

# Model Comparison with r4MAS - snapper-grouper complex

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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](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](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/1Ohvx5hnpfiK2M8LpLOurlS\\_NI686T0D/view?usp=sharing](https://drive.google.com/file/d/1Ohvx5hnpfiK2M8LpLOurlS_NI686T0D/view?usp=sharing)
  - R Markdown:  
<https://drive.google.com/file/d/1Y3p5foK9uB9P7ZliMlHaKmXVFdgfMLyV/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 0.8 and max of 1.
- Case 13: Misreported catch
  - Multiply “true” age composition with randomly generated values that follow an uniform distribution with min of 0.5 and max of 1.

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

## Preliminary results

$F_{low}$  and  $F_{high}$

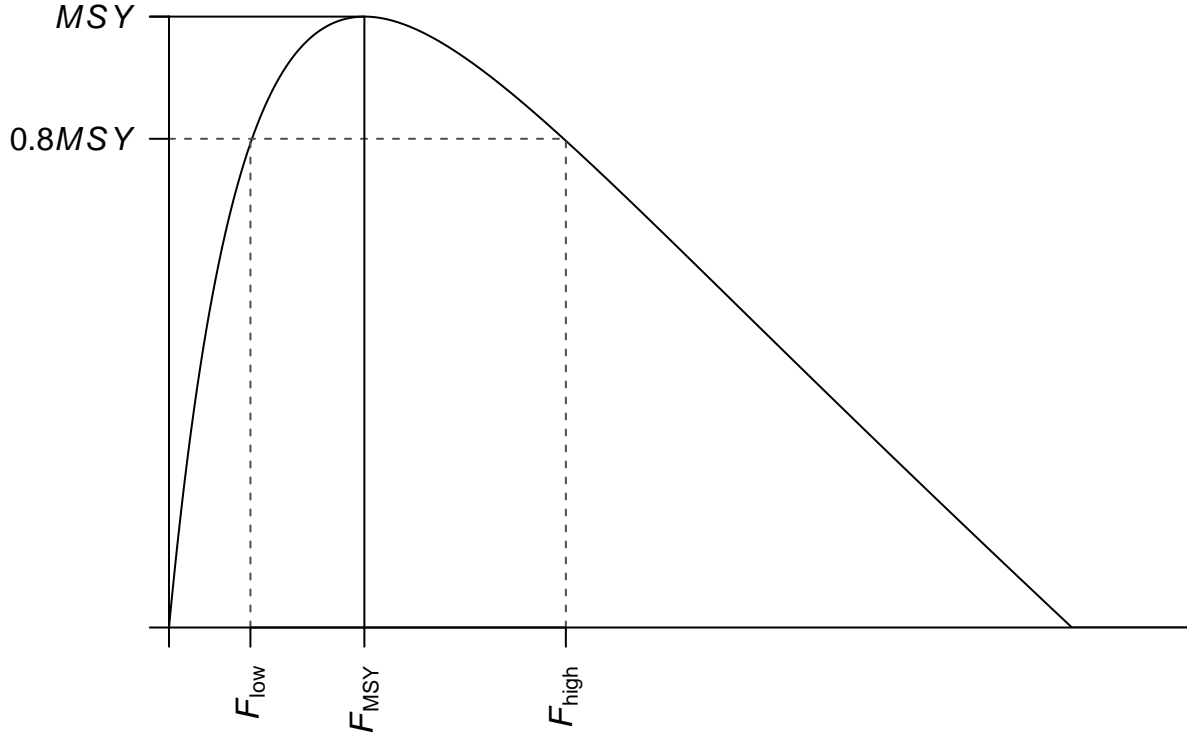


Figure 1. The curve of the relationship of yield and fishing mortality rate ( $F$ ) and the definitions of the lower  $F$  value ( $F_{low} = 0.08$ ) and higher  $F$  value ( $F_{high} = 0.39$ ) used in creation of various patterns of  $F$  in

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 corresponds to  $MSY$  ( $F_{MSY}$ ).

