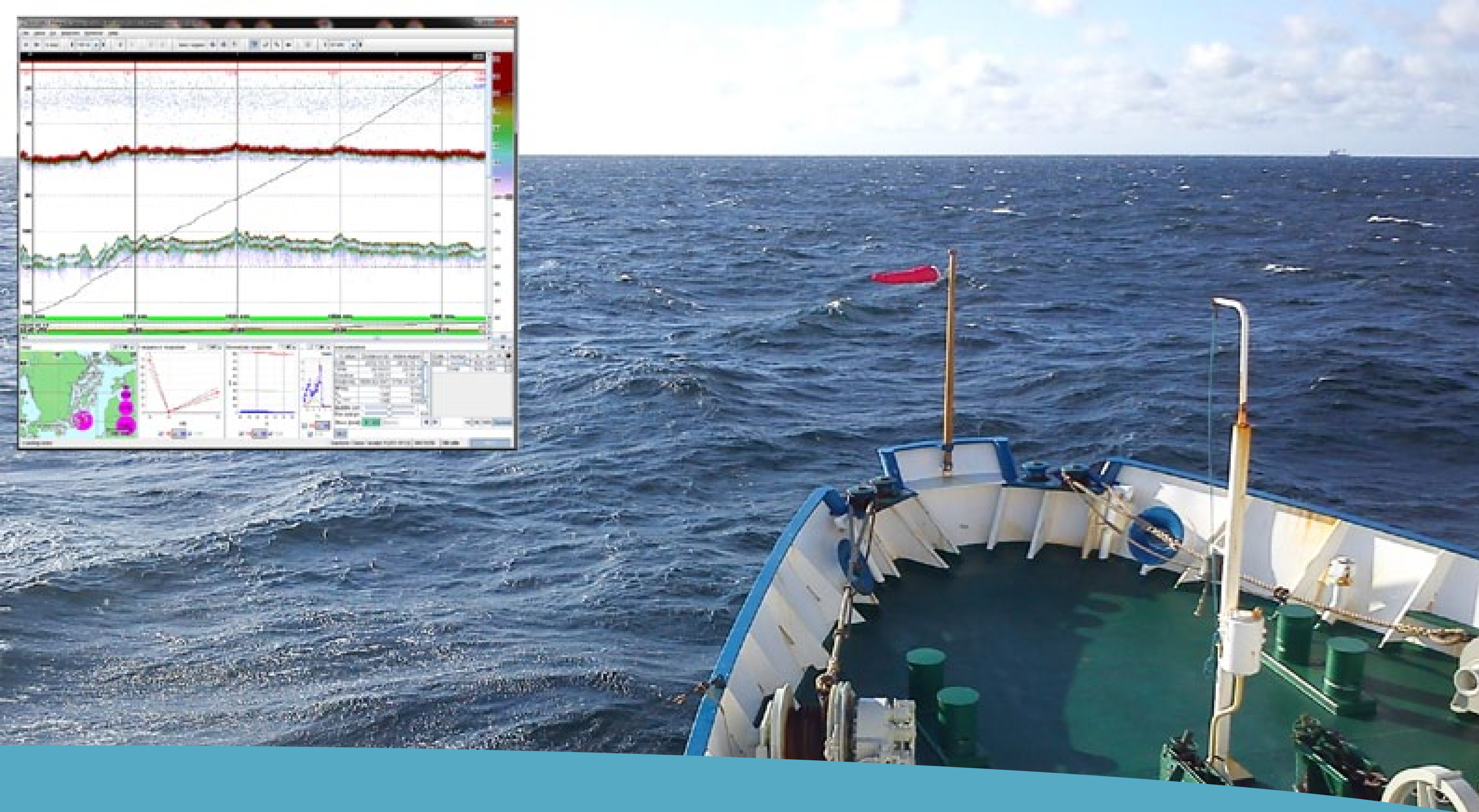

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Baltic International Acoustic Survey report, October 2019

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Baltic International Acoustic Survey report, October 2019

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Baltic International Acoustic Survey Report for R/V Svea

Survey 2019-10-08 - 2019-10-20

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

Contents

1 Svensk Sammanfattning

Internationellt koordinerade hydroakustiska expeditioner har regelbundet genomförts av Havsfiskelaboratoriet i Lysekil sedan 1978 i Östersjön. Baltic International Acoustic Survey (BIAS), som utförs varje år i oktober, regleras under Europeiska Commissionens Data Collection Framework (DCF) och är obligatorisk för varje medlemsland i EU runt Östersjön. Sverige ansvarar för subdivision(SD) 27 och för delar av subdivisionerna 25, 26, 28 samt 29. Syftet med expeditionen är att bedöma beståndstatus för sill samt skarpsillbeståndet, resultaten rapporteras årligen till Baltic International Fish Survey Working Group (WGBIFS) och Baltic Fisheries Assessment Working Group (WGBFAS), båda är arbetsgrupper inom International Council for the Exploration of the Sea (ICES).
I år utfördes kalibrering av ekoloden den 2019-10-08 i Gullmarsfjorden och därefter tog sig Svea till gränsen mellan SD24 och SD25 där datainsamlingen startade. Expeditionen slutade 2019-10-20 Lysekil. Under expeditionen samlas akustisk rådata in med ett vetenskapligt ekolod (EK80 38kHz) och pelagisk trålning utförs för att få information om art och längfördelning. Den akustiska rådatan efterbehandlas i LSSS. Trålfångsten analyseras vad gäller arter samt längder, dessutom tar man fram en åldersstruktur på målarterna i fångsten som i detta fallet är sill, skarpsill och torsk. Informationen om arter och längder som fås från trålfångsterna används tillsammans med information från ekolodet för att räkna fram ett index för biomassan av fiskarterna och deras åldersstruktur.
I WGBIFS tas gemensamma riktlinjer och manualer fram och resultaten från varje land kombineras i en gemensam databas som rapporteras till WGBFAS(ICES), vilka använder BIAS-resultaten tillsammans med annan information i en modell för att uppskatta det totala beståndet av sill respektive skarpsill. Resultatet från 2019 års svenska BIAS survey bedömdes av WGBIFS vara representativt för mängden sill och skarpsill i Östersjön. WGBIFS möte hölls via videokonferans, i april 2020. Tidigare års resultat samt mer information kring BIAS samt WGBIFS arbete finns i arbetsgruppens årliga rapport.

2 Introduction

International hydroacoustic surveys have been conducted in the Baltic Sea since 1978. The starting point was the cooperation between the 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 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 Data Collection Framework (DCF) web page[1]).
The 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 DCF and surveys in the marine environment. The Institute assesses the status of the marine ecosystems, develops and provides biological advices for the sustainable use of the aquatic resources.
The BIAS survey is 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 provides data to the ICES Baltic Fisheries Assessment Working Group (WGBFAS).

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

3 Methods

3.1 Narrative

Sweden has a newbuilt fisheries research vessel, Svea that was delivered in July 2019. The BIAS survey was the first real data collection expedition made with R/V Svea. This year's calibration of the SIMRAD EK80[2] sounder was made in the Gullmarsfjorden on the Swedish west coast. This year the survey started 2019-10-08 between Sweden and Bornholm at the border between ICES subdivision (SD) 24 and SD 25, and ended 2019-10-20 close to where it startedsee figure 2. The total cruise covered SD 27 and parts of 25, 26, 28 and 29[3].

3.2 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[4]. 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 such design. The total area covered was 20832 square nautical miles and the distance used for acoustic estimates was 1359 nautical miles. The cruise track and positions of trawl hauls are shown in figure 2.

3.3 Calibration

The SIMRAD EK80 echo sounder with the 38kHz transducer was calibrated at Bornö in Gullmarssfjorden on 2019-10-08 according to the BIAS manual[4]. Values from the calibration were within required accuracy. The calibration site has been used in previous years and was initially 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)$(G = Gain, c = Soundvelocity)$

3.4 Acoustic data collection

The acoustic sampling was performed around the clock. SIMRAD EK80[2] echo sounder with the 38 kHz transducer mounted on a drop keel is used for the acoustic transect data collection. The settings of the hydroacoustic equipment were as described in the BIAS manual[4]. The post processing of the stored raw data was made using the software LSSS[5]. 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 filtered out from the echogram using LSSS.

3.5 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 the species composition was based on the trawl catch results. For each rectangle the species composition and

[2]http://www.simrad.com/ek80
[3]see figure 1
[4]ICES CM 2011/SSGESST:05 Addendum 2
[5]www.marec.no/english/products.htm

length distribution were determined as the unweighted mean of all trawl results in this rectangle. 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.

3.6 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 the stations.

