



HKE STOCK ASSESSMENT IN GSA 04

Reference year: 2017

Reporting year: 2018

Abstract

European hake is one of the most targeted demersal species of the Mediterranean fishing fleets. It is largely exploited in GSA 04 by trawlers on the shelf and slope, but also by small-scale fisheries. The trawler fleet is the largest in landings. The state of exploitation of Hake stock in GSA 04 was assessed by means of pseudocohort analysis using VIT in the framework of the CopeMed working Group on demersal species held in October 2018 in Tangiers . The assessment was carried out using length frequency data for three years of sampling 2015-to 2017 and the official landings from the trawl fleets. An overfishing situation, similar to that found in the last year 2016 and the other GSAs of the western Mediterranean Sea, was observed in this study.

Stock assessment form

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1 Basic identification data

| | | |
|--|---------------------|----------------------|
| Scientific name: | Common name: | ISCAAP Group: |
| <i>Merluccius merluccius</i> | European hake | 32 HKE |
| Geographical sub-area: | | |
| Southern Alboran Sea GSA4 | | |
| Country | | |
| Algeria | | |
| Stock assessment method: (direct, indirect, combined, none) | | |
| Indirect (Virtual Population Analysis in VIT) | | |
| Authors: | | |
| FILALI Tahar ¹ ; AINOUCHE Nawel ¹ ; HERNÁNDEZ Pilar ² ; VASCONCELLOS Marcelo ² . | | |
| Affiliation: | | |
| ¹ CNRDPA, Algeria | | |
| ² FAO - CopeMed II | | |

2 Stock identification and biological information

2.1 Stock units

The assessment covers the stock of European hake in the southern part of Alboran Sea (GSA_04). Samples coming from Trawl landing collected in Ghazaouet and Beni Saf ports from 2015 to 2017 (3 years) were used for an alternative estimation of references points. Length frequency data collected in the last three years were reconstructed into age structure of the stock using R.

2.2 Growth and maturity

Different information of European hake coming from Algeria, Spain and Morocco has been presented in the last working groups organised by CopeMed II in Morocco and Spain.

After discussion among experts, VPA method was selected to assess European hake stock only in GSA-04 by Vit software using Algerian growth parameters as input data.

Growth parameters (table 2.2.2) estimated by **Filali & Hemida (2014)** and natural mortality by age classes vector (table 2.2.3) calculated using PRODBIOM (**Abella et al, 1999**), were used to run the stock assessment.

Table 2.2.1. Maximum size, size at first maturity and size at recruitment.

| Somatic magnitude measured (LT, LC, etc) | | | Total Length (LT) | Units | cm |
|---|-----|-----|----------------------|------------------------|---|
| Sex | Fem | Mal | Combined | Reproduction season | All year: Feb and June |
| Maximum size observed | 75 | 47 | 75 | Recruitment season | All year (higher peaks in winter and spring) |
| Size at first maturity | | | 28.5 | Spawning area | Shelf and upper Slope |
| Recruitment size to the fishery | | | 14.5 | Nursery area | Continental Shelf |

Table 2.2.2. Growth and length-weight relationship parameters.

| Biological information | | Units | Sex | | | Years |
|--------------------------------|--------------|--------------------------|--------|------|----------|-------|
| | | | female | male | Combined | |
| Growth model | L_{∞} | cm | | | 85.5* | |
| | K | an^{-1} | | | 0.18* | |
| | t_0 | an | | | -0.71 | |
| | Data source | *Filali et Hemida (2014) | | | | |
| Length-Weight relationship | a | | | | 0.0039* | |
| | b | | | | 3.1387* | |
| Sex ratio (% of Females/Total) | | 0.42 | | | | |

Table 2.2.3. M vector and proportion of matures by size or age (Combined Males-Females)

| Age | Natural mortality ** | Proportion of matures |
|-----|----------------------|-----------------------|
| 0 | 0.73 | 0.03 |
| 1 | 0.28 | 0.28 |
| 2 | 0.20 | 0.97 |
| 3 | 0.17 | 1 |
| 4 | 0.15 | 1 |
| 5+ | 0.14 | 1 |

**Natural mortality (M) vector, PRODBIOM. (Abella et *al.*, 1999).

3 Fisheries information

3.1 Fleet Description

In GSA 04, Algerian part of Alboran Sea (fig. 3.1.1), European hake, is one of several demersal species targeted on the shelf and slope (15 % of national demersal fish landings). It is largely targeted by trawlers (98.2 % of national landings), but also small-scale fisheries using gillnets and trammel nets (1.2 %) (CNRDPA 2016).

