ICES WGEGGS2 REPORT 2018

ECOSYSTEM OBSERVATION STEERING GROUP

ICES CM 2018/EOSG:09

REF ACOM AND SCICOM

Report of the Working Group 2 on cod and plaice egg surveys in the north sea (WGEGGS2)

3-7 December

IJmuiden, The Netherlands

ICES International Council for the Exploration of the Sea

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Recommended format for purposes of citation:

ICES. 2019. Report of the Working Group 2 on cod and plaice egg surveys in the north sea (WGEGGS2). 3-7 December. IJmuiden, The Netherlands. ICES CM 2018/EOSG:09. 37 pp.

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Executive summary

The Working Group 2 on North Sea Cod and Plaice Egg Surveys in the North Sea (WGEGGS2) met in IJmuiden, the Netherlands, from 3 to 8 December 2018. Nine participants representing six different countries participated in the meeting, which was chaired by Matthias Kloppmann, Germany. The objectives of the meeting were to: a) Review results of the 2018 MIKeyM net surveys; b) Plan for the 2019 survey, d) Finalize the MIKeyM-net manual after review, d) Prepare WGEGGS2 data for archiving in the ICES eggs and larvae database, e) Review results on molecular identification of fish eggs, f) Prepare publications based on sampling with MIKeyM-net attachment to the MIK net, g) Review the results of the 2017/18 International Herring Larvae Surveys (IHLS) in the North Sea, h) Plan the 2018/19 IHLS, and i) Develop multi-annual ToRs for a new ICES working group on ichtyoplankton surveys in the North Sea and adjacent seas in succession of WGEGGS2.

In 2018, a full MIKeyM-net survey with a complete sample analysis, including genetic identification where possible, was conducted by Norway, Germany, The Netherlands, Denmark and France during the IBTS. The weather conditions from the end of January to the end of February 2018, particularly in the north of the survey area, were rather poor. Together with the failure of the MIK-operation winch on RV Scotia, this resulted in a much poorer than anticipated coverage of the northern North Sea with MIKeyM sampling. Sweden could not participate, thus Kattegat and Skagerrak remained unsampled for fish eggs. Due to different staff and funding limitations, the status of sample processing differs among the participating institutes. A new molecular method to identify fish eggs was developed and tested for the first time on egg samples from the Danish and German surveys. Other participants were, so far, only able to sort, stage and measure the eggs from the samples.

After being reviewed, the MIKeyM-net manual was amended with respect to the suggestions of the two referees and uploaded to the EOSG SharePoint for publication as an ICES SISP document.

Data obtained from the MIKeyM net sampling will be progressively uploaded to the ICES eggs and larvae database.

While not related to the primary tasks of this working group, an update on the marine litter sampling with the Midwater Ring trawl (MIK) net during the Q1 IBTS was presented. Collection of marine litter catches with the MIK was for the second time carried out by all survey participants. All of the participants of this WGEGGS2 meeting are also the principal investigators of their country's MIK survey and agreed to continue pursuing marine litter observations in the MIK in 2019 and onwards.

The outlines of two papers on MIKeyM net sampling were discussed and a schedule for data collation and manuscript drafting was set. One manuscript will focus on the description of the MIKeyM net including first results from egg surveys. The second manuscript will compare different plankton nets, including the MIKeyM net, with respect to the catchability of the different early life stages of fish.

The new multi-annual Terms of Reference on the IHLS, which were added during the last WGEGGS2 meeting, were addressed for the first time during this meeting. The 2017/18 survey suffered from the breakdown of the Walther Herwig III, which is why the Orkney/Shetland area could not be covered during the September surveys. The results of the surveys showed that the Downs component's contribution to the LAI is still high.

In continuation of the discussion from the last WGEGGS2 meeting, the group discussed the establishment of a new ichthyoplankton survey working group WGSINS that should provide a location for planning the IHLS and other ichthyoplankton surveys in the North Sea and adjacent seas that currently lack such a platform. Multi-annual Terms of Reference were formulated, collated in a Working Group meeting draft resolution, and submitted to ICES.

1 Administrative details

Working Group name

Working Group 2 on Cod and Plaice Egg Surveys in the North Sea

Year of Appointment within the current three-year cycle

2016

Reporting year concluding the current three-year cycle

2018

Chair(s)

Matthias Kloppmann, Germany

Name, Country

Meeting venue(s) and dates

24–26 October 2016 Hamburg, Germany, (5 participants)

10–11 October 2017, Boulogne-sur-Mer, France (6 participants)

3–7 December 2018, IJmuiden, The Netherlands, (9 participants)

2 Terms of Reference (copy from Reslution)

Tor	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
a	Review results of the 2016–2018 surveys and plan for the 2017– 2019 Survey	In 2017–2019, the MIKey-M net sampling will be conducted during the IBTS-MIK sampling	4.28, 4.30	Year1,2,3	Report : reviewing survey results, need for improvement and plan for potential collaborative publications
b	Study the spatio- temporal distribution of winter spawning habitats	Spawning grounds are of primary relevance for fish stock renewal. They experienced interannual and long- time spatial variations that need to be quantified and related to environmental/biotic variations.	1.1, 4.28, 4.30	Year 3 : Samples will be collected every year, but will be analysed every three years	Report : review current and past spatial distribution of winter spawning grounds in the North Sea.
c	Write the MIKey-M Net manual	In 2012, a new net called the MIKey-M net was developped to collect fish eggs alongside the MIK sampling during the IBTS. Since 2012 it has been used each year, there is a need for a standard manual as recommended by ICES.	4.28, 4.30	Year 1	SISP : describe the MIKey-M Net, its implemetation during the IBTS since 2012 and instructions for sampling
d	Prepare WGEGGS2 data for archiving	WGEGGS2 data need to be prepared and uploaded in the ICES Eggs and Larvae database	4.28, 4.30	Yearly, once the data are published	Data uploaded to the ICES Eggs and Larvae database by the ICES data centre and WGEGGS2 coordinator
e	Review results on molecular identification of eggs	There is a potential problem in visual identification of stage I gadoid eggs and in some areas it will be necessary to utilize genetic techniques for species	4.28, 4.30	Year1,2,3	Report : review methods for genetically identifying eggs

		identifications where spawning locations of gadoids exist. The means to undertake genetic identifications should be sought were possible			
f	Publish first results of MIKey-M net 2012–2015 surveys	MIKey-M net samples represent a huge amount of data and scientific insights on winter fish spawning grounds in the North Sea that need to be published.	4.28, 4.30	Year 3	Report : list of scientific publications based on 2012– 2015 surveys
g	Coordinate the tim-ing, area, and method-ologies for the international herring larvae surveys in the North Sea and adjacent waters (IHLS)	The International Herring Larvae Surveys delivers abundance data of recently hatched herring larvae that allow for SSB estimates at spawning component level for North Sea her-ring.	1.1, 4.28, 4.30	Year 3	Report : reviewing survey results, needs for improvement and plan for potential collaborative publications
h	Periodically review and update the IHLS manual to address and maintain moni-toring requirements in the surveys.	A survey manual is in place for many years but needs permanent reviewing in order to cope with changing envi-ronmental and technical circum-stances	4.28, 4.30	Year 3	Report: reviewing survey strategies and methods and preparation for SISP manual

3 Summary of work plan

Year 1: Discuss results of the 2016 survey and plan for the 2017 survey

Year 2: Discuss results of the 2017 survey and plan for the 2018 survey

Year 3: Discuss results of the 2018 surveys and plan for the 2019 surveys

4 Summary of achievements of the EG during the 3 year term

- WGEGGS2 completed the Manual for the North Sea cod and plaice egg survey for publication as an ICES SISP document
- A new molecular method for identification of fish eggs, the MALDI-TOF mass spectrometry, has been successfully tested on fish eggs caught during the 2018 egg survey
- Two papers from North Sea egg surveys were published (Hannes, Franziska)
  - H. Höffle, C.J.G. van Damme, C. Fox, S. Lelièvre, C. Loots, R.D.M. Nash, S. Vaz, P.J. Wright & P. Munk. 2018. Linking spawning ground extent to environmental factors - patterns and dispersal during the egg phase of four North Sea fishes. Can. J. Fish. Aquat. Sci. 75: 357–374.
  - F. Bils, M. Moyano, N. Aberle, C.J.G. van Damme, R.D.M. Nash, M. Kloppmann, C. Loots & M.A. Peck, 2019. Broad-scale distribution of the winter protozooplankton community in the North Sea. J. Sea Res.
- Presentations at conferences (flat fish symposium, larval fish conference, otolith symposium):
  - **International Flatfish Symposium, St Malo, 2017:**
    - Geffen, A.J., Berg, G., Nåvik, H., Tonheim, S., Albretsen, J., Huwer, B., and Nash, R.D.M. Age growth and drift of over-wintering Lemon Sole, Microstomus kitt, larvae in the north-ern North Sea in 2016 and 2017. Poster.
    - Nash, R.D.M., Kloppmann, M., Huwer, B., Bland, B., and Loots, C. Distribution of Lemon Sole, Microstomus kitt, pre-recruits in the North Sea. Poster
    - Pernak, M., Giraldo, C., Loots, C., Huwer, B., Van Damme, C.J.G., Nash, R.D.M., Kloppmann, M., Ritchie, L. Winter dis-tribution of plaice (Pleuronectes platessa) and lemon sole (Microstomus kitt) larvae in the English Channel and North Sea, inferred from the 2016 IBTS-MIK sampling. Poster.
  - **International Otolith Symposium, Taiwan, 2018:**
    - Nash, R.D.M., Geffen, A.J., Albretsen, J., Berg, G., Nåvik, H., Tonheim, S., and Huwer, B. Connectivity of lemon sole Mi-crostomus kitt in the northern North Sea as determined from a combination of otolith characteristics and particle tracking.
  - **Larval Fish Conference 2016**
    - Kloppmann, M., Damme, C. van, Nash, R.D.M., Huwer, B. Loots, C. When (How?) things go wrong: How larval drift can distort stock abundance estimates. Poster.
  - **Larval Fish Conference 2017**
    - Damme, C.J.G. van, Hintzen, N., Kleissen, F., Bolle, L.J., Kloppmann, M., Nash, R.D.M. Improving Larvae Survey Indi-ces: A case study of North Sea Autumn Spawning Herring (Clupea harengus). Presentation.
  - **Larval Fish Conference 2018**
    - Damme, C.J.G. van, Hintzen, N., Kleissen, F., Bolle, L.J., Kloppmann, M., Nash, R.D.M. Enhanced North Sea Herring management through improved larval surveys. Presentation.
  - **Annual Science Conference 2018**

    - Damme, C.J.G. van, Hintzen, N., Kleissen, F., Bolle, L.J., Nash, R.D.M. Evaluating and improving herring larvae survey indi-ces.
- Completion of a Manual for the registration and collection of Marine Litter from IBTS Q1 MIK samples.

