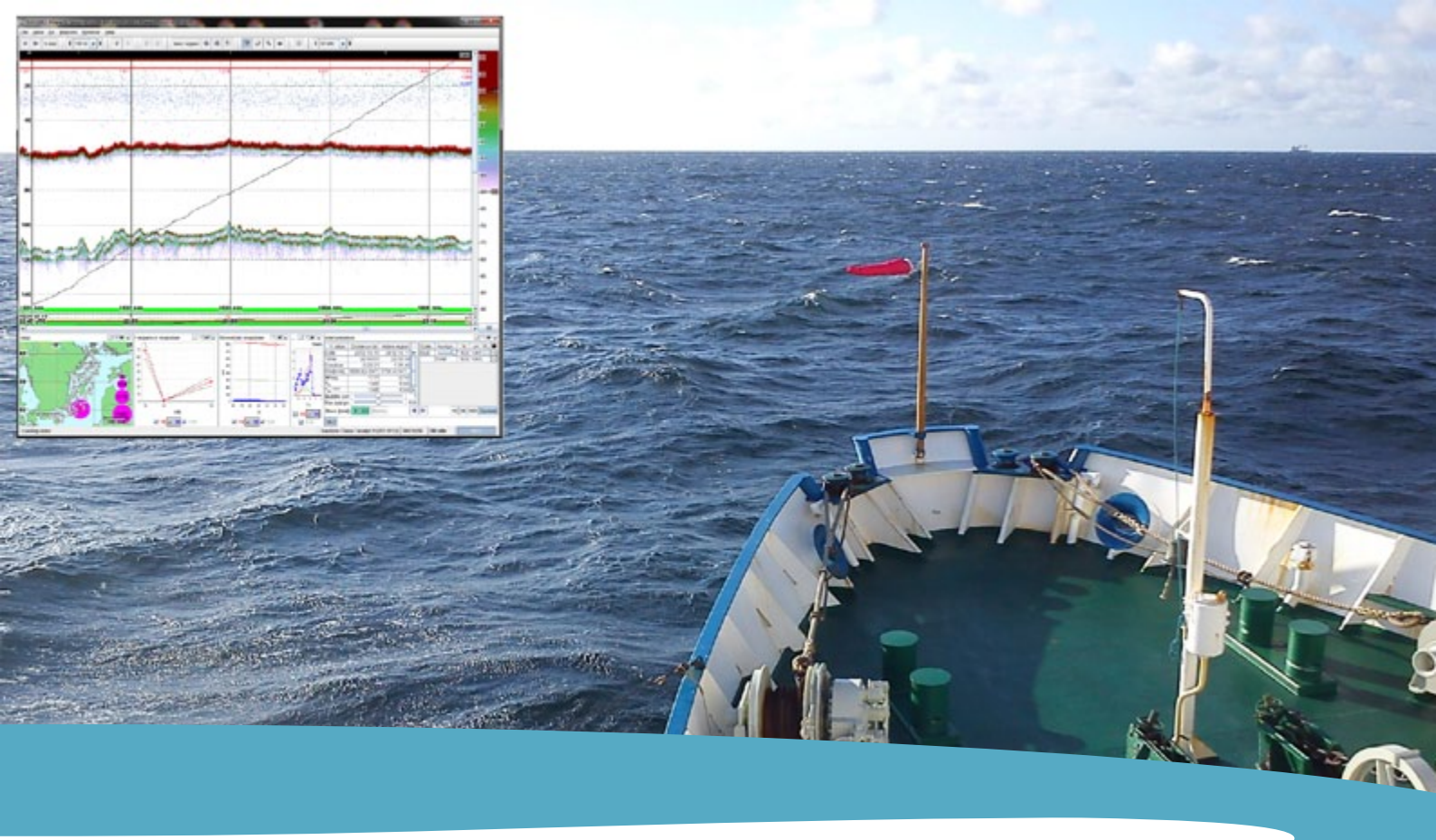

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Baltic International Acoustic Survey report, October 2016

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Baltic International Acoustic Survey report, October 2016

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Baltic International Acoustic Survey Report for R/V Dana

Survey 2016-10-01 - 2016-10-15

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

1 Svensk Sammanfattning

Internationellt koordinerade hydroakustiska surveyer 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 25, 26, 28 samt 29. Dessutom har Sverige 2007-2012 tillsammans med Finland täckt SD30. Syftet med undersökningen är att bedöma sillbeståndet och resultaten rapporteras 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 startade expeditionen med en kalibrering 2016-10-01 och 2016-10-02 i Gullmarsfjorden och slutade 2016-10-15 i Köpenhamn. Under surveyen samlas akustisk rådata in från ett kalibrerat vetenskapligt ekolod[1] och pelagisk trålning utförs för att få information om art och längdfördelning. Den akustiska rådatan efterbehandlas i en mjukvara som 2011 byttes till en nyare programvara, LSSS[2]. Trålfångsten analyseras och man tar fram en längdfördelning per art, dessutom tar man fram en åldersstruktur på målarterna som i detta fallet är sill, skarpsill och torsk. Därefter sammanställs de akustiska värdena med resultatet av analysen av trålfångsterna.

De deltagande länderna skickar årligen de vetenskapligt ansvariga för surveyen och/eller expeditionsledarna, till arbetsgruppen WGBIFS. Där tas gemensamma riktlinjer och manualer fram och resultaten från varje land kombineras i en gemensam databas som rapporteras till WGBFAS, vilka använder BIAS resultaten tillsammans med annan information i en modell för att uppskatta det totala beståndet. Resultatet från 2016 års svenska BIAS survey bedömdes av WGBIFS vara representativt för mängden sill och skarpsill i Östersjön. Tidigare års resultat samt mer information kring BIAS samt WGBIFS arbete finns i arbetsgruppens årliga rapport.[3]

[1] simrad.com
[2] Marec.no
[3] ICES CM 2014/SSGESST:13

Contents

1 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 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 the 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 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 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 is Swedish and the ship crew is Danish. This year's calibration of the SIMRAD EK60 sounder was made at Gullmarsfjorden on the Swedish west coast, the location change occurred because the normal calibration site at H¨og¨on is inaccessible for Dana due to deeper draft. The first part of the cruise started 2016-10-01 in Gullmarsfjorden, and ended 2016-10-15 in Copenhagen. 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 21752 square nautical miles and the distance used for acoustic estimates was 1307 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 2016-10-01 and 2016-10-02 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: G = G0 + 10*log10(c0*c0 / c*c) (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 the species composition was based on the trawl catch results. For each rectangle the species composition

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

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	Fish sampling
Jernberg, Carina	IMR, Lysekil	Fish sampling
Larson, Niklas	IMR, Lysekil	Scientific & Expedition leader, Acoustics
Lövgren, Olof	IMR, Lysekil	Acoustics
Öman, Cristin	IMR, Lysekil	Fish sampling
Johansson, Marianne	IMR, Lysekil	Fish sampling
Sjöberg, Rajlie	IMR, Lysekil	Fish sampling
Svenson, Anders	IMR, Lysekil	Expedition leader, Acoustics
Tell, Anna-Kerstin	SMHI, Gothenburg	Oceanography

Table 2: Participating scientific crew

3 Results

3.1 Biological data

In total 45 trawl hauls were carried out, 15 in SD 25, 2 in SD 26, 13 in SD 27, 9 in SD 28 and 6 hauls in SD 29. 2243 herrings, 1401 sprats and 164 cod 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{square nmi}, 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 Subdivision/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 2016 for SD25 to 29 and thus can be used in the assessment work done by WGBFAS.

