Model Comparison with r4MAS - quarterly tropical tunas

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Workflow

- Use the operating model (OM) from the age-structured stock assessment comparison project to simulate true population dynamics.
  - Age-structured stock assessment comparison project OM:

  https://github.com/Bai-Li-NOAA/Age_Structured_Stock_Assessment_Model_Comparison

  - R script to run the OM and Metapopulation Assessment System (MAS):

  https://drive.google.com/file/d/1QevaqJ-GnEyC_ctRsa7fczC9MmKsYXAt/view?usp=sharing
- Compare MAS estimates and OM "true" values
  - R script:

  https://drive.google.com/file/d/1Ohvx5hnpfiiK2M8LpLOurlS_NI686T0D/view?usp=sharing

  - R Markdown:

  https://drive.google.com/file/d/1Y3p5foK9uB9P7ZIiMlHaKmXVFdgfMLyV/view?usp=sharing

Description of cases

- Case 1: Null case
  - $\sigma_R = 0.4$
  - Fishing mortality (F) deviations are same per iteration
  - F pattern: increase
  - Selectivity pattern: simple logistic
  - Number of survey: 1
  - Initial condition: $\phi_F \neq \phi_0$
- Case 2: Increase recruitment variability
  - $\sigma_R = 0.6$
- Case 3: Stochastic F
  - F deviations are stochastic per iteration
- Case 4: Roller coaster F pattern
  - F increases first and then decreases
- Case 5: Constant F pattern
  - $F = F_{low}$
- Case 6: Constant F pattern
  - $F = F_{MSY}$
- Case 7: Constant F pattern
  - $F = F_{high}$
- Case 8: Selectivity pattern
  - Double logistic selectivity
- Case 9: Increase number of surveys

  - Number of survey: 2
- Case 10: Initial condition
  - $\phi_F = \phi_0$
- Case 11: Increase survey coefficient of variation
  - $CV_I = 0.5$
- Case 12: Misreported catch
  - Multiply "true" age composition with randomly generated values that follow an uniform distribution with min of 0.5 and max of 1. Misreporting follows a uniform random distribution across ages and years.

Table 1. Settings of recruitment variability, fishing mortality deviations, fishing mortality patterns, selectivity patterns, and initial condition.

