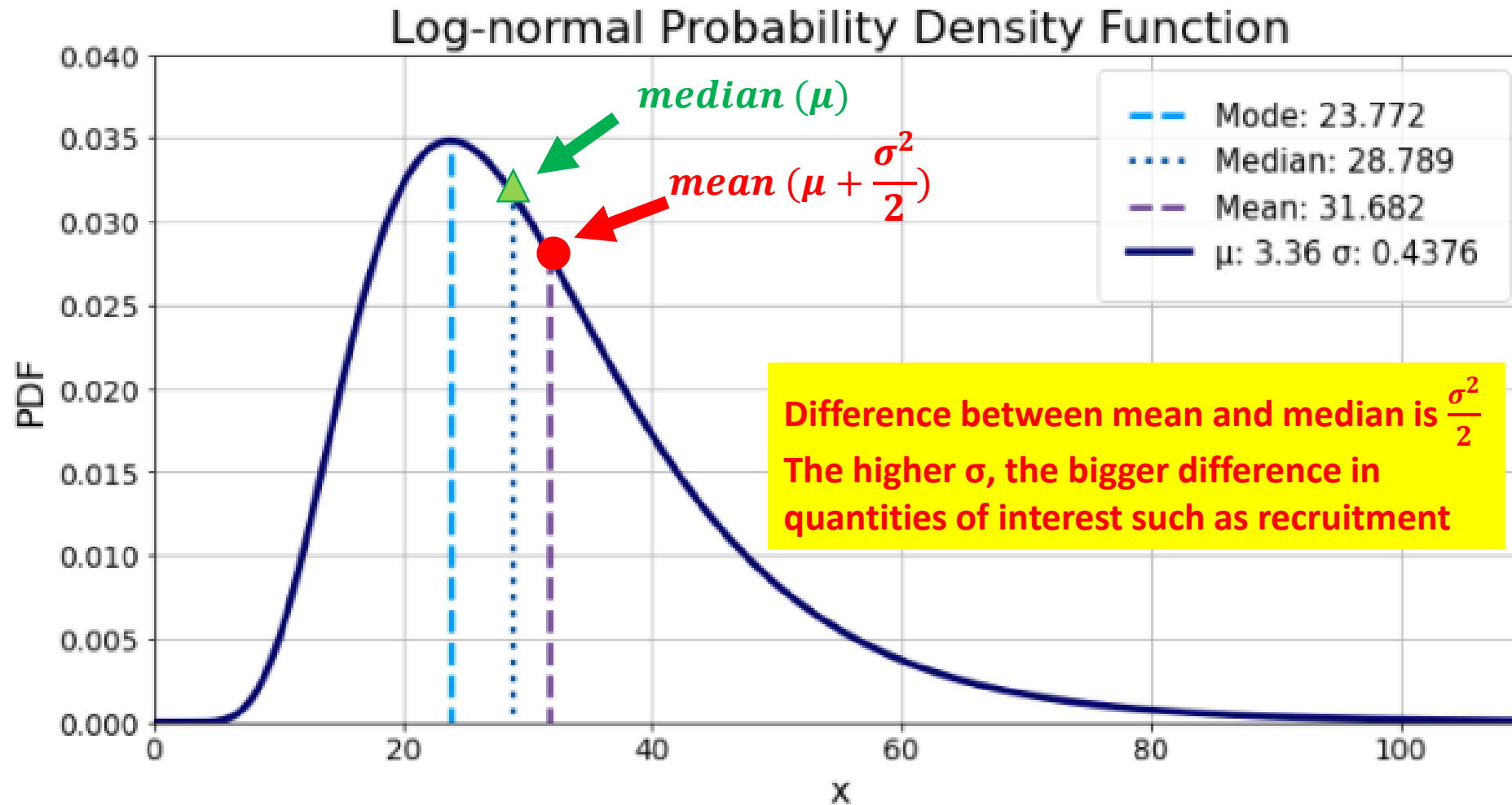


Bias Correction Project

March 4

Lognormal distribution

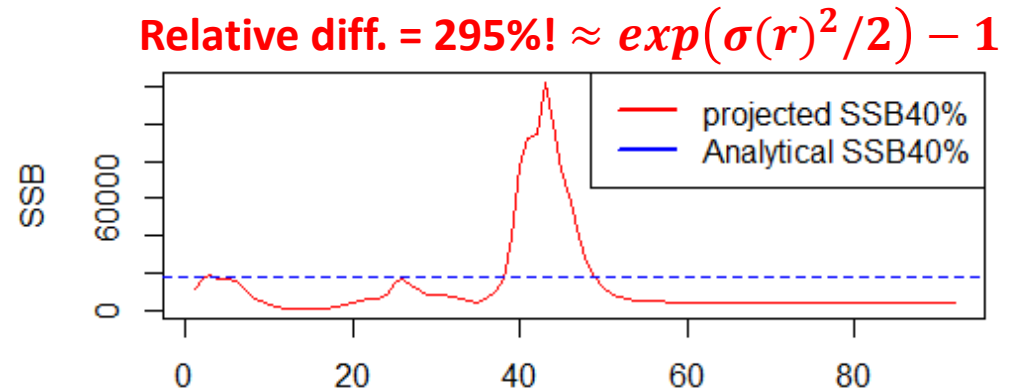


Operating Model Setup

- Target stock: GoM haddock (1977-2018)
- Model configuration: NAA (rec+1) treated as RE; logistic-normal-miss0 for age comp.
- Why GoM haddock?

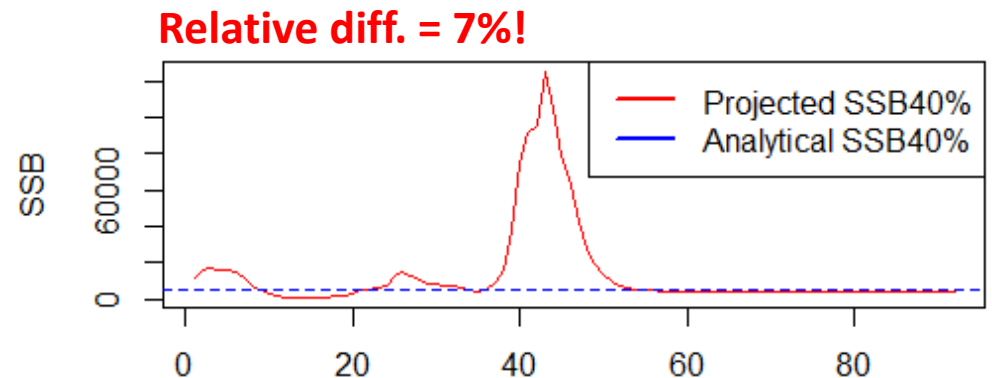
