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**Report from the SPC pre-assessment workshop, Noumea, April 2011**

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**WCPFC-SC7-2011/SA-IP-02**

**Oceanic Fisheries Programme<sup>1</sup>**

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<sup>1</sup> Secretariat of the Pacific Community, Noumea, New Caledonia



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*Oceanic Fisheries Programme, Secretariat of the Pacific Community*

## **Introduction**

To assist it in undertaking its stock assessments for the WCPFC, OFP sought input from stock assessment scientists in the region. The sixth pre-assessment workshop was held in Nouméa, New Caledonia 4-8 April 2011.

Thirteen scientists from ten organizations participated in the workshop as well as OFP-SPC staff: SungKwon Soh, Steve Brouwer, Naozumi Miyabe, Keith Bigelow, Samasoni Sauni, Miki Ogura, Keisuke Sato, Shui-Kai Chang, Christophe Fonfreyde, Hiroaki Okamoto, Lucy Joy, Thomas Usu, Francisco Abascal, plus John Hampton, Simon Hoyle, Shelton Harley, Nick Davies, Tim Lawson, Simon Nicol and Shelley Clarke.

The agenda was focused on stock assessment methods, the proposed approaches for the stock assessments for bigeye, yellowfin, and skipjack tunas, and methods for evaluating management options and reference points (see Appendix 1). Presentations were invited from all participants, with the majority made by SPC staff. The meeting operated under the terms of reference provided in Appendix 2 and was chaired by John Hampton, Head of the Oceanic Fisheries Programme.

This report briefly describes the various presentations made and reports the conclusions. As this meeting was not a formal WCPFC meeting, but a technical meeting of experts who have a common interest in progressing the stock assessment of key tuna stocks in the WCPO, the report does not attribute comments to countries except where the comment related to the agreement to provide data or undertake particular analyses.

The outcomes of this meeting will be reflected in the papers submitted to WCPFC-SC. Copies of the PowerPoint presentations prepared by SPC can be provided on request.

## **Catch estimates**

### **Update on catch estimates from Indonesia and the Philippines**

John Hampton presented a PowerPoint presentation, prepared in conjunction with Peter Williams, that updated the information available on Indonesian and Philippine fisheries. Overall the three tropical tunas caught by these fisheries account for annual catches of around 500,000 mt.

In the 2010 BET assessment data for these countries is treated as follows:

- Longline catches were included in the 'Offshore' longline fishery (fishery 5)

- Separate Philippines and Indonesian small fish fisheries (fisheries 18 and 24) but size data were only available for the Philippines so both fisheries shared a selectivity
- A combined Philippines / Indonesia large fish handline fishery was included

Continued work has been supported by the GEF-WPEA project and other sources. Main advances since the last assessment have been the improved breakdown of the 'small fish' catches into individual gear types and the availability of data from post sampling programmes for many of the different gears. These data, and other more detailed analyses presented by Simon Hoyle, indicate that the relatively large volumes of small fish catches across the two regions have likely been represented with an inappropriate selectivity curve with too much weight towards the youngest ages. Strong regional differences in size composition were also apparent.

One of the more significant data issues that remain is the separation of the so-called 'baby' purse seine from the industrial purse seine for the Philippines - the catch estimates and length data are not stratified into these sub-gear type categories. However, for the most part, the new information should assist with separating catches and length samples into these sub-gear type categories (i.e. 'baby' purse seine and industrial purse seine) in archipelagic waters and in the outer EEZ/high seas. This separation will be beneficial for modeling management options.

The workshop noted that Peter Williams was currently in Philippines and was scheduled to visit Indonesia in mid-May and both trips could result in additional insights, and that further analysis of the length composition data might be undertaken prior to 2011 assessments.

The workshop recommended that a paper be prepared for SC7 which outlines the improvements to the data from Indonesia and the Philippines, in particular those that result in changes to the assessments.

In addition the workshop made the following tentative recommendations (which may be revised based on the outcomes of the country visits or subsequent analysis, and will be reported in the SC paper noted above) for changes to the fisheries definitions in the tropical tuna assessments:

- Retain the current longline definitions;
- Separate industrial purse seine from the other small fish fisheries where possible (noting the problems for the Philippines);
- Potentially link the selectivity curves for these fisheries to the FAD fishery selectivity in region 3 (fishery 14) if length data are insufficient or considered unreliable;
- Keep the remaining small fish fisheries (e.g. baby purse seine, ring net, pole and line, and handline) in flag-specific fisheries unless specific components are shown to have significant catches with very different length compositions; and
- Possibly retain the current single large fish handline fishery if the overall catches are not that high.

### **Purse seine catches determined from observer grab samples corrected for size selectivity**

Tim Lawson provided an update of the analysis of selectivity bias in grab samples. He noted that while an additional seven trips on purse seiners during which paired spill and grab sampling had taken place

since SC6, data from four of the trips were unusable either because the spill sampling protocol was not followed or, in one case, the grab sampler disembarked prior to the start of fishing. It was noted that the key difference between the MFCL catch data determined from “s\_best” and the MFCL catch data determined from grab samples corrected for selectivity bias was that the former assumed that logsheet estimation of skipjack catches was correct, whereas the latter did not. Further, it was noted that the purse seine length frequencies determined from observer grab samples will also be corrected for the selectivity bias and that these data would be an important new input to the stock assessments.

The workshop noted the importance of this work and the need to continue the field work and potentially expand the analyses by comparing the species compositions determined from spill samples to those determined from port sampling of landing categories at canneries, if both types of data become available for individual trips.

The workshop recommended:

- That additional paired sampling trips be undertaken on purse seiners in order to obtain better estimates of the selectivity bias; and
- Other factors that may affect the selectivity bias, such as species, be examined if the data permit.

## **MULTIFAN-CL developments**

Nick Davies presented a summary of developments in the MULTIFAN-CL software used for the tuna assessments. To refresh the workshop’s understanding, an overview was presented of the status of the MULTIFAN-CL software as reported to SC6, including the major developments implemented for the 2010 tuna stock assessments, such as stochastic projections and tag-release group-specific reporting rates. Recent developments undertaken since SC6 were also described including:

- Flexibility in the time period used for the Beverton-Holt stock-recruitment relationship (SRR) calculation applied in deriving equilibrium yield estimates;
- An increased number of estimable parameters;
- Various fixes to model functions;
- Model enhancements implemented during a small workshop held in January 2011; and,
- The posting of a new version on the MULTIFAN-CL website.

A description was given of the developments now in progress and proposed for 2011 including:

- Alternative recruitment options applied in deterministic projections;
- Fixes to processes affecting recruitment and catches in deterministic projections;
- The implementation of a increased dimensionality for multiple species, stocks, or sexes;
- Testing of stochastic projection functionality;
- Correlates for recruitment and selectivity;
- Seasonal variability in fishing selectivity;
- Time-series variation in movement coefficients;
- Various additional outputs to enhance model diagnostics; and,

- Constructing a model development testing framework;

It is proposed to upgrade the MULTIFAN-CL website using a new platform that will better manage the international interest in the model software, and this will occur over the next 2-3 months.

