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Progress on the updated silky shark stock assessment in the WCPO

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Oceanic Fisheries Programme, SPC

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At SC8 the first stock assessment for silky shark in the Western Central Pacific Ocean was presented. The conclusions made by SC8 regarding this assessment are provided in Attachment 1 of this paper and are briefly summarized below:

- The conclusions on stock status from the stock assessment depended heavily on the catch per unit effort series used. Some indices suggested major sustainability concerns and other suggested no concerns;
- A level of discomfort that the non-target longline catch per unit effort series showed patterns that could be an artifact due to a gaps in data for one fleet;
- A conclusion that it was not possible to provide management advice based on the assessment at this time; and
- A recommendation to update the assessment and in doing so address concerns over some data conflicts (including the purse seine CPUE) and include other data series that were available, but not included in the assessment.

The purpose of this paper is to provide an update on progress since SC8 towards an updated assessment for silky shark in the WCPO. This paper does not include detailed data or analysis descriptions – these will be provided in the working paper(s) for the full assessment provided to SC9. In this paper we compare the original and updated Kobe plot describing the stock status (Figure 1). Note that for the shark assessments for WCPFC, we have preferred to describe stock status with a large number of model runs (that include different assumptions and data sets) to capture uncertainty.

In response to requests from SC8, we have:

- addressed concerns over the partial inclusion of the Hawaiian longline data;
- addressed the conflict between the purse seine CPUE and other CPUE series that seems to have been driven by our exclusion of unidentified sharks from the data set. These were most likely silky sharks, and their inclusion has reduced the conflict; and
- included two alternative longline series, one derived solely from Hawaiian longline data, and a second derived from Japanese research and training vessels.

A detailed breakdown of the stock status outcomes against particular data inputs is provided in Table 1. A summary of the changes from the SC8 assessment and the impacts that they had are provided in Table 2.

The conclusions regarding this updated assessment are:

- Any conclusions regarding stock status are strongly dependent on which CPUE series is believed to be a true reflection of trends in abundance.
- The revised stock assessment is slightly more optimistic than the one presented to

SC8, though most CPUE series lead to conclusions that the stock is subject to overfishing and more than half also suggest that it is overfished.

- Across all combinations of CPUE series, catch series, and alternative biological assumptions, 58.5% of the runs are in the red quadrant, 20.5% are in the orange quadrant and only 21% are in the green. Almost all the 'green runs' are for the target longline series, and these runs do not provide plausible estimates of population biomass.

Table 1. Distribution of stock status outcomes (percentage of model runs in each quadrant of the Kobe plot) for models that included different CPUE and catch time series (see Table 2 for further details of the data sets).

	Kobe plot quadrant			
CPUE	RED	ORANGE	GREEN	YELLOW
Non-target LL (no Hawaii)	87	13	0	0
Japanese research and training vessels	52	45	3	0
Target LL	0	0	100	0
Purse seine (catch per set)	58	35	7	0
Purse seine (catch per mt of tuna)	83	17	0	0
Hawaiian LL	36	36	28	0

Catches	RED	ORANGE	GREEN	YELLOW
Lawson	57	19	24	0
Rice	58	18	24	0
Clarke (area based)	50	28	22	0
Clarke (tuna catch based)	46	33	22	0

Table 2. Summary of the key changes to the stock assessment presented to SC8 and the impacts of these on predicted stock status.

Change to the assessment	Impact on stock status
The partial data for the Hawaiian longline fleet was removed from the non-target longline index.	The revised non-target index led to small improvements in stock status, but model runs that included this CPUE series resulted predominantly in an overfished state with overfishing occurring (red quadrant of the Kobe plot)
Inclusion of the “Hawaii-only” longline series from Walsh and Clarke (2011 ¹)	This new series was the most optimistic of the non-target series, but was quite variable. Model runs were split almost equally between red, orange, and green quadrants of the Kobe plot.
Inclusion of the Japanese longline research and training vessel series from Clark et al. (2011 ²)	This new series results in estimates of stock status in the red / orange quadrant, i.e., with overfishing occurring and some model runs also predicting that the stock is overfished.
Replacing the purse seine CPUE series with two alternative series that both include the large numbers of ‘unidentified shark’ that were excluded from the previous series – detailed observer reports of the species composition of sharks in purse seine catches indicates that a very high proportion would likely have been silky sharks.	These new series result in estimates of stock status predominantly in the red quadrant, but with a significant amount of orange (and a little green).
Inclusion of two alternative catch series based on the analyses of market / trade based data of Clarke (2005 ³). The advantage of these estimates is that they are independent of the catch and effort data used to generate the other catch series considered.	The new catch series had minimal impact compared to the impact of the different catch per unit effort series used. These new catch series gave slightly more optimistic estimates of stock status (less red and more orange) compared to the model runs undertaken using the alternative catch series.

¹ Walsh, W.A. and Clarke, S. 2011. Catch Data for Oceanic Whitetip and Silky Sharks from Fishery Observers Document Changes in Relative Abundance in the Hawaii-based Longline Fishery in 1995–2010. WCPFC-SC7-2011/EB-WP-03.

² Clarke, S., Yokawa, K., Matsunaga, H. and Nakano, H. 2011c. Analysis of North Pacific Shark Data from Japanese Commercial Longline and Research/Training Vessel Records. WCPFC-SC7-2011/EB-WP-02.

³ Clarke, S.C. 2005. An alternative estimate of catches of five species of sharks in the Western and Central Pacific Ocean based on shark fin trade data. WCPFC – SC5- 2005/EB-WP-02.

