



DTU Aqua – National Institute of Aquatic Resources – Technical University of Denmark

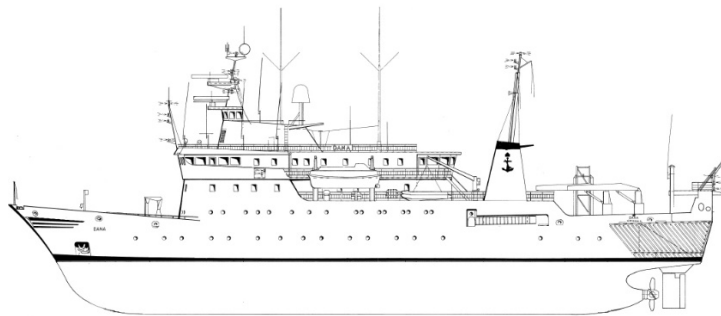
CRUISE REPORT

RV DANA

CRUISE NUMBER: 04 / 2022

”NORTH SEA MEGS 2022”

Mackerel egg survey in the North Sea



Bastian Huwer
DTU Aqua

Vessel: R/V DANA

Cruise dates: 07/06 – 19/06 2022

Cruise number: 04/2022

Cruise name: NORTH SEA MEGS 2022

Port of departure:	Hirtshals	Date:	07 June
Port of return:	Hirtshals	Date:	19 June
Other ports:	None	Date and justification:	n.a.

Participants

Name	Institute	Function and main tasks
Bastian Huwer	DTU Aqua Marine Living Resources	Cruise leader, plankton sorting, egg staging
Sakis Kroupis	Thünen Institute Bremerhaven	Plankton sampling & sorting, egg staging
Anne-Mette Kroner	DTU Aqua Monitoring and Data	Plankton sampling & sorting, egg staging
Maria Krüger Johnsen	DTU Aqua Oceans & Arctic	Plankton sampling & sorting, egg staging
Gert Holst	DTU Aqua Monitoring and Data	Plankton sampling (night), fish data, otoliths
Sofie Graae Norsker	DTU Aqua Marine Living Resources	Adult fish analyses, ovary sampling
Marie Gjessing Bruun	DTU Aqua Marine Living Resources	Adult fish analyses, ovary sampling
Paraskevas Koumpiadis	DTU Aqua Marine Living Resources	Adult fish analyses, ovary sampling
Camilla Nørregaard Drejjer Andersen	DTU Aqua Marine Living Resources	Adult fish analyses, ovary sampling
Ronny Sørensen	DTU Aqua Monitoring and Data	CTD, Technical support

Objectives

The survey is part of the Mackerel Egg Surveys (MEGS) which are carried out triennially and are coordinated by the ICES Working Group on Mackerel and Horse Mackerel Egg Surveys (WGMEGS). These surveys aim to investigate the spatial distribution and abundance of eggs, divided into different developmental stages (1A to 5). In particular the abundance of eggs in stage 1A and 1B is relevant, as this is needed for the further analyses. Furthermore, the fecundity of adult fish is investigated. The egg and adult data are then combined and applied in egg production methods, in order to provide fisheries-independent estimates of spawning stock biomass (SSB) indices.

More specifically, the present cruise DANA 04/2022 contributed to the mackerel egg survey in the North Sea (NS MEGS). Due to a lack of sufficient vessel time to cover the entire mackerel distribution area in the same year, the survey area in the North Sea was previously usually covered one year later than the survey area in the Northeast Atlantic (NEA MEGS). As the MEGS is a triennial survey, the last NEA MEGS took place in 2019, i.e. the last NS MEGS had actually been planned for 2020. However, due to the Covid-19 pandemic, the survey had been postponed to 2021 and was conducted in collaboration between The National Institute of Aquatic Resources, Denmark (DTU Aqua - DANA cruise 04/2021) and Wageningen Marine Research, The Netherlands (WUR).

However, covering the North Sea one year later than the survey area in the Northeast Atlantic was regarded sub-optimal. After the Centre for Environment, Fisheries and Aquaculture Science, UK (CEFAS) decided to join the MEGS surveys, there was now sufficient vessel time to cover the entire survey area in the same year. Thus, WGMEGS decided that from 2022 and onwards, both the NEA MEGS and the NS MEGS will be conducted in the same year.

Furthermore, the NS MEGS had previously been conducted as an AEPM (annual egg production method) survey. However, in 2018 WGMEGS had decided to change the NS MEGS from an AEPM to a DEPM (Daily egg production method) survey. Therefore, the sampling strategy was changed as well to one full coverage of the whole North Sea during peak spawning time (in contrast to the previous AEPM survey, which sampled the main part of the spawning area several times over the spawning season).

The present NS MEGS 2022 was conducted in close collaboration between DTU Aqua and CEFAS. DTU Aqua covered approximately 1/3 of the survey area on RV DANA, while CEFAS covered approximately 2/3 of the area on RV ENDEAVOUR. In addition, the Institute of Marine Research, Norway (IMR) covered a small area in the northernmost North Sea in connection with their NEA MEGS.

On RV DANA, the sampling of fish eggs was carried out with a High Speed Plankton Sampler "Nackthai" with a mesh size of 500 µm. The amount of water filtered during each haul was measured with an electronic flowmeter. The gear was towed at 4 knots through the water, in a 'double oblique' haul from the surface to 5 m above the sea floor (or to a maximum depth of 200 m).

Adult fish samples were collected with FOTØ trawls. The catch was sorted by species and the total weight per species was recorded. For mackerel, length distributions were recorded and samples of mackerel gonads for fecundity estimates as well as otoliths for age estimates were collected.

Further technical details about the MEGS sampling methods and sample analyses are described in the current version of the survey manual:

[https://www.ices.dk/sites/pub/Publication%20Reports/ICES%20Survey%20Protocols%20\(SISP\)/SISP%206%20-%20MEGS%20V1.3.pdf](https://www.ices.dk/sites/pub/Publication%20Reports/ICES%20Survey%20Protocols%20(SISP)/SISP%206%20-%20MEGS%20V1.3.pdf)

Additional tasks

In addition to the MEGS standard program, the following additional tasks were conducted for the national Danish projects EASIMACK & GenClim and for Thünen Institute Bremerhaven, Germany:

1. Sets of fishing hauls in different depths at the same position to investigate the vertical distribution of adult mackerel (EASIMACK).
2. Collection of genetic samples and various other tissue samples from selected mackerel individuals (EASIMACK).
3. Collection of mackerel eggs and eggs of other fish species for future egg identification workshops (Thünen Institute Bremerhaven, Germany).
4. Collection of mackerel stomachs for future analyses of the feeding ecology of North Sea mackerel
5. Collection of genetic samples of anchovy (GenClim).

Itinerary

R/V Dana left Hirtshals on Tuesday June 07 in the evening. The field work started around 20:30 (UTC) with a gear test north-west of Hirtshals, and continued on June 08 in the morning with the first station on the northernmost plankton sampling transect (Ship station 2, station ID 76, see Fig. 1 & 2). Afterwards the field work continued on a 24-h basis along the plankton station transects. During daytime, the plankton sampling was interrupted in order to conduct fishing hauls targeting adult mackerel. R/V Dana returned to Hirtshals on Sunday June 19 around 17:00 (UTC).

The cruise track and sampling stations are depicted in Fig. 1. Very favorable weather conditions prevailed during the entire survey.

Achievements

Due to the excellent weather conditions, more plankton stations and fishing hauls than initially planned could be conducted. There were initially planned 76 standard stations with the High-speed plankton sampler "Nackthai" in order to collect mackerel eggs (Fig. 2). The westernmost station on the northernmost transect (station ID 60) had to be cancelled due to problems with the sampling gear. However, the previous stations on that transect yielded no mackerel eggs (see Fig. 5), and it can be safely assumed that no mackerel eggs would have been caught on station ID 60 either. All other 75 planned Danish plankton stations could be conducted (Fig. 3, Table 1).

In addition, it was possible to conduct 10 additional Nackthai hauls on station transects allocated to our collaborating institute CEFAS, England, in order to compare results between the two participating institutes. These were conducted on CEFAS station ID's E57, E58, E59 and E60 in ICES squares 38F6 and 38F7, as well as E96, E97, E98, E99, E100 and E101 in ICES squares 42F5, 42F6 and 42F7 (Fig. 2 & 3, Table 1).

