Comparison of the results of the 2015 ISC Striped Marlin Stock Assessment Base-Case Model using Stock Synthesis versions 3.24f and 3.30

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Abstract

The International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) Billfish working group (BILLWG) provided an assessment of Western and Central North Pacific Striped Marlin in 2015 using Stock Synthesis (SS) version 3.24f. In preparation for the 2019 assessment, this model was run in the updated SS version 3.30 to ensure that any changes in the model results in 2019 would not be due to the updated assessment model. This working paper provides the estimated log-likelihood and figures showing the estimates produced from the 2015 assessment run in both SS versions. Based upon these results, the parameter estimates and derived stock status for the 2015 assessment were identical. This confirms that the 2019 assessment run in SS3.30 will be consistent with the results from the 2015 assessment run in SS3.24f.

Introduction and methods

This working paper is to document the results of the 2015 North Pacific striped marlin base-case assessment model run in Stock Synthesis (SS, Methot and Wetzel, 2013) originally run in version 3.24f (ISC BILLWG, 2015) and translated into version 3.30 to ensure consistency between the two versions. Some minor changes between the two models were necessary to account for differences in the data and control files' structures; however, both models have total likelihoods within 0.2 of each other and produce the same parameter estimates and stock status (Table 1). To produce the figures and tables in this working paper, the 2015 striped marlin base-case model was run using ss_trans.exe, which automatically translates the SS3.24 model into SS3.30. Then the new input files were compared to the original input files and any differences were noted. The models were then compared using the R4SS package in R version 3.4.0 (R Core Team, 2017; Taylor *et al.,* 2017).

Results

Changes made to data and control files' structure upon translating from SS3.24 to SS3.30:

- The equilibrium catch applied to fleet 5 is included in quarter 1 only (with zeros for quarters 2-4). This is because SS3.24 reads in catch annually and is assumed to be removed at the beginning of each year but SS3.30 reads in catch seasonally and is assumed to be removed at the beginning of each season.
- SS3.24 assigns seasons based on numbers (i.e. 4 seasons = seasons 1, 2, 3, 4) and SS3.30 assigns seasons based on months (4 seasons = months 2.5, 5.5, 8.5, 11.5) so those adjustments were made for the CPUE and length composition data. Catch still uses season numbers as inputs, not months.
- SS3.24 had an offset for equilibrium recruitment to account for the fact that the first year of the model was not the first year of fishing, whereas for SS3.30 this is a specific setting in the control file, this required adding a block pattern for 1974 to the initial recruitment parameter.
- In SS3.24 the F ballpark year is set to 1970. In SS3.30 the F ballpark year cannot be prior to the start of the model, so it is set to 1974.
- In SS3.30 only inputs for initial Fs for year/seasons in which you have equilibrium catch were necessary. Extra inputs from SS3.24 were deleted.

- In SS3.30 only catchabilities for survey fleets are required. Catchabilities for catch fleets were deleted.
- In SS3.30 only variance adjustments for fleets you want adjusted are required, other placeholder values from SS3.24 were deleted.

Figure 1 and Figure 2 show the posterior estimates of the virgin (unfished) spawning biomass and virgin recruitment, respectively, for the SS3.24f model and SS3.30 model. Both posterior estimates overlap completely, indicating the estimates are equivalent. Figure 3 shows the annual number of recruits for each model, and Figure 4 shows the recruitment deviations and the 95% confidence intervals. SS3.30 provides the stock-recruitment estimates of recruitment for the last year of the assessment and the first year of projections automatically while SS3.24 only estimates recruitment for the n-1 year of the assessment, estimates in the final year of the assessment have an uncertainty equal to σ_R. Otherwise, both results are identical. Figure 5 provides the annual estimates of 1-SPR. The results of both models are identical. Figure 6 provides the estimated total annual fishing mortality for ages 3-12 for both models with 95% confidence intervals. Figure 7 provides annual estimates of spawning output from each model as well as virgin spawning output. Figure 8 provides annual estimates of relative spawning biomass. For all figures provided, the results of both models are identical which indicates that any changes in the 2019 stock assessment will not be a result of changing from SS3.24f to SS3.30. Furthermore, the likelihood estimates for both models are within 0.2 and this difference is likely due to the change for the CPUE/survey time series and the length composition data from seasonally time steps to monthly time steps. Adjusting the precise month in which these time series occur would likely slightly modify the likelihood in the SS3.30. Overall, the working group could proceed with the updated SS3.30 without any impacts to the model results.