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

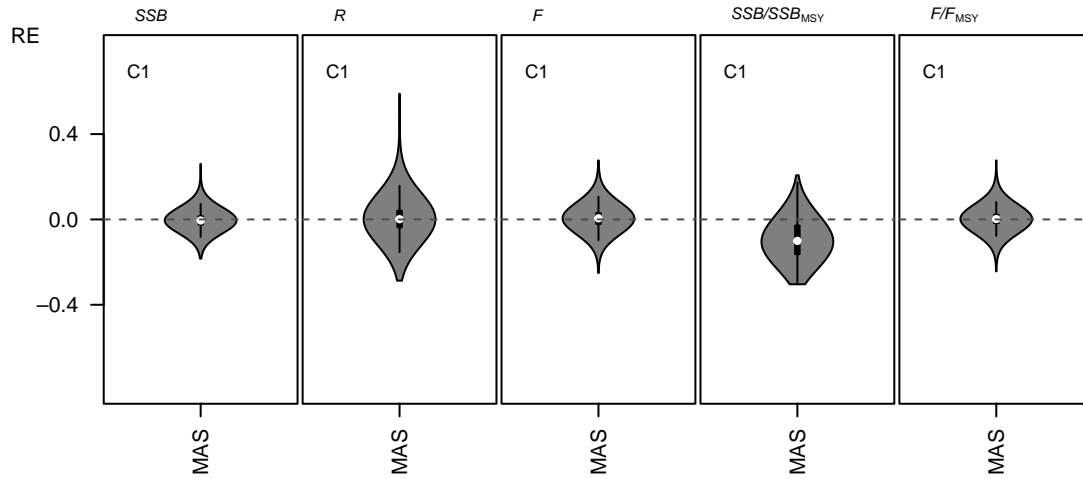
