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# WCPFC PROJECT127/127A - REVIEW AND RECONCILIATION OF SIZE DATA COLLECTED IN THE WCPFC-CA FOR STOCK ASSESSMENT PURPOSES: PHASE 2 PROGRESS REPORT

**WCPFC-SC22-2026-ST-WP02**
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# Executive Summary

This report documents progress since SC21 on WCPFC SC project 127/127a: *Review and reconciliation of size data collected in the WCPFC-CA for stock assessment purposes*, scheduled to finish in December 2026. The work provided to SC21 constituted a 'getting the house in order' phase. The second phase of work post-SC21 is covered in this paper and has been focussed on:

- Following up areas of uncertainty in documentation of size data collection sources.
- Development and consultation with relevant CCMs on a size data information proforma to be provided with annual submissions of aggregated size data under the WCPFC SciData submission process.
- Development of data exploration tools to explore size data available for stock assessments.
- Summarise recent data coverage and provide recommendations for monitoring and enhancing size data collections – initially focussed on the bigeye and yellowfin assessment data sets.

Online meetings, email and in-person engagements with data staff from CCMs that provide significant amounts of aggregated size data (JP, CN, TW, KR, US, AU, NZ, ID) helped to clarify uncertainties in the data source descriptions table compiled for the SC21 report. The updated tables are included as appendix 1 in this paper. The discussions also assisted in refining the proposed SciData aggregate size data information proforma (appendix 2). Conversion factor tables are updated in appendix 3, and data collection for conversion factors will continue with another year of sampling by the Soccsksargen program (General Santos, Philippines), including enhanced focus on partial length – to fork lengths for tunas, and gill gutted to whole weight for species lacking data, e.g. albacore and bigeye. Examples of R Shiny dashboards for size data exploration are provided (e.g. https://ofp-sam.shinyapps.io/sizecomp-explorer/ ). An example graphical framework for regular review of size data coverage using a traffic light monitoring system based on specified sampling targets, is provide for SC comment (also see: https://github.com/PacificCommunity/ofp-sam-tunastory). Noting further development would be required to refine this, particularly sampling targets. The targets in this paper are for demonstration only, and we would seek a statistical basis for setting targets with follow-up work, pending SC feedback on the value of the approach.

**We recommend that the remainder of Project 127/127a continue to focus on**:

- Development of size data exploration tools – add spatial maps of size data collections into the "Composition Sample Explorer" dashboard and create tools for exploring spatial and temporal trends in size frequency compositions, i.e. the "Composition Frequency Explorer".
- Develop statistically based sampling targets as guidance for CCMs to focus their size data collection activities and refine the traffic light size data collection review and monitoring system.
- Conduct further analysis on specific conversion factors using the recent data collections and update the conversion factors in the coming year.
- Continue discussions with CCMs to assist in improving/enhancing size data collection, data quality and provision – with the view to its use in stock assessments.

**We invite SC22 to:**

1. Provide feedback and consider whether or not to recommend that the WCPFC23 adopt the proposed SciData size data submission information proforma to be added to the standardised data submission process adopted at WCPFC22.
2. Provide feedback on further developing flag or fishery specific size data sampling targets by species, gears and fishery areas, and a simple 'i.e. recent 5 year' traffic light system such as presented in this paper.

# Contents

# Background

WCPFC stock assessments of tuna, billfish and sharks utilize size (length and/or weight) data to inform the models on fishing gear selectivity/vulnerability, growth, recruitment, abundance and ultimately influence the estimated stock status trends used for management advice. The WCPFC Science Services Provider (SSP) (SPC, Pacific Community) has recognized that due to the large number of current and historical size data sources (83 sources listed in the current database) assessment scientists face difficulties when considering the appropriate use of the diverse array of size data sources. Stock assessment scientists are far removed from the data collection processes and are often new to SPC, unfamiliar with the data sources and new to the assessments they are tasked with conducting. It is a steep learning curve. Improved data familiarisation tools and documentation on data collections is important to assist assessment scientists to make informed decisions on data use and mitigate the steepness of the 'data knowledge' learning curve. This is a key role of this project. Even for more experienced assessment staff the lack of documentation and data exploration tools leads to inefficiency, poorly guided decisions and bottlenecks in developing assessments, particularly when unusual features are found in the data that cannot be readily explored.

Project 127/127a was proposed by the SSP and support by WCPFC to address this issue of poor documentation of size data collections, lack of size data exploration tools, lack of information on size data collection methods for WCPFC SciData size data submission, and a need for guidance on improving size data collection for WCPFC stock assessments.

The project was initially supported by WCPFC with funding for 1 year (2025), but additional funds to continue the work into 2026 were provide by WCPFC22 based on support by SC21. The project (127a) now ends in December 2026. The first year's work is described in the SC21 report on Project 127 SC21-ST-WP-02, (Hamer *et al.*, 2025). This phase 2 report focuses on following up on work areas from the SC21 report and the Project 127a Terms or Reference which supported additional resourcing to:

- Conduct a detailed analysis of current size data coverage, initial focus on yellowfin and bigeye tuna.
- Continued conversion factor sampling – fund Socsksargen (General Santos, Philippines) annual sampling, and observer/port sample tasking.

For the period since SC21 and reported in this paper, the work has:

- Continued consultations and work on improving documentation of size data sources.
- Refined a size data information proforma for submission with WCFPC SciData aggregated size submissions: to be considered by SC22 for adoption by WCPFC23.
- Developed tools for exploring size data – i.e. data exploration dashboards.
- Continued work on improving conversion factors – implemented the Soccsksargen program for another year and explored length-length conversion factors, updated the conversion factor tables in this paper.
- Conducted preliminary analysis of 'current' size data coverage with initial focus on yellowfin and bigeye tuna assessments – and provided a proposed prototype traffic light system for monitoring data coverage levels and guiding targeted improvements.

# Improving documentation: updates to descriptive information on size data sources

## Following up areas of uncertainty on historic and ongoing size data collections

Follow-up discussions and email exchanges with several Distant Water CCMs – China, Japan, Chinese Taipei, Korea, Indonesia, New Zealand, US – Hawai'i, Australia, and also Philippines were conducted to clarify remaining uncertainties about their respective size data collection programs and data provisions after the phase 1 report. Appendix 1, Table 1provides updated documentation of size data sources (i.e. descriptions of each of the 83 size data ORIGIN_ID codes used in SPC databases), and provides a simplified version of the reference tables that were provided by species in the SC21 paper.

### *China*

The discussion with China provided the following information now included in appendix 1, Table 1.

- Port sampling is done by researchers and students from Shanghai Ocean University (SHOU). The objective of the sampling is mostly to collect biological samples rather than obtain representative size compositions of landed catches from specific fishing trips or time/area strata. Although this may be a byproduct the level of catch representation is unclear. These port sampling data might be better considered as 'research samples', and their representativeness of catch compositions is uncertain. China does not collect weight data during the port sampling. The port sampling lengths are typically fork length (UF) for albacore which are mostly landed frozen whole by Chinese vessels, but for bigeye and yellowfin tuna, the tails are mostly removed, and partial lengths are being collected using the 'upper jaw to first anal fin insertion' (below). This partial length is not typically used in other sampling programs, it is not described in SPCs port sampling or observer guides, and there is no standard SPC code or conversion factor. The SHOU researchers are however collecting data to produce a conversion factor to convert upper jaw to anal fin to UF on yellowfin and bigeye (Figure 1). This can be provided to SPC in due course. Data for bigeye and yellowfin from recent port sampling is provided in an unconverted 'upper jaw – anal fin' form. The port sampling data are provided as aggregate size data to WCPFC under the recently adopted standardised reporting format (see Data Standardization to Improve Efficiency of WCPFC Data Procedures, (Vidal *et al.*, 2025)) but the recent submission only includes data where the spatial resolution of the data collection is 1 x 1°, even though data is apparently available from coarser spatial resolutions. There is currently no SPC ORIGIN_ID specific for Chinese port sampling size data. This needs to be created in SPC's data base as the port (research) data should not be mixed with the Regional Observer Program (ROP) size data.

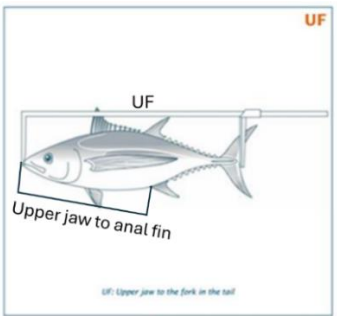



*Figure 1 Diagram showing the upper jaw to anal fin insertion partial length measure used in Chinese port sampling of yellowfin and bigeye tuna*

- Observer collected size data by China (ORIGIN_ID: CNOB) follows the Regional Observer Programme (ROP) protocol since 2008, UF etc., based on the 2004 version of that protocol. The observer data will be the most representative and appropriate for use in stock assessments. Importantly, China does not include the observer size data in its aggregate SciData size data provision to WCPFC, and this should continue.
- China did not indicate any perceived difficulties with the completion of the proposed SciData aggregate size data information proforma.

### *Chinese Taipei*

Discussion with Chinese Taipei clarified:

- That their observer program (ORIGIN_ID: TWOB) closely follows the FFA/SPC Regional Observer protocols and adheres to and has passed audit under the WCPFC Regional Observer Programme CMM 2018-05. A straight single ended (L-shaped) measurement device is used, accuracy to cm level of individual lengths would be less than programs that use calibrated callipers. The Chinese Taipei size data collected under the ROP methods is considered more representative and better quality for use in stock assessments, than the aggregate size data which is largely based on skipper/crew estimated size reported in logbooks. Estimated lengths for first 30 fish landed of any species for each longline set.
- As noted in appendix 1, Table 1, data collected by skipper/crew on vessels is stored under ORIGIN_ID: TWLL, are estimated lengths without measurement devices and while they may be indicative, are not recommended for use in stock assessment.
- Chinese Taipei port sampling data is provided as weights (ORIGIN_ID: TWWT) measured on scales with standard SPC codes used for the processed form of the fish and the data are not converted. These data are in aggregated form, so have less spatial resolution that TWOB, but are still deemed suitable for stock assessment. These weight data are included in the aggregate WCPFC SciData size data submissions.
- Chinese Taipei did not indicate any perceived difficulties with the completion of the proposed SciData aggregate size data information proforma.

### *Korea*

Discussions with Korea clarified:

- Korea's aggerated size data submissions covers both longline (ORIGIN_ID: KRLL) and purse seine (ORIGIN_ID: KRPS) size data that are derived from fish measured by crew onboard vessels during fishing operations. Captains of longline vessels must complete captain training provided by National Institute of Fisheries Science (NIFS) and Fisheries Monitoring Center (FMC) prior to departure, and this training includes content on biological measurement surveys. In addition, educational materials containing detailed relevant information are distributed to all fisheries industries, and the companies conduct the training of their own subsidiary captains and crews. However, standard measurement tools are not used, and measurement accuracy/rounding will be variable across vessels depending on how the lengths are measured or estimated by crews - some may use manufactured devices, by eye estimations and other methods (i.e. estimation by comparing the fish to a standard deck plate of known length) as guides to estimate sizes. The uncertain accuracy of the crew collected size data needs to be considered if using these data in stock assessments. There are instructions provided in the Korean longline logbook on the requirement for providing size data and a section for recording it for key/priority species. The instructions are aimed at promoting a random sample of the catches for the key species. This data source is no longer important for purse seine due to the high observer coverage and

collection of size data by observers. These data sources focus on length data, although some weight data (for the same fish as lengths) have been provided, these weight data are also likely estimated by crew and should not be used in stock assessments.

- Size data from observers (ORIGIN_ID: KROB) is collected according to the WCPFC ROP requirements. It is all length data, UF for tuna, LF for billfish. An important point is that observers on longline vessels are mostly from Korea and the longline observer size data are provided to the WCPFC by Korea. However, observers on purse seine vessel are mostly from the coastal states, and the size data are provided to WCPFC by those coastal states under their ROP data provisions with data attribution to Korean flagged vessels.
- Korea did not indicate any perceived difficulties with the completion of the proposed SciData aggregate size data information proforma.

### *Japan*

Discussion with Japan indicated:

- The summaries of the Japan size data sources in the SC21 paper tables were generally accurate. The long-term (historic) Japanese longline size data were collected by skippers/crew on fishing vessels and also research/training activities on research vessels, before the implementation of the WCPFC observer requirements (2008). It would be useful to separate these data sources within the historical size data, and also for any weight data that has both port sampling and research/training vessel sources. This is to check that the mixing of the data sources is not affecting historical trends/changes in this important long-term time series of size data for stock assessments. For example, (Satoh *et al.*, 2016) identified differences in size distributions between fish measured on commercial vessels and those measured on research and training vessels, yet these sources are not identified/separable in the historic aggregated size data.
- A concern raised by Japan was that size data from the Japanese Observer Programme (ORIGIN_ID: JPOB) have also been included in their mandatory annual aggregate SciData size data submitted to WCPFC. This could lead to some duplication of data if observer and aggregated size data are used in assessments, and also potential double measuring of the same fish if the same trips are measured by observers and port samplers. It is difficult to distinguish duplicated data because the size composition data included in the mandatory submissions (i.e. aggregated data) do not contain information indicating the data source (i.e. observer or other sources). As above it is important to provide data source information with the aggregate submissions and to add this information to the historic data where possible. Although it is unclear when this duplication began (perhaps from 2007 when Japan started using observers), an examination to identify and consider removing past duplication, and/or add source information may be necessary. However, given the low longline observer coverage we expect the issue of the same fish being measured twice is minor and not a concern for the stock assessments. The ongoing aggregated size data submission should not include observer data going forward, and the observer data should be provided separately in the observer data submission. Japan confirmed that their recent submission of the 2025 aggregate size data **did not** include any observer collected data.
- Japan did not indicate any perceived difficulties with the completion of the proposed SciData aggregate size data information proforma. But noted it will be difficult in many cases to provide reliable information on if/how fish may have been sorted prior to being measured in port sampling programs.

### *Indonesia*

Indonesia noted that:

- Their aggregated size data have been submitted to the WCPFC since at least 2013 and are up to date, their recent submission in April 2026 through WCPFC SciData portal. The aggregate size data are non-ROP size data that are based on Port sampling data conducted by trained enumerators. Indonesia conducts a Port sampling audit review under WPEA (West Pacific East Asia data improvement project) which includes review of the aggregate size data to be submitted to WCPFC. The data collected are from unsorted catches from the landing vessel at ports and rounded down to the unit (specified as 1 cm or 2 cm). The sampling protocols that are followed were developed in collaboration with SPC, the protocols were provided (Anung Widodo *et al.*, 2017).
- Indonesia successfully completed a trial run of the draft information proforma for SciData size data submission and raised no concerns regarding completing the proforma.

### *Philippines*

Confirmed that their observer program size data collection follows WCPFC ROP protocols and fish are measured with callipers or measuring boards. Their port sampling programs is under the NSAP (appendix 1, Table 1) program and data is entered directly into Tufman2. As such the SciData information proforma is not relevant for them, however, they were able to compete a trial version.

### *US*

Discussions with US (NOAA) focussed on the data collected in the Hawai'i sampling programs, both the Hawai'i observer data (ORIGIN_ID: HWOB) and the longline/handline auctions weight data for bigeye and yellowfin tuna (ORIGIN_ID: HWWT).

- The HWWT data has been provided as whole weights that have been pre-converted from processed forms before provided to SPC. Virtually all fish landed at the auctions are weighed. SPC prefers all size data to be provided in its original (raw) measured form if possible. The processed form should be indicated (using standard codes) for each fish and the processed weights provided, irrespective if a conversion to whole weight was applied by the data provider. Ideally, conversion factors should be applied by SPC using their standard conversion factors.
- Tables in the SC21 report did not have information on this conversion process or the conversion factors applied. The conversion factor information has been provided to SPC. It could be possible to now make an adjustment to historic data to account for the different conversion factors if information on the individual original processed form is provided, i.e. back convert. The NOAA staff have also indicated the possibility to provide the raw measured weights and processed form of each fish. This would be preferable and would allow SPC to apply their standard conversion factors to the data and update the WT_Master data.
- The conversion factors applied to the HWWT data are sourced from an historic document of Bykov (1983) that is difficult to source and there are no data available for the conversion factors (see appendix 3 b).
- US did not indicate any perceived difficulties with the completion of the proposed SciData aggregate size data information proforma.

As observed in the exploration of billfish size data in the recent striped marlin and swordfish assessments (see Hamer *et al*. 2025) comparisons of port sampled size data with observer sampled size data often show underrepresentation of smaller fish in the port sampled data. This may relate to a range of factors, including high grading, use of smaller non-marketable fish for crew consumption,

other sales points, discarding for any reason. Underrepresentation of smaller fish is evident in comparisons of the HWWT and HWOB data (Figure 2Figure 2). The issue appears considerably worse for yellowfin. For this reason, in the 2026 assessments the analysts chose to continue to use the HWWT data for bigeye but to use the HWOB length data for yellowfin.

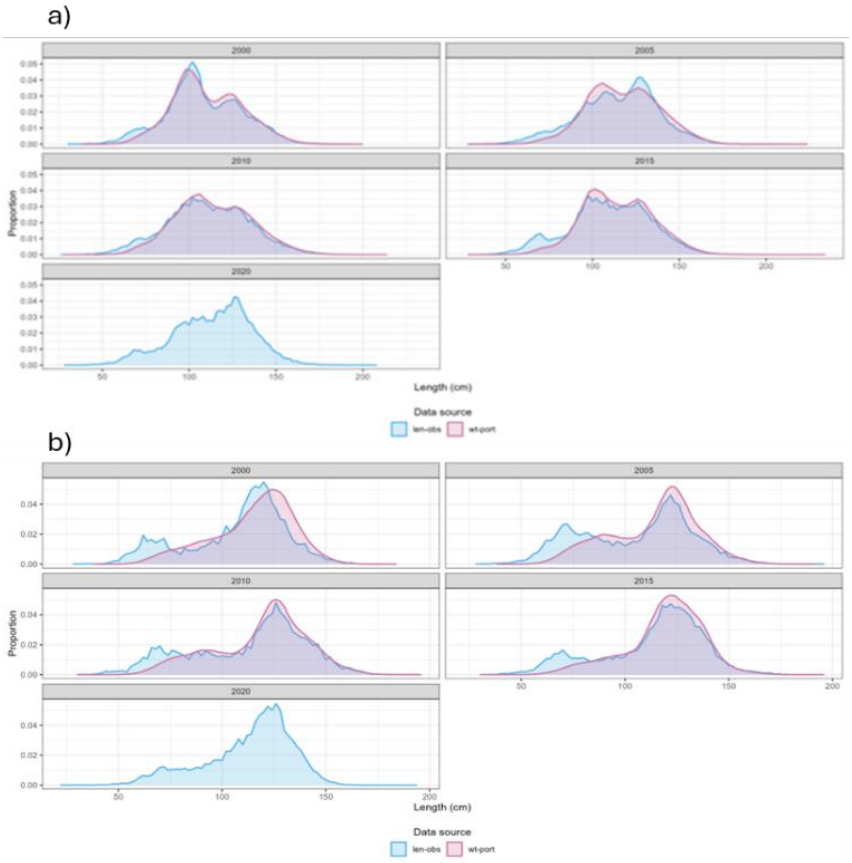



*Figure 2 a) Bigeye tuna, b) yellowfin tuna. Comparisons of 5-year aggregated length (fork length) composition data from the Hawai'i port/auctions data (i.e. HWWT) (pink – wt-port), and the Hawai'i observer program (i.e. HWOB) (blue – len-obs). For these comparisons, the weight data have been converted to fork length using the weight – length conversion factors from the 2023 stock assessments (see Appendix 3). The wt-port data from 2020 period onwards are currently not included due the need to for an additional position data field in the recent submissions, so they were not loaded at the time this figure was produced or used in the 2026 stock assessments.*

### *Australia*

Communication with AU confirmed the description of their aggregate size data collections are as noted in Appendix 1, Table 1, and that the completion and provision of the proposed SciData size data information proforma should be possible.