Literature Cited

ISC BILLWG. 2015. Report of the billfish working group workshop (Annex 10). International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean 20-28 April 2015. Yokohama, Japan.

Methot Jr, R. D. and C. R. Wetzel (2013). Stock synthesis: A biological and statistical framework for fish stock assessment and fishery management. Fisheries Research 142: 86-99.

R Core Team 2017. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Taylor, I.G., Stewart, I.J., Hicks, A.C., Garrison, T.M., Punt, A.E., Wallace, J.R. Wetzel, C.R., Thorson, J.T., Takeuchi, Y., Ono, K., Monnahan, C.C., Stawitz, C.C., A'mar, Z.T., Whitten, A.R., Johnson, K.F., Emmet, R.L., Anderson, S.C., Lambert, G.I., Stachura, M.M., Cooper, A.B., Stephens, A. and Klaer, N. 2017. R4ss: R Code for Stock Synthesis. https://github.com/r4ss

Tables

Table 1. Log-likelihood and parameter estimates for the 2015 striped marlin base-case model in SS3.30 and SS3.24f.

	SS3.30	**SS3.24f**
TOTAL likelihood	3510.02	3510.25
Survey likelihood	-42.5932	-42.5945
Length comp likelihood	3556.03	3556.01
Virgin Recruitment (thousands)	566.362	566.211
SR_LN(R_0)	6.33923	6.33897
Steepness	0.87	0.87
Length at Amax	214	214
VonBert K	0.24	0.24
Virgin SPB (thousand mt)	9.467	9.4645

