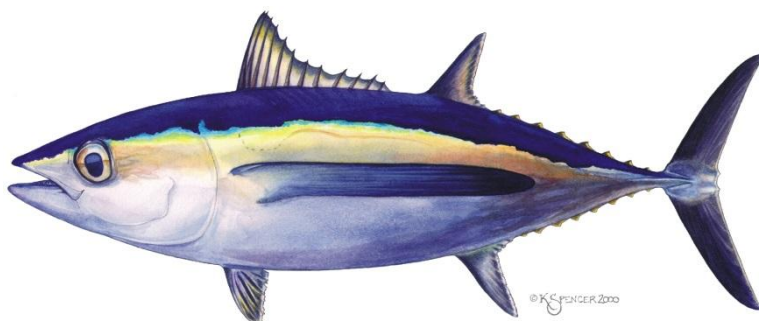


Erratum: Stock Assessment of Albacore Tuna in the North Pacific Ocean in 2023¹

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ABSTRACT

We recently discovered several errors in Table ES1 of the 2023 North Pacific Albacore Tuna (NPALB) stock assessment report. Errors were found for all the $F_{\text{SPR}, 2018-2020}/F_{\text{SPR}, \text{MSY}}$ ratios, as well as the $F_{\text{SPR}, 2011-2020}$ and $F_{\text{SPR}, 2011-2020}/F_{45\% \text{SPR}}$ ratio for the base case model. A corrected version of the Table ES1 is reported in this working paper. In order to minimize this source of error in future assessments, R code was developed to produce the management quantities directly from model files, and a Github repository was setup to store the code. The primary functions in the Github repository were briefly described. The corrected values did not result in any qualitative change in the reported stock status of NPALB. It is recommended that these errors be reported to the ISC Plenary but with a note that no change in reported stock status is necessary. It is also recommended for the ALBWG to review and use the code in the Github repository for future assessments.

INTRODUCTION

The Albacore Working Group (ALBWG) of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) conducted the latest stock assessment for North Pacific Albacore Tuna (NPALB) in 2023 (ALBWG 2023). The NPALB stock is managed by two regional fisheries management organizations (RFMOs): the Western and Central Pacific Fisheries Commission's Northern Committee (WCPFC NC) and the Inter-American Tropical Tuna Commission (IATTC) in the Western and Central Pacific Ocean (WCPO) and the Eastern Pacific Ocean (EPO) respectively. The RFMOs developed reference points and harvest strategies for the NPALB stock, which were adopted in 2023 (WCPFC NC Harvest Strategy 2023-01; IATTC Resolution C-23-02). Accordingly, as part of the 2023 assessment, the ALBWG evaluated and reported NPALB stock status relative to a series of reference points (Table 1).

However, we recently found several errors in Table ES1 of the 2023 stock assessment report. Errors were found for all the $F_{\text{SPR}, 2018-2020}/F_{\text{SPR}, \text{MSY}}$ ratios, as well as the $F_{\text{SPR}, 2011-2020}$ and $F_{\text{SPR}, 2011-2020}/F_{45\% \text{SPR}}$ ratio for the base case model (compare bolded values in Table 1 with Table ES1 in the 2023 assessment). During the 2023 assessment, model results were transferred to spreadsheets, which were in turn used to calculate a portion of the values reported in Table ES1. Unfortunately, inadvertent errors were made in the spreadsheets, which were propagated into Table ES1 of the 2023 assessment report.

In order to minimize this source of error in future assessments, R code was

developed to produce Table 1 directly from Stock Synthesis (SS) model files. A Github repository (https://github.com/SteveTeo-NOAA/NPALB_assessment_2023) was setup to store the R code. Members of the ALBWG will have access to this repository and are encouraged to review and improve the code. The SS model files and R code to plot the stock status and other figures in the stock assessment (e.g., Fig. ES7 in the 2023 assessment) have also been stored in the repository.

The primary aim of this working paper is to report and correct these errors in the 2023 stock assessment to the ALBWG. The secondary aim is to provide some details of the code in the Github repository so that the code could be more easily used in future assessments.

METHODS

A Github repository (https://github.com/SteveTeo-NOAA/NPALB_assessment_2023) was setup to store the R code. The SS model files for the 2023 base case model can be found in the “stock_synthesis” folder. Four R files can be found in the “R” folder. The file “make_refpttable_es1.r” contains an R script that sources several functions in the “calcrefpts_NPALB_functions.r” file to produce Table 1 in MS-Word format. Importantly, the function “calcrefpts_NPALB” checks the setup of the SS model files and reruns the models if necessary, and calculates the management quantities in Table 1. The “plot_NPALB_refpt_yellowF45.r” file contains an R script and functions to plot the Kobe-like stock status plots (e.g., Fig. ES7 in the 2023 assessment). Lastly, the “plot_SScompare_v4.r” contains several functions that were useful comparing the output and fit from several SS models and used in the 2023 assessment report.