5 Final report on ToRs, workplan and Science Implementation Plan

5.1 Review results of the 2016-2018 surveys and plan for the 2017-2019 Survey (ToR a)

5.1.1 Results of the 2018 survey

MIKeyM (MM) samples were obtained by five of the countries participating in the 2018 1st Quarter IBTS (see Table 5.1). MM samples were taken with every MIK samples (see Figure 5.1). The extent of sample analyses completed thus far varied between institutes ranging from fish eggs identified where possible, staged and measured to the samples still need to be sorted for fish eggs and larvae.

Table 5.1. MIKeyM sampling undertaken in 2018 during the Q1 IBTS MIK sampling.

Country	Number of MM nets	No MM stations	Eggs/ Larvae	Sample processing	Comments
The Netherlands	1	85 valid hauls, eggs and larvae sorted from all samples	E+L	Sorted & id (Eggs, stage and diameter; Larvae, lengths)	
France	1	96 valid hauls, eggs and larvae sorted from all samples	E+L	Sorted & id (Eggs, stage and diameter; Larvae, lengths)	
Denmark	1	80 valid tows, eggs sorted from 67 samples	E	Gadoid like eggs sorted, staged calibrated pictures taken for later diameter measurements and preserved individually in ethanol; Plaice like eggs sorted and preserved in 4% formalin	MALDI-TOF on gadoid like eggs
Germany	1	106, eggs sorted from 1 haul per rectangle	E	Sorted & id (Eggs, stage and diameter)	MALDI-TOF MS and DNA barcoding aided species analyses
Norway	1	102 valid tows, eggs and larvae sorted	E+L	Sorted and visual id (eggs, stage and diameter)	

		from 85 samples		
Scotland	2	11, not sorted	None yet	Ichthyoplankton staff member will be recruited during Q1 2019 and part of remit will be to work up Scottish MIKey M samples
Sweden				No MM sampling in 2018

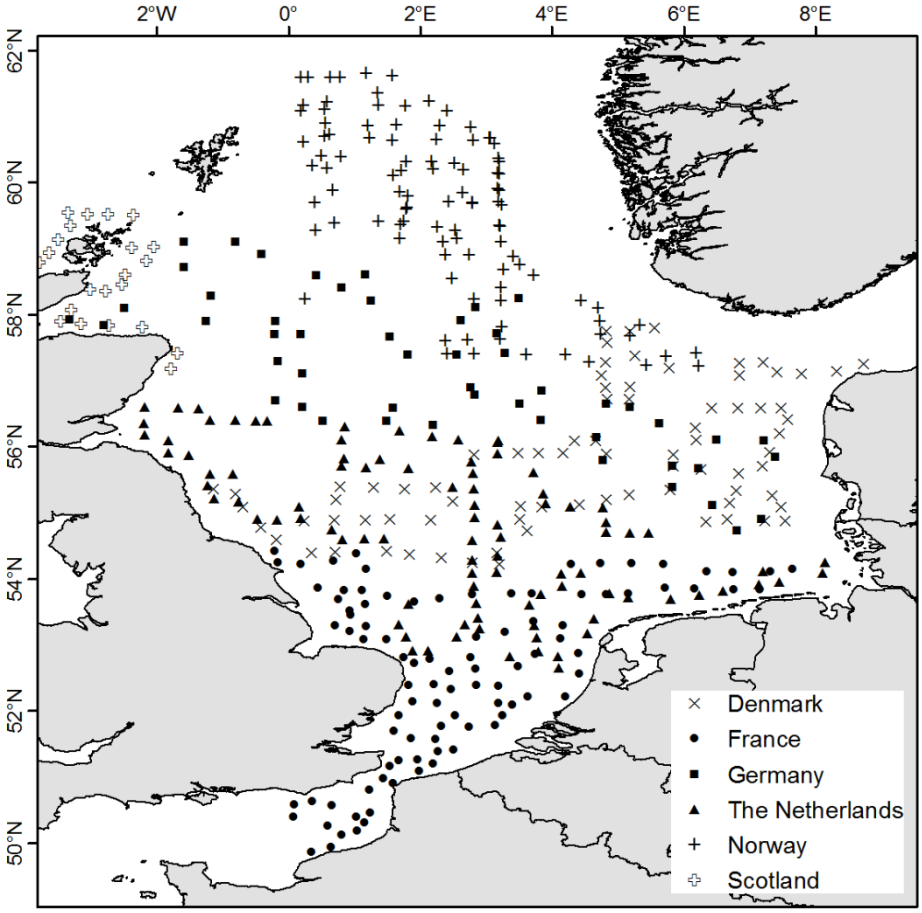

Fig 5.1.1.1 Location of MIKeyM samples for 2018 during the Q1 IBTS MIK survey.

It is apparent that with current manning levels for processing the MIK night time samples, on the various research vessels, in some cases sorting, staging and measuring eggs and larvae 'at sea' cannot be undertaken. In some cases, there is insufficient personnel and/or expertise to process these samples to any level. Therefore, in some cases the MM samples can only be collected and preserved and left for further processing ashore and often by another laboratory. Members of WGEGGS2 will endeavour to ensure that a representative set of the unprocessed samples will be examined to provide a reasonable spatial coverage of fish egg distributions.

5.1.2 Planning for the 2019 survey

As in previous years, MIKeyM net sampling is planned to be carried out along-side MIK sampling during the first quarter IBTS in the North Sea. For 2019, all institutes are asked to carry out at least two MIKeyM net hauls (one 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 in 2019 or 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 MIKeyM manual. The remaining plankton can then be discarded. As with the above, 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.

Sweden will be requested to undertake MIKeyM sampling so as to provide coverage of the Skagerrak area.

5.2 Study the spatio – temporal distribution of winter spawning habitats (ToR b)

French MikeyM net samples from 2012 to 2018 have been processed with the zooscan. Eggs were classified into three size classes: small, medium and big. From previous visual identification using a binocular, it can be assessed that small eggs gather rockling, dab and flounder eggs, medium eggs gather gadoid eggs and big eggs gather plaice and long-rough dab eggs. Spatial distribution for the three classes were mapped (Figure 5.2.1). Distinct areas of eggs concentrations can be identified, illustrating potential spawning grounds of the different species. Further analyses should be conducted in order to study how these areas vary annually over a long time period.

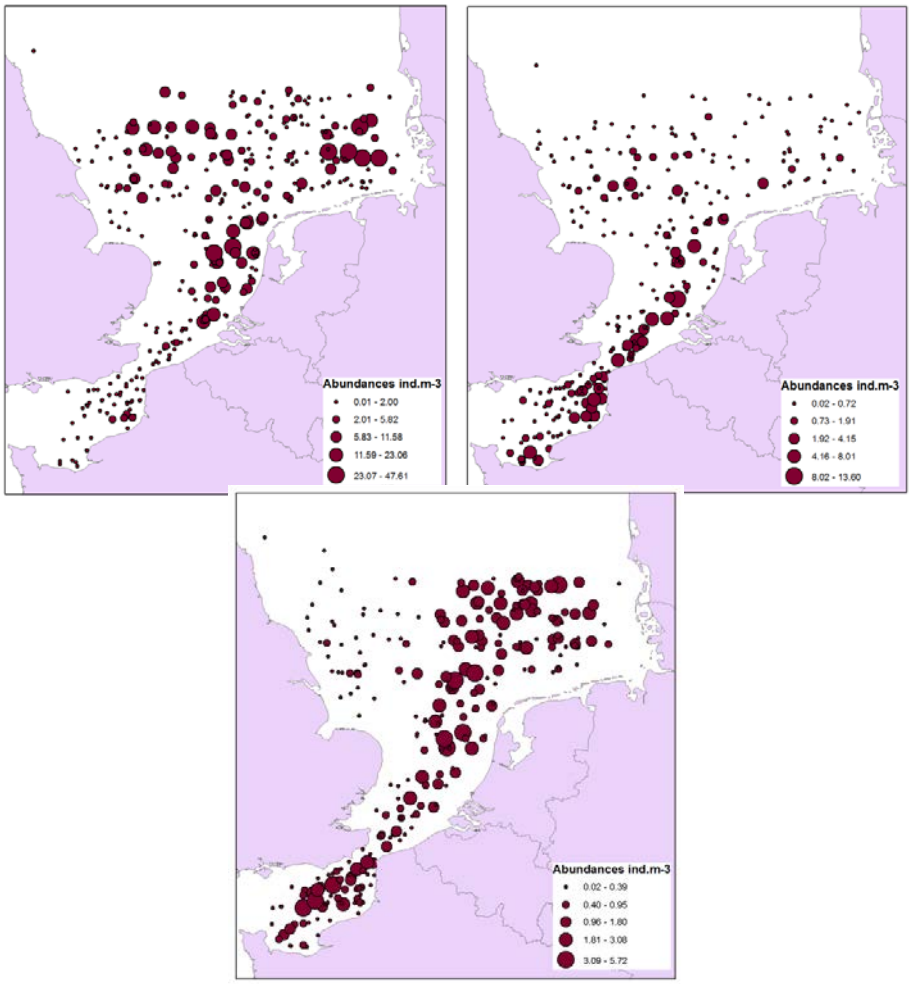

Figure 5.2.1 : Spatial distribution of the different size classes of eggs from the 2012-2018 French MikeyM net sampling during the IBTS. Topleft : small size class, top right : medium size class, bottom : big size class.