Figures

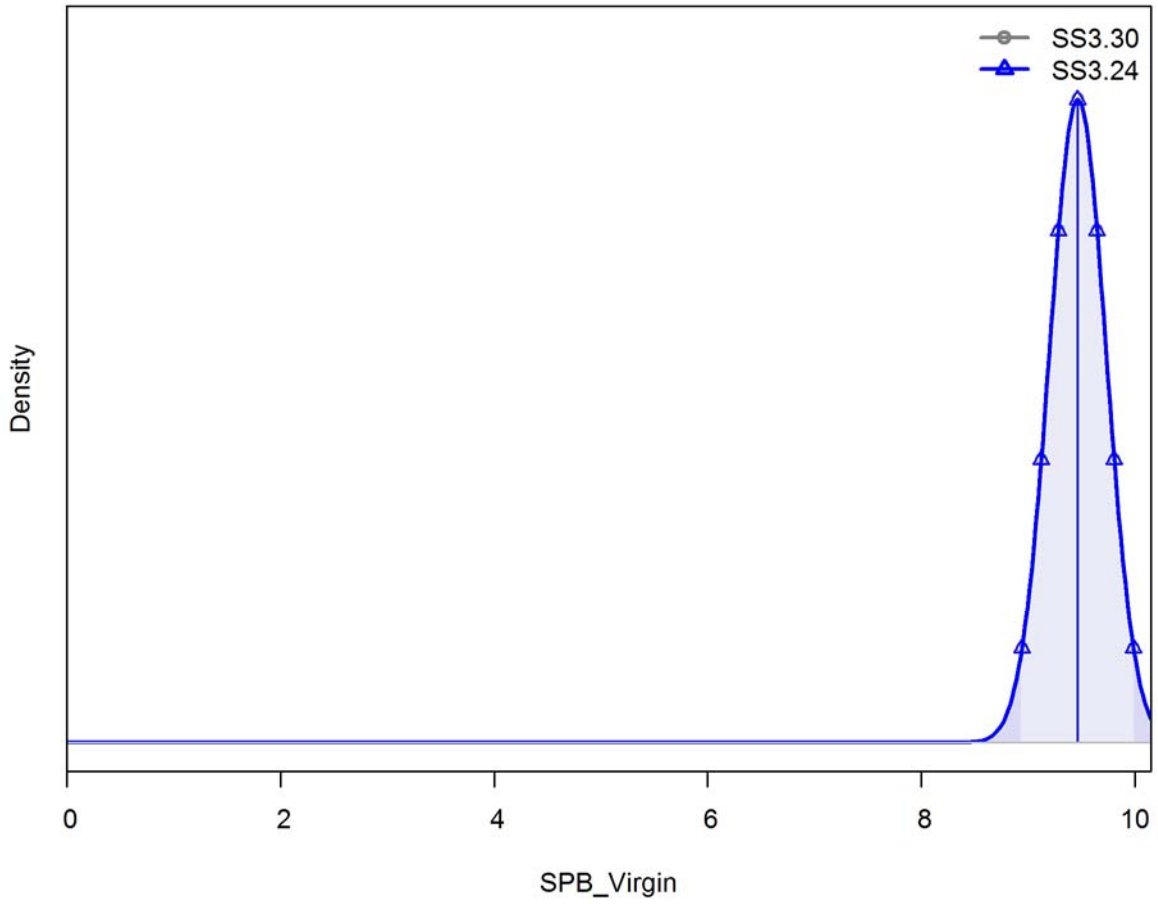

Figure 1. Posterior estimates of virgin spawning biomass from the 2015 striped marlin base-case model in SS3.30 (gray circles) and SS3.24f (blue triangles). Darker shading indicates values outside the 95% confidence interval bounds.

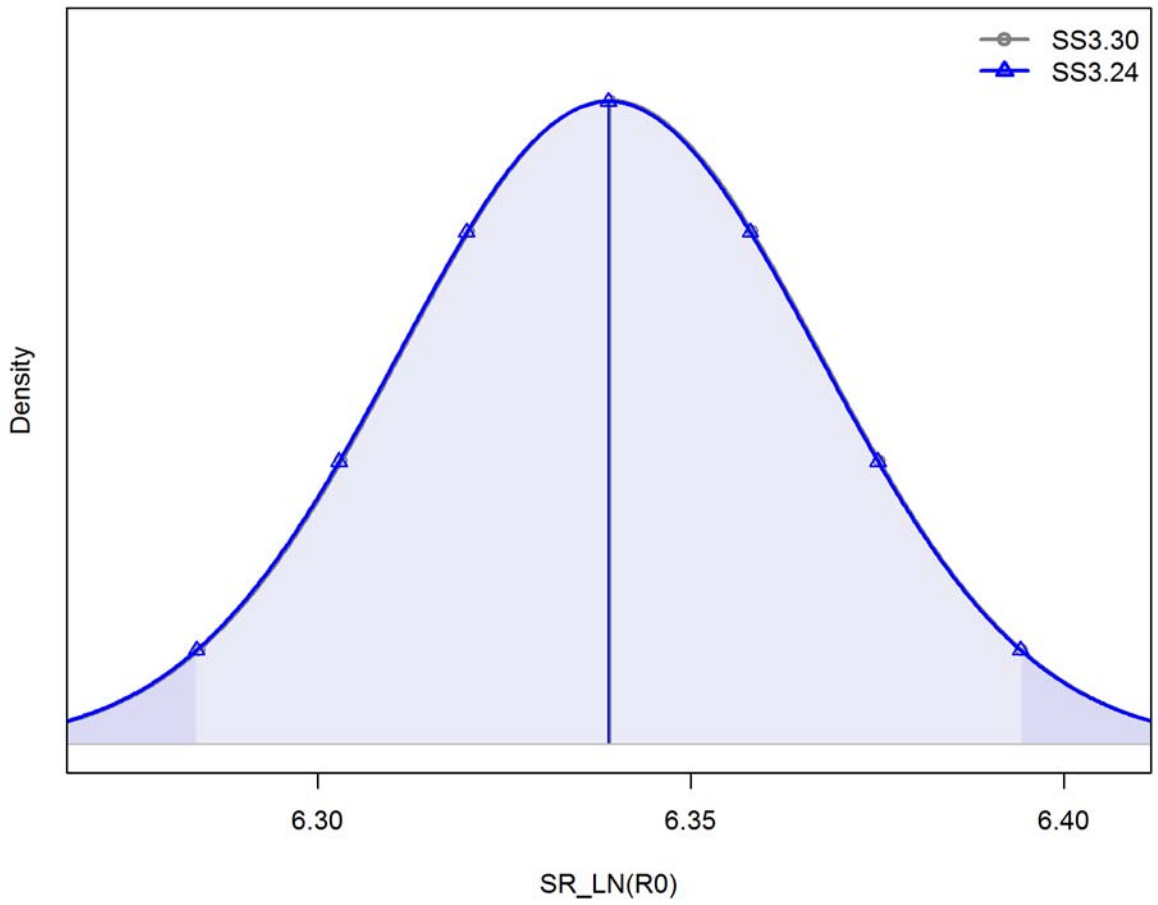

Figure 2. Posterior estimates of virgin recruitment (R_0) from the 2015 striped marlin base-case model in SS3.30 (gray circles) and SS3.24f (blue triangles). Darker shading indicates values outside of the 95% confidence interval bounds.

