Annex 4

PACIFIC BLUEFIN TUNA WORKING GROUP
INTERSESSIONAL WORKSHOP

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

November 18-25, 2015
International Building, National Sun Yat-sen University
70 Lienhai Rd., Kaohsiung 80424, Taiwan, R.O.C.

1. Opening and Introduction

1.1. Welcome and Introduction

Shui-Kai (Eric) Chang, Institute of Marine Affairs, National Sun Yat-sen University opened the meeting on 18 November 2015. He welcomed participants and hoped for fruitful results of the important meeting. The Chair of the Pacific Bluefin Tuna Working Group (PBFWG), H. Nakano, highlighted the main objectives of the meeting on data preparation for full assessment: review and discuss catch and size data, CPUE, biological data, model setting, and setting for the future projections.

1.2. Adoption of Agenda

The Chair introduced the draft agenda and the agenda was adopted. The adopted agenda is provided as Appendix 1. A list of participants is provided as Appendix 2. The Chair noted that there were 16 Working Papers submitted and 2 oral presentations for discussion at the meeting (Appendix 3).

1.3. Appointment of Rapporteurs

S. Nakatsuka was appointed as the lead rapporteur for the meeting and support rapporteurs were assigned by the Chair as follows: Item 2-Catch and Size Data (N. Suzuki, S. Teo); Item 3-CPUE (M. Dreyfus, J. Powers); Item 4-Biological Data (K. Oshima, C. Farwell); Item 5-Model Setting (T. Akita, O. Sakai); Item 6.1-Description of the Current Soft Ware used for the Future Projection (H. Fukuda); Item 6.2-Consideration on the Future Projection Scenarios for the 2016 Stock Assessment (K. Piner).

2. Catch and Size Data

2.1. Catch Data Deference between 2014 Stock Assessment and ISC Catch Table

Updates of Japanese quarterly catch data up to 2014 fishing year presented by K. Oshima (ISC/15/PBFWG-2/01)

In the next full stock assessment on Pacific bluefin tuna, input data such as quarterly catch, size composition and CPUE will be updated up to June 2015 (2014 fishing year). This paper presents updated quarterly catch of fleets related to the Japanese fisheries up to 2014 fishing year. Prior to the updates, errors in the input data for the previous stock assessment were corrected and those influences were tested through a sensitivity run. In addition, annual catches for the Japanese coastal longline and other fisheries from 2007 to 2013 were revised.

Discussion

The WG noted the revision of Japanese catch data as well as that there was double reporting of catch of small scale longline from Tsugaru Strait to both Fleet 1 and 14. The proposed revision of ISC catch table to fix the double reporting was discussed and supported as a reasonable approach to correct the situation.

With regard to the proposal to include the small-scale longliners in Tsugaru Strait into Fleet 14 due to the difference of its catch composition from other coastal longline, concerns were raised that by including multiple fisheries into a single Fleet it might become hard to fit assessment results to the data. The selectivity of Fleet 14 might changes annually if the proportion of catch of included fisheries changes. In response, it was clarified that if necessary the catch of fleets included in Fleet 14 can be evaluated separately to see if time blocks are needed.

The WG supported the correction and modifications as proposed in the document to be adopted in the next assessment.

2.2. Japanese Longline (F1)

Estimation of length frequency of Pacific bluefin tuna caught by Japanese coastal longliners: updated up to 2014 fishing year presented by O. Sakai (ISC/15/PBFWG-2/02)

The catch at size data for Japanese coastal longline was updated using a revised method which was approved by ISC PBF WG in April 2015 meeting; the estimation methods using “Month & Prefecture strata” and “Quarter & Prefecture strata”. Updated catch at size data in 2nd quarter of 1994-2015 calendar year shows that the main part of the longline catch have been constituted by some strong cohorts, but this has not been composed of only a single cohort. In 2014 fishing year, the length frequencies indicate the strong year classes of 182-260 cm FL and a new mode of small fish between 146 and 158 cm FL in the catch. The next step is the consideration whether to use “Month & Prefecture strata” or “Quarter & Prefecture strata” as the reference method.

Discussion

It was clarified that no spatial stratification was used for the raising of the catch data of this Fleet 1 in the previous assessment. The WG also noted that it was reported in April PBFWG meeting by Hiraoka et al. (2015) that the results using the revised method and previous method provided a similar results.

With regard to the rationale for the stratification based on landing prefectures, the author explained that the landing prefecture can be considered as a proxy of fishing area because of the difference of size composition from each prefecture. The WG supported the new method to estimate the catch at size data of this Fleet. **Regarding to the choice of "Month & Prefecture strata" or "Quarter & Prefecture strata" to be used for the raising, the WG considered that "quarter" approach would be preferable due to robustness against possible future operational changes.**

Then the question was raised about the historical proportion among prefectures and the WG noted that Okinawa is becoming more dominant landing port recently. This raised a concern that the change in landing ports might result in the change in selectivity of the Fleet 1, possibly causing the difficulty of fitting the data. Size composition data among prefectures were compared and the WG noted that there seems to be a difference between Okinawa and the other prefectures possibly due the difference in fishing grounds.

This was considered to be a very important question since the CPUE index of Fleet 1 is possibly the most important index. However, several reasons for the difference of selectivity could be considered; different availability, movement of fish, or Okinawa fleet changing its fishing technique. But it was difficult to conclude. Separating Okinawa fleet from other longlines was a possible option, but the WG preferred not to have more Fleets to fit the data, although it was pointed out that this may not prove to be a major problem since the latest Japanese index and Taiwanese index seem to show a very similar trend.

The WG concluded that the default approach at the next assessment should be the same with the previous assessment which is to have a constant selectivity after 1993.

2.3. Purse Seine in the East China Sea & Korean Small Pelagic Purse Seine (F2): Including Purse Seine Catch by Japan and Korea

K. Oshima made an oral presentation. Operation of Japanese Small Pelagic Purse Seine (JSPPS) and the method used to estimate its catch-at-size data were explained. There is a consistency in size composition except for the two quarters in 2015. JSPPS catch started to be used for farming after the new management measures were introduced in 2015 and fish for farming were smaller than landed fish. The catch data is available from logbook but length composition data for the 2nd quarter of 2015 is not available due to this reason. Therefore, in the next assessment the size composition of 2nd quarter of 2015 should be the length composition from previous years.

