

ICES WGMEGS Report 2007

ICES Living Resources Committee

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Report of the Working Group on Mackerel and Horse Mackerel Egg Surveys (WGMEGS)

By Correspondence



ICES

International Council for
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1 Executive Summary

The Working Group on Mackerel and Horse Mackerel Egg Surveys (WGMEGS) is primarily responsible for the planning and data analysis of the ICES Triennial mackerel and horse mackerel egg surveys. The meetings are held in the years before and after the surveys themselves. As 2007 was an egg survey year, the WG carried out its activities by correspondence. The Terms of Reference for 2007 and the outcomes were as follows:

- a) Consider the results of the two Lowestoft Workshops (23 October – 2 November 2006) on – i) mackerel and horse mackerel egg staging and identification (23–27 October) and – ii) fecundity estimation and incorporate these into the 2007 survey (30 October–2 November). The Workshops made a number of recommendations on methods of sample handling, preservation and analysis, as well as recommendations for future workshops. The recommendations are detailed in the present report and the actions taken on these. In general all the recommendations were accepted and employed on the surveys in 2007;
- b) Fine-tune survey execution in 2007. Although the broad planning of the 2007 surveys was carried out at the 2006 Planning WG, the detailed conduct required co-ordination within the survey year. Most importantly this involved ensuring that the coverage, in time and space, was as complete as possible with the vessel resources available.

The next meeting of WGMEGS will be held in IJmuiden IMARES (Netherlands), in April 2008.

2 Introduction

2.1 Terms of Reference

At the ICES WGMEGS in Vigo, Spain, in March 2006 it was decided that the **Working Group on Mackerel and Horse Mackerel Egg Surveys [WGMEGS]** (Chair: D. Reid, UK) will work by correspondence in 2007 to plan for a meeting in 2008 to:

- a) consider the results of the Lowestoft Workshops (23 October – 2 November 2006) on i) mackerel and horse mackerel egg staging and identification and ii) fecundity and incorporate these into the 2007 survey;
- b) fine-tune survey execution in 2007.

WGMEGS will report by 1 June 2007 for the attention of the Living Resources and the Resource Management Committees.

3 Incorporation of WKMHMES recommendations in the 2007 triennial egg survey (referring to ToR "a")

A workshop on Mackerel and Horse Mackerel Egg Staging and Identification (WKMHMES) was held at CEFAS, Lowestoft, from 23 October to 27 November 2006. The workshop made a number of recommendations for the conduct and analysis of the 2007 Triennial egg survey and beyond.

In the present report the recommendations and consequent actions are described. The original recommendations are in italics and the response is in normal face.

- a) *It is time consuming to organise and participate in Egg staging and Fecundity Workshops and financial assistance should be considered essential. Standardisation of procedures and techniques is a requirement of all ICES working groups and is recognised as being vitally important. However, without access to central financial resources, each participant is wholly reliant on funding from their own institute for travel and subsistence. It is recommended*

that each institute include the cost of their participation in workshops such as this in their bid for EU Data Regulations funding.

To the best of the Working Group's knowledge this was carried out and was presented within the negotiations.

- b) *IEO, AZTI and IPIMAR to compare the performance of Bongo and Gulf type samplers on the 2007 surveys. Note. It is hoped that standardisation of the various Bongo sampler designs will take place prior to the beginning of the 2007 surveys.*

The institutes involved agreed that this was desirable and would attempt to put the measure in place. The degree of take up will be addressed at the next full meeting of WGMEGS in 2008, and in preparation for the next workshop.

- c) *IMR, Bergen, Norway, is requested to provide validated mackerel and horse mackerel eggs from captured fish for the next WKMHMES in 2009.*

Although in previous Working Groups it was recommended to prepare and incubate fertilised eggs to provide examples of each egg development stage this has not been possible because of either inadequate facilities or no spawning fish caught on the survey. It was therefore agreed that this exercise would be more successful if it was carried out in an aquaculture facilities where the quality of samples is easier to control.

- d) *The well plates (used to hold the egg samples under the microscope) should be re-designed to help prevent eggs becoming dislodged from the individual wells during analysis.*

This recommendation was made to improve the efficiency during the identification and staging of eggs exercise. The new well plates should prevent the egg displacement during the staging process.

- e) *A range of stages of megrim eggs should be provided for the next WKMHMES if they are available.*

It is recognized that some species have similar structures and size ranges to the survey target species and that this analysis would assist in discrimination.

- f) *All institutes participating in the 2007 tri-ennial survey are asked to check the pH of their buffered 4% formaldehyde. Each institute are asked to report back to the survey co-ordinator (Finlay Burns, FRS) and WGMEGS chair (Paula Alvarez, AZTI) on the quantity of sodium acetate trihydrate buffer, required to make their buffered 4% formaldehyde reach pH 7.*

It was agreed to report this data to ensure a standardised approach to the preservation of the samples.

- g) *All institutes are requested to keep their plankton samples in the buffered 4% formaldehyde solution for one month, to ensure full fixation of the eggs.*
- h) *A template for 2007 survey data should be provided by the survey co-ordinator (Finlay Burns, FRS) prior to the start of the 2007 surveys. This will ensure that all the required data is supplied in a consistent format for compilation into the survey database.*

It was agreed that the current egg template presented some deficiencies related to the different sources of data provided by the participants. IEO and FRS will prepare an egg template for the 2007 Triennial surveys.

- i) *A manual should be written for handling the complicated spreadsheets required for compiling and analysing the data collected during WKMHMES. A new term of reference (ToR) is to be included for the next meeting of WKMHMES to address this issue.*

A Workshop on Mackerel and Horse fecundity determination was held at CEFAS, Lowestoft, from 30 October to 2 November 2006. The Workshop made a number of recommendations for the conduct and analysis of the 2007 Triennial egg survey and beyond. In the present report the recommendations and consequent actions are described. The original recommendations are in italics and the response is in normal face.

- a) *carry out inter-calibration work on fecundity determination and harmonise the analysis and interpretation of fecundity samples.*
- A table was prepared to summarise the changes made in fecundity estimation since the decision was taken at WGMEGS 2004 to use formaldehyde rather than Gilson fixative to preserve ovary samples. The new addition of the fecundity manual was prepared to describe the recommended procedures, during and following the meeting, and this has been sent to all participating Institutes.
 - A comparison was made to determine the utility of staining in the analysis of potential fecundity using standard images. The cv of fecundity scores amongst participants was similar using Periodic acid Schiffs, Rose Bengal or unstained tissue at 2.6, 1.9, and 2.3% respectively. It was felt that the trade off between better automatic analyses from applying stain was at the expense of masking detail to identify atretic follicles and longer preparation time. Results from analysis of unstained tissue showed the most reduction in cv before and after discussion of results.
 - A comparison of staining methods (Heamatoxylin eosin, PAS Mallory or Toluidine blue to quantify alpha atretic follicles) gave non significant differences between the experienced analysts who have been involved since the 2001 survey. It was agreed that each laboratory would use either of the staining methods according to their preference.

Recommendation: All analysts producing data on potential fecundity and atresia for the 2007 Triennial survey should analyse a set of standard images available on the FTP site at IMR Bergen.

4 Fine tuning of the 2007 surveys (referring to ToR "b")

One of the main tasks for WGMEGS at the 2006 meeting was the planning for the 2007 surveys, and this was carried out successfully. However, it should be recognized, that this could be an outline only, and that vessel and personnel availability could change. In addition weather or vessel breakdown could compromise one or more individual surveys requiring in season modifications.

During this year 2007 planning surveys suffered important changes. The initial five sampling periods (ICES, 2006) was increased to six. In the southern area, Portugal brought backwards by about one month its programmed survey (from 20 February to 2 February) forcing it to increase the sampling periods to six. The rest of the surveys went ahead broadly as planned in the previous WGMEGS report (ICES, 2006). Coordination in the western area required more manipulation. The final plan was provided to all participants in February 2007 although additional modifications were added in April 2007 because of a new funding by FRS for a third egg survey. Detailed planning proposal with the whole modifications are attached as Annex 1.

The key changes were as follows:

- During period 1, only southern area (Portugal) will be surveyed and will be concentrated on horse mackerel DEPM based.
- Period 2 was well supported by a number of countries and the opportunity was taken to make stronger and wider area coverage over as much of the spawning area as possible. Ireland and Germany modified their 2006 schemes and inter-

changed the sampling areas. No changes in the coverage occurred. Full survey coverage from the Portugal/Spain border to the north of Scotland was possible.

- In period 4 a new vessel was available for this period. FRS informed about the incorporation of a new survey in this period. This fourth vessel reduced the sampling pressure on the IMR survey, (large area during a period of high egg abundance). All the team working in the area agreed the new sampling scheme.

Despite of the effort carry out for all participants to complete as much as possible the mackerel and horse mackerel spawning periods and the areas, the coverage was reduced in 2007.

Other small scale changes were made to allow for slight changes in cruise track or timing throughout the survey. All these were carried out in consultation with the Chair.

5 Proposed Terms of Reference for next meeting in IJmuiden IMARES (the Netherlands), April 2008

- analyse and evaluate the results of the 2007 mackerel and horse mackerel egg surveys of the western and southern areas;
- calculate the total seasonal stage 1 egg production estimates for mackerel;
- calculate the total seasonal stage 1 egg production estimates for western horse mackerel stock (AEPM) and Po for southern stock (DEPM);
- analyse and evaluate the results of the mackerel and horse mackerel fecundity and mackerel atresia sampling in the western and southern areas;
- analyse and evaluate the results of the horse mackerel batch fecundity and spawning fraction in the southern stock;
- evaluate the results of studies on horse mackerel fecundity determination and proxies on the basis of data collected during the 2007 surveys and in other relevant work (captivity studies);
- provide estimates of the spawning stock biomass of mackerel, using stage 1 egg production estimates and the estimates of fecundity and atresia, separately for the western and southern areas;
- provide estimates of the spawning stock biomass of horse mackerel, using Po production estimates and the estimates of batch fecundity and spawning frequency for southern stock
- evaluate the quality and reliability of the 2007 survey in the light of the previous surveys.

