SCIENTIFIC COMMITTEE
NINETEENTH REGULAR SESSION

Koror, Palau
16 – 24 August 2023

ISSUES ARISING FROM THE COMMISSION (SC18 and WCPFC19)

WCPFC-SC19-2023/GN-IP-01

WCPFC Secretariat and SPC-OFP

ISSUES ARISING FROM SC18 (Report paragraphs indicated below)		
Issues	**References**	Outputs/Comments
Data gaps	31. SC18 recommended WCPFC support a project to improve the coverage and quality of purse seine processor data. 32. SC18 recommended the inclusion of tables of the operational level catch and effort data fields for longline, purse seine and pole-and-line gears, as a guideline and without the column of "binding" and adding the title of "Annex 2, guidelines for data submission of operational level catch and effort data fields for fisheries", as an additional ANNEX of the "Scientific Data to be Provided to the Commission", with an additional paragraph under Section 3. Operational level catch and effort data as follows: "Annex 2 provides tables of the guidelines of operational level catch and effort data fields for longline, purse seine and pole-and-line gears in order to clarify and assist members in understanding the requirements of each data field and thereby facilitate the submission of data to the WCPFC." 33. Noting the inconsistency in the data reporting requirements between the Scientific Data to be Provided by the Commission (SciData), and other WCPFC reporting obligations (e.g., in CMMs), and the need to improve the data available for stock assessments, SC18 recommended that the Scientific Services Provider undertake a review of the minimum data reporting requirements and report to SC19 in 2023. SC18 requested CCMs to submit proposals for additional or amended data field, with associated justification, before 30th March 2023. For example, the proposal for including FAD minimum data fields recorded by vessel operators in the SciData which was presented to SC18 should be forwarded to SC19 for consideration.	Agenda 3.1.1 SC19-ST-IP-06 *Progress in improving coverage of cannery receipt data for WCPFC scientific work - Project 114* Revised *Scientific Data to be Provided to the Commission* SC19-ST-WP-01 *Scientific data available to the Western and Central Pacific Fisheries Commission* SC19-ST-WP-05 *FAD Minimum Data Fields to be Recorded by WCPFC Vessel Operators* SC19-ST-WP-03 *Proposal from*

		Australia for additional or amended data fields for collection within WCPFC
Other commercial fisheries for bigeye, yellowfin and skipjack tuna	43. SC18 noted the information provided by Indonesia related to options for a baseline of the "large-fish" handline fishery fishing in Indonesia's EEZ. SC18 observed the decision on this fishery's baseline is a policy decision, and that it did not believe it appropriate to provide any recommendations on a baseline, but recommended the Commission consider the information provided in the relevant SC18 papers and the comments in the SC18 Online Discussion Forum (ODF) on the topic in its decisions making.	Agenda 3.5
General recommendations for WCPFC stock assessments	103. SC18 noted the challenge of fully reviewing the key inputs into WCPFC stock assessments and providing feedback within the time available. SC recommended that approaches that may address this issue be discussed at SC19 and recommended that the Scientific Services Provider develop a discussion paper to inform those discussions. *Model diagnostics* 104. Model diagnostics serve an important function in the stock assessment process. They are integral to the development of a sensible assessment model, and are critical for reviewers to assess whether proposed models are suitable for the provision of management advice. This is especially true at the SC where reviewers have a short period of time to review assessments and obtain clarification from the Scientific Services Provider about areas of concern. 105. Key diagnostics are required for both the diagnostic case model and for models included in the structural uncertainty grid. In the case of 2022 WCPO skipjack SC18 thanked the assessment authors for updating the assessment report to include these diagnostics and note that the Shiny app is a useful tool. However, SC18 also noted a lack of consistency in the level of available diagnostics between assessments of different species. In light of this, SC18 recommended that SC19 consider guidelines for WCPFC stock assessments defining: • The minimum set of diagnostics that should be provided for each model being considered for management advice; • Consideration of the importance and interpretation of alternative model diagnostics depending on how the assessment is used to provide management advice (i.e., single best model vs. ensembles and structural uncertainty grids); • For key input analyses, such as the preparation of standardized indices of abundance, the minimum set of diagnostics that should be included in the supporting working paper or information paper describing the analysis; and • Guidelines for the graphical presentation of diagnostics to ensure legibility.	Agenda 4.7.3 SC19-SA-WP-14 *Options to address time challenges in the review of WCPFC stock assessment inputs*
Research recommendations specific to the WCPO skipjack assessment	106. SC18 identified a wide range of cross-cutting research recommendations for inclusion within the WCPFC tuna research plan for consideration, prioritisation and sequencing at SC19. SC18 noted the research recommendations made in SC18-SA-WP-01 (Stock assessment of skipjack tuna in the western and central Pacific Ocean: 2022) and suggested the following items for consideration as high-priority research areas: • Hyperstability and effort creep in the CPUE indices, and incorporation of CPUE uncertainty in assessment results (i.e. inclusion as an axis in the structural	Agenda 4.3.3.1b SC19-SA-WP-07 *Follow up work on 2022 skipjack assessment recommendations* Agenda 4.7.1 SC19-SA-WP-12 *Project 113: Further*

