Annex 7

REPORT OF THE ALBACORE WORKING GROUP WORKSHOP

International Scientific Committee for Tuna and Tuna-like Species
In the North Pacific Ocean

19-26 March 2013
Shanghai, China

1.0 OPENING OF THE WORKSHOP

An intercessional workshop of the Albacore Working Group (ALBWG or WG) of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was convened at Shanghai Ocean University, Shanghai, China, 19-26 March 2013. The goals of this workshop were: (1) to review results of high priority research and develop proposals for incorporation into stock assessment process/model; (2) to discuss information and advice on biological reference points requested by the Northern Committee of the Western and Central Pacific Fisheries Commission (Northern Committee 2012) and develop work plans and assignments to prepare WG responses for ISC Plenary review in July 2013; and (3) to discuss Chinese fishery data for north Pacific albacore with Chinese scientists. In addition, matters related to the future work plans for the working group and the next stock assessment cycle, beginning in the fall of 2013, were included on the agenda for this workshop.

Professor Xu Liuxiong, Dean of the College of Marine Sciences, Shanghai Ocean University, welcomed 18 participants (Attachment 1) from Canada, China, Chinese Taipei, Japan, Korea, and the United States of America (USA) to Shanghai and wished participants a productive meeting. John Holmes, Chair of the ALBWG, noted that representatives from Mexico, the Inter-American Tropical Tuna Commission (IATTC), and the Secretariat of the Pacific Community (SPC) were unable to attend the workshop and sent their regrets.

2.0 MEETING LOGISTICS

2.1 Meeting Protocol

The ALBWG Chair noted that the efforts of the WG at this meeting would be collegial and follow the scientific method with an emphasis placed on empirical testing, open debate, documentation and reproducibility, reporting uncertainty, peer review and constructive feedback to authors and presenters. He asked everyone to consider how the results and conclusions presented and debated might be used to improve the stock assessment modeling process and to provide their input to move forward for the next assessment cycle, which begins in the fall of 2013.

2.2 Review and Adoption of Agenda

A draft agenda was circulated prior to the meeting and two changes were suggested at the meeting. These changes are denoted as 5.2bis and 5.3bis in the revised agenda (Attachment 2). The revised agenda was adopted at the meeting, noting that discussion on some agenda items did not follow the order outlined in the agenda, but are reported here in the order specified in the agenda.

2.3 Assignment of Rapporteurs

Rapporteuring duties were assigned to Chiee-Young Chen, John Holmes, Hidetada Kiyofuji, Takayuki Matsumoto, Hideki Nakano, Kevin Piner, Steven Teo, Vidar Wespestad, and Zane Zhang. John Holmes had the overall responsibility for assembling the workshop report.

3.0 DISTRIBUTION OF DOCUMENTS AND WORKING PAPER AVAILABILITY

Fifteen working papers and one information paper were submitted and assigned numbers for the workshop (Attachment 3). Steve Teo made a presentation on scaling issues in the 2011 assessment model (Section 5.2bis), but did not provide a working paper on the topic. The policy of the ISC is to make working papers presented at WG workshops publicly available through the ISC website (http://isc.ac.affrc.go.jp/). There are two exceptions to this policy: (1) when working paper authors are submitting their working paper for publication in a peer-reviewed journal, and (2) when the working paper contains data or conclusions considered confidential by the authors and/or their government. Working paper authors were asked by the WG Chair if they wished to make their paper publicly available through the ISC website to which most authors agreed. Working paper titles, author names, and contact details will be provided for those papers that are not publicly available on the ISC website.

4.0 STATUS OF WORK ASSIGNMENTS

The WG reviewed the status of work assignments from the July 2012 meeting. The WG's assessment of progress is shown in italics following each task. These assignments are based on the research plan and WG responses to three external reviews of the 2011 stock assessment and were as follows:

High Priority Research

- Improved sampling in all regions, particularly fish < 60 cm and > 85 cm FL; *No progress to date for smaller fish, but some larger fish have been sampled; discussion and output of age and growth workshop in fall 2013;*
- Validation of aging and comparison of aging by multiple readers; *Output of upcoming age and growth workshop in fall 2013;*
- Daily growth ring analysis of otoliths from young albacore to validate aging, especially time of annulus formation, and investigate growth patterns in young fish; *Some results are available and will be discussed at upcoming age and growth workshop in fall 2013;*
- Combine results of ISC/11/ALBWG/IP/01 and ISC/11/ALBWG/02; *No progress to date;*
- Investigate spatial and temporal distribution by size for fishery definitions; *Addressed by multiple working papers at the present workshop;*

- Investigate spatial & temporal changes in size composition of JPN LL fisheries to support the use of appropriate selectivity; *Addressed by ISC/13/ALBWG-01/11, ISC/13/ALBWG-01/14;*
- Investigate spatial and temporal changes in size composition of TWN LL fisheries to support the use of appropriate selectivity; *Addressed by ISC/13/ALBWG-01/16;*
- Investigate explanations for unexplained increases and decreases in F8 (JPN LL south) in 1990s; *Addressed by ISC/13/ALBWG-01/13;*
- Document the development and trends of the F6s1 quarterly CPUE index ; *Addressed by ISC/13/ALBWG-01/09;*
- Split the USA LL fishery into shallow-set and deep-set fisheries; *In progress, will be completed for data preparation workshop in fall 2013;*
- Investigate different CPUE trends in surface fisheries in EPO (UCLTN) and WPO (JPN PL) since 2005; *ISC/13/1ALBWG-01/10, ISC/13/ALBWG-01/11 address JPN PL; Working paper on UCLTN will be developed and discussed at upcoming data preparation workshop in fall 2013;*
- Investigate length composition anomalies in USA LL fishery with respect to very large fish; *In progress, will be completed for data preparation workshop in fall 2013;*
- Document historical socio-economic factors of fisheries to understand changes in fishing grounds, fishing strategies, market developments that may influence CPUE standardization; *ISC/13/ALWG-01/13 for JPN LL; ISC/13/ALBWG-01/11 for JPN PL; ISC/13/ALBWG-01/16 for TWN LL;*
- Provide information on targeting practices and effort in all fisheries; *ISC/13/ALBWG-01/13, ISC/13/ALBWG-01/16;*
- Document existing national sampling programs; *No progress to date;*
- Explore scaling in the model, including weighting of different data types; *Exploratory analysis completed by US scientists and presentation discussed at present workshop;*
- Explore the stock-recruitment relationship and steepness estimate; *No analysis to date;*
- Incorporate existing conventional tagging data into the model; *Data development stage, data not considered sufficient to capture movement patterns.*

The WG Chair reported that many of the tasks identified as high priority and completable by the next assessment (shown above) have been addressed or work is ongoing and progress will be briefly reviewed in July 2013. The WG expects that final results of this research will be available for discussion at the data preparation workshop and/or the age and growth workshop in the fall of 2013. Substantial work is underway on critical research items such as a reconsideration of spatial and temporal patterns in catch, effort and size composition data for the development of fishery definitions and abundance indices for the next assessment. Progress on lower priority research or research with mid- to long-term time horizons was also briefly reviewed. The WG is satisfied with progress on all items and believes it will be in a good position at the data preparation workshop to update fishery definitions and develop representative abundance indices for the assessment model.

5.0 STOCK ASSESSMENT RESEARCH

Fifteen working papers were presented to the WG. The WG reviewed these working papers to provide feedback to the authors and to consider how the results and conclusions drawn in these papers could be used to improve the next stock assessment. The working papers are grouped into the categories used in the research plan developed during the 2011 assessment (ALBWG 2011).

5.1 Chinese Albacore Fishery Data

Three working papers describing the distribution of albacore catch and effort in the Chinese longline fishery and size composition sampling of this catch were presented and reviewed by the WG.

5.1.1. Records on the catch of albacore in the North Pacific Ocean from the China longline fishery (2002-2011) presented by Yan Chen. (ISC/13/ALBWG-01/02)

Abstract - This paper describes the spatial pattern of north Pacific albacore catch and effort by the Chinese longline fishery from 2002 to 2011. The analysis is based on monthly fishery reports forwarded by fishing boats to the Distant Water Fisheries Branch of the China Fisheries Association and were obtained with the assistant of the Chinese Ministry of Agriculture. Total reported albacore catch ranged from 210 mt in 2002 to 665.3 mt by 2006 and nominal CPUE ranged from 26.0 to 47.3 kg/1000 hooks over the same period. Much lower albacore catches (76.6-184.9 mt) and CPUE values (3.9-18.9 kg/1000 hooks) were recorded from 2007 to 2009. The catch of albacore recovered to 906.5 mt in 2010 and CPUE values were 33.5 kg/1000hooks and 2.2 ind./1000 hooks. There was a significant increase in catch and nominal catch rate in 2011 to 2927.8 mt and 85.3 kg/1000 hooks and 5.1 ind./1000 hooks, respectively, partly due to a change in targeting from bigeye tuna to albacore by some Chinese longline vessels. The Chinese fishery generally operates in tropical waters between 0 and 20°N in the eastern, central and western Pacific. The fishery shifted locations in 2011 to tropical waters between 0 and 20°N and west of 170°W. The first and fourth quarters are the primary periods of albacore catch.

<u>Discussion</u>

The WG noted that the Chinese longline fishery moves seasonally between the North (NP) and South Pacific (SP) Oceans and the WG questioned whether the catch data presented in the WP included South Pacific albacore catches. The authors clarified that the catch data are only from the NP and included non-targeted albacore catch from a fishery that targets bigeye tuna. The WG noted anomalously high CPUE values in an equatorial band in the western Pacific (150-160°E) in 2011, which was inconsistent with prior understanding of the spatial distribution of the stock. The authors clarified that in the most recent years the fishery was shifting spatially to this western area. The WG questioned if this spatial shift in fishing could be related to increased targeting of albacore, especially in 2011. It was noted that some of the albacore taken in this fleet are used for canning in Papua New Guinea, which may be related to the area associated with high CPUE in the western Pacific. The WP authors stated that albacore catches from the early period in this fishery (pre-2002) are probably under-reported due to the aggregation of albacore into by-catch because of their low value so the accuracy of historical catch records is uncertain. The WG recommended investigating potential under-reporting of catch in early years and the apparent shift in targeting in 2011. More information on gear configuration may be helpful to confirm latitudinal CPUE patterns. China is currently putting more effort into collecting accurate data from its longline fishery.

5.1.2. Size composition and CPUE of the North Pacific albacore based on Chinese longline observer data presented by Jiangfeng Zhu. (ISC/13/ALBWG-01/03)

Abstract - This working paper present size composition data and nominal CPUE for north Pacific albacore caught during observer trips on Chinese longline vessels between 2006 and 2012. All albacore were caught as by-catch since the vessels were targeting bigeye tuna in the central or western tropical Pacific during those trips. Size composition data are presented by month and CPUE data are presented by month and 1° x 1° spatial block. The observed albacore size range was 70-120 cm (fork length) and the observed CPUE range was 0-9.13 individuals/1000 hooks.

Discussion

It was noted that the Chinese observer program covered 5% of the vessel trips in the North Pacific, which is the targeted coverage for observed trips. The WG noted that all the observers were on trips that targeted bigeye tuna and that observed trips showed a similar shift in fishing effort to the western Pacific as discussed in ISC/13/ALBWG-01/02. The authors clarified that the fishery takes relatively large albacore, however there were some vessels targeting albacore and these vessels could be catching fish of a different size than those measured by the observers. It was noted that no observer data were available from vessels that were targeting albacore. The observer size data show that the Chinese longline fishery captures large mature fish > 100 cm FL. Fish caught in the southern area are similar in size to albacore caught by the JPN LL fisheries operating in the same area. The WG noted that the size composition data in this WP could be used to inform the model of the size composition of the catch of albacore in non-targeted trips. More information is needed for albacore-targeting trips and improved spatial coverage of the observer program since all observed trips occurred in the central and western Pacific Ocean. The WG recommends continued monitoring of the catch because the fishery is increasing in importance and changing its operational area.

5.1.3. Size composition of the albacore catch by Chinese longline fishery in the Northern Pacific Ocean presented by Xiaojie Dai. (ISC/13/ALBWG/05)

Abstract - Chinese longline vessels have caught albacore as by-catch since the 1990s, with total catches of several hundred metric tons, mostly in the tropical areas of the Pacific Ocean. This document presents information of size data measured by vessel crews in 2010, 2011 and 2012 and from port sampling during a three-day period in 2012. The fishing vessel data were recorded as individual weights in logbooks and converted to length using a length-weight relationship. Length was measured by port samplers in 2012. Sample sizes were low in 2010 and improved in 2011 and 2012. Average fork lengths (± standard deviation) were 106.4 ± 8.0 cm in 2010, 90.36 ± 13.05cm in 2011, and 106.0 ± 8.79 cm in 2012.

Discussion

In response to a question about the source of the size composition data, the authors clarified that the samples were taken from relatively few boats from a single company. It was also noted that some lengths were based on conversions from weight. A question regarding inconsistency between sample locations in Table 1 and the effort map in Fig.7 in ISC/13/ALBWG-01/02 was raised. The authors clarified that ISC/13/ALBWG-01/02 presents historical catch reported by fishermen without logbook validation. Work is planned in the future to address this issue. It was further clarified that total catch data reported in ISC/13/ALBWG-01/02 are considered reliable and does not need validation from logbooks, but the catch locations could be updated with the logbook information. The authors also clarified that the length-weight relationship used in the conversion of weights to lengths was taken from an IATTC publication. It was also noted that fish in 2011 were smaller than in 2010, which may reflect albacore targeting in the north.

The WG recommended more detail be included in the WP on the number and units of measurements and any conversion processes. The WG recommended that lengths estimated from weights recorded in logbooks be compared to port sampled lengths and that vessel-based length data and port sampled length data be presented separately rather than aggregated as in the present WP. The WG recommended that the catch data be used in the assessment model, but due to spatial changes in fishing operations and target shifting, the CPUE time series should not be considered representative of the relative abundance of the north Pacific albacore stock. For similar reasons, more scrutiny of the size composition data is need before they can be considered for use in the assessment model.

5.2 CPUE Analyses

Five working papers were presented by Japan outlining new analyses on abundance indices for pole-and-line and longline fisheries designed to improve the development of abundance indices for the next assessment. Prior to the detailed presentations of abundance index WPs, Japan proposed new guidelines for defining its fisheries based on their unique characteristics rather than target fish size as used in the 2011 stock assessment.

5.2.1. Updated abundance indices of north Pacific albacore by Japanese longline fishery presented by Hirotaka Ijima. (ISC/13/ALBWG-01/07)

Abstract - We updated the standardized abundance indices for north Pacific albacore caught by Japanese longline fisheries with data for 2010 to 2011 in this paper. We used a similar standardization method to that used for the previous stock assessment, in which the fisheries were separated based on fish size. The updated standardized abundance indices were approximately the same as previous standardized indices.

<u>Discussion</u>

Abundance indexes were updated with two more years of data using the same methods, factors, and fishery definitions employed in the 2011 assessment. The WG noted that differences between the updated CPUE and CPUE used in the last assessment were bigger than expected considering that the only change was two additional years of data. The WG also noted the difference between nominal and standardized CPUE in recent years, and it was suggested that this difference resulted from increasing effort in the coastal longline fishery. The WG encouraged the authors to continue to investigate the reasons for these differences.

5.2.2. Preliminary analysis for the standardized albacore CPUE for Japanese longline fisheries by vessel type in the northwestern Pacific Ocean presented by Hirotaka Ijima. (ISC/13/ALBWG-01/08)

Abstract - We investigated the effects of separating Japanese large and small longline fisheries on standardized albacore abundance indices using GLM modeling. Annual changes in catch and effort and spatial distribution for these fisheries show different trends. Several explanatory variables were significant, including year-quarter, fishing gear effect, and fishing area effect. The trend of standardized CPUE was similar to that of nominal CPUE and all explanatory variables were significantly correlated for the analyses of both fisheries.