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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	193.4	1.725	321.98	5.55	94.38	0.000
25	39G5	979.0	353.2	2.055	1682.71	17.86	81.72	0.202
25	40G4	677.2	270.0	2.377	769.12	20.26	67.39	0.968
25	40G5	1012.9	307.4	2.820	1104.12	62.96	35.96	0.285
25	40G6	1013.0	526.4	1.872	2848.45	20.21	79.62	0.062
25	40G7	1013.0	289.9	2.473	1187.30	65.16	34.16	0.259
25	41G6	764.4	730.7	1.443	3870.04	30.45	27.33	0.489
25	41G7	1000.0	288.1	1.727	1668.50	24.14	74.69	0.042
26	41G8	1000.0	1157.4	1.931	5993.20	46.01	27.17	0.025
27	42G6	266.0	1140.5	1.316	2304.42	3.38	96.03	0.000
27	42G7	986.9	632.2	1.429	4365.17	13.10	81.03	0.061
27	43G7	913.8	501.5	0.559	8192.63	4.30	10.23	0.039
27	44G7	960.5	577.0	0.444	12492.53	0.14	9.98	0.004
27	44G8	456.6	429.4	0.582	3369.11	6.95	6.74	0.000
27	45G7	908.7	1081.7	0.539	18230.22	8.24	6.21	0.044
27	45G8	947.2	526.9	0.504	9910.85	1.38	13.18	0.000
27	46G8	884.8	667.7	0.898	6577.14	16.32	41.47	0.000
28	42G8	945.4	739.9	1.030	6789.62	7.73	54.91	0.012
28	43G8	296.2	599.0	0.484	3669.07	0.80	13.70	0.000
28	43G9	973.7	498.8	0.822	5905.41	0.38	51.82	0.000
28	44G9	876.6	506.0	0.495	8960.78	2.52	9.57	0.037
28	45G9	924.5	369.9	0.600	5701.14	4.99	20.27	0.016
29	46G9	933.8	627.1	0.587	9971.01	5.64	19.02	0.007
29	46H0	933.8	876.4	0.804	10178.33	0.62	53.32	0.016
29	47G9	876.2	1436.5	1.393	9036.57	56.74	15.60	0.000
29	47H0	920.3	816.3	0.500	15029.44	0.94	19.53	0.000

Table 3: Survey statistics

SD	RECT	NSprTOT	NSpr0	NSpr1	NSpr2	NSpr3	NSpr4	NSpr5	NSpr6	NSpr7	NSpr8
25	39G4	303.88	0.93	33.93	93.22	97.50	18.83	45.30	4.85	1.12	8.20
25	39G5	1375.14	9.12	123.77	560.82	137.24	337.03	136.67	64.41	0.00	6.08
25	40G4	518.33	0.00	34.56	192.09	66.06	172.27	38.62	0.00	0.00	14.74
25	40G5	397.07	0.00	28.75	38.72	118.45	134.98	31.75	29.82	5.01	9.59
25	40G6	2268.03	15.17	49.26	423.03	594.91	705.27	140.48	6.79	58.80	274.33
25	40G7	405.60	0.51	5.34	133.86	75.12	73.56	47.81	17.22	24.63	27.54
25	41G6	1057.79	5.51	0.00	549.01	330.62	112.65	26.16	5.49	2.19	26.16
25	41G7	1246.20	6.46	89.73	545.08	268.88	170.33	102.58	5.06	30.32	27.77
26	41G8	1628.13	18.92	40.30	723.86	498.77	137.78	122.29	46.56	27.65	12.00
27	42G6	2213.00	32.54	338.46	963.31	742.01	82.99	14.64	30.92	8.14	0.00
27	42G7	3536.96	84.84	209.95	1975.32	500.80	307.96	219.25	30.87	207.96	0.00
28	42G8	3727.98	215.54	61.50	2265.33	1102.10	41.75	0.00	21.49	20.26	0.00
27	43G7	837.95	36.58	19.69	357.44	283.16	88.84	24.49	0.00	21.18	6.59
28	43G8	502.69	64.34	31.77	238.08	135.53	16.49	8.45	4.02	4.02	0.00
28	43G9	3060.34	610.54	501.80	974.56	495.71	394.29	0.00	45.97	37.47	0.00
27	44G7	1246.50	214.31	39.81	476.78	285.47	189.90	11.67	28.56	0.00	0.00
27	44G8	227.07	3.21	7.70	65.47	79.27	63.55	2.09	0.00	0.00	5.78
28	44G9	857.16	62.90	100.48	356.11	225.53	91.72	5.66	5.66	9.09	0.00
27	45G7	1131.39	82.80	8.98	505.53	360.14	97.54	28.81	15.97	6.94	24.68
27	45G8	1306.48	37.95	73.73	536.69	408.75	136.61	32.53	0.00	31.44	48.79
28	45G9	1155.44	460.20	128.00	261.70	187.83	66.22	13.00	9.30	7.23	21.96
27	46G8	2727.35	237.39	237.10	1388.69	745.23	95.25	10.30	1.55	0.00	11.85
29	46G9	1896.31	307.55	66.14	1247.17	25.98	136.47	59.99	22.48	14.80	15.72
29	46H0	5426.67	639.51	1151.11	2338.77	617.58	434.86	73.09	135.21	18.27	18.27
29	47G9	1409.46	73.11	97.00	915.24	194.83	83.34	16.16	5.50	24.28	0.00
29	47H0	2935.47	998.23	145.50	1341.69	280.43	120.97	40.18	8.46	0.00	0.00

Table 4: Estimated number (millions) of sprat

SD	RECT	WSpr0	WSpr1	WSpr2	WSpr3	WSpr4	WSpr5	WSpr6	WSpr7	WSpr8
25	39G4	5.14	10.87	12.15	13.22	17.59	15.75	16.44	17.45	16.50
25	39G5	5.01	12.20	13.18	14.49	15.97	17.26	17.36		18.93
25	40G4		13.13	12.25	15.07	16.54	16.01			14.92
25	40G5	1.43	13.18	10.89	11.25	14.98	18.07	16.46	19.18	18.83
25	40G6	3.39	8.18	10.29	12.18	14.36	17.03	17.50	15.67	14.80
25	40G7	4.21	8.93	9.82	11.59	14.17	13.62	14.16	15.88	14.45
25	41G6	1.88		8.71	10.91	14.30	14.64	14.24	17.73	13.34
25	41G7	3.51	7.91	9.70	10.72	13.83	13.25	15.31	14.39	13.25
26	41G8	3.95	13.93	9.76	11.58	12.12	13.72	13.61	15.79	16.08
27	42G6	4.09	7.07	8.67	9.64	12.00	10.41	13.38	14.07	
27	42G7	3.37	7.28	8.73	12.96	13.45	13.76	14.09	12.69	
28	42G8	3.54	7.62	9.12	11.59	13.71		12.12	12.57	
27	43G7	3.97	5.96	8.93	10.35	13.17	11.84		11.88	14.34
28	43G8	3.52	7.12	8.63	10.44	12.63	11.28	12.26	12.58	
28	43G9	4.05	8.93	8.81	11.05	11.81		11.47	13.43	
27	44G7	3.50	6.31	9.07	10.27	12.19	12.93	12.02		
27	44G8	4.05	6.71	8.14	11.20	11.78	13.42			12.04
28	44G9	3.72	6.95	8.00	9.98	11.64	12.57	13.82	12.54	
27	45G7	3.76	6.93	7.79	9.83	10.90	13.02	11.22	12.71	13.53
27	45G8	4.47	7.28	7.49	10.36	11.65	11.36		13.10	11.56
28	45G9	3.03	7.23	8.46	10.04	12.05	12.21	12.12	10.78	12.68
27	46G8	3.25	6.16	8.69	10.03	10.90	12.29	12.49		12.46
29	46G9	3.14	7.00	8.00	11.32	10.34	11.49	11.32	14.54	13.05
29	46H0	3.11	7.48	7.71	10.06	10.97	10.91	10.40	14.30	15.32
29	47G9	2.92	5.44	7.52	9.84	11.80	11.05	10.76	11.72	
29	47H0	3.05	5.89	7.97	9.57	10.93	10.98	11.71		