	uncertainty grid), including alternative model assumptions related to regional scaling • Data conflicts that affect assessment outcomes, and approaches to resolving them. • Review the model specification with the goal of conforming to the set of diagnostic criteria to determine whether an assessment model is suitable to provide management advice. • Assumptions dealing with the parametrization of key model settings, such as the fishing effort regression used in the catch-conditioned approach to minimize their impact on estimates of stock status • Tag mixing, including estimation using observed data, simulation, and simulation validation. 107. SC18 noted the terms of reference (TOR) for Project 18X2a and 18X2b (Further development of ensemble model approaches for presenting stock assessment uncertainty) and Project 18X4 (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 defensible effort creep scenarios) in SC18-GN-IP-07, which would address further issues of importance. 108. SC18 noted additional items that had relevance for both skipjack and wider WCPFC tuna stock assessments considered by the SC and ISC. These and additional items to consider where possible are further detailed below. Items also relevant to the upcoming WCPO yellowfin tuna peer review are denoted with an asterisk (*). i) Indices of abundance: * • Investigate a range of hypotheses which encompass the uncertainties in the spatial-temporal dynamics of the stock and the fishing effort. • Refine effort creep scenarios for the Japanese pole-and-line fishery and equatorial purse seine fisheries. • Develop alternative approaches for the interpolation of abundance into unfished areas when spatially averaging predictions to compute regional scalers. The use of preferential sampling models for standardizing CPUE data should be considered. • Consider the biological limits to the spatiotemporal distribution of skipjack when making predictions of biomass in unfished areas with spatiotemporal models. • Conduct analyses to incorporate additional process error in CPUE indices • Evaluation of alternative sources of CPUE time series, such as FAD echo sounder buoys or additional indices for the purse seine fishery. ii) Data conflicts * • Likelihood profiles show conflict between data sources included in the model. The cause of these conflicts should be identified and methods to address them should be explored.	*development of ensemble model approaches for presenting stock assessment uncertainty* SC19-SA-IP-05 *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 defensible effort creep scenarios: progress update* SC19-SA-IP-07 *Analysis of tag seeding data and reporting rates for purse seine fleets* Agenda 4.7.4 SC19-SA-WP-15 *Draft Tuna Assessment Research Plan (TARP) for 'key' tuna species assessments in the WCPO, 2023-2026*

	iii) Trend in estimated recruitment: • Estimated WCPO skipjack recruitment steadily increased between 1975 and 2010. Possible explanations for this trend should be researched, including model misspecification. If the trend is related to model misspecification options to resolve it within the model should be presented, The SC noted the TOR for Project 18X4 (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 defensible effort creep scenarios) in SC18-GN-IP-07. iv) Recruitment distribution by region and season • Consider the thermal limits to the spatiotemporal distribution of skipjack recruitment within the model settings. v) Growth * • Model diagnostics for each growth curve indicate poor fit to some components of the size data. Given the potential for spatial and temporal growth variation which any assessment cannot represent, recommend approaches to modeling growth and fitting size data that are robust to the potential for bias due to systematic lack of fit. • Support epigenetic aging for skipjack in the long-term while work progressing age validation and age estimation using otolith and spines should still be pursued. vi) Tag mixing * • Examine the utility of alternative approaches for including tagging data in the assessment, such as estimating movement and harvest rate parameters outside the assessment model and including them as priors. • Review evidence for rates of tag mixing based on the tagging data included in the stock assessment. • Consider the role of the Ikamoana simulation model in exploring scenarios of tag mixing, and the need for validation by comparing simulated and observed tag recovery patterns. vii) Tag reporting rates * • Identify approaches to prevent tag reporting rates being estimated on the boundary, as these indicate some form of model misspecification such as incomplete tag mixing or data conflicts. viii) Model structure enabling a converged solution * • Review the model structure as it relates to achieving a converged solution. This includes consideration of the spatial structure as well as confirming that estimated parameters are identifiable and well-determined. Consider the utility of such models for the provision of management advice, including evaluation of relevant CMMs.	