<u>Discussion</u>

It was further clarified that the authors consider that the actual size composition from this Fleet 2 in the 2nd quarter of 2015 would not be different from the historical trend and its observed data does not represent the actual catch since only large fish are sent to markets, those are the only fish measured. Therefore, the catch amount of 2nd quarter of 2015 is correct but its size composition data should not be used. **The WG supported the suggestion.**

Preliminary analysis of catch and size data for Pacific Bluefin tuna, Thunnus orientalis caught by Korean offshore large purse seine (ISC/15/PBFWG-2/15) presented by Y. Kwon

Korean catch of PBF increased from 31 t in 1982 to 2,601 t in 2003, then it has decreased to 1,311 t in 2014, which is only half of the highest catch with fluctuation. Over 98% of catch were caught by offshore large purse seine (OLPS). CPUE (ton / number of set) of OLPS showed the highest value in 2004. In the catch of PBF and common mackerel by OLPS, PBF was concentrated on 1st and 2nd quarters, while common mackerel was 3rd and 4th quarters. The fluctuation of catch amount between PBF and common mackerel by OLPS represents significant differences by time series. The number of PBF estimated from quarterly catch and average weight was ranged from approximately 40 fish to 250,000 fish for 2004-2015. The quarterly number of measured fish was ranged from 0 to 5,909 fish for 2004-2015. Length of 1-fish per box was sorted about 100 cm and ranged approximately from 80 cm to 180 cm. The variance of length for 1-fish per box was high. This might be caused by not separating by weight or not being enough sample size. The lengths of multi-fish per box were no significant increase or decrease.

<u>Discussion</u>

It was clarified that the observers measure length and weight and also count the number of boxes. In response to a question, the author noted that they have not constructed size composition data yet. The WG considered that it would be desirable if Korea can raise the size composition data for its fleet.

Afterwards the WG were provided with the length composition data of Japanese and Korean purse seine fleets from 2011 to 2015. The data showed a similar trend and the WG considered the size composition data of the two fleets can be combined. The weighting methods for combining two fleets were discussed. Weighting by catch is simple but may need to split the fleet before and after the combining of data because it essentially treat the fleets as two separate fleets. On the other hand, by weighing by sample size the both fleets are considered to be a part of same fleet and the difference of sampling coverage can also be dealt with. **After the discussion, the WG requested Japan and Korea to submit combined size composition data based on weighting by catch because it considered that the size composition of the two fleets is basically the same.**

2.4. Japanese Tuna Purse Seine Fisheries in the Sea of Japan (F3)

K. Oshima made an oral presentation on the update of the catch information of the Fleet 3. This Fleet 3 has abundant size measurement and the data is consistent through time. He suggested that no change is made for this Fleet 3.

<u>Discussion</u>

The WG agreed that no change in data preparation is necessary for the Fleet 3.

2.5. Japanese Purse seine off the Pacific coast of Japan (F4)

K. Oshima made an oral presentation. The catch of the Fleet 4 fluctuates among years and because of this the WG had decided that its catch-at-size data in recent years should not be used for assessment. Therefore, no update was provided and it was recommended to follow the approach taken in the last assessment.

Discussion

It was clarified that the catch of this Fleet 4 in recent years is about 200-300 t but the Fleet 4 recorded some large catches historically. Its size range also fluctuates from about 50 cm to very large fish. Although no suggestion for an improvement was made, it was recognized that this Fleet 4 will continue to be a difficult Fleet to deal with. **The WG agreed that no change in data preparation is necessary for the Fleet 4.**

2.6. Japanese Troll (F5): Including Catch Data by Japanese Troll Fishery for Tuna Pen Culture

A minor change in the estimation of length composition data of Japanese troll fisheries presented by H. Fukuda (ISC/15/PBFWG-2/03)

Japanese troll fishery which mainly catch age-0 PBF are widely operated in the coastal waters of west part of Japan by small vessels based on many small ports. The management system was changed from registration system to licensing system in 2014, and the number of vessels licensed by Fishery Agency of Japan were more than 20,000 vessels. Even though it was very difficult to measure the size of landed fish in high coverage, NRIFSF organized the size sampling framework to measure fish intensively in several major landing ports since 2007 (Oshima et al. 2008). This sampling program resulted in large sample sizes in major landing ports. These efforts should be continued to secure the coverage of size sampling in the major landing ports.

Even with this improvement of size sampling program, the data should be raised properly to the total catches to make a size composition data which represented actual catch number at size in each quarter. In the previous works, spatial and temporal strata were considered on ‘Area’ and ‘quarter’ basis, respectively. However, since the nature of this species that grows very fast at summer time particularly at younger age, it would be better to set a temporal strata on ‘month’. In this document, the size composition of PBF caught by troll fishery was estimated with stratification of areas and months.

Discussion

A question was raised about the reason for the flattening trend of the size of fish caught after November. The author responded that the main reason is the slowdown of growth in winter, not that fish with different birth date is recruiting, since the otolith analysis demonstrated that those fish hatched on similar dates. The WG noted that the reason of the shift of the size composition towards smaller fish in the “monthly” strata approach only in 3rd quarter is the rapid growth observed in early months after birth and that this is an important issue to be solved. **The WG supported the approach to raise the data on a monthly basis.**

It was noted that the size composition of Yamaguchi Prefecture is different from others. However, the WG considered that this is not a major problem since the catch from Yamaguchi Prefecture is not very large.

2.7. Japanese Pole & Line (F6)

The WG noted that the size composition data of this Fleet 6 mirrors that of Fleet 5 in the current assessment. Since there is no new information to do otherwise, it was reported that no update was conducted.

A question was raised whether it is possible to combine the Fleet 5 and 6 if the size information of Fleet 6 mirrors that of Fleet 5. It was clarified that since Fleet 6 had substantial catch in early period and its range of length were larger than that for Fleet 5 in 1970s, it would be desirable to keep a separate Fleet for future possibility to use the information of the Fleet 6. **The WG agreed that no change in data preparation is necessary for the Fleet 6.**

2.8-11. Japanese Set Net (F7-10)

Estimation of catch at size of Pacific bluefin tuna caught by Japanese set net fisheries: Updated up to 2014 fishing year presented by O. Sakai (ISC/15/PBFWG-2/04)

The catch at size data for Japanese set net fishery was updated using revised method which was approved by ISC PBF WG in April meeting in 2015; the estimation was based on multi-stratified raising of size-measurement data using the catch amount. In the revised method, excessive estimation was avoided by the introduction of broad size category stratum (i.e. Small/Medium/Large) and limitation of over-strata calculation. After separating the “North area (Hokkaido and Aomori)”, this document proposes the following options for the fleet definition based on the results of the catch-at-size estimation by area and quarter; 1) combine the catch-at-size data for all prefectures, 2) combine all prefectures but divides by the 2nd quarter and the other quarters (1st, 3rd, and 4th), 3) make two groups of prefectures (“Tohoku area” and “South area”) which have similar catch-at-size. The “North area” cannot be combined with the other areas because weight frequency is used in this area.

