

Cruise Report FRV Walther Herwig III Survey WH455 30.03. - 25.04.2022

German Participation in the International Mackerel and Horse Mackerel Egg Survey 2022

Scientist in charge: Jens Ulleweit

INTRODUCTION

The mackerel and horse mackerel egg survey forms a part of an ICES-coordinated international study in the Eastern North Atlantic conducted during the first half of 2022. This investigation takes place triennially since the late 1970s and is coordinated by the ICES Working Group on Mackerel and Horse Mackerel Egg Surveys (WGMEGS).

The main objective of this series of individual cruises from January until August is to produce both an index and a direct estimate of the biomass of the Northeast-Atlantic mackerel stock and the southern and western horse mackerel stocks. The mackerel and horse mackerel egg survey is the main source providing fishery independent information for these stocks.

The general method is to quantify the freshly spawned eggs in the water column on the spawning grounds. To be able to establish a relationship between eggs and spawning stock biomass, the fecundity of the females must also be determined. This is done by sampling sufficient numbers of gonads before, during and after spawning. These samples are then histologically analysed. In combination, the realised fecundity (potential fecundity minus atresia) of the females and the actual number of freshly spawned eggs in the water render an estimate of the spawning stock biomass.

As a consequence of the long spawning period and the large area involved – for the first time in 2022 including the North Sea in the same year-, the mackerel and horse mackerel eggs surveys have been highly international from the very beginning. In 2022 a total of 18 individual cruises with research vessels and chartered fishing vessels will be carried out, with the contribution of UK (Scotland and England), Denmark, Spain, Ireland, Portugal, Germany, the Netherlands, Faroese Islands and Norway.

The cruise of FRV “Walther Herwig III” is a contribution to these international efforts assessing and managing the mackerel and horse mackerel stocks. Due to the pandemic (positive PCR tests) the start of the survey was delayed by 9 days. The survey itself is part of the European data sampling directive established in 2002 and financially supported by the EU.

Verteiler:

Schiffsführung FFS „Solea“
BA für Landwirtschaft und Ernährung (BLE) Fischereiforschung
BM für Ernährung und Landwirtschaft (BMEL), Ref. 614
BA für Seeschifffahrt und Hydrographie (BSH), Hamburg
Deutscher Angelfischerverband e.V.
Deutsche Fischfang-Union, Cuxhaven
Deutscher Fischereiverband Hamburg
Doggerbank Seefischerei GmbH, Bremerhaven
Erzeugergemeinschaft der Deutschen Krabbenfischer GmbH
GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
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LA für Landwirtschaft, Lebensmittels. und Fischerei (LALLF)

LFA für Landwirtschaft und Fischerei MV (LFA)
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Thünen-Institut - Institut für Ostseefischerei
Thünen-Institut - Pressestelle, Dr. Welling
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CRUISE ITINERARY

Date/UTC

21/03, 06:30 hrs	1st PCR-Testing
29/03, 05:30 hrs	2nd PCR-Testing
29/03, 15:00 hrs	Boarding Bremerhaven
30/03, 10:00 hrs	Departure Bremerhaven
02/04, 00:00 hrs	Arrival in standard sampling area, start of sampling
09/04, 15:00 hrs	End of sampling 1 st leg
10/04, 11:00 hrs	Start of sampling 2 nd leg
21/04, 19:30 hrs	End of sampling and departure from survey area
25/04, 12:00 hrs	Arrival in Bremerhaven
26/04, 10:30 hrs	Disembarkment of scientific crew and equipment

Narrative

In 2022 the entire spawning period of mackerel and horse mackerel is divided into seven sampling periods. According to the survey proposal of the responsible ICES working group it is planned to obtain a full coverage of the entire spawning area throughout all sampling periods. FRV "Walther Herwig III" was advised to contribute to the sampling during the 3rd period from the 21st of March to the 19th of April and during the 4th period from the 10th to the 25th of April. For period 3 FRV "Walther Herwig III" was supposed to cover the survey area in the West of Ireland and the Celtic Sea between 53°15'N and 49°15'N and in period 4 in the area West of Ireland, the Celtic Sea and the northern Bay of Biscay between 54°15'N and 47°45'N, respectively. The proposal was to conduct, if possible, alternate transects during the first part of every leg of the survey and then fill in the missing transects on the way back.