Discussion

The authors recommended separating the coastal longline abundance index from the offshore (OS) and distant-water (DW) longline abundance indices. The WG agreed with this recommendation, namely that two separate indices should be developed for the coastal longline and OS/DW longline fisheries combined. It was noted that there were a lot spatial blocks with zero-catch in the analysis and that a lognormal model may not be the most effective approach for CPUE standardization. The authors suggested that zero-catches were not high in the analyzed area as indicated in Figure 1 of the Appendix in ISC/13/ALBWG-01/09, although the ratio of zero-catch/catch differs, depending on season and period. The WG recommended that the authors explore a Delta log-normal model for standardization and that they provide justification for their model choice. In addition, it was recommended that data on the number of spatial blocks with zero-catch by year should be provided in a table.

5.2.3. Japanese longline CPUE for albacore tuna in the northwestern Pacific Ocean standardized by Generalized Linear Model using operational catch and effort data from 1966 to 2011 presented by Hiroaki Okamoto. (ISC/13/ALBWG-01/09)

Abstract - Japanese longline CPUE for albacore tuna in the northwestern Pacific Ocean was standardized up to 2011 using a log-normal error structured GLM model. The number of hooks-between-floats (NHF) was used in the model to standardize for changes in catchability. NHF is derived from the fishing gear configuration reported in logbooks. SST (sea surface temperature) was applied in the model as an oceanographic factor. Quarter-based and year-based CPUEs were obtained from lsmeans of year and that of the year-quarter interaction.

CPUE of the distant-water (DW) and offshore (OS) longline fisheries declined sharply from 8 in 1966 to 4 fish/1000 hooks in 1971, and remained at this level until 1991 when it increased steeply again and has remained around 11 fish/1000 hooks until 2001. CPUE decreased to 5 fish/1000 hooks in 2003 and 2004, after which it increased again to around 8 fish/1000 hooks with some fluctuation. CPUE of the small longline fishery increased from 9 in 1994 to 12 fish/1000 hooks in 1999 and has fluctuated between 6 and 9 fish/1000 hooks since this time. If these CPUEs are overlaid on a relative scale in which the average from 1994 to 2011 is 1.0, then they show similar trends, but some small differences in peak magnitudes. The final log-normal model with all factors was compared to a negative binomial model. CPUEs standardized by each model showed very similar trends.

Historical changes in fishing power were estimated by introducing vessel identification into the log-normal model as explanatory variable. The estimated relative fishing power of both the DW and OS longline fisheries was about 0.5 in 1979, gradually increased to about 1.2 by 1998 and remained at a similar level thereafter, fluctuating between 1.1 and 1.2. The estimated relative fishing power of the small longline fishery has not changed greatly, remaining around 1.0, with a very slight increasing trend.

Discussion

It was noted that the CPUE trends were not analyzed using 5° x 5° spatial cells to consider the area definition. Clarification was sought on the model assumption of no interaction between year-quarter and area (5° x 5° blocks). The authors responded that this was correct and that they did not test for this interaction, but it will be explored in the future. The WG recommended the inclusion of additional terms in the model shown in Table 1 of the paper. For example, a season-area interaction term should be considered. It was noted that the increase in catchability of the DW/OS longline fishery when the hooks-per-float term was not included in the analysis may be related to changes in fishing area as this fishery has a large operational area. In contrast, there was no increase in catchability in the small longline fishery, which has a limited operational area. The author responded that for most of the analyzed period, catchability estimated for DW and OS longline also did not shown large changes, as was found for the small longline. The analysis in this WP is ongoing so the results are not considered conclusive at this time. The WG recommended that more definitive results be provided at the upcoming data preparation workshop.

5.2.4. Reconsideration of CPUE for albacore caught by the Japanese pole and line fishery in the northwestern North Pacific Ocean presented by Hidetada Kiyofuji. (ISC/13/ALBWG-01/11)

Abstract - Catch-per-unit effort (CPUE) indices used in the 2011 stock assessment for north Pacific albacore (NPALB) caught by the Japanese pole-and-line (JPN PL) fishery are reconsidered in this paper. Two characteristics of the JPN PL fishery considered important for CPUE standardization in the last assessment were: (1) differences in target fish size by latitude. Smaller and larger fish are caught in northern and southern areas, respectively. A latitude of 35°N was selected as a boundary for northern and southern areas based on length data analysis; and (2) vessel size (20GRT-199GRT and > 200GRT) was considered one of the main effects in the model. However, it is difficult to separate target fish size clearly by latitude and the two vessel size categories can be better separated by their fishing characteristics such as fishing strategy and equipment than size alone. New CPUEs for NPALB caught by the JPN PL based on the two types of JPN PL fisheries (offshore and distant water) were estimated. Technological innovation including bird radar, sonar, meteorological satellite image receiver have improved fish school searching capabilities, and the development of low temperature bait tanks to keep live bait for longer periods during long cruises were also considered as explanatory variables in the model.

Discussion

The author recommend defining the JPN PL fishery and CPUE based on fishery characteristics rather than target fish size, the primary criterion used in the 2011 assessment model, because fish and fishing locations seem to be affected by other factors such as oceanic conditions. The author also recommends using the JPN distant water (DW) PL fishery CPUE as an index of abundance for albacore in the northwestern Pacific because it has consistently higher albacore catch rates that the JPN offshore (OS) PL fishery. It was noted that there is not much contrast in the standardized CPUE based on the OS PL fishery whereas the DW PL CPUE shows considerable contrast. The WG agreed with these recommendations and encouraged the author to continue with his analysis and provide a WP at the data preparation workshop in the fall of 2013.

5.2.5. Update standardized CPUE for albacore caught by the Japanese pole and line fishery in the northwestern North Pacific Ocean presented by Hidetada Kiyofuji. (ISC/13/ALBWG-01/10)

Abstract - In this document, updated standardized CPUE for North Pacific albacore caught by the Japanese pole-and-line fishery were estimated using the same method as in the 2011 stock assessment (Kiyofuji and Uosaki, 2010). Data were updated with two additional years, but the CPUE used in 2011 stock assessment were also used for comparison with the updated CPUE in this study. Standardized CPUEs were estimated with a delta-lognormal model because of the high percentage of zero-catches and area was defined by latitudinal differences of target fish size. Smaller and larger albacore appeared north and south of 35°N, respectively, based on length composition analysis (Ichinokawa and Uosaki, 2009). Updated CPUEs show the same trends as in 2011. Southern CPUE (PL2: larger fish) increased after 2009 and northern CPUE (PL3: smaller fish) remained at the same level. Possible mechanisms were also discussed in order to address questions raised by peer reviewers about different CPUE trends in surface fisheries in the eastern Pacific Ocean (US/CAN TROLL) and the western Pacific Ocean (JPN PL).

<u>Discussion</u>

The updated indices show that PL2 CPUE continued to increase after 2009 and the PL3 showed a sharp decrease after 2002. A question was asked about the decrease in PL3 and whether it reflects a shift south by albacore. The author suggested that it may be related to the meander strength of the Kuroshio Current. The WG noted that this paper attempts to account for target shifting between albacore and skipjack by the JPN PL fleets during the standardization process. However, the WG was unable to determine if the approach used by the author was successful. The WG tentatively agreed with the conclusion that the JPN OS PL index should not be used because it is not representative of stock abundance as a result of changes in technology (which were documented in the WP) and vessel numbers that occurred around 1990. The WG recommended that the author continue to work on the DW PL index and determine if albacore targeting vessels can be identified and used in CPUE standardization.

5.2bis Influences on the population scaling of north Pacific albacore presented by Steve Teo.

Abstract - The results of the 2011 assessment of north Pacific albacore were highly sensitive to the weighting given to the size composition data. In this presentation, we investigate the data sources that influence the estimated population scaling. The R0 parameter (virgin recruitment level) is the primary parameter that sets the relative scaling of the population estimates. Therefore, we produced R0 profiles for the various data sources for several size composition

weightings. The R0 estimates were highly variable at low weightings (lambda < 0.1) but were relatively stable at higher weightings for the size composition data (lambda ≥ 0.1). At very low size composition weighting (lambda = 0.01), the S2 index (US longline index) was highly influential. Since the WG considered the S2 index to be the least representative index used in the previous assessment, the relatively large influence of this index on population scaling is not ideal. At higher weightings (lambda ≥ 0.1), the F8 (Japanese longline fishery targeting large fish) size composition data strongly influenced population scaling. However, the model fits to the abundance indices was degraded substantially at these relatively high weightings, which is interpreted to mean that there is substantial conflict between the size composition data and the abundance indices, using the current model structure and assumptions (e.g., selectivity, and catchability). Further analyses on the two Japanese longline indices, considered to be the two most important indices in the previous assessment, indicated that there is substantial tension between the two indices with respect to the estimated R0. In addition, there appears to be tension between different periods of the indices as well, which may be due to differing amounts of contrast in different periods of the indices. In conclusion, the working group needs to investigate the data sources (indices and size composition) prior to the upcoming assessment so as to ensure consistent data sources are used in the assessment.

Discussion

Model sensitivity to input parameters was examined and the results demonstrate that small variations in weighting strongly influences abundance estimates. The U.S. longline and Japanese longline indices had a very strong influence on model estimated abundance of albacore. Discussion of these results suggested that the longline CPUE data are either spatially limited and not representative of the whole population, such as in the U.S. longline data, or that changes in harvest patterns may be occurring as in the Japanese longline fisheries. It was noted that inshore longline fisheries and offshore fisheries exhibited trends that are out of phase with each other. There was no conclusion reached on how to handle this problem. The primary suggestion was to remove the U.S. longline data from the model. It may be necessary to redefine the Japanese fishery units or add additional variables in the CPUE standardization process. It was suggested that a possible cause of the observed pattern is target species switching between bigeye tuna and albacore.

The WG agreed with the conclusion that all data sources must be thoroughly investigated and that fishery definitions used in the 2011 assessment should be reconsidered. Abundance indices should be representative of the stock and the choice of indices to include in the assessment model should be based on criteria including, but not limited to, spatial coverage, and proportion of total catch. Additionally, outside information such as socio-economic factors should be used in assessing the strengths and weaknesses of potential abundance indices. The WG concluded that this discussion is important in shaping the upcoming data preparation workshop in the fall of 2013.

5.3 Spatial Pattern Analysis

5.3.1. Spatio-temporal length composition caught by Japanese pole and line and longline fisheries presented by Hidetada Kiyofuji. (ISC/13/ALBWG-01/14)

Abstract – Definitions of Japanese fisheries in the 2011 stock assessment were determined by differences in target fish size between season and area (Ichinokawa, 2009a; 2009b; Ichinokawa and Uosaki, 2009). However, a concern was raised that different ages were caught in the same season and areas because target fish size could change due to changes in fishing ground formations, which means that it may be difficult to determine boundaries for fisheries definitions. In this document, length data collected by the National Research Institute of Far Seas Fisheries (NRIFSF) were analyzed to develop a better understanding of the spatio-temporal characteristics (season and areas) of North Pacific albacore length composition data collected from Japanese fisheries and to provide some ideas for improved area definitions for SS3. Despite this analysis, the use of latitude to define fisheries is problematic because similar size albacore were caught in the different areas in same quarter. This issue may also cause conflicts between the CPUE and length composition data in SS3. Thorough investigation of length data and actual spatio-temporal conditions of albacore length compositions by Japanese fisheries also gives some perspective for further considering of fisheries definitions.

Discussion

The author recommended separating the PL fisheries into JPN OS PL and JPN DW PL and the longline fisheries into the coastal longline and OS longline fisheries to investigate whether target size is different between these fisheries. The WG agreed with the recommendation to separate the length composition by the fishery types described in the WP. In addition, the WG recommended that the size composition data for both Japanese pole-and-line and longline fisheries should be further investigated for spatial and seasonal patterns.

5.3bis CPUE Information Requirements

The WG discussed the analyses and information provided in Sections 5.2 and 5.3 to develop a plan for data review and abundance index development for the data preparation workshop in the fall of 2013. The independent reviews of the 2011 assessment noted that all abundance indices were used in the model without any attempt to be selective in the choice of indices included and that documentation of the development process for these indices was poor. Fishery definitions were based on a target fish size criterion and may have resulted in overlap among fisheries that is not helpful. Several WPs in Section 5.2 concluded that using operational characteristics rather than target fish size will likely result in more appropriate fishery definitions. It was noted that the revised ISC Operations Manual (ISC 2012) provides guidance on the development of the best available scientific information (BASI) for stock assessments in three areas: (1) fishery catch, effort, and operational characteristics, (2) fishery performance statistics (i.e., CPUE) and (3) biological parameters. The guidelines for developing the best available scientific information on fishery CPUE standardizations consist of the following:

- Fishery descriptions including history of fishery development and changes;
- Describe data selection, CPUE standardization model, and CPUE estimates;
- Model diagnostics and goodness-of-fit criteria relative to alternative configurations; and
- Comparison(s) of nominal and standardized CPUE.

The WG developed a list of criteria, based on the guidance in the ISC operations manual and a similar table developed by the SHARK WG, that it will use to judge the strengths and weaknesses of potential CPUE indices at the data preparation workshop (Table 1). This table should provide more transparency in assessing CPUEs and assist the WG in providing information supporting decisions to include or exclude indices in the 2014 stock assessment model.

Table 1. Proposed criteria and their descriptions for evaluating the strengths and weaknesses of candidate abundance indices to represent relative abundance of north Pacific albacore in the 2014 stock assessment model.

Criterion	**Description**
Spatial distribution	Portion of north Pacific covered by fishery; latitude and longitude
Size/age range	Distribution of size or ages in catch
Fishing ground map	Showing area of operations for each fishery by season/decade
Relative contribution	Proportion of total catch in fishery
Temporal coverage	Time period of data collection
Temporal consistency	Change in spatial location of fishing grounds over temporal period, e.g., decadal changes/seasonal changes
Temporal consistency in size composition	Decadal and seasonal changes in size of fish captured
Statistical soundness	Standardization method, diagnostic plots and CPUE variability provided
Targeting	ALB primary target, by-catch species
Catchability Changes (due to management, fishing practices, etc.)	External factors affecting catchability (e.g., management practices, fishing technology, targeting changes)
Socio-economic factors	Price, demand, technological changes (e.g., freezers), etc.

Table 2. Information requirements in working papers to support the development of abundance indices.

Fishery description	Describe fishery including catch, effort, size composition of catch, nominal CPUE by area, season, history of fishery development and changes
Analysis description	Describe data selection, CPUE standardization model, and CPUE estimates. Include any data filtering, outlier removal
Statistical Results	Provide model diagnostics and goodness-of-fit criteria relative to alternative model configurations; ANOVA tables, etc.
Nominal/Standardized	Comparison plot of nominal and standardized indices
Diagnostic plots	QQ, residuals, etc.
Point estimate & variability	Characterize uncertainty in estimates of standardized CPUE; SE or CV of standardized CPUE (generated or assumed)

The WG developed a table of information requirements that it expects in WPs describing the development of CPUE indices at the data preparation workshop in the fall of 2013 (Table 2). With respect to the upcoming data preparation meeting, the WG decided that the authors should continue to work on improving the quality of their data to better characterize the fishery CPUE data. The choice of fishery definition for these indices is up to the judgment of individual analysts, but the WG will need to evaluate the data and justification (Tables 1 and 2) at the data preparation workshop in order to consider an index for inclusion in the assessment model.

