

Simulation testing of management procedures for Indian ocean albacore tuna based on ABC operating models: report on progress

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Development of albacore MSE using ABC OMs

- Progress of work from 2025 WPM MSE
- Base case and robustness OMs finalized
- Proposal for update of OMs to new data WPTMT 2025
- Tested model-free MPs, tuning to be finalized
- Robustness OMs plus climate change scenarios
- Tests of model-based MP
- Observation error scenarios

Operating models

OM model structure: population dynamics

- Timeline is 2000 to 2020 (2023), all existing cohorts
- Age, sex and quarterly structured population model
- Beverton-Holt with exploited equilibrium initialisation
- Designed around simplified version of assessment model structure
- Reproduces key stock status variables:
 - MSY variables: SB_{MSY} , HR_{MSY}
 - Depletion relative to SB_0

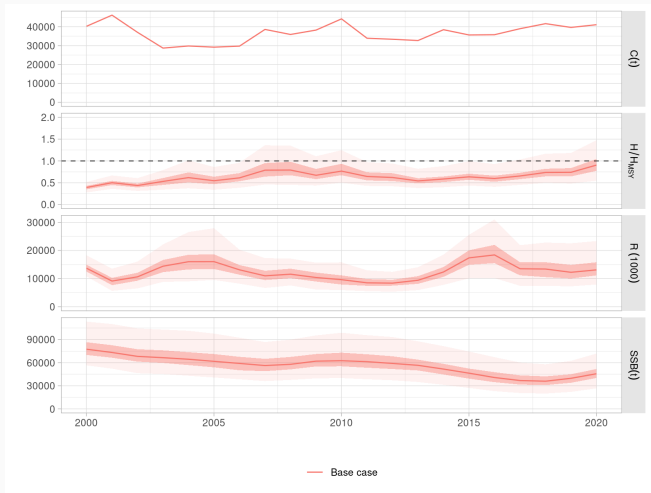
OM model structure: fishery dynamics

- Model considers 4 LL fleets, each with seasonal catch, effort and size data.
- One PS fleet and one *Other* fleet, 6 in total.
- Size data from LL and PS is aggregated across time.
- Single LL CPUE as index of abundance (NW or SW)
- Seasonal vs. annual catchability explored

- Status priors from assessment
 - Relative SSB
 - B_{MSY} ratio
 - HR_{MSY} ratio
 - Overfishing penalty
- Integrates status information with LF & CPUE data
- Axes of uncertainty
 - Steepness & M : covariance joint prior (not discrete grid)
 - σ_R : (i) fixed at 0.3; (ii) estimated with prior CI 0.2–0.5
 - LF: weight/influence (aggregating and ABC discrepancy)
 - LL catchability: alternative 1% annual increasing trend
 - CPUE series: seasonal q using fleet 1 and 3 *separately*