	ix) Specification of the catch-conditioned model * • Estimation of the required fishing mortality spline regression parameters attracted a large penalty in the likelihood and modified population scale. The impact of parameterization on estimated quantities should be examined. x) Dirichlet-Multinomial set-up * • Review grouping assumptions when setting up the Dirichlet-Multinomial likelihood for size composition data, and identify if the model is sensitive to grouping assumptions. 109. SC18 recommended that SC19 consider the need for a review of the skipjack tuna stock assessment taking into account the outcomes of the 2023 yellowfin review.	
Southwest Pacific blue shark (*Prionace glauca*)	151. SC18 noted the following research recommendations to achieve improvement in future shark assessments: (i) Providing more time, either as inter-session projects, or by extending time-frames for shark data analyses. This will allow more thorough investigation of input data quality and trends, which shape assessment choices. In addition, it would allow input analyses to be completed in time to be presented to the SPC's Pre-assessment Workshop prior to the stock assessment. In addition, allowing more time for the assessments themselves will allow a more thorough investigation of alternative model structures, which may include comparisons with low-information methods such as spatial risk assessments. (ii) Increased effort to reconstruct catch histories for sharks (and other bycatch species) from a range of sources. Our catch reconstruction models showed that model assumptions and formulation can have important implications for reconstructed catches. Additional data sources, such as log-sheet reported captures from reliably reporting vessels, may be incorporated into integrated catch-reconstruction models to fill gaps in observer coverage. (iii) Additional tagging be carried out using satellite tags in a range of locations, especially known nursery grounds in South-East Australia and New Zealand, as well as high seas areas to the north and east of New Zealand, where catch-rates are high. Such tagging may help to resolve questions about the degree of natal homing and mixing of the stock. (iv) Tagging may also help to obtain better estimates of natural mortality, if carried out in sufficient numbers. This could be taken up as part of the WCPFC Shark Research Plan to assess the feasibility and scale of such an analysis. (v) Additional growth studies from a range of locations could help build a better understanding of typical growth, as well as regional growth differences. Current growth data are conflicting, despite evidence that populations at locations of current tagging studies are likely connected or represent individuals from the same population.	Agenda 4.5.1 SC19-SA-WP-10 *Data inputs and recommendations for stock assessment approach(es) for silky shark in the western and central Pacific Ocean (Project 108)* Agenda 6.3.2 SC19-EB-WP-06 *Shark research plan 2021-2025 mid-term review (Project 97b)*

	(vi) Genetic/genomic studies could be undertaken to augment the tagging work to help resolve these stock/sub-stock structure patterns. To support this work, a strategic tissue sampling program for sharks is recommended with samples to be stored and curated in the Pacific Marine Specimen Bank.	
Southwest Pacific shortfin mako shark (*Isurus oxyrinchus*)	170. Given some of the fundamental uncertainties highlighted above, SC18 recommended: • Future assessments should spend increased effort to reconstruct spatiotemporal abundance patterns for shortfin mako, and develop a better understanding of how these patterns drive regional abundance indices. • Providing more time, either as inter-sessional projects, or by extending time-frames for shark analyses will allow more thorough investigation of input data quality and trends, which shape assessment choices. In addition, this approach would allow input analyses to be completed in time to be presented to the SPC's Pre-assessment Workshop prior to the stock assessment commencing. Moreover, this will provide more time for the assessments themselves allowing a more thorough investigation of alternative model structures or assessment approaches. • Increased effort should be made to re-construct catch histories for sharks (and other bycatch species) from a range of sources. Our catch reconstruction models showed that model assumptions and formulation can have important implications for reconstructed catch. Additional data sources, such as log-sheet reported captures from reliably reporting vessels, may be incorporated into integrated catch-reconstruction models to fill gaps in observer coverage. • Additional tagging should be carried out using satellite tags in a range of locations, especially known nursery grounds off southeast Australia and New Zealand, as well as high seas areas to the north and east of New Zealand, where catch-rates are high. Such tagging may help to resolve questions about the degree of natal homing and mixing of the stock. • Tagging may also help to obtain better estimates of natural mortality, if carried out in sufficient numbers. This could be taken up as part of the WCPFC Shark Research Plan to assess the feasibility and scale of such an analysis. • Additional growth studies and validation of aging methods from a range of locations could help build a better understanding of typical growth, as well as regional growth differences. Current growth data are conflicting, despite evidence that populations at locations of current tagging studies are likely connected or represent individuals from the same population. • Genetic/genomic studies could be undertaken to augment the tagging work to help resolve the stock/sub-stock structure patterns. To support this work, a strategic tissue sampling program for sharks is recommended with samples to be stored and curated in the Pacific Marine Specimen Bank. • Aggregated data are currently submitted as annual totals for the WCPFC area only, making them uninformative for a stock specific assessment. Therefore, shortfin mako shark aggregated data (and probably other Key Sharks) should be reported by ocean area not simply as WCPO and, where possible, these data should be	Future work Agenda 6.3.2 SC19-EB-WP-06 *Shark research plan 2021-2025 mid-term review (Project 97b)*

