ANNEX 04

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 ALBACORE WORKING GROUP WORKSHOP[1]

June 2025

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ANNEX 04

REPORT OF THE ALBACORE WORKING GROUP WORKSHOP

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

10 – 14 March 2025
Institute of Oceanography, National Taiwan University
Taipei City, Taiwan

1. OPENING AND INTRODUCTION

1.1. Welcome and Introduction

An intersessional workshop of the Albacore Working Group (ALBWG or WG) of the International Science Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was convened at the Institute of Oceanography, National Taiwan University, Taipei, Taiwan, 10-14 March 2025. The last time an ALBWG meeting was held in Taiwan was in conjunction with the 9th meeting of the ISC Plenary in Kaohsiung, Taiwan in July 2009.

Dr. Yi-Jay Chang, Professor at National Taiwan University Institute of Oceanography, welcomed participants from Canada, Chinese Taipei (TWN), Japan, the United States of America (USA), and the Inter-American Tropical Tuna Commission (IATTC) to the workshop, both in-person and virtually. The participants and their affiliations are listed in **Attachment 1**.

The ALBWG Chair briefly described the objectives of the meeting and the expected outcomes. The objectives of this workshop were to: 1) make progress on improvements to biological modelling, data collection, and abundance index improvements; 2) address requests for advice from the RFMOs; and 3) create a workplan for the next stock assessment.

1.2. Meeting Protocol

The ALBWG Chair noted that the efforts of the WG at this meeting would be collegial and follow the scientific method with an emphasis on empirical testing, open debate, documentation and reproducibility, reporting uncertainty, peer review, and constructive feedback to authors and presenters.

1.3. Adoption of Agenda

The draft agenda was circulated prior to the meeting, reviewed, and adopted at the workshop (**Attachment 2**). A list of working papers and presentations can be found in **Attachment 3**.

1.4. Assignment of Rapporteurs

Rapporteuring duties were assigned to Haikun Xu, Steven Teo, and Peter Kuriyama. Sarah Hawkshaw, the ALBWG Chair, had the overall responsibility for assembling the report.

1.5. Distribution of Documents and Working Paper Availability

Twelve (12) working papers (WP) were submitted and assigned numbers for the workshop (**Attachment 3**). Working papers will be publicly available through the ISC website (http://isc.fra.go.jp/) and author contact details will be provided for the other related materials.

2. REVIEW WORK ASSIGNMENTS

The WG chair briefly reviewed the table of work assignments developed at previous WG meetings and the WG discussed plans to update the work assignments during this meeting (**Table 1**).

3. REVIEW WORKING PAPERS

3.1. Abundance Index Improvements

An Update of the Standardized Abundance Index for the US Surface Fleet in the North Pacific. Peter Kuriyama and Steven Teo (ISC/25/ALBWG-01/01)

This study updated the standardized index of abundance for the US surface fleet logbook data. Similar to previous efforts, the data were grouped into three time periods and generalized linear models were applied to the data. The full model that estimated fixed effects for year, area, and season were selected for each of the time periods. The estimates from 1999-2024 were similar to those estimated for the 2023 benchmark assessment. The recent CPUE estimates were relatively high in 2022, low for 2023, then relatively high in 2024. Spatiotemporal models with sdmTMB were also explored. The full GLM estimated in sdmTMB had identical coefficient estimates, and preliminary results that estimated a spatial random field were described. A more thorough investigation of spatiotemporal models will be completed prior to the data preparation workshop scheduled for the end of 2025.

Discussion

The WG thanked the authors for this updated analysis. The WG asked if the data source for this analysis included logbooks from both Canada and the US and the authors clarified that the data source for this index was just the logbooks from the US surface fleet. The WG inquired about potential reasons for what appeared to be a very large reduction in effort in 2024. The authors clarified that the 2024 data was preliminary and incomplete at the time of this analysis. The WG also asked about the changes in the spatial coverage of the US surface fleet, especially in recent years. The authors responded that most of the catch and effort for this fishery in recent years is in Q3 and within the US and Canadian EEZs. Prior to 1999, a substantial amount of the fishing effort would occur on the high seas but in recent years, fishing on the high seas is generally limited to much fewer vessels. **The WG recommended that this index be considered in a sensitivity run for the next stock assessment and that the authors should prepare an updated analysis for the data preparation meeting.**

Standardized CPUE and size for North Pacific Albacore by Japanese Longline using VAST package. Naoto Matsubara, Haikun Xu, Hirotaka Ijima, and Yuichi Tsuda (ISC/25/ALBWG-01/02)

This study provides information on the updated Japanese longline CPUE and the associated length composition. To examine the index of abundance used for the stock assessment, we standardized the CPUE from Japanese longline logbook data using the VAST package. Similar to the previous CPUE using the INLA model, we could observe a sharp decline around 2020 in the standardized CPUE from the VAST model. We re-examined the following hypotheses regarding the sharp decline in area 2's CPUE in 2020.

- COVID-19 impacted fishing operations – last year's document (ISC/24/ALBWG-01/02) did not support this hypothesis.

- Albacore moves to area 2 not in the first quarter of 2020 – the quarterly model for Area 2 did not support this hypothesis because the index was low in adjacent quarters as well.
- Albacore moves out of area 2 in the first quarter of 2020 – the center of biomass plot and the comparison of indices based on area 2 and area 2 + northern area (latitude 30–40°N, longitude 140–160°E) both support this hypothesis.

Additionally, the length compositions for the index of abundance were calculated successfully, which expected to help avoid conflicts between standardized CPUE and LF when inputting data into the stock assessment model.

Discussion

The WG thanked the authors for their presentation of the WP which described the updated analysis of the JPLL CPUE that was requested at the last WG meeting. The WG agreed that the likely explanation for the large drop in CPUE in 2020 was a large shift in albacore distribution northward and therefore the spatial coverage for the standardized adult index would have to expand beyond Area 2, and if possible, to the entire North Pacific. The WG noted that the spatial coverage may have to be restricted to smaller than the entire North Pacific by removing the grids with poor size composition data. For the length composition data, the WG noted that the data are relatively coarser and sparser, especially in Areas 4 and 5. **The WG recommended that the authors continue the future work outlined in the WP, expand the spatial coverage of the CPUE index beyond Area 2, and present this as a candidate for the primary adult index in the upcoming stock assessment.** Since the expanded spatial domain will likely include juvenile habitat **the WG also recommended that the authors use the length bins associated with adult females to compute the adult index and the associated size compositions or selectivity.** The WG notes that in a change in concept from previous assessments, this candidate adult index will be considered a survey fleet in the assessment, and independent of fishery fleets with catches.

The WG will make a decision on the primary adult index at the ALBWG data preparation meeting. **The WG recommended that the authors also provide an update to the primary adult index used in the 2023 stock assessment (Area 2, Quarter 2)** in order to prepare a model that reasonably represents an update of the 2023 base case model.

CPUE Standardization Considering Spatial Fish-Size Distribution. Hirotaka Ijima, Naoto Matsubara, Marko Jusup, and Yuichi Tsuda (ISC/25/ALBWG-01/03)

ISC albacore working group has used the area-as-fleet approach in North Pacific albacore stock assessment, assuming distinct length compositions in each region. However, annual fluctuations in age-specific distribution around area boundaries may impact CPUE standardization. We applied a mixture model to classify Japanese longline logbook data (1994–2023) based on mean body-mass groups. This method, defined at the year, month, and 5×5-degree block levels, provides a finer-scale alternative to the area-as-fleet approach. For CPUE standardization, we developed a spatiotemporal multi-species model using Tweedie and negative binomial distributions. Compared to the 2023 model and VAST model result, Tweedie model improved unrealistic spikes. The negative binomial model showed the steepest CPUE decline and large fluctuations, highlighting potential biases. Standardized CPUE for both juveniles and adult females declined, particularly around the Emperor Seamounts. Fishing effort has decreased in this region, requiring careful interpretation of CPUE trends. Future work includes refining models with GMRF-based intercepts, cross-validation for model selection, and residual validation. These improvements aim to enhance CPUE standardization accuracy and provide more reliable stock assessment indices.

Discussion

The WG thanked the authors for this updated analysis and asked for points of clarification regarding the relationships between size composition, weights, and the specific index calculations for the JPLL logbook data. The challenge seemed to be that length composition data were from port samples and only available for year, month, and 5x5 degree blocks. But the logbook data had average weights for each longline set. One challenge was that the length composition data are from 5x5 degree blocks which is a coarser spatial resolution than the 1x1 degree longline data.

The WG noted that the standardized CPUE from this study and the standardized CPUE values from the 2023 stock assessment and ISC/25/ALBWG-01/02 are different, in particular the CPUE estimates do not have a big drop in 2020. This was likely due to the CPUE values in this analysis being estimated for the entire north Pacific compared to ISC/25/ALBWG-01/02 which only used data from Area 2.

The WG discussed general protocols for spatiotemporal models. A Tweedie distribution or a Poisson-link delta model, which approximates the Tweedie distribution, should be used as the default distribution for the CPUE standardization model. Model selection for hierarchical models should be done with cross-validation as AIC is not valid for mixed effects models.

The WG recommended updating this Japanese CPUE index and providing details on any changes with updated versions of R-INLA. The results will be compared to those from ISC/25/ALBWG-01/02 at the data preparation meeting.

The WG noted that the abundance index from this study is meant for use in an assessment model taking a mixture model approach, rather than a fleets-as-areas approach. **The WG recommended that the 2026 stock assessment should continue to use a fleets-as-areas approach and the mixture model-based assessment approach continue to be developed as a research track model.**

Spatiotemporal Modelling for Size-Specific CPUE Standardization of Albacore Tuna in the North Pacific Ocean Caught by Taiwanese Longline Fisheries. Zi-Wei Yeh, Jhen Hsu, and Yi-Jay Chang (ISC/25/ALBWG-01/04)

Understanding the spatial and temporal variations in the size structure of highly migratory fish populations is critical for improving abundance estimates and stock assessments. This study focuses on the North Pacific albacore tuna (*Thunnus alalunga*) and aims to develop a size-specific spatiotemporal model using Taiwanese longline fishery data to generate standardized size compositions for stock assessment purposes. We used fishery CPUE data and length measurements from 2004 to 2023, categorizing albacore into juvenile, intermediate, and adult size groups based on maturity schedules. Spatiotemporal modeling was performed using two modelling packages, VAST and sdmTMB, to estimate both abundance and size-specific CPUE across various years and locations. Results showed that both modelling packages produced consistent abundance trends, with a slight upward trend in juvenile abundance since 2017 and a significant decline in adult abundance since 2010. Additionally, size-specific abundance estimates indicated distinct spatial distributions for juveniles and adults, with juveniles concentrated in higher latitudes. Our analysis highlights the efficacy of the Stepwise method for integrating both CPUE and size composition data, providing a more comprehensive size-specific abundance index. This study offers valuable insights for improving stock assessments and supports the inclusion of Taiwanese data in future abundance indices for albacore tuna in the North Pacific Ocean.

