# WORKING GROUP FOR THE BAY OF BISCAY AND THE IBERIAN WATERS ECOREGION (WGBIE)

VOLUME 3 | ISSUE 48

ICES SCIENTIFIC REPORTS

RAPPORTS
SCIENTIFIQUES DU CIEM

**ICES** INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
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ISSN number: 2618-1371



ICES Scientific Reports

Volume 3 | Issue 48

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## Recommended format for purpose of citation:

ICES. 2021. Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE). ICES Scientific Reports. 3:48. 1101 pp. https://doi.org/10.17895/ices.pub.8212

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# Section contents

# 5 Megrim and four-spot megrim in divisions 7.b–k, 8.a, 8.b, and 8.d

## *Lepidorhombus whiffiagonis* – meg.27.7b-k8abd (west and southwest of Ireland, Bay of Biscay)

**Assessment type**

An updated assessment has been carried out as this stock was benchmarked in 2016 (ICES, 2016a)—executing a full assessment for this stock—and is now considered a category 1 stock.

**Data revisions**

This was done through an Inter Benchmark Process (IBPMegrim; ICES, 2016a); no additional revisions have been done during this Working Group (WG).

## *Lepidorhombus boscii* – ldb.27.7b-k8abd (west and southwest of Ireland, Bay of Biscay)

**Assessment type**

First assessment.

**Data revisions**

First assessment (survey indices included).

## 5.1 General

See Stock Annex for more details on the general aspects related to megrim assessment.

### 5.1.1 Ecosystem aspects

See Stock Annex for more details on the ecosystem aspects related to megrim assessment.

### 5.1.2 Fishery description

Megrim in the Celtic Sea, west of Ireland, and in the Bay of Biscay are caught in a mixed fishery predominantly by French followed by Spanish, UK and Irish demersal vessels. In 2020, the four countries together have reported around 94% of the total landings (Table 5.1). Estimates of total landings (including unreported or misreported landings) and catches (landings and discards) as used by the WG up to 2020 are shown in Table 5.2.

### 5.1.3 Summary of ICES advice for 2020 and management for 2019 and 2020

#### 5.1.3.1 ICES advice for 2021 (as extracted from ICES Advice 2020):

ICES advises that when the EU multiannual plan (EU MAP; EU, 2019) for Western Waters and adjacent waters is applied, catches in 2021 that correspond to the F ranges in the MAP are between 12 706 t and 27 748 t. According to the MAP, catches higher than those corresponding to $F_{MSY}$ (19 184 t) can only be taken under conditions specified in the MAP, whereas the entire range is considered precautionary when applying the ICES advice rule.

Management of catches of the two megrim species, *L. whiffiagonis* and *L. boscii*, under a combined species TAC prevents effective control of the single-species exploitation rates and could lead to overexploitation of either species.

#### 5.1.3.2 Management applicable for 2020 and 2021:

The agreed TAC for the combined species was set at 20 526 t for 2020. Due to Brexit, fishing quotas are partially published with a provisional value of 4460 t for the first quarter of 2021.

The minimum landing size for megrim was reduced from 25 to 20 cm in 2000.

## 5.2 Megrim (*L. whiffiagonis*) in divisions 7.b–k, 8.a, 8.b, and 8.d

### 5.2.1 General

See general section for both species.

### 5.2.2 Data

#### 5.2.2.1 Commercial catches and discards

Stock catches for the period 1984–2020, as estimated by the WG, are given in Table 5.1. This is the fourth year where all landings and discards data that have been uploaded to InterCatch were used to make data allocations.

Landings in 2020 (11 141 t) are slightly lower than in 2019 (12 164 t) ( < 9%).

Since 2011, estimates of unallocated or non-reported landings have been included in the assessment. These were estimated based on the sampled vessels (Spanish concurrent sampling) raised to the total effort for each *métier*.

Spanish data showed a decreasing trend from 2009 onwards. During the IBPMegrim held in 2016 (ICES, 2016a), France landing dataseries were updated from 2003–2014. Landings data from France showed initially an increasing trend from 2015 onwards then decreased in the last two years. In 2020, landings from Ireland and UK decreased while Belgium increased.

French discard data from 2004–2014 were provided for the IBPMegrim in 2016 (ICES, 2016a), and have been updated in 2017. An increase in discards was only observed in Belgium while significant decreases were declared by France, Spain, Ireland and UK.

Discard data available by country and the procedure to derive them are summarized in Table 5.3. The discards decrease in year 2000 can be partly explained by the reduction in the minimum landing size from 25 cm to 20 cm. Since 2000, fluctuating trends are observed with a peak in 2004 and the minimum observed level in year 2020.

Table 5.4 presents the discard ratio in percentage (%) from catches in weight of the most recent years.

#### 5.2.2.2 Biological sampling

Age and length distribution data provided by countries are explained in Stock Annex-Meg78 (Annex E).

##### Age

France, Ireland, UK and Belgium provided numbers-at-age to InterCatch and eventually completed numbers- and weights-at-age up to 2020. Age distribution for landings and discards from 2011–2020 are presented in Figure 5.1.

##### Lengths

Table 5.5 shows the available original length composition of landings by Fishing Unit in 2020. Data for the OTB DEF 70-99 Spanish fleet was not provided in 2020.

##### Natural Mortality

A value of 0.2 for the natural mortality (M) has been used as input data for all ages and years in the final model.

#### 5.2.2.3 Survey data

UK survey Deep Waters (UK-WCGFS-D, Depth > 180 m) and UK Survey Shallow Waters (UK-WCGFS-S, Depth < 180 m) indices for the period 1987–2004 and French EVHOE survey (EVHOE-WIBTS-Q4, G9527) indices for the period 1997–2020 are summarized in Table 5.6. Due to vessel technical problems, no French EVHOE survey was carried out in 2017 but recommenced in 2018.

The UK-WCGFS-D and UK-WCGFS-S show the same pattern of indices for ages 2 and 3 since 1997; in agreement with the high values of EVHOE-WIBTS-Q4 (G9527) age 1 index for the years 1998 and 2000. These high indices in the deep component of the UK Surveys are even more remarkable in 2003 for all age-groups and in 2004 for the younger ages (1–2).

When comparing Spanish (SpPGFS-WIBTS-Q3, G5768), French (EVHOE-WIBTS-Q4, G9527) and Irish (IGFS-WIBTS-Q4, G7212) survey biomass indices some contradictory signals are detected (Figure 5.2). The EVHOE-WIBTS-Q4 (G9527) survey index decreased from 2001 until 2005 and since then has sharply increased until 2011. The SpPGFS-WIBTS-Q4 (G5768) survey shows an increasing but fluctuating trend until 2014 and then started declining with a fluctuating trend until 2020. In the case of the IGFS-WIBTS-Q4 (G7212) survey, the highest biomass index was estimated in 2005. In 2011, a slight increase of the index occurred following a sharp decline in 2010 compared to 2009, a trend similarly observed in the Spanish survey during the same year.

Figure 5.3 shows the abundance indices by age-group for the three surveys. The abundance index by age-group for the IGFS-WIBTS-Q4 (G7212) survey from 2003–2020 shows an increasing trend during the last 4 years for younger ages (1–2), in line with middle ages (3–5), while declining for older (6–9) ages during the last five years in the dataseries. The abundance index per age-group for the EVHOE-WIBTS-Q4 (G9527) survey from 1997–2020, with the absence of 2017 value, shows increasing trends for all age-groups despite a decline for ages 3–5 in the last year.

In Figure 5.4, the time-series of *L. whiffiagonis* abundance by age composition of the SpPGFS-WIBTS-Q4 (G5768) survey from 2001 to 2020 is presented.

In Figure 5.5, the time-series of *L. whiffiagonis* abundance by age composition of the EVHOE-WIBTS-Q4 (G9527) survey from 2011 to 2020 is presented. In most years, middle ages (3–5) show the highest abundance except in 2012 where the abundance of *L. whiffiagonis* was low.

It must be noted that the areas covered by the three surveys almost do not overlap (Figure 5.6). There are some overlaps between the northern component of the EVHOE-WIBTS-Q4 (G9527) and the southern coverage of the IGFS-WIBTS-Q4 (G7212) surveys, whereas the eastern boundary of the SpPGFS-WIBTS-Q4 (G5768) survey essentially coincides with the western one of the IGFS-WIBTS-Q4 (G7212).

#### 5.2.2.4 Commercial catch and effort data

During the WKFLAT Benchmark (ICES, 2012), a new Irish trawler index was provided as the result of the revision carried out for the Irish otter trawl fleet. Irish beam trawl (TBB) data are limited to mesh sizes of 80–89 mm as larger mesh sizes are no longer used since 2006.

The evolution of the different bottom-trawl fleets effort is described in Figure 5.7. Efforts of SP-CORUTR7 and SP-VIGOTR7 fleets have decreased sharply until 1993 and continues to progressively decline until 2020. SP-VIGOTR7 showed a very slight increase in 2007 then gradually declined again until 2014. SP-CANTAB7 remains quite stable since 1991 and has decreased slightly since 2000, for the last six years no effort was deployed. The effort of the French benthic trawlers in the Celtic Sea decreased until 2008 after which no more information was provided to the WG.

Commercial series of the catch-at-age and effort data were available for the three Spanish fleets in Subarea 7 (Figure 5.8): A Coruña (SP-CORUTR7) for the period 1984–2019, Cantábrico (SP-CANTAB7) from 1984 to 2011 as no effort has been deployed onwards by this fleet in subarea 7, and Vigo (SP-VIGOTR7) for the period 1984–2019. No updated data were provided for year 2020 for these fleets due to the COVID-19 disruption. Cpues of SP-CORUTR7 have fluctuated until 1990 when it started to decrease followed with a slight increase in 2003 with a peak in 2011 then decreased afterwards. Over the same period, SP-VIGOTR7 has remained relatively stable until 1999, reaching in 2004 and 2014, the highest cpue values of the time-series. In recent years, the cpues have fluctuated but with a decreasing trend.

From 1985 to 2008, LPUEs from four French trawling fleets: FR-FU04, Benthic Bay of Biscay, Gadoids Western Approaches and *Nephrops* Western Approaches were available. (Table 5.7 and Figure 5.9). No data from 2009 onwards was received for these fleets.

The LPUE of all Irish beam trawlers fleets shows oscillating trends. From 2007, an increase in the LPUE was observed with a peak in 2013 (Figure 5.10) followed by a slightly decreasing trend afterwards.

An analysis of the abundance indices of the different age-groups in the dataseries for commercial fleets was carried out (Figure 5.11). Age-groups were categorized as: i) ages 1–2; ii) age 3–5 and iii) age 6–10. For Spanish and Irish commercial fleets, the most abundant age-group was ii) at the beginning of the dataseries. Age-group i) appears more abundant than group iii) from 2003 onwards in the Spanish fleets. French fleets appear to land mostly old individuals (group iii) at the beginning of the dataseries but a marked decrease in abundance index for this age-group was observed afterwards.

### 5.2.3 Assessment

An analytical assessment was conducted using the updated landings and discards data for 2020. With the inclusion of French discard data in 2016, some changes to the model were executed in relation to the discard estimation coefficient and the data input for the Bayesian model (ICES. 2016a).

#### 5.2.3.1 Data exploratory analysis

In summary, the stock's catch-at-age matrix shows three periods: 1984–1989; 1990–1998 and 1999–2020.

The data analysed consist of landed, discarded and catch numbers-at-age and abundance indices-at-age. Five of the available fleets were considered appropriate to include in the assessment model as tuning fleets: SpPGFS_WIBTS-Q4 (G5768), EVHOE-WIBTSQ4 (G9527), Vigo commercial trawl cpue series separated in two periods: 1984–1998 (VIGO84) and 1999–2019 (VIGO99), and Irish Otter trawlers LPUE (IRTBB), based on their representativeness of the megrim stock abundance. Several exploratory data analyses were performed to examine their ability to track cohorts through time.

These analyses were carried out with the R software (R Core Team, 2020). The analysis of the standardized log abundance indices for the updated data revealed an increase in ages 1–5 in the EVHOE-WIBTSQ4 (G9527) survey (Figure 5.12). Otherwise, a slight increase in ages 4–8 was observed in the SpPGFS-WIBTS-Q4 (G5768) survey. Figure 5.12 shows little or no cohort tracking in the surveys. Presumably as a consequence of the lack of variability of recruitment, leading to an absence of contrast between cohorts.

The analysis of the standardized log abundance indices revealed yearly trends for VIGO99 with an increase in the index of group iii) individuals detected in 2019. IRTBB shows a slight increase of ages 1–2 (group i).

The time-series of catch-at-age (Figure 5.13) showed very low catches of ages 1–5 from 1984 to 1989. From 2004 to 2010, the catch of older ages ( > 6) was remarkably low, whereas catches of ages 1 and 2 increased markedly from 2003. This could be a result of an underestimation of catches of these younger ages (especially age 1) during the previous years and probably due to the sparseness of discard data during the same period. For ages 6 and older, large discrepancies in the number of individuals caught before and after 1990 are apparent, with large catches of these ages before 1990 and a decrease of all ages at the end of the dataseries.

The analysis of landings since 1990 is presented in Figure 5.14. Landings of ages 1 and 2 have increased from the beginning of the time-series. In fact, the proportion of older ages in the landings decreased significantly from 2004 to 2009, as already discussed in relation to the catch. From year 2017, ages 1 increased significantly mainly due to the French landings.

The signal coming from the discard data showed that, at the beginning of the dataseries, discards of age 1 were low (Figure 5.15 and 5.16). Discards of this age increased along the dataseries, particularly from 2003 onwards. From 2010 to 2013, ages 1 to 3 appear to be highly discarded and in the last six years (2015–2020) overall discards decrease.

#### 5.2.3.2 Model

The model explored during the WKFLAT benchmark (ICES, 2012) is an adaptation of the one originally developed for the southern hake stock published in Fernández *et al*. (2010). It is a statistical catch-at-age model that allows incorporating data at different levels of aggregation in different years, and also works with missing discards data in certain fleets and/or in some years. These are all relevant features for the megrim stock.

The model is described in the Stock Annex.

#### 5.2.3.3 Results

The model results were analysed by looking at three different kinds of plots: convergence plots to analyse the convergence behaviour of the MCMC chains, diagnostic plots to analyse the goodness of the fit and, finally, model estimates plots which display the estimated stock status over time.

Regarding the settings of the prior for the final run, some changes were done in relation to the inclusion of the French discards during the IBPMegrim in 2016 (ICES, 2016a), which became

input data instead of being estimated by the model. Settings used in WGBIE 2021 are listed in Table 5.8.

In order to ensure that the model has produced a representative sample of the posterior distribution, the MCMC chain was examined for behaviour ("convergence" properties). This was done by examining trace and autocorrelation plots for most parameters in the model (Figure 5.17 to Figure 5.19) showing good behaviour.

Model diagnostic plots examined were: prior-posterior plots and time-series and bubble plots of the residuals. Prior-posterior distributions are shown in Figure 5.20. Posterior distributions for log-population abundance in the first assessment year (1984), log-f(y) and log-catchabilities of abundance indices were much more concentrated than the priors and were often centred at different places. This indicates that the model was able to extract information from the data in order to substantially revise the prior distribution. In these cases, the model fits are mostly driven by the data, with the prior having only a small influence. The posterior distributions for log-rSPD, log-rFR or log-rOTD in the first assessment year (1984) were similar to the prior distributions in most cases. This was especially true for log-rOTD, where data directly associated with it was not available to the model. This indicates that the available data does not contain sufficient information concerning these parameters and that the priors have to be chosen carefully to be realistic.

Results of the estimated spawning-stock biomass (SSB), reference fishing mortality ($F_{bar}$), recruits and catch, landings and discards time-series are shown in Figure 5.21. The SSB shows an overall decreasing trend from the start of the series in 1984–2005 followed by a marked increasing trend until 2020. The uncertainty in the SSB was low for the whole time-series. The median recruitment fluctuated between 200 000 and 300 000 thousand in the whole series, with a decreasing trend in the last years. The F showed three marked periods which coincide with the data periods, 1984–1989, 1990–1998 and 1999–2020 with a decreasing trend and reaching its lowest value in 2020 with small uncertainty. This decreasing F trend in recent years explains the increase of SSB since catches and recruitment remain relatively constant. Overall, the catches showed a slightly decreasing trend reaching their minimum value in 2020 with the landings showing a similar trend. In the last year, a decreasing trend in landings and discards can be observed.

#### 5.2.3.4 Retrospective pattern

Retrospective analysis was conducted for 5 years, the retrospective time-series of the most relevant indicators are shown in Figure 5.22. In terms of SSB, estimates were very similar throughout the entire time-series and there was a downward revision of the SSB with a Mohn's rho (Mohn, 1999) value of 0.329. F was revised upwards year after year with a Mohn's rho value of −0.24. Recruitment estimates towards the end of the time-series showed significant revisions in the retrospective analysis with a Mohn's rho value of 0.670, but this is something common, as recruitment in the most recent year(s) is usually not correctly estimated by assessment models.

#### 5.2.3.5 Short-term forecasts

Short-term projections have been made using the R script developed by Fernández *et al*. (2010). Some modifications have been done to the script during the IBPMegrim in 2016 (ICES, 2016a) as the previous results of the projection were inconsistent with the stock dynamics estimated by the assessment model. During WGBIE 2017, a short R script was added to the short-term projection script to allow the change of last year recruitment data, if it is not considered credible (ICES, 2017a). As the recruitment-at-age 1 estimated by the model for the year 2020 was not considered credible, it was replaced by the geometric mean of all the recruitments since 1984 except for the last two years (1984–2018). The Baranov catch equation (Baranov, 1918) was used to project the recruitment one year forward.

For the current projection, the following short-term forecast settings were used: the average of the last three years is used for F-at-age pattern, the proportion landed-at-age, and the vectors of weight-at-age and maturity-at-age.

Although there is a clear decreasing trend in the F estimates due to a significant retrospective pattern that revises the F upwards year after year, F *status quo* was not scaled to the last year and the mean of the last three years was used for the projections. For the 2021 recruitment, the geometric mean of the recruitment posteriors during all the assessment years except for the final 2 years was used.

Landings in 2022 and SSB in 2023 predicted for various levels of F in 2022 are given in Table 5.9. Maintaining F status quo in 2022 is expected to result in an increase in landings and an increase in SSB in 2022 with respect to 2021.

### 5.2.4 Biological reference points

Biological reference points were calculated during the IBPMegrim in 2016 (ICES, 2016a) and reviewed by the WGBIE (ICES, 2016b). The reference points for this stock were estimated using methods based on the recommendations from the WKMSYREF4 (ICES, 2017b). They are listed in Table 5.10 and the Stock Annex, and where $F_{MSY}$ ranges have also been included. A new definition for $F_{pa}$ has been also included in WGBIE 2021 based on the ACOM recommendation.

### 5.2.5 Conclusions

The incorporation of the requested data, mainly French discards and also the reviewed French landings data, was completed and the script to deal with these new data were updated. The model results show that the new data does not alter substantially the perception of the stock status and F compared with the preliminary models performed by WGBIE in 2015 (ICES, 2015).

The group considers that the model diagnosis is adequate to evaluate the quality of the fit. The use of the Bayesian statistical catch-at-age model, the methodology for deriving biological reference points, the methodology for short-term forecast and the estimation of discards are statistically sound and adequate to the stock.

Nevertheless, as in most stock assessments, the stock–recruitment relationship and M remain uncertain, which have an impact on the assessment and the reference points that should be investigated in future.

However, the increase of assessment years makes the JAGS software (Plummer, 2003) less efficient as each model run takes 10 hours to complete.

In addition, in the issue list identified in WGBIE 2019 (ICES, 2019) it was stated: *"The Bayesian SCA model was ad-hoc implemented to solve the lack of discard data from France. After IBP, Megrim 2016 discard from France were provided, so the problem disappeared. Therefore, a change to a more standardized model is proposed to ease the implementation and shorten the iteration times."*

To provide an answer to this issue, intersessional work was done to implement the a4a (Millar and Jardim, 2019) model which was presented in WD06 in WGBIE 2020 (Iriondo *et al*., in ICES, 2020). It shows promising results and a proposal to change this model will be analysed. In addition, during the WKTADSA early this year (ICES, 2021), some progress was made in relation to the different assessment trials which is why this stock was finally proposed to go to a benchmark in 2022–2023.