The workshop noted these developments, and interest was expressed in the development for seasonal parameters in selectivity and when this might be implemented. Since adding the dimensionality for multiple species, stocks, or sexes is a high priority, it is unlikely that the seasonal selectivity parameterisation will be developed before SC7.

### **Independent review of 2009 yellowfin tuna stock assessment**

Keith Bigelow presented an outline of the two independent reviewer's reports of the 2009 assessment for Western and Central Pacific Ocean yellowfin tuna. These reviews were undertaken as 'desk-top' reviews through the Centre for Independent Experts (CIE) process which provides reviews of US domestic assessments and internationally conducted assessments where the US has an interest. The reviews were undertaken according to seven terms of reference.

After this initial presentation, OFP provided an initial response to comments made in the reviews. For the most part, the recommendations related to additional research or historical data analysis rather than specific recommendations for changes to the stock assessments (e.g. further refinement of catch histories). Many of these recommendations were noted within the proposed work plans for CPUE, size data, and biological inputs covered later in the agenda.

Some specific recommendations that could have an immediate bearing on the assessments are summarized below:

- There was a recommendation that the assessment reports be expanded to include further summaries of the input data files, e.g. individual length frequency samples. The workshop agreed that it was not necessary to make the reports any longer. The workshop recommended that, in addition to providing the assessment input and output files on the SPC website, SPC provide links and instructions for the use of the MULTIFAN-CL viewer (an ideal package for viewing data inputs and model outputs), any particularly useful R-scripts for dealing with these files (e.g. R4MFCL), and excel spreadsheets of some of the more important model outputs (e.g. biomass trajectories and estimates of catch and fishing mortality at age);
- There was a recommendation that stock production and VPA models could be used to ground truth the MULTIFAN-CL assessment results. SPC indicated that it would be happy to collaborate with researchers that wished to investigate alternative modelling approaches; and
- There was a recommendation that surplus production be estimated as a potential alternative indicator to MSY. SPC indicated that it would aim to include such calculations in the 2011 assessments for skipjack, yellowfin, and bigeye tunas.

The workshop noted that SPC will prepare a paper for SC outlining its response to the two reviews.

## Biological approaches

Under this agenda item there two types of information presented: 1) proposed research activities to address the key assessment related issues; and 2) research progress to date.

### A plan for future work direction:

Simon Nicol presented a summary of the WCPFC strategic research plan for the collection and analysis of biological information over the period 2007-11. The presentation noted the following aspects of the research plan:

- Age, Growth and reproductive biology. Completed studies include Skipjack (Spawning Activity in tropical WCPO (Ashida et al SC6/2010 and Maturity ogive, batch fecundity, spawning frequency (Ashida et al SC5/2009)), Striped Marlin (Kopf SC5/2009), Swordfish (North Pacific (Valeiras et al SC4/2008), AU & HI comparison of maturity and age (Young et al SC3/2007)), Black Marlin (Age and growth in eastern Taiwan (Sun et al SC3/2007)) and current studies include south pacific albacore (age, growth and reproductive parameters) and bigeye (pilot study for basin wide age, growth and reproductive parameters). For south pacific albacore the biological sampling is complete with coverage from all regions facilitated by very good industry cooperation. Annual Ageing has been validated and 80% of laboratory analyses completed. Results will available for stock assessment in 2012. For bigeye observer based sampling of otoliths, gonads in Palau, FSM, Marshall Islands has occurred with concentration of sampling on LL vessels to collect appropriate size classes. Certified 90 Observers in biological sampling and eight observer trainers were certified. Progress has been slower than desired largely due to the observer coverage on LL vessels in Micronesia being near zero. Dedicated sampling trips have been organized most recently to collect samples. Industry collaboration excellent but complex with multiple businesses requiring involvement (Fleet owners, agents, processes, markets). Current schedule has completion of sampling in April, completion of laboratory analyses in June, and reporting in July.
- Tagging studies to estimate movement and migration; behaviour and habitat utilization. An update was provided on Pacific Tuna Tagging Project progress as well as a description of the new tagging program in PNG. Tagging analyses discussed and the potential for wider collaboration.

In the context of bigeye age and growth estimation, the workshop discussed the potential to use available size data to estimate region-specific growth parameters in the stock assessment model. It was noted that this could be explored by allowing, in turn, each individual region's size data to drive the overall (multi-region) growth trend and comparing the results. Although regional growth patterns appear stronger in YFT than in BET, both were considered worth exploring and should be presented to the SC in conjunction with the revised growth curve estimated from this study.

## **Sex, Growth, Vulnerability and Death: some progress on alternative hypotheses for tuna sex ratio variation**

Simon Hoyle presented a discussion of various explanations for the observed variability in tuna sex ratios, including:

- Sex-specific natural mortality (the current assumption)
- Sex-specific growth resulting in different average maximum lengths
- Sex-specific vulnerability to fishing gear, e.g. females are less catchable than males when spawning.

The workshop noted the alternative hypotheses for the patterns in sex ratios and the suggested recommendations for future work described in the paper, in particular fitting a two-sex model to sex-structured data and estimating separate biological parameters for each sex.

## **Stock assessment inputs**

### **Size data**

#### ***Research outline for size data used in WCPO stock assessments***

Simon Hoyle explained the many factors affecting size compositions in samples and how these may affect model results. Approaches were outlined for investigating:

- the causes of size variation;
- their effects on stock assessments; and
- approaches to improve our assessments.

This was illustrated by means of an investigative framework having four components: causes, effects of biases, investigation, and changes needed. A set of five proposed work areas were proposed:

1. Examine potential effects of biases in size data and growth rate estimates on MUTLIFAN-CL stock assessment results using model sensitivities based on an existing assessment.
2. Investigate fleet-sourced data for size variation associated with space, season, gear type, flag, and fleet, using GLMs, GAMs, regression trees, and other approaches.
3. Investigate growth variation by location, sex, and time, using data on length at age, sex ratio at length, modal progression, and tag recapture. Develop modelling strategies to include growth variation in stock assessments, or strategies robust to these sources of variation.
4. Investigate the effects of grab size sample bias on size frequency estimates, and simultaneously adjust both present and historical size frequency data for these effects.
5. Investigate the sources of sampled size data, remove unrepresentative data, and adjust both the size data and the effective sample sizes where necessary to reflect representativeness of the data.

The workshop noted that SPC would work with SC conveners and participants to determine the best way to integrate the ideas described in the paper into the SC research planning process.

### *Progress on size data research*

Simon Hoyle presented a summary of progress made to date on the collection of size data for input to the tuna assessments and a preview of analyses of these data to estimate spatial variation in fish size.

#### 1. Apparent problems in size sampling data

Problems are apparent with BET size sampling data collected in the 1950's and 1960s because there are a large number of small fish which are not apparent in the weight-sampling data. A GLM was fitted to these size data which clearly showed a year effect peculiar to these years and very different from the other years in the time series. A similar pattern was evident in the YFT data used for the 2009 assessment. It was recommended to refine data analyses so as to decide which data to exclude from the 2011 assessment for BET and YFT.

