FINAL

ISC/20/ANNEX/04

ANNEX 04

20th Meeting of the
International Scientific Committee for Tuna
and Tuna-Like Species in the North Pacific Ocean
Held Virtually
July 15-20, 2020

REPORT OF THE ALBACORE WORKING GROUP WORKSHOP

July 2020

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ANNEX 04

REPORT OF THE ALBACORE WORKING GROUP WORKSHOP

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

12 – 18 November 2019
NRIFSF/FRA, Shimizu
Shizuoka, JAPAN

1. OPENING OF THE WORKSHOP

1.1 Welcome and Introduction

An intersessional workshop of the Albacore Working Group (ALBWG or WG) of the International Science Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was convened at the National Research Institute of Far Seas Fisheries (NRIFSF/FRA), Shimizu, Shizuoka JAPAN, 12 – 18 November 2019.

Minami H., director of the tuna and skipjack resource department, National Research Institute of Far Seas Fisheries/Fisheries Research Institute, welcomed 13 participants (**Attachment 1**) to the NRIFSF/FRA, and wished them a productive meeting.

The ALBWG Chair briefly described the objectives of the meeting and the expected outcomes. The objectives of this workshop were to: (1) Review input data series for consistency with definitions; (2) Assess CPUE indices, specifically both adult and juvenile indices by the JPN LL; (3) Review model parameterization, assumptions, and diagnostic tools for the base-case model and future projection software; (4) Review timeline and work plan for 2020 stock assessment including data submission deadline and 2nd round of MSE.

1.2 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 on empirical testing, open debate, documentation and reproducibility, reporting uncertainty, peer review, and constructive feedback to authors and presenters.

1.3 Review and Approval of Agenda and Assignment of Rapporteurs

The draft agenda was circulated prior to the meeting, reviewed and adopted at the workshop (**Attachment 2**). Rapporteuring duties were assigned to Steven Teo and Akiko Aoki.

1.4 Distribution of Documents and Working Paper Availability

Eleven (11) working papers (WP) were submitted and assigned numbers for the workshop (**Attachment 3**). Working papers will be publicly available through the ISC website (http://isc.fra.go.jp/) and author contact details will be provided for the other related materials.

2. REVIEW PREVIOUS ASSESSMENT IN 2017 AND WORK ASSIGNMENTS

The WG chair briefly presented the conceptual model for north Pacific Albacore, highlighting the fleet and area definitions in the 2017 stock assessment and the known aspects of albacore biology (**Figure 1**). In general, the adult albacore and spawning areas are in the lower latitudes (Areas 2 & 4) while the juveniles and subadults tend to be found in the higher latitudes (Areas 1, 3, & 5). Recent genetic work on north and south Pacific albacore also support the assumption that the north Pacific albacore stock is a single well-mixed stock with limited mixing with the south Pacific stock. **The WG agreed to continue with this conceptual model for the 2020 stock assessment.** It was discussed whether the fishery definitions especially for the Japanese fishery need to be separated into single quarters from aggregated quarters because of quarterly basis model. **The WG agreed the modified fisheries definitions will be used for the 2020 stock assessment summarized in Table 1.**

3. INPUT DATA REVIEW

3.1 Update standardized CPUE for North Pacific albacore caught by the Japanese Longline data from 1976 to 2018. *Fujioka, K., Ochi, D., Ijima H. and Kiyofuji, H.* (ISC/19/ALBWG-02/01)

In this document, adult abundance indices (standardized CPUE) of albacore was calculated from operational data by Japanese longline fisheries on refined area 2, as an input data for stock assessment in 2020. Data of year and season in this calculation was from 1996 to 2018 with quarter 1, which operational pattern (hooks per basket) is stable and the main fishing season of longline targeted this species. Considering necessity calculating coefficient of variation of standardized CPUE, we carried out generalize liner mixed model analysis with Bayesian inference for the CPUE standardization. Our standardized CPUE based on the same procedures and assumptions as previous study (Ochi et al., 2017) showed similar trends with the previous CPUE, indicating that it can be a candidate for the stock analysis.

Discussion

The WG considered the abundance indices from the Japanese longline fishery to be the most important data components for the 2020 assessment. Therefore, discussions on this paper were substantial and spread over several days, with the WG requesting numerous additional analyses from the authors. Based on these discussions and analyses, the WG made the following recommendations:

1) **The WG recommended that the primary index for the 2020 assessment be based on data from Area 2 during Quarter 1 for 1996 – 2018, which was the same primary index used in the 2017 assessment.** The size data associated with this index indicates it is primarily composed of adult albacore of moderate to large size. The fishery primarily targets albacore

during Quarter 1 before switching to other targets in other Quarters. Most of the albacore are caught during Quarter 1. The WG considered an index with a start year of 1994 but residual patterns for 1994 and 1995 were poorer than expected. This was likely because the species composition in 1994 and 1995 were substantially different from1996 – 2018, with a much lower proportion of albacore. The Japanese longline fishery appeared to have changed fishing gear and operations around this period. The hooks per basket and species composition for the 1996 – 2018 period also appeared to be relatively consistent. Model diagnostics were adequate.

2) **The WG also recommended that an index for juveniles and subadults be based on data from Areas 1 and 3 during Quarter 1 for 1996 – 2018**. The size data associated with this index indicates it is primarily composed of juvenile and subadult albacore. The fishery primarily targets albacore during Quarter 1, with most of the albacore caught during Quarter 1. A comparison of this index with the abovementioned adult index shows that the adult index lags this juvenile index by about 3 years, which indicates that these two indices are consistent with each other.

Preliminary decisions for inclusion of above indices along with rationale are summarized in Table 2.

3) **The WG also recommended that a secondary adult index be developed from data from Area 2 during Quarter 1 for 1976 – 1993**. However, the WG considered this to be a secondary index because the residual patterns for this index were relatively poor compared to the primary index, the hooks per basket data had a substantial trend that may not have been completely corrected for, and the size and species compositions were also different from the most recent period. The WG considered that the trend in the relative abundance appeared to be confounded by the trend in hooks per basket, making it difficult to decipher the actual trend in the population.

4) The WG examined an index based on data from Areas 1 and 3 during Quarter 1 for 1976 – 1993 but **recommended that the index not be used for the 2020 assessment**. The size composition data for Areas 1 and 3 during this period indicated that the likely age classes for this period was substantially older than the current period. The model diagnostics for this index was also substantially poorer than the other indices described in this study.