Furthermore, 5 additional Nackthai hauls were conducted to collect eggs of mackerel and other fish species for future egg identification workshops (Fig. 3, Table 2).

Figure 3 gives an overview of all the Nackthai stations that were sampled during the cruise. Note that the numbers on this map are not the station ID's, but the ship's station numbers.

Concerning the fishing hauls for adults with the FOTØ trawl, the initial plan was to conduct 3-4 hauls on each of the 4 transects, i.e. a total of 12-16 hauls. However, due to technical problems on RV ENDEAVOUR, our collaborators from CEFAS were not able to conduct any trawl fishing. Thus, they were limited to rod and line fishing to try to catch adult mackerel, which was of limited success. Therefore, we increased the trawl fishery efforts on RV DANA considerably in order to obtain sufficient numbers of ovary samples for the subsequent analyses and application in the daily egg production method.

As a result of this increase in trawling effort and favored by the excellent weather conditions, we were able to conduct a total of 33 valid FOTØ hauls (2 hauls were invalid due to issues with the trawl sensor and a broken wire, respectively). The trawling positions are shown in Fig. 4 and station information is provided in Table 3. Note that in 12 cases, sets of 2 "double hauls" were conducted on the same position. In 11 of these cases, the sets consisted of 1 shallow surface haul (i.e. the head rope was at or close to the surface) and 1 deep haul (i.e. the footrope was close to the sea floor). These sets were conducted to investigate the vertical distribution of mackerel in the water column. In 1 case, 2 hauls were conducted at the same position but both at the surface (stations 45 & 47). This was done because the first haul only yielded 59 mackerel, and the second haul was conducted in an attempt to increase the number of mackerel samples from that sampling position. However, this second haul did unfortunately not yield any mackerel at all.

Thus, while a total of 34 valid trawl hauls were conducted, these only correspond to a total of 21 different sampling positions due to the 12 sets of “double hauls” (see Fig. 4, 7 & 8). On each of the 21 sampling positions, a CTD cast was conducted to obtain measurements of the ambient environmental conditions (temperature, salinity, oxygen content, see Table 4).

In summary, the following valid activities were achieved:

Gear type	Number of valid stations
High speed plankton sampler “Nackthai”	90*
Pelagic trawl “FOTØ”	34
CTD casts (Seabird 911)	21

*Note: 75 of the 90 Nackthai hauls were hauls for the standard MEGS sampling on Danish transects, 10 were additional MEGS standard hauls on English transects, while 5 additional Nackthai hauls were conducted to collect eggs for future egg identification work shops.

Results

Standard MEGS sampling

A total of 8530 mackerel eggs were caught in the 85 standard Nackthai samples, 6738 on the 75 Danish stations and 1792 on the 10 additionally sampled English stations. Concerning only stage 1A eggs, the numbers are 2881, 2404 and 477 for total, Danish and English stations, respectively, and concerning stage 1A and 1B eggs combined, the numbers are 3287, 2687 and 600, respectively (Table 1).

The spatial distribution and abundance per station for all eggs (i.e. all egg stages combined) and only for stage 1 eggs are shown in Fig. 5 and 6, respectively. The station with the highest abundance of stage 1 mackerel eggs (Station ID 71, 295 stage 1 eggs*m⁻²) was located on our northernmost transect in ICES square 45F3. Highest egg abundances were generally found in the northeastern part of our study area, while lower abundances were found in the southern part with very low abundances in the Dogger Bank area. The stations in the western and particularly the north-western parts of the study area yielded very low numbers of mackerel eggs or none at all.

In the 33 fishery trawl hauls, a total of 25 different fish species were caught, as well as squid, jellyfish and other invertebrates (Table 6). A total of 600.35 kg mackerel were caught, corresponding to a total number of 3681 individuals (Table 6 & 7). However, it should be noted that some stations (133, 138 & 139) contained high numbers of relatively small juveniles. The amounts of mackerel caught per station (total kg) in surface and deep FOTØ hauls are depicted in Fig. 7 & 8, respectively.

Besides mackerel, the most abundant species by weight were herring, sprat, haddock, whiting, grey gurnard and Raitt’s sandeel as well as jellyfish, while the remaining species were only caught in relatively small amounts (Table 6). It is noteworthy that several stations contained large numbers of small juvenile whiting and haddock. Besides, several stations west of Denmark (station numbers 58, 61, 129 & 133) contained several kg of adult pilchard, and in the same area pilchard eggs occurred in the Nackthai samples, indicating spawning of pilchard in this area.

Individual single fish measurements (pinched tail length, standard length, total weight, gutted weight, gonad weight, liver weight, sex & maturity stage) were recorded and otoliths collected from a total of 1180 mackerel, and suitable ovary samples for fecundity estimates could be obtained from 366 of these (Table 7).

Additional tasks

On 11 fishing positions, sets of 2 fishing hauls were conducted at the same position but in different depths, in order to investigate the vertical distribution of adult mackerel for the EASIMACK project (stations 5 & 8, 16 & 18, 28 & 30, 40 & 42, 45 & 47, 71 & 72, 75 & 77, 87 & 89, 101 & 102, 114 & 115 and 138 & 139). See also figure 4 for the location of sampling positions.

In connection with the standard MEGS adult sampling, gill clips of mackerel were collected for genetic analyses in the EASIMACK project. Furthermore, various other tissue samples from selected mackerel individuals were collected for a pilot study.

Eggs of mackerel and various other fish species were collected for future egg identification workshops from a total of 5 additional Nackthai hauls, which were conducted specifically for this purpose (request by Thünen Institute Bremerhaven, Germany, see Table 2).

Mackerel stomachs were collected for future analyses of the feeding ecology of North Sea mackerel. Mackerel stomachs were collected from 1136 of the 1180 single fish mackerel (see Table 7). On station 139, stomachs as well as pinched tail length, total weight and sex were collected from an additional 96 mackerel, i.e. a total of 1232 mackerel stomachs were collected during the cruise.

Samples of anchovy were collected for genetic analyses in the GenClim project. Unfortunately, no genetic samples from hake could be collected, as no hake were caught during the survey at all.

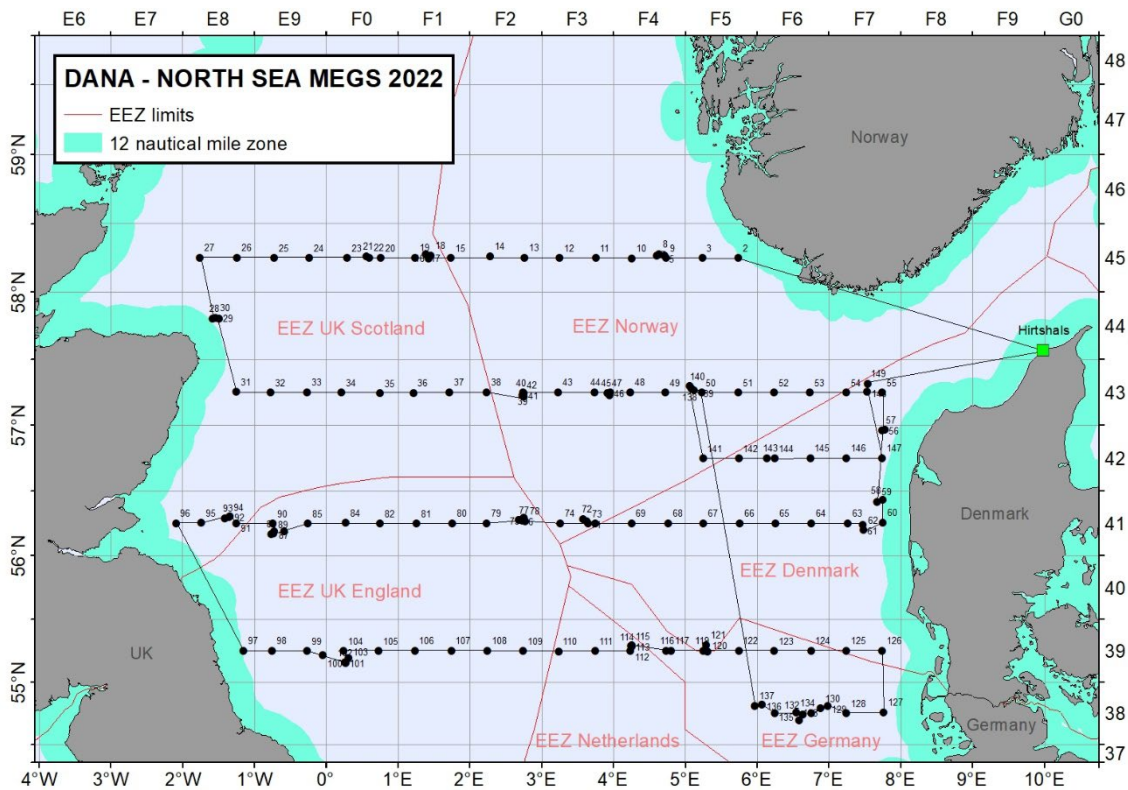


Fig. 1: Cruise track and sampling locations (all gears).