### *New Zealand*

Discussion with NZ:

- Noted that NZ aggregated size data includes weights (mostly processed forms) for tunas, billfish, and sharks from port sampling (referred to as 'shed' sampling) and lengths for albacore. The albacore length data that is included in the aggregate data for the troll fishery is not collected at the same locations as the other longline tuna/billfish weights. Albacore size data is collected as part of the albacore catch sampling program that is focussed on the troll fishery and is a separated/dedicated sampling program that applies a different sampling protocol to the shed sampling, the troll length data are provided as a separated data sheet as part of the aggregate

size data submission to WCPFC, but SPC assigns these data to a different ORIGIN_ID: SPTR, than the other port sampled weight data that is assigned to ORIGIN_ID: NZWT.

- Similar to Australia, observers in NZ longline fisheries have been replaced by Electronic Monitoring (EM). There are no longer size data from the NZ observer program (NZOB), or from EM data, and there are no immediate plans to obtains size data from EM.
- **To note:** prior to 2026, NZ provided raw individual size data with additional data fields. Since the implementation of the WCPFC SciData standardised aggregate size data format, they only provide the aggregated data. The raw individual data is available on request.
- **Striped marlin (MLS) recreational tournament data:** the NZ longline fishery has non-retention of MLS**,** size data for this species used in stock assessments comes primarily from the recreational fishery and have been provided separately to SPC by NZ (recently through contacting John Holdsworth john@bluewatermarine.co.nz). Data are available back to 1925 from fishing club records. These recreational tournament data are the main size data for MLS since NZ implemented non-retention in October 1987. Weighed as whole weights at landing points. Conversions not required. Weights are considered highly accurate, as they use fishing tournament certified scales. Note that from 1988 onwards tournament anglers were encouraged to return smaller fish <90 kg WW, and weights of returned smaller fisher were estimated by anglers, so the data post 1988 should be treated as a separate data set for stock assessment, or as a selectivity time block (assume the smaller released fish survive – which is reasonable) as it could be biased towards the larger fish (>90 Kg). These data are currently not loaded into the SPC WT_Master database and need to be incorporated directly into the assessment inputs by the assessment scientist. Updated data would need to be requested from: John Holdsworth john@bluewatermarine.co.nz
- NZ did not express concerns around completing the proposed information proforma with annual aggregate size data submission to WCPFC.

**Appendix 1** provides the updated descriptions of the data sources by ORIGIN_ID.

# Refining the aggregate size data submission information proforma with CCM consultations – SC21 requested

Project 127 SC21 report (SC21-ST-WP-02, (Hamer *et al.*, 2025)) noted the lack of documentation specific to aggregate SciData size data submissions. Aggregate SciData size data submission refers to size data that are 'not' collected under documented/dedicated regional programs such as the authorised WCPFC Regional Observer Program (ROP) or Pacific Islands Port Sampling programs (Brogan, 2002) or other dedicated CCM programs that provide data directly to SPC or entered directly into Tufman2 (such as Philippines NSAP). Importantly any ROP data should be provided separately and not included in the WCPFC aggregate size data submissions. Information on the aggregate size data submission process and guidelines is available HERE. CCMs that typically provide these aggregated data are: Japan, Korea, Chinese Taipei, China, Indonesia, New Zealand, United States, and Australia, and in 2025 some aggregated size data were also provided by Canada and El Salvador.

Data provided to the WCPFC as aggregated submissions have typically lacked documentation on data collection sources, methods and protocols. This makes it difficult for stock assessments scientists to assess data quality and changes in representativeness over time that might relate to different sampling methods or sources of data that comprise the aggregated data submissions**. SC21 supported the SSP as part of Project 127a to consult with CCMs on developing an information**

**proforma to be provided with annual aggregated WCPFC SciData size data submissions (see below SC21 report excerpt).**

Aggregate size data, due to being aggregated, do not allow specification of how individual data were collected. For example, any row in the aggregated size data sheets could be comprised of samples collected from different sampling locations (i.e. landing ports, on vessels, fish markets, research sampling etc.), using different specimen selection approaches and measurement tools, and by people with different levels of training/skills, and in some case catches have varying levels of sorting prior to measurements etc. However, the aggregate size frequency data assume the data for each row in the spreadsheet are collected in the same way and therefore have equal measurement accuracy and reliability. This is unlikely the case and the aggregate data will include a mix of data of varying measurement quality and representativeness. CCMs know the sources of the data that are included in their aggregate size data submissions, however, because data are aggregated there is no easy way to include this information in the data submission file. To do this would require the individual data to be provided with additional columns of meta data about the sampling process/source for each data.

The WCPFC SciData requirements (SCIENTIFIC DATA TO BE PROVIDED TO THE COMMISSION) specify that:

*In addition to the data reporting, it is important to also notify the Commission of the following (from the SciData):*

*1. CCMs shall indicate whether lengths and/or weights are rounded up or rounded down to the unit.*

*2. The statistical and sampling methods that are used to derive the size composition data, including reference to whether sampling was at the level of fishing operation or during unloading, details of the protocol used, and the methods and reasons for any adjustments to the size data.*

*3. Information on operational changes in the fishery that are not an attribute in the data provided is to be listed and reported with the data provision.*

To our knowledge there are no records held by the WCPFC or SPC where CCMs have provided this information routinely along with their annual aggregated size data submissions. To start to capture and keep a record of important information and changes in aggregate size data submissions, the Project 127 SC21 report proposed the development of an '*aggregate size data submission information proforma*'.

SC21 recommended (see SC21 Outcome document, pp 2-3):

*3.1.2. Reconciliation of size composition data for stock assessments (Project 127)*

*SC21 Outcomes Document*

1. *SC21 recognized the importance of reconciling size composition data for stock assessments and recommended continuation of the projects identified as part of phase 2 of this project.*
2. *SC21 requested the SSP circulate a draft pro forma of supporting information to accompany non-ROP size data submissions, for CCMs to review and provide feedback to the SSP.*
3. *SC21 encouraged CCMs to provide responses to the SSP on the draft pro forma and communicate with them on size data collection methods for non-ROP size data.*
4. *SC21 requested that the SSP provide a report to SC22 on the development of the pro forma and a summary of CCM responses, with the objective of working towards implementing a standardized*

*pro forma (consistent with the requirements for size data provisions contained in the SciData guidelines) by 2027.*

The development of the information proforma would complement the other recommendation (below) regarding standardised data reporting formats for SciData that was accepted at WCPFC22.

*3.1.3. Improving operational data evaluation and submission standards*

*5. SC21 supported the development of a standardized data reporting mechanism by the SSP to enhance the efficiency of processing required data submissions under the SciData guidelines. SC21 encouraged CCMs to work with the SSP as it prepares revised templates for consideration at TCC21.*

WCPFC22 approved a set of standardised reporting procedures for SciData submissions (WCPFC22-2025-38, Videl et al. 2025). These procedures provide specifications for the provision of size data that were previously provided in non-standard forms.

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | year | month | gear_code | flag_code | fleet_code | lat | lon | sp_code | length_cm | freq | meas_type |
| 2 | 2025 | 1 | L | XX | DW | -4 | 165 | SKJ | 45 | 6 | LF |
| 3 | | | | | | | | | | | |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | year | month | gear_code | flag_code | fleet_code | lat | lon | sp_code | sp_kg | freq | meas_type |
| 2 | 2025 | 10 | S | XX | DW | 13 | 173 | YFT | 12 | 1 | WW |
| 3 | | | | | | | | | | | |

*Figure 3 From WCPFC22-2025-38, standardised reporting templates for size data submissions (top – length and bottom – weight) under SciData requirements.*

The above data provision templates assume consistency in the way size data are collected, which is not necessarily the case. A proposed aggregate size data information proforma set of 10 questions was provided in the Project 127 SC21 report. These questions were refined into the draft proforma that was circulated to the relevant CCMs who submit significant aggregated size data. They were asked to attempt completing the proforma, and comment on the possibility to answer/provide responses to the proforma questions on an annual basis as part of the aggregate size data submission process and raise any issues.

All CCMs contacted indicated that the **DRAFT proforma (appendix 2)** was reasonably straight forward to complete and possible to do an annual basis. The questions that were more problematic related to question 3 regarding whether fish are sorted/graded in any way before being measured. This may be difficult to know for fish measured at ports or markets or being offloaded. The proforma was revised several times based on discussion with the CCMs resulting in the proposed proforma in appendix 2. **This proforma can be reviewed by SC22 to consider recommendation or not for adoption by WCPFC23 as a standard addition to SciData submission process for aggregate size data.** The proforma could be converted into an excel spreadsheet/.CSV format and included as a separate worksheet with the standardised data provision template for size data submission that was adopted by WCPFC22 (i.e. Figure 3).

# Conversion factors: updates and enhancement

The terms of reference for the additional funding for Project 127a included support for the continued collection of data to improve estimation of conversions factors (CF), and to support an extension of

the data collection program with the SOCSKSARGEN FEDERATION OF FISHING AND ALLIED INDUSTRIES, General Santos, Philippines (hereafter Socsksargen) for another 12 months. The Socsksargen sampling was previously support under Project 90: Better data on fish weights and lengths for scientific analyses, which ceased in 2025. SPC has recently implemented the new contract agreement with Socsksargen so the data collection can begin and will continue into next year.

The data collection instructions were reviewed and modified slightly from previous contracts to target some deficiencies in data for specific CFs. These include:

- increased weight to weight conversions that have limited data given the greater focus on weight to length CFs.
- continued collection of partial lengths to fork length CF data, especially for tunas, and across a wider size range.

In terms of processed weight (i.e. GG) to whole weight conversions, additional conversion factor data will be useful, particularly for albacore and bigeye. An additional 195 samples of paired gilled gutted (GG) to whole weight (WW) bigeye tuna samples have been collected recently in the Pacific which has substantially improved the data set for this important CF. One more year of data collection from Socsksargen should be sufficient for the GG to whole weight CFs for bigeye and will hopefully build a data set for albacore to a level where and an estimated conversion factor from data can be produced, rather than using the current conversion factor from old literature (Bykov, 1983) with no data.

The increased collection of partial length to fork length CFs is strategic. Long-term it is desirable to reduce the amount of weight data for fishery size compositions in assessments and replace it with length data, even if this is from partial lengths converted to fork lengths. Partial length to the fork length CFs might be more precise and less subject to biases that using processed weight (e.g., gilled and gutted, and various other forms etc.) converted to whole weights, which then require another conversion from whole weight to the length measure used for stock assessments. These multiple conversions can introduce errors and biases and weight to length conversions are likely to have regional and seasonal variability due to fish condition, spawning etc. (i.e. in some areas and times fish will be heavier at the same length than other areas/times). Partial length to fork length conversions (i.e. length - length conversion) are based more on a fixed body geometry, and involve one conversion, therefore they should be less affected by spatial/temporal variation in fish condition and uncertain weight to weight conversions from variably processed fish, although this is yet to be thoroughly tested.

While the above rationale is about getting better data for the fishery size compositions used in stock assessment, the stock assessment models still need to produce biomass estimates, via a growth curve relating age-to-length-to-weight. Hence a length-weight conversion factor is still required for this step, but importantly this step happens after the model is fitted to the fisheries and other data, so is independent of the model estimation of the numbers at age in the population. The biomass related management reference points are therefore still influenced by uncertainty in the length-weight relationship, but this uncertainty is easier to deal with when it is not part of the model fitting process.

While tuna in whole form should be measured for upper jaw to fork length (UF), processed tuna have several options for repeatable partial length measurements. Interestingly, partial lengths for tunas have not been used in the past, and we suggest that they should be considered and conversion factors developed. Two measurement axes that are available in the observer and port sampling guides that have only recently been collected (focused on yellowfin and bigeye through the

Socsksargen work in General Santos, Philippines, under former WCPFC Project 90) are US – upper jaw to anterior insertion of second dorsal fin and PS – anterior insertion of pectoral fin to anterior insertion of second dorsal fin (Figure 4).

The data collected so far, while substantial, has a narrow size range, but provides indication of the partial length to fork length relationships for bigeye and yellowfin (Figure 5). These conversion factors require additional data to fill the gaps in smaller sizes. As part of the enhancement of the conversion factors available, efforts under Project 127a are now being placed on collecting more paired data for UF-PS, and UF-US to enhance these CF data sets, particularly for yellowfin, bigeye and albacore (not necessary for skipjack). The available data along with additional data to be collected over the next Socsksargen contract, is expected to be sufficient to complete these conversion factors for bigeye and yellowfin tuna.

It would be possible to build this partial length measurement into any size data sampling that involves processed tuna that have typically only provided processed weight data, if feasible for those sampling programmes/CCMs. It will require shorter callipers, and the need for carrying heavy scales to weigh fish is removed. In fact, these partial lengths could start being collected routinely by any port sampling from now. The PS partial length would be possible on any processed tuna form, but preliminary analysis would suggest US might be less variable or less prone to measurement error that PS, when the head is on but tail removed. Also, there is indication that the PS to UF relationship is non-linear which likely relates to this measurement being partially influenced by body width/depth, compared the US axis that is more linear (Figure 5). For any headed and gutted fish, the PS measurement is suitable, for tailed fish, US would be best.

While not suggested as a standard partial length measure for general use across tuna, the SPC is also collecting data on a new conversion factor for use in the south Pacific albacore Close Kin Mark Recapture (CKMR) program. This conversion requires three measurements shown in Figure 6, and is

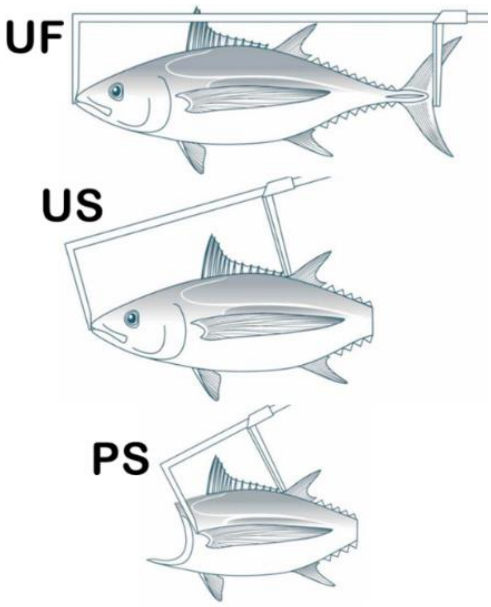



*Figure 4 Length measurement methods for conversion factor data collection for tuna: UF – upper jaw to fork in tail; US – upper jaw to anterior insertion of second dorsal fin; PS – anterior insertion of pectoral fin to anterior insertion of second dorsal fin.*

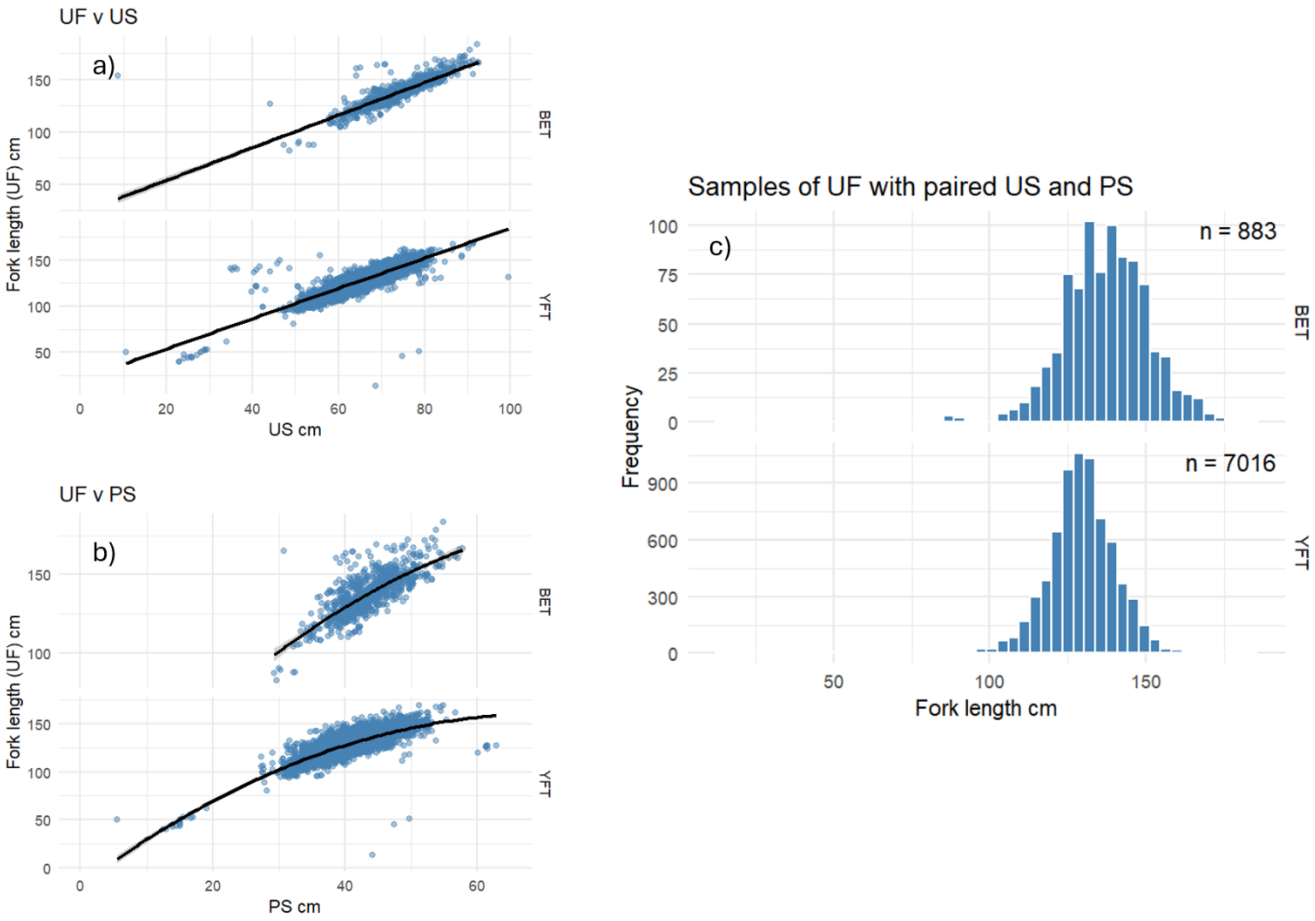



*Figure 5 Plots of the raw data (points) for a) UF versus US lengths with linear relationship, b) UF versus PS lengths with second order polynomial curve, and c) size frequency (by UF length) of samples collected so far with paired data for UF, PS, US. n=total number of samples.*

being developed because tissue sampling for the CKMR project can access large numbers of tails that have been cut from processed albacore. This finlet measurement can be used to estimate the fork length of the fish that the tail section came from. This could be another useful partial length measure for other tunas and only requires the measurer to carry a small set of callipers for any size fish, making it more practical than the long callipers needed for measuring other length measures, however, the downside is it requires more than one length to be measured and recorded.

