

R/V Dana

Cruise 07/2018

"DK IBTS 3Q 2018"



Vessel: R/V DANA

Cruise dates (planned): 30/7 – 17/8 2018

Cruise number: 07/18

Cruise name: DK IBTS 3Q 2018

Port of departure:	Hirtshals	Date:	30 July
Port of return:	Hirtshals	Date:	17 August
Other ports:	Esbjerg	Date and justification:	8 August: Scheduled exchange of scientific staff and crew

Participants

Leg 1: Hirtshals – Esbjerg		
Name	Institute	Function and main tasks
Helle Rasmussen	DTU Aqua, Monitoring	Cruise leader, Fish lab
Lise Sindahl	DTU Aqua, Monitoring	Technician, Fish lab
Tom Svoldgaard	DTU Aqua, Monitoring	Technician, Fish lab
Jane Gudmandsen	DTU Aqua, Monitoring	Technician, Fish lab
Mads Jensen	DTU Aqua, Monitoring	Technician, Fish lab
Ronny Sørensen	DTU Aqua, Monitoring	Technician, CTD, Maintenance
Peter Munk	DTU Aqua, Oceans and Arctic	Scientist, Fish eggs and larvae
Christina Gawinski	GEOMAR Kiel	Scientist, Jellyfish

Leg 2: Esbjerg – Hirtshals		
Name	Institute	Function and main tasks
Kai Wieland	DTU Aqua, Monitoring	Cruise leader, Fish lab
Maria Jarnum	DTU Aqua, Monitoring	Technician, Fish lab
Stina Hansen	DTU Aqua, Monitoring	Technician, Fish lab
Brian Thomsen	DTU Aqua, Monitoring	Technician, Fish lab
Tom Svoldgaard	DTU Aqua, Monitoring	Technician, Fish lab
Ronny Sørensen	DTU Aqua, Monitoring	Technician, CTD, Maintenance
Esther Beukhof	DTU Aqua, Centre for Ocean Life	Scientist, Fish Lab
Bastian Huwer	DTU Aqua, Marine Living Resources	Scientist, Fish eggs and larvae
Christina Gawinsky	GEOMAR Kiel	Scientist, Jellyfish

Objectives

The survey is part of the 3rd quarter International Bottom Trawl Survey (IBTS) in the North Sea, which is coordinated by the ICES International Bottom Trawl Survey Working Group and has been conducted with standard fishing gear in the 3rd quarter since 1991.

The IBTS aims to provide ICES assessment and science groups with consistent and standardised 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 3rd 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 collect information of the amount and distribution of marine litter

The area to be covered by Denmark with RV Dana in the 3rd quarter 2018 was allocated during the IBTS Working Group meeting in April 2018. Technical details are described in the current version of the survey manual (ICES 2015. Manual for the International Bottom Trawl Surveys. Series of ICES Survey Protocols. SISP 10-IBTS IX. 86 pp.). Additional requests from the IBTS WG for the 3Q survey in 2018 were to collect information on the trawl setting and retrieval duration of the standard 30 minute tows and to conduct 15 minute and so called zero-minute tows in order to estimate the catch obtained outside the nominal tow duration of the standard tows. This year, additional plankton sampling with MIK and Bongo nets and collection of water samples was conducted during night.

Itinerary

R/V Dana left Hirtshals on Monday 30th July at 12:00 local time. The field work started in the western Skagerrak (Fig. 1). The vessel stayed in the port of Esbjerg on Wednesday 8th August from 9:05 to 13:15 for the scheduled exchange of scientific staff and crew. Favorable weather conditions prevailed during almost the entire cruise but in particular during the 1st cruise leg (Fig. 2). R/V Dana returned to Hirtshals on Friday 17th February at 7:45 local time.

Achievements

The original working area consisted of 46 ICES statistical rectangles located in the Skagerrak and the North Sea and in 7 of these rectangles two stations were planned (Fig. 1). The GOV trawl was severely damaged during the 2nd cruise leg at two stations in the English Channel at locations which had been fished without problems in the year before. The time needed for changing to another GOV trawl and necessary changes in the re-allocation of sampling stations made it impossible to conduct a valid tow in rectangle 34F0. Furthermore, just one set of a 15 min and a 0 min tow adjacent to a standard 30 min tow (in rectangle 37F7) could be made. The following activities were carried out:

53 valid standard trawl hauls with a GOV 36/47 (chalut á Grande Overture Verticale), all hauls were carried with the standard groundgear A (see IBTS Manual for specifications) and with 60 m sweeps. In all of hauls two Vonin flyers were used replacing the standard kite.

53 CTD profiles (with additional sensors for dissolved oxygen, fluorescence and turbidity) at standard GOV stations.

Results

Routine sampling

The trawl parameters for the standard tows (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, except for the old nylon GOV's which showed unacceptable net opening in almost all tows and urgently requires a reset before they can be used again (Fig. 3a). The remaining deviations from the theoretical values for door spread and in particular net opening are likely due to the high sensibility of the GOV to current effects. The actual facilities on DANA, however, do not allow to measure adequately current strength and direction in the near bottom layer. The wing sensors did not work properly in most of tows. However, the recorded values of wing spread for 23 out of the 53 hauls showed the usual linear relationship with door spread (Fig. 3b) but with a much higher scatter than in previous years.

In total, 75 different species of fish and invertebrates were found in catches. The total weight of the catches from the 53 tows has been 29 tons (Tab. 1). Total catch of fish, cephalopods and shellfish and species richness in the standard tows ranged from 30 kg to 6 tons and from 7 to 32 different fish and IBTS invertebrate species with low and species-poor catches predominantly recorded in the north-western part of the survey area (Fig. 4). The total catch of the 30 min standard tow, the 15 min tow and the 0 min tow in rectangle 37F7 amounted to 398 kg (16 species), 202 kg (20 species), and 52 kg (10 species), respectively, which may suggest that the catch outside the nominal tow duration (0 min tow) is relatively more important for shorter than for longer tows. This, however, requires a much larger data set which is currently collected in the IBTS for confirmation.

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 hake in order to fulfil requirements of the national DCF (Data Collection Framework of the European Union) sampling requirements (Tab. 2). The preliminary abundance indices for the main commercial species (Tab. 3) indicate that e.g. whiting but also sprat, mackerel and plaice were widely distributed in the survey area whereas cod was quite rare and it appears noteworthy that not a single 0-group cod was caught.

