DTU Aqua

Cruise Report

F/V Ceton S205

"IESSNS 2018 DK"

European Union
European Maritime and Fisheries Fund

HAV & FISK

Kai Wieland

23-01-2019

Vessel: F/V Ceton S205 Cruise dates (planned): 2/7 – 13/7 2018

Cruise number: na Cruise name: IESSNS 2018 DK

Port of departure:	Skagen	**Date:**	02 July
Port of return:	Hirtshals	**Date:**	13 July
Other ports:	Egersund	**Date and justification:**	6 July Collection of new crane scale

Participants

Scientific team (DTU Aqua, Section for Monitoring and Data, Hirtshals):

Kai Wieland (Cruise leader),
Per Christensen,
Dirk Tijssen

Fishing vessel Ceton S205 (Gifico Aps):

Jacob Claeson (Skipper) and 5 crew members

Objectives

The main objective of the IESSNS (International Ecosystem Summer Survey in the Nordic Seas) is to estimate mackerel abundance per age class, but also CTD and plankton samples are being collected. The survey is carried out during July and a special designed gear, the Multipelt 832 pelagic trawl with Dynema warps, is used to catch the mackerel. The trawl fishery takes place at a combination of fixed and non-fixed stations located along transects, and fishing depth is form surface to about 30 – 35 m depth.
Even though the importance of the IESSNS survey for the mackerel assessment has recently increased, one criticism of the survey that has been raised several times is that the survey does not cover the southern edge distribution. Only samples taken north of 60° N is included in the index, thus the entire North Sea, Waters around the British Isles and the Bay of Biscay are not sampled. There are two reasons for that. First, the survey is designed and performed by Norway, Iceland, Faeroes and Greenland with focus on their waters. Secondly, there is concern to what extend the survey design are applicable in more shallow areas like the North Sea. The reason for this concern is the absence of a thermocline in the southern and shallower waters which is dividing the water column into a warmer upper layer and a colder deeper layer. The presence of a thermocline in the northern waters (at around 30 m depth) is believed to limit the habitat of the mackerel, as the fish are unlikely to cross the thermocline and dive into the cold deeper waters. If such a thermocline is not present then the depth range of the mackerel south of 60°N is larger extending beyond the layer fished by the trawl.

Despite the concern about the applicability of the survey design south of 60°N there appears to be a potential in expanding the survey as this might improve the index, especially for the younger year classes which are expected to be located more southerly than older and larger individuals.

With this background, Denmark joined the IESSNS in 2018 using a commercial vessel in order to investigate whether the applied methods in the IESSNS would also work for the North Sea.

Itinerary (local time)

2/7-2018	10:00 Arrival of scientific team and loading of equipment in Skagen
	16:00 Departure from Skagen
	17:00 Test of trawl and adjustments of rigging (5 trials, finished 22:00)
3/7-2018	01:30 Start of the survey sampling, interrupted (after station 17)
6/7-2018	18:25 Arrival Egersund
	18:30 Departure Egersund
7/7-2018	01:00 Survey sampling resumed (station 18)
12/7-2018	00:00 Survey sampling completed (station 39)
13/7-2018	06:30 Arrival Hirtshals, Unloading of equipment and samples (until 07:15)

Achievements

Eight transects between about 59°25’ N to 54°08’N were covered with in total 39 sampling locations (Fig. 1) and the following activities:

- 39 CTD profiles (Sea-Bird SeacatPlus, down to about 5 m above bottom, prior to each fishing operation)
- 39 valid hauls with a Multipelt 832 Pelagic Trawl (cod end mesh size 20 mm).

Results

Sampling and gear performance

The survey was conducted with F/V Ceton (62.60 m length, 1337 GT) in 24 h operation covering almost equally all times of the day (Fig. 2). Tow duration measured from the time at which vessel speed and trawl geometry was stable until hauling back the warp was 30 min in all cases. So-called banana tows were conducted in which heading was constantly changed with a curvature between 60 and 100° in total. Since no continuous digital recording system has been available (except for the Simrad ES 60 echo sounder, 38 khz), position, course, speed and trawl geometry (from Marport sensors) were protocolled every 5 minutes. Towing speed, vertical net opening and door spread ranged from 4.6 to 5.4 kn, 24 to 35 m and 116 to 127 m between the stations (Fig. 2) and amounted to 5.1 kn, 31 m and 122 m on average for all stations.

Bottom depth and distance of footrope to bottom were between 51 and 525 m and between 20 and 490 m during nominal tow duration. However, during setting the trawl the footrope had touched the bottom at the shallowest stations with bottom depths of about 50 m (station 34 to 37).

Horizontal trawl opening (Wing spread, WS) calculated according to the equation from the IESSNS manual for an average towing speed of 5 kn based on flume tank simulations, i.e.

$$WS = 0.3959 * \text{Door spread} + 20.094,$$

ranged from 66 to 70 m, and towed distance calculated from towing speed and duration was between 4.2 and 5 km per banana tow. These values were used to compute swept area converting total catch (kg) to densities (kg/km^2) per tow for mackerel and herring.

Catches and species distribution

Mackerel was caught on all stations and the highest catch amounting 3.3 tons was recorded 15 nm off the English coast (Fig. 3), and average mackerel density was 1743 kg/km^2.

Herring was restricted to the northern part of the survey area with a maximum catch of 2.7 tons and an average density of 3.1 kg/km^2.

Several other species were caught (Tab. 1) and it appears remarkable that classical demersal species such as grey gurnard and lumpfish occurred in the surface layer catches even at deep stations and this was observed both during night and day.

Mackerel length frequencies, mean weight and age distribution

Mackerel length was between 17 and 43 cm but with pronounced difference between the stations (Fig. 5, Tab. 2). Single fish weight was recorded for one specimen per cm group and station which yielded in total data for 602 individuals and the resulting length-weight relationship is shown in figure 6. Mean individual weight by station was highest in the western and northwestern part of the survey area whereas the lowest values were found east and north east from the Doggerbank (Fig. 7).

Otoliths (and stomachs) were collected along with the recording of single weight. Age readings for a subset of uneven station numbers indicated that the entire sample set had to be worked up at least for fish > 25 cm before numbers at age by haul as input for stock assessment can be provided. The final age length key based on 594 age readings is shown in Fig. 8. In future surveys, the number of age samples for lengths below 20 cm can be decreased to 2 individuals per 5 cm group and station in favor to increase the numbers to 2 individuals per 1 cm group for length above 30 cm.