3.7 Personnel

The participating scientific crew can be seen in table 2

Jernberg, Carina	IMR, Lysekil, Sweden	Fish sampling
Johannesson, Per	IMR, Lysekil, Sweden	Technician
Johansson, Marianne	IMR, Lysekil, Sweden	Fish sampling
Larson, Niklas	IMR, Lysekil, Sweden	Scientific & Expedition leader, Acoustics
Lövgren, Olof	IMR, Lysekil, Sweden	Acoustics
Ovegård, Mikael	IMR, Lysekil, Sweden	Acoustics
Palmen-Bratt, Anne-Marie	IMR, Lysekil, Sweden	Fish sampling
Sjöberg, Rajlie	IMR, Lysekil, Sweden	Fish sampling
Svensson, Matilda	IMR, Lysekil, Sweden	Fish sampling
Tell, Anna-Kerstin	SMHI, Gothenburg	Oceanography
Wikström, Peter	IMR, Lysekil, Sweden	Technician

Table 2: Participating scientific crew

4 Results

4.1 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. In total 1622 herrings and 1232 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.

4.2 Acoustic data

The survey statistics concerning the survey area, the mean backscatter (SA), the mean scattering cross section (SIGMA), the estimated total number of fish (NTOT), the percentages of herring (HHer), sprat (HSpr) and cod (HCod) per Sub-division/rectangle are shown in Table 3.

4.3 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.

5 Discussion

This year was the first year R/V Svea was used and it was a new crew running Svea, some equipment was not totally up and running but as a whole the evaluation was that the survey was accomplished as planned. The weather was good throughout the cruise and assisted the operations. The data collected during the survey was accepted at the WGBIFS meeting and can be considered as representative for the abundance of the pelagic species during the BIAS in 2019 for the covered area (see figure 2) for further information regarding the procedures of WGBIFS see the WGBIFS report[6] https://www.ices.dk/community/groups/Pages/WGBIFS.aspx.

[6] https://www.ices.dk/community/groups/Pages/WGBIFS.aspx

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

7 Tables, map and figures

SD	RECT	AREA	SA	SIGMA	NTOT	HHer	HSpr	HCod
25	39G4	287.3	256.8	2.634	280.04	38.29	59.16	0.705
25	39G5	979.0	216.4	1.593	1329.41	2.92	96.49	0.124
25	40G4	677.2	642.3	2.332	1865.24	41.84	56.13	0.471
25	40G5	1012.9	481.6	1.056	4619.83	4.42	50.81	1.218
25	40G6	1013.0	614.0	2.260	2752.13	64.73	10.09	0.583
25	40G7	1013.0	600.1	1.396	4354.23	10.70	86.24	0.000
25	41G6	764.4	720.1	0.932	5908.43	16.57	18.38	0.037
25	41G7	1000.0	456.5	1.119	4080.24	7.84	61.06	0.000
26	41G8	1000.0	843.0	1.118	7537.90	4.46	60.87	0.120
27	42G6	266.0	496.7	0.561	2354.00	5.29	10.06	0.072
27	42G7	986.9	673.0	0.559	11891.91	4.75	9.14	0.033
27	43G7	913.8	505.6	0.473	9759.12	6.73	12.18	0.000
27	44G7	960.5	380.3	0.595	6140.98	8.24	61.63	0.000
27	44G8	456.6	522.0	0.586	4066.70	1.53	19.18	0.000
27	45G7	908.7	272.5	0.509	4867.64	9.21	30.14	0.000
27	45G8	947.2	252.3	0.434	5500.58	1.00	6.98	0.000
27	46G8	884.8	273.2	0.486	4973.15	2.66	26.07	0.000
28	42G8	945.4	889.8	1.212	6940.84	11.35	67.80	0.001
28	43G8	296.2	705.9	0.841	2487.50	16.93	18.42	0.000
28	43G9	973.7	271.9	0.525	5040.17	1.40	14.45	0.000
28	44G9	876.6	260.6	0.602	3796.68	3.58	54.54	0.000
28	45G9	924.5	430.7	0.588	6773.72	5.67	11.04	0.005
29	46G9	933.8	430.6	0.414	9707.79	1.62	2.11	0.003
29	46H0	933.8	489.8	0.500	9155.93	4.16	20.00	0.000
29	47G9	876.2	581.9	0.565	9027.27	2.70	52.30	0.000

Table 3: Survey statistics, see chapter 4.2 for more info

SD	RECT	NSprTOT	NSpr0	NSpr1	NSpr2	NSpr3	NSpr4	NSpr5	NSpr6	NSpr7	NSpr8
25	39G4	165.65	0.00	5.03	25.13	38.34	36.48	41.13	2.23	8.19	9.12
25	39G5	1282.79	0.00	173.78	0.00	186.60	153.89	670.32	38.70	59.50	0.00
25	40G4	1046.94	0.00	149.56	60.26	139.92	219.61	316.21	60.80	95.74	4.83
25	40G5	2347.45	5.70	185.58	344.86	354.58	463.21	595.57	307.51	85.98	4.47
25	40G6	277.58	9.10	37.17	72.47	54.95	20.64	70.29	8.09	0.00	4.87
25	40G7	3754.97	717.26	374.29	269.28	527.11	734.70	956.34	75.05	92.76	8.17
25	41G6	1085.88	167.75	168.67	48.32	328.83	159.74	129.01	13.11	9.90	60.53
25	41G7	2491.19	378.06	289.23	148.30	250.15	616.50	803.75	0.00	5.19	0.00
26	41G8	4588.65	30.27	835.12	499.17	1340.12	539.38	950.77	52.84	202.27	138.70
27	42G6	236.90	34.95	22.52	28.74	22.01	24.60	76.12	16.83	1.29	9.84
27	42G7	1087.19	22.95	25.62	96.52	93.08	235.57	490.61	34.35	12.94	75.54
28	42G8	4705.98	852.23	738.35	346.67	841.38	306.47	1464.06	78.87	20.81	57.14
27	43G7	1188.69	760.54	125.02	37.89	71.85	48.40	114.41	15.14	11.80	3.62
28	43G8	458.26	354.78	0.00	4.14	23.06	27.79	48.49	0.00	0.00	0.00
28	43G9	728.37	189.20	187.99	121.86	70.70	103.42	55.19	0.00	0.00	0.00
27	44G7	3784.41	3711.42	20.35	10.17	0.00	0.00	21.23	11.95	9.29	0.00
27	44G8	779.82	104.85	95.02	122.54	96.99	134.99	169.07	30.80	25.56	0.00
28	44G9	2070.87	1975.55	7.34	14.23	16.38	36.52	19.51	1.34	0.00	0.00
27	45G7	1467.13	1435.64	13.71	0.00	4.11	4.11	9.57	0.00	0.00	0.00
27	45G8	384.20	238.13	28.46	48.72	19.23	18.43	27.34	1.27	1.27	1.36
28	45G9	747.67	129.47	130.09	115.56	49.23	76.35	167.49	62.61	5.62	11.24
27	46G8	1296.51	1276.67	7.44	0.00	2.48	0.00	9.92	0.00	0.00	0.00
29	46G9	205.08	139.23	4.41	4.37	23.03	8.04	20.48	4.00	1.52	0.00
29	46H0	1831.06	1617.19	55.49	9.94	37.26	40.09	48.64	5.20	0.00	17.27
29	47G9	4721.43	4150.74	83.94	59.29	71.06	0.00	334.94	0.00	21.47	0.00

Table 4: Estimated number (millions) of sprat (Nspr0 stands for number of 0 year old sprat)