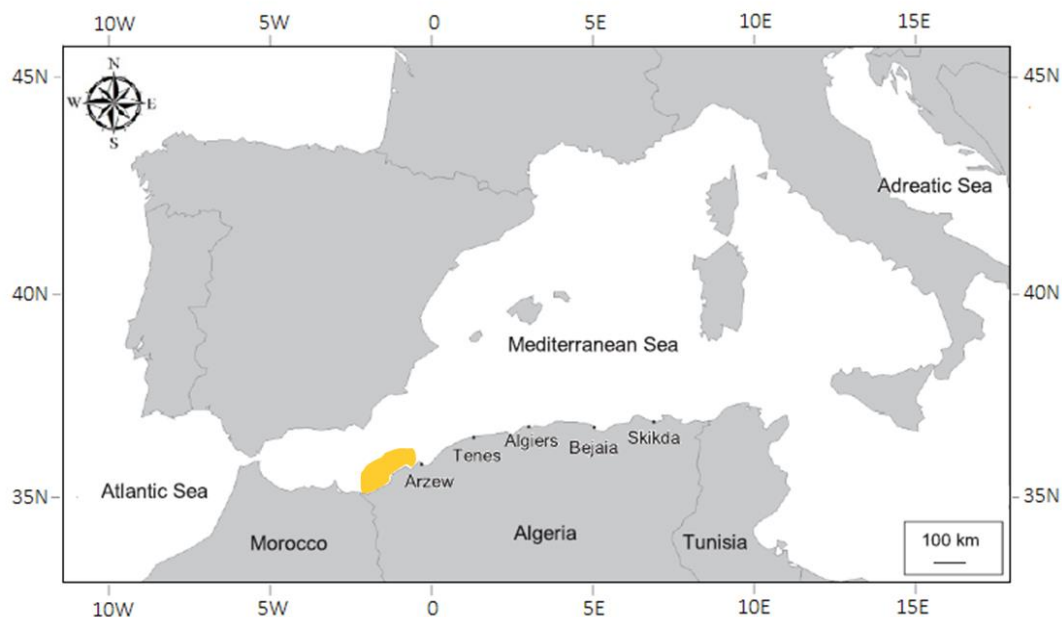


Fig. 3.1.1. Alboran Part of GSA 04

Landings come from three fishing area (Ghazaouet, Beni Saf and Bouzedjar), the first two ports are the most important in terms of *M. merluccius* production (96.04 %) in the western part of GSA 04. Actually, Trawlers fleet actives in this area are 99 boats with an average engine power of 446.2 HP and a mean GRT of 57 TX (Table 3.1.1).

Table 3.1.1. Segment fleet characteristics in Algerian GSA 04

| Ports | Number of trawlers | Mean HP | Mean GRT |
|-----------|--------------------|---------|----------|
| Ghazaouet | 69 | 548.27* | 67.82* |
| Beni Saf | 30 | 344.12* | 47.38* |

*Data of 2012

Table3.1.2. Description of operational units exploiting the stock

| | Country | GSA | Fleet Segment | Fishing Gear Class | Group of Target Species | Species |
|--------------------|---------|-----|--------------------|--------------------|-----------------------------|---------|
| Operational | ALG | 04 | E-Trawl 12-24 m | 03-Trawls | 33 – Demersal shelf species | HKE |

Table 3.1.3. Catch, bycatch, discards and effort by operational unit in the reference year

| Operational Units | Fleet (n° of boats. Average 2015 to 2017)* | Landings/Catch (T average 2015-2017 species assessed) | Other species caught (names and weight) | Discards (species assessed) | Discards (other species caught) | Effort average 2015-2017 (days) |
|-------------------|--|---|--|-----------------------------|---------------------------------|---------------------------------|
| Trawls- GSA04 | 99 | 105 | | | | 9047 |

3.2 Historical trends

Hake annual trawlers landings in the period 2000-2016 and its CPUE in the period 2005-2016 in the Western part of GSA 04, issue from official statistics (MPRH, 2016), are showed in figure 3.2. 1 and table 3.2.1.

