

Stichting Wageningen Research Centre for Fisheries Research (CVO)

North Sea Herring and Pelagic Ecosystem Survey (HERAS) report for RV "TRIDENS", 22 June – 13 July 2020

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1 Introduction

The Dutch institute Wageningen Marine Research (WMR) has participated in the international North Sea acoustic survey for herring (HERAS) since 1991. The other participating countries in this survey are Scotland, Norway, Germany, Denmark and Ireland. The survey is part of the EU data collection framework (DCF) and is coordinated by the ICES Working Group for International Pelagic Surveys (WGIPS).

The aim of this survey is to provide an abundance estimate of the whole North Sea herring population. This estimate is used as a tuning index by the ICES Herring Assessment Working Group (HAWG) in its assessment of the population size. In this report the results for the 2020 survey in the central North Sea as carried out by the Dutch research vessel Tridens are presented. The area covered is therefore limited to the biological strata covered by Tridens. As a consequence, the presented size and composition of the herring and sprat stock is independent from the remainder of the North Sea.

For the estimation of the total North Sea stocks, the acoustic and biological data of all participating countries will be uploaded to the ICES acoustic database and used by WGIPS to carry out an integrated analysis using the software StoX.

2 Material and methods

2.1 Scientific staff

Table 1. Scientific staff on board Tridens during the North Sea herring acoustic survey 2020

Name	Organisation	Role	Wk 26	Wk 27	Wk 28	Wk 29
			1 st half		2 nd half	
Bram Couperus	WMR	Acoustics (CL)	X		X	
Benoit Berges	WMR	Acoustics	X		X	
Dirk Burggraaf	WMR	Technician/Acoustics	X		X	
André Dijkman	WMR	Fish Lab	X		X	
Beanne Snaar	WMR	Fish Lab	X			
Hendrik Westerink	WMR	Fish Lab				X

2.2 Narrative

Table 2. Departure – and arrival dates and time (UTC) in ports

Departure	Date	Time (UTC)	Arrival	Date	Time (UTC)
Scheveningen	22-06-2020	10:00	Scheveningen	3-07-2020	11:00
Scheveningen	06-07-2020	8:45	Scheveningen	13-07-2020	13:00

During the survey a blog is kept which contains all activities: <http://herringsurvey.blogspot.com/>

2.3 Transect coverage

Since 2016, a stratified transect design with random start is applied. Parallel transects along latitudinal lines are used with spacings set at 15 and 35 nmi in the respective strata, based on the observed

abundance and variance in the survey over the last 10 years. The aim of the current survey design is to choose transect spacing to maintain or improve the precision of the survey. Acoustic data from transects running north-south ("intertransects") are excluded from the dataset to avoid sampling autocorrelation, according to standard practice. Inshore extension was maintained at the 20m contour for shallow waters regions of the Baltic and southern North Sea, and the 30m contour for all other areas where applicable. The 200m contour marks the lower depth limit of the international survey at the shelf edge and in the northern boundary.

The change in 2016 was initiated by the ICES WKEVAL 2015 workshop (ICES 2015) where several geographical areas requiring standardization amongst participating survey nations were identified. With the move away from rectangle based estimation, a new set of survey strata were established at WGIPS 2016 maintaining the historical geographical coverage for the HERAS survey area. These strata were applied in the herring acoustic survey in 2016 onwards.