	retrospectively corrected. As such we propose that paragraph 1 bullet point 3 of the Scientific Data to be Provided to the Commission should include the following sentence: "For Key Sharks, estimates of annual catch should be separated into catch north and south of the Equator. The WCPFC secretariat should work with CCMs to get these data retrospectively corrected where possible."	
Progress of the peer review	193. SC18 noted that the in-person peer review workshop for the 2020 WCPO yellowfin tuna stock assessment will occur from the 7-13 September 2022 at SPC in Noumea. SC18 agreed that the results of the peer review would be initially considered through the submission of a draft review paper to an online discussion forum later in 2022 with participation by invitation; results of the peer review would subsequently be discussed at the 2023 Pre-assessment Workshop, either by SPC or a peer review panel member, and used to inform the 2023 stock assessment work; and the final peer review outcomes would be presented in a working paper at SC19 by either SPC or, if possible, a peer review panel member.	Agenda Item 4.1 SC19-SA-WP-01 *Independent review of recent WCPO yellowfin tuna assessment*
Characterization of stock assessment uncertainty	194. SC18 noted that, related to the characterization of stock assessment uncertainty, a project Terms of Reference for P18X2 (*Further development of ensemble model approaches for presenting stock assessment uncertainty*) was provided in SC18-SA-IP-09, following the request from SC17, and will be considered by the Commission for funding in 2023.	Agenda 4.7.1 SC19-SA-WP-12 *Project 113: Further development of ensemble model approaches for presenting stock assessment uncertainty*
Bigeye and yellowfin tuna TRP analyses	289. Noting the Commission is scheduled to adopt a TRP for both bigeye tuna and yellowfin tuna in 2022, that the results of the analyses on candidate TRPs for bigeye and yellowfin had been reviewed by SC17 and presented to WCPFC18, and noting that no further analyses had been undertaken since, SC18 was unable to provide any further advice or recommendations to the Commission on this issue and reiterates the advice provided by SC17, as follows (subparagraphs i-v below): (i) SC17 noted that these analyses (see SC17-MI-WP-01) reflected the original request made by SC16, and the additional request by the Commission for additional information. SC17 also noted the usefulness of these updates as they facilitate an improved understanding of multispecies implications of alternative harvest levels. (ii) SC17 noted that impacts on skipjack tuna depletion associated with relative changes to fishing levels to achieve a candidate bigeye tuna TRP are contingent on the proportion of fishing scalars related to purse seine fishing that target skipjack tuna. The relative change in fishing scalars to achieve candidate TRPs assume equal proportionality in purse seine and longline fishing scalars, provided for comparative purposes from the SC16 request. (iii) SC17 noted that the analyses will greatly aid in considering candidate TRPs for bigeye and yellowfin tuna. (iv) SC17 also noted that the risks of breaching the LRPs outlined in the paper are dependent on the treatment of uncertainty in any assessment and may underestimate uncertainty.	Future work Agenda 5.1.3 SC19-MI-WP-07 *Mixed fishery harvest strategy update*

	(v) SC17 recommended forwarding this working paper to the Commission for its deliberations on target reference points for bigeye and yellowfin tuna and that the results be taken into account at the next Tropical Tuna Workshop.	
Skipjack tuna TRP analyses	211. Several CCMs noted that one of the challenges with the specification of absolute depletion-based TRPs is their possible susceptibility to changes in the perception of stock status when successive stock assessments predict different stock trajectories or levels. To counter this, it was recommended the Commission adopt TRPs specified in terms of a reference year, or a set of years. 212. SC18 was informed that the interim TRP for skipjack tuna is 50% of the spawning biomass in the absence of fishing (SBF=0) as set out in CMM 2015-06, and while the TRP is still under review, no agreement had been reached at WCPFC18. 213. SC18 requested the Scientific Service Provider update SC18-MI-WP-09 (Table 2) to include evaluations based on the 2022 skipjack assessment (the Scientific Services Provider noted that this will need to wait until updates to the current software are completed). This update should be performed using the same settings as SC18-MI-WP-09 and include the projected outcomes from a set of candidate TRP options ranging between 40% to 60% depletion ratios and should continue to assess the change in purse seine effort from 2012 levels for the different candidate TRPs, the change in depletion relative to 2018-2021 average levels, as well as the projected impacts on equilibrium yields and the risk of breaching the LRP. 214. SC18 recommended that this update be provided to WFCPF19, and that the Commission take appropriate management action to ensure that the biomass depletion level fluctuates around the TRP (e.g., through the adoption of a harvest control rule).	WCPFC19-2022-10 *Evaluations to support decisions on the WCPO skipjack tuna target reference point based upon the 2022 stock assessment* Agenda 5.1.1 CMM 2022-01 *CMM on a management procedure for WCPO skipjack tuna*
Skipjack operating models	226. Noting the Commission is scheduled to adopt a management procedure (MP) for skipjack tuna in 2022, and the request from WCPFC18 for SC18 to review and recommend an agreed grid of operating models (OMs) that reflect important sources of uncertainty and plausible states of nature for WCPO skipjack, SC18 reviewed SC18-MI-WP-01 (Operating models for skipjack tuna in the WCPO). 227. SC18 noted the settings and configurations of the models that comprise the reference set of OMs for skipjack tuna are working well. While there were some differences, the range of uncertainty in the trajectories of spawning potential depletion estimated by the reference set spanned the results of the 2022 stock assessment, especially in recent years. Noting that stock assessments focus on historical uncertainty while OMs focus on future uncertainty, updating the reference set of OMs to be based on the 2022 assessment was unlikely to result in any changes in the relative performance of candidate MPs. 228. SC18 also noted that the OM grid should not require updating each time a new assessment is accepted unless new evidence is provided that indicates that population	Agenda 5.1.1 CMM 2022-01 *CMM on a management procedure for WCPO skipjack tuna* SC19-MI-WP-01 *Running the management procedure for WCPO skipjack tuna* SC19-MI-WP-02 *Monitoring the WCPO skipjack management procedure*