Temperature conditions

Surface temperature ranged from about 13 and 18 °C. A pronounced thermocline in the upper 20 to 40 m was found for most of the stations (Fig. 9). Only in the northwestern part of the survey area, i.e. off the Scottish coast, such stratification was missing.

Acknowledgements

Many thanks to Skipper Jacob Claeson and his competent and efficient crew for the very successful cooperation onboard. Further thanks to Claus Sparrevohn, 'Danmarks Pelagiske Producent Organisation' (DPPO), for organizational issues and logistics prior to the survey.
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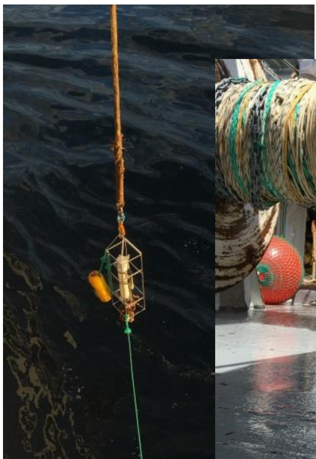

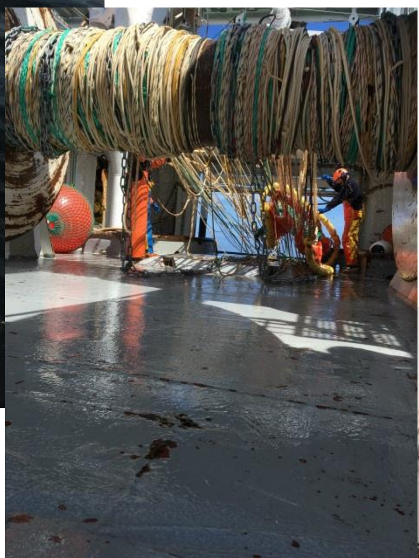

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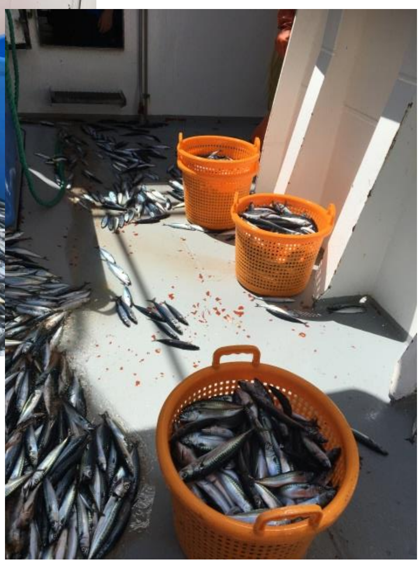

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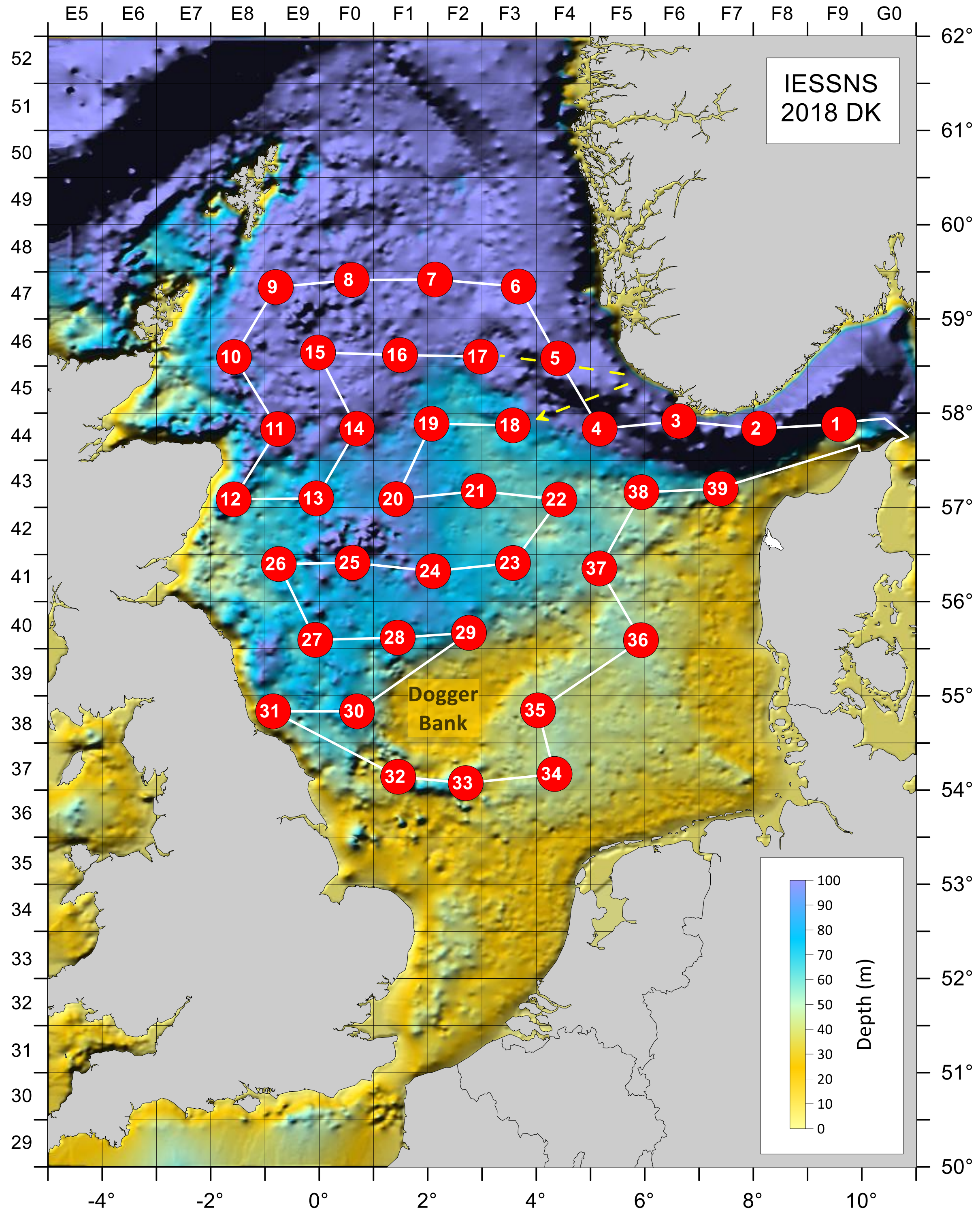

Fig. 1: Survey map with sampling locations.

