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Summary of major changes in the 2014 tropical tuna assessments

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Executive Summary

The purpose of this information paper is to briefly summarise the major changes from the 2011 stock assessments for bigeye, skipjack, and yellowfin tunas to those undertaken in 2014. Further details are contained in various working and information papers.

We focus on changes to assessment data and model structure and compare the reference case models for three key reference points. Many of the improvements to the assessments relate to recommendations from the 2011 Independent Review of the Bigeye Assessment, which were also applied to the yellowfin and skipjack assessments where appropriate. Changes were discussed during the 2014 Pre-Assessment Workshop held in April in Noumea.

Overall stock status estimates from the 2014 assessments are similar to those from the 2011, though fishing mortality on bigeye and skipjack tuna continues to increase.

Data and model changes

Component	Improvements
Spatial structure	• Additional sub regions were added to the three assessments to better model the available data (Figures 1 and 2). • The previous western equatorial region of the assessments was divided into three. A far western sub region was created to reduce the impact of uncertainty in the catch time series from Indonesia, Philippines, and Vietnam (region 7 for BET and YFT and region 4 for SKJ) (BET review recommendation). For bigeye tuna this also allowed for separation of the offshore fleets in this area which catch significantly larger fish. • A new region was added covering the area best described as the Bismarck and Solomon Seas (region 8 for BET and YFT and region 5 for SKJ). Considerable tagging has occurred here and analyses of skipjack tuna showed slower mixing compared to wider western equatorial region. • Finally a new region was added covering the specific region of the Coral Sea in south-western region of the bigeye and yellowfin models where specific tagging of bigeye and yellowfin tuna occurred (region 9 for BET and YFT) (BET review recommendation).
Fishery structure	• New fisheries were defined as necessary for the new regions.
Catch	• New and updated catches through 2012. • Some catches for Japan coastal longline and Vietnam longline and gillnet fisheries were included for the first time.
Longline size data	• For fisheries where both length and weight data exist, only the data set with the best sampling (consideration of sample sizes and temporal coverage) was used (BET review recommendation). • Japanese weight frequency data was weighted by catch at the 5x5 degree resolution within a region (BET review recommendation). • For other mixed fleet fisheries, size data was weighted by fleet catches (the mixed resolution of size data and temporal variation in catch and sampling made fleet/area weighting impractical) .
Purse seine size data	• Pago Pago port sampling data was included as these data have been collected consistently over many years and greatly improve the available data. • Size data was weighted by the catch (BET review recommendation).
Tagging data	• New releases events for 2010-12 and updated recaptures through 2012. • Updated analyses to estimate reporting rates and initial tagging mortality.
Longline CPUE data	• All available operational data was used with clustering based on the catches of the three tuna species. Use of data for multiple flags gave better spatial coverage and

	addressed decreasing spatial coverage of the Japanese fleet (BET review recommendation) and clustering was done to address target shifts (BET review recommendation). • It was not possible to use the previous indices as these were not available for the new regional structure.
Other CPUE data	• A standardised purse seine CPUE index for region 8 of the yellowfin and skipjack assessment was constructed and considered in the assessment, as were standardised CPUE series for skipjack and yellowfin for Philippine fleets fishing in the western equatorial region. Note: not all of these were used in the reference case models.
MULTIFAN-CL assumptions	• We reduced the impact that the assumed values of steepness had on estimated population dynamics (BET review recommendation). • Lognormal bias correction was applied in the estimation of the SRR (BET review recommendation). • We did not attempt to estimate some of the most recent recruitments. Retrospective analysis showed that these were often poorly estimated and changed substantially with the addition of another year of data. • Early recruitments were excluded from SRR fitting as they are poorly estimated.

Stock status outcomes

The table below provides three key reference points for the previous 2011 and current 2014 stock assessments. Note that a) the WCPFC-SC has yet to decide which model run(s) to use for the provision of management advice; b) historical catches have changed between assessments which typically has a direct impact on MSY; and c) the time windows used to calculate the reference point differs slightly due to the additional two years in the 2014 assessment.

