FINAL

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ANNEX 06

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 PACIFIC BLUEFIN WORKING GROUP DATA PREPARATION WORKSHOP, NOVEMBER 18-23, 2019

July 2020

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REPORT OF THE PACIFIC BLUEFIN TUNA WORKING GROUP INTERSESSIONAL WORKSHOP

International Scientific Committee for Tuna and Tuna-Like Species In the North Pacific Ocean (ISC)

November 18-23, 2019
South West Fisheries Science Center, NOAA
La Jolla, USA

1. Opening and Introduction

1.1 Welcome and introduction

S. Nakatsuka (Japan), Chair of the ISC Pacific bluefin tuna Working Group (PBFWG), welcomed the participants and opened the meeting. The PBFWG has been tasked with completing a benchmark stock assessment of PBF in 2020. The present meeting is the data-preparatory meeting, whose main objectives are: 1) to review the progress of tasks identified in March 2019 meeting (Appendix 5 of PBFWG report), 2) to agree on basic approach to the benchmark assessment, and 3) to develop workplan towards the benchmark assessment.

1.2 Adoption of agenda

The adopted agenda is attached as Appendix 1 and a list of participants is provided in Appendix 2. A list of documents reviewed during the meeting is provided in Appendix 3.

1.3 Appointment of rapporteurs

Rapporteurs were assigned by the Chair as follows: Item 2: H. Fukuda, Y. Tsukahara, and K. Nishikawa, Item 3: M. Maunder, Item 4: K. Piner, Item 5: K. Piner, Item 6: H. Fukuda, Item 8: M. Dreyfus.

2. Catch and Size Data

2.1 Catch Time Series

It was reconfirmed that the 2020 assessment will incorporate data through FY 2018, ending in June 2019. Members are requested to provide catch information in accordance with the units used in the assessment by the deadline (end of 2019) to the data manager of PBFWG (H. Fukuda).

2.2 Japanese Longline (F1)

Estimation of catch-at-length of Pacific bluefin tuna caught by Japanese coastal longliners: Update up to 2018 fishing year (ISC/19/PBFWG-2/01) presented by Y. Tsukahara

Y. Tsukahara presented the updated the catch-at-length of PBF caught by Japanese coastal longliners up to 2019 (2018 fishing year). The estimated catch-at-length in 4th fishing quarter (Fqt) 2018 showed the catch has been constituted by some strong cohorts for larger PBF and some moderate modes for smaller PBF. In accordance with the increasing catch amount in 3rd Fqt, catch-at-length at that quarter was also estimated. The comparison of the catch-at-length in 3rd Fqt with that in 4th quarter indicated the difference that the relatively smaller PBF was caught mainly at eastern area of Japan in 3rd Fqt. The difference in CAS has been remarkable since 2017 FY, therefore there would be two options to deal with this problem. First one is separating the data in Fqt. 3 from Japanese longline fleet, Fleet 1, and defining new fleet for Japanese longline in Fqt. 3. The other option is assuming time block selectivity for Fleet 1 before and after around 2017 FY and estimating combined CAS in Fqt. 3 and 4.

Discussion:
WG agreed to the modified method to estimate the catch at size, which assumes the coverage of 100 % in case the total weight of measured fish exceeded the total landing in the same port.

The WG member noted that the selectivity of Fleet 1 during 1993 to 2018 was estimated from the size composition data of season 4 since other seasons catch amount was considerably small in the previous assessment. However, the catch in season 3 became significant in the last couple of years. The WG made request for verifying season 3 size data quality and coverage. After checking season 3 data, the WG member noted that a new fleet for season 3 could be created to account for smaller size catch than the other season. The WG also acknowledged that catch in season 3 exceeds 100 tons only in 2018. Fitting the size data in the new fleet will increase the number of estimate parameter. **The WG requested Japan to prepare size composition data separately for season 3 and for the other seasons and agreed to decide whether they should be separated or combined after further investigating the cost and benefit before the March meeting.**

2.3 Japanese Small Pelagic Purse Seine (Season 1, 3, 4) (F2)
Estimation of the PBF length-composition for the Japanese purse seine with new data collected at young PBF farming operation using stereoscopic camera (ISC/19/PBFWG-2/02) presented by H. Fukuda
He reviewed the recent development of the farming operation by the Japanese Small Pelagic Fish Purse Seine fleet (JSPF-PS) and the data collecting system for this new fishery. His presentation mentioned several points as listed here; 1, Catch in weight by this fishery was calculated based on the catch in number of fish, which was counted for every farming operation, and average weight of individual fish, which was estimated using stereoscopic camera; 2, If the catch in number of fish were available, it would be better to use that information for the stock assessment rather than using the calculated catch in weight from the number and weight of fish; 3, The accuracy tests for the length measurement indicated that the measurements were enough accurate to use for the stock assessment purpose; 4, Size measurement using stereoscopic camera were conducted in the most of farming operations by the purse seine and farming industries and those could be available for the stock assessment; 5, Estimated size composition for the JSPF-PS farming operation was similar with the JSPF-PS market landing operation. He concluded that since the measurement system was validated, using the number of fish caught and length measurement data using stereoscopic camera can contribute to the improvement of the next stock assessment.

Discussion:
It was noted that size composition data for farming operation and fresh market were similar. **The WG agreed to split fleet 2 into 2 fleets, one is the for fresh market, whose catch amount is reported by weight, and the other is for farming operation, whose catch amount is reported by number.** However, those new 2 fleets could have combined composition data and shared

selectivity so that the model complexity is not increased.

2.4 Korean Offshore Large-Scale Purse Seine (F3)
Update of Korean fisheries information for Pacific bluefin tuna, Thunnus orientalis (ISC/19/PBFWG-2/03) presented by MK. Lee
The catch of Pacific bluefin tuna in 2018 and 2019 are 535 ton and 567 ton respectively caught by offshore large purse seine, trawl and set-net fisheries in the Korean water, and catch by set-net fishery has been increasing in recent years. Most PBF were caught around Jeju island during the first quarter, and some of PBF were caught by set-net, which are located along the east coast all the seasons of the year. The mean length and predominant range of PBF are gradually increasing.

Discussion:
It was clarified that catch in fisheries other than purse seine, i.e. set-net and trawl, is included in Korean catch in the current assessment. As the catch by set-net, which seemingly has different size selectivity than purse seine, is increasing in recent years, it may need to be separated from the fleet in future assessment. WG member asked data availability and resolution of the set-net data. It was clarified that data were collected since 2013 FY and could be aggregated by the quarter.

As to the selectivity for the fleet, in the assessment it currently shares the selectivity with Japanese purse seine (F2), which is created using data from both fleets. It was clarified that Korean purse seine fishery mainly operate in February and March, and it might be the cause of difference in size composition by Japanese purse seine, which operates in similar fishing ground but in different season. It may be the timing for considering whether size composition data of this Fleet should be independent from Fleet 2. After reviewing the updated size composition data from Korea, **the WG agreed to separate size composition for Japanese and Korean purse seine and see the implications.**

2.5 Japanese Tuna Purse Seine Fisheries in the Sea of Japan (F4)
It was agreed to take the same approach used in the previous assessment.