Table 5: Estimated mean weights (g) of sprat

SD	RECT	NHerTOT	NHer0	NHer1	NHer2	NHer3	NHer4	NHer5	NHer6	NHer7	NHer8
25	39G4	17.87	0.42	3.29	3.12	2.93	5.80	0.79	1.10	0.28	0.14
25	39G5	300.46	31.42	35.67	50.54	79.12	50.21	27.48	8.05	9.69	8.28
25	40G4	155.81	0.00	8.06	21.57	72.86	31.16	16.62	3.21	0.22	2.11
25	40G5	695.16	0.00	10.26	104.73	141.60	264.29	99.65	28.67	21.30	24.66
25	40G6	575.63	0.95	31.35	128.66	163.13	147.58	70.08	15.98	14.19	3.71
25	40G7	773.64	0.00	14.65	275.32	120.31	163.40	71.56	54.72	45.43	28.26
25	41G6	1178.50	0.00	41.31	287.53	219.43	324.43	138.26	98.16	58.19	11.18
25	41G7	402.82	0.00	6.45	171.80	87.18	45.34	46.30	25.32	15.58	4.83
26	41G8	2757.52	3.45	30.83	472.05	379.05	870.83	150.18	543.12	228.80	79.21
27	42G6	77.92	1.01	3.37	33.12	10.25	10.19	9.04	6.88	3.04	1.01
27	42G7	571.95	1.17	17.56	369.64	53.72	68.86	44.82	8.39	1.66	6.13
28	42G8	524.93	2.07	17.30	301.38	54.79	95.46	31.97	9.53	9.86	2.57
27	43G7	352.53	4.78	1.99	82.27	51.27	121.22	61.60	15.50	11.92	1.99
28	43G8	29.31	0.95	2.36	18.44	0.47	1.89	0.95	2.36	1.89	0.00
28	43G9	22.19	7.01	0.00	7.13	4.12	3.65	0.09	0.09	0.00	0.09
27	44G7	16.97	10.03	0.00	3.79	0.63	1.89	0.63	0.00	0.00	0.00
27	44G8	234.18	5.71	5.20	84.28	47.09	37.82	20.05	15.99	11.93	6.09
28	44G9	225.81	11.88	0.63	82.84	45.61	40.28	25.09	10.85	7.66	0.96
27	45G7	1502.05	6.11	63.63	751.43	279.72	198.82	85.35	110.47	5.00	1.53
27	45G8	137.12	72.65	2.72	29.06	4.54	17.80	4.18	3.45	1.82	0.91
28	45G9	284.76	25.89	4.80	110.28	49.93	73.24	14.14	3.02	1.74	1.74
27	46G8	1068.04	99.87	290.32	614.13	43.49	15.17	5.06	0.00	0.00	0.00
29	46G9	562.77	64.57	36.16	309.49	36.98	84.75	10.36	16.36	1.36	2.73
29	46H0	62.63	23.65	5.74	24.66	6.76	1.69	0.00	0.00	0.13	0.00
29	47G9	5126.97	122.26	635.71	3364.36	366.88	332.38	172.86	70.15	55.51	6.87
29	47H0	141.82	77.36	9.28	47.45	2.58	2.58	2.58	0.00	0.00	0.00

Table 6: Estimated number (millions) of herring

SD	RECT	WHer0	WHer1	WHer2	WHer3	WHer4	WHer5	WHer6	WHer7	WHer8
25	39G4	15.05	27.03	45.21	66.53	47.28	88.59	33.36	110.18	47.76
25	39G5	12.44	28.03	32.09	71.24	82.73	96.48	94.15	120.53	52.66
25	40G4	9.98	32.42	37.81	86.49	89.94	109.24	98.20	32.48	92.09
25	40G5	7.36	21.11	25.32	62.09	47.85	60.23	72.77	60.01	62.00
25	40G6	14.05	25.91	20.63	42.98	44.77	45.08	52.03	59.08	60.25
25	40G7		27.96	20.16	35.68	38.30	48.77	51.11	53.48	51.88
25	41G6		18.02	22.09	40.70	33.96	47.49	52.91	52.29	59.64
25	41G7		18.19	21.05	29.94	35.26	42.29	49.23	51.71	65.73
26	41G8	5.57	17.09	18.43	23.08	33.43	39.70	43.50	49.49	55.66
27	42G6	4.66	15.55	19.76	28.40	27.24	36.99	44.00	32.21	46.57
27	42G7	6.62	22.05	17.50	27.74	33.26	38.15	40.06	64.10	51.41
28	42G8	4.58	14.18	18.45	24.52	31.72	33.03	39.64	37.42	44.02
27	43G7	5.49	12.52	17.69	22.65	28.58	28.51	35.51	41.91	38.29
28	43G8	4.17	11.52	16.93	20.45	22.55	21.80	37.00	37.20	
28	43G9	5.17		16.18	21.62	24.37	48.85	26.61		92.81
27	44G7	4.44		17.33	19.01	22.14	26.61			
27	44G8	4.88	9.45	16.58	23.31	26.65	32.17	33.13	36.14	29.82
28	44G9	4.78	12.39	15.67	21.57	27.45	33.05	32.45	35.88	38.48
27	45G7	4.57	16.03	17.06	22.39	28.81	32.09	30.12	34.35	43.17
27	45G8	4.68	12.16	17.91	21.08	23.74	33.18	24.09	26.82	26.16
28	45G9	4.41	10.38	16.30	21.46	27.08	33.65	32.96	34.09	40.67
27	46G8	3.79	12.17	17.59	20.60	27.65	25.43			
29	46G9	4.41	12.00	16.33	23.43	25.98	30.50	27.01	31.02	41.49
29	46H0	4.30	13.53	16.85	20.08	24.94			99.94	
29	47G9	3.35	11.24	16.36	20.80	28.03	30.91	24.07	33.66	32.12
29	47H0	4.21	13.22	15.74	17.98	19.78	23.48			

Table 7: Estimated mean weights (g) of herring

Species	2_39G4	4_40G4	8_40G5	13_40G6	15_41G6	17_41G6	19_43G7	21_43G7
Anguilla anguilla		0.01						
Clupea harengus	37.38	174.03	34.14	15.50	17.70	124.30	0.02	28.25
Cyclopterus lumpus	2.43	1.01	0.99	0.39		0.27	0.10	0.25
Enchelyopus cimbrius								
Engraulis encrasicolus								
Gadus morhua		29.82	0.32	0.32	1.20	2.18	0.00	0.01
Gasterosteus aculeatus			0.00		7.58	0.72	41.88	18.88
Hyperoplus lanceolatus					0.03			0.02
Liparis liparis					0.00			
Lumpenus lampretaeformis								
Merlangius merlangus								
Myoxocephalus scorpius								
Nerophis ophidion								
Platichthys flesus		4.05			0.31	0.51		
Pleuronectes platessa		2.26						
Pomatoschistus		0.38	0.01		0.02	0.01		
Pungitius pungitius		0.00	0.00			0.01	0.02	0.04
Salmo salar				4.47				
Salmo trutta								
Scophthalmus maximus								
Sprattus sprattus	209.84	116.00	12.85	15.10	34.78	22.52	14.99	16.90
Trachurus trachurus								

Table 8: Catch composition in kg per haul (trawlnumber and ICES rectangle in columname)

Species	23_44G8	25_44G7	27_44G7	29_45G7	31_45G7	33_45G8	35_46G8	37_46G8
Anguilla anguilla								
Clupea harengus	12.60	0.53	1.54	296.27	37.92	1.94	3.57	45.08
Cyclopterus lumpus		0.33			0.60			
Enchelyopus cimbrius								
Engraulis encrasicolus								
Gadus morhua		0.01			0.02			
Gasterosteus aculeatus	13.60	159.29	109.09	145.89	50.42	16.38	21.45	6.40
Hyperoplus lanceolatus		0.02	0.01		0.01		0.09	
Liparis liparis								
Lumpenus lampretaeformis								
Merlangius merlangus								
Myoxocephalus scorpius					0.13	0.11		
Nerophis ophidion						0.00	0.01	
Platichthys flesus		0.18						
Pleuronectes platessa								
Pomatoschistus								
Pungitius pungitius	0.07	0.22	0.10	0.02	0.14	0.01	0.05	0.00
Salmo salar		0.40						
Salmo trutta				0.80				
Scophthalmus maximus		0.12	0.09					
Sprattus sprattus	5.90	76.71	65.18	46.46	27.09	13.79	256.28	9.91
Trachurus trachurus								

Table 8 (continued): Catch composition per haul (trawlnumber and ICES rectangle in columname)

Species	39_47G9	41_47G9	43_47H0	45_46H0	47_46G9	49_46G9	51_45G9	53_45G9
Anguilla anguilla								
Clupea harengus	478.49	133.94	2.29	6.25	43.33	1.28	10.85	54.27
Cyclopterus lumpus				0.15	0.16		0.08	0.13
Enchelyopus cimbrius								
Engraulis encrasicolus								
Gadus morhua				0.01	0.00			0.00
Gasterosteus aculeatus	8.62	11.32	32.58	62.39	24.80	74.10	54.68	47.52
Hyperoplus lanceolatus	0.15	0.04	0.03		0.03			0.02
Liparis liparis								
Lumpenus lampretaeformis								
Merlangius merlangus								
Myoxocephalus scorpius								
Nerophis ophidion			0.00			0.01		
Platichthys flesus				0.29				
Pleuronectes platessa								
Pomatoschistus								
Pungitius pungitius			0.01	0.01			0.00	0.04
Salmo salar						0.52		
Salmo trutta								
Scophthalmus maximus		0.11						
Sprattus sprattus	79.39	12.52	30.91	351.01	20.62	122.39	95.55	24.55
Trachurus trachurus								