Bigeye tuna			
	2011	2014	Comments
MSY	76,760 mt	108,520 mt	Including of additional catches and improvements to the assessment have increased the MSY. However, the stock has continued to decline since 2010 and both fishing mortality and depletion reference points suggest a poorer stock status.
$F_{current}/F_{MSY}$	1.46	1.57	
$SB_{latest}/SB_{F=0}$	0.21	0.16	
Skipjack tuna			
	2011	2014	Comments
MSY	1,503,600 mt	1,532,800 mt	Yield estimates are similar to the 2011 assessment, but the rapid increase in fishing mortality observed in the final years of the 2011 assessment has continued.
$F_{current}/F_{MSY}$	0.36	0.61	
$SB_{latest}/SB_{F=0}$	0.50	0.51	
Yellowfin tuna			
	2011	2014	Comments
MSY	538,800 mt	586,400 mt	The MSY and stock status reference points for yellowfin tuna are generally similar to those from the 2011 assessment. Fishing mortality is slightly lower, but depletion levels are slightly increased.
$F_{current}/F_{MSY}$	0.77	0.72	
$SB_{latest}/SB_{F=0}$	0.44	0.38	

Further information[1]

Abascal, F., Lawson, T., and Williams, P. 2014. Analysis of purse seine size data for skipjack, bigeye and yellowfin tunas. WCPFC SC10- SA-IP-05, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

Berger, A., McKechnie, S., Abascal, F., Kumasi, B., Usu, T., and Nicol, S. 2014. Analysis of tagging data for the 2014 tropical tuna assessments: data quality rules, tagger effects, and reporting rates. WCPFC SC10- SA-IP-06, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

Davies, N., Fournier, D., Hampton, J., Bouyé, F., and Harley, S. 2014. Recent developments in the MULTIFAN-CL stock assessment software. WCPFC SC10-SA-IP-08, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

Davies, N., Harley, S., Hampton, J., and McKechnie, S. 2014. Stock assessment of yellowfin tuna in the western and central Pacific Ocean. WCPFC SC10-SA-WP-04, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

Harley, S., Davies, N., Hampton, J., and McKechnie, S. 2014. Stock assessment of bigeye tuna in the western and central Pacific Ocean. WCPFC SC10- SA-WP-01, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

Ianelli, J., Maunder, M., and Punt, A. E. 2012. Independent review of the 2011 WCPO bigeye tuna assessment. WCPFC SC8-SA-WP-01, Busan, Republic of Korea, 7-15 August 2012.

McKechnie, S., Harley, S., Davies, N., Rice, J., and Hampton, J. 2014. Basis for regional structures used in the 2014 tropical tuna assessments, including regional weights. WCPFC SC10-SA-IP-02, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

McKechnie, S. 2014. Analysis of longline catch per unit effort data for bigeye and yellowfin tunas. WCPFC SC10- SA-IP-03, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

McKechnie, S. 2014. Analysis of longline size data for bigeye and yellowfin tunas. WCPFC SC10- SA-IP-04, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

OFP. 2014. Report from the 2014 pre-assessment workshop. WCPFC SC10-SA-IP-07, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

Pilling, G., Kumasi, B., Usu, T., Harley, S., and Hampton, J. 2014. Standardisation of PNG domestic purse seine vessel CPUE up to 2013, operating within Papua New Guinea's archipelagic waters for skipjack and yellowfin tuna. WCPFC SC10-SA-IP-09, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

Rice, J., Hampton, J., Davies, N., and McKechnie, S. 2014. Stock assessment of skipjack tuna in the western and central Pacific Ocean. WCPFC SC10-SA-WP-05, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

Williams, P. 2014. Major changes in data available for the 2014 tropical tuna assessments. WCPFC SC10-SA- IP-04, Majuro, Republic of the Marshall Islands, 6 – 14 August 2014.

[1] Note: Some papers were not completed at the time of writing so titles and authors are subject to change.

