81	14.28	10.72	265.20
25	40G7	7.25	43.53	111.66	204.01	129.28	224.82	135.66	71.72	68.65	996.57
Sum SD25		463.41	122.40	291.31	493.47	333.17	530.19	316.78	161.72	140.62	2853.07
26	37G8	161.89	4.28	2.62	8.54	3.20	4.42	1.51	0.82	3.18	190.47
26	37G9	371.38	45.79	37.63	126.00	51.40	68.75	22.37	9.78	23.20	756.30
26	38G8	10.04	4.88	27.43	69.65	33.56	67.84	39.73	18.57	77.75	349.45
26	38G9	119.14	34.13	65.55	181.58	81.97	153.98	72.98	31.57	119.14	860.04
26	39G8	33.26	21.17	56.78	161.32	73.46	139.47	68.35	28.54	88.95	671.29
26	39G9	47.06	9.80	17.00	52.35	23.51	42.13	17.96	6.95	26.45	243.22
26	40G8	27.62	15.24	25.32	81.88	35.79	61.28	23.98	7.40	21.62	300.12
Sum SD26		770.38	135.29	232.33	681.32	302.89	537.88	246.88	103.63	360.29	3370.89

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, 13.09-30.09.2017.

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	289.53	0.00	115.84	565.46	131.77	280.87	207.79	118.76	54.51	1764.52
Sum SD24		289.53	0.00	115.84	565.46	131.77	280.87	207.79	118.76	54.51	1764.52
25	37G5	2797.81	72.10	98.14	143.44	99.58	118.21	99.12	65.64	50.97	3545.00
25	38G5	357.58	544.56	2164.32	3032.25	2450.31	4659.94	2838.46	1664.19	1488.95	19200.57
25	38G6	795.51	109.85	264.85	425.55	316.65	448.92	260.18	109.89	65.39	2796.79
25	38G7	35.92	3.31	9.81	14.47	11.12	19.19	12.40	6.56	3.58	116.36
25	39G5	140.94	658.59	2000.30	3228.94	2135.51	4315.89	3097.40	1898.40	2022.14	19498.10
25	39G6	454.52	636.34	1502.68	2458.97	1720.23	2518.30	1401.08	614.02	479.55	11785.68
25	39G7	747.27	283.32	1007.35	1548.43	1124.20	2139.90	1406.20	814.09	714.04	9784.81
25	40G7	105.59	1306.27	4535.53	7886.20	5115.22	10649.44	7007.15	4102.44	4665.52	45373.35
Sum SD25		5435.13	3614.33	11582.98	18738.25	12972.82	24869.80	16121.99	9275.22	9490.15	112100.67
26	37G8	1379.34	105.25	89.18	282.92	115.60	178.14	73.10	44.93	252.20	2520.66
26	37G9	3256.77	1201.68	1333.41	4243.65	1822.56	2741.89	997.81	458.93	1463.95	17520.65
26	38G8	99.63	159.44	1314.28	3291.73	1667.74	3322.46	2278.58	1169.90	5328.70	18632.44
26	38G9	1181.53	963.35	2832.88	7524.51	3632.46	7013.50	3920.72	1864.59	8141.01	37074.55
26	39G8	350.34	624.49	2551.20	6938.82	3302.80	6374.82	3603.66	1666.62	5617.19	31029.95
26	39G9	474.68	277.26	707.54	2064.35	971.24	1824.01	923.92	391.91	1827.99	9462.91
26	40G8	312.35	439.13	1025.27	3110.23	1362.57	2590.69	1148.23	388.53	1225.55	11602.57
Sum SD26		7054.65	3770.61	9853.76	27456.21	12874.98	24045.50	12946.03	5985.41	23856.59	127843.74

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, 13.09-30.09.2017.

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	11.7		45.7	34.7	38.0	50.5	49.7	61.5	181.0	29.9
MW SD24		11.7		45.7	34.7	38.0	50.5	49.7	61.5	181.0	29.9
25	37G5	11.4	15.6	41.4	36.2	36.0	47.1	53.4	60.2	66.0	13.4
25	38G5	11.9	31.2	40.1	39.4	39.5	46.7	50.6	57.8	67.3	42.9
25	38G6	11.7	28.7	37.3	35.6	36.9	42.7	45.3	53.4	61.0	23.5
25	38G7	11.2	26.7	39.7	38.2	39.0	45.1	48.6	55.0	61.0	22.9
25	39G5	13.4	30.1	39.8	37.7	39.1	49.1	52.8	58.6	67.8	45.2
25	39G6	12.7	29.8	37.0	34.7	36.5	43.4	45.6	54.6	64.8	36.5
25	39G7	11.8	29.4	40.3	39.0	39.4	46.5	50.6	57.0	66.6	36.9
25	40G7	14.6	30.0	40.6	38.7	39.6	47.4	51.7	57.2	68.0	45.5
MW SD25		11.7	29.5	39.8	38.0	38.9	46.9	50.9	57.4	67.5	39.3
26	37G8	8.5	24.6	34.0	33.1	36.1	40.3	48.4	55.0	79.3	13.2
26	37G9	8.8	26.2	35.4	33.7	35.5	39.9	44.6	46.9	63.1	23.2
26	38G8	9.9	32.6	47.9	47.3	49.7	49.0	57.3	63.0	68.5	53.3
26	38G9	9.9	28.2	43.2	41.4	44.3	45.5	53.7	59.1	68.3	43.1
26	39G8	10.5	29.5	44.9	43.0	45.0	45.7	52.7	58.4	63.1	46.2
26	39G9	10.1	28.3	41.6	39.4	41.3	43.3	51.4	56.3	69.1	38.9
26	40G8	11.3	28.8	40.5	38.0	38.1	42.3	47.9	52.5	56.7	38.7
MW SD26		9.2	27.9	42.4	40.3	42.5	44.7	52.4	57.8	66.2	37.9

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, 13.09-30.09.2017.

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Sum cod [mln indivi.]
24	38G4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum SD24		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	37G5	0.00	0.00	0.00	0.00	0.98	0.98	0.00	0.00	0.00	1.95
25	38G5	0.00	0.00	0.37	0.67	0.55	0.12	0.00	0.00	0.00	1.72
25	38G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	38G7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	39G5	0.00	0.00	2.70	2.04	1.07	0.26	0.02	0.00	0.00	6.08
25	39G6	0.00	0.00	0.16	0.34	0.27	0.07	0.01	0.00	0.00	0.85
25	39G7	0.00	0.00	0.01	0.07	0.45	0.11	0.01	0.00	0.00	0.66
25	40G7	0.00	0.00	0.00	0.47	0.85	0.66	0.00	0.00	0.00	1.97
Sum SD25		0.00	0.00	3.24	3.60	4.16	2.19	0.04	0.00	0.00	13.24
26	37G8	0.00	0.00	0.00	0.00	0.04	0.01	0.01	0.00	0.00	0.05
26	37G9	0.00	0.00	0.08	0.61	1.74	0.05	0.04	0.00	0.00	2.52
26	38G8	0.00	0.00	0.16	0.67	0.84	0.28	0.05	0.00	0.00	2.01
26	38G9	0.00	0.00	0.44	3.00	2.51	0.43	0.27	0.10	0.00	6.75
26	39G8	0.00	0.00	0.04	0.27	0.25	0.00	0.00	0.00	0.00	0.55
26	39G9	0.00	0.00	0.14	1.30	0.94	0.42	0.13	0.14	0.00	3.07
26	40G8	0.00	0.00	0.08	0.15	0.24	0.03	0.05	0.00	0.00	0.56
Sum SD26		0.00	0.00	0.94	6.00	6.57	1.22	0.54	0.24	0.00	15.51

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, 13.09-30.09.2017.

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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum SD24		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	37G5	0.00	0.00	0.00	0.00	1058.57	1058.57	0.00	0.00	0.00	2117.13
25	38G5	0.00	0.00	78.00	194.53	247.72	57.36	2.00	0.00	0.00	579.62
25	38G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	38G7	0.00	0.00	0.00	0.00	0.30	0.07	0.00	0.00	0.00	0.37
25	39G5	0.00	0.00	462.50	489.51	475.00	131.85	8.77	0.00	0.00	1567.62
25	39G6	0.00	0.00	41.62	96.00	145.92	49.47	5.38	0.00	0.00	338.39
25	39G7	0.00	0.00	3.53	24.18	263.42	71.56	10.37	0.00	0.00	373.06
25	40G7	0.00	0.00	0.00	167.55	501.38	516.62	0.00	0.00	0.00	1185.55
Sum SD25		0.00	0.00	585.65	971.77	2692.30	1885.50	26.52	0.00	0.00	6161.74
26	37G8	0.00	0.00	0.00	0.00	48.72	2.83	2.83	0.00	0.00	54.37
26	37G9	0.00	0.00	15.87	247.03	2177.31	28.47	25.64	0.00	0.00	2494.32
26	38G8	0.00	0.00	24.03	290.45	464.07	226.10	36.19	0.00	0.00	1040.85
26	38G9	0.00	0.00	90.39	1210.06	1304.28	355.83	166.37	79.76	0.00	3206.69
26	39G8	0.00	0.00	8.97	105.77	158.42	0.00	0.00	0.00	0.00	273.16
26	39G9	0.00	0.00	29.28	562.01	450.74	398.20	79.20	108.74	0.00	1628.16
26	40G8	0.00	0.00	19.05	56.14	130.86	16.57	29.20	0.00	0.00	251.82
Sum SD26		0.00	0.00	187.59	2471.45	4734.41	1027.99	339.42	188.50	0.00	8949.36

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, 13.09-30.09.2017 .

SD	ICES Rectangle	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+	Mean W cod [g]
24	38G4										
MW SD24											
25	37G5					1085.00	1085.00				1085.00
25	38G5			210.51	288.31	453.56	460.61	566.11			337.09
25	38G6										
25	38G7					462.00	462.00				462.00
25	39G5			171.57	239.66	441.99	516.12	566.11			257.67
25	39G6			254.81	280.92	538.68	713.51	566.11			395.87
25	39G7			259.47	340.28	586.31	647.42	696.88			565.79
25	40G7				356.43	592.54	785.00				600.48
MW SD25				180.58	269.93	646.65	859.48	610.95			465.25
26	37G8					1157.63	537.00	537.00			1033.50
26	37G9			207.00	404.43	1248.62	593.21	638.36			990.04
26	38G8			149.75	434.73	551.58	799.56	676.38			518.80
26	38G9			205.82	403.80	519.07	827.27	621.01	780.00		475.14
26	39G8			243.00	396.41	633.97					493.41
26	39G9			210.00	431.47	479.91	946.13	631.26	780.00		530.88
26	40G8			225.60	373.31	535.31	515.05	565.64			447.21
MW SD26				200.18	412.23	720.22	843.17	624.03	780.00		576.98

Table 15. Values of the basic meteorological and hydrological parameters recorded in September 2017 at the positions of the r.v. "Baltica" fish control catches.

Haul	Symbol	Data	Average	Temperature	Salinity	Oxygen	Atmospheric	Temperature	Wind	Wind	Sea

number	Of station		depth	[°C]	PSU	[ml/l]	pressure	of air	direcction	Scale	state
			of haul [m]				[hPa]	[°C]		[°B]	[°B]
1	H4	13-09-2017	30	12,73	7,37	4,46	998,1	15,8	S	8	3
2	H38	16-09-2017	36	6,27	8,06	6,08	1011,1	12,8	SSW	3	2
3	H37	16-09-2017	47	6,09	9,66	4,75	1011,8	13,5	SSW	3	2
4	H36	17-09-2017	30,5	10,68	7,81	5,53	1013,2	14,3	ENE	4	2
5	H35	17-09-2017	52,75	6,58	11,55	4,70	1013,8	14,6	ENE	3	2
6	H34	17-09-2017	64	5,98	14,50	3,89	1013,5	14,7	NE	2	2
7	H33	17-09-2017	64	6,31	14,40	3,12	1012,3	14,1	NNE	4	2
8	H32	18-09-2017	45	6,18	9,98	4,23	1009,8	13,8	NW	6	3
9	H31	18-09-2017	33	15,61	7,53	6,28	1011,2	14,2	WNW	5	3
10	H30	18-09-2017	38	6,33	7,95	5,34	1012,1	14,7	WNW	5	3
11	H29	19-09-2017	67,5	6,24	15,59	1,88	1012,2	14,6	W	5	3
12	H28	19-09-2017	48,5	6,28	8,34	4,98	1012,9	14,3	WSW	4	3
13	H27	19-09-2017	34,5	15,48	7,40	6,23	1013,9	14,4	W	5	3
14	H26	20-09-2017	50,25	6,24	7,60	6,39	1015,9	14,7	SSW	4	2
15	H25	20-09-2017	48,25	5,63	7,65	5,88	1015,9	15,2	SW	5	3
16	H24	20-09-2017	57	5,36	8,16	4,13	1016,5	14,7	SW	4	2
17	H23	21-09-2017	21	16,39	7,28	6,63	1018,8	14,9	N	3	2
18	H22	21-09-2017	62	6,56	10,55	3,81	1019,1	14,9	N	3	2
19	H21	21-09-2017	56	5,07	7,81	4,23	1018,8	13,9	N	4	2
20	H20	22-09-2017	52	4,94	7,82	4,43	1016,2	13,8	N	4	2
21	H19	22-09-2017	63,5	6,39	11,06	4,92	1016,3	14,8	NE	4	2
22	H18	22-09-2017	30	15,97	7,26	6,56	1017,9	14,7	E	3	2
23	H17	22-09-2017	56,5	5,30	8,28	3,86	1019,4	15,5	ESE	3	2
24	H16	23-09-2017	55	4,93	7,85	3,40	1021,6	15,2	ENE	3	2
25	H15	23-09-2017	53,5	5,38	9,48	2,76	1021,9	15,5	N	3	2
26	H14	23-09-2017	56	5,22	8,09	3,77	1021,4	15,4	ENE	5	3
27	H13	24-09-2017	59	5,63	8,85	4,13	1025,7	16,2	ENE	5	2
28	H12	24-09-2017	67,25	5,74	10,30	2,97	1025,9	16,4	ENE	5	3
29	H11	25-09-2017	64	5,18	7,62	7,00	1029	15,7	E	6	3
30	H10	25-09-2017	50	5,08	7,41	7,31	1029,7	15,1	E	6	3
31	H9	25-09-2017	56	5,14	7,42	6,75	1029,9	16,3	E	5	3
32	H8	26-09-2017	55,5	5,35	7,43	6,47	1031,7	15,5	E	5	2
33	H7	26-09-2017	89,5	6,62	12,64	0,96	1031,1	16,3	E	4	2
34	H6	26-09-2017	69,75	5,74	11,15	2,57	1030,4	17,3	E	5	2
35	H3	27-09-2017	55	5,38	8,50	1,82	1033,9	13,6	ESE	4	2
36	H2	27-09-2017	67	5,71	11,12	1,74	1034,2	14,7	SE	5	2
37	H1	27-09-2017	70	5,49	10,15	1,68	1033,8	17	ESE	5	3
38	H4b	28-09-2017	36,5	5,15	8,03	5,57	1034,8	12,4	SE	4	1
39	H5	28-09-2017	50	5,28	8,63	3,46	1034	14,6	ESE	4	2

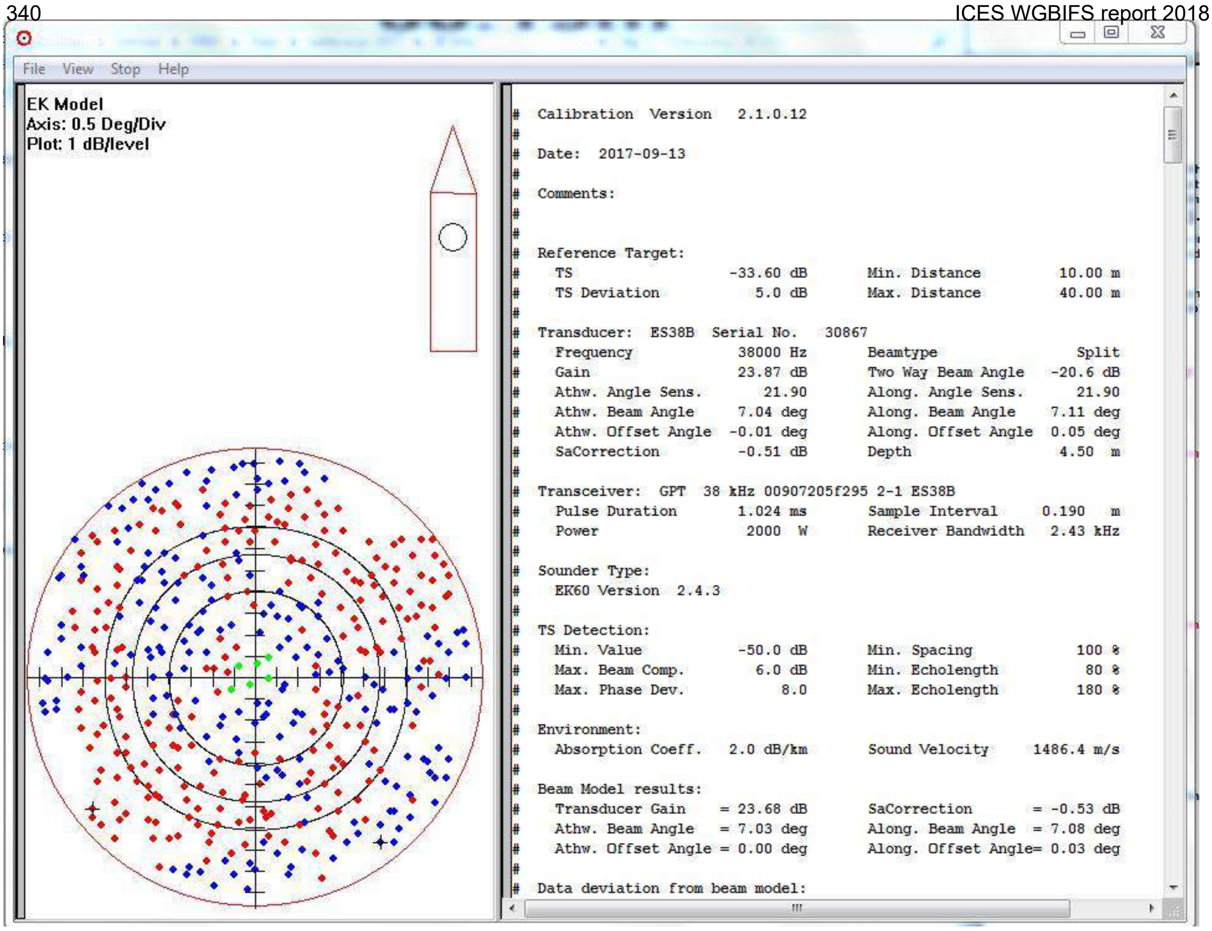

Fig.1. A screenshot after finishing calibration of the 38 kHz transducer.

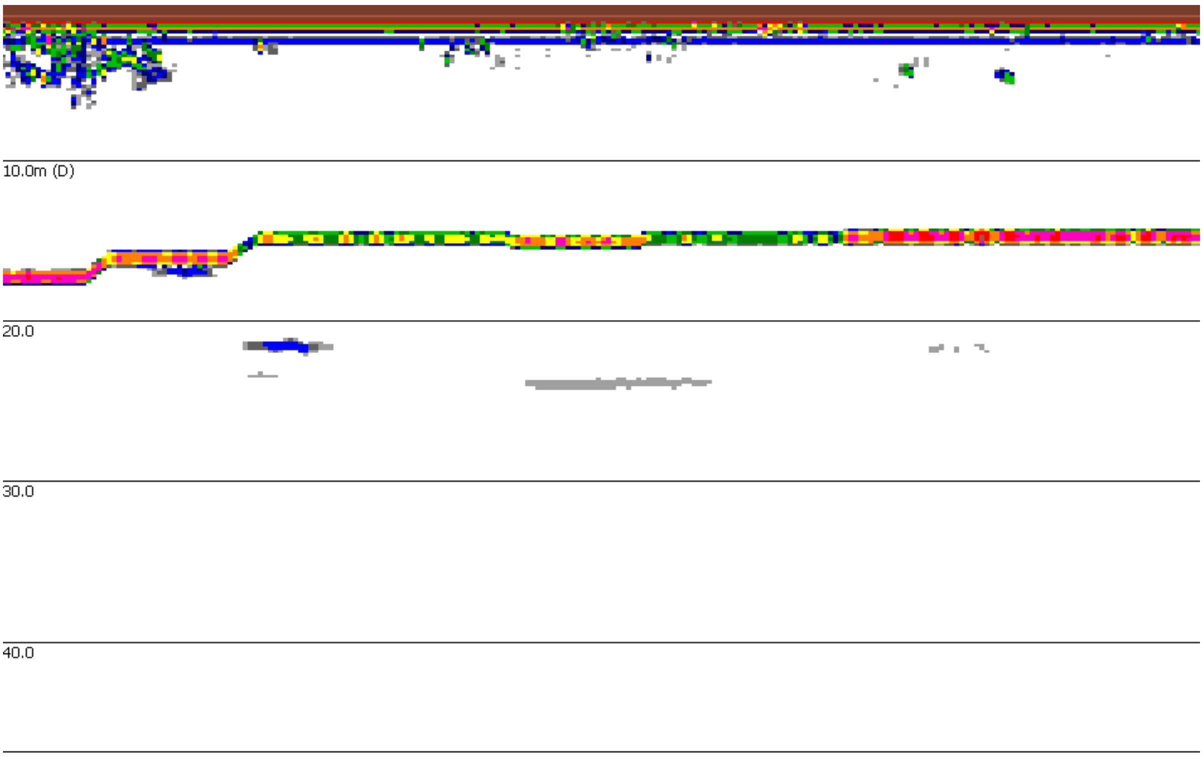

Fig. 2. Observed position of the calibration sphere for the 38 kHz transducer.

