Western and Central Pacific Fisheries Commission

**SCIENTIFIC COMMITTEE**
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# Project 120: Progress report on Reproductive Biology of WCPO Yellowfin Tuna

**SC21-SA-IP-10**

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**SPC-OFP**

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**Executive Summary**

This information paper provides an update on the progress of the WCPFC supported P120 project on the reproductive biology of Western and Central Pacific Ocean (WCPO) yellowfin tuna (*Thunnus albacares*), initiated in 2024. The project's objective is to improve estimates of key reproductive parameters to better inform stock assessments and fisheries management for this important tropical tuna species.

The work builds on an initial inventory of approximately 3,000 female gonad samples held in the Pacific Marine Specimen Bank (PMSB), focusing on fish over 60 cm fork length (FL). To date, approximately 70% of the targeted samples have been located, retrieved, and processed into analyzable histological slides, with around 20% having been examined and maturity stages determined. Audits and sample retrieval continue across secondary storage sites, requiring coordination with in-country partners.

With sample recovery and processing well advanced, the project is entering its next phase in the coming year focused on analysis and estimation of key reproductive indicators. In parallel, alternative approaches to maturity assessment are being trialled to support future data collection efforts. The project remains on track to deliver critical biological information to support more informed management of WCPO yellowfin tuna.

**Recommendations**

SC20 is invited to:

- Note the progress of the project examining the reproductive potential of WCPO yellowfin tuna.
- Encourage continued collaboration and coordination with regional partners to complete sample recovery and additional sampling campaign.
- Invite the Scientific Committee to consider and support further exploration and development of alternative maturity assessment methods and other emerging techniques as this area evolves.

## Background

The need for updated baseline measures of reproductive potential for WCPO tropical tunas has been recognized as critical for improving the precision of spawning biomass estimates used to assist management decision making (OFP-SPC 2023).

Previous studies in the WCPO have indicated significant spatial variation in spawning potential for some tuna species (e.g., yellowfin and albacore tuna - (Farley et al. 2013; Farley et al. 2014; Itano 2000), while information is limited for others (e.g. bigeye and skipjack tuna - (Farley et al. 2018). Gaining an improved understanding of reproductive biology data across the WCPO is essential for improving stock assessment models and projections, thereby facilitating informed decisions for more effective and sustainable fisheries management. Additionally, given the potential impacts of increasing climate variability on the spawning potential of tropical tunas, establishing current baseline levels is crucial for identifying future changes.

In 2023, the WCPFC Scientific Committee initiated a project to study the reproductive biology of WCPO tropical tunas, the planning phase was presented in 2024 (OFP-SPC 2024; OFP-SPC 2023). This paper provides an update on the ongoing progress of that work. It summarises, recent sampling activities, progress made in retrieving, processing and analysing gonad samples and upcoming phases of the study.

## PMSB audit

Significant progress has been made in auditing and retrieving gonad samples originally identified for this study, though additional work remains and will require continued coordination with in-country partners.

Originally, approximately 3,000 gonad samples from the Pacific Marine Specimen Bank (PMSB) were identified for inclusion in this study (OFP-SPC 2024). As part of the audit process, inventories were conducted at the two main long-term storage facilities, where 70% of the targeted samples were successfully located and retrieved.

The remaining 29% of samples are held across 12 secondary storage facilities in 9 countries, with a final 1% scattered in very small batches across another 9 locations. Four of these secondary sites have been visited so far, and audits of the remaining facilities are planned in the coming months.

During the audit, a portion of samples were found to be unsuitable for histological analysis due to cold chain failures and were discarded. A small number were also confirmed as lost. While the full audit is ongoing, preliminary estimates suggest a final sample loss of up to 10% from the original pool.

Completing this audit will depend on having personnel available on the ground to access and verify holdings across multiple locations. Engagement with local partners and regional coordination will be essential to recovering and processing the remaining samples.

**Additional sampling effort**

One limitation of the existing dataset is the relatively low number of samples from the eastern portion of the WCPFC area. To address this, several targeted opportunities have been leveraged to improve spatial coverage:
-In the Cook Islands, approximately 240 gonad samples were collected locally. This effort was enabled opportunistically through training activities delivered for the Close-Kin Mark-Recapture (CKMR) project, which helped reactivate the local sampling network in this previously underrepresented region (Anderson 2025).
-The CP17 tagging cruise conducted as part of the Pacific Tuna Tagging program (PTTP) is currently underway and is expected to collect gonad samples from fish caught in waters between south of Hawaii and north of Kiritimati (Line Islands) (SPC-OFP 2025). While exact numbers are not yet available, this activity is anticipated to help close sampling gaps in the central-eastern Pacific, particularly around Line Island waters. In addition to gonad collection, the CP17 cruise is also collecting pair blood samples and trialing a gonad biopsy protocol, which will be evaluated against classic histology approach as part of ongoing investigations into alternative maturity assessment methods.

Despite these new contributions, sampling gaps remain, particularly:

- east of 150°W,
- between 130°E and 150°E, and 5°N and 15°N, around FSM and Guam waters.

These remaining gaps are geographically specific and often limited in spatial and temporal scope, making large-scale sampling strategies less efficient. To address this, a targeted opportunistic sampling approach is being trialled. This involves contacting volunteer vessels operating in priority areas and requesting that a small number of fish be set aside during regular fishing operations. These fish are then sampled upon landing by local samplers, allowing data collection of fish caught in specific targeted areas.