5.3 Write the MIKey-M Net manual (ToR c)

The MIKey-M net manual was finalized and uploaded to the EOSG SharePoint for review in January 2018. After being reviewed, the necessary amendments and corrections were added and the final document was uploaded to the EOSG SharePoint in December 2018 publication through ICES.

5.4 Prepare WGEGGS2 data for archiving (ToR d)

It was agreed in 2017 that each survey participant would upload their 2018 (and going back to 2012 if available) data to the ICES Egg and Larvae database. Due to various reasons this was not possible. At the time of the WGEGGS2 meeting the uploading web API was finalised by ICES. The WGEGGS2 data of the 2018 survey will be prepared, checked and uploaded by the survey participants by 15th March 2019.

5.5 Review results on molecular identification of eggs (ToR e)

The Matrix-Assisted-Laser-Desorption/Ionisation Time-Of-Flight Mass Spectrometry (MADI-TOF MS) was developed and applied for the first time to identify 1106 fish eggs from Danish and German samples from the North Sea cod and plaice egg survey. MALDI-TOF MS targets the species-specific proteome, i.e. the entity of all proteins of a sample, is widely used in clinical analysis to e.g. characterize bacterial strains and has

only recently been applied to metazoan research in the marine environment (e.g. Peters et al. 2018). Since MALDI-TOF MS had never been used before on fish eggs, a reference database had to be set up. Therefore, a subset of 298 eggs were first identified utilizing DNA barcoding after which MALDI-TOF MS was applied to the same egg samples. The resulting spectrograms were then analysed for characteristic peaks with respect to the DNA barcoding species identification results. These spectrograms with the respective DNA species id went into the MALDI-TOF reference database. The remaining 808 eggs were then run through MALDI-TOF MS only and were assigned to the different species utilizing the reference database (Figure 5.5.1).

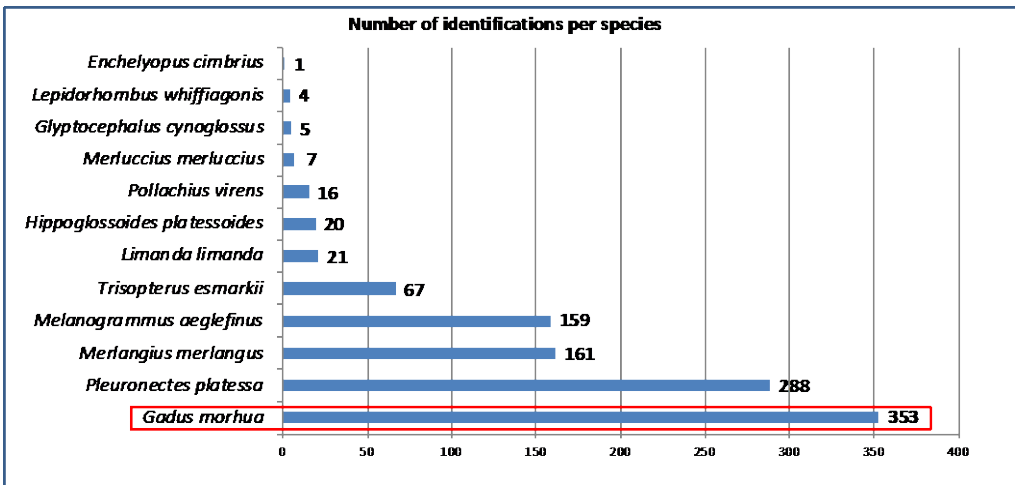

Figure 5.5.1: Species composition of all successfully identified eggs using MALDI-TOF MS.

The method will be due to further development, e.g. by adding more proteome spectrograms of other species to the database, which would improve the accuracy of the method and also widen its scope also to other egg surveys.

The resulting distribution of the fish eggs from the Danish and German participation are shown in figure 5.5.2 and 5.5.3. The majority of all eggs were found in a relatively broad band stretching from the Danish coast northwestwards towards Scotland, while in the southwest, eggs were relatively sparse. Plaice eggs were found predominantly west of the Danish coast in the eastern North Sea and in the area of the Moray Firth, dab eggs were less abundant but mostly in a similar area as plaice eggs, while the eggs of long rough dab were confined to an area in the centre of the survey area. Cod eggs were most abundant near the Orkneys and towards the edge of the Norwegian Trench. Small amounts of cod eggs occurred, however, also scattered over a larger part of the south-eastern North Sea. Eggs of haddock and Norway pout were confined to the northern part of the survey area while whiting eggs were much less abundant and only occurring in the southeastern part close to the Danish coast.

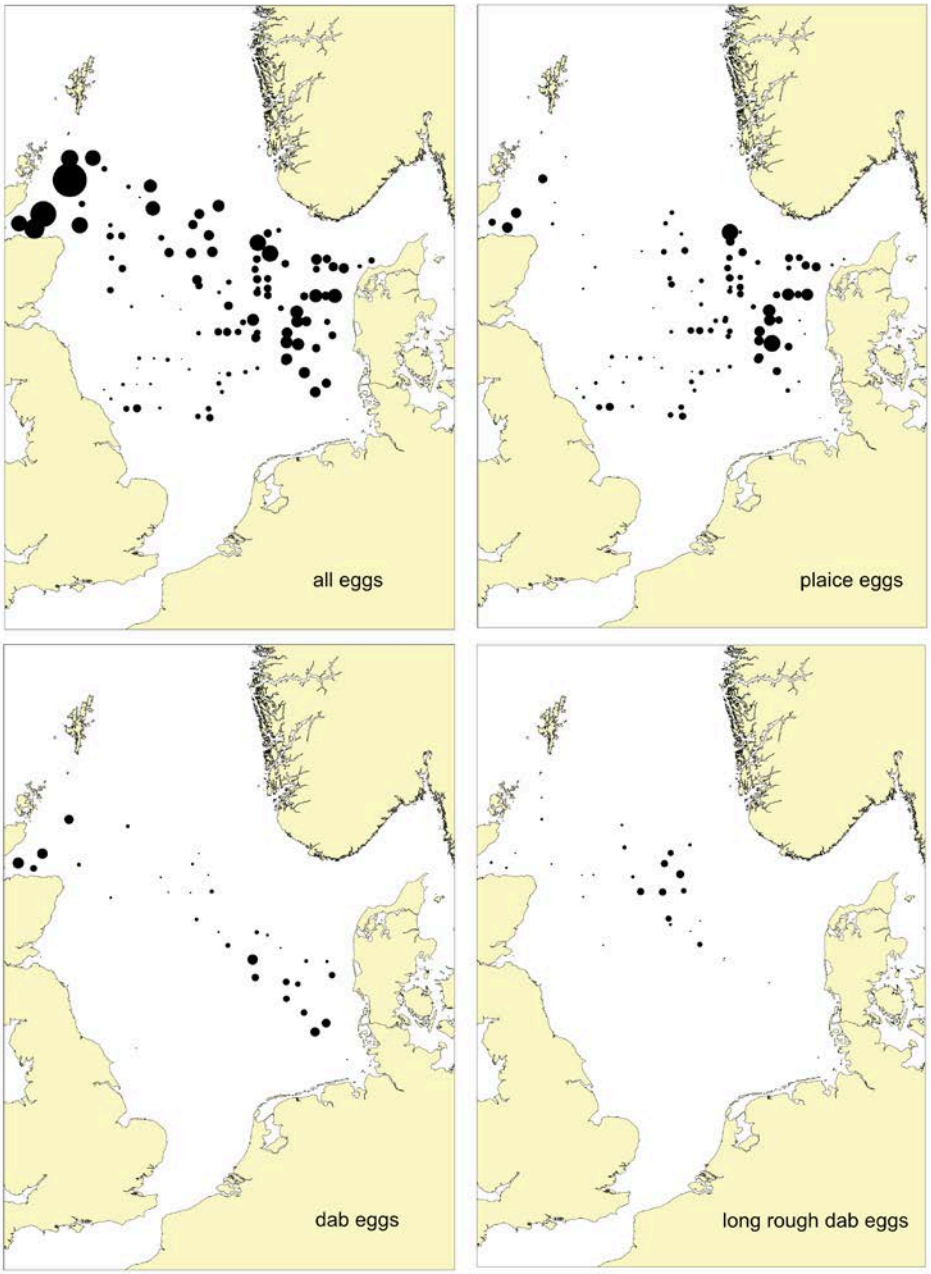

Figure 5.5.2 The distribution of all fish eggs, and eggs of plaice, dab and long rough dab as identified with MALDI-TOF MS from the Danish and German MIKeyM-net samples from the 2018 IBTS.

