WORKING GROUP ON SURVEYS ON ICHTHYOPLANKTON IN THE NORTH SEA AND ADJACENT SEAS (WGSINS; outputs from 2024 meeting)

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i Executive summary

The Working Group on Surveys on Ichthyoplankton in the North Sea and adjacent Seas (WGSINS) coordinates surveys on fish early life stages undertaken for assessment and management purposes. The objectives of WGSINS include review and coordination of these surveys, quality assurance on survey methodology, species identification, provided data and indices, preparation of data for archival, as well as identification of additional objectives that can be achieved by the surveys. WGSINS coordinates seven surveys, three in the North Sea (IHLS - International herring larvae surveys in the North Sea, MIK - North Sea Midwater Ring Net survey, DRS - Downs recruitment survey), two in the Irish Sea (NINEL - Northern Irish Northeastern Larvae Survey, NI-MIK - Northern Ireland MIK Survey) and two in the Baltic (RHLS - Rügen herring larvae survey, BIS - Baltic Ichthyoplankton Surveys). Most surveys target herring larvae from various stocks, while the NI-MIK targets pelagic juvenile gadoids and the BIS eggs and larvae of Eastern Baltic cod.

At WGSINS 2024, cruise summaries and results from the seven surveys were presented. All relevant estimates and indices from the surveys were updated, and data were uploaded into the ICES eggs and larvae database. New methodologies to incorporate the DRS into the MIK recruitment index time-series were discussed, concluding that these can provide improvements to the existing MIK index. These recent developments will be presented to the Herring Assessment Working Group (HAWG). The chair of WGELFADG and representatives from the ICES Data Centre presented updates regarding the ICES eggs and larvae database. Members of WGSMART presented updates with focus on the egg and larvae module in SmartDots. Several topics concerning the standardization of sampling and sample processing procedures were discussed, including updates to the survey manuals, species identification, sub-sampling & treatment of damaged larvae.

WGSINS provides a forum to present and discuss additional information and data products that can be provided by ichthyoplankton surveys, such as investigations on non-target ichthyoplankton species, other organisms like jellyfish and zooplankton, or marine litter. Several presentations highlighted the potential of ichthyoplankton surveys to provide added value, improving our understanding of pelagic ecosystems and contributing to stock assessment and management. This included e.g. sampling of cephalopod early life stages to identify spawning and nursery areas and the concept of a “holistic approach”, aiming to combine data from various surveys on different life stages to obtain a more holistic understanding of the life cycle of a specific species in time and space.

A major goal of WGSINS is to assess possibilities for the different ichthyoplankton surveys to supply ecosystem data to support the implementation of an ecosystem approach to fisheries management. Thus, tables with “Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS” were compiled, providing comprehensive information on all presently ongoing additional sample and data collections on the surveys coordinated by WGSINS.

WGSINS will continue to collect and archive additional information, underrepresented in traditional fishery survey datasets, aiming to contribute to the implementation of an ecosystem approach to fisheries management.

ii Expert group information

Expert group name	Working Group on Surveys on Ichthyoplankton in the North Sea and adjacent Seas (WGSINS)
Expert group cycle	Multiannual fixed term
Year cycle started	2022
Reporting year in cycle	3/3
Chair	Bastian Huwer, Denmark
Meeting venue(s) and dates	29 November - 01 December 2022, Belfast, Northern Ireland (13 participants)
	28 November - 01 December 2023, Aberdeen, Scotland, United Kingdom (12 participants)
	26 November - 29 November 2024, Kgs. Lyngby, Denmark (12 participants)

1 Survey results

1.1 The International Herring Larvae Surveys in the North Sea (IHLS)

1.1.1 The IHLS in 2023/2024

Five areas were covered within the framework of the International Herring Larvae Surveys in the North Sea during the sampling period 2023–2024. They monitored the abundance and distribution of newly hatched herring larvae in the Orkney/Shetlands area, in the Buchan area (two observation periods) and the central North Sea (CNS) in September and in the southern North Sea (SNS) in December 2023 (Figure 1.1.1). While four cruises were conducted as scheduled, the survey in the English Channel in January 2024 had to be cancelled due to technical problems of the vessel. Chartering a replacement vessel in due course was not possible.

The survey around the Orkneys revealed relatively low quantities of newly hatched larvae. Their distribution was in line with previous years, catching most larvae just east of the Orkney. The strikingly different distribution observed in 2022, when most larvae were found much more easterly than usual, was not present again.

In the Buchan and the central North Sea, larger concentrations of newly hatched larvae were observed in two areas, while the remaining stations contributed only very low numbers of larvae (Figure 1.1.1).

An average, most larvae in the southern North Sea in the December survey are found on stations in the western survey area. This was also observed in 2023. However, larvae were distributed somewhat closer towards the English and French coast line than usual. This may be a result of wind-induced larvae drift or changes in preference of or absence on used spawning grounds.

No survey was planned for the second half of January 2024. Instead, an additional MIK sampling is scheduled for April 2024 in the German Bight and Skagerrak/Kattegat area. This sampling should shade light on the foraging and recruitment of herring larvae originating from the Downs stock component. The survey is described in section 1.3.

The Larvae Abundance Index (LAI, Tab 1.1.1) is used as input data into the North Sea autumn spawners assessment model. Spatial stock dynamics are resolved inside the model.

For the second year in a row, newly hatched herring larvae at the spawning grounds were less abundant compared to previous years (Tab.1.1.1, Fig 1.1.2). To what extend this is due to only partial coverage of the hatching period, changes in spawning time or mortality (egg mortality or reduced larvae survival due to a mismatch with food occurrence and food size) can't be disentangled.

However, the low abundance of herring larvae observed in the last two years in the IHLS and low numbers of 0-ringers found in the MIK sampling somewhat later in the year, could be taken as a kind of alarm signal when successful herring reproduction is concerned.

At time of the 2024 WGSINS meeting, the 2024/2025 sampling period is still in progress. Plankton sorting and larvae length measurements are ongoing.

Table 1.1.1 Herring Larvae Abundance Time-Series (LAI) of larvae <10 mm long (<11 mm for the SNS), by sampling area and time periods. The numbers of larvae are expressed as mean numbers per area * 10^9

	Orkney/ Shetland		Buchan		Central North Sea		Southern North Sea			
Period/ Year	1-15 Sep.	16-30 Sep.	1-15 Sep.	16-30 Sep.	1-15 Sep.	16-30 Sep.	1-15 Oct.	16-31 Dec.	1-15 Jan.	16-31 Jan.
1973	2029	822	3	4	492	830	1213			1
1974	758	421	101	284	81		1184		10	
1975	371	50	312			90	77	1	2	
1976	545	81		1	64	108			3	
1977	1133	221	124	32	520	262	89	1		
1978	3047	50		162	1406	81	269	33	3	
1979	2882	2362	197	10	662	131	507		111	89
1980	3534	720	21	1	317	188	9	247	129	40
1981	3667	277	3	12	903	235	119	1456		70
1982	2353	1116	340	257	86	64	1077	710	275	54
1983	2579	812	3647	768	1459	281	63	71	243	58
1984	1795	1912	2327	1853	688	2404	824	523	185	39
1985	5632	3432	2521	1812	130	13039	1794	1851	407	38
1986	3529	1842	3278	341	1611	6112	188	780	123	18
1987	7409	1848	2551	670	799	4927	1992	934	297	146
1988	7538	8832	6812	5248	5533	3808	1960	1679	162	112
1989	11477	5725	5879	692	1442	5010	2364	1514	2120	512
1990		10144	4590	2045	19955	1239	975	2552	1204	
1991	1021	2397		2032	4823	2110	1249	4400	873	
1992	189	4917		822	10	165	163	176	1616	
1993		66		174		685	85	1358	1103	
1994	26	1179				1464	44	537	595	
1995		8688					43	74	230	164
1996		809		184		564		337	675	691
1997		3611		23				9374	918	355

	Orkney/ Shetland		Buchan		Central North Sea			Southern North Sea		
1998		8528		1490	205	66		1522	953	170
1999		4064		185		134	181	804	1260	344
2000		3352	28	83		376		7346	338	106
2001		11918		164		1604		971	5531	909
2002		6669		1038			3291	2008	260	925
2003		3199		2263		12018	3277	12048	3109	1116
2004		7055		3884		5545		7055	2052	4175
2005		3380		1364		5614		498	3999	4822
2006	6311	2312		280		2259		10858	2700	2106
2007		1753		1304		291		4443	2439	3854
2008	4978	6875		533		11201		8426	2317	4008
2009		7543		4629		4219		15295	14712	1689
2010		2362		1493		2317		7493	13230	8073
2011		3831		2839		17766		5461	6160	1215
2012		19552		5856		517		22768	11103	3285
2013		21282		8618		7354		5	9314	2957
2014		6604		5033		1149				1851
2015		9631		3496		3424		2011	1200	645
2016				3872		3288		20710	1442	1545
2017				5833		3965		10553	5880	
2018		102		1740		1509		1140		
2019	2488		5654	3794		10605		14082	5258	
2020		3208		3418		7663		4077	9704	
2021		6651		1413		3282		8899	8764	
2022		2758		1471		188		3712	743	
2023	759		318	1049		1392		2474		

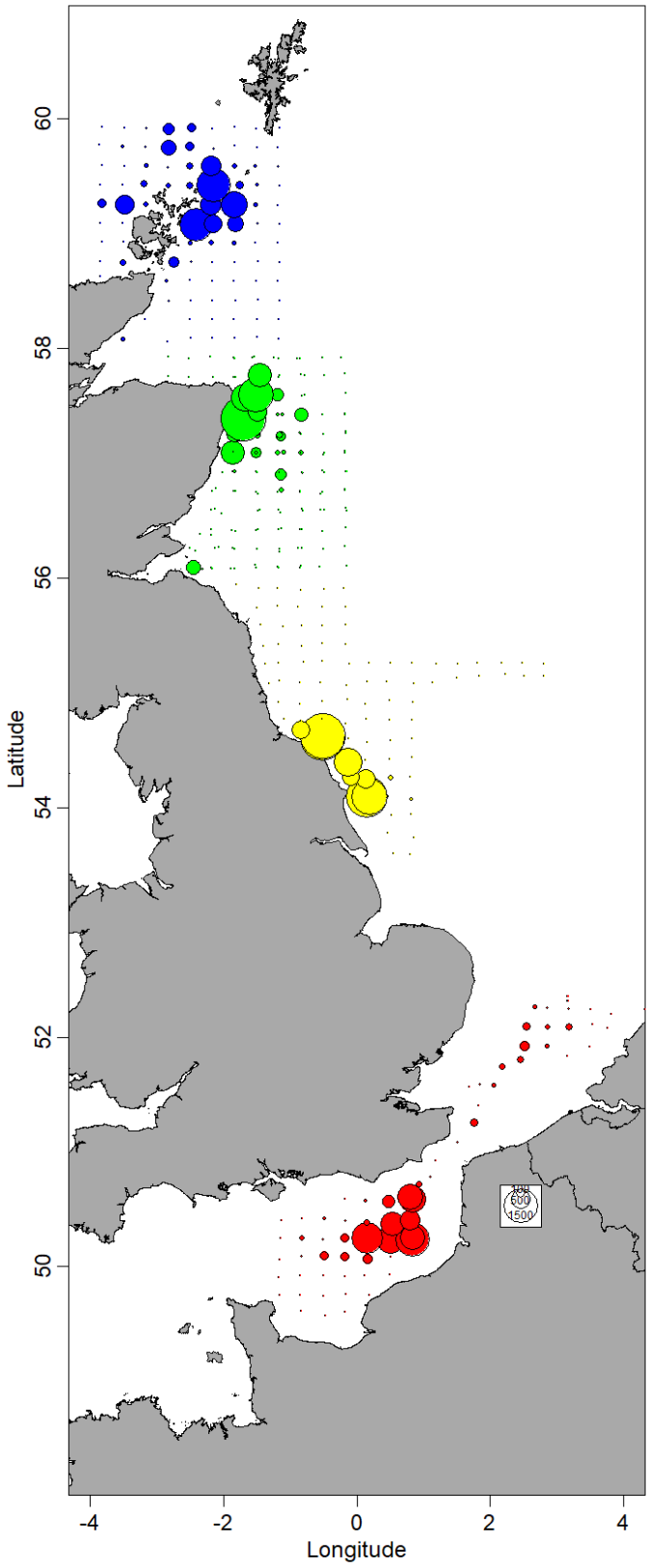

Figure 1.1.1 North Sea herring - Abundance of herring larvae < 10 mm (n/m²) at the main spawning grounds (Orkney/Shetlands = blue circle, Buchan area = green circles, central Banks = yellow circles and Downs = red circles, maximum circle size = 1 500 n/m²). The three northern areas were monitored in September 2023 and the southern North Sea in December 2023.

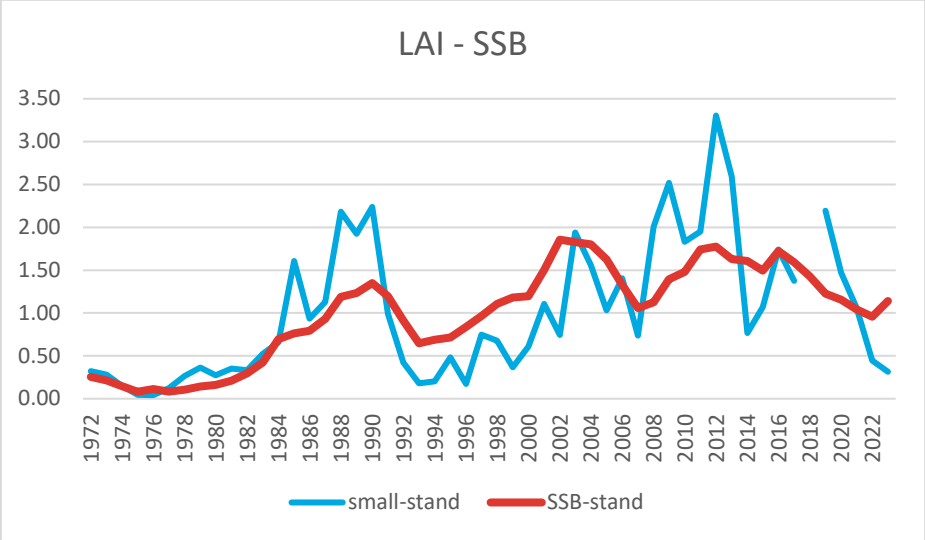

Figure 1.1.2. North Sea herring – Comparison of standardized LAI time-series and SSB in the North Sea.

1.1.2 Planning of the 2025 IHLS surveys

The IHLS surveys give information about herring larvae hatching success and larvae abundance on the main spawning grounds of North Sea autumn spawning herring. They also inform about the relative contribution of the different spawning components to the whole stock. In general, on four different spawning areas, two (Orkney/Shetlands and Buchan) or three (Banks and Downs) sampling periods are needed monitoring the full spawning activity. This condition hasn't been met since the mid of the 1990s, when several participants left the larvae surveys and continued with acoustic surveys thereafter. Nowadays, only the Netherlands and Germany participate in the IHLS and it is only possible to cover some sets out of the 10.

With concerns about the large gaps in the time-series and a number of areas uncovered over a wide range of years (e.g., Central North Sea in first half of September and October), it is hardly impossible to judge on the survey results properly. The LAI estimates can be biased due to survey effort. WGSINS discussed how to proceed with the IHLS and the survey design.

It was agreed that the focus of the surveys should be on a full coverage of one or two spawning areas each year, e.g., monitoring the whole hatching period, and that the effort should be shifted between years. Thus, a more robust LAI estimate for the NSAS assessment will become available every second year.

However, UK is in the process of seeking options for survey participation, possibly starting in the next campaign with area coverage in the first half of September 2025. This would simplify a better survey coverage, and the calculation and interpretation of LAI estimates. With additional survey effort by UK, monitoring the full hatching period become much more likely.

Samples that cannot worked up by the UK should be shipped to the Thünen-Institute of Sea Fisheries at Bremerhaven, where the samples will be analysed according to the IHLS procedure.

Instead of the survey in the southern North Sea in the 2nd half of January, an additional MIK-Survey, following foraging Downs herring larvae, was introduced and conducted since 2018. This additional survey sheds lights on the recruitment in the Downs stock component and is also scheduled to take place in spring 2024 (see Section 1.3 below).

The plan of the upcoming sampling period is given below.

Table 1.1.2 Areas and periods to be covered during the 2025 IHLS surveys

Area / Period	01.-15.09.	16.-30.09.	01.-15.10.
Orkney/Shetlands	UK?	FRG	
Buchan	None	NL	
Central	UK?	NL	FRG
Area/Period	16.-31.12.	01.-15.01.	16.-31.01.
Southern North Sea	NL	FRG	None

1.2 The North Sea Midwater Ring Net survey (MIK)

1.2.1 Background information

The North Sea Midwater Ring Net survey (MIK) is conducted at night-time during the International Bottom Trawl Survey in the North Sea in the first quarter of the year (Q1 IBTS). Hauls are conducted with the MIK net, a fine meshed (1600 μm) 2-m-midwater ring net (ICES 2017), in order to catch larvae of herring and other fish species. The MIK survey provides abundance estimates for large herring larvae (0-ringers) of the autumn spawning stock components. The total abundance of 0-ringers in the survey area provides the 0-ringer index (also called MIK index), which is used as a recruitment index for the North Sea herring stock by the Herring Assessment Working Group for the Area South of 62°N (HAWG).

Since 2017, this 0-ringer index time series is calculated with a new algorithm, which excludes larvae of Downs origin more rigorously. This is done by excluding the smaller larvae – presumably of Downs origin – from the analyses in certain parts of the survey area. Index values are calculated as described in detail in the Stock Annex for Herring in Subarea 4 and divisions 3.a and 7.d, autumn spawners (ICES 2022a). Note that this new index time-series based on the new algorithm only dates back to 1992, and that all French data before 2008 are excluded because of data quality issues.

In addition to the 0-ringer index, the Q1 IBTS also provides a time series of juvenile herring abundance in the North Sea (1-ringer index) which is based on the GOV bottom trawl catches carried out during daytime.

The time series of 0-ringer and 1-ringer indices from the Q1 IBTS survey exist since the 1977 year-class. It has to be borne in mind that the 0-ringer index reflects recruitment in the autumn spawning components, while the 1-ringer index includes both autumn spawning and other components. For more details on these two times series and their utilization in stock assessment, the reader is referred to the reports of the Herring Assessment Working Group for the Area South of 62°N (HAWG).

NOTE: There is presently an ongoing effort to establish a combined recruitment index for both the autumn spawning components and the winter spawning component (i.e. the Downs component), based on the Q1 MIK survey and the Downs Recruitment Survey (DRS). Further details on this can be found in the report section on the DRS (see section 1.3.2).

1.2.2 The MIK survey in 2024

The previous MIK surveys in 2022 and 2023 had been faced with numerous challenges including technical/mechanical problems, issues with Covid-19 infections and severe weather (see previous WGSINS reports for details). The 2024 survey was only faced with some minor challenges concerning technical/mechanical problems. However, there were again issues with severe weather conditions during large parts of the survey period, including very strong winds and wave heights up to 8-10 meters. As a result, basically all survey participants lost several days of survey time. None of the survey participants was able to conduct 100% of the planned MIK stations, and some only managed to conduct between 50-75% of planned stations. Nevertheless, due to intense coordination during the survey, it was possible to obtain a good coverage of the survey area.

A total of 581 MIK hauls were conducted in 2024 (Table 1.2.1, Figure 1.2.1), which is very similar to the 586 hauls conducted in 2023 and 148 hauls more than in 2022. For the 2024 MIK 0-ringer index (corresponding to the 2023 year-class), all hauls north of 51° N were used, in total 565 hauls (for comparison: 2023 = 569 hauls and 2022 = 410 hauls).

A total of 716 MIK hauls were planned according to the 2024 NSIBTS Q1 program (the target is 4 hauls per ICES rectangle) and 581 were conducted, i.e. 81% of the planned MIK-stations were sampled in 2024 (Table 1.2.1). However, there has been a general increase in the number of MIK hauls throughout the time-series, and the 581 MIK hauls achieved in 2024 are above the long-term average of 507 hauls (time-series since 1992). Besides, thanks to intense coordination between participants during the survey, almost all ICES squares in the survey area were covered (except for 3 squares), and the majority of ICES squares in the main distribution area of the herring larvae in the central and southern North Sea was well covered with 3 to 4 MIK hauls. However, in some cases the weather conditions and associated swapping of squares between participants resulted in a slightly uneven coverage, i.e. some squares were covered with even 5-6 hauls, while others were covered with only 1 or 2 hauls. Overall, the coverage achieved during the 2024 MIK survey was good and can be regarded to provide a representative 0-ringer index.

Table 1.2.1 Summary table of the MIK stations sampled during the North Sea Midwater Ring Net Survey in 2024

COUNTRY	MIK HAULS PLANNED	MIK HAULS CONDUCTED	% MIK CONDUCTED
Denmark	90	87	97
France	108	89	82
Germany	132	102	77
Netherlands	112	103	92
Norway	90	79	88
Scotland	116	88	76
Sweden	68	33	49
TOTAL	**716**	**581**	**81**

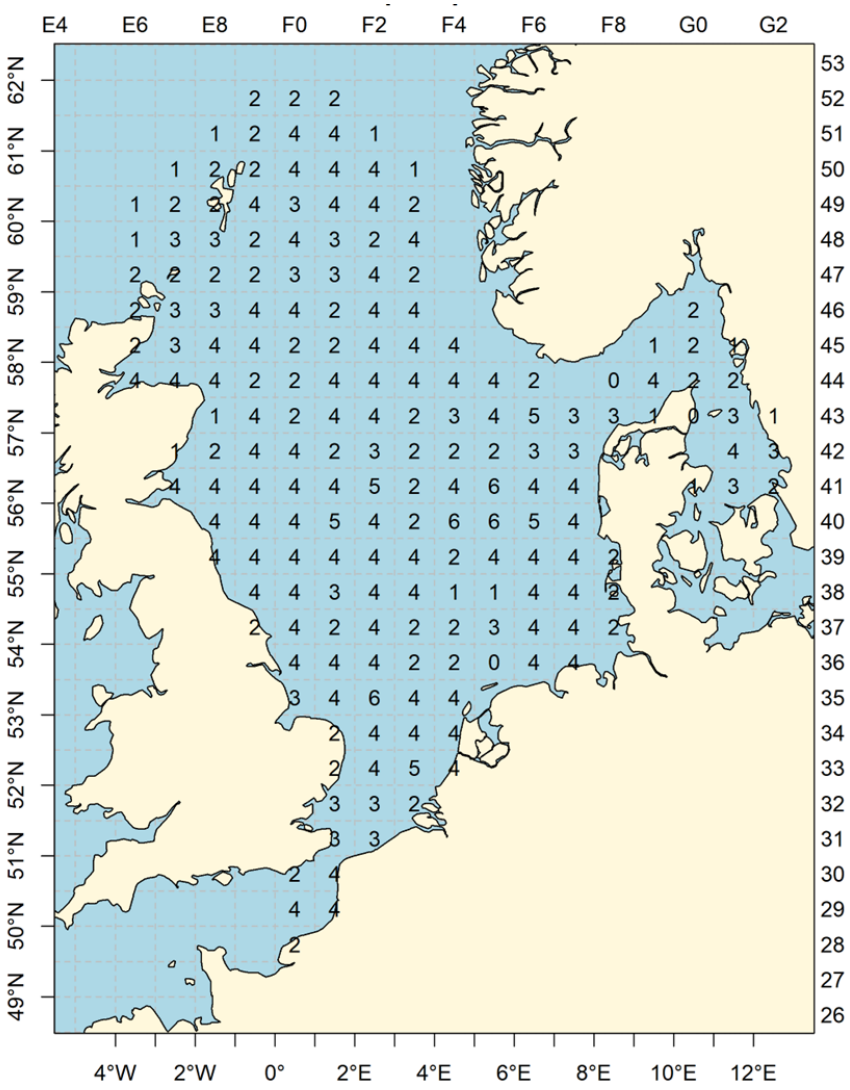

Figure 1.2.1 Numbers of conducted MIK hauls per ICES rectangle during the North Sea Midwater Ring Net Survey 2024.

1.2.3 Herring larvae distribution and abundance

Figure 1.2.2 shows the size distribution of herring larvae caught in the MIK in 2024. Herring larvae measured between 6 and 41 mm standard length (SL), which is similar to previous years. In most previous years, the smallest larvae <12 mm (which most likely are originating from the Downs component) are very numerous and often accounted for around 50 to 60% of the total number of larvae. At first glance, the size distribution for the 2024 survey gives the impression that there have been relatively many larger larvae in the size range 19-32 mm. However, looking at the absolute numbers reveals that there were actually rather few larvae in 2024 (total number of herring larvae in 2024 = 17899, in 2023 = 74801, in 2022 = 53697). Particularly the smaller larvae <12 mm were much less abundant than in other years, and they only made up 33% of the total number of larvae. Thus, the larger larvae actually only seem relatively numerous in relation to the few smaller larvae, but are not very abundant in absolute terms. The lower proportion of smaller larvae in 2024 may indicate a reduction or a shift in spawning time of the Downs component.

In the two previous surveys in 2022 and 2023, larvae in the size range between 13 and 17 mm were also numerous, with another peak at 15 mm. In contrast, the 2024 length distribution does not show this "intermediate" peak around 15 mm, but only two rather distinct peaks at 11 and 25 mm. This is also reflected in the relative share of larger larvae >18 mm SL in 2024 which was 36%, compared to only 20, 11 and 12% in the three previous years 2023, 2022 and 2021, respectively.

Figure 1.2.3 illustrates the spatial distribution of 0-ringers in 2022, 2023 and 2024. The 2024 distribution is partly similar to 2023, with higher abundances east of Scotland and along the UK coast. However, in the southeastern and eastern part of the North Sea, the potential nurseries, abundance of larger herring larvae in 2024 was higher than in the previous year, and the larvae seemed generally more spread out over the central North Sea in 2024. Furthermore, the rather high abundances in the English channel/Southern Bight area which were observed in 2022 and in particular in 2023 - and which had a relatively strong impact on the index values for these years - were not observed in 2024.

