Report of the 2025 Shortfin Mako Shark Stock Assessment Meeting
(*Hybrid/Madrid, Spain, 9-13 June 2025)*

The results, conclusions and recommendations contained in this Report only reflect the view of the Shark Species Group. Therefore, these should be considered preliminary until the SCRS adopts them at its annual Plenary meeting and the Commission revises them at its annual meeting. Accordingly, ICCAT reserves the right to comment, object and endorse this Report, until it is finally adopted by the Commission.

1. Opening, adoption of agenda and meeting arrangements and assignment of rapporteurs

The rapporteur of the Sharks Species Group and the SCRS Vice Chair opened the meeting and welcomed the participants (the Group). The Assistant Executive Secretary also welcomed the participants, noting the importance of this stock assessment, and wished them a successful meeting. The Chair then proceeded to review the agenda, which was adopted with minor changes (**Appendix 1**). The List of participants is contained in **Appendix 2**. The List of documents presented at the meeting is included in **Appendix 3**. Summaries of the documents and presentations are available in **Appendix 4**.

Rapporteurs were assigned as follows:

Section

1. N.G. Taylor
2. F. Mas, E. Cortés, C. Mayor, R. Forselledo
3. M. Ortiz, H. Bowlby, M. Narváez, J. Rice, G. Cardoso, G. Liniers, T.-C. Kuo, M. Kai, B. Babcock, L. Kell
4. H. Bowlby, M. Narváez, B. Babcock, J. Rice, G. Liniers, D. Courtney, R. Sant´Ana, E. Kikuchi, C. Fernández, R. Coelho, G. Cardoso, A. Kimoto
5. M. Ortiz, A. Kimoto, C. Fernández
6. G. Díaz, N.G. Taylor, R. Forselledo
7. N.G. Taylor, Rodrigo Forselledo
8. M. Neves dos Santos, R. Forselledo
9. R. Forselledo
10. F. Mas, R. Forselledo
11. N.G. Taylor

2. Summary of available data for the assessment

Based on the alternative hypothesis on biological parameters, the Group agreed to use the terms "higher productivity" and "lower productivity" for shortfin mako shark (SMA, *Isurus oxyrinchus*). The term low productivity for shortfin mako stocks refer to biological features associated with slower individual growth rates, lower production of recruits, and longer age of maturity (Cortés and Brooks, 2018). While the term high productivity indicates biological parameters with higher individual growth rates (based on the tag recapture information), reaching maturity at earlier ages and effectively higher production of recruits.

For North Atlantic shortfin mako (SMA-N), scenarios 1 and 2 correspond to the assumptions of higher productivity and scenario 3 to lower productivity. For South Atlantic shortfin mako (SMA-S), scenarios 1 and 2 correspond to higher productivity, while 3 and 4 correspond to lower productivity.

2.1 Intersessional work

SCRS/P/2025/055 presented the work carried out during two informal meetings held between the 2025 Shortfin Mako Data Preparatory and Stock Assessment Meetings.

At the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025), it was agreed that pending tasks would be presented in an informal meeting in early April 2025. The meeting was held on 4 April 2025. Tasks that had been pending and were resolved are summarized below:

- North Atlantic SMA catch series:

  - During the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025), it was agreed that SMA-N historical catch estimates for the period 1971-1984, based on Mejuto *et al.*, 2021, would be split by fleet (see the Report of the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025) for details) and presented during the April 2025 informal meeting.
  - The estimated historical catches split by fleet were presented. However, the Group decided to use these estimates as a single fleet for the period 1950-1984. For the period 1985-2023 the catches were those from Task 1 Nominal Catches (T1NC).
  - SMA-N catches used in the stock assessment are presented in **Table 1.** SMA-S catches used in the stock assessment are presented in **Tables 2** and **3**.
  - Fleet structure for North and South Atlantic are presented in **Tables 4** and **5** respectively.

- Chinese Taipei CPUE index:

  - During the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025), the catch per unit effort (CPUE) indices from Chinese Taipei were presented (SCRS/2025/031) and reviewed. The Group had some concerns (see 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025) for details) and asked the authors to address these concerns and present the index again.
  - The document was updated and presented, and the Group agreed that indices for the North and South be included. The document SCRS/2025/031 was published by Kuo *et al.* (2025).
  - All CPUE indices used in the assessment are presented in **Tables 6** and **7** for the North and South, respectively.

- Age and growth:

  - During the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025), an updated study on the age and growth of SMA for the South Atlantic was presented (SCRS/2025/040). The Group discussed that, for consistency between stocks (see 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025) for details), the same methodology should be applied to both. Documents for both stocks, North (Anon., 2017) and South (SCRS/2025/040), should be updated to assume two band pairs per year until the age of maturity, and one band pair per year thereafter, for each sex.
  - Anon., 2017 was updated and presented as presentation SCRS/P/2025/058, and the analysis in SCRS/2025/040 was revised accordingly. The resulting parameters used in the assessment are shown in the biological parameter tables (**Tables 8** to **17**). As agreed during the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025), document SCRS/2025/074 on estimates of vital rates and population dynamics parameters was presented during the April 2025 informal meeting. The document was then updated and presented again in the Stock Assessment meeting (see Section 2.6).

After the informal meeting in April 2025, the Group reviewed stock assessment input tables, which led to recommendations for additional scenarios. From this revision, it was suggested that a second scenario for the South be run, that considered the biological parameters used in the 2017 shortfin mako stock assessment. For consistency with scenarios considered for the North stock, it was agreed that a productivity scenario consistent with the 2017 shortfin mako stock assessment should also be included. Model scenarios for the northern and southern stocks are presented in **Table 21**. A second informal meeting was held on 19 May 2025. During the meeting, progress on JABBA and SS3 models was presented for discussion by the Group. Questions/clarifications were raised related to CPUE index series, model scenarios, population parameters, and minimum number of specimens measured for each sample size class among others. The model-weighting discussion for each scenario was proposed to be included in the shortfin mako stock assessment meeting agenda before presentation of the models.

2.2 Catches

The Secretariat presented an updated summary of the statistical data available for the assessment of the shortfin tagging information (both conventional and electronic) for both stocks (SMA-N and SMA-S), Task 2 catch and effort data (T2CE), Task 2 size frequency data (T2SZ), and both conventional and electronic tagging information for shortfin mako in both stocks. The information available for the Mediterranean stock (SMA-MD) remains very limited. The Secretariat informed the Group about all the files containing this information, which were made available to participants in the corresponding meeting NextCloud folder.

The Secretariat made available the following files: the SCRS catalogues for SMA-N and SMA-S, covering the period 1994-2023, as shown in **Table 18** and **Table 19**, respectively; files for landings and dead discards (**Table 20**), provided in both pivot table and executive summary formats, as well as the file containing live discards (DL). A link to the interactive dashboard was also included, enabling users to explore the nominal catch data by stock, gear, and flag. In addition, the Secretariat provided detailed catalogues for T2CE, T2SZ, and tagging information.

The Secretariat noted that, as of the stock assessment meeting, only minor updates had been made to the T1NC series compared to those presented during the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025). Differences were concentrated in the period 2012-2023 and remained below 10 t per year from 2012-2021, while for 2022 and 2023 the differences were 47 t and 386 t, respectively. These changes, made after the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025), correspond to the updated shortfin mako dead discard estimates for EU-PRT in the North and South Atlantic (Coelho *et al*.,2025), as well as small updates to the Venezuelan artisanal gillnet fishery - La Guaira (Narváez *et al*., 2025), which had already been approved by the Group during the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025).

The Group noted that shortfin mako nominal catches show a general declining trend since the mid 2010s, with an increasing share of catches from the southern Atlantic stock. The Secretariat also pointed out that, for both stocks, nearly all shortfin mako catches in the ICCAT database in recent years come from longline (LL) gear, while rod and reel (RR) catches - significant during the 1980s - have progressively declined (**Figure 1** for SMA-N and **Figure 2** for SMA-S). It was also reported that, thanks to reclassification efforts by EU-PRT, there has been a slight improvement in the identification of gear types, reducing the proportion of catches reported as "Unclassified".

The Group was informed that no significant updates have been made to historical data since the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025). However, the Secretariat reiterated that substantial data gaps remain, especially for the Mediterranean stock (SMA-MD), for which very limited data are currently available. CPCs were once again reminded to report missing Task 2 data and, where possible, to improve the quality of T2CE and T2SZ data, especially by reclassifying records submitted for non-monthly time periods or with non-standard spatial grids. For T2CE data, it is obligatory to report LL data at 5°x5° resolution. For all other gears it is obligatory to report data T2CE data at 1°x1° resolution.

2.3 Indices of abundance

A joint presentation was made showing the results from the analysis and comparison of shortfin mako South (SCRS/2025/129) and North (SCRS/2025/130) CPUE series for the 2025 shortfin mako shark stock assessment.

The Group acknowledged the utility of these analyses to assist with comparison of the different identified conflicting CPUE series to help fine-tune model specifications. The analysis showed for both the North and the South Atlantic high correlations among some CPUE series and conflicting trends among others. It was noted that the consideration of conflicting and divergent series would likely affect the ability of the models to fit the data, and that shorter series with less time overlap with others could also affect the performance of the models. Furthermore, it was acknowledged that the inclusion of conflicting series in the models may prevent the ability of the models to fit the data or may cause inconsistencies in the residuals and instability.

The importance of considering the biological aspects of the species as an objective way of assessing catch series was underscored, and some concerns were raised specifically regarding sharp increases (e.g. doubling of population size for low-productivity species interannually) in some of the CPUE series, which are inconsistent with the known life history of the species.

There was a lengthy discussion regarding whether all series should be used, if series with similar trends should be grouped, or if different series should be weighed differently. The Group was reminded, however, that all CPUE series had been accepted during the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025), and agreed to by the Group to be used in the evaluation. Taking this into consideration, the Group agreed that the series groupings identified in the comparative analysis could be considered as sensitivity analysis, but that the initial case models should consider all individual CPUE series.

Although suggestions were made that CPUE series could be weighted based on catch levels and/or spatial coverage, the Group agreed that there was no objective way at the moment to assign different weights to the different CPUE series, and that the process would be too time-consuming at this stage.

With respect to CPUE weighting, the Group agreed to the following:

- To use the error estimate from the standardization process for each point
- If warranted, increase the error term for each point to a minimum coefficient of variation (CV) of 0.2
- To estimate the additional observation-error as appropriate

Detailed weighting methods used in the models are available in the corresponding SCRS papers and below.

The Group acknowledged that it would be beneficial to make a recommendation to the Working Group on Stock Assessment Methods (WGSAM) to explore potential protocols that may help future evaluations with assigning different weights to CPUE series, especially when dealing with conflicting trends.

The Group also agreed that future evaluations could greatly benefit from considering fleet-combined indices as a way to explore the data and tendencies. Given recent positive experiences in the development of combined indices for other species, the Group recognized that this approach could be beneficial for other shark species besides the shortfin mako. It was noted that this approach would require clear protocols in terms of data sharing, confidentiality, and possibly the involvement of more participants in the data analysis process.

2.4 Biology

Updates to biology are addressed in Section 2.1 of this report.

2.5 Length compositions

There were no updates to the length composition data after the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025).

2.6 Other relevant data

The presentation SCRS/2025/074 summarized the results of the updated demographic analyses, including changes introduced after the April 2025 online informal meeting, where the standard errors (SEs) for the North Atlantic stock maturity ogive parameters were corrected.

Following the presentation, concerns were raised that the values of steepness and the position of the inflection point (B_{MSY}/K) for the relatively lower productivity scenarios for both the North (scenario 3) and the South (scenario 3 and 4) Atlantic stocks were higher than those for the other scenarios (scenario 1 for the North and scenario 1 for the South). After scrutinizing the analyses, it was explained that this was due to the combination of several issues related to using the theoretical maximum age: 1) more age classes were able to reproduce and thus contribute to the net reproductive rate (R_0 in demographic terms or SPR_0 in fisheries terms) compared to using the maximum observed age; and 2) first year survivorship (S_0) was higher because two of the indirect M estimators were based on the higher theoretical maximum age used in the analysis. Because steepness is a function of the maximum lifetime reproductive rate, which for sharks is computed as the product of R_0 and S_0, steepness values were thus unintuitively higher for the low productivity scenarios.

To resolve these issues, after further exploration and discussion, it was decided that the most pragmatic approach was to use the deterministic estimates that relied on maximum *observed* age. Using this approach resulted in steepness and B_{MSY}/K values that aligned with ecological theory, i.e. the lower productivity scenarios had lower values of steepness and higher values of B_{MSY}/K than the relatively more productive scenarios. **Table 21** summarizes the results by scenario.

The Group noted that may consider different productivity scenarios in the future.

There was also discussion about what vectors of natural mortality (M) were most appropriate to use in Stock Synthesis (SS). While the values of M used to derive productivity (r_{MAX} and steepness) were the minimum of seven estimators, it was noted that the M vector used in SS did not necessarily have to be the same as that used to derive r_{MAX} and steepness (which is a minimum value in order to obtain maximum, or intrinsic, productivity) and that it would make more ecological sense to use an estimator that decreased M as age increased. After inspecting the M at age curves obtained with the different estimators, the Peterson and Wroblewski mass-based method was deemed the most appropriate because it showed a more attenuated decrease in M in the early ages, consistent with the biology of this species, which give birth to pups that are about 1 m in total length and thus are believed to have relatively low natural mortality in the early ages. **Figure 3** shows the M curves obtained with the different estimators for the North Atlantic stock scenario 2 for females as an example.

The Group discussed the fact that JABBA-Select uses a single value of M. Given that the stochastic results were no longer being considered, it was decided that the simplest approach was to use the average M across exploited ages. After reviewing the length range of exploited ages of females and males for the North and South Atlantic stocks, it was seen that these ranges included all ages from 0 to maximum observed age for both sexes and stocks, thus the average M value from age 0 to maximum observed age was computed for each scenario by sex and stock. **Table 22** summarizes the range of exploited lengths (cm FL) by stock and sex.

Tables 23 and **24** list the M vectors obtained with the Peterson and Wroblewski method for females and males, respectively, by scenario to use with SS; values highlighted in orange in the tables are the mean M to use for JABBA-Select.

3. Intersessional work

3.1 Discussion on methods for model scenarios weighting

The Group discussed the issue of model weighting. Issues were raised regarding equal weighting and/or weighting using model diagnostics. The Group also expressed concerns about using the model ensemble approach to combine models with different structures and assumptions (e.g. SS and JABBA), particularly when making stock projections. This creates a problem in that JABBA only models project the exploitable biomass as opposed to SS3, which projects the entire age structure.

The Group agreed that the use of the SS age-structured model was more appropriate for assessing shortfin mako, given the species' biological characteristics. These include its extended life expectancy, delayed sexual maturity, low productivity, and time-lags between recruitment and spawning biomass (SSB). While the JABBA-Select model might be considered as a better alternative to JABBA, the Group noted that JABBA-Select is not included in the ICCAT catalogue and, therefore, it could be used to evaluate sensitivities, but not to provide scientific advice.

The Group suggested that model weighting should be determined based on model diagnostics and model/biological plausibility. However, the Group concluded that evaluating different model-weighting methods is beyond the scope of this meeting. The Group agreed that evaluating and recommending methods for model weighting is a subject that should be evaluated by the WGSAM.

3.2 Production models

North Atlantic

Document SCRS/2025/135 presented the methods and results from Bayesian production models fit using JABBA (Version 2.3.1, Winker *et al.*, 2025, Winker *et al.*, 2018) and JABBA-Select (Winker *et al*., 2020) for the North stock. Continuity runs demonstrated that JABBA gave similar results to the BSP2JAGS production models used in the 2017 shortfin mako stock assessment (Anon., 2017) and the 2019 projections (Courtney *et al.*, 2020). These produced similar trends to the three productivity scenarios when using the data from the current assessment. For the three productivity scenarios, different priors for K, fixed or estimated process error, and different observation error assumptions in the CPUE series were evaluated.

For JABBA, the Group agreed to use revised productivity priors based on the medians of the deterministic demographic methods. For scenario 1, the prior for r was lognormal(mu=0.085, log-sd=0.2), and B_{MSY}/K was fixed at 0.597, for scenario 2, r was lognormal(mu=0.085, log-sd=0.2) and B_{MSY}/K was fixed at 0.590, and for scenario 3, r was lognormal(mu=0.44, log-sd=0.2) and B_{MSY}/K was fixed at 0.660. All other priors and settings were the same as the reference cases in SCRS/2025/135. To address the lack of correlation between CPUE indices, sensitivity analyses were run using the index groups suggested in SCRS/2025/130, which were: (1) SPN-LL, JPN-LL1, POR-LL; (2) USobs-LL, MOR-LL1, JPN-LL2; and (3) CTP-LL.

Priors for K and SSB_0 were influential, and the Group requested the modeler to evaluate the impact of individual CPUE series on the overall scale of K or SSB_0 to diagnose the scale issues. It was also suggested to project from 2015 to 2023 using the continuity model to evaluate predictive ability for the observed catches.

The Group discussed different options for grouping the CPUE series or implementing a time block for the Spanish index. The strong increase in recent years in that index is not consistent with the biology of the stock. With all CPUEs in the model, biomass in 1950 was estimated to be substantially above Maximum Sustainable Yield (MSY), yet MSY was highly variable in sensitivity analyses. The Group agreed that the scale of the yield curve would be problematic if used for projections. The Group recommended the modeler to compare the maximum potential increase in recent years based on biology, to the increase in the Spanish index to determine the biological plausibility of the most optimistic results.

JABBA-Select

JABBA-Select models incorporate selectivity by fleet to account for the difference in exploitable biomass relative to SSB. JABBA-Select uses an age-structured equilibrium model (ASEM) to generate a joint informative prior for the discrete harvest rate, H_{MSY}, and the shape parameter m, and also allows inputs of selectivity for each fleet (Winker *et al.*, 2020). The input parameters for the ASEM for each life history scenario include growth parameters, length-weight relationships, the maturity ogive, steepness, and natural mortality. Natural mortality was calculated as the average value over all age classes and both sexes described from the estimator in Section 2.6 for consistency with the SS3 runs. The fleet configurations and selectivities were taken from the stock synthesis run for scenario 1, and the same selectivity inputs were used for all three life history parameters. The prior for unfished SSB was lognormal (100000, CV=0.2), the same as the K prior for the JABBA models, although SSB and K in units of exploitable biomass are not expected to be the same for mako sharks. The same lognormal (1, 0.2) prior was also used for initial depletion. Maximum age was 42. Process error sigma was set to 0.05, and observation error was estimated from the input CVs plus an estimated variance per series as in some of the JABBA runs.

South Atlantic

The most recent version of JABBA (v4.4.3., Winker *et al.*, 2018) Bayesian surplus model was applied to the time series of catches and indices to assess the South Atlantic shortfin mako stock with data up to 2023.

Document SCRS/2025/128 presented the methodology and preliminary results from JABBA main runs for the South Atlantic stock, as well as a large grid model ensemble. The main 4 models considered included combinations of 2 different productivity scenarios, given through the population growth rate r, and B_{MSY}/K used as a proxy for m used to define the shape of Pella-Tomlinson production function. Each of those productivity scenarios were then run considering each of the 2 catch scenarios (reported or estimated catches).

Mod.07: higher productivity scenario (r=0.114, B_{MSY}/K =0.578) with estimated catches.
Mod.08: lower productivity scenario (r=0.049, B_{MSY}/K =0.637) with estimated catches.
Mod.09: higher productivity scenario (r=0.114, B_{MSY}/K =0.578) with reported catches.
Mod.10: lower productivity scenario (r=0.049, B_{MSY}/K =0.637) with reported catches.

JABBA was implemented in R (R Core Team, 2025) with Just Another Gibbs Sampler (JAGS) interface (Plummer, 2003) to estimate the Bayesian posterior distributions of all quantities of interest using a Markov Chains Monte Carlo (MCMC) simulation.

Some initial model runs using all CPUEs agreed at the 2025 Shortfin Mako Data Preparatory Meeting (Anon., 2025), showed unreasonable results mainly because of conflicting trends among some CPUEs, and between the CPUEs and catch trends. The author explored models by splitting indices into different time periods as follows, allowing the estimation of different catchability (q) parameters for each time period. It was noted that in the case of Japan, the 2 time periods were provided by the CPUE analysts directly, while for the other cases they were split afterwards.

- Japan LL 1994-2011 (logbook data)/ 2012-2023 (observer data)
- Brazil/Uruguay LL 1978-1982 / 1983-2013 / 2014-2022
- South Africa LL 2000-2012 / 2013-2023
- Spain LL 1990-2011 / 2012-2023

The Chinese Taipei longline index had a relatively short period with a strong and continuous decreasing trend. All preliminary JABBA runs results in extremely high values of fishing mortality and unreasonable credibility intervals. The author suggested using the Chinese Taipei longline index only in sensitivity analyses.

The Group requested clarification on the criteria used for establishing the time blocks, suggesting considering possible historical changes in the fisheries (such as changes in regulations, in target species, among others).

The author explained that time blocks were set trying to consider possible inflection or sharp peaks in the indices time series, as well as the improvement in model adjustment and diagnostics. In general, with the implementation of time blocks, the diagnostics for the four model scenarios improved relative to the initial models. Additionally, the diagnostics were similar for all the final four initial case models and did not indicate substantial issues in the models.

It was also noted by the Group that considerable differences in MSY were observed in 2 different productivity scenarios. The author mentioned that it was to be expected and that similarities between the two catch scenarios were considered as a good sign for model results.

The Group discussed using different prior values for initial depletion (B_{1971}/K) in the estimated catch scenarios, considering that the estimated catch in the 1970s was 1500 t and the stock was exploited at the beginning of the time series. The author pointed out that the preliminary runs used a starting biomass of 0.9K, based on a beta distribution. This prior already considers possible higher depletion levels. The Group requested the models with priors set to lower initial biomass. These analyses are in an updated version of the document.

The Group also suggested showing pairwise correlations between posteriors of the estimated parameters. These results were provided during the meeting and shown to the group.

Regarding the jackknife analysis (leaving out one CPUE index at the time), the Group inquired if some indices caused different trends in biomass or fishing mortality.

It was explained that under those configurations (time blocks), CPUEs were not too strongly influential compared to the rest of the input data and parameters. The results of jackknife analyses and evaluation of one CPUE at a time suggested that the CPUE indices provided the same information to the model and there was not any single index that was too influential on the fit. The main difference among the scenarios is the scale of F_{MSY}.

It was noted that there was no apparent reason to make time blocks in the Spanish longline and South African longline indices and suggested using whole CPUE series. The Group also noted that a higher CV (0.4) for the early period on the Spanish longline index might not be appropriate because shortfin mako shark was a valuable species and the index was more precise than the later period. Using CV 0.2 for the earlier Spanish time series was suggested.

The (assessment) author noted that the differential use of minimum CPUE CVs of 0.4 for the early periods and 0.2 for the later periods was trying to address eventual higher uncertainties in the data from the early time periods, which can be related with data collection procedures in the early years. Nonetheless, the models were re-run with the Spanish initial period CPUE CV set to a minimum of 0.2, as requested. The results show some differences in the initial period overall trends but result in almost the same terminal year status.

The Group also inquired if the time and spatial dimensions were taken into account in population growth, as environmental changes in time and space can affect some population parameters. The author answered that until that moment, the Group had not available information specifically related to environmental changes, which was the reason why it was not possible to consider this request for the current stock assessment.

The author also noted that for top-predator species like shortfin mako shark, the population dynamics is expected to follow more K-selected life history patterns, with an expectation that such species are less prone to short-term environmental changes that could affect for example recruitment, as is the case for r-selected shorter-lived species.

3.3 Length-based age-structured models: Stock Synthesis

North Atlantic Shortfin Mako Stock Assessment with SS3

The modelers presented a preliminary integrated model for each of the biological scenarios associated to the North shortfin mako stock (SCRS/2025/132). They were mostly developed intersessionally, but also during the meeting, as the Group decided to implement a revision of the values of steepness (h) and natural mortality at age (M) for each of the scenarios. The Stock Synthesis (SS3) modelling platform was used for all scenarios.

After considerable effort, the Group was not able to obtain credible model results. Consequently, the Group identified the need to develop a new workplan with options to re-do the assessment in 2026, see section 6. In addition, the Group recommended that SCRS/2025/132 be revised to reflect the SS configuration changes to each biological scenario updated during the 2025 Shortfin Mako Shark Stock Assessment Meeting, as described below.

Scenario 1 discussion

The Group observed stable diagnostics and inquired about the use of Beverton-Holt (BH) recruitment. The modeler clarified that Low Fecundity Spawner-Recruitment (SR) was being used instead.

Some concerns were raised regarding USA selectivity patterns, with suggestions to explore temporal blocks. The modeler acknowledged potential annual variability but noted residual analysis showed no obvious patterns.

The Group discussed differences between USA logbook and USA observer CPUE series, with observer data yielding more optimistic results about stock abundance. The logbooks index was used in the 2017 shortfin mako stock assessment, but an update was not presented for the 2025 Shortfin Mako Data Preparatory Meeting. Instead, an abundance index based on observer data was presented and agreed to be used for the 2025 assessment. The modeler indicated that switching to the logbook index might produce results more similar to the 2017 shortfin mako shark stock assessment.

The influence on stock status of the values corresponding to recent years in Spanish (SPN) CPUE series was noted, though the modeler emphasized that retrospective analyses and data substitutions (USA observer vs. logbook) in the 2017 shortfin mako shark stock assessment showed similar trends.

The modeler underscored that stock status estimates may differ significantly from the 2017 shortfin mako shark stock assessment, pending further review. The Group was advised to consider data source implications, with additional insights to be provided later.

The modelers presented several diagnostics including likelihood profiles that indicated inconsistencies between the CPUE series (SCRS/2025/129 and SCRS/2025/130). The Group noted that this might be of concern due to fact that some of the CPUE series were based on relatively small sample sizes in recent years due to regulations about retention. These factors, along with the likelihood profile, indicated conflict among CPUE series in the estimation of the population scale, which led the Group to discuss whether it was appropriate to include all the CPUE series or if other groupings should be used. The Group chose to include all the CPUE series approved during the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025) for models evaluated at this meeting.

Scenario 2 discussion

The Scenario 2 for the North was noted to be broadly similar to scenario 1 in terms of model configuration. The modeler interpreted the implications of using a high coefficient of variation (CV) associated with the growth curve, especially for females. The modeler explained that this high variability leads the model to expect the presence of females exceeding 400 cm, a situation that raises concerns regarding potential cryptic biomass. The Group noted that there is no strict requirement for applying the same CVs to both males and females, providing some flexibility in the modelling process.

It was reported that the CPUE series for the Spanish (SPN) and Portuguese (PRT) fleets display acceptable fits. Further diagnostics included residual analysis for both CPUE and length composition data. The retrospective analysis yielded encouraging results, with a small Mohn's rho indicating the absence of significant retrospective bias. Mean Absolute Scaled Error (MASE) scores were also presented as a measure of predictive performance, supporting the current model's consistency.

A review of the model output highlighted several configuration changes. The updated model had lower CV values for both male and female growth curves, with direct implications in the model's treatment of length composition data. Recruitment deviations now begin in 1990, although it was suggested that an appropriate configuration should allow these deviations to start roughly between 5 to 16 years prior to the first available length data. Moreover, numbers-at-age plots show noticeable accumulation in the plus group (ages 35 and older), particularly among females, suggesting either the existence of unobservable mature biomass or model misspecification. This raises concern, as these individuals could be contributing to recruitment without being captured by the fisheries. The modeler also addressed concerns regarding the Mexico (MEX) length compositions, which displayed high valued Pearson residuals.

The issue of whether to include all CPUE series or implement a grouping strategy was a key topic of debate. While there was agreement during the prior 2025 Shortfin Mako Data Preparatory Meeting (Anon., 2025) to retain all CPUE indices, the Group acknowledged that significant fitting issues or diagnostic failures might justify the exclusion of certain series. Nevertheless, it was emphasized that excluding a CPUE series based solely on a failed diagnostic test was not justifiable. Instead, any such decision should include a discussion with the relevant CPC regarding the CPUE it developed and a review of comprehensive model diagnostics, as well as clear evidence of poor fit. It was suggested that Leave-One-Out (LOO) analyses are generally more informative than studying the behaviour of single-CPUE-fitted models, especially considering the restricted nature of abundance series and temporal coverage.

Concerns were raised regarding the accumulation of individuals in the plus age group and the implications for estimates of fecundity. In particular, it was noted that only one fleet employs logistic (asymptotic) selectivity. This suggests that a portion of the spawning stock - potentially responsible for a significant share of recruitment - is not being observed. This cryptic biomass represents a major source of uncertainty, especially in long-lived, low-fecundity species such as shortfin mako. It was questioned why these large individuals are not being caught, and whether this points to a shortcoming in the model's selectivity assumptions.