Table 3.2.1. Catches (tons), minimum and maximum size sampled in this area

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Landings (t) GSA4 | 223 | 199 | 247 | 114 | 132 | 186 | 179 | 83 | 126 | 123 | 92 | 101 | 102 | 108 | 120 |
| Minimum size | - | - | - | - | - | - | - | - | - | - | - | - | 5.9 | 10.4 | 9.6 |
| Average Size | - | - | - | - | - | - | - | -- | - | - | - | - | 18 | 18.5 | 18.6 |
| Maximum Size | - | - | - | - | - | - | - | - | - | - | - | - | 69 | 45 | 75 |
| Fleet:OTB (GSA4) | - | - | 84 | 88 | 94 | 95 | 99 | 99 | 102 | 103 | 105 | 108 | 100 | 99 | 99 |

In this area, the greater part of the European hake production is targeted in Ghazaouet port. The plot (Figure 3.2.1) emphasized the decrease of the catch. The minimum production was observed on 2010. The increase of *M. merluccius* landings in Ghazaouet ports compared with Beni Saf ports was observed after 2013, which could be explained by the relocation of trawlers in the first area. The maximum capture by effort unit was marked in the period 2008-2009.

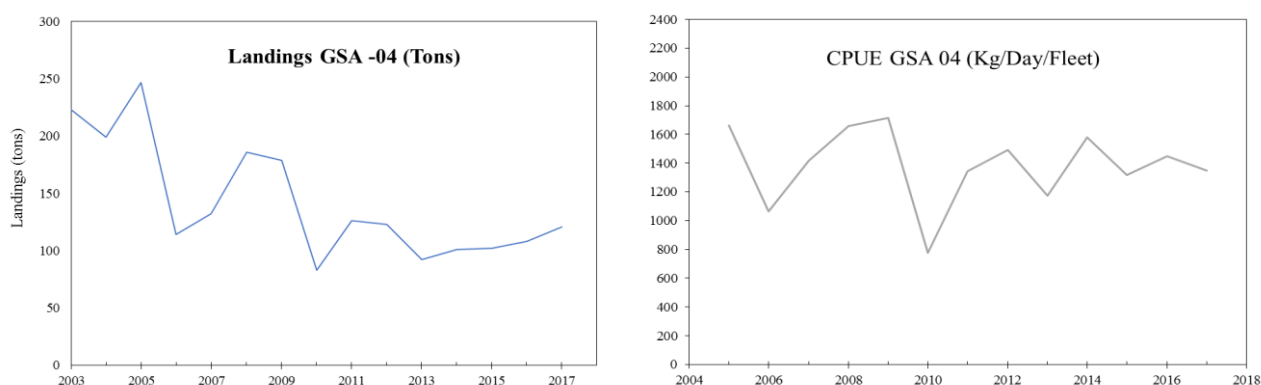


Figure 3.2.1. Trawlers landings and CPUE of *M. merluccius* (GSA-04)

In terms of regulation, namely in Algeria trawling is prohibited from 0-50m depth. The closed fishing season was from May 1st to August 31th for trawlers operating in area under 3 miles. The mesh size of the cod end is 40 mm.

3.2.1 Spatial distribution of the resources

Algerian demersal surveys (ALDEMs) are carried out from 2012 to 2017 using Medits protocol with Algerian scientific ship BELKACEM GRINE (40m).

Spatial distribution of hake in the Alboran part of GSA 04 on 2017 are presented on kg/km² (Fig.3.3.1). Survey data analysis (ALDEM 2017) using ATrIS v.2.1 (FAO, 2007) show a maximum biomass index (>10kg/km²) of European hake in the stratum ranged between 100-200m in depth. The maximum biomass index in the whole GSA 04 is observed in the eastern part of Algerian coast.