The MIK 0-ringer index from the 2024 survey (corresponding to the 2023 year-class) is 62.47. This is clearly below the long-term average of 99.5 (in the time-series since 1992), and only 11 years in the time series had a lower index while 21 years had a higher index than in 2024. The index values for the entire time series can be found in the reports of HAWG - Herring Assessment Working Group for the Area South of 62°N.

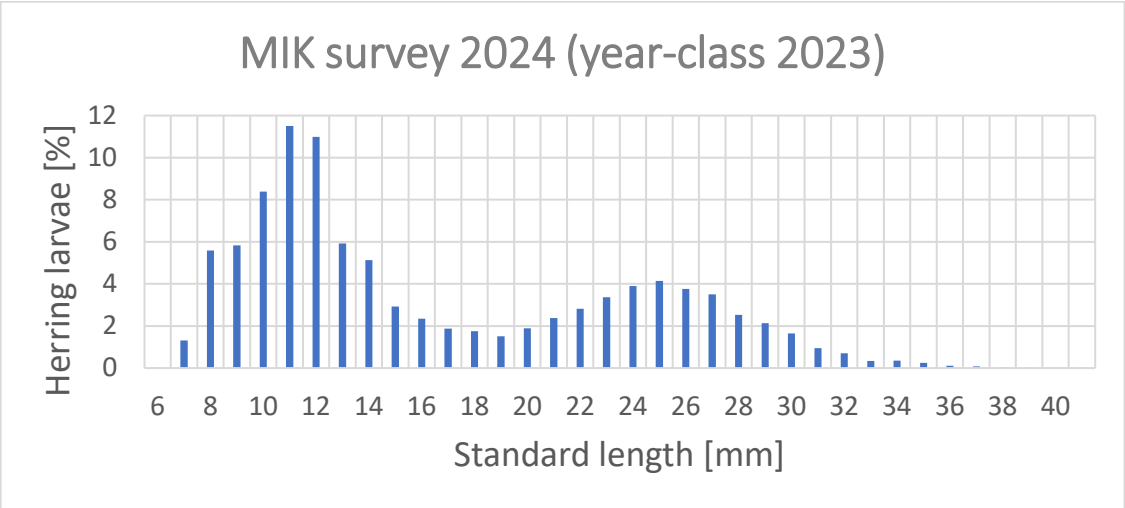

Figure 1.2.2 North Sea herring. Length distribution of all herring larvae caught in the MIK during the 2024 North Sea Midwater Ring Net Survey.

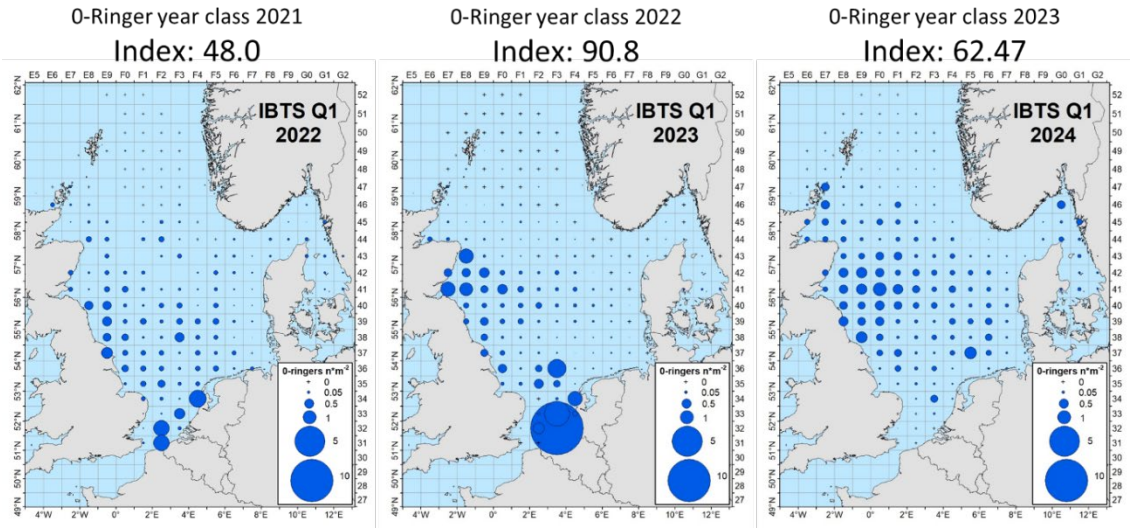

Figure 1.2.3 North Sea herring. Distribution of 0-ringer herring, year classes 2021–2023. Density estimates of 0-ringers (>18 mm) within each statistical rectangle are based on MIK catches during the North Sea Midwater Ring Net Surveys in January/February 2022-2024. Areas of filled circles illustrate densities in no m^{-2}.

1.2.4 Sardine larvae

As in previous years, sardine larvae were again found in the samples of the 2024 MIK survey. They occurred mainly in the southern and south-eastern North Sea as well as in the Skagerrak, but some were also found relatively far north up to ICES squares 44F4 and 44F5. However, their abundance was relatively low compared to previous years. A sardine larvae index was calculated with the same method as for the herring larvae. The sardine larvae index for 2024 was 3.94, while it was 7.84, 8.15 and 7.63 for 2023, 2022 and 2021, respectively.

1.2.5 Planning & Coordination of the 2025 North Sea Midwater Ring Net Survey (MIK)

The 2025 North Sea Midwater Ring Net Survey (MIK) will be carried out during the night-time of the 2025 first quarter IBTS (IBTS Q1). The IBTS Q1 survey coordinator circulates the international survey program during December 2024. MIK survey participants are now requested to submit their data directly to the ICES Eggs and Larvae Database (ELDB) in due time (i.e. 7 - 10 days) before the HAWG meeting.

ADDITIONAL SAMPLES TO BE COLLECTED FROM THE Q1 MIK HAULS:

Other fish larvae species & Marine litter: As in previous years, other fish larvae species and marine litter should be collected from the MIK samples.

NEW SINCE 2024 - CEPHALOPODS: At WGSINS 2023, the chair of WGCEPH gave a presentation on the general lack of information about early life stages and spawning areas of cephalopods in the North Sea (see also section 3.4). In order to start filling this knowledge gap, it was suggested to collect cephalopods from the MIK samples, and all MIK participants agreed to conduct this additional sampling. At WGSINS 2024, the chair of WGCEPH presented first results of this new effort from the 2024 survey, which looked very interesting and promising. Thus, even though funding for future sample analyses remains to be clarified, it was decided to continue this additional sampling. Samples of cephalopods should be preserved in separate sample

containers - preferably in ethanol - and sent to the chair of WGCEPH for future species identification and analysis.

Gelatinous zooplankton: Denmark has registered data on gelatinous zooplankton (species, numbers & sizes of jellyfish & ctenophores) from the Q1 MIK since 2014 and Sweden and Germany have also contributed in recent years. In order to improve the spatial coverage, other participants in the MIK surveys are encouraged to collect data on gelatinous zooplankton as well.

1.2.6 The MIKeyM net sampling

Since 2012, eggs are collected along with the MIK sampling using the MIKey M net (MM, ICES, 2018). In 2024, MM samples were obtained by all seven countries participating in the North Sea Midwater Ring Net Survey. MM samples were taken with every MIK sample when possible. The status of sample analyses varied between institutes, ranging from fish eggs identified where possible, staged and measured to still needs to be sorted.

1.2.7 Planning for the 2025 MIKey M net sampling

As in previous years, MM net sampling is planned to be carried out along-side MIK sampling during the North Sea Midwater Ring Net Survey in 2025. All institutes are asked to carry out at least two MIKey M net hauls (1 with every MIK haul) in each ICES statistical rectangle. However, there is no requirement for these samples to be worked up this year. The intention is to retain a reservoir of samples that can be used if interesting questions arise concerning egg and larvae distributions in the North Sea and Skagerrak or if there is a need for an uninterrupted time series of egg or larvae data. These samples should be stored at the respective institutes. Those institutes with sufficient resources will work up their samples and inform the rest of the group as to what they have done. The intention, as in previous years, is that every other haul per rectangle should be worked up according to the MM manual. The remaining plankton can then be discarded. All samples that are not sorted for fish eggs and larvae shall be stored at the respective institutes. In addition, the WG will consider a suitable time frame for retaining these samples for future analyses.

1.3 The Downs Recruitment Survey (DRS)

1.3.1 Survey in 2024

In 2024 the Downs Recruitment Survey (DRS) was carried out following the IBTS-MIK protocol (ICES 2017) as much as possible. After discussing the comparative sampling results at WGSINS 2023 (ICES 2024a), it was decided that from 2024 onwards sampling would only be carried out at night time. Because the daylight sampling is not carried out anymore a blue netting material is not necessary anymore. Instead of the usual black fabric is used for the night time sampling.

In 2024 it was planned that Germany, Norway and the Netherlands would participated in the survey. Unfortunately, Germany did not have a vessel available and Norway did not have survey time available for the DRS sampling. The Netherlands were the only participant in 2024.

The survey was conducted from 16 – 26 April, sampling 55 stations in total (Figure 1.3.1), but two stations were sampled during day time for the collection of herring larvae for genetic analyses. These last two stations are not included in the results figures. Due to the cancellation of the German survey it was not possible to cover the whole German Bight.

Herring larvae distribution was similar to last year, but different from previous surveys, with highest numbers found in the southern North Sea and some larvae North of the Netherlands

(Figure 1.3.2). There were a high number of empty stations (28%). Sprat larvae were found in many sample (Figure 1.3.3), but in fewer stations and lower numbers compared to 2023. All samples also contained high volumes of jellyfish, and other larvae, such as sandeel, gadoid and flatfish.

Length distributions of the herring larvae in the DRS was similar to previous surveys (Figure 1.3.4). Sprat larvae in the samples were smaller than the herring larvae and the sardine larvae were of comparable size as the herring larvae (Figure 1.3.4).

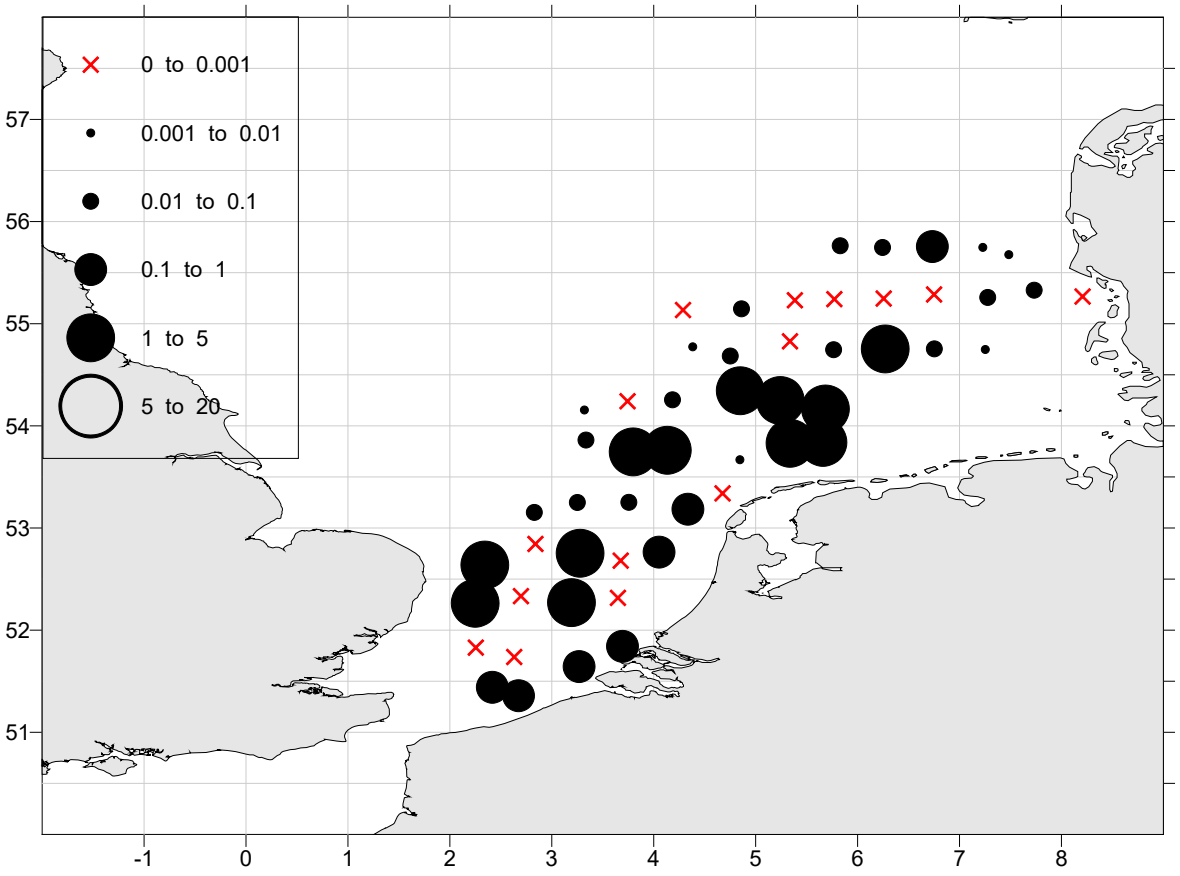

Figure 1.3.1. Herring larvae distribution by haul from the 2024 DRS.

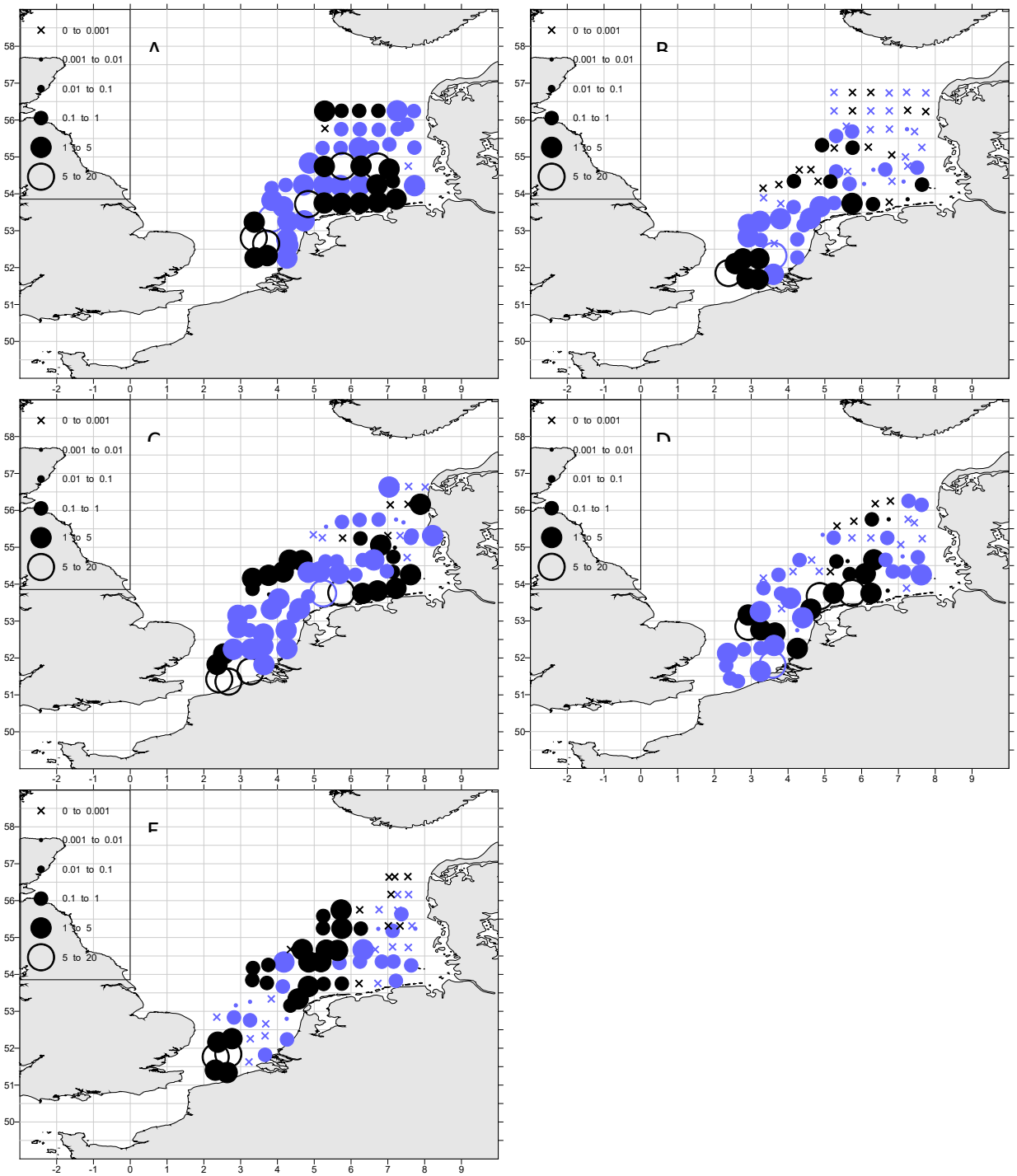

Figure 1.3.2. Herring larvae distribution for the time series, 2018-2023; blue is day light samples, black is night time sampling. (Note: No survey was carried out in 2020.)

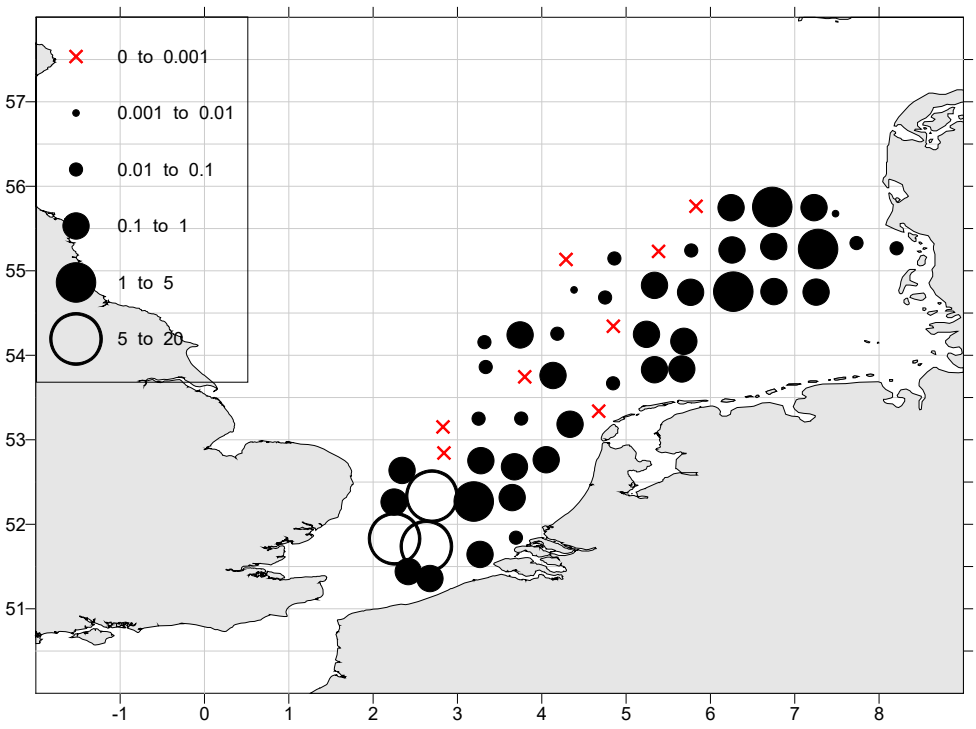

Figure 1.3.3 Sprat larvae distribution by haul from the 2024 DRS.

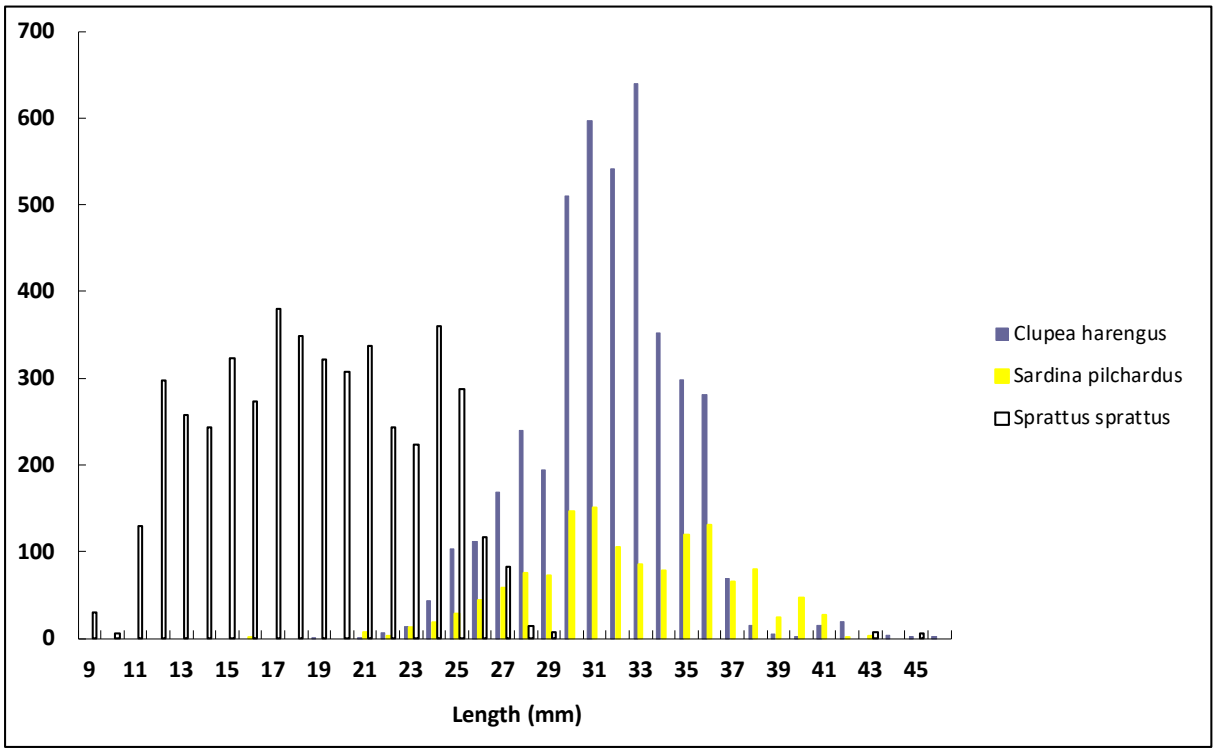

Figure 1.3.4 Clupeoid larvae length distribution from the 2024 DRS.

Nights are shorter during the DRS compared to the IBTS-MIK. Especially during the last haul in the morning there may be increasingly more light. Light has an effect on the behaviour and distribution of the herring larvae. However the experiment showed that the light increase at dawn

does not have an abrupt effect on the catchability (ICES 2024a). However, WGSINS recommends to investigate the decrease or increase in light during the first haul in the evening and the last haul in the morning. Therefor a recommendation has been drafted to investigate if light meters are installed on the participating research vessels in the IBTS-MIK and DRS and if light measurements can be recorded, either with already installed light meters or with hand-held devices. If so, light measurements should be recorded at the first MIK haul and the last MIK haul each day during the IBTS-MIK and DRS to gain information on the actual light during these hauls. Collecting light measurements can help with data interpretation of these surveys and refining survey protocols. Light measurements should be recorded during the entire first MIK haul of the evening and the last haul in the morning, if possible at 5 minute intervals and without any artificial light source influencing the light measurement. It should also be noted what the weather circumstances and cloud coverage were during the haul.

1.3.2 Indices calculations

A new GAM modelling approach to the MIK and DRS indices calculations was presented. These indices were compared to other 0 and 1 group herring indices. Results will be presented to HAWG 2025. HAWG needs to decide how DRS data can be included in the assessment in the future. The DRS is carried out after the HAWG meeting, thus probably the DRS information will need to be added with a 1-year time lag.

WGSINS supports the development of the GAM modelling for the assessment but in order to keep track of the trend in the time series the current method of index calculation for the MIK and DRS will continue to be carried out.

1.3.3 Planning for the 2025 survey

In 2025 the Netherlands, Germany and Denmark plan to carry out the Downs Recruitment Survey. Participation of our countries is highly desirable and should be investigated.

Netherlands plans to sample from 14 - 26 April. Dates for the German survey are not yet available. Denmark plans to sample for 10 days during April. A plan for the international sampling distribution will be prepared in Q1 2025 in discussion with the participating institutes.

1.4 The Northern Irish Northeastern Larvae Survey (NINEL)

1.4.1 Background information

Herring larvae surveys of the northern Irish Sea (ICES area 7aN) have been carried out by the Agri-Food and Biosciences Institute (AFBI), formerly the Department of Agriculture and Rural Development for Northern Ireland (DARD), in November each year since 1993. The surveys are conducted on-board the RV “Corystes” since 2005 and prior to that on the smaller RV “Lough Foyle”. Sampling is carried out on a systematic grid of stations covering the spawning grounds and surrounding regions throughout the north Irish Sea (Figure 1.4.1). Larvae are sampled using a Gulf7 high-speed plankton sampler with 280μm net and on-board Valeport Midas+ CTD. Mean catch-rates (nos.m-2) are calculated over stations and strata to give area specific indices of abundance. Larval production rates and birth-date distributions are computed based on the mean density of larvae by length class. A growth rate of 0.35 mm per day and instantaneous mortality of 0.14 per day are assumed based on estimates made in 1993–1997. The index has been historically used as an indicator of spawning-stock biomass (SSB) in the assessment of Irish Sea herring by the ICES Herring Assessment Working Group (HAWG). The assessment of this stock was

benchmarked in 2012 and issues concerning the survey raised. Specifically, the survey index exhibited a diverging trend in SSB from that observed in Irish Sea herring acoustic surveys, not indicating the increasing SSB confirmed from all the repeated acoustic surveys (ICES, 2012).

