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Progress against the 2023-2027 Billfish Research Plan - 2024

WCPFC-SC20-2024/~~SA~~-IP-09 [rev2](#)
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Revision 2

This revision includes updates to budget for *Biology project 2: Biology of South Pacific striped marlin, blue marlin, black marlin, shortbill spearfish and sailfish in the WCPO from longline fisheries.* There was no budget provided for this project in the previous versions of this document.

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Introduction

The report of Project 112 (Billfish Research Plan 2023-2027 (Brouwer and Hamer 2023)) was adopted by SC19 and endorsed by WCPFC20 in December 2023. The 2023-2027 Billfish Research Plan (BRP) is the 1st phase of the WCPFC's BRP. The 2023-2027 BRP is a living document that can evolve based on the information needs and priorities of the WCPFC. When reviewing the BRP the SC19 recommended that the BRP be extended to 2030 with short annual reviews to evaluate the progress and ensure that the next years' work remains relevant and required.

The purpose of this document is to review progress against the BRP tasks to facilitate future planning of WCPFC billfish research. The project list are included in Table 1. In addition, Table 2 is provided to update the Scientific Committees assessment schedule for billfish. It is suggested that data rich assessments be undertaken for blue marlin; striped marlin; and swordfish, with standardised CPUE analyses and fishery characterisations for black marlin, sailfish and shortbill spearfish. At SC19 the ISG-Billfish suggested that prior to beginning any assessment or analysis of these species it is important to develop conceptual models for these species, and identify the most appropriate assessment approaches. The ISG-Billfish proposed that this characterisation/conceptual modelling work could take place in 2025, and development of the ToR for this work was deferred until SC20.

For SC20 two projects have been completed, Stock assessment of Southwest Pacific striped marlin (SC20-SA-WP-03, SC20-SA-WP-12 and SC20-SA-WP-13) and the development of a statistically robust sampling plan for billfish (SC20-SA-IP-13). Two papers were submitted to SC20 that fall outside of the BRP; a rebuilding plan for WCPO striped marlin (SC20-SA-IP-15) and a CPUE analysis of the New Zealand recreational fishery for striped marlin (SC20-SA-IP-~~17~~~~XX~~). [At the SC20 ISG-billfish an additional project was added "Developing a management procedure for southwest Pacific swordfish" Australia intends to fund this work.](#)

There are four new projects scheduled to start in 2025 pending agreement at the SC20 ISG-Billfish and approval of the budget by WCPFC21. The new projects have a draft project specification included in Appendix 1 for review by SC20 ISG-Billfish.

Recommendations

1. SC20 ISG-Billfish review the work plan and project list for the 2024/25 year, and make recommendations to SC20 for any changes the SC may want to consider.
2. SC20 ISG-Billfish review the project specifications and make any changes for SC20's review.

References

Brodziak, J. 2024. Rebuilding Plan Scenarios for the Western and Central North Pacific Ocean Striped Marlin Stock in 2024. SC20-SA-IP-15.

Brouwer, S. and Hamer, P. 2023. Billfish research plan 2023 – 2027. SC19-SA-WP-16.

Holdsworth, J. C. 2024. Striped marlin catch and CPUE in the New Zealand sport fishery, 2019-20 to 2021-22 SC20-SA-IP-~~XX~~~~17~~.

ISC. 2024. Western and Central North Pacific Striped Marlin Assessment Consensus Peer Review SC20-SA-WP-12.

SPC-OFP. 2024. WCPFC Billfish Biological Sampling Plan. SC20-SA-IP-13.

Relevant recent publications from outside of the WCPFC

Bolin, J., Evans, K., Schoeman, D., Spillman, C. M., Moore, T. S., Hartog, J. R. Cummins, S. F., Scales, K.L., Vanalderweireldt, M.R., Sandolo, F. and Durieux, E.D.H. 2023. Age estimates derived from hard parts of swordfish *Xiphias gladius* from the north-western Mediterranean Sea. <https://doi.org/10.1111/jfb.15558>.

Rosa, D., Mosqueira, I., Fu, D. et al. 2023. Management strategy evaluation operating model conditioning: a swordfish case study. *Rev Fish Biol. Fisheries*. <https://doi.org/10.1007/s11160-024-09868-w>.