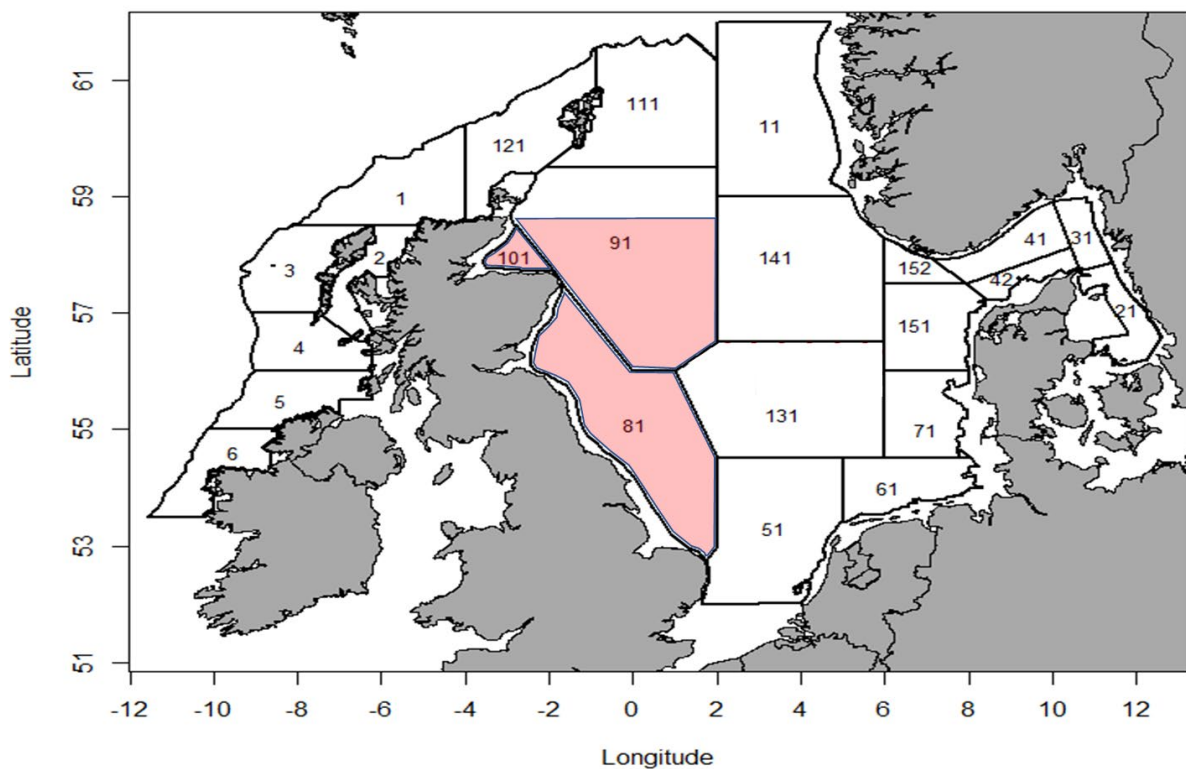


Figure 1. International HERAS survey strata with area (strata 81, part of 91 and 101) covered by RV Tridens during the July 2020 North Sea herring acoustic survey.

The Dutch survey was carried out during two periods of two weeks from 22th June to 3th July and from 6th to 13th July 2020, covering the survey strata in an area east of Great Britain from latitude 53°00' to 58°30' North and from longitude 2°30' West (off the Scottish/English coast) to 2°00' East. Tridens covered stratum 101, 81 and part of 91 in 2019 (Figure 1).

The actual cruise track, trawl- and hydrographical station positions are presented in Figure 2.

Acoustic calibrations

At the start of the first period, on 23rd and 24th of June the acoustic equipment has been calibrated in Scapa Flow, Scotland. The survey was carried out using acoustic sensors mounted in the drop keel of RV Tridens.

The echosounders calibrated were the 18, 38, 70, 120, 200 and the 333 kHz split-beam transducers operated with the EK80 and the ME70 multibeam echosounder. The calibration files are stored at WMR. Annex 1 gives a summary of all the calibrations that have been carried out since 2016. The results show that the calibrations for all frequencies have been very consistent. In the two calibrations in 2018 the gain for 38kHz was very low. Investigation after the survey in 2018 showed that the dip was caused by a bug in the new EK80 software. This has been reported to the manufacturer which released a new version of the software.