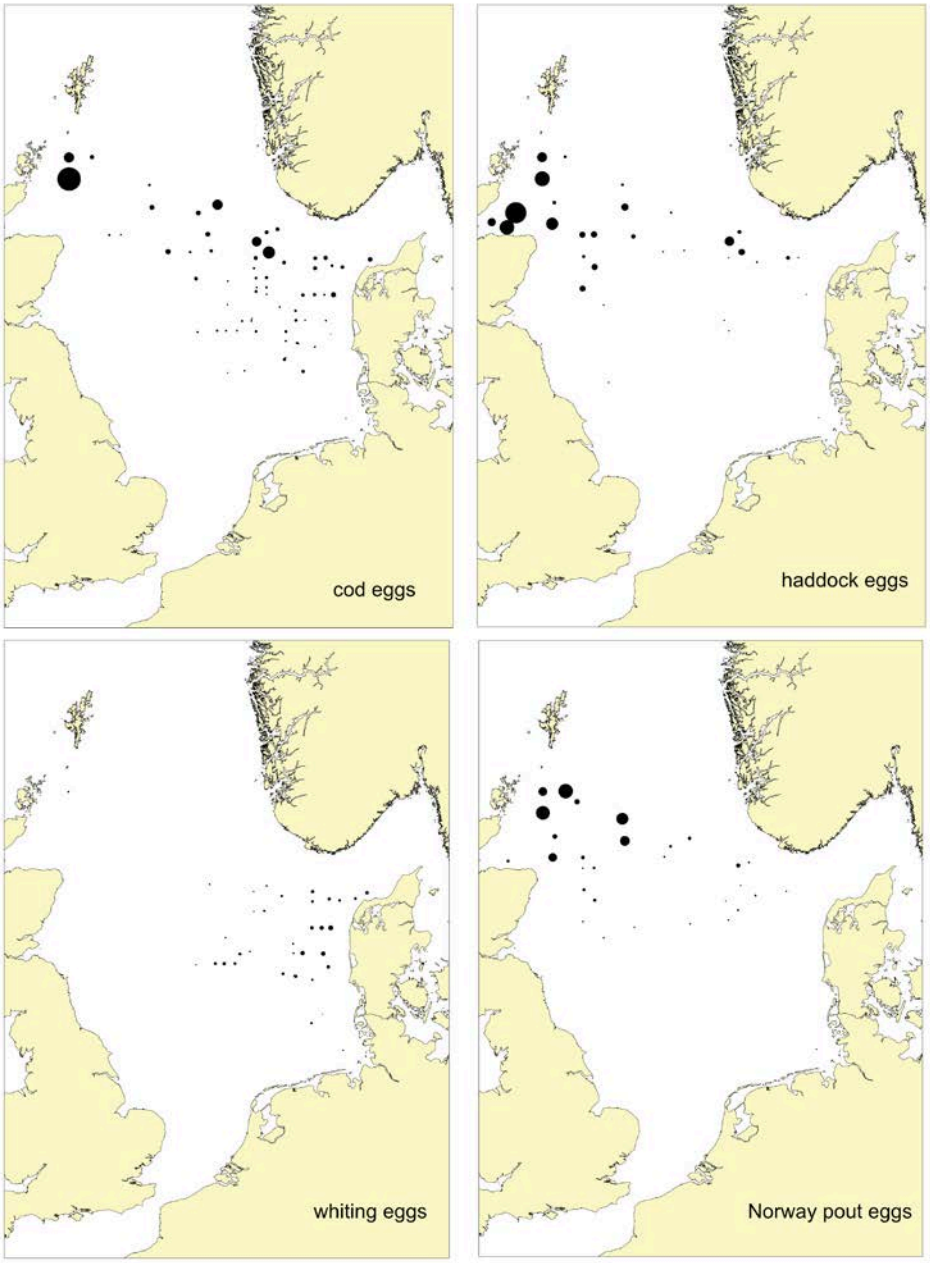

Figure 5.5.3 The distribution of the eggs of cod, haddock, whiting and Norway pout as identified with MALDI-TOF MS from the Danish and German MIKeyM-net samples from the 2018 IBTS.

5.6 Publish first results of MIKey M net surveys (ToR f)

During this term's final meeting of the working group, the outlines of two manuscripts utilizing data from MIKey M net sampling were drafted. One manuscript will cover the description of the MIKey-M net, its use during surveys as well as an evaluation of its sampling performance. Another manuscript will utilize MIKey-M net results in comparison with results from other plankton samplers in order dis-cuss and provide advice for efficiently sampling the different life stages of marine fishes.

5.6.1 The description of the MIKeyM net

The manuscript shall be finalized by 1 April 2019 for submission. The following deadlines and data calls are set in order to meet that date:

- Initial outline completed by 7 December 2018;
- Flowmeter data needed from Germany: 2018, Denmark: all, Scotland: all, Norway: 2012-2016, The Netherlands: 2012 onwards. The data shall be sent to Christophe Loots by 14 December 2018;
- Data on MIKeyM2 nets: Norway 2012 onwards;
- MIKeyM egg distributions (coordinated by Christophe Loots, IFREMER);
- MIKeyM northern North Sea eggs and larvae (coordinated by Richard Nash, IMR).

5.6.2 Fish early life history sampling

The intended publication will be on the efficiency of different sampling devices, the MIKeyM net, the Gulf VII, the MIK and a small pelagic trawl for catching fish eggs, larvae and early juveniles of marine fish. The following deadlines are set:

- The numbers and length frequencies of herring larvae from MIK and Krill trawl sampling shall be submitted to Cindy van Damme, Wageningen Marine Research, by no later than end December 2018;
- French catchability data, numbers of herring larvae, MIK, MIKeyM shall be submit-ted to Cindy van Damme, Wageningen Marine Research, by no later than end Jan-uary 2019;
- Descriptive and analytical statistics shall be finalized by Cindy van Damme, Wa-geningen Marine Research, by End March 2019.

5.7 Coordinate the timing, area, and methodologies for the international herring larvae surveys in the North Sea and adjacent waters (IHLS, ToR g)

5.7.1 Results of the 2017/2018 surveys

Four survey areas were covered within the framework of the International Herring Larval Surveys in the North Sea during the sampling period 2017/2018. They monitored the abundance and distribution of newly hatched herring larvae in the Buchan area and the central North Sea (CNS) in the second half of September and in the southern North Sea (SNS) in the second half of December 2017 as well as in the first half of January 2018 (Fig 5.7.1.1. – 5.7.1.2).

The survey around the Orkneys, planned for September 2017, had to be cancelled due to unforeseen technical problems with the research vessel Walther Herwig III scheduled for the survey. This became obvious just when the survey should start, thus no replacement vessel could be organized. As a consequence, as for 2016, no estimate for the Orkney/Shetland area is available.

Two surveys were planned and conducted in the southern North Sea. The historic third observation in the second half of January was moved to an additional MIK sampling in March/April in the German Bight and along the Dutch coast. This sampling should shad light recruitment of herring larvae originating from the Downs stock component.

In the North Sea, larger quantities of newly hatched larvae were observed on several banks used as spawning habitat in the Buchan area and the central North Sea (CNS). The total numbers of larvae are in the same order of magnitude as in the year's before. However, no larvae were found in the northern parts of the CNS (Fig. 5.7.1.1). Some methodical problems occurred during the September survey, resulting in 33 invalid hauls. Thus, it is most likely that larvae abundance in the CNS is underestimated and

the spatial distribution of larvae as shown in Fig. 5.7.1.1 is biased, but not obviously different from preceding years.

The estimates of the southern North Sea are in line with observations in the period 2004-2012, when the main proportions of the North Sea abundance index were contributed by the Downs stock component (Tab. 5.7.1.1).

During the most recent benchmark of the North Sea herring assessment (ICES, WKPELA 2018), it was decided to use the Larvae Abundance Index (LAI) as direct input into the assessment model and to resolve spatial stock dynamics inside the model.

Most of the survey areas have not been fully covered (or only on occasion) since the beginning of the 1990s, e.g. the first half of September in Orkney/Shetland and Buchan and CNS. It is more than unlikely that survey effort will increase in the upcoming years. Thus, the survey design will be revisited during coming WG meetings, examining other and probable more efficient ways to make use of the current survey effort.

Table 5.7.1.1: North Sea herring – LAI time-series of herring larval abundance <10 mm long (<11 mm for the SNS), by standard sampling area and time periods. The number of larvae are expressed as mean number per ICES rectangle * 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.
1972	1133	4583	30		165	88	134	2	46	
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
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	