Total 'fishing' time and additional time the trawl was on the bottom outside the nominal tow duration of the standard tows with a nominal duration of 30 min ranged from 7 to 16 min and 3 to 9 min, respectively, of which total fishing time is positively correlated to depth, and winch speed during deployment and retrieval amounted to about 1 m/s on average (Fig. 5).

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 IBTS Working Group. The total amount of marine litter was 60.6 kg.

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. These temperature and salinity values will be submitted to the ICES DATRAS database together with the GOV catch

results to DATRAS, and the complete CTD profiles will be submitted to the ICES hydrographical data center.

Additional activities

Samples of cod livers were collected for toxicological analysis.

Selected mixed fish and shellfish species collections were taken for education and open ship arrangements at DTU Aqua.

Results of the plankton and water sampling conducted during night are reported in Annex 1.

Others

A cruise summary report has been delivered online to

http://seadata.bsh.de/csr/online/V1_index.html.

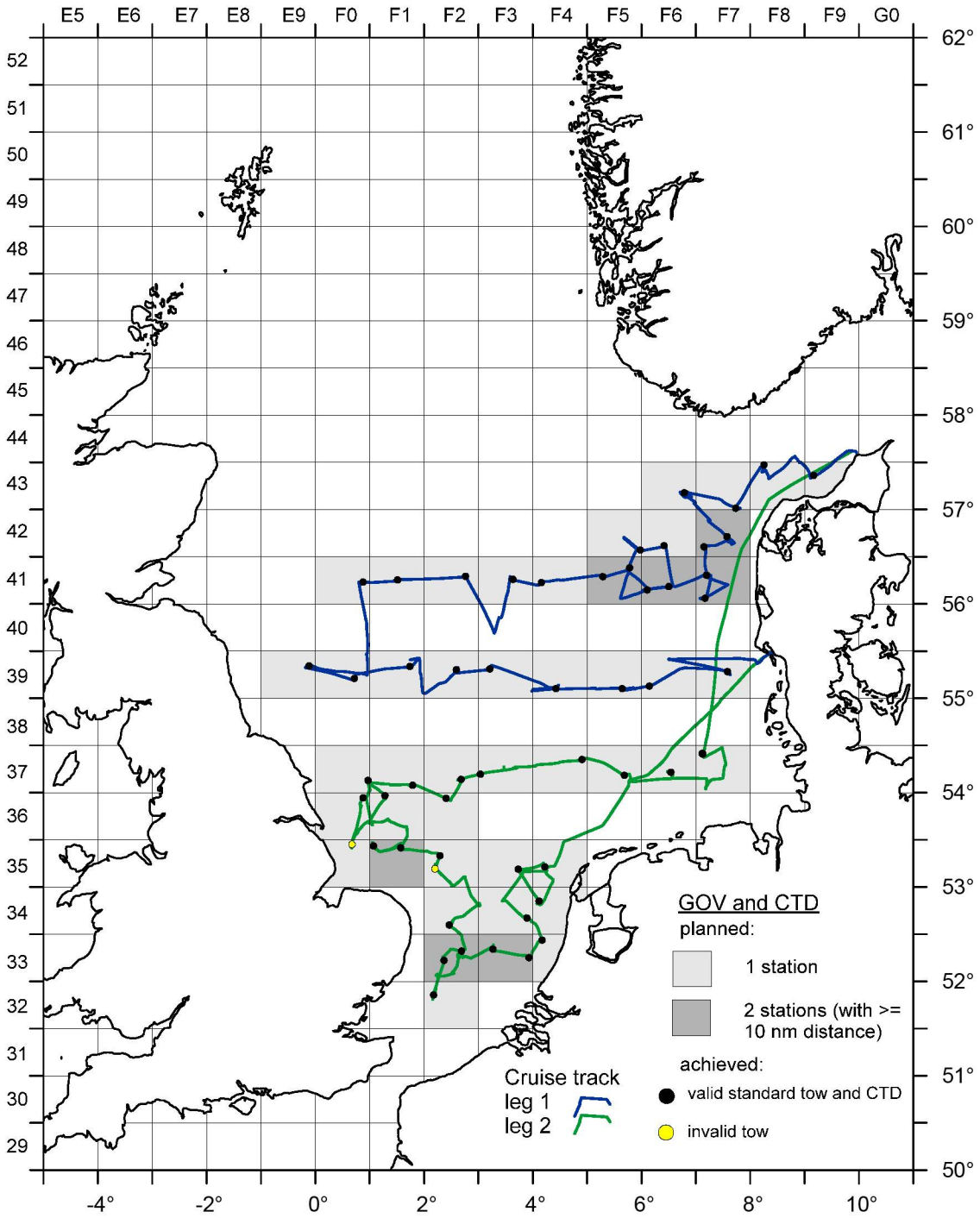


Fig. 1: Survey map with cruise track and sampling locations, Dana DK IBTS 3Q 2018.