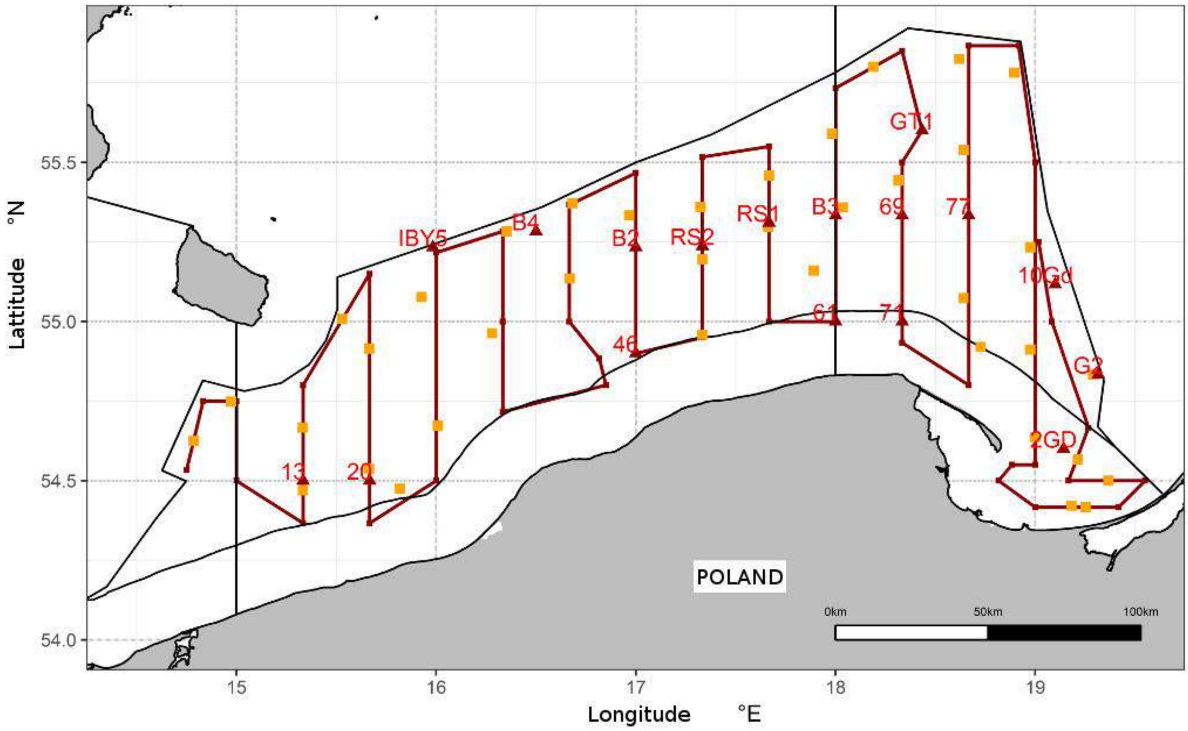

Fig. 3. A map showing realised cruise tracks.

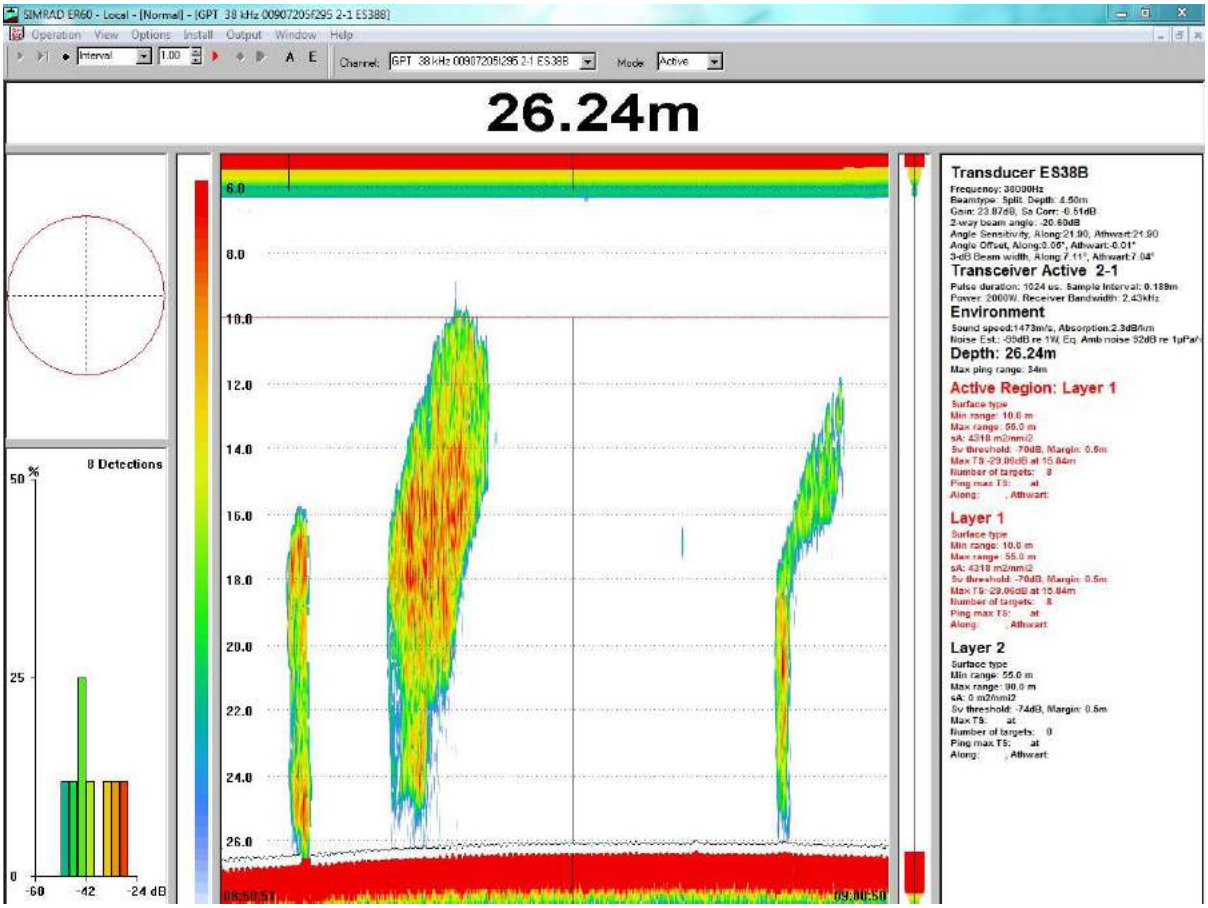

Fig. 4. A screenshot from the SIMRAD EK60 software showing a large school of clupeids with the NASC over 4300 in the ICES rectangle 37G9 near Krynica Morska (south-eastern part of the Gulf of Gdansk).

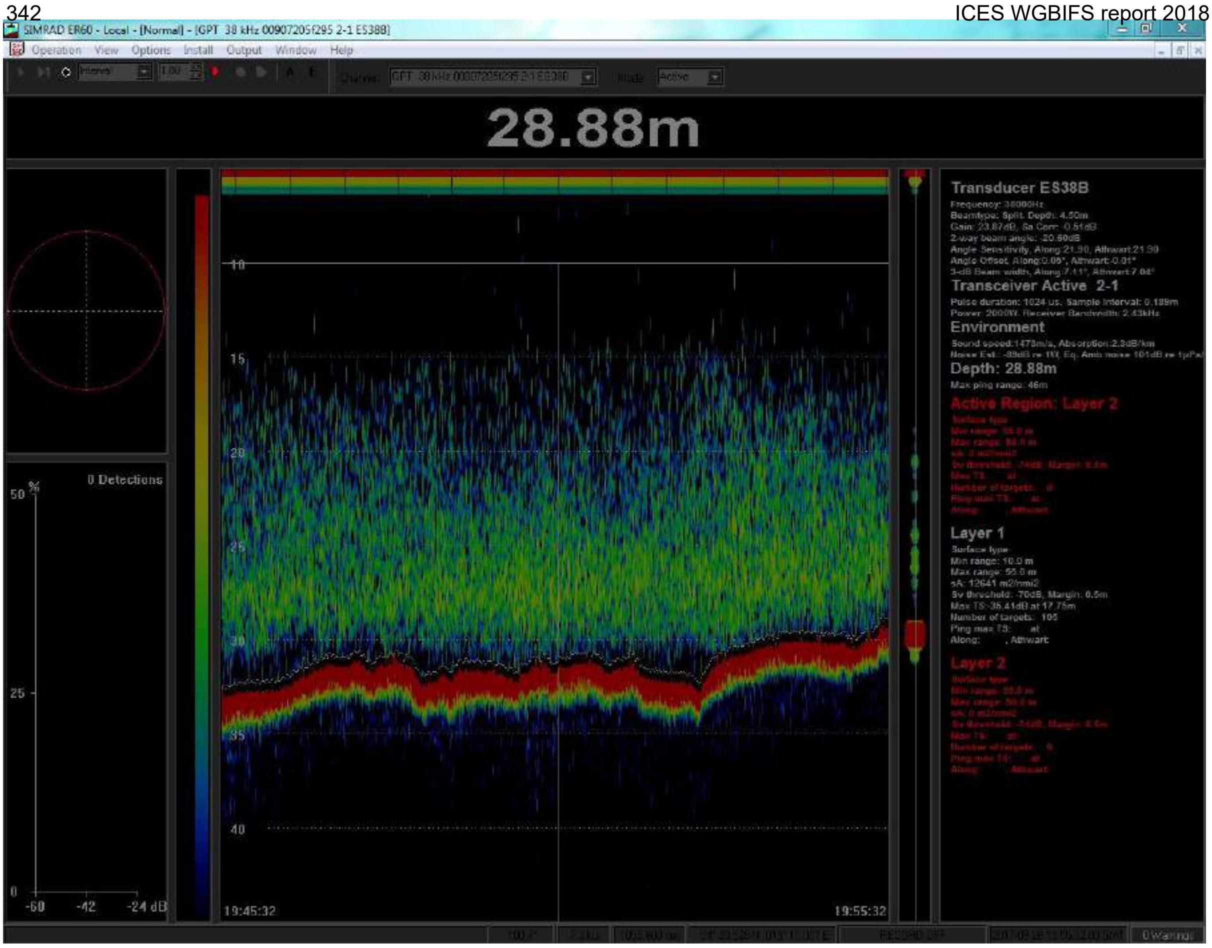

Fig. 5. A screenshot from the SIMRAD EK60 software showing dispersed clupeids after the sunset in the ICES rectangle 37G9 near Krynica Morska (south-eastern part of the Gulf of Gdansk).

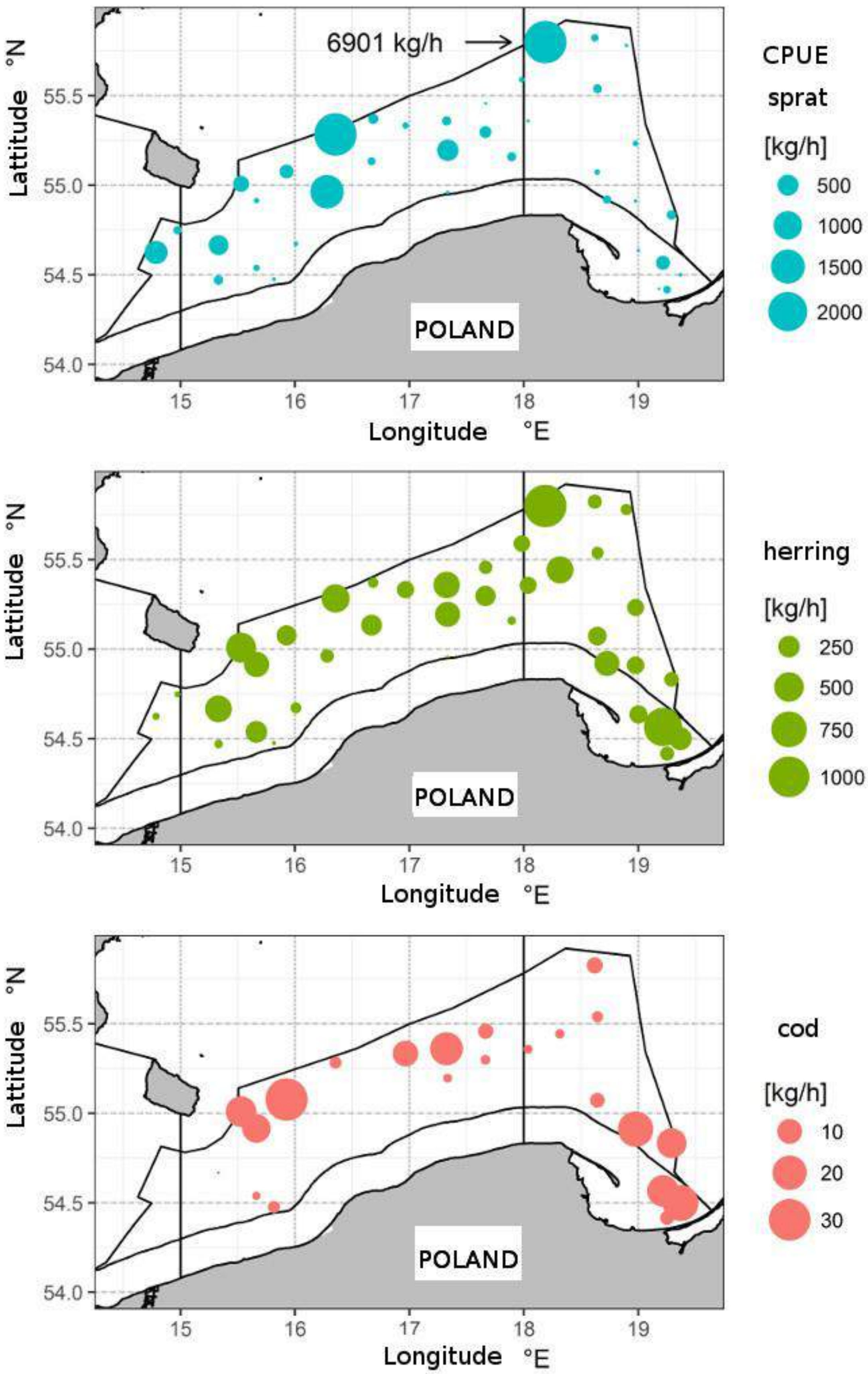

Fig. 6. Mean CPUE [kg h^{-1}] per species in Polish EEZ per single pelagic haul

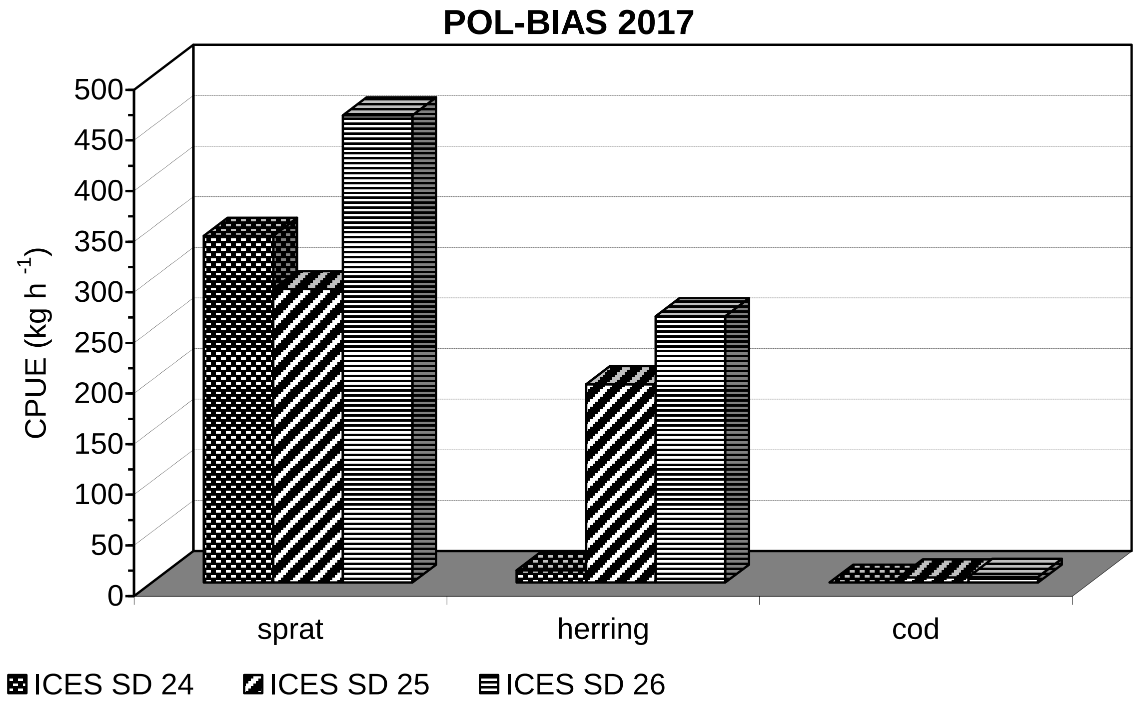

Fig. 7. Mean CPUE [kg h^{-1}] per fish species and the ICES SDs.

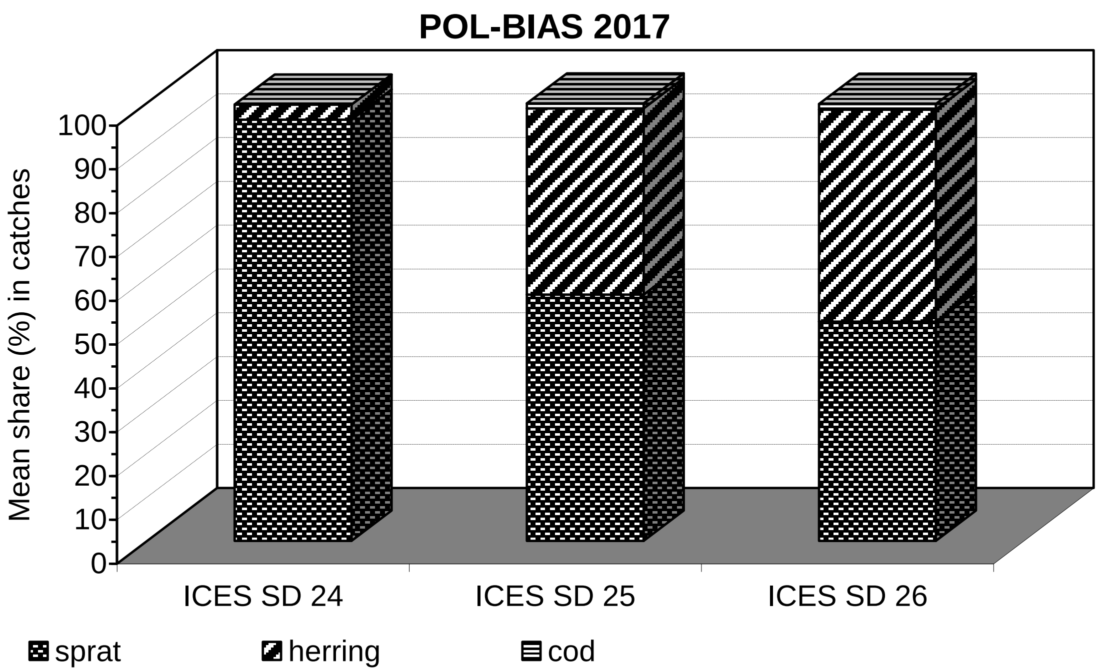

Fig. 8. Mean share (%) of sprat, herring, cod and other fishes in the mass of total catches per the ICES SDs.