Discussion

The WG thanked the authors for this updated analysis that was requested at the last meeting. The WG asked if the authors included vessel effects into the models. The authors clarified that the abundance model included vessel effects but not the size composition model. The WG agreed that vessel effects could be included in the CPUE model but may not be critical for the size composition model. The WG also thought that using the conventional one-step modelling approach would be better, given that the size composition data can be linked to logbook data.

The WG recommended that the authors continue to develop a juvenile index and, with a lower priority, an adult index from the Taiwan longline data. The WG recommended using smaller size bins in the size composition model so that the standardized size composition could be used to estimate a selectivity curve for the juvenile index. The WG also recommended that the authors develop an adult index and size compositions to be compared with the corresponding Japanese index (ISC/25/ALBWG-01/02). The WG noted that the Taiwan longline data set does not cover the entire range of juvenile albacore and is missing the part of the juvenile albacore population near the Japanese coast. However, in comparison to the other likely candidate juvenile indices, the spatial coverage of the Taiwan longline appears to be currently the most representative.

The WG recommended that the authors coordinate with Japan on adult vs. juvenile size cutoff, and to use the same approach in sdmTMB for CPUE and size compositions.

A Spatiotemporal Population Model for Stock Assessment: Application to North Pacific Albacore Tuna. Hirotaka Ijima, Marko Jusup and Yuichi Tsuda (ISC/25/ALBWG-01/06)

Stock assessment models play a crucial role in fisheries management. However, they are increasingly affected by process errors in population dynamics, which can lead to overly optimistic stock estimates. One major issue is the inadequate separation of changes in catchability from process error. Traditional CPUE standardization has difficulty distinguishing true population density signals from observational errors, which reduces the accuracy of stock assessments. Moreover, existing stock assessment models do not adequately account for spatial and migratory dynamics, which is particularly problematic for highly migratory species. To overcome these limitations, we developed the Spatio-Temporal Population Model (STPM), which separates population dynamics from observational processes using a state-space modeling approach. We applied STPM to North Pacific albacore tuna and estimated spatial stock depletion and quarterly population density from 1994 to 2023. The model successfully distinguished process and observation errors, providing a more detailed representation of spatial stock structure than traditional approaches. Despite these advancements, challenges remain, particularly in computational efficiency and model refinement. Future efforts will focus on optimizing computational performance, integrating a logistic production function, and improving the observation model to enhance stock assessment reliability.

Discussion

The WG thanked the authors for presenting this interesting work. The WG noted that this analysis is currently a work in progress and not expected to influence the 2026 assessment. The authors agreed and noted that the long-term aim of this project is to incorporate population dynamics and as much of the raw observations into the estimation model as possible. The WG recommended that the authors continue to develop this analysis for future inclusion in the NPALB stock assessment.

Exploration of Time-Varying Age-Based Selectivity Options in Stock Synthesis in Preparation for the Albacore Benchmark Assessment. Peter Kuriyama, and Steve Teo (ISC/25/ALBWG-01/07)

This working paper evaluated the potential of estimating time-varying selectivity with the two-dimensional autoregressive (2dAR) option in Stock Synthesis (Xu et al. 2019). Exploration was motivated by estimated selectivities that did not fit length composition data well for some fleets and years in the 2023 benchmark stock assessment. The recent assessment estimated time-varying age-based selectivity with the time block option in Stock Synthesis. The 2dAR seemed to result in slightly better fits to the length composition data for some of the years of concern and seemed to result in model convergence. There were slight changes to the scale of spawning stock biomass and biomass ratio values, although the trends were the same. Selectivity estimated with the 2dAR feature will likely be included in the 2026 benchmark, and a more thorough comparison and justification will be presented at the upcoming data preparation meeting.

Discussion

The WG thanked the authors for the updated analysis to consider for the upcoming stock assessment. The WG discussed that time-varying selectivity feature for JPPL fisheries can have a large impact on the estimates of juvenile abundance. **The WG recommended the authors 1) use the hindcasting model diagnostic to test model improvements, 2) test if age-specific SigmaS would improve model fits, and 3) explore adding time-varying selectivity and reducing the number of associated fisheries at the same time.**

3.2. Biological Modelling

Modelling the Vertical Behavior and Distribution of Albacore Tuna in the North Pacific. Kuan-Chun Tseng, Yi-Jay Chang, Martin Arostegui, and Barbara Muhling (ISC/25/ALBWG-01/Presentation01)

Albacore tuna (*Thunnus alalunga*) exhibit distinct vertical movement patterns influenced by environmental factors, yet their depth distribution in the North Pacific Ocean remains poorly understood. This study employs species distribution models (SDMs) to investigate the vertical behavior of juvenile albacore tuna, utilizing archival tag data from 25 individuals tagged between 2001 and 2015. Daily mean depth and ambient temperature were aggregated at a 1° × 1° spatial resolution and matched with environmental variables obtained from the CMEMS database. Using the *sdmTMB* package in R, we developed spatiotemporal models incorporating key environmental factors, including mixed layer depth, sea surface height, ambient temperature, bathymetry, moon fraction, and chlorophyll-*a*. Model selection was based on AIC and deviance explained, with spline functions providing the best fit for environmental responses. Results indicate that albacore tuna depth varies non-linearly with sea surface height and temperature, while moon fraction and chlorophyll-a exhibit distinct influences. This study enhances our understanding of albacore tuna vertical distribution and highlights the importance of environmental drivers. Future work will focus on refining model predictions, further elucidating the mechanisms shaping tuna movement patterns, and evaluating the behavioral patterns and distributional changes of albacore tuna in the North Pacific under climate change.

Discussion

The WG thanked the authors for presenting this interesting study and engaged in an in-depth discussion on various aspects of the research. The WG noted that the SPDE mesh resolution was

too coarse, potentially leading to a loss of spatial detail and fine-scale variability in albacore tuna's vertical behavior and distribution. To improve model accuracy, they recommended using a finer resolution when configuring the SPDE mesh. The WG pointed out that the analysis did not clarify potential biases in the tagging data, as they could impact the result. **The WG recommended incorporating additional environmental factors to better capture variations in albacore tuna behavior and distribution and including this research in the discussions about how to incorporate climate change considerations into the NPALB stock assessment.**

4.3. Data Collection

Estimating Sex Ratio in North Pacific Albacore (Thunnus alalunga) Using Genetic Methods. Matthew T. Craig, Miasara Andrew, Yuichi Tsuda, Chiee-Young Chen, Joseph O'Malley, and John R. Hyde (ISC/25/ALBWG-01/08)

Albacore (Thunnus alalunga) is a pelagic tuna species that supports a lucrative fishery worldwide. Like all tuna species, Albacore are not sexually dimorphic. This means that accurate identification of sex in Albacore is only possible through direct observation of gonads. This process is costly, time consuming, and lethal, and often necessitates histological confirmation of sex due to the large numbers of immature animals captured in some fisheries. Genetic methods have shown to be successful in facilitating sex determination via PCR and DNA sequencing. We used a PCR-based method to genetically determine sex in 1255 Albacore and show that larger size classes are dominated by male fish.

Discussion

The WG thanked the authors for the presentation, and agreed that the sex composition data appeared to be reasonable and consistent with the other available data. The WG agreed to assemble the sex composition data from this study and the sex composition samples from Japan (see ISC/25/ALBWG-01/Presentation 04 and ISC/25/ALBWG-01/12), and experiment with fitting the sex ratio data in an assessment model to understand whether our assumptions about natural mortality and growth are consistent with observed sex ratio. **The U.S. scientists agreed to take on this work and will present to the WG at the data preparation meeting.**

The WG asked the authors about potential contamination of samples and the methods used to minimize this, and if the authors could share these methods. The authors responded that hyper-variable microsatellites were used as tests for potential contamination of samples, and will enquire if these microsatellites could be provided to WG members.

The Development of Sex Determination Methods for the Fishery Catch Samples of Albacore (Thunnus alalunga). Norihiko Yokoyama, Naoto Matsubara, Yuki Hongo, Hirotaka Ijima, Yoji Nakamura, Yuichi Tsuda, Motoshige Yasuike, and Yohei Tsukahara (ISC/25/ALBWG-01/Presentation 04)

To consider the methods for collecting many DNA samples of albacore, we examined the method of DNA sampling using swabs without damaging the fish. At first, we evaluated the DNA quality of samples by swabbing site. The body surface, the inner surface of the pectoral fin, gills, and anus were examined. As a result, we concluded that sampling from the inner surface of pectoral fin is appropriate. Then, we examined whether the swab sample could work for sex determination PCR using Suda's primer (Suda et al., 2019). The male specific bands were successfully detected in

pectoral fin swab samples. In summary, swab sampling is possible to collect many DNA samples from ALB, for example, before the fish auction.

Discussion

The WG thanked the authors for their presentation and interesting analysis. The WG discussed the methods and noted that the swab methods is very useful when tissue samples cannot be taken. The WG noted concern about the purity level of the DNA and potential contaminations. It was clarified that the purity of the DNA is not as important as long as the PCR reaction is working which it appears to be in this analysis. The bigger concern is contamination from one fish to the next. The authors noted that they tested several different areas of the fish, such as under the pectoral fin versus the skin to find areas with the lowest chance of contamination with other fish DNA. **The WG recommended that the authors continue to analyze more samples using this swabbing method and use hyper-variable microsatellites as tests for potential contamination of samples**. **The WG recommended that the authors report to the WG at the data preparation meeting, on whether the data from this approach would be ready for the 2026 assessment.**

Update on the Age and Growth of North Pacific Albacore Tuna (Thunnus alalunga) from the Central and Eastern Pacific Ocean. Owyn Snodgrass, Kelsey James, Chiee-Young Chen, and Brad Erisman (ISC/25/ALBWG-01/05)

Regional and sex-specific, length-at-age data are important for stock assessments for North Pacific albacore tuna. We generated updated length-at-age data and modeled sex-specific growth for albacore sampled from recreational and commercial fisheries in the eastern and central Pacific Ocean from 2013 through 2023. The von Bertalanffy growth model was selected to estimate growth parameters, which were then compared to previous parameter estimates from both sex-specific and non-sex-specific models. The sex-specific model produced by this study overlapped with the sex-specific model presented by James et al. (2020a) until age 6, with small differences in length-at-age between males and females observed among older age classes. Results of this study were consistent with previous studies showing that females may grow slower than males, and a sex-specific growth model fit the data best according to a bias-corrected Akaike Information Criteria (AICc). However, a combined sexes growth model was selected using Bayesian Information Criterion (BIC) indicating the difference in sex-specific growth was slight and inconclusive. The sex-specific growth models from this study were associated with higher $L\infty$ values and correspondingly lower K values compared to previous studies. This pattern was likely driven by the inclusion of older, larger males and females in the current dataset. These data are presented for consideration and use in future management evaluations of the North Pacific albacore stock.