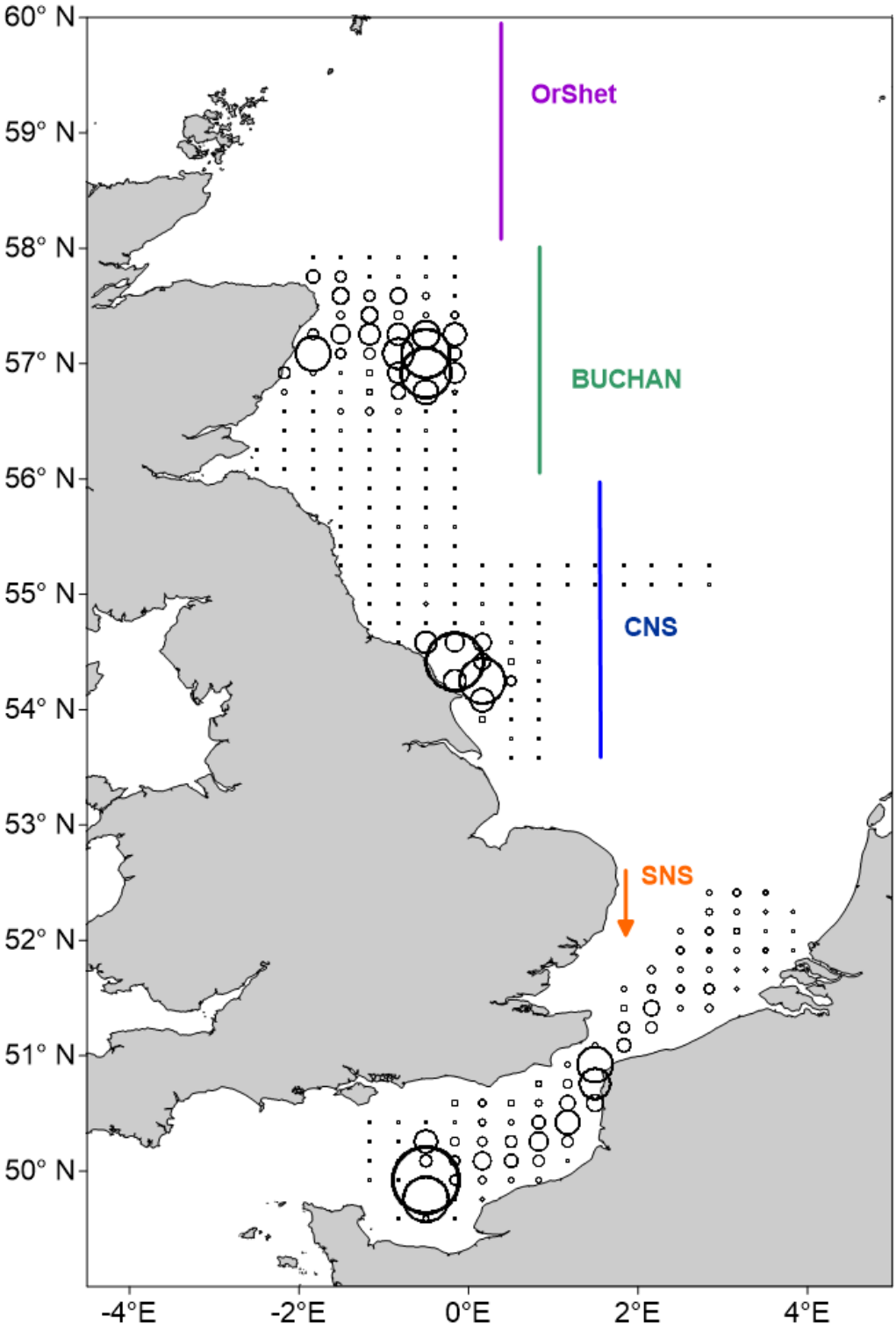

Figure 5.7.1.1: North Sea herring - Abundance of larvae < 10 mm (n/m²) in the Buchan, Central and Southern North Sea as obtained from the International Herring Larvae Surveys in autumn and winter 2017 / 2018 (maximum circle size = 5 850 n/m²). The survey around the Orkneys was cancelled due to technical problem of the research vessel. The abundance in the Southern North Sea is given as the mean of the two surveys done in December 2017 and January 2018.

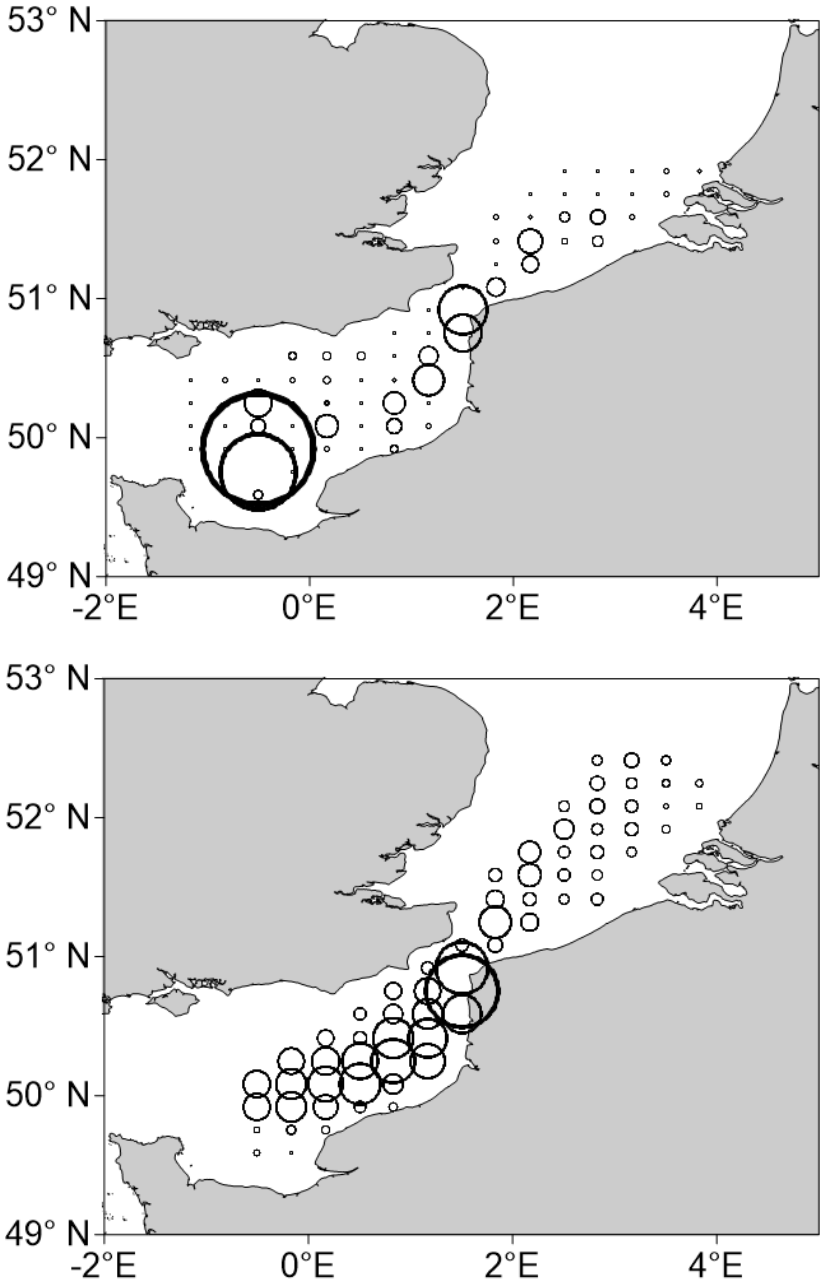

Figure 5.7.1.2 : North Sea herring - Abundance of larvae < 11 mm (n/m²) in the southern North Sea as obtained from the International Herring Larvae Survey in the second half of December 2017 (upper panel, maximum circle = 5 000 n/m²) and in the first of January 2017 (lower panel, maximum circle size = 1 200 n/m²).

5.7.2 Planning for the 2018/2019 surveys

The IHLS surveys give information on 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. In general, on four different spawning areas two (Orkney/Shetlands and Buchan) to three (Banks and Downs) sampling periods are needed to fully monitor the spawning activity. This condition has not 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.

Instead of the survey in the southern North Sea in the 2nd half of January, an additional MIK-Survey, following Downs herring larvae, is scheduled in spring 2019. This additional survey shall shad lights into the recruitment of this stock component.

The plan of the upcoming campaign is given below.

Tab. 5.7.2.1: Areas and periods to be covered during the 2018/19 IHLS surveys

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

5.8 Surveys presented to the working group

During the second year of this term, WGEGGS2 was asked through HAWG to pro-vide a platform for the International Herring Larvae Survey which has been dis-banded from its former working group WGIPS. The issue was discussed during the last meeting in Boulogne-Sur-Mer, France, and two new terms of reference were added to the existing ones (ICES 2018). The group also decided during that meeting that WGEGGS2 should be resolved at the end of this term and a new working group on ichthyoplankton surveys in the North Sea and adjacent seas should be established. The new group should become a platform for other ichthyoplankton surveys in those areas to receive assistance in planning and conducting their work. Representatives of such surveys were, therefore, invited to participate in the final meeting to present their work in order to provide information to establish multi-annual Terms of Reference for the new group.

The following surveys were presented during the meeting: The Rügen Herring Larvae Survey (RHLS), which had also been disbanded by WGIPS and was seeking a new platform, the Downs Recruitment MIK survey, the Baltic Ichthyoplankton Survey, the Northern Ireland Methot–Isaacs–Kidd Survey (NIMIK), the Northern Ireland Irish Sea Herring Larvae Survey (NINEL), the pilot survey for sprat larvae during the Danish Q3 IBTS in the North Sea, and the litter sampling from the MIK survey during the IBTS Q1. All those surveys, except for the RHLS, are currently not associated to any ICES working group. Short descriptions of these survey are given in the following chapters.

5.8.1 The Rügen Herring Larvae Survey

The inshore waters of Strelasund/Greifswalder Bodden (ICES SD 24) are considered a major spawning area of Ruegen herring which represents a significant component of the Western Baltic spring spawning (WBSS) herring stock. The Institute of Baltic Sea Fisheries (TI-OF), Rostock, Germany monitors the density of herring larvae as a proxy of recruitment success within the frame work of the Ruegen Herring Larvae Survey (RHLS). As a fishery-independent indicator of stock development, the recruitment index is incorporated into the ICES Herring Assessment Working Group (HAWG) advice since 2008 as the only 0-group recruitment index for the assessment of Western Baltic Spring Spawning herring. Additionally, the collected data provide an important baseline for detailed investigation of herring spawning- and recruitment ecology. From early March until late June, 35 stations are sampled weekly throughout Strelasund/Greifswalder Bodden. Herring larvae are assessed quantitatively using a plankton-Bongo net performing stepwise-oblique-tows (surface and each subsequent

1 m depth step 30 sec. tow time) down to 1 m above ground. Consequently, the total time for each tow depends on the particular water depth at the station. To assess larvae of multiple size classes, the nets simultaneously used in the RHLS-Bongo have different mesh sizes (335 and 780 μm) to account for size dependent catch efficiency i.e. assuming that larger larvae have higher potential to avoid the 335 μm net, the 780 μm net is used for inter calibration of mesh size effects. Samples are preserved in 4% buffered (Borax) Formalin. However, only the larvae from the 335 μm are used for the recruitment index. During 11 years of Bongo-sampling no advantage of the 780 μm could be seen. Future sampling will include two 335 μm nets of which one will be used on selected stations to sample larvae for fixation in ethanol and freezing (-80°C) for further analysis of otolith increments, genetics etc.