RESULTS AND DISCUSSION

As noted above, all the $F_{\%SPR, 2018-2020}/F_{\%SPR, MSY}$ ratios in Table ES1 of the 2023 NPALB stock assessment report (i.e., 2.04, 1.42, 2.78, and 1.47) were found to be erroneous. The corrected ratios were found to be 3.60, 2.50, 3.99, and 2.61 respectively (Table 1). The ratios remained >1 before and after the corrections, and indicated that the NPALB stock was not experiencing overfishing relative to $F_{\%SPR, MSY}$.

The $F_{\%SPR, 2011-2020}$ and $F_{\%SPR, 2011-2020}/F_{45\%SPR}$ values for the base case model in Table ES1 of the 2023 NPALB stock assessment report (55.0 and 1.22 respectively) were also found to be erroneous. The corrected values were found to be 53.3 and 1.19 respectively (Table 1). Similarly, the values were similar before and after the corrections, and indicated that the NPALB stock was not experiencing overfishing relative to $F_{45\%SPR}$.

It is recommended that these errors be reported to the ISC Plenary but no change in reported stock status is necessary. It is also recommended for the ALBWG to review and use the code in the Github repository for future assessments.

REFERENCES

ALBWG. 2023. Stock assessment of albacore tuna in the North Pacific Ocean in 2023. Page 124. International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean, Stock Assessment. (Include link to this ref?)

Table 1. Bold values indicate corrected values from the 2023 stock assessment. Estimates of maximum sustainable yield (MSY), female spawning stock biomass (SSB), fishing intensity (F), and reference point ratios for north Pacific albacore tuna for: 1) the base case model; 2) two important sensitivity models due to uncertainty in growth parameters; and 3) a model representing an update of the 2020 base case model to 2023 data. SSB_0 , $SSB_{current, F=0}$ and SSB_{MSY} are the expected female SSB of a population in the equilibrium, unfished state; in the current, dynamic, unfished state; and at MSY, respectively. The F_s in this table are indicators of fishing intensity based on spawning potential ratio (SPR) and calculated as %SPR. SPR is the ratio of the equilibrium SSB per recruit that would result from the estimated F -at-age relative to that of an unfished population. Depletion is calculated as the proportion of the age-1+ biomass during the specified period relative to an unfished age-1+ equilibrium biomass. The model representing an update of the 2020 base case model is similar to but not identical to the 2020 base case model due to changes in data preparation and model structure. *Model may not have converged and uncertainty estimates were unreliable because of the lack of a positive, definite Hessian matrix. †A value of >1 for the depletion ratio indicates higher age-1+ biomass in 2021 relative to the 2006 – 2015 period. §Higher %SPR values indicate lower fishing intensity levels. ¶Values of >1 for ratios of $F_{\%SPR}$ to $F_{\%SPR}$ -based reference points indicate fishing intensity levels lower than the reference points.

Quantity	Base Case	Growth CV = 0.06 for Linf	Growth All parameters estimated	Update of 2020 base case model to 2023 data*
MSY (t)	121,880	93,167	144,792	97,777
SSB_{MSY} (t)	23,154	18,133	30,435	18,756
SSB_0 (t)	165,567	128,155	198,913	132,570
SSB_{2021} (t)	70,229	35,418	101,161	36,909
$SSB_{current, F=0}$ (2021 estimate)	129,581	97,368	155,542	93,808
$SSB_{2021}/SSB_{current, F=0}$	0.54	0.36	0.65	0.39
$SSB_{2021}/30\%SSB_{current, F=0}$	1.81	1.21	2.17	1.31
$SSB_{2021}/14\%SSB_{current, F=0}$	3.87	2.60	4.65	2.81
† Depletion ₂₀₂₁ /Depletion ₂₀₀₆₋₂₀₁₅	1.34	1.33	1.37	1.30
§ $F_{\%SPR, 2018-2020}$ (%SPR)	59.0	41.4	70.4	43.2
§ $F_{\%SPR, 2011-2020}$ (%SPR)	53.3	36.6	63.8	37.9
¶ $F_{\%SPR, 2018-2020}/F_{\%SPR, MSY}$	3.60	2.50	3.99	2.61
¶ $F_{\%SPR, 2011-2020}/F_{45\%SPR}$	1.19	0.81	1.42	0.84
¶ $F_{\%SPR, 2018-2020}/F_{45\%SPR}$	1.31	0.92	1.56	0.96
¶ $F_{\%SPR, 2018-2020}/F_{\%SPR, 2002-2004}$	1.48	1.63	1.40	1.25