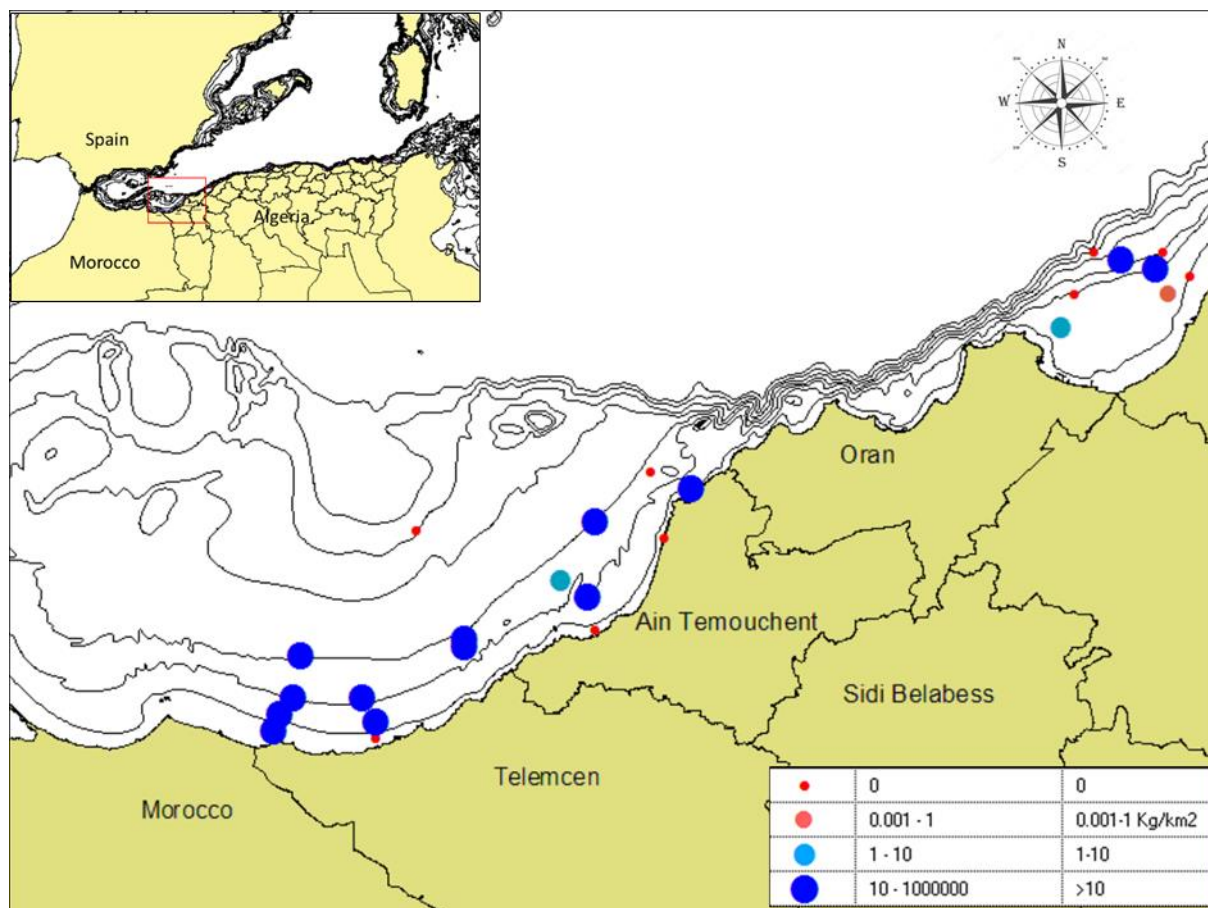


Fig. 3.3.1. Biomass indexes observed in the western part of GSA 04, Algerian demersal survey (ALDEM 2017_CNRPDA, 2017)

4 Analyse by VIT 1.3

After analysing of all data presented by experts, two expert's teams are created for the *M. merluccius* stock assessment in the Alboran Sea. Considering that exclusively, landings series data of ten years (2007-2017) in Spain and Morocco were available, experts present in the working group agreed to perform a joint assessment only for GSAs 03 and 01 using XSA model. For the data of GSA 04 collected only for 3 years, another exercise was carried out to assess European hake stock in GSA 04 using pseudocohort analysis of three years (2015-2017) with VIT software (Leonart and Salat, 1997).

4.1 Stock assesement

► Data and methods

Length-frequency distribution in GSA 04 collected from commercial catch (obtained from monthly sampling on two ports) in the western area and the official landings were used in this analyse.