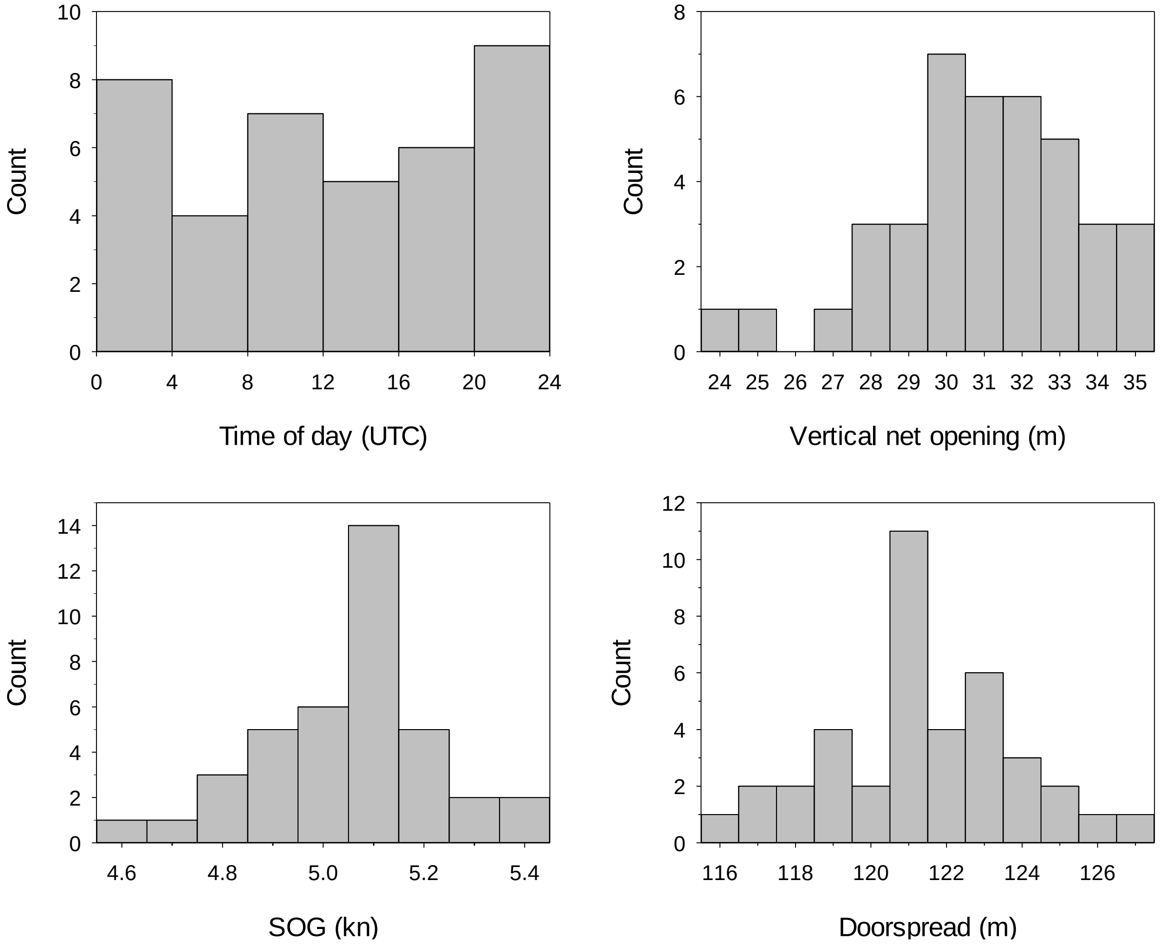

Fig 2: Times of day fished, vessel and gear performance (average values by station).

