SOUTH PACIFIC ALBACORE
ROADMAP INTERSESSIONAL WORKING GROUP

ELECTRONIC MEETING
13 November 2020

OVERVIEW OF THE SOUTH PACIFIC ALBACORE ROADMAP IWG ACTIVITIES

SPALB-RM-2020/IP-01 (Rev.01)

Secretariat

OVERVIEW OF THE SOUTH PACIFIC ALBACORE ROADMAP WG ACTIVITIES

Prepared by the Secretariat

OVERVIEW OF THE SPA-VIWG ACTIVITIES

1. This paper provides as information on overview of the activities of the South Pacific Albacore Working group since it was established by the Commission in December 2017 at WCPFC14. It also outlines as reference the stock status and management advice for the said stock.

2. In December 2017, WCPFC14 agreed to formulate an intersessional working group, led by Ms Sarah Williams (New Zealand), to develop a roadmap for effective management of the South Pacific albacore stock, and provided procedural matters including terms of references of this working group as stipulated in Paragraphs 264 - 266, WCPFC14 Summary Report:

> *264. The Commission agreed to the formation of a virtual intersessional process to develop a Roadmap to implement the elements needed for the effective conservation and management for South Pacific albacore. The roadmap will take into account the outcome of a revised stock assessment for South Pacific albacore in 2018 and recommend an overall limit for the fishery, how it could be distributed (taking into account the interests of SIDS) and the actions required to achieve biological and economic stability in the fishery. This roadmap will include recommendations for a review of the existing CMM for South Pacific albacore. The terms of reference of this intersessional group will be to consider management issues for South Pacific albacore including:*
>
> *a) The elements necessary for the implementation of a Harvest Strategy approach to the management of the stock;*
> *b) an allocation process; and*
> *c) monitoring and reporting priorities, and addressing of gaps, for all fisheries taking South Pacific albacore within the WCPFC convention area.*
>
> *265. Also in support of the development of a Roadmap for South Pacific albacore, the Commission also agreed to task:*
>
> *a. SC14 to provide WCPFC15 with advice on technical aspects of the South Pacific albacore harvest strategy including, for example, a consideration of scientific elements of candidate harvest control rules, and potential components of the management procedure (e.g. the use of CPUE (vulnerable biomass) indices to inform on stock status);*
> *b. TCC14 to evaluate monitoring and reporting gaps in the South Pacific albacore fishery, as well as SIDS and Participating Territories implementation considerations; and*
> *c. SC14 and TCC14, based on their evaluations, will provide any appropriate advice or recommendations to WCPFC15 with respect to informing the development of the Roadmap for improving South Pacific albacore management.*
>
> *266. The Commission accepted New Zealand's offer to lead this intersessional working group, and noted New Zealand's request that all CCMs with an interest in participating in this*

intersessional working group nominate a point of contact to New Zealand before the conclusion of WCPFC14.

3. At WCPFC15 in December 2018, the Chair of the SPA-VIWG introduced the *Intersessional activity report from the South Pacific albacore roadmap virtual working group* (WCPFC15-2018-SPalbroadmap[1]), noting that the intersessional working group meetings discussed several components of the roadmap including a review of the current measure, potential consideration for an allocation process including the SP albacore Roadmap Draft Workplan (**Attachment A**), and technical components of the harvest strategy. In addition, the Chair also introduced a supplementary document which collated all discussions from previous SC, TCC and the Commission meetings since 2010 related to the past CMMs for SP albacore (WCPFC15-2018-SPalbroadmap_suppl[2]). The Chair referenced *Technical aspects of a potential south Pacific albacore harvest strategy* (WCPFC15-2018-09[3]) and noted that SC14 had recommended that WCPFC15 use the working paper to inform the development of the roadmap. In response, WCPFC15 tasked the SPA-VIWG to continue work intersessionally to develop the Roadmap for Effective Conservation and Management of South Pacific Albacore (Paragraphs 182, WCPFC15 Summary Report).

4. As part of the successful progress of the SPA-VIWG, WCPFC15 adopted an interim target reference point for the South Pacific albacore and other harvest strategy related decisions as stipulated in Paragraphs 207 – 212, WCPFC15 Summary Report:

> *207. WCPFC15 agreed on an interim target reference point (TRP) for south Pacific albacore at 56 percent of spawning stock biomass in the absence of fishing (0.56 SBF=0)[4] with the objective of achieving an 8 percent increase in catch per unit of effort (CPUE) for the southern longline fishery as compared to 2013 levels[5]. If a future stock assessment indicates that this interim TRP will not result in the desired longline CPUE, then the interim TRP will be revised in order to meet this objective. The TRP shall be reviewed every 3 years, consistent with the SP albacore assessment schedule.*
>
> *208. The Commission shall amend or develop appropriate conservation and management measures to implement a harvest control rule, developed in accordance with CMM 2014-06, with the objective of maintaining the south Pacific albacore spawning stock biomass at the target level on average and according to the timeframes specified in paragraph 209.*
>
> *209. In order to manage the required reduction in catches, the timeline for achieving the interim target reference point shall be no later than 20 years. The Scientific Services Provider is tasked with identifying a range of alternative catch pathways and timeframes that achieve this, for consideration in 2019.*
>
> *210. In undertaking the assessment identified in paragraph 209 information from all fisheries will be included while noting that any management measures must take account of the impact of different gear types.*

[1] https://www.wcpfc.int/node/32618
[2] https://www.wcpfc.int/node/33010f
[3] https://www.wcpfc.int/node/32646f
[4] The method to be used in estimating the recent average spawning biomass in the absence of fishing shall be the same as that adopted by the Commission for the limit reference point, as described in paragraph 3 of CMM 2015-06.
[5] The proxy for CPUE will be the southern longline vulnerable biomass as estimated within the stock assessment.

211. The Scientific Committee shall refer to the target reference point in its assessment of the status of the WCPO South Pacific albacore tuna stock and in reporting to the Commission on management advice and implications for this stock.