SD	RECT	WSpr0	WSpr1	WSpr2	WSpr3	WSpr4	WSpr5	WSpr6	WSpr7	WSpr8
25	39G4		9.95	13.93	12.89	14.85	13.60	18.09	15.07	14.09
25	39G5		8.84		11.45	13.17	13.23	14.88	13.97	
25	40G4		9.16	10.31	12.36	13.86	13.12	17.02	13.76	15.92
25	40G5	3.33	7.97	10.35	13.19	11.99	15.79	13.52	16.15	15.37
25	40G6	3.63	8.59	10.80	10.83	13.96	12.65	13.16		13.36
25	40G7	3.62	7.74	10.05	10.71	11.21	12.46	13.64	13.81	16.83
25	41G6	3.50	8.40	9.27	11.27	12.28	12.55	15.14	12.74	15.03
25	41G7	3.25	8.47	8.49	10.71	10.22	12.63		14.84	
26	41G8	3.41	7.97	8.97	10.21	12.03	11.90	12.77	11.47	13.69
27	42G6	3.36	8.68	9.20	10.94	10.99	11.48	12.20	11.95	14.19
27	42G7	2.10	9.17	10.59	9.32	11.02	11.87	13.59	13.48	13.93
28	42G8	3.27	7.96	8.36	9.75	11.33	10.51	13.00	13.99	12.33
27	43G7	2.78	8.98	9.77	11.13	11.21	11.38	13.04	10.89	11.87
28	43G8	3.11		8.57	9.42	11.25	10.89			
28	43G9	2.93	8.65	8.97	11.04	11.09	12.44			
27	44G7	2.87	7.32	6.36			12.21	10.82	13.38	
27	44G8	3.70	9.39	11.71	10.11	12.74	13.00	15.02	11.67	
28	44G9	3.02	8.17	9.37	10.72	10.17	11.46	13.87		
27	45G7	2.23	6.20		11.88	11.55	10.78			
27	45G8	3.13	9.09	10.66	11.78	11.13	11.49	13.14	12.66	17.55
28	45G9	3.21	9.67	10.50	9.77	10.96	11.03	12.97	15.42	14.77
27	46G8	2.56	8.76		9.20		10.34			
29	46G9	2.84	8.04	10.71	10.31	8.67	10.30	12.44	11.19	
29	46H0	2.65	8.00	10.06	9.64	11.18	11.92	9.14		11.54
29	47G9	3.02	9.37	10.02	10.68		11.05		13.09	

Table 5: Estimated mean weights (g) of sprat
(Wspr1 stands for average weight of the 1 year old sprat)

SD	RECT	NHerTOT	NHer0	NHer1	NHer2	NHer3	NHer4	NHer5	NHer6	NHer7	NHer8
25	39G4	107.21	2.54	10.94	31.94	23.43	20.56	14.81	1.88	0.00	1.11
25	39G5	38.85	5.79	5.60	8.28	2.56	3.32	10.72	1.47	1.13	0.00
25	40G4	780.39	21.77	103.16	151.18	115.69	56.55	220.27	91.83	19.95	0.00
25	40G5	204.11	29.66	28.43	16.14	19.12	25.82	75.22	7.17	0.52	2.02
25	40G6	1781.52	9.26	83.92	122.15	309.62	173.34	973.20	63.40	44.15	2.46
25	40G7	465.91	1.48	2.61	92.71	40.35	162.29	151.86	5.22	9.39	0.00
25	41G6	978.97	11.73	111.89	114.87	170.82	270.36	285.43	9.60	1.06	3.21
25	41G7	319.83	5.18	1.44	29.63	55.69	44.76	170.66	8.50	3.10	0.86
26	41G8	336.16	7.86	3.05	42.44	20.19	49.25	186.39	10.41	16.58	0.00
27	42G6	124.59	13.65	4.55	19.57	16.04	16.61	51.88	1.71	0.00	0.57
27	42G7	564.83	17.66	20.91	76.17	30.18	139.22	274.20	0.00	6.49	0.00
28	42G8	787.76	20.04	0.00	189.85	161.85	180.57	223.72	7.65	0.00	4.07
27	43G7	656.54	635.61	1.40	3.54	5.95	2.23	5.86	1.95	0.00	0.00
28	43G8	421.25	5.05	22.20	35.82	56.00	66.59	211.38	19.17	5.04	0.00
28	43G9	70.64	1.21	0.60	20.89	9.78	12.80	22.58	2.78	0.00	0.00
27	44G7	505.86	423.07	22.82	24.67	5.94	8.96	19.02	1.38	0.00	0.00
27	44G8	62.26	55.71	0.00	0.00	0.00	6.55	0.00	0.00	0.00	0.00
28	44G9	135.76	25.81	3.86	11.15	34.35	17.35	42.47	0.00	0.77	0.00
27	45G7	448.42	392.72	10.68	21.10	3.37	2.25	11.88	6.42	0.00	0.00
27	45G8	55.08	48.37	1.34	0.90	0.00	1.65	2.83	0.00	0.00	0.00
28	45G9	384.28	71.24	31.98	43.75	71.37	69.51	82.27	14.16	0.00	0.00
27	46G8	132.47	22.73	9.50	24.03	14.33	25.91	23.34	12.62	0.00	0.00
29	46G9	157.19	30.93	2.64	20.12	20.50	13.61	61.40	5.27	0.00	2.72
29	46H0	380.85	102.71	16.46	19.11	52.13	47.91	102.34	38.05	2.13	0.00
29	47G9	244.11	201.48	1.15	15.90	9.97	4.45	6.74	2.93	0.00	1.49

Table 6: Estimated number (millions) of herring

SD	RECT	WHer0	WHer1	WHer2	WHer3	WHer4	WHer5	WHer6	WHer7	WHer8
25	39G4	11.13	21.71	39.84	62.17	57.72	62.72	129.99		181.64
25	39G5	11.78	15.23	35.31	30.49	25.90	33.51	34.16	34.67	
25	40G4	12.20	18.75	37.11	47.29	47.02	41.04	47.79	64.72	
25	40G5	12.31	17.68	43.40	42.46	46.75	36.35	43.66	77.56	43.69
25	40G6	11.21	22.69	36.77	29.49	32.83	39.82	46.55	43.89	57.44
25	40G7	10.55	19.25	30.63	32.37	30.19	33.75	39.53	39.57	
25	41G6	6.95	19.09	21.53	24.40	34.30	32.22	40.06	42.52	50.02
25	41G7	4.10	15.98	21.14	25.56	29.41	33.71	47.07	31.98	59.24
26	41G8	5.66	16.12	22.72	22.99	33.17	32.45	41.19	35.87	
27	42G6	6.60	15.65	24.68	24.60	30.66	30.76	31.46		32.10
27	42G7	7.01	16.95	23.97	23.70	30.48	32.00		33.19	
28	42G8	5.53		24.22	24.95	31.32	31.96	39.96		34.18
27	43G7	5.24	17.63	26.33	26.42	30.80	30.10	31.09		
28	43G8	4.75	20.56	22.02	25.44	29.70	30.82	37.61	40.27	
28	43G9	5.25	14.90	23.82	27.70	27.66	30.59	32.23		
27	44G7	4.28	18.46	24.99	24.31	30.58	28.45	30.71		
27	44G8	5.79				29.01				
28	44G9	4.87	17.70	25.70	26.96	25.60	31.48		39.61	
27	45G7	5.07	17.39	22.84	26.88	26.85	27.36	33.70		
27	45G8	5.88	18.18	21.19		27.31	28.49			
28	45G9	5.81	18.67	21.71	26.00	32.10	32.64	32.37		
27	46G8	4.66	18.00	23.94	27.33	26.31	28.46	30.43		
29	46G9	4.62	17.00	22.08	27.21	23.48	26.97	31.30		27.28
29	46H0	5.23	16.71	23.66	28.38	27.23	28.01	29.98	34.84	
29	47G9	4.43	16.16	24.31	25.10	27.12	25.89	24.91		36.95

Table 7: Estimated mean weights (g) of herring

	Species	5	6	8	9	10	11	12	19
1	Ammodytidae								
2	Anguilla anguilla								
3	Clupea harengus	97.94	64.24	16.36	168.51	46.05	25.31	2.07	35.12
4	Cyclopterus lumpus	0.35	0.13	0.24			0.16		
5	Enchelyopus cimbrius								
6	Gadus morhua	10.33	1.99	0.90			0.01		
7	Gasterosteus aculeatus			25.68	10.04	6.07	18.87	39.97	43.97
8	Hyperoplus lanceolatus						0.01		
9	Lumpenus lampretaeformis								
10	Myoxocephalus scorpius							0.07	
11	Nerophis ophidion						0.01		
12	Platichthys flesus	0.72					0.10		
13	Pleuronectes platessa	0.53							
14	Pomatoschistus	0.03							
15	Pungitius pungitius	0.01		0.12	0.07	0.08	0.13	0.21	
16	Scophthalmus maximus			0.13		0.06			
17	Sprattus sprattus	42.68	234.55	207.20	19.93	16.69	15.08	7.42	55.58
18	Zoarces viviparus								

Table 8: Catch composition per haul.

