



**SCIENTIFIC COMMITTEE
NINETEENTH REGULAR SESSION**

Koror, Palau
16-24 August 2023

**CONCEPT NOTE FOR A NEW EU SUPPORTED STUDY ON THE
REPRODUCTIVE BIOLOGY OF YELLOWFIN TUNA**

WCPFC-SC19-2023/SA-WP-17

SPC-OFP

Executive summary

Knowing when a fish reaches sexual maturity, and whether it then spawns each year or not, plays a key role in effective and sustainable fisheries management. Female age at maturity is used in fishery assessment models to set a threshold above which all individuals are assumed to be part of the spawning biomass. Spawning biomass has traditionally been used to assess population status relative to biological reference points, and so accurate and up-to-date estimates of maturity and spawning dynamics allow fisheries scientists to make better stock assessments and projections, which in turn leads to more informed decisions and overall confidence in a fishery's management.

Spawning potential for tropical tunas is affected by a number of intrinsic factors, including size-related, age-related, and spatial changes in: sex ratio, maturity, annual fecundity per kg (i.e., spawning frequency x batch fecundity), and egg viability (senescence). Unfortunately, spawning potential is rarely monitored or updated despite the obvious importance of these parameters to fisheries management. A lack of maturity monitoring data also reflects the generally held assumption that underpins most, if not all, of the world's current stock assessment models: life history parameters such as maturity do not change through time (i.e., they are 'stationary'). We know from a growing number of empirical studies that this assumption is wrong. These empirical studies show that life-history parameters are influenced by density dependent processes and environmental/climatic conditions.

This study will use modern histology, pathology and proteomics to empirically estimate the reproductive biology parameters used to derive a new baseline for the spawning potential for tropical tunas in the WCPO. Age and size at maturity, annual fecundity per kg (batch fecundity x spawning fraction), and egg viability will be estimated.

The study is proposed to be supported by the European Maritime, Fisheries and Aquaculture Fund (EMFAF) commencing work in 2024. A total budget of Euro240,000 is required including a Euro40,000 contribution from WCPFC. This contribution will satisfy the minimum EMFAF co-finance requirements from WCPFC.

Recommendations

We invite the Scientific Committee to:

- Endorse the project concept and establish it as a Scientific Committee project to facilitate its steering, guidance and review of the work.
- Recommend that WCPFC provide a Euro40,000 co-finance contribution to the project to facilitate further funding through the European Maritime, Fisheries and Aquaculture Fund.
- Note that the project would commence in January 2024 with a final report to the SC scheduled in August 2026.

Background

A significant challenge for WCPFC tropical tuna stocks assessments is the estimation of spawning potential. Uncertainty in estimates of the parameters used to define spawning potential can decrease the precision of spawning biomass estimates that are used to assist management decision making. Spawning potential for tropical tuna is affected by a number of intrinsic factors, including size-related, age-related, and spatial changes in: sex ratio, annual fecundity per kg(spawning fraction x batch fecundity), and egg viability. Previous studies on the reproductive biology of tropical tunas have been limited in their geographic coverage, but a compilation of these studies indicates that the parameters used to estimate spawning potential vary with longitude and latitude. The last study to examine the reproductive biology across a broad spatial range for yellowfin tuna was published in 2000 (Itano, 2000). No such study has been undertaken for bigeye or skipjack tuna in the WCPO. Spawning potential is also expected to be strongly influenced by climate change, however, without baseline estimates the ability to detect and attribute change is limited.

As such the general objectives of this project are:

- a) to undertake the research needed on the reproductive biology of tropical tunas in the WCPO to improve WCPFC stock assessments.
- b) Establish baselines of reproductive potential for tropical tunas in the WCPO for monitoring the impacts of climate change.

Needs Analyses

In recognition of the need to increase the accuracy and precision of WCPFC stock assessments traditional biological sampling programs have been regularized within the WCPFC fisheries monitoring activities to enhance the quality of information used in stock assessment models. This regularized monitoring has resulted in major improvements in stock assessment. The Pacific Marine Specimen Bank holds ~4000 gonads collected from tuna caught in WCPFC fisheries. Responding to the noted assessment recommendations of recent stock assessments for tropical tuna species in the WCPFC this study will undertake analyses of the reproductive biology of tropical tunas across their spatial ranges in the WCPO.

Specific Objectives

With the primary aim to establish updated baseline estimates of reproductive potential of tropical tunas in the WCPO, the project has the following objectives:

- a) Complete the base research needed for estimating the reproductive potential of tropical tunas in the WCPO, accounting for spatial variability.
- b) Establish updated baseline estimates of reproductive potential for application in WCPFC stock assessments of tropical tunas and climate modelling.

Methodology

The study will utilise the gonad collection within the Pacific Marine Specimen Bank (PMSB) and associated metadata, and otoliths. WCPFC has been supporting the PMSB since 2013. There are now

in excess of 4000 tuna gonads held within this collection. A first task will be to QC these samples and identify gaps in the spatial distribution of the collection. If necessary, additional gonads will be collected to remove any gaps in the data set.

This study will then use modern histology, pathology and proteomics to empirically estimate the reproductive biology parameters used to derive a new baseline for the spawning potential for tropical tunas in the WCPO. Age and size at maturity, annual fecundity per kg (spawning fraction x batch fecundity), and egg viability will be estimated.

Communication, dissemination and visibility

The project will conduct regular seminars to communicate and disseminate the results and information derived from this project. The project will provide working and information papers annually to the WCPFC-SC and provide presentations to the WCPFC-SC and SPC pre-assessment workshops. The project will be integrated into the SPC communications plan to disseminate information through social, print and electronic media (as appropriate). Scientific results are expected to also be published in the peer-reviewed science literature.

Workplan

ACTIVITY	YEAR 1 (2024)				YEAR 2 (2025)				YEAR 3 (2026)			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Task 1 - ... Sampling from PMSB and filling gaps with fresh samples												
Task 2 - ... Laboratory and Histological preparation and analyses												
Task 3 - ...Parameter Estimation												

Budget

ACTIVITY	Budget (Euro)
Task 1 - ... Sampling from PMSB and filling gaps with fresh samples	50,000
Task 2 - ... Laboratory and Histological preparation and analyses	150,000
Task 3 - ...Parameter Estimation	40,000
Total	240,000

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