	dynamics or key uncertainties are substantially outside of the bounds of that encompassed by the OM sets. Such an instance would be covered under exceptional circumstances. 229. SC18 also noted that further expansion of the axes of uncertainty at this time, as suggested by some CCMs, would unlikely change the relative performance of candidate MPs. 230. SC18 agreed to accept the reference set of 96 OMs as currently specified in SC18-MI-WP-01, noting the broad range of uncertainty encompassed by the grid axes, and recommended this reference set be adopted by WCPFC19. 231. SC18 agreed, and recommended to WCPFC19, to provisionally adopt the robustness set of OMs as listed in Table 1 of SC18-MI-WP-01, noting that SC18 also discussed expanding this set of models to include additional uncertainties. These included models that could account for effort-creep in the Japanese pole-and-line fisheries, likely changes on skipjack productivity due to the impacts of climate change, and a lower productivity (lower recruitment) 'stress test'. This further work is an integral part of the MSE and will be presented to SC19 and where possible key elements will be presented to WCPFC19. 232. Noting that the Commission is scheduled to adopt a monitoring strategy for skipjack tuna in 2023, SC18 noted that further discussion will be undertaken at SC19.	
South Pacific albacore TRP	267. SC18 noted the implications of a potential MP to be developed across the South Pacific, particularly with the areas outside of the WCPFC jurisdiction, and sought advice on how an MP that only applied to the WCPO could be developed. The Scientific Service Provider explained that this could be undertaken in a similar manner as done for skipjack tuna, where fishing in WCPO archipelagic waters is not controlled by the MP. The MP would be designed so it only applied to the WCPO, and not to the EPO. 268. Noting the request for additional catch scenarios to inform management options to clarify management objectives, several CCMs suggested a 10% and 20% reduction in catch from the 2017-2019 baseline for consideration. 269. SC18 recommended forwarding this updated working paper to WCPFC19 for its deliberations on alternative target reference points for south-Pacific albacore tuna.	Agenda 5.1.2.1 WCPFC19-2022-15 *Further analyses to inform discussions on South Pacific albacore objectives and the TRP* SC19-MI-WP-03 *Update to further inform discussions on South Pacific albacore objectives and the TRP*
South Pacific albacore operating models	277. SC18 noted the two alternative sets of OMs listed in Table 1 of SC18-MI-WP-05 – one based on the 2018 assessment (WCPO area only) and one based on the 2021 assessment (including the EPO) – but also noted that it was not able to definitively agree on the reference set of OMs for South Pacific albacore tuna because it was necessary for the Commission to decide whether or not to consider the impacts of fishing within the EPO in their decision making. Nevertheless, SC18 agreed to specify an OM grid for both options so there is a clear way forward for this work pending the Commission's decision.	Agenda 5.1.2.2 SC19-MI-WP-04 *Operating models for South Pacific albacore MSE* SC19-MI-IP-03 *An online tool for exploring the South Pacific albacore operating model grid*

	278. SC18 noted the axes of uncertainty currently outlined in each set of OMs and recommended that additional axes be considered for inclusion in each (if practical). For the 2018 grid a movement axis should be considered, while for the 2021 grid the addition of an axis exploring CPUE uncertainty should be considered. For both grids, axes examining effort creep and hyperstability should be explored. 279. One CCM also noted that both options exhibit some retrospective bias and suggested that adjustment of terminal estimates to account for retrospective bias in projections might be included as another axis of uncertainty (i.e., with or without bias adjustment). 280. SC18 sought advice from WCPFC19 on whether the impacts of fishing within the EPO need to be included in a set of OMs for South Pacific albacore tuna, and recommended that both the Science-Management-Dialogue and the Commission note the further additions recommended to the alternative sets of OMs.	SC19-MI-IP-04 *CPUE analyses for South Pacific albacore* SC19-MI-IP-10 *Factors contributing to recent and projected declines in South Pacific albacore stock status*
SP Albacore management procedures	284. Noting the Commission is scheduled to adopt an MP for South Pacific albacore tuna in 2022, SC18 reviewed the progress on developing and testing MPs for South Pacific albacore tuna as outlined in SC18-MI-WP-05 (Progress update and technical challenges for the South Pacific albacore MSE framework). 285. SC18 noted the progress on the development of MPs using model-based approaches (SPiCT) for South Pacific albacore tuna and recommended that candidate HCRs for this species be adapted from those already considered for skipjack tuna. 286. SC18 recommended that both the Science-Management Dialogue and WCPFC19 take note of the progress to date on the development of an MSE framework for South Pacific albacore tuna and that further work is required prior to adoption of an MP.	Agenda 5.1.2.3 SC19-MI-WP-05 *Developing Management Procedures for South Pacific albacore* SC19-MI-WP-06 *Evaluation of candidate management procedures for South Pacific albacore* SC19-MI-IP-02 *Testing and developing estimation models for South Pacific albacore*
Mixed fishery performance indicators	301. Noting the work reviewed by SC17 in developing a multi-species modelling framework for including mixed fishery interactions when developing and testing harvest strategies for the four main WCPO tuna stocks, SC18 reviewed an update on the development of this framework outlined in SC18-MI-WP-06 (Mixed fishery harvest strategy update) and SC18-MI-WP-07 (Mixed-fishery harvest strategy performance indicators). 302. SC18 thanked the Scientific Service Provider for the progress in developing the mixed fishery harvest strategies and noted the encouraging results in including South Pacific albacore in the multi-species modelling framework. However, SC18 also noted that considerable work remains to be completed, such as building a full suite of OMs for bigeye and yellowfin tuna and considering candidate MPs for the tropical longline fisheries. 303. SC18 noted that most of the performance indictors used in the working paper were useful and easy to understand, but also noted that the indicators may need to be separated for fisheries, and the set of performance indicators could be further developed (such as an	Agenda 5.1.3 SC19-MI-WP-07 *Mixed fishery harvest strategy update*

