#### 4.1.3 WCPO Skipjack Tuna (Katsuwonus pelamis)

#### Provision of scientific information

S. Mckechnie presented SC12-SA-WP-04 (stock assessment of skipjack tuna in the western and central Pacific Ocean) that assessed the stock of skipjack tuna in the WCPO up to the end of 2015. New developments to the assessment include addressing the recommendations of the previous assessment (2014), exploration of uncertainties in the assessment model, particularly in response to the inclusion of additional years of data, and to improve diagnostic weakness of previous assessments. Other key papers were presented to document: 1) methods of estimating standardized catch per unit effort indices, 2) construction of the tagging data input file, 3) revisions and summaries of fisheries definitions, and the guidance of the Pre-assessment workshop.

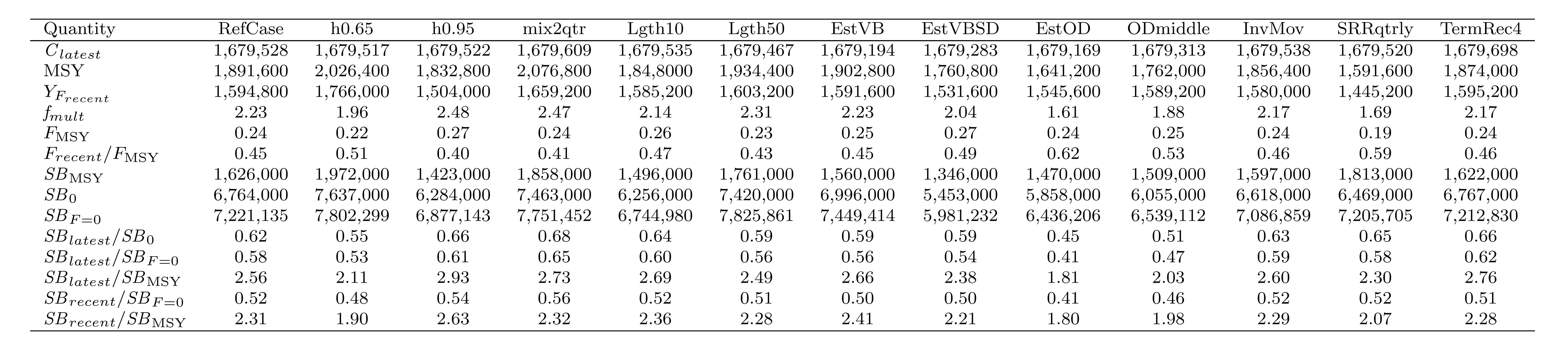
The SC12 was unable to reach consensus on the description of stock status based on the 2016 stock assessment.

SC12 notes that the majority of member countries agreed on the following description of WCPO skipjack tuna status and trends.

##### Majority view of status and trends

* SC12 selected the reference case model as the base case to represent the stock status of skipjack tuna. To characterize uncertainty, SC12 chose the structural uncertainty grid. Summaries of important model quantities for these models are shown in Table SKJ1.

**Table SKJ1:** Estimates of management quantities for the selected stock assessment models. For the purpose of this assessment, “recent” is the average over the period 2011–2014 and “latest” is 2015. (INSERT TABLE 6 FROM THE ASSESSMENT)



Trends in estimated recruitment, spawning biomass, fishing mortality and depletion are shown in Figures SKJ 1-4.

|  |  |
| --- | --- |
| C:\skj\2016\Writeup\Figures\Stepwise\plot_recruitment_compare_2016_Sensitivities2.png | C:\skj\2016\Writeup\Figures\Stepwise\plot_biomass_compare_2016_Sensitivities2.png |
| **Figure SKJ1:** Estimated annual recruitment (millions of fish) for the WCPO obtained from the reference case model and six additional runs. | **Figure SKJ2:** Estimated annual average spawning potential for the WCPO obtained from the reference case model and six additional runs. |
| C:\skj\2016\Writeup\Figures\Reference_Case\plot_temporal_F.png | C:\skj\2016\Writeup\Figures\Reference_Case\plot_fishery_impact_SKJ-SSB.png |
| **Figure SKJ3:** Estimated annual average juvenile and adult fishing mortality for the WCPO obtained from the reference case model. | **Figure SKJ4:** Estimates of reduction in spawning potential due to fishing (fishery impact = *1-SBt/SBt,F=0*) by region and for the WCPO attributed to various fishery groups for the reference case model. |
| C:\skj\2016\Writeup\Figures\Reference_Case\plot_Majuro_Temporal.png  C:\skj\2016\Writeup\Figures\Grid\plot_Majuro_grid_compare.png | C:\skj\2016\Writeup\Figures\Reference_Case\plot_temporal_MSY.png |
| **Figure SKJ5:** Temporal trend for the reference case model (top) and the structural uncertainty grid (bottom panel) in stock status relative to *SBF=0* (x-axis) and *FMSY* (y-axis). The red zone represents spawning potential levels lower than the agreed LRP, which is marked with the solid black line (*0.2SBF=0*). The orange region is for fishing mortality greater than *FMSY* (*F=FMSY*; marked with the black dashed line). The green line indicates the interium target reference point 50%*SBF=0*. | **Figure SKJ6:** History of annual estimates of MSY compared with catches of three major fisheries for the reference case model. |