A complete set of the resolutions can be seen in Annex 4 of the report.

Annex 1: Triennial Egg Surveys 2007- Detailed planning proposal

1. Introduction

In the WKMHMES (Lowestoft, 2006) and with the participation of the members of the different teams involved in the Triennial surveys, adjustments on the original surveys planning was discussed. As the number of changes in the planning section resulted significantly important, it was decided that the coordinator of surveys (FRS, Scotland) re-wrote the section 2 of WGMEGS 2006 report, modified the figures and added a new figure on horse mackerel stock boundaries following to the new redefinition agreed in 2005 by WGMHSA (ICES, 2005). Once all the text and figures were agreed, the final version was sent, by e-mail, to all the members of WGMEGS.

2. Planning of the 2007 Mackerel and Horse Mackerel Egg Survey in the Western and Southern Areas (referring to TOR "b")

2.1. Countries and Ships Participating

Germany, Ireland, Netherlands, Scotland, Portugal, Spain, Spain/Basque Country and Norway will participate in the mackerel/horse mackerel egg surveys in the western and southern area in 2007. The vessels and dates available for the survey are given in Table 2.1.1. CEFAS (UK) have withdrawn from the 2007 survey programme. The result of this is that the full survey area for all periods can no longer be sampled at the minimum required level of one station per sampling rectangle. Survey coverage of the western and southern area is given by area and period in Table 2.1.2. Detailed maps of the survey coverage by period are given in Figures 2.1.1–2.1.6. Both vessel availability and area assignments are provisional and will be finalised by the survey coordinator at the appropriate times.

The survey coordinator for the 2007 survey will be Finlay Burns, FRS Marine Laboratory, Aberdeen.

Table 2.1.1. Countries, vessels, areas assigned, dates and sampling periods for the 2007 survey.

COUNTRY	VESSEL	AREAS	DATES	PERIOD
Portugal	Noruega	Cadiz, Portugal & Galicia	23 January – 28 February	1
Spain (IEO)	Cornide de Saavedra	Cantabrian Sea & S. Biscay	14 March – 2 April	2
		Biscay & Cantabrian Sea	15 April – 12 May	3
Germany	Walther Herwig III	West Ireland & W Scotland	20 March – 10 April	2
		Celtic Sea & Biscay	11 – 26 April	3
Netherlands	Tridens	Celtic Sea & Biscay	7 – 24 May	4
		Celtic Sea & N. Biscay	4 – 21 June	5
Spain (AZTI)	Itaslagunak/ Emma Bardan	Biscay	2 – 22 April	2
	Investigador/ Emma Bardan	Biscay & E. Cantabrian Sea	3 – 22 May	4
Norway	G.O. Sars	West Ireland & West of Scotland	14 May – 9 June	4
Ireland	Celtic Explorer	Celtic Sea	6 – 26 March	2
		Celtic Sea, West Ireland & West of Scotland	1 – 21 July	6
Scotland	Scotia	West Ireland & West of Scotland	16 April – 7 May	3
		West Ireland & West of Scotland	1 – 21 June	5

2.2. Survey Design

In contrast to previous years, the survey will be split into 6 sampling periods. The first period (approximately February) will include a survey in ICES area IXa only, with fuller coverage starting in period 2 (March). In 2007 the survey effort in area IXa will be targeted on a single extended DEPM survey for horse mackerel rather than three which was previously the case. (See section 2.4.) This is to be carried out in January/February and will constitute survey period 1. No survey of area IXa will be made after period 1. Sampling of the western area will commence in period 2. This period is broadly equivalent to period 3 in the 2004 survey. During period 2 the survey will cover the full western area plus the Cantabrian Sea. From period 5 onwards coverage will only be of the western area north of the Cantabrian Sea. Some spawning is expected in the Cantabrian Sea during this period, and it has been surveyed at this time in previous years, but no vessels were available for 2007. Egg production in this area in period 5 will be assumed to be zero. In periods 5 and 6 the surveys are designed to identify a southern boundary of spawning and to survey all areas north of this boundary. The deployment of vessels to areas and periods is summarised in Table 2.1.1.

In the western area maximum deployment of effort is during the second, third and fourth sampling periods. These periods coincide with the expected peak spawning of both mackerel and horse mackerel in the area. The loss of the CEFAS (UK – ENG) April survey means that survey coverage for periods 3 and 4 is much reduced. Bearing this in mind, for the 2007 survey the emphasis will be based on area coverage, even more so than 2004, and if necessary occupation of alternate east/west transects. Cruise leaders have been asked to cover their entire assigned area using alternate transects and then use any remaining time to fill in the missed transects. If time is short this should be concentrated in those areas identified as having high egg abundance on the first part of that vessels survey. Particular points to note are:

Period 1

The southern area (ICES Division IXa) will only be surveyed in period 1. This is to accommodate the changes made to the Portuguese survey which has been condensed from 3 surveys into a single extended (horse mackerel DEPM based – see section 2.4.) survey.

Period 2

Period 2 marks the commencement of the western area surveys and now reflects the calendar period traditionally covered by period 3. For reasons which relate to the control of the period 2 survey it would be preferable for the German vessel to start and finish surveying at the southern boundary of her designated survey area (51°30N)(Figure 2.1.2). The AZTI survey which straddles periods 1 and 2 will survey Biscay (46° – 48° 30N) and will remain within period 2.

Period 3

There are 3 vessels available for period 3. The German vessel will commence sampling in the Celtic Sea along the Northern boundary of the designated survey area (50°30N). It will then continue south into Biscay until the southern boundary at 47°N. The Spanish vessel will complete the survey coverage in Biscay to the south of that covered by the German survey. In the area between 46°30N – 47°N, 6°– 10°W the west – east direction of the shelf break at this latitude requires careful sampling to avoid having large samples at the edge of the survey area. It is therefore **imperative** that between these two surveys that this area receives comprehensive coverage in order to define the edge of the spawning distribution. It should also be noted that the Spanish vessel will probably not have to survey in the area 45°N – 46°N, 5°– 10°W. This area is over deep water and very few eggs are normally found here. Given that the Spanish vessel will start its survey in Vigo, it is recommended that the survey be carried out as follows (Figure 2.1.3):

- Survey to the east through the Cantabrian Sea, occupying alternate north/south transects;
- Move to 46° 45' N and complete that transect and then survey to the south, occupying all east/west transects;
- Survey to the west through the Cantabrian Sea, occupying the remaining north/south transects.

Period 4

In period 4 a similar situation exists as for period 3. There are 3 vessels available during this period to survey the western area. AZTI will be carrying out a targeted DEPM survey for anchovy in Biscay, although this provides mackerel and horse mackerel egg samples as well. The design of this survey is therefore constrained by that purpose. In 2004, this resulted in weak coverage along the shelf break between 45° 30' and 47°N. AZTI have been requested by WGMEGS to take some additional samples in this area, to allow full coverage. The stations required will be advised to AZTI by the survey coordinator. The IMARES vessel will commence its survey north of 47°N, and information from this transect will be used to advise AZTI. (Figure 2.1.4).

Period 5

In period 5, two vessels have to cover the entire area of spawning from northern Biscay to the West of Scotland. Alternate transects are recommended. The IMARES vessel covering the Biscay area will commence the survey along the southern boundary of the designated area although its exact latitude will depend on the results from period 4. The survey coordinator will advise the IMARES cruise leader prior to the survey. (Figure 2.1.5)

Period 6

In period 6, only one vessel will be available, and will have to cover the entire spawning area. This assignment has been given to Ireland who traditionally carries out this last survey. Again the southern boundary will be defined according to the results in period 5. Irrespective of this an alternate transect design will be necessary. (Figure 2.1.6)

Table 2.1.2. Periods and area assignments for vessels by week for the 2007 survey. Area assignments and dates are provisional.

week	Starts	AREA					Period	
		Portugal, Cadiz & Galicia	Cantabrian Sea	Biscay	Celtic Sea	North west Ireland		West of Scotland
1	22-Jan-07	PO1(DEPM)					1	
2	29-Jan-07	PO1(DEPM)					1	
3	5-Feb-07	PO1(DEPM)					1	
4	12-Feb-07	PO1(DEPM)					1	
5	19-Feb-07	PO1(DEPM)					1	
6	26-Feb-07	PO1(DEPM)					1	
7	5-Mar-07				IRL1		2	
8	12-Mar-07		IEO1		IRL1		2	
9	19-Mar-07		IEO1		IRL1	GER	GER	2
10	26-Mar-07		IEO1	AZTI-1		GER	GER	2
11	2-Apr-07			AZTI-1		GER	GER	2
12	9-Apr-07			AZTI -1	GER			3
13	16-Apr-07		IEO2	GER/ AZTI -1	GER	SCO1	SCO1	3
14	23-Apr-07		IEO2	IEO2	GER	SCO1	SCO1	3
15	30-Apr-07		IEO2	IEO2		SCO1	SCO1	3
16	7-May-07		IEO2/ AZTI- 2(DEPM)	IMARES1	IMARES1			4
17	14-May-07			AZTI- 2(DEPM)	IMARES1	IMR	IMR	4
18	21-May-07		AZTI- 2(DEPM)	IMARES1	IMARES1	IMR	IMR	4
19	28-May-07					IMR	IMR	4
20	4-Jun-07			IMARES2	IMARES 2	IMR	IMR/ SCO2	5
21	11-Jun-07				IMARES 2	SCO2	SCO2	5
22	18-Jun-07			IMARES2	IMARES 2	SCO2	SCO2	5
23	25-Jun-07							5
24	2-Jul-07				IRL2	IRL2	IRL2	6
25	9-Jul-07				IRL2	IRL2	IRL2	6
26	16-Jul-07				IRL2	IRL2	IRL2	6
27	23-Jul-07							6