FRV "Walther Herwig III" started at ICES statistical rectangle 27E2 at 49°15'N 007°15'W continuing sampling westwards on the same latitude thereafter. The survey area was then covered by plankton hauls on every other row of statistical ICES rectangles on alternate transects northwards towards 52°15'N. This was the most northern transect to be covered during the 1st leg due to an upcoming storm which made it consequently necessary to interrupt the sampling for 24 hours. On the way southwards FRV "Walther Herwig III" sampled two transects until 51°45'N. Overall, the total coverage for period 3 was less than planned due to the delayed start. Missing transects were sampled by the Irish research vessel.

For fecundity sampling seven fishing hauls were conducted by FRV "Walther Herwig III" during this part of the survey.

Sampling for period 4 started on 10th April at ICES rectangle 24E3 at 47°45'N 006°15'W and the investigation area was then covered in northerly direction until the transect on 54°15'N. Two additional transects on 54°45'N and 55°15'N were then sampled following a request of the survey coordinator. The remaining survey time was then used steaming southwards to fill in some gaps. Sampling for FRV "Walther Herwig III" ended with the 129th plankton haul at 50°45'N 9°45'W. Only two fishing hauls could be conducted during this part of the survey due to technical problems with the winches.

Results of the survey were intermittently communicated to the survey-coordinator. Figure 1 provides an overview over all positions and activities carried out during the cruise.

METHODS

Plankton

Plankton samples were taken with a Hydrobios “Nackthai” (a modified Gulf sampler) equipped with a CTD probe to measure real time in-situ depth, temperature and salinity as well as the permanent water flow through the mouth opening and outside the net to determine the volume of filtered water.

The “Nackthai” net mesh size was 280 μm . The plankton sampler was towed at a nominal speed of 5 knots through the water at a towing cable lowering as well as retrieval speed of 0.5 ms^{-1} allowing for a uniform sampling of the water column. Maximum sampling depth was 200 m or 5 m above the sea bed. Ship’s and towing cable lowering and retrieval speed were monitored continuously and noted along with data on starting position, date, time (both UTC), weather condition, total cable length, temperature and salinity at pre-defined depths as well as the haul duration.

After completion of each plankton haul the contents of the net was gently washed down into the cod-end bucket that was detached thereafter and the plankton sample was preserved and stored according to the standard WGMEGS operation procedure. The samples were then allowed to stand for at least 12 h before they were further processed to make sure that all organisms were well fixed and soaked with formaldehyde. For the obtaining of genetic fish egg samples a number of samples (22 stations) were investigated directly after the haul in sea water.

Fish eggs in the samples were separated from the remaining plankton organisms by performing the spray method recommended by the WGMEGS report. All fish eggs were sorted into eggs with and without oil globule and counted. Fish eggs with oil globules were then identified by species and staged.

At the end of the cruise all egg samples had been sorted once for mackerel and horse mackerel eggs in total or, as representative sub-samples of up to 200 eggs per sample. At least sub-samples of up to 150 individuals per target species were staged.

Fecundity

For trawling the semi-pelagic net PSN 205 and the ICES standard bottom trawl GOV were used. The trawling stations were placed on the shelf edge between 130 and 270m depth, since concentrations of mackerel and horse mackerel were expected here. No trawling was conducted in Irish Coral Reef Special Areas of Conservations.

The whole catch was sorted by fish species. Either all mackerel or a subsample of mackerel was selected, of which length and weigh, sex and maturity were determined and otoliths were taken. Furthermore, for mature female mackerel the following parameters were also determined: Length, weight (total, ovary), sex and maturity. Four parallel micropipette samples were then taken of the ovaries. Then the ovaries were removed, sliced into halves and put into different formalin jars.

Micropipette samples and ovaries will be sent to different laboratories for the histological fecundity analysis.

Additional work

For genetic investigations 722 fish egg samples from 22 plankton stations were collected. For the “European Reference Genome Atlas (ERGA)”-initiative genetic samples of adult mackerel muscle of 48 animals were taken.

