THE INTER-AMERICAN TROPICAL TUNA COMMISSION

103rd MEETING

Panama City, Panama
01-05 September 2025

DOCUMENT IATTC-103 INF-C

PROPOSAL FOR THE CONTINUATION OF THE REGIONAL TUNA TAGGING PROJECT IN THE EASTERN PACIFIC OCEAN FOR 2026-2028

SUMMARY

Proposed continuation of the Regional Tuna Tagging Project (RTTP) in the eastern Pacific Ocean (EPO) for 2026-2028 aims to provide absolute abundance estimates for skipjack tuna and enhance stock assessments and management of skipjack, yellowfin, and bigeye tunas in the EPO. The project will be implemented and managed by the Inter-American Tropical Tuna Commission (IATTC), with a total proposed budget of approximately US$ 1.8 million.

The objectives of the project are (i) to collect tagging data for skipjack tuna to be used in the recently developed spatio-temporal tagging model for estimating absolute abundance (Mildenberger, et. al., 2023); (ii) obtain data that will contribute to, and reduce uncertainty in, EPO tuna stock assessments, particularly for skipjack tuna; (iii) obtain information on movement rates, dispersion, and mixing of skipjack, yellowfin, and bigeye tunas within the EPO and between adjacent regions of the Pacific basin; and (iv) to estimate spatially explicit growth, mortality, and exploitation rates in the EPO.

Careful consideration was given to identifying the most effective and cost-efficient method for implementing a successful tagging project, with priority placed on the condition of released fish. To achieve the project objectives, skipjack, yellowfin, and bigeye tuna will be tagged with conventional and archival tags across much of the range of the purse-seine and longline tuna fisheries operating in the EPO. A commercial pole-and-line vessel, suitably modified for tagging, will be chartered for a single 90-120 day tagging cruise scheduled for the last quarter of 2026 or the first quarter of 2027, although if funding is secured in the short term, efforts may begin as soon as late 2025. Targeted tunas will include those associated with floating objects (including dFADs), islands, seamounts, dolphins, as well as unassociated schools.

Efforts will be made to secure the support of fishing vessels and companies to allow IATTC access to dFADs throughout the fishing area. This will include the establishment of agreements with vessels and fleets to provide the tagging team with real-time access to the location and status of dFADs. It will also be imperative to maintain communication with fishing vessels to ensure that tagging activities around dFADs do not interfere with industry fishing operations.

Adequate measures to maximize the return of tagged fish are crucial to the success of the project. To achieve and verify high rates of tag reporting and ensure quality recovery information, intense publicity campaigns, attractive rewards, annual lotteries, and tag-seeding experiments will be implemented. Tag recovery officers will continue to operate in the major ports of Ecuador and Mexico where purse-seine vessels unload.

PROJECT TITLE

Extension of the regional tuna tagging project for skipjack, yellowfin, and bigeye tuna in the eastern Pacific Ocean, 2026- 2028.

1. OBJECTIVE

Conduct large-scale tagging of the three principal tuna species, skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), and bigeye (*Thunnus obesus*), captured in the fisheries of the eastern Pacific Ocean (EPO). The data collected will enhance the scientific basis for estimating absolute abundance, exploitation rates, movements, mixing, natural mortality, and growth rates of these tunas in the EPO.

2. BACKGROUND INFORMATION AND JUSTIFICATION

In the EPO, purse-seine fleet capacity has increased substantially since 2000, along with a rise in skipjack tuna catches. During this period, purse-seine catches of yellowfin decreased between 2000 and 2006 but have since remained relatively stable (Anonymous, 2024). In contrast, bigeye catches remained relatively stable between 2000 and 2020, but have since begun to decline rapidly (Anonymous, 2024). These rapid shifts in fishery dynamics have made it difficult to evaluate their impact on tuna stocks. Recent assessments (Anonymous, 2024) highlight the need for caution in managing these fisheries and, more importantly, demonstrate the urgent need for improved scientific information to support stock assessments, provide alternate data sources for estimating abundance, and ultimately inform sound management decisions. The introduction of the bigeye Individual Vessel Threshold (IVT) management measure appears to have significantly reduced fishing mortality (F) on bigeye tuna. This may allow for easing some conservation measures, such as the purse-seine fishery closure, which would likely increase F on skipjack and yellowfin stocks. Achieving this will require improved stock assessments, particularly for skipjack, where reliable assessments depend on an abundance index derived from tagging data.