Turn bias correction for pe and oe 'ON' and 'OFF' for brp

	Estimate	Std. Error
Mean Recruitment	8828.489	3638.860
NAA σ (age 1)	1.600	0.189
NAA σ (age 2-9+)	0.199	0.031



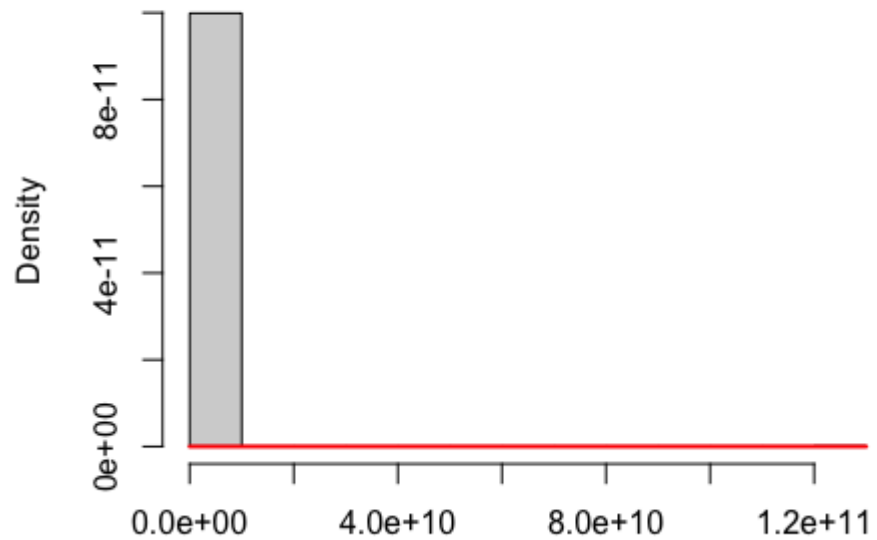
Turn bias correction for pe and oe 'OFF' and 'ON' for brp

	Estimate	Std. Error
Mean Recruitment	2210.973	591.211
NAA σ (age 1)	1.615	0.190
NAA σ (age 2-9+)	0.201	0.032



