

ICES WGEGGS2 REPORT 2017

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Report of the Working Group on North Sea Cod and Plaice Egg Surveys in the North Sea (WGEGGS2)

10-11 October 2017

Boulogne sur Mer, France



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H. C. Andersens Boulevard 44–46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

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Executive Summary

The Working Group 2 on North Sea Cod and Plaice Egg Surveys in the North Sea (WGEGBS2) met in Boulogne-sur-Mer, France, on 10 and 11 October 2017. Six participants representing five 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 2017 MIKey-M net surveys; b) Plan for the 2018 survey; c) Write the MIKey-M net survey manual; d) Prepare WGEGBS2 data for archiving in the ICES eggs and larvae database; and e) Review results on molecular identification of fish eggs.

In 2017, sampling of fish eggs was undertaken by Norway, Germany, The Netherlands, Denmark, France and Scotland during the IBTS, using the MIKey-M net as recommended by WGEGBS2. The weather conditions from end of January to end of February 2017 were better than in 2016, particularly in the north of the survey area. This resulted in a much better coverage with MIKey-M sampling. However, the lack of sufficient personnel resulted in a rather poor level of sample analysis. Many samples remained unprocessed while for other samples only simple egg counts are available. MIKey-M samples from the 2017 survey will be kept at the sampling institutes. For 2018, a full MIKey-M net survey with a complete sample analysis, including genetic identification where possible, is planned. For this survey, also Sweden will be invited to participate in order to cover Skagerrak and Kattegat. In preparation of this survey, the MIKey-M net survey manual, which is currently only part of the MIK manual, was finalized as a stand-alone version for publication in the ICES SISP series.

Data obtained from the MIKey-M net sampling will be progressively uploaded in to the eggs and larvae database.

Although 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 first time carried out by all survey participants. The presentation highlighted the usefulness of the MIK survey for research on occurrence of marine litter in the water column. All of the participants of this WGEGBS2 meeting are also the principal investigators of their country's MIK survey and agreed to continue pursuing marine litter observations in the MIK in 2018 and onwards.

Two new multi-annual Terms of reference were added to the currently existing ones in order to include the International Herring Larvae Survey (IHLS) into the scope of this working group. The IHLS was until recently carried out under the auspices of the Working Group on International Pelagic Surveys (WGIPS), which did no longer consider itself as the ideal working group for that survey. The addition of the IHLS to this working group (WGEGBS2) was done in direct response to the request and recommendation of the Herring Assessment Working Group (HAWG).

1 Administrative details

Working Group name

Working Group on North Sea Cod and Plaice Egg Surveys in the North Sea 2 (WGEGGS2)

Year of Appointment within the current cycle

2016

Reporting year within the current cycle (1, 2 or 3)

2

Chair

Matthias Kloppmann, Germany

Meeting venue

Boulogne-sur-Mer, France

Meeting dates

10-11 October 2017

2 Terms of Reference a) – f)

- a) Review results of the 2016–2018 surveys and plan for the 2017–2019 surveys;
- b) Study the spatio-temporal distribution of winter spawning habitats;
- c) Write the MIKey-M Net manual;
- d) Prepare WGEGBS2 data for archiving;
- e) Review results on molecular identification of eggs;
- f) Publish first results of MIKey-M net 2012–2015 surveys.

3 Summary of Work plan

Year 1	Discuss results of the 2016 survey and plan for the 2017 survey and draft a stand-alone version of the MIKey-M net survey.
Year 2	Discuss results of the 2017 survey and plan for the 2018 survey and finalize the stand-alone version of the MIKey-M net survey.
Year 3	Discuss results of the 2018 survey and plan for the 2019 survey

4 List of Outcomes and Achievements of the WG in this delivery period

- Carried out MIKey-M net survey for North Sea cod and plaice eggs during the 2017 Q1 IBTS, alongside MIK sampling.
- Planned MIKey-M net survey for North Sea cod and plaice eggs during the 2018 Q1 IBTS, alongside MIK sampling.