Preliminary results

F_{low} and F_{high}

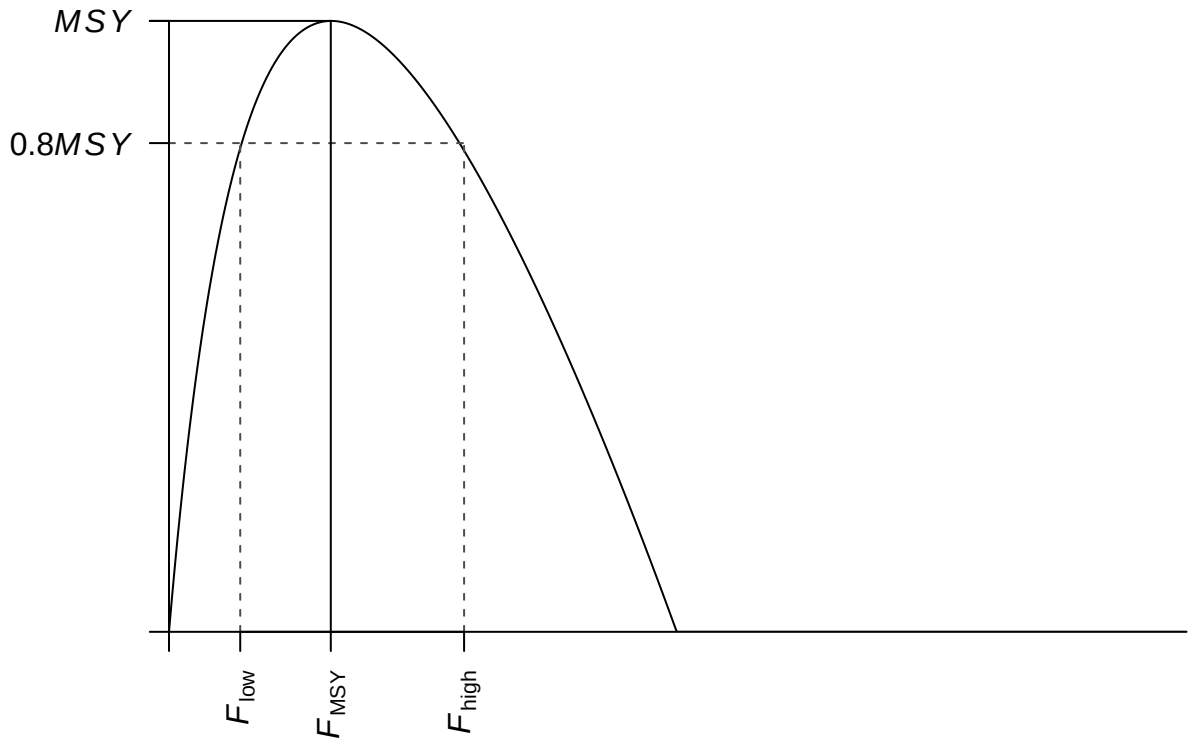


Figure 1. The curve of the relationship of yield and fishing mortality rate (F) and the definitions of the lower F value ($F_{low} = 0.07$) and higher F value ($F_{high} = 0.29$) used in creation of various patterns of F in the operating model. The horizontal lines indicate maximum sustainable yield (MSY) and $0.8MSY$, which is 80% of MSY. The vertical solid line indicates the F that correponds to MSY (F_{MSY}).

