
DTU Aqua - Cruise report

Danish Sole Survey 4Q 2021

HAVFISKEN, SG25

Denmark

From 07-11-2021 to 25-11-2021

Contents

Cruise summary	3
Introduction	5
Gear	5
Trawl procedure	5
Weather conditions	5
Oxygen conditions	5
Gear performance	6
List of guests	6
Other remarks	6
Stations by ICES area	8
Area 20	8
Area 21	10
Area 22	13
Handling of the catch	15
Processing of the results	15
CPUE	15
Biomass and abundance	16
Catch	17

Cruise summary

General information

<i>Cruise</i>	Danish Sole Survey
<i>Cruise leader</i>	Henrik Degel
<i>Research vessel(s)</i>	HAVFISKEN, SG25
<i>Year and quarter</i>	4Q 2021
<i>Country</i>	Denmark

Participants and time

Trip no.	Start date and time	End date and time	Ship
2	07-11-2021 18:00	11-11-2021 00:00	SG25
1	10-11-2021 08:00	26-11-2021 16:00	HAVFISKEN
4	14-11-2021 13:00	18-11-2021 00:00	SG25
6	21-11-2021 14:00	25-11-2021 10:00	SG25

Name	Institute	Function and tasks	Part
Aage Thaarup	DTU-Aqua	Skipper	a
Jesper Knudsen	DTU-Aqua	Ship's mate	a
Per C	DTU-Aqua	Cruise-leader	a
Søren E	DTU-Aqua	Length measurements	a
Søren Grønby	DTU-Aqua	Skipper	b
Reinhardt J.	DTU-Aqua	Ship's mate	b
Thomas Møller	DTU-Aqua	Cruise-leader	b
Brian WT	DTU-Aqua	Length measurements	b
Rene Erlandsen	DTU-Aqua	Skipper	c
Mads Jensen	DTU-Aqua	Ship's mate	c
Per C	DTU-Aqua	Cruise-leader	c
Søren E	DTU-Aqua	Length measurements	c

Trip: 1, Vessel: Havfisken, Start: 10-11-2021 08:00, End: 26-11-2021 16:00

Name	Institute	Function and tasks	Part
Peter Vingaard Larsen	DTU-Aqua	Cruise-leader	

Trip: 2, Vessel: SG25 Anni Holm, Start: 07-11-2021 18:00, End: 11-11-2021 00:00

Name	Institute	Function and tasks	Part
Peter Vingaard Larsen	DTU-Aqua	Cruise-leader	

Trip: 4, Vessel: SG25 Anni Holm, Start: 14-11-2021 13:00, End: 18-11-2021 00:00

Name	Institute	Function and tasks	Part
Peter Vingaard Larsen	DTU-Aqua	Cruise-leader	

Trip: 6, Vessel: SG25 Anni Holm, Start: 21-11-2021 14:00, End: 25-11-2021 10:00

Introduction

The “Tunge Survey” (Sole Survey) is an annual survey carried out every autumn in the Kattegat, Skagerrak and Western Belt area. The purpose of the cruise is to provide CPUE data for sole. The results are used for maintaining a time series used in the annually assessment of sole from Kattegat. From 2016 and onwards the survey is carried out by a commercial fishing vessel and the research vessel “Havfisken” owned by DTU Aqua. The gear used is a demersal otter trawl.

Gear

Trawl: Twin “Icelandic-sole-trawl” with 140 mm mesh and rockhopper type ground gear with 150 mm rubber discs. Mesh size in the cod end: 55 mm stretch mesh Otter boards: 66' “Thyborøn”. Warp: 13 mm.

The otter boards are mounted directly on the tips of the wings without bridles. Wing spread (otter board spread) is app. 44 m.

Trawl procedure

Towing time is 30 min.

Before 2016 the towing time was 60 min but towing time down to 20 min has been accepted if no circumstances disqualified the haul.

In 2016 towing time was reduced to 30 min on 25% of the traditional stations and in 2017 the towing time was reduced to 30 on 50% of the stations. Towing time was 30 min on all new stations in Jammerbugt and Storebælt.

Towing speed: 2.5 kn. over the seabed.

Hauls start: when the trawl is considered going stable on the bottom.

Haul end: when hauling starts.

Warp length: The depth varies from station to station and so does the warp length. The warp length was recorded at each station in 2004 and this warp length is used at the station in 2005 and onwards.

Each station is fished in the same direction each year if wind and current allows.

