COMMISSION
SIXTEENTH REGULAR SESSION
Port Moresby, Papua New Guinea
5 - 11 December 2019

REFERENCE DOCUMENT FOR THE REVIEW OF CMM 2015-02 AND DEVELOPMENT OF HARVEST STRATEGIES (SOUTH PACIFIC ALBACORE)

WCPFC16-2019-18
15 November 2019

Paper prepared by the Secretariat

A. INTRODUCTION

1. The purpose of this paper is to provide a quick reference guide to the recommendations of the Scientific Committee (SC) and Technical and Compliance Committee (TCC) of relevance to the discussions in support of the review of the CMM 2015-02 and the progress in the development of harvest strategies under CMM 2014-06. This paper includes stock status, management advice, research recommendations, and the development of a harvest strategy framework from SC15 and TCC15 for the South Pacific albacore stock. The results of the latest stock assessment from SC14 is in **Attachment 1**.

B. SCIENTIFIC COMMITTEE RECOMMENDATIONS

Stock status and management advice (Paragraphs 41 – 48, SC15 Outcomes Document)

a. Stock status and trends

2. SC15 noted that no stock assessments were conducted for South Pacific albacore in 2019. Therefore, the stock status descriptions from SC14 are still current for South Pacific albacore. Updated information on fishery trends and indicators were compiled for and reviewed by SC15.

3. SC15 noted that the total provisional Pacific Ocean catch south of the Equator in 2018, updated since the paper was submitted, was 80,820 mt, a 13% decrease from 2017 and a 2% decrease from the average 2013-2017. Longline catch in 2018 (77,776 mt) was a 14% decrease from 2017 and an 8% decrease from the 2013-2017 average.

4. The average stock status in 2016 (the last year of the assessment) across the 72 model runs was $SB_{latest}/SB_{F=0}$ = 0.52, below the interim target reference point ($SB_{latest}/SB_{F=0}$ = 0.56) established by the WCPFC in 2018. The probability of being below the TRP in 2016 is 63%. The stock is not overfished nor is overfishing occurring.

5. SC15 noted projections from the 2018 assessment which apply to the WCPFC Convention Area. The historical status and projections have a greater uncertainty in spawning stock depletion than observed for bigeye and yellowfin tuna because South Pacific albacore has a different grid which incorporates natural mortality and growth and this gives a wider spread of uncertainty. SC15 noted that under recent fishery conditions of assuming that the 2018 catch remains constant, the albacore stock is initially projected to increase as recent estimated relatively high recruitments support adult stock biomass, then decline as future recruitment is sampled from the long-term historical estimates The projections indicate that median $F_{2020}/F_{MSY} = 0.24$; median $SB_{2020}/SB_{F=0} = 0.43$; and median $SB_{2020}/SB_{MSY} = 3.2$. The risk that $SB_{2020}/SB_{F=0} < LRP = 0\%$, $SB_{2020} < SB_{MSY} = 0\%$ and $F_{2020} > F_{MSY} = 0\%$.

6. The stock biomass is expected to decline from the 2016 level of 0.52 to 0.39 by 2035. The risk of the stock biomass breaching the LRP in 2035 is expected to be 23%. The longline-vulnerable biomass (the longline CPUE proxy) is expected to decrease by 36% relative to 2013 levels.

b. Management advice and implications

7. Given the stock assessment in 2018 and SC15 projections, SC15 advises that WCPFC develop comprehensive binding South Pacific albacore management measures which will result in the stock reaching the TRP within the 20-year time horizon. SC15 advises WCPFC16 may consider establishing a CMM to further reduce total catch or effort in order to reverse the projected decline in the vulnerable biomass.

8. SC15 notes that the 2018 South Pacific albacore stock assessment pertained to the WCPFC Convention Area. The South Pacific albacore catch in the eastern Pacific Ocean has recently increased and the scheduled 2021 South Pacific albacore assessment may pertain to the entire south Pacific stock in order to incorporate all population dynamics. WCPFC and IATTC compatible measures would be more easily implemented should an entire south Pacific assessment be conducted.

c. Research recommendation

9. SC15 noted that the assumed future recruitment can have a large impact on the projection result. It was recommended that research be undertaken to quantify autocorrelation behavior of recruitment to be included in the future projection.

Development of a harvest strategy framework

a. **Target Reference Points – South Pacific albacore tuna** (Paragraphs 117 – 119, SC15 Outcomes Document)

10. SC15 reviewed information on alternative catch trajectories to achieve the South Pacific albacore interim TRP within no later than 20 years (SC15-MI-WP-02). SC15 noted the historical status and the projections have a greater uncertainty in spawning stock depletion for South Pacific albacore than observed for bigeye and yellowfin tuna because South Pacific albacore has a different grid which incorporates natural mortality and growth and this gives a wider spread of uncertainty. SC15 noted that the recovery target can be achieved through many different approaches with the assumed long-term recruitments. However, catch (and effort) reductions from the 2014-16 average (of 60,000 mt) are required under all scenarios, and the resulting stock trajectories have different consequences for the associated fisheries. For example, if catch reductions are insufficient, or management action is delayed, the stock declines in the short term, with the consequence that management interventions may then need to be greater to achieve the interim TRP within 20 years, as stock recovery will be from a lower biomass

level. Delays in the introduction of the reduction of catch may also increase the risk (12% in 2022 under 2014-2016 average catch levels) of breaching the LRP in the short term.

11. Several CCMs expressed a preference for a recovery time shorter than 20 years, while one CCM stated that the introduction of legally-binding catch quotas would be needed to order to implement a re-building strategy.

12. SC15 also noted that constant catch scenarios may mask declines in catch rates and associated economic conditions and requested that the Science Service Provider undertake a similar set of analyses based on fishing effort-based projections. SC15 recommends that WCPFC16 take note of both sets of results in consideration of rebuilding the South Pacific albacore stock to the interim TRP within 20 years.

b. Progress on the Development of Harvest Control Rules and Management Strategy Evaluation (MSE) for South Pacific albacore tuna (Paragraph 129 - 133, SC15 Outcomes Document)

13. SC15 reviewed several papers related to ongoing work which is being undertaken by the Scientific Services Provider as specified in the Harvest Strategy Work Plan on the MSE framework for South Pacific albacore.

14. First, noting that the initial work on the development of harvest strategies for South Pacific albacore has focused on developing an empirical MP that uses standardised CPUE as the primary indicator of stock status, SC15 reviewed information on alternative sources of CPUE data and standardisation approaches to inform this process (SC15-MI-WP-07). SC15 endorsed the use of both the traditional GLM and the geostatistical modelling approaches for standardizing CPUE and their use in the Reference Set of uncertainties. Furthermore, noting difficulties associated with the use of the daily set-by-set data (currently used in the assessment) within the MSE framework, SC15 also endorsed the use of the aggregated catch/effort data set. However, SC15 also noted some small differences in the resulting biomass indicators based on these two different data sets, and requested that the Science Service Provider undertake some additional analyses to clarify any consequences on the performance of candidate HCRs which may be used to achieve management objectives.