Discussion

The WG thanked the authors and noted that these data will be helpful in the upcoming assessment. The WG ask for clarification on the number of samples needed per size bin and the authors noted that they had more samples than is statistically necessary for most size bins because they had time to process them but they were looking to add more samples to bins >100cm. **The WG recommended that the authors combine these data with the age data collected previously for the current growth curve, and, if ready, the new Japanese age data (see ISC/25/ALBWG-01/12) and provide an update for the data preparation meeting. The WG also recommended the authors attempt to fit to the Richards growth curve, which is more flexible than the von Bertalanffy growth curve.**

Review of the Biological Data for the North Pacific Albacore Tuna from Japan. Yuichi Tsuda, Norihiko Yokoyama, Naoto Matsubara, Hirotaka Ijima and Yoshinori Aoki (ISC/25/ALBWG-01/12)

This study examines biological data of North Pacific albacore tuna (*Thunnus alalunga*) collected from Japanese fishing vessels between 1998 and 2025. A total of 3,195 individual samples were analyzed, with data on length, weight, otoliths, and gonads collected to assess sex ratio, maturity, and age structure. Sex ratio analysis revealed a male-biased population, particularly in southern waters, with larger males dominating in areas south of 30°N. Maturity assessment showed that female albacore reached reproductive maturity predominantly in waters south of 25°N, with seasonal variation in the proportion of mature individuals. Age determination based on otolith samples indicated differences in growth patterns from current stock assessment models, particularly for individuals below 90 cm in fork length.

Discussion

The WG thanked the authors for presenting these updated biological data from Japan. The WG discussed the age determination from the otolith samples, and the large discrepancies between the samples and the expected growth curve. After some discussion, **the WG recommended that the US and Japan scientists work together on age and growth methods before the data preparation meeting.**

The WG discussed spawning seasonality and agreed that there was good evidence that NP Albacore spawns over Season 2 and 3. However, the WG noted that past models have attempted to model spawning occurring over two seasons and found this to have a minor impact on assessment results. The authors also agreed to present the histological sex data at the data preparation meeting.

4.4. High Seas Driftnet and Squid Gillnet Fisheries

S. Teo provided a short update on the estimation of catch and bycatch of NP albacore by historical high seas driftnet and squid gillnet fisheries. Unfortunately, due to time constraints, the project to estimate catch and bycatch of NP albacore from observer data from historical high seas driftnet and squid gillnet fisheries made relatively little progress. One important stumbling block is that the observer data is limited to 1990 and 1991. Therefore, there may be a need to assume a constant CPUE and population density in order to extrapolate beyond 1990 and 1991 but this assumption is likely invalid**. S. Teo agreed to provide an update on this project for the data preparation meeting**.

4.5 Climate Change Considerations

The WG Chair provided a summary of climate change consideration in stock assessment discussions that occurred at ISC24 and noted that all ISC species WGs were tasked by the ISC Plenary to provide an update at ISC25 about how they have and/or plan to consider climate change in assessments. To help facilitate discussions within the WGs, the ISC Chair provided an example of a climate effects knowledge vulnerability matrix. The WG reviewed the matrix approach and discussed the most appropriate approach to take at this time.

Discussion

The WG noted that the matrix has a lot of topics and details and is largely aspirational. Not a lot of research has been completed in this area for NPALB and the WG may be guessing or leaving blanks for a number of topics in the matrix. Given this the **WG recommended that a summary on climate change considerations be added to the upcoming stock assessment and that the WG members continue to consider research topics in this area. The WG Chair will provide an update to the ISC Plenary at ISC25.**

Tuna and Billfish Larval Distributions in a Warming Ocean. H. Ijima, and M. Jusup. (ISC/25/ALBWG-01/Presentation02)

The authors of this preprint paper provided a summary of their findings. Tuna and billfish are charismatic pelagic fishes attracting considerable scientific attention due to their ecophysiological and socioeconomic importance. However, the knowledge of their basin-wide spawning and larval habitats, especially in a warming ocean, is limited. We use the largest available dataset on tuna and billfish larvae in the Pacific Ocean to build a geostatistical species-distribution model with high explanatory power. The results reveal the spatial distribution of tuna and billfish larvae through all seasons across the Pacific. The model also identifies the optimal temperature ranges for nine major species and assesses the potential impact of ocean warming on larval distributions. We additionally present evidence that environmental variables, such as pH, phosphate concentration, and sea-surface height, exert secondary effects on larval distributions that warrant further investigation. Our findings make a quantum leap in understanding the ecophysiology of tuna and billfish, providing valuable information for future conservation efforts.

Discussion

The WG thanked the authors for the presentation and noted that the results from this paper would be useful in considering climate change effects on albacore tuna. Based on the results, the WG noted that the climate change effects on albacore likely appear similar to that of tropical tunas, and likely less than for Pacific bluefin tuna. The authors noted that the paper is available as a preprint article and will hopefully be published soon. **The WG recommended that this analysis be summarized in the climate change considerations section proposed for the next stock assessment report.**

Albacore Tagging Research and Thermal Tolerance. Naoto Matsubara, Yoshinori Aoki, Yuichi Tsuda and Hirotaka Ijima (ISC/25/ALBWG-01/Presentation 03)

The presentation about the tagging research conducted in Japan and the published paper (Matsubara et. al., 2024) were made for considering the impact of climate change. In Japan, the tagging study using archival tags has been conducted since 2020, and several individuals have been recaptured in recent years. The recently obtained data confirmed an east-west migration pattern, consistent with previous tagging results. Matsubara et. al. (2024) indicated that the lower thermal tolerance of juvenile albacore is 13°C, which restricts their vertical behavior. Furthermore, the restriction on vertical behavior influences the primary fishing grounds for PL and LL.

Discussion

The WG thanked the authors for the presentation of this interesting research. The WG discussed the tolerance limit identified in this analysis and noted the similarities to the analysis in ***ISC/25/ALBWG-01/Presentation 01*** using Taiwan data. The WG noted the shallower fishing in

Northern waters compared to the deeper fishing in Southern areas. Additionally, the WG noted that if climate change leads to changes in water temperature this will change the distribution of NPALB given Tmin and temperature preferences. **The WG recommended that this research be considered in a summary of climate change consideration that will be presented in the 2026 stock assessment report.**

4.6. Uncertainty

The WG discussed how uncertainty in the stock assessment results is to be represented in the 2026 stock assessment. In the 2023 assessment, the results were primarily represented by a base case model, with uncertainty represented by sensitivity runs and a bridging analysis. The WG discussed the use of small and large ensembles to represent uncertainty, as well as how other fisheries science organizations represented uncertainty in their assessments. After substantial discussion, the WG agreed that this topic required more discussion and a decision could not be made here. **The WG agreed to discuss this more during the data preparation meeting.**

5. REVIEW STOCK STATUS AND CONSERVATION ADVICE

5.1. Review Biological Reference Points and Kobe Plots

The WG reviewed the biological reference points adopted for NPALB and the La Jolla plots developed during the most recent stock assessment and agreed no updates were required. Additionally, the WG reviewed and discussed an error found in the reference points table presented in the 2023 stock assessment report.

Erratum: Stock Assessment of Albacore Tuna in the North Pacific Ocean in 2023. Steve Teo and Peter Kuriyama (ISC/25/ALBWG-01/10)

We recently discovered several errors in Table ES1 of the 2023 North Pacific Albacore Tuna (NPALB) stock assessment report. Errors were found for all the F%SPR, 2018-2020/F%SPR, MSY ratios, as well as the F%SPR, 2011-2020 and F%SPR, 2011-2020/F45%SPR ratio for the base case model. A corrected version of the Table ES1 is reported in this working paper. In order to minimize this source of error in future assessments, R code was developed to produce the management quantities directly from model files, and a Github repository was setup to store the code. The primary functions in the Github repository were briefly described. The corrected values did not result in any qualitative change in the reported stock status of NPALB. It is recommended that these errors be reported to the ISC Plenary but with a note that no change in reported stock status is necessary. It is also recommended for the ALBWG to review and use the code in the Github repository for future assessments.

Discussion

The WG thanked the authors for finding the errors and **recommended that these errors be reported to the ISC Plenary but with a note that no change in reported stock status is necessary.**

5.2. Stock Status and Conservation Advice

The WG Chair presented the text describing the current stock status and conservation information from the ISC24 Plenary report and discussed minor editorial changes to be presented at ISC25:

Stock Status

Based on these findings, the following information on the status of the NPO ALB stock is provided:

1. The stock is likely not overfished relative to the threshold ($30\%SSB_{current,\ F=0}$) and limit ($14\%SSB_{current,\ F=0}$) reference points adopted by the WCPFC and IATTC in their harvest strategies (WCPFC Harvest Strategy 2023-01; IATTC Resolution C-23-02);

2. The stock is likely not experiencing overfishing relative to the adopted target reference point ($F_{45\%SPR}$), which is the fishing intensity that results in the stock producing a SPR of approximately 45%; and

3. Current fishing intensity ($F_{2018\text{-}2020}$) is lower than the average fishing intensity from the 2002-2004 period (the reference level for effort in IATTC Resolution C-05-02 and WCPFC CMM-2019-03).

Conservation Information

Based on these findings, the following conservation information is provided for the NPO ALB stock:

1. If fishing intensity over the next ten years is maintained at the current fishing intensity ($F_{2018\text{-}2020}$), then female SSB is expected to remain around $54\%SSB_{current,\ F=0}$ (90,098 t), with a 97.7% probability that female SSB will remain above the $14\%SSB_{current,\ F=0}$ LRP for all ten years and the management objectives in the IATTC and WCPFC harvest strategies (IATTC Resolution C-23-02; WCPFC Harvest Strategy 2023-01) will likely be met.

2. If fishing intensity over the next ten years is similar to the 2005 – 2019 period, then female SSB is expected to decrease to $52\%SSB_{current,\ F=0}$ (87,669 t), with a 98.1 % probability that female SSB will remain above the $14\%SSB_{current,\ F=0}$ LRP for all ten years and the management objectives of the IATTC and WCPFC harvest strategies (IATTC Resolution C-23-02; WCPFC Harvest Strategy 2023-01) will likely be met.

5.3. Updated Exceptional Circumstances Criteria

The WG reviewed the current version of the exceptional circumstances criteria for NPALB (Attachment 5). The WG Chair noted one minor change from the previous version that was requested at ISC25 Plenary. The WG discussed the importance of stressing that these are preliminary criteria and are subject to change as more information becomes available.