2.6 Japanese Purse seine off the Pacific coast of Japan (F5)
Estimation of the PBF length-composition for the Japanese purse seine operating in the Pacific side ((ISC/19/PBFWG-2/05) presented by H. Fukuda
He reviewed the domestic management of the ministry registered purse seine fishery in Japan and the change in the size selectivity of the Japanese Tuna Purse Seine operating the Pacific Ocean (JTPS-PO) fleet due to the management change. His presentation mentioned several points as listed here; 1, The size selectivity of JTPS-PO fleet was changed to the only large size PBF fishery due to the domestic quota allocation since 2011, where they had caught wider size of PBF from age 1and older; 2, The size sampling has been conducted in high coverage since 2015; 3, Estimated size composition for this fishery indicated distinct selectivity change before and after the introduction of the new management; 4, There also were annual variation in the size composition data after 2015 due to the possible change in the local availability and/or reflection of the age structure. The author recommended to use the size composition data of this fishery and to assume the selectivity change in 2011 in the next assessment.

Discussion:
It was clarified that the selectivity of this fleet was estimated in time varying manner for the years when reliable size data were available (1995-2006FY), and selectivity in the recent years, when reliable size data were not available, is assumed as similar shape with the data available years. The authors suggested that the catch and size composition data after 2011 FY can be estimated using recent period when more reliable data is available (2014-) in the next stock assessment. **The WG agreed to implement the author's recommendation.**

2.7 Japanese Troll (Season 2-4) (F6)
It was agreed to take the same approach used in the previous assessment.

2.8 Japanese Pole & Line (F7)
It was agreed to take the same approach used in the previous assessment.

2.9 Japanese Set Net (Season 1-3) (F8)
It was agreed to take the same approach used in the previous assessment.

2.10 Japanese Set Net (Season 4) (F9)
It was agreed to take the same approach used in the previous assessment.

2.11 Japanese Set Net (Hokkaido and Aomori) (F10)
It was agreed to take the same approach used in the previous assessment.

2.12 Japanese Other Fishery (F11)
It was agreed to take the same approach used in the previous assessment.

2.13 Taiwanese Longline South Fishing Ground (F12)
The WG was informed that it is observed that some strong cohorts coming in both north and south fishing grounds and the average size in the south became smaller than that in the north in recent years. **It was agreed to take the same approach used in the previous assessment for size composition data.**

2.14 Eastern Pacific Ocean Commercial Purse Seine (1952-2001) (F13)
It was agreed to take the same approach used in the previous assessment.

2.15 Eastern Pacific Ocean Commercial Purse Seine (2002-) (F14)
M. Dreyfus presented the following. In relation to catch and size data, there are no changes detected, so Mexico will provide 2018 and 2019 catch and size composition as in previous assessment. The methodology for estimating size composition has been discussed in PBFWG and there are documents in the ISC web page explaining the method used. The only issue to discuss is that in 2019, there was a release of 245 tons of PBF from pens weeks after they were caught. Although an over catch of PBF in 2018 by Mexico was already compensated, reducing 2019-2020 biannual quota, the Mexican government decided to take measures with the company involved in the over catch. That is the reason of the release and we should not consider those 245 tons as part of the catch of Mexico. Size composition in that case will not include size data from this release.

Discussion:

The WG member asked how to estimate the amount of released fish in 2019. It was clarified that the fish are released only after 2 weeks of caging and the amount would be estimated by the data obtained by stereoscopic camera. It was noted that the treatment of the released fish for the stock assessment will be determined independently from management decision. **The WG agreed to deduct the amount of fish released in 2019 from the recorded catch in 2019 in the assessment.** It was also mentioned that excluding the size composition of released fish from the whole size composition would be desirable if it is technically possible. It was clarified that the size composition of released fish not be included in the catch composition of Mexico.

2.16 Eastern Pacific Ocean Sports Fishery (F15)

Updated size composition data from the San Diego Commercial Passenger Fishing Vessel (CPFV) recreational fishery for Fleet 15: Eastern Pacific Ocean Sport Fisheries, 2014-2019 (ISC/19/PBFWG-2/06) presented by L. Heberer

The size composition data collected by the National Oceanic and Atmospheric Administration (NOAA) Pacific Bluefin Tuna Port Sampling Program is considered the best available data to represent the PBF caught recreationally in the Eastern Pacific Ocean Sport Fishery, Fleet 15, included in the ISC stock assessment (Lee et al., 2015). Due to inconsistent sampling prior to 2014 and a short time series after 2014, the size composition data for Fleet 15 have not been used to inform the fleet selectivity in previous stock assessments. This paper updates the size composition data representative of Fleet 15 by providing results from July 2014 to October 2019.

Discussion:

It was pointed out that the coverage of this fleet was not based on the number of trips but the number of measured fish. It was also pointed out the individual size within each trip could be autocorrelated. **The WG agreed to use size composition as provided.**

Updates to catch estimates from the U.S. recreational fishery from 2014 to 2017 (ISC/19/PBFWG-2/07) presented by J. Childers

Discussion:

The WG noted the revised catch data from the USA.

2.17 Japanese Troll for Penning (F16)

It was agreed to take the same approach used in the previous assessment.

2.18 Taiwanese Longline North Fishing Ground (F17)

It was agreed to take the same approach used in the previous assessment.

2.19 Japanese Small Pelagic Purse Seine (Season 2) (F18)

It was agreed to take the same approach used in the previous assessment.

2.20 Japanese Troll (Season 1) (F19)

It was agreed to take the same approach used in the previous assessment.

2.21 Others

The WG developed a table summarizing the data treatment of the fleets (Appendix 4).

3. CPUE

3.1 Japanese Troll Fishery

Updated standardized CPUE for 0-age Pacific bluefin tuna caught by Japanese troll fisheries: Updated up to 2018 fishing year (ISC/19/PBFWG-2/08) presented by K. Nishikawa

To estimate the recruitment abundance index for Pacific bluefin tuna, Japanese troll CPUE in the East China Sea (coastal waters of western Kyushu) was standardized for the period of 1980-2018 fishing year (S4). Generalized liner model (GLM) with lognormal error distribution was applied for the standardization, which was exactly the same method as agreed in the previous workshop. The "best model" was exactly the same model as used in the previous model. The standardized CPUE in FY2018 fishing year was lower than one in FY2017 and lower than the historical average. However, efforts became small and FY2017 has wider CV than previous years. As residual pattern showed, the values of CPUE after fishery management introduction might be biased. It is necessary to do further investigation of recruitment index for stock assessment

Discussion:

The number of landing ports from where data is available as well as data were less in FY 2017, increasing the CV. When fit in the model a constant standard deviation is used and the year specific uncertainty in the index is not taken into consideration. Recent management measures may be compromising the index. It was also noted that the index of recruitment monitoring shows a different trend to the this index (see 3.4).

This index (S4) is proven to be a good indicator of recruitment because when incorporated in the assessment it predicts the longline index of spawned abundance. However, it will not be for a few years before it is known if the 2017 (and other recent) recruitment is high or low when the cohort reaches the age represented by other data in the model. The WG decided to consider the recruitment index to be used in the model after reviewing the results of recruitment monitoring index (3.4 below).