Tracey, S. Pepperell, J. and Wolfe, B. 2023. Post release survival of swordfish (*Xiphias gladius*) caught by a recreational fishery in temperate waters. *Rev. Fish Biol. Fisheries*. <https://doi.org/10.1016/j.fishres.2023.106742>.

Tracey, S.R., Wolfe, B.W., Hartmann, K. et al. 2023. Movement behaviour of swordfish provisions connectivity between the temperate and tropical southwest Pacific Ocean. *Sci Rep* 13, 11812. <https://doi.org/10.1038/s41598-023-38744-z>

Table 1: The 2021-2030 billfish work as agreed at SC19, and updated for 2024.

1. Stock assessment				
Title	Priority	Start year	End year	Comments
Assessment 1) North Pacific striped marlin stock assessment	High	2023	2023	Completed (2023)- assessment accepted by SC19 (SC19-SA-WP-11 and SC20-SA-WP-12)
Assessment 2) Southwest Pacific striped marlin stock assessment	High	2024	2024	Completed (2024)– to be evaluated by SC20. SC20-SA-WP-03 and SC20-SA-IP-06
Assessment 3) North Pacific swordfish stock assessment	High	2023	2023	Completed –(2023) assessment accepted by SC19 (SC19-SA-WP-09)
Assessment 4) Southwest Pacific swordfish stock assessment	High	2025	2025	Previous assessment successfully conducted by the SPC. Draft project specification in Appendix 1.
Assessment 5) Pacific blue marlin stock assessment	High	2026	2026	Previous assessment successfully conducted by the ISC
Assessment 6) Stock assessment approaches for WCPO black marlin, sailfish and shortbill spearfish	Medium	2025	2025	Develop conceptual models for each species to identify appropriate modelling approaches for low catch low information assessments. Draft project specification in Appendix 1.
CPUE analysis of the New Zealand recreational fishery for striped marlin		2028	2029	This work should be done in time so that these outputs can be included in the next SP striped marlin assessment (2029). Funded by New Zealand. This work is unprioritized as it was not on the project list during the SC19 prioritisation process.

2. Biology				
Title	Priority	Start year	End year	Comments
Biology 1) Development of a statistically robust sampling plan for the collection of fisheries dependent biological samples (by sex), including but not limited to age, size frequency data, and genetic samples for WCPO swordfish (north and south).	High	2024	2025	Completed (2024)- (SC20-SA-IP-13)
Biology 2) Biology of South Pacific striped marlin, blue marlin, black marlin, shortbill spearfish and sailfish in the WCPO from longline fisheries.	High	2025	2028	Collect samples (fin spines and otoliths) and then undertake age growth and reproductive analyses to get growth and maturity parameters to inform productivity rates of this species. Length-weight and length-length conversion factor data collection for

				SP striped marlin. Draft project specification in Appendix 1.
Biology 3) Undertake directed longitudinal tagging of Southwest Pacific swordfish to reduce the uncertainty in movement rate.	High	2025	2027	Draft project specification in Appendix 1. The ISG-billfish proposed that SC20 cancel this project as SPC does not currently have the capacity to undertake this work.

3. Harvest strategies

Title	Priority	Start year	End year	Comments
Harvest Strategy 1) Developing a management procedure for southwest Pacific swordfish.		2025	2028	Project to develop candidate management procedures for southwest Pacific swordfish through management strategy evaluation. [Commission funding not sought in 2025].

Table 2: Billfish stock assessment table. Note this includes all assessment types from data rich to low information assessment models. The assessment type will be determined by the SC ISG-Billfish for each successive year. Billfish assessments are currently scheduled 5-yearly, but 4-yearly for swordfish. A = Assessment; L/C = Low information assessment or characterisation.

Species	Stock	Last assessment	2022	2023	2024	2025	2026	2027	2028	2029	2030
Striped marlin	N Pacific	2023		A				A			
	SW Pacific	2019			A					A	
Swordfish	N Pacific	2023		A					A		
	SW Pacific	2021				A				A	
Blue marlin	Pacific	2021					A				
Black marlin	WCPO	Never					L/C				
Sailfish	WCPO	Never					L/C				
Shortbill spearfish	WCPO	Never					L/C				

Appendix 1 – Draft project specs for 2024/25 projects for evaluation and completion by SC20 ISG-Billfish