	Species	23	25	26	27	29	31	32	33	34
1	Ammodytidae				0.01			0.01	0.03	
2	Anguilla anguilla									
3	Clupea harengus	20.93	2.63	4.86	18.81	10.22	2.39	2.23	60.40	11.26
4	Cyclopterus lumpus		0.15					0.29	0.04	
5	Enchelyopus cimbrius									
6	Gadus morhua									0.00
7	Gasterosteus aculeatus	4.77	34.31	118.91	44.00	11.14	60.75	48.93	74.60	32.10
8	Hyperoplus lanceolatus			0.79						
9	Lumpenus lampretaeformis									
10	Myoxocephalus scorpius									
11	Nerophis ophidion			0.03	0.02	0.01	0.00		0.03	0.01
12	Platichthys flesus							0.22	0.15	
13	Pleuronectes platessa									
14	Pomatoschistus									
15	Pungitius pungitius	0.03	0.09	0.24	0.02	0.05	0.28	0.07	0.10	0.08
16	Scophthalmus maximus									
17	Sprattus sprattus	106.41	40.97	46.64	7.64	25.98	3.61	25.97	41.10	2.66
18	Zoarces viviparus							0.00		

Table 8 (continued): Catch composition per haul

	Species	35	36	37	38	39	40	41	43	44
1	Ammodytidae									
2	Anguilla anguilla									
3	Clupea harengus	11.06	4.26	48.64	20.00	2.48	3.07	28.80	33.26	3.27
4	Cyclopterus lumpus			0.34	0.57		0.18		0.36	
5	Enchelyopus cimbrius									
6	Gadus morhua							0.24		
7	Gasterosteus aculeatus	6.28	47.98	42.99	67.56	77.83	104.88	16.07	32.61	8.09
8	Hyperoplus lanceolatus			0.03					0.04	
9	Lumpenus lampretaeformis							0.02		
10	Myoxocephalus scorpius							0.17	0.12	
11	Nerophis ophidion	0.03	0.01		0.01	0.01	0.01			0.04
12	Platichthys flesus						0.11		0.38	
13	Pleuronectes platessa									
14	Pomatoschistus									
15	Pungitius pungitius		0.10	0.05	0.23	0.05	0.16	0.10	0.02	0.04
16	Scophthalmus maximus									
17	Sprattus sprattus	127.13	17.91	57.15	5.05	3.04	26.18	18.33	14.37	264.69
18	Zoarces viviparus									

Table 8 (continued): Catch composition per haul

	Species	45	46	47	48	49	50	51	52	53
1	Ammodytidae									
2	Anguilla anguilla				0.11					
3	Clupea harengus		83.19	139.27	228.48	10.70	13.38	97.96	29.33	78.48
4	Cyclopterus lumpus		0.14	0.26		0.25				
5	Enchelyopus cimbrius					0.03		0.00		
6	Gadus morhua		0.07			0.34		0.04		0.03
7	Gasterosteus aculeatus	74.96	170.42	40.39	19.45	15.71	28.40	100.71	62.62	97.26
8	Hyperoplus lanceolatus									
9	Lumpenus lampretaeformis									
10	Myoxocephalus scorpius									0.05
11	Nerophis ophidion						0.01			0.01
12	Platichthys flesus			0.91			0.08		0.38	0.39
13	Pleuronectes platessa									
14	Pomatoschistus									
15	Pungitius pungitius	0.02				0.14	0.13	0.10	0.10	0.01
16	Scophthalmus maximus									
17	Sprattus sprattus	9.40	247.18	28.71	204.01	329.13	20.51	112.76	2.94	58.61
18	Zoarces viviparus									

Table 8 (continued): Catch composition per haul

	Species	54	55	56	57	58	59	60	61	62	63
1	Ammodytidae										
2	Anguilla anguilla										
3	Clupea harengus	90.27	13.47	25.34	36.72	51.02	0.18	141.49	12.73	7.50	3.73
4	Cyclopterus lumpus		0.14		0.28		1.03	0.54	0.66		0.37
5	Enchelyopus cimbrius	0.02									
6	Gadus morhua				0.01			3.22	0.08	0.01	0.02
7	Gasterosteus aculeatus	13.71	10.03	13.25	19.20	0.83	0.76	0.37	4.50	0.07	0.03
8	Hyperoplus lanceolatus	0.02			0.14						
9	Lumpenus lampretaeformis										
10	Myoxocephalus scorpius			0.30							
11	Nerophis ophidion										
12	Platichthys flesus							0.15	0.54		
13	Pleuronectes platessa										0.18
14	Pomatoschistus							0.00			
15	Pungitius pungitius	0.04	0.08						0.08	0.01	
16	Scophthalmus maximus										
17	Sprattus sprattus	149.31	83.65	1216.40	45.93	64.72	217.52	3.71	36.44	61.56	402.68
18	Zoarces viviparus										

Table 8 (continued): Catch composition per haul

	Species	59	60	61	62	63
1	Ammodytidae					
2	Anguilla anguilla					
3	Clupea harengus	0.18	141.49	12.73	7.50	3.73
4	Cyclopterus lumpus	1.03	0.54	0.66		0.37
5	Enchelyopus cimbrius					
6	Gadus morhua		3.22	0.08	0.01	0.02
7	Gasterosteus aculeatus	0.76	0.37	4.50	0.07	0.03
8	Hyperoplus lanceolatus					
9	Lumpenus lampretaeformis					
10	Myoxocephalus scorpius					
11	Nerophis ophidion					
12	Platichthys flesus		0.15	0.54		
13	Pleuronectes platessa					0.18
14	Pomatoschistus		0.00			
15	Pungitius pungitius			0.08	0.01	
16	Scophthalmus maximus					
17	Sprattus sprattus	217.52	3.71	36.44	61.56	402.68
18	Zoarces viviparus					

Table 8 (continued): Catch composition per haul

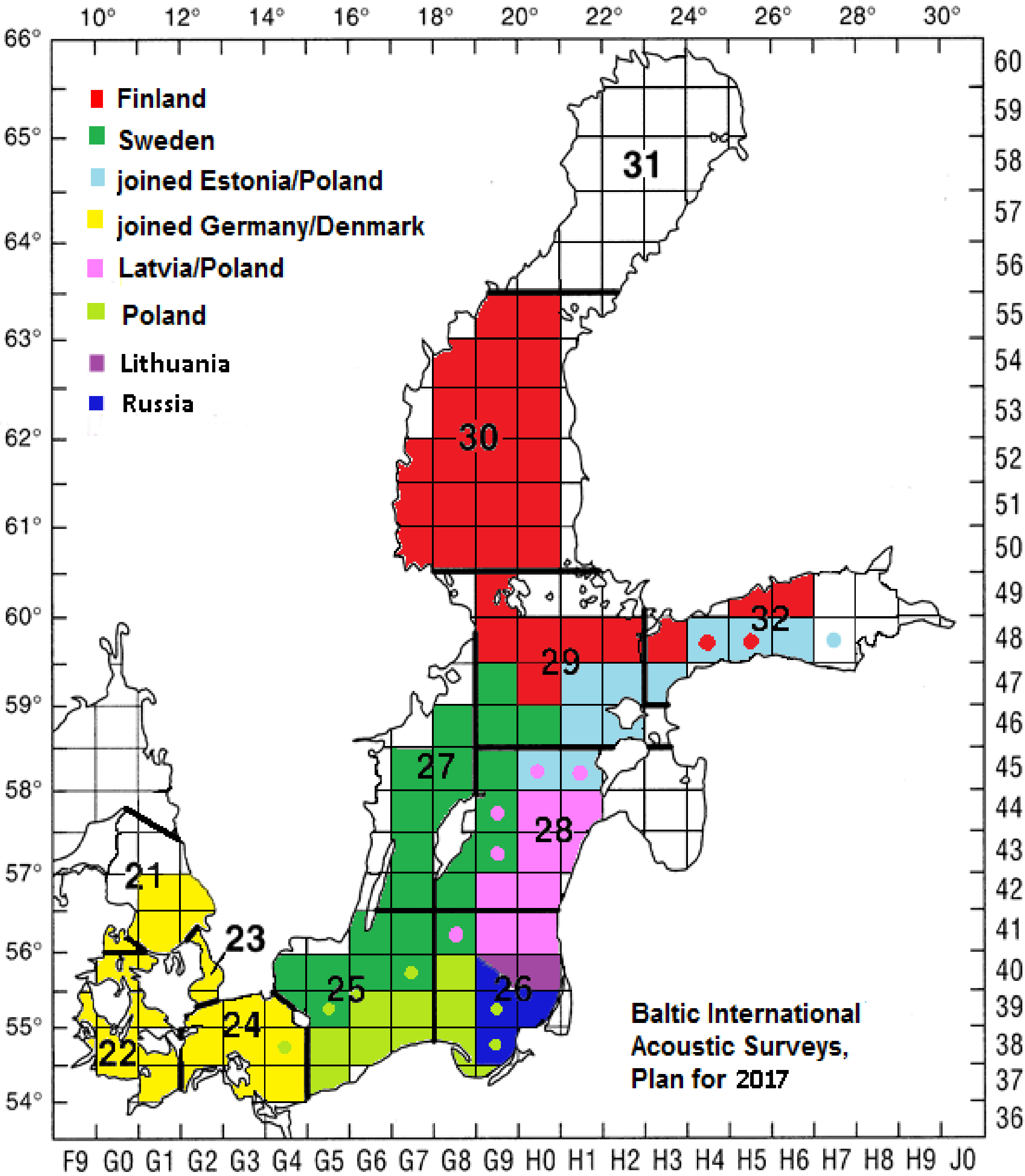

Figure 1: Map over which ICES square are allocated to each country in the BIAS survey 2019 (On axes: longitude, latitude and ICES name of square eg:41G8)

