SCIENTIFIC COMMITTEE
TWENTY-SECOND REGULAR SESSION
11-19 August 2026
Apia, Samoa (Hybrid)

SUMMARY REPORT FROM THE SPC PRE-ASSESSMENT WORKSHOP – MARCH 2026

WCPFC-SC22-2026-SA-IP01
1 July 2026

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Report from the SPC Pre-assessment Workshop (PAW), March 24-27th 2026

Pre-assessment Workshop Overview

To help guide stock assessments and related modelling work and analyses for the Western and Central Pacific Fisheries Commission (WCPFC), the Oceanic Fisheries Programme (OFP) of the Pacific Community (SPC) has sought input from regional (WCPFC CCMs) fisheries scientists, consultants, representatives from regional fisheries organisations and other interested stakeholders, through the SPC pre-assessment workshop (PAW) process. The eighteenth PAW was held over four days from the 24th – 27th March 2026. The meeting was held under a hybrid format with 40 people joining in person in Noumea including 21 external (non-SPC) participants travelling to Noumea. An additional approximately 20 people joined online across the four days.

Paul Hamer (OFP-SPC) chaired the meeting. The meeting agenda focused primarily on:

- Modelling approaches and data inputs for the 2026 stock assessments of yellowfin (YFT) and bigeye (BET) tuna in the Western and Central Pacific Ocean (WCPO)
- Technical developments and work planning for Management Strategy Evaluation (MSE)
- Developments to the MULTIFAN-CL modelling framework in 2025 and the 2026 workplan, and the next generation tuna model development
- Developments in tuna age and growth work
- Updates on WCPFC Projects
- Progress of the Close Kin Mark Recapture (CKMR) project for south Pacific albacore
- Overview of the updated bigeye and yellowfin tuna SEAPODYM reference models for the Pacific

The agenda is in Appendix 1, and list of attendees is in Appendix 2. The majority or presentations were made by SPC staff or consultants working with SPC, with several additional presentations from collaborators from WCPFC CCMs. The workshop operated under the terms of reference provided in Appendix 3.

This report summarises the meeting presentations, discussion and recommendations, according to the agenda items. The report does not generally attribute comments to countries or individuals except for those that provided presentations, SPC staff and where the comment related to the agreement to provide data or to undertake particular analyses to support SPC's work. The relevant stock assessment scientists will consider the discussions, comments and recommendations from PAW as they develop the assessments and other related research activities. The extent to which suggestions can be explored and/or incorporated into the stock assessments will be constrained by the available time, complexity, other issues that arise and prioritization by the SPC stock assessment scientists as the work progresses. The PAW is an advisory workshop and the final decisions on model development, data inputs, and characterising

uncertainty rest with the SPC-OFP assessment team, and/or the SPC-OFP assessment team in consultation with external contractors involved in the assessment work. The SPC scientists will make effort to consult with particular members of the PAW who have strong interests in particular aspects of the assessments, or for more general consultation on problematic areas.

The outcomes of this meeting will be reflected in the various papers submitted to SC22. Copies of presentations can be obtained on request from paulh@spc.int or at PAW2026_docs.

2026 SPC Pre-assessment workshop, in-person participants, SPC Noumea headquarters.

DAYS 1, 2 and 4: Yellowfin and bigeye tuna assessments

Day 1 Bigeye and yellowfin assessments

Day 1 began with recaps of the previous YFT and BET assessments conducted in 2023 and the Pre-PAW run in November 2025, which emphasised the key issues that are common to both assessments, particularly; *data conflict and model instability*. The Chair noted that these issues are symptoms of wider underlying problems with the two assessments that require exploration, further development and testing of options to ameliorate or rectify in the 2026 assessments. Specific issues were discussed in detail in later sessions of the workshop.

Day 1 then focused mostly on the biology and population structure areas for the YFT and BET assessments.

Biological parameters

Growth

Background on growth data and the conditional age-at-length (CAAL) internal growth estimation was provided by the Chair, noting the CAAL approach was recommended by the YFT peer review panel prior to the 2023 YFT and BET assessments (Punt et al. 2023). New CAAL data for the model region north of 10°N is available thanks to Japan Fisheries Research and Education Agency (FRA). Japan FRA scientist, Takaaki Hasegawa, provided a presentation on this new data. Plots showing how the age-at-length for the new north Pacific data compared to the available SPC data (equatorial and south Pacific) were provided. These suggested more notable differences of length at age for BET at larger sizes (i.e. >110 cm FL) where the north Pacific BET samples were younger at larger sizes than the equatorial and south Pacific samples. There are no samples of <60 cm FL from the north Pacific for either YFT or BET. Contrary to BET, the north Pacific YFT samples appeared slightly older at sizes from around 60 – 110 cm FL than the equatorial/south Pacific samples. It was noted later in the workshop that while these patterns will be inherent to the CAAL data submitted to the assessment model, the data is still insufficient in itself to robustly quantify the significance and extent of spatial 'growth' variation, with north Pacific data being restricted to sizes >60 cm FL and collected at very different time periods (cohorts) compared to the equatorial/south Pacific samples. Temporal growth variation is likely and can be a confounding factor in spatial growth comparisons, more data is needed to clearly quantify spatial growth variation.

Takaaki-san also presented work to explore options to sample age-length observations (BET focused) from the expanded CAAL data set with the weighting of the sample sizes in relation to spatial patterns of CPUE using a spatiotemporal model of Japanese longline CPUE. The intent is that the CAAL sample composition selected for the assessment model is weighted more highly towards spatial areas that have higher CPUE and therefore assumed higher abundance.

Nick Davies (SPC consultant) provided an overview of how CAAL data is treated in MFCL and the CAAL likelihood term. He explained the option to use manual data weighting divisors in MFCL to adjust the effective samples sizes (ESS) of CAAL data observations (both upweight and downweight) at either the sample (fishery incident), fishery, region and overall level. This approach could therefore apply data weightings consistent with any sample weighting scheme provided by the Japanese analysis if that was

desired. The assumption for the ESS scalar to be uniform for all fisheries (hence regions) as applied in the 2023 assessments could be re-visited.

It was noted that the Japanese sample weighting was only applicable to samples from the longline fisheries as the CPUE used was longline, i.e. fish > 60 cm FL. Further work would be required in relation to weighted sampling of smaller fish from equatorial purse seines fisheries. The equatorial samples are the only samples for the smaller fish, so it probably has to be assumed that the large fish north on 10N have the same early growth pattern. PAW also suggested that, assuming there is consistent spatial growth variation (which cannot be modelled in MFCL or SS3), it would be preferable to fit the size data well where you have the most reliable and best coverage of the CAAL data and therefore the growth estimation, this is the tropical fishery region south of 10N. Trying to fit size data in model regions using a misspecified growth curve could lead to biased estimation. This could be achieved by downweighting the size data in model regions where the CAAL data is poor and you have some good evidence that region specific growth is likely. The PAW recommended that a combination of both size data and CAAL data weighting should be considered.

The MFCL code to input catch-at-age (CAA) data has been reviewed, refined and tested successfully. There is the possibility to now use region specific growth curves to estimate region specific CAA data that could be fit in MFCL – this would mean size data is not required for the assessment model, but a growth curve would still be required to estimate release ages of tagged fish (when tag data is used). John Hampton (SPC - consultant) is currently exploring this method. For this exploration, the spatial otolith-based growth data is limited, and some areas will rely on length data to inform growth. This approach would not be presented as an assessment option this year, but perhaps as an IP to SC22 that initially explores the differences between models that are fit to CAA data versus traditional catch at size data.

Reproductive biology

Background on the previous method for the reproductive ogive was provided by Arni Magnusson (SPC). An update on the EU funded WCPFC project 120 was provided by Sebastien Gislard (SPC), indicating laboratory work is ongoing, but an updated maturity ogive is unlikely to be available for these assessments. Therefore, the same 2023 ogives would be used in 2026 assessments. Post PAW the SPC team had some discussion on the combination of data that is used to create what is termed the 'reproductive potential' at length ogive – which includes maturity at length, fecundity at length and sex ratio at length. While the maturity and fecundity components may have no new information, perhaps the sex ratio at length warrants review. However, there are considerable uncertainties with this data include a lot of data for the larger fish that are 'undetermined' – these could be potentially biased by sex, so would require assumptions as to whether they are 50/50 male female or some other ratio. More exploration of this data is required and is unlikely to be done for these assessments, given the other priorities.

Natural mortality (M)

The chair provided some background on the previous assessments' approach to M-at-age, including the more complex ogive that incorporates sex ratio by size class, proportion mature females by size class, a growth curve and an estimate of the M-scale. This was changed to a simpler Lorenzen form in the 2023

BET and YFT assessments after the CAPAM recommendations in early 2023 and recommendation of a review of yellowfin tuna M-at-age by Hoyle et al. (2023). The Lorenzen M-at-age was estimated internally, both the shape (inverse of the internally estimated growth curve from the CAAL and size data) and the M-scale. It was suggested that this likely influenced the model's instability. Recent jittered BET model runs (Kyuhan Kim, SPC) with the M-scale fixed showed some improved stability. The PAW recommended to start fixing the M-scale for further model development in an attempt to improve stability while focusing on the other key issues such as the data conflict. Estimating M-scale could be revisited later if the other issues are resolved. PAW suggested moving forward with fixing M at the current best M-scale from the 2023 assessments.

Nicholas Ducharme-Barth (NOAA, Hawai'i) provided a presentation on the use of BET archival tag data to estimate an M-at-age ogive. The preliminary results estimate an M-scale very similar to the 2023 assessment but a different shape of the Lorenzen curve for M at younger ages, partly due to a different external growth curve. The PAW suggested adding the conventional tag data to the analysis. The approach provides an alternative for an externally derived M-at-age Lorenzen curve, or M-scale, that could utilize the long time at liberty tag-recaptures from the problematic model region 9 in the BET assessment. The tag release groups from model region 9 could then be dropped from the assessment and thus region 9 could be removed. This idea was further supported later when Kyuhan Kim (SPC) showed that the region 9 tag release groups dominate the tag data likelihood, which is not desirable given the very small region, low catches and associated biomass.

There was support from PAW for Nicholas to continue to develop the analysis of the tagging data (in collaboration with IATTC) to produce an alternative external M-at-age Lorenzen curve and M-scale for the BET assessment (and pending time, a generalised code that could be applied to YFT also).

The other alternative for M-at-age was described using the Hamel and Cope (2022) *Amax* method for the external M-scale and estimating the shape internally in MFCL based on the growth curve from CAAL and size data. A prior distribution of M-scale can be used to subsample from for the uncertainty ensemble as per the 2024 South Pacific albacore assessment (Teears et al. 2024).

Spatial structure

The chair provided a recap of the conceptual models of Pacific wide population structure for BET and YFT that were developed for the 2023 assessments (Hamer et al. 2023) in response to a recommendation of the YFT peer review. The PAW was asked to discuss if these conceptual models remain relevant or require revision based on new information available since the previous assessments. The PAW did not bring forward any substantial new information that would prompt revisions. The later presentation on the new YFT SEAPODYM solution predicted a similar pattern of spatial biomass distribution by life stages as the conceptual model of YFT. As there were no suggestions to fundamentally change the conceptual model the PAW then discussed the spatial structures applied to the 2023 assessments.

Starting with YFT, the PAW was provided with background that the YFT structure was simplified from a 9 region to a 5 region structure in 2023 during the later stages of the assessment development. The simplified 5 region structure was aligned with the conceptual population structure model and was

suggested as an option at the 2023 PAW, but as it occurred later in the assessment, the fisheries definitions were maintained as they were for the 9 region configuration due to time constraints. Where regions were merged, the defined fisheries within the merged regions (noting region boundaries were not altered) were treated as fleets-as-area. It was put to PAW that the 5 region YFT assessment structure be maintained, but that the fisheries definitions should be revised and simplified, where appropriate upon reviewing size data. This proposal was generally supported, however, some raised concerns about tag mixing assumptions in the larger equatorial region of the 5 region model, and that splitting this region is worth considering (discussed later). Models applying much simpler structures – single region (fleets-as-areas, no tag data), equatorial only, were also suggested as worthy explorations, particularly if model diagnostics and stability remained problematic with the 5 region model.

The BET assessment in 2023 maintained the complex 9 region model. However, it was noted that a simpler 6 region model was explored but not presented in the assessment due to time constraints. The Chair commented on the general desire of the assessment team to simplify the BET model spatial structure – given the instability issues. The PAW supported exploring simplification and discussed several options. A first decision involved the small region 9 in the Coral Sea that was incorporated after the 2011 BET peer review (Ianelli et al. 2012) to better accommodate the unique nature of the tagging program in that area during the 1990s. The tag releases in this region have some uniquely long times at liberty, but also atypical high recapture rates in the vicinity of the releases – due to this being a targeted seasonal spawning aggregation fishery, with likely spawning area philopatry. As was previously noted, these tag release groups have an undesirable domination of the tag data likelihood. Removing the region 9 tag release groups and using the longevity information from these data in the external M analysis was supported by PAW along with support for the removal of region 9.