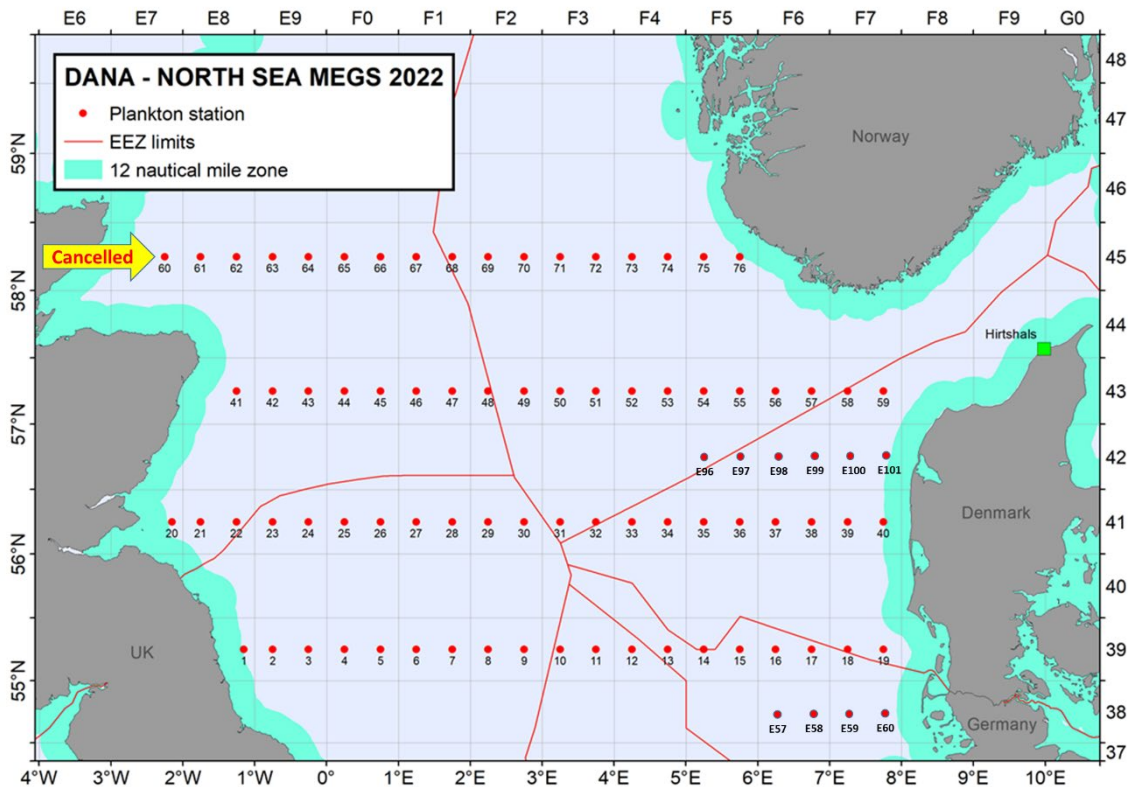


Fig. 2: Initially planned plankton sampling locations by Denmark (Station ID's 1-76) and additional stations sampled on English transects (Station ID's E57-E60 & E96-E101). Danish station ID 60 had to be cancelled due to problems with the sampling gear.

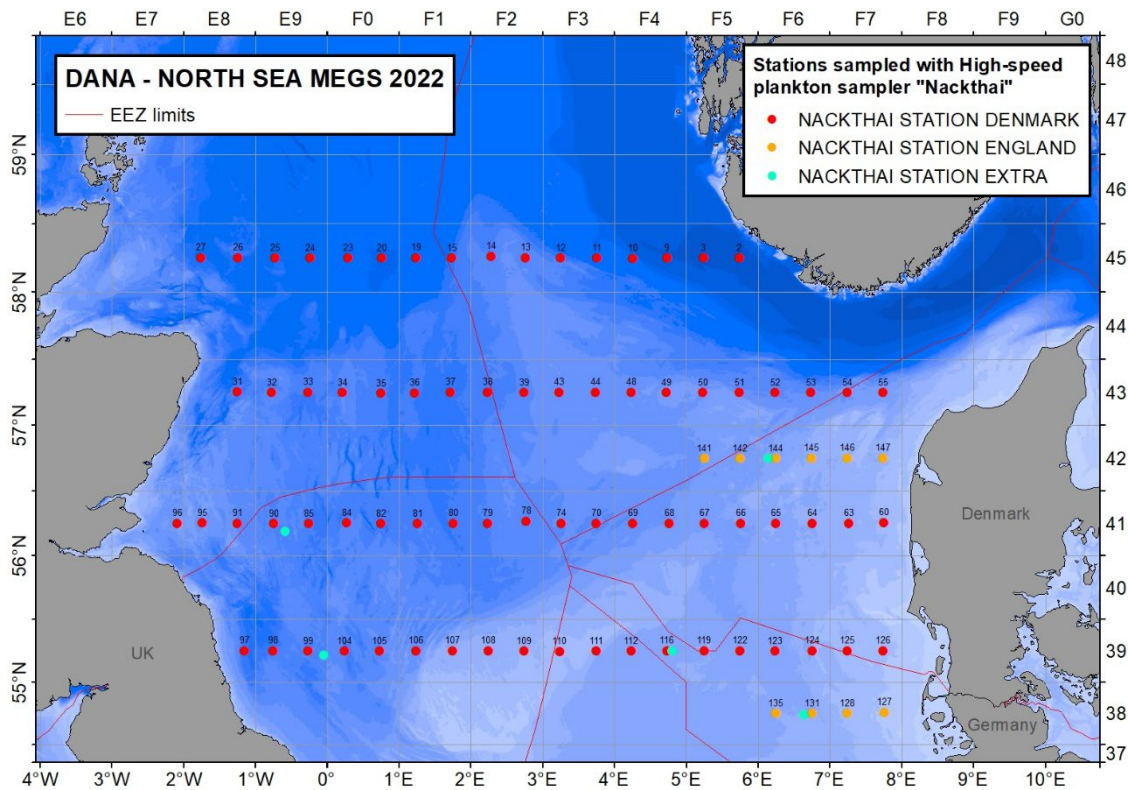


Fig. 3: Sampling locations of all 90 Nackthai hauls. Red symbols = Danish stations, Orange symbols = additional stations on English transects, Blue stations = additional stations to collect eggs of mackerel and other fish species for future egg identification workshops. Note that numbers are not the station ID's (as in Fig. 2), but the ship's station numbers (these are not shown for the additional stations).