#### 2. GLM analyses of size data, to estimate sources of size variation

Results from GLMs having spatial-temporal covariates on length were presented that clearly demonstrate effects from these variables, in particular the spatial covariate. Several possible oceanographic processes underpinning the response were offered, with the suggestion to investigate these further. It was suggested that there were implications of these covariates on assessment model assumptions relating to stock connectivity between east and west; growth and mortality rates in all areas; fish movement at age; potential for range contraction and hyperstability of BET longline CPUE; and fisheries definitions.

#### 3. Size sampling locations and stratification

A discussion was presented of stratification approaches for deriving catch size compositions, and how this matches assumptions made in the assessment model. Spatial and temporal sources of variation in size data were considered, including temporal shifts in sampling and fishing locations. Investigations suggested using GLMs to estimate year effects on BET and YFT size, but also to estimate the effects of depth of set (HBF), season, flag, fleet and bait type.

#### 4. Effects of size data problems on bigeye stock assessment

A review was presented of the effects of conflicts between size data and CPUE upon the anomalies within the BET stock assessment, in particular how the relative weight assigned to each data type can affect trends in the estimated recruitments and effort deviates.

The workshop noted the patterns found in the analyses and supported continued investigation into the sources of size variation and its influence on the assessment.

### **Surface fishery CPUE**

No research plan was developed for pole and line CPUE, but a presentation was provided on recent developments in the methods as applied to the 2010 skipjack tuna assessment. This paper was previously presented to SC6 in Tonga.

*Progress on pole and line CPUE: A standardized CPUE analysis of the Japanese distant-water skipjack pole-and-line fishery in the western and central Pacific Ocean (WCPO), 1972-2009*

Simon Hoyle presented this item on behalf of Adam Langley and his co-authors. The analysis of the Japanese distant water pole-and-line fishery catch and effort data undertaken for input to the 2010 skipjack assessment was summarized to provide background to the analyses proposed for 2011. The 2010 analysis was undertaken in a collaborative study between the Japan National Research Institute of Far Seas Fisheries (NRIFSF) and SPC. This analysis was regarded as an improvement on the previous approach but can be further refined since potentially major sources of bias in indices exist that are evident in conflicts in the CPUE signal between the binomial and lognormal indices and among regions.

Following this presentation Miki Ogura contributed some information on this analysis for 2011:

- Work is progressing on updating the analysis to include 2010 data for the DW and OS vessels;
- Vessel id data for the pre-1982 period is being obtained;
- The impacts of overall fleet size on CPUE are being examined; and
- Searching technology records for OS fleet are not available so obtaining these data is a work in progress. Such data may only be available for a limited number of vessels.

The workshop noted that the analysis will be updated by Japan through to 2010 and will be made available for input to the 2011 assessment.

*Current approaches to modeling purse seine CPUE in MULTIFAN-CL*

Shelton Harley presented an overview of the fitting procedure and the results of recent MFCL assessment models to purse seine CPUE indices. Generally steep and positive catchability trends are estimated in the purse seine fisheries for both the yellowfin and skipjack models. A trade-off exists between recruitment estimates and the increasing catchability (in the short-term), and it was suggested that improved purse seine CPUE indices would have consequent benefits in the estimates of recruitment and juvenile fishing mortality.

John Hampton outlined how OFP is looking at improving the purse CPUE reliability as an index of abundance, making the following key points:

- This work is necessary because the pole and line index which is currently used, is only a minor fraction of the SKJ catch.
- SPC is contracting Adam Langley to prepare a scoping paper on potential research ideas to improve the estimates of effort and therefore CPUE from purse seine fleets. This will be prepared for SC7 in Pohnpei. This may result in a proposal to the Commission with funding implications.
- The initial focus was likely to be on fleets which have a greater focus on unassociated school sets to avoid many of the problems in accounting for the technological advances surrounding the use of FADs.
- Observer and VMS data may be particularly important in the analyses.

The workshop noted and supported this initiative for improving estimates of purse seine CPUE.

### **Longline CPUE**

Under this item there were presentations on a proposed research plan plus two presentations of current progress in this area.

#### *Research outline for CPUE data used in WCPO stock assessments*

Simon Hoyle presented a summary of key issues concerning CPUE data in WCPO assessments. Based on a review of analyses to date, Simon Hoyle grouped these issues into the following areas: regional weighting; modelling approaches; spatial effects and weighting; targeting, fishing behaviour and catchability; covariate and data resolution; data; model selection; and other factors. Among these, regional weighting methods and targeting/fishing behaviour/catchability effects were highlighted as being of particular importance. Simon Hoyle detailed the components of a research plan for CPUE data used in tuna stock assessments reported to WCPFC. This plan entailed four proposed work areas:

1. Weighting given to different strata – explore alternative approaches;
2. Review assumptions about abundance trends in areas not fished early or late in the time series;
3. Fishing practices changing through time – analyses using fine-scale location data and using clustering approaches to separate sub-fleets; and
4. Regional weighting factors – explore alternative perspectives and alternative datasets.

The workshop noted that:

- Uncertainty in the modelling results should reflect the uncertainty in the regional weighting methodology. This is partially implemented at present but more work should be done.
- Since the potential effect of the re-weighting on the stock assessment results is large, and no clear alternative is currently available, it should be a priority for further analysis.
- Development of methods for filling data gaps through making assumptions based on available data is also a high priority for research. It was noted that much work which has been done on this topic elsewhere may help inform the WCPO assessments.
- Changes in targeting (i.e. an example was given of BET/ALB target switching in the Chinese Taipei fleet) need to be addressed.
- Opportunities for collaborative analysis between SPC and Japan's NRIFSF, in particular derivation of operational-level CPUE indices for BET and YFT over a longer time series (i.e. 1952-- ) for use in the stock assessments, are encouraged.
- Similar collaborative analysis between SPC and Chinese Taipei was also encouraged but may be more limited by data availability and thus may take more time to complete.
- Changes to the assessment methodologies should be kept to a minimum, and only made when necessary, in order to provide scientific advice which can be easily compared with previous years and thus facilitate discussions surrounding a new measure to replace CMM 2008-01.

The workshop agreed that:

- The identified research priorities detailed in the proposed research plan should be presented to SC7 for further discussion and endorsement.

### *Taiwanese Longline CPUE*

Eric Chang explained his intention to attempt a cluster analysis of TW LL CPUE that will factor out ALB targeting so as to derive a BET standardised index in regions 4 and 6.

The workshop noted:

- The intention to undertake this work
- That the indices could be used for a sensitivity analysis and not necessarily for the base case. A final decision on this was delayed until full consideration of the stock assessment approach for 2011.