Growth parameters of Von Bertalanffy and length weight relationship (Table 2.2.2) used in this assesement are those estimated by Filali & Hemida (2014) in the Eastern part of GSA 04.

Length frequency data, are converted to age frequency data. Six age classes (5+) was obtained after carrying out a slicing using FLR package in R. Figure (4.1.1) shows the population structure in the different years and in the merged data of the three years.

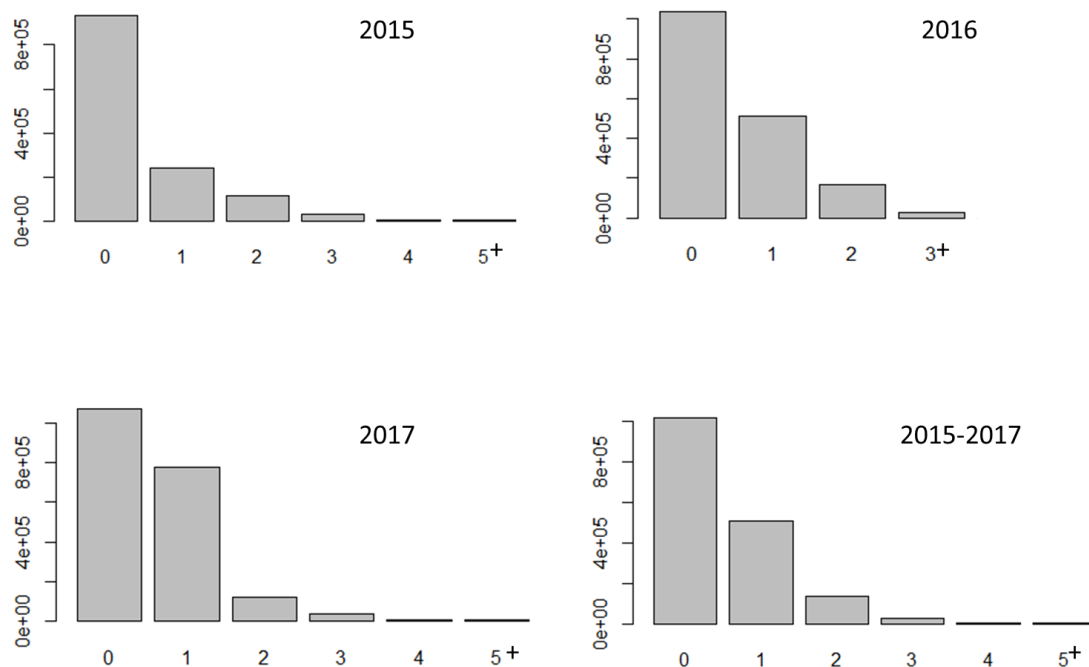


Fig. 4.1.1. Population structure of hake in GSA 04

The three years data are analysed separately, after that the merged data of the three years of sampling was used to assess the stock of hake in the western part of GSA 04. Each time, several VPA and a yield per recruit (Y/R) analysis with different terminal fishing mortality values ranging between 0 and 1.5 were carried out to choose the most suitable one for the next analysis.

In the last part of the exercise, length frequencies data collected from the most productive ports in the western part of GSA 04 are used to raise to the national landings to assess hake stock situation in the whole GSA 04 and to compare it with the others stocks in the adjacent areas of Western Mediterranean Sea.

► Results

After running several VPA using several values of terminal F , the fishing mortality curves (Fig. 4.1.2) of different F ranged from 0 and 1.5 are presented by age classes.

The study group agreed to take the VIT results for the terminal $F = 0.6$ as the best run to continue the Y/R analysis. Age classes ranged from 0 to 3 year (Figure 4.1.3) are the most exploited in GSA04.

