ANNEX 5b

25th Meeting of the
International Scientific Committee for Tuna
and Tuna-Like Species in the North Pacific Ocean
Busan, Republic of Korea
17-20 June 2025

REPORT OF THE PACIFIC BLUEFIN WORKING GROUP WORKSHOP[1]

June 2025

[1] Prepared for the 25th Meeting of the International Scientific committee on Tuna and Tuna-like Species in the North Pacific Ocean (ISC) held 17-20 June 2025, in Busan, Republic of Korea. Document should not be cited without permission of the authors.

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ANNEX 5B

REPORT OF THE PACIFIC BLUEFIN WORKING GROUP WORKSHOP

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

14-18 April 2025
La Jolla, United States of America

1. OPENING AND INTRODUCTION

1.1. Welcome and Introduction

The Chair of the ISC Pacific Bluefin Tuna Working Group (hereafter PBF WG), Shuya Nakatsuka (Japan), opened the meeting. He welcomed the participants and thanked the U.S. delegation for hosting the meeting. He noted that the main purpose of the current meeting is to finalize the PBF Management Strategy Evaluation (MSE) to be presented in the upcoming Joint Working Group of the IATTC and WCPFC NC on Pacific Bluefin Tuna (JWG), scheduled in July this year.

1.2. Adoption of agenda

The adopted agenda is attached as Appendix 1. The list of participants and the list of documents are attached as Appendix 2 and Appendix 3, respectively.

1.3. Appointment of rapporteurs

Stephanie Flores (USA) was appointed rapporteur.

2. MODEL SETTING AND RESULTS

Oral Presentation 1: Overview of Results of the PBF MSE. Desiree Tommasi.

Here we present the final results of the Pacific Bluefin tuna Management Strategy Evaluation code for all the candidate harvest control rules (HCRs) and across all the operating models (OMs) in the reference set. We also show that after reviewing the simulation runs, we detected that some of the simulated stock assessments (i.e., estimation models) had estimation issues in some years and produced unrealistically low levels of spawning stock biomass (SSB) not seen in the OM's. Finally, we outline results for the robustness scenarios.

Discussion

Estimation Issues in EM (i.e., the Simulated Stock Assessment):

The WG reviewed all EM results and held an in-depth discussion on the presence of outliers in SSB, with some iterations estimating SSB close to zero (less than 1 fish) in a certain year, despite no corresponding drops in the OM. These outliers were linked to very high estimated fishing intensity (i.e., 1-SPR) and triggered drastic management actions in the projected MSE simulations. Following these sharp reductions in fishing intensity, very high SSB levels subsequently appeared. The author clarified that the identified outliers were specific to iteration, HCR, and year. However, to maintain consistency in recruitment across HCRs, once an outlier iteration was identified, it was removed for all HCRs.

The WG expressed reservations about the outlying EM results and debated whether these outliers should be retained in the final MSE analyses. A WG member raised concerns about the potential bias introduced by the arbitrary removal criteria.

It was re-emphasized by the author that the outliers appear to be the result of an estimation issue, although the underlying cause is unclear. An initial review of one outlier showed that the problem was due to a failure to converge. It was noted that, in a real stock assessment, convergence issues can be addressed using proper diagnostic tools. However, this is not feasible in the MSE, as diagnostic model runs cannot be performed for every simulated assessment across all iterations.

It was shown that excluding these problematic runs had little impact on the overall performance metrics. More importantly, the exclusion had no impact on the ranking of HCRs— a critical aspect of the MSE.

The WG further discussed what would be the best approach to handle the outliers whether to remove problematic iterations for all HCRs or remove only these years with problematic simulated stock assessments for specific HCRs and iterations. The WG noted either approach may bring a different type of bias.

The Working Group requested a detailed examination of all problematic EM iterations to determine whether the issue of non-convergence was consistent across the board. If some iterations did not show convergence problems, additional analyses would be needed to demonstrate the robustness of the results with and without the exclusion of these iterations. The Working Group tentatively agreed to not include the problematic/outlier EM results for all HCRs but to provide final gradients of problematic EMs and results also for all iterations for transparency.