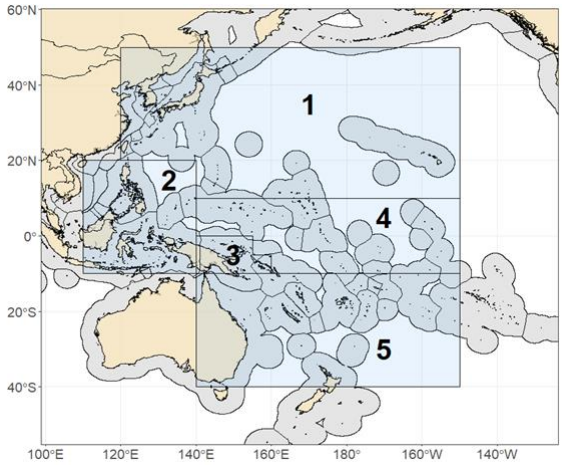
Discussions of merging the two northern and two southern regions, with consideration of fleets-as-areas within these regions, received support – given the limited tag data in these regions and the limited influence of the Japanese tagging data in the tag data likelihood shown by Kyuhan (SPC). This left the discussion to focus more on the treatment of the equatorial model regions, noting that the Indonesia/Philippines/Vietnam region would need to be retained given the unique fisheries and the data issues/uncertainties and complexity related to this region of predominant archipelagic waters, with unique fisheries not directly managed by WCPFC CMMs.

For the BET equatorial region, the conceptual model supported a continuous stock distribution spanning the WCPO and EPO region with a concentration of BET catches by long line in the central to eastern region of the equatorial WCPO overlapping into the EPO region. While a Pacific wide BET assessment would be more appropriate, the WCPFC BET stock assessment is restricted to the WCPO region due to the management jurisdiction boundary and growth differences indicated by previous studies in the EPO (Hamer et al. 2023). The discussion focused on similar aspects to the YFT equatorial region, including tag mixing assumptions and whether to maintain or merge the equatorial regions. This included whether or not to maintain the smaller region 8 around the Solomon Islands and Papua New Guinea. Region 8 was established in 2014 to better account for tag mixing assumptions, but this was more focused on yellowfin and skipjack with their higher tag releases around PNG and Solomons. With few bigeye tagged in that region, removing that region was suggested as a further justifiable simplification. The discussion on

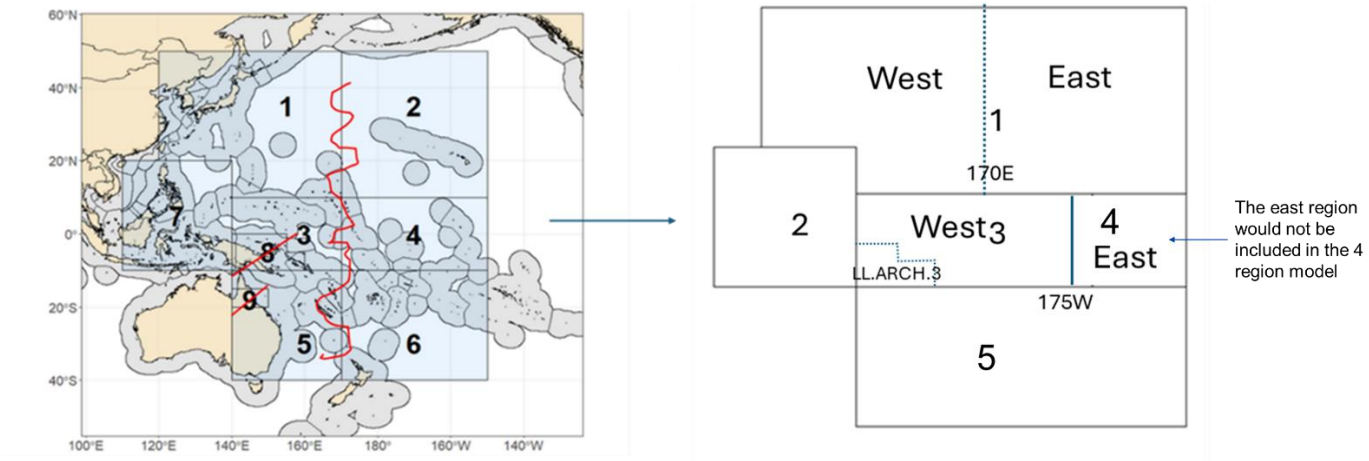
simplifying the spatial configuration was revisited later in the workshop. SPC showed the distribution of tag releases for BET confirming the very low numbers of releases in the PNG/Solomon Islands region where tagging is done from pole and line vessels that catch fewer bigeye, with most of the releases occurring to the east of around 180°W. Ultimately a four region model was proposed with an option for an alternative of a fifth region by splitting the equatorial region at somewhere between 170 and 180°W to perhaps better meet the tag mixing assumption for the area where most BET tags have been released.

Proposed spatial configurations for YFT and BET below:

YFT- 5 regions, same as 2023 assessment



BET – proposed change from 9 region (left) to 4 region, with option for alternative 5 region (right) spatial structure.



Day 2: Bigeye and yellowfin assessments continued.

Catch and effort data

Day 2 started with a summary of the updated catch and effort data from Thom Teears (SPC) according to the model regions used in the 2023 assessments. The recent and historic trends were shown and the issue of uncertainty in the attribution of catch as large or small fish to the Indonesian handline fishery catches was raised. The PAW made the point that the catches are small in the northern and southern regions, and this needs to be considered in the CPUE discussion regarding regional biomass scaling. Given these low catches in the northern and southern regions, the option of an equatorial region only model was raised. There was no further substantiative discussion on the catch and effort updates, and no notable issues identified.

Size composition data

The next presentation from Claudio Castillo-Jordán (SPC) presented information on the size composition data R Shiny dashboard developments as part of WCPFC Project 127. The first dashboard is aimed at providing a flexible tool for exploring the sources and amounts of size composition data by lengths and weights for defined model fisheries and sources. The tool currently works off data files generated from SPCs LF and WF_Master data bases aggregated at MFCL model fishery levels, with data summarized as numbers of size measurements by: year, quarter, defined model fishery, flag.fleet, and data Origin.id (according to definitions used in the databases – see table 2 Hamer et al. (2025)), with options for raw sample numbers or after minimum sample size filters are applied (i.e. filters on minimum number of measurements per fishery-year.quarter strata). The tool can be used to better understand how changes in size compositions over time for individual model fisheries may relate to changes in the sources and flag/fleets contributing to the size data. These changes may have introduced sampling artefacts or biases or represent true changes in the catch size composition and shifts in selectivity due to different flags taking more catch and providing more size data (e.g. in mixed flag fisheries), which could be best dealt with using selectivity time blocks. The PAW considered this data exploration tool would be useful and encouraged further development. Another R Shiny is now needed to allow plotting of the actual size distributions based on flags (single or combinations), data sources, and in both time and space. Further work could also aim to link these dashboards directly to the SPC master databases.

Tom Peatman (consultant to SPC) then provided an overview of his work on size data preparation, noting the conflict in size data in the previous YFT and BET assessments, and the need to take an in depth look at the size data inputs for the 2026 assessments. He noted an example for the BET assessment length composition for fishery 17.MISC.PH.7 that was in conflict with all other model fisheries. The past BET and YFT assessments have had conflict between weight data (i.e. longline) and length data (i.e. purses seine, pole and line and various other smaller fish fisheries in Indonesian/Vietnam/Philippines region). The growing availability of length data for longline fisheries and across a greater diversity of flags and areas means that it is increasingly difficult to justify not using this data in stock assessments as has been past practice for longline size data in these assessments (i.e. just using weight frequency data for longline catches).

Summary plots showed how the size composition data (weights and lengths) is all provided by the Japanese prior to around 1990, after which other countries started to contribute. Although there is a substantial delay of 10-20 years or more between when other countries started reporting significant catches (i.e. 1970s for Korea and Chinese Taipei) and then started providing size data. This means that for multiflag longline fisheries in the assessments the size data for the multiflag catches from the late 1970s to the mid-late 1990s, is dominated by Japanese data.

The plan to begin using the available longline length data in the 2026 assessments was discussed along with the proposal to convert weight data to lengths prior to inputting into the stock assessment. The PAW did not object to considering using the length data. Tests for contamination of length and weight compositions with larger rounded size classes suggest this is not a significant issue. The session then focused mostly on the approach to convert the weights to lengths.

Converting weights to lengths outside the assessment model provides advantages including:

- Easier to assess consistency between size distributions between the two the data types from different data sources for any flag or between flags, time and space when they are both in length units.
- Could account for variability in the length at weight conversion if this is prominent in space or time.
- Incorporation of variance in the individual length-weight relationship/data set.
- Could incorporate variability in weight-weight conversions, noting many whole weights used in the paired length-weight relationship data sets are derived from processed weights using weight to weight conversion factors.
- Easier to explore size data conflicts at fishery level when only one type of size measure is used.

The method for converting weights to length was explained along with plots showing the comparisons of weight to length conversion distributions versus actual length distributions from the Project 90 data set (i.e. paired weight-length data). The analysis of weight-length conversion noted some areas for further work, including: accounting for variability in conversion factors used to convert processed weight to whole weight, accounting for spatial and or temporal variation on length-weight conversion factors where data allows, and that a more complex weight-length conversion routine could be developed for future assessments, if this approach is to be applied routinely.

Example plots comparing weight converted to length with actual length data from the same flags and model regions across time indicated consistent distributions for some long-term data sources (i.e. JPDW, TWOS) but differences for others (i.e. USHW – weight data from Hawaiian auction samples lacked smaller fish compared to length data from observers and requires some follow-up enquiries). The issue isn't as bad for BET as it is for YFT.

The challenges of objectively assessing the quality of the size data inputs were further described, with spatial, temporal and data source/sampling method factors all potentially influencing reliability and variability, and good documentation is still lacking, despite the documentation in tables in the Project 127 SC21 paper (Hamer et al. 2025). Aggregate data (which is much of the historical data) also lack information

on the sampling sources and could be a mix of port samples, vessel skipper or crew, measured with tools versus by eye estimation, and research/training samples with the proportions of these sources changing over time and space. The issue of what to do when you have both length (mostly from observers) and weight data (mostly from port sampling) for the same flag and model region at the same time was also raised. PAW recommended using one raw data type only, even if the weights are converted to length.

Other considerations raised were the Australia fishery data which has large amounts of port sampled weight data, but also historic lengths measured on vessels. The suggestion to not use the length data was made as this was done under advice from Australian colleagues for the billfish assessments, and length data is no longer collected by Australia under their full e-monitoring. Guam port sampling was also raised. While it has large amounts of samples, they are from limited fleets (JPDW and TWOS) and spatial coverage and show different composition to other data sources for the same model region, i.e. region 1. The Guam data may be unrepresentative for region 1 compared to the data collected more broadly in that region.

Most defined longline fisheries in the BET and YFT assessments are mixed flag fisheries (exceptions being the US and AUS fleets), but with size data dominated by Japan (weight data) until the 1990s. The implications of changes in which fleets provide size data to these mixed flag fisheries require careful consideration to ensure it does not artificially drive trends or abrupt shifts in extraction or index fishery size compositions. Further, identifying when the length data becomes more representative than the weight data and switching to only length data from that point on is an option (i.e. early period would be weight data converted to length and later period would be original length data). This is recommended to avoid using different data types collected from the same catches at the same time. The size data preparations will aim to:

- Use weight compositions for initial period (but converted to lengths)
- Identify fisheries where length data has more representative sampling than weight data (post-2000s)
- Add in/switch to length compositions for these later periods where length data has more coverage than weight data
- Assess model fits to length data, and weight data that is converted to length
- Increase the strength of data filtering (i.e., minimum samples per strata) and build on stronger filtering options that were prepared for the 2023 assessments
- Reduce apparent representative noise in size compositions
- Deeper dive into sampling coverage per fleet to attempt to reduce sampling-driven temporal variability, including:
    - Exclude samples from fleets with limited contribution to catches (similar to approach used in recent SWO & MLS assessments)
    - Or, identify fleets (and data sources) with representative sampling spatially, then reweight this subset by fleet

The PAW suggested exploring statistical methods to indicate differences in the data sources, i.e. length versus weight converted to length, it may be that some of the differences are minor enough to be ignored, or that bias correction might be possible? PAW also noted that maintaining the actual length data separate

to the weight converted to length data would be advisable so that effective sample sizes are calculated for the different data sources.

Biases between port sampling and observer data require further consideration and comparisons to guide decisions on the use of these data. Port sampling is mostly weight data from processed fish that require conversion to whole weight and then to length, and small fish that are not marketable may not be landed/measured in ports for various reasons. The implications of these sampling biases for use of this data in stock assessments requires consideration.

Mixed flag fisheries are problematic and need consideration of the flag and spatial coverage of size data collection in relation to catches. The variability in sources of size data collection for mixed flag fisheries can influence variability, irrespective of the filtering, and there will be periods of poorly characterized size compositions for mixed flag fisheries. The periods should be identified and dealt with in the model fitting, with options including:

- Remove the data during these time periods
- Downweight the data during these time periods (if possible in MFCL?)
- Collapse data into a single time step if time series information is unreliable but selectivity can be estimated
- Time block the selectivity if it is thought to be a real selectivity shift due to changes in fleet composition or fishing areas

The PAW noted that MFCL does not allow time varying selectivity, and while time blocks can be used, this has not been common practice. Assuming constant selectivity will mean that when the sampled (observed) size composition changes the model interprets that as a population effect. Variation in the size compositions due to different flags or the same flags fishing in different areas and encountering different size fish might cause variation in size data that will be modelled as population changes under a fixed selectivity. This will create issues for model estimation and conflict. Therefore, it is important to be wary of spatial shifts in where the size data is being collected, as much, or more so, than trying to make size data representative of the catch amounts by each flag.

After the data preparation and reweighting, the resultant size data inputs by fishery will need review to identify any shifts in size composition that require further investigation (spatial shifts, flags changes etc..) to decide among the options noted above.

It was noted that the length-weight conversion factors are still required by MFCL for biomass calculations, so it is important to ensure that they are consistent between what is used for the external conversions and the internal fixed a/b parameters provided to MFCL for the conversion of numbers to biomass.