Project xxx	Southwest Pacific swordfish stock assessment
Objectives	Undertake a stock assessment of southwest Pacific swordfish
Notes	This project received a high priority rating at SC19.
Rationale	<p>This stock was last assessed in 2021 (WCPFC SC17-2021/SA-WP-04) using data from 1952-2020.</p> <p>Since the last assessment, more catch and effort data as well as observer data are available. It has been four years since the last assessment.</p> <p>This project is designed to assess the stock status of southwest Pacific swordfish using the most informative approach with respect to the available data. The assessment should assess the stock status against conventional stock assessment metrics as well as those listed SC19-SA-WP-16 Tables 4 and 5 when reporting assessment results, noting that for some of the metrics listed, specific percentage values are undefined, and providing some guidance on these to the extent possible, could be helpful.</p>
Assumptions	<ul style="list-style-type: none"> • Much of the existing fisheries and biological data are readily available from the WCPO. • Assessment personnel are available to undertake this work.
Scope	<ul style="list-style-type: none"> • Reviewing the previous assessment in the WCPO to assess and improve on methods to increase the understanding of data strengths and weaknesses, and update stock status. • Update WCPO longline catch estimates and abundance indices using recent observer and logbook operational data. • Present the stock status in terms of the metrics outlined in SC19-SA-WP-16 Tables 4 and 5. • Prepare a report containing the above results for SC21.
Timeframe	March 2025 – August 2025
Budget	0.8 FTE (\$90,000 – 2025) Travel to SC21 (\$10,000) Total: \$100,000
References	WCPFC SC19-2023/SA-WP-16 WCPFC SC17-2021/SA-WP-04

Project xxx	Assessment approaches for WCPO black marlin, sailfish and shortbill spearfish
Objectives	Determine the most appropriate modelling/assessment approach(es) to evaluate the stock status and trends for low information billfish species.
Notes	<p><u>At SC19 heads of delegations were surveyed SC19 survey respondents were asked to rank projects within the Billfish Research Plan (BRP) this work was given a medium priority within the BRP. This project was rated as a medium priority at SC19.</u> This project would need to be completed prior to any low information assessments being attempted for black marlin, sailfish and shortbill spearfish.</p>
Rationale	Develop conceptual models and data reviews for each species to identify the appropriate modelling or other assessment approaches for each species/stock considering their low catch and relatively low level of biological information.
Assumptions	<ul style="list-style-type: none"> • Much of the existing fisheries and biological data are readily available from the WCPO. • Assessment personnel at SPC or suitably qualified consultants are available to undertake this work.
Scope	<ul style="list-style-type: none"> • Review approaches that have been undertaken on low information billfish and other stocks within and outside of the WCPO to assess potential methods that could be used with the data and information available. • Suggest improvements to increase the data, understanding of the data, enhance the biological information and improve the likelihood of success in evaluating stock status for each species. • Prepare a report containing the above results for SC21.
Timeframe	March 2025 – August 2025
Budget	0.3 FTE (\$30,000 – 2025) Travel to SC21 (\$10,000) Total: \$40,000
References	

Project xxx	Biology of South Pacific striped marlin, blue marlin, black marlin, shortbill spearfish and sailfish in the WCPO from longline fisheries. [if SPC and the ROP are doing this work do we need a project spec?]
Objectives	Collect biological samples from billfish in the WCPO and analyse them to get estimates for growth and maturity.
Notes	At SC19 heads of delegations were surveyed SC19 survey respondents were asked to rank projects within the Billfish Research Plan (BRP) this work was given a high priority within the BRP. This project was given a high priority at SC19
Rationale	Collect samples (fin spines and otoliths, maturity stages) and then undertake age growth and reproductive analyses to improve growth and maturity parameters to inform productivity rates of this species. Length-weight and length-length conversion factor data collection for billfish to improve conversion factor information across all five species.
Assumptions	<ul style="list-style-type: none"> • Observers can be trained and deployed to collect these data in the relevant areas, noting the difficulty in extraction of otoliths from billfish. • Materials can be sent back to SPC for analysis.
Scope	<ul style="list-style-type: none"> • Use the results from SC20-SA-IP-13 to plan the spatio-temporal data collection. • Ensure that data collection is stratified across the WCPO and cover all sex and size classes for each species. • Collect fin spines, otoliths, maturity stages information from billfish. • Collect length-weight and length-length conversion factor data for all billfish. • Undertake age and growth and reproductive analyses to inform productivity rates of this species. • Present annual updates to the SC in 2025, 2026 and 2027; and a final report in 2028.
Timeframe	2025-2028
Budget	0.4 FTE (\$40,000 – 2025) Total: \$40,000 Project funds to incentivise observers for spine collection at USD20/fish ??? is this covered by P35b Pacific Marine Specimen Bank
References	SC20-SA-IP-13

