SCIENTIFIC COMMITTEE
TWENTIETH REGULAR SESSION

Manila, Philippines
14 – 21 August 2024

Tuna Assessment Research Plan (TARP) for 'Key' Tuna Species Assessments in the WCPO, 2024-2027

WCPFC-SC20-2024/SA-IP-08
27 July 2024

SPC-OFP[1]

[1] Oceanic Fisheries Programme of the Pacific Community

Executive Summary

This paper updates with the latest information previous versions of the Scientific Committee (SC) research plan for improving the stock assessments of 'key' WCPO tuna stocks: WCPO skipjack, bigeye and yellowfin and South Pacific albacore and highlights some important potential research and development areas that SC may wish to consider for submission as SC projects into the meeting's prioritization process.

Every stock assessment performed by SPC-OFP identifies areas for improvement and provides recommendations for future work. Some recommendations are pointers for areas to consider in future assessments. Others indicate key gaps in fishery data and understanding of biology and population structure that, if filled, may reduce both future model misspecification and uncertainty in assessment outcomes. Many of these cannot be directly rectified through improvements to the assessment model alone; ongoing efforts to improve regional fishery data collection and a well-structured and appropriately resourced programme of biological studies that target the areas required to reduce stock assessment uncertainty are needed. Furthermore, many of the enhancements to MULTIFAN-CL and key tuna stock assessments arose through the independent peer review of the bigeye stock assessment undertaken in 2012 (Ianelli et al., 2012) while the 2022 yellowfin assessment review (Punt et al. 2023) identified further recommendations, and relevant issues are captured in this TARP.

Some of this work is undertaken by WCPFC members and the SPC-OFP through specific SC research projects that arise directly from SC discussions on these issues. Other key work is undertaken by WCPFC members or SPC-OFP through other funding sources, and capturing these efforts within the plan will enhance SC's research planning and facilitate the identification of gaps to be filled.

The Scientific Committee tuna assessment research plan aims to:

- More formally capture key research and development recommendations arising from stock assessments;
- Enable SC prioritization of research prior to subsequent assessments of a stock;
- Clearly indicate how ongoing SC Projects support improvements to tuna stock assessments;
- Capture relevant WCPFC-member research on key tuna stocks being undertaken outside WCPFC's direct funding that will contribute to improvements in assessments;
- Allow the SC and Commission to better prioritise the research budget needed for improved assessment advice;
- Identify gaps in funding that can be the subject of proposals external to WCPFC;
- Enable the SC to review activities and progress over time. To this end, an additional table capturing completed elements has been included, with hyperlinks to relevant documentation for reference/auditing purposes.

The plan currently focusses on activities and projects of relevance to key tuna stock assessments. For example:

- Developments to the MULTIFAN-CL assessment platform, including future proofing WCPO stock assessments through the scoping of the next generation of tuna stock assessment software;
- Research into appropriate assessment model specifications;
- Research on biological inputs into stock assessments, the need for which has been demonstrated in all tuna assessments in recent years;
- Data gaps and areas for improved fishery data collection;
- Development of data inputs into stock assessments, for example models used for the standardization of CPUE, tagging information, age at length data etc.; and
- Work undertaken to address specific requests by WCPFC SC members.

The TARP has been reviewed to reflect progress and the latest SC projects, and to capture research and development recommendations identified in the latest adopted tuna assessments, allowing SC to identify key emerging areas, plan activities, and document requests. As with the shark research plan (e.g. Brouwer and Hamer, 2023) and billfish research plan (Brower et al., 2023), the tuna assessment research plan is viewed as a document for SC's focus. Implications for Commission decision making would arise through prioritised budgetary requests.

Development and delivery of the TARP does have implications for and must reflect the available capacity of SC members and the SPC-OFP, balancing the delivery of key stock assessments with the developments planned around those assessments and the budget available. SC may consider the development of an 'urgent and important' matrix to aid prioritization and budgetary discussions, relative to the planned tuna assessment timetable. Planning should take into account the 2-3 year time lag between e.g. SC project prioritization and the delivery of project results for incorporation into stock assessments.

