Western and Central Pacific Fisheries Commission

SCIENTIFIC COMMITTEE
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Project 122a: longline CPUE

Paul Hamer[1] and Mark Maunder[2]

[1] Oceanic Fisheries Programme of the Pacific Community
[2] Inter-American Tropical Tuna Commission

Executive summary

In 2023 WCPFC provided funding support for scoping work on longline effort creep, with a view towards consideration of effort creep importance, analysis methods and scenarios for future tuna assessments that use longline CPUE as indices of stock abundance. Coincident with the project, but unknown at the time, another purse seine and longline effort creep review project was being conducted for the IOTC, and the paper for that project was ultimately also submitted to SC20 (Hoyle 2024, WCPFC-SC20-2024/SA-IP-19). Due to the comprehensive nature of SC20-SA-IP-19, a much-reduced review document was provided under project 122 to SC20 (Day and Hamer 2024, WCPFC-SC20-2024/SA-WP-05). As much of the allocated WCPFC funds were therefore not spent, the SC20/WCPFC21 agreed to extend Project 122 at no cost, as a more general longline CPUE project (Project 122a), consistent with the general need (*Improved abundance indices*) identified in the Tuna Assessment Research Plan (TARP).

The SC20 project 122 paper recommended:
- the remaining resources are utilised in a no cost extension, to pick up incomplete aspects of the current project (engagement with DWFNs) and initiate a collaboration on a broader inter-tRFMO project on challenges and solutions to improve the reliability of CPUE indices for tuna assessments (which is a priority research area in the Tuna Assessment Research Plan).
- Such a project will include effort creep, and we feel it will be more effective to consider effort creep as a component of a broader project considering challenges associated with CPUE abundance indices for tuna.

Since SC20, SPC-OFP has taken a lead role, in collaboration with the stock assessment program lead of IATTC (Mark Maunder), and with technical advice from the author of WCPFC-SC20-2024/SA-IP-19 (Simon Hoyle) to initiate scoping, planning and fund raising for a joint tuna RFMO technical workshop on longline CPUE analysis, to occur in 2026.

Given the recent developments in analytical approaches and their rapid uptake and application it is timely to conduct a global tuna RFMO technical workshop on longline CPUE standardisation. A recent general review of CPUE modelling good practices (Hoyle et al. 2024), provides a strong foundation to dig deeper into the particular challenges of tuna longline CPUE data and their modelling. Discussions among analysts involved in longline CPUE analysis across tuna RFMOs bring up similar concerns, uncertainties and challenges. Reliable CPUE analysis is also important in developing robust harvest strategies as it can be a key component of both their development and operation, including management strategy evaluation (MSE), management procedures and monitoring strategies. All tuna RFMOs have or are in the process of developing harvest strategy-based management. A global tuna RFMO technical workshop would encourage analysts to conduct studies to present to the workshop, discuss the challenges and develop guidelines and good practices to support improved longline CPUE modelling across all tuna RFMOs. The workshop would refocus and drive research, development and collaboration on this critical area of tuna stock assessments.

The efforts to make this workshop a reality over the recent period have involved communications with all tuna RFMOs – targeting science leaders and analysts to gauge interest and support. There is strong interest and *in principle* support across all tuna RFMOs, however, obtaining funding commitments from RFMOs has been challenging and complicated by funding cycles. Various external funding possibilities have since been explored, and this has successfully raised commitments of 75K USD through the generous support of the organisations below:

- International Seafood Sustainability Foundation (ISSF): **20 K USD**
- International Pole and Line Foundation (IPNLF): **5K USD**
- Sustainable Fisheries and Communities Trust (SFACT): **10K USD**
- FAO – via Ocean Foundation (Common Oceans Tuna project): **10K USD**
- Blue Marine Foundation: **10K USD**

Potential additional **20K USD** from the European Union through IATTC, pending application and approvals.

The estimated total funding required is 120K USD, therefore assuming the additional 20K USD from the EU to IATTC, this leaves a further 45K USD to source.

We have also had discussions with the Japanese delegation regarding the hosting of the workshop in Yokohama, supported by the Japan Fisheries Research and Education Agency (FRA). They have offered to assist with support of the workshop hosting in Yokohama. There are alternative options for hosting if this option was to fall through for any reason, such as due to timing etc.

Given the success in raising the base funding we have initiated a workshop steering group (10 people with links to tuna RFMOs, technical expertise and donor organisations), with an initial online meeting held (April 16th 2025) to consider workshop objectives and scope, timing and funding options for 2026.

The attached TOR is to support a request for additional funding from the WCPFC through project 122, and provides more detail on the background, rational, scope and timing options for the workshop.