212. Considering that the distribution of the South Pacific albacore stock goes beyond the WCPFC Convention area and the management of this stock is responsibility of both WCPFC and IATTC, WCPFC15 requested the Scientific Services Provider to coordinate with the IATTC scientific staff with the view to consider including the entire South Pacific in future assessments.

5. Since the WCPFC15 meeting, the working group had little activities in 2019, and the Chair country New Zealand advised the Commission on 2 August 2019 that it would step down from the Chair of the SPA-VIWG.

6. In December 2019, WCPFC16 reviewed *South Pacific Albacore Roadmap and Harvest Strategy* (WCPFC16-2019-DP05[6]) and *Alternative Trajectories to achieve the South Pacific albacore interim TRP* (WCPFC16-2019-19[7]) and agreed to reinvigorate the working group (Paragraphs 390 - 391, WCPFC16 Summary Report):

390. The Commission agreed to reinvigorate the South Pacific Albacore Roadmap Working Group in 2020 under the leadership of Fiji and for it to continue to work intersessionally to develop the Roadmap for Effective Conservation and Management of South Pacific Albacore.

391. *The Commission further agreed that the South Pacific Albacore Roadmap Working Group would meet in the margins of SC16 and TCC16 and that during the intersessional period it would work to develop its workplan and terms of reference.*

7. In addition, WCPFC16 noted that possible future amendments to CMM 2015-02 would be among the matters to be considered through the South Pacific Albacore Roadmap Working Group (Paragraph 408, WCPFC16 Summary Report).

8. WCPFC16 also agreed that in 2020, there will be two South Pacific Albacore Roadmap Intersessional Working Group face-to-face meetings, led by Fiji, the first will be held immediately prior to SC16 in Apia, Samoa on Monday 10 August 2020 and the second would be held immediately following TCC16 in Pohnpei, FSM on Wednesday 30 September 2020 (Paragraphs 667a, WCPFC16 Summary Report). However, due to the COVID-19 pandemic, the meeting was delayed, and the Chair (Fiji) decided to hold a one-day, 3-hour virtual meeting on 13 November 2020 from 10AM to 1PM, Pohnpei time.

STOCK STATUS AND MANAGEMENT ADVICE

9. The SC16 virtual meeting did not have discussions on the South Pacific Albacore stock status and management advice. However, a compendium of fisheries indicators for SP albacore is available at SC16-SA-WP-01[8] and also discussed through the Online Discussion Forum Category *16th Regular Session of the Scientific Committee* Topic 8[9], and trends in the SP albacore longline and troll fisheries are described in SC16-SA-IP-11[10].The last stock assessment for the SP albacore was conducted in 2018 and the results were

[6] https://www.wcpfc.int/node/44327
[7] https://www.wcpfc.int/node/44344
[8] https://www.wcpfc.int/node/46472
[9] https://forum.wcpfc.int/t/topic-8-review-of-indicators-paper/58
[10] https://www.wcpfc.int/node/46625 (data updated version: WCPFC-TCC16-2020-IP07: https://www.wcpfc.int/node/47681)

presented to SC14 (**Attachment B**). Updated information on stock status and trends, and management advice and implications including research recommendations are available in Paragraphs 233 – 240 of the SC15 Summary Report, which is briefly summarized below.

Stock status and trends

10. The total provisional Pacific Ocean catch south of the Equator in 2018was 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.

11. 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.

12. SC15 noted projections from the 2018 assessment which apply to the WCPFC Convention Area (SC15-SA-WP-01[11]).

- 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%.

13. According to the projections in SC15-SA-WP-08[12], based upon the 2018 stock assessment and assuming 2018 catch levels through 2018-2035, the stock biomass is projected to decline from the 2016 level of 0.52 ($SB_{latest}/SB_{F=0}$ = 0.52) to 0.39 by 2035 ($SB_{2035}/SB_{F=0}$ = 0.39). The risk of the stock biomass breaching the LRP in 2035 ($SB_{2035}/SB_{F=0}$ < LRP) is expected to be 23%.

- Overall, the longline-vulnerable biomass (the longline CPUE proxy) is expected to decrease by 36% relative to 2013 levels (a year where some CCMs considered the longline fishery to have an adequate catch rate to meet economic fishery objectives).

Management advice and implications

14. 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.

15. 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

[11] https://www.wcpfc.int/node/42927
[12] https://www.wcpfc.int/node/42934

to incorporate all population dynamics. WCPFC and IATTC compatible measures would be more easily implemented should an entire south Pacific assessment be conducted.

Research recommendation

16. 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.

PROGRESS TOWARDS IMPLEMENTING THE HARVEST STRATEGY ELEMENTS FOR SOUTH PACIFIC ALBACORE

17. SC16 acknowledged the work of the Scientific Services Provider (SPC-OFP) to progress the implementation of the harvest strategy elements for SP albacore, noting the following papers prepared for SC16 will continue discussions through the WCPFC Online Discussion Forum (https://forum.wcpfc.int/c/HS-Framework/12):

- SC16-MI-IP-01[13] *Additional trajectories to achieve the South Pacific albacore interim TRP*;
- SC16-MI-IP-04[14] *Retrospective CPUE forecasting of south Pacific albacore*;
- SC16-MI-IP-05[15] *HCR design considerations for south Pacific albacore*;
- SC16-MI-IP-11[16] *Report on the second external MSE review: Developments in the South Pacific albacore MSE framework*

18. The current status of the harvest strategy framework for the SP albacore longline fishery is briefly described below along with the elements of the harvest strategy.

a) Management objectives

From the harvest strategy perspective, several management objectives were identified in relation to biological, economic, social and ecosystem aspect. Details of the candidate management objectives are described in Attachment K of the WCPFC14 Summary Report **(Attachment C)**. At WCPFC16, the Commission reviewed the Management Objectives for South Pacific albacore and considered that there was no need to review the Management Objectives on an annual basis, but they should be amended as required.

b) Target reference points

WCPFC15 agreed on an interim TRP for south Pacific albacore at 56 percent of spawning stock biomass in the absence of fishing ($0.56SB_{F=0}$)[17] with the objective of achieving an 8 percent increase in catch per unit of effort (CPUE) for the southern longline fishery as compared to 2013 levels[18]. If a future stock assessment indicates that this interim TRP will not result in the desired longline CPUE, then the interim TRP will be revised in order to meet this objective. The TRP shall

[13] https://www.wcpfc.int/node/46475
[14] https://www.wcpfc.int/node/46693
[15] https://www.wcpfc.int/node/46695
[16] https://www.wcpfc.int/node/46710
[17] The method to be used in estimating the recent average spawning biomass in the absence of fishing shall be the same as that adopted by the Commission for the limit reference point, as described in paragraph 3 of CMM 2015-06.

