Report of the 2026 ICCAT North Atlantic Shortfin Mako Shark Stock Assessment Meeting (including Blue Shark MSE)

(Hybrid, Lisbon, Portugal, 8–12 June 2026)

The results, conclusions, and recommendations contained in this report reflect only the views of the Sharks 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

The ICCAT Assistant Executive Secretary welcomed and thanked the participants, the EU for funding the meeting and the Oceanário de Lisboa for hosting an ICCAT meeting for the second time. He also highlighted the importance of the meeting, since in 2025 the SCRS could not conclude the stock assessment of the northern Atlantic shortfin mako shark, a stock that has raised major concerns due to its status in recent years. The SCRS Vice Chair welcomed the participants. Dr Miguel Oliveira (Director at the Oceanário de Lisboa) welcomed the participants and emphasized the importance of ICCAT's work in sustainable fisheries management and species conservation - a shared commitment with the Oceanário aiming the protection of marine ecosystems, advancing scientific knowledge, and promoting responsible use of ocean resources. He concluded by stating that the alignment between both institutions' missions reinforces the value of collaboration, enhancement of science knowledge, and dialogue in safeguarding the future of the oceans.

The Chair proceeded to review the agenda, which was adopted without changes (**Appendix 1**). The List of participants is included in **Appendix 2**. The List of papers and presentations presented at the meeting is attached as **Appendix 3**. The abstracts of all SCRS documents presented at the meeting are included in **Appendix 4**. The following served as Rapporteurs:

Item 1	N.G. Taylor
Item 2	R. Coelho
Item 3.1	B. Babcock
Item 3.2	C. Fernández, D. Courtney and J. Rice
Item 3.3	L. Kell
Item 4.1	B. Babcock
Item 4.2	C. Fernández, D. Courtney and J. Rice
Item 4.3	L. Kell
Item 4.4	H. Bowlby and L.G. Cardoso
Item 5	G. Liniers and A. Kimoto
Item 6	M. Ortiz and R. Forselledo
Item 7	G. Díaz, M. Neves dos Santos and R. Forselledo
Item 8	N.G. Taylor
Item 9	M. Neves dos Santos, and R. Forselledo
Item 10	R. Forselledo
Item 11	S.A. Baibbat and J. Fernández-Costa
Item 12	N.G. Taylor

SCRS/P/2026/061 outlined the Oceanário de Lisboa's ocean conservation work across three pillars: a Breeding Lab that produced animals for conservation and restocking, support for field conservation projects, including elasmobranch research in the Azores and Angola, and a Centre for Species Survival partnership with International Union for Conservation of Nature (IUCN) that focused on Red List assessments of marine species. A case study on shortfin mako shark illustrated how ICCAT stock assessment data, rather than national landing data, had served as the best available information for informing national Red List evaluations under IUCN Criterion A.

2. Summary of available data for the assessment

2.1 Intersessional work

The Chair presented SCRS/2026/151, which summarized the intersessional work conducted after the 2025 North Atlantic shortfin mako stock assessment meeting. Because the 2025 assessment had not been concluded, the Group agreed to continue the work in 2026 without holding a formal data preparatory meeting. Instead, two informal intersessional meetings were convened to address outstanding issues before the 2026 North Atlantic Shortfin Mako Shark Stock Assessment Meeting (including Blue Shark MSE).

The first informal meeting, held over one day in February 2026, focused on catch per unit effort (CPUE) indices. A combined CPUE index was developed using detailed set-level contributions from Canada, EU-Portugal, EU-Spain, Mexico, Chinese Taipei, the United States and Venezuela for the period 1993–2024. The Group also agreed that EU-Spain's standardized index would be used only for 1990–2017 to avoid overlap with the combined index, given that the data used for the combined index from EU-Spain only started in 2018. The second informal meeting, held over two days in April 2026, reviewed model inputs. Japan's updated standardized index for 2008–2024 was approved, and the first period of Morocco's index, covering 2010–2019, was accepted. The Group agreed that all indices should be used together to improve spatial and temporal coverage. Catches and fleet structure remained unchanged from the 2025 shortfin mako shark stock assessment, while natural mortality was revised using a modified Peterson-Wroblewski (Peterson and Wroblewski, 1984) method, with life-history parameters updated accordingly. The same three growth scenarios considered in 2025 were retained.

In the discussion that followed, the Group raised some concerns about the process of having only informal meetings before the stock assessment session, with the data inputs agreed only during the informal process. It was noted that during the informal meetings there were sometimes different views on what data inputs should be used, but there was no process to report the full range of the discussions and caveats that were raised during those meetings. In addition, there were concerns that CPCs could argue they were not obligated to participate in those informal processes, and therefore such final acceptance and validation should only take place in formal meetings.

The Group also emphasized the need for all model runs to be made available in a transparent and reproducible manner, and noted that this was a special situation, given that no formal data preparatory meeting had been held.

The Group agreed that all those are part of broader issues that should be raised and discussed by the SCRS plenary in September 2026, so that clear guidelines are provided to the species groups.

2.2 Catches

All the stock's statistics were updated on the meeting's NextCloud folder and were available for the Group's review.

2.3 Indices of abundance

No new information was presented on indices of abundance.

2.4 Biology

No new biological information was presented.

2.5 Length compositions

No new length composition information was presented.

2.6 Other relevant data

No new information on other relevant data was presented.

3. Methods used in the assessment

3.1 Production models

Document SCRS/2026/149 presented the results from the JABBA and JABBA-Select models. For JABBA, the model configuration was the same as the reference runs from 2025, except with updated CPUE and catch data, and the revised demographic priors for r and B_{MSY}/K. The runs for JABBA-Select were the same as 2025, except with updated catch and CPUE data, and revised demographic priors.

Consistent with the SS3 models, the base case for all three scenarios included demographic priors calculated with natural mortality rates at age adjusted so that only 0.4% of the population survived to the maximum age, and the sensitivity runs included demographic priors calculated with the original mortality at age vector from the 2025 SS3 runs (SCRS/2026/132 and SCRS/2026/144). The runs presented in the paper had very high estimates of K. At the meeting, the author discovered that a bug in the latest JABBA had inflated the population scale, so the runs were repeated with an older version of JABBA. This caused the scale of the population to be more consistent with previous assessments. The results discussed here have been run with the correct version of JABBA.

For JABBA, the Group requested a sensitivity run where the Combined CPUE index is split between 2020 and 2021 to account for the fact that some of the decline in CPUE might be due to the non-retention regulation that was imposed in 2020. The Group also discussed the relatively small priors for r and higher values of B_{MSY}/K used in the base runs. These values imply a very unproductive population, which is less productive than the South Atlantic shortfin mako population or other pelagic sharks. These comments were addressed with sensitivities using the priors for r and B_{MSY}/K from the 2025 shortfin mako shark stock assessment, from the 2019 shortfin mako shark stock assessment update, and from the 2025 shortfin mako shark stock assessment higher productivity run for South Atlantic mako (**Table 1**). The Group also requested plots of the surplus production diagnostics suggested in document SCRS/2026/074.

The Group discussed whether JABBA models should be used for stock status determination. The surplus production models are implicitly based on exploitable biomass, and do not track changes in adult spawning stock biomass. They do not include a time lag between catch on juveniles and the effect on the adult spawning stock, so they should not be used for projections, and some argued against using them for stock status assessment. Others argued that, since the age structure is not well defined for this population, and the spawners are almost never observed in the fishery, age-structured models are also problematic. The JABBA models can provide a way to evaluate a wider range of uncertainties, thus serving as a sensitivity analysis to the SS3 models.

There was also discussion about excluding or down-weighting JABBA runs that were less biologically plausible. The three runs with very high values of B_{MSY}/K (Base 2, Base 3, Sensitivity 3) implied unrealistically small values of H_{MSY}, corresponding to very high values of H/H_{MSY} throughout the time series. These three runs were thus eliminated.

JABBA-Select uses an age-structured model to link exploitable biomass to surplus production, which should be better for a species like shortfin mako when the maturity schedule does not match the exploitation structure. However, JABBA-Select was not considered useable for the assessment because it has all the same uncertainties as SS3 in that not much is known about the ageing and because JABBA-Select is not in the ICCAT software catalogue.

3.2 Length-based age-structured models: Stock Synthesis

SCRS/2026/143 was presented in several separate presentations, corresponding to different sections of the document, as follows:

SCRS/P/2026/062 described the general settings used in the SS3 runs for the three biological growth scenarios agreed by the Sharks Species Group for the 2026 North Atlantic shortfin mako shark stock assessment. The SS3 runs include updated catch data through 2024, length-composition data, CPUE indices and, in some runs, conditional age-at-length data. The biological parameters were described, noting that those parameters that depend on length are common across scenarios, whereas those that are dependent on age (fecundity-at-age, natural mortality-at-age) differ across scenarios. The modified

Peterson-Wroblewski natural mortality was used for the main runs in the document. The presentation described the common modelling workflow used across all three scenarios, including Beverton-Holt stock recruitment, updated steepness values, weights assigned to CPUE series and length-composition data, conditional age-at-length data treatment, recruitment-deviation settings, and $F_{initial}$ assumptions, and showed very similar fits to the CPUE series across the three scenarios.

The Group remarked on the extremely low steepness value (0.196) obtained from the demographic analysis for Scenario 2 under the modified Peterson–Wroblewski natural mortality, and asked whether this could indicate that the modified Peterson–Wroblewski method was inappropriate. It was, however, noted that several parameters and assumptions intervene in the derivation of steepness from the demographic analysis, and that it was difficult to specify the cause for this impossible steepness value. The Group expressed concern about the steepness value obtained for Scenario 2.

It was also noted that the length-at-birth assumed in Scenario 1 is too high (90.5 cm for females and 87.4 cm for males), to which the modellers agreed but noted that the choice of growth model for each scenario had been a Group decision. The modellers noted that the sensitivity run conducted for Scenario 1, including conditional age-at-length data and estimating growth within SS3 estimated lower L_0 values. The addition of the conditional length-at-age data improved the fit to the length composition data.

It was also observed that the choice of initial equilibrium catch (130 t, a fifth of the total catch estimated by the Group for year 1950) seemed arbitrary and the Group asked if sensitivities had been run for each choice of this initial equilibrium catch. The modelers indicated that in earlier runs the initial equilibrium catch was higher (equal to the catch estimated by the Group for year 1950) and that the model had difficulties estimating a reasonable value of R_0.

The Group asked whether sigmaR was an input to the SS3 model or an estimated parameter, and why it was not the same for the three scenarios. The modellers explained that at the start of a run development, the same sigmaR value (0.4) was used in the three scenarios. Subsequently, through an agreed workflow that was applied consistently to the three scenarios (Table 11 of SCRS/2026/143) the sigmaR value was modified according to the method developed by Methot and Taylor (2011), as described and recommended in the SS3 manual. This process leads to different final sigmaR values for the different scenarios.

Clarification was sought about how exactly the modification to the original Peterson and Wroblewski natural mortality had been done (SCRS/2026/144). It was explained that the modification was based on achieving 0.4% of the unfished equilibrium population at the oldest age, using for the oldest age the theoretical maximum age (42, 35 and 69, for Scenarios 1-3, respectively), and that the value added or subtracted from the original M was the same value for all ages.

SCRS/P/2026/067 described the Scenario 1 diagnostics. These showed that the model converged with a low final gradient and an invertible Hessian matrix, and no parameters hit bounds. Several selectivity parameters were estimated with large CVs even though their gradient was low. CPUE and length-composition fits were broadly acceptable, although some misfits were observed and discussed. The R_0 profile plot illustrated the need of a prior distribution on $F_{initial}$ in order to estimate R_0. Retrospective, hindcast cross-validation, jitter, recruitment deviates, CPUE exclusion and length composition data exclusion diagnostics were presented. All diagnostics generally supported the main declining stock pattern.

SCRS/P/2026/066 described the Scenario 2 diagnostics. These indicated that the model converged with a low final gradient and an invertible Hessian, although one parameter hit a bound and several selectivity parameters had high Coefficients of Variation (CVs). CPUE and length-composition residuals were generally acceptable, with retrospective, hindcast, jitter, R_0-profile, and recruitment-deviation diagnostics used to evaluate model stability. Additional robustness checks showed that removing or isolating individual CPUE series, fixing selectivities and removing length-composition data affected the scale and some trajectories, but the broad declining pattern in stock reproductive capacity was generally retained.

SCRS/P/2026/068 described the diagnostics for scenario 3. These diagnostics showed that the model converged with a low final gradient, although $F_{initial}$ was close to its lower bound, several selectivity parameters were imprecisely estimated, and strong correlations occurred among growth and selectivity parameters. The CPUE, length-composition, retrospective, hindcast, jitter, R_0-profile, recruitment-deviation, and CPUE-removal diagnostics generally supported the main declining stock pattern, but fixing selectivities and removing length-composition data produced larger changes in scale and fishing pressure estimates.

The main concern expressed by the Group was that population scale, related to R_0, is not well estimated, as indicated by the R_0 likelihood profile and other diagnostics, which has potential implications for stock status estimates. The modellers noted that, according to their understanding, the issue appears to be related to a lack of contrast in the current CPUE series. In the 2017 shortfin mako stock assessment, the USA logbook series provided contrast, because it started earlier (1985) and showed a consistent decline over a number of years, but the CPUE series available for this year's assessment start later (1990 for the Spanish CPUE and 1993 for the Combined CPUE) and do not show a clear initial decline. Using a prior on $F_{initial}$ allowed for a better estimate of R_0 and the Group expressed that having a prior is not necessarily a bad thing, provided that there is justification for the particular prior chosen.

It was noted that the current model seems to be most influenced by the Spanish CPUE and a suggestion was made to consider increasing the weight of the Combined CPUE, and possibly to reduce the weight of the length-composition data and conditional age-at-length data.

Some Group members also noted that, particularly in Scenario 3, the recruitment deviations appeared too large to seem plausible. The Group asked which data were influencing the estimates of recruitment deviations. The modellers responded that in all three scenarios, recruitment deviations are influenced by the CPUE and length-composition data. In addition, in Scenario 3 the conditional age-at-length data also influence the estimates of recruitment deviations.

It was observed that the Mean Absolute Scaled Error (MASE; Hyndman and Koehler, 2006) for the Combined CPUE index was greater than 1, reaching 1.54 in Scenario 1. The modellers noted, however, that the Combined CPUE index shows a sudden and large decline in 2021 that is difficult to interpret as reflecting an equally large decline in population abundance within a single year. Accordingly, some difficulty in predicting the Combined CPUE index was expected, and the relatively high MASE values may partly reflect the model's inability to reproduce this abrupt change.

The model-results presentation (SCRS/P/2026/063) showed that the three biological scenarios produced broadly similar trajectories in stock reproductive capacity (measured as spawning stock fecundity (SSF)), with SSF/SSF_{MSY} declining from well above 1.0 early in the time series to lower values but still generally above values of 1.0 in recent years. However, the scenarios differed substantially in fishing pressure, with Scenario 2 showing much higher F/F_{MSY} than Scenarios 1 and 3. Total biomass and recruitment plots indicated declining biomass and variable recent recruitment across scenarios.

The modellers were asked why Scenario 3 produced the most optimistic population dynamics, given that it represents the least productive of the biological hypotheses. The response was that the CPUE series did not show a sustained decline; a model configured with low productive biology would need to estimate an unrealistically large population in order to reconcile this with the data. It was further remarked that this happened in each of the three scenarios, and that this was the rationale for setting a prior on $F_{initial}$.

A concern was raised regarding the results of Scenario 2. This time series shows values of F/F_{MSY} above 2 throughout most of the modelled period. Still, the relative spawning output (SSF/SSF_{MSY}) remains relatively unaffected. The modellers noted that there is a time lag between when the fishing pressure occurs and the actual impact on SSF, since fishing pressure primarily affects the immature fraction of the population. As an alternative explanation, the modelled population could be so large at the beginning of the assessment period (1950) that it could withstand a long period of intense fishing pressure before the SSF falling below SSF_{MSY}.

SCRS/P/2026/064 described the sensitivity analyses for Scenario 1. These sensitivity analyses showed that alternative $F_{initial}$ priors generally converged and produced similar fits to the main run, although the very low prior median placed the $F_{initial}$ estimate near its lower bound. The alternative natural-mortality and steepness run also converged and reduced difficulties estimating R_0, but produced a large plus-group contribution, while incorporating conditional age at length data (CAAL) improved fits to the smaller lengths and modestly shifted growth estimates without significantly altering the main stock-status trajectories.

SCRS/P/2026/065 described the sensitivity analyses for Scenario 2. These sensitivity analyses showed that alternative $F_{initial}$ priors and the alternative natural-mortality/steepness run generally converged and produced CPUE and length-composition fits similar to the base run, although the lowest $F_{initial}$ prior was estimated near its lower bound. The alternative biological assumptions reduced difficulties in estimating R_0 but implied a large plus-group, while steepness and other model-structure sensitivities affected stock scale, fishing-pressure estimates, and some status trajectories, highlighting the importance of these assumptions for Scenario 2.

SCRS/P/2026/069 described the sensitivity analyses for Scenario 3. These showed that all runs converged, but changes to $F_{initial}$ priors, natural mortality and steepness, and CAAL treatment affected the absolute population scale and therefore F and F/F_{MSY} more strongly than SSF/SSF_{MSY}. Removing or altering CAAL changed growth estimates and stock scale, while the Low Fecundity Stock Recruit Relationship sensitivities, especially Beta values 2 and 3, produced substantial changes in SSF/SSF_{MSY}, indicating that stock-recruitment formulation remained an important uncertainty for Scenario 3.

The modellers were asked about the configuration of recruitment deviations. In particular about the SS3 setting used that forces the recruitment deviations of the 1990-2020 period to sum to zero. The modellers replied that they considered it to be the best alternative of the configurations permitted in SS3. They indicated some exploration of not imposing a sum to zero constraint was done. This showed mainly positive recruitment deviations during the 1990-2020 period, which could create biases in the estimation of the stock-recruitment curve.