3.4 Japanese Recruitment Monitoring Index

Real-time recruitment monitoring for Pacific bluefin tuna using CPUE for troll vessels: Update up to 2018 fishing year (ISC/19/PBFWG-2/12) presented by Y. Tsukahara

Y. Tsukahara presented a real-time monitoring of the CPUE from troll fisheries for strengthening the recruitment monitoring to comprehend the trend of most recent recruitment of Pacific bluefin tuna in a timely manner. The updated results were shown up to 2018 fishing year in East China Sea and up to 2019 fishing year in Pacific side. The result in East China Sea showed that the level of recruitment in 2018 fishing year was less than that in 2017 but were higher than historical averages. The result in Pacific showed the levels of recruitment in 2019 fishing year was higher than that in 2018 fishing year and point estimation was the highest level throughout the period of this survey. These results were published on the Japan Fisheries Agency's website in a timely manner.

Discussion:

This index is based on the same fishery as the troll CPUE recruitment index (S4) except it is using real-time monitoring from vessels rather than relying on sales slips. However, the data is based on fewer vessels participating in the programme. Due to the use of the real-time monitoring equipment it may not have the issues with the missing information in data collection. The 3rd report, which describes the winter season, is used as index of recruitment from both spawning areas. The troll fishery index of recruitment (S4) is for the whole season from the same fishing ground.

The trend of recruitment monitoring index since 2016 is different from S4. There is larger uncertainty in the 2017 value for S4 based on sales slip because data from two out of five ports was not available. Also, after 23rd January fishing stopped in FY 2017 due to management limits so there was no fishing in the main fishing season. It is not clear why data could not be collected from the two ports for recruitment index, but these ports changed the data collection system. Data from these ports was collected in FY 2018 so it was only an issue for 2017. One participant asked whether fishermen from a given port fish in a different fishing ground than those from other ports. This is partly, but not completely true.

The group needed to decide which index for recruitment to include in the assessment model and how to deal with the data from 2017. The two indices are based on the same fishery, so they should not both be included in the assessment model. The real-time monitoring data include one more year (FY2019), but not other data for this year will be included in the assessment model. Therefore, the data from the additional year does not improve the assessment results. However, it could be useful for improving the projections by providing information on the recent recruitment. The monitoring data could also be used to determine if the recent recruitment is low, medium or high, with measure of confidence. The recruitment estimate from the sales slip (S4) for 2018 recruitment is lower than average so would be conservative than using average recruitment (but it may be higher than the low recruitment scenario).

Several approaches could be used to deal with the missing data from the troll fishery recruitment index for 2017. For example, the ports missing from 2017 could be eliminated from the whole series and the analysis rerun. However, this might eliminate too much data. It was considered better to simply exclude the 2017 recruitment index value from the fit in the assessment model. To ensure that the 2017 data dose not bias the results it should also be removed from the CPUE standardization procedure. **The WG reviewed the recruitment index based on sales slip (S4) without 2017 data and agreed to incorporate it in the next assessment. It also agreed to incorporate recruitment monitoring indices to the model, without fitting, to evaluate their performance, including for the possible use in future projection.**

3.2 Japanese Longline Fishery

Japanese coastal longline CPUE for Pacific bluefin tuna: Preliminary update up to 2018 fishing year (ISC/19/PBFWG-2/09) presented by Y. Tsukahara

The CPUE was standardized by the best model based on Bayesian Information Criteria using the updated dataset until June 2019 in the same procedure used for the previous stock assessments in February 2016 and March 2018. The data in the periods of suspensions on catch for PBF in the last two years during main fishing season due to fishery management for Pacific bluefin tuna in Japan was removed from dataset for standardization, which was called "ad-hoc method". This index showed continuous increase from 2011 fishing year. The CPUE standardized by the removed dataset would be representative for the abundance index of adult PBFs because of the smoothness of recent trend and the fit to historical values, although this approach had some issues caused by difference of main fishing season by area.

Discussion:

In FY 2017 and 2018 the fishery was suspended for some periods. However, the suspensions were for different periods each year. The impact of the suspension is in the core area where operation concentrated on relatively large fish in past years. The spatial distribution of catch has changed in recent years between suspension and non-suspension periods. This has compromised the index and an ad-hoc method was used that dropped the data during the suspension periods. Recent index values are higher using the ad-hoc method and the 2017 estimate is more consistent with adjacent years.

It was suggested that the 2017 data when operation was interfered be left out of the troll fishery recruitment index and the same could be done for the longline index. The longline CPUE is an index of spawning biomass. This differs from leaving out recent data from the recruitment index for which there is no additional data on the cohort strength. Therefore, WG considered leaving out additional recent years of data which are more uncertain. It was also noted that the composition data might be compromised for these years. The 2017 length composition data was calculated using the standard and the ad-hoc methods. There was less bigger fish using the ad-hoc method and this is considered due to the reduction of catch in the core area. This suggests that the CPUE may be representative of different size classes throughout the year and management may change the effective selectivity. This also indicates that composition and selectivity should be different for the index and catch. However, this may be less of a problem if the data for the most recent years is dropped. One option is to have time block in selectivity and drop CPUE for those years so catch is taken out at the right size. This discussion continued after the presentation of the spatio-temporal model (see below).

Preliminary result of spatial and temporal modelling for Bluefin tuna caught by Japanese coastal longline (ISC/19/PBFWG-2/10) presented by Y. Tsukahara

The CPUE predicted by spatiotemporal model were compared with that estimated by traditional GLM. Although accumulative absolute deviation in stock assessment model of abundance index predicted by spatiotemporal model was slightly worse than that by traditional GLM, the both trends showed similar trends.

Discussion:

The catch at length differs by area. However, most of the port sampling of length measurements are not linked to the trip and therefore location of catch is not available though more recent length measurements have information about location. As an alternative the total catch by set was considered. Data in both weight and number is available and can be used to calculate average weight, but many observations with zero catch by weight category and strata impeded the analysis. Therefore, the average weight was not used and the analysis was conducted just using the CPUE data.

The spatial temporal model also did not include data during the suspension period, but filled in these time periods using the spatio-temporal correlation. Therefore, it is considered more appropriate than the ad-hoc method. The results were similar between the spatio-temporal model and the ad-hoc method.

It was noted that the IATTC aggregates its data by spatial cell to remove zeros. However, even if the Japanese longline bluefin data is aggregated by spatial temporal cell and 20kg strata, there are still many zeros. Even with zeros the IATTC gets model converge. The IATTC uses the same effort for each length bin and this approach may work for the bluefin analysis and should be considered.

The advantage of the spatio-temporal approach is to impute the missing space and time cells, and providing different length compositions for the index and the catch. However, the current analysis only deals with the former and since the result is similar to the ad-hoc approach, it is less important which method is used. The spatio-temporal length composition work should be continued, but not for the assessment as it is too preliminary to be considered.

There are several alternatives when including the index in the stock assessment with respect to the 2017 and 2018 data. It was noted that spatio-temporal model solves the recent spatial-temporal issues caused by the introduction of management measures, and therefore **it was agreed the index from the spatio-temporal model should be used for the assessment. However, since the composition data is compromised it should not be used and for 2017 and 2018 size composition from earlier years should be applied.** It was noted that the spatial temporal model could be revised for the March working group meeting using updated data, new filtering methods, etc.