5.4 Data Documentation

5.4.1. Preliminary analysis for target species of Japanese longline fishery operated in the North Pacific Ocean presented by Keisuke Satoh. (ISC/13/ALBWG-01/13)

Abstract - In order to understand the target species of Japanese longline fishery in the Pacific Ocean from 1993 to 2002, we investigated historical changes in (1) species composition (albacore, bigeye and yellowfin) of the fishery, (2) the distribution of number of fish per set using operational logbook data, and (3) market prices in Japanese fishing ports and the quantity of imports. Four pieces of evidence support increased targeting of albacore by the Japanese longline fishery in the North Pacific Ocean from 1993 to 2002. First, the species composition data show a high proportion of albacore and low proportion of bigeye in this period. Second, the length of the fishing season for albacore by large vessels increased, which was often observed before 1970 when the fishery primarily targeted albacore. Third, the proportion of sets with zero-catches and more than 100 albacore per set of the large vessels was lower and higher, respectively, during this period. Such high proportions for these set types were also observed before 1970. Fourth, there was increased demand for albacore and decreased demand for bigeye tuna during this period, based on changes in price and import quantities.

<u>Discussion</u>

The WG wondered if the coastal longline fishery might be affected by a switch in targeting from bigeye tuna to albacore differently than distant-water and offshore fleets. The authors agreed that coastal longliners are smaller vessels and might behave differently. The WG noted that the local abundance of bigeye tuna may vary by region, which would confound the behavioural effect in the coastal fleet. It was also noted that smaller longline vessels are affected greatly by regional cultural factors. For example, sashimi albacore was developed in the mid-1990s and may have increased the targeting of albacore by the smaller vessels. The WG noted that the shift in targeting to albacore in the late 1990s appears to coincide with increasing albacore abundance, the question is how to deal with this shift. Hooks-per-basket (HPB) is similar for bigeye and albacore targeting trips, but it was suggested that bait type may differ between these trip types. The WG agreed that the information in the WP demonstrates that important targeting shifts in the longline fleet have occurred and recommends attempting to identify observations (sets or trips) that are consistently targeting albacore and use these observations in the CPUE standardization process. The WG was concerned that using high albacore CPUE on a set-by-set basis to identify albacore targeting sets as suggested by the authors, which is then used to standardize albacore CPUE, may not be appropriate statistically. However, the WG agreed that the authors should continue investigating several approaches to this problem and identify the most appropriate method to correct for albacore targeting. If this approach fails, then an alternative is to identify time periods in which targeting is believed to be relatively consistent and produce multiple series.

5.4.2. Suggestion of alternative estimation of albacore catch by Japanese coastal longline fishery to apply to stock synthesis model presented by Takayuki Matsumoto. (ISC/13/ALBWG-01/12)

Abstract - This paper briefly reviews the Japanese coastal longline fishery and problems with catch estimation for this fishery and presents an alternative method of estimating catch for this fishery. There are three vessel categories in the Japanese coastal longline fishery, for which operational area and availability of logbook data differ. Vessels that do not submit logbooks are regarded as operating within the Japan EEZ area, and the seasonal proportion of catch is estimated by assuming that it is the same as the nominal quarterly CPUE for the vessels which submit logbooks. Catch before 1994, in which logbooks are not available, was estimated based on landing statistics and applying seasonal and spatial proportions of the average catch for 1994-1997. A slight difference was observed between catch data used for the last assessment and that estimated by the new method in the present study.

Discussion

The WG noted that the logbook program for coastal longline vessels was established in 1994. Catch prior to 1993 is noticeably lower than after the logbook program was implemented in 1994. The WG noted that the sudden and large change in catch magnitude may be due to changes in the categorization of vessels (coastal and offshore) after 1994. The WG recommends investigating catch prior to 1993 to assess the source of change in catch magnitude.

5.4.3. Development of Taiwanese albacore-targeting longline fisheries in the North Pacific Ocean, 1995-2010 presented by Chiee-Young Chen. (ISC/13/ALBWG-01/16).

Abstract - Taiwanese longline fisheries have operated in the North Pacific Ocean since 1995. This fishery has two types of operations: albacore-targeting and non-albacore-targeting. The albacore-targeting fishery is characterized as fishing in temperate waters, using less than 13 hooks-per-basket, and catching smaller albacore. In contrast, the non-albacore-targeting fishery tends to fish in tropical waters, uses more than 14 hooks-per-basket, and catches larger albacore. Before 2000, the albacore-targeting fishery dominated Taiwanese longline fisheries in the north Pacific Ocean and most of the catches were albacore. Around 2000, the non-albacore-targeting fishery was introduced and grew in importance at the expense of the albacore-targeting fishery. The increasing catch of species other than albacore also reflects the increasing number of non-albacore-targeting longliners since 2000. In this study, albacore-targeting and non-albacore-targeting catch statistics were defined based on the results of clustering and discriminant analyses. Three sub-areas were also defined based on the similarity of catch compositions of each 5° X 5° cell. A general linear model was applied to estimate the CPUE trend, which is believed to be more informative on the status of the north Pacific albacore stock exploited by Taiwanese longline fisheries.

Discussion

The WG noted the potential spatial shifts of effort in this fleet over time. Shift in effort and targeting may be related to improving fish storage technology such as introduction of super-cold freezers. The WG noted the size of fish taken in this fleet is related to latitude and recommended that the fleet be split into two fleets (North and South) for the compilation of catch, size composition, and CPUE data. The WG continues to recommend the use of size composition data from the post-2003 period and would like to see these data for the two recommended fleets.

5.5 Model Improvements – Environmental Covariates

5.5.1. Environmental Influences on Albacore Tuna (*Thunnus alalunga*) Distribution in the Coastal and Open Oceans of the Northeast Pacific: Preliminary Results from Boosted Regression Trees Models presented by Yi Xu. (ISC/13/ALBWG-01/01)

Abstract - A boosted regression tree (BRT) model was used to study the distribution of albacore tuna (*Thunnus alalunga*) in the northeastern Pacific Ocean, based on logbook data from the US and Canadian troll and pole-and-line fisheries. The model domain covered the northeast Pacific Ocean and was divided into two sub-regions to study coastal ocean and open ocean processes. The logbooks from US and Canadian vessels provided time, location, catch and effort over two decades from 1992 to 2011. Satellite data including sea surface temperature, sea surface height (SSH) anomaly, meridional and zonal geostrophic currents and chlorophyll-a (chl-a) concentration were used as environmental predictors for the BRT model. We used data from 1998-2008 as the training dataset and 2009 as an independent testing dataset. The preliminary results showed that the open ocean and coastal ocean oceanographic dynamics affected albacore tuna distribution differently. In the open ocean, meridional geostrophic currents, SSH anomaly and zonal geostrophic currents were important influences on albacore CPUE (catch-per-unit-effort) changes. In the coastal ocean, chl-a concentration was the leading factor, followed by SSH anomaly. The predicted albacore CPUE showed a near 1:1 relationship in both the training and testing datasets. If these relationships are found to be robust in the future, then these types of analyses may be integrated into population dynamic models to help improve fisheries management in the face of environmental changes.

Discussion

The WG noted that the analysis in this WP is related to processes occurring in the EPO because the troll fisheries operate primarily east of 180° so few data were available for the WPO. Sea surface salinity data were not used because a usable product with these data was not found by the authors. The WG noted that such a product may exist and the authors were encouraged to find it. The WG questioned how the results from this study could be used to inform CPUE standardization. It was suggested that the results could identify environmental influences on catchability, but it was clarified that this is a work in progress and the investigation is not expected to influence CPUE analysis for next assessment in 2014.

5.5.2. A Study on Effects of Climatic Variables on the Production of the North Pacific Albacore Tuna Population presented by Zane Zhang. (ISC/13/ALBWG-01/04)

Abstract – A logistic production model was used to examine the potential effects of three climatic variables, the North Pacific Gyre Oscillation (NPGO), the Pacific Decadal Oscillation (PDO), and the Multivariate El Niño-Southern Oscillation Index (MEI) on the productivity of the north Pacific albacore tuna population. Catch data from three longline fisheries (Japan, US, and Taiwan) and two surface fisheries (Japan, Can/USA) were used in the model. The estimated probability that the NPGO had a positive impact on stock productivity was 0.98, and the calculated probability that MEI had a negative impact on the productivity was 0.95. These impacts were evident when fish were vulnerable to the Japanese longline fishery at 4 years of age. The PDO did not seem to have any apparent impact on productivity.

Discussion

The WG discussed the fact that the model fits primarily to the JPN longline fleet, but did not fit the other fleets as well. Some members of the WG thought this finding might occur because of the lack of age structure in the model and the longline fleet best represented adult biomass. The authors noted that while this hypothesis may be true, the general results should be robust. The WG questioned how this study could influence the stock assessment model. The authors clarified that the identified environmental covariates could be introduced into the model if you understand the correct process influenced. Some WG members thought that environmental influences are more helpful to inform projections than reconstruct past dynamics.

5.5.3. Brief review of regime shift in the North Pacific Ocean and preliminary analysis to investigate relationship between environmental regime shift and North Pacific albacore recruitment presented by Hidetada Kiyofuji. (ISC/13/ALBWG-01/15)

Abstract - Recent research on climate effects on physical, biological and ecosystem dynamics in the north Pacific Ocean has demonstrated the existence of regime shifts based on their relatively longer time series of data. Although the evidence of "regime shifts" in the north Pacific from lower trophic levels to tuna is scientifically-valid, knowledge of the underlying mechanisms is limited. North Pacific albacore (NPALB) recruitment estimated by 2011 stock assessment (ALBWG, 2011) and the Pacific Decadal Oscillation index (PDOI) were used to evaluate the influence of decadal scale climatic variation on albacore population dynamics in this paper. Concurrent changes in NPALB recruitment levels and winter PDOI were detected. Shifts in NPALB recruitment levels occurred in 1977/78, 1987/88 and 2004/2005 (Fig.1) and these shifts are consist with results reported by Kurota et al. (2012). Regime shifts in the winter PDOI were identified in 1975/1976, 1987/88 and 2006/2007. The coincidence between NPALB recruitment shifts and PDOI in 1987/88 implies that this relationship cannot be neglected and further quantitative analysis is necessary to test the predictability of changes in NPALB recruitment to changes in PDOI or sea surface temperature.

Discussion

The WG discussed whether the correlation between recruitment and environment may be the result of covariation with other factors such as fishing behaviour. The WG recognized that environmental effects may influence both the population dynamics and reference point calculations. It was noted that the WG has implicitly included environmental regimes in stock assessment modeling by resampling low, medium, and high recruitment in the future projection scenarios.

6.0 REQUEST FOR ADVICE ON POTENTIAL LIMIT REFERENCE POINTS

A request for advice on potential limit reference points (Attachment 4) was made at the Eighth Regular Session of the Northern Committee of the Western and Central Fisheries Commission (Northern Committee 2012). The ISC Chairman directed the WG to develop responses to these requests for approval at the ISC13 Plenary Session. The WG discussed the requests and developed work plans and assignments to develop responses for the update meeting of the WG held in advance of the ISC13 Plenary Session.

6.1 Parameter Estimates

The WG discussed stock-recruitment, biological, and selectivity parameter estimates. The WG Chair was tasked with drafting a response in paragraph format based on the following points that were made during WG discussions. This draft document will be circulated in advance of the July 2013 update meeting, where it will be finalized.

Stock recruitment and steepness

- A Beverton-Holt stock recruitment relationship is assumed;
- A steepness value (h) of 1.0 was assumed in the 2011 assessment, which means that albacore are modeled as an environmentally-driven stock;
- Two working papers (ISC/11/ALBWG/11 and ISC/11/ALBWG/18) presented at the 2010 data preparation workshop provide evidence that neither h=1.0 nor values of h < 0.6 are plausible for this stock, but strong evidence for more appropriate values within this range is not available;
- The WG wrote the following in the 2011 assessment report about these steepness results: "The WG noted that the estimated steepness of the stock-recruitment relationship is related to the length of the early life history period in the analyses in these papers and that the definition of this period is ambiguous. In addition, the growth curves used in these WPs were different shapes than the curve used in the base-case model";
- Estimating the steepness parameter is an ongoing area of research;

Maturity

- Current age-based maturity schedule is based on Ueyanagi (1957), 50% of the albacore at age-5 and all fish age-6 and older are assumed to be mature;
- Ueyanagi results seem reasonable, but are based on fish from the western Pacific Ocean so spatial/temporal variation is unknown;
- Recent maturity info for the western Pacific is available in Chen et al. (2010). Additional sampling is needed in the central Pacific to develop a new maturity schedule since the old schedule used in assessment is based on WPO data;
- There may be two papers in 1960s on maturity, which should be checked to determine if sampling was sufficient spatially and temporally and the methods used were appropriate;
- There is a need to develop a better description of population maturity at age or length;

Fecundity

- Recent data for fish from the western Pacific are available in Chen et al. (2010);

- No recent information on spawning or fecundity for central Pacific near Hawaii;

Natural Mortality, M

- M was not estimated in the 2011 assessment, but was fixed at 0.3 yr^{-1} for all ages;
- This assumption is unchanged from previous assessments as no new data or analyses that support a change in this assumption were available;
- M assumption is from Atlantic albacore assessments (ICCAT 2010);
- M cannot be reliably estimated from existing north Pacific albacore tagging data because tag return rates for adults are lower than expected, especially in the WPO, although return rates in surface fisheries for juveniles are consistent with expectations. Therefore, M of adults cannot be reliably estimated;

Growth

- Confident in new growth information in Wells et al. (2011: ISC/11/ALBWG/02) as growth parameters are well estimated and based on data from eastern, central and western Pacific Ocean;
- Growth was estimated in assessment model and estimated parameter values were quite similar to those estimated in Wells et al. (2011);
- However, there is some evidence for regional differences in growth that are not modeled in the current assessment model;
- Additional age and growth data have been collected and will be published shortly with the data in Wells et al. (2011);
- New growth data will be used in next assessment;

Selectivity

- Given data available and model structure, selectivity is reasonably well estimated for eight fleets for which size composition data are reported;
- Selectivity of fleets for which no size data were available was mirrored to one of the eight fleets based on similarities in operating characteristics;

6.2. Estimated Quantities and Probabilities for Candidate Reference Points

The WG discussed Part 2a of the Northern Committee request (Attachment 4) and developed a table (Table 3) to provide the estimated future yield associated with harvest scenarios corresponding to F-based reference points and the probability of exceeding associated biomass depletion levels at least once in a 10 year projection period (plus a 25 year projection period for $F_{SSB-ATHL}$) for each reference point harvest scenario. Separate tables will be provided for low, average, and high historical recruitment scenarios (see example in Table 3). Japan committed to providing the estimates for these tables at the July 2013 meeting. The WG noted that these estimates will be based on the 2011 assessment model which includes data through 2009, i.e., it will not be updated with 2010 and 2011 data.

6.3 Harvest Scenarios

Projections made in the last stock assessment meeting will provide a partial answer for this request to assess harvest scenario impacts on reference point levels. Table 11.1 in the

Table 3. Sample table for providing estimated quantities. One table is required for each recruitment scenario: low, average, high historical recruitment. SB xx% refers to spawning biomass depletion relative to the unfished state. Blank cells will be filled with appropriate estimates at the July 2013 update meeting of the WG.

