

# Model Comparison with r4MAS - snapper-grouper complex

## Contents

<b>Workflow</b>	<b>2</b>
<b>Description of cases</b>	<b>2</b>
<b>Preliminary results</b>	<b>3</b>
$F_{low}$ and $F_{high}$ . . . . .	3
Overall relative error (RE) in $SSB$ , $R$ , $F$ , $SSB/SSB_{MSY}$ , and $F/F_{MSY}$ . . . . .	4
$SSB$ over time . . . . .	5
$R$ over time . . . . .	6
$F$ over time . . . . .	7
$SSB/SSB_{MSY}$ over time . . . . .	8
$F/F_{MSY}$ over time . . . . .	9
Relative error in $MSY$ , $F_{MSY}$ and $SSB_{MSY}$ . . . . .	10

## 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/1Ohvx5hnpfiiK2M8LpLOurlS\\_NI686T0D/view?usp=sharing](https://drive.google.com/file/d/1Ohvx5hnpfiiK2M8LpLOurlS_NI686T0D/view?usp=sharing)
  - R Markdown:  
<https://drive.google.com/file/d/1Y3p5foK9uB9P7ZLiMIHaKmXVFdgfMLyV/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
  - $F = F_{high}$
- Case 7: Selectivity pattern
  - Double logistic selectivity
- Case 8: Increase number of surveys
  - Number of survey: 2
- Case 9: Initial condition
  - $\phi_F = \phi_0$