15. Second, SC15 reviewed a demonstration set of southern longline fishery performance indicators (PIs, taken from the list of prioritized indicators identified at WCPFC14) for evaluating the relative performance of candidate MPs South Pacific albacore, noting that the lack of inclusion of a PI, at this stage, does not imply it has reduced priority in the framework (SC15-MI-WP-03). SC15 noted that the utility of many economic indicators is currently limited by the unavailability of specific fleet-based economic data with the consequence that less informative proxies have to be used. CCMs also noted that several of the PIs are similar and perhaps redundant. Several CCMs also noted that a number of important PIs are currently not included in the demonstration set (often due to a difficulty in calculation due to a lack of information) but expressed a willing to work with the Science Service Provider and other CCMs on providing more information for improving the calculation of these proposed PIs. SC15 recommends that WCPFC16 take note of this demonstration set of PIs and provide feedback to the Science Service Provider as needed.

16. Third, SC15 reviewed the current status of the MSE framework for South Pacific albacore and the details of some illustrative analyses that have been completed (SC15-MI-WP-08). SC15 made a number of suggestions aimed at clarifying and improving aspects of the analyses, such as being able to see retrospective analysis of the CPUE generated from the operating model, incorporating the DWFN index in the HCR, and including a density dependence/hyperstability option and recruitment autocorrelation in the Reference Set of the uncertainty grid. One CCM also suggested inclusion of an additional flux of

South Pacific albacore from the IATTC convention area as an additional axis of uncertainty, but it was noted that this would be difficult. CCMs were also invited to suggest possible HCRs for testing in this MSE framework for South Pacific albacore. SC15 recommends that WCPFC16 note the current status of the MSE framework for South Pacific albacore and provide feedback to the Science Service Provider as needed.

17. SC15 recommends that WCPFC16 note the progress on the development of the MSE being undertaken under the Harvest Strategy Work Plan for South Pacific albacore tuna and provide additional elements, if any, as specified in the Harvest Strategy Work Plan to further progress this work against the scheduled time-lines noted in this Work Plan.

C. TECHNICAL AND COMPLIANCE COMMITTEE RECOMMENDATIONS

18. TCC15 requested that the Science Provider prepare an update of TCC15-2019-IP15 *Assessment of the number of vessels fishing for South Pacific Albacore south of 20S* each year to support the Secretariat's and TCC's roles in compliance monitoring. TCC15 also requested that the Secretariat use the information in those updated reports in its preparation of the dCMR each year, as well as to advise TCC of any improvements that should be made to the information in those updated reports. TCC agreed to use, in future years, the information in those updated reports, in addition to other relevant information, in its compliance reviews of obligations under the SP albacore measure. *(TCC15 draft summary report, para 360)*

Attachment 1

SOUTH PACIFIC ALBACORE TUNA

(*Paragraphs 236 – 246, SC14 Summary Report*)

Provision of scientific information

1. SC14 accepted as SC14-SA-WP-05 as providing the best available scientific information for the purpose of stock assessment determination.

Stock status and trends

2. The median, 10 percentile and 90 percentile values of recent (2013-2016) spawning biomass ratio (SB_{recent}/ $SB_{F=0}$) and recent fishing mortality in relation to F_{MSY} (F_{recent}/F_{MSY}) over the structural uncertainty grid were used to characterize uncertainty and describe the stock status.

3. A description of the structural sensitivity grid used to characterize uncertainty in the assessment is set out in Table SPA-1. The regional structure used within the assessment is presented in Figure SPA-1, and the time series of total annual catch by fishing gear for the diagnostic case model over the full assessment period is shown in Figure SPA-2 for the total assessment region, and Figure SPA-3 by model region. Estimated annual average recruitment, spawning potential, juvenile and adult fishing mortality and fishing depletion for the diagnostic case model are shown in Figures SPA-4 – SPA-7. Figure SPA-8 displays Majuro plots summarising the results for each of the models in the structural uncertainty grid, while Figure SPA-9 shows equivalent Kobe plots for SB_{recent} and SB_{latest} across the structural uncertainty grid. Figure SPA-10 provides estimates of reduction in spawning potential due to fishing by region, and over all regions attributed to various fishery groups (gear-types) for the diagnostic case model. Table SPA-2 provides a summary of reference points over the 72 models in the structural uncertainty grid. Figure SPA-11 presents the history of the annual estimates of MSY for the diagnostic case model, compared with annual catch by the main gear types. Finally, Figure SPA-12 presents the estimated time-series (or 'dynamic') Kobe plots for four example models from the assessment (one from each of the combinations of growth types, and natural mortality M set to 0.3 or 0.4)

4. SC14 noted that the median level of spawning biomass depletion from the uncertainty grid was $SB_{recent}/SB_{F=0}$ = 0.52 with a probable range of 0.37 to 0.63 (80% probability interval). There were no individual models where ($SB_{recent}/SB_{F=0}$) < 0.2 which indicated that the probability that recent spawning biomass was below the LRP was zero. SC14 noted that the grid median F_{recent}/F_{MSY} was 0.20, with a range of 0.08 to 0.41 (80% probability interval) and that no values of F_{recent}/F_{MSY} in the grid exceeded 1.

5. SC14 also noted that there was a 0% probability (0 out of 72 models) that the recent fishing mortality had exceeded F_{MSY}.

6. SC14 noted that the structural uncertainty grid for the south Pacific albacore had changed since the 2015 assessment, with the 2018 assessment examining additional axes of uncertainty including assumptions on growth and CPUE standardization approach. As a consequence, the uncertainty identified is higher than in previous assessments.

7. SC14 also noted that the assessment results show that while the stock depletion ($SB/SB_{F=0}$) has exhibited a long-term decline (Figure SPA-7) the stock is not in an overfished state and overfishing is not taking place.

Management Advice and implications

8. SC14 noted that the preliminary estimate of total catch of south Pacific albacore (within the WCPFC Convention Area south of the equator) for 2017 was 75,707mt, which was a 33% increase from 2016 and a 13% increase over 2012-2016. (see SC14-SA-WP-02).

9. Preliminary catch for longliners in 2017 (72,785mt) was 34% higher compared with 2016 and a 14% increase over 2012-2016. Preliminary other gear (primarily troll) catch in 2017 (2,896t) was 17% higher compared with 2016 but a 1% decrease over 2012-2016. (see SC14-SA-WP-02).

10. Based on the uncertainty grid adopted by SC14, the South Pacific albacore tuna spawning biomass is very likely to be above the biomass LRP and recent F is very likely below F_{MSY}, and therefore the stock is not experiencing overfishing (100% probability $F < F_{MSY}$) and is not in an overfished condition (100% probability $SB_{recent} > LRP$).

11. SC14 recalled its previous advice from SC11, SC12, and SC13 that longline fishing mortality and longline catch be reduced to avoid decline in the vulnerable biomass so that economically viable catch rates can be maintained, especially for longline catch of adult albacore. SC14 recommends that this advice be taken into consideration when the TRP for South Pacific albacore is discussed at WCPFC15.

Table SPA-1. Description of the structural sensitivity grid used to characterize uncertainty in the 2018 south Pacific albacore assessment. Levels used within the diagnostic case are starred.