<u>Discussion</u>

The complexity of those four Fleets were recognized by the WG. It was noted that it would be possible to subdivide the Fleets into homogeneous groups and to apply time varying selectivity. However, it would not be desirable if solving the misfit in those Fleets sacrifices the fit in other Fleets because those four Fleets do not provide abundance index. A suggestion was made to combine those four Fleets in to “other” Fleet (F14) but a comment was made that the data from this Fleet should be duly evaluated due to its magnitude of catch. In response, it was suggested to combine all non-index Fleets into one Fleet and use time-varying selectivity. This approach has more applications now than the time of the previous assessment. In the experience in IATTC, originally it was intended to have many fleets with as accurate selectivity as possible but this did not resulted in a robust assessment. Therefore, the Organization is now moving towards the other direction; aggregated Fleets with more accurate time-varying selectivity. The WG noted that a choice has to be made between complex data or complex modelling but it should be avoided to have both complexity. **The WG agreed to use the new method of raising data** and Fleet definition was further discussed at model setting (see agenda 5).

2.12. Taiwanese Longline (F11)

Brief Review on Size Distribution of Taiwanese PBF Catch (ISC/15/PBFWG-2/16) presented by S.K. Chang

Brief review on Taiwanese PBF size distribution was provided based on two data sources: (1) market landing data (fish weight and fish number) of 2001-2015, of which data the fish number of 2001-2003 were re-estimated by a MCMC simulation due to low coverages in the data. (2) Length data from port sampling program for 2002-2009 and from catch documentation scheme (CDS) from 2010 onwards. The landing data showed that the proportion of fish < 210 kg has continuously declined since 2003 to the lowest level of 2012 and started recovering thereafter to a proportion of 50% in 2015. This decline was observed in both the North and South fishing grounds off Taiwan. Most of the fish ≥ 210 kg was caught in the South fishing ground and the percentage started to decline since 2012. In the North fishing ground however, the large fish showed continuous increase since 2007. Length distribution has showed clear modal movement during the years. CDS data has provided much more samples than those previously provided to the ISC. These size data were considered with higher quality and so was recommended to be used for future stock assessment

<u>Discussion</u>

Similar questions to the JPLL fishery (Fleet 1) were asked by the WG. The WG noted that there seems to be cohorts of smaller fish from 2013 to 2015 and questioned if that might be caused by change of operation by this Fleet 11. In response, the author clarified that the increase in catch in the North fishing ground started in 2007 but the increase of small fish occurred very recently. In addition, the increase in the proportion of smaller-sized PBF is observed for both the North and South fishing grounds. So, they believed that the appearance of the cohort of smaller fish was not because of the shifting of fishing ground. Another question was raised if there is a possibility that the vessels target the dominant cohort and then move to the next dominant cohort when the previous one is exhausted. In response, the author pointed out that fishermen will catch whatever available so the catch should reflect the available stock.

The WG agreed to use the revised data for the next assessment.

2.13 and 14. Eastern Pacific Ocean Commercial Purse Seine (F12) and Eastern Pacific Ocean Sports Fishery (F13)

PBF catch size-composition of the Mexican purse seine fishery from data collected at pen rearing operations: an update for 2013-2014 (ISC/15/PBFWG-2/05) by M. Dreyfus

An analysis of the PBF catch and size-composition data for the 2013 and 2014 fishing seasons is presented based on length measurements taken from stereoscopic underwater cameras during pen transfer operations of live PBF tuna. PBF average size for the 2013 and 2014 fishing seasons were 103 cm and 104 cm, respectively (median values were located in 98-100 cm and 108-110 cm for those same years). The location of the peak of the dominant mode was 88-89 cm in 2013 and 112-113 cm in 2014. An estimated total of 124,500 fish were captured in 2013 and 215,712 fish in 2014 based on this analysis.

<u>Discussion</u>

The WG noted that this is the first attempt to raise the Mexican PS catch using information collected by stereoscopic cameras and that the previous method was using the observer data of dead fish during the operation. In response to questions, several points were clarified. The data used is from the largest farming company out of existing three companies. The total number of fish caught is estimated through this method while the total catch in weight is estimated using data from observers/divers. A report was made to the WG in 2012 that the estimation using observer data and that using stereoscopic camera data were very similar (Aires-da-Silva and Dreyfus 2012).

A question was made how well the data represents the whole operation of the Fleet 12 and the author answered that since the operation of the Fleet 12 is conducted in a very limited area, in a very limited time, and by a small number of vessels, the data obtained should represent the general picture of the Fleet 12.

The WG noted that the new method presented by Mexico is an improvement from the previous one and supported to use of the data from the new method when available. At the same time, the WG requested Mexico and IATTC to continue to collect data using both methods in case the cooperation from the industry may change in future.

US commercial and recreational fleets catch and associated composition data presented by K. R. Piner (ISC/15/PBFWG-2/06)

The time series of seasonal catches from US commercial and recreational fleets are provided. Catch from commercial fleets are given in tons and recreational fleets in 1000’s of fish. The recreational fleet is dominated by the Commercial Passenger Fishing Vessels (CPFV) fleet. In recent years, the catch from private boats for recreational fleets has increased due to the warmer than average waters in the eastern Pacific Ocean as well as improvement of sampling. Catch estimates for private boats were retrieved from the Recreational Fisheries Information Network. Also, a new NOAA biological sampling program conducted for recreational fleets was used to provide raised observations of length compositions for the most recent years. Catch for both the US recreational and commercial fleets should be considered the best available data and used in the next stock assessment. The new estimate of length composition of the recreational catch is appropriate for use in the stock assessment; however some consideration of parsimony (prevention of fleet proliferation) should be given.

Discussion

With regard to the modeling approach to obtain the selectivity for the Fleet 13, it was suggested to use the selectivity of the EPO PS when US fleets were dominant since both fleets were considered to target the same age fish and the WG supported the approach. **Regarding the actual time block for the setting of selectivity for this Fleet 13, the WG agreed the following. US dominant period: up to 1982 (fit the data, no deeper net use), transition period: 1983-2001 (do not fit the data and mirror the selectivity of US dominant period because deeper net was not used), and Mexico dominant period (when Mexican farming operation is fully developed and the vessels started using deeper net): 2002 onwards (fit the data).**

The WG also agreed with the proposal to include the size composition data from the new sampling program for the US sports fishery into the model but may not fit the data, depending on the modelling approach.