The WG requested authors to document more in detail, specifically 3) and 4) as additional information for WP01 prior to stock assessment workshop by January 31, 2020.

The WG also discussed about progress and preliminary results from geostatistical model. The results show that the trend by the geostatistical model were similar to that of WP01, but the author concluded that the results should be reviewed more thoroughly and would take more time to reach conclusion. **The WG agreed that the application of geostatistical model to standardized CPUE is still undergoing active development and should be considered for the 2023 stock assessment.**

3.2 Update standardized CPUE for North Pacific albacore caught by the Japanese pole and line data from 1972 to 2018. ***Matsubara, N., Aoki, Y. and Kiyofuji, H.*** **(ISC/19/ALBWG-02/02)**

This document shows spatial size distributions and the index of standardized CPUE (i.e., relative abundance index) of north Pacific albacore caught by Japanese pole-and-line distant water (JPN DWPL). By revisiting decadal changes in the size distributions, it was confirmed that the size has been getting smaller since 2000s in north of 30N compared to those caught before that period. It was used the same methodologies as the 2017 albacore tuna stock assessment for the analysis of CPUE standardization but the data period was extended to include the end of 2018. Recent trends (2016-2018) calculated in the updated JPN DWPL CPUE stay at the historically low level.

Discussion

The WG noted that this index was used in a sensitivity run for the 2017 assessment and **recommended that the same approach be used for the 2020 assessment.** The WG considered that it is difficult to define a unit of effort for the pole-and-line fishery and the fishery is known to switch between targeting skipjack and albacore. The size composition for the pole-and-line fishery was also highly variable, which indicates that the selectivity and likely catchability of the pole-and-line fishery was highly variable. Given that a juvenile and subadult index was developed from the Japanese longline data in Areas 1 and 3, **the WG recommended not to use the pole-and-line index in the base case model in the 2020 assessment**. The WG also noted that this fishery is one of largest fisheries targeting juvenile albacore in the north Pacific Ocean and **requested further analysis to examine representativeness of size composition data relative to catch.**

3.3 Update of albacore CPUE and length distribution of Taiwanese longline fishery in the North Pacific Ocean, 1995-2018. ***Chiee-Young Chen and Fei-Chi Cheng*** **(ISC/19/ALBWG-02/11)**

In this working paper, the time series trend of albacore CPUE exploited by Taiwanese longliners in the North Pacific Ocean was estimated. The albacore-targeting catch statistics were extracted from the daily operational data, 1995-2018. The extraction procedures was carried out based on their catch compositions and fishing activities, i.e. fishing area, fishing month and number of HPB, by using clustering and discriminant analyses, which were adopted in previous studies. The albacore-targeting fishery apparently contributed majority of the albacore catch throughout the years. Then, general linear model was applied to estimate the CPUE trend. This estimation is believed to be more informative to the stock status of North Pacific albacore exploited by Taiwanese longline fishery.

Discussion

The WG noted that in the 2017 assessment, the size composition data for the albacore-targeting fishery was fit in the base case model but not for the non-albacore-targeting fishery. The abundance index for the Taiwan longline fishery was also not fit in the 2017 assessment. **The WG recommended that the same approach be used for the 2020 assessment.**

3.4 Summary of Canadian Albacore fisheries. *Zane, Z.* (Presentation)

Canada has a troll fishery targeting juvenile north Pacific Albacore Tuna (*Thunnus alalunga*) in the east Pacific Ocean. The fishery operates predominantly within the Canadian and United States exclusive economic zones. Annual fishing effort ranged between 4196 and 10021 vessel-days in 1995-2018. Fishing effort was relatively high before 2012, and has exhibited a decreasing trend since 2012. Annual catch varied between 1761 and 7851 mt in 1995-2018. Amount of catch had an increasing trend between 1995 and 2004, remained relatively high in 2005-2011, and has shown a decreasing trend since 2011. Catch per unit effort had an increasing trend between 1995 and 2014, declined annually in 2015-2017, but increased in 2018 relative to 2017. Fork lengths of sampled fish have been measured since 2007. The dominant mode of the length frequency distribution in each year remained around 67 cm.

Discussion

The WG noted that the Canadian fishery was highly similar to the U.S. surface fishery, and **recommended that the catches from the Canadian fishery be combined with the U.S. and Mexico surface fishery to form an E.P.O. surface fishery**. This was the same approach as the 2017 assessment.

3.5 Preliminary catch and size composition time series of the US and Mexico surface fishery for the 2020 north Pacific albacore tuna assessment. *Teo, S. L. H., Gu, Y. and Childers, J.* (ISC/19/ALBWG-02/04)

The objective of this paper is to describe the data sources and methods used to develop preliminary, seasonal catch and size composition time series of the U.S. and Mexico albacore surface fleet in the north Pacific Ocean, in preparation for the 2020 stock assessment. Similar to the 2017 assessment, in order to simplify model structure, it is proposed that albacore landings from all U.S. gears, except handline and longline, and all Mexico gears be combined as part of the Eastern Pacific Ocean (EPO) surface fleet. Three main sources of data were used: 1) annual landings of albacore tuna in metric tons by gear in the north Pacific Ocean reported to the ISC by the U.S. and Mexico; 2) catch-effort information from U.S. fishermen logbooks; and 3) size composition (fork length) information from a U.S. port sampling program. Size composition data in 1 cm bins were first matched to logbooks to obtain average fishing location for specific vessel- trips, and subsequently aggregated into area/month/year strata. Strata with <3 sampled trips were discarded because large spikes were evident in preliminary size compositions. Size compositions from these strata were combined into seasonal size compositions by performing a weighted average of the size compositions of all strata by year and season. Strata weights were calculated as the relative proportion of albacore catch in each stratum within each season and year, using the albacore catch in number recorded in the abovementioned logbook program. Similarly, the input sample size for the size composition data was considered to be the weighted average of the number of trips of all strata by year and season. The catch in a season was calculated by multiplying the estimated proportion of catch in weight for that season with the total annual catch of the U.S. and Mexico surface fishery for the year. For the 2017 assessment, size information from a specific vessel-trip were matched to the average fishing location for the corresponding vessel during the same month. For this study, an improved algorithm was developed to match size information from a specific vessel-trip to the corresponding vessel-trip in the logbook database. However, the resulting size compositions from both algorithms were largely similar. The difficulty in matching the port sampling data with the logbook data resulted in the size composition time series starting only in 1977, and predominantly in Season 3. The initial input sample sizes ranged from 3 to 217.3, with an average of 37.7. It is recommended that the ALBWG use the catch and size composition time series described in this working paper for the 2020 stock assessment of north Pacific albacore tuna. In addition, it is recommended that the ALBWG rescale the initial input sample size of the size composition data of this and other fleets in the assessment (i.e., reweighting the size composition data) and set a minimum input sample size, before fitting the size compositions in the assessment model. Finally, it is also recommended that the seasonal Canadian albacore catches be combined with the U.S. and Mexico surface fishery for the 2020 assessment.