In this context, the interpretation of profile plots was discussed in detail. Asymmetries and sharp gradients in some likelihood profiles were observed, particularly for certain CPUE series. These suggest potential conflicts between indices and the model likelihood, which may undermine the reliability of the covariance matrix used to quantify uncertainty. The Group agreed that future work should include R_0 profiling across all scenarios, by fleet and data type. This would allow a clearer understanding of how different data components influence model outputs and could help identify problematic trends.

The Group inquired about the proportion of stock fecundity accumulated in the plus age group and asked if results across different scenarios could be effectively integrated. One suggestion was that the weight assigned to CPUE data in the likelihood may need to be adjusted so that model outputs better reflect the observed data trends. There was also a call to investigate whether the patterns observed in profile plots align with proposed CPUE groupings.

Scenario 3 discussion

The third scenario for the age-structured modelling of the northern stock was presented twice, and both instances intended to accommodate the Group's suggestions regarding model configuration. These situations typically affected all scenarios, but especially Scenario 3.

The Group acknowledged that USA logbooks CPUE was no longer considered appropriate for the assessment, due to recent changes in reporting practices and the fact that the standardization process did not incorporate all the key variables needed for this task.

The Group asked about the influence of latter years in the SPN CPUE index, and their reliability given those year's retention policies. It was clarified that those years have significantly higher CV values than the rest of the series.

The Group discussed the effect of having an increased value for the variability in recruitment, and the modeler clarified that the modification of steepness and natural mortality have a greater impact in the model's results.

The Group discussed growth parameterization and updates on the configuration for selectivity estimation. As a sensitivity analysis, the conditional age at length was analysed based on data provided for age and length from Scenario 3' von Bertalanffy growth curve estimation (as reviewed in SCRS/2025/131). conditional age-at-length (CAAL) for Scenario 3 included the estimation of the von Bertalanffy length-at-age parameters L_{INF}, K, along with the CV of L_{INF} for both males and females within the Stock Synthesis model.

The Group requested to examine the diagnostics associated with the latest Scenario 3 model run. Likelihood profile plots were shown to the Group, displaying visible conflict between CPUE series with respect to population scale parameter R_0. A set of 10 jitter runs evidenced the model's general consistency regarding convergence, as most runs reached identical solutions. However, a single different result was also attained. It was identified as a local maximum in the likelihood maximization process. Retrospective analysis results were also displayed. The model's ability to correctly predict mean length was identified as relevant, especially considering MEX length data. However, as these length data were unavailable for some recent years, hindcasting could not address this issue. Suggestions for addressing this issue included the implementation of a jackknife strategy to assess the predictive power of the model with respect to these length data.

A clear consensus emerged in the Group that the current state of the model for the SMA-N was not sufficient to estimate stock status. While efforts were made intersessionally and during the meeting to progress toward consensus, significant concerns remain. These include the uncertainty in recent CPUE values and continued disagreement and uncertainty regarding biological assumptions.

Document SCRS/2025/126 was presented, which analysed the structure and process of stock assessment via iteration, model diagnostics and model validation (especially residual and retrospective patterns) with respect to biological realism.

The Group discussed if a Management Strategy Evaluation (MSE) process would be appropriate for shortfin mako, and the author said no, given the need to provide advice and that MSE would be lengthy, but that a simulation study to determine robust methods for management would be useful.

South Atlantic shortfin mako shark stock assessment with SS3

The Group reviewed a presentation of document SCRS/2025/134, which incorporated updated life-history parameters discussed on the first day of the 2025 Shortfin Mako Shark Stock Assessment Meeting. The document described the development of age-structured, sex-specific Stock Synthesis (SS3) models to evaluate the status of the South Atlantic shortfin mako stock over the period 1950-2023. The model included nine fisheries, standardized CPUE indices from six fleets, and length composition data from seven fleets.

A total of four alternative scenarios were evaluated, all assuming Beverton and Holt stock-recruitment relationships, and reflecting two catch histories and two life-history productivity assumptions. Low-fecundity spawner-recruitment relationship (LFSR) assumptions were also considered.

Structural uncertainty in the CPUE series was also investigated by testing three alternative configurations: including all CPUEs, grouping indices differently, and applying time blocks.

Results demonstrated that stock status estimates were sensitive to both biological assumptions and the structure of the observational data. The Group noted that selectivity patterns differed between higher and lower productivity scenarios. Modelers clarified that these differences were primarily due to the higher length-at-birth (L_0) values used in the low productivity scenarios, which led to larger individuals becoming vulnerable to fishing earlier in life.

The Group also discussed apparent inconsistencies between the CPUE indices from Spain and Chinese Taipei (TPE). As a potential mitigation measure, it was suggested that these indices could be downweighted to reduce their influence on model outputs. While concerns were raised regarding the plausibility of individual indices, the Group agreed that all available series should be retained in the initial case model. This decision was made to ensure the full representation of uncertainty and due to the absence of objective criteria for excluding specific indices.

Upon examining the outputs across scenarios, the Group observed that the scenarios assuming a slower life history - characterized by slower growth, a longer reproductive cycle, older age at maturity, and lower steepness - produced biologically implausible results. These included unrealistically low MSY estimates when compared to the catch histories and initial recruitment levels exceeding the virgin spawning biomass. Consequently, the Group agreed to proceed only with the scenarios reflecting a more productive life history for estimating stock status and conducting projections to inform management advice.

The diagnostics on the model fits follow. The Hessian matrix could be inverted and was positive definite for all scenarios. The final model gradient values for each assessment scenario are summarized below:

- s01_Hi_Prod_Catch_01_sd_B-H = 2.8968e-05
- s02_Hi_Prod_Catch_02_sd_B-H = 4.29702e-05

In most cases, the model exhibited poor fits to the CPUE data, with the runs test being acceptable only for the Japanese index, which was the only series modelled with a time-block structure. Residuals in the final years were generally positive across most fleets, except for the CPUE_TPE series, which showed predominantly negative residuals during the same period. Additionally, the BR-UY_LL fleet index displayed strongly negative residuals at the beginning of the time series (1978–1990), a period during which it was the only available abundance index. The influence of these large negative residuals early in the BR-UY_LL series contributed to elevated Root Mean Square Error (RMSE) values in the joint residual plots.

The fits to aggregated length compositions were good for some fleets, suggesting that the estimated selectivity curves removed individuals from the modelled population at lengths comparable to those observed in the data. The joint residual plots showed low RMSE values and exhibited a random pattern of residuals. At the individual level, the runs test indicated that most of the length composition series displayed normally distributed residuals across all scenarios.

When evaluating the model's predictive skill, the predicted observations for the length compositions of SPN and JPN fleets fell within the hindcast evaluation period (2018–2023) with the MASE scores were below 1 (one), indicating good predictive performance. For BR-UY and ZAF fleets, the MASE values exceeded this reference threshold, but the increase was minimal. Regarding CPUE predictive performance, only the JPN_index_TB02 configuration passed the hindcast skill test, presenting a MASE score below 1 (one) and thus within the acceptable predictive threshold. All other CPUE configurations yielded MASE values considerably higher than 1 (one), indicating poor predictive skill.

The results of a five-year retrospective analysis applied to all scenarios indicate a negligible retrospective pattern across models. The estimated Mohn's rho values for both spawning stock fecundity (SSF) and the F/F_{MSY} ratio fell within the acceptable range of −0.15 to 0.20.

In all scenarios, the minimum value along the R0 profile for the CPUE likelihood component differed from that associated with the length composition data, indicating a possible conflict between these two likelihood components. This discrepancy suggested that the model was unable to simultaneously fit both data sources optimally under a single R_0 value.

Among the CPUE data, the CTP_LL index showed substantial changes in its contribution to the likelihood across the R_0 profile with a minimum likelihood that diverged from those of the other fisheries. These differences in the negative log-likelihood support for the minimum point suggest that conflict exists among individual CPUE indices. In contrast, the likelihood profiles for the length-composition data exhibited consistent behaviour across all fleets, with similar R_0 values minimizing the negative log-likelihood. This consistency indicates an absence of conflict among the length data sources and suggests that the length composition information provides a coherent signal regarding population size.

The comparison between the fully integrated model scenario 1 and their corresponding age-structured-surplus production model recruitment deviations (ASPM RecDev) diagnostics indicated that the trajectories of spawning output, SSF_{RATIO}, F_{RATIO}, and recruitment were generally consistent across models throughout most of the time series. The overlap in confidence intervals suggests that abundance indices alone, when combined with estimated recruitment deviations, could capture the overall population dynamics. Discrepancies became more apparent in the terminal years (post-2010), particularly with ASPM RecDev tending to overestimate spawning output and underestimate the F_{RATIO}. This indicates that, although the abundance indices provide informative signals on recruitment patterns, the inclusion of length composition data remained informative for stock status estimates.

3.4 Other methods

SCRS/2025/133 evaluated the use of the Low Fecundity Spawner-Recruit (LFSR) relationship for shortfin mako in the North and South Atlantic. LFSR offers flexibility by allowing for a convex, decreasing-survival stock-recruitment relationship, that is more appropriate for low-fecundity sharks.

Two parameters of LFSR (SFrac and Beta) were calculated using steepness (h) from life history parameters and equilibrium estimates (R_0 and SSB_0) from all SS scenarios for the North and South. Because both parameters could not be reliably estimated simultaneously, Beta was fixed and SFrac derived. Models were run across three Beta values, and the one with the lowest total negative log-likelihood was selected. Some Beta values produced unrealistic SFrac estimates, especially under low-fecundity scenarios, indicating problems with the current model settings.

The Group acknowledged the valuable insights this study brought to the ongoing discussions. The Group noted that the implausible scenarios (North scenario 3, South scenario 3 and 4) were all lower productivity scenarios. It was discussed that the lower productivity scenarios were too close to the "edge" of low productivity, forcing the model to infer unrealistically high recruitment (age-zero) to compensate for historically high catches and maintain population dynamics using process error. It was also suggested that the slow life history traits could make it difficult for the model to interpret the catch and CPUE changes. The author suggested that the issue might stem from inconsistencies among life history parameters within these scenarios, potentially leading to rapid population decline.

The Group discussed whether applying R_0 and SSB_0 parameters from a Beverton-Holt model directly to an LFSR model with a high beta is valid. The author indicated that, based on Taylor *et al.* (2013), the method is theoretically correct. There was some discussion on this point and the Group concluded that some simulation study might be beneficial.

The Group noted that the juvenile natural mortality could influence R_0 estimates, potentially contributing to some of the observed issues. The author agreed and noted that low fecundity species typically have longer lifespans and lower natural mortality, which might contradict some of the current scenario assumptions.

The Group discussed the degree of density dependence in wide-ranging, highly migratory pelagic sharks like shortfin mako. While strongest compensatory mechanisms at high stock sizes are theoretically reasonable for low-fecundity species, it remains difficult to determine the density-dependent effect on the pre-recruitment survival in shortfin mako sharks.

Caution was advised when using likelihood values to distinguish between models if the differences are less than two deviance units (1 log likelihood unit). The Group suggested that large likelihood changes support beta=3 for all scenarios, which could mean beta=3 is broadly applicable. However, if the likelihoods are almost the same, the author suggested choosing the best parameters based on the SS outputs (e.g. fitting of stock-recruitment relationships) or the model diagnostics.

4. Stock status results

For the northern stock, the Group reviewed SS, JABBA, and JABBA-Select model. JABBA-Select is currently used mostly for ongoing research and was not at this stage intended to provide stock status or advice for the 2025 shortfin mako shark stock assessment. The Group had lengthy discussions on how to produce acceptable Stock Synthesis and JABBA models. The implications of the revisions of the biological parameters (steepness and natural mortality in Stock Syntheses, and r and B_{MSY}/K in JABBA) during the meeting could not be fully explored and resolved. Model results for the three scenarios require more careful review and work. Although the Group had JABBA results, some concerns remained that production models in general might not appropriately capture the dynamics of shortfin mako (e.g. selectivity and lag effect), noting that the majority of the catches are immature sharks. The Group also had concerns about conflicting information among the abundance indices (see Section 2.3). The Group tried to reconcile the concerns but there was no consensus on how to resolve them. The Group felt the need for more careful reviews on all CPUEs and concluded that at this point the production models were not suitable for estimating the current stock status or for projections.

For the South Atlantic shortfin mako, the Group reviewed assessments based on the Stock Synthesis and JABBA. The southern stock suffered from the same incoherence in population dynamics between the surplus production model and the stock's dynamics as observed in the North. Although the Group attempted JABBA models, conflicting information in the input data, especially between the catches and CPUE data, produced extremely implausible results, unless introducing time-blocks in the CPUEs. The Group decided to apply all CPUE indices without time-blocks for all model platforms, therefore the Group agreed not to use JABBA results for stock management advice.

To summarize, the conclusion of the Group with regard to stock assessment models were as follows:

- JABBA-Select was not used for any stock.
- JABBA was not used for any stock.
- SS was not used for the northern stock and was only used for the southern stock.

With the exception of the SS model for the southern stock, the exploration of model diagnostics will be moved to **Appendix 5** for the northern stock and to **Appendix 6** for the southern stock.

Therefore, it was suggested that the Group continue working on those stock assessment models intersessionally. The Group will develop a detailed workplan for 2026 to complete the North stock assessment during 2026.

4.1 Production models

Northern stock

The Group decided that production model results could not be used for presenting stock status results. Details of the discussions about the exploration of these models are found in **Appendix 5**.

Southern stock

The Group decided that production model results could not be used for presenting stock status results. Details of the discussions about the exploration of these models are found in **Appendix 6.**

4.2 Stock Synthesis

Northern stock

SS was not used for the northern stock.

Southern stock

All recommendations made by the Group at the 2025 Shortfin Mako Data Preparatory Meeting (Anon., 2025), were implemented in Stock Synthesis, and additional revisions on the biological parameters during the meeting were incorporated in the analyses.

During the discussion on the developments of four scenarios, the Group found that the lower productivity scenarios did not produce biologically plausible results. The biological configurations defined for the scenarios conflicted with both the catch and the CPUE data, leading the models to estimate highly unrealistic initial recruitment (R_0) values in order to reconcile the observed removals and abundance indices. As a result, these models projected initial recruitment levels more than twice the virgin spawning fecundity, which is biologically implausible. Therefore, the Group decided not to proceed with the lower productivity scenarios.

The Group agreed that two scenarios would be used for final Stock Synthesis results. These scenarios differ only in the catch series used (Catch_01 and Catch_02), both assuming higher productivity hypotheses. The first series (Catch 01) corresponds to reported landings and post release mortality on live discards available in the ICCAT Task 1 NC database. The second series (Catch 02) included historical estimates derived from catch ratios developed by the Sharks Species Group for the period 1971-2015 combined with reported landings and post release mortality on live discards from the Task 1 NC database for 2016–2023. The detailed specifications and all diagnostics for each scenario are provided in Appendix C of document SCRS/2025/134.

Spawning stock size in the stock-recruitment relationship was modelled as spawning stock fecundity (SSF) and calculated as the sum of female numbers at age (reported in 1,000s) multiplied by annual female pup production at age (male and female pups, assuming a 1:1 ratio of male to female pups) at the beginning of each calendar year. The time series of spawning stock output, recruitment, and fishing mortality of each scenario are plotted in **Figure 4**.

The Group provided equally weighted combined catch scenarios. The combined time series of relative spawning stock fecundity (SSF/SSF_{MSY}), relative fishing mortality (F/F_{MSY}) (**Figure 5**) were built with 10,000 iterations based on the multivariate lognormal (MVLN) approach for each scenario. The Group did not check that sampling from a multivariate normal density would not produce biased results. The joint time SSF/SSF_{MSY} remained above the MSY level (~1.5–2.0) until the late 1990s, after which it declined steadily. From the early 2000s onward, SSF/SSF_{MSY} stabilized slightly below 1.0, indicating potential overexploitation of the spawning potential in recent years. The F/F_{MSY} increased sharply in the 1990s, surpassing the overfishing threshold (F/F_{MSY} = 1.0), and remained elevated mostly above 1.5 until around 2022. In recent estimates fishing mortality remained above the sustainable threshold, although a decline is observed in the final year (2023).

4.3 Other methods

No documents or discussion occurred for this agenda item.

4.4 Synthesis of assessment results

South Atlantic

For the South Atlantic shortfin mako, the Group reviewed assessments based on the JABBA and SS which was applied for the first time. Although the Group attempted JABBA models, conflicting information in the input data, especially between the catches and CPUEs data produced extremely implausible results, unless introducing time-blocks in the CPUEs. The Group decided to apply all CPUE indices without time-blocks in any model platforms, therefore the Group agreed not to use JABBA results for stock management advice.

The Group discussed 4 different Stock Synthesis scenarios based on the combinations of catch and productivity scenarios. It was found that SS models assuming a lower productivity scenario (consistent with the 2017 shortfin mako shark stock assessment, based on the production model) showed biologically implausible results due to conflicting information between the biological configuration and the catch and CPUEs. The Group decided not to use two SS scenarios assuming a lower productivity scenario consistent with the 2017 shortfin mako shark stock assessment.

The Group agreed to provide stock management advice based on the 2 catch scenarios that assumed higher productivity. It was also agreed to conduct a projection based on those scenarios and to give both hypotheses equal weighting.

Based on the Stock Synthesis results, the trend in the spawning stock fecundity (SSF) relative to MSY levels (SSF_{MSY}) shows a general continuous decline over time until approximately 2010, followed by slight increases for the more recent years (**Figure 6**). Estimates of fishing mortality rate (F) relative to MSY levels (F_{MSY}) increased until around 2005, then oscillated, in some years very strongly, until the more recent period and at levels higher than F_{MSY} and finally showed a drop to values near F_{MSY} in 2023 (**Table 25** and **Figure 6**).

The median MSY estimate for the combined scenario was 1648 t (95% confidence interval: 1519-1795 t). The median estimate of SSF_{2023}/SSF_{MSY} was 0.949 (95% confidence interval: 0.763-1.179), indicating the stock was likely to have been overfished in 2023 (**Table 25**). The median estimate of F_{2023}/F_{MSY} was 1.052 (95% confidence interval: 0.837-1.287), indicating that overfishing was likely to have been occurring in 2023.

The probability of the stock being in each quadrant of the Kobe plot in 2023 for combined scenarios is provided in **Figure 7**. For the combined scenarios, the corresponding probabilities are 50.5% of the 20,000 trials, based on multivariate log-normal (MVLN) distributions, occurred in the red (being overfished and subject to overfishing), 17.1% in the green (not being overfished not subject to overfishing), 16.4% were in the yellow (being overfished but not subject to overfishing), and 16.0% were in the orange (not being overfished but subject to overfishing).

5. Projections

The following are the projection settings for the South Atlantic shortfin mako stock based on the assessment results from the Stock Synthesis platform:

- Apply Stock Synthesis results for the two catch scenarios with higher productivity (scenarios 1 and 2).

- Set 2,052 t (3-year average (2021-2023) catch with estimates of post release mortality used in the stock assessment) for the 2024 and 2025 projection years.

- Use a 3-year average (2021-2023) for future catch distribution by fleet and its corresponding selectivity.

- 12 scenarios of constant future catch for 2026 to 2050 (equivalent to 2 times of population generation time with the biological parameters used in the assessment) as follows: 0, 500, 1,000, 1,295 (retention allowance in *Recommendation by ICCAT on the conservation of the South Atlantic stock of shortfin mako caught in association with ICCAT fisheries* (Rec. 22-11)), 1,500 to 3,000 t with a 250 t interval, and 1,650 t the estimated MSY level.

- 10,000 iterations in both scenarios.

- Apply the MVLN approach for the stochastic projections.

- Future recruitment values (beyond the year 2021) should be taken directly from the stock-recruitment relationship used in the assessment model.

The Group agreed to conduct the projections intersessionally due to the limited time during the meeting, and to review the results at the Sharks Species Group meeting in September 2025.

6. Recommendations

6.1 Research and statistics

- Given the difficulty of obtaining robust and reliable model results from either of the two platforms used (SS3 and JABBA) to determine the stock status of the northern shortfin mako during the 2025 Shortfin Mako Shark Stock Assessment Meeting, the Group recommended continuing the stock assessment and scheduling a meeting to complete the assessment in 2026.

- The Group recommended trying to update the data for the 2026 assessment completion, making the terminal year for the updated model to be 2024.

- Based on the diagnostics and influence of several CPUEs on both the JABBA and SS3 assessment models of the northern shortfin mako stock, the Group recommended that national scientists attempt to include the potential effects of recent management regulations in their standardization analyses and report to the Group. In addition, they should consider evaluating the effect of low sample sizes resulting from recent regulations on shortfin mako retention.

- The Group recommended, following the experience of other SCRS Species Groups, producing a joint CPUE index for the continuation of the stock assessment of North Atlantic shortfin mako.

- The Group recommended that CPCs confirm if they can provide detailed data, and at what resolution (i.e. logbook or observer data, in anonymized form) for the joint index by the Sharks Species Group Meeting in September 2025.

- The Group recommended treating scenarios consistently across modelling platforms and applying consistent diagnostics across approaches. This will help ensure comparable results. Some concerns were raised regarding the use of different standards for different sets of scenarios, noting that doing so can introduce bias or lead to misleading interpretations of model performance.

- The Group recommended that the SCRS Working Group on Stock Assessment Methods continue to discuss and develop advice on model weighting to combine assessment results to develop management advice.

- The Group recommended that the SCRS Working Group on Stock Assessment Methods continue to discuss and adopt procedures for considering CPUE clusters.

- Given the uncertainty in estimates of productivity of northern and southern shortfin mako stocks the Group recommended that funds be allocated within the Shark Research and Data Collection Programme (SRDCP) to support research oriented to improve the knowledge on biological productivity for both stocks.

- For both stocks, the Group recommended age-validation studies, with preference for a bomb radiocarbon age validation study (using both new and any existing samples) and other approaches, with particular focus on validating the early growth and defining growth band periodicity throughout the lifespan.

- For both stocks, the Group recommended that CPCs and the SCRS promote and continue additional conventional tagging programs, considering the inclusion of oxytetracycline (OTC) marking to support age and growth estimation.

- The Group recommended that CPCs fund and conduct pelagic shark fishery-independent surveys that could help to estimate biomass of the cryptic breeding population, and to help elucidate spatiotemporal patterns in abundance.

- The Group recommended including in the SRDCP studies aiming at obtaining better biological information, particularly with regard to spawning stock, and to have a better comprehension of the reproductive biology (e.g. reproductive cycle) of the shortfin mako.

- Following the recommendation of the Subcommittee on Ecosystems and Bycatch (SC-ECO), the Group recommended considering both basking shark and great white shark as species of greatest biological vulnerability and that precautionary management measures for their conservation should be considered by the Commission. Specifically, measures similar to those adopted for mobulid rays (*Recommendation by ICCAT replacing Rec. 23-14 on mobulid rays (family Mobulidae) caught in association with ICCAT fisheries* (Rec. 24-12)) and whale sharks (*Recommendation by ICCAT for the conservation of whale sharks (*Rhincodon typus*) caught in association with ICCAT fisheries* (Rec. 23-12)) should be considered.

6.2 Management

Management recommendations will be developed at the Sharks Species Group meeting in September 2025. Below follows a tentative Workplan for completing the shortfin mako North Assessment with a complete suite of diagnostics.

One important consideration regarding the work needed to complete the stock assessment for the northern shortfin mako stock is whether to use the data and life-history parameters assembled during the 2025 Shortfin Mako Data Preparatory Meeting (Anon., 2025) and the 2025 shortfin mako shark stock assessment, or to attempt to update these data. If the data are not updated, then the data used in the 2025 shortfin mako shark stock assessment will be used but modelers can explore different model structures and specifications and ways to treat input data, potentially exploring time blocks and grouping CPUEs.

The Group recommended exploring the possibility of preparing a joint index. Scientists attending the 2025 Shortfin Mako Stock Assessment Meeting who have presented CPUE indices for the North Atlantic, along with others who have not, expressed their willingness and/or interest in participating in the development of a joint index that ideally considers spatial and size effects.

To proceed with the joint index, the following factors need to be considered and resolved:

- Develop a clear process to share confidential data.
- Request that CPCs scientists share their data.
- Designate a CPC scientist to generate the joint index.
- The Sharks Species Group Rapporteur will be in charge of organizing the practical elements of this endeavour including managing the scientists involved, the timely submission of data, confidentiality agreements etc.

- The minimal requirements of the data (e.g. Lat. and Long. resolution, vessel ID, set by set but not only for the species of interest) will be defined at the Sharks Species Group meeting in September 2025.
- Updating the size compositions by including the year 2024.
- Updating the T1 nominal catch series by including the year 2024.
- The Group agreed that biological parameters will remain the same, as well as the three proposed scenarios. However, modelers will have the liberty to explore different parameters that might improve model performance.
- The Group recommends using SS for stock status and future projections.

Options and timelines for joint index

- Timeline for CPCs to declare their ability to participate in a joint index (Sharks Species Group meeting in 2025).
- Joint index data, including length composition data if applicable to be provided by 30 November 2025.
- If applicable, hold a 3-day online meeting to produce it (February/March 2026).
- A 2-3-day online meeting to review CPUE indices and size data (TBD).
- A 1-day online meeting to discuss grouping/time blocks of CPUE indices (TBD).
- A 1-day online meeting to discuss and establish a protocol for model weighting (two weeks before stock assessment).
- A 5-day stock assessment in-person meeting (June/July 2026).

7. Responses to the Commission

SCRS/2025/078 found that conducting an MSE for the northern and southern Atlantic blue shark stocks within either a two-year timeline (estimated at €120,000 - €140,000) or a three-year timeline (estimated at €180,000 - €210,000) is technically feasible and cost-effective, with the former offering lower total cost and faster delivery and the latter providing greater flexibility and broader engagement, provided that early funding, clearly defined management objectives, and coordinated scientific engagement are secured to prevent delays.

The Group reviewed the document and expressed broad support for an SCRS-led process, noting the need to create a technical sub-group on MSE within the Sharks Species Group that participates in the process. Main concerns raised during the discussion related to the amount of work that developing an MSE represents. In this regard, some members favoured the three-year timeline, emphasizing that developing and evaluating Management Procedures typically demands sustained SCRS engagement. It was also mentioned that, on a three-year timeline, an update of the indices used in the last stock assessment carried out in 2023 might be the best way to proceed. The Group agreed to prepare a response to the Commission ahead of the Sharks Species Group meeting in 2025 that accounts for the full meeting burden - including those of the Sharks Species Group, the Commission, and the blue shark technical sub-group on MSE.

8. Sharks Draft Executive Summaries

The Chair provided the new version of the Executive Summary for the Atlantic stocks of blue shark and porbeagle based on the latest assessment for each species. They were made available for review and comments and will be adopted at the next Sharks Species Group meeting together with the final results from the shortfin mako assessment.

9. Shark Research and Data Collection Programme (SRDCP)

This matter will be discussed at the Sharks Species Group meeting in September 2025.

10. Other matters

Due to time constraints the scheduled presentation "First Insights into Shortfin Mako Movements in the Bay of Biscay: A Journey to Cape Verde" (SCRS/P/2025/053, Erauskin *et al.*, 2025) was postponed to the next SCRS Sharks Species Group meeting in September 2025.

The Chair reminded the Group about Ellis *et al.*, 2025 presented during the 2025 Shortfin Mako Shark Data Preparatory Meeting (Anon., 2025) with information on biological vulnerability and bycatch of basking and white sharks. As proposed by the Group, the document was presented by the authors to the Subcommittee on Ecosystems and Bycatch (SC-ECO), during its meeting in May 2025.

The SC-ECO recommended that the SCRS Shark Species Group review, if available, any additional information on biological vulnerability of basking and white sharks in addition to the information presented in Ellis *et al.* (2025). Despite this, the SC-ECO also recommended in its report considering both basking shark and great white shark as species of greatest biological vulnerability and that precautionary management measures for their conservation should be considered by the Commission. Specifically, measures similar to those adopted for mobulid rays (Rec. 24-12) and whale sharks (Rec. 23-12) should be considered.

It was proposed that even though no additional information on biological vulnerability of these species was presented, the Shark Species Group, in support of the SC-ECO recommendation, also recommends considering both basking shark and great white shark as species of greatest biological vulnerability and that precautionary management measures for their conservation should be considered.

11. Adoption of the report and closure

The report was adopted, and the meeting was closed.

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Table 1. The time series of the catches (including post-release mortality) for the northern stock in tonnes (t) as estimated by Mejuto *et al.,* 2021. Post-release mortality was estimated for the period 2018-2023.