2.15. Others such as Japanese Trawl and Japanese other Longline (F14)

Estimation of weight composition for Japanese small scale fisheries in Tsugaru Strait: Fleet 14 (Other fisheries) presented by H. Fukuda (ISC/15/PBFWG-2/07)

Hand line and small-scaled longline assigned to Fleet 14 (Other fisheries) in stock assessment model for Pacific bluefin tuna are major gears for coastal fisheries in Tsugaru Strait and its adjacent waters. In the 2014 stock assessment, catch-at-size data for Fleet 14 were weight frequencies made through simple aggregation of number of fish by weight bin using individual body weight. This paper provided newly estimated catch-at-size calculated with a modified estimation procedure where the weight frequencies by gear were raised according to annual catch in number by gear.

Discussion

It was noted that the longline and handline in Tsugaru Strait is the dominant fleet in this Fleet 14 (close to 90% on average recently). **The WG supported the new approach as an improvement and considered that the Fleet 14 should be fitted with the estimation in the next assessment.** It was also noted that the Fleet 14 could be compared with Fleet 7, both of which probably target similar fish.

The proposal by the author to combine the smallest bin to the second smallest bin due to modelling reason was considered not to be a problem.

3. CPUE

3.1. Japanese Troll Fishery

Japanese troll CPUE targeting age-0 Pacific bluefin tuna: Updated up to 2014 fishing year presented by O. Sakai (ISC/15/PBFWG-2/08)

The estimate of relative recruitment abundance index from troll fishery in the East China Sea (coastal area around Nagasaki prefecture) in 2014 fishing year was a record-low. This recruitment index was standardized CPUE for troll fishery during 1980-2014 fishing year. Generalized liner model (GLM) with lognormal error distribution was applied for standardization which was authorized and used in previous studies (Ichinokawa et al. 2012, Oshima et al. 2013, Fujioka et al., 2014). This index is a candidate of the abundance index as an input data for upcoming stock assessment of Pacific bluefin tuna.

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

It was clarified that the information from trips with zero catch is not included in the calculation of the index. It was also clarified that there are no new information that suggests to modify the current three variables used in GLM and that the model assumes log normal distribution and the assessment results provide a good fit to the observed data.

It was commented that the variance of catch of fleets targeting recruits should naturally be higher than those targeting adult fish due to the fluctuation of recruitment and that may need to be taken into account in the modeling process. It was also questioned why the data from Nagasaki, which lacks zero-catch data, is used for index and it was clarified that the data from Nagasaki is considered to be most representative of the recruitment. It was also pointed out that the zero-catch data will be available from Nagasaki in future.

The WG agreed to use the presented results in the next assessment.

3.2. Japanese Longline Fishery

Japanese coastal longline CPUE for Pacific bluefin tuna: Tentative update up to 2014 fishing year presented by O. Sakai (ISC/15/PBFWG-2/09)

Japanese coastal longline CPUE was updated using Zero-Inflated Negative Binomial model (ZINB) for the standardization. This approach was proposed in ISC PBF WG in April; firstly a cluster analysis was conducted to define the targeting, then the result of cluster analysis was used for an explanatory variable of ZINB model. Dataset using this approach was aggregated to trip-level and the model was selected by Bayesian Information Criterion (BIC). The standardized CPUE has similar trend with that from previous method (Delta-type 2 step method), but a large fluctuation in 2005-2008 calendar year was reduced. The data-size in most recent year (2015 calendar year = 2014 fishing year) is still small, thus this standardized CPUE should be noted as a provisional result. In this document, we also presented the results of ZINB model without interactions and some main variables (e.g. cluster index and area index) as the explanatory variables for comparison.

Discussion

The WG supported the general approach using clustering. However, several suggestions were made to improve the method. Firstly, it was pointed out that the catch of PBF should not be used in the clustering because the PBF catch will be used in the standardization process, meaning the information is used twice. Also, the filtering should be done before clustering and all the clustered data set should be used for standardization. The author revised the method as suggested by the WG and presented the standardization result. **The WG considered the result is appropriate and agreed to use the new method in the next assessment. The final version of the index including 2014 fishing year data will be provided for the next assessment.** The presentation explaining the revision of the new method is attached to ISC/15/PBFWG-2/09 and the author will also submit the revised Working Paper to the assessment meeting to document the method.

A point was raised about how to deal with a possible change in catchability. It was noted that there is no easy way to deal with the change in catchability but it should be taken care if the proposed approach works properly. The WG agreed the matter should be kept in mind in the future assessment work.

3.3. Taiwanese Long Line Fishery

Estimation of Standardized CPUE Series of Pacific Bluefin Tuna for Taiwanese Longline Fishery under Incomplete Data (ISC/15/PBFWG-2/10) presented by S.K. Chang

PBF was a seasonal target species to Taiwan offshore longline fishery. Since 2010, catch information of date and location and size information of length and weight, of each PBF could be obtained from a catch documentation scheme (CDS). Before that year, however, only market landing data with small coverage of logbooks were available. Therefore, several non-traditional procedures were performed to estimate standardized PBF CPUE series for 2001-2014. (1) Estimating PBF catch in number from landing weight for 2001-2003 of which years the information was not available, based on an MCMC simulation; (2) Deriving fishing days for 2007-2009 from data of vessel monitoring system (VMS) and voyage data recorder (VDR) based on a newly developed algorithm; (3) Deriving fishing days for 2001-2006 from vessels trip information based on linear relationships between fishing days and at-sea days for a trip, by vessel size and fishing port, during 2007-2014; (4) Standardizing the CPUE for 2001-2014 using generalized linear models with delta lognormal and zero-inflated negative binomial assumptions. Results of both models showed a declining trend from 2001 to 2010 with annual fluctuations and starting to increase since 2013 after two years' low status.

Discussion

The WG noted that the difference in the results between the previous method and the new method was due to the difference of data such as incorporation of complete CDS data in the new method and the difference of estimation method of fishing effort. The WG considered the proposed method to be an improvement although it was noted that the new data series misses the oldest two years' data which was included in the previous series because of difference of data set. The author responded that the current data set was more complete and with better quality than the previous one and suggested to be used although there were two years' data missing.

The author presented two standardization methods and the WG considered that both methods are appropriate but could not choose the better one. The author offered that he will conduct further diagnostics including by adding the 2014 fishing year data and then decide on one of the two methods. The choice will be reported to the WG at the time of submitting the index data. The WG noted the proposal.