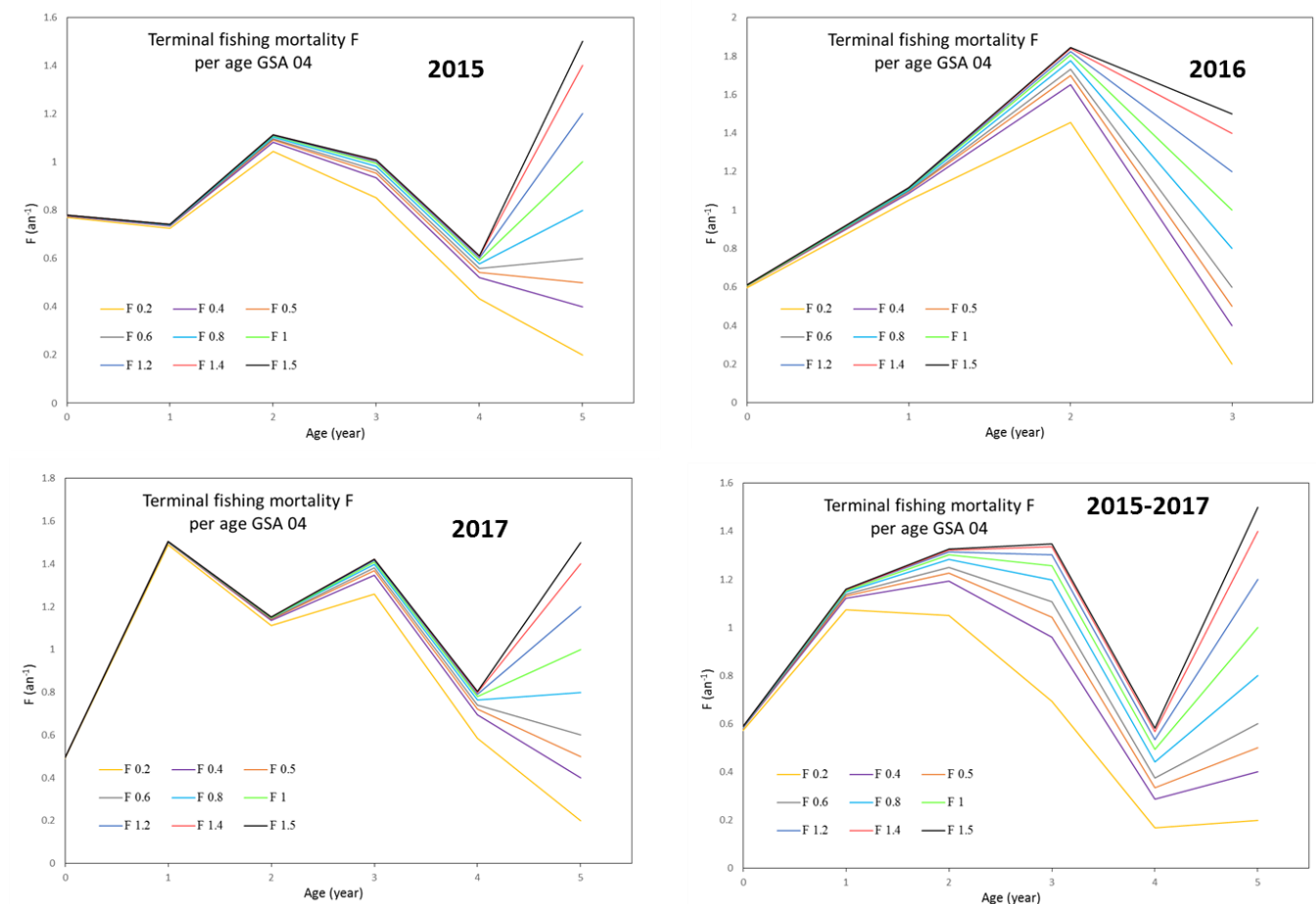


Figure 4.1.2. Fishing mortality by age classes using different values of terminal F .