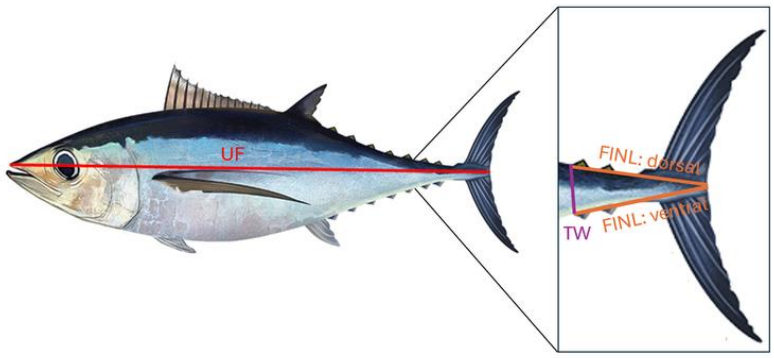



*Figure 6 Measurements required to develop relationships between fork length (UF) (red line), finlet length (FINL) (orange lines) and tail width (TW) (purple line) for Pacific tunas, with SP ALB used as an example here. Images courtesy of NOAA Fisheries.*

Partial lengths are possible for processed billfish, and some conversion factors are available in appendix 3d. More data collection of partial lengths to lower jaw fork length (LF) and eye orbital fork length (EO) is desirable, for the same reasons as discussed for tunas – length data is better than weight data for stock assessment. Many of the billfish length - length conversions have uncertain origins and would benefit from improved conversion factor data collections.

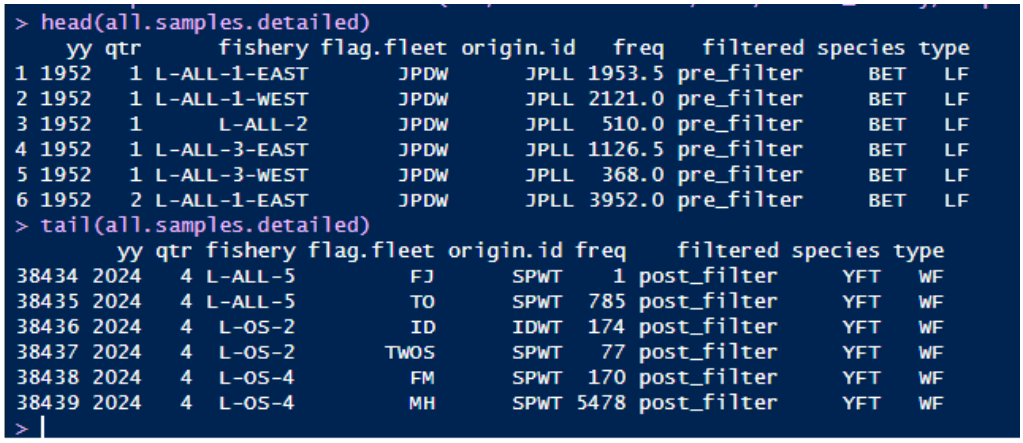
**Updates to recommended conversion factors tables**

A consolidation of conversion factors was conducted to update the table of recommended CFs that was presented in the SC21 Project 127 paper (appendix 3). In particular, additional information was included for the weight-length conversions, these are critical for all assessments in conversion of model estimated numbers at age to biomass measures used for stock status and management reference points. The information includes summary of methods to estimate the CFs and the data sources, including file storage locations at SPC (appendix 3). The data sets are recommended to be added as resources that can be accessed by Tufman2. To note there are no length-length conversion factors added for tuna species at this stage, while preliminary conversions can be estimated, we suggest the proper analysis of these data is completed after the next year of data collection.

# Dashboards and data exploration tools

To support stock assessment scientists to more readily explore and consider the size data available for stock assessments, data exploration dashboards are being developed using R Shiny. We envisage that these tools might be developed into more 'live' dashboards that link directly to the core data bases. These data exploration tools will be valuable when reviewing data inputs in live forums such as the 'Pre-assessment Workshops'. The first dashboard "Composition Samples Explore" is designed to explore the amount of available size data from different sources (flags, ORIGIN_IDs) for the defined fisheries in a stock assessment, it does not explore size frequency compositions (another dashboard being developed for that "Composition Frequency Explorer"). Recalling that a defined assessment fishery is flag(s)/gear/area combination that could draw from size data collected from different sources (i.e. ORGIN_IDs) across time and include both weight and length data samples. This dashboard uses .csv summary tables derived from SPCs LF_Master and WF_Master databases (see Figure 2 in Hamer et al. 2025). These tables summarise data from the Master databases and assign it to the defined model fisheries, so the data available can be explored at the level of a stock assessment's defined fishery structure. This is important because data availability in the databases as a whole does not indicate data availability for a stock assessment fishery. The data table layout is shown in Figure 7. Each row has these fields:

- **year** – year of samples
- **quarter** – quarter of samples
- **fishery** – model fishery
- **flag.fleet** – which flag (or fleet within a flag, i.e. JPDW, TWOS etc.)
- **origin_id** - source ORIGIN_ID of the samples (see Appendix 1, table 1)
- **pre-filter or post-filter** – data is presented with and without a pre-specified minimum sample size filter
- **type** – type of measure, LF- lengths or WF-weights

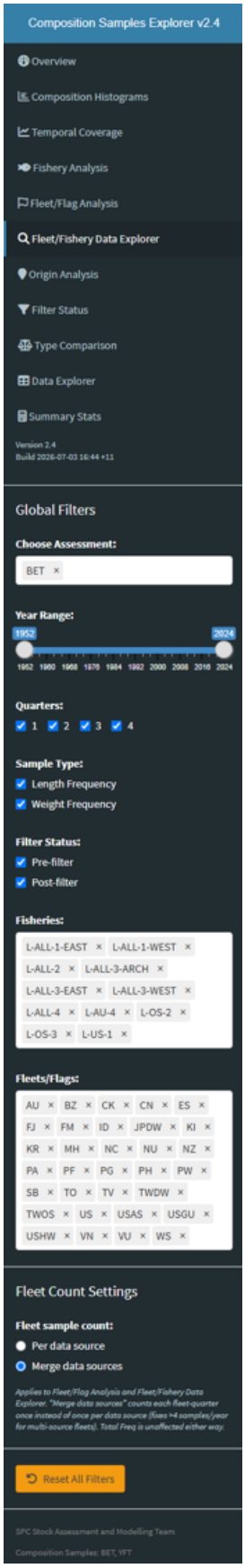


```
> head(all.samples.detailed)
    yy qtr      fishery flag.fleet origin.id   freq   filtered species type
1 1952   1 L-ALL-1-EAST       JPDW      JPLL 1953.5 pre_filter     BET   LF
2 1952   1 L-ALL-1-WEST       JPDW      JPLL 2121.0 pre_filter     BET   LF
3 1952   1      L-ALL-2       JPDW      JPLL  510.0 pre_filter     BET   LF
4 1952   1 L-ALL-3-EAST       JPDW      JPLL 1126.5 pre_filter     BET   LF
5 1952   1 L-ALL-3-WEST       JPDW      JPLL  368.0 pre_filter     BET   LF
6 1952   2 L-ALL-1-EAST       JPDW      JPLL 3952.0 pre_filter     BET   LF
> tail(all.samples.detailed)
        yy qtr fishery flag.fleet origin.id freq    filtered species type
38434 2024   4 L-ALL-5         FJ      SPWT    1 post_filter     YFT   WF
38435 2024   4 L-ALL-5         TO      SPWT  785 post_filter     YFT   WF
38436 2024   4  L-OS-2         ID      IDWT  174 post_filter     YFT   WF
38437 2024   4  L-OS-2       TWOS      SPWT   77 post_filter     YFT   WF
38438 2024   4  L-OS-4         FM      SPWT  170 post_filter     YFT   WF
38439 2024   4  L-OS-4         MH      SPWT 5478 post_filter     YFT   WF
>
```

*Figure 7 Data fields use for the "Composition Samples Explorer" R Shiny dashboard.*

The "Composition Samples Explore" has many options to aggregate, subset and filter data, described in Figure 8. The first choice would typically be to 'Choose Assessment' – this allows the user to choose the species assessment data they wish to explore, which means all other filters are specific for that assessment's fishery definitions/spatial structure. The underlying data files for each assessment are 'static files' that are produced for each assessment based on the spatial structure/fishery definitions for that assessment. While the most recent assessments for each species would be the default, it would be simple enough to provide an option to explore earlier assessments, so long as those data are added to the static file with a unique species/assessment label, i.e. BET_2026, BET_2023 etc.. The current version uses the input files for the 2026 bigeye and yellowfin tuna assessments. The current version of the dashboard can be accessed here: https://ofp-sam.shinyapps.io/sizecomp-explorer/

Some example plots are shown in Figure 9 and Figure 10Figure 10, but there are many options for figures and tables. The next dashboards to be developed will allow exploration of the composition trends both for the raw data and the actual assessment model inputs after the pre-processing and reweighting/filtering procedures are applied (i.e. SC22-SA-IP06, (Peatman *et al.*, 2026)). This next dashboard "Composition Frequency Explorer", may include maps of spatial patterns in size compositions. The paper SC22-SA-IP13 (Castillo-Jordán, *et al.*, 2026) provides a detailed exploration of trends in bigeye tuna weights by data sources (flags) in space and time. The paper provides examples of map formats that could be produced in a size composition explorer app to explore spatial patterns in size data across time. The app could also include sampling intensity maps to compare spatial sampling coverage. This dashboard could also use static files of the complete size frequency data inputs for each assessment, or more spatially resolved size frequency data from the LF_Master and WF_Master databases.




## 'Composition Samples Explore'

All plots and tables can be downloaded as PNG or CSV

**Choose Assessment:** a first choices global filter that will allow only consideration of data summary for the species assessment chosen. The user will mostly want to explore one species assessment, but it is possibly to summarise data across multiple species, this makes sense for some plots/tables, but if the fisheries in the assessment are defined differently this is not advised.

**Composition Histograms:** simple summary plots of total samples. **Note on metrics:** a 'sample' refers to a set of length or weight data for a fishery or flag.fleet or origin.id-year-quarter strata, compared to 'frequency' which is the number of individual size measurement data).

**Temporal Coverage:** provides time series of sample numbers and frequencies and yearly or quarterly resolution. Filters by species, metric and temporal resolution.

**Fishery Analysis**: detailed comparative summary plots and tables of samples and frequencies available by fishery, flag.fleet, and origin.id and time.

**Fleet/Flag analysis:** explore data availability, including across time at the flag.fleet, origin.id level. Use global filters to narrow in on fisheries of interest, to explore sources of composition data across time.

**Fleet/Fishery data explorer:** select a flag.fleet or fishery and explore data availability with summery plots, time series and tables.

**Origin Analysis**: explore data available by origin.id

**Filter Status:** see the effect on data retained with and without the filter applied.

**Type Composition:** explore the data available by measurement type – length or weight.

**Data Explorer:** provides a sortable and filterable table of the full data set than can also be downloaded in completed or filtered subset as CSV.

**Summary Stats**: tabulates summary statistics of available data.

**Global Filters:** allow filtering across all data fields according to; year range, quarters, sample type, pre-filter/post-filter, fisheries (i.e. the fishery as defined for the assessment model), flag.fleets.

**Fleet count settings:** within each flag.fleet there can be more than one data source (origin.id, Fig. 7). This switch allows the origin.id to be ignored by selecting 'Merge data sources' – this can be useful for some summaries of numbers of samples by flag.fleet, where you want to only see the quarterly sample coverage for the flag.fleet and not summed across the multiple sources (origin.ids).

*Figure 8 Left – control panel of "Composition Samples Explorer" R Shiny dashboard, right – descriptions of dashboard functions.*

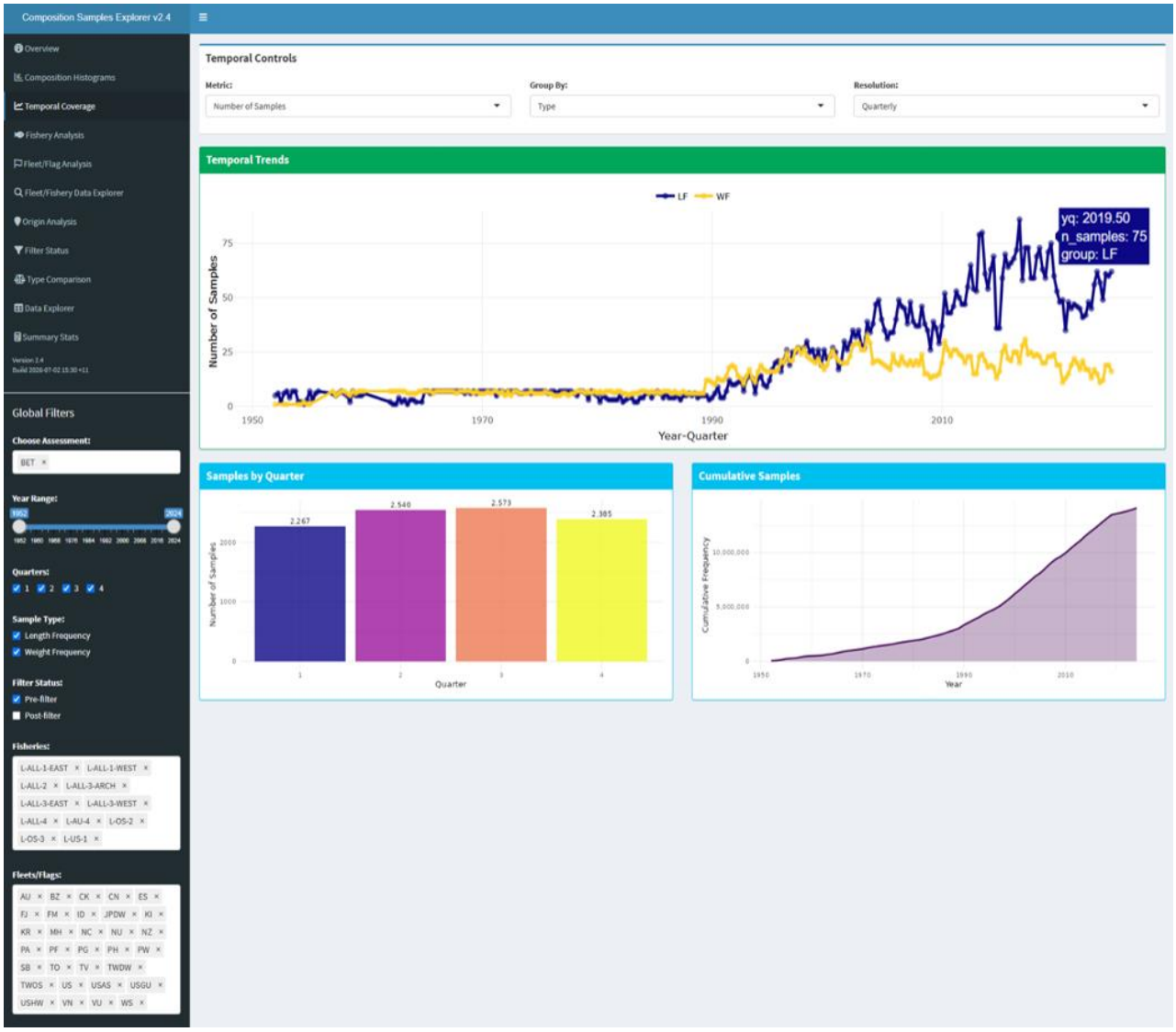



*Figure 9* ***Example plots from the 'Composition Samples Explore' dashboard****. Quarterly time series of number of samples (i.e. a sample = a set of size frequency data collected by a specific flag.fleet) across all fisheries available in the SPC LF_ and WT_Master bases (i.e pre-filter) for the 2026 bigeye tuna assessment, separated by weight and length, hover over each data point reveals the number of samples for that year-quarter, the plots shows how length samples have increased since the 2000s while weight samples have decreased.*

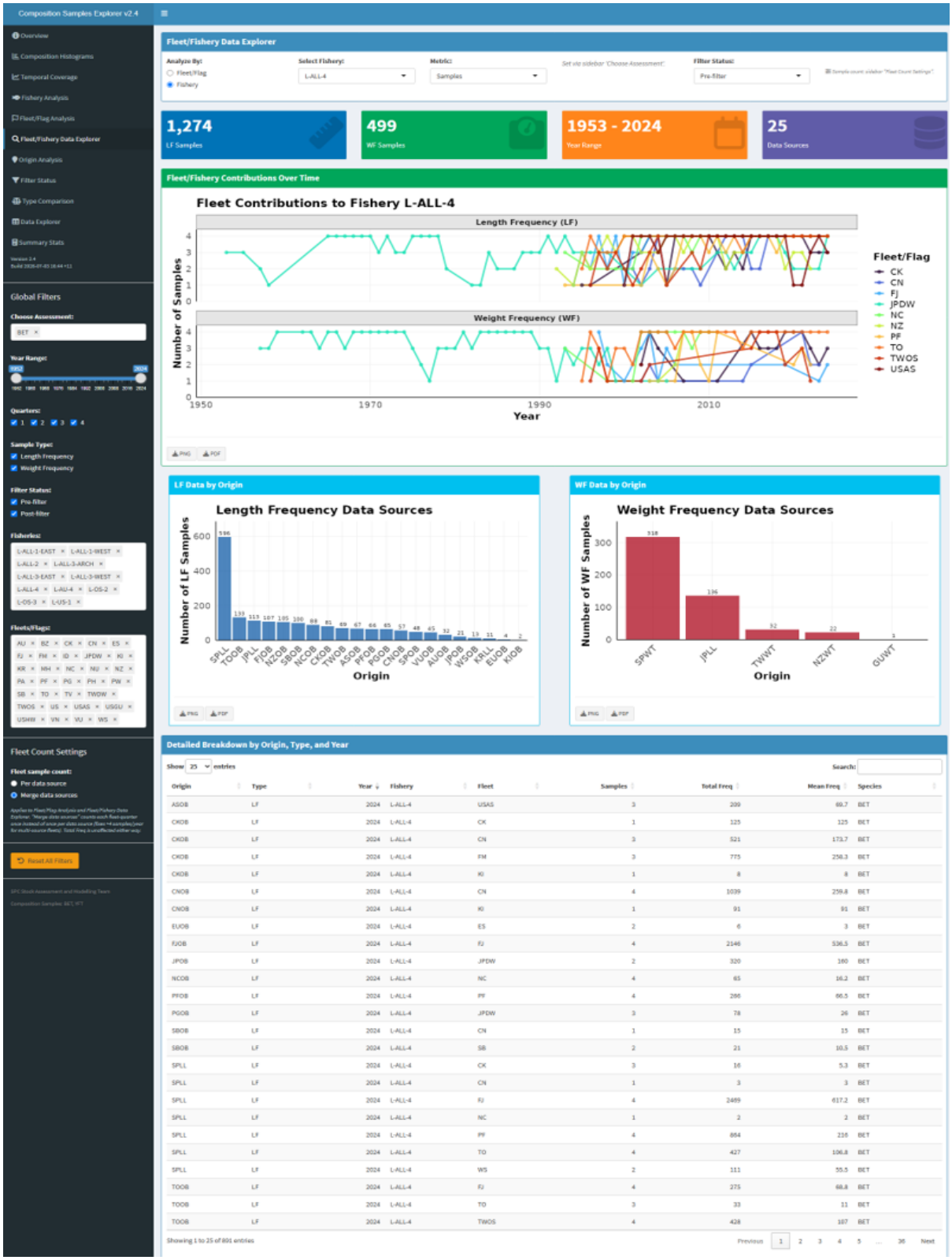



*Figure 10* ***Example fishery specific analysis****: Top -Examination of the pre-filter time series of the number samples per year available by each flag.fleet for 2026 bigeye tuna assessment fishery definition: L-ALL-4 (i.e. the all flag longline fishery in model region 4, note that if the Merge data sources is activated there can be no more than 4 quarterly samples in a year in this plot, if Per data source is selected there can be more than 4 samples per year because they are summed across the data sources and quarters (i.e. origin.id). Middle - Histograms of the numbers of samples by data source (i.e. ORIGIN_ID code) for the fishery across the entire time period, and; Bottom -summary table for the selected fishery (can be downloaded as CSV). The top plot clearly shows that both length and weight data are only available from JPDW until the early 1990s, after which the JPDW contribution drops aways and a variety of other flag.feets begin to provide most of the data.*

# Guidance for monitoring and improving size data sampling coverage

Providing advice to CCMs on priorities for enhancing size data sampling for stock assessments is important, as data collection systems/programmes are often initiated and persist on an opportunistic basis, or to satisfy RFMO data submission requirements. In large tuna RFMOs, including WCPFC, these data collections programmes have not typically been designed from the outset focused on optimisation for stock assessments. Some programs may be oversampling, which is not an issue for stock assessment (too much data is always better than not enough data), but may be wasteful of sampling resources that could be deployed on other duties, whereas other programs may be under sampling and not providing enough coverage to be representative of their catches, and this is an issue for stock assessments.