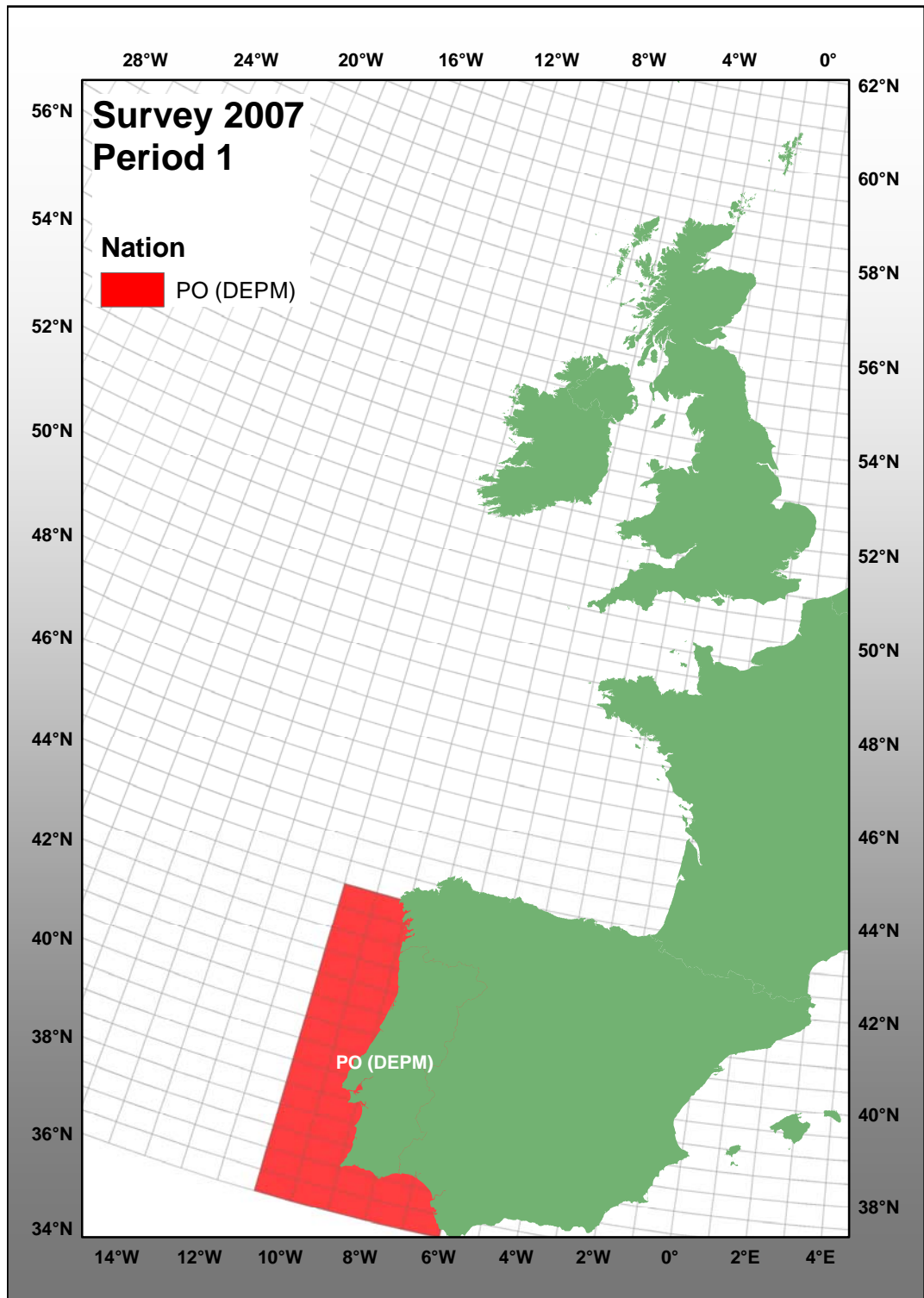


Figure 2.1.1. Survey plan for Period 1.

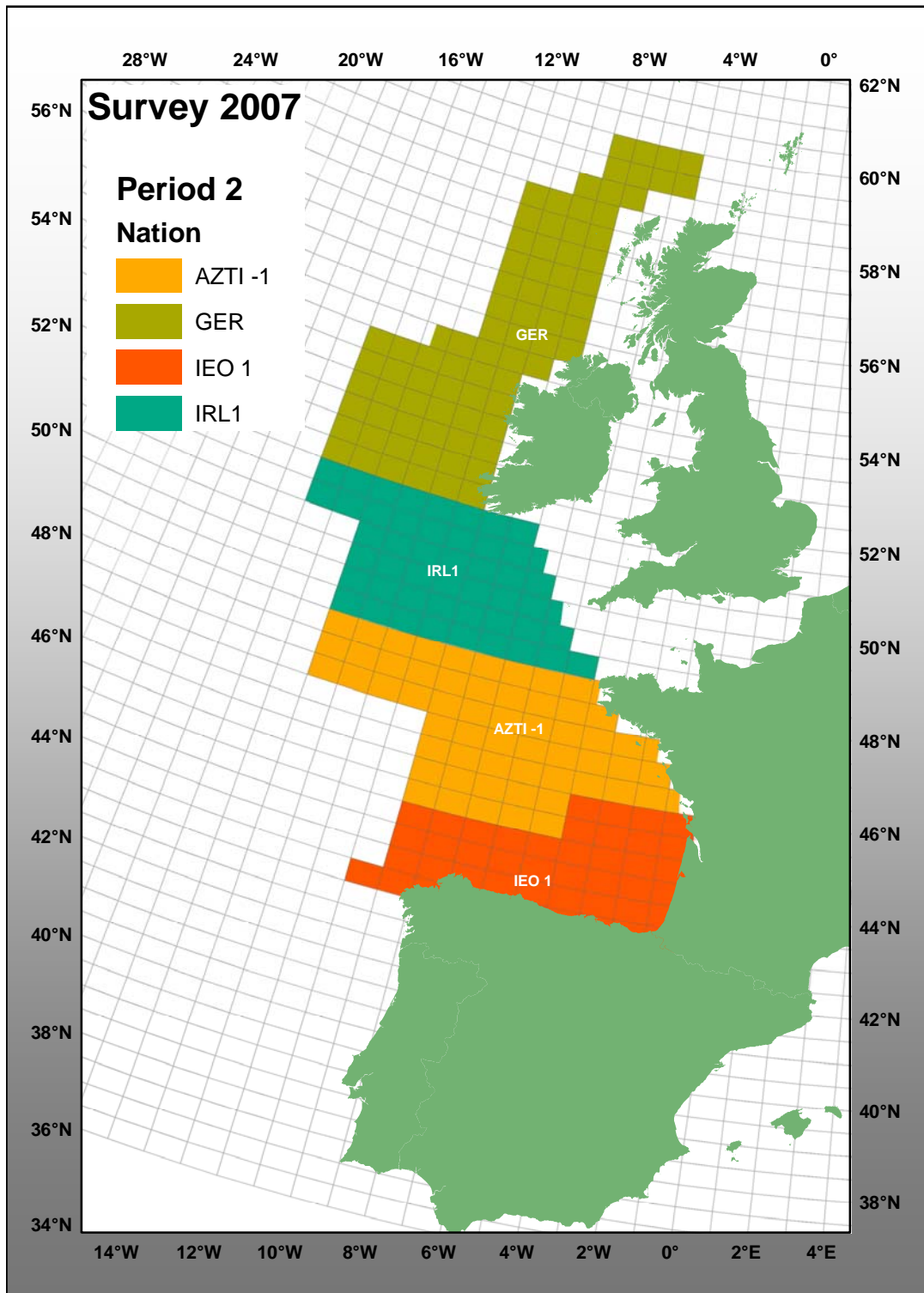


Figure 2.1.2. Survey plan for Period 2.