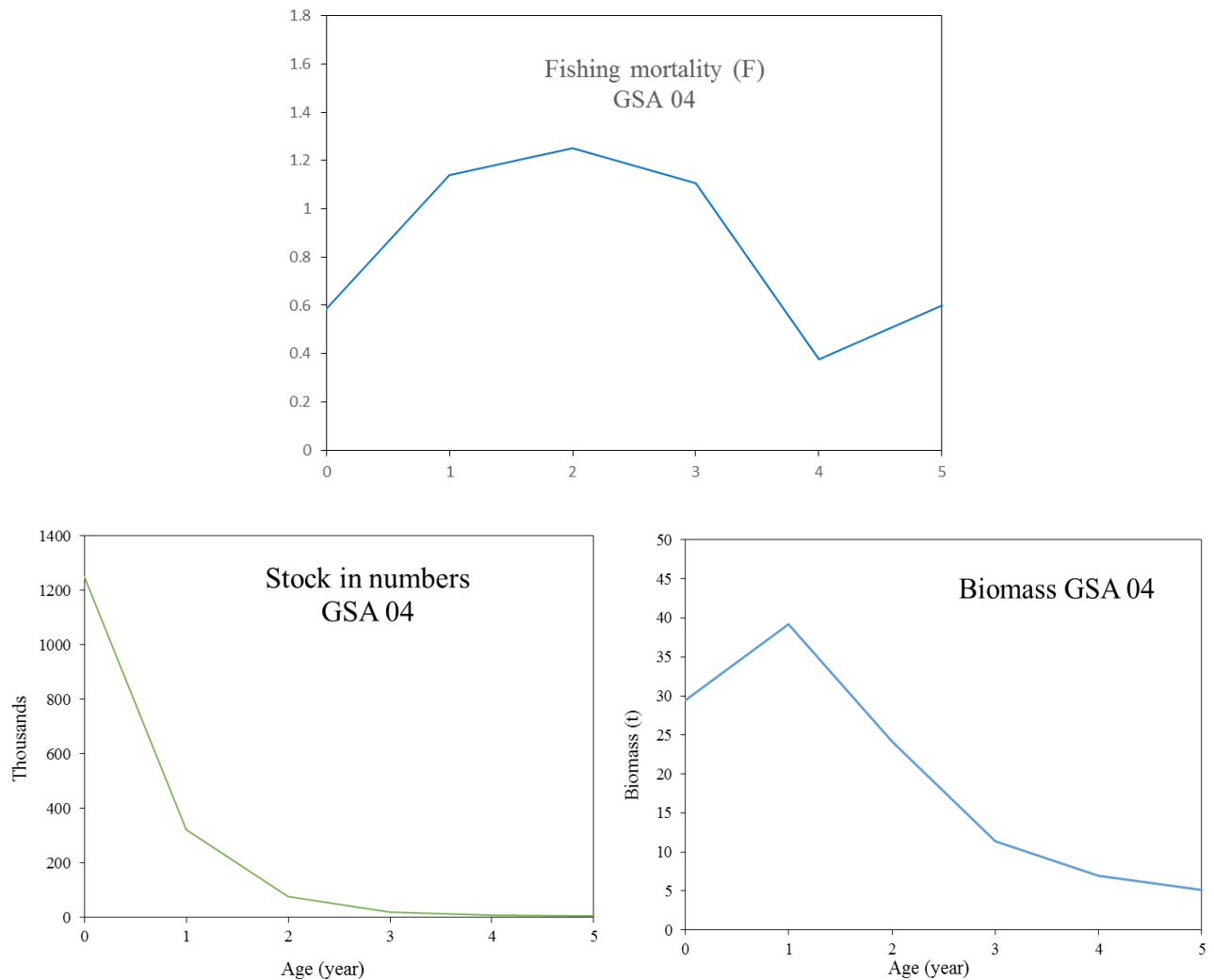


Figure 4.1.3. Fishing mortality, biomass and population of pseudocohort analysis in GSA 04.

For this analysis, the current F value ($F_{\text{current}} = 1.3 \text{ y}^{-1}$) corresponding to the average mortality F of the most exploited age classes ranging from 0 to 3 years (Table 3.4.1).

In the Y/R curve and biological reference points $F_{0.1}$ F_{MSY} (fig. 4.1.4) show that actual level of fishing mortality ($F_{\text{current}} = 1.3$) is higher than the values calculated for the F_{MSY} proxy ($F_{0.1} = 0.2$), which indicates that the current European hake stock is in overfishing status.