Discussion

The WG agreed with the recommendation that the catches from the Canadian fishery be combined with the U.S. and Mexico surface fishery to form an E.P.O. surface fishery. This was the same approach as the 2017 assessment.

3.6 Preliminary catch and size composition time series of the US pelagic longline fishery for the 2020 north Pacific albacore tuna assessment. *Teo, S. L. H.* (ISC/19/ALBWG-02/05)

The objective of this paper is to describe the data sources and methods used to develop seasonal catch (in metric tons) and size composition (raised to the catch) time series for two U.S. pelagic longline fleets based in the north Pacific Ocean, for use in the 2020 assessment. In a previous study, two U.S. pelagic longline fleets were defined, based on the consistency of size compositions within areas. Fleet 1 consists of vessels fishing in a northern area with mostly juvenile and sub-adult albacore. Fleet 2 consists of vessels fishing in a southern area with mostly large, adult albacore. Size composition data in 1 cm bins from an observer sampling program were subdivided into 10x10° area/month/year strata. Strata with <3 observed trips were discarded. Size compositions of stratas in each fleet were combined into seasonal size compositions by performing a weighted average of the size compositions of all stratas in each fleet by year and season. The initial input sample sizes for the size compositions were calculated as the weighted average of the number of trips of all stratas in each fleet by year and season. The total annual landings by U.S. pelagic longline fishery were subdivided into the seasonal landings for Fleets 1 and 2, based on the relative proportion of albacore catch in each area and season using logbook data, and the size composition of albacore in each area and season. Seasonal albacore catch in metric tons for Fleets 1 and 2 of the U.S. pelagic longline fishery in the north Pacific Ocean are shown. Most of the albacore catch occurred in the area defined for Fleet 2. Seasonal size compositions (raised to the catch) for Fleets 1 and 2 of the U.S. pelagic longline fishery are shown. Input sample sizes ranged from 3 to 16 for Fleet 1, and 3 to 20.7 for Fleet 2. It is recommended that the ALBWG use the seasonal catch and size composition time series described in this working paper for the 2020 stock assessment of north Pacific albacore tuna. In addition, it is recommended that the ALBWG rescale the initial input sample size of the size composition data of this and other fleets in the assessment (i.e., reweighting the size composition data) and set a minimum input sample size and/or number of fish sampled, before fitting the size compositions in the assessment model.

Discussion

The WG agreed to maintain the same approach, as in the 2017 assessment, for the U.S. longline fishery, with one fleet for Areas 3 and 5, and another fleet for Areas 2 and 4.

3.7 Updated North Pacific albacore catch data by Japanese fisheries for the 2020 stock assessment. *Kiyofuji, H. and Ijima, H.* (ISC/19/ALBWG-02/03)

This document describes updated North Pacific albacore catch by the Japanese fisheries including longling, pole-and-line, drift net, purse sein, troll, set net and other miscellaneous fishery. Data were also summarized in same fisheries definition as in 2017 stock assessment.

Discussion

The WG noted that albacore catches for the Japanese and other countries have declined over the past few years. However, there were no obvious reasons for this decline. **The WG recommended that the modified fleet definition from the 2017 assessment be used for the Japanese data.**

3.8 Summary of historical size data of North Pacific albacore (*Thunnus alalunga*) caught by Japanese fisheries. *Ohashi, S., Ijima, H. and Kiyofuji, H.* (ISC/19/ALBWG-02/06)

Using area definition of the last stock assessment of North Pacific albacore, we summarized the length composition data of North Pacific albacore caught by Japanese fisheries between 1966 and 2018. There are three major sources of albacore size composition data that are "Size original", "Size csv", and "SKJ database". In the last stock assessment, ALBWG used only length data in the "Size original" and "SKJ database". The length frequency of longline fishery was smaller in area 1 with mode between 70-80cm FL than other areas with mode between 90-110cm, and represented a seasonal change in the northern areas (Area 1, 3, 5). The length frequency of pole and line fishery represented a trend that was smaller in the northern area (>30°N) than the southern area (<=30°N) with a seasonal change between 1-2 quarters and 3-4 quarters of Area6. There are no clear trends in the length frequency of driftnet fishery because of the small and fragmentary data. In the previous stock assessment, the ALBWG pointed out that the 1990s-length data might be biased sampling measuring large fish. To verify the presence or absence of bias, we tabulated the weight data and the mean body weight of the logbook data annually. The weight data and logbook data represented similar trend to that of original length composition. Hence the trend, large albacore was caught by longline fishery in area2, would be accurate.

Discussion

The ALBWG thanked the author for providing an update on length and weight composition data by the Japanese fisheries. After much discussion, **the WG agreed with the authors that the size composition data with the very large fish in the 1980s were representative of the albacore catch by the Japanese longline fishery during this period**. However, the WG still do not have a clear understanding of the reasons behind the larger change in size compositions during this period. The WG raised and discussed three hypotheses for observed larger size of fish in the 1980's: (1) changes in fishing area, (2) growth change and (3) movement of fish. An examination of the fishing area before and during this period shows that there were no major changes in fishing operation areas before and after that period. The large change in size compositions during this period remain an open question but the WG thought that it was more likely due to changes in the growth or movement patterns. **The WG requested to document the additional information made during the WS as supporting information by January 31, 2020.**

3.9 A review of North Pacific Albacore Fisheries Data Reported by Non-ISC countries (Data were provided by SPC and IATTC). Presented by *Kiyofuji, H.*

This presentation is catch summary of albacore in the north of equator by non-ISC member countries. Data were provided by the SPC (secretariat pacific community) and IATTC. SPC also provided 5° x 5° length data by China and Vanuatu.