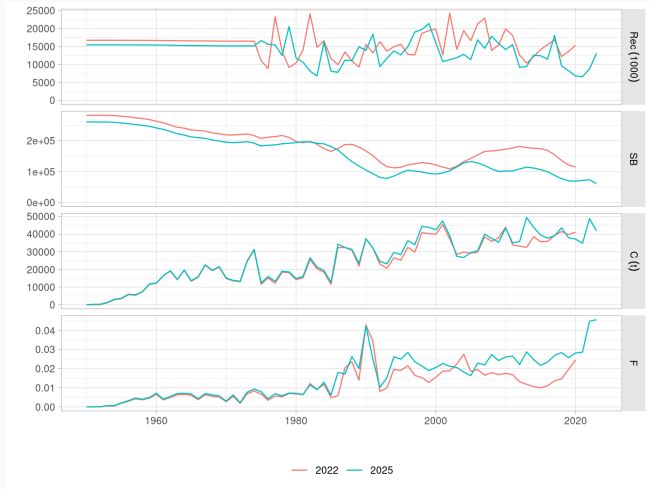
Base case OM

- LL CPUE1 (NW), SSB priors, recruitment variability, and overfishing penalty

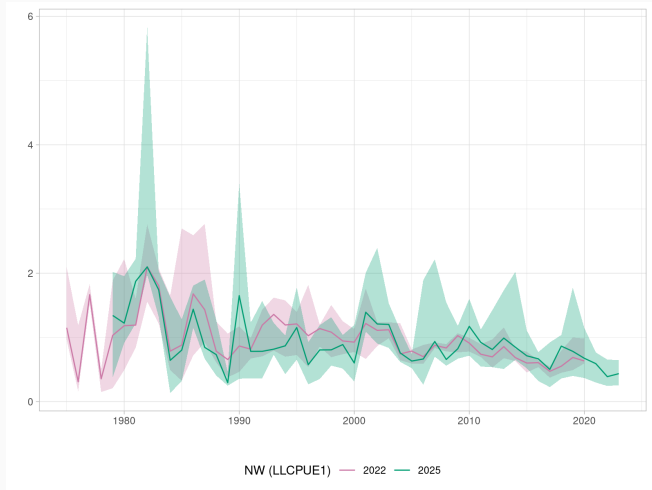


WPT_{mT} SA 2025

- Updated catch series, up to 2023
- New indices of abundance

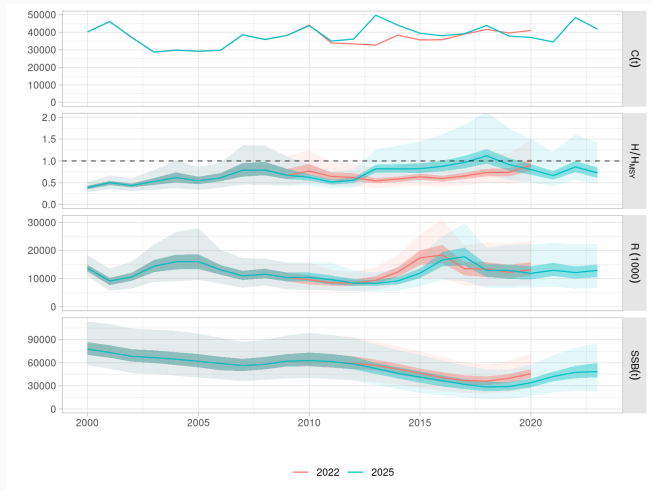


NW LL CPUE indices of abundance, 2022 & 2025

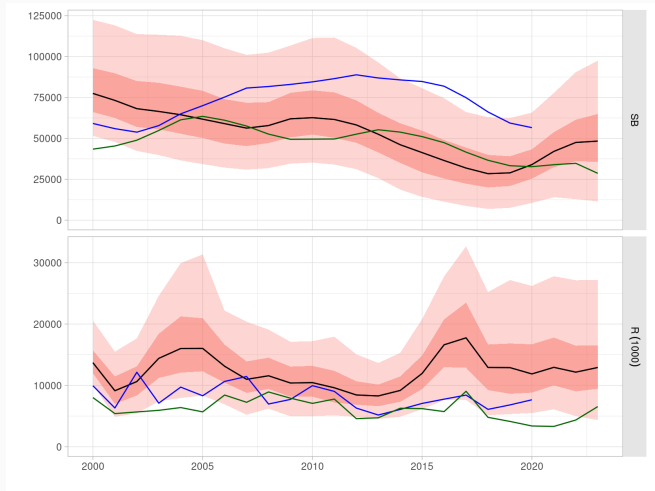


- Conditioned OM, same selectivities & biology
- Projected for updated nominal catch 2010-2023
- Recruitment predicted from original SRR and LN deviances (σ_R , ρ)
- LL CPUE reconstructed from new biomasses and previous selectivities