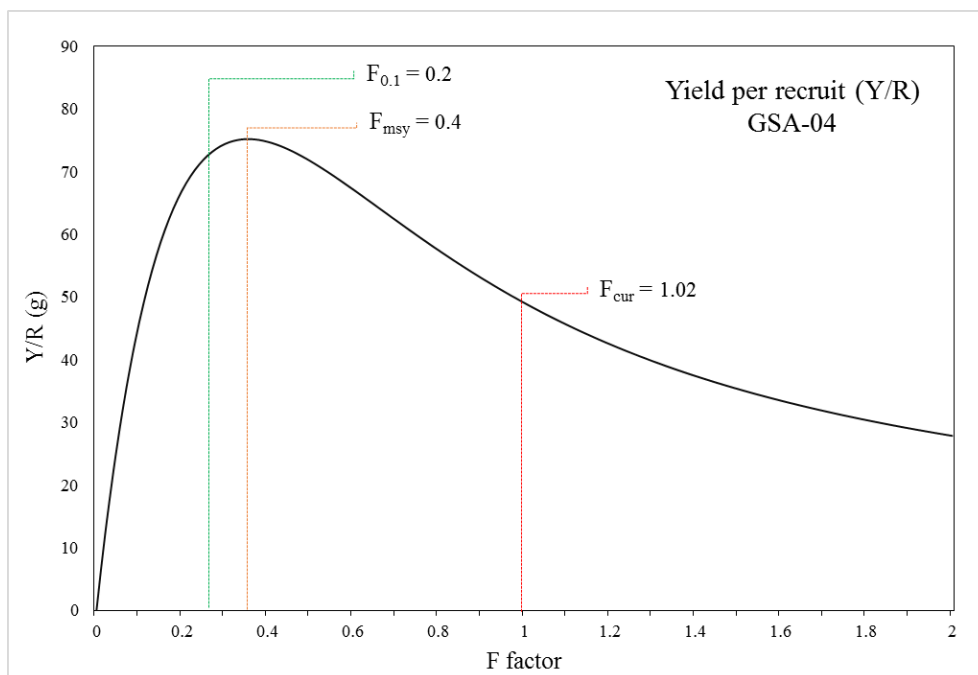


Figure. 4.1.4. Yield per recruit curve and reference points in GSA 04.

4.2 Draft scientific advice

Table 4.3.1. Draft scientific advice from all GSA'S joint analysis (GSA 04)

| Based on | Indicator | Analytic reference point (name and value) | Current value from the analysis (name and value) | Empirical reference value (name and value) | Trend (time period) | Stock Status |
|---|--------------------------|---|--|--|----------------------|--------------|
| Fishing mortality | Fishing mortality | $F_{0.1} = 0.2 \text{ an}^{-1}$ $F_{\max} = 0.4 \text{ an}^{-1}$ $F_{\text{curr}} = 1.02 \text{ an}^{-1}$ | $F_{\text{curr}}/F_{0.1} = 5.1$ | | 2015 2016 2017 | O_H |
| | Catch (t) (3 years) | | 110 | | | |
| Stock abundance | Biomass_(t) (3 years) | | 116 | 33% percentile; 113 66% percentile; 118 | | O_I |
| | SSB_(t) (3 years) | | 59 | 33% percentile; 55 66% percentile; 63 | | O_I |
| Recruitment | R (3 years) thousands | thousands | 2248 | | | |
| Final Diagnosis | | - In high overexploitation ($F_c = 1.02 > F_{0.1} = 0.2$) | | | | |
| Scientific advice for management | | - Reduce F_{current} towards $F_{0.1}$ - Progressive reduction of the fishing effort | | | | |

The comparison of European hake stock situation in GSA 04 among the different GSAs of the western Mediterranean Sea show a similar fishing level (Table 4.3.2).

Table 4.3.2. Comparison among different Western GSAs

| GSAs | $F_{0.1}$ | F_{cur} | $F_c / F_{0.1}$ |
|---------------------------|-----------|-----------|-----------------|
| GSA 04_W_2015 | 0.12 | 0.89 | 7.4 |
| GSA 04_W_2016 | 0.21 | 1.41 | 6.7 |
| GSA 04_W_2017 | 0.16 | 1.34 | 8.4 |
| GSA 04_W_2015-2017 | 0.2 | 1.02 | 5.1 |
| GSA_04 (national landing) | 0.2 | 1.3 | 6.5 |
| GSA (1+3+4W)_SAF_2017 | 0.27 | 1.3 | 4.8 |
| GSA 01_2018 | 0.2 | 1.4 | 7.0 |
| GSA 07_2018 | 0.12 | 1.8 | 15.0 |
| GSA 07_2017 | 0.15 | 1.9 | 12.7 |