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## 5.2.7 Tables and figures

**Table 5.1. .Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Nominal landings and catches (t) by country provided by the Working Group.**

| | Landings | | | | | | | | | Discards | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | France | Spain | U.K. (England & Wales) | U.K. (Scotland) | Ireland | Northern Ireland | Belgium | Unallocated | Total landings | France | Spain | U.K. | Ireland | Northern Ireland | Belgium | Others | Total discards | Total catches | TAC |
| **1984** | | | | | | | | | **16659** | | | | | | | 2169 | **2169** | **18828** | |
| **1985** | | | | | | | | | **17865** | | | | | | | 1732 | **1732** | **19597** | |
| **1986** | 4896 | 10242 | 2048 | | 1563 | | 178 | | **18927** | | | | | | | 2321 | **2321** | **21248** | |
| **1987** | 5056 | 8772 | 1600 | | 1561 | | 125 | | **17114** | | | | | | | 1705 | **1705** | **18819** | 16460 |
| **1988** | 5206 | 9247 | 1956 | | 995 | | 173 | | **17577** | | | | | | | 1725 | **1725** | **19302** | 18100 |
| **1989** | 5452 | 9482 | 1451 | | 2548 | | 300 | | **19233** | | | | | | | 2582 | **2582** | **21815** | 18100 |
| **1990** | 4336 | 7127 | 1380 | | 1381 | | 147 | | **14370** | | | | | | | 3284 | **3284** | **17654** | 18100 |
| **1991** | 3709 | 7780 | 1617 | | 1956 | | 32 | | **15094** | | | | | | | 3282 | **3282** | **18376** | 18100 |
| **1992** | 4104 | 7349 | 1982 | | 2113 | | 52 | | **15600** | | | | | | | 2988 | **2988** | **18588** | 18100 |
| **1993** | 3640 | 6526 | 2131 | | 2592 | | 40 | | **14929** | | | | | | | 3108 | **3108** | **18037** | 21460 |
| **1994** | 3214 | 5624 | 2309 | | 2420 | | 117 | | **13684** | | | | | | | 2700 | **3284** | **16968** | 20330 |
| **1995** | 3945 | 6129 | 2658 | | 2927 | | 203 | | **15862** | | | | 422 | | | 2230 | **2652** | **18514** | 22590 |
| **1996** | 4146 | 5572 | 2493 | | 2699 | | 199 | | **15109** | | | | 410 | | | 2616 | **3026** | **18135** | 21200 |
| **1997** | 4333 | 5472 | 2875 | | 1420 | | 130 | | **14230** | | 414 | | 568 | | | 2083 | **3066** | **17296** | 25000 |
| **1998** | 4232 | 4870 | 2492 | | 2621 | | 129 | | **14345** | | 381 | | 681 | | | 4309 | **5371** | **19716** | 25000 |
| **1999** | 3751 | 4615 | 2193 | | 2597 | | 149 | | **13305** | | 3135 | | 162 | | | | **3297** | **16601** | 20000 |
| **2000** | 4173 | 6047 | 2185 | | 2512 | | 115 | | **15031** | | 1033 | 208 | 630 | | | | **1870** | **16901** | 20000 |
| **2001** | 3645 | 7575 | 1710 | | 2767 | | 80 | | **15778** | | 1275 | 250 | 736 | | | | **2262** | **18040** | 16800 |
| **2002** | 2929 | 8797 | 1787 | | 2413 | | 62 | | **15987** | | 1466 | 435 | 912 | | | | **2813** | **18800** | 14900 |
| **2003** | 3227 | 8340 | 1732 | | 2249 | | 163 | | **15711** | | 3147 | 279 | 582 | | | | **4008** | **19719** | 16000 |
| **2004** | 2817 | 7526 | 1622 | | 2288 | | 106 | | **14358** | 1003 | 4511 | 257 | 472 | | | | **6243** | **20602** | 20200 |
| **2005** | 2972 | 5841 | 1764 | | 2155 | | 156 | | **12888** | 697 | 1831 | 289 | 458 | | | | **3275** | **16163** | 21500 |
| **2006** | 2763 | 5916 | 1509 | | 1751 | | 99 | | **12037** | 382 | 2568 | 271 | 529 | | | | **3751** | **15788** | 20400 |
| **2007** | 2745 | 6895 | 1462 | | 1763 | | 195 | | **13060** | 330 | 2114 | 272 | 317 | | | | **3033** | **16092** | 20400 |
| **2008** | 2578 | 5402 | 1387 | | 1514 | | 167 | | **11048** | 329 | 1479 | 289 | 764 | | | | **2860** | **13908** | 20400 |
| **2009** | 3032 | 8062 | 1840 | | 1918 | 2 | 209 | | **15064** | 674 | 1761 | 389 | 454 | | | | **3278** | **18342** | 20400 |
| **2010** | 3651 | 7095 | 1805 | | 2283 | 5 | 261 | | **15101** | 937 | 3489 | 463 | 453 | | | | **5343** | **20444** | 20106 |
| **2011** | 3235 | 3500 | 1845 | | 2227 | | 330 | 2089 | **13226** | 847 | 2097 | 898 | 344 | | | | **4187** | **17413** | 20106 |
| **2012** | 4012 | 4055 | 1744 | | 3047 | | 609 | 966 | **14433** | 796 | 2668 | 88 | 152 | | | | **3704** | **18137** | 19101 |
| **2013** | 4549 | 4982 | 2918 | | 3038 | | 538 | | **16025** | 748 | 3792 | 53 | 286 | | 5 | | **4885** | **20910** | 19101 |
| **2014** | 4311 | 3318 | 2753 | 176 | 2391 | | 179 | 150 | **13277** | 795 | 1337 | 72 | 360 | | 5 | | **2569** | **15846** | 19101 |
| **2015** | 3073 | 2863 | 2804 | 147 | 2436 | | 246 | 1 | **11569** | 634 | 513 | 47 | 308 | | 4 | | **1507** | **13076** | 19101 |
| **2016** | 3141 | 2672 | 2694 | 145 | 2593 | | 302 | 1 | **11548** | 1276 | 649 | 74 | 404 | | 42 | | **2445** | **13992** | 20056 |
| **2017** | 5101 | 3178 | 2512 | 176 | 2458 | | 360 | | **13784** | 783 | 706 | 265 | 378 | | 40 | | **2173** | **15957** | 15043 |
| **2018** | 4680 | 2276 | 2337 | 112 | 2128 | 6 | 347 | 261 | **12147** | 610 | 483 | 85 | 495 | | 66 | | **1738** | **13885** | 13528 |
| **2019** | 4332 | 2617 | 2150 | 129 | 2454 | 1 | 481 | | **12164** | 424 | 130 | 63 | 252 | | 120 | | **989** | **13153** | 19836 |
| **2020** | 4387 | 2420 | 1883 | 5 | 1797 | 1 | 649 | | **11141** | 398 | 253 | 53 | 64 | | 117 | | **885** | **12026** | 20526 |

**Table 5.2. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Nominal landings and catches (t) provided by the Working Group.**

| | Total landings | Total discards | Total catches | Agreed TAC (1) |
|---|---|---|---|---|
| **1984** | 16659 | 2169 | 18828 | |
| **1985** | 17865 | 1732 | 19597 | |
| **1986** | 18927 | 2321 | 21248 | |
| **1987** | 17114 | 1705 | 18819 | 16460 |
| **1988** | 17577 | 1725 | 19302 | 18100 |
| **1989** | 19233 | 2582 | 21815 | 18100 |
| **1990** | 14370 | 3284 | 17654 | 18100 |
| **1991** | 15094 | 3282 | 18376 | 18100 |
| **1992** | 15600 | 2988 | 18588 | 18100 |
| **1993** | 14929 | 3108 | 18037 | 21460 |
| **1994** | 13684 | 2700 | 16384 | 20330 |
| **1995** | 15862 | 3206 | 19068 | 22590 |
| **1996** | 15109 | 3026 | 18135 | 21200 |
| **1997** | 14230 | 3066 | 17296 | 25000 |
| **1998** | 14345 | 5371 | 19716 | 25000 |
| **1999** | 13305 | 3297 | 16601 | 20000 |
| **2000** | 15031 | 1870 | 16750 | 20000 |
| **2001** | 15778 | 2262 | 18040 | 16800 |
| **2002** | 15987 | 2813 | 18800 | 14900 |
| **2003** | 15711 | 4008 | 19719 | 16000 |
| **2004** | 14358 | 6243 | 20602 | 20200 |
| **2005** | 12888 | 3275 | 16163 | 21500 |
| **2006** | 12037 | 3751 | 15788 | 20425 |
| **2007** | 13060 | 3033 | 16092 | 20425 |
| **2008** | 11048 | 2860 | 13908 | 20425 |
| **2009** | 15064 | 3278 | 18342 | 20425 |
| **2010** | 15101 | 5343 | 20444 | 20106 |
| **2011** | 13226 | 4187 | 17413 | 20106 |
| **2012** | 14433 | 3704 | 18137 | 19101 |
| **2013** | 16025 | 4885 | 20910 | 19101 |
| **2014** | 13277 | 2569 | 15846 | 19101 |
| **2015** | 11569 | 1507 | 13076 | 19101 |
| **2016** | 11548 | 2445 | 13992 | 20056 |
| **2017** | 13784 | 2173 | 15957 | 15043 |
| **2018** | 12147 | 1738 | 13528 | 13528 |
| **2019** | 12164 | 989 | 13153 | 19836 |
| **2020** | 11141 | 885 | 12026 | 20526 |

(1) for both megrim species and VIIa included.

**Table 5.3. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Discards information and derivation.**

| | FR | SP | IR | UK |
|---|---|---|---|---|
| 1984 | **FR84-85** | - | - | - |
| 1985 | **FR84-85** | - | - | - |
| 1986 | (FR84-85) | (SP87) | - | - |
| 1987 | (FR84-85) | **SP87** | - | - |
| 1988 | (FR84-85) | **SP88** | - | - |
| 1989 | (FR84-85) | (SP88) | - | - |
| 1990 | (FR84-85) | (SP88) | - | - |
| 1991 | **FR91** | (SP94) | - | - |
| 1992 | (FR91) | (SP94) | - | - |
| 1993 | (FR91) | (SP94) | - | - |
| 1994 | (FR91) | **SP94** | - | - |
| 1995 | (FR91) | (SP94) | **IR** | - |
| 1996 | (FR91) | (SP94) | **IR** | - |
| 1997 | (FR91) | (SP94) | **IR** | - |
| 1998 | (FR91) | (SP94) | **IR** | - |
| 1999 | - | **SP99** | **IR** | - |
| 2000 | - | **SP00** | **IR** | **UK** |
| 2001 | - | **SP01** | **IR** | **UK** |
| 2002 | - | (SP01) | **IR** | **UK** |
| 2003 | - | **SP03** | **IR** | **UK** |
| 2004 | **FR04** | **SP04** | **IR** | **UK** |
| 2005 | **FR05** | **SP05** | **IR** | **UK** |
| 2006 | **FR06** | **SP06** | **IR** | **UK** |
| 2007 | **FR07** | **SP07** | **IR** | **UK** |
| 2008 | **FR08** | **SP08** | **IR** | **UK** |
| 2009 | **FR09** | **SP09** | **IR** | **UK** |
| 2010 | **FR10** | **SP10** | **IR** | **UK** |
| 2011 | **FR11** | **SP11 (*)** | **IR** | **UK** |
| 2012 | **FR12** | **SP12 (*)** | **IR** | **UK** |
| 2013 | **FR13** | **SP13 (*)** | **IR** | **UK** |
| 2014 | **FR14** | **SP14 (*)** | **IR** | **UK** |
| 2015 | **FR15** | **SP15 (*)** | **IR** | **UK** |
| 2016 | **FR16** | **SP16 (*)** | **IR** | **UK** |
| 2017 | **FR17** | **SP17 (*)** | **IR** | **UK** |
| 2018 | **FR18** | **SP18 (*)** | **IR** | **UK** |
| 2019 | **FR19** | **SP19 (*)** | **IR** | **UK** |
| 2020 | **FR20** | **SP20 (*)** | **IR** | **UK** |

**- In bold: years where discards sampling programs provided information**
- In (): years for which the length distribution of discards has been derived
**(*) Scientific estimates were provided**

**Table 5.4. Discard ratio in percentage (%) from catches in weight for the years 2008–2020.**

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % Discard | 21% | 18% | 26% | 24% | 20% | 24% | 16% | 12% | 17% | 14% | 13% | 8% | 7% |

**Table 5.5. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Length composition by fleet (thousands) in 2020.**

| | | NOT UPDATED |
|---|---|---|
| Length | FRANCE | SPAIN |
| class (cm) | OTT_DEF_>=70_0_0 (ICES 8a) | OTB_DEF_70-99_0_0 (ICES 7b-k) |
| 10 | 0 | |
| 11 | 0 | |
| 12 | 0 | |
| 13 | 0 | |
| 14 | 0 | |
| 15 | 0 | |
| 16 | 0 | |
| 17 | 0 | |
| 18 | 0 | |
| 19 | 0 | |
| 20 | 0 | 385 |
| 21 | 678 | 7486 |
| 22 | 0 | 26959 |
| 23 | 4344 | 80878 |
| 24 | 4044 | 179766 |
| 25 | 23964 | 414540 |
| 26 | 33004 | 485666 |
| 27 | 73252 | 436620 |
| 28 | 61274 | 374552 |
| 29 | 98820 | 275765 |
| 30 | 84940 | 248516 |
| 31 | 99424 | 153617 |
| 32 | 89542 | 128715 |
| 33 | 92867 | 92220 |
| 34 | 69387 | 72630 |
| 35 | 72153 | 57275 |
| 36 | 82423 | 49390 |
| 37 | 67838 | 37645 |
| 38 | 85301 | 31484 |
| 39 | 64327 | 21646 |
| 40 | 42177 | 22128 |
| 41 | 39542 | 14778 |
| 42 | 29775 | 13998 |
| 43 | 17480 | 9454 |
| 44 | 10093 | 8907 |
| 45 | 12392 | 13533 |
| 46 | 13000 | 8516 |
| 47 | 6509 | 5988 |
| 48 | 7462 | 5022 |
| 49 | 3850 | 5204 |
| 50 | 2009 | 4200 |
| 51 | 742 | 1583 |
| 52 | 650 | 1446 |
| 53 | 288 | 1307 |
| 54 | 144 | 75 |
| 55 | 0.00 | 0 |
| 56 | 0.00 | 173 |
| 57 | 0 | |
| 58 | 0 | |
| 59 | | |
| 60 | | |
| 61 | | |
| 62 | | |
| TOTAL | 1293693 | 3292067 |

**Table 5.6. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Abundance Indices for UK-WCGFS-D, UK-WCGFS-S, IGFS-WIBTS-Q4 (G7212) , SpPGFS-WIBTS-Q4 (G5768) and EVHOE-WIBTS-Q4 (G9527).**

| | | UK-WCGFS-D | | | | | | | Effort in hours | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Age | | | | | | | | |
| | Effort | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1987 | 100 | | 863 | 5758 | 0 | 0 | 0 | 95 | 1753 | 151 |
| 1988 | 100 | 8 | 256 | 59 | 49 | 0 | 228 | 1008 | 1262 | 632 |
| 1989 | 100 | | 70 | 188 | 471 | 2540 | 788 | 3067 | 680 | 1060 |
| 1990 | 100 | 8 | 526 | 1745 | 553 | 2584 | 1985 | 974 | 1154 | 974 |
| 1991 | 100 | | 415 | 1375 | 1250 | 989 | 912 | 1677 | 593 | 731 |
| 1992 | 100 | 7 | 28 | 425 | 414 | 349 | 189 | 206 | 132 | 121 |
| 1993 | 100 | | 122 | 382 | 1758 | 1505 | 728 | 739 | 666 | 718 |
| 1994 | 100 | | 69 | 1593 | 1542 | 2663 | 1325 | 1278 | 825 | 595 |
| 1995 | 100 | 47 | 582 | 747 | 1755 | 1686 | 1303 | 548 | 281 | 421 |
| 1996 | 100 | 15 | 69 | 475 | 549 | 1580 | 1231 | 870 | 327 | 117 |
| 1997 | 100 | | 329 | 751 | 1702 | 1518 | 541 | 149 | 47 | 17 |
| 1998 | 100 | | 120 | 797 | 1432 | 1134 | 866 | 242 | 246 | 13 |
| 1999 | 100 | | 237 | 270 | 734 | 760 | 302 | 94 | 33 | 17 |
| 2000 | 100 | | 143 | 1004 | 619 | 681 | 395 | 67 | 35 | 13 |
| 2001 | 100 | 20 | 384 | 690 | 1426 | 581 | 460 | 376 | 226 | 45 |
| 2002 | 100 | | 162 | 2680 | 1915 | 1349 | 761 | 690 | 315 | 104 |
| 2003 | 100 | | 330 | 1705 | 3149 | 2662 | 1451 | 676 | 417 | 179 |
| 2004 | 100 | 168 | 1001 | 1382 | 1069 | 897 | 628 | 208 | 47 | |
| | | UK-WCGFS-S | | | | | | | Effort in hours | |
| | | Age | | | | | | | | |
| | Effort | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1987 | 100 | | 499 | 3082 | 641 | 891 | 180 | 794 | 264 | 587 |
| 1988 | 100 | | 47 | 55 | 585 | 95 | 367 | 0 | 50 | 93 |
| 1989 | 100 | | 616 | 574 | 547 | 1540 | 576 | 361 | 297 | 198 |
| 1990 | 100 | | 375 | 1057 | 816 | 661 | 1220 | 195 | 454 | 176 |
| 1991 | 100 | 2 | 373 | 829 | 822 | 394 | 460 | 550 | 178 | 293 |
| 1992 | 100 | | 149 | 278 | 323 | 193 | 109 | 164 | 93 | 36 |
| 1993 | 100 | | 470 | 877 | 1140 | 601 | 327 | 321 | 143 | 233 |
| 1994 | 100 | | 74 | 1000 | 1301 | 998 | 521 | 374 | 185 | 153 |
| 1995 | 100 | 28 | 435 | 878 | 1167 | 1054 | 805 | 488 | 359 | 130 |
| 1996 | 100 | 2 | 64 | 401 | 389 | 823 | 592 | 372 | 152 | 43 |
| 1997 | 100 | 3 | 284 | 1028 | 550 | 540 | 289 | 202 | 75 | 29 |
| 1998 | 100 | 4 | 30 | 438 | 665 | 381 | 209 | 97 | 48 | 21 |
| 1999 | 100 | | 69 | 82 | 222 | 214 | 103 | 53 | 41 | 20 |
| 2000 | 100 | | 72 | 377 | 249 | 313 | 169 | 81 | 52 | 20 |
| 2001 | 100 | 2 | 131 | 297 | 594 | 104 | 145 | 122 | 80 | 37 |
| 2002 | 100 | | 134 | 808 | 506 | 757 | 339 | 326 | 181 | 82 |
| 2003 | 100 | 5 | 184 | 289 | 639 | 416 | 328 | 113 | 102 | 36 |
| 2004 | 100 | 50 | 343 | 467 | 270 | 394 | 303 | 124 | 49 | 21 |

| | | FR-EVHOE (NEW TIME SERIES PROVIDED IN WGBIE 2018) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Age | | | | | | | | |
| | Effort | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1997 | 100 | 0.64 | 1.37 | 0.96 | 1.16 | 1.70 | 1.57 | 1.32 | 0.79 | 0.56 |
| 1998 | 100 | 0.64 | 0.58 | 0.58 | 0.64 | 0.38 | 1.02 | 1.02 | 0.45 | 0.19 |
| 1999 | 100 | 1.18 | 3.04 | 0.79 | 2.20 | 4.02 | 2.92 | 1.46 | 1.20 | 1.52 |
| 2000 | 100 | 0.96 | 1.31 | 2.26 | 1.06 | 1.09 | 1.12 | 0.99 | 1.14 | 0.71 |
| 2001 | 100 | 1.03 | 1.68 | 0.76 | 0.67 | 0.97 | 1.57 | 2.58 | 1.36 | 1.12 |
| 2002 | 100 | 1.42 | 0.58 | 1.35 | 1.10 | 2.01 | 0.95 | 1.94 | 1.07 | 0.55 |
| 2003 | 100 | 1.26 | 1.15 | 0.82 | 1.37 | 0.96 | 1.94 | 0.88 | 0.80 | 0.71 |
| 2004 | 100 | 0.40 | 1.73 | 1.02 | 0.88 | 1.47 | 1.13 | 1.05 | 1.39 | 0.99 |
| 2005 | 100 | 0.62 | 0.91 | 2.41 | 0.83 | 0.76 | 1.11 | 1.16 | 0.56 | 0.87 |
| 2006 | 100 | 0.83 | 0.62 | 0.95 | 1.86 | 0.82 | 1.10 | 1.69 | 0.75 | 0.84 |
| 2007 | 100 | 1.91 | 1.71 | 1.12 | 0.64 | 1.26 | 1.42 | 1.75 | 1.23 | 1.15 |
| 2008 | 100 | 0.53 | 3.18 | 4.01 | 2.13 | 1.49 | 1.92 | 1.73 | 0.57 | 0.26 |
| 2009 | 100 | 2.04 | 2.12 | 5.41 | 1.67 | 1.16 | 1.17 | 0.49 | 0.20 | |
| 2010 | 100 | 2.01 | 1.68 | 1.74 | 4.08 | 1.92 | 1.16 | 1.11 | 1.38 | 2.15 |
| 2011 | 100 | | 2.73 | 2.81 | 3.11 | 2.37 | 2.70 | 1.07 | 0.45 | 1.01 |
| 2012 | 100 | 0.78 | 0.72 | 1.36 | 0.72 | 0.96 | 0.80 | 1.25 | 1.14 | 0.70 |
| 2013 | 100 | 1.72 | 1.91 | 2.82 | 3.89 | 0.96 | 2.15 | 2.60 | 0.35 | 0.90 |
| 2014 | 100 | 0.45 | 3.31 | 2.16 | 4.05 | 2.54 | 2.46 | 0.93 | 0.38 | |
| 2015 | 100 | 1.57 | 1.77 | 4.41 | 3.06 | 2.76 | 1.93 | 0.72 | 0.26 | 0.26 |
| 2016 | 100 | 0.80 | 2.26 | 1.90 | 2.31 | 1.84 | 3.09 | 1.13 | 2.72 | 0.74 |
| 2017 | No updated data | | | | | | | | | |
| 2018 | | 1.68 | 1.60 | 1.84 | 3.48 | 2.96 | 2.31 | 0.98 | 0.73 | 0.32 |
| 2019 | | 1.69 | 3.30 | 6.97 | 5.22 | 3.86 | 2.41 | 1.97 | 0.63 | 0.32 |
| 2020 | | 0.97 | 2.59 | 3.18 | 2.95 | 2.76 | 2.41 | 2.20 | 1.48 | 0.75 |