The data inputs paper for the 2026 bigeye and yellowfin assessments (Teears, 2026) provides useful plots showing the time series of size data sampling in relation to catches, aggregated by flag.fleets, an example is included in Figure 11. These plots provide useful visuals to indicate when sampling sources change across time for each fishery in an assessment model, which is important when considering the size composition trends for mixed flag.fleet data. For example, changes in a fishery size composition over time might relate to changes in which flags take the catch and or provide the size data. Such changes need to be explored by assessment scientists to determine if they are due to the introduction of new sampling methods with different biases, or true changes in fishery selectivity, which will need to be treated in different ways.

To compliment the Figure 11 plots, as a proposed approach for identifying and monitoring where under sampling and over sampling might be present, we have produced graphical summaries of sampling coverage in the form of a traffic light tracking system, with some examples panels shown in Figure 12Figure 13Figure 14. This is presented as a possible approach for consideration as a regular reporting framework in relation to tracking levels of size data provision by CCMs for stock assessments.

The examples show for a recent period 2020-2024, and some selected fisheries in the 2026 bigeye tuna assessment (noting again that available size data needs to be considered in relation the different fisheries defined for the stock assessments), the number of size measurements (in these examples combining both length and weight measurements, across all data sources for a flag. i.e. observer and aggregate size data), available for each quarter and year for each CCM flag that contributes to the catch of the selected model fishery. The plots also include the % of the total catch from the stock over the chosen year period taken by the selected fishery, and the % of the catch from the chosen fishery that each flag is responsible for (noting some model fisheries combine many flags and some have only one flag). These catch % are important to consider because fisheries, and the flags within fisheries, that account for higher % of catches should contribute more/better size data for the stock assessment.

We have included a traffic light indicator system with some arbitrary threshold values, i.e. >300 fish measured by a flag within a defined model fishery (i.e. gear and model region strata) in a year-quarter – gets a green light. Of course, the measured or weighed fish also need to have been selected in a way that aims to produce a representative sample of the catch size distribution, and the individual lengths or weights collected with a certain level of precision/accuracy (i.e. at least using a measurement device). The data quality assessment aspect can be informed by the size data

proforma information, or available protocols (i.e. ROP) discussed previously, and each data source can therefore also be assigned a 'quality rating', to go with the 'quantity' rating.

Scientific data collection provides challenges that vary among CCMs, and we propose this data tracking system to provide a focus for where additional support and guidance can be provided to CCMs, it is not to create a system for simply pointing out under/over provision of data.

This is a simple practical approach, and further work would be required to provide a more scientific basis to setting size data sampling targets for CCMs to aim for. Such targets will depend somewhat on their catch levels and the different species assessments and their fisheries structures.

***We seek SC22 views on the value of a traffic light reporting system on size data collection levels against targets for periodic review by SC. The aim of the reporting system is to track and flag where improvements could be encouraged and supported in size data provisions from CCMs for stock assessment purposes.***

# Summary and recommendations

This paper provides a summary of progress since SC21 against the objectives of Project 127 and 127a, noting the project completion date under the current WCPFC project 127a funding is December 2026.

## Documentation

The recent activities have followed-up and revised the descriptions of the size data sources available in the SPC's LF_ and WF_Master databases used for stock assessments. There are currently 83 size data ORIGIN_IDs under which size data is stored in SPC databases. Appendix 1, Table 1 provides a documentation resource of these data sources for SPC scientists and others who interact with the SPC size data. This table should be reviewed and updated if new data sources (ORIGIN_IDs) are added into these databases or if new information is provided from the regular submission of the proposed SciData aggregate size data information proforma, should it be adopted by WCPFC.

The proposed size data submission information proforma would help ensure that documentation on the size data collection methods is maintained over time and is consistent with the wording in the 'Scientific Data to be Provided to the Commission, Section 5. Size composition data'. This documentation will allow scientists to access information on when data collection methods may have changed and to consider whether the collection methods in any period are sufficiently reliable to use the data for certain analyses. **Improvements in data submission efficiencies have recently been achieved by the adoption of a *standardized data reporting mechanism/template,* and we suggest the *information proforma* is added as an additional worksheet to the recently adopted reporting template. Together, this will improve the data provision efficiency and the documentation requirements.**

## Conversion factors

Conversion factors have been updated in tables in Appendix 3 to provide the latest recommended conversion factors to be used for the weight-length conversion applied in stock assessments and the weight-weight conversions used by SPC to convert raw processed weight data to whole weights for the WF_Master data. Length – length conversions are also included, but these are the most uncertain and hence receiving increased focus with recent data collection.

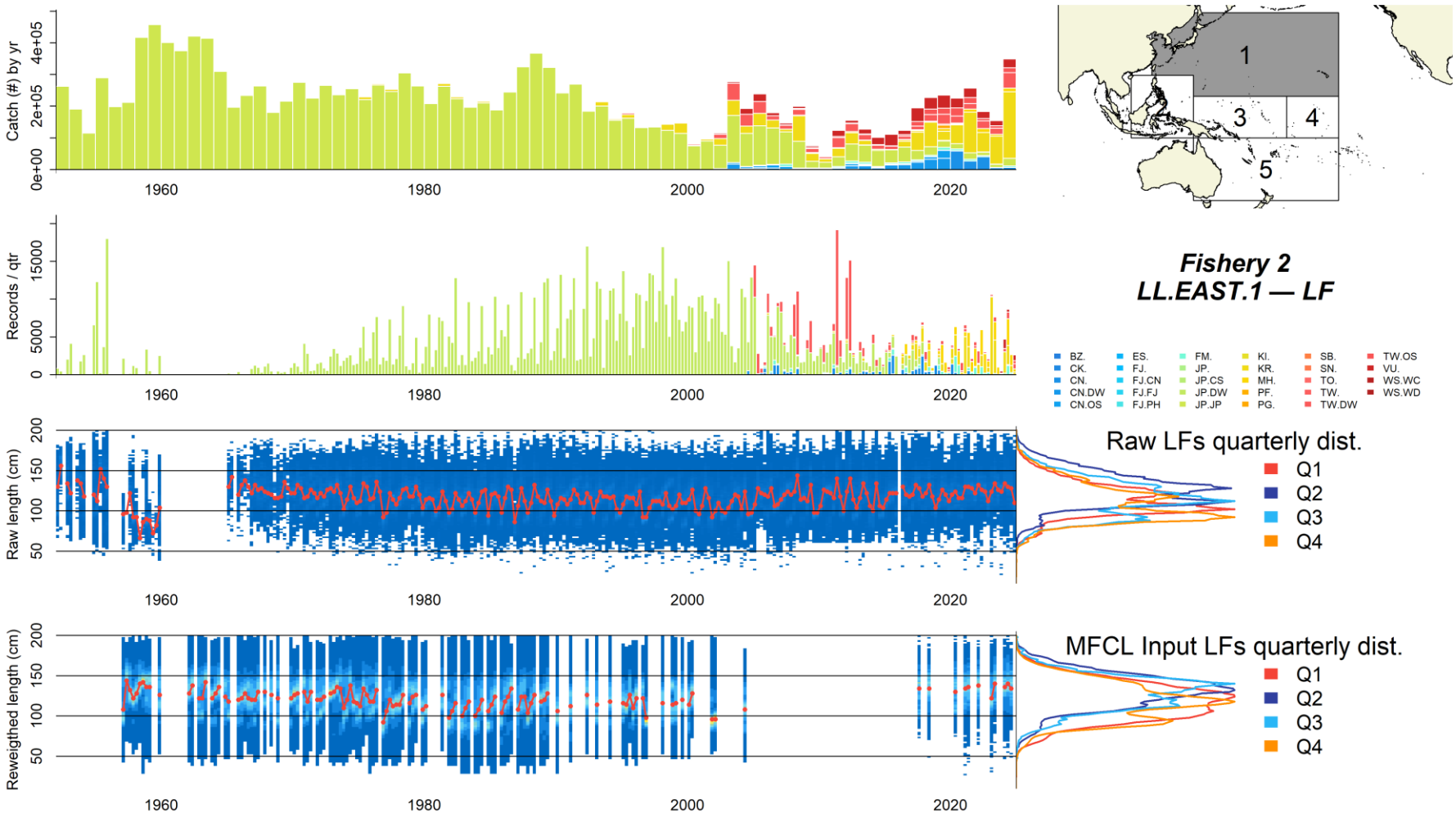



*Figure 11 Example set of time series plots for bigeye assessment fishery 2. LL.EAST.1; Top - catch in numbers (i.e. longline fishery), Second from top - number of size measurements (individuals) by quarter, Third from top - raw unfiltered size composition trends (can be plotted for lengths or weights if both available-example here is lengths), Bottom -) size composition trends after pre-processing to produce the reweighted/filtered assessment inputs (see Peatman 2026). Catch and size data grouped by flag.fleet codes. Top right - map of assessment model regions, shaded region is the model region relevant to the fishery data displayed in the plot, noting in the example this is a sub-fishery or fleet-as-area in the eastern half of region 1.*

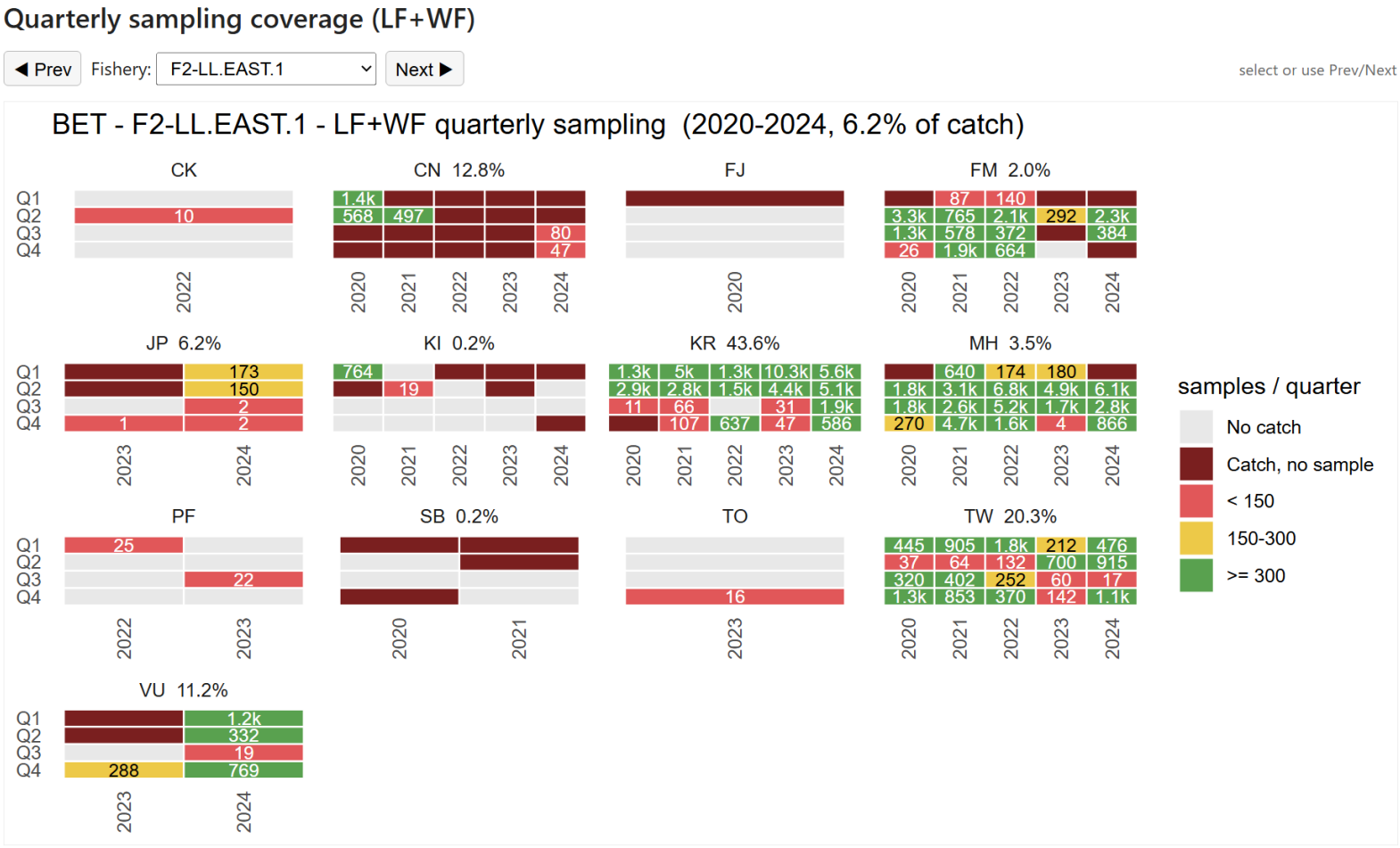



*Figure 12 Example size data coverage traffic light table for monitoring size data collection levels. This example is for the same fishery as in Fig. 11. The table header has a selector to move between fisheries, the label indicates the species assessment – BET (bigeye tuna), the fishery definition used in the assessment, whether the summary includes both length (LF) and weight (WF) data, the year range selected and the % of the total catch of that species by the selected fishery summed across the year range selected. The individual facets show summaries by flag, for each year and quarter of the number of 'individual' fish measurements available in the SPC LF and/or WF_Master data bases. If a flag has no catch from the selected fishery in a year, that year won't be shown. The % values at top of each facet next to the flag ID indicates the % of catch from the selected fishery (summed across the selected year range) that the flag was responsible for. The thresholds on sample sizes for the traffic light system are arbitrary for now and require further consideration. The flags that take the highest % of the catch should ideally be meeting the 'green' light threshold.*

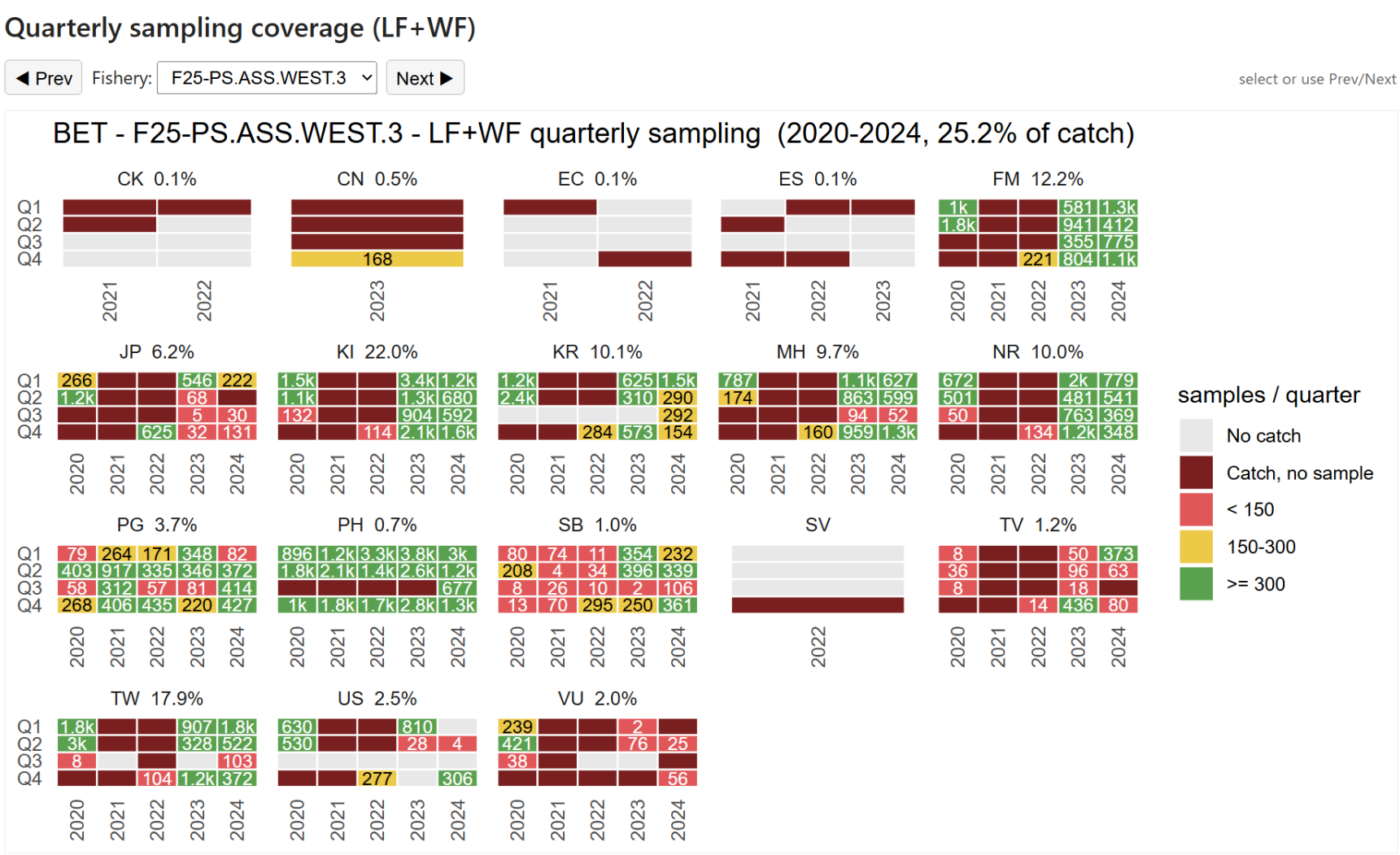



*Figure 13 Same description as Figure 12, but for a multi-flag purse seine associated FAD fishery.*