The WG Chair also noted that the exceptional circumstances criteria document has been presented to the WCPFC NC and IATTC. However, it is still currently unclear if there are any plans to adopt these exceptional circumstances formally into the harvest strategy. **The WG agreed to include the current exceptional circumstances document as part of the assessment report as an annex and to evaluate if exceptional circumstances occurred as part of the stock assessment process.**

5.4 Review Options for HCR Fishing Intensity Implementation

Relationships Between Fleet-Specific Spawning Potential Ratios and Measures of Catch and Effort for Japanese Longline Fleets Targeting North Pacific Albacore Tuna. Steve Teo, Yuichi Tsuda and Peter Kuriyama (ISC/25/ALBWG-01/09)

In 2024, the Western and Central Pacific Fisheries Commission's Northern Committee (WCPFC NC) requested that the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) analyze the relationships between fleet-specific spawning potential ratios (SPRs), and effort for the portions of the Japanese longline (JPLL) fishery that targeted North Pacific Albacore Tuna (NPALB). In response to this request, this study: 1) identified the areas and quarters in which the JPLL fishery likely targeted NPALB; 2) calculated the fleet-specific SPRs for the NPALB targeting portions of the JPLL fishery; and 3) related the fleet-specific SPRs with the catch and effort for these portions of the JPLL fishery. The JPLL fishery operating in Areas 1 and 3 during Quarters 1 and 2 (i.e., F01_Q1 and F03_Q2) were likely to be targeting NPALB because these fleets had consistently high ratios of NPALB to total catch, consistently high NPALB CPUEs, relatively high NPALB catch, and relatively high fishing effort. Similarly, the JPLL fishery operating in Area 2 during Quarters 1 and 4 (i.e., F11_Q1 and F14_Q4) were likely to be targeting NPALB because these fleets had consistently high ratios of NPALB to total catch, and consistently high NPALB CPUEs. The fishing intensity in terms of SPR (F%SPR) were calculated for these two groups of fleets (i.e., JPLL_A13_Q12: F01_Q1 combined with F03_Q2; and JPLL_A2_Q14: F11_Q1 combined with F14_Q4), and found to be highly negatively correlated with the effort metrics (number of days, vessels and hooks), albeit with more variability than for catch. This suggests that these two NPALB-targeting JPLL fleets may be able to be managed using effort or catch controls. The increased variability in the relationships between effort and SPRs, relative to catch, should be taken into account. In addition, it should also be noted that the relationships between effort and SPR are slightly weaker for the JPLL_A2_Q14 fleet, which operates south of 30°N. It is recommended that the WG consider the information from this paper to develop advice on how fishing intensity should be interpreted into actual management under this harvest strategy, and to respond to the WCPFC NC request.

Discussion

The WG thanked the authors for this updated analysis and asked for a couple points of clarification. One point was to clarify how they made the classification of vessels as targeting NPALB. For example, 66% was used as the threshold for the albacore percentage of total catch for fleet. After some discussion, **the WG recommended that the information in this WP would be added into the science advice document (Attachment 6) and presented to the ISC Plenary for review and approval to presented to the WCPFC NC and IATTC.**

Estimating Fleet-Specific Allocations of Spawning Potential Ratios. Steve Teo and Peter Kuriyama (ISC/25/ALBWG-01/11)

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

The WG thanked the authors for providing this preliminary analysis and for starting the conversation on how to tackle providing scientific advice for this topic. A suggested additional analysis to add was to evaluate the frequency that countries and/or fleets would reach their SPR allocation targets historically. The idea behind this was to get an understanding of the frequency that fleets reach their allocation amounts. It was emphasized by the WG and the authors that this analysis was preliminary and just one of many potential ways this could be addressed. **The WG recommended that all members should take some time to review the analysis, check the calculations in the provided excel spreadsheet, and consider any alternative approaches.** After some discussion, the **WG recommended that the updated science advice document (Attachment 6) would also include a general statement that the WG is able to calculate the fleet-specific share in SPR units, and estimate the fleet-specific allocation of SPR from a given desired total SPR, only if provided with specific decisions on allocation shares for each country and/or gear [ie., specifics can include the percentage of allocations, number of fleets (e.g. separating Japanese longline and pole and line fleets), the reference time period, or a specific percentage of allocations].**

6. ADMINISTRATIVE MATTERS

6.1. Work Plan for 2026 Stock Assessment

The WG developed a detailed plan for the next data preparation meeting, highlighting topics that were priorities for the next stock assessment cycle (**Table 1**).

6.2 Time and place of next ALBWG meeting

The WG discussed the tentative time and place of the data preparation and stock assessment workshops for the 2026 stock assessment cycle. Japan offered to host the WG data preparation workshop, October 27-November 2, 2025, in Yokohama and the US offered to host the stock assessment workshop, March 23-30, 2026, in La Jolla.

7. OTHER MATTERS

7.1 2023 Stock assessment erratum

The WG discussed this topic under "5. Review Stock Status and Conservation Advice" above. Please refer to discussions above for WG recommendations on this topic.

7.2. MSE Code Update Plans

The WG briefly discussed how and when they might need to make updates to the technical MSE simulation work in the future. The WG noted that this would be a significant amount of work and that the updates to the stock assessment model would need to be incorporated. At this time there is currently no evidence presented to the WG that would warrant an update to the MSE work. However, the WG noted that the RFMOs have requested the ISC to review the performance of the harvest strategy in 2030 and 2033 (IATTC Resolution C-23-02; WCPFC Harvest Strategy 2023-01).

7.3. Code Archiving (MSE and NPALB Projections Software)

The WG discussed the Open Science training that was provided by the ISC Plenary members. The WG noted that some member's agencies did not allow the use of some software, such as GitHub, making it difficult for them to participate in collaboration and sharing of code using these methods.

8. CLEARING OF MEETING REPORT

The WG Chair prepared a draft of the meeting report, which was reviewed by the WG prior to adjournment of the workshop. The WG Chair incorporated final edits. The final report will be forwarded to the Office of the ISC Chair for review and approval by the ISC25 Plenary.

9. ADJOURNMENT

The ALBWG meeting was adjourned at 1pm on March 14, 2025 (CST). The WG held a virtual meeting on March 24, 2025, PST (March 25, 2025 CST/JST) to review final edits to the meeting report and clear the report. The WG Chair thanked the WG members for their commitment to this research, their hard work, for presenting their research and contributing to this successful modeling improvements workshop.

10. LITERATURE CITED

Matsubara N, Aoki Y, Aoki A and Kiyofuji H (2024) Lower thermal tolerance restricts vertical distributions for juvenile albacore tuna (*Thunnus alalunga*) in the northern limit of their habitats. Front. Mar. Sci. 11:1353918. doi: 10.3389/fmars.2024.1353918

Table 1. Work assignments identified at the March 2024 ALBWG meeting and the ISC23 Plenary.

Assignment	Lead(s)	Mar 2024 Modelling Improvements	Mar 2025 Modelling Improvements	Oct/Nov 2025 Data Preparation	Mar 2026 Stock Assessment
Standardized CPUE and size for JPLL using VAST package à Juvenile and Adult index	Matsubara, N., Xu, H., Ijima, H. and Tsuda, Y.		- New analysis presented in **ISC/25/ALBWG-01/02**. -The WG requested that authors: 1) Explore updating the model in sdmTMB; 2) Expand the spatial coverage of the index beyond Area 2; 3) Document methods used to determine adult female size cut off (ie. size bins).	-Discuss WP documenting improvements -The WG will consider using this method for the adult index in the stock assessment and compared to other candidates.	-Potential WP for 2026 stock assessment cycle.
Further development of CPUE standardization for the 2023 **JPLL adult index**	Nishimoto, M., Ijima, H., Matsubara, N., and Tsuda, Y.	-WP ISC/24/ALBWG-01/04 presented improvements and updates to the adult index used in the 2023 assessment. Addition of 2022/23 data and uncertainty estimates. -WG agreed to continue to update and improve this index while working on developing new methods.	- The WG recommended this index should be updated with 2024 data for comparisons in the 2026 stock assessment. - No further development of this index is recommended.	- The WG will compare updated index to any new indices being considered for the 2026 stock assessment.	
Further development of CPUE standardization for **JPPL Juvenile index**	Nishimoto, M., Ijima, H., and Matsubara, N.	-WP ISC/24/ALBWG-01/03 presented updates to this juvenile index. -WG agreed to continue to update and improve this index while working on developing new methods.	- No updates and no further development recommended.		

Assignment	Lead(s)	Mar 2024 Modelling Improvements	Mar 2025 Modelling Improvements	Oct/Nov 2025 Data Preparation	Mar 2026 Stock Assessment
Updated standardized CPUE from Taiwanese distant-water longline fisheries – **TWN LL Juvenile and adult**	Yi-Jay Chang, Jhen Hsu, and Zi-Wei Yeh	- Authors provided an update ISC/24/ALBWG-01/Presentation 01on the TWN LL juvenile index - WG provided suggestions for updates and improvements for the next stock assessment cycle.	-Updated analysis presented in **ISC/25/ALBWG-01/04** - Coordinate with JPLL index about the adult female size cut off. - Coordinate with JPLL method in sdmTMB for CPUE index.	-Discuss updated WP documenting improvements - Discuss comparisons to other juvenile indices.	WP for 2026 stock assessment cycle.
Candidate relative abundance indices of juvenile albacore tuna for the US surface fishery in the north Pacific Ocean **EPO Surface Juvenile index**	Teo, S. and Peter Kuriyama	- No updates presented at this workshop. - WP presented at 2022 data preparation meeting	- Updated analysis presented in **ISC/25/ALBWG-01/01** - Authors provided an update of the spatial distribution of effort by years.	- Updated WP presented -Potentially run as a juvenile index sensitivity run	WP for 2026 stock assessment cycle.
CPUE standardization considering spatial fish-size distribution à **JPLL Adult and Juvenile indices**	Ijima, H., Matsubara, N., Jusup M., and Tsuda, Y.	- WP **ISC/24/ALBWG-01/06** presented preliminary results from this new approach. - The WG agreed this was an important method to continue to develop and made several suggestions for the authors to consider.	-Updated analysis presented in **ISC/25/ALBWG-01/03** - R-INLA mixture model approach. - This approach does not work with an area-as-fleet approach - Comparisons to the previous method used in the 2023 stock assessment and WP#2 will be required.	- Updated WP presented - Discuss whether this method will be used in the next stock assessment cycle. - The WG will generate a comparison table with all CPUE indices that are being considered in the	

Assignment	Lead(s)	Mar 2024 Modelling Improvements	Mar 2025 Modelling Improvements	Oct/Nov 2025 Data Preparation	Mar 2026 Stock Assessment
				2026 stock assessment.	
A spatiotemporal population model for stock assessment	Ijima, H., Jusup, M. and Tsuda, Y.		-Updated analysis presented in **ISC/25/ALBWG-01/06** - The WG recommended the authors continue to work on improving this method and compare to other methods. -Consider this a research track method		
Fleet definitions in the stock assessment	All WG members	-The WG discussed updating and comparing the fleet definitions with the potential new fleet definitions from the finite mixture model.	- The WG discussed the options for fleet definitions for the upcoming stock assessment compared to 2023. - Will we keep the area-as-fleet approach? If so **ISC/25/ALBWG-01/03** mixture model approach will not work. But **ISC/25/ALBWG-01/02 & 04** can be applied. -Potentially combining F01/02 which is the 2020 fleet structure.	- WG will discuss area-as-fleet structure in more detail. -JPN will update SS using the mixture model approach before the Data Preparation meeting. -WG will discuss during this meeting.	
Growth	US and Japan	- The WG discussed using updated age, sex, and maturity data to improve growth models and investigate spatiotemporal variation in length-at-age.	-Updated analysis presented in **ISC/25/ALBWG-01/05 &12** - WG recommended adding previous data collected to the updated analyses (ie. TWN and old Japan data)	- Updated WP to be presented.	