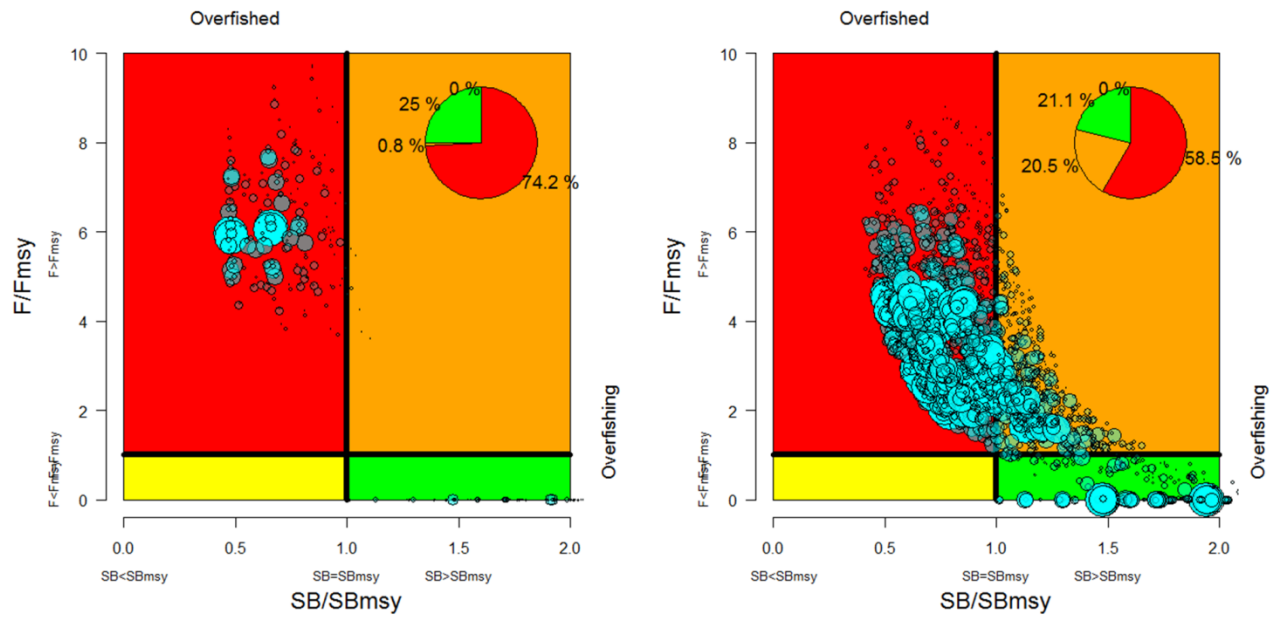


Figure 1. Kobe plots indicating annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis). These present the reference points and based on the current (average of 2005-2008) estimates for all 648 models from the analysis delivered to SC8 (left panel), and the current (average of 2005-2008) estimates for all 2592 models in the updated analysis (right panel). In each plot the size of the circle is proportional to the weight (plausibility) of the model run, respectively.

Attachment 1: Extract from the Executive Summary of the SC8 report

Silky Shark

Status and trends

53. The 2012 silky shark assessment was the first assessment completed for this species. There is conflict among the different CPUE series and this conflict carries through the assessment to indicate very different management implications. The longline bycatch series suggests significant declines in abundance (and overfishing), while the models incorporating the purse seine CPUE series resulted in unrealistically high biomass estimates, with no sustainability concerns.

54. It might be expected that the CPUE series developed on longline bycatch would be more reflective of changes in abundance than the target longline CPUE series, which is extremely spatially limited, or the purse seine CPUE series which has no clear measure of fishing effort. The SC considered that the incorporation of additional existing observer data could lead to significantly different conclusions from the assessment, and therefore additional work is required. Therefore, the SC concluded that it was not possible to determine estimates of stock status and yields.

55. SC8 noted the findings of WCPFC-SC7-2011/EB-WP-03 which state:

"Although silky sharks have been shown to have declining catch rate trends in past studies in the Pacific, no strong trends were found in recent (2011) WCPO analyses. Nevertheless, declining size trends in two datasets, declining catch rates in these two datasets for the most recent years of the time series, and increasing removals all indicate a need for close, ongoing monitoring of indicators. Further research may allow better definition of trends and a clearer depiction of stock status."

Refining standardized CPUE and the assessment

56. There is large structural uncertainty in the silky shark assessment which needs to be addressed in future assessments, however the 2012 silky shark assessment represents the best available information. The conflicting trends in the standardized longline (declines after 2004) and purse seine (increases in most of the time series) fisheries require further investigation. The model fit to the highly influential bycatch longline series is poor. Particular investigation should be made on the divergence between standardized and nominal CPUE after 2004 which occurs when vessel effects are incorporated into the standardization process.

Management Advice and Implications

57. Noting SC8's concerns over the data conflict and potential biases in the silky shark assessment, it is not possible to provide management advice based on the assessment at this time. However, noting that some basic fishery indicators (e.g. mean lengths and some CPUE series) are showing declines in recent years, the SC recommends no increase in fishing mortality on silky sharks.

58. Further, recognizing that the major fishery impacts relate to non-target fisheries, the SC recommends that the Commission consider mitigation measures to reduce the impact of these non-target fisheries as a precautionary measure. SC8 recommends that the silky shark assessment be updated to incorporate all potentially important data series.