The PAW also noted that the current approach is starting with a lot of data from different sources and trying to identify data that needs to be removed (unreliable) or treated differently. The alternative is to start with data that you know is good and then consider the remaining data in terms of whether to add or deal with it differently, asking would it add any value. The principle of triage is first do no harm, so don't make the data worse. The PAW also noted that data weighting is not the end of the process, data fits need

to be considered. If the model cannot fit certain data, then those data are problematic, and should be further downweighed or even removed.

Tagging data

Joe Scutt Phillips (SPC) provided a summary of the tagging data available for the 2026 assessments, covering:

- Overview of available tagging data
- New data for 2026 assessments
- Reporting rates and tag seeding
- Tagging research plan

Two major tagging programs provide tag-recapture data to these assessments: RTTP (Regional Tuna Tagging Programme) from 1989-1992, and the PTTP (Pacific Tuna Tagging Programme) 2006-ongoing. Other tagging data has come from the JTTP (Japanese Tuna Tagging Programme) and Coral Sea Tagging Programme (CSTP), but the overwhelming data is from RTTP and PTTP.

RTTP (1989-1992)

- ~55,000 YFT releases, ~7,000 YFT recaptures
- ~17,000 BET releases, ~10,000 BET recaptures

PTTP (2006-Ongoing)

- ~120,000 YFT releases, ~20,000 YFT recaptures
- ~70,000 BET releases, ~15,000 BET recaptures

Tagging data for the 2026 assessments (terminal year 2024) will include releases up until the end of 2023 and recaptures until the end of 2024. Additional tagging data collected since the 2023 assessments include:

- BET: 12,440 releases, 2,114 recoveries (451 EPO), 17%, 1,345 > 1qrt
- YFT: 611 releases, 1,598 recoveries (59 EPO), 10%, 113 > 1qrt
- BET older releases: 2192 new recoveries
- YFT older releases: 789 new recoveries

Tag reporting rates will be informed by new tag seeding results, with increased tag seeding since 2023 responding to recommendations from the previous assessments. To facilitate increased tag seeding the protocol of hiding tag seeding activities had to be relaxed and 75% of the recent tag seeding has occurred in plain sight. Seeded tags (placed directly into wells) in plain sight cannot be recovered during the fishing operations.

Joe provided an update of the current tagging plans including the newly refitted Soltai 105 pole and liner, renamed the Solomon Searcher, with 2026 tagging cruises to target the Solomons and Federated States of Micronesia.

Tom Peatman then explained the statistical modelling of tag seeding data including the plain site and secretive seeding, i.e. categorical - tag seeding protocol effects, pre and post fishing vessel models. Results showed the effects on reporting rates for single/double tagging, seeding protocol and flag and year effects for the on-fishing vessel and ex-fishing vessel tag detections. The reporting rate penalty parameters will next be developed using the revised modelling approach.

Tag mixing

Joe Scutt Phillips (SPC) provided an overview of tag mixing simulation methods to provide release group specific tag mixing estimates as has been done for the previous two skipjack assessments. The mixing simulations will depend on the new SEAPODYM reference model solutions for BET and YFT, presented later in the workshop. The estimation of the dissimilarity (D-statistic from KS tests) between recapture probability distributions of tag and untagged fish was previously based on the recapture probabilities for a simulation period after a specified assumed time of mixing, either at the completion of the simulation period or as the median across the simulation period. For skipjack this was feasible because they are short-lived and recapture probabilities asymptote after a few years but as BET and YFT are longer lived and could continue to be exposed to fishing mortality over much longer (i.e. 5 + years), this may not be suitable for time reasons. The question was raised on the need to run the post mixing simulations longer as this will take more time. Or because the assessment model assumes the fish are mixed immediately after the assumed mixing period, is it reasonable to calculate the D-statistic straight after the assumed mixing period, rather than after all the individual recapture probabilities have reached their asymptotes.

Four points for advice on tag mixing were requested from PAW:

1. *Given integration or not of tagging data into MFCL assessments for bigeye, are tag mixing analyses a worthwhile use of resources?*

The PAW discussed approaches to the tag mixing analysis with no clear rejection of continuing with the proposed tag mixing simulation approach. There was a thought to consider skipjack as a kind of tag mixing indicator for the other species, but this was also suggested as not appropriate for BET given their different behavior and release locations, and also questionable for YFT. The objective of 'release specific' mixing periods that account for the spatiotemporal variation in mixing rates related to oceanographic variability was also raised in this context. Statistical approaches using the actual tag data had mixed views. Doing these at release group specific resolution would suffer from low statistical power, and aggregating release groups was suggested to be undesirable given the expected variability in mixing rates among release groups (time and locations) and the objective to provide release group specific mixing periods.

2. *Should the same approach be taken for yellowfin, dependent on new JRA55 reference solution for this species?*

Given the discussion on question 1, the PAW support to do the tag mixing simulations for both species was implied but pending the presentation on the SEAPODYM yellowfin reference model.

3. *Should calculation of dissimilarity between tagged/untagged probability distributions change?*

PAW supported using the D-statistic values calculated directly after the assumed mixing period.

4. *Would tag recapture density plots be useful diagnostics for tag mixing (irrespective of Ikamoana tag mixing simulations)?*

PAW agreed with the value of providing tag recapture density plots (i.e. tags recaptured per catch) but some more thought on how to present these as supporting information for levels of mixing. The tag recapture density plots/maps could be provided with associated D-statistic values at each tag mixing period as a kind of visual cross validation. Noting the D-statistic values index how similar (i.e. level of mixed) the recapture probabilities are between tag and untagged fish in the Ikamoana release group simulations. It would be useful, at least qualitatively, to be able to compare the D-statistic values for each mixing period of a release group with the observations of the actual tag recapture densities at that mixing period for the release group. This might also help with validating the range of the D-statistics used in the uncertainty characterization of mixing periods, supporting an upper-level threshold of the D-statistic at which to classify any release groups as unmixed.

CPUE - session 1

Thom Teears (SPC) provided a presentation on the work done on CPUE analysis since the November Pre-PAW. He first showed the differences in the time series of percentages of zero data in the set level CPUE data by model regions, and the nominal CPUE time series by flag for both BET and YFT. Prior to 1990 the CPUE is dominated by Japan (with data back to the early 1950s), while there are data from Korea and Chinese Taipei from the mid-1960s, their CPUE is low and different to Japan, and the reliability of these early data are questionable as the Korean and Chinese Taipei tropical tuna fleets developed. Post 1990 a lot more flags contribute to available CPUE data. The PAW noted that it would be useful to have some more guidance from DWFNs on data confidence across time for the historic distant water CPUE data so analysts could make more informed decisions on which data/time periods to include in analyses. In seems data, other than Japan, is of questionable reliability prior to at least 1990, and for Chinese Taipei it was suggested to not use data before at least 2002.

Thom then discussed a new approach being developed in response to recommendations from the Pre-PAW around exploring ways of increasing the amount of data subsampled for the CPUE modelling. The large basin scale sdmTMB models are not feasible to run on the full operational data set and require sub-sampling, i.e. 5 observations per 5 x 5° cell-year-quarter, per flag if more than one flag. The Pre-PAW had asked about testing larger sub-sampling effects, even if on a subset of data. The approach presented considered this request along with other considerations around likely spatial variation in the effects of covariates. Inspired by the analysis of observer CPUE data being conducted independently, the approach described considered conducting separate sdmTMB CPUE models for individual flags that are spatially and temporal constrained with less data. The smaller data sets could be modelled using various levels of sub-sampling (i.e. % of total data) and replicated with different random seeds within each sub-sampling level to assess the level of subsampling above which the results show negligible change and negligible effects of the different random seeds (i.e. different sub-sampled data). This was done separately for all flags and results were shown for New Caledonia (small area), Fiji (larger area) and Japan (covers most of the WCPO). The results showed that subsampling above 20% of data there are negligible differences between different subsamples and overall, the main trends and dynamics were similar for lower (4-6%) and higher (24-30%) subsampling levels.

While the main long-term CPUE data set is Japan, the spatial coverage of Japanese data changes over time and the fleet and data contracts continually starting from the late 1980s to early 1990s when EEZs and exclusive fishing rights became enforced, along with increased competition with fleets from Korea and Chinese Taipei that operated at lower cost. The areas were the Japan LL fleet used to fish began being fished by these other distant water countries and the Pacific Island based fleets. To maintain continuity of spatial coverage of CPUE data, multi-flag(fleet) analysis has been used in previous assessments. However, the global multi-fleet data set is large, and analyzing it as a whole requires low subsampling rates which also limits the ability to estimate more local scale trends and covariate effects. The new approach proposed combines the separate flag specific analysis predictions with those from the global full basin scale analysis of the Japanese longline data. The flag specific predications and Japanese predictions are combined only for the areas and times they overlap and the flag specific predictions are scaled so their mean is the same as the mean of the overlapping Japanese data – thus the scaling of CPUE across the full WCPO area is determined by the Japanese data. Combination of the Japanese and other flags CPUE predictions (where they overlap) uses a bootstrap sampling with equal weighting, although the weighting could be easily modified. The idea is that this approach provides more refined representation of sub-regional CPUE trends and dynamics and allows more flexibility in modelling the individual flag CPUE using more of the data, alternative covariates, different covariate effects in different areas, and faster run times, but still integrates the information across all flags into a global scale CPUE surface with the regional scaling determined by the Japanese data. Allowing the scaling to be determined by the Japanese CPUE data is more appropriate in terms of the assumption of similar catchability across space for the MFCL model to use the CPUE to inform scaling of biomass among model regions.

Thom then presented work on the changes in the gear configurations, particularly the main line material that was requested at Pre-PAW. Models focused on the Japanese data only and were run incrementally adding vessel ID, number of hooks in the binomial sub-model, mainline dummy variable (with a hard 1995 switch from kuralon to mono), and HBF-mainline interaction. Results of each model were also plotted as ratios between different models across the time series as recommended by Pre-PAW. Vessel ID had impacts, especially after the 1980s when that information became more available across the fleet data, number of hooks in the binomial sub-model had a minor effect, more so for BET than YFT, adding the mainline material change alone had little impact, but the interaction of HBF and mainline did have a notable impact. It was noted that using the number of hooks in the binomial sub model only, causes an issue in sdmTMB software preventing the use of splines which are preferable for the environmental covariates. After PAW, it was possible to run the binomial sub-model separately, and that alleviates this issue.

Environmental covariates were explored by developing models for each model region to explore the regional (vs global) influence of environmental covariates, including:

- Sea-surface temperature (sst)
- Difference in depth of 12° and 1°8 isotherms (delta.temp.12.18)
- 15° isotherm (iso.15)
- Sea-surface salinity (sss)
- Chlorophyll a (chlor.a) (planktonic productivity indicator)

- Diffuse attenuation coefficient (kd-490) (planktonic productivity indicator)
- El-Nino Southern Oscillation (ENSO)
- Pacific Decadal Oscillation (PDO)

The models with environmental covariates were compared to a base model with only vessel and gear covariates (i.e. YearQuarter, VesselID, hooks (binomial), HBF*mainline.change). Impacts of including environmental covariates were noted.

Regional scaling was discussed using a YFT example (Japan data only), with comparisons between a global model and region-specific models showing different scaling, but some uncertainty in how appropriate it is the use the region specific sdmTMB models for scaling among regions. The global model seemed to produce the more plausible scaling outcomes, with more biomass attributed to the equatorial regions, than the region-specific models. The PAW supported using a global model for regional scaling.

Thom also discussed the possibility of annual models by model region but restricted to the season of peak CPUE for the development of abundance indices. There was little discussion on this option. Thom came back to the mainline change adjustment approach used by IATTC (EPO bigeye) whereby a simple adjustment to HBF was made (i.e. +3 HBF after 1993). The rationale was that the change of mainline from kuralon to monofilament allowed on average an additional 3 hooks to be added between each float, but there was little detail on the catchability influences of this since the effort metric is number of hooks. Perhaps it allows more hooks to be at depths where they have more chance to encounter BET, but this was unclear. Thom noted the data for Japan.DW in the equatorial region 3 indicated that 1980-1990 showed the largest increase in HBF, and an increase of around 8 HBF occurred, which is not consistent with the suggestion of + 3 HBF, or the mainline change being in the 1990s, as applied by the IATTC analysis. There appeared to be three regimes in HBF: 1960-1980 <10 HBF, 1980-1990 10-15 HBF, post 1990 15-20 HBF. Similar data for Korea in region 4 (more bigeye target area) was more consistent with a step up in HBF in the mid-late 1990s to the early 2000s of +4 HBF, with a further increase around 2015. Similar to the Japan data, HBF change occurred in regimes: early-mid 1980s < 10 HBF, late 1980s-mid 1990s 10-15 HBF, mid-late 1990s – early 2010s 12-20 HBF, post mid 2010s 16-30 HBF. This comparison indicates inconsistency in HBF changes across time, and that HBF changes are not necessarily directly aligned with mainline changes or among flags, they changed across time from well before monofilament was in use, and maybe more related to targeting practices. This issue warrants further investigation. It was noted that the exploration of the patterns in HBF for other fleets and areas are not as clear as the examples shown to PAW, so this issue is more complex than at first thought. Later modelling of this effect across fleets suggested changes during the 90's are less than 1 HBF, which is negligible given the HBF is modelled in 5 HBF groups. The impacts of mainline changes could instead be captured as part of effort creep adjustments, as it is not clear that a simple HBF adjustment is appropriate given the observed patterns and variability in the data across flags and fishing areas.

Thom came back to the issue of the use of total hooks in the binomial sub-model for presence absence. His question related to use of number of hooks in both sub-models to allow splines. As noted above, since the PAW, the approach has been to do separate models for the presence/absence and positive sub-models. This also has computational advantages.