2.4 Acoustic data collection

A Simrad EK80 echosounder operating at 18, 38, 70, 120, 200 and 333 kHz was used for acoustic data collection. Transducers were mounted close together on the vessels drop-keel which protruded 3.23 m below the vessel given a total transducer depth of around 7 m below the water surface. Acoustic raw data were logged and post-processed using LSSS (v2.6.0) software. The EK80 received position data and vessel speed from the ship's GPS. A ping rate of 0.6 seconds was used. The data were logged in 1 nautical mile intervals. A typical vessel speed of 10 knots was used on one engine, to avoid interference with the acoustic data collection. Acoustic density values (Nautical Area Scattering Coefficient's: NASC's) by log interval were assigned to the categories "herring", "sprat", "Norway pout", "bottom fish", "sandeel", "mackerel", "haddock" and "whiting", based on school characteristics and trawl catch composition. All echoes were recorded with a threshold of -82dB up to a depth of 250 meters below the transducer.

2.5 Biological data collection

Fishing

The acoustic recordings were verified by fishing with a 2000 mesh pelagic trawl with a 20 mm mesh lining in the cod-end. Fishing was carried out to identify species-composition of major recordings observed on the echo sounder and to obtain biological samples of herring and sprat. In general, after it was decided to make a tow with a pelagic trawl, the vessel turned and fished back on its track line. During fishing the ME70 and SU90 sonars were used as a supplementary help to identify the real centre of the schools in comparison to the trackline. In most hauls, the footrope was very close to the bottom with vertical net opening varying from 20 to 30 m (specifications are listed in the survey manual: Damme *et al.*, 2021).

During the survey extensive use was made of the scientific omnidirectional sonar SU90 to facilitate capture of fish of the target schools identified on the echogram. With the new sonar it was possible to track the schools after the vessel turned to shoot the net, and therefore chances were higher to actually catch the desired school to collect a representative biological sample – and eventually increase survey accuracy. In 2020, like in 2019, portions of the SU90 data were recorded to perform trials for post-processing.

Biological samples

- For all fish: Total species weight of the catch
- 150 to 250 specimens for individual length measurement, for herring and sprat 'to the 0.5 cm below', which means that fish between 20 and 20.5 cm is recorded as 20, and fish from 20.5 to 21.0 cm as 20.5. Other species are measured 'to the cm below'. Depending on the catch weight, subsampling is applied, based on weights.
- Stratified samples of five fish per length class were taken from the length measured herring and sprat. The following parameters are sampled from these fish:
 - Individual length 'to the mm below'
 - Individual weight

- Gender
- Maturity stage
- Age of herring and sprat, by means of otolith reading (otoliths collected on board, age reading is and onshore activity)