	indicator related to stability and impacts on SIDS). SC18 also noted that the question about what indicators are necessary is generally a management or policy decision. 304. Several CCMs, in noting that the analysis outlined in SC18-MI-WP-07 indicated a larger impact by the purse-seine fleet on bigeye tuna than the impact of the tropical longline fleet, explained that they had not yet agreed on the mixed fisheries MSE framework outlined in this paper (e.g., the order in which the individual MPs are implemented). They suggested, for instance, that a stock status-based approach could be considered while another CCM suggested a stock productivity-based approach may also be considered. However, the difficulty in implementing such approaches was acknowledged. 305. Several CCMs noted they would not be able to support any proposed MP outcomes unless those outcomes are designed to ensure that there is no disproportionate burden transfer. They also noted that it will not usually be possible to achieve all the TRPs at the same time and that there will need to be trade-offs. 306. SC18 supported continuing the work on the development of the mixed fishery MSE framework and recommended that both the Science-Management Dialogue and WCPFC19 take note of the progress to date and provide feedback.	
LRPs for elasmobranchs	332. SC18 noted that no further progress in developing appropriate LRPs for non-target WCPO elasmobranchs has been made since SC17, and that the recommendations and need for further research made by SC17 had been adopted by WCPFC18. 333. Noting the need to appraise a broader range of reference points to assess their applicability to WCPO elasmobranchs, and to avoid undesirable consequences on allowable catch levels of target species, SC18 recommended that SC19 consider reviewing and including the further research identified at SC17 in the WCPFC's Shark Research Plan 2021-2025 (Project 97).	Agenda 6.3.2 SC19-EB-WP-06 *Shark research plan 2021-2025 mid-term review (Project 97b)*
Review of appropriate LRPs for SWP striped marlin and other billfish (Project 104)	336. SC18 noted that no further progress in developing appropriate LRPs for WCPO billfish species has been made since SC17, and that the recommendations and need for further research made by SC17 had been adopted by WCPFC18. 337. SC18 recommended that SC19 consider reviewing and including the further research identified at SC17 in the Scientific Committee's Billfish Research Plan 2023-2027 (Project 18X1 listed in the SC18-GN-IP-07).	Agenda 4.7.5 SC19-SA-WP-16 *Draft billfish research plan (Project 112)*
Ecosystem and climate indicators	345. SC18 noted that the Scientific Services Provider has selected a suite of candidate indicators for monitoring ecosystems and climatic trends across the WCPO. 346. SC18 recommended making "Ecosystem and Climate Indicators" a standing agenda item of the Ecosystem and Bycatch Mitigation theme session. This would provide a mechanism for the Scientific Committee to annually consider adopting candidate indicators	Agenda 6.1 C19-EB-WP-01 *Ecosystem and Climate Indicators* SC19-EB-IP-02 *Green Climate Fund tuna proposal*

	presented to the Committee but also review and respond to existing trends/triggers identified in adopted indicators. 347. SC18 recommended the development and testing of "Ecosystem and Climate Indicators" as a project of the Scientific Committee. This would provide a mechanism for the Scientific Committee to easily track its progress towards evaluating and adopting candidate indicators. 348. SC18 recommended that available information and updates on the impacts of climate change be included or combined with status of stocks reporting.	
Review of potential mitigation measures to reduce fishing-related mortality on silky and oceanic whitetip sharks (Project 101)	361. SC18 recommended the Commission consider revising the Conservation Management Measure for Sharks (CMM 2019-04), taking into account the results of Project 101 and previous studies, which considered several options, including the prohibition of branchlines of wire trace and shark lines, in order to reduce fishing mortality on oceanic whitetip shark and silky sharks in the WCPO.	WCPFC19 adopted CMM 2022-04 *CMM for sharks*
Seabird bycatch mitigation methods	370. SC18 recommended the Commission note a global decline in specific Agreement on the Conservation of Albatrosses and Petrels (ACAP) seabird population trends, which are vulnerable to threats posed by longline fisheries in the WCPO. 371. SC18 recommended the Commission conduct a review of the current seabird mitigation measure (CMM 2018-03) in 2023 or 2024 whereby new bycatch mitigation studies would be evaluated with respect to bycatch mitigation effectiveness and compared against current ACAP Best Practices. 372. With regard to seabird bycatch mitigation, SC18 noted the following: a) Tori-lines have been proven to be an effective and practical means to reduce seabird bycatch in small vessels in the North Pacific; b) Trade-offs between modification of tori-line characteristics, such as the weight of streamers and keeping sufficient aerial extent should be taken into account when designing a tori-line; and c) Recent scientific evidence indicates that the use of blue-dyed bait and offal management are ineffective as seabird mitigation measures, despite being mitigation options in the seabird measure (CMM 2018-03) for the North Pacific.	Agenda Item 6.4.1 Several bycatch mitigation studies, including: SC19-EB-IP-06 *Updated ACAP Advice on Reducing the Bycatch of Albatrosses and Petrels in WCPFC Fisheries* SC19-EB-IP-08 *Global prevalence of setting longlines at dawn highlights bycatch risk for threatened albatross* SC19-EB-IP-10 *Supplemental information for SC18-EB-WP04: Statistical comparison of bycatch mitigation performance with and without streamers in tori-lines for small LL vessels* SC19-EB-IP-11 *CCSBT Multi-year Seabird Strategy and its action plan -- toward establishment of global risk assessment framework of seabird bycatch by tuna longliners* SC19-EB-IP-13 *Update on flesh-footed shearwater tracking and potential areas of bycatch risk* SC19-EB-IP-15 *Mitigation of seabird bycatch in pelagic longline fisheries:*

