



Scoping the next stock assessment platform

Project 123 progress update and outline of options

**Arni Magnusson, Nick Davies,
Graham Pilling, Paul Hamer**

WCPFC Scientific Committee Meeting (SC20)
Manila, 14 August 2024

Overview

Introduction *background, project outline, existing software, new development*

Possible Tasks *migrate assessments to existing software, model exploration,
software development*

Timeline *PAW 2024, expert meeting 2024, workshops 2024–2026,
launching the main project*

Required Resources *collaboration with other tuna RFMOs,
SPC staff positions & consultants*

The need to migrate to new software

MULTIFAN-CL (MFCL) has been used in SPC tuna assessments since 1990s

MFCL team (Dave Fournier, John Hampton, Nick Davies) retiring in the 2020s

Development of new features is slowing down

Resources are being allocated to succession plans

Migrating all MFCL assessments to other platforms

Shared process, **continuous** communications, **adaptive** strategy

WCPFC – ownership, guidance, and decisions

SPC – conduct and coordinate the work

Also involved: other tuna RFMOs and various research labs

Possibly different software platforms for different stocks

Project outline

This scoping project is scheduled from 1 Feb 2024 to 31 Dec 2026. It will:

- Evaluate features and capabilities that will be important in future tuna assessments

- Explore fitting models to tuna data using existing software platforms

- Guide decisions on what kind of new software development will be required

- Establish collaboration with tuna RFMOs and research labs to achieve these goals

Possible tasks for SPC to prioritize

Subject to SC advice and funding approvals by WCPFC:

- ▶ *Migrate assessments to existing software*
- ▶ *Model exploration using existing software*
- ▶ *Extend existing software*
- ▶ *Design and develop new software for tuna assessments*

2024 project activities

Scoping project launched (Feb)

Pre-assessment workshop (Mar)

International expert meeting (May–Jun)

SC20 discussion (Aug)

Developer workshop (Aug–Sep)

Follow up with tuna RFMOs and research labs (Oct–Dec)

International expert meeting 2024



Invited stock assessment and software development experts from around the world

tuna RFMOs and various research labs

stock assessment software projects, relevant programming environments

Around 40 participants, two sessions covering European and N American time zones

Objectives: communicate, discuss, seek advice and collaboration

Outcomes: **recommendations**, expressed interest in **collaboration** among scientists

Timeline

2024 Scoping project launched
Pre-assessment workshop
International expert meeting
SC20 discussion

2024–2026 Workshops

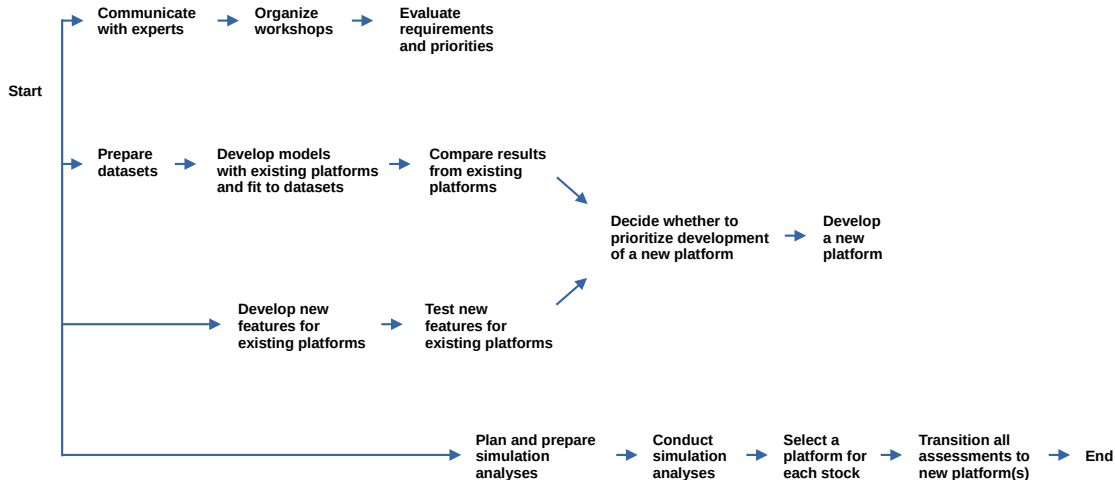
2024–2026 Launching the **main project**

The main project

The current annual budget of project 123 is sufficient for **scoping the needs**, identifying current software platforms, reaching out to the scientific community for consultation, and to conduct occasional workshops to strengthen collaboration ties and initial explorations.

The goal of the **main project**, which could either overlap or succeed the scoping project, is to test/develop tuna stock assessment software and transition all SPC assessments from MFCL to other platforms.

Scoping project (first line) and main project (next lines)



Required resources

The overarching objective of transitioning all WCPFC assessments from MULTIFAN-CL to other software platforms will require a larger project with additional project resources beyond the standard service provision agreement for stock assessments, to allow some staff to focus on model exploration and software development.

Collaboration with other tuna RFMOs

Other tuna RFMOs use primarily Stock Synthesis for tuna assessments, a platform that is also expected to be phased out in the not-too-distant future. Therefore, it would make sense for WCPFC and other tuna RFMOs to coordinate and collaborate in software succession plans and new software development.

Ideally, each tuna RFMO could hire/assign one full-time person to the project for 5 years, or until assessments have been transitioned to the new software.

