Report of the June 2016 CPUE Web Meeting.

Start times

Seattle:	3:00pm, Tue 28 June
London:	11:00pm, Tue 28 June
Cape Town, Copenhagen & Paris:	12:00am, Wed 29 June
Jakarta	5:00am, Wed 29 June
Taipei:	6:00am, Wed 29 June
Seoul & Tokyo:	7:00am, Wed 29 June
Canberra:	8:00am, Wed 29 June
Wellington:	10:00am, Wed 29 June

Prepared by the Chairman (John Pope).

Attachments
Attachment 1: List of Participants
Attachment 2: List of Documents

Agenda 1. Opening -Agree Agenda

The meeting was opened at 2300h BST 28th June. The Chair (John Pope) welcomed members (see list of members at appendix 1). He noted that that if possible the meeting should aim to finish in 2 hours which meant that on average only 15 minutes could be spent on each paper (see list of papers at appendix 2). He asked all members to respect the problems of non-English Speakers by speaking slowly and clearly or better still by typing their questions and responses.

He asked the meeting to agree the agenda. This was agreed.

Agenda 2. To check and agree that the current core series continues to behave adequately as an input to OM, MP and annual status advice.

This agenda item covers a vital part of the CPUE modelling group's mission. It was addressed by two papers (3 & 4) provided by Japan. These were presented by the chair with the authors' agreement. The chair also drew on results from papers 6 and 8 in discussion.

Paper 3 Change in operation pattern of Japanese southern bluefin tuna longliners in the 2015 fishing season.

By Tomoyuki ITOH and Izumi YAMASAKI

This paper gives the annual update on any changes in the fishing behaviour of the Japanese LL fleet. Since this fleet provides the main input to the Base CPUE Series used by the MP, checking that it continues to function in a consistent fashion is a vital input for to this WGs task of checking and agreeing that the current core series continues to represent changes in SBT populations of 4+ fish.

The paper provides a series of useful summary tables and figures of various aspects of the fleet's behaviour e.g. the distribution of fishing in time and space, concentration on SBT etc.

The Chair particularly drew the meeting's attention to Table 1-3 and figures 1-7. It was noted that the size composition of the catch indicated a build up of larger fish but showed virtually no fish smaller than 100cm when compared to previous years. While this may result from changes in fishing practice it could also indicate a reduction in recruitment. It was however noted that the CPUE series refer to 4+ fish, which would be greater than 100cm. The authors were asked to consider size compositions further and to compare their results with the indices of recruitment but it was generally considered that the catchability at size of age 4 fish in a longline fishery, as we have seen, might be expected to vary between years.
It was also noted that the concentration indices were largely unchanged in areas 8 and 9 but were difficult to interpret in other areas. The chair emphasised the need for continued vigilance as to the adequacy of the core series and asked if any technological changes, other than those reported on e.g. use of new electronic kit, were occurring. This lead to a short discussion on effort creep- a factor that is included in the MP but is not measured.

The meeting broadly agreed with the authors conclusions that:-

•No Changes in fleet operation of concern were noted.

•No remarkable change was found in the 2015 operational pattern in terms of catch amount, the number of vessels, time and area operated, proportion by area, length frequency, and concentration of operations.

•It can be said that the longline CPUE in 2015 represents the change of SBT stock abundance consistently as in previous years.

Paper 4 Update of the core vessel data and CPUE for southern Bluefin tuna in 2016.

By Tomoyuki ITOH and Norio TAKAHASHI.

This paper was also presented by the chair, who noted that it provides the annual update of the base CPUE series and of three of the 3 monitoring series. He also noted that the methodology was the same used in previous years. He drew attention to figures 1 and 2 showing trend and q-q plots and also presented comparisons with results from Korea (paper 6) and a GAMM model of the Japanese data (paper 8). For the most part these trends all seemed consistent although the Authors note differences between the base series and the reduced base series in recent years. These are thought likely to be due to different trends in different areas and latitudes which are accounted for by the Year*Lat and Year*Area interactions used in the base but not in the reduced base series. Moreover, the gap between the two series had narrowed in the last year.

The large increase in CPUE in 2015 was noted and was thought to be associated with the strong mode of 120cm fish that may well relate to stronger recruitment seen in the aerial surveys in recent years.

The need for continued "due diligence" to be applied to the CPUE series was stressed as was the need to consider the residual of various CPUE series in appropriate assessments (even when these are not used in the assessment as such). The meeting agreed though that the trends seen were encouraging and seeming consistent between series and remained happy for the base CPUE to be recommended for use by the MP group.