In addition to the larval assessment, hydrographic variables are measured on each station. This includes data collection on Secchi-depth as well as sea surface and –bottom data on temperatures, salinities, turbidity and dissolved oxygen content (CTD data, Sea-Bird incorp.). Additionally, vertical profiles of these variables are taken (CTD) on each station. Since 2012 an additional Fluorescence probe is used on the CTD to measure depth profiles of in situ Chlorophyll-a (CHL) content.

The annual N20 larval survival index is calculated by correcting weekly growth of larvae for seasonal temperature change and taking the sum of larvae reaching ≥ 20 mm by every week of the survey until the end of the investigation period. On the spatial scale, the 35 sampling stations are assigned to 5 strata and mean larval abundance on stations of each stratum are extrapolated to the entire strata area. The final sum of 20 mm larvae derived from weekly intervals is incorporated into the annual N20 index (Fig.2) (see Oeberst et. al. 2009 for detailed description of the method and rationale).

After the record low N20 in 2016 the relation with the 1-group juveniles as monitored by the German Hydroacoustic Survey (GERAS) after the one-year growth phase was re-evaluated to see if the N20 2016 produces an outlier in this time series. The results indicate an even stronger correlation between N20 and GERAS 1-wr juveniles. The low N20 years resulted in correspondingly low GERAS indices for the 1-wr juveniles.

5.8.2 The Downs Recruitment MIK survey

In 2016 WKHERLARS evaluated the North Sea herring larvae surveys (ICES, 2016). One conclusion was that the current IBTS-MIK recruitment index does not contain information on the Downs spawning component. A recommendation was put for-ward to investigate the possibility to collect data to include information on Downs recruitment. In 2017 Wageningen Marine Research investigated the effect on the herring assessment of dropping one of the three IHLS surveys carried out on the Downs spawning ground. The effect of this on the SSB estimation of the North Sea herring assessment was maximum 2%. Based on this it was decided to drop the IHLS survey carried out by the Netherlands in the second half of January in 2018. The vessel time and budget of this survey was instead used for a Downs Recruitment Survey (DRS). Based on larval drift modelling the timing of the survey needed to be in April to sample the same development stage of the herring larvae com-pared to the IBTS-MIK. The drift modelling also predicted the area to be sampled during the DRS 2018.

The DRS was carried out following the IBTS-MIK protocol as much as possible, but the sampling was carried out both day and night, instead of only at night. Because of this the original black net was changed to a blue one. It is assumed that the black net is visible for the larvae during the daytime and this might cause avoidance by the larvae. The blue net is believed to be less visible for the larvae during both day and night time.

In total 54 stations were sampled, all except one contained herring larvae. Due to the time constraints, it was not possible to cover the whole larvae distribution area. Compared to the MIK, numbers of herring larvae found in the DRS samples were much higher per sample. Length distributions of the herring larvae in the DRS were the same as for the MIK.

The data from the first DRS survey are promising in that they can probably be add-ed to the original IBTS-MIK index. In 2019, another DRS survey will be executed by the Netherlands, sampling 5 days. In an attempt to cover the whole distribution area, Norway will aid by sampling the most northern rectangles during a spring survey that is conduct in the Norwegian coastal areas. This will allow the Nether-lands to sample further west and south. After the 2019 survey, results of both surveys will be evaluated and a decision will be made on the continuation of the DRS.

5.8.3 The Baltic Ichthyoplankton Surveys (BIS)

A time series of ichthyoplankton surveys was initiated in 1986 by the IfM – "Institut für Meereskunde" (Institute of Marine Sciences, now GEOMAR) in Kiel, Germany and has been running ever since. However, the extremely protracted spawning season of eastern Baltic cod makes it necessary to conduct several surveys throughout the year if one wants to obtain a reliable picture of the seasonal egg production and allow for determination of egg and larval survival. As this requires considerable vessel time, personnel and resources, which is difficult to handle by one institute alone, several institutes joined forces to cover the spawning season with several surveys per year. Presently, the following partners are involved: 1. DTU Aqua – National Institute of Aquatic Resources, Kgs. Lyngby, Denmark; 2. GEOMAR – Helmholtz Centre for Ocean Research Kiel, Germany; 3. IMF – Institute of Marine Ecosystem and Fishery Science, Hamburg University, Germany; 4. TI-OF – Thünen Institute of Baltic Sea Fisheries, Rostock, Germany; 5. NMFRI – National Marine Fisheries Research Institute, Gdynia, Poland; 6. BIOR – Institute of Food safety, Animal health and Environment, Riga, Latvia.

Baltic cod is spawning in the deep Baltic basins, i.e. the Bornholm Basin, Gdansk Deep and Gotland basin. However, oxygen conditions in the two latter, more east-ern basins have deteriorated over the past decades, and eggs require minimum salinity of S=11 to get fertilized and to stay buoyant. Spawning is therefore presently largely restricted to the layers below the permanent halocline in the Born-holm Basin, i.e. at depths >55-60 m. Thus, the present ichthyoplankton surveys are covering those parts of the Bornholm Basin which are deeper than 60 m on a standard station grid consisting of 45 stations. The number of conducted surveys per year was somewhat variable over time, depending on funding possibilities. However, most years were covered by at least 6 surveys, and it was possible to maintain a continuous time-series in spring (April/May) and summer (July/August) throughout all years.

On each sampling station profiles of the ambient hydrographic conditions are obtained by CTD casts. The standard gear to sample ichthyoplankton is a Bongo net with an opening diameter of 60 cm and one net with 500 μm and one net with 335 μm mesh size. The gear is equipped with a V-fin depressor, a depth sensor and flowmeters. On most surveys, an additional Baby-Bongo net with an opening diameter of 20 cm and 150 μm mesh size is attached above the Bongo net in order to collect additional samples of smaller zooplankton. 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.

These samples are fixed with a 4% Borax-buffered formalin-seawater solution. The 335 μm samples are used for quantitative analyses of eggs and larvae. All eggs are sorted from the samples, identified to species and counted, and at least 100 eggs per species are staged. Larvae are sorted from the samples, identified to species, counted and measured to the nearest 0.5 mm below.

The surveys have been used for a multitude of scientific purposes but have until recently not been utilized in a stock assessment context. However, recent difficulties with the stock assessment of Baltic cod have resulted in efforts to test if the surveys can be used to estimate stock biomass via egg production methods and to obtain a recruitment index using larval abundances. In relation to this, the surveys have recently been evaluated by WGALES 2018, and from 2019 on both SSB and recruitment estimates are expected to be used in the assessment of Baltic cod by the Baltic Fisheries Assessment Working Group (WGBFAS).

5.8.4 UK (Northern Ireland) Methot-Isaacs-Kidd Survey (NIMIK)

Steven Beggs presented an overview of the UK (Northern Ireland) Methot–Isaacs–Kidd Survey (NIMIK). The survey has been using a Methot–Isaacs–Kidd frame trawl to target pelagic juvenile gadoids in the Irish Sea since 1993. The survey is a stratified design and takes place in May and June during the period prior to settlement of gadoid juveniles (for station grid see Figure 5.8.4.1). Indices are calculated as the arithmetic mean of the numbers - per - unit sea area (nos.m^{-2}). The MIK net is deployed during the hours of darkness (1± hr sunset). During daylight hours a Gulf-VII high speed plankton sampler with on-board Valeport Midas+ CTD is deployed to collect abundance and distribution data on larval fish, zooplankton and water structure properties (SST, salinity, chlorophyll a). See Figure 5.8.4.2 for the station grid. 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. In 2018 a standard WP2 frame with side floats for neuston sampling (333μm mesh) was deployed for the study of marine micro plastics.

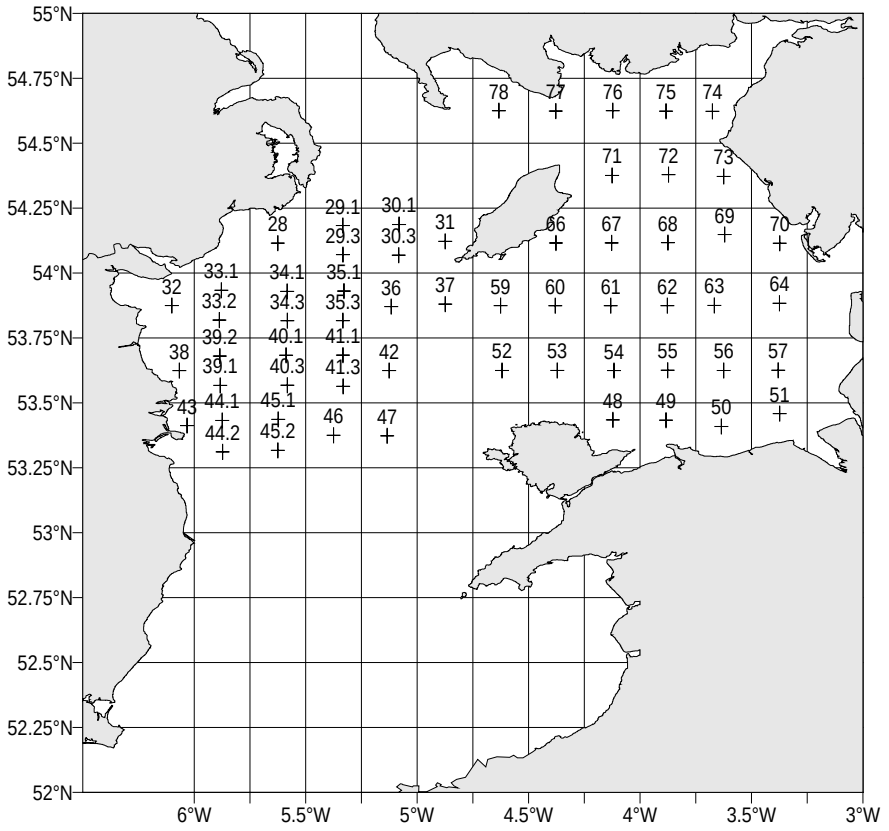

Figure 5.8.4.1: Station positions for deployment of MIK net during Methot–Isaacs–Kidd Survey (NIMIK)

