SCIENTIFIC COMMITTEE
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Stock assessment of South Pacific Albacore Tuna (Results of Weighted Stochastic Projections)

WCPFC-SC17-2021/SA-WP-02a (Rev.02-17Aug21)

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SPA weighted stochastic projections – REV2

REV1 - updated with vulnerable biomass estimates for the WCPO tables
REV2 - correction of error in calculated values in WCPFC-CA results - Tables 2 and 4.

The potential stock consequences of fishing at alternative "status quo" conditions (i.e. at recent average fishing levels) were evaluated, where future longline fishing was projected based upon recent catch or effort levels (see Tables 1-4). For both alternatives all other fisheries (i.e. troll) were projected based upon catch. A summary of the approach is as follows:

- Catch-based projections: Two scenarios for future longline and troll catches were considered: 2017-2019 average catches across the South Pacific; 2020 average catches within the WCPFC-CA, and 2017-2019 average catches in the EPO (given EPO data for 2020 are likely still incomplete).
- Effort-based projections: Two scenarios for future longline effort and troll catch were considered: 2017-2019 average levels across the South Pacific; 2020 average levels within the WCPFC-CA, and 2017-2019 average levels in the EPO (given EPO data for 2020 are likely still incomplete). All other settings were as assumed for the catch-based projections.
- Stochastic 30 year projections were conducted from each assessment model within the uncertainty grid developed for the 2021 South Pacific albacore assessment.
- For each model, 100 stochastic projections were conducted, with future recruitments randomly sampled from historical deviates across the period used to estimate the stock-recruitment relationship within the assessment.
- Results across models were combined taking into account the weightings agreed by SC17 (models assuming movement based upon SEAPODYM estimates being down-weighted by 50% compared to those where movement was estimated internally within MULTIFAN-CL).
- The outputs of the projections are median depletion ($SB_{year}/SB_{F=0}$) for specific years of the projection period, F/F_{MSY}, and risk $SB_{2049}/SB_{F=0}$ <LRP and $F > F_{MSY}$, were calculated across the model grid for the whole of the South Pacific.
- Median $SB_{year}/SB_{F=0}$ for specific years of the projection period and risk $SB_{2049}/SB_{F=0}$ <LRP and median 'equilibrium; weighted vulnerable biomass in 2049 relative to that in 2013 + 8% were also calculated across the model grid for the southern WCPFC-CA region only.
- Catchability (which can have a trend in the historical component of the model) was assumed to remain constant in the projection period at the level estimated in the terminal year of the assessment model.

Table 1. **Catch based**: Summary of median South Pacific-wide albacore tuna stock outcomes under alternative average future fishing conditions.

Fishing (effort) level	$SB_{2025}/SB_{F=0}$	$SB_{2035}/SB_{F=0}$	$SB_{2049}/SB_{F=0}$	Risk $SB_{2049}/SB_{F=0}$ < LRP	F/F_{MSY}	Risk $F>F_{MSY}$
2017-2019 average	0.38	0.45	0.43	21%	0.31	19%
2020	0.41	0.49	0.47	19%	0.29	17%

Table 2. **Catch based**: Summary of median WCPFC-CA albacore tuna stock outcomes under alternative average future fishing conditions.

Fishing (effort) level	$SB_{2025}/SB_{F=0}$	$SB_{2035}/SB_{F=0}$	$SB_{2049}/SB_{F=0}$	Risk $SB_{2049}/SB_{F=0}$ < LRP	$VB_{2049}/(VB_{2013}+8\%)$
2017-2019 average	0.38	0.44	0.43	22%	0.64
2020	0.42	0.50	0.48	18%	0.72

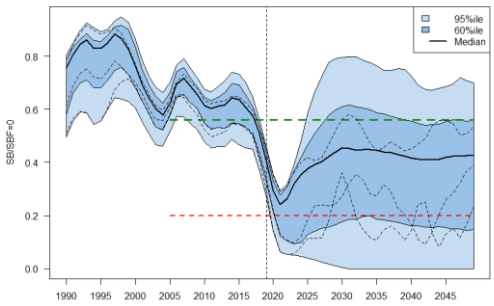
Table 3. **Effort based**: Summary of median South Pacific-wide albacore tuna stock outcomes under alternative average future fishing conditions.

Fishing (effort) level	$SB_{2025}/SB_{F=0}$	$SB_{2035}/SB_{F=0}$	$SB_{2049}/SB_{F=0}$	Risk $SB_{2049}/SB_{F=0}$ < LRP	F/F_{MSY}	Risk $F>F_{MSY}$
2017-2019 average	0.45	0.51	0.47	1%	0.25	0%
2020	0.48	0.55	0.51	0%	0.22	0%

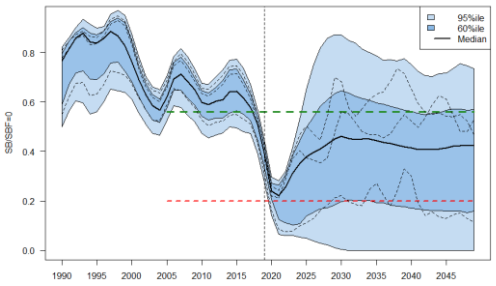
Table 4. **Effort based**: Summary of median WCPFC-CA albacore tuna stock outcomes under alternative average future fishing conditions.