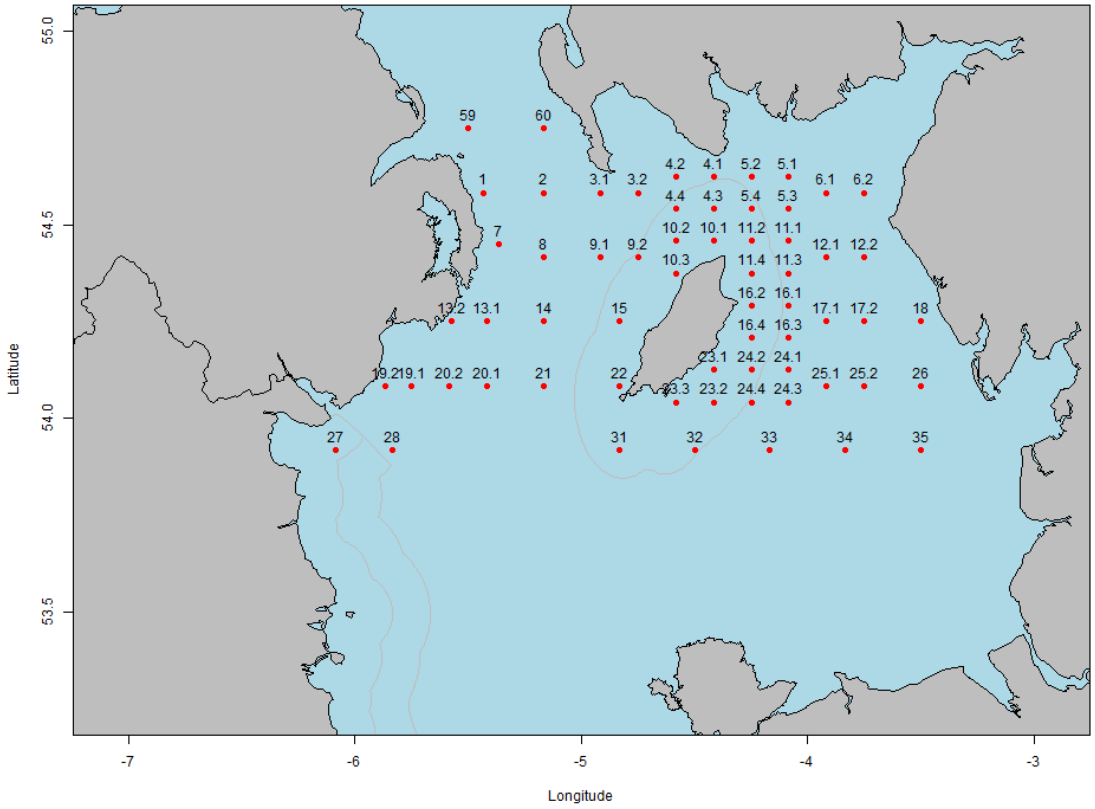

Figure 1.4.1 Station positions for NINEL survey.

1.4.2 Survey Results in 2024

The 2024 NINEL survey was planned for the period 4-10th November. Due to mechanical issues with the research vessel the survey was unable to go ahead this year.

1.5 The Northern Ireland MIK Survey (NI-MIK)

1.5.1 Background information

The survey previously used a modified Methot-Isaacs-Kidd frame trawl to target pelagic juvenile gadoids (whiting, cod, haddock) in the Irish Sea between 1993 - 2018. The modified Methot-Isaacs-Kidd frame was replaced with a 2m midwater ring net in 2019 (ICES 2017). The survey is a stratified design and takes place in May and June during the period prior to settlement of gadoid juveniles. Indices are calculated as the arithmetic mean of the numbers per unit sea area (no.m^{-2}). The MIK net is deployed during the hours of darkness (max. 30 mins $\pm$ hr sunset). During daylight hours a Gulf7 high speed plankton sampler with on-board Valeport Midas+ CTD is deployed. Density and distribution data on larval fish, zooplankton and water structure properties (SST, salinity, chlorophyll *a*) are recorded. While the main objective of the survey is to

provide recruitment information on gadoids, the survey provides the opportunity and tools to collect valuable information on the wider ecosystem. For example, data collected on the survey has provided the basis for the development of a 20+ year time-series of gelatinous zooplankton abundance in the Irish Sea. Since 2018 a standard WP2 frame with side floats for neuston sampling (333 μm mesh size) has been deployed for the study of marine micro plastics at a number of the Gulf7 stations.

1.5.2 Survey Results in 2024

The 2024 NIMIK survey coverage was restricted to UK waters due to noncompliance of the vessel with the international ballast water management convention. The vessel subsequently was not able to enter ROI waters where traditionally juvenile gadoids are caught in high numbers. This undoubtedly has an impact on the ability of the survey to detect trends in 2024 gadoid recruitment in the region. To reduce the impact of the area restrictions a number of stations were relocated within the western Irish Sea survey area to ensure sampling levels remained high in UK waters. The NIMIK survey is timed to coincide with the pre-settlement stage of juvenile gadoids in the western Irish Sea (Figures 1.5.1-1.5.2).

Despite the issues above it is noted that this was the 3rd year in which no juvenile cod (*Gadus morhua*) were caught in the region (Figure 1.5.3). The current level of recruitment of Irish sea cod maybe at its lowest point since the survey began in 1994. This suggests cod in the Irish Sea continues to struggle in the face of possible anthropogenic and climatic pressures. Alternatively, the reduced survey coverage in recent years has impacted the surveys ability to track cod recruitment or local populations have adapted their spawning behaviours.

In 2024 the 111 GulfVII and 80 MIK stations provided important data on the pelagic habitat and organisms within, including Euphausiids and gelatinous zooplankton. Additionally, a further 80 neuston net samples were collected, providing information on the presence of marine micro plastics in the Irish Sea. These samples also demonstrated a high abundance of crab larvae in the area. The increasing abundance of *Solea solea* larvae in the eastern Irish Sea is also a possible useful indictor of recruitment for this species in the VIIa management area.

A number of images of fish larvae for QA and training purposes were taken, while larvae were also selected and preserved for future genetic analysis.

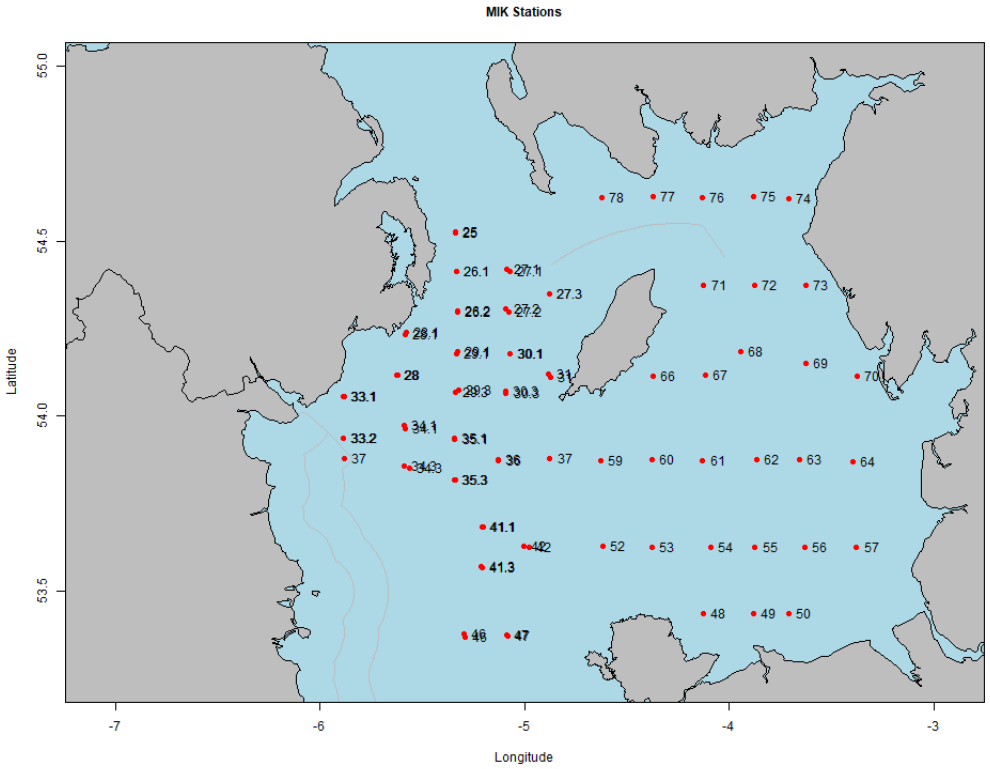

Figure 1.5.1. MIK Station positions during 2024 NIMIK survey.

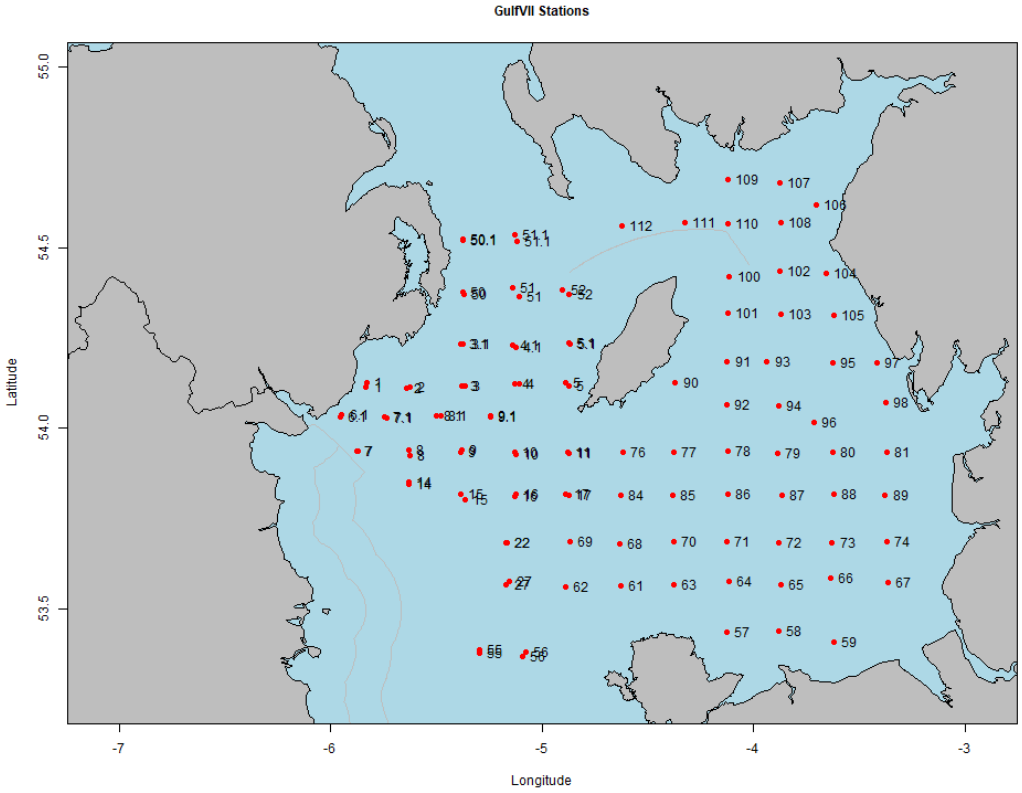

Figure 1.5.2. Gulf7 station positions during 2024 NIMIK survey.

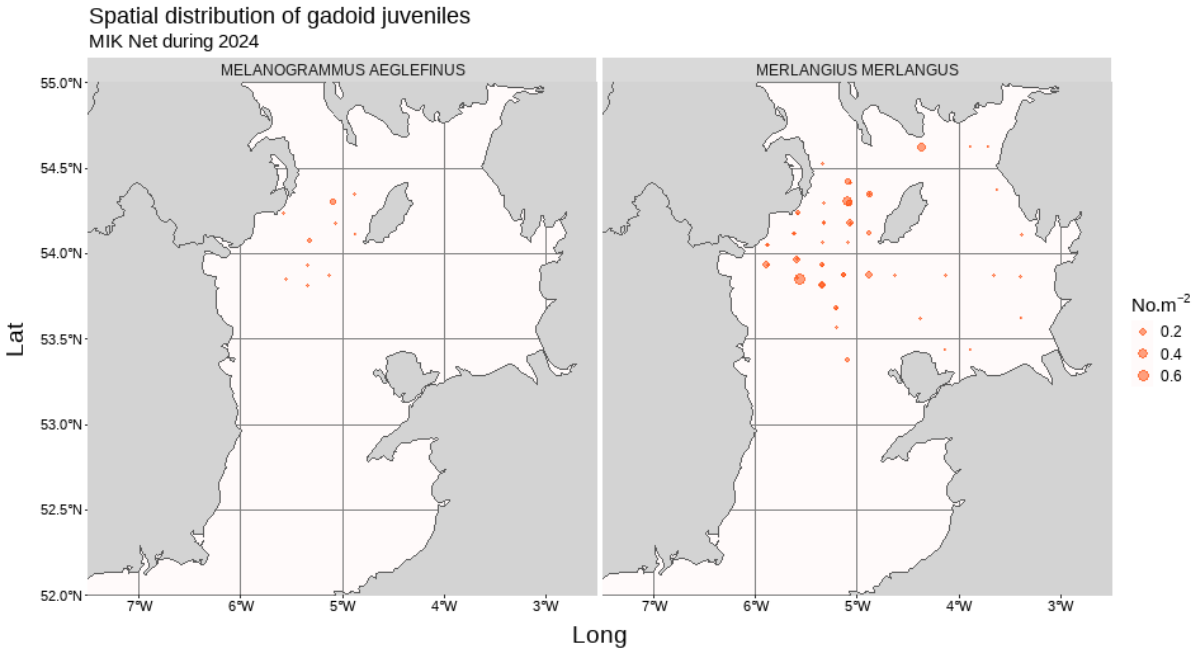

Figure 1.5.3. Spatial abundance (No. m-2) of juvenile gadoids haddock (*Melanogrammus aeglefinus*) and whiting *(Merlangius merlangus*) NIMIK 2024.

1.6 The Rügen Herring Larvae Survey (RHLS)

1.6.1 The RHLS

The waters of Greifswald Bay (ICES area 24) are considered a major spawning area of Western Baltic spring spawning (WBSS) herring. The German Thünen Institute of Baltic Sea Fisheries (TI-OF), Rostock, and its predecessor monitors the density of herring larvae as a vector of recruitment success since 1977 within the framework of the Rügen Herring Larvae Survey (RHLS). It delivers a unique high-resolution dataset on the herring larvae ecology in the Western Baltic, both temporally and spatially. Onboard the research vessel FFS CLUPEA a sampling grid including 35 stations is sampled weekly using ichthyoplankton gear (Bongo-net, mesh size 335 µm, Figure 1.6.1) during the main reproduction period from March to June. The weekly assessment of the entire sampling area is conducted within two consecutive days (detailed description of the survey design can be found in Polte 2013). The collected data provide an important baseline for detailed investigations of spawning and recruitment ecology of WBSS herring spawning components. As a fishery-independent indicator of stock development, the recruitment index is incorporated into the assessment of the ICES Herring Assessment Working Group (HAWG).

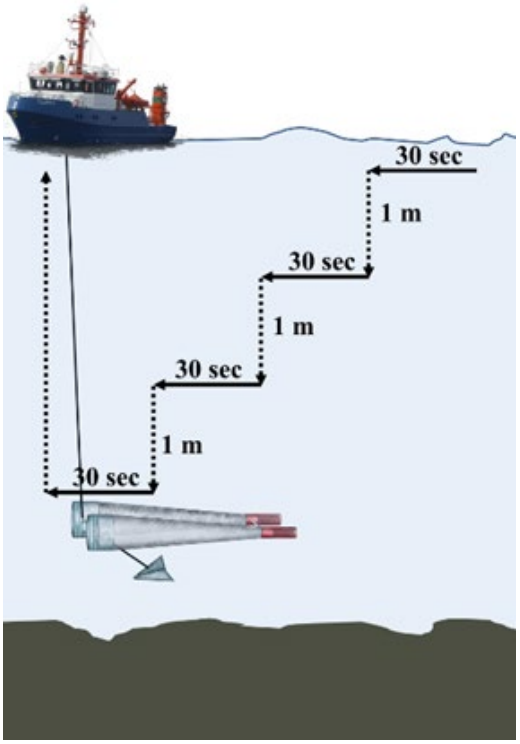

Figure 1.6.1 Schematic of the Bongo net sampling procedure during the RHLS. Note that min. water depth is 4 m (10 m max.). Limit of the haul depth is 1 m above ground. Towing speed is 2 knt.

The rationale for the N20 recruitment index is based on strong correlations between the amount of larvae reaching a length of 20 mm (TL) in Greifswald Bay and abundance data of juveniles (1-wr and 2-wr fish) as determined by acoustic surveys in the Arkona and Belt Seas (GERAS).

This correlation supports the underlying hypotheses that i) major variability of natural mortality occurs at early life stages before larvae reach a total length of 20 mm and ii) larval herring production in Greifswald Bay is an adequate proxy for annual recruitment strength of the WBSS herring stock.

The N20 recruitment index is calculated every year based on data obtained from the RHLS. This is done by estimating weekly growth of larvae for seasonal temperature change and taking the sum of larvae reaching 20 mm by every survey week until the end of the investigation period. On the spatial scale, the 35 sampling stations are assigned to 5 strata and mean values of stations for each stratum are extrapolated to the strata area (for details see Oeberst et. al 2009).

Calculation procedures have been externally reviewed in 2006 and 2011. Consequently, the survey design was refined in 2007. Accordingly, the recalculated index for the time series from 1992 onwards is used by HAWG since 2008 as 0-group recruitment index for the assessment of Western Baltic Spring Spawning herring.

1.6.2 2023 N20 index

The regular Rügen-herring larvae Survey started on February 27th and continued weekly for 17 weeks until June 20th 2023 including a total of 582 stations/hauls. Along the entire Survey period, 13 stations had to be cancelled due to bad weather. However, an adequate coverage of stations (>19) could be sampled every week (minimum 29 stations). With an estimated product of 1516

million larvae, the 2023 N20 recruitment index is > 4 times lower than in 2022 (6603 million) when the index exceeded the time series mean (6095 million) for the first time after 11 years. Therefore, after two years of increasing larval production in 2021 and 2022, the 2023 N20 is again lower (Table 1.6.1, Figure 1.6.2).

Table 1.6.1 N20 larval herring index for spring spawning herring of the Western Baltic Sea (WBSS), generated by RHLS data.

Year	N20 (Millions)	Year	N20 (Millions)	Year	N20 (Millions)
1992	660	2003	4775	2014	681
1993	4542	2004	6818	2015	3001
1994	15158	2005	5118	2016	482
1995	9327	2006	4173	2017	1247
1996	24540	2007	1986	2018	1563
1997	5290	2008	1903	2019	1317
1998	18782	2009	7989	2020	239
1999	22342	2010	8004	2021	2751
2000	3404	2011	4493	2022	6603
2001	5670	2012	1340	2023	1516
2002	12452	2013	3588		

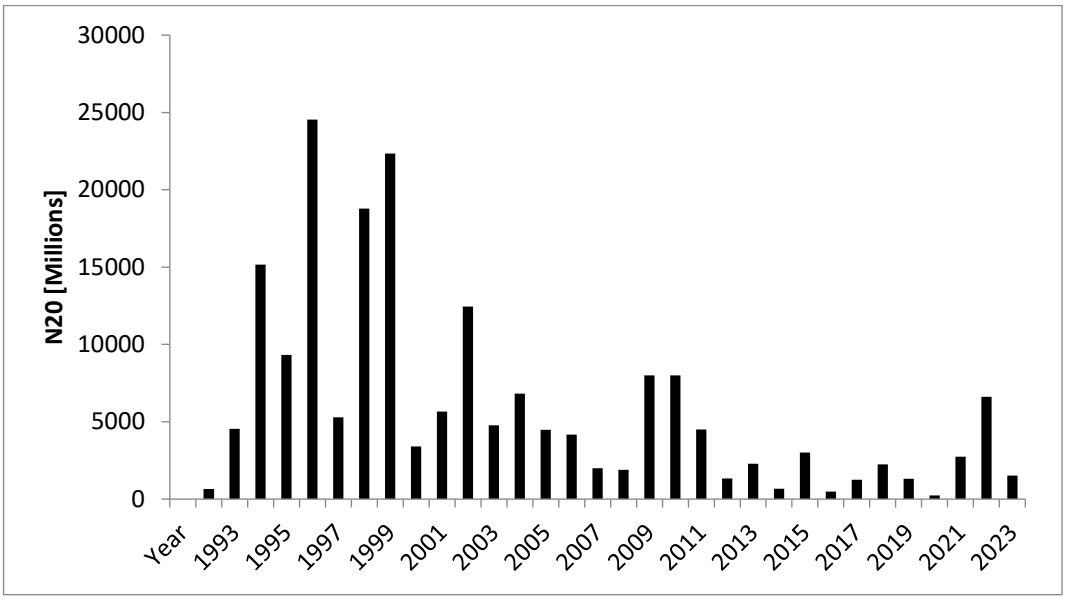

Figure 1.6.2 Time series of the N20 index (1992-2023). Time series average: 5,400 millions.

1.6.3 Relation between N20 and GERAS 1-wr herring

Correlation between N20 and GERAS 1-wr herring

Figure 1.6.3 shows the correlation between the N20 index and the 1-group monitored during the German hydroacoustic survey (GERAS) in October of the following year. After multiple years with the record low N20 (2014, 2016, 2020), the relation with the 1-group juveniles as monitored by the GERAS was re-evaluated to see if recent years with extremely low larvae production are reflected in the abundance of the 1-group juveniles of WBSSH in SDs 21-24. The results reveal that recent years resulted in a lower abundance of 1-wr juveniles detected during the GERAS compared to the period before 2019.

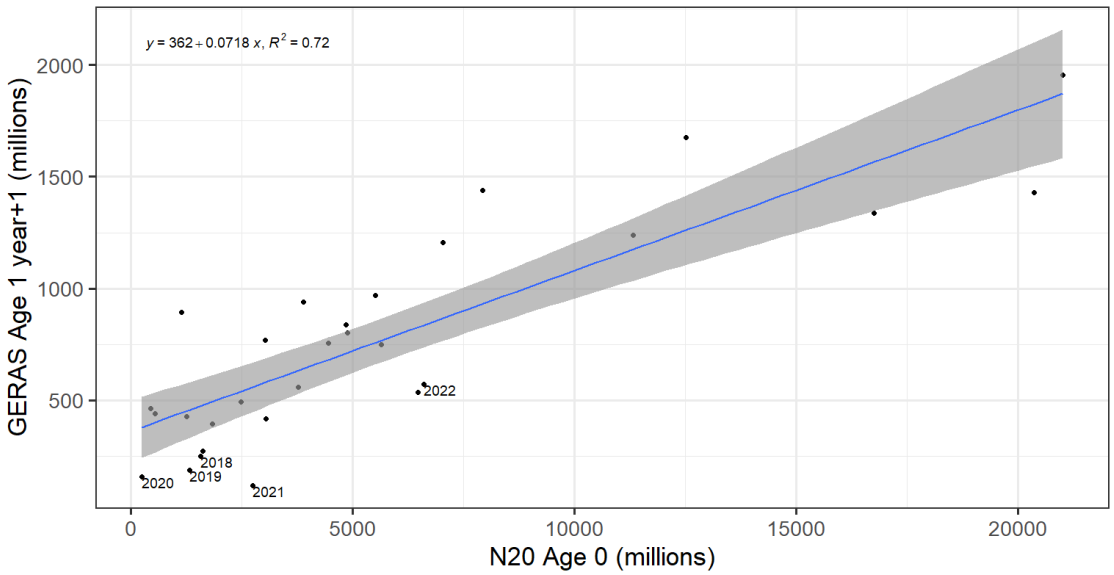

Figure 1.6.3 Correlation of N20 larvae index (1993-2022, excl. 2000) with the 1-wr herring from GERAS (1994-2023 excl. 2001 as SD 23 was not covered in that year). Note the one-year lag phase between indices, i.e. the exceptionally low N20 year 2020 is represented by the GERAS 1-wr index 2021. The years 2018-2022 are labelled.

1.7 The Baltic Ichthyoplankton Surveys (BIS)

1.7.1 Background information about ichthyoplankton surveys in the Baltic

Ichthyoplankton surveys in the Baltic have a long tradition, dating back to egg studies by Hensen & Apstein as early as the late 1800s and early 1900s. Starting in 1904, Ehrenbaum & Strodtmann have conducted more or less regular egg and larvae surveys for several years, followed by the surveys of Kändler, Mielck & Künne in the 1920s and 1930s as well as a series of surveys by Grauman, Bagge & Müller in the 1970s and early 1980s (e.g. Bagge *et al.* 1994). Already in these early days of ichthyoplankton surveys in the Baltic, there has been particular focus on the Bornholm Basin, located between Sweden, Poland and east of the Danish island Bornholm. The importance of this area for Baltic fish stocks, in particular cod and sprat, is related to the unique

hydrographic situation in the Baltic and the resulting limitations for the survival of marine, steno-haline fish eggs and larvae.

Reproductive success of the Eastern Baltic cod stock is closely linked to these unique hydrographic conditions (review by Köster *et al.* 2017), which are restricting the main spawning grounds to deeper areas, i.e. the Bornholm Basin (BB) just east of Bornholm as well as the Gdansk Deep (GD) and the Gotland Basin (GB) further east. However, due to oxygen deficiencies in the GD and GB in recent decades, successful spawning of Baltic cod is largely restricted to the Bornholm Basin in recent years.

Presently, Eastern Baltic cod is spawning from approx. March to November, which is the longest reported spawning period of any cod stock. This extremely protracted spawning season can be interpreted as a risk-spreading strategy to cope with the highly variable environmental conditions in the Baltic and the related inter-annual as well as seasonal differences in the survival chances of eggs and larvae.