Fishing takes place only during night time from app. 5 pm to 7 am.

Weather conditions

x

Oxygen conditions

x

Gear performance

x

List of guests

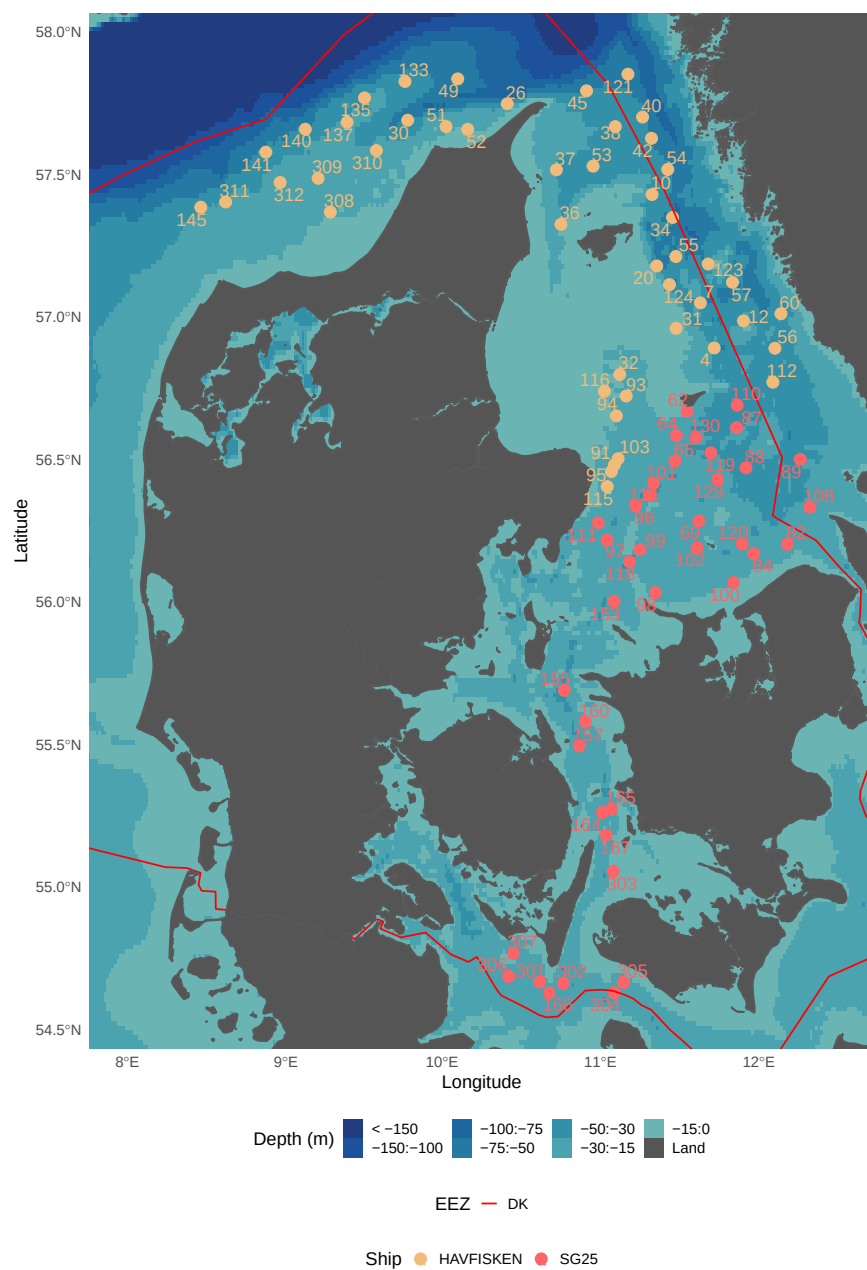
x

Other remarks

x