Axis	Levels	Option
Steepness	3	0.65, 0.80*, 0.95
Natural mortality	2	0.3*, 0.4
Growth	2	Estimated* (K, L_∞) or fixed (Chen-Wells)
Size frequency weighting	3	Sample sizes divided by 20, 50* or 80
CPUE	2	Geostatistical*, Traditional

Table SPA-2. Summary of reference points over all the 72 individual models in the structural uncertainty grid.

	Mean	Median	Min	10%	90%	Max
C_{latest}	61719	61635	60669	60833	62704	63180
MSY	100074	98080	65040	70856	130220	162000
$YF_{recentt}$	71579	71780	56680	62480	80432	89000
fmult	6.2	4.96	1.89	2.44	12.05	17.18
F_{MSY}	0.07	0.07	0.05	0.05	0.09	0.1
F_{recent}/F_{MSY}	0.23	0.2	0.06	0.08	0.41	0.53
SB_{MSY}	71407	68650	26760	39872	100773	134000
SB_0	443794	439800	308800	353870	510530	696200
SB_{MSY}/SB_0	0.16	0.17	0.07	0.1	0.21	0.23
$SB_{F=0}$	469004	462633	380092	407792	534040	620000
$SB_{MSY}/SB_{F=0}$	0.15	0.15	0.06	0.09	0.2	0.22
SB_{latest}/SB_0	0.55	0.56	0.33	0.42	0.69	0.74
$SB_{latest}/SB_{F=0}$	0.53	0.52	0.3	0.37	0.69	0.77
SB_{latest}/SB_{MSY}	4	3.42	1.45	1.96	7.07	10.74
$SB_{recent}/SB_{F=0}$	0.51	0.52	0.32	0.37	0.63	0.72
SB_{recent}/SB_{MSY}	3.88	3.3	1.58	1.96	6.56	9.67

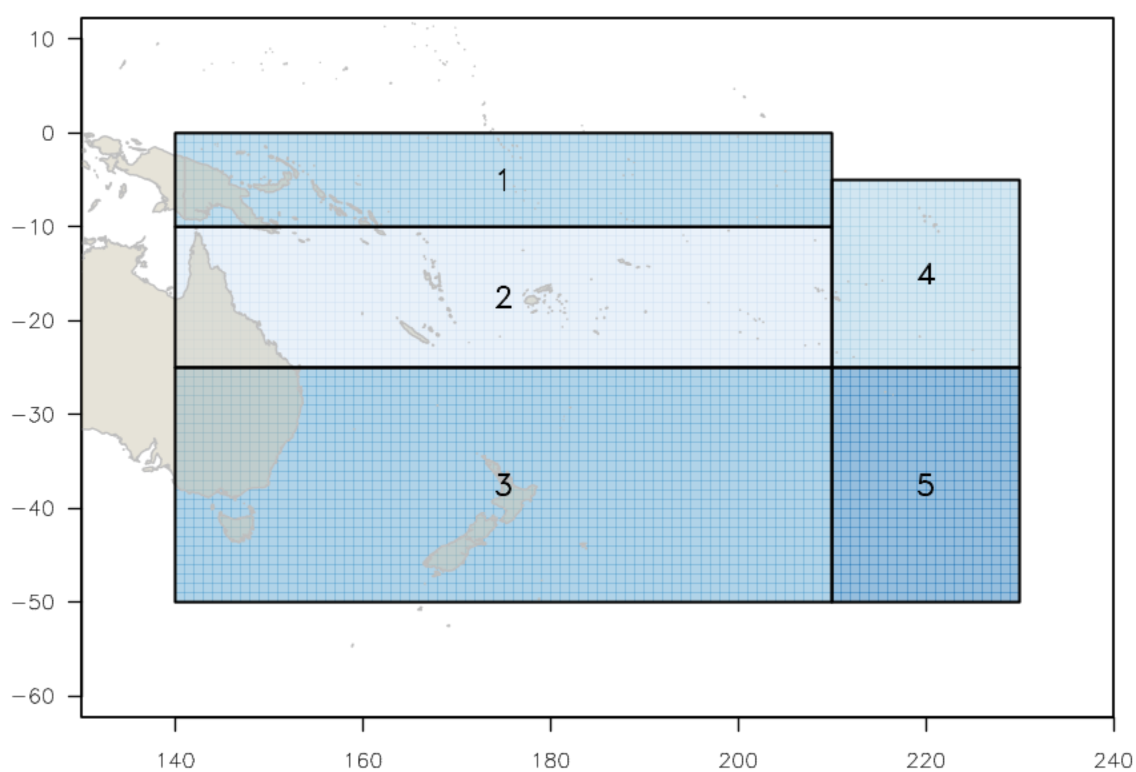

Figure SPA- 1. The geographical area covered by the stock assessment and the boundaries for the 5 regions under the “updated 2018 regional structure".

