

# 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

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# 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  $SB_0$

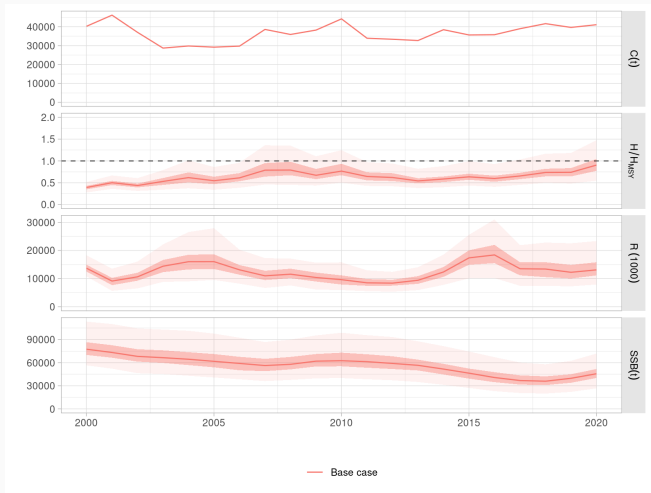
## OM model structure: fishery dynamics

- 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)
  - $\sigma_R$ : (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*

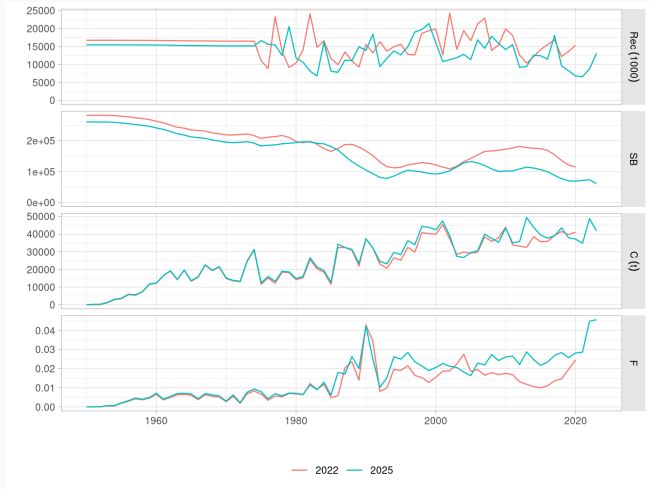
# Base case OM

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



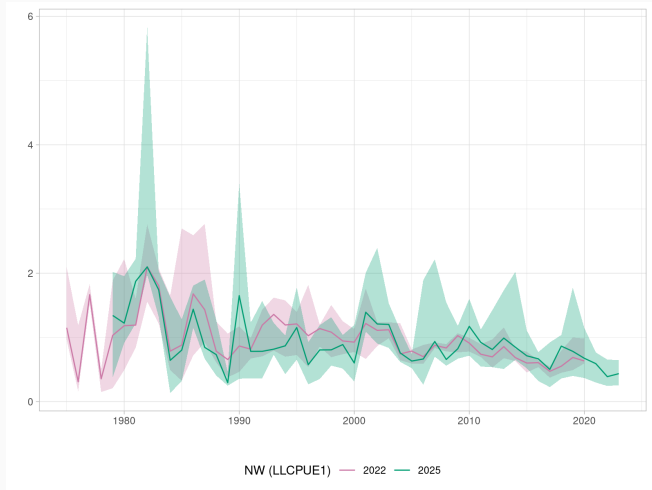
# WPT<sub>mT</sub> SA 2025

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



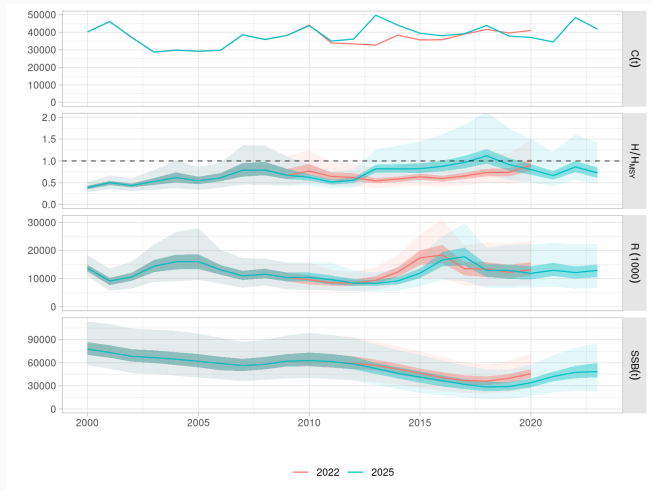


# NW LL CPUE indices of abundance, 2022 & 2025

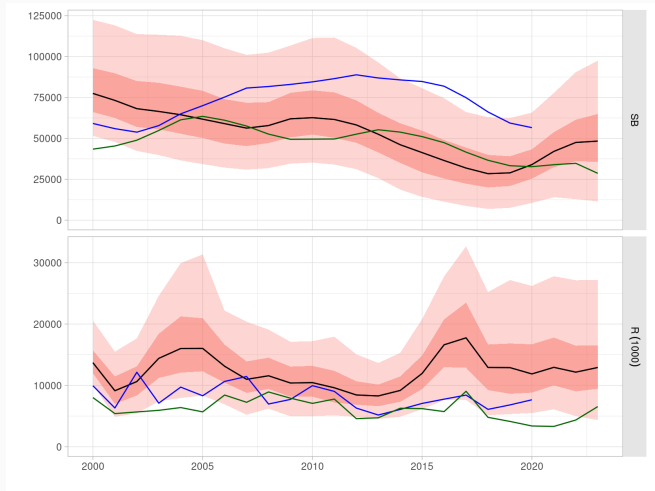


- Conditioned OM, same selectivities & biology
- Projected for updated nominal catch 2010-2023
- Recruitment predicted from original SRR and LN deviances ( $\sigma_R$ ,  $\rho$ )