Time-Series of Fishing Intensity and SSB:

It was pointed out that the EMs tend to overestimate fishing intensity (1-SPR) and initial SSB compared to the OMs. This is due to estimation errors in the EMs, attributed to the simplified ASPM-R+. In addition, the productivity assumption in EM used in MP is consistent with OM1, which has a high productivity assumption compared to other OMs. Since the MP operates on the underlying EMs, their characteristics including the overestimating nature are evaluated as part of MP performance. It was confirmed that the MP is functioning as expected, except for the cases described above. As the EM tends to overestimate fishing intensity, which is set based on the estimated biomass by EM, fishing intensity across the OMs (i.e., simulated true) tends to be lower than the Ftarget set by the MP.

Performance Metrics:

A WG member requested the calculation of the Safety Performance Metric based on the IATTC's interim reference point for tropical tunas, with the probability of breaching the 7.7%SSB0 being less than 10%. The author completed the requested analysis the following day. The WG acknowledged the author for demonstrating the Safety Performance Metric by year for each HCR**.** Although almost all HCRs met the safety objective and had less than a 20% probability of SSB being below their respective LRP and 20%SSB0 and less than a 10% probability of breaching the IATTC's interim reference point for tropical tunas, some HCRs showed a declining trend in probability over time. In response to WG requests, the author updated the Safety Performance Metric portraying the reference point used in the IATTC's tropical tuna.

The WG noted that the downward change in the Stability Performance Metrics of the TAC between management periods did not display when the SSB is below the LRP as specified by the JWG. However, there is no cap at 25% once the SSB falls below the LRP. The WG requested including a Stability Performance Metric plot with results from all the simulation years, including those in

which SSB was below the LRP. In response to WG requests, the author included a Stability Performance Metric plot with results of downward TAC change summarized across all management periods.

For the Yield Performance Metrics, the WG requested the author to replot Metric 2-4 (fleet specific yield) with annual catch from years 5-10 and 10-23, rather than the average catch. They also requested the author to add the 2023 US recreational catch when the plots refer to the EPO catch limit and, for further clarification, use half of the biennial limit rather than the 1-year maximum.

In response to WG requests, the author presented the replotted Yield Performance Metric 2-4 with annual catch on the Y-axis and replotted the EPO using half of the biennial limit and the 2023 calendar year recreational catch.

The WG requested that the final graphs include a defining line between HCRs 1-8 and 9-16.

While reviewing the trade-off plots, the author noted that there is a strong trade-off between yield and safety but no apparent trade-off among others (between Yield and Stability, Stability and Safety, Yield and Status, Status and Safety, or Stability and Status). The author clarified that the target reference points are what determine safety performance when calculated relative to the 20%SSB0 level. In trade-offs between Performance Indicators: Status and Stability, Status and Safety, and Yield and Status, the author opened a discussion on the choice to use F instead of SSB for the status. There was no disagreement.

The WG reviewed the final table of all performance indicators. It was noted that the author included a negative sign in the percentage of upward change in the TAC+ row to show the change in a visually cohesive manner comparable to the other columns of the table. The author addresses this decision within the MSE report. **The WG requested no color for the impact ratio columns and to include another stability metric that includes simulated years with the SSB below the LRP. However, in order to avoid crowding the table, it was later agreed to include a separate table in the main body of the report which compares stability performance with and without the TAC change when SSB is below the LRP. The WG requested interactive options that will allow choosing which performance indicators and HCRs are featured in the table for the PBF MSE Shiny app.**

Robustness Tests:

The WG discussed the robustness test results where there is a drop in recruitment from 2052-2061. Though the degree was different, all MPs had challenges in dealing with this scenario. The WG noted that it is expected for MPs to have a delay in identifying the decline in recruitment given that the only CPUE used in the MP is from adult abundance. However, it was noted that once SSB declines, the MPs eventually take action to reduce F. It was also argued how realistic the projected recruitment decline is, which is a 40% decline from the average level. Also, the current projection results may be too short to evaluate the performance of MPs, as they do not include a potential recovery period back to target levels. The WG considered whether adding more years to the projection may show the stock eventually increasing and whether that would be beneficial to management. **Ultimately, the WG decided to move the period of low recruitment earlier in the projection in the recruitment drop scenario to show biomass recovery after the drop and to recalculate the performance metrics.**

The WG noted that MPs based on total biomass metrics other than SSB might be useful for stocks like PBF that have a large amount of catch of immature fish.