			Biomass Level				
Reference Point	Projection Period (yr)	Future Yield (mt)	SSB-ATHL	$SB_{10\%}$	$SB_{20\%}$	$SB_{30\%}$	$SB_{40\%}$
$F_{SSB\text{-}ATHL}$	25	mean ± variability	P > threshold in 1 yr				
	10			P > threshold in 1 yr			
F_{MAX}	10				P > threshold in 1 yr		
$F_{0.1}$	10					P > threshold in 1 yr	
F_{MED}	10						P > threshold in 1 yr
$F_{10\%}$	10						
$F_{20\%}$	10						
$F_{30\%}$	10						
$F_{40\%}$	10						
$F_{50\%}$	10						

assessment document (ALBWG 2011) provides estimates of the F-ratio using $F_{2006\text{-}2008}$ for all reference points in the request except $F_{10\%}$. Therefore, estimates of the F-ratio for $F_{10\%}$ using $F_{2006\text{-}2008}$ and all F-ratios with $F_{2002\text{-}2004}$ are needed to complete the WG's response. The WG noted that the selectivity for $F_{2002\text{-}2004}$ and $F_{2006\text{-}2008}$, will be used, respectively, for these calculations. Japan committed to completing Table 4 shown below.

Table 4. Potential reference points and estimated F-ratio using Fcurrent ($F_{2006\text{-}2008}$). Taken from Table 11.1 in the 2011 stock assessment report. To be completed for July 2013. Blank cells will be filled with appropriate estimates at the July 2013 update meeting of the WG.

Reference Point	$F_{2006\text{-}2008}/F_{RP}$	$F_{2002\text{-}2004}/F_{RP}$
$F_{SSB\text{-}ATHL}$	0.71	
F_{MAX}	0.14	
$F_{0.1}$	0.29	
F_{MED}	0.99	
$F_{10\%}$		
$F_{20\%}$	0.38	
$F_{30\%}$	0.52	
$F_{40\%}$	0.68	
$F_{50\%}$	0.91	

6.4 Environmental Influences on Reference Points

The north Pacific albacore stock is implicitly modeled as an environmentally-driven stock since a steepness value of 1.0 was used in the stock-recruitment relationship in the 2011 assessment (ALBWG 2011). Furthermore, ISC/13/ALBWG-01/15, which was discussed at the present workshop, provides evidence of changes in albacore recruitment levels (high, low, average) that are consistent with documented regime shifts in the North Pacific Ocean, although the WG does not consider these results conclusive regarding environmental influence(s) on the recruitment level. However, a preliminary assessment of the effects of regime shifts on values of FSPRs can be accomplished by comparing the results for the low and high recruitment scenarios in 2a of the Northern Committee request. The discussion in Section 5.5 of this report captures some of the WG's understanding of environmental influences on the NPALB stock.

7.0 ALBACORE-PACIFIC BLUEFIN AGE AND GROWTH WORKSHOP

The WG discussed the upcoming age and growth workshop in terms of participation, timing and development of an albacore aging manual. A 3-day workshop is planned for Shimizu, Japan. Osamu Abe is leading the planning for the PBFWG and is developing a bluefin aging manual. Japan has funds to invite a small number of external experts. A logistics meeting involving the

WG Chairs (Holmes, Takeuchi), the ISC Chair, and ISC support staff (Sarah Shoffler) will be held in July 2013. The ALBWG recommends that the workshop be held Nov 13-15, 2013. The ALBWG Chair (Holmes) will lead the development of an albacore aging manual. Participation at this workshop will involve a small group of experts from Japan, the United States, and Canada among others.

8.0 PICES SPECIAL ISSUE OF PROGRESS IN OCEANOGRAPHY

The Pacific Marine Science Organization (PICES) has issued a call for scientific papers on subtropical fronts and transition zones in the North Pacific (Attachment 5) for inclusion in a special issue of the journal *Progress in Oceanography*. The deadline for submissions is 30 September 2013. The WG Chair brought this announcement to the attention of WG members and discussed potential participation in developing a joint submission on behalf of the WG. The WG tentatively agreed, conditional on the development of an acceptable draft paper. The WG Chair agreed to draft a paper and circulate to the WG for discussion at the July 2013 meeting.

9.0 OTHER MATTERS

9.1 Information Paper from Korea

Korea briefly introduced an information paper (ISC/13/ALBWG-01/06) describing historical albacore catches and fishing grounds of the Korean tuna longline fleet in the north Pacific Ocean. Korean scientists promised to provide more detailed analysis of their fishery at the July 2013 meeting. The WG asked that historical catch values be provided in a table to facilitate comparison with data in the catch table maintained by the WG. The WG also requested that Korean scientists provide maps showing the approximate areas of operation when the Korean tuna longline fleet was targeting albacore historically in the 1980s as this information is important for modeling.

9.2 Reference Point Workshop

Japan announced that an international workshop on "Alternative Biological Reference Points for Tuna Stocks" will be held 13-14 June 2013 at the National Research Institute of Far Seas Fisheries Laboratory in Shimizu, Shizuoka, Japan. The goal of this workshop is to discuss alternative reference points for temperate tuna stocks since there are questions about the appropriateness of traditional MSY-based reference points as management tools when environmental conditions and human activities are changing. The workshop will discuss alternative reference pints for tuna stocks taking into account the characteristics of biology and fishery, and environmental and socio-economic effects.

10.0 SCHEDULE FOR 2014 STOCK ASSESSMENT

- Data Preparation Workshop – 5-12 November 2013 in Shimizu, Japan
- Stock Assessment Workshop: 14-28 April 2014 in La Jolla, USA

It was noted that the stock assessment workshop includes a model sub-group meeting and that it may be shorter in length than currently scheduled, depending on the outcome of the data preparation workshop in November 2013.

11.0 WORK ASSIGNMENTS

- Complete reviews of fishery data (catch, effort, size composition, CPUE) and provide working papers documenting results (see Tables 1 and 2) for WG review at the data preparation workshop;
- Japan to estimate quantities necessary to complete NC8 requests (Tables 3 and 4) for July 2013 meeting;
- All countries will provide fishery updates for 2012 at July 2013 meeting;
- WG Chair to lead drafting of WG response to NC8 and circulate to members prior to July 2013 meeting;
- WG Chair to draft potential paper for submission to PICES Special Issue of Progress in Oceanography and circulate to WG members by July 2013;
- WG Chair to be part of discussions on logistics of ALB-PBF Aging Workshop in July 2013 and report details to WG members via email;
- WG members to consider single vs. multiple recruitment period models and decide on appropriate model at data preparation workshop.

12.0 NEXT MEETING

The next meeting of the WG is scheduled for 13-14 July 2013 in Busan, Korea. The objectives of this meeting are: (1) to update fishery catch and effort data for 2012 and note any developments/events, (2) to complete the WG response to the Northern Committee requests for reference point advice for approval by the ISC13 Plenary Session, (3) to complete standard administrative tasks, and (4) to confirm the next assessment cycle schedule in Section 10.0.

13.0 CLEARING OF THE REPORT

The WG Chair prepared a draft of the report, which was reviewed by the WG prior to adjournment of the workshop. After the workshop, the WG Chair evaluated and incorporated suggested revisions, made final decisions on content and style and distributed a second draft of the report via email for approval by the WG members. Subsequently, the WG Chair provided the report to the ISC Chair for review at the ISC13 Plenary Session.

14.0 ADJOURNMENT

The ALBWG meeting was adjourned at 11:50 on 25 March 2013. The WG Chair thanked the hosts (Professor Xiaojie Dai and Jiangfeng Zhu, College of Marine Science, Shanghai Ocean

University) for their hospitality and overall meeting arrangements, which served as the foundation for meaningful scientific discussion and a productive meeting. He also thanked all of the participants for their attendance and contributions and stressed the need to maintain ongoing communication and cooperation concerning the exchange of research results as the WG enters the next stock assessment cycle.

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ATTACHMENT 1

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ATTACHMENT 2

ALBACORE WORKING GROUP (ALBWG)

INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC

INTERCESSIONAL WORKSHOP AGENDA

19-26 March 2013
Shanghai Ocean University, Shanghai, China

REVISED AND ADOPTED

March 19 (Tuesday) 09:30-16:30

1. Opening of the Workshop
    - Welcoming Remarks
    - Chair’s Remarks (context, objectives)
    - Meeting Arrangements
    - Introductions
2. Meeting Logistics
    - Meeting Protocol
    - Review and Adoption of Agenda
    - Assignment of Rapporteurs
    - Group Photo
3. Distribution of documents and review of ISC working paper availability policy
4. Status of Work Assignments (based on research plan, responses to CIE comments)
5. Stock Assessment Research

    5.1 Chinese Albacore Fishery Data
    - Catch and effort distribution: ISC/13/ALBWG-01/02
    - Size composition: ISC/13/ALBWG-01/03, ISC/13/ALBWG-01/05

20 March (Wednesday) 09:00-16:30

5. Stock Assessment Research

    5.2 CPUE Analyses
    - Longline fishery: ISC/13/ALBWG-01/07, ISC/13/ALBWG-01/08, ISC/13/ALBWG-01/09
    - Pole-and-line fishery: ISC/13/ALBWG-01/10, ISC/13/ALBWG-01/11

    5.2bis Model Scaling
    - Presentation with diagnostic plots

    5.3 Spatial Pattern Analysis

- Japan length frequency data: ISC/13/ALBWG-01/14

5.3bis CPUE Information Requirements

21 March (Thursday) 09:00-16:30

5. Stock Assessment Research

   5.4 Data Documentation
   - Targeting practices: ISC/13/ALBWG-01/013
   - Catch estimation: ISC/13/ALBWG-01/12
   - Fishery development: ISC/13/ALBWG-01/16

   5.5 Model improvements - Environmental covariates
   - Distribution: ISC/13/ALBWG-01/01
   - Stock Productivity: ISC/13/ALBWG-01/04
   - Recruitment: ISC/13/ALBWG-01/15

22 March (Friday) 09:00-16:30

6. Request for advice on potential limit reference points

   6.1 Parameter Estimates
   - Stock-recruitment and steepness estimate
   - Biological parameters – M, maturity, growth
   - Fishery parameters – selectivity

   6.2 Candidate reference points: $F_{SSB\text{-}ATHL}$, F_{MAX}, $F_{0.1}$, F_{MED}, $F_{10\%}$, $F_{20\%}$, $F_{30\%}$, $F_{40\%}$, $F_{50\%}$
   - Update fishery data to 2011 or go with data from 2011 assessment?
   - Quantity of Interest: Expected yield and variability
   - Simulation conditions: low, average, high historical recruitment
   - Projection period: 10 years, except 25 yr for $F_{SSB\text{-}ATHL}$
   - Prob > $SB_{10\%}$, $SB_{20\%}$, $SB_{30\%}$ and $SB_{40\%}$ in at least 1 yr in 10 yr projection and 1 yr in 25 yr projection for $F_{SSB\text{-}ATHL}$

   6.3 Harvest Scenarios
   - Prob > RPs with$F_{2006\text{-}2008}$
   - Prob > RPs with $F_{2002\text{-}2004}$

   6.4 Environmental Influences on FSPR and empirical based reference points
   - Regime shift and decadal change
   - ENSO
   - Other?

   6.5 Work plans and assignments to complete work for July 2013

23 March (Saturday) 09:00-16:30

6. Reference point information request from NC8

7. ALB-PBF Age and Growth Workshop
   - Development of method manual
   - Participation

- Work assignments

8. PICES Special Issue of Progress in Oceanography
    - "Progress in Fisheries Oceanography of Subtropical Fronts and Transition zones in the North Pacific Ocean" Deadline – 30/9/2013
    - Discuss possibility of contribution by ALBWG collectively or individually

24 March (Sunday) – No meeting, excursion planned

25 March (Monday) 09:00-16:30

9. Complete discussion of Items 5, 6, 7, and 8 above
10. Other Matters
11. Schedule leading up to 2014 stock assessment
12. Work Assignments for 2014 stock assessment
13. Time, place, and objectives of next meeting
14. Rapporteurs and participants complete assigned sections of workshop report

26 March (Tuesday) 09:00-16:30

15. Clearing of Report
16. Adjournment

ATTACHMENT 3

List of Working Papers

WP Number	Title and Authors	Availability
ISC/13/ALBWG-01/01	Environmental Influences on Albacore Tuna (*Thunnus alalunga*) Distribution in the Coastal and Open Oceans of the Northeast Pacific: Preliminary Results from Boosted Regression Trees Models. Yi Xu, Steven L.H. Teo, and John Holmes.	Public
ISC/13/ALBWG-01/02	Records on the catch of albacore in the North Pacific Ocea n from the China longline fishery (2004-2011). Yan Chen , Xiaojie Dai, Jiangfeng Zhu.	Public
ISC/13/ALBWG-01/03	Size composition and CPUE of the North Pacific albacore based on Chinese longline observer data by Jiangfeng Zhu, Xiaojie Dai, and Yan Chen.	Public
ISC/13/ALBWG-01/04	A Study on Effects of Climatic Variables on the Production of the North Pacific Albacore Tuna Population. Zane Zhang, John Holmes, and Steven L. H. Teo.	Contact details only
ISC/13/ALBWG-01/05	Size composition of the albacore catch by Chinese longline fishery in the Northern Pacific Ocean. Xiaojie Dai, Jiang-feng Zhu, and Yan Chen	Contact details only
ISC/13/ALBWG-01/06	Catch characteristics of albacore tuna caught by Korean tuna longline fishery in the North Pacific Ocean. Sang Chul Yoon, Zang Geun Kim, Sung Il Lee, Mi Kyung Lee, Yeon Kyu Jeong, Jeong Eun Ku, and Dong Woo Lee.	Contact details only
ISC/13/ALBWG-01/07	Updated abundance indices of North Pacific albacore by Japanese longline fishery. Hirotaka Ijima, Takayuki Matsumoto and Hiroaki Okamoto	Public
ISC/13/ALBWG-01/08	Preliminary analysis for the standardized albacore CPUE for Japanese longline fisheries by vessel type in the northwestern Pacific Ocean. Hirotaka Ijima, Takayuki Matsumoto, and Hiroaki Okamoto	Public

ISC/13/ALBWG-01/09	Japanese longline CPUE for albacore tuna in the northwestern Pacific Ocean standardized by Generalized Linear Model using operational catch and effort data from 1966 to 2011. Hiroaki Okamoto, Hirotaka Ijima, and Keisuke Satoh	Public
ISC/13/ALBWG-01/10	Update standardized CPUE for albacore caught by the Japanese pole and line fishery in the northwestern Pacific Ocean. Hidetada Kiyofuji.	Public
ISC/13/ALBWG-01/11	Reconsideration of CPUE for albacore caught by the Japanese pole and line fishery in the northwestern Pacific Ocean. Hidetada Kiyofuji.	Public
ISC/13/ALBWG-01/12	Suggestion of alternative estimation of albacore catch by Japanese coastal longline fishery to apply to stock synthesis model. Takayuki Matsumoto, Hidetada Kiyofuji, and Hirokai Okamoto.	Public
ISC/13/ALBWG-01/13	Preliminarily analysis for target species of Japanese longline operated in the North Pacific Ocean. Keisuke Satoh, Hirotaka Ijima, Hidetada Kiyofuji, and Hiroaki Okamoto.	Public
ISC/13/ALBWG-01/14	Spatio-temporal length frequency caught by Japanese pole and line, and longline fishery. Hidetada Kiyofuji.	Public
ISC/13/ALBWG-01/15	Review of regime shift in the North Pacific Ocean and preliminary analysis to investigate relationship between environmental regime shift and North Pacific albacore recruitment. Hidetada Kiyofuji.	Public
ISC/13/ALBWG-01/16	Development of Taiwanese albacore-targeting longline fisheries in the North Pacific Ocean, 1995-2010. Chiee-Young Chen and Fei-Chi Cheng.	Contact details only
Presentations	Influences of the population scaling of the north Pacific albacore. Steve Teo and Kevin Piner.	