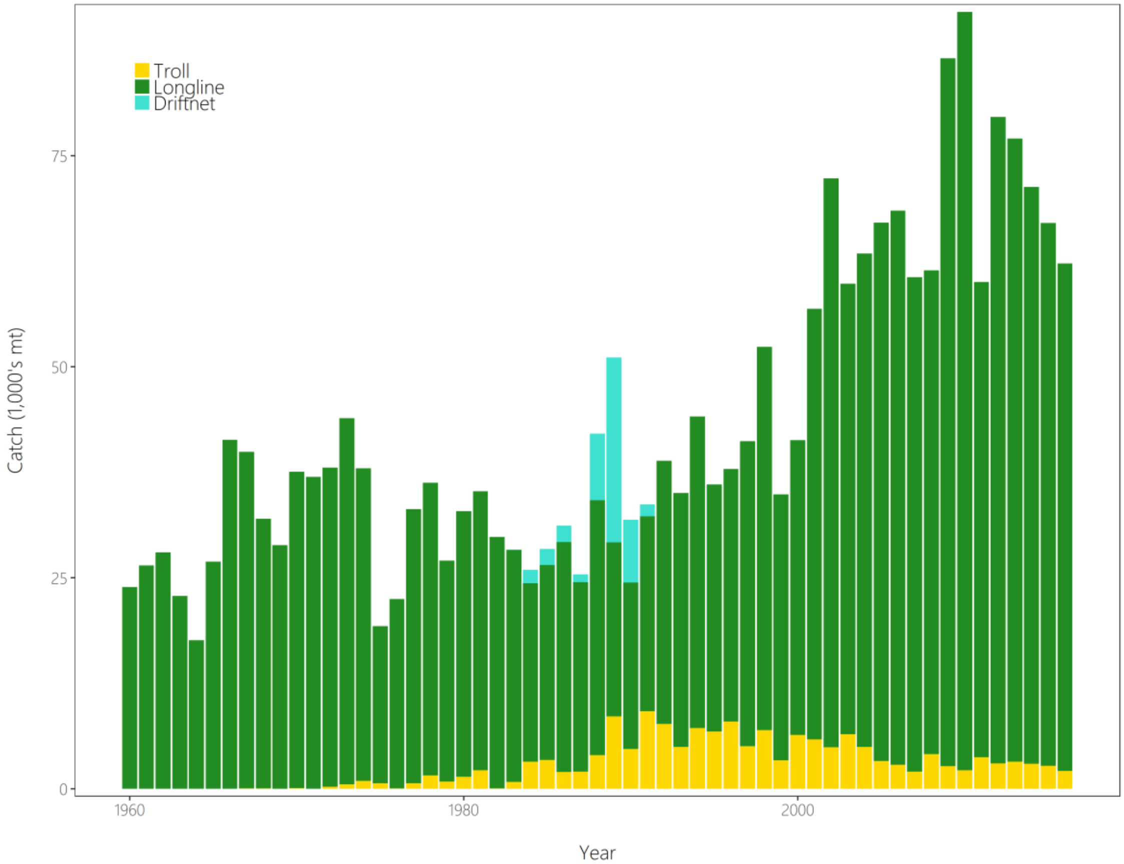

Figure SPA- 2. Time series of total annual catch (1000's mt) by fishing gear for the diagnostic case model over the full assessment period. The different colours refer to longline (green), troll (yellow) and driftnet (turquoise). Note that the catch by longline gear has been converted into catch-in-weight from catch-in-numbers.

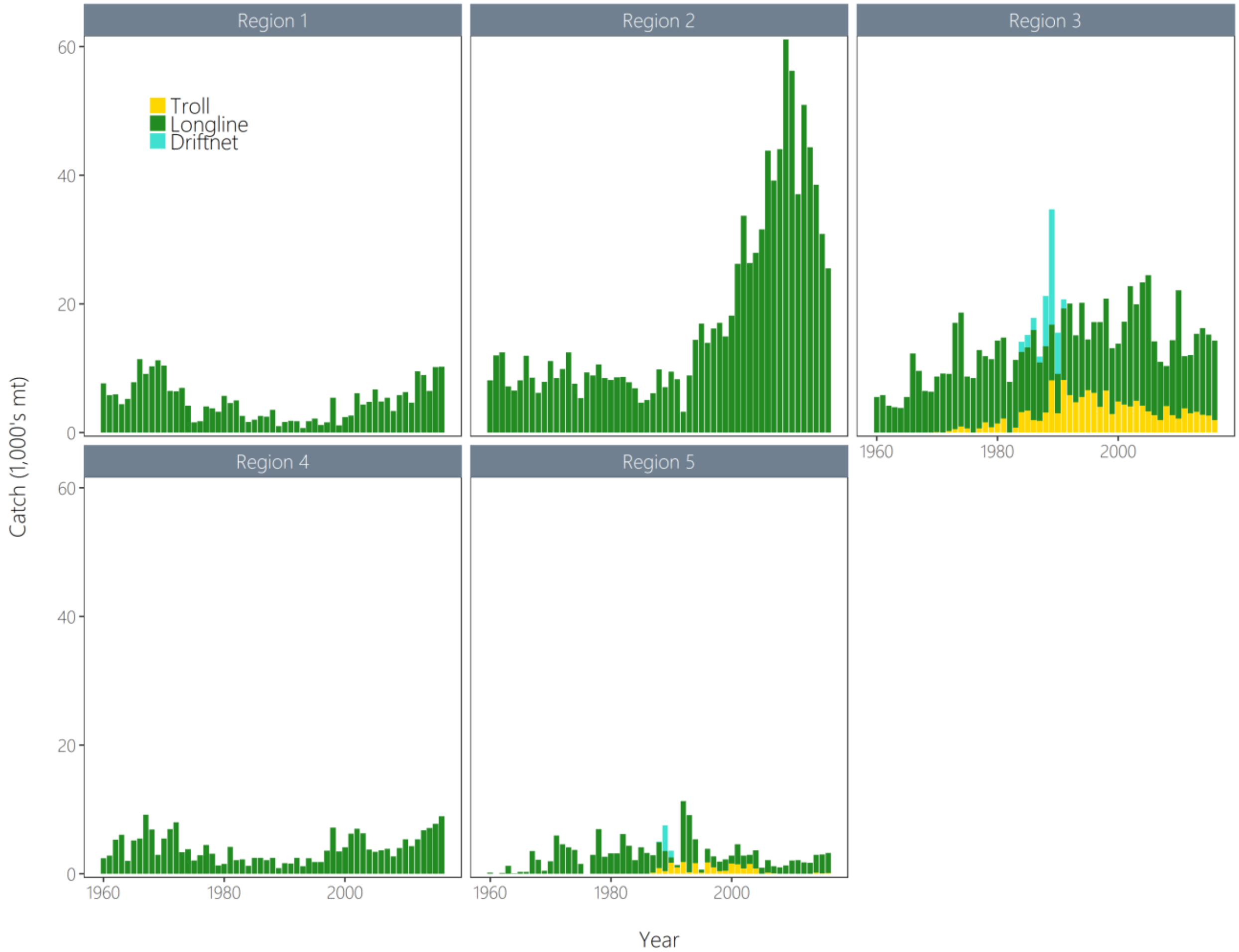

Figure SPA-3. Time series of total annual catch (1000's mt) by fishing gear and assessment region from the diagnostic case model over the full assessment period. The different colours denote longline (green), driftnet (turquoise) and troll (yellow).