Discussion

The WG thanked the Chair for assembling the catch and size composition data for non-ISC countries. The WG also noted that drift gillnet catches for Korea are not available from the SC database but the WG has maintained an historical record of those catches and will be used in the 2020 assessment.

3.10 Otolith sampling of adult North Pacific albacore tuna (*Thunnus alalunga*) for precise age and growth estimation. *Aoki, A., Ohashi, S., Tanaka, F. and Kiyofuji, H.* (ISC/19/ALBWG-02/08)

National Research Institute of Far Seas Fisheries, Japan (NRIFSF) has been collecting data and biological samples of adult albacore *Thunnus alalunga* for more precise age and growth estimation, especially to reveal the effect of sexually dimorphic growth of this species. With brief introduction of collected data, this document reports the otolith sample collections in recent years and preliminary analysis for age determination of adult albacore.

3.11 Early growth of juvenile albacore, *Thunnus alalunga* based on increments in sagittal otolith. *Tanaka, F., Ohashi, S., Aoki, A. and Kiyofuji, H.* (ISC/19/ALBWG-02/09)

In the present study, early growth of juvenile albacore *Thunnus alalunga* was deduced by analyzing otolith increments of 80 specimens (24.3 to 117.3 mm SL) collected by midwater trawling in the sub-tropical western Pacific from 2015 to 2017. Increments on the transverse plane were counted by otolith-measuring system equipped with a light microscope. If the number of increments are verified as daily growth, then the daily growth rate could be calculated as 3.8 mm/d in 2015, 5.5 mm/d in 2016, 1.1 mm/d in 2017 based on the regression line.

Discussion

The WG discussed WP08 and WP09 together. The WG noted that this research would be necessary to improve analysis of growth of this species in the future. **Therefore, the WG recommended continuing sampling in broader spatial scale.**

3.12 Sex identification method in Albacore using DNA markers. *Chiba, S. N., Ohashi, S., Tanaka, F. and Kiyofuji, H.* (ISC/19/ALBWG-02/10 presented by H. Kiyofuji)

Sex-identification DNA markers are useful tools for sexing of albacore (ALB) which lack sexual dimorphisms on external morphology and coloration. In this paper, we applied the recently developed genotypic sex-identification assays for Pacific bluefin tuna (PBF) for ALB to evaluate the accuracy. The assays demonstrated relatively high accuracy in ALB. The assay was further tested in samples of albacore collected during the scientific observer program of onboarding Japanese commercial long-line vessels. The sex ratio of ALB samples was significantly different from expected 1:1 with a dominance of males and the mean body size was greater in males than in females.

<u>**Discussion**</u>

The WG thanked the Chair for the presentation and noted the importance of the work in the future. The U.S. scientists plan on further testing the sex markers using samples of known sex in the near future, and will keep the WG notified of the results. Once the sex markers have been further tested, **the WG recommends that the WG design a sampling program for sex, especially for adult albacore**.

4 REVIEW 2017 ASSESSMENT MODEL USING UPDATED DATASETS – LOOKING AT EFFECTS ON DATA FIT

The WG did not run an assessment model using updated datasets. However, the WG noted that Teo et al. (ISC/19/ALBWG-01/03) performed an analysis of the 2017 assessment model and made some recommendations to improve the assessment model. **The WG recommended that a similar approach be used for the 2020 assessment, if possible**.

5 BASE CASE SCENARIO: ASSUMPTIONS AND RATIONALE (TABLE 3)

The WG discussed structural and parameter assumptions and developed a provisional base case scenario for the 2020 stock assessment. **The WG recommended that a similar base case scenario as in the 2017 assessment be used for the 2020 assessment, albeit with several options for possible improvements. The WG agreed to develop two candidate models (Models A and B) for evaluation as the base case model for the 2020 stock assessment, with priority to be given to Model A.**

Model A. This model will be similar to the base case model in the 2017 assessment, with a main model period of 1994 – 2018. However, several improvements to the model are possible, including time annually varying age selectivity of the surface fleets, M and *h* priors, and the inclusion of juvenile/subadult indices from Japan longline fisheries in Areas 1 and 3.

Model B. This model will be largely identical to Model A during the 1994 - 2018 period. However, the start year of Model B will be from 1966. Therefore, catch and size composition data from 1966 to 1993 will be included in Model B. In addition, an adult index from Japan longline fisheries in Area 2 will be included for 1976 – 1993.

6 DIAGNOSTIC ANALYSES

In 2017 stock assessment, the following diagnostic tools were employed: 1) model convergence tests, 2) Age-Structured Production Model (ASPM) diagnostic, 3) R_0 likelihood profiles, 4) residual analysis, and 5) retrospective analysis (http://isc.fra.go.jp/pdf/ISC17/ISC17_Annex12-Stock_Assessment_of_Albacore_Tuna_in_the_North_Pacific_Ocean_in_2017.pdf). **The WG recommended that the same diagnostic analyses in the 2017 assessment be used for the 2020 assessment.**

7 SENSITIVITY ANALYSES

The WG examined the sensitivity analyses from the 2017 assessment (See Table 4.5 in stock assessment report in 2017. http://isc.fra.go.jp/pdf/ISC17/ISC17_Annex12-Stock_Assessment_of_Albacore_Tuna_in_the_North_Pacific_Ocean_in_2017.pdf). **The WG agreed that similar sensitivity analyses will likely be performed for the 2020 assessment. However, the exact sensitivity analyses will depend on the model structure of the base case model.**

8 FUTURE PROJECTIONS

Update of future projection program "SS future C++" ***Ijima, H.*** **(ISC/19/ALBWG-02/07)**

R software SSfuture C++ is the future projection program that can use an output of Stock Synthesis 3 (SS3). This study constructed the new SSfuture C++ to reflect the updates of SS3. Two major revision points are 1) the population dynamics model change to quarterly, and 2) the fishing mortality rate calculates by age selectivity. Besides, the new version of the SSfuture C++ added the Harvest Control Rules (HCRs) and the options of process error due to the recruitment. As a result of these updates, consistency between SS3 and SSfuture C++ has increased. We also examined how to deal with uncertainty regarding the results of the stock assessment. SS3 ver3.30 can calculate the uncertainties of estimated values (e.g., the standard deviation from the Hessian matrix, bootstrap resampling, and MCMC). In the last stock assessment, the ISC albacore working group used the standard deviation given by the Hessian matrix, but this study will propose to use the result of bootstrap in the next stock assessment.

