

Reference points and short-term forecast for WKBANSP 2024: Anchovy in ICES Subdivision 9a South (ane.27.9a Southern component)

María José Zúñiga*, Margarita María Rincón†, Fernando Ramos‡

Biological Reference points

The methodology applied was the same decided in WKPELA 2018 (page 286 of WKPELA 2018 report (ICES, 2018)) following ICES guidelines for calculation of reference points for category 1 and 2 stocks and the report of the workshop to review the ICES advisory framework for short lived species ICES WKMSYREF5 2017 (ICES, 2017).

According to the above ICES guidelines and the S-R plot characteristics (Figure 1), this stock component can be classified as a “stock type 5” (i.e. stocks showing no evidence of impaired recruitment or with no clear relation between stock and recruitment (no apparent $S - R$ signal)).

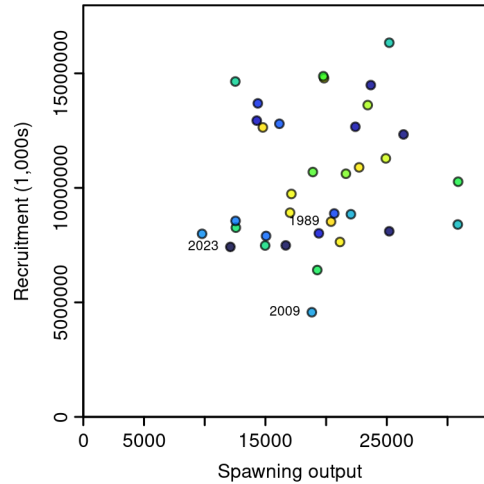


Figure 1: ane.27.9a Southern stock. Stock-recruit curve. Point colors indicate year, with warmer colors indicating earlier years and cooler colors in showing later years.

According to this classification, B_{lim} estimation is possible according to the standard method and it is assumed to be equal to B_{loss} ($B_{lim} = B_{loss}$). The value of B_{loss} for the 9a South anchovy corresponds to

*Centro Oceanográfico de Cádiz (COCAD-IEO), CSIC

†Centro Oceanográfico de Cádiz (COCAD-IEO), CSIC

‡Centro Oceanográfico de Cádiz (COCAD-IEO), CSIC

the estimated SSB in 2010 (9783.28 t), hence B_{lim} is set at 9783.28 t. Note that age 1+ individuals (B_{1+}) are assumed as mature i.e. B_{1+} class is equivalent to Stock Spawning Biomass (SSB).

ICES recommends to calculate B_{pa} as follows:

$$B_{pa} = e^{(1.645\sigma)} B_{lim},$$

where σ is the estimated standard deviation of $\ln(SSB)$ in the last year of the assessment, accounting for the uncertainty in SSB for the terminal year.

In that case assuming that SSB_{2023} and its corresponding standard deviation (sd) are the mean and the sd of a normal distribution, $\ln(SSB_{2023})$ is lognormally distributed with standard deviation as follows:

$$\sigma = \sqrt{\ln \left(1 + \left(\frac{\sigma_{SSB_{2023}}}{\mu_{SSB_{2023}}} \right)^2 \right)} = \sqrt{\ln \left(1 + \left(\frac{1727.34}{12112.7} \right)^2 \right)} = 0.142$$

Then $B_{pa} = e^{(1.645\sigma)} B_{lim} = 0.23 B_{lim} = 0.23 * 9783$. According to this, B_{pa} is set at 1.2355×10^4 t.

Figure 2 shows the biological reference points for spawning biomass.

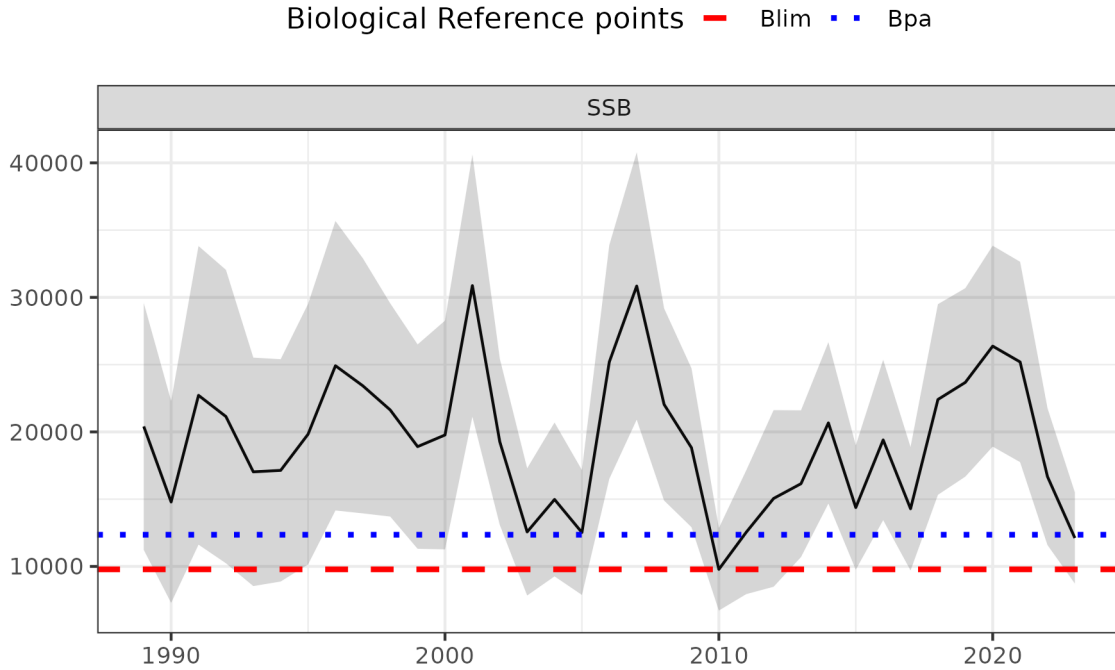


Figure 2: ane.27.9a Southern stock. Time series estimated by the model for spawning biomass (in tons) with Biological reference points

Short-term predictions

SS3 includes a forecast module that enables projections for a specified number of years, linked to the model ending conditions, associated uncertainties, and a specified level of fishing intensity. This tool was used to perform the short-term projections.