[18] The proxy for CPUE will be the southern longline vulnerable biomass as estimated within the stock assessment.

be reviewed every 3 years, consistent with the SP albacore assessment schedule. In order to manage the required reduction in catches, the timeline for achieving the interim TRP shall be no later than 20 years.

c) Management procedure

The SPC-OFP prepared a paper on *Performance indicators for comparing management procedures for South Pacific albacore using the MSE modelling framework* (SC15-MI-WP-03[19]) and *HCR design considerations for south Pacific albacore* (SC16-MI-IP-05[20]).

d) Performance indicators

At WCPFC16, the Chair noted that CCMs had raised various issues regarding Performance Indicators (PIs) and that the Scientific Committee had reviewed various PIs for South Pacific albacore (SC15-MI-WP-03). In addition, the Commission considered that it was important to consider economic indicators as performance indicators (PIs) and encouraged CCMs to assist the SPC-OFP by providing economic and other data to assist in development of PIs, including in relation to the disproportionate burden on SIDS, particularly with respect to multi-species fisheries.

e) Management strategy evaluation

This harvest strategy element is under development and the most recent paper submitted to SC16 was a *Report on the second external MSE review: Developments in the South Pacific albacore MSE framework* (SC16-MI-IP-11[21]). The development of an MSE under mixed fishery conditions is also on-going and can be referred to SC16-MI-IP-06[22].

f) Monitoring strategy

This harvest strategy element will be substantially considered subject to the progress of other elements.

[19] https://www.wcpfc.int/node/42948
[20] https://www.wcpfc.int/node/46695
[21] https://www.wcpfc.int/node/46710
[22] https://www.wcpfc.int/node/46697

Attachment A

Work Plan for the Development of a South Pacific Albacore Roadmap

(This matrix came from Attachment 3, WCPFC15-2018-SPalbRoadmap and needs to be updated)

year	Harvest Strategy	Monitoring/Reporting	Allocation
2018	SC • Provide advice on technical aspects of harvest strategy including scientific elements of candidate harvest control rules and potential components of the management procedure. TCC • Consider the implications of candidate harvest control rules (ongoing). Commission • Agree Target Reference Point. • Consider advice on progress towards harvest control rules (ongoing). • Provide advice to SPC on which fisheries will be used for abundance indices, which fisheries will be controlled by the HCR(s), and how those fisheries will be controlled (catch, effort, or?). • Decision on Science Management Dialogue group.	ER/EM WG • Met around SC • Made recommendations regarding: ○ Update or revisions to ER SSPs ○ E-reporting standards for HS transhipment ○ EM process TCC • Provide advice on monitoring and data gaps and priorities. Commission • Adopt the E-Reporting Standards for transhipment declarations and transhipment notices. • Consider SC and TCC advice on potential data needs analysis and associated data collection and verification methods. • Note the approach outline in the ER/EM concept papers. • Consider advice from SC and TCC and agree to prioritising electronic monitoring in areas where independent data collection and verification is currently low.	Commission • Workgroup to meet
2019	SC • Provide advice on performance of candidate harvest control rules. • Agree initial range of operating models for HCR evaluation.	SC • TBD TCC • [Update after review of TCC workplan]	

	• Science Management Dialogue (if approved). TCC • Consider the implications of candidate harvest control rules [could include consideration of how harvest control rules can be monitored and implemented, are those system available, and do members have the capability to implement]. Commission • Consider advice on progress towards harvest control rules		
2020	SC • Provide advice on performance candidate harvest control rules TCC • Consider the implications of candidate harvest control rules. Commission • Consider advice on progress towards harvest control rules		
2021	SC • Provide advice on performance candidate harvest control rules. TCC • Consider the implications of candidate harvest control rules. Commission • Consider advice on progress towards harvest control rules. • Adopt harvest control rule(s).		SC • TBD TCC • TBD Commission • Adoption of overall limit for the fishery