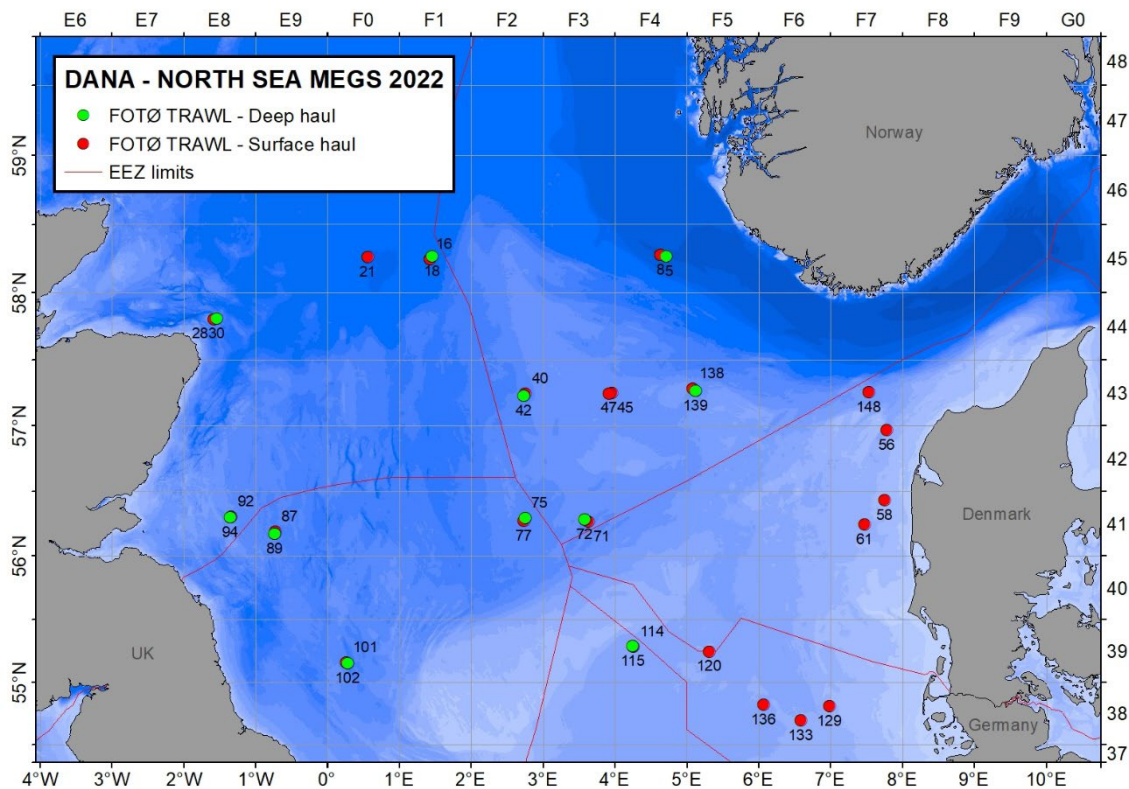


Fig. 4: Sampling locations of the 33 hauls with the pelagic FOTØ trawl conducted at the surface (red symbols) and close to the bottom (green symbols). Note that green and red symbols are overlapping, as some hauls were conducted at the same position but in different depths, in order to investigate the vertical distribution of the mackerel.

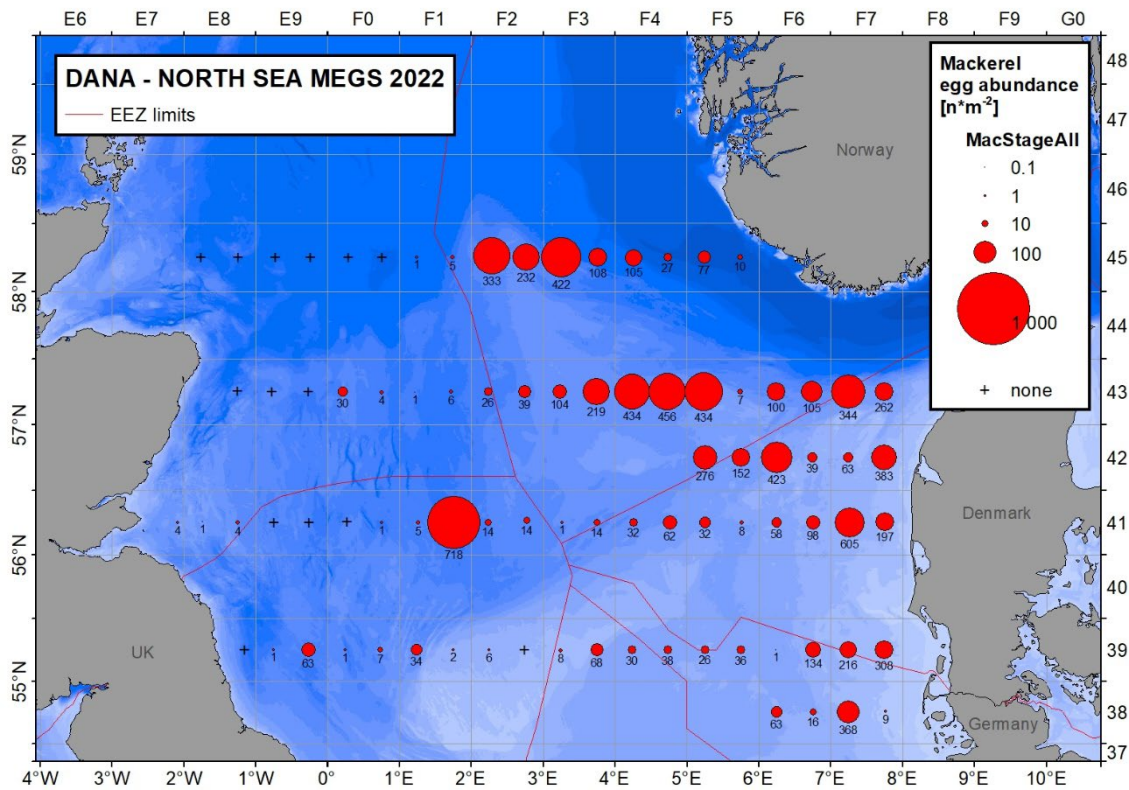


Fig. 5: Spatial distribution and abundance ($n \cdot m^{-2}$) of mackerel eggs (all stages). Numbers = absolute numbers of all mackerel eggs per station.

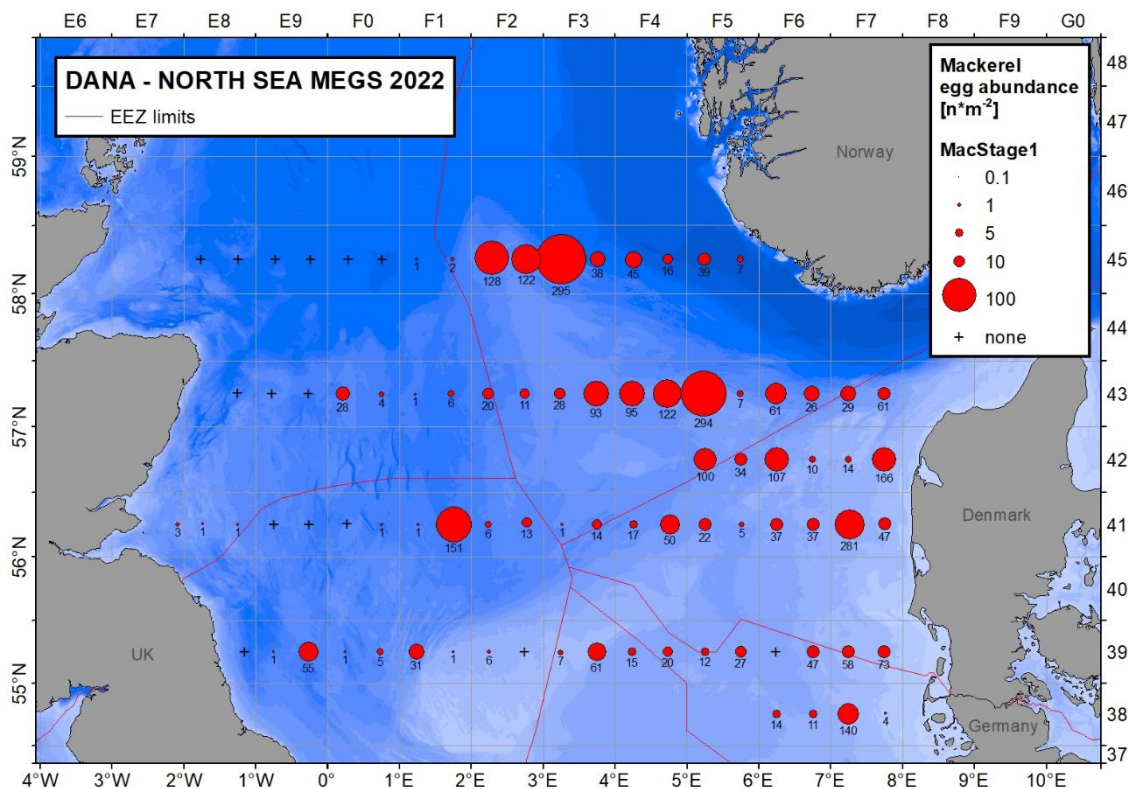


Fig. 6: Spatial distribution and abundance ($n \cdot m^{-2}$) of mackerel eggs in stage 1. Numbers = absolute numbers of stage 1 mackerel eggs per station.