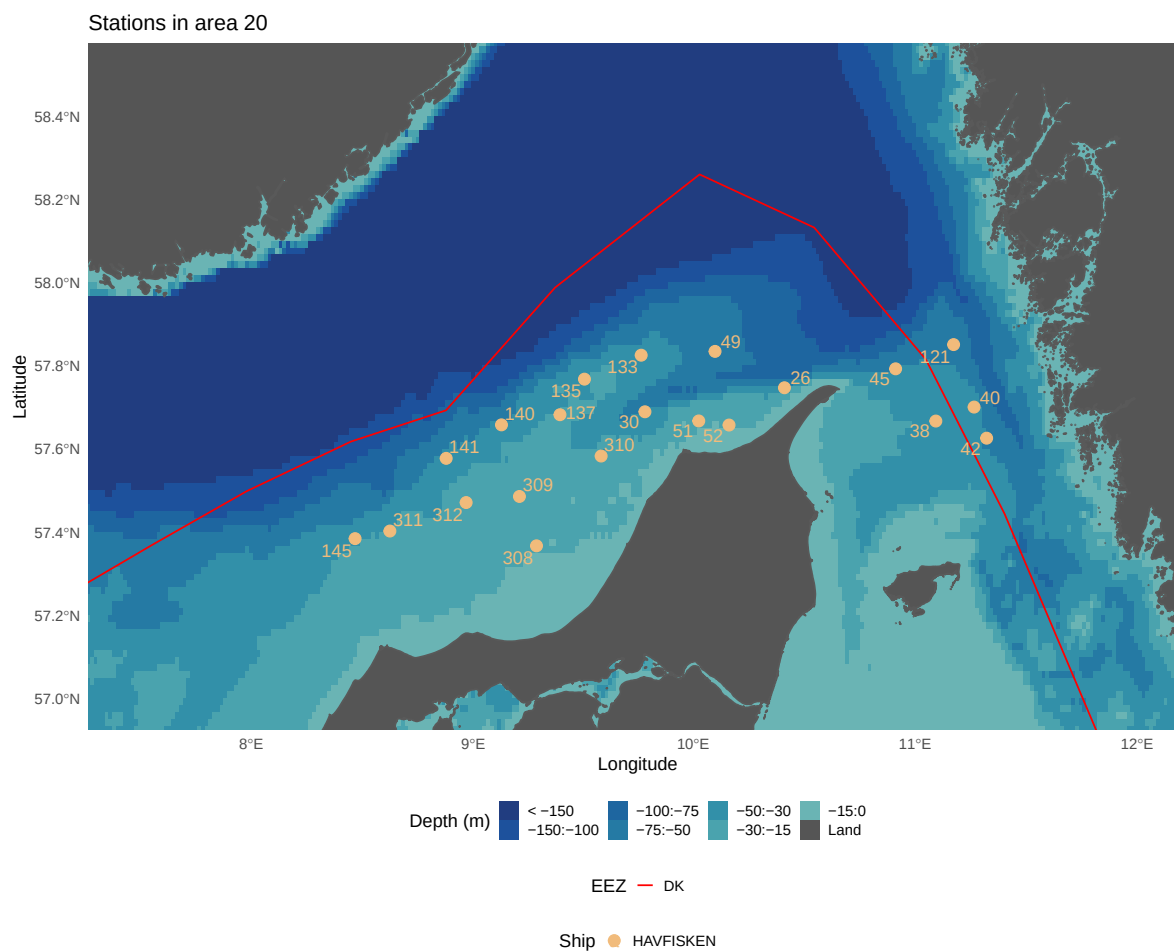
Stations

87 hauls were conducted during the survey. The positions off all hauls are presented in the map in Fig. 1 and hauls per ICES area are plotted in the maps in Fig. 2-4.



