

INTER-AMERICAN TROPICAL TUNA COMMISSION

SCIENTIFIC ADVISORY COMMITTEE

12TH MEETING

(by videoconference)

10-14 May 2021

DOCUMENT SAC-12 INF-D

5. DORADO SCIENTIFIC REGIONAL PLAN

The Antigua Convention, adopted on Jul7 27, 2003, it is a multilateral agreement where 26 countries participate (Members and Cooperating non-Members (CPCs)) and work together in a pre-competitive environment to achieve the conservation target and the sustainable use of tuna resources in the Eastern Pacific Ocean (EPO). This convention mandates to the Inter-American Tropical Tuna Commission (IATTC) to “adopt appropriate measures to avoid, reduce and minimize ... impacts on associated or dependent species” (IATTC, 2003 p5). Due to the incidental capture of dorado (*C. hippurus*) by tuna purse-seine vessels in the EPO, the IATTC has provided the opportunity for collaborative research on dorado. This collaboration included the development of three dorado technical meetings between 2014 and 2016 (Valero, Aires-da-silva, & Maunder, 2019). In the first meeting the IATTC members committed to collaborate in dorado research and identified fishery and biological data gathered by the countries (Aires-da-silva et al., 2016). Also, in this meeting a Regional Research Plan was outlined (IATTC, 2014). In the second meeting, the discussion focused on the methodologies and indicators of stock status. In the third meeting data needs and assessment methods for data-limited were identified. With all these elements, the IATTC scientific staff conducted: a) an exploratory stock assessment for the “core” of dorado stock, b) an exploratory management strategy evaluation (MSE) for the South EPO, and c) potential reference points and harvest control rules for dorado in the EPO (Valero et al., 2019).

Although these studies have contributed to improve the knowledge of the population dynamics of dorado and its exploitation records in the EPO, the IATTC scientific staff have recommended future research to improve stock assessment analyses of dorado in the EPO. This recommendation was embraced during the 10th Meeting of the Scientific Advisory Committee, where the SAC recommended "that the IATTC staff continue working with CPCs on research on the stock status of dorado"(IATTC, 2019b).

In order to continue with research on the stock status of dorado in the EPO, the following dorado scientific plan has been prepared to be presented in the 12^o meeting of the Scientific Advisory Committee. This plan was developed with the participation of producers and processors of mahi-mahi (COREMAHI)¹ and the National Fisheries Institutes from Ecuador (IPIAP) and Peru (IMARPE). The plan structure is based on the IATTC staff’s research and work plan and includes recommendations and research needs identified in the mahi-mahi technical meetings and IATTC studies.

¹ COREMAHI is a group of mahi processors and producers from Costa Rica, Ecuador, and Peru, the principal exporters of mahi in the eastern Pacific Ocean (EPO). The aim of this group is to coordinate regional actions to promote the sustainability and responsible management of EPO mahi fisheries.

This regional mahi-mahi scientific plan involves three projects. Every project has been organized according to the Themes, Goals and Targets of the proposed Strategic Science Plan (IATTC, 2018)

Main expected deliverables (see individual project reports for details):

- 2022: A data collection program for large pelagic fisheries.
- 2023: Report on movement and dispersion rates of dorado in the EPO
- 2023 & 2026: Mahi-mahi stock assessment
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TABLE E. Projects included in the mahi-mahi scientific regional plan, 2021-2026. **Green:** completed; **blue:** funded; **red:** unfunded; **pink:** partially funded (funded components completed, other components pending)

SSP ref.	Target/Project	Timeframe & status					
		2021	2022	2023	2024	2025	2026
1. DATA COLLECTION FOR SCIENTIFIC SUPPORT OF MANAGEMENT							
GOAL: C. Improve quality and expand coverage of data-collection programs							
C.4.c:	Improving data collection for mahi-mahi fisheries in the EPO						
2 LIFE-HISTORY STUDIES FOR SCIENTIFIC SUPPORT OF MANAGEMENT							
GOAL: F Obtain key life history information for assessment and mitigation of ecological impacts on prioritized species.							
F.3.a:	Conduct a mahi-mahi tagging study to improve the stock structure knowledge in the EPO.						
3. SUSTAINABLE FISHERIES							
GOAL: H: Improve and implement stock assessments, based on the best available science							
H.7.C	Conduct stock assessment of mahi-mahi						

Dorado projects:

1. DATA COLLECTION FOR SCIENTIFIC SUPPORT OF MANAGEMENT

PROJECT C.4.c: Improving data collection for dorado fisheries in the EPO	
<p>THEME: 1. Data collection GOAL: C. Improve quality and expand coverage of data-collection programs TARGET: C.4. Artisanal longline fleet EXECUTION: Stock Assessment Program</p>	
Objectives	<ul style="list-style-type: none"> Automate the data collection and optimize the quality of the data collected in the Southeastern Pacific Ocean Obtain standardized fishery and biological data from the Northern Pacific Ocean, that could be use in stock assessments.
Background	<ul style="list-style-type: none"> During the third technical meeting on dorado the data necessary for this fishery management were identified (Vera, 2016). An exploratory stock assessment for dorado was conducted in the southeastern Pacific Ocean using data only from Ecuador and Peru. Due to data-limited of Central America dorado fisheries, conventional stock assessments couldn't be conducted in this region (Aires-da-silva et al., 2016). The exploratory management strategy evaluation (MSE) for dorado in the southern EPO shows that the Stock Synthesis model works very well to conduct mahi-mahi stock assessments. However, is necessary more research to improve the model and data used on it. Also, data from more fisheries (Central America) could be consider in this model in the future. (Valero et al., 2016). A stock assessment for dorado in the north of the equator should be conducted. However, the dorado fishery data available from this region is limited, total captures and potential indices of relative abundance (e.g. catch rates) are little known (Aires-da-silva et al., 2016). Future directions of the exploratory stock assessment recommend improve the data collection process and the quality of the data collected in the Southeastern Pacific Ocean (Aires-da-silva et al., 2016) The Public Institute of Aquaculture and Fishing of Ecuador (IPIAP) and the Peruvian Institute of the Sea (IMARPE) signed and agreement to coordinate dorado research activities and to standardized data collection protocols. In the 5th Binational Workshop on Biological Fishing Research of Perico / Dorado <i>Coryphaena hippurus</i> in Peru and Ecuador, IMARPE and IPIAP agreed to continue advancing in the standardization of the methodology for the registration and analysis of fishery biological data, both at the point of landing and onboard observations. The IATTC scientific staff prepared a work plan to enhance data collection and stock assessments for sharks and get funds from FAO-GEF to enhance data collection for the coastal longliners. The staff is preparing an experimental design for a long-term shark fishery sampling program in the EPO (IATTC, 2019a). Mahi-mahi data collection could be included in this program.
Relevance for management	Improving fishery and biological data collection will help to conduct regular stock assessments and thus lead to better management of dorado fisheries in the EPO
Duration	4 years

Workplan and status	<ol style="list-style-type: none"> 1. Design and implement a standardized protocol to collect data onboard by captains or observers. 2. Design and implement a standardized protocol to collect data in landing facilities 3. Compute an order of magnitude estimate of total dorado catch for the artisanal fleet from sample data and map information. 4. Design and implement a protocol to report gather data to the IATTC scientific staff 		
External collaborators	Regional Committee of Mahi (COREMAHI) IPIAP, IMARPE		
Deliverables	2021-2026 annual data standardized reports presented in SAC and IATTC meetings.	Funding sources	
Budget (US\$)	Annual binational workshops with the institutes of fisheries research of Ecuador and Peru for the automation and standardization of data with participation of the IATTC scientific staff.	20,000	IPIAP/ IMAR PE
	Pilot sampling programs (observers, inspectors) (including wages, travel, insurance) x 4 years in 3 countries and regional meetings	1'200,000	CPCs
	Technician training for Central America countries (including travel, materials, insurance)	30,000	
	Total	1'250,000	

2 LIFE-HISTORY STUDIES FOR SCIENTIFIC SUPPORT OF MANAGEMENT

PROJECT F.3.a: Conduct a dorado tagging study to improve the stock structure knowledge in the EPO.

TEMA: 2. Life history studies for scientific support of management

GOAL: F Obtain key life history information for assessment and mitigation of ecological impacts on prioritized species.

TARGET: F.3. Conduct life-history studies of prioritized species.

EXECUCIÓN: Biology and Ecosystem Program.

Objectives	<ul style="list-style-type: none"> • Estimate dorado movements between the north and south of Ecuador to improve the knowledge of dorado life history and its stock structure in the EPO. • Obtain information on movement and dispersion rates of dorado, and water temperature in the EPO, to estimate (i) tag loss rates; (ii) dorado mortality rates; (iii) information on population size; and behavioral attributes.
Background	<ul style="list-style-type: none"> • The IATTC staff, provided support in dorado regional research. This generated the development of three technical meetings in 2014, 2015, and 2016 (Aires-da-silva et al., 2016). • The IATTC staff conducted an exploratory stock assessment for the “core” of the dorado stock and an exploratory management strategy evaluation (MSE) for the South EPO (Aires-da-silva et al., 2016). • The document DOR-01 Appendix 4 Regional research plan, that was developed in the first technical meeting of dorado states: "Development of a regional tagging program for dorado considering appropriate statistical design elements (spatial and temporal component). Explore the possibility of developing/strengthening tagging activities in collaboration with the private sector (commercial and sport) and/or based on research platforms" (IATTC, 2014 p204). • The document SAC-07-06a(i) Exploratory Stock Assessment of dorado in the Southeastern Pacific Ocean, recommends "determining the movement, if any, of dorado north and south of the Equator is important for conceptualizing the life history of the species and its potential impact on stock structure in the EPO"(Aires-da-silva et al., 2016, p 200). • The 10th Meeting of the Scientific Advisory Committee recommended "that the IATTC staff continue working with CPCs on research on the stock status of dorado" (IATTC, 2019b) • In the 5th Binational Workshop on Biological Fishing Research of dorado <i>Coryphaena hippurus</i> in Peru and Ecuador, IMARPE and INP agreed to carry out a dorado tagging project in the short term, with the support of governmental and non-governmental organizations.
Relevance for management	Spatially-structured stock assessments based on geographically-explicit life history parameters based on an improved understanding of stock structure will provide a more accurate basis for developing management advice.
Duration	1 year