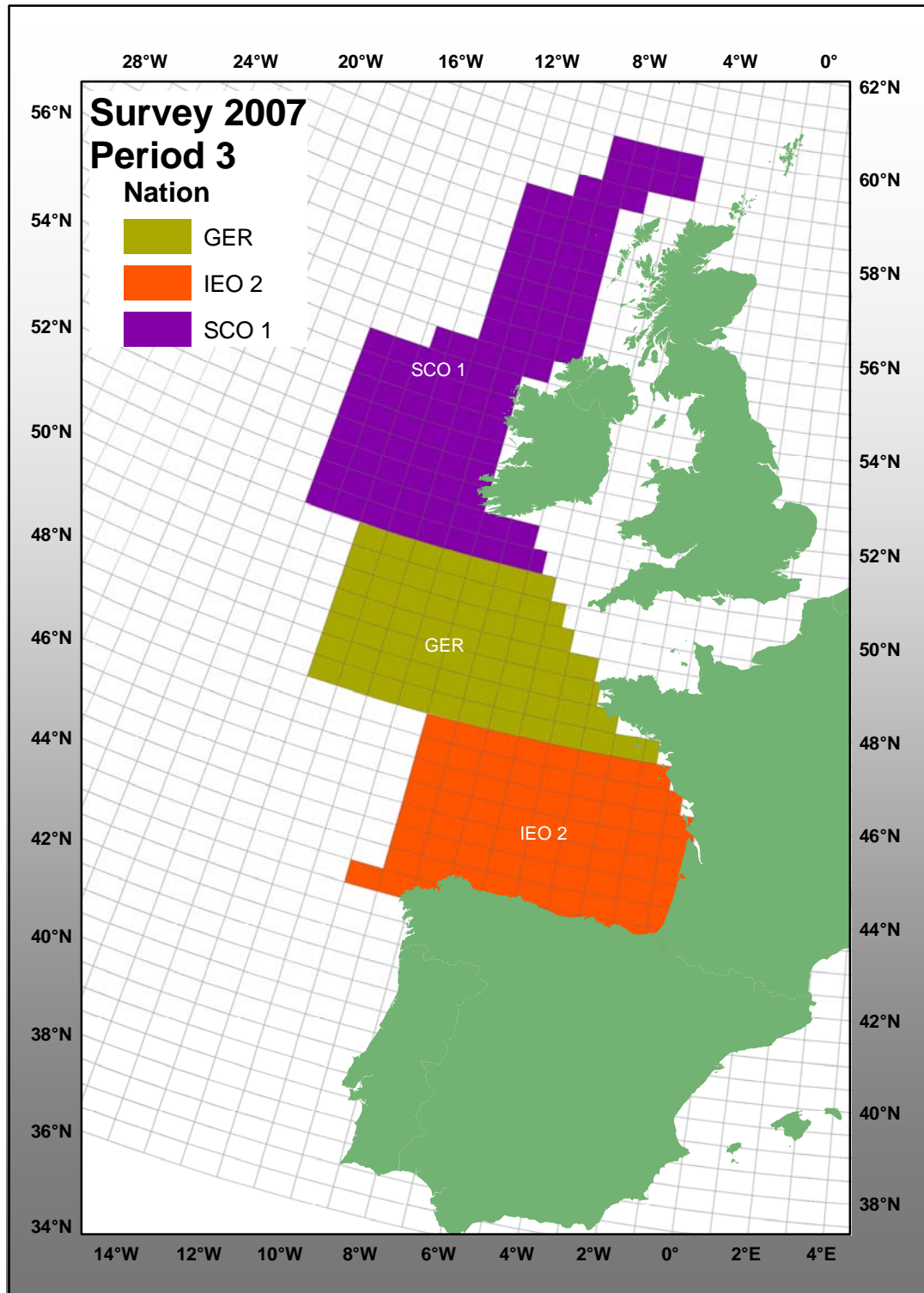


Figure 2.1.3. Survey plan for Period 3.

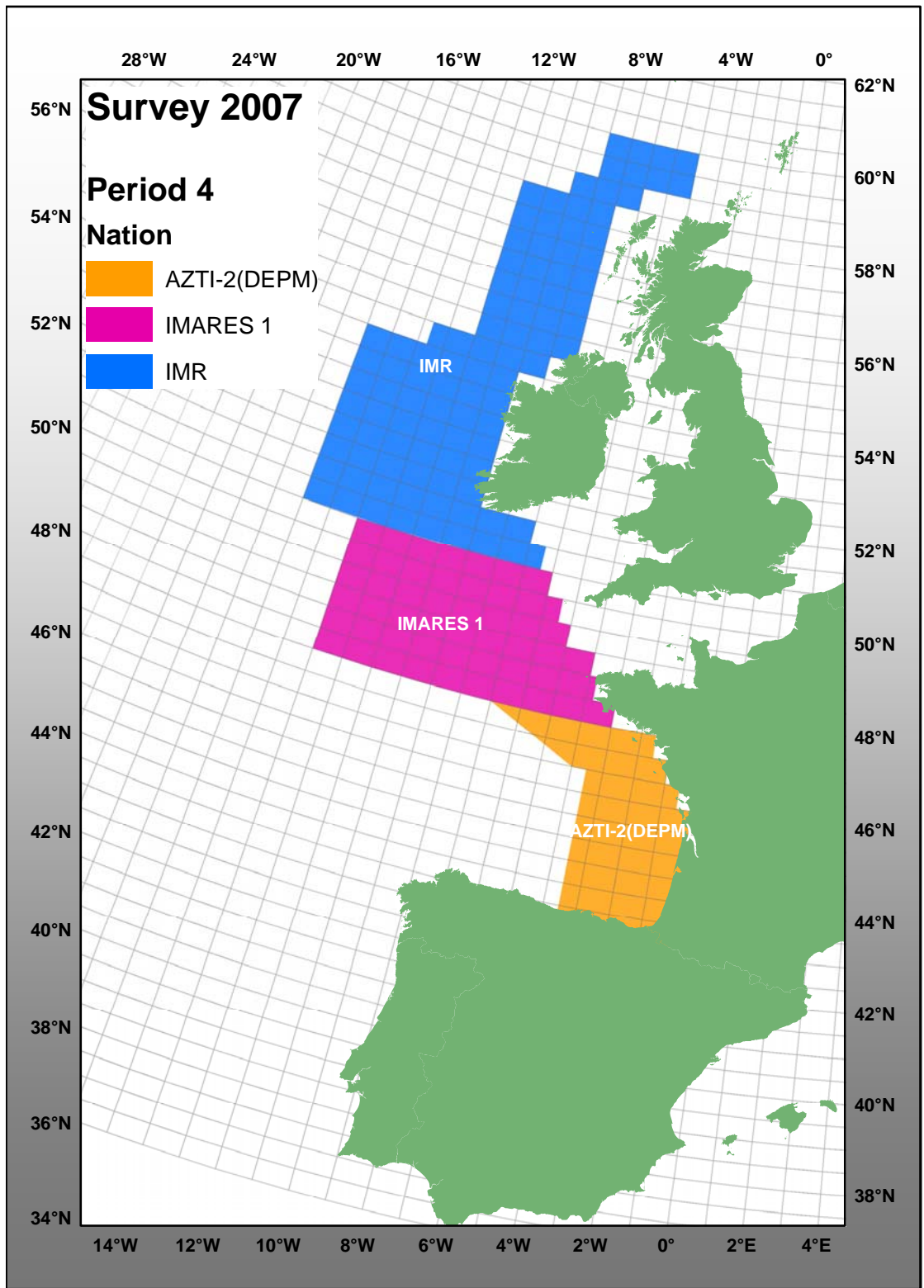


Figure 2.1.4. Survey plan for Period 4.

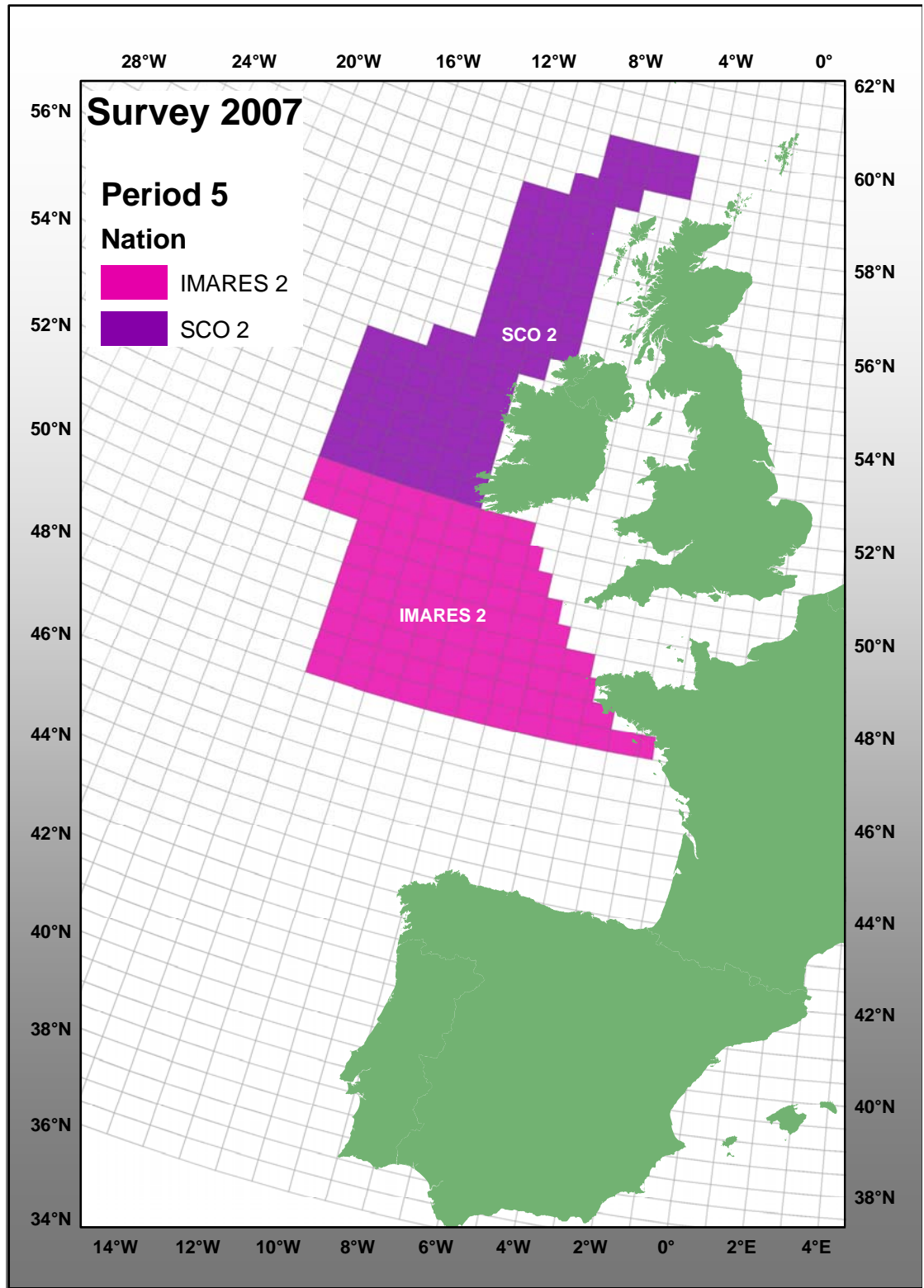


Figure 2.1.5. Survey plan for Period 5.