We invite WCPFC-SC20 to:

- Discuss and refine the Tuna Assessment Research Plan.
- Provide feedback on potential gaps in or improvements to the plan, including approaches to better capture SC member activities and plans.
- Consider convening a small working group during SC20 to:
    - assess the TARP and fill identified gaps,
    - identify priority work areas for the development of new SC project proposals for consideration at SC20.
- Task the WCPFC Secretariat, with the assistance of the SSP, to review and update the tuna assessment research plan annually.

Table 1. WCPFC stock assessment schedule for 2024-2027 – 'key' tuna

Species	Stock	Last assessment	2024	2025	2026	2027
Bigeye tuna	WCPO	2023			X	
Skipjack tuna	WCPO	2022		X		
Yellowfin tuna	WCPO	2023			X	
Albacore	S Pacific	2024	X			X

Table 2. Research plan for WCPO 'key' tuna stocks

Shaded cells in the species' section indicate the year of next scheduled assessment. Note that timescales are to be refined/prioritised by SC. 'Lead' is indicative and does not exclude the involvement of any Scientific Committee member. Specific yellowfin tuna (YFT)-peer review research area paragraphs noted in parentheses. With respect to timescale, (X) indicates years in which work is desirable but cannot yet be undertaken without specific funding. For ongoing projects, an X is subject to the decisions of SC and the Commission regarding funding priorities.

Stock/Focus area	Research need	Activity	Funding (incl. SC budget lines)	Timescale				Lead
				2024[1]	2025	2026	2027	
Common across stocks	Improved stock assessment software performance and features suited to WCPFC tuna assessments	Refinement of MULTIFAN-CL: e.g. addressing 1) remaining Ianelli et al. (2012) recommendations (and ongoing testing), 2) addressing relevant outcomes of 2022 YFT assessment review (report Section E3)	Existing WCPFC SC 'additional resourcing SPC' funding line	X	X	X	X	SSP
		Testing of newly developed MULTIFAN-CL features for assessments, with a focus on those to reduce model complexity.	Existing WCPFC SC 'additional resourcing SPC' funding line.	X	X	X	X	SSP
		Explore approaches to capture spatial patterns and variation in biological parameters into assessments	**Not currently resourced**	(X)	(X)	(X)	(X)	TBD

		Continued development and support of features to progress harvest strategy MSE	Existing WCPFC SC 'additional resourcing SPC' funding line	X	X	X	X	SSP
		Investigation of approaches to ensure WCPO assessment software remains fit-for-purpose, including enhancing existing or developing new modelling software	Existing WCPFC SC 'additional resourcing SPC' funding line; SC project 123 **(Additional funding will be required)**	X	X	X	(X)	SSP/SC
	General	Developments to improve model stability and convergence, including alternative model structures and reduced model complexity	Existing 'Scientific Services (SPC)' funding line	X	X	X	X	SPC
	Improved provision of advice	Review and recommend approaches for characterising stock assessment uncertainty	Existing 'Scientific Services (SPC)' funding line, SC project 113b	X				SC
		Identification and approaches to resolve data conflicts affecting assessment outcomes	Existing 'Scientific Services (SPC)' funding line,	X	X	X	X	SSP
		Improved diagnostic presentation approaches for all grid models and ability to characterise output uncertainty	Existing WCPFC SC 'additional resourcing SPC' funding line	X	X	X	X	SSP
	Improved abundance indices	Further development of geostatistical and other relevant approaches for CPUE analyses (E1(6))	Existing WCPFC SC 'additional resourcing SPC' funding line, EU PEUMP project (ends 2024)	X	X	X		SSP/SC
		Proposal for a cross-tuna-RFMO workshop on abundance indices modelling to apply best practice, and to consider approaches for standardisation of size composition data.	**Not currently resourced**	(X)	(X)			SC
		Improved understanding of oceanographic influences related to gear deployment and tuna behaviour (e.g. 'habitat-based models) to inform CPUE modelling	Existing WCPFC SC 'additional resourcing SPC' funding line, EU PEUMP project (ends 2024) **additional**	X	(X)	(X)		SSP/SC