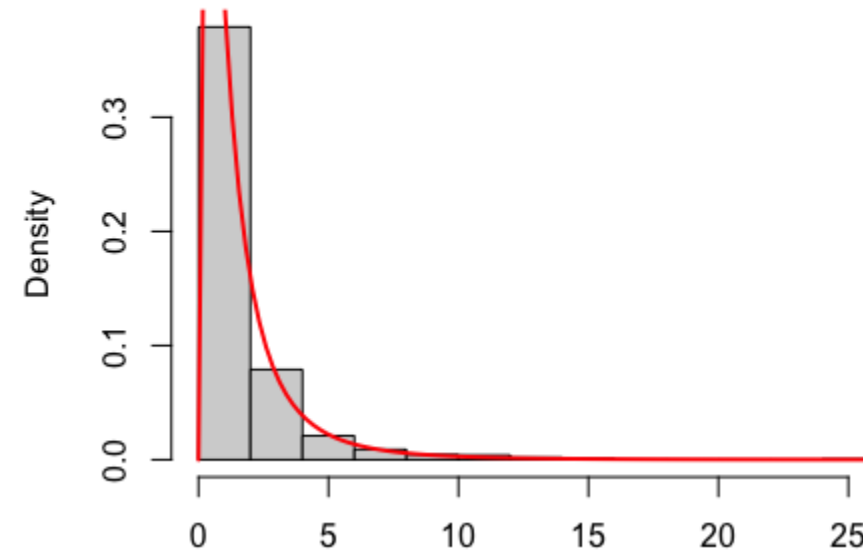
Hypothesis

Histogram of Generated Data with Bias Corrector



Fit data using lognormal with bc turned off

Histogram of Generated Data without Bias Corrector

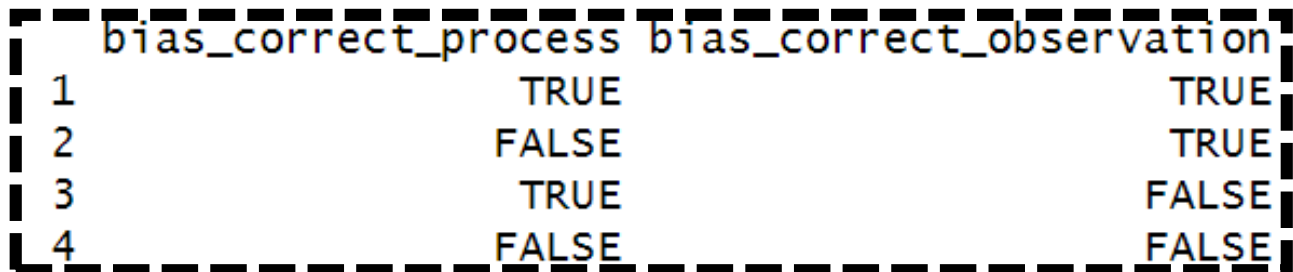