The topic of species targeting cluster was also raised, and it was evident that there are mixed views on the use of clustering. PAW suggested that clustering could be considered for the southern longline region given there is a mix of albacore and BET/YFT targeting. But it was countered that clustering has issues that using catch proportion by species to estimate catch rates is confounding, particularly if there are no clear operational changes, and the proportions are changing due to species availability in different areas rather than gear changes for targeting certain species in a location.

Phil Neubauer (Dragonfly) then provided a presentation on preliminary work to explore CPUE abundance indices from onboard observer data. While observer CPUE has been used in shark assessments and recently in billfish, it has not been explored in depth for tuna assessments. The exploration used data in subsets for the tropical region 10°N - 10°S, and the southern region 10°S-40°S, excluding observer programs with very short time series and/or very little data. A Bayesian GLMM in BRMS with sequentially added variables was used, data as number of fish per hooks, negative binomial with estimated overdispersion. There was too much spatial change to apply a spatial-temporal model (STM). The models included year, observer program, observer program x year, number hooks, hooks between floats, bait, vessel ID, month, lat:long and spatial-temporal terms. The preliminary model fits were reasonable. A key comparison shown for the tropical region YFT example was that while the nominal data pooled across the observer programs showed trends similar to the operational CPUE trends, when you add the observer program, and observer program x year effects the trends are removed and the index becomes very flat. Trends were then shown for the individual observer programs and these showed regional differences among programs, so the combined nominal trends across time were being influenced by which observer programs contributed most data in different periods. This is standardised out by the flag/year effects to flatten the indices. The flattening effects were similar for BET. Combined observer programs also weight the early data towards regions with observer coverage in the early the period, which means temporal trends might be driven/confounded by spatial patterns. While STMs might be better, there are large spatial holes over time as observer programs develop, and as there is a lot of regional variation, this is problematic. It was suggested that an STM type analysis might work better if restricted to more recent periods, and specific subareas. The observer CPUE analysis is a work in progress to develop the best approach to utilize the observer data. We expect to present more on this to the longline CPUE workshop in Yokohama in October.

Discussion on CPUE

The discussion on the CPUE session focused initially on the observer CPUE. PAW noted more work is required to consider more appropriate comparisons to the logbook data and this may require more constrained spatial and temporal analysis to achieve good/consistent coverage for comparing with equivalent analysis of operational logbook based CPUE. Spatial temporal models could also be considered but they may be problematic given the temporal patchiness of coverage across the different observer programs. The PAW asked about the covariate effects, noting that given the low observer coverage there would not be much overlap across vessels so vessel ID might provide limited influences, but asked about other operational covariates such as bait and HBF etc.. Phil noted that the operational variables including vessel ID tended to have minimal impacts on the flattening of the trend but had secondary influence on the magnitude of variation between time steps. He re-emphasized that the observer program effects,

which are spatially confounded, had the most influence on the temporal trends, the model is probably fitting through the middle of these spatially-temporally confounded observer data sets. Dealing with the spatial-temporal variability of the observer data sets requires some more thought.

The discussion then focused on proposed recommendations put to the PAW from the earlier presentation from Thom (SPC), that considers two approaches:

- **Global model** with seasons modelled separately
    - JP as the base model bootstrapped with flag-specific rescaled-estimates
    - This approach allows the use of much more of the total data
- **Alternative regional models** with seasons modelled separately
    - Specify vessel ID (random effect) nested in flag (fixed effect)
    - Use targeting cluster in temperate regions

Applied to both model types:

- Adjust HBF by some factor applied to a specific time frame to compensate for mainline material change on catchability
- Add # of hooks to both sub-models to allow the use of splines - resolved by running the sub-models separately.
- Removal of extrapolation/prediction cells in far north that seldom have observations

The PAW commented that they supported an approach where a global CPUE model was used to provide information on regional relative abundance scales, but that separate regional (sub-basin) models were done to provide the time series of abundance indices for each assessment model region. This allows the regional level models to be developed independently with more flexibility to have different covariates and variable covariate effects. Thom noted that the global model with flag-specific rescaled-estimates still allows some of this flexibility, vessel ID can be included, and the flag-specific models can allow the flexibility with different covariates, and their effects, to better model local dynamics.

The PAW asked for clarification about the global model – particularly the approach to combining the global Japanese estimates with the localised flag-specific estimates. Thom explained that data are simulated from the model fits for the Japanese and flag-specific models, for example 500 simulated data for each cell and time step, and then the simulated data are combined (i.e. the current version is equally weighted between Japan and flag-specific). The mean and standard deviation of the combined simulated data provides the new combined estimate, noting that the flag-specific estimates are also re-scaled to the mean of the Japanese global model estimates for the overlapping data area.

The PAW asked for clarification on the problem this new method solves. Thom explained that the main impetus was to allow the use of more data and flexibility in modelling the localised dynamics using the flag specific analysis. The full, global, multi-flag models could only utilize about 5% of data with the computational limitations, and recent tests suggest this is probably not enough data for stable model solutions. The new approach was developed to allow much more data and better use of covariates for the local scales. A follow-up question was asked about whether the use of flag specific models creates more issues with spatial patchiness in coverage. It was explained that the flag specific models actually supplement the core global Japanese data set for the spatial cells where there is overlap but are rescaled to the Japanese data to allow the constant catchability assumption.

The PAW raised concerns about the proposal to run separate quarterly models which would be a lot of modelling given the limited time available and options to reduce this should be considered. There was support for a global model with a seasonal spatial field, rather than separate seasonal models. The PAW noted that the HBF adjustment was not clear in relation to mainline changes, although the Japanese delegates understand that mainline changes occurred during the 1990s. The PAW also suggested that two separate indices could be applied – prior and post mid-1990s.

The PAW asked for clarification on the MFCL use of a global model for regional scaling and separate regional models for abundance indices. It was explained that an approach was used in some previous assessments where they ran a global CPUE model using Japanese data for a period with good coverage (i.e. some period through the 1980-90s) and used that to develop the regional scaling (relative abundance among regions) values. They then ran separate regional models and then scaled those indices so that the relative abundance among regions was the same as the global model for the same time period over which the global model was run. Those adjusted indices (or standardised effort in the old effort deviates approach) where then used for the assessment model with grouped catchability/selectivity.

Uncertainty about the bootstrapping method to combine the Japanese global and flag-specific data was raised as an issue for PAW and further documentation and discussion on the method would be needed before it could be thoroughly considered as there are possible issues with the catchability/selectivity assumptions requiring more information. The PAW recommended that number of hooks should be included in the binomial sub-model and noted that there are potential advantages of including number of hooks in in the positives sub model but with catch per set as the dependent variable (i.e. hook saturation, targeting information etc.). If number of hooks is only applied in the binomial sub-model, the PAW recommended that to get around the software issues preventing the use of splines, it is possible to run the binomial and positive sub-models separately and combine them later.

The PAW supported avoiding extrapolation of predictions into cells with little or no data and consider temperature masking or minimum data observation thresholds to do this.

The PAW recommended to move forward with the approaches that had been applied before, but to continue to develop and explore the newly prosed global Japan plus flag-specific models approach later, after SC. As such the PAW supported using the Japanese data (perhaps with one or two other flags to improve recent spatial coverage if necessary) to produce a global model for a specific time period of good data coverage and use this for regional scaling but develop separate regional models for the model region specific abundance indices.

CPUE – follow-up session Wednesday April 1

The CPUE discussion at PAW required more time than available. Given the importance of this input a follow-up hybrid session was held the following Wednesday with those PAW participants with keen interest in this area of the assessments. The session went for two hours and revisited discussion on target clustering, global and sub-basin models, the new approach proposed combining Japan global data with flag specific CPUE at finer scales, regional scaling, masking of areas due to unsuitable temperature, and whether or not to do separate quarterly models.

The key outcomes of the follow-up discussion were:

- Confirmed to use a global sdmTMB model with Japan and potentially Chinese Taipei and Korean data post-2005 if required, for regional scaling and consider running separate quarterly models for the global data to obtain separate regional scaling estimates for each quarter (see below),
- Under the proposed simplified 4 region BET model and the 5 region YFT model, run sub-basin models to better model the CPUE for the abundance indices. These sub-basin models could be done for the northern, southern and equatorial regions, and also attempted for west Pacific east Asian (WPEA) region. If the BET 5 region option is used could just extract that area from the 4 region CPUE configuration. The issue of poor information for CPUE analysis to represent abundance trends in the WPEA (Indo/Phil/Viet) region was raised – noted that we just don't have sufficiently reliable CPUE data for that area.
- Remove areas of the global model that are considered unsuitable for each species based on SST levels – i.e. predictions into unsuitable thermal areas should not be used in the CPUE abundance calculations used for scaling. Information on relationships between % of zero CPUE data and SST were shown.
- The option to add a feature to Multifan-CL to specify relative biomass scalar values as Bayesian type priors was described. This allows the catchability and selectivity of region specific CPUE indices to be freed up so that sub-basin models can be developed independently to provide the abundance indices for each model region. This approach also takes account of a recommendation by the YFT peer review (Punt et al. 2023) to: "Allow for some differences among regions in selectivity and catchability while maintaining similarities to keep information on regional scaling". This work has since been done and tested, it requires input of a separate set of CPUE data from the global CPUE model that is used only for informing regional scaling.
- It was noted that a separate sub-basin model was not really necessary for the region of the YFT assessment around the PNG/Solomons. The index for that region could be extracted from a wider equatorial sub-basin model that includes that area.

In relation to the separate quarterly global models, SPC has since decided in the interests of time this is not necessary. Global models with quarter terms will be run and predictions from these will be removed if they fall in areas/times with SST below specified thresholds determined by the analysis of SST versus the proportion of zero CPUE data. The proposed SST thresholds based on the probability of positive CPUE observations being greater than 10% is 17°C for BET and 19°C for YFT. SPC will aim to select a period(s) of good data coverage across the model regions to model the global CPUE patterns for use to estimate regional scaling priors. SPC will not run a global model across the entire time period, although this could be required for a single region model.

Revisiting key issues and modelling work planning – day 4

On the final afternoon PAW returned to BET and YFT stock assessment issues that required further discussion along with revision of the more important areas to focus on for the assessment model development work.

The first topic revisited was CPUE analysis. The Chair summarized that the approach being supported by PAW was a global (aka basin scale) analysis to provide the basis for regional scaling information among

model regions (based on largely Japanese operational data) and then individual regional (aka sub-basin scale) analyses to produce the region specific CPUE abundance indices for the assessments to fit to. The issue of the Indonesia/Philippines/Vietnam region was raised again, noting the very little longline effort in that area since the 2000s, but perhaps sufficient in earlier years to estimate a relative biomass scale from a global model. Also noted that much of the effort is to the west of the Philippines and does not really index abundance in the Indonesia/Philippines/Vietnam large archipelagic region. The PAW did not offer discussion or any recommendations on the issue of poor CPUE data from this region

The PAW was asked about the earlier approach to applying a global analysis for regional scaling and it was described that such an analysis for a subset of the time period with good data (including year/area effects) could be used to estimate the relative abundance among model regions. The individual model region indices can then be adjusted to be consistent with the relative abundance scale for the global model for the time period specified in the global model. This could be done similarly using the global sdmTMB model, and the individual sdmTMB model predictions. The issue of seasonal variation in scaling due to fish movement between tropical and temperature regions was noted and would need to be dealt with to avoid overestimating the abundance in the temperate zones, possibly requiring running separate quarterly models.

Using region specific indices for the model fitting was further supported by the PAW and in this context the use of environmental variables such as catchability or density covariates was raised. The PAW discussed how BET spatial density is mostly driven by forage abundance and temperature, in three dimensions, smaller fish are more in the mid-upper epipelagic zone in the tropics, larger fish are able to forage deeper into the mesopelagic zone and into sub-tropical area. Covariates based on SST probably mostly affect density, but the thermocline depth might influence catchability due to interactions with gear depths. Chl a was discussed as not appearing important for larvae as there is enough larval prey in most areas where larvae occur. But it is unclear why the Chl a covariate would be important for the larger BET CPUE. Forcing variables from SEAPODYM were noted as being potentially available to consider as covariates in future CPUE modelling. Future exploration of these is worthwhile.

The PAW noted that on the topic of the more spatiotemporally consistent environmental covariates for density, such as SST, the random spatial and spatiotemporal effects implicitly account for this environmental variability on the abundance component. Environmental density covariates may be less important than focusing on the catchability covariates in these spatiotemporal models, but this is still an area of active research. The seasonal (quarterly) models were raised again, these would only include data for each season and you'd get four sets of scalar values. The PAW was uncertain on how this would be applied, because the separate regional indices will have seasonal variability included. Given the importance and uncertainty of regional scaling the PAW supported including regional scaling uncertainty in the model ensemble for management advice if sensitivity analysis warrant this. The PAW noted the model parameter uncertainty is usually less uncertain than the actual process or structural uncertainty, it could be possible to estimate the scaling uncertainty by running the global models in different time periods. PAW also suggested the need to run sensitivities and then see what the impacts were. SEAPODYM may also be able to provide regional scaling information (i.e. for mature biomass) and could provide an alternative set of values.

Effort creep

Effort creep was then discussed, starting with an introductory presentation from Simon Hoyle (NZ consultant). This provided the theory behind effort creep and efficiency improvements that are ubiquitous in industry settings. The types of technology, gear, information and communication advancements that have no doubt influenced fishing efficiency in purse seine and longline fisheries were described along with examples of how effort creep related catchability trends could be explored. Noting reviews of longline effort creep were provided to the WCPFC Scientific Committee in 2024 (SC20) (Day and Hamer 2024, Hoyle 2024). The presentation provided examples of literature estimates of rates of catchability increases and noted that most tRFMOs have not typically added additional effort creep adjustments to CPUE abundance indices. Those that have included effort creep adjustment to longline CPUE include CCSBT that adds 0.5% per year from 2005, IATTC in the 2024 assessments applied 0, 1 and 2% year, and IOTC in 2024 assessments applied 0 and 0.5% per year.

