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Progress against the 2023-2030 Billfish Research Plan - 2025

WCPFC-SC21-2025/SA-IP-18

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Introduction

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

Purpose and tasks of the BRP

The purpose of this document is to review progress against the BRP tasks to facilitate future planning of WCPFC billfish research. The project list is included in Table 1. In addition, Table 2 is provided to update the Scientific Committees assessment schedule for billfish. It was previously suggested that data rich assessments be attempted 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. A workshop to review stock assessment methods for billfish is proposed below to address this.

For SC21 one scheduled project was completed, southwest Pacific swordfish stock assessment (SC21-SA-WP-05, SA-IP-11, SA-IP-12, SA-IP-13 and SA-IP-14). In addition, a revised assessment for southwest Pacific striped marlin has been tabled (SA-WP-06, SA-WP-07, SA-IP-13, SA-IP-14 and SA-IP-15) as have projections for north Pacific striped marlin (SA-WP-04).

One project (Stock assessment project 6 - Assessment approaches for WCPO black marlin, sailfish and shortbill spearfish) was not started. Given the difficulty in running billfish assessments the authors believe that there would be value in conducting a review of stock assessment methods for billfish. This should include low and high information stocks as well as multi-model approaches (low and high information for the same stock) and Bayesian assessment methods as is done in the shark assessments. This would preferably be done as an in-person workshop (and would benefit from including people who have successfully completed this type of approach for sharks). The review should be Pacific wide and include participation from IATTC and ISC. We suggest this be tabled as a joint bycatch assessment workshop for billfish and sharks. The focus should be pan-Pacific but could also invite experts from other tuna RFMOs. It is recommended that this be discussed at the ISG - billfish as SC21 and, if approved, a project specification be included. It is suggested that Stock assessment project 6 be repurposed as a ToR for this workshop.

There are two new projects scheduled to start in 2026 pending agreement at the SC21 ISG-Billfish and approval of the budget by WCPFC21. The first project, *Pacific blue marlin stock assessment*, would be undertaken by ISC subject to resourcing, if this is required to be outsourced by WCPFC, a ToR should be developed by SC21 ISG-Billfish. The second project, biology project 3, *Undertake directed longitudinal tagging of Southwest Pacific swordfish to reduce the uncertainty in movement rate*, was due to start this year. However, this project would likely be logistically complex, expensive and will have a small sample size and the results would be of limited use in the context of application within stock assessments. The authors suggest that this project would be more valuable and sample a wider range of fish if it is re-purposed as a genetics project, that could also include age validation and epigenetic aging work. It is recommended that this be discussed at the ISG - billfish at SC21 and, if

approved, a project specification be included. Note that some elements of this may be included in the general billfish biology work (SA-WP-11) and cost saving areas of overlap (such as sample collection and design) should be sought if possible.

Recommendations to SC21

1. SC21 ISG-Billfish review the work plan and project list for the 2025/26 year and make recommendations to SC21 for any changes the SC may want to consider.
2. SC21 ISG-Billfish review the project specifications and make any changes for SC21's review.
3. Re-purpose the Biology project 3 (SWO tagging) as a genetics project and develop the ToR at SC21 ISG-billfish, if approved.
4. The WCPFC host a joint bycatch - billfish and sharks - assessment methods workshop and amend Stock assessment project 6 (new TOR) if approved by SC21 ISG-billfish.

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.

Brouwer, S. and Hamer, P. 2024. Progress against the 2023 – 2027 billfish research plan - 2024. SC20-EB-IP-09.

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

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

Neubauer, P., Castillo-Jordán, C., Day, J. and Hamer, P. 2025. Exploring the potential for observer CPUE for southwest Pacific swordfish (Xiphias gladius) and striped marlin (*Kajikia audax*). WCPFC-SC21-SA-IP-13.

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. *Re.v 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 2025.*

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). Projections provided for 2025 (SA-WP-04)
Assessment 2) Southwest Pacific striped marlin stock assessment	High	2024	2025	Completed (2024) – evaluated but rejected by SC20 (SC20-SA-WP-03 and SC20-SA-IP-06) Revised assessment tabled at SC21 (SA-WP-06 and SA-WP-07) other relevant papers (SA-IP-13, SA-IP-14 and SA-IP-15).
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	Completed tabled for SC21 review (SA-WP-05) other relevant papers (SA-IP-11, SA-IP-12, SA-IP-13 and SA-IP-14).
Assessment 5) Pacific blue marlin stock assessment	High	2026	2026	Previous assessment successfully conducted by the ISC.
Assessment 6) 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. Listed in the budget as **P20X03** but was not done. Note the proposal for a workshop. This project should be re-purposed as a workshop ToR by ISG-Billfish at SC21.

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) Additional work in 2025 (SC21-SA-WP-14)
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	Project initiated under WCPFC project 125 - update report expected at SC21 (SC21-SA-WP-11).

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. Proposed re-purpose to a genetics project by ISG-Billfish at SC21.

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; X = Scheduled work moved; U = Assessment tabled but not accepted.

Species	Stock	Last assessment	2022	2023	2024	2025	2026	2027	2028	2029	2030
Striped marlin	N Pacific	2023		A					A		
	SW Pacific	2025			U	A				A	
Swordfish	N Pacific	2023		A				A			
	SW Pacific	2025				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 2025/26 projects for evaluation and completion by SC21 ISG-Billfish

Project xxx	**Assessment approaches for WCPO black marlin, sailfish and shortbill spearfish - Suggest re-purpose as a joint bycatch assessment workshop for billfish and sharks**
Objectives	Determine the most appropriate modelling/assessment approach(es) to evaluate the stock status and trends for low information billfish species.
Notes	This project was rated as a medium priority at SC19. This project would need to be completed prior to any low information assessments being attempted for black marlin, sailfish and shortbill spearfish.
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	• 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	• 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	**Undertake directed longitudinal tagging of Southwest Pacific swordfish to reduce the uncertainty in movement rate. Suggest re-purpose as a genetics project.**
Objectives	Get better estimates of longitudinal movement and stock structure of Southwest Pacific swordfish
Notes	This project received a high priority rating at SC19. 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).
Rationale	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. 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. If a longitudinal tagging program is in place even a small number of additional fish tagged in the right place can lead to better estimates of movement.
Assumptions	• 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	• 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 Kermadeck 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 *et al*. (2012); Evans *et al*. (2014); Evans *et al*. (2021) and Holdsworth *et al*. (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	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
References	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. Journal of Experimental Marine Biology and Ecology, 450:55–67. 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. 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. 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.