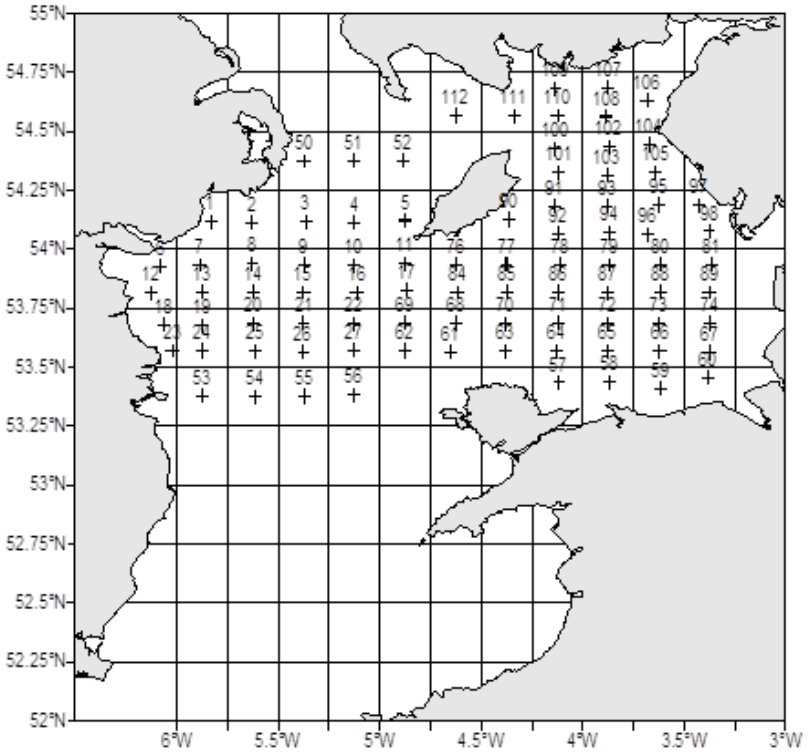

Figure 5.8.4.2 Station positions for deployment of Gulf-VII high speed plankton sampler during Methot–Isaacs–Kidd Survey (NIMIK).

5.8.5 UK (Northern Ireland) Irish Sea Herring Larvae Survey (NINEL)

Herring larvae surveys of the northern Irish Sea (ICES area VIIaN) 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 carried on 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 5.8.5.1). Larvae are sampled using a Gulf-VII 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 day-1 and instantaneous mortality of 0.14 day-1 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. Subsequently the use of the survey in the stock assessment has ceased.

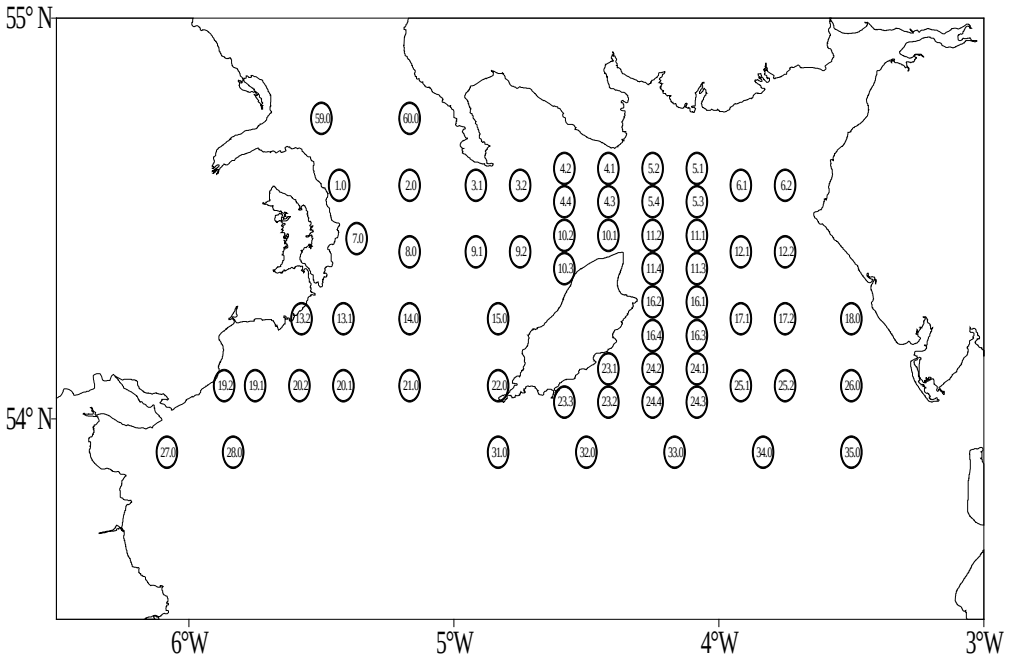

Figure 5.8.5.1: Station positions for north Irish Sea herring larvae survey (NINEL).

5.8.6 A pilot survey for sprat larvae during the Danish Q3 IBTS in the North Sea

Sprat is an important forage fish and therefore highly relevant in multispecies approaches to fisheries management. The sprat stock in the North Sea is dominated by young fish and stock size is therefore driven to a large degree by the recruiting year class. An analytical assessment of sprat was established some years ago, however the availability & quality of data for the assessment are relatively poor and the assessment of and advice for the North Sea sprat stock need to be improved. There is e.g. presently no information on early life stages available for short-term fore-casts or for use in the stock assessment model. However, such information would be important, in particular because sprat is a short-lived species that matures early.

With this background, a pilot survey targeting sprat larvae was conducted during nighttime in August 2018 during the Danish Q3 IBTS, with a second pilot survey

planned for the Q3 IBTS in 2019. The overall goal of these surveys is to evaluate the feasibility of establishing a sprat recruitment index based on larval sampling on the Q3 IBTS surveys. Thus, the basic idea is to follow similar procedures as the MIK herring larvae surveys during the Q1 IBTS, i.e. targeting larger larvae and utilizing their abundance as recruitment index.

The gear in use during the 2018 survey was a MIK net with 2 meter diameter and a mesh size of 1.0 mm. In addition, a MIKey M net (20 cm Ø, 500 µm mesh size) was attached to the MIK ring (Fig. 1) in order to test if there are still eggs and/or very small larvae in the area, which would indicate that spawning activity has not finished yet. The gear was equipped with a Scanmar depth sensor and was deployed in a double-oblique haul from the surface to 5 meter above the sea-floor (measured from the lower end of the MIK ring). Fishing speed was 3 knots through the water, and the wire was paid out at a speed of 25 meters per minute (= 0.4 ms-1) and retrieved at 15 meters per minute (= 0.25 ms-1). Both the MIK and the MIKey M were equipped with flowmeters to record the volume of filtered water.

A total of 80 valid MIK hauls were conducted in Q3 2018. Clupeid larvae were observed in all hauls except two, many of them yielding several hundred or even thousands of larvae. In total, it is estimated that about 20000 clupeid larvae were caught. Clupeid larvae in a size range from approx. 6 mm to juvenile fish of 4-5 cm were caught. Considering the usual spawning times of clupeids in the area, it can be assumed that the majority of clupeid larvae are sprat, but it cannot be excluded that also sardine and maybe also small herring larvae are among the sample material. Thus, precise identification to species level as well as precise determination of larval numbers and sizes by species awaits further detailed analyses in the laboratory.

In addition to clupeids, a number of larvae of other fish species were caught, including mackerel, horse mackerel, sandeel, gurnards, lemon sole, scaldfish & several other flatfish, a few larger gadoids as well as several other, non-commercial species, e.g. gobies, crystal goby, rocklings, pipefish, dragonets and greater weaver.

5.8.7 Litter sampling from the MIK survey during the IBTS Q1

DTU AQUA - Denmark has been collecting data of marine litter from standard MIK samples collected during the Q1 IBTS from 2014-2016, and first results were presented at the 2016 WGEGGS2 in Hamburg, Germany. Given the information on spatial distribution and composition of different litter types that may be obtained from these litter samples, the group agreed that this additional sampling was worthwhile, and it was possible to convince all nations participating in the Q1 IBTS to contribute to this effort. For this purpose and in order to standardize methodology, a manual and a MIK litter protocol sheet were developed and distributed to the MIK survey participants. Thus, since 2017 all nations participating in the Q1 IBTS MIK surveys collected marine litter from the MIK samples and sent the samples to DTU Aqua for further analysis. While a first, preliminary analysis of the samples from 2014-2017 was conducted, detailed analyses were so far hampered by a lack of funding. However, DTU Aqua has been able to obtain funding from the Danish VELUX FOUNDATION for the project "MARLINS – Marine litter in the water column of the North Sea", which will allow the detailed analyses of all MIK litter samples from 2014-2020. The litter items will be classified in different categories, and as far as possible the size of the different litter items will be measured. Furthermore, the color is noted, as this can give important information about the source of the litter. For each litter item, station ID, litter category, size, color and if necessary additional comments describing the item are noted. The litter

items are stored in plastic bags for potential later laboratory analyses such as e.g. Raman spectroscopy, which can give information about the type of plastic and thereby the source of the litter items.