RESULTS

Meteorology and Hydrography

The first leg was hampered by heavy weather conditions within the last sampling days due to the passing of severe low pressure systems with strong westerly winds. This leads to an interruption of the sampling activity for 24 hours.

During both legs sea temperature in 20m depth was between $< 9.7^{\circ}\text{C}$ in the North and East and $> 12.8^{\circ}\text{C}$ in the South and West of the sampled area. Temperatures on the shelf were always distinctly cooler than over the shelf edge and beyond it. Fig 2 shows the water temperatures for both periods. Due to still wintry conditions the water body was well mixed.

Egg distribution (preliminary results)

A total of 129 Nackthai catches (2019: 180, 2016 and 2013: 96) were conducted containing a total of 14236 fish eggs. Only a small proportion of samples contained no fish eggs at all and highest egg densities were encountered above the shelf edge as well as above Porcupine Bank (Fig 3).

Preliminary results show that of all fish eggs, 64% (n=9083; 2019: 32814) were of mackerel and 20 % (n=2862; 2019: 352) of horse mackerel, respectively. The percentage of mackerel eggs is therefore substantially lower than observed in previous surveys (91% in 2019) whereas the percentage of horse mackerel is much higher (1% in 2019). Other eggs caught in significant numbers were those of blue whiting (*Micromesistius poutassou*), pearlside (*Maurolicus muelleri*), Soleidae and macrourids (Macrouridae). In addition, for the first time eggs of the pearlfish *Echiodon drummondi* were found.

Mackerel eggs were found in 47% of the plankton samples with the highest abundance above the shelf break and water depths between 127 and 209 m. Highest mackerel egg densities were encountered on the Irish shelf and around the Great Sole Bank (Fig.3). 22% of all mackerel eggs were freshly spawned (stages 1A and 1B), in period 3 1019 eggs of 6786 (15%), in period 4 987 of 2297 eggs in total (43%). Figure 4 shows the geographical distribution of these eggs. Mean egg number per station were 70 eggs (all stages; 2019: 182, 2016: 197). Highest mackerel egg numbers could be found at 52°15'N 011°15'W with a maximum value of 1371.

Horse mackerel eggs were less abundant than mackerel eggs (in 37% of all hauls). All together 2862 horse mackerel eggs (all stages) of which 1322 horse mackerel eggs in stages 1A and 1B) were found. Figure 5 shows the geographical distribution of these eggs.

In comparison to the German surveys in 2016 and 2019, spawning activity seems to be less for mackerel and higher for horse mackerel but this cannot be taken as a general trend as the results of all participating institutes needs to be taken into account.

Fecundity sampling

9 fishing stations were conducted during the survey, 7 in sampling period 3 and 2 in period 4. The first 4 fishing hauls were carried out with the pelagic trawl but yielded in only 5 mackerel all together. In contrast, mackerel catch with the bottom trawl was much more successful.

In period 3 mackerel were only caught in two hauls. Only one mixed mackerel and horse mackerel aggregation could be detected. Both fishing hauls in period 4 yielded mackerel and horse mackerel. Other species caught were boarfish, blue whiting, hake, John Dory, monkfish, megrim, whiting, haddock argentines, conger eel, witch, lemon sole, thickback sole, grenadiers, pearlshades and different cephalopods.

All together 152 fecundity samples of mackerel were taken as well as length, sex, maturity and otoliths of a bigger subsample of mackerel.