| | | IGFS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Age | | | | | | | | | |
| | Effort | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2003 | 100 | 0 | 152 | 316 | 368 | 238 | 96 | 36 | 14 | 5 | 2 |
| 2004 | 100 | 0 | 153 | 461 | 595 | 454 | 162 | 57 | 30 | 12 | 3 |
| 2005 | 100 | 29 | 414 | 643 | 431 | 370 | 215 | 68 | 44 | 18 | 17 |
| 2006 | 100 | 44 | 505 | 548 | 481 | 215 | 154 | 68 | 10 | 7 | 5 |
| 2007 | 100 | 1 | 100 | 293 | 125 | 91 | 70 | 25 | 7 | 7 | 3 |
| 2008 | 100 | 5 | 140 | 481 | 349 | 101 | 66 | 60 | 17 | 12 | 5 |
| 2009 | 100 | 3 | 1 | 234 | 371 | 455 | 346 | 159 | 53 | 44 | 23 |
| 2010 | 100 | 6 | 1 | 128 | 377 | 259 | 173 | 90 | 38 | 13 | 10 |
| 2011 | 100 | 5 | 2 | 121 | 333 | 331 | 144 | 69 | 40 | 25 | 30 |
| 2012 | 100 | 4 | 24 | 141 | 140 | 108 | 52 | 36 | 16 | 9 | 33 |
| 2013 | 100 | 9 | 31 | 132 | 93 | 83 | 58 | 30 | 10 | 8 | 22 |
| 2014 | 100 | 40 | 62 | 143 | 106 | 56 | 57 | 52 | 22 | 23 | 17 |
| 2015 | 100 | 26 | 127 | 149 | 154 | 57 | 44 | 30 | 16 | 10 | 7 |
| 2016 | 100 | 28 | 211 | 370 | 207 | 108 | 83 | 75 | 37 | 27 | 39 |
| 2017 | 100 | 13 | 201 | 310 | 142 | 61 | 36 | 23 | 12 | 18 | 27 |
| 2018 | 100 | 19 | 251 | 559 | 266 | 77 | 32 | 20 | 22 | 17 | 29 |
| 2019 | 100 | 25 | 317 | 486 | 349 | 96 | 46 | 17 | 16 | 10 | 34 |
| 2020 | 100 | 1 | 278 | 463 | 334 | 68 | 29 | 9 | 6 | 4 | 22 |
| | | | | | | | | | | | |
| | NEW | SP-PGFS | | | | | | | | | |
| | | Age | | | | | | | | | |
| | Effort | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7+ | | |
| 2001 | 100 | 43 | 1770 | 2208 | 2842 | 3434 | 1941 | 1357 | 740 | | |
| 2002 | 100 | 6 | 1069 | 2502 | 3168 | 3997 | 2237 | 1107 | 515 | | |
| 2003 | 100 | 11 | 1081 | 2913 | 4105 | 5262 | 2789 | 1284 | 636 | | |
| 2004 | 100 | 7 | 719 | 3457 | 5498 | 5569 | 3071 | 1125 | 828 | | |
| 2005 | 100 | 77 | 633 | 626 | 2279 | 8249 | 4959 | 2605 | 688 | | |
| 2006 | 100 | 5 | 1776 | 1443 | 3275 | 4719 | 3312 | 901 | 383 | | |
| 2007 | 100 | 30 | 4856 | 6990 | 3556 | 3622 | 1814 | 852 | 399 | | |
| 2008 | 100 | 14 | 260 | 2219 | 5406 | 4010 | 1807 | 1219 | 428 | | |
| 2009 | 100 | 6 | 534 | 661 | 5320 | 7097 | 1635 | 877 | 606 | | |
| 2010 | 100 | 39 | 318 | 2158 | 2557 | 6723 | 2313 | 494 | 476 | | |
| 2011 | 100 | 37 | 393 | 1174 | 2510 | 3940 | 5141 | 1452 | 626 | | |
| 2012 | 100 | 5 | 157 | 692 | 3759 | 2862 | 3207 | 2926 | 1902 | | |
| 2013 | 100 | 6 | 1473 | 1184 | 1174 | 1619 | 3703 | 2657 | 2579 | | |
| 2014 | 100 | 39 | 243 | 3174 | 1001 | 2286 | 4400 | 3409 | 2198 | | |
| 2015 | 100 | 23 | 2220 | 2188 | 4056 | 2078 | 1847 | 2099 | 1830 | | |
| 2016 | 100 | 15 | 1104 | 6137 | 3263 | 4137 | 2248 | 2176 | 1712 | | |
| 2017 | 100 | 10 | 1869 | 5166 | 3608 | 2563 | 3122 | 1650 | 1079 | | |
| 2018 | 100 | 5 | 826 | 5347 | 7702 | 2762 | 1766 | 869 | 988 | | |
| 2019 | 100 | 12 | 939 | 4392 | 5543 | 3262 | 3292 | 1880 | 565 | | |
| 2020 | 100 | 6 | 224 | 2957 | 5074 | 4227 | 2783 | 2068 | 444 | | |

**Table 5.6. (cont). Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, 8.d. Abundance Indices by kilograms and numbers per 30 minutes haul duration IGFS-WIBTS-Q4 (G7212) , SpPGFS-WIBTS-Q4 (G5768) and EVHOE-WIBTS-Q4 (G9527).**

**FR-EVHOEFS Abundance Indices by kilograms and numbers by 30 minutes haul duration**

| | kg/30' | Nb/30' | |
|---|---|---|---|
| **1997** | 1.93 | 12.03 | |
| **1998** | 2.12 | 13.52 | |
| **1999** | 1.82 | 13.41 | |
| **2000** | 1.45 | 11.69 | |
| **2001** | 2.19 | 17.03 | |
| **2002** | 2.04 | 16.95 | |
| **2003** | 1.79 | 12.81 | |
| **2004** | 1.50 | 10.67 | |
| **2005** | 1.45 | 9.94 | |
| **2006** | 1.69 | 15.59 | |
| **2007** | 1.97 | 14.68 | |
| **2008** | 2.05 | 13.66 | |
| **2009** | 2.49 | 14.68 | |
| **2010** | 2.57 | 15.53 | |
| **2011** | 3.22 | 17.13 | |
| **2012** | 2.93 | 17.71 | |
| **2013** | 2.89 | 14.69 | |
| **2014** | 2.07 | 13.16 | |
| **2015** | 2.51 | 13.82 | |
| **2016** | 2.63 | 14.91 | |
| **2017** | | | NO updated information |
| **2018** | 2.67 | 17.00 | |
| **2019** | 3.62 | 23.67 | |
| **2020** | 3.18 | 26.20 | |

**SP-PGFS Abundance Indices by kilograms and numbers by 30 minutes haul duration**

| | OLD | SP-PGFS | | NEW | SP-PGFS | |
|---|---|---|---|---|---|---|
| | kg/30' | Nb/30' | | AÑO | kg/30' | Nb/30' |
| **2001** | 6.80 | 143.34 | | **2001** | 6.80 | 143.34 |
| **2002** | 6.66 | 147.00 | | **2002** | 6.66 | 146.00 |
| **2003** | 8.15 | 180.79 | | **2003** | 8.16 | 180.81 |
| **2004** | 7.45 | 167.47 | | **2004** | 9.01 | 202.72 |
| **2005** | 8.28 | 170.17 | | **2005** | 9.81 | 201.19 |
| **2006** | 6.03 | 125.37 | | **2006** | 7.64 | 158.14 |
| **2007** | 7.31 | 177.38 | | **2007** | 9.15 | 221.18 |
| **2008** | 5.99 | 109.70 | | **2008** | 8.46 | 153.61 |
| **2009** | 8.11 | 113.68 | | **2009** | 11.79 | 165.49 |
| **2010** | 8.52 | 112.56 | | **2010** | 11.47 | 150.76 |
| **2011** | 9.82 | 126.60 | | **2011** | 11.89 | 152.72 |
| **2012** | 10.82 | 130.21 | | **2012** | 13.03 | 155.08 |
| **2013** | 12.82 | 124.92 | | **2013** | 12.82 | 143.96 |
| | | | | **2014** | 15.78 | 166.68 |
| | | | | **2015** | 13.07 | 163.42 |
| | | | | **2016** | 14.77 | 207.93 |
| | | | | **2017** | 14.11 | 190.65 |
| | | | | **2018** | 11.15 | 202.65 |
| | | | | **2019** | 13.64 | 205.12 |
| | | | | **2020** | 12.63 | 181.00 |

**IGFS Abundance Indices by numbers by 10 square kilometers**

| | |
|---|---|
| **2003** | 1227 |
| **2004** | 1926 |
| **2005** | 2254 |
| **2006** | 2039 |
| **2007** | 725 |
| **2008** | 1238 |
| **2009** | 1724 |
| **2010** | 1103 |
| **2011** | 1116 |
| **2012** | 583 |
| **2013** | 497 |
| **2014** | 593 |
| **2015** | 629 |
| **2016** | 1224 |
| **2017** | 864 |
| **2018** | 1311 |
| **2019** | 1406 |
| **2020** | 1225 |

**Table 5.7. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. French and Spanish cpues for the different bottom-trawl fleets.**

| | French (single and twin bottom trawls combined) CPUE (kg/h) | | | | Spanish CPUE (kg/(100day*100 hp)) | | | Irish LPUE ('000 h) |
|---|---|---|---|---|---|---|---|---|
| | Benthic Bay of Biscay | Benthic Western Approaches | Gadoids Western Approaches | Nephrops Western Approaches | A Coruña -VII | Cantábrico- VII | Vigo-VII | Otter trawlers |
| 1984 | | | | | 16.3 | 130.1 | 99.1 | - |
| 1985 | 3.0 | 5.3 | 4.7 | 4.7 | 9.8 | 39.5 | 108.9 | - |
| 1986 | 3.2 | 4.8 | 2.8 | 4.4 | 21.1 | 52.8 | 105.1 | - |
| 1987 | 3.3 | 5.1 | 2.7 | 4.5 | 8.3 | 80.7 | 96.2 | - |
| 1988 | 3.8 | 5.8 | 3.0 | 4.1 | 9.8 | 78.3 | 106.1 | - |
| 1989 | 3.6 | 5.5 | 2.6 | 4.2 | 14.6 | 48.1 | 92.1 | - |
| 1990 | 3.1 | 4.2 | 1.8 | 3.4 | 15.1 | 18.4 | 73.8 | - |
| 1991 | 2.6 | 4.0 | 1.3 | 2.8 | 12.9 | 25.9 | 85.4 | - |
| 1992 | 2.5 | 4.5 | 1.5 | 3.4 | 6.9 | 32.8 | 105.6 | - |
| 1993 | 1.9 | 4.6 | 1.2 | 3.5 | 5.1 | 33.5 | 92.3 | - |
| 1994 | 1.9 | 4.2 | 1.2 | 3.4 | 7.4 | 52.7 | 78.7 | - |
| 1995 | 2.3 | 4.9 | 1.4 | 3.4 | 7.8 | 61.3 | 94.3 | 13.7 |
| 1996 | 2.6 | 5.0 | 1.4 | 3.5 | 3.9 | 58.4 | 79.3 | 13.6 |
| 1997 | 3.3 | 5.6 | 1.2 | 3.0 | 3.0 | 46.9 | 96.0 | 12.1 |
| 1998 | 2.9 | 6.5 | 1.5 | 3.6 | 2.4 | 35.7 | 82.4 | 10.0 |
| 1999 | 3.0 | 6.3 | 0.9 | 3.4 | 1.1 | 32.5 | 137.0 | 11.3 |
| 2000 | 2.9 | 6.8 | 0.6 | 4.0 | 5.5 | 45.0 | 128.9 | 13.4 |
| 2001 | 2.2 | 6.8 | 0.7 | 4.1 | 1.3 | 75.6 | 131.2 | 13.1 |
| 2002 | 2.1 | 6.8 | 0.5 | 3.2 | 1.3 | 76.4 | 185.3 | 12.2 |
| 2003 | 1.8 | 5.8 | 0.6 | 3.2 | 11.2 | 54.0 | 192.1 | 8.2 |
| 2004 | 1.8 | 4.6 | 0.5 | 3.4 | 3.3 | 60.0 | 211.0 | 9.3 |
| 2005 | 1.9 | 5.1 | 0.4 | 4.2 | 1.7 | 58.46 | 135.3 | 10.0 |
| 2006 | 2.5 | 4.8 | 0.3 | 3.6 | 1.4 | 76.42 | 146.1 | 7.5 |
| 2007 | 2.4 | 5.1 | 0.4 | 2.9 | 2.4 | 87.86 | 144.3 | 8.5 |
| 2008 | 2.2 | 4.6 | 0.5 | 3.1 | 3.0 | 37.58 | 114.0 | 8.4 |
| 2009 | NA | NA | NA | NA | 8.3 | 0.00 | 173.2 | 10.3 |
| 2010 | NA | NA | NA | NA | 7.9 | 38.78 | 198.3 | 11.8 |
| 2011 | NA | NA | NA | NA | 19.7 | 0.0 | 151.2 | 13.5 |
| 2012 | NA | NA | NA | NA | 6.4 | 0.0 | 135.3 | 19.3 |
| 2013 | NA | NA | NA | NA | 10.0 | 0.0 | 210.2 | 19.4 |
| 2014 | NA | NA | NA | NA | 3.4 | 0.0 | 116.7 | 15.3 |
| 2015 | NA | NA | NA | NA | 4.5 | 0.0 | 89.7 | 17.9 |
| 2016 | NA | NA | NA | NA | 3.3 | 0.0 | 96.6 | 17.8 |
| 2017 | NA | NA | NA | NA | 2.6 | 0.0 | 85.5 | 16.1 |
| 2018 | NA | NA | NA | NA | 1.7 | 0.0 | 65.5 | 13.7 |
| 2019 | NA | NA | NA | NA | 2.4 | 0.0 | 78.2 | 15.9 |
| 2020 | NA | NA | NA | NA | NA | 0.0 | NA | 16.0 |

(*) LPUEs, no discards available

**Table 5.8. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. IBP 2016 Prior distributions of the final run.**

$LN(\mu,\psi)$ **denotes the lognormal distribution with median** $\mu$ **and coefficient of variation** $\psi$**, and** $\Gamma(u,v)$ **denotes the Gamma distribution with mean** $u/v$ **and variance** $u/v^2$**.**

| Parameter and prior distribution | Values used in prior settings |
|---|---|
| $N(y,1) \sim LN(medrec,2)$ | $medrec = 250000$ |
| $N(1984,a) \sim LN(medrec$ $\exp[-(a-1)M - \sum_{j=1}^{a-1} medF(j)],2), a = 2,...,9$ | $medrec$ as above, $M = 0.2$, $medF = (0.05,0.1,0.3,0.3,0.3,0.3,0.3,0.3,($ |
| $N(1984,10+) \sim LN(medrec \exp[-9M -$ $\sum_{j=1}^{9} medF(j)]/\{1-\exp[-M-medF(9)]\},2)$ | $medrec, M, medrecF$ as above |
| $f(y) \sim LN(med_f, CV_f)$ | $med_f = 0.3, CV_f = 1$ |
| $\rho \sim Uniform\ (0,1)$ | |
| | |
| $r_L(1984,a) \sim LN(medr_L(a),1), a = 1,...,8$ | $medr_L = (0.0005,0.05,1,1,1,1,1,1)$ |
| $r_L(y,9) = r_L(y,10+) = 1$ | |
| | |
| $r_{SPD}(1984,a) \sim LN(medr_{SPD}(a),1), a = 1,..$ | $medr_{SPD} = (0.002,0.02,0.02,0.02,$ $0.01,0.01,0.01)$ |
| $r_{IRD}(1984,a) \sim LN(medr_{IRD}(a),1), a = 1,..$ | $medr_{IRD} = (0.001,0.01,0.01,0.01,$ $0.005,0.005,0.005,0.001)$ |
| $r_{UKD}(1984,a) \sim LN(medr_{UKD}(a),1), a = 1,.$ | $medr_{UKD} = (0.00001,0.001,0.001,0.001,$ $0.001,0.001,0.001,0.001)$ |
| $r_{FRD}(1984,a) \sim LN(medr_{FRD}(a),1), a = 1,$ | $medr_{FRD} = (0.002,0.02,0.02,0.02,$ $0.01,0.01,0.01,0.01)$ |
| $r_{OTD}(1984,a) \sim LN(medr_{OTD}(a),1), a = 1,..$ | $medr_{OTD} = (0.002,0.02,0.02,0.02,$ $0.01,0.01,0.01,0.002)$ |
| $r_{SPD}(y,7) = r_{SPD}(y,a) = r_{IRD}(y,a)$ $= r_{UKD}(y,a) = r_{FRD}(y,a) = r_{OTD}(y,a) = 0,\ a = 8,9,10+$ | |
| $\tau_C(a), \tau_L(a), a = 1,2,3; \tau_D(a), a = 1,...,8$ | $\Gamma(4,0.345)$ |
| $\tau_C(a), \tau_L(a), a = 4,...,10+$ | $\Gamma(10,0.1)$ |
| $\tau_{SPD}(a), a = 1,...,7; \tau_{IRD}(a), \tau_{UKD}(a), \tau_{FRD}(a) a = 1,...,8$ | $\Gamma(4,0.345)$ |
| $\log[q_k(a)] \sim N(\mu_{Ik}, \tau_{Ik}), a \le 8,$ index $k = 1,...,5$ | $\mu_{Ik} = -7,\ \tau_{Ik} = 0.2$ |
| $q_k(a) = q_k(8), a > 8$, indices $k$ with ages > | |
| $\tau_k(a)$, index $k = 1,...,5$ | $\Gamma(4,0.345)$ |

**Table 5.9. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Catch forecast: management option table.**

| Short term forecast table | | | F UNSCALED | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model: NMEG0-R1 | | | R 2021-2022 REPLACED | | | | | | | |
| Projection: 3 | | | | | | | | | | |
| | | | | | | | | | | |
| Quantile | Rec_2021 | SSB_2021 | TSB_2021 | Fbar_2021 | Catch_2021 | Land_2021 | Disc_2021 | Rec_2022 | SSB_2022 | TSB_2022 |
| 5% | 216068 | 108523 | 154524 | 0.17 | 18672 | 16063 | 2374 | 216068 | 115984 | 159410 |
| 50% | 221690 | 126311 | 177349 | 0.19 | 20682 | 17806 | 2860 | 221690 | 136377 | 181799 |
| 95% | 227698 | 145747 | 202755 | 0.21 | 23128 | 19874 | 3560 | 227698 | 159408 | 206530 |
| | | | | | | | | | | |
| Table for quantile: 0.5 | | | | | | | | | | |
| | | | | | | | | | | |
| Fmult | F_2022 | Catch_2022 | Land_2022 | Disc_2022 | Rec_2023 | SSB_2023 | TSB_2023 | | | |
| 0 | 0 | 0 | 0 | 0 | 221690 | 162887 | 207283 | | | |
| 0.1 | 0.019 | 2461 | 2162 | 296 | 221690 | 160273 | 204534 | | | |
| 0.2 | 0.038 | 4878 | 4284 | 587 | 221690 | 157758 | 201928 | | | |
| 0.3 | 0.056 | 7249 | 6364 | 875 | 221690 | 155252 | 199338 | | | |
| 0.4 | 0.075 | 9576 | 8404 | 1158 | 221690 | 152819 | 196782 | | | |
| 0.5 | 0.094 | 11860 | 10408 | 1437 | 221690 | 150422 | 194250 | | | |
| 0.6 | 0.113 | 14100 | 12380 | 1712 | 221690 | 147963 | 191775 | | | |
| 0.7 | 0.131 | 16299 | 14306 | 1983 | 221690 | 145660 | 189357 | | | |
| 0.8 | 0.15 | 18456 | 16197 | 2251 | 221690 | 143360 | 187003 | | | |
| 0.9 | 0.169 | 20570 | 18047 | 2515 | 221690 | 141092 | 184663 | | | |
| 1 | 0.188 | 22656 | 19871 | 2774 | 221690 | 138843 | 182356 | | | |
| 1.1 | 0.207 | 24692 | 21659 | 3030 | 221690 | 136674 | 180051 | | | |
| 1.2 | 0.225 | 26702 | 23416 | 3282 | 221690 | 134511 | 177863 | | | |
| 1.3 | 0.244 | 28677 | 25138 | 3530 | 221690 | 132386 | 175683 | | | |
| 1.4 | 0.263 | 30620 | 26826 | 3774 | 221690 | 130361 | 173559 | | | |
| 1.5 | 0.282 | 32516 | 28487 | 4017 | 221690 | 128408 | 171536 | | | |
| 1.6 | 0.3 | 34383 | 30115 | 4256 | 221690 | 126443 | 169544 | | | |
| 1.7 | 0.319 | 36217 | 31709 | 4491 | 221690 | 124529 | 167545 | | | |
| 1.8 | 0.338 | 38025 | 33288 | 4723 | 221690 | 122648 | 165571 | | | |
| 1.9 | 0.357 | 39792 | 34829 | 4951 | 221690 | 120805 | 163680 | | | |
| 2 | 0.376 | 41527 | 36352 | 5175 | 221690 | 118989 | 161803 | | | |