Attachment B

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

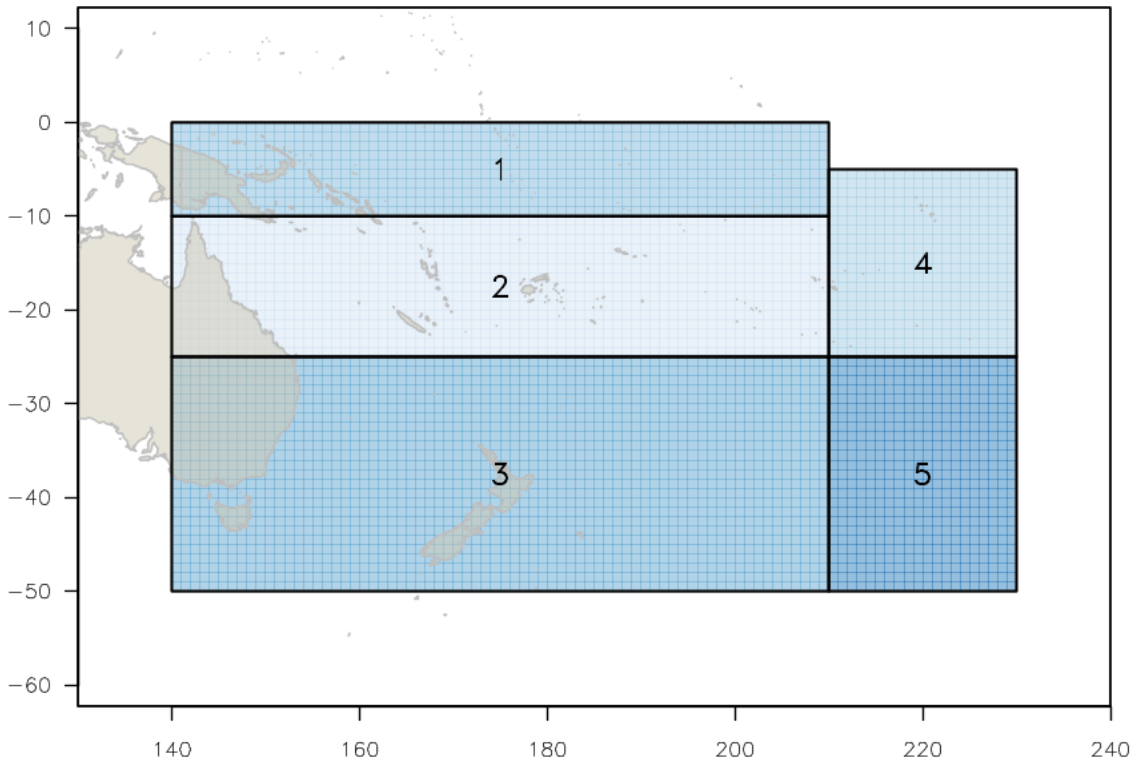

Figure SPA- 1. The geographical area covered by the stock assessment and the boundaries for the 5 regions under the "updated 2018 regional structure".

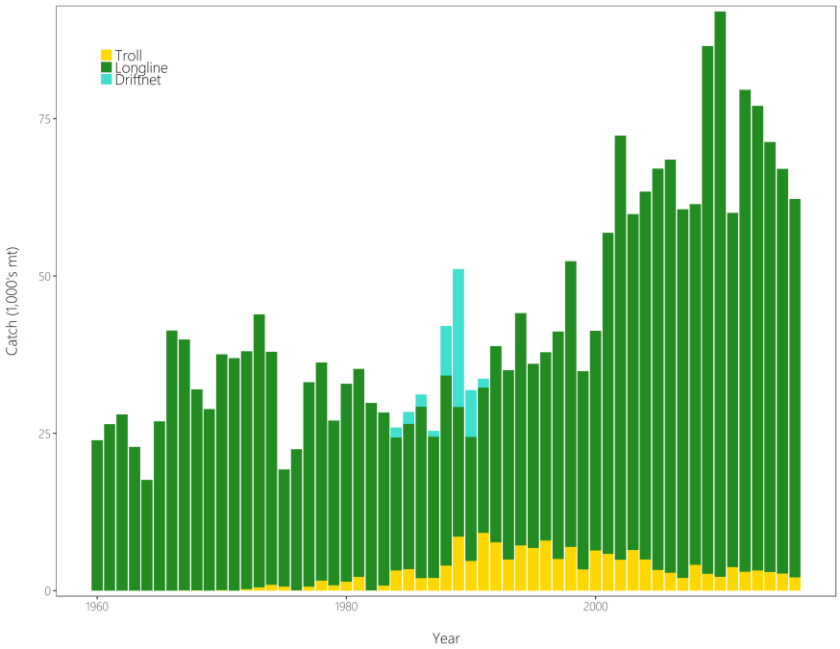

Figure SPA- 2. Time series of total annual catch (1000's mt) by fishing gear for the diagnostic case model over the full assessment period. The different colours refer to longline (green), troll (yellow) and driftnet (turquoise). Note that the catch by longline gear has been converted into catch-in-weight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

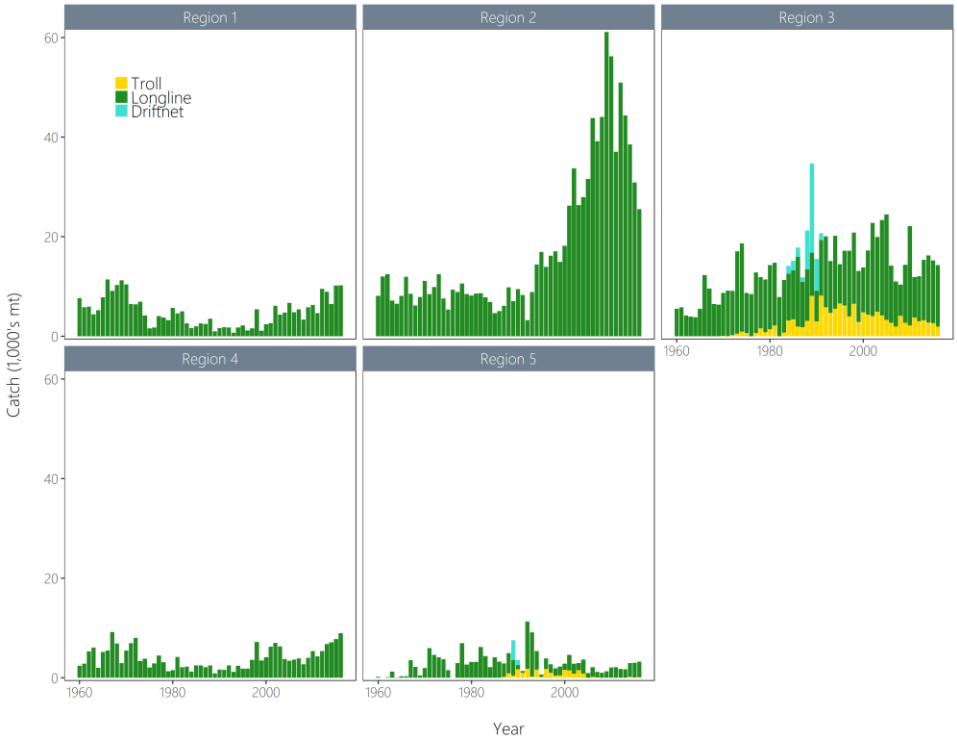

Figure SPA-3. Time series of total annual catch (1000's mt) by fishing gear and assessment region from the diagnostic case model over the full assessment period. The different colours denote longline (green), driftnet (turquoise) and troll (yellow).

