Comisión Interamericana del Atún Tropical
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# Skipjack tuna independent review and potential assessment improvements

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# Independent review

- Reviewing and making recommendations
  - Current assessment
  - Tagging analysis
  - How to use tagging analysis in future assessments
- 7-10 November 2022, La Jolla
- Panelists
  - James Bence – Michigan State University (Chair)
  - Matthew Vincent – NOAA, Southeast Fisheries Science Center
  - Inna Senina – The Pacific Community (SPC)
  - Darcy Webber – Quantifish Limited, New Zealand

# Independent review

"The panel agreed that the basic stock assessment modeling approach was sound and did not recommend a major overhaul of model structure in the short term."

"However, the panel had concerns about the reliability of both abundance indices, the assumed level of natural mortality (and its dependence on age), and the estimated selectivities, particularly regarding the assumed strongly domed shaped selectivity for the purse seine fisheries."

"the panel strongly recommends further work to develop estimates of absolute biomass from tagging data, and that these estimates be integrated into the next assessment as an additional data input."

# Assessment improvements: Conceptual model

- Describes the characteristics of the stock and fishery
  - Stock structure
  - Biological parameters
  - Fisheries
  - Data
- Used to define alternative hypotheses and models
- Challenging task taking a considerable amount of time

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# Assessment improvements: Catch data

- A port sampling program is used to determine the species and size composition
- Has limited sampling and there can be many space-time strata with no data
- A CAR model has been developed to improve the estimates during COVID-19 years
- This or a related approach could be used for all years
- The uncertainty in the catch estimates could be explicitly included in the assessment model.
- The catch uncertainty for skipjack is probably low and may be more important for the yellowfin and bigeye assessments.

# Assessment improvements: Length composition data

- There are spatio-temporal strata with missing length composition data
- A spatio-temporal model might improve the estimates for both the purse-seine and longline fisheries.
- The model might also be able to provide estimates of effective sample size
- The length composition data for the indices should be area weighted by CPUE
- The length composition data for the fisheries should be weighed by catch.
- The quality of the longline length composition data needs to be investigated

# Assessment improvements: Longline index of abundance

- Information on the discards and their variability over time is needed
- Application of spatio-temporal methods to standardize the CPUE
- Further investigation of the length composition data is needed

# Assessment improvements: Echosounder buoy index of abundance

- Ongoing improvements
  - Including adding new historical data
  - Updating with current data
- Using the composition data for the same areas as the index data

# Assessment improvements: Selectivity

- Determine the most appropriate selectivity for the assessment
- Redefinition of the fisheries by area, season, or other factors
- Ensure that the selectivities are “regular” (i.e., double normal or logistic).

# Assessment improvements: Natural Mortality

- The level of natural mortality and how it varies with age need to be reconsidered.
- The new spatio-temporal model for analyzing the SKJ tagging data shows promise in estimating natural mortality.
- Increases for medium-aged fish and this is not consistent with the good practices.
- The magnitude should be based on maximum age and M should decline with size based on the Lorenzen relationship.
- Unfortunately, there is no reliable aging method for skipjack and tag recoveries are generally not available from the largest skipjack.
- Therefore, maximum age is unknown and other methods need to be investigated to determine the magnitude.
- There may be an interaction between natural mortality and selectivity and the assumptions about selectivity and natural mortality to be considered together.
- The estimates of M from Peatman et al. (2022) should also be considered.

# Assessment improvements: Growth

- Reliable aging data is not available and there are few tag recaptures of large skipjack
- The tag growth increment data provides substantial information on growth of intermediate aged skipjack, but the absolute age is uncertain and there is little information on the asymptotic age.
- Other models such as the Richards growth curve should be considered.
- Fitting the growth model inside the stock assessment should be considered. The length composition data may provide information on growth and the variation of length-at-age.

# Assessment improvements: Tagging analysis

- Potentially estimate absolute biomass, fishing mortality, and natural mortality.
- Ongoing improvements
  - The processes (e.g., fishing mortality, natural mortality, movement) can be made a function of length.
  - Account should be made for tag loss, tag reporting, and tag-related mortality.
  - Additional covariates and interactions among covariates for movement
    - Ocean currents.
  - Coastal boundaries could be added to the analysis
  - Tag location uncertainty

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  - Tag location uncertainty
- Use in the stock assessment
  - Estimates of absolute abundance, natural mortality, and/or fishing mortality.
  - Length-group specific estimates of absolute abundance
    - Fit using a likelihood function
  - Length-group estimates of natural mortality
    - Priors

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