Table 8 (continued): Catch composition per haul (trawlnumber and ICES rectangle in columname)

Species	55_44G9	57_44G9	59_43G9	61_43G9	63_43G8	65_42G8	67_42G8	69_41G8
Anguilla anguilla								
Clupea harengus	23.78	20.74	3.21	0.89	2.80	73.30	48.70	62.01
Cyclopterus lumpus	0.32	0.25	0.21	0.26		0.25	0.79	0.33
Enchelyopus cimbrius								
Engraulis encrasicolus								
Gadus morhua	0.01	0.02				0.01		
Gasterosteus aculeatus	59.84	82.11	16.07	44.71	25.85	41.74	3.42	6.71
Hyperoplus lanceolatus								
Liparis liparis								
Lumpenus lampretaeformis					0.01			
Merlangius merlangus								
Myoxocephalus scorpius		0.08						
Nerophis ophidion								
Platichthys flesus		0.06						
Pleuronectes platessa								
Pomatoschistus								
Pungitius pungitius	0.02	0.09	0.04	0.01			0.01	
Salmo salar								
Salmo trutta								
Scophthalmus maximus								
Sprattus sprattus	29.33	46.67	221.12	88.43	20.27	68.88	311.50	26.68
Trachurus trachurus								

Table 8 (continued): Catch composition per haul (trawlnumber and ICES rectangle in columname)

Species	71_41G8	73_41G7	75_42G7	77_42G7	79_42G6	82_41G7	84_40G7	86_40G7
Anguilla anguilla								
Clupea harengus	717.65	214.83	30.24	36.22	77.24	40.81	315.04	60.07
Cyclopterus lumpus	0.75	1.60	0.16					
Enchelyopus cimbrius		0.01	0.00					
Engraulis encrasicolus								
Gadus morhua	0.54	1.17	0.00	0.01		0.18	6.44	
Gasterosteus aculeatus	9.05	0.58	0.64	4.19	0.92	0.11	0.01	
Hyperoplus lanceolatus		0.20	0.02					
Liparis liparis								
Lumpenus lampretaeformis								
Merlangius merlangus								
Myoxocephalus scorpius								
Nerophis ophidion								
Platichthys flesus		0.22					0.39	0.27
Pleuronectes platessa								
Pomatoschistus		0.02						0.01
Pungitius pungitius			0.01	0.02	0.03			
Salmo salar								
Salmo trutta								
Scophthalmus maximus								
Sprattus sprattus	86.06	123.34	47.52	317.27	774.93	152.23	30.70	19.87
Trachurus trachurus								

Table 8 (continued): Catch composition per haul (trawlnumber and ICES rectangle in columname)

Species	88_40G6	90_40G6	92_40G5	94_39G5	96_39G5
Anguilla anguilla					
Clupea harengus	36.71	161.97	258.26	26.46	60.37
Cyclopterus lumpus	0.92	0.88		1.23	0.17
Enchelyopus cimbrius			0.04	0.08	
Engraulis encrasicolus					0.04
Gadus morhua		1.40	5.06	1.45	2.81
Gasterosteus aculeatus					
Hyperoplus lanceolatus				0.04	
Liparis liparis					
Lumpenus lampretaeformis					
Merlangius merlangus					0.29
Myoxocephalus scorpius					
Nerophis ophidion					
Platichthys flesus			0.18		0.36
Pleuronectes platessa			0.10		
Pomatoschistus	0.01				
Pungitius pungitius					
Salmo salar					
Salmo trutta					
Scophthalmus maximus					
Sprattus sprattus	570.39	150.93	28.67	62.80	51.15
Trachurus trachurus					0.03

Table 8 (continued): Catch composition per haul (trawlnumber and ICES rectangle in columname)

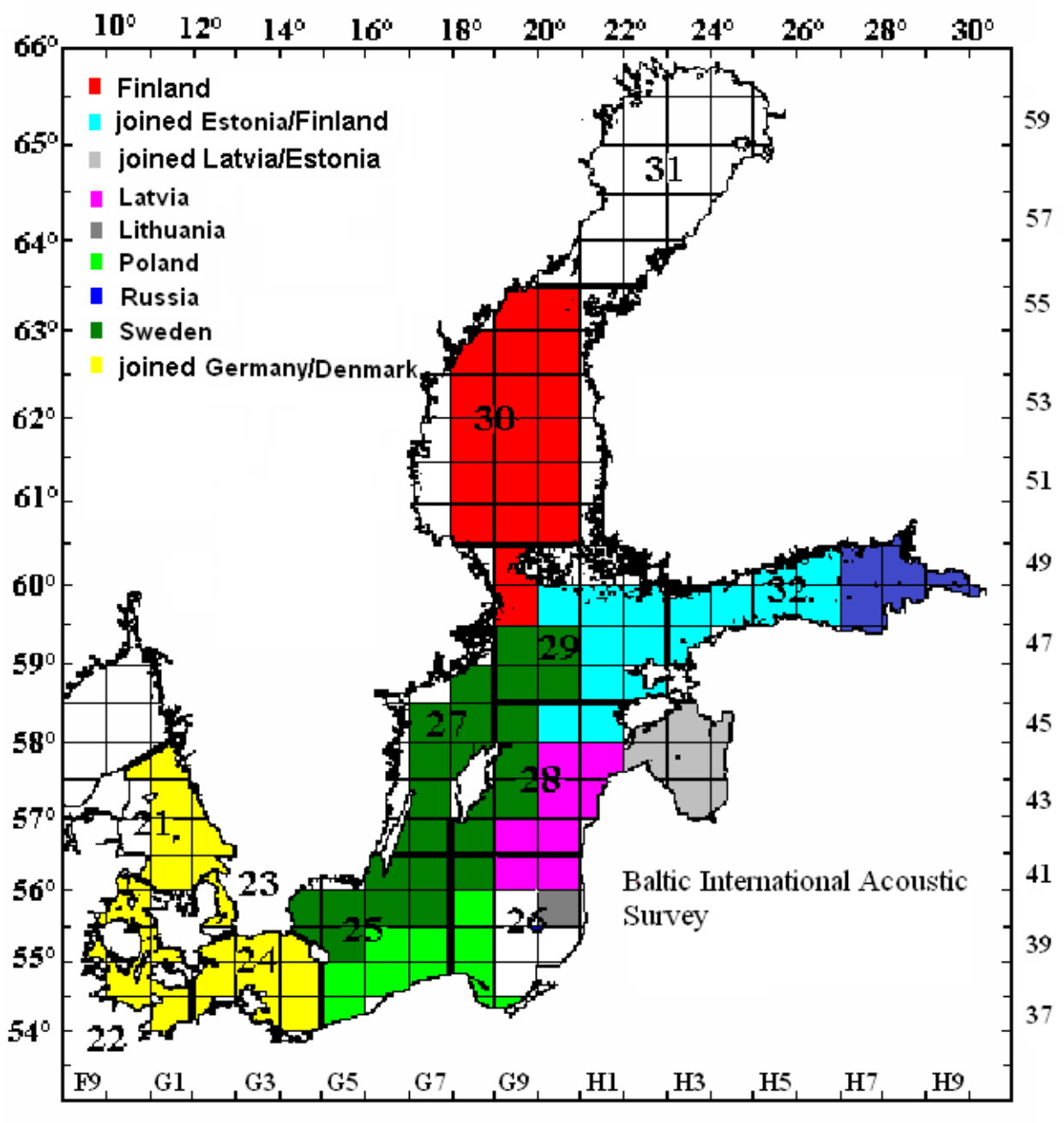

Figure 1: Map over planned ICES squares (axes: longitude, latitude and ICES name of square eg:41G8)