Discussion

The ALBWG thanked the author for providing an update on the future projections software. It was discussed which method should be used for the uncertainties of estimated values. The WG agreed that MCMC would be the most appropriate way of deriving the uncertainty of the assessment and providing input sfor the future projections. However, the MCMC output from SS does not currently provide values for F multiplier and age selectivity, and the future projection software will not be able to perform stochastic resampling of past age-selectivities. Steve Teo was kindly tasked to ask to Dr. Methot whether additional output can be provided in time for the assessment. However, even if the additional output is not available, the projections can be performed using the average F-at-age over a period instead of stochastic resampling. **The ALBWG recommended that the author is aiming to provide more detailed documentation for the updated programs one month prior to the stock assessment workshop in March 2020.** It was also discussed regarding future projection scenario and **the WG agreed the same scenarios (constant catch and constant F) as in the 2017 assessment be used for the 2020 assessment.**

9 RECOMMENDATIONS

Major recommendations are provided in each discussion part.

10 WORK PLAN AND ASSIGNMENTS FOR STOCK ASSESSMENT WORKSHOP

10.1 Time and place of next meeting

The WG developed a work plan for the stock assessment scheduled for 2020 and second round of MSE (**Attachment 4**). **The WG agreed with the proposed work plan.**

10.2 Work assignments for stock assessment workshop

- Provide catch, size composition, and CPUE data up to 2018 along with agreed schedule in attachment 4 – all WG members
- Distribute the latest release of SS version 3.30 to the WG when data compilation has been completed – S. Teo.
- Submit additional information for WP-01 and detailed documentation for WP-07 along with agreed schedule in attachment 4 – K. Fujioka and H. Ijima.
- Submit supporting information for size and catch data by Japanese LL and PL along with agreed schedule in attachment 4 – JPN

11 OTHER MATTERS

Two presentations were provided to the working group on the MSE progress and historical larval distribution.

11.1 Overview of North Pacific Albacore Effort Data for the MSE Process. *Tommasi, D. and Teo, S.* (Presented by Teo, S.)

In the first round of the North Pacific Albacore (NPALB) MSE, effort was not modeled explicitly as the number of hooks, fishing days, or vessels. It was modeled as fishing intensity. One of the recommendations from managers and stakeholders following presentation of the first round of results during the 4th NPALB MSE Workshop was that the relationship between how effort is modelled in the MSE operating models and effort in the real world should be examined by the ALBWG and included in the future round of MSE to help managers and stakeholders, if possible. To that end, members of the ALBWG compiled effort data from their respective country on number of vessels, number of hooks (for longline vessels) or number of fishing days (for surface fleets). Here we show temporal trends in the effort data and assess if apical fishing mortality as estimated by the base case operating model is correlated with changes in effort. Japanese effort, both for the longline and surface fleet, has decline from 1993 to present. Effort of the U.S. and Canadian surface fleet has remained relatively stable. Chinese Taipei's longline effort has been relatively stable since the mid 2000s. U.S. longline effort, Korean longline effort, Vanuatu longline effort, and China's longline effort (numbers of hooks, quarter 1) has increased from 1993 to present. However, longline effort was often found not to be representative of fishing mortality, possibly because many longline vessels are not targeting albacore.

Discussion
The WG thanked the authors for the update and encouraged the authors to keep the WG informed of the progress in the MSE modelling.

11.2 Environmental effects on the larval fish distribution on the Pacific Ocean: Using a geostatistical model. (Presented by Ijima, H.)

Constructing a mathematical model and understanding the behavior of the population dynamics is a fundamental study and plays an essential role in wildlife conservation and management. In highly migratory species such as tuna and billfish, it is known that there is substantial uncertainty in recruitment that has a large effect on the population growth rate. Thus, understanding the mechanism of changes in recruitment is important. Tuna and billfish have been suggested that recruitment uncertainty depends on the ocean environment but, the causal relationship between recruitment and the environment is unknown. Besides, the spawning ground and season of these species are not also well understood. In this study, we constructed the latest geostatistical model using the larval data and estimated the spawning ground and the environmental field that affects the appearance of tunas and billfish larval.

Discussion
The WG thanked the author for the presentation. The WG noted that this work may be valuable in the future for understanding the reasons for changes in recruitment.

12 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 via email for approval by WG members. The final report will be forwarded to the Office of the ISC Chair for review and approval by the ISC20 Plenary.

13 ADJOURNMENT

The ALBWG meeting was adjourned at 11:00 on 18 November 2019. The WG Chair thanked the scientists participating in the workshop for their attendance and contributions on albacore matters.

14 LITERATURE CITED

Brodziak., J. Lee, H.-h., and Mangel, M. 2011. Probable values of stock-recruitment steepness for North Pacific albacore tuna. Working paper presented at the ISC Albacore Working Group Stock Assessment Workshop, 30 May-11 June 2011, Nat. Res. Inst. Far Seas Fish., Shimizu, Shizuoka, Japan. ISC/11/ALBWG/11: 9 p.

Chen, K.-S., Crone, P.R., and Hsu, C.-C. 2010. Reproductive biology of albacore *Thunnus alalunga*. Journal of Fish Biology 77: 119–136. doi:10.1111/j.1095-8649.2010.02662.x

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Table 1. Fisheries definitions tentatively agreed for the 2020 stock assessment of North Pacific albacore tuna. C, S, I in "Data available" column denote Catch, Size and Index, respectively. Note that F10, F12, F16 and F17 defined in 2017 stock assessment are no longer used for the 2020 stock assessment.