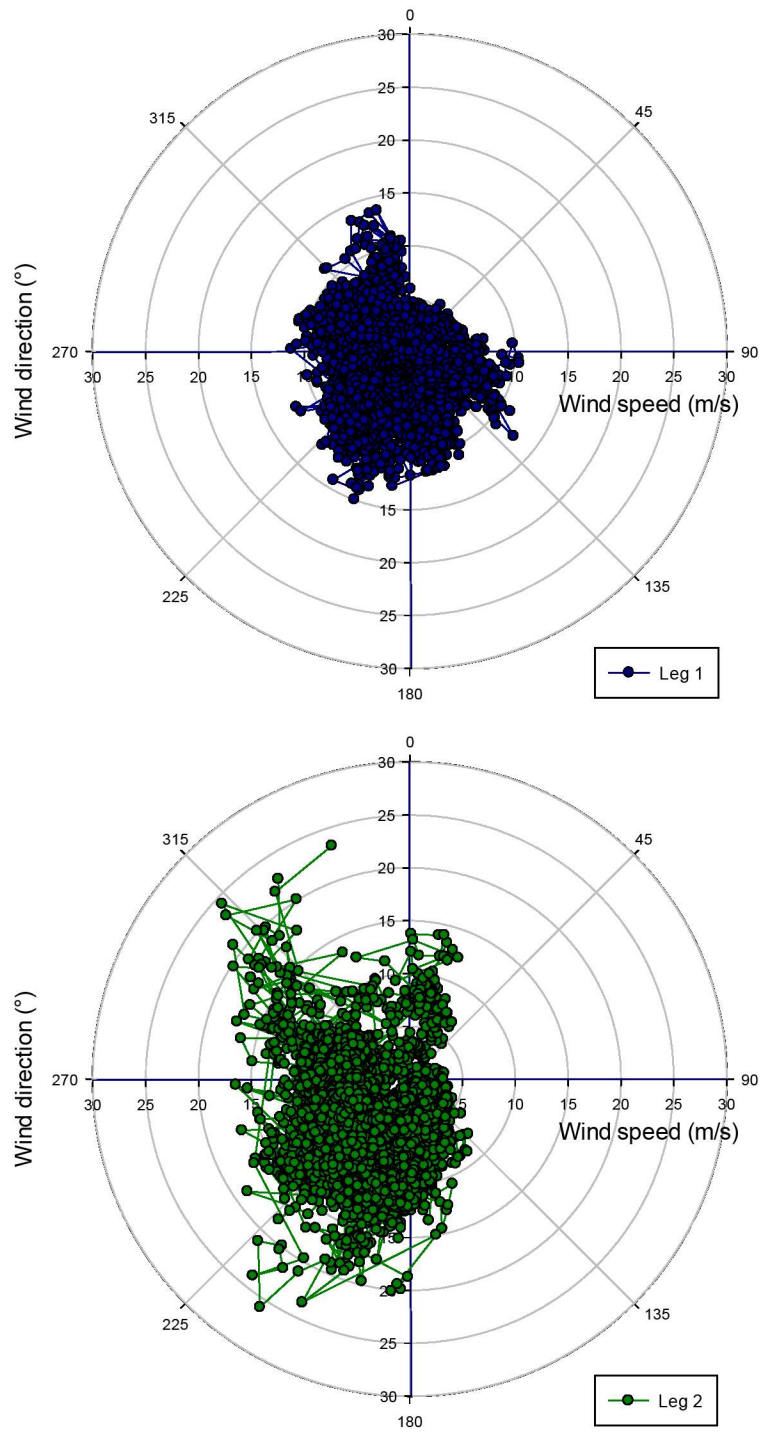


Fig. 2. Wind speed (m/s) and wind direction ($^{\circ}$) recorded along the cruise track, Dana DK IBTS 3Q 2018.

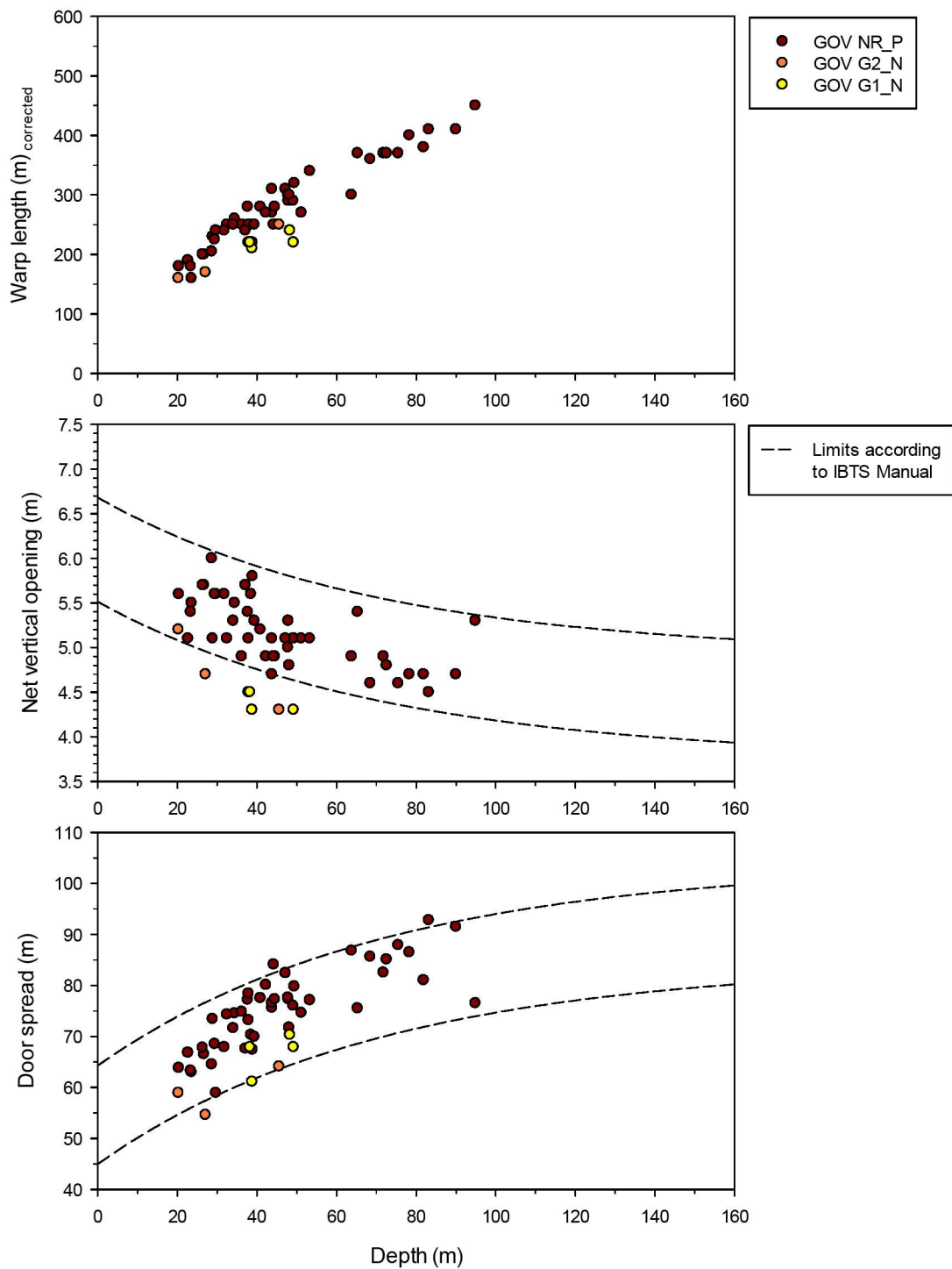


Fig. 3a: Warp length, net opening and door spread in relation to depth, Dana DK IBTS 3Q 2018 (GOV NR_P: New polyethylene GOV, G1_N and G2_N: Old nylon GOV's).