5 Progress report on ToRs and workplan

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

5.1.1 Review results of the 2016 survey

MIKey-M samples were obtained by six of the 7 nations participating in the 2017 1st Quarter International Bottom Trawl Survey (IBTS) (see Table 5.1.1.1). MIKey-M samples were taken with every MIK sample in 5 cases and in 1, MM samples were taken once in each rectangle (see Figure 5.1.1.1). 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 5.1.1.1 MIKey-M sampling undertaken in 2017 during the Q1 IBTS MIK sampling

Country	Number of MM	No MIK stations	Eggs/Larvae	Sample processing	Comments
The Netherlands	1	All	E+L	Sorted and id (Eggs, stage and diameter; Larvae, lengths)	
France	1	All	E+L	Scanned	
Denmark	1	All	E+L	None; samples in jars, formalin	
Germany	1	1 per rectangle	E	Egg counts (no id or stage). Samples in formalin	C. Loots has egg count data
Norway	1	All	E+L	Approximately 2/3 picked and imaged, Many Egg samples, staged and diameters	
Scotland	1	All	E+L	None; samples in jars, formalin	
Sweden					No MIKey-M sampling in 2017

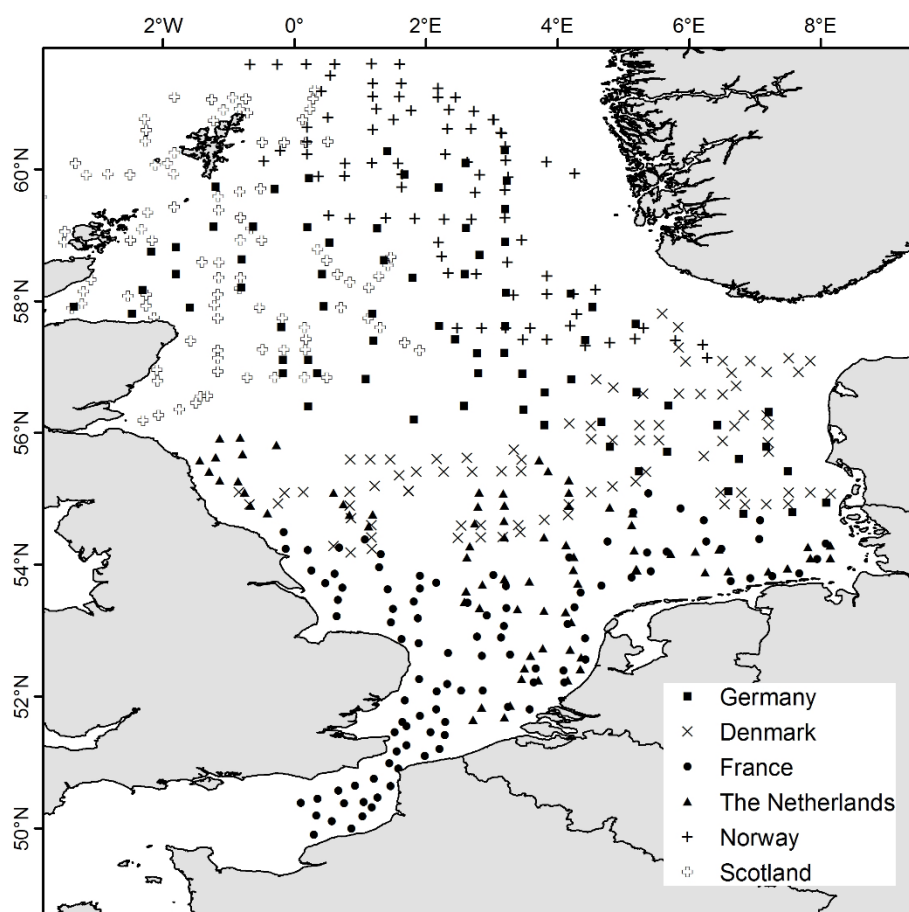


Figure 5.1.1.2 Location of MIKey-M samples for 2017 during the Q1 IBTS MIK survey.

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. 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 WGEGBS2 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 Plan for the 2018 survey

As in previous years, MIKey-M net sampling is again planned to be carried out alongside MIK sampling during the first quarter IBTS in the North Sea. For 2018, it is planned to conduct a full egg survey in the North Sea with complete sample analysis, as opposed to the previous years, where samples were only worked up partially in conjunction with the limited resources of the participating institutes. Participants are asked to carry out at least 2 MIKey-M net hauls (1 with every MIK haul) in each ICES statistical rectangle. Every other haul per rectangle should be sorted for fish eggs and larvae, which are then worked up according to the MIKey-M 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.