The Group commented about the use of a prior on the initial fishing mortality parameter ($F_{initial}$). Particularly, the Group noted that Scenario 3 was sensitive to different priors on the initial fishing mortality parameter ($F_{initial}$). The modellers clarified that the estimate of R_0 is relatively sensitive to model assumptions, and so the prior on $F_{initial}$ was chosen as a way to effectively bound the scale of the modelled population, precluding R_0 from reaching extremely high values. Sensitivities show that some priors on $F_{initial}$ do not strongly alter the model results, while others do.

Some concerns remained in the Group regarding the use of $F_{initial}$ priors as important drivers of the model results. The resulting estimates of the population dynamics were questioned, given that a sustained strong fishing pressure should induce a more noticeable drop on the SSF than currently estimated by the models. However, it was discussed that given that the fishery is mostly on juveniles and that shortfin mako is a long-lived species, then there will be a time lag before fishing pressure affects SSF.

Some other questions were asked regarding the interpretation and implication of the current prior of $F_{initial}$ within the models. Particularly, there were significant changes in the modelled population structure going from 1949 to 1950. The modellers showed a plot representing numbers at age throughout the model period where no such change was appreciated.

The modellers were also asked what selectivity was associated to the pre-1950 initial equilibrium catch and the answer was that it corresponds to the selectivity of the historical fleet (F11_HIS in SS3), whose actual catches are estimations made by the Sharks Species Group in 2025. This historical fleet has no associated length composition data and its selectivity in SS3 was mirrored to the Spanish fleet selectivity.

It was mentioned that it is possible that some of the CPUE standardization processes could not take into account all of the factors that influence catch rates, thus making some CPUE indices not fully representative of actual stock abundance. The Group discussed that a sharp drop in the combined CPUE index in 2021 may not fully correspond with a drop in stock abundance.

The Group asked whether steepness was modified in order to run the Scenario 1 sensitivity that includes CAAL data and estimates the growth curve within the model. The modellers responded that steepness was not modified since the steepness value used was from the demographic analysis (SCRS/2026/132, external to SS3).

The Group recommended that model selection should be done taking into account diagnostics performance. It was mentioned that in other Regional Fisheries Management Organizations (RFMOs) there are formal procedures to select models for advice based on their diagnostics outputs.

The Group asked for several sensitivity runs for each of the biological scenarios. Their main purpose was to search for a model configuration that was able to better estimate the value of the parameter R_0. In line with that goal, R_0 profile plots and a run without prior distribution on parameters were also agreed for each of the sensitivities. The following sensitivity configurations were requested:

- HW1. For all fleets (excluding the Mexican fleet, which has already been treated in a specific way and will not be changed), estimate selectivity at the largest lengths (Size_DblN_end_logit parameter) rather than fix it.

- HW2. For all fleets (excluding the Mexican fleet, which has already been treated in a specific way and will not be changed), fix the selectivity of the largest lengths to be 0.08 (in original scale, i.e. Size_DblN_end_logit parameter = -2.44). This fixed selectivity is to be applied to both males and females.

- HW3. Include a time-block on the combined CPUE series, with the first block ending in 2020, and the second block starting in 2021.

- HW4. If we see an improvement in sensitivity runs 1 or 2, conduct a sensitivity run with the selectivity of that particular sensitivity run + the time-block of sensitivity run 3.

- HW5. Exclude the Spanish CPUE series, the Mexican length composition data (fixing the selectivity of Mexico at what is estimated in the main run), and upweight the Combined CPUE. To upweight the Combined CPUE use the CV values reported by the authors (in the data.ss file) without including any variance adjustment in the control.ss file.

- HW6. If we see an improvement in sensitivity runs 1 or 2, conduct a sensitivity run with the selectivity of that particular sensitivity run + the changes indicated in run 5.

For the three scenarios, the runs configured as HW1 provided selectivity estimates which were very similar to the estimates used in the original runs and did not offer improved performance relative to the original runs.

Fixing the selectivity for the largest lengths to be low but not zero (HW2) scaled the estimated R_0 to lower values, due to the implication that all fleets would have a non-zero probability of capturing larger animals. The Group considered a selectivity value of 0.08 (for the terminal selectivity of otherwise domed-shaped selectivities) appropriate, similar to the values used in the 2025 southern shortfin mako stock assessment. For Scenario 1, this run was able to estimate R_0 within a realistic range, even without a prior on $F_{initial}$. The results indicated that Scenario 3 failed to converge for HW2 without a prior on $F_{initial}$. The results of HW3 and HW4 (HW2 combined with HW3, attempted for Scenarios 1 and 2) showed somewhat better fits to the combined CPUE, which is unsurprising due to the time block applied in these cases. For Scenario 1, the HW6 run (HW2 combined with HW5) also resulted in a plausible estimate of R_0, even without the use of a prior on $F_{initial}$.

The Group discussed that Scenario 2 showed the stock to be overfished almost from the beginning of the time series because low estimated steepness and productivity severely constrained its capacity to respond to fishing pressure. The Group agreed that such a low steepness value is not biologically plausible. As such, the Group decided not to use Scenario 2.

The Group noted that incorporating CAAL data to estimate growth parameters within SS3 should also be explored. Furthermore, the growth model estimated in SS3 when CAAL data are used in Scenario 1 is closer to the growth model in Scenario 2 and provides a better fit to the lengths of small individuals.

For Scenario 3, an additional sensitivity was presented where the top logit parameters of the selectivities were fixed at their initially estimated value, which contributes to improved convergence in jitter analyses. It was therefore suggested to try this approach in combination with the additional sensitivity analyses for Scenario 1.

The Group discussed what modifications to Scenario 1 and Scenario 3 would be useful to investigate further. For both scenarios, the Group requested to see full diagnostics on a modified version of runs HW2 and HW6, including CAAL data in both scenarios, excluding the prior on $F_{initial}$, as well as including fixed top logit parameter for the selectivities.

For Scenario 1, the additional requested runs converged, achieving realistic estimates of R_0. While both models (i.e. the modified HW2 and HW6) showed overall acceptable diagnostics, HW2 had better diagnostics, in particular, a better retrospective pattern than the HW6 model. For both runs, it was shown that removing the length-composition data from the model would prevent the estimation of R_0, indicating that the selectivity assumption made in these runs together with the length composition data were the key to achieve realistic estimates of R_0 in the absence of a prior on $F_{initial}$.

For Scenario 3, only the modified HW6 could be presented, and the results indicated that the model failed to converge without using a prior on $F_{initial}$. Therefore, for Scenario 3, using a prior on $F_{initial}$ seemed to be the key to achieving a realistic estimate of R_0.

Based on what was learnt from both scenarios, the Group then requested exploration of one additional modification to the latest HW2 configuration. This consisted of reinstating the prior specification on $F_{initial}$. Full diagnostics for this new configuration of HW2 were examined by the Group and considered acceptable for Scenario 1, therefore becoming the base case for this scenario. This run (called HW2_final) corresponded to:

– HW2_final: Like HW2 (i.e. for all fleets, excluding the Mexican fleet, fix the selectivity of the largest lengths to 0.08), include CAAL data and estimate growth within SS3, fix the top logit selectivity parameters, keep the prior distribution on $F_{initial}$.

The full set of model fits and diagnostics of HW2_final for Scenario 1 is provided in SCRS/2026/143. **Figure 1** shows the estimated growth model, **Figure 2** shows the estimated selectivities, **Figure 3** the estimated recruitment deviations, and **Figure 4**, the stock-recruit relationship and the bias adjustment ramp used in the model for Biological Scenario 1.

The Group assessed the Scenario 3 diagnostics which showed questionable model performance and, consequently, rejected Scenario 3 as a basis for further analysis. Scenario 3 also failed when run for JABBA in the North. The low productivity scenario for the southern stock also failed. Main issues are described next:

1. Retrospective analysis for Stock Synthesis Scenario 3 (HW6) showed extreme retrospective patterns, e.g., for spawning stock fecundity, Mohn's Rho = 5.4.

2. The profile on R_0 for Stock Synthesis Scenario 3 (HW6) indicated that recruitment (process error) was the most important component of the model likelihood for R_0 over most of the range explored for the profile. This result indicated that when the prior on $F_{initial}$ was removed for Stock Synthesis Scenario 3 (as in HW6), then recruitment (process error) became the most important component of the model likelihood, indicating a lack of information content in the data for the estimation of R_0 in Stock Synthesis Scenario 3.
3. Excluding one CPUE at a time for Stock Synthesis Scenario 3 (HW6) indicated extreme sensitivity to removal of the combined index, and Stock Synthesis Scenario 3 (HW6) failed to converge after removing the CPUE obtained for the combined index.

4. Including one CPUE at a time for Stock Synthesis Scenario 3 (HW6) indicated extreme sensitivity to including one CPUE index at a time, and Stock Synthesis Scenario 3 (HW6) only converged after including the CPUE obtained for the combined index.

Presentation of SENSITIVITIES SCENARIO 3 V4-Corrected

1. Retrospective analysis for Stock Synthesis Scenario 3 (HW7) showed less pronounced retrospective pattern, e.g., for spawning stock fecundity, Mohn's Rho = 0.12.

2. The R_0 profile of Scenario 3 for HW7 exhibits unexpected results at low $Ln(R_0)$ that require further investigation before the model results could be recommended for use in management advice.

3.3 Other methods

No other methods were used.

4. Stock status results

4.1 Production models

JABBA was considered for status assessment, but not for projections. The three runs used were Base 1, Sensitivity 1 and Sensitivity 2. These found a consistent trend of biomass decreasing until around 2000, increasing in the early 2000s, and decreasing over the most recent decade to a current biomass of about half the unfished level (**Table 2, Figure 5**). The harvest rate time series were also fairly consistent. However, due to the uncertainty about the life history, the MSY-based reference points differed between runs, leading to differences in the scale of B/B_{MSY} and H/H_{MSY}. The trend in biomass was driven by the CPUE series, which could only be fit due to a series of positive process error deviates in the early 2000s, when CPUE was increasing with high catches, and negative process error deviates in recent years when the population was decreasing with relatively low catches (**Figure 6**).

The additional sensitivity runs requested by the Group produced variable estimates of MSY, K, r and current status (**Figure 7**). This reinforces the point that, although the CPUE data provide information about the trends in biomass and harvest rate, the uncertainty about the age and growth of this population leads to uncertainty in the reference points, and highly variable status relative to the reference points.

4.2 Stock Synthesis

For Stock Synthesis, the Group only approved the run corresponding to Scenario 1. The settings of this run (called HW2_final in Section 3.2 of this report) are fully described in document SCRS/2026/143. The model includes CAAL data and estimates the growth parameters within SS3.

The time series of estimated recruitment, total stock biomass, spawning stock output (modelled as spawning stock fecundity, SSF), fishing mortality relative to F_{MSY} and SSF relative to SSF_{MSY} are plotted in **Figure 8**.

The spawning stock output 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.

4.3 Other methods

SCRS/2026/142 presented a three-strand diagnostic framework (based on internal, external and robustness tests) for evaluating whether SS3 runs are fit for purpose for advice, extending the Carvalho *et al*. (2021) diagnostics cookbook. Process-error diagnostics for the 2025 shortfin mako runs were shown, including the sensitivity of estimates process error to the SS3 recruitment-deviation options.

The Group noted that the approach had already been presented to Working Group on Stock Assessment Methods (WGSAM) and draws on methods developed in other scientific bodies, including the International Council for the Exploration of the Sea (ICES). The presenter emphasised that the framework is not yet operational for routine advice. The Group also discussed process-error diagnostics and the effect of using recruitment-deviation option~2 in SS3 (random-effects recruitment around the stock-recruit curve, rather than the dev-vector option used in the preliminary runs). Option~2 produced different estimates of process error in the illustrative examples; the presenter cautioned that these comparisons were for demonstration only and should not be over-interpreted at this stage.

4.4 Synthesis of assessment results

The Group discussed that some scenarios do not appear to represent biologically consistent life histories. While age-structured models should describe population dynamics more appropriately for a long-lived species like shortfin mako, the age structure, growth and population dynamics remain highly uncertain. Nearly all of the observed data are from juveniles, yet stock status is expressed in terms of the mature component of the population. The CPUE indices were relatively flat during the period when catches were highest, and the models seemed to resolve this conflict by favoring very large R_0. In scenario 2, productivity was so low that the models predicted overfishing from very early in the exploitation time series from all sensitivities tested. In scenario 3, the data contained very little information on the appropriate scale of biomass, even when the model incorporated a prior on $F_{initial}$ and fixed selectivity on larger sizes at 0.08. The Group recommended future work to try to improve understanding of shortfin mako population dynamics, in order to reduce uncertainties that could not be resolved at this meeting.

For JABBA, the Group noted that extremely high values for H/H_{MSY} (> 24) were produced from several of the lowest productivity scenarios. These reflected calculated values for B_{MSY}/K that were higher than the upper bound for the parameter in JABBA and had to be reduced in order to fit the model. Therefore, the Group agreed that only three of the original six scenarios should be used to provide information on stock status, representing the base and sensitivity runs for scenario 1, and the sensitivity run for scenario 2.

The Group discussed the need for an objective approach for weighing alternative model configurations in the future. It was recognized that no agreed framework currently exists within the Group for assigning differential weights among models or scenarios based on diagnostic performance, biological plausibility, or predictive skill. Consequently, the Group agreed to apply equal weighting across the accepted model configurations for the purpose of summarizing stock status results. The Group expressed some reservations regarding the application of equal weighting among SS3 and JABBA model configurations.

All the retained model runs predicted similar abundance trends with a consistent decline from 1950 to 2024 (**Table 3** and **Figure 9**), while the fishing mortality trends suggest a gradual increase to a peak in 1996 for all scenarios, remaining high (> 1) until 2019 before declining near 2020.

The joint time series and the Kobe plot were built using the Monte-Carlo multivariate lognormal (MVLN) approach for the Stock Synthesis (SS) model with 15,000 iterations, and 5,000 Markov Chain Monte Carlo (MCMC) samples from each of the JABBA models, giving 50% of the overall weight to the one SS model and 50% to the three JABBA configurations (**Figures 10** and **11**). The joint biomass related quantities (SSF/SSF_{MSY} for Stock Synthesis and B/B_{MSY} for JABBA) trajectory decreased from 1.99 (95% confidence interval (CI) = 1.24-2.36) in 1951 to 0.95 (0.54-1.29) in 2024 (**Table 4** and **Figure 11**). The combined results suggest fishing mortality related quantities (F/F_{MSY} for Stock Synthesis and H/H_{MSY} for JABBA) gradually increased to a peak of 2.4 in 1996, remained high (> 1) until 2019, before declining to 0.72 (0.35-2.37) in 2024 (**Table 4** and **Figure 11**). The value used for MSY was 1883 t (1556-2209 t), which came directly from SS. A combined estimate was not calculated because only the SS model will be used for projections.

The Group examined stock status estimates from three JABBA scenarios and one Stock Synthesis scenario (**Figure 12**). While the Stock Synthesis model indicated high probabilities of the SSF being above SSF_{MSY} and fishing mortality below F_{MSY}, the JABBA scenarios generally indicated higher probabilities of biomass being below B_{MSY} and divergent figures on fishing mortalities depending on the different scenarios (**Figure 12**). Overall, the combined results indicated that in 2024 the stock was overfished but that overfishing was not occurring. A joint Kobe phase plot (**Figure 13**) showed a 43.3% chance that the stock is currently in the yellow quadrant of the Kobe plot, a 37.1% probability that it falls within the green quadrant, a 18.3% probability of being in the red quadrant, and a 1.3% probability of being in the orange quadrant of the Kobe plot.

5. Projections

The Group agreed that projections for the North Atlantic shortfin mako stock would be conducted using only the Stock Synthesis model, given the importance of incorporating age structure to realistically capture the stock's future population dynamics for a long-lived and slow maturing species. JABBA model structure does not consider age-structure, therefore the Group decided to proceed with the projections based only on the Stock Synthesis Scenario 1.

The Group recognized that the use of a single life-history scenario in the projections, representing a faster growth hypothesis and intermediate longevity, did not fully reflect the uncertainty associated with alternative interpretations of growth. The fact that both the slower and faster growth hypotheses were not retained for advice should not be interpreted as a rejection of these hypotheses. Rather that when combined with the available data and other life history assumptions, these interpretations of population dynamics generated results that did not seem reasonable based on the examined diagnostics. The starting point of the projections is expected not to match exactly the joint estimated stock status, which is a combination of production models and an age-structured model. In addition to the latter, the Group discussed the limitations of how well a single scenario, could represent the extent of uncertainty on the dynamics of this stock, and the suitability of the multivariate log-normal approximation. Accordingly, the Group emphasized that the results in the Kobe II Strategy Matrix should be interpreted with caution.

Due to the limited time during the meeting, the Group agreed to conduct the projection intersessionally and to review the projection results at the Sharks Species Group meeting in September 2026. The Group also agreed that an SCRS document describing the stock projection results will be shared on the nextCloud folder two weeks prior to the September 2026 Sharks Species Group meeting.

The Group discussed and agreed to the following settings for the stock projections for the North Atlantic shortfin mako stock based on the assessment results from the Stock Synthesis platform:

- Use the Stock Synthesis results from scenario 1.
- Assume a catch value of 1,174 t for the 2025 and 2026 projection years. This value is the estimated 3-year average (2022-2024) of total removals (i.e. catch plus dead discards and post-release live mortality components) input used in the stock assessment.
- Use a 3-year average (2022-2024) for future catch distribution by fleet and its corresponding selectivities.
- Set future catch as follows: 0, 100, 200, 250, and 300 to 2,300 t in 100 t increments, the estimated MSY (1,883 t). If appropriate, higher catch and other scenarios would be evaluated at the discretion of the analysts.
- A complementary projections exercise will be done in order to check the expected outcome of the projection methodology.
- The projection period for constant future catch will be from 2027 to 2070 as required by paragraph 23 of *Recommendation by ICCAT on the conservation of North Atlantic stock of shortfin mako caught in association with ICCAT fisheries* (Rec. 21-09).
- 15,000 iterations.
- Apply the MVLN approach for the stochastic projections.
- Future recruitment values (beyond the year 2024) should be taken directly from the stock-recruitment relationship used in the assessment model by setting recruitment deviations to 0 in the projection period.

6. Intersessional workplan

The Group agreed to carry out the projections of the model adopted for management advice during the intersession and be presented in an SCRS document in advance to the Sharks Species Group meeting in September 2026. The selected model for stock projections as well as its settings and specifications are described in detail in section 5 of this report.