### *Longline CPUE analysis methods, progress to date and plans for 2011*

Simon Hoyle reviewed the methods used for the 2010 analysis of Japanese longline CPUE, described his collaborative work with NRIFSF using operational level data, gave background information on the problems encountered in deriving CPUE indices, and presented plans for developing CPUE indices for input to the 2011 assessments. The basis for the indices input to the assessments have to date been the aggregated Japanese longline logsheet data since 1952, therefore any biases in these data may have a large effect on the stock status estimates. Some particularly noteworthy issues were identified including i) lack of representative coverage of Region 6; ii) a potential change of targeting (possibly from BET to ALB) in the northern portion of Region 3 resulting in a proposal to split the northern 10 degrees of Region 3 into a separate region; iii) shrinkage of effort over time into areas of high CPUE (now mainly concentrated in Regions 2, 3 and 4). Standardization models with factors time, cell, HBF (hooks between floats) and effort were applied and indicated declines in YFT CPUE in Regions 3 and 4 but a stable CPUE for BET in the same areas. Methodologies for regional weighting of CPUE trends were highlighted due to their importance in informing the stock assessment model of the relative abundance of fish in each region. It was noted that the current methodology is based on assumptions of constant  $q$  and equal vertical distribution, both of which are unreliable.

The workshop noted that:

- CPUE trends are different among the species in Regions 3 and 4: there are obvious declines for YFT but not for BET;
- The index for Region 6 is not particularly representative due to lack of coverage;
- It appears reasonable to separate out the northern 10 degrees of Region 3 (since there are not a lot of BET caught there and new vessels (to region 3) that are fishing there appear to be targeting albacore rather than the tropical tunas. Indices should focus on the core area of Region 3 where most of the catch occurs;
- There might be some value in lowering the boundary between Regions 3 and 5 for YFT to match the patterns in CPUE. This would influence regional weighting estimates.

- Japanese fishing effort coverage appears to be shrinking over time into areas with higher catch rates (noticeably since 1987).

Simon Hoyle presented a summary of a paper presented to SC6 describing CPUE indices for BET estimated from operational-level data. The need for this operational-level analysis was identified due to discrepancies between nominal and standardized indices based on aggregated data, and conflicting signals from CPUE and size data. The spatial focus of the analysis was on the area between 0 and 10 degrees N in Region 3. Key findings of the analysis were i) the standardized operational CPUE trend was less strongly declining than the standardized aggregated CPUE trend; ii) a 19% difference from the CPUE trend in the base case was estimated for the 30 years analyzed when a vessel effect was included in the standardization model; and iii) contrary to expectations, equatorial regions showed somewhat higher CPUE at lower HPB.

The workshop agreed that:

- The increasing CPUE trend in Region 3 for BET may derive from the offshore rather than the distant water Japanese longliners and thus it might be useful to explore fleet identifier as an explanatory factor.
- The factor HBF (hooks between floats) may not be adequately representative of the variance in CPUE due to depth if it is confounded with changes in the materials used for the main and branch lines.
- There are several key methodological issues requiring further research (see Research Outline for CPUE Data used in WCPO Stock Assessments below).

#### *Update of South Pacific ALB CPUE Indices*

SPC explained that the South Pacific ALB CPUE indices have been updated with recent data using a previous approach (Bigelow and Hoyle 2009: WCPFC-SC5-SA-WP5). This involved using operational data from fleets identified through cluster analysis as targeting ALB (fleets from Japan, Korea and Chinese Taipei). These updated indices were applied to the stock assessment model and updated assessment results are now available. The workshop discussed ongoing efforts by Chinese Taipei to partition the data to reflect ALB targeting and thus produce appropriate CPUE indices.

The workshop agreed that:

- Given the remaining uncertainties in the identification of vessels and fleets targeting ALB, standardization of Chinese Taipei's ALB data to produce an index of abundance should focus on the southern portion of Region 6 only (i.e. where there is known to be little BET targeting).
- Further exploration of target identification will be necessary but it is unlikely to be accomplished in time to be used in submissions to SC7.

## Reference points and related issues

### Current developments on steepness for tunas

Shelton Harley summarized his presentation made to the International Seafood Sustainability Foundation (ISSF) Steepness workshop, followed by a listing of the main outcomes of this workshop, and concluded with the results of a meta-analysis of steepness in tunas that he undertook during the course of the workshop.

The presentation to the ISSF focused on three main areas:

- It is unlikely that an individual estimated value of steepness from a tuna assessment will be accurate due to a number of issues related to data (e.g. lack of age data) and biological processes. Many of these issues have been identified through simulation studies in the published literature;
- It is necessary to include uncertainty in steepness in stock assessments; and
- There is scope for more theoretical consideration of the biological processes that relate to spawning in tropical tunas to develop hypotheses about both the expected relationship between spawners and recruits and the uncertainty around this curve.

The major recommendations **from the ISSF workshop** were:

- Estimated values of steepness from individual assessments should be treated with considerable caution. Analysts should evaluate the extent to which the stock recruitment estimation or assumptions influence the estimates of recruitment;
- RFMOs should collaborate on a meta-analysis of spawner-recruitment data as initiated during the ISSF Workshop. It was recommended that analysts continue to develop this work with a view to provide further advice for the estimation of steepness in tuna assessments;
- Stock status advice should incorporate stock assessment structural and parameter uncertainty including a range of plausible steepness values;
- RFMO decision-makers should consider management measures and/or Harvest Control Rules that are robust to uncertainty in steepness, noting the precautionary approach and the economic benefits of maintaining stocks at higher stock sizes; and
- RFMOs should collaborate on methods for the incorporation of uncertainty in steepness into stock assessment advice, including approaches such as management strategy evaluation.

Finally, the results of two independent meta-analysis of steepness in tunas that were conducted during and after the ISSF workshop were presented. The former was a fully integrated Bayesian analysis using only the Beverton and Holt formulation, while the latter considered both the Ricker and Beverton Holt functional forms and used maximum likelihood methods. Both analyses were considered preliminary with further work to be done on both the input data and the analytical methods, nevertheless they represent the most comprehensive analyses yet of steepness in tunas.

Key outcomes consistent across both analyses included:

- the finding that the estimated value for WCPO BET was the highest of any stock considered and stood out from the other estimates;
- an 'average' value for steepness for the stocks under consideration was around 0.8.

In considering the outcomes from the workshop SPC indicated that in the upcoming assessments it intended to focus on the following principles:

- steepness estimates from any single model run should be treated with caution and were likely to be biased; and
- it will be important to incorporate alternative assumptions about steepness when developing management.

The workshop noted:

- the points made in the presentation, but deferred any consideration on how this information might influence the assessments until discussion of the proposed approaches to the 2011 assessments; and
- that a presentation of a life-history based approach to determining steepness might be given at SC7.

### **Draft CSIRO Report: Identification of candidate limit reference points for the key target species in the WCPFC**

Shelton Harley offered his interpretation of an information paper submitted to the workshop by CSIRO, relating to a project to provide the WCPFC and SC:

- with a set of candidate limit reference points for the key target species; and
- to review steepness and depletion levels used across the tuna RFMOs.