Table 5.1.2.1 gives an overview over the proposed depth of sample analysis of each survey participant. All participants will take MIKey-M samples in conjunction with

each MIK haul, however the extent of sample processing will be different. With respect to coverage of the survey area, figure 5.1.2.1 gives an overview of the potential results for the 2018 egg survey.

Table 5.1.2.1: Proposed depth of MIKey-M net sample analysis by each IBTS participant.

Country	Sampling	Sorting	Identification	Staging
Denmark	yes	no	none	no
France	yes	yes	visual, egg diameters	no
Germany	yes	yes	visual, genetic, egg diameters	yes
The Netherlands	yes	yes	visual, egg diameters	yes
Norway	yes	yes	visual, egg diameters, genetic*	yes
Scotland	yes	no	none	no
Sweden	?	?	?	?

* from selected stations only

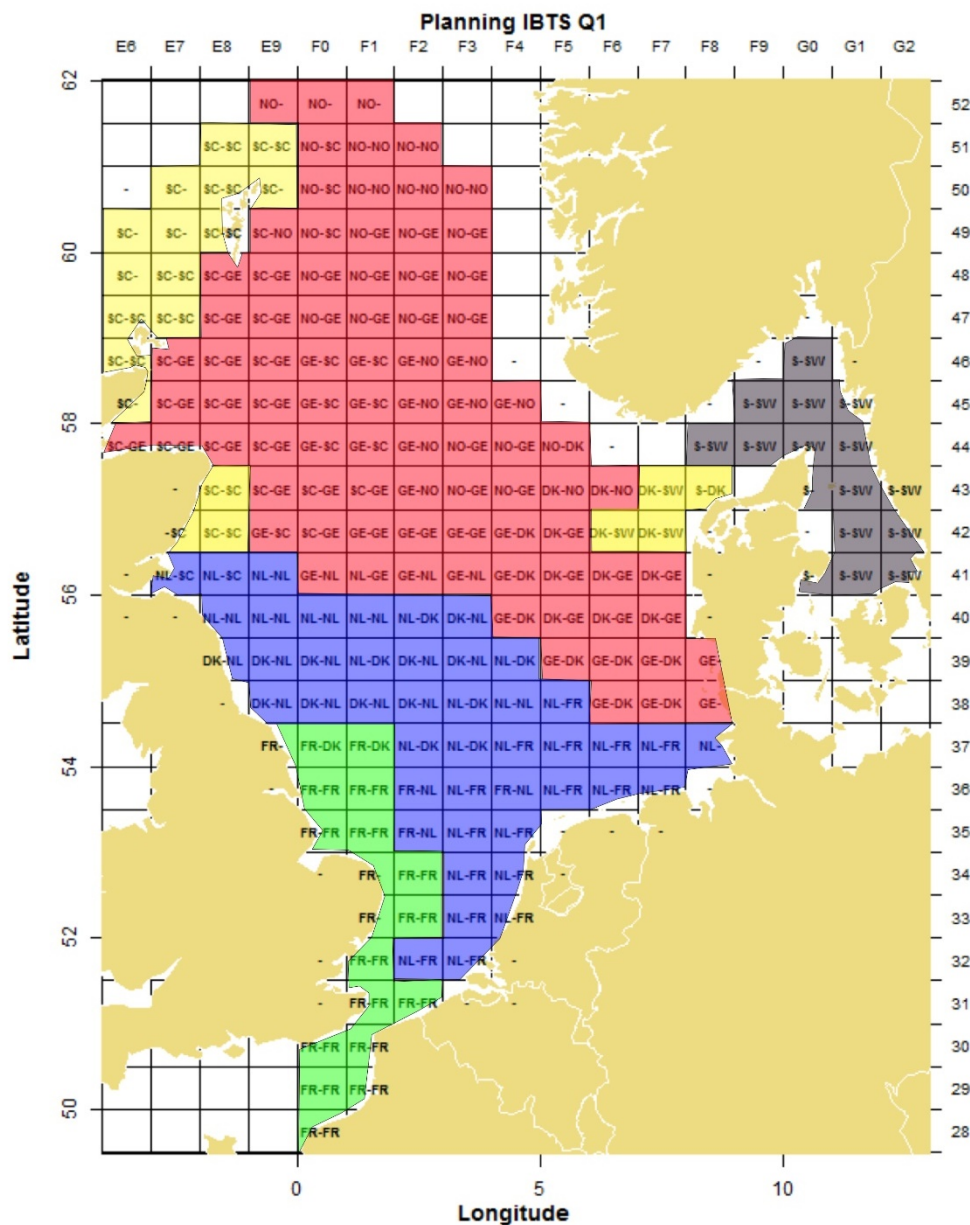


Figure 5.1.2.1 Coverage of the proposed North Sea egg survey in the first quarter of 2018. Red: At least 1 MIKey-M sample from each rectangle, eggs sorted, counted and mostly visually identified and staged, genetic identification from selected stations. Blue: At least 1 MIKey-M sample from each rectangle, eggs sorted, counted, measured and visually identified and staged. Green: At least 1 MIKey-M sample from each rectangle, eggs sorted, counted, measured and visually identified but not staged. Yellow: At least 1 MIKey-M sample from each rectangle, no eggs counts and identifications. Grey: Egg sampling with MIKey-M nets not yet confirmed.

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

This particular term of reference was according to the multi-annual work plan, envisaged for the final year of this term and after the planned 2018 full egg survey (see section 5.1.2)

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

Currently, the manual for the MIKey-M net sampling is part of the latest version of the MIK manual which has recently been published as SISP publication no. 13. For the next full egg survey, which will take place during the Q1 IBTS in 2018, a stand-alone version

for the MIKey-M net has been completed during this WGEGBS2 meeting and will be submitted for publication in the ICES SISP series.

5.4 Prepare WGEGBS2 data for archiving (ToR d)

5.4.1 Adding gear descriptions and updating survey factsheet for the ICES Egg and Larvae database