Year	Historical	EU ESP_LL	EU POR_LL	JPN_LL	CTP_LL	USA_LL	CAN_LL	MOR_LL	MEX_LL	VZA_LL	OTH	Total N-SAM
1950	652.04											652.04
1951	435.90											435.90
1952	435.90											435.90
1953	542.84											542.84
1954	137.63											137.63
1955	279.31											279.31
1956	168.77											168.77
1957	451.24											451.24
1958	375.43											375.43
1959	496.36											496.36
1960	325.80											325.80
1961	791.58											791.58
1962	1,086.81											1,086.81
1963	475.72											475.72
1964	885.67											885.67
1965	703.74											703.74
1966	1,402.22											1,402.22
1967	1,258.71											1,258.71
1968	1,655.38											1,655.38
1969	1,645.51											1,645.51
1970	1,486.53											1,486.53
1971	2,357.80											2,357.80
1972	2,218.99											2,218.99
1973	2,114.19											2,114.19
1974	2,259.54											2,259.54
1975	1,742.71											1,742.71
1976	1,907.04											1,907.04
1977	2,066.53											2,066.53
1978	2,168.45											2,168.45
1979	2,146.76											2,146.76
1980	1,720.46											1,720.46
1981	2,286.07											2,286.07
1982	2,579.61											2,579.61
1983	2,293.28											2,293.28
1984	2,854.37											2,854.37
1985		543.21		142.00	71.00	75.77					2,949.43	3,781.41
1986		2,097.43		120.00	78.00	93.40			-	2.78	1,297.09	3,688.70
1987		2,404.53		218.00	22.00	134.43			-	1.74	462.39	3,243.10
1988		1,851.31		113.00	4.00	159.70			-	2.57	795.40	2,925.98
1989		1,078.54		207.00	2.00	188.36			-	8.12	686.02	2,170.03
1990		1,537.21	193.00	221.00	9.00	146.08			-	1.46	281.69	2,389.44
1991		1,390.08	314.00	157.00	39.00	175.71			-	2.12	218.29	2,296.21
1992		2,145.44	220.00	318.00	16.00	273.18			-	0.67	259.56	3,232.84
1993		1,964.07	796.00	425.00	9.00	248.90			-	0.58	669.97	4,113.53
1994		2,163.56	649.00	214.00	29.00	268.62			-	3.49	334.21	3,661.88
1995		2,209.48	657.00	592.00	32.00	259.16	93.39		10.44	4.22	1,449.04	5,306.74
1996		3,293.77	691.00	790.00	45.00	165.37	56.07		-	11.71	258.74	5,311.66
1997		2,415.55	354.00	258.00	42.00	181.09	99.01		-	3.38	186.00	3,539.03
1998		2,223.05	307.00	892.00	47.00	145.75	54.63		-	0.76	183.02	3,853.20
1999		2,050.88	327.39	120.00	75.00	125.24	53.83		-	1.96	109.71	2,864.01
2000		1,560.65	317.50	138.00	56.00	131.12	58.68		10.09	2.19	323.63	2,597.88
2001		1,684.47	377.63	105.00	47.00	135.35	59.64		16.02	20.34	236.40	2,681.85
2002		2,046.58	414.70	438.00	53.00	123.23	61.12		-	16.04	281.11	3,433.78
2003		2,067.60	1,248.63	267.00	37.00	104.61	63.36	147.39	9.50	21.94	20.37	3,987.41
2004		2,087.65	472.35	572.00	70.00	139.63	69.39	168.54	6.42	57.95	356.48	4,000.42
2005		1,751.30	1,109.32	419.50	68.00	138.41	73.86	214.81	9.30	19.63	310.04	4,114.18
2006		1,918.02	950.56	357.97	40.00	95.47	64.45	220.10	5.25	6.29	274.14	3,932.24
2007		1,813.56	1,539.67	82.42	6.00	166.67	63.69	151.36	8.11	11.10	315.27	4,157.84
2008		1,895.26	1,033.06	130.86	23.43	148.70	38.94	282.89	6.11	1.80	240.82	3,801.86
2009		2,216.17	1,169.31	98.39	11.20	170.54	50.34	475.88	7.36	35.10	308.26	4,542.55
2010		2,090.74	1,431.93	116.29	14.23	168.40	38.64	636.49	8.32	21.87	255.81	4,782.74
2011		1,667.13	1,044.63	53.27	12.57	159.91	37.18	390.00	7.55	17.97	333.42	3,723.63
2012		2,307.99	1,022.55	56.05	15.46	152.06	27.61	380.00	8.14	24.27	446.10	4,440.23
2013		1,508.83	817.43	32.66	7.92	139.74	34.65	616.00	3.92	5.83	438.57	3,605.56
2014		1,480.93	217.39	69.24	4.05	154.79	53.12	580.00	3.70	7.48	900.26	3,470.95
2015		1,361.72	213.25	45.10	14.50	99.61	84.19	807.00	3.69	7.45	651.53	3,288.06
2016		1,574.13	256.62	74.12	7.51	108.11	82.39	1,000.00	3.58	6.61	248.52	3,361.57
2017		1,783.54	269.78	89.32	1.36	111.82	109.03	320.00	5.00	8.89	427.48	3,126.21
2018		1,165.29	267.72	20.21	24.94	41.07	62.01	422.50	2.61	7.49	396.74	2,410.58
2019		866.22	283.53	33.29	5.59	39.42	65.99	357.10	2.27	8.26	241.93	1,903.61
2020		869.55	355.92	32.78	13.48	35.21	41.78	382.40	2.52	7.67	47.72	1,789.01
2021		681.38	217.89	18.63	1.49	40.03	40.25	298.70	2.55	2.94	38.72	1,342.59
2022		684.93	216.31	11.82	1.86	37.02	50.62	8.81	3.54	0.57	40.85	1,056.33
2023		1,143.32	133.62	14.92	8.84	41.49	17.48	13.31	2.40	0.34	12.19	1,387.89

Table 2. Catch scenario A, the time series of Task 1 nominal catches (including post-release mortality) for the southern stock in tonnes (t). Post-release mortality was estimated for the period 2020-2023.

Year	EU ESP_LL	JPN LL	BRA-URY_LL	EU POR_LL	ZAF_LL	CTP_LL	NAM_LL	OTH_LL	OTH	Total S-SMA
1971	-	88.00	9.33	-	-	-	-	-	-	97.33
1972	-	53.00	7.33	-	-	-	-	-	-	60.33
1973	-	202.00	9.75	-	-	-	-	-	-	211.75
1974	-	39.00	28.16	-	-	-	-	-	-	67.16
1975	-	45.00	31.13	-	-	-	-	-	-	76.13
1976	-	8.00	22.11	-	-	-	-	-	-	30.11
1977	-	229.00	23.26	-	-	-	-	-	-	252.26
1978	-	146.00	22.23	-	-	-	-	-	-	168.23
1979	-	268.00	31.49	-	-	-	-	-	-	299.49
1980	-	228.00	95.63	-	-	-	-	-	-	323.63
1981	-	206.00	61.09	-	-	108.00	-	-	-	375.09
1982	-	703.00	139.62	-	-	131.00	-	-	-	973.62
1983	-	252.00	200.64	-	-	59.00	-	-	-	511.64
1984	-	462.00	246.78	-	-	36.00	-	-	-	744.78
1985	-	540.00	154.55	-	-	91.00	-	-	-	785.55
1986	5.56	428.00	88.22	-	-	87.00	-	-	-	608.79
1987	-	234.00	85.56	-	-	66.00	-	-	0.56	386.11
1988	378.15	525.00	93.07	-	-	35.00	-	-	0.45	1,031.66
1989	808.88	618.00	89.69	-	-	29.00	-	-	0.06	1,545.62
1990	552.13	538.00	128.90	-	-	36.00	-	-	0.08	1,255.11
1991	327.41	506.00	92.94	-	-	80.00	-	-	55.33	1,061.68
1992	421.25	460.00	178.31	-	64.34	44.00	-	-	15.07	1,182.97
1993	772.22	701.00	149.94	-	43.39	31.00	-	34.44	10.98	1,742.97
1994	552.15	1,369.00	107.06	-	22.96	65.00	-	45.33	20.92	2,182.42
1995	1,084.04	1,617.00	136.09	92.00	46.06	87.00	-	22.63	15.17	3,099.98
1996	1,481.66	514.00	109.08	94.00	36.01	117.00	-	27.00	16.27	2,395.03
1997	1,356.00	244.00	210.48	165.00	29.21	139.00	-	19.20	24.52	2,187.41
1998	984.15	267.00	256.06	116.00	168.42	130.00	-	74.40	12.32	2,008.35
1999	861.30	151.00	47.78	118.50	66.11	198.00	1.23	152.26	10.30	1,606.48
2000	1,089.67	264.00	253.34	387.70	102.54	162.00	-	306.35	22.38	2,587.97
2001	1,234.62	56.00	449.38	140.10	67.81	120.00	-	22.00	17.53	2,107.44
2002	810.51	133.00	263.90	56.00	11.64	146.00	458.85	208.00	15.40	2,103.31
2003	1,158.23	118.00	470.27	624.61	115.44	83.00	374.71	260.00	31.22	3,235.48
2004	702.70	398.00	426.08	12.78	101.27	180.00	509.02	120.27	75.58	2,525.71
2005	583.60	-	571.57	241.79	110.55	226.00	1,415.25	95.89	14.26	3,258.91
2006	664.37	-	251.28	493.33	86.15	166.00	1,243.50	87.72	43.35	3,035.69
2007	653.87	72.29	192.48	374.74	223.93	147.00	1,001.81	94.82	29.68	2,790.62
2008	628.00	115.16	161.75	321.02	136.58	123.95	294.55	17.88	82.18	1,881.07
2009	921.98	108.28	197.45	502.26	146.16	117.35	23.32	39.71	6.75	2,063.26
2010	1,192.16	103.24	150.31	336.29	151.63	143.77	306.44	100.84	1.10	2,485.77
2011	1,535.43	132.30	254.62	409.16	217.87	203.60	328.47	114.65	61.87	3,257.95
2012	1,207.14	290.96	228.98	175.93	107.57	157.84	554.34	127.60	54.90	2,905.27
2013	1,082.64	114.03	276.98	132.19	249.96	157.29	8.50	127.10	34.05	2,182.74
2014	1,076.90	181.95	256.05	126.60	476.21	160.55	949.80	14.96	30.89	3,273.91
2015	861.58	109.20	172.08	157.57	613.05	153.81	660.90	33.97	12.42	2,774.57
2016	882.42	77.32	124.24	392.89	338.55	95.27	798.80	41.88	14.21	2,765.59
2017	1,048.68	96.31	275.21	502.86	304.92	88.17	193.75	113.67	164.18	2,787.75
2018	1,043.80	92.72	395.71	300.26	244.39	66.19	980.22	27.44	7.88	3,158.60
2019	1,089.59	54.95	739.31	242.72	110.17	44.16	-	19.41	8.50	2,308.82
2020	799.37	7.77	542.33	448.70	45.83	54.03	929.38	2.46	29.47	2,859.59
2021	649.60	14.14	476.93	356.94	69.53	37.24	637.49	8.75	8.95	2,259.86
2022	657.20	4.55	555.00	358.17	66.06	28.76	788.65	26.82	3.07	2,490.10
2023	222.76	4.51	121.00	387.94	96.02	13.27	545.29	17.25	0.24	1,410.08

Table 3. Catch scenario B, the time series of catches (including post-release mortality) for the southern stock in tonnes (t) as estimated by the Group using catch ratios. Post-release mortality was estimated for the period 2020-2023.

Year	EU ESP_LL	JPN_LL	BRA-URY_LL	EU POR_LL	ZAF_LL	CTP_LL	NAM_LL	OTH_LL	OTH	Total S-SMA
1971	-	257.96	3.65	-	-	558.20	-	495.90	32.22	1,347.93
1972	-	231.25	3.32	-	-	747.85	-	485.24	35.42	1,503.08
1973	-	222.99	3.97	-	0.55	595.66	-	437.73	171.93	1,432.83
1974	-	85.51	10.31	-	-	440.21	-	560.01	94.99	1,191.04
1975	-	150.62	9.95	-	-	389.01	-	456.38	75.96	1,081.93
1976	-	38.78	10.23	-	-	400.29	-	450.19	279.81	1,179.30
1977	-	93.45	17.22	-	-	395.28	-	501.76	411.79	1,419.50
1978	-	113.85	19.24	-	-	494.07	-	366.91	155.96	1,150.02
1979	-	177.57	24.91	-	2.42	484.53	-	238.60	195.11	1,123.13
1980	-	262.62	15.25	-	14.51	446.57	-	292.99	339.29	1,371.22
1981	-	268.67	21.00	-	15.20	429.11	-	264.39	186.98	1,185.36
1982	-	499.48	53.71	-	2.54	528.82	-	255.56	281.98	1,622.08
1983	-	260.32	83.55	-	15.96	235.87	-	222.50	224.91	1,043.11
1984	-	460.81	128.49	-	9.22	186.33	-	182.15	188.83	1,155.82
1985	-	548.77	105.71	-	1.09	441.98	-	246.45	203.20	1,547.21
1986	-	403.96	54.60	-	4.28	612.50	-	136.95	211.55	1,423.84
1987	-	362.51	51.53	-	-	655.70	-	174.19	220.02	1,463.95
1988	-	622.26	42.57	-	1.56	494.09	-	179.01	150.89	1,490.37
1989	-	634.82	42.02	-	0.00	444.23	-	157.68	163.13	1,441.89
1990	-	691.96	36.66	-	-	574.10	-	57.99	195.26	1,555.97
1991	-	564.49	24.13	-	-	662.84	-	86.13	219.55	1,557.14
1992	-	548.19	23.88	-	-	750.12	-	47.20	196.29	1,565.68
1993	-	659.93	27.90	-	-	750.16	-	44.73	185.74	1,668.46
1994	-	686.28	237.22	-	-	887.31	-	92.64	175.70	2,079.15
1995	-	586.85	227.61	78.88	-	882.29	-	108.79	123.57	2,007.99
1996	0.60	476.36	208.40	80.72	-	916.21	-	126.07	126.33	1,934.70
1997	616.09	376.55	307.88	126.08	-	853.04	-	145.02	130.55	2,555.21
1998	608.72	314.14	243.18	83.92	2.35	818.54	-	192.27	94.81	2,357.93
1999	720.30	259.88	41.64	103.35	1.74	764.65	0.11	387.00	73.05	2,351.70
2000	805.74	288.16	221.21	215.21	6.55	809.56	-	396.29	88.17	2,830.88
2001	875.11	206.39	186.68	227.01	16.61	748.53	-	387.40	100.99	2,748.71
2002	570.68	215.17	257.86	202.48	10.85	773.25	226.30	216.03	82.75	2,555.37
2003	709.41	310.06	277.82	213.44	0.63	877.46	226.38	160.28	148.15	2,923.63
2004	734.82	332.91	246.06	157.95	16.55	654.30	204.47	236.95	199.32	2,783.33
2005	660.79	198.67	257.34	307.02	27.87	496.29	677.87	253.31	115.52	2,994.68
2006	860.95	287.48	180.35	275.76	21.66	330.71	406.54	304.59	165.05	2,833.08
2007	897.46	455.83	203.79	411.40	30.15	543.02	376.02	309.89	340.82	3,568.37
2008	929.46	357.84	199.35	437.05	26.51	397.81	180.67	254.20	183.25	2,966.14
2009	1,234.90	206.15	123.20	495.21	25.93	434.30	19.34	234.91	359.24	3,133.16
2010	1,329.03	258.91	113.22	563.56	26.01	469.13	223.97	169.05	240.84	3,393.73
2011	1,631.58	295.77	155.41	677.69	41.64	544.39	249.67	151.64	144.74	3,892.52
2012	1,308.18	407.06	194.28	219.43	15.09	518.24	148.92	114.09	61.04	2,986.34
2013	971.85	418.65	104.18	149.50	28.32	419.79	122.68	91.39	127.88	2,434.23
2014	1,052.30	336.64	235.24	147.06	11.39	441.84	288.45	89.31	203.67	2,805.90
2015	924.15	265.35	184.82	11.59	8.78	521.82	263.26	138.08	230.44	2,548.28
2016	882.42	77.32	124.24	392.89	338.55	95.27	798.80	41.88	14.21	2,765.59
2017	1,048.68	96.31	275.21	502.86	304.92	88.17	193.75	113.67	164.18	2,787.75
2018	1,043.80	92.72	395.71	300.26	244.39	66.19	980.22	27.44	7.88	3,158.60
2019	1,089.59	54.95	739.31	242.72	110.17	44.16	-	19.41	8.50	2,308.82
2020	799.37	7.77	542.33	448.70	45.83	54.03	929.38	2.46	29.47	2,859.35
2021	649.60	14.14	476.93	356.94	69.53	37.24	637.49	8.75	8.95	2,259.57
2022	657.20	4.55	555.00	358.17	66.06	28.76	788.65	26.82	3.07	2,488.28
2023	222.76	4.51	121.00	387.94	96.02	13.27	545.29	17.25	0.24	1,408.29

Table 4. Fleet structure for the northern stock.

Time series #	Symbol	Catch (t) and abundance (numbers or biomass)	Name	Definition
1	F1	Catch (t)	EU ESP LL	EU España Longline (1985-2023)
2	F2	Catch (t)	EU POR LL	EU Portugal Longline (1990-2023)
3	F3	Catch (t)	JPN LL	Japan Longline (1985-2023)
4	F4	Catch (t)	CTP LL	Chinese Taipei Longline (1985-2023)
5	F5	Catch (t)	USA LL	USA Longline (1985-2023)
6	F6	Catch (t)	CAN LL	Canada Longline (1995-2023)
7	F7	Catch (t)	MOR LL	Morocco Longline (2003-2023)
8	F8	Catch (t)	VZA LL	Venezuela (1986-2023)
9	F9	Catch (t)	MEX LL	Mexico (1995-2023)
10	F10	Catch (t)	OTH	Other (1985-2023)
11	F11	Catch (t)	HIST	Reconstructed (1950-1984)

Table 5. Fleet structure for the southern stock.

Time series	Symbol	Catch (t) and abundance (numbers or biomass)	Name	Definition	Length composition (10 cm FL bins)
1	FL1	Catch (t)	SPN_LL	EU.España/LL	EU-España/LL
2	FL2	Catch (t)	JPN_LL	Japan/LL	Japan/LL
3	FL3	Catch (t)	BRA-URY_LL	Brazil-Uruguay/LL	Brazil and Uruguay/LL
4	FL4	Catch (t)	POR_LL	EU.Portugal/LL	EU.Portugal/LL
5	FL5	Catch (t)	ZAF_LL	South Africa	South Africa/LL
6	FL6	Catch (t)	CTP_LL	Chinese Taipei/LL	Chinese Taipei/LL
7	FL7	Catch (t)	NAM_LL	Namibia/LL	Namibia/LL
8	FL8	Catch (t)	OTH_LL	all CPCs except Fleets 1-6/LL	all other LL
9	FL9	Catch (t)	OTH	all others	
10	S1	Relative abundance (Number)	SPN_LL	SPN LL (SCRS/2025/026) 1990-2023	Mirror SPN_LL (FL1)
11	S2	Relative abundance (Number)	JPN_LL	Japan LL (SCRS/2016/030, SCRS/2025/030) 1994-2011, 2012-2020	Mirror JPN_LL (FL2)
12	S3	Relative abundance (Number)	BRA-URY_LL	Brazil/Uruguay LL (SCRS/2025/038) 1978-2022	Mirror BRA-URY_LL (FL3)
13	S4	Relative abundance (Number)	ZAF_LL	ZAF LL (SCRS/2025/036) 2000-2023	Mirror ZAF_LL (FL4)
14	S5	Relative abundance (Number)	CTP_LL	Chinese Taipei LL (SCRS/2025/031) 2007-2023	Mirror CTP_LL (FL5)

Table 6. Available indices of relative abundance series for the North Atlantic shortfin mako stock for use in the stock assessment. Venezuela will be deleted from the final table.

	Spain LL		US observer LL		Japan LL 1		Japan LL 2		Chinese-Taipei LL		Portugal LL		Morocco LL	
	SPN-LL		USobs-LL		JPN-LL1		JPN-LL2		CTP-LL		POR-LL		MOR-LL	
SCRS Doc No.	SCRS/2025/026		SCRS/2025/032		SCRS/2017/054		SCRS/2025/030		SCRS/2025/031		SCRS/2025/025		SCRS/2025/042	
Age range														
Catch Units	Number		Number		Number		Number		Number		Weight		Weight	
Effort Units														
Std. Methods	GLM													
Year	Std.CPUE	CV	Std.CPUE	CV	Std.CPUE	CV	Std.CPUE	CV	Std.CPUE	CV	Std.CPUE	CV	Std.CPUE	CV
1990	0.85	0.10												
1991	0.81	0.10												
1992	0.98	0.10	1.09	0.24										
1993	0.88	0.10	0.79	0.22										
1994	0.82	0.10	0.56	0.24	0.18	0.05								
1995	0.72	0.10	0.85	0.22	0.11	0.05								
1996	0.93	0.10	0.40	0.43	0.11	0.04								
1997	0.57	0.10	0.51	0.28	0.11	0.06								
1998	0.64	0.10	0.46	0.32	0.09	0.05								
1999	0.56	0.10	0.43	0.28	0.08	0.06					8.75	0.50		
2000	0.67	0.10	0.81	0.23	0.08	0.04					16.11	0.33		
2001	0.72	0.10	0.63	0.28	0.12	0.05					18.61	0.31		
2002	0.96	0.10	0.82	0.27	0.12	0.06					26.32	0.35		
2003	1.17	0.10	0.67	0.25	0.11	0.06					29.79	0.32		
2004	1.25	0.10	1.10	0.23	0.10	0.05					29.85	0.29		
2005	1.16	0.10	0.87	0.22	0.10	0.04					25.97	0.32		
2006	1.04	0.10	1.00	0.23	0.13	0.06					32.88	0.40		
2007	1.38	0.11	0.84	0.25	0.14	0.06			0.02	0.13	79.43	0.27		
2008	1.42	0.11	0.76	0.23			0.10	0.38	0.01	0.16	57.45	0.30		
2009	1.29	0.10	1.09	0.22			0.10	0.40	0.01	0.15	31.18	0.34		
2010	1.15	0.10	1.02	0.22			0.06	0.50	0.01	0.17	42.79	0.31	304.00	0.15
2011	0.91	0.10	1.27	0.21			0.10	0.29	0.01	0.14	33.76	0.44	307.00	0.10
2012	1.18	0.10	0.98	0.23			0.05	0.32	0.02	0.14	23.56	0.41	292.00	0.14
2013	0.87	0.10	0.77	0.22			0.08	0.33	0.03	0.12	25.37	0.38	315.00	0.12
2014	0.90	0.10	0.66	0.24			0.11	0.26	0.01	0.20	27.60	0.48	228.00	0.13
2015	1.11	0.10	0.56	0.26			0.11	0.49	0.01	0.14	28.34	0.43	240.00	0.14
2016	0.95	0.10	1.03	0.23			0.15	0.47	0.01	0.20	25.12	0.38	322.00	0.15
2017	0.98	0.10	1.34	0.23			0.11	0.32	0.00	0.25	26.92	0.41	384.00	0.13
2018	1.69	0.48	0.48	0.29			0.11	0.31			22.09	0.43	516.00	0.07
2019	2.27	0.29	0.43	0.29			0.09	0.25			29.81	0.45	347.00	0.12
2020	3.30	0.19	0.34	0.33			0.08	0.72			23.41	0.58	46.00	0.19
2021	0.83	0.11	0.45	0.28							11.07	0.51	54.00	0.19
2022	1.54	0.12	0.52	0.27			0.08	0.31			14.14	1.46		
2023	1.80	0.10	0.64	0.26			0.12	0.41			33.01	1.65		

Table 7. Available indices of relative abundance for the South Atlantic shortfin mako stock for use in the stock assessment.

	Spain LL SPN-LL		Japan LL 1 JPN-LL1		Japan LL 2 JPN-LL2		Chinese-Taipei LL CTP-LL		Brazil-Uruguay LL BRA/URY-LL		South Africa LL ZAF-LL	
SCRS Doc No.	SCRS/2025/026		SCRS/2016/084		SCRS/2025/030		SCRS/2025/031		SCRS/2025/038		SCRS/2025/036	
Age range												
Catch Units	Number		Number		Number		Number		Number		Number	
Effort Units												
Std. Methods	GLM											
Year	Std.CPUE	CV	Std.CPUE	CV	Std.CPUE	CV	Std.CPUE	CV	Std.CPUE	CV	Std.CPUE	CV
1978									0.05	0.56		
1979									0.15	0.56		
1980									0.25	0.56		
1981									0.96	0.56		
1982									0.92	0.28		
1983									0.73	0.28		
1984									0.55	0.28		
1985									0.71	0.28		
1986									0.56	0.28		
1987									0.48	0.28		
1988									0.71	0.28		
1989									0.56	0.33		
1990	0.76	0.08							0.67	0.28		
1991	0.59	0.07							0.97	0.28		
1992	0.74	0.06							1.00	0.28		
1993	0.77	0.06							0.71	0.33		
1994	0.78	0.06	0.09	0.04					1.48	0.28		
1995	0.95	0.05	0.06	0.05					2.34	0.28		
1996	1.13	0.05	0.07	0.06					1.09	0.28		
1997	0.84	0.05	0.08	0.06					1.01	0.28		
1998	0.65	0.05	0.07	0.06					1.14	0.28		
1999	0.54	0.05	0.10	0.16					1.03	0.28		
2000	0.97	0.06	0.08	0.06					1.11	0.28	0.93	0.27
2001	1.26	0.05	0.06	0.13					1.06	0.28	0.62	0.27
2002	1.19	0.05	0.05	0.06					0.78	0.28	0.58	0.24
2003	1.15	0.06	0.07	0.05					1.04	0.28	0.66	0.24
2004	1.06	0.06	0.08	0.10					1.18	0.28	0.63	0.36
2005	1.20	0.07	0.07	0.06					0.82	0.28	0.89	0.16
2006	1.05	0.06	0.15	0.13					0.65	0.28	0.81	0.17
2007	1.00	0.07	0.09	0.19			0.05	0.03	0.54	0.28	0.82	0.15
2008	0.91	0.06	0.12	0.05			0.04	0.03	0.59	0.28	0.85	0.13
2009	1.12	0.06	0.15	0.12			0.03	0.03	0.93	0.28	1.06	0.14
2010	1.24	0.06	0.15	0.06			0.03	0.03	1.46	0.28	0.97	0.13
2011	1.57	0.06	0.32	0.06			0.04	0.03	0.90	0.28	1.28	0.13
2012	1.53	0.06			0.20	0.36	0.04	0.04	0.99	0.28	1.10	0.12
2013	1.67	0.07			0.10	0.19	0.06	0.04	0.57	0.34	1.21	0.11
2014	1.59	0.07			0.08	0.16	0.05	0.04	0.14	0.40	1.02	0.12
2015	1.41	0.07			0.16	0.20	0.04	0.05	0.70	0.56	1.22	0.12
2016	1.78	0.08			0.09	0.21	0.03	0.05	0.94	0.56	1.39	0.14
2017	1.67	0.08			0.13	0.24	0.03	0.04	1.19	0.56	1.43	0.13
2018	1.70	0.07			0.10	0.35	0.02	0.05	0.97	0.28	1.02	0.16
2019	1.74	0.06			0.10	0.16	0.01	0.06	1.39	0.28	1.12	0.13
2020	0.73	0.26			0.05	0.23	0.01	0.06	1.62	0.28	0.88	0.17
2021	1.80	0.21					0.01	0.07	1.44	0.28	1.27	0.15
2022	1.44	0.19					0.01	0.08	1.47	0.28	0.99	0.17
2023	1.12	0.12			0.13	0.42					1.05	0.13
2024											1.20	0.14

Table 8. Biological input values for females used to compute r_{MAX}, steepness and natural mortality (M) for North Atlantic shortfin mako (scenario 1). Values in parentheses are standard errors. For the maturity ogive, values in parentheses were changed after the 2025 Shortfin Mako Shark Data Preparatory Meeting because they were erroneous.

Parameter	Definition	Value	Unit	References
L_∞	Theoretical maximum length (FL)	361.53 (17.75)	cm FL	Rosa et al. (2025)
K	Brody growth coefficient	0.103 (0.01)	yr^{-1}	Rosa et al. (2025)
L_0	Length at birth	90.5 (3.34)	cm FL	Rosa et al. (2025)
a	Intercept of maturity ogive	-12.525 (2.9996)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.046 (0.0111)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	5.4E-06	dimensionless	DP meeting (ICCAT 2025)
d	Power coefficient of weight on length (FL)	3.14	dimensionless	DP meeting (ICCAT 2025)
w	Observed lifespan	20	yr	DP meeting (ICCAT 2025)
	Theoretical lifespan (99% of Linf)	41.9	yr	Cortés (2025)
	Sex ratio at birth	1:1	dimensionless	DP meeting (ICCAT 2025)
	Reproductive cycle	2-3	yr	DP meeting (ICCAT 2025)
e	Intercept of maternal length (FL) vs. fecundity	1.92	dimensionless	DP meeting (ICCAT 2025)
f	Slope of maternal length (FL) vs. fecundity	0.033	dimensionless	DP meeting (ICCAT 2025)
GP	Gestation period	15-18	months	DP meeting (ICCAT 2025)
g	Intercept of total length to fork length relation	1.39	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.08	dimensionless	DP meeting (ICCAT 2025)

Table 9. Biological input values for males used to compute natural mortality (M) for North Atlantic shortfin mako (scenario 1). Values in parentheses are standard errors.