1.7.2 General information about the present time series of Baltic Ichthyoplankton Surveys (BIS)

The present time series of Baltic Ichthyoplankton Surveys (BIS) was initiated in 1986 by the "Institut für Meereskunde" (IfM, Institute of Marine Sciences, now GEOMAR) in Kiel, Germany and has been running ever since. The extremely protracted spawning season of Eastern Baltic cod makes it necessary to conduct several surveys throughout the year in order to obtain a reliable picture of the seasonal egg production and larval abundances. As this requires considerable vessel time, personnel and resources, several institutes joined forces to cover the spawning season with several surveys per year.

Presently, the following partners are involved in the BIS:

1. DTU Aqua – National Institute of Aquatic Resources, Kgs. Lyngby, Denmark
2. NMFRI – National Marine Fisheries Research Institute, Gdynia, Poland
3. TI-OF – Thünen Institute of Baltic Sea Fisheries, Rostock, Germany
4. GEOMAR – Helmholtz Centre for Ocean Research Kiel, Germany
5. IMF – Institute of Marine Ecosystem and Fishery Science, Hamburg University, Germany
6. AU - Section for Aquatic Biology, Department of Biology, Aarhus University
7. BIOR – Institute of Food safety, Animal health and Environment, Riga, Latvia

The time-series of individual BIS surveys by month is shown in Figure 1.7.1. In the earlier part of the time-series the seasonal coverage is somewhat variable, as the surveys relied largely on funding via running research projects as well as partly on national funding sources. Nevertheless, it was possible to maintain a continuous survey time-series since 1986. In the most recent period since 2008 the seasonal coverage has been very good, with all years covered by 7 to 9 surveys, except for 2020 when only 6 surveys could be conducted due to the Covid-19 pandemic. During this recent period the surveys were usually conducted in March, April, May, June, July and/or August and November, in some years even with 2 surveys in August (early and late) as well as some years with additional surveys in September.

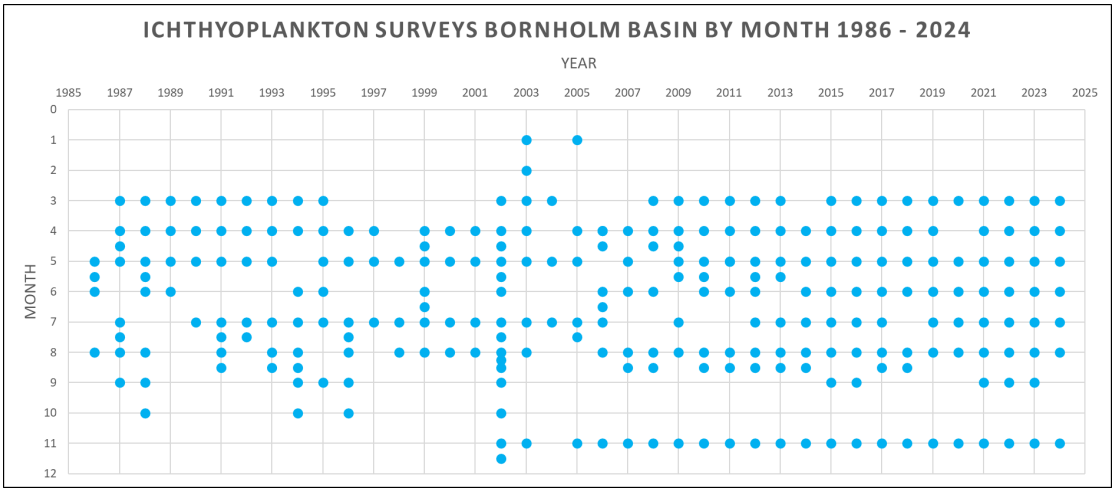

Figure 1.7.1 Time series of individual BIS surveys by years and months.

As mentioned above, oxygen conditions in the eastern spawning grounds (GD and GB) have deteriorated over the past decades and spawning is therefore largely restricted to the Bornholm Basin. Thus, the present BIS are focusing on the Bornholm Basin. However, some additional information about egg and larval abundances in the GD and GB is also collected every year, in order to detect potential future changes in the utilization of these spawning grounds.

In the beginning of the survey series from 1986 - 1989, only the central BB was covered by a station grid consisting of 20 stations, which was extended to 30 stations from 1990 - 1993. Since 1994, the standard station grid is consisting of 45 stations (Figure 1.7.2). On some cruises additional stations are covered, e.g. in the Slupsk Furrow or at the basin edges.

On each station ichthyoplankton is sampled with a Bongo net (Ø 60 cm, nets length 320 cm, mesh sizes 335 and 500 µm). The gear is further equipped with a V-fin depressor, a depth sensor and flowmeters. On most surveys, an additional Baby-Bongo net (Ø 20 cm, net length 200 cm, mesh size 150 µm) is attached above the Bongo net in order to collect additional samples of smaller zooplankton size fractions. The gear is deployed at 3 knots ship speed in a double-oblique haul from the surface to 3 m above the sea floor, measured from the lower edge of the Bongo ring. Samples are preserved in 4% formaldehyde-sea water solution for later analysis on land. In addition, profiles of the ambient hydrographic conditions are obtained by CTD casts. Furthermore, adult cod are sampled on selected cruises by trawl fishery to obtain information on fecundity, sex ratios and maturity ogives which are needed for egg production methods and stock biomass estimates (see also next section “Utilization of BIS results in research and stock assessment”).

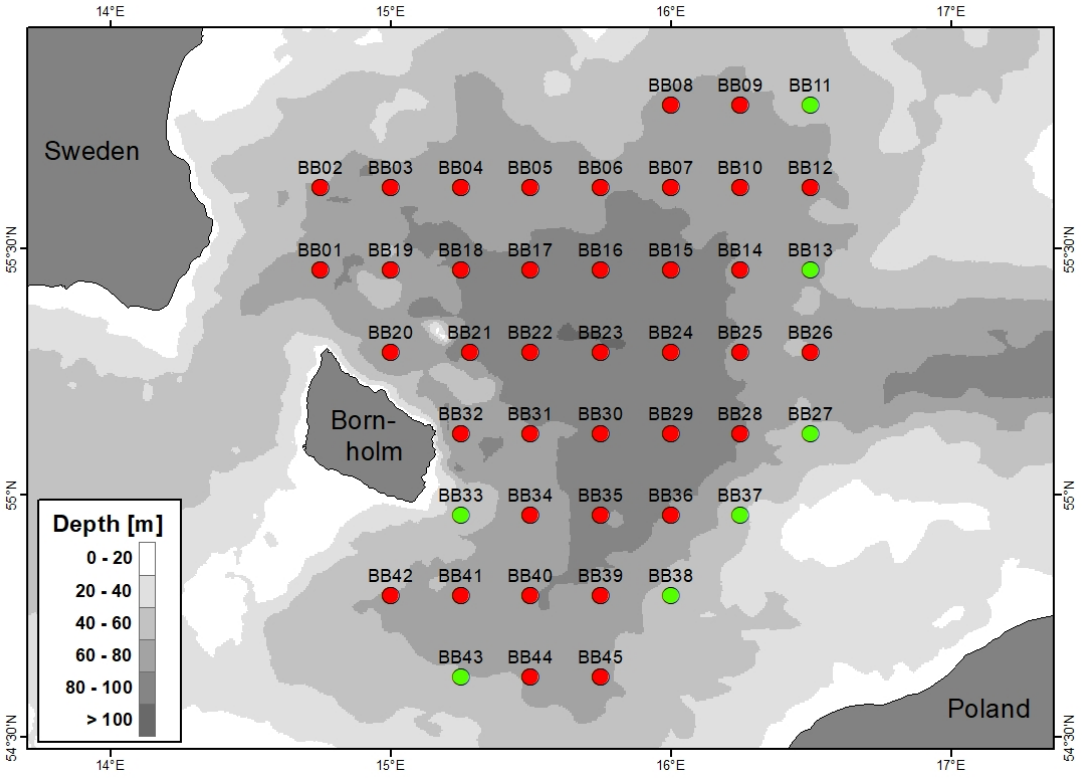

Figure 1.7.2 The present BIS standard station grid in the Bornholm Basin, consisting of 45 stations. The seven stations shallower than 60 m (green symbols) are excluded from the calculations of average egg abundances used in the AEPM and DEPM.

1.7.3 Utilization of BIS results in research and stock assessment

The BIS surveys have been used for a multitude of scientific research purposes in various projects, including studies on ichthyoplankton ecology and the recruitment dynamics of Baltic cod and sprat. Besides, SSB estimates based on egg production methods for Baltic cod and sprat have been developed, but despite providing promising results these methods had previously not been implemented into the stock assessment.

However, due to increasing issues with the stock assessment of Eastern Baltic cod in the late 2000s and early 2010s, the ideas of fishery independent stock biomass estimates based on egg production have been revived and were implemented in the assessment of Eastern Baltic cod since the benchmark assessment in 2019. Thus, the BIS is now providing input data for annual (AEPM) and daily (DEPM) egg production methods, which are used to provide a time-series of Eastern Baltic cod stock biomass estimates (1986 - present) to WGBFAS.

Besides, the BIS is providing a recruitment index to WGBFAS, based on average larval abundances during the summer months (June - August, time-series 1987 - present). This recruitment index provides an early indication of year-class strength, while the BITS bottom trawl surveys are not catching the new incoming year-classes representatively until age 2. Both the egg-based stock estimates and the larvae index are used as relative trends in stock dynamics to tune the assessment models.

1.7.4 The Baltic Ichthyoplankton Surveys in 2024

Throughout the 2024 spawning season of Eastern Baltic cod, a total of 7 individual BIS surveys were conducted in March, April, May, June, July, August and November (see Table 1.7.1 for details). On most of the surveys the complete standard grid consisting of 45 stations was conducted. Due to rough weather and resulting time constraints, 4 and 3 stations could not be conducted on the surveys in March & November, respectively. However, these were shallower stations at the edges of the Bornholm Basin, which usually do not yield very high egg abundances. In total, 308 standard stations were sampled on the 7 individual cruises in 2024. Furthermore, several additional stations outside the standard grid were sampled on some of the surveys. The sample analyses were still ongoing at the time of WGSINS 2024, but the preliminary data suggest similarly low egg and larvae abundances as in recent years. The final data will be collated and the time-series of stock biomass estimates and larvae indices will be provided to WGBFAS in spring 2025.

It is noteworthy that high numbers of the invasive ctenophore *Mnemiopsis leidyi* were again found on the survey in November. Even though not as high as the record-high abundance found in November 2023, the abundance in November 2024 was still above the long-term average (since 2008).

Table 1.7.1 Overview of individual BIS surveys conducted in 2024.

Institute	Ship	Cruise Nr	Year	Month	n standard stations conducted	Cruise dates
DTU Aqua	DANA	DANA 02/2024 (BITS 1)	2024	3	41	March 05 – 23
GEOMAR	ALKOR	AL 610	2024	4	45	April 04 – 16
TI-OSF & DTU Aqua	WH III	WH 478	2024	5	45	May 23 – 26
NMFRI & DTU Aqua	BALTICA	Baltica June 2024	2024	6	45	June 20 - July 01
Aarhus University	AURORA	AURORA 202407	2024	7	45	July 22 – 26
NMFRI	BALTICA	Baltica August 2024	2024	8	45	August 16 - 27
DTU Aqua	DANA	DANA 06/2024 (BITS 2)	2024	11	42	November 04 – 22

1.7.5 Planning for the 2025 Baltic Ichthyoplankton Surveys

For the 2025 spawning season of Eastern Baltic cod, a total of 7 individual BIS surveys are planned in March, April, May, June, August, August/September and November. On each of these surveys, it is planned to cover the 45 standard grid stations, amounting to a total of 315 planned stations for 2025. See Table 1.7.2 for details.

Table 1.7.2 Overview of individual BIS surveys planned for 2025.

Institute	Ship	Cruise Nr	Year	Month	n standard stations planned	Cruise dates (preliminary)
DTU Aqua	DANA	DANA 02/2025 (BITS 1)	2025	3	45	March 05 - 23
GEOMAR	ALKOR	AL 630	2025	4	45	April 05 - 16
GEOMAR	ALKOR	AL 632	2025	5	45	May 06 - 21
NMFRI & DTU Aqua	BALTICA	Baltica June 2025	2025	6	45	June 19 - 30
NMFRI	BALTICA	Baltica August 2025	2025	8	45	August 13 - 24
GEOMAR	ALKOR	AL 639	2025	8/9	45	August 27 – September 07
DTU Aqua	DANA	DANA 08/2025 (BITS 2)	2025	11	45	November 03 - 21

2 Pilot surveys & Additional work on existing surveys

2.1 A pilot survey on the feasibility of establishing a sprat recruitment index based on larval sampling during Q3 IBTS surveys

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 to a large degree driven by the recruiting year class, and catches are mainly composed of 1-year old fish (up to 80%). Sprat is also an important forage fish and represents a major food source for many other fish species as well as sea birds and mammals. It is therefore a highly relevant species in multispecies and ecosystem approaches to fisheries management. An analytical assessment for 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 needs to be improved. There is presently no information available on young-of-the-year (0-group) sprat for possible use in short-term forecasts or for use in the stock assessment model. However, such information could potentially be very useful, in particular because sprat is a short-lived species that matures early.

The aim of the present study is - by conducting a series of pilot surveys - to evaluate the feasibility of establishing a sprat recruitment index based on larval sampling during night-time on the Q3 IBTS surveys and to contribute generally to a better understanding of the biology, ecology and distribution of the North Sea sprat stock. Thus, the basic idea is to follow similar procedures as the MIK herring larvae surveys during the Q1 IBTS. These surveys are targeting relatively large larvae (2 to 3 cm) 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.

By the time of WGSINS 2024, a total of seven pilot surveys had been conducted in July/August 2018, 2019 & 2020 and in August/September 2021, 2022, 2023 & 2024 targeting sprat larvae with a MIK net. The surveys were conducted by DTU Aqua, Denmark, in 2018 and 2019 in the framework of the project "BEBRIS - Maintaining a sustainable sprat fishery in the North Sea" and in 2020 and 2021 in the follow-up project "PELA – Pelagic species". Sampling was conducted during nighttime on the Q3 IBTS. Besides, the Thünen Institute of Sea Fisheries in Bremerhaven, Germany contributed to the sampling in 2020 and 2021.

During the first 4 years, it became clear that a number of prerequisites for establishing a recruitment index were fulfilled, e.g. that sprat larvae are present in the survey area at the time of the survey and can be caught representatively, spawning activity of sprat is finished before the time of the survey and the MIK sampling can effectively be incorporated into the standard routines of the Q3 IBTS. However, catchability tests between daylight and nighttime have shown that sprat larvae are only caught representatively at night, which is limiting the available time for sampling to approximately 7-8 hours per night. Furthermore, while the main distribution area of sprat larvae seems to be covered by the Danish Q3 IBTS, a better spatial coverage would be desirable. Based on the promising preliminary results from these first 4 years, DTU Aqua decided to continue the pilot survey in 2022, 2023 & 2024.

Table 2.1.1 provides an overview of the sampled stations in the first 7 years of pilot surveys. In 2018 and 2019, 71 and 66 valid standard hauls (plus several additional hauls for gear tests etc.) were conducted, respectively. In 2020, a total of 128 hauls was conducted (68 by Denmark and 60 by Germany). In 2021, a total of 89 hauls was conducted on a joint Danish-German survey. In

2022, 2023 & 2024, a total of 63, 70 & 63 hauls were conducted by Denmark, respectively. Figure 2.1.1 shows a map of the MIK sampling stations during the 2024 Q3 IBTS.

In addition, Marine Scotland Science also conducted MIK sampling during their Q3 IBTS in 2021, 2023 and 2024 on 51, 17 and 42 stations, respectively (Figure 2.1.2). Preliminary results from these surveys showed that some sprat larvae do also occur in the Scottish survey area (i.e. in the area from 54°N to 61°N). However, these results are not yet included in the further analyses of larval abundance and distribution.

Table 2.1.1 Overview of MIK sampling stations conducted during the Q3 IBTS

Year	Denmark	Germany	TOTAL
2018	71	-	71
2019	66	-	66
2020	68	60	128
2021	89 (joint DK/GE survey)		89
2022	63	-	63
2023	70	-	70
2024	63	-	63

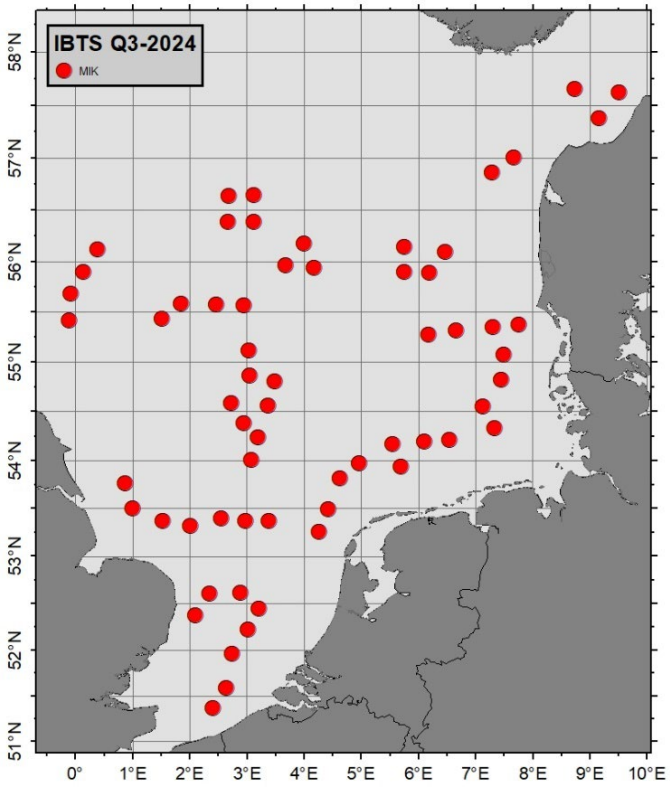

Figure 2.1.1 MIK sampling stations during the Danish Q3 IBTS in 2024.

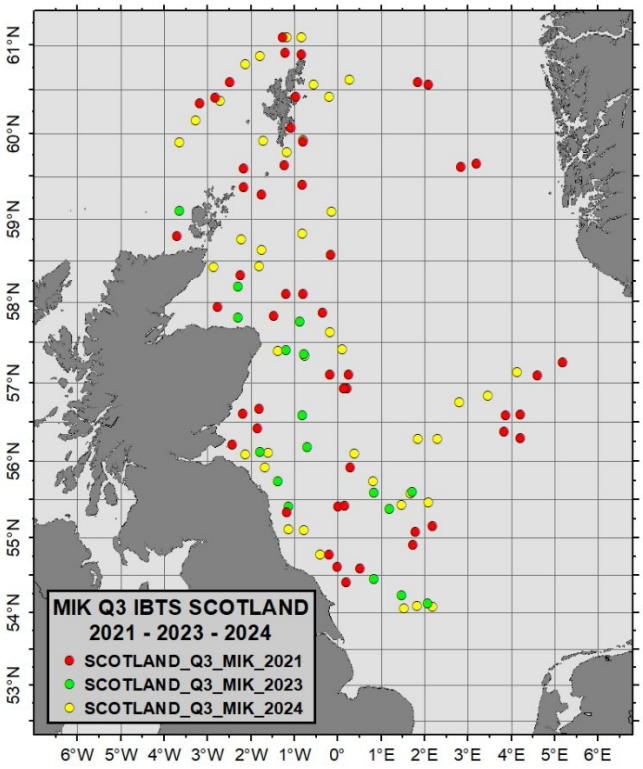

Figure 2.1.2 MIK sampling stations during the Scottish Q3 IBTS in 2021, 2023 & 2024.

The gear in use during the pilot surveys is a MIK net with a ring of two meter in diameter and a mesh size of 1.6 mm. In addition, a small MIKeyM net (20 cm Ø, 500 µm mesh size) was attached to the MIK ring on the Danish surveys in 2018 – 2020, 2022 and 2024. This was done to test if there still are eggs and/or very small larvae in the area during the time of the Q3 IBTS surveys, which would indicate that the seasonal spawning activity has not finished yet. The gear was equipped with a 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 meters per minute (= 0.4 ms-1) and retrieved at 15 meters per minute (= 0.25 ms-1). Both the MIK and the MIKeyM were equipped with flowmeters to record the volume of filtered water.

With very few exceptions, clupeid larvae were found on all sampling stations in the 7 years investigated. However, in all years the clupeid larvae not only contained sprat but also sardine larvae. A similar, recurring pattern in the spatial distribution of sprat and sardine larvae could be observed in all 7 years, with sprat larvae mainly occurring in the northern part of the study area while sardine larvae were most abundant in the south (Munk et al. 2024). This shows that careful identification procedures to species level are mandatory. In the first 6 years, abundances of sprat larvae were generally relatively high, with many stations yielding several hundreds of larvae. In contrast, only few sprat larvae were caught in 2024 (Fig. 2.1.3a). This may indicate lower recruitment, but may also be due to the somewhat later timing of the survey in 2024. It is noteworthy that relatively high numbers of juvenile sprat were caught in 2024, and these were mainly found in the southern part of the survey area (Fig. 2.1.3b).

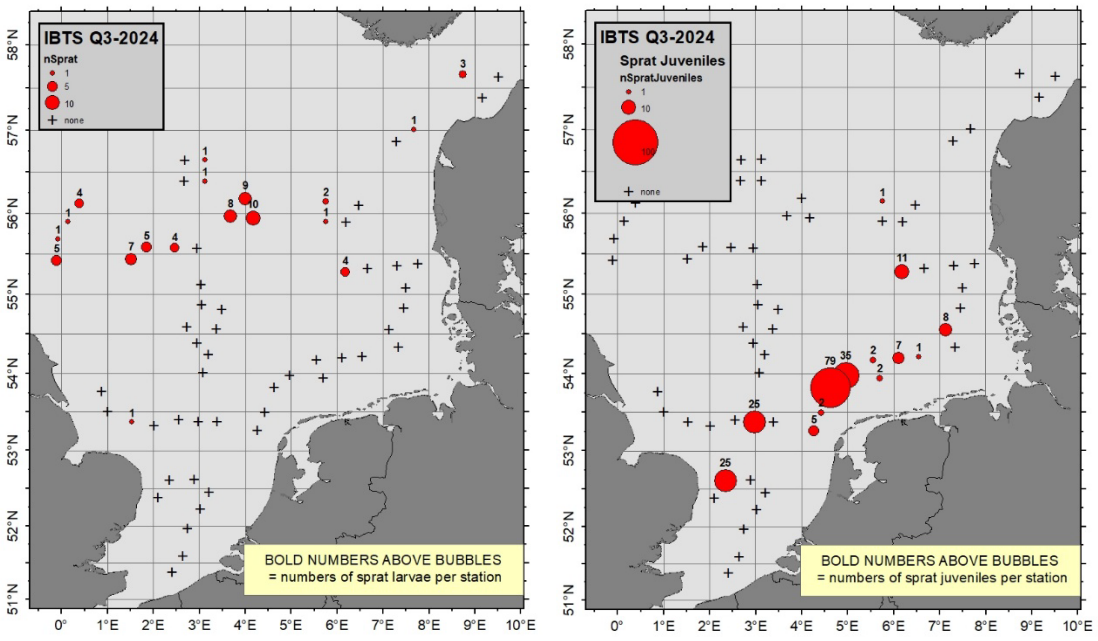

Figure 2.1.3 MIK sampling during the Danish Q3 IBTS in 2024. Catches of (a) sprat larvae (left panel) and (b) sprat juveniles (right panel).

The MIKeyM samples did not suggest any catches of sprat eggs, indicating that sprat spawning activity had been finished and larvae had hatched well before the time of the surveys.

The larvae had a broad size range from approx. 6 mm larvae to juvenile fish of 4 - 5 cm with very similar size frequency distributions for the two species sprat and sardine, but the majority of larvae were in a size range between 12 and 20 mm.

The results from 7 years of pilot surveys that are available so far illustrate that this kind of larvae survey during nighttime of the Q3 IBTS has the potential to provide larval abundance estimates and potentially a recruitment index for North Sea sprat. However, it will still require further analyses to make a final judgement if the larvae survey can provide an early recruitment index that can be used for assessment purposes.

DTU Aqua is planning to conduct such further analyses in the project "BEBRIS-2", a follow-up project to the previous "BEBRIS" and "PELA" projects. The aim is to present results at the upcoming benchmark assessment for North Sea sprat in 2026.

If a recruitment index can be established, additional surveys will be necessary to provide further yearly observations and more data for the modelling of recruitment patterns. Therefore - and based on the promising results from the first 7 years - DTU Aqua is planning to continue the pilot surveys in 2025. However, a better area coverage than obtainable by the Danish survey with RV DANA alone would be advisable, and other nations participating in the Q3 IBTS are encouraged to contribute to these pilot surveys.

As mentioned above, a distinct, recurring pattern of spatial separation between sprat and sardine larvae was observed, which lead to a first scientific publication based on these Q3 MIK pilot surveys (Munk et al. 2024). It is noteworthy that in addition to sprat and sardine, a number of larvae of other fish species were caught in the MIK. The more abundant species were mackerel, horse mackerel, sandeel, gurnards and lemon sole, scaldfish and other flatfishes, as well as several non-commercial species, e.g. gobies, crystal goby, rocklings, pipefish, dragonets and greater weever. In addition, a limited number of larger gadoid larvae and/or pelagic juveniles were caught. Furthermore, relatively many anchovy larvae were caught in 2023 & 2024 in the southern

part of the survey area. 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. No dedicated funding is presently available to investigate these other species in detail. However, numbers of larvae of other species from the 2018 and 2019 surveys and partly from the 2020 survey were analyzed in the framework of student theses.