Purse-seine fisheries throughout the Pacific now focus a large proportion of their effort on tunas associated with drifting fish-aggregating devices (dFADs), a mode of fishing that has evolved to become highly effective at harvesting all three tropical tuna species (Fonteneau *et al.,* 2013). However, this shift has created challenges for scientists attempting to calculate species-specific catch-per-unit effort (CPUE) indices within the purse-seine fishery. The result has increased uncertainty in the estimation of indices of relative abundance and, consequently, greater difficulty in developing robust management recommendations. This is partially a result of a limited understanding of the behavior and dynamics of tuna aggregations associated with dFADs. Continued research into the spatial and temporal dynamics of these aggregations is essential to better quantify key life history characteristics, including movements, behavior, residence times, and vulnerability to fishing gear.

In the EPO, schools of tuna within large multi-species aggregations associated with FADs have been exploited by large purse-seine vessels since at least 1994 (Lennert-Cody and Hall 2000; Anonymous, 2024), primarily in the region between 5°N and 15°S. The practice of deploying FADs and targeting the tunas that associate with them has evolved significantly and become more efficient over the past decade, primarily due to the adoption of GPS buoys equipped with echo-sounders. While skipjack tuna makes up the largest portion of the catch in the FAD fishery, there is also a substantial catch of small to medium bigeye and yellowfin tunas (Anonymous, 2024).

Bigeye tuna is the primary target species of the distant water longline fleets operating in the EPO. The longline fishery targets medium to large bigeye, while the purse-seine fishery mainly catches small to medium bigeye. Within the EPO, there is growing concern that the purse-seine fishery may be negatively impacting the longline fishery, as large catches of small to medium bigeye could be reducing the overall stock size and the sustainable catches. Catches in the longline fishery declined from an annual average of approximately 63 thousand metric tons during 2000-2003 to about 20 thousand metric tons during 2020-2023, coinciding with the expansion of the purse-seine fishery targeting tunas associated with drifting FADs (Anonymous, 2024). Although the fishing effort of the once predominant Japanese longline fleet

has declined in recent years, efforts by the fleets of China, Chinese Taipei, and Korea has increased (Anonymous, 2024).

Knowledge of current levels of exploitation, as well as movements, natural mortality, and growth rates of skipjack, yellowfin, and bigeye tunas is essential for accurate stock assessments. Although assessments have been performed for these species in the eastern Pacific (Anonymous, 2024), uncertainties remain in many of the assumptions and parameter estimates used in these analyses. The proposed tagging program would provide a direct means of estimating exploitation, movement, natural mortality, and growth rates for these three species. In Addition, a recently developed spatio-temporal tagging model (STTM) has shown strong potential for estimating absolute abundance from tagging data (Mildenberger, et. al., 2023). The STTM integrates both conventional and archival tagging data, enabling the simultaneous estimation of absolute abundance, mortality, and movement parameters. This approach complements and strengthens integrated assessment models, as it provides robust, externally derived parameter estimates that reduce uncertainty and increase confidence in model outputs. Valid estimates of these parameters would improve assessments and would likely provide the means to quantify the interaction between purse-seine and longline fisheries to support the development of more effective management recommendations. Tagging data can allow these key parameters to be both estimated and applied within the broader assessment framework.