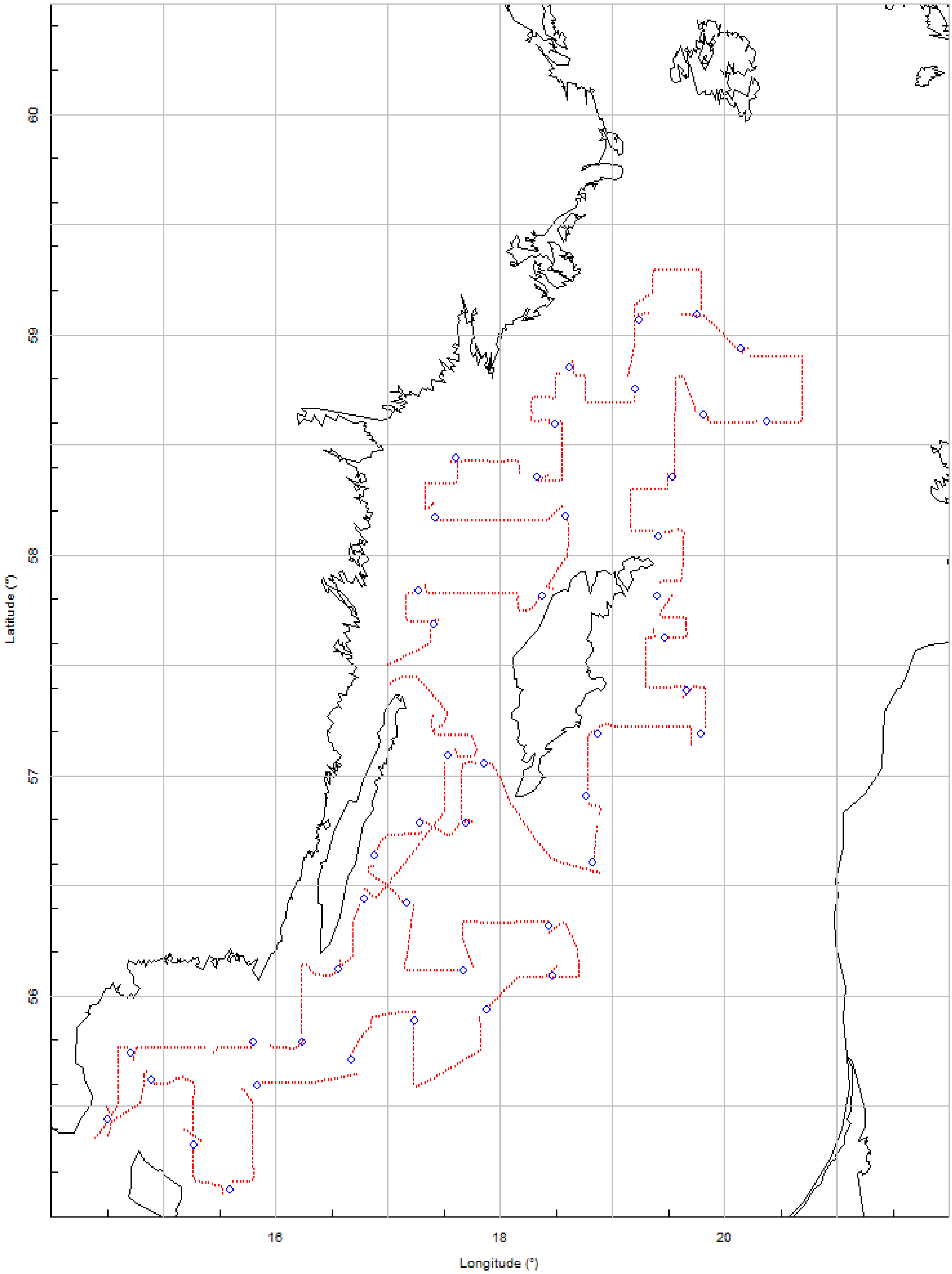

Figure 2: Cruise track(red), positions of trawl hauls (blue) and survey grid (ICES squares)(grey) for BIAS 2019

