

Project Title: Global and regional temporal trends and variability in the spatial distribution of tropical tuna purse-seine fishing

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Duration:

6-12 months, starting in late 2021, ideally in November.

Budget:

No monetary commitments are associated with this collaboration.

Deliverables:

Two main deliverables are expected: i) for the tropical tuna purse-seine fisheries of the eastern Pacific Ocean (EPO) and globally, time series of spatial indices describing changes in the spatial extent and heterogeneity of catches, of both target and non-target species, within the fishing grounds; ii) dissemination material, including peer-reviewed publications and documents and presentations for the Scientific Advisory Committee, the IATTC FAD Working Group and the Bycatch working group, as well as local and international conferences of interest. The dissemination of the work is expected to have a positive impact on the recommendations developed by the abovementioned groups.

Project description:

Project details are described below.



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Introduction to the problem: Catch per unit effort (CPUE) standardization and model-based stock assessments are the gold standard for assessing the abundance and stock status of exploited species. However, these approaches are quite complex and at times it can be difficult to identify all pertinent covariates for estimating stock size while controlling for changes in fishing efficiency. If these approaches are not properly implemented, they can lead to hyperstability, wherein CPUE values remain constant despite stock decline. Hyperstability can in turn lead to overly positive assessments of stock status, threatening fisheries sustainability and impairing management decision making.

Opportunity for study: After the publication of document SCRS/2021/148, where the spatial-temporal indices and trends were estimated for the Atlantic and Indian Oceans, a collaboration invitation was extended by the leading author, David M. Kaplan, to the fisheries organizations in the Pacific, including the IATTC, to investigate temporal trends in both regional and global spatial indices for target and non-target species that are derived from the spatial characteristics of the species' annual catch distributions within the fishing grounds. These indices, which include measures such as Area of Occupancy and the Gini Segregation Index, are derived from spatial characteristics of the species' annual catch distributions, and can provide useful information on stock status and/or hyperstability of the fishery to compliment stock assessments.

Rationale: Though there is currently no evidence that hyperstability is a problem in the tropical tuna purse-seine fisheries, it is useful to complement more sophisticated stock status estimations based on stock assessment models with simpler approaches based on analyses of raw catch and effort data to maximize the probability of detecting overexploitation and hyperstability as early as possible. Although simpler spatial or temporal indices of fishing activity and catch cannot be used as direct indicators of stock abundance, they can highlight observed changes in fisheries and provide simple checks for more sophisticated approaches to stock status evaluation. Time series of spatial indices of fisheries can help identify temporal patterns with a focus on any long-term trends that might be indicative of declining stock status for tuna species or hyperstability. These spatial indices can also be calculated for important bycatch species from observer data and be good indicators for stability as well as major perturbations (e.g. Piracy, major El Niño events), as demonstrated in SCRS/2021/148. Besides, the proper monitoring of these indices and trends for tuna and certain bycatch species could help designing experiments that merit further investigation.

Summary of work to be completed: In addition to presenting basic exploratory statistics of the data, the study will develop a series of annual spatial indices for the catch of the three major species of tropical tunas, yellowfin tuna, (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*) and skipjack tuna (*Katsuwonus pelamis*), as a function of ocean and fishing mode (i.e., floating object, free swimming school and dolphin associated sets). Time series of these indices will be examined to identify temporal trends and/or unique events with a particular eye towards any long-term trends that might be indicative of declining stock status and hyperstability in stock status estimates. Similar analyses will also be carried out for the most important purse-seine bycatch species based on data from observers aboard class-6 purse-seine vessels. Though the results are specific to the tropical tuna purse-seine fisheries examined, the spatial indices are generic and likely have wide applicability to other fisheries.

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We will achieve these tasks using a case study for the eastern Pacific Ocean, based on the methodologies developed for the Atlantic and Indian Oceans and described in SCRS/2021/148.

Broader Impacts: The proposed research will provide considerable benefit to the IATTC staff, Commission, and the broader scientific community and public. This project will help developing spatial-temporal indices and statistics of tropical tuna purse-seine fishery distribution in the EPO and beyond, which will help ultimately to understand the dynamics of the purse-seine fishing operations and fishing behavior in the eastern Pacific Ocean, supporting ongoing and future demand for sustainable resources. It is also expected to receive feedback and support of well-established working groups in other t-RFMOs, such as the tropical tuna, FAD or Bycatch and Ecosystem working groups of IOTC and ICCAT.

Relevance to the IATTC Scientific Strategic Plan and Commission's goals: This project will contribute to advance our understanding of tropical tuna purse-seine fisheries spatial-temporal dynamics and their relationship to both target and non-target species catch. Project activities will support several objectives for increasing the sustainability of exploited resources described in the SSP, such as, goal J “Improve our understanding of the effects of the operational characteristics of the fishery on fishing mortality, stock assessments, and management advice”, and in particular J.1 “Identify and monitor changes in technology and fishing strategies to improve stock assessments and management advice”.

Acknowledged by on behalf of IATTC

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