The current assessment of skipjack tuna in the EPO represents a significant improvement over past assessments, largely due to the availability of an estimate of absolute abundance derived from the STTM (Bi et. al., 2024; Mildenberger, et. al., 2023). This estimate was possible by recent tagging conducted during 2019 – 2022 (Fuller et. al., 2023) where mark-recapture data, coupled with daily position estimates from archival tagged fish, formed the basis for the STTM abundance estimates. Additionally, estimates of exploitation rates, natural mortality, and absolute abundance from the tagging program can provide critical parameter inputs contributing to a more robust and reliable stock assessment for skipjack tuna. Assessments of all three species are highly sensitive to both the absolute levels and age-specific patterns of natural mortality. The most recent assessments of yellowfin utilized data from the tagging program, enabling more accurate and consistent estimates, which were essential for reducing model uncertainty (Minte-Vera et. al., 2025). The assessments for skipjack and bigeye tuna use values for natural mortality estimated using tagging data from the WCPO (Bi et. al., 2024; Xu, 2024).

Recent stock assessments considered multiple stock structure hypotheses. Skipjack and BET were assessed under the assumption of a single stock, whereas YFT included scenarios modeled as separate stocks. There is uncertainty in the stock structure and different data sources provide conflicting information. It remains uncertain whether different spatial scales would be more appropriate for the assessment and management of these species. All three species of tunas clearly move across the regional management boundary at longitude 150ºW, in both directions. However, considering the characteristically restricted movements of these species and the historical dynamics of the fishing fleets, regional assessments and management recommendations have been considered appropriate. This proposed tagging program will provide up-to-date information on tuna movements and exploitation needed to evaluate appropriate spatial scales for assessments and management.

Recent analyses of data derived from bigeye tagging experiments across the equatorial Pacific (Schaefer et al., 2015) have demonstrated that bigeye exhibit relatively restricted geographical movements, similar to those of yellowfin and skipjack tunas throughout the Pacific (Hunter *et al.,* 1986; Sibert and Hampton, 2003, Schaefer and Fuller, 2022) and also exhibit various degrees of regional fidelity. Furthermore, investigation of the population structure of yellowfin across the Pacific provided evidence of genetically discrete populations (Grewe et. al., 2015). These results clearly highlight the need to better understand stock structure for skipjack, yellowfin, and bigeye tunas in the EPO, as well as the extent of mixing among stocks for inclusion in the regional stock assessments.

In addition to tagging the three species of tuna externally with conventional plastic dart tags, the program

will include the release of appropriate numbers of geolocating archival tags for each species, across as large of a size range as possible. Data recovered from archival tags allow for the reconstruction of detailed movement paths. This information, combined with data from conventional tag recoveries, is essential in the STTM and for quantifying exploitation, movements, mixing rates, and stock structure (Schaefer et. al., 2011; Schaefer et. al., 2015; Schaefer and Fuller, 2022). Archival tag data also provides both small and large-scale resolution estimates of residence times, complementing the results from conventional tagging, and provides long-term information on geographical and spatial distributions (Schaefer et. al., 2015; Schaefer and Fuller, 2016; Schaefer and Fuller, 2022). The data obtained from archival tags on vertical movements, behavior, and habitat utilization (Schaefer and Fuller, 2010; Schaefer et. al., 2011; Fuller et. al., 2015) are crucial for understanding the vulnerability and catchability of tunas by purse-seine and longline fisheries, and for further consideration in standardization of catch and effort data for stock assessments (Maunder and Punt, 2004). The integration of data streams from both archival and conventional tags within the STTM framework enables joint estimation of key demographic and spatial parameters, reducing uncertainty relative to single-data-source approaches.