The Group agreed for a sub-group to prepare a presentation for the upcoming Intersessional Meeting of Panel 4 (7-8 July 2026) on the status, advances and requiring inputs from the Commission to advance in the development of the MSE of blue shark stocks. This presentation should be based on the three documents discussed during this meeting (for details see section 8 of this report). The SCRS will inform the Group of the discussions and recommendations from Panel 4 at the Sharks Species Group meeting in September 2026.

Finally, the Group agreed to advance intersessionally on the preparation of the documents to be provided to the SCRS Plenary (i.e., responses to the Commission, 2027 workplan, recommendations with financial implications, three shark species Executive Summaries).

7. Recommendations

To the SCRS Plenary:

- Given the increasing number of informal intersessional meetings conducted by the SCRS Groups for which formal reports are not currently required, the Group recommended that the SCRS explores potential mechanisms to allow the discussions and decisions made during such meetings be part of the record (e.g. consider requiring formal reports and set guidelines for drafting these).

– Given that SCRS documents and presentations are often submitted after the meetings' deadline (set as one week prior to the start of the meeting), the Group recommended that the SCRS discuss how to deal with late submissions, which are of particular concern in the case of key documents that are highly technical by nature and therefore require time to be fully reviewed by the participants prior to the meetings.

– The Group recommended that growth curves and other biological inputs be based on studies with adequate sample sizes and appropriate methods, including validation with an adequate range of ages for growth studies and validated methods.

– The Group recommended considering that MSY based reference points are highly dependent on population age structure, which is not well understood for some shark species, alternative methods and metrics should be considered for shark stocks (e.g. spawning potential ratio).

To the WGSAM:

– The WGSAM should develop methods to deal with cryptic biomass, while ensuring that biological inputs are mutually consistent and biologically plausible.

– The Group recommended that the WGSAM develop objective procedures for the selection, exclusion, and weighting of alternative assessment models and scenarios, particularly when integrating outputs from multiple modelling frameworks.

– The Group recommended exploring if stock projections using the MVLN approach provide comparable and consistent results compared to alternative projection options including MCMC with consistent recruitment assumptions.

8. Blue shark MSE – Technical team and advances

SCRS/2026/140 described progress from the 2025 Global Blue Shark MSE Workshop in Rome, including the development of an openMSE analytical pipeline from SS3 assessment outputs, preliminary candidate management procedures, proposed ICCAT-style performance metrics, prototype simulations, and visualisation tools.

The Group confirmed that a technical working group for the blue shark MSE has been established. Preliminary Operating Model (OM) development can continue before the Commission adopts formal management objectives. However, the ongoing shortfin mako assessment has constrained analytical capacity. The technical team is expected to meet in September or October 2026. After that meeting, it will consider what additional sources of uncertainty OMs should capture. Substantial MSE work is expected to resume after completion of the shortfin mako assessment. At that point, the technical team will be better placed to evaluate the workplan for completing the blue shark MSE, including whether OM reconditioning is required.

The Commission has not yet agreed on management objectives for the blue shark MSE. The Group therefore questioned whether the MSE process should advance substantially before managers define those objectives. At the same time, MSE work in other Species Groups, such as swordfish, has proceeded technically before final agreement on management objectives. Barring explicit multi-species requirements, the Group considered that the management objectives for blue shark should remain simple. The Commission roadmap anticipates adoption of management objectives in 2026 and final management procedure adoption in 2028.

Panel 4 is scheduled to meet on 7–8 July 2026. The blue shark MSE is on the agenda under items related to technical progress, working approach and next steps. The Group considered that this meeting could provide an opportunity to solicit initial management objectives and guidance from managers. However, Panel 4 may not be able to agree final objectives at that meeting.

SCRS/2026/139 demonstrated that a joint blue shark–shortfin mako MSE cannot be built directly from the existing SS3-derived OMs without resolving fleet, age, and historical-year incompatibilities, and that effort coupling in openMSE must be implemented at the management procedure layer rather than assumed to propagate automatically through the multi-stock simulator.

The Group deferred discussion of SCRS/2026/139 until after presentation of SCRS/2026/138.

SCRS/2026/138 showed that, although South Atlantic blue shark and shortfin mako fishing mortality were historically correlated, structural-break, rolling-regression, GAM, effort, catch, and robustness diagnostics indicate that this relationship has collapsed in the contemporary period, and concluded that a direct blue shark-shortfin mako coupling parameter is not empirically defensible for the near-term blue shark MSE.

The Group agreed that analyses based on model-derived fishing mortality estimates require caution. Raw catch data are closer to direct observations and may provide a more defensible basis for some comparative analyses. The Group also asked whether the coupling analysis assumed a linear relationship across the full time series or considered nonlinear formulations. The presenter clarified that the analysis used linear relationships.

The Group suggested that a similar analysis could be useful for the North Atlantic. The presenter noted that this analysis is planned once the North Atlantic assessment is complete. However, as in the South Atlantic, differences in fleet structure between the two species' assessment models may preclude direct fleet-by-fleet comparisons. The main analysis is therefore likely to use aggregate data.

The Group asked whether the MSE could consider spatial management procedures. The presenter clarified that openMSE can technically accommodate such procedures, including spatial redistribution effects, but that these procedures have not yet been implemented. The presenter also noted that the authors have implemented an implicitly spatial OM to explore uncertainty in the distribution of juvenile and adult fish.

The Group discussed what should be reported to Panel 4 on progress with the blue shark MSE roadmap. The preliminary exploration of shortfin mako and blue shark interactions could be mentioned, since the Commission raised this issue the previous year. However, the Group cautioned against overstating progress. The results remain preliminary and may change as the analysis develops.

The Group agreed that the message to Panel 4 should be clear. It should report completed work, explain that the results are preliminary, and avoid presenting the outputs as more developed than they are. The Group also stressed the need to elicit clear management objectives from the Commission. It also recommended seeking clarification on whether the MSE process should follow a two-year or three-year development schedule.

The Group discussed the need to clarify what can realistically be completed within the current MSE roadmap's schedule. Aside from bluefin tuna, this is the first ICCAT MSE process to address two stocks simultaneously. The process is also being asked to consider bycatch-related questions. The Group confirmed that the Commission has made no formal request for a multi-species MSE or for an explicit bycatch control component within the blue shark MSE. The key message to Panel 4 should therefore be the need for management objectives from the Commission.

9. Responses to the Commission

The ICCAT Secretariat developed an SCRS Responses to the Commission Tracking System, which was presented at previous 2026 SCRS meetings. The Secretariat presented a brief overview of the tool to the Group, including role-based access, status tracking, filtering and exporting.

The Group thanked the development team and noted that the tool will be useful for tracking requests from the Commission and the status of SCRS responses. Several process-related clarifications emerged during the discussion:

- Requests from the Commission have been compiled by the Secretariat, with SCRS Officers validating these entries and potentially including additional requests from intersessional Commission meeting reports. In the future, SCRS Officers should be responsible for reviewing Recommendations and meeting reports to identify new Commission requests.
- Currently, only SCRS Officers and Commission Panel Chairs can modify selected entries. The SCRS and Commission may consider whether to expand access.

- Responses should only be entered once they have been adopted by the SCRS. The Group clarified that the tool should not be used to track the progress of draft responses.
- The SCRS view of the status of each response should be input by the SCRS Officers, in line with the adopted responses.

Regarding next steps for the use of the tool, the Group emphasized the importance of receiving feedback from the Commission to understand when responses are considered complete. The SCRS Chair explained that ICCAT Panel and Working Group Chairs would be asked to review the SCRS responses and the SCRS view of the status of each response, and then determine whether they are content with the response prepared by the SCRS or whether further work is required. It was noted that the tool will include an option to indicate cases where the SCRS considers that no response is required.

The Group then reviewed the active requests from the Commission, as well as any previous responses, and provided guidance to the Chair on how previous responses might be updated and new responses developed.

The Group noted that two documents are being developed that may be useful for updating responses regarding mobulids (*Recommendation by ICCAT replacing Recommendation 23-14 on mobulid rays (family mobulidae) caught in association with ICCAT fisheries* (Rec. 24-12)), as well as basking shark and great white shark (*Recommendation by ICCAT on basking shark and great white shark caught in association with fisheries managed by ICCAT* (Rec. 25-07)).

10. Shark Research and Data Collection Programme (SRDCP)

10.1 Funding and use of science funds

The Secretariat provided the Group with an update on the use of science project funds between 2021-2025. It was noted that the Group has utilized most of the available funds in recent years (mostly above 85% in the three most recent years). The exception was year 2022, when a decision was made to stop purchasing pop-up satellite archival tags (PSAT) from Wildlife Computers due to the battery issues. In 2026 almost all the available funds are already committed, and the activities are being carried out as planned.

It was recommended that the Group avoid making major changes to the 2027 funding requests unless such changes were duly justified by achievements made in the interim. Instead, new activities should be discussed within the long-term planning of the activities and funding requests to be considered for the next biennial period (2028-2029).

The Secretariat also highlighted the importance of duly justifying funding requests, particularly by linking them to specific Commission requests. In addition, it was noted that the Group should report back on the progress achieved and inform the Commission of the expected completion dates for the different studies.

11. Other matters

Document SCRS/2026/148 presented preliminary work on a tagged longfin mako shark in the equatorial Atlantic, showing diel vertical movement patterns and demonstrating that depth-corrected light-based geolocation combined with a Kalman filter produced a more plausible reconstructed track, with further analyses planned as additional tagged specimens are incorporated.

The Group inquired whether the method applied to the longfin mako was similar to that used for the basking shark. The author stated that he was not familiar with the methodology used in the case of basking shark study and explained that, in their analysis with longfin mako, trajectory reconstruction was performed using a Kalman filter applied to depth-corrected data.

The Group noted the importance of identifying transboundary movements in shark species such as shortfin mako, blue shark, and porbeagle. These movement studies, together with genetic analyses, provide complementary evidence and improve understanding of their spatial population structure and dynamics. The Group encouraged the authors to continue their collaboration within the Shark Research and Data Collection Programme (SRDCP).

The Group also inquired whether both surface water temperature and subsurface temperature were recorded. The author indicated that temperatures were recorded.

SCRS/2026/147 extended the Moroccan swordfish longline discard estimates to a three-year series (2023–2025) using the FishLongline observer-bootstrap platform and a new Flutter mobile app (FishStatApp) for fisher reporting. Shortfin mako discards followed an arc-shaped trend (1,048; 5,557; 1,608) with steadily declining at-haulback mortality (36.5% to 25.6%), while blue shark discards stayed variable with at-haulback mortality rebounding to 65.4% in 2025, and swordfish reappeared in 2025 (147 juveniles, 12.2%).

The Group asked the author regarding the post-release mortality rate of shortfin mako (which has decreased over the years), whether fishers are handling the captured specimens better, or if other measures are in place. The author responded that in Morocco, under the “Sentinel Fishery” project, extensive awareness campaigns were carried out by the Institut National de Recherche Halieutique (INRH) scientists, alongside training sessions for fishers on best practices for handling sharks. Additionally, as part of this project, smartphones were distributed to fishers to ensure regular daily monitoring, thereby actively involving them in a concrete way in the management of this fishery.

Regarding the statistical method for estimating discards, the Secretariat highlighted that under the *Recommendation by ICCAT to establish minimum standards for fishing vessel scientific observer programs* (Rec. 16-14), all CPCs are required to submit estimates of both dead and live discards. Regarding the validation of the method, two potential pathways exist: the first is to present the method to the WGSAM, and the second is to present it to the Sharks Species Group. The SCRS Chair clarified that a table had been developed by the WGSAM for the Sharks Species Group to validate the statistical methods presented by the CPCs.

At the end, the Group asked why the discard rate of blue sharks, unlike that of shortfin mako, is higher. The author confirmed this observation and clarified that the paper includes a recommendation noting that the blue shark requires special attention due to the high mortality rate observed.

Document SCRS/2026/175 studied Morocco's blue shark (*Prionace glauca*) in Atlantic waters (2023–2025, Casablanca market): sizes 70–350 cm, seven cohorts, growth $L\infty$=387 cm and K=0.21/yr, size at maturity $L50\approx$180 cm, slight female dominance (52%). A shift toward larger sizes since 2015–2017 was observed, with a recommendation to limit juvenile catches in line with ICCAT conservation objectives.

The Group noted that the presentation contains a large amount of biological information and asked the authors whether they had compared these results with other species in the same area, given that the size at first maturity for males is larger than that for females. The author replied that they had, adding that they would have liked to have more samples to confirm this finding.

12. Adoption of the report and closure

The Report of the 2026 ICCAT North Atlantic Shortfin Mako Shark Stock Assessment Meeting (including Blue Shark MSE) was adopted. The Chair and the Secretariat thanked all the participants for their efforts to work effectively and efficiently throughout the meeting, the interpreters for facilitating the discussions and the Oceanário de Lisboa for hosting the meeting. The meeting was adjourned.

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Table 1. Base and sensitivity runs conducted in JABBA, with * indicating the models retained for assessment.

Case	***Label***	***Scenario***	B_{MSY}/K	***r median***
Base*	B	1	0.670	0.052
Base	B	2	0.846	0.020
Base	B	3	0.745	0.019
Sensitivity*	S	1	0.541	0.107
Sensitivity*	S	2	0.557	0.099
Sensitivity	S	3	0.793	0.015
2025 prior	S2	1	0.597	0.089
2025 prior	S2	2	0.590	0.089
2025 prior	S2	3	0.660	0.045
Break at 2020	S3	1	0.670	0.052
Break at 2020	S3	2	0.846	0.020
Break at 2020	S3	3	0.745	0.019
2019 prior	S5	NA	0.500	0.025
South prior	S6	NA	0.578	0.114

Table 2. Base and sensitivity results for the three runs retained for assessment for JABBA.

Parameter	***Base 1***	***Sensitivity 1***	***Sensitivity 2***
K (1000)	136 (111-175)	102 (73-120)	108 (72-157)
r	0.057 (0.039-0.082)	0.107 (0.08-0.156)	0.105 (0.073-0.159)
psi	0.975 (0.765-1.131)	0.911 (0.615-1.124)	0.974 (0.73-1.136)
sigma.proc	0.05 (0.05-0.05)	0.05 (0.05-0.05)	0.05 (0.05-0.05)
m	5.037 (5.037-5.037)	2.475 (2.475-2.475)	2.693 (2.693-2.693)
H_{MSY}	0.011 (0.008-0.016)	0.043 (0.032-0.063)	0.039 (0.027-0.059)
SB_{MSY} (1000)	91 (74-117)	55 (40-65)	60 (40-88)
MSY	1053.512 (702.338-1539.693)	2384.107 (1757.752-3256.158)	2336.196 (1670.308-3511.202)
B_{MSY}	0.67 (0.67-0.67)	0.541 (0.541-0.541)	0.557 (0.557-0.557)
P1950	0.974 (0.766-1.129)	0.911 (0.615-1.123)	0.973 (0.729-1.132)
P2024	0.438 (0.305-0.587)	0.503 (0.355-0.684)	0.503 (0.361-0.694)
B_B_{MSY}.cur	0.654 (0.456-0.876)	0.93 (0.657-1.265)	0.903 (0.647-1.247)
H_H_{MSY}.cur	1.729 (0.974-3.116)	0.534 (0.306-0.969)	0.564 (0.28-0.994)

Table 3. Individual time series of SSF/SSF_{MSY} and F/F_{MSY} for the Stock Synthesis model using the Monte-Carlo multivariate lognormal (MVLN) approach with 15,000 iterations and of B/B_{MSY} and H/H_{MSY} for the JABBA models (5,000 MCMC samples from each of the JABBA models). Each model output contains the median (Med) and the 95% confidence interval or credibility interval (lower confidence interval, LCI; upper confidence interval, UCI).