Stations by ICES area

Area 20

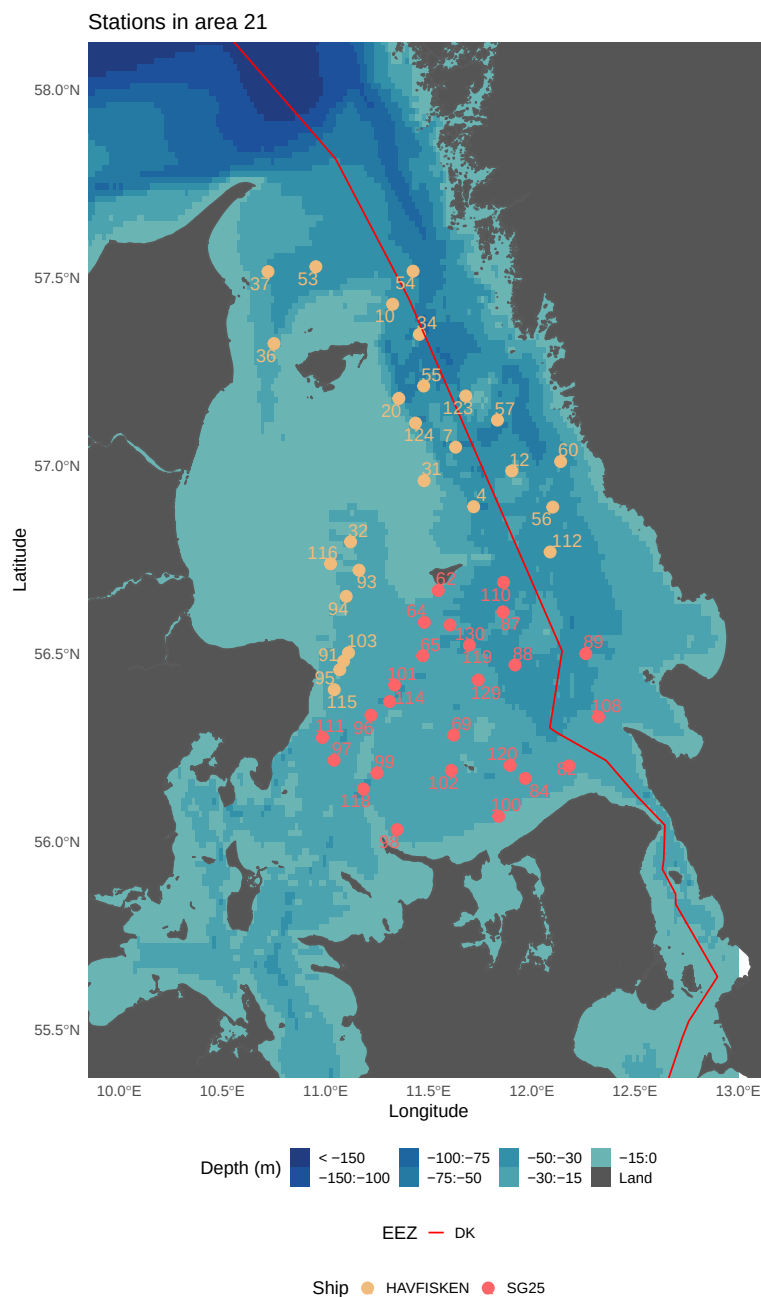


Station Name	Latitude dec.	Longitude dec.	Latitude deg.	Longitude deg.	Ship
49	57.835166	10.098250	57.50.1100 N	010.05.8950 E	HAVFISKEN
133	57.826016	9.765450	57.49.5610 N	009.45.9270 E	HAVFISKEN
135	57.768416	9.509850	57.46.1050 N	009.30.5910 E	HAVFISKEN

Station Name	Latitude dec.	Longitude dec.	Latitude deg.	Longitude deg.	Ship
137	57.682950	9.399600	57.40.9770 N	009.23.9760 E	HAVFISKEN
310	57.583600	9.585083	57.35.0160 N	009.35.1050 E	HAVFISKEN
308	57.367716	9.293800	57.22.0630 N	009.17.6280 E	HAVFISKEN
309	57.486416	9.216933	57.29.1850 N	009.13.0160 E	HAVFISKEN
312	57.471750	8.976800	57.28.3050 N	008.58.6080 E	HAVFISKEN
145	57.385016	8.476416	57.23.1010 N	008.28.5850 E	HAVFISKEN
311	57.403250	8.633150	57.24.1950 N	008.37.9890 E	HAVFISKEN
141	57.578033	8.886833	57.34.6820 N	008.53.2100 E	HAVFISKEN
140	57.658550	9.135983	57.39.5130 N	009.08.1590 E	HAVFISKEN
30	57.689966	9.782433	57.41.3980 N	009.46.9460 E	HAVFISKEN
51	57.667933	10.024866	57.40.0760 N	010.01.4920 E	HAVFISKEN
52	57.658083	10.161316	57.39.4850 N	010.09.6790 E	HAVFISKEN
26	57.747733	10.410916	57.44.8640 N	010.24.6550 E	HAVFISKEN
45	57.793300	10.911783	57.47.5980 N	010.54.7070 E	HAVFISKEN
121	57.851516	11.173016	57.51.0910 N	011.10.3810 E	HAVFISKEN
38	57.667683	11.093050	57.40.0610 N	011.05.5830 E	HAVFISKEN
40	57.701266	11.265366	57.42.0760 N	011.15.9220 E	HAVFISKEN
42	57.626500	11.321950	57.37.5900 N	011.19.3170 E	HAVFISKEN

Area: 20, Geartype: DTU55, GearQuality: V

Area 21



Station Name	Latitude dec.	Longitude dec.	Latitude deg.	Longitude deg.	Ship
31	56.960366	11.477233	56.57.6220 N	011.28.6340 E	HAVFISKEN