			resources required post 2024					
	Evaluation of model spatial structure	Investigation of tuna stock and sub-population structure (e.g. through genetics, otolith chemistry etc.)	EU PEUMP project (ends 2024); existing SPC resourcing, **additional resources required post 2024**	X	(X)	(X)		SSP
		Examination of data needs to support existing model spatial structures, and re-evaluate spatial structures where necessary to improve model fits	Existing 'Scientific Services (SPC)' funding line, SC Project 117	X	X	X	X	SSP/SC
	Tagging and tag modelling	Examination and review of tagging programme design (WPO, CPO), e.g. cf model spatial structure	SC Project 42, other SPC resources	X	X	X		SSP/SC
		Further investigation of release event-specific tag mixing rates and approaches to better deal with tag mixing assumptions in stock assessment models (E2(7))	SC Project 42, other SPC resources	X	X	X	X	SSP
		Improved data and modelling of release event, shedding and tagging induced mortalities (E1(5))	SC Project 42, other SPC resources,	X	X	X		SSP
		Increase tag seeding experiments to get better estimates of reporting rates (E4(3))	SC Project 42, other SPC resources	X	X	X	X	SSP
		Review of wider options to maximise the utility of tag/recapture data for assessments	Existing 'Scientific Services (SPC)' funding line, EU PEUMP project (ends 2024), SC Project 42	X	X	X		SSP
	Improved cross-stock biological understanding and fishery independent estimates of biomass	Explore utility of close-kin mark-recapture approaches to estimate absolute biomass, spawning biomass and reproductive potential for tuna stocks (see also SPA, below)	EU and SC Project 100c, other SPC resources and additional AU support	X	X			SSP/AU
	Spatial dynamics	Examine ways to formally incorporate the spatial results of explicit movement models (e.g. SEAPODYM, IKAMOANA, archival tags) into assessments	Other SPC resources	X	X	X	X	SSP

	Improved fishery input data	Improved data for WPEA fisheries (E1(7))	NZ-funded WPEA project, NZ SPF project	X	X	X	X	WCPFC Sec/SSP
		Enhanced data collection, auditing and validation processes, incl species ID	Existing SPC resourcing, SC Project 60, SC member activities	X	X	X	X	SC
		Collection of processor (cannery) time series data for the validation of tuna species composition	SC Project 114	X	X			SSP
		Improved accounting for discards and longline depredation losses in stock assessments	**Not currently resourced**		(X)	(X)		TBD
		Enhanced approaches to input data weighting within models	Existing SPC resourcing	X	X	X	X	SSP
		Improved/enhanced collection of logbook and observer longline data, including the use of EM, to improve SC analyses (CPUE standardisation focus)	**Requires WCPFC mandate**	(X)	(X)	(X)		SC
	Biological inputs	Improved length-weight relationship (e.g. E1(8))	SC Project 90	X	X			SSP/SC
		Evaluation of alternative appropriate natural mortality models	Existing SPC resourcing	X	X	X	X	SSP
		Enhanced collection of fish hard parts and measurements from across the WCPO region for all relevant stocks, with a focus on age-length data (E4(6))	SC Project 35b, SC Project 117	X	(X)	(X)	(X)	SSP/SC
		Re-evaluation of and monitoring for non-stationarity in key life history parameters (reproductive biology, growth) for all stocks (see also species-specific areas below)	EU PEUMP project (ends 2024), SC Project 35b, EU and SC funding through Project 120	X	X	X	(X)	SSP/SC
		Further investigation of input size composition data, with review of all size composition data for tuna assessments (E1(1); E1(2); E1(3))	Existing SPC resourcing, **additional resources required**	X	(X)	(X)	(X)	SSP
Skipjack	Biological inputs	Update estimates of reproductive potential (E4(4))	EU and SC funding through Project 120	X	X	X		SSP