We invite SC21 to:

- Note progress so far to develop the workshop proposal and raise funds for the joint tuna RFMO workshop on longline CPUE analysis,
- Note the collaboration between SPC (on behalf of WCPFC) and the IATTC stock assessment program leads to drive this initiative,
- Acknowledge the generous funding commitments from non-RFMO organisations,
- Consider and prioritise the attached Terms of Reference for WCPFC22 with a request for a minimum of 20K USD contribution for the calendar year 2026, under the assumption that the outstanding 25K USD for the workshop can be raised from other sources.

Terms of Reference: Global tuna RFMO technical workshop on longline CPUE analysis

Project 122 - extension	Global tuna RFMO technical workshop on longline CPUE analysis to support best available science
Objectives	1. Conduct a comprehensive stocktake and synthesis of longline CPUE standardization approaches across all five tuna RFMOs. 2. Develop and publish technical guidelines specific to tuna longline CPUE analysis, addressing identified issues and gaps in current methods. 3. Provide actionable recommendations for each tuna RFMO to improve CPUE standardization for bigeye, yellowfin, albacore and bluefin tuna assessments. 4. Produce a set of technical peer reviewed papers exploring key issues with tuna longline CPUE analysis and recommended good practices to support best available science on longline abundance indices for tuna RFMOs. 5. Establish ongoing collaboration mechanisms between tuna RFMO CPUE analysts to facilitate knowledge sharing and methodological consistency.
Background and Rationale	**Background** Abundance indices derived from fishery-dependent catch and effort data are central to the stock assessments of tuna and tuna-like species across the world's oceans. They are typically the most important and influential data for the stock assessments of many/most species. If these indices do not represent the 'true' abundance trends, their use in stock assessments can bias status estimates and lead to unreliable management advice. Fishery-dependent catch and effort data from pelagic longline fisheries are the basis of CPUE abundance indices for most tuna stock assessments globally, including yellowfin, bigeye, albacore and bluefin. They are also essential for billfish and shark assessments. In the largest industrial tuna fisheries, managed by five tuna RFMOs (Pacific - WCPFC, IATTC, Indian Ocean – IOTC, Atlantic Ocean – ICCAT, Southern Ocean bluefin tuna – CCSBT), longline fleets comprise thousands of vessels from different flags, fishing over huge areas, with varying operational/gear characteristics and primary target species. The many operational and environmental processes at play can influence the spatial and temporal dynamics of tuna longline CPUE and confound its use as a population abundance index. Analysts are continually challenged to somehow extract the true population abundance from these complex fishery-dependent data. Composition data associated with the indices (and fisheries) are also very important, not only because they ensure that the index is representing the correct component of the population, but because they also provide catch-curve type information on absolute abundance. This is particularly true for composition data from longline fisheries that generally catch large individuals and are often assumed to have asymptotic selectivity. Similar issues to those for standardising CPUE data are encountered when modelling composition data. This should be seen an important

component for developing CPUE based abundance indices, and should be covered in the workshop.

CPUE standardisations model the relationships between observed catch rates and various other variables (covariates) that influence the catchability and local availability of the species. They aim to remove the impact of these other variables so that the remaining CPUE signal reflects the underlying 'true' population abundance trends.

Longline CPUE provides particular challenges, because targeting practices and selectivity can vary over time, even for the same vessel. Different flags/fleets may fish in different areas (e.g., depending on access arrangements to EEZs versus high seas) and these areas can change. Typically, no one fleet covers the full range of a stock, and analysts must often consider how to incorporate data from multiple fleets.

An added complication is combination of large-scale migratory habits and differing vertical habitat usage among species. Longline CPUE data come from diverse fleets, areas and hook depths, depending on the decade, fishing season, and target species. Analysts must consider how the spatial and vertical dynamics of fishing effort affect the CPUE of individual species.

Furthermore, the quality and quantity of longline CPUE data have changed over time due to changes in reporting methods, RFMO requirements, and degree of compliance. Observer data are also now available, which is often richer in operational variables. Analysts must often consider the trade-off between time series length and availability of covariates for CPUE standardisation.

Over the last decade, highly resolved spatiotemporal modelling approaches have been applied to CPUE standardisation. With increased computing power, and spatial reporting of catch and effort data, these methods, including VAST (Vector Autoregressive Spatio-Temporal) and sdmTMB (Spatial Distribution Model using Template Model Builder) have been increasingly applied to large datasets (1,000,000s of observations) of tuna longline catch and effort data, spanning entire ocean basins. However, while they have advantages over the more traditional GLMs and GAMs, they have introduced new challenges that require further technical exploration and guidance. There are considerable risks associated with misuse of both traditional and new methods, and uncertainties remain around how to optimize their benefits.