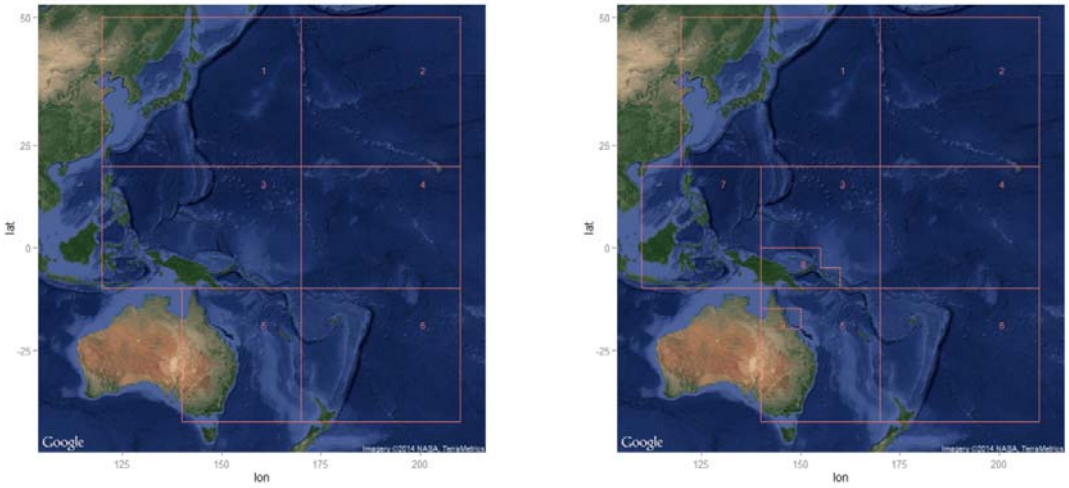

Figure 1: 2011 six region (left) and 2014 nine region (right) spatial structures used in the bigeye and yellowfin tuna stock assessments.

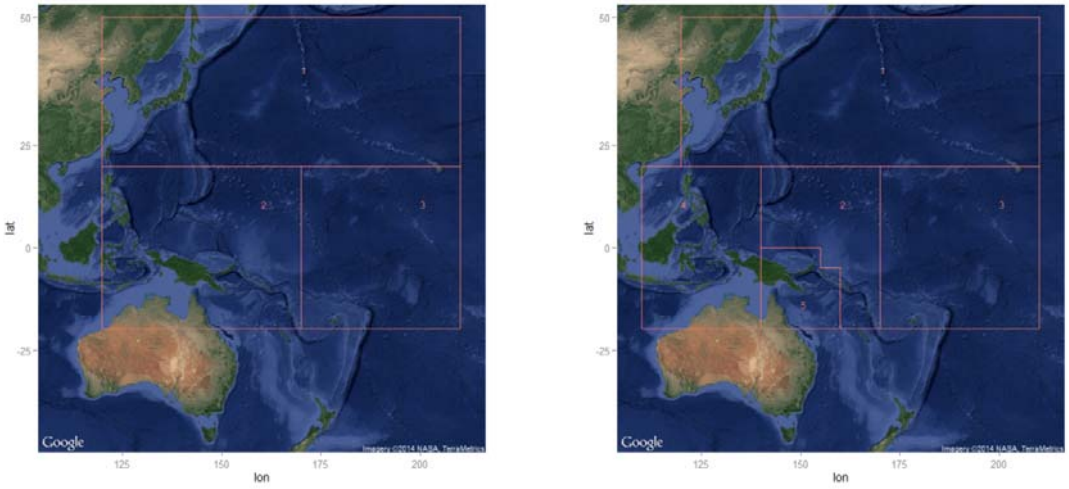

Figure 2: 2011 three region (left) and 2014 five region (right) spatial structures used in the skipjack tuna stock assessment.

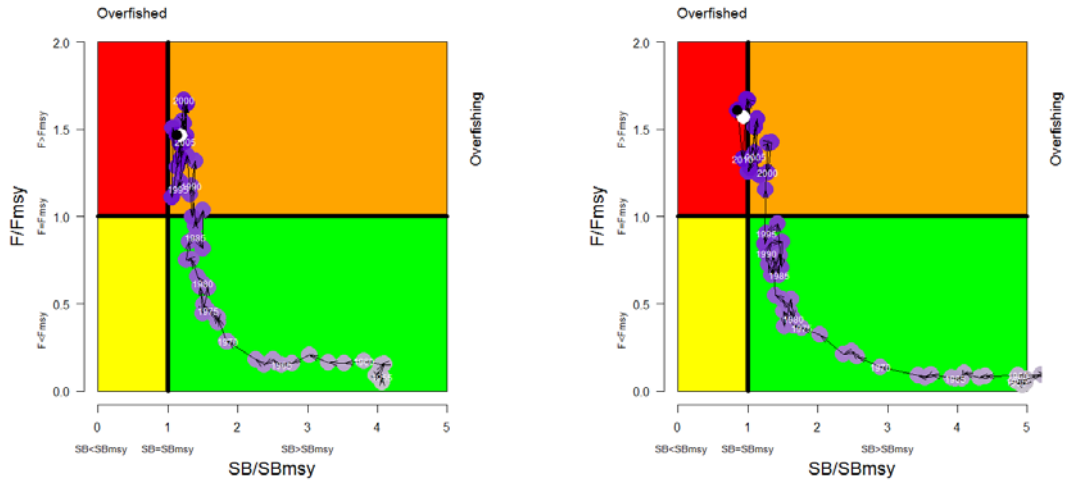

Figure 3: Kobe plots for the 2011 and 2014 reference case models for bigeye tuna.