Fit data using lognormal with bc turned on

Study Design

100 realizations for each OM

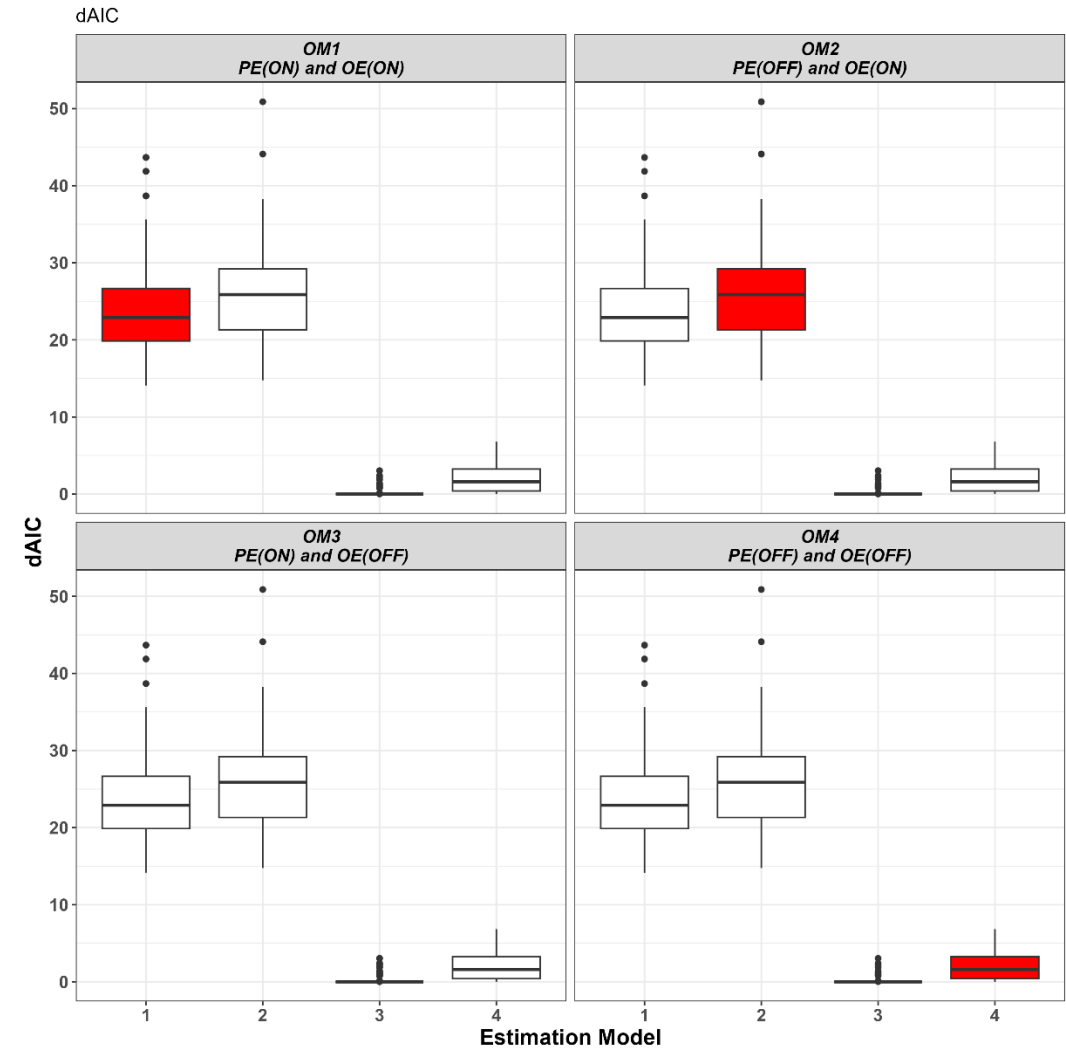
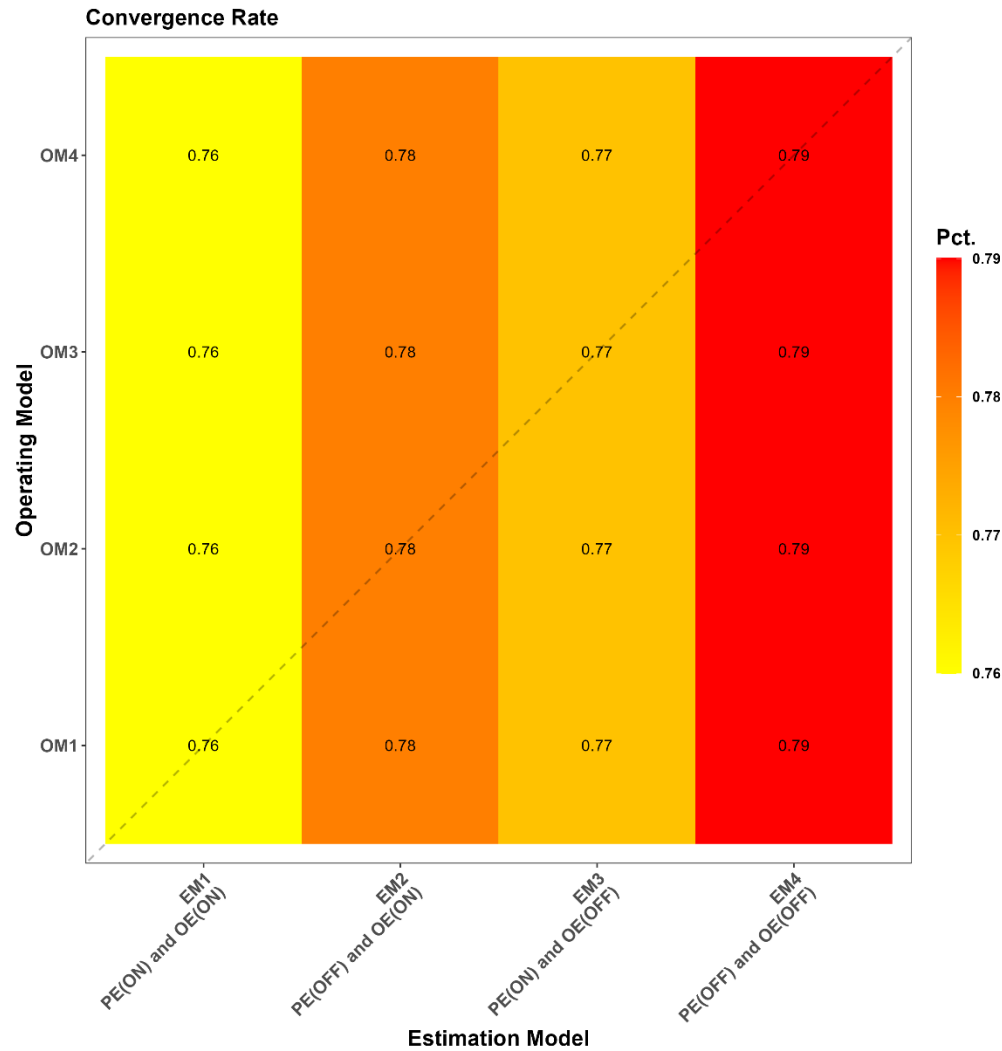
Total # of realizations = $4 \times 100 = 400$