Scenario	JABBA_1-B						JABBA_1-S						JABBA_2-S						SS_Scn1					
Item	B/Bmsy			H/Hmsy			B/Bmsy			H/Hmsy			B/Bmsy			H/Hmsy			SSF/SSFmsy			F/Fmsy		
	Med	LCI	UCI	Med	LCI	UCI	Med	LCI	UCI	Med	LCI	UCI	Med	LCI	UCI	Med	LCI	UCI	Med	LCI	UCI	Med	LCI	UCI
1950	1.45	1.16	1.66	0.43	0.28	0.66	1.69	1.16	2.04	0.17	0.10	0.30	1.74	1.33	1.99	0.16	0.10	0.25						
1951	1.45	1.16	1.65	0.29	0.19	0.45	1.70	1.19	2.01	0.11	0.07	0.20	1.74	1.36	1.97	0.11	0.07	0.16	2.19	2.00	2.39	0.12	0.10	0.14
1952	1.44	1.17	1.63	0.29	0.19	0.45	1.70	1.22	1.98	0.11	0.07	0.19	1.74	1.39	1.95	0.11	0.07	0.16	2.18	2.00	2.38	0.12	0.10	0.14
1953	1.44	1.17	1.62	0.36	0.23	0.55	1.71	1.25	1.96	0.14	0.09	0.24	1.73	1.41	1.93	0.14	0.08	0.20	2.18	2.00	2.38	0.15	0.12	0.18
1954	1.44	1.18	1.62	0.09	0.06	0.14	1.72	1.28	1.95	0.03	0.02	0.06	1.74	1.44	1.92	0.03	0.02	0.05	2.18	2.00	2.38	0.04	0.03	0.04
1955	1.44	1.18	1.61	0.19	0.12	0.29	1.73	1.31	1.94	0.07	0.04	0.12	1.74	1.46	1.91	0.07	0.04	0.10	2.18	2.00	2.38	0.08	0.06	0.09
1956	1.44	1.19	1.60	0.11	0.07	0.17	1.74	1.34	1.93	0.04	0.03	0.07	1.74	1.48	1.90	0.04	0.03	0.06	2.18	2.00	2.38	0.05	0.04	0.05
1957	1.44	1.20	1.59	0.30	0.20	0.47	1.74	1.36	1.92	0.11	0.07	0.19	1.73	1.49	1.89	0.11	0.07	0.17	2.18	2.00	2.37	0.12	0.10	0.15
1958	1.44	1.20	1.58	0.25	0.16	0.39	1.74	1.39	1.91	0.09	0.06	0.15	1.73	1.51	1.87	0.09	0.06	0.14	2.18	2.00	2.37	0.10	0.09	0.12
1959	1.43	1.21	1.57	0.33	0.21	0.51	1.75	1.40	1.90	0.12	0.08	0.20	1.73	1.53	1.86	0.12	0.08	0.18	2.17	2.00	2.36	0.13	0.11	0.16
1960	1.43	1.22	1.57	0.22	0.14	0.34	1.75	1.43	1.89	0.08	0.05	0.13	1.73	1.54	1.86	0.08	0.05	0.12	2.17	2.01	2.36	0.09	0.07	0.11
1961	1.42	1.22	1.56	0.53	0.35	0.82	1.74	1.44	1.88	0.19	0.13	0.31	1.72	1.55	1.84	0.20	0.12	0.29	2.17	2.01	2.35	0.22	0.18	0.26
1962	1.42	1.22	1.55	0.73	0.48	1.13	1.73	1.45	1.86	0.26	0.18	0.42	1.71	1.56	1.83	0.27	0.17	0.40	2.17	2.01	2.34	0.30	0.25	0.36
1963	1.41	1.23	1.54	0.32	0.21	0.49	1.73	1.46	1.86	0.12	0.08	0.18	1.71	1.57	1.82	0.12	0.07	0.18	2.17	2.01	2.33	0.13	0.11	0.16
1964	1.41	1.23	1.53	0.60	0.39	0.93	1.73	1.47	1.85	0.22	0.14	0.34	1.70	1.57	1.82	0.22	0.14	0.33	2.16	2.02	2.33	0.24	0.20	0.29
1965	1.40	1.23	1.53	0.48	0.31	0.74	1.73	1.48	1.84	0.17	0.12	0.27	1.70	1.58	1.81	0.18	0.11	0.26	2.16	2.02	2.32	0.19	0.16	0.23
1966	1.39	1.23	1.51	0.96	0.62	1.47	1.71	1.48	1.82	0.34	0.23	0.53	1.68	1.57	1.79	0.35	0.22	0.52	2.16	2.02	2.31	0.39	0.32	0.46
1967	1.38	1.22	1.50	0.87	0.57	1.34	1.70	1.48	1.81	0.31	0.21	0.48	1.67	1.56	1.78	0.32	0.20	0.48	2.15	2.02	2.30	0.35	0.29	0.42
1968	1.37	1.22	1.49	1.14	0.75	1.76	1.68	1.47	1.79	0.41	0.28	0.63	1.65	1.55	1.77	0.42	0.26	0.63	2.14	2.01	2.29	0.46	0.38	0.56
1969	1.36	1.21	1.47	1.15	0.74	1.77	1.66	1.46	1.77	0.41	0.28	0.64	1.64	1.54	1.75	0.43	0.26	0.63	2.14	2.01	2.28	0.46	0.38	0.56
1970	1.35	1.21	1.46	1.05	0.68	1.62	1.65	1.45	1.76	0.38	0.25	0.58	1.63	1.54	1.74	0.39	0.24	0.58	2.13	2.00	2.26	0.42	0.35	0.51
1971	1.33	1.20	1.44	1.68	1.08	2.58	1.62	1.43	1.74	0.60	0.41	0.93	1.60	1.51	1.72	0.62	0.38	0.92	2.12	1.99	2.25	0.67	0.56	0.81
1972	1.31	1.18	1.42	1.60	1.04	2.49	1.60	1.41	1.72	0.57	0.38	0.88	1.58	1.49	1.70	0.59	0.36	0.88	2.10	1.98	2.23	0.64	0.53	0.77
1973	1.29	1.17	1.40	1.55	1.00	2.40	1.59	1.39	1.70	0.55	0.37	0.86	1.56	1.47	1.69	0.57	0.34	0.86	2.09	1.97	2.21	0.61	0.51	0.74
1974	1.28	1.16	1.39	1.67	1.08	2.60	1.57	1.38	1.68	0.60	0.41	0.93	1.54	1.45	1.68	0.62	0.38	0.93	2.07	1.96	2.20	0.66	0.54	0.80
1975	1.27	1.16	1.37	1.31	0.84	2.05	1.56	1.37	1.68	0.47	0.31	0.72	1.54	1.44	1.67	0.48	0.29	0.73	2.06	1.95	2.18	0.51	0.42	0.62
1976	1.25	1.14	1.36	1.44	0.92	2.24	1.55	1.35	1.67	0.51	0.34	0.78	1.53	1.43	1.67	0.53	0.32	0.81	2.05	1.94	2.16	0.56	0.46	0.68
1977	1.24	1.13	1.35	1.57	1.01	2.46	1.53	1.34	1.65	0.56	0.38	0.86	1.51	1.41	1.66	0.58	0.35	0.88	2.03	1.92	2.15	0.61	0.49	0.76
1978	1.23	1.12	1.34	1.67	1.07	2.60	1.52	1.32	1.64	0.59	0.39	0.91	1.50	1.39	1.64	0.61	0.36	0.92	2.01	1.91	2.13	0.66	0.52	0.83
1979	1.21	1.10	1.32	1.67	1.06	2.60	1.51	1.31	1.63	0.59	0.40	0.91	1.49	1.37	1.64	0.61	0.37	0.92	2.00	1.89	2.11	0.67	0.53	0.84
1980	1.20	1.09	1.32	1.36	0.85	2.14	1.50	1.30	1.63	0.48	0.32	0.74	1.48	1.37	1.63	0.49	0.29	0.76	1.98	1.88	2.09	0.55	0.44	0.69
1981	1.19	1.08	1.30	1.82	1.15	2.88	1.49	1.29	1.61	0.64	0.42	0.98	1.47	1.35	1.63	0.66	0.39	1.01	1.96	1.86	2.07	0.74	0.59	0.93
1982	1.17	1.06	1.28	2.07	1.31	3.28	1.47	1.27	1.60	0.72	0.48	1.13	1.45	1.33	1.61	0.75	0.44	1.17	1.94	1.84	2.06	0.85	0.68	1.07
1983	1.16	1.04	1.27	1.87	1.18	2.99	1.46	1.25	1.58	0.65	0.43	1.02	1.44	1.31	1.61	0.68	0.40	1.05	1.93	1.82	2.04	0.77	0.62	0.97
1984	1.13	1.02	1.25	2.37	1.48	3.72	1.44	1.23	1.56	0.82	0.54	1.31	1.42	1.28	1.59	0.86	0.50	1.33	1.90	1.79	2.03	0.98	0.78	1.22
1985	1.10	0.99	1.22	3.19	2.01	5.12	1.40	1.18	1.52	1.10	0.75	1.73	1.38	1.23	1.57	1.13	0.66	1.81	1.87	1.75	2.01	1.30	1.04	1.63
1986	1.07	0.95	1.20	3.20	2.02	5.13	1.37	1.14	1.50	1.10	0.72	1.74	1.35	1.19	1.54	1.15	0.67	1.81	1.84	1.71	2.00	1.28	1.02	1.61
1987	1.05	0.92	1.18	2.90	1.80	4.68	1.34	1.12	1.48	0.99	0.66	1.57	1.32	1.15	1.53	1.03	0.60	1.65	1.81	1.66	1.98	1.14	0.90	1.44
1988	1.03	0.90	1.17	2.67	1.63	4.31	1.32	1.09	1.46	0.92	0.60	1.48	1.31	1.13	1.52	0.95	0.53	1.52	1.78	1.62	1.96	1.05	0.83	1.32
1989	1.01	0.86	1.17	2.02	1.22	3.32	1.30	1.08	1.49	0.69	0.45	1.12	1.28	1.09	1.54	0.71	0.40	1.16	1.75	1.58	1.94	0.80	0.63	1.01
1990	1.00	0.84	1.17	2.27	1.38	3.70	1.28	1.05	1.51	0.77	0.49	1.25	1.26	1.06	1.53	0.80	0.44	1.28	1.72	1.55	1.91	0.92	0.73	1.16
1991	1.00	0.82	1.18	2.20	1.34	3.58	1.28	1.05	1.53	0.75	0.47	1.21	1.26	1.05	1.55	0.78	0.42	1.26	1.69	1.51	1.89	0.93	0.73	1.18
1992	0.98	0.80	1.17	3.09	1.90	5.08	1.26	1.02	1.52	1.05	0.67	1.70	1.23	1.02	1.53	1.11	0.60	1.79	1.65	1.47	1.86	1.36	1.06	1.75
1993	0.96	0.77	1.16	4.00	2.48	6.51	1.24	0.99	1.50	1.36	0.86	2.20	1.21	0.99	1.52	1.42	0.78	2.27	1.61	1.43	1.82	1.75	1.35	2.27
1994	0.95	0.76	1.15	3.63	2.21	5.98	1.21	0.97	1.50	1.23	0.78	2.03	1.19	0.96	1.52	1.30	0.70	2.06	1.58	1.39	1.79	1.58	1.21	2.06
1995	0.92	0.73	1.13	5.33	3.24	8.71	1.17	0.93	1.45	1.81	1.14	2.95	1.15	0.92	1.47	1.92	1.02	3.03	1.53	1.34	1.75	2.37	1.81	3.10
1996	0.89	0.70	1.10	5.43	3.36	9.05	1.12	0.88	1.41	1.88	1.18	3.08	1.10	0.87	1.43	1.98	1.04	3.15	1.49	1.30	1.70	2.43	1.84	3.20
1997	0.88	0.70	1.09	3.76	2.30	6.28	1.12	0.87	1.40	1.31	0.82	2.14	1.09	0.86	1.41	1.37	0.73	2.23	1.44	1.25	1.67	1.64	1.24	2.18
1998	0.88	0.69	1.08	4.15	2.52	6.81	1.11	0.86	1.40	1.43	0.89	2.35	1.09	0.85	1.41	1.52	0.79	2.43	1.40	1.21	1.62	1.84	1.38	2.45
1999	0.91	0.71	1.13	3.09	1.87	5.10	1.15	0.90	1.45	1.06	0.66	1.75	1.13	0.89	1.46	1.13	0.60	1.81	1.36	1.17	1.58	1.47	1.10	1.96
2000	0.96	0.74	1.18	2.70	1.64	4.44	1.22	0.95	1.54	0.93	0.58	1.54	1.19	0.94	1.53	0.98	0.51	1.60	1.32	1.13	1.54	1.36	1.01	1.82
2001	1.00	0.77	1.24	2.65	1.60	4.40	1.27	1.00	1.61	0.91	0.57	1.50	1.25	0.98	1.60	0.96	0.51	1.55	1.28	1.09	1.50	1.37	1.02	1.84
2002	1.03	0.80	1.28	3.26	1.97	5.35	1.32	1.02	1.66	1.11	0.69	1.81	1.29	1.02	1.65	1.17	0.63	1.89	1.24	1.05	1.46	1.68	1.24	2.26
2003	1.06	0.81	1.31	3.67	2.27	6.13	1.35	1.04	1.70	1.25	0.79	2.08	1.32	1.04	1.68	1.32	0.71	2.12	1.20	1.01	1.42	1.89	1.40	2.56
2004	1.08	0.83	1.33	3.56	2.18	5.97	1.38	1.07	1.74	1.22	0.75	2.04	1.34	1.06	1.73	1.30	0.69	2.08	1.16	0.97	1.38	1.87	1.38	2.54
2005	1.11	0.85	1.38	3.39	2.04	5.70	1.42	1.10	1.79	1.15	0.72	1.90	1.38	1.08	1.77	1.21	0.66	1.95	1.13	0.94	1.35	1.73	1.27	2.36
2006	1.14	0.87	1.41	3.18	1.95	5.41	1.46	1.13	1.85	1.09	0.67	1.80	1.42	1.12	1.84	1.15	0.62	1.84	1.10	0.91	1.33	1.63	1.19	2.22
2007	1.13	0.86	1.41	3.46	2.10	5.85	1.45	1.11	1.82	1.19	0.73	1.93	1.42	1.10	1.83	1.26	0.66	2.02	1.07	0.89	1.30	1.78	1.30	2.43
2008	1.12	0.85	1.38	3.21	1.93	5.42	1.43	1.09	1.81	1.08	0.68	1.80	1.40	1.09	1.81	1.16	0.61	1.88	1.05	0.87	1.28	1.67	1.21	2.29
2009	1.08	0.82	1.35	3.90	2.33	6.48	1.38	1.05	1.73	1.32	0.81	2.20	1.35	1.04	1.74	1.41	0.74	2.28	1.04	0.85	1.27	2.09	1.51	2.89
2010	1.04	0.79	1.30	4.24	2.56	7.25	1.32	1.01	1.67	1.44	0.91	2.38	1.30	1.00	1.68	1.53	0.79	2.50	1.02	0.83	1.26	2.23	1.61	3.10
2011	1.01	0.77	1.27	3.44	2.06	5.77	1.29	0.99	1.64	1.17	0.73	1.97	1.27	0.98	1.65	1.24	0.66	2.04	1.02	0.82	1.26	1.77	1.27	2.47
2012	0.98	0.74	1.23	4.18	2.52	7.07	1.25	0.95	1.59	1.44	0.89	2.36	1.22	0.94	1.59	1.52	0.79	2.47	1.02	0.82	1.27	2.19	1.56	3.07
2013	0.96	0.72	1.21	3.52	2.10	6.02	1.22	0.93	1.56	1.22	0.76	2.04	1.20	0.92	1.58	1.29	0.66	2.12	1.02	0.82	1.28	1.84	1.31	2.61
2014	0.95	0.71	1.20	3.47	2.08	5.93	1.22	0.92	1.57	1.18	0.73	2.00	1.19	0.91	1.55	1.25	0.65	2.07	1.02	0.81	1.29	1.82	1.29	2.59
2015	0.94	0.70	1.19	3.32	1.97	5.65	1.21	0.91	1.56	1.13	0.69	1.88	1.18	0.90	1.55	1.20	0.63	1.96	1.03	0.81	1.30	1.71	1.20	2.44
2016	0.91	0.67	1.16	3.42	2.04	5.80	1.18	0.87	1.53	1.16	0.72	2.00	1.15	0.87	1.52	1.24	0.64	2.06	1.03	0.81	1.30	1.68	1.18	2.41
2017	0.87	0.64	1.11	3.31	1.97	5.65	1.13	0.83	1.48	1.12	0.69	1.94	1.10	0.82	1.48	1.19	0.61	2.01	1.03	0.81	1.31	1.59	1.11	2.28
2018	0.81	0.59	1.04	2.69	1.58	4.61	1.06	0.78	1.41	0.91	0.55	1.56	1.04	0.77	1.40	0.96	0.48	1.64	1.02	0.80	1.31	1.28	0.89	1.84
2019	0.76	0.55	0.97	2.28	1.32	3.96	1.00	0.73	1.33	0.75	0.46	1.35	0.98	0.72	1.32	0.81	0.40	1.36	1.02	0.80	1.31	1.03	0.71	1.49
2020	0.70	0.50	0.91	2.27	1.30	4.00	0.94	0.69	1.26	0.75	0.45	1.32	0.92	0.67	1.26	0.80	0.40	1.36	1.02	0.79	1.31	0.98	0.67	1.43
2021	0.68	0.49	0.88	1.80	1.04	3.21	0.93	0.67	1.25	0.59	0.35	1.05	0.90	0.66	1.24	0.63	0.31	1.09	1.02	0.79	1.31	0.78	0.53	1.14
2022	0.67	0.47	0.88	1.36	0.78	2.40	0.93	0.66	1.25	0.44	0.26	0.78	0.90	0.66	1.25	0.46	0.23	0.80	1.02	0.79	1.31	0.60	0.41	0.88
2023	0.65	0.46	0.87	1.99	1.14	3.56	0.93	0.66	1.27	0.62	0.36	1.11	0.91	0.65	1.26	0.66	0.32	1.16	1.01	0.79	1.30	0.87	0.60	1.27
2024	0.65	0.45	0.87	1.73	0.98	3.12	0.95	0.67	1.30	0.53	0.30	0.96	0.93	0.66	1.28	0.56	0.27	0.99	1.01	0.79	1.30	0.74	0.50	1.08

Table 4. Joint time series between the Stock Synthesis model and the JABBA models. SSF/SSF_{MSY} or B/B_{MSY} and F/F_{MSY} or H/H_{MSY} were produced from 15,000 iterations using the MVLN approach for Stock Synthesis and 15,000 iterations of MCMC samples from three JABBA models. Joint time series and each model platform output contain the median and the 95% confidence interval or credibility interval (LCI; UCI).