ATTACHMENT 4

Attachment E

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Northern Committee
Eighth Regular Session

Nagasaki, Japan
3–6 September 2012

North Pacific Albacore Reference Points
Requests to the ISC

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1. For the purposes of determining potential limit reference points for a precautionary approach management framework for North Pacific albacore, Northern Committee (NC) requests advice from the ISC on the following:
   i) Is the stock-recruitment relationship known, and in particular a reliable estimate of the steepness parameter (h) for the stock?
   ii) Are the key biological (natural mortality, maturity) and fishery (selectivity) variables reasonably well estimated?

2. To determine the suitability of candidate reference points identified by the ALBWG in its 2011 stock assessment, NC8 further requests that the ISC provide advice with respect to the following:
   a) For each of the following levels of F, expected yields, with measures of variability of these expected yields, under high, low and historical average recruitment scenarios, over the course of 10 years projections (and, in addition, 25 year projections for $F_{SSB\text{-}ATHL}$), the probabilities of breaching (in at least 1 year of the projection period) the Interim Management Objective (average of the 10 historical lowest years of SSB) and each of the depletion levels $SB_{10\%}$, $SB_{20\%}$, $SB_{30\%}$ and $SB_{40\%}$;
      i) $F_{SSB\text{-}ATHL}$
      ii) F_{MAX}
      iii) $F_{0.1}$
      iv) F_{MED}
      v) $F_{10\%}$, $F_{20\%}$, $F_{30\%}$, $F_{40\%}$, $F_{50\%}$
   b) A determination of whether or not under different levels of fishing mortality (average $F_{2006\text{-}2008}$, average $F_{2002\text{-}2004}$) that the above candidate reference points will be exceeded.
   c) To provide the influence of the environmental variation such as regime shift and decadal change on F_{SPR} and empirical based reference points.

ATTACHMENT 5

Special Issue of Progress in Oceanography

Progress in Fisheries Oceanography of Subtropical Fronts and Transition Zones in the North Pacific Ocean

Call for Papers

Submission Deadline – September 30, 2013

Guest Editors
Taro Ichii (Fisheries Research Agency, Japan),
Michael Seki (National Marine Fisheries Service, USA), and
Skip McKinnell (North Pacific Marine Science Organization)

Call - We seek papers that offer new or refined perspectives on the oceanography (physical, chemical, biological), zooplankton, fishes, invertebrates, marine birds and mammals and fisheries of blue water, open ocean ecosystems in the subtropical North Pacific and their transitions to coastal and subarctic regions. The special issue will combine invited reviews, contributed papers, and selected papers presented at the PICES-2012 Topic Session on the region that inspired this special issue.

Subtropical, oligotrophic oceanic gyres are the largest marine ecosystems in the world, yet in the current vernacular, are not considered Large Marine Ecosystems. They provide important habitat for many species of fish and squid, seabirds, and marine mammals that undergo extensive seasonal migrations between the Subtropical Fronts and summer feeding grounds in the Subarctic. Knowledge of the structure, variability and trends of the ecosystems has developed slowly because of their immense size, remote location, and cost of sampling. The last overview of the subtropical North Pacific was published 20 years ago in a bulletin of the now defunct International North Pacific Fisheries Commission (Ito et al. 1993). That research imperative arose from a need for governments to understand the effects of large-scale pelagic driftnet fishing on marine ecosystems at a time when little was known (Wetherall 1991). For a brief period from 1986-1992, significant resources were directed by Canada, Japan, and the United States to study the region. The United Nations moratorium in 1992 extinguished the fisheries and most of the research. Data collected during this period remain underutilized, so new contributions based on driftnet fishery era data are welcome.

Likewise, the passage of 20 years has seen remarkable technical developments for ocean observing and has seen major international initiatives such as WOCE, JGOFS, and Argo with their rich legacies of synoptic *in situ* data. Remote sensing technologies are providing views of the North Pacific that were unimaginable only a few decades ago. Papers that improve our understanding of patterns and processes from these data sets are encouraged.

Ito, J., Shaw, W., and Burgner, R.L. 1993. Symposium on biology, distribution, and stock assessment of species caught in the high seas driftnet fisheries in the North Pacific Ocean. Bull. INPFC 53(1-3).

Wetherall, J. 1991. Biology, Oceanography, and Fisheries of the North Pacific Transition Zone and Subarctic Frontal Zone. NOAA Technical Report NMFS 105.

Appendix 1

REPORT OF THE ALBACORE WORKING GROUP WORKSHOP

International Scientific Committee for Tuna and Tuna-like Species
In the North Pacific Ocean

12-13 July 2013
Busan, Korea

1.0 INTRODUCTION

1.1 Welcome and Introduction

A two day meeting of the Albacore Working Group (ALBWG or WG) was held 12-13 July 2013 in conjunction with the 13th Meeting of the ISC Plenary in Busan, Korea.

Twenty-three (23) participants from Canada, Chinese-Taipei, Japan, Korea, Mexico, the United States of America, and the Western and Central Pacific Fisheries Commission (WCPFC) were present (Attachment 1).

The ALBWG Chair, John Holmes, welcomed all participants to Busan and outlined the objectives of the meeting:

1. Update fisheries statistics through 2012;
2. Monitor and review trends in catch, effort, CPUE and other stock status indicators;
3. Confirm scheduling for the 2014 stock assessment and intercessionally to 2015;
4. Develop a recommended response to the NC8 request for information and advice on reference points for north Pacific albacore, and
5. Develop stock status and conservation advice recommendations for the ISC13 Plenary.

1.2 Approval of agenda

The ALBWG Chair circulated a draft agenda prior to the meeting. No revisions to the agenda were suggested and it was adopted for the meeting (Attachment 2).

1.3 Distribution of Documents

Three working papers were distributed electronically to the ALBWG working group at the meeting (Attachment 3). The authors two working papers agreed to the request to make their working papers publicly available through the ISC website.

1.4 Appointment of Rapporteurs

Kevin Piner and Hirotaka Ijima were appointed as rapporteurs.

2.0 REVIEW OF RECENT FISHERIES

2.1. Review and update of fisheries statistics by country and gear

Recent developments and fishery issues in ISC member countries were described and reviewed. Catch and effort data for 2011 and 2012 by gear, time series of catches and/or landings, catch-effort or CPUE trends, and size composition data were also discussed when data were available.

2.1.1. Canada

Summary **-** John Holmes reviewed the 2012 Canadian albacore troll fishery (ISC/13/ALBWG-02/01) and also reported revisions to catch and effort data for 2004 to 2010. The Canadian fleet of 175 vessels operated within eastern Pacific Ocean waters and expended an estimated 6,010 vessel-days of effort to catch 2,497 metric tonnes (t) of north Pacific albacore in 2012. Effort and catch declined 30% and 54% in 2012 relative to 2011 levels. Nominal catch rates were below average in 2012, although they followed the normal seasonal pattern. Fork length measurements (N = 11,139) were dominated by fish between 64-69 cm FL corresponding to 2-year old fish and a significant number of fish between 74-78 cm FL, which are 3-years old. The decline in this fishery in 2012 appears to be the result of a lack of Canadian vessel access to waters in the US EEZ owing to the absence of a fishing regime for 2012 under the bilateral tuna treaty between Canada and the United States. The 2004-2010 data were revised to correct an error in the database loading procedure for the most recent year that silently inflated estimates of catch and effort in prior years already loaded into the database. The data for 1995-2011 in this report are considered definitive.

Discussion – The WG received clarification that the expiration of the fishing regime in a bilateral agreement allowing Canadian fisheries to access US waters or US fleets to enter Canadian waters affected the behavior of the Canadian fleet, accounting for the decrease in catch and effort. The WG noted that the elimination of Canadian vessels in the US EEZ likely affected CPUE estimates and that this should be investigated during standardization. **The WG agreed that the revised catch and effort estimates from Canada are accepted as the best estimates of catch and effort.**

2.1.2. Chinese-Taipei

Summary **–** Wei-Jen Wang briefly summarized the activities of the small-scale (SSLL) and large-scale (LSLL) longline fisheries for 2012. He reported that the north Pacific albacore catch of the large scale longline fleet was 2,055 t, which is a decrease from 2,972 t in 2011, and the number of fishing vessels targeting albacore remained at 21 as in 2011. There was no obvious fishing pattern change between 2011 and 2012. Catch in the small scale tune longline fishery, which does not target north Pacific albacore, increased from 462 tons in 2011 to 588 tons in 2012.

Discussion – A question was asked about the operational area of the Chinese-Taipei fleet and it was clarified that there was no change in 2012 relative to previous years.

2.1.3. Japan

Summary – Keisuke Satoh summarized the 2012 albacore data for Japan (ISC/13/ALBWG-02/02). Japanese albacore catch and effort data in the north Pacific Ocean were compiled from the Annual Report of Catch Statistics by the Japanese government and logbook data. The data for 2012 are considered preliminary. Albacore is mainly caught by pole-and-line and longline fisheries. Total Japanese catch in 2012 was 49,494 t, which was similar to catch in 2011 (47,724 t) and average of past 5 years (47,207 t, 2007-2011). In general, albacore catch by the pole-and-line has fluctuated inter-annually while catch by longline has been comparatively stable. Catch by pole-and-line in 2012 (27,117 t) was similar to the catch in 2011 (25,117 t). Catch by longline in 2012 (21,315 t) was also similar to the catch in 2011 (20,956 t). Fishing effort (fishing days) by medium-sized (20-199 GRT) pole-and-line vessels continued to decrease in recent years, whereas that by large (>200 GRT) vessels fluctuated. Fishing effort (number of hooks) by the longline fishery (>20 GRT) has decreased in the last five years whereas effort in the coastal longline fishery (10-19 GRT) has been stable during this period. Size sampling of albacore caught by longline and pole-and-line fisheries is being conducted by NRIFSF and related organizations, and in 2011 and 2012 about 4,000 and 80,000 fish were measured annually for pole-and-line and longline fisheries, respectively. Otolith sampling of albacore was conducted for a cooperative study with US scientists.

Discussion - The WG received clarification that effort in the pole-and-line fleet did not include addition effort from target switching of the skipjack fleet in 2012. It was noted that middle-sized skipjack vessel effort declined, but the decline in skipjack effort was the result of a decrease in the number of vessels in 2012 and not target switching to albacore. The WG also sought clarification of the size sampling program. It was clarified that no specific targets for sampling coverage have been established, but a sampling plan ensures that both seasonal and spatial coverage is sufficient to generate representative samples of the catch.

2.1.4. Korea

Summary – Hee Won Park presented historical Korean fishery data for north Pacific albacore from 1980 to 2012 (ISC/13/ALBWG-02/03). Catch and nominal CPUE were estimated from these data for these years. Five-year averages of CPUE were used to analyze changes in fishing distribution pattern. The catch of albacore caught by Korean tuna longline fishery in the North Pacific Ocean was high in the 1980s ranging between 1624 and 5956 t until the mid-1980s and then declined quickly to 2 t by 1992. Estimated albacore catch by the Korean longline fleet in 2012 is 157 t. Catches for 1981 and 1983 were re-estimated relative to previous reports by Korea because these earlier figures were regarded as underestimates compared to estimates in adjacent years. The fishing distributions for the 1980s and the latter half of 1990s with the high nominal CPUE showed high densities, in particular, in the area of 30°-40°N, and extended farther to the east and west.

Discussion - The WG sought clarification on the spatial extent of the Korean fishery noting that in 1995-1999 high nominal CPUE for albacore occurred above and below 20°N, which is unusual. Normally high CPUE is only found above 20°N. Korea indicated that effort was scaled incorrectly in the plot, which was corrected and shown to the WG. The WG noted a decline in albacore catches after the 1980s, which the authors explained was related to a change in the areas fished. Specifically, the more recent effort has concentrated in tropical areas. It was also explained that the drop in recorded catch in 1981 and 1983 is due to low logbook coverage and an inability to expand catch for the entire fleet based on the few logbooks that were returned. **The WG agreed that the revised data for 1980-1993 are the best representation of the Korean fisheries.** Korea plans to continue to improve historical data, especially catch in 1981 and 1983.

2.1.5. Mexico

Summary – Mexico does not have a fishery targeting ALB tuna. All catch is opportunistic and dominated by purse seiners searching for other tuna stocks with a record catch of 109 t in 2006.

The most important catch of ALB in the Mexican EEZ is obtained by the US sport fishery. The statistics of that fishery are reported by the USA.

Discussion – There was no discussion of Mexico's report.

2.1.6. United States

Summary – Steve Teo gave an oral presentation summarizing albacore fisheries in the USA for 2012. The main US fishery targeting North Pacific albacore is the US troll and pole-and-line fishery operating primarily in the northeastern Pacific Ocean. Preliminary estimates of 2012 catch indicated that catches from this fishery increased by approximately 3000 metric tons from 11,037 metric tons in 2011 to 14,137 metric tons in 2012. Preliminary estimates of the number of vessels in this fishery in 2012 indicated an increase from 687 vessels in 2011 to 820 vessels in 2012. The increase in catch and number of vessels in this fishery for 2012 was likely due to the lack of a fishing regime under the US-Canada albacore treaty for 2012, which had previously allowed Canadian vessels to fish for albacore in the US EEZ and vice versa, as well as high albacore prices in 2011. However, research on the effects of the lack of fishing regime in 2012 is needed in order understand its full effects on the fishery. The fishery operation area for the US troll and pole-and-line fishery was similar to recent years, operating primarily in US coastal waters, except that it could not operate in the Canadian EEZ. The logbook and port sampling program for this fishery continued in 2012. The preliminary catch estimates for 2012 catch from other US fisheries catching North Pacific albacore were similar to previous years. In addition to fishery monitoring, US scientists are working on various research projects on North Pacific albacore, often in collaboration with US and international scientists, including projects on age and growth, electronic tagging, otolith microchemistry, migration and habitat use.

Discussion - The WG noted that the 2012 increase in the number of US albacore vessels did not represent newly built vessels but were existing vessels switching permits. The increase in participating vessels may be related to the exclusion of Canadian vessels or high prices paid in 2011 encouraging new participants. US scientists are investigating the factors that may be responsible for the increase in vessel participation by the troll fleet in 2012.