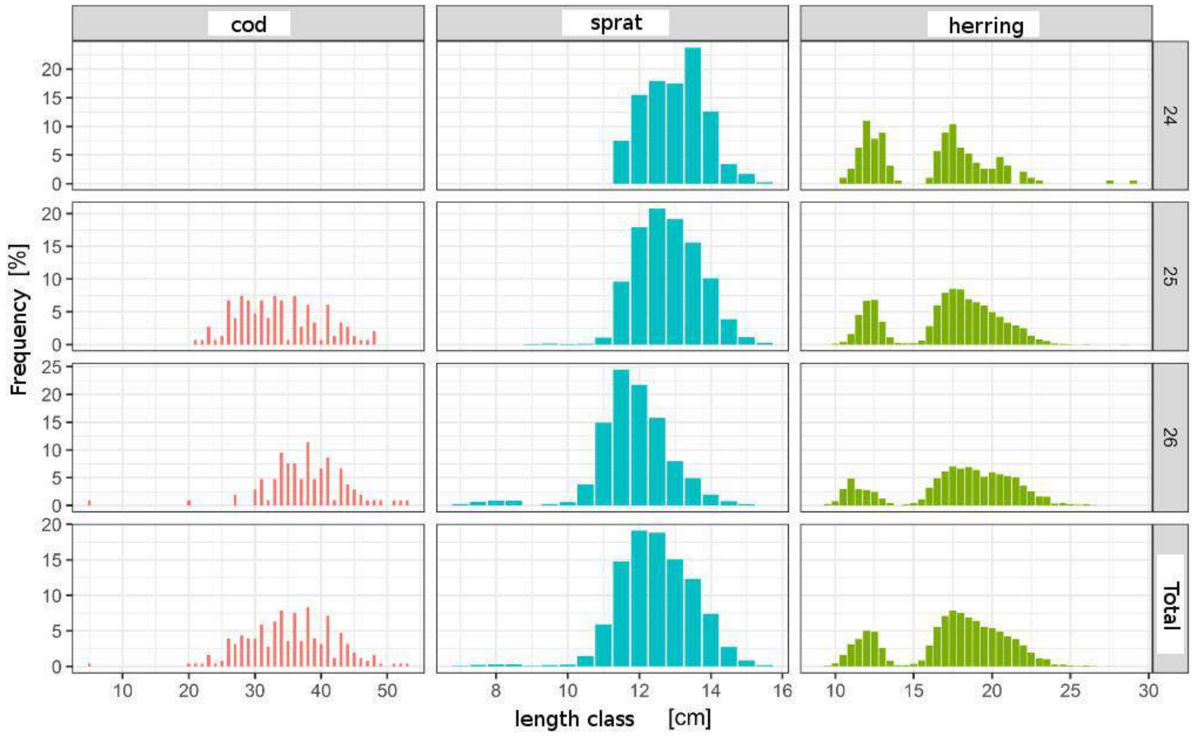

Fig. 9. Length distribution of cod, sprat and herring in samples taken from the control catches.

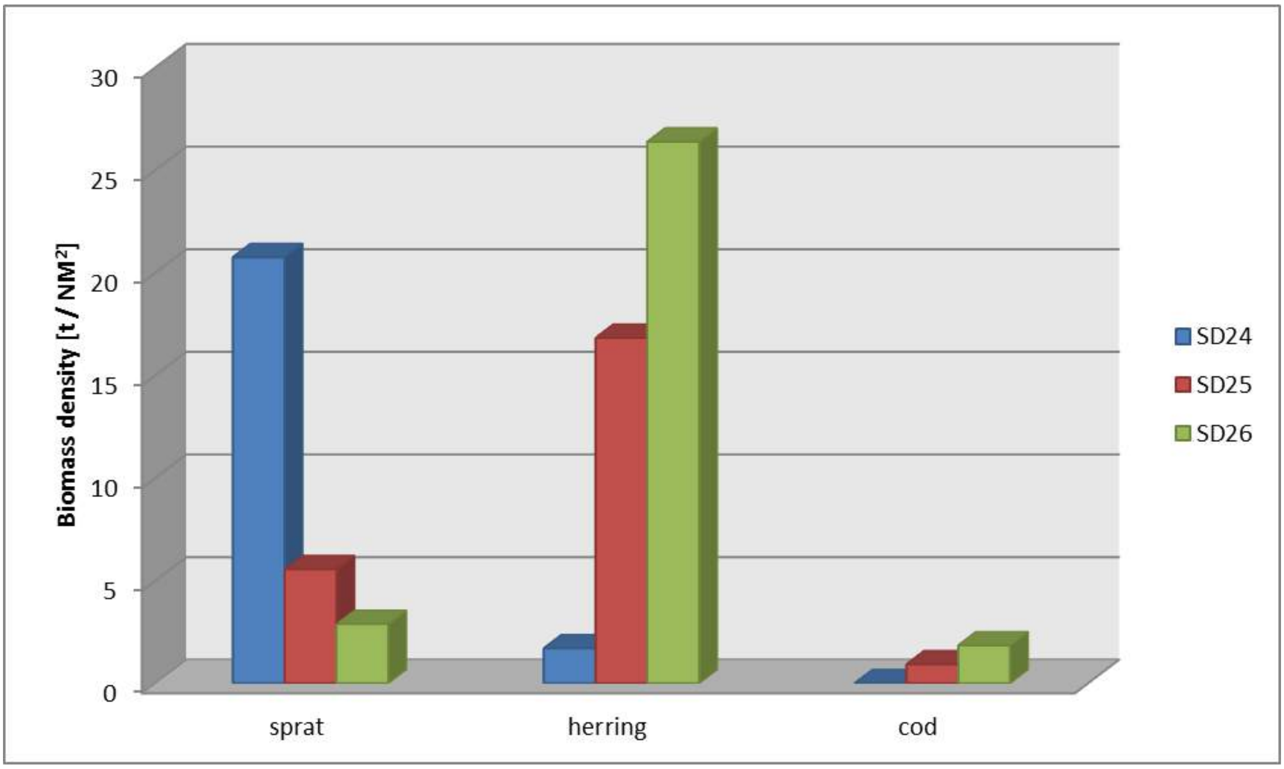

Fig. 10. Total biomass density in the ICES Sub-divisions for the three major species during BIAS 2017.

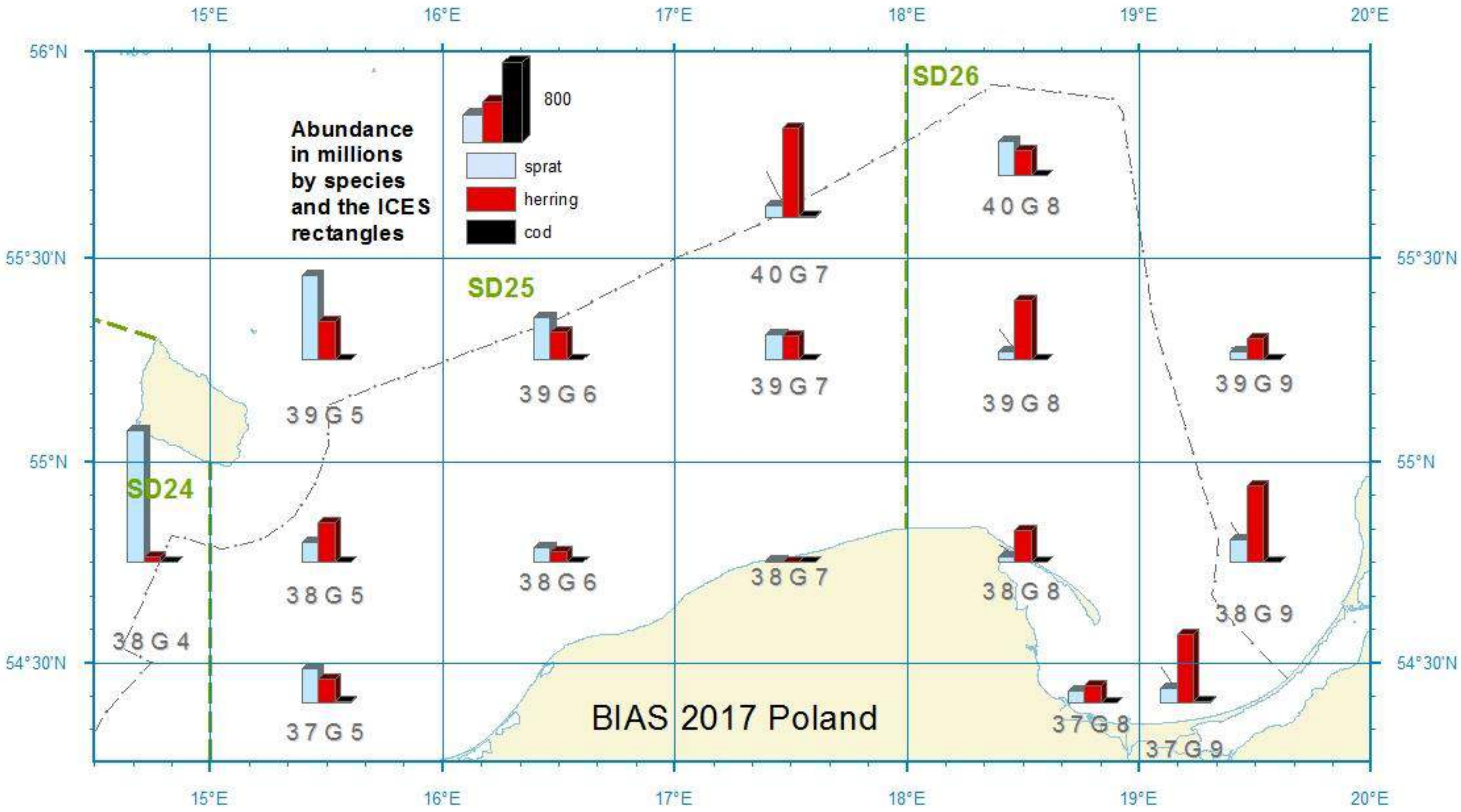

*Fig. 11. Cruise statistics (the black bar's size in a legend represents 700*10⁶ of indiv.).*

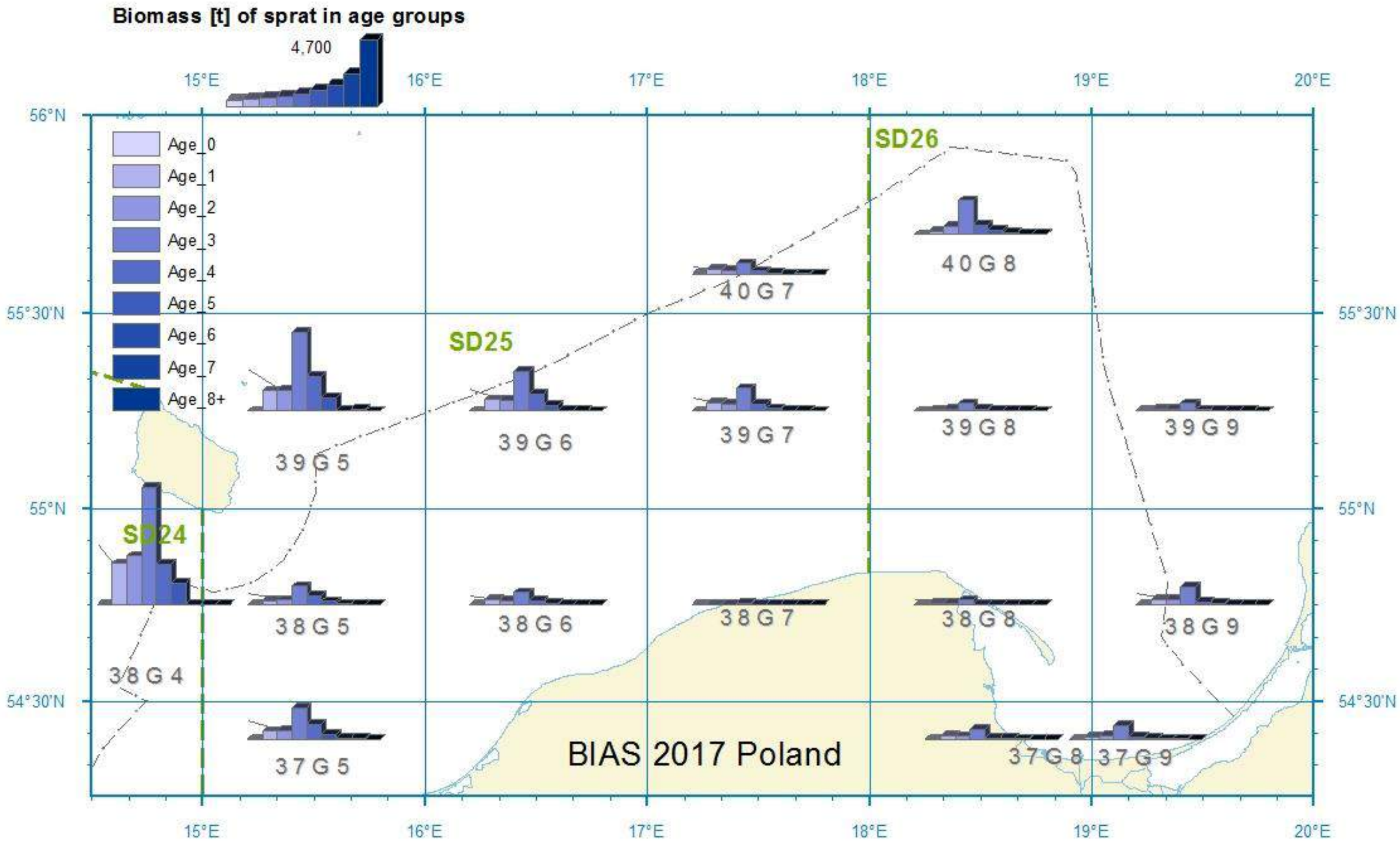

Fig. 12. Biomass of sprat (in tons) per age groups, ICES rectangles and ICES SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13-30.09.2017. The largest bar's size in the legend represents 4700 t.

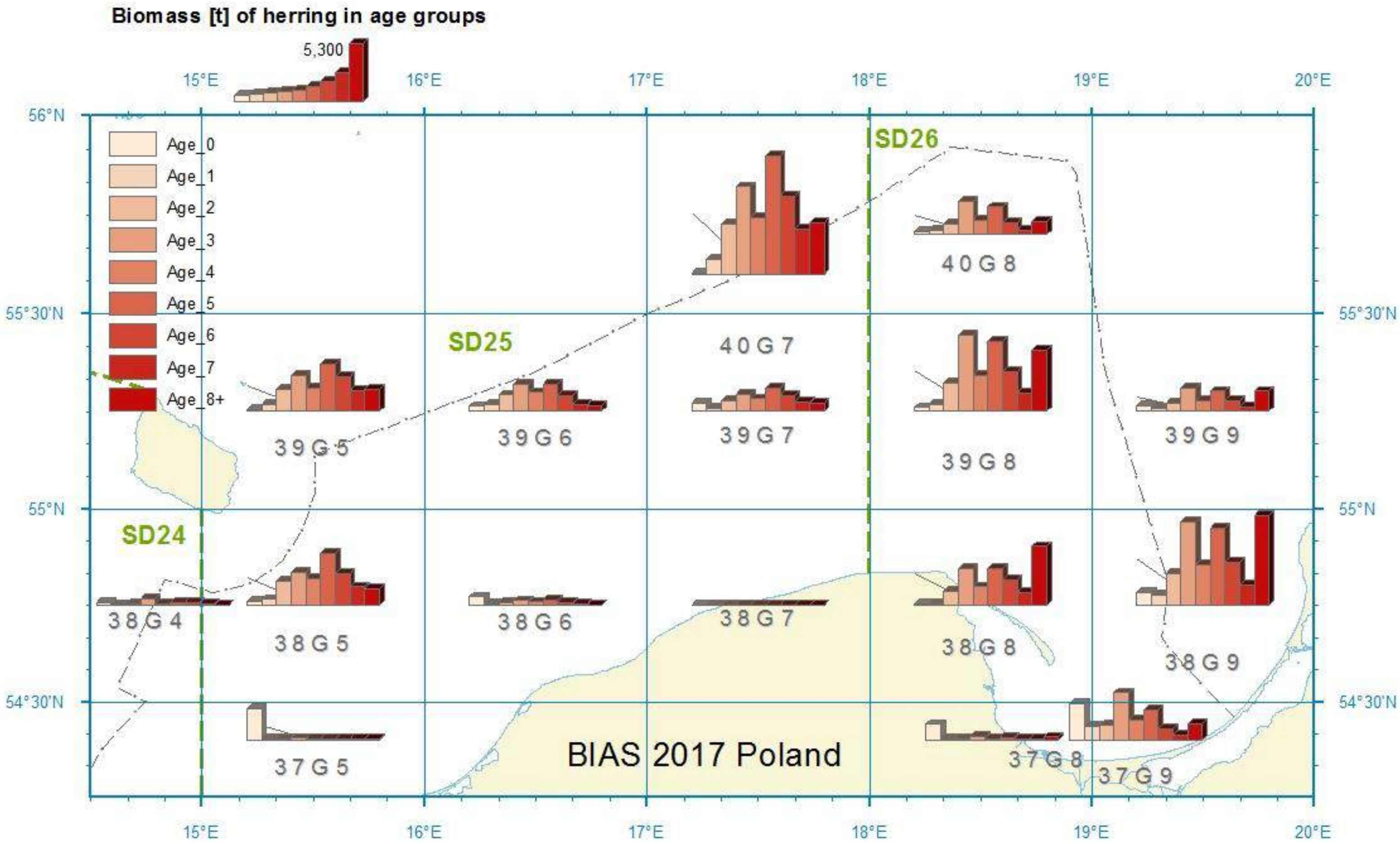

Fig. 13. Biomass of herring (in tons) per age groups, ICES rectangles and ICES SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13-30.09.2017. The largest bar's size in the legend represents 5300 t.

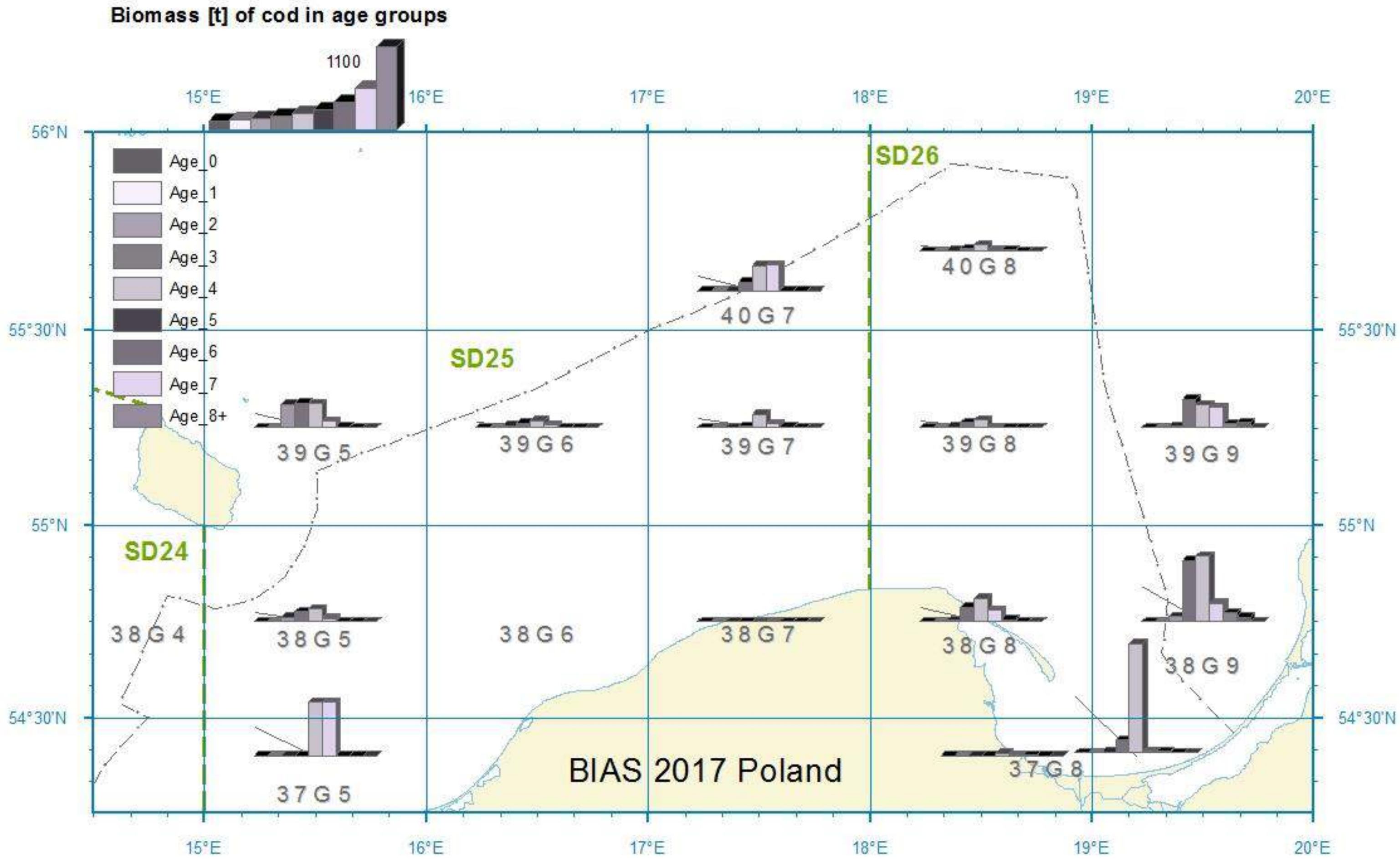

Fig. 14. Biomass of cod in tons per age groups, ICES rectangles and ICES SDs, estimated using acoustic method based on data collected during the Polish BIAS survey on board of the r.v. Baltica, 13-30.09.2017. The largest bar's size in the legend represents 260 t.