The report recommends a three-level hierarchical approach to selecting and setting limit reference points based on decreasing levels of available information.

- The first level uses  $F_{MSY}$  and  $SSB_{MSY}$  but only in the case where a reliable and precise estimate of steepness is available;
- The second level uses  $F_{SPR}$  and 20% of  $SSB_0$  for cases in which uncertainty in steepness is high, but the key biological (natural mortality, maturity) and fishery (selectivity) variables are reasonably well estimated; and
- The third level does not include an F-based limit reference point if the key biological and fishery variables are not well estimated, but simply uses a SSB limit of 20% of  $SSB_0$ .

Specific recommendations of the paper were:

- For BET and YFT they recommend a **level-two** approach:
  - $F_{SPR-40\%}$  and 20% of  $SSB_0$
- For skipjack, given the strong sensitivity of the estimates of  $F_{SPR}$  to the specifics of the maturity-at-age relationship, they recommend a **level-three** approach:

- 20% of  $SSB_0$

The workshop noted that:

- CSIRO will present an updated paper to SC7 and SPC will provide some feedback to CSIRO on the current draft;
- The report did not provide specific recommendations on risk levels to associate with the LRPs. They recommend simulations and MSE to refine these with consultation among managers/stakeholders;
- The depletion estimate  $SSB$  is defined as the average virgin biomass rather than the biomass predicted to exist at any given time in the absence of fishing;
- SPC will continue to include the standard suite of reference points until the use of specific reference points is directed by the Commission, but the additional reference point recommended by CSIRO will be included where possible for the 2011 assessments.

SPC noted that it will undertake further work on the reference points proposed in the CSIRO report based on tasks outlined at SC5 and SC6.

### **Issues with the Bigeye Tuna Recruitment Trend and MSY-Based Stock Status Determination**

John Hampton made a presentation regarding how alternative views about the estimated recruitment trend in the BET assessment can affect the stock assessment model output and therefore the evaluation of stock status against reference points. This was partly motivated by the current low estimates of MSY relative to removals over several years.

Under the current framework, MSY and other productivity parameters are estimated over the entire model temporal domain which, with steepness  $\sim 1$ , implies a common level of recruitment through time with deviations around it. The trend of increased recruitment in recent years is not factored in the calculation of reference points. Two alternative hypotheses were provided:

1. The recruitment trend is real and we are now in a high productivity period (i.e. a regime shift) and therefore the calculation of reference points and stock status should consider the current conditions; or
2. The recruitment trend is an artifact of conflicts among the various data sets and model assumptions and therefore we need to adjust the assessment methodology to solve these problems.

With respect to the first hypothesis, a new feature recently implemented in MULTIFAN-CL which allows the user to specify a time window over which to calculate the MSY-based reference points may be helpful. When the MSY based reference points were estimated over the recent period with high recruitment, the estimated MSY was much higher and closer to recent catches. Also, estimates of fishing mortality relative to  $F_{MSY}$  were higher therefore overfishing was occurring at a higher level. Most

importantly, the higher level of recruitment led to a much higher estimate of  $SB_{MSY}$  and therefore the results suggested that BET was already in an overfished state.

With respect to the second hypothesis, this issue was discussed in considerable detail during the 2010 PAW and results are described in WCPFC-SC6-WP1. A general conclusion of the investigations is that there are some significant data conflicts, at least between the relatively stable longline CPUE in Region 3 and the rapidly increasing catches of predominantly small fish. As was shown in the last assessment, patterns in some of the size data sets are also contributing to the conflicts. Hampton presented a model run where longline CPUE in regions 3 and 4 prior to 1990 was ignored – the catches were removed, and no information from the longline fishery on relative abundance was assumed. In this model the overall recruitment trend vanished, the estimated value of steepness declined from 0.98 to 0.88, MSY increased by 32,000 mt, overfishing was lessened, but the stock was still estimated to be in an overfished state.

There was considerable discussion in response to the presentation. Some of it focused on better understanding the temporal window approach, and the remainder focused on other potential data / model conflicts that were responsible for the estimated trend. The working group noted that the projection models currently being used to examine the impacts of alternative management options apply the recent average recruitment values. There were numerous recommendations for analyses to be undertaken in the upcoming BET assessment and these are reported both below and included in the table / discussion relating to the proposed approaches for the 2011 assessments presented in the following section.

The working group recommended that:

- Assumptions of higher natural mortality for juvenile BET be investigated in the 2011 assessment, in particular extending the age for higher mortality out to older year classes;
- The exclusion of both early and late longline CPUE (separately) be examined in the upcoming assessment;
- If the recruitment trend persists in the new BET assessment, that consideration be given to using the temporal time window to provide an alternative estimate of stock status that is consistent with the approach currently used for the projections. This analysis should be presented as a separate SC7 paper; and
- SPC should continue to investigate potential causes of these recruitment trends.

### **Proposed stock assessment approaches for 2011**

The workshop considered a draft plan of the approaches to the 2011 stock assessments prepared by OFP. A review of the approaches was done for each species in turn while maintaining consistency among them as necessary. The workshop agreed upon the plan presented in Table 1, and points of discussion follow.

In terms of general principles for the assessments, the workshop noted that:

- as in previous years a model run would be undertaken using a configuration as close to the previous configuration as possible, but with updated data;

- where possible step-by-step changes in any model assumptions would be presented;
- the treatment of steepness (as either fixed across a range or estimated) is probably the most contentious aspect of the stock assessment modeling decision-making process;
- the range of values of steepness proposed for sensitivity analyses was informed by the results from the meta-analyses undertaken at the ISSF workshop; and
- some participants strongly advocated that steepness should be estimated in base case models (rather than those which assume fixed values) in order to keep consistency with former assessments in the absence of any reliable reason to adopt one fixed steepness value. Other participants were skeptical about the ability to estimate steepness and preferred to fix steepness based on existing information such as meta-analyses.

In terms of general principles for the assessments, the workshop agreed that:

- it is necessary to present key model diagnostics;
- the model diagnostics for the reference case will be presented in an appendix;
- a reference case will be designated in order to have a single model for which a full suite of model diagnostics is presented. SPC will be clear in the assessment paper and presentations that the reference case does not necessarily represent the most plausible case; and
- the SC should determine which is/are the most plausible model(s) (including results from the grid) that would be used to for the provision of management advice. SPC will provide model results for the reference case, key sensitivity analyses, and all of the results from the grid (the latter would be presented graphically to save space, but the actual files will all be available). This determination by the SC will also consider how uncertainty in stock status is qualified, e.g. through a range of point estimates, likelihood profiles from individuals runs, or probabilities from the grid.