ID in 2017	NEW	Country	Area	Gear	Quarter	Catch Unit	Data available
F1	F1	Japan	1 & 3	Longline	1	mt	C, S, I
F2	F2	Japan	1 & 3	Longline	2	mt	C, S
F3	F3	Japan	1 & 3	Longline	3	mt	C, S
F4	F4	Japan	1 & 3	Longline	4	mt	C, S
F5	F5	Japan	1 & 3	Longline	1	number	C
F6	F6	Japan	1 & 3	Longline	2	number	C
F7	F7	Japan	1 & 3	Longline	3	number	C
F8	F8	Japan	1 & 3	Longline	4	number	C
F9	F9	Japan	2	Longline	1	mt	C, S, I
–	**F10**	**Japan**	**2**	**Longline**	**2**	**mt**	C, S
–	**F11**	**Japan**	**2**	**Longline**	**3**	**mt**	C, S
–	**F12**	**Japan**	**2**	**Longline**	**4**	**mt**	C, S
~~F10~~	~~–~~	~~Japan~~	~~2~~	~~Longline~~	~~2, 3 & 4~~	~~mt~~	~~–~~
F11	**F13**	Japan	2	Longline	1	number	C
–	**F14**	**Japan**	**2**	**Longline**	**2**	**number**	C
–	**F15**	**Japan**	**2**	**Longline**	**3**	**number**	C
–	**F16**	**Japan**	**2**	**Longline**	**4**	**number**	C
~~F12~~	~~–~~	~~Japan~~	~~2~~	~~Longline~~	~~2, 3 & 4~~	~~number~~	~~–~~
F13	**F17**	Japan	4	Longline	All	mt	C, S
F14	**F18**	Japan	4	Longline	All	number	C
F15	**F19**	Japan	5	Longline	All	number	C, S
–	**F20**	**Japan**	**3**	**Pole-and-Line**	**1**	**mt**	C, S
–	**F21**	**Japan**	**3**	**Pole-and-Line**	**2**	**mt**	C, S
–	**F22**	**Japan**	**3**	**Pole-and-Line**	**3**	**mt**	C, S
–	**F23**	**Japan**	**3**	**Pole-and-Line**	**4**	**mt**	C, S
~~F16~~	~~–~~	~~Japan~~	~~3~~	~~Pole-and-Line~~	~~1 & 2~~	~~mt~~	~~–~~
~~F17~~	~~–~~	~~Japan~~	~~3~~	~~Pole-and-Line~~	~~3 & 4~~	~~mt~~	~~–~~
F18	**F24**	Japan	2	Pole-and-Line	All	mt	C, S
F19	**F25**	US	3 & 5	Longline	All	mt	C, S
F20	**F26**	US	2 & 4	Longline	All	mt	C, S
F21	**F27**	Taiwan	3 & 5	Longline	All	mt	C, S, I
F22	**F28**	Taiwan	2 & 4	Longline	All	mt	C
F23	**F29**	Korea	All	Longline	All	mt	C
F24	**F30**	China	3 & 5	Longline	All	mt	C, S
F25	**F31**	China	2 & 4	Longline	All	mt	C, S
F26	**F32**	Vanuatu **Other Countries**	All	Longline	All	mt	C, S
F27	**F33**	US, Canada, Mexico	3 & 5	PL and Troll	All	mt	C, S
F28	**F34**	Japan, Korea, Taiwan	All	Driftnet	All	mt	C, S
F29	**F35**	Japan, Taiwan	All	Miscellaneous	All	mt	C

Table 2. Descriptions of primary abundance (CPUE) indices for adult and juvenile and preliminary decisions concerning use in 2020 stock assessment model.

Criteria	Adult: area2 & quarter 1 (JPN-LL)	Juvenile: area1, 3 & quarter 1 (JPN-LL)
Supporting Working Paper	ISC19-ALBWG-02/01 ISC19-ALBWG-02/06	ISC19-ALBWG-02/01 ISC19-ALBWG-02/06
Time series	1996 – 2018	1996 – 2018
Spatial Distribution	The area enclosed by (10-25°N, 130-160°E) and (25-30°N, 140-160°E)	The area enclosed by (25-35°N, 130-140°E) and (30-40°N, 140°E - 180°)
Size and age	Larger averaged size with peak 100cm (approximate range: 80-120cm)	Smaller averaged size with peak 75cm (approximate range: 60 – 110cm, skewed distribution)
Fishing ground map	Maps provided in supporting WP and Figure 1	Maps provided in supporting WP and Figure 1
Albacore catch relative to total catch: total catch is defined as catch included all species in area and quarter	76.0% (1996 – 2018 average)	88.4% (1996 – 2018 average)
Temporal consistency of fishing grounds	Consistent – no longer term changes in fishery location	Consistent – small area and no longer term changes in fishery location
Temporal consistency in size composition	Consistent size composition	Consistent size composition
Targeting	Primary target species	Primary target species
Catchability Changes	Constant – hooks per basket (hpb) and catch composition remain stable	Constant – hooks per basket (hpb) and catch composition remain stable
Best Available Science Information Development in Working Paper		
Fishery description	Described in terms of historical catch, effort, size composition, seasonal distribution of fishing grounds, and potential target species.	Described in terms of historical catch, effort, size composition, seasonal distribution of fishing grounds, and potential target species.
Analysis	Zero-inflated negative binomial model (ZINB) used with GLMM for standardization. Explanatory variables were year, quarter, hooks per basket and fleet type, area (5° × 5°) and vessel ID were included as random effects. Standardized CPUE values are estimated as least squares means in the GLMM.	Zero-inflated negative binomial model (ZINB) used with GLMM for standardization. Explanatory variables were year, quarter, hooks per basket and fleet type, area (5° x 5°) and vessel ID were included as random effects. Standardized CPUE values are estimated as least squares means in the GLMM.
Statistical results	Standard statistical output was not provided in working paper	Standard statistical output was not provided in working paper
Nominal & Standardized Index	Compares nominal and standardized CPUE	Compares nominal and standardized CPUE

Criteria	Adult: area2 & quarter 1 (JPN-LL)	Juvenile: area1, 3 & quarter 1 (JPN-LL)
Diagnostic Plots	Frequency distribution of catch, hooks per basket by year, residuals from standardized index.	Frequency distribution of catch, hooks per basket by year, residuals from standardized index.
Point estimate and variability in index values described	Point estimates of index both in graphical and tabular format.	Point estimates of index both in graphical and tabular format.

Table 3. Preliminary parameterization of the base case model for the 2020 stock assessment of north Pacific albacore. Parameterization implemented in2014 and 2017 stock assessment were also shown for comparison.