Scenario	Joint run						Stock Synthesis						JABBA					
Item	SSF/SSFmsy or B/Bmsy			F/Fmsy or H/Hmsy			SSF/SSFmsy			F/Fmsy			B/Bmsy			H/Hmsy		
	Median	95%LCI	95%UCI	Median	95%LCI	95%UCI	Median	95%LCI	95%UCI	Median	95%LCI	95%UCI	Median	95%LCI	95%UCI	Median	95%LCI	95%UCI
1950													1.60	1.18	2.00	0.19	0.10	0.60
1951	1.99	1.24	2.36	0.12	0.08	0.37	2.19	2.00	2.39	0.12	0.10	0.14	1.60	1.20	1.97	0.13	0.07	0.40
1952	1.98	1.26	2.36	0.12	0.08	0.37	2.18	2.00	2.38	0.12	0.10	0.14	1.60	1.21	1.95	0.13	0.07	0.41
1953	1.97	1.27	2.35	0.15	0.10	0.46	2.18	2.00	2.38	0.15	0.12	0.18	1.60	1.22	1.93	0.16	0.09	0.50
1954	1.96	1.28	2.35	0.04	0.02	0.12	2.18	2.00	2.38	0.04	0.03	0.04	1.61	1.24	1.92	0.04	0.02	0.13
1955	1.95	1.29	2.35	0.08	0.05	0.24	2.18	2.00	2.38	0.08	0.06	0.09	1.62	1.25	1.91	0.08	0.05	0.26
1956	1.95	1.31	2.35	0.05	0.03	0.14	2.18	2.00	2.38	0.05	0.04	0.05	1.63	1.26	1.91	0.05	0.03	0.15
1957	1.94	1.31	2.34	0.12	0.08	0.38	2.18	2.00	2.37	0.12	0.10	0.15	1.64	1.27	1.89	0.13	0.07	0.41
1958	1.94	1.32	2.34	0.10	0.07	0.32	2.18	2.00	2.37	0.10	0.09	0.12	1.64	1.27	1.89	0.11	0.06	0.35
1959	1.93	1.32	2.34	0.14	0.09	0.42	2.17	2.00	2.36	0.13	0.11	0.16	1.65	1.28	1.88	0.14	0.08	0.45
1960	1.93	1.32	2.33	0.09	0.06	0.27	2.17	2.01	2.36	0.09	0.07	0.11	1.66	1.28	1.87	0.09	0.05	0.30
1961	1.93	1.32	2.32	0.22	0.14	0.67	2.17	2.01	2.35	0.22	0.18	0.26	1.66	1.28	1.86	0.22	0.13	0.73
1962	1.92	1.32	2.32	0.30	0.20	0.92	2.17	2.01	2.34	0.30	0.25	0.36	1.65	1.28	1.84	0.31	0.18	1.01
1963	1.92	1.32	2.31	0.13	0.09	0.40	2.17	2.01	2.33	0.13	0.11	0.16	1.66	1.28	1.84	0.14	0.08	0.44
1964	1.91	1.32	2.30	0.24	0.16	0.76	2.16	2.02	2.33	0.24	0.20	0.29	1.65	1.28	1.83	0.25	0.15	0.83
1965	1.91	1.32	2.30	0.20	0.13	0.60	2.16	2.02	2.32	0.19	0.16	0.23	1.65	1.28	1.82	0.20	0.12	0.66
1966	1.91	1.31	2.29	0.39	0.25	1.20	2.16	2.02	2.31	0.39	0.32	0.46	1.64	1.28	1.80	0.40	0.24	1.31
1967	1.91	1.30	2.28	0.35	0.23	1.09	2.15	2.02	2.30	0.35	0.29	0.42	1.63	1.27	1.79	0.36	0.21	1.19
1968	1.89	1.29	2.27	0.47	0.31	1.43	2.14	2.01	2.29	0.46	0.38	0.56	1.62	1.26	1.77	0.48	0.28	1.57
1969	1.88	1.28	2.25	0.47	0.30	1.44	2.14	2.01	2.28	0.46	0.38	0.56	1.61	1.26	1.76	0.48	0.28	1.59
1970	1.89	1.27	2.24	0.42	0.28	1.31	2.13	2.00	2.26	0.42	0.35	0.51	1.60	1.25	1.75	0.44	0.26	1.45
1971	1.85	1.25	2.23	0.68	0.45	2.11	2.12	1.99	2.25	0.67	0.56	0.81	1.57	1.23	1.72	0.70	0.41	2.30
1972	1.85	1.24	2.21	0.65	0.42	2.02	2.10	1.98	2.23	0.64	0.53	0.77	1.55	1.22	1.70	0.67	0.39	2.22
1973	1.84	1.22	2.20	0.62	0.41	1.94	2.09	1.97	2.21	0.61	0.51	0.74	1.53	1.20	1.69	0.65	0.38	2.13
1974	1.83	1.21	2.18	0.67	0.44	2.11	2.07	1.96	2.20	0.66	0.54	0.80	1.51	1.19	1.67	0.70	0.41	2.31
1975	1.82	1.20	2.16	0.52	0.34	1.65	2.06	1.95	2.18	0.51	0.42	0.62	1.50	1.18	1.66	0.55	0.32	1.81
1976	1.81	1.19	2.15	0.57	0.38	1.83	2.05	1.94	2.16	0.56	0.46	0.68	1.49	1.17	1.65	0.60	0.35	2.00
1977	1.80	1.17	2.13	0.62	0.41	1.98	2.03	1.92	2.15	0.61	0.49	0.76	1.48	1.15	1.64	0.66	0.38	2.17
1978	1.78	1.16	2.11	0.67	0.43	2.11	2.01	1.91	2.13	0.66	0.52	0.83	1.47	1.14	1.63	0.70	0.40	2.33
1979	1.78	1.14	2.09	0.68	0.43	2.11	2.00	1.89	2.11	0.67	0.53	0.84	1.45	1.12	1.62	0.70	0.40	2.32
1980	1.77	1.14	2.07	0.55	0.35	1.73	1.98	1.88	2.09	0.55	0.44	0.69	1.45	1.12	1.61	0.57	0.32	1.90
1981	1.76	1.12	2.06	0.74	0.46	2.31	1.96	1.86	2.07	0.74	0.59	0.93	1.43	1.10	1.60	0.75	0.42	2.54
1982	1.75	1.10	2.04	0.85	0.52	2.64	1.94	1.84	2.06	0.85	0.68	1.07	1.41	1.08	1.59	0.86	0.48	2.92
1983	1.72	1.09	2.02	0.77	0.47	2.40	1.93	1.82	2.04	0.77	0.62	0.97	1.40	1.07	1.58	0.77	0.44	2.65
1984	1.70	1.06	2.01	0.98	0.60	3.02	1.90	1.79	2.03	0.98	0.78	1.22	1.38	1.04	1.56	0.97	0.54	3.31
1985	1.66	1.03	1.99	1.30	0.80	4.11	1.87	1.75	2.01	1.30	1.04	1.63	1.34	1.01	1.53	1.31	0.74	4.48
1986	1.62	1.00	1.97	1.29	0.79	4.14	1.84	1.71	2.00	1.28	1.02	1.61	1.30	0.98	1.50	1.32	0.73	4.51
1987	1.59	0.97	1.95	1.15	0.71	3.73	1.81	1.66	1.98	1.14	0.90	1.44	1.27	0.95	1.49	1.19	0.65	4.13
1988	1.56	0.95	1.93	1.06	0.64	3.45	1.78	1.62	1.96	1.05	0.83	1.32	1.25	0.92	1.47	1.10	0.59	3.81
1989	1.55	0.93	1.91	0.81	0.49	2.63	1.75	1.58	1.94	0.80	0.63	1.01	1.22	0.90	1.49	0.83	0.44	2.90
1990	1.53	0.91	1.88	0.92	0.54	2.94	1.72	1.55	1.91	0.92	0.73	1.16	1.20	0.88	1.50	0.93	0.49	3.26
1991	1.51	0.90	1.86	0.93	0.52	2.86	1.69	1.51	1.89	0.93	0.73	1.18	1.19	0.87	1.51	0.91	0.47	3.17
1992	1.48	0.88	1.82	1.35	0.74	4.04	1.65	1.47	1.86	1.36	1.06	1.75	1.17	0.84	1.50	1.28	0.68	4.50
1993	1.45	0.86	1.79	1.73	0.95	5.20	1.61	1.43	1.82	1.75	1.35	2.27	1.14	0.82	1.48	1.66	0.86	5.74
1994	1.42	0.84	1.75	1.56	0.86	4.72	1.58	1.39	1.79	1.58	1.21	2.06	1.12	0.80	1.47	1.51	0.78	5.23
1995	1.37	0.81	1.71	2.33	1.28	6.94	1.53	1.34	1.75	2.37	1.81	3.10	1.08	0.77	1.43	2.21	1.15	7.72
1996	1.32	0.78	1.67	2.40	1.29	7.15	1.49	1.30	1.70	2.43	1.84	3.20	1.04	0.74	1.39	2.30	1.17	7.90
1997	1.30	0.77	1.63	1.64	0.90	4.91	1.44	1.25	1.67	1.64	1.24	2.18	1.03	0.74	1.38	1.61	0.82	5.45
1998	1.27	0.77	1.59	1.82	0.98	5.41	1.40	1.21	1.62	1.84	1.38	2.45	1.03	0.73	1.38	1.76	0.89	6.03
1999	1.25	0.80	1.55	1.43	0.74	4.05	1.36	1.17	1.58	1.47	1.10	1.96	1.06	0.76	1.43	1.31	0.67	4.48
2000	1.25	0.84	1.53	1.31	0.64	3.54	1.32	1.13	1.54	1.36	1.01	1.82	1.12	0.79	1.50	1.14	0.58	3.92
2001	1.24	0.87	1.53	1.31	0.63	3.50	1.28	1.09	1.50	1.37	1.02	1.84	1.18	0.82	1.57	1.12	0.57	3.85
2002	1.23	0.90	1.56	1.61	0.77	4.28	1.24	1.05	1.46	1.68	1.24	2.26	1.21	0.85	1.62	1.37	0.69	4.72
2003	1.21	0.91	1.59	1.81	0.86	4.81	1.20	1.01	1.42	1.89	1.40	2.56	1.24	0.87	1.66	1.53	0.79	5.30
2004	1.20	0.93	1.63	1.79	0.84	4.68	1.16	0.97	1.38	1.87	1.38	2.54	1.27	0.89	1.70	1.50	0.76	5.19
2005	1.18	0.93	1.67	1.66	0.80	4.43	1.13	0.94	1.35	1.73	1.27	2.36	1.30	0.91	1.74	1.41	0.72	4.95
2006	1.18	0.92	1.73	1.56	0.75	4.21	1.10	0.91	1.33	1.63	1.19	2.22	1.34	0.93	1.80	1.34	0.68	4.67
2007	1.16	0.90	1.72	1.70	0.81	4.57	1.07	0.89	1.30	1.78	1.30	2.43	1.33	0.93	1.79	1.46	0.73	5.10
2008	1.14	0.88	1.69	1.59	0.75	4.21	1.05	0.87	1.28	1.67	1.21	2.29	1.31	0.92	1.77	1.34	0.68	4.72
2009	1.11	0.86	1.63	1.99	0.92	5.12	1.04	0.85	1.27	2.09	1.51	2.89	1.27	0.88	1.71	1.63	0.82	5.75
2010	1.09	0.84	1.57	2.13	1.00	5.58	1.02	0.83	1.26	2.23	1.61	3.10	1.21	0.85	1.64	1.78	0.90	6.24
2011	1.08	0.82	1.54	1.70	0.80	4.55	1.02	0.82	1.26	1.77	1.27	2.47	1.19	0.82	1.61	1.45	0.73	5.03
2012	1.06	0.81	1.49	2.09	0.98	5.48	1.02	0.82	1.27	2.19	1.56	3.07	1.14	0.79	1.55	1.77	0.89	6.15
2013	1.06	0.80	1.47	1.76	0.83	4.64	1.02	0.82	1.28	1.84	1.31	2.61	1.12	0.77	1.53	1.51	0.75	5.19
2014	1.06	0.79	1.46	1.74	0.81	4.56	1.02	0.81	1.29	1.82	1.29	2.59	1.11	0.77	1.52	1.46	0.73	5.14
2015	1.06	0.79	1.46	1.63	0.77	4.39	1.03	0.81	1.30	1.71	1.20	2.44	1.10	0.76	1.52	1.40	0.70	4.89
2016	1.04	0.77	1.42	1.63	0.79	4.56	1.03	0.81	1.30	1.68	1.18	2.41	1.07	0.73	1.49	1.46	0.72	5.08
2017	1.03	0.73	1.39	1.54	0.75	4.39	1.03	0.81	1.31	1.59	1.11	2.28	1.02	0.69	1.44	1.40	0.68	4.91
2018	1.00	0.69	1.34	1.24	0.61	3.58	1.02	0.80	1.31	1.28	0.89	1.84	0.96	0.64	1.37	1.14	0.55	4.02
2019	0.98	0.64	1.30	1.01	0.51	3.05	1.02	0.80	1.31	1.03	0.71	1.49	0.90	0.60	1.29	0.95	0.45	3.42
2020	0.95	0.59	1.28	0.97	0.49	3.04	1.02	0.79	1.31	0.98	0.67	1.43	0.85	0.56	1.23	0.95	0.45	3.45
2021	0.94	0.57	1.27	0.77	0.39	2.46	1.02	0.79	1.31	0.78	0.53	1.14	0.83	0.53	1.21	0.75	0.35	2.76
2022	0.94	0.56	1.27	0.59	0.29	1.85	1.02	0.79	1.31	0.60	0.41	0.88	0.83	0.52	1.21	0.55	0.26	2.07
2023	0.94	0.54	1.28	0.85	0.41	2.69	1.01	0.79	1.30	0.87	0.60	1.27	0.83	0.50	1.23	0.79	0.36	3.02
2024	0.95	0.54	1.29	0.72	0.35	2.37	1.01	0.79	1.30	0.74	0.50	1.08	0.84	0.50	1.26	0.68	0.31	2.69

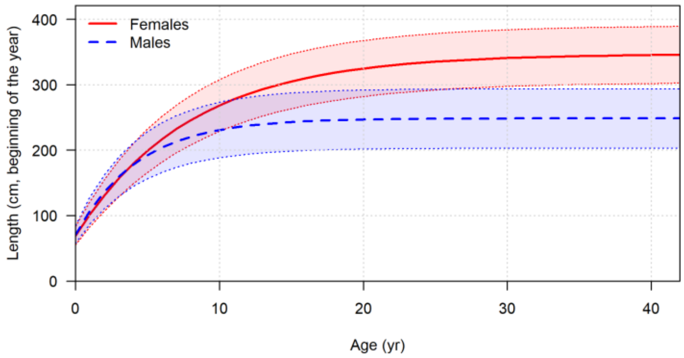

Figure 1. North Atlantic shortfin mako, biological Scenario 1, HW2_final run results. Estimated growth curves for females and males. Shaded areas represent approximate confidence intervals.

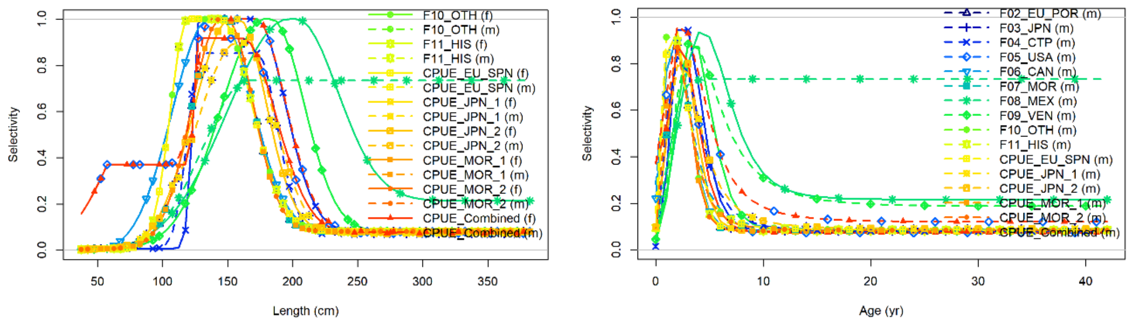

Figure 2. North Atlantic shortfin mako, biological Scenario 1, HW2_final run results. Estimated selectivity at length (left) and at age (right). For some fleets the estimated selectivities are sex specific.

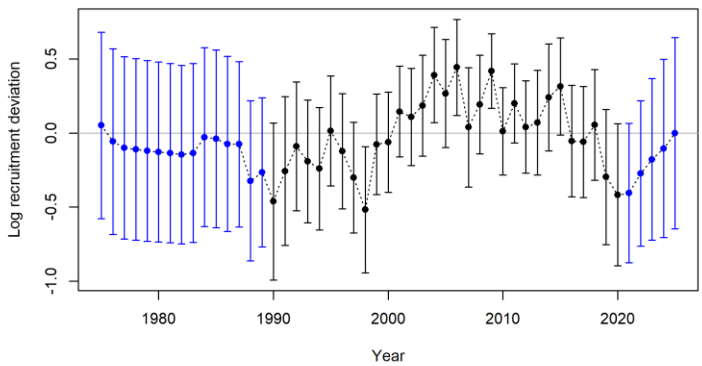

Figure 3. Recruitment deviations for the final agreed-to scenario 1.

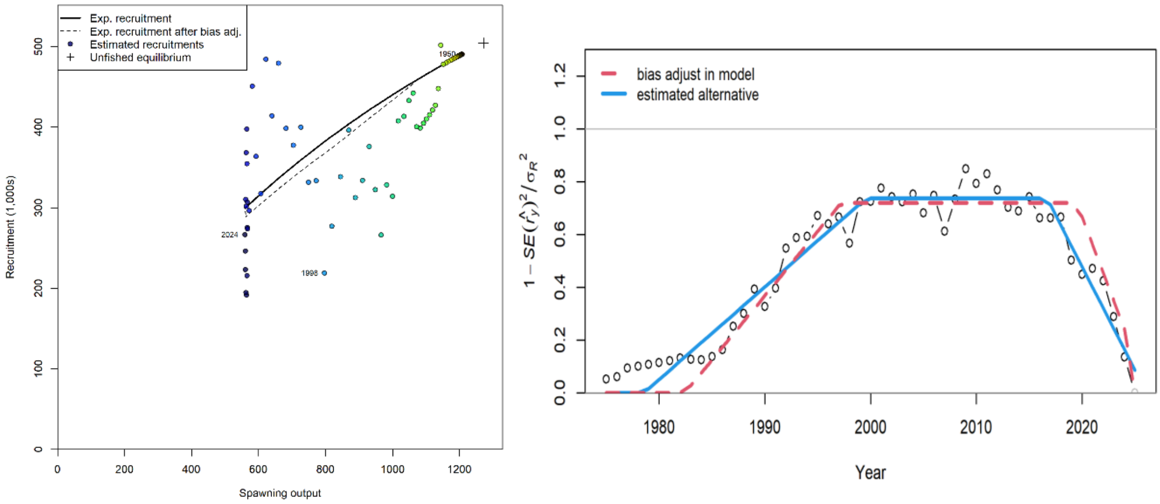

Figure 4. North Atlantic shortfin mako, biological Scenario 1, HW2_final run results. Annual recruitments and stock-recruitment curve (left) and bias adjustment used in the model (right).