For the preliminary results of the other two robustness scenarios ("effort-creep" and "doubling-of-discard"), the WG noted that all the MPs demonstrated fairly robust performance. The WG later discussed the timeline for completing the remaining simulations for the discard scenario and will hold an online meeting in May to review the results.

The WG later reviewed the results of recruitment drop scenarios with the low-recruitment period moved earlier in the simulation as well as a robustness test simulation based on OM3 (Presentation 5). It was noted that the stock will eventually recover in the "recruitment-drop" scenario under all MPs and **the WG confirmed that its earlier observations on the results of the "recruitment-drop" scenario remain valid.** The results from the OM3 (the OM with the lowest starting relative SSB) based robustness test showed higher robustness of MPs than under the OM1based robustness test because the SSB grows larger in the OM3-based simulation than the OM1-based simulation before the recruitment drop starts. The WG also reviewed the completed simulation of "doubling-of-discard" scenario and concluded that it is not necessary to modify the MSE report.

Oral Presentation 2: Estimation Model and the TAC for 2026 Based on the Candidate MPs. Hiromu Fukuda.

H. Fukuda (Japan) made a presentation entitled "Estimation model and the TAC for 2026 CY based on the candidate MPs". The process to develop an age-structured production model with estimated recruitment deviation (ASPM-R+) model was explained, and the presenter welcomed the PBFWG to confirm and adopt the structure of the estimation model to calculate the actual TAC. Because the ASPM-R+ model was the one applied in the PBF MSE simulation, the ASPM-R+ model was recommended for the use of TAC calculation. The SSB/SSB0, SPR, and estimated recruitment were presented, and the possible causes of differences in those variables between the fully integrated model and the ASPM-R+ model were explained. At the end of his presentation, a possible TAC for 2026 based on each candidate MP was presented.

Discussion:

A WG member raised a question about the differences in relative SSB and fishing intensity after 2020 between the full model and the ASPM-R+ model. The author clarified that recruitment information was based on the average spawner-recruit relationship after 2017 in the ASPM-R+ model, whereas recruitment was primarily informed by size composition data in the full model. Although the data used in the ASPM-R +model within the MSE-EMs differ from those used in the ASPM-R+ model for TAC calculation, the underlying ASPM-R+ structure remains the same.

The WG discussed how the TAC calculation would be maintained if relative fishing intensity diverges from the current average (2015-2022) in the future. The WG noted that the model used in the MP calculation will continue to be updated, but over the long term, this divergence could become an issue. **The WG agreed to use the ASPM-R+ model as the basis for the TAC calculation.**

3. DRAFTING MSE REPORT

Based on the results and discussion, the WG reviewed the MSE report. The WG focused its efforts on finalizing the executive summary of the report, while also discussing the general structure of the main body of the report. After an extensive review, the executive summary was finalized, except for a few final checks, which include:

i) inclusion of the OM trajectory figures and renumbering of figures and their references
ii) finalization of the "big table",
iii) confirmation of recovery for the recruitment-drop robustness test by extending the projection period.

The executive summary will be finalized by the end of April after the above final checks and formatting by the USA. Then the WG Chair was tasked with initiating the preliminary approval process, as outlined in the ISC Operations Manual, so that it can be forwarded to the IATTC SAC in June. It will become public only when posted on the IATTC SAC website.

The main body of the report needs to be completed by the end of April, and then WG members will review it and make suggestions/comments by May 16th. Japan will subsequently conduct the final formatting so that the report can be submitted to ISC Plenary 25.

4. WORK PLAN AND RECOMMENDATIONS

The WG reviewed the schedule of upcoming meetings where the MSE will be presented. The presentation file will be mainly prepared by the USA, while the actual presentations may be made by different members depending on the circumstances. Presentations are currently expected at the following meetings: IATTC SAC (early June), ISC Plenary (mid June), JWG MSE Workshop (late June), and JWG (early July). In addition, presentations may be requested at the WCPFC SC (August), IATTC Commission (September), and WCPFC Commission (November).