Assignment	Lead(s)	Mar 2024 Modelling Improvements	Mar 2025 Modelling Improvements	Oct/Nov 2025 Data Preparation	Mar 2026 Stock Assessment
			- The WG recommended that Japan and US collaborate on aging and growth analysis and present at next meeting -WG recommended exploring additional growth curves for comparison		
Maturity	Japan	- The WG discussed recent data collection by Japan biological sampling program.	-Updated analysis presented in **ISC/25/ALBWG-01/12** - Focused on spawning seasonality -WG recommended that previous assumptions about spawning seasonality from previous stock assessment		
Sex composition	US and Japan	- Both Japan and US are working on collecting updated sex composition data. - The WG discussed the potential to update this information in the next stock assessment.	-Updated analysis presented in **ISC/25/ALBWG-01/05 & Presentation 04** -US will prepare sex comp data presented in WP#5 for the assessment model. -Japan will work on preparing sex composition data and discuss inclusion in stock assessment model. -WG recommended showing the updates in a sensitivity run of the stock assessment at the next meeting.	- WP with sensitivities *(ie. Sex ratio, growth, spawn timing, selectivity)* to stock assessment to be presented.	
Spawning seasonality	Ijima, H.	To support the development and interpretation of the juvenile indices the WG further recommended the reevaluation	-Updated analysis presented in **ISC/25/ALBWG-01/Presentation 03 & 12**	- Discuss inclusions in 2026 stock assessment	

Assignment	Lead(s)	Mar 2024 Modelling Improvements	Mar 2025 Modelling Improvements	Oct/Nov 2025 Data Preparation	Mar 2026 Stock Assessment
		of the reproductive spawning analysis for NPALB as well as development of a larval distribution working paper.	- WG recommended work continue on developing this analysis as time permits -WG recommended to explore as a sensitivity analysis to the current assumption of Q2 (April 1)		
Updating catch and size composition data and previous abundance index estimates	All WG members		- WG recommended all WG providing updated data for an update run to the 2023 stock assessment structure. -Japan will provide an update to the main abundance index (up to 2024) from the 2023 assessment. - S. Teo will send out a reminder email (August) with the spreadsheet structure		
Updates to the exceptional circumstances criteria	Hawkshaw, S.	WG recommended sending the updated criteria for exceptional circumstances to the ISC chair for plenary review before the IATTC SAC meeting.	- The WG reviewed the one minor update made to criteria wording at ISC24. - WG recommended including exceptional circumstances in the next stock assessment	- Discuss how to present evaluation of exceptional circumstances in 2026 stock assessment cycle.	
Fishing intensity conversion to catch and effort controls	Hawkshaw, S.	-Meeting April 24/25, 2024 to discussion final WP and generate advice to provide to managers -Present advice to Plenary before ISC24.	- Request was made at NC to analyze the relationships between fleet-specific SPRs, and effort for JPLL fishery that targeted NPALB. - Authors presented WP **ISC/25/ALBWG-01/09** with updated analyses.	- WG members can present alternatives to allocation options.	

Assignment	Lead(s)	Mar 2024 Modelling Improvements	Mar 2025 Modelling Improvements	Oct/Nov 2025 Data Preparation	Mar 2026 Stock Assessment
			- Authors presented WP **ISC/25/ALBWG-01/11.** - WG recommended that information from **ISC/25/ALBWG-01/09 & 11** be included in an updated science advice document for interpreting fishing intensity. - Although WG agreed they need time to consider analyses and other options in the case of **ISC/25/ALBWG-01/11**. And only a more general statement about the options for allocation can be included in science advice document. - Present update to ISC25 and SAC and NC meetings.		
Evaluate and document historical high seas drift gillnet catch by member countries.	Teo, S.	WG was updated about the status of these data. Updates will be provided to the ISC STATWG and to ISC24	- Author provided update on plans for next WG meeting.	-Discuss WP describing progress on metadata documentation and potential catch reconstruction methodologies for historical high seas and squid gillnet fisheries	
Projection and MSE code archiving	Hawkshaw, S.	-Currently stored on GitHub – WG discussed how to collaboratively edit these pieces of code and it was suggested to bring this up with the ISC	-WG briefly discussed		

Assignment	Lead(s)	Mar 2024 Modelling Improvements	Mar 2025 Modelling Improvements	Oct/Nov 2025 Data Preparation	Mar 2026 Stock Assessment
		Plenary and potentially the STATWG first.			
MSE updates	All WG members	- The WG received training to use the MSE code and discussed potential updates that would need to be made if additional MSE was required.	-WG briefly discussed		
Ensemble models? Grid? Sensitivity runs?	All WG members	-The WG briefly discussed the best approach to represent uncertainty for NPALB stock assessment.	- The WG discussed the most important uncertainties for the stock assessment. -WG recommended initially only looking at sensitivities and discuss alternative options based on preliminary results presented at the next WG meeting.	- Discussions of the most important uncertainties for the stock assessment -WP will be presented with preliminary sensitivity runs and WG will discuss how to proceed.	
Time-varying age based selectivity sensitivity	Kuriyama P. and Teo S.		**- ISC/25/ALBWG-01/07** - WG recommended checking hindcasting validation - Using age specific sigma for selectivity - Plots of actual selectivities		

Attachment 1

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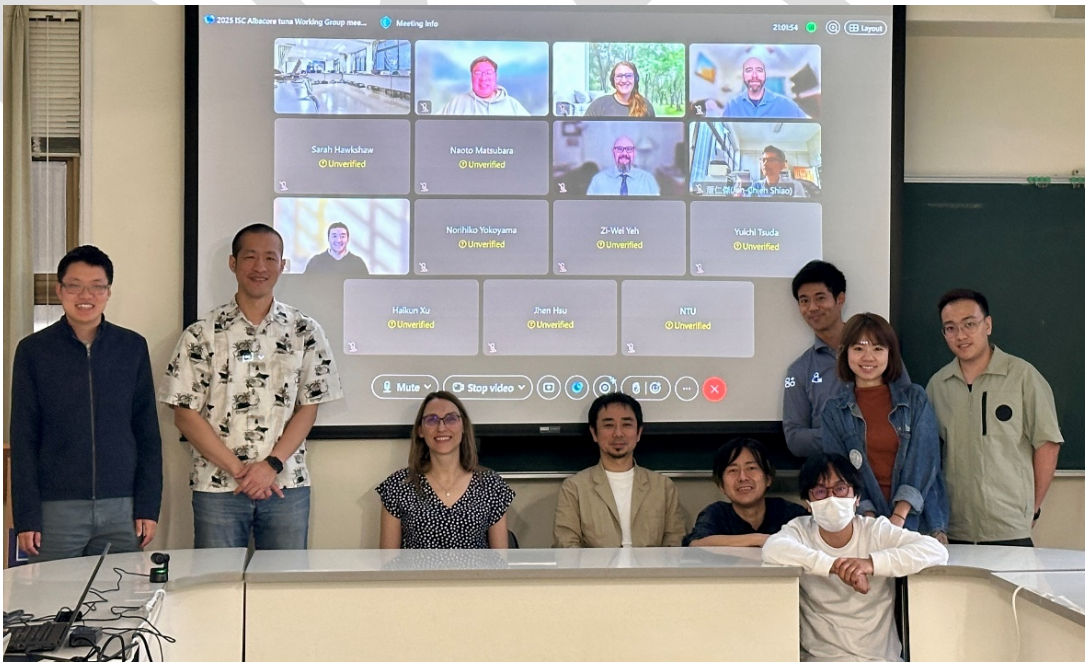
The Albacore Working Group 2025 (left to right) – Jhen Hsu, Naoto Matsubara, Kuan-Chun Tseng, Yuichi Tsuda, Chih-Yi Cheng, Haikun Xu, Sarah Hawkshaw, Hirotaka Ijima, Norihiko Yokoyama, Zi-Wei Yeh, and Yi-Jay Chang.

Steve Teo, Kelsey James, Owyn Snodgrass, Matthew Craig, Yohei Tsukahara, Peter Kuriyama Yuki Hongo, and Motoshige Yasuike also participated virtually.



