



**TECHNICAL AND COMPLIANCE COMMITTEE
TWENTY-SECOND REGULAR SESSION**
23-29 September 2026
Pohnpei, FSM (Hybrid)

Development of Early Warning Tools to Anticipate Climate-Driven Changes

**WCPFC-TCC22-2026-31
25 August 2026**

Submitted by the Secretariat and SPC-OFP

1. At WCPFC22, following consideration of the Climate Change Vulnerability Assessment, the Commission tasked the Scientific Services Provider (SSP) and the WCPFC Secretariat to explore the development of early warning tools to anticipate climate-driven changes and encouraged CCM support for associated data and resource needs¹. In response to this tasking, the SSP presented [WCPFC-SC22-2026-EB-IP03: "Development of Early Warning Tools and Expanded Climate Impact Assessments"](#), (**Annex 1**) to SC22. The paper outlines existing and emerging work that could contribute to an early warning capability, including ecosystem and climate indicators under Project 121, SEAPODYM modelling, species distribution modelling, and improved climate and ocean forecasting.
2. SC22 considered this work in the context of its broader climate change agenda. SC22 encouraged the SSP to ensure that reporting of ecosystem and climate indicators distinguishes between short-term climate variability, longer-term climate trends, and changes that may instead reflect stock abundance or fishing behavior. SC22 also requested stronger links between Project 121 and fishery indicators, including changes in catch rates, fishing distributions and fish size, to assist in interpreting observed fishery changes in the context of oceanographic variability and longer-term climate change.
3. The [WCPFC Climate Change Workplan](#) (**Annex 2**) provides a complementary role for TCC, including consideration of information arising from the Climate Change Vulnerability Assessment and an annual review of climate change information to provide the Commission with technical advice and recommendations relating to the implementation of, and compliance with, conservation and management measures (CMMs). The workplan further provides for TCC to identify relevant information gaps, necessary analyses, and additional tasks that may assist the Commission in ensuring the long-term sustainability of stocks.
4. Based on this background, **TCC22 is invited to:**
 - **note** WCPFC-SC22-2026-EB-IP03 and the relevant outcomes of SC22;
 - **provide advice**, within TCC's mandate, on data and information needs relevant to the further development of climate early warning tools; and

¹ [WCPFC22 Summary Report](#), paragraph 351.

- **provide advice on practical implementation considerations**, particularly where climate-driven changes may have implications for the implementation, monitoring or compliance aspects of WCPFC conservation and management measures.



**SCIENTIFIC COMMITTEE
TWENTY-SECOND REGULAR SESSION**
11-19 August 2026
Apia, Samoa (Hybrid)

DEVELOPMENT OF EARLY WARNING TOOLS AND EXPANDED CLIMATE IMPACT ASSESSMENTS

WCPFC-SC22-2026-EB-IP03

11 July 2026

Submitted by Simon Nicol¹, Max Gillespie², Campbell Davies³

¹ Pacific Community

² Pacific Islands Forum Fisheries Agency

³ CSIRO

Recommendations

SC22 is advised of the following:

- If the Scientific Committee and Commission wish to develop early warning tools further, it would be efficient to establish an SC project, or revise the ToRs of P121, to facilitate access to WCPFC-held data by project participants (subject to standard WCPFC data request and data confidentiality practices).
- If the Scientific Committee wishes to apply existing tools to incorporate a climate change component into CMM evaluations, it should budget approximately USD 50,000 per evaluation.
- The WCPFC may wish to resource non-RTP countries or territories (e.g. WPEA countries) to participate in RTP-tailored workshops.
- Request the SSP and Secretariat to prepare a more detailed workplan for the development of early warning tools for 2028 and onwards to be considered by SC23.

Early Warning Tools

WCPFC22, as an outcome of their discussions around the Climate Change Vulnerability Assessment, tasked the SSP and the WCPFC Secretariat to explore the development of early warning tools to anticipate climate-driven changes and encouraged CCM support for associated data and resource needs. (paragraph 351 (WCPFC22 Summary Report (11 March 2026))). WCPFC-SC22 is advised that the following activities align with this tasking:

1. Project 121 (Ecosystem and Climate Indicators) implements an annual work program to prepare indicators that track oceanographic climate trends in the WCPFC jurisdiction. These indicators provide WCPFC with the extent and speed of environmental change in the jurisdiction (see **WCPFC-SC22-2026/EB-IP-01**).
2. Project 62 (SEAPODYM simulation modelling) applies the SEAPODYM model to tuna stocks in the WCPFC jurisdiction, principally to explore the impacts of climate change. An outcome of this work provides WCPFC with early warning on the impacts of climate change in the twenty + year time horizon (see **WCPFC-SC22-2026/EB-IP-04**).
3. Climate Science to Ensure Pacific Tuna Access (CSEPTA, Government of New Zealand) was a SPC implemented project to establish the foundations for the Green Climate Fund “Regional Tuna Project (RTP)” - a 7 year investment that assists the Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu with preparing adaptations to maintain the benefits they receive from tuna fisheries (see below). This work has provided a robust framework for preparing species distribution models using WCPFC fisheries data for secondary and bycatch species (see **WCPFC-SC22-2026/EB-IP-11**). These models which are amendable for projecting future climate conditions and integrates animal and fishery dynamics –are well suited to evaluating CMMs performance under the impacts of climate change in addition to providing early warning for these species.

4. The application of the Ecosystem Traits Index (see **WCPFC-SC22-2026/EB-IP-02**), if further developed, will facilitate the simulation of climate change impacts on ecosystem status.
5. The RTP, which commenced in July 2025 with SPC, FFA and CSIRO providing technical support for its implementation. The RTP includes the following early warning work:
 - a. Current impacts of climate change on Pacific tuna resources;
 - b. Estimation of the impacts of climate change on Pacific economies and livelihoods;
 - c. Expand the baselines (from those established under CSEPTA) of climate tolerances for ecosystem and species traits;
 - d. Improved skill in ENSO and ocean state forecasting to twelve-eighteen months;
 - e. Tailored workshops on climate and climate change impacts on tuna and pelagic ecosystems and adaptation options.



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[WCPFC Climate Change Workplan 2024 - 2027](#)¹

WCPFC22-2025-IP07

1 November 2025

¹ Attachment 13, WCPFC21 Outcomes

WCPFC Climate Change Workplan 2024 - 2027

Objective

Using the WCPFC Convention and Resolution 2019-01 as guides, in response to the WCPFC20 Outcomes, and upon review and input from each subsidiary body (SB), this Workplan will inform the Commission's efforts to address climate change impacts on WCPFC fisheries in the Convention Area.

The following sections describe tasks to be taken by the Commission and its SBs to address climate change impacts on WCPFC fisheries in the Convention Area.

A schedule of ongoing and planned activities related to climate change work within the Commission and the Subsidiary Bodies is included.

Commission

- Consider and discuss appropriate ways to incorporate climate change into the work of the Commission and the SBs.
- Consider the information derived from the CMM Climate Change Vulnerability Assessment.
- Identify and discuss appropriate avenues for incorporating climate change resources available outside the Commission into the work of the Commission in support of executing the work of the Commission.
- Enhance cross-RFMO coordination for climate change discussions, especially with IATTC.

Northern Committee

- Coordinate with ISC as it considers how to incorporate climate change advice into management recommendations to NC
- Consideration of climate change impacts on predator-prey interaction, and ultimately on NC tuna stocks. This would include integration of this information to provide advice to NC and Commission, and engagement with other Pacific Fisheries Bodies

Scientific Committee

- Continue the ongoing work with respect to implementing an ecosystem approach to fisheries management (EAFM), including developing the ecosystem indicator report

cards; climate and ecosystem modelling; enhancing information on essential habitats for WCPFC target and bycatch species, and on the potential changes to species interactions and spatial overlap in target and bycatch species

- Continue the ongoing work in the SC to agree to climate indicators to track the impact of climate change and ecosystem changes, and develop a process to provide advice to the Commission on the performance of those indicators and the impact of climate change on WCPFC target stocks, non-target species and other scientific aspects, and continue to update and discuss the Ecosystem and Climate Indicator Report Card annually;
- Continue exploring ways to enhance data collection systems on environmental and climate information to inform the modelling;
- Consider how the SC structure might be updated to facilitate climate change work while still maintaining other core SC functions, and report on these deliberations and any conclusions to the Commission;
- SC to include as part of the standing agenda on climate change a review of available data to inform the Commission on climate change impacts to stocks and ecosystems in the WCPO, and the potential effects of climate change on related fishing activities, including incorporating climate considerations in the development of harvest strategies and management procedures. The annual review of available data should also provide advice and recommendations to the Commission which identifies information gaps, necessary analyses, and any additional tasks that may further enhance the Commission's ability to account for climate change impacts on WCPFC fisheries;
- Coordinate with SPC, ISC and IATTC in continued consideration of how to incorporate climate change advice into stock assessments and associated management recommendations;
- Consider outcomes from the CMM climate vulnerability assessment and discuss appropriate ways to incorporate scientific advice that may assist in future development of CMMs based on the outcomes of the assessment.