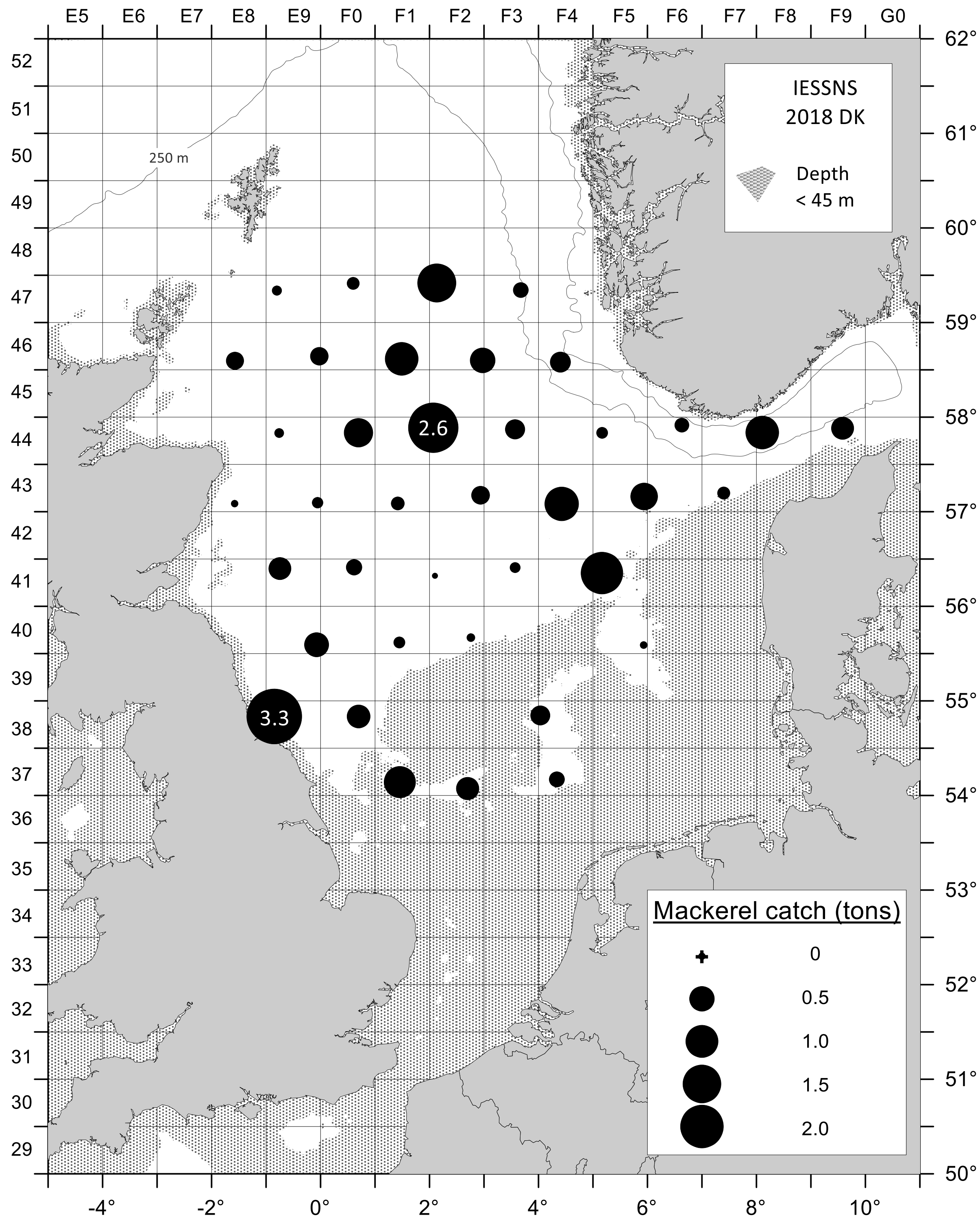

Fig. 3: Distribution of mackerel catches.

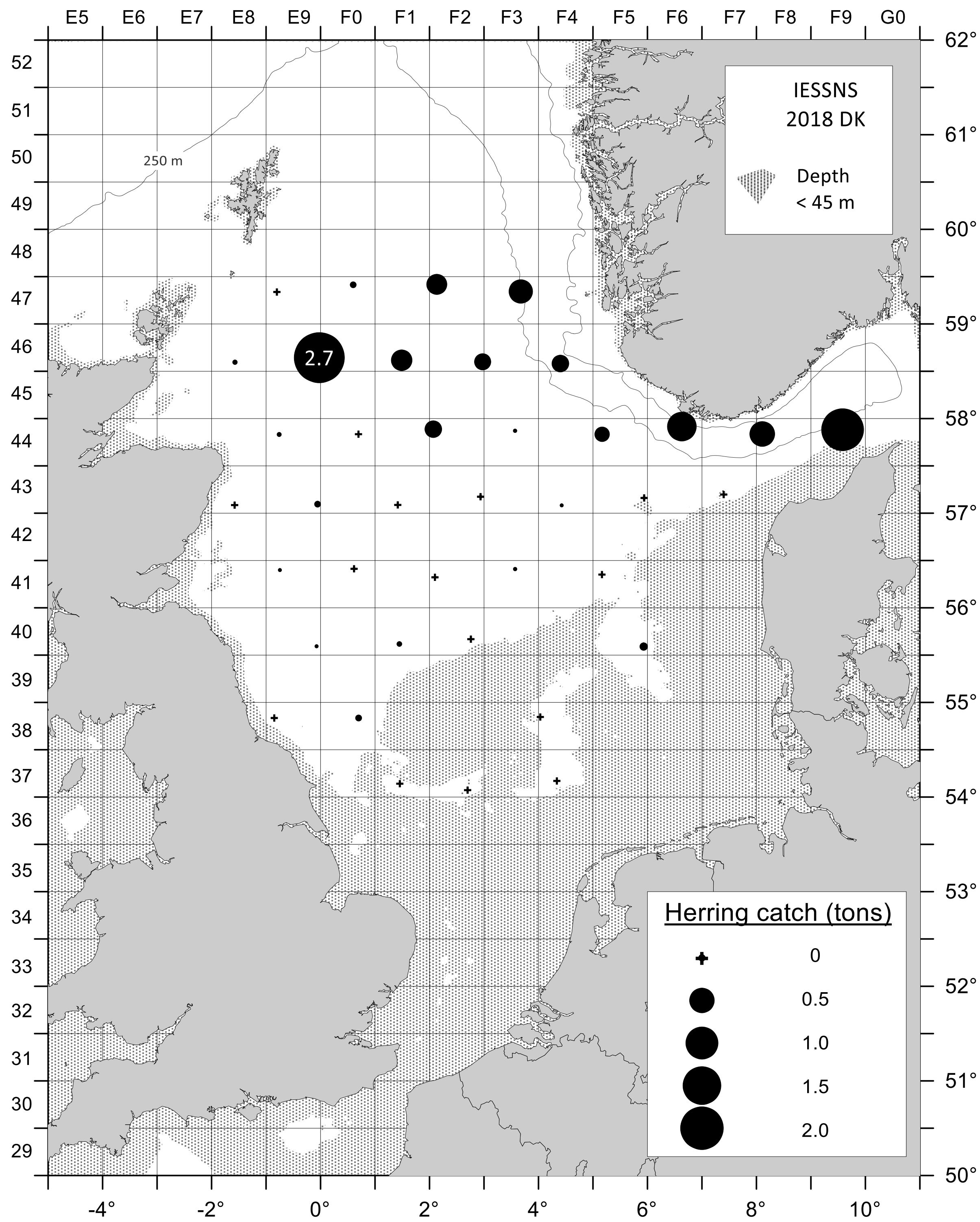

Fig. 4: Distribution of herring catches.