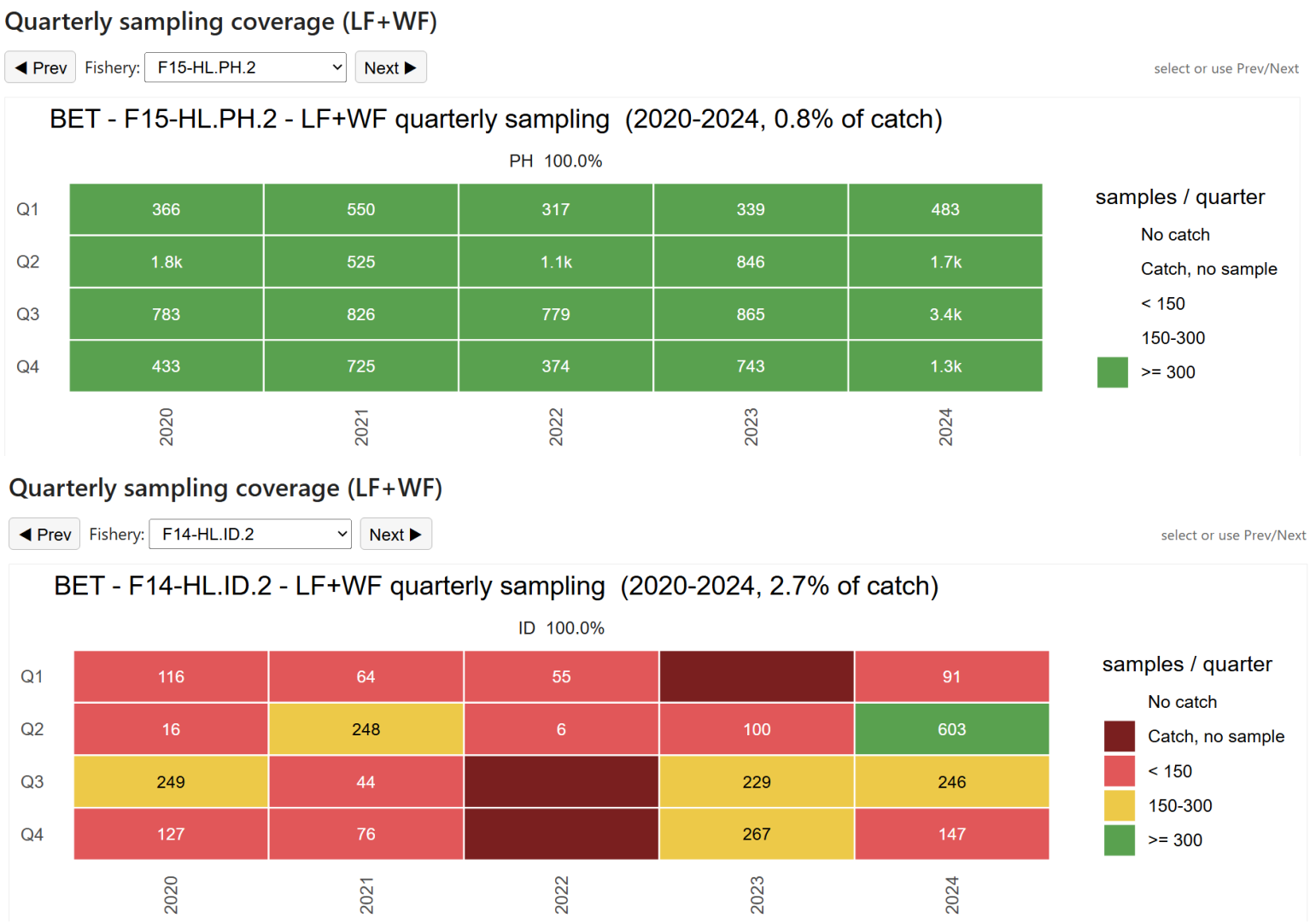



*Figure 14 Same description as Figure 12, single flag handline fisheries examples.*

The tables can be used to update the preferred conversion factors within the Tufman2 web database. The conversion factors data will be enhanced for a further year with the Socsksargen sampling programme supported under Project 127a. Partial length to fork length conversions for tuna will be updated based on this sampling along with the improved data for the GG to WW conversion, particularly for bigeye. This will enhance the recent samples from the Pacific and complete the data set for this conversion factor.

We note that the 2026 assessments for yellowfin and bigeye tuna have moved to converting all size data not originally measured as UF (i.e. weights), to UF length before using it in the assessment model. This provides opportunity to include uncertainty in conversion factor data sets into the conversions and also consider spatial variation in conversion factors if it is significant (future work). This approach makes better use of the conversion factor data sets, compared to the fixed conversion parameters previously used in the assessment models. However, there is a desire to limit the use of weight data for stock assessments due to the need for multiple conversions and explore the potential for partial lengths on tuna (and billfish) that have had their heads and or tails removed, using the PS or US measurements. Further analysis should be conducted to demonstrate the increased precision and accuracy of this proposed partial length to fork length conversion versus the current two step conversion process, i.e. processed weight to whole weight to UF length conversions. ***The SPC would be interested in CCMs feedback on the potential to measure these partial lengths where necessary, i.e. some port sampling programmes that receive processed (headless and/or tailless fish) fish. Other port sampling programs that receive fish with their head and tails on (i.e. gilled and gutted), but have only provided weight data, could consider measuring UF on all or a selection of fish from each landed catch.***

## Data exploration and coverage tools

The work since SC21 has developed dashboard tools for more efficient exploration of size data available for stock assessments that consider/aggregate the data according to the defined fisheries for the assessments. The "Composition Sample Explorer" dashboard provides many options to explore the available data by flag/fleet and source ORIGIN_ID with graphics and data tables. The documentation of the ORIGIN_ID sources (appendix 1) allows the user to consider the available data with an understanding of how/who collected the data across time. The ORIGIN_ID descriptions could even be added into the dashboard. This level of documentation and exploration capacity was not easy for scientists in the past who used size data aggregated across many sources with little understand of the data sources. The dashboard provides a template that could be the basis for a dashboard that links directly to the LF and WF_Master databases and allows the user to input details on fisheries definitions for an assessment, rather than having to run separate code to extract the sample summary data and create the static files. The next phase of size data exploration tool development would be to create a dashboard to explore spatial and temporal trends in size composition data and coverage.

Reviewing coverage of size data has temporal, spatial and flag level considerations. Consideration of data coverage according to fishery definitions in spatially structured assessments (or fleets-as-areas), such as WCPO yellowfin and bigeye, to a degree incorporates spatial coverage because the data summarised are for discrete spatial regions rather than across the entire assessment domain. Coverage cannot be improved for historical periods unless there are suitable historical data that have not yet been provided to SPC. In this paper we have provided a simple approach to consider/review data coverage according to spatial fishery definitions in respect of flag and catch levels for the recent period (2020—2024). The graphical traffic light system with sampling thresholds at flag-year-quarter strata provides a useful rapid assessment visualisation of data coverage to highlight where increased

sampling collections should be focussed /encouraged for each assessment. The system requires further work to more objectively/statistically determine threshold sampling targets. However, we see this as being important to advising CCMs on how to structure and resource their sampling programs to meet specified targets. Currently there are no targets or objectives for size data sampling.

An example objective could be*: For each model time period (i.e. year-quarter) each flag collects a random sample of X size measurements of X species caught by X gear across X trips to provide a reasonable representation of the size composition of their catch of that species in the model defined fishery.*

The X's in such an objective could be turned into a 'numbers' with a statistical estimation process. We recommend that future work on project 127a or a successor develop an objective/statistical approach for advising CCMs on size data collections targets. The current ad hoc sampling results in considerable spatio-temporal-flag patchiness in the data coverage and noisy time series. Plus, some flags that take low percentages of catch collect lots of size data (oversampled) and other flags that catch high percentage of catch provide low data (under sampled). Flags that take more of the catch from a fishery ideally should provide more size data.

We propose that providing size data sampling targets can improve the quality of size composition data for stock assessments and help CCMs to focus their SciData collection activities on the most effective options to reach targets, given their individual challenges and resources available, acknowledging that for some CCMs meeting targets may be difficult.

## Recommendations

We recommend that the remainder of Project 127/127a continue to focus on;

- Development of size data exploration tools – add spatial maps of size data collections into the "Composition Sample Explorer" dashboard and create tools for exploring spatial and temporal trends in size frequency compositions "Composition Frequency Explorer".
- Develop statistically based sampling targets as guidance for CCMs to focus their size data collection activities and refine the traffic light size data collection review and monitoring system.
- Conduct further analysis on specific conversion factors using the recent data collections and update the conversion factors in the coming year.
- Continue discussions with CCMs to assist in improving/enhancing size data collection, data quality and provision – with the view to its use in stock assessments.

## We invite SC22 to:

1. Provide feedback and consider whether or not to recommend that the WCPFC23 adopt the proposed SciData size data submission information proforma to be added to the standardised data submission process adopted at WCPFC22.
2. Provide feedback on further developing flag or fishery specific size data sampling targets by species, gears and fishery areas, and a simple 'recent 5 year' traffic light system such as presented in this paper.

# Acknowledgements

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**Declaration of generative AI and AI-assisted technologies in this SC paper preparation process.**

The generative AI tool Claude (Anthropic) was used to assist with adapting and refactoring R/Shiny code — reusing components from other Shiny applications developed at SPC — to develop the Composition Samples Explorer. All design decisions, functionality, and code logic are those of the authors, who reviewed and verified all AI-assisted output. The application's implementation and functionality are the responsibility of the authors.

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# Appendices

## Appendix 1 Size data sources descriptions by ORIGIN_ID used in SPC databases

*Table 1 Data sources than can be discriminated by ORIGIN_ID in SPCs size data databases used for stock assessment (LF_Master, WF_Master). Data category codes: A=aggregated, T=trip level, O=observer, P=port sampling, X = tagging programmes.*