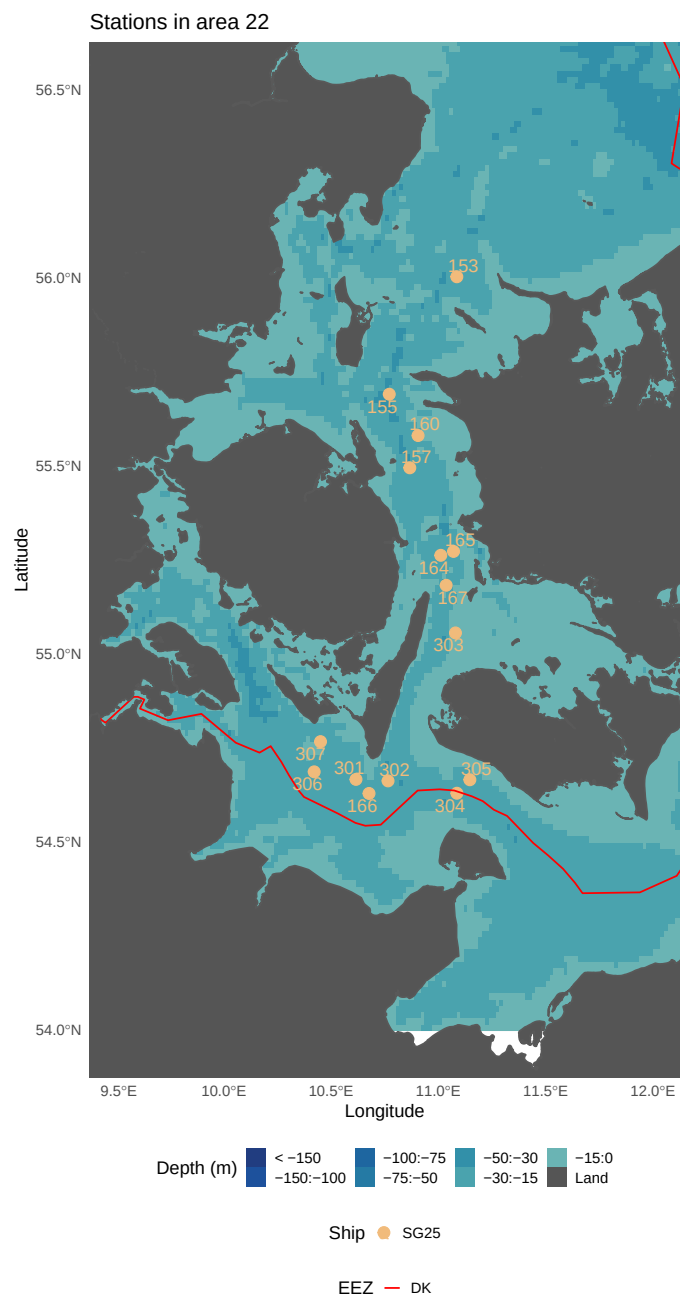
Area: 21, Geartype: DTU55, GearQuality: I