Careful consideration was given to identifying the most effective and cost-efficient method for implementing a successful tagging project, with priority placed on the condition of released fish. This approach is informed by a long history of successful tagging using pole-and-line vessels dating back to the 1950s. Between 1968 and 1974, several tagging cruises aboard purse-seine vessels resulted in the tagging of 30,290 yellowfin tuna; however, only 1,449 fish (4.8%) were recaptured, a rate significantly lower than the approximately 15% return observed in historical pole-and-line tagging programs. A subsequent purse-seine tagging effort in 1978 released just over 500 bigeye tuna, but only 4 fish (<0.01%) were recaptured, further indicating poor post-release survival associated with purse-seine capture methods.

3. DESCRIPTION OF PROPOSED ACTIVITIES

The objective is to conduct a single 90–120-day cruise aboard a chartered pole and line vessel beginning in late 2026 or early 2027. Tagging efforts will be focused on skipjack, but efforts to tag bigeye and yellowfin will also be made. The goal is to tag at minimum 7,500 skipjack and 3,000 yellowfin and bigeye each with conventional plastic dart tags. Skipjack, yellowfin, and bigeye tuna across as wide a size range as possible will be targeted for tagging. Tagging activities will focus on targeting tunas associated with floating objects, islands, seamounts, dolphins, and unassociated surface schools.

Industry support will be critical to the success of the tagging campaign. Historically, during directed tagging charters a vast majority of charter days have been spent searching (85% searching, 15% fishing) for unassociated schools, or schools associated with dFADs. This has proven to be incredibly inefficient and impedes mission success. With industry collaboration where the tagging vessel and cruise leader have access to industry dFADs that have either drifted out of the fishing area (primarily north), or to dFADs in the traditional fishing areas which will not be fished for several weeks- the probability of achieving project objectives improves dramatically.

Tag releases will be distributed over as wide of a spatial area as possible (Figure 1). The tagging cruise will focus on three primary offshore areas: 1) the northern area offshore Mexico including the Revillagigedo Islands, 2) the equatorial area offshore between 5ºN and 5ºS from the 150ºW to the coast and 3) the central area offshore Central America and northern South America. To the extent possible tagging efforts will be focused across historical catch and fleet distributions. Efforts will also be made to tag key school associations (e.g., dFADs, seamounts, dolphin, and unassociated) so as to attempt to represent sampling across ecological and fishery gradients.

In addition to plastic dart tags, archival tags will also be implanted in skipjack, yellowfin, and bigeye tunas. Archival tags provide data on the movements, behavior, and habitat utilization of the three species throughout the EPO. Due to the high rewards paid for recovered archival tags (US$250), the reporting rate is expected to be nearly 100%. This provides the basis for an alternative estimate of natural mortality and exploitation rate that is not affected by tag recovery and reporting issues. It is expected that 150

archival tags will be deployed in skipjack, and 50 archival tags each in yellowfin and bigeye tunas. Tags will be surgically implanted in the coelomic cavities of the fish; a method shown to result in minimal tag shedding, high post-release survival, and high recovery rates (Schaefer and Fuller, 2016).

Tag seeding experiments will be conducted throughout the duration of the program and concurrently with tagging experiments to estimate the recovery rates and assess the reporting accuracy of recaptured tagged tunas, by fleets and landing port. For this study, IATTC observers aboard purse-seine vessels will insert plastic dart tags into tunas prior to freezing them in the vessel's wells.

The successful execution of the program will require several activities beyond the fieldwork and including the following:

1. Collaboration with the fishing industry for access to dFADs. A successful field effort will not be possible without close collaboration with the fishing industry. Efforts will be made to establish agreements with vessels and fleets to provide the tagging vessel with real-time access to the location and status of dFADs. It will also be imperative to maintain communication with vessels to ensure that tagging activities around dFADs do not interfere with industry fishing operations.
2. Securing high-confidence tag recapture information, including data on location, date, and size (measured by tag recovery specialists in each port). This will require: a) continued employment of tag recovery specialists (TRSs) in major unloading ports in Ecuador and Mexico; b) expanded outreach to inform fishermen about the program and its potential benefits to the fishery; c) provision of adequate reward payment for the return of tags, including the implementation of a lottery as an additional incentive; and d) a streamlined process for returning tags still attached to tunas by establishing a system in which IATTC TRSs respond promptly phone calls from finders during vessel unloading. Staff will collect as much data as possible through field offices and the observer program and will seek cooperation from national fisheries authorities and observer programs, especially to recover tags and catch data from longline recoveries.
3. Analysis of tag release and recapture information. IATTC staff has extensive experience and expertise in analyzing both conventional and archival tagging data. This part of the program is likely to interest CPC's, and collaborations with scientists from those organizations on data analysis are encouraged. Additionally, efforts will be made to advance the STTM and to develop spatially explicit assessment models capable of integrating movement, growth, and mortality rates.