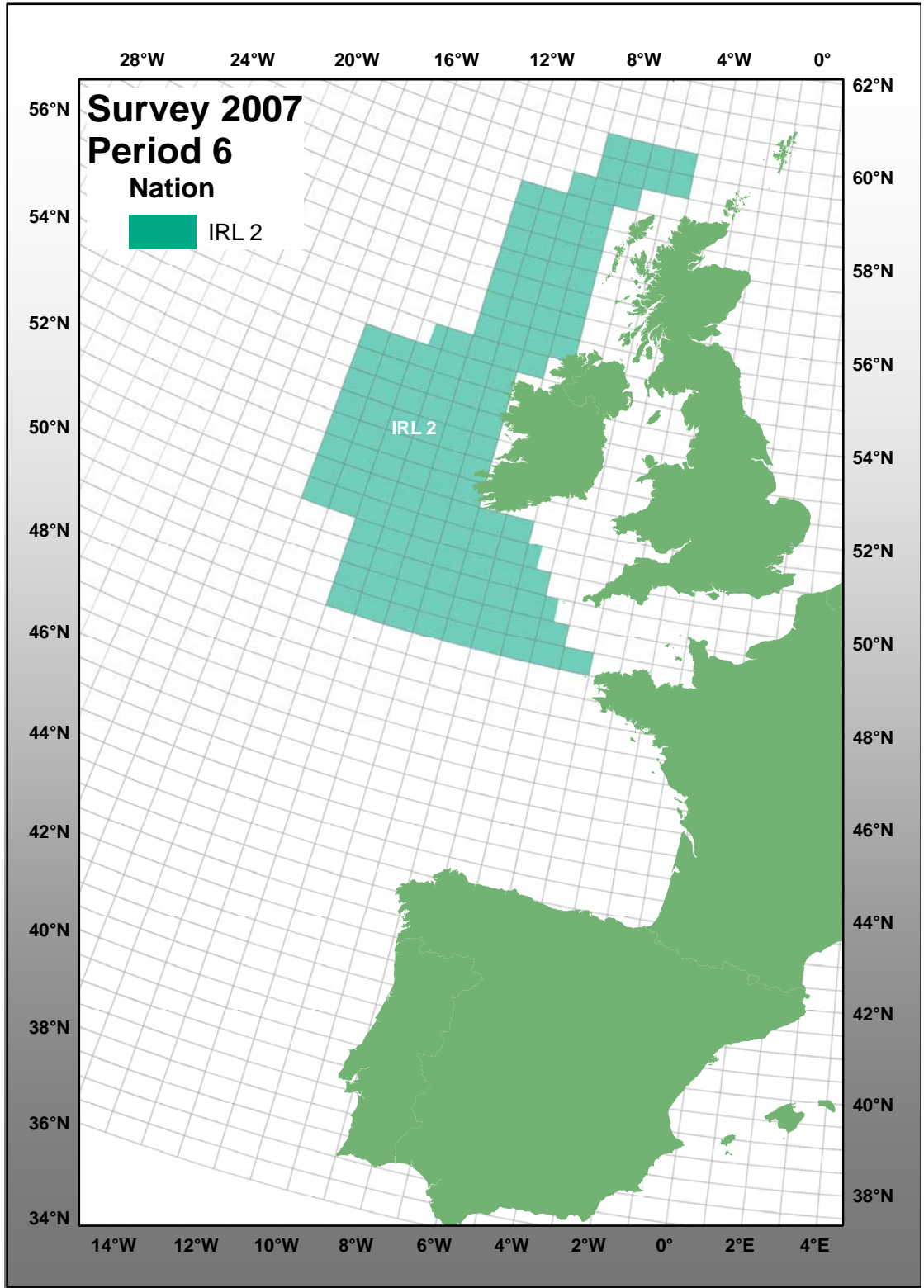


Figure 2.1.6. Survey plan for Period 6.

2.3 Sampling Areas and Sampling Effort

As in previous years it was decided that the spatial and temporal distribution of sampling would be designed to ensure an adequate coverage of both mackerel and horse mackerel spawning and that estimates of stage 1 egg production would be made for both species.

Since the surveys were started in 1977 considerable changes have been made to the standard sampling area and these have been described in Section 8.4 (ICES, 1994). In 1995 changes were made to the western boundaries of the western area because of the unusual westerly distribution of mackerel eggs which occurred in period 3, 1992. Examination of the 1995 egg distributions prior to the 1998 survey resulted in the addition of further rectangles to the standard sampling area. A total of eight rectangles were added at the northern edge and twenty five on the western edge between latitude 45°30'N and 51°N (ICES, 1997b). Examination of the 1998 survey data showed that the distribution of mackerel and horse mackerel spawning in both the western and southern areas was adequately covered with the exception of mackerel spawning from mid May to July at the northern edge of the western standard area. As a result some additional rectangles were added to the standard area north of latitude 58°30'N.

Based on this steady growth of the “standard area” every survey, the Working Group agreed at the Dublin meeting to reconsider its use. It was agreed that the existing “standard area” should be retained only as a guide to the core survey area for cruise leaders, and that the extent of coverage should be decided based on finding the edges of the egg distribution only i.e. boundaries should be set based on the adaptive sampling guidelines. (Annex 2) The core areas for the western and southern surveys for both species are presented in Figures 2.2.1 and 2.2.2. A more detailed survey map of the Iberian areas as surveyed by IPIMAR and IEO can be found in Figure 2.2.3 and 2.2.4. Section 2.4 below also provides a description of the Portuguese DEPM survey.

The sampling area in the south has been modified from the design used in 2001 and previously. The stations have been placed closer together in the onshore/offshore direction and further apart in the alongshore direction. As stated above the limits of the survey in both areas should be established on the basis of two consecutive zero egg samples, and not by the boundaries on this map.

2.4 Horse mackerel DEPM survey in ICES Division IXa

Taking into account the strong and consistent evidence that horse mackerel is an indeterminate spawner (Abaunza, P. *et al.*, 2003, ICES, 2003); southern horse mackerel stock spawning biomass will be assessed by Portugal and Spain during the spawning season by means of the Daily Egg Production Method (DEPM). This will cover the new defined stock area for southern horse mackerel corresponding to ICES Division IXa (36° to 43° N), from Gibraltar to Finisterre (WD Costa, A.M. *et al.*, 2006).

Portugal/IPIMAR will perform from 23 January to 28 February 2007 a 35 days cruise with RV “Noruega”, in order to collect egg samples and catch adult fishes (Figure 2.2.3).

272 double oblique hauls from surface to 200 meters depth with a 40 cm diameter Bongo net will be performed through a grid with ten minutes egg stations distance and twenty minutes between radials.

Fish sampling strategy is to perform two bottom-trawl hauls each day (60–70 hauls), located in selected places where horse mackerel is known to be usually present (Figure 2.2.3). From each positive trawl a simple random sample of at least 300 fishes and 100 gonads of maturity stages 3, 4 or 5 will be collected whenever possible

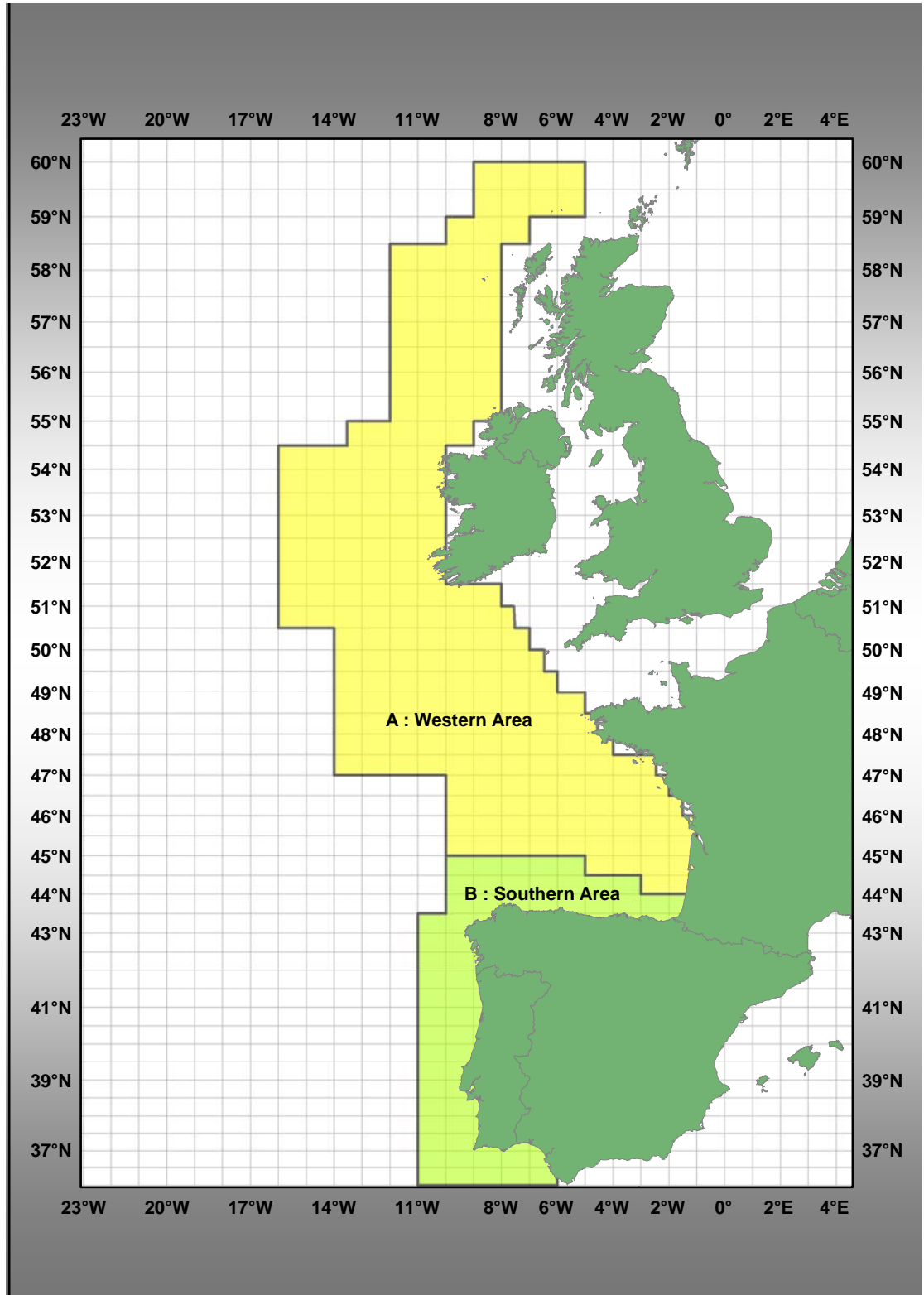


Figure 2.2.1. Core sampling areas for mackerel eggs in the western and southern areas for 2007. Sampling will be continued outside these limits on surveys based on the adaptive sampling guidelines (Annex 2).