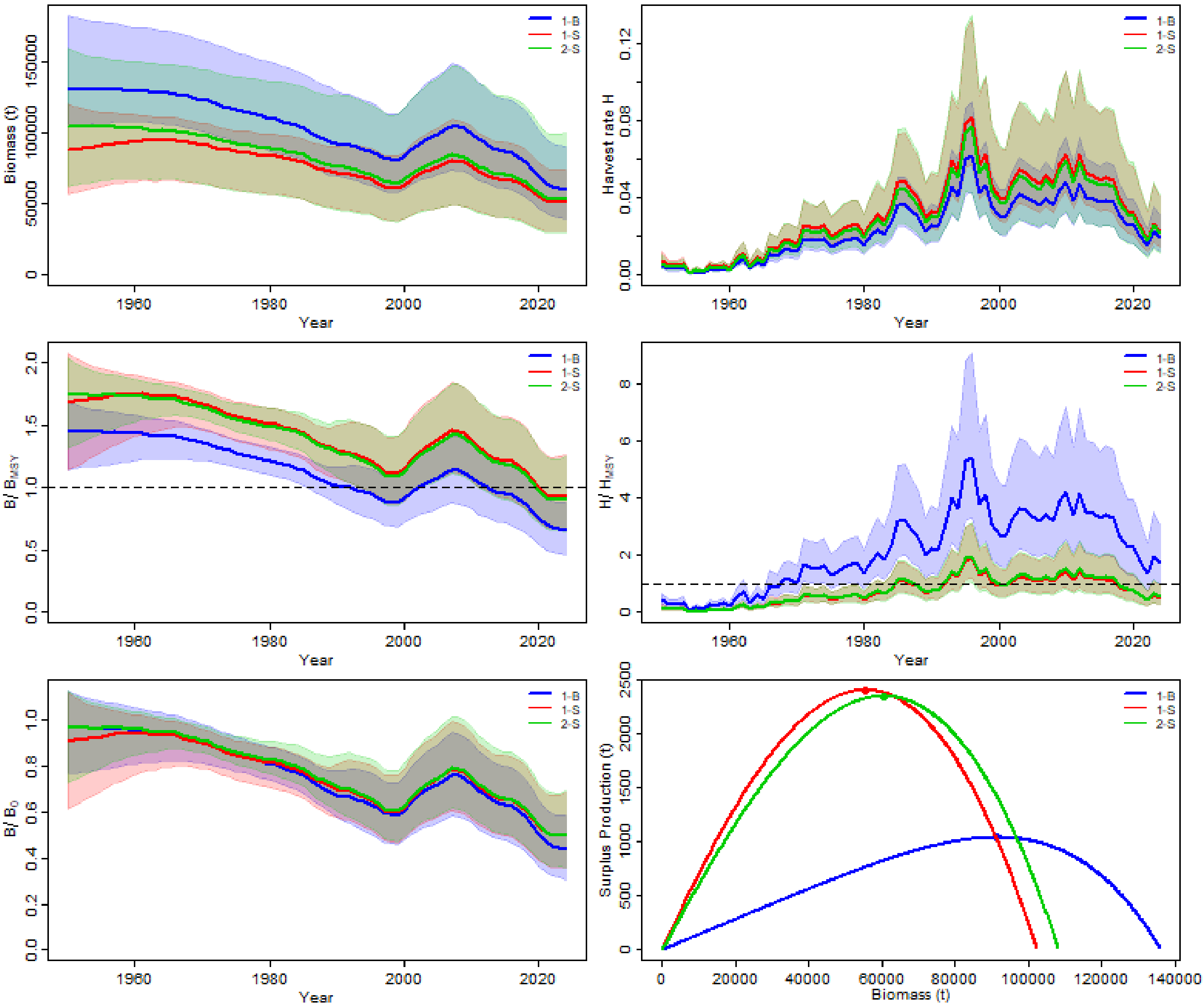

Figure 5. Results of the three JABBA run used to evaluate North Atlantic shortfin mako status.

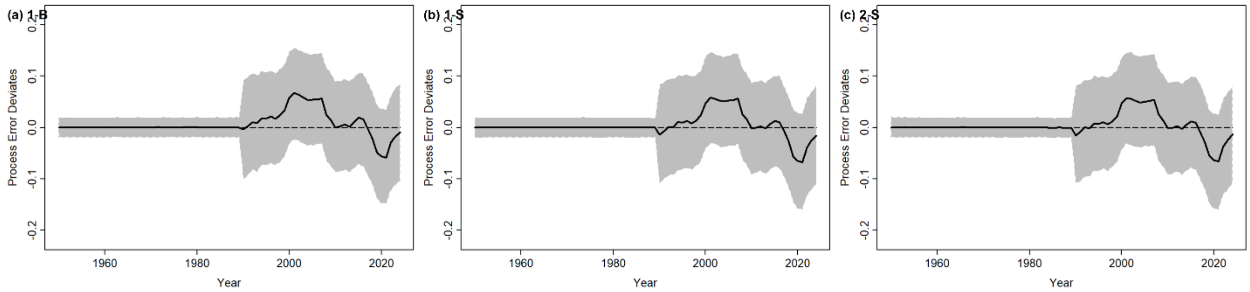

Figure 6. Process error deviations for the three main JABBA runs.

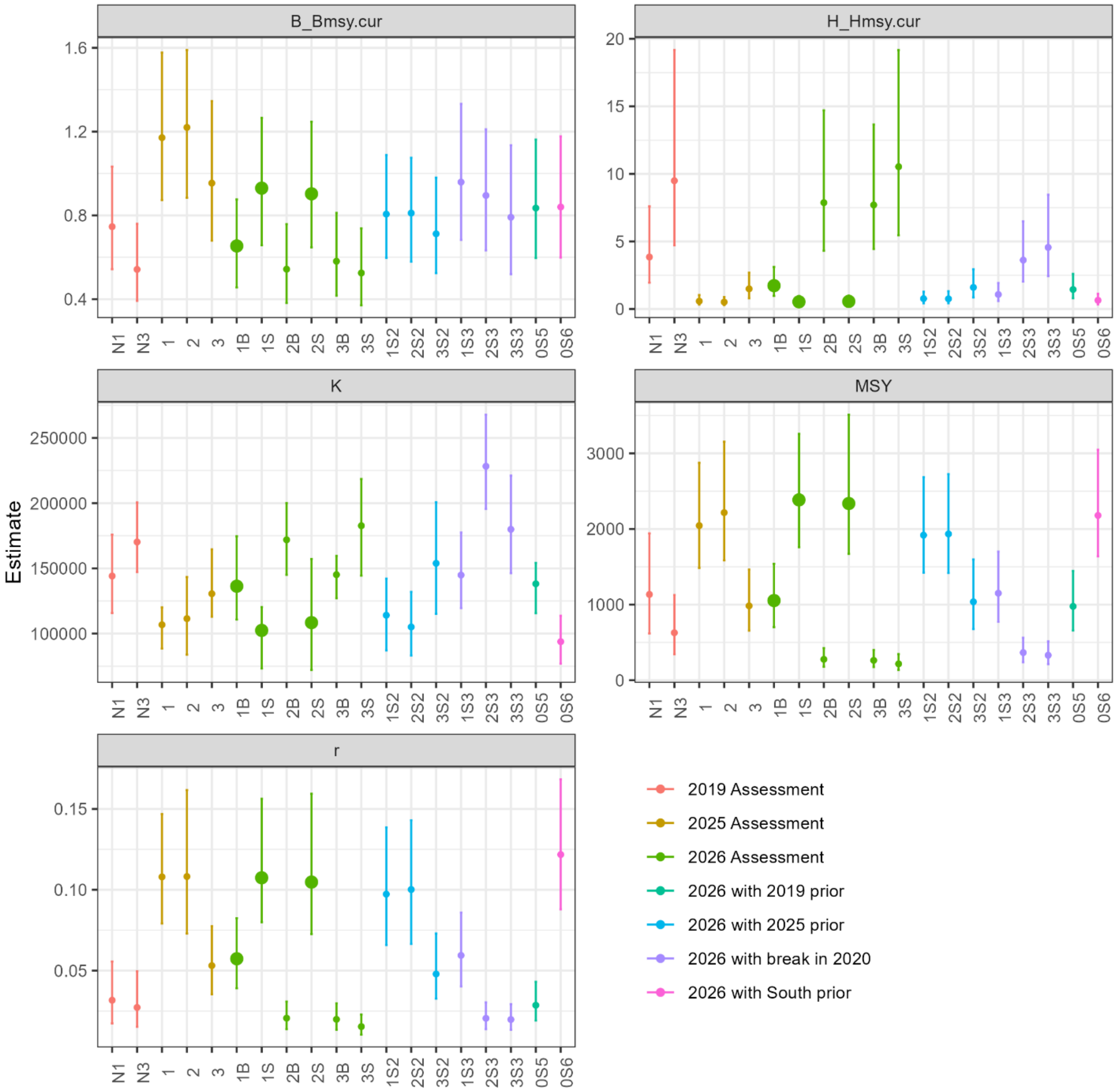

Figure 7. Means and credible intervals of parameters from the base and sensitivity runs, as well as the runs from 2019 and 2025 for comparison. Larger circles indicate the runs used for evaluating status.

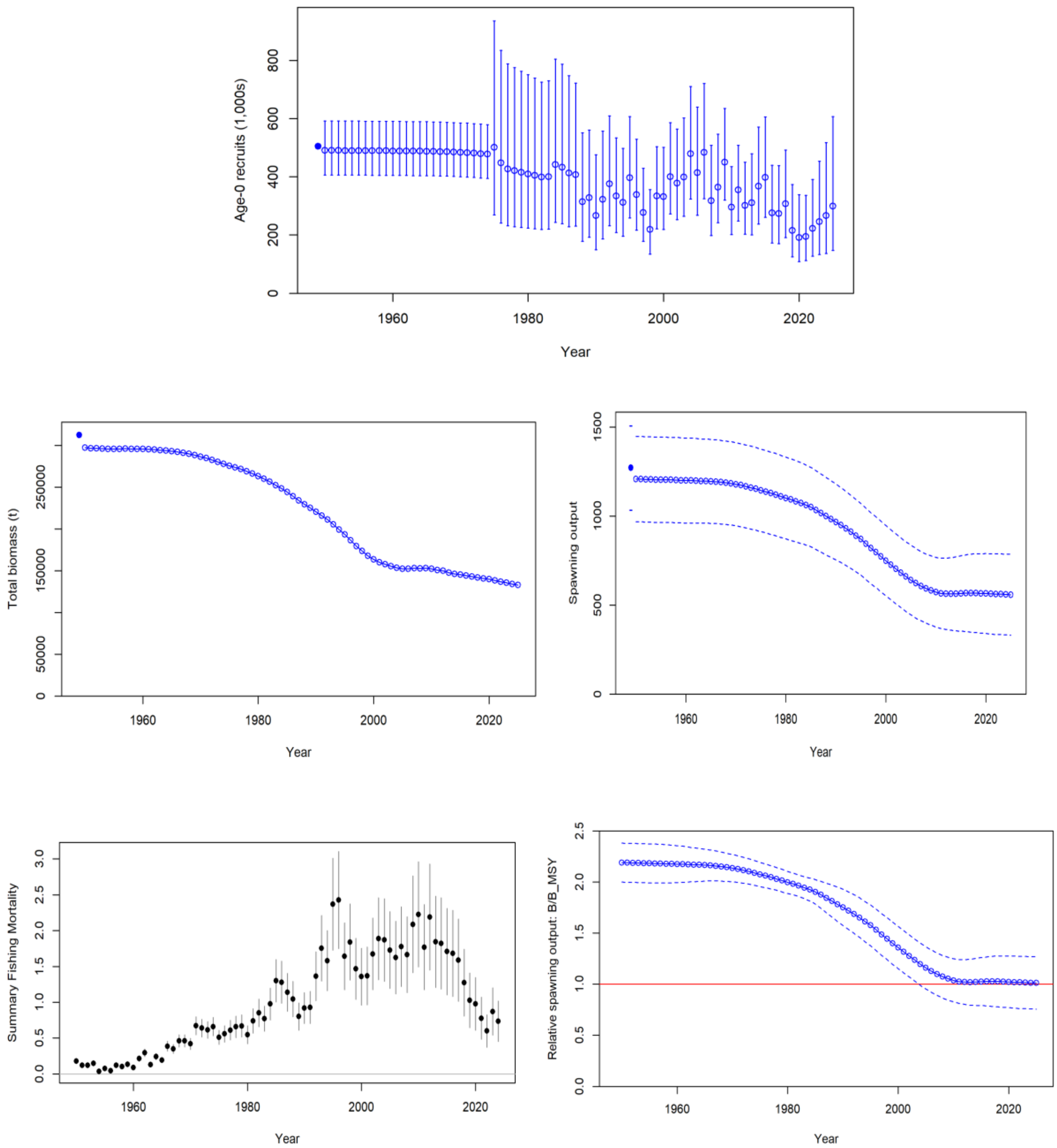

Figure 8. North Atlantic shortfin mako, SS3 results for biological scenario 1: Annual recruitment in thousands (top), total biomass in tons (middle left), spawning output measured as female stock fecundity SSF (middle right), F/F_{MSY} (bottom left), SSF/SSF_{MSY} (bottom right).

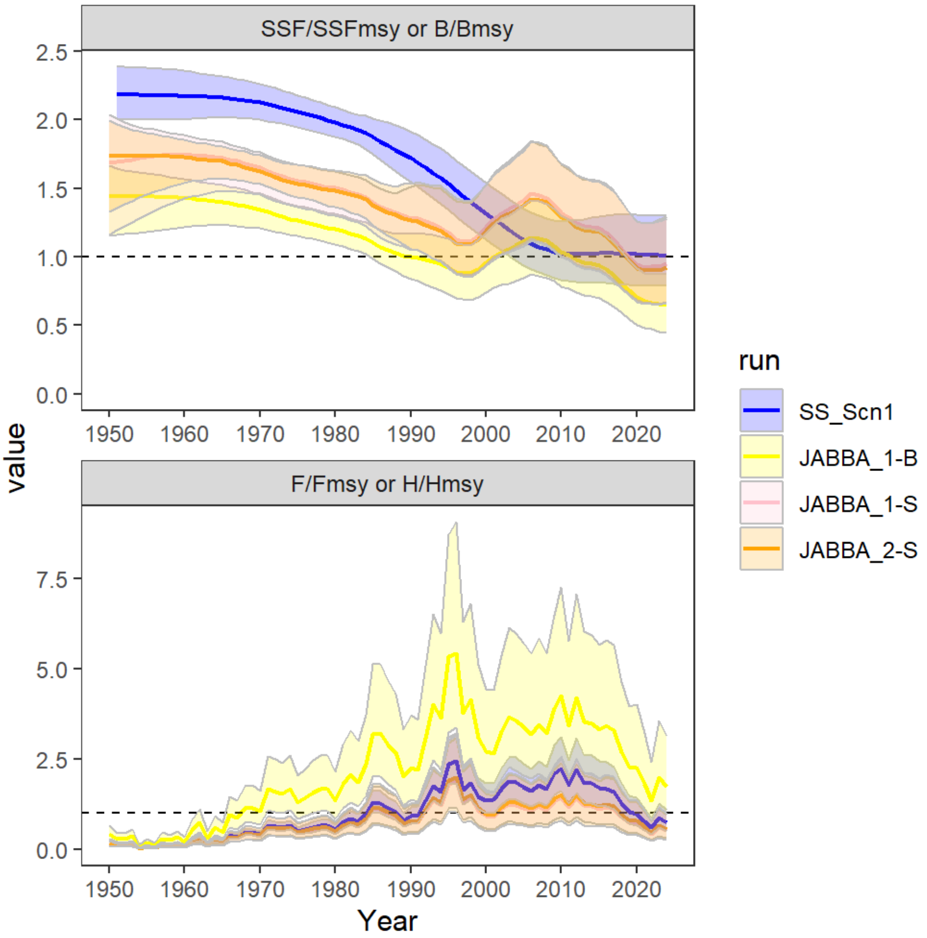

Figure 9. Individual time series of SSF/SSF$_{MSY}$ and F/F$_{MSY}$ for the Stock Synthesis model using the MVLN approach with 15,000 iterations and of B/B$_{MSY}$ and H/H$_{MSY}$ for the JABBA models (5,000 MCMC samples from each of the JABBA models). The shaded areas represented 95% confidence intervals or credibility intervals. Trajectories were produced with SSF or B at the end of each year.

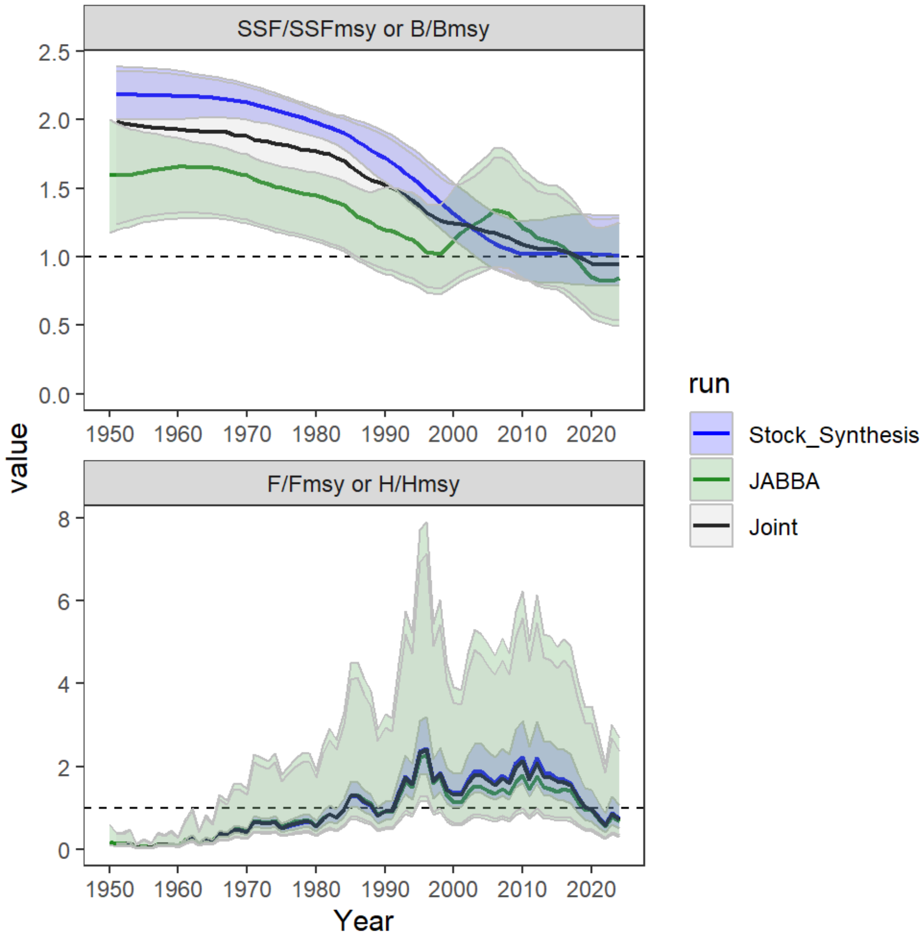

Figure 10. Weighted time series of SSF/SSF$_{MSY}$ and F/F$_{MSY}$ for the Stock Synthesis model using the MVLN approach with 15,000 iterations and of B/B$_{MSY}$ and H/H$_{MSY}$ for combined three JABBA models (5,000 MCMC samples from each of the JABBA models). The black line represents the joint model using the MVLN approach for the SS model with 15,000 iterations, and 15,000 MCMC samples from the three JABBA models. The shaded areas represented 95% confidence intervals or credibility intervals. Trajectories were produced with SSF or B at the end of each year.