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

## Preliminary results

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

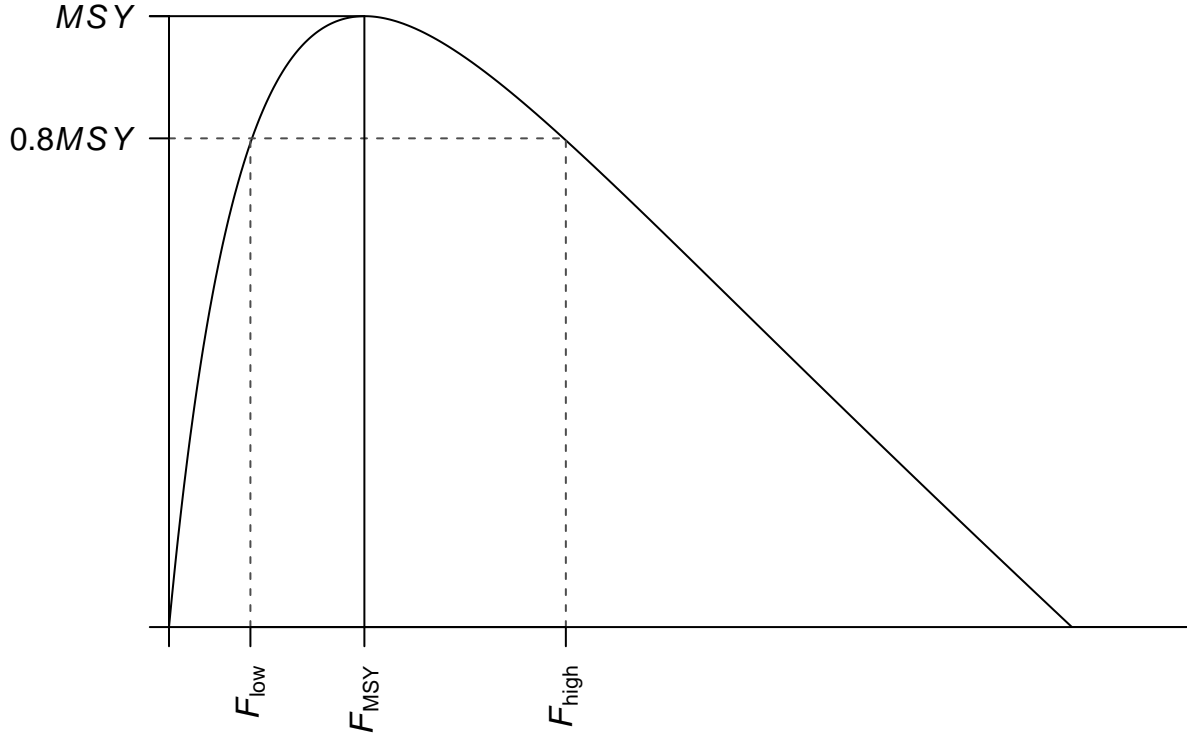


Figure 1. The curve of the relationship of yield and fishing mortality rate ( $F$ ) and the definitions of the lower  $F$  value ( $F_{low} = 0.08$ ) and higher  $F$  value ( $F_{high} = 0.39$ ) used in creation of various patterns of  $F$  in the operating model. The horizontal lines indicate maximum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