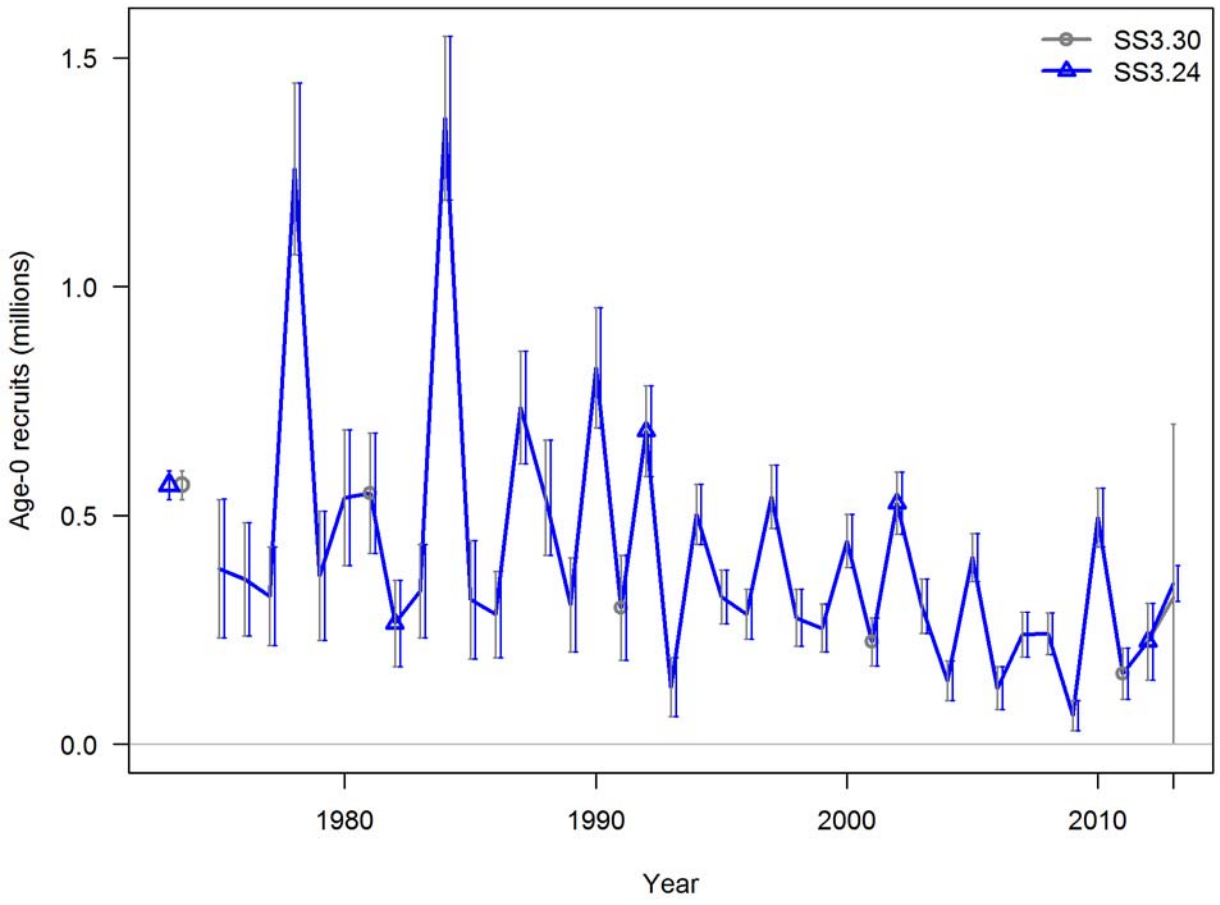

Figure 3. Age zero recruits by year with 95% confidence intervals from the 2015 striped marlin base-case model in SS3.30 (gray circles) and SS3.24f (blue triangles). Points are offset slightly to show overlap of the time series. First points are virgin recruitment.

