

Scoping the Next Generation of Tuna Stock Assessment Software

WCPFC Project P123 Progress Report | WCPFC-SC22-2026/SA-WP01

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Background and Need for New Software

Preparing for the future of WCPFC stock assessments:

- Current software packages, MULTIFAN-CL (MFCL) and Stock Synthesis 3 (SS3), are reaching the end of their innovative development cycles.
- A state-of-the-art successor is required to ensure WCPFC tuna, billfish, and shark assessments remain robust and use the best available science.
- Project 123 Year 3 focuses on delivering core prototype components, proof of concept analysis of skipjack tagging data externally, and proposing a roadmap, structure and funding TOR for the next phase.
- Informed by two international expert online workshops.

Proof of Concept: opal Development

opal (Open Population Assessment Library) provides the foundation:

- `opal` is an R/RTMB-based, modular, and open-source framework developed to provide human-readable code and build a wider user community.
- It successfully demonstrated proof-of-concept on two diverse datasets, including WCPO bigeye tuna and Hawai'i 'Opakapaka
- Next steps for `opal` include code optimization, deriving biological reference points, and adding dimensionality for spatial structure and new likelihood components (e.g., age, CKMR).

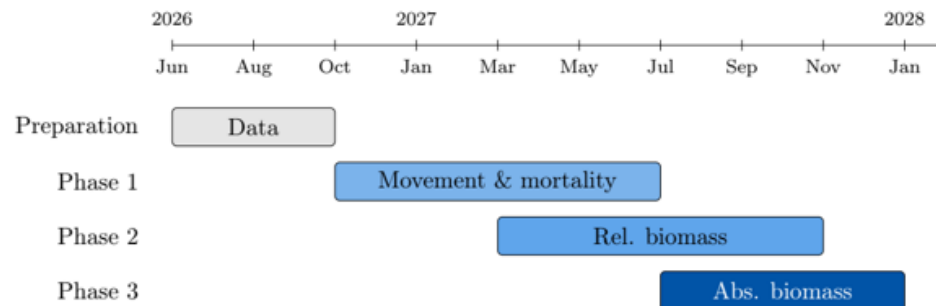
External Skipjack Tagging Analysis

A collaborative effort with the Technical University of Denmark (DTU):

- Analyzed tagging data externally using the `admove` fine-scale spatio-temporal model
- Relaxes mixing assumptions present in large region spatial models.
- Modular and phased: Phase 1 focuses on movement and mortality, Phase 2 on relative abundance, and Phase 3 on absolute biomass.
- Challenges to address: incorporating biological data (length), utilizing fine-scale spatial effort data, and overcoming computational demands.
- Importantly:** still needs to consider reporting rates, and tagging effects, and mixing assumptions are not totally removed.



Stages subject funding



The Case for a Pacific-led Tuna Focussed Approach

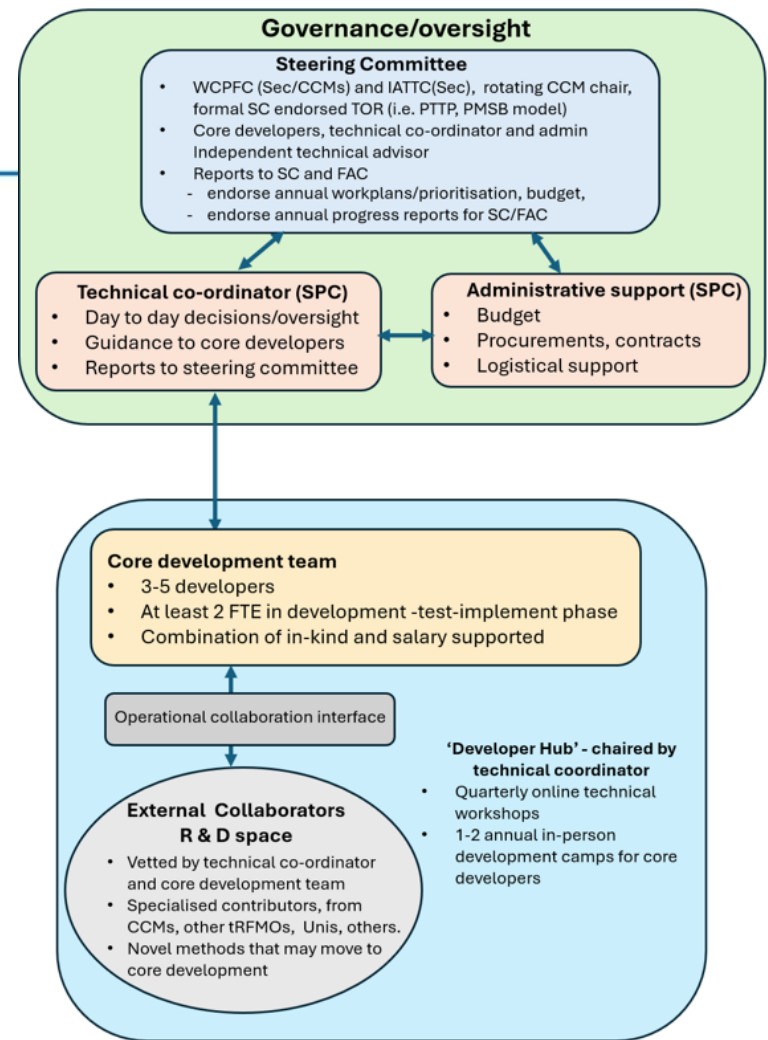
Retaining regional control over assessment software development priorities and timelines is critical:

- A Pacific-led, collaborative approach ensures WCPFC and IATTC maintain direct influence over development priorities, timelines, and features.
- Joining larger external projects (like NOAA's FIMS – i.e. SS3 successor) carries the risk of misaligned priorities and slower timelines for critical WCPFC needs (e.g., CKMR integration).
- Building the software entirely in R/RTMB offers collaborative flexibility and accessibility compared to C++ backends, helping to foster local scientific capacity and a user community.