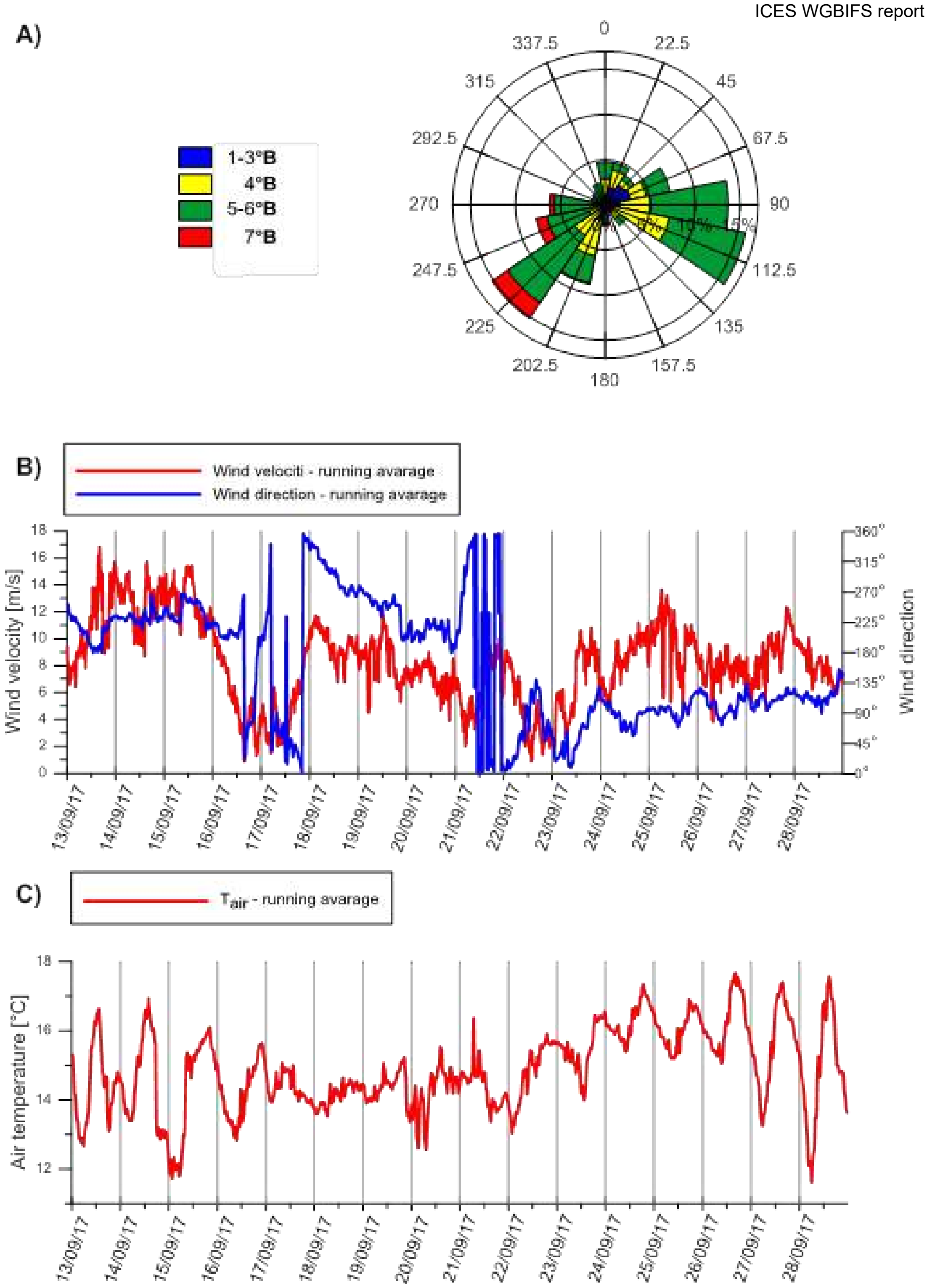

Fig. 15. Changes of meteorological parameters during consecutive days of the Polish BIAS survey (September 2017).

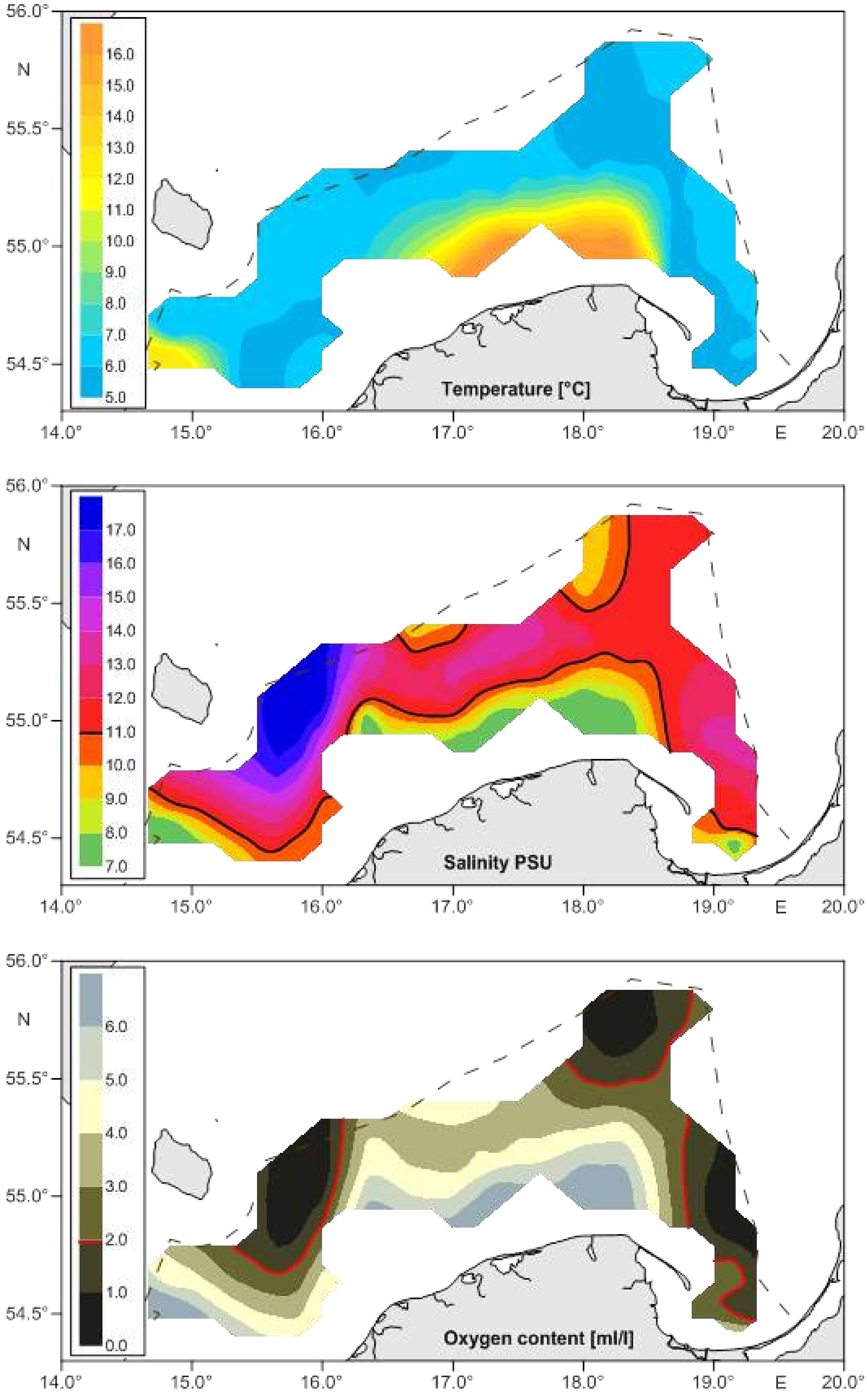

Fig. 16. Horizontal distribution of the seawater temperature, salinity and oxygen content in near the seabed layer of the southern Baltic (September 2017).

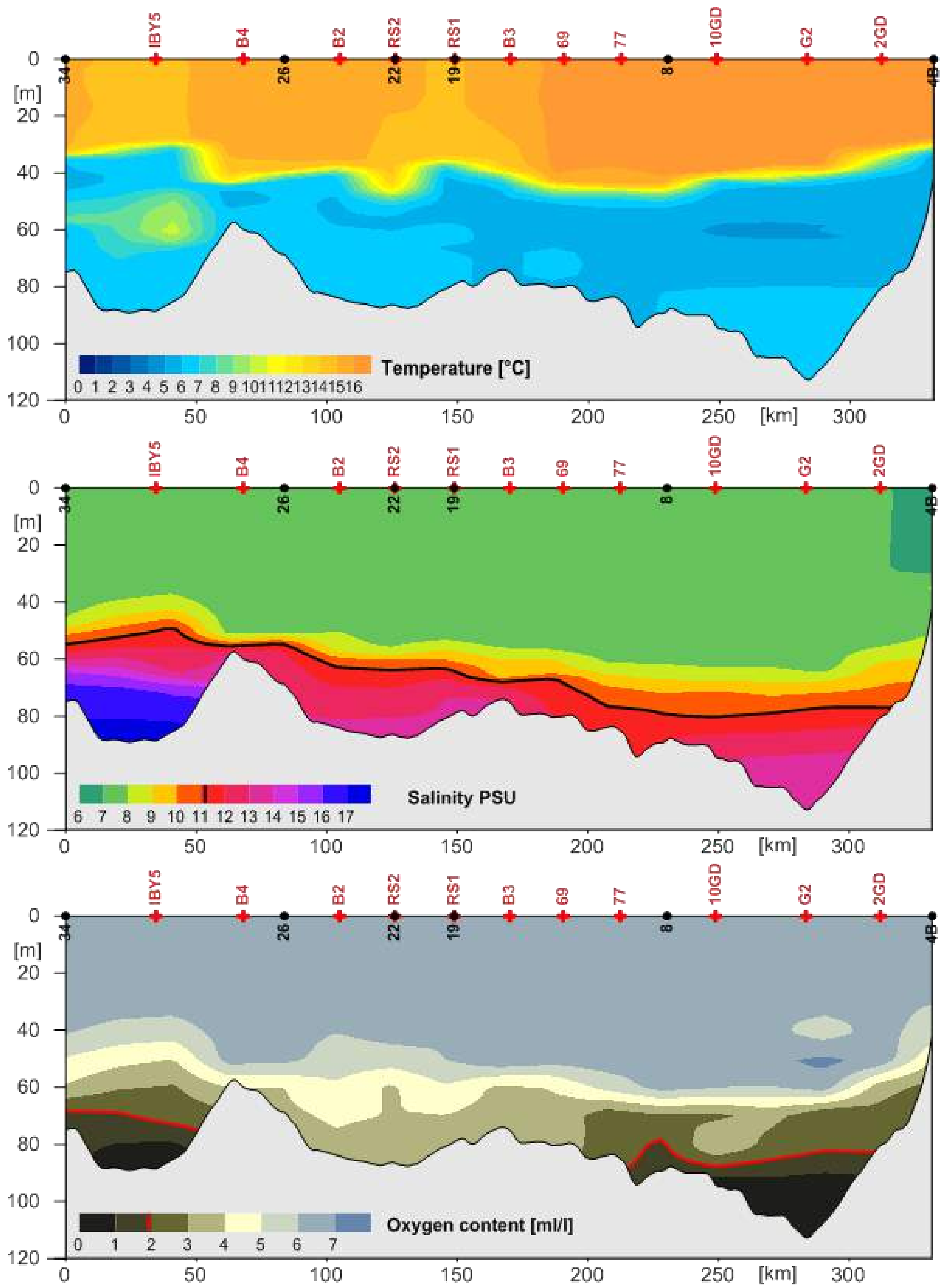

Fig. 17. Vertical distribution of the seawater temperature, salinity and oxygen content, along the research profile determined in the southern Baltic (September 2017); X- and Y-axes reflects distance (in kilometers) and depth (in meters) from the sea surface to the seabed, respectively.

Federal Research Institute for Rural Areas, Forestry and Fisheries

Thünen Institute of Sea Fisheries (TI-SF)[1]
Thünen Institute of Baltic Sea Fisheries (TI-OF)[2]

Survey Report FRV Solea

German Acoustic Autumn Survey (GERAS)

04 – 23 October 2017

Matthias Schaber[1] & Tomas Gröhsler[2]

1 INTRODUCTION

1.1 Background

The cruise was part of an international hydroacoustic survey providing information on stock parameters of small pelagics in the Baltic Sea, coordinated by the ICES Working Group of International Pelagic Surveys (WGIPS) and the ICES Baltic International Fish Survey Working Group (WGBIFS). Further WGBIFS contributors to the Baltic survey are national fisheries research institutes of Sweden, Poland, Finland, Latvia, Estonia and Lithuania. FRV Solea participated for the 30th time. The survey area covered the western Baltic Sea including Kattegat, Belt Sea, Sound and Arkona Sea (ICES Subdivisions (SD) 21, 22, 23 and 24). Altogether, 1167 nmi (plus 132 nmi night and daytime transects for comparison) of hydroacoustic transects were covered. The survey effort was comparable to previous years.

1.2 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).

The following objectives were planned:

- Hydroacoustic measurements for the assessment of small pelagics in the Kattegat and western Baltic Sea including Belt Sea, Sound and Arkona Sea (ICES Subdivisions 21, 22, 23 and 24)
- (Pelagic) trawling according to hydroacoustic registrations
- Hydrographic measurements on hydroacoustic transects and after each fishery haul
- Identification and recording of species- and length-composition of trawl catches
- Collection of biological samples of herring, sprat and additionally European anchovy and cod for further analyses

1.3 Survey summary

In the majority of sampled rectangles, mean NASC values per nautical mile were distinctly lower than the values measured in 2016 and also often lower than the long-time mean values. Only in altogether seven rectangles in ICES SD 21, 22 and 24, mean NASC values were occasionally distinctly higher than in the previous year (and in 3 cases than the long-time mean). In SD 23, as in 2016, unusually low NASC values (even significantly lower than in the previous year) were measured, indicating absence of the dense aggregations of herring usually observed in that area at this time of the year. It has to be mentioned, that during a repetition of the transect in SD 23 during daytime for comparison, NASC values measured and echorecordings clearly showed presence of a significant amount of clupeids in the area.

For species allocation and identification, altogether 57 fishery hauls were conducted. Vertical hydrography profiles were measured on 87 stations.

2 SURVEY DESCRIPTION & METHODS APPLIED

2.1 Cruise narrative

The 740th cruise of FRV Solea represents the 30th subsequent GERAS survey. Embarkation of scientific crew as well as equipment of FRV Solea with all hydroacoustic equipment and biological sampling gear took place on the morning of October 4th in Kiel harbor. On the same afternoon, Solea left port for the calibration of scientific echosounders. A calibration site off Strande was chosen according to prevailing weather conditions providing acceptable conditions deteriorating towards the evening. After calibration the vessel returned to Kiel harbor in the late evening to allow switching of survey operations to night time. Leaving of port and start of survey was scheduled for October 5th. Hydroacoustic survey operations commenced October 5st at 06:50 PM in SD 22 southeast of

Langeland Island.

Generally, survey operations were conducted during nighttime to account for the more pelagic distribution of clupeids during that time. Adverse weather conditions at the start of the survey required to start survey operations in the comparatively sheltered western Baltic SD 22. After finishing SD 22, FRV Solea steamed to Warnemünde port to allow disembarking of a scientific crew member on October 10th. Survey operations commenced the same evening in SD 24. Due to expected severe weather conditions during the following evening and afterwards, a cruise track waypoint southwest of Bornholm Island was approached the following day and survey operations commenced in an opposing direction to be able to enter Sassnitz harbor for an interruption of survey work the following morning. Accordingly, the survey had to be suspended for one night on October 12th due to bad weather. On October 13th, survey operations commenced on the waypoint near Bornholm Island in westerly directions according to the cruise plan. The rest of SD 24 as well as SD 23 were covered as planned due to favorable weather conditions. In SD 21 (Kattegat), the cruise track in the northernmost rectangles to be covered had to be shortened due to adverse weather conditions but was finished as planned in the remaining subdivision. After accomplishing the regular survey work, a comparative sampling (hydroacoustics and fishery) of the SD 23 (Sound) was conducted to validate weak registrations recorded during the regular, initial passage. Afterwards, Solea entered Copenhagen port on October 21st to switch survey operations back to day time. On October 22nd, a third passage of the Sound (SD 23) transect was conducted (hydroacoustics and fishery) to identify drivers for variable registrations of clupeids in that area. The scientific program was finished on October 22th, 05:15 PM. The ship arrived at Marienehe port on October 23rd, 07:00 AM.

Altogether, the following survey schedule was accomplished:

Belt Sea	(SD 22)	05. - 09.10.
Arkona Sea	(SD 24)	10. - 15.10.
Sound	(SD 23)	16.10.
Kattegat	(SD 21)	17. - 19.10.
Sound (comp.)	(SD 23)	20.10.
Sound (day)	(SD 23)	22.10.

Total survey time	15 nights (+ 1 night / 1 day comparison in SD 23)
Fishery hauls	57
CTD-casts	87
Hydroacoustic transects	1167 nmi (+ 132 nmi transects for comparison)

Overall hydroacoustic transect length was 1167 nmi (2016: 1179 nmi).

2.2 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 1 167 nmi covering a survey area of 12 400 nmi^2 (Figure 1).

2.3 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. Hydroacoustic data were recorded with a Simrad EK80 scientific echosounder with hull-mounted 38, 70, 120 and 200 kHz transducers at a standard ship speed of 10 kn. Post-processing and analysis were conducted with Echoview 8 software (Echoview Software Pty Ltd, 2017). Mean volume back scattering values (sv) were integrated over 1 nmi intervals from 10 m below the surface to ca. 0.5 m over the seafloor. Interferences from surface turbulence, bottom structures and scattering layers were removed from the echogram. The transducer settings applied were in accordance with the specifications provided in ICES (2015, 2017).

2.4 Calibration

All transducers (38, 70, 120 and 200 kHz) were calibrated prior to the beginning of the survey in acceptable but increasingly inclement 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. Calibration results for the 38 kHz transducer are given in Table 1.

2.5 Biological data – trawl hauls

Trawl hauls were conducted with a pelagic gear "PSN388" in midwater layers as well as near the seafloor. Mesh size in the codend was 20 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. To validate and allocate echorecordings, altogether 57 fishery hauls were conducted (Figure 1), out of which 54 (night time) hauls were utilized for further processing. 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).

2.6 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, 87 CTD-profiles were measured (Figure 6).

2.7 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)
Scomber scombrus	= 20 log L (cm) - 84.9	ICES (2017)

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

In accordance with the guidelines in the "SISP Manual of International Baltic Acoustic Surveys (IBAS)" (ICES, 2017) further calculations were performed as follows:

Fish species considered:

Herring	(*Clupea harengus*)
Crystal goby	(*Crystallogobius linearis*)
Cod	(*Gadus morhua*)
Three-spined stickleback	(*Gasterosteus aculeatus*)
Whiting	(*Merlangius merlangus*)
Saithe	(*Pollachius pollachius*)
Mackerel	(*Scomber scombrus*)
Sprat	(*Sprattus sprattus*)
Horse mackerel	(*Trachurus trachurus*)
Norway pout	(*Trisopterus esmarckii*)

Exclusion of trawl hauls with very low catches:

Haul No.	Rectangle	Subdivision (SD)
3	39G0	22
36, 52	40G2	23
37	41G2	23
43	41G1	21
48	41G2	21

Exclusion of day time trawl hauls:

Haul No.	Rectangle	Subdivision (SD)
55-57	40G2	23

Inclusion of hauls with low catches:

Despite low catches 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 the following rectangles:

Haul No.	Rectangle	Subdivision (SD)
1	39G1	22
4	40G1	22
5	41G0	22
6, 7	40G0	22
9	39G0	22
13	38G1	22
17	37G2	24
38, 53	41G2	23
49	42G2	21
50	43G1	21
39, 51	41G2	23

Usage of neighboring trawl information for rectangles which contain only acoustic investigations:

Rectangle/SD to be filled	with Haul No.	of Rectangle/SD
43G2/21	49 and 50	42G2 and 43G1/21
39F9/22	8 and 9	40F9 and 39G0/22
39G2/23	29, 35	39G2/24
37G4/24	21, 24, 25	38G4/24

3 RESULTS

3.1 Hydroacoustic data (M. Schaber)

Figure 2 depicts the spatial distribution of mean NASC values (5 nmi intervals) measured on the hydroacoustic transects covered in 2017, the majority of which can be allocated to clupeids. In almost all rectangles surveyed, mean NASC values were significantly lower than those recorded in 2016, and often also well below the long-time survey average. On ICES subdivision scale, mean NASC values were lower than in the previous year in all subdivisions covered.