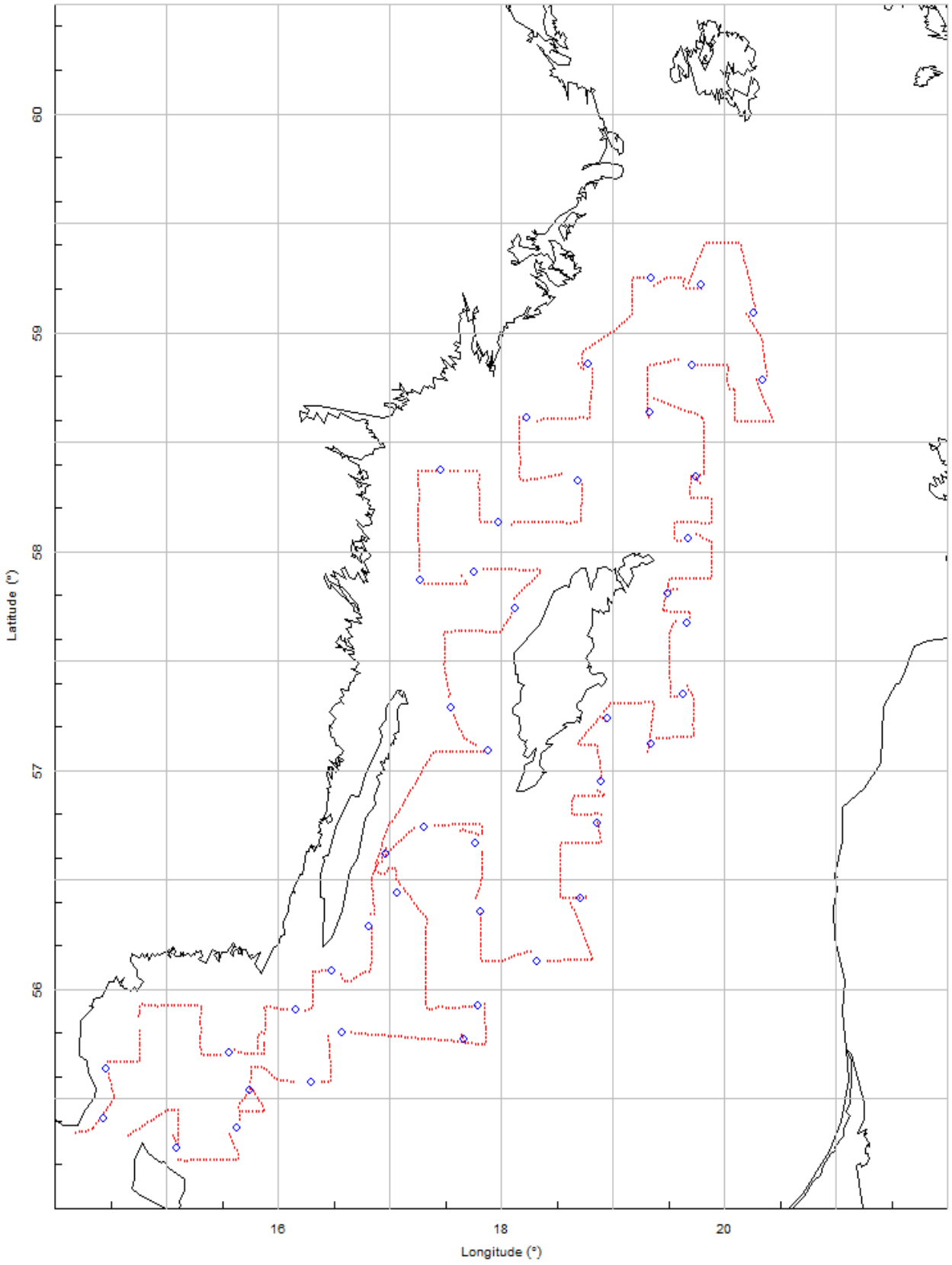

Figure 2: cruise track(red), positions of trawl hauls (blue) and survey grid (ICES squares)(grey)