Workplan	<ul style="list-style-type: none"> • Dorado individuals will be tagged with conventional plastic dart tags and archival (electronic data storage) tags in the waters off Costa Rica, Ecuador and Peru. Fish will be tagged by experienced persons operating on commercial vessels facilitated by COREMAHI. While the satellite marks will be placed by technicians from the fishing institutes trained with the accompaniment of experts in sports boats. It is expected to tag approximately 2 000 individuals of dorado with conventional plastic tags and 30 individuals with archival satellite tags (storage electronic data). • Archival tag datasets from discrete areas of the EPO will be analyzed to describe geographic variation in movements, behavior, and habitat utilization. • Historical conventional tag datasets for mahi-mahi from the EPO will also be included in the evaluations of movements. • Conventional and archival tags will be recovered from the fishery, supported by an IATTC information campaign to fishers and a simple reward scheme. 		
External collaborators	Regional Committee of Mahi (COREMAHI) IPIAP, IMARPE		
Deliverables	<ul style="list-style-type: none"> • 2022: Paper and presentation for SAC-13 on movement and dispersion rates of mahi-mahi in the EPO • 2022: Manuscript for publication in a scientific journal. 		
Budget (US\$)	Regional workshop with the countries where the mahi-mahi individuals will be tagged (Costa Rica, Ecuador, Peru). Institutes of Fishing from each country and fishers (vessels owners) will participate in the workshop.	30,000	COREMAHI, NGOs
	Post-doctoral researcher (8 months)	60,000	
	Material for prototypes (2000 physical marks (\$1 each one) + 30 archival tags (\$1500 each one) + materials+ shipping)	125,000	COREMAHI, NGOs
	Travels to tag mahi-mahi individuals.	10,000	COREMAHI
	Coordinator project	10,000	
	Total	175,000	

3. SUSTAINABLE FISHERIES

PROJECT H.7.C Conduct stock assessment of dorado

THEME: 1. Sustainable fisheries

GOAL: H: Improve and implement stock assessments, based on the best available science

TARGET: Develop conventional stock assessments for data-rich prioritized species and species of specific interest

EXECUTION: Stock Assessment Program

Objectives	Conduct a conventional stock assessment for dorado in the EPO	
Background	<ul style="list-style-type: none"> • An exploratory stock assessment for dorado was conducted in the southeastern Pacific Ocean using data only from Ecuador and Peru. Due to data-limited of Central America mahi-mahi fisheries, conventional stock assessments couldn't be conducted in this region (Aires-da-silva et al., 2016). • The exploratory management strategy evaluation (MSE) for dorado in the southern EPO shows that the Stock Synthesis model works very well to conduct mahi-mahi stock assessments. However, is necessary more research to improve the model and data used on it. Also, data from more fisheries (Central America) could be consider in this model in the future. (Valero et al., 2016). • A stock assessment for dorado in the north of the equator should be conducted. However, the dorado fishery data available from this region is limited, total captures and potential indices of relative abundance (e.g. catch rates) are little known (Aires-da-silva et al., 2016). • Future directions of the exploratory stock assessment recommend improve the data collection process and the quality of the data collected in the Southeastern Pacific Ocean (Aires-da-silva et al., 2016) 	
Relevance for management	The stock assessment is needed to provide management advice for the fishery and captured resources	
Duration	Every three year	
Workplan and status	2022: Obtain data (PROJECT C.4.c) and stock assessment with Ecuador and Peru data 2023: Conduct regular stock assessment with Central America data 2023: Report to SAC-13 2025: Stock assessment 2026: Report SAC-16	
External collaborators	Regional Committee of Mahi (COREMAHI) IPIAP, IMARPE	
Deliverables	Stock assessment reports for the SAC and the IATTC; presentations at SAC and IATTC meetings	
Budget (US\$)	Consultancy to conduct regular stock assessments including Central America data	80,000

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