In SD 21, overall NASC values measured were low. Only in 2 rectangles (41G1 and 42G1), mean NASC NASC per 1 nmi EDSU was marginally higher in almost all rectangles observed than in the previous year, but still lower than the long-time survey average, as in all rectangles surveyed.

In SD 22, mean NASC values recorded were lower than the previous year in 9 out of 11 rectangles surveyed. In comparison to the long-term survey mean of rectangles in SD 24, the NASC measured was lower in all but one rectangles. Increased aggregations of clupeids were measured in Kiel Bight and Mecklenburg Bight as well as near the northern entrance to the Little Belt, where mean NASC was almost 10fold higher than in the previous year. This area however contains only a short transect distance and is usually characterized by extremely low NASC levels.

As in the previous year, the large aggregations of big herring that usually can be observed in SD 23 in the Sound were not present in autumn 2017. NASC values were significantly lower than the already low levels measured in 2016 as well as the long-term survey mean. A replicate measurement of the transect in SD 23 during night time a few days later corroborated these findings. It has to be mentioned however, that on another replicate measurement 2 days later during daytime, significant NASC values were measured and dense aggregations of clupeids were detected on the echosounder (see Figure 7).

In SD 24, mean NASC values were significantly lower than the values measured in 2016 in 3 out of 6 rectangles surveyed. In rectangle 38G4 and 39G4 (eastern part of Arkona Basin) however, mean NASC levels were around twice as high as the levels measured during the previous survey in 2016. As in the years before, higher aggregations were also detected north of Rügen Island.

3.2 Biological data (T. Gröhsler)

Fishery hauls according to ICES Subdivision:

SD	Hauls (n)
21	11
22	16
23	11 (incl. 3 daytime hauls)
24	19

Altogether, 1 701 individual herring, 757 sprat, 12 European anchovies and 5 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, 39 different species were recorded. Herring were caught in 49, 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 (during nighttime hauls). In contrast to 2016, when sardines (*Sardina pilchardus*) were caught in SD 22-24, this species only appeared in catches from SD21 in 2017. As in previous years, anchovy (*Engraulis encrasicolus*) were present in in the whole survey area, albeit in a lower frequency of occurrence (41 of 55 hauls in 2016; 7 of 57 hauls in 2017).

Altogether, the following species were sampled and processed:

Species	Length measurements (n)	Prevalence (n of hauls)
Clupea harengus	11 021	49
Crystallogobius linearis	224	23
Ctenolabrus rupestris	7	3
Cyclopterus lumpus	7	6
Engraulis encrasicolus	15	7
Eutrigla gurnardus	40	8
Gadus morhua	269	23
Gasterosteus aculeatus	366	26
Limanda limanda	108	22
Merlangius merlangus	378	37
Mullus surmuletus	3	3
Platichthys flesus	47	20
Pleuronectes platessa	8	5
Pomatoschistus minutus	193	27
Sardina pilchardus	5	4
Scomber scombrus	255	12
Sprattus sprattus	8 624	51
Trachinus draco	233	20
Trachurus trachurus	84	21
Trisopterus esmarckii	5	4
Others	798	-

Figures 3 and 4 show relative length-frequency distributions of herring and sprat in ICES subdivisions 21, 22, 23 and 24 for the years 2016 and 2017. Compared to results from the previous survey in 2016, the following conclusions for **herring** can be drawn (Figure 3):

- In contrast to 2016, catches in SD 21 showed a less pronounced bimodal distribution characterized by the presence of the incoming year class (ca. ≤15 cm) and older herring (>15 cm). The fraction of the incoming year class dominated in 2016, whereas in 2017 older herring accounted for the largest share.
- The catches in SD 22 showed a multimodal distribution with two modes at 11.25 cm and 15.26 cm corresponding to the incoming year class (ca. ≤15 cm) and one mode of 18.75 cm for older herring (>15 cm). This was in contrast to the dominant contribution of herring <10 cm (mode at 9.75 cm) in 2016.
- In contrast to the years before, larger herring (>20 cm) were more or less absent from night time catches conducted in SD 23. The catches in 2017 were dominated by the contribution of the incoming year class (ca. ≤15 cm).
- In SD 24, the herring length-frequency distribution was characterized by a similar contribution of the incoming year class (≤15 cm) and older herring (>15 cm) in both years. However, the bimodal distribution in 2017 showed more lager herring (≤15 cm: mode 2016/9.75 cm and mode 2017/11.75 cm; >15 cm: mode 2016/17.75 cm and mode 2017/18.25 cm).
- Altogether, the present contribution of the incoming year class (ca. <15 cm) seemed to be rather low.

Relative length-frequency distributions of **sprat** in the years 2016 and 2017 (Figure 4) can be characterized as follows:

- In SD 21 catch numbers of the incoming year class (ca. ≤10 cm) were virtually absent in both years. The catches were dominated by the contribution of larger sprat (>10 cm).
- In SD 22 - 24 catch numbers of the incoming year class (ca. ≤10 cm) dominated in 2016, whereas the catches now show a larger contribution of larger sprat (>10 cm) in 2017.

- Altogether, as for herring the present contribution of the incoming year class (ca. ≤10 cm) seemed to be rather low.

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 2011-2016 and in 2017 support the applicability of the 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; WD Gröhsler, T & Schaber, M., 2018). 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 2017 indicated a low contribution of older fish of CBH origin. Thus, the SF was not applied in 2017 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 2005-2017 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 2.8 x 10^9 fish (Table 7) or 111.7 x 10^3 tonnes (Table 9). For the included area of Subdivisions 22-24 the number of herring was calculated to be 2.5 x 10^9 fish or 100.9 x 10^3 tonnes.

The estimated sprat stock in Subdivisions 21-24 was 7.5 x 10^9 fish (Table 10) or 99.5 x 10^3 tonnes (Table 12). For the included area of Subdivisions 22-24 the number of sprat was calculated to be 7.1 x 10^9 fish or 93.3 x 10^3 tonnes. The overall abundance estimate in 2017 was dominated by on year old sprat (year class 2016, Figure 4 and Table 10).

3.3.2 Estimates excl. Central Baltic Herring in SDs 22&24

Estimated numbers of herring excluding CBH in 39G2/SD 23 and SD 24 by age group and SD/rectangle for 2017 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 2017 resulted in biomass reductions of 15.8 % with corresponding reductions in numbers of 12.7 % (-29.4 % and -18.7 %, respectively in 2016; Figure 5).

3.4 Hydrography

Vertical profiles of temperature and salinity were measured with a SeaBird SBE CTD-probe on a station grid covering the whole survey area. Hydrography measurements were either conducted directly after a trawl haul or, in case of no fishing activity, in regular intervals along the cruise track. Altogether, 87 CTD casts were conducted during this survey.

Surface temperatures ranged from ca. 11°C in the eastern Arkona Basin and ca. 13 °C in the Kattegat area to around 14°C in the Kiel Bight and southern Belt Sea (Figure 6). Bottom temperatures were also mostly around 14°C in the largest part of the survey area except for the deeper western parts of the

Bornholm Basin, where temperatures near the seafloor were below 7°C.

Surface salinities showed a large gradient from ca. 7 PSU in the eastern Arkona Sea to ca. 15 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. Near the seafloor, low oxygen levels were measured in the central eastern parts of the Arkona Basin. Anoxic conditions above the seafloor were observed in the southern part of the Little Belt and the inner Mecklenburg Bight.

4 DISCUSSION

Compared to 2016, the present estimates of herring (incl. CBH) show a significant decrease in stock biomass and abundance:

Herring	Difference compared to 2016	
Area	Numbers (%)	Biomass (%)
Subdivisions 22-24	-42	-22
Subdivisions 21-24	-44	-20

The significant decrease in 2017 was mainly driven by lower numbers or biomass estimates in SD 23 (-83 % in numbers and -93 % in biomass). The present herring abundance and biomass estimates in SD 23 represent the lowest recorded values in the whole time series since 1993.

The usually recorded dominant high number of large herring fish 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), was in 2017 as in 2016 for the second time since many years almost absent. This complete absence could be explained by delayed immigration of WBSSH from the feeding areas in the Skagerrak in 2016. The exceptionally low numbers in 2016 and even further decreased numbers in 2017 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. The strong correlation of N20 with the 1-age group (Polte, P. and Gröhsler, T., 2018) of GERAS index supports this assumption. It has to be mentioned, however, that also methodological biases could lead to the low numbers observed: While during recurrent measurements along the transect during night time both S_A values and catches were low, significant and massive schools of presumably large herring were detected in a following recording conducted during daytime. While diurnal differences in distribution can be ruled out based on the long-term observations, other factors affecting the presence or absence of the large schools/aggregations in the deeper (surveyed) parts of SD 23 should be investigated.

Older and bigger herring were in 2017 only detected in SD 24. In contrast to last year's results, the exclusion of CHB in SD 24 did not lead to a virtual elimination of older and bigger herring in this area. This is in accordance with the results in 2015, when some older and bigger herring already had started to migrate out of the Sound (SD 23). It is assumed that these migrations are triggered by hydrographic conditions in a way that barotropic inflow events in late summer and early autumn prevent deoxygenation in the Sound. This leads to prolonged aggregations of herring in the Sound (Miethe et al., 2014). In 2017, such migration of big herring was already partially detected during the survey period, indicating that according hydrographic conditions were met driving herring out of the Sound.

In SD 21 and 23 some 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. This immigration has been observed in past years, albeit only in single individuals. Analyses of 2016-2017 data validating the SF indicate 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.

5 SURVEY PARTICIPANTS

Name	Function	Institute
Dr. M. Schaber	Hydroacoustics, Cruise leader	TI-SF
B. Stefanowitsch	Hydroacoustics	TI-SF (student assistant)
M. Koth	Fishery biology	TI-OF
S.-E. Levinsky	Fishery biology	DTU Aqua, Kgs. Lyngby, (DK)
F. Müller	Fishery biology	TI-SF (student assistant)
M. Püts	Fishery biology	TI-SF
L. Wietrzynski	Fishery biology	TI-OF (04.- 10.10.)

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7 FIGURES

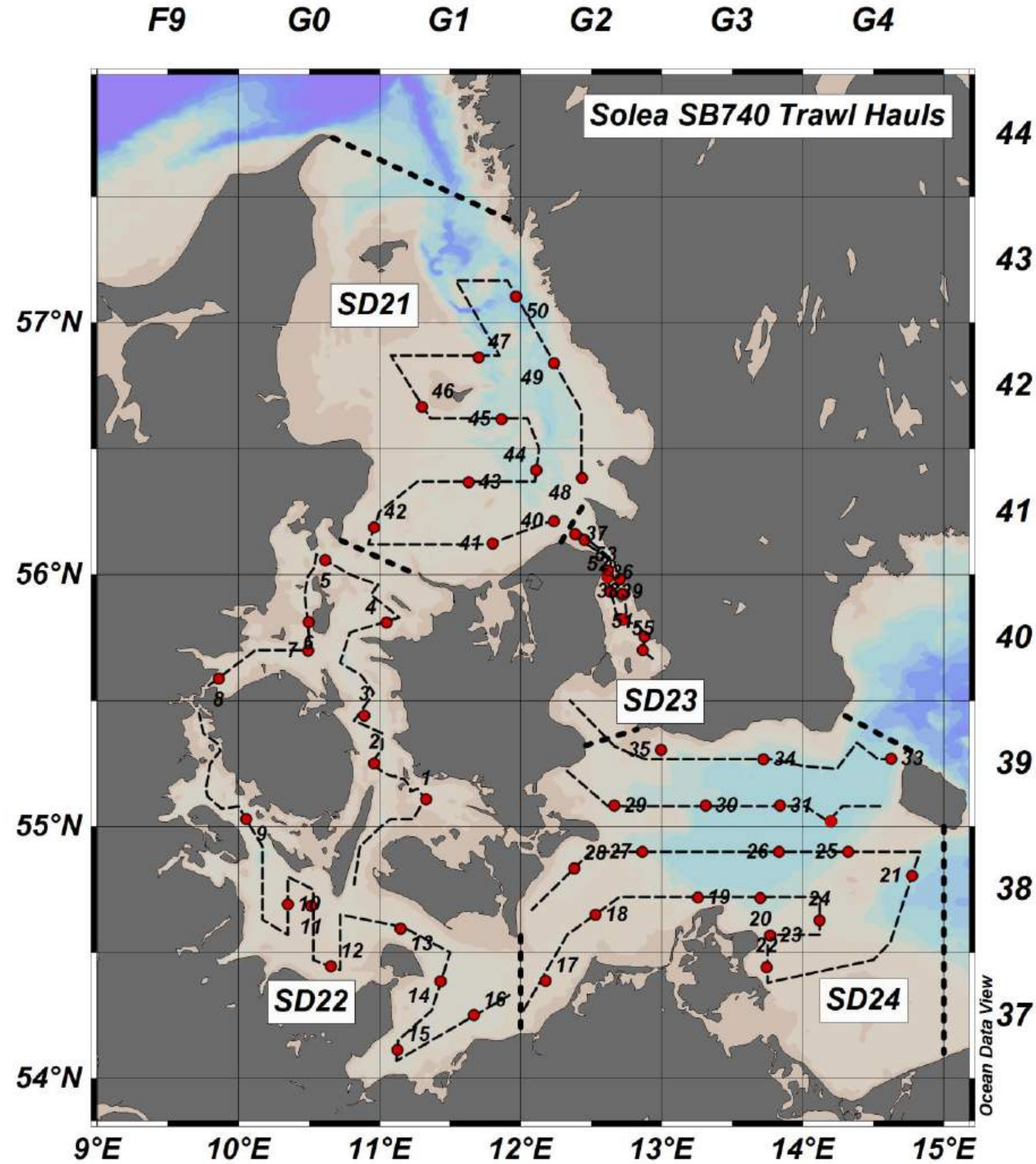

Figure 1: FRV Solea cruise 740/2017. Cruise track (thin dashed lines) and fishery hauls (red dots). ICES statistical rectangles are indicated in the top and right axis. Thick dashed lines separate ICES subdivisions (SD).

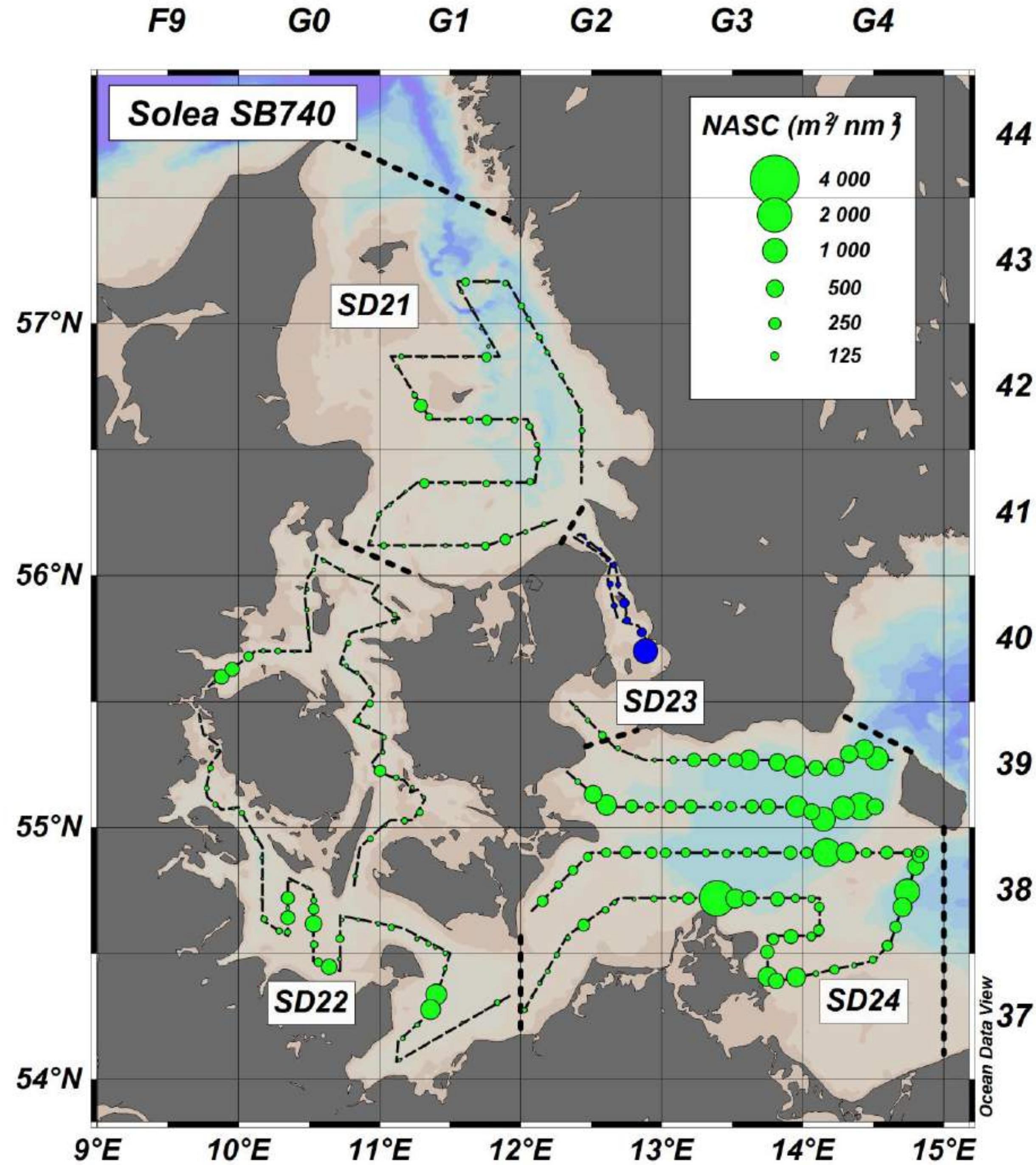

Figure 2: FRV Solea cruise 740/2017. Cruise track (thin dashed lines) and mean NASC (5 nmi intervals, dots). ICES statistical rectangles are indicated in the top and right axis. Thick dashed lines separate ICES subdivisions (SD). Blue NASC values in Subdivision 23 (Sound) represent mean of two (night time) recordings.

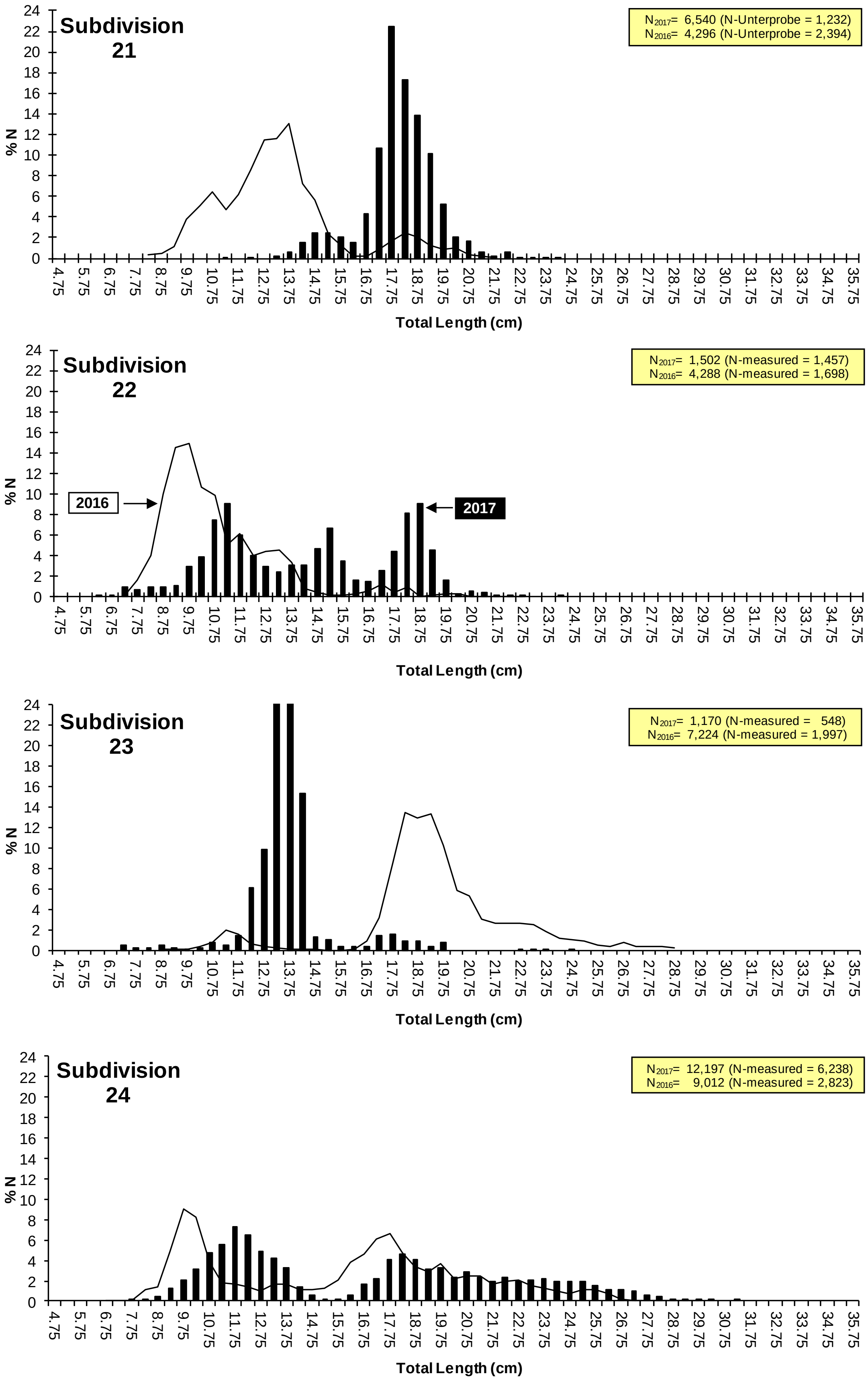

Figure 3: FRV Solea cruise 740/2017. Herring (*Clupea harengus*) length-frequency distribution compared to previous year (cruise 726/2016).