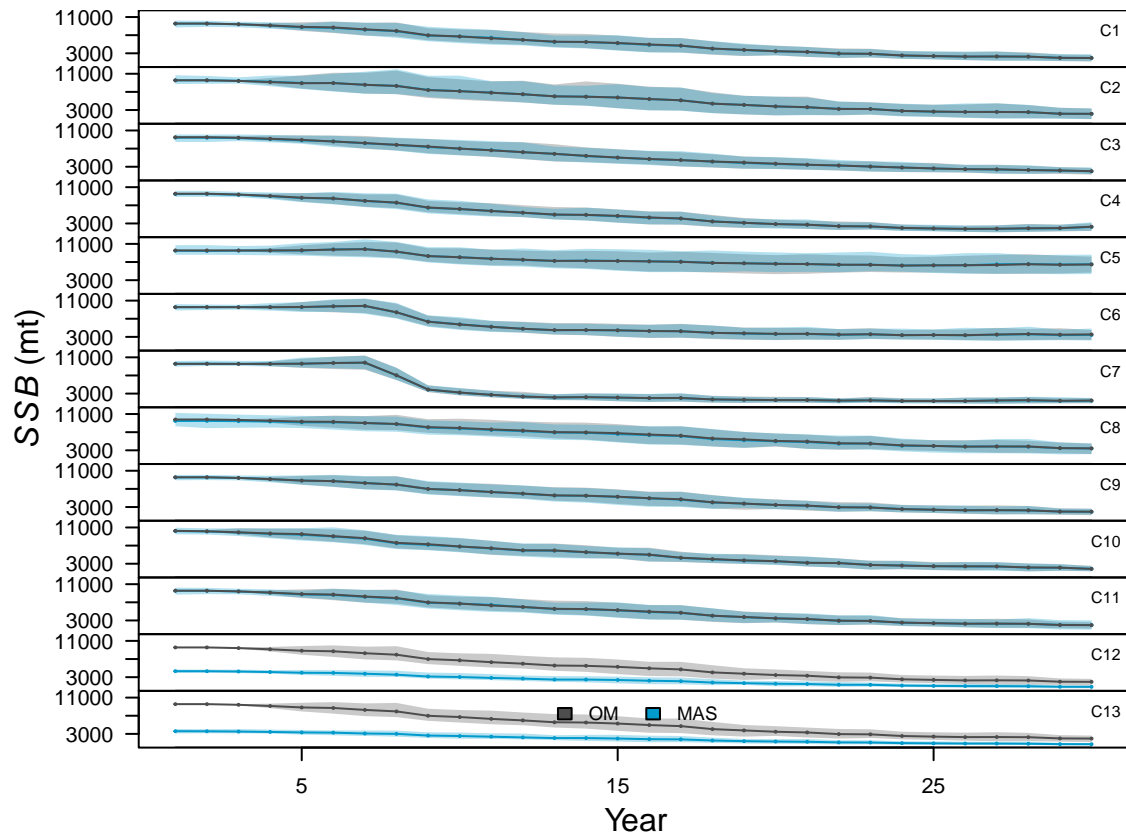
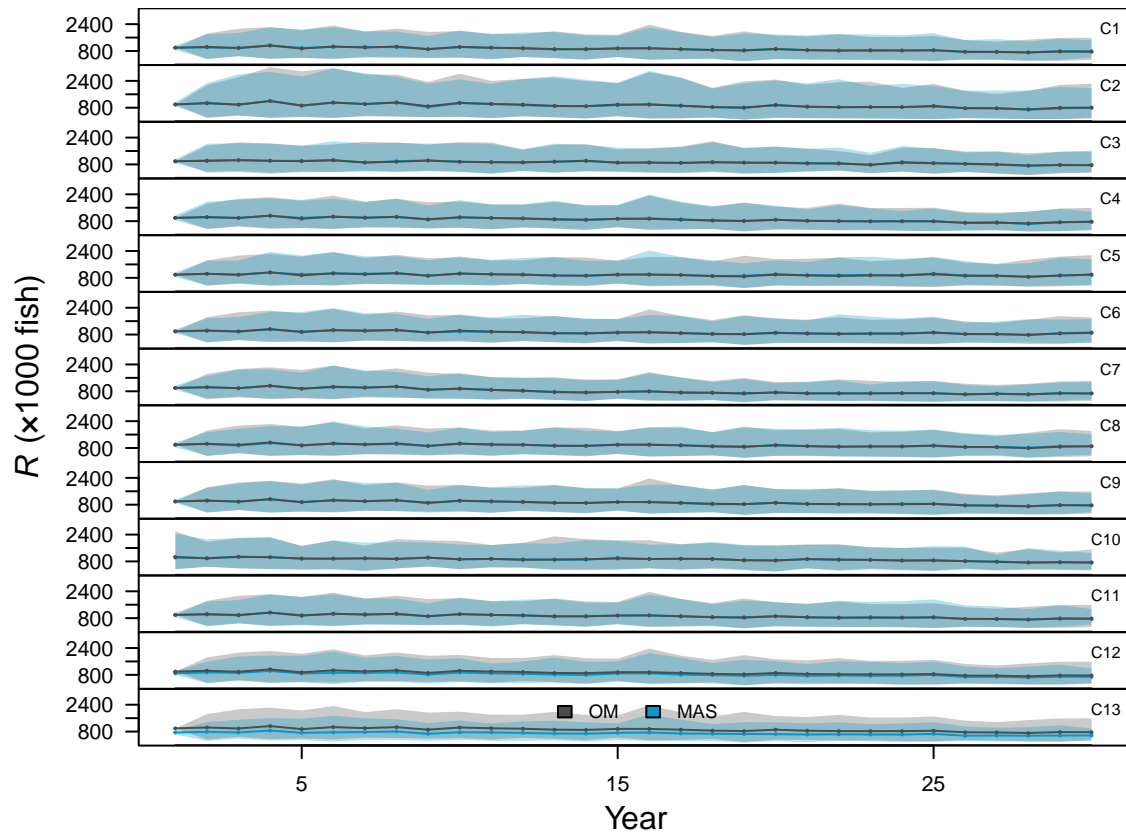