Overall relative error (RE) in SSB, R, F, SSB/SSB_{MSY}, and F/F_{MSY}

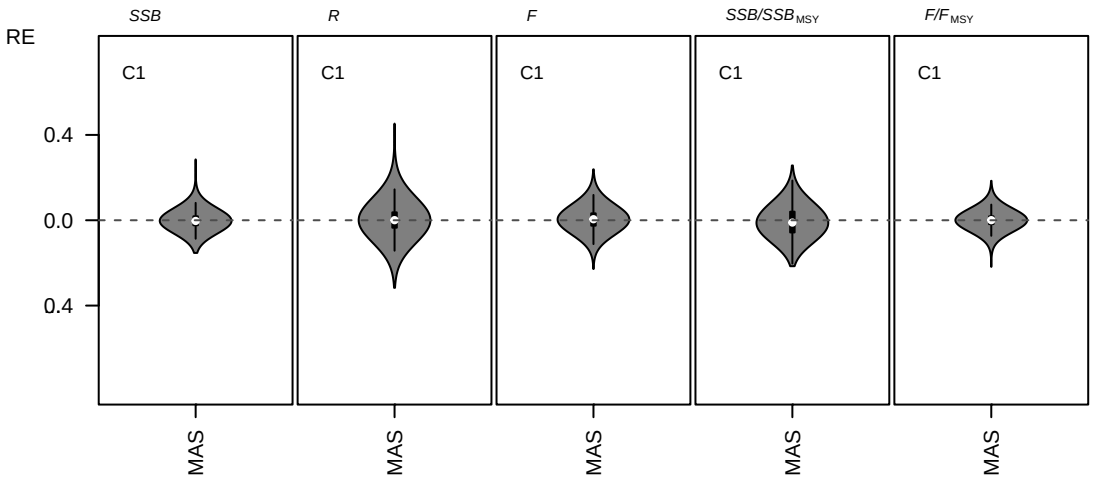