3.4. Others

Chair asked if it is possible to develop CPUE index from other fisheries such as longline in Tsugaru Strait. It was noted that from modeling perspective, the current status where we have indices only for age-0 as well as spawning adults works well because the index in between when the distribution of PBF is uncertain may confuse the modeling process. The Chair agreed this but he also pointed out that there could be other use of index such as for management or monitoring purposes. It was also pointed out that the index in non-spawning area would be important if PBF were a skip-spawner. With regard to the development of CPUE index for longline in Tsugaru Strait, it was reported that it is difficult to obtain effort data to construct CPUE series. The WG encouraged members to continue to work to develop additional CPUE series. It was confirmed that CPUE index of Japanese Purse seine fishery in the Sea of Japan (Kanaiwa et al. 2015) will not be used for the base case of the next assessment.

With regard to the deadline for the submission of index data, it was agreed that the available updated data should be submitted by January 1st, 2016 but it shall be finalized to include 2014 fishing year by February 1st.

4. Biological Data

4.1. Growth Curve

The authors provided new information about the birthday, 2-stanza growth pattern of the Pacific bluefin tuna, as well as the effect of updates of a length-at-age data based on the improvement of age determination technique to the estimation of parameters of von Bertalanffy growth function (VBGF). The otolith daily increment data showed the different two birthday groups (about 2 month difference), and those two groups showed different length at catch day, as well as growth pattern during age-0. A simple VBGF could not depict the growth pattern of the age-0 fish, but 2-stanza VBGF could do that. The age of growth rates change was estimated to be between 3-5 months after hatching, which was coincides with the changes in the water temperature surrounding the age-0 PBF. The authors recommended to includes those new information to the next assessment, since the growth of age-0 fish is critically important for the assessment of this species.

Discussion

The WG noted the importance of having accurate growth curve for age-0 fish given the dominance of catch in number of this age and welcomed the proposal as a way towards improvement. However, the WG felt that the proposed method could be improved to better fit the data. Various approaches were suggested but the discussion did not conclude and needed to continue in modeling discussion. However, it was recognized that the matter needs to be addressed somehow in the next assessment as a priority.

4.2. Others (Including Steepness)

The WG agreed to use the same biological parameters as used in the previous assessment except for the growth curve.

Simulation of methods of dealing with age-based movement in PBF stock assessment (ISC/15/PBFWG-2/12) presented by K. Piner

Spatial patterns in the distribution of age-classes are often the result of movement. The data needed to include movement in stock assessment models typically do not exist, and modelers use areas- as-fleets approach. In an attempt to better understand the effect of the age-based movement, this study used simulation methods and a factorial design with modeling movement, ignoring movement, modeling with substitute process, increasing observation error to reduce effect of un-modeled movement, and aggregated fleet structure. Two different states of nature governing the movement process are explored. Only the inclusion of the correct spatial structure along with estimation of movement rates produces unbiased and precise estimates of derived quantities, although some management quantities are less biased in non-spatially explicit models

Discussion

It was noted that patterns and magnitude in residuals in catch-at-age data indicate the existence of model misspecification which needs to be addressed. The presented results suggested that a correctly specified spatial model would reduce model bias but the WG considered that it would be unrealistic to construct a correctly specified spatial model, at least in a short run. As a way to improve, a suggestion was made to combine all non-index Fleets together and to give time-varying selectivity to the combined Fleet. It was considered to be beneficial to reduce data the model needs to fit but challenges such as how to combine Fleets with different confidence in data were also noted. The WG noted the result for the discussion of model setting.

Infection status of Euryphorus brachypterus (Copepoda: Caligidae) on wild Pacific bluefin tuna: A case study in the Tsugaru Strait, northern Japan presented by M. Kanaiwa (ISC/15-

2/PBFWG/13)

Parasitic copepods, infecting large scombrid fishes, have been known for a long time because of the economic importance of their hosts. Most studies, however, have focused on their morphology or their infection status in aquaculture from pathological viewpoints, and very few quantitative surveys have been conducted under conditions in the wild. This study therefore investigated the prevalence of *Euryphorus brachypterus* (Caligidae) in Pacific bluefin tuna (PBF) landed at Matsumae Port in southern Hokkaido, Japan. Results of sampling from August to September 2015 showed that 13.2% of the PBF individuals (n = 1,978) were infected with this copepod. The prevalence of infections was higher in the larger body-size and varied among landing dates which were classified into three clusters. These findings suggest that *E. brachypterus* mainly use the larger PBF, which become sources of further infections in open sea environments, and that at least two host populations with different infection statuses visit the study area.

<u>Discussion</u>

The WG noted the result with interest as a potential method to identify the area of the growth of PBF.

5. Model Setting

5.1. Follow up Model Setting in the 2012 Stock Assessment and Available Options Appendix 4 of PBFWG Meeting Report in April 2015.

The WG noted that, given the accumulated experiences of the past assessments, as a general rule any change of the model setting should be supported by scientifically evaluated arguments.

After the detailed discussion, the options for model setting for the next assessments were identified as Appendix 4. Importantly, it was noted that although these general default model settings were agreed upon by the WG, the modelers in the WG will have the flexibility to develop and use alternative model settings to improve the model. Some of the points noted in the discussions were as follows:

- S/R relation: There is no new information that necessitates the change of stock-recruitment relationship assumption. Appropriate different steepnesses can be tried as sensitivity analysis.
- Recruitment: SigmaR and DevVector should be examined to see if they restrict the variance of recruitment too much.
- Natural mortality: No new information to change natural mortality. Sensitivity analysis should be done.
- Maturity: Age specific maturity rate is directly linked to the absolute SSB but not necessarily affect the assessment result in general because of the almost lack of stock-recruitment relationship.
- Growth curve: Two options will be investigated. Option A: A method using quarterly

average length for age 0 and the current von Bertalanffy curve for age-1+ (with consultation with Dr. Methot). Option B: 2 stanza model. Fukuda further investigates a growth curve for age-0 fish.
- Tail compression: Default is not to use but evaluate its effect as sensitivity analysis.
- Fleet structure: Fleet 2 will be divided into Japanese Fleet and Korean Fleet. The discussion on whether Fleet 4 should be combined with other Fleets was difficult. Since it was once a dominant Fleet, its proper evaluation is important particularly for old period. No better option for combining was suggested so the WG decided to do same from the previous assessment. With regard to set net Fleets (F7-10), it was recognized that Fleet 7 should not be combined due to the difference of measurement unit. In accordance with the suggestion by Japan, the WG agreed to combine Fleet 8 and 9 as a default option. The option to re-group set net Fleets in an area-basis (Option 3) was considered possibly to be evaluated in future. It was also agreed to combine Fleet 7 and 14 considering that they are targeting the same fish.
- Selectivity: The WG noted that although general default options will be agreed in this meeting, participants are free to try other options to see if it can improve the result. Also, flexible selectivity may be tested in the assessment.
- Initial sample size: Japan is intending to present a Working Paper in the assessment meeting. The WG agreed to discuss the matter further in the assessment meeting.
- CUPE CV: The WG agreed that the increased CV for recent JPLL in the last assessment is no longer necessary since the clustering analysis should have addressed the targeting effect. The WG agreed to employ “additive approach” where CV will be uniformly increased to have the average/minimum of 0.2.