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| ESLL | Spanish Longline length data<br><br>Gear: L<br><br>Flags: ES | L | A | 2004-2019 | Data are collected by observers, but the ES observer data submission is a non-standard format so are not yet imported into SPCs Regional observer database and exist as a distinct specific source of data that are processed and imported separately into LF_MASTER. **These data are for swordfish and blue sharks.** Size data are LF at 5cm intervals.<br><br>For SWO observers are instructed to measure " straight lower jaw fork length ". However, depending on size of the fish the measurement may be conducted with other lengths, in accordance with conversion charts on board and endorsed by the flag of the vessel. Note that tapes are used for large fish. According to one of the observer reports, the lengths taken by the observer are as per WCPFC ROP data collection recommendations which is “lower jaw – fork length (LF)”, which is the standard for the assessments, so no conversion factor is applied. However, from communications with Spanish colleagues at the WCPFC Science Committee, Francisco Abascal and an industry contact Pedro Martins, 11/4/2025, there may be other |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | forms of measurement as noted above that would require conversions. **SPC needs to request that the length measurement methods (measurement axis) are recorded and ascertain that raw lengths are provided with no prior conversions. If prior conversions are applied SPC need to have this documented.** The original data are available.<br><br>For blue shark according to one of the observer reports, the lengths taken by the observers are as per ROP data collection recommendations which is "Upper snout to fork length (UF) which is the standard for the assessments, so no conversion factor is applied. Confirmation through Francisco Abascal and ES fleet industry representative (June 27, 2025) indicate that UF is always used. The original data are available.<br><br>This data going to this ORIGIN_ID is now entered under EUOB since 2021. |
| IAEP | US Purse seine data by EPO Statistical area for EPO<br><br>Gear: L<br><br>Flags: US? | L | A | Y<br><br>1971-2019 | IATTC Albacore tuna longline data for the Eastern Pacific Ocean (EPO). Lengths are understood to be standard UF = "Upper jaw to fork length", no other length types are considered. These data are provisions on request to the IATTC for South Pacific Albacore assessments. The original data are available. |
| IAPS | US Purse seine data for WCPO (IATTC) | L | A | Y<br><br>1981-1983 | US fleet IATTC purse seine data for the WCPFC Area. Lengths are understood to be standard (UF = "Upper jaw to fork length"), no other length types are considered. These |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | data existed as aggregated size data that were compiled prior to 1990 (before the databases were established) and original data are not available. |
| IAWP | US Purse seine data by Western Pacific Yellowfin Research Programme (WPYRG) areas for WCPO<br>Gear: S<br>Flags: US | L | A | Y<br>1984-1987 | US Purse seine data from the Western Pacific Yellowfin Research Programme (WPYRG) for areas in the WCPO. Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. These data existed as aggregated size data compiled prior to 1990 (before databases were established) and original data are not available. |
| IPTP | Indo-Pacific Tuna Program (Indonesia)<br>Gear: P, S, T<br>Flags: IN | L | T | Y<br>1985-1991 | Indo Pacific Tuna Programme (IPTP) port sampling data for several gears in Indonesia, mainly collected during the 1980s. The data collection protocol was developed by FAO Statisticians and subsequently adapted and used in Indonesia under the Indonesia Philippines Data Collection Project (IPDCP) and then the WCPFC administered Western Pacific East Asia (WPEA) Project (see SOURCE = 'PKSI' below). Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. The original data are available. |
| JBPL | Historic Japanese Pole-and-line data<br>Gear: P<br>Flags: JP | L | A | Y<br>1978-1979 | Historic Japanese Pole-and-line size data. Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. These data existed as aggregated size data compiled prior to 1990 (before |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | databases were established) and the original data are not available. |
| JBPS | Historic Japanese purse seine (PS) data<br>Gears: S<br>Flags: JP | L | A | Y<br>1976-1981 | Historic Japanese purse seine size data. Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. These data existed as aggregated size data compiled prior to 1990 (before databases were established) and the original data are not available. |
| JPLL | Japanese longline size (LENGTH) data<br>Gear: L<br>Flags: JP | L | A | 1948-ongoing | Japanese longline data, most data would be port-based with measurement devices. Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. Length data from this source are provided as an aggregated WCPFC data submission, or historically, provided for assessments for DWFN fleets prior to the establishment of the WCPFC. Limited length data are available compared to historic weight data. Length data has been increasingly collected by observers and is reported under JPOB. However, SPC has been advised that prior to 2025 data, observer length data may have been provided mixed in with this aggregated data submission to WCPFC. This may have occurred since 2007 and will have created some duplication off measurements if the same trips, were sampled by observers and at ports. The extend of this is unclear. |
| JPPL | Japanese pole and line port sampling | L | A | 1965-ongoing | Japanese pole and line port sampling. Lengths are understood to be standard (UF = "Upper jaw to fork |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | Gear: P<br>Flags: JP | | | | length"), no other lengths are considered. Prior to 1990 data exist as aggregated size data (before databases were established) and original data are not available for the early period. |
| JPPS | Japanese purse seine port sampling<br>Gear: PS<br>Flags: JP | L | A | 1967-ongoing | Japanese port sample purse seine length data submission, first provided for the work of the Standing Committee for Tuna and Billfish (SCTB), and then under the WCPFC requirements covering their purse seine fisheries. Lengths are UF = "Upper jaw to fork length", no other length types are considered. |
| JPSJ | Japan length data (Skipjack)<br>Gear: L, P, S<br>Flags: JP | L | A | Y<br>1970-2022 | Japanese length data submissions, firstly provided for the work of the Standing Committee on Tuna and Billfish (SCTB), and then under the WCPFC requirements covering Japan's skipjack catches from longline, pole-and-line and purse seine fisheries. Although most of the skipjack length samples are from their pole-and-line fishery. Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. The original data are available. |
| KRLL | Korean Longline Length data<br>Gears: L<br>Flags: KR | L | A | 2006-ongoing | Longline data submitted as aggregate data under WCPFC SciData. Aggregate Korean longline fishery size samples are collected on vessels at sea by crew. Lengths for tuna are understood to be UF = Upper jaw to fork length, and for billfish, LF = lower jaw fork length, all measured on fresh whole. Lengths are provided in cm, although no standard measurement devices are used by crew, the accuracy of measurements and the level of rounding will vary depending on vessels and how they estimate sizes. Crew |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | will apply different ways to estimate lengths depending on what is available on the vessel. For example, they may manufacture a measuring rule or use deck plate lengths as a guide, or other methods to provide a length scale. For some lengths the weights of the same fish are also estimated, and weight data may be included in recent aggregated data submissions. The weights should not be used for the purpose of stock assessments. There is a section of the Korean longline logbook for reporting size data and there are instructions of how to subsample and measure fish, that aim to produce a random sample of the landed catches for the specified target/priority species. The provision of size data in the logbook reporting is monitored by the National Institute of Fisheries Science (NIFS), Failure to provide size data records in logbook reporting is followed up with fishing companies. |
| KRPS | Korean Purse seine size data<br>Gear: S<br>Flags: KR | L | A | Y<br>1993-2024 | Purse seine data submitted as aggregate data under WCPFC SciData. Aggregate Korean purse seine size data is collected by crew on vessels at sea, following same approach as for the longline fishery size data describe above. This crew collected data is reported in logbooks, following instructions in the logbooks that aim to collect randoms samples. However, this source is now a minor source of purse seine size data, and substantial size data for this fleet are now available through the implementation of 100% purse seine observer coverage (R_OB). There are limited data under this source since 2009 noting that observer data on Korean |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | purse seine vessel is now mostly collected by observers from coastal states and reported under those programs, rather than by Korea. The original data are available. |
| LCEM | Landed Catch and Effort Monitoring System (Philippines)<br>Gear: K, N, O, R, S<br>Flags: PH | L | T | Y<br>1993-1994 | Philippines - Landed Catch and Effort Monitoring (LCEM) project port sampling size data for several small-scale fishing gears for the domestic Philippines tuna fisheries. The IPTP data collection protocol (or adaption thereof) was used, and the data are stored in the LCEM Database. Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. The original data are available. |
| NSAP | Philippines National Stock Assessment Project (NSAP) size data<br>Gear: H, K, R, S, T<br>Flags: PH | L | T | 1997-ongoing | Philippines National Stock Assessment Project (NSAP) port sampling size data for several small-scale fishing gears for the domestic Philippines tuna fisheries. Data with standard lengths UF = "Upper jaw to fork length" are only considered. Measured with callipers or fish measuring boards. The original data are entered and managed in the NSAP TUFMAN2 Database system. SPC applies a process for extracting aggregate NSAP data from the NSAP T2 Database system for input to LF_MASTER. There are manuals available for the NSAP Data Collection and the NSAP Database System. |
| NZPS | New Zealand Purse seine data<br>Gear: S | L | A | Y<br>1978-1981 | Historical NZ purse seine size data. Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. These data existed as aggregated size data |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | Flags: NZ | | | | compiled prior to 1990 (before databases were established) and original data are not available. |
| OBPS | Historic Regional Observer Data - Purse seine | L | O | Y | No information. |
| PGPL | Historic Papua New Guinea (PNG) Pole-and-line data<br>Gear: P<br>Flags: PNG | L | A | Y<br>1984-1985 | Historical PNG pole-and-line size data. Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. These data existed as aggregated size data compiled prior to 1990 (before databases were established) and original data are not available. |
| PHIL | Philippines pre-LCEM port sampling (IPTP protocol)<br>Gear: K, O, R, S<br>Flags: PH | L | T | Y<br>1980-1987 | Historic Philippines domestic fisheries port sampling size data for several small-scale fishing gears for the domestic Philippines tuna fisheries. The IPTP data collection protocol (or adaption thereof) was used, and the data stored in a similar format as the LCEM data (see above). Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. The original data are available. |
| PKSI | Indonesia - port sampling under WPEA (previously PKSI agency)<br>Gear: H, K, L, O, P, S, T<br>Flags: IN | L | T | 2010-ongoing | Indonesia Port Sampling data collected in recent years, firstly through the Indonesia Philippines Data Collection Project (IPDCP) and in more recent years, the WCPFC-administered **Western Pacific East Asia (WPEA) Project**. In the early part of the period of this data collection, the agency in Indonesia with responsibility for overseeing the data collection and management was 'PKSI', hence the origin name of this SOURCE OF DATA. Data with lengths UF = "Upper jaw to fork length" are only considered. **The** |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | **original data are entered and managed through a database system maintained by the Indonesian Ministry of Maritime Affairs and Fisheries (MMAF) and the aggregated data are submitted to the WCPFC each year.** ***Data at the level of vessel trip may be available on request.*** The size data stored under the PKSI source, has been managed by BRIN (contact: Pak Bayu) (and their predecessors) for which the protocol is essentially the WPEA Indonesian data collection. **We note that significant amounts of port sampling data are also collected through various NGO programs, but these data are not yet included in the Indonesia size data submissions to the WCPFC**. It is recommended that Indonesia, with SPC assistance through the WPEA project**, review the protocols of the NGO data collection and quality and determine if it can be included in future Indonesia size data submissions to the WCPFC as a separate data source.** |
| AUOB | AFMA (AFZ) Observer Data, Australia<br>Gears: L<br>Flags: AU (Eastern Tuna and Billfish Fishery) | L | O | Y<br>1990-2015 | AFMA observer data from the Eastern Tuna and Billfish Fishery (ETBF). Data are for tuna are UF = Upper jaw to fork length, for billfishes, typically LF = lower jaw to fork length, and sharks typically UF = upper snout to fork length. These data have been suggested to be less reliable than port sampled weight data, and the port sampling data (AUWT) has been used in stock assessments. Furthermore, the observer coverage is now very low on ETBF vessels since implementation of electronic monitoring (EM) in 2015-2016. Original data are available. |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| CKOB | Cook Islands Observer Programme | L | O | Depending on program and gear, data start from the late from 1979 for longline and 1982 for purse seine and are ongoing. Pole and line data from 1998 but ceased in 2006. | Pacific Islands and Territories observer programs. Individual fish length data are collected from the Regional Observer data collected through (i) SPC Member National Observer Programmes, (ii) PNA Observer Programme. For tunas data are UF = Upper jaw to fork length, for billfishes, typically LF = lower jaw to fork length, and sharks typically UF = upper snout to fork length. Original data are available in Tufman 2 database or the SQL SERVER OBSV_MASTER and OBSV_FULL databases. Data are collected according to the Regional Observer Program (regional observer program: https://www.wcpfc.int/regional-observer-programme) requirements and minimum data reporting standards. For Pacific Island Regional observer guides: see PIRFO-manuals for longline and purse seine. |
| FAOB | FSM Arrangement Observer Programme | L | O | | |
| FJOB | Fiji Observer Programme | L | O | | |
| FMOB | FSM Observer Data | L | O | | |
| HWOB | Hawaii observer programme | L | O | | |
| KIOB | Kiribati Observer Programme | L | O | | |
| MHOB | Marshall Islands Observer Data | L | O | | |
| NCOB | New Caledonia Observer Programme | L | O | | |
| NZOB | New Zealand Observer programme | L | O | | |
| PFOB | French Polynesia Observer Programme | L | O | | |
| PGOB | PNG Observer Data | L | O | | |
| PWOB | Palau Observer Programme | L | O | | |
| SBOB | Solomon Islands Observer Data | L | O | | |
| SPOB | SPC Observer Data | L | O | | |
| TOOB | Tonga Observer Programme | L | O | | |
| EUOB | EU – Spanish observer data | L | O | 2021—ongoing | This replaces ESLL, and now included tuna species as well as sharks and billfish. |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| TTOB | US Multilateral Treaty Observer data | L | O | -2023 | Observer data collected by US under the South Pacific Tuna Treaty. Details of collections protocols need follow-up, assumed to follow the Regional Observer Program protocols. FFA used to place observers in US vessel, now PNAO is placing observers since 2023 – these data since reported under FAOB. |
| CNOB | China Observer Data<br>Gear: L, S<br>Flags: CN | L | O | 2008-ongoing | The Chinese observer data collection follows the Regional Observer Programme protocols, under the minimum data requirements of the WCPFC, https://www.wcpfc.int/regional-observer-programme, MINIMUM STANDARDS. Data for tuna are UF, billfish LF, and sharks UF, based on the 2004 version of that ROP protocol. China does not include the observer size data in its aggregate size date provision to WCPFC. The size data from observers is provided only with the other observer data provisions. |
| JPOB | Japan Observer Data<br>Gear: L, S<br>Flags: JP | L | O | 2007-ongoing | Data provided according to the WCPFC Regional Observer Programme requirements, under the minimum data requirements of the WCPFC, https://www.wcpfc.int/regional-observer-programme, MINIMUM STANDARDS. Data for tuna are UF, billfish LF, and sharks UF. Callipers are used. |
| KROB | Korea Observer Data<br>Gear: L, S | L | O | 2008-ongoing | For longline operations, observer size data for Korean vessels is typically collected by Korean observers in accordance with the WCPFC ROP requirements and is submitted by Korea with its observer data submissions. As |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | Flags: KR | | | | The standard measurement methods are applied under the ROP.<br><br>For purse seine operations, observer size data is collected by observers from coastal states. These data are reported to the WCPFC by the coastal state observer programmes operating under the WCPPFC ROP guidelines for Korean flagged vessels. Korea therefore does not typically submit observed size data themselves. |
| PHOB | Philippines Observer Data<br><br>Gear: L, S<br><br>Flags: PH | L | O | 2008-ongoing | Follow WCPFC ROP standards and the observers use measuring tools like callipers and measuring board. |
| TWOB | Chinese Taipei Observer Data<br><br>Gear: L, S<br><br>Flags: TW | L | O | 2008-ongoing | Data provided according to the Regional Observer Programme protocols, under the minimum data requirements of the WCPFC, https://www.wcpfc.int/regional-observer-programme, MINIMUM STANDARDS. Data for tuna are UF, billfish LF, and sharks UF. A straight measurement device is used although it is not necessarily a calliper, so accuracy of individual lengths could be less than programs that use calibrated callipers. |
| SBPL | Historic Solomon Islands Pole-and-line data | L | A | Y | Historical Solomon Islands pole-and-line size data. Lengths are understood to be UF = “Upper jaw to fork length”, no other length types are considered. These data existed as |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | Gear: P<br>Flags: SB | | | 1971-1992 | aggregated size data compiled, mostly prior to 1990 (before databases were established) and original data are not available. |
| SRAU | **South Pacific Albacore Research Programme (SPAR)**<br>SPAR Data - Australian Contribution | L | A | Y<br>Gillnet (G)<br>1988-1990<br>Longline (L)<br>1982-1997<br>Troll (T)<br>1987-2006 | South Pacific Albacore Research Programme (SPAR). Contributions from various fleets/flags. Data with standard lengths (UF = "Upper jaw to fork length"). Data are available for multiple gears. |
| SRFJ | SPAR Data - Fijian Contribution | L | A | | |
| SRJP | SPAR Data - Japanese Contribution | L | A | | |
| SRNZ | SPAR Data - New Zealand Contribution | L | A | | |
| SRPF | SPAR Data - French Polynesia Contribution | L | A | | |
| SRUS | SPAR Data - US Contribution | L | A | | |
| SPGN | SPC Driftnet sampling in Noumea | L | P | Y<br>1989-1989 | SPC sampling of driftnet vessels transhipping in Noumea port. Data with standard lengths (UF = "Upper jaw to fork length") |
| SPLL | Regional (PICTs) Port sampling data – Longline (LENGTHS)<br>Gear: mostly L, some H<br>Flags: PICTS | L | P | 1991-ongoing | Individual fish length data are collected from the Regional Port Sampling in Pacific Island Countries. For tunas, data are lengths UF = "Upper jaw to fork length". Other pelagic species are also included with UF, and billfish are as LF, PF, EO. Sharks are UF. All port sampling length data are included in the LF_Master irrespective if they have weight data collected also. Original raw data are available in the Port Sampling databases and since 2015 for LONGLINE, in |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | the Tufman 2 database system. The port sampling protocol was developed in 2002 and has not been revised since: oceanfish.spc.int-fisheries-monitoring-172-port-sampling.Data are almost all form longline, with some minor data for handlines.<br><br>NZ – length data – not much provided… NZWT???? |
| SPPL | Regional (PICTs) Port sampling data - Pole-and-line<br>Gear: P<br>Flags: PICTS | L | P | Y<br>1991-1997 | Individual fish length data are collected from the Regional Port Sampling in Pacific Island Countries. Data with lengths UF = "Upper jaw to fork length" are only considered. Original raw data are available in the Port Sampling databases. |
| SPPS | Regional (PICTs) Port sampling data - Purse seine<br>Gear: S<br>Flags: PICTS | L | P | Y<br>1993-2015 | Individual fish length data are collected from the Regional Port Sampling in Pacific Island Countries. Data with lengths UF = "Upper jaw to fork length" are only considered. Original raw data are available in the Port Sampling databases. Note that samples from the purse seine fishery port sampling (source = "SPPS") for vessel trips where there is observer data have been excluded, particularly since the implementation of 100% observer coverage to avoid duplication and there are very few samples since 2013 for source SPPS. |
| SPTR | Regional (PICTs) Port sampling data – Troll | L | P | 1994-ongoing | South Pacific Troll port sampling data – for NEW ZEALAND and US Troll fleet. Regular WCPFC submissions from New Zealand (it is submitted with their aggregate size data |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | Gears: T<br>Flags: NZ, US | | | | submission along the port sampled weigh data- i.e. NZWT). No recent submissions from US, although landings for south Pacific albacore into north-west US coastal ports may be available for sampling in the future. Data with standard lengths (UF = "Upper jaw to fork length") are only considered. Original raw data and import procedures are available. These data are imported in the Port Sampling databases and need to be transferred to TUFMAN 2. |
| ARTP | Regional and National Tagging Projects (TAG_)<br>Albacore Research Tagging Project size data | L | X | Y<br>1986-2001 | Historic south Pacific albacore tagging programme. Data with standard lengths (UF = "Upper jaw to fork length"). Note the size data for tagged fish in LF_MASTER is not used in the assessment a sized data for fisheries. Size data for tagged fish is extracted from the TAG_MASTER database used to generate the tag data size inputs for the assessments. |
| CS | Coral Sea Tagging | L | X | Y<br>(1990s) | Historic Australian Coral Sea tagging programme. Size data is not used for fisheries in assessments, but data for tagged fish is extracted from the TAG_MASTER database used to generate the tag data size inputs for the assessments. These data only relate to yellowfin and bigeye tuna. |
| FJCT | Fiji In-country Tagging | L | X | Time periods depending on the tag programme. PTTP is the current tagging | Data available in the TAG_MASTER database from these various historic programmes. Tag size data loaded in LF_Master is not used to contribute to fisheries size composition data in stock assessments. If tag data are used, |
| HWTP | Hawaiian Tagging Project (PFRP) | L | X | | |
| IATT | IATTC Tagging | L | X | | |
| KACT | FSM (Kapingamarangi) In-country Tagging | L | X | | |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| KICT | Kiribati In-country Tagging | L | X | programme, and has been implemented since 2006 | these size data are used for assigning release and recapture sizes to individual tagged fish. |
| PTRP | Philippines tuna research Project (Tagging) | L | X | | |
| PTTP | Pacific Tuna Tagging Project (Current) | L | X | | |
| RTTP | Regional Tuna Tagging Project | L | X | | |
| SEED | (Tag Seeding Experiments) | L | X | | |
| SICT | Solomon Islands In-country Tagging | L | X | | |
| SMPI | Ad hoc tagging in Pacific-Island countries (SPC) | L | X | | |
| SSAP | Skipjack Survey and Assessment Programme | L | X | | |
| TTPS | US Multilateral treaty Port sampling data | L | T | Y<br><br>(1987-2016) | US Multilateral Treaty Port Sampling (non-standard) data using the NMFS data collection protocol. Data lengths UF = "Upper jaw to fork length" are only considered. Original raw data are available in the Port Sampling databases and since 2015, in the Tufman 2 database system. Note that samples for this source do not have the SET TYPE information available. Since 2010 samples from increased observer coverage with set type recorded became available. Therefore, samples from this port sampling source collected since 2010 are not used in assessments because PS SKJ fisheries data in the assessments require a breakdown by SET TYPE. Alternatively, data from 2010 onwards from this port sampling source can be excluded from the LF_MASTER |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | process to avoid any potential duplication with observer collected size data. |
| TWLL | Taiwanese Longline length data (includes fleets OS and DW)<br>Gears: L<br>Flags:TW | L | A | Y<br>(2005-2016) | Data are collected by the captains on TW DWFN and STLL (offshore=OS) LL vessels (pers. Comm, Yi-Jay Chang, 12/11/2024). Lengths are understood to be UF = "Upper jaw to fork length", estimated by skippers/crew, the first 30 fish (irrespective of species) form a set, no other length types are considered. Data are no longer provided but are understood to be now available in observer data (see above DW_OB for TW fleet). The original data are available. |
| VNWP | Vietnam -- WPEA Port sampling project – LENGTHS<br>Gears: H, G, L<br>Flags: VN | L | T | 2010-2017 | Vietnam weight data from port sampling. Lengths are understood to be UF = "Upper jaw to fork length", no other length types are considered. Note there is no longline fishery anymore. Vietnam handline fishing for larger tuna (primarily yellowfin) has mostly replaced longline fishing since 2014 as the main target method (only about 3 dedicated tuna longliners left in 2025). The original data are available. |
| AUWT | Australian LONGLINE unloading weights (collected by processors)<br>Gears: L<br>Flags: AU | W | A | 1997-ongoing | Aggregated data provided by Australia. Data are collected at ports of landing on the East Coast of Australia, all fish landed are weighed – by processors. Data provided are broken down by AREA (which we understand is related to broad areas related to the port of landing), year and month. SPC attempt to assign 10°x10° lat/lon on the assumption that the fishing area is in proximity to the port/area of landing. Data are available in Australia to link the port |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | samples to trips. A request has been made to link these size data to the fishing trip so we can determine more accurate spatial assignment to the weight data. The data provided are processed weight and CSIRO (Ashley Williams) confirmed that the processing for tuna is gilled and gutted (GG), gill cover retained (Pacific style). SPC applies a conversion factor for GG to whole weight. For billfish the data provided are processed weight and CSIRO (Ashley Williams) confirmed that the processing is headed, and gutted, with fins and tailfins removed, but caudal peduncle attached for lifting. Original Raw data are available. |
| GUWT | Guam LONGLINE unloading weights | W | T | Y<br>1989-2011 | Original data represents port sampling of Longline vessel landings in Guam. This sampling has since stopped. The trunk form is assumed to have been gilled and gutted (GG), but worth to confirm that it is not Japan style GT. A conversion factor from GG to whole weight (WW) is applied to each individual. Original Raw data are available. |
| HWWT | Hawaiian LL/HL BET unloading weights<br>Gear: L, H<br>Flag: US | W | A | 1991-ongoing | Weights collected by US Hawaii HDAR Commercial Marine dealer are in pounds to the nearest half-pound weight. NOTE: HDAR uses its own conversion factors to convert processed weights in pounds to whole weights in pounds to one decimal place. The following conversion from lbs to kgs are applied by SPC when these data are loaded. Wt_kgs = round((wt_lbs + Rand()- 0.5) * 0.4536 ,0). The conversion factors applied by the US have now been provided to SPC, but the raw unconverted data with its processed form codes is preferred and could be requested by SPC. The US |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | conversion factors are not based on an available conversion factors data set and come from historic literature reference (Bykov 1983). Original converted data are available. |
| IDWT | Indonesia -- WPEA LONGLINE / HANDLINE port sampling – WEIGHTS<br>Gear: H, O, L<br>Flags: IN | W | T | 2011-ongoing | Indonesia Port Sampling data collected in recent years through the WCPFC-administered Western Pacific East Asia (WPEA) Project. YFT that are weighed at ports are in the GG form (tail on) (advice from Pak Bayu 21/6/2025). The data are converted to WW by SPC. The original data are entered and managed through a database system maintained by Indonesia Maritime Affairs and Fisheries (MMAF) (Pak Bayu) and aggregated data are submitted to the WCPFC each year. Data at the level of vessel trip may be available on request. |
| JPWT | Japanese LONGLINE Weight data | W | A | Y<br>1951-2019 | Aggregated port sampling data provided by Japan. Spatial information (LAT x LON) is provided. The data provided are processed weight and based on advice from Japan for their frozen fish are gilled (gill cover removed), gutted, finned and tailed (GT). Japanese has provided a specific conversion factor GT to WW that is used by SPC for these data. The Japanese form for processing billfish is unique: gilled, gutted, and upper jaw – including the bill and tip of lower jaw removed (i.e. at the point of 1 - 2 cm back from the tip of lower jaw). This is a form of gilled and gutted (GG) but has a different conversion factor provided by the Japanese, (Advice provided by Kotaro Yokawa, FRA, 20/5/2025). Original Raw data are available. As the Japanese billfish are typically landed with the head on, where length data are |