Parameter	Definition	Value	Unit	References
L_∞	Theoretical maximum length (FL)	238.49 (4.55)	cm FL	Rosa et al. (2025)
K	Brody growth coefficient	0.24 (0.016)	yr^{-1}	Rosa et al. (2025)
L_0	Length at birth	87.37 (2.976)	cm FL	Rosa et al. (2025)
a	Intercept of maturity ogive	-43.496 (16.813)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.2436 (0.094)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	1.250E-05	dimensionless	DP meeting (ICCAT 2025)
d	Power coefficient of weight on length (FL)	2.97	dimensionless	DP meeting (ICCAT 2025)
w	Observed lifespan	21	yr	Cardoso et al. (2025)
	Theoretical lifespan (99% of Linf)	17.3	yr	Cortés (2025)
g	Intercept of total length to fork length relation	1.39	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.08	dimensionless	DP meeting (ICCAT 2025)

Table 10. Biological input values for females used to compute r_{MAX}, steepness and natural mortality (M) for North Atlantic shortfin mako (scenario 2). Values in parentheses are standard errors. For the maturity ogive, values in parentheses were changed after the 2025 Shortfin Mako Shark Data Preparatory Meeting because they were previously erroneous. (*) Taken as that for the North stock scenario 1.

Parameter	Definition	Value	Unit	References
L_∞	Theoretical maximum length (FL)	350 (44.3)	cm FL	Ramos-Cartelle et al. (2025)
K	Brody growth coefficient	0.124 (0.0036)	yr^{-1}	Ramos-Cartelle et al. (2025)
L_0	Length at birth	63	cm FL	Ramos-Cartelle et al. (2025)
a	Intercept of maturity ogive	-12.525 (2.9996)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.046 (0.0111)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	5.4E-06	dimensionless	DP meeting (ICCAT 2025)
d	Power coefficient of weight on length (FL)	3.14	dimensionless	DP meeting (ICCAT 2025)
w	Observed lifespan	20*	yr	DP meeting (ICCAT 2025)
	Theoretical lifespan (99% of Linf)	35.5	yr	Cortés (2025)
	Sex ratio at birth	1:1	dimensionless	DP meeting (ICCAT 2025)
	Reproductive cycle	2-3	yr	DP meeting (ICCAT 2025)
e	Intercept of maternal length (FL) vs. fecundity	1.92	dimensionless	DP meeting (ICCAT 2025)
f	Slope of maternal length (FL) vs. fecundity	0.033	dimensionless	DP meeting (ICCAT 2025)
GP	Gestation period	15-18	months	DP meeting (ICCAT 2025)
g	Intercept of total length to fork length relation	1.39	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.08	dimensionless	DP meeting (ICCAT 2025)

Table 11. Biological input values for males used to compute natural mortality (M) for North Atlantic shortfin mako (scenario 2). Values in parentheses are standard errors. (*) Taken as that for the North stock scenario 1.

Parameter	Definition	Value	Unit	References
L_∞	Theoretical maximum length (FL)	247.81 (21.22)	cm FL	Ramos-Cartelle et al. (2025)
K	Brody growth coefficient	0.196 (0.024)	yr^{-1}	Ramos-Cartelle et al. (2025)
L_0	Length at birth	63	cm FL	Ramos-Cartelle et al. (2025)
a	Intercept of maturity ogive	-43.496 (16.813)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.2436 (0.094)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	1.250E-05	dimensionless	DP meeting (ICCAT 2025)
d	Power coefficient of weight on length (FL)	2.97	dimensionless	DP meeting (ICCAT 2025)
w	Observed lifespan	21*	yr	Cardoso et al. (2025)
	Theoretical lifespan (99% of Linf)	22	yr	Cortés (2025)
g	Intercept of total length to fork length relation	1.39	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.08	dimensionless	DP meeting (ICCAT 2025)

Table 12. Biological input values for females used to compute r_{MAX}, steepness and natural mortality (M) for North Atlantic shortfin mako (scenario 3). Values in parentheses are standard errors. For the maturity ogive, values in parentheses were changed after the 2025 Shortfin Mako Shark Data Preparatory Meeting because they were previously erroneous.

Parameter	Definition	Value	Unit	References
L_{∞}	Theoretical maximum length (FL)	350.3 (20.9)	cm FL	Rosa et al. (2017)
K	Brody growth coefficient	0.064 (0.007)	yr^{-1}	Rosa et al. (2017)
L_0	Length at birth	63	cm FL	Rosa et al. (2017)
a	Intercept of maturity ogive	-12.525 (2.9996)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.046 (0.0111)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	5.4E-06	dimensionless	DP meeting (ICCAT 2025)
d	Power coefficient of weight on length (FL)	3.14	dimensionless	DP meeting (ICCAT 2025)
w	Observed lifespan	32	yr	ICCAT (2017)
	Theoretical lifespan (95% of Linf)	43.7	yr	Cortés (2025)
	Sex ratio at birth	1:1	dimensionless	ICCAT (2017)
	Reproductive cycle	3	yr	ICCAT (2017)
e	Intercept of maternal length (FL) vs. fecundity	1.92	dimensionless	DP meeting (ICCAT 2025)
f	Slope of maternal length (FL) vs. fecundity	0.033	dimensionless	DP meeting (ICCAT 2025)
GP	Gestation period	15-18	months	DP meeting (ICCAT 2025)
g	Intercept of total length to fork length relation	1.39	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.08	dimensionless	DP meeting (ICCAT 2025)

Table 13. Biological input values for males used to compute natural mortality (M) for North Atlantic shortfin mako (scenario 3). Values in parentheses are standard errors.

Parameter	Definition	Value	Unit	References
L_{∞}	Theoretical maximum length (FL)	241.8 (6.0)	cm FL	Rosa et al. (2017)
K	Brody growth coefficient	0.136 (0.009)	yr^{-1}	Rosa et al. (2017)
L_0	Length at birth	63	cm FL	Rosa et al. (2017)
a	Intercept of maturity ogive	-43.496 (16.813)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.2436 (0.094)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	1.250E-05	dimensionless	DP meeting (ICCAT 2025)
d	Power coefficient of weight on length (FL)	2.97	dimensionless	DP meeting (ICCAT 2025)
w	Observed lifespan	29	yr	ICCAT (2017)
	Theoretical lifespan (99% of Linf)	17.3	yr	Cortés (2025)
g	Intercept of total length to fork length relation	1.39	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.08	dimensionless	DP meeting (ICCAT 2025)

Table 14. Biological input values for females used to compute r_{MAX}, steepness and natural mortality (M) for South Atlantic shortfin mako (scenarios 1 and 2). Values in parentheses are standard errors.

Parameter	Definition	Value	Unit	References
L_{∞}	Theoretical maximum length (FL)	392.93 (9.21)	cm FL	Marquez et al. (2025)
K	Brody growth coefficient	0.107 (0.004)	yr^{-1}	Marquez et al. (2025)
L_0	Length at birth	65.65 (0.707)	cm FL	Marquez et al. (2025)
a	Intercept of maturity ogive	-55.181 (21.302)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.199 (0.077)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	4.670E-06	dimensionless	Mejuto et al. (2008)
d	Power coefficient of weight on length (FL)	3.16457	dimensionless	Mejuto et al. (2008)
w	Observed lifespan	15	yr	Marquez et al. (2025)
	Theoretical lifespan (99% of Linf)	41.3	yr	Cortés (2025)
	Sex ratio at birth	1:1	dimensionless	DP meeting (ICCAT 2025)
	Reproductive cycle	2-3	yr	DP meeting (ICCAT 2025)
e	Intercept of maternal length (FL) vs. fecundity	1.92	dimensionless	DP meeting (ICCAT 2025)
f	Slope of maternal length (FL) vs. fecundity	0.033	dimensionless	DP meeting (ICCAT 2025)
GP	Gestation period	15-18	months	DP meeting (ICCAT 2025)
g	Intercept of total length to fork length relation	0	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.127	dimensionless	DP meeting (ICCAT 2025)

Table 15. Biological input values for males used to compute natural mortality (M) for South Atlantic shortfin mako (scenarios 1 and 2). Values in parentheses are standard errors.

Parameter	Definition	Value	Unit	References
L_{∞}	Theoretical maximum length (FL)	251.15 (2.93)	cm FL	Marquez et al. (2025)
K	Brody growth coefficient	0.35 (0.008)	yr^{-1}	Marquez et al. (2025)
L_0	Length at birth	66.49 (0.75)	cm FL	Marquez et al. (2025)
a	Intercept of maturity ogive	-37.32 (13.68)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.189 (0.069)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	4.670E-06	dimensionless	Mejuto et al. (2008)
d	Power coefficient of weight on length (FL)	3.16457	dimensionless	Mejuto et al. (2008)
w	Observed lifespan	10	yr	DP meeting (ICCAT 2025)
	Theoretical lifespan (99% of Linf)	12.3	yr	Cortés (2025)
g	Intercept of total length to fork length relation	0	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.127	dimensionless	DP meeting (ICCAT 2025)

Table 16. Biological input values for females used to compute r_{MAX}, steepness and natural mortality (M) for South Atlantic shortfin mako (scenarios 3 and 4). Values in parentheses are standard errors. For theoretical maximum length, value in parentheses was decreased by an order of magnitude because it produced errors in estimating the theoretical lifespan.

Parameter	Definition	Value	Unit	References
L_∞	Theoretical maximum length (FL)	407.66 (9.768)	cm FL	Barreto et al. (2016)
K	Brody growth coefficient	0.04 (0.01)	yr^{-1}	Barreto et al. (2016)
t_0	Age at zero length	-7 (1.32)	yr	Barreto et al. (2016)
a	Intercept of maturity ogive	-55.181 (21.302)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.199 (0.077)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	4.670E-06	dimensionless	Mejuto et al. (2008)
d	Power coefficient of weight on length (FL)	3.16457	dimensionless	Mejuto et al. (2008)
w	Observed lifespan	15	yr	Marquez et al. (2025)
	Theoretical lifespan (99% of Linf)	41.3	yr	Cortés (2025)
	Sex ratio at birth	1:1	dimensionless	DP meeting (ICCAT 2025)
	Reproductive cycle	3	yr	DP meeting (ICCAT 2025)
e	Intercept of maternal length (FL) vs. fecundity	1.92	dimensionless	DP meeting (ICCAT 2025)
f	Slope of maternal length (FL) vs. fecundity	0.033	dimensionless	DP meeting (ICCAT 2025)
GP	Gestation period	15-18	months	DP meeting (ICCAT 2025)
g	Intercept of total length to fork length relation	0	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.127	dimensionless	DP meeting (ICCAT 2025)

Table 17. Biological input values for males used to compute natural mortality (M) for South Atlantic shortfin mako (scenarios 3 and 4). Values in parentheses are standard errors.

Parameter	Definition	Value	Unit	References
L_∞	Theoretical maximum length (FL)	328.74 (40.84)	cm FL	Barreto et al. (2016)
K	Brody growth coefficient	0.08 (0.02)	yr^{-1}	Barreto et al. (2016)
t_0	Age at zero length	-4.47 (0.73)	yr	Barreto et al. (2016)
a	Intercept of maturity ogive	-37.32 (13.68)	dimensionless	DP meeting (ICCAT 2025)
b	Slope of maturity ogive	0.189 (0.069)	dimensionless	DP meeting (ICCAT 2025)
c	Scalar coefficient of weight on length (FL)	4.670E-06	dimensionless	Mejuto et al. (2008)
d	Power coefficient of weight on length (FL)	3.16457	dimensionless	Mejuto et al. (2008)
w	Observed lifespan	10	yr	DP meeting (ICCAT 2025)
	Theoretical lifespan (99% of Linf)	12.3	yr	Cortés (2025)
g	Intercept of total length to fork length relation	0	dimensionless	DP meeting (ICCAT 2025)
h	Slope of total length to fork length relation	1.127	dimensionless	DP meeting (ICCAT 2025)

Table 18. SCRS Catalogue of Task 1 (T1, in tonnes) and Task 2 (T2 availability) data for North Atlantic shortfin mako (SMA-N), detailing the 10 most important fisheries between 1994 and 2023. T2 availability is classified as: 'a' (T2CE only), 'b' (T2SZ only), 'ab' (both T2CE & T2SZ), and '-1' (no data)

Table 7. Species: SMA - Stock: ATN

Score 4.47

Species	Stock	Status	FlagName	GearGrp	DSet	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
					T1 Total	3662	5307	5312	3539	3853	2864	2598	2682	3434	3987	4000	4114	3932	4158	3802
SMA	ATN	CP	EU-España	LL	t1	2164	2209	3294	2416	2223	2051	1561	1684	2047	2068	2088	1751	1918	1814	1895
SMA	ATN	CP	EU-España	LL	t2	-1	-1	-1	b	b	b	b	b	b	b	b	b	b	b	b
SMA	ATN	CP	EU-Portugal	LL	t1	649	657	691	354	307	327	318	378	415	1249	472	1109	951	1540	1033
SMA	ATN	CP	EU-Portugal	LL	t2	-1	a	a	a	a	a	a	a	a	a	a	a	ab	ab	ab
SMA	ATN	CP	Maroc	LL	t1										147	169	215	220	151	283
SMA	ATN	CP	Maroc	LL	t2										-1	-1	-1	-1	-1	-1
SMA	ATN	CP	USA	RR	t1	317	1422	232	164	148	69	290	214	248	0	336	282	257	158	156
SMA	ATN	CP	USA	RR	t2	-1	-1	-1	-1	-1	-1	-1	b	b	b	-1	-1	-1	-1	-1
SMA	ATN	CP	Japan	LL	t1	214	592	790	258	892	120	138	105	438	267	572	420	358	82	131
SMA	ATN	CP	Japan	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
SMA	ATN	CP	USA	LL	t1	269	259	165	181	146	125	131	135	123	105	140	138	95	167	149
SMA	ATN	CP	USA	LL	t2	ab	ab	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab
SMA	ATN	CP	Canada	LL	t1		93	56	99	55	54	59	60	61	63	69	74	64	64	39
SMA	ATN	CP	Canada	LL	t2		-1	a	a	a	a	a	-1	a	a	a	a	-1	a	a
SMA	ATN	NCC	Chinese Taipei	LL	t1	29	32	45	42	47	75	56	47	53	37	70	68	40	6	23
SMA	ATN	NCC	Chinese Taipei	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	ab	ab	ab
SMA	ATN	CP	Maroc	PS	t1															
SMA	ATN	CP	Maroc	PS	t2															
SMA	ATN	CP	Belize	LL	t1															
SMA	ATN	CP	Belize	LL	t2															

FlagName	GearGrp	DSet	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Rank	%	%cum
		T1 Total	4543	4783	3724	4445	3611	3475	3294	3368	3134	2406	1896	1735	1187	782	1094			
EU-España	LL	t1	2216	2091	1667	2308	1509	1481	1362	1574	1784	1165	866	870	585	588	936	1	51.81	51.81
EU-España	LL	t2	b	b	b	b	b	b	b	b	b	b	b	b	b	-1	-1	1		
EU-Portugal	LL	t1	1169	1432	1045	1027	823	221	216	261	274	271	288	341	201	80	77	2	18.05	69.85
EU-Portugal	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	b	2		
Maroc	LL	t1	476	636	390	380	616	580	807	1000	320	423	357	382	299	9	9	3	7.81	77.67
Maroc	LL	t2	-1	-1	-1	a	a	-1	a	ab	ab	ab	ab	ab	ab	-1	-1	3		
USA	RR	t1	163	183	180	236	227	816	480	168	192	125	25	24	22	27	0	4	7.11	84.78
USA	RR	t2	-1	-1	-1	-1	-1	-1	-1	b	b	b	b	ab	b	a	a	4		
Japan	LL	t1	98	116	53	56	33	69	45	74	89	20	33	28	15	10	12	5	6.09	90.86
Japan	LL	t2	ab	ab	ab	a	a	a	a	a	a	a	a	-1	-1	-1	-1	5		
USA	LL	t1	171	168	160	152	140	155	100	108	112	41	32	26	20	23	29	6	3.74	94.60
USA	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	6		
Canada	LL	t1	50	39	37	28	35	53	84	82	109	54	62	18	22	26	11	7	1.61	96.21
Canada	LL	t2	a	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a	a	7		
Chinese Taipei	LL	t1	11	14	13	15	8	4	15	8	1	22	5	12	1	2	7	8	0.80	97.01
Chinese Taipei	LL	t2	a	ab	ab	ab	ab	ab	ab	ab	a	-1	-1	-1	-1	-1	-1	8		
Maroc	PS	t1			30	26	51	44	140	50	130	172	144					9	0.78	97.79
Maroc	PS	t2			-1	-1	-1	-1	-1	-1	-1	-1	-1					9		
Belize	LL	t1	23	28	69	114	99	1	1	1	9	12	2		3			10	0.36	98.15
Belize	LL	t2	ab	ab	ab	ab	a	a	-1	a	a	a	ab		-1			10		

Table 19. SCRS Catalogue of Task 1 (T1, in tonnes) and Task 2 (T2 availability) data for South Atlantic shortfin mako (SMA-S), detailing the 10 most important fisheries between 1994 and 2023. T2 availability is classified as: 'a' (T2CE only), 'b' (T2SZ only), 'ab' (both T2CE & T2SZ), and '-1' (no data).

Table 8. Species: SMA - Stock: ATS

Score 5.57

Species	Stock	Status	FlagName	GearGrp	DSet	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Rank	%	%cum
				T1 Total		2182	3100	2395	2187	2008	1606	2588	2107	2103	3235	2526	3517	3380	2786	1881	2196	2531	3467	2908	2678	3291	2943	2766	3278	3160	2944	2858	2255	2496	992			
SMA	ATS	CP	EU-España	LL	t1	552	1084	1482	1356	984	861	1090	1235	811	1158	703	584	664	654	628	922	1192	1535	1207	1083	1077	862	882	1049	1044	1090	799	650	657	187	1	35.83	35.83
SMA	ATS	CP	EU-España	LL	t2	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	-1	b	b	b	-1	1		
SMA	ATS	CP	Namibia	LL	t1						1			459	375	509	1415	1345	1002	295	155	349	536	554	483	950	829	799	684	980	634	929	637	789	545	2	19.47	55.30
SMA	ATS	CP	Namibia	LL	t2						-1			a	-1	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	a	a	ab	ab	ab	ab	ab	ab	a	a	2		
SMA	ATS	CP	EU-Portugal	LL	t1		92	94	165	116	119	388	140	56	625	13	242	493	375	321	502	336	409	177	133	127	158	394	504	302	244	450	358	370	11	3	9.84	65.14
SMA	ATS	CP	EU-Portugal	LL	t2		-1	-1	a	a	a	a	a	a	a	a	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	a	-1	3		
SMA	ATS	CP	Brazil	LL	t1	95	119	83	190	233	27	219	409	226	283	177	426	183	152	121	92	128	179	193	276	256	172	124	275	396	739	542	477	555	121	4	9.53	74.67
SMA	ATS	CP	Brazil	LL	t2	-1	-1	-1	a	-1	-1	ab	a	a	a	a	ab	a	ab	a	ab	ab	ab	a	a	a	a	a	a	a	a	a	ab	ab	ab	4		
SMA	ATS	CP	Japan	LL	t1	1369	1617	514	244	267	151	264	56	133	118	398	258	243	72	115	108	103	132	291	114	182	109	77	96	93	55	5	9	3	3	5	9.19	83.86
SMA	ATS	CP	Japan	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	a	a	a	a	a	a	a	a	a	-1	a	-1	5		
SMA	ATS	CP	South Africa	LL	t1	23	46	36	29	168	66	103	68	12	115	101	111	86	224	137	146	152	218	108	250	476	613	339	305	244	110	46	70	66	96	6	5.82	89.68
SMA	ATS	CP	South Africa	LL	t2	-1	-1	-1	-1	-1	-1	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	6		
SMA	ATS	NCC	Chinese Taipei	LL	t1	65	87	117	139	130	198	162	120	146	83	180	226	166	147	124	117	144	204	158	157	161	154	95	88	66	44	54	37	26	11	7	4.60	94.28
SMA	ATS	NCC	Chinese Taipei	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	7		
SMA	ATS	CP	China PR	LL	t1	45	23	27	19	74	126	305	22	208	260	68	45	70	77	6	24	32	29	8	9	9	5	3	1			1	1	4	3	8	1.92	96.20
SMA	ATS	CP	China PR	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a	a	a	a	a	a	a	a	a	a		a	a	a	a	a	8		
SMA	ATS	CP	Uruguay	LL	t1	12	17	26	20	23	21	35	40	38	188	249	146	68	36	41	106	23	76	36	1											9	1.53	97.73
SMA	ATS	CP	Uruguay	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	ab	ab	ab	a	-1	ab	ab	ab											9		
SMA	ATS	CP	Côte d'Ivoire	GN	t1	20	13	15	23	10	10	9	15	15	30	15	14	16	25					19	33	19	11	13	161	4	8	7		1		10	0.65	98.38
SMA	ATS	CP	Côte d'Ivoire	GN	t2	-1	-1	-1	-1	-1	-1	-1	-1	b	b	-1	-1	-1	a					a	a	ab	a	a	b	-1	a	-1		a		10		

Table 20. Estimated catches (landings and dead discards) in tonnes, of shortfin mako (SMA *Isurus oxyrinchus*) by area, gear, and flag from 1994 to 2023.

SMA-Table 1. Estimated catches (t) of Shortfin mako (Isurus oxyrinchus) by area, gear, and flag (v0, 2025-06-09)
SMA-Tabla 1. Capturas estimadas (t) de Marrajo dientuso (Isurus oxyrinchus) por area, arte y bandera (v0, 2025-06-09)
SMA-Tableau 1. Prises estimées (t) de Taupe bleue (Isurus oxyrinchus) par zone, engin et pavillon (v0, 2025-06-09)

				1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TOTAL				5844	8407	7707	5732	5870	4475	5190	4796	5539	7225	6528	7648	7322	6946	5684	6740	7316	7193	7354	6289	6766	6238	6133	6412	5567	4840	4592	3442	3278	2087
	ATN			3662	5307	5312	3539	3853	2864	2598	2682	3434	3987	4000	4114	3932	4158	3802	4543	4783	3724	4445	3611	3475	3294	3368	3134	2406	1896	1735	1187	782	1094
	ATS			2182	3100	2395	2187	2008	1606	2588	2107	2103	3235	2526	3517	3380	2786	1881	2196	2531	3467	2908	2678	3291	2943	2766	3278	3160	2944	2858	2255	2496	992
	MED					0	6	8	5	4	7	2	2	2	17	10	2	1	1	2	2	2	0	0	0	0	0	1	0	0	0	1	0
Landings	ATN		Longline	3310	3829	5059	3354	3678	2762	2270	2451	3163	3970	3645	3806	3660	3976	3623	4346	4588	3500	4147	3315	2588	2639	3119	2714	1998	1622	1625	521	18	3
			Other surf.	331	1448	252	183	175	99	320	231	271	17	355	308	273	175	169	177	193	215	273	286	871	642	237	411	379	213	42	33	34	6
	ATS		Longline	2162	3085	2379	2163	1996	1596	2566	2090	2088	3204	2450	3503	3336	2745	1799	2190	2530	3405	2844	2643	3257	2928	2748	3110	3149	2926	2820	2234	2462	778
			Other surf.	21	15	16	25	12	10	22	18	15	31	76	14	43	30	82	7	1	62	55	34	31	12	13	162	7	8	29	9	3	0
	MED		Longline			0	6	8	5	4	7	2	2	2	17	10	2	1	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0
			Other surf.																0		0	0	0	0				1	0	0	0	0	0
Discards	ATN		Longline	21	29	0	2		1	8				0			7	9	20	2	9	24	11	15	13	12	9	28	60	65	632	730	1084
			Other surf.						2								0	1	0	0	0	0	0	0	0	0	1	1	1	2	0	0	1
	ATS		Longline														12	0		0	0	9	1	3	3	4	5	3	10	8	13	31	214
			Other surf.																			0	0		0	1	1	1	1	0	0	0	0
	MED		Longline																		0	0	0	0	0	0	0	0	0	0	0	1	0
Landings	ATN	CP	Barbados																						4	3	3						
			Belize																23	28	69	114	99	1	1	1	9	12	2		3		
			Canada		111	67	110	69	70	78	69	78	73	80	91	71	72	43	53	41	37	29	35	55	85	82	109	53	63	1	0		0
			China PR							0							81	16	19	29	18	24	11	5	2	4	2						
			Costa Rica								0						0	1	1	1	2	2	1	2	1	1	0	1	0	0			
			Curaçao																								0						
			EU-España	2164	2209	3294	2416	2223	2051	1561	1684	2047	2068	2088	1751	1918	1814	1895	2216	2091	1667	2308	1509	1481	1362	1574	1784	1165	866	870	0	0	0
			EU-France																15	2	0	0	0	1	1	2	1	0	1	0	1	1	0
			EU-Netherlands																								0						
			EU-Portugal	649	657	691	354	307	327	318	378	415	1249	473	1109	951	1540	1033	1169	1432	1045	1023	820	219	222	264	276	272	289	342	202	1	0
			FR-St Pierre et Miquelon														1	2		4	0		4	0				0					
			Great Britain						2	3	2	1	1	1	0	0	0	1	15	0	0	0	0	0					0	0	0		0
			Guatemala																								0						
			Japan	214	592	790	258	892	120	138	105	438	267	572	420	358	82	131	98	116	53	56	33	69	45	74	89	20	4	0	0	0	0
			Korea Rep																		27	27	15	8	2	1	3	5	4			0	0
			Liberia																											10			
			Maroc										147	169	215	220	151	283	476	636	420	406	667	624	947	1050	450	594	501	382	299		0
			Mauritania																							2							
			Mexico		10	5	2	6	5	10	16	8	10	6	9	5	8	6	7	8	8		4	4	4	3	5	2	2	2	2	3	2
			Panama						1	0						0	49	33	39				19	7			0						
			Philippines						1									1	1		2	0	1	2									
			Russian Federation																								0	0	0		0	0	
			Senegal														8	17	21			2	0	2	2	2	68	68	26				
			St Vincent and Grenadines			0			3																2				3				
			Trinidad and Tobago	3	1	1	1	2	1	3	6	2	3	1	2	1	1	1	1	1	0	2	1	1	1	1	2	2	1	1	1	1	0
			UK-Bermuda				1	2								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
			USA	574	1658	400	345	297	198	414	350	372	106	477	422	353	319	296	314	350	332	371	363	961	572	271	302	165	57	48	39	41	0
			Venezuela	7	7	17	9	8	6	9	24	21	28	64	27	14	19	8	41	27	20	33	9	13	17	13	19	18	14	11	5	6	6
		NCC	Chinese Taipei	29	32	45	42	47	75	56	47	53	37	70	68	40	6	23	11	14	13	14	8	4	13	7	1	0	0	0	0	0	0
		NCO	Sta Lucia															0		0	1		1	0						0	1		
	ATS	CP	Angola																								31		0	0	7	23	14
			Belize												38		17	2		32	59	78	88	1	15	14	34	15	7	2	1		
			Brazil	95	119	83	190	233	27	219	409	226	283	238	426	210	145	203	99	128	192	196	276	268	173	124	275	399	739	542	477	557	121
			China PR	45	23	27	19	74	126	305	22	208	260	68	45	70	77	6	24	32	29	8	9	9	5	3	1						
			Curaçao																				0	0			0						
			Côte d'Ivoire	20	13	15	23	10	10	9	15	15	30	15	14	16	25		5	7		20	34	19	11	13	161	4	8	14	9	1	
			EU-España	552	1084	1482	1356	984	861	1090	1235	811	1158	703	584	664	654	628	922	1192	1535	1207	1083	1077	862	882	1049	1044	1090	799	650	657	0
			EU-Portugal		92	94	165	116	119	388	140	56	625	13	242	493	375	321	502	336	409	176	132	127	158	393	503	300	243	449	357	358	
			El Salvador																								0						
			Great Britain													5			11														
			Guatemala																								0						
			Japan	1369	1617	514	244	267	151	264	56	133	118	398	258	243	72	115	108	103	132	291	114	182	109	77	96	93	53	1	0	0	0
			Korea Rep																	29	13	7	7	4	4	18	8	9	1			0	0
			Namibia						1			459	375	509	1415	1345	1002	295	155	349	584	586	483	950	829	799	684	980	634	945	637	789	545
			Panama						24	1								10									0						
			Philippines						2	0								1	1	3	2	2	20	16									
			Russian Federation												0																		
			Senegal																		13	34	23		11	6	39	4	7				
			South Africa	24	49	37	31	171	67	116	70	12	116	101	111	86	224	137	146	152	218	108	250	476	613	339	305	244	110	46	70	66	96
			UK-Sta Helena																		0	0	0	0	0	0	0	0	0	0	0		0
			Uruguay	12	17	26	20	23	21	35	40	38	188	249	146	68	36	41	106	23	76	36	1										
		NCC	Chinese Taipei	65	87	117	139	130	198	162	120	146	83	180	226	166	147	124	117	144	203	150	157	158	152	92	85	64	42	52	35	13	2
		NCO	Vanuatu											52	12	13	1	0															
	MED	CP	EU-Cyprus													1	1	0	0	1	1												
			EU-España				6	7	5	3	2	2	2	2	2	4	1	0	0	1	2	2	0	0	0					0			
			EU-France																0										0	0	0	0	0
			EU-Italy																									1	0				
			EU-Portugal					1		1	5		0		15	5					0												
			Japan			0												0	0				0	0	0		0	0	0	0	0	0	0
			Maroc																		0	0	0	0									
Discards	ATN		Canada																				0		0	1	0	2	1	20	22	26	12
			China PR																										20	2	1	5	4
			Curaçao																								0						
			EU-España																								0				585	588	936
			EU-France																								0	0	0		0	0	1
			EU-Portugal																			4	5	4	3	4	5	4	4	3	4	80	77
			El Salvador																								0						
			Guatemala																								0						
			Japan																					0	0				30	28	15	10	12
			Korea Rep																				0	0	1	0	0	0	0			0	0
			Maroc																					0		0	0	0		0	0	9	9
			Mexico		1												0					0	0	0	0	0	0	0	0	0	0	0	0
			Panama																								0						
			Russian Federation																								0	0	0		0	0	
			UK-Bermuda						2															0				0	0	0	0		0
			USA	21	28	0	2		1	8				0			7	10	20	2	9	18	5	11	8	6	4	2	1	3	4	10	29
		NCC	Chinese Taipei																		0	1	0	0	1	1	0	22	5	12	1	2	7
	ATS	CP	Brazil														12	0															
			China PR																											1	1	4	3
			Curaçao																								0						
			EU-España																								0						187
			EU-France																						0	1	0	1	1	0	0	0	0
			EU-Portugal																			1	1	1	1	1	1	1	1	1	1	12	11
			El Salvador																								0						
			Guatemala																								0						
			Japan																					0	0				2	5	9	3	3
			Korea Rep																				0	0		0	0	0	5			0	0
			Panama																								0						
			South Africa																														0
		NCC	Chinese Taipei																	0	0	8	0	2	2	3	3	2	2	2	2	13	9
	MED	CP	EU-España																						0						0	1	0

Table 21. Summary of productivity scenarios for the North Atlantic (NA) and the South Atlantic (SA). H is steepness, B_{MSY}/K is the ratio of the unfished biomass at which MSY is produced, and rmax is the intrinsic rate of growth.