The presentation provided suggested rates for the BET and YFT longline CPUE that depended on whether vessel effects (vessel ID) could be included or not. Before 1976 no data is available on vessel effects for the Japanese fleet (Japan was the predominant/only longline fleet fishing BET and YFT in the WCPO at that time), values of 0.5 – 1.5% per year were estimated based on the vessel turnover analysis (Hoyle and Okamoto 2013, Hoyle 2024), and an additional 0.5-1.5% year for other unmeasured affects since 1952. Therefore, effort creep adjustments recommended are from 1-3% per year from 1952-1976 and post 1976, when vessel ID is included, 0.5-1.5% year. PAW suggested that 0% effort creep for longline fleets is not appropriate if we accept effort creep has occurred and is not totally accounted for in the CPUE standardisation. The PAW proposed that the minimum should be 0.5% per year. The PAW noted that effort creep adjustment rates are also uncertain and this should be factored into the sensitivity analysis. If the management quantities are sensitive to effort creep adjustment to CPUE, it should be included in the uncertainty ensemble used for management advice.

The PAW then heard about how effort creep can be an emergent property from the SEAPODYM models, with skipjack as example. Unfortunately, fully worked examples for BET and YFT tuna longline fisheries were not available. Preliminary analysis interestingly suggested a small decline in catchability in the tropical region longline fishery, but increased catchability in the purse fishery that has the bigger impact. It was unclear how to interpret this, as it contradicted the previous suggestions.

There were no alternatives proposals for effort creep adjustments and the PAW settled on the proposed values as described above, with 0.5% as the minimum on top of the vessel effects when included in the CPUE model, and 1% per year as the minimum where vessel effects are not accounted for in the model. There was no discussion on the form of temporal effort creep changes, for example, sigmoid to account for a specified period of more rapid catchability increases, versus the default of applying the values as constant rate per year.

Return to CAAL data

The PAW then revisited the use of the CAAL data, and noting that a further 400-600 age-length data, for each species, are likely to be available from a new SPC aging effort for the current assessments. The PAW received clarification from Nick Davies on the weighting approach that is possible in MFCL to apply data

weightings consistent with the external analysis from Japan FRA. Nick indicated observation specific weighting (to reduce or increase effective sample size) can be done in MFCL. Discussion on the side suggested that MFCL weighting divisors could be applied to all the observations from specific model regions to create data weights (effective sample sizes) at the model region scale consistent with the Japan analysis. It was noted that what this will do is simply adjust the relative influence of the CAAL samples from different model regions in deriving a single growth curve that applies to the entire model region.

The PAW asked about the ability to estimate a growth curve internally and maintain a stable model. Kyuhan (SPC) responded that variance parameters (sigma parameters) were unidentifiable so may have to fix some growth parameters. It would be a surprise if just fixing M would solve all the instability issues. The PAW indicated that the instability issues in the 2023 assessment would not be acceptable, so with this in mind, estimating growth internally would need to see resolution of the instability issues, otherwise external growth estimation may be required. The PAW also revisited the issue of growth variation and that the weighting of the size data needs to be considered carefully also. The model should have less weight towards fitting the size data that are not derived from the region(s) where CAAL data that has most influence on the growth curve, irrespective if the growth is estimated internal of external. Perhaps simply fixing selectivity for those fisheries where it is considered growth would be different to the growth curve applied.

The chair asked about the options of external growth curves if the assessment needs this. The growth curves could still be developed with the alternative subsampling weighting, and also downweight the size data from the regions with assumed different growth.

The PAW noted that the estimation of growth would focus on the areas with most CAAL data and so fitting the size data in those regions well should be a priority, with downweighting of the other size data. This could improve model stability even with the internal growth estimation. The CAAL data weighting really needs to occur in combination with the size data weighting, this was not explored enough in the 2023 assessments and needs some greater focus in the current assessments.

The PAW, however, commented that the spatial growth differences are still not clear and more data is required to confirm the consistency and extent of the growth differences between northern, equatorial and southern areas and that there is no way to set a strict boundary for where one or another growth pattern occurs, it would likely be a gradient of growth change. The PAW suggested to be cautious about the new CAAL data and assumptions when modelling with different growth curves. It was further noted that the sampling is different between the north and equatorial/south Pacific, with more samples from the purse seine fishery in the equatorial regions, so any apparent growth differences between the two sampling areas could be influenced by the sampling biases between each area. The point was then made that there were differences in the growth patterns when displayed as CAAL. Also, that use of CAAL in the model will account for the selectivity difference between the fisheries that collected the samples.

The PAW also noted that you can't really compare the previous MFCL estimated growth curve with the new Japanese data. Both need to be estimated the same way – you could exclude the larger and smaller

samples to see if those size ranges are driving growth differences – i.e. larger fish are sparse for the SPC data and small fish are absent from the northern region Japanese data.

From this discussion on the CAAL data, it seems that it will require considerable exploration, and work on the data weighting interplay between the spatial/fishery level weighting of the CAAL and size data. As such the PAW did not offer precise scenarios to explore with alternative models.

Return to natural mortality

Natural mortality was then revisited, noting the earlier PAW recommendations to start the model development work for the 2026 assessments with a fixed M-scale at the previous diagnostic model best estimate. The PAW was asked about the options for setting M-scale if it is to be fixed, noting the Amax approach (as per 2024 albacore assessment), and the tag-based M estimates proposed by Nicholas Ducharme-Barth. The chair asked Nicholas about the tag-based M, how far this might progress, and whether a similar approach could be applied to YFT. Nicholas noted he'll work with SPC staff to progress this and try to provide code that could be applied to YFT, but could not guarantee he could do YFT, and will focus mostly on BET. Kyuhan noted the relationship between M and growth and if M is estimated external based on a different growth to that estimated by MFCL this will be problematic. Nicholas agreed and suggested that when the assessments have growth curves, they are more comfortable with, they can provide them and he can rerun the tag-based M estimations.

Return to spatial structure

Spatial structure was then revisited. The chair noted that simplification of the BET was a direction favored by PAW, with perhaps some additional complexity for YFT to cater for tag mixing. YFT was discussed first, noting the default to maintain the 5-region structure of the 2023 assessment. To inform the discussion, Joe Scutt Phillips showed the distribution of tag releases for YFT. The main question was whether to further split the equatorial region 4 at around 170°W, but it was noted tag mixing is an issue for any release group and this may not provide much benefit and require splitting the other data in the assessment. For the archipelagic region 3 (PNG/Solomons), it was suggested that this region should remain due to the large number of tag releases and the stickiness of YFT in this region. The issue of tag mixing in the larger equatorial region 4 was discussed noting that you need to be able to assume that the tags mix with the entire untagged population in proportion to the density of the untagged fish in the model region, and not just within the area that fishing occurs. If this is not met the recapture rates in the fished area will be higher and lead to overestimation of F and underestimate the population size for the model region. The PAW asked the question about the cost of increasing the spatial complexity. SPC noted that it increases the parameter estimations and the related stability issues, parameters on bounds etc. It could be possible to run the old model with the split of the region 4 with the old tag mixing assumptions (i.e. no Ikamoana releases group specific mixing periods).

The PAW tended to support not moving to more complexity for YFT before solving other stability issues. However, it was noted that the idea of splitting region 4 was related to tag mixing and that some reporting rate parameters for the region 3 fisheries were on the bounds, but this may have been a miscommunication since the discussion was related to the splitting of region 4, noting the main purse seine fisheries with tag-recaptures for the region 4 have quite strong priors/penalties and estimated

reporting rates for the PTTP for these fisheries were very close to those prior values. The point really is that if the reporting rates are estimated on the bounds this can indicate issue that may relate to tag mixing. The general feeling was to continue with the current 5 region structure.

Arni (SPC) then discussed the plan to revise and simplify the fisheries definitions. The current starting point is the full 32 fisheries as we had no time to revise these when the spatial structure was simplified late in the 2023 assessment. It is proposed to simplify the number of fisheries by combining some fisheries from the 2023 assessment. Some options were discussed, but further consideration was required post-PAW, considering size data and potentially other factors to justify combining some fisheries. There may be some advantages to keeping some fisheries separated but combining others. Keeping the USHW fishery separated in region 1 was noted. Principals for combining fisheries, include same regions, similar size composition, minor catch proportions. The PAW suggested if considering combining two fisheries or are uncertain on a specific combination, run a model with the two fisheries separated and their own selectivity, then run a model where they share selectivity – if no notable likelihood changes you can combine into one.

The PAW then discussed the simplification of the BET spatial structure. The PAW raised that if the goal of simplification was a focus, that it is worth considering models without fitting to tag data. Therefore if a spatial model is to be preferred, the movement and recruitment distribution based on SEAPODYM could be tried, or a single region fleets as areas model with no tag data at all. It was however also noted the if considering single region models you need to consider carefully how you construct the abundance index, whether it would be a type of area weighted index to represent and average of the WCPO or whether it would be weighted to represent the areas of highest catches. It is not so clear how to do this when you have high heterogeneity in fishing pressure across such a large are and then also how to interpret the results in respect of what are the key areas within the large WCPO area that the model is actually assessing. If the single region model is weighted towards areas where most of the data or catches are coming from, then it is reducing to a tropical region assessment. The key point was that a single region model is not so straightforward and has an additional set of questions that need to be considered, along with additional work including the full set of diagnostics if it is to be used as a serious comparison to the spatial model.

The PAW asked about the possible implications for scaling if the tag data are removed as being suggested, and only the movement information derived from SEAPODYM is used in MFCL assessment. It was noted that this will likely have an impact but will need to do the work to understanding the implication when tags do not inform F or population scaling.

The PAW noted the practical advantages of a simpler single region fleets-as areas model but also agreed the approach to the abundance index needs to be considered. Also, that the use of information from tag data analysed outside the model can reduce some difficult complexities that the MFCL model struggles with, such as M-estimation and movement.

In terms of simplifying the BET spatial structure the PAW did not object to removing the small region 9 or removing region 8. The proposal was then made to merge regions 1 and 2 (northern regions) and 5 and 6

(southern regions) to be left with a 4 region model. The PAW was asked to respond on the proposal of the 4 region model structure for BET. The BET assessment lead responded positively to working with a 4 region model, noting it will run a lot faster, but was concerned about impacts of the suggestion to remove the tag data, relying only on SEAPODYM movement, with no information on F or population scale from the tags. There were no additional comments for, or against, the 4 region structure.

The PAW noted that a simplified 4 region structure or even a simpler structure, still needs to consider the use of the assessment beyond the stock status advice. The WCPFC may request management advice based on alternative management scenarios that involve different future assumptions of fishing mortality in areas such as the archipelagic waters around PNG/Sols (that would not fall under direct control of a WCPFC management procedure), so the fleet and spatial structures to separate the dynamics are important to consider in this respect.

The PAW was asked again for some clarity about moving forward with the 4 region model, dropping the tag data for region 9, that would be used in external analysis for M estimation. The PAW noted that dropping region 8 archipelagic water tags, would create a problem in that the new larger region 3 tags would not mix into that archipelagic region, so that region would not have any recaptures although the tags would be assumed mixed. As discussed earlier, tags are assumed mixed through the entire untagged population in a model region irrespective of the spatio-temporal fishing effort. This tag mixing issue is a problem with the large equatorial region in the 4 region structure. An additional structure has been proposed that would split the equatorial region into two at around 175°W (later noted that this is more consistent with SEAPODYM), this would potentially improve the assumption of tag mixing for the central-eastern WCPO BET tag releases. The tag releases in the more western area could be retained or if dropped altogether and the biomass scale in this area would be informed by the CPUE scaling factors from the global model. Post PAW analysis of the tag mixing simulations let to choosing the 5 region structure.

The PAW came back to the option of the single region model, being easier to get started on, acknowledging the CPUE index development. The PAW suggested that the CPUE index developed for the other spatial models can be used, for example just use the equatorial region CPUE index. However, the PAW also responded with some concerns about this option considering the strong spatial heterogeneity of exploitation and abundance. If there is declining CPUE in the equatorial region but flat CPUE in the northern and/or southern regions, the model would be forced to fit a declining trend overall. The outcomes would be driven by the equatorial trend and not represent the entire stock area very well. The PAW noted that the previous global CPUE indicates over 40% of the biomass is outside of the equatorial region, but in the case of YFT only about 6% of catch comes from the northern and southern regions. This suggest that there are larger areas with low exploitation (no purse seine fishing) and considerable biomass and the equatorial/tropical region with high exploitation and lower biomass, how should this be represented in a WCPO wide stock assessment? Should you average the CPUE over the northern, southern, and equatorial areas to ty to make it more representative of the entire stock area?

The Chair noted the concerns around a single region model for management use, but also that it is worth exploring. The PAW commented again on the advantages of a single region model for model development as it removes some of the problematic assumptions (i.e. around tag data) and stability issues, and that

this exploration should be conducted. The chair noted the main structure for BET would be the 4 or 5 region model and the additional exploration of a single region fleets-as-areas model with the same fleet structure as the spatial model.