<table>
<tr><th>ORIGIN_ID Code</th><th>Description</th><th>Length (L) or Weight (W)</th><th>Data Category Code</th><th>Historical, and no longer submitted = Y, time period of data available.</th><th>Details of data collection</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>taken, they are measured for eye orbital to fork length. Original Raw data are available.</td></tr>
<tr><td>NZWT</td><td>New Zealand LL unloading weights<br><br>Gears: L<br><br>Flags: NZ</td><td>W</td><td>A</td><td>1950 – ongoing</td><td>NZWT data are from port sampling (referred to as ‘shed’ sampling by NZ) for tunas, billfishes, sharks. This data is virtually all longline but may have occasional troll data for albacore. Tuna are mostly in gilled and gutted or gilled and gutted with tail removed, from ice slurry (see below codes). Most fish in the landed catches are weighed, rather than a subsampling protocol. Data are provided to SPC in raw unconverted form. SPC does the conversion to whole weights, noting that NZ conversion factors are different to SPC. Prior to 2025, NZ provided the raw individual size data with additional data fields. Since the implementation of the WCPFC SciData standardised aggregate size data format, they only provide the aggregated data. The raw individual data is available on request. The recent data submission (2025) NZ provided the standard SPC processed fish codes, rather than NZ codes.<br><br>Swordfish weights are a key data from this source. The data provided are mostly NZ HGF = SPC GF (below). Data beyond 2011 have recently been loaded for use in the 2025 assessment. Advice from NZ staff is that the full tail is rarely removed, typically it is trimmed to remove the fins, but the caudal peduncle is retained for lifting by tail rope.<br><br>
<table>
<tr><th>NZ code</th><th>NZ description</th><th>SPC code</th><th>SPC description</th></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>ORIGIN_ID Code</th><th>Description</th><th>Length (L) or Weight (W)</th><th>Data Category Code</th><th>Historical, and no longer submitted = Y, time period of data available.</th><th>Details of data collection</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>
<table>
<tr><td>HGU</td><td>Headed and gutted</td><td>GH</td><td>Headed, gutted</td></tr>
<tr><td>GRE</td><td>Green or Whole</td><td>WW</td><td>Whole Weight</td></tr>
<tr><td>HGF</td><td>Headed, gutted and finned</td><td>GF</td><td>Gutted, headed, flaps removed</td></tr>
<tr><td>GGO</td><td>Gilled and gutted, tail on</td><td>GG</td><td>Gilled and gutted</td></tr>
<tr><td>GGT</td><td>Gilled and gutted, tail off</td><td>GT</td><td>Gilled, gutted, tailed</td></tr>
<tr><td>HGT</td><td>Headed, gutted and tailed</td><td>GX</td><td>Gutted, headed, tailed</td></tr>
<tr><td>GUT</td><td>Gutted</td><td>GO</td><td>Gutted only, not gilled</td></tr>
<tr><td>FIL</td><td>Fillets</td><td>FW</td><td>Fillets weight</td></tr>
</table>
</td></tr>
<tr><td>SBWT</td><td>Solomon Is. LONGLINE Trimarine (TMI) WEIGHT data<br>Gear: L<br>Flags: SB (includes chartered TW LL)</td><td>W</td><td>A</td><td>Y<br>(2016-2019)</td><td>Individual fish weight data from the Solomon Is. LONGLINE Trimarine (TMI), for bigeye and yellowfin. The data have been provided as many EXCEL files which have required an automated process to load but also a manual data entry at SPC into a MS ACCESS database to consolidate and standardise their data for import. There are additional data since 2019 that are potentially available on request. There was discussion of the possibility of SPC providing some tool to TMI to organise these data (contact Russell Dunham). Note that the individual fish weight data are provided to kg at one decimal place. The processing confirmed by Russell Dunham is similar to the processing for frozen fish by Japanese. Based on this information, the conversion from Japanese GT to WW should be applied. NOTE: Go back and check that correct conversions have been applied (may have</td></tr>
</table>

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | been GG). The original data are available. There may also be albacore weight data available. |
| SPPK | Regional LL Packing List data | W | P | Y<br>(1997-2005) | Regional LL Packing List data, individual weights from companies. Could be a undervalued source to explore, not used in assessments currently. |
| SPWT | Regional (PICTs) Port sampling data – Longline (WEIGHTS)<br>Gear: L<br>Flags: PICTs | W | P | 1991-ongoing | Individual fish weight data are collected from the Regional Port Sampling in PICTs. There are generally more LENGTHs from this data source than WEIGHTs for some species, so the LENGTH data take priority. Only weight data for longline bigeye and yellowfin tuna are consolidated into the WT_MASTER database, as up until 2023 those assessments only used weight data for these species from longline fisheries. The data are converted from various processed forms, predominantly GG for tuna. The original data are available. |
| TWWT | Taiwanese LL DWFN – WEIGHTS<br>Gear: L<br>Flags: TW | W | A | 2014-ongoing | Individual fish weights data are understood to be collected at ports of landing from Chinese Taipei longline vessels. Weights are processed weights, if frozen the form for tunas is GT (tail off and gill flaps removed same as Japanese GT form) and if landed fresh (ice slurry) the fish is whole including the guts (confirmed by Ren-Fen Wu, 20/6/2025). The original data are available. |
| VNWT | Vietnam WPEA LONGLINE/HANDLINE Port sampling project WEIGHTS and LENGTHS | W and L | T | Y<br>(2010-2017) | Vietnam Longline port sampling, yellowfin and bigeye. Weights are for ice chilled, gilled and gutted (GG), with fins removed, the SPC conversion (GG) to whole weight (WW) is |

| ORIGIN_ID Code | Description | Length (L) or Weight (W) | Data Category Code | Historical, and no longer submitted = Y, time period of data available. | Details of data collection |
|---|---|---|---|---|---|
| | | | | | applied. Lengths are understood to be UF = “Upper jaw to fork length”, no other length types are considered. Note there is no longline fishery anymore. Vietnam handline fishing for larger tuna (primarily yellowfin) has mostly replaced longline fishing since 2014 as the main target method (only about 3 dedicated tuna longliners left in 2025). The original data are available. Check if additional data since 2017, but length data preferred. These data are entered into the WF_Master and LF_Master, but need to confirm if the individual data are from the same fish. |

## Appendix 2 Draft SciData aggregate size data submission information proforma

### WCPFC SciData aggregate size data submission supporting information proforma: DRAFT version 5

This proforma relates **only to the aggregated WCPFC SciData size data submissions**. Data provided under the WCPFC ROP (i.e. Regional Observer Programme) or other special size data sampling programs (e.g., port sampling) that provide data to the SSP (SPC – Pacific Community) are not considered under this proforma. **The purpose of the proforma is for CCMs to provide general information on how the size data provided in their annual WCPFC aggregated size data submissions have been collected and to flag any changes in the collection processes/methods.**

**Size data provider details**

CCM: _____ Reporting year(s) of data covered by this proforma: _____

Contact person: _____

Position title: Contact email:

**Questions**

**Question 1:** Can you provide information on the platform/locations where the fish were measured or weighed? For example: port/landing point, on vessel at sea, fish market etc.

YES ☐ NO ☐ UNSURE ☐

IF YES, can the sampling platform/locations be selected from the options below (more than one option can be selected):

1. Port/landing point (catch is sampled direct from the vessel or as the vessel is being unloaded or directly after unloading at the port) ☐
2. Fish market/auction ☐ 3. Onboard fishing vessel at sea ☐ 4. Processing plant ☐
5. Research/training vessel ☐

6. Other, please specify:

If NO, would this information be available on request? YES ☐ NO ☐

Notes:

_____

**Questions 2:** Can you provide information on who measured the fish in submitted size data ?

YES ☐ NO ☐ UNSURE ☐

IF YES, can the sampling person(s) be selected from the options below (more than one option can be selected):

1.Skipper/crew ☐ 2. Trained port sampler ☐ 3. Fishing company staff ☐ 4. Research staff/students ☐ 5. Fisheries compliance officers ☐

6. Other, please specify:

If NO, would this information be available on request? YES ☐ NO ☐

Notes:

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**Questions 3:** Were the catches sorted or graded in any way prior to being measured?

YES ☐ NO ☐ UNSURE ☐

If YES, can the sorting process be documented/described on request? YES ☐ NO ☐

Notes:

---

**Questions 4:** Has a measurement device been used to measure '**all**' the fish in the data submission?

YES ☐ NO ☐ UNSURE ☐

If YES, can the measurement device be specified for each sample? YES ☐ NO ☐

What type of measurement device(s) have been used (more than one option can be selected)?

1. Adjustable caliper ☐ 2. Straight ruler/measuring stick ☐
3. Fish measuring board ☐ 4. Tape measure ☐ 5. Measuring mat ☐
6. Electronic (digital) scale (weights) ☐ 7. Manual analog scale (weights) ☐

7. Other, please describe and provide a photo or diagram if possible:

Can samples where a measurement device **was not used** be identified and removed from the data?
YES ☐ NO ☐

Can photos of the measurement device(s) being used be provided on request?
YES ☐ NO ☐

Notes:

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**Questions 5:** Did the size data sampling follow a sampling protocol or set of instructions? For example, this could be a formal sampling protocol document or instructions provided in the logbooks filled by skippers.

YES ☐ NO ☐ UNSURE ☐

NO, there are no formal protocols or instructions ☐

If YES, please provide a LINK or reference for the protocol(s)/logbook instructions or provide a file/pdf of the relevant document/logbook pages.

Link to size sampling protocols/instructions used:

Notes:

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**Questions 6:** Was the sampling protocol/instructions applied to the best of your knowledge in the year(s) of size data collection included for this submission?

YES ☐ NO ☐ UNSURE ☐

If NO, note the main changes in the sampling protocol/instructions below.

Notes on changes to sampling protocols/instructions:

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**Questions 7:** Is there quality control processes and refresher training on sampling methods for the people who are measuring the fish?

YES ☐ NO ☐ UNSURE ☐

Can details of the quality control and refresher training process be provided on request? YES ☐ NO ☐ UNSURE ☐

Notes:

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**Questions 8:** Were the standard SPC measurement codes applied? (see appendix 1)
YES ☐ NO ☐ UNSURE ☐

If NO, can a list of measurement codes be provided on request? YES ☐ NO ☐ UNSURE ☐

---

Notes:

**Questions 9:** Are all size data (length or weight) provided in submission in their **raw measured** form (no conversions applied)?
YES ☐ NO ☐ UNSURE ☐

If NO, can the raw unconverted data be provided YES ☐ NO ☐ UNSURE ☐

Can any converted data be identified in the submission and the conversion factors be provided on request? YES ☐ NO ☐ UNSURE ☐

Notes:

**Questions 10:** Is there a preferred point of contact to provide information/follow-up on the size data collection methods?

YES ☐ NO ☐ UNSURE ☐

Name of contact: Email of contact:

Appendix 1

Standards codes for size data collection (L-length, W – weight)

| meas_type | meas_id | meas_desc | meas_id_old |
|---|---|---|---|
| L | AN | Anal fin length | |
| L | BL | Bill to fork in tail | |
| L | CC | Curved Carapace Length | CL |
| L | CK | Cleithrum to anterior base caudal keel | |
| L | CL | Carapace length (redundant-do not use) | |
| L | CW | Carapace width | |
| L | CX | Cleithrum to caudal fork | |
| L | EO | Posterior eye orbital to caudal fork | |
| L | EV | Posterior eye orbital to vent | |
| L | FF | 1st dorsal to fork in tail | |
| L | FS | 1st dorsal to 2nd dorsal | |
| L | GI | Girth | |
| L | LF | Lower jaw to fork in tail | |
| L | NM | Not measured | |
| L | PF | Anterior base of Pectoral fin to fork in tail | |
| L | PS | Pectoral fin to 2nd dorsal | |
| L | SC | Straight Carapace Length | CL |
| L | SL | Tip of snout to end of caudal peduncle | |
| L | TH | Body Thickness (Width) | |
| L | TL | Tip of snout to end of tail | |
| L | TW | Body width | |
| L | UF | Upper jaw to fork in tail | FL |
| L | US | Upper jaw to 2nd dorsal fin | SD |
| W | CW | Captain's Estimate | |
| W | FN | Weight of all fins (sharks) | |
| W | FW | Fillets weight | |
| W | GF | Gilled, gutted, headed, flaps removed | |
| W | GG | Gilled and gutted weight | GW |
| W | GH | Gutted and headed weight | HG |
| W | GO | Gutted only (gills left in) | |
| W | GT | Gilled, gutted and tailed | |
| W | GX | Gutted, headed and tailed | |
| W | NM | Not measured | |
| W | OW | Observer's Estimate | |
| W | TW | Trunk weight | |
| W | WW | Whole weight | |

Standard gear codes

- G Drift Gillnet
- H Handline
- J Handline or gears other than pole-and-line used in tagging experiments
- K Handline (targeting small tunas in the Philippines)
- L Longline
- N Gillnet (small-scale)
- Multiple gears
- P Pole–and–Line
- R Ringnet
- S Purse Seine
- T Troll
- Y Recreational Fishery

## Appendix 3 Updated recommended conversion factor tables

### a) Weight to length conversion factors table

**Weight-length relationship table:** Weight-length conversions for key WCPFC assessed tuna and billfish stocks [Updated as of 25 May 2026]. To estimate the *a* and *b* parameters, we assume that whole weight (WW in kg) is a function of length [either fork length: UF, eye orbital fork length: EO, or lower jaw fork length: LF] (in cm) according to the equation: $WW = a\ length^b\ \xi$, where parameter *a* describes body shape and condition, exponent *b* indicates isometric (b ~ 3) or allometric (b < 3, b > 3) growth, and ξ is a lognormally distributed multiplicative error term. We fit a linear model of log(WW) as a function of log(length), with *a* back-transformed and corrected for log transformation bias. The coefficient of determination ($R^2$) is calculated from the linear regression on log-transformed data. Preferred parameter estimates for WCPFC assessments are shown in bold for each species. NA = currently not available. *See the notes below the table for further details on the datasets used.

| Species | Conversion | Region of assessment | Sample size (n) | *a* (95% CI) (Recommended in bold) | *b* (95% CI) (Recommended in bold) | $R^2$ | Datasets and code | References and comments |
|---|---|---|---|---|---|---|---|---|
| SKJ | UF to WW | WCPO | NA | **1.1437e-05** (NA, NA) | **3.1483** (NA, NA) | NA | Three data sources used:<br>1) Historical SPC tagging cruises (1977-1980)<br>2) SPC port sampling (1993-2015)<br>3) Japanese pole-and-line fishery and research cruises (1972-2017)<br><br>Data sets can be found in:<br>**P:/OFPEMA/Project 90/Data/SKJ_LengthWeight** | - Derived by Vincent et al. (2019a) and used in the 2019 (Vincent et al. 2019b), 2022 (Castillo-Jordán et al. 2022) and 2025 assessments (Teears et al. 2025b).<br>- *a* estimate bias corrected. |
| ALB | UF to WW | South Pacific | 824,745 | **1.7075e-05** (1.6901e-05, 1.7251e-05) | **3.048321** (3.046064, 3.050579) | 0.8947 | | - Derived by Macdonald et al. (2024).<br>- Used in the 2024 assessment (Teears et al. 2024). |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | - *a* estimate not bias corrected. |
| | | | | **1.712853e-05** (1.695337e-05, 1.730550e-05) | **3.048321** (3.046064, 3.050579) | 0.8947 | Cleaned dataset for modelling:<br>'ALB_LWR.RData'<br><br>Raw data files:<br>'LW_CF_Data_01_ALB.csv' [bio_LW]<br>'LW_CF_Data_02_ALB.csv' [obsv_LW]<br>'LW_CF_Data_03_no.pre.filter_ALB.csv' [port1_LW]<br>'LW_CF_Data_04_ALB.csv' [port2_LW]<br><br>R code:<br>'SP_ALB_length-weight_relationships.R'<br><br>File location:<br>**P:/OFPEMA/Project 90/Data/2024 data/ALB_assessment_LW** | **June 2025 update.**<br>- *a* estimate bias corrected.<br>- Recommend for use in the 2027 assessment. |
| YFT | UF to WW | WCPO | 1,542,557 | 1.9865e-05 (1.9775e-05, 1.9955e-05) | 2.990779 (2.989830, 2.991728) | 0.9612 | | - Derived by Macdonald et al. (2023).<br>- Used in the 2023 assessment (Magnusson et al. 2023).<br>- *a* estimate not bias corrected. |
| | | | | **1.993812e-05** (1.984810e-05, 2.002855e-05) | **2.990814** (2.989865, 2.991762) | 0.9612 | Cleaned dataset for modelling:<br>'YFT_LWR.RData'<br><br>Raw data files:<br>'LW_CF_Data_01.csv' [bio_LW]<br>'LW_CF_Data_02.csv' [obsv_LW] | **June 2025 update.**<br>- *a* estimate bias corrected.<br>- Recommended for use in the 2026 assessment. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 'LW_CF_Data_03_no.pre.filter.csv' [port1_LW]<br>'LW_CF_Data_04.csv' [port2_LW]<br>'LW_CF_Data_SFFAII.csv' [SFFAII_LW]<br>R code:<br>'BET.YFT_length-weight_relationships.R'<br><br>File location:<br>**P:/OFPEMA/Project 90/Data/2023 data/BET.YFT_assessment_LW** | |
| BET | UF to WW | WCPO | 1,358,097 | 3.0634e-05<br>(3.0494e-05, 3.0774e-05) | 2.932384<br>(2.931436, 2.933333) | 0.9643 | | - Derived by Macdonald et al. (2023).<br>- Used in the 2023 assessment (Day et al. 2023).<br>- *a* estimate not bias corrected. |
| | | | | **3.073533e-05**<br>(3.059509e-05, 3.087622e-05) | **2.932410**<br>(2.931461, 2.933358) | 0.9643 | Cleaned dataset for modelling:<br>'BET_LWR.RData'<br><br>Raw data files:<br>'LW_CF_Data_01.csv' [bio_LW]<br>'LW_CF_Data_02.csv' [obsv_LW]<br>'LW_CF_Data_03_no.pre.filter.csv' [port1_LW]<br>'LW_CF_Data_04.csv' [port2_LW]<br>'LW_CF_Data_SFFAII.csv' [SFFAII_LW]<br><br>R code:<br>'BET.YFT_length-weight_relationships.R'<br><br>File location: | **June 2025 update.**<br>- *a* estimate bias corrected.<br>- Recommended for use in the 2026 assessment. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | **P:/OFPEMA/Project 90/Data/2023 data/BET.YFT_assessment_LW** | |
| MLS | EO to WW | Southwest Pacific | Sex-aggregated: 113 | **5.425259e-07** (2.349155e-07, 1.252937e-06) | **3.583776** (3.424904, 3.742648) | 0.9474 | Raw data files:<br>'STMlengthextract.csv'<br>'MLS data for SPC New Zealand_220425.csv'<br><br>R code:<br>'MLS_length-weight_relationship.R'<br><br>File location:<br>**P:/OFPEMA/Project 90/Data/2024 data/MLS_assessment_LW** | - Derived from data from Kopf et al. (2011) study.<br>- Data exploration and modelling described in Macdonald et al. (2025).<br>- *a* estimates bias corrected.<br>- Used in the revised 2024 assessment (Castillo-Jordán et al. 2025). |
| | | | Female: 65 | **4.849174e-07** (1.906227e-07, 1.233562e-06) | **3.608258** (3.431708, 3.784808) | 0.9636 | | |
| | | | Male: 44 | **1.087518e-06** (1.911076e-07, 6.188637e-06) | **3.445321** (3.113681, 3.776961) | 0.9128 | | |
| SWO | LF to WW | Southwest Pacific | Sex-aggregated: 7024 | **2.774087e-06** (2.511274e-06, 3.064404e-06) | **3.303671** (3.284199, 3.323144) | 0.9403 | Cleaned datasets for modelling:<br>'SWO_LWR.csv' (sex-aggregated model)<br>'SWO_LWR_obsvLL4_LW.csv' (sex-specific models)<br><br>Raw data files:<br>'BioD_LW_extraction_SWO.csv' [bio_LW]<br>'Gen_LW_SRC_02_Observer_SWO_GEN4.csv' [obsvGEN4_LW]<br>'Gen_LW_SRC_02_Observer_SWO_LL4.csv' [obsvLL4_LW]<br>'Gen_LW_SRC_03_Port_SWO_pre2015.csv' [port_LW]<br><br>R code:<br>'SWO_length-weight_relationships.R'<br>File location: | - Derived from SPC observer and port sampling data<br>- Data exploration and modelling described in Macdonald et al. (2025).<br>- *a* estimates bias corrected.<br>- Used in the 2025 assessment (Day et al. 2025) |
| | | | Female: 1940 | **6.565533e-06** (5.228345e-06, 8.244715e-06) | **3.139509** (3.095440, 3.183577) | 0.9097 | | |
| | | | Male: 998 | **8.942387e-06** (6.448529e-06, 1.240070e-05) | **3.063015** (2.998319, 3.127711) | 0.8965 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | **P:/OFPEMA/Project 90/Data/2025 data/SWO_assessment_LW** | |

*NOTES ON DATASETS

**Skipjack**

The weight-length relationship was recalculated for the 2019 assessment (see p. 16 in Vincent et al. 2019a) as the previous parameter estimates used in the 2016 assessment could not be recreated. Vincent et al. (2019a) state that the length and weight data to derive the relationship came from three sources:

1) Historical SPC-led skipjack tagging cruises conducted from 1977 through 1980 during which fish were tagged and biological samples were collected, including measurement of the length and weight of specimens.
2) Port sampling data available from SPC. Samples from the ports extend from 1996 through 2015 with the majority of length-weight data collected from 2012 through 2014.
3) Collection of length and weight information for skipjack also occurred in the Japanese commercial pole-and-line fishery and research vessels between 1953 and 2017. These data were filtered to be over the assessment period starting in 1972 and for latitudes between 10S and10N. These data were filtered to be in the equatorial region because this is where the majority of the skipjack tuna population is believed to reside, but we note a large portion of the total data were collected outside of this area.