Project xxx	Undertake directed longitudinal tagging of Southwest Pacific swordfish to reduce the uncertainty in movement rate [if SPC and the ROP are doing this work do we need a project spec?] [and genetic sampling]
Objectives	Get better estimates of longitudinal movement and stock structure of Southwest Pacific swordfish
Notes	<p>At SC19 heads of delegations were surveyed SC19 survey respondents were asked to rank projects within the Billfish Research Plan (BRP) this work was given a high priority within the BRP.</p> <p>This project could be redrafted as a stock structure project which could be addressed through CKMR. It may be more useful to have a CKMR scoping study/pilot project for SWPO swordfish as an initial phase (to develop the sampling strategy, potentially piggy backing on the sampling infrastructure that has already been put in place for SPO albacore).</p>
Rationale	<p>SC17 noted the significant unresolved uncertainties exist in the stock assessment including those relating to the reliability of CPUE indices, longitudinal movements, spatial connectivity and absolute population size. The SC17 recommended that research priorities for this stock include directed longitudinal tagging of swordfish.</p> <p>The 2021 SWPO swordfish stock assessment report suggested that paired genetic and tagging across the south Pacific (e.g., samples and tags across French Polynesia, Cook Islands, Kiribati, Tonga, Fiji, New Zealand, New Caledonia, and Australia) could be informative to define SWPO swordfish stock structure.</p> <p>If a longitudinal tagging program is in place even a small number of additional fish tagged in the right place on a regular basis can lead to better estimates of movement.</p>
Assumptions	<ul style="list-style-type: none"> • Observers can be trained to deploy tags and tags can be deployed in the appropriate areas. • SC20-SA-IP-13 included CKMR as one of its variables
Scope	<ul style="list-style-type: none"> • Using the Regional Observer Program, train observers to deploy PSAT tags on swordfish. • Tag and release XX swordfish in each of Australia, New Zealand, French Polynesia and the south central Pacific Ocean to the east of the New Zealand Kermadec Islands (and are fished by the EU and Chinese Taipei longline fleets). • Possible additions could include New Caledonia, Fiji and the Cook Islands if feasible, noting that some of these areas have high rates of shark depredation on swordfish. • The data analysis should include historic data e.g. Evans <i>et al.</i> (2012); Evans <i>et al.</i> (2014); Evans <i>et al.</i> (2021) and Holdsworth <i>et al.</i> (2007). • Present annual updates on the number of tags deployed to the SC in 2025 and 2026; and a final report that includes the data analysis in 2027. • [Using SC20-SA-IP-13 as a guide to collect the spatio-temporal genetic samples for a CKMR study for SWPO swordfish this could be a standalone project]
Timeframe	2025–2027

Budget	<p>X Tags xxx (2025) 0.1 FTE (\$10,000) Annual running cost (2025 and 2026) 0.3 FTE (\$30,000) Analysis (2027) Travel to SC23 \$10,000</p>
References	<p>Evans, K., Abascal, F., Kolody, D., Sippel, T., Holdsworth, J., and Maru, P. (2014). The horizontal and vertical dynamics of swordfish in the South Pacific Ocean. <i>Journal of Experimental Marine Biology and Ecology</i>, 450:55–67.</p> <p>Evans, K., Grewe, P., Foster, S., Gunasekera, R., Lansdell, M., Meredith, S., Sarau, S., Tracey, S., and Wichman, M. (2021). Connectivity of broadbill swordfish targeted by Australian Eastern Tuna and Billfish Fishery with the broader Western Pacific Ocean. Technical Report WCPFCSC17-2021/SA-IP-12.</p> <p>Evans, K., Kolody, D., Abascal, F., Holdsworth, J., Maru, P., and Sippel, T. (2012). Spatial dynamics of swordfish in the South Pacific Ocean inferred from tagging data. Technical Report WCPFC-SC8-2012-SA-IP-05.</p> <p>Holdsworth, J. C., Sippel, T. J., and Saul, P. (2007). An investigation into swordfish stock structure using satellite tag and release methods. Technical Report WCPFC-SC3-2007-BI-SWG/WP-3.</p>