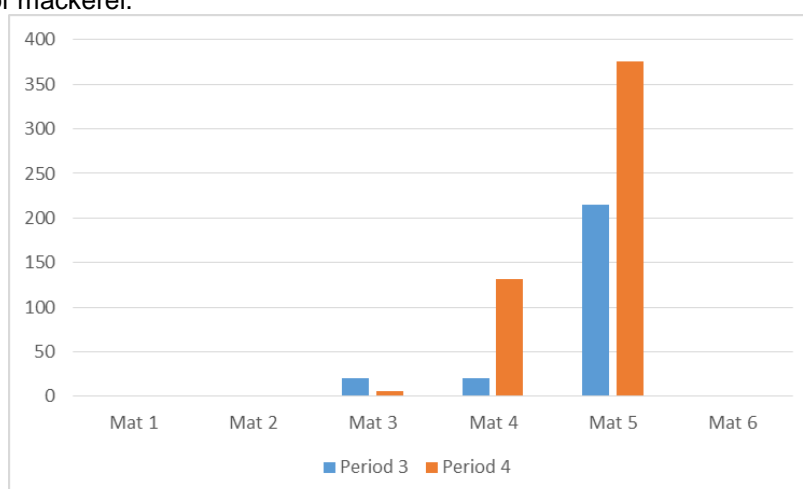


Fig.6: Maturity stages distribution of female mackerel, MECS 2022

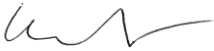
Like 2016 and 2019 most of the mackerel (male and female) had already spawned (Maturity stage ≥ 4) but due to the low number of samples this alone cannot be taken as an indicator for the spawning time. Fig. 5 shows the maturity stage distribution of female mackerel analysed during the egg survey.

ACKNOWLEDGEMENT

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I wish to thank Captain Werner Stumpp and his crew onboard FRV "Walther Herwig III" for their excellent work and co-operation. Also, I would like to thank all members of the scientific team for their hard work especially in very bad weather conditions.

Bremerhaven, 29/02/2022



Jens Ulleweit
(Scientist in charge)

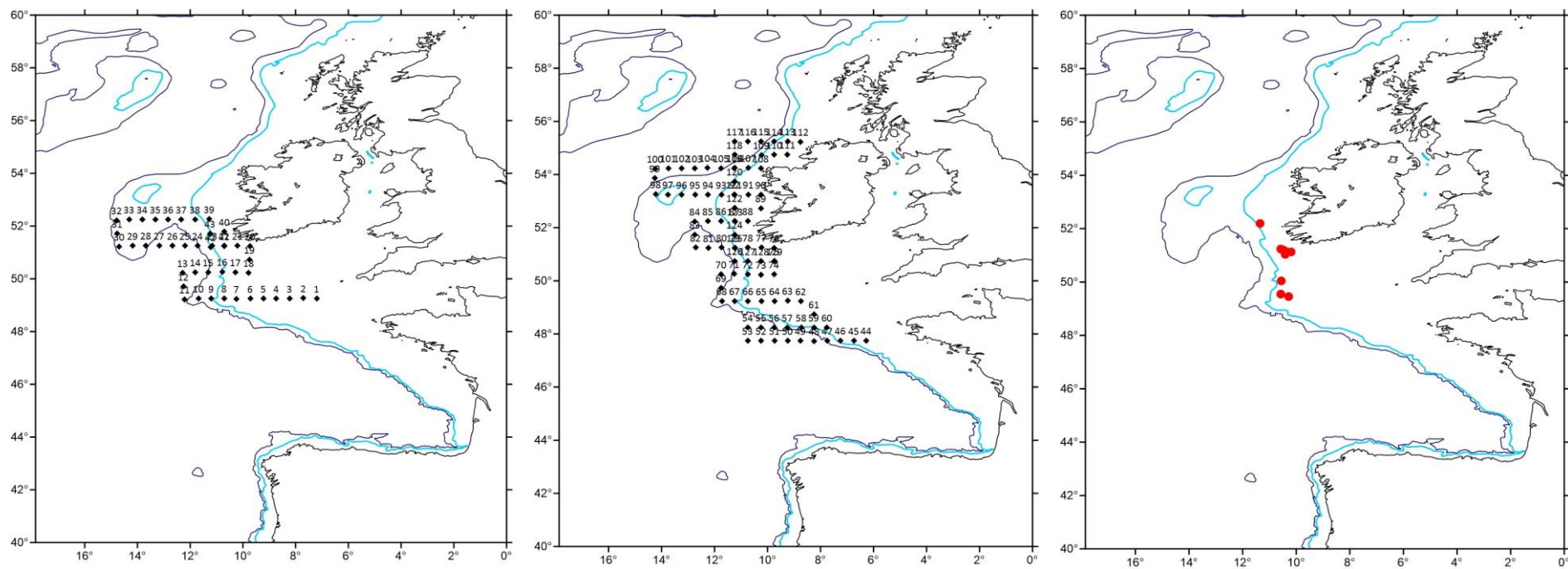


Fig.1: FRV "Walther Herwig III" MEGS22, plankton station grid in the 3rd (left panel) and 4th sampling period (middle panel) and the position of the fishing hauls for both periods (right panel); black diamonds = positions of plankton hauls; red circles = positions of fishing hauls