The initial stock size is the stock number-at-age 0-3 estimated at the 1st of January in the final year of the assessment. The spawning stock biomass is estimated on April 1st of the same year, with age 1+ individuals assumed to be mature. Recruitments (age 0) at the 1st of July estimated in the final year of the assessment.

Natural mortality-at-age and maturity-at-age are the input values for the final year of the assessment. Natural mortality and maturity-at-age are time invariant and the same as in the assessment and current assessment. Mean weight-at-age is the average of the last 3 years (years 2021-2023).

The exploitation pattern is the average of the last 3 years assessment. F status quo is the average of the last 3 years by fleets. Recruitment is predicted from Stock Synthesis stock-recruit relationship, corresponding to recruitment in the forecast years. Short term forecast results including catch in 2024 and SSB in 2025 are predicted for the various levels of fishing mortality in 2024. Table 1 shows the management options table from the stochastic short-term forecasts at fishing mortalities levels used for the different catch scenario options in the advice.

The forecasts are stochastic, allowing for estimates of uncertainty in SSB. Consequently, the probability of SSB falling below B_{lim} in 2025 is also estimated.

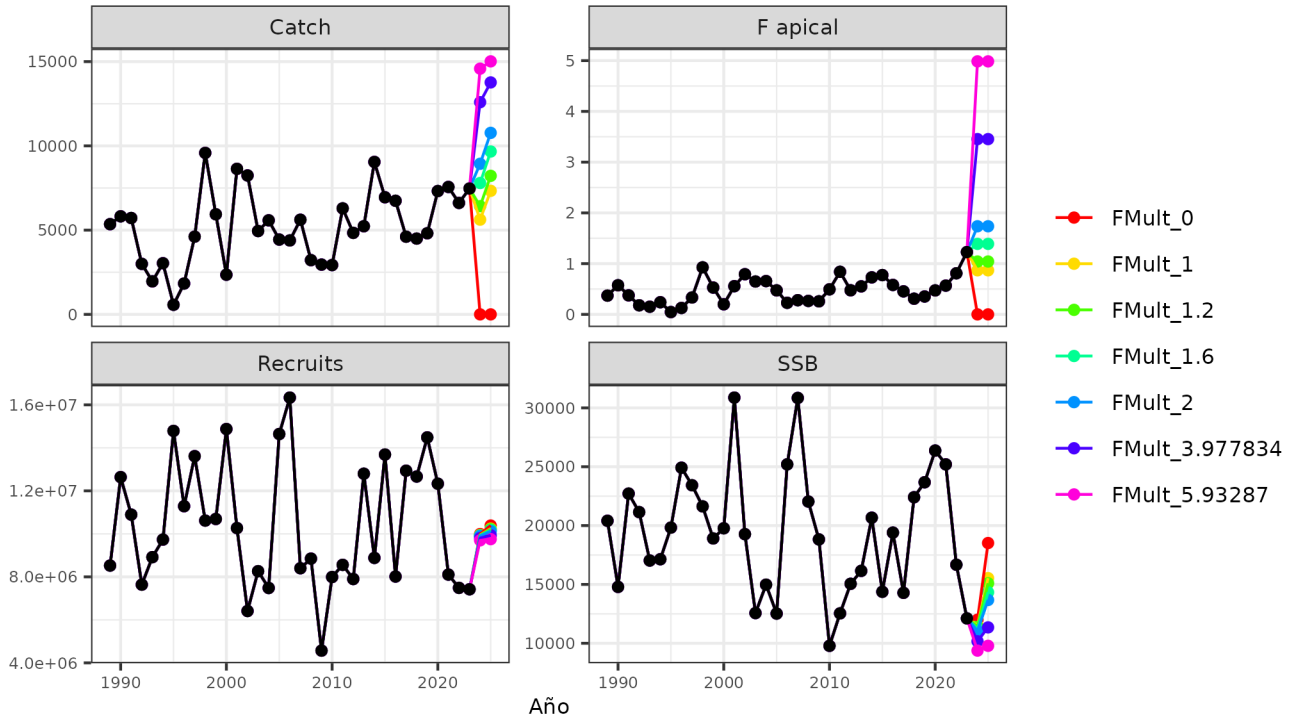


Figure 3: ane.27.9a Southern stock. Short-term predictions

Table 1: Management options from the stochastic short-term forecasts at fishing mortalities levels used for the different catch scenario options in the advice

Mult	F	Rec_2024	Rec_2025	SSB_2024	SSB_2025	pBlim_2024	pBlim_2025	Catch_2024
0.0	0.0	10.0	10.4	12003.9	18518.0	0.2	0.0	0.0
1.0	0.9	9.9	10.2	11514.2	15533.3	0.3	0.0	5621.9
1.2	1.0	9.9	10.2	11418.6	15097.1	0.3	0.0	6421.0
1.6	1.4	9.9	10.2	11230.0	14330.8	0.3	0.0	7797.1
2.0	1.7	9.9	10.1	11044.4	13676.0	0.3	0.0	8936.6
4.0	3.5	9.8	9.9	10171.0	11351.0	0.4	0.1	12591.3
5.9	5.0	9.7	9.8	9375.7	9783.3	0.6	0.5	14582.3