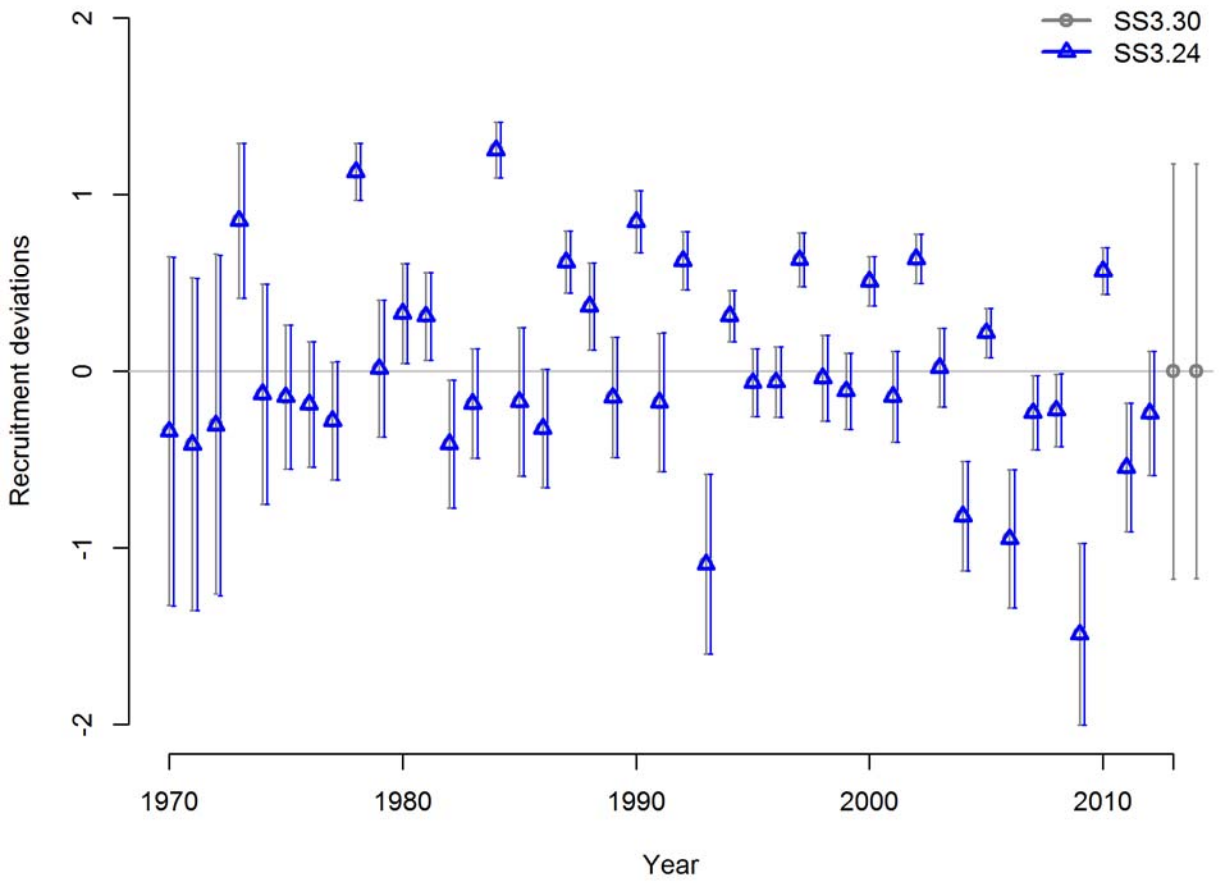

Figure 4. Annual recruitment deviations from the 2015 striped marlin base-case model in SS3.30 (gray circles) and SS3.24f (blue triangles) with 95% confidence intervals. Points and confidence intervals are jittered slighly for visibility.