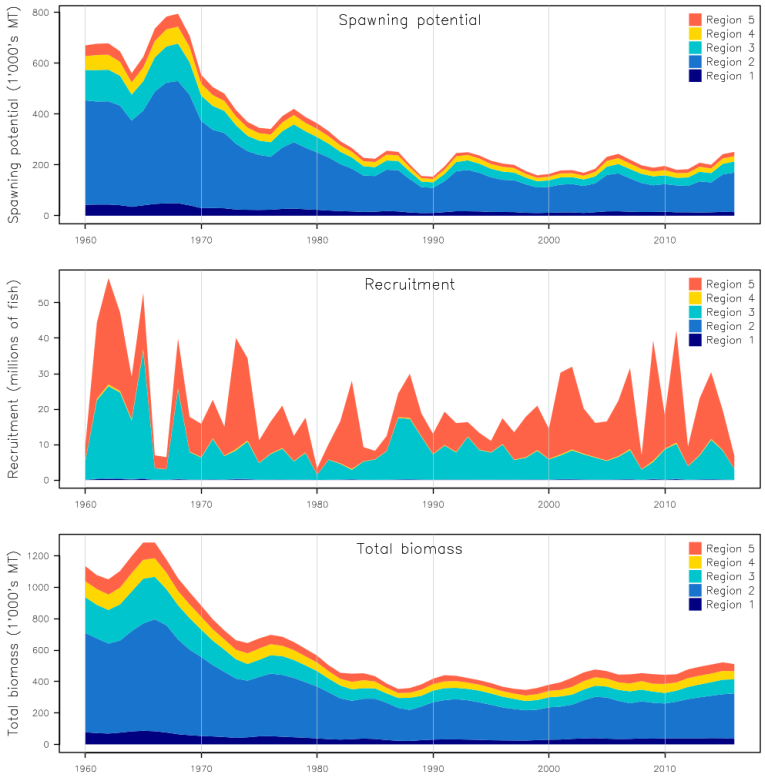

Figure SPA-4. Estimated annual average recruitment, spawning potential and total biomass by model region for the diagnostic case model, showing the relative sizes among regions.

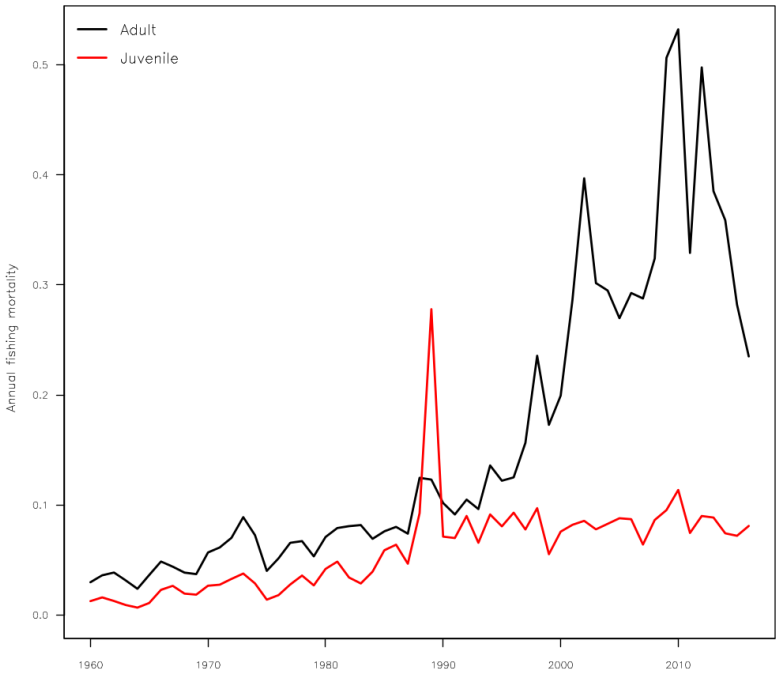

Figure SPA-5. Estimated annual average juvenile and adult fishing mortality for the diagnostic case model.

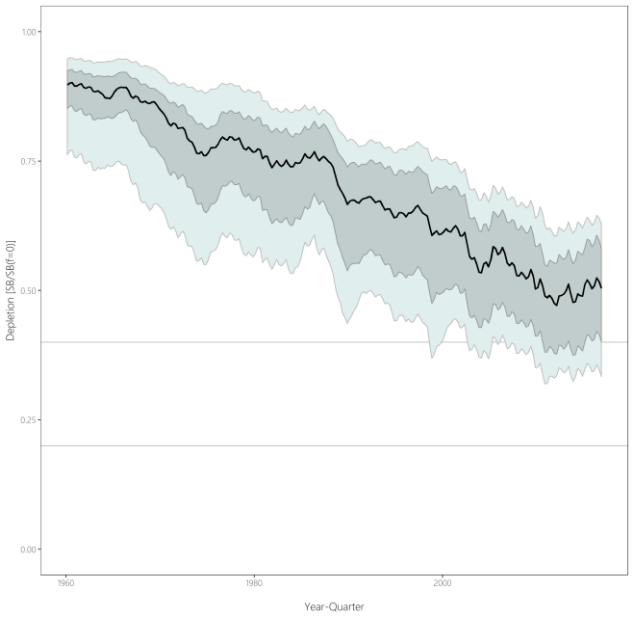

Figure SPA-6. Distribution of time series depletion estimates across the structural uncertainty grid. Black line represents the grid median trajectory, dark grey region represents the 50%ile range, light grey the 90%ile range.