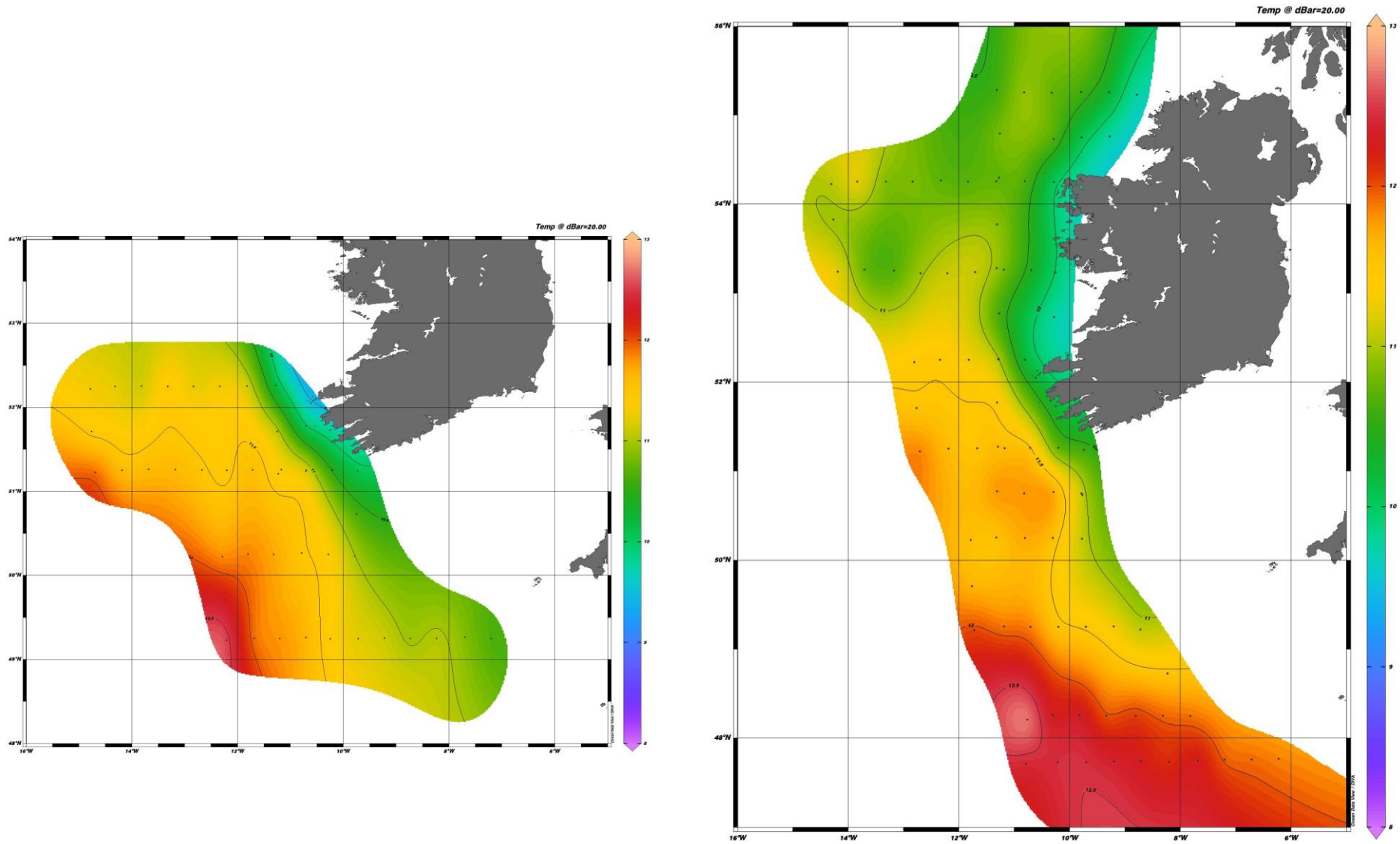


Fig .2: Water temperatures (°C) in 20m depth in the 3rd (left panel) and 4th sampling period (right panel)

