R/V Dana

Cruise 01/2023

”DK IBTS 1Q 2023”

Vessel: R/V DANA

Cruise dates (planned): 25/1 – 13/2 2023

Cruise number: 01/23

Cruise name: DK IBTS 1Q 2023

Port of departure:	Hirtshals	**Date:**	25 January
Port of return:	Hirtshals	**Date:**	13 February
Other ports:	Esbjerg	**Date and justification:**	4 – 6 February: Exchange of scientific staff and vessel crew, and a minor technical repair

Participants

Leg 1: Hirtshals – Esbjerg		
Name	**Institute**	**Function and main tasks**
Kai Wieland	DTU Aqua, Monitering	Cruise leader, Scientist, Fish lab
Helle Rasmussen	DTU Aqua, Monitering	Technician, Fish lab
Tom Svoldgaard	DTU Aqua, Monitering	Technician, Fish lab
Kapers Schaltz	DTU Aqua, Monitering	Technician, Fish lab
Kim Pedersen	DTU Aqua, Monitering	Technician, Fish lab
Bastian Huwer	DTU Aqua, Marine Living Resources	Scientist, Fish eggs and larvae
Gert Holst	DTU Aqua, Monitering	Technician, Fish eggs and larvae
Christian Petersen	DTU Aqua, Monitering	Technician, CTD, Maintenance
Marie Meffre	DTU Aqua, Marine Living Resources	Scientist, Jellyfish
Vivian Fischbach	Thuenen Institut Rostock	Scientist, Herring larvae

Leg 2: Esbjerg – Hirtshals		
Name	**Institute**	**Function and main tasks**
Helle Rasmussen	DTU Aqua, Monitering	Cruise leader, Technician, Fish lab
Kai Wieland	DTU Aqua, Monitering	Scientist, Fish lab
Tom Svoldgaard	DTU Aqua, Monitering	Technician, Fish lab
Kapers Schaltz	DTU Aqua, Monitering	Technician, Fish lab
Per Christensen	DTU Aqua, Monitering	Technician, Fish lab
Bastian Huwer	DTU Aqua, Marine Living Resources	Scientist, Fish eggs and larvae
Gert Holst	DTU Aqua, Monitering	Technician, Fish eggs and larvae
Christian Petersen	DTU Aqua, Monitering	Technician, CTD, Maintenance
Marie Meffre	DTU Aqua, Marine Living Resources	Scientist, Jellyfish
Vivian Fischbach	Thuenen Institut Rostock	Scientist, Herring larvae

Objectives

The survey is part of the 1st quarter International Bottom Trawl Survey in the North Sea (NS-IBTS), which is coordinated by the ICES International Bottom Trawl Survey Working Group and has been conducted with standard fishing gear in the 1st quarter since 1983.

The IBTS aims to provide ICES assessment and science groups with consistent and standardized data for examining spatial and temporal changes in (a) the distribution and relative abundance of fish and fish assemblages; and (b) of the biological parameters of commercial fish species for stock assessment purposes. The main objectives in the 1st quarter IBTS are to:

- To determine the distribution and relative abundance of pre-recruits of the main commercial species (cod, haddock, whiting, Norway pout, saithe, herring, sprat, and mackerel) with a view of deriving recruitment indices;
- To monitor changes in the stocks of commercial fish species independently of commercial fisheries data;
- To monitor the distribution and relative abundance of all fish species and selected invertebrates;
- To collect data for the determination of biological parameters for selected species;
- To collect hydrographical and environmental information;
- To determine the distribution of in particular herring and sprat larvae;

Technical details are described in the current version of the survey manual (ICES. 2020. Manual for the North Sea International Bottom Trawl Surveys. Series of ICES Survey Protocols SISP 10-IBTS 10, Revision 11. 102 pp. http://doi.org/10.17895/ices.pub.7562 , and ICES. 2013. Manual for the Midwater Ring Net sampling during IBTS Q1. Series of ICES Survey Protocols SISP 2-MIK 2. 18 pp. http://doi.org/10.17895/7578.

The area to be covered by Denmark with RV Dana in the 1st quarter 2023 (Fig. 1) was allocated during the most recent IBTS Working Group meeting in April 2022. The survey area consisted of 42 ICES statistical rectangles located in the Skagerrak and the North Sea. In 41 of these rectangles, one GOV/CTD station and two MIK stations were planned whereas in two of the rectangles in which Denmark was the only country sampling intensity should have been doubled.

Itinerary

R/V Dana departed from Hirtshals as scheduled on Wednesday 25th January at 10:00 local time and field work started in the western Skagerrak (Fig. 1) in the afternoon. Work continued in the following days in the Skagerrak and the northern part of the study area. During a period of bad weather in the central North Sea (Fig. 1 inlet), the western part of the survey area off the English coast was sampled. A planned change of crew was re-scheduled so that most of the work in the western part of the survey could be finished before entering the port of Esbjerg.

The vessel arrived in the port of Esbjerg on Saturday 4th February at 18:15 local time and left again on Monday 6th February at 13:00.

Reasonable weather conditions prevailed during the second leg of the cruise (Fig. 2) so that all mandatory work could be completed, and R/V Dana returned to Hirtshals on Monday 13th February at 08:30 local time.

Achievements

All trawl hauls were carried out with a 36/47 polyethylene GOV (chalut á Grande Overture Verticale) with the standard groundgear A (see IBTS Manual for specifications), 60 m sweeps and Vonin flyers replacing the standard kite, representing the standard rigging used for the IBTS on DANA since 2019.