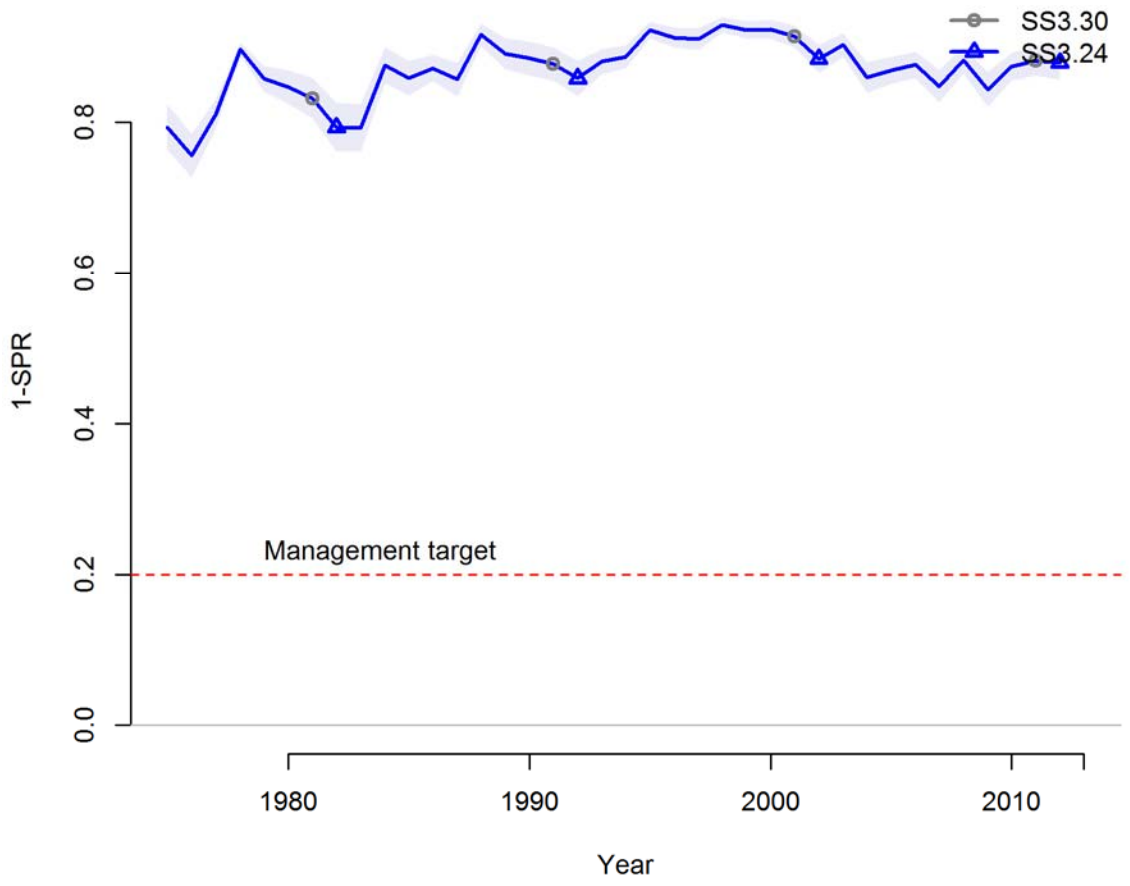

Figure 5. Annual estimate of 1-SPR from the 2015 striped marlin base-case model in SS3.30 (gray circles) and SS3.24f (blue triangles). Shaded band indicates 95% confidence interval; points are offset by a year to show overlap of the time series. Red dashed line indicates 1-$SPR_{0.2(F=0)}$.