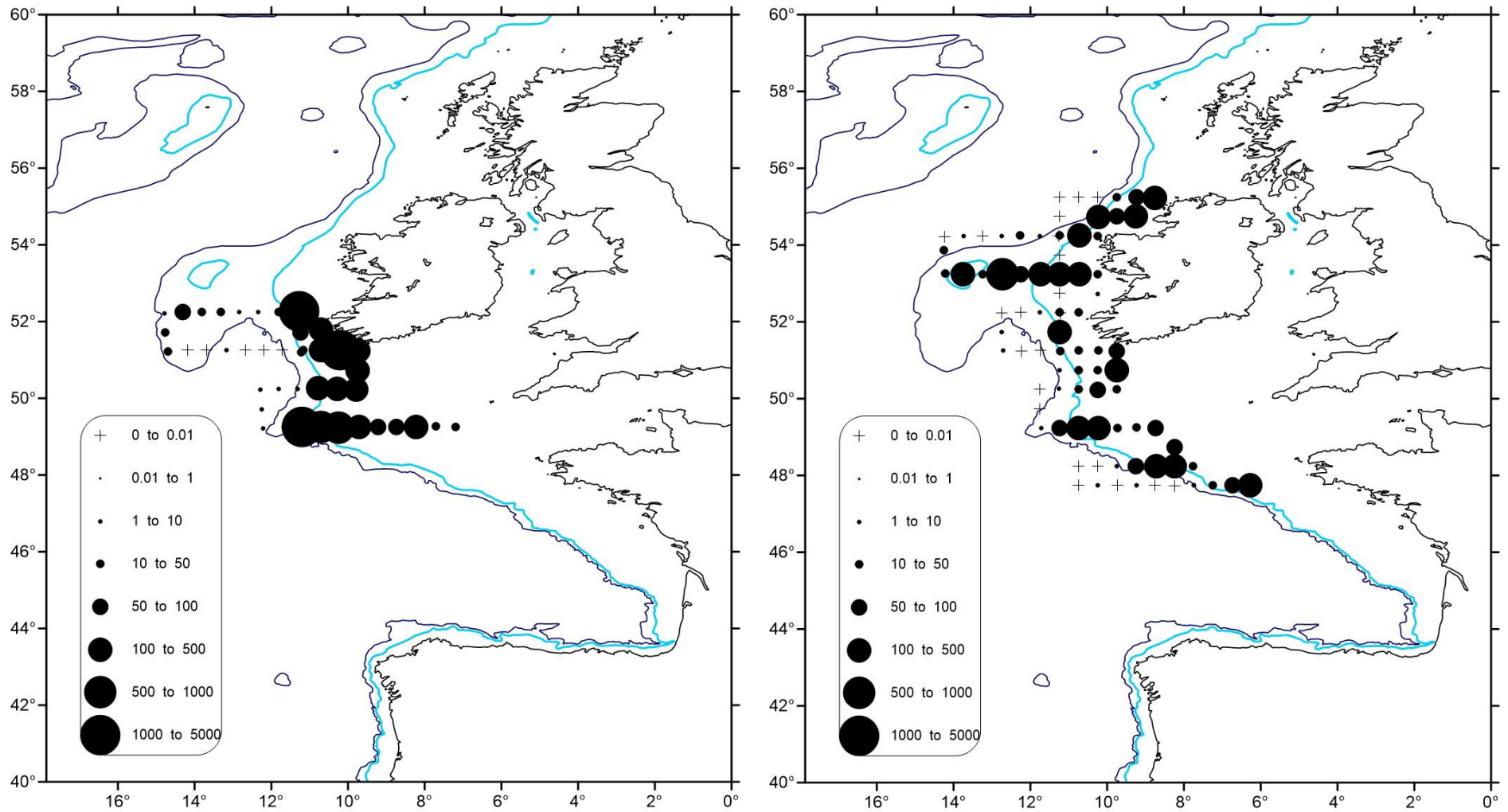


Fig.3: FRV "Walther Herwig III" MEGS22, distribution of all fish eggs in the 3rd (left panel) and 4th sampling period (right panel) in absolute numbers