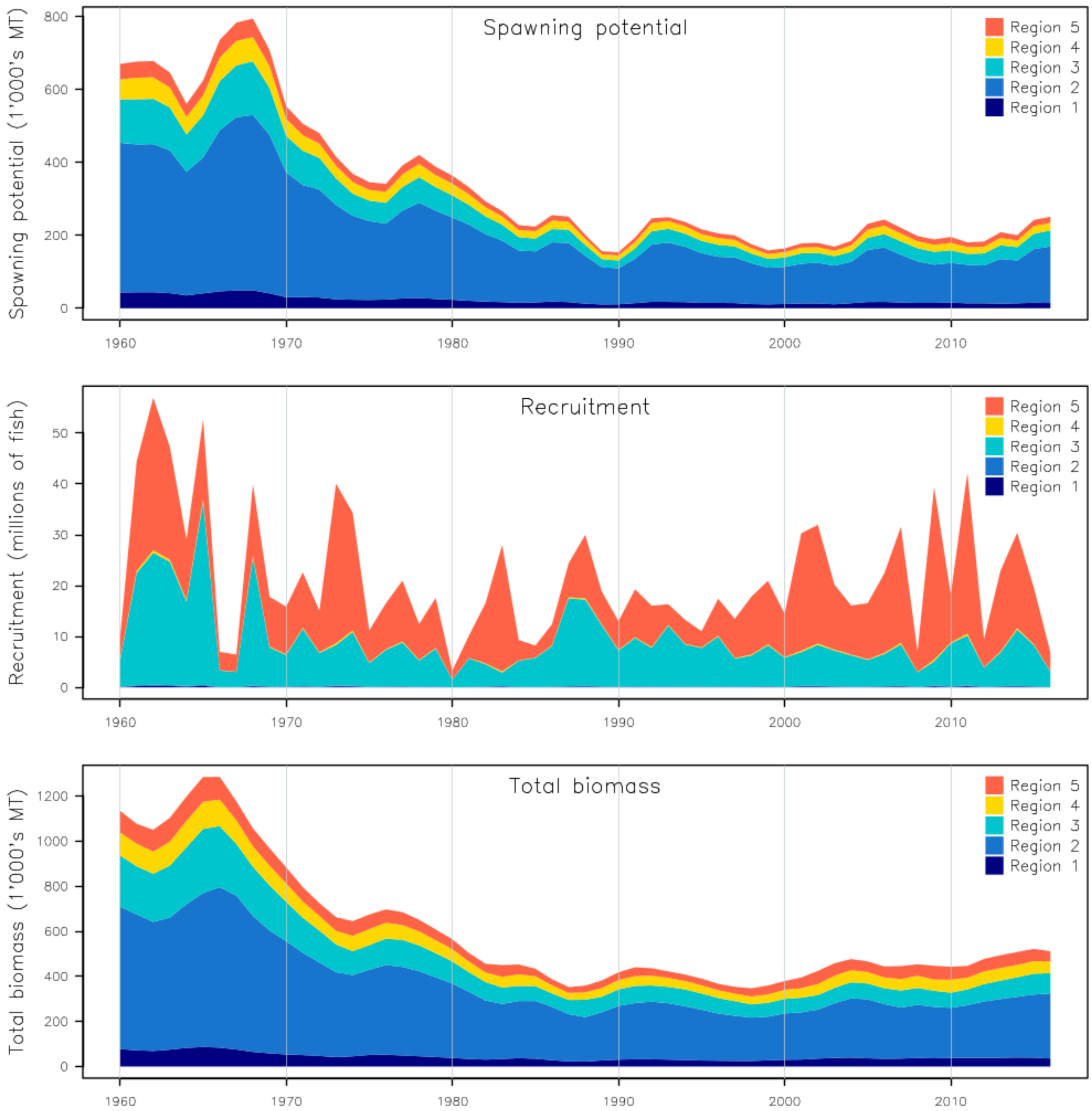

Figure SPA-4. Estimated annual average recruitment, spawning potential and total biomass by model region for the diagnostic case model, showing the relative sizes among regions.

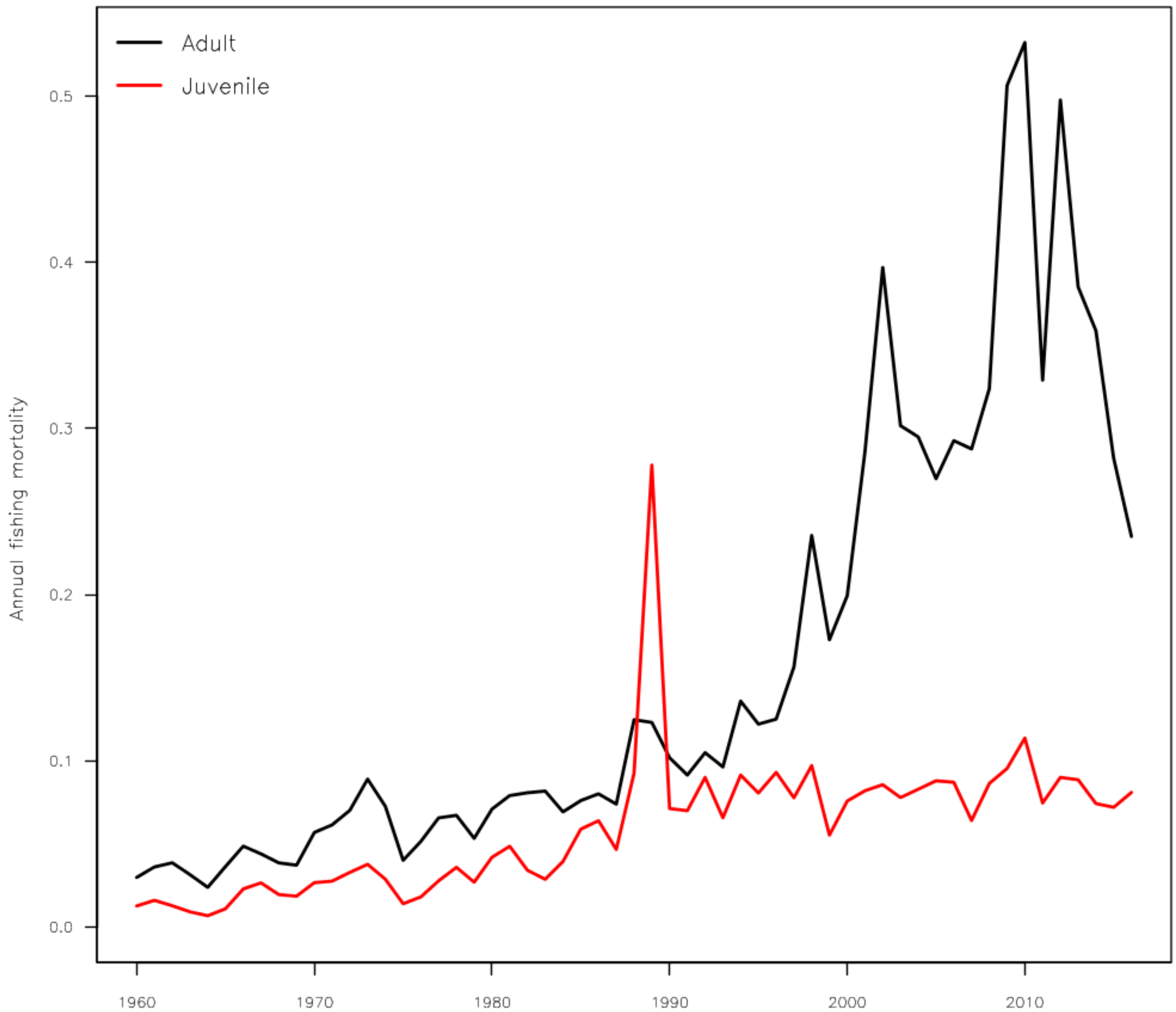

Figure SPA-5. Estimated annual average juvenile and adult fishing mortality for the diagnostic case model.