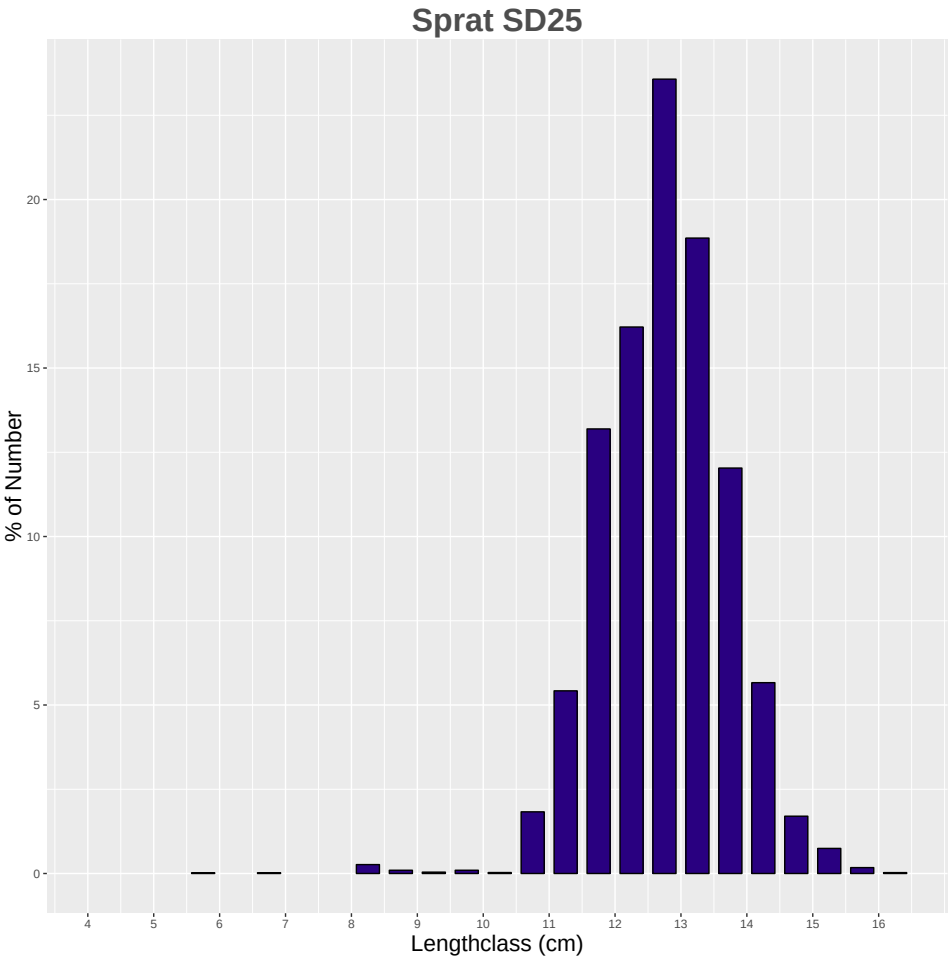

Figure 3: Length distribution of sprat from subdivision 25

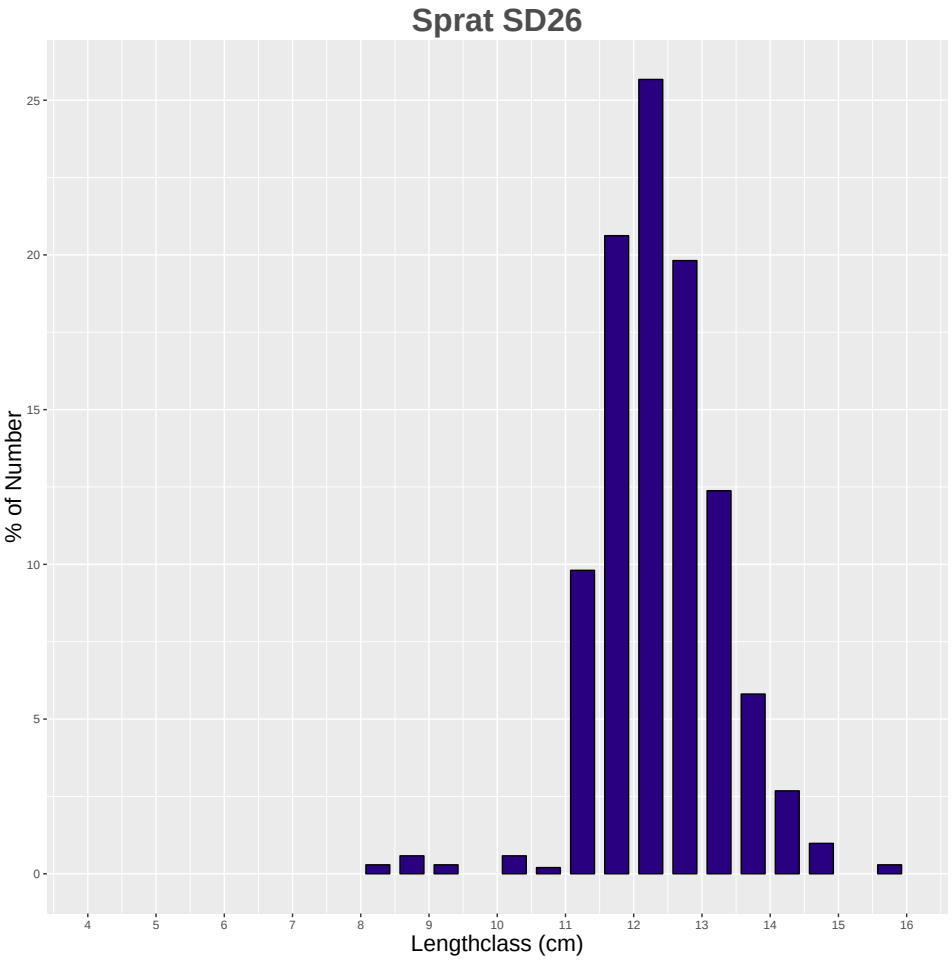

Figure 4: Length distribution of sprat from subdivision 26

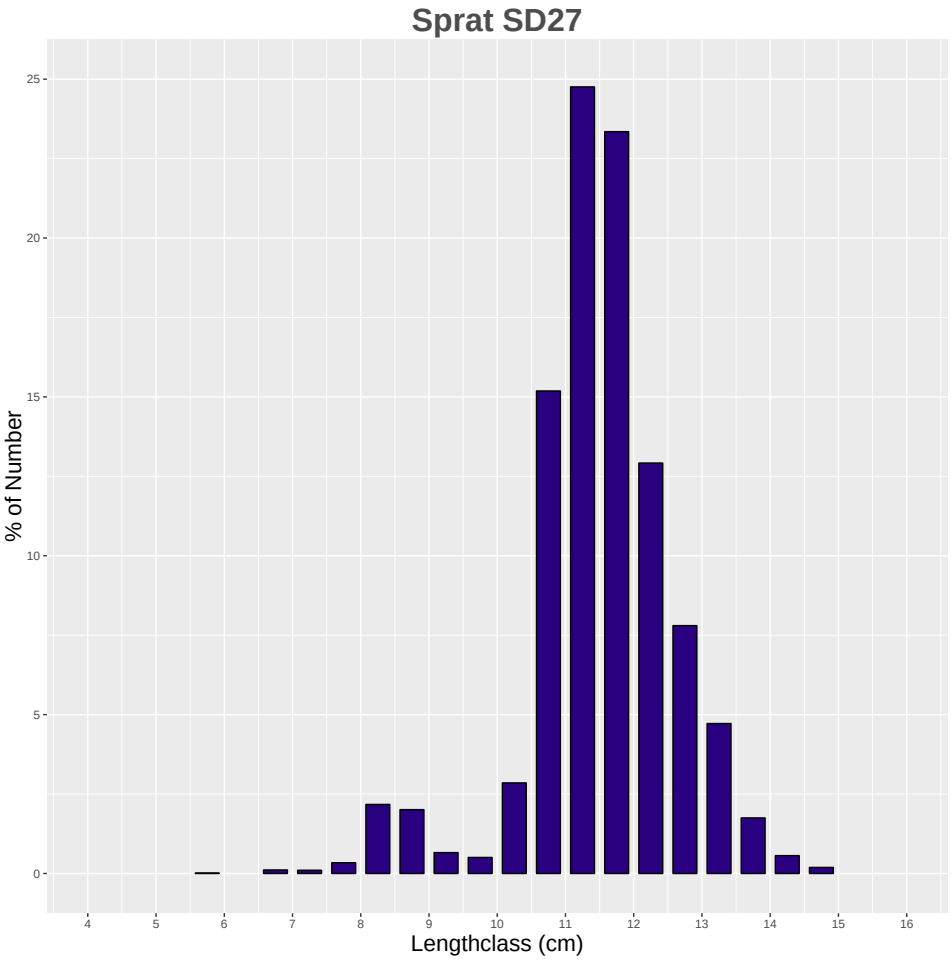

Figure 5: Length distribution of sprat from subdivision 27

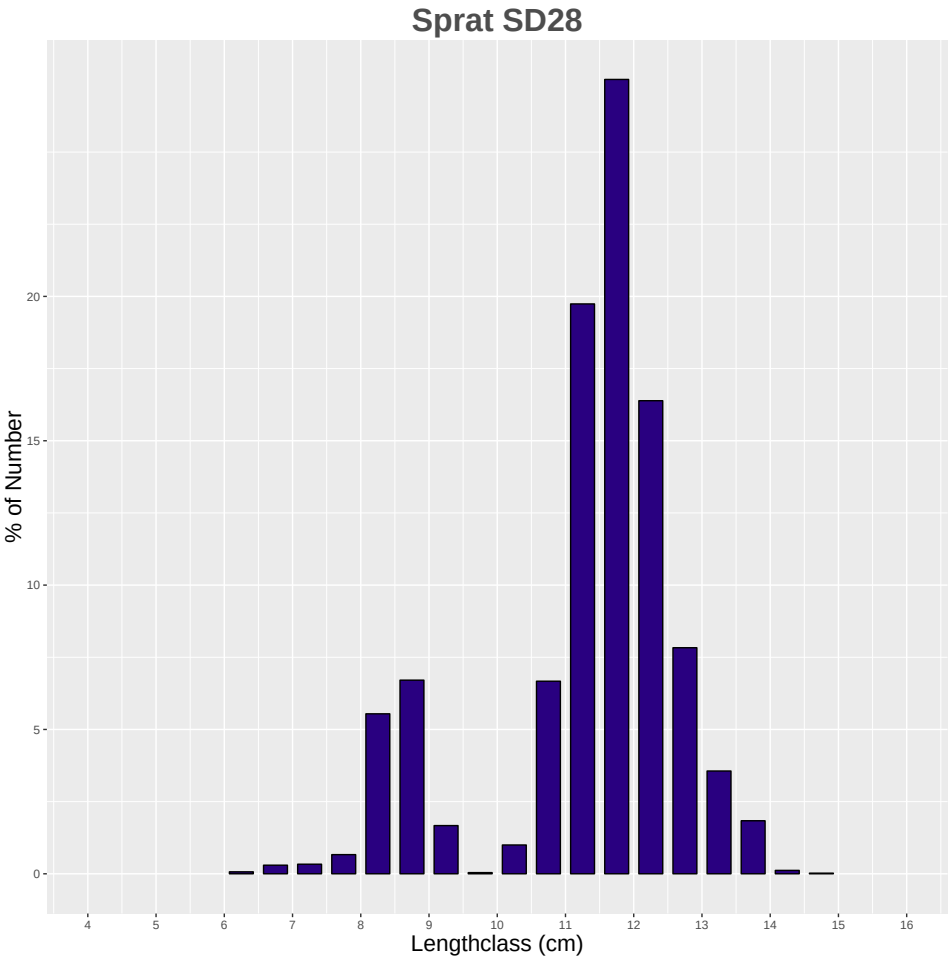