3.3 Taiwanese Longline Fishery

Standardized index of relative abundance of Taiwanese PBF fisheries based on traditional and spatiotemporal delta-generalized linear mixed models (ISC/19/PBFWG-2/11) presented by SK. Chang

The PBF CPUE series was standardized using vector-auto-regressive spatiotemporal model (VAST) with shorter time period (since 2007) due to the availability of geolocation information, to derive the abundance index without excluding information from the northern fishing ground (geostat model). The same series was also standardized using traditional delta-generalized linear mix model (non-geostat model). Altogether five models were designed in this study: the base model (model-1) is applying geostat model on core-area, with vessel effect and using 50 knots in the procedure; model-2, 3, and 4 are similar to model-1 with considerations of different spatial coverage of the data, without the effect of vessel on catchability, and different numbers of knots in the procedures; the last one (model-5) is using non-geostat model as previous years but on core-area only. The results suggested that the geostat model is not sensitive to the effect of vessel and the number of knots but is sensitive to the spatial coverage of the data. Generally, resulted standardized CPUE series from the five models showed similar trend that the relative CPUE declined continuously from 2007 to 2012 and started to increase slowly thereafter. However, the Model-1 (geostat model) index suggests a slightly more pessimistic population trend than the Model-5 (non-geostat model) index (higher initial values and lower terminal values in the Model-1 index). For the size of fish, the size of the south fishing ground was similar to the north in early years, became larger than the north during 2009-2016, and then became smaller in 2018 and 2019.

Discussion:

The location information in the catch and effort data for CPUE analyses is only by trip, so the mode of location during the trip was used. On a trip the vessel may have caught bluefin, but most of their fishing occurred in an area where bluefin is not usually caught. Therefore, trips with locations outside the core area may not be appropriate to use in the spatiotemporal analysis. There is only 7% of the bluefin catch assign to trips with the mode location outside the core area.

All the models including both spatial and non-spatial models produce similar results. The vessel effect and number of knots did not make much difference. The spatial models included data for both the northern and southern areas and the index was for the whole area. The index for the southern area was only presented for the non-spatial models. The northern index for the non-spatial models had large fluctuations and no data in some years. The separation of the areas in the non-spatial model was supported by AIC tests. The non-spatial whole area southern model was similar to the southern core area.

Use of the spatio-temporal model for the whole area avoids the need to split the area into North and South in the model. However, since the length composition data differs between the two areas, it might be more appropriate to split the data into north and south so that the index is more consistent with the length composition data. Particularly, since the length composition data is raised by the catch and not the spatial-explicit CPUE

The data before 2007 is only available by port so the spatial temporal model can not be used on this data. It is considered that the port is a good indication of fishing in the north or the south in the early years. Since the spatial and non-spatial indices are similar for the overlapping period, it might be better to use the non-spatial model to extend the number of years of data. An alternative is to use the spatial model for 2007 onwards, and the non-spatial model for earlier years. However, this would break the time series with different estimated catchabilities, which reduces the information content. The 2002 index value is very low and may indicate a bias. A review of the data shows that the data of 2001 and 2002 have the lowest data representativeness (20~40%) during the whole period in terms of the proportion of the catches in the catch/effort data for analyses to the annual total catch. Also, the quality of the trip information to construct the effort data (fishing days) for the two years was concerned. Therefore, the two years data of 2001 and 2002 are suggested to be removed from the standardization analyses.

The WG agreed to use GLM non-spatial index excluding the 2001 and 2002 data because the data for these years are considered less reliable. In doing so, the authors are requested to re-standardize the index without data from 2001 and 2002 using data from whole south area. The stock assessment will continue to have fleets for the northern and southern areas and the index will be associated with the southern fishery. This is to ensure that the index is more consistent with the composition data used. The reason to use the non-spatial model over the spatial-temporal model is because they estimate similar indices and it is more important to include the earlier years in the assessment. It was also noted that Chinese Taipei is not constrained by its quota, so management is not causing the same issues as Japan with respect to the spatio-temporal distribution of catch, which is better addressed using the spatio-temporal model. The non-spatial model should be based on the whole southern area as in the previous assessment because the earlier areas do not have location information and use port information to determine location, and this can not be used to determine if the catch was from the core area.

In the spatio-temporal model, it was recommended to use the data for all the core area but only extract the index from the southern area. This allows data near the boundary in the northern area to inform the cells in the southern area, and is appropriate when there are gradual changes in CPUE and length composition spatially. However, the northern area will also inform the spatial temporal correlation, which is assumed to be constant over space and time. Therefore, the results should be compared with just using the data in the south core area. After reviewing the results, it was found that the results are almost the same. **The WG requested authors to produce two spatio-temporal CPUEs, both using spatio-temporal data filled using correlation in core area with one extracting data from the south area and the other from the north area, and incorporate them in the assessment but not included in the likelihood function used to fit the data, so they can be evaluated since they may be used in the future.** Inclusion of length composition data into the satio-temporal model should be further investigated so that the composition for the index and the catch can be separated and when this is conducted might be a good time to change over to use the spatio-temporal model.

3.5 Others

Updated standardized CPUE by Korean PS (ISC/19/PBFWG-2/13) presented by SI. Lee

In this study we standardized Pacific bluefin tuna (PBF) CPUE from Korean offshore large purse seine fishery (2004-2018) using Generalized Linear Models (GLMs). The data used for the GLMs were vessel id, fishing date, location (1° cell), effort (no. of hauls), and catch (weight) by species from Korean offshore large purse seine fishery. The cluster approach was applied to separate effort into groups that may have targeted PBF, and then included the categorical cluster variable in the standardization model. The CPUE was standardized using lognormal constant and delta lognormal approaches, and the estimates from delta lognormal are chosen as the indices. The standardized CPUEs had a large fluctuation through time, and are showing an increasing trend in 2017 and 2018.

Discussion:

The WG is still deciding if the length composition is fit and the selectivity estimated for this fleet (see also 2.4). If the CPUE index of abundance is used this should be done. **At this moment the WG considered it is appropriate that the CPUE could be included in the model not to include to likelihood function but simply to see how well it fits.** Specifying or estimating selectivity is an issue because Korean purse seine vessels have caught small fish and large fish in recent years.

Other matter

The WG compiled a summary table of CPUE to be included in the assessment, both to be fit and not to be fit, with brief description (Appendix 5).

It was suggested that a new section should be added to the assessment report on evaluation of potential data sets to use in future assessments.

4. Biological Information

4.1 Growth Function

Estimates of growth functions from age at length data based on otolith annual rings and daily rings for pacific Bluefin tuna (ISC/19/PBFWG-2/14) presented by H. Fukuda

He showed two age-length relationships of PBF in the functional forms based on the

Richards growth function (RGF) and von Bertalanffy growth function (VBGF). Both growth function showed similarity in the length at age from 0 to 8, but VBGF showed better fit to the length at older age. Estimated VBGF with new observation data were almost identical with the currently used VBGF in the stock assessment. Based on those things the author recommended to maintain currently used VBGF in the next stock assessment.