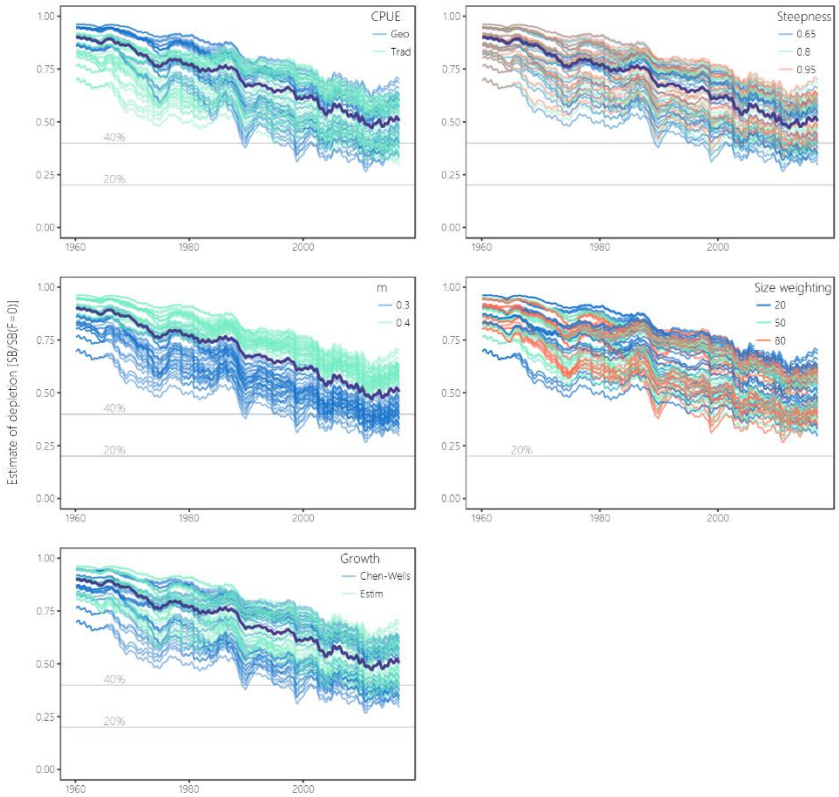

Figure SPA-7. Plots showing the trajectories of fishing depletion (of spawning potential) for the model runs included in the structural uncertainty grid. The five panels show the models separated on the basis of the five axes used in the grid, with the colour denoting the level within the axes for each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

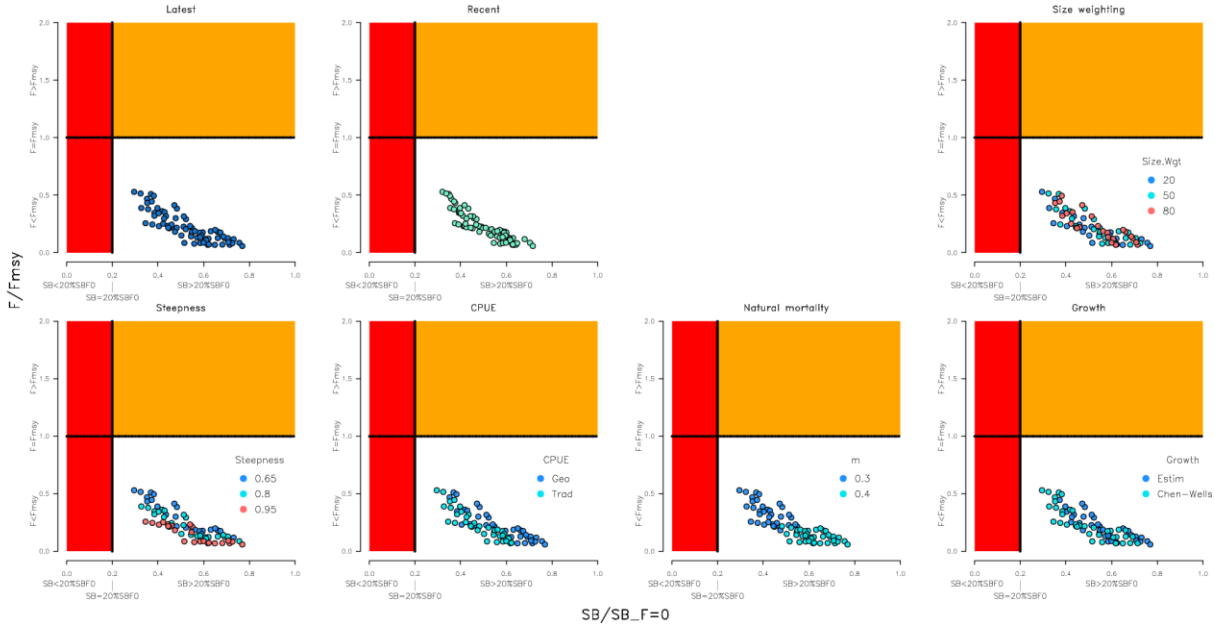

Figure SPA-8. Majuro plots summarising the results for each of the models in the structural uncertainty grid under the $SB_{latest}/SB_{F=0}$ and the $SB_{recent}/SB_{F=0}$ reference points (top left) and each axis of uncertainty.