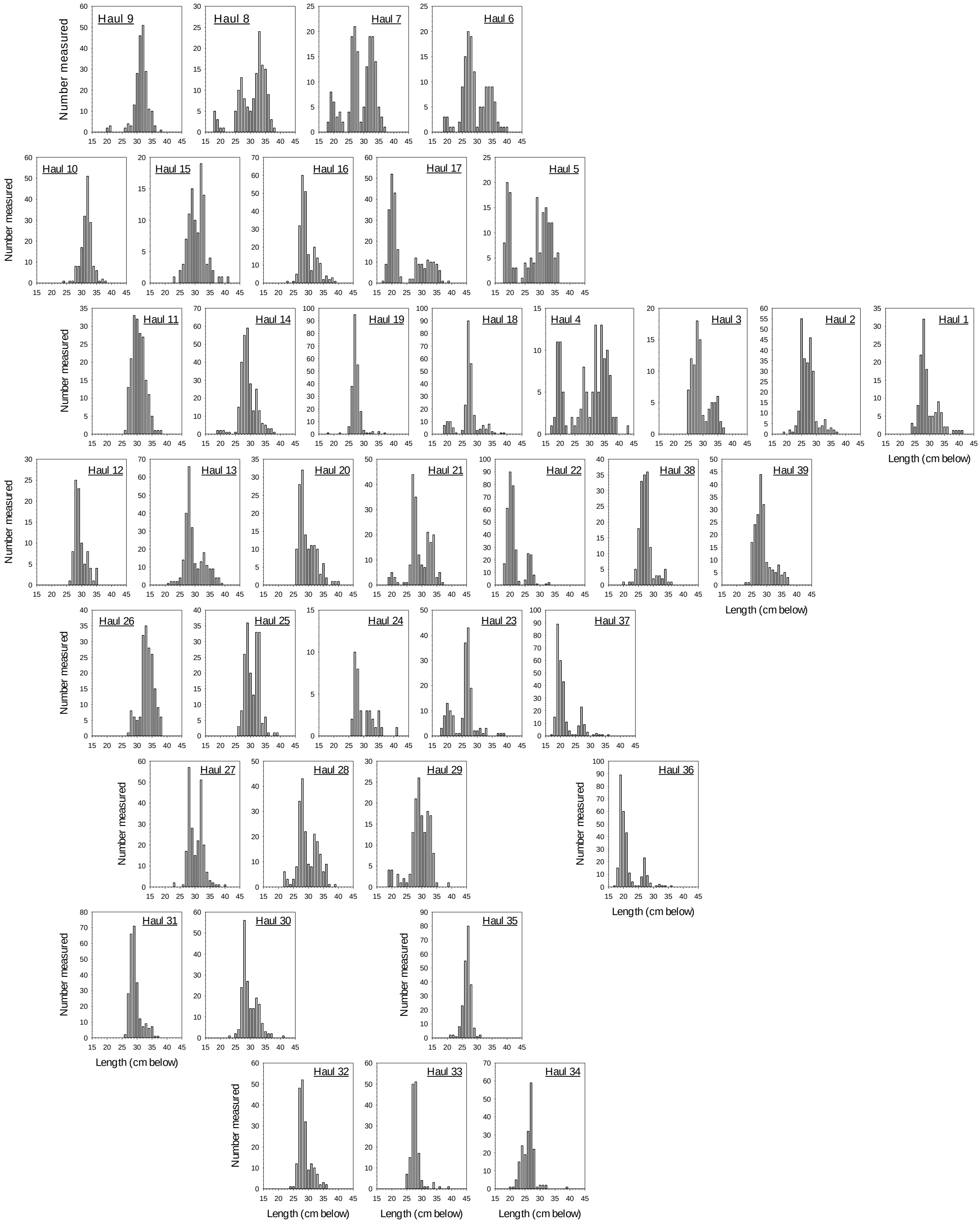

Fig. 5: Length distributions of mackerel.

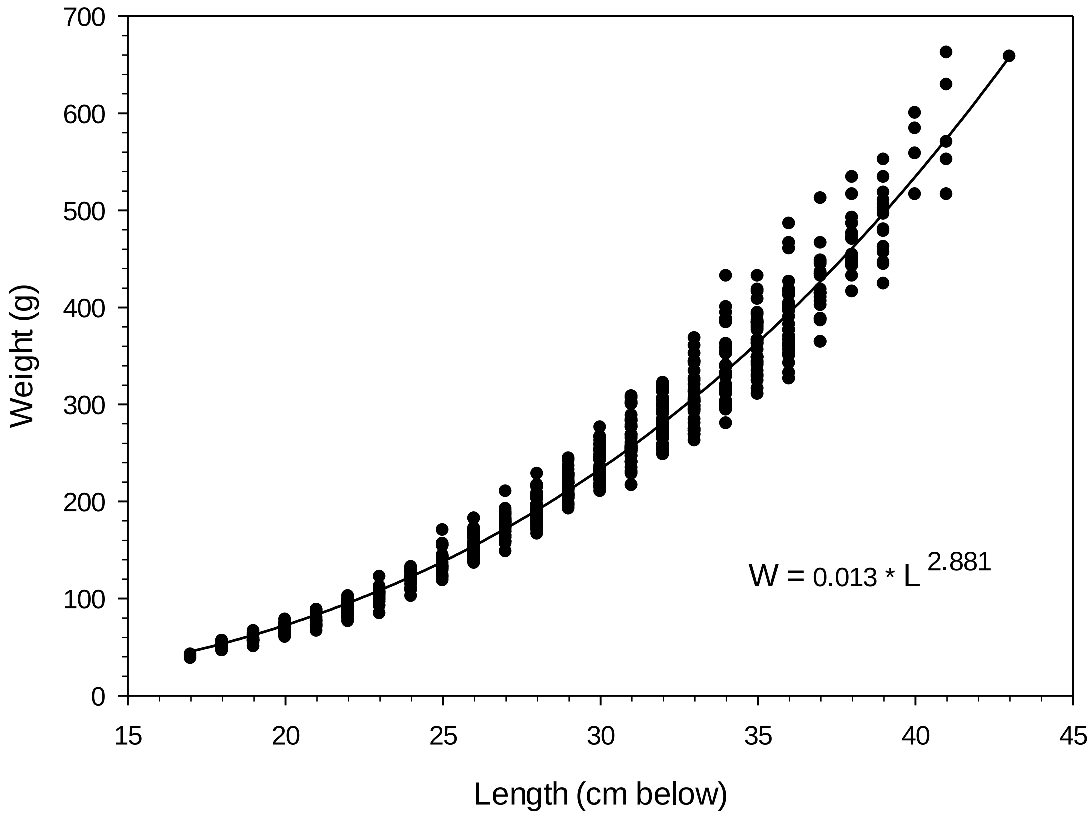

Fig. 5: Length-weight relationship for mackerel.

