Development of Management Strategy Evaluation analyses for Indian ocean albacore tuna

IOTC TCMP09 - 12/04/2025

Summary

- Albacore MSE has moved to condition OMs away from stock assessment.
- New methodology based on Development of Aproximate Bayesian Computation (ABC) now endorsed by WPM & SC.
- Data and priors combined to quantify recent and future stock and fishery dynamics.
- OMs include a wide range of uncertainty.
- Technical difficulties delayed work so MSE runs waiting for WPM approval.
- Work carried out by WMR (NL), funded by IOTC/FAO, and CSIRO (AU), funded by DFAT, Government of Australia.

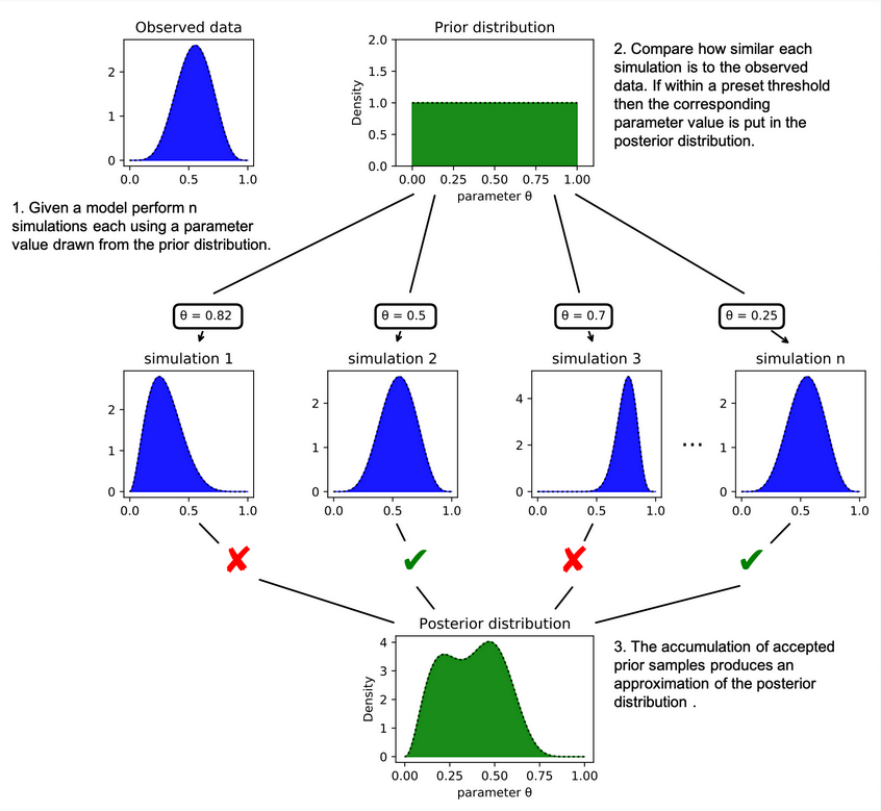
Conditioning of Operating Models

Axes of uncertainty

- Use of - and generation of data from - alternative CPUE series
- Influence of size data on estimates
- Impact of assumed catchability increases in LL fleets
- Uncertainty in stock-recruitment steepness and natural mortality
- Uncertainty in recruitment variability

The ABC algorithm

- Methodology similar to that used for first SKJ MSE.
- *Discrepancy functions* rather than maximun likelihood.
- Flexible approach when quantifying uncertainty.
- Allows use of priors on many other quantities.



Prior distributions

- Stock-recruitment steepness and natural mortality.
- Variance in recruitment, but also estimated.
- Importance of length-frequency data.
- Annual change in longline catchability.
- Priors on stock status and overfishing probability, informed by assessment.
- Overfishing penalty on runs with unrealistic depletion.
- Integrated with length frequency and CPUE data.