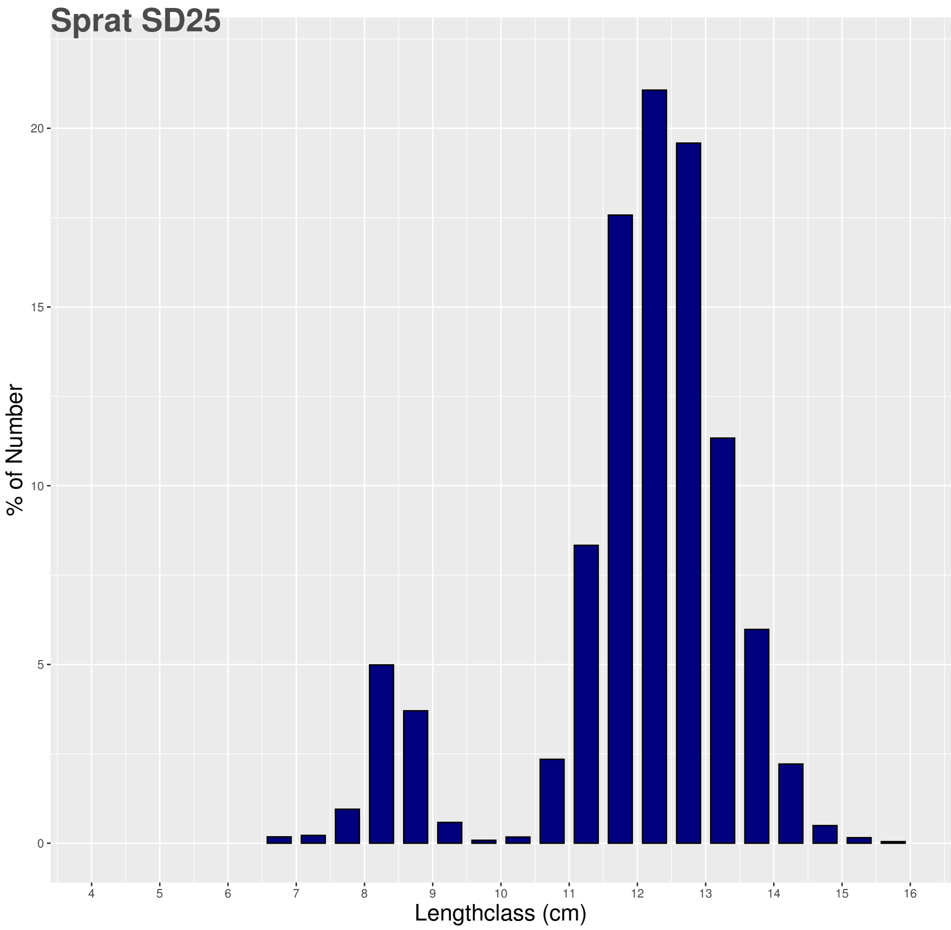

Figure 3: Length distribution of sprat from subdivision 25 for BIAS 2019

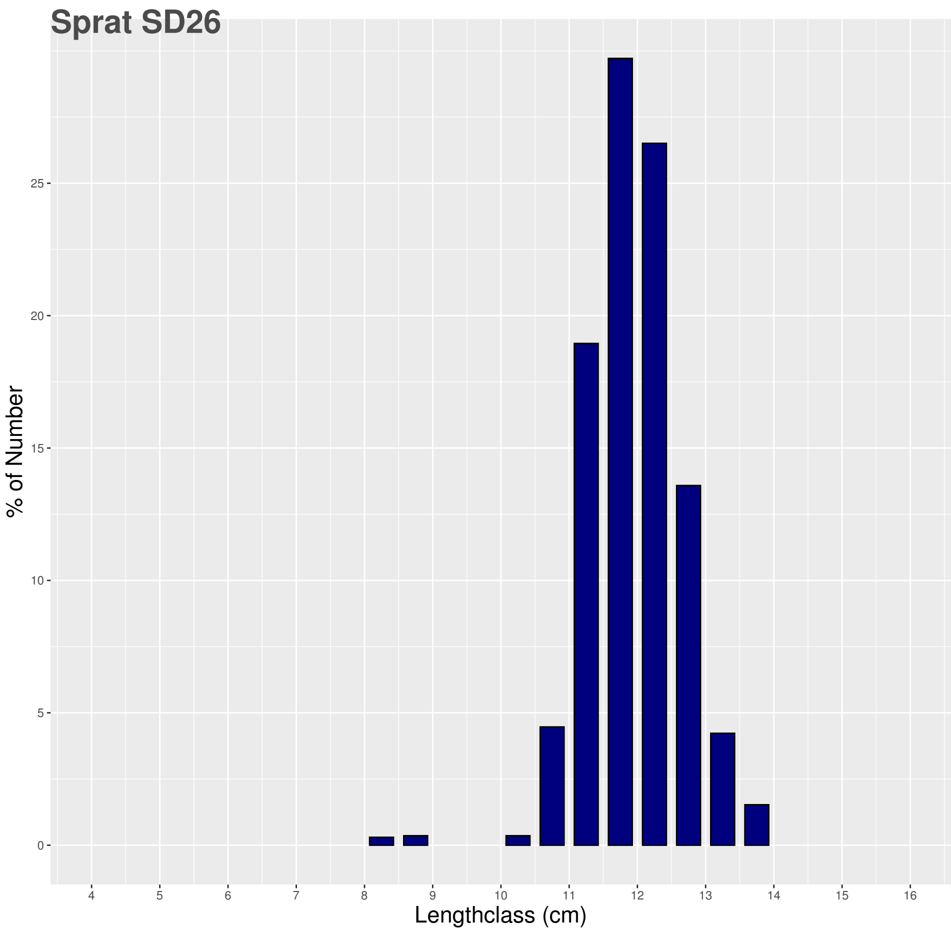

Figure 4: Length distribution of sprat from subdivision 26 for BIAS 2019

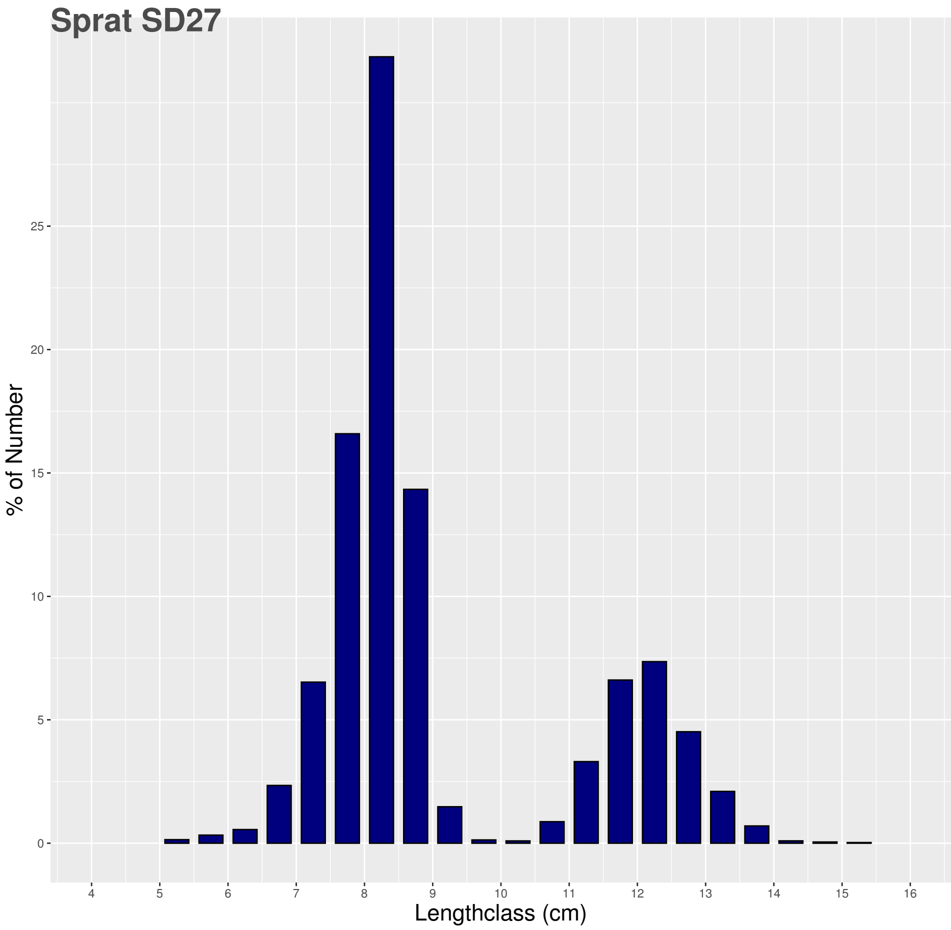

Figure 5: Length distribution of sprat from subdivision 27 for BIAS 2019

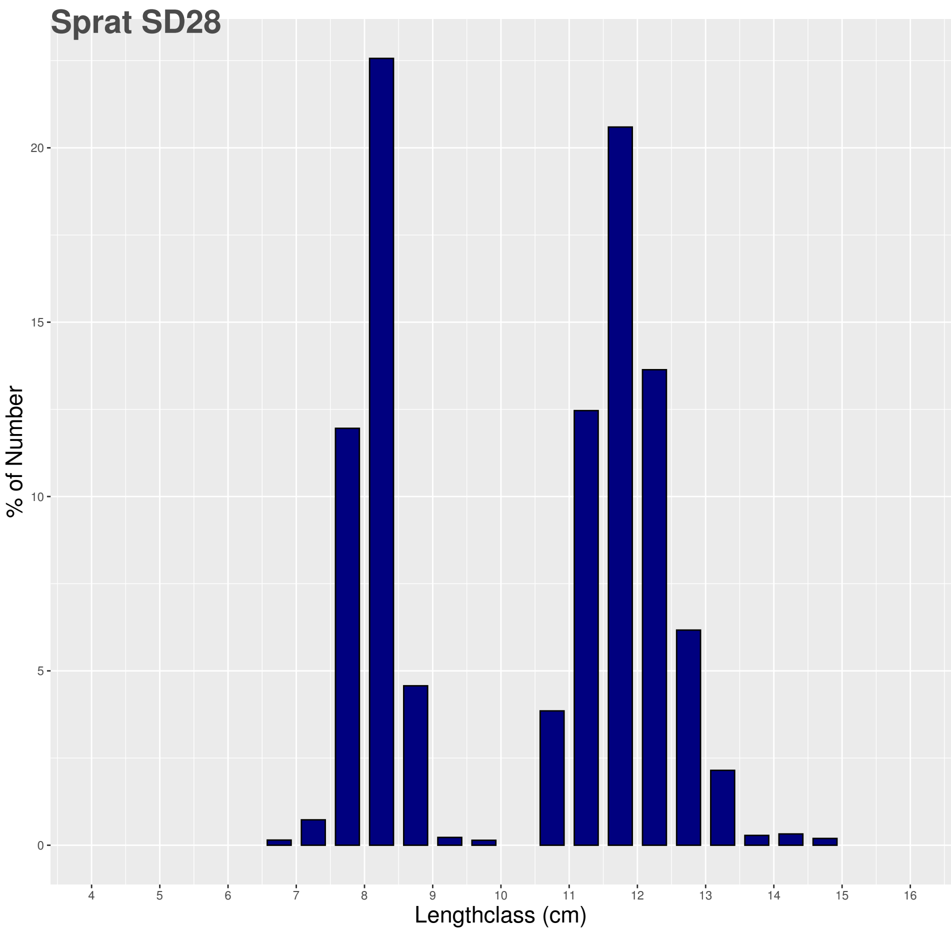