When the WGEGBS2 data of the MIKey-M surveys are finalised they will be uploaded to the ICES Egg and Larvae database by each institute in 2018. This will include the time-series since 2012 (as far as the data are available). Currently the description of the MIKey-M gear is not included in the ICES Egg and Larvae database. The descriptions below need to be added to 'Gear' in the ICES database (Table 5.4.1). The MIKey-M is a 20 cm midwater ringnet. To adhere to ICES vocabulary already present, the gear will be referred with the code MRN (Table 5.4.1.1).

Table 5.4.1.1 Gear descriptions for the MIKey-M surveys (for configurations see Figure 2.1.1.1 in the 'Manual for the egg surveys on winter spawning fish in the North Sea').

Gear (Sampler type (SMTYP))	Description
MRN0.2-1	Midwater ringnet - 0.2m diameter – configuration 1 (one net on top of the MRN2)
MRN0.2-2	Midwater ringnet - 0.2m diameter – configuration 2 (one net on the side of the MRN2)
MRN0.2-3	Midwater ringnet - 0.2m diameter – configuration 3 (one net at an angle of approximately 45 or 315 degrees on the MRN2)
MRN0.2-4	Midwater ringnet - 0.2m diameter – configuration 4 (two nets at an angle of approximately 45 and 315 degrees on the MRN2)
MRN0.2-5	Midwater ringnet - 0.2m diameter – configuration 5 (two nets on either side of the MRN2)

The webpage and factsheet of the ICES egg and larvae database currently only contains information on the 2004 and 2009 dedicated surveys. This information needs to be expanded with the information on the MIKey-M surveys carried out since 2012. Updated text for the factsheet can be found in Annex 4.

5.4.2 Data template for the 2018 MIKey-M survey

Based on the ICES Egg and Larvae database input format an excel sheet template has been created for collecting data during the 2018 survey (Annex 5). All survey participants are obliged to use this template. Data of the 2018 survey (and going back till 2012) should be uploaded in the ICES Egg and Larvae database by 1st October 2018.

5.5 Review results on molecular identification of eggs

The implementation of molecular techniques in to the MIKey-M sampling programme did not occur during 2017. This was mainly due to not being able to secure adequate funding to undertake the analyses of samples. Due to most of the available methodologies not being able to use formalin-preserved material there is also an 'at sea' manpower requirement for sample pro-processing which in turn has a further cost implication.