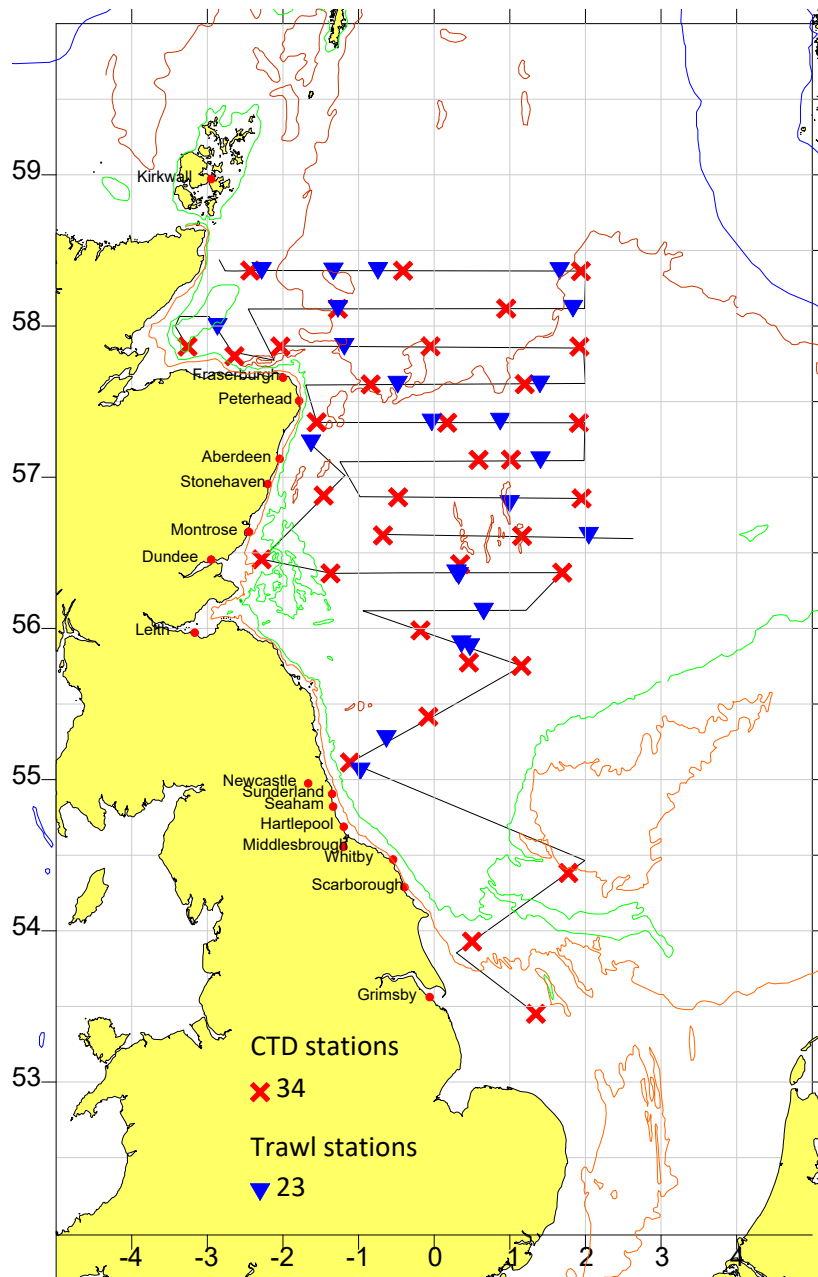


Figure 2. Trawl – and CTD stations during HERAS 2021.

2.6 Hydrographical data

Hydrographical data (conductivity, temperature at different depths) were collected on pre-defined stations on the transects with approximately 30nmi interspacing, in total 34. At each station a downcast was carried out with a Seabird CTD device, type SBE 9plus. It had been successfully calibrated in advance by the manufacturer. The CTD stations are presented in Figure 2.

3 Results

3.1 Trawl data results

Sample ID's used in 2020: 2020.5400001 – 2020.5400020 and 2020.5400271 - 2020.5400273

In total, 23 trawl hauls have been carried out (Figure 2). In total 533 herring samples for biological sampling were taken in 15 hauls (2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 16, 18, 20 and 23); 201 sprat samples were taken in 8 hauls (2, 6, 7, 8, 9, 16, 22 and 23); 58 Norway pout samples were taken in haul 13 and 14.

The trawl list, and the catch weights per haul and species are presented in Table 3.

3.2 Acoustic data results

The total transect length surveyed was 1800 nmi (2130 Nmi including steaming and transitioning between the transects). Most herring (HER) was found in two areas: (1) in the northern part of the survey area (stratum 91) south of 59°, down to and 58°N and west of the 0°E/W line and (2) in the southeastern part of strata 91 in a limited area east of the 0°E/W line at 57°N. In contrast to previous 15 years, the area in between was empty. Instead of herring, this year echo's attributed to Norway pout (NOP), haddock (HAD) and whiting (WHG), the last two in particular between 55°N and 57°N (Figure 3). Sprat (SPR) was found in the northwestern part of the area, east of the Moray Firth. The appearance of sprat over the years has always been irregular in quantity and distribution. However, unlike other years the species showed up relatively north towards the east, whereas is usually found more along the coast and in the southern part of the area. It should be noted that by introducing zigzag transects in stratum 81, the coast is less well covered, making it more likely to miss incidental sprat concentrations.