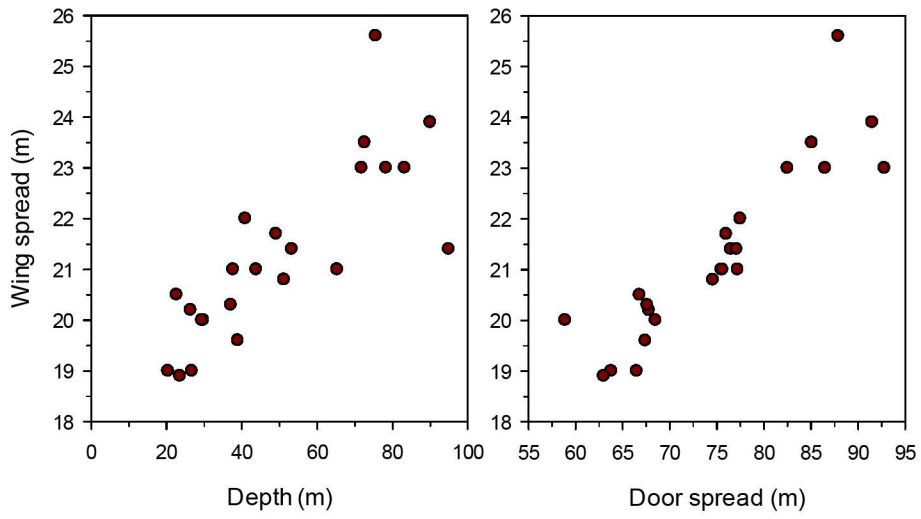


Fig. 3b: Wing spread in relation to depth and door spread, Dana 3Q IBTS 2018.

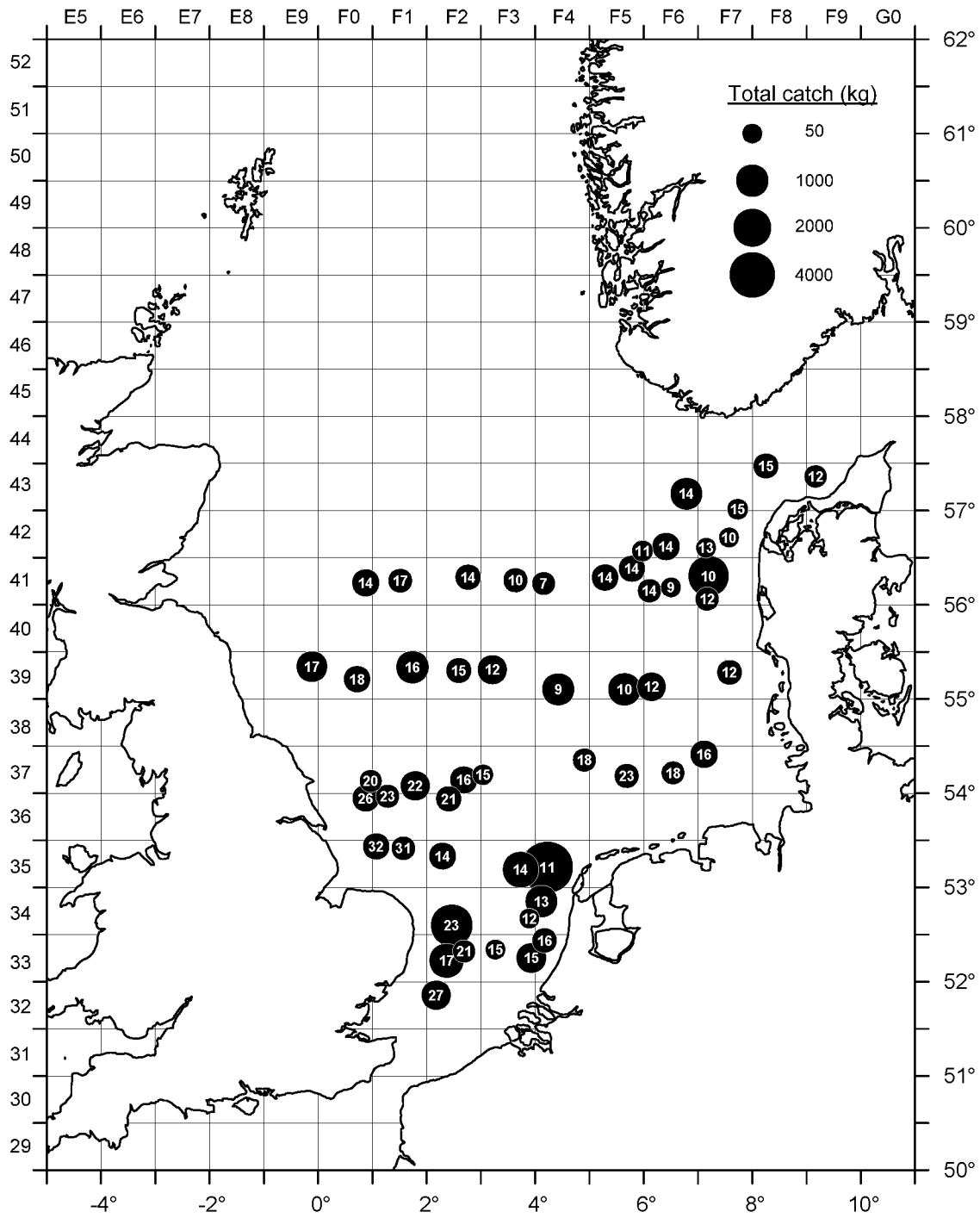


Fig. 4: Total catch (symbols) and species richness (numbers), Dana DK IBTS 3Q 2018.