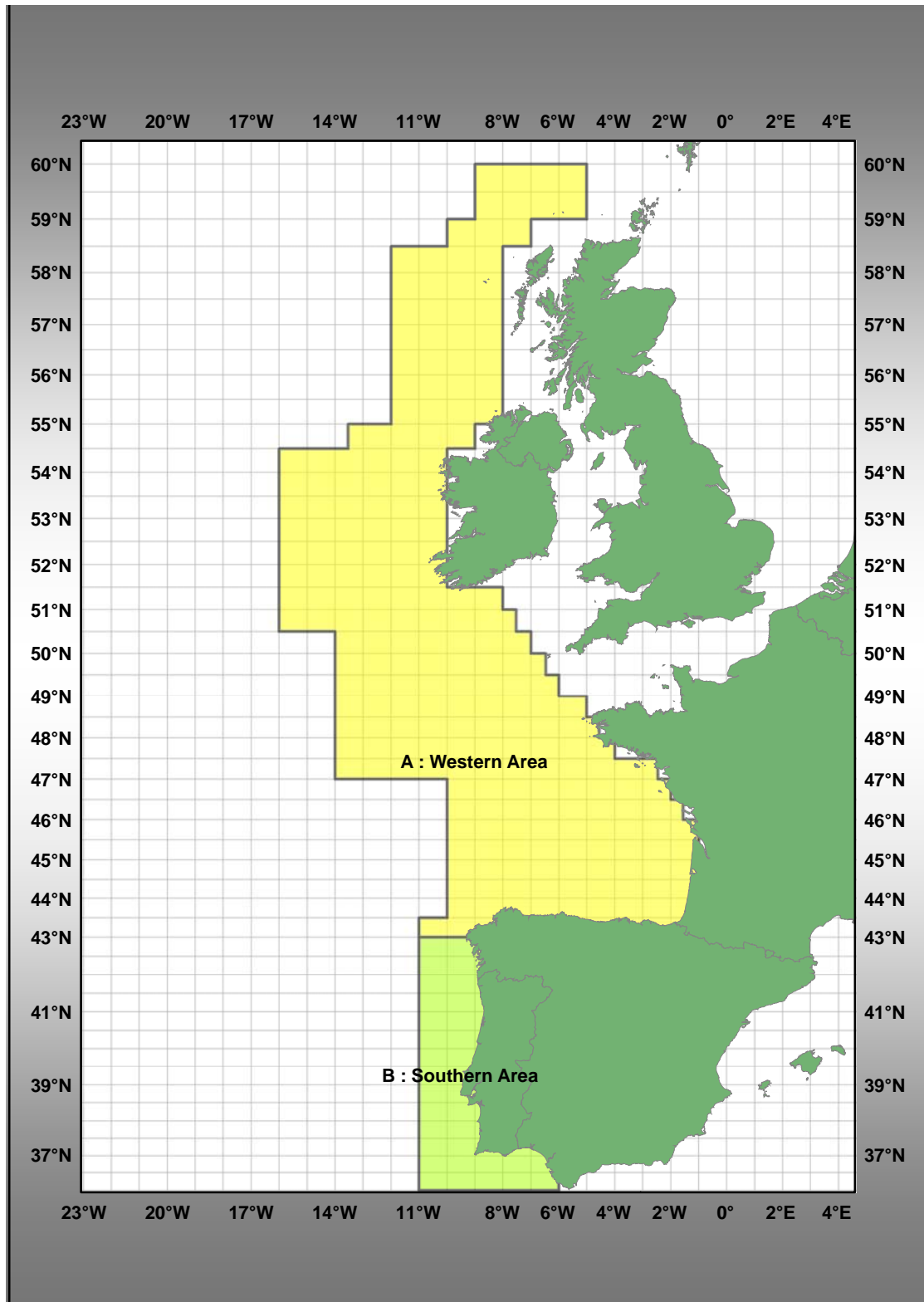


Figure 2.2.2. Core sampling areas for horse mackerel eggs in the western and southern areas for 2007. Sampling will be continued outside these limits on surveys based on the adaptive sampling guidelines (Annex 2).

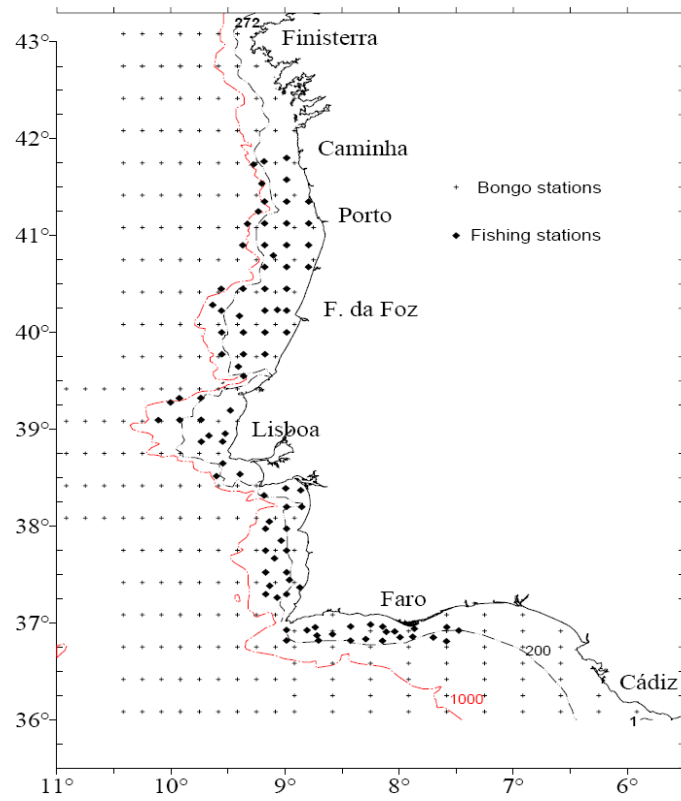


Figure 2.2.3. IPIMAR DEPM Survey area- Bongo egg sampling and fishing stations.

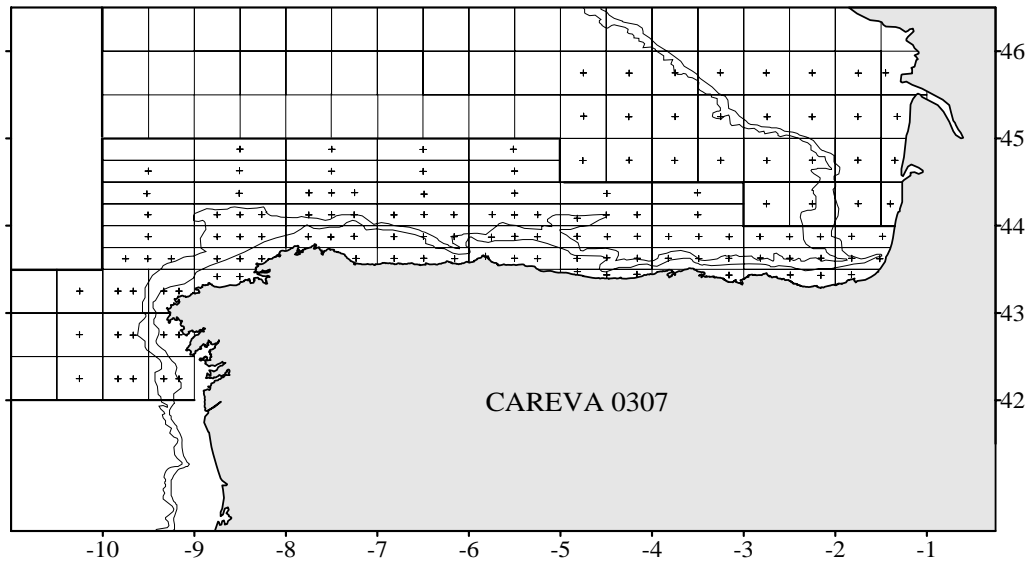


Figure 2.2.4. IEO sample locations for Galicia and the Cantabrian Sea.

Annex 2: Detailed sampling proposal for fecundity studies

Introduction

The original planning for adults collection (ICES, 2006) had to be adapted to the new surveys calendar. After the workshop of fecundity analysis (Lowestoft, October 2006), coordinators of adults sampling, (IMARES (Netherlands) and IMR (Norway)), agreed to re-distribute adults samples between the different members. The new tables (see table) were e-mailed to whole participants together with the standard procedures in the adult sampling. By post, all partakers received the labels for the samples and sub-samples of mackerel and horse mackerel.

Tab. 3.1.2a: Desired temporal and spatial distribution of the mackerel fecundity sampling in the Southern Area

Fecundity sampling (numbers of fish)			Southern Area (Cantabrian and Biscay)											Southern Area (Cadiz to Galicia)**																	
MACKEREL			Lon °											Lat °																	
Week	Date	Period*	11W	10	9	8	7	6	5	4	3	2	1	36N	37	38	39	40	41	42											
4	22/01/2007	1	100 (prespawning (purseine/trawl))											10																	
5	29/01/2007	1												10																	
6	05/02/2007	1																													
7	12/02/2007	1																													
8	19-feb-07	1																													
9	26-feb-07	1																													
10	05-mar-07	2																													
11	12-mar-07	2	20																												
12	19-mar-07	2	20																												
13	26-mar-07	2																													
14	02-abr-07	2	20***																												
15	09-abr-07	3																													
16	16-abr-07	3	20																												
17	23-abr-07	3																													
18	30-abr-07	3																													
19	07-may-07	4	10					20																							
20	14-may-07	4																													
21	21-may-07	4																													
22	28-may-07	4																													
23	04-jun-07	5																													
24	11-jun-07	5																													
25	18-jun-07	5																													
26	25-jun-07	5																													
27	02-jul-07	6																													
28	09-jul-07	6																													
29	16-jul-07	6																													
30	23-jul-07	6																													
31	30-jul-07	6																													

* Note that period 1/2 is dominated by prespawning fish; in periods 3 to 5 = atresia sampling

** numbers of sampled fish in the area Cadiz to Galicia are referring to mackerel as well as to horse mackerel

*** these samples will be take by acoustic survey that will take place in this area

Country colour codes.