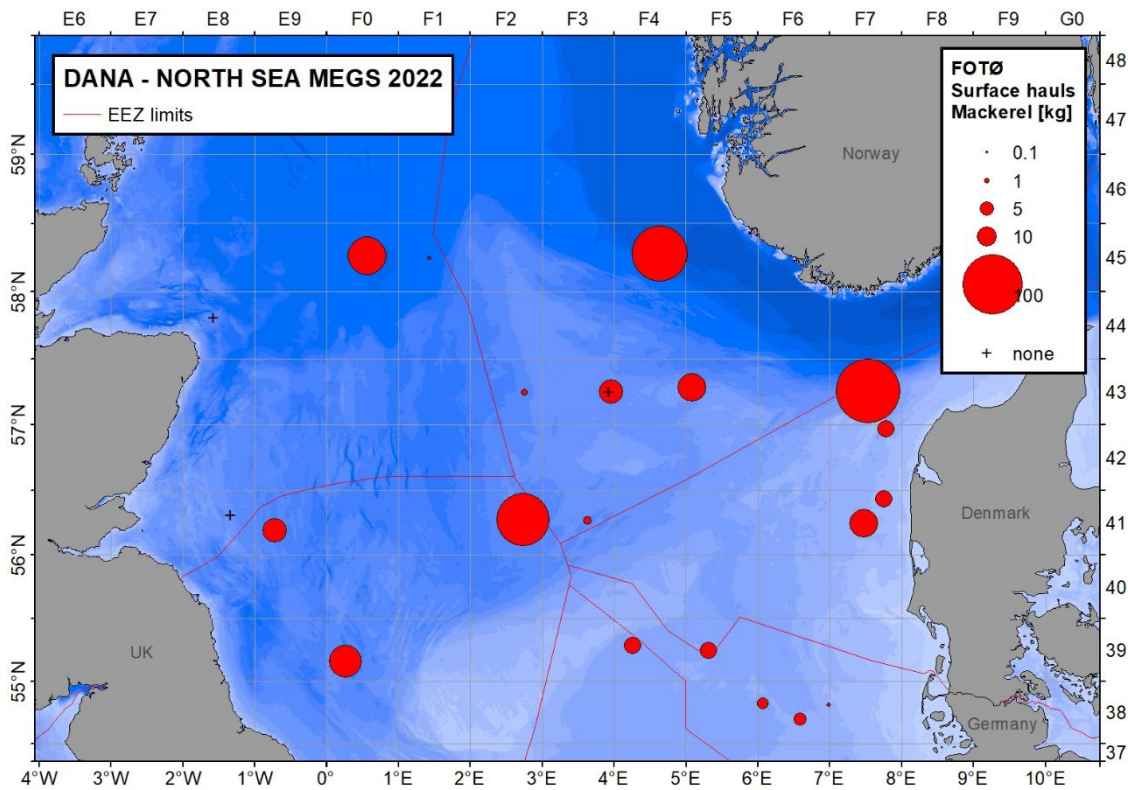


Fig. 7: Total weight (kg) of mackerel caught in surface hauls with the FOTØ trawl.

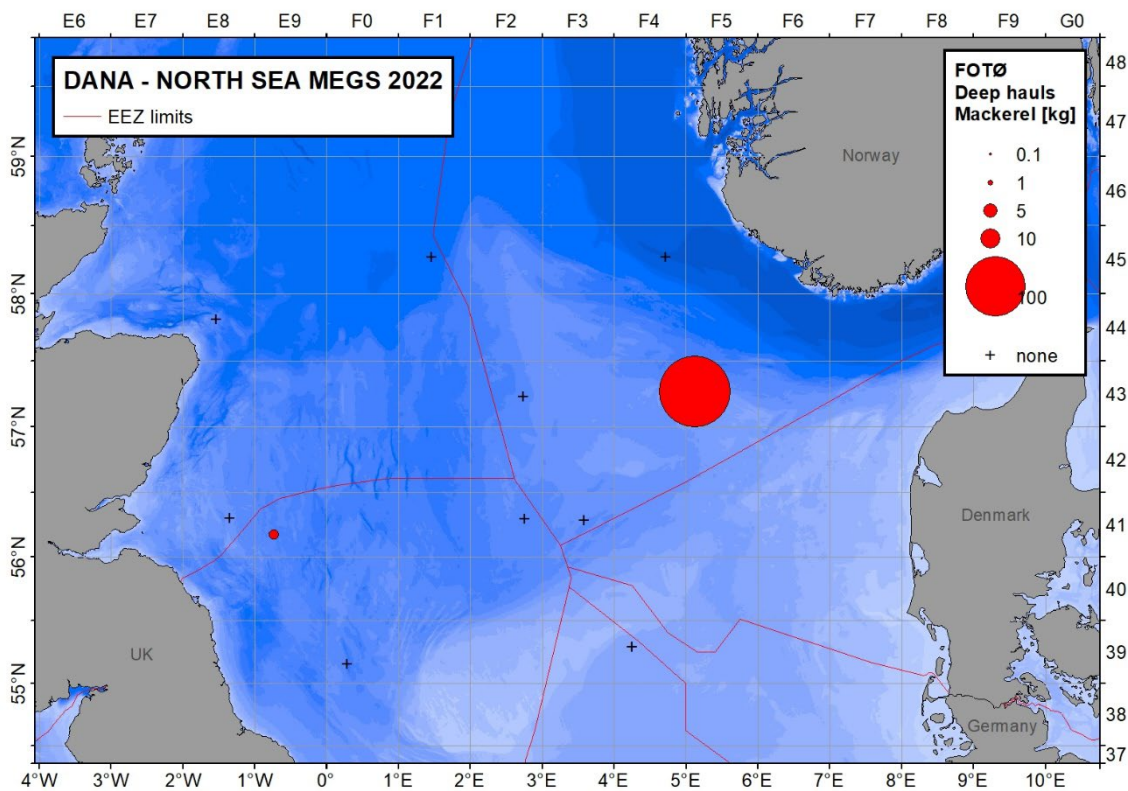


Fig. 8: Total weight (kg) of mackerel caught in deep hauls with the FOTØ trawl.

Table 1: Standard MEGS stations High-speed plankton sampler "Nackthai"