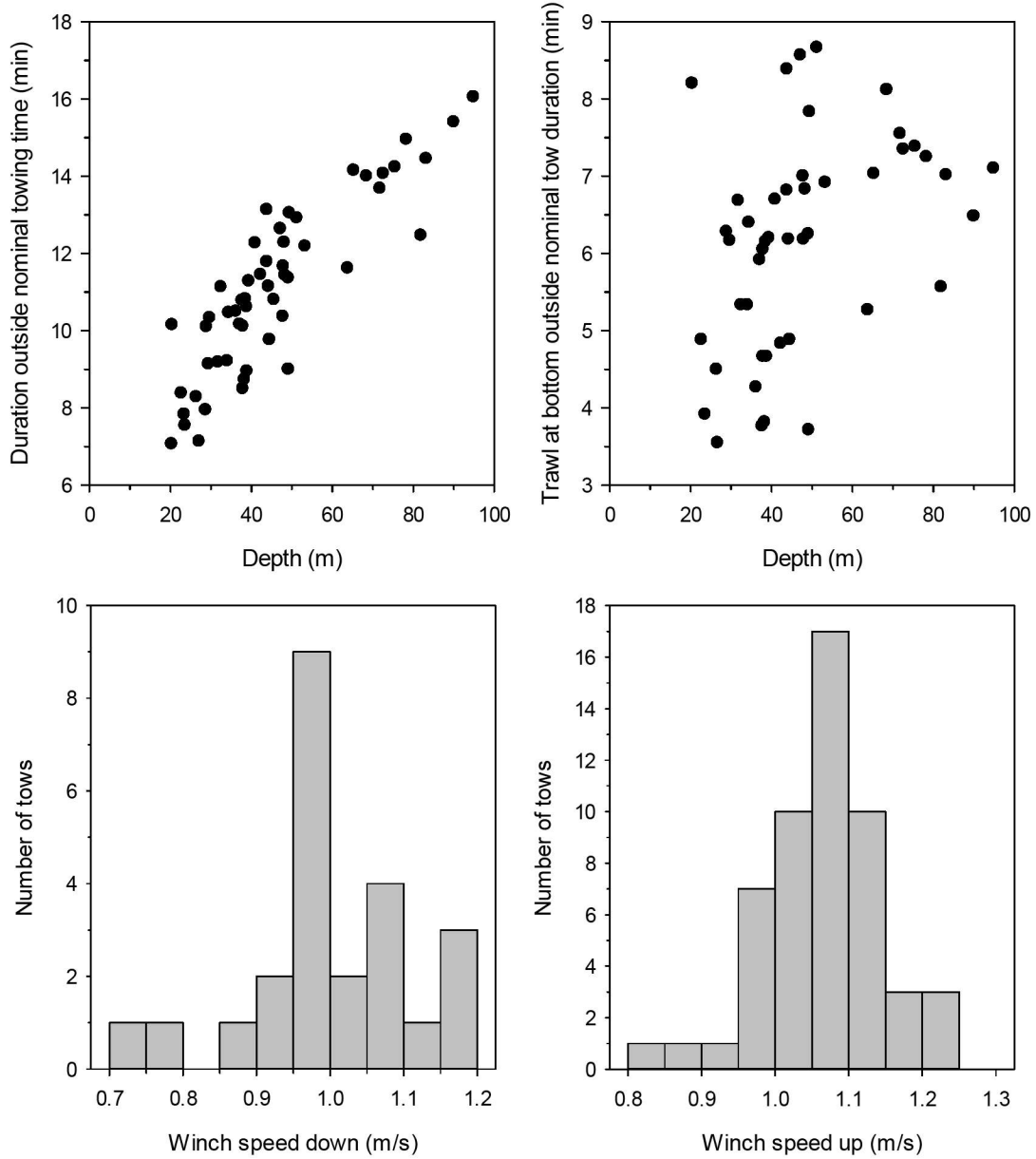


Fig. 5: Fishing times outside the nominal tow duration and winch speeds during descend and ascent.

Tab. 1: Species list, Dana DK IBTS 3Q 2018 (L: total length in mm below (fish); ML: mantle length (cephalopods); CPL or CPW: carapace length or width (crustaceans)).