Tab. 3.1.2b: Desired temporal and spatial distribution of the mackerel fecundity sampling in the Western Area

Fecundity sampling			Western Area																										
MACKEREL			Lat °																										
Week	Date	Period*	44N	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59											
4	22/01/2007	1																											
5	29/01/2007	1																											
6	05/02/2007	1																											
7	12/02/2007	1																											
8	19-feb-07	1																											
9	26-feb-07	1																											
10	05-mar-07	2					20		20																				
11	12-mar-07	2						20	10																				
12	19-mar-07	2					10			20		20				10													
13	26-mar-07	2		20														10											
14	02-abr-07	2		20	20						20			20															
15	09-abr-07	3		20			20																						
16	16-abr-07	3		20	20													20											
17	23-abr-07	3		20			20				20		20		20														
18	30-abr-07	3		20					20																				
19	07-may-07	4					20																						
20	14-may-07	4		20	20			20																					
21	21-may-07	4						20		10			10																
22	28-may-07	4												10		10													
23	04-jun-07	5						20		10		10			10		10												
24	11-jun-07	5						20				10				10													
25	18-jun-07	5					20			10		10																	
26	25-jun-07	5																											
27	02-jul-07	6												20			10												
28	09-jul-07	6							10				20		10			10											
29	16-jul-07	6							10		10																		
30	23-jul-07	6																											
31	30-jul-07	6																											

* Note that period 1/2 is dominated by prespawning fish; in periods 3 to 5 = atresia sampling

Country colour codes.



Tab. 3.2.2: Desired temporal and spatial distribution of the horse mackerel fecundity sampling in the Western Area

Fecundity sampling			Biscay, Celtic Sea, North West Ireland, West of Scotland																											Cantabrian and Biscay*										
HORSE MACKEREL			Lat °																											Lon °										
Week	Date	Period*	44N	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	11W	10	9	8	7	6	5	4	3	2	1											
4	22/01/2007	1																																						
5	29/01/2007	1																																						
6	05/02/2007	1																																						
7	12/02/2007	1																																						
8	19-feb-07	1																																						
9	26-feb-07	1																																						
10	05-mar-07	2					5		5																															
11	12-mar-07	2						5		5																														
12	19-mar-07	2							10				10																											
13	26-mar-07	2		10																																				
14	02-abr-07	2		10	10							10			10																									
15	09-abr-07	3		10				10																																
16	16-abr-07	3		10																																				
17	23-abr-07	3		5																																				
18	30-abr-07	3		10																																				
19	07-may-07	4						10																																
20	14-may-07	4		10	10				10																															
21	21-may-07	4								10				5		5																								
22	28-may-07	4																																						
23	04-jun-07	5								10				5		5																								
24	11-jun-07	5								10				5		5																								
25	18-jun-07	5								10				5		5																								
26	25-jun-07	5																																						
27	02-jul-07	6																																						
28	09-jul-07	6																																						
29	16-jul-07	6																																						
30	23-jul-07	6																																						
31	30-jul-07	6																																						

* Refer to Tab.3.1.2a for the area Cadiz to Galicia

Procedures

Horse mackerel sampling procedure at sea

Before the cruise:

Fill the labelled 2.5 ml eppendorf tubes with 1.2 ml of 3.6% buffered (sodium phosphate) formaldehyde (see excel-file: Buffered formaldehyde) and measure the weight ($\pm 0,0001$ g).

During the cruise:

Measure the weight of the whole catch and select a subsample of 100 fish and measure the total weight of the subsample.

Measure total length, weight, maturity (Walsh scale) and sex of each fish in the subsample.

Select females in maturity stages 3–6 (see Table 3.1.2 WGMEGS 2006) from the subsample for fecundity analysis. Be sure to divide the females equally into the 4 weight categories : < 150g, 151-250g, 251-350g, >351g

Measure

Total length

Total weight

Maturity

Otoliths for age reading

Weight of gut, ovary and liver

Stomach fullness (1: empty, 2: filled, 3: full and 4: bursting)

Ovary sampling :

From the ovary take 4 * 25 μ l samples with a pipette and immediately put each sample in individual coded eppendorf tubes.

Make sure that all the ovary samples are covered with formaldehyde.

Freeze and label the gutted fish separately in plastic bags for lipid measurements. Be sure to use the same code for the eppendorf tubes and frozen fish for each individual

After the cruise:

Measure the weight of the eppendorf tubes containing the sample.

Send all the frozen fish to IMARES, see address in Table 1.

Send the eppendorf samples for analysis to the different institutes referring to Table 1.

COLOUR CODE	COUNTRY	INSTITUTE AND ADDRESS	RESPONSIBLE PERSON
Blue	Norway	IMR, Nordnesgaten 50, PB 1870, 5817 Bergen-Nordnes, Norway	Merete Fonn
Pink	Ireland	MI, Rinville, Oranmore, Co.Galway, Ireland	Brendan O'Hea
Green	Netherlands	IMARES, Haringkade 1, 1976 cp IJmuiden, Netherlands	Cindy van Damme
White	Spain	IEO, Cabo Estay-Canido, 36280 – VIGO (Pontevedra) Spain	Jose Ramon Perez

Mackerel sampling procedure at sea

Before the cruise:

Fill the labelled 2.5 ml eppendorf tubes with 1.2 ml of 3.6% buffered (sodium phosphate) formaldehyde (see excel-file: Buffered formaldehyde) and measure the weight ($\pm 0,0001$ g).

During the cruise:

Measure the weight of the whole catch and select a subsample of 100 fish and measure the total weight of the subsample.

Measure total length, weight, maturity (Walsh scale) and sex of each fish in the subsample.

Select females in maturity stages 3–6 (see Table 3.1.2 WGMEGS 2006) from the subsample of 100 for DNA, fecundity and atresia analysis. Be sure to divide the females equally into the 4 weight categories: < 250g, 251–400g, 401–550g and >550g.

Measurements :

Total length

Total weight

Maturity

Otoliths

Weight of gut, ovary and liver

DNA sampling:

Cut a tissue sample (about 10*5*5 mm) of the muscle from the tick muscle behind the head, put each tissue sample in a 1.5 ml eppendorf tube in absolute alcohol.

Fecundity sampling:

From one half of the ovary take 4 samples of each 25µl with a pipette and immediately put each sample in individual coded eppendorf tubes.

Atresia sampling:

For atresia: Place the other half of the ovary in a bottle filled with 3.6 % buffered (sodium phosphate) formaldehyde.

Make sure that all the ovary samples are covered with formaldehyde

Parasites sampling:

Select new fish from the catch to freeze individually in plastic bags. The total number of fish should be 50 for each cruise, following Table 1.

Table 1.

AREA	SAMPLING BY	PERIOD / NUMBER OF FISH				
		1	2	3	4	5
Southern	POR/IPMAR	50				
	ESP/IEO	50	50			
	ESP/AZTI			50		
Western	GER/BFA Fi	50				
	IRL/MI					50
	SCO/FRS		50			
	NED/IMARES			50		
	NOR/IMR				50	

After the cruise:

Measure the weight of the eppendorf tubes containing the sample.

From the fixed half ovary, cut two 5mm thick slices and put them in a labelled cassette. If the ovary is very big you may have to use 2 cassettes. Separate the cassettes into 4 colour coded bottles filled with 70% ethanol. Send the cassettes and eppendorf samples for analysis to the different institutes referring to Table 2.

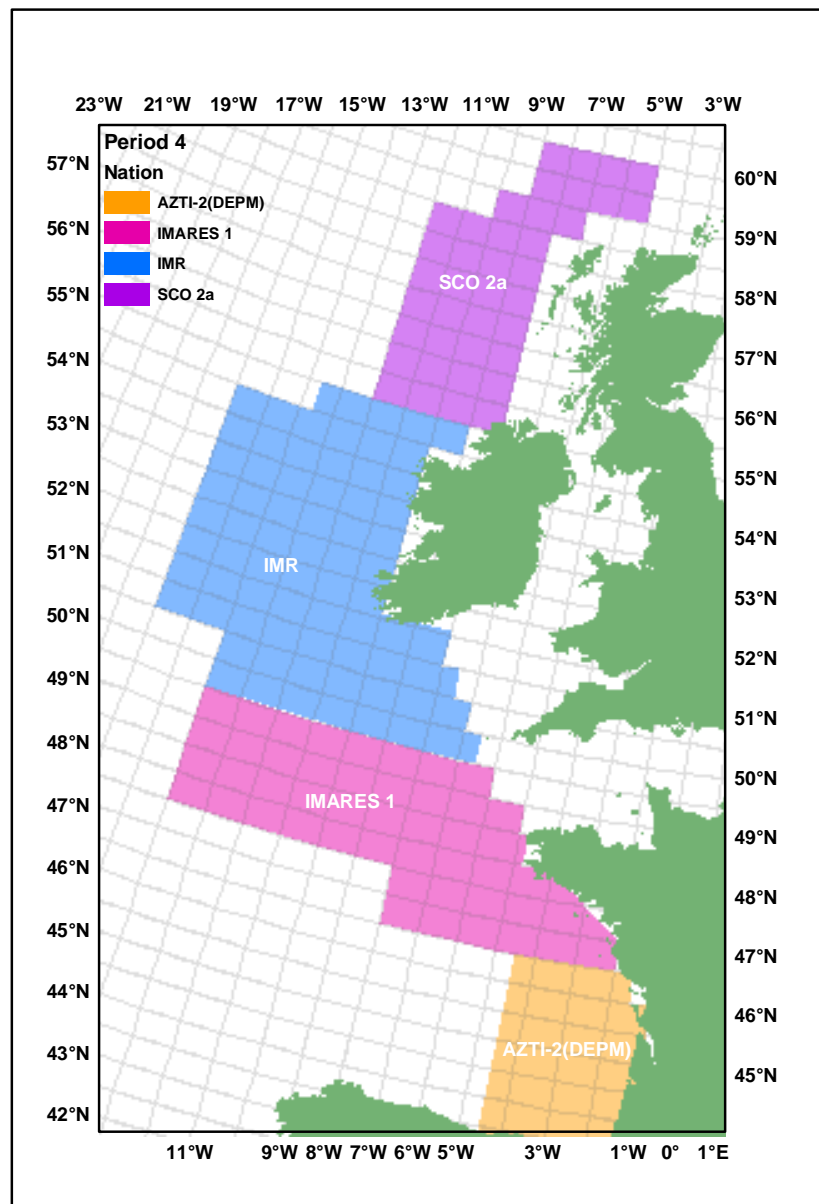
Table 2.