Attachment 2

ALBACORE WORKING GROUP (ALBWG)

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

MODELLING IMPROVEMENTS WORKSHOP

10-14 March 2025
9AM-5PM Daily Local TWN Time
Institute of Oceanography, National Taiwan University
Taipei City, Taiwan

DRAFT AGENDA

1. Opening of workshop
   1.1. Welcoming Remarks
   1.2. Introductions
2. Meeting Logistics
   2.1. Meeting Protocol
   2.2. Review and Adoption of Agenda
   2.3. Assignment of Rapporteurs
   2.4. Group Photo
3. Review Work Assignments
4. Review Working Papers
   4.1. Abundance index improvements
   4.2. Biological modeling (Growth)
   4.3. Data collection (Catch, Effort, Aging Data, Sex Composition, etc.)
   4.4. High seas driftnet and squid gillnet fisheries
   4.5. Climate Change Considerations
   4.6. Uncertainty
5. Review Scientific Advice
   5.1. Review biological reference points and Kobe plots
   5.2. Review Stock status and conservation advice
   5.3. Review updated exceptional circumstances criteria
   5.4. Review Options for HCR fishing intensity implementation
6. Administrative Matters
   6.1. Workplan for 2026 Stock Assessment
   6.2. Time and place of next ALBWG meeting
7. Other matters
   7.1. 2023 Stock assessment erratum
   7.2. MSE code update plans
   7.3. Code Archiving Updates (MSE, projections software, assessment)

8. Clearing of Meeting Report
9. Adjournment

Attachment 3

List of Working Papers and Presentations

Number	Title and Authors	Availability
ISC/25/ALBWG-01/01	An update of the standardized abundance index for the US surface fleet in the North Pacific. Peter Kuriyama and Steven Teo	ISC Website
ISC/25/ALBWG-01/02	Standardized CPUE and size for North Pacific Albacore by Japanese Longline using VAST package. Naoto Matsubara, Haikun Xu, Hirotaka Ijima, and Yuichi Tsuda	ISC Website
ISC/25/ALBWG-01/03	CPUE standardization considering spatial fish-size distribution. Hirotaka Ijima, Naoto Matsubara, Marko Jusup and Yuichi Tsuda	ISC Website
ISC/25/ALBWG-01/04	Spatiotemporal modelling for size-specific CPUE standardization of albacore tuna in the north Pacific Ocean caught by Taiwanese longline fisheries. Zi-Wei Yeh, Jhen Hsu, and Yi-Jay Chang	ISC Website
ISC/25/ALBWG-01/05	Update on the age and growth of North Pacific albacore tuna (*Thunnus alalunga*) from the central and eastern Pacific Ocean. Owyn Snodgrass, Kelsey James, Chiee-Young Chen, and Brad Erisman	ISC Website
ISC/25/ALBWG-01/06	A spatiotemporal population model for stock assessment: Application to North Pacific albacore tuna. Hirotaka Ijima, Marko Jusup and Yuichi Tsuda	ISC Website
ISC/25/ALBWG-01/07	Exploration of time-varying age-based selectivity options in Stock Synthesis in preparation for the albacore benchmark assessment. Peter Kuriyama and Steven Teo	ISC Website
ISC/25/ALBWG-01/08	Estimating sex ratio in North Pacific Albacore (*Thunnus alalunga*) Using Genetic Methods. Matthew Craig, Miasara Andrew, Yuichi Tsuda, Chiee-Young Chen, Joseph O'Malley, and John R. Hyde	ISC Website
ISC/25/ALBWG-01/09	Relationships between fleet-specific spawning potential ratios and measures of catch and effort for Japanese longline fleets targeting North Pacific Albacore Tuna. Steven Teo, Yuichi Tsuda, and Peter Kuriyama	ISC Website

Number	Title and Authors	Availability
ISC/25/ALBWG-01/10	Erratum: Stock Assessment of Albacore Tuna in the North Pacific Ocean in 2023. Steven Teo and Peter Kuriyama	ISC Website
ISC/25/ALBWG-01/11	Estimating fleet-specific allocations of spawning potential ratios. Steven Teo, and Peter Kuriyama	ISC Website
ISC/25/ALBWG-01/12	Review of the biological data for the North pacific albacore tuna from Japan. Yuichi Tsuda, Norihiko Yokoyama, Naoto Matsubara, Hirotaka Ijima and Yoshinori Aoki	ISC Website
Presentation 01	Modelling the vertical behavior and distribution of albacore tuna in the North Pacific of albacore tuna in the North Pacific. Kuan-Chun Tseng, Yi--Jay Chang, Martin Arostegui, and Barbara Muhling	Contact the author
Presentation 02	Tuna and billfish larval distributions in a warming ocean. Hirotaka Ijima, and Marko Jusup	Contact the author
Presentation 03	Albacore tagging research and thermal tolerance. Naoto Matsubara, Yoshinori Aoki, Yuichi Tsuda and Hirotaka Ijima	Contact the author
Presentation 04	The development of sex determination methods for the fishery catch samples of albacore (*Thunnus alalunga*). Norihiko Yokoyama, Naoto Matsubara, Yuki Hongo, Hirotaka Ijima, Yoji Nakamura, Yuichi Tsuda, Motoshige Yasuike, Yohei Tsukahara	Contact the author

Attachment 4

Meetings and Workplan

Date	Location	Task/Event
June 2025	La Jolla, USA	IATTC SAC
June 2025	Busan, Korea	ISC Plenary
July 2025	Japan	NC21
October 27-Nov 2, 2025	Yokohama, Japan	ALBWG workshop: Data Preparation
March 23-30, 2026	La Jolla, USA	ALBWG workshop: Benchmark Stock Assessment 2026

Attachment 5

Subject to Change as more Information Becomes Available to the International Science Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC)

Criteria for identifying exceptional circumstances for north Pacific albacore tuna V03. March 2025

The Albacore Working Group (ALBWG) of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) was tasked by the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC) with developing criteria for the identification of exceptional circumstances that would result in suspending or modifying the application of the adopted harvest strategy, and potentially may require updated Management Strategy Evaluation (MSE) simulation work. Exceptional circumstances define situations outside the range of scenarios over which robustness of the harvest strategies was evaluated in the MSE analysis, and for which a different management action than specified by the adopted harvest strategy may have to be taken. This guidance document provides an outline of the process for identifying exceptional circumstances for north Pacific albacore tuna (NPALB). The criteria presented in this document were developed based on criteria developed by other Regional Fisheries Management Organizations (RFMOs), such as the International Commission for the Conservation of Atlantic Tunas (ICCAT), for other tuna stocks. The document, however, does not provide all necessary actions to apply should an exceptional circumstance be identified for this stock, nor does it cover all possible exceptional circumstances.

To identify exceptional circumstances for NPALB, the ALBWG will continue to conduct benchmark stock assessments for the stock every 3 years with updated data sources and research as well as, examine new evidence about the current stock status and environmental conditions.

The following general elements will be considered when examining signals of possible exceptional circumstances for NPALB:

Stock and Fleet Dynamics: Evidence from stock assessment estimates that the stock is in a state not previously simulated in the MSE (e.g., current or projected SSB estimates are outside the range of uncertainty, or new evidence about the biology of the stock is presented). As well as evidence that the fleet structure or fishing operations have changed substantially.

Application: Data collection required to produce the stock assessment is no longer available and/or appropriate to apply the adopted harvest strategy.

Implementation: The implementation of the management action is substantially different from what is prescribed by the HCRs. For example, the total removals or effort by the fishery differ substantially (i.e. more than what was specified by the implementation error used in the MSE) from what is prescribed by the HCRs.

Based on the general elements above, several indicators for NPALB were identified by the ALBWG and are summarized in the following table:

Element	Indicator	Range	Evaluation Schedule
Stock and Fleet Dynamics	Depletion stock biomass ($SSB/SSB_{current, F=0}$)	In any year estimates fall outside the range of uncertainty simulated by the operating models (OMs) used in the most recent MSE (accepted by the ALBWG in 2021)	Benchmark stock assessment every 3 years
	Fishing intensity ($F_{\%SPR}$) where SPR is the spawning potential ratio		
	Changes in fleet dynamics	Any substantial differences from the structure and parameterization used in the OMs of the most recent MSE (accepted by the ALBWG in 2021)	As new evidence and research is presented and accepted by the ALBWG
	Biological parameters		
Application	Stock assessment	Stock assessment is not producible or estimates are unreliable	Benchmark stock assessment every 3 years
Implementation	Fishing intensity ($F_{\%SPR}$)	The fishing intensity is different from what is prescribed by the HCR, given the uncertainty range that was simulated by the most recent MSE (accepted by the ALBWG in 2021)	Benchmark stock assessment every 3 years
	Realized catch or effort	If a TAC/TAE is implemented and the realized catch or effort exceeds the TAC/TAE by greater than 20%	Benchmark stock assessment every 3 years

Should evaluation of the above criteria identify any exceptional circumstances, the ALBWG will assess the severity and potential impacts on the performance of harvest strategies, including the HCRs, and provide advice on the action required, including the need for a change in harvest strategy (e.g., reference points, HCRs), additional research, and/or updates to the MSE framework for NPALB.

Attachment 6

Scientific advice on interpreting fishing intensity from the north Pacific albacore tuna harvest strategies in terms of catch and effort management measures

Background

The Western and Central Pacific Fisheries Commission (WCPFC) Northern Committee (NC) and the Inter-American Tropical Tuna Commission (IATTC) adopted a harvest strategy for north Pacific albacore (NPALB) in 2023. This harvest strategy includes harvest control rules that mandate reductions in fishing intensity if the female spawning stock biomass (SSB) falls below the adopted reference points. The WCPFC NC and IATTC have requested scientific advice from the Albacore Working Group (ALBWG) of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) on interpreting required changes in fishing intensity for NPALB, as described in the harvest strategy (WCPFC NC Harvest Strategy 2023-01; IATTC Resolution C-23-02).

> *"The NC requested ISC in 2024 to advise how the fishing intensity should be interpreted to actual management measures under this harvest strategy"*
>
> *"The IATTC scientific staff in 2024 shall collaborate with the ISC to advise how fishing intensity should be interpreted to actual management under this harvest strategy"*

Fishing intensity across all fleets in the NPALB stock assessment and harvest strategy is currently defined as $F_{\%SPR}$, which is the fishing intensity associated with a specific spawning potential ratio (SPR). It is a measure of fishing mortality expressed as the decline in the proportion of the spawning stock biomass (SSB) produced by each recruit relative to the unfished state. For example, a fishing mortality at age leading to $F_{20\%}$ is expected to result in an SSB of approximately 20% of SSB_0 over the long run. Fishing intensity and SPRs are particularly useful in stocks like NPALB, where: 1) there are multiple fisheries exploiting different age classes on the same stock due to different gear selectivities and/or availability; and 2) important reference points for NPALB are based on dynamic SSB_0 ($SSB_{current,F=0}$). Using fishing intensity and SPRs allows fishing mortality at different age classes to be related to impacts on SSB equivalence and compared using the same units.

Fishing mortality on different age-classes have differing impacts on SSB and SPR. It is assumed that female albacore has age-specific differences in natural mortality, maturity, and average weights, which causes fishing on different age classes to have different impacts on the resulting SSB. Fisheries with different age selectivities and/or availabilities will therefore have different levels of catch-per-recruit and $F_{\%SPR}$, even with the same level of maximum F-at-age. A fleet with higher selectivities for juvenile albacore is expected to have a larger impact on female SSB (i.e., a larger decline in SPR) than a fleet with higher selectivity for older fish (See Fig.1 in ALBWG 2024). Under only one fleet with a constant selectivity and availability, an increase in fishing mortality will be associated with a lower SPR, but for a stock with multiple fleets, SPR is also dependent on the relative fishing mortality across fleets and their selectivities and availabilities.