2.2. Update ALBWG Catch Table

The WG reviewed the albacore catch table and each ISC member country confirmed their catch data (Attachment 4). The provisional estimate of total catch of north Pacific albacore in 2012 is 82,040 t, which is an increase of about 1,800 t from 2011. However, it was noted that the 2011 figure contains relatively high longline catches by China and Vanuatu, which do not report their data to the ISC. The 2011 catches reported by Vanuatu and China are 4- and 10-times greater, respectively, than the 2006-2010 average for each country and they represent 14% of the total north Pacific albacore catch in 2011. The WG did not have 2012 catch estimates for countries that do not report to the ISC and used the 2011 figure was an approximation. The WG Chair was tasked with following up with the STATWG Chair and the WG data manager to address these issues. **The WG accepts the catch table as representing the best available data, noting that the 2011 and 2012 data are provisional until these data issues are addressed.**

3.0 QUALITATIVE REVIEW OF STOCK STATUS

3.1 Catch and Effort Trends

The Working Group reviewed total catch (Figure 1), catch by major gear type (Figure 2) and nominal effort (number of vessels, Figure 3). The average catch between 1981 and 2010 is 72,864 t. Preliminary total catch for 2012 is 82,040 t, which is less than 2,000 t higher than the revised 2011 catch estimate of 80, 206 t. ISC member country catch by troll has been relatively

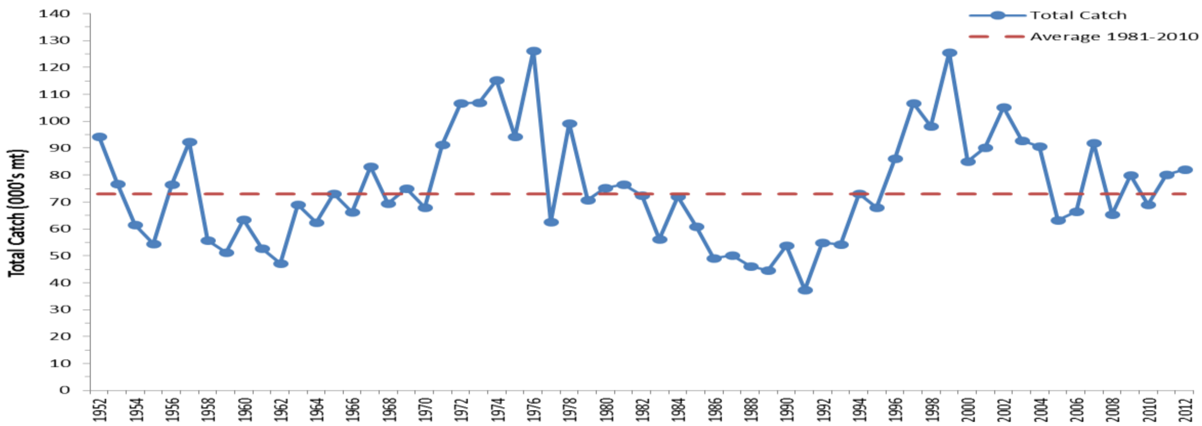

Figure 1. Total catch of north Pacific albacore from all sources, 1952-2012. The red dashed line is the 30-year average (1981-2010) of 72,864 t.

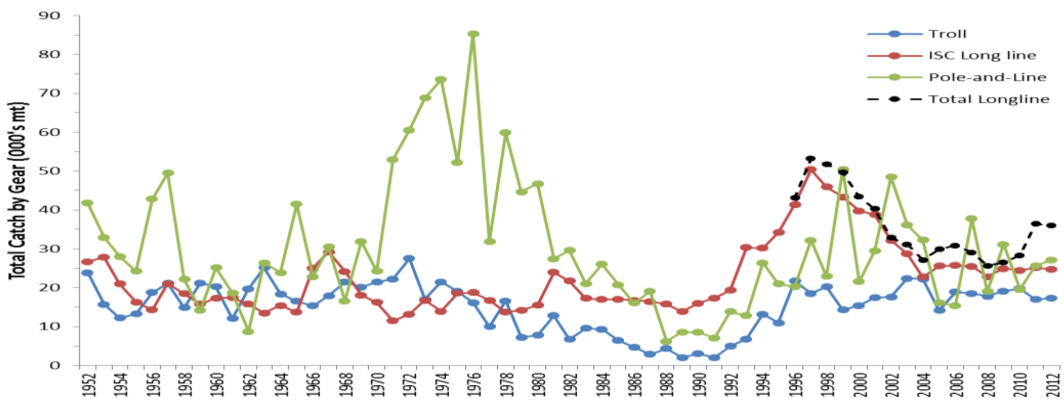

Figure 2. Total catch of north Pacific albacore by ISC member countries for the three major gear types, 1952-2012. Catch data for minor gear types are not shown. Longline catches based on data reported to the ISC (red) and total longline data from all sources (black dash) are shown separately.

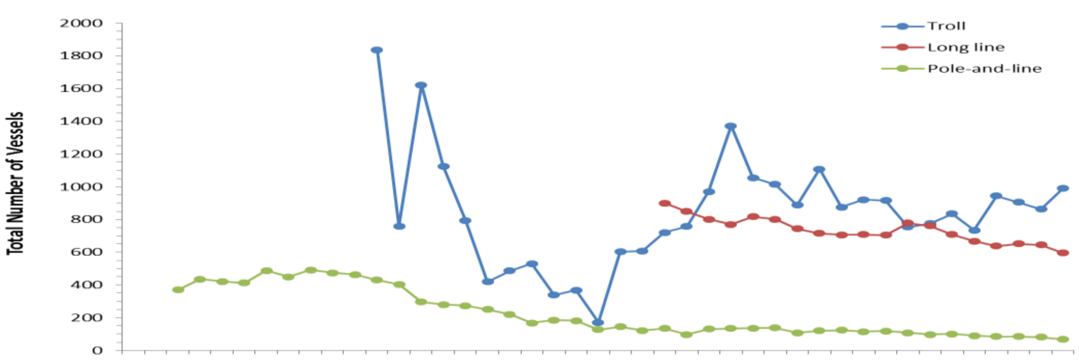

Figure 3. Nominal effort of ISC member countries (1970-2012) measured as the number of vessels in fleet for the major gear types catching north Pacific albacore.

constant since the mid-2000s while pole and line catch has exhibited considerable inter-annual variability since the mid-2000s, respectively (Figure 2). Variability in the pole-and-line catches is driven by a combination of market conditions and albacore/skipjack tuna availability. Longline catches reported to the ISC have been relatively stable since the mid-2000s while longline catches reported by China and Vanuatu have increased substantially since 2010 reflecting an apparent expansion in fisheries by these countries. Nominal longline effort by countries reporting their data to the ISC has been decreasing since 1994 while troll and pole-and-line fleets seem relatively stable through the 2000s (Figure 3).

3.2 Strength of Recent Year-classes

This item was not discussed as no new data were presented at the meeting.

3.3 CPUE Trends

No data were available at the meeting to assess trends in CPUE

.3.4 Comparison with Biological Reference Points

This item was not discussed because no data or analytical results were available at the meeting to assess stock status relative to biological reference points.

3.5 Other Stock Status Indicators

No other stock status indicators have been selected for albacore and as a result the ALBWG did not discuss this item.

3.6 Uncertainties

The north Pacific albacore stock is modeled as an environmentally driven stock through recruitment (h =1). However, between stock assessments the WG has no independent way to track recruitment in this stock. The 2012 catch data from China and Vanuatu and other countries that do not report directly to the ISC are not known at present so it remains unclear whether their fisheries are continuing to expand. Important life history parameters for the north Pacific albacore stock, which may influence the WGs interpretation of stock status, are either highly uncertain at present (steepness of the stock-recruitment relationship) or are in need of updating because they are based on old data (maturity, fecundity) or have never been estimated (natural mortality) for this stock.

4. REVIEW OF STOCK ASSESSMENT AND BIOLOGICAL STUDIES

No stock assessment or biological studies were reviewed at this meeting.

5. RESPONSE TO NC8 REQUEST FOR INFORMATION AND ADVICE ON REFERENCE POINTS FOR NORTH PACIFIC ALBACORE

NC8 requested that the ISC provide information on the reliability and precision of key stock parameter estimates, current estimates of candidate reference point values, and the impact of climate-ocean forcing on the productivity of the north Pacific albacore stock (Attachment 5). The WG discussed the request and developed work plans and assignments at its March 2013 intercessional workshop (ALBWG 2013). The resulting information and data were compiled and circulated for review in July 2013 and a recommended response was developed (Attachment 5) for Plenary approval at ISC13.

The WG discussed whether to use SSB_0 or $SSB_{F=0}$ to calculate probability estimates for stock depletion thresholds when different constant harvest scenarios corresponding to F-based reference points are applied to the stock. It was decided that $SSB_{F=0}$ would be used as the reference for these calculations. The WG reviewed the estimated probabilities for each recruitment scenario (low, average and high historical recruitment) and was satisfied with the results. Some additional text describing some of the broad trends was suggested and accepted by the WG for the recommended response to the NC8 request (Attachment 5).

6. RESEARCH RECOMMENDATIONS AND UPDATED WORKPLAN

6.1 Workshop and meeting schedule, 2013-2014

The WG reconfirmed its meeting schedule leading up to the upcoming stock assessment in 2014 and added plans for 2015 as well. That schedule is

1. Data preparation Workshop – 5-12 November 2013. Japan will host this workshop at the NRIFSF Laboratory in Shimizu;
2. Tuna Ageing and Growth Workshop – 13-15 November 2013, immediately following the data preparation workshop in Shimizu;
3. Stock Assessment Workshop – 14-28 April 2014 in La Jolla, CA, United States;
4. Administrative Meeting, July 2014 – 1 day meeting in advance of ISC14 to update fisheries data, complete annual administrative tasks and prepare a stock assessment presentation; and
5. The ALBWG recommends that an intercessional workshop not be scheduled between ISC14 and ISC15. If the Northern Committee requests advice, then the WG will use electronic online meeting tools such as Webinar, Webex, and conference calling, to address the request.

6.2 Research Needs for 2014 Stock Assessment

This item was previously discussed at the March 2013 workshop in Shanghai, China. No new discussions took place during this meeting.

6.3 Work Assignments to Address Research Needs

The Chair reiterated that he expected National scientists to thoroughly review their fishery data and to prepare working papers describing the results of these reviews for the data preparation meeting. The Chair expects that the WG will be revising fishery definitions and being more selective in the use of CPUE indices in the next assessment and that these issues will be discussed and decided at the data preparation meeting.

6.4 Tuna Age and Growth Workshop

The Chair briefly discussed the upcoming age and growth workshop. He noted that the proposed dates are 13-15 November and that a planning meeting involving the Office of the Chair (ISC) and the PBF WG and ALBWG Chairs would take place on July 16 to firm up details about the meeting, including products that will be produced. The WG was asked about inviting an outside expert, with the Chair suggesting Dr. Jessica Farley (CSIRO) as a possibility because she has done much of the recent age and growth work on south Pacific albacore. There was agreement that Dr. Farley would be a good choice if available and funds can be found to support her travel if necessary. **The WG Chair was tasked with contacting Dr. Farley and addressing the logistics of her participation.**

7. RECOMMENDATIONS FOR THE ISC13 PLENARY

7.1 Current Stock status

The new data and information reviewed by the ALBWG requires no change to its view of stock status as a result of the 2011 stock assessment. The WG noted that the qualitative review of catch and effort showed no indications of concern about either catch or effort trends, except for increased longline catches since 2010 by China and Vanuatu. Whether this expansion has continued in 2012 is uncertain and requires further investigation. The ALBWG notes, however, that albacore stock status may be related to recruitment and that it has no information with which to monitor recruitment between assessments.

The ALBWG does not recommend any changes to its stock status determination in 2011, i.e., the stock is healthy and overfishing is likely not occurring and the stock likely is not in an overfished condition, although biomass-based reference points have not been established.

7.2 Conservation advice

The WG noted that it has not reviewed new information since the 2011 stock assessment that requires a change to previous conservation advice. Therefore, the WG recommends no changes to the conservation advice formulated at ISC11 and shown below:

1. The stock is considered to be healthy at average historical recruitment levels and fishing mortality ($F_{2006\text{-}2008}$).
2. Sustainability is not threatened by overfishing as the $F_{2006\text{-}2008}$ level (current F) is about 71% of $F_{SSB\text{-}ATHL}$ and the stock is expected to fluctuate around the long-term median SSB (~400,000 t) in the short- and long-term future.
3. If future recruitment declines by about 25% below average historical recruitment levels, then the risk of SSB falling below the SSB-ATHL threshold with $F_{2006\text{-}2008}$ levels increases to 54% indicating that the impact on the stock is unlikely to be sustainable.
4. Increasing F beyond $F_{2006\text{-}2008}$ levels (current F) will not result in proportional increases in yield as a result of the population dynamics of this stock.
5. The current assessment results confirm that F has declined relative to the 2006 assessment, which is consistent with the intent of the 2006 WG recommendation.

7.3 Other Issues Needing Plenary Attention

WG members did not raise any issues requiring ISC Plenary attention.

7.4 Data Needs for the STATWG

The WG Chair noted that he had communicated two recommendations to the STATWG on behalf of the ALBWG: (1) that the STATWG Chair make an annual request for non-member country catch and effort data to the IATTC and the WCPFC; and (2) that the STATWG Chair clarify comments from the WCPFC data manager concerning the rationale for not using catches attributed to "unspecified fleets" when estimating north Pacific albacore catches by non-member countries in the WCPO. The ALBWG agreed with these recommendations.

8. ADMINISTRATIVE MATTERS

8.1 Update National ALBWG Contacts

Canada – John Holmes, Zane Zhang
China – X. Dai, Y. Chen
Chinese Taipei - S.-Y. Yeh, C.-Y. Chen
Japan - Keisuke Satoh
Korea - Sang Chul Yoon
Mexico - Michel Dreyfus, Luis Fleischer
USA – Kevin Piner, Steve Teo
IATTC – Carolina Minte-Vera
SPC – Simon Hoyle
Data Manager – John Childers

8.2 Clearing of report

The WG reviewed a draft of the meeting report prepared by the Chair during the meeting. The Chair prepared a revised report and circulated it via email on July 13 for review, comment, and approval by meeting participants. Comments and approval were requested by 17:00 on July 14. Subsequently, the Chair evaluated any suggested changes that were received, made final decisions on content and style, and provided the final report for the ISC13 Plenary to review.

8.3 Other Matters

No other matters were raised by members of the Working Group.

9. ADJOURNMENT

The Chair expressed his appreciation to WG members for their efforts, which ensured a successful meeting. ALBWG participants collectively thanked the hosts (Korea, particularly Dr. Zang Geun Kim) for their hospitality and overall meeting arrangements.

The meeting of the ISC-ALBWG was adjourned at 11:35 on 13 July 2013.

ATTACHMENT 1 - LIST OF PARTICIPANTS

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ATTACHMENT 2

INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN

ALBACORE WORKING GROUP MEETING

Novotel Ambassador Hotel

Busan, Korea

12-13 July 2013

1. Introduction
    - 1.1 Welcome and introduction
    - 1.2 Approval of agenda
    - 1.3 Distribution of Documents
    - 1.4 Appointment of rapporteurs
2. Review of Recent Fisheries
    - 2.1 Review and update of fisheries statistics by country and gear
    - 2.2 Update ALBWG Catch Table
3. Qualitative review and update of stock status
    - 3.1 Catch and effort trends
    - 3.2 CPUE trends
    - 3.3 Strength of recent year-classes
    - 3.4 Comparison with biological reference points
    - 3.5 Other stock status indicators
    - 3.6 Uncertainties
4. Review of Stock Assessment and Biological Studies
5. Response to NC8 Request for Information and Advice on Reference Points for North Pacific Albacore
6. Research Recommendations and Updated Work Plan
    - 6.1 Workshop and meeting schedule, 2013-2014
    - 6.2 Research Needs for 2014 Stock Assessment
    - 6.3 Work Assignments to Address Research Needs
    - 6.4 Joint Age and Growth Workshop
7. Recommendations for ISC13 Plenary
    - 7.1 Current Stock status
    - 7.2 Conservation advice
    - 7.3 Other issues for Plenary Attention
    - 7.4 Data Needs for the STATWG
8. Administrative Matters
    - 8.1 Update ALBWG National Contacts
    - 8.2 Clearing of report.
    - 8.3 Other Matters
9. Adjournment

ATTACHMENT 3

LIST OF WORKING PAPERS

Document Number	Title	Authors	Availability
ISC/13/ALBWG-02/01	Canadian North Pacific Albacore Tuna Troll Fishery Data	John Holmes	Public on the ISC website (john.holmes@dfo-mpo.gc.ca)
ISC/13/ALBWG-02/02	A review of Japanese albacore fisheries in the North Pacific as of June 2013	Keisuke Satoh, Takayuki Matsumoto, Koji Uosaki and Hiroaki Okamoto	Public on the ISC website kstu21@fra.affrc.go.jp
ISC/13/ALBWG-02/03	Historical catch and distribution of albacore tuna by Korean tuna longline fishery in the North Pacific Ocean	Hee Won Park, Sang Chul Yoon, Zang Geun Kim, Sung Il Lee, Mikyung Lee and Dong Woo Lee	Contact details only scyoon@korea.kr

ATTACHMENT 4

Table 1. [1] North Pacific albacore catches (in metric tons) by fisheries, 1952-2012. Blank indicates no effort.