Technical and Compliance Committee

- Consider the outcomes and technical information from the CMM vulnerability assessment, and continue to discuss appropriate ways to incorporate climate change into the work of the TCC.
- TCC to annually review climate change information to provide the Commission with information, technical advice and recommendations relating to the implementation of, and compliance with, conservation and management measures
- TCC's annual review of available information to also provide recommendations to the Commission identifying information gaps, necessary analyses, and any additional tasks to ensure the Commission's conservation and management measures contribute to the long-term sustainability of the stocks in accordance with Article 10 of the Convention.

Finance and Administration Committee

- Consider and prioritize any Commission or Secretariat requests for supplementary funds or other resources needed to carry out expanded scientific work or technical assessments associated with climate change.

Science and Management Dialogues and other WCPFC Intersessional Fora

- Addressing climate change is an underlying question for all WCPFC fora, including the 2024 SMD. Include discussions on the incorporation of climate considerations in the development of management procedures for skipjack and South Pacific albacore.

The tasks defined in this Workplan will be adaptive and flexible to respond to the discussions and needs of the Commission and its Subsidiary Bodies.

Schedule of Activities included in the Workplan

Rows in blue are new activities that will require agreement on timeline. In the final column, where no funds are listed, an activity does not need funds to take place.

<u>Schedule</u>	<u>Activity</u>	<u>Project/link to SB workplan</u>	<u>Expected outcome</u>	<u>Overall link to advice to Commission (link to policy)</u>	<u>Responsible/ Funds assigned- available?</u>
2024	Climate change expert workshop	WCPFC Project 121: Ecosystem and Climate Indicators (ECI) + Report cards	Test the candidate ECI, progress and refine these, based on expert feedback	Providing key information for monitoring the pathway through which climate change is manifesting in the WCPO, enabling the ground-truthing of oceanographic models, monitoring which physical properties of the Western and Central Pacific Ocean (WCPO) are approaching climate change induced tipping points, and supporting the inputs to and monitoring of implemented harvest strategies.	SSP Funds available under project 121
2025-2027	Indicator Validation				SC Further funds are required

Annually	Ecosystem and Climate Indicator Report Card to be updated and presented annually to the Commission and its subsidiary bodies. (WCPFC20 request)				SSP
2024-25	Review of existing modelling and data to improve understanding of drivers of trends in the early life history of skipjack tuna in the Western	WCPFC Project 115: Exploring evidence and mechanisms for a long-term increasing trend in recruitment of skipjack tuna in the equatorial Pacific and the development and modelling of	Environmental or technological impact on estimated SKJ recruitment trends, to improve the robustness of future stock assessments and inform skipjack OMs	The analysis of CPUE indices in skipjack stock assessments is vital for informing effective fisheries management policies, as misleading stability in these indices—potentially due to effort creep—could mask declines in stock biomass, leading to unsustainable fishing practices.	SSP

	Pacific Warm Pool	defensible effort creep scenarios Tuna Research Plan			
2024-25	Calibrating and evaluating the precision of epigenetic ageing as a tool for rapid and cost-effective ageing of WCPO key tuna stocks	WCPFC Project 100c: Preparing western and central Pacific tuna fisheries for application of close-kin-mark-recapture (CKMR) methods to resolve key stock assessment uncertainties	Provide an improved understanding of connectivity and adaptive potential and variation, which is increasingly important for understanding how stock biomass will respond to climate change and other changes to environmental conditions.	Accurately estimating absolute spawning biomass is a key challenge in WCPFC stock assessments. Close-Kin Mark-Recapture (CKMR) offers a practical solution, providing not only biomass estimates but also insights into population structure, connectivity, and natural mortality to improve management decisions	SSP Funded under the project