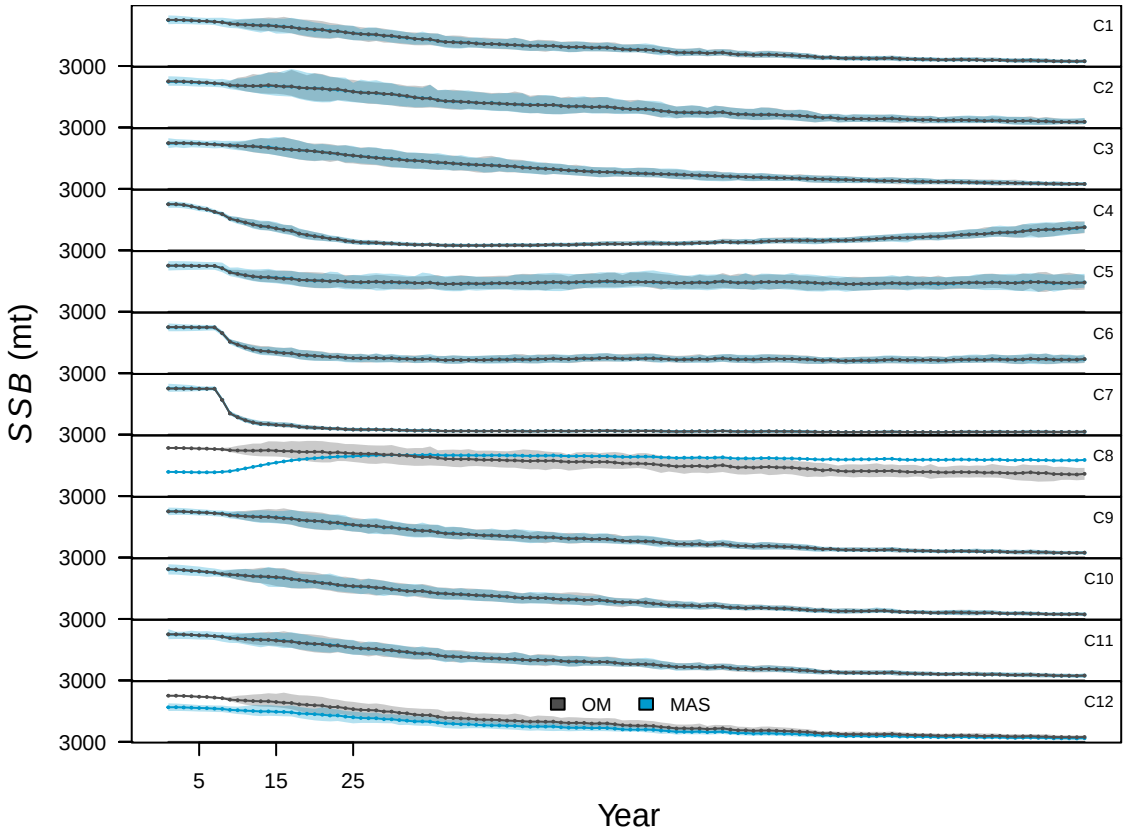
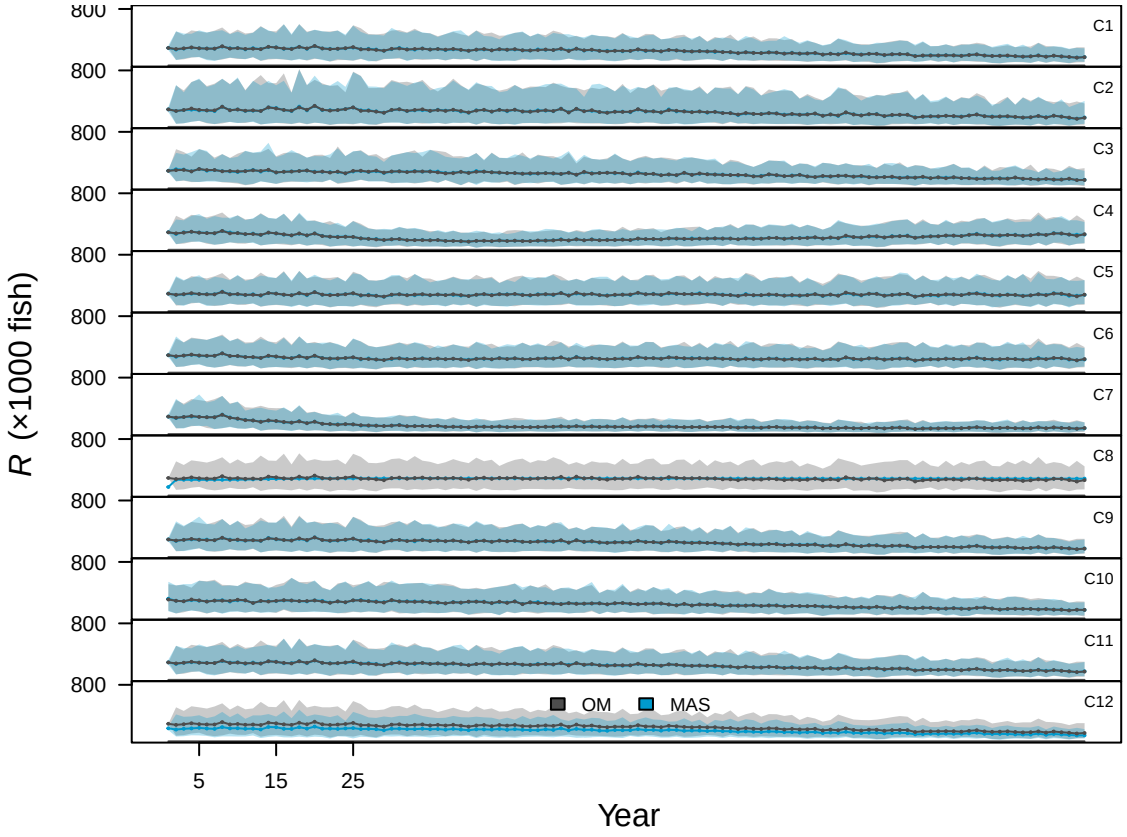