	Deterministic		
scenario	observed max age		
	h	B_{MSY}/K	r_{max}
NA scenario 1	0.43	0.597	0.085
NA scenario 2	0.44	0.590	0.085
NA scenario 3	0.39	0.660	0.044
SA scenarios 1 and 2	0.46	0.578	0.114
SA scenarios 3 and 4	0.39	0.637	0.049

Table 22. Range of exploited lengths (cm FL) by stock and sex.

	Minimum FL (cm)		Maximum FL (cm)
	North Atlantic		
Females	43		414
Males	50		398.5
	South Atlantic		
Females	50		350
Males	50		320

Table 23. Vectors of natural mortality (M) obtained with the Peterson and Wroblewski method for females by scenario to use with SS; the value highlighted in orange is the mean M to use for JABBA-Select.

Age	NA	NA	NA	SA	SA
	scenario 1	scenario 2	scenario 3	scenario 1 and 2	scenario 3 and 4
0	0.206	0.274	0.274	0.395	0.296
1	0.168	0.196	0.225	0.299	0.274
2	0.145	0.159	0.194	0.250	0.256
3	0.130	0.137	0.173	0.220	0.242
4	0.119	0.123	0.157	0.199	0.229
5	0.111	0.112	0.145	0.184	0.219
6	0.104	0.105	0.135	0.173	0.210
7	0.099	0.099	0.127	0.164	0.202
8	0.095	0.095	0.121	0.157	0.196
9	0.092	0.091	0.116	0.152	0.189
10	0.089	0.088	0.111	0.147	0.184
11	0.086	0.086	0.107	0.143	0.179
12	0.084	0.084	0.104	0.140	0.175
13	0.082	0.082	0.101	0.137	0.171
14	0.081	0.080	0.098	0.135	0.167
15	0.080	0.079	0.096	0.132	0.164
16	0.078	0.078	0.094		0.161
17	0.077	0.077	0.092	0.189	0.158
18	0.077	0.077	0.090		0.156
19	0.076	0.076	0.089		0.153
20	0.075	0.075	0.087		0.151
21			0.086		0.149
22	0.103	0.108	0.085		0.147
23			0.084		0.145
24			0.083		
25			0.082		0.191
26			0.081		
27			0.080		
28			0.080		
29			0.079		
30			0.079		
31			0.078		
32			0.078		
			0.112		

Table 24. Vectors of natural mortality (M) obtained with the Peterson and Wroblewski method for males by scenario to use with SS; the value highlighted in orange is the mean M to use for JABBA-Select.

Age	NA scenario 1	NA scenario 2	NA scenario 3	SA scenario 1 and 2	SA scenario 3 and 4
0	0.212	0.265	0.274	0.392	0.299
1	0.165	0.194	0.215	0.261	0.268
2	0.142	0.161	0.182	0.216	0.245
3	0.129	0.143	0.162	0.194	0.227
4	0.120	0.131	0.148	0.182	0.214
5	0.114	0.122	0.138	0.174	0.203
6	0.109	0.116	0.130	0.169	0.194
7	0.106	0.112	0.124	0.166	0.187
8	0.104	0.109	0.119	0.164	0.181
9	0.102	0.106	0.115	0.162	0.175
10	0.101	0.104	0.112	0.161	0.171
11	0.100	0.102	0.110		0.167
12	0.099	0.101	0.108	0.204	
13	0.098	0.100	0.106		0.211
14	0.098	0.099	0.104		
15	0.098	0.099	0.103		
16	0.097	0.098	0.102		
17	0.097	0.098	0.101		
18	0.097	0.097	0.100		
19	0.097	0.097	0.100		
20	0.097	0.097	0.099		
21	0.097	0.097	0.099		
22			0.098		
23	0.113	0.120	0.098		
24			0.097		
25			0.097		
26			0.097		
27			0.097		
28			0.096		
29			0.096		
			0.121		

Table 25. Estimated fishing mortality rate relative to MSY (F/F_{MSY}) and spawning stock fecundity ratio (SSF/SSF_{MSY}) at the end of the year from the Stock Synthesis for the South Atlantic shortfin mako.

	SSF/SSF_{MSY}			F/F_{MSY}		
Year	Median	95%LCI	95%UCI	Median	95%LCI	95%UCI
1972	1.616	1.140	2.245	0.336	0.020	0.846
1973	1.620	1.139	2.244	0.354	0.066	0.806
1974	1.622	1.139	2.246	0.257	0.024	0.634
1975	1.627	1.140	2.248	0.230	0.027	0.560
1976	1.627	1.141	2.251	0.252	0.012	0.646
1977	1.629	1.139	2.252	0.346	0.076	0.771
1978	1.631	1.142	2.255	0.271	0.051	0.623
1979	1.653	1.158	2.273	0.297	0.090	0.617
1980	1.680	1.177	2.296	0.347	0.106	0.728
1981	1.710	1.197	2.320	0.314	0.122	0.613
1982	1.732	1.210	2.330	0.533	0.307	0.848
1983	1.752	1.226	2.345	0.325	0.178	0.541
1984	1.767	1.241	2.351	0.389	0.251	0.576
1985	1.775	1.251	2.355	0.470	0.254	0.785
1986	1.776	1.260	2.353	0.420	0.194	0.766
1987	1.793	1.267	2.327	0.381	0.127	0.794
1988	1.785	1.274	2.315	0.500	0.330	0.739
1989	1.785	1.278	2.297	0.609	0.516	0.728
1990	1.791	1.283	2.287	0.613	0.460	0.838
1991	1.789	1.283	2.264	0.597	0.414	0.883
1992	1.775	1.284	2.243	0.662	0.495	0.898
1993	1.778	1.288	2.213	0.769	0.661	0.898
1994	1.751	1.287	2.178	0.942	0.810	1.098
1995	1.708	1.266	2.088	1.214	0.862	1.705
1996	1.653	1.229	1.991	1.187	0.971	1.537
1997	1.573	1.190	1.885	1.479	1.130	1.794
1998	1.511	1.163	1.791	1.502	1.176	1.833
1999	1.456	1.152	1.725	1.373	0.916	1.893
2000	1.439	1.186	1.673	1.844	1.461	2.243
2001	1.364	1.126	1.581	1.590	1.221	1.967
2002	1.254	1.031	1.467	1.515	1.165	1.920
2003	1.160	0.953	1.366	2.049	1.766	2.400
2004	1.078	0.883	1.278	1.708	1.426	2.010
2005	0.994	0.813	1.186	1.996	1.716	2.351
2006	0.935	0.761	1.131	1.807	1.561	2.109
2007	0.931	0.774	1.103	1.920	1.495	2.397
2008	0.903	0.749	1.068	1.424	0.982	1.919
2009	0.855	0.705	1.021	1.493	1.037	2.025
2010	0.856	0.707	1.022	1.680	1.214	2.208
2011	0.841	0.690	1.010	1.980	1.537	2.461
2012	0.818	0.667	0.990	1.524	1.274	1.799
2013	0.839	0.680	1.022	1.255	1.041	1.485
2014	0.860	0.694	1.051	1.643	1.368	2.004
2015	0.879	0.709	1.076	1.423	1.190	1.725
2016	0.885	0.714	1.083	1.494	1.262	1.737
2017	0.893	0.721	1.097	1.657	1.391	1.940
2018	0.960	0.785	1.169	1.988	1.654	2.339
2019	0.968	0.785	1.187	1.870	1.356	2.444
2020	0.947	0.767	1.164	1.956	1.585	2.354
2021	0.972	0.788	1.194	1.663	1.339	2.014
2022	0.981	0.793	1.214	1.979	1.577	2.419
2023	0.949	0.763	1.179	1.052	0.837	1.287

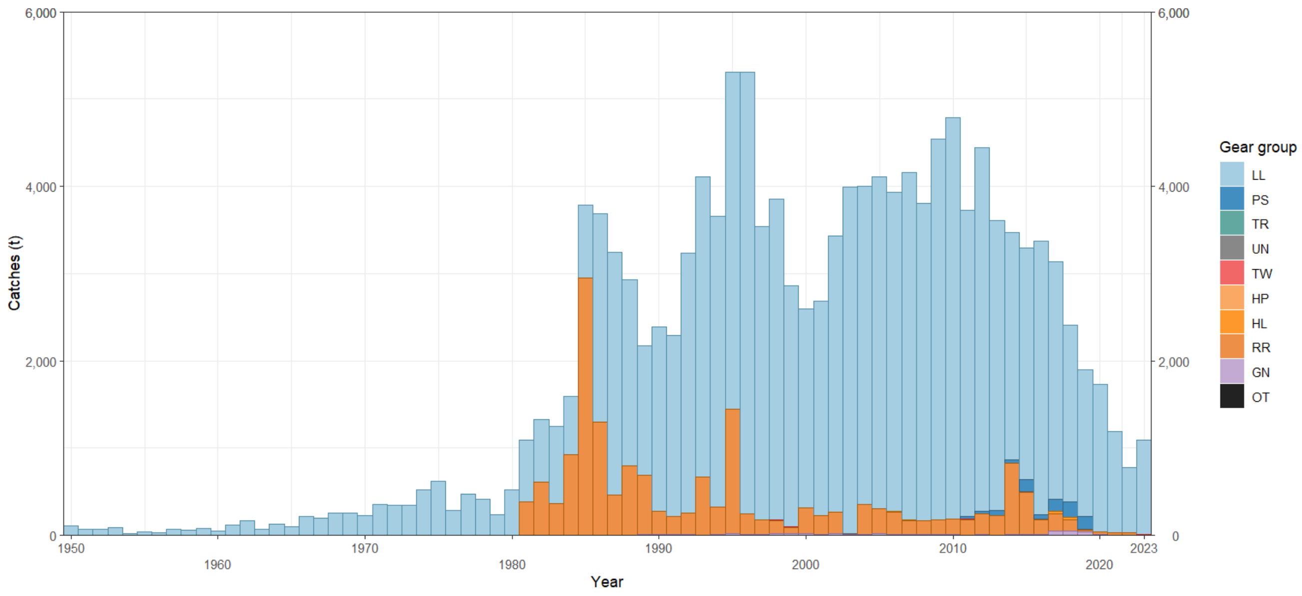

Figure 1. Task 1 Nominal catches of shortfin mako (SMA, *Isurus oxyrinchus*) in the northern stock (SMA-N) in tonnes (t) by gear group (1950-2023).

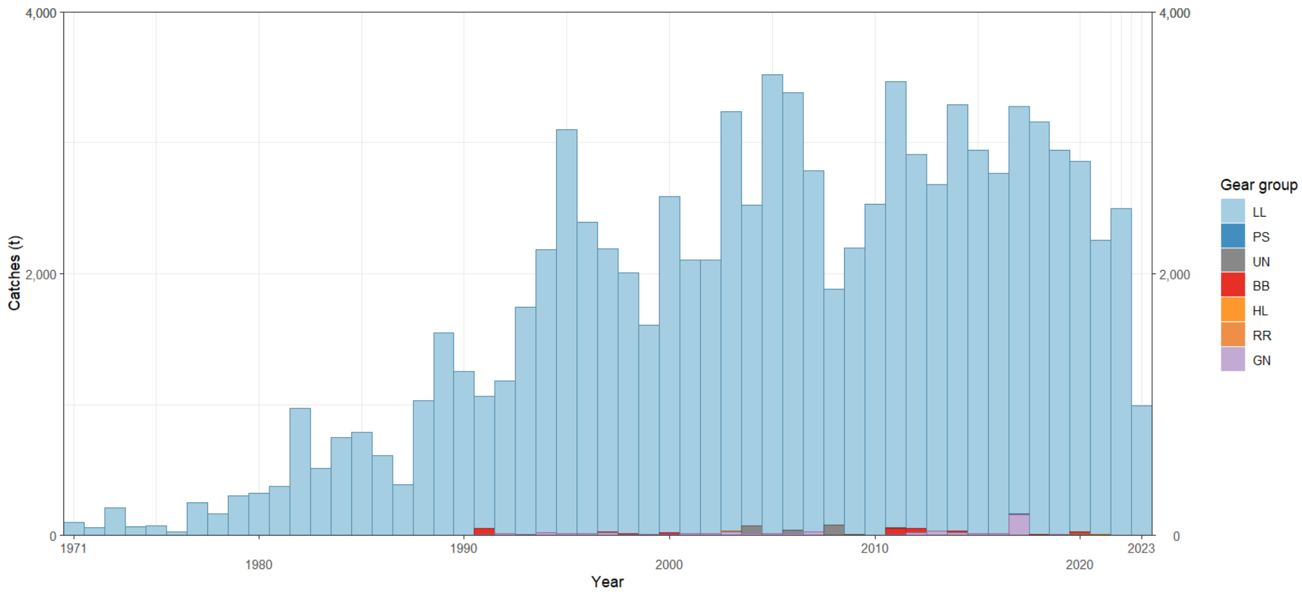

Figure 2. Task 1 Nominal catches of shortfin mako (SMA, *Isurus oxyrinchus*) in the southern stock (SMA-S) in tonnes (t) by gear group (1950-2023).

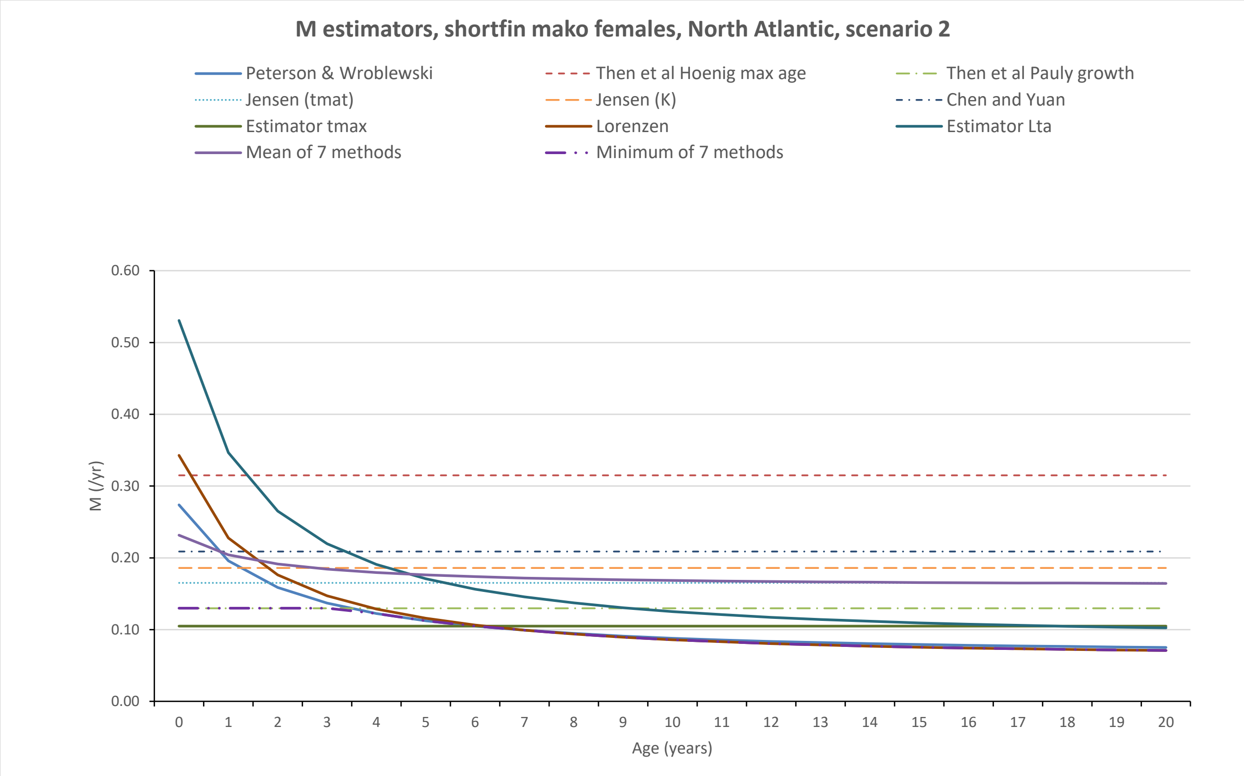

Figure 3. Curves of natural mortality M at age obtained with the different estimators for the North Atlantic stock scenario 2 for females.

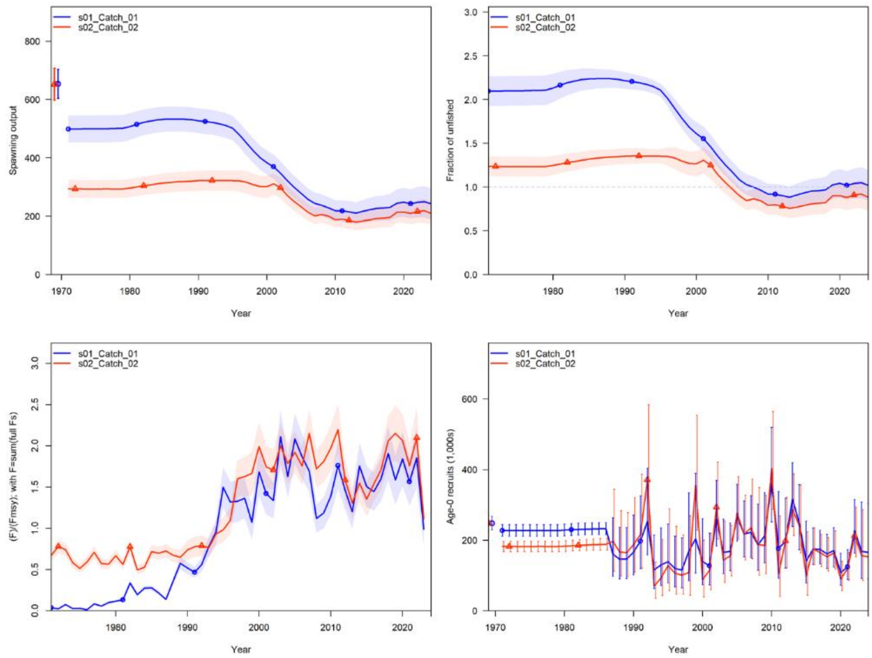

Figure 4. Comparison between the s01_Catch01 (blue) and s02_Catch02 (red) for the South Atlantic shortfin mako shark. The panels show (top-left) spawning stock fecundity (SSF), (top-right) fraction of unfished SSF, (bottom-left) fishing mortality relative to F_{MSY}, and (bottom-right) recruitment deviations. Shaded areas represent approximate confidence intervals.

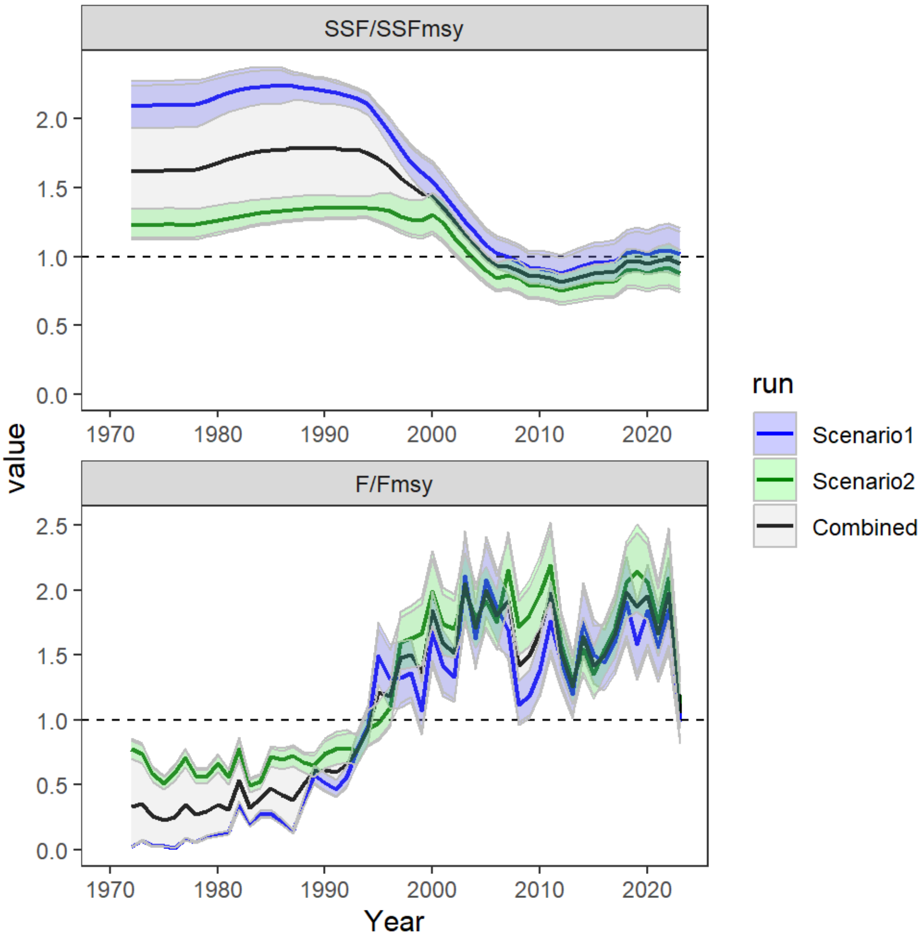

Figure 5. Time series of relative spawning stock fecundity (SSF/SSF_{MSY}; top panel) and relative fishing mortality (F/F_{MSY}; bottom panel) for scenario 1 (s01_Catch_01) in blue and Scenario 2 (s02_Catch_02) in green and their combined trajectory in black. Shaded areas represent the 95% confidence intervals estimated using the multivariate lognormal (MVLN) approach. The horizontal dashed lines at value = 1.0 indicate the MSY reference points for each metric.

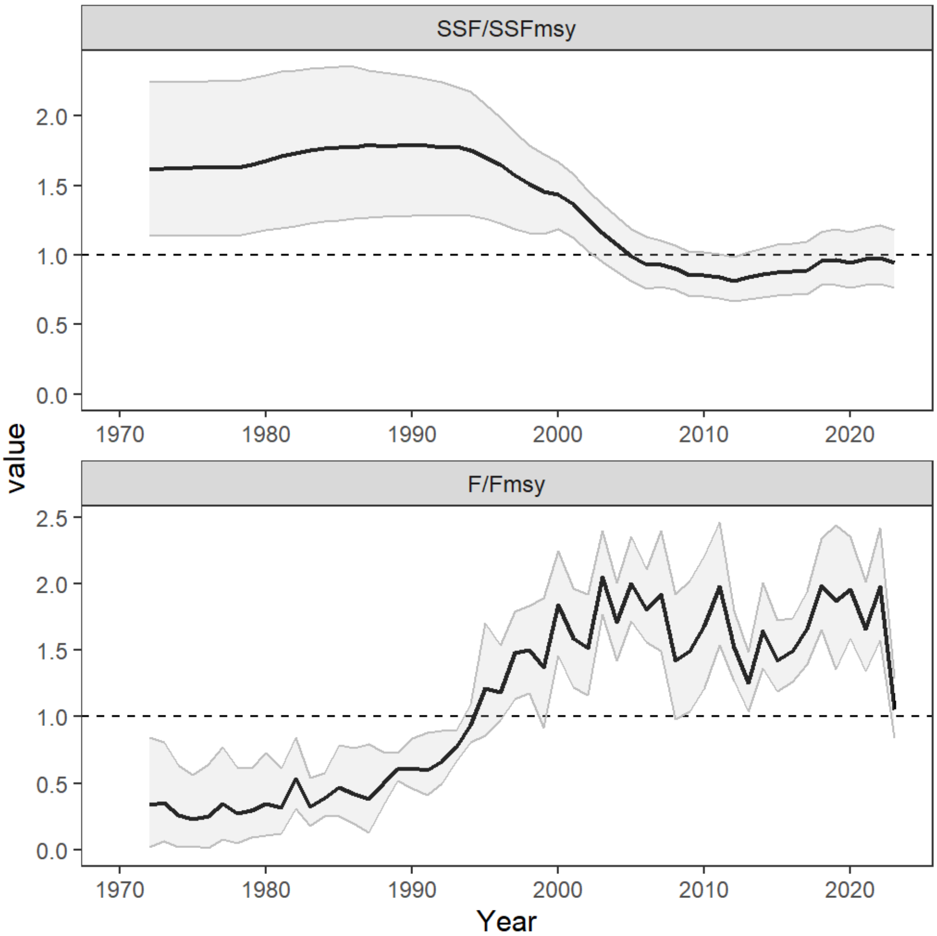

Figure 6. Trajectories of fishing mortality rate relative to MSY (F/F_{MSY}) and spawning stock fecundity ratio (SSF/SSF_{MSY}) at the end of the year from the Stock Synthesis for the South Atlantic shortfin mako.