Latin name	English name	Danish name	Weight (kg)	Number	L _{min}	L _{max}	Remark
<i>Aequipecten opercularis</i>	Queen scallop	Jomfruøster	0.076	3	-		
<i>Agonus cataphractus</i>	Pogge	Panser ulk	0.375	29	80	150	
<i>Alloteuthis subulata</i>	European common squid	Dværghælksprutte	3.670	556	20	140	ML
<i>Amblyraja radiata</i>	Starry ray	Tærbe	11.795	27	190	470	
<i>Ammodytes marinus</i>	Lesser sandeel	Tobis-hav	820.456	29751	50	255	
<i>Arnoglossus laterna</i>	Scaldfish	Tungehvarre	0.756	70	70	190	
<i>Raja brachyura</i>	Blonde ray	Blond rokke	8.724	4	470	710	
<i>Buglossidium luteum</i>	Solenette	Glastunge	1.361	160	40	120	
<i>Callionymus lyra</i>	Common dragonet	Stribet fløjfisk	4.700	144	30	240	
<i>Cancer pagurus</i>	Edible crab	Taskekrabbe	77.848	209	50	209	CPW
<i>Chelidonichthys cuculus</i>	Red gurnard	Tværstribet knurhane	0.966	6	230	300	
<i>Chelidonichthys lucerna</i>	Tub gurnard	Rød knurhane	6.303	20	210	440	
<i>Ciliata mustela</i>	Five-bearded rockling	Femtrådet havkvæbde	0.112	1	230	230	
<i>Clupea harengus</i>	Herring	Sild	6387.112	471734	55	275	
<i>Dicentrarchus labrax</i>	Bass	Havbars	1.418	1	510	510	
<i>Echiichthys vipera</i>	Lesser weever	Fjæsing lille	53.407	2381	50	180	
<i>Enchelyopus cimbrius</i>	Four-bearded rockling	Firetrådet havkvæbde	1.393	36	110	240	
<i>Engraulis encrasicolus</i>	Anchovy	Ansjos	0.065	2	160	180	
<i>Eutrigla gurnardus</i>	Grey gurnard	Grå knurhane	1052.522	12441	120	360	
<i>Gadus morhua</i>	Cod	Torsk	40.346	51	210	740	
<i>Gaidropsarus macrothalamus</i>	Big-eye rockling	Storøjet havkvæbde	0.069	1	240	240	
<i>Galeorhinus galeus</i>	Tope	Gråhaj	235.512	19	610	1610	
<i>Glyptocephalus cynoglossus</i>	Witch	Skærising	0.942	3	310	420	
<i>Gymnammodytes semisquamatus</i>	Smoothed sandeel	Tobis-nøgen	6.266	507	160	210	
<i>Hippoglossoides platessoides</i>	American plaice	Håising	63.513	1282	100	270	
<i>Hippoglossus hippoglossus</i>	Atlantic halibut	Helleflynder	6.546	2	570	720	
<i>Homarus gammarus</i>	Lobster	Almindelig hummer	19.067	48	47	126	CPL
<i>Hyperoplus lanceolatus</i>	Greater sandeel	Tobiskonge	150.269	4865	145	360	
<i>Illex coindetii</i>	Southern shortfin squid		1.463	18	110	170	ML
<i>Lampetra fluviatilis</i>	River lamprey	Flodlampret	0.037	1	280	280	
<i>Limanda limanda</i>	Common dab	Ising	2299.152	38422	30	340	
<i>Liparis sp.</i>	Sea-snail	Ringbug	0.005	3	40	60	
<i>Lithodes maja</i>	Norway king crab	Troidkrabbe	4.966	7	100	124	CPL
<i>Loligo forbesii/vulgaris</i>			1.841	163	10	130	ML
<i>Loligo forbesii</i>	Northern squid		4.211	282	20	240	ML
<i>Loligo vulgaris</i>	European squid		0.544	4	130	180	ML
<i>Lophius piscatorius</i>	Monk	Havask	6.637	4	210	640	
<i>Lumpenus lamprætaeformis</i>	Snake blenny	Spidsalet langebarn	0.028	1	280	280	
<i>Melanogrammus aeglefinus</i>	Haddock	Kuller	421.535	1693	70	460	
<i>Merlangius merlangus</i>	Whiting	Hvilling	5046.278	49000	30	380	
<i>Merluccius merluccius</i>	Hake	Kulmule	14.659	7	360	830	
<i>Microchirus variegatus</i>	Thickbak sole	Båndet tunge	0.052	1	160	160	
<i>Microstomus kitt</i>	Lemon sole	Rødtunge	124.049	1227	50	380	
<i>Mullus surmuletus</i>	Striped red mullet	Stribet (rød) mulle	10.739	85	140	300	
<i>Mustelus asterias</i>	Starry smooth-hound	Stjernehaj	45.172	21	520	970	
<i>Mustelus mustelus</i>	Smooth hound	Glathaj	33.970	13	750	1090	
<i>Myoxocephalus scorpius</i>	Sculpin	Ulke	1.400	33	40	200	
<i>Myxine glutinosa</i>	Hagfish	Slimål	0.045	1	not measured		
<i>Nephrops norvegicus</i>	Norway lobster	Jomfruhummer	14.225	506	22	53	CPL
<i>Pecten maximus</i>	Atlantic scallop	Stor kammusling	0.194	3	-		
<i>Pholis gunnellus</i>	Butter fish	Tangspræl	0.288	17	120	200	
<i>Phrynorhombus norvegicus</i>	Norwegian topknot	Småhvarre	0.031	2	80	130	
<i>Platichthys flesus</i>	Flounder	Skrubbe	3.723	15	220	340	
<i>Pleuronectes platessa</i>	Plaice	Rødspætte	429.304	2952	100	490	
<i>Pollachius virens</i>	Saithe	Sej	15.916	3	400	1090	
<i>Pomatoschistus spp.</i>	Sand gobies	Sand kutling	0.003	3	20	60	
<i>Raja clavata</i>	Thornback ray	Sømrøkke	57.588	20	360	910	
<i>Raja montagui</i>	Spotted Ray	Storpletet rokke	21.264	25	310	580	
<i>Rossia macrosoma</i>	Stout bobtail squid		0.015	5	-		
<i>Sardina pilchardus</i>	Pilchard	Sardin	68.816	760	120	250	
<i>Scomber scombrus</i>	Mackerel	Makrel	484.471	2840	100	400	
<i>Scophthalmus maximus</i>	Turbot	Pighvarre	12.046	16	210	460	
<i>Scophthalmus rhombus</i>	Brill	Slethvarre	2.996	4	330	400	
<i>Scyliorhinus canicula</i>	Lesser spotted dogfish	Småpletet rødhaj	259.804	431	300	690	
<i>Sepiella atlantica</i>	Atlantic bobtail squid		0.075	24	-		
<i>Solea solea</i>	Sole	Tunge	3.205	31	160	300	
<i>Sprattus sprattus</i>	Sprat	Brisling	8116.699	975681	50	145	
<i>Squalus acanthias</i>	Picked dogfish	Pighaj	52.850	11	740	1210	
<i>Todaropsis eblanae</i>	Lesser flying squid		0.093	1	100	100	ML
<i>Trachinus draco</i>	Greater weever fish	Fjæsing	7.296	46	180	400	
<i>Trachurus trachurus</i>	Horse mackerel	Hestemakrel	2413.361	372777	40	270	
<i>Trisopterus esmarkii</i>	Norway pout	Sperling	25.611	920	50	200	
<i>Trisopterus luscus</i>	Whiting pout	Skægtorsk	58.920	445	150	290	
<i>Trisopterus minutus</i>	Poor-cod	Glyse	18.708	398	130	210	
<i>Zeus faber</i>	John dory	Sct. peter fisk	0.426	2	210	230	

Tab. 2: Number of single fish data (length, weight, sex and maturity) and samples for ageing, Dana DK IBTS 3Q 2018.

Species	Total
Herring (<i>Clupea harengus</i>)	459
Sprat (<i>Sprattus sprattus</i>)	255
Cod (<i>Gadus morhua</i>)	51
Haddock (<i>Melanogrammus aeglefinus</i>)	142
Whiting (<i>Merlangius merlangus</i>)	517
Saithe (<i>Pollachius virens</i>)	3
Norway pout (<i>Trisopterus ermarkii</i>)	23
Mackerel (<i>Scomber scombrus</i>)	225
Plaice (<i>Pleuronectes platessa</i>)	681
Hake (<i>Merluccius merluccius</i>)	7
Sum:	2363

Tab. 3: Preliminary abundance indices (number per hour trawling) for commercial IBTS species per tow, Dana DK IBTS 3Q 2018.