		Best practice measures, evidence and operational considerations SC19-EB-IP-20 *Tori line experiments on Taiwanese tuna longline fishing vessels in the North Pacific Ocean*
Graphics associated with the Best Handling Practices for the Safe Handling and Release of Cetaceans	380. SC18 noted the *Graphics for Best Practices for the Safe Handling and Release of Cetaceans*[1] and forwarded these to TCC18 and WCPFC19 for consideration and possible adoption.	WCPFC19 adopted: Attachment P, WCPFC19 Summary Report
FAD Management Options IWG issues	383. SC18 noted that in the ODF there was support / no objection to the proposed IATTC definition of biodegradable and categories of biodegradable FADs (paragraph 10, SC18-EP-IP-13). Responding to the Commission's tasks under the CMM 2021-01, SC18 supported the definition of "biodegradable" and several preliminary categories of biodegradable FADs to be considered for its gradual implementation as stated in paragraph 10, SC18-EP-IP-13 and listed below: • "Non-synthetic materials[2] and/or bio-based alternatives that are consistent with international standards [3] for materials that are biodegradable in marine environments. The components resulting from the degradation of these materials should not be damaging to the marine and coastal ecosystems or include heavy metals or plastics in their composition." • The different categories to be considered in this gradual implementation process are (These definitions do not apply to electronic buoys attached to FADs to track them): • Category I. The FAD is made of 100% biodegradable materials. • Category II. The FAD is made of 100% biodegradable materials except for plastic-based flotation components (e.g., plastic buoys, foam, purse-seine corks). • Category III. The subsurface part of the FAD is made of 100% biodegradable materials, whereas the surface part and any flotation components contain nonbiodegradable materials (e.g., synthetic raffia, metallic frame, plastic floats, nylon ropes).	Agenda 6.2.2 WCPFC19 Summary Report: 182. The Commission supported the SC18 and TCC18 recommendations for the IATTC definition of biodegradable and categories of biodegradable FADs. The Commission further noted that the FADMO-IWG will further examine the categories of biodegradable FADs, timeline for the stepwise introduction of biodegradable FADs, potential gaps and other relevant information. 183. The Commission tasked the FADMO-IWG with assistance from the Secretariat and the Scientific Services Provider to review the effectiveness of paragraph 22 of CMM 2021-01 and other FAD related issues and incorporate into its 2023 work plan. SC19-EB-WP-02 *Progress Report of Project 110: Non-entangling and biodegradable FAD trial in the Western*

[1] SC18-EB-IP-12 https://meetings.wcpfc.int/node/16340

[2] For example, plant-based materials such as cotton, jute, manila hemp (abaca), bamboo, or animal-based such as leather, wool, lard.

[3] International standards such as ASTM D6691, D7881, TUV Austria, European or any such standards approved by the WCPFC CCMs.

	• Category IV. The subsurface part of the FAD contains non-biodegradable materials, whereas the surface part is made of 100% biodegradable materials, except for, possibly, flotation components. • Category V. The surface and subsurface parts of the FAD contain nonbiodegradable materials. 384. SC18 noted that these categories are preliminary and will be further examined by the FADMO-IWG, SC, TCC for Commission's consideration. 385. SC18 further recommended to the Commission that the FADMO-IWG continues its work on exploring a timeline for the stepwise introduction of biodegradable FADs, potential gaps/needs and any other relevant information for Commission's consideration. SC18 noted that the FADMO-IWG may seek advice from SC and TCC.	*and Central Pacific Ocean* SC19-EB-WP-03 *FAD materials*
WPEA Project Update	388. SC18 noted the WPEA-ITM Project Update (SC18-RP-WPEA-01) and: a) recommended extending the initiative into 2024 at "no cost" due to current allocated budget underspend, which will mean most, if not all, of the WPEA-ITM activities will be completed; and b) recommended development of a new project proposal for the next phase of WPEA work that is relevant to the WCPFC, to begin immediately after the current WPEA-ITM project expires.	Agenda 7.3 WCPFC19 Summary Report: 436. WCPFC19 adopted the Summary Report of SC18 (WCPFC19-2022-SC18) and endorsed the recommendations not covered under other agenda items (WCPFC19-2022-29 rev 1.)
SPC – 2023 scientific services	394. SC18 recommended the proposed work program and budget for 2023 and indicative budget for 2024 – 2025 together with CCM's priority scores to the budgeted projects in Table WP-01 to the Commission.	Refer to Attachment AA (*FAC16 Summary Report as adopted by the Commission*), WCPFC19 Summary Report

