Comisión Interamericana del Atún Tropical Inter-American Tropical Tuna Commission

IATTC

YELLOWFIN TUNA STOCK ASSESSMENT: CONCEPTUAL MODEL AND EXPLORATORY ANALYSES Carolina Minte-Vera, Mark N. Maunder, Haikun Xu, Cleridy E. Lennert-Cody, Jon Lopes, Alexandre Aires-da-Silva, Daniel W. Fuller, Mitchell S. Lovell

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Outline

- 1. Background
- 2. Update of the conceptual model for yellowfin tuna in the EPO
- 3. Dynamic discrimination of stocks
- 4. Future directions



Background

- 2019 assessment rejected too sensitive to the longline index of abundance
- Longline index and purse-seine indices had contradictory information
- Model misspecification due to spatial structure
- 2020 benchmark assessment used risk analysis approach



2020 Conceptual model for yellowfin tuna in the EPO





2020 Conceptual model for yellowfin tuna in the EPO



- Needed more research
- Assessment centered where the core of the catches are taken (Purse-seine index of abundance)



Update of the conceptual model for yellowfin tuna in the EPO

Two stocks in the EPO (NE and SW)

- Stocks associated with epi and mesopelagic biogeochemical provinces
- Boundaries between NE and SW stocks are dynamic and depend on the movement of the water masses (which correlates with ENSO)

Evidence:

Genomic/ Molecular Larval distribution/ Reproductive biology Archival and conventional tagging Fisheries dynamic

Purse seine



Evidence: genomic/genetic data



Within each study, different color indicate genetically or genomically different, same color indicate similarity:
D D: Díaz-Jaimes and Uribe-Alcocer 2006
G G G: Grewe et al 2015

- **P**: Pecoraro et al 2018
- M M: Muñoz-Abril et al 2022
- WW: Ward et al 1997

- There may be:
 - several stocks of yellowfin tuna across the Pacific Ocean
 - 2 different stock in the EPO



Evidence: biological data



Tagging data is consistent with the conceptual model

IATTC tagging data



Tagging data is consistent with the conceptual model

WCPFC tagging data

Source: SPC data, prepared by Mathew Vincent (2019) at the IATTC staff request

Release longitude

Stocks associated with biogeochemical provinces

Epipelagic

average period January 1998 to December 2007.

Mesopelagic

Biogeochemical provinces are dynamic

(b)

- WARM pool expansion,
- Contraction of
- PNEC: North Pacific Equatorial Counter Current
- PEQD: Pacific Equatorial divergence

 WARN contraction,

La Nina

(June 1998 - March 2001)

PNEC, PEQD expansion

Principal component analysis on oceanographic variables

Principal component analysis on oceanographic variables

PC2

Gradient in sea Surface temperature

Tree analysis on length frequency using environmental gradients as explanatory variable

Floating objects set

Warm area (PC2 > -0.25)

gradient

Tree analysis

Stock separation

Catch distribution: dolphin sets

Catch distribution: longline sets

Quarter

Catch distribution: proportion by area

Average proportion of the catches (in weight for purseseine and in numbers for longline) from the NE and SE putative stocks and from the north area

Gear	Set type	NE	SW	Ν
Purse-seine	Dolphin	99%	1%	1%
	Unassociated	96%	2%	2%
	Floating Objects	83%	17%	0%
Longline		17%	79%	4%

Population trends

- At least two stocks of yellowfin tuna (NE,SW) in the EPO associated with biogeochemical provinces
- This conceptual model is supported by available information
- The boundary is dynamic
- The boundary was informed using environmental gradients and length composition data, this may be a viable technique to split the catches

Future directions

Future directions

Follow recommendations from:

- 2019 <u>external review panel</u>
- CAPAM meetings
- new review planned for 2023

Collection of new and updated information, continue

- collection and analysis of purse-seine data (catch, effort, and size-composition)
- collaborative work with longline CPCs
- tagging and biology studies and analyses
- Changes in fishing strategies (PS, LL)

<u>Refinements to the assessment model and methods</u>

- Address uncertainty in spatial/stock structure, growth, natural mortality
- Continue research on CPUE and length-frequency standardization methods
- Explore different stock assessment time spans, initial conditions and types of models (monthly/weekly models, depletion models)