No single standardisation method works best for all longline catch and effort datasets. The complexity and size of these data sets across multi-fleet tuna fisheries are daunting. Many decisions are required, regarding data preparation, definition of fleets, modelling approaches, covariate selection and ultimately how the CPUE abundance indices are incorporated into the stock assessment model. When combined with the growing complexity of analytical approaches, CPUE standardisation is becoming increasingly expensive in human and computational resources. The levels of expertise and technical rigor have increased beyond the review capacity of most RFMO science committees. Uncertainty about the rigor of alternative analysis methods makes it difficult to resolve technical issues. Independent stock assessment reviews across RFMOs consistently highlight CPUE standardization as a priority area requiring attention, given its key role in influencing stock assessment outcomes.

	Rationale Given the recent developments in analytical approaches and their rapid uptake and application, it is timely to conduct a global tuna RFMO technical workshop on longline CPUE standardisation. A recent general review of CPUE modelling good practices Hoyle et al. (2024), provides a basis to dig deeper into the particular challenges of tuna longline CPUE data and their modelling. Discussions among analysts involved in longline CPUE analysis across tuna RFMOs bring up similar concerns, uncertainties and challenges. Reliable CPUE analysis is also important in developing robust harvest strategies as it is a key component of both their development and operation, including management strategy evaluation (MSE), management procedures and monitoring strategies. All tuna RFMOs have or are in the process of developing harvest strategy-based management. A global tuna RFMO technical workshop would allow analysts to discuss these challenges and develop guidelines and good practices to support improved CPUE modelling across all tuna RFMOs as well as focus and drive research, development and collaboration.
Assumptions	- Tuna RFMOs commit and support the participation of their analysts - Travel restrictions permit international participation - Cofunding partners maintain funding commitments **Suitable Timing:** Option 1: February 2026 (first or last week), pending full funding availability in 2025 Option 2: November 2026 (allows more time for funds to be raised and conduct preparatory work, but may present issues with continued availability of already committed co-funds) Note that a **workshop steering group** has already been formed, with an online meeting convened in April 2025. The group involves technical experts and key people involved with each RFMO.
Scope	This project will support: 1. Convening a 5-day technical workshop on longline CPUE analysis attended by analysts involved in CPUE modelling across all tuna RFMOs, with invited experts in relevant statistical modelling methods. 2. The workshop would cover the key themes: - Fishery structure and data - Analytical methods - Implementation and application in stock assessment 3. The outcomes of the workshop would include: - Peer-reviewed papers compiled for a special theme/issue in Fisheries Research - Synthesis paper reviewing current practices across all tuna RFMOs - Good practices guidelines specific to tuna longline fisheries CPUE analysis - Workshop report with actionable recommendations by RFMO
Timeline	Phase 1 (5 months): Preparation and coordination Literature review and RFMO consultation

	- Participant selection and workshop planning - Venue confirmation and logistics Phase 2 (Workshop): February 2026 (Option 1) or November 2026 (Option 2) Phase 3 (12 months): Follow-up and deliverables - Paper compilation and peer review - Guidelines development - Implementation support
Budget	**Salary** - The project requires a key technically proficient person (consultant) to oversee and coordinate the production of the synthesis/review paper, the paper contributions to the journal issue, and support the co-ordination and development of the technical inputs to the workshop: **60 K USD** - Logistical organisation of the workshop will be provided in-kind through science staff supported by RFMOs and host venue support organisation. The workshop venue is tentatively being supported by Japan Fisheries Research and Education Agency, venue Yokohama. Back-up options are available, but may incur additional costs. **Operational** - Catering for the meeting, **5K USD** - Journal fees, **5K USD** **Contingency** - Unforeseen expenses, travel cost changes etc.**, 10K USD** **Travel** - Flights and subsistence for at least 4 independent experts: **40 K USD** Travel costs for the RFMO analysts would be expected to be covered from their own budgets. In-person attendance is essential, but hybrid sessions could be considered. **Total: <u>120K USD</u>** **Co-funds already committed:** International Seafood Sustainability Foundation (ISSF): **20 K USD** International Pole and Line Foundation (IPLF): **5K USD** Sustainable Fisheries and Communities Trust (SFACT): **10K USD** FAO – via Ocean Foundation (Common Oceans Tuna project): **10K USD** Blue Marine Foundation: **10K USD** Pending application and approval process, European Union, through IATTC: **20K USD** **Outstanding funds requested across tuna RFMOs:** (we propose that this is shared across those RFMOs able to provide funds) - **45K USD** **Quantity requested from WCPFC for 2026:** - **20K USD** (Noting a carryover of approximately 15K USD from the current project 122 will support SPC technical work and travel for the workshop, organisational and logistical support by SPC will be covered under the standard scientific services agreement)