Figure 2. Violin plot of relative error (RE) across years and iterations for spawning stock biomass (SSB), recruitment (R), fishing mortality rate (F), SSB/SSB_{MSY} (SSB/SSB at maximum sustainable yield [MSY]), and F/F_{MSY} (F/F at maximum sustainable yield [MSY]) for MAS.

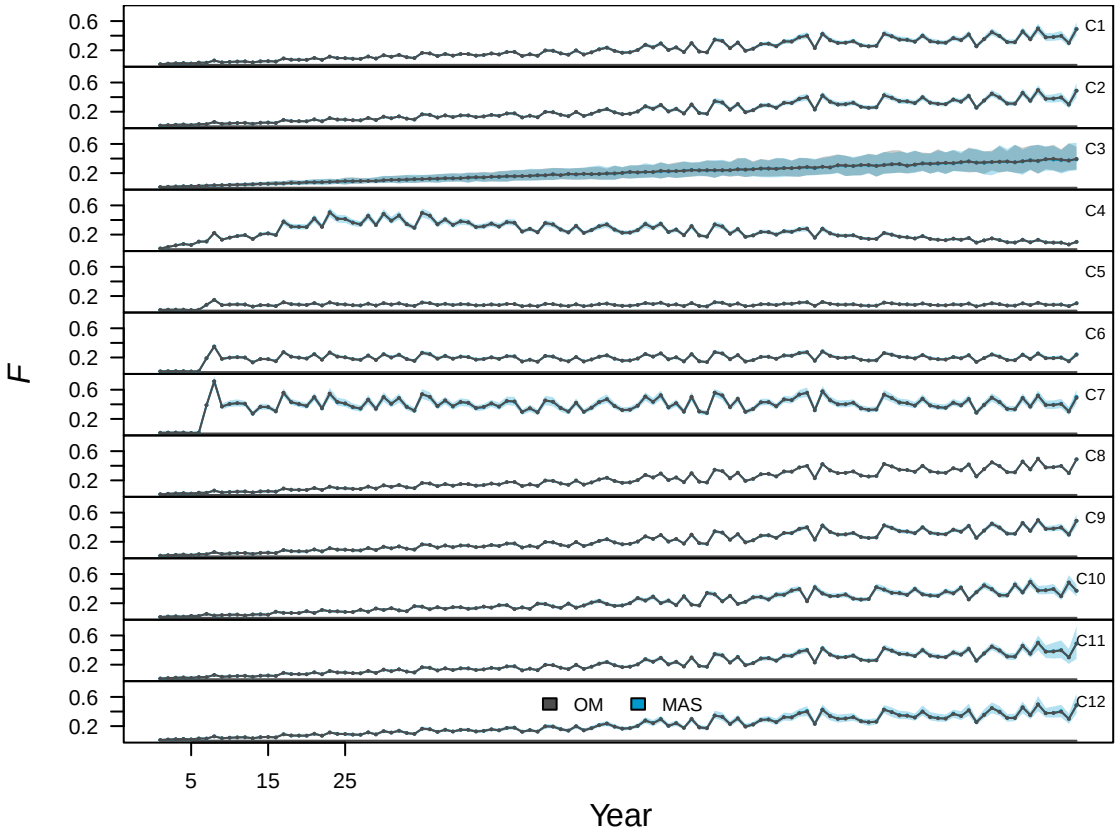