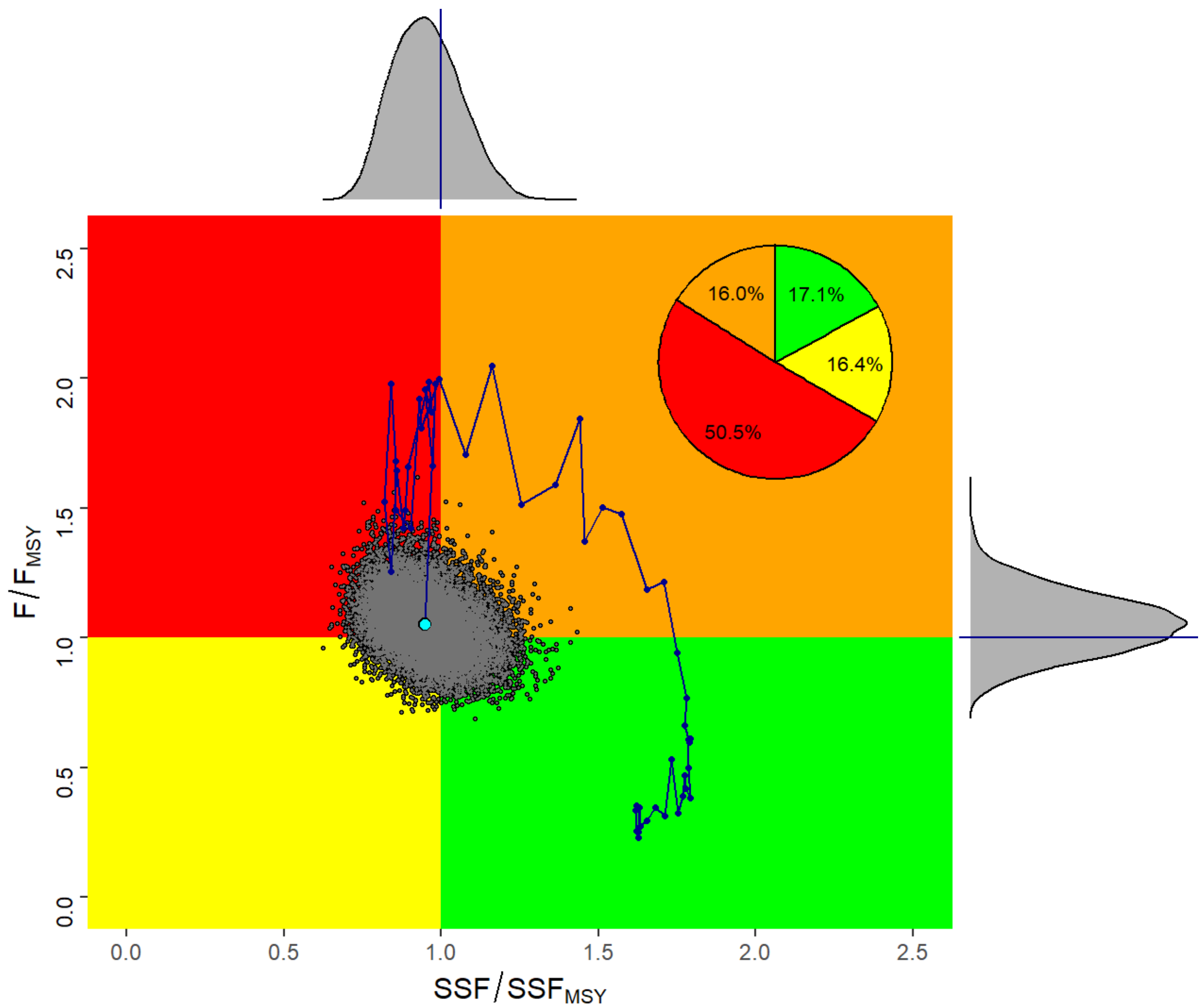

Figure 7. Final stock status (Kobe plot) with the associated uncertainties for the South Atlantic shortfin mako shark. The corresponding probabilities of the stock being in each quadrant are represented in the pie chart.

Appendix 1

Agenda

Objectives

The Sharks Species Group main objective for 2025 is to conduct a stock assessment for Atlantic shortfin mako shark. In addition, it will draft its recommendations on research, statistics and for management, draft its responses to the Commission, draft the new Executive Summaries and review the activities of the Shark Research and Data Collection Programme (SRDCP).

1. Opening, adoption of Agenda and meeting arrangements

2. Summary of available data for the assessment

    2.1 Intersessional work
    2.2 Catches
    2.3 Indices of abundance
    2.4 Biology
    2.5 Length compositions
    2.6 Other relevant data

3. Methods and other data relevant to the assessment

    3.1 Production models
    3.2 Length-based age-structured models: Stock Synthesis
    3.3 Other methods

4. Stock status results

    4.1 Production models
    4.2 Stock Synthesis
    4.3 Other methods
    4.4 Synthesis of assessment results

5. Projections

6. Recommendations

    6.1 Research and statistics
    6.2 Management

7. Responses to the Commission

8. Sharks Draft Executive Summaries

9. Shark Research and Data Collection Programme (SRDCP)

10. Other matters

11. Adoption of the report and closure

Appendix 2

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Appendix 3

List of papers and presentations

DocRef	Title	Authors
SCRS/2025/040	Preliminary results on the age and growth of the shortfin mako shark (*Isurus oxyrinchus*) in the South Atlantic Ocean	Márquez R., Santos C., Semba Y., Rosa D., Jagger C., Forselledo R., Mas F., Domingo A., Sant'Ana R., Coelho R., Gustavo Cardoso L.,
SCRS/2025/074	Estimates of vital rates and population dynamics parameters of interest for shortfin makos in the North and South Atlantic Ocean	Cortés E.
SCRS/2025/078	Feasibility of Management Strategy Evaluation of northern and southern blue shark in ICCAT waters	Taylor N.G., Miller S., Coelho R., Fernández C., Sant Ana R., Liniers G.
SCRS/2025/126	Strong beliefs weakly held: likelihood profiling in stock assessments	Kell L., Cardinale M., Rice J., Sant'Ana R., Taylor N., Dean D., Courtney C.
SCRS/2025/128	Stock assessment of the South Atlantic shortfin mako shark, using Bayesian surplus production models (JABBA) and large grid model ensembles	Coelho R.
SCRS/2025/129	Analysis and comparison of Catch Per Unit Effort series submitted for the 2025 South Atlantic shortfin mako shark assessment in the ICCAT region	Rice J., Sant'Ana R., Kikuchi E., Cardoso L.G.
SCRS/2025/130	Analysis and comparison and Catch Per Unit Effort series submitted for the 2025 assessment of shortfin mako shark in the North Atlantic ICCAT region	Rice J.
SCRS/2025/131	Stock Synthesis version update and life history review for the 2017 North Atlantic shortfin mako shark Stock Synthesis (SS3) model run 3	Courtney D.
SCRS/2025/132	Preliminary Stock Synthesis (SS3) model runs conducted for North Atlantic shortfin mako shark (1950-2023)	Courtney D.
SCRS/2025/133	Application of Low-Fecundity Spawner-Recruitment relationship to the 2025 stock assessment of shortfin mako in the North and South Atlantic	Kai M., Rice J., Courtney D., Sant Ana R., Cardoso L., Kikuchi E.
SCRS/2025/134	Preliminary Stock Synthesis (SS3) model runs conducted for South Atlantic shortfin mako shark (1971-2023)	Sant'Ana R., Kikuchi E., Courtney D., Rice J., Kai M., Bowlby H., Fernández C., Kell L.T., Cardoso L.G.
SCRS/2025/135	Bayesian production models applied to North Atlantic mako sharks using JABBA and JABBA-Select	Babcock E.A.
SCRS/2025/136	Continuity runs and projections of shortfin mako in the North Atlantic based on the 2017 assessment, with catch updated until 2023	Rice J.
SCRS/P/2025/053	First insights into shortfin mako movements in the Bay of Biscay: A journey to Cape Verde	Erauskin-Extramiana M., Lopetegui-Eguren L., Salgado A., Claver C., Cabello de los Cobos M., Vossgaetter L., Müller L.
SCRS/P/2025/054	Summary of available statistical data for the shortfin mako stock assessment	ICCAT Secretariat
SCRS/P/2025/055	2025 shortfin mako stock assessment intersessional work	Forselledo R.
SCRS/P/2025/058	North Atlantic shortfin mako shark (*Isurus oxyrinchus*) age and growth exercise considering 2 band pair formation per year of life until the size at maturity and 1 band pair onwards	Rosa D., Marquez R., Mas F., Mathers A., Natanson L., Domingo A., Carlson J., Coelho R., Cardoso L.G.

Appendix 4

SCRS documents and presentation abstracts as provided by the authors

SCRS/2025/040 - An update of the age and growth study for the South Atlantic shortfin mako shark (*Isurus oxyrinchus*) was presented to the Group, following the decisions made during the Shortfin Mako Data Preparatory Meeting. The study initially assumed the hypothesis of two band pairs (BP) forming per year until age five, followed by one band pair per year for older ages. At the Data Preparatory Meeting, the Group requested an updated analysis adopting a revised interpretation: two band pairs per year (2BP/year) should be assumed up to the age corresponding to the size-at-maturity for each sex — estimated at 197 cm FL for males and 278 cm FL for females, based on Cabanillas-Torpoco et al. (2024). Under this new scheme, the age-at-maturity corresponds to 5 years for males and 8 years for females. As the original results for males already applied the 2BP/year approach up to age 5, the growth parameters for males remained unchanged. For females, however, the revised interpretation led to updated growth parameter as follows. Males: $L\infty$ = 251.15 cm FL, k = 0.35, L_0 = 66.49 cm FL and for Females: $L\infty$ = 392.93 cm FL, k = 0.107, L_0 = 65.65 cm FL.

SCRS/2025/074 - Estimates of vital rates and population dynamics parameters of the North and South Atlantic stocks of shortfin makos (*Isurus oxyrinchus*) for potential use as inputs into production and integrated stock assessment models were computed based on the latest biological information available gathered at the 2025 Shortfin Mako Data Preparatory Meeting and thereafter. Population dynamics parameters included maximum population growth rate (r_{MAX}), generation time ($\bar{A}$), steepness of the Beverton-Holt stock-recruitment relationship (h), spawning potential ratio at maximum excess recruitment (SPR_{MER}), position of the inflection point of population growth curves (R) and the corresponding shape parameter (m), and natural mortality (M). Five methods were used to compute deterministic estimates of r_{MAX}: four age-aggregated methods and one analogous age-structured method (life table/Euler-Lotka equation). Additionally, a Leslie matrix approach was used to incorporate uncertainty in growth parameters, the maturity ogive, fecundity, natural mortality, and lifespan by assigning statistical distributions to those biological traits. Three scenarios were considered for the North Atlantic stock, based on re-analysis of vertebral centra (scenario 1), mark-recapture data (scenario 2), and assumed lower productivity (scenario 3). Productivity (r_{MAX}) for the North Atlantic estimated with the deterministic methods ranged from 0.064 to 0.163 yr^{-1} (scenario 1), 0.054 to 0.123 yr^{-1} (scenario 2), and 0.032 to 0.076 yr^{-1} (scenario 3). Two scenarios were considered for the South Atlantic stock, based on re-analysis of vertebral centra (scenario 1) and assumed lower productivity (scenario 2). Productivity for the South Atlantic ranged from 0.065 to 0.159 yr^{-1} (scenario 1) and 0.035 to 0.094 yr^{-1} (scenario 2). Median productivity estimated with the stochastic Leslie matrix was 0.096 yr^{-1} (95% CI: 0.064-0.136), 0.073 yr^{-1} (95% CI: 0.019-0.108), and 0.057 yr^{-1} (95% CI: 0.041-0.084) for the North Atlantic scenarios 1, 2, and 3, respectively. For the South Atlantic stock, it was 0.138 yr^{-1} (95% CI: 0.085-0.186) and 0.086 yr^{-1} (95% CI: 0.040-0.131) for scenarios 1 and 2, respectively. Productivity was also expressed in terms of steepness (h=0.52, 95% CI: 0.37-0.67 for North Atlantic scenario 1; h=0.40, 95% CI: 0.23-0.52 for North Atlantic scenario 2; h=0.54, 95% CI: 0.38-0.70 for North Atlantic scenario 3; h=0.62, 95% CI: 0.43-0.74 for South Atlantic scenario 1; h=0.72, 95% CI: 0.42-0.86 for South Atlantic scenario 2).

SCRS/2025/078 - ICCAT Recommendations 23-10 and 23-11 mandate that the SCRS assesses the feasibility of conducting Management Strategy Evaluations (MSEs) for northern and southern Atlantic blue shark (BSH) stocks. This document defines MSE in its broader institutional context, encompassing both technical closed-loop simulations and stakeholder engagement. Drawing on ICCAT's prior MSE experience, the analysis highlights that BSH presents a more tractable case due to clear stock structure, existing assessments, and aligned management objectives. Substantial groundwork has been laid, including exploratory Operating Models, closed-loop simulations, and candidate management procedure tuning. Two work plans - one targeting MP adoption by 2027 and another by 2028 - are proposed, with estimated contracting costs of €180,000-€270,000. These represent 27-41% of the cost of the SWO-N MSE, reflecting anticipated efficiencies. The analysis emphasizes the importance of maintaining a focused scope, using recent data and assessment results, and embedding analytical work within the SCRS to enhance institutional capacity. Opting to obtain new data would extend timelines and increase in-kind costs, underscoring the value of leveraging existing resources for timely and cost-effective MSE completion. Embedding core analytical responsibilities within the SCRS is expected to enhance institutional capacity and ensure cost-effective implementation.

SCRS/2025/126 - Stock Synthesis (SS3) integrates catch, abundance indices, size composition and biological data to estimate stock status relative to reference points. Ensuring robustness requires systematic evaluation of assumptions, data conflicts, and parameter estimability. For example, uncertainties in key parameters such as natural mortality, the stock-recruitment relationship and selectivity impact model estimates. Likelihood profiling, for fixed and estimated parameters, can reveal how data and assumptions influence reference points and management advice. Distinct likelihood minima for parameters indicate strong data support; divergent minima among likelihood components (e.g. catch versus survey indices) indicate data conflicts or model misspecification; flat profiles identify parameters poorly informed by the data; and spikes can reveal instability. Comparison of likelihood profiles with asymptotic estimates of uncertainty derived quantities from the Hessian can identify model instability, if, for example, M is correlated with growth and selectivity parameters. Likelihood profiling of key biological parameters such as M and steepness, supported by additional diagnostics such as jittering, runs tests, retrospective analysis, and hindcasting can help identify key uncertainties and avoid overconfidence in single-model outputs, strengthening the scientific basis for fisheries management.

SCRS/2025/128 - Bayesian Surplus Production Models were fitted to the South Atlantic shortfin mako using JABBA (Just Another Bayesian Biomass Assessment). Four base models were constructed with combinations of base vs low productivity, and reported vs estimated catches. Models were checked for goodness of fit and validated, and sensitivity analysis was conducted. A large model grid (500 models) was run, by randomly selecting priors from distributions built from the plausible and agreed limits for their values, and using alternatively each of the 2 catch scenarios. Stock status from the 4 main models ranged from overfished ($B<B_{MSY}$) to not overfished ($B>B_{MSY}$), and in all scenarios not subject to overfishing ($F<F_{MSY}$). Stock status for the large grid ensemble was weighted in 2 alternative ways (equal-weighting and DIC-weighting), and resulted in a stock status not overfished ($B>B_{MSY}$) and not subject to overfishing, with the current B value very close to B_{MSY}.

SCRS/2025/129 - This document presents a comparison of the six CPUE series submitted for consideration in the 2025 South Atlantic shortfin mako shark *(Isurus oxyrinchus*) assessment in the ICCAT region. Candidate CPUE series are compared with hierarchical cluster analysis, cross-correlation analysis, analysis of residuals and comparison of trends. The analysis indicated two groups of CPUE series that differed in the last 10 years of the time series (1978-2023) with one group, Chinese Taipe and Japanese TB2 (Time Block 2, i.e. later) series, characterized by a declining trend. The Brazil – Uruguay, Spanish, Japanese TB1 and South African series all showed slightly increasing trends throughout.

SCRS/2025/130 - This study presents a comparative analysis of eight catch-per-unit-effort (CPUE) time series submitted for the 2025 ICCAT stock assessment of shortfin mako shark (*Isurus oxyrinchus*) in the North. The indices were provided by the United States, Spain, Japan (representing early and late periods), Chinese Taipei, Morocco, Portugal, and Venezuela. A combination of hierarchical cluster analysis, cross-correlation analysis, residual diagnostics, and trend comparisons was applied to evaluate the consistency and reliability of the candidate indices. The results revealed notable differences in both long-term trends and interannual variability among the series, with substantial divergence observed between fleets. Notably, the CPUE series submitted by Chinese Taipei exhibited limited coherence with other indices, suggesting it may be reflecting a distinct component of the stock or influenced by fleet-specific operational practices and reporting protocols. Conversely, the early Japanese, Portuguese, and Spanish indices demonstrated a high degree of internal consistency and are likely indicative of a common underlying signal in population abundance. These findings underscore the importance of carefully evaluating CPUE data sources when selecting indices for inclusion in stock assessments, particularly for bycatch-dominated fisheries with heterogeneous data inputs.

SCRS/2025/131 - This analysis summarizes a North Atlantic shortfin mako shark (SMA) Stock Synthesis version update from 3.30.12.beta (old version) to version 3.30.23.02 (new version) for the final 2017 North Atlantic shortfin mako shark (SMA) Stock Synthesis model implemented during the ICCAT 2017 Shortfin Mako Shark Stock Assessment Meeting (2017 North Atlantic SMA model run 3). The data are not updated here for 2025. Instead, life history inputs used in the 2017 model run are reviewed and model results are compared between model versions. Model results for likelihood components and biological reference points did not differ substantially between the two different model versions except for the likelihood values of Parm_priors (4% increase) and the estimate of Maximum Sustainable Yield (MSY, metric tons, 1% increase). The change in likelihood values for Parm_priors may have resulted from estimated catchability parameters in the new model version (estimated in phase 1) compared to catchability parameters obtained with an analytical solution (the "float" option) in the old model version. The change in catchability parameter estimation in the new model version was made to facilitate interpretation of models diagnostics (lnR0 profile), which require at least one parameter, in addition to lnR0, estimated during phase 1. In comparison, other annual results including annual biomass, annual spawning stock fecundity, annual fishing mortality computed as the sum of apical F among all fleets, and annual recruitment were almost identical between two different versions indicating that the model update did not have a substantial effect on these annual model results.

SCRS/2025/132 - Stock Synthesis model runs were conducted for the North Atlantic shortfin mako shark based on the available catch, CPUE, length composition, and life history data compiled by the Shark Working Group. A sex-specific model was implemented in order to allow for observed differences in growth between sexes. A low-fecundity spawner-recruitment relationship (LFSR) was assumed with the steepness of the stock recruitment relationship and natural mortality at age fixed at independently estimated values obtained from life history by the Shark Working Group. Three alternative life history scenarios were evaluated based on data compiled by the Shark Working Group. Continuity analysis results for the three alternative life history scenarios did not differ substantially from those obtained for the 2017 ICCAT shortfin mako shark stock assessment in the North Atlantic However, preliminary model results obtained here with updated catch, CPUE and length composition differed substantially from those obtained for the 2017 ICCAT shortfin mako shark stock assessment in the North Atlantic. Preliminary model diagnostics also identified conflict among the model fits to input data and strong retrospective patterns in fits to data. In addition, there are several outstanding issues related to Stock Synthesis model development for growth, natural mortality, and the stock recruit relationship that require review within the Shark Working Group before Stock Synthesis model development can proceed. Consequently, there is still substantial ongoing work that will need to address these outstanding issues (discussed in Section 4.1) and the Stock Synthesis model results presented here are considered preliminary and not recommended for use in providing management advice at this time.

SCRS/2025/133 - This document presents the application of the Low-Fecundity Spawner-Recruitment relationship (LFSR) to the 2025 benchmark stock assessment of shortfin mako in the North and South Atlantic. The advantage in the application of LFSR is the flexibility of the stock-recruitment relationship that allows us to assume convex decreasing survival which is suitable for low-fecundity sharks. Two parameters of LFSR (SFrac and Beta) are computed based on the steepness (h) derived from the life history parameters, and the recruitment and the spawning outputs at equilibrium (R_0 and B_0) estimated from the SS. Since it is difficult to simultaneously accurately estimate two parameters using the interrelation equation of LFSR, we fixed Beta and derived SFrac. These parameters were then applied to the SS for different values of Beta, and the model with the smallest total negative log-likelihood was adopted as the final model. This methodology was applied to three scenarios of North Atlantic shortfin mako and four scenarios of South Atlantic.

SCRS/2025/134 - Age-structured, sex-specific stock assessment model scenarios were developed using Stock Synthesis (SS3) to evaluate the status of the South Atlantic shortfin mako shark (*Isurus oxyrinchus*) stock. Eight alternative scenarios defined by combinations of catch histories, biological productivity levels, and two spawner-recruitment relationships (standard Beverton-Holt and low-fecundity) were evaluated. Structural uncertainty in CPUE configurations was also explored through three alternative CPUE grouping and time-block structures. Across scenarios, estimates of stock status were sensitive to these structural assumptions. The spawning stock fecundity (SSF) estimated in 2023 to the level required to sustain MSY (SSFratio) ranged from 0.72 to 1.26, with values below 1.0 observed predominantly in low productivity and high catch scenarios, suggesting potential overexploitation of spawning potential. In contrast, SSFratio values above 1.0 occurred in scenarios with high productivity and lower catches, suggesting the stock could sustain MSY-level reproduction under those more optimistic conditions. The structural CPUE sensitivity runs showed improved overall likelihoods for configurations that grouped indices or implemented time-blocks; however, these scenarios often produced more pessimistic stock status outcomes. Likelihood profiles also revealed conflicts among CPUE and length composition components, emphasizing the importance of future improvements in data quality and weighting approaches. These preliminary results provide an updated basis for evaluating stock status in the South Atlantic and highlight the sensitivity of assessment outcomes to key assumptions.

SCRS/2025/135 - The Bayesian Surplus Production (BSP) using JAGS (BSP2JAGS), which was used for the North Atlantic population in the 2017 ICCAT shortfin mako assessment and the 2019 assessment. For the 2025 assessment, two of the original 2019 scenarios were recreated in JABBA to verify that the results were similar. Continuity runs applied the same priors and settings to the current data. For the reference case JABBA runs, the current data were used along with a the priors agreed to by the working group in scenarios 1, 2 and 3 were used, applying several alternative settings for observation and process error. Finally, the same three scenarios were run in JABBA-select, using the selectivity inputs from the SS3 runs. Both JABBA and JABBA-Select runs were generally more optimistic about stock status than the 2019 and 2019 runs.

SCRS/2025/136 - This document presents continuity runs conducted using the same biological parameters and CPUE series used in the previous assessment, and extending the time series of catches used in the previous assessment to the year 2023. The intent is that these projections from the 2017 assessment, will be compared to estimated stock status from this year's assessments to examine consistency.

SCRS/P/2025/053 - The study highlights the broad-scale migratory behavior of juvenile shortfin makos in the Northeast Atlantic, including prolonged use of continental shelf habitats and transboundary movements to West African waters. It also contributes to growing knowledge from electronic tagging and eDNA surveys in the region, aiding future conservation and management efforts for this vulnerable species.

SCRS/P/2025/054 - No summary provided by the author.

SCRS/P/2025/055 - No summary provided by the author.

SCRS/P/2025/058 - This exercise aimed to evaluate age and growth parameters for North Atlantic shortfin mako (SMA) using a revised approach to vertebral band pair (BP) counts, based on hypotheses developed by the Shark Working Group during the Data Preparatory Meeting. The new interpretation scheme assumes the formation of two band pairs per year (2BP/year) up to age 5 for males, aligning with the reported size-at-maturity (182 cm FL). The same approach was used for females assuming (2BP/year) up to age 8, aligning with the reported size-at-maturity (280 cm FL). The same vertebral dataset used by Rosa *et al.* (2018) was applied, consisting of 183 male and 168 female specimens. Two modeling approaches were tested, first estimating all three von Bertalanffy growth parameters (L8, k, and L0); and the second estimating L8 and k, while fixing L0at 63 cm FL as suggested by Rosa *et al.* (2018). Growth models were fitted using the AquaticLifeHistorypackage (Smart, 2023), and model selection was based on Akaike Information Criterion (AIC) values and biological plausibility. Based on these criteria, the following parameter estimates were selected for stock assessment purposes. For males: L8 = 238.49 cm FL, k= 0.24, L0= 87.37 cm FL and for females: L8 = 361.52 cm FL, k= 0.103, L0= 90.49 cm FL.

Appendix 5

Summary of production model results

For the three life history scenarios, the JABBA reference runs converged adequately. All CPUE series passed the runs test except Morrocco (**Figure A5.1**). The retrospective analysis showed no obvious patterns (**Figure A5.2**), and Mohn's rho was near zero (**Table A5.1**) implying that the models had adequate predictive skill. Both the model fits (**Figure A5.1**) and the hindcast cross validations (**Figure A5.3**) showed a relatively flat trend in recent years. The disagreement between the recent increasing trend in SPN-LL, the decreasing trend in CTP-LL and the decrease followed by increase in USObs-LL were not fit well by this flat recent trend. The models accommodated this disagreement between indices by estimating relatively large observation error (in addition to the input values), particularly for the CTP-LL index (**Figure A5.4**).

The estimated biomass trends for the three life history scenarios were similar (**Figure A5.5**). However, the two scenarios with higher r (1 and 2) produced higher estimates of MSY than scenario 3 (**Figure A5.5**). The MSY from scenario 3 was more similar to the values estimated from the continuity runs and in the previous assessment (**Figure A5.6**).

The fractional increase in biomass from one year to the next (**Figure A5.6**) was very high in the period 2001-2006, estimated with multiple years of positive process error (**Figure A5.2**). However, in most years the estimated increase was less than the prior median for the maximum intrinsic growth rate (r), implying that the biomass trend was biologically plausible.

According to the catch-only diagnostic run (**Figure A5.7**), the priors implied a continuing decrease in the stock in recent years. The estimated increase in the reference runs was thus driven by the CPUE index data. When the indices were separated into groups that were correlated with each other (**Figure A5.7**), the estimated recent trend could be increasing, flat, or decreasing. These results imply that the choice of indices is the largest source of uncertainty in the models, and that stable recent trend in the reference cases is the result of the model averaging over the conflicting indices with high estimated observation error. Fitting the models while leaving out one index at a time indicated that the series with the most influence was the Spanish longline (**Figure A5.8**). When using all the indices, alternative runs with different assumptions about observation error and different K priors (**Figure A5.9**) gave quite similar trends.

The Group further investigated the model to see the effect of the time-block (1990-2017/2018-2023) on the Spanish longline index, noting that the sample size contributing to the index was low in recent years. A preliminary analysis adding a time block from 2018-2023 gave a predicted abundance trend that was similar to the leave-one-out analyses that excluded the Spanish LL index.

The Group noted that the abundance indices were not consistent with each other, so that the assessment results were different depending on which indices were included. The Group noted that other indices may have similar issues and influence in the JABBA models that have not been fully explored. Therefore, the Group recommended more careful reviews on all indices for the North Atlantic shortfin mako.

JABBA-Select

The JABBA-Select runs with the updated life history parameters gave slightly more optimistic trends in SSB/SSB_{MSY} compared to the trend B/B_{MSY} in the JABBA runs for scenarios 1 and 2 (**Figure A5.10**). Scenario three in JABBA-Select estimated more of an increase in SSB in recent years than the other scenarios. The diagnostics in JABBA-Select were not as good. In particular, the Spanish longline index did not pass the runs test in any scenario (**Figure A5.11**).

Although the models produced biologically plausible results with good diagnostics, the group agreed not to use the JABBA-Select runs for management advice because JABBA-Select is not yet included in the ICCAT catalogue of methods.

Table A5.1. JABBA North Mohn's rho averaged over peels with end years from 2016 to 2023 for the reference runs in each life history scenario.

Scenario	B	F	B_{MSY}	F_{MSY}	procB	MSY	MSY
1	0.077	-0.054	0.035	-0.041	-0.003	0.010	0.010
2	0.033	-0.014	0.036	-0.015	-0.003	-0.013	-0.013
3	0.045	-0.036	0.025	-0.007	-0.006	-0.011	-0.011

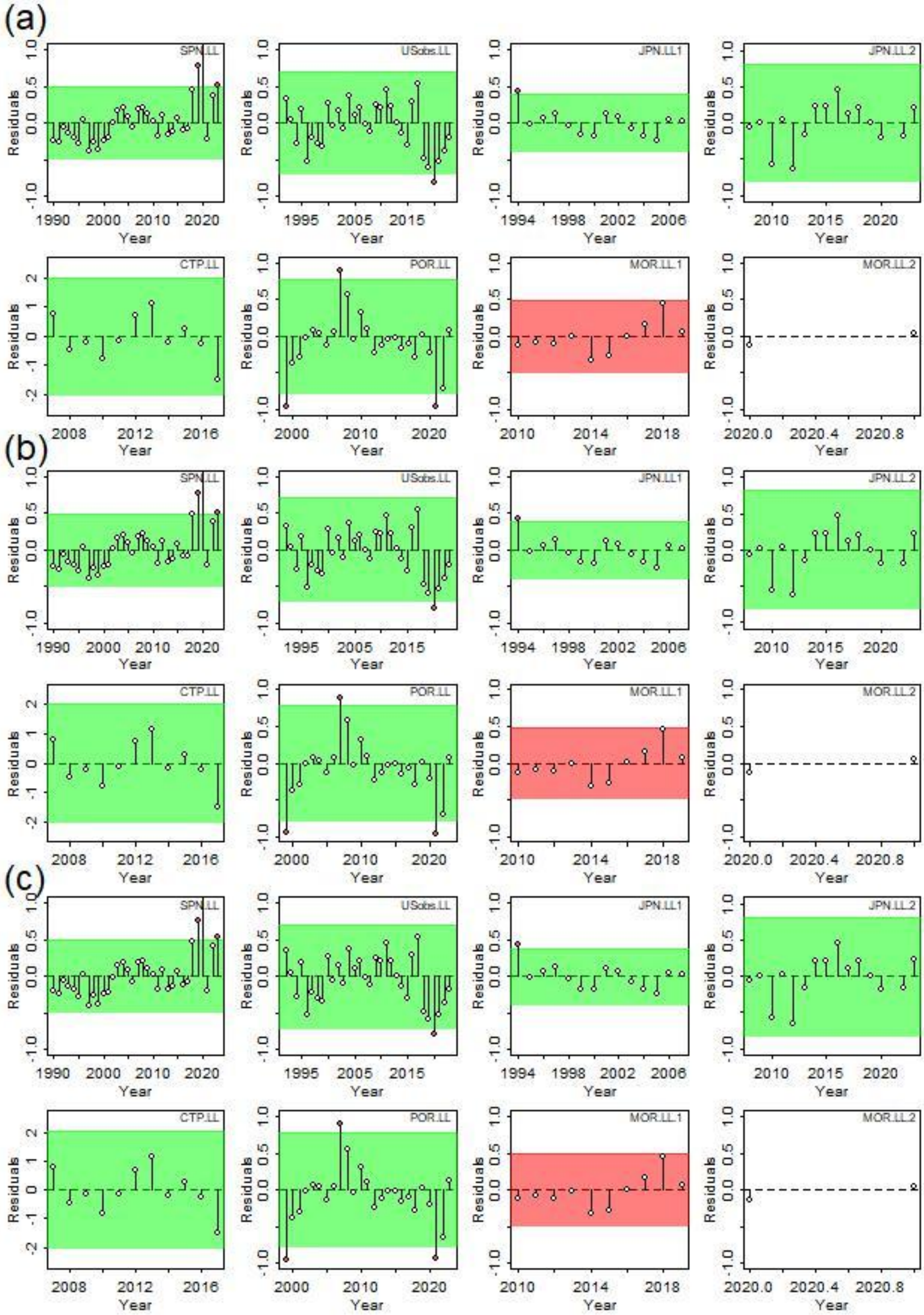


Figure A5.1. JABBA North runs tests for the reference runs.