Schools of gadoid's and sprat can easily be confused with herring schools. Distinguishing the species requires frequent fishing and requires experience in the scrutiny of acoustic data in the area. During this year's survey, this appeared to be no problem. We are confident that we were able to assign the right species to the acoustic recordings.

References

- ICES (2015). Report of the Workshop on evaluating current national acoustic abundance estimation methods for HERAS surveys (WKEVAL). ICES CM 2015/SSGIEOM:16: 48.
- Damme, C. van, U. Beier, L. Bolle, I. de Boois, D. Burggraaf, B. Couperus, R. van Hal & Th. Pasterkamp (2021). CVO Handboek en protocollen voor bestandsopnamen en routinematige bemonsteringen op zee en in estuaria. Intern CVO rapport: 21.008

Table 3. Details of the trawl hauls and catches in kg taken on RV Tridens during the North Sea herring acoustic survey 22 June – 13 July 2020

<i>stat</i>	<i>sample_id</i>	<i>Date</i>	<i>Time</i>	<i>Lat_</i> <i>N</i>	<i>Lon</i>	<i>HER</i>	<i>SPR</i>	<i>NOP</i>	<i>HAD</i>	<i>WHG</i>	<i>MAC</i>	<i>Oth</i>	<i>Total</i>	<i>Bott- Dept h</i>	<i>Wind -Dir</i>	<i>Spd m/s</i>
1	5400001	25- 6- 2020	6:24	58.3 4	-2.3	0.2	0	0	65.9	71	16.4	38	191. 5	65.5	315	4
2	5400002	25- 6- 2020	11:1 9	58.3 9	- 1.36	0.3	0.8	8.9	10.6	1.6	2.2	1.1	25.5	18.3	359	1
3	5400003	25- 6- 2020	14:3 8	58.3 5	- 0.83	2125	0	229. 2	114. 9	14.5	1	3.2	2487 .9	117	90	4
4	5400004	26- 6- 2020	6:34	58.3 6	1.6	2.3	0	1821	137. 1	22.3	0.3	63.4	2046 .4	112. 1	135	7
5	5400005	26- 6- 2020	11:4 3	58.1 1	1.92	0	0	243. 1	26	15.1	5.9	10.3	300. 4	86.2	113	7
6	5400006	27- 6- 2020	4:57	58.0 8	- 1.24	18.9	86.2	3.5	17.9	21.8	6.2	0	154. 5	113	113	7
7	5400007	27- 6- 2020	16:3 9	57.9 6	- 2.81	0.1	30.1	0.2	58.3	4.8	0	0.2	93.7	82.5	113	7
8	5400008	28- 6- 2020	6:16	57.8 6	- 1.24	2.8	123	3.6	44.4	3	0	0.6	177. 4	110. 1	158	7
9	5400009	29- 6- 2020	6:45	57.6 2	1.46	1.2	0.3	4.5	58.7	13.3	0.2	0.1	78.4	96.5	180	16

