Western and Central Pacific Fisheries Commission

TERMS OF REFERENCE
for
WCPFC Project P123: Scoping the Next Generation of Tuna Stock Assessment Software

BACKGROUND AND NEED

Following the retirement of the lead developer of MULTIFAN-CL (MFCL), Dave Fournier, future advances to the MFCL software are not expected to be as mathematically innovative as they were in the past. While this does not render MFCL obsolete in the medium-term, it flags the need to plan and identify whether alternative existing software exists, or new software must be developed in the longer-term, to continue to support the specificities and future requirements of WCPFC tuna stock assessments.

While MFCL continues to be improved to service the WCPFC tuna assessment needs over at least the next 5+ years, it is important to start on a phased approach to its replacement. An initial scoping phase is required to assess what features and capabilities will be important in future assessment software for tunas. This scoping phase will benefit from input from stock assessment scientists across global tuna RFMOs. Once this scoping phase is conducted, consideration of available software packages in relation to the desired features and capabilities can be conducted. This may identify suitable existing software that has potential to provide the desired features and/or has potential to be developed further. Alternatively, it may indicate whether embarking on development of a new software package is recommended.

There has also been discussion around the need to explore, through modeling/simulation exercises, the benefits of applying alternative assessment structures (i.e., length-age structured versus the traditional length-based age-structured approach of MFCL and Stock Synthesis) before embarking on major software developments or changing methodology. Similar can be said about exploring benefits of state-space models and their use of random variables. Simulation exercises to explore the benefits or drawbacks of alternative model structures or approaches will also require collaboration across tuna RFMOs and experienced practitioners using the alternative approaches and/or software.

An important outcome of this work would be to ultimately have a software package that has the desired functionality for tuna assessments, not only for WCPFC, but globally, thus creating a user community and ongoing development support capacity, so as to avoid the current situation we are facing with MFCL. Wider collaboration in this venture is essential to achieving this and is expected to be encouraged through this project.

OBJECTIVES

The overriding goal of the project is to ensure WCPFC tuna stock assessments remain robust and provide the best available scientific information through the appropriate planning for a state-of-the-art successor to the MULTIFAN-CL assessment software.

SCOPE OF WORK

A. Note the originally proposed TOR for Project 123 in the SC20-GN-WP-06, which is listed below:

Year 2024 (tasks completed or still to be conducted)

1. Review and identify a list of necessary features for software to do tuna stock assessments and identify existing software platforms that have these features or capacity to develop these. (completed)
2. Conduct two workshops with selected experts from other tuna RFMOs and/or with relevant expertise. The first workshop can be remote (prior to SC20) and the second one potentially in person (post SC20). The main goal will be to communicate the scoping project, upcoming model explorations, and succession plans for MFCL and Stock Synthesis, to seek advice from the scientific community, and to seek collaboration with tRFMOs and various research labs. (completed)

Focus on documenting activities

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3. Explore the new RTMB programming environment and how it could be used in future tuna assessments. Specifically, how to modularize and organize code in RTMB models, on one hand code that is specific to one assessment and on the other hand code that is shared between assessments. (August workshop - completed)

4. Establish collaboration with NOAA scientists to explore the feasibility of enhancing the tagging module in Stock Synthesis, making it more similar to the tagging module in MFCL (October meeting, and engagement with the SS3 development team has occurred, SPC staff contributed to review and improvement of the SS3 growth formulation, thus demonstrating a successful collaboration and capacity to contribute to FIMS),

Year 2025

5. Provide support to the stock assessment team transitioning the 2025 swordfish assessment from MFCL to Stock Synthesis. Consider whether any issues identified with the 2024 southwest Pacific striped marlin assessment might be more readily improved by features available in Stock Synthesis that are not available in MFCL.