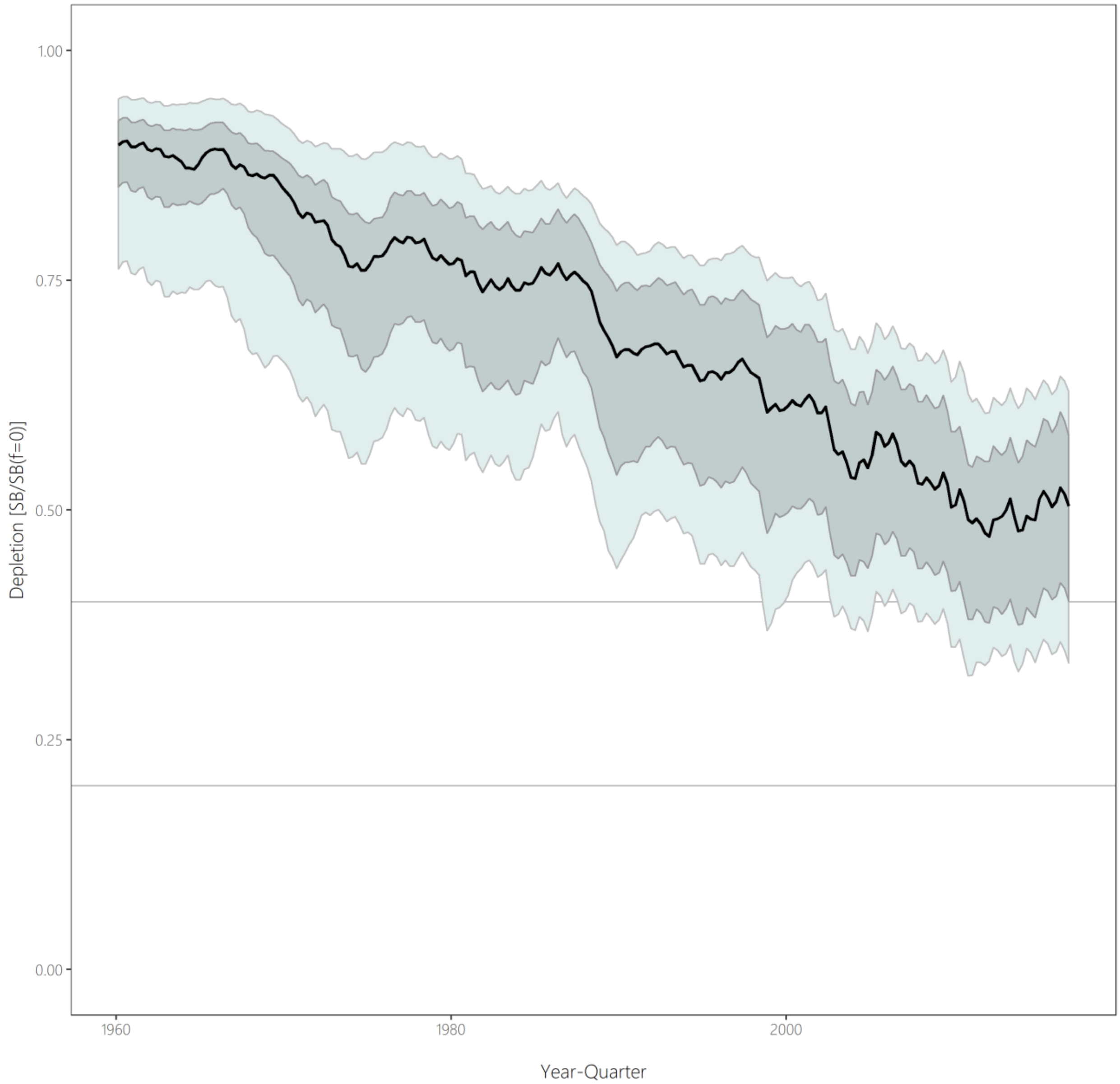

Figure SPA-6. Distribution of time series depletion estimates across the structural uncertainty grid. Black line represents the grid median trajectory, dark grey region represents the 50%ile range, light grey the 90%ile range.

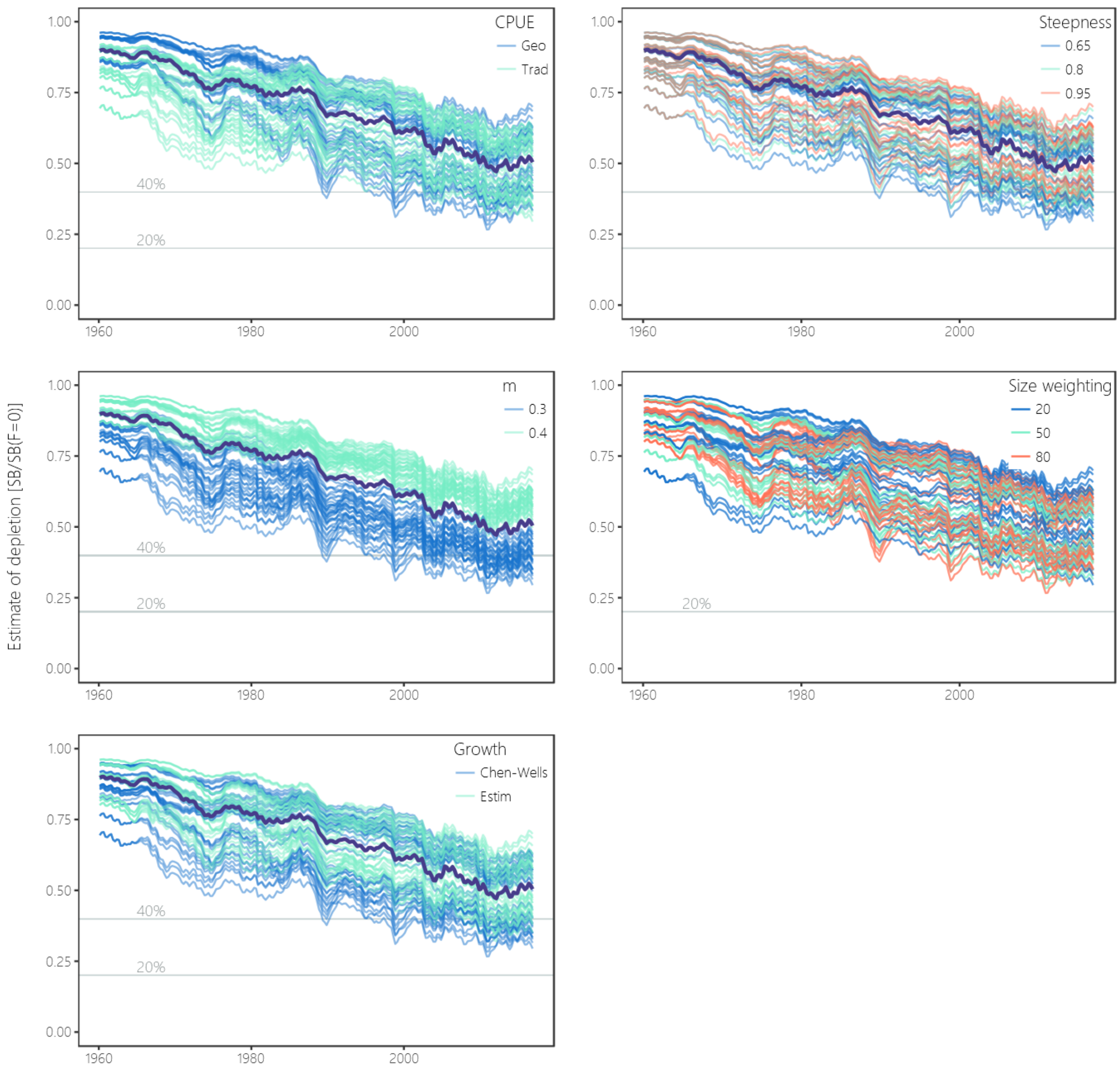

Figure SPA-7. Plots showing the trajectories of fishing depletion (of spawning potential) for the model runs included in the structural uncertainty grid. The five panels show the models separated on the basis of the five axes used in the grid, with the colour denoting the level within the axes for each model.