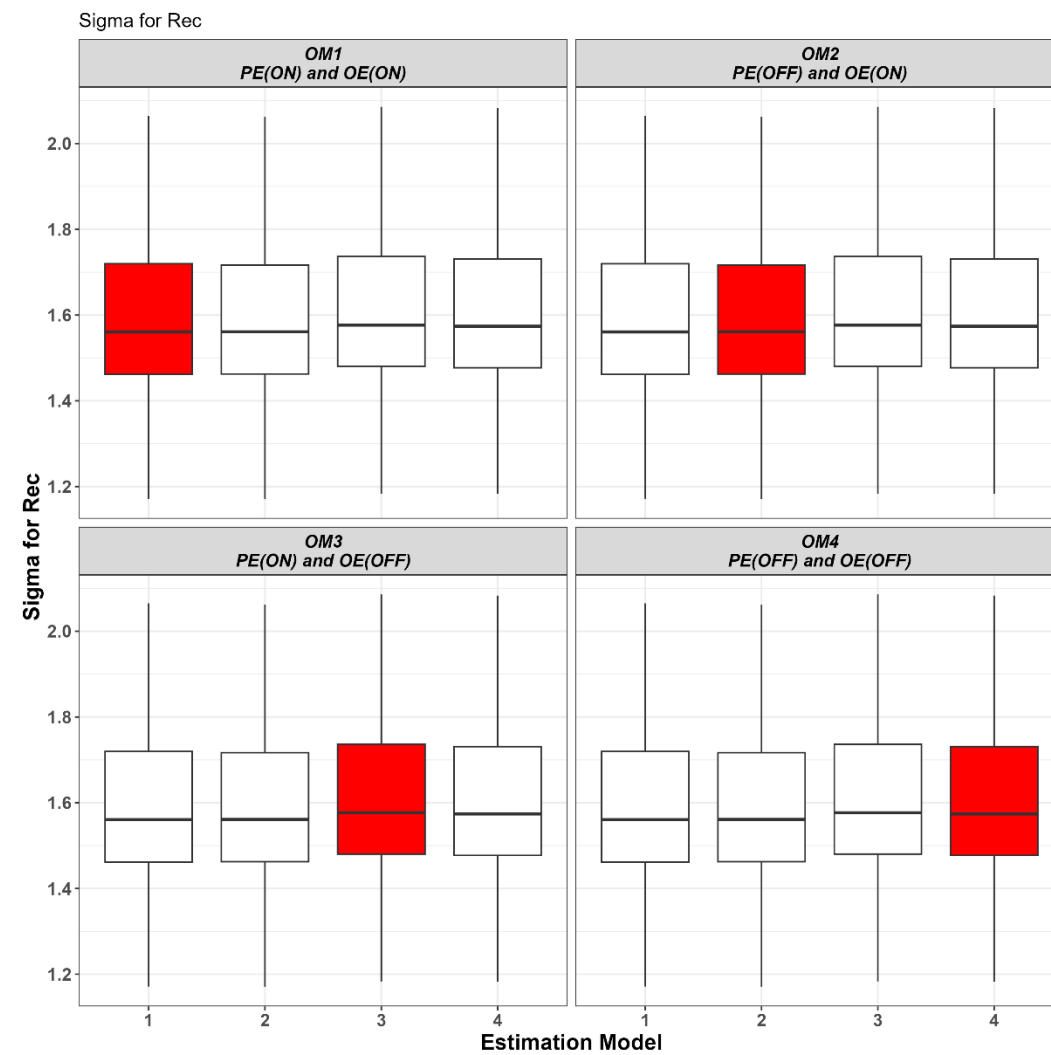
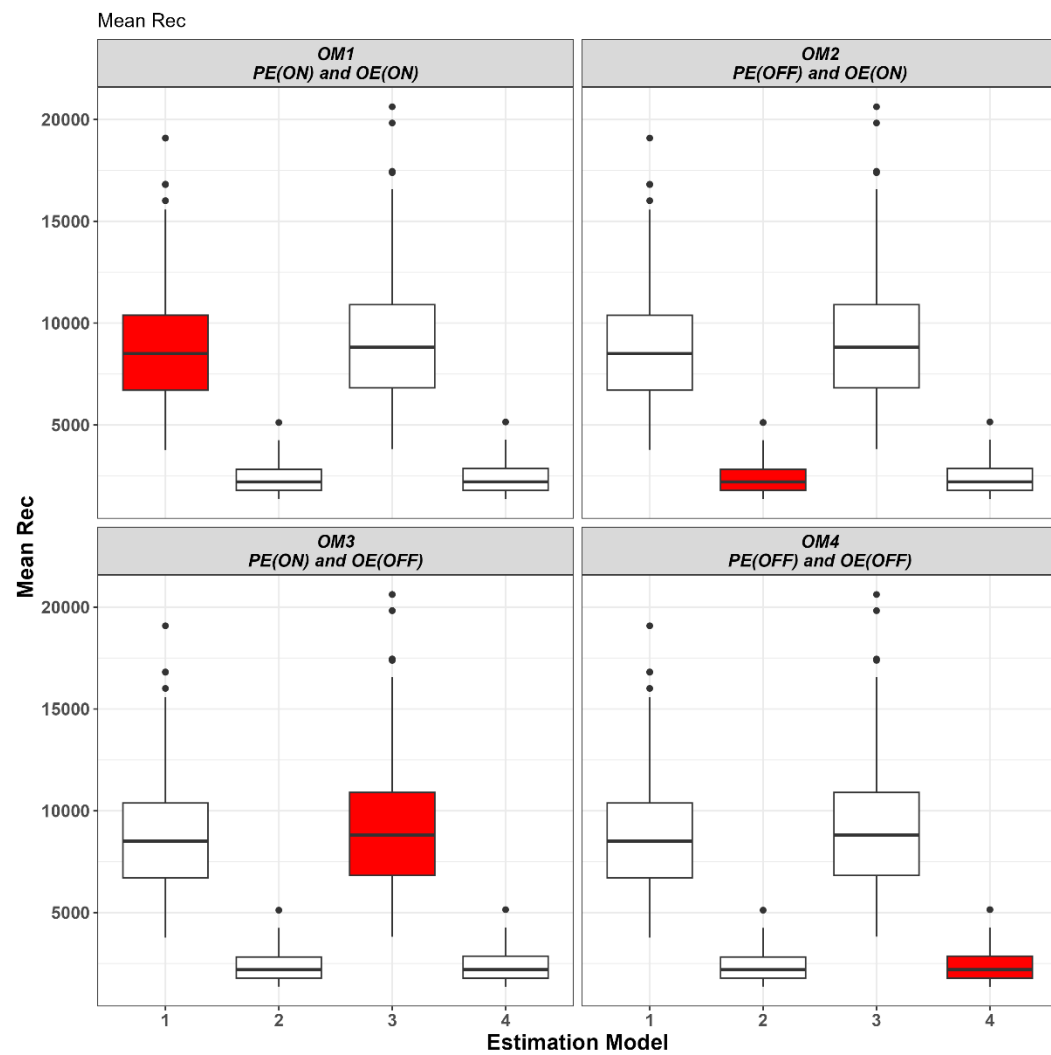
	bias_correct_process	bias_correct_observation	bias_correct_BRPs
1	TRUE	TRUE	TRUE
2	FALSE	TRUE	TRUE
3	TRUE	FALSE	TRUE
4	FALSE	FALSE	TRUE
5	TRUE	TRUE	FALSE
6	FALSE	TRUE	FALSE
7	TRUE	FALSE	FALSE
8	FALSE	FALSE	FALSE