Agenda 3. To look at improving or refining estimates of Non Member Catch of SBT.

This agenda item is a new task given to the group. One Document (Paper7) from Australia and NZ was available to consider this issue.

Paper 7 -Updated estimates of Southern BluefinTuna Catch by CCSBT Non-Member states by Charles Edwards, Ashley Williams and Simon Hoyle.

This was presented by the authors. It builds on past efforts to calculate Non-member Catch. The objective of this paper is to contribute to determining the probable catch of SBT by non-members of CCSBT in tuna fisheries that do not report catch to CCSBT. Cooperating non-members do report catch to CCSBT, and in this paper are grouped with members in all analyses. The term "non-member" therefore refers to non-cooperating non-members only unless specified otherwise by the context.

The methodology used was carefully explained. In particular the Japanese catch in number data first had to be converted to catch in weight. The paper considered results from two CPUE Models:-
•Delta –lognormal and
•Random Forests.
These are fitted separately by Ocean and for assumptions of non-targeted (Taiwan) and Targeted SBT fishing (Japan).
These provided 4 estimates of Non-Member catch for each ocean. It was noted in both the presentation and discussion that much of the Non Member effort is at the Northern Fringe of the distribution of SBT in areas not well sampled by CCSBT CPUE data and much of the variability stems from this.

The authors summarised their results as follows.

- Predicted catches differed between modelling approaches, but magnitude of differences depended on catchability assumptions, Ocean and year.
- However, predicted catches were similar when averaged across catchabilities. Results from Random Forests were more similar to GLM than in 2015 (because CPUE in 2015 analysis was log transformed).

- Predicted catches were greatest in the Atlantic Ocean.
- Total predicted Non Member catches were approximately
- ~1-6% of CCSBT catches (with the TW catchability assumption)
- ~2 – 20% of CCSBT catches (with the JP catchability assumption).

There was considerable discussion both as to methodology and as to how to use the results in the MP. In particular it was noted that while there are still considerable differences in results between the different methodologies although these differences had narrowed. The possibility of using other data such as VMS, AIS, satellite was suggested and might be discussed further at the ESC. It was asked that this issue be further investigated before the ESC. It was noted that the lower estimates would make little difference to assessments but the higher level would, particularly if there was a strong time trend. It was noted that the 20% estimate of non member catch as a % of CCSBT catch (flagged above) was an outlier and that the next highest result was 12%. At the least the results raise the possibility that Non Member catch is larger than that reported. Therefore reported Non Member reported catch should be treated as a minimum estimate in OM work.

It was also questioned whether EU data were included in the Non Member effort and it seems that it was but where any catch was reported it would be included in the CCSBT catch and excluded from estimates of non-cooperating Non Member catch.

The Authors posed a series of questions they would like help on from members. It was agreed that these would be addressed by dialog between them and the relevant group members.

The group were appreciative of the authors' efforts to narrow the estimates but found it difficult to provide definitive advice to the OMMP group or ESC at this time. Rather they regard this as a work in progress and look forward to its further development for the ESC.

Agenda 4. To develop and encourage new work on CPUE series

This agenda item is an ongoing task of the CPUE modelling group. It covers both developing alternative CPUE series based upon data other than that used in the Core CPUE series and developing new methodologies and understanding of the data used to form the Core CPUE series. Four papers addressed this agenda item. Two (papers 6 and paper 8) were concerned with developing series from Korean CPUE data and from Taiwan CPUE data and two (papers 5 and 8) were concerned with achieving a better understanding of and different interpretive methodologies for the Core CPUE data.

Paper 6. Data exploration and CPUE standardization for the Korean southern Bluefin tuna longline fishery (1996-2015)

By Simon Hoyle, Sung Il Lee, and Doo Nam Kim

The paper was presented by the lead author. It first shows a thorough investigation of the data set (Figs 1-18 Table 3) and then the results of standardizing the CPUE in areas 8 and 9. It also shows diagnostics of the standardizations and time trends of vessel effects

The data examination noted that catches were low in the mid 2000.It showed:-
Core Korean fishing areas by year groups and by quarter.

The move of effort from Subarea 9 to 8 through the year.

Changes in the dist. of hooks between floats and hooks per set through time.

The distribution of catch rate by species, proportion of zero sets by species and proportion of zero catches per set for species, by year-quarter and statistical area.

Maps of proportion of SBT and of albacore by 5 years groups and of proportion of SBT by month aggregated 2005-2014.