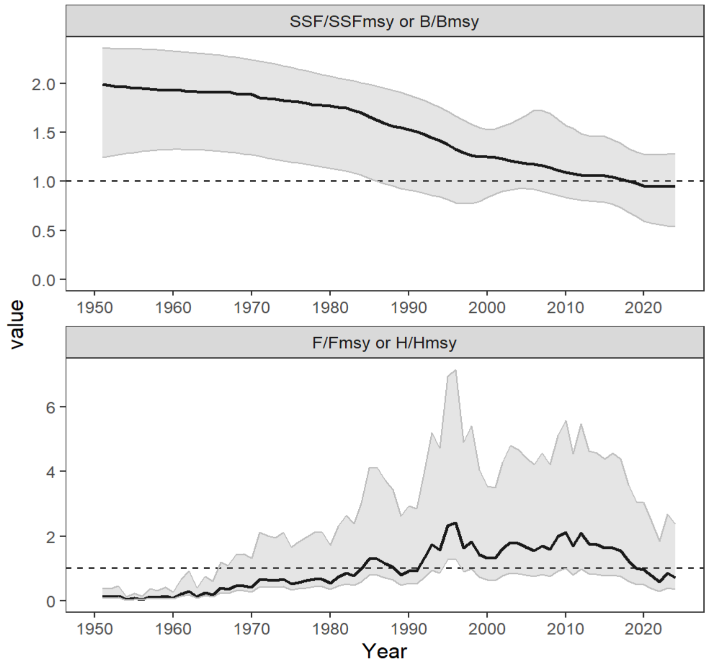

Figure 11. Joint time series of relative SSF and relative F, built with 15,000 iterations based on the MVLN approach for the Stock Synthesis reference case and 5,000 MCMC samples from each of the three JABBA models. The shaded area represents a 95% confidence interval. Trajectories were produced with SSF or B at the end of each year.

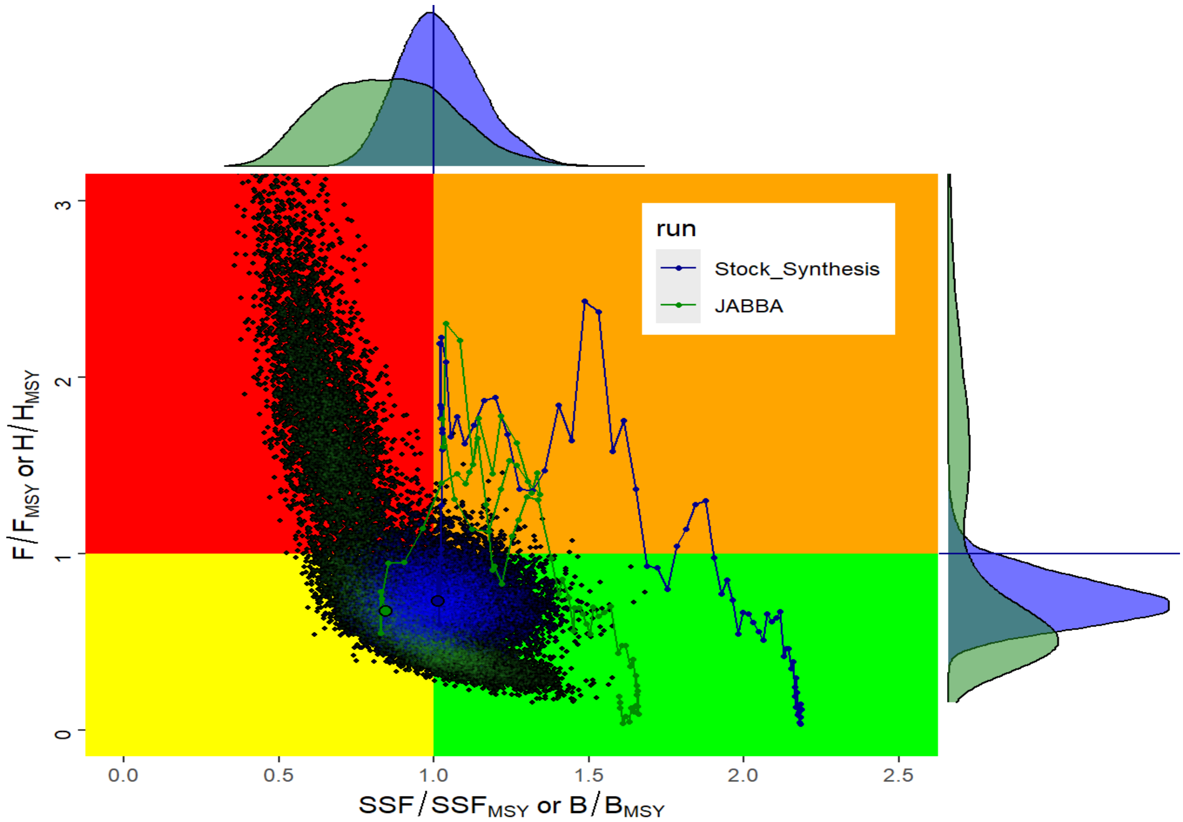

Figure 12. Weighted Kobe phase plot from three JABBA (5,000 iterations for each scenario) and one Stock Synthesis (15,000 iterations) scenarios for the northern stock of Atlantic shortfin mako shark. For Stock Synthesis the y axis represents F/F_{MSY} while the x axis represents SSF/SSF_{MSY}. For JABBA, the y axis represents H/H_{MSY} while the x axis represents B/B_{MSY}. Kobe plot was produced with SSF or B at the end of each year.

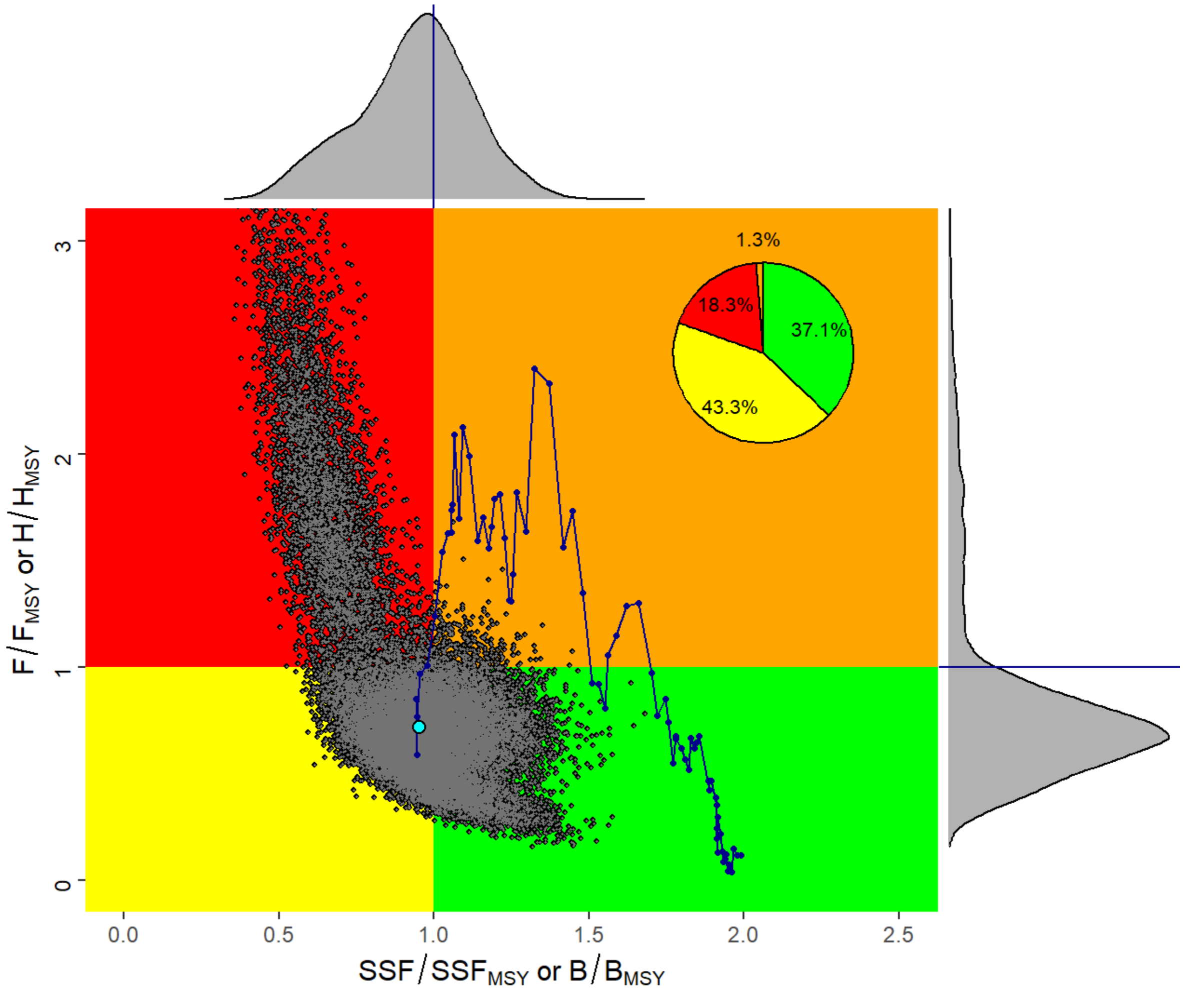

Figure 13. Joint Kobe phase plot from JABBA with 15,000 iterations and Stock Synthesis with 15,000 iterations for the northern stock of Atlantic shortfin mako shark. Solid blue dots and solid line indicate the stock status trajectory, with the light blue dot indicating the terminal year (2024), grey dots are the interactions from each model for the terminal year with the marginal distributions plotted in the lateral axis. Trajectories and Kobe plot were produced with SSF or B at the end of each year.

Appendix 1

Agenda

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 used on 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. Intersessional workplan
7. Recommendations
8. Blue shark MSE – Technical team and developments
9. Responses to the Commission
10. Shark Research and Data Collection Programme (SRDCP)
11. Other matters
12. Adoption of the report and closure

Appendix 2

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Appendix 3

List of papers and presentations

DocRef	Title	Authors
SCRS/2026/019	Update standardized catch rates of the North Atlantic stock of shortfin mako (*Isurus oxyrinchus*) inferred from Spanish surface longline fishery targeting swordfish during the 1990-2024 period	Ramos-Cartelle A., Fernández-Costa J.
SCRS/2026/070	The growth of the North Atlantic shortfin mako: reliability and accuracy according to Δ14C data	Ramos-Cartelle A., Fernández-Costa J.
SCRS/2026/074	Process error diagnostics in Stock Synthesis (SS3): an example based on North Atlantic shortfin mako shark	Kell L., Cardinale M.
SCRS/2026/083	Preliminary analysis of satellite telemetry data from tagged blue and shortfin mako sharks reveals substantial connectivity across the ICCAT–IOTC boundary	DaSilva C., West W.M., Rogers T., Booth A.J., Marsac M., Meyer M., Singh S., Wilke C.W., Kerwath S.E.
SCRS/2026/132	Evaluation of demographic analyses to derive inputs for stock assessment of northern shortfin mako sharks	Bowlby H.D., Babcock E.
SCRS/2026/136	A multi-fleet standardized relative abundance index for North Atlantic shortfin mako shark	Coelho R., Arocha F., Baez J.-C., Bowlby H., Carlson J., Courtney D., Diaz G., Fernandez C., Kuo T.-C., Liniers G., Lino P.-G., Ramirez-Lopez K., Rice J., Rosa D., Rueda L., Ruiz M., Salmeron F., Su N.-J., Cardoso L.-G., Forselledo R.
SCRS/2026/138	Decoupling of blue shark and shortfin mako fishing mortality in the South Atlantic: implications for BSH MSE design	Taylor N.G.
SCRS/2026/139	Multi-species Operating Model infrastructure for BSH and SMA: a technical diagnostic	Taylor N.G.
SCRS/2026/140	Atlantic blue shark Management Strategy Evaluation: operating model development and preliminary analysis	Taylor N.G., Sant'ana R., Fernandez C., Liniers G.
SCRS/2026/141	Update of standardized CPUE of shortfin mako (*Isurus oxyrinchus*) caught by Japanese tuna longline fishery in the North Atlantic Ocean through 2024	Semba Y., Kai M.
SCRS/2026/142	From fitted to fit-for-purpose: intertwining the strands of stock assessment; internal, external, and robustness diagnostics for stock assessment	Kell L., Cardinale M.
SCRS/2026/143	Preliminary 2026 Stock Synthesis (SS3) model runs for North Atlantic shortfin mako shark (1950–2024) under three alternative biological scenarios	Fernández C., Courtney D., Rice J., Liniers G., Cardoso L.G., Forselledo R.
SCRS/2026/144	Longevity-based constraints on equilibrium age structure: an application using age- and sex-specific natural mortality	Rice J.
SCRS/2026/145	Stock Synthesis version update for the 2017 North Atlantic shortfin mako shark Stock Synthesis (SS3) model run 3	Courtney D.

DocRef	Title	Authors
SCRS/2026/147	Discards estimates in the swordfish longline fishery from 2023 to 2025: an updated analysis using an integrated web and mobile application that combines traditional and advanced sampling plans	Serghini M., Baibbat S.A., Abid N., Bensbai J., Ikkis A.
SCRS/2026/148	Spatial and vertical behaviour analysis of the longfin mako shark (*Isurus paucus*) using satellite tagging, including depth-based trajectory correction	Teixeira J., Rosa D., Coelho R.
SCRS/2026/149	Bayesian production models applied to North Atlantic mako sharks using JABBA and JABBA-Select, updated in 2026	Babcock E.A.
SCRS/2026/151	Report of the Shark Species Group informal meetings on the 2026 North Atlantic shortfin mako stock assessment	Forselledo R.
SCRS/2026/175	Contribution to the biological study of the blue shark (*Prionace glauca*) in Moroccan Atlantic waters	Hamdi H., Abid N., Baibbat S.A., Bensbai J., Ikkis A., Joumani M.
SCRS/P/2026/006	First documentation of putative mating behavior in blue sharks (*Prionace glauca*) reveals a potential reproductive area in the Northeast Atlantic.	Vossgaetter L., Müller L., Cruz I., Schultz M., Renner A.T., Erauskin Extramiana M.
SCRS/P/2026/036	From diagnostics to advice: building a robust shortfin mako assessment	Kell L., Cardinale M.
SCRS/P/2026/061	From awareness to action: ocean conservation at Oceanário de Lisboa	Fonseca C.
SCRS/P/2026/062	Preliminary 2026 Stock Synthesis (SS3) model runs for North Atlantic shortfin mako shark (1950–2024) under three alternative biological scenarios: general results	Fernandez C.
SCRS/P/2026/063	Preliminary 2026 Stock Synthesis (SS3) Model Runs for North Atlantic Shortfin Mako Shark (1950–2024) Under Three Alternative Biological Scenarios	Fernandez C.
SCRS/P/2026/064	Preliminary 2026 Stock Synthesis (SS3) Model Runs for North Atlantic Shortfin Mako Shark (1950–2024) Under Three Alternative Biological Scenarios: Sensitivities Scenario 1	Fernandez C.
SCRS/P/2026/065	Preliminary 2026 Stock Synthesis (SS3) model runs for North Atlantic shortfin mako shark (1950–2024) under three alternative biological: sensitivities scenario 2	Fernandez C., Courtney D., Rice J., Liniers G., Cardoso L.G., Forselledo R.
SCRS/P/2026/066	Preliminary 2026 Stock Synthesis (SS3) model runs for North Atlantic shortfin mako shark (1950–2024) under three alternative biological scenarios: diagnostics for scenario 2	Fernandez C., Courtney D., Rice J., Liniers G., Cardoso L.G., Forselledo R.
SCRS/P/2026/067	Preliminary 2026 Stock Synthesis (SS3) model runs for North Atlantic shortfin mako shark (1950–2024) under three alternative biological scenarios: diagnostics for scenario 3	Fernandez C., Courtney D., Rice J., Liniers G., Cardoso L.G., Forselledo R.

DocRef	Title	Authors
SCRS/P/2026/068	Preliminary 2026 Stock Synthesis (SS3) model runs for North Atlantic shortfin mako shark (1950–2024) under three alternative biological scenarios: diagnostics for scenario 3	Fernandez C., Courtney D., Rice J., Liniers G., Cardoso L.G., Forselledo R.
SCRS/P/2026/069	Preliminary 2026 Stock Synthesis (SS3) model runs for North Atlantic shortfin mako shark (1950–2024) under three alternative biological scenarios: sensitivities scenario 3	Fernandez C., Courtney D., Rice J., Liniers G., Cardoso L.G., Forselledo R.

Appendix 4

SCRS Documents and Presentation Abstracts as provided by the authors

SCRS/2026/019 - Standardized catch rates in number per unit effort for the North Atlantic shortfin mako stock were updated using generalized linear models for the 1990–2024 period. Time blocks were considered to account for the potential effects of different management regulations implemented between 2018 and 2021. The models explained 33%, 58%, and 49% of the variability in CPUE in number of fish for the 1990–2017, 2018–2020, and 2021–2024 periods, respectively. CPUE variability was mainly attributable to the area factor. The results in number of fish showed a stable, slightly increasing trend in all time blocks, with greater uncertainty following the implementation of the first recommendations, probably because of the limited amount of data available for those years, particularly during the second period. No signs of stock depletion were observed during the period analysed. Overall, the models suggested a generally stable CPUE trend.