**Table 5.10. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Reference points table updated in WGBIE 2021.**

| From the IBP megrim (ICES, 2016): | Type | Value | Technical Basis |
|---|---|---|---|
| MSY approach | MSY $B_{trigger}$ | 41 800 | $B_{pa}$, because the fishery has not been at $F_{MSY}$ in the last 10 years |
| | $F_{MSY}$ | 0.191 | F giving maximum yield at equilibrium Computed using Eqsim. |
| | $F_{MSY}$ ranges | 0.122–0.289 | Stochastic simulations, 5% reduction in long-term yield compared with MSY. |
| Precautionary approach | $B_{lim}$ | 37 100 | $B_{loss,}$ which is the lowest biomass observed corresponding to year 2006 |
| | $B_{pa}$ | 41 800 | $\mathbf{B_{lim}}e^{1.645\,\sigma}$<br>where $\boldsymbol{\sigma = 0.07}$isthe standard deviation of the logarithm of SSB in 2014 |
| | $F_{lim}$ | 0.533 | It is the F that gives 50% probability of SSB being above $B_{lim}$ in the long-term. It is computed using Eqsim based on segmented regression with the breakpoint fixed at $B_{lim}$, without advice/assessment error and without $B_{trigger}$ |
| | $F_{pa}$ | 0.417 | $F_{p0.5}$: The F that provides a 95% probability for SSB to be above $B_{lim}$<br>$F_{p0.5}$ (5% risk to $B_{lim}$ with $B_{trigger}$=$B_{pa}$). |

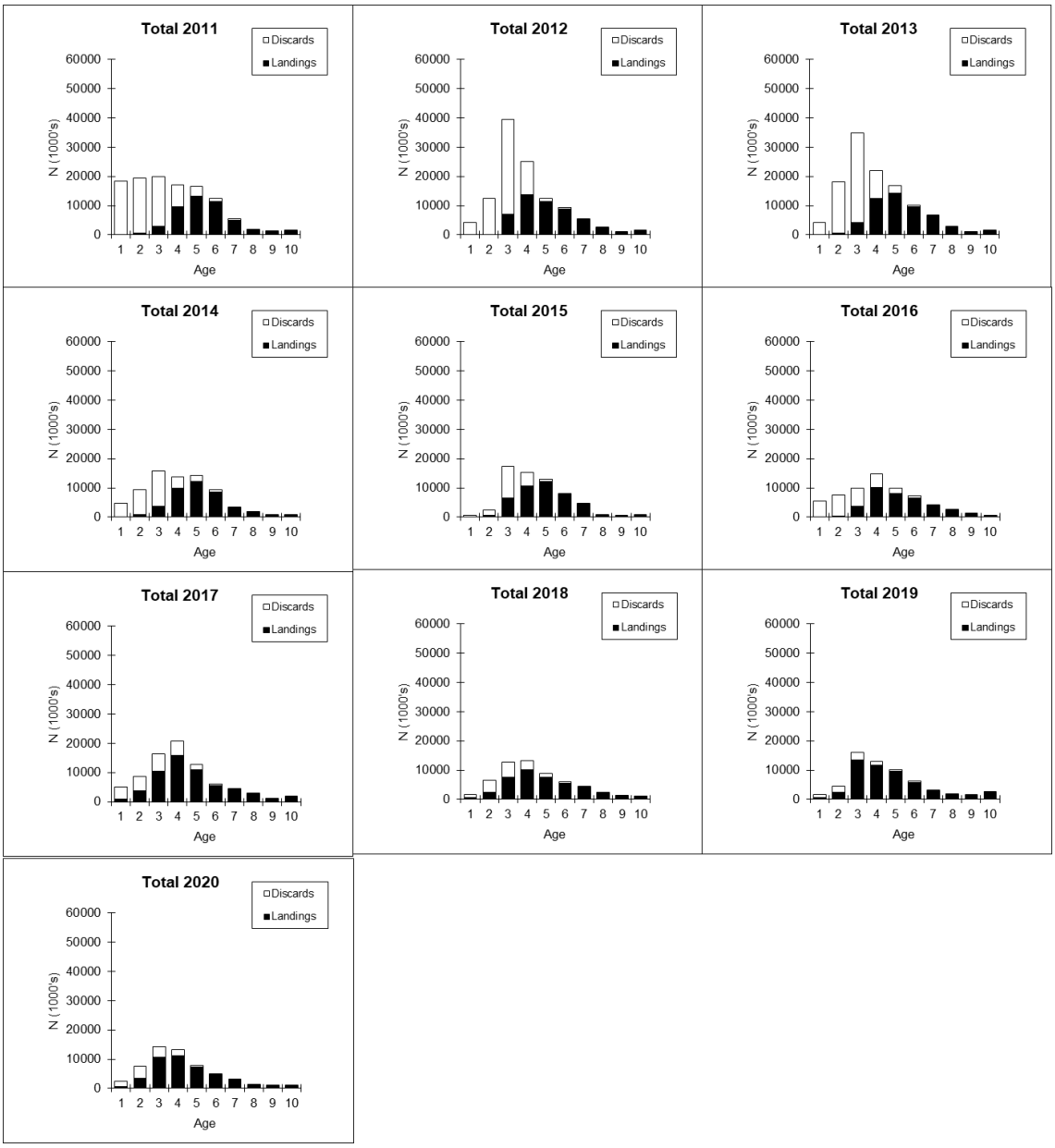


**Figure 5.1. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Age composition of catches for the years 2011–2020.**

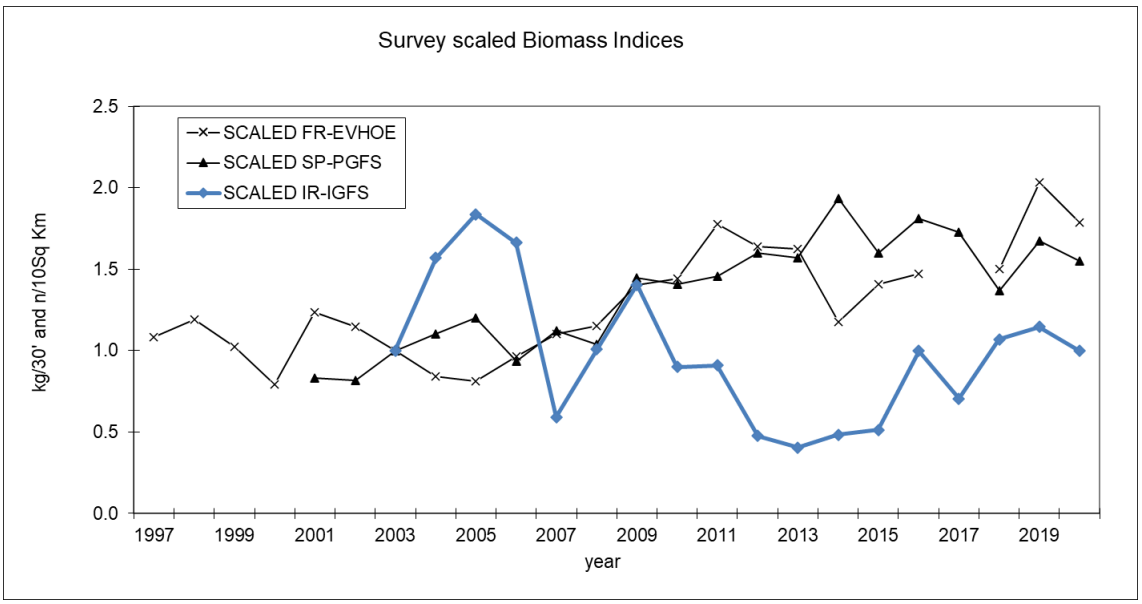


**Figure 5.2. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Scaled Biomass Indices for IGFS-WIBTS-Q4 (G7212), SpPGFS-WIBTS-Q4 (G5768) and EVHOE-WIBTS-Q4 (G9527).**

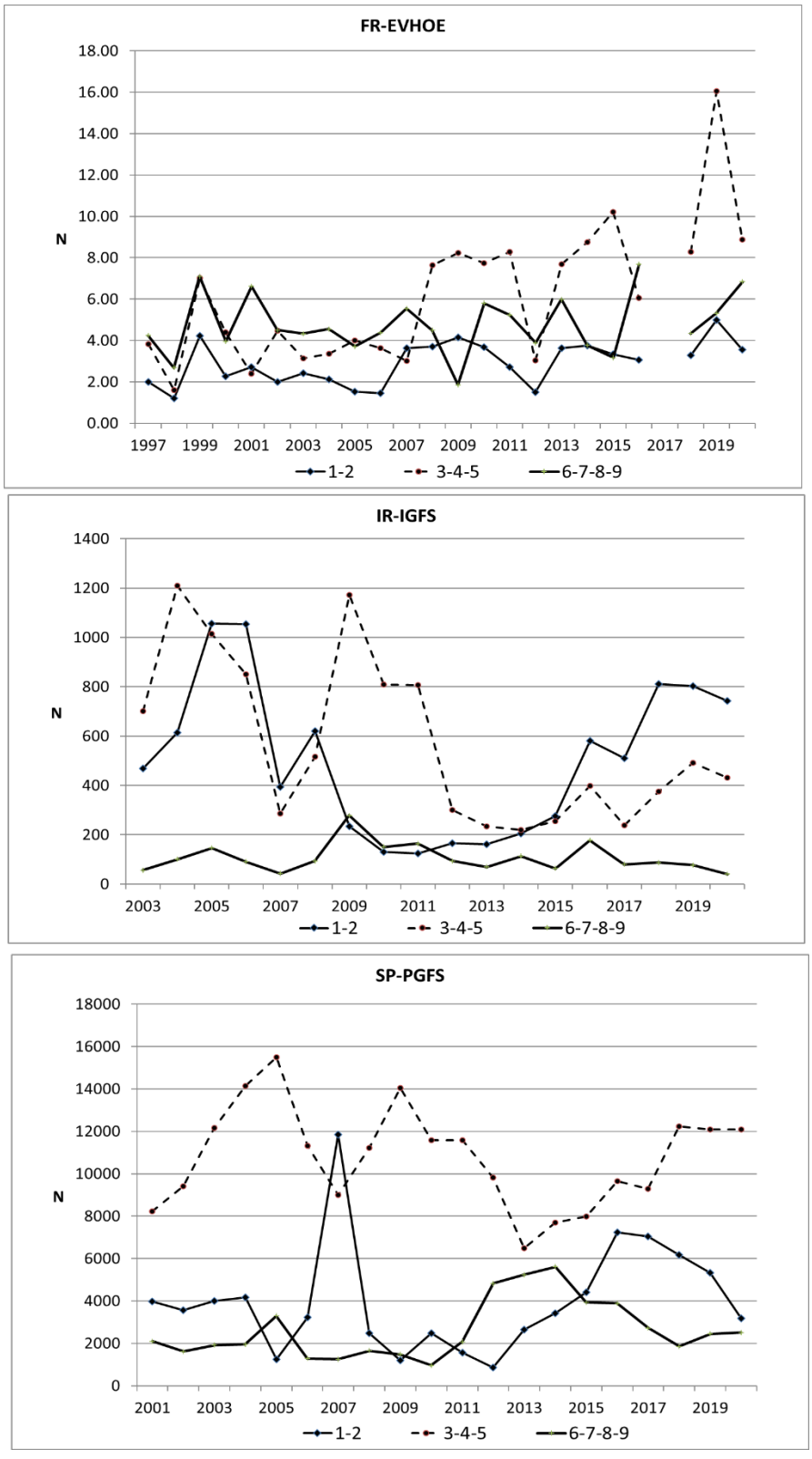


**Figure 5.3. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Abundance Indices for IGFS-WIBTS-Q4 (G7212), SpPGFS-WIBTS-Q4 (G5768) and EVHOE-WIBTS-Q4 (G9527) by ages grouped: i) 1+2; ii) 3+4+5 and iii) 6+7+8+9+10+.**

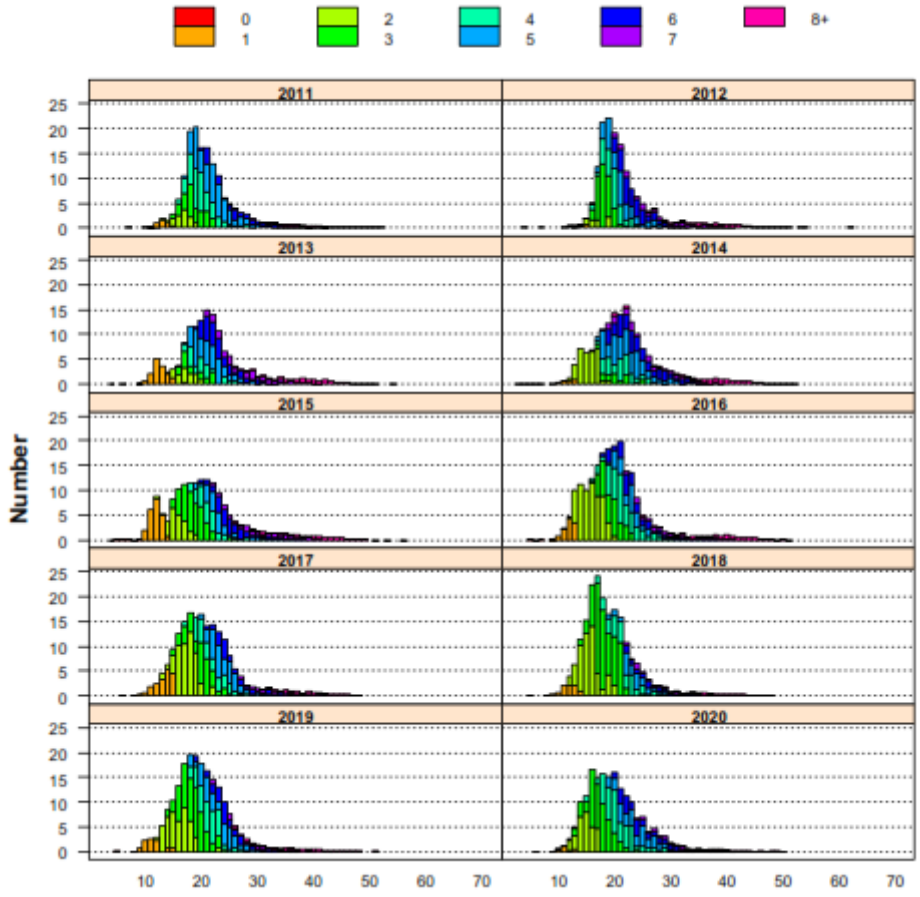


**Figure 5.4. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Age composition of SpPGFS-WIBTS-Q4 (G5768) survey in abundance (numbers).**

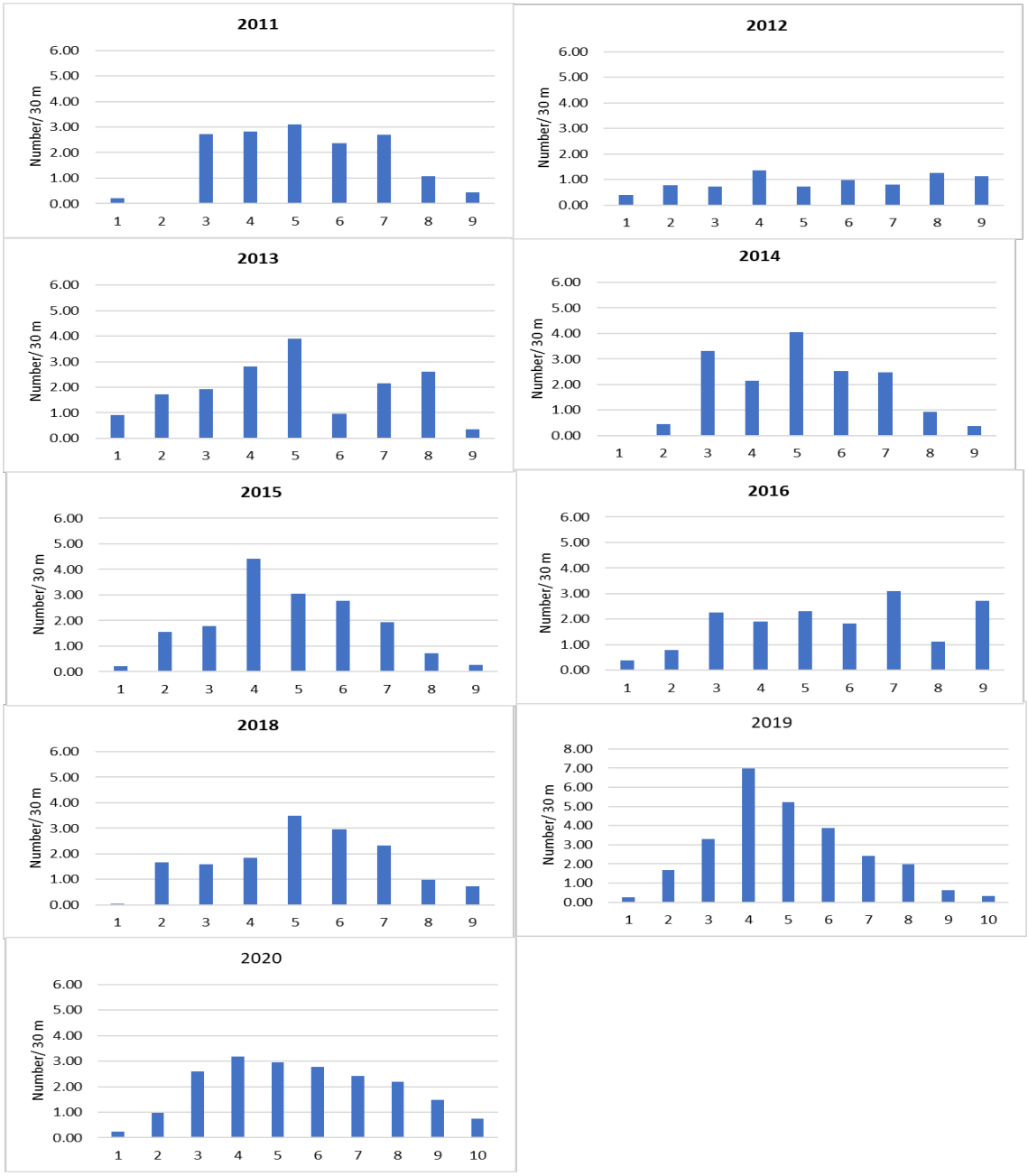


**Figure 5.5. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Age composition of EVHOE-WIBTS-Q4 (G9527) survey in abundance (numbers/30min haul).**

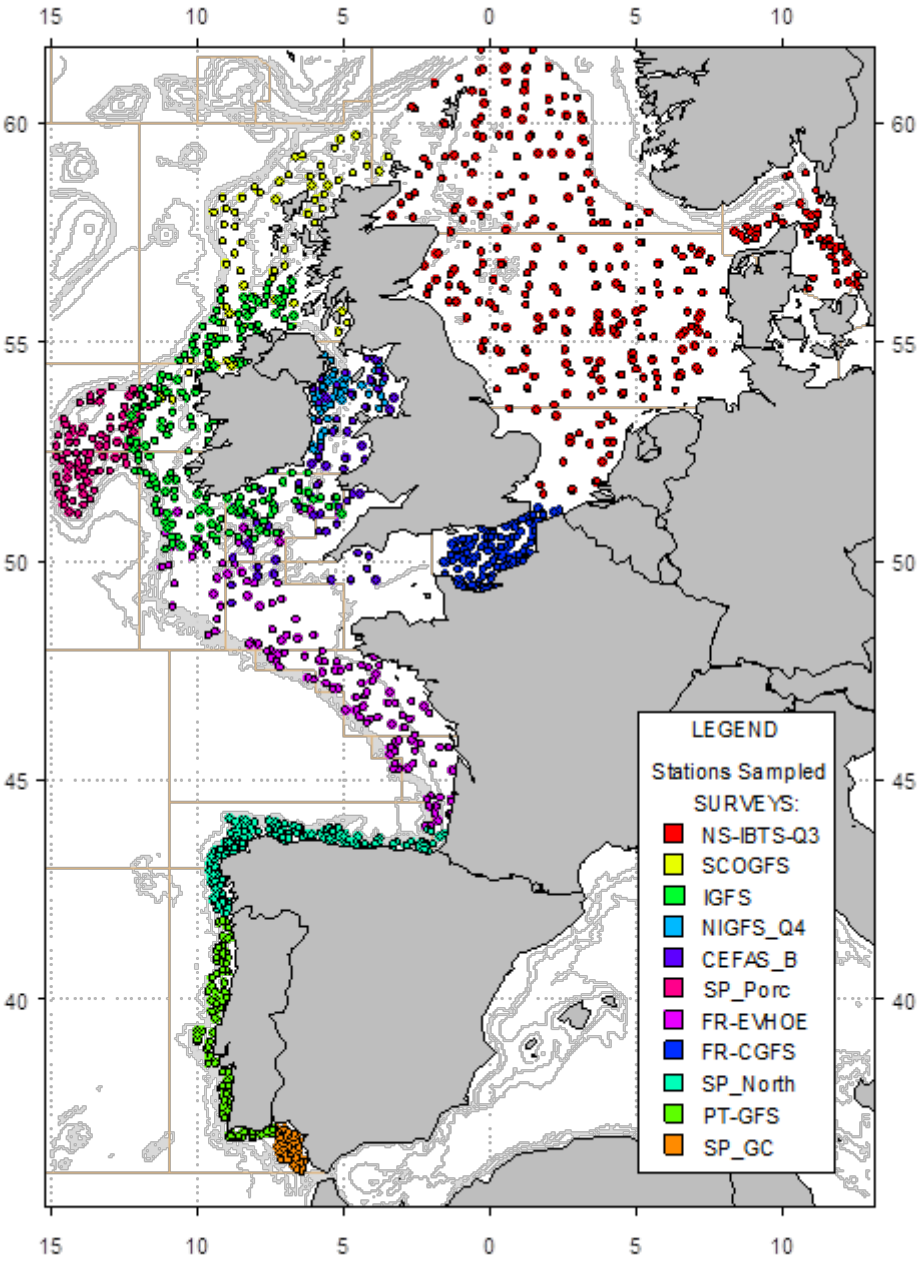


**Figure 5.6. Station positions for the IBTS Surveys carried out in the Western Atlantic and North Sea area in autumn/winter of 2008. (From IBTSWG Report, ICES 2009). Just to be used as general location of the surveys.**