Preliminary results of the 2017 MIK litter sampling were presented at the 2017 IBTSWG at ICES headquarters in Copenhagen, at the 2017 WGEGGS2 in Boulogne-sur-Mer and at various national meetings in Denmark. As all nations participated in the sampling in 2017, the spatial coverage was identical with the MIK coverage, comprising the entire North Sea IBTS area. Overall, 33% (188 out of 571) of the analyzed MIK samples contained marine litter. However, the number of samples containing litter varied considerably between nations: France (69%), Denmark (65%), Sweden (35%), the Netherlands (29%), Germany (7%) and Scotland (7%). Plastic was by far the most frequent type of litter, comprising 92% of all items. The most frequently occurring litter items were plastic monofilaments (30%), plastic foils and ribbons (30%), plastic pieces (16%) and synthetic rope (11%). The remaining 13% were comprised of plastic fibers, fishing line, polystyrene, paint, metal, paper, natural rope and wood.

Stations containing litter were mainly located in the south and the east of the sur-vey area, whereas only very few stations in the northwest contained litter. The amount of litter (number of items per station) showed a distinct spatial distribution pattern, with hotspots in the English Channel, along the west coast of Denmark and in Skagerrak. This pattern was particularly evident for monofilaments, plastic foils and plastic pieces, whereas synthetic rope was more evenly distributed over the entire southern North Sea. Based on the distinct spatial distribution of monofilaments, the prevailing circulation in the area, as well as available literature on Danish beach surveys and on the spatial intensity of beam trawling, the use of so called “dolly ropes” seems to be one of the main sources of this litter type. Additionally, the color of the plastic filaments points to this source as well, as dolly ropes are usually orange or blue, and ca. 35% of all plastic filaments in the samples were also either orange or blue. Other dominant colors of monofilaments were green (28%), white (12%), black (8%) and clear (8%). The majority of monofilaments had a length of 1-5 cm, but also filaments of 5-20 cm length were frequently observed, as well as some even larger ones from 30 to 70 and one of 118 cm.

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, filtering large volumes of water. The sampling of marine litter from MIK samples does not require any additional vessel time, and the sorting and registration of litter items requires relatively little additional effort as many samples in offshore areas contain no or only few items. Furthermore, the amount of litter can be quantified as flowmeter data are available anyhow, where-as many other marine litter studies are qualitative or semi-quantitative, and the MIK survey covers a large area. Thus, the MIK survey has a high potential to pro-vide a holistic view of the occurrence, distribution and abundance, as well as potential sources and transport pathways, of free-floating marine litter in the entire North Sea area. Given the preliminary results from the 2017 survey, as well as previous Danish results from 2014-2016, the group agreed that it is worthwhile to continue the MIK litter sampling in the future. The results are expected to provide valuable information for various other ICES WGs, e.g. the Working Group on Marine Litter (WGML) as well as various stakeholders and authorities, in particular in relation to the Marine Strategy Framework Directive.

6 Cooperation

WGEGGS2 continued to collaborate with WGALES (Working Group on Atlantic Fish Larvae and Eggs surveys) and with the IBTSWG as the IBTS supports the MIK sampling and, hence, the MIKey-M net sampling.

7 Summary of Working Group self-evaluation of conclusions

A summary list of WGEGGS2 achievements during this term is given in section 4. Because of the widening of the scope of the group by adopting other ichthyoplank-ton surveys, the group recommends its discontinuation and proposes the establishment of a new working group in 2019 with a new chair (Annex 3). A copy of the full Working Group self-evaluation is included in the report as Annex 4.

8 References

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Peters, J.; Laakmann, S.; Rossel, S.; Martínez Arbizu, P; Renz, J. 2018. Can proteomic fingerprinting help identify zooplankton diversity? ICES CM 2018/M:412, Poster.

Annex 1: List of participants

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Annex 2: Recommendations

	RECOMMENDATION	ADRESSED TO
1.	Assistance is needed for the Downs Recruitment Survey to cover the complete distribution area	HAWG

Annex 3: WGSINS(WGEGGS2) terms of reference

Working group meeting draft resolution for multi-annual ToRs (Category 2)

The **Working Group 2 on North Sea Cod and Plaice Egg Surveys in the North Sea (WGEGGS2)** will reconvene as the **Working Group on Surveys on Ichthyoplankton in the North Sea and adjacent Seas (WGSINS),** chaired by Norbert Rohlf, Germany, 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 2019	22 – 25 October	Bremerhaven, Germany	Interim report by 15 December 2019	
Year 2020	October	Belfast, Northern Ireland	Interim report by 15 December	
Year 2021	October	TBD	Final report by 15 December	

ToR descriptors[1]

ToR	Description	Background	Science plan codes	Duration	Expected Deliverables
a	Planning and execution of North Sea and adjacent seas ichthyplankton 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, 5.2	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 cruicial prerequisite for the use of a time series in the assessment.	3.1, 3.2, 5.2	year 1, 2, 3	
c	Prepare a manual for ichthyoplankton surveys in the North Sea and adjacent seas	A manual that describes the standard procedures of ichthyoplankton surveys and their necessary adaptations to the survey specific objectives needs to be in place and reviewed regularly.	3.1, 3.2	year 3	SISP manual on standards in ichthyoplankton surveys
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	

[1] Avoid generic terms such as "Discuss" or "Consider". Aim at drafting specific and clear ToR, the delivery of which can be assessed

e	Standardization of sampling and sample processing procedures	Standards of sampling and sample processing procedures need to be optimized w.r.t. efficiency	3.1	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 on the ICES egg and larval database
g	Assess possibilities for the different ichthyoplankton surveys to supply data for the implementation of 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 w.r.t. feasibility of new survey objectives.	3.1, 3.3	year 1, year 2, year 3	Review any additional objectives that are proposed for the different ichthyoplankton surveys in the North Sea and adjacent seas.

Summary of the Work Plan

Year 1	Plan and execute the International Herring Larvae Survey (IHLS), the Rügen Herring Larvae Survey (RHLS), the Baltic Ichthyoplankton Survey (BIS), MIK Surveys in the North Sea (MIK), the Northern Ireland Method Isaacs Kidd Survey (NIMIK), and the Irish Sea Herring Larvae Survey (ISHLS)
Year 2	Plan and execute the IHLS, the RHLS, the BIS, the MIK, the NIMIK, ISHLS
Year 3	Plan and execute the IHLS, the RHLS, the BIS, the MIK, the NIMIK, ISHLS

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 Group is normally attended by some 8 – 15 members and guests.
Secretariat facilities	None.
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
Linkages to other organizations	None

Annex 4: Copy of Working group self-evaluation

1. WORKING GROUP 2 ON COD AND PLAICE EGG SURVEYS IN THE NORTH SEA(WGEGGS2).
2. 2016.
3. Matthias Kloppmann, Germany.
4. Venues, dates and number of participants per meeting.
   24–26 October 2016 Hamburg, Germany, (5 participants)
   10–11 October 2017, Boulogne-sur-Mer, France (6 participants)
   3–7 December 2018, IJmuiden, The Netherlands, (9 participants)

WG Evaluation

5. If applicable, please indicate the research priorities (and sub priorities) of the Science Plan to which the WG make a significant contribution.

   Integrated Ecosystem Observation and Monitoring Programme (EOSG)

6. In bullet form, list the main outcomes and achievements of the WG since their last evaluation. Outcomes including publications, advisory products, modelling outputs, methodological developments, etc. *

   - **Write and publish the MIKeyM net manual**
   - **Application of MALDI-TOF MS to identify fish eggs**
   - **Conduct a full egg survey in the North Sea in 2018**
   - **Provide a new and more efficient platform for the IHLS**
   - **Published 2 papers on survey results**
   - **Contributions to several international ichthyoplankton conferences**
   - **Developed a Manual for the registration & collection of marine litter from IBTS Q1 MIK samples**

7. Has the WG contributed to Advisory needs? If so, please list when, to whom, and what was the essence of the advice. **Yes, to HAWG the results of IHLS**
8. Please list any specific outreach activities of the WG outside the ICES network (unless listed in question 6). For example, EC projects directly emanating from the WG discussions, representation of the WG in meetings of outside organizations, contributions to other agencies' activities.

   The project "MARLINS – Marine litter in the water column of the North Sea", which is coordinated by DTU Aqua, funded by the Danish VELUX FOUNDATION and running from October 2018 to September 2020, has emerged from WGEGGS2 discussions. The objective of the project is to conduct detailed analyses of marine litter collected from IBTS Q1 MIK samples from 2014-2020. Results are expected to be relevant for various other ICES WGs, e.g. the Working Group on Marine Litter (WGML) as well as various stakeholders and authorities, in particular in relation to the Marine Strategy Framework Directive.

9. Please indicate what difficulties, if any, have been encountered in achieving the workplan.

The main difficulty was the lack of funding to carry out the surveys and to sort plankton samples for fish eggs and to identify those to species. This was particularly true for ToR d on the molecular identification of fish eggs where only part of the samples from the 2018 survey could be analyzed that way.

Future plans

10. Does the group think that a continuation of the WG beyond its current term is required? (If yes, please list the reasons) **No**
11. If you are not requesting an extension, does the group consider that a new WG is required to further develop the science previously addressed by the existing WG. **Yes**

    Already during this term, WGEGGS2 was asked through HAWG to provide a platform for the International Herring Larvae Survey which has been disbanded from its former working group WGIPS. Similarly, the Rügen Herring Larvae Survey, also being disbanded by WGIPS was seeking a new platform. Other ichthyoplankton surveys, that currently are not associated to any ICES working group should also be given a platform to receive assistance in planning and conducting their work. Therefore, it was decided to widen the scope of the working group and turning it in a general working group for ichthyoplankton surveys in the North Sea and adjacent seas.
    (*If you answered YES to question 10 or 11, it is expected that a new Category 2 draft resolution will be submitted through the relevant SSG Chair or Secretariat*.)

12. What additional expertise would improve the ability of the new (or in case of renewal, existing) WG to fulfil its ToR? **None**
13. Which conclusions/or knowledge acquired of the WG do you think should be used in the Advisory process, if not already used? (please be specific) **Data is already used in some assessments.**