Figure 6: Length distribution of sprat from subdivision 28

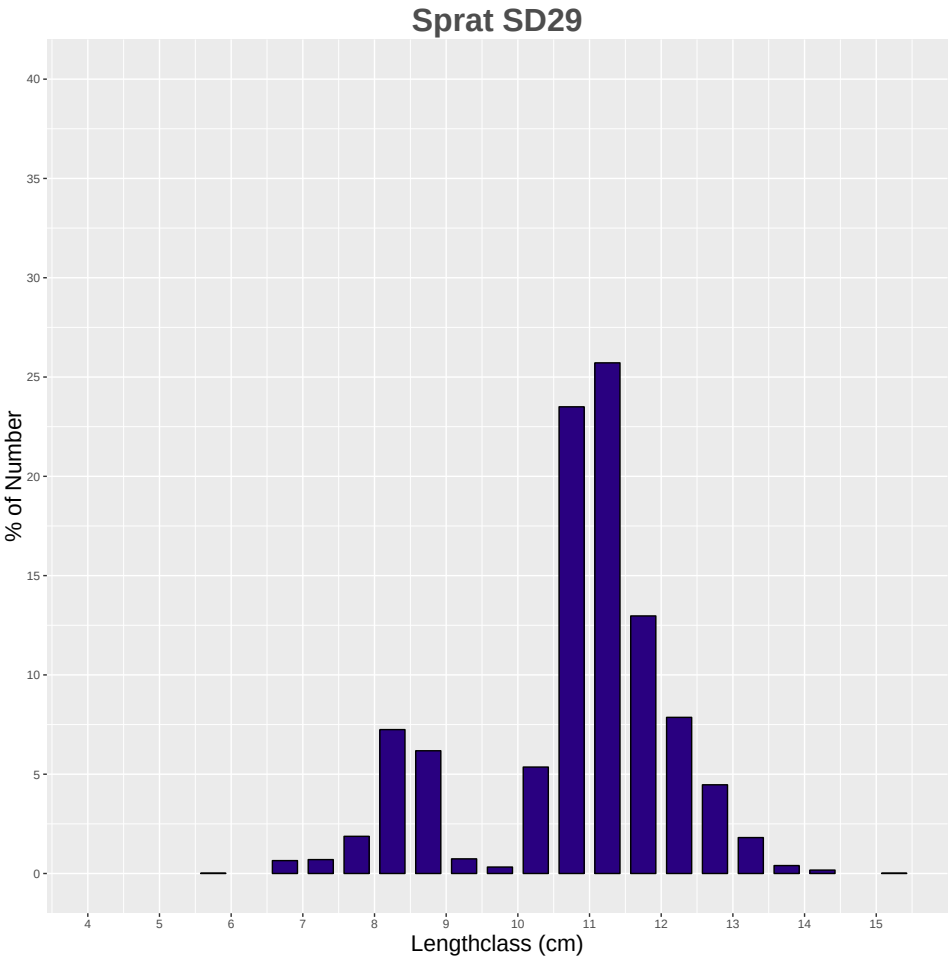

Figure 7: Length distribution of sprat from subdivision 29

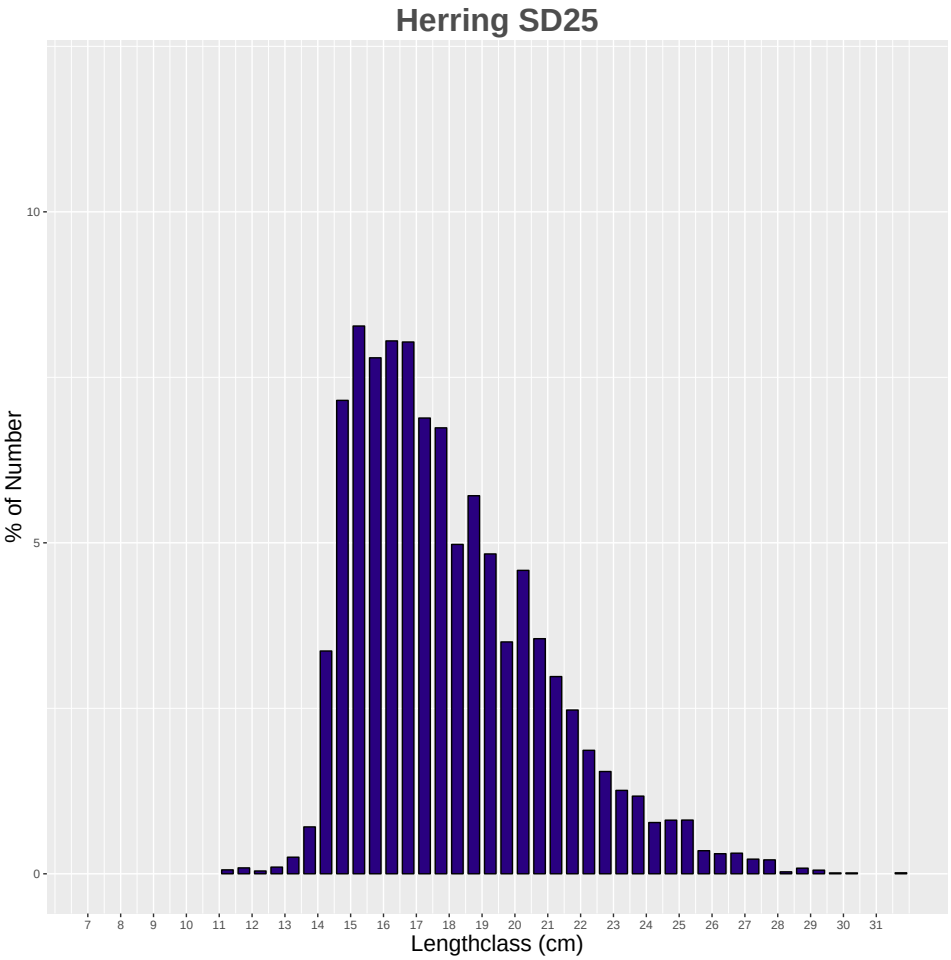

Figure 8: Length distribution of herring from subdivision 25

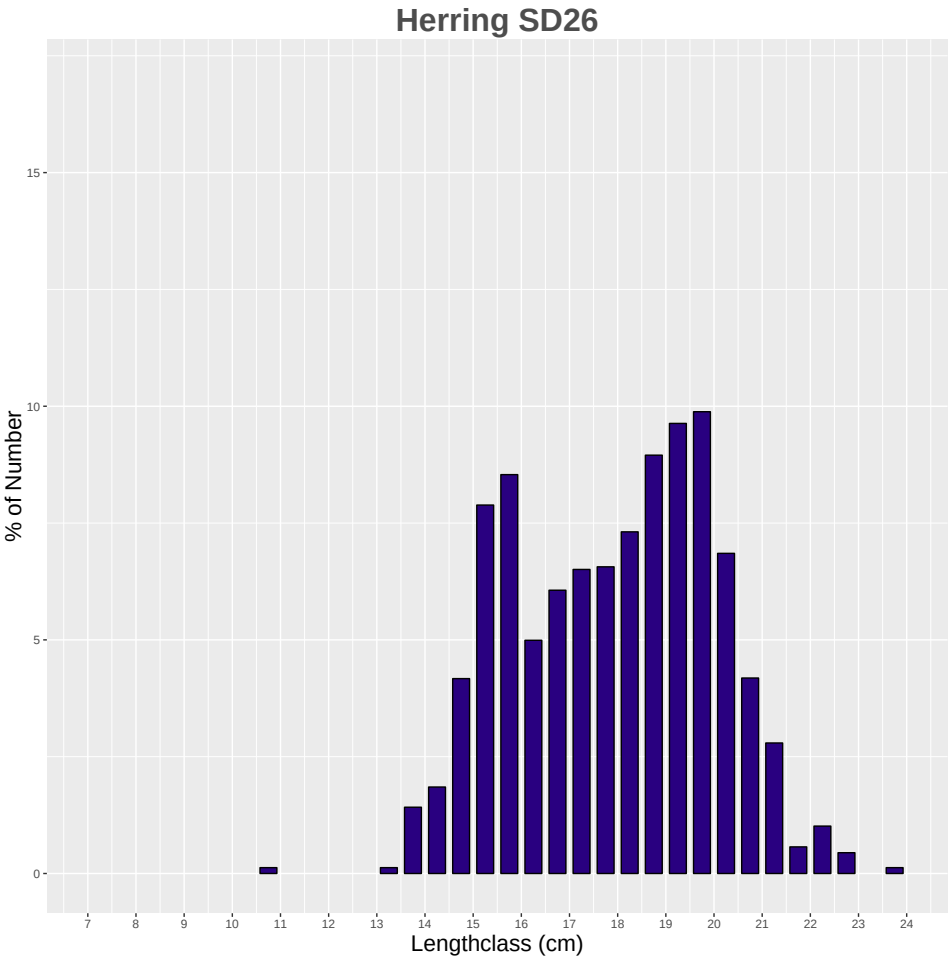

Figure 9: Length distribution of herring from subdivision 26