COLOUR CODE	COUNTRY	INSTITUTE AND ADDRESS	RESPONSIBLE PERSON
Blue	Norway	IMR, Nordnesgaten 50,PB 1870, 5817 Bergen-Nordnes, Norway	Merete Fonn
Red	Ireland	MI, Rinville, Oranmore, Co.Galway, Ireland	Brendan O'Hea
Yellow	Scotland	FRS, Marine Laboratory, Victoria Road, Torry, Aberdeen, AB9 8DB, Scotland	Finlay Burns
White- Even numbers	Spain	IEO, Apartado 1552, Cabo Estay, Canido, 36280-VIGO (Pontevedra), Spain	Jose Ramon Perez
White- Uneven numbers	Spain	AZTI, Foundation Herrera Kaia, Portualde z/ g20110 Pasaia, Basque Country, Spain	Maria Santos

Annex 3: Final sampling adjust for period 4

Introduction

In February 2007 FRS in Aberdeen was informed about additional funding to carry out a third Scottish survey in period 4. The idea was to take place upon a commercial charter vessel with duration of about 15 days. Although this was a very welcome addition to the survey plan, it posed a few challenges, how to fit this new survey into the plan so close to survey starting. Three countries were involved in this change: IMR (Norway), IMARES (Nederland) and FRS (Scotland).



Fecundity sampling **Western Area**
MACKEREL Lat °

Week	Date	Period*	44N	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
4	22/01/2007	1																
5	29/01/2007	1																
6	05/02/2007	1																
7	12/02/2007	1																
8	19-feb-07	1																
9	26-feb-07	1																
10	05-mar-07	2					20		20									
11	12-mar-07	2						20		10								
12	19-mar-07	2					10				20		20				10	
13	26-mar-07	2		20														10
14	02-abr-07	2		20	20						20			20				
15	09-abr-07	3		20			20											
16	16-abr-07	3			20									30	30			
17	23-abr-07	3		20				20										
18	30-abr-07	3		20														
19	07-may-07	4					20							10				
20	14-may-07	4		20	20		20							10		10		
21	21-may-07	4						20			10							
22	28-may-07	4																
23	04-jun-07	5						20		10		10			10		10	
24	11-jun-07	5						20					10				10	
25	18-jun-07	5					20			10		10						
26	25-jun-07	5																
27	02-jul-07	6											20				10	
28	09-jul-07	6						10				20			10			10
29	16-jul-07	6						10		10								
30	23-jul-07	6																
31	30-jul-07	6																

* Note that period 1/2 is dominated by prespawning fish; in periods 3 to 5 = atresia sampling

Fecundity sampling **Biscay, Celtic Sea, North West Ireland, West of Scotland**
HORSE MACKEREL Lat °

Week	Date	Period*	44N	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
4	22/01/2007	1																
5	29/01/2007	1																
6	05/02/2007	1																
7	12/02/2007	1																
8	19-feb-07	1																
9	26-feb-07	1																
10	05-mar-07	2					5		5									
11	12-mar-07	2						5		5								
12	19-mar-07	2						10			10		10				5	
13	26-mar-07	2		10														5
14	02-abr-07	2		10	10						10			10				
15	09-abr-07	3		10			10				10	10						
16	16-abr-07	3		10			10			10				20				
17	23-abr-07	3		5				10										
18	30-abr-07	3		10														
19	07-may-07	4					10							5				
20	14-may-07	4		10	10		10							5		5		
21	21-may-07	4						10			5							
22	28-may-07	4																
23	04-jun-07	5						10		5		5			5		5	
24	11-jun-07	5					10					5		5		5		
25	18-jun-07	5					10			5		5						
26	25-jun-07	5																
27	02-jul-07	6											10				5	
28	09-jul-07	6						5				10			5			5
29	16-jul-07	6					5		5									
30	23-jul-07	6																
31	30-jul-07	6																

* Refer to Tab.3.1.2a for the area Cadiz to Galicia

Annex 4: WGMEGS Terms of References for 2008

The **Working Group on Mackerel and Horse mackerel egg surveys** [WGMEGS] (Chair: P. Alvarez*, Spain) will meet in IJmuiden, the Netherlands, 7–11 April 2008 to:

- a) analyse and evaluate the results of the 2007 mackerel and horse mackerel egg surveys of the western and southern areas;
- b) calculate the egg production:
 - i) total seasonal stage 1 egg production estimates for mackerel separately for western and southern component.
 - ii) total seasonal stage 1 egg production estimates for horse mackerel for western stock.
 - iii) P_0 estimates for horse mackerel for southern stock (DEPM application).
- c) Analyse and evaluate the results of the mackerel and horse mackerel fecundity and atresia sampling for mackerel and horse-mackerel southern stock:
 - i) analyse and evaluate the results of the horse mackerel batch fecundity and spawning fraction in the southern stock;
- d) evaluate the results of studies on horse mackerel fecundity determination and proxies on the basis of data collected during the 2007 surveys and in other relevant work (captive studies);
- e) provide estimates of the spawning stock biomass of mackerel, using stage 1 egg production estimates and the estimates of fecundity and atresia, separately for the western and southern areas;
- f) provide estimates of the spawning stock biomass of horse mackerel, using P_0 production estimates and the estimates of batch fecundity and spawning frequency for southern stock;
- g) evaluate the quality and reliability of the 2007 survey in the light of the previous surveys.

WGMEGS will report by 1 June 2008 for the attention of the Living Resources and the Resource Management Committees.

Supporting Information

PRIORITY:	Essential. Terms of Reference are set up to provide ACFM with the information required for responding to requests for advice/information from NEAFC and EC DGXIV.
SCIENTIFIC JUSTIFICATION AND RELATION TO ACTION PLAN:	<p>Action Plan No: 1.</p> <p>The egg survey provides the only fishery-independent stock estimate for north-east Atlantic mackerel and for both the western and the southern horse mackerel spawning component. The surveys provide the most essential indices for the tuning of the VPAs. The survey is based on a time-series since 1977.</p> <p>Term of Reference a)</p> <p>This aspect is especially relevant as CEFAS withdrawn from the survey and will no longer to provide adult mackerel .A review of surveys coverage (in time and space), including modifications, and adaptations are analysed and discussed. The WG will make recommendation if were necessary.</p> <p>Term of Reference b)</p> <p>Total seasonal stage 1 egg production for mackerel and western stock horse mackerel are calculated using routine methodology and it is compared with those obtained in previous year. Special attention will be paid in the application of the DEPM for southern stock horse mackerel.</p> <p>Term of reference c)</p> <p>WGMEGS set up a detailed adult sampling for fecundity and for atresia in mackerel. The degree of compliance of sampling is assessed and the</p>

	<p>difficulties reported are discussed. Variations within and between institutes are minimized thanks to an inter-change and inter-calibration plans designed “ad hoc”.</p> <p>Term of reference d) Important effort has been carried out in order to identify any factor to convert eggs production into SSB in horse-mackerel. According to last year surveys, neither lipid content nor stomach content seem to provide good results. High variability was observed between institutes. In 2007 only one institute, IMARES is in charge for this task. Additionally, captivity studies were proposed in order to confirm, definitively, the fecundity strategy for horse-mackerel. We will look closely at these experiments.</p> <p>Term of reference e) Based of the total eggs production, fecundity and atresia data estimates of the spawning stock biomass and variance are provided and are compared with previous year.</p> <p>Term of reference f) Daily Egg Production Method (DEPM) for southern horse mackerel is applied at the first time in Portuguese waters. This change in the methodology is consequence of serious evidence of indeterminate fecundity of this species. Due to recent modifications of horse mackerel stock boundaries, no historical series of stock biomass estimates are available.</p> <p>Term of reference g) Analysis of surveys coverage, eggs identification, adults sampling and intercalibration exercise is discussed and compared with other years. Additionally , operational methods are checked and Manual protocol is reviewed.</p>
RESOURCE REQUIREMENTS:	None. The meetings are partially funded under the EU data directive
PARTICIPANTS:	N, NL, P, ESP, UK (Scotland), D, Ireland, Usually 25 – 30 participants
SECRETARIAT FACILITIES:	None.
FINANCIAL:	No financial implications.
LINKAGES TO ADVISORY COMMITTEES:	ACFM
LINKAGES TO OTHER COMMITTEES OR GROUPS:	Reports to the Living Resources and the Resource Management Committees, as well as WGMHSA. Other less formal links with WGLESP, and WGACEGG
LINKAGES TO OTHER ORGANIZATIONS:	