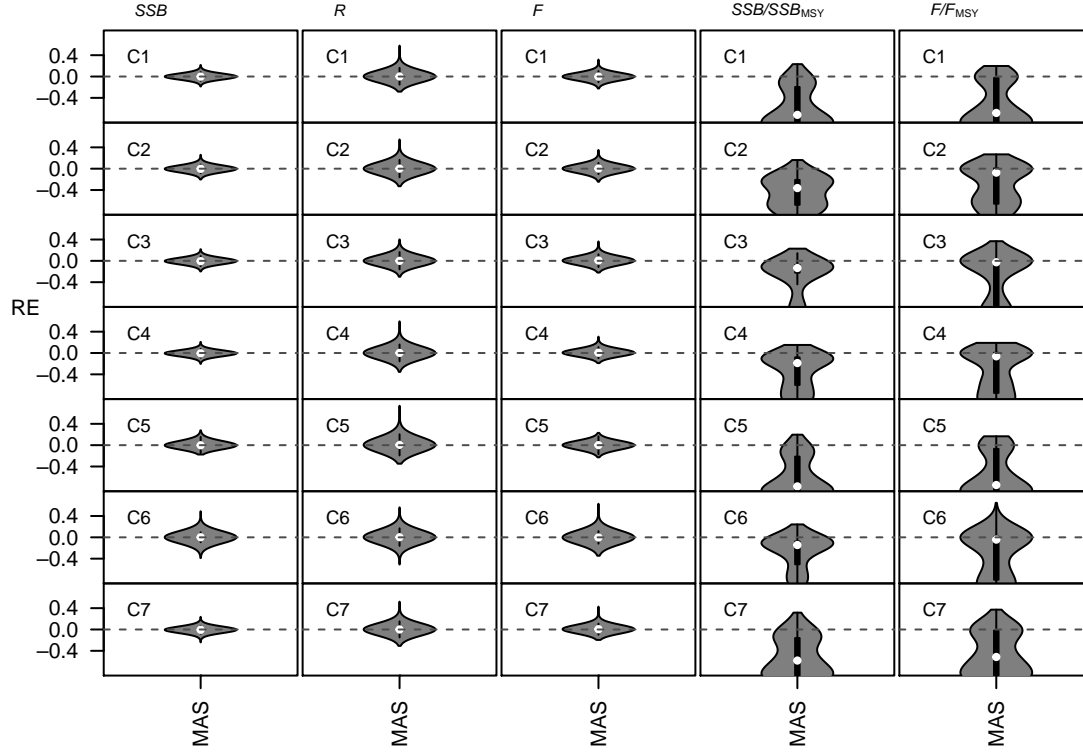
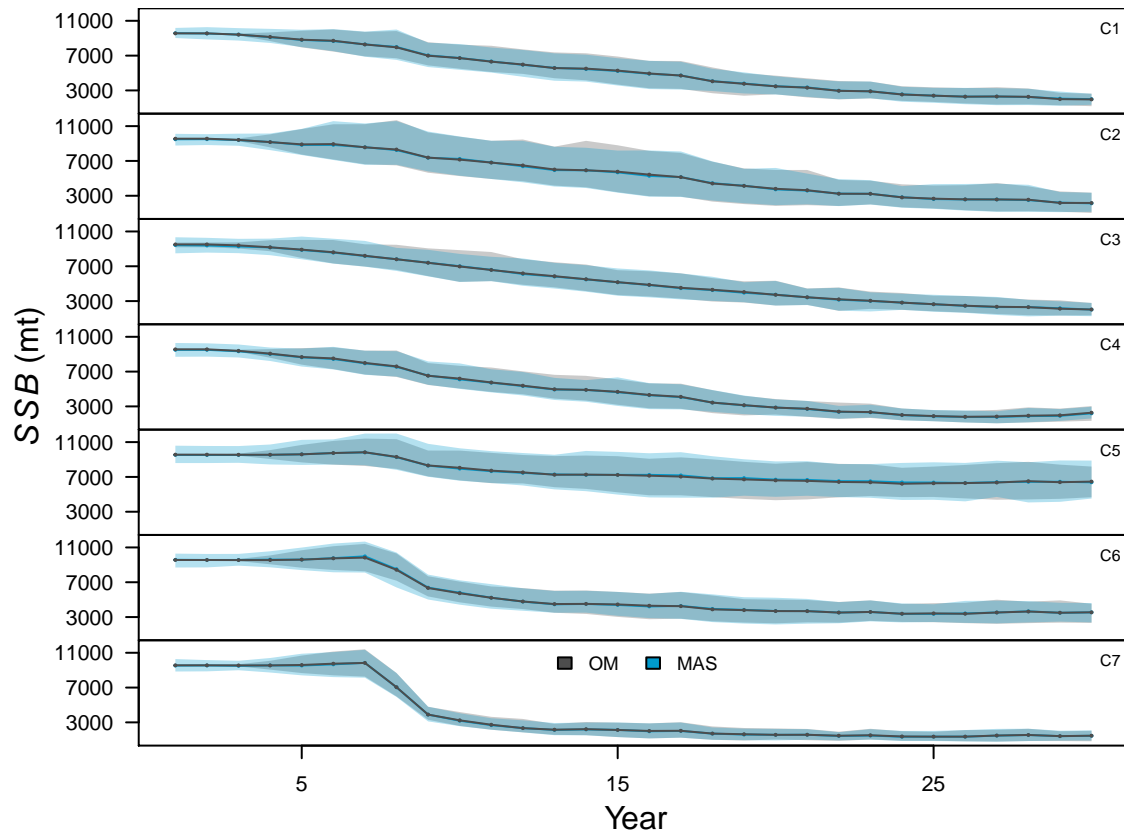