Figure 2. Violin plot of relative error (RE) across years and iterations for spawning stock biomass ( $SSB$ ), recruitment ( $R$ ), fishing mortality rate ( $F$ ),  $SSB/SSB_{MSY}$  ( $SSB/SSB$  at maximum sustainable yield [ $MSY$ ]), and  $F/F_{MSY}$  ( $F/F$  at maximum sustainable yield [ $MSY$ ])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

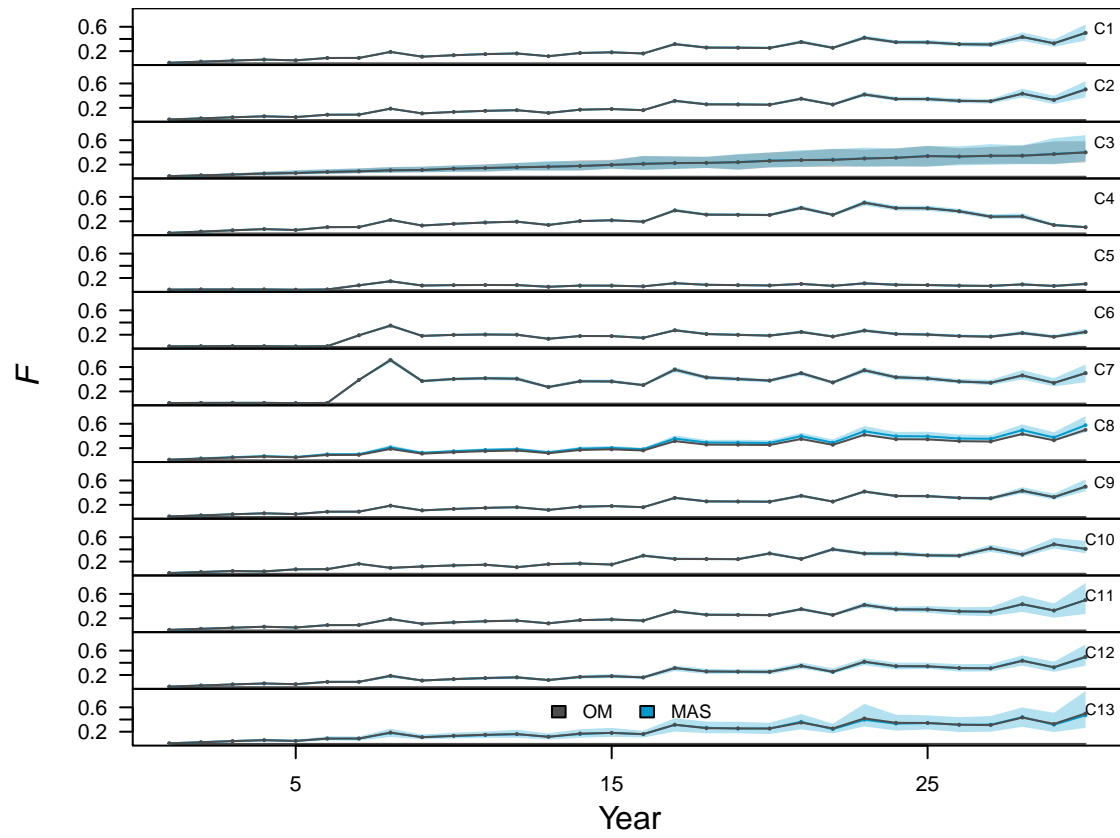
## SSB over time



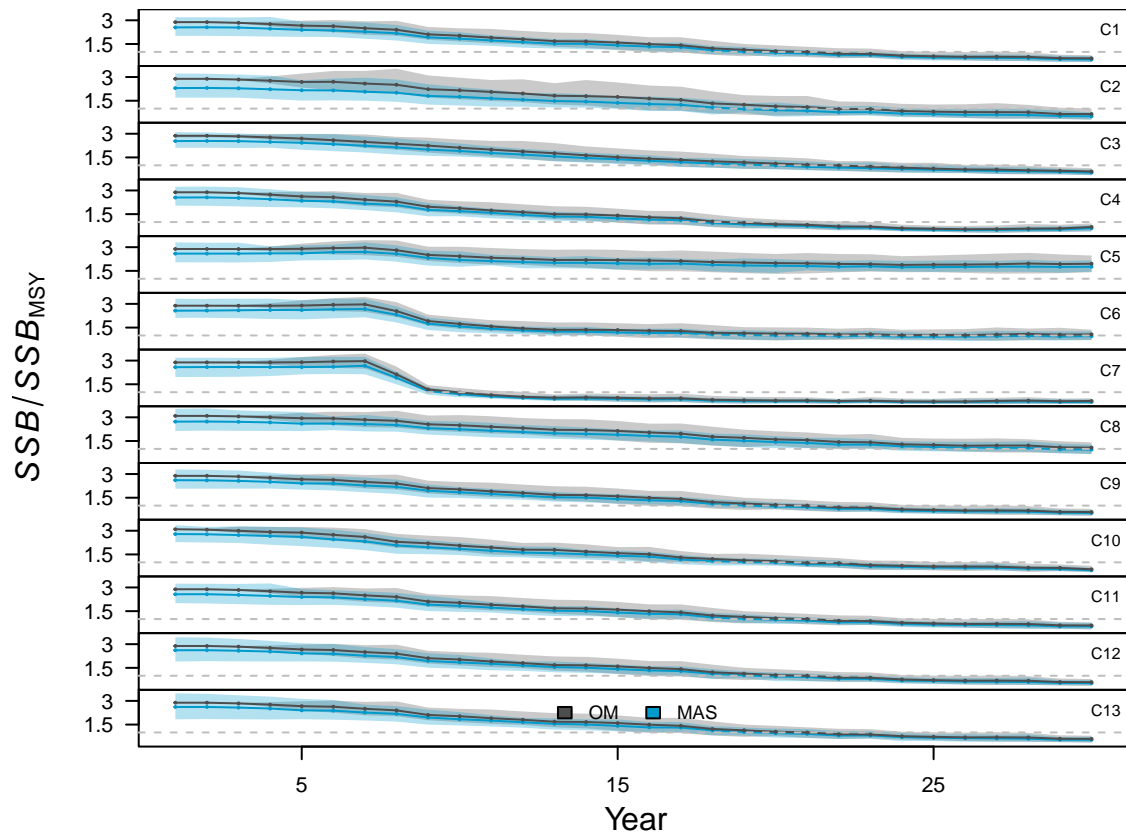
## $R$ over time



$F$  over time

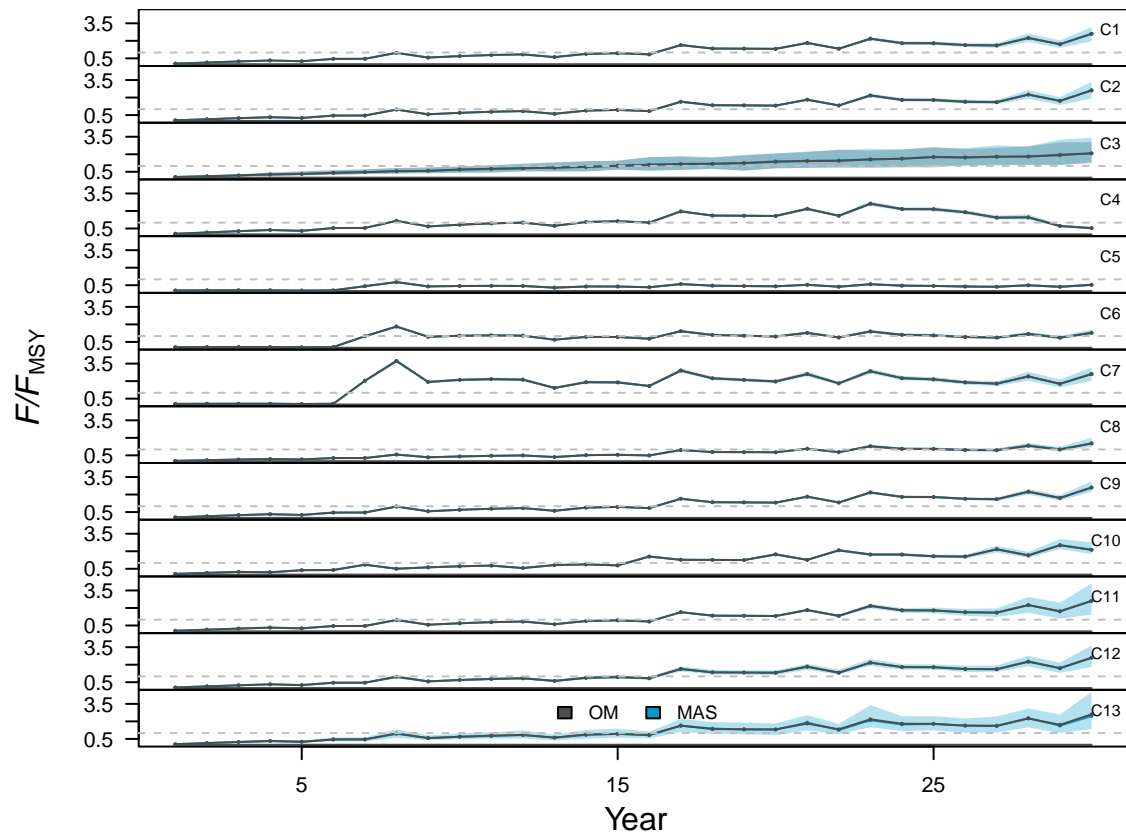


$SSB/SSB_{MSY}$  over time





$F/F_{MSY}$  over time



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