For the 2018 survey, Norway and Germany plan to conduct molecular egg identification on at least a limited number of selected stations, where the correct discrimination

between the different gadoid species appears most important. Germany will also try to establish the cheaper and faster MALDI-TOF method of proteome analysis, which explores the species-specific protein composition by means of mass-spectrometry. The method should deliver re-sults equivalent to barcoding. Since this would be the first time that this method will be applied during this survey, the results shall be validated by traditional genetic methods.

5.6 Publish first results of MIKey-M net 2012–2015 surveys

WGEGBS2 will prepare two manuscripts, ready for publication, by 2018. One will be a description of the MIKey-M sampling during the MIK surveys with some illustrative results for winter spawning grounds. The second paper will be a comparison between the various sampling gears used for egg and larvae production sampling, i.e. Gulf VII, MIK and MIKey-M. This paper will also include an overview of what the data from each of the gears could be used for.

5.7 Cooperation with other working groups

Since standard sampling for the North Sea Plaice and Cod Egg Survey is currently undertaken simultaneously with MIK sampling, WGEGBS2 cooperates with IBTSWG which plans and carries out the IBTS in the first quarter. The Working Group on Atlantic Fish Egg and Larvae Surveys (WGALES) advises all ICES ichthyoplankton surveys and the respective working groups. Cooperation also occurs with other ICES working groups dealing with Ecosystem approach to fisheries management (e.g. WGISUR).

5.8 Cooperation with advisory structures

Up until recently, there was no direct cooperation with ICES advisory structures. However, abundance data on recently hatched sandeel larvae may become useful for assessment and advice on North Sea sandeel stocks. The required data still needs to be collated and evaluated for their usefulness.

5.9 Collection of Pelagic Marine Litter Data from MIK samples

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 WGEGBS2 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 in 2017 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 prior to the 2017 IBTS. Marine litter was sorted from the MIK samples and classified in different categories. As far as possible the size of the different litter items was measured, or estimated in cases of very irregularly shaped items such as pieces of plastic foil etc. Furthermore, the colour was 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 were noted. The litter items were also collected in plastic bags by station and taken ashore for potential later quality checks concerning the categorization of different items, as well as for potential 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 WGECCS2 in Boulogne-sur-Mer. As all nations participated in the sampling, the spatial coverage was identical with the MIK coverage, comprising the entire North Sea IBTS area. However, Norway was not able to sort and register litter onboard due to time restrictions, but no litter was removed from the MIK samples which were preserved in formalin, such that it is still possible to analyse the litter from these preserved samples. Overall, 33% (188 out of 571) of the analysed 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 fibres, fishing line, polystyrene, paint, metal, paper, natural rope and wood.

Stations containing litter were mainly located in the south and the east of the survey area (Figure 5.9.1), 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 hot spots 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 colours 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, whereas 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 provide 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 future, and is sending corresponding recommendations to the IBTSWG as well as to WGALES.

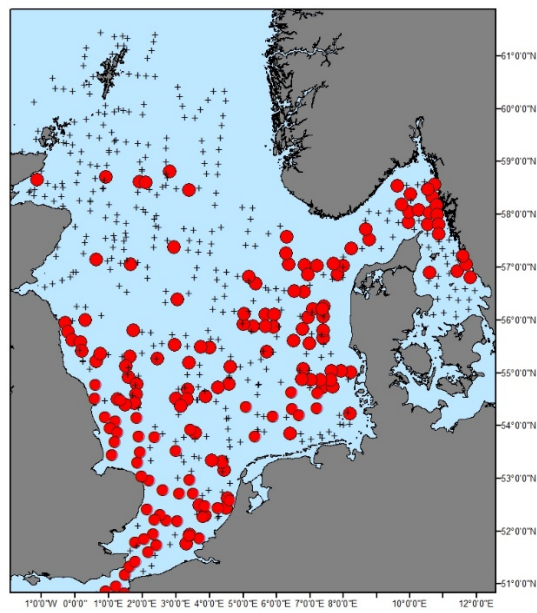


Figure 5.9.1: MIK stations during Q1 IBTS 2017 that did contain litter (red circles) and that did not (black crosses).