* Dynamics of most model quantities are relatively consistent with the results of the 2014 stock assessment, although there has been a period of several subsequent years with high recruitments and increased spawning biomass.
* Fishing mortality of all age-classes is estimated to have increased significantly since the beginning of industrial tuna fishing, but fishing mortality still remains below the level that would result in the MSY (*Frecent/FMSY* = 0.45 for the reference case), and is estimated to have decreased moderately in the last several years. Across the reference case and the structural uncertainty grid *Frecent/FMSY* varied between 0.38 (5% quantile) to 0.64 (95% quantile). This indicates that overfishing is not occurring for the WCPO skipjack tuna stock (Figure SKJ 5).
* The estimated MSY of 1,891,600 mt is moderately higher than the 2014 estimate due to the adoption of an annual, rather than quarterly, stock-recruitment relationship. Recent catches are lower than, but approaching, this MSY value (Figure SKJ 6).
* The latest (2015) estimate of spawning biomass is well above both the level that will support MSY (SBlatest/SBMSY = 2.56, for the reference case model) and the adopted LRP of 0.2 SBF=0 (SBlatest/SBF=0 = 0.58, for the reference case model), and SBlatest/SBF=0 was relatively close to the adopted interim target reference point (0.5 SBF=0) for all models explored in the assessment (structural uncertainty grid: median = 0.51, 95% quantiles = 0.39 and 0.67).

##### Alternative view of status and trends

* SC12 noted that some other members, however, considered it is not possible to select a base-case model from various sensitivity models in the 2016 assessment, given the advice from the Scientific Service Provider that all the sensitivity models were plausible. Therefore, those members considered that it would be more appropriate to provide advice to WCPFC13 on skipjack stock status based on the range of uncertainty expressed by the alternative model runs in the sensitivity analysis grid rather than based on the single base case model and thus offered this “Alternative view of status and trends” to WCPFC13.
* The estimated MSY of WCPO skipjack stock ranges from 1,641,200 to 2,076,800 mt across the alternative skipjack stock assessment models represented in the sensitivity grid.
* Across the alternative models Frecent/FMSY ranges from 0.45 to 0.62. This indicates that overfishing is not occurring for the WCPO skipjack tuna stock (Figure SKJ 5).
* The 2015 estimates of spawning biomass are above both the level that will support MSY, noting that SB2015/SBMSY ranges from 1.81 to 2.93 across the alternative models, and that relative to the adopted LRP of 0.2SBF=0 that SB2015/SBF=0 ranges from 0.41 to 0.65 across models. This suggests that the skipjack stock is not overfished relative to its LRP. However, SC12 also notes that some alternative models indicate that the 2015 biomass is below the adopted TRP of 0.5SBF=0.



Figure SKJ 5. Estimated fisheries depletion SB/SBF=0, for each of the sensitivity models.

Management advice and implications

* SC12 noted that the skipjack assessment continues to show that the stock is currently moderately exploited and fishing mortality level is sustainable. The recent catches are fluctuating around and some models also indicate that the stock is currently under the TRP.
* SC12 noted that fishing is having a significant impact on stock size and can be expected to affect catch rates. The stock distribution is also influenced by changes in oceanographic conditions associated with El Niño and La Niña events, which impact on catch rates and stock size. Additional purse-seine effort will yield only modest gains in long-term skipjack tuna catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.
* SC12 noted that skipjack spawning biomass is now around the adopted TRP and SC12 recommends that the Commission take action to keep the spawning biomass near the TRP and also advocates for the adoption of harvest control rules based on the information provided.
* In order to maintain the quality of stock assessments for this important stock, SC12 recommends 1) continued work on developing an index of abundance based on purse seine data; 2) regular large scale tagging cruises and complementary tagging work continue to be undertaken in a way that provides the best possible data for stock assessment purposes.
* SC12 also notes that the current method of calculating the TRP is based on the most recent 10 years of recruitment information. However, the information on spawning potential, SB2015, which is used to evaluate current stock status relative to the TRP can change very rapidly for skipjack which mature at age 1 and this rapid maturation may provide an optimistic status evaluation when recruitment is estimated have an increasing trend but is estimated with substantial uncertainty, as is currently observed in the case of skipjack which does not have a fishery-independent index of recruitment strength.
* In order to provide the best available scientific advice to WCPFC13, SC12 requests the scientific service provider develop alternative stock assessment analyses (i) to conduct an alternative assessment based on the area definition suggested by Kiyofuji et al. (SA-IP09) and (ii) to prepare likelihood profile analysis for both the current and the alternative assessment configuration to SC13.
* SC12 further requests that the scientific service provider for the next full stock assessment to (i) evaluate the results of multiple models such as SEAPODYM or Stock Synthesis, (ii) test different growth models such as suggested by Ochi et al. (SA-IP08), (iii) test alternative natural mortalities such as constant one or one that decreases as aging, and (iv) evaluate appropriate method to weigh tag information. In doing so, SC12 requests the scientific service provider to further promote the inclusiveness of the assessment process of member country scientists by allowing greater participation and frequent information sharing in the course of the development of assessment.
* SC12 further advises the WCPFC that there is ongoing concern by at least one CCM that high catches in the equatorial region may be causing a range contraction of WCPO skipjack tuna, thus reducing skipjack tuna availability to fisheries conducted at higher latitudes than the Pacific equatorial region. As a result, SC12 recommends that ongoing research on range contraction of skipjack tuna be continued in the framework of Project 67.