10	5400010	29- 6- 2020	14:4 9	57.6 1	- 0.42	0.5 0	0	1.8	13.3	0.8	1.2	0.2	17.8	191. 7	203	4
11	5400011	30- 6- 2020	8:41	57.3 1	- 0.02	8.3 0	0	27	895. 4	0	15.4	10.3	956. 3	79	293	7
12	5400012	30- 6- 2020	13:3 7	57.3 6	0.72	2.5 0	0	770. 6	8.2	0.9	16.7	5	803. 7	91.2	293	4
13	5400013	1-7- 2020	5:37	57.1 1	1.46	13.9 0	0	101. 3	29.5	4.3	7.2	1.9	158. 1	97.6	270	7
14	5400014	2-7- 2020	6:31	56.7 8	0.99	0.2 0	0	26.3	85	0	0	1.5	113	91.9	338	7
15	5400015	7-7- 2020	10:3 3	56.6 2	2.1	0 0	0	5.9	22.5	93.4	0	97.1	219	89.2	135	4
16	5400016	8-7- 2020	5:10	57.1 5	- 1.56	0.6 5	5	0	1.9	0	0.8	0.4	8.8	76.5	293	4
17	5400017	9-7- 2020	5:14	56.3 8	0.35	0 0	0	0	2659 .2	7.4	227. 9	0	2894 .6	88	135	4
18	5400018	9-7- 2020	7:07	56.4	0.33	8.8 0	0	0	984. 1	123. 8	134. 4	0.8	1251 .9	89.2	135	4
19	5400019	9-7- 2020	15:1 5	56.1 2	0.65	0.3 0	0	0	98.6	14.2	1411 .8	0	1524 .9	89.2	135	4
20	5400020	10- 7- 2020	10:2 8	55.9 4	0.35	0 0	0	0	332. 1	110. 5	21.9	0.8	465. 3	78.1	270	4
21	5400271	10- 7- 2020	12:5 0	55.9	0.42	0.5 0	0	0	3256 .3	180. 8	28.8	151	3617 .4	80	315	7
22	5400272	11- 7- 2020	6:27	55.3	- 0.54	0 0.2	0	0	1.5	0.9	2.8	0.5	5.8	75.6	315	7

23 | 5400273

11-	11:1	55.0	-	11073	55.9	0	0	1006	36.1	0	2122	87.3	315	7
7-	9	9	1.04					0.3			5.9			
2020														