The models fitted were a lognormal constant GLM(with an added constant) GLM and a delta log normal GLM; both were fitted separately to areas 8 and 9. The lognormal constant GLM had terms for year, vessid and latlong as categorical variables and terms for hooks, month and moon as cubic splines. The delta log normal GLM had terms of year, vessid and latlong as categorical variables and terms for hooks and month as cubic splines. Both models show a 2 to 4 fold increase in CPUE from the mid-2000's. Diagnostics include Residuals, AIC and influence plots were also show where possible.

The models were run both with and without vessel effects to gauge the trend in vessel efficiency through time. These indicated that vessel efficiency increased through time by about 1% per year. While these estimates are somewhat uncertain they may provide estimates of effort creep. These are probably lower estimates of effort creep because they only measure the increased efficiency of new vessels rather than any more general increases.

In discussion it was noted that the standardised results mostly differed from the unstandardized results in the last two years. It was suggested that this should be further investigated. The trend in vessel efficiency may well be of interest to the OMMP group. It would also be useful to repeat this sort of analysis for the Japanese LL fleet and collaboration between Japan and NZ on this would seem to be indicated. The chair suggested that members read the paper careful for new ideas.

Paper 5. Some exploratory analyses on age-based longline CPUE of southern Bluefin tuna

By Norio Takahashi and Tomoyuki Itoh

With the authors agreement this paper was presented by the chair. It further explores the use of age data in CPUE analysis, following on from work in the previous year by Itoh and Takahashi (2015) who presented the result from preliminary analysis of standardized CPUE for three age groups, age 5&6, age 7-10 and age 11+ but without showing a detailed validation of this age aggregation. Hence, first paper 5 shows a simple analysis that supports the validity of this age grouping and also suggests that disaggregating age groups further than

the three age groups proposed would be meaningless because of strong correlation of the CPUE trends within these age groupings.

Secondly the paper examines the effect of age on the year*area interaction in CPUE. Data exploration (fig 5) suggests that there are different year trends by area for different age groups and this is backed up by maps (fig 9) of CPUE and average age by year.

To examine this further a tentative model,

log(CPUE.age4plus) ~ year + area + average.age^2 + area:average.age^2, was fitted.

The main effect of average.age^2 and its interaction with area were both significant. This suggests the average.age^2 term captures some of the variation that perhaps was previously fitted by an area*year interaction term.

This prompted the following thoughts, suggestions and questions from the Chair.

- Being able to take the year interaction terms out of the base model would be very helpful!
- The Authors note the problem of zero cells and this might suggest fitting a delta lognormal model as adopted in papers 5 and 6.
- The effectiveness of using the age term might be checked either by first fitting the quadratic age terms and subsequently fitting the year area or year lat interaction terms to see if these were diminished.
- Using the square of age seems to get around the problem of including data in the CPUE that are also used in the OM. He asked the meeting if the squared age term a reasonable way to include an age effect without causing spurious correlations with the catch-at-age data that are also used in assessments?

In discussion, as last year, the main concern expressed was the potential double use of age data both in a CPUE measure and in other parts of the assessment, which might introduce incorrect measure of goodness of fit. While this was seen as far less serious with the model proposed this year, the potential correlation between assessment components needed to be considered carefully before introducing a new CPUE series in to assessments or MPs. At the same time it is clear that if the year*area or year*latitude interaction terms, which are used in the base CPUE model, could be explain wholly or in part by age effects this would certainly clarify our understanding of "how CPUE worked" and potentially lead to better CPUE series. The intention was certainly not to replace the base CPUE series right away but to understand, explain and possibly in the longer term substitute its more difficult components, if this could be done safely. Several suggestions were made as to how the model (proposed in paper 5) might be usefully modified with different forms of the average age term (e.g. log). It was also suggested this endeavour would benefit from pooling the expertise available between members.

Paper 8.An updated CPUE Index based on a GAMM

By Fay Helidoniotis

The author presented paper 8. This was an update of a model Mark Chambers had developed last year. The model used is

$$\log .CPUE_{lo,la,m,y} = t\left(LONG_{lo}, LAT_{la}, MONTH_{m}\right) + YEAR_{y}^{*} + 1 \,|\, \left(Cell_{lo,la} : YEAR_{y}^{*}\right) + e_{lo,la,m,y}$$

Where CPUE is for the Japanese LL fleet for Months 4-7 and areas 4-7 for the age 4+ age group. A constant of 0.2 added to CPUE to handle zero CPUE's so as to allow the CPUE to be log transformed. The model terms are:-.