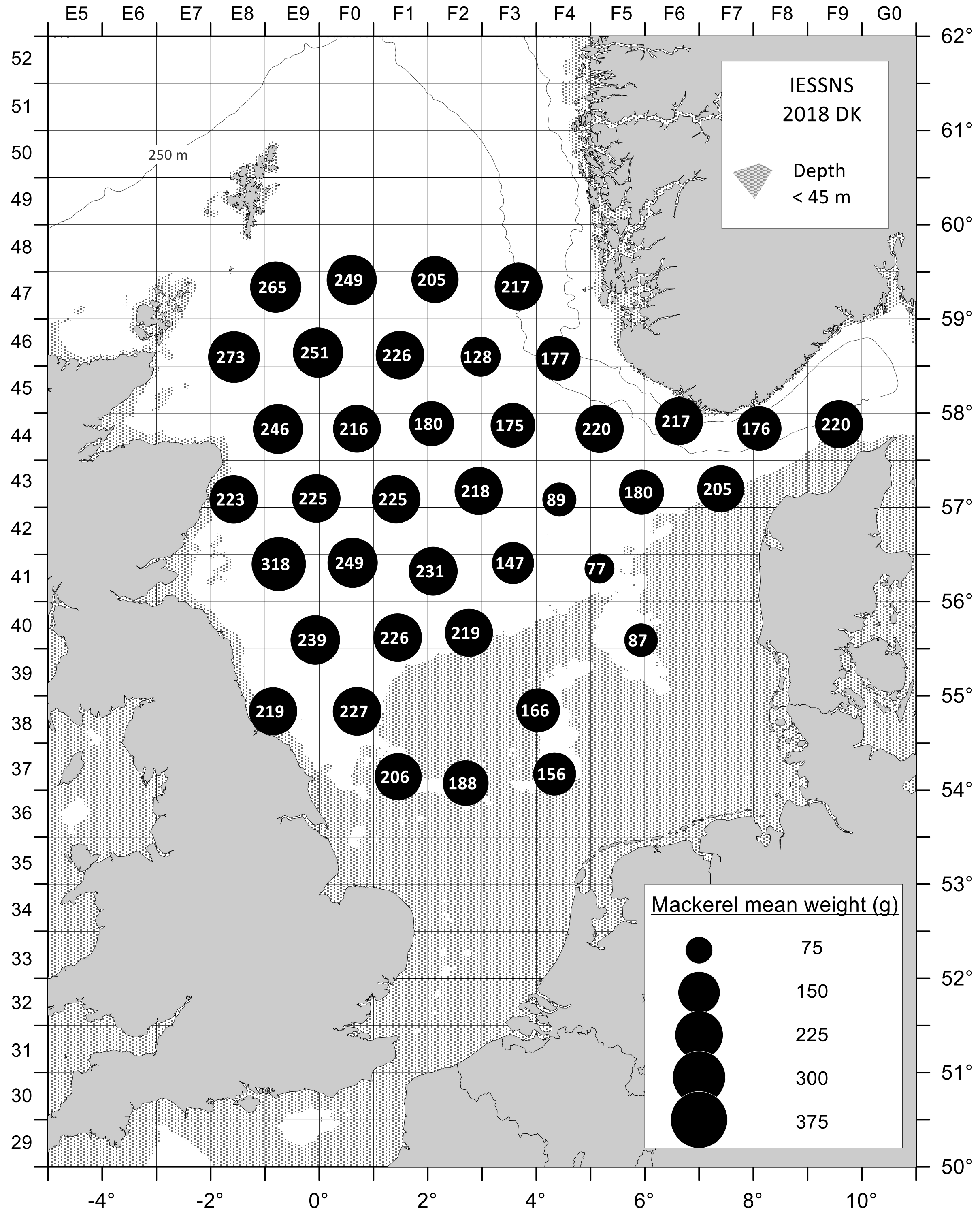

Fig. 7: Distribution of mean individual weight of mackerel.