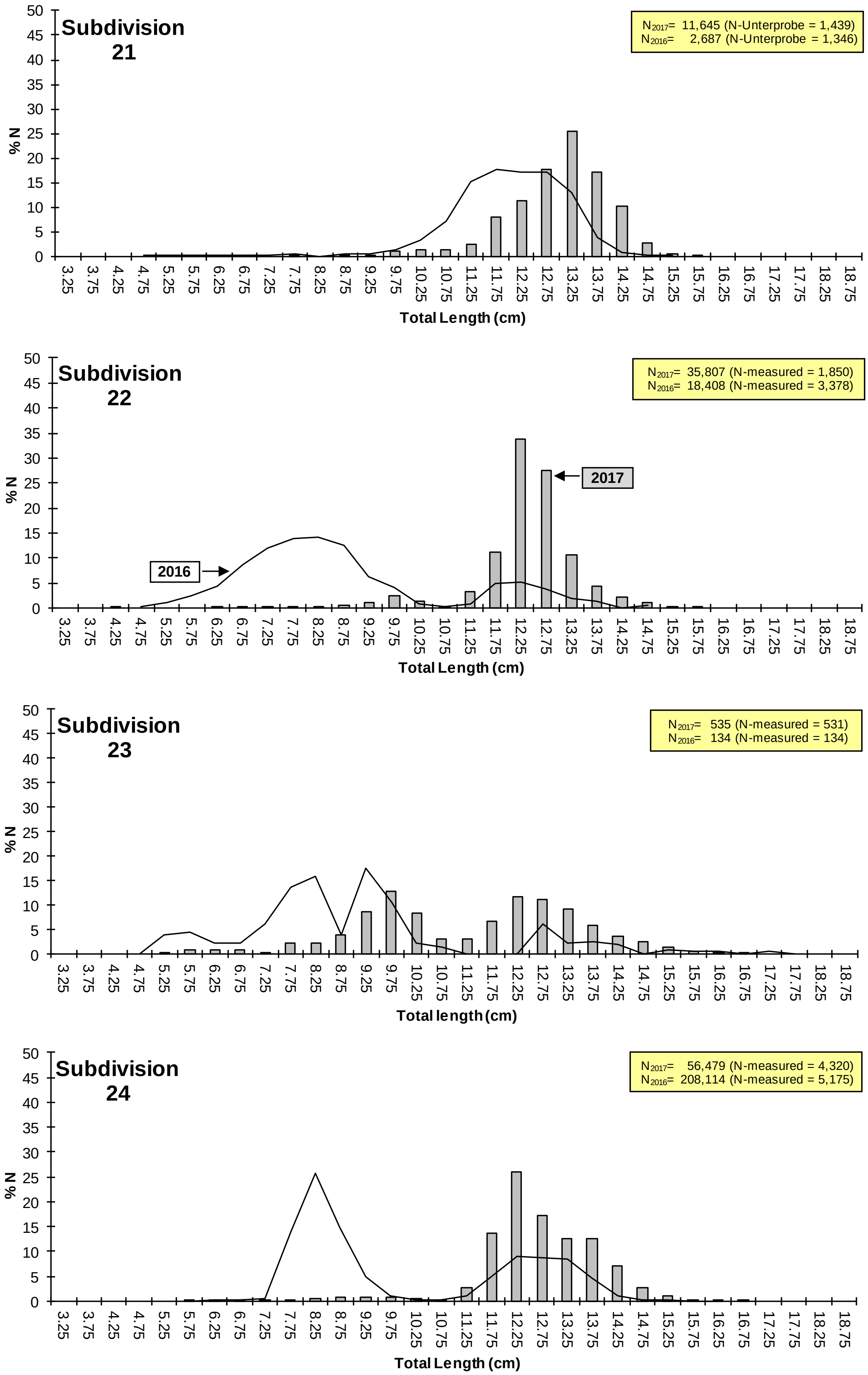

Figure 4: FRV Solea cruise 740/2017. Sprat (*Sprattus sprattus*) length-frequency distribution compared to previous year (cruise 726/2016).

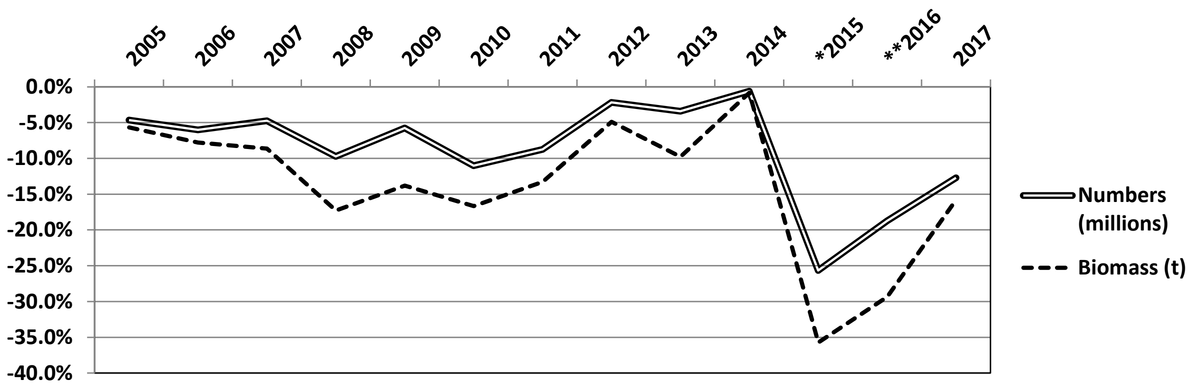

Figure 5: Relative changes in abundance and biomass of Western Baltic Spring Spawning herring in ICES Subdivisions 21-24 (2005-2017) after application of the stock separation function (SF, Gröhsler et al., 2013) to the abundance and biomass index generated from German acoustic survey data (GERAS). **2015= excl. CBH also in SD 22 and mature herring (stages ≥6) in SD 23;*
***2016= excl. CBH also in SD 22).*

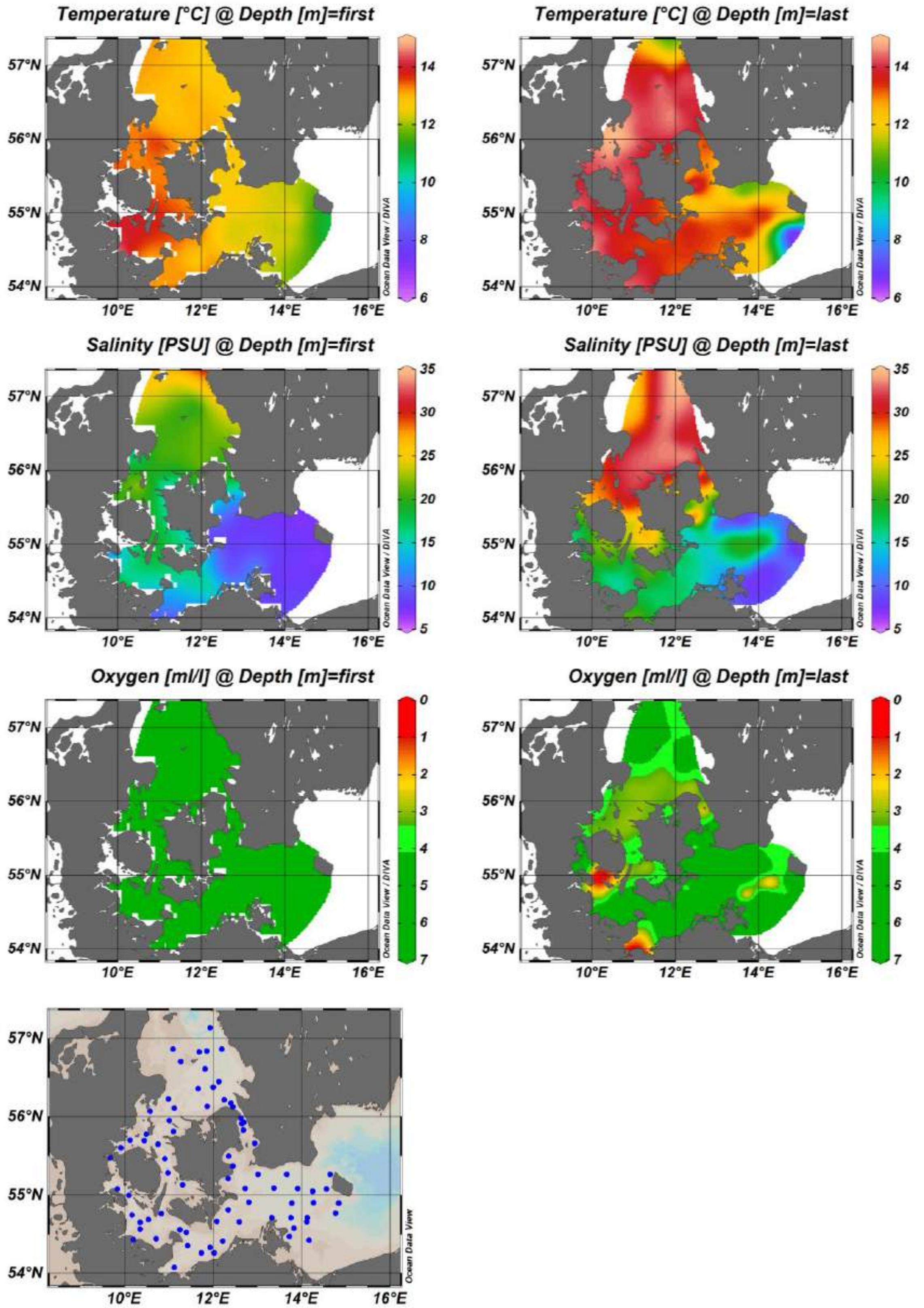

Figure 6: FRV Solea cruise 740/2017: Hydrography. CTD stations are depicted as blue dots in the area map (lower panel). Temperature (°C, top panels), salinity (PSU, middle panels and oxygen concentration (ml/l, lower panels) at the surface (left) and near the seafloor (right).

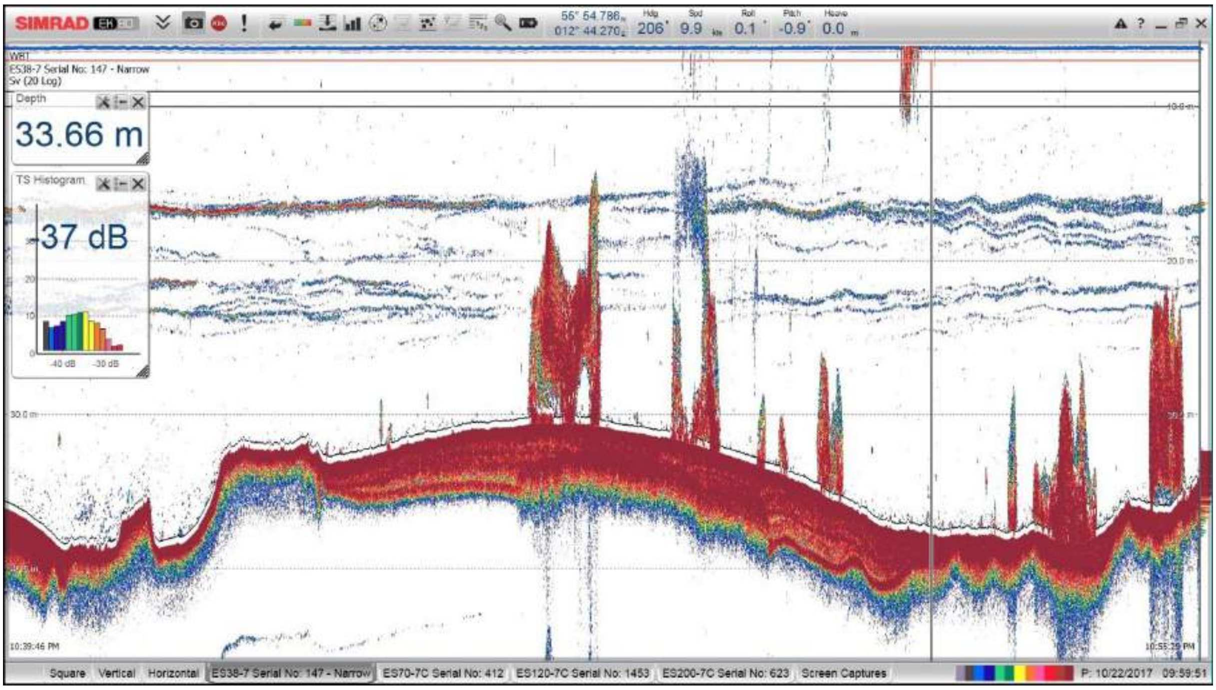

Figure 7: FRV Solea cruise 740/2017. Echosounder EK80 screenshot (38 kHz) of large clupeid schools measured during a day time sampling of the SD23 transect in the Sound for comparison with the virtually absent detections recorded during night time during two preceding recordings.

8 TABLES

Table 1: FRV Solea cruise 740/2017: Simrad EK80 calibration report (38 kHz Transducer).

Date:	04.10.2017		
Transceiver Type:	WBT		
Software Version:	EK80 1.10.3.0		
Reference Target:	Tungsten (WC-Co) 38.1 mm		
Transducer:	ES38-7 Serial No. 147		
Frequency:	38000 Hz	Beamtype:	Split/Narrow
Gain:	27.33 dB	Equivalent Beam Angle:	-20.7 dB
Beamwidth Athw.:	6.79 deg	Beamwidth Along.:	6.67 deg
Offset Athw.:	0.33 deg	Offset Along.:	-0.23 deg
Depth:	4.20 m		
Pulse Duration:	0.256 ms		
Power:	1000 W		
TS Detection:			
Min. Value:	-49.0 dB	Min. Spacing:	0.0
Max. Gain Comp.:	3.0 dB	Min. Echolength:	0.8
Max. Echolength:	1.8		
Environment:			
Absorption Coeff.:	0.005295	Sound Velocity:	1486.2 m/s
Calibration results:			
Transducer Gain:	27.41 dB	SaCorrection:	-0.30 dB
Beamwidth Athw.:	6.52 deg	Beamwidth Along.:	6.69 deg
Offset Athw.:	-0.30 deg	Offset Along.:	0.13 deg
RMS-Error:	0.08		

Table 2: FRV Solea cruise 740/2017: Catch composition (kg 0.5 h^{-1}) by haul in SD 21.

Haul No.	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**Total**
Species/ICES Rectangle	**41G2**	**41G1**	**41G0**	**41G1**	**41G2**	**42G1**	**42G1**	**42G1**	**41G2**	**42G2**	**43G1**	
ALLOTEUTHIS SUBULATA						0.03				0.02	0.01	**0.06**
CANCER PAGURUS											0.47	**0.47**
CARCINUS											0.01	**0.01**
CLUPEA HARENGUS	0.19	139.22	2.06		8.41	77.54	8.10	10.79		0.42		**246.73**
CRANGON CRANGON											0.03	**0.03**
CRYSTALLOGOBIUS LINEARIS	+			+	+	+			+	+	+	**+**
CTENOLABRUS RUPESTRIS				+								**+**
ENGRAULIS ENCRASICOLUS						0.03			0.01	0.02		**0.06**
EUTRIGLA GURNARDUS						0.83		0.02		0.12	0.03	**1.00**
GASTEROSTEUS ACULEATUS				0.02								**0.02**
HIPPOGLOSSOIDES PLATESSOIDES										0.01		**0.01**
LEANDER											+	**+**
LIMANDA LIMANDA		0.24	0.44		0.20	1.29		0.22		0.08		**2.47**
LOLIGO FORBESI	0.04	0.01	0.07	0.07	0.01	0.22	0.01	0.09	0.01	0.17	0.12	**0.82**
MERLANGIUS MERLANGUS	0.06	0.84	0.03			0.74	+	0.10	0.05	0.67	0.02	**2.51**
MERLUCCIUS MERLUCCIUS						0.07						**0.07**
MYSIDACEA											+	**+**
NEPHROPS NORVEGICUS									0.57			**0.57**
PLEURONECTES PLATESSA											0.10	**0.10**
POMATOSCHISTUS MINUTUS			+	+		+					+	**+**
SARDINA PILCHARDUS	+	0.04			0.01				+			**0.05**
SCOMBER SCOMBRUS	2.50	7.16	0.05		1.12	0.37		5.16		0.14	9.68	**26.18**
SEPIOLA			+					0.00			0.04	**0.04**
SPRATTUS SPRATTUS	2.47	72.82	6.66		0.71	85.66	0.05	16.76	0.10	0.98		**186.21**
SYNGNATHUS TYPHLE	+											**+**
TRACHINUS DRACO		1.67	1.38	0.36	0.59	1.83	0.10	5.18		0.49	0.40	**12.00**
TRACHURUS TRACHURUS	0.06	0.27		+	+	0.01		0.02	0.01		0.01	**0.38**
TRISOPTERUS ESMARKI						+				0.01	+	**0.01**
Total	**5.32**	**222.27**	**10.69**	**0.45**	**11.05**	**168.62**	**8.26**	**38.34**	**0.75**	**3.13**	**10.92**	**479.80**
Medusae	1.19	0.22	0.75	6.45	0.91	0.15	33.90	6.20	2.29	1.51	3.01	56.59

+ = < 0.01 kg

Table 3: FRV Solea cruise 740/2017: Catch composition (kg 0.5 h^{-1}) by haul in SD 22.

Haul No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Species/ICES Rectangle	**39G1**	**39G0**	**39G0**	**40G1**	**41G0**	**40G0**	**40G0**	**40F9**	**39G0**	**38G0**	**38G0**	**37G0**	**38G1**
CLUPEA HARENGUS	0.72	10.47	0.38	1.24				11.28		0.68	0.65	0.31	0.24
CRANGON CRANGON						+							
CRYSTALLOGOBIUS LINEARIS	0.01		+		+	+					+		
CYCLOPTERUS LUMPUS			0.10										0.10
ENGRAULIS ENCRASICOLUS	+												
GASTEROSTEUS ACULEATUS	+			+			+	0.01	0.42	+		0.01	+
GOBIUS NIGER	+												0.02
LIMANDA LIMANDA		0.06	0.04		0.04						0.44	0.11	0.16
LOLIGO FORBESI	0.01		+	+	0.06	0.01							
MERLANGIUS MERLANGUS			+	0.07	0.01		+	+	+		0.29		+
MULLUS SURMULETUS			0.01	0.01									
PLATICHTHYS FLESUS													
POMATOSCHISTUS MINUTUS	+				+						0.01		
SCOMBER SCOMBRUS						11.80	0.31						
SOLEA VULGARIS						0.01							
SPRATTUS SPRATTUS	0.07	64.18	0.03	0.16		0.03	0.02	8.78		6.36	3.15	29.96	
SYNGNATHUS TYPHLE			+										
TRACHINUS DRACO			0.05	0.10	0.49								
TRACHURUS TRACHURUS		0.01	0.01	+	0.03	0.01	+	0.03	+				
TRISOPTERUS ESMARKI	+												
Total	**0.81**	**74.72**	**0.62**	**1.58**	**0.63**	**11.86**	**0.33**	**20.10**	**0.42**	**7.04**	**4.54**	**30.39**	**0.52**
Medusae	1.11	1.19	4.15	2.00	2.11	3.56	29.26	26.90	22.59	8.72	9.63	11.63	7.32

Haul No.	14	15	16	Total
Species/ICES Rectangle	**37G1**	**37G1**	**37G1**	
CLUPEA HARENGUS	2.00	3.31	1.10	**32.38**
CRANGON CRANGON				**+**
CRYSTALLOGOBIUS LINEARIS	0.01	+		**0.02**
CYCLOPTERUS LUMPUS				**0.20**
ENGRAULIS ENCRASICOLUS				**+**
GASTEROSTEUS ACULEATUS	0.01	0.05	0.02	**0.52**
GOBIUS NIGER				**0.02**
LIMANDA LIMANDA	0.19			**1.04**
LOLIGO FORBESI				**0.08**
MERLANGIUS MERLANGUS	0.14			**0.51**
MULLUS SURMULETUS				**0.02**
PLATICHTHYS FLESUS		0.15	0.23	**0.38**
POMATOSCHISTUS MINUTUS	+			**0.01**
SCOMBER SCOMBRUS				**12.11**
SOLEA VULGARIS				**0.01**
SPRATTUS SPRATTUS	56.18	0.40	338.71	**508.03**
SYNGNATHUS TYPHLE				**+**
TRACHINUS DRACO		0.07		**0.71**
TRACHURUS TRACHURUS				**0.09**
TRISOPTERUS ESMARKI				**+**
Total	**58.53**	**3.98**	**340.06**	**556.13**
Medusae	1.23	0.78	13.38	145.55

+ = < 0.01 kg

Table 4: FRV Solea cruise 740/2017: Catch composition (kg 0.5 h^{-1}) by haul in SD 23.