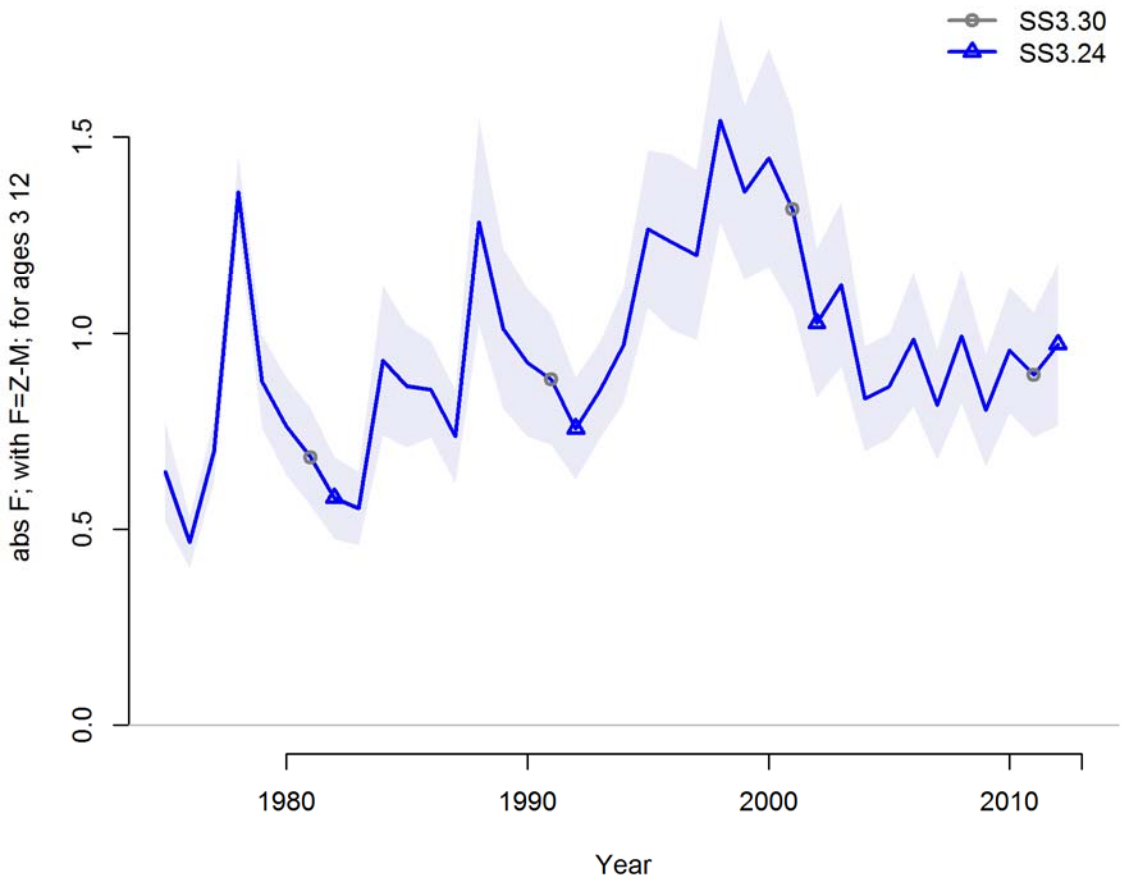

Figure 6. Estimate of F over ages 3-12 from the 2015 striped marlin base-case model in SS3.30 (gray circles) and SS3.24f (blue triangles). Shaded area indicates 95% confidence interval; points are offset by a year to show overlap of the time series.

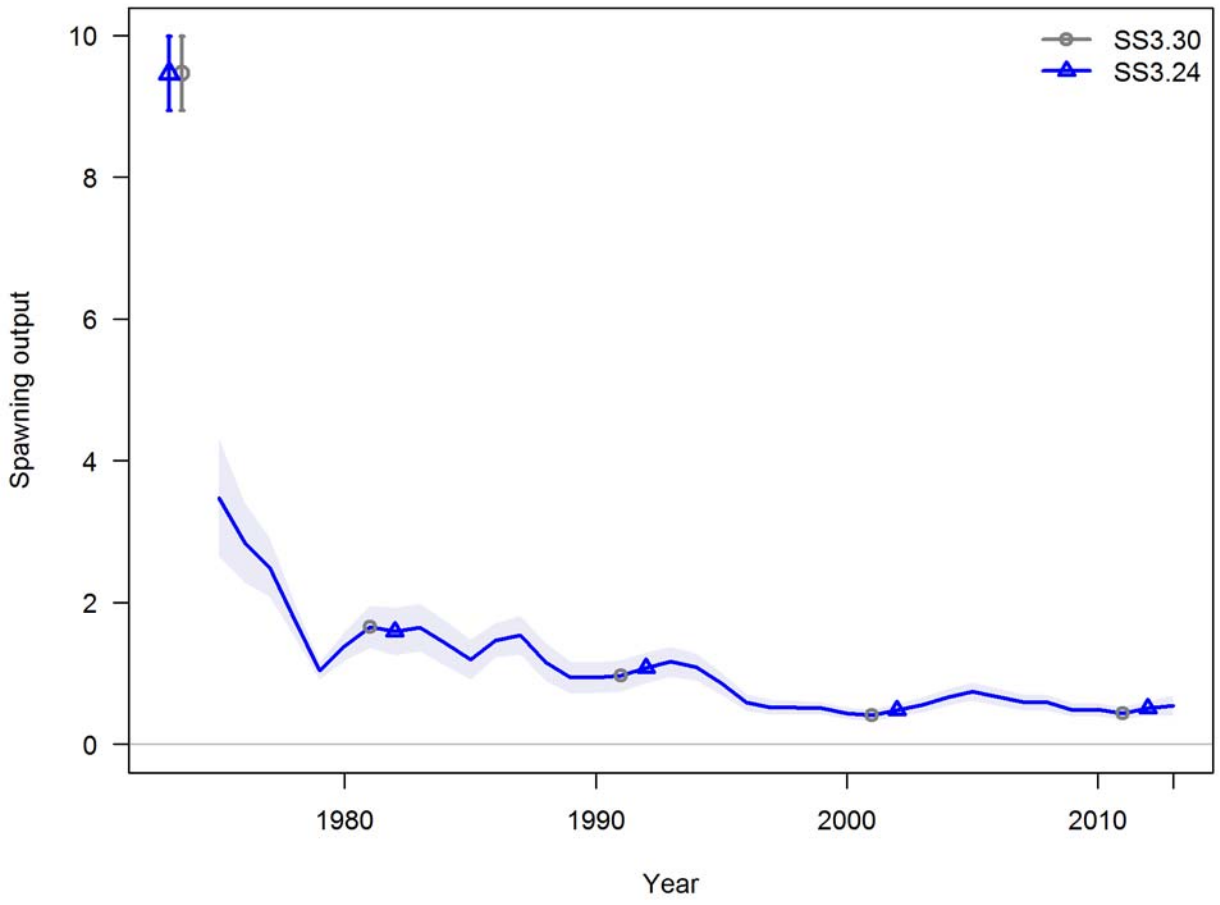

Figure 7. Estimates of spawning output from the 2015 striped marlin base-case model in SS3.30 (gray circles) and SS3.24f (blue triangles). The shaded area indicates 95% confidence intervals; points are offset by a year to show overlap of the time series. The first points in the series indicate virgin spawning output.