Annually	Identifying sampling gaps in biological data (age & growth) stored within the Tuna Tissue Bank and developing a biological sampling plan to collect age and growth information for key WCPFC tuna species	WCPFC Project 117: WCPFC Tuna Biological Sampling Plan	A structured sampling program is expected to directly translate into stock assessments with more reliable estimates of growth and with sufficient temporal observations to identify how growth may be changing as a function of climate change.	A well-designed and comprehensive sampling plan for collecting biological data (e.g., age, growth) will significantly enhance the accuracy of stock assessments, providing a stronger foundation for informed management decisions.	SSP Funded under the project
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	Identifying sampling gaps in biological data (age & growth) stored within the Tuna Tissue Bank and developing a biological sampling plan to collect age and growth information for billfish species	WCPFC Project 118: WCPFC billfish biological sampling plan. Billfish Research Plan	A structured sampling program is expected to directly translate into stock assessments with more reliable estimates of growth and with sufficient temporal observations to identify how growth may be changing as a function of climate change.	A well-designed and comprehensive sampling plan for collecting biological data (e.g., age, growth) will significantly enhance the accuracy of stock assessments, providing a stronger foundation for informed management decisions.	SSP Funded under the project
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2024-26	Quality checking and resolving issues including collection of samples for estimation of spawning potential through histological analyses of tropical tunas	WCPFC Project 120: Updated reproductive biology of tropical tunas	Establish baselines of reproductive potential for tropical tunas in the WCPO for monitoring the impacts of climate change	Improving the estimation of spawning potential is essential for enhancing the accuracy of stock assessments, which directly informs policy decisions on sustainable harvest strategies and conservation measures. Without reliable data, management policies may be less effective in ensuring the long-term sustainability of tropical tuna stocks, especially in the face of climate change impact	SSP Funded under the project
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2025-26	Exploring new tuna stock assessment software	WCPFC Project 123: Scoping the next generation of tuna stock assessment software	Establish a new WCPFC tuna stock assessment software as a successor to the MULTIFAN-CL	Establishing new software for WCPO tuna stock assessments is essential for informing effective management decisions and policies. Enhanced modelling capabilities of the new software can assist in providing options for sustainable harvest strategies and adaptive management practices, particularly in the face of climate change impacts on the tuna population.	SSP Funds are required
2024-27	Continued enhancements to the SEAPODYM	SEAPODYM (Spatial Ecosystem and Population Dynamics Model)	climate-informed stock assessments	SEAPODYM is integrating biological, ecological, and environmental data to help inform policy decisions by projecting the effects of climate change on tuna distribution and abundance, enabling fisheries managers to have information to support adaptive strategies to ensure the long-term viability of tuna resources in WCPO.	SSP
2024-[27]	Collation and curation of regional	Project 35b: WCPFC Pacific Marine Specimen Bank	Time series of biological samples to underpin	Improved estimation of biological parameters is essential for enhancing the accuracy of stock assessments,	SSP Funded under the project, a 2% annual increase is requested

	marine specimens, including genetic samples.		improvements to inputs to stock assessments and monitoring of climate impacts	which directly informs policy decisions on sustainable harvest strategies and conservation measures. Ongoing collection of reliable data allows monitoring of potential climate impacts and informed advice.	
Annually	Tagging and monitoring of tuna and tuna-like species, collection of marine specimens, including genetic samples.	Project 42: Pacific tuna tagging programme	Time series of biological samples to underpin improvements to inputs to stock assessments and monitoring of climate impacts	Improved estimation of biological parameters is essential for enhancing the accuracy of stock assessments, which directly informs policy decisions on sustainable harvest strategies and conservation measures. Ongoing collection of reliable data allows monitoring of potential climate impacts and informed advice.	SSP Funded under the project
Annually	Updates on international and regional fishery bodies developments related to climate change (paragraph			The Commission will get regular updates on other international and regional fisheries bodies activities and relevant news and information regarding climate change that is valuable for WCPFC to engage with.	WCPFC Secretariat

	20 WCPFC20 Outcome document)				
TBD	Explore mechanisms to test the robustness of existing and candidate management procedures under plausible climate change scenarios within the MSE framework.	Harvest Strategy Workplan		Activity to be discussed and refined by SC. TCC to discuss how to provide advice to the Commission regarding MSE and climate change.	TBD
[202#]	Engagement with other Regional Fisheries Management Organizations	2019-01 WCPFC Resolution on Climate Change	Create a community of practice within the RFB/RFMOs regarding cooperative fisheries	Will inform this workplan, and allow for updates as appropriate.	Commission, Secretariat, SSP, and Members

	ns and the Food and Agriculture Organization and their members to discuss shared challenges, leverage available resources, and identify potential pathways for cooperation on addressing climate change effects on fisheries		management and climate change.		
[2025 - 202#]	CMM Climate Change Vulnerability Assessment		[Identify information GAPS and analysis that need to be further undertaken to understand the implications of	Will provide information for Members consideration on vulnerability to climate change on specific CMM provisions	Consultant with support of Secretariat Funds available through voluntary contributions

			climate change on certain CMM provisions.]		
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