Discussion:

The WG questioned if the poor performance of the Richards growth model was due to the influence of the smallest fish. It was suggested that the effect of the small fish could be evaluated by dropping those fish out of the analysis. Although the Richards growth model performed poorly in this study, the WG recommends continuing the search for a more flexible growth model option. Fitting length composition associated with age-0 continues to be an issue in the stock assessment. This problem for age-0 sizes is due in part to the overly simple assumption of recruitment timing. It was clarified that Stoc Synthesis (SS.) v3.30 allows flexible timing to both recruitment (settlement) and fishery catches which may help the age-0 size composition fit. The issue of fitting age-0 lengths is important when catches are recorded as weight because it influences estimating removal numbers correctly. It was suggested that we can potentially consider using age-based selection and catches in numbers (estimate them outside the model) to deal with this problem. **The WG recommends continued use of the length-at-age parameters used in the prior stock assessment. The WG further recommends investigating methods to better fit the age-0 size composition. Finally, the WG recommends that process variation associated with the length-at-age relationship be evaluated in concert with development of the assessment model.**

4.2 Length-Weight Relationship

K. Nishikawa presented the results of analysis of length-weight relationship. Nominal L-W relationship and Standardized L-W relationship were estimated by the data collected by Korea, Chinese Taipei and Japan. The allometric model ($W = a*L^b$) were used for estimating both L-W relationship. Nominal L-W using whole fish by categories were estimated at first to consider about which parameter affects artificial and environmental biases. Parameter a was seemed to affect biases, thus GLM with lognormal error distribution was applied for parameter a. And gutted fish data were included to standardized L-W relationship to increase a number of data for large fish. Comparison of the standardized L-W relationship to previous one demonstrated little difference.

Discussion:

Nominal analysis of entire samples of whole fish showed similar results with Kai (2007) but results varies depending on the stratification. Also, according to the standardization results, the convergent factor of gutted fish to whole fish was estimated to be 1.59, which was considered inconceivable. The WG noted that model fit not as good for large fish as small. Authors clarified this is due to the much larger sample size for smaller fish. The working group provided some alternatives to better represent larger fish in the model (e.g. reducing the number of observations of smaller fish or weighting of observations). The author reminded the WG that the previous length-weight relationship (Kai 2007) also had poor predictions of weights of large fishes. It was discussed that if we can't fit the observed weights for all length bins well, it is better to get the relationship right for the size of fish taken by fisheries that catch large amounts measured in weight, i.e. small fish. It was also discussed that weights in the assessment model are whole weight, some of which were converted from gutted weight, thus the assessment will need a relationship that is length to whole weight. After further reviewing results of additional analysis, it was found that the updated L-W relationship using both whole fish and gutted fish looks very similar to the Kai (2007) L-W relationship. **The WG recommends continuing to use the Kai (2007) L-W relationship for the sake of continuity while research continue on L-W relationship on the cause of variation of L-W relationship depending on various data stratification.**

4.3 Natural Mortality

There is no new information on natural mortality (M). The WG noted that current age-based M is similar philosophically to the Lorenzen methods that decrease M with increasing fish size. It was further noted that the assessment model can estimate M and this could be included as a sensitivity run. However, lacking any new information, **the WG recommends using the previous age-specific M values with appropriate sensitivity tests** because it facilitates the comparison of new results to previous assessment results.

4.4 Maturity

Histological Evaluation of Gonads from Large Pacific Bluefin Tuna Captured in the Eastern Pacific Ocean during 2015-2019 (ISC/19/PBFWG-2/15) presented by O. Snodgrass

Due to speculation in recent years by some commercial and recreational fisherman, as well as scientists, that large Pacific bluefin tuna (PBF) may be spawning in the Southern California Bight (SCB), a study was undertaken to evaluate whether there was any scientific evidence to support that assumption. A total of 64 gonads were collected from PBF ranging in size from 125-188 cm (3-8 years old) for females and 142-183 cm (4-8 years old) for males, which were captured in the SCB between 2015-2019. Histological analyses of the ovaries revealed that all individuals were immature with no evidence of spawning activity. The fact that there was no evidence found in this study from the histological evaluations of PBF ovaries for spawning of PBF in the SCB was not unexpected for a number of reasons. The principal reason is because PBF are a highly migratory species and even though some individuals undertake trans-Pacific migrations for feeding in the eastern Pacific, spawning is confined to a very restricted time-area strata in the western North Pacific (Schaefer, 2001). Secondarily, if PBF spawning ever occurred in the SCB it is highly probable it would have been detected in the extensive time-series of larval fish collections by CalCOFI (Gallo et al, 2019 and SWFSC unpublished data). Additionally the waters of the ENPO may not be optimal for PBF larval growth and survival.

Discussion:

The WG noted that temperatures in the areas of the EPO sampled are not as high as spawning areas in the WPO. It was questioned if spawning fish in the EPO might be expected in more southernly areas than sampled. The authors clarified that although their samples were not taken from southern areas off Mexico, relatively few large fish are found in that region. The WG also noted that this study found that smaller fish were predominantly female and larger fish predominantly male. Although the authors agreed, the study was not designed to estimate size-specific sex ratio. The WG questioned if the authors found seasonal differences in maturity or gonad size. Authors clarified that they did not document seasonal differences in gonad size or vascularization. **The WG concluded that there is no evidence of a separate spawning ground in the EPO**.

4.5 Stock-Recruitment Relationship

There is no new biological information on the SRR.

4.6 Others
No discussion.

5. Model Setting
5.1 Follow up Model Setting in the 2016 Stock Assessment and Available Options (Appendix 5 of PBFWG Meeting Report in March 2019).
A closer look at the 2018 stock assessment model for Pacific bluefin tuna (ISC/19/PBFWG-2/16) presented by HH. Lee
This working paper provides potential areas of improvement for the 2018 Pacific bluefin tuna stock assessment model. The 2018 assessment model was revisited, and an alternative model or approach is recommended for each aspect as follows: 1) improved fit to size composition data for two age-0 fleets by using less constrained selectivity parameterization for these fleets, 2) use of the US recreational length compositions to account for the increased number of size classes in the data observed since 2014 in the eastern Pacific Ocean, 3) relaxation of the assumption of asymptotic selectivity, 4) simplified selectivity parameterization to reduce the number of estimated parameters, 5) convergence issue with the steepness, and 6) transition of the 2018 assessment model to Stock Synthesis 3.30. Given the complexity of the parametrization, we evaluated each alternative model as one-off changed from the 2018 stock assessment model. Also, there could be other alternatives within each aspect that were not explored in the paper.

Discussion:
The WG noted that given the complexity of the model, random perturbations of parameter values (jitter) and phase order is needed to investigate model convergence. In addition, the assumption that the recruitment deviation vector sums to zero may be influential. The WG considers investigations into the influence of this constraint a lower priority issue because model results appear robust to this issue. In response to a question the authors also clarified that previous assessment used the Methot and Taylor approach to setting the SS parameters for SRR.