- Collect diagnostic results such as convergence rate, AIC.
- Compare management quantities
- Calculate difference in Brps between projection and analytic solution

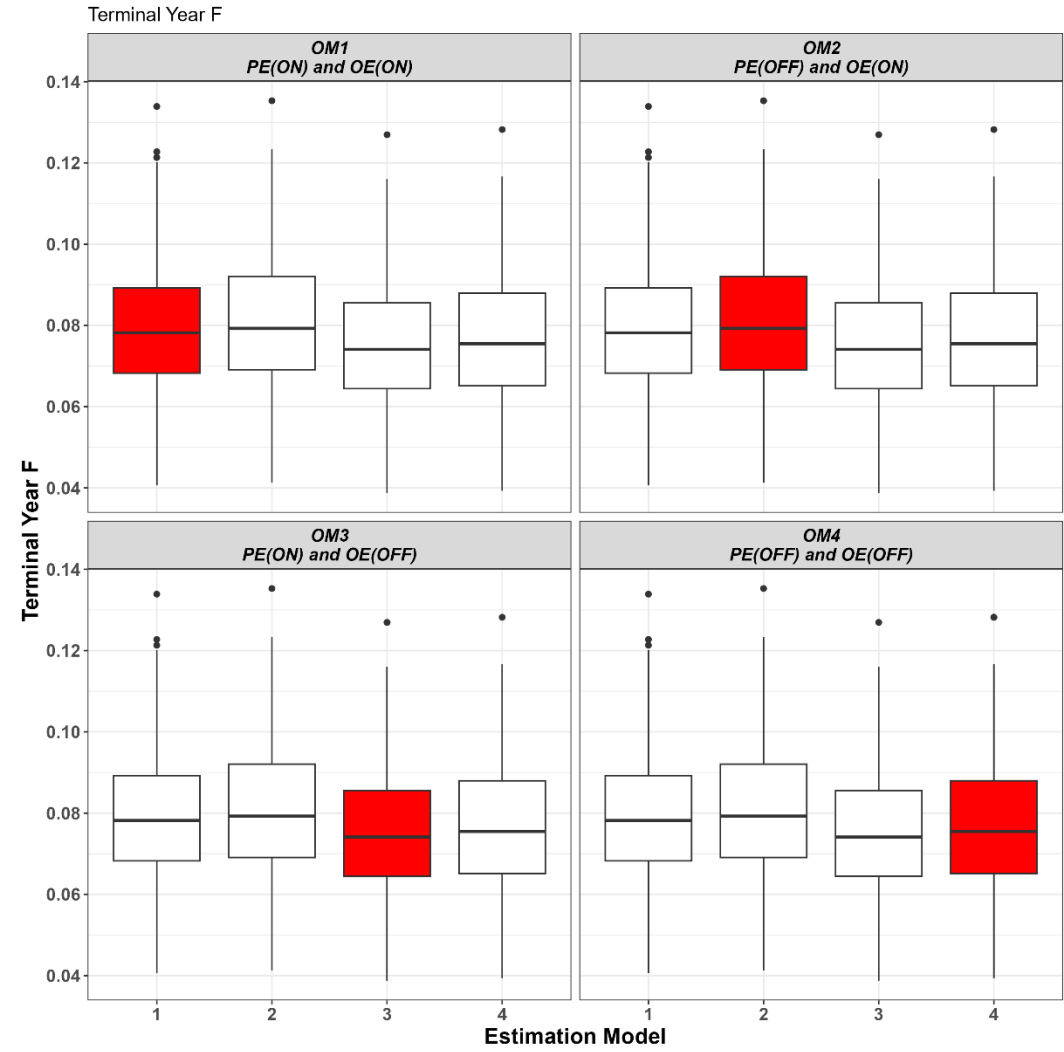
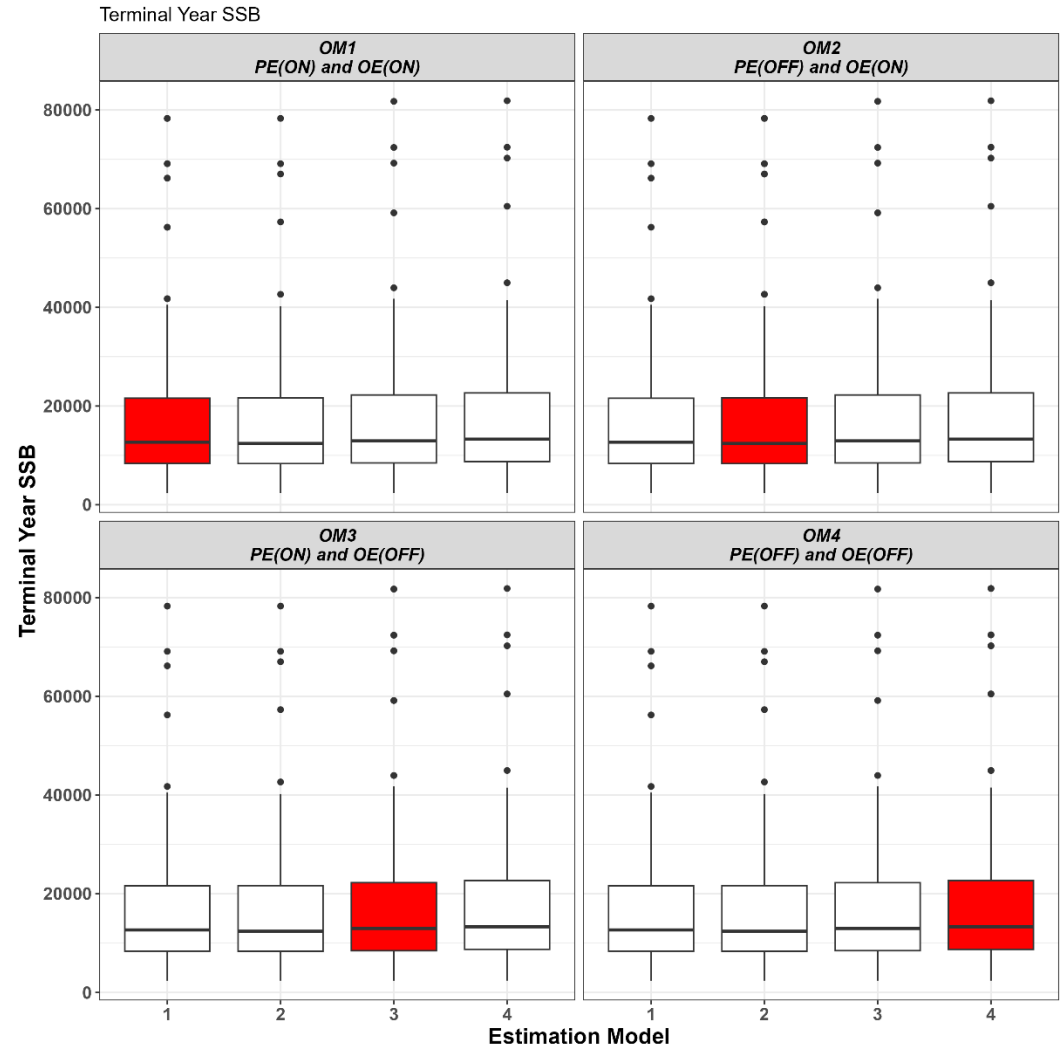
Convergence Rate and AIC