5. REPORTING

The activities and results of the program will be regularly reported on a dedicated page on the IATTC website. Updates, including preliminary findings, will be presented at IATTC Scientific Advisory Committee (SAC) meetings. Results from various aspects of the program are expected to be published in peer-reviewed journals.

All funds will be used exclusively for the program. Any remaining funds upon program completion will be reported to the CPC's and/or funding entities and handled according to their instructions. Financial accounting will be maintained with full transparency to CPC's and/or funding entities and reflected in the IATTC's financial accounts.

6. FUNDING

Committing experienced scientific staff to manage tagging operations, analyze data, and report the results is essential. IATTC staff will also oversee the recovery and reward program. However, there are currently no funds allocated for this project or the tag recovery specialists in the general budget, so external support is required.

7. BUDGET

Funds are requested to support the following proposed budget for executing the tagging programduring 2026-2028:

Vessel(s)		**US$**	**Year 1 US$**
Dedicated tagging vessel, captain, crew, and all operational expenses	120 days @ $8,000/day	960,000.00	960,000.00
Miscellaneous (port fees, etc)		40,000.00	40,000.00
Personnel			
Sea pay for IATTC personnel on tagging cruises		65,000.00	65,000.00
Travel expenses		40,000.00	40,000.00
Tag recovery officers (2) Manta and Playas, Ecuador 3 years		195,000.00	65,000.00
Tag recovery officer Mazatlan, Mexico 3 years		95,000.00	31,666.67
Contracted Quantitative analyses		50,000.00	0.00
Equipment			
Archival tags for SKJ (ArcGeo9)	150 @ $605/ea	90,750.00	90,750.00
Archival tags for YFT and BET (Lotek ArcGeo13)	100@ $700/ea	70,000.00	70,000.00
Miscellaneous (Fishing gear, surgical equipment, etc…)		40,000.00	40,000.00
Plastic dart and Plastic intramuscular tags	15,000@$2.67	40,000.00	40,000.00
Rewards			
SKJ all tag types		20,000.00	18,500.00
YFT all tag types		17,000.00	11,900.00
BET plastic dart tags (Based on 5000 releases)		28,250.00	19,775.00
Archival tag rewards	all species, assuming 35% return	22,000.00	12,000.00
Tag Lottery	Yearly @ $5000	15,000.00	0.00
Plastic dart and Plastic intra-muscular tags (tag seeding experiments, based on the deployment of 1,200 tags)		16,000.00	5,333.33
Reward for Observer seeding tags (40 trips)	$100/trip	4,000.00	1,333.33
TOTAL EXPENSES		**$1,808,000**	$1,511,258