Haul No.	36	37	38	39	51	52	53	54	*55	*56	*57	Total
Species/ICES Rectangle	40G2	41G2	41G2	40G2	40G2	40G2	41G2	40G2	40G2	40G2	40G2	
ALLOTEUTHIS SUBULATA				0.04	0.01		0.01					0.06
CARCINUS					0.04							0.04
CLUPEA HARENGUS	0.54		1.42	1.19	1.49	0.34	0.77	12.74	858.51	22.53	30.87	930.40
CRANGON CRANGON	0.02				+	+						0.02
CRYSTALLOGOBIUS LINEARIS	+	+	+	+			+	+				0.00
CTENOLABRUS RUPESTRIS	0.03		+									0.03
ENGRAULIS ENCRASICOLUS							+	0.01				0.01
EUTRIGLA GURNARDUS	0.21		+	0.21				0.16				0.58
GADUS MORHUA	6.35		10.96	18.96	88.34	8.28	3.19	1.85		19.52	18.84	176.29
GASTEROSTEUS ACULEATUS	+						+	+				0.00
HIPPOGLOSSOIDES PLATESSOIDES					+							0.00
LIMANDA LIMANDA	0.50	0.05	0.09	0.06			0.87	0.40				1.97
LOLIGO FORBESI	0.07	0.05	0.02	0.02	0.02	0.15	0.18	0.01			+	0.52
MELANOGRAMMUS AEGLEFINUS	1.71					7.26						8.97
MERLANGIUS MERLANGUS	0.16	0.05	0.08		0.47		0.10	0.83			0.17	1.86
MULLUS SURMULETUS				+								0.00
MYSIDACEA	+											0.00
PLATICHTHYS FLESUS	0.22					0.47	0.51					1.20
POLLACHIUS POLLACHIUS								0.03				0.03
POMATOSCHISTUS MINUTUS	0.05	+	0.01	0.03		0.01		+				0.10
SCOMBER SCOMBRUS			0.62								0.69	1.31
SEPIOLA	0.03				+	0.04	0.03					0.10
SPRATTUS SPRATTUS	0.02	+	0.06	0.07	4.81	0.02	0.28	0.54	4.41	5.32		15.53
TRACHINUS DRACO	0.04	0.05	0.05		0.02	0.04	0.02	0.05				0.27
TRACHURUS TRACHURUS		+	+	0.01				0.01				0.02
Total	**9.95**	**0.20**	**13.31**	**20.59**	**95.20**	**16.61**	**5.96**	**16.63**	**862.92**	**47.37**	**50.57**	**1139.31**
Medusae	2.79	3.49	2.84	13.64	0.77	1.22	0.08	4.94	1.80	1.16	0.59	**33.32**

* = recording during daytime + = < 0.01 kg

Table 5: FRV Solea cruise 740/2017: Catch composition (kg 0.5 h^{-1}) by haul in SD 24.

Haul No.	17	18	19	20	21	22	23	24	25	26	27	28	29
Species/ICES Rectangle	37G2	38G2	38G3	38G3	38G4	37G3	38G3	38G4	38G4	38G3	38G2	38G2	39G2
BELONE BELONE	0.03												
CLUPEA HARENGUS	0.81	4.10	7.14	23.12	25.78	45.10	22.37	21.11	17.89	11.85	55.40	4.51	12.08
CRYSTALLOGOBIUS LINEARIS		+							+				+
CYCLOPTERUS LUMPUS	0.27				0.30				0.41				
ENGRAULIS ENCRASICOLUS	+												
GADUS MORHUA				4.02	+	21.66	5.17	2.38	13.24	0.64			2.25
GASTEROSTEUS ACULEATUS	0.04	0.06	+		+					+	0.03	0.03	0.05
LAMPETRA FLUVIATILIS				0.16									
LIMANDA LIMANDA	0.30	0.01											
MERLANGIUS MERLANGUS	+			20.77		4.03	8.56		0.56	3.85		+	
OSMERUS EPERLANUS						0.01	0.01						
PLATICHTHYS FLESUS	1.08		0.46	0.62		0.41	0.59		2.02	0.16	0.58	0.99	
PLEURONECTES PLATESSA	0.17			0.46									
POMATOSCHISTUS MINUTUS	+	+	+	+	+				+	+	+	+	+
SPRATTUS SPRATTUS	0.05	1.59	14.87	40.22	2.01	6.85	11.15	46.40	7.49	42.34	1.62	3.79	0.83
TRACHURUS TRACHURUS													+
Total	**2.75**	**5.76**	**22.47**	**89.37**	**28.09**	**78.06**	**47.85**	**69.89**	**41.61**	**58.84**	**57.63**	**9.32**	**15.21**
Medusae	4.55	6.38	7.99	1.42	5.59	18.19	9.05	2.14	1.28	2.01	15.10	17.00	8.04

Haul No.	30	31	32	33	34	35	Total
Species/ICES Rectangle	39G3	39G3	39G4	39G4	39G3	39G2	
BELONE BELONE							0.03
CLUPEA HARENGUS	6.18	31.50	26.33	5.19	166.67	15.27	502.40
CRYSTALLOGOBIUS LINEARIS							+
CYCLOPTERUS LUMPUS			0.19				1.17
ENGRAULIS ENCRASICOLUS							+
GADUS MORHUA	0.00	1.46	+	0.54	11.92	4.08	67.36
GASTEROSTEUS ACULEATUS	0.11	0.04			0.04		0.40
LAMPETRA FLUVIATILIS							0.16
LIMANDA LIMANDA	0.03						0.34
MERLANGIUS MERLANGUS	0.16	1.54	6.88		6.48	0.16	52.99
OSMERUS EPERLANUS							0.02
PLATICHTHYS FLESUS	0.70	0.24	0.99	0.15	0.53	0.28	9.80
PLEURONECTES PLATESSA	0.85				0.20		1.68
POMATOSCHISTUS MINUTUS	0.01	+				0.01	0.02
SPRATTUS SPRATTUS	17.30	154.48	229.05	14.03	137.36	11.06	742.49
TRACHURUS TRACHURUS							+
Total	**25.34**	**189.26**	**263.44**	**19.91**	**323.20**	**30.86**	**1378.86**
Medusae	6.58	2.34	2.58	4.99	0.57	3.76	**119.54**

+ = < 0.01 kg

Table 6: FRV Solea, cruise 740/2017. 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	16.8	1.770	10.26	11.59	87.37	1.19	8.96
21	41G1	946.8	62.4	2.177	271.38	42.53	55.48	115.41	150.55
21	41G2	432.3	48.0	1.798	115.41	40.12	51.48	46.30	59.41
21	42G1	884.2	56.6	2.595	192.85	48.94	49.95	94.39	96.32
21	42G2	606.8	49.6	2.312	130.18	11.88	57.43	15.47	74.76
21	43G1	699.0	46.0	0.192	1674.69	0.00	0.00	0.00	0.00
21	43G2	107.0	39.2	1.112	37.72	5.94	28.71	2.24	10.83
21	Total	3,784.2			2432.49			275.00	400.83
22	37G0	209.9	117.2	1.445	170.24	0.74	98.98	1.26	168.51
22	37G1	723.3	127.4	1.257	733.08	27.30	70.10	200.10	513.85
22	38G0	735.3	90.1	1.626	407.44	9.14	86.15	37.23	351.02
22	38G1	173.2	37.2	2.362	27.28	70.00	0.00	19.10	0.00
22	39F9	159.3	29.7	1.215	38.94	18.17	31.45	7.07	12.25
22	39G0	201.7	76.2	0.944	162.81	4.22	45.76	6.88	74.50
22	39G1	250.0	56.9	1.021	139.32	27.78	9.72	38.70	13.55
22	40F9	51.3	254.1	2.077	62.76	36.33	62.90	22.80	39.47
22	40G0	538.1	36.2	0.474	410.95	0.00	10.48	0.00	43.05
22	40G1	174.5	26.2	2.444	18.71	71.43	16.07	13.36	3.01
22	41G0	173.1	22.4	0.472	82.15	0.00	0.00	0.00	0.00
22	Total	3,389.7			2253.68			346.50	1219.21
23	39G2	130.9	53.3	2.238	31.18	64.80	32.21	20.21	10.04
23	40G2	164.0	235.5	6.166	62.64	61.10	30.24	38.27	18.94
23	41G2	72.3	30.8	3.866	5.76	62.19	23.75	3.58	1.37
23	Total	367.2			99.58			62.06	30.35
24	37G2	192.4	31.4	1.289	46.87	59.21	6.58	27.75	3.08
24	37G3	167.7	509.5	3.635	235.06	39.12	54.60	91.97	128.35
24	37G4	875.1	103.7	3.055	297.05	35.50	62.75	105.46	186.41
24	38G2	832.9	128.6	1.289	830.96	64.30	33.53	534.31	278.60
24	38G3	865.7	341.3	1.902	1553.44	21.05	77.36	326.94	1201.72
24	38G4	1034.8	385.9	3.055	1307.13	35.50	62.75	464.08	820.28
24	39G2	406.1	203.4	2.238	369.08	64.80	32.21	239.17	118.89
24	39G3	765.0	355.1	1.902	1428.24	14.75	83.78	210.60	1196.55
24	39G4	524.8	668.9	1.737	2020.95	3.61	96.14	73.04	1942.95
24	Total	5,664.5			8,088.78			2073.32	5876.83
22-24	Total	9,421.4			10,442.04			2481.88	7126.39
21-24	Total	13,205.6			12,874.53			2756.88	7527.22

Table 7: FRV Solea, cruise 740/2017. 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	0.24	0.95								1.19
21	41G1	10.64	103.91	0.65	0.21						115.41
21	41G2	14.20	31.73	0.27	0.09	0.01					46.30
21	42G1	4.10	79.10	9.20	1.68	0.30					94.38
21	42G2	2.29	13.18								15.47
21	43G1										0.00
21	43G2	0.33	1.91								2.24
21	Total	31.80	230.78	10.12	1.98	0.31	0.00	0.00	0.00	0.00	274.99
22	37G0	1.00	0.25								1.25
22	37G1	188.33	11.32	0.22	0.19	0.04					200.10
22	38G0	18.32	18.61		0.31						37.24
22	38G1	0.00	18.21	0.55	0.34						19.10
22	39F9	1.62	5.05	0.22	0.13	0.04					7.06
22	39G0	4.57	2.11	0.12	0.07	0.01					6.88
22	39G1	10.47	22.21	4.68	1.13	0.22					38.71
22	40F9	5.23	16.30	0.72	0.42	0.14					22.81
22	40G0										0.00
22	40G1	4.47	8.40	0.25	0.21	0.04					13.37
22	41G0										0.00
22	Total	234.01	102.46	6.76	2.80	0.49	0.00	0.00	0.00	0.00	346.52
23	39G2	13.71	1.59	0.97	1.63	1.01	1.04	0.18	0.07	0.02	20.22
23	40G2	34.16	3.33	0.22	0.31	0.18	0.07				38.27
23	41G2	3.42	0.11	0.03	0.01						3.57
23	Total	51.29	5.03	1.22	1.95	1.19	1.11	0.18	0.07	0.02	62.06
24	37G2	22.20	2.48	0.55	0.89	0.89	0.67	0.07			27.75
24	37G3	16.62	4.45	13.76	20.01	22.01	9.31	3.32	1.78	0.71	91.97
24	37G4	20.65	5.92	13.08	19.81	26.02	13.01	4.96	1.36	0.67	105.48
24	38G2	459.90	28.42	5.04	16.33	11.68	11.55	1.39			534.31
24	38G3	168.28	24.98	30.55	40.44	30.91	23.20	4.83	2.43	1.33	326.95
24	38G4	90.86	26.04	57.55	87.19	114.48	57.24	21.81	5.97	2.95	464.09
24	39G2	162.21	18.77	11.52	19.29	11.94	12.28	2.09	0.83	0.24	239.17
24	39G3	67.57	23.00	23.85	36.93	31.78	19.76	4.85	1.73	1.13	210.60
24	39G4	2.86	3.89	12.82	18.93	19.78	9.35	2.88	1.94	0.59	73.04
24	Total	1,011.15	137.95	168.72	259.82	269.49	156.37	46.20	16.04	7.62	2,073.36
22-24	Total	1,296.45	245.44	176.70	264.57	271.17	157.48	46.38	16.11	7.64	2,481.94
21-24	Total	1,328.25	476.22	186.82	266.55	271.48	157.48	46.38	16.11	7.64	2,756.93

Table 8: FRV Solea, cruise 740/2017. 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	14.50	43.15								37.37
21	41G1	19.68	38.70	65.58	61.71						37.14
21	41G2	15.98	36.84	62.51	60.33	66.29					30.64
21	42G1	19.68	44.24	70.92	69.87	66.29					46.30
21	42G2	16.82	39.57								36.20
21	43G1										0.00
21	43G2	16.82	39.57								36.22
21	Total	17.75	40.42	70.35	68.57	66.29					39.13
22	37G0	15.10	33.84		38.83						18.85
22	37G1	10.49	40.03	45.27	38.83	48.32					12.23
22	38G0	15.26	35.74		38.83						25.69
22	38G1		39.28	45.27	38.83						39.44
22	39F9	18.67	40.40	54.40	55.46	48.32					36.17
22	39G0	17.40	38.85	59.08	46.30	48.32					25.04
22	39G1	17.59	38.82	62.92	56.21	48.32					36.55
22	40F9	18.67	40.40	54.40	55.46	48.32					36.19
22	40G0										0.00
22	40G1	16.15	38.68	60.38	43.14	48.32					31.65
22	41G0										0.00
22	Total	11.68	38.78	59.56	49.62	48.32					20.99
23	39G2	13.31	37.17	57.52	47.87	55.71	44.33	52.21	78.40	70.19	24.43
23	40G2	13.58	38.00	51.59	34.09	34.97	33.77				16.23
23	41G2	13.37	34.76	94.58	76.63	36.76	33.77				14.89
23	Total	13.49	37.67	57.36	45.83	52.57	43.66	52.21	78.40	70.19	18.82
24	37G2	11.77	37.57	48.48	42.63	39.54	38.41	40.21			17.40
24	37G3	8.23	40.02	71.93	84.73	105.66	81.07	106.34	91.56	82.33	72.36
24	37G4	11.28	39.27	69.39	85.42	116.95	110.39	127.88	91.37	78.25	79.21
24	38G2	8.98	36.27	41.26	35.80	36.71	38.88	43.85			12.90
24	38G3	9.04	37.88	65.66	60.91	70.91	57.28	73.78	84.58	74.19	34.00
24	38G4	11.28	39.27	69.39	85.42	116.95	110.39	127.88	91.37	78.25	79.21
24	39G2	13.31	37.17	57.52	47.87	55.71	44.33	52.21	78.40	70.19	24.43
24	39G3	11.26	37.54	66.32	66.22	82.33	61.33	84.72	88.27	79.18	48.11
24	39G4	10.82	37.67	75.98	84.62	107.16	87.81	112.66	87.45	88.23	85.44
24	Total	10.14	37.77	67.27	72.71	99.50	82.44	109.11	88.88	78.58	44.60
22-24	Total	10.55	38.19	66.91	72.27	99.20	82.16	108.89	88.84	78.56	40.66
21-24	Total	10.73	39.27	67.09	72.24	99.16	82.16	108.89	88.84	78.56	40.51

Table 9: FRV Solea, cruise 740/2017. 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	3.5	41.0								44.5
21	41G1	209.4	4,021.3	42.6	13.0						4,286.3
21	41G2	226.9	1,168.9	16.9	5.4	0.7					1,418.8
21	42G1	80.7	3,499.4	652.5	117.4	19.9					4,369.8
21	42G2	38.5	521.5								560.1
21	43G1										0.0
21	43G2	5.6	75.6								81.1
21	Total	564.6	9,327.7	712.0	135.8	20.6	0.0	0.0	0.0	0.0	10,760.6
22	37G0	15.1	8.5								23.6
22	37G1	1,975.6	453.1	10.0	7.4	1.9					2,448.0
22	38G0	279.6	665.1		12.0						956.7
22	38G1	0.0	715.3	24.9	13.2						753.4
22	39F9	30.3	204.0	12.0	7.2	1.9					255.4
22	39G0	79.5	82.0	7.1	3.2	0.5					172.3
22	39G1	184.2	862.2	294.5	63.5	10.6					1,415.0
22	40F9	97.6	658.5	39.2	23.3	6.8					825.4
22	40G0										0.0
22	40G1	72.2	324.9	15.1	9.1	1.9					423.2
22	41G0	0.0	0.0	0.0	0.0	0.0					0.0
22	Total	2,734.0	3,973.6	402.7	138.94	23.7	0.0	0.00	0.00	0.0	7,272.9
23	39G2	182.5	59.1	55.8	78.03	56.3	46.1	9.40	5.49	1.4	494.1
23	40G2	463.9	126.5	11.4	10.6	6.3	2.4				621.0
23	41G2	45.7	3.8	2.8	0.8						53.2
23	Total	692.1	189.5	70.0	89.4	62.6	48.5	9.4	5.5	1.4	1,168.2
24	37G2	261.3	93.2	26.7	37.9	35.2	25.7	2.8			482.8
24	37G3	136.8	178.1	989.8	1,695.5	2,325.6	754.8	353.1	163.0	58.5	6,654.9
24	37G4	232.9	232.5	907.6	1,692.2	3,043.0	1,436.2	634.3	124.3	52.4	8,355.4
24	38G2	4,129.9	1,030.8	208.0	584.6	428.8	449.1	61.0			6,892.0
24	38G3	1,521.3	946.2	2,005.9	2,463.2	2,191.8	1,328.9	356.4	205.5	98.7	11,117.9
24	38G4	1,024.9	1,022.6	3,993.4	7,447.8	13,388.4	6,318.7	2,789.1	545.5	230.8	36,761.2
24	39G2	2,159.0	697.7	662.6	923.4	665.2	544.4	109.1	65.1	16.9	5,843.3
24	39G3	760.8	863.4	1,581.7	2,445.5	2,616.5	1,211.9	410.9	152.7	89.5	10,132.9
24	39G4	31.0	146.5	974.1	1,601.9	2,119.6	821.0	324.5	169.7	52.1	6,240.2
24	Total	10,257.9	5,211.0	11,349.7	18,891.9	26,814.1	12,890.6	5,041.0	1,425.7	598.8	92,480.6
22-24	Total	13,684.0	9,374.1	11,822.4	19,120.2	26,900.3	12,939.1	5,050.4	1,431.2	600.2	100,921.7
21-24	Total	14,248.5	18,701.8	12,534.3	19,256.0	26,920.9	12,939.1	5,050.4	1,431.2	600.2	111,682.3