These three data sources were then combined to fit the model of WW as a function UF using standard methods according to $WW = a\ UF^b\ \xi$, to derive the *a* (bias-corrected) and *b* parameter estimates in the table above.

Relevant datasets form the Vincent et al. (2019) assessment have been found and now stored at P:/OFPEMA/Project 90/Data/SKJ_LengthWeight.

**South Pacific albacore, yellowfin and bigeye tuna**

'ALB_LWR.RData', 'YFT_LWR.RData' and 'BET_LWR.RData' are the final, cleaned datasets used for modelling the length-weight relationships for South Pacific albacore, yellowfin and bigeye tuna, respectively, for the most recent WCPFC assessments. Each dataset contains three fields:

**df_name:** identifier for one of the following five raw datasets from which we extracted coupled length and weight records.

- bio_LW: Includes L-W records taken from individual fish sampled by either observers or port samplers, for which other biological material (e.g., otoliths, gonads, liver, dorsal spine, stomachs) was also collected. (Drawn from the 'BioDaSys' database).
- obsv_LW: Includes L-W records from individual fish measured by at-sea observers on longline vessels. (Drawn from the 'OBSV_MASTER' database).
- port1_LW: Includes L-W records for fish measured at port prior to 2015. (Drawn from the 'FISH_MASTER_WORK' database)
- port2_LW: As for port1_LW, but includes L-W records for fish measured at port after 2015. (Drawn from the 'Tufman2' database)
- SFFAII_LW: Port sampling L-W records from handline and purse-seine caught bigeye and yellowfin landed whole in General Santos Port, collected from 2019 to 2023 onwards. (Drawn from the 'Tufman2' database)

**len:** fork length (cm) (UF)

**WW_kg:** whole weight (kg)

To produce the 'WW_kg' field for each species often required the conversion of processed weights (e.g. GG, GT, etc) to WW. Using the bigeye data as an example, here's a breakdown of the different processed weight codes (and sample sizes available for each) per dataset, after completing all data filtering steps:

bio_LW: GG (n = 1,604), WW (n = 766), GO (n = 1)
obsv_LW: WW (n = 4,822)
port1_LW: GG (n = 1,053,335), WW (n = 10,484), GT (n = 1,666), GX (n = 598), GH (n = 146), GO (n = 65)
port2_LW: GT (n = 152,527), GG (n = 125,061), WW (n = 5,754), GX (n = 198), GH (n = 4), GO (n = 1)
SFFAII_LW: WW (n = 1,085)

with a reminder of what these codes refer to:

| | |
|---|---|
| GG | Gilled and gutted weight |
| GH | Gutted and headed weight |
| GO | Gutted only (gills left in) |
| GT | Gilled, gutted and tailed |
| GX | Gutted, headed and tailed |

So, there is a mix of different codes, particularly for the port1_LW and port2_LW datasets. We used the same relationships to convert processed weights to WW across the bio_LW, port1_LW and port2_LW datasets. Apart from the GG to WW relationship, derived from the SFFAII data collected between 2020 and 2023 (n = 125) (see Macdonald et al. 2023 for details), all other relationships were taken from Langley et al. (2006), as follows: GT to WW, GX to WW, GH to WW and GO to WW relationship based on processed catch from the Hawaii longline fishery (from Table 2b Langley et al. 2006)

**Striped marlin**

'STMlengthextract.csv' (n = 113 after filtering) is the original dataset provided by Keller Kopf (Charles Darwin University), associated with the Kopf et al. (2011) paper. Whilst Kopf et al. (2011) did not derive an EO to WW relationship for southwest Pacific striped marlin, they did measure a total of 114 coupled EO (in mm) and WW (in kg) measurements on fish captured from the Australian (n = 55) and New Zealand (n = 59) EEZs between 2005 and 2008. Sex was also recorded. Follow-up work (see Appendix 1 in Macdonald et al. 2025) confirmed that these measurements represented the best available data upon which to develop an EO-WW relationship for the southwest Pacific striped marlin. Therefore, we used this dataset for modelling the sex-aggregated and sex-specific length-weight relationships for the most recent WCPFC assessment by Castillo-Jordán et al. 2025. Data fields are self-explanatory.

'MLS data for SPC New Zealand_220425.csv' (n = 542 after filtering) is NZ recreational fishery data provided to SPC by John Holdsworth (Blue Water Marine Research Ltd). This dataset comprises measurements of EO (in mm), LF (in mm) and WW (in kg), by sex, recorded for striped marlin captured by the recreational fishery off New Zealand's North Island between 1985 and 2020. John confirmed that the

length measurements were made using a tape measure, as were those made by Kopf et al. (2011). Therefore, we assumed that any biases associated with measuring length in this manner, as opposed to using a standard measuring caliper, would be common to both datasets. Data fields are self-explanatory, noting that there are some other measurements provided on dorsal spine dimensions and estimated age from spine readings.

**Southwest Pacific swordfish**

'SWO_LWR.csv' is the final, cleaned dataset used for modelling the sex-aggregated length-weight relationship for the most recent WCPFC assessment by Day et al. (2025). The dataset contains eight fields:

**yy:** year of capture

**mm:** month of capture

**dd:** day of capture

**latd:** latitude of capture location

**lond:** longitude of capture location

**len:** observer measured lower jaw fork length (LF) in cm

**wt:** observer measured whole weight (kg)

**dataset:** identifier for one of the following three raw datasets from which we extracted coupled length and weight records.

- obsvGEN4_LW: data collected on the 'GEN4' data form by Australian and New Zealand observers from swordfish captured in Australian and New Zealand waters between 1988 and 2008 (n = 3,209 after filtering steps). This dataset contained no information on the sex of captured individuals.
- obsvLL4_LW: data collected on the 'LL4' data form by WCPO observers from swordfish captured off New Zealand and in more tropical waters across the central WCPO between 2011 and 2023 (n = 3,814 after filtering steps). This dataset contained

information on the sex of captured individuals. We note that this dataset (minus the three most recent years of data) was used to estimate the LJFL-WW relationship for the 2021 southwest Pacific swordfish assessment (Ducharme-Barth et al. 2021a, b) [SC17/SA-IP-07, SC17/SA-WP-04].

- port_LW: a single, reliable port sampled record from 2007.

'SWO_LWR_obsvLL4_LW.csv' is the final, cleaned dataset used for modelling the sex-specific length-weight relationships for the most recent WCPFC assessment by Day et al. (2025).

In essence, this dataset comprises the 'obsvLL4_LW' data described above. It contains the **yy**, **mm**, **dd**, **latd**, **lond**, **len**, **wt** fields**,** plus a **sex_code** variable and some additional vessel-, trip- and set-related variables.

## b) Processed weight to whole weight conversion factors table for assessed species: 2026 recommended

| Species | Size category | From | To | Conversion equations<br>a) Simple without disaggregation, random adjustments etc.<br>b) Complete conversion procedure | Source |
|---|---|---|---|---|---|
| ALB | Weight | GG | WW | **a) WW=1.1 *GG**<br>b) WW = 1.1 * (GG +(Rand()-0.5) | Tufman2 Hawaii LL fishery processed catch sampling, - this is same as indicated for Hawai'i auctions WW=GG/0.89 – see notes below table and is from Bykov 1993.<br>*(Peter Willams also had this one also WW=1.274959 *GG $^{0.960613}$ but source is unknown and not in Tufman2, maybe from AUS*)<br>This conversion really needs some data collection. |
| YFT | Weight | GG | WW | **a) WW=1.1821997*GG$^{0.9755}$**<br>b) WW=1.1821997*(GG + Rand()-0.5)$^{0.9754946}$ | 2023 updated – Macdonald et al. 2023, added to Tufman2 and should now be used. data collected at General Santos, Philippines from 2020-2023. |
| YFT | Weight | GT | WW | **a) WW = 1.298823 * GT $^{0.967869}$**<br>b) WW = 1.298823 * (GT + Rand()-0.5) $^{0.967869}$ | From Langley et al. (2006), **Japanese freezer vessels**, gill covers, fins and tails removed. |
| BET | Weight | GG | WW | **a) WW=1.1617889*GG$^{0.9817353}$**<br>b) WW=1.1617889*(GG + Rand()-0.5)$^{0.9817353}$ | 2023 updated – Macdonald et al. 2023, added to Tufman2 and should now be used, data collected at General Santos, Philippines from 2020-2023. |
| BET | Weight | GT | WW | **a) WW= 1.32641 * GT$^{0.968651}$**<br>b) WW= 1.32641 * (GT + Rand()-0.5) $^{0.968651}$ | From Langley et al. (2006), **Japanese freezer vessels**, gill covers, fins and tails removed |
| MLS[1] | Weight | GH/GX | WW | **a) WW= 1.17883743 *GX/GH$^{0.9984}$**<br>b) WW= 1.17883743 *(GX/GH + Rand()-0.5)$^{0.9984}$ | Langley et al. 2006, from Australia sampling approx. 250 samples on Japanese vessels, fins likely trimmed, tail removed = GX, Ashley Williams, CSIRO has the data. Would benefit from more data collection. |
| MLS[2] | Weight | GG - Japan | WW | **a) WW= 1.098 *GG + 3.655**<br>b) WW= 1.098 *(GG + Rand()-0.5) + 3.655) | Conversion provided by Japan FRA. This conversion is not in Tufman2 but should be applied to Japanese GG.<br>**This only for MLS GG from Japan – head on but bill removed including small bit of lower jaw, tail maybe removed for frozen form.** |

| | | | | | |
|---|---|---|---|---|---|
| SWO[1] | Weight | GH (New Zealand – HGF) | WW | **a) WW= 1.3717 * GH**<br>b) WW= 1.3717 * (GH + + Rand()-0.5) | Source Song and Liuxiong 2004 - Col. Vol. Sci. Pap. ICCAT, 56(3): 940-946 (2004), samples from Atlantic Ocean. Full heads removed and gutted. Listed in Langley et al. (2006). Ito 2005 has WW = 1.39*GH, data amount/quality unknown. Headed, fins, guts removed, but tail caudal peduncle retained for lifting. No data available. |
| SWO[2] | Weight | GG - Japan | WW | **a) WW= 1.548 * GG - 0.479**<br>b) WW= 1.548 *(GG + Rand()-0.5) – 0.479) | Conversion provided by Japan FRA. This conversion is not in Tufman2 but should be applied to Japanese GG – with head on but bill removed including small bit of lower jaw-Japan, gill covers likely removed, tail may be removed for frozen.<br><br>(Ito 2005 ISC/05/MAR&SWO_WGs/3), Hawaii WW =1.14*GG, but GG form is unclear, and data amount/quality unknown) |
| SWO | Weight | GX (NZ – HGT) | WW | **a) WW=1.45*GX**<br>b) WW=1.45*(GX+ Rand()-0.5) | Ito 2005 Hawaii – data amount/quality unknown. Head, fins, guts and tail removed. |
| BUM | Weight | GG | WW | **a) WW=1.2605*GG**<br>b) WW=1.2605*(GG + Rand()-0.5) | This is uncertain where the data or origin comes from, but it is same as the HW conversion – assume it is from the Bykov 1983 conversions used in HW i.e. WW=GG/0.8<br>Not that GG is not commonly landed, expect for Japan style with head on bill removed. |
| BUM | Weight | GH | WW | **a) WW = 1.47*GH**<br>b) WW = 1.47*(GH + Rand()-0.5) | This is uncertain where the data or origin comes from, but it is same as the HW conversion so assume it is from the Bykov 1983 conversions used in HW i.e. WW=HG/0.68. This would be more common processed form. |
| BLM | Weight | GG | WW | **a) WW=1.2*GG**<br>b) WW=1.2*(GG + Rand()-0.5) | This is uncertain where the data or origin comes from, assume it is based on the conversion for HW from Bykov 1983, i.e. WW=GG/0.83. Not that GG is not commonly landed, expect for Japan style with head on bill removed. |
| BLM | Weight | GH | WW | **a) WW = 1.43*GH**<br>b) WW = 1.43*(GH + Rand()-0.5) | This is uncertain where the data or origin comes from, assume it is based on the conversion for HW from Bykov 1983, i.e. WW=HG/0..7. Not that GG is not commonly landed, expect for Japan style with head on bill removed. |

**Note:** Whole weight data provided from the Hawai'i auctions, ORIGIN_ID HWWT are pre-converted from processed forms. The conversion factors used are mostly derived from the publication of *Bykov, V.P., 1983. Marine fishes: chemical composition and processing properties. Published for the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Dept. of Commerce, and the National Science Foundation by Amerind. Available from Pacific Islands Fisheries Science Ctr. Library, Honolulu, HI.* **These conversion factors can be found in P:\OFPEMA\Project 90\Data\HW_auctions_conversions,** as an example of the Hawai'i auctions Bykov 1983 conversion factors: yellowfin WW = GG/0.89, bigeye WW = GG/0.86, albacore WW = GG/0.91

c) Partial length to fork length conversion factors table for billfish; no updates to these CFs in 2026. There are no length to length conversions factors listed in Tufman2 for any tuna species.

| Species | Size category | From | To | Conversion equations<br>a) Simple without disaggregation, random adjustments etc.<br>b) Complete conversion procedure | Source |
|---|---|---|---|---|---|
| MLS | Length | PF | EO | **a) EO = (PF/0.7309)*0.862096-2.93**<br>b) b) $LEN_{EO}$ = FLOOR( ROUND( ($LEN_{PF}$ + (Rand()*LSTRAT - (0.5*LSTRAT)) / 0.7309 ) * 0.862096 – 2.93 ,0) , 0 ) / LSTRAT ) * LSTRAT | Unknown, not included in Tufman2, probably based PF-LF then LF-EO both from **SPC Observer data** |
| MLS | Length | LF | EO | **a) EO=LF*0.862096-2.93**<br>b) $LEN_{EO}$ = FLOOR( ROUND( ($LEN_{LF}$ + (Rand()*LSTRAT - (0.5*LSTRAT)) * 0.862096 – 2.93 ,0) , 0 ) / LSTRAT ) * LSTRAT | SPC observer data (n=498 fish, AU/NZ 1996/97, 1990-2007) WCPFC-SC20-2024/ST-IP-04 |
| MLS | Length | PF | LF | **a) LF=PF*1.17946**<br>b) $LEN_{LF}$ = FLOOR( ROUND( ($LENP_{F}$ + (Rand()*LSTRAT - (0.5*LSTRAT)) * 1.17946 ,0) , 0 ) / LSTRAT ) * LSTRAT | SPC Observer data, assume same 498 fish as above? |
| SWO | Length | PF | LF | **a) LF=PF/0.7600**<br>b) b) $LEN_{LF}$ = FLOOR( ROUND( ($LEN_{PF}$ + (Rand()*LSTRAT - (0.5*LSTRAT)) / 0.7600 ,0) , 0 ) / LSTRAT ) * LSTRAT | SPC conversion assume from observer data<br>Equivalent in Tufman2 LF=1.31578*PF |
| SWO | Length | EO | LF | **a) LF=EO/0.900 (same as EO*1.1111 in T2)**<br>b) LENLF = FLOOR( ROUND( ($LEN_{EO}$ + (Rand()*LSTRAT - (0.5*LSTRAT)) / 0.900 ,0) , 0 ) / LSTRAT ) * LSTRAT | Unknown<br>Alternative in Tufman2 is LF=EO*1.0753 + 6.898 from Campbell 2008 (note he had the conversion back to front in his paper - WCPFC-SC4-2008/SA-IP-3), this option was used in the 2017 assessment Takeuchi et al. (2017) |
| BUM | Length | PF | LF | **a) LF=PF/0.8149**<br>b) $LEN_{LF}$ = FLOOR( ROUND( ($LEN_{PF}$ + (Rand()*LSTRAT - (0.5*LSTRAT)) / 0.8149 ,0) , 0 ) / LSTRAT ) * LSTRAT | SPC conversion assume from observer data<br>Equivalent to Tufman2 LF=1.22714*PF |
| BUM | Length | EO | LF | **a) LF=EO/0.900** | Unknown source (same as SWO?) – need data collection. |

| | | | | | |
|---|---|---|---|---|---|
| | | | | b) $LEN_{LF}$ = FLOOR( ROUND( ($LEN_{EO}$ + (Rand()*LSTRAT - (0.5*LSTRAT)) / 0.900 ,0) , 0 ) / LSTRAT ) * LSTRAT | |
| BLM | Length | EO | LF | **a) LF=EO/0.900**<br>b) LENLF = FLOOR( ROUND( ($LEN_{EO}$ + (Rand()*LSTRAT - (0.5*LSTRAT)) / 0.900 ,0) , 0 ) / LSTRAT ) * LSTRAT | Unknown (same as SWO?) – needs data collection. |
| BLM | Length | PF | LF | **a) LF=PF/0.7750**<br>b) $LEN_{LF}$ = FLOOR( ROUND( ($LEN_{PF}$ + (Rand()*LSTRAT - (0.5*LSTRAT)) / 0.7750 ,0) , 0 ) / LSTRAT ) * LSTRAT | SPC conversion assumed from observer data<br>Equivalent to Tufman 2<br>LF=1.29032*PF |