SPC staff positions and consultants

Compared to the other tuna RFMOs, there is greater urgency for WCPFC to move this project forward.

Independent of decisions and commitments of the other tuna RFMOs, the main project would probably require one staff to be dedicated to this work initially and, depending on the direction taken, an additional staff or consultant with software development skills.

It is likely that transitioning MFCL assessments to other software is at least a 5 year proposition.

Scientific quality and rate of progress

The resources committed to the main project will determine the scientific quality of the end result and the number of years it takes to transition all SPC assessments from MFCL to other platforms.

Now that the first author of MFCL, David Fournier, has retired, it would be highly beneficial for the project to move relatively fast, before the remaining MFCL team (John Hampton and Nick Davies) will retire and no longer be available for consultation and involvement regarding software design, testing and technical decisions.

Summary

Introduction *background, project outline, existing software, new development*

Possible Tasks *migrate assessments to existing software, model exploration,
software development*

Timeline *PAW 2024, expert meeting 2024, workshops 2024–2026,
launching the main project*

Required Resources *collaboration with other tuna RFMOs,
SPC staff positions & consultants*

SC20 discussion

- ▶ Whether SPC should migrate upcoming **billfish assessments** to Stock Synthesis
swordfish 2025, striped marlin 2029
- ▶ Select **scoping project** tasks to prioritize in 2024–2026
from the list of 10 tasks in the report, or other tasks
- ▶ What is needed to launch the **main project** and when
conducting model exploration and software development, TORs, resources

Recommendations from 2024 international expert meeting

1. **Tuna** assessment software

design and develop a model specific for tuna assessments

2. **RTMB** programming environment

lean software development paradigm, maybe a specific model for each species

3. **State-space** formulation

statistically and computationally efficient way to allow time-varying processes

4. **Age-length** structure

explicitly track the population by age and length, if not too costly

5. **Simple** models

short-term staff, young scientists, simple user interface, simpler models

6. **Collaboration** between tuna RFMOs

MFCL and Stock Synthesis in a sunset phase, data analyses comparable between RFMOs

Stock assessment software

Existing software, ready for multi-region tuna assessments

- **Stock Synthesis** is used by IATTC, IOTC, and ICCAT
- **Gadget** has many features relevant for tuna assessments
- **Casal** has many features relevant for tuna assessments

These could be extended further as needs arise

Stock assessment software

Software that could be developed further:

- **sbt** is built around CKMR, currently for single-region assessments
- **ALSCL** is a state-space model that fits length comps, currently no catches
- **WHAM + Length** is a state-space that fits length comps, currently single-region
- **SAM + Length** is an early exploration of extending SAM to fit length comps
- **Stock Synthesis + Enhanced Tags** is a proposed enhancement of the tag module

Stock assessment software

Also relevant:

- **Stock Synthesis + CKMR** is an experimental add-on, not included in core software
- **FIMS**, NOAA project coordinating the development of a next-generation framework

Stock Synthesis

Cons

- expected to be phased out in the not-too-distant future
- fewer features than MFCL

Pros

- + used by IATTC, IOTC, ICCAT, and ISC (and NOAA, ICES, GFCM, etc.)
- + next-generation frameworks will support transitioning from Stock Synthesis
- + facilitates collaboration between the tuna RFMOs, including future development
- + shortens training time for new SPC staff, makes skills and experience transferable
- + large user community, relevant for peer reviews and discussing technical decisions
- + exceptionally complete suite of tools, diagnostics, automated plots and tables

Possible tasks for SPC to prioritize

Subject to SC advice and funding approvals by WCPFC:

Migrate assessments to existing software

1. Move the **swordfish** assessment to Stock Synthesis
relatively simple compared to other SPC assessments
2. Move the **striped marlin** assessment to Stock Synthesis
also relatively simple

stepwise: previous MFCL diagnostic \Rightarrow catch-conditioned MFCL \Rightarrow Stock Synthesis

Possible tasks for SPC to prioritize

Subject to SC advice and funding approvals by WCPFC:

Model exploration using existing software

3. Explore Casal/Gadget/Stock Synthesis/sbt models for **albacore**
simpler than the other tuna species
4. Explore Casal/Gadget/Stock Synthesis models for original **five-region yellowfin** data
test capabilities of platforms: regions, tags, large number of fisheries
5. Explore a variety of models for a simplified **single-region yellowfin** tuna dataset
ALSCL, Casal, Gadget, MFCL, sbt, Stock Synthesis, WHAM+Length

Possible tasks for SPC to prioritize

Subject to SC advice and funding approvals by WCPFC:

Extend existing software

6. ALSCL + Fleets

Fan Zhang (Shanghai Ocean University) and Nick Davies (SPC consultant)

7. Stock Synthesis + Enhanced Tags

Nicholas Ducharme-Barth, Matthew Vincent (NOAA), and Arni Magnusson (SPC)

8. WHAM + Length

Giancarlo Correa (AZTI) and Arni Magnusson (SPC)

9. SAM + Length

Anders Nielsen (DTU), Colin Millar (ICES), and Arni Magnusson (SPC)

Possible tasks for SPC to prioritize

Subject to SC advice and funding approvals by WCPFC:

Design and develop new software for tuna assessments

10. Initial explorations using RTMB

Nick Davies (SPC consultant) and Arni Magnusson (SPC)