Parameter	2014 assessment	2017 assessment	Tentative value	Notes
Model period	1966 – 2009	1993 – 2015	1994 – 2018	Start year from 1966 will be developed and discussed at the stock assessment workshop
Stock structure	Single, well-mixed stock	Single, well-mixed stock	Single, well-mixed stock	
Natural mortality	0.3 yr^{-1} for all ages	Female age-0: 1.36 y^{-1} Female age-1: 0.56 y^{-1} Female age-2: 0.45 y^{-1} Female age-3+: 0.48 y^{-1} Male age-0: 1.36 y^{-1} Male age-1: 0.56 y^{-1} Male age-2: 0.45 y^{-1} Male age-3+: 0.39 y^{-1}	Female age-0: 1.36 y^{-1} Female age-1: 0.56 y^{-1} Female age-2: 0.45 y^{-1} Female age-3+: 0.48 y^{-1} Male age-0: 1.36 y^{-1} Male age-1: 0.56 y^{-1} Male age-2: 0.45 y^{-1} Male age-3+: 0.39 y^{-1}	Options for M prior
Growth	Sex-specific growth model Length at age 1 (L_1): CV=0.06 Female: 43.504 cm Male: 47.563 cm Asymtotic length (L_∞): CV=0.04 Female: 106.57 cm Male: 119.15 cm Growth rate (K): Female: 0.29763 yr^{-1} Male: 0.20769 yr^{-1}	Sex-specific growth model Length at age 1 (L_1): CV=0.06 Female: 43.504 cm Male: 47.563 cm Asymtotic length (L_∞): CV=0.04 Female: 106.57 cm Male: 119.15 cm Growth rate (K): Female: 0.29763 yr^{-1} Male: 0.20769 yr^{-1}	Sex-specific growth model Length at age 1 (L_1): CV=0.06 Female: 43.504 cm Male: 47.563 cm Asymtotic length (L_∞): CV=0.04 Female: 106.57 cm Male: 119.15 cm Growth rate (K): Female: 0.29763 yr^{-1} Male: 0.20769 yr^{-1}	
Stock-recruitment	Beverton-Holt, steepness = 0.9	Beverton-Holt, steepness = 0.9	Beverton-Holt, steepness = 0.9	Options for prior based on Brodziak et al. (2011)

Parameter	2014 assessment	2017 assessment	Tentative value	Notes
Maturity	50% at age-5, 100% at age-6	50% at age-5, 100% at age-6	50% at age-5, 100% at age-6	Ueyanagi (1957); Chen et al. (2016)
Fecundity	Proportional to spawning biomass	Proportional to spawning biomass	Proportional to spawning biomass	Ueyanagi (1957)
Spawning season	2	2	2	Ueyanagi(1957); Chen et al. (2010)
Length-weight	Seasonal length weight relationships	Seasonal length weight relationships	Seasonal length weight relationships	Watanabe et al. (2006)
CV of indices	Minimum CV of 0.2	Average CV of 0.2 only if CV is less than 0.2	Average CV of 0.2 only if CV is less than 0.2	
Size composition effective sample size	Based on number of trips for USA LL and EPO TR, other fleets are adjusted so that the average sample size is equivalent to USA LL and EPO TR. Further down-weighted by lambda of 0.01	Based on number of fish or sets sampled to the number of trips from an analysis of the US longline fisheries. Based on this analysis, we assumed that 17.7 fish per trip were sampled for the other fisheries. Size composition records with <3 sample sizes were considered unrepresentative and removed. The input sample sizes for each fishery were further rescaled by a multiplier so that the average input sample size for each fishery was approximately the same as for the US longline fisheries (~7) .	The WG tentatively agreed to the same approach as the 2017 assessment, but some modification may be necessary because of very low sample size of US longline fisheries recently. This will be discussed further at the stock assessment workshop.	

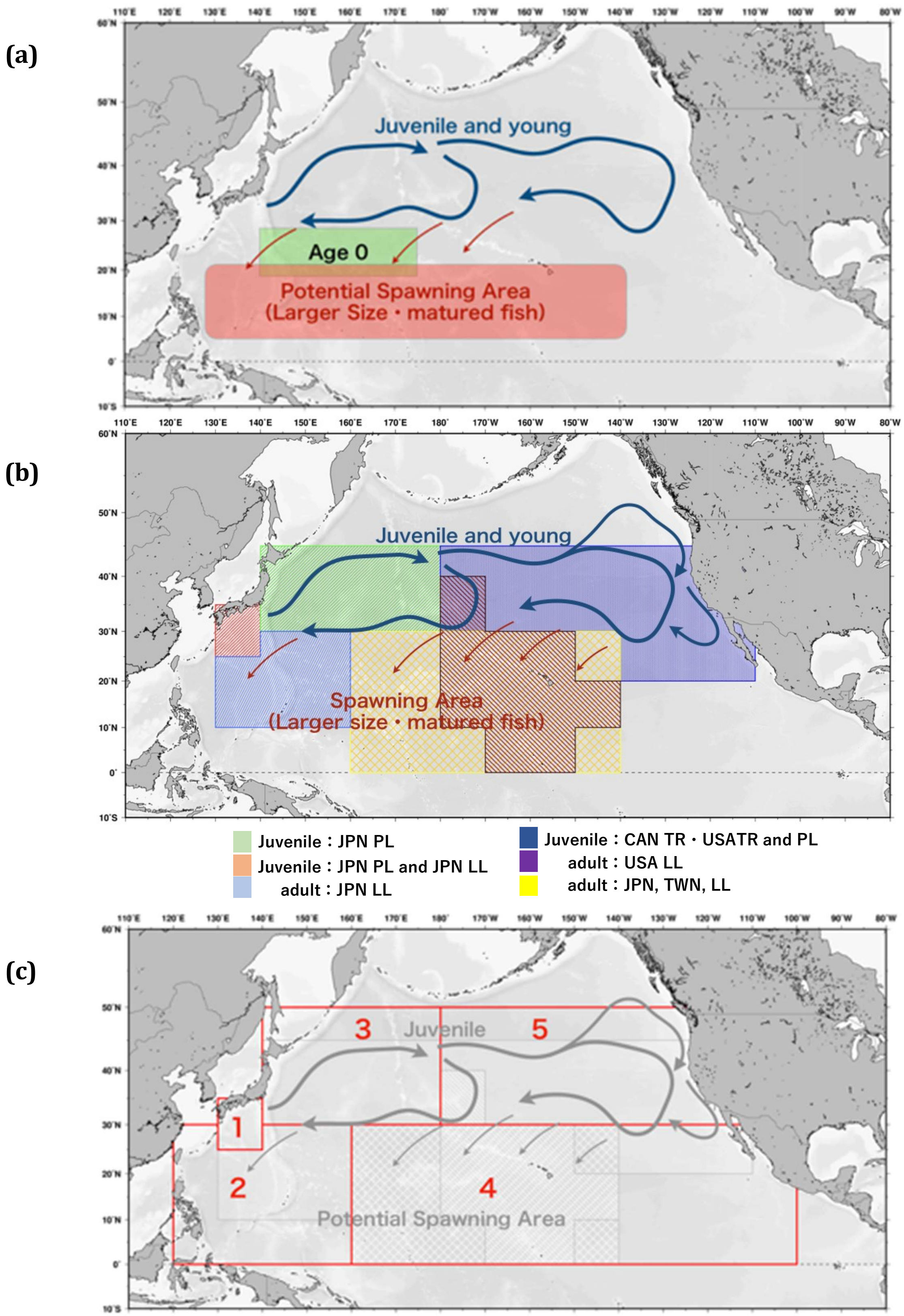

Figure 1. Schematic map of migration and potential spawning area (a) and fishing area by each country (b) and area definitions used for the 2017 north Pacific albacore stock assessment.