Gear	Station nr	Date and time	posLatStart	posLonStart	posLatStartDec	posLonStartDec	ICES square
Nackthai	2	2022-06-08T06:41:22+02:00	58.14.984 N	005.44.818 E	58.2497	5.7470	45F5
Nackthai	3	2022-06-08T09:13:58+02:00	58.14.989 N	005.14.785 E	58.2498	5.2464	45F5
Nackthai	9	2022-06-08T16:58:07+02:00	58.14.996 N	004.44.029 E	58.2499	4.7338	45F4
Nackthai	10	2022-06-08T19:13:04+02:00	58.14.886 N	004.15.397 E	58.2481	4.2566	45F4
Nackthai	11	2022-06-08T21:10:02+02:00	58.15.012 N	003.45.532 E	58.2502	3.7589	45F3
Nackthai	12	2022-06-08T23:01:26+02:00	58.14.932 N	003.15.104 E	58.2489	3.2517	45F3
Nackthai	13	2022-06-09T00:40:52+02:00	58.15.222 N	002.45.773 E	58.2537	2.7629	45F2
Nackthai	14	2022-06-09T03:35:37+02:00	58.15.791 N	002.17.106 E	58.2632	2.2851	45F2
Nackthai	15	2022-06-09T05:24:30+02:00	58.14.980 N	001.44.391 E	58.2497	1.7399	45F1
Nackthai	19	2022-06-09T10:36:44+02:00	58.15.226 N	001.14.656 E	58.2538	1.2443	45F1
Nackthai	20	2022-06-09T12:30:05+02:00	58.15.042 N	000.45.607 E	58.2507	0.7601	45F0
Nackthai	23	2022-06-09T16:14:04+02:00	58.15.067 N	000.17.756 E	58.2511	0.2959	45F0
Nackthai	24	2022-06-09T18:22:08+02:00	58.14.971 N	000.14.132 W	58.2495	-0.2355	45E9
Nackthai	25	2022-06-09T20:13:45+02:00	58.14.965 N	000.43.300 W	58.2494	-0.7217	45E9
Nackthai	26	2022-06-09T22:45:23+02:00	58.15.123 N	001.14.149 W	58.2521	-1.2358	45E8
Nackthai	27	2022-06-10T01:11:52+02:00	58.15.114 N	001.45.355 W	58.2519	-1.7559	45E8
Nackthai	31	2022-06-10T13:43:31+02:00	57.15.312 N	001.14.795 W	57.2552	-1.2466	43E8
Nackthai	32	2022-06-10T15:25:49+02:00	57.15.042 N	000.46.158 W	57.2507	-0.7693	43E9
Nackthai	33	2022-06-10T17:09:08+02:00	57.15.066 N	000.15.519 W	57.2511	-0.2587	43E9
Nackthai	34	2022-06-10T18:52:03+02:00	57.14.899 N	000.13.061 E	57.2483	0.2177	43F0
Nackthai	35	2022-06-10T20:41:52+02:00	57.14.712 N	000.45.027 E	57.2452	0.7505	43F0
Nackthai	36	2022-06-10T22:24:40+02:00	57.14.880 N	001.13.018 E	57.2480	1.2170	43F1
Nackthai	37	2022-06-11T01:10:06+02:00	57.15.127 N	001.43.233 E	57.2521	1.7206	43F1
Nackthai	38	2022-06-11T03:02:41+02:00	57.15.074 N	002.14.437 E	57.2512	2.2406	43F2
Nackthai	39	2022-06-11T04:59:39+02:00	57.14.966 N	002.44.637 E	57.2494	2.7440	43F2
Nackthai	43	2022-06-11T10:22:56+02:00	57.15.068 N	003.13.721 E	57.2511	3.2287	43F3
Nackthai	44	2022-06-11T12:19:29+02:00	57.15.054 N	003.44.586 E	57.2509	3.7431	43F3
Nackthai	48	2022-06-11T16:40:43+02:00	57.15.053 N	004.14.079 E	57.2509	4.2347	43F4
Nackthai	49	2022-06-11T18:14:59+02:00	57.14.975 N	004.43.527 E	57.2496	4.7255	43F4
Nackthai	50	2022-06-11T19:50:39+02:00	57.14.947 N	005.13.770 E	57.2491	5.2295	43F5
Nackthai	51	2022-06-11T21:28:59+02:00	57.15.016 N	005.44.391 E	57.2503	5.7399	43F5
Nackthai	52	2022-06-11T23:10:48+02:00	57.14.951 N	006.14.651 E	57.2492	6.2442	43F6
Nackthai	53	2022-06-12T00:50:43+02:00	57.15.036 N	006.44.537 E	57.2506	6.7423	43F6
Nackthai	54	2022-06-12T02:29:55+02:00	57.15.042 N	007.14.785 E	57.2507	7.2464	43F7
Nackthai	55	2022-06-12T04:04:36+02:00	57.14.951 N	007.44.728 E	57.2492	7.7455	43F7
Nackthai	60	2022-06-12T12:50:54+02:00	56.15.356 N	007.45.041 E	56.2559	7.7507	41F7
Nackthai	63	2022-06-12T16:08:47+02:00	56.15.140 N	007.15.696 E	56.2523	7.2616	41F7
Nackthai	64	2022-06-12T18:05:22+02:00	56.14.996 N	006.45.757 E	56.2499	6.7626	41F6
Nackthai	65	2022-06-12T20:03:23+02:00	56.14.990 N	006.15.293 E	56.2498	6.2549	41F6
Nackthai	66	2022-06-12T22:01:56+02:00	56.14.999 N	005.45.497 E	56.2500	5.7583	41F5
Nackthai	67	2022-06-12T23:56:12+02:00	56.15.004 N	005.15.431 E	56.2501	5.2572	41F5
Nackthai	68	2022-06-13T01:40:52+02:00	56.15.027 N	004.45.764 E	56.2505	4.7627	41F4
Nackthai	69	2022-06-13T03:30:56+02:00	56.15.001 N	004.15.209 E	56.2500	4.2535	41F4
Nackthai	70	2022-06-13T05:17:14+02:00	56.14.994 N	003.44.982 E	56.2499	3.7497	41F3
Nackthai	74	2022-06-13T11:29:19+02:00	56.15.025 N	003.15.536 E	56.2504	3.2589	41F3
Nackthai	78	2022-06-13T16:31:09+02:00	56.16.018 N	002.46.721 E	56.2670	2.7787	41F2
Nackthai	79	2022-06-13T18:37:35+02:00	56.15.014 N	002.14.072 E	56.2502	2.2345	41F2
Nackthai	80	2022-06-13T20:42:26+02:00	56.15.013 N	001.45.654 E	56.2502	1.7609	41F1
Nackthai	81	2022-06-13T22:33:46+02:00	56.14.823 N	001.15.596 E	56.2471	1.2599	41F1
Nackthai	82	2022-06-14T00:24:13+02:00	56.14.832 N	000.45.428 E	56.2472	0.7571	41F0

Table 1 (continued): Standard MEGS stations High-speed plankton sampler "Nackthai"

Gear	Station nr	Date and time	posLatStart	posLonStart	posLatStartDec	posLonStartDec	ICES square
Nackthai	84	2022-06-14T03:17:29+02:00	56.15.244 N	000.16.484 E	56.2541	0.2747	41F0
Nackthai	85	2022-06-14T05:11:53+02:00	56.14.860 N	000.15.186 W	56.2477	-0.2531	41E9
Nackthai	90	2022-06-14T11:03:45+02:00	56.14.841 N	000.44.374 W	56.2474	-0.7396	41E9
Nackthai	91	2022-06-14T12:52:57+02:00	56.15.000 N	001.14.650 W	56.2500	-1.2442	41E8
Nackthai	95	2022-06-14T17:37:22+02:00	56.15.201 N	001.44.337 W	56.2534	-1.7390	41E8
Nackthai	96	2022-06-14T18:56:05+02:00	56.15.023 N	002.05.320 W	56.2504	-2.0887	41E7
Nackthai	97	2022-06-15T01:45:59+02:00	55.15.079 N	001.08.834 W	55.2513	-1.1472	39E8
Nackthai	98	2022-06-15T03:23:41+02:00	55.15.020 N	000.45.053 W	55.2503	-0.7509	39E9
Nackthai	99	2022-06-15T05:06:13+02:00	55.14.979 N	000.15.785 W	55.2497	-0.2631	39E9
Nackthai	104	2022-06-15T11:03:28+02:00	55.14.834 N	000.14.756 E	55.2472	0.2459	39F0
Nackthai	105	2022-06-15T15:27:58+02:00	55.14.866 N	000.44.181 E	55.2478	0.7364	39F0
Nackthai	106	2022-06-15T17:11:16+02:00	55.15.069 N	001.14.281 E	55.2512	1.2380	39F1
Nackthai	107	2022-06-15T18:55:33+02:00	55.15.017 N	001.44.686 E	55.2503	1.7448	39F1
Nackthai	108	2022-06-15T20:38:26+02:00	55.15.010 N	002.14.970 E	55.2502	2.2495	39F2
Nackthai	109	2022-06-15T22:20:11+02:00	55.14.974 N	002.44.683 E	55.2496	2.7447	39F2
Nackthai	110	2022-06-16T00:03:58+02:00	55.14.809 N	003.14.431 E	55.2468	3.2405	39F3
Nackthai	111	2022-06-16T01:53:26+02:00	55.14.951 N	003.44.777 E	55.2492	3.7463	39F3
Nackthai	112	2022-06-16T03:55:48+02:00	55.14.970 N	004.14.603 E	55.2495	4.2434	39F4
Nackthai	116	2022-06-16T10:49:34+02:00	55.15.062 N	004.44.268 E	55.2510	4.7378	39F4
Nackthai	119	2022-06-16T14:24:10+02:00	55.15.060 N	005.15.174 E	55.2510	5.2529	39F5
Nackthai	122	2022-06-16T18:03:47+02:00	55.15.039 N	005.44.929 E	55.2507	5.7488	39F5
Nackthai	123	2022-06-16T19:48:27+02:00	55.14.969 N	006.14.648 E	55.2495	6.2441	39F6
Nackthai	124	2022-06-16T21:34:03+02:00	55.15.060 N	006.45.231 E	55.2510	6.7539	39F6
Nackthai	125	2022-06-16T23:25:55+02:00	55.15.123 N	007.14.891 E	55.2521	7.2482	39F7
Nackthai	126	2022-06-17T01:05:05+02:00	55.15.006 N	007.44.642 E	55.2501	7.7440	39F7
Nackthai	127	2022-06-17T04:29:23+02:00	54.45.494 N	007.45.865 E	54.7582	7.7644	38F7
Nackthai	128	2022-06-17T06:19:02+02:00	54.45.070 N	007.14.791 E	54.7512	7.2465	38F7
Nackthai	131	2022-06-17T10:02:19+02:00	54.44.958 N	006.45.230 E	54.7493	6.7538	38F6
Nackthai	135	2022-06-17T14:10:11+02:00	54.45.064 N	006.14.903 E	54.7511	6.2484	38F6
Nackthai	141	2022-06-18T12:56:31+02:00	56.44.948 N	005.14.971 E	56.7491	5.2495	42F5
Nackthai	142	2022-06-18T14:42:44+02:00	56.44.928 N	005.44.904 E	56.7488	5.7484	42F5
Nackthai	144	2022-06-18T16:52:05+02:00	56.44.989 N	006.14.744 E	56.7498	6.2457	42F6
Nackthai	145	2022-06-18T18:36:23+02:00	56.45.181 N	006.44.578 E	56.7530	6.7430	42F6
Nackthai	146	2022-06-18T20:18:30+02:00	56.45.120 N	007.14.882 E	56.7520	7.2480	42F7
Nackthai	147	2022-06-18T22:02:33+02:00	56.45.050 N	007.44.817 E	56.7508	7.7470	42F7