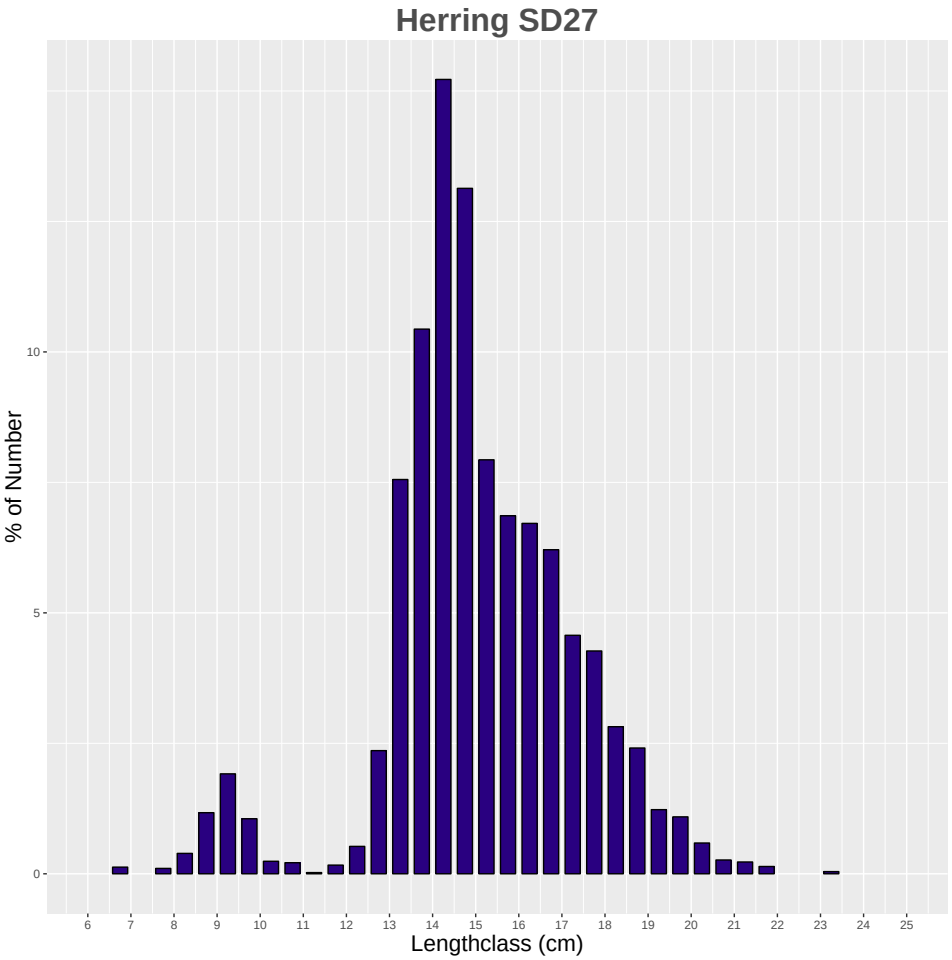

Figure 10: Length distribution of herring from subdivision 27

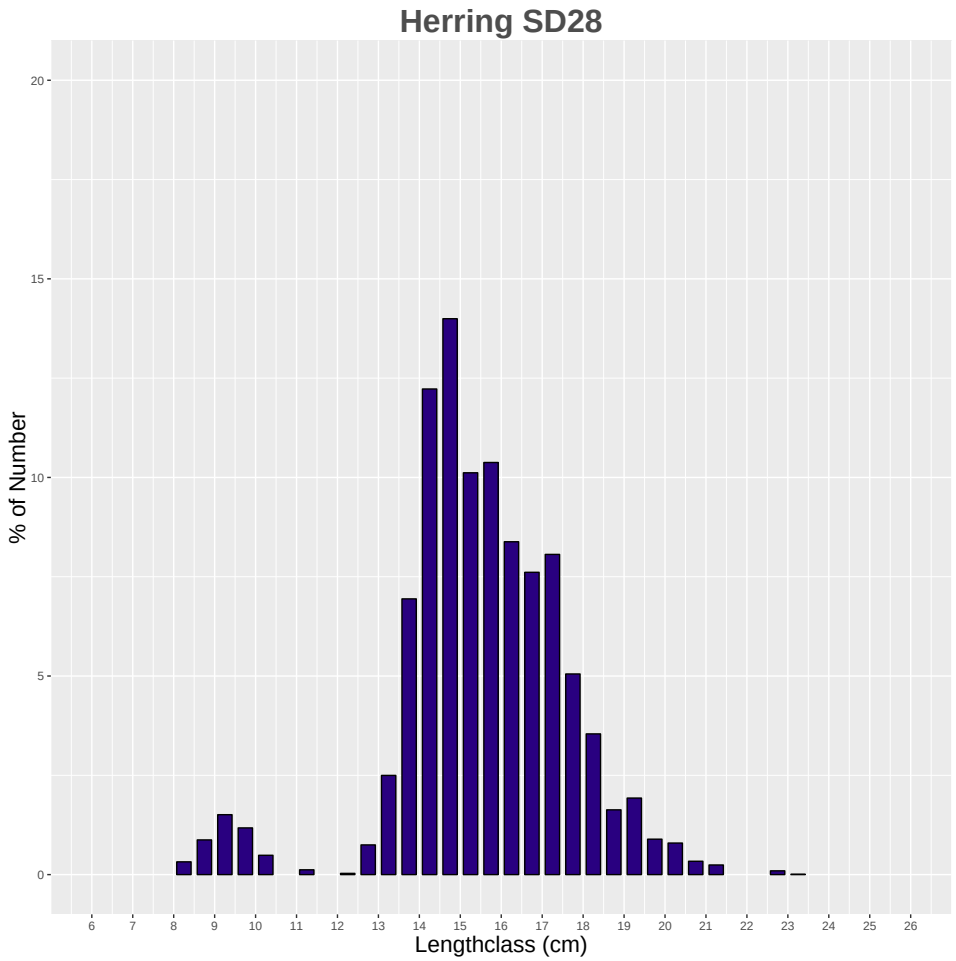

Figure 11: Length distribution of herring from subdivision 28

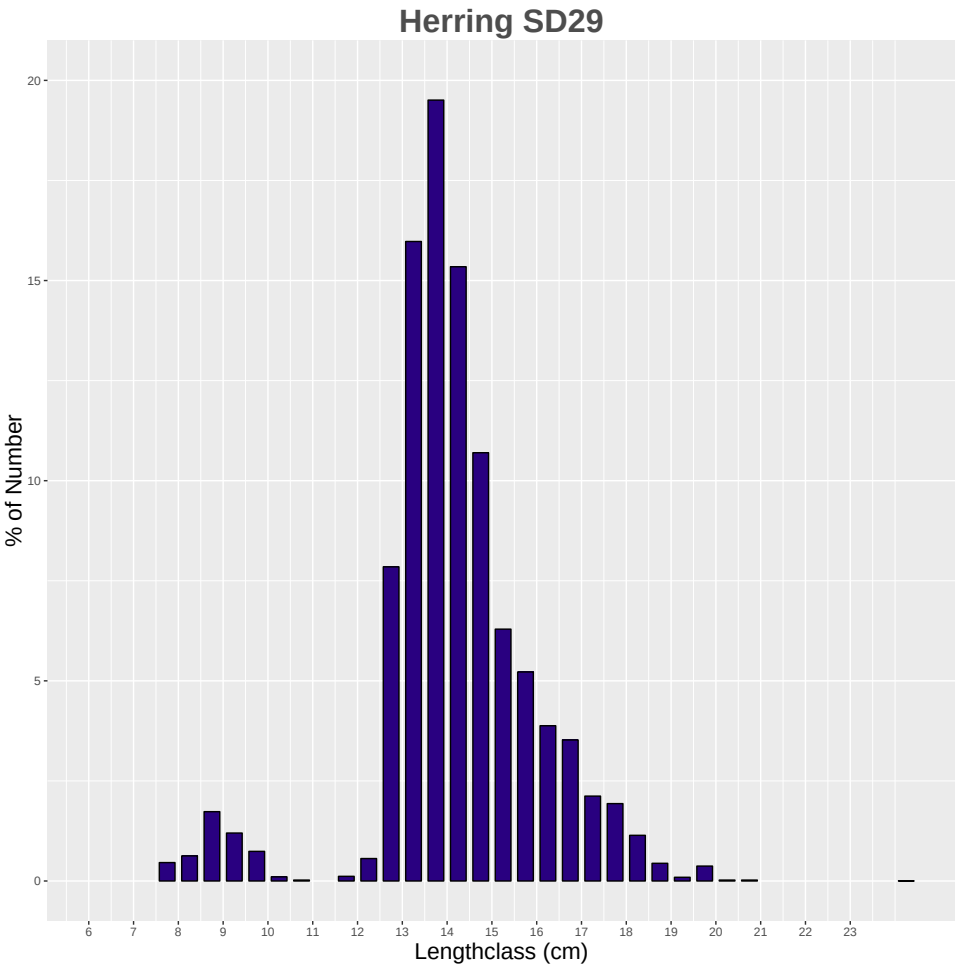

Figure 12: Length distribution of herring from subdivision 29