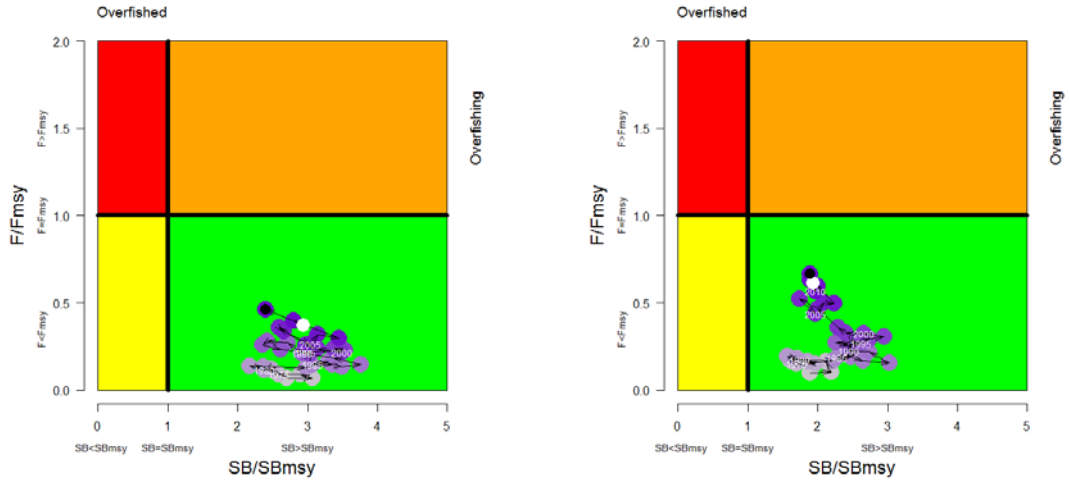

Figure 4: Kobe plots for the 2011 and 2014 reference case models for skipjack tuna.

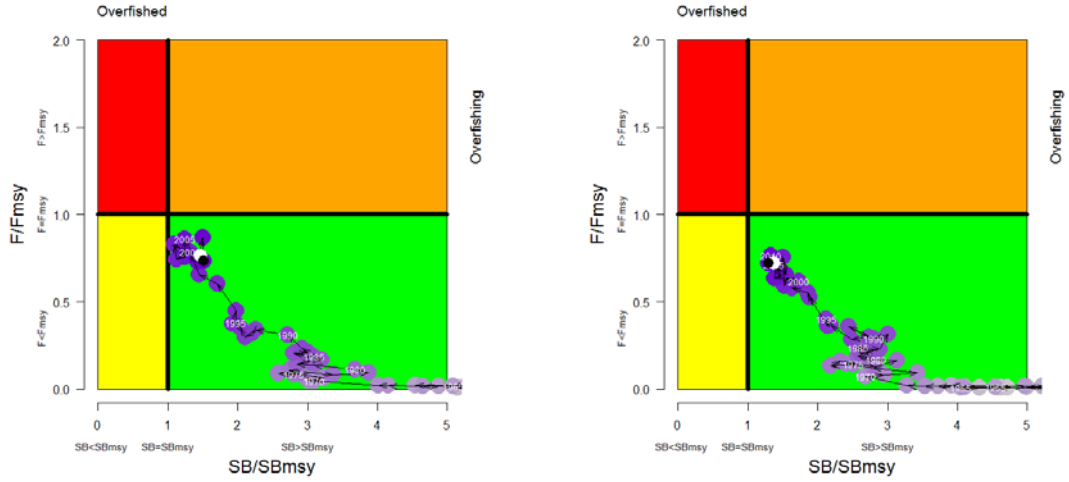

Figure 5: Kobe plots for the 2011 and 2014 reference case models for yellowfin tuna.