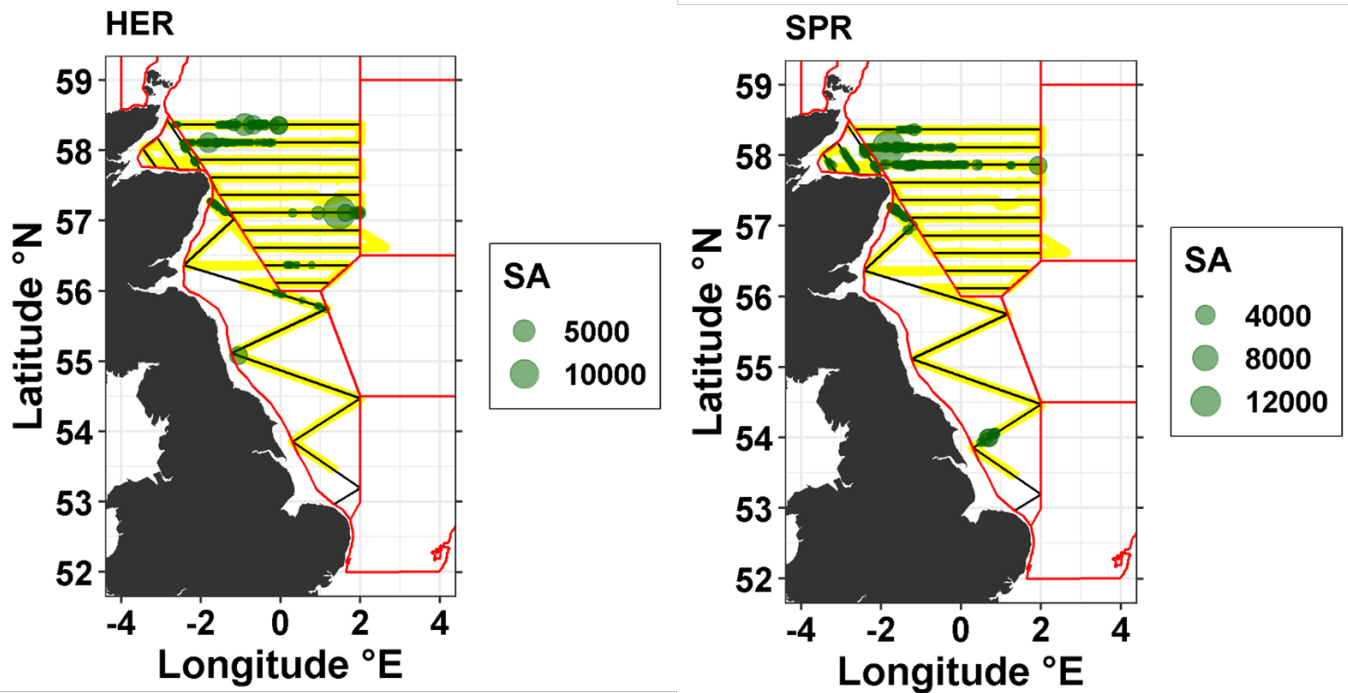


Figure 3a-b. Post plot showing the distribution of total herring(*l*) and sprat(*r*) NASC's of 1 nm intervals in 2020.

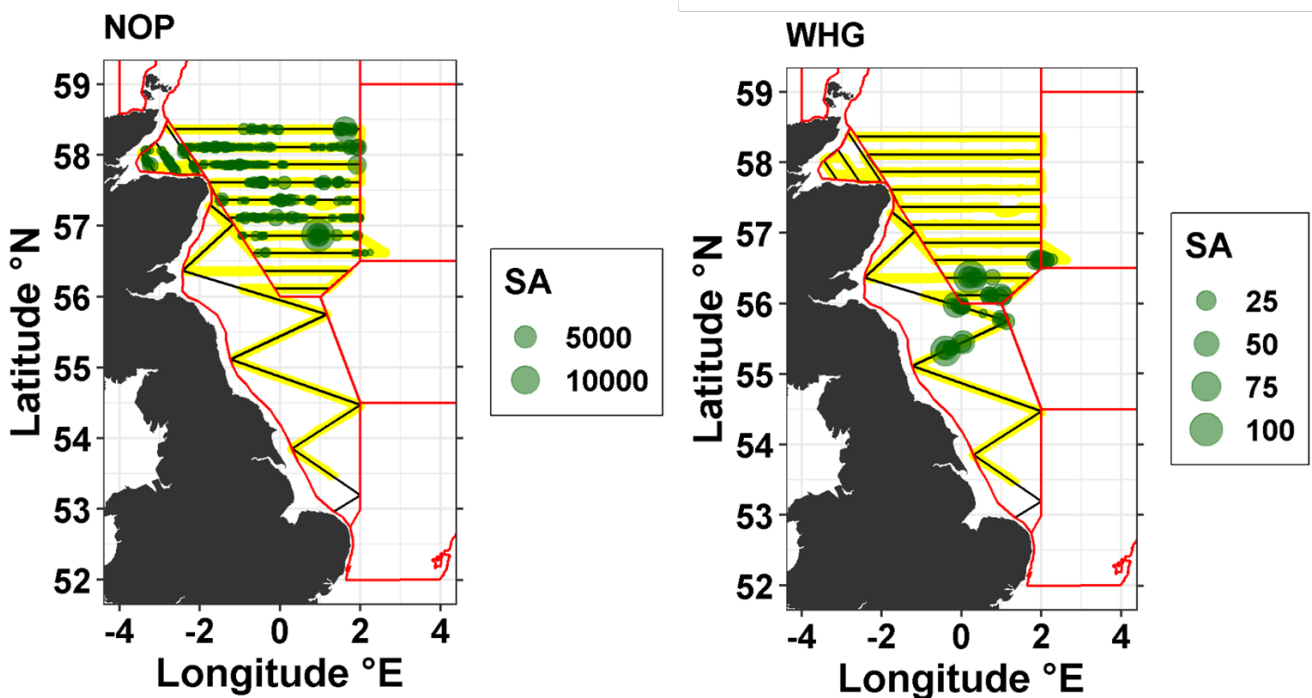


Figure 3c-d. Post plot showing the distribution of Norway pout (*l*) and whiting(*r*) NASC's of 1 nm intervals in 2020.