Figure 6: Length distribution of sprat from subdivision 28 for BIAS 2019

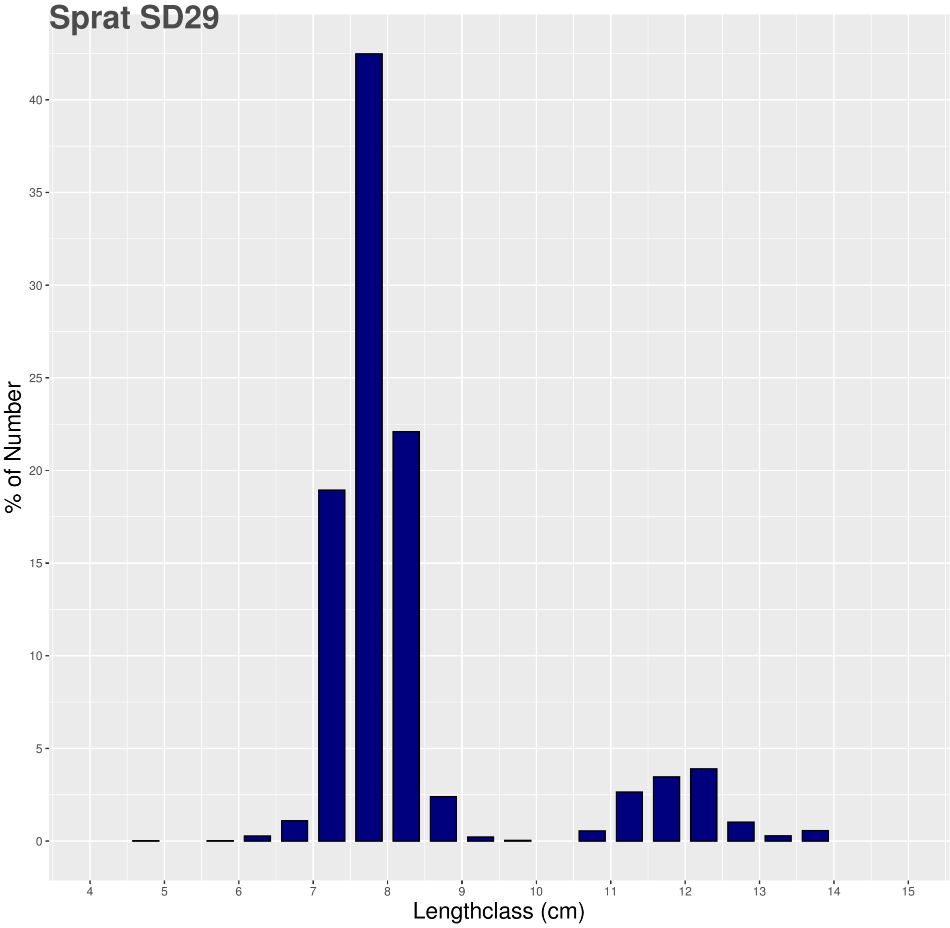

Figure 7: Length distribution of sprat from subdivision 29 for BIAS 2019

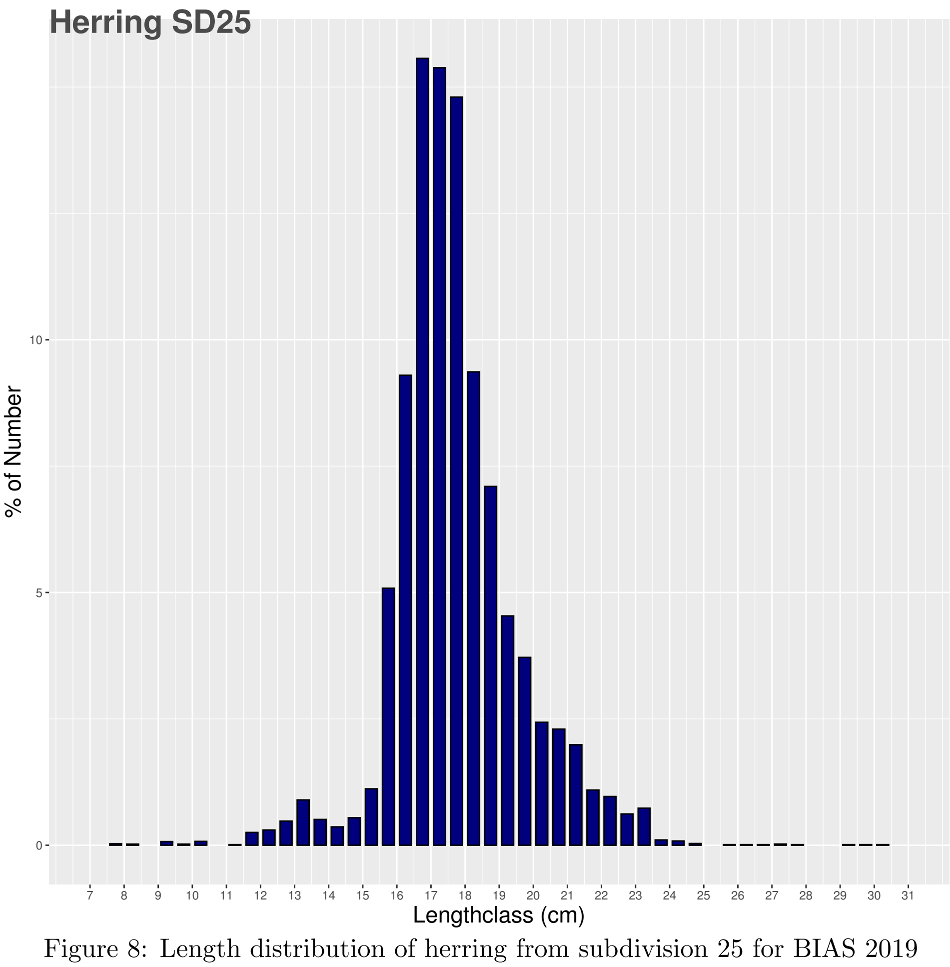

Figure 8: Length distribution of herring from subdivision 25 for BIAS 2019

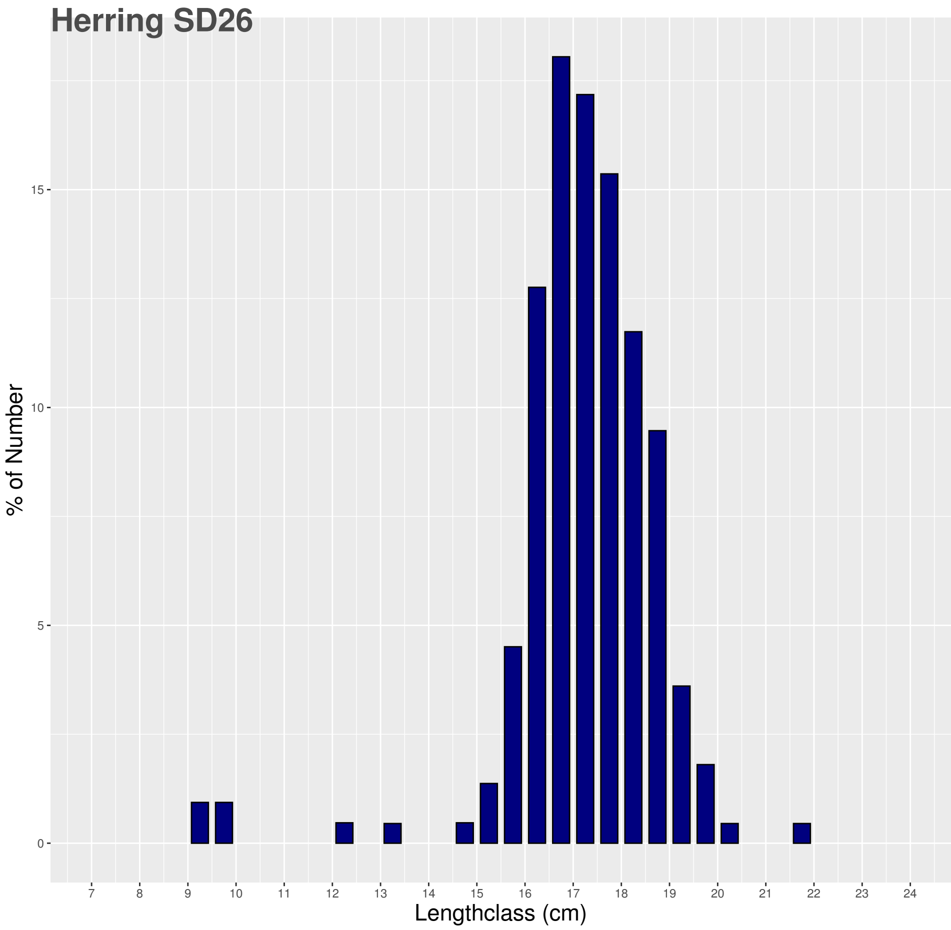

Figure 9: Length distribution of herring from subdivision 26 for BIAS 2019