6. Setting for the Future Projections

6.1. Description of the Current Soft Ware used for the Future Projection

Update of R packages ‘ssfuture’ for stochastic projections in future presented by T. Akita (ISC/15/PBFWG-2/14)

The detailed description of the updated software for stochastic future projection, especially the options used for the latest scenario for Pacific bluefin tuna in the PBFWG, was provided. Newly featured options include 1) flexible way of specifying periods in which estimated number of recruitment is resampled; 2) adjustment of fishing mortality not to exceed catch limits allocated for fleet groups and age classes. Under the condition where capping were set, both SSBs that are calculated by the old and new versions are almost the same. Furthermore, trajectory of catch by grouped fleets in future indicates that specified capping rules are accurately represented. Therefore, we conclude that updated version of the software works well and can be used for future projections in the next stock assessment.

<u>Discussion</u>

It was clarified that the current program does not have an ability implement an HCR type strategy to modify the catch responding to the SSB level. A question was made if the program can handle the change of steepness and it was clarified that it can change steepness in the projection model but B0 and R0 would be fixed at the estimated values in the stock assessment model. **The WG was generally comfortable with the future projection program but also noted the possibility that it may need to be modified depending on scenarios to be requested from management bodies.**

The WG noted that there are some lack of explanation in the Working Paper. The WG noted that the Working Paper will be revised to explain the features of the program more in detail and be distributed to the participants.

6.2. Consideration on the Future Projection Scenarios for the 2016 Stock Assessment

The WG noted that, taking into accounts of the request from NC9, at least the four following projection scenarios need to be evaluated in the next assessment. (1) replication of Scenario 6 in the previous assessment (to see the difference between the previous and new assessments), (2) replication of current CMMs (NC9 request no. 1), (3) 10% reduction for all age fish from (2) (NC9 request no. 2), and (4) projection based on the latest F from the next assessment (to see the actual current status).

A request was made to conduct an additional scenario to see the impact of reduction of the catch of large (≥30kg) fish. In order to compare the effect of reduction of the catch of small fish (<30kg) vs. large fish, the WG agreed to add two scenarios to scenario (3) which are 10% reduction in small fish catch and 10% reduction in large fish catch.

Additional request was also made to have a scenario with a biologically closer definition of juvenile than the current 30kg threshold since ISC had noted that the result could be different if the definition of juvenile is more consistent with the maturity ogive in the assessment. The WG noted that the 30kg threshold was chosen by ISC and the current management measures by RFMOs have already been developed along with the threshold which ISC provided. It was also noted that the projection which formed the basis of the conservation advice by ISC is consistent with the threshold (30kg) so the difference of threshold and the actual maturity size does not mean that the ISC conservation advice is incorrect. However, in order to provide the information on the impact of the difference of threshold, the WG agreed to add another scenario with the threshold of 4 years old but did not agree on the definition. It will be decided at the assessment meeting.

The WG also emphasized that “less than 30kg” is not consistent with the biological definition of “juvenile” in terms of proportion of maturity. According to the current maturity ogive used in the assessment, juvenile of PBF is assumed to contain all individuals of age-0-2, 80% of age-3 and 50% of age-4.

The WG agreed to conduct the following harvesting scenarios for the projection at the next assessment.

(1) replication of Scenario 6 of the previous assessment

(2) replication of the current CMMs

(3) replication of the current CMMs, with the different definition of juvenile (definition to be agreed)
(4) 10% reduction of catch of all ages from the current CCMs
(5) 10% reduction of catch of small fish (<30kg) from the current CMMs
(6) 10% reduction of catch of large fish (≥30kg) from the current CMMs
(7) based on the latest F from the next assessment and catch limits of the current CMMs

With regard to the recruitment assumptions, concerns were expressed that the assumptions in the previous assessment might have been too optimistic and unrealistic because it assumed that the recruitment will be maintained at least at "low recruitment" level however the SSB decreases. Therefore, a suggestion was made to add a recruitment assumption of steepness of 0.85 to see the impact of the existence of maternity effect. However, there was a question to use low steepness as 0.85 which the current model cannot handle. After the further discussion, the WG agreed to add a recruitment assumption of steepness of 0.9. It was noted that the treatment of the projection result using steepness of 0.9 might need to be discussed further at the assessment meeting since it will change B0 as well as R0.

The WG agreed to conduct projection on the following recruitment options in the next assessment;

(1) historical recruitment
(2) low recruitment ("low recruitment period" to be decided at the assessment)
(3) maternity-effect recruitment of steepness of 0.9

6.3. Other Matters

Although the usual deadline of working paper is two weeks before the meeting, the WG decided to allow the assessment paper to be submitted by 1 week before the meeting (by February 22nd).

7. Adoption of Report

The report was adopted by consensus.

8. Adjournment

The meeting was adjourned on November 24, 2015.

9. References

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Oshima, K., Ichinokawa, M., Yokawa, K., and Takeuchi, Y. 2008. Preliminary analysis on length data from intensive size sampling of Pacific Bluefin tuna caught by Japanese troll fisheries. ISC/08/PBF-2/12

Oshima, K., Fujioka, K., Ichinokawa, M., and Takeuchi Y. 2013. Updated Japanese troll CPUE targeting age 0 PBF through 2011. ISC/13/PBFWG/Appendix C.

Appendix 1. Meeting Agenda

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

PACIFIC BLUEFIN TUNA WORKING GROUP
WORKING GROUP MEETING

November 18-25, 2015
International Building, National Sun Yat-sen University
70 Lienhai Rd., Kaohsiung 80424, Taiwan, R.O.C.