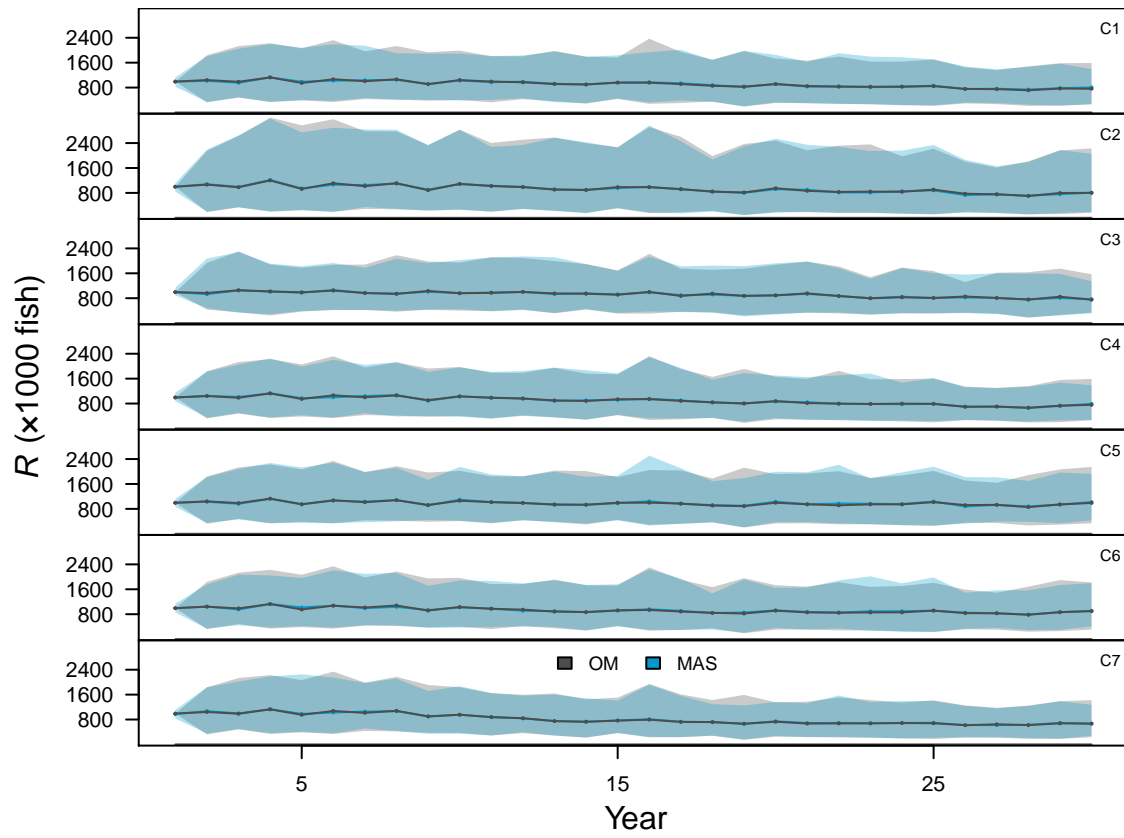