Station Name	Latitude dec.	Longitude dec.	Latitude deg.	Longitude deg.	Ship
62	56.668583	11.546300	56.40.1150 N	011.32.7780 E	SG25
64	56.583983	11.478783	56.35.0390 N	011.28.7270 E	SG25
65	56.495183	11.470833	56.29.7110 N	011.28.2500 E	SG25
69	56.284350	11.621083	56.17.0610 N	011.37.2650 E	SG25
82	56.202533	12.179333	56.12.1520 N	012.10.7600 E	SG25
84	56.169266	11.967783	56.10.1560 N	011.58.0670 E	SG25
87	56.612000	11.859250	56.36.7200 N	011.51.5550 E	SG25
88	56.470616	11.918150	56.28.2370 N	011.55.0890 E	SG25
89	56.500716	12.261350	56.30.0430 N	012.15.6810 E	SG25
96	56.337116	11.220133	56.20.2270 N	011.13.2080 E	SG25
97	56.217500	11.041133	56.13.0500 N	011.02.4680 E	SG25
98	56.033216	11.346750	56.01.9930 N	011.20.8050 E	SG25
99	56.183333	11.249266	56.11.0000 N	011.14.9560 E	SG25
100	56.068416	11.839016	56.04.1050 N	011.50.3410 E	SG25
101	56.417233	11.334783	56.25.0340 N	011.20.0870 E	SG25
102	56.190483	11.609266	56.11.4290 N	011.36.5560 E	SG25
108	56.332550	12.322633	56.19.9530 N	012.19.3580 E	SG25
110	56.690283	11.862416	56.41.4170 N	011.51.7450 E	SG25
111	56.277800	10.985250	56.16.6680 N	010.59.1150 E	SG25
114	56.373616	11.310516	56.22.4170 N	011.18.6310 E	SG25
118	56.141200	11.183200	56.08.4720 N	011.10.9920 E	SG25
119	56.523383	11.696883	56.31.4030 N	011.41.8130 E	SG25
120	56.203700	11.894650	56.12.2220 N	011.53.6790 E	SG25
129	56.430750	11.740083	56.25.8450 N	011.44.4050 E	SG25
130	56.576850	11.602983	56.34.6110 N	011.36.1790 E	SG25
53	57.528983	10.952900	57.31.7390 N	010.57.1740 E	HAVFISKEN
10	57.429416	11.325150	57.25.7650 N	011.19.5090 E	HAVFISKEN
54	57.517216	11.424333	57.31.0330 N	011.25.4600 E	HAVFISKEN
34	57.349216	11.454600	57.20.9530 N	011.27.2760 E	HAVFISKEN
55	57.211916	11.475483	57.12.7150 N	011.28.5290 E	HAVFISKEN
20	57.178933	11.355083	57.10.7360 N	011.21.3050 E	HAVFISKEN
124	57.113616	11.435816	57.06.8170 N	011.26.1490 E	HAVFISKEN
94	56.653016	11.099916	56.39.1810 N	011.05.9950 E	HAVFISKEN
103	56.503033	11.111233	56.30.1820 N	011.06.6740 E	HAVFISKEN
91	56.481000	11.087433	56.28.8600 N	011.05.2460 E	HAVFISKEN
115	56.405033	11.041983	56.24.3020 N	011.02.5190 E	HAVFISKEN
95	56.458000	11.068783	56.27.4800 N	011.04.1270 E	HAVFISKEN
93	56.722583	11.162083	56.43.3550 N	011.09.7250 E	HAVFISKEN
32	56.797983	11.121050	56.47.8790 N	011.07.2630 E	HAVFISKEN
116	56.739650	11.024150	56.44.3790 N	011.01.4490 E	HAVFISKEN

Station Name	Latitude dec.	Longitude dec.	Latitude deg.	Longitude deg.	Ship
112	56.771016	12.088250	56.46.2610 N	012.05.2950 E	HAVFISKEN
56	56.890233	12.101133	56.53.4140 N	012.06.0680 E	HAVFISKEN
12	56.986350	11.902783	56.59.1810 N	011.54.1670 E	HAVFISKEN
60	57.011366	12.139233	57.00.6820 N	012.08.3540 E	HAVFISKEN
57	57.121383	11.833050	57.07.2830 N	011.49.9830 E	HAVFISKEN
123	57.185550	11.679550	57.11.1330 N	011.40.7730 E	HAVFISKEN
4	56.891250	11.717666	56.53.4750 N	011.43.0600 E	HAVFISKEN
7	57.049466	11.630283	57.02.9680 N	011.37.8170 E	HAVFISKEN
36	57.324883	10.750116	57.19.4930 N	010.45.0070 E	HAVFISKEN
37	57.516016	10.721100	57.30.9610 N	010.43.2660 E	HAVFISKEN

Area: 21, Geartype: DTU55, GearQuality: V

Area 22



Station Name	Latitude dec.	Longitude dec.	Latitude deg.	Longitude deg.	Ship
153	56.002300	11.086016	56.00.1380 N	011.05.1610 E	SG25
155	55.690216	10.770983	55.41.4130 N	010.46.2590 E	SG25
157	55.494650	10.866816	55.29.6790 N	010.52.0090 E	SG25
160	55.580366	10.905383	55.34.8220 N	010.54.3230 E	SG25
164	55.262116	11.011200	55.15.7270 N	011.00.6720 E	SG25