-- indicates data not available. 0 indicates less than 1 metric ton. Provisional estimates in ().

Year	Japan							Korea		Chinese-Taipei		
	Purse Seine	Gill Net	Set Net	Pole and Line	Troll	Longline	Other	Gill Net	Longline	Gill Net [2]	Distant Water Longline	Offshore Longline
1952	154		55	41,787	--	26,687	182					
1953	38		88	32,921	--	27,777	44					
1954	23		6	28,069	--	20,958	32					
1955	8		28	24,236	--	16,277	108					
1956			23	42,810	--	14,341	34					
1957	83		13	49,500	--	21,053	138					
1958	8		38	22,175	--	18,432	86					
1959			48	14,252	--	15,802	19					
1960			23	25,156	--	17,369	53					
1961	7		111	18,639	--	17,437	157					
1962	53		20	8,729	--	15,764	171					
1963	59		4	26,420	--	13,464	214					
1964	128		50	23,858	--	15,458	269					
1965	11		70	41,491	--	13,701	51					
1966	111		64	22,830	--	25,050	521					
1967	89		43	30,481	--	28,869	477				330	
1968	267		58	16,597	--	23,961	1,051				216	
1969	521		34	31,912	--	18,006	925				65	
1970	317		19	24,263	--	16,222	498				34	
1971	902		5	52,957	--	11,473	354		0		20	
1972	277	1	6	60,569	--	13,022	638		0		187	
1973	1,353	39	44	68,767	--	16,760	486		5		--	
1974	161	224	13	73,564	--	13,384	891		91		486	
1975	159	166	13	52,152	--	10,303	230		7,051		1,240	
1976	1,109	1,070	15	85,336	--	15,812	270		2,213		686	
1977	669	688	5	31,934	--	15,681	365		501		572	
1978	1,115	4,029	21	59,877	--	13,007	2,073		670		6	
1979	125	2,856	16	44,662	--	14,186	1,139	0			81	
1980	329	2,986	10	46,742	--	14,681	1,177	6	592	--	249	
1981	252	10,348	8	27,426	--	17,878	699	16	5,956	--	143	
1982	561	12,511	11	29,614	--	16,714	482	113	4,874	--	38	
1983	350	6,852	22	21,098	--	15,094	99	233	2,162	--	8	
1984	3,380	8,988	24	26,013	--	15,053	494	516	1,925	--	--	
1985	1,533	11,204	68	20,714	--	14,249	339	576	2,789	--	--	
1986	1,542	7,813	15	16,096	--	12,899	640	726	3,833	--	--	
1987	1,205	6,698	16	19,082	--	14,668	173	817	1,624	2,514	--	
1988	1,208	9,074	7	6,216	--	14,688	170	1,016	800	7,389	--	
1989	2,521	7,437	33	8,629	--	13,031	433	1,023	562	8,350	40	
1990	1,995	6,064	5	8,532	--	15,785	248	1,016	30	16,701	4	
1991	2,652	3,401	4	7,103	--	17,039	395	852	5	3,398	12	
1992	4,104	2,721	12	13,888	--	19,042	1,522	271	2	7,866	--	
1993	2,889	287	3	12,797	--	29,933	897		3		5	
1994	2,026	263	11	26,389	--	29,565	823		3		83	
1995	1,177	282	28	20,981	856	29,050	78		14		4,280	
1996	581	116	43	20,272	815	32,440	127		158		7,596	
1997	1,068	359	40	32,238	1,585	38,899	135		404		9,119	337
1998	1,554	206	41	22,926	1190	35,755	104		226		8,617	193
1999	6,872	289	90	50,369	891	33,339	62		99		8,186	207
2000	2,408	67	136	21,550	645	29,995	86		15		7,898	944
2001	974	117	78	29,430	416	28,801	35		64		7,852	832
2002	3,303	332	109	48,454	787	23,585	85		112		7,055	910
2003	627	126	69	36,114	922	20,907	85		146		6,454	712
2004	7,200	61	30	32,255	772	17,341	54		78		4,061	927
2005	850	154	97	16,133	665	20,420	234		420		3,990	482
2006	364	221	55	15,400	460	21,027	42		135		3,848	469
2007	5,682	226	30	37,768	519	22,336	44		137		2,465	451
2008	825	1,531	101	19,060	549	19,092	15		405		2,490	579
2009	2,076	149	33	31,172	410	21,995	43		101		1,866	512
2010	330	24	42	19,561	588	21,167	37		109		2,281	537
2011	480	12	50	25,705	443	20,956	78		84	3	2,972	462
2012	(480)	(12)	(50)	(27,117)	(443)	(21,315)	(78)		(157)	(3)	(2,055)	(588)

1 Data are from the ISC Albacore Working Group, July 12, 2013 except as noted.
2 Chinese-Taipei gill net catches for 2011 include 2 t from Offshore Other gear category.

ATTACHMENT 4

Table 1. (Continued)

Year	United States of America [2]								Mexico		Canada	Other		Grand Total
	Purse Seine	Gill Net	Pole and Line	Albacore Troll [3]	Tropical Troll & Handline	Sport	Longline	Other [4]	Purse Seine	Pole and Line [5]	Troll	Troll [6]	Longline [7,8]	
1952				23,843		1,373	46				71			94,198
1953				15,740		171	23				5			76,807
1954				12,246		147	13							61,494
1955				13,264		577	9							54,507
1956				18,751		482	6				17			76,464
1957				21,165		304	4				8			92,268
1958				14,855		48	7				74			55,723
1959				20,990		0	5				212			51,328
1960				20,100		557	4				141			63,403
1961			2,837	12,055		1,355	5	1	2	39	4			52,649
1962			1,085	19,752		1,681	7	1	0	0	1			47,264
1963			2,432	25,140		1,161	7		31	0	5			68,937
1964			3,411	18,388		824	4		0		3			62,393
1965			417	16,542		731	3	1	0		15			73,033
1966			1,600	15,333		588	8		0		44			66,149
1967			4,113	17,814		707	12				161			83,096
1968			4,906	20,434		951	11				1,028			69,480
1969			2,996	18,827		358	14		0		1,365			75,023
1970			4,416	21,032		822	9		0		390			68,022
1971			2,071	20,526		1,175	11		0		1,746			91,240
1972			3,750	23,600		637	8		100	0	3,921			106,716
1973			2,236	15,653		84	14		0		1,400			106,841
1974			4,777	20,178		94	9		1	0	1,331			115,204
1975			3,243	18,932		640	33	10	1	0	111			94,284
1976			2,700	15,905		713	23	4	36	5	278			126,175
1977			1,497	9,969		537	37		3	0	53			62,511
1978			950	16,613		810	54	15	1	0	23			99,264
1979			303	6,781		74	--		1	0	521			70,745
1980			382	7,556		168	--		31	0	212			75,121
1981			748	12,637		195	25		8	0	200			76,539
1982			425	6,609		257	105	21	0	0	104			72,439
1983			607	9,359		87	6		0	0	225			56,202
1984	3,728		1,030	9,304		1,427	2		107	6	50			72,047
1985	26	2	1,498	6,415	7	1,176		118	14	35	56			60,819
1986	47	3	432	4,708	5	196		66	3	0	30			49,054
1987	1	5	158	2,766	6	74	150	139	7	0	104			50,207
1988	17	15	598	4,212	9	64	307	76	15	0	155			46,036
1989	1	4	54	1,860	36	160	248	10	2	0	140			44,574
1990	71	29		2,718	15	24	177	20	2	0	302			53,738
1991		17		1,845	72	6	312	20	2	0	139			37,274
1992		0		4,572	54	2	334	40	10	0	363			54,802
1993		0		6,254	71	25	438	194	11	0	494	0	1	54,302
1994		38		10,978	90	106	544	66	6	0	1,998	0	6	72,995
1995		52		8,125	177	102	882	4	5	0	1,761	94	0	67,948
1996	11	83		16,962	188	88	1185	10	21	0	3,321	469	0	84,487
1997	2	60		14,325	133	1,018	1653	12	53	0	2,166	336	1	103,942
1998	33	80		14,489	88	1,208	1120	15	8	0	4,177	341	0	92,371
1999	48	149		10,120	331	3,621	1542	61	0	57	2,734	228	2	119,297
2000	4	55		9,714	120	1,798	940	24	70	33	4,531	386	46	81,465
2001	51	94		11,349	194	1,635	1295	39	0	18	5,248	230	652	89,404
2002	4	30		10,768	235	2,357	525	13	28	0	5,379	466	223	104,760
2003	44	16		14,161	85	2,214	524	8	29	0	6,847	431	(657)	91,178
2004	1	12		13,473	157	1,506	361	3	104	0	7,857	82	4,617	90,953
2005		20		8,479	175	1,719	296	1	0	0	4,829	52	4,637	63,654
2006		3		12,547	95	385	270	0	109	0	5,833	1	5,469	66,733
2007	77	4		11,908	98	461	250	0	40	0	6,040	7	3,765	92,308
2008	--	1		11,761	29	418	354	0	10		5,464	0	2,992	65,676
2009	39	4		12,938	100	677	203	0	17		5,693	0	1,693	79,720
2010	--	5		12,634	55	704	421	19	25		6,527	0	3,854	68,919
2011	--	5		11,037	88	424	708	37	0		5,415	(0)	(11,248)	(80,206)
2012	(5)	(8)		(14,137)	(280)	(902)	(659)	(6)	(0)		(2,497)		(11,248)	(82,040)

2 USA estimates updated July 2013.
3 Albacore Troll estimates include catches caught with Pole-and-Line gear.
4 Other may include catches by Purse Seine.
5 Mexico Pole-and-line catches for 1999 and 2000 include 34 and 4 metric tons, respectively, from Longline.
6 Other Troll catches are from vessels registered in Belize, Cook Islands, Tonga, and Ecuador.
7 Other Longline data are from WCPFC Yearbook 2011 for non-member nations. Other Longline also includes updates provided by China.
8 Catch reported for Other Longline in 2011 requires verification of accuracy as this figure is much higher than the historical record.

ATTACHMENT 5

INFORMATION AND ADVICE ON BIOLOGICAL REFERENCE POINTS FOR NORTH PACIFIC ALBACORE REQUESTED BY THE NORTHERN COMMITTEE

ALBACORE WORKING GROUP

International Scientific Committee for Tuna and Tuna-like Species
In the North Pacific Ocean

12-13 July 2013
Busan, Republic of Korea

1.0 INTRODUCTION

The Northern Committee (NC) of the Western and Central Pacific Fisheries Committee (WCPFC) requested information (Addendum 2) on potential limit reference points (LRPs) for north Pacific albacore tuna (*Thunnus alalunga*) during its Eight Regular Session (Northern Committee 2012). The WCPFC uses a three-level hierarchical system to evaluate and select limit reference points (LRP) for fishing mortality (F) and spawning stock biomass (SSB) based on the information richness available for the stock (Preece et al. 2011). The NC requested that the ISC provide information on the reliability and precision of key stock parameter estimates, current estimates of candidate reference point values, and the impact of climate-ocean forcing on the productivity of the north Pacific albacore stock (Addendum 2). The ISC Plenary reviewed and endorsed the NC8 request at an intercessional Plenary meeting and tasked the Albacore Working Group (ALBWG or WG) with completing the assignment and presenting the results for review at ISC13 in July 2013 (ISC 2012).

This document provides the information and advice requested by NC8. The WG discussed the requests and developed work plans and assignments to fulfill these requests at an intercessional workshop in March 2013 (ALBWG 2013). The resulting information and data were formulated into a recommended response for ISC13 and approved by the WG in July 2013. The organization of this document follows the questions posed by NC8 (Addendum 2).

2.0 KEY POPULATION AND MODEL PARAMETERS

Information was requested on key population dynamics relationships and parameter estimates. The WG discussed the stock-recruitment relationship and key biological, and fishery (selectivity) parameter estimates. This information is reported below.

2.1 Stock-recruitment Relationship and Steepness Parameter

The 2011 stock assessment assumed that a Beverton-Holt stock recruitment relationship was representative of stock-recruitment dynamics in the north Pacific albacore stock and that the value of the steepness parameter (h) in this relationship is 1.0. The $h = 1.0$ assumption has low biological plausibility because it implies that there will be recruitment in the absence of spawning biomass. This value was assumed in 2011 because modeling results showed that the likelihood profile of *h* was minimized at a value of 1.0, given the structure and other assumptions in the base-case model.

Steepness (*h*) is not well estimated for the north Pacific albacore stock, but the assumption of a Beverton-Holt stock-recruitment relationship is considered plausible, although the relationship may be weak. Frequency distributions of estimated steepness values provide evidence that plausible values of *h* for the north Pacific albacore stock are in the range $0.6 < h < 1.0$ (Brodziak et al. 2011; Iwata et al. 2011). Estimating credible values of the steepness parameter (*h*) is an ongoing area of research.

2.2 Maturity

The age-based maturity schedule used in the 2011 stock assessment is that 50% of albacore at age-5 are assumed to be sexually mature and all fish age-6 and older are mature. Although the WG considers this age-based maturity schedule to be reasonable, it also notes that the maturity data on which it is based are more than 40 years old (see Ueyanagi 1957), they reflect maturity in fish from the western Pacific only, and they represent the results of macroscopic techniques, which are known to be less accurate and precise in classifying gonadal development than modern microscopic approaches. Otsu and Uchida (1959) also assessed gonadal development and maturity with macroscopic techniques in the central Pacific Ocean and they along with Ueyanagi (1957) concluded that the minimum size at maturity is about 90 cm. Recently, Chen et al. (2010) reported that males and females mature at smaller sizes in the western Pacific Ocean than 90 cm on the basis of both macroscopic and microscopic examination of gonads. The WG recognizes that there is a need to develop a better description of maturity at age or length for north Pacific albacore since existing information, even the most recent information, does not capture spatial variation in maturity across the range of the adult component of this stock.

2.3 Fecundity

Ueyanagi (1957) estimated that albacore fecundity in the western Pacific Ocean was between 0.8 and 2.6 million eggs while Otsu and Uchida 1959) reported fecundity estimates ranging from 0.9 to 1.8 million eggs for albacore in Hawaiian waters. Both estimates are based on the assumption that all eggs in the most advanced developmental stage in an ovary were released. Recent batch-fecundity estimates of 21 females collected in the western Pacific Ocean ranged from 0.17 to 1.66 million eggs and was found to increase linearly with fish size (Chen et al. 2010). Recent fecundity for albacore females data in the central Pacific Ocean near Hawaii are not available. The 2011 stock assessment assumed that fecundity is proportional to weight, consistent with the findings of Chen et al. (2010).

2.4 Natural Mortality, M

Natural mortality, M, was not estimated by the 2011 assessment model. The WG fixed M at 0.3 yr^{-1} for all ages. This assumption is unchanged from previous assessments (e.g., ALBWG 2007) because new data or analyses supporting an alternative value or age-specific vector of M were not available. The assumed value was taken from assessments of Atlantic albacore (e.g., ICCAT 2010). Natural mortality of north Pacific albacore cannot be reliably estimated from existing conventional tagging data because tag return rates for adults were lower than expected, especially in the western Pacific Ocean (Bertignac et al. 1999), and estimates of M are positively correlated with tag return rates (see Ichinokawa et al. 2008). The WG has no explanation for the low adult tag returns at present.