- LL CPUE reconstructed from new biomasses and previous selectivities

# Conditioned and updated base case OM

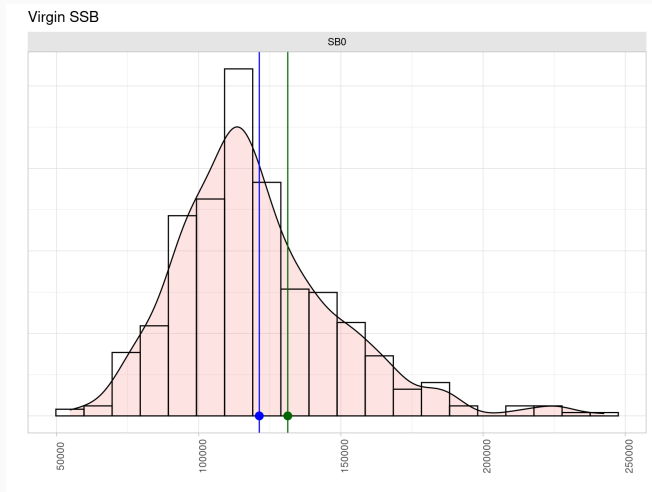


# Updated OM and stock assessment scale



# Updated OM and stock assessment scale

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

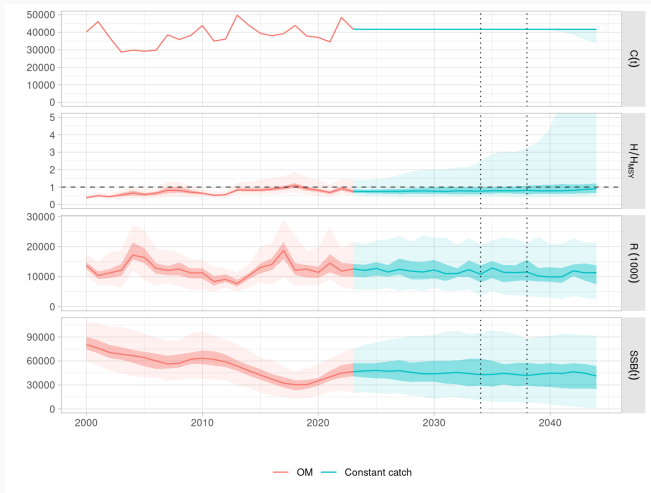


# Management procedures

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# Constant catch tuned MP

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



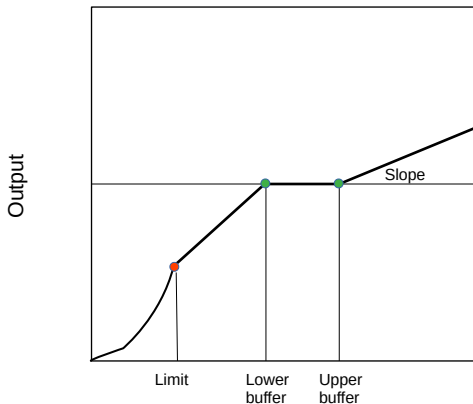
## Contact catch tune MP, lessons learned

- 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

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## 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?
- Assumed lags: 2 years on data, 2 years on management

# Acknowledgements

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