Areas of model development for the 2026 assessments that could lead to change from 2023

Arni (SPC) then provided a summary of potential areas that could be subject to changes in the 2026 assessments compared to the 2023 assessment. Many of these were suggested from the previous assessment and/or discussed in this PAW. On top of the changes noted, the PAW also suggested to include the Orthogonal Polynomial Recruitment (OPR), try using SEAPODYM movement, with or without tags, and SEAPODYM recruitment distribution could be considered given the strange recruitment distributions estimated in last YFT assessment. Also, the new CPUE and regional scaling approaches. The refined list is included below. The final discussion was on whether the tag mixing simulation analysis was possible based on the recent YFT SEAPDOYM work, and it was indicated that it was possible, and would therefore be attempted.

List of model development areas that could be explored for the 2026 BET and YFT assessments:

Spatial structure

1. Change the regional structure for BET to a simpler 4 (or 5) region spatial structure.
2. Maintain YFT 5 regions as per 2023 structure but refine (reduce) fisheries definitions.
3. Conduct single-region fleets-as-areas model explorations with no tag data included, noting this will need consideration on how to construct CPUE indices based on the separate sub-basin CPUE indices as there will not be a global (basin) scale analysis across the full model time period (see below). Time dependent on how far we can go with this.

Fisheries data

4. Convert weight comps to length comps
5. Downweight the size data in general, and apply greater downweighting in areas for which growth is more likely mispecified and/or there are no/few CAAL data
6. Analyze data conflict – considering it more as fisheries conflict – purse seine v longline instead of weight v length data, identify and test different approaches to resolve conflict
7. Consider different scenarios for the Indonesian catches, in particular proportions of large and small fish in the handline fisheries, also separate the Indonesian and Philippines handline fisheries. We know Philippines handline is large fish, but Indonesia is uncertain/variable.
8. More work on refining and reviewing the size data inputs, removing unreliable data, increased filtering, better approach to mixed flag fishery compositions.

Recruitment

9. Explore implementing the Orthogonal Polynomial Recruitment (OPR) parameterisation in MFCL
10. Consider SEAPODYM recruitment distributions

Natural mortality

11. Fix M-scale at different levels in the uncertainty ensemble, including using an external tag-analysis to estimate M and the Amax (Hamel and Cope) method applied in the 2024 south Pacific albacore assessment.

Movement

12. Try the SEAPODYM movement coefficients (models with no tags and models where tags included but do not inform movement)

Growth

13. Use the expanded CAAL data sets, try weighting the CAAL observations data by model region groups in MFCL to focus the growth estimation on the important regions (higher density and catches etc.), downweight size data in other areas, and/or downweight size data in areas where there is little CAAL data.
14. Try the Richards curve
15. Implement age error (not possible now due to time required)

Selectivity

16. Use length-based selectivity

Tags

17. Apply release group specific mixing periods based on tag-mixing simulations for each release group
18. Updated reporting rate penalties from recent increased tag seeding effort for the PTTP
19. Provide tag recapture density plots

CPUE and regional scaling

20. Conduct a global CPUE model over a restricted time period of 'good' data coverage to derive relative abundance scales among model regions.
21. Try SEAPDODYM regional scale estimates as alternatives to CPUE based scaling and run sensitivities on alternate regional scale values.
22. Implement a new feature in MFCL to specify a Bayesian type prior for regional scaling values, and take account of the covariance structure, allow to free up selectivity/catchability of regional indices
23. Conduct separate sub-basin scale CPUE models to develop separate CPUE abundance indices for each model region
24. Apply a time-varying CV
25. Apply effort creep adjustments to all regional CPUE indices

Day 3

Multifan-CL and Project 123 – next generation tuna assessments model

Day 3 started with a recap of the previous day's YFT and BET discussions before moving onto an overview from Nick Davies (SPC consultant) of recent developments since SC21 in the Multifan-CL software and the work planning for the current assessments and 2026 in general. The key developments have involved:

- Multi-sex extensions for - Lorenzen and CAAL data and shared length-based selectivity that includes growth-offsets (reported to SC21)
- Length-based selectivity with constraints - non-decreasing, common selectivity above a specified age, zero selectivity above/below a specified age (reported to SC21)
- Initial population survival rate – assigned finer resolution
- Initial values input file *.ini:
    - Allowed specification of total population scalar value
    - Input of the tag_flags assignments
- Warnings relating to implausible tag mixing assumptions
- More informative screen error messages
- Dependent variables variances report – improvements, including establish options for levels of abbreviated calculations, and add SP ALB iTRP metrics to the report, full-abbreviated – stock status reference points only, intermediate-abbreviated – Ref.Pts and time-series of adult biomass, total recruitment, and SB/SBF=0; and terminal N_{age}
- Fixed terminal recruitments – mean value of specified period
- Recaptures-conditioned tag likelihood – testing
- Catch-at-age likelihood – review, reinstate to allow modelling of catch-at age data

Nick provided summaries of these developments and the associated testing.

Various other enhancements and corrections were noted:

- Review and testing of Richards growth (SKJ2025)
- Tagging negative binomial τ – option to disable estimation
- Increased upper bound on diffusion coefficients
- No. evaluations and iterations reported to solution *.par file
- Independent variables bounds check **********
- Improved code algorithm for CPUE fit
- Error check: input tag data has implausible mixing periods

All these developments passed through the benchmark testing and a new version released as vsn 2.2.7.7

Other work was to update the MFCL user guide and make the MFCL source code public at https://github.com/PacificCommunity/multifan-cl. Making the MFCL code public required a lot of work, from Nick, Arni Magnusson and Fabrice Bouye at SPC.

Besides supporting the 2026 YFT and BET assessments and WCPFC project 123 (next generation tuna models), things on the list for 2026-27 include:

- Extend MULTIFAN-CL so that account can be taken of age-reading error when fitting to conditional age-at-length data.
- Add the ability to specify overdispersion in CPUE as an additive rather than multiplicative factor.
- Catch-conditioned model
- Apply q-regression estimation conditional on a fish_flags(fi)
- review the operation of existing control phase routines
- Resolve the discrepancy between Frecent/FMSY in variance report and Fmult in plot.rep
- Natural mortality parameters added to variance report
- Recruitment constraints – time-variant penalties
- Implicit catchabilities – report "NA" for no-effort cases
- Growth – option for stdev linear relationship in normal space
- Support for MSE developments of parallel OM
- Concentrated CPUE likelihood – implement CASAL version

The PAW acknowledged the considerable amount of work achieved and continued enhancement of MFCL by Nick, noting the value of new/enhanced features to the upcoming assessments.

Following the MFCL update the Arni Magnusson (SPC) provide an update on the WCPFC *Project 123: scoping the next generation of tuna stock assessment software*. The presentation focussed on the work required for 2026 under the updated terms of reference agreed at the SC and funded by WCPFC. The key work areas are:

- Exploring external analysis of skipjack tag data with the Technical University of Denmark (DTU) collaborators – Tobias Mildenberger and Anders Nielsen
- Start developing simple model packages to explore software design and implementing RTMB, working with consultants and possibly IATTC
- Develop a pathway and proposal to provide SC22, with funding required, workplan/approach and timeline.

Arni spoke about each of these areas, describing differences between the external tag analyse methods developed by DTU and the use of tag data in SEAPODYM. He provided a summary of the recent CAPAM workshop collaboration with IATTC to discuss important features for the next tuna models, that included most of the features already available in current WCPFC assessment models (i.e. MFCL, SS3) but with addition of random effects, and options for analysis of tag data outside the main assessment model. The models will still need capability for spatially structured population dynamics, and length and age-based structure were noted as important. CKMR would need a separate model package and would not include spatial regions. Models that treat space more continuously were discussed but the research and development is note progressed enough yet to consider the immediate work to develop next generation tuna models.

In relation to the second dot point work area above, Nicholas Ducharme-Barth (NOAA, Pacific Islands Fisheries Science Center, Hawai'i) provided a presentation on the work being conducted on OPAL (Open Population Assessment Library). The OPAL development has been discussed with the SPC project 123 team and is considered a ready fit to be integrated directly into the project 123. The work so far on OPAL was described. OPAL is an open collaboration project, applying modular code development in R using RTMB for automatic differentiation and gradient based optimization. It is building off a base provided by the sbt R package developed by Darcy Webber for southern bluefin tuna. The development is drawing for other software including, SPoRC: Stochastic Population Model Over Regional Components, Stock Synthesis and Multifan-CL. A key goal of OPAL is providing flexibility in both model structures using modular code base in R and enhanced diagnostics, leveraging of RTMB. Also build the capability to integrate into a Bayesian framework. Nicholas noted that OPAL is now under the WCPFC project 123 umbrella, with several core developers contributing so far, but open to additional collaborators. Currently OPAL is an age structured population dynamics model with length-based processes, with possibility of random effects. Also a range of diagnostics including estimability checks, parameter correlations, simulation self-test and one-step-ahead residuals and the ability to incorporate prior information either in a penalized maximum likelihood estimation (MLE) approach or through direct Bayesian inference using SparseNUTS. The development so far is using case studies, a 2020 single region fleets as areas 'real' data set for bigeye tuna in the western and central Pacific Ocean and 'simulated' data set for Hawai'I opakapaka (a demersal snapper). The presentation discussed the results so far, that look encouraging, noting issues with not yet being able to effectively fit to the large volume of size data for the bigeye example, but was successfully applying an ASPM with fixed selectivities. More code optimisation needed. Catch based projection also developed. The simpler opakapaka model fitted the size data well, so the issue is code optimization, and the population dynamics look good. The next steps will involve refining the case studies, code optimization, enhance functionality, and produce a WCPFC Scientific Committee paper, with possible future application to the 2027 NPO blue shark stock assessment.

The Chair noted the value of the OPAL development and that it fits neatly into project 123, also that developing this collaboration to take project 123 to the next phase is important. The PAW commented on the value of the software having simpler model structure and more diagnostics but noted the importance of being able to do Bayesian analysis and integrate with software such as STAN. The PAW clarified about how tag data is used in the IATTC model external analysis, not that it is a two step process, first generating the movement model and the using this to estimate abundance and mortality, but it is similar to SEAPODYM in how movement is modelled, using only tags with both release and recapture information. Effort data is essential for the fishing mortality, and requires good data – especially for purse seine, IATTC have struggled with this aspect so far. Abundance estimates then use all tags and a Lincoln-Peterson estimator, again the attempt by the IATTC have been problematic, so we need to temper our expectations from the external tag analysis and what it might be able to deliver, be a bit wary about relying on moving tag data outside the assessment model. The PAW was asked that if the tag data analysis outside the model is the future, what is the feeling about regular/enhanced skipjack tagging, and also increased use of archival tags to inform the movement models, with the traditional tags used for the abundance and mortality estimates. The Chair noted the importance of this question and the need to hear from DTU after some further work presented to SC. The PAW asked about whether the new model development can

incorporate time varying process and biology (i.e. that might relate to climate change etc). Nicholas suggested it is not currently developed but would be possible. The PAW noted that the OPAL approach is new, and some will be developers and others like Indonesia/Philippines and Vietnam users, the modular approach using R code should be easier than the large models like MFCL and SS3, but how will users be involved to provide advice and get training and kept aware of the developments. Nicholas noted the online repo with documentation and instructions, so the provision of information and user interfaces is a key part of this development: https://github.com/N-DucharmeBarth-NOAA/opal. The chair noted a technical group and a user advisory group would be useful. The PAW questioned on whether OPAL will include spatial structure. Nicholas noted the initial development will be fleets as areas, but the Indian Ocean simulation study provides a basis for exploring spatial structured models. The Chair noted, that these decisions on model features would need to be discussed and prioritised by a technical working group and run through SC in some sort of formal review and work planning process, assuming WCPFC is the key ongoing funder for the development.

South Pacific albacore Close Kin Mark Recapture

The next presentation by Giulia Anderson (SPC) and Laura Tremblay-Boyer (CSIRO) provided an update on the progress with the CKMR sampling and analysis for South Pacific albacore (WCPFC Project 110d). The key points relating to progress towards sampling targets, included that the sampling targets have been revised up to between 36,000 to 85,000 fish (since the start of the work), with around 63,000 samples collected so far (over 3 years) and the sampling is on track, albeit suffering from some unplanned biases in spatial coverage of sampling. Preliminary analyses show there is enough evidence of population structure to impact sampling strategy and CKMR models. The result of previous analysis of population structure however require review, and there are now samples from the EPO which can contribute to expanding spatial coverage for population structure analysis. Epigenetic aging methods still require a lot more work and are not expected to be ready for the first population estimates, therefore age estimates will need to be derived from length data, which will add additional uncertainty. Developing a new finlet-fork length conversion factor now allows use of fish tails, when this is all that is available, and has allowed collection of 1000's of additional samples. Lots of logistical challenges (shipping, lab handling, metadata association), but so far have sequenced ~17,000 individuals in 2025 and found 18 kin pairs (15 HSPs, 3 POPs), only 5% of samples were rejected. The age-structured population model is being developed, and is on track to produce a preliminary population estimate (time series of adult abundance) by SC23 (August 2027), but perhaps not with the 15% target CV. The accurate age estimation remains a key issue.

SPC schlerochronology lab – tuna aging

The next presentation was provided by Corey Wakefield (SPC) on the work being done on tuna aging and method development by the SPC schlerochronology lab team. He covered a range of areas where significant work has been conducted recently, and is ongoing as part of WCPFC Project 129 including:

- Consolidating the otolith inventory and archiving
- Develop validated ageing protocols, and explore otolith chemical profiles to assist with age validation and increment zone interpretations
- Determine aging precision (error matrices)

- Enhancing the representativeness length-age data for assessments, including age a large batch of BET and YFT otolith to be available to add to the 2026 assessments
- Explore spatiotemporal variations in growth with expanded data
- Drive WCPFC project 129: developing an age-length data pipeline, including rapid age predication methods using otolith biometry – results shown for YFT are very promising.
- Future otolith sampling: increasing representativeness for stock assessment data inputs\
- WCPFC project 100: Ageing tuna for epigenetic clocks

In relation to the 2026 assessments, the goal is to add up to 600 additional age-length data to each of the BET and YFT day sets in time to be included in this year's assessments. A sampling strategy was shown with greater allocation to larger fish, to try to enhance the age-length information for older fish.