• Fixed effect: Year

• Smoothing term: estimate average spatio-temporal distribution of CPUE

• Random interaction effect: between 5-degree square and Year: Differences in the spatial distribution of CPUE between years

Trends calculated for past years data emulated Mark Chambers results while with the full data the resulting trend is very similarly to the w0.8 trend of the base CPUE series in recent years. The author would like to further discuss how to handle rectangles with no effort with Japan. In Conclusion, this analysis suggests an increased CPUE in 2015. This was indicated in all CPUE series. The paper suggests notable increase in numbers caught of 4-10 year olds.

Paper 9. Update of CPUE standardization for Southern Bluefin Tuna caught by Taiwanese longline fishery

By Sheng-Ping Wang, Shu-Ting Chang, I-Lu Lai, Shiu-Ling Lin

With the authors agreement this paper was presented by the Chair. It shows new approaches to standardizing the Taiwan SBT CPUE series. These data are particularly difficult to interpret due to the variable species targeting of this fishery. To help with this problem, vessels were selected by a cluster analysis method to give vessels more engaged in SBT fishing.

An area based and an age based model were then fitted. In both models Longitude was treated as a categorical variable. Both CPUE standardization models were GLMs. When included ages were grouped into 0-2, 3-5, 6-9 and 10+ years. The GLM was conducted as below:

$Ln(CPUE+c)=\mu+Y+M+A+Lon+C+AG+interactions+\varepsilon$

Where AG is the age effect.

Because the age-specific catches data did not occur in every areas and years, paper 9 did not attempt to estimate age- and area-specific standardized CPUE. The age-specific standardized CPUE trends were estimated based on the exponentiations of the adjust means of the interaction between year and age effects (i.e. Y*AG). Thus the paper provides trends by area and by age separately.

It was noted that trends in Areas 8 and particularly 9 differ from those of the directed fisheries of Japan and Korea. The question was thus posed as to whether it would be useful to comparing these to the trends that were calculated in paper 7 using TW CPUE? It would be

worth checking if the alternative methodology (delta log normal and random forests) used in that paper had any benefits to offer in interpreting this difficult data set.

It was also noted that the age group trends appears to be rather similar, particularly in all exhibiting a 2012 peak and a 2014 dip. Thus there was no clear cohort effects. This may suggest some systematic difference in catchability is driving the signal rather than year class strength. It was therefore suggested that the authors might find it useful to ask the question "How did the vessels behave in 2012 compared to 2014?

In discussion it was noted that the Taiwan LL fishery tends to catch younger fish at the northern end of the range of SBT. Consequently if some way of controlling the variations in catchability of SBT in this multispecies fishery it could provide a potential recruitment index. However, it would seem at present that catchability issues dominate this CPUE series. It was suggested that an analysis of patterns of fishing along the lines of paper 3 and paper 6 could be helpful in identifying when and where catchability changes might be occurring.

Agenda 5. Closure of Meeting

The chair thanked all the authors, presenters and contributors together with Jim Ianelli who had managed the desk top and CCSBT staff for their help. He felt it had been a useful meeting with an interesting group of papers. He urged members to continue collaborating with the work of the CPUE modelling group. The agenda presentation together with the audio visual and the written records of the meeting are available on the CCSBT website and can be consulted for more detail on individual presentations.

There being no other business the meeting was closed at 0103 BST. 29th June.

Attachment 1

List of ParticipantsCCSBT CPUE Modeling Working Group Webinar on 29 June 2016

Attachment 2

List of Documents.

Attachment 1

List of Participants
CCSBT CPUE Modeling Working Group Webinar on 29 June 2016

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Attachment 2

List of Documents
CCSBT CPUE Web Meeting - June 2016

(CCSBT-CPUE/1606/)

1. List of Documents.
2. (CPUE Chair) June 2016 CPUE Web Meeting Presentation.
3. (Japan) Change in operation pattern of Japanese southern bluefin tuna longliners in the 2015 fishing season.
4. (Japan) Update of the core vessel data and CPUE for southern bluefin tuna in 2016.
5. (Japan) Some exploratory analyses on age-based longline CPUE of southern bluefin tuna
6. (Korea) Data exploration and cpue standardization for the Korean southern bluefin tuna longline fishery (1996-2015). Simon Hoyle, Sung Il Lee, and Doo Nam Kim
7. (New Zealand / Australia) Updated estimates of Southern Bluefin Tuna Catch by CCSBT Non-Members states
8. (Australia) An updated CPUE index based on a GAMM
9. (Taiwan) Update of CPUE standardization for southern bluefin tuna caught by Taiwanese longline fishery