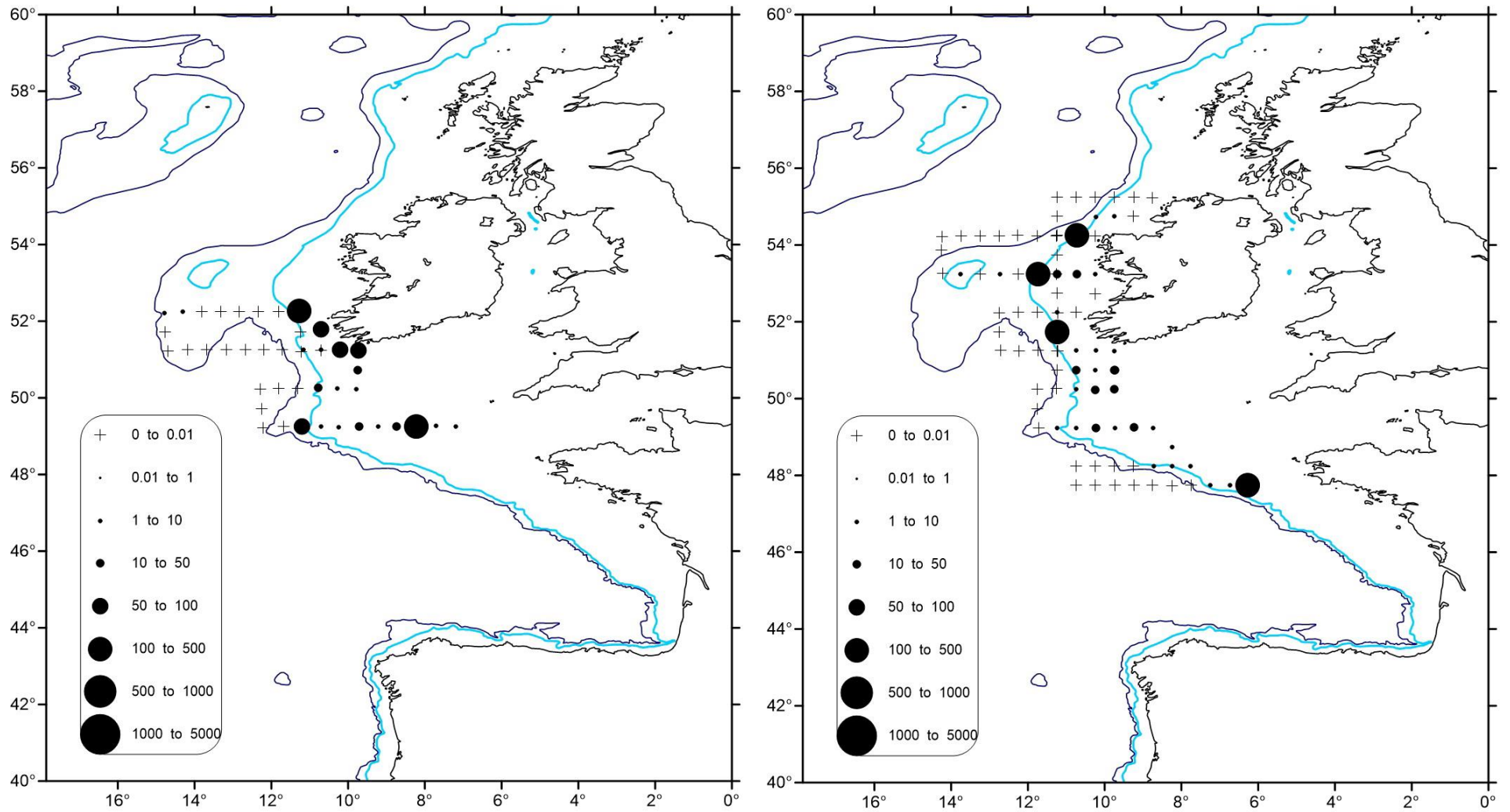


Fig.4: FRV "Walther Herwig III" MEGS22, distribution of freshly spawned mackerel eggs (stages 1A, 1B) in the 3rd (left panel) and 4th sampling period (right panel) in absolute numbers