Conditioned and updated base case OM

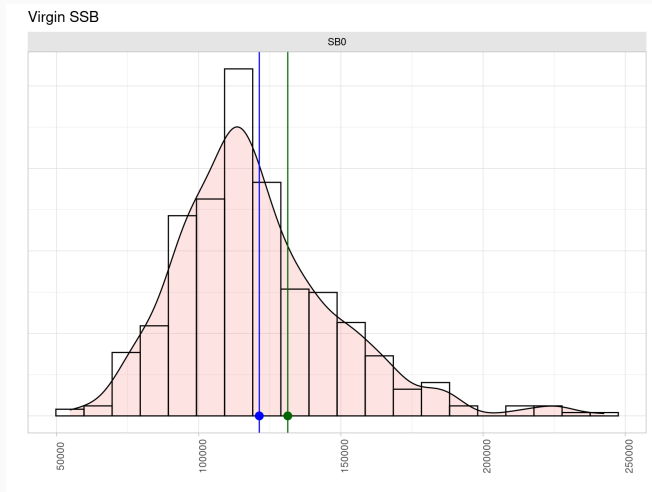


Updated OM and stock assessment scale



Updated OM and stock assessment scale

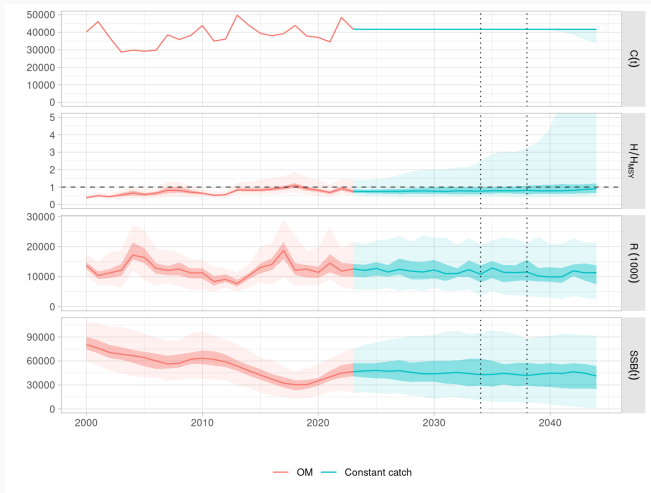
- SB0 131,315 t (2022) 121,296 t (2025)



Management procedures

Constant catch tuned MP

- Tuned to $P(\text{Kobe}=\text{green})=60\%$ in 2034-2038
- $C = 40,000$ t. $C(2023) = 41,806$ t

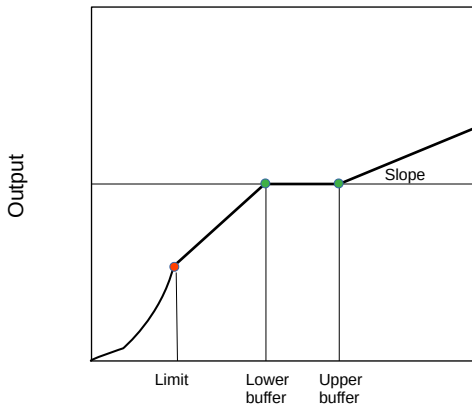


Contact catch tune MP, lessons learned

- Current CPUE likely at desired level
- Catches might need increasing to achieve targets
- Little catch variation needed to tune, but
- MP needs to react quickly after increases in catch
- Reference from years when assessment says stock is at FMSY

Model-free MP: CPUE + buffer HCR

- TAC multiplier \sim index
- Target catch level at around current
- Buffer width and position for potential tuning.



Harvest rate as exploitation metric

- Exploitation level metric, C/VB
- Computer quarterly by fleet, limited to 90%
- Annual metric is average over quarters of sum over fleets

$$HR = \sum_{s=1}^4 \left(\sum_{f=1}^6 (C_{fs} / \sum_{a=0}^{14} (N_a s \cdot W_a s \cdot S_{fas})) \right) / 4$$

Status of work

Next steps

- Finalize tuning of the proposed model-free MP.
- Run and tune model-based MP, JABBA + buffer.hcr(multiplier ~ depletion)
- Finalize climate-change robustness scenarios
- Test the tuned MPs on the robustness OMs
- Test MPs under some observation error scenarios for total catch.
- Report to WPM and WPTmT by end of 2025.

- Is the update of OM sufficient?
- Any potential alternative MP option?

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