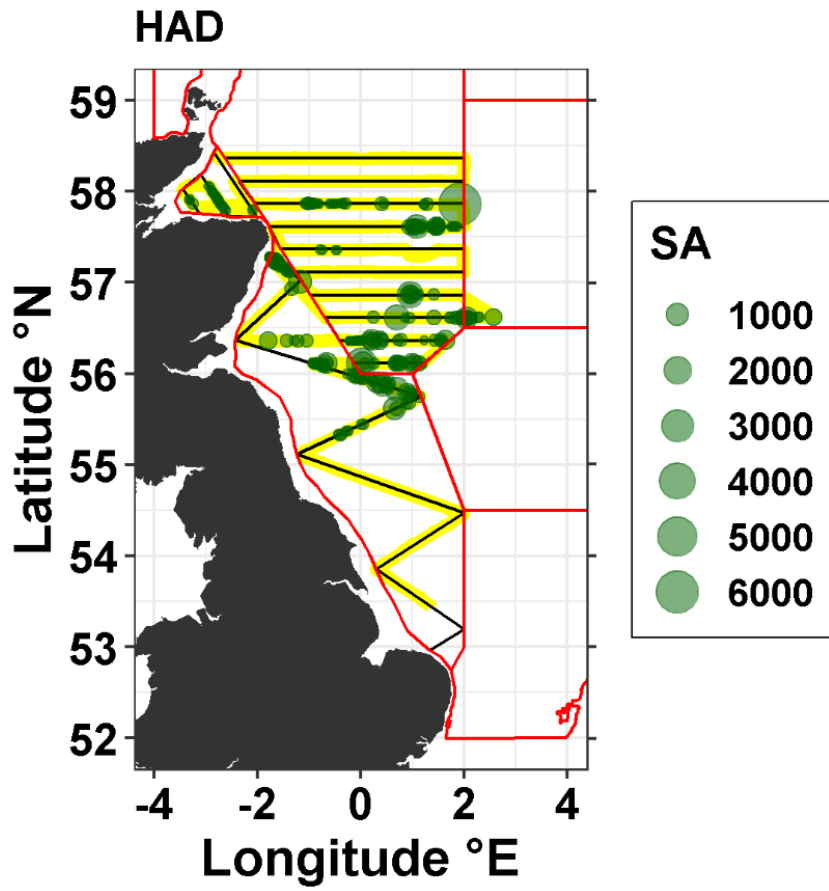


Figure 3e. Post plot showing the distribution of Haddock NASC's of 1 nm intervals in 2020.

Justification

CVO Report: 21.013

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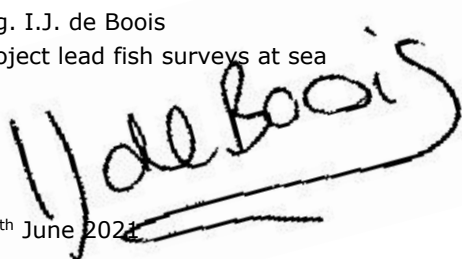
The quality of this report has been peer reviewed by a colleague scientist and the head of CVO.

Approved by: Ing. I.J. de Boois
project lead fish surveys at sea

Signature:

Date:

11th June 2021




Approved by: Ing. S.W. Verver
Head Centre for Fisheries Research

Signature:

Date:

11th June 2021



Annex 1

Boxplots of calibration performances since 2016 of all installed frequencies on board RV Tridens. 38 kHz is used for the abundance estimation. The dip in gain of 38kHz in 2018, was due to a dip in the EK80 software. The bug was recognized shortly after the survey and the acoustic data has been corrected by applying a correction factor.