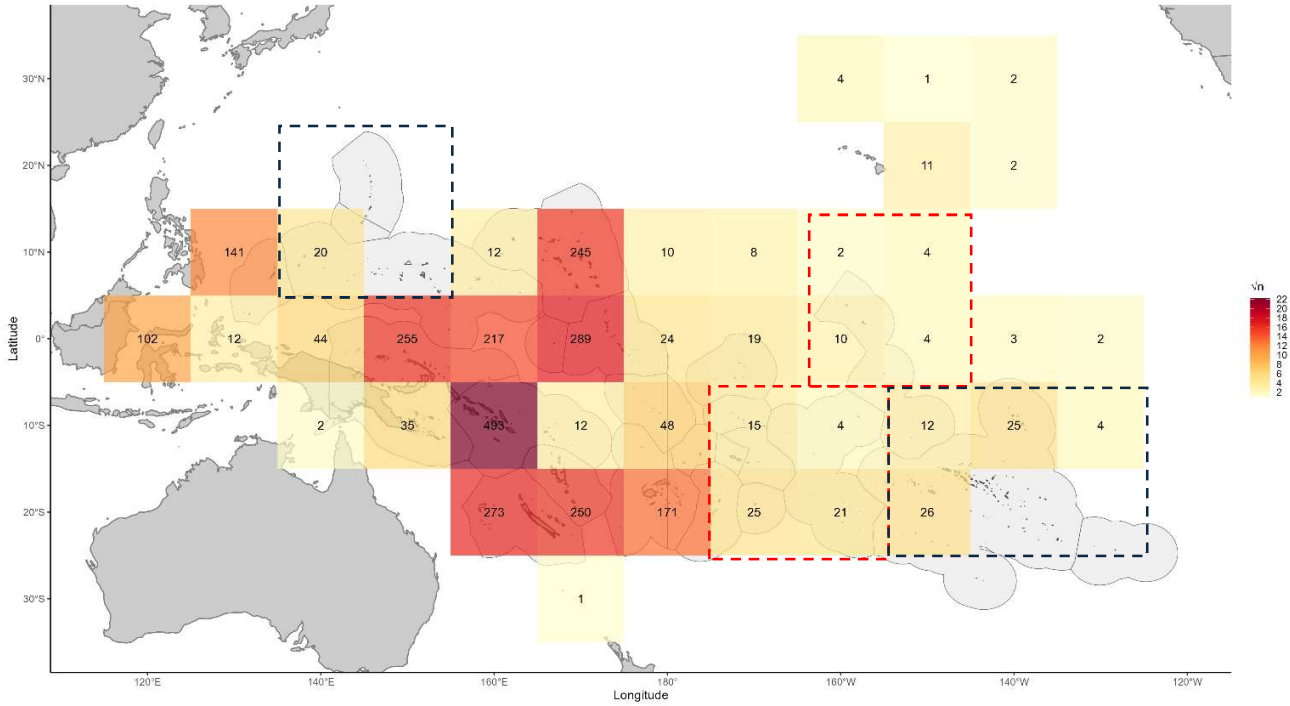


*Figure 1 Spatial distribution of the available female gonad's samples from fish larger than 60 cm fork length. Aggregated to 10-degree squares. Red dashed lines indicate regions with known sampling gaps that are currently being addressed, and blue lines show areas where targeted efforts are being made to increase sample coverage.*

## Processing and Analysis

Substantial progress has been made in processing samples for histological analysis, positioning the project to now begin the analytical phase.

To date, 1,254 gonad samples representing over one third of the final target sample pool were weighed, trimmed, embedded in paraffin blocks, sectioned, stained using standard hematoxylin and eosin (H&E) and mounted on histological slides, representing over one-third of the final target sample pool. An additional 580 samples have been weighed,trimmed, cassetted, and shipped to the University of Queensland for slide preparation. Their delivery is expected by the end of Q3 2025, which will bring the total processed samples to over half of those identified as suitable for histological analysis.

At this stage, 566 slides have been read. This includes 350 slides from archived samples preserved in formalin or ethanol, which have been instrumental in developing a reference library to support identification of key reproductive features and maturity stages. Of the slides read, 18 were male and 522 were successfully staged for maturity classification and reproductive phase. The staging and assessment protocol is adapted from (Farley et al. 2013; Itano 2000), using criteria aligned with established tuna histology frameworks. Final consolidation of the reference library and staging methodology is underway, and once complete, the protocols will be shared more broadly with partners.

**Perspectives**

With the planning, sample retrieval, and biological sampling phases now largely complete, the project is shifting its primary focus toward histological analysis alongside continuing and finalizing the processing and retrieval of the remaining samples of interest. As these tasks conclude, attention will turn to estimating key reproductive parameters, including batch fecundity, spawning frequency, spawning fraction, total annual fecundity, and maturity ogive. In parallel, the project will begin testing alternative approaches to maturity assessment, including the use of hormonal composition from blood samples and the trial of a gonad biopsy protocol. These combined efforts will provide robust biological data to support improved stock assessment and sustainable management of WCPO yellowfin tuna.

**Timeline**

| Activity | 2024 | | | | 2025 | | | | 2026 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| PMSB Audit | | | | | | | | | | | | |
| Additional Sampling | | | | | | | | | | | | |
| Inventory and Collation of existing samples | | | | | | | | | | | | |
| Preparation and processing of gonads for histology | | | | | | | | | | | | |
| Analysis of histological slide | | | | | | | | | | | | |
| Investigation of alternative approach for maturity assessment | | | | | | | | | | | | |
| Data analysis/Parameter estimation | | | | | | | | | | | | |
| Reporting | | | | | | | | | | | | |
| Final Report | | | | | | | | | | | | |

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