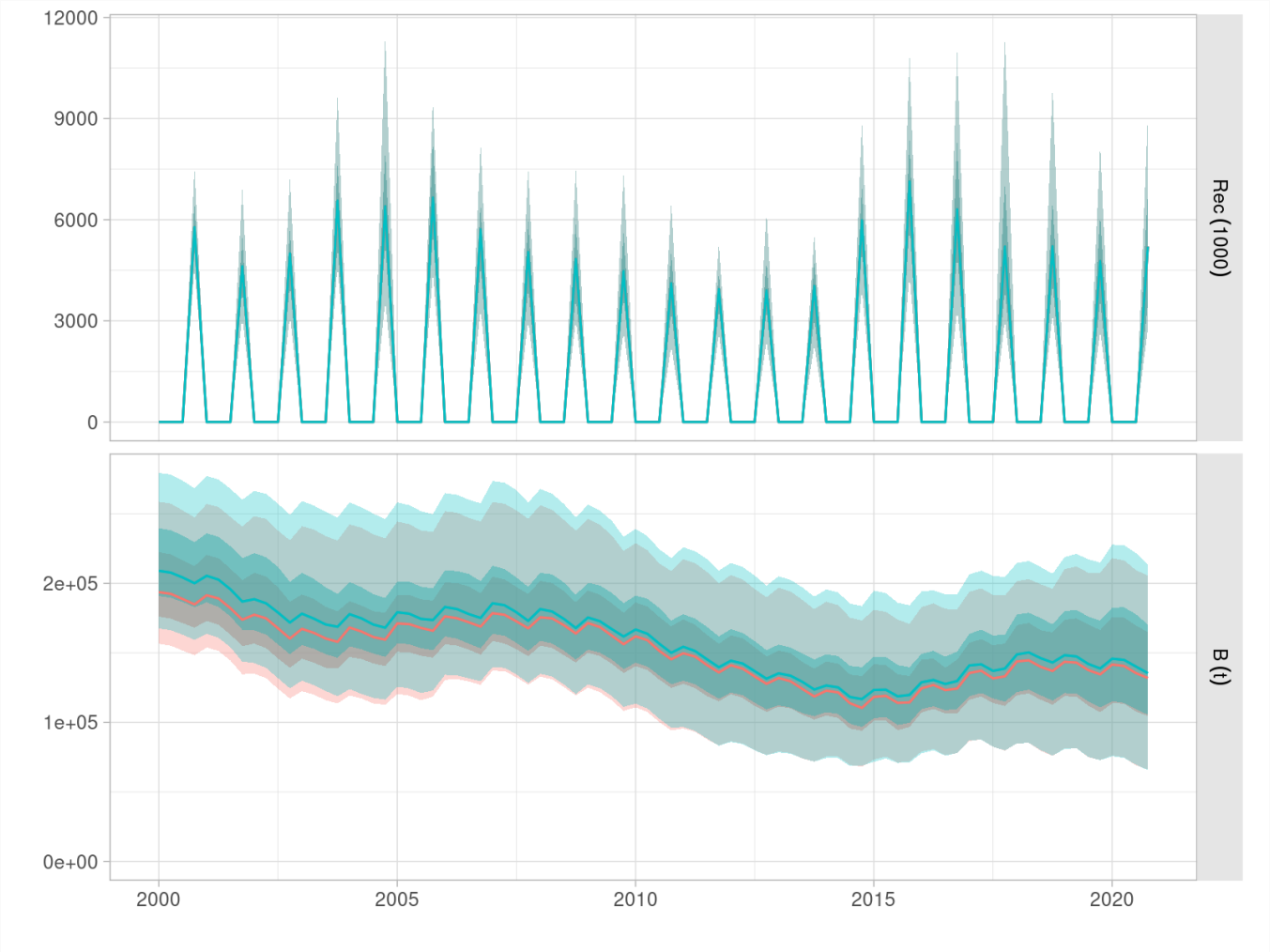
Conditioning data

- Interested in characterizing current cohorts.
- Last 21 years (2000-2021) of:
  - Longline CPUE.
  - Total catch by fishery.
  - Catch-at-length by fishery, aggregated over time.