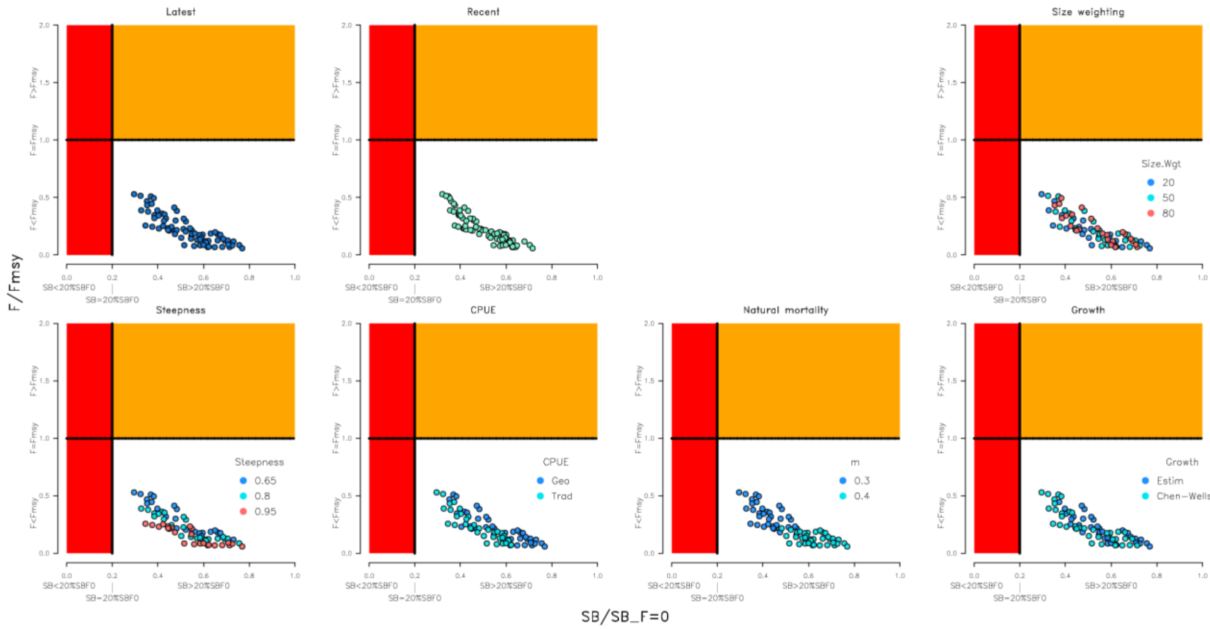

Figure SPA-8. Majuro plots summarising the results for each of the models in the structural uncertainty grid under the $SB_{latest}/SB_{F=0}$ and the $SB_{recent}/SB_{F=0}$ reference points (top left) and each axis of uncertainty.

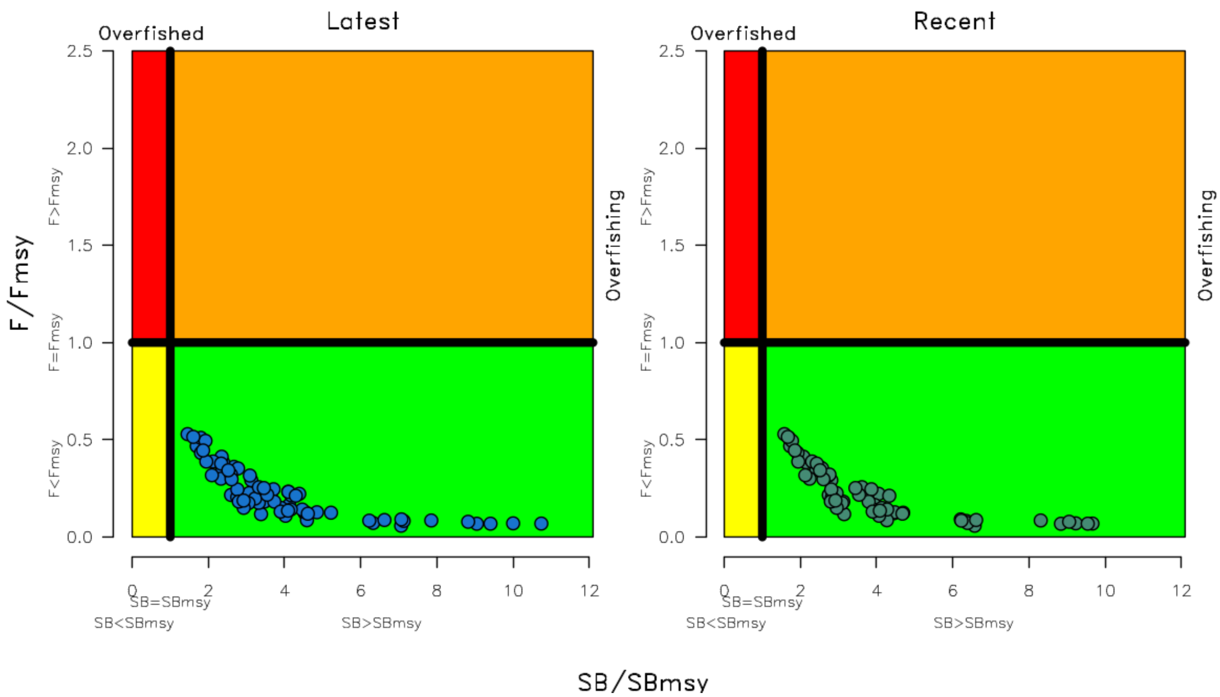

Figure SPA-9. Kobe plots summarising the results for each of the models in the structural uncertainty grid under the $SB_{latest}/SB_{F=0}$ and the $SB_{recent}/SB_{F=0}$ reference points.