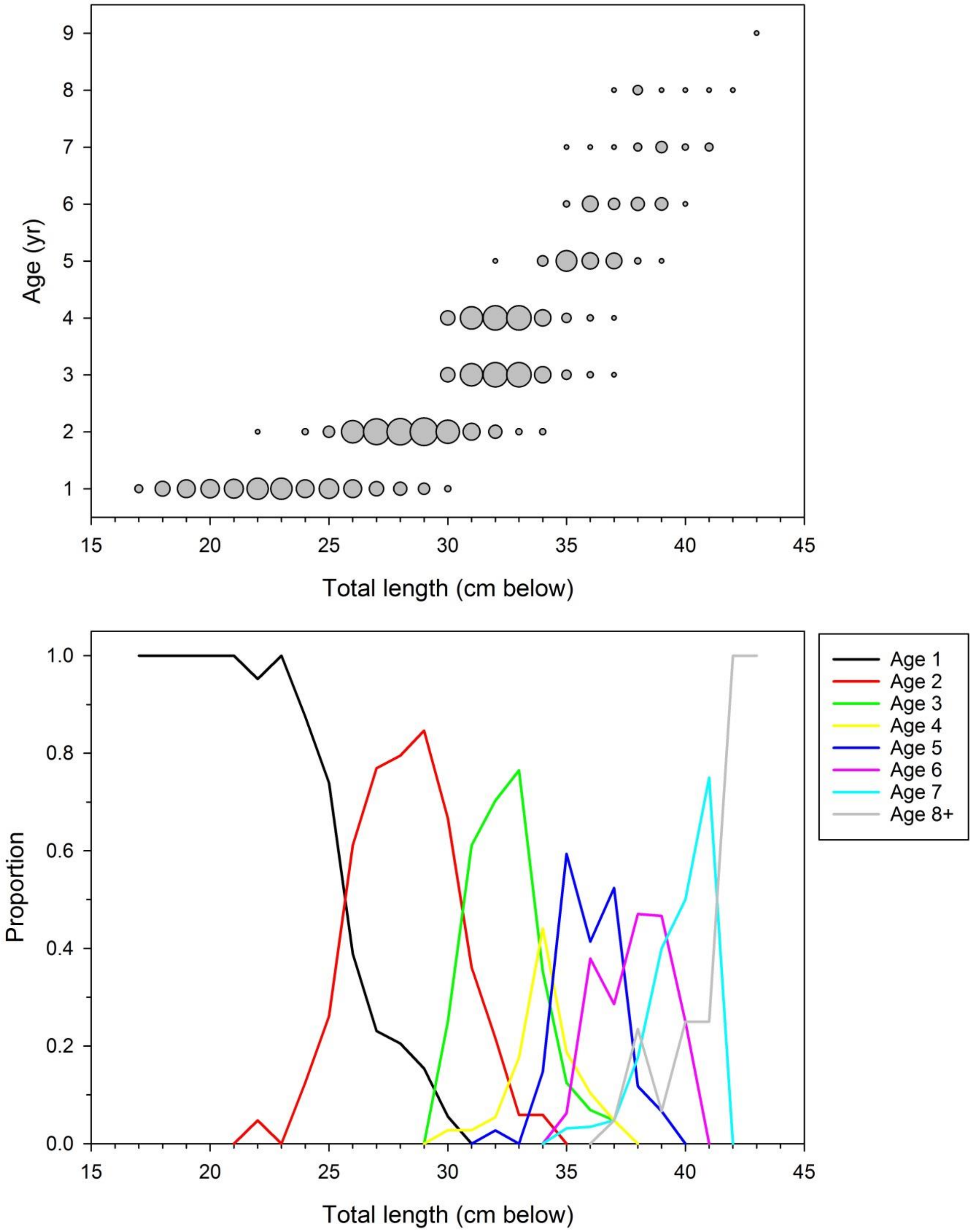

Fig. 8: Age-length key for mackerel (bubble size in upper panel refer to number of observations which ranged from 1 to 33 individuals per cm interval and age group).

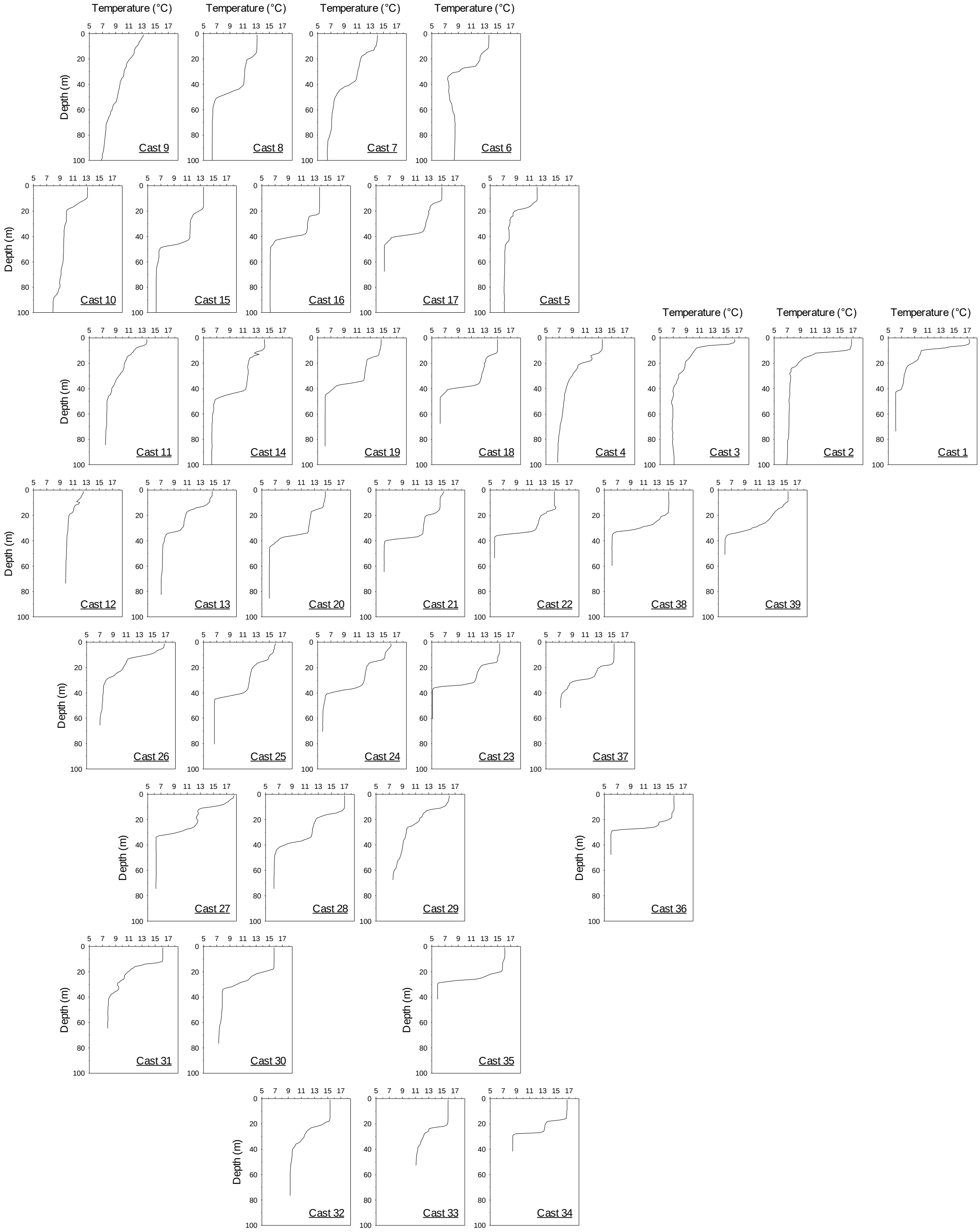

Fig. 9: Temperature conditions in the surface layer.

Tab. 1: Species list (L: total length in mm below (fish); ML: mantle length (cephlapods).