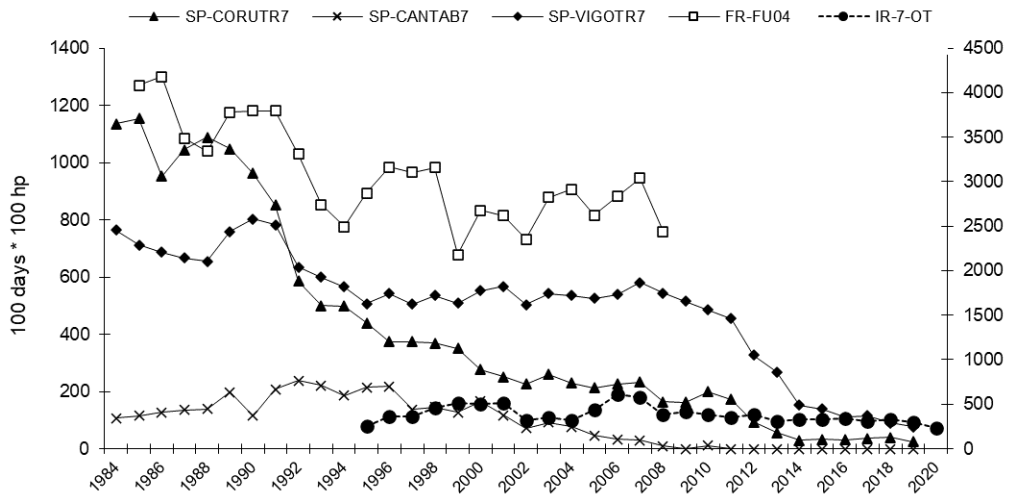


**Figure 5.7. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Evolution of effort for different bottom-trawler fleets.**

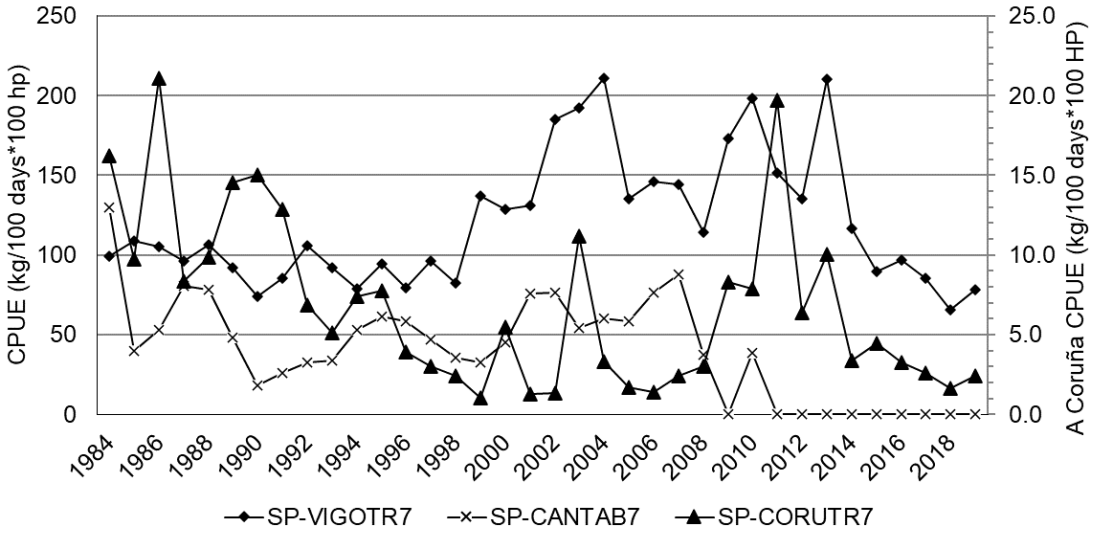


**Figure 5.8. Megrim *(L. whiffiagonis*) in divisions 7.b, 7.c, 7.e–k and 8.a, 8.b, and 8.d. Spanish cpue for different bottom-trawler fleets.**

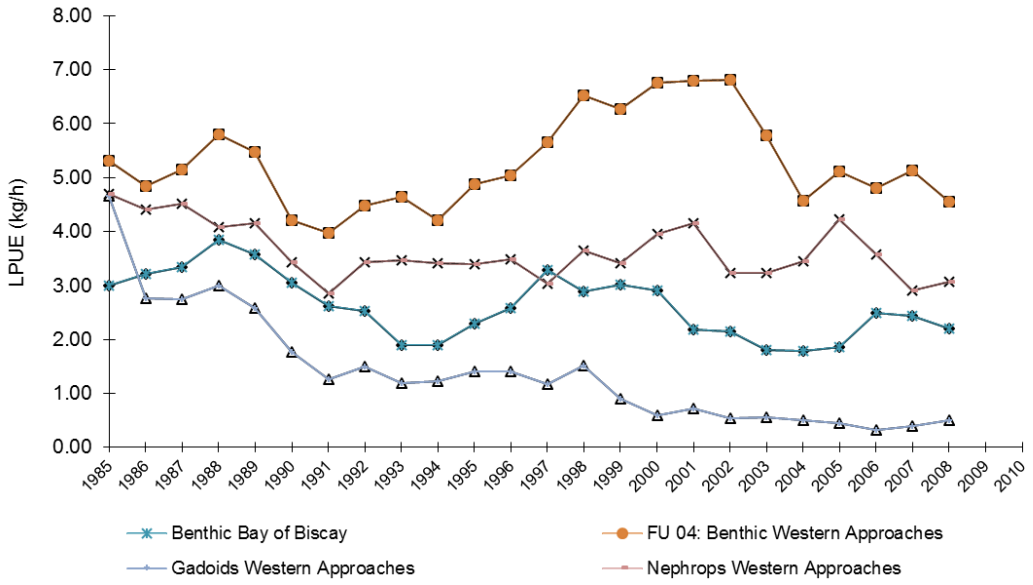


**Figure 5.9. Megrim *(L. whiffiagonis*) in divisions 7.b, 7.c, 7.e–k and 8.a, 8.b, and 8.d. French LPUE for different bottom-trawler fleets.**

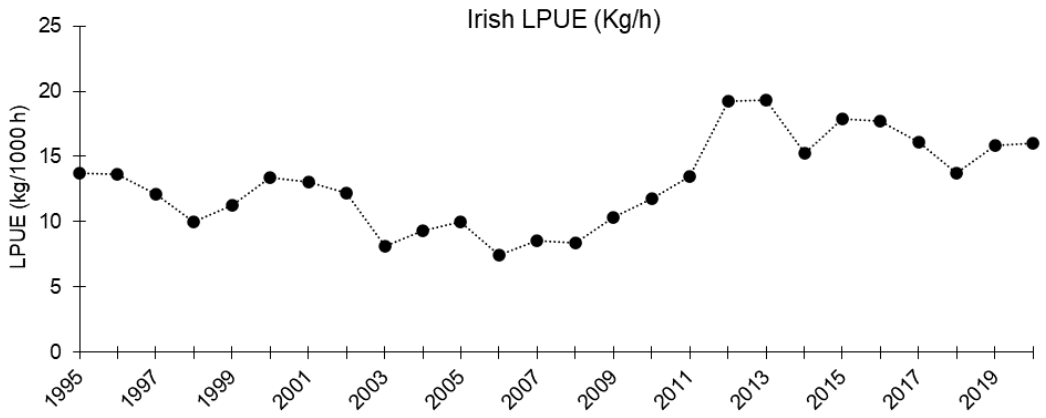


**Figure 5.10. Megrim (*L. whiffiagonis*) in divisions 7.b, 7.c, 7.e–k and 8.a, 8.b, and 8.d. Irish LPUE for beam trawl fleet.**

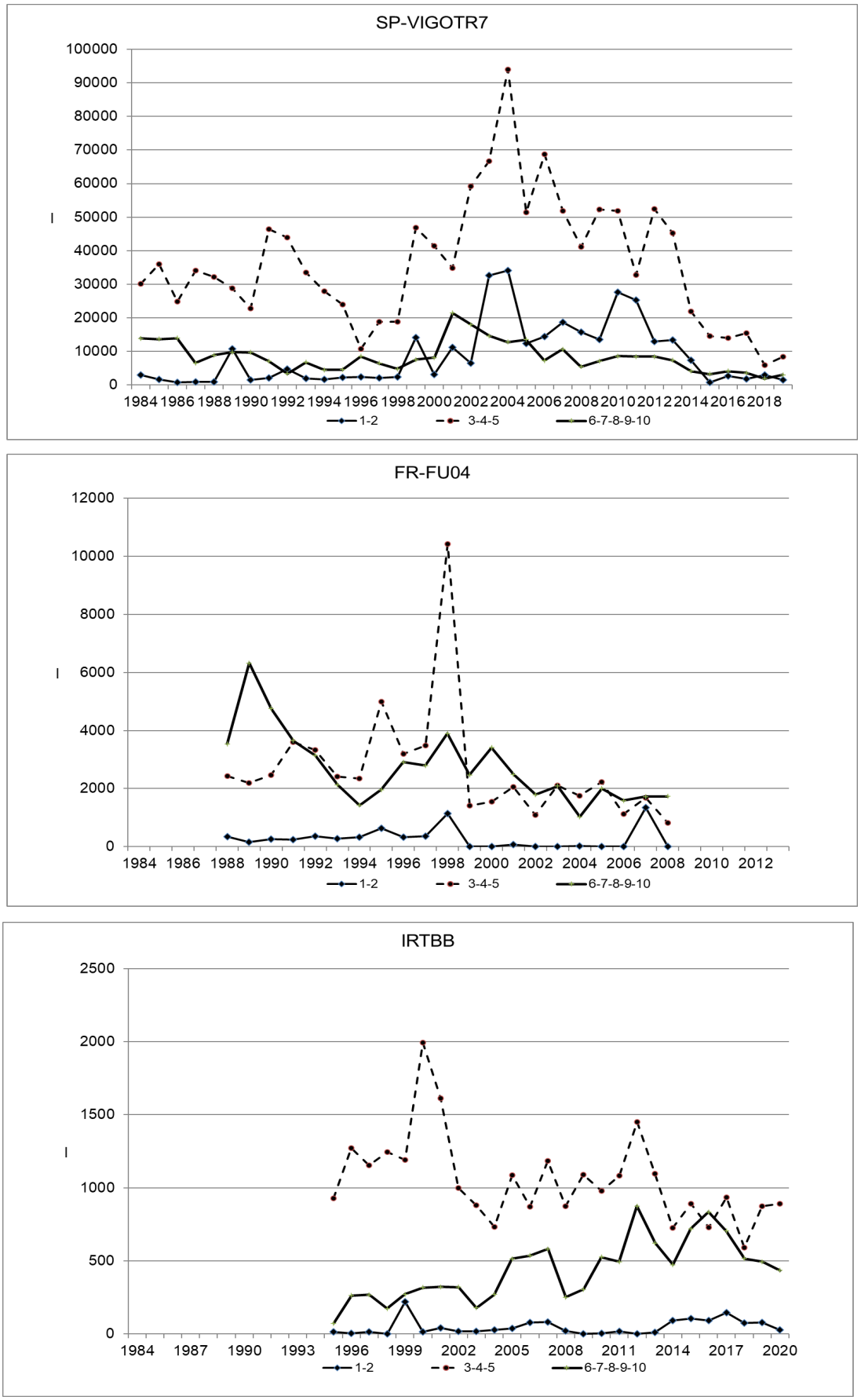


**Figure 5.11. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Abundance Indices for SP-VIGOTR7, FR-FU04 and IRTBB by ages grouped: i) 1+2; ii) 3+4+5 and iii) 6+7+8+9+10$^{+}$.**

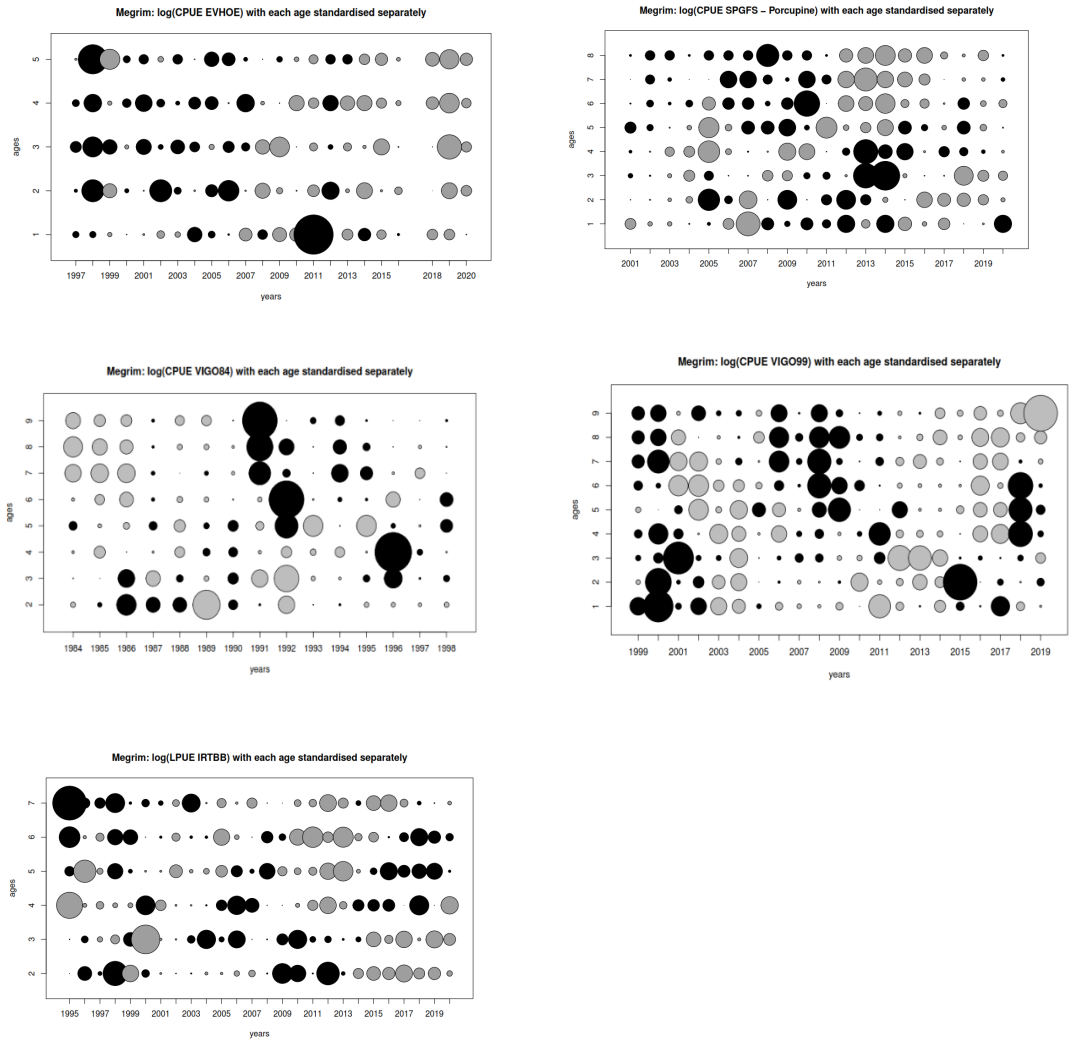


**Figure 5.12. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Bubble plots of the standardized log abundance indices of the surveys and commercial fleets used as tuning fleets (grey – positive values, black – negative values).**

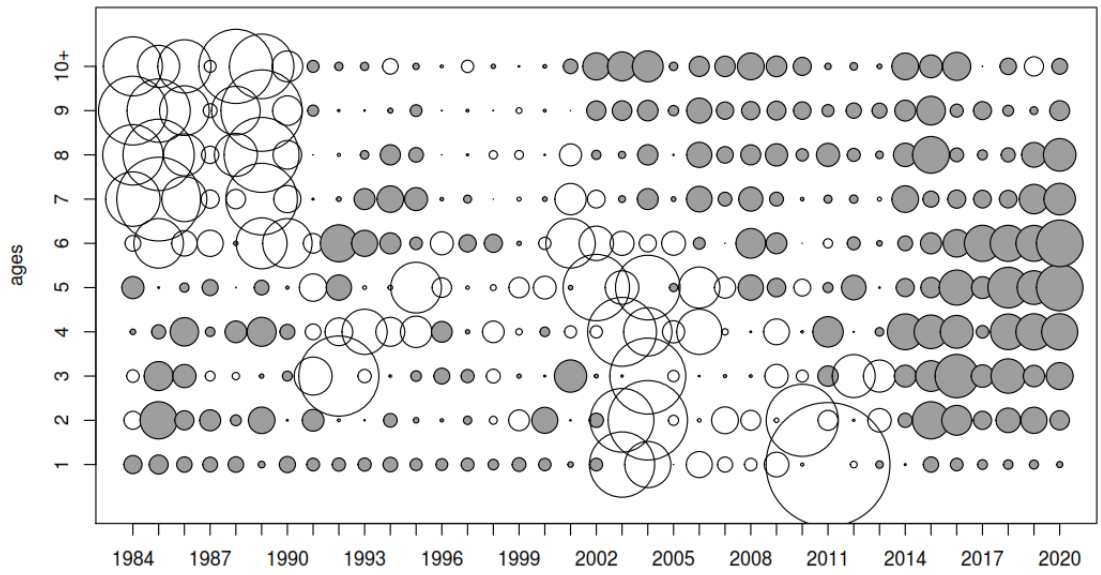


**Figure 5.13. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Bubble plots for catch numbers-at-age (grey – positive values, black – negative values).**

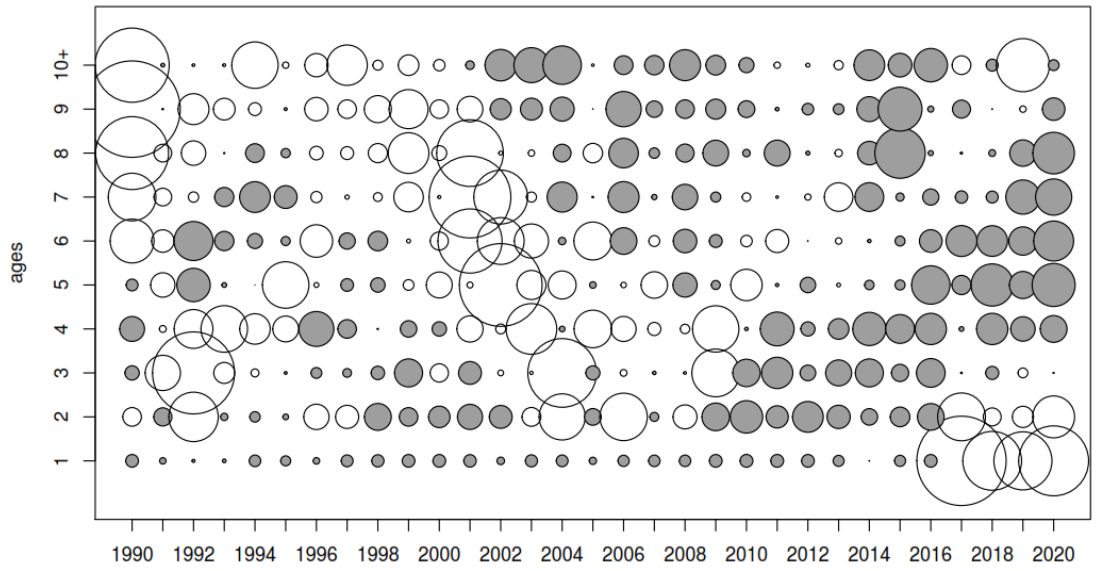


**Figure 5.14. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Bubble plots for landing numbers-at-age (grey – positive values, black – negative values).**