On the 2023 survey a number of sea horses were caught in the southern parts of the survey area, both adults (n = 10) and juveniles (n = 6). This was the first time that sea horses were observed on this survey (except for a single specimen in 2022 which however was dead and in rather poor condition). Sea horses were again caught during the 2024 survey, in total 40 specimens (21 of these in one single haul), and again both adults and juveniles (Figure 2.1.4a). The majority of the 40 sea horses were again caught in the southern part of the study area in the English Channel, but some were also caught in the German Bight as far north as 55°N. These findings are expected to contribute to a scientific publication on the occurrence of sea horses in the North Sea that is planned in collaboration with German colleagues (Neumann et al. in prep.).

While juvenile cephalopods were frequently caught during the previous pilot surveys in 2018-2023, numbers in 2024 were particularly high. A total of 565 squid were caught, and the majority of these were small juveniles (Fig. 2.1.4.b). In addition, 35 bobtail squid were caught.

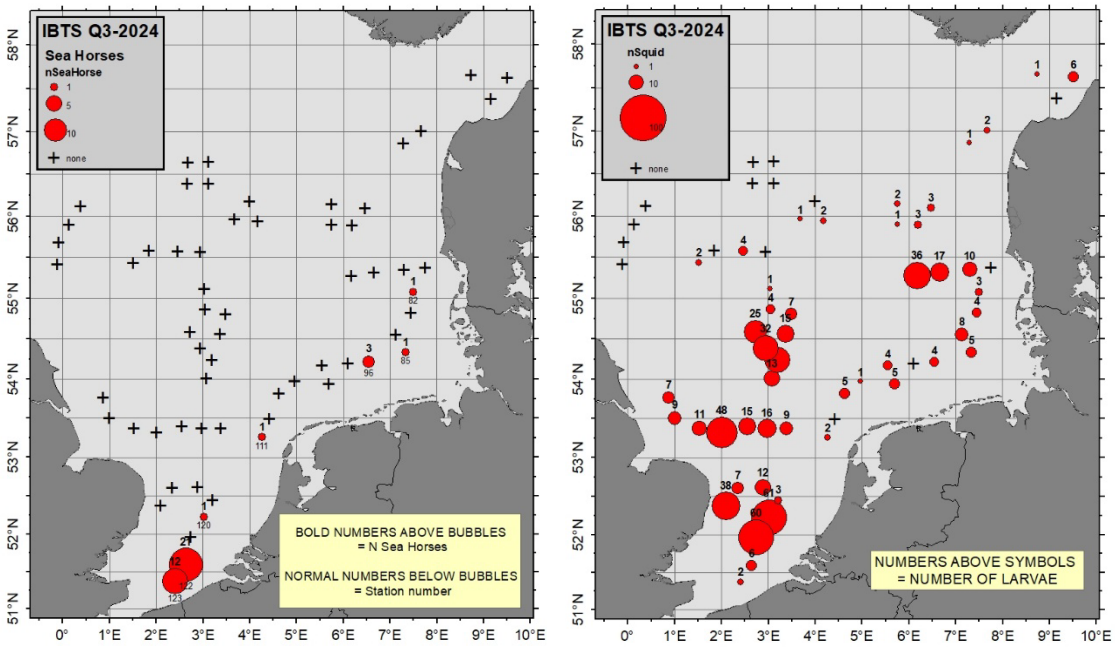

Figure 2.1.4 MIK sampling during the Danish Q3 IBTS in 2024. Catches of (a) sea horses (left panel) and (b) squid (right panel).

2.2 Investigations on recently hatched sandeel larvae in MIKeyM samples collected during the North Sea Mid-water Ring Net surveys

Several sandeel species are found in the North Sea, with Raitt's sandeel (Ammodytes marinus) being by far the most common. Being a major prey for predatory fish, seabirds and mammals, this species is one of the most important forage fish in the North Sea and is also supporting one

of the largest single species fisheries in that area. Due to its high ecological and economical importance, a relatively large body of research exists about the species, covering various aspects. However, there is only limited knowledge about the spawning ecology, which may be due to the unique life cycle. From late summer to autumn, the adults and newly recruited juveniles are burying into the sediment where they are overwintering for several months, utilizing specific areas with suitable sediment. Spawning is also taking place in these areas during winter, when the adults are briefly leaving the sediment to deposit demersal eggs on or in the sediment. Thus, the eggs are more or less impossible to sample, and knowledge about the occurrence and intensity of spawning activity in the different sandeel areas is largely lacking.

The project PELA, which was conducted by DTU Aqua from 2019 - 2022, was aiming to close this knowledge gap by mapping the spatial distribution and abundance of recently hatched larvae as an indicator for spawning activity. It was investigated which of the adult burying areas are actually used for spawning, if the area utilization is consistent between years or if there are inter-annual differences, and if there are differences in larval abundance between years.

The analyses were making use of samples collected with a so called "MIKeyM net", a small ring net with a diameter of 20 cm and a mesh size of 335 µm, which is attached to the larger MIK ring on the annual North Sea Midwater Ring Net surveys (MIK) which are conducted at nighttime during the Q1 IBTS. The use of this additional MIKeyM net was introduced some years ago by ICES WGEGGS2, with the aim to obtain information on the occurrence and distribution of cod and plaice eggs. However, it was noticed that the samples also contained very small sandeel larvae, which gave rise to the present study.

The PELA project analyzed MIKeyM samples for a 6-year period from 2015 - 2020, which includes years with contrasting recruitment (2015 and 2017 very poor, 2016 exceptionally high, 2019 very good recruitment). The analyses included all available samples from Denmark, Germany, Norway, the Netherlands and France, as these nations are covering the main sandeel habitats during their MIK surveys. Larvae of sandeel and other fish species were sorted from the samples, counted, and sandeel larvae were scanned and length measurements conducted with an image analysis system. An exception are the French samples, which are anyhow regularly analyzed by Ifremer via Zooscan or Zoocam, and for which the sandeel larvae data were provided to DTU Aqua.

Results show that the majority of sandeel larvae in the samples are only about 5 to 6 mm. As the hatch size of *A. marinus* is approx. 5.5 mm, the sampled larvae can be considered to have hatched very recently, i.e. they have not drifted very far and should indeed provide an indication for spawning areas. This is also supported by the spatial distribution of larvae, which only show considerable larval abundances in the immediate vicinity of the known sandeel burying areas. In addition to maps showing the actual larval abundances, hot spots of larval occurrence were also analyzed with a spatial GAM model (see WGSINS reports 2021 & 2022). These analyses indicate spatial differences in the utilization of burying areas, as certain areas are frequently used for spawning while other areas are apparently not regularly used. High larval abundances were usually found in the Dogger Bank area as well as in the Horns Reef area west of Denmark, indicating that these are major spawning areas. In contrast, in the central area at "Elbow Spit" no or at least only few larvae were found, which indicates that this is an area of minor importance for spawning. In addition, the data show clear differences in larval abundance between years.

As the burying areas are located in different management areas, another aim was to gather more information if sandeel in a specific management area are also reproducing and recruiting in that area, or if they are migrating from other management areas. This was supported by hydrodynamic modelling, i.e. backward and forward projections of larval drift routes, starting at their catch positions, were conducted to identify hatching and settling areas.

In combination with information from other investigations (e.g. genetic analyses), these results were utilized in the recent WKSANDEEL - Benchmark Workshop on Sandeel (*Ammodytes spp.*) in 2022 & 2023 (ICES 2024b), to delineate the stock structure of sandeel in the North Sea and to review and re-define the borders of the sandeel management areas.

Project outcomes are summarized in a working document (Huwer et al. 2024, ICES 2024b), and it is planned to elaborate on this and publish the results in a scientific journal. This publication may also draw on information from dredge surveys aiming at the buried adults and juveniles, which may allow to investigate if the sandeel are utilizing different areas for overwintering, spawning and foraging, and how they are moving between different areas throughout the year. In addition, data on sediment samples from the dredge surveys could be used to analyze if the sandeel prefer different sediment types for overwintering and for spawning.

2.3 Marine Litter sampling during the North Sea Midwater Ring Net survey

Marine litter is collected from standard MIK samples taken during the North Sea Midwater Ring Net survey (Denmark since 2014, all other nations since 2017). The samples collected up to 2020 have been analyzed in the project MARLINS (Marine Litter in the water column of the North Sea) coordinated by DTU Aqua and funded by the Danish VELUX Foundation.

In addition, samples from Dutch Downs MIK surveys and Danish Q3 MIK pilot surveys were analyzed in the project. The following samples were analyzed and results compiled in a database in the MARLINS project:

(1) Q1 MIK Denmark 2014 - 2016

(2) Q1 MIK All nations 2017 - 2020

(3) Dutch Downs MIK 2018 & 2019

(4) Danish Q3 sprat pilot surveys 2018 - 2020

The final database includes data from a total of 2988 sampling stations and detailed information for 2356 individual litter items.

For further details, it is referred to previous WGSINS reports, the final MARLINS project report and a presentation at the ICES ASC 2021 (Theme Session J: "Advances and challenges in marine litter pollution"). It is further planned to publish results in a relevant scientific journal, e.g. Science of the Total Environment or Marine Pollution Bulletin.

There is presently no additional funding available to continue the detailed MIK litter analyses from 2021 onwards. However, in contrast to many other studies on marine litter which are usually based on either beach surveys, bottom trawling or sampling in surface waters, the MIK net is sampling the entire water column down to 100 m, filtering large volumes of water. Besides, the MIK survey covers a large area and the amount of litter can be quantified as flowmeter data are available anyhow, whereas many other marine litter studies are spatially restricted and only qualitative or semi-quantitative. Furthermore, the sampling of marine litter from MIK samples does not require any additional vessel time. Thus, the MIK survey can provide unique and valuable data on the occurrence, distribution and abundance of free-floating marine litter in the entire North Sea area, as well as indications of potential sources and transport pathways. Therefore, WGSINS agreed that it is worthwhile to continue the MIK litter sampling in the future, and to investigate options for the future funding of the MIK litter analyses.

2.4 Larvae of autumn spawning herring on Baltic Ichthyoplankton Surveys

The Baltic Ichthyoplankton Surveys (BIS – see section 1.7) are mainly targeting eggs and larvae of cod and sprat and are organized as annual series of several individual survey cruises over the spawning season of these two target species. However, the surveys are also collecting eggs & larvae of several other fish species, depending on the time of the individual surveys. The surveys in November do e.g. collect larvae of autumn spawning herring. These additional data have resulted in a recent publication entitled "Spatio-temporal larval abundance dynamics of a depleted Baltic Sea herring ecotype" (Ojaveer et al. 2024). Autumn-spawning herring was the dominant herring ecotype in the Baltic until the early/mid-20th century. However, the current fishery assessment and management in the area assumes that the abundance of autumn spawning herring has been negligible since the 1970s, while the share of spring spawning herring has become dominant and is considered to be the only ecotype. BIS data from autumn 2002–2019 show that the abundance of the smallest larval stages have increased significantly, a pattern which could be due to an increase in autumn spawners in recent years. Genetic analyses confirmed that these larval herring are indeed offspring of true autumn spawners. Results are discussed in relation to the so-called portfolio effect, i.e. that fish stocks composed of several populations are considered to have more stable productivity than stocks containing only one or few populations because of complementary or independent dynamics among the populations within the stock. Preserving intraspecific diversity may also be critical for a species' future abilities to adapt to and survive in changing environmental conditions. Thus, these results not only provide new insights into the temporal dynamics of herring ecotypes and challenge the current understanding of central Baltic herring stock processes in general, but are also important in the context of monitoring, assessment and spatial management of herring in the Baltic Sea.

In addition, samples of autumn spawning herring larvae from the BIS surveys have contributed to a mixed-stock analysis of Atlantic herring (Bekkevold et al. 2023), which can be used as valuable tool for identifying management units and complex migration dynamics.

2.5 Holistic approach to the ichthyoplankton surveys in the North Sea and adjacent waters. Can we define common themes/cross overs between the different surveys?

Currently there are a number of surveys sampling ichthyoplankton in each of the Greater North Sea (including a small part of the Celtic Sea region), Irish Sea, Baltic Sea (e.g. the Bornholm Basin) and to the west of the British Isles. The general location and timing of a selection of these surveys are shown in Figure 2.4.1.

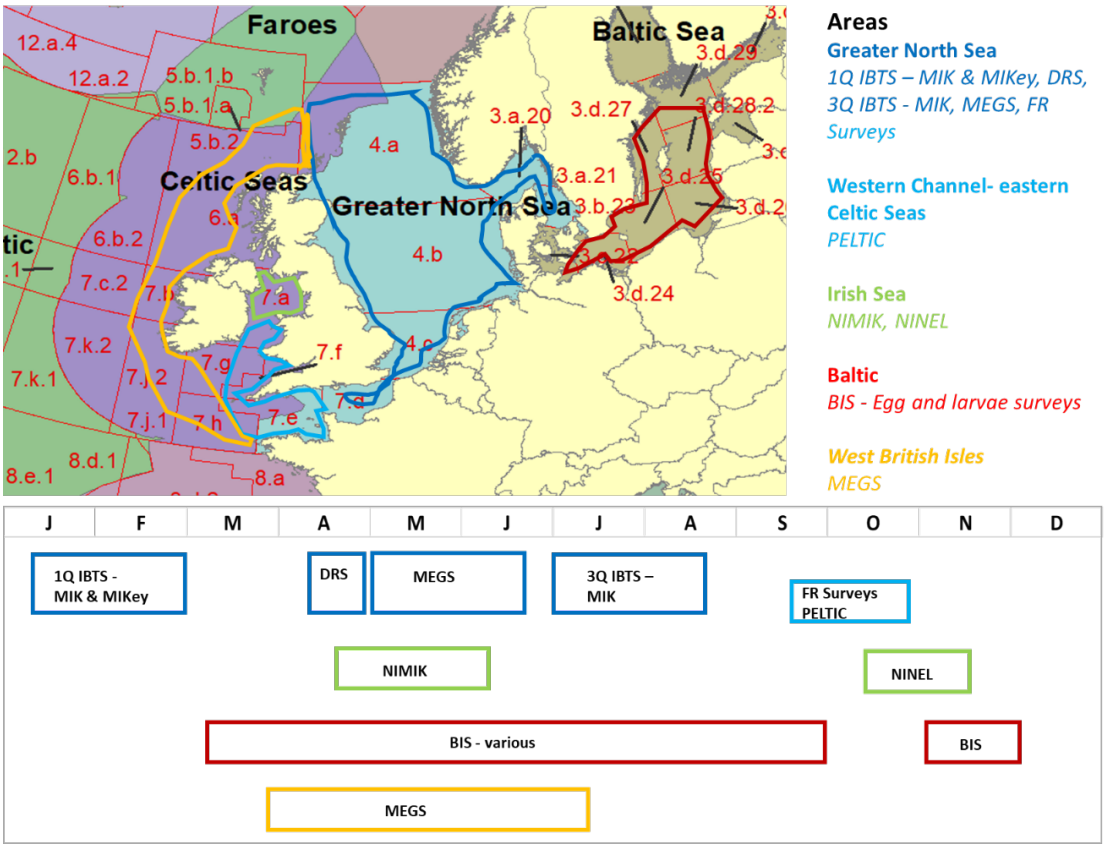

Figure 2.4.1 Current ichthyoplankton surveys in the North Sea and adjacent areas. Upper panel; Geographic location of surveys. Lower panel; Annual survey time slots. Note that the MEGS to the west of the British Isles is triennial and there are other surveys which are not shown here.

Each of these surveys generally has one or two target species and whilst other eggs and larvae are also sampled, currently these non-target species are often not reported, identified, or enumerated. A summary of the target species and the eggs and larvae routinely identified and enumerated is given in Table 2.2 in the WGSINS 2023 report (ICES 2024a).

There was further discussion on the potential for using information from combinations of surveys and the need to keep considering the development of future analyses. The WG decided to look further into the available data for sardine (*Sardina pilchardus*). The motivation for choosing this species is that the sardine abundance is increasing both in the Channel and the North Sea. There is currently a fishery for sardine in the Channel and it is assessed in WGHANSA. The population occurring in the North Sea is currently not subjected to a target fishery but presumably if the population increases then it could be. If this occurs, then there will be a necessity to assess the stock and then to provide advice. An additional question is whether the sardine in the North Sea can be considered as a separate population or part of the population found in the Channel.

There are sardine egg and larvae data available for both the North Sea (Q1 MIK, Q3 MIK and MEGS) and the western Channel (PELTIC). There are additional data held by Ifremer (France) from various cruises they undertake in the Channel and southern North Sea. Collectively these data can provide descriptors and dynamics of the early life history stages and to a certain extent spawning dynamics of sardine in this area. There are also further data available from the North Sea IBTS, HERAS and from the Channel IBTS and PELTIC on the distribution and biological characteristics of the juvenile and adult population. WGSINS has decided to convene an online

meeting in the early part of 2025 to bring scientists together from a number of different institutions to explore the available data (eggs to adults) for the North Sea and Channel area and suggest a direction for the analyses of the available data and future research directions.

3 Discussions on various ToRs and other topics

3.1 Data handling, ICES Eggs and Larvae database & quality assurance of survey indices time series

Several surveys organised under WGSINS contribute both haul and ichthyoplankton abundance data to the ICES Eggs & Larvae Database (ELDB). In the case of the North Sea Midwater Ring Net survey (MIK), the calculation of the MIK index is also implemented via the ICES TAF environment. In WGSINS 2023, it was agreed that each national institute is responsible for the submission and quality checking of their own data prior to submitting it to the database.

During WGSINS 2024, representatives from the governance group WGELFADG (Working Group for Egg & Larvae and Fecundity & Atresia Database Governance) presented on developments and changes made to the databases, as well as their accompanying documentation, in 2024. WGELFADG is made up of representatives from the ICES Data Centre and from WGs contributing data to the databases, including members with expertise in ichthyoplankton taxonomy and ecology, fecundity and batch fecundity analysis, and atresia analysis. The group acts as a forum to discuss issues with the databases, and to come to resolutions regarding recommendations or requests from other WGs.

From January 2025 new permissions structures regarding uploading, deleting, and overwriting (by resubmitting) data will be introduced to both databases. For the ELDB, which is the primary database used by WGSINS members, uploading permissions will remain as they currently are, with any ICES sharepoint user able to upload, delete, and overwrite their own data. However a new role of data coordinator will be introduced, with permission to delete and overwrite any data uploaded by their institute. WGELFADG requested that institutes represented in WGSINS that upload data to the ELDB provide a list of named data co-ordinators to the ICES Data Centre by January 1st 2025.

WGELFADG also requested input from WGSINS members into how to best indicate which species are mandatory target species of each survey for which data is uploaded to the ELDB. Providing information on this would allow users downloading data from the database to know for which species an absence of data is a true absence, and which may have been present but not recorded as they are not mandatory target species. A dedicated discussion session is planned on this subject in 2025, which WGSINS members were invited to participate in.

Representatives from the ICES Data Centre then presented the current format and status of both the FADB and ELDB, providing a demonstration of the database webpages and how they function and highlighting any major changes made in the last year. One key change for the ELDB was the introduction of specific RECO cruise codes as an additional identification key for data; which was introduced to address an issue raised in WGSINS 2023, where some countries faced issues when uploading data as they carried out multiple surveys using the same country code, vessel ID, and survey type during one year, and were overwriting past data files when uploading new survey data. New RECO codes have been generated so that surveys such as the IHLS which has multiple cruises a year can upload files from each cruise without overwriting data from the others. A new screening process has been introduced for both databases which allows users to submit files for screening, close the window, and return later to the check whether the file contained errors or warnings, and upload files which have been successfully screened to the database.

During the 2023 WGSINS meeting several suggestions were made regarding updates to the ELDB format (field names, DATSU record descriptions, etc) and function. Regarding database function, WGSINS had requested that the time between uploading data to the database, and that data being available for download be reduced, particularly during key periods such as the days prior to Assessment Group meetings where data may have to be corrected and indices recalculated to tight deadlines. These suggestions were agreed and implemented by WGELFADG during 2024. In particular, the time between uploading and being able to access data has been reduced from overnight to almost immediate, and this change is not limited to key periods.

3.2 Survey manuals

As some of the methodologies used in ichthyoplankton surveys are quite universal, WGSINS had developed an idea to produce a new, combined survey manual which describes several surveys coordinated by WGSINS. A first draft of this manual was planned for May 2023. However, this draft could not be developed as planned, as it turned out in the development process that most of the surveys did anyhow have many different settings and specific preferences. Thus, the initial idea of an overall manual combining several ichthyoplankton surveys could not be accomplished.

However, two of the surveys, the IHLS and the NINEL, are comparable in their methodologies and will therefore be combined in one manual. The already existing IHLS manual was updated were necessary and the relevant information to include the Northern Irish herring larvae surveys (NINEL) is at hand. It was planned to finalize the combined manual by the end of the recent term of WGSINS (2022-2024). However, this had to be postponed as discussions on the allocation of efforts in the IHLS survey are presently ongoing, and it makes little sense to produce a new manual at the moment which then potentially needs to be changed again. Thus, the further work on the manual will need to wait until discussions on the IHLS effort allocation are concluded. Nevertheless, the final aim is still to publish a combined manual for IHLS and NINEL as ICES TIMES publication.

At WGSINS 2023, it was decided not to include the MIK survey in the planned combined manual, as many of the applied methodologies are rather different than in the IHLS and NINEL surveys, and a specific manual already exists for this survey (SISP 2 - Manual for the Midwater Ring Net sampling during IBTS Q1. Currently on its 3rd edition, published in 2017 https://doi.org/10.17895/ices.pub.7578). The manual is still up to date and working well during the surveys, and an update therefore not needed at present. However, a conversion of the MIK manual from SISP to TIMES format, including a thorough review and update, will be required at some point within the coming years.

Likewise, methodologies used during the North Sea cod and plaice egg surveys (which are actually an addition to the Q1 MIK survey, i.e. an additional, smaller MIKey M net is attached to the larger MIK net) are rather different from IHLS and NINEL, and a separate manual already exists for these surveys as well (SISP 13 - Manual for North Sea cod and plaice egg survey. Currently on its 3rd edition published in 2018 https://doi.org/10.17895/ices.pub.5225). Also in this case an update of the manual is not needed at present, but a conversion from SISP to TIMES format will be required at some point.

The RHLS, NI-MIK and BIS surveys are presently using manuals that were developed by the participating national institutes. These are regularly maintained and updated if necessary, but there are presently no plans to convert these national manuals into ICES TIMES manuals.

3.3 Ichthyoplankton species identification

Correct species identification is essential to obtain reliable survey results and indices for use in stock assessments. Most of the surveys coordinated by WGSINS are targeting larvae of different clupeid species, which are co-occurring in the survey areas (herring, sprat and sardine). The correct identification of these species requires specific expertise, including knowledge of certain morphological traits such as the position of the pelvic fins in relation to the pylorus or the number of pre-anal myomeres. Therefore, dedicated larval identification workshops are organized in order to ensure expertise and consistency in species identification. Recent workshops were WKIDCLUP in 2014 (ICES 2014) and WKIDCLUP2 in 2021 (ICES 2022b). Based on the re-assuring results of the most recent workshop identification trials, the potential error caused by misidentification of clupeid larvae can be considered as low or negligible.

Due to the Covid-19 pandemic and related international travel restrictions, WKIDCLUP2 had to be held online. Prior to the workshop, the WebApp SmartDots was adapted to be utilized for ichthyoplankton identification based on images. Overall, the WebApp SmartDots proved to be very useful for holding such larval identification events. However, while the ICES data centre and the SmartDots team provided excellent support to get WKIDCLUP2 established and conducted, it also became apparent during the workshop that there was room for improvements and to adapt SmartDots (which was originally invented for otolith age reading) more specifically for identification workshops on fish eggs and larvae.

Therefore, the new egg and larvae module was recently further developed by the SmartDots team, considering the experiences and advice from the WKIDCLUP2 and WKMACHIS workshops (ICES 2022b,c). Furthermore, several WGSINS members contributed to the testing of the new module and provided feed-back during 2023, prior to the final implementation of the new module. At WGSINS 2023, SmartDots and the new egg and larvae module were presented by one of the chairs of WGSMART, Julie Olivia Davies (DTU Aqua). The final version is now implemented, and an online workshop was held in 2023 to introduce the new module and features of SmartDots to e.g. coordinators of identification workshops and other interested persons. At WGSINS 2024, Hannes Höffle, a member of WGSINS and new member in WGSMART, provided updates on recent developments in SmartDots, including several technical improvements in the software modules. He also reported on future plans for maintenance and development of SmartDots, including also plans for acquisition of funding for these efforts.

This was followed by a fruitful discussion on the use and value of SmartDots for ichthyoplankton identification. There was general agreement that the final implementation of the new egg and larvae module and the recent updates were an important step forward, which makes the use of SmartDots even more convenient and user-friendly. While SmartDots can not entirely replace hands-on identification training on actual egg and larvae samples, it provides several important advantages for larval identification workshops. These include the possibility to establish and store image libraries that can be re-utilized at future workshops and the fact that a larger number of interested persons can participate in online workshops, e.g. due to reduced travel costs. In addition to internationally coordinated identification workshops, the egg and larvae module also provides excellent opportunities for in-house training of personnel at the institutes participating in ichthyoplankton surveys. Representatives from the ICES data centre could also report that in recent years, between 40 and 70 identification events in SmartDots have been conducted per year. However, they also pointed out the need for additional participation of persons with ichthyoplankton expertise in WGSMART. Several members of WGSINS expressed interest, but are presently not able to commit as full members of WGSMART due to time and funding constraints.

In summary, WGSINS considers SmartDots a useful tool to ensure training in and quality of ichthyoplankton identification, and supports its further maintenance and development.

As another step to ensure the continued expertise and quality of species identification, the collection of sample material for future species identification workshops will be continued during the surveys coordinated by WGSINS.

At WGSINS 2024, several members also expressed interest in training in species identification of larvae of non-target species, in particular flatfish. Information on available fish larvae identification courses was exchanged. It was further agreed to gather relevant identification literature e.g., from WKIDFL 2011, ICES ID leaflets etc. and to provide access to this literature, e.g. via an "eternal" WGSINS folder on the sharepoint (see also section 3.5). It was further discussed to share photos of different larvae species (target and non-target, fresh and preserved) and to build up a database to catalogue images of identified larvae (potentially use SMARTDOTS for this purpose if funding is available).