Fishing (effort) level	$SB_{2025}/SB_{F=0}$	$SB_{2035}/SB_{F=0}$	$SB_{2049}/SB_{F=0}$	Risk $SB_{2049}/SB_{F=0}$ < LRP	$VB_{2049}/(VB_{2013}+8\%)$
2017-2019 average	0.46	0.51	0.48	0%	0.68
2020	0.48	0.53	0.50	0%	0.70

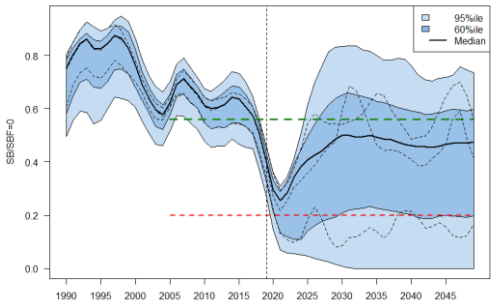
South Pacific-wide
2017-2019 catches



WCPFC-CA
2017-19 catches



2020 catches



2020 catches

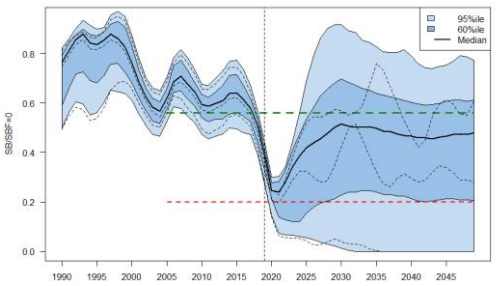
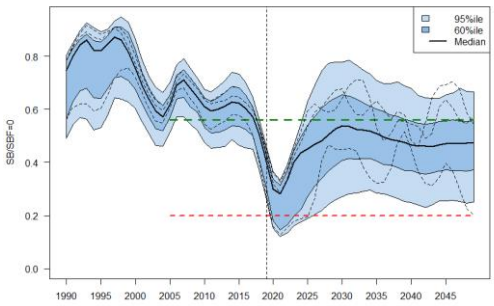


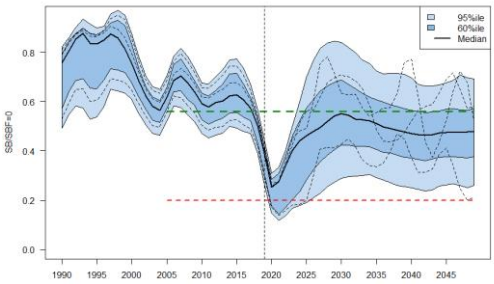
Figure 1 **Catch based**: Time series of South Pacific albacore tuna spawning potential $SB_t/SB_{F=0}$ for the whole of the South Pacific (left column) and WCPFC-CA (right column) where $SB_{F=0}$ is the average SB from t-10 to t-1, from the S17 weighted uncertainty grid of assessment models for the period 1990 to 2019, and stochastic projection results for the period 2020 to 2049 assuming 2017-2019 (top row) and 2020 (bottom row) catch (longline and troll) levels continue. Vertical line at 2019 represents the last year of the assessment. During the projection period (2020-2049) levels of recruitment variability are assumed to match those over the period used to estimate the stock recruitment relationship (1960-2017). The dashed lines indicate three example trajectories (chosen randomly out of 5,400) from the weighted model grid; the dark and light blue areas contain 60 and 95%, respectively, of depletion estimates for each year. The red horizontal dashed line represents the agreed limit reference point, the green dashed line the interim target reference point.

We note that 8% of the weighted stochastic catch-based projections failed to run to completion. This may result from a combination of particular grid models with lower stock productivity, low future recruitments sampled from the historical estimates within the projection period, and the assumption that fixed catch levels are assumed in the future regardless of the underlying stock status. Under those conditions the biomass can be reduced to zero.

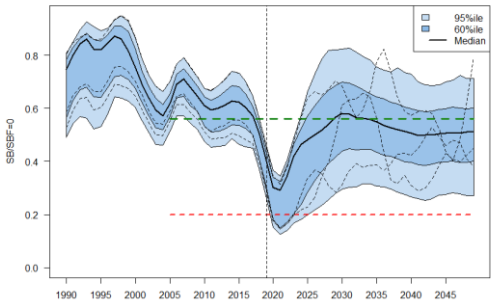
South Pacific-wide
2017-2019 effort



WCPFC-CA
2017-19 effort



2020 effort



2020 effort

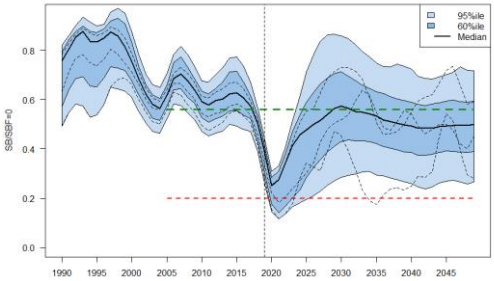


Figure 2 **Effort based**: Time series of South Pacific albacore tuna spawning potential $SB_t/SB_{F=0}$ for the whole of the South Pacific (left column) and WCPFC-CA (right column) where $SB_{F=0}$ is the average SB from t-10 to t-1, from the S17 weighted uncertainty grid of assessment models for the period 1990 to 2019, and stochastic projection results for the period 2020 to 2049 assuming 2017-2019 (top row) and 2020 (bottom row) effort (longline) and catch (troll) levels continue. Vertical line at 2019 represents the last year of the assessment. During the projection period (2020-2049) levels of recruitment variability are assumed to match those over the period used to estimate the stock recruitment relationship (1960-2017). The dashed lines indicate three example trajectories (chosen randomly out of 5,400) from the weighted model grid; the dark and light blue areas contain 60 and 95%, respectively, of depletion estimates for each year. The red horizontal dashed line represents the agreed limit reference point, the green dashed line the interim target reference point.