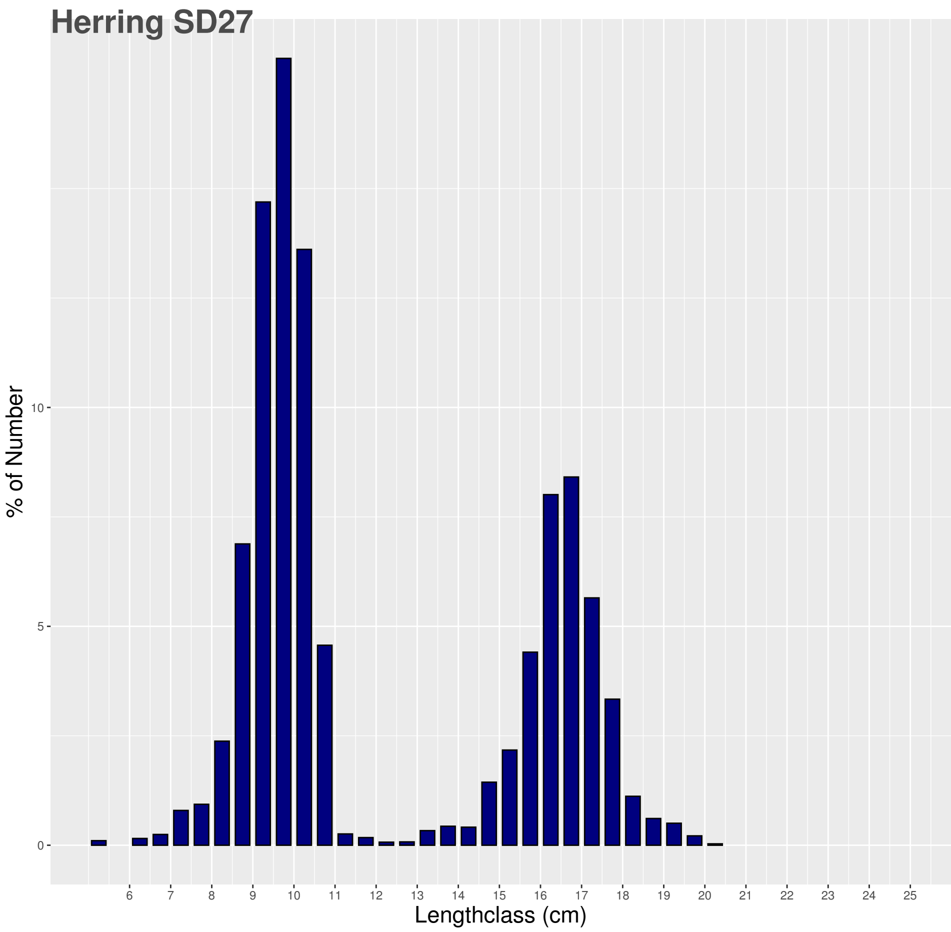

Figure 10: Length distribution of herring from subdivision 27 for BIAS 2019

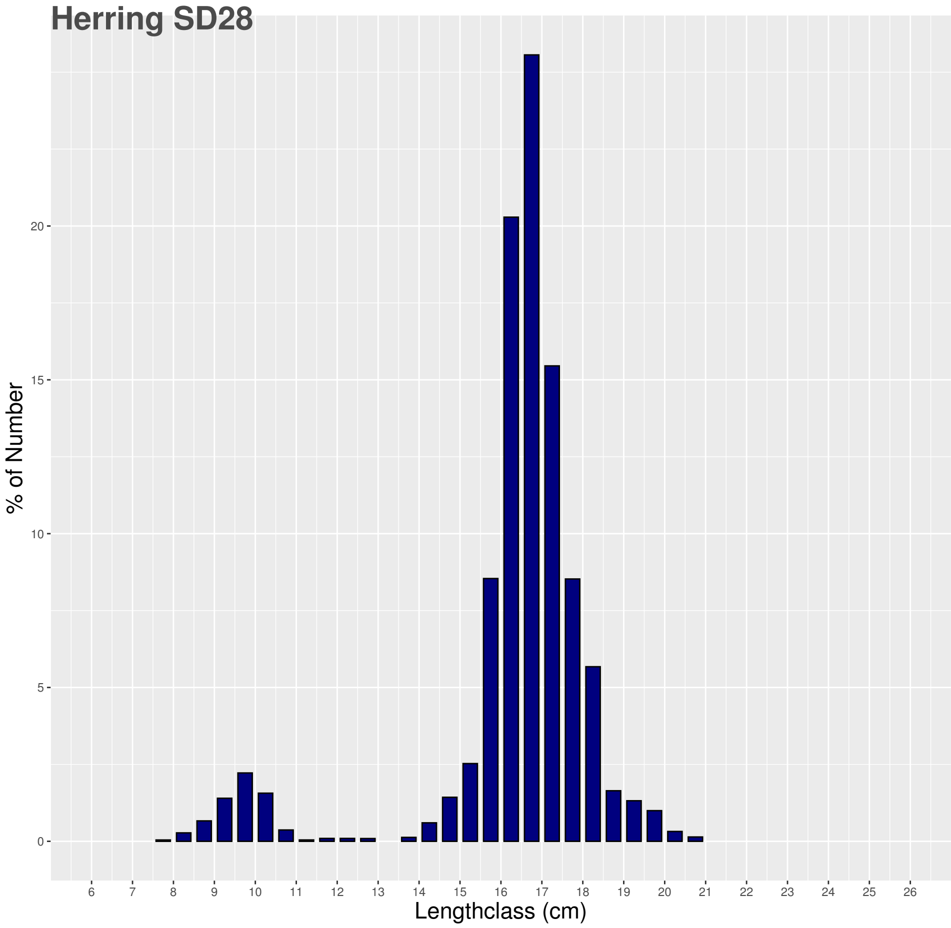

Figure 11: Length distribution of herring from subdivision 28 for BIAS 2019

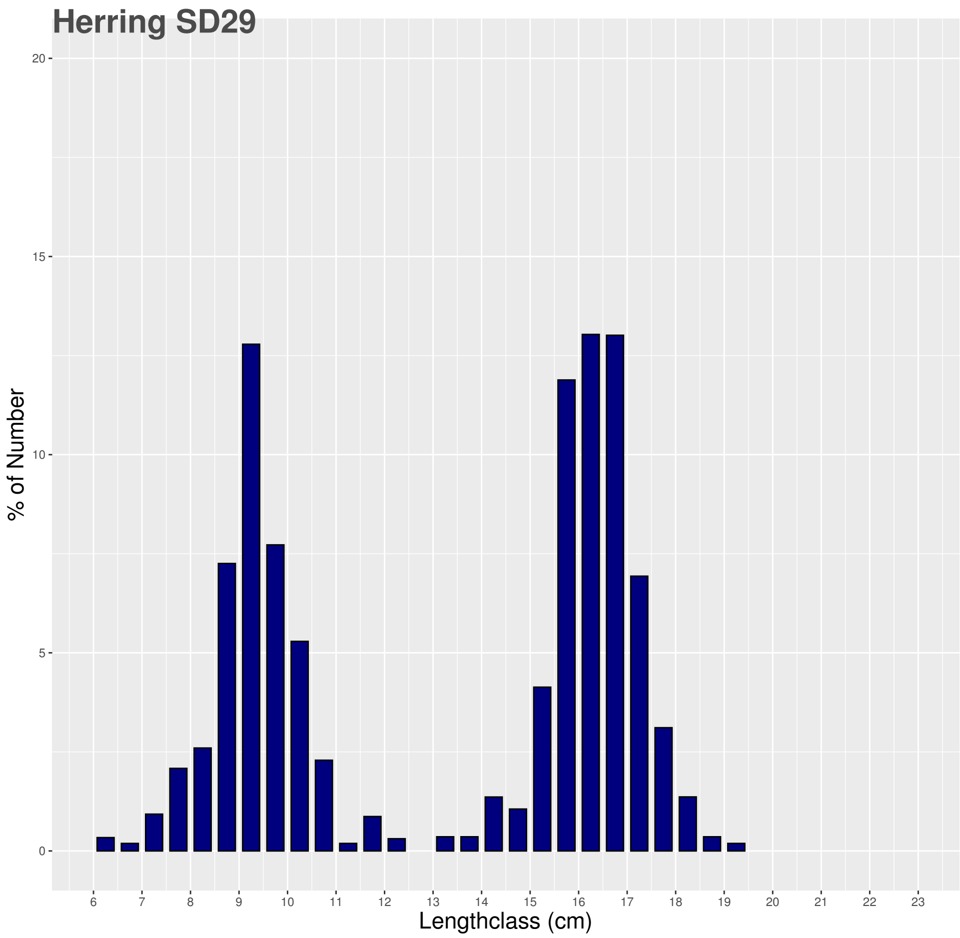

Figure 12: Length distribution of herring from subdivision 29 for BIAS 2019