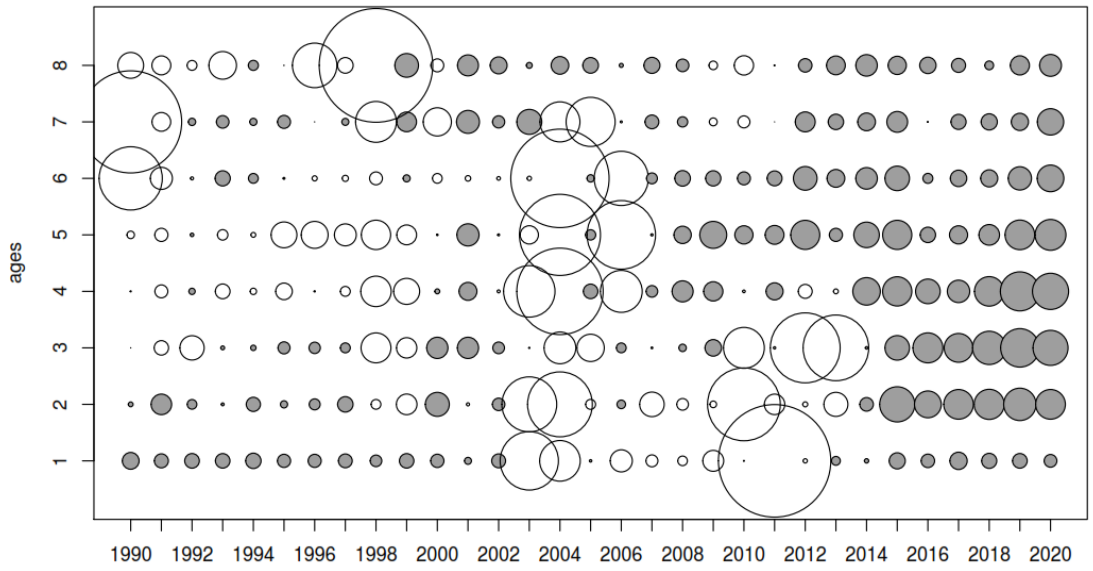


**Figure 5.15. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Bubble plots for discarded numbers-at-age (grey – positive values, black – negative values).**

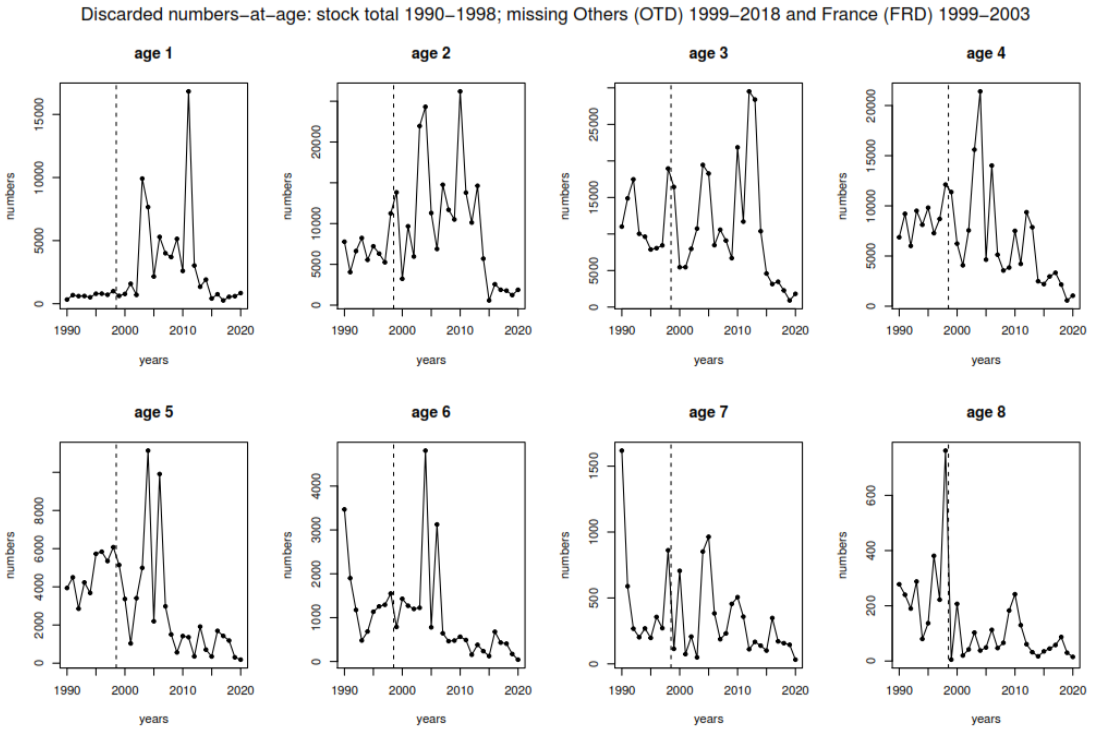


**Figure 5.16. Megrim (*L. whiffiagonis*) in divisions 7.b–k and 8.a, 8.b, and 8.d. Discarded numbers-at-age separated by age from 1990 to 2019.**

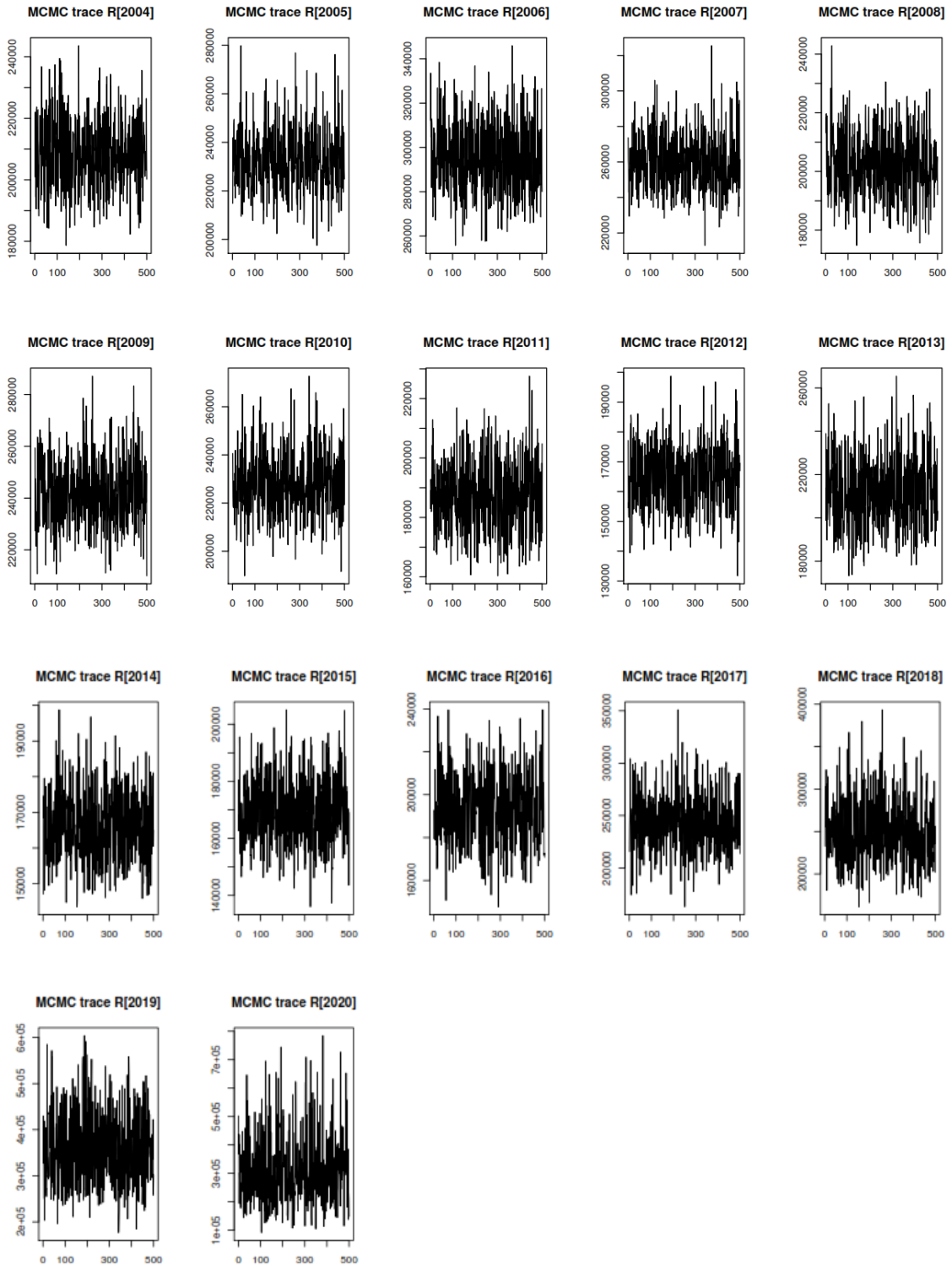


**Figure 5.17. Trace plots of recruitment draws from 2004 to 2020.**

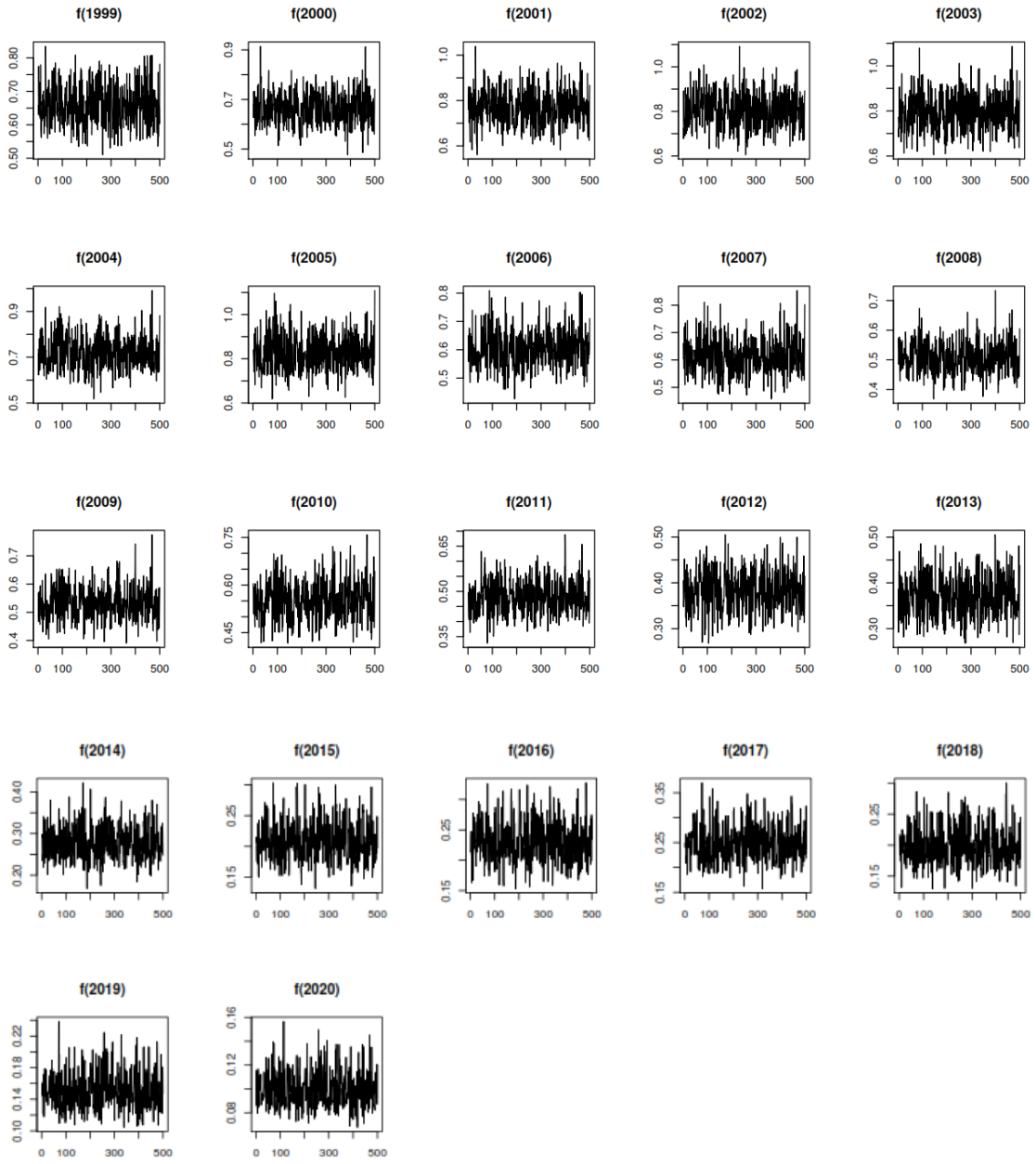


**Figure 5.18. Trace plots of f(y) fishing mortality in ages 9 and 10 from 1999 to 2020.**

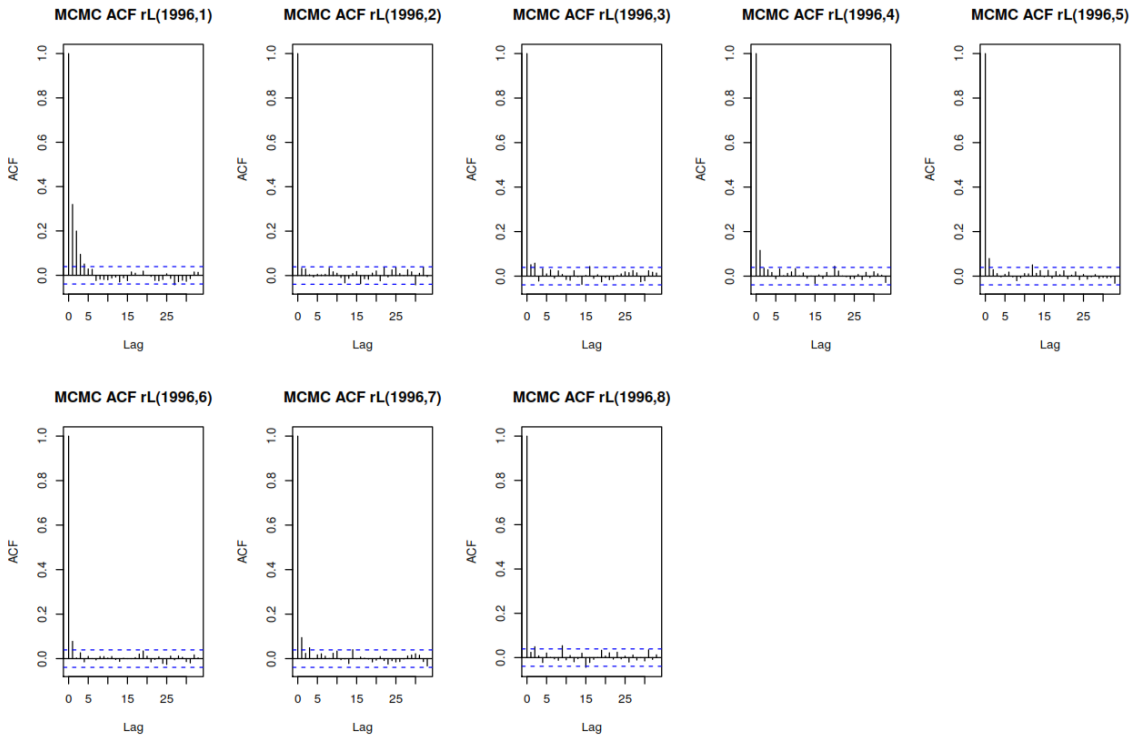


**Figure 5.19. Autocorrelation plots of rL for years 1996 and 2020.**

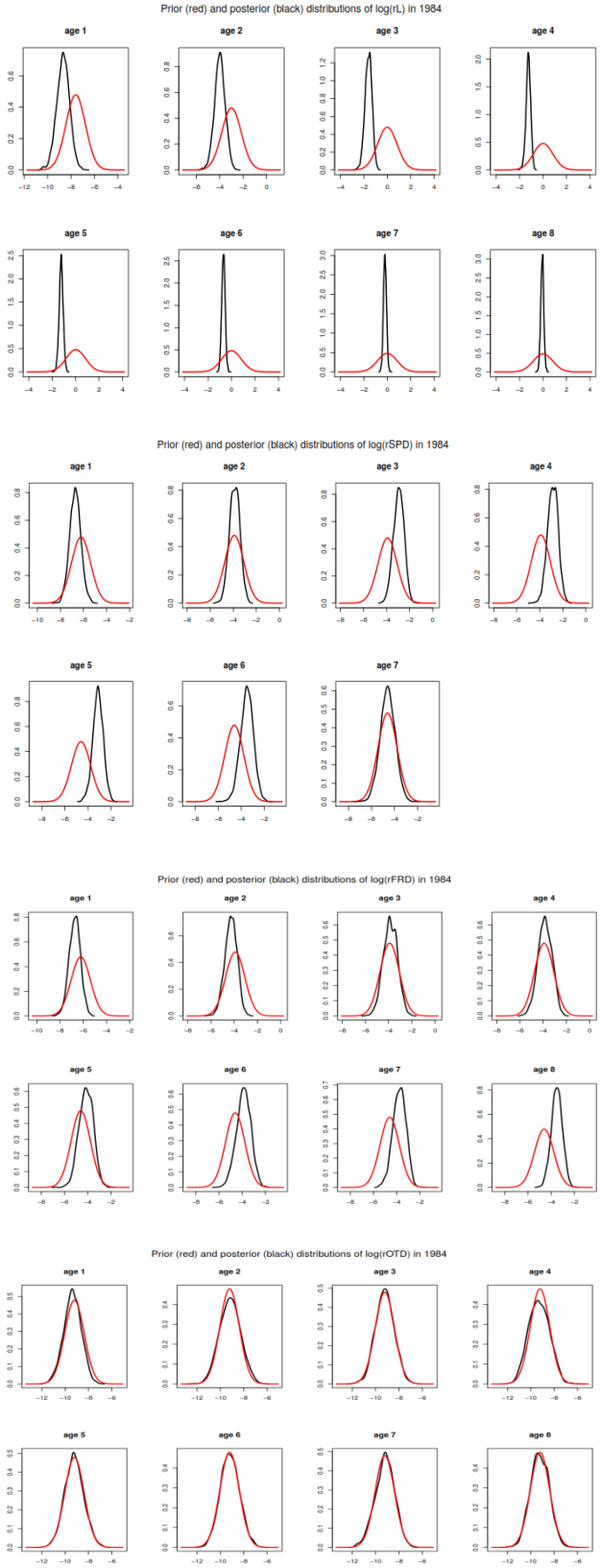


**Figure 5.20. Prior (red) and posterior distribution of log (L) in 1984, log (rSPD) at age in 1984, log (rFRD) at age in 1984 and log (rOTD) at age in 1984.**

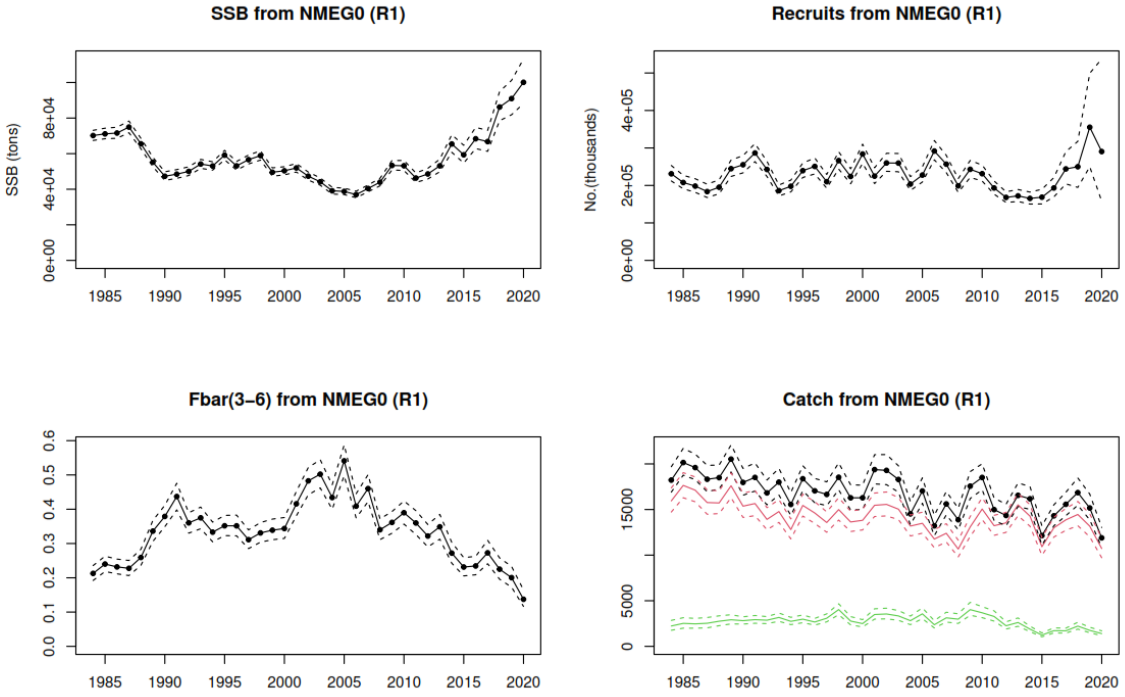


**Figure 5.21. WGBIE 2021 results of time-series of spawning-stock biomass (SSB), recruits, $F_{bar}$, catch (black), landings (red) and discards (green) from 1984 to 2020. The solid dotted lines correspond to the median of the distribution and the dashed lines to the 5% and 95% quantiles.**