		Validate growth and improve growth estimates	Other resourcing, **additional resourcing may be required**	X	(X)	(X)		AU/SSP
		Better understanding of recruitment trends estimated by stock assessment models	SC Project 115	X				
	Fishery inputs	Ongoing development of alternative PS-based CPUE abundance indices	EU PEUMP project (ends 2024) **additional resourcing may be required**	X	X	(X)		SSP
		Evaluation of tagging mortality and school cohesion analyses	Other SPC resourcing, SC Project 42	X	X			SSP
		Better account for effort creep in stock assessment and CPUE indices	EU PEUMP project, SC Project 115 (both end 2024)	X	(X)			SSP/JP/SC
Bigeye	Biological inputs	Age validation and improved growth estimates	(SC Project 105 complete) **Additional resourcing required**		(X)	(X)		TBD
		Epigenetic ageing evaluation	EU and SC Project 100c and additional AU support	X	X			SSP/AU
		Update reproductive biology estimates (E4(4))	EU and SC funding through Project 120	X	X	X		SSP
		Improved weight conversion factors (e.g. G&G to whole wt) (E4(5))	SC Project 90. **Additional resourcing required**	X	X	(X)		SSP/SC
	Fishery inputs	Investigation of effort creep in fisheries used for abundance indices (E2(9))	EU PEUMP project, SC Project 122 (both end 2024)	X	(X)	(X)	(X)	SSP/JP/SC
Yellowfin	Biological inputs	Age validation and improved growth estimates	(SC Project 105 complete) **Additional resourcing required**		(X)	(X)		TBD
		Epigenetic ageing evaluation	Additional resourcing required (not part of SC Project 100c TOR)			X	X	SSP/AU

		Update reproductive biology estimates (E4(4))	EU and SC funding through Project 120	X	X	X		SSP
		Ongoing development of alternative PS-based CPUE abundance indices	EU PEUMP project (ends 2024) **additional resourcing may be required**	X	(X)	(X)		SSP
		Improved weight conversion factors (e.g. G&G to whole wt) (E4(5))	SC Project 90. **Additional resourcing required**	X	X	(X)		SSP/SC
	Fishery inputs	Evaluation of alternative selectivity assumptions	Existing 'Scientific Services (SPC)' funding line	X	X	X		SSP
		Investigation of effort creep in fisheries used for abundance indices (E2(9))	EU PEUMP project, SC Project 122 (both end 2024)	X	(X)	(X)	(X)	SSP/JP/SC
South Pacific albacore	Biological inputs	Sex-specific population modelling	Existing 'Scientific Services (SPC)' funding line		X	X		SSP
		Epigenetic ageing evaluation	EU and SC Project 100c and additional AU support	X	X			SSP
		Utility of close-kin mark-recapture approach for SPA to estimate population size and inform SPA stock assessments	EU and SC Project 100c and additional AU support	X	X			SSP/AU
		Ongoing NZ troll fishery characterisation and CPUE	Undertaken by NZ	X	X			NZ
	Fishery inputs	Investigation of effort creep in fisheries used for abundance indices (E2(9))	EU PEUMP project, SC Project 122 (both end 2024)	X	(X)	(X)	(X)	SSP/JP/SC
		Better understanding of movement rates and connectivity between WCPO and EPO for the South Pacific wide assessments	EU and SC Project 100c and additional AU support	X	X			SSP/AU

[1] Remainder of 2024

Appendix: Completed tasks

Tasks completed since the first draft of the TARP in 2020 are captured here, with relevant references.

Stock/Focus area	Research need	Activity	Lead	Reference
Common across stocks	Improved cross-stock biological understanding and fishery independent estimates of biomass	Review approaches for estimating natural mortality and apply to the four key tuna stocks following the recent CAPAM meeting	SSP/SC	Articles in Fisheries Research
	Tagging and tag modelling	External review of tag/recapture data treatment prior to input into stock assessments	SSP /SC	Online workshop undertaken
		Improved CPUE through archival tagging to define school and behavioural influences	-	Abandoned due to changes in AT production
Skipjack	Spatial dynamics	Updated SEAPODYM Reference model with fully integrated tagging data	SSP	Article in CJFAS
Bigeye	Spatial dynamics	Updated SEAPODYM Reference model with fully integrated tagging data	SSP	SC17-EB-IP-08
	Biological inputs	Age Validation – SC Project 105	US/JP/AU/ SSP	SC17-SA-IP-14a
	Stock Structure	Preliminary Analyses of SKJ structure	USP/ SSP	Article in FMS
Yellowfin	Biological inputs	Age Validation – SC Project 105	US/JP/AU/ SSP	SC17-SA-IP-14a
South Pacific albacore	Biological inputs	Evaluation of alternative growth model formulations	SPC	SC17-SA-WP-02