6 Revisions to the work plan and justification

The International Herring Larvae Survey in the North recently lost its parent Working Group on International Pelagic Surveys (WGIPS) because that WG no longer considered themselves suitable for a herring larvae survey, as most of their work is focused on acoustic surveys. The IHLS delivers abundance data for recently hatched herring larvae that allow for SSB estimates at substock/component level for North Sea herring stock. The data are used in the assessment and the Herring Assessment Working Group (HAWG) considers the IHLS data important. HAWG therefore recommended that SSGIEOM(EOSG) creates a new WGSINS (Working Group for Surveys of Ichthyoplankton in the North Sea and adjacent ecoregions) which will provide a location for planning the IHLS and new MIK type surveys for recruitment of the Downs component of the North Sea herring stock. This WG should also bring all the coordinators and survey personnel for the MIK and IHLS surveys together. In addition, it was also suggested that the existing WGEGBS2 be replaced by WGSINS.

The chair of WGEGBS2 discussed this recommendation with the SSGIEOM(EOSG) chair. The proposed solution was that WGEGBS2 completes its ToRs (ends 2019) after which the WG will be dissolved and the new group WGSINS will be established. In the meantime, the IHLS should be adopted by WGEGBS2 by adding two new terms of references to its exiting TORs of the group. This suggestion was accepted by WGEGBS2. The new TORs will be:

- Coordinate the timing, area, and methodologies for the international herring larvae surveys in the North Sea and adjacent waters (IHLS).
- Periodically review and update the IHLS manual to address and maintain monitoring requirements in the surveys.

(see also the following chapter 7 for a full description of the two new ToRs.

7 Next meetings

The Working Group 2 on North Sea Cod and Plaice Egg Surveys in the North Sea (WGEGBS2), chaired by Matthias Kloppmann*, TISF, Germany, will meet in IJmuiden, the Netherlands, 3 - 7 December 2018, to work on ToRs and generate deliverables as listed in the Table below. Final Report is due by 18 January 2018.

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 developed 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 implementation during the IBTS since 2012 and instructions for sampling
d	Prepare WGEGBS2 data for archiving	WGEGBS2 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 WGEGBS2 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 identifications where spawning locations of gadoids exist. The means to undertake genetic identifications should be sought were possible	4.28, 4.30	Year 1,2,3	Report : review methods for genetically identifying eggs
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 timing, area, and methodologies 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 herring.	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 monitoring requirements in the surveys.	A survey manual is in place for many years but needs permanent reviewing in order to cope with changing environmental and technical circumstances	4.28, 4.30	Year 3	Report: reviewing survey strategies and methods and preparation for SISP manual

Annex 1: List of participants

Name	Address	E-mail
Matthias H.F. Kloppmann chair	Thuenen Institute of Sea Fisheries, Germany	matthias.kloppmann@thuenen.de
Cindy J.G. van Damme	Wageningen Marine Research, The Netherlands	Cindy.vandamme@wur.nl
Christophe Loots	Ifremer, France	Christophe.Loots@ifremer.fr
Richard D.M. Nash	Institute of Marine Research, Norway	Richard.Nash@imr.no
Bastian Huwer	Technical University of Denmark, DTU Aqua - National Institute of Aquatic Resources Denmark	bhu@aqua.dtu.dk
Carolina Giraldo	Ifremer, France	Carolina.Giraldo@ifremer.fr

Annex 2: Recommendations

Recommendation	Adressed to
Standard protocols for flowmeter calibration and the implementation of calibration data for determining volume sampled should be established	WGALES
Update egg and larvae database gear description and the metadata survey description given in chapter 5.4	DIG, ICES data centre
Marine litter retained in the standard MIK sampling during the Q1 IBTS should be documented and catalogued	IBTSWG, WGALES

Annex 3: Agenda

Tuesday 10 October

09:00 Welcome and general announcements, house keeping

09:30 Results of the 2017 egg survey in the North Sea

10:00 Molecular ID of fish eggs: results from previous surveys and updates. **Presentation** by Matthias Kloppmann (Thomas Knebelberger) on MALDI-TOF method.

10:30 Coffee break

11:00 Planning of the 2018 egg survey in the North Sea

12:00 Lunch break

13:30 MIKey M net manual for the IBTS

15:00 Coffee break

15:15 MIKey M net manual for the IBTS

16:30 End of day 1 – Visit NAUSICAA

Wednesday 11 October

09:00 Finalizing the MIKey M net manual

10:00 Fish egg and larvae database: preparation of data for archiving

10:30 coffee break

11:00 WGEGBS2: future of the working group, IHLS TORs, new name from 2019 onwards and TORs for continuation. **Presentations** by Bastian Huwer on MIK litter sampling and on proposal for a sprat larvae survey during IBTS Q3.