St No	Age:	COD			HADDOCK			WHITING			NORWAY POUT			HERRING			SPRAT		MACKEREL			SAITHE			PLAICE			
		<18	18-37	≥38	<17	17-29	≥30	<17	17-23	≥24	<13	13-15	≥16	<15.5	5.5-22.5	≥23	<13	≥13	<17	17-29	≥30	<22	22-32	≥33	<10	10-18	≥19	
Rect	Length:																											
2	43F9							8												214	28						124	166
16	43F8		6	2	30	48	8	22	168	140	54	1351	155	11	1874	826							6			2	6	
18	43F7				4			6	22					2	28				2							10	62	
20	43F6		10	10	10	94	6		430	112					6	2											119	
33	42F7							4	8					32	158				2	10						34	60	
34	42F7							2	4					48	269	2	10	38	2							52	217	
36	41F7							2	6				113270	53478		140149	1310									54	245	
39	41F7							2	42											6						26	141	
50	41F6		2	10				30	40	2				517	2715		4891	508								4	117	
52	41F6							10	8					124	258	2	1545	99								10	154	
53	42F6			2				4	8											642	6						32	
55	42F5							54	12	2				4	2		381	33								2	86	
69	41F5				2			82	56	10	2			929	5095		7255	3628								4	150	
71	41F5				6			4						98	363		28604	8513									34	
72	41F4				16	6	6	2	12	6																	16	
75	41F3				16	8	4	32	36	32																	22	
86	41F2		2		129	6	14	2	319	277																	36	
87	41F1		6		8	106	242	2	408	697				2											4		20	
89	41F0		6		16	387	636		507	1109		128	70		4	10				191	505							
101	39E9		2			606	284		1546	4748				2	2	6	10	4		8	14					4	76	
102	39F0		4		2	74	447		1404	1318				9	996	4	76	66			6						44	
104	39F1				138			4	4	14				1799	46782		9103	1000			2						32	
118	39F2							46	155	2					22		14	2			28						135	
119	39F3							280	44	2										4						2	68	
121	39F4			2				64	54	10				10063	25792		31125	14301									38	
135	39F5													20776	23509		69531	1391								8	299	
136	39F6							255	106	22				6421	283		102321										66	
138	39F7							6	16	2											1948	105				97	12	
146	35F4							203	4					302325	44	1168375	5842	28	96	2						12	24	
149	35F3							2	6					494	2	74	18	229	18							26	36	
150	34F4							70	8					161797	18	86971		8	56							2	2	
159	34F3							30	22	10				389	2	12										2	24	
160	33F4							513	10	4				12367	2	29724										64	24	
162	33F3							245	16	2				143408	4	59778			28	24						4	18	
164	33F3							4	4												4						2	30
176	32F2		2						1356	2888					2	2					70	42				2	72	
177	33F2		2						1498	3460					1088	787					596	126					8	
179	33F2		2	2				2	6	20	44									28	2						14	
181	34F2		6						29094	22306					30	8					54	18					24	
197	35F2													299			140683				28	2					88	
198	35F1							26	10	2							144	2			14	4				116	192	
199	35F1		2					135	53	148											2	11						
215	36F0							2462	181	68	2			416	2	2	11385				10					122	367	
216	37F0				2			68	107	76				4	16	163	52	66	18							12	30	
217	36F1							731	98	18				22	2	380	2	2								14	64	
234	37F1			12			20	16	2975	2975		6	16			18	2	2	4							29	680	
235	36F2							262	1918	68				6		54				4	4					6	82	
237	37F2		4	6				763	3054	2700		2	6	822	10	3859	5									2	38	
239	37F3							8	14					30	4	448	12			24						12	58	
254	37F4							1424	156	14				1036		19194	69									6	50	
255	37F5							30	12					70		184	2	2	184	20						128	108	
257	37F6							324	2					44		134				36						18	56	
273	37F7							340	38	2				38		651				32	6					34	119	

Annex 1: A Pilot survey on the feasibility of establishing a sprat recruitment index based on larval sampling during Q3 IBTS surveys

Bastian Huwer & Peter Munk, DTU Aqua

Background

Sprat is a short-lived species, and the sprat stock in the North Sea is dominated by young fish. Thus, the size of the stock is driven to a large degree by the recruiting year class, and catches are mainly composed by 1 year old fish (up to ~80%). Sprat is an important forage fish and represents a major food source for many other fish species as well as sea birds and mammals. Thus it is a highly relevant species in multispecies approaches to fisheries management. An analytical assessment of sprat was established some years ago, however the availability & quality of data for the assessment are relatively poor and the assessment of and advice for the North Sea sprat stock need to be improved. There is e.g. presently no information on early life stages available for short-term forecasts or for use in the stock assessment model. However, such information would be important, in particular because sprat is a short-lived species that matures early.

With this background, a pilot survey targeting sprat larvae was conducted during nighttime in August 2018 during the Danish Q3 IBTS onboard of DANA, with a second pilot survey planned for the Q3 IBTS in 2019. The overall goal of these surveys is to evaluate the feasibility of establishing a sprat recruitment index based on larval sampling on the Q3 IBTS surveys. Thus, the basic idea is to follow similar procedures as the MIK herring larvae surveys during the Q1 IBTS. These surveys are targeting larger larvae and the abundance of these has shown to relate to later recruitment to the stock, thus providing a recruitment index for autumn spawning herring in the North Sea.

The specific aims of the sprat larvae pilot surveys are to investigate if:

- sprat larvae can be caught in appropriate numbers with a MIK net during nighttime on the Q3 IBTS
- the MIK sampling can effectively be incorporated into the standard routines during Q3 IBTS
- the sampling can cover the relevant areas of major sprat larvae occurrence
- spawning activity of sprat is finished well before the time of the survey
- there are significant differences in catchability during daylight vs. nighttime hours
- the caught sprat larvae have a suitable size range, are representative for the entire year-class and can provide a reliable recruitment index

Survey description

The gear in use during the 2018 survey was a MIK net with 2 meter diameter. During the first hauls, a net with a mesh size of 1.6 mm was used. However, as there were many relatively small larvae in the first samples, the mesh size was changed to 1.0 mm during the remainder of the survey (Fig. 1). In addition, a small MIKey M net (20 cm Ø, 500 µm mesh size) was attached to the MIK ring (Fig. 1) in order to test if there are still eggs and/or very small larvae in the area, which would indicate that spawning activity has not finished yet.

The gear was equipped with a Scanmar depth sensor and was deployed in a double-oblique haul from the surface to 5 meter above the sea-floor (measured from the lower end of the MIK ring). Fishing speed was 3

knots through the water, and the wire was paid out at a speed of 25 metres per minute ($= 0.4 \text{ ms}^{-1}$) and retrieved at 15 metres per minute ($= 0.25 \text{ ms}^{-1}$). Both the MIK and the MIKey M were equipped with flowmeters to record the volume of filtered water.

Preliminary results

A total of 80 valid MIK hauls were conducted. However, 14 of these hauls were conducted in relation to tests of catchability between day and night or between different mesh sizes, and in these cases a series of hauls were conducted at the same position. As a result, in terms of different sampling locations a total number of 66 different stations were sampled (Fig. 2).