Specifically for bigeye tuna (those with a \* also apply to the yellowfin tuna assessment):

- Some participants encouraged the exploration of a 7-region model structure (i.e. splitting out Indonesia and the Philippines). SPC indicated that this exploration is proposed for 2012 and could be considered in the context of a peer review.\*
- SPC reiterated that improvements to catch data from Indonesia and the Philippines would be documented through a SC7 working paper.\*
- Sensitivity analyses that involve alternative longline CPUE indices will require careful consideration of assumptions relating to regional weightings, and shared catchability coefficients, and shared selectivity curves.
- There will be further examination of the longline data that might result in changes to data weightings, etc. For example, currently JP length data and TWN and Chinese offshore size data are down-weighted due to known problems with consistency in that data. If these problems can be addressed then down-weighting of these data may no longer be necessary.
- Sensitivity analyses (and grid options) relating to vessel effects in longline catchability will depend on whether the operational or aggregate-based indices are used in the reference case.\*

- Length-based selectivity has not yet been fully tested.\*

Specifically for yellowfin tuna:

- CPUE patterns in the northern part of Region 5 are more similar to those in Region 3 than further south. This will have implications for the recalculation of the LL CPUE series and the regional weights.
- A sensitivity analysis should be undertaken with this change in regional structure.
- If possible, a standalone Region 3 model will be run in addition to the six region model.
- Changes will need to be made to the YFT longline fishery definition to make it consistent with BET.
- The same assumptions for size data weightings should be used for both BET and YFT and the merits of iterative re-weighting for size data should be brought to the attention of the peer-review process.
- Catchability should be handled as for BET except that the q-trend values are different (1.4 and 0.5%).

Specifically for skipjack:

- Where appropriate, the fisheries definitions used for BET and YFT should also be applied to SKJ.
- Japan will provide updated training vessel size data.

**TABLE 1: PROPOSED APPROACHES FOR THE 2011 TUNA STOCK ASSESSMENTS (BIGEYE, YELLOWFIN, SKIPJACK)**

**Bigeye tuna**

<b>Factor</b>	<b>Base 2010 model</b>	<b>2011 model</b>	<b>Reference</b>	<b>Sensitivity analyses</b>	<b>Grid</b>
<b>Regional structure</b>	Six region model	Six region model		None	
<b>Temporal model domain</b>	1952- present by quarter	1952- present by quarter		None	
<b>Fisheries definitions</b>	Reassigned all off-shore longline fleets to single fishery	New ID/PH domestic fishery definitions		Same as 2010, but perhaps done thru a shared selectivity	
<b>Purse seine catch</b>	Spill sampling estimates	Spill, but with modified length frequency samples		SBEST	<ul style="list-style-type: none"> <li>• SBEST,</li> <li>• Spill estimates</li> </ul>
<b>Catches for Indonesia and Philippines fisheries</b>	Revised best estimates for domestic and longline fisheries	Revised best estimates – including new fisheries definitions. Size data included.		None	

<b>CPUE indices</b>	Based on 5x5 degree aggregated Japanese LL data – YFT offset removed CV =0.20 and no temporal weighting of the effort deviates	CV=0.2 with temporal effort deviates. Use operational CPUE indices if available.	1)Exclude JP index for regions 3 and 4 prior to 1975, 1990, and post 1990 (three separate runs) 2)JP R3 index for core area only 3)Include the TW-DW indices for region 6 to replace the LL-ALL 6 index 4)Aggregated indices vs operational (depending on reference case) 5)TW indices for R3/R4 if available	<ul style="list-style-type: none"> <li>• Reference model index;</li> <li>• Exclude JP index for regions 3 and 4 prior to 1990</li> </ul>
<b>Length and weight frequency data</b>	Down-weighted offshore data and JP length data from research and other sources. Some non-JP length data were excluded from some combined fisheries.	As done in 2010	Full weight to JP length and offshore size data	<ul style="list-style-type: none"> <li>• Reference model weighting</li> <li>• Full weighting</li> </ul>
<b>Tagging data</b>	No PTPP	Include PTPP and JP tagging data	Without PPTP & JP	
<b>Reporting rates</b>		By tagging program		
<b>Catchability trends</b>	No forced vessel effect	Applied if using aggregated series, estimates from SC6-WP02, use year-by-year numbers if possible. None, if using operational series	If using aggregated series, no time series trend applied	<ul style="list-style-type: none"> <li>• If, operational CPUE used in reference case then no grid</li> <li>• If aggregate-based CPUE used then time series trend on/off</li> </ul>

<b>Selectivity</b>	Age-based	Same	None
<b>Steepness:</b>	Estimated	Fixed at 0.8	0.65, 0.95 and estimated <ul style="list-style-type: none"> <li>• 0.65</li> <li>• 0.8</li> <li>• 0.95</li> </ul>
<b>Growth:</b>	Estimated	Estimated	
<b>Natural mortality:</b>	Fixed	Fixed	1) Increased juvenile mortality to YFT level over 1 <sup>st</sup> 4 age classes 2) Extend the increase to the 1 <sup>st</sup> 8 age classes. 3) Estimates from Hampton M paper <ul style="list-style-type: none"> <li>• Reference model fixed values</li> <li>• Estimates from Hampton M paper</li> </ul>
<b>Movement:</b>			
<b>Comparative run with 2010 model structure</b>		Match run 3d: No q trend Don't include PTTP Steepness estimated	
<b>Equilibrium recruitment</b>	Full time series	Full time series	Shorter time period for SRR: 1989-2009

## Yellowfin tuna

Factor	Base 2009 model	2011 model	Reference	Sensitivity analyses	Grid
<b>Regional structure</b>	Six region model	Six region model		1) A new regional weights accounted for the 'adjusted' Region 3 and 5. 2) Region 3 model	
<b>Temporal model domain</b>	1952- present by quarter	1952- present by quarter		None	
<b>Fisheries definitions</b>	Non-optimal grouping of LL fisheries as with 2008 BET assessment	Same as for BET		Same as 2009 model	
<b>Purse seine catch</b>	Spill sampling estimates	Spill, but with modified length frequency samples		SBEST	<ul style="list-style-type: none"> <li>• SBEST</li> <li>• Spill</li> </ul>
<b>Catches for Indonesia and Philippines fisheries</b>	Revised best estimates for domestic and longline fisheries	Revised best estimates – including new fisheries definitions		None	
<b>CPUE indices</b>	Based on 5x5 degree aggregated Japanese LL data – BET offset removed Temporal variation in CV, average CV=0.2 Catchability estimates based on operational data from R3	CV=0.2 with temporal effort deviates. Use operational CPUE indices if available.		1)Exclude JP index for regions 3 and 4 prior to 1975, 1990, and post 1990 (three separate runs) 2)JP R3 index for core area only 3)Include the TW-DW indices for region 6 to replace the LL-ALL 6 index 4)Aggregated indices vs operational (depending on reference case)	