Proposed Governance Framework

A structured approach for Phase 2 development:

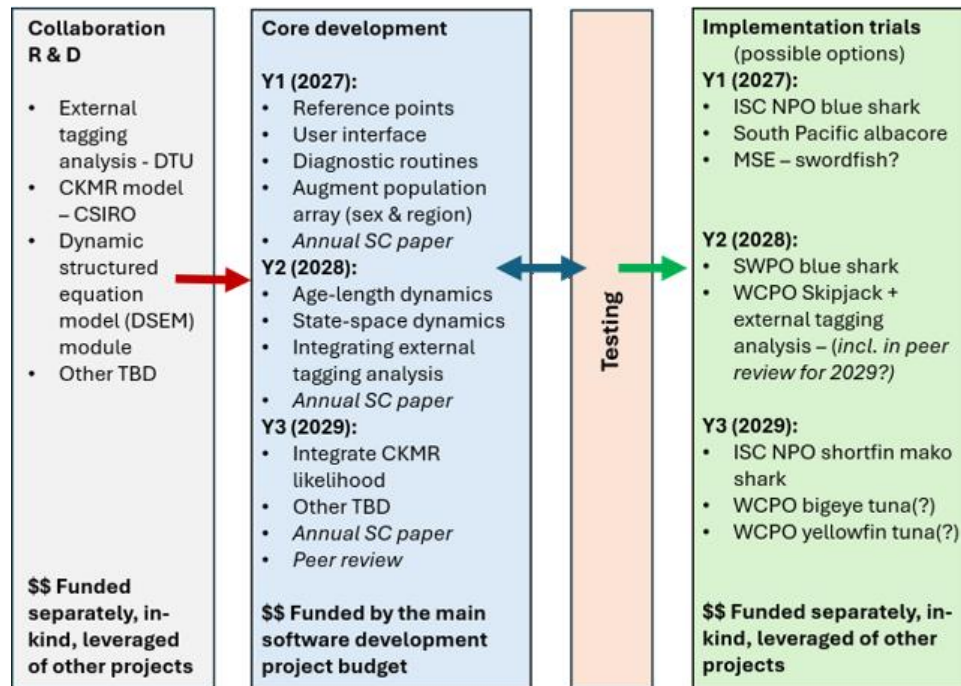
- **Steering Committee:** Provides oversight, progress reporting, and ensures transparency for WCPFC and IATTC.
- **Technical Coordinator & Admin Support:** Based at SPC to oversee day-to-day collaborative development, budgets, and logistics.
- **Core Development Team:** Responsible for building the software, supported by a “Developer Hub” for technical workshops.
- **R&D Space:** For external collaborators to test novel methods (like external tag analysis and CKMR) before moving them into core development.



The 3-Year Workplan (2027-2029)

A “Develop-Test-Implement” strategy:

- The project will run development, testing, and implementation trials simultaneously.
- **Implementation Trials:** The new software will run side-by-side with benchmark MFCL and SS3 assessments to test performance (not yet for management advice).
- This process allows stakeholders to build confidence, identify bugs, and evaluate new model features (e.g., random effects for time-varying selectivity) before full operational adoption.



Proposed Budget Overview

Indicative budgets requiring refinement post-SC22 for WCPFC23 consideration:

1. Core Software Development (3 Years): ~\$1,030,000 USD

- **Years 1 & 2:** \$360k/year (2 FTE Senior Scientists + \$60k operating/travel)
- **Year 3:** \$310k (1.75 FTE Senior Scientists + \$50k operating/travel)

2. External Tagging Analysis with DTU (2 Years): \$220,000 USD

- **Years 1 & 2:** \$110k/year (0.5 FTE Senior Scientist + \$40k operating/travel) - *Note:* collaboration arrangements with IATTC could potentially reduce the funding request to WCPFC?

Funding and efficiency – let's move faster

Why structured funding is critical for success:

- **Dedicated Focus:** Software development of this magnitude is not piecemeal work. It requires dedicated, fully-funded core developers rather than relying solely on part-time or in-kind contributions.
- **Cost-Effectiveness:** Building on R/RTMB and leveraging open-source code (like CCSBT's `sbt`) drastically reduces development time and costs compared to starting from scratch.
- **Strategic Consultancies:** Funds allow the project to bring in highly specialized external expertise (e.g., RTMB optimization, tagging modeling with DTU).
- **Collaborative Leverage:** A funded core allows WCPFC and IATTC to effectively leverage each other's science capacity and technical capabilities.

Requested actions from the Scientific Committee:

- **Note** the significant proof-of-concept achievements of the opal framework and the external tagging analysis.
- **Review and provide feedback** on the proposal for a Pacific-led, collaborative approach to next-generation software development.
- **Review and provide feedback** on the proposed governance framework and the 3-year project workplan.
- Convene an Informal Small Working Group at SC22 to discuss the proposed approaches and funding structures.

Acknowledgement

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