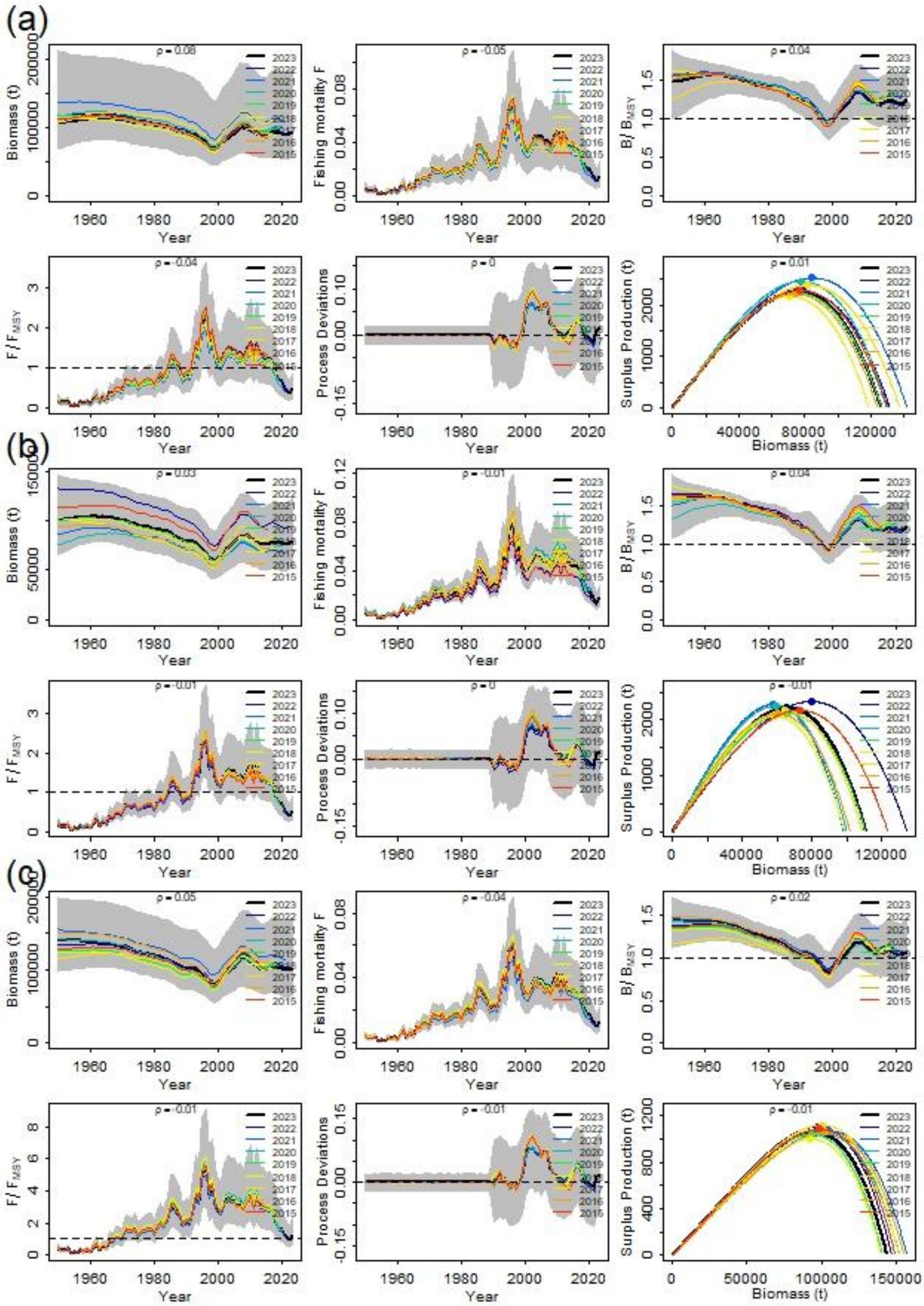


Figure A5.2 (continue). JABBA North retrospective for the reference runs.

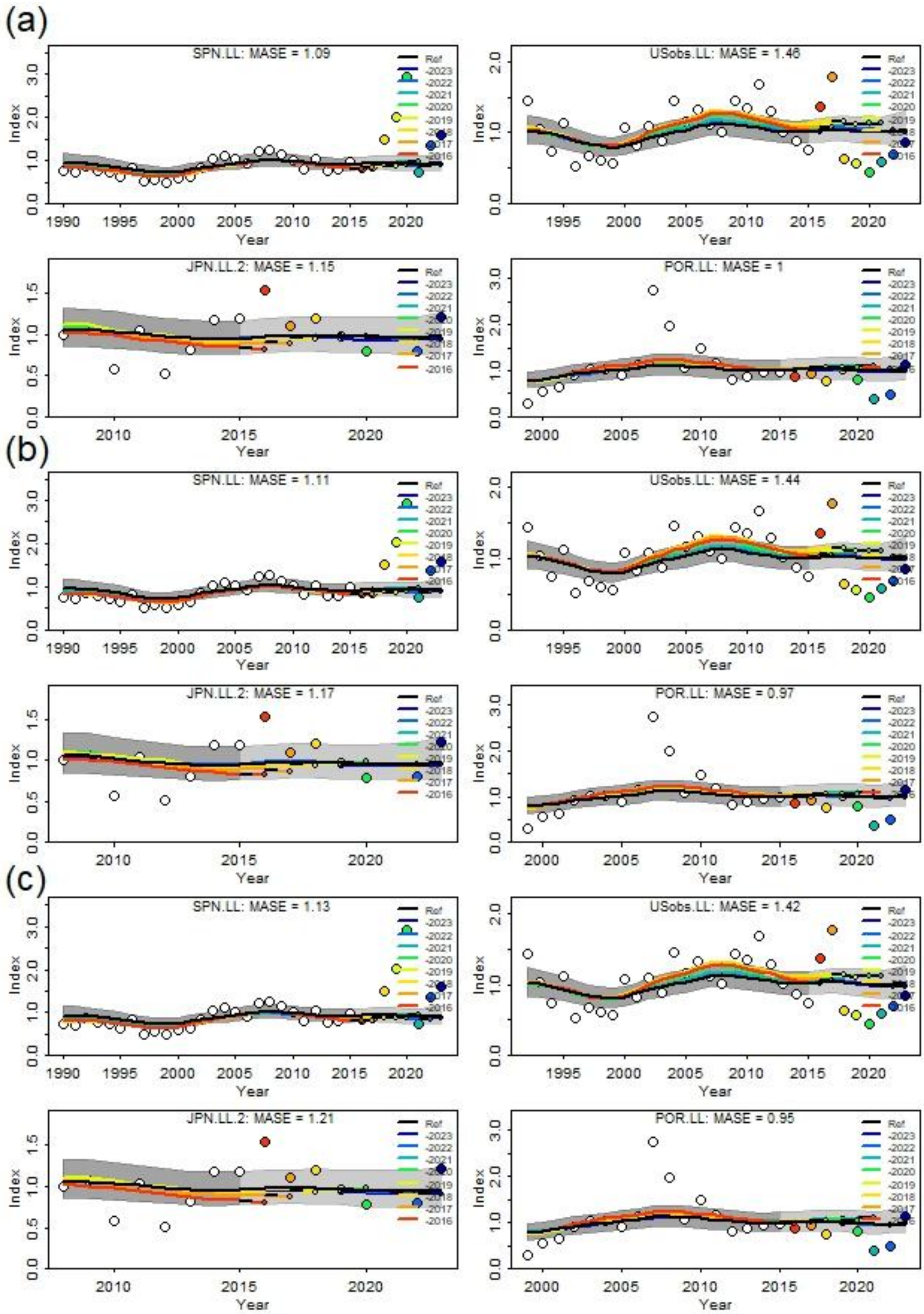


Figure A5.3. JABBA North hindcast cross-validation for the reference runs.

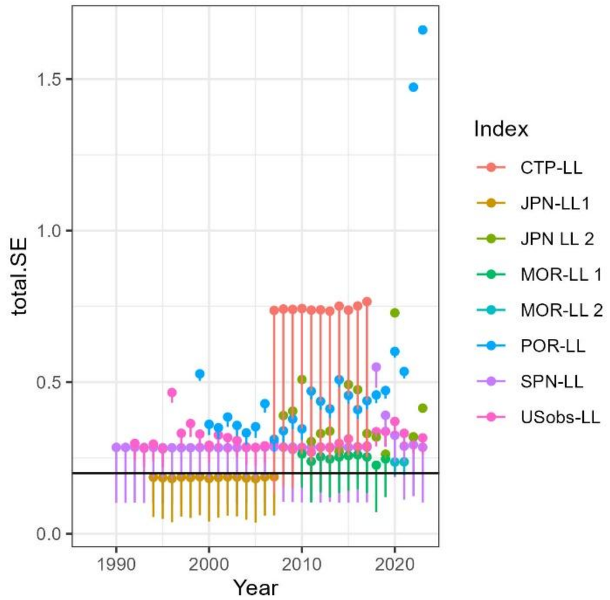


Figure A5.4. Observation error standard deviations for each point in scenario 1. The dots are the total and other end of each segment is the input value.

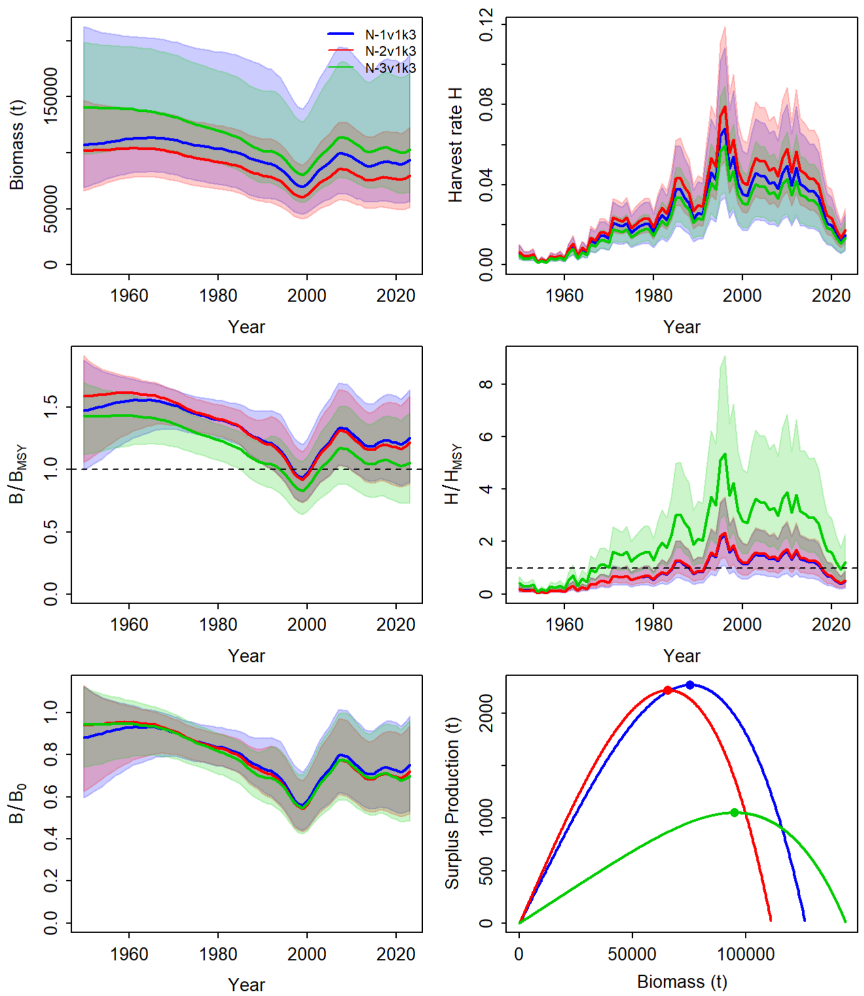


Figure A5.5. Results of JABBA North reference runs by life history scenario.

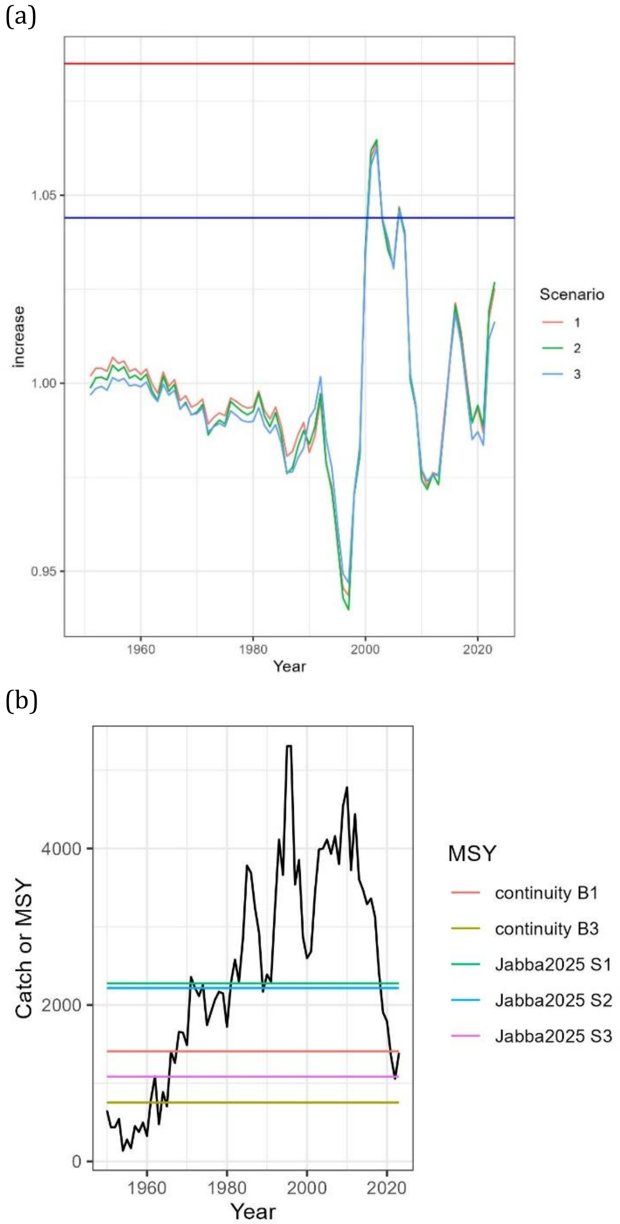
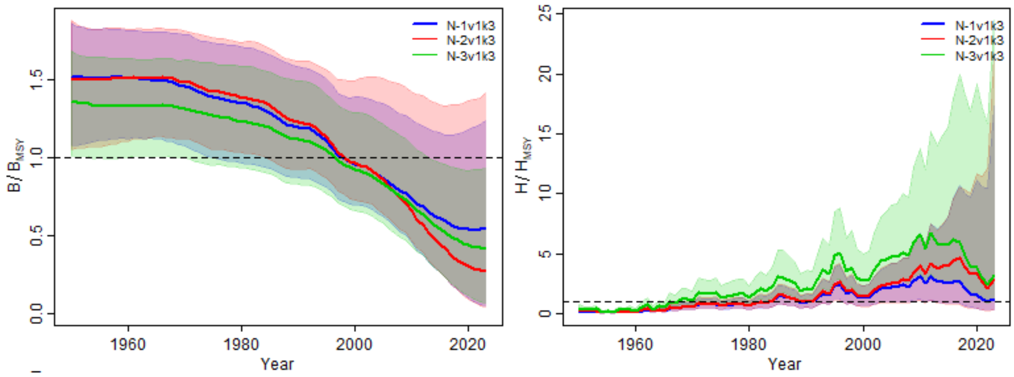


Figure A5.6. (a) Change in biomass from one year to the next for each reference case run and (b) median estimates of MSY relative to the catch time series from the continuity runs (SCRS/2025/135) and the three life history scenarios.

(a) Catch only results



(b) By CPUE group

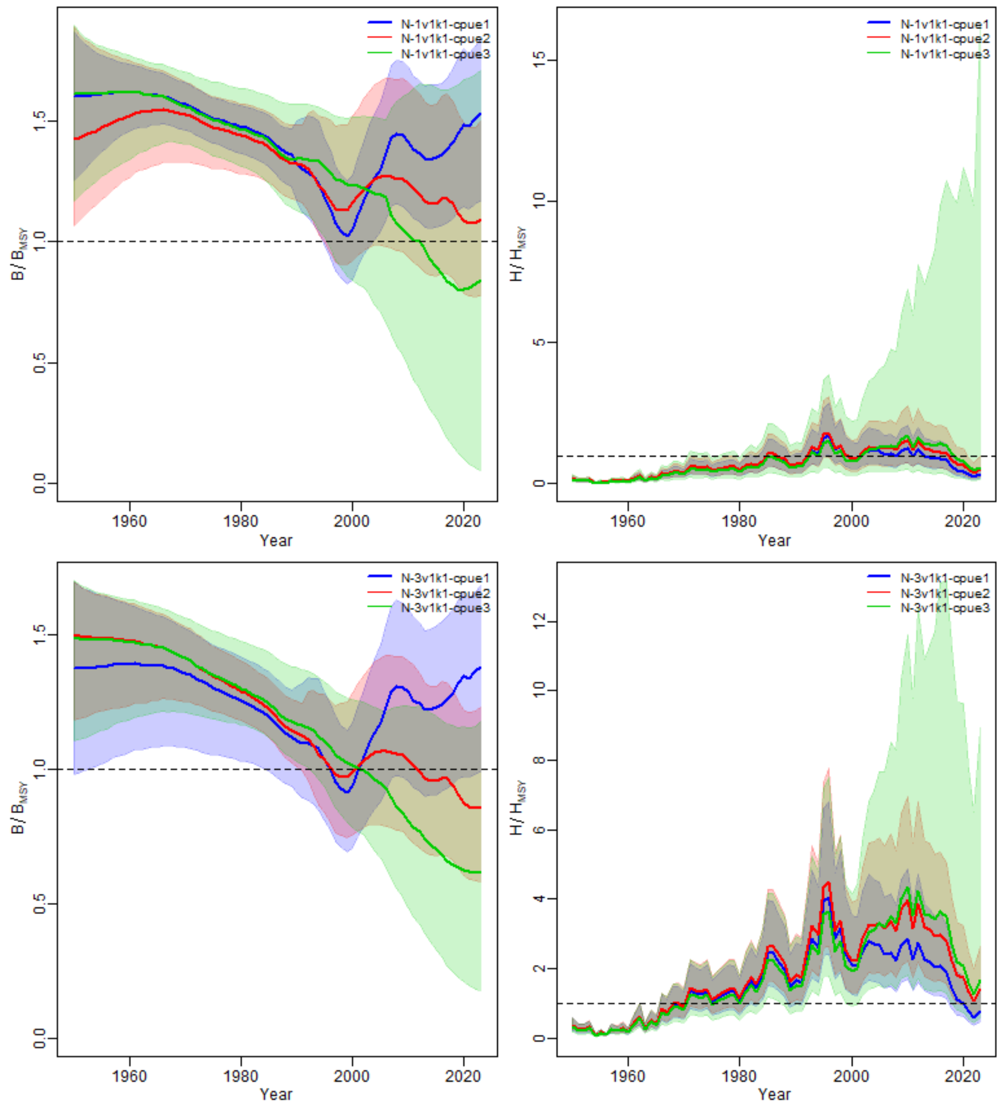


Figure A5.7. JABBA North (a) catch-only model diagnostic runs by life history scenario, and (b) results grouped by CPUE groups (1: SPN-LL, JPN-LL1, POR-LL; 2:USobs-LL, MOR-LL 1, JPN LL 2; 3: CTP-LL) in life history scenarios 1 (top) and 3 (bottom).

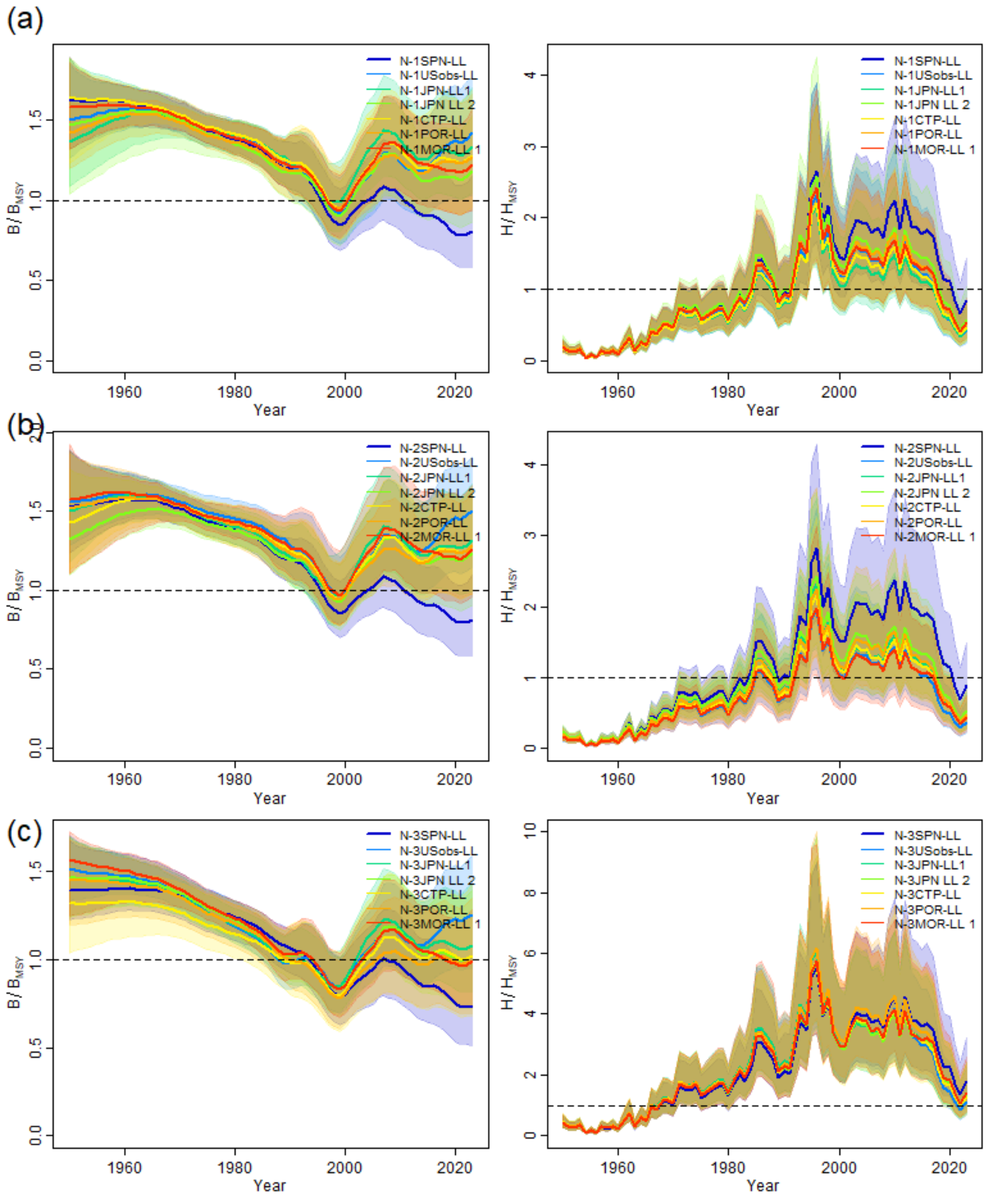


Figure A5.8. Leave one out fits for JABBA North mako for (a) scenario 1, (b) scenario 2, and (c) scenario 3.

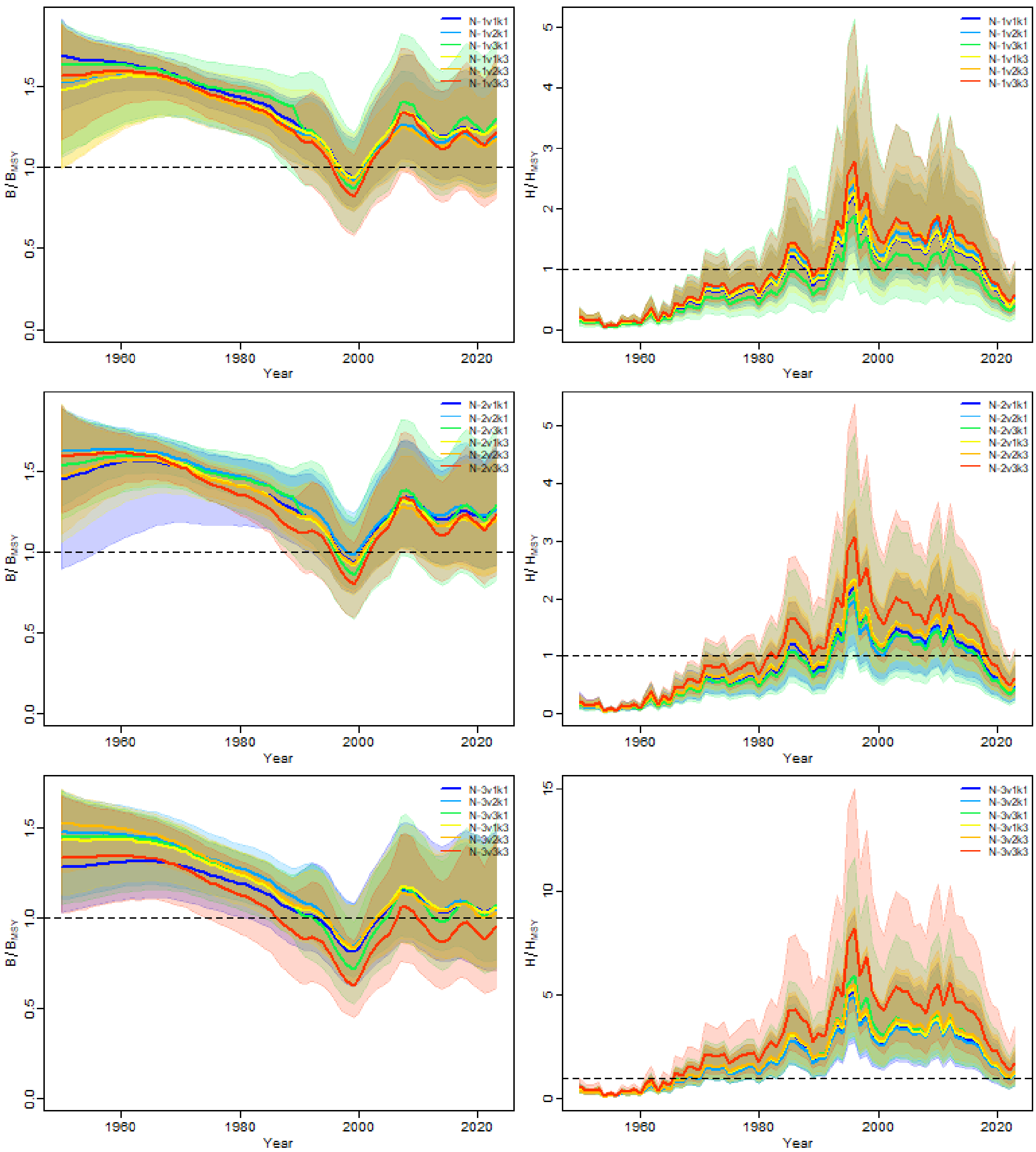


Figure A5.9. JABBA North alternative scenarios with different variance assumptions and priors for K (see SCRS/2025/135 for details).