5. OTHER MATTERS

5.1. New Scientific Information Relevant to PBF

The SSB Difference Between Base Case Model and Bootstrapping Result. Kirara Nishikawa*, Yohei Tsukahara, and Hiromu Fukuda (ISC/25/PBGWG-01/01)

K. Nishikawa presented *The SSB difference between base case model and bootstrapping model.* During the stock assessment meeting in spring 2024, the WG also conducted the future projections based on the base case (BC) model of the assessment. The uncertainty in the future projection analysis was considered by the combination of the uncertainties from parameter estimation and from the future recruitment, and these uncertainties were estimated by the bootstrapping method. However, the point estimates of SSB from the BC and the median SSB from the bootstrapping replicates had some discrepancies. These discrepancies had already been observed during the previous 2 stock assessments. To reduce this kind of discrepancy, the WG applied the bias correction method. This additional process to remove the bias was applied in the 2024 stock assessment as well. However, the bias between the BC point estimates and the bootstrapping medians became obvious once again. Thus, the authors clarified the possible sources of this bias.

From the comparison between the BC and ASPM-R, the differences between the SSB point estimates and the bootstrapped replicates in ASPM-R were smaller than those from the fully integrated model, thus, the possible source of this bias might come from size composition

residuals. From the comparison of residuals between the BC, the expected model, which uses the expected values in the BC as input data, and the replicates of the bootstrapping, the random sampling error and the number of bins for the weight composition fleet were considered as possible issues regarding the current bootstrapping procedure.

Discussion:

A WG member clarified that the difference in SSB between the full model and the corresponding expected model from Stock Synthesis is greater than the difference between the expected model and the corresponding bootstrapped median. A similar pattern was also observed in the ASPM-R model. A suggestion was made to further investigate the expected model, which represents the expected data values based on the model fit. One notable pattern was observed in the weight composition data for fleet 18. The author clarified that the bootstrapped median accounts for the bias introduced by the added larger minimum in fleet 18, whereas the expected model does not. The WG discussed that potential sources of bias could arise from multiple fleets, given the large number of size composition data. A WG member suggested toggling individual fleets on and off to explore potential effects. Another WG member suggested reconsidering the input sample sizes in future assessments to better align with the bootstrapped results. **The WG agreed to further investigate the issue towards the next assessment.**

5.2. Requests from the 9th Joint IATTC WCPFC-NC WG Meeting

Oral Presentation 3: Estimating Fleet-Specific Allocations of Spawning Potential Ratios. Steve Teo.

S. Teo presented *Estimating fleet-specific allocations of spawning potential ratios*. In 2024, the ALBWG advised the WCPFC NC and IATTC on how to interpret fishing intensity in spawning potential ratio (SPR) units, based on an analysis of the relationships between fleet-specific SPRs and measures of catch and effort for North Pacific Albacore Tuna (NPALB). However, the ALBWG did not tackle the question: if an allocation of fleet-specific SPRs are set based on the current total SPR but subsequently, changes to the total SPR are needed, how is the new total SPR to be allocated such that relative benefits to each fleet would be maintained at the same or some other desired level? In this study, we show how: 1) SPRs are related to the Poisson-binomial distribution; 2) to use the Poisson-binomial distribution to calculate the fleet-specific share of benefits from the fleet-specific SPRs; 3) to use Excel (or some other platform) to estimate the fleet-specific SPRs such that they result in the specified total SPR and at the same time, result in the specified fleet-specific share of benefits; and 4) as an example, to convert the fleet-specific SPRs into catch and/or effort controls based on the relationships previously established by the ALBWG. The Excel code and R scripts associated with this study were demonstrated and made available to the ALBWG. The tests of the Excel code showed that Solver was able to solve the equations for nine aggregated fleets and a series of desired total SPR values ranging from F20%SPR to F90%SPR, such that the desired total SPR values were met, while the share of benefits for each fleet were maintained at fixed levels. This study demonstrates one potential way to estimate the fleet-specific SPRs such that the desired total SPR values were met, while the share of benefits for each fleet were maintained at the desired levels. These fleet-specific SPRs could in turn be related to catch and/or effort controls. We recommend that the ALBWG consider this information when providing advice on relating reductions in fishing intensity to more traditional measures of catch and/or effort.