The next two presentations covered the new SEAPODYM models for YFT – Lucas Bonnin (SPC) and BET – Inna Senina (SPC). The YFT SEAPODYM updated reference model is in the final development stages and has significant updates and improvements over the previous 2015 version. These include new growth and maturity, new climate forcings from the JRA55, updated fisheries data and definitions, updated tagging data, and inclusion of the historical (Nishikawa) larval data set. The fisheries and tagging data are split into training and validation data sets, with the larval data just used for training. Effort is used for catch prediction for longline fisheries but not purse seine fisheries (catch based). Fits to catch data were good for longline and the higher catch purse seine fisheries and likewise for size data. Fits to tag data were good but with greater diffusion predicted by SEAPODYM compared to the observations. Fits to larval data were generally good for the broad spatial and seasonal predictions. Fits to the validation data sets were also good for catch, and for the size data in the recent validation period, not so good for the earlier period, which may be due to data quality, but good fits for tag data. Based on the new best solution, fishing impacts and climate projections were shown. Finally, the new solution compared to the old solution shows much better explanation of Pacific wide catch distributions.

Overall, the PAW commented that the new reference model is much approved and the new diagnostics are very useful. However, less aggregated diagnostics would be good if possible. Lucas noted additional diagnostics are provided in a presentation that is in the repository and also showed the spatial residual plots. PAW asked about the Indonesia/Philippines region and noted this region accounts for a lot catch but has complex oceanography. Lucas commented that this region cannot be modelled well so it is buffered out and does not contribute. The PAW noted that this would influence the fishing impacts etc. if this area is excluded, and if compared to MFCL. The PAW asked if there are any spatial depletion plots, that could indicate spatial depletion patterns. Lucas indicated these are available. The YFT SEAPODYM was considered suitable for attempting the Ikamoana tag mixing simulation work for the YFT assessment.

Inna Senina presented the new BET SEAPODYM reference model, she covered:

- The model configuration, inputs, fixed parameters, data in the likelihood.
- Estimation of and validation of the estimated parameters, model validation and existing uncertainties.

- Analysis of model outputs, including estimated stock structure and size, fishing impact, environmental impact on recruitment and movement, and comparisons with MULTIFAN-CL (MFCL).

It was noted that SEAPODYM uses the BET growth from the eastern and central Pacific Ocean, which has a larger Linf than the updated growth used in the 2020, 2023 assessments, which has more western equatorial and South Pacific samples. Interestingly, applying the more recent assessment's growth inflates the biomass in the western WCPO and the model fit deteriorates, noting the SEAPODYM is Pacific wide and not just the WCPO stock assessment region. Maturity ogive is consistent with recent assessments. Catch, length and tagging data (with EPO tag data including in the optimisation this time) are used, and the new model also uses the historical (Nishikawa) larval data. Environment forcings are NEMO-JRA55V2-ORCA1, similar to YFT. There are 53 parameters to estimate (14 are biological parameters).

The results of the new reference model were discussed, it was noted that prediction of high biomass around New Zealand (NZ) and to the east of NZ, where there is no catch data. It was suggested to likely be a model artifact and needs further work. The MLE fits and validation tests were generally good. As with the YFT, fits were better to the longline size data than the purse seine size data. Tags with <10 days or greater than 6 months at liberty weren't used in MLE. Fits to tag data were fair to good. Stock size, stock distribution by life stages and depletion patterns with age and across space were shown. The most depletion was noted in the EPO due to the purse seine impacts on smaller fish. In the WCPO the depletion was lower (less depleted). Overall, the biomass of adults was about 40% of the unfished level in 2022. Comparisons of SEAPODYM with MFCL show no relationship for recruitment, the trends and levels of juvenile, adult and total biomass were similar in recent years, but differed at the start of the time period, before 1970's. The recent biomass scales are quite similar between models. Regional biomass scaling (among model regions) was similar, but SEAPODYM estimated higher relative biomass in regions 1, 5, 6 and 7 (2023 assessment 9 region structure). It was concluded that the new models is a more robust MLE-parameters model, quantitatively better than the previous reference with GLORYS-free forcing for catch and length frequency data, although the latter is better to describe tagging data. The new MLE shows diffusive solution, which is expected at this resolution and for the mesopelagic species (might be a bias in micronekton model). Uncertainties in estimation of recruitment parameters and stock size sensitivity analysis needs to be done. The SEAPODYM-BET MLE parameters were provided to IKAMOANA for the tag mixing analysis.

The PAW commented that for the estimation dataset for the purse seine size data it would better to use the data post 2010 as this is when the observer programs kicked with proper training and better species identification and size data. The largest differences in the recruitment scaling shown between SEAPODYM and MFCL were questioned regarding whether they are representing the same size fish. Inna replied SEAPODYM recruitment should be at the second quarter of life, similar to MFCL, but will double check. The PAW also asked about the increasing M at older ages in SEAPODYM and if this related to selectivity estimates. Inna replied it could be related to selectivity methods, and sensitivities could be done with a Lorenzen curve that does not increase at older ages, consistent with that applied in the latest stock assessments.

The PAW appreciated the level of diagnostics included in the presentations and the presentation provide online and noted that the paper to the SC22 will have fuller details of diagnostics. The PAW asked if choosing different time periods for training and validation could impact the results. Inna indicated that the fact that the training data model fit could describe the validation set, indicates that enough training data was used. The PAW asked about the high biomass estimates around NZ. Inna explained this was due to the model structure and was an artificial prediction that needs further work to correct. Recent work indicates that this artifact can be removed, without removing the predictions in the north that are actually supported by the catch data.

Management Strategy Evaluation

The remainder of the day was spent on the Management Strategy Evaluation (MSE) work. The first presentation was provided by Rob Scott (SPC) who provided background to the WCPFC harvest strategy development and an overview of the progress in the MSE work program and the workplan for 2026. He noted that when harvest strategies are implemented the management of fishing levels is driven by the management procedures (MPs) and the stock assessment takes a different role as a key part of the monitoring strategy which monitors if the MP is working as expected based on the MSE. Rob noted the key work areas and likely SC22 papers, but that the focus of the main presentations at PAW were on:

- Bigeye Operating Models
- Bigeye MP – Estimation method (addressing SC21 recommendations)
- Bigeye MP – design and implementing considerations
- Yellowfin Operating Models
- Skipjack CPUE analyses improvements

Before the above topics, a brief summary of the South Pacific albacore MP adopted at WCPFC22 (CMM2025-01) was provided, noting that the MP will be run for the first time in 2026 and an 'implementing measure' now needs to be adopted at WCPFC23. The monitoring strategy will also need to be developed and reviewed by SC22 this year. Rob then briefly discussed the implication of the reduced FAD closure (1 month EEZs and 2.5 months high seas), considering the skipjack MP assumed the 3 month EEZ/5 month high seas closure. It was shown that the FAD closure reduction had little impact on the performance of the skipjack MP (skipjack composition is not that different between FAD and free-school sets).

Rob then gave overviews of the mixed fishery approach and bigeye operating models (OMs) development, which focussed on the aspects of uncertainty to be covered by the OMs. He also outlined some changes in fisheries definitions needed to cater for the structuring of the Northern LL, Tropical LL and Southern LL fishery regions. He then discussed the design of the BET MP and the plan to incorporate the FAD closure into the BET MP, noting that recent purse seine catches (mostly smaller juveniles) account for 45% of the total catch. The approach to having MP options that include combinations of HCRs for both longline and the length of the purse seine FAD closure was presented, and how these options could be tuned based on a nuclear grid of projected depletion levels from the OMs under different scalars (levels) of purse seine FAD versus longline fishing levels. The term 'arc of possibilities' was coined to describe how you could achieve the same stock depletion objectives across a range of possible combinations of longline and purse

seine FAD fishing levels. He finished by outlining the next steps and the need for guidance from the WCPFC members, particularly and the upcoming Bigeye Management Worksop (BMW) and SC22.

The PAW asked about the three BET HCR combinations (i.e. purse seine FAD closure - longline HCR combos) and if they represented the extremes being considered. Rob noted they were more illustrative at this stage, and they will need to be updated, and the scalars considered in relation to how they might be applied in an MP. Noting this will also influence the OMs and the related projections to produce the nuclear grid that will be used to fine tune the HCRs. The PAW asked for clarification on the range of FAD closures that would be covered, and SPC responded that they will need guidance on this aspect, and it will need to be reasonable given the number of evaluations that can done in the limited time available. The PAW asked about how constraints might be applied given there are two HCRs that are being used, the constraints place a buffer zone around trade-off points in the nuclear grid. The PAW suggested it could be useful to apply the nuclear grid approach in terms of fishing impacts to find settings where the share of the impacts on the stock depletion is equal between longline and purse seine FAD fishing. This may help better understand what the different longline and purse seine HCRs in each combination relate to in terms of relative fishing impacts. The PAW asked that to narrow down the arc of possibilities, does the range of HCR shown constrain things enough? The PAW also suggested that it will be useful to decide on what the increments of FAD closure, and longline effort could be. Rob suggested the illustrative options are probably indicative but really need to do the work and get the input from WCPFC members at the upcoming 'BMW'.

Day 4

The chair provided a recap of the day 3 discussions on MFCL updates, Project 123 and the OPAL collaboration, CKMR work, the SPC skeletochronology labs work, SEAPODYM development and the MSE work. The PAW was provided a clarification that there is an exception that there will be a paper ready by SC23 that will provide an abundance estimate for South Pacific albacore in the WCPFC region (the CKMR work currently does not extend into the EPO region), but it won't be available until close to the paper deadline, so it won't be possible to incorporate the estimate into the stock assessment.

MSE continued

The MSE presentations continued with the mixed fishery approach and the yellowfin tuna operating models (OMs), also provided by Rob Scott (SPC). The PAW was reminded that there will not be a specific MP for YFT, fishing of YFT will be controlled through the MPs on skipjack (i.e. purse seine), BET (tropical longline) and South Pacific albacore (southern longline). Rob noted the substantial catches of YFT in archipelagic waters, particularly in Indonesia/Philippines and Vietnam, but also Papua New Guinea and Solomons that are outside the scope of WCPFC adopted MPs. A small component of these catches will be managed by the skipjack MP, but most will be under management by those countries. If the BET MP is adopted this year all the mixed fishery MPs will be adopted and then we can test the full mixed fishery framework to assess outcomes for YFT. In terms of TRPs the WCPFC will decide the TRP for BET first and then based on meeting that TRP, see what the levels are for YFT by running the mixed fishery simulations, and if they are acceptable, a threshold type TRP might be considered for YFT (and also possibly BET).

The YFT OMs would be developed starting from the 2023 YFT assessment models. Rob outlined the recommendations from the SC21 and the WCPFC22. The uncertainty aspects to be carried forward into the OMs were discussed, noting that the OM grid would cover similar areas of uncertainty to that for BET based on the advice from SC. There will also likely be the need to increase the model regions to better separate the northern longline fishery region (as per BET). The uncertainty in the Indonesian region catches, both the level of catches and size compositions (especially the handline fishery) presents an uncertainty that may also require consideration in the OMs.

The workplan involves preparing for the BMW01 in May, where the proposed BET OM grid and initial MP design (baselines, TRPs/thresholds) would be discussed to guide the preliminary BET MP evaluations. The preliminary evaluations would be presented and discussed at SC22, where the proposed OM grids need to be adopted by the SC, both BET and YFT. Updated BET MP evaluations would be required after SC. YFT outcomes may then be explored under the mixed fishery approach. The work would be discussed at the BMW02 in September. All going well a final set of evaluations can be provided for consideration by WCPFC23 to choose a preferred MP. Rob also described the reasoning on why the 2023 assessments will be used as the basis for the OMs and that there will be no possibility to change this if some people at SC suggest using the 2026 assessments. The PAW discussed the scalars and how these baseline periods are decided, noting managers will have preferred baseline periods even if the choice of period is not so important because the scalars will just change depending on the baseline.

The PAW asked how YFT is considered without its own MP and the how the archipelagic MPs (Indonesia) would be taken account of. Rob explained the YFT stock will be evaluated in the mixed fishery simulations, while it does not have an MP the stock is modelling in the MSE - it has its own OMs, but will likely required enhance monitoring in lieu of not having a dedicated MP.

The final MSE presentation from Nan Yao (SPC) involved the issue of future proofing the current Japan pole and line (JPPL) based CPUE index used in the skipjack MP estimation method. The ongoing spatial contraction of the JPPL fishery in the equatorial region has led to data degradation. SC20 therefore recommended *"the further development of alternative indices in advance of the third implementation of the MP"*. SPC is collaborating with Japan FRA, with technical advice from IATTC analysts, to develop a CPUE index that can use both the pole and line and 'free school' purse seine (PS) catch and effort (as used in the stock assessment). It is hoped that this combined fishery CPUE method can better represent future abundance trends both in the equatorial and more northern regions where the JPPL now operates. The statistical method was outlined (implemented with the package intCPUE (Rujia Bi, IATTC)) and the results from a limited overlapping (JPPL and PS) dataset from the equatorial region since 2010 were shown. The results look promising that this can provide a viable way forward. Further work with a larger data set is now required. This will likely require the Japanese collaborator to spend some time at SPC in the near future as SPC does not have access to the JPPL data set.