			5)TW indices for R3/R4 if available	
<b>Length and weight frequency data</b>	0.2* actual N, max=50	Weighting as applied to BET	Full weight to JP length and offshore size data	<ul style="list-style-type: none"> <li>• Reference model weighting</li> <li>• Full weighting</li> </ul>
<b>Tagging data</b>	No PTPP	Include PTPP and JP tagging data	Without PPTP & JP	
<b>Reporting rates</b>		By program		
<b>Catchability trends</b>	Vessel effect 1.4% p.a. in region 3 and 0.5% elsewhere	Changes to same penalties and timing as BET PS fisheries Applied if using aggregated series, estimates from 2009 assessment, with year-by-year numbers if possible None, if using operational series	If using aggregated series, no time series trend applied	<ul style="list-style-type: none"> <li>• If, operational CPUE used in reference case then no grid</li> <li>• If aggregate-based CPUE used then time series trend on/off</li> </ul>
<b>Selectivity</b>	Age-based	Same	None	
<b>Steepness:</b>	Fixed at 0.75	Fixed at 0.8	0.65, 0.95 and estimated	<ul style="list-style-type: none"> <li>• 0.65</li> <li>• 0.8</li> <li>• 0.95</li> </ul>
<b>Growth:</b>	Estimated	Estimated		
<b>Natural mortality:</b>			Estimates from Hampton M paper	Estimates from Hampton M paper
<b>Movement:</b>				
<b>Comparative run with 2009 approach</b>		The reference case from 2009: CPUE Low, LL sample High, q_incr		

## Skipjack tuna

Factor	Base 2010 model	2011 model	Reference	Sensitivity analyses	Grid
<b>Regional structure</b>	Three region model	No change			
<b>Temporal model domain</b>	1972- present by quarter	No change			
<b>Fisheries definitions</b>	Redesigned all fisheries	No change ID/PH consistent BET/YFT	changes, with	Combined selectivity approach, to mimic 2010	
<b>Purse seine catch</b>	Spill sampling estimates	No change		S_BEST	<ul style="list-style-type: none"> <li>• SBEST</li> <li>• Spill</li> </ul>
<b>Catches for Indonesia and Philippines fisheries</b>	Revised best estimates	Improved estimates			
<b>CPUE indices</b>	Based on operational Japanese PL data Delta-lognormal indices	Same method as 2010 base model with updated data Use improved index (include more vessel ids, group size effect, and search devices for OS) if analysis is successful.		1) Binomial and adjusted binomial indices 2) Delta-lognormal using 2010 approach 3) If available, indices that include more vessel ids, group size effect, and search devices for OS	<ul style="list-style-type: none"> <li>• Delta lognormal, binomial,</li> <li>• Adjusted binomial indices</li> </ul>
<b>Length frequency data</b>	LF data	Adjusted for grab bias Include new ID/PH size data		2010 approach	<ul style="list-style-type: none"> <li>• SBEST</li> <li>• Spill</li> </ul>
<b>Tagging data</b>	All JP tagging All SPC tagging but PTTP removed for final run	PTTP included		Without PTTP	
<b>Reporting rates</b>	By tagging program	No change			
<b>Catchability trends</b>	None	No change			
<b>Selectivity</b>	Age-based	No change			
<b>Steepness:</b>	0.75	Fixed at 0.8		0.65, 0.95 and estimated	<ul style="list-style-type: none"> <li>• 0.65</li> <li>• 0.8</li> </ul>

			• 0.95
<b>Growth:</b>	Estimated	No change	
<b>Natural mortality:</b>	Estimated M at age	No change	
<b>Movement:</b>	Estimated, constant movement at age	No change	
<b>Comparative run with 2010 approach</b>		Choose the reference case from 2010 (Run 41)	

## General approaches to SC stock assessments

John Hampton presented a discussion of what general approaches can be taken to providing stock assessments to the Scientific Committee, in particular the frequency of assessments entailing various levels of investigation.

The workshop agreed that:

- Assessments should be referred to simply as ‘assessments’ rather than ‘full’, ‘streamlined’, or ‘updated’. These labels may introduce bias into the evaluation of the modeling results;
- stock assessments for the tropical tunas should be undertaken in synchrony in order to provide complete information for CMM-related analyses, but these assessments might not necessarily be undertaken every year. In ‘off’ years there would be scope for in-depth analyses of data inputs and investigation of alternative model structures; and
- Discussion by the SC is needed to determine the appropriate frequency of peer review and how it might relate to the proposed introduction of major changes to the assessments.

## Projections

### MULTIFAN-CL implementation of deterministic and stochastic projections

Nick Davies presented a summary of recent work undertaken and presented to SC6 on projection of population models under deterministic and stochastic processes. The methodology, called Yield Management Catch Analysis, involves using the basic population dynamics model to produce estimates of population parameters based on data from an observed (i.e. historical) period. These parameters are then projected into the future using a combination of deterministic projections for catch and effort, and stochastic processes for recruitment, number at age in the first year of the projection, and effort deviates. Once a large number of iterations are processed, the risk that the projected biomass falls below a given reference point can be calculated and evaluated. For the sake of example, two reference points ( $0.5SB_{MSY}$  and  $0.2SB_0$ ) and two risk levels (5% and 10%) were applied. Stochastic recruitment was applied as the single source of variation in the stochastic process. The method can be used to evaluate the risk associated with a given management strategy or to develop new strategies.

The workshop noted that:

- A further step in the methodology involving sampling the iterations to produce confidence intervals for the risk estimates should be undertaken as an enhancement.
- Presentation of the methodology to SC7 will reference CSIRO's recently completed work on the development of reference points.
- Because these model projections link risk and levels of projected biomass, they can inform the selection of reference points (RPs). The interaction between the selection of the RP and the risk level was noted (i.e. a conservative RP might be accompanied by a higher acceptable risk than a non-conservative RP).

- The projection methodology should ultimately be embedded into the model grid to cover structural uncertainty due to different models, but the practicality of the resulting computational demands will need to be considered.
- There is a trade-off between the specification of uncertainty and the usefulness of the estimates, for example, if the estimate has an extremely broad confidence interval it may be very difficult to interpret for management purposes.
- SC7 should consider how to implement the projection methodology as a routine component of CMM formulation and evaluation.
- The method for including stochastic recruitment entails re-sampling the historical estimates (assuming a multinomial distribution) and applying each in the future. This takes no account of spawning biomass or the stock recruitment relationship (SRR) in the projection period. An improvement would be to re-sample the recruitment deviations and apply this to mean recruitment predicted from the SRR in each projection year. This approach could feasibly be extended to include serial correlations in the year-to-year variability and to re-sample with respect to season variability.

## TUMAS

Simon Hoyle presented the interactive software called TUMAS (Tuna Management Simulator) which allows users to explore the outcomes of specified fisheries management options in population projections for bigeye, yellowfin, and skipjack tunas.

Feedback was provided by the workshop and general points of discussion included:

- It would be useful to provide advice on how to modify the fisheries defined in TUMAS to manipulate them to be consistent with CMM 2008-01-- this can guide the user to explore modifications to the measure, in the context of the fisheries defined.
- It is not currently possible to explore effects at the EEZ or high seas pocket level of spatial resolution.
- SPC asked for users to give feedback on results that appear implausible or incorrect. Although there may still be bugs, SPC has attempted to only use scenarios that are plausible.
- SPC indicated that it is possible to include other MULTIFAN-CL assessments, e.g. IOTC or ICCAT, and that SPC is currently examining this.
- Updated assessment models will be posted on the TUMAS website for downloading into the user's TUMAS application.
- Some users may require historical assessments for running TUMAS; these will be made available for downloading into TUMAS.
- SPC will make available a wide range of model options for each species, e.g. the major ones decided in SC (reference cases and sensitivity runs), but not the whole grid.
- Some participants were very interested in examining the trade-offs among fisheries associated with a given management strategy and encouraged development of capabilities to run multi-species scenarios.