Latin name	Danish name	English name	Weight (kg)	Number	L_{min}	L_{max}	Remark
Scomber scombrus	Makrel	Mackerel	21947.812	129744	130	430	
Clupea harengus	Sild	Herring	8621.972	73528	135	325	
Eutrigla gurnardus	Grå knurhane	Grey gurnard	254.135	1976	150	400	
Cyclopterus lumpus	Stenbider	Lumpfish	81.006	82	70	390	
Belone belone	Hornfisk	Garfish	41.950	65	500	820	
Sprattus sprattus	Brisling	Sprat	19.771	1343	80	150	
Squalus acanthias	Pighaj	Spurdog	7.140	2	480	1220	
Merlangius merlangus	Hvilling	Whiting	7.109	805	30	390	
Merluccius merluccius	Kulmule	Hake	7.098	3	400	830	
Trachurus trachurus	Hestemakrel	Horsemackerel	6.576	24	200	420	
Scophthalmus maximus	Pighvarre	Turbot	4.754	12	280	570	
Echiichthys vipera	Fjæsing lille	Lesser weever	3.818	228	90	150	
Pollachius virens	Sej	Saithe	3.200	2	530	590	
Todaropsis eblanae		Lesser flying squid	1.924	30	60	200	ML
Illex coindetii		Southern shortfin squid	1.304	20	60	280	ML
Chelidonichthys lucerna	Rød knurhane	Tub gurnard	0.982	4	240	360	
Sardina pilchardus	Sardin	Pilchard	0.928	10	30	230	
Limanda limanda	Ising	Common dab	0.925	15	150	270	
Maurolicus muelleri	Laksesild	Pearlside	0.621	28	50	60	
Melanogrammus aeglefinus	Kuller	Haddock	0.554	84	50	110	
Anarhichas lupus	Stribet havkat	Catfish	0.414	1	360	360	
Loligo forbesii		Northern squid	0.275	27	30	60	ML
Lophius piscatorius	Havtaske	Monkfish	0.188	1	220	220	
Pleuronectes platessa	Rødspætte	Plaice	0.154	1	250	250	
Ammodytes marinus	Tobis-hav	Sandeel	0.100	3	215	255	
Agonus cataphractus	Panser ulk	Pogge	0.004	1	80	80	

Tab. 2: Mackerel length frequencies raised to total catch and swept area by haul.

	Number caught per haul																																						
TL_cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
17	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
18	0	0	0	6	98	0	79	14	0	0	0	0	0	0	0	0	147	0	66	0	0	656	8	0	0	0	0	0	0	0	0	0	0	0	0	15	1029	0	0
19	0	27	0	32	245	17	315	8	0	0	0	0	0	26	0	0	574	54	0	0	19	2355	21	0	0	0	0	0	4	0	0	0	0	0	0	89	5400	0	0
20	0	0	0	32	221	17	236	3	2	0	0	0	0	26	0	0	852	77	0	0	31	3475	35	0	0	0	0	0	4	0	0	0	0	7	0	60	9515	24	0
21	0	54	0	14	37	6	118	3	3	0	0	0	1	26	0	0	705	77	0	0	19	3050	27	0	0	0	0	0	0	0	0	0	0	7	19	43	6750	0	0
22	0	27	0	3	37	6	157	0	0	0	0	0	3	13	0	0	262	38	66	0	6	1081	21	0	0	0	0	12	3	0	0	0	0	34	19	11	1800	24	0
23	0	107	0	0	0	0	79	0	0	0	0	0	3	13	11	20	49	8	0	0	0	116	3	0	0	0	20	6	1	11	0	0	0	101	9	4	64	24	3
24	50	295	0	6	12	11	0	0	0	5	0	0	3	0	0	0	0	0	0	0	6	0	3	0	0	0	0	2	2	0	0	24	0	162	76	1	0	118	3
25	33	1474	56	3	49	50	157	14	0	0	0	0	5	13	21	20	0	23	397	0	6	154	19	0	0	0	0	6	1	23	0	24	119	128	218	1	0	424	46
26	132	965	95	6	37	83	747	28	2	5	1	1	19	197	32	102	33	176	2517	39	50	965	99	2	13	0	10	16	3	46	125	292	255	216	522	8	193	778	65
27	363	911	87	9	61	111	826	36	4	5	13	8	53	527	74	653	33	690	6294	109	277	927	115	10	36	8	174	66	13	274	1753	1169	851	398	760	23	386	825	75
28	528	1233	143	23	49	106	629	22	3	42	21	25	88	724	116	1225	197	429	3644	125	220	309	51	8	117	65	583	84	21	640	4133	1266	868	148	361	9	257	848	118
29	297	804	119	14	208	67	79	17	13	42	33	23	43	777	158	1041	147	115	1192	55	75	39	5	3	161	49	286	43	26	309	4446	779	289	7	66	3	64	283	86
30	83	161	24	6	74	6	197	14	28	89	32	10	16	369	105	327	147	23	199	39	50	0	5	0	90	41	153	18	17	160	2192	219	68	13	9	0	0	47	24
31	83	80	16	14	172	28	511	22	46	168	28	5	12	171	84	143	115	31	66	43	44	0	8	3	58	49	225	16	13	160	751	292	17	13	19	1	0	71	19
32	99	107	32	37	184	28	747	39	51	268	27	8	17	329	200	408	180	54	66	43	132	39	3	3	148	261	521	41	18	217	438	244	17	13	0	2	0	71	16
33	149	188	40	14	147	50	747	67	29	152	15	4	24	171	148	286	164	31	132	39	107	77	8	2	148	285	204	35	17	183	564	170	0	0	0	1	0	47	13
34	99	54	40	37	147	50	551	45	11	42	11	1	15	79	32	225	164	61	0	12	126	0	0	1	18	228	72	25	8	80	376	49	51	0	0	1	0	118	22
35	33	80	48	26	61	50	197	42	10	32	5	4	12	66	42	41	147	15	132	23	19	0	0	3	27	212	31	12	1	34	438	73	0	0	0	0	0	24	11
36	33	54	16	29	74	33	118	25	3	5	1	0	12	39	21	82	98	8	0	8	31	0	0	1	4	122	20	18	0	23	63	49	17	0	0	1	0	24	13
37	0	27	8	20	0	11	39	8	0	11	1	0	5	39	0	41	16	0	66	0	6	0	3	0	0	73	10	2	0	23	63	0	0	0	0	0	0	0	8
38	17	0	0	6	0	6	0	3	1	5	1	0	5	13	11	61	0	8	0	4	0	0	3	0	4	49	10	0	0	0	0	0	0	0	0	0	0	0	0
39	17	0	0	6	0	6	0	0	0	0	0	0	1	0	11	20	16	8	0	4	0	0	3	0	4	0	0	2	1	0	0	0	17	7	0	0	0	0	0
40	17	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
41	17	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	1	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swept area_km^2	0.3056	0.3187	0.3202	0.3306	0.3261	0.3303	0.3098	0.3121	0.3261	0.3151	0.3337	0.3085	0.3061	0.3295	0.3217	0.3270	0.3236	0.3020	0.3174	0.3195	0.3254	0.3265	0.3205	0.3201	0.3258	0.3202	0.3292	0.3085	0.3065	0.3414	0.3164	0.2991	0.3034	0.3095	0.3283	0.3287	0.3411	0.3038	0.3231