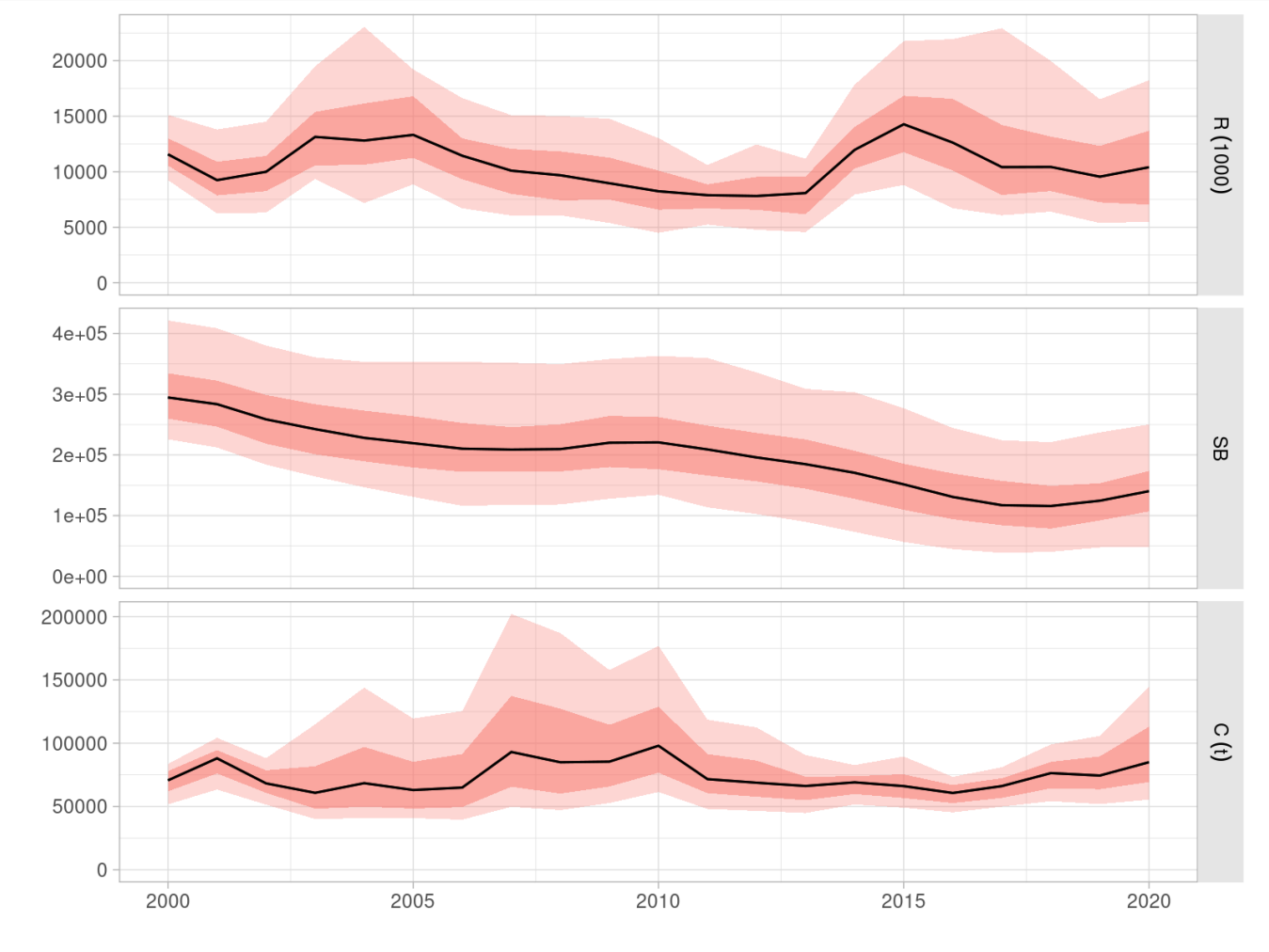
Population and fishery model structure

- Population by age, sex and quarter
- Beverton & Holt stock-recruits relationship with initial exploited equilibrium
- Reduced number of fleets with aggregated size data
  - Longliners areas 1-4
  - Purse seiners
  - Other
- Seasonal and annual catchability explored