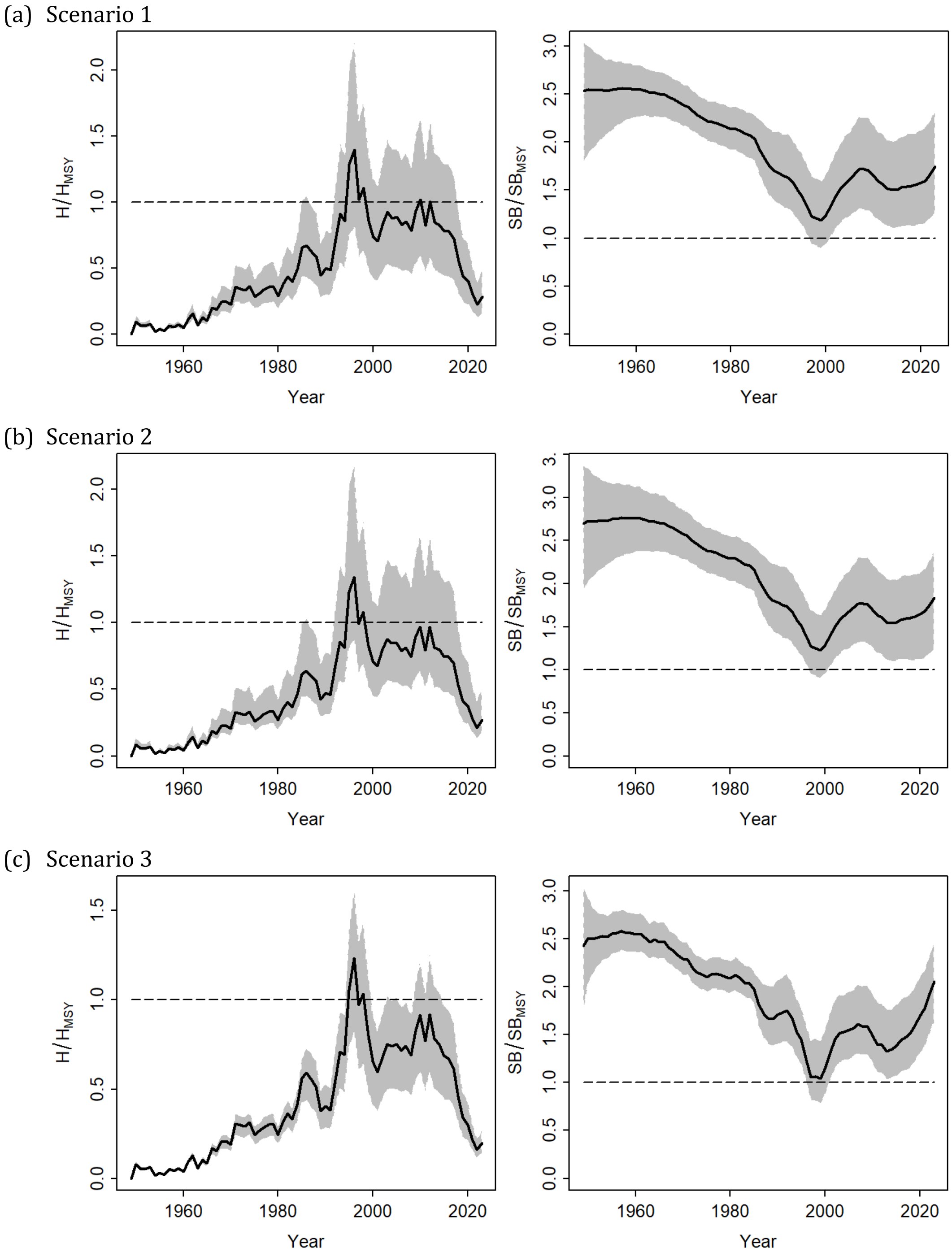


Figure A5.10. JABBA-Select north results for the three life history scenarios.

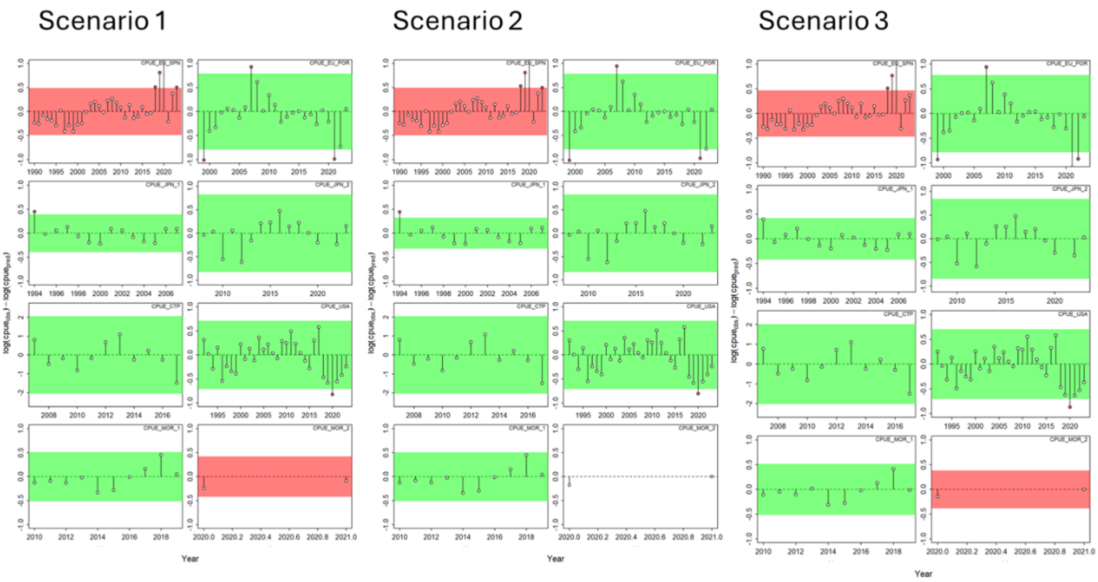


Figure A5.11. JABBA-Select runs tests.

Appendix 6

JABBA South Atlantic model

The JABBA South Atlantic model was presented in document SCRS/2025/128. The diagnostics included model convergence statistics, JABBA-residual plot (Winker *et al.*, 2018), the Root-Mean-Squared-Error (RMSE) fit to the loess smoother of all residuals CPUE indices combined and the runs test to detect non-randomness in CPUE residuals (Carvalho *et al.*, 2017). A retrospective and hindcast analysis were also provided with n = 5 years. In addition, various sensitivity analyses were provided, including comparison of the base models with catch-only models, models using one CPUE at a time, models leaving out one CPUE at a time, using CPUEs for swordfish/sharks target/bycatch species, sensitivities to process error, additional CPUE observation error, and initial depletion levels.

Using CPUEs directly as they were provided resulted in highly implausible results, ranging from current biomass levels at virgin stock levels, to collapse stock levels, depending on the CPUE series used. Those are reflective of the strong conflicts between catch and CPUE time series trends. After various attempts to solve those inconsistencies, by increasing CPUE CVs, and process error, the only alternative that resulted in biologically plausible results was by introducing time blocks in the CPUEs, allowing different catchability (q) estimations for each block. **Table A6.1** shows the point estimates for the various parameters estimated in 4 grid models

Using those configurations, the initial case models provided reasonable and similar results in terms of runs tests, with RMSE between 41.3-41.9% (**Figure A6.1**), process error deviations suggesting no major evidence of structural misspecifications (**Figure A6.2**), no major retrospective patterns (**Figure A6.3**), and predictions mostly falling within the limits of the 95% confidence intervals in the hindcast cross-validation analysis (**Figure A6.4**).

JABBA runs tests to quantitatively evaluate the randomness of the time series of CPUE residuals by fleet, showing that Japan and Spain in the early time period failed but they passed the test in the later period. Brazil-Uruguay combined index had more issues, failing in the later period (**Figure A6.5**).

The final trajectories of the main 4 initial case models are represented in **Figure A6.6.** It is noted that the final relative B/B_{MSY} levels are all relatively similar on all models, while the main differences are in the relative F/F_{MSY} levels, as the low productivity scenarios show much higher overall F/F_{MSY} levels over most of the period and in the terminal year.

Table A6.1. Estimates (mean, lower and upper confidence intervals) of the point estimates for the various parameters estimated in the 4 main base grid models, developed for the 2025 ICCAT shortfin mako shark South Atlantic stock assessment.

	Base productivity			Low productivity			
Parameters	**mu**	**lci**	**uci**	**mu**	**lci**	**uci**	
K	54415	33696	81976	62335	41971	90478	**Estimated catches**
r	0.166	0.093	0.298	0.069	0.034	0.139	
psi	0.895	0.522	0.996	0.916	0.646	0.997	
sigma.proc	0.063	0.039	0.117	0.081	0.044	0.139	
m	2.352	1.356	4.094	3.339	1.800	6.199	
Hmsy	0.070	0.032	0.154	0.020	0.007	0.059	
SBmsy	28842	15938	48430	36945	23282	56685	
MSY	2030	1223	3026	773	282	1781	
bmsyk	0.531	0.425	0.634	0.597	0.480	0.704	
P1971	0.874	0.508	1.068	0.895	0.629	1.108	
P2023	0.489	0.295	0.735	0.505	0.311	0.803	
B_Bmsy.cur	0.922	0.552	1.428	0.852	0.533	1.354	
H_Hmsy.cur	0.772	0.320	1.789	2.153	0.751	7.092	

	Base productivity			Low productivity			
Parameters	**mu**	**lci**	**uci**	**mu**	**lci**	**uci**	
K	43494	29702	69484	79482	51573	146200	**Reported catches**
r	0.183	0.095	0.334	0.059	0.031	0.110	
psi	0.903	0.522	0.996	0.885	0.537	0.995	
sigma.proc	0.071	0.042	0.128	0.067	0.040	0.122	
m	2.349	1.348	4.187	3.695	2.024	6.747	
Hmsy	0.078	0.032	0.173	0.016	0.006	0.039	
SBmsy	22991	14354	40451	48021	29665	93618	
MSY	1850	926	3002	806	320	1763	
bmsyk	0.531	0.424	0.638	0.616	0.502	0.717	
P1971	0.881	0.504	1.085	0.859	0.524	1.062	
P2023	0.537	0.348	0.763	0.536	0.318	0.823	
B_Bmsy.cur	1.015	0.639	1.502	0.879	0.509	1.373	
H_Hmsy.cur	0.772	0.313	2.048	2.046	0.679	6.513	

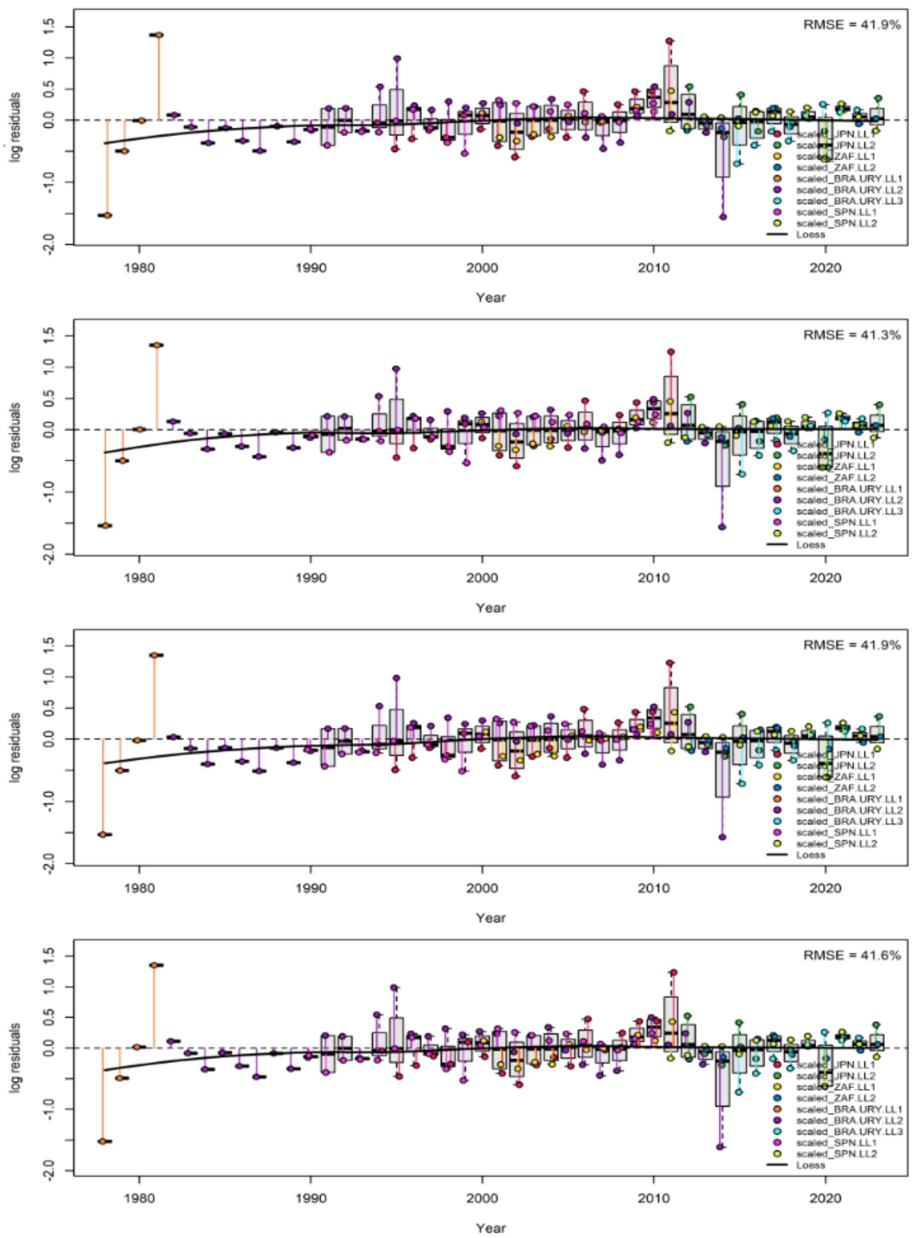


Figure A6.1. Residuals diagnostic plots for the main 4 base grid models, for the ICCAT South Atlantic shortfin mako. Each individual CPUE index and its respective residuals are represented by a different color. The solid black lines represent loess smoothers through all residuals combined.

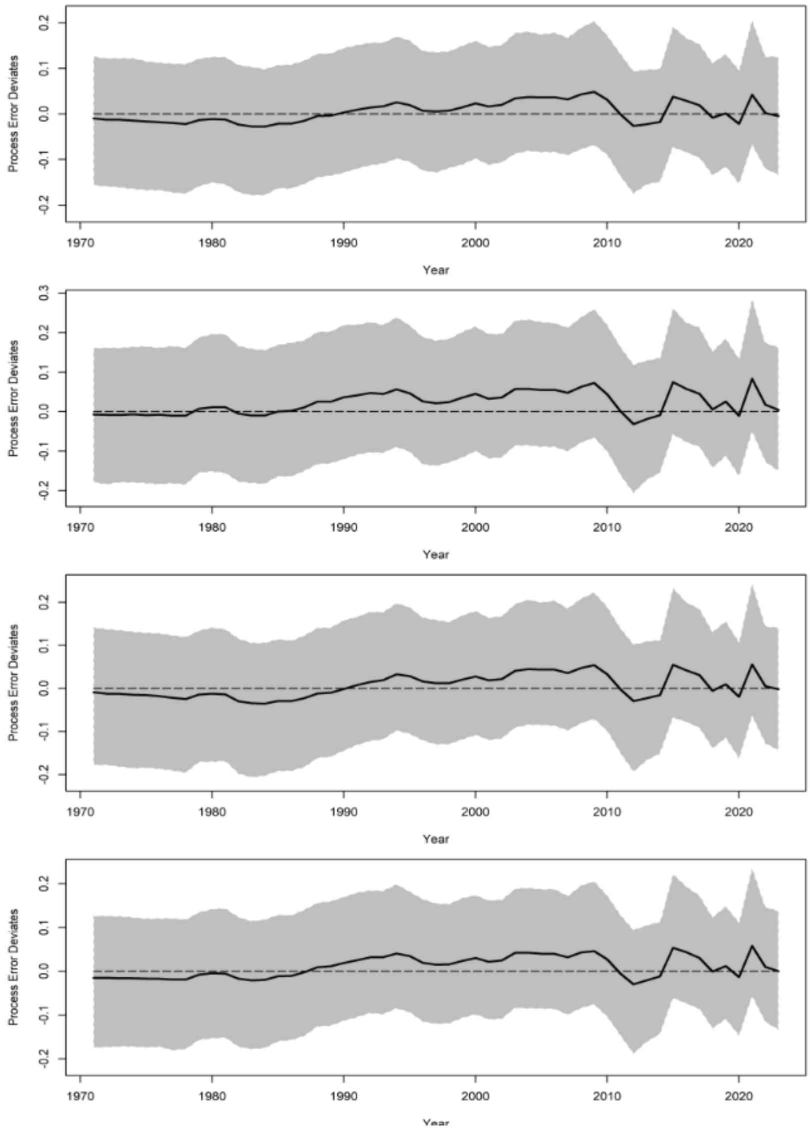


Figure A6.2. Process error deviates for the main 4 grid models used for the ICCAT SMA South Atlantic stock assessment. The solid line represents the median, and the shaded gray area the 95% credibility intervals.

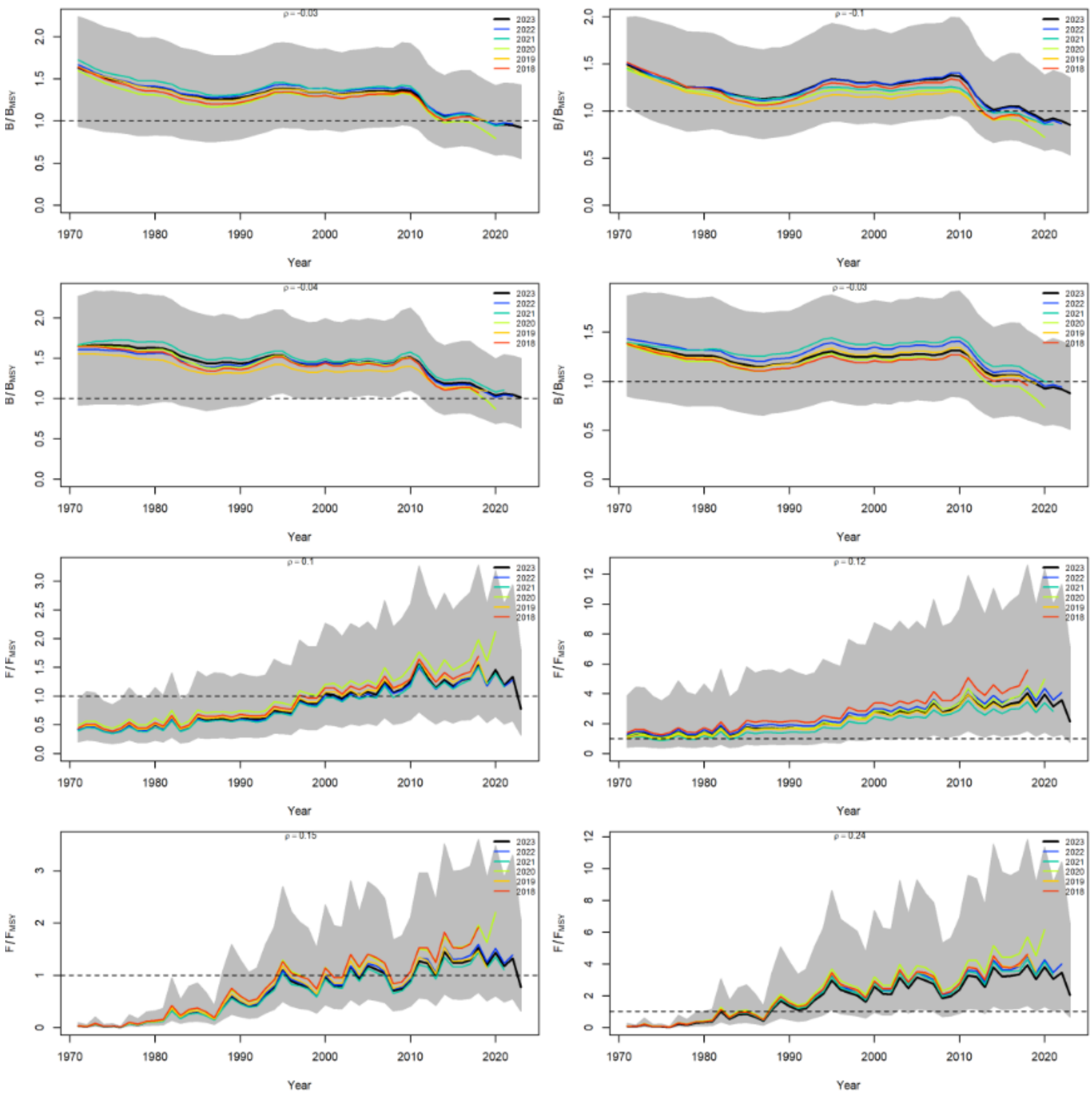


Figure A6.3. Retrospective analysis conducted for the 4 main base grid models developed for the 2025 ICCAT shortfin mako shark South Atlantic stock assessment, by removing 1-year at a time sequentially (n=5) and predicting the trends in biomass and fishing mortality relative to MSY (i.e. B/B_{MSY} and F/F_{MSY}).

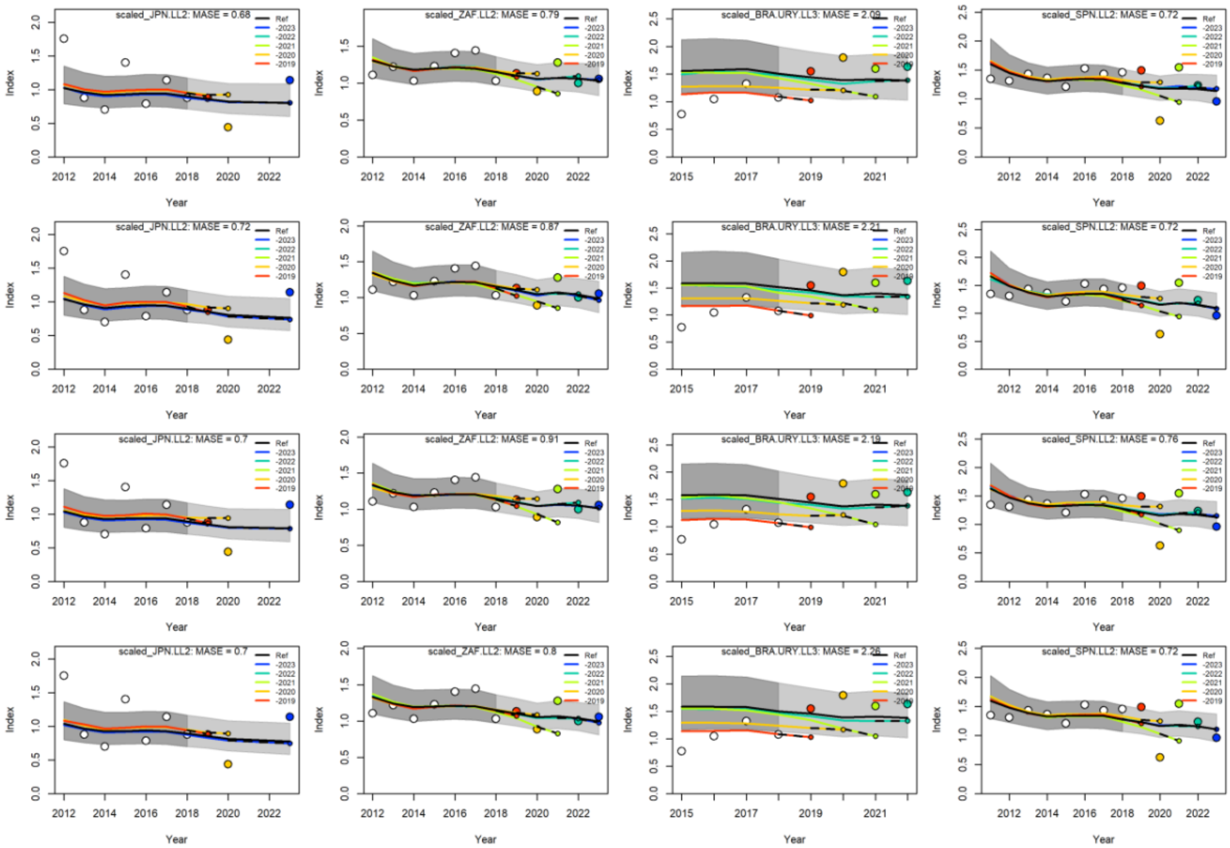


Figure A6.4. Hindcasting cross-validation results for the index available in the last years of the model, run for the 4 main base grid models. The plots show 1-year-ahead forecasts of CPUE values, when the last years are removed one at a time, relative to the observed CPUE using all data. The CPUE observations, used for cross-validation are highlighted as the color-coded solid circles with associated light-grey shaded 95% confidence interval.

Figure A6.5. Runs tests for the CPUE index for all the initial case and low productivity models, used for the ICCAT South Atlantic shortfin mako shark stock assessment.

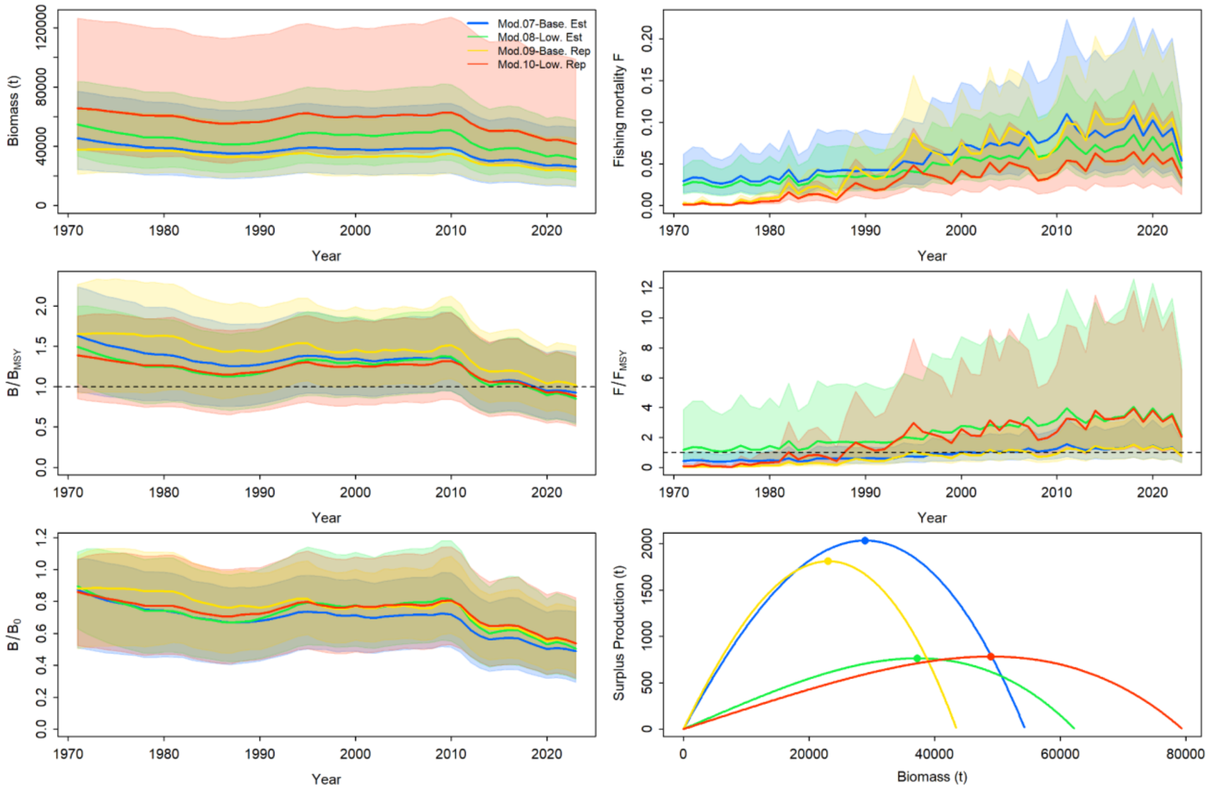


Figure A6.6. Comparative trends and trajectories of the 4 main base grid models, run with JABBA for the 2025 ICCAT shortfin mako shark South Atlantic stock assessment.