The WG noted this study improved fits to composition with the small changes in selectivity. **Therefore, the WG agrees to evaluate the parameterization of selectivity for all fleets, but will leave this investigation to small modelling group.**

WG noted that previously assumed selection pattern for US Sport fleet is inconsistent with the observed lengths. **The WG agrees to use the US recreational sampling and IATTC sampling lengths as representing the US Sport fleet catches. The degree of time-varying selectivity invoked will be determined by the reliability of the data.**

The WG recognized that increasing the number of fleets with time varying selectivity results in increasing numbers of estimated parameters. Tradeoffs between simpler and complex models should also take into account management implication and not only scientific considerations. **If reduction of parameters is needed in the next assessment, the WG agrees that sharing the age-based availability component of the combined selectivity across fleets operating in the same area could be considered.** The WG expects that the small modelling group will bring their recommendation on selectivity parameterization to the assessment meeting.

It has been a general practice to assume one fleet operates with an asymptotic selectivity to avoid "cryptic biomass". The WG notes that relaxing the strong assumption of asymptotic selectivity did not result in a large difference in estimates of population scale of 2018 assessment, suggesting its robustness regarding this assumption. However, it was also noted that the assumption of selectivity shape interacts with Linf, CV@age and M in determining population scale estimates. **The WG recommends keeping the current assumption of asymptotic selection on the Taiwanese longline fleet.**

The assessment has previously used a fishing year (July 1st start) instead of calendar year (Jan 1st start). This is often confusing to the public. Stock synthesis (SS) v.3.30 makes transitioning to a Calendar year model possible while maintain the same dynamics. Moving to a calendar year will also mean some modification in data preparation. The implication for management actions are not clear. The WG will discuss again in 2022 assessment, but will conduct the next assessment using fishing year.

Appendix 5 Table of model settings from March 2019 meeting
Discussion:
The WG did not revise the table of model settings because the next assessment will largely carry over the system process parameterization from the previous stock assessment. The WG noted that the R0 offset is no longer included in SS v.3.30 but an equivalent parameterization in v.3.30 will be used. The most appropriate method to estimate the initial conditions will be investigated by the modelling group and discussed during the assessment workshop.

Due to influence of management in recent years the WG acknowledges that an unknown but perhaps significant level of discard mortality is not included in the catch. **The WG agreed that the base-case of 2020 assessment should include such "unaccounted mortality". The WG recommends that each member attempt to estimate and document this unseen mortality at age for potential inclusion in the stock assessment. This information needs to be provided by data deadline.**

5.2 Software Update to the Stock Synthesis version 3.30
A closer look at the 2018 stock assessment model for Pacific bluefin tuna (ISC/19/PBFWG-2/16) presented by HH. Lee

Discussion:
The WG considered the decision to convert the assessment to the newest version of SS is trading off continued support and more flexible model (SS v 3.30) against a better tested code (older versions). It does not appear that moving the current aessment model to v 3.30 will appreciably change the current understanding of the dynamics. **The WG tentatively recommends moving to the newest version of SS. Furthermore the WG does not recommend continuing a parallel modelling effort using the older version of SS.**

6. Setting for the Future Projections
6.1 Description of the Current Soft Ware used for the Future Projection
The WG agrees to continue applying the projection programme as conducted in the 2018

assessment.

6.2 Consideration on the Future Projection Scenarios for the 2020 Stock Assessment

The WG was informed of the harvest scenarios requested by the 4th IATTC-WCPFC NC Joint Working Group in September to be applied for future projection in the next assessment and confirmed to use them in the projection.

6.3 Other Matters

Estimating Impacts on the Spawning Stock Biomass by Fleets in Pacific Bluefin Tuna Future Projection (ISC/19/PBFWG-2/17) presented by S. Nakatsuka

Currently, ISC provides historical impact plot at times of assessments. The paper proposes to apply a similar method to produce a "future impact plot". For doing so, certain group of fleets are assumed to have zero fishing mortality and projection is conducted. After repeating the projection for all groups of fleets, the impacts from each group is calculated by proportionately dividing the difference between projected SSB and projected unfished biomass.

Discussion:

The WG considered it could be useful for managers and agreed to include the result in the 2020 assessment.

The WG was also informed that the IATTC-WCPFC NC Joint Working Group requested ISC to provide "a matrix of conversion values across age classes", which was intended to be expected asymptotic SSB under unfished condition, i.e. assumed natural mortality and growth, which a unit weight of certain age class will produce. This can be calculated independently from assessment. **It was agreed that the results should be confirmed and included in the report of March 2020 meeting.**

A problem of bootstrap for generating future recruitment and estimating confidence interval in PBF stock assessment presented by Y. Tsukahara

It was found that the confidence intervals from bootstrapped result vary depending on the applied multiplier of sample size. Since there is no established way to decide sample size for bootstrapping, the WG needs to decide what to do.

Discussion:

It was found difficult to decide the multiplier for sample size at this moment. **The WG agreed to continue discussing the matter at the assessment meeting.**

7. Workplan toward the assessment meeting

It was confirmed that the stock assessment workshop of PBFWG will be held in March 2-12, 2020 in Shimizu Japan. Input data (catch including unaccounted mortality, size and CPUE) needs to be submitted to data manager (H. Fukuda) by the end of 2019, while only CPUE can be updated until the end of January 2020. Documents, except for modeling, need to be submitted 2 weeks before the meeting starts, while modeling papers can be submitted by 1 week before the meeting. Documentation is necessary for input data which has not been previously done so.

8. Management Strategy Evaluation

8.1 Review the discussions at 2nd ISC PBF MSE workshop and 4th IATTC-WCPFC NC Joint WG meeting

S. Nakatsuka briefed the outcome of the 2nd ISC PBF MSE workshop as well as 4th IATTC-WCPFC NC Joint WG meeting related to MSE. 2nd ISC PBF MSE workshop was held in San Diego, USA as requested by RFMOs. The discussion was informative but it became unclear which fora will lead the MSE process of PBF as participants did not want the ISC Workshop to be the venue for decision-making. Terms of Reference of PBF MSE was then agreed at 4th IATTC-WCPFC NC Joint WG meeting, which clarifies the purpose or structure of PBF MSE. The purpose of PBF MSE is now clarified to develop a harvest strategy to be applied after the 2nd rebuilding target (20%$SSB_{F=0}$) is achieved and the primal decision-making body would be the IATTC-WCPFC NC Joint WG meeting.

Discussion:

The WG discussed how the MSE related work should be incorporated in the WG workload. The Chair clarified his expectation to follow ALBWG framework, which is that dedicated programmers will work on MSE programming separately from PBFWG but under regular review and feedback from the WG. It was also clarified that even though ISC is requested to complete MSE by 2024 and the PBFWG needs to start working on MSE as requested, at a certain point in future the MSE process will need clear input from RFMOs to proceed further.

8.2 Workplan

The suggestion by H. Fukuda to use the 2020 assessment model as the basis of the Operating Model in MSE scheme was considered positively by the WG. It was commented that this option could have limitations depending on decision makers intentions and requests regarding their management objectives. To analyze HCR and performance indicators, projection programme likely needs to be developed, more flexible than the future projections program in the SS. The WG is already conducting with the assessment and future projections model something similar to an MSE although depending on objectives to be decided, it might be insufficient. There is still lack of clarity of objectives of MSE but developing model for the future process scenarios can start now, before more input is available from the managers. Also it was noted that the pressure to develop MSE by 2024 seems odd since it would be used only after reaching the second rebuilding target, while the WG is expected conduct assessment every 2 years.