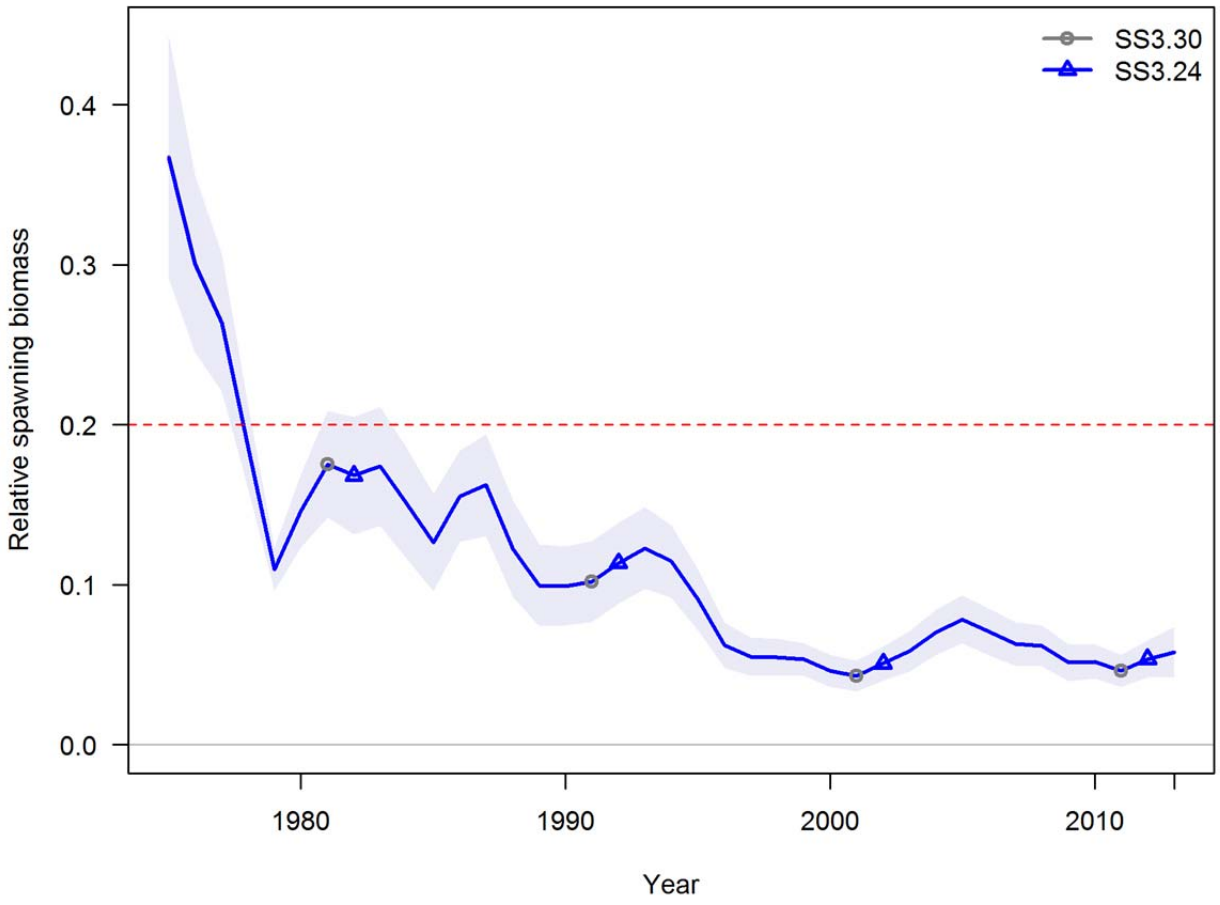

Figure 8. Relative spawning biomass estimates from the 2015 striped marlin base-case model in SS3.30 (gray circles) and SS3.24f (blue triangles). Shaded area indicates 95% confidence intervals; points are offset by a year to show overlap of the time series. The red dashed line indicates $SSB_{0.2(F=0)}$.