Station Name	Latitude dec.	Longitude dec.	Latitude deg.	Longitude deg.	Ship
165	55.272400	11.070483	55.16.3440 N	011.04.2290 E	SG25
166	54.629333	10.676666	54.37.7600 N	010.40.6000 E	SG25
167	55.182516	11.036266	55.10.9510 N	011.02.1760 E	SG25
301	54.666700	10.615883	54.40.0020 N	010.36.9530 E	SG25
302	54.662700	10.765333	54.39.7620 N	010.45.9200 E	SG25
303	55.055850	11.079666	55.03.3510 N	011.04.7800 E	SG25
304	54.629883	11.086366	54.37.7930 N	011.05.1820 E	SG25
305	54.665683	11.146766	54.39.9410 N	011.08.8060 E	SG25
306	54.686766	10.421000	54.41.2060 N	010.25.2600 E	SG25
307	54.767033	10.450600	54.46.0220 N	010.27.0360 E	SG25

Area: 22, Geartype: DTU55, GearQuality: V

Handling of the catch

After each haul the catch is sorted by species and weighed to nearest 0.1 kg and the number of specimens recorded. Most fish species are measured as total length (TL) to 1.0 cm below. Norway lobster is measured in mm carapace length.

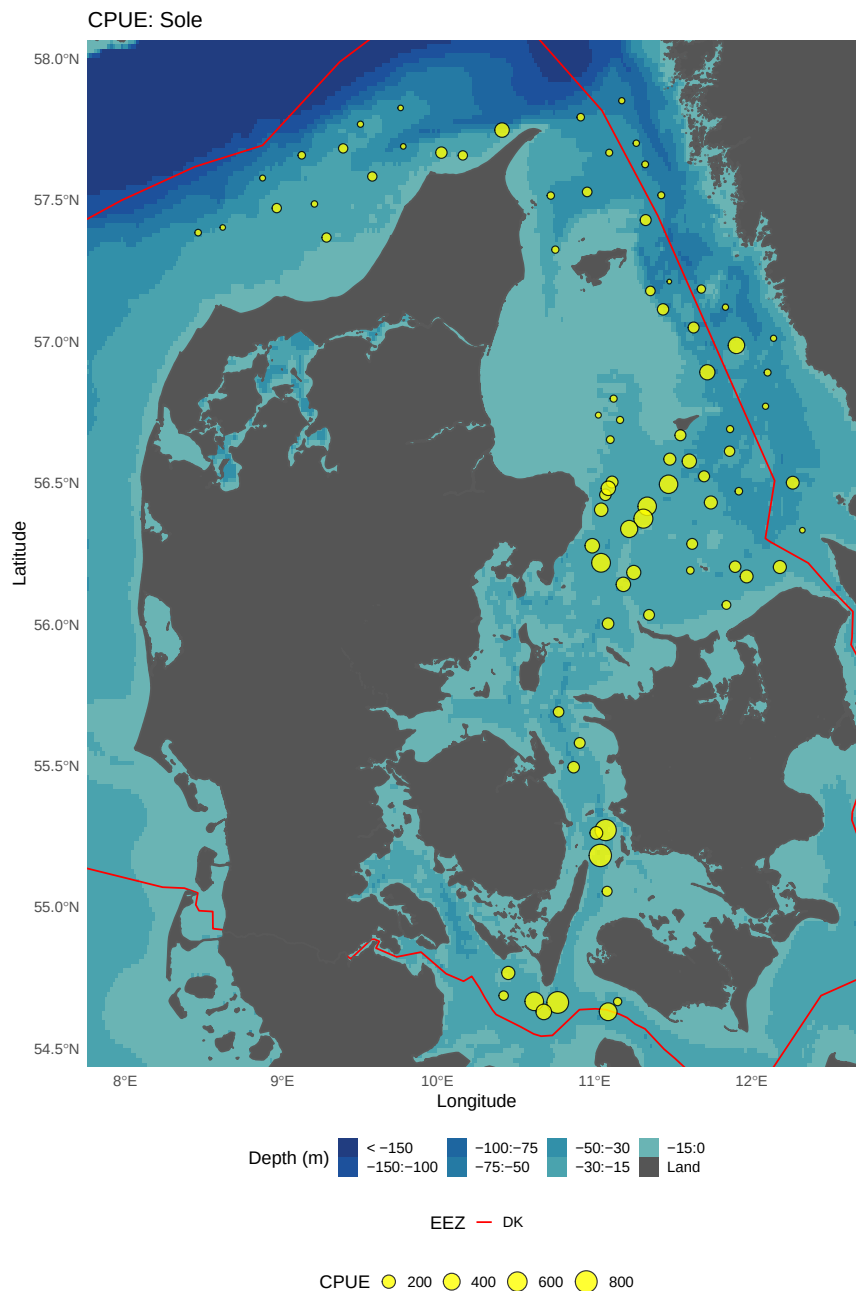
Processing of the results

CPUE

CPUE for sole, cod, plaice and Norway lobster is estimated as mean catch (kg or numbers) per hour with Standard Error based on the Standard Stations (i.e. not including the stations in Jammerbugt and Storebælt).