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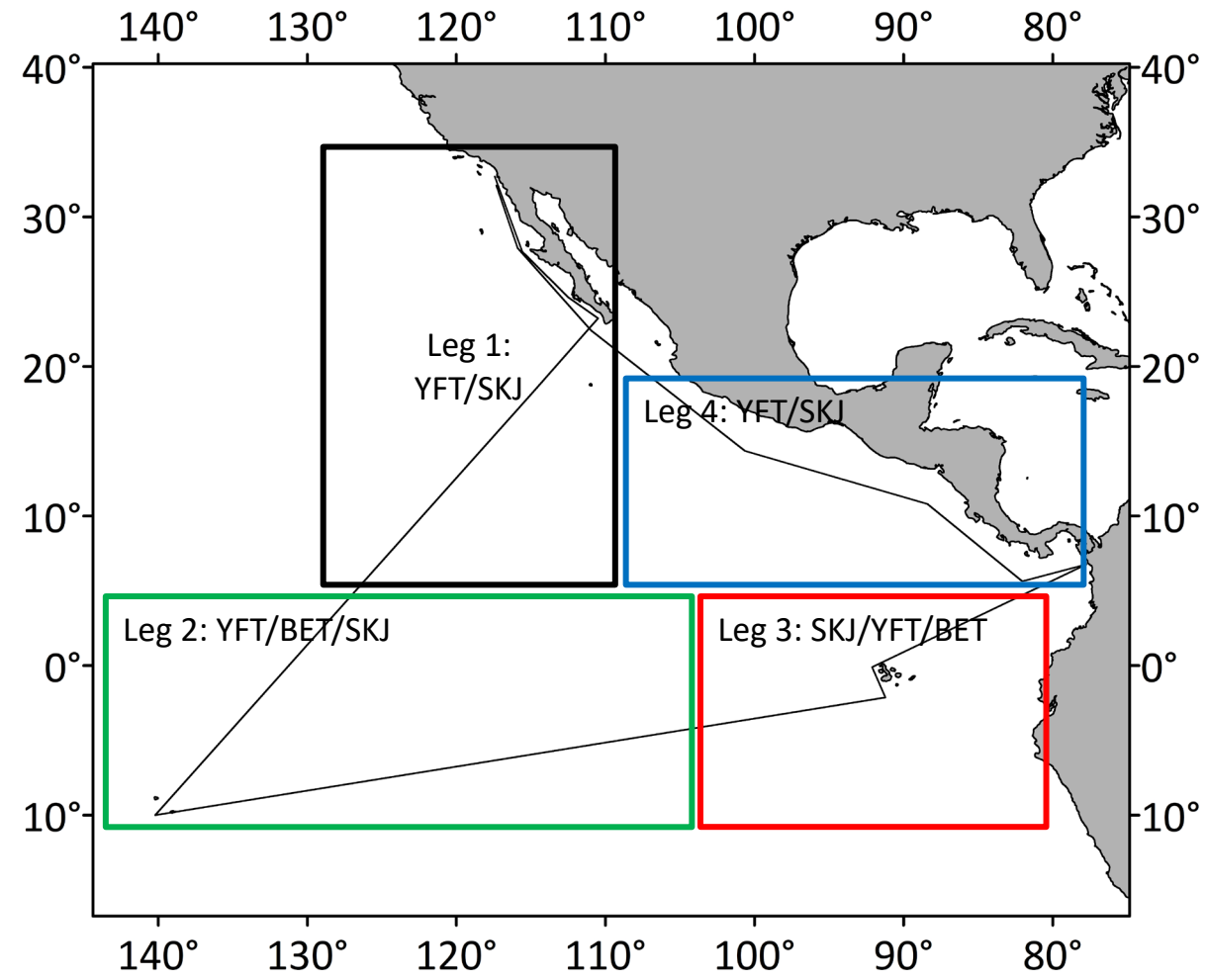

FIGURE 1. Proposed cruise track indicating target areas for tagging. Each leg outlines the anticipated species likely to be encountered within the respective regions. Leg 1 will depart from San Diego, CA, USA, and terminate in the Marquesas Islands. Leg 2 will begin in the Marquesas Islands and end in either the Galapagos Islands, Ecuador, or Panama City, Panama. Leg 3 will start from either the Galapagos Islands or Panama City and is planned to terminate in Panama City; however, depending on the duration of earlier legs, the cruise may instead conclude in San Diego. Leg 4, if required, will depart Panama City and conclude the cruise in San Diego.