12:00 Lunch break

13:00 report writing

17:00 End of WGEGBS2 meeting

Annex 4: Suggested update of Egg and Larvae dataset webpage and factsheet

Webpage

North Sea cod and plaice egg surveys (2004, 2009, 2012 - present) (CP-EGGS, 2004, 2009, 2012 till present)

The survey was aimed at studying cod and plaice spawning grounds by means of egg distribution in the North Sea. Since 2012 the survey has been carried out as part of the Mid water ring trawl sampling during the IBTS. The scope of the survey has been widened from cod and plaice as target species to winter spawning fish in the North Sea. The program was steered by the WGEGBS until 2012 and is currently steered by WGEGBS2.

Factsheet

Working Group on North Sea Cod and Plaice Egg Surveys in the North Sea (WGEGBS2)

The North Sea cod and plaice egg surveys have been conducted in 2004 and 2009 and have been continued since 2012 alongside the mid water ring trawl herring larvae sampling during the IBTS (IBTS-MIK). The surveys were originally directed at cod and plaice, but since 2012 the scope has been widened to supply data of winter spawning North Sea fish.

The surveys were conducted with Gulf III or VII plankton torpedo's, Bongo nets or CUFES in 2004 and 2009. With the Gulf's and Bongo's double oblique hauls are conducted through the water column till 5m above the sea floor or a maximum of 200m depth. The CUFES sampling is a continues sampling at 5m depth. The mesh size of all sampling equipment is 280 µm. During the sampling temperature and salinity are measured. Flowmeters are used to measure the amount of water filtered while sampling. Since 2012 the surveys are conducted with a 20 cm mid water ring trawl, which is attached to the ring of the 2 m mid water ring trawl used during the IBTS-MIK survey. The mesh size of the 20 cm midwater ring trawl is 335 µm. Sampling is carried out to 5 m above the sea floor or 100 m depth maximum.

The database contains the haul information data, position, time , duration, water volume, depth, temperature and salinity. Eggs and larvae in the samples were counted. All eggs > 1mm were measured and identified to species were possible. Eggs < 1 mm are counted and in 2004 measured and identified as well. There is large overlap in size some gadoids, including cod, and other species, thus identification by eye is not possible. For these, genetic analysis was used to identify the species. All eggs that are measured and identified were also staged following the stage descriptions in Appendix A. Larvae in the samples were identified to species, measured and development stage assigned.

WGEGBS and WGEGBS2 are the ICES EG responsible for these surveys and more information and analysis of the results can be found in the EG's reports on the ICES website. Results have also been published in various scientific journals:

Fox, C. J., Taylor, M., Dickey-Collas, M., Fossum, P., Kraus, G., Rohlf, N., Munk, P., et al. 2008. Mapping the spawning grounds of North Sea cod (*Gadus morhua*) by direct and indirect means. *Proceedings of the Royal Society B: Biological Sciences*, 275: 1543-1548.

- Taylor, N., Fox, C. J., Bolle, L., Dickey-Collas, M., Fossum, P., Kraus, G., Munk, P., et al. 2007. Results of the spring 2004 North Sea ichthyoplankton surveys. The distribution of fish eggs and larvae from the international ichthyoplankton survey. 60 pp.
- Munk, P., Fox, C. J., Bolle, L. J., Damme, C. J. G. v., Fossum, P., and Kraus, G. 2009. Spawning of North Sea fishes linked to hydrographic features. *Fisheries Oceanography*, 18: 458-469.
- Damme, C. J. G. v., Bolle, L. J., Fox, C. J., Fossum, P., Kraus, G., Munk, P., Rohlf, N., et al. 2009. A reanalysis of North Sea plaice spawning-stock biomass using the annual egg production method. *ICES J. Mar. Sci.*, 66: 1999-2011.
- Nash, R. D. M., Wright, P. J., Matejusova, I., Dimitrov, S. P., O'Sullivan, M., Augley, J., and Höffle, H. 2012. Spawning location of Norway pout (*Trisopterus esmarkii* Nilsson) in the North Sea. *ICES Journal of Marine Science: Journal du Conseil*, 69: 1338-1346.

