INTER-AMERICAN TROPICAL TUNA COMMISSION

EXTERNAL REVIEW OF IATTC YELLOWFIN TUNA ASSESSMENT

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INTRODUCTION TO THE REVIEW OF THE ASSESSMENT OF YELLOWFIN TUNA IN THE EASTERN PACIFIC OCEAN, 2012

CONTENTS

This report summarizes the information available for the 2012 review of the IATTC staff's 2012 assessment of yellowfin tuna in the eastern Pacific Ocean (EPO), the issues with the assessment, and the IATTC staff's view on these issues.

Yellowfin Assessment

The EPO yellowfin tuna stock assessment is carried out using Stock Synthesis. The most recent assessment[1], carried out in 2012, was only an update, and a more comprehensive description of the assessment is available in the 2011 assessment report[2].

The Stock-Synthesis model files are available on request.

Fishery information

Some information on the fishery is available in the IATTC's Fishery Status Reports[3].

Data

The data used in the EPO tuna assessments was summarized in a document[4] presented at the review of the bigeye tuna assessement in 2010.

Previous sensitivity analyses

Sensitivity analyses carried out in previous stock assessments are summarized in Document YFT-01-08[5]: *A review of historical EPO YFT stock assessment sensitivity analyses.*

2010 review of the bigeye assessment

The bigeye tuna external review meeting report[6] and the meeting documents can be found here[7].

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[1] http://iattc.org/PDFFiles2/StockAssessmentReports/SAR-13-YFTENG.pdf
[2] http://iattc.org/PDFFiles2/StockAssessmentReports/SAR-12-YFTENG.pdf
[3] http://iattc.org/PDFFiles2/FisheryStatusReports/FisheryStatusReport10ENG.pdf
[4] http://iattc.org/PDFFiles2/BET-01-07-Summary-of-data-DRAFT.pdf
[5] http://fisheriesstockassessment.com/files/YFTreview2012/Historicalsensitivities.docx
[6] http://iattc.org/Meetings2010/PDF/May/BET-01-Meeting-report-ENG.pdf

Assessments of yellowfin tuna by other RFMOs

The analyses and assumptions in the assessments of yellowfin tuna by other RFMOs may provide insights about the EPO assessment.

WCPFC: http://www.wcpfc.int/doc/sa-wp-03/stock-assessment-yellowfin-tuna-western-and-central-pacific-ocean

ICCAT: http://www.iccat.es/Documents/Meetings/Docs/2011_YFT_ASSESS_REP.pdf

IOTC: http://www.iotc.org/files/proceedings/2011/wptt/IOTC-2011-WPTT13-36%20Rev_1.pdf

Reference points and harvest strategies

Reference points relevant to yellowfin are discussed in *Reference points, decision rules, and management strategy evaluation for tunas and associated species in the eastern Pacific Ocean*[8].

Information on the Kobe plot and matrix relevant to yellowfin is discussed in the following two documents:

Evaluation of the Kobe plot and strategy matrix and their application to tuna in the eastern Pacific Ocean[9];

Application of Kobe plot and matrix to bigeye tuna[10].

AREAS OF FOCUS

1) What is the most appropriate stock structure for the yellowfin tuna stock assessment?

Should the stock assessment be based on a single EPO stock, as in the current assessment, or on multiple stocks within the EPO, with or without interactions, or should the region of stock assessment be increased to include some area west of 150°W?

The following two documents investigate the spatial structure of the yellowfin tuna stock and fisheries.

YFT-01-02: *Exploring large-scale patterns in yellowfin tuna data from dolphin sets in the eastern Pacific Ocean purse-seine fishery*[11]

YFT-01-03: *Poststratification of purse-seine port-sampling data from dolphin sets*[12]

Several historical documents are available that summarize the methods used to evaluate the spatial structure in the CPUE and length-composition data and methods to postratify the data:.

Stock structure of bigeye, yellowfin, and skipjack tunas in the eastern Pacific Ocean[13]

Progress report on the development of poststratified estimators of total catch for the purse-seine fishery port-sampling data[14]

Poststratified estimators of total catch for the purse-seine fishery port-sampling data[15]

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[7] http://iattc.org/Meetings2010/Bigeye-AssessmentMay2010ENG.htm
[8] http://iattc.org/PDFFiles2/StockAssessmentReports/SAR-13-Reference-pointsENG.pdf
[9] http://iattc.org/PDFFiles2/StockAssessmentReports/SAR-12-KobeENG.pdf
[10] http://iattc.org/Meetings2012/May/PDFs/SAC-03-06c-Applicaton-of-Kobe-strategy-matrix-to-BET-DRAFT.pdf
[11] http://fisheriesstockassessment.com/files/YFTreview2012/YFTSpatial.pdf
[12] http://fisheriesstockassessment.com/files/YFTreview2012/Poststratification.pdf
[13] http://iattc.org/PDFFiles2/StockAssessmentReports/SAR9-Stock-Structure-ENG.pdf
[14] http://iattc.org/PDFFiles2/StockAssessmentReports/SAR-13-Post-stratifiedENG.pdf

Lennert-Cody, C.E. Minami, M., Tomlinson, P.K. and Maunder, M.N. (2010) Exploratory analysis of spatial-temporal patterns in length-frequency data: an example of distributional regression trees. Fisheries Research, 102(3): 323-326. http://www.sciencedirect.com/science/article/pii/S0165783609003166

Lennert-Cody, C.E., Maunder, M.N., Aires-da-Silva, A., Minami, M. (in press) Defining population spatial units: simultaneous analysis of frequency distributions and time series. Fisheries Research.