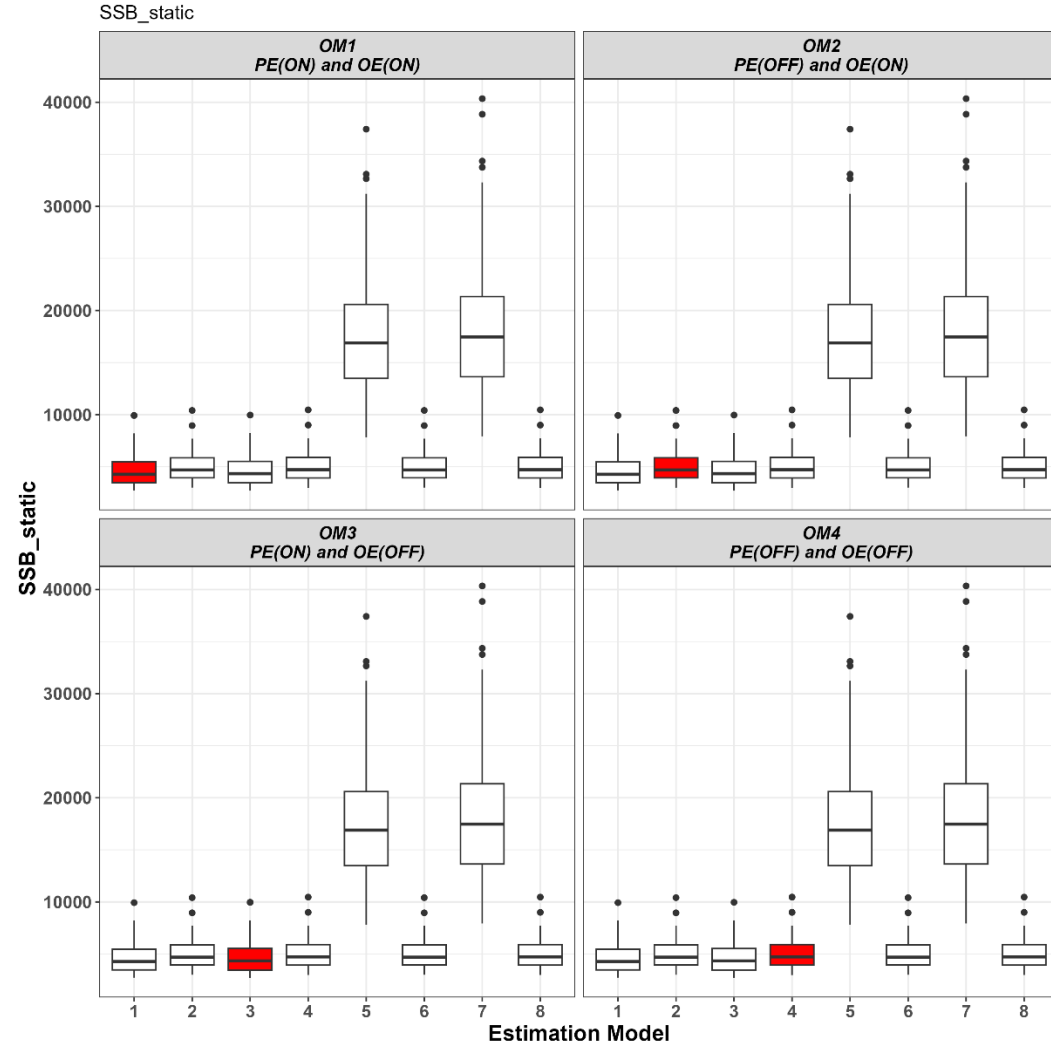
Mean Recruitment Estimates



Terminal-year SSB and F