## **Final remarks**

John Hampton thanked participants for a fruitful workshop and indicated that a draft workshop report would be circulated for comment among meeting participants prior to finalization and submission to SC7.

## APPENDIX 1: Agenda

<b>Monday, 4<sup>th</sup> April</b>	<p><b>Introduction</b>  <i>Participants will be welcomed and the process for the meeting and documenting outcomes discussed</i></p> <p><b>MULTIFAN-CL</b>  <i>The current status, recent, and future developments will be discussed. This will include the website and current release details.</i></p> <p><b>Catch estimates</b></p> <ul style="list-style-type: none"> <li>• <b>Indonesian and the Philippines</b></li> <li>• <b>Purse seine catches determined from grab samples corrected for size selectivity</b></li> </ul> <p><i>Updates will be provided on the progress on improved catch estimates for fleets from the Philippines and Indonesia.</i></p> <p><i>Estimates of catches and size frequencies determined from observer grab samples corrected for size selectivity, and estimates of size selectivity based on paired spill and grab samples, will be discussed</i></p> <p><i>It is envisaged that the discussions had could result in changes to the assumptions and/or data used in the 2011 assessments.</i></p>
Afternoon (1300-1630)	<p><b>CIE review</b>  <i>SPC will present the recommendations from the reviews (which will be distributed to participants in advance of the meeting) and their summarised response. More detailed responses will come through in the specific agenda items. A written response will come in the form of a SC7 paper.</i></p>
<b>Tuesday-Wednesday</b>	
All day (0830-1630)	<p><b>Stock assessment inputs</b></p> <ul style="list-style-type: none"> <li>• <b>Longline CPUE</b></li> <li>• <b>Size data</b></li> <li>• <b>Pole and line CPUE</b></li> <li>• <b>Purse seine CPUE</b></li> <li>• <b>Tagging data</b></li> <li>• <b>Biological inputs</b></li> </ul> <p><i>Presentations in each of the above-listed work areas will focus on two aspects a) a strategic approach to address the issues in the form of a medium term research plan; b) an update on any progress to date.</i></p> <p><i>These planning documents will lay out the different work areas and a suggested timeline.</i></p> <p><i>We will be seeking some comment from the WS on these plans which will then be presented to SC7 for endorsement as documents to direct work in these areas (the Science Manager will need to determine how best to incorporate these into existing planning documents).</i></p> <p><i>We would not be anticipating that the work presented under (b) would necessarily result in changes to the assumptions from the previous assessments.</i></p>
<b>Thursday</b>	

Morning (0830-1200)	<p><b>Reference points and related issues</b></p> <ul style="list-style-type: none"> <li>• <b>Report from ISSF steepness workshop</b></li> <li>• <b>CSIRO consultancy on reference points (To be confirmed)</b></li> <li>• <b>Use of temporal windows to estimate spawner recruitment relationships in MFCL</b></li> </ul> <p><i>Resulting from these discussions could be suggestions for a range of assumptions to be considered in the assessments. It should be noted that the implementation of the SPC reference point work will be discussed in the context of projections.</i></p>
Afternoon (1300-1630)	<p><b>Proposed stock assessment approaches for 2011</b></p> <p><i>During the meeting SPC will update last year's assessment tables which outline key assumptions / data sources etc. SPC will be seeking input on the runs to be considered. SPC notes that it does not intend to undertake full grids of structural uncertainty analyses for these assessments –the extra time will be needed for the projections and reference point work.</i></p> <p><b>A general approach for WCPFC stock assessments</b></p> <p><i>SPC will present a proposed framework for 'streamlined' and full assessments which integrated peer review and the update of conservation and management measures. SPC will be seeking comments from the WS and a decision will then be made as to whether this be developed into a SC7 working paper</i></p>
<b>Friday</b>	
Morning (0830-1200)	<p><b>Projections</b></p> <ul style="list-style-type: none"> <li>• <b>MULTIFAN-CL implementation of deterministic and stochastic projections</b></li> <li>• <b>TUMAS</b></li> </ul> <p><i>We will first provide an overview of the projection methods used for the evaluation of management options and reference point analyses and then demonstrate the features of TUMAS.</i></p>
Afternoon (1300-1630)	<p><b>Review of meeting outcomes</b></p> <p><i>A summary of the key meeting outcomes will be produced for initial discussion if time allows. The full draft report will be distributed within ten working days.</i></p>

## APPENDIX 2: Terms of Reference

The Oceanic Fisheries Programme (OFP) of SPC is contracted by WCPFC to undertake stock assessments. The results of these assessments will be presented at the WCPFC Scientific Committee. In preparation for these assessments, OFP is hosting a pre-assessment workshop to discuss key issues related to the assessments. The terms of reference for this workshop are provided below.

### *Terms of Reference*

- Review the most recent completed assessments, in particular, any concerns, suggestions and/or recommendations raised by the Scientific Committee, the Commission, research providers, individual CCMs, or any independent reviews;
- Review preliminary work undertaken by the service provider relating to the stock assessments, including any proposed:
  - revisions to biological parameters
  - revisions to historical data
  - changes to structural assumptions in the model
  - methodological issues, e.g. characterization of uncertainty
  - standardized CPUE analysis
  - incorporation of tagging data or other auxiliary data
- Provides guidance to the OFP on:
  - the suitability of any proposed changes and any suggested additional work
  - a minimum set model runs to be undertaken, in particular the range of key sensitivity analyses
  - desired model diagnostics to be presented
  - alternative modeling approaches that could be considered

The outcomes of the meeting will be documented in two ways, a report of the meeting and in the assessment working papers themselves. The report of the meeting will be distributed to workshop participants for comment within 10 working days of the meeting and revised and provided to WCPFC Scientific Committee members 30 days after the meeting. It will also be submitted to the next Scientific Committee as a Working Paper. Many of the matters discussed to the workshop will be the subject of meeting papers to the Scientific Committee.

Due to the timing of the meeting, any model runs presented will be based on previous assessment data sets, and therefore no preliminary stock assessment runs will be undertaken. Further, the workshop will occur prior to the submission of data and completion of supporting analyses (e.g. CPUE analyses). Therefore, any major changes to historical data submitted by CMM's, or new data could result in a need to consider alternative model runs or structures not considered previously. In such instances, supporting documentation will be provided to the SC via working papers to allow the SC to determine the merits of any proposed changes.

The consultation will be open to participation by all CCMs and to other experts, by invitation. CCMs will be expected to fund their participation although SIDS and participating territories may seek support from the Commission's Special Requirements Fund or other sources, as appropriate.