Attachment 1 - List of participants

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The Albcore Working Group - (Back: left to right) – Hidetada Kiyofuji, Akiko Aoki, Steve Teo, Takahiro Ijima, Chiee-Young Chen, Zane Zhang. (front: left to right) Ko Fujioka, Naoto Matsubara and Yoshinori Aoki. Ship behind the WG members is the R/V Shunyo-Maru of NRIFSF/FRA. This picture was taken on Nov. 15, 2019 just departing for 29 days skipjack and tuna research cruise in the subtropical area.

Attachment 2 - Meeting Agenda
ALBACORE WORKING GROUP (ALBWG)
INTERNATIONAL SCIENTIFIC COMMITTEE FOR TUNA AND TUNA-LIKE SPECIES IN THE NORTH PACIFIC OCEAN

DATA PREPARATORY WORKSHOP

12-18 November 2019
NRIFSF/FRA, Shimizu, JAPAN
Agenda

1. Opening of the Workshop
    - Welcoming Remarks
    - Chair's Remarks (context, objective, outputs)
    - Meeting Arrangements
    - Introductions

2. Meeting Logistics
    - Meeting Protocol
    - Review and Adoption of the Agenda
    - Distribution of documents and Working Paper Availability
    - Assignment of Rapporteurs
    - Group Photo

3. Review previous assessment in 2017 and Work Assignments
    - Fishery Definitions
    - CPUE indices

4. Input Data Review
    - Catch data
    - CPUE
    - Size composition

5. Review 2017 assessment model using updated datasets – looking at effects on data fit

6. Base case scenario: Assumptions and rationale
    - Model period
    - Structural assumptions
    - Biological parameters (M, growth form, maturity schedule)
    - Abundance Indices for fitting
    - Initial conditions

7. Diagnostic Analyses
    - R0 profiling
    - Residuals
    - Fits to indices, size composition data
    - Age Structured Production Model (ASPM) analysis
    - Retrospective
    - Jitter analysis

8. Sensitivity analyses
    - Natural mortality
    - Steepness of stock-recruitment relationship
    - Growth
    - Starting year

9. Future Projections
    - Review of projection software
    - Harvest Scenarios

10. Recommendations
    - Data format and submission deadlines
    - Invitation to Peer Reviewer
    - Research

11. Work plan and assignments for stock assessment workshop

12. Other matters
    - MSE Update

13. Clearing of Report

14. Adjournment

Attachment 3 - Working Papers and Presentations

Number	Title and Authors	Availability
ISC/19/ALBWG-02/01	Update standardized CPIE for North Pacific albacore caught by the Japanese Longline data from 1976 to 2018 Fujioka et al.	Public
ISC/19/ALBWG-02/02	Update standardized CPUE for North Pacific albacore caught by the Japanese pole and line data from 1972 to 2018 Matsubara et al.	Public
ISC/19/ALBWG-02/03	Updated North Pacific albacore catch by Japanese fisheries. Kiyofuji, H. and Ijima, H.	Public
ISC/19/ALBWG-02/04	Preliminary catch and size composition time series of the US and Mexico surface fishery for the 2020 north Pacific albacore tuna assessment Teo et al.	Public
ISC/19/ALBWG-02/05	Preliminary catch and size composition time series of the US pelagic longline fishery for the 2020 north Pacific albacore tuna assessment Teo et al.	Public
ISC/19/ALBWG-02/06	Summary of historical size data of North Pacific albacore caught by Japanese fisheries. Ohashi et al.	Public
ISC/19/ALBWG-02/07	Update of future projection program "SS future C++". Ijima, H.	Public
ISC/19/ALBWG-02/08	Otolith sampling of adult North Pacific albacore tuna (*Thunnus alalunga*) for precise age and growth estimation. Aoki, A. et al.	Public
ISC/19/ALBWG-02/09	Growth of juvenile albacore (*Thunnus alalunga*) based on increments in sagittal otolith. Tanaka, F. et al.	Public
ISC/19/ALBWG-02/10	Sex identification method in albacore using DNA markers Chiba et al.	Contact details
ISC/19/ALBWG-02/11	Update of albacore CPUE and length distribution of Taiwanese longline fishery in the North Pacific Ocean, 1995-2018 Chiee-Young Chen and Fei-Chi Cheng	Public
Presentation		
01	Review of Canadian albacore fishery Zaine, Z.	Contact details
02	A review of North Pacific Albacore Fisheries Data Reported by Non-ISC countries (Data were provided by SPC and IATTC) Kiyofuji, H.	Contact details
03	Overview of North Pacific Albacore Effort Data for the MSE Process Tommasi, D. and Teo, S.	Contact details
04	Environmental effects on the larval fish distribution on the Pacific Ocean: Using a geostatistical model. Ijima, H.	Contact details

Attachment 4 - Workplan

Date	Location	Task/Event
November 25 2019		Data format spreadsheet circulation by Teo, S.
December 20 2019		Data submission Deadline
January 10 2020		Finalized Data and circulate WG members
January 31 2020		Documentation deadline for additional and supporting information (WP01 and WP07)
March 16 – 23 2020	La Jolla, CA, USA	ALBWG: stock assessment
May 11 – 15 2020	La Jolla, CA, USA	IATTC SAC
July 15 – 20 2020	TBD, USA	ISC20
August 11 – 20 2020	Apia, Samoa	SC16
September, 2020	Japan	NC16
Late 2020 or early 2021	TBD	ALBWG: review results from 2nd round of MSE 5th ISC MSE workshop