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 Data Update
2.2. Japanese Longline (F1)
2.3. Purse Seine in the East China Sea & Korean Small Pelagic Purse Seine (F2)
Including Purse Seine Catch by Japan and Korea
2.4. Japanese Tuna Purse Seine Fisheries in the Sea of Japan (F3)
2.5. Japanese Purse seine off the Pacific coast of Japan (F4)
2.6. Japanese Troll (F5)
Including Catch Data by Japanese Troll Fishery for Tuna Pen Culture
2.7. Japanese Pole & Line (F6)
2.8. Japanese Set Net (Northern Part of Japan) (F7)
2.9. Japanese Set Net (Q1-Q2, Hokuriku) (F8)
2.10. Japanese Set Net (Q1-Q3, Other Area) (F9)
2.11. Japanese Set Net (Q4, Other Area) (F10)
2.12. Taiwanese Longline (F11)
Including Revised Taiwanese Catch Data from Weight to Number
2.13. Eastern Pacific Ocean Commercial Purse Seine (F12)
2.14. Eastern Pacific Ocean Sports Fishery (F13)
2.15. Others such as Japanese Trawl and Japanese other Longline (F14)

3. CPUE
3.1. Japanese Troll Fishery
3.2. Japanese Long Line Fishery

3.3. Taiwanese Long Line Fishery
3.4. Others

4. Biological Data
4.1. Growth Curve
4.2. Others (Including Steepness)

5. Model Setting
5.1. Follow up Model Setting in the 2012 Stock Assessment and Available Options Appendix 4 of PBFWG Meeting Report in April 2015.

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 2016 Stock Assessment
6.3. Other Matters

7. Adoption of the Report

8. Adjournment

Appendix 2. List of Participants

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Appendix 3. List of Working Papers and Presentations

Working Papers

No.	Title	Authors	Contact
ISC/15/PBFWG-2/01	Updates of Japanese quarterly catch data up to 2014 fishing year	Kazuhiro Oshima, and Yuko Hiraoka	oshimaka@affrc.go.jp
ISC/15/PBFWG-2/02	Estimation of length frequency of Pacific bluefin tuna caught by Japanese coastal longliners: updated up to 2014 fishing year	Osamu Sakai, Yuko Hiraoka, and Kazuhiro Oshima	sakaios@affrc.go.jp
ISC/15/PBFWG-2/03	A minor change in the estimation of length composition data of Japanese troll fisheries	Hiromu Fukuda, Hitomi Uyama and Kazuhiro Oshima	fukudahiromu@affrc.go.jp
ISC/15/PBFWG-2/04	Estimation of catch at size of Pacific bluefin tuna caught by Japanese set net fisheries: updated up to 2014 fishing year	Osamu Sakai, Yuko Hiraoka, Hiromu Fukuda, and Kazuhiro Oshima	sakaios@affrc.go.jp
ISC/15/PBFWG-2/05	PBF catch size-composition of the Mexican purse seine fishery fromdata collectdat pen reating operations: an update for 2013-2014	Michel Dreyfus-Leon and Alexandre Aires-da-Silva	dreyfus@cicese.mx
ISC/15/PBFWG-2/06	US commercial and recreational fleets catch and associated	Hui-Hua Lee, Kevin R. Piner, Liana Hebere, Jenny M. Suter	huihua.lee@noaa.gov
ISC/15/PBFWG-2/07	Estimation of weight composition for Japanese small scale fisheries in Tsugaru Strait: Fleet 14 (Other fisheries)	Kirara Nishikawa, Hiromu Fukuda, and Kazuhiro Oshima	kiraranishi@affrc.go.jp
ISC/15/PBFWG-2/08	Japanese troll CPUE targeting age-0 Pacific bluefin tuna: updated up to 2014 fishing year	Osamu Sakai and Kazuhiro Oshima	sakaios@affrc.go.jp

ISC/15/PBFWG-2/09	Japanese coastal longline CPUE for Pacific bluefin tuna: Tentative update up to 2014 fishing year	Osamu Sakai, Yuko Hiraoka, and Kazuhiro Oshima	sakaios@affrc.go.jp
ISC/15/PBFWG-2/10	Estimation of Standardized CPUE Series on Pacific Bluefin Tuna for Taiwanese Longline Fishery under Incomplete Data	Shu-Kai Chang, Hung-I Liu, and Yu-Wen Fu	skchang@faculty.nsysu.edu.tw
ISC/15/PBFWG-2/11	Estimates of growth function from length-at-age data based on otolith annual rings and daily rings for pacific Bluefin tuna	Hiromu Fukuda, Izumi Yamasaki, Yukio Takeuchi, Toshihide Kitakado, Tamaki Shimose, Taiki Ishihara, Tomoko Ota, Mikio Watai, Han-Bo Lu, Jen-Chieh Shiao	fukudahiromu@affrc.go.jp
ISC/15/PBFWG-2/12	Simulation of methods of dealing with age-based movement in PBF stock assessment	Hui-Hua Lee, Kevin R. Piner, Mark N. Maunder, and Richard D. Methot, Jr.	huihua.lee@noaa.gov
ISC/15/PBFWG-2/13	Infection status of *Euryphorus brachypterus* (Copepoda: Caligidae) on wild Pacific bluefin tuna: A case study in the Tsugaru Strait, northern Japan	Minoru Kanaiwa, Yuki Yamamoto, Yuko Hiraoka, Minoru Kato, and Hirotaka Katahira	m3kanaiw@bioindustry.nodai.ac.jp
ISC/15/PBFWG-2/14	Update of R packages ‘ssfuture’ for stochastic projections in future	Tetsuya Akita, Isana Tsuruoka, Hiromu Fukuda, Kazuhiro Oshima, and Yukio Takeuchi	akitatetsuya1981@affrc.go.jp
ISC/15/PBFWG-2/15	Preliminary analysis of catch and size data for Pacific bluefin tuan, Thunnus orientalis caught by Korean offshore large purse seine	Doo Nam Kim, Youjung Kwon, Sung Il Lee, Doo-hae An, Hunjoo Cho and Ari	youjungkwon@gmail.com
ISC/15/PBFWG-2/16	Brief Review on Size Distribution of Taiwanese PBF Catch	Shui-Kai Chang, Yu-Wen Fu and Hung-I Liu	skchang@faculty.nsysu.edu.tw

Presentations

Agenda No	Title	Presenters	Contact
2.3	Updates of catch at size for Japanese small pelagic fish purse seiners	Yuki Kumegai, Yaoki Tei, Hiromu Fukuda, and Kazuhiro Oshima	oshimaka@affrc.go.jp
2.5 and 2.6	Updates of catch at sizefor Japanese tuna purse seiners operated in the Sea of Japan and the Pacific Ocean	Isana Tsuruoka, Hitomi Uyama, and Hiromu Fukuda	fukudahiromu@affrc.go.jp