SSB over time



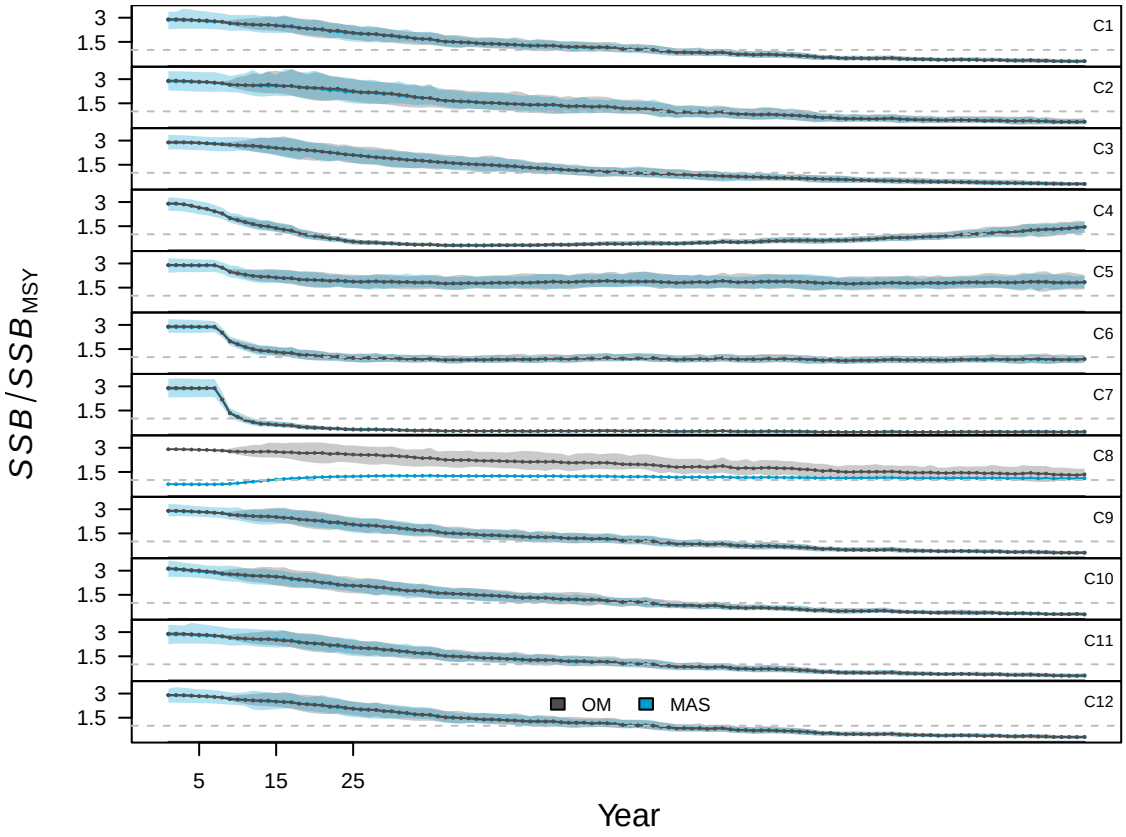
R over time


R (×1000 fish)
800
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
OM
MAS
5
15
25
Year

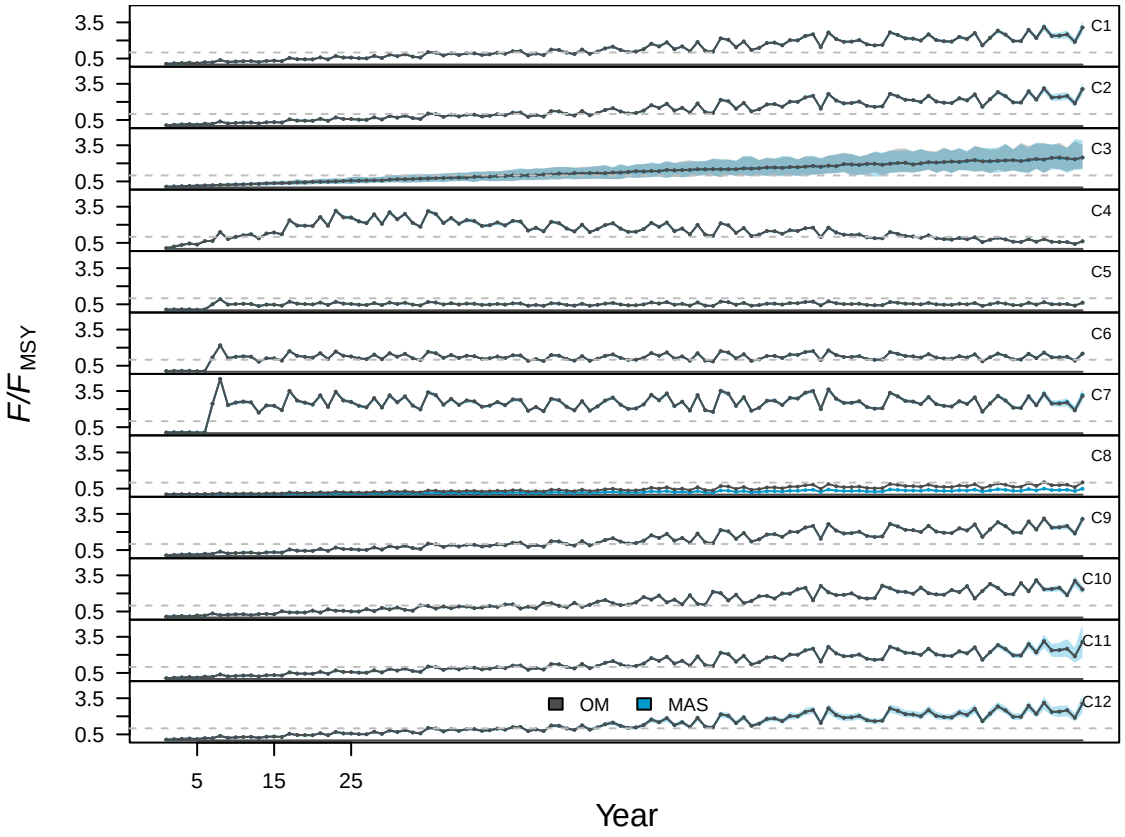
F over time



SSB/SSB_{MSY} over time



F/F_{MSY} over time



Relative error in MSY, F_{MSY} and SSB_{MSY}