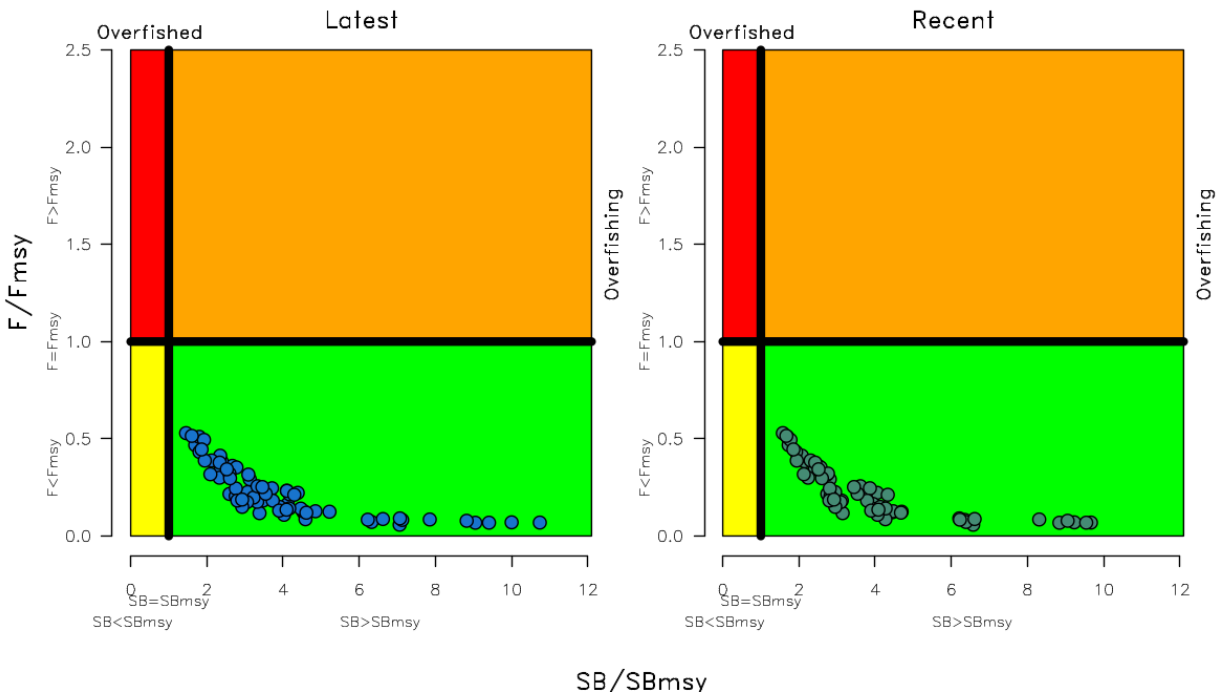

Figure SPA-9. Kobe plots summarising the results for each of the models in the structural uncertainty grid under the $SB_{latest}/SB_{F=0}$ and the $SB_{recent}/SB_{F=0}$ reference points.

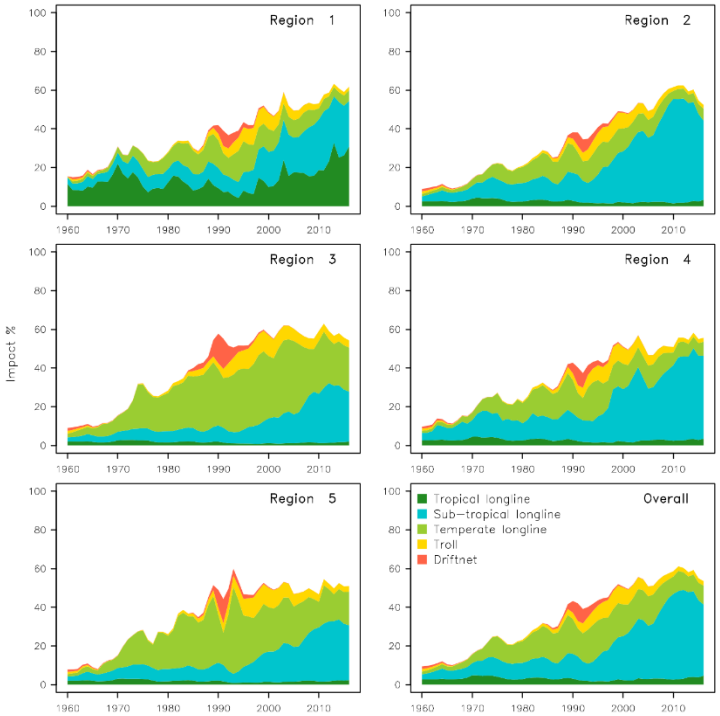

Figure SPA-10. Estimates of reduction in spawning potential due to fishing (fishery impact = 1-$SB_{latest}/SB_{F=0}$) by region, and over all regions (lower right panel), attributed to various fishery groups for the diagnostic case model.

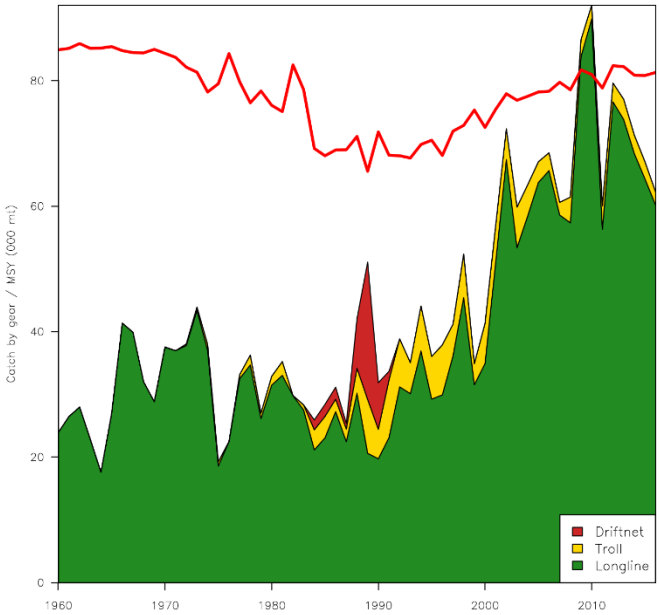

Figure SPA-11. History of the annual estimates of MSY (red line) for the diagnostic case model compared with annual catch by the main gear types.