The WCPFC and IATTC members have traditionally used catch and/or effort controls to manage their fisheries. Although the $F_{\%SPR}$ is an effective way to communicate stock status, it is complex to interpret in terms of these operational management controls for each fishery given the variety of age classes intercepted by different gear types in different locations throughout the north Pacific ocean. Furthermore, the fishing intensity referred to in the current stock assessment and the harvest strategy is reported as the overall $F_{\%SPR}$ and fleet-specific $F_{\%SPR}$ have not been reported on yet.

Summary of Analyses

The ALBWG performed analyses to evaluate the relationships between fishing intensity and catch and/or effort (ALBWG 2024 and ALBWG 2025). Given that fishing intensity reported in the 2023 stock assessment and the harvest strategy is the overall annual $F_{\%SPR}$, the ALBWG started by producing estimates of fleet-specific fishing intensities using the base case model from the 2023 stock assessment and the methods described in Lee & Taylor (2023). These estimates were then used to relate changes in the estimated fleet-specific fishing intensities to multiple fleet-specific measures of catch and effort. The 2023 assessment used a relatively complex fleet structure of 35 fleets accounting for various combinations of country, gear, catch unit, area, and season. For this analysis, the ALBWG recommends using a simplified approach with 9 fleet groupings dependent on gear and country to relate to traditional management controls (Table 1).

The ALBWG advised that the relationships between catch or effort and SPR are expected to change if recruitment and/or fleet selectivity change substantially in the future. The analysis is based on the historical (1994 – 2021) conditions in the 2023 assessment and if the stock conditions are very different in the future, the analysis may not be useful. The ALBWG therefore recommends that the fleet-specific catch and effort reduction per unit of SPR estimated in the analysis be thought of as approximate and illustrative, and will likely need to be reevaluated if SSB falls below the threshold or limit reference points, as this may be an indication of exceptional circumstances.

The ALBWG found that all fleet groups exhibited strong relationships between catch and SPRs. For the longline fleet groups, catch was highly negatively correlated with fleet-specific SPR. For illustration, the fleet-specific SPRs and seasonal fleet-specific catch in weight as explanatory variables, indicated that catches would have to be reduced by 901 – 1,473 mt, depending on the fleet group, in order to increase fleet-specific SPR by 1%pt (i.e., lower fishing impact and fishing mortality) (Fig. 1). Those fleet groups with higher catch (mt) per unit of change in SPR have a lower impact on the female SSB per unit of catch in weight. The fishing impact on SSB per unit of catch depends on the ages and sex ratios of fish (i.e., removing male fish do not impact SPR) caught by the fleet group. For example, the USLL, which catches both the largest fish and the highest proportions of male fish, shows the highest catch (mt) per unit of change in SPR among all fleet groups (Fig. 1).

Similar to the longline fleet groups, the surface fleet groups (JPPL and EPOSF) also showed that their fleet-specific catch was highly correlated with the fleet-specific SPR. However, the relationships between catch and SPRs for the surface fleet groups were slightly more variable and uncertain than for the longline fleet groups. This was because the surface fleet groups caught predominantly juvenile fish (Ages 2 – 4) and were more sensitive to changes in recruitment and availability. Interestingly, results indicated that catches of both fleet groups would have to be reduced by similar amounts in order to increase SPR by 1%pt (Fig. 1). In addition, it was noted that the JPPL fleet group exhibited a stronger relationship between effort and skipjack catch, as

compared to albacore catch. This was likely due to skipjack being the primary target species for this fishery.

The relationships between effort and SPRs were found to be fleet-specific and more variable than those between catch and SPR. Some of the longline fleet groups (JPLL, and CNLL) had moderate correlations between effort (number of hooks) and SPRs but other longline fleet groups (USLL, TWLL, KRLL, and VUOTHLL) had much weaker relationships. Even among the longline fleet groups with stronger relationships, the correlations between effort (number of hooks) and SPRs were more variable than between catch and SPRs.

Both surface fleet groups (JPPL and EPOSF) also showed moderately strong correlations between the number of vessel days and SPRs. These relationships between effort and SPRs were weaker than for the corresponding relationships between catch and SPRs. In contrast to the similar impact on SSB per unit of catch in weight, the GLMs for effort (number of vessel days) show an order of magnitude difference between the two fleet groups (Fig. 2). This is likely due to the order of magnitude difference between the recorded effort for these fleets.

Scientific Advice and Recommendations

It should be noted that both RFMOs currently maintain fishing effort for NPALB at or below the average of 2002 – 2004 levels (e.g., IATTC Resolution C-05-02) and that has maintained the fishing impact on NPALB around or below the target reference point of 45% $F_{\%SPR}$.

The ALBWG cautions that the fleet-specific catch and effort reduction per unit of SPR presented in this document (Figs. 1 & 2) will likely change if stock conditions (i.e. recruitment and/or selectivity or availability patterns) change in the future and it is recommended that the relationships presented in the advice be reevaluated if reference points are breached for the stock (i.e. if the SSB falls below the threshold or limit reference points for NPALB ($30\%SSB_{current,F=0}$ and $14\%SSB_{current,F=0}$),) or if exceptional circumstances are identified.

All fleet groups exhibited strong relationships between catch and SPRs. The relationships for the surface fleet groups (JPPL and EPOSF) were slightly more variable and uncertain than for the longline fleet groups, due to these fleets predominantly catching juvenile fish (Ages 2 – 4). However, there was still high correlation between catch and SPRs for these fleets. Based on these results the ALBWG recommends that changes in fishing intensity required by the NPALB harvest strategy can potentially be translated into catch reductions for all fleet groups.

The relationships between effort and SPRs were found to be fleet-specific and tended to be more variable and often less correlated than for catch and SPR. However, the fleet groups using surface gears (i.e., JPPL and EPPOSF) exhibited moderately strong relationships between effort and SPRs. In addition, it should be noted that the WCPFC has adopted a harvest strategy for skipjack tuna in the WCPO (WCPFC CCM 2020-01) and the JPPL fishery, which targets primarily skipjack tuna, is managed using effort controls under that harvest strategy. It should also be noted that the JPPL fleet group exhibited a stronger relationship between effort and skipjack catch, as compared to albacore catch. This was likely due to skipjack being the primary target species for this fishery. The ALBWG therefore recommends that changes in fishing intensity required by the NPALB harvest strategy can potentially be translated into effort reductions for the surface fleet groups, JPPL and EPOSF.

An additional analysis of JPLL fleets found that the fishery operating in Areas 1 and 3 in Quarters 1 and 2 (JPLL_A13_Q12) and in Areas 2 in Quarters 1 and 4 (JPLL_A2_Q14) are potentially

targeting NPALB. The effort of these two NPALB-targeting fleets had highly negative correlations between SPR, and both catch and effort (Figure 3). This suggests that these two NPALB-targeting JPLL fleets may be able to be managed using effort or catch controls. The increased variability in the relationships between effort and SPRs, relative to catch, should be taken into account. In addition, it should also be noted that the relationships between effort and SPR is slightly weaker for the JPLL_A2_Q14 fleet, which operates south of 30°N.

In order for the ALBWG to provide further scientific advice on translating fishing intensities ($F_{\%SPR}$), resulting from the harvest control rule, into operational control measures, allocation rules will need to be provided by the RFMOs to guide the calculation of fleet-specific target SPRs based on the current total SPR. As an example, an approach may be for the RFMOs to specify a historical or current time period. The ALBWG can then calculate the mean percentage share of the SPR for each fleet or country during that period. Once the allocation guidelines are provided the ALBWG can provide options for estimating the fleet-specific SPRs such that the desired total SPR values were met, while the share of benefits for each fleet or country were maintained at the desired levels. These fleet-specific SPRs could then in turn be converted into catch and/or effort levels, as needed. An alternative example may be for the RFMOs to specify the exact amounts and/or shares of catch and/or effort for each fleet or country, and potentially recalculate the exact amounts after every stock assessment.

REFERENCES

ALBWG. 2023. Stock assessment of albacore tuna in the North Pacific Ocean in 2023. Page 124. International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean, Stock Assessment.

ALBWG. 2024. Relationships between fleet-specific spawning potential ratios and measures of catch and effort for North Pacific albacore tuna. ISC/24/ALBWG-01/07.

ALBWG. 2025a. Relationships between fleet-specific spawning potential ratios and measures of catch and effort for Japanese longline fleets targeting North Pacific Albacore Tuna. ISC/25/ALBWG-01/09.

Lee, H.-H., and I. Taylor. 2023. Calculating spawning potential ratio in fishery groups from a seasonal stock assessment model. ISC/23/PBFWG-2/13. Working paper submitted to the ISC Pacific Bluefin Tuna Working Group Workshop, 27 November -1 December, 2023. Webinar.

Table 1. Fleet groups used in this study with reference to the fleets in the 2023 stock assessment.

Fleet Group	Fleet Group Name	Fleet ID in 2023 assessment	Units of Effort	Fleet Group Description
1	JPLL	F1 to F20	Hooks, Vessels, Days	Japan longline; all areas; all seasons
2	JPPL	F21 to F24	Vessels, Days, Poledays, Avg poles, SKJ catch	Japan pole-and-line; all areas; all seasons
3	USLL	F26 & F27	Hooks, Vessels, Sets	US longline; all areas; all seasons
4	TWLL	F28 & F29	Hooks, Vessels, Days	Taiwan longline; all areas; all seasons
5	KRLL	F30	Hooks	Korea longline; all areas; all seasons
6	CNLL	F31 & F32	Hooks	China longline; all areas; all seasons
7	VUOTHLL	F33	Hooks	Vanuatu & Others longline; all areas & seasons
8	EPOSF	F34	Vessels, Days	EPO Surface fleet (primarily US and Canada); all seasons
9	MISC	F35	NA	Miscellaneous fleets from Japan, Taiwan, & Korea