Table 2: Additional stations High-speed plankton sampler "Nackthai" (for collection of fish eggs for egg identification workshops)

Gear	Station nr	Date and time	posLatStart	posLonStart	posLatStartDec	posLonStartDec	ICES square
Nackthai	86	2022-06-14T06:37:24+02:00	56.11.333 N	000.34.912 W	56.1889	-0.5819	41E9
Nackthai	100	2022-06-15T06:05:22+02:00	55.12.789 N	000.02.333 W	55.2132	-0.0389	39E9
Nackthai	117	2022-06-16T11:20:48+02:00	55.15.131 N	004.48.235 E	55.2522	4.8039	39F4
Nackthai	132	2022-06-17T10:42:45+02:00	54.44.434 N	006.38.469 E	54.7406	6.6412	38F6
Nackthai	143	2022-06-18T16:14:19+02:00	56.45.093 N	006.08.392 E	56.7516	6.1399	42F6

Table 3: Sampling stations pelagic trawl "FOTØ"

Gear	Station nr	Date and time	posLatStart	posLonStart	posLatStartDec	posLonStartDec	ICES square
FOTØ trawl	5	2022-06-08T13:36:29+02:00	58.16.003 N	004.43.165 E	58.2667	4.7194	45F4
FOTØ trawl	8	2022-06-08T15:41:05+02:00	58.16.731 N	004.38.232 E	58.2789	4.6372	45F4
FOTØ trawl	16	2022-06-09T06:50:10+02:00	58.14.928 N	001.25.812 E	58.2488	1.4302	45F1
FOTØ trawl	18	2022-06-09T08:39:35+02:00	58.16.104 N	001.27.479 E	58.2684	1.4580	45F1
FOTØ trawl	21	2022-06-09T13:59:05+02:00	58.15.793 N	000.33.970 E	58.2632	0.5662	45F0
FOTØ trawl	28	2022-06-10T07:26:42+02:00	57.48.276 N	001.34.569 W	57.8046	-1.5762	44E8
FOTØ trawl	30	2022-06-10T09:09:19+02:00	57.48.563 N	001.32.015 W	57.8094	-1.5336	44E8
FOTØ trawl	40	2022-06-11T06:25:34+02:00	57.14.757 N	002.45.573 E	57.2460	2.7596	43F2
FOTØ trawl	42	2022-06-11T08:05:47+02:00	57.13.803 N	002.43.925 E	57.2301	2.7321	43F2
FOTØ trawl	45	2022-06-11T13:25:16+02:00	57.14.888 N	003.57.594 E	57.2481	3.9599	43F3
FOTØ trawl	47	2022-06-11T14:53:27+02:00	57.14.880 N	003.55.023 E	57.2480	3.9171	43F3
FOTØ trawl	56	2022-06-12T06:21:49+02:00	56.58.206 N	007.46.713 E	56.9701	7.7786	42F7
FOTØ trawl	58	2022-06-12T10:46:06+02:00	56.25.807 N	007.44.986 E	56.4301	7.7498	41F7
FOTØ trawl	61	2022-06-12T14:19:10+02:00	56.14.479 N	007.28.523 E	56.2413	7.4754	41F7
FOTØ trawl	71	2022-06-13T06:18:04+02:00	56.16.051 N	003.38.102 E	56.2675	3.6350	41F3
FOTØ trawl	72	2022-06-13T08:59:33+02:00	56.17.040 N	003.34.876 E	56.2840	3.5813	41F3
FOTØ trawl	75	2022-06-13T13:38:52+02:00	56.17.489 N	002.45.192 E	56.2915	2.7532	41F2
FOTØ trawl	77	2022-06-13T15:19:07+02:00	56.16.407 N	002.44.145 E	56.2735	2.7358	41F2
FOTØ trawl	87	2022-06-14T07:43:05+02:00	56.11.280 N	000.43.320 W	56.1880	-0.7220	41E9
FOTØ trawl	89	2022-06-14T09:43:24+02:00	56.10.219 N	000.43.701 W	56.1703	-0.7284	41E9
FOTØ trawl	92	2022-06-14T13:47:35+02:00	56.18.242 N	001.20.117 W	56.3040	-1.3353	41E8
FOTØ trawl	94	2022-06-14T15:32:00+02:00	56.17.950 N	001.20.662 W	56.2992	-1.3444	41E8
FOTØ trawl	101	2022-06-15T07:43:59+02:00	55.09.553 N	000.16.189 E	55.1592	0.2698	39F0
FOTØ trawl	102	2022-06-15T09:25:39+02:00	55.09.217 N	000.16.817 E	55.1536	0.2803	39F0
FOTØ trawl	114	2022-06-16T06:23:27+02:00	55.17.028 N	004.15.742 E	55.2838	4.2624	39F4
FOTØ trawl	115	2022-06-16T08:39:26+02:00	55.17.353 N	004.15.168 E	55.2892	4.2528	39F4
FOTØ trawl	120	2022-06-16T15:19:29+02:00	55.14.805 N	005.19.085 E	55.2468	5.3181	39F5
FOTØ trawl	129	2022-06-17T07:48:27+02:00	54.48.565 N	006.59.035 E	54.8094	6.9839	38F6
FOTØ trawl	133	2022-06-17T11:36:55+02:00	54.41.620 N	006.35.214 E	54.6937	6.5869	38F6
FOTØ trawl	136	2022-06-17T15:17:41+02:00	54.49.148 N	006.04.349 E	54.8191	6.0725	38F6
FOTØ trawl	138	2022-06-18T06:43:59+02:00	57.16.923 N	005.05.375 E	57.2821	5.0896	43F5
FOTØ trawl	139	2022-06-18T08:53:11+02:00	57.15.886 N	005.07.462 E	57.2648	5.1244	43F5
FOTØ trawl	148	2022-06-19T06:20:35+02:00	57.15.254 N	007.32.302 E	57.2542	7.5384	43F7