3.4 Standardization of sampling and sample processing procedures

Subsampling of eggs and larvae

Bastian Huwer gave a presentation on the importance of proper sub-sampling of eggs & larvae, with particular focus on the MIK survey. Generally sub-sampling should be avoided as far as possible, but in some cases sub-sampling is simply necessary due to very high abundances. Examples of potential pitfalls and errors during sub-sampling were presented, including the potential effects on raised numbers. The importance of conducting the sub-sampling in a sound and proper manner was stressed. It was also pointed out that the description of subsampling procedures in the MIK manual are relatively extensive but not always straight forward.

This was followed by a brief description of sub-sampling procedures applied by the different institutes for their surveys and a general discussion on the topic. It was concluded that most survey participants try to avoid sub-sampling as far as possible and if it cannot be avoided strive to conduct the sub-sampling in a proper manner. However, there is still room for improvement, for standardization of applied methods and for a better description of sub-sampling procedures in relevant survey manuals. Thus, it was agreed to dedicate some time (approximately ½ day) for this important topic during the next WGSINS 2025 in Ijmuiden, the Netherlands, which will also include a hands-on workshop on different sub-sampling techniques.

Treatment of damaged larvae

Damaged larvae are often difficult or impossible to measure, which may introduce some bias and issues with further data handling. Damaged larvae can e.g. not be handled by the present R code calculating the MIK index, as it requires size measurements. In practice the damaged larvae are usually apportioned evenly to all size classes. However, this leads to strange raising factors and numbers and may actually introduce a relatively large bias, in particular for samples with a rather broad size distribution, where one or few damaged larvae of a certain size are attributed to all other size classes. Different ideas and suggestions how to treat damaged larvae were discussed. Usually, damaged larvae have the head or tail ripped off. With the rest of the body intact it should be possible to assign the larvae to a proper size class drawing from the proportions, as was demonstrated with an example, suggesting less bias with that method. However, this suggestion was also criticized, because it is basically making up lengths for damaged larvae. It was discussed that there should be at least a cut-off to how intact a larva has to be to assign a length.

A similar issue is the fact that damaged larvae are sometimes not possible to identify to species. For the MIK survey it was previously agreed that damaged larvae, that cannot be identified, will be assigned as herring. However, it was pointed out that in some areas of the MIK survey, like the German Bight, this does not make sense, as most or even all larvae there are actually sardines.

No final conclusion was reached how to deal with these issues with damaged larvae. But it was suggested to proceed by analyzing how many damaged larvae there actually are and how big of a problem it is, before deciding what to pursue further. The topic will be revisited during WGSINS 2025.

3.5 Discussions on other topics

General WGSINS business

The information describing the work of WGSINS on the ICES homepage was reviewed, discussed and edited by the group. The new WGSINS description text is now updated on the ICES homepage.

The Survey descriptions and associated Fact sheets about the different ichthyoplankton surveys on the ICES Eggs and Larvae Database (ELDB) webpage were reviewed and discussed. Most descriptions and fact sheets were up to date. However, the description and fact sheet for the North Sea Midwater Ring Net survey (MIK) is missing and needs to be included. This will be done by the survey coordinator primo 2024. In the future, updates and maintenance of the ELDB descriptions and factsheets will be handled by the recently established Working Group for Egg & Larvae and Fecundity & Atresia Database Governance (WGELFADG).

The WGSINS membership information was reviewed and updated, i.e. members that have retired or have not been actively participating for several years were removed from the list and the status of active members was updated.

Establishment of an "eternal" WGSINS folder on the Sharepoint

It was suggested to establish an "eternal" WGSINS folder on the Sharepoint, in order to store information that is relevant for the group on a longer term, e.g. literature on egg and larvae identification, lists with names and contact details of manufacturers and suppliers of sampling gear and other material, and any other relevant information which should be made generally available for longer-term future use. Other groups (e.g. WGBIOP) did already have established such folders, but they may have been shifted to a special "library folder". Hannah Holah is going to investigate with the ICES data center if and how such a folder can be established for WGSINS.

Recommendation: Light measurements on Q1 MIK-IBTS surveys

As light may have an effect on the behaviour and distribution of larvae, it was suggested and discussed to try to obtain light measurements during the Q1 MIK-IBTS surveys. This lead to the following recommendation from WGSINS to IBTSWG:

Recommendation from WGSINS 2024 – Light meter measurements on Q1 IBTS

WGSINS recommends that Q1 IBTS participants investigate if light meters are installed on the participating research vessels and if light measurements can be recorded, either with already installed light meters or with hand-held devices. If so, light measurements should be recorded at the first MIK haul and the last MIK haul each day during the IBTS-MIK and DRS to gain information on the actual light during these hauls. Light has an effect on the behaviour and distribution of the herring larvae. Collecting light measurements can help with data interpretation of these surveys and refining survey protocols. Light measurements should be recorded during the entire first MIK haul of the evening and the last haul in the morning, if possible at 5 minute intervals and without any artificial light source influencing the light measurement. It should also be noted what the weather circumstances and cloud coverage were during the haul.

4 Additional Data products & support for an ecosystem approach to fisheries management

4.1 Background and ongoing activities to collect additional data products

Apart from the data needed for the original survey objectives (e.g., calculating indices for assessment purposes), Ichthyoplankton surveys can provide additional information on e.g. the spatial and temporal distribution of other fish eggs and larvae, co-occurring in the catches. For some of these species, this will be the only source of information about their planktonic phase, because they are not of high commercial value and thus not part of any dedicated survey program. However, they may actually be very abundant and highly relevant in an ecosystem context, e.g. as prey for other species or as predator on various organisms.

Additional samples and data products from Ichthyoplankton surveys can also support the implementation of an ecosystem approach to fisheries management through the provision of data on important pelagic components of marine ecosystems (e.g. gelatinous zooplankton, macro plankton and early life stages of cephalopods). These components are not sampled effectively by traditional fishery survey methods and therefore are underrepresented in many existing survey datasets. Data collected by ichthyoplankton surveys on the distribution and abundance of these ecosystem components can be used to parameterize food web models and support research developing our understanding of the pelagic habitat.

Additional sampling and sorting of fish larvae (other than herring) was continued on the MIK surveys. Analyses of other fish larvae species of the Q1 MIK sampling is requested for at least sardine, sprat, lemon sole and eel, while details on sprat, sardine, mackerel, horse mackerel, lemon sole and red mullet larvae are wanted from the Q3 MIK sampling. The Q1 MIK 2024 sampling results were imported into the ICES eggs and larvae database (as far as available).

Additional data products are also available with regards to the marine litter monitoring in some of the MIK surveys (see section 2.3) and on the distribution of jellyfish and other planktonic species in the northern Irish Sea (NI-MIK). Besides, information on jellyfish is available for some of the Danish, Swedish and German Q1 MIK surveys and the Danish Q3 MIK surveys in the North Sea and is partly already published (Gawinski et al. 2019, Køhler et al. 2022, Jensen et al. 2024). Likewise, some of the BIS surveys in the Baltic provide information on jellyfish, which has also resulted in several publications (e.g. Huwer et al. 2008, Schaber et al. 2011a,b, Jaspers et al. 2018a,b).

Following a presentation by Daniel Oesterwind (Thünen Institute, present chair of WGCEPH) at WGSINS 2023 which highlighted the need for a better understanding on early life stages of cephalopods, all MIK-Q1, MIK-Q3 and IHLS participants agreed to collect and provide samples and/or data of cephalopods from their 2024 surveys and if available also from previous surveys. Preliminary results were presented at WGSINS 2024 and looked very promising (see also the following section “Sessions on added value of ichthyoplankton surveys”). Thus, it was agreed to continue the dedicated collection of cephalopods during the relevant surveys in 2025 and beyond.

Furthermore, several institutes conduct a number of different, additional data collections on national level for various purposes (see section 4.3 and Annex 5 for details).

4.2 Sessions on added value of ichthyoplankton surveys

To highlight the potential of ichthyoplankton surveys to provide additional data products, several presentations at the 2023 WGSINS meeting were grouped into a dedicated "Session on added value of ichthyoplankton surveys: Possibilities to supply additional ecosystem data". Various different topics were presented, ranging from analyses on non-target ichthyoplankton species over other organisms like jellyfish, zooplankton and cephalopods to marine litter (for details see WGSINS 2023 report).

As these presentations received great interest by the group and resulted in fruitful discussions on improved coordination and collaboration between surveys as well as ideas for future research, a dedicated session on the added value of ichthyoplankton surveys was again held at the 2024 WGSINS meeting.

Daniel Oesterwind (Thünen Institute, present chair of WGCEPH) presented results on early life stages of cephalopods, based on samples collected during the Q1 MIK surveys in 2024 as well as Danish Q1 MIK samples from 2014 to 2023. Cephalopod abundance in the North Sea is increasing in recent years and they are getting more and more important for North Sea fisheries, but there is presently no established management. Furthermore, there are large gaps in our knowledge about cephalopods, in particular concerning spawning grounds and the ecology of early life stages as these are not caught during standard trawl surveys. Results showed that on average, 21% of the MIK hauls contained cephalopods of different groups (Sepiolidae, Loliginidae, Ommastrephidae and Eledonidae) and provided new insights into their spatial distribution, spawning areas and spawning periods. This highlighted the potential of the surveys to provide valuable data for understanding their ecology and for establishing management measures. More detailed results can be found in the working document "Unlocking the Secrets of North Sea Cephalopods - Determining Age of Early Life Stages and Spawning Grounds" in Annex 4. It is planned to further elaborate on this WD and publish it as a scientific paper. Daniel Oesterwind will also provide a description of species identification of the paralarvae to WGSINS and apply for funding of future analyses. Based on these promising results and the potential to contribute to future management, it was agreed to continue the dedicated collection of cephalopods during relevant WGSINS surveys in 2025 and beyond.

Margit Hindholm (DTU Aqua & DPPO) presented results on sandeel larvae from the Dutch Downs Recruitment Surveys (DRS) in 2023 & 2024. Sandeel larvae occur in high numbers in the samples. Furthermore, a range of different size classes was found, depending on the sampling areas. Results show a potential to identify e.g. spawning areas and spawning periods.

Hannes Höffle (IMR) presented "Thirteen years of change and stability in the northern North Sea – Ichthyoplankton in the Norwegian ecosystem survey". This survey is conducted in April/May since 2006 and samples 18 transects + 4 process stations, using a variety of nets and gears. Ichthyoplankton is included on a regular basis since 2012. Results show distinct and in general annually recurring patterns in the spatial distribution of different groups/species. Gadoid larvae were e.g. mainly found in the northern parts of the study area, while larval flatfish were mainly found in the south. The distribution patterns were related to ambient hydrography. Future work is planned to refine statistical models for individual species, including additional variables to explain the observed patterns. In addition, data are planned to serve as basis for IBM modelling.

Bastian Huwer provided "Updates on Sandeel, Sprat & Sardine larvae and Marine litter from Q1 & Q3 MIK + various "Added value" of the surveys". Most of these topics are described in detail in report section 2 "Pilot surveys & Additional work on existing surveys" (Sprat & Sardine larvae - section 2.1, Sandeel larvae - section 2.2, Marine litter - section 2.3). In addition, results on distribution and abundance of anchovy larvae, sea horses and pipefish were presented. Samples

and data of these 3 species or species groups were provided to collaborators at DTU Aqua, TI Bremerhaven and Kiel University and will contribute to investigate their population genetics across European waters and to an analysis if sea horses are increasing in the North Sea area in recent years. Furthermore, new results on cephalopod larvae from the Danish Q3 MIK survey in 2024 showed high abundances of very small specimen, which can provide further insight into spawning times and spawning areas in the North Sea.

Cornelia Jaspers (DTU Aqua, Centre for Gelatinous Plankton Ecology & Evolution) gave a presentation on "How gelatinous macrozooplankton can support ecosystem assessments: Added value of a largely neglected key functional group". She pointed out that jellyfish, ctenophores and other gelatinous zooplankton are largely disregarded in most food web studies and that long term data are scarce, even though there is increasing evidence that these organisms play an important role in marine ecosystems. This includes interactions with fish, as gelatinous zooplankton can act as both predator, competitor and prey for many fish species. As gelatinous zooplankton can be sampled with the same gears as ichthyoplankton, it is obvious to combine sampling efforts to improve our understanding of these understudied organisms. Cornelia provided examples of already ongoing collaboration with several surveys under the WGSINS umbrella. This included investigations on jellyfish conducted on the Q1 and Q3 MIK surveys in the North Sea (by Danish, Swedish and German partners during Q1 surveys) and on most of the BIS surveys in the Baltic Sea. These initiatives have already resulted in a number of publications (e.g. Huwer et al. 2008, Schaber et al. 2011a,b, Jaspers et al. 2018a,b Gawinski et al. 2019, Køhler et al. 2022, Jensen et al. 2024). However, she suggested further coordination of efforts and combination of approaches between ichthyoplankton & jellyfish surveys, especially considering countries not currently involved as well as implementing of new technologies (e.g. optical systems). She particularly emphasized the need to establish solid, long-term time series and to improve research on the interactions between gelatinous zooplankton and fish.

The dedicated "Session on added value of ichthyoplankton surveys" was rounded up by revisiting and elaborating on the idea of a "Holistic approach to ichthyoplankton surveys" which had been introduced by Richard Nash at WGSINS 2022. The basic idea of this approach is to combine the available data from various surveys on different life stages of a specific species to obtain a more holistic understanding of the species life cycle in time and space, including migrations and connectivity between different areas as well as population structure. As discussed during previous WGSINS meetings, sardine (*Sardina pilchardus*) would be a good candidate species to test this approach, as it is regularly caught on several surveys coordinated by WGSINS as well as on other surveys. It was decided to establish a sub-group meeting in early 2025 to to explore the available data (from eggs to adults) and to discuss ideas for further analyses (for details see section 2.5).

4.3 Overviews of current and potential new additional data collections

During the recent term of WGSINS (2022-2024), ToR g aimed to "Assess possibilities for the different ichthyoplankton surveys to supply ecosystem data to support the implementation of an ecosystem approach to fisheries management". The dedicated "Sessions on added value of ichthyoplankton surveys" showed that a number of additional data collections are already ongoing during the different surveys and suggestions for new additional data collections were discussed as well. However, the types of additional data collections are rather diverse and differ between surveys and institutes, and also some of the applied methodologies differ, e.g. regarding gears, sample treatment and preservation methods. Furthermore, a detailed overview which additional information is collected on which surveys with which methods was so far lacking. Such an overview would help to exploit the potential of the additional data collections more efficiently, e.g.

by identifying which information from different surveys can be combined or supplement each other. Therefore, the deliverable of ToR g was to "Provide an overview of current and potential new data collections, in addition to the target species, and their potential uses for ecosystem management".

WGSINS 2023 discussed how the rather comprehensive and diverse information on additional data collections could best be summarized and presented. It was decided to produce one overview table for each of the ichthyoplankton surveys coordinated under the WGSINS umbrella.

These tables with "Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS" are now presented in the present WGSINS 2024 end-of-term report as a separate Annex (see Annex 5).

For the upcoming term of WGSINS (2025-2027), a new ToR g was defined, aiming to "Promote and provide a platform for broader and innovative uses of data, samples and information collected on WGSINS co-ordinated surveys, to support the implementation of an ecosystem approach to fisheries management." This will e.g. be done by presenting the overview tables at meetings of relevant groups such as EOSG & WGNS-NETSEA. Besides, the overview tables of additional sample & data collections will be maintained and updated when necessary. Furthermore, the dedicated sessions on added value & additional data sources and their application will be continued during the annual WGSINS meetings.

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Annex 2: Resolutions

2021/FT/EOSG07 The **Working Group on Surveys on Ichthyoplankton in the North Sea and adjacent Seas (WGSINS),** is chaired by Bastian Huwer, Denmark, and will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2022	29 November – 01 December	Belfast, Northern Ireland	Interim report by 7 January 2023 to ACOM/SCICOM	Incoming Chair Bastian Huwer (DK)
Year 2023	28 November – 01 December	Aberdeen, Scotland	Interim report by 1 January 2024 to ACOM/SCICOM	Bastian Huwer (DK)
Year 2024	26 November-29 November	Kgs. Lyngby, Denmark	Interim report by 10 January 2025 to ACOM/SCICOM	Present chair Bastian Huwer (DK) continues for another 3-year term

ToR descriptors

ToR	Description	Background	Science plan codes	Duration	Expected Deliverables
a	Planning and execution of North Sea and adjacent seas ichthyoplankton surveys used for assessment and management purposes	Ichthyoplankton surveys in the North Sea and adjacent Seas deliver abundance data of early life history stages for fish SSB and/or recruitment for assessment of several fish stocks.	3.1, 3.2,	year 1, 2, 3	Survey Plan
b	Provide quality assurance of the survey indices time series to assessment working groups	Consistency in generation of data is a crucial prerequisite for the use of a time series in the assessment.	3.1, 3.2, 5.2	year 1, 2, 3	
c	Update manuals for ichthyoplankton surveys in the North Sea and adjacent seas	Existing manuals should be updated regularly as new information becomes available	3.1	year 3	Updated Times manuals
d	Provide quality assurance of ichthyoplankton identification, including molecular methods	The accurate identification of ichthyoplankton and the developmental stages is crucial for species specific abundance estimates.	3.1, 3.2	year 1, 2, 3	
e	Standardization of sampling and sample processing procedures	Standards of sampling and sample processing procedures need to be optimized w.r.t. efficiency	3.3	year 1, 2, 3	

f	Prepare data for archiving in the ICES eggs and larvae database	WGSINS data need to be prepared and uploaded to the ICES eggs and larvae database by each institute	3.2	year 1, 2, 3	Updated dataset in the ICES eggs and larvae database
g	Assess possibilities for the different ichthyoplankton surveys to supply ecosystem data to support the implementation of an ecosystem approach to fisheries management	Ichthyoplankton surveys are able to provide additional data than needed for the original survey objectives. The acquisition of additional data has to be assessed.	3.1, 3.3	year 3	Provide an overview of current and potential new data collections, in addition to the target species, and their potential uses for ecosystem management

Summary of the Work Plan

Year 1	Plan and execute the International herring larvae surveys in the North Sea (IHLS), the North Sea Midwater Ring Net survey (MIK), the Downs recruitment survey (DRS), the Northern Irish Northeastern Larvae Survey (NINEL), the Northern Ireland MIK Survey (NI-MIK), the Rügen herring larvae survey (RHLS) and the Baltic Ichthyoplankton Surveys (BIS)
Year 2	Plan and execute the IHLS, the MIK, the DRS, the NINEL, the NI-MIK, the RHLS and the BIS
Year 3	Plan and execute the IHLS, the MIK, the DRS, the NINEL, the NI-MIK, the RHLS and the BIS

Supporting information

Priority	This working group is important for the fisheries advisory process. The different ichthyoplankton surveys in the North Sea and adjacent seas provide important fishery-independent stock and/or recruitment data used in the assessment for herring stocks in the North and Baltic Seas as well as for cod in the Baltic and the Irish Sea, as well as for haddock in the Irish Sea and informs management of whiting in the Irish Sea.
Resource requirements	None.
Participants	The working group is normally attended by 8 – 15 members and guests.
Secretariat facilities	ICES data center
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	HAWG, WGCSE, WGBFAS
Linkages to other committees or groups	EOSG, WGBIOP, IBTSWG, WGALES, WGML, WGZE, DSTSG
Linkages to other organizations	None

Annex 3: Survey Summary Sheets

International Herring Larvae Surveys in the North Sea (IHLS)

Nation:	Vessel:	Dates
Germany	Walther Herwig 3	01 September – 12 September 2023
Netherlands	Tridens 2	18 September – 29 September 2023
Netherlands	Tridens 2	18 December – 21 December 2023

Cruise	North Sea IHLS monitor the abundance and distribution of newly hatched herring larvae at the main spawning grounds of autumn spawning herring along the Scottish and English coast in September and on the Downs spawning ground in the English Channel in December and January.
Gear details:	Gulf-type high speed plankton sampler catches are taken during day and night time. Mesh size of the net is 280 microns. The sampler is equipped with a CTD for measurements of actual sampler depth, salinity and temperature profiles as well as internal and external flowmeters determining the filtered water volume. Samples are taken in a V-shape manner, e.g. from the sea surface down to near the seabed (5m above the bottom) and back to the surface.
Notes from survey (e.g. problems, additional work etc.):	Four survey areas could be sampled as scheduled. The German part of the survey in the English Channel had to be cancelled due to technical problems of the vessel. A replacement or charter vessel was not available. The resulting larvae index for this area is therefore only based on the December estimate. Larvae abundance around the Orkneys was low. This may be due to the timing of the survey right at the beginning of the hatching period or shifts in spawning time. In the Buchan and the central North Sea, newly hatched larvae concentrated in two areas. In all survey areas, herring larvae abundance was relatively low. However, the estimated larvae abundance indices could be used in the assessment of North Sea autumn spawning herring.
Number of fish species recorded and notes on any rare species or unusual catches:	In total, 459 plankton samples were taken during the IHLS surveys between September 2023 and December 2023. They contained 22,548 herring larvae.

Stations fished

ICES Divisions	Strat.	Gear	Tows planned	Valid	Add.	Inv.	% stations fished	comments
4a, 4b	N/A	Gulf	319	319	0	0	100 %	Extra hauls taken when abundance was dense.
4c, 7d	N/A	Gulf	140	72	0	0	51 %	Extra hauls taken when abundance was dense.
total	N/A	Gulf	459	381	0	0	83 %	Due to cancelled cruise in 01/24

North Sea Midwater Ring Net survey (MIK)

Nation:	Vessel:	Dates (planned according to Q1 IBTS cruise program)	Comment
Denmark	Dana	12-01 to 30-01	Survey dates earlier than in previous years due to German charter of DANA
France	Thalassa II	19-01 to 10-02	
Germany	Dana	31-01 to 19-02	German RV Walther Herwig III not available, replaced by RV DANA but resulting in reduced number of days at sea
Netherlands	Tridens 2	22-01 to 23-02	
Norway	GO Sars	23-01 to 16-02	
Scotland	Scotia III	22-01 to 12-02	
Sweden	Svea	21-01 to 04-02	

Cruise	The North Sea Midwater Ring Net survey (MIK) aims to conduct plankton net tows to determine the abundance of late North Sea herring larvae, which is used to provide a recruitment index, the so-called "0-ringer index", for the stock assessment of North Sea herring. Work is carried out at night-time during the Q1 IBTS in the North Sea.
Gear details:	Night-time plankton catches are carried out with the standard midwater ring net (MIK), a large ring net with a diameter of 2 meters and a mesh size of 1600 µm.
Notes from survey (e.g. problems, additional work etc.):	The 2024 MIK survey was faced with severe weather conditions during large parts of the survey period, resulting in several days of lost survey time for most participants. The German RV Walther Herwig III was not available and Germany used the Danish RV DANA, resulting in reduced days at sea for the German survey and a shift in survey timing of the Danish survey. A total of 716 MIK hauls were planned according to the 2024 NSIBTS Q1 program and 581 were conducted, i.e. 81% of the planned stations. For the 2024 MIK 0-ringer index (corresponding to the 2023 year-class), all hauls north of 51° N were used, in total 565 hauls (for comparison: 2023 = 569 & 2022 = 410 hauls). Thanks to extensive coordination between participants during the survey, all except three of the planned ICES squares were covered. Furthermore, the main distribution area of the herring larvae in the central and southern North Sea was well covered with 3-4 hauls in most ICES squares. However, the swapping of rectangles due to severe weather resulted in a slightly uneven coverage, i.e. some squares were covered with 5-6 hauls while others only with 2 hauls. Coverage of the Skagerrak/Kattegat area was below average. Overall, the achieved coverage was sufficient and can be regarded to provide a representative 0-ringer index.
Number of fish species recorded and notes on any rare species or unusual catches:	Besides the target species herring, larvae and juvenile stages of various other species were caught, including e.g. lemon sole, crystal goby, sandeel, dab, pearlside, pipefish and gobies. As in previous years, catches of sardine larvae were again observed, specifically in the German Bight area and in the Skagerrak.