Annex 5: Template for MIKey-M net data submission

Hauldata			
order	Field	Mandatory	Units/references
1	RecordType	y	EH
2	Survey	y	RECO DatasetVer
3	Country	y	RECO ISO_3166
4	Institute		EDMO codes, http://vocab.ices.dk/?ref=1398
5	Campaign		The national campaign name/ Survey name (e.g. BOCADEVA)
6	SurveyPeriod		Survey period
7	Ship	y	RECO SHIPC
8	Gear	y	RECO SMTYP
9	GearDeployment		http://vocab.ices.dk/?ref=1416
10	MeshSize	y	microns
11	MeshType		http://vocab.ices.dk/?ref=1417
12	CodendMesh		Codend mesh size in microns
13	StationNumber	y	The number of the station
14	HaulID	y	ID of that haul
15	ELHaulFlag		U (=Untrusted haul) or blank (=trusted); write in the notes why it is untrusted
16	NationalHaulID		Haul reference in the national database, if different from the HaulID
17	Day	y	Start date of the haul in UTC
18	Month	y	Start date of the haul in UTC
19	Year	y	Start date of the haul in UTC
20	Hour	y	Start time of the haul in UTC
21	Minute	y	Start time of the haul in UTC
22	StartLatitude	y	Latitude at shooting in decimal degrees and using + and – for North/South
23	StartLongitude	y	Longitude at shooting in decimal degrees and using + and – for East/West
24	HaulDurationMinutes		minutes
25	HaulDurationSeconds		seconds
26	Distance		Distance towed in metres
27	WireAngle		The angle (in degrees) of the wire during hauling of the net in vertical tows
28	WireLength		Maximum length of the wire shot in metres
29	Netopening		inner diameter in metres
30	NetopeningArea		net opening area (square metres)
31	FlowEfficiency		Flow efficiency factor (scaled to 1)
32	NetClogging		Qualitative estimate of clogging of the net vocab.ices.dk/?ref=1420
33	FlowmeterType		http://vocab.ices.dk/?ref=1418
34	FlowmeterBrand		Free text
35	FlowIntRevs		Internal flowmeter revolutions
36	FlowIntCalibr		Calibration factor of the internal flowmeter in Revs/m
37	FlowExtRevs		External flowmeter revolutions
38	FlowExtCalibr		Calibration factor of the external flowmeter in Revs/m
39	VolumeFiltInt		Internal volume filtered in m ³
40	ELVolFlag		vocab.ices.dk/?ref=1419
41	DepthUpper		Minimum sampling depth in metres
42	DepthLower	y	Maximum sampling depth in metres
43	DepthBottom		Bottom depth in metres
44	SurTemp		Surface or 5m temperature in degrees Celsius
45	Temp20m		20m temperature in degrees Celsius
46	Temp50m		50m temperature in degrees Celsius
47	Temp100m		100m temperature in degrees Celsius
48	BotTemp		Bottom temperature in degrees Celsius
49	SurSal		Surface or 5m salinity
50	Sal20m		20m salinity
51	BotSal		Bottom salinity
52	Notes		Free text
Measurements			
order	Field	Mandatory	Units/references
1	RecordType	y	EH
2	HaulID	y	
3	Species	y	valid Latin name as in WoRMS
4	ELSAMPLEFLAG	y	RECO STAGE (EG or LV)
5	IndividualNumber		Identification number of the individual egg or larvae measured
6	Length		Length of the larvae or egg diameter in 0.000 mm
7	DevScale	y (if developmental stage is entered)	New to be updated list on the WKIEDL sharepoint references Geffen & Nash 2012 and recommendation for all ichthyoplankton surveys WGs
8	DevStage		So far in RECO STAGE, new to be updated list on the WKIEDL sharepoint references Geffen & Nash 2012 and recommendation for all ichthyoplankton surveys WGs
9	Number	y	Count
10	SubFactor	y	1 or raising factor - subsampling factor
11	SpecidentMethod		RECO METOA method of identification
12	OilGlobulesFlag		Possible values Y or N
13	OilGlobulesNumber		Number of oil globules, possible values 1,2 or many
14	OilGlobulesDiam		Average diameter in microns
15	PreservationMethod		RECO METFP Preservation method at the time of measurement
16	Notes		Free text

Data sheet "Hauldata"

Temp100m	BotTemp	SurSal	Sal20m	BotSal	Notes

[illegible]