Figure 2. Violin plot of relative error (RE) across years and iterations for spawning stock biomass ( $SSB$ ), recruitment ( $R$ ), fishing mortality rate ( $F$ ),  $SSB/SSB_{MSY}$  ( $SSB/SSB$  at maximum sustainable yield [ $MSY$ ]), and  $F/F_{MSY}$  ( $F/F$  at maximum sustainable yield [ $MSY$ ])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

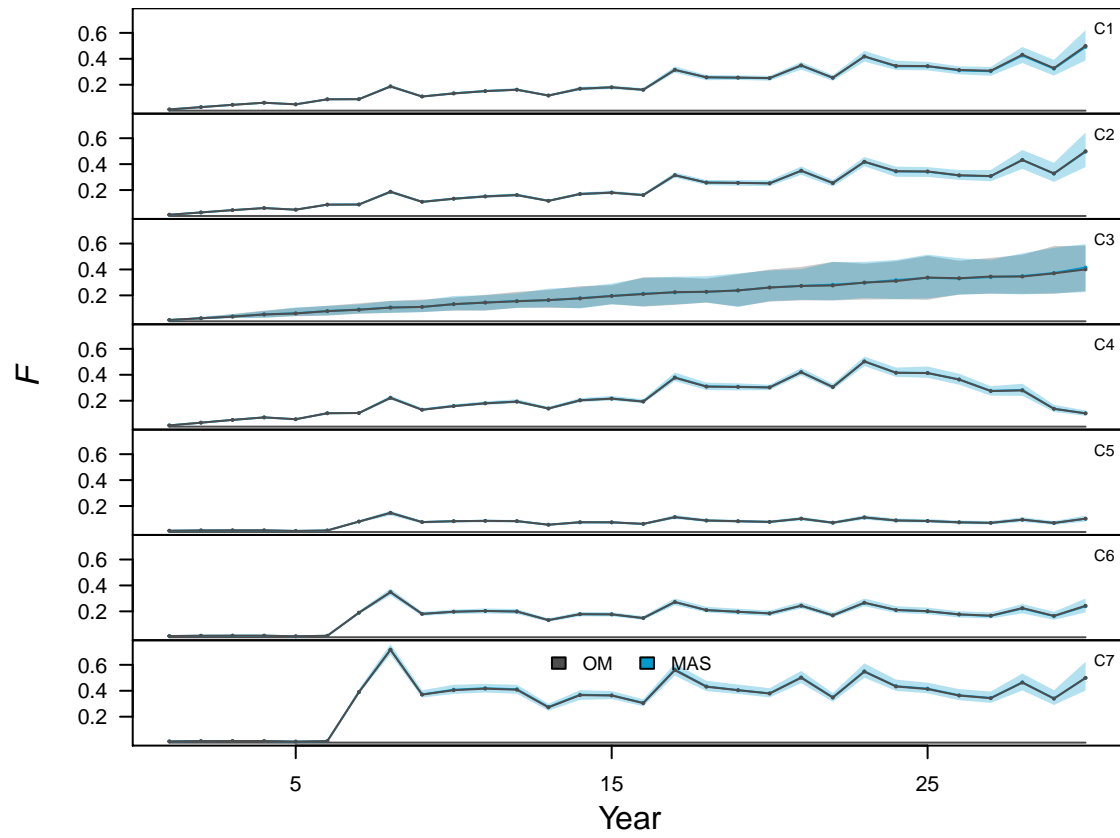
## *SSB over time*



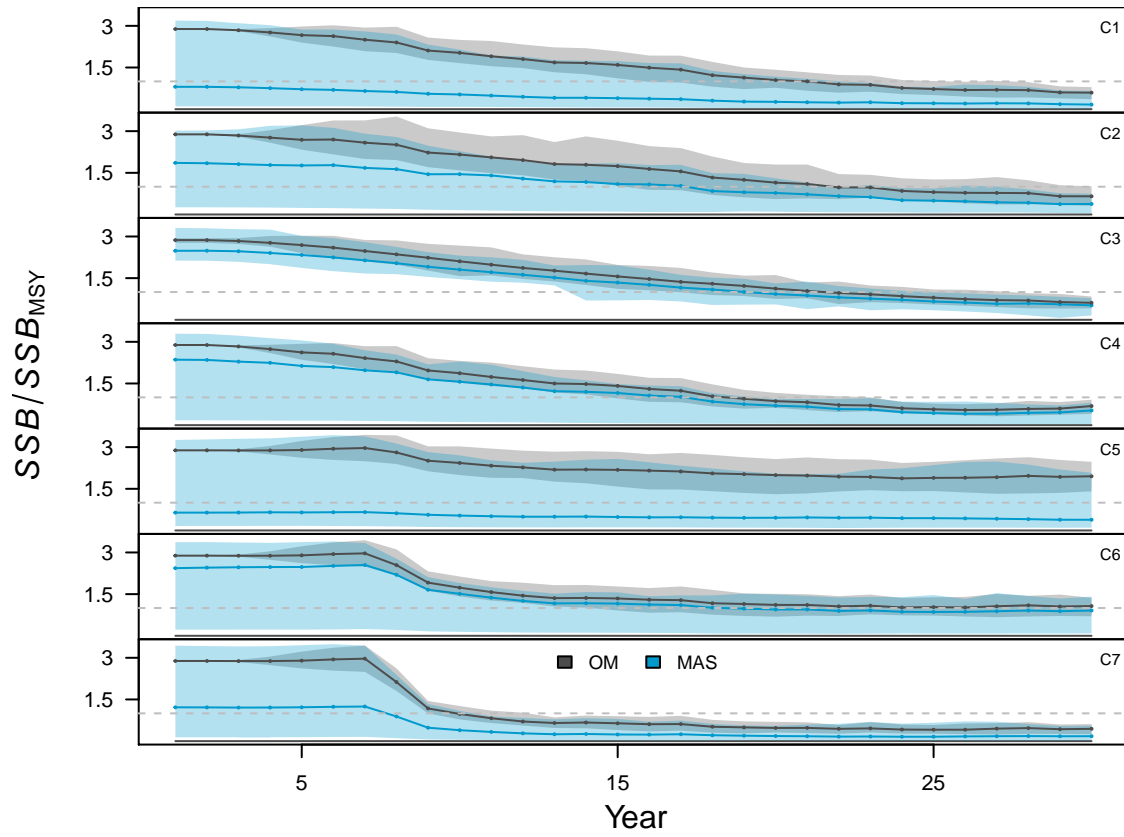
## $R$ over time



$F$  over time

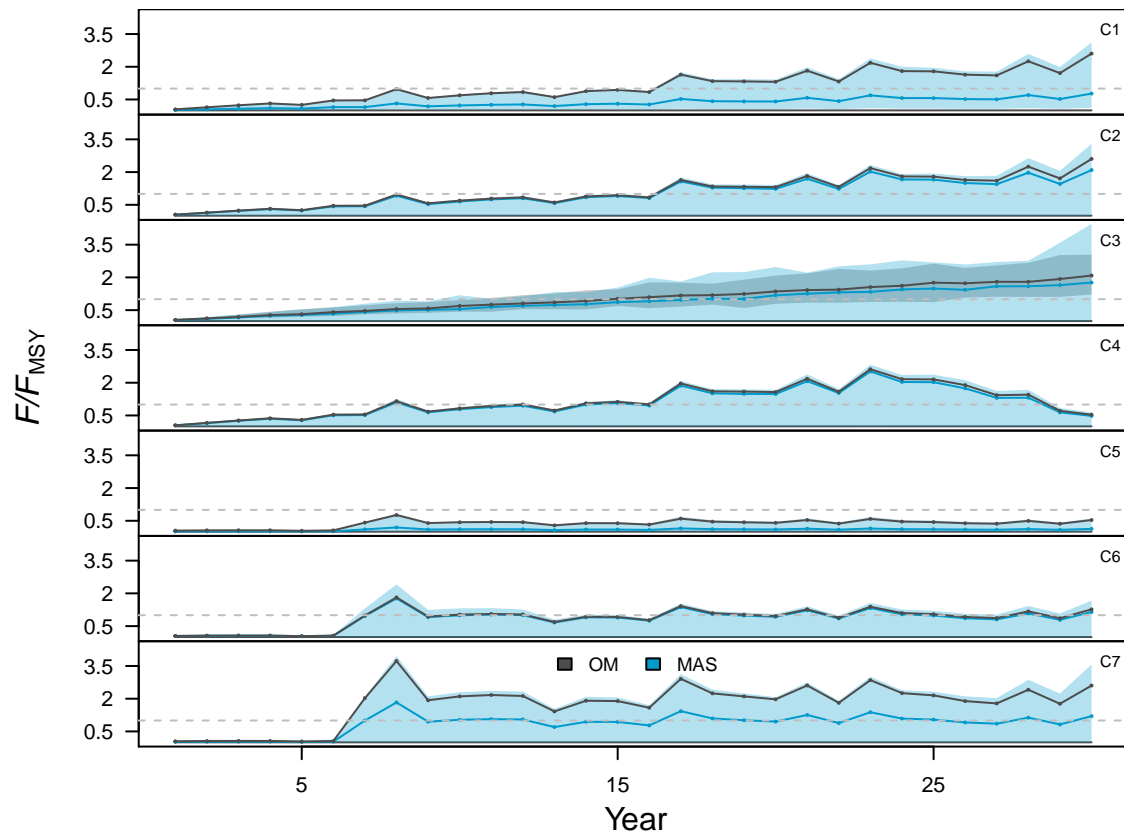


$SSB/SSB_{MSY}$  over time





$F/F_{MSY}$  over time



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