The following sampling activities were performed:

44 valid standard GOV hauls and 1 invalid GOV haul. All tows with a nominal duration of 30 min.

45 CTD profiles (with additional sensors for dissolved oxygen and turbidity).

90 valid MIK (2 m diameter ringnet) hauls, performed during nighttime, all with MIKey (20 cm diameter fine meshed ringnet) net attached. Furthermore, 3 additional tows with an old MIK net (without MIKey) of which 1 tow qualifies as a standard tow and 3 MIK tows for flowmeter calibration were carried out.

Results

Routine sampling

The trawl parameters for the standard tows (vertical net opening and door spread) as monitored with a Scanmar system were in the range or close to the suggested limits specified in the IBTS manual in most cases (Fig. 3a). GOV #1 got seriously damaged on the second last day of the field work (invalid tow in the northwestern corner of rectangle 42F6, Fig. 1). Large deviations from the theoretical values for net opening occurred for GOV #2 on two stations at the end of the survey and this trawl has thus been sent for checking.
Marport sensors for wing spread did work reliable on most of the stations. The obtained data indicate a sufficiently close relationship door spread so that the few missing observations (n=4) for wing spread can easily be estimated by linear regression (Fig. 3b).

In total, 80 different species of fish, cephalopods and crustaceans were found in catches. The total weight of the catches was 16.3 tons (Tab. 1). Total catch and species richness in the standard tows ranged from 22.5 to 1985.3 kg per haul and from 10 to 29 different fish and IBTS mandatory invertebrate species (Fig. 4). Compared to previous years high catches of anchovy were observed predominantly in the western part of the survey area and a high number of small herring (down to 7 cm length) were found in the eastern area just off the German coast.

Length measurements were made for all commercial and non-commercial fish species. Sharks, skates and rays and selected shellfish species were measured separately by sex (length composition and weight). Single fish data (length, weight, sex and maturity) and

otoliths were collected for the main commercial species (cod, haddock, whiting, Norway pout, saithe, herring, sprat, mackerel and plaice) as well as for dab and lemon sole (Tab. 2). In addition, individual length and weight were recorded for all specimens for which stomachs or genetic samples were taken (see below).

Preliminary abundance indices for the main commercial species indicate that herring, haddock and whiting recruits were widely distributed in the sampled area (Tab. 3).

Stomach data were collected for cod, horse mackerel, turbot, brill, halibut, pollack, ling and tub gurnard according to a request from the EU. The number of individuals (≥ 15 cm length) and examined and the number of non-empty stomach collected for later analysis are listed in table 4.

Marine litter was recorded in each GOV catch using four main categories: plastic, glass, metals and miscellaneous, which were subdivided in several minor categories to meet the request by the ICES Working Group for Marine Litter. The total amount of marine litter sorted from the catches retained in the codend was 30.6 kg for the 44 valid tows.

Temperature, salinity and dissolved oxygen content at surface and bottom were extracted from the CTD profiles for storage in the institute's fish data base. The temperature and salinity values will be submitted to the ICES DATRAS database together with the GOV catch results and measurements of surface and bottom currents (speed and direction) at the trawl stations to DATRAS, and the complete CTD profiles will be submitted to the ICES hydrographical data center.

The water column was well mixed as typical for this time of the year, and surface and bottom temperatures ranged from 6.1 to 8.0 °C (Fig. 5) and from 6.1 to 8.2 °C, respectively. Turbidity in the bottom layer was much lower than in the previous year indicating that the catches of roundfish species for which a herding effect by the warps, doors and sweeps affects its catchabilities, are representative also for shallow water stations close to the Danish coast.

Special requests

Infestation with liver worms and gill parasites was recorded for cod and haddock, respectively, for all individuals for which single fish data were taken.

Genetic samples for national projects were taken from anchovy (n=80) and hake (n=9) as well as from adult cod in spawning condition (n=8) together with the recording of single length and weight.

Mackerel stomachs were visually inspected to check whether a full-scale sampling in a future 1st quarter survey make sense or not. From 67 individuals examined 18 fish, i.e., 27 %, were feeding, either on planktonic crustaceans (n=14) or sand eels (n=4). However, the size range of the mackerel caught was almost limited to juveniles (15-21 cm length).

Miscellaneous

Results of the MIK and MIKey plankton sampling for in particular herring larvae, fish eggs and jellyfish conducted during night will be reported later elsewhere.