Table 4: CTD stations

Gear	Station nr	Date and time	posLatStart	posLonStart	posLatStartDec	posLonStartDec	ICES square
CTD	7	2022-06-08T14:49:40+02:00	58.16.004 N	004.36.141 E	58.2667	4.6024	45F4
CTD	17	2022-06-09T07:44:59+02:00	58.16.734 N	001.23.444 E	58.2789	1.3907	45F1
CTD	22	2022-06-09T14:56:19+02:00	58.15.134 N	000.36.367 E	58.2522	0.6061	45F0
CTD	29	2022-06-10T08:20:41+02:00	57.48.155 N	001.29.498 W	57.8026	-1.4916	44E8
CTD	41	2022-06-11T07:16:43+02:00	57.13.023 N	002.45.397 E	57.2171	2.7566	43F2
CTD	46	2022-06-11T14:18:46+02:00	57.13.878 N	003.56.824 E	57.2313	3.9471	43F3
CTD	57	2022-06-12T07:21:05+02:00	56.57.852 N	007.44.323 E	56.9642	7.7387	42F7
CTD	59	2022-06-12T11:37:48+02:00	56.25.014 N	007.40.427 E	56.4169	7.6738	41F7
CTD	62	2022-06-12T15:08:11+02:00	56.11.918 N	007.28.831 E	56.1986	7.4805	41F7
CTD	73	2022-06-13T09:58:48+02:00	56.14.885 N	003.38.767 E	56.2481	3.6461	41F3
CTD	76	2022-06-13T14:32:49+02:00	56.16.478 N	002.41.232 E	56.2746	2.6872	41F2
CTD	88	2022-06-14T08:47:55+02:00	56.10.076 N	000.45.833 W	56.1679	-0.7639	41E9
CTD	93	2022-06-14T14:39:00+02:00	56.17.323 N	001.24.688 W	56.2887	-1.4115	41E8
CTD	103	2022-06-15T10:18:40+02:00	55.11.597 N	000.19.078 E	55.1933	0.3180	39F0
CTD	113	2022-06-16T05:05:46+02:00	55.17.652 N	004.15.225 E	55.2942	4.2538	39F4
CTD	121	2022-06-16T16:24:49+02:00	55.17.807 N	005.17.927 E	55.2968	5.2988	39F5
CTD	130	2022-06-17T09:10:02+02:00	54.47.488 N	006.53.460 E	54.7915	6.8910	38F6
CTD	134	2022-06-17T13:01:27+02:00	54.45.452 N	006.32.672 E	54.7575	6.5445	38F6
CTD	137	2022-06-17T16:43:46+02:00	54.48.598 N	005.58.200 E	54.8100	5.9700	38F5
CTD	140	2022-06-18T09:45:02+02:00	57.17.895 N	005.03.681 E	57.2983	5.0614	43F5
CTD	149	2022-06-19T07:30:40+02:00	57.18.980 N	007.32.433 E	57.3163	7.5406	43F7

Table 5: Numbers of caught mackerel eggs per stage and in total for Nackthai stations on Danish transects, English transects and both transects combined.

TRANSECTS	N STATIONS	MACKEREL EGG STAGES							
		1A	1B	2	3	4	5	1A + 1B	ALL
DENMARK (DK)	75	2404	283	928	1285	955	883	2687	6738
ENGLAND (EN)	10	477	123	249	572	213	158	600	1792
DK + EN	85	2881	406	1177	1857	1168	1041	3287	8530

Table 6: Overview of fish catches: total weights per species per trawl station.

Common name	Station number																SUM	
	5	8	16	18	21	28	30	40	42	45	47	56	58	61	71	72		75
Anchovy														0.03				
Blue whiting	14.68																	
Cod																		
Crystal goby				0.00														
Dab												0.20	0.13					
Garfish												0.17		0.16				
Great sandeel						0.10							0.04	0.08				
Greater argentine	18.10																	
Grey gurnard								3.76		12.76	3.98	3.42	2.58	7.35	5.48	0.82	1.14	
Haddock					1.18	0.00	9.16		0.65			0.18	0.02		0.13	2.74	88.65	
Herring		782.39									3.18	1.38		0.61	5.99		637.22	
Lancetfish	1.25																	
Lumpsucker		13.62	0.04		0.46						0.62							
Mackerel		82.71	0.55		39.97			1.08		16.19		8.23	8.05	22.80	1.83			
Norway pout				7.08														
Pearlside	0.33																	
Pilchard										0.14		3.06	2.69					
Poor cod																		
Raitt's sandeel	0.00		0.00			10.04	22.42											
Salmon						1.77												
Seabass																		
Spiny dogfish		0.28																
Sprat						0.19	0.00							27.53				
Velvet belly lanternshark	2.48																	
Whiting					0.20							1.16	0.88	0.05		2.18	32.10	
Jellyfish	0.20					6.26	0.15					17.82	45.57	14.66				
Sandy swimming crab														0.03				
Shrimp	5.20																	
Squid																	0.03	
SUM	42.25	879.00	0.59	7.08	41.81	18.36	31.73	4.84	0.65	32.13	6.12	31.18	60.95	81.37	7.44	643.00	121.89	

Common name	Station number																SUM	
	77	87	89	92	94	101	102	114	115	120	129	133	136	138	139	148		
Anchovy																		0.03
Blue whiting																		14.68
Cod				0.00	0.00		0.00											0.01
Crystal goby					0.02													0.02
Dab															0.05			0.38
Garfish												0.65		1.32		2.48		4.78
Great sandeel														0.01				0.24
Greater argentine																		18.10
Grey gurnard					0.32	0.09		1.06	3.68	52.70	0.50	26.68	23.05	1.92	6.80	1.26		159.35
Haddock	0.01		32.30	0.00	17.32		1.78	1.80	34.97	0.01			0.01		18.18			209.09
Herring			3.48				0.48				0.07		0.19		0.05	0.24		1435.30
Lancetfish																		1.25
Lumpsucker	0.60			0.99													0.62	16.96
Mackerel	76.67	16.46	2.36			29.00		7.34		7.96	0.42	3.86	3.56	22.10	136.70	112.50		600.35
Norway pout																		7.08
Pearlside																		0.33
Pilchard											11.08	8.68						25.65
Poor cod							0.04											0.04
Raitt's sandeel	44.71	12.18		7.30									0.00					96.66
Salmon																		1.77
Seabass													1.20					1.20
Spiny dogfish																		0.28
Sprat			8.36	5.68		6.10		255.71		0.01		0.00						303.57
Velvet belly lanternshark																		2.48
Whiting					0.46		126.80	0.23	0.13	0.04	0.14	0.30	0.19		8.12			172.98
Jellyfish							12.78	11.46	20.50	4.08	22.02	13.62	11.64					180.76
Sandy swimming crab											0.01							0.04
Shrimp																		5.20
Squid							0.01	0.01	0.01	0.00		0.02	0.00	0.20				0.28
SUM	122.00	28.64	38.14	16.65	23.80	29.09	147.99	21.89	315.00	64.80	34.26	53.80	39.85	25.56	169.90	117.10	3258.85	

Table 7: Overview of mackerel catches and collected samples

Station	Mackerel [n]	Mackerel [kg]	Mackerel single fish data [n]	Mackerel ovary samples [n]	Mackerel otoliths [n]	Mackerel stomachs [n]
5	0	0	0	0	0	0
8	237	82.71	100	30	100	56
16	2	0.546	2	1	2	2
18	0	0	0	0	0	0
21	132	39.97	100	33	100	100
28	0	0	0	0	0	0
30	0	0	0	0	0	0
40	3	1.084	3	1	3	3
42	0	0	0	0	0	0
45	59	16.194	59	22	59	59
47	0	0	0	0	0	0
56	33	8.234	33	15	33	33
58	34	8.05	34	15	34	34
61	77	22.798	77	22	77	77
71	5	1.834	5	3	5	5
72	0	0	0	0	0	0
75	0	0	0	0	0	0
77	188	76.67	100	32	100	100
87	55	16.46	55	25	55	55
89	10	2.36	10	3	10	10
92	0	0	0	0	0	0
94	0	0	0	0	0	0
101	93	29	93	33	93	93
102	0	0	0	0	0	0
114	20	7.34	20	10	20	20
115	0	0	0	0	0	0
120	33	7.964	33	17	33	33
129	1	0.422	1	1	1	1
133	36	3.856	36	4	36	36
136	30	3.56	30	3	30	30
138	259	22.1	130	20	130	130
139	1875	136.7	148	32	148	244
148	499	112.5	111	44	111	111
SUM	3681	600.352	1180	366	1180	1232