9. Others

SK. Chang (Chinese Taipei) was tentatively elected Vice Chair of PBFWG unanimously.

10. Adoption of the Report

The draft report was reviewed, revised and adopted.

11. Adjournment

The meeting was adjourned at 14:50 on November 22, 2019.

Appendix 1

PACIFIC BLUEFIN TUNA WORKING GROUP
INTERSESSIONAL WORKSHOP
November 18-23, 2019
SWFSC, La Jolla, USA

AGENDA

1. Opening and Introduction
    - 1.1 Welcome and introduction
    - 1.2 Adoption of agenda
    - 1.3 Appointment of rapporteurs

2. Catch and Size Data
    - 2.1 Catch Time Series
    - 2.2 Japanese Longline (F1)
    - 2.3 Japanese Small Pelagic Purse Seine (Season 1, 3, 4) (F2)
    - 2.4 Korean Offshore Large-Scale Purse Seine (F3)
    - 2.5 Japanese Tuna Purse Seine Fisheries in the Sea of Japan (F4)
    - 2.6 Japanese Purse seine off the Pacific coast of Japan (F5)
    - 2.7 Japanese Troll (Season 2-4) (F6)
    - 2.8 Japanese Pole & Line (F7)
    - 2.9 Japanese Set Net (Season 1-3) (F8)
    - 2.10 Japanese Set Net (Season 4) (F9)
    - 2.11 Japanese Set Net (Hokkaido and Aomori) (F10)
    - 2.12 Japanese Other Fishery (F11)
    - 2.13 Taiwanese Longline South Fishing Ground (F12)
    - 2.14 Eastern Pacific Ocean Commercial Purse Seine (1952-2001) (F13)
    - 2.15 Eastern Pacific Ocean Commercial Purse Seine (2002-) (F14)
    - 2.16 Eastern Pacific Ocean Sports Fishery (F15)
    - 2.17 Japanese Troll for Penning (F16)
    - 2.18 Taiwanese Longline North Fishing Ground (F17)
    - 2.19 Japanese Small Pelagic Purse Seine (Season 2) (F18)
    - 2.20 Japanese Troll (Season 1) (F19)
    - 2.21 Others

3. CPUE
    - 3.1 Japanese Troll Fishery
    - 3.2 Japanese Longline Fishery
    - 3.3 Taiwanese Longline Fishery
    - 3.4 Japanese Recruitment Monitoring Index
    - 3.5 Others

4. Biological Information
    - 4.1 Growth Function
    - 4.2 Length-Weight Relationship

- 4.3 Natural Mortality
- 4.4 Maturity
- 4.5 Stock-Recruitment Relationship
- 4.6 Others

5. Model Setting
   - 5.1 Follow up Model Setting in the 2016 Stock Assessment and Available Options (Appendix 5 of PBFWG Meeting Report in March 2019).
   - 5.2 Software Update to the Stock Synthesis version 3.30

6. Setting for the Future Projections
   - 6.1 Description of the Current Soft Ware used for the Future Projection
   - 6.2 Consideration on the Future Projection Scenarios for the 2020 Stock Assessment
   - 6.3 Other Matters

7. Workplan toward the assessment meeting

8. Management Strategy Evaluation
   - 8.1 Review the discussions at 2nd ISC PBF MSE workshop and 4th IATTC-WCPFC NC Joint WG meeting
   - 8.2 Workplan

9. Adoption of the Report

10. Adjournment

Appendix 2

List of Participants

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Appendix 3
List of documents

Index	Agenda	Title	Author	Contact	Website availability
ISC/19/PBF WG-2/01	2.2	Estimation of catch-at-length of Pacific bluefin tuna caught by Japanese coastal longliners: Update up to 2018 fishing year	Yuki Ohashi, Yohei Tsukahara	tsukahara_y@affrc.go.jp	Yes
ISC/19/PBF WG-2/02	2.2	Estimation of the PBF length-composition for the Japanese purse seine with new data collected at young PBF farming operation using stereoscopic camera	Hiromu Fukuda, Shuya Nakatsuka	fukudahiromu@affrc.go.jp	Yes
ISC/19/PBF WG-2/03	2.4	Update of Korean fisheries information for Pacific bluefin tuna, Thunnus orientalis	Doo Nam Kim, Mi Kyung Lee, Sung Il Lee, Doo Hae An	ccmklee@korea.kr	Yes
Withdrawn					
ISC/19/PBF WG-2/05	2.6	Estimation of the PBF length-composition for the Japanese purse seine operating in the Pacific side	Hiromu Fukuda	fukudahiromu@affrc.go.jp	Yes
ISC/19/PBF WG-2/06	2.16	Updated size composition data from the San Diego Commercial Passenger Fishing Vessel (CPFV) recreational fishery for Fleet 15: Eastern Pacific Ocean Sport Fisheries, 2014-2019	Liana Heberer, Huihua Lee	liana.heberer@noaa.gov	Yes
ISC/19/PBF WG-2/07	2.16	Updated to Catch Estimates from the U.S.A. Recreational Fishery from 2014 to 2017	John Childers, Huihua Lee	john.childers@noaa.gov	Yes
ISC/19/PBF WG-2/08	3.1	Updated standardized CPUE for 0-age Pacific bluefin tuna caught by Japanese troll fisheries: Updated up to 2018 fishing year	Kirara Nishikawa, Yohei Tsukahara, Shuya Nakatsuka	kiraranishi@affrc.go.jp	Yes

ISC/19/PBF WG-2/09	3.2	Japanese coastal longline CPUE for Pacific bluefin tuna: Preliminary update up to 2018 fishing year	Yuki Ohashi, Yohei Tsukahara, Shuya Nakatsuka	tsukahara_y@affrc.go.jp	Yes
ISC/19/PBF WG-2/10	3.2	Preliminary result of spatial and temporal modelling for Bluefin tuna caught by Japanese coastal longline	Yohei Tsukahara	tsukahara_y@affrc.go.jp	No
ISC/19/PBF WG-2/11	3.3	Standardized index of relative abundance of Taiwanese PBF fisheries based on traditional and spatiotemporal delta-generalized linear mixed models	Tzu-Lun Yuan, Shui-Kai Chang, Haikun Xu, Hung-I Liu	skchang@faculty.nsysu.edu.tw	No
ISC/19/PBF WG-2/12	3.4	Real-time recruitment monitoring for Pacific bluefin tuna using CPUE for troll vessels: Update up to 2018 fishing year	Yohei Tsukahara, Kana Chiba	tsukahara_y@affrc.go.jp	Yes
ISC/19/PBF WG-2/13	3.5	CPUE standardization of Pacific bluefin tuna from Korean offshore large purse seine fishery	Sung-Il Lee, Doo Nam Kim and Mi Kyung Lee	k.sungillee@korea.kr	Yes
ISC/19/PBF WG-2/14	4.1	Estimates of growth functions from age at length data based on otolith annual rings and daily rings for pacific Bluefin tuna	Hiromu Fukuda et al.	fukudahiromu@affrc.go.jp	No
ISC/19/PBF WG-2/15	4.4	Histological Evaluation of Gonads from Large Pacific Bluefin Tuna Captured in the Eastern Pacific Ocean during 2015-2019	Owyn Snodgrass, Heidi Dewar, Kurt Schaefer	owyn.snodgrass@noaa.gov	No
ISC/19/PBF WG-2/16	5.1	A closer look at the 2018 stock assessment model for Pacific bluefin tuna	Huihua Lee, Kevin Piner, Mark Maunder	huihua.lee@noaa.gov	Yes
ISC/19/PBF WG-2/17	6.3	Estimating Impacts on the Spawning Stock Biomass by Fleets in Pacific Bluefin Tuna Future Projection	Shuya Nakatsuka, Kirara Nishikawa, Hiromu Fukuda	snakatsuka@affrc.go.jp	Yes