Discussion:

A WG member asked whether the method would be effective when more fishery groups need to be allocated, noting that Lee and Taylor's paper showed the potential for increased bias under such conditions. The author responded positively, with the caveat that the method has not yet been tested in a real application. An example based on the proposed method was demonstrated using an Excel spreadsheet.

The WG also discussed the potential application of the method to calculate the conversion factor between small and large fish in the EPO and WCPO. **It was agreed to test this method to calculate the conversion factor requested by the JWG. The results will be reviewed at the informal meeting on May 13/14th.** Although the WG reviewed a proposed method to calculate conversion factors (ISC/25/PBFWG-01/02), it could not reach a consensus on the method due to technical complexity. It will continue to work on the matter.

Other Issues

Additionally, the WG briefly discussed the other outstanding requests from the JWG, which include the projections under the current measure, the effect of no increase in age-0 catch, and research on the migratory pattern of PBF. The results of the first two requests were already presented at the November meeting last year, while the request for research on the migratory pattern has not been formally made by the WCPFC-NC. WG members were encouraged to summarize their research activities on migratory patterns, so that the WG Chair can explain the current knowledge and assumptions regarding the migration of PBF.

5.3. Research Plan to Collect Reliable Indices of Abundance

Oral Presentation 4: Reevaluation of the Dataset from the Real-Time Troll Monitoring (RTM) Survey to Calculate the Recruitment Index of Pacific Bluefin Tuna. Ifue Fukuchi*, Yohei Tsukahara, Hiromu Fukuda, Shuya Nakatsuka.

I. Fukuchi presented *Reevaluation of the dataset from the real-time troll monitoring (RTM) survey to calculate the recruitment index of Pacific bluefin tuna*. The recruitment index based on RTM data has been developed using both conventional and chartered RTM operations. However, there were obvious differences in the nominal CPUE between the chartered RTM operations and the conventional RTM operations. In this study, we reviewed the tracks of charter operations to identify the characteristics of PBF targeting operations. Based on these features, we manually reviewed the tracks of conventional RTM operations and removed those that did not match these features, considering them as non PBF targeting. As a result, the number of operational days was approximately half that of the conventionally filtered dataset. The nominal CPUE of conventional RTM operations showed consistently higher values after reevaluation and showed similar values to the chartered RTM. The index estimated by VAST showed a similar trend before and after reevaluation. The reevaluated dataset contributes to a more reliable PBF recruitment index.

Discussion:

This index was considered previously for the assessment model but was ultimately rejected due to the concern about whether the index retained the same representativeness and catchability between real-time monitor troll data by commercial operations and chartered operations, which were intended to provide additional fishing trips' worth of data after their quota was reached.

The WG agreed that selecting the trips targeting PBF was a step in the right direction and suggested an automated process for data collection (e.g., cross validation, machine learning), as opposed to manual selection. This may also require additional time as fishermens' habits change over time, so a longer dataset may be necessary to encompass situational variability.

Group members debated whether the additional screening on real-time monitor troll data was worth the time it would take to validate it. On one hand, the charter data only provides four years' worth of data, and there is an advantage of more information if the additional dataset is added. A WG member noted that the index must be validated in the assessment model.

5.4. Others

Oral Presentation 5: Planning: PBF Assessment Peer Review. Hiromu Fukuda.

The WG tentatively agreed to hold the peer review meeting of the PBF assessment on March 20-27. March 20-24 will be allocated for the peer review, and March 25-27 will be used to prepare responses to the review. To prepare, the group will hold an informal virtual meeting at the end of 2025 to organize the discussion and documents. One major topic of discussion will be the group's presentations. It was noted that, as the PBF stock assessment work spans over a decade, some model assumptions were made a long time ago and may need recovery work of the original research.

The WG discussed the draft Terms of Reference (ToR) for the peer review. It was generally agreed to focus the review on the data and modeling aspects of the assessment, and less on the management advice aspects (e.g., reference points and future projections). The WG agreed to finalize the ToR intersessionally before the Plenary meeting. It is anticipated that the selection process for reviewers will start after the ISC Plenary 25 once the ToR are adopted. The Chair was requested to contact the WCPFC Secretariat to confirm the schedule.