ISSUES ARISING FROM WCPFC19
(Report paragraphs indicated below)

Issues	References	Outputs/Comments
Review of results from the FAD Management Options IWG	181. WCPFC19 noted with appreciation the report of the Chair of the FAD Management Options IWG (WCPFC19-2022-FADMgmtOptions). 182. The Commission supported the SC18 and TCC18 recommendations for the IATTC definition of biodegradable and categories of biodegradable FADs. The Commission further noted that the FADMO-IWG will further examine the categories of biodegradable FADs, timeline for the stepwise introduction of biodegradable FADs, potential gaps and other relevant information. 183. The Commission tasked the FADMO-IWG with assistance from the Secretariat and the Scientific Services Provider to review the effectiveness of paragraph 22 of CMM 2021-01 and other FAD related issues and incorporate into its 2023 work plan.	Agenda 6.2.2 SC19-EB-WP-13 *Progress of the FADMO-IWG Priority Tasks for 2023* SC19-EB-WP-05 *FAD tracking data update*
Baseline period or limit of the Indonesian Large Fish Handline Fishery	192. WCPFC19 noted the delegation paper submitted by Indonesia and the Scientific Services Provider on the Indonesian large fish handline fishery (WCPFC19-2022-DP11). There was no agreement to adopt the recommendation in the paper and WCPFC19 noted that it would appreciate receiving further information from Indonesia in response to questions raised at WCPFC19.	Agenda 3.5

NP striped marlin	267. WCPFC19 noted that a proposed CMM on North Pacific striped marlin was deferred until 2023 and expressed concern regarding the continued delay in the rebuilding plans for the stock.	Agenda 4.6.1 SC19-SA-WP-11 *Stock Assessment Report for Striped Marlin (Kajikia Audax) in the Western and Central North Pacific Ocean through 2020*
Seabird Mitigation (CMM 2018-03)	329. WCPFC19 agreed to conduct review of the current seabird mitigation measure (CMM 2018-03 Conservation and Management Measure to mitigate the impact of fishing for highly migratory fish stocks on seabirds) in 2023 or 2024 whereby new bycatch mitigation studies would be evaluated with respect to bycatch mitigation effectiveness and compared against current ACAP Best Practices.	Agenda 6.4.2 SC19-EB-IP-16 *Proposed scope and process for the seabird CMM 2018-03 review* SC19-EB-IP-06 *Updated ACAP Advice on Reducing the Bycatch of Albatrosses and Petrels in WCPFC Fisheries*
Ecosystem and climate indicators	342. WCPFC19 endorsed the following recommendations of SC18 relating to climate change: i. SC18 recommended making "Ecosystem and Climate Indicators" a standing agenda item of the Ecosystem and Bycatch Mitigation Theme session. This would provide a mechanism for the Scientific Committee to annually consider adopting candidate indicators presented to the Committee but also review and respond to existing trends/triggers identified in adopted indicators. ii. SC18 recommended the development and testing of "Ecosystem and Climate Indicators" as a project of the Scientific Committee. This would provide a mechanism for the Scientific Committee to easily track its progress towards evaluating and adopting candidate indicators. iii. SC18 recommended that available information and updates on the impacts of climate change be included or combined with status of stocks reporting. 343. Recognizing the urgency of developing a comprehensive approach to understanding and addressing the impacts of climate change on highly migratory fish stocks in the Convention Area, and any related impacts on the economies of CCMs and food security and the livelihoods of their people, in particular Small Island Developing States (SIDS) and Participating Territories, the Commission agrees to include Climate Change as a standing agenda item and to prioritize discussion of how best to incorporate climate change information and analyses in its work, as well as the work of TCC and the NC.	Agenda Item 6.1 Ecosystem and Climate Indicators SC19-EB-WP-01 *Ecosystem and Climate Indicators* SC19-EB-IP-02 *Green Climate Fund tuna proposal*
Other SC18 Recommendations	434. WCPFC19 endorsed the SC18 recommendation that the inclusion of tables of the operational level catch and effort data fields for longline, purse seine and pole-and-line gears, as a guideline and without the column of "binding" and adding the title of "Annex 2, guidelines for data submission of operational level catch and effort data fields for fisheries", as an additional ANNEX of the "Scientific Data to be Provided to the Commission", with an additional paragraph under Section 3. Operational level catch and effort data as follows:	Revised *Scientific Data to be Provided to the Commission*

	"Annex 2 provides tables of the guidelines of operational level catch and effort data fields for longline, purse seine and pole-and-line gears in order to clarify and assist members in understanding the requirements of each data field and thereby facilitate the submission of data to the WCPFC." (Attachment N)	