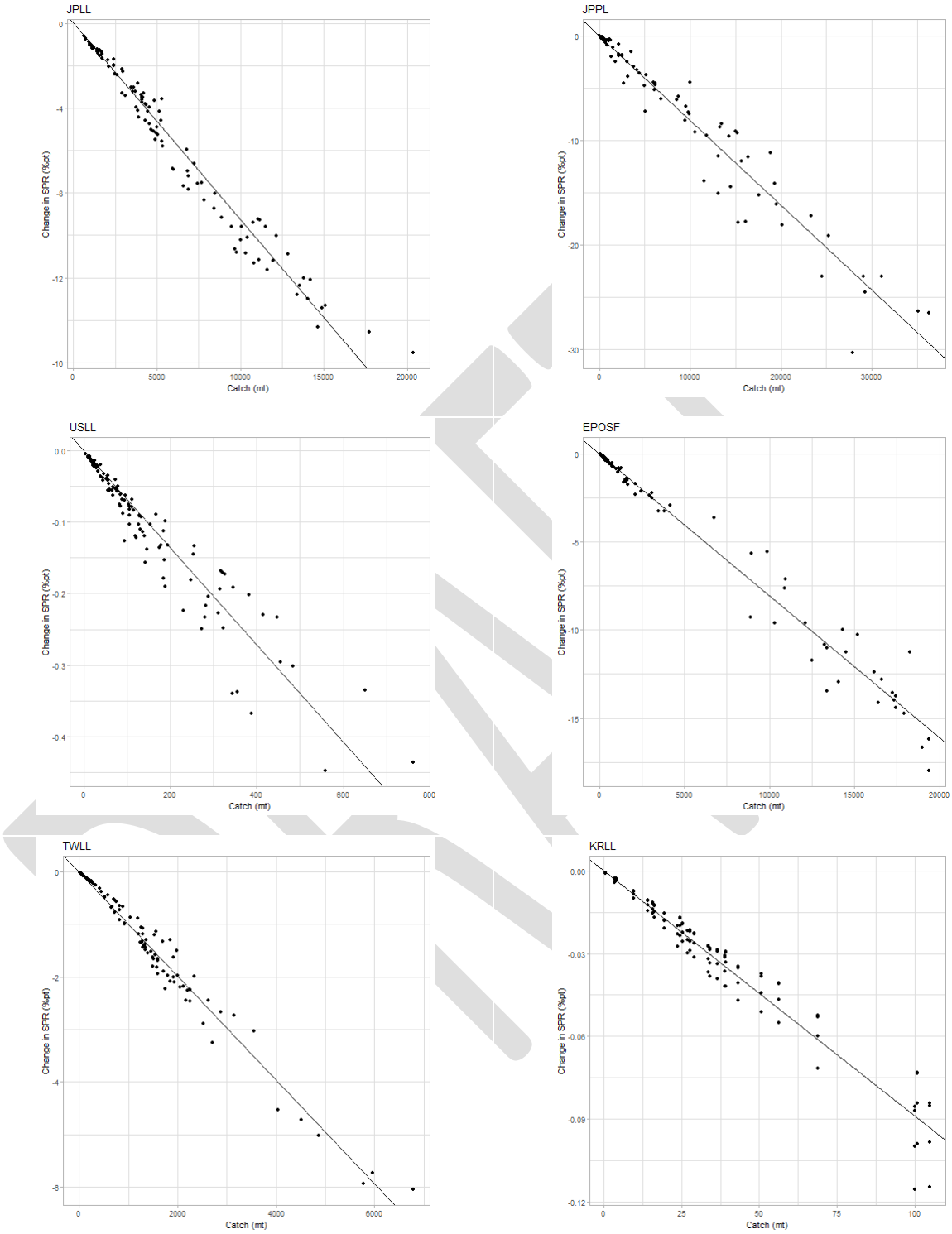


Figure 1. Estimated relationships (line) between seasonal catch in weight (t) and expected change in spawning potential ratio (SPR; %pts) for nine fleets using single variable GLMs with a fixed intercept at 0. See Table 1 for fleet abbreviations. Note that scales of the x- and y-axes are variable.

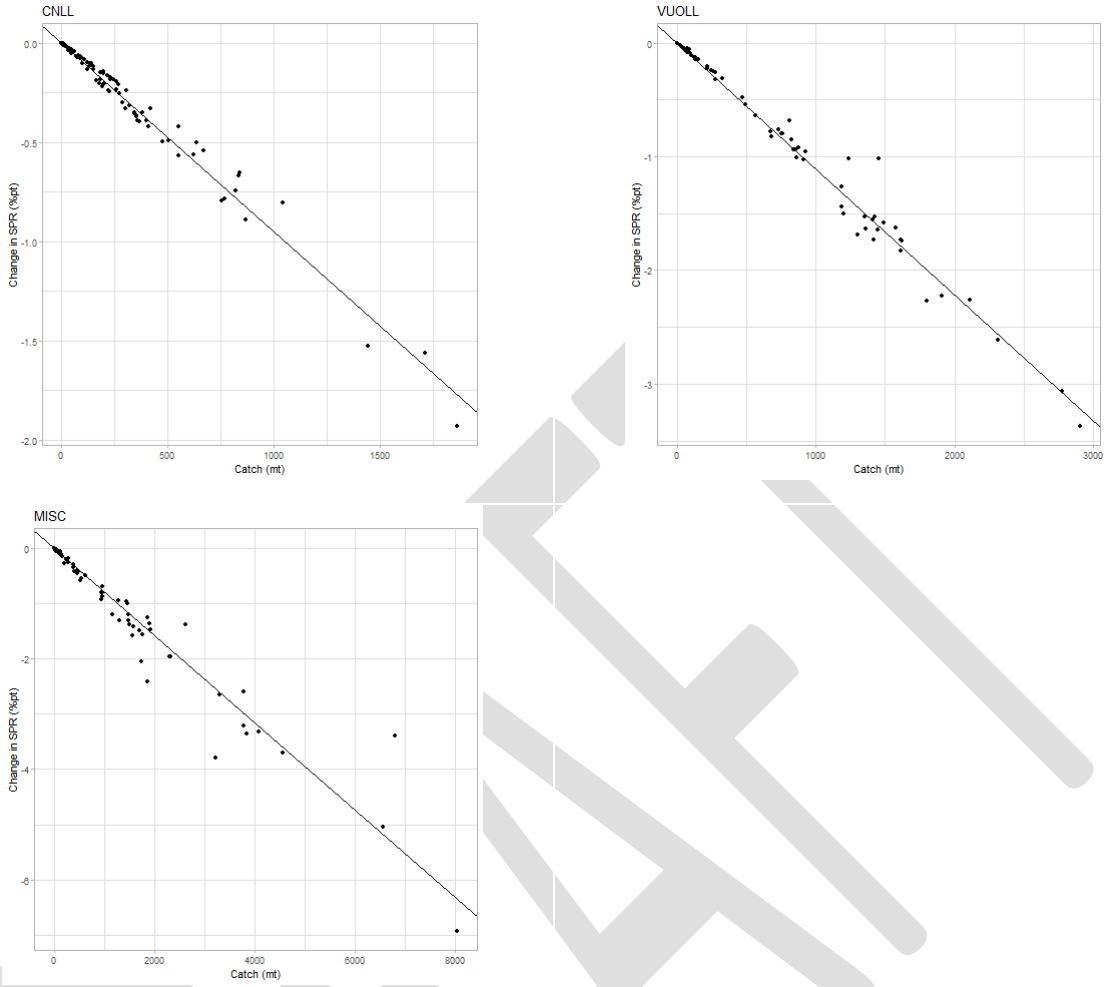


Figure 1. continued.

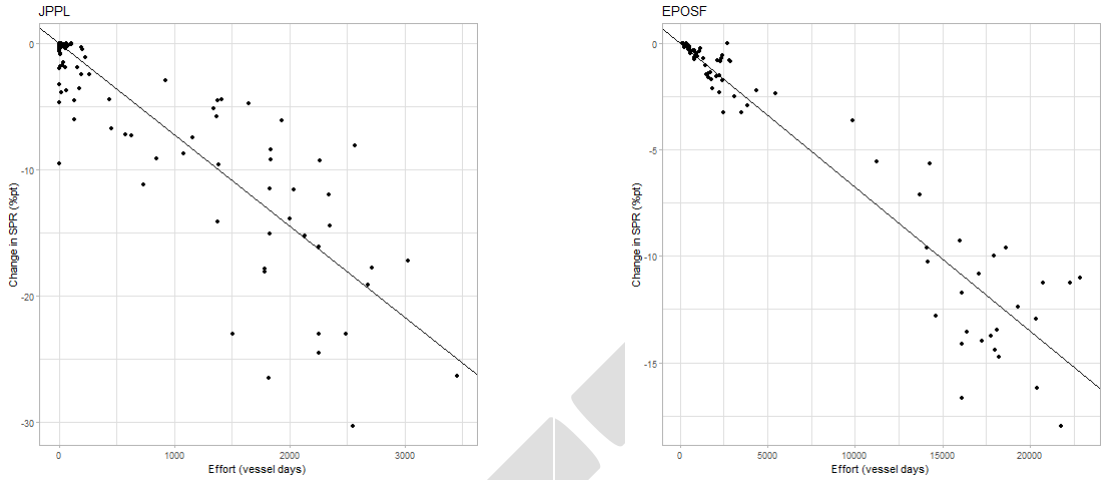


Figure 2. Estimated relationship (line) between seasonal fishing effort (vessel days) and expected change in spawning potential ratio (SPR; %pts) for the two surface gears (troll and pole-and-line) fleets using single variable GLMs with a fixed intercept at 0. See Table 1 for fleet abbreviations. Note that scales of the x- and y-axes are variable.

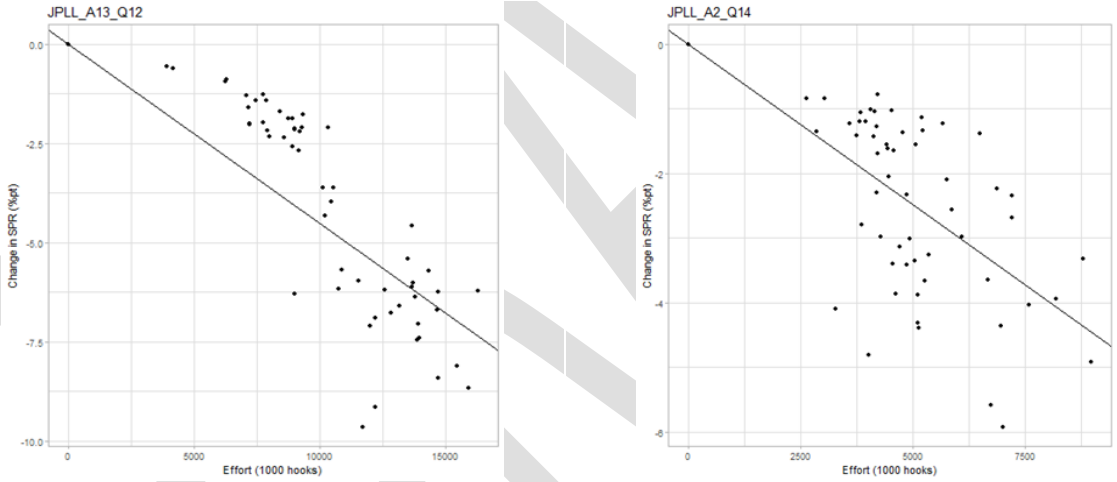


Figure 3. Estimated relationships between seasonal fishing effort (1000s of hooks) and expected change in spawning potential ratio (SPR; %pts) for the two aggregated Japan longline fleets targeting NPALB (JPLL_A13_Q12 and JPLL_A2_Q14) fleets using single variable GLMs with a fixed intercept at 0. Note that scales of the x- and y-axes are variable.