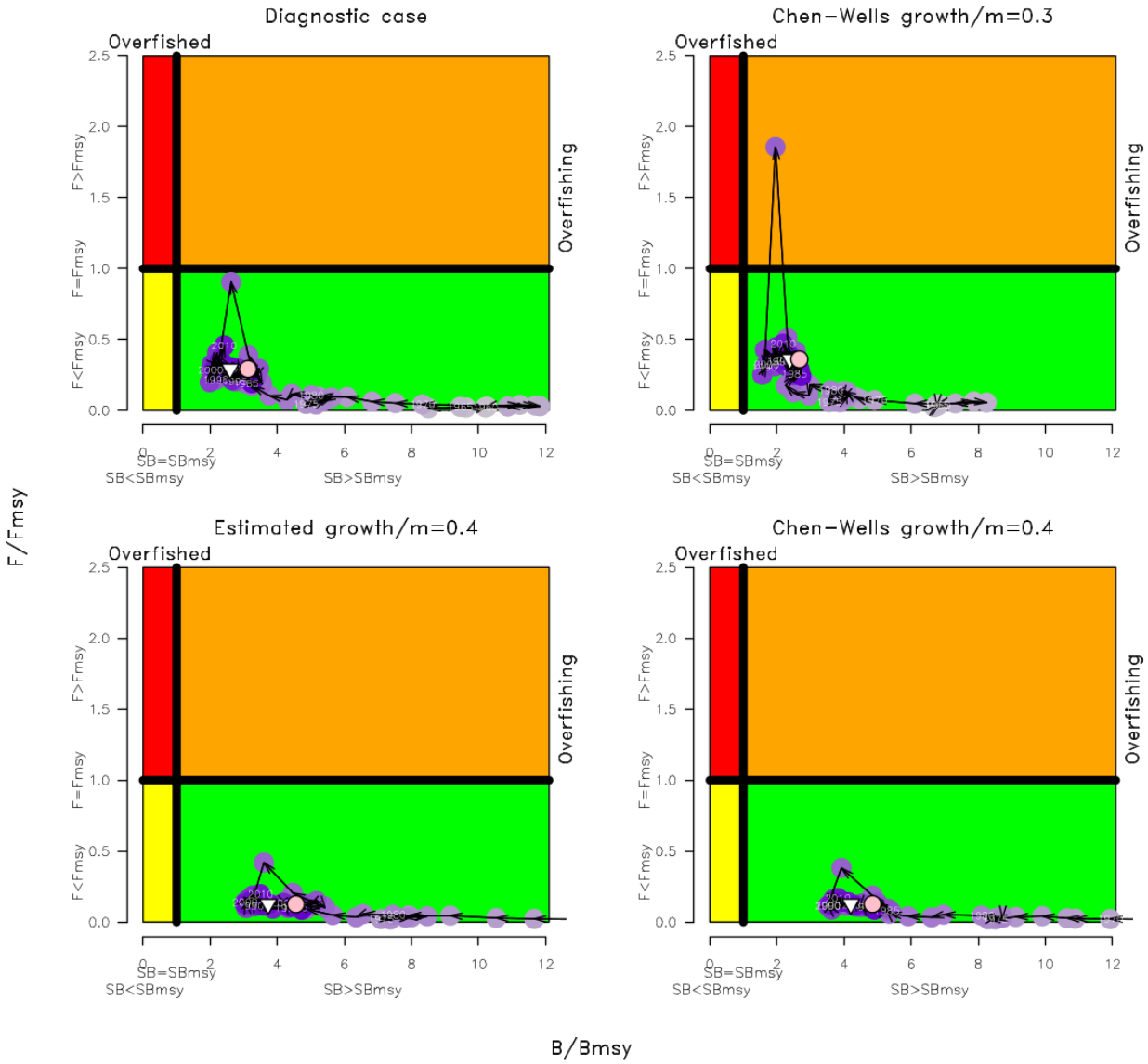

Figure SPA-12. Estimated time-series (or 'dynamic') Kobe plots for four example models from the assessment (one from each of the combinations of growth types, and natural mortality *M* set to 0.3 or 0.4).

Attachment C

Summary of proposed performance indicators (PIs) for the southern longline fishery (Attachment K, WCPFC14 Summary Report / Table 1, SC15-MI-WP-03). The *Calculated* column notes whether or not the indicator can be calculated using the current operating models.

* Description modified to better reflect the original intent of the PI.

	Objective type	**Objective Description**	**Performance Indicator (WP14)**	**Calculated**
1	Biological	Maintain ALB (and SWO, YFT and BET) biomass at or above levels that provide fishery sustainability throughout their range	Probability of $SB/SB_{F=0} > 0.2$ as determined from MSE	Y
2	Economic	Maximise economic yield from the fishery	Predicted effort relative to E_{MEY} (to take account of multi-species considerations, BET and other spp. may be calculated at the individual fishery level). B_{MEY} and F_{MEY} may also be considered at a single species level	N
3	Economic	Maximise economic yield from the fishery	Average expected catch (may also be calculated at the assessment region level)	Y
4	Economic	Maintain acceptable CPUE	Average deviation of predicted ALB CPUE from reference period levels	Y
5	Economic	Taking Article 30 of the WCPFC convention into account: Maximise SIDS revenues from resource rents*	Proxy: average value of SIDS / non-SIDS catch	N
6	Economic	Catch stability	Average annual variation in catch	Y
7	Economic	Stability and continuity of market supply	Effort variation relative to reference period level (may also be calculated at the assessment region level)	Y
8	Economic	Stability and continuity of market supply	Deviation from $SB/SB_{F=0} > 0.56$ (ALB) in the short-, medium- and long-term as determined from MSE (may also be calculated at the assessment region level)	Y
9	Social	Food security in developing states (import replacement)	As a proxy: average proportion of CCMs catch to total catch for fisheries operating in specific regions	N
10	Social	Avoid adverse impacts on small scale fishers	• MSY of ALB, BET, YFT • Possible information on other competing fisheries targeting ALB (may also be calculated at the assessment region level) • Any additional information on other fisheries/species as possible	N
11	Ecosystem	Minimise bycatch	Expected catch of other species	N