2.5 Growth

One of the major advancements in the 2011 stock assessment was the implementation of a new growth model, which was based on length-frequency data and estimated within the base-case model. Estimating growth within the base-case model resulted in the best fit to the length data (ALBWG 2011) and the resulting growth parameter estimates were corroborated by independent estimates based on otolith age and growth data (Wells et al. 2011). Growth parameters in Wells et al. (2011) were well estimated and are based on fish aged 2 to 15 from the eastern, central and western Pacific Ocean, i.e., across the age and spatial range of the north Pacific albacore stock. The WG is confident in the new growth model parameterization and concluded that the growth curve used in previous assessments (based on Suda 1966) was not representative of growth in the north Pacific albacore stock. However, exploration of the hypothesis that there may be regional differences in growth not captured in the current assessment because it is not a spatial model has been identified as an important research need by the WG. Additional age and growth data have been collected since 2011 and were published by Wells et al. (2013). These new growth data will be used in upcoming assessment scheduled to be delivered in 2014.

2.6 Selectivity

Given the data inputs and model structure, the WG concludes that fishery selectivity for north Pacific albacore is well estimated for the eight fleets for which size composition data are available. Selectivity of fleets for which no size data were available was mirrored to one of the eight fleets based on similarities in operating characteristics.

3.0 CANDIDATE REFERENCE POINTS

3.1 Estimated Yields and Probabilities

Introduction - The NC requested advice on expected future yields and variability under low, average, and high historical recruitment scenarios over a 10-yr projection period to assist in determining the suitability of candidate reference points identified in the 2011 stock assessment. Additional information in the form of the estimated probability of breaching the Interim Management Objective (average of the 10 historical lowest years of SSB) and several biomass depletion levels for each candidate reference point harvest scenario was also requested from the ALBWG. The WG developed separate tables to provide these estimates for low, average, and high historical recruitment scenarios (Tables 1 to 3). These estimates are based on the 2011 assessment model, which includes data only through 2009, i.e., the model was not updated with 2010 and 2011 fishery data.

Methods - Biomass depletion is calculated relative to SSB_0. Since the model estimate of SSB_0 is highly uncertain, we used $SSB_{F=0}$ for the biomass depletion levels. $SSB_{F=0}$ is estimated as the mean spawning biomass (N = 200) at the terminal year of a 30-yr projection with F=0 and low, average, or high recruitment, i.e., the mean SSB at 2040. Thus, an average value of $SSB_{F=0}$ was calculated for each recruitment scenario and applied to the nine harvest scenarios, i.e., within a recruitment scenario a single $SSB_{F=0}$ was used for the nine harvest scenarios. Estimating $SSB_{F=0}$ was a first and separate step from the projections described below.

A second set of projections to derive estimates of future yield and probabilities that biomass will fall below depletion levels in at least one year of the projection period was performed with the R package “ssfuture” (Ichinokawa 2012,) which was also used for future projections in the 2011 stock assessment. Biological parameter values and initial population number were estimated for 2010 and recruitment was estimated by random resampling of the historical low, average, or high recruitment period data from the 2011 base case model. Projections were conducted for 27 combinations of recruitment (3 scenarios) and constant harvests strategies (9 scenarios corresponding to candidate reference points $F_{SSB\text{-}ATHL}$, F_{MAX}, $F_{0.1}$, F_{MED}, $F_{10\%}$, $F2_{0\%}$, $F_{30\%}$, $F_{40\%}$ and $F_{50\%}$). Two hundred (200) bootstrap replicates were used to estimate the mean expected yield (±CV) and the probability that SSB would fall below biomass depletion levels at a constant fishing mortality equivalent to the candidate reference points for each recruitment-harvest combination projection. Mean expected yield is calculated as average harvest at the terminal year of the projection, which is 2020 for 10-year and 2035 for the 25-year projections.

Results - Expected yield in all recruitment scenarios increased with increasing recruitment level After 10- and 25-yr projection periods and the differences are approximately 30,000-60,000 t, depending on the harvest scenario (Tables 1 to 3). The largest expected yield is obtained with the F_{MAX} harvest scenario and the lowest yield with the F_{MED} and $F_{50\%}$ harvest scenarios. There was little difference in expected yield after 10 or 25 years when fishing at $F_{SSB\text{-}ATHL}$. Yield is approximately double between the minimum and maximum values in all recruitment scenarios.

The WG notes that given the current model structure (steepness h = 1.0), F_{MAX} is theoretically equivalent to F_{MSY}. However, F_{MAX} is not well estimated by the 2011 stock assessment model since the yield curve is extremely flat, which places F_{MAX} well beyond historical or observed fishing mortality during the stock assessment time period.

Fishing at F_{MAX} has the highest probability of causing SSB to drop below various depletion levels in at least one year. Fishing at F_{MED} was the least aggressive harvest strategy, regardless of recruitment scenario.

3.2 Harvest Scenarios

Estimated F-ratios of candidate reference points to two different constant harvest scenarios ($F_{2002\text{-}2004}$, $F_{2006\text{-}2008}$) are shown in Table 4 to determine if reference point levels are exceeded. It is important to note that the WG used selectivity for $F_{2002\text{-}2004}$ and $F_{2006\text{-}2008}$, respectively, for these calculations.

$F_{2002\text{-}2004}/F_{RP}$ ratios are consistently higher than $F_{2006\text{-}2008}/F_{RP}$ ratios with a maximum difference of 16%. None of the candidate reference points are exceeded (ratio > 1.0) under an F-current ($F_{2006\text{-}2008}$) harvest scenario, although the F_{MED} and $F_{50\%}$ reference points are close to this threshold. In contrast, the F_{MED} and $F_{50\%}$ with the $F_{2002\text{-}2004}$ harvest scenario. The ratio for F_{MAX} is unrealistically low for both harvest scenarios because the yield curve for north Pacific albacore is very flat and determining the location of F_{MAX} on this curve is imprecise.

3.3 Environmental Influences on Candidate Reference Points

The north Pacific albacore stock is modeled as an environmentally-driven stock since a steepness value of 1.0 was used in the stock-recruitment relationship in the 2011 assessment (ALBWG 2011). This decision is a model-related rather than data-related because there is insufficient contrast in stock-recruit data to reject the null hypothesis that h = 1.0. Thus, although the h=1 hypothesis was accepted, the WG does not have strong evidence at present that recruitment is "environmentally driven". Kiyofuji (2013) presented a working paper that provides evidence of cyclic changes in albacore recruitment levels (high, low, average) that seems to fit regime shifts in productivity of the North Pacific Ocean in the 1970s and 1980s. Zhang et al. (2013) showed that stock productivity, when modeled with a logistic surplus production model, was positively affected by the North Pacific Gyre Oscillation (NPGO) and negatively affected by the multivariate ENSO index (MEI) at a lag period of four years. Although it is not clear what population process is impacted by large scale climate-ocean forcing represented by the NPGO and MEI, Zhang et al. (2013) and the WG speculate that these results could be a latent recruitment effect.

A preliminary assessment of the effects of regime shifts on values of F_{SPR}s can be accomplished by comparing the results for the low and high recruitment scenarios in Tables 1 and 3. The probability of SSB breaching the Interim Management Objective and other depletion levels when harvesting at F_{MAX} was higher than the other harvests scenarios for both high and low recruitment. Probabilities were always higher in the low recruitment scenario relative to those of high recruitment scenario. In particular, for the $F_{30\%}$ to $F_{50\%}$ harvest scenarios, there was more than a 10% difference between low and high recruitment level probabilities.

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Table 1. Expected future yield at the end of the projection period **(± CV**) and estimated probabilities that SSB will be lower than several biomass depletion level thresholds in at least one year of the projection period under nine constant harvest scenarios corresponding to candidate reference points and the low historical recruitment scenario. $SSB_{F=0\ xx\%}$ refers to spawning biomass depletion relative to the unfished state. Probabilities highlighted in bold are ≥ 0.50.

Low Historical Recruitment Scenario

			Biomass Depletion Level				
Reference Point	Projection Period (yr)	Future Yield (mt)	SSB-ATHL	$SSB_{F=0\ 10\%}$	$SSB_{F=0\ 20\%}$	$SSB_{F=0\ 30\%}$	$SSB_{F=0\ 40\%}$
$F_{SSB\text{-}ATHL}$	25	75,901 (0.10)	**0.531**	0.000	0.014	0.148	0.386
$F_{SSB\text{-}ATHL}$	10	76,303 (0.09)	0.337	0.000	0.005	0.063	0.213
F_{MAX}	10	129,474 (0.23)	**0.737**	0.352	**0.518**	**0.610**	**0.684**
$F_{0.1}$	10	116,501 (0.16)	**0.613**	0.059	0.247	0.408	**0.541**
F_{MED}	10	61,133 (0.09)	0.210	0.000	0.000	0.015	0.112
$F_{10\%}$	10	118,648 (0.14)	**0.628**	0.084	0.278	0.436	**0.563**
$F_{20\%}$	10	105,537 (0.12)	**0.549**	0.014	0.127	0.295	0.456
$F_{30\%}$	10	91,264 (0.10)	0.447	0.000	0.037	0.165	0.337
$F_{40\%}$	10	79,225 (0.09)	0.350	0.000	0.008	0.068	0.228
$F_{50\%}$	10	65,026 (0.10)	0.241	0.000	0.000	0.025	0.138

Table 2. Expected future yield at the end of the projection period (± CV) and estimated probabilities that SSB will be lower than several biomass depletion level thresholds in at least one year of the projection period under nine constant harvest scenarios corresponding to candidate reference points and the average historical recruitment scenario. $SSB_{F=0\ xx\%}$ refers to spawning biomass depletion relative to the unfished state. Probabilities highlighted in bold are ≥ 0.50.

Average Historical Recruitment Scenario

Reference Point	Projection Period (yr)	Future Yield (mt)	Biomass Depletion Level				
			SSB-ATHL	$SSB_{F=0\ 10\%}$	$SSB_{F=0\ 20\%}$	$SSB_{F=0\ 30\%}$	$SSB_{F=0\ 40\%}$
$F_{SSB\text{-}ATHL}$	25	99,820 (0.11)	0.300	0.000	0.025	0.174	0.439
$F_{SSB\text{-}ATHL}$	10	101,394 (0.12)	0.221	0.000	0.015	0.118	0.356
F_{MAX}	10	174,733 (0.27)	**0.732**	0.409	**0.572**	**0.680**	**0.774**
$F_{0.1}$	10	152,885 (0.17)	**0.582**	0.081	0.305	**0.501**	**0.669**
F_{MED}	10	81,803 (0.12)	0.114	0.000	0.000	0.059	0.223
$F_{10\%}$	10	155,580 (0.18)	**0.600**	0.107	0.338	**0.528**	**0.680**
$F_{20\%}$	10	139,187 (0.16)	**0.501**	0.022	0.167	0.390	**0.595**
$F_{30\%}$	10	120,929 (0.13)	0.365	0.001	0.057	0.241	0.484
$F_{40\%}$	10	104,004 (0.12)	0.244	0.000	0.018	0.132	0.378
$F_{50\%}$	10	86,221 (0.12)	0.144	0.000	0.003	0.064	0.253

Table 3. Expected future yield at the end of the projection period (± CV) and estimated probabilities that SSB will be lower than several biomass depletion level thresholds in at least one year of the projection period under nine constant harvest scenarios corresponding to candidate reference points and the high historical recruitment scenario. $SSB_{F=0\ xx\%}$ refers to spawning biomass depletion relative to the unfished state. Probabilities highlighted in bold are ≥ 0.50.

High Historical Recruitment Scenario

Reference Point	Projection Period (yr)	Future Yield (mt)	Biomass Depletion Level SSB-ATHL	$SSB_{F=0\ 10\%}$	$SSB_{F=0\ 20\%}$	$SSB_{F=0\ 30\%}$	$SSB_{F=0\ 40\%}$
$F_{SSB\text{-}ATHL}$	25	112,561 (0.11)	0.234	0.000	0.030	0.206	0.467
$F_{SSB\text{-}ATHL}$	10	113,447 (0.10)	0.182	0.000	0.022	0.162	0.422
F_{MAX}	10	191,925 (0.27)	**0.729**	0.428	**0.595**	**0.711**	**0.815**
$F_{0.1}$	10	172,289 (0.17)	**0.568**	0.097	0.337	**0.548**	**0.721**
F_{MED}	10	90,113 (0.10)	0.097	0.000	0.003	0.085	0.313
$F_{10\%}$	10	178,653 (0.16)	**0.590**	0.123	0.367	**0.571**	**0.736**
$F_{20\%}$	10	156,192 (0.14)	0.468	0.028	0.194	0.444	**0.651**
$F_{30\%}$	10	136,104 (0.12)	0.320	0.002	0.075	0.287	**0.566**
$F_{40\%}$	10	116,402 (0.10)	0.210	0.000	0.023	0.184	0.438
$F_{50\%}$	10	96,250 (0.10)	0.105	0.000	0.002	0.092	0.338

Table 4. Potential reference points and estimated F-ratios using Fcurrent ($F_{2006\text{-}2008}$) and $F_{2002\text{-}2004}$ (current F in the 2011 assessment). Ratios ≥ 1.0 are highlighted in bold.

Reference Point	$F_{2006\text{-}2008}/F_{RP}$	$F_{2002\text{-}2004}/F_{RP}$
$F_{SSB\text{-}ATHL}$	0.71	0.78
F_{MAX}	0.14	0.18
$F_{0.1}$	0.29	0.35
F_{MED}	0.99	**1.15**
$F_{10\%}$	0.27	0.31
$F_{20\%}$	0.38	0.45
$F_{30\%}$	0.52	0.61
$F_{40\%}$	0.68	0.80
$F_{50\%}$	0.91	**1.06**

ATTACHMENT 5

ADDENDUM 2

Attachment E

The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

Northern Committee Eighth Regular Session

Nagasaki, Japan 3–6 September 2012

North Pacific Albacore Reference Points Requests to the ISC

1. For the purposes of determining potential limit reference points for a precautionary approach management framework for North Pacific albacore, Northern Committee (NC) requests advice from the ISC on the following:
   - i) Is the stock-recruitment relationship known, and in particular a reliable estimate of the steepness parameter (h) for the stock?
   - ii) Are the key biological (natural mortality, maturity) and fishery (selectivity) variables reasonably well estimated?

2. To determine the suitability of candidate reference points identified by the ALBWG in its 2011 stock assessment, NC8 further requests that the ISC provide advice with respect to the following:
   - a) For each of the following levels of F, expected yields, with measures of variability of these expected yields, under high, low and historical average recruitment scenarios, over the course of 10 years projections (and, in addition, 25 year projections for $F_{SSB\text{-}ATHL}$), the probabilities of breaching (in at least 1 year of the projection period) the Interim Management Objective (average of the 10 historical lowest years of SSB) and each of the depletion levels $SB_{10\%}$, $SB_{20\%}$, $SB_{30\%}$ and $SB_{40\%}$;
     - i) $F_{SSB\text{-}ATHL}$
     - ii) F_{MAX}
     - iii) $F_{0.1}$
     - iv) F_{MED}
     - v) $F_{10\%}$, $F_{20\%}$, $F_{30\%}$, $F_{40\%}$, $F_{50\%}$
   - b) A determination of whether or not under different levels of fishing mortality (average $F_{2006\text{-}2008}$, average $F_{2002\text{-}2004}$) that the above candidate reference points will be exceeded.
   - c) To provide the influence of the environmental variation such as regime shift and decadal change on F_{SPR} and empirical based reference points.