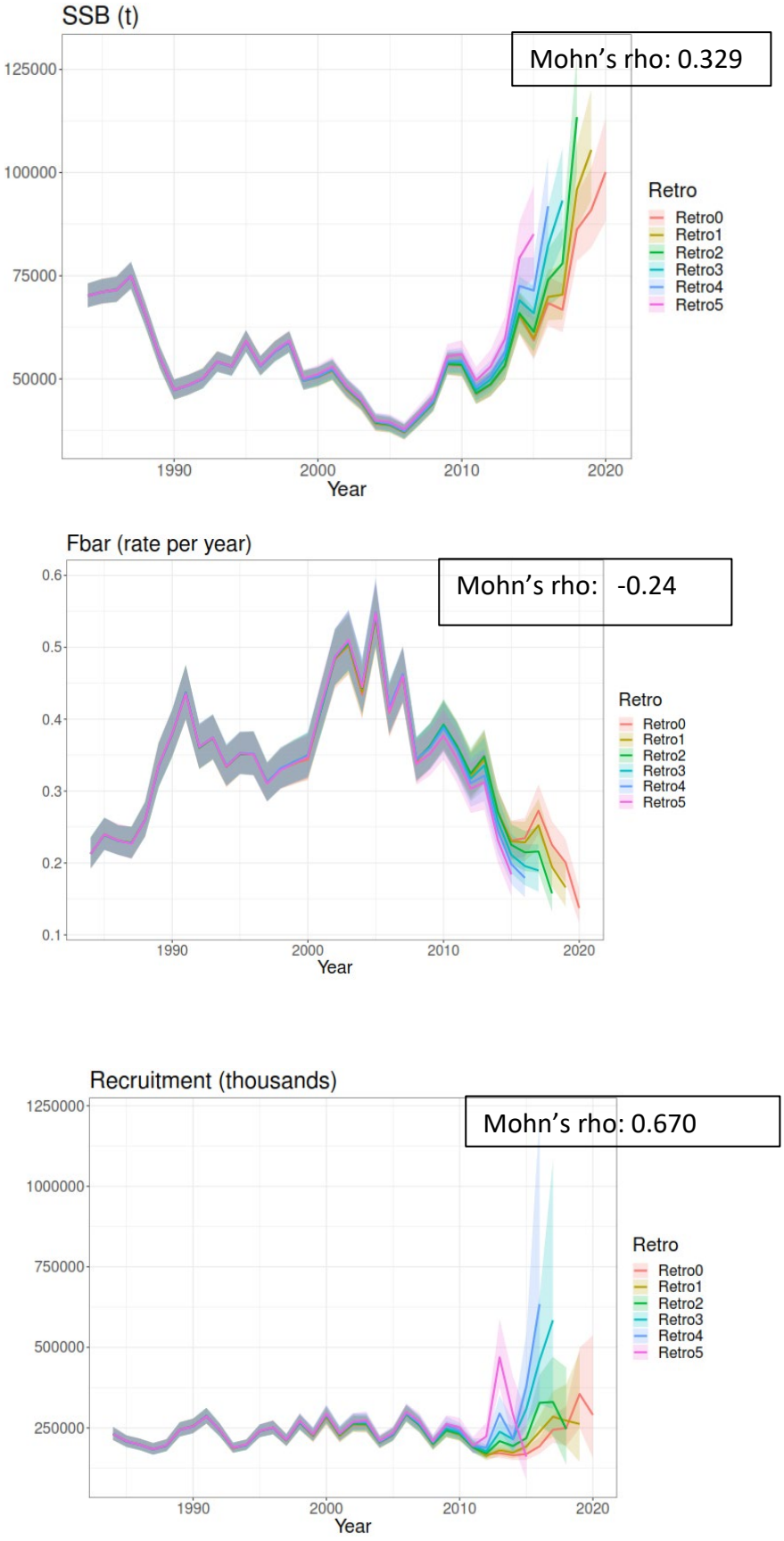


**Figure 5.22. Time-series of median SSB, recruitment and $F_{bar}$ in retrospective analysis.**

# 5.3 Four-spot megrim (*L. boscii*) in divisions 7.b–k, 8.a, 8.b, and 8.d

## 5.3.1 Fishery description

Four-spot megrim (*Lepidorhombus boscii*) in the Celtic Sea, west of Ireland, and in the Bay of Biscay are caught in a mixed fishery predominantly by French followed by Spanish, UK and Irish demersal vessels (see Stock Annex for details).

## 5.3.2 Summary of ICES Advice for 2022 and Management applicable for 2021 and 2022

### 5.3.2.1 ICES advice for 2022

ICES has been requested to provide advice on fishing opportunities for four-spot megrim in divisions 7.b–k, 8.a–b, and 8.d. ICES advises that when the precautionary approach is applied, catches in 2022 should be reduced by at least 20% relative to the average catches of 2017–2019 resulting in catch advice of 867 t.

### 5.3.2.2 Management applicable for 2021 and 2022

Management of four-spot megrim and megrim under a combined species TAC prevents effective control of the single-species exploitation rates and could lead to overexploitation of either species.

## 5.3.3 Data

### 5.3.3.1 Commercial catches and discards

Four-spot megrim was included in the ICES catch and discard data call for the first time in 2018 and data on commercial catch and discard information were made available to the working group (WG) from France, Ireland, Spain and UK. Historical data on commercial catch and discards, going back to 2003, were requested in the 2020 ICES data call and France, Ireland, Spain and UK responded to this request. Historical Spanish catches were requested again in the 2021 ICES data call but are still unavailable prior to 2017. Belgium provided catch and biological information to WGBIE for the first time this year.

Sampling of commercial catches in 2020 was negatively impacted by COVID-19 and France could not estimate four-spot megrim catches for this year as the proportion of this species in the mixed landings could not be determined.

**Table 5.1. Commercial catches (in tonnes) of four-spot megrim in 2020 by country and gear type.**

| | BMS landing | Discards | Landings | Logbook Registered Discard | Total |
|---|---|---|---|---|---|
| Belgium | | | | | |
| TBB_DEF | - | 0 | 0 | - | 0 |
| France | | | | | |
| MIS_MIS | - | - | 0 | - | 0 |
| OTB_CRU | - | - | 0 | - | 0 |
| OTB_DEF | - | 0 | 0 | - | 0 |
| OTT_CRU | - | 0 | 0 | - | 0 |
| OTT_DEF | - | - | 0 | - | 0 |
| Ireland | | | | | |
| GNS_DEF | - | - | 1 | - | 1 |
| MIS_MIS | - | - | 0 | - | 0 |
| OTB_CRU | - | 2 | 2 | - | 4 |
| OTB_DEF | - | 4 | 32 | - | 36 |
| SSC_DEF | - | 0 | 3 | - | 3 |
| TBB_DEF | - | 0 | 12 | - | 12 |
| Spain | | | | | |
| GNS_DEF | - | - | 1 | - | 1 |
| LLS_DEF | - | - | 0 | - | 0 |
| OTB_DEF | 0 | 117 | 436 | 0 | 553 |
| OTB_MPD | - | - | 0 | - | 0 |
| PTB_DEF | - | - | 0 | - | 0 |
| UK (England) | | | | | |
| GNS_DEF | - | - | 0 | - | 0 |
| UK(Scotland) | | | | | |
| MIS_MIS | - | - | 0 | - | 0 |
| Total | 0 | 122 | 488 | 0 | 611 |

**Table 5.2. Commercial catches (in tonnes) of four-spot megrim 2003–2020 by year and country.**

| | France | | Ireland | | Spain | | | | UK (England) | UK(Scotland) | Belgium | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Discards | Landings | Discards | Landings | BMS Landings | Discards | Landings | Logbook Discards | Landings | Landings | Discards | Landings | |
| 2003 | - | 0.0 | - | - | - | - | - | - | - | - | - | - | **0** |
| 2004 | - | 0.0 | - | - | - | - | - | - | - | - | - | - | **0** |
| 2005 | 0 | 62 | - | - | - | - | - | - | - | - | - | - | **62** |
| 2006 | 4 | 1 | - | - | - | - | - | - | - | - | - | - | **5** |
| 2007 | 3 | 123 | - | - | - | - | - | - | - | - | - | - | **126** |
| 2008 | - | 0.0 | - | - | - | - | - | - | - | - | - | - | **0** |
| 2009 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | **2** |
| 2010 | 8 | 65 | - | - | - | - | - | - | - | - | - | - | **73** |
| 2011 | 2 | 39 | 31 | - | - | - | - | - | - | - | - | - | **71** |
| 2012 | 1 | 2 | 73 | - | - | - | - | - | - | - | - | - | **75** |
| 2013 | 3 | 33 | - | - | - | - | - | - | - | - | - | - | **36** |
| 2014 | 2 | 31 | - | - | - | - | - | - | - | - | - | - | **33** |
| 2015 | 2 | 131 | - | - | - | - | - | - | - | - | - | - | **133** |
| 2016 | 8 | 268 | - | - | - | - | - | - | - | - | - | - | **275** |
| 2017 | 5 | 25 | 288 | 130 | - | 273 | 439 | - | - | - | - | - | **1160** |
| 2018 | 4 | 16 | 35 | 64 | - | 214 | 833 | 0.0 | 0.0 | - | - | - | **1166** |
| 2019 | 24 | 380 | 41 | 62 | 0.4 | 41 | 378 | 0.0 | 0.2 | 0.0 | - | - | **926** |
| 2020 | 0 | 0.0 | 6 | 51 | 0.1 | 117 | 437 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | **611** |

### 5.3.3.2 Biological sampling

Biological sampling data for four-spot megrim were included in the ICES data call for the first time in 2018. Data on length were made available to the 2019 WG from Ireland and Spain. Historical data on length, going back to 2003, were requested in the 2019 and 2020 data calls and Ireland, France, Spain and UK responded to this request (UK has not sampled this species).

Length frequency distributions for landings and discards were not available from all countries due to COVID-19 pandemic. Spain provided length distributions for landings and discards, whereas Ireland could only provide information on discard length distribution. Belgium also provided landings length distributions and information on age at length.

#### Age

Age data were made available for the first time to the 2021 WG from Belgium only. Fish from age 4 to age 11 were identified in landings with a modal age of 7 years.

#### Lengths

**Table 5.3. Number of length samples and measurements of four-spot megrim by year and country.**

| | Number of Length Samples | Number of Length Measurements |
|---|---|---|
| **France** | | |
| 2007 | 140 | 202 |
| 2014 | 8 | 124 |
| 2015 | 9 | 32 |
| 2016 | 14 | 103 |
| 2017 | 23 | 39 |
| 2019 | 45 | 393 |
| 2020 | 0 | 0 |
| **Ireland** | | |
| 2011 | 168 | 2120 |
| 2012 | 184 | 8352 |
| 2017 | 402 | 34 736 |
| 2018 | 171 | 1198 |
| 2019 | 100 | 11 475 |
| 2020 | 12 | 1025 |
| **Spain** | | |
| 2017 | 424 | 13 396 |
| 2018 | 427 | 15 502 |

| | Number of Length Samples | Number of Length Measurements |
|---|---|---|
| 2019 | 323 | 7410 |
| 2020 | 116 | 2023 |
| **Belgium** | | |
| 2020 | 21 | 39 |

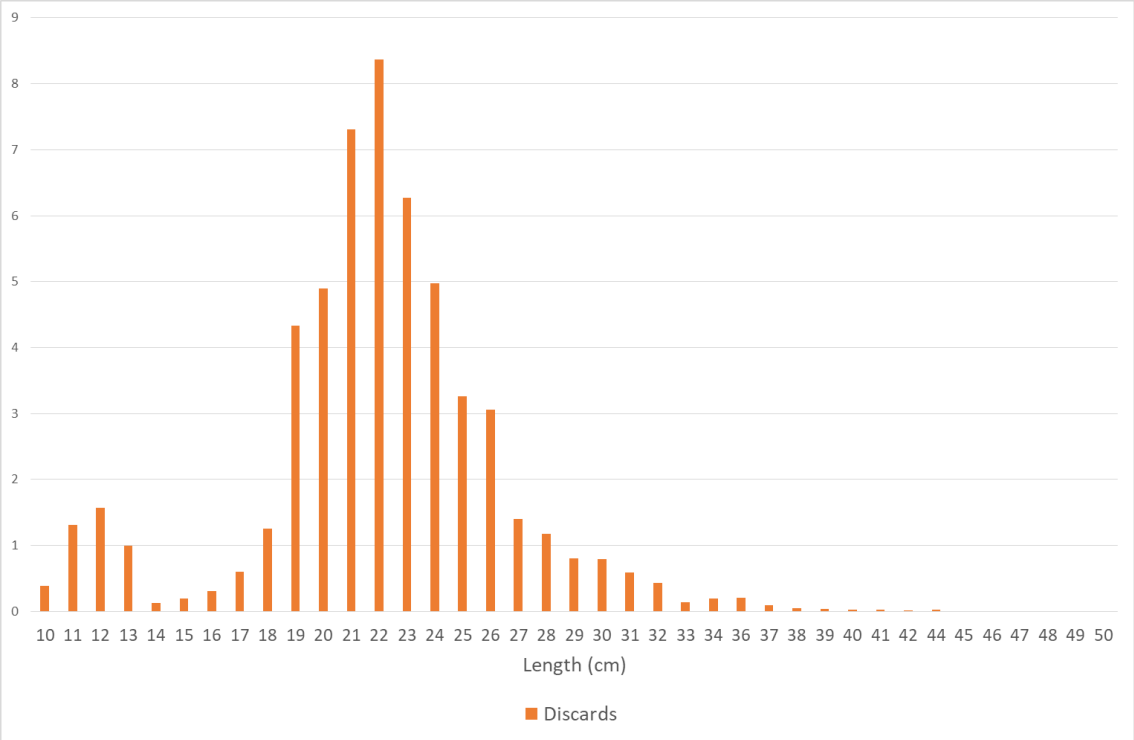


**Figure 5.1.Length–frequency distribution of discards from Irish fleets.**

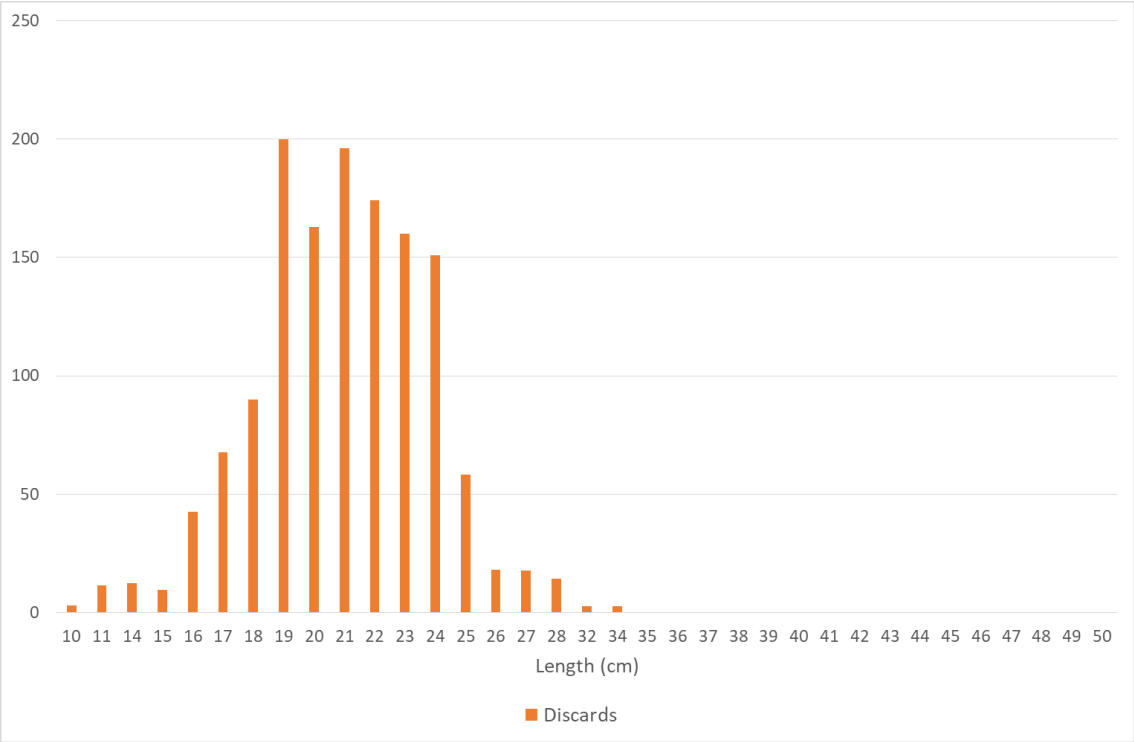


**Figure 5.2. Length–frequency distribution of discards from Spanish fleets (source: IEO).**

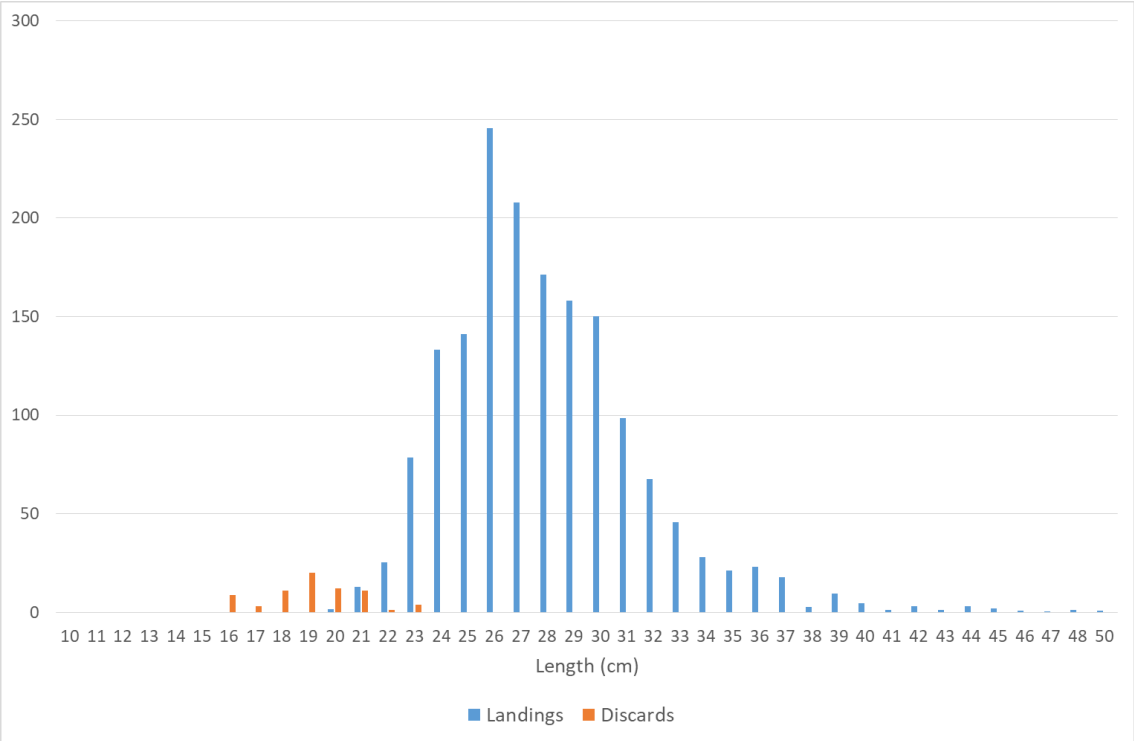


**Figure 5.3. Length–frequency distribution of landings and discards from Spanish fleets (source: AZTI).**

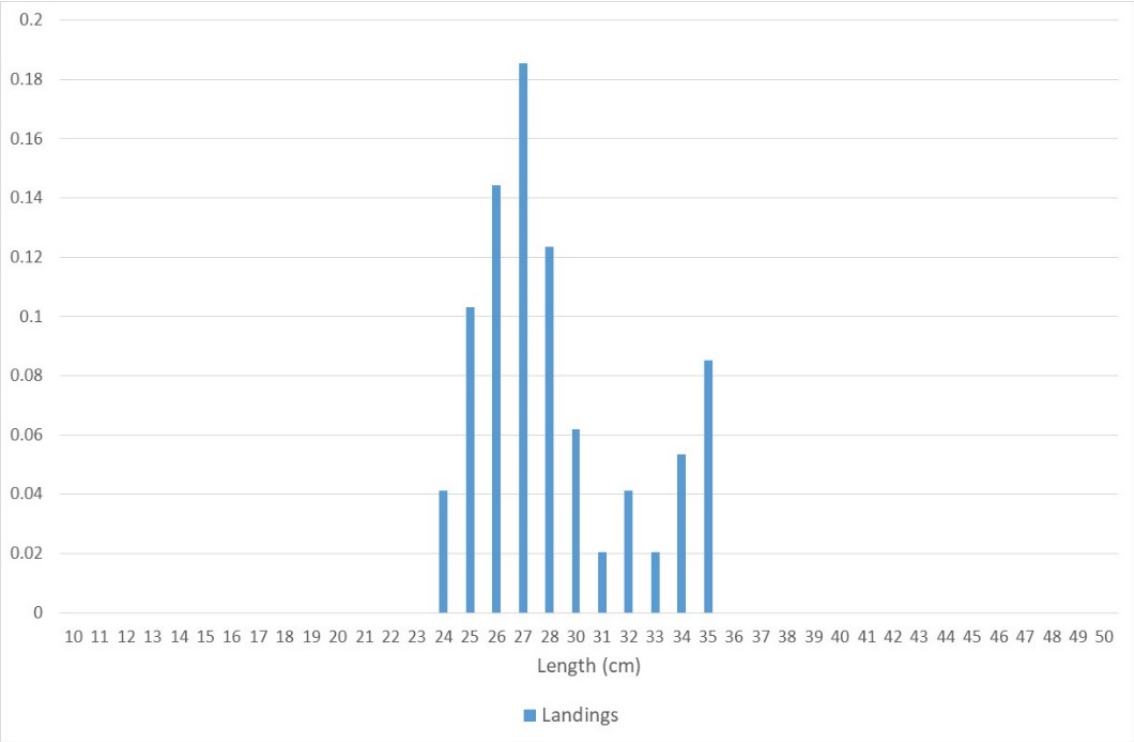


**Figure 5.4. Length–frequency distribution of landings from Belgian fleets.**

### Natural Mortality

Not included in the assessment.