Clupeid larvae were observed in all hauls except for the first two stations north of Jutland (Fig. 3). Preliminary estimates of numbers of clupeid larvae per station show that many stations yielded several hundred larvae, 5 stations around 1000 larvae and at a single station west off Esbjerg about 3500 larvae (Fig. 3 & 4a). In total, it is estimated that about 20000 clupeid larvae were caught. Concerning the size of clupeid larvae, a broad size range from approx. 6 mm to juvenile fish of 4-5 cm was caught (Fig. 4b). Considering the usual spawning times of clupeids in the area, it can be assumed that the majority of clupeid larvae are sprat, but it cannot be excluded that also sardine and maybe also small herring larvae are among the sample material. Thus, precise identification to species level as well as precise determination of larval numbers and sizes by species awaits further detailed analyses in the laboratory.

The MIKey M nets await further, detailed analysis in the laboratory, but preliminary checks of the samples during the survey did not suggest any catches of sprat eggs. This indicates that sprat spawning activity was finished well before the time of the survey, that all larvae have hatched and that the surveys are thus covering the total larval production. On some stations high numbers of relatively small larvae were caught, in particular along the Danish coast. These smaller larvae may still experience high variability in survival between years, i.e. a linkage to recruitment may not yet be established for these size ranges. Therefore, detailed analyses of size-frequencies and modelling of size related mortalities would be necessary to evaluate the potential of the surveys for providing a suitable recruitment index for sprat.

The catchability tests between day and night hauls showed significant differences, with considerably lower numbers of clupeid larvae caught during daylight hours than during darkness. Thus, if one wants to establish a regular sprat larvae survey during the Q3 IBTS, it is strongly suggested to limit larval sampling to the period between sunset and sunrise.

In addition to clupeids, a number of larvae of other fish species were caught in the MIK. Some of the most abundant species were mackerel, horse mackerel, sandeel, gurnards and lemon sole, scaldfish & several other flatfish, as well as several other, non-commercial species, e.g. gobies, crystal goby, rocklings, pipefish, dragonets and greater weever. In addition, a rather limited number of larger gadoid larvae and/or pelagic juveniles were caught. Concerning mackerel larvae, there was a tendency of higher catches in the northern part of the sampling area, whereas horse mackerel dominated in the southern part.



Figure 1:

The MIK net (1000 μm mesh size) with attached MIKey M net (500 μm mesh size) on the upper left.

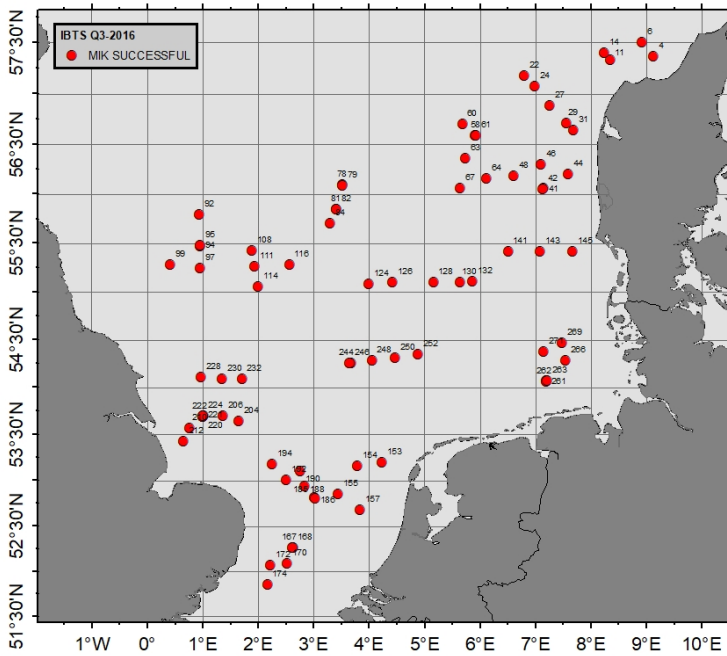


Figure 2:

Map of the sampling stations. Numbers indicate the ship station numbers. A total of 66 different positions were sampled. However, on some stations several hauls were conducted in order to test for differences in catchability between day and night or between different mesh sizes. Thus, a total of 80 valid hauls were conducted.

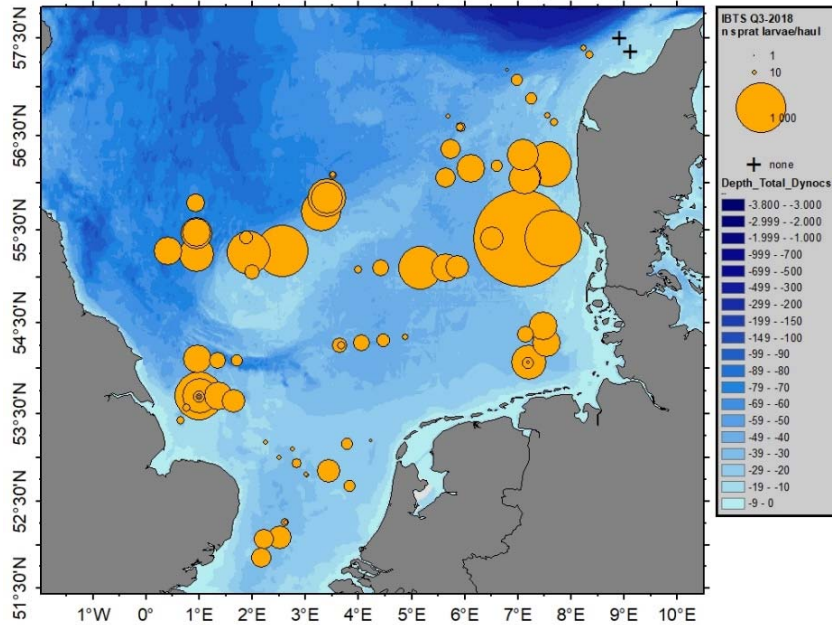


Figure 3:

Preliminary estimates of numbers of clupeid larvae per haul. The high larval numbers close to the Danish coast were mainly comprised of relatively small larvae.



Figure 4a (left) and b (right): A broad range of size classes of clupeid larvae were caught during the survey. The picture on the left shows the sample with the highest number of larvae west off Esbjerg (Station 143 in Fig. 2), which was mainly comprised of relatively small larvae. The picture on the right shows an example from a station close to the UK coast (Station 206 in Fig. 2), where a broad size range of clupeid larvae and juveniles were caught, ranging from approx. 8-10 mm to juvenile fish of 4-5 cm.