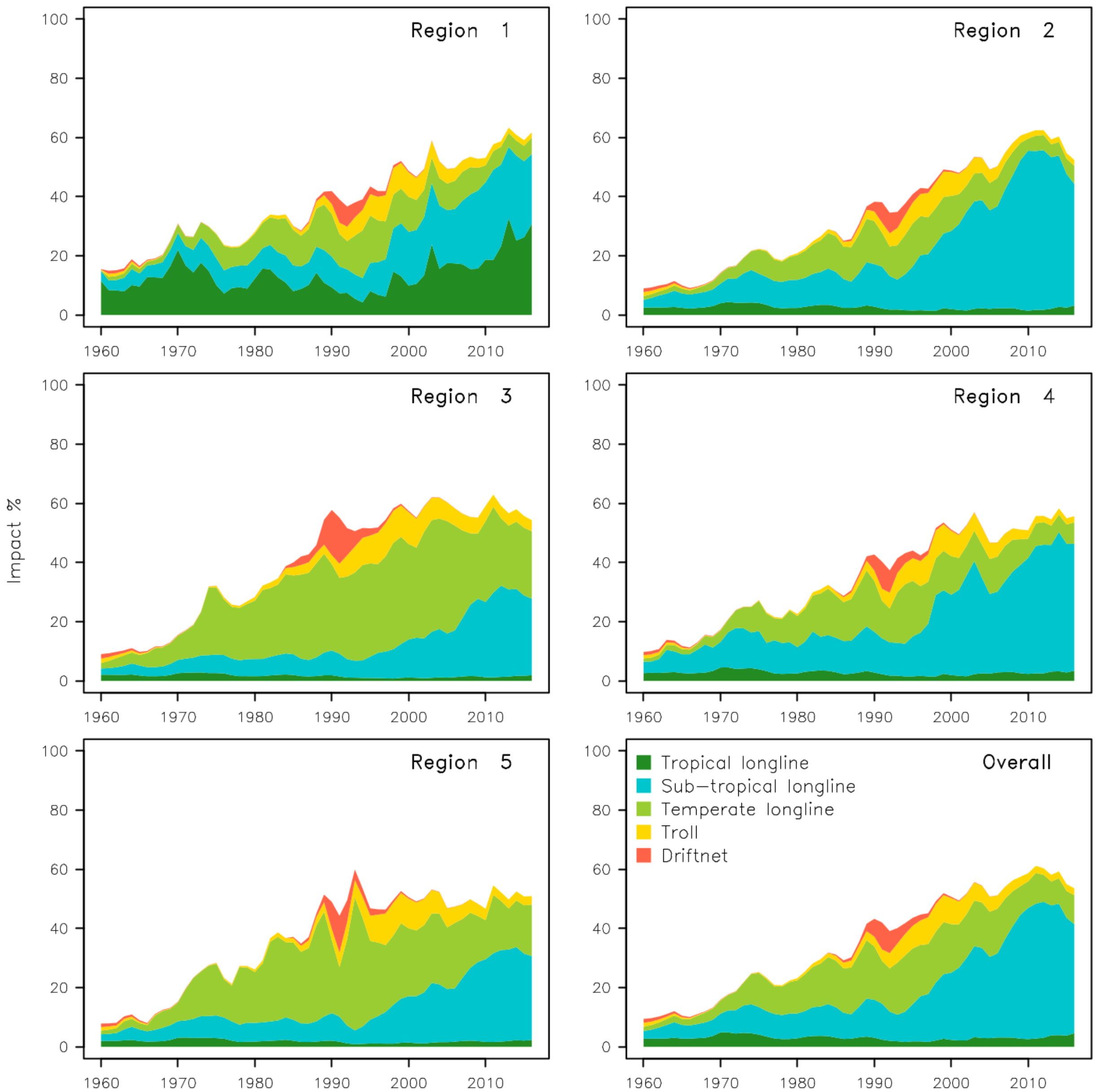

Figure SPA-10. Estimates of reduction in spawning potential due to fishing (fishery impact = 1-$SB_{latest}/SB_{F=0}$) by region, and over all regions (lower right panel), attributed to various fishery groups for the diagnostic case model.

Figure SPA-11. History of the annual estimates of MSY (red line) for the diagnostic case model compared with annual catch by the main gear types.

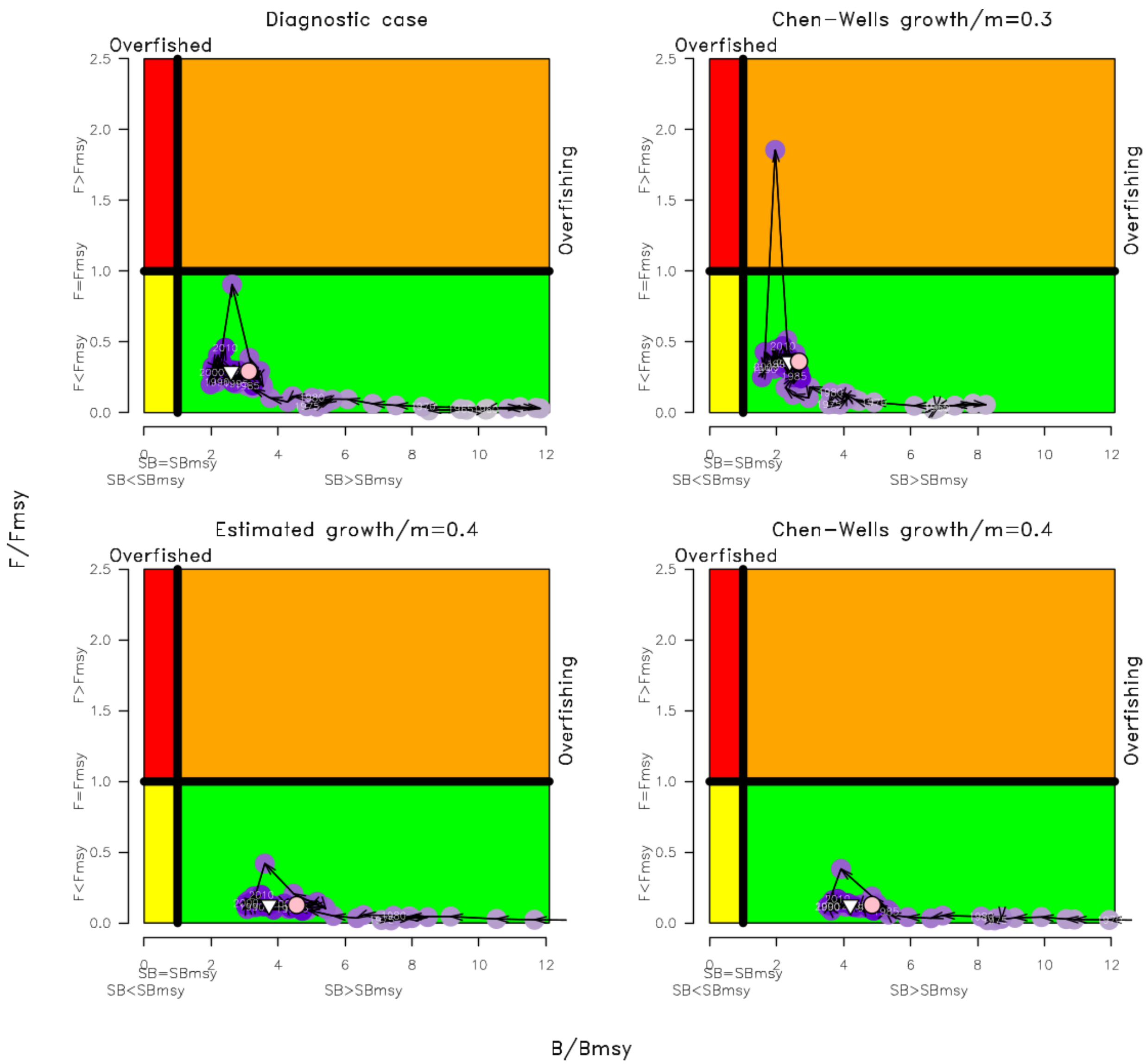

Figure SPA-12. Estimated time-series (or 'dynamic') Kobe plots for four example models from the assessment (one from each of the combinations of growth types, and natural mortality *M* set to 0.3 or 0.4).