### 5.3.3.3 Survey data

Survey data were extracted from DATRAS for Spanish Porcupine Bottom Trawl Survey (SpPGFS-WIBTS-Q3, G5768), Irish Ground Fish Survey (IGFS-WIBTS-Q4, G7212) and French EVHOE Survey (EVHOE-WIBTS-Q4, G9527). French survey data were not available for 2017 but recommenced in 2018. The Spanish Porcupine index was initially down weighted by an arbitrary factor of ten because the Baka trawl used was highly more efficient at catching megrim than the GOV (Grande Ouverture Verticale) trawl used in the Irish and French surveys. Due to the large differences in catchability between Baka and GOV gears, it was decided to remove the SpPGFS-WIBTS-Q3 (G5768) data from the final index which are based on data from IGFS-WIBTS-Q4 (G7212) and EVHOE-WIBTS-Q4 (G9527) surveys. This combined French and Irish survey index is referred to by the ICES acronym 'FR_IE_IBTS'. To include Spanish Porcupine Bottom Trawl Survey (G5768) data in the final index will require inter-calibration correction based on comparison of four-spot megrim catches in the area where the Spanish and Irish surveys overlap. No difference in catchability was found between the Irish and the French surveys in the area where they overlap.

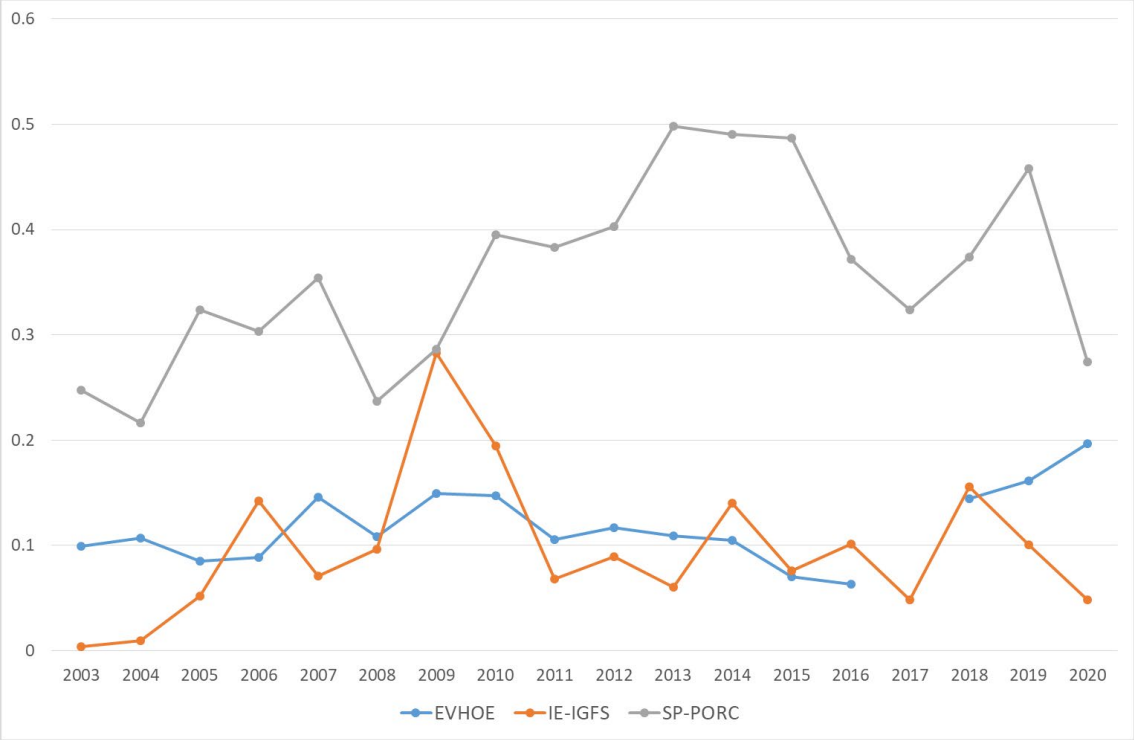


**Figure 5.5. Abundance indices of four-spot megrim from French EVHOE (EVHOE-WIBTS-Q4, G9527), Irish Ground Fish Survey (IGFS-WIBTS-Q4, G7212) and Spanish Porcupine Bottom Trawl Survey (SpPGFS-WIBTS-Q3, G5768).**

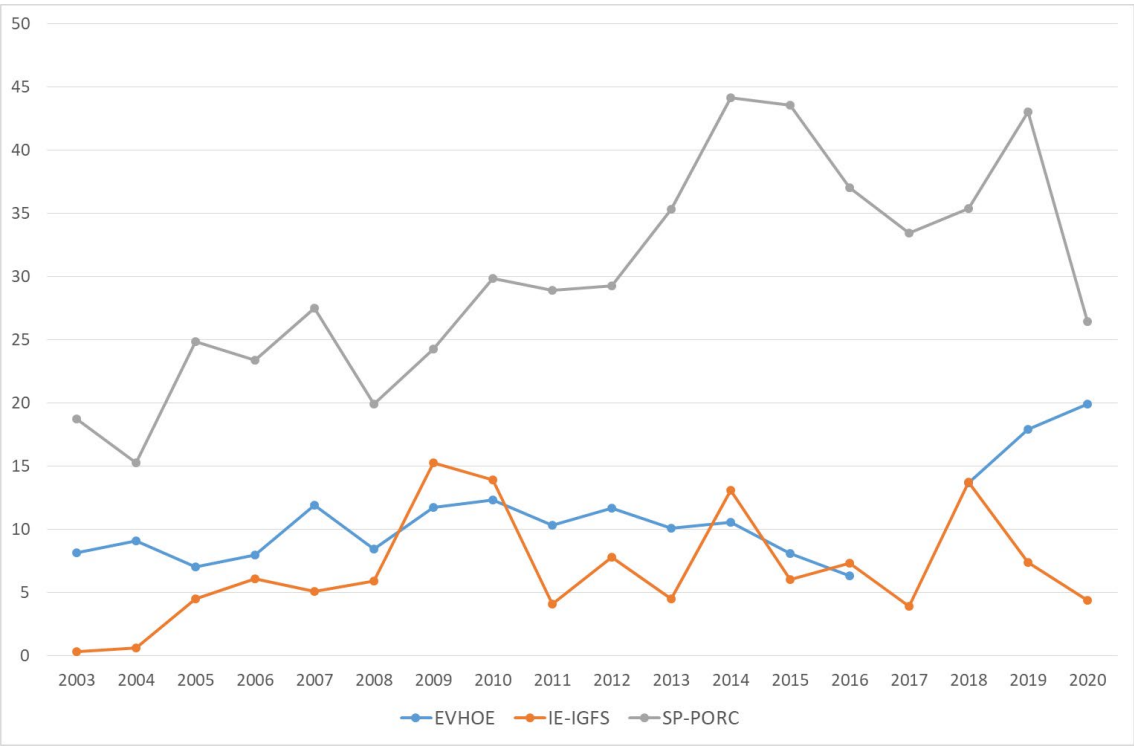


**Figure 5.6. Biomass indices of four-spot megrim from French EVHOE (EVHOE-WIBTS-Q4, G9527), Irish Ground Fish Survey (IGFS-WIBTS-Q4, G7212) and Spanish Porcupine Bottom Trawl Survey (SpPGFS-WIBTS-Q3, G5768).**

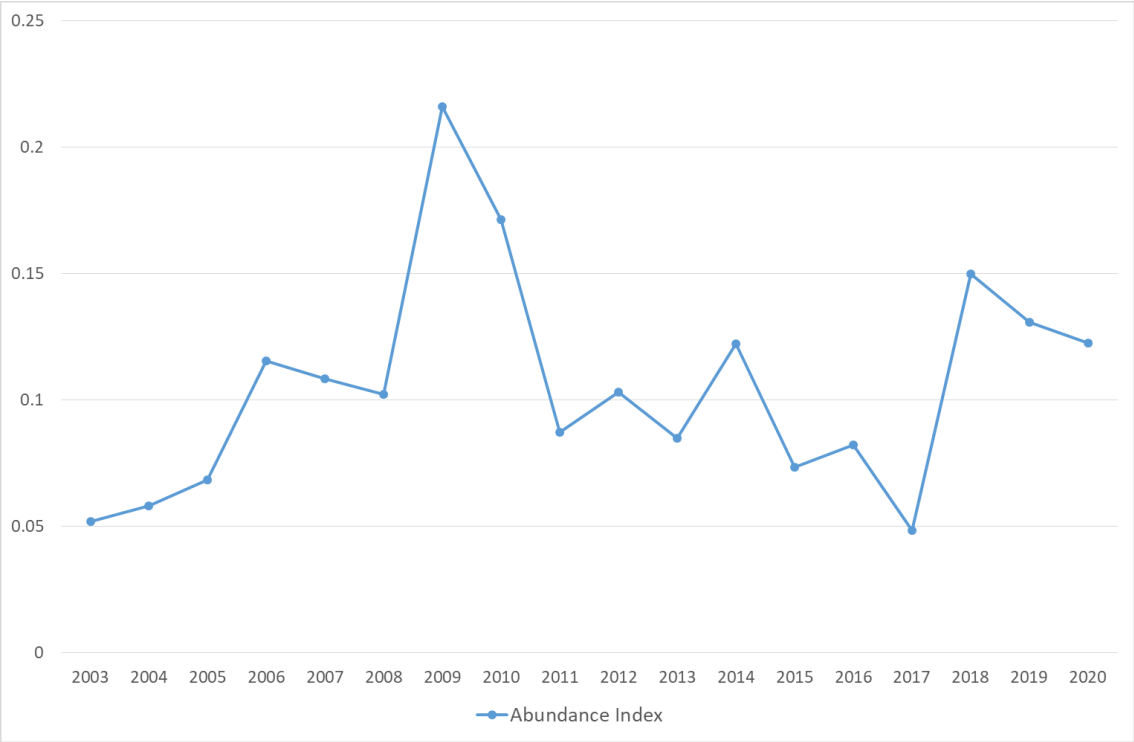


**Figure 5.7. Abundance index of four-spot megrim from combined French EVHOE (EVHOE-WIBTS-Q4, G9527) and Irish Ground Fish Survey (IGFS-WIBTS-Q4, G7212).**

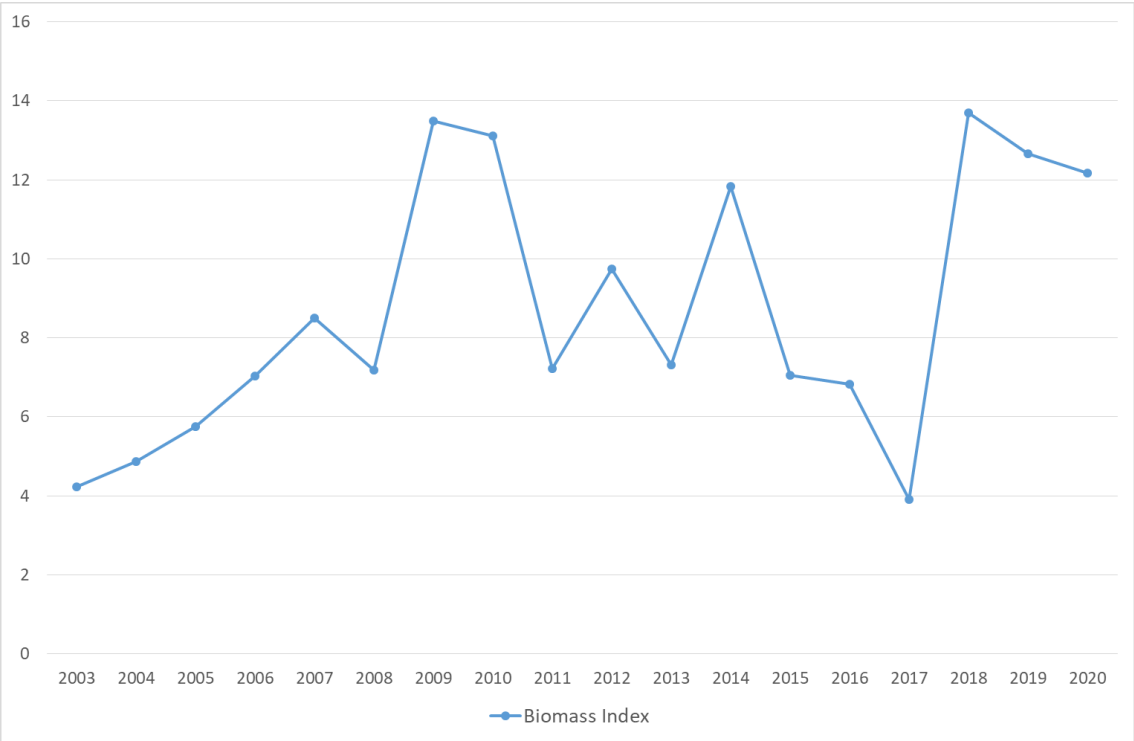


**Figure 5.8. Biomass index of four-spot megrim from combined French EVHOE (EVHOE-WIBTS-Q4, G9527) and Irish Ground Fish Survey (IGFS-WIBTS-Q4, G7212).**


**Figure 5.9. Biomass densities distribution of four-spot megrim from French EVHOE (EVHOE-WIBTS-Q4, G9527), Irish Ground Fish Surveys (IGFS-WIBTS-Q4, G7212) and Spanish Porcupine Bottom Trawl Survey (SpPGFS-WIBTS-Q3, G5768).**

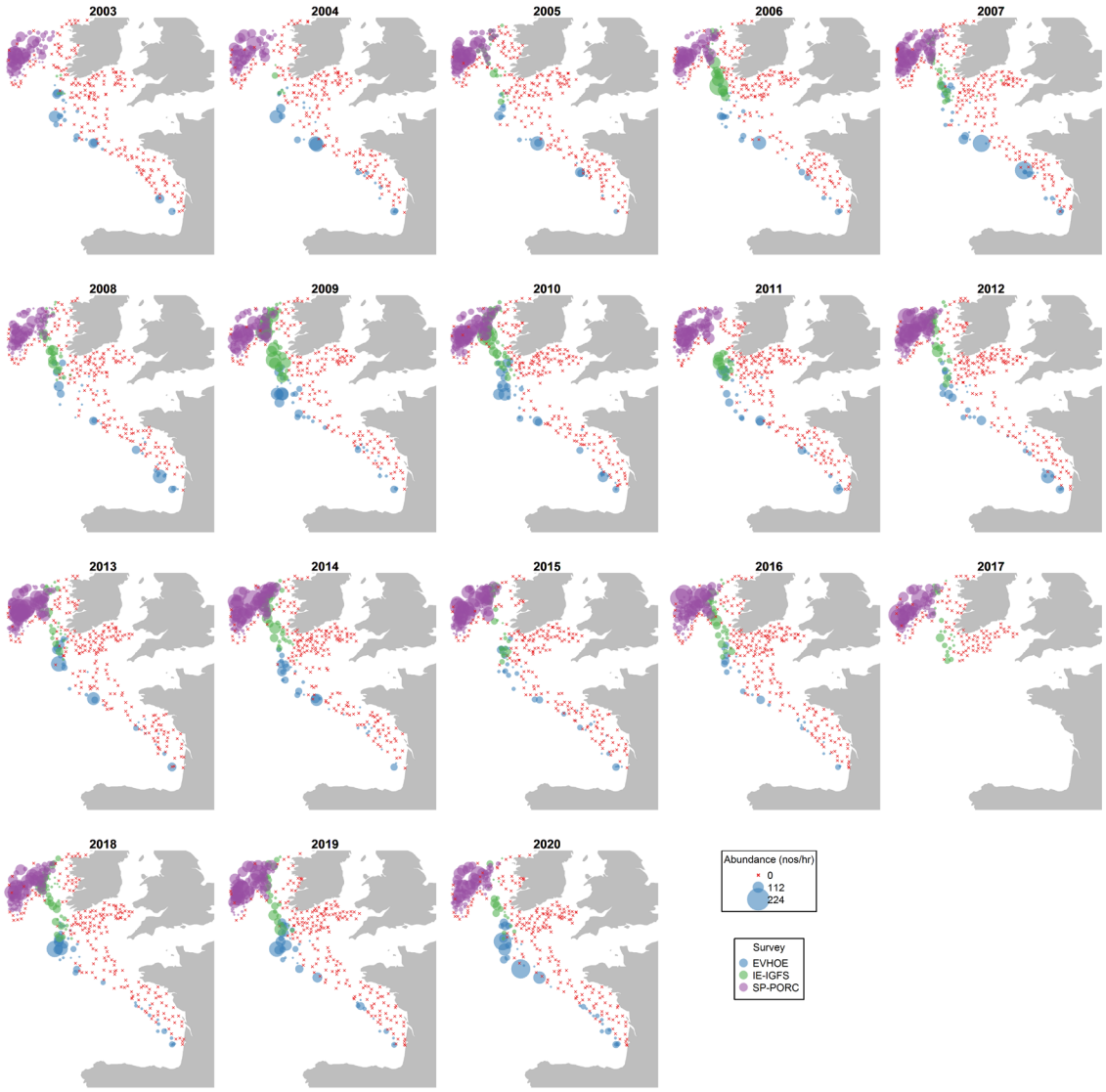


**Figure 5.10. Abundance densities distribution of four-spot megrim from French EVHOE (EVHOE-WIBTS-Q4, G9527), Irish Ground Fish Survey (IGFS-WIBTS-Q4, G7212) and Spanish Porcupine Bottom Trawl Survey (SpPGFS-WIBTS-Q3, G5768).**

## 5.3.4 Assessment

No quantitative stock assessment was carried out at WGBIE 2021 although the analysis was updated with available catch data and biological information from 2020.

### 5.3.4.1 Data exploratory Analysis

The following exploratory analyses were carried out for quality control reasons: sample weights were checked against expected weights (as estimated from length-weight parameters), excessive raising factors (from sample to catch weight) were checked and abundance indices (numbers per hour) were calculated for each survey series using all valid hauls and ignoring the spatial stratification.

### 5.3.4.2 Model

No model was used in the assessment.

### 5.3.4.3 Results

The stock status relative to candidate reference points is unknown. The precautionary buffer was last applied in 2017. Therefore, the precautionary buffer was applied again this year. Discards were not estimated in 2020 due to insufficient sampling, but average discards from 2017 to 2019 were estimated to be 27% of the total catch.

### 5.3.4.4 Retrospective pattern

No retrospective analysis was performed.

### 5.3.4.5 Short-term forecasts

No short-term forecast was produced.

## 5.3.5 Biological reference points

No biological reference points were produced at WGBIE 2021.

## 5.3.6 Conclusions

This was the fifth year that an assessment was carried out for this stock and the fourth year that the stock was included in the ICES data call. This year, catch advice was requested and it was decided to apply the precautionary buffer to recent average catches from 2017, 2018 and 2019. Catch data from 2020 were deemed to be incomplete due to unavailability of data from France.

The quality of this assessment was improved on the previous year by the addition of commercial landings, discards and length data. However, the incomplete historical (2003–2016) catch data from Spain means that the time-series of commercial catch is not sufficiently long to support the assessment.

There is still a requirement for substantial port samplings to provide an accurate species split for the landings as it is unsure how the survey catches relate to the commercial catches. The COVID-19 pandemic reduced the availability of samples of landings and discards and meant that catches of four-spot megrim from France could not be estimated. In 2019, France contributed 44% of total landings (403 t) and the absence of these data undermined confidence in 2020 catch data.

Last year investigations into Length-Based indicators (LBI; ICES, 2017) and Mean Length-Z (MLZ) as defined in WKLIFE V (ICES, 2015) was carried out using data from SpPGFS-WIBTS-Q3 (G5768). However, it was decided that this survey did not sufficiently cover the stock area to

provide catch advice (ICES, 2020). Future work on combining survey indices and using spatial models such as the Vector Autoregressive Spatio-Temporal (VAST; Thorson, 2019) package (www.github.com/james-thorson/VAST) in R (R Core Team, 2020) will be advanced before next year's WG.

### 5.3.7 References

ICES, 2015. Report of the Fifth Workshop on the Development of Quantitative Assessment Methodologies based on Life-history Traits, Exploitation Characteristics and other Relevant Parameters for Data-limited Stocks (WKLIFE V), 5–9 October 2015, Lisbon, Portugal. ICES CM 2015/ACOM: 56, 157 pp.

ICES. 2020. Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE). ICES Scientific Reports. 2:49. 845 pp. http://doi.org/10.17895/ices.pub.6033.

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R Core Team. 2020. A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Thorson, J.T. 2019. Guidance for decisions using the Vector Autoregressive Spatio-Temporal (VAST) package in stock, ecosystem, habitat and climate assessments. Fisheries Research 210: 143–161.