The WG also discussed the potential benefits of opening the Peer Review meeting to the public. The WG generally supported accepting observers but noted that the current manual does not have any provision for observers at WG meetings. Therefore, this issue needs to be raised at the Plenary. The WG also discussed the limitations on allowing unlimited observers during the peer review, noting that meeting room capacity could be a potential constraint. The WG tentatively agreed to make the session publicly accessible, provided logistics allow.

Regarding the chair of the peer review meeting, it was noted that the ISC peer review process requires the ISC Vice-Chair to chair the peer review meeting. However, this may be difficult in this case, as the current ISC Vice-Chair is also the PBFWG Chair. The WG considered that it is most preferable for the ISC Chair to chair the PBF peer review meeting. If that is not possible, it is hoped that one of the reviewers can take on the role.

Climate Change Matrix:

Noting that the ISC Chair was tasked to prepare the Climate vulnerability matrix, and that the Chair kindly prepared the first draft, the WG considered that much of the requested information is currently unknown and difficult to fill. In the meantime, the members were encouraged to promote the studies on the impact of climate change on PBF and report to the WG.

Election of Chair:

It was noted that the current Chair, S. Nakatsuka, finishes his final year in his 2nd of 3-year term. The WG unanimously elected him to serve an additional 1-year-term of the PBFWG Chair as provided by the Operations Manual.

5.5. Future Meeting

The WG will hold an informal online meeting on May 13/14 (EPO/WPO) to check the results of the revised simulation under the recruitment drop scenario, the increased discard scenario, and the conversion factor calculation. In the short session during the Plenary, the WG will confirm the presentations for the Plenary, finalize the ToR of the peer review, and discuss any outstanding issues.

The next PBFWG meeting for the peer review is scheduled for March 20-27, 2026.

6. ADOPTION OF THE WORKSHOP REPORT

The WG reviewed the draft report and adopted it as amended.

7. ADJOURNMENT

The meeting was adjourned at 11:30 am on 18th April, 2025.

ANNEX 1: MEETING AGENDA

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

INTERSESSIONAL WORKSHOP
April 14-18
La Jolla, United States of America

DRAFT AGENDA

1. Opening and Introduction
   1.1. Welcome and introduction
   1.2. Adoption of agenda
   1.3. Appointment of rapporteurs
2. Model setting and results
   2.1. Review of the Harvest Control rules
   2.2. Results of the PBF MSE
3. Drafting MSE report
4. Work plan and recommendations
5. Other matters
   5.1. New scientific information relevant to PBF
   5.2. Requests from the 9th Joint IATTC WCPFC-NC WG meeting
      5.2.1. Research plan to collect reliable indices of abundance
   5.3. Others
   5.4. Future meeting
6. Adoption of the workshop report
7. Adjournment

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ANNEX 3: LIST OF DOCUMENTS

Working Papers

Index	Related Agenda	Title	Author
ISC/25/PBGWG-01/01	5.1	The SSB Difference Between Base Case Model and Bootstrapping Result	Kirara Nishikawa*, Yohei Tsukahara, and Hiromu Fukuda
ISC/25/PBGWG-01/02		Conversion factor based on the fishery impact plot: using the fishery impact per unit catch to maintain the overall fishery impact constant while transferring catch from one to another	Hiromu Fukuda, Kirara Nishikawa, and Shuya Nakatsuka

Oral Presentations

Number	Related Agenda	Title	Author
1	2	Overview of Results of the PBF MSE	Desiree Tommasi
2	2	Estimation Model and the TAC for 2026 Based on the Candidate MPs	Hiromu Fukuda
3	5.2	Estimating Fleet-Specific Allocations of Spawning Potential Ratios	Steve Teo
4	5.3	Reevaluation of the Dataset from the Real-Time Troll Monitoring (RTM) Survey to Calculate the Recruitment Index of Pacific Bluefin Tuna	Ifue Fukuchi*, Yohei Tsukahara, Hiromu Fukuda, Shuya Nakatsuka
5	5.4	Planning: PBF Assessment Peer Review	Hiromu Fukuda