Table 10: FRV Solea, cruise 740/2017. 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	0.04	2.80	3.98	2.10	0.04					8.96
21	41G1	4.96	56.30	56.93	29.92	2.45					150.56
21	41G2	30.22	4.92	10.79	12.26	1.22					59.41
21	42G1	0.14	19.26	39.74	34.50	2.68					96.32
21	42G2	2.34	15.99	26.47	26.54	3.42					74.76
21	43G1										0.00
21	43G2	0.34	2.32	3.83	3.84	0.49					10.82
21	Total	38.04	101.59	141.74	109.16	10.30	0.00	0.00	0.00	0.00	400.83
22	37G0	1.60	131.76	13.57	19.22	0.60	1.59	0.18			168.52
22	37G1	215.28	213.26	31.73	46.97	2.08	4.01	0.52			513.85
22	38G0	2.33	221.40	43.40	73.82	4.08	4.56	1.42			351.01
22	38G1										0.00
22	39F9	0.33	6.63	1.93	3.03	0.12	0.19	0.01			12.24
22	39G0	8.26	42.59	8.78	12.98	0.61	1.05	0.22			74.49
22	39G1	7.57	3.86	0.00	1.15	0.97					13.55
22	40F9	1.08	21.37	6.22	9.77	0.39	0.62	0.02			39.47
22	40G0	16.14	6.83	3.91	15.19	0.98					43.05
22	40G1		0.78	0.59	1.50	0.09	0.03	0.03			3.02
22	41G0										0.00
22	Total	252.59	648.48	110.13	183.63	9.92	12.05	2.40	0.00	0.00	1,219.20
23	39G2	0.27	2.73	2.81	2.71	1.05	0.19	0.17	0.02	0.09	10.04
23	40G2	9.15	5.84	1.66	1.55	0.52	0.16	0.05	0.01		18.94
23	41G2	0.98	0.28	0.07	0.03	0.01					1.37
23	Total	10.40	8.85	4.54	4.29	1.58	0.35	0.22	0.03	0.09	30.35
24	37G2	1.23	0.73	0.47	0.50	0.06	0.03	0.03		0.03	3.08
24	37G3	63.72	55.75	4.64	3.42	0.55	0.14	0.11	0.01	0.02	128.36
24	37G4	0.85	70.47	46.06	46.07	15.84	2.83	2.54	0.20	1.53	186.39
24	38G2	183.63	63.40	14.10	13.13	2.65	0.65	0.65		0.39	278.60
24	38G3	198.23	715.35	124.48	123.53	25.97	6.08	5.50	0.29	2.29	1,201.72
24	38G4	3.73	310.10	202.70	202.73	69.72	12.47	11.20	0.89	6.74	820.28
24	39G2	3.21	32.28	33.30	32.14	12.43	2.28	1.96	0.20	1.09	118.89
24	39G3	7.81	588.02	249.17	247.73	63.67	15.74	15.01	0.78	8.62	1,196.55
24	39G4		1,082.39	364.24	360.24	83.24	21.13	20.77	0.18	10.76	1,942.95
24	Total	462.41	2,918.49	1,039.16	1,029.49	274.13	61.35	57.77	2.55	31.47	5,876.82
22-24	Total	725.40	3,575.82	1,153.83	1,217.41	285.63	73.75	60.39	2.58	31.56	7,126.37
21-24	Total	763.44	3,677.41	1,295.57	1,326.57	295.93	73.75	60.39	2.58	31.56	7,527.20

Table 11: FRV Solea, cruise 740/2017. 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	7.95	14.61	15.90	17.27	20.23					15.80
21	41G1	8.98	13.23	15.10	18.02	20.71					14.87
21	41G2	7.35	13.49	17.17	18.90	20.55					12.30
21	42G1	9.83	15.08	16.82	18.37	20.55					17.12
21	42G2	8.87	14.00	16.53	19.22	21.03					16.91
21	43G1										0.00
21	43G2	8.87	14.00	16.53	19.22	21.03					16.91
21	Total	7.68	13.77	16.07	18.55	20.77					15.49
22	37G0	7.85	13.56	15.94	16.02	18.16	15.96	19.85			14.02
22	37G1	6.10	13.83	16.06	16.46	18.34	16.51	20.02			11.02
22	38G0	6.71	13.93	16.57	17.12	18.96	16.51	21.32			15.00
22	38G1										0.00
22	39F9	4.73	14.78	16.11	16.64	17.30	15.74	19.65			15.22
22	39G0	5.37	14.20	16.25	16.81	18.27	16.49	21.41			14.00
22	39G1	4.78	12.16	0.00	23.66	25.50					9.97
22	40F9	4.73	14.78	16.11	16.64	17.30	15.74	19.65			15.22
22	40G0	3.46	15.08	17.75	17.62	17.75					11.92
22	40G1	0.00	15.73	17.98	17.74	18.10	16.70	19.65			17.29
22	41G0										0.00
22	Total	5.88	13.88	16.34	16.87	19.17	16.38	20.89			12.98
23	39G2	6.8	13.11	16.29	16.48	17.58	16.77	16.33	19.67	15.9	15.37
23	40G2	5.69	12.61	14.63	18.07	18.77	22.77	21.58	26.09		10.18
23	41G2	5.01	11.89	13.14	16.12	15.97					7.15
23	Total	5.65	12.74	15.63	17.05	17.96	19.51	17.52	21.81	15.90	11.76
24	37G2	4.25	12.90	15.22	14.78	15.90	14.60	14.60	0.00	15.90	10.23
24	37G3	5.68	10.92	12.34	13.35	16.29	16.28	15.35	19.67	15.90	8.47
24	37G4	5.17	12.87	16.05	16.10	17.32	16.58	16.28	19.67	15.90	14.93
24	38G2	4.53	12.02	14.55	14.46	15.69	15.47	15.47		15.90	7.38
24	38G3	5.13	11.74	14.26	14.50	16.58	15.92	15.52	19.67	15.90	11.35
24	38G4	5.17	12.87	16.05	16.10	17.32	16.58	16.28	19.67	15.90	14.93
24	39G2	6.80	13.11	16.29	16.48	17.58	16.77	16.33	19.67	15.90	15.37
24	39G3	5.66	12.58	15.41	15.35	16.74	15.92	15.80	19.67	15.90	14.03
24	39G4		12.49	15.24	14.97	16.25	15.62	15.55	19.67	15.90	13.71
24	Total	4.99	12.34	15.37	15.31	16.78	16.01	15.81	19.67	15.90	13.12
22-24	Total	5.31	12.62	15.46	15.55	16.87	16.09	16.02	19.69	15.90	13.09
21-24	Total	5.42	12.65	15.53	15.80	17.01	16.09	16.02	19.69	15.90	13.22

Table 12: FRV Solea, cruise 740/2017. 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	0.3	40.9	63.3	36.3	0.8					141.6
21	41G1	44.5	744.9	859.6	539.2	50.7					2,238.9
21	41G2	222.1	66.4	185.3	231.7	25.1					730.5
21	42G1	1.4	290.4	668.4	633.8	55.1					1,649.1
21	42G2	20.8	223.9	437.6	510.1	71.9					1,264.2
21	43G1										0.0
21	43G2	3.0	32.5	63.3	73.8	10.3					182.9
21	Total	292.1	1,398.9	2,277.5	2,024.8	213.9	0.0	0.0	0.0	0.0	6,207.2
22	37G0	12.6	1,786.7	216.3	307.9	10.9	25.4	3.6			2,363.3
22	37G1	1,313.2	2,949.4	509.6	773.1	38.2	66.2	10.4			5,660.1
22	38G0	15.6	3,084.1	719.1	1,263.8	77.4	75.3	30.3			5,265.6
22	38G1										0.0
22	39F9	1.6	98.0	31.1	50.4	2.1	3.0	0.2			186.3
22	39G0	44.4	604.8	142.7	218.2	11.1	17.3	4.7			1,043.2
22	39G1	36.2	46.9	0.0	27.2	24.7					135.1
22	40F9	5.1	315.9	100.2	162.6	6.8	9.8	0.4			600.6
22	40G0	55.8	103.0	69.4	267.7	17.4					513.3
22	40G1		12.3	10.6	26.6	1.6	0.5	0.6			52.2
22	41G0										0.0
22	Total	1,484.5	9,001.0	1,799.0	3,097.5	190.2	197.4	50.1	0.0	0.0	15,819.7
23	39G2	1.8	35.8	45.8	44.7	18.5	3.2	2.8	0.4	1.4	154.3
23	40G2	52.1	73.6	24.3	28.0	9.8	3.6	1.1	0.3		192.7
23	41G2	4.9	3.3	0.9	0.5	0.2					9.8
23	Total	58.8	112.8	71.0	73.2	28.4	6.8	3.9	0.7	1.4	356.9
24	37G2	5.2	9.4	7.2	7.4	1.0	0.4	0.4		0.5	31.5
24	37G3	361.9	608.8	57.3	45.7	9.0	2.3	1.7	0.2	0.3	1,087.1
24	37G4	4.4	907.0	739.3	741.7	274.4	46.9	41.4	3.9	24.3	2,783.2
24	38G2	831.8	762.1	205.2	189.9	41.6	10.1	10.1		6.2	2,056.8
24	38G3	1,016.9	8,398.2	1,775.1	1,791.2	430.6	96.8	85.4	5.7	36.4	13,636.2
24	38G4	19.3	3,991.0	3,253.3	3,264.0	1,207.6	206.8	182.3	17.5	107.2	12,248.9
24	39G2	21.8	423.2	542.5	529.7	218.5	38.2	32.0	3.9	17.3	1,827.2
24	39G3	44.2	7,397.3	3,839.7	3,802.7	1,065.8	250.6	237.2	15.3	137.1	16,789.8
24	39G4		13,519.1	5,551.0	5,392.8	1,352.7	330.1	323.0	3.5	171.1	26,643.2
24	Total	2,305.6	36,016.0	15,970.4	15,764.9	4,601.0	982.1	913.4	50.2	500.4	77,103.9
22-24	Total	3,848.9	45,129.7	17,840.4	18,935.5	4,819.5	1,186.4	967.4	50.8	501.8	93,280.4
21-24	Total	4,141.0	46,528.6	20,117.9	20,960.3	5,033.4	1,186.4	967.4	50.8	501.8	99,487.7

Table 13: FRV Solea, cruise 740/2017. 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	0.24	0.95								1.19	
21	41G1	10.64	103.91	0.65	0.21						115.41	
21	41G2	14.20	31.73	0.27	0.09	0.01					46.30	
21	42G1	4.10	79.10	9.20	1.68	0.30					94.38	
21	42G2	2.29	13.18								15.47	
21	43G1										0.00	
21	43G2	0.33	1.91								2.24	
21	Total	31.80	230.78	10.12	1.98	0.31	0.00	0.00	0.00	0.00	274.99	
22	37G0	1.00	0.25								1.25	
22	37G1	188.33	11.32	0.22	0.19	0.04					200.10	
22	38G0	18.32	18.61		0.31						37.24	
22	38G1	0.00	18.21	0.55	0.34						19.10	
22	39F9	1.62	5.05	0.22	0.13	0.04					7.06	
22	39G0	4.57	2.11	0.12	0.07	0.01					6.88	
22	39G1	10.47	22.21	4.68	1.13	0.22					38.71	
22	40F9	5.23	16.30	0.72	0.42	0.14					22.81	
22	40G0										0.00	
22	40G1	4.47	8.40	0.25	0.21	0.04					13.37	
22	41G0										0.00	
22	Total	234.01	102.46	6.76	2.80	0.49	0.00	0.00	0.00	0.00	346.52	
23	39G2	13.71	1.59	0.76	0.33	0.23	0.03	0.01			16.66	excl. CBH
23	40G2	34.16	3.33	0.22	0.31	0.18	0.07				38.27	
23	41G2	3.42	0.11	0.03	0.01						3.57	
23	Total	51.29	5.03	1.01	0.65	0.41	0.10	0.01	0.00	0.00	58.50	
24	37G2	22.20	2.48	0.25	0.22	0.00	0.00	0.00	0.00	0.00	25.15	
24	37G3	16.62	4.45	13.31	14.71	16.65	3.86	2.02	0.37	0.28	72.27	
24	37G4	20.65	5.92	12.37	14.37	20.46	7.49	3.66	0.26	0.19	85.37	
24	38G2	459.90	28.42	2.33	0.15	0.00	0.00	0.00	0.00	0.00	490.80	
24	38G3	168.28	24.98	27.86	18.04	11.88	3.86	1.17	0.27	0.25	256.59	excl. CBH
24	38G4	90.86	26.04	54.45	63.22	90.02	32.96	16.10	1.16	0.84	375.65	
24	39G2	162.21	18.77	9.02	3.90	2.71	0.40	0.16	0.02	0.02	197.21	
24	39G3	67.57	23.00	21.20	18.01	15.98	4.17	1.87	0.36	0.36	152.52	
24	39G4	2.86	3.89	12.36	14.26	15.70	5.06	1.92	0.32	0.32	56.69	
24	Total	1,011.15	137.95	153.15	146.88	173.40	57.80	26.90	2.76	2.26	1,712.25	
22-24	Total	1,296.45	245.44	160.92	150.33	174.30	57.90	26.91	2.76	2.26	2,117.27	
21-24	Total	1,328.25	476.22	171.04	152.31	174.61	57.90	26.91	2.76	2.26	2,392.26	

Table 14: FRV Solea, cruise 740/2017. 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	14.50	43.15								37.37	
21	41G1	19.68	38.70	65.58	61.71						37.14	
21	41G2	15.98	36.84	62.51	60.33	66.29					30.64	
21	42G1	19.68	44.24	70.92	69.87	66.29					46.30	
21	42G2	16.82	39.57								36.20	
21	43G1										0.00	
21	43G2	16.82	39.57								36.22	
21	Total	17.75	40.42	70.35	68.57	66.29					39.13	
22	37G0	15.10	33.84		38.83						18.85	
22	37G1	10.49	40.03	45.27	38.83	48.32					12.23	
22	38G0	15.26	35.74		38.83						25.69	
22	38G1		39.28	45.27	38.83						39.44	
22	39F9	18.67	40.40	54.40	55.46	48.32					36.17	
22	39G0	17.40	38.85	59.08	46.30	48.32					25.04	
22	39G1	17.59	38.82	62.92	56.21	48.32					36.55	
22	40F9	18.67	40.40	54.40	55.46	48.32					36.19	
22	40G0										0.00	
22	40G1	16.15	38.68	60.38	43.14	48.32					31.65	
22	41G0										0.00	
22	Total	11.68	38.78	59.56	49.62	48.32					20.99	
23	39G2	13.10	37.80	64.34	82.12	96.88	99.95	121.96	106.38	106.38	20.54	excl. CBH
23	40G2	13.58	38.00	51.59	34.09	34.97	33.77				16.23	
23	41G2	13.37	34.76	94.58	76.63	36.76	33.77				14.89	
23	Total	13.44	37.87	62.46	59.13	69.70	53.62	121.96			17.38	
24	37G2	11.54	38.09	60.15	60.15						15.07	
24	37G3	7.97	40.75	73.56	97.72	122.05	124.91	138.27	127.52	106.38	77.50	
24	37G4	10.97	39.98	71.73	99.92	133.66	155.62	152.98	130.43	106.38	85.52	
24	38G2	8.73	36.80	47.43	60.15						10.55	
24	38G3	8.76	38.53	68.94	83.41	107.91	112.29	140.99	114.30	106.38	30.40	excl. CBH
24	38G4	10.97	39.98	71.73	99.92	133.66	155.62	152.98	130.43	106.38	85.52	
24	39G2	13.10	37.80	64.34	82.12	96.88	99.95	121.96	106.38	106.37	20.59	
24	39G3	11.00	38.13	70.45	91.79	117.73	118.83	137.50	106.37	106.37	49.03	
24	39G4	10.57	38.34	77.33	96.84	120.76	120.09	140.05	106.38	106.38	94.49	
24	Total	9.89	38.40	70.83	95.80	127.57	144.53	149.17	122.36	106.38	43.97	
22-24	Total	10.35	38.55	70.31	94.78	127.21	144.37	149.16	122.36	106.38	39.47	
21-24	Total	10.53	39.46	70.31	94.44	127.10	144.37	149.16	122.36	106.38	39.43	

Table 15: FRV Solea, cruise 740/2017. Total biomass (t) of herring excl. CBH herring by age/W-rings and area.

Sub-division	Rectangle/ W-rings	0	1	2	3	4	5	6	7	8+	Total	
21	41G0	3.5	41.0								44.5	
21	41G1	209.4	4,021.3	42.6	13.0						4,286.3	
21	41G2	226.9	1,168.9	16.9	5.4	0.7					1,418.8	
21	42G1	80.7	3,499.4	652.5	117.4	19.9					4,369.8	
21	42G2	38.5	521.5								560.1	
21	43G1										0.0	
21	43G2	5.6	75.6								81.1	
21	Total	564.6	9,327.7	712.0	135.8	20.6	0.0	0.0	0.0	0.0	10,760.6	
22	37G0	15.1	8.5								23.6	
22	37G1	1,975.6	453.1	10.0	7.4	1.9					2,448.0	
22	38G0	279.6	665.1		12.0						956.7	
22	38G1	0.0	715.3	24.9	13.2						753.4	
22	39F9	30.3	204.0	12.0	7.2	1.9					255.4	
22	39G0	79.5	82.0	7.1	3.2	0.5					172.3	
22	39G1	184.2	862.2	294.5	63.5	10.6					1,415.0	
22	40F9	97.6	658.5	39.2	23.3	6.8					825.4	
22	40G0										0.0	
22	40G1	72.2	324.9	15.1	9.1	1.9					423.2	
22	41G0	0.0	0.0	0.0	0.0	0.0					0.0	
22	Total	2,734.0	3,973.6	402.7	138.94	23.7	0.0	0.00	0.00	0.0	7,272.9	
23	39G2	179.6	60.1	48.9	27.10	22.3	3.0	1.22	0.00	0.0	342.2	excl. CBH
23	40G2	463.9	126.5	11.4	10.6	6.3	2.4				621.0	
23	41G2	45.7	3.8	2.8	0.8						53.2	
23	Total	689.2	190.5	63.1	38.4	28.6	5.4	1.2	0.0	0.0	1,016.4	
24	37G2	256.2	94.5	15.0	13.2	0.0	0.0	0.0	0.0	0.0	378.9	
24	37G3	132.5	181.3	979.1	1,437.5	2,032.1	482.2	279.3	47.2	29.8	5,600.9	
24	37G4	226.5	236.7	887.3	1,435.9	2,734.7	1,165.6	559.9	33.9	20.2	7,300.7	
24	38G2	4,014.9	1,045.9	110.5	9.0	0.0	0.0	0.0	0.0	0.0	5,180.3	
24	38G3	1,474.1	962.5	1,920.7	1,504.7	1,282.0	433.4	165.0	30.9	26.6	7,799.8	excl. CBH
24	38G4	996.7	1,041.1	3,905.7	6,316.9	12,032.1	5,129.2	2,463.0	151.3	89.4	32,125.4	
24	39G2	2,125.0	709.5	580.4	320.3	262.5	40.0	19.5	2.1	2.1	4,061.4	
24	39G3	743.3	877.0	1,493.5	1,653.1	1,881.3	495.5	257.1	38.3	38.3	7,477.5	
24	39G4	30.2	149.1	955.8	1,380.9	1,895.9	607.7	268.9	34.0	34.0	5,356.7	
24	Total	9,999.4	5,297.5	10,848.0	14,071.6	22,120.7	8,353.6	4,012.7	337.7	240.4	75,281.6	
22-24	Total	13,422.7	9,461.6	11,313.7	14,249.0	22,172.9	8,358.9	4,013.9	337.7	240.4	83,570.8	
21-24	Total	13,987.2	18,789.4	12,025.7	14,384.7	22,193.4	8,358.9	4,013.9	337.7	240.4	94,331.4	

Annex 8: List of presentations made at the WGBIFS 2018 meeting

1. BASS presentation of Estonia, made by Elor Sepp (Estonia);
2. BASS presentation of Latvia, made by Guntars Strods (Latvia);
3. BASS presentation of Lithuania, made by Marijus Spegys (Lithuania);
4. BASS presentation of Poland, made by Włodzimierz Grygiel (Poland);
5. BASS presentation of Germany, made by Paco Rodriguez-Tress (Germany);
6. BIAS presentation of Finland, made by Juha Lilja (Finland);
7. BIAS presentation of Estonia, made by Elor Sepp (Estonia);
8. BIAS presentation of Latvia, made by Guntars Strods (Latvia);
9. Gulf of Riga Herring Survey presentation of Latvia, made by Guntars Strods (Latvia);
10. BIAS presentation of Lithuania, made by Marijus Spegys (Lithuania);
11. BIAS presentation of Russia, made by Vladimir Severin (Russia);
12. BIAS presentation of Poland, made by Włodzimierz Grygiel (Poland);
13. BIAS presentation of Germany, made by Paco Rodriguez-Tress (Germany);
14. BIAS presentation of Sweden, made by Niklas Larson (Sweden);
15. BITS presentation of Estonia, made by Elor Sepp (Estonia);
16. BITS presentation of Latvia, made by Ivo Sics (Latvia);
17. BITS presentation of Lithuania, made by Marijus Spegys (Lithuania);
18. BITS presentation of Russia, made by Igor Karpushevskiy (Russia);
19. BITS presentation of Poland, made by Krzysztof Radtke (Poland);
20. BITS presentation of Germany, made by Andrés Velasco (Germany);
21. BITS presentation of Denmark, made by Henrik Degel (Denmark);
22. BITS presentation of Sweden, made by Olof Lövgren (Sweden);
23. Presentation of summary actions on WGCHAIRS, made by Olavi Kaljuste (Sweden);
24. Presentation of Evaluation of CBH acoustic time-series, made by Olavi Kaljuste (Sweden);
25. Presentation of Variability in abundance estimates of pelagic fish communities, made by Elor Sepp (Estonia);
26. Presentation of Polish marine litter, made by Włodzimierz Grygiel (Poland);
27. Presentation of ICES Acoustic Trawl Data Portal, made by Hjalte Parner (ICES secretariat);
28. Presentation of Baltic Large Fish Indicator, made by Adriana Villamor (ICES secretariat);
29. Presentation of DATRAS, Progress and Development, made by Vaishav Soni (ICES secretariat);
30. Presentation of Wish list for additional data in DATRAS, made by Casper Berg (Denmark).

All these presentations are available in the folder "Presentations" in the WGBIFS 2018 SharePoint site.