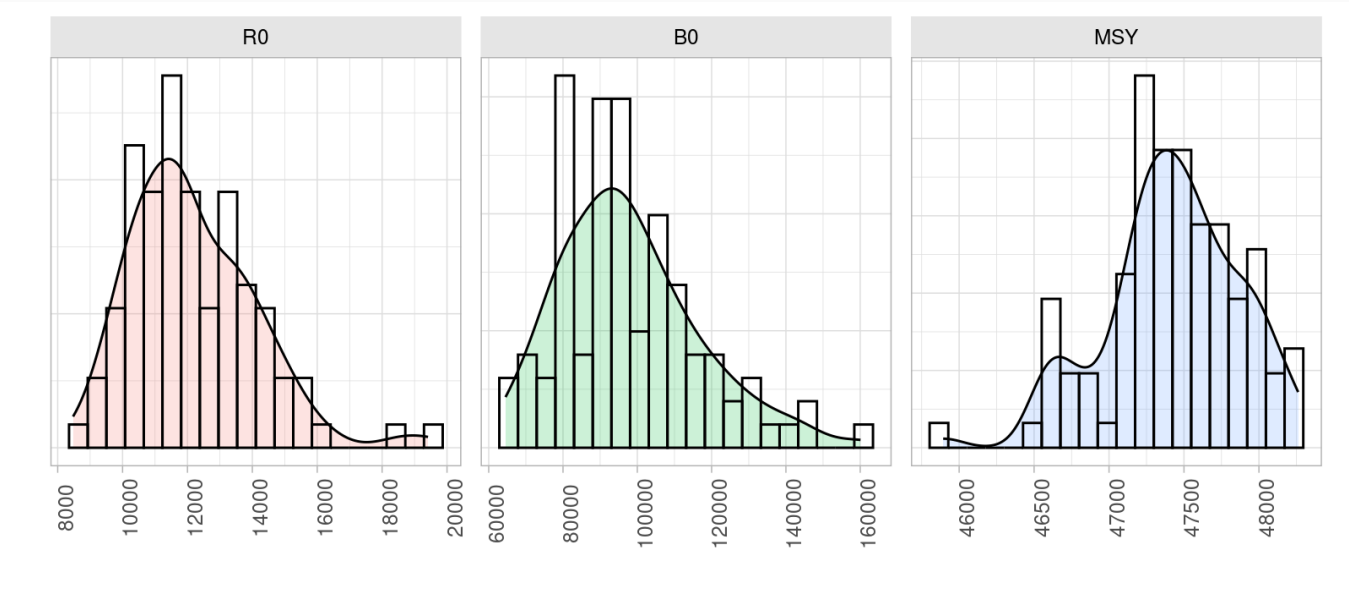
Operating Models - seasonal



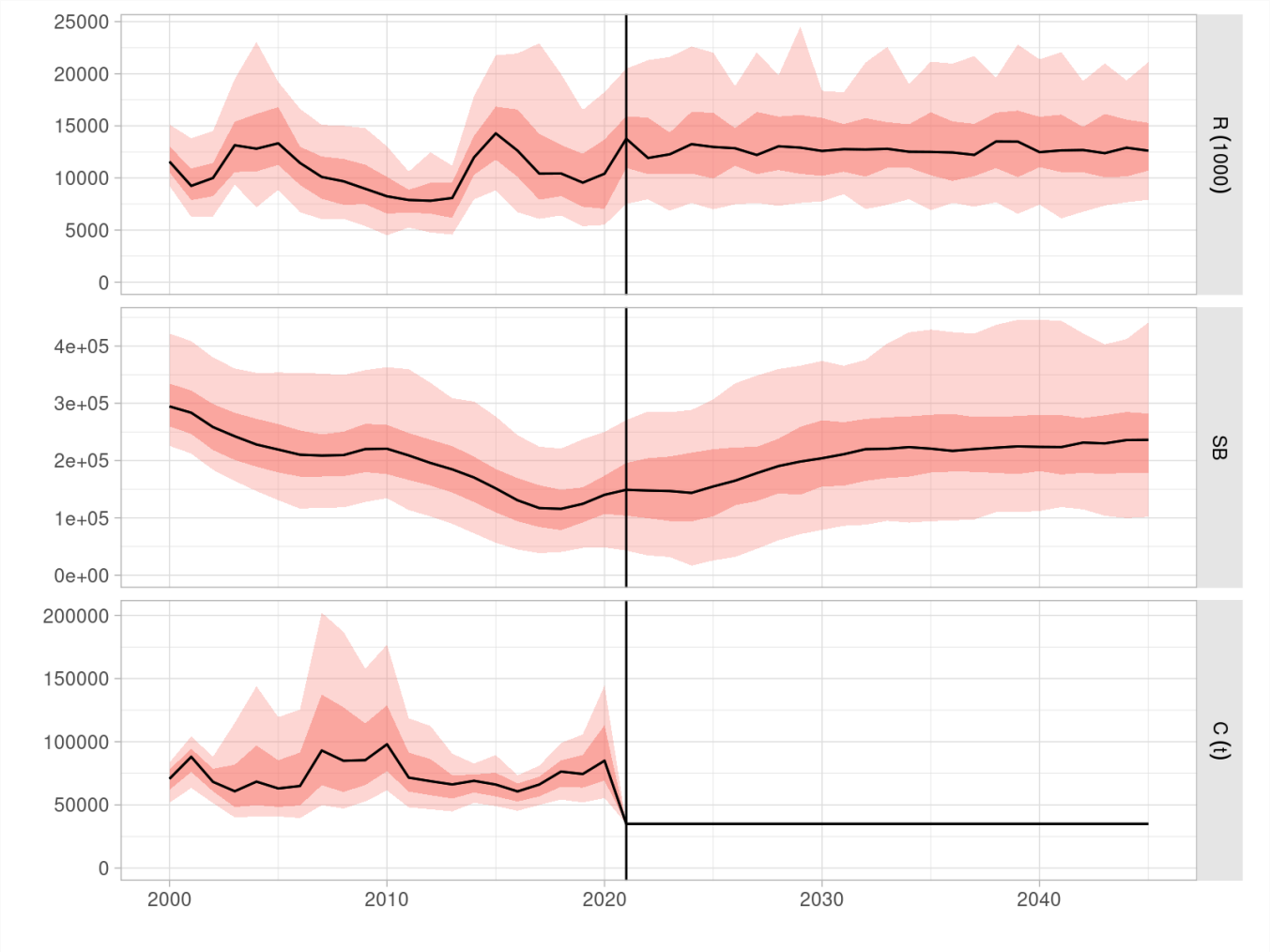
Operating Models - annual



Operating Models - reference points



OM projections - C = 35,000 t



Robustness trials

- Low and high (30%) future recruitment over historical levels.
- Larger spasmodic recruitment, more intense increases and decreases in abundance.
- Climate change scenario: faster growth, earlier maturity and a reduced maximum size.
- Different levels of precision and bias in the CPUE indices of abundance.

Management Procedures

Candidate MPs

- **Model-free MP**: trend and value of longline CPUE (area 1 or 3).
- **Model-based MP**: surplus production model (JABBA).
- In both cases applying a catch-based hockeystick (*buffer*) HCR.

Buffer HCR

- Stable catch between ‘normal’ levels.
- Increases catch if stock grows.
- Decreases catch if stock below range.
- Decreases more rapidly below limit.

Candidate MPs

- **Model-free MP**: trend and value of longline CPUE (area 1 or 3).
- **Model-based MP**: surplus production model (JABBA).
- In both cases uses catch-based hockeystick (*buffer*) HCR.
- Catch split across fisheries following recent proportions.
- Limits tio TAC change tested: 15 and 30% (TCMP 2022).
- Setting minimum catch at 10% MSY (TCMP 2022).
- Data lag of 2 years, as current.
- Decision lag of 2 years, as SWO.
- Management decision applied for 3 years.

Management objectives

Tuning objectives

- Stock to be at Kobe green
  - Years 2034-2043
  - Probabilities of 50, 60 and 70%

Future steps

Timeline of work

- Updated datasets obtained from WPTmT09 (July).
- Full set of OMs and MSE simulations presented to WPM (October).
- Feedback from WPM incorporated prior to SC (December).
- Final product available for TCMP consideration (February 2026).

Feedback from TCMP

- Are tuning objectives still relevant?
  - P(Kobe=green) = 50, 60 or 70%
- Any performance statistic to be added?
- Are the proposed MPs acceptable?
- Any other matter to be explored?
- Thanks for your feedback!