Available on request

2) What is the most appropriate fishery structure for the yellowfin tuna stock assessment?

What methods should be used to define fisheries?

See topic (1) for relevant papers.

3) What approach should be used to deal with the uncertainty in the length of old individuals and the impact it has on the stock assessment results?

Should tagging and otolith data be combined to estimate the growth curve? How should variability in length at age be represented and estimated? Information about EPO yellowfin tuna growth is evaluated in:

YFT-01-04: *Growth of Yellowfin Tuna in the Eastern Pacific Ocean: New Estimates from an Integrated age-at-length and tag-recapture Model and its Impact on the Management Quantities*.

4) What is the appropriate stock-recruitment relationship?

How should the steepness of the stock-recruitment relationship be estimated? What are the consequences of getting the stock-recruitment relationship wrong? Should a precautionary value be used for steepness since the yield curve is flat at high steepness levels? Information about the stock-recruitment relationship of EPO yellowfin tuna growth is evaluated in:

YFT-01-05: *A review and evaluation of recruitment and the stock-recruitment relationship for the assessment and management of yellowfin tuna in the eastern Pacific Ocean*[16]

5) How should the CPUE indices of abundance be used in the stock assessment?

How should the CPUE be standardized? Which CPUE indices should be used in the assessment (purse seine and/or longline) and how should they be used. Should catchability be allowed to change over time and for which indices? How should the different data sets be weighted?

6) What selectivity curves should be used?

What selectivity curves should be used: the standard Stock Synthesis double normal, cubic splines, smoothness penalties, or others? What methods should be used to determine the appropriate selectivity curve and its parameter values? Should selectivity curves change over time using time blocks, random walks, or a VPA-type approach?

Information about time varying selectivity is evaluated in

YFT-01-06: *An exploration of alternative methods to deal with time-varying selectivity in the stock assessment of yellowfin tuna in the Eastern Pacific Ocean*[17]

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[15] http://iattc.org/PDFFiles2/StockAssessmentReports/SAR-12-PostENG.pdf
[16] http://fisheriesstockassessment.com/files/YFTreview2012/YFTh.pdf
[17] http://fisheriesstockassessment.com/files/YFTreview2012/YFTselectivity.pdf

7) Age- and sex-specific natural mortality

How should natural mortality be determined? Should natural mortality differ by age and/or sex?

Information about the natural mortality of EPO yellowfin tuna growth is evaluated in:

YFT-01-07: *A review and evaluation of natural mortality for the assessment and management of yellowfin tuna in the eastern Pacific Ocean*[18]

Other topics of interest

- Reference points
- Using tagging data
- Methods used to create the length-composition data
- Inclusion of age conditioned on length data
- Definition of spawning biomass
- Diagnostics
- Research recommendations
- Data collection
- Data analysis[19]

IATTC staff assessment recommendations

The following recommendations were developed by the IATTC staff after conducting the investigations for the yellowfin tuna review. They are not intended to be final, but provide an indication of the staff's current thinking.

Growth

Use the Richards growth equation parameters and the standard deviation of the variation of length-at-age estimated by integrating the otolith data and recent tag growth increment data. Base the variation of length-at-age as a linear function of length.

Natural mortality

Use estimates of natural mortality (*M*) for bigeye and yellowfin tuna from Hampton (2000) for ages less than 80 cm, and estimate the female mature *M* with the ratio between mature male and mature female *M* fixed at levels used in the current assessment.

Investigate integrating the sex-composition data into the model to estimate both male and female mature *M*. Request that priors on *M* at a given age be implemented in Stock Synthesis. Alternatively, re-estimate *M* outside the model using the approach of Harley and Maunder (2003), using both yellowfin and bigeye estimates of *M* from Hampton (2000). Consider using the historical sex ratio data.

Recruitment

Use a steepness value of 0.9 as a first step to add robustness to the uncertainty in steepness.

Spatial structure

Conduct separate assessments for north and south of 5°N. Separate the dolphin-associated fisheries based on the simultaneous regression-tree analysis. Group the floating-object fisheries into a single fishery with time-varying selectivity.

[18] http://fisheriesstockassessment.com/files/YFTreview2012/YFTM.pdf
[19]

Repeat the regression-tree analysis for the unassociated fisheries. Consider grouping the unassociated fisheries into a single fishery with time-varying selectivity.

Time-varying selectivity

Group the floating-object fisheries into a single fishery, with time-varying selectivity in the most recent five years, and use the length-composition data for the most recent five years only.

Consider grouping the unassociated fisheries into a single fishery, with time-varying selectivity in the most recent five years, and use the length-composition data for the most recent five years only.