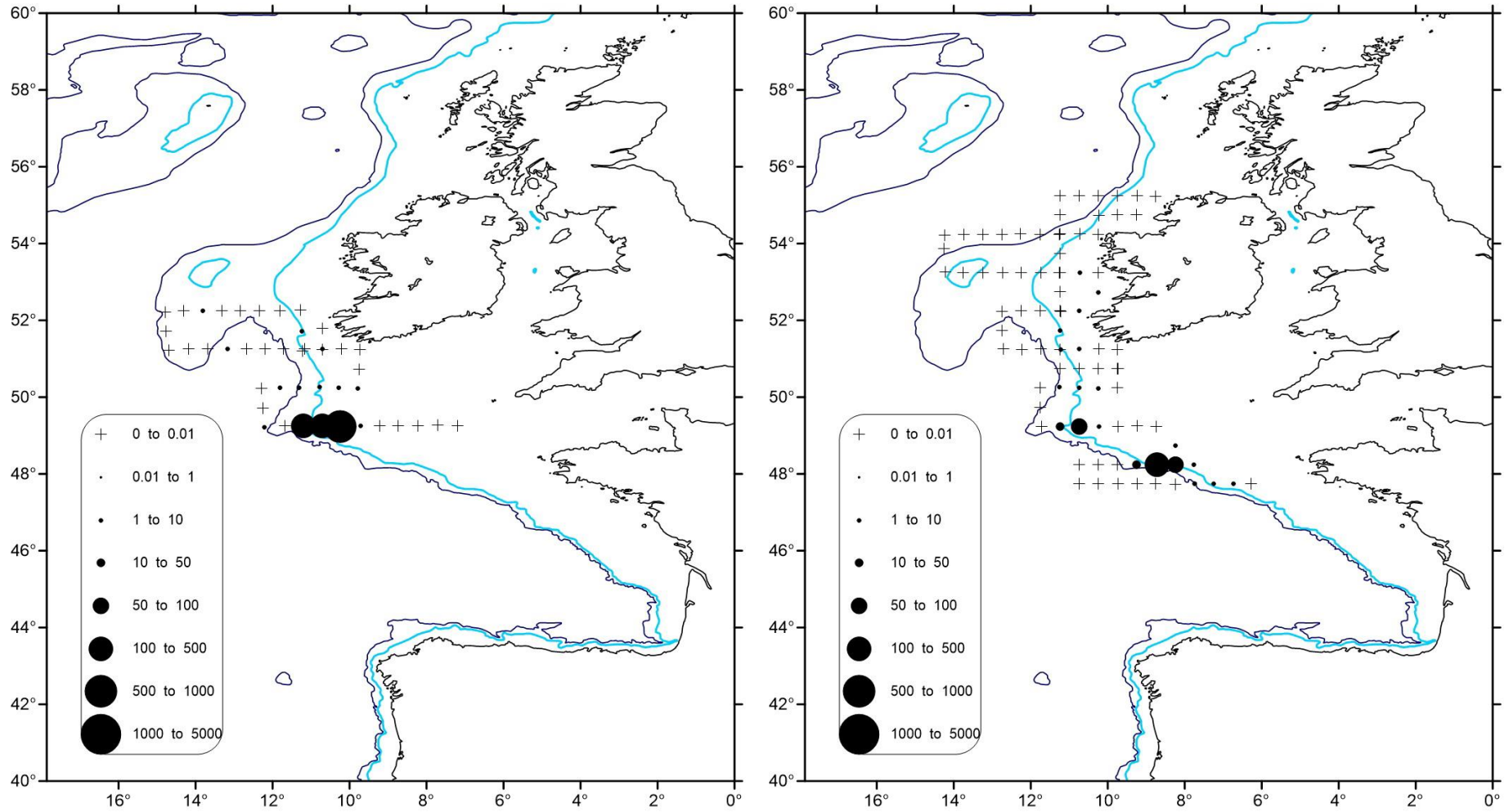


Fig.5: FRV "Walther Herwig III" MEGS22, distribution of all freshly spawned horse mackerel eggs (stages 1A, 1B) in the 3rd (left panel) and 4th sampling period (right panel) in absolute numbers