SCRS/2026/070 - A comparative analysis was conducted between the female growth scenarios used in the 2025 North Atlantic stock assessment of shortfin mako (*Isurus oxyrinchus*) and the ^{14}C-derived ages obtained from published bomb-radiocarbon validation studies. In addition to the graphical comparison, model accuracy was evaluated by quantifying the discrepancies between predicted ages under each growth scenario and the observed ages of the ^{14}C-dated female specimens. The von Bertalanffy growth function parameterized with L_∞ = 350 cm FL, k = 0.124 year^{-1}, and L_0 = 63 cm FL yielded the highest concordance with the ^{14}C-validated age estimates.

SCRS/2026/074 - Process error (PE) represents departures of the estimated population trajectory from that implied by the deterministic dynamics after accounting for observation error. It captures variability arising from processes not represented in the model, such as time-varying productivity, changes in selectivity and fleet behaviour, catch misreporting, variation in the survival of non-retained fish, and many others. PE diagnostics therefore provide a check on whether the assumed population dynamics and error structure are compatible with stock estimates by examining trends, autocorrelation, and regime shifts in model PE. If such structure exists but likelihood components assume independent, homoscedastic residuals, uncertainty will be underestimated, confidence intervals for status and forecasts will be too narrow, and the perceived risk of exceeding targets (e.g., FMSY) or falling below limits (e.g., B_{LIM}) will be biased. PE diagnostics should therefore be used as a first-stage screening tool, particularly for integrated assessments such as Stock Synthesis (SS3) and state-space surplus-production models (e.g., JABBA and SPiCT). PE behaviour provides evidence of potential model misspecification and non-stationarity, which should be critically evaluated before providing advice on stock status and future stock development under different management scenarios.

SCRS/2026/083 - Pelagic sharks, including the blue shark *Prionace glauca* and the shortfin mako *Isurus oxyrinchus*, exhibit extensive spatial distributions that may extend across the jurisdictional boundaries of tuna Regional Fisheries Management Organisations (tRFMOs). Such transboundary movements present challenges for data reporting, stock assessment, and management. Using satellite telemetry from a small number of individuals tagged off South Africa, this study demonstrated that both species routinely crossed the IOTC/ICCAT boundary at 20°E. For blue sharks, although only three individual tracks were used, their movements suggested the potential for localized residency in addition to broad-scale dispersal. Furthermore, previous research has provided evidence of parturition habitats within the Benguela–Agulhas transition zone that straddles the boundary. Since this boundary encompasses an area of biological importance that is closely linked to dynamic environmental conditions, the location and extent of parturition habitats are likely to fluctuate over time, further complicating the delineation of management units and the interpretation of fishery-dependent indices. Shortfin mako sharks displayed consistent site fidelity to the Agulhas Bank shelf edge, with movement patterns strongly associated with the Agulhas Current retroflection and associated mesoscale eddies. These findings align with previous work (e.g., Parker *et al.* 2017), which highlighted how the application of the IOTC/ICCAT boundary can introduce spurious variability into reported shortfin mako statistics. Collectively, the results suggest that truncating datasets or CPUE indices at this boundary is biologically unjustified and potentially risks introducing bias into assessments of wide-ranging pelagic sharks.

SCRS/2026/132 - Shark assessments at ICCAT typically incorporate parameters derived from stochastic demographic analyses based on available life-history information. Three scenarios for the northern stock of shortfin mako shark were considered in the 2025 assessment, incorporating different growth models. Despite considerable effort, the stochastic analyses produced non-intuitive results, and deterministic demographic analyses were implemented as an alternative. However, the calculation of natural mortality and the assumed maximum age differed from their implementation in the age-structured assessment models for the equivalent scenario. These analyses explored the implications of that inconsistency by rerunning the deterministic demographic analyses using the age structure implemented in SS, both for the parameterization used in the 2025 assessment and after additional changes were made to survival at age during an informal meeting held on April 13–14, 2026.

SCRS/2026/136 - Shortfin mako (*Isurus oxyrinchus*) catch and effort data were compiled from multiple pelagic longline fleets operating in the North Atlantic at the set-level resolution. Catches were standardized using negative binomial generalized linear mixed models (GLMMs). The base model used a type 1 NB distribution and included year, month, fleet, and a targeting-cluster factor derived from multispecies catch composition. Vessel identity and spatial 5 × 5 grids were included as random variables to account for vessel-level and spatial heterogeneity. Annual CPUE indices were derived from marginal means as the expected shortfin mako (SMA) catch per 1,000 hooks, with the respective 95% confidence intervals and CVs. Sensitivity analyses were compared using alternative error structures (Tweedie, type 2 NB, and zero-inflated models), alternative spatial structures (GLMTree fixed areas and GAMM nonlinear smooths), leave-one-fleet-out analyses, one-fleet-at-a-time analyses, and different uses of random variables in the models. The results provide a final standardized index of SMA relative abundance for the North Atlantic that can be considered for future stock assessments.

SCRS/2026/138 - This paper presents an empirical analysis of the relationship between fishing mortality imposed on South Atlantic blue shark (BSH; *Prionace glauca*) and shortfin mako (SMA; *Isurus oxyrinchus*) by the pelagic longline fleet, as a diagnostic for the design of a two-species management strategy evaluation (MSE). The central question is whether the BSH fishery imposes meaningful, predictable bycatch mortality on SMA in the contemporary period; specifically, whether that mortality can be usefully parameterized as a function of pelagic longline fishing effort or BSH fishing mortality. Five complementary analyses were applied to time series of fishing mortality (F), spawning stock biomass (SSB), nominal catch, and longline effort derived from the SS3 assessments and ICCAT Task 1 data. The results are unambiguous on the key question: statistically detectable coupling between FBSH and FSMA existed during the historical period before approximately 2000 but has been absent from the data since then. In the post-2000 period, neither FBSH nor aggregate longline effort explains any meaningful fraction of the year-to-year variation in FSMA. The high SMA fishing mortality observed in recent decades is depletion-driven. By this, we mean that F is elevated not through intensified fishing pressure, but because a relatively stable level of fishing-induced mortality is being applied to a declining biomass. As the biomass denominator shrinks, the same level of retained catch, dead discards, and post-release mortality corresponds to a higher fishing mortality rate. This process is both a consequence of stock decline and a cause of it. The mechanism is self-reinforcing: as biomass declines, F rises at any given level of removals, which further reduces biomass in the subsequent period and further elevates F. This is a related but distinct problem from one that can be addressed through a BSH management procedure alone. The implication for the BSH MSE is straightforward: the empirical basis for treating SMA as a predictable bycatch consequence of pelagic longline fishing effort does not exist in the contemporary data and is unlikely to emerge over the 5–10-year projection horizon relevant to the current management cycle.

SCRS/2026/139 - The 2025 ICCAT Commission meeting raised a concern that management actions affecting longline fishing effort would have consequences for shortfin mako (SMA; *Isurus oxyrinchus*) bycatch mortality and that any blue shark (BSH; *Prionace glauca*) management strategy evaluation (MSE) must account for this linkage. Taking that concern seriously, this paper documents a technical diagnostic for multispecies MSE of South Atlantic BSH and SMA using the openMSE multi-stock operating model (MOM) framework. Two findings are reported. First, operating models (OMs) derived from Stock Synthesis 3 assessments via SS2OM() cannot be cleanly combined into a MOM when the constituent assessments differ in fleet structure, maximum age, or historical year range; the dimensional mismatch in the cpars arrays requires a different conditioning approach. Second, the openMSE simulator does not propagate effort decisions across stocks at the dynamics layer; coupling must be implemented at the management procedure (MP) layer. A multi-stock management procedure (MMP) using a lead-stock pattern achieves the correct joint management behaviour and faithfully represents how ICCAT longline fisheries are managed in practice. Neither finding is an obstacle to eventual multispecies MSE delivery, but both represent non-trivial work requiring scoping before a joint MSE is commissioned.

SCRS/2026/140 - This report summarizes progress from the Global Blue Shark Management Strategy Evaluation (MSE) Workshop held in Rome in October 2025. The workshop was convened to initiate MSE development for blue shark stocks across relevant tRFMOs, using the South Atlantic stock as the principal case study. Participants established a working analytical pipeline linking existing SS3 stock assessment outputs to operating models within the openMSE framework and defined an initial set of candidate management procedures ranging from empirical harvest control rules to model-based approaches. Prototype simulations were run over a 30-year horizon and evaluated using performance metrics covering conservation risk, stock status, fishing mortality, catch, and catch stability; these metrics are consistent with the standard ICCAT format for operational management objectives, and the simulation infrastructure is in place to evaluate candidate procedures against whatever thresholds the Commission adopts. The workshop also produced interactive visualization tools using the Slick package. The process is currently ahead of the ICCAT Commission roadmap schedule. The immediate next priority is defining the operating-model uncertainty grid: the axes and factor levels that will constitute the reference and robustness sets for the MSE.

SCRS/2026/141 - Following the agreement/recommendation by the Shark Working Group to update the abundance index of shortfin mako (*Isurus oxyrinchus*) in the North Atlantic north of 5° latitude, we estimated the standardized CPUE of this stock based on Japanese observer data collected through 2024. As in the previous analysis, we used observer data after 2008 because the observed sets were skewed toward either fishing grounds for bluefin tuna or tropical tunas in the earlier period. For the standardization, we applied a GLM assuming a zero-inflated negative binomial model because of the high proportion of zero catches (>80% of total sets). The estimated annual abundance index for this stock fluctuated considerably between 2008 and 2012, followed by an increase until 2016 and a decrease until 2020. Thereafter, it showed an increase and decrease between 2022 and 2024. As the fishing grounds of the Japanese fleet include areas not covered by other fleets and the current results were based on reliable observer data, we suggest that the updated standardized CPUE be used as an abundance index in the stock assessment of northern shortfin mako.

SCRS/2026/142 - This document proposed extending the integrated-assessment diagnostics cookbook beyond internal goodness-of-fit to three strands: (i) internal diagnostics (convergence, parameters at bounds, residual patterns, retrospectives, and hindcasts); (ii) external diagnostics (consistency with life-history and fishery information independent of the likelihood, including process-error diagnostics to detect misspecification and non-stationarity); and (iii) robustness diagnostics (stability of status, reference points, and advice under plausible changes in structure, priors, data weights, and recruitment assumptions).

SCRS/2026/143 - Preliminary Stock Synthesis model runs were conducted for North Atlantic shortfin mako. The model runs from 1950 to 2024 and was fitted to available catch, CPUE, and length-composition data. Three alternative life-history "biological" scenarios were evaluated based on sex-specific parameters compiled by the Shark Working Group. A main development in the assessment this year is the availability of a combined CPUE series, which was developed based on set-level data from multiple CPCs. All model results are considered preliminary, with the stock assessment expected to be finalized by the Shark Working Group at its June 2026 stock assessment meeting.

SCRS/2026/144 - Longevity-based heuristics are widely used in fisheries stock assessment to inform natural mortality (M) and expectations about the abundance of very old individuals. A theoretical identity links maximum age to an assumed survivorship fraction via the assumed maximum age. A frequently cited historical rule of thumb corresponds to constant M. However, the choice is arbitrary and depends on sampling design, sample size, and the timing of senescence. Recent reviews emphasize a preference for log-scale treatment of longevity–M relationships and the use of longevity-based methods as informative priors, diagnostics, and sensitivity analyses rather than fixed estimators. This document evaluates whether scenario-specific age- and sex-specific natural mortality schedules imply terminal ages that are compatible with an unfished equilibrium age structure in which approximately 0.4% of the population occurs in the terminal age class. The analysis also evaluates whether modest adjustment of the final five age-specific mortality values can reconcile the assumed natural mortality schedules with this criterion.

SCRS/2026/145 - This analysis summarizes an update of the North Atlantic shortfin mako shark (SMA) Stock Synthesis (SS3) model from version 3.30.23.02 to version 3.30.24.02. SS3 version 3.30.24.02 (March 2026) implemented a correction to the low-fecundity stock–recruit relationship (LFSR) used in the 2017 North Atlantic SMA model. Consequently, model results for MSY, SSF_{MSY}, SSF_{2016}/SSF_{MSY}, SPR_{MSY}, F_{MSY}, and F_{2015}/F_{MSY} differed substantially between the two model versions (-16.37%, 18.50%, -15.61%, 10.47%, -31.85%, and 46.73%, respectively). In comparison, most 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 the two versions, indicating that the model update did not have a substantial effect on these annual model results. Similarly, model results for likelihood components, as well as unfished spawning stock fecundity (SSF_0), unfished biomass (B_0), and unfished recruitment (R_0), also did not differ between the two model versions.

SCRS/2026/147 - This study updates the preliminary discard estimates previously reported by incorporating two additional years, 2024 and 2025, of onboard observer data from the Moroccan swordfish longline fleet operating south of Cap Boujdor. It also presents a new component of the data-collection ecosystem, the FishStatApp Mobile application, developed as a Flutter-based companion to the FishLongline web platform that runs on both Android and iOS and enables the direct participation of fishers in data reporting. A consistent methodological framework was applied across all three years to ensure comparability. This approach combines a stratified sampling design based on onboard observers with a nonparametric bootstrap estimation procedure implemented within the FishLongline platform, which was built using the Django framework. Fishing effort exhibited a non-monotonic trend, increasing from 1,687 fishing days in 2023 to 1,779 in 2024 before declining to 1,532 in 2025, representing an overall decrease of approximately 9% relative to 2023. For shortfin mako (*Isurus oxyrinchus*), total discards increased markedly between 2023 and 2024 and declined in 2025 (1,048; 5,557; and 1,608 individuals, respectively). However, haulback mortality rates decreased consistently over the same period, from 36.5% in 2023 to 28.4% in 2024 and 25.6% in 2025. In contrast, blue shark (*Prionace glauca*) discards were highly variable and seasonally concentrated, with peaks shifting across years, suggesting less frequent but more lethal interactions in 2025. Swordfish (*Xiphias gladius*) discards, which were absent in 2024, reappeared in the third quarter of 2025, with an estimated 147 individuals and a relatively low mortality rate of 12.2%. Integration of the FishStatApp Mobile component is expected to broaden both spatial and temporal data coverage by complementing observer-based sampling with fisher-reported data. Overall, these results highlight the operational value of the FishLongline system, demonstrate the emergence of meaningful temporal trend signals, and identify key priorities for the upcoming 2026 cycle.

SCRS/2026/148 - The longfin mako shark (*Isurus paucus*) is one of the least-studied large pelagic sharks and has been identified as one of the species at highest ecological risk in Atlantic pelagic longline fisheries. Data recorded by a pop-up satellite archival tag (PSAT) deployed on a longfin mako in the equatorial Atlantic in August 2013 were analysed. The tag remained active for 168 days, relaying depth, temperature, and light levels. A depth-based correction model was applied to solar-event times recorded by the tag to reduce systematic geolocation errors caused by light attenuation at depth. Trajectory reconstruction using a Kalman filter on depth-corrected data yielded an estimated route of 12,146 km, substantially more realistic than the 29,657 km obtained from uncorrected data. Results revealed a marked diel vertical pattern, with a mean daytime depth of 245 m and a mean night-time depth of 101 m. Night-time vertical overlap with drift-longline fishing depths reached 9.4–15.6%, substantially higher than daytime values. Lunar phase influenced night-time depth, with the deepest positions recorded during the full moon. These results contribute new information on the spatial and vertical ecology of *I. paucus* and highlight the importance of considering vertical behaviour when assessing bycatch risk in pelagic longline fisheries.

SCRS/2026/149 - The surplus-production models used in the 2025 North Atlantic shortfin mako assessment were updated to include an additional year of catch and CPUE data, as well as revised life-history parameters under the three growth scenarios agreed by the Working Group. The demographic priors were updated using revised natural mortalities. The base case included M values adjusted to reduce the number of animals surviving to the last time period. A sensitivity analysis used the M values from the 2025 SS3 runs. For both JABBA and JABBA-Select, the CPUE series implied a decrease–increase–decrease trend in biomass. However, the different scenarios implied widely different productivities, leading to different estimates of potential yield and current status across scenarios.

SCRS/2026/151 - During the 2025 Species Group meeting, the Shark Species Group (SHK SG) agreed, in its 2026 Workplan, to hold a series of informal meetings in preparation for the 2026 North Atlantic Shortfin Mako Stock Assessment Meeting. Two informal meetings were held in February and April 2026. This document provides information presented during the informal meetings, as well as the discussions and decisions of the SHK SG.

SCRS/2026/175 - The blue shark (*Prionace glauca*) is a pelagic species belonging to the family Carcharhinidae and is considered one of the top predators in the marine food chain. In Morocco, a scientific monitoring programme has been initiated to conduct biological and ecological studies that provide essential data for stock assessment and management. The growth study of this species aimed, first, to determine its growth pattern and, second, to estimate the growth parameters required for stock assessment models. In parallel, reproductive studies were carried out to determine size at first maturity, the proportion of juveniles, and the reproductive and parturition periods. Biological sampling was conducted between 2023 and 2025 at the Casablanca fish market, through which catches from several Moroccan ports transit. The results indicate that blue sharks caught in Moroccan waters have a wide size range of 70–350 cm TL, with an average size of 186 cm. The size-frequency distribution indicates the presence of seven cohorts within the exploited population. Total and natural mortality rates were estimated at 0.77 $year^{-1}$ and 0.26 $year^{-1}$, respectively. The estimated growth parameters were $L\infty$ = 387 cm, K = 0.21 $year^{-1}$, and t_0 = -0.401 year. The length–weight relationship showed a coefficient b slightly greater than 3, indicating positive allometric growth, whereby weight increases faster than length. Size at first maturity for both sexes was estimated at approximately L50 = 180 cm. Analysis of the sex ratio revealed a slight overall predominance of females (52%). This female predominance was more pronounced during the spring–summer period, while males were more prevalent during autumn–winter. Overall, the estimated biological parameters of blue shark provide key information for stock assessment and fisheries management in Moroccan waters and an essential scientific basis for improving management strategies and ensuring the sustainable use and conservation of this important pelagic species.

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