Stations fished (aims: to complete 716 MIK tows per year)

Country	Gear	Tows planned	Valid	Add.	Inv.	% stations fished	comments
Denmark	MIK	90	87	0	0	97	
France	MIK	108	89	0	0	82	
Germany	MIK	132	102	0	0	77	
Netherlands	MIK	112	103	0	0	92	
Norway	MIK	90	79	0	0	88	
Scotland	MIK	116	88	0	0	76	
Sweden	MIK	68	33	0	0	49	
TOTAL	MIK	716	581	0	0	81	

Northern Irish Northeastern Larvae Survey (NINEL)

Nation:	UK(NI)	Vessel:	RV Corystes
Survey:	NINEL	Dates:	Planned 4- 10th November 2024

Cruise	Herring larvae surveys of the northern Irish Sea (ICES area 7aN) have been carried out by the Agri-Food and Biosciences Institute (AFBI), formerly the Department of Agriculture and Rural Development for Northern Ireland (DARD), in November each year since 1993. The surveys have been carried out onboard the RV "Corystes" since 2005, and prior to that on the smaller RV "Lough Foyle". Sampling is carried out on a systematic grid of stations covering the spawning grounds and surrounding regions in the NE and NW Irish Sea. Mean catch-rates (nos.m-2) are calculated over stations to give separate indices of abundance for the NE and NW Irish Sea. Larval production rates (standardized to a larva of 6 mm), and birth-date distributions, are computed based on the mean density of larvae by length class. A growth rate of 0.35 mm day-1 and instantaneous mortality of 0.14 day-1 are assumed based on estimates made in 1993–1997.
Gear details:	Sampling is conducted using a Gulf7 high-speed plankton sampler fitted with 280µm mesh net. A Valeport MIDAS+CTD system is fitted providing flow rates of internal and external Valeport model 002 current meters with 50mm diameter impellers, depth, temperature and salinity profiles. A Seabird SBE19plus CTD is also carried recording depth, temperature, salinity and fluorescence.
Notes from survey (e.g. problems, additional work etc.):	The 2024 NINEL survey was planned for the period 4-10th November. Due to mechanical issues with the research vessel the survey was unable to go ahead this year.
Number of fish species recorded and notes on any rare species or unusual catches:	N/A

Northern Ireland MIK Survey (NI-MIK)

Nation:	UK(NI)	Vessel:	RV Corystes
Survey:	NI-MIK	Dates:	20th May – 7th June 2024

Cruise	MIK net surveys of the Irish Sea (ICES area 7aN) have been carried out by the Agri-Food and Biosciences Institute (AFBI), formerly the Department of Agriculture and Rural Development for Northern Ireland (DARD), in the spring/early summer each year since 1993. The surveys have been carried out onboard the RV "Corystes" since 2005, and prior to that on the smaller RV "Lough Foyle". Sampling is carried out on a systematic grid of stations covering the main nursery ground of juvenile gadoids (cod (*Gadus morhua)*, whiting (*Merlangius merlangus*) and haddock (*Melanogrammus aeglefinus*) in the western Irish Sea. From 2006 additional sampling in the eastern Irish Sea has also taken place. While the MIK net is deployed during the hours of darkness (30±mins) a GULFVII high speed plankton sampler is deployed during the day to sample zooplankton and ichthyoplankton. Catches of cod, haddock and whiting from the MIK net survey are reported to WGCSE. Since 2018 Neuston sampling for marine litter (micro/macro) have been included in the survey.
Gear details:	GulfVII high-speed plankton sampler fitted with 280µm/425µm mesh net dependent on clogging. A Valeport MIDAS+CTD system is fitted providing flow rates of internal and external Valeport model 002 current meters with 50mm diameter impellers, depth, temperature and salinity profiles. A Seabird SBE19plus CTD is also carried recording depth, temperature, salinity and fluorescence. Between 1993-2018 a 5m^2 modified Isaacs Kidd trawl was deployed. In 2019 a 2 metre diameter midwater ring net replaced this gear. Scanmar sensors are fitted to the MIK frame to provide depth and monitor deployment. A General Oceanics mechanical standard flowmeter records internal flow rates. From 2018 a WP2 net with side floats for neuston sampling fitted with 333µm mesh and internal flowmeter (General Oceanics mechanical standard) has been deployed at GULFVII stations.
Notes from survey (e.g. problems, additional work etc.):	A total of 111 Gulf7, 80 MRN2, 80 WP2 deployments were made.
Number of fish species recorded and notes on any rare species or unusual catches:	Of the target species 278 whiting, 20 haddock were recorded in the MRN2 catches. Larval fish catches in the Gulf7 were dominated by dragonets (*Callionymidae*) 3261, dab (*Limanda limanda*) 1901, clupeiformes (predominantly *Sprattus sprattus* 1327 and 179. In addition, various species of gelatinous zooplankton and crustacea were recorded. *Zeugopterus regius* larvae were identified for the second year in the survey. A special identification was that of a Leptocephalus larvae located in the deeper waters north west of Anglesey.

Rügen herring larvae survey (RHLS)

Nation:	Germany	Vessel:	CLUPEA
Survey:	375	Dates:	27.02.-20.06.2023

Cruise	Target herring population is the Western Baltic spring-spawning herring. The main aim is to monitor the spawning activity and larval production in a major spawning area, the Greifswald Bay as an indicator of reproductive success in the coastal Baltic Sea. Target data are a high-resolution spatial and temporal records of the larval abundance (35 stations/week) during the entire spawning period as well as hydrographic data (temperature, salinity and oxygen). Weekly mean abundance of larva is summarized in an annual index value (N20) expressing the sum of larvae reaching a critical length of 20 mm by the end of the reproduction season. The collected data are stored nationally and in the ICES Fish Eggs and Larvae dataset.
Gear details:	Bongo net (0.6m diameter) of 335 µm mesh, HYDROBIOS-electronic flow-meters
Notes from survey (e.g. problems, additional work etc.):	The Rügen Herring Larvae Survey (RHLS) in the western Baltic (ICES area IIId/SD24) took place during 17 weeks from Feb (27th)-June (20th) on FRV "Clupea". In total 582 stations could be achieved during 51 days at sea. Due to early spawning activity (January) the regular survey was started earlier than in former years, leading to an extended sampling period. During this period, the core program could be fully achieved. In total 13 stations had to be cancelled due to bad weather. However, a minimum of 29 stations (of 35) could be sampled throughout the survey leading to a, adequate coverage of stations. One additional survey week was conducted during November 2023 to control for autumn spawner larvae abundance. On each station a vertical CTD-profile was taken (T, Sal, DO2, turbidity, Chl a-fluorescence). Vertical Zooplankton samples (55µm, 200µm) were taken weekly on a grid of 5 stations throughout the Bay.
Number of fish species recorded and notes on any rare species or unusual catches:	Samples are processed for herring larvae exclusively. Remaining samples are stored for potential future processing of other species. Zooplankton samples (55 µm, 200 µm mesh) are taken on 5 stations/week.

Table 4.1.2.3.1. Stations fished

ICES Divisions	Strat.	Gear	Towsplanned	Valid	Add.	Inv.	% stations fished	comments
24	N/A	Bongo	595	582			98 %	

ccStrat: strata; Add: Additional tows; inv: Invalid

Baltic Ichthyoplankton Surveys (BIS)

Nation:	Denmark, Poland, Germany	Vessel:	DANA, BALTICA, ALKOR & others
Survey:	BIS-Baltic Ichthyoplankton Surveys	Dates:	Monthly from March-August & November, 2024

Cruise	The Baltic Ichthyoplankton Surveys (BIS) are an annual series of individual surveys conducted by several participating institutes from Denmark, Poland and Germany. The surveys aim to cover the main spawning area of the target species, Eastern Baltic cod (EBC), throughout its spawning season, i.e. individual surveys cover a standard grid of 45 Bongo net stations and are usually conducted in March, April, May, June, July, August and November, in some years also in September. The surveys provide a stock biomass estimate for EBC based on egg abundances and a recruitment index based on larval abundances. In addition, the surveys provide information on eggs and larvae of several other species, including sprat, herring and flounder. On some cruises, Bongo net hauls are also conducted on additional stations to supplement the standard grid, and sometimes also vertically resolved Multinet sampling is conducted. Besides, most surveys are multidisciplinary and also include sampling of adult fish (e.g. for fecundity estimates needed for egg production methods) and zooplankton (e.g. as prey for larvae) as well as hydrographic measurements. The collected data are stored in national databases, and the time series of egg based stock biomass estimates and recruitment indices for EBC are updated every year and provided to WGBFAS for use in the stock assessment of EBC.
Gear details:	Bongo net (0.6 m diameter) of 335 and 500 µm mesh, flowmeters + on some cruises additional other gears, e.g. different types of fishing trawls, Baby-Bongo net (0.2 m diameter) of 150 µm mesh, WP-2 net (100 µm mesh), Multinet (335 µm mesh)
Notes from survey (e.g. problems, additional work etc.):	In 2024, a total of 7 individual BIS surveys were conducted in March, April, May, June, July, August and November. On most cruises, the entire 45 station standard grid was sampled. On the cruises in March & November, 4 and 3 standard stations could not be sampled due to severe weather, respectively. In total, 308 of the planned 315 standard stations were sampled in 2024, corresponding to 98%.
Number of fish species recorded and notes on any rare species or unusual catches:	In addition to cod as the target species, eggs and larvae of several other species are caught. Depending on the sampling month, abundant species include sprat, herring, flounder, plaice, sandeel and gobies. Additional species occur at relatively low abundances, including e.g. rockling, sea snail, turbot and sculpin. In addition, various species of gelatinous plankton are recorded. The last survey in November yielded again high abundances of the invasive American comb jelly *Mnemiopsis leidyi* above the long-term average, although not as high as the record-high numbers found in November 2023.

Stations fished

ICES Divisions	Strat.	Gear	Tows planned	Valid	Add.	Inv.	% stations fished	comments
25	N/A	Bongo	315	308	Several	0	98 %	

Annex 4: Working Document

Unlocking the Secrets of North Sea Cephalopods – Determining Age of Early Life Stages and Spawning Grounds

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Landings of North Sea cephalopods, especially squids have been increased within the last years (ICES, 2023). Their semelparous life cycle, involving just a single spawning event before death, make them potentially vulnerable for targeted and bycatch fisheries (Bobowski et al., 2023) Consequently, protecting spawning grounds and ensuring a successful recruitment might help to reduce the risk of stock collapse (ICES, 2023). However, information about early life stages and spawning grounds of North Sea cephalopods is very rare.

Therefore, we analysed the potential of samples collected during the Q1 MIK surveys to gain new knowledge about the distribution of cephalopod early life stages and potential spawning grounds. Analysed samples were provided by Denmark, Germany, Norway, Scotland and Sweden for the year 2024 (Table 1). In addition, Denmark sent samples for the years 2014 to 2023 (not analysed were samples from the years 2015 and 2016 due to late arrivals, but listed catch data was used), Germany for 2020, and Norway provided some extra data by sending files for the years 2018 to 2023, where cephalopod catches were listed. In total a number of 771 specimens out of 1811 hauls were identified. 663 samples were examined personally, additional 108 individuals were listed in data and were taken into account for the creation of distribution maps of the different cephalopod families within the North Sea.

Samples included Sepiolidae (299 individuals identified), Loliginidae (264), Ommastrephidae (148), and Eledonidae (20). Most catches were identified in the western-central part, least catches in the eastern area along Norwegian Trench. Sepiolidae were distributed over the entire sampled area, with slightly more individuals found in western central part and north-western part between Shetland Islands and Orkney. Most catches for Loliginidae were in central North Sea and a few more up in the northern Moray Firth, whereas ommastrephids also captured in central North Sea, but ranged in the more northern central part of the North Sea compared to loliginids. Few octopods were found along UK shores and western central North Sea. In addition, a few were found in the central (along dogger bank) and some more along Shetland Islands (Figure 1).

Table 1: Number of individuals and haul data provided by participating countries for the years 2014 to 2024.

	Country														
	Denmark			Germany			Norway			Scotland			Sweden		
Year	Indiv. Analysed	Indiv. Additional Listed	Nr MIKHauls & Test Hauls	Indiv. Analysed	Indiv. Additional Listed	Nr MIKHauls & Test Hauls	Indiv. Analysed	Indiv. Additional Listed	Nr MIKHauls & Test Hauls	Indiv. Analysed	Indiv. Additional Listed	Nr MIKHauls & Test Hauls	Indiv. Analysed	Indiv. Additional Listed	Nr MIKHauls & Test Hauls
2014	**23**	**6**	**68**	-	-	-	-	-	-	-	-	-	-	-	-
2015	**0**	**44**	**76**	-	-	-	-	-	-	-	-	-	-	-	-
2016	**0**	**33**	**82**	-	-	-	-	-	-	-	-	-	-	-	-
2017	**31**	**3**	**86**	-	-	-	-	-	-	-	-	-	-	-	-
2018	**51**	**5**	**83**	-	-	-	-	**1**	**108**	-	-	-	-	-	-
2019	**16**	**1**	**87**	-	-	-	-	**2**	**88**	-	-	-	-	-	-
2020	**30**	**4**	**65**	**31**	-	**129**	-	**0**	**61**	-	-	-	-	-	-
2021	**137**	**0**	**92**	-	-	-	-	**3**	**90**	-	-	-	-	-	-
2022	**48**	**0**	**54**	-	-	-	-	**3**	**85**	-	-	-	-	-	-
2023	**50**	**0**	**90 + 3**	-	-	-	-	**1**	**74**	-	-	-	-	-	-
2024	**104**	**0**	**87**	**28**	-	**103**	**4**	**0**	**79**	**94**	**0**	**88**	**16**	**2**	**33**
Sum Indiv. Analysed	490			59			4			94			16		
Sum Additional		96			0			10			0			2	
Sum Hauls			873			232			585			88			33

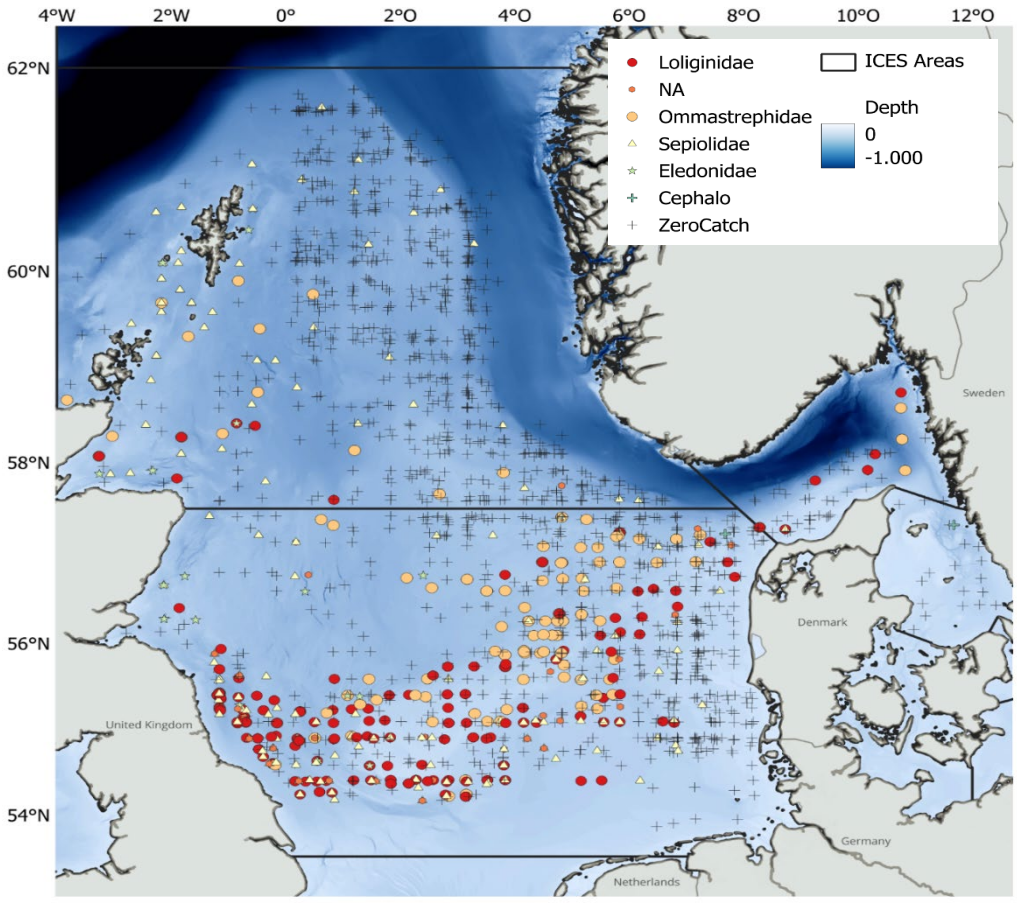

Figure 1: Distribution of all families from 2014 to 2024. Identified individuals from the analysed NS-IBTS MIK samples belong to Eledonidae (turquoise star), Loliginidae (red dot), Ommastrephidae (light orange dot), Sepiolidae (yellow triangle). Not identified squids (little orange dots), not identified Cephalopoda (blue thick cross), and stations with zero catches (black cross) are also displayed.

Sizes were measured in mm Dorsal Mantle Length (DML) for 17 individuals of Eledonidae, 222 Sepiolidae, 240 Loliginidae, and 147 Ommastrephidae. For Eledonidae, most individuals (94.1 %) were smaller or equal than 5 mm DML. Most Sepiolidae (40.5 %) were between 5 and 10 mm DML. For both, Loliginid (24.2 %) and Ommastrephid (35.4 %) squids, most were between 10 and 15 mm DML. In conclusion, it can be deduced that the selectivity of the MIK is between 5 and 20 mm DML for squids and sepiolids, and < 5 mm DML for Eledonidae. Early life stages can be sampled by the MIK, but paralarvae were not necessarily present for all found cephalopod families.

After identification, age determination was carried out by counting the daily increments on both individual statoliths and calculating the mean age of Alloteuthis sp.. Age was determined for a total of 81 Alloteuthis sp. individuals caught in 2021 (year with most loliginids) and range from 83 days to 184 days. Most individuals (58) were between 100 and 140 days old. By calculating backward from the time of sampling using the determined age, hatching season from September to Mid-November was concluded for Alloteuthis sp.

With the age and fishing area of each individual Lagrangian stochastic drift module that treats larvae as passive particles was coupled offline with a hydrodynamic model called Atlantic-European North West Shelf- Ocean Physics Reanalysis, by Copernicus services (LINK https://data.marine.copernicus.eu/product/NWSHELF_MULTIYEAR_PHY_004_009/) to identify potential spawning grounds of Alloteuthis sp.. A similar drift model has been already successfully coupled with another hydrodynamic model in Hufnagl et al., (2013, 2015) and Akimova et al., (2019). The modelled hatching area of Alloteuthis sp. starts at the central of the English Coast and runs all the way up the most northern part of the Scottish coast, reaching east-wards to the Shetland Islands and the Dogger Bank (Figure 2). Calculated particle density shows highest values off the coast of Scottish St. Andrews.

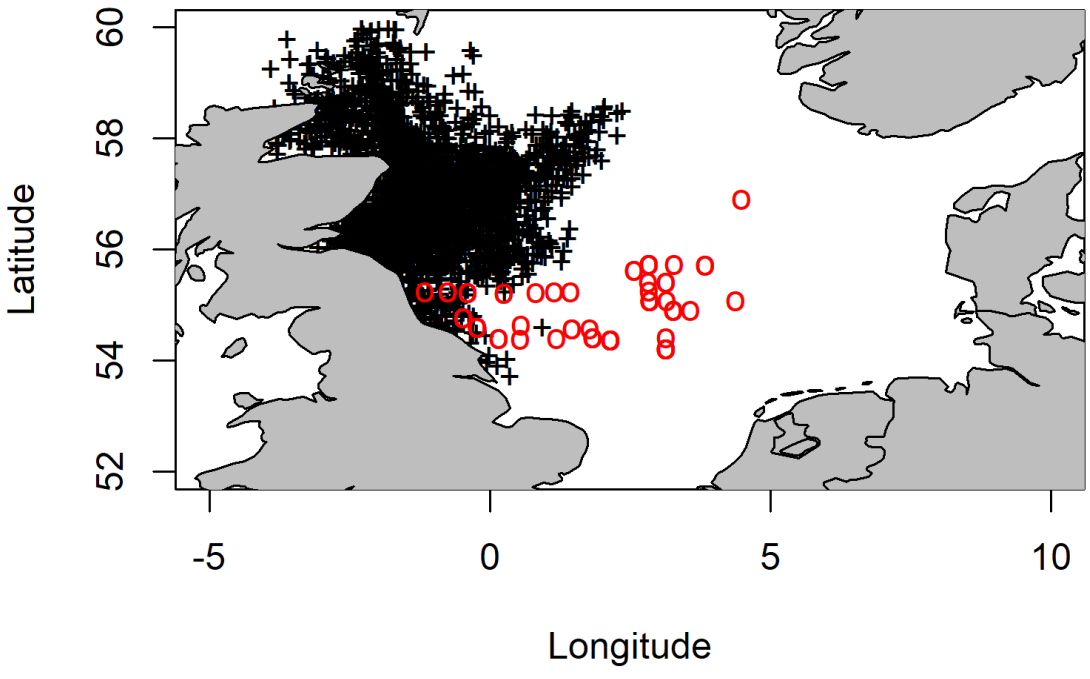

Figure 2. Model results of potential spawning areas for Alloteuthis sp.. Black crosses indicat potential spawning areas; red circles fishing stations of individuals in NS-IBTS 2021 Q1.

Future work on southern parts as well as the north-western parts of the North Sea is still needed to further understand the North Sea cephalopods and their biology to implement management measures.

The study shows the high potential of the MIK survey with regard to other relevant fisheries questions. Even if the selectivity of the MIK net for the early life stages appears to be high, the survey could be used in future to find out more about the distribution of the early life stages and spawning grounds of cephalopods across the whole survey area.

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Annex 5: Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS

Background & Introduction

Ichthyoplankton surveys are able to provide additional samples & data beyond those needed for the original survey objectives, which can contribute valuable and unique information for our understanding of the state and functioning of marine ecosystems. A number of additional data collections are already ongoing during the different surveys coordinated by WGSINS. However, the types of additional data collections are rather diverse and differ between surveys and institutes, and also some of the applied methodologies differ, e.g. regarding gears, sample treatment and preservation methods. Furthermore, a detailed overview which additional information is collected on which surveys with which methods was so far lacking. Such an overview would help to exploit the potential of the additional data collections more efficiently, e.g. by identifying which information from different surveys can be combined or supplement each other.

Therefore, major goals of WGSINS are to assess possibilities for the different ichthyoplankton surveys to supply ecosystem data to support the implementation of an ecosystem approach to fisheries management, and to provide an overview of current and potential new data collections and their potential uses for ecosystem management.

The following tables with "Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS" provide comprehensive overviews of all presently ongoing additional sample and data collections for each of the ichthyoplankton surveys coordinated under the WGSINS umbrella.

How to read and interpret the overview tables

The information presented in the overview tables is rather comprehensive. Therefore, we here present a guide which information is presented, and how the information should be read, understood and interpreted.

The upper part of each table provides basic information about the individual survey coordinated by WGSINS. This includes e.g. information on the target species and main purpose of the survey, as well as technical details about the gears and methodologies.

The lower part of each table provides information about the additional samples, data and information that is collected.

The tables below provide detailed descriptions of the different columns and fields in the upper and lower parts of the overview tables.

We hope these overviews will inspire to collaboration and innovative uses of the data, samples and information collected on WGSINS co-ordinated surveys, and lead to future research to support the implementation of an ecosystem approach to fisheries management.

Guide to upper part of the overview tables

Basic information about the survey	
Target species & life stage	The main species (english & scientific name) and life stage targeted by the survey, e.g. "Herring larvae - *Clupea harengus*"
Main purpose of the survey	The main outcome of the survey, e.g. "Recruitment index for North Sea herring" or "SSB estimate for Baltic cod"
Survey time series	Since when is the survey conducted, or during which periods was it conducted (in case there have been longer interruptions)
Survey period	How often and when during the year is the survey conducted, e.g. "Annually in Q1"
Survey area	Area covered by the survey
Survey design	Brief description of the survey design (e.g. "Station grid with x nm spacing between stations" or "X hauls per ICES rectangle")
Survey gear	Name of the main survey gear & mesh size, e.g. "Midwater ring trawl - MIK net (1600 μm)"
Sampling method	Sampling details of the main survey gear, such as deployment method and ship speed, e.g. "Double oblique hauls from surface to 5 m above seafloor at 3 knots"
Sampling period	Time of the day when the sampling is conducted, e.g. "Nighttime", "Daytime" or "Daytime & Nighttime"
Survey coordinator	The group responsible for coordination of the survey
Database for target species	The database where the data for the target species (and other mandatory species) are stored
Other mandatory species	All species that should be reported in addition to the target species (and in parentheses the year since when it is mandatory to report the species)

Guide to lower part of the overview tables

Additional information collected during the survey	
Type of additional information Column 1	Specifies the gear (and if applicable mesh size) used to collect the additional information. Separated into information collected with the main survey gear (e.g. MIK net on the North Sea Midwater ring net survey) and with additional gears if applicable (e.g. MIkey M net on the North Sea Midwater ring net survey or CTD casts).
Type of additional information Column 2	Specifies the type of additional information that is collected, e.g. which organisms are collected like "Other fish larvae" or "Jellyfish" or which data e.g. "Hydrography"

Type of additional information Column 3	This column gives further information about availability, sorting status and preservation of samples & available data - details below
Samples available	Are the physical samples available and since when?
Samples separated	Are the physical samples already sorted and separated, and since when? (e.g. other fish larvae sorted from plankton samples and stored in separate jars) or not sorted and still in the main plankton sample
Preservative	Which preservative is used? (overview of preservative codes see below)
Data - Counts	Are counts of the organisms available and since when?
Data - sizes	Are size measurements of the organisms available and since when?
Participating country Separate columns for each country or institute participating in the survey	Provide information which of the participating countries (or institutes) are collecting the respective additional information and since when, which samples and data are available and since when/for which years, and how samples are preserved. DEN = Denmark, FRA = France, GER = Germany, NED = The Netherlands, NOR = Norway, SCO = Scotland, SWE = Sweden, NIR = Northern Ireland / DTU = DTU Aqua, Denmark; MIR = National Marine Fisheries Research Institute, Poland; GEO = GEOMAR Kiel, Germany; UHH = University of Hamburg, Germany; TI = Thünen Institute, Germany
	The colour code shows if the information is available (grey background) or not available (blank/white background)
	Written text in the cells provides additional information, using the following codes:
	A written year (e.g. "2014") shows since when the information was collected (in case of a still running, continuous time series)
	PA = Partly available, i.e. not a continuous time series but only for certain years. Further details about the availability may be specified in the column "Additional comments" or by using footnotes.
	X = information usually available for most of the time series or at least for recent years, but no exact information available for which years data are available
	Preservative Codes: AL = Alcohol, FO = Formaline, FR = Frozen, na = information not available or not relevant (e.g. marine litter samples no preservative used).
Column "Additional comments"	Used to provide additional, relevant information that is general or applies to all participants (e.g. if all samples are sent to and stored at one institute).
Foot notes	Used to provide additional, relevant information that is specific for only one participant (e.g. if part of the sample was treated differently from the usual procedure).

Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS	
Status of the information that is provided in this table	December 2024

International herring larvae surveys in the North Sea (IHLS)

Target species & life stage	**Herring (*Clupea harengus*), newly hatched larvae**
Main purpose of the survey	**SSB index**
Survey time series	**1972**
Survey period	**Q3, Q4, Q1**
Survey area	**Orkney-Shetlands, Buchan, Banks, English Channel & Southern North Sea**
Survey design	**fixed station grid, 10 nm apart**
Survey gear	**Gulf 3, Gulf7**
Sampling method	**double oblique tows from surface to 5m above seabed at 5 knots**
Sampling period	**daytime and nighttime sampling**
Survey coordinator	**ICES WGSINS**
Database for target species	**ICES Eggs and larvae database (ELDB)**
Other mandatory species that should be reported	**none**

Type of additional information			Participating Country							Additional Comments
			GER	NED						
Gulf7 (NL), Gulf 3 (GER), 280 µm mesh	Clupea harengus larvae	Samples available	2009	2019						
		Samples separated	1972	1972						
		Preservative	F	F						
		Data - Counts	1972	1972						
		Data - sizes	1972	1972						
	Sprattus sprattus larvae	Samples available	2009	2019						
		Samples separated	2009	???						
		Preservative	F	F						
		Data - Counts	2009	???						
		Data - sizes	2009	???						
	Sardina pilchardus	Samples available	2009	2019						
		Samples separated	2009	???						
		Preservative	F	F						
		Data - Counts	2009	???						
		Data - sizes	2009	???						
	Remaining plankton sample	Samples available	2009	2019						
		Samples separated	2009							
		Preservative	F	F						
		Data - Counts	2009							
		Data - sizes	2009							
	Plaice eggs	Samples available	2009							
		Samples separated	2009							
		Preservative	F							
		Data - Counts	2009							
		Data - sizes	no							
	Remaining plankton sample	Samples available		*1						
		Samples separated								
		Preservative								
		Data - Counts								
		Data - sizes								

International herring larvae surveys in the North Sea (IHLS) - cont.											
Type of additional information			Participating Country							Additional Comments
			GER	NED						
CTD	Hydrography	Temperature	x	x						
		Salinity	x	x						
		Oxygen								
		Fluorescence (Chl a)		x						
		Turbidity								

FOOTNOTES		
	*1	Only samples from most recent 5 years are kept. Some older may exist.

Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS	
Status of the information that is provided in this table	December 2024

North Sea Midwater Ring Net survey (MIK)

Target species & life stage	**Herring (*Clupea harengus)* , larvae (NSAS - North Sea Autumn Spawners)**
Main purpose of the survey	**Recruitment index for North Sea herring based on larval abundance**
Survey time series	**Since 1977**
Survey period	**Annually in quarter 1 (January - February)**
Survey area	**North Sea (including Skagerrak & Kattegat)**
Survey design	**4 hauls per ICES rectangle. No fixed positions inside the rectangle, but at least 10 nm between stations and 5 nm from rectangle borders**
Survey gear	**Midwater ring trawl - MIK net (mesh size 1600 µm)**
Sampling method	**Double oblique hauls from surface to 5 m above seafloor at 3 knots**
Sampling period	**Nighttime (from 30 min past sunset to 30 min before sunrise)**
Survey coordinator	**ICES WGSINS**
Database for target species	**ICES Eggs and larvae database (ELDB)**
Other mandatory species that should be reported	**Sprat - *Sprattus sprattus* (data submission only mandatory in recent years)**
	Sardine - *Sardina pilchardus* (d.s. only mandatory in recent years)
	Lemon sole - *Microstomus kitt* (d.s. only mandatory in recent years)
	European eel - *Anguilla anguilla* (d.s. only mandatory in recent years)
	Pearlside - *Maurolicus muelleri* (d.s. only mandatory in recent years)

Type of additional information			Participating Country							Additional Comments
			DEN	FRA	GER	NED	NOR	SCO	SWE	
Midwater ring trawl - MIK net (1600 µm, cod end 500 µm)	Sardine larvae	Samples available	2009	2000	2005	2019	X	2019*9	*6	
		Samples separated	2012	2007	2005	2019	2016	2019		
		Preservative	AL	FO	FO	FO	AL	FO	AL	
		Data - Counts	2013*1	2007	2005	???	2016	2019	2012	
		Data - sizes	2013*1	2007	2005	???	2016	2019	2012	
	Sprat larvae & juveniles	Samples available	2009	2000	2005	2019	X	2019*9	*6	
		Samples separated	2012	2007	2005	2019	2016	2019		
		Preservative	AL	FO	FO	FO	AL	FO	AL	
		Data - Counts	2013*1	2007	2005	???	2016	2019	2008*7	
		Data - sizes	2013*1	2007	2005	???	2016	2019	2008	
	Lemon sole larvae	Samples available	2009	2000	2005	2019	X	2019*9	*6	
		Samples separated	2012	2008	2005	2019	2016	2019		
		Preservative	AL	FO	FO	FO	FO	FO	AL	
		Data - Counts	2013	2008	2005	???	2016	2019*1	2008	
		Data - sizes	2017	2013	2005	???		2019*1	2008	
	European eel (glass eels)	Samples available	2009	2000	2005	2019	X	X	*6	
		Samples separated	2012	2008	2005	2019	2016	X		
		Preservative	AL	FO	??	FO	FO	FO	AL	
		Data - Counts	2013*1	2021	2005	???	2016	2019*1	2008	
		Data - sizes	2013*1	2021	2005	???	2016	2019*1	2008	
	Pearlside	Samples available	2009		2005		X	2019*9	*6	
		Samples separated	2012		2005		2016	2019		
		Preservative	AL		FO		FO	FO	AL	
		Data - Counts	2013		2005		2016	2019*1	2008	
		Data - sizes	2013		2005			2019*1	2008	

North Sea Midwater Ring Net survey (MIK) - continued

Type of additional information			Participating Country							Additional Comments
			DEN	FRA	GER	NED	NOR	SCO	SWE	
Midwater ring trawl - MIK net (1600 µm, cod end 500 µm)	Other fish larvae	Samples available	2009	2000	2005	2019	X	2019[*9]	*6	
		Samples separated	2012	2008	2005	2019	2016	2019		
		Preservative	AL	FO	FO	FO	FO	FO	AL	
		Data - Counts	2013	2021	2005		2016		2008	
		Data - sizes		2021	2005				2008	
	Scyphozoa & Ctenophora	Samples available	PA[*2]	x				PA		
		Samples separated	PA[*2]	x						
		Preservative	FO	x				FO		
		Data - Counts	2014	x					2021	
		Data - sizes	2015	x					2021	
	Hydrozoa	Samples available	2009	x				PA		
		Samples separated	PA[*3]	x						
		Preservative	FO	x				FO		
		Data - Counts	2020	x					2021	
		Data - sizes	2020	x					2021	
	Cephalopods	Samples available	2014	x	2005	2024	X	PA		
		Samples separated	2014	x	2005	2024	2016		2024	Since 2024 sent to TI Rostock
		Preservative	AL	x	FO	FO	AL	FO	AL	
		Data - Counts	2014	x	2005		2016		2024	
		Data - sizes		x						
	Marine litter	Samples available	2014	2017	2017	2017	2017	2017	2017	All samples stored at DTU Aqua, DK
		Samples separated	2014	2017	2017	2017	2017	2017	2017	Sorted from plankton samples
		Preservative	na	na	na	na	na	na	na	Samples are stored dry in zip-lock bags
		Data - Counts	PA	PA	PA	PA	PA	PA	PA	All samples 2014-2020 analyzed
		Data - sizes	PA	PA	PA	PA	PA	PA	PA	All samples 2014-2020 analyzed
	Remaining plankton sample	Samples available	2012	2000	2005	*6	2019	2019[*9]		
		Samples separated			2005					
		Preservative	AL/FO	FO	FO	FO	FO	FO		DK 2012-2020 in AL since 2021 in FO
		Data - Counts							PA[*8]	
		Data - sizes								
MIKey M net (335 µm)	Fish eggs	Samples available	2014	2012	2018[*10]	???	2016	2019[*9]	2022	
		Samples separated	PA[*4]	x	2018[*10]		2016		PA	
		Preservative	FO	FO	FO	FO	FO	FO	FO	
		Data - Counts	PA[*5]	x	2018[*10]		2016		PA	
		Data - sizes	PA[*5]	x	2018[*10]		2018			
	Sandeel larvae	Samples available	2014	2012		???	2016	2019[*9]		
		Samples separated	PA	PA	PA	PA	PA	NA	PA	DK-FR-GE-NE-NO 2015-2020 worked up
		Preservative	FO	FO	FO	FO	FO	FO	FO	
		Data - Counts	PA	PA	PA	PA	PA	2019[*1]	PA	DK-FR-GE-NE-NO 2015-2020 worked up
		Data - sizes	PA	PA	PA	PA	PA	2019[*1]	PA	DK-FR-GE-NE-NO 2015-2020 worked up

North Sea Midwater Ring Net survey (MIK) - continued

Type of additional information			Participating Country							Additional Comments
			DEN	FRA	GER	NED	NOR	SCO	SWE	
MIKey M net (335 µm)	Other fish larvae	Samples available	2014	2012		???	2016	2019*9		
		Samples separated	PA	PA	PA	PA	PA		PA	DK-FR-GE-NE-NO 2015-2020 worked up
		Preservative	FO	FO	FO	FO	FO	FO	FO	
		Data - Counts	PA	PA	PA	PA	PA			DK-FR-GE-NE-NO 2015-2020 worked up
		Data - sizes								
	Remaining plankton sample	Samples available	2014	2012	2015	???	2016	2019*9		
		Samples separated		x						
		Preservative	FO	FO	FO	FO	FO	FO		
		Data - Counts		x						
		Data - sizes		x						
CTD	Hydrography	Temperature	x	x	x	x	x	x	x	CTD data are usually available from fishing hauls in the same area, but not from the actual plankton stations
		Salinity	x	x	x	x	x	x	x	
		Oxygen	x	x	x		x	x	x	
		Fluorescence (Chl a)		x			x			
		Turbidity	2022	x						

FOOTNOTES	
*1	Data potentially also available from earlier years.
*2	Scyphozoa & Ctenophora DK: Most species are sorted from the samples, worked up on board & discarded, but some small or very abundant species are sub-sampled i.e. some specimen are left in the remaining, preserved plankton sample. Selected species are also preserved frozen or dried.
*3	Hydrozoa DK: since 2020 sub-samples separated, counted & measured on board, rest preserved in remaining sample
*4	Fish eggs Mikey M DK: for some years separated on board, otherwise preserved in remaining plankton sample
*5	Fish eggs Mikey M DK: for some years selected samples analyzed by Norway
*6	Only samples from most recent 5 years are kept. Some older may exist.
*7	Sweden has data from 1992 on all fish species, but from 2008 in our database.
*8	A rough estimate of different categories of zooplankton are registrered, but no samples are saved.
*9	Samples possibly available from earlier but may have been lost during site works and currently inaccessible
*10	Egg counts and size only for 2018

Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS	
Status of the information that is provided in this table	December 2024

Downs recruitment survey (DRS)

Target species & life stage	**Herring (*Clupea harengus*), larvae**
Main purpose of the survey	**Recruitment index for North Sea herring based on larval abundance, targetting specifically the Downs spawning component**
Survey time series	**Since 2018**
Survey period	**Q2 (April-May)**
Survey area	**Southern North Sea and German Bight**
Survey design	**1 haul per half ICES rectangle. No fixed positions inside the rectangle,**
Survey gear	**Midwater ring trawl - MIK net (mesh size 1600 µm, last meter and code**
Sampling method	**Double oblique hauls from surface to 5 m above seafloor at 3 knots**
Sampling period	**Q2 (April-May)**
Survey coordinator	**WG SINS**
Database for target species	**ICES Eggs and larvae database (ELDB)**
Other mandatory species that should be reported	**none**

Type of additional information			Participating Country						Additional Comments
			NED	NOR					
Midwater ring trawl - MIK net (mesh size 1600 µm, cod end 500 µm)	Clupea harengus larvae	Samples available	2018						
		Samples separated	2018	2021/2023					
		Preservative	F	F					
		Data - Counts	2018	2021/2023					
		Data - sizes	2018	2021/2023					
	Sardina pilchardus larvae	Samples available	2018						
		Samples separated	2018	2021/2023					
		Preservative	F	F					
		Data - Counts	2018	2021/2023					
		Data - sizes	2018	2021/2023					
	Sprattus sprattus larvae	Samples available	2018						
		Samples separated	2018	2021/2023					
		Preservative	F	F					
		Data - Counts	2018	2021/2023					
		Data - sizes	2018	2021/2023					
	Microstomus kitt larvae	Samples available	2018						
		Samples separated	2018						
		Preservative	F						
		Data - Counts	2018						
		Data - sizes	2018						
	Anguilla anguilla larvae	Samples available	2018						
		Samples separated	2018						
		Preservative	F						
		Data - Counts	2018						
		Data - sizes	2018						

Downs recruitment survey (DRS) - continued									
Type of additional information			Participating Country						Additional Comments
			NED	NOR					
Midwater ring trawl - MIK net (cont.)	Sandeel larvae	Samples available	2018						
		Samples separated	2022						
		Preservative	F						
		Data - Counts	2022						
		Data - sizes	2022						
	Gadoid larvae	Samples available	2018						
		Samples separated	2018						
		Preservative	F						
		Data - Counts	2023						
		Data - sizes	2023						
	Flatfish larvae	Samples available	2018						
		Samples separated	2018						
		Preservative	F						
		Data - Counts	2023						
		Data - sizes	2023						
	Remaining plankton sample	Samples available	2018						
		Samples separated							
		Preservative	F						
		Data - Counts							
		Data - sizes							
CTD	Hydrography	Temperature	X	X					
		Salinity	X	X					
		Oxygen		X					
		Fluorescence (Chl a)		X					
		Turbidity							

Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS	
Status of the information that is provided in this table	December 2024

Northern Irish Northeastern Larvae Survey (NINEL)

Target species & life stage	**Herring (*Clupea harengus*), larvae**
Main purpose of the survey	**SSB index**
Survey time series	**since 1993**
Survey period	**Q4 (November)**
Survey area	**North Irish Sea**
Survey design	**Fixed station**
Survey gear	**Gulf3 Gulf7**
Sampling method	**Double oblique hauls from surface to 5 m above seafloor at 3-4 knots**
Sampling period	**24 hours**
Survey coordinator	**ICES WGSINS**
Database for target species	**ICES Eggs and larvae database (ELDB)**
Other mandatory species that should be reported	**none**

Type of additional information			**Participating Country**						**Additional Comments**
			NIR						
GULF3/GULF7 280µm	**Larvae samples**	Samples available	x						Larvae samples available from haul positions for approx the last 20 years
		Samples separated	x						
		Preservative	AL						
		Data - Counts	1993						
		Data - sizes	1993						
	Remaining plankton sample	Samples available	x						Plankton samples available from haul positions for approx the last 20 years
		Samples separated	x						
		Preservative	FO						
		Data - Counts							
		Data - sizes							
CTD	**Hydrography**	Temperature	x						CTD data available from haul positions for most years
		Salinity	x						
		Oxygen							
		Fluorescence (Chl a)	x						
		Turbidity							

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Northern Ireland MIK Survey (NI-MIK)

Target species & life stage	**Gadus morhua, Melanogrammus aeglefinus, Merlangius merlangus (pelagic post settlement)**
Main purpose of the survey	**Recruitment index**
Survey time series	**since 1993**
Survey period	**Q2 (May/June)**
Survey area	**Irish Sea (VIIa)**
Survey design	**Fixed station**
Survey gear	**MIK net, Gulf3/Gulf7**
Sampling method	**Double oblique hauls from surface to 5 m above seafloor at 3-4 knots**
Sampling period	**Daytime Gulf MIK - 30mins before and 30mins after sunset/sunrise**
Survey coordinator	**ICES WGSINS**
Database for target species	**ICES Eggs and larvae database (ELDB)**
Other mandatory species that should be reported	**none**

Type of additional information			Participating Country						Additional Comments
			NIR						
MIK NET/Midwater ring trawl (5mm)	Juvenile gadoids	Samples available	x						Juvenile gadoids available for most recent years. Earlier samples have been used in previous research studies and/or lost
		Samples separated	x						
		Preservative	AL						
		Data - Counts	1993						
		Data - sizes	1993						
	Gelatinous zooplankton	Samples available							Abundance and weights
		Samples separated							
		Preservative							
		Data - Counts	1993						
		Data - sizes							
	Micronekton	Samples available							Abundance and weights
		Samples separated							
		Preservative							
		Data - Counts	1993						
		Data - sizes							
	Remaining plankton sample	Samples available	x						A number of plankton samples have been analysed providing full counts and species ID
		Samples separated	x						
		Preservative	FO						
		Data - Counts	PA						
		Data - sizes	PA						

Northern Ireland MIK Survey (NI-MIK) - continued										
Type of additional information			Participating Country						Additional Comments
			NIR						
Gulf7 (280-425µm)	Fish larvae	Samples available	x						Larvae available for approx 20 years
		Samples separated	x						
		Preservative	AL						
		Data - Counts	1993						
		Data - sizes	1993						
	Remaining plankton sample	Samples available	x						A number of plankton samples have been analysed providing full counts and species ID
		Samples separated	x						
		Preservative	FO						
		Data - Counts	PA						
		Data - sizes	PA						
CTD	Hydrography	Temperature	x						CTD data available from haul positions for most years
		Salinity	x						
		Oxygen							
		Fluorescence (Chl a)	x						
		Turbidity							

Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS	
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Rügen herring larvae survey (RHLS)

Target species & life stage	**Herring (*Clupea harengus*), larvae (WBSS - Baltic Sea Spring Spawners)**
Main purpose of the survey	**Recruitment index for WBSS herring based on groth model**
Survey time series	**Since 1992**
Survey period	**Weekly quarter 1 & 2 (Feb.-June)**
Survey area	**Strelasund (STS)/Greifswald Bay (GWB)**
Survey design	**35 fixed stations in STS/GWB**
Survey gear	**Bongo net (335 µm)**
Sampling method	**Double oblique hauls from surface to 1 m above seafloor at 2 knots**
Sampling period	**daytime**
Survey coordinator	**ICES WGSINS**
Database for target species	**ICES Eggs and larvae database (ELDB)**
Other mandatory species that should be reported	**none**

Type of additional information			Participating Country						Additional Comments
			GER						
Bongo Net (335 µm)	Other fish larvae	Samples available	2007						
		Samples separated	0						
		Preservative	FO						
		Data - Counts	0						
		Data - sizes	0						
	Remaining plankton sample	Samples available	2007						
		Samples separated	0						
		Preservative	FO						
		Data - Counts	0						
		Data - sizes	0						
Apstein Net	Zooplankton	Samples available	2008						
		Samples separated	ca. 720						
		Preservative	FO						
		Data - Counts	2008						
		Data - sizes							
WP-2 net	Zooplankton	Samples available	2011						
		Samples separated	0						
		Preservative	FO						
		Data - Counts	0						
		Data - sizes	0						
CTD	Hydrography	Temperature	1992						
		Salinity	1992						
		Oxygen	1992						
		Fluorescence (Chl a)	2011						
		Turbidity	2011						
		Secchi Depth	1992						

Overviews of additional information collected on ichthyoplankton surveys coordinated by ICES WGSINS	
Status of the information that is provided in this table	December 2024

Baltic Ichthyoplankton Surveys (BIS)

Target species & life stage	**Eastern Baltic Cod (*Gadus morhua)* , eggs & larvae**
Main purpose of the survey	**SSB index (based on eggs) & recruitment index (based on larvae)**
Survey time series	**Since 1986**
Survey period	**Several surveys per year over the spawning season (March-November)**
Survey area	**Bornholm Basin (& sometimes adjacent areas)**
Survey design	**Station grid (approx. 10 nm spacing, 45 standard stations)**
Survey gear	**Bongo net (mesh size 335 & 500 µm)**
Sampling method	**Double oblique hauls from surface to 5 m above seafloor at 3 knots**
Sampling period	**Daytime & Nighttime**
Survey coordinator	**ICES WGSINS**
Database for target species	**n.a.**
Other mandatory species	**Sprat - *Sprattus sprattus***

Type of additional information			Participating Institute *1							Additional Comments
			DTU	MIR	GEO	UHH	TI			
BONGO NET (335 µm)	Sprat eggs & larvae	Samples available	2008	2005	1986	x	x			
		Samples separated	2008	2005	1986	x	x			see *2
		Preservative	FO	FO	FO	FO	FO			
		Data - Counts	2008	2005	1986	x	x			
		Data - sizes	2008	2005	1986	x	x			
	Eggs of other fish species	Samples available	2008	2005	x	x	x			
		Samples separated	2008	2005	x	x	x			see *2
		Preservative	FO	FO	FO	FO	FO			
		Data - Counts	2008	2005	x	x	x			
		Data - sizes	2008	2005	x	x	x			
	Larvae of other fish species	Samples available	2008	2005	x	x	x			
		Samples separated	2008	2005	x	x	x			see *2
		Preservative	FO	FO	FO	FO	FO			
		Data - Counts	2008	2005	x	x	x			
		Data - sizes	2008	2005	x	x	x			
	Scyphozoa & Ctenophora	Samples available	PA*3	x	PA*3	PA*3	PA*3			
		Samples separated	PA*3	x	PA*3	PA*3	PA*3			
		Preservative	na*3	x	na*3	na*3	na*3			
		Data - Counts	2008	x	x	x	x			
		Data - sizes	2008	x	x	x	x			
	Zooplankton biovolume	Samples available	2008	x	1987	x	x			A rough estimate of the total zooplankton biovolume is determined by measuring the height of the sedimented zooplankton in the sample jars
		Samples separated	na	x	na	x	x			
		Preservative	FO	FO	FO	FO	FO			
		Data - Counts	2008	x	1987	x	x			
		Data - sizes								
	Remaining plankton sample	Samples available	2008	x	1986	x	x			
		Samples separated								
		Preservative	FO	FO	FO	FO	FO			
		Data - Counts								
		Data - sizes								

Baltic Ichthyoplankton Surveys (BIS) - continued

Type of additional information			Participating Institute *1							Additional Comments
			DTU	MIR	GEO	UHH	TI			
BONGO NET (500 µm)	Fish larvae (frozen)	Samples available	2008	x	x	x	x			Larvae of cod, sprat, herring and partly also other species are sorted from the 500 µm Bongo nets and frozen at -80°C. Cod larvae are usually photographed for later size measurements.
		Samples separated	2008	x	x	x	x			
		Preservative	FR	FR	FR	FR	FR			
		Data - Counts	2008	x	x	x	x			
		Data - sizes	PA	PA	PA	PA	PA			
	Scyphozoa & Ctenophora	Samples available	PA*3	x	PA*3	PA*3	PA*3			
		Samples separated	PA*3	x	PA*3	PA*3	PA*3			
		Preservative	na*3	na*3	na*3	na*3	na*3			
		Data - Counts	2008	x	x	x	x			
		Data - sizes	2008	x	x	x	x			
	Remaining plankton sample	Samples available	2023	x	x	x	x			
		Samples separated								
		Preservative	FO	FO	FO	FO	FO			
		Data - Counts								
		Data - sizes								
BABY-BONGO NET (150 µm)	Scyphozoa & Ctenophora	Samples available	PA*3	PA*3	PA*3	PA*3	PA*3			
		Samples separated	PA*3	PA*3	PA*3	PA*3	PA*3			
		Preservative	na*3	na*3	na*3	na*3	na*3			
		Data - Counts	2008	x	x	x	x			
		Data - sizes	2008	x	x	x	x			
	Zooplankton biovolume	Samples available	2008							A rough estimate of the total zooplankton biovolume is determined by measuring the height of the sedimented zooplankton in the sample jars
		Samples separated	na							
		Preservative	FO							
		Data - Counts	2008*4							
		Data - sizes	na							
	Remaining plankton sample	Samples available	2008	x	x	x	x			
		Samples separated								
		Preservative	FO	FO	FO	FO	FO			
		Data - Counts								
		Data - sizes								
WP-2 net	Zooplankton (100 µm)	Samples available	2008	2005	PA	PA	PA			
		Samples separated	2008	2005	PA	PA	PA			
		Preservative	FO	FO	FO	FO	FO			
		Data - Counts	PA	2005	PA	PA	PA			
		Data - sizes	PA	2005	PA	PA	PA			
Apstein net	Zooplankton (55 µm)	Samples available	2008	PA	PA	PA	PA			
		Samples separated	2008	PA	PA	PA	PA			
		Preservative	FO	FO	FO	FO	FO			
		Data - Counts	PA	PA	PA	PA	PA			
		Data - sizes	PA	PA	PA	PA	PA			

Baltic Ichthyoplankton Surveys (BIS) - continued

Type of additional information			Participating Institute *1							Additional Comments
			DTU	MIR	GEO	UHH	TI			
CTD	Hydrography	Temperature	2008	2005	x	x	x			
		Salinity	2008	2005	x	x	x			
		Oxygen	2008	2005	x	x	x			
		Fluorescence (Chl a)	PA	PA	PA	PA	PA			
		Secchi depth		2005						
Trawl	Adult fish	Samples available	PA	x	PA	PA	PA			Additional trawl hauls during most of the surveys to obtain data on adult fish. This includes numbers & sizes for all species, partly weight, sex, maturity, fecundity & stomach samples for cod, herring, sprat, and partly single fish data (gutted - liver - gonad weight), otoliths & tissue samples for cod.
		Samples separated	na	x	na	na	na			
		Preservative	na	na	na	na	na			
		Data - Counts	PA	2019	PA	PA	PA			
		Data - sizes	PA	2019	PA	PA	PA			

FOOTNOTES		
	*1	Participating institutes: DTU = DTU Aqua, Denmark; MIR = National Marine Fisheries Research Institute, Poland; GEO = GEOMAR Kiel, Germany; UHH = University of Hamburg, Germany; TI = Thünen Institute, Germany
	*2	Separated from the plankton samples for analysis. In early years of the time series since 1986 kept in separate sample jars but afterwards returned to the remaining plankton sample
	*3	Scyphozoa & Ctenophora are sorted from the samples, worked up on board & discarded, but for selected cruises
	*4	Biovolumes for Baby-Bongo 150 µm only analyzed for November cruises 2008-2023