6. Compare various software platforms using a simplified single-region WCPO yellowfin tuna dataset. The comparison will evaluate available features, run time speed, auxiliary tools, time and skills required to develop and diagnose models, and other characteristics. This task would aim to determine which if any platforms can be considered viable candidates, at least in an interim phase of assessment software transitioning for individual assessments. Gadget/Kyuhan's (SPC in-house age-length models, and SS comparison), age-length, CKMR (albacore).

7. Prepare alternative workplans and budget scenarios for a larger implementing (main) project to go beyond the scoping phase. The scoping project/funds in 2026 could transition into the main implementing project based on the discussions at SC21, budget considerations, and funding availability. It is expected that the work leading up to SC21 will inform the workplan options for the main implementing project and budget estimations.

Provide a clear direction for next year – out 2029.

Strategy- SC21 paper - continue with the current contribution $50 – 60k: some SPC staff, support workshops, collaboration work (DTU and FIMs (split the budget across these)).
Post 2026 – continue with current funds (50-60K -WS/testing etc..), or expand to allow SPC to coding staff time or outsource to DTU (direct)/FIMs (support development) – min 100K – preferable fast track, allows contracts – deliverable. Don't

8. Communicate further with tuna RFMOs and other research labs to establish which RFMOs and labs are willing and able to commit scientist time to collaborate on specific tasks of the scoping project, as well as contribute resources to the main project.

In person workshop – complication with trump.

Emails and responses: CCSBT – happy with Darcy……CKMR…..

9. Communicate with tuna RFMOs and the NOAA FIMS project team to explore the possibility and possible mode of collaboration to develop future tuna assessment models through the FIMS project, specifically by contributing modules (i.e. tagging module) required for tuna assessments.

Other activities – DTU, etc……

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10. Progress report to SC21

Year 2026

To be decided, based on discussions at SC21 and findings from stages 1 through 9.

B. Review and conduct SC20 recommendations on this project (paragraphs 137 – 146, SC20 Summary Report), highlighting the following prioritization of proposed project 123 activities in paragraph 144:
   - **Move the SW Pacific swordfish assessment to Stock Synthesis;**
   - **Move the next SW Pacific striped marlin assessment to Stock Synthesis, if the successor software is not available;**
   - **Explore a variety of models for a simplified single region yellowfin tuna**

dataset; and

- **Explore including the MFCL tagging module into Stock Synthesis (as a lower priority).**

C. Review and conduct the project with the revised 2025 work plan (Attachment E, SC20 Summary Report):
   1) Explore and compare existing platforms, fitting to SPC tuna data,
   2) Determine which platforms can be considered viable candidate and
   3) If a viable candidate platform has been identified, plan transition.

Only billfish – SS3, the key piece of puzzle is tagging analysis and CKMR (albacore). CKMR will not integrated into SS3

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Note that this scoping project should strongly focus on generating collaborative opportunities to work with other agencies/RFMO scientists on finding/developing a suitable software platform for common use in tuna assessments across tuna RFMOs. This is an anticipated multi-year endeavor that may need to adapt as it progresses. Based upon the findings of the work in 2025 and subsequent recommendations from the SC21, further project TORs would be developed to progress the work in following years. Findings would be reported to SC each year.

OUTPUTS AND SCHEDULE

The key outputs of the assignment will be:

1. Submission of paper titles and preliminary abstracts to the WCPFC Secretariat (SungKwon.Soh@wcpfc.int; Elaine.Garvilles@wcpfc.int) by 24 June 2025 (50 days before SC21);
2. Submission of a preliminary progress report for Project P123 to the WCPFC Secretariat by 14 July 2025 (30 days before SC21) and succeeding year (2026), 30 days before the SC22, subject to the funding support by the Commission;
3. Presentation of Project P123 to SC21 in 2025, and to SC22 in 2026 (no travel cost required for the presentation);
4. Submission of a final progress report for Project P123 (2025) to the WCPFC Secretariat by 1 November 2025 and for succeeding year (2026) by 1 November 2026; and
5. Submission of a final report for Project P123 to the WCPFC Secretariat by 31 December 2026 or earlier.