The PAW suggested tinyVAST could also be explored to apply different distributions to the gears and asked about the selectivity assumptions as the method requires the same selectivity for each gear type. The selectivity issue need some more exploration. The PAW suggested to reach out to other people working

on this approach and consider presenting it at the Yokohama CPUE workshop. FRA re-emphasised the commitment to keep working with SPC on this.

The PAW asked about the different units of effort and other features of the fishing methods, and how to consider the different factors that affect catch rates of the different gears. Nan responded that different covariates can be used for the different gears, but more work required on this aspect.

WCPFC projects

The chair provided a brief summary of the progress and planned 2026 activities under WCPFC funded projects not already discussed:

- Project 122: LL CPUE workshop
    - workshop to be held in Yokohama, Japan, 12-16th October 2026. SPC co-organising with FRA, IATTC and consultant (Simon Hoyle), guided by a workshop steering group.
    - https://fame.spc.int/event/global-joint-tuna-rfmo-longline-cpue-technical-workshop
- Project 127: size data reconciliation
    - focus on analysis of patterns in size data and developing better tools like R Shiny dashboards to explore and visualise trends, identify areas for improving the size data collection (where to increase or decrease sampling).
    - progressing the size data information proforma to be completed with aggregated size data submissions, feedback from distant water data staff.
    - continue to collect data and improve conversion factors, focussing a bit more on the ones then need better data, and can help move away from weights to lengths and length-length conversions, renew the contract with the Soccsksargen in General Santos, Philippines to continue sampling with revised tasking.
- Project 129: developing an age-length data stream for tuna assessments
    - scoping the sampling options and methods to allow major expansion of the collection of paired age-length samples to feed into the stock assessments, with goal of having an ongoing sampling program implemented in 4 years.
    - further develop rapid aging methods
- Project 130: sharks and billfish bycatch assessment methods workshop
    - conduct a review/synopsis and technical workshop on methods of assessment to provide conservation and management advice for sharks and billfish, given challenges with current integrated assessment methods, and reducing fishery dependent data for sharks due to non-retention. It was noted that due to the busy meeting schedule the workshop will need to be delayed until early 2027. There is also a need to revisit the scope. Create a steering group and review the scope with a small progress paper to SC22 outlining the revised workshop scope, steering group and planning. Possible venue could by Honolulu, Feb-early March 2027?

Tom Peatmen (consultant to SPC) provided an update on WCPFC projects 117, 118, 125 and 126. This package of projects relates to biological sampling plans to develop robust estimates of biological parameters across the WCPO (tunas, sharks and billfish), centred on improving sampling for growth, but

using this core focus also for prioritising sampling of other biological information such as reproductive biology. The approach aims to allow good representation across the WCPO, sizes and sexes and allow exploration of spatial variation in biological parameters. The plans implement a proportional sampling according to the contribution of each length class to the catches and has been tested using power analysis (SC21 paper), with target sampling rates of 300 samples per course spatial region (i.e. assessment model regions). The sampling is aimed to provide unbiased growth estimates with some target samples of smaller and larger fish. The application of the method to South Pacific albacore was presented, followed by the planned applications of the approach to billfishes and sharks. Reports on the various biological sampling plans will be provided to SC22 for discussion regarding implementation of sampling.

The PAW noted the importance of this planning work but asked about the objectives. The idea is to collect a lot of data that can hopefully answer a lot of questions. But may need focus on the most important questions such as growth variation, need to think about sampling in relation to specific objectives, sampling in proportion to catches might not provide the required spatial coverage. Tom replied that the proportional sample approach being conducted was supported by the literature, but agreed, additional sampling is required for maturity studies, so this is why we have additional targeted sampling of smaller fish. Tom also noted that the plans are based on observers taking the samples, so this does limit spatial coverage.

The PAW asked if the port sampling can be built in, especially for the distant water fleets where observers fly in and fly out, and sampling and sample transportation is an issue. There are many logistical advantages for increased biological sample collection from ports. The observer just do not have the time to do all the biological collections. Tom noted the difficulties, while observers would be the samplers of choice, we probably need to consider port sampling options. Non retention species were also noted as problematic, so the planning will need to consider the availability of dead samples for sampling, or special consideration of sacrificing a number of sharks to collect samples.

The remainder of the day returned to the CPUE topic, including effort creep, and the stock assessment discussions, which is summarised in the earlier sections.

Wrap-up

The Chair wrapped up the meeting thanking participant, in-person and online, thanking the presenters and SPC staff for the preparation work and contribution to the meeting, Karen Kaspan (SPC) for her support in organising the meeting and peoples travel arrangements. The Chair provided some perspective on the large amount of material covered and that the PAW had turned into a mixed stock assessment workshop-mini-OFP conference. He proposed a re-think of whether there is an alternative format where the stock assessment workshop component is separated over 2-3 days, and a day just for discussion and workshopping through problematic areas with less time pressure and more open/breakout type discussions. After the weekend break PAW could reconvene for two days on the MSE/harvest strategy area. This may depend on the assessment workloads that need discussion, if only one tuna assessment, a 5 day agenda – 2 days stock assessment plenary, one day discussion/workshopping, then two days on MSE and other areas, might work.

Acknowledgement

We than Karen Kaspan of SPC-OFP for her support with organising the 2026 PAW. The PAW is supported by funds from the WCPFC contract with the Science Services Provider (SPC-OFP) to deliver the core stock assessment services.

Declaration of generative AI and AI-assisted technologies in the SC paper preparation process: No AI technologies were used in the preparation of this paper, not even the Zoom meeting summary!

APPENDIX 1: Agenda

DAY 1 24th March: Bigeye (BET) and Yellowfin (YFT) assessments

Time: New Caledonia (UTC+11)	Item	Leads	Note
8.30	Meeting room open/arrive/get set up		
9.00	Opening, introduction, agenda	Chair	15 mins
9.15	Yellowfin assessment 2023 - recap	Arni Magnusson	20 mins
9.35	Bigeye assessment 2023 - recap	Kyuhan Kim	20 mins
9.55	Pre-PAW recap	Chair	15 mins
10.05	Some common areas for focus in 2026	Chair/all	20 mins
10.30 am	Morning tea		30 mins
11.00	Biology (YFT/BET combined)		
	• Age and growth • New information (Japan otoliths) • Modeling implications – CAAL in MFCL overview, incorporating the new age-length data as CAAL	Previous assessments (SPC) (15 mins) Taka-san –Japan FRA (15 mins) Nick Davies – 15 mins	60 mins (expect to come back to this)
12.00	• Reproductive biology	Sebastian Gislard (EU project), Arni Magnusson	30 mins
	• Natural mortality	Paul Hamer – previous assessment Kyuhan Kim (2023 model exploration) Nicholas DB - NOAA/IATTC tag based methods for M estimation.	30 mins (expect to come back to this)
1.00 pm	Lunch		60 mins
2.00	Spatial structure – YFT (no change proposed, fleet restructure)	Paul Hamer – recap conceptual models and previous assessments Arni Magnusson – fleet revisions	20mins
2.30	Spatial structure – BET (consider simplification)	Kyuhan Kim (9 and 6 regions options) Nicholas DB – Hawai'i region size dynamics + conceptual	20 mins 20 mins

3.00 pm	Coffee/tea break		20 mins
3.20	Catch and effort data updates/trends		
	YFT and BET Issue to note: Indonesia catch composition data issues/uncertainty	Thom Teears (and/or Tiffany Vidal)	30 mins
3.50	Size composition data		
	• data summaries	Claudio CJ	30 mins
4.20	Additional discussion time as needed	Chair/all	10 min
4.30 pm	Close day 1		

DAY 2 25th March: BET and YFT assessments

Time: New Caledonia (UTC+11)	Item	Lead Presenter	Note
8.30	Follow-up time	Chair/group	10 mins
8.40	Size data (cont.) • data preparation including re-weighting and external weight to length conversions - pros-cons discussion	Tom Peatman	60 mins
9.40	Tagging data summary		
	• BET and YFT	Marc or Joe Scutt	20 mins
10.00	Tagger effects and reporting rates	Tom Peatman	30 mins
10.30 am	Morning tea		30 mins
11.00	Tag data analysis and mixing		
	• Tag mixing	Joe Scutt	50 mins
11.50	**CPUE analysis - start**	Thom Teears	50 mins
12.30 pm	Lunch		60 mins
1.30	CPUE analysis cont.	Thom Teears with Phil Neubauer observer CPUE	30 mins
2.00	Model development and workflow set-up – BET	Kyuhan Kim/all	60 mins
3.00 pm	Coffee/tea break		20 mins
3.20	Model development – YFT	Arni Magnusson/all	60 mins
4.30 pm	Close day 2		

DAY 3 26th March: Research projects (AM) SEAPODYM, MSE/harvest strategies (PM)

Time: New Caledonia (UTC+11)	Item	Lead Presenter	Note
8.30	Follow-up time	Chair/group	10 mins
WCPFC supported stock assessment related project updates (those not already covered)			
8.40	Multifan-CL developments	Nick Davies	30 mins
9.10	Project 123 - next gen assessment models	Arni Magnusson Nicholas DB - OPAL	30 mins 10 mins
9.40	Project 127 – size composition data	Paul Hamer	10 mins
9.55	Project 129 - age-length data pipeline	Paul Hamer	10 mins
10.10	Projects 110d CKMR update	Giulia Anderson	20 mins
10.30 am	Morning tea		30 mins
11.00	Project 122 – longline CPUE workshop	Paul Hamer	10 mins
11.10	Project 117, 118, 125, 126 – biological sampling – tuna/billfish/sharks	Tom Peatman	15 mins
11.25	Project 130 – sharks/billfish assessment methods WS	Paul Hamer	5 mins
Other research and development areas			
11.30	**Sclerochronology lab**		
	• Sectioning method advancements and rapid aging research	Corey Wakefield	30 mins
	• Age validation	Allen Andrews	15 mins
	• Discussion	Chair/all	15 mins
12.30 pm	Lunch		60 mins
SEAPODYM update			
1.30	Update on BET and YFT SEAPODYM models	Inna Senina and Lucas Bonnin	60 mins 10 mins (disc)
Management strategy evaluation			
2.30	Outline of 2026 MSE work (just to warm up and take us to coffee break)	Robert Scott	20 mins
3.00 pm	Coffee/tea break		20 mins
3.20	BET OMs	Robert Scott and Montana Wickens	70 mins
	• Recap on SC21 BET OMs		
	• Spatial structure & fishery definitions		
	• Data issues		
	• OM reference set		
	• OM robustness set (and one offs)		
4.30 pm	Close day 3		

Social event: BBQ 6-10 pm (SPC Social Club area)

DAY 4 27th March: MSE/harvest strategies (AM), BET/YFT assessments (PM)

Time: New Caledonia (UTC+11)	Item	Lead Presenter	Note
9.00 am	Follow-up time	Chair/group	10 mins
9.10 am	YFT OMs	Robert Scott and Montana Wickens	50 mins
10.00	BET management procedure	Finlay Scott	30 mins
10.30 am	Morning tea		30 mins
11.00	SKJ – MP CPUE	Nan Yao	30 mins
11.30	MSE additional discussion time	Chair/all	60 mins
12.30	Lunch		60 mins
BET and YFT assessments			
1.30	CPUE and effort creep Return to areas/issue that need further discussion/follow-up	Simon Hoyle Chair/all	90 mins
3.00 pm	Coffee/tea break		20 mins
3.20	As above, model sensitivities, uncertainty characterization etc.	Chair/all	70 mins
4.30 – 5 pm	Wrap-up/next step - close of workshop		30 mins

APPENDIX 2: List of participants

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APPENDIX 3: Terms of Reference

The Oceanic Fisheries Programme (OFP) of SPC is contracted by WCPFC to undertake stock assessments. The results of these assessments will be presented at the WCPFC Scientific Committee. In preparation for these assessments, OFP is hosting a pre-assessment workshop to discuss key issues related to the assessments. The terms of reference for this workshop are provided below.

Terms of Reference

- Review the most recent completed assessments, in particular, any concerns, suggestions and/or recommendations raised by the Scientific Committee, the Commission, research providers, individual CCMs, or any independent reviews;
- Review preliminary work undertaken by the service provider relating to the stock assessments, including any proposed:
    - revisions to biological parameters
    - revisions to historical data
    - changes to structural assumptions in the model
    - methodological issues, e.g., characterization of uncertainty
    - standardized CPUE analysis
    - incorporation of tagging data or other auxiliary data
- Provides guidance to the OFP on:
    - the suitability of any proposed changes and any suggested additional work
    - a minimum set model runs to be undertaken, in particular the range of key sensitivity analyses
    - desired model diagnostics to be presented.
    - alternative modelling approaches that could be considered

The outcomes of the meeting will be documented in two ways, a report of the meeting and in the assessment working papers themselves. The report of the meeting will be distributed to workshop participants for comment within 10 working days of the meeting and revised and provided to WCPFC Scientific Committee members 30 days after the meeting. It will also be submitted to the next Scientific Committee as a Working Paper. Many of the matters discussed to the workshop will be the subject of meeting papers to the Scientific Committee.

Due to the timing of the meeting, any model runs presented will be based on previous assessment data sets, and therefore no preliminary stock assessment runs will be undertaken. Further, the workshop will occur prior to the submission of data and completion of supporting analyses (e.g., CPUE analyses). Therefore, any major changes to historical data submitted by CMM's, or new data could result in a need to consider alternative model runs or structures not considered previously. In such instances, supporting documentation will be provided to the SC via working papers to allow the SC to determine the merits of any proposed changes.

The consultation will be open to participation by all CCMs and to other experts, by invitation. CCMs will be expected to fund their participation although SIDS and participating territories may seek support from the Commission's Special Requirements Fund or other sources, as appropriate.