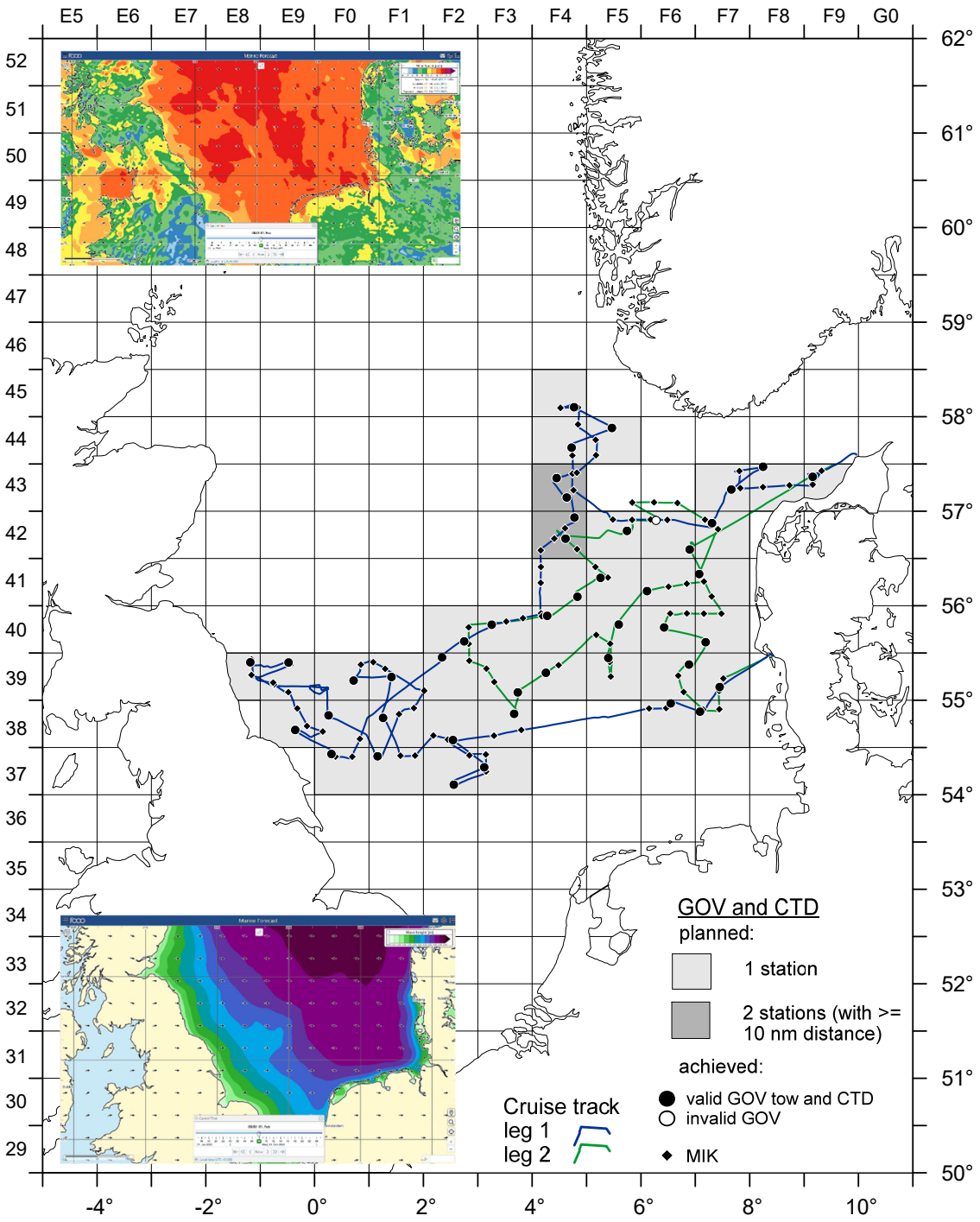


Fig. 1: Survey map with cruise track and sampling locations, RV Dana DK IBTS 1Q 2023 (Note: the additional MIK tows in rectangles 43F5 and 43F6 were done on behalf of another country (Norge)).