*For detail information about these presentations, contact to the author

Appendix 4. Model Setting in the 2012 Stock Assessment and Decision of "Modelling Small group"

	Full stock assess. in 2012	Decision of "Modelling Small group"
SS version	SS-V3.23b	Latest version on NOAA toolbox
Year definition	July to June (Fishing year)	July to June (Fishing year)
Time step	Quarter	Quarter
Stock (spawning population)	Single spawning population	Single spawning population
Area	Single for assessment	Single for assessment
Number of age class	21(0-20) -default; 21- lumped	21(0-20) -default; 21- lumped
Ngender	sex-combined	sex-combined
SRR	B-H w/ h=0.999	B-H (h=0.999) w/ Appropriate sensitivity runs
R0	estimated	estimated
sigmaR	0.6	Compare with estimated variation
R0 offset	estimated	estimated
recruitment deviation	option 1	option 1
Natural mortality	Age specific M M0=1.6 M1=0.386 M2+=0.25	Age specific M M0=1.6 M1=0.386 M2+=0.25 w/ Appropriate sensitivity runs
Maturity	Age specific Maturity Age3=0.2 Age4=0.5 Age 5+=1.0	Age specific Maturity Age3=0.2 Age4=0.5 Age 5+=1.0 w/ Appropriate sensitivity runs
Growth curve	Shimose et al. 2009 for single sex model adjust L1=21.5 for optimal fit Shimose et al. (2012) CV(L1); estimate CV(L2);0.05	Fukuda et al. (2015) 2-stanza like growth 1. Input average length at age (Quarter) 2. 2-stanza by assuming growth rate changing age as A1 (L1)
#of growth patterns	1	1 growth pattern (prioritize) 2 growth pattern
#of morphs, sub-morphs	1	1

Functional form of CV growth	CV=F(L)	CV=F(L)
Amin **Amx**	0 3	1. should be tuned to optimize the model fit
L-W	Kai et al. 2007	Kai et al. 2007
Length bin definition	2 cm for young, 4 cm for middle, 6 cm for old	default; old structure
Weight bin definition	0,1,2,5,10,16,24,32,42,53,65,77,89,101,114,126,138,150,161,172,182,193,202,211,220,228,236,243,273	0,1,2,5,10,16,24,32,42,53,65,77,89,101,114,126,138,150,161,172,182,193,202,211,220,228,236,243,273
Population length bin	2cm for all	2cm for all
Catch unit	Weight/numbers EPO-sport (numbers)	troll for pen(numbers) option; TLL (-2000; weight, 2001-; number)
Catch error	0.1	0.1
F-method	3 (solve catch eq) - catch exact	3 (solve catch eq) - catch exact
upperF	10	10
Fishery definition	14 Fleets	
Fleet 1	Japanese Longline (Length Comp., double normal, Time varying selectivity (1994-2012))	Japanese Longline(1.Dome shaped 2. try asymptotic selectivity)
Fleet 2	Japanese and Korean Small Pelagic Purse Seine (Length Comp., double normal)	Separate to Japanese SPPS (fitting to data: 2001-1Q2014) Korean OLPS (mirror Jpn or fitting to data 2011-2014) Composition data of Japanese SPPS (2001-1Q2014) & Korean OLPS (2011-2014) will be combined. Double normal selectivity will be estimated, and shared by those two Fleets.
Fleet 3	Japanese Tuna Purse Seine operating in Japan Sea (Length Comp., double normal, Time varying selectivity (2007-2012))	Japanese Tuna Purse Seine operating in Japan Sea (Length Comp., double normal, w/ some more time varying selectivity)
Fleet 4	Japanese Tuna Purse Seine operating in Pacific coast (Length Comp., double normal)	Same as the last assessment (fitted data 1995-2006)
Fleet 5	Japanese troll (Length Comp., double normal)	Same as the last assessment
Fleet 6	Japanese Pole and Line (Selectivity is shared with Japanese troll)	Same as the last assessment
Fleet 7	Japanese Set Net operating in Northern Part	weight composition data

	of Japan (Aomori & Hokkaido) (Weight Comp., double normal)	1. Combine with Fleet 14 2. Fleet 7 as same as the last assessment Selectivity; Flexible selex for time and length/age
Fleet 8	Japanese Set Net operating in Northern Part of Japan from Sept. to Dec. (Hokuriku area) (Length Comp., double normal)	1. Create a set-net fleet with Quarter 1-3 (fishing year) and another set net Fleet with Quarter 4 2. Combine all in to one set-net fleet Selectivity; Flexible selex for time and length/age
Fleet 9	Rest of the Japanese Set Net from Sept. to Mar. (Length Comp., double normal)	
Fleet 10	Rest of the Japanese Set Net from Apr. to Jun. (Length Comp., double normal)	
Fleet 11	Taiwanese Longline (Length Comp., Flattop)	Taiwanese Longline (Length Comp., Flattop) option; try double normal.
Fleet 12	EPO Commercial Purse Seine (Length Comp., double normal, Time varying selectivity)	1952-2001; US com (fitting data 1952-1982) 2002-2014; Mexican PS for pen (include US catch)
Fleet 13	EPO Sports (Selectivity is shared with EPO Commercial PS)	Mirror to the EPO PS early period
Fleet 14	Other Fisheries (Mainly Aomori & Hokkaido handline and Longline fisheries)	weight composition data 1. Combine with Fleet 14 2. Fleet 7 as same as the last assessment Selectivity; Flexible selex for time and length/age
CPUE (JLL) selectivity	double normal	Same as Fleet 1
CPUE (Jp Troll) selectivity	double normal	Same as Fleet 5
CPUE (TWLL) selectivity	flattop	Same as Fleet 11
CPUE likelihood	lognormal	lognormal
CPUE lambda	1	1
CPUE CV	JLL; Lowest is 0.2, gradual increase in recent years. Troll; 0.2 constant. TWLL; 0.2 constant.	1. Lowest/average is 0.2 add observation error. Flexibility by modelers
Input sample size for LenComps	No of haul well measured, bootstrapping method	Submit an input sample size time series with an explanation, may submit a document in Feb.
1st year of main	1953	1953

Rdev		
SR auto correlation	No	no
Initial F	Estimate without fitting to EqC LL, troll with eqC	Estimate without fitting to EqC Fleet 1, Fleet 12
Diagnostics of the model	Jitters, retrospective analysis, Likelihood profile relative to R0	Jitters, retrospective analysis, Likelihood profile relative to R0

References

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