CPUE is in the following map estimated with the equation:

$$CPUE_{station} = \frac{\sum Sole_{station}}{FishingTime_{station}} * 60$$



Biomass and abundance

The traditional survey area has been stratified in ICES squares (Fig 3, Table 4).

Biomass and abundance estimates is obtained by applying the swept area method (estimated trawling speed * wing spread * trawling time) using the recorded speed, wing spread and trawling time and the stratum area as weighting factor. The catchability coefficient is assumed to be 1.0.

All catches are standardized to 1 km² swept prior to further calculations.

Over all S.E. is estimated using the stratum area as weighting factor. In strata with one haul only STD=biomass (or abundance).

Catch

The total catch of all species, cod, plaice and sole are presented below. The total catch per species per ICES area are presented in table 1-3.

	Weight (kg)	Number
Total catch	24781.2	368607
Cod	334	3692
Plaice	3976.6	46419
Sole	950.1	6443

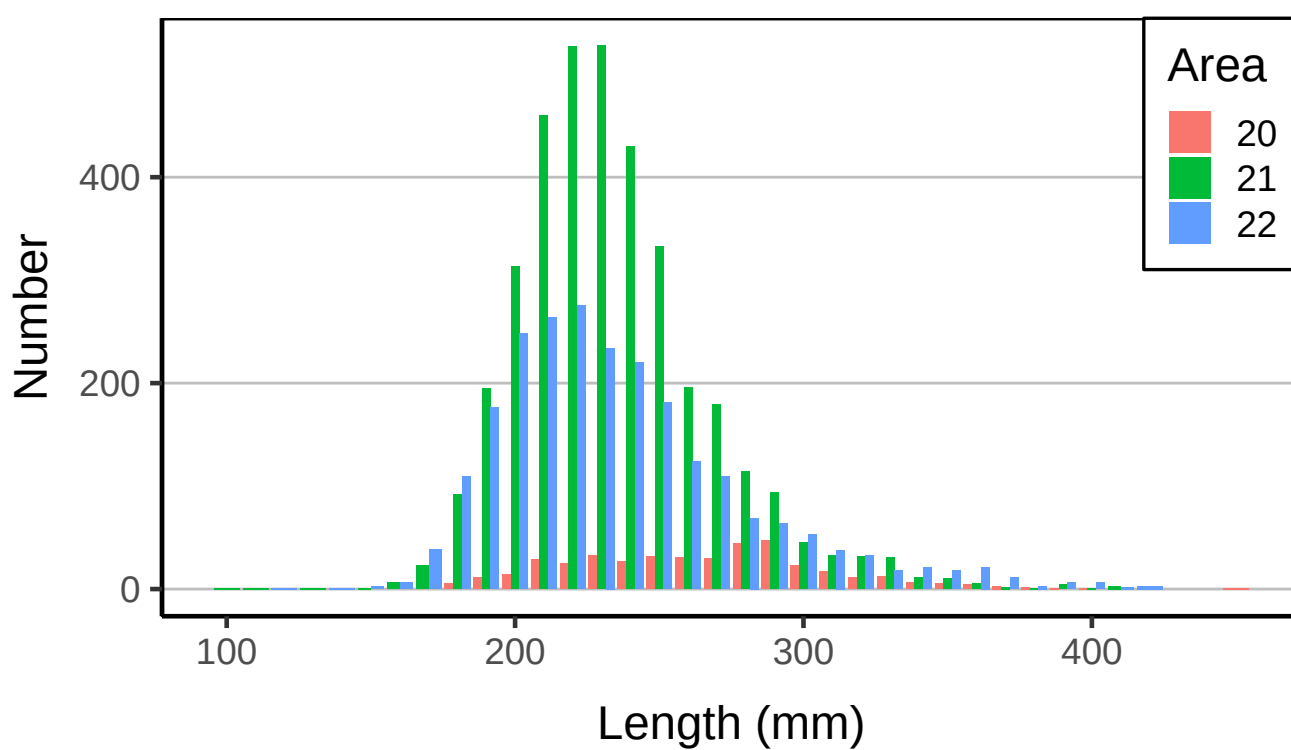


Figure 1: Length distribution per area for sole, Sole Survey 2021