Appendix 4

Amendment of fleet definition for 2020 assessment

Fleet #	Fleet name	Unit of Catch	Gears included Representative component	Data update	Dicision make	Alternatives
Fleet 1	JPLL	Weight	JP Longline	X	·Same method to estimate the size comp. ·Not to include in Likelihood function for 2017-18FYsize comp.	·estimate selectivity of season 3 independently or not.
Fleet 2	JSPPS (Seas1, 3, 4)	Weight	JP SPPS (Season 1, 3, 4)	X	·Spliting a farming operation as a new Fleet. ·Same method to estimate the size comp. for the market landing operation (Fleet 2). ·Proposed method to estimate the size comp. for the farming operation (new Fleet).	·Shared or independent selectivity?
Fleet 3	KROLPS	Weight	KR OLPS, KR Trawl*1, KR Setnet*1, KR Troll	X	·New method to estimate the size composition. ·Used as an independent size comp.	·Shared or independent selectivity?
Fleet 4	JPTPSJS	Weight	JP TPSJS, TW PS*2	X	·Same method to estimate the size comp.	·Shared or independent selectivity?
Fleet 5	JPTPSPO	Weight	JP TPSPO	X	·Same size comp. during 1995-2006. ·New method to estimate the size comp for	·Shared or independent selectivity?
Fleet 6	JPTroll (Seas2-4)	Weight	JP Troll (Season 2-4)	X	·Same method to estimate the size comp.	
Fleet 7	JPPL	Weight	JP Pole-and-Line, JP Driftnet*3, TW Driftnet*3, TW Others*4	X (Only for Catch)	none	
Fleet 8	JPSetNet (Seas1-3)	Weight	JP Setnet (Season 1-3), JP Miscellaneous (Season 1-3)	X	·Same method to estimate the size comp.	·Shared or independent selectivity?
Fleet 9	JPSetNet (Seas4)	Weight	JP Setnet (Season 4), JP Miscellaneous (Season 4)	X	·Same method to estimate the size comp.	·Shared or independent selectivity?
Fleet 10	JPSetNet_HK_AM	Weight	JP Setnet in Hokkaido and Aomori	X	·Same method to estimate the size comp.	·Shared or independent selectivity?
Fleet 11	JPOthers	Weight	JP Handline & Tsugaru Longline, JP Trawl, JP OtherLL	X	·Same method to estimate the size comp and combine with Fleet 10.	
Fleet 12	TWLL (South)	Weight	TW Longline (South area), Out of ISC members (NZ, AU, etc.)*5	X	·Same method to estimate the size comp.	
Fleet 13	USCOMM (-2001)	Weight	US Commercial Fisheries (PS, Others), Mex Commercial Fisheries (PS, Others)	X (Only for Catch)	·Same size compoisition.	·Shared or independent selectivity?
Fleet 14	MEXCOMM (2002-)	Weight	Mex Commercial Fisheries (PS, Others), US Commercial Fisheries (PS, Others)	X	·Same method to estimate the size comp.	·Shared or independent selectivity?
Fleet 15	EPOSP	Number	US Recreational Fisheries	X	·Proposed method to estimate the size comp. ·Estimating selectivity based on its data.	·Shared or independent selectivity?
Fleet 16	JPTroll4Pen	Number	JP Troll for Farming	X (Only for Catch)	·No size comp were used.	
Fleet 17	TWLL (North)	Weight	TW Longline (North area)	X	·Same method to estimate the size comp.	
Fleet 18	JPSPPS (Seas2)	Weight	JP SPPS (Season 2)	X	·Same method to estimate the size comp.	
Fleet 19	JPTroll (Seas1)	Weight	JP Troll (Season 1)	X	·Same method to estimate the size comp.	

*1 Catch for KRean Trawl, KRean Setnet and KRean Troll were **not included** in the input data until the 2016 stock assessment.
*2 Annual catches for Taiwanese PS are put into the Season 1 in the input data.
*3 Annual catches for Japanese and Taiwanese Driftnets are put into the Season 1 in the input data.
*4 Annual catches for Japanese and Taiwanese Others are put into the Season 4 in the input data.
*5 Annual catches of out of ISC PBFWG members are put into the Season 1 in the input data.
Note: Seasons follow the fishing year.

Appendix 5

CPUE definitions for 2020 assessment

CPUE #	Abundance index	Available period (fishing year)	Corresponding fleet for the selectivity setting	Data quality	Data Update	Decision make
S1	Japanese coastal longline CPUE for spawning season.	**1993-2018**	Fleet 1 : JPLL	Standardized by spatio-temporal GLMM	X	·Geo-Stat standardized CPUE will be used.
S2	Japanese offshore and distant water longliners CPUE	1952-1973	Fleet 1 : JPLL	Standardized by lognormal model		
S3	Japanese offshore and distant water longliners CPUE	1974-1992	Fleet 1 : JPLL			
S4	Japanese troll CPUE in Nagasaki prefecture (Sea of Japan and East China sea)	**1980-2016, and 2018**	Fleet 6 : JP Troll (Seas 2-4)	Standardized by lognormal model	X	·GLM CPUE w/o the data of 2017FY will be used.
S5	Taiwanese longline CPUE (South area)	**2002-2018**	Fleet 12 : TWLL (South)	Standardized by GLMM	X	·GLMM standardized CPUE from 2002-2018 FY will be used.
S6	Taiwanese geo-stat South core area CPUE	2006-2018	Fleet 12: TWLL (South)	Standardized by spatio-temporal GLMM	X	·Included in the assessment model without including to the Likelihood function.
S7	Taiwanese geo-stat North core area CPUE	2000-2001, 2004-2018	Fleet 17: TWLL (North)	Standardized by spatio-temporal GLMM	X	·Included in the assessment model without including to the Likelihood function.
S8	Taiwanese GLMM North whole area CPUE	2000-2001, 2004-2018	Fleet 17: TWLL (North)	Standardized by GLMM	X	·Included in the assessment model without including to the Likelihood function.
S9	Korean Offshore Large scale Purse Seine CPUE	2004-2018	Fleet 3: KROLPS	Standardized by GLM	X	·Included in the assessment model without including to the Likelihood function.
S10	Japanese Recruitment monitoring in the East China Sea	2011-2018	Fleet 6 : JP Troll (Seas 2-4)	Standardized by GLMM	X	·Included in the assessment model without including to the Likelihood function.
S11	Japanese Recruitment monitoring in the Pacific Ocean	2011-2018	Fleet 19: JP Troll (Seas 1)	Standardized by GLMM	X	·Included in the assessment model without including to the Likelihood function.