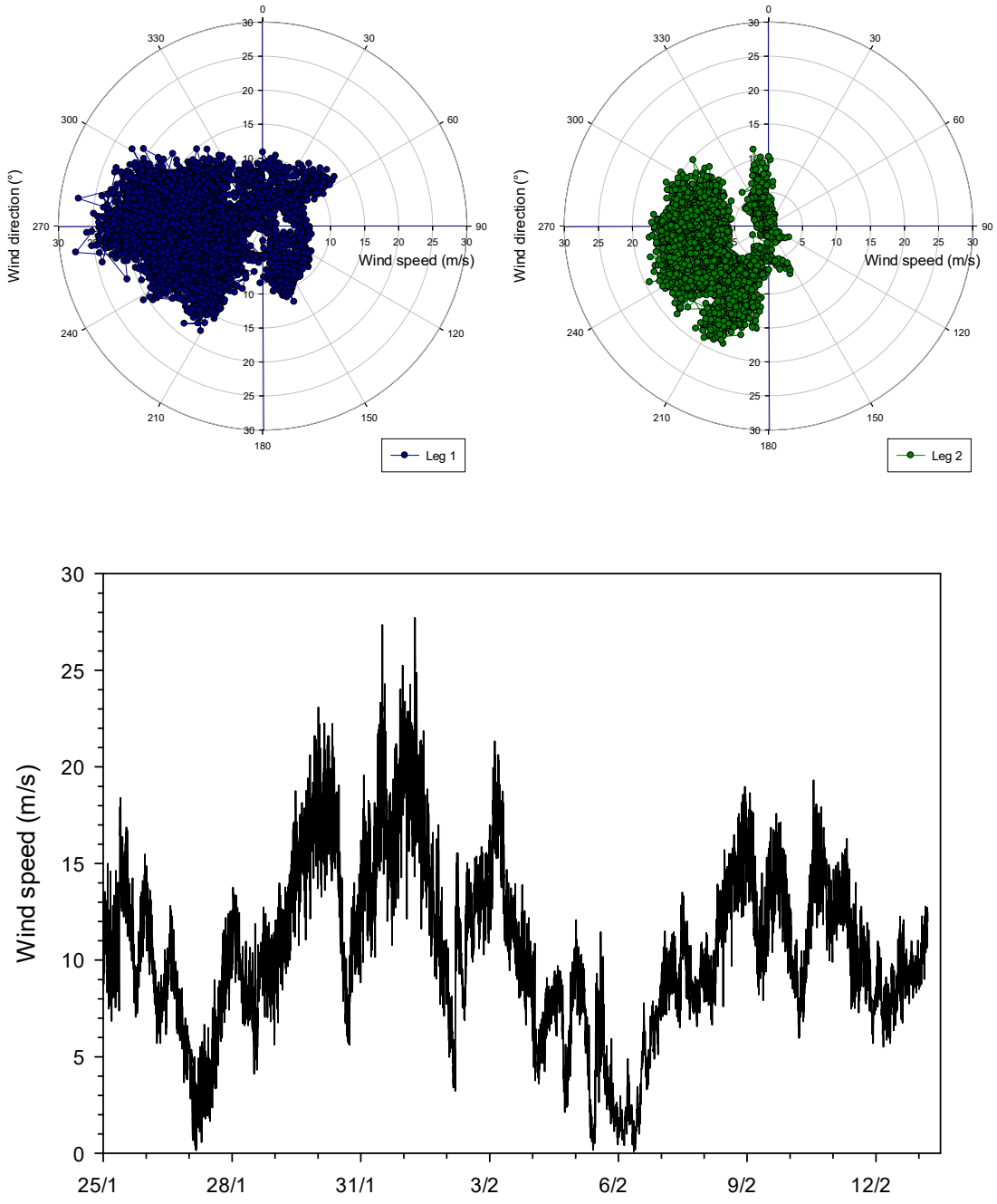


Fig. 2. Wind speed (m/s) and wind direction (°) recorded along the cruise track, RV Dana DK IBTS 1Q 2023.

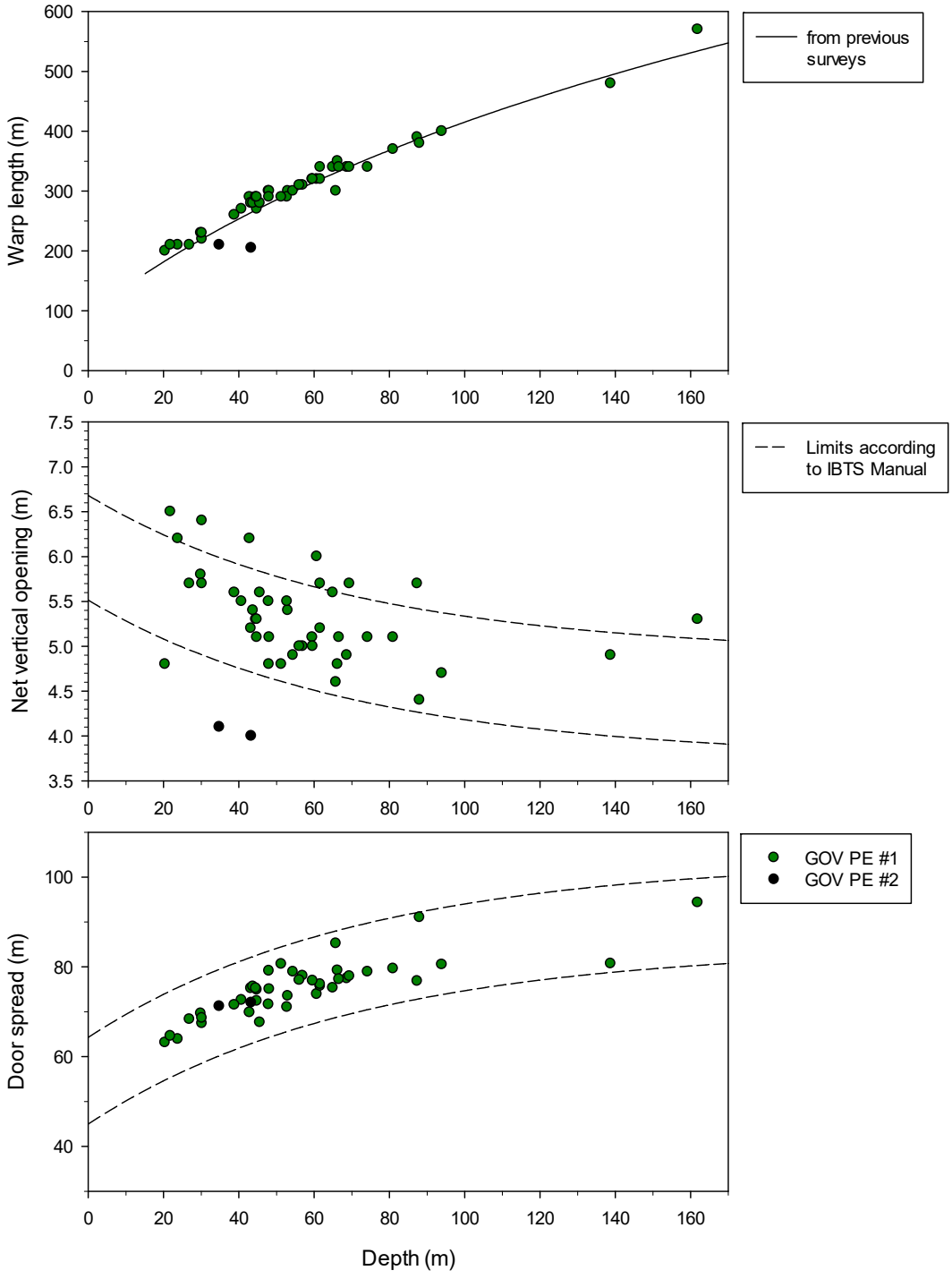
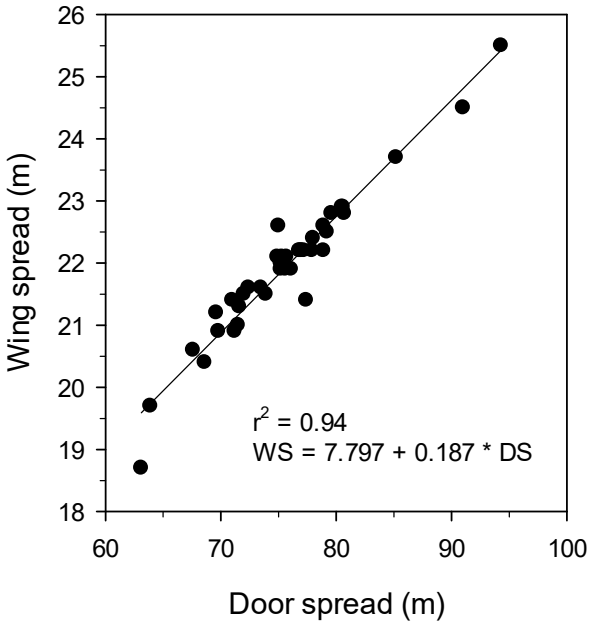


Fig. 3a: Warp length, net opening and door spread in relation to depth, RV Dana DK IBTS 1Q 2023.



Data Source: Data 1 in DanaTrawlGeometry_1Q2023.JNB
Equation: Polynomial, Linear
f = y0+a*x

R	Rsqr	Adj Rsqr	Standard Error of Estimate
0.969	0.938	0.937	0.295

	Coefficient	Std. Error	t	P
y0	7.797	0.598	13.034	<0.0001
a	0.187	0.008	23.738	<0.0001

Analysis of Variance:

	DF	SS	MS
Regression	2	18841.680	9420.840
Residual	37	3.230	0.087
Total	39	18844.910	483.203

Corrected for the mean of the observations:

	DF	SS	MS
Regression	1	49.188	49.188
Residual	37	3.230	0.087
Total	38	52.417	1.379

Fig. 3b: Relationship between door and wing spread, RV Dana DK IBTS 1Q 2023.

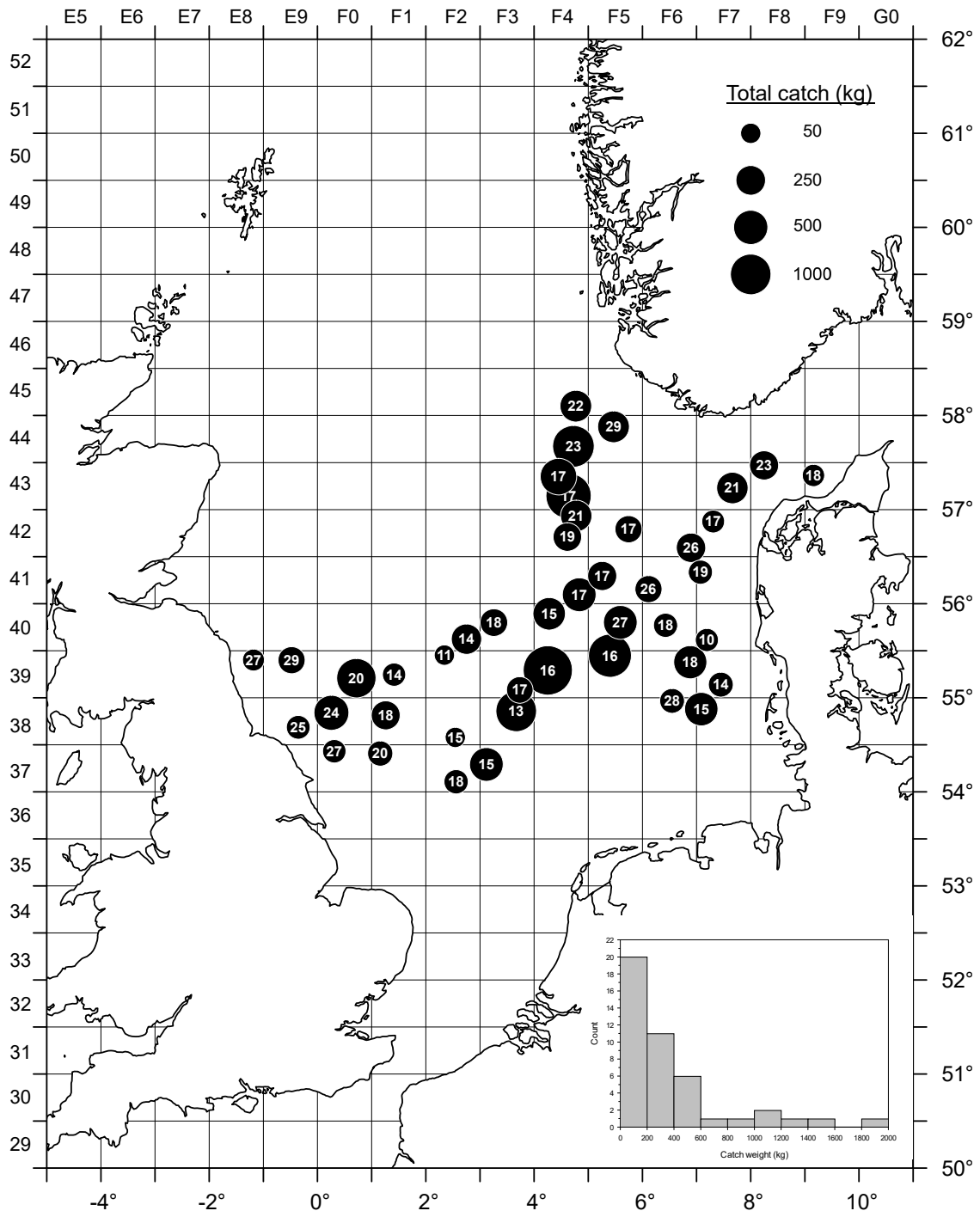


Fig. 4: Total catch of fish and shellfish (symbol size) and species richness (numbers within the circles) per tow (Note: catch in kg per tow, i.e. not adjusted for differences in tow duration and swept area fished), Dana DK IBTS 1Q2023.

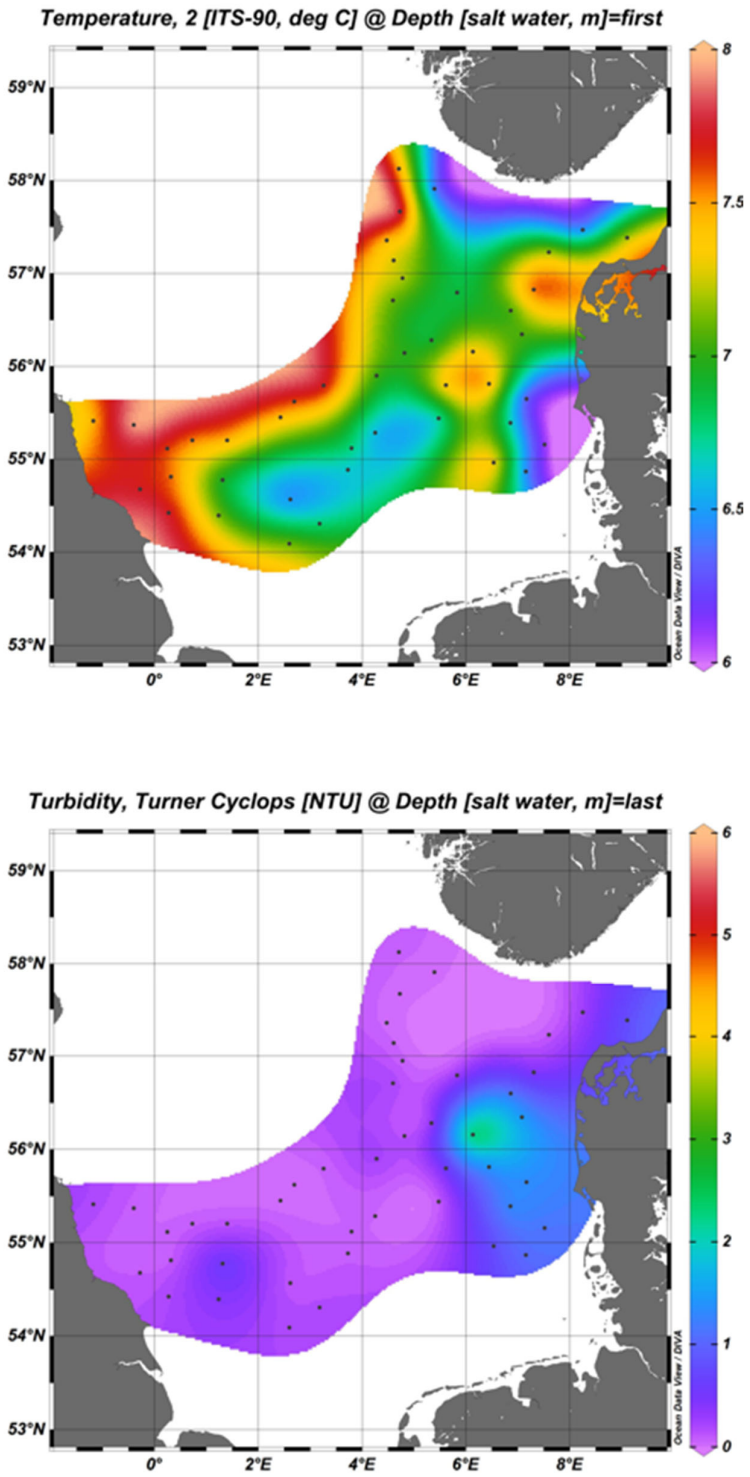


Fig. 5: Temperature in the surface layer and turbidity in bottom layer, Dana DK 1Q2023

Tab. 1: Species list, Dana DK IBTS 1Q 2023 (L: total length in cm below (fish); ML: mantle length (cephlapods); CPL or CPW: carapace length or width (crusteaceans).

Latin name	English name	Danish name	Weight (kg)	Number	L_{min} (cm)	L_{max} (cm)	Remark
Aequipecten opercularis	Queen scallop	Jomfruøsters	0.631	13	-	-	
Agonus cataphractus	Pogge	Panser ulk	0.146	11	4.0	13.0	
Alloteuthis subulata	European common squid	Dværgblæksprutte	17.958	5347	2.0	12.0	ML
Amblyraja radiata	Starry ray	Tærbe	13.492	44	16.0	44.0	
Ammodytes marinus	Lesser sandeel	Havtobis	0.099	60	6.5	10.0	
Anarhichas lupus	Catfish	Stribet havkat	5.970	2	65.0	67.0	
Aphia minuta	Transparent goby	Glaskutling	0.001	2	3.0	5.0	
Argentina sphyraena	Lesser silver smelt	Strømsild	1.136	31	13.0	24.0	
Arnoglossus laterna	Scaldfish	Tungehvarre	0.376	33	8.0	15.0	
Buglossidium luteum	Solenette	Glastunge	2.106	241	7.0	13.0	
Callionymus lyra	Common dragonet	Stribet fløjfisk	1.762	44	13.0	25.0	
Callionymus maculatus	Spotted dragonet	Plettet fløjfisk	0.050	8	7.0	15.0	
Callionymus reticulatus	Reticulated dragonet	Kortfinnet fløjfisk	0.003	1	7.0	7.0	
Cancer pagurus	Edible crab	Taskekrabbe	20.758	59	9.0	18.2	CPW
Chelidonichthys lucerna	Tub gurnard	Rød knurhane	1.031	4	21.0	34.0	
Clupea harengus	Herring	Sild	4522.128	278068	7.0	32.5	
Cyclopterus lumpus	Lumpfish	Stenbider	2.020	1	32.0	32.0	
Echiichthys vipera	Lesser weever	Fjæsing lille	0.151	3	15.0	17.0	
Eledone cirrhosa	Horned octopus	Eledone Blæksprutte	0.082	1	-	-	
Enchelyopus cimbrius	Four-bearded rockling	Firetrådet havkvabbe	1.197	22	10.0	28.0	
Engraulis encrasicolus	Anchovy	Ansjos	7.610	846	6.0	15.0	
Eutrigla gurnardus	Grey gurnard	Grå knurhane	495.040	6427	8.0	39.0	
Gadiculus argenteus	Silvery pout	Sølvtorsk	0.059	13	6.0	11.0	
Gadus morhua	Cod	Torsk	164.522	189	11.0	104.0	
Galeus melastomus	Blackmouth catshark	Ringhaj	1.256	2	58.0	66.0	
Glyptocephalus cynoglossus	Witch	Skærising	2.518	12	15.0	39.0	
Gymnammodytes semisquamatus	Smoothed sandeel	Nøgentobis	0.010	1	16.5	16.5	
Helicolenus dactylopterus	Blackbelly rosefish	Blåkæft	0.049	1	15.0	15.0	
Hippoglossoides platessoides	Long-rough dab	Håising	35.939	854	6.0	28.0	
Hippoglossus hippoglossus	Atlantic halibut	Helleflynder	5.700	2	60.0	63.0	
Hyperoplus lanceolatus	Greater sandeel	Plettet tobiskonge	0.154	7	15.5	29.0	
Illex coindetii	Southern shortfin squid	Rød blæksprutte	3.980	85	4.0	17.0	ML
Limanda limanda	Common dab	Ising	1219.817	21548	5.0	32.0	
Lithodes maja	Norway king crab	Troldkrabbe	5.658	13	4.2	10.3	CPL
Loligo forbesii	Northern squid	Loligoblæksprutte	23.706	132	4.0	31.0	ML
Loligo vulgaris	European squid	Europæisk loligo	12.880	40	15.0	30.0	ML
Lophius piscatorius	Angler fish	Havtaske	10.254	9	13.0	62.0	
Lumpenus lampretaeformis	Snake blenny	Spidshalet langebarn	0.020	2	10.0	28.0	
Maurolicus muelleri	Pearlside	Laksesild	0.012	7	4.0	6.0	
Melanogrammus aeglefinus	Haddock	Kuller	5052.723	60170	12.0	58.0	
Merlangius merlangus	Whiting	Hvilling	2025.001	20119	6.0	40.0	
Merluccius merluccius	Hake	Kulmule	2.997	9	30.0	41.0	
Micromesistius poutassou	Blue whiting	Blåhvilling	48.162	434	16.0	33.0	
Microstomus kitt	Lemon sole	Rødtunge	28.832	288	10.0	35.0	
Molva molva	Ling	Lange	8.968	5	59.0	79.0	
Mullus surmuletus	Striped red mullet	Stribet rød Mulle	2.618	54	8.0	27.0	
Mustelus asterias	Starry smooth-hound	Stjernehaj	7.158	22	37.0	56.0	
Myoxocephalus scorpius	Sculpin	Almindelig ulk	4.576	31	10.0	29.0	
Nephrops norvegicus	Norway lobster	Jomfruhummer	11.202	391	2.1	6.0	CPL
Pecten maximus	Great scallop	Stor kammusling	2.329	8	-	-	
Pholis gunnellus	Butter fish	Tangspræl	0.026	2	15.0	16.0	
Phrynorhombus norvegicus	Norwegian topknot	Småhvarre	0.022	3	6.0	9.0	
Platichthys flesus	Flounder	Skrubbe	0.237	2	21.0	23.0	
Pleuronectes platessa	Plaice	Rødspætte	274.701	2744	8.0	42.0	
Pollachius pollachius	Pollack	Lyssej	14.201	5	36.0	72.0	
Pollachius virens	Saithe	Sej	89.199	87	26.0	91.0	
Pomatoschistus sp.	Sand gobies	*Sandkutlinger	0.030	36	3.0	7.0	
Raja brachyura	Blonde ray	Småplettet rokke	0.480	1	48.0	48.0	
Raja clavata	Thornback ray	Sømrokke	13.080	7	53.0	72.0	
Raja montagui	Spotted Ray	Storplettet Rokke	0.810	2	38.0	41.0	
Rossia macrosoma	Stout bobtail squid	Ross's blæksprutte	0.063	34	-	-	
Sardina pilchardus	Pilchard	Sardin	1.054	92	8.0	21.0	
Scomber scombrus	Mackerel	Makrel	98.977	2748	15.0	28.0	
Scophthalmus maximus	Turbot	Pighvarre	2.786	3	23.0	42.0	
Scophthalmus rhombus	Brill	Slethvarre	2.728	2	39.0	50.0	
Scyliorhinus canicula	Lesser-spotted dogfish	Småplettet rødhaj	13.911	22	32.0	69.0	
Scyliorhinus stellaris	Greater-spotted dogfish	Storplettet rødhaj	0.696	1	54.0	54.0	
Sepia officinalis	Common cuttlefish	Sepiablæksprutte	0.386	3	7.0	11.0	ML
Sepiola atlantica	Atlantic bobtail squid	Sepiola atlantica	0.001	1	-	-	
Solea solea	Sole	Tunge	1.219	4	25.0	34.0	
Sprattus sprattus	Sprat	Brisling	1749.384	281900	5.5	18.0	
Syngnathidae	Pipefishes	*Tangnåle	0.000	1	9.0	9.0	
Todarodes sagittatus	European flying squid	Flyveblæksprutte	0.009	2	5.0	5.0	ML
Todaropsis eblanae	Lesser flying squid	Todaropsis eblanae	1.909	27	3.0	13.0	ML
Trachinus draco	Greater weever fish	Fjæsing	10.863	55	22.0	43.0	
Trachurus trachurus	Horse mackerel	Hestemakrel	9.066	432	8.0	33.0	
Trisopterus esmarkii	Norway pout	Sperling	208.384	22468	4.0	20.0	
Trisopterus luscus	Bib	Skægtorsk	0.127	1	21.0	21.0	
Trisopterus minutus	Poor-cod	Glyse	3.092	88	6.0	23.0	
Zeus faber	John dory	Sanktpetersfisk	0.100	1	19.0	19.0	

Tab. 2: Number of single fish data (length, individual weight, sex and maturity, infestation with liver or gill parasites for cod and haddock) and samples for ageing (*: no otoliths collected), Dana DK IBTS 1Q 2023.

Species	Total
Herring (Clupea harengus)	822
Sprat (Sprattus sprattus)	307
Cod (Gadus morhua)	150
Haddock (Melanogrammus aeglefinus)	795
Whiting (Merlangius merlangus)	742
Saithe (Pollachius virens)	33
Norway pout (Trisopterus ermarkii)	119
Mackerel (Scomber scombrus)	67
Plaice (Pleuronectes platessa)	497
Dab (Limanda limanda)	122
Lemon sole (Microstomus kitt)	20
Sum:	3674

Tab. 3: Preliminary recruitment indices (age 1 based on length split, number per hour trawling) for commercial IBTS species per tow, Dana DK IBTS 1Q2023.

Station	Rectangle	Herring < 20 cm	Cod < 25 cm	Haddock < 20 cm	Whiting < 20 cm	Norway pout < 15 cm	Sprat < 10 cm	Mackerel < 25 cm
1	43F9	826	6	0	375	6	4044	0
10	43F8	471	40	749	80	630	0	34
11	43F7	1814	0	5273	60	2	26	630
13	42F7	1119	2	22	133	2	7046	34
23	44F4	8	0	60	0	0	0	38
24	44F5	0	0	6	7	28977	0	0
26	45F4	0	12	90	0	4733	0	0
36	43F4	1833	2	10250	11	211	0	4351
38	43F4	10393	2	43777	1000	26	0	142
40	42F4	18163	0	184	24	1003	30	54
50	40F3	178	0	441	14	2	8	4
51	40F2	24	0	6165	332	0	0	2
53	39F2	0	2	40	2	0	0	0
59	37F0	0	6	324	12	183	4	0
60	38E9	8	2	16	40	66	1261	0
71	39E8	4	0	5	251	284	1498	0
72	39E9	52	0	216	46	14	3177	0
77	38F0	184	0	2872	76	4634	108	0
79	37F1	98	2	92	65	146	146	2
89	39F0	1331	2	1931	676	1789	6	0
90	39F1	10	0	30	4	0	0	0
92	38F1	922	0	2	46	6	20452	0
102	37F2	434	0	24	203	58	261	0
103	37F3	315	0	167	579	8	102	0
105	38F2	38	0	0	2	0	280	2
112	38F6	730	0	26	863	0	1277	8
113	38F7	43444	0	0	943	0	85696	0
115	39F7	18628	0	0	831	0	5762	0
125	39F6	32980	0	0	353	0	35924	10
126	40F7	10493	0	0	85	0	3950	0
128	40F6	1541	0	16	685	0	610	0
141	41F6	6077	0	70	78	0	6101	4
143	40F5	3912	0	9329	3833	0	1463	18
144	39F5	150984	0	24	68	0	105650	78
152	39F4	168364	0	66	104	0	11780	10
154	39F3	1417	0	38	40	0	1819	0
155	38F3	10194	2	983	1088	0	30840	0
164	40F4	13706	0	1646	236	26	211	0
165	41F4	20099	0	2565	88	240	2124	4
167	41F5	7679	0	1451	62	84	2267	6
173	42F4	8937	0	370	161	272	12	8
174	42F5	6134	0	925	10	206	401	6
183	41F7	1264	0	4	267	0	331	0
184	42F6	1320	0	1534	162	2	267	2
	mean:	12412	2	2086	318	991	7612	124

Tab. 4: Number of stomach data collected by species (V: everted, R: regurgitated, F: feeding, E: empty, -: not caught; note: only category F stomachs were collected for later analysis), Dana DK IBTS 1Q 2023.

Species	V	R	F	E	total
Cod	0	12	39	87	138
Horse mackerel	0	0	1	16	17
Turbot	0	0	1	2	3
Brill	0	0	1	0	1
Halibut	0	0	2	0	2
Pollack	0	1	4	0	5
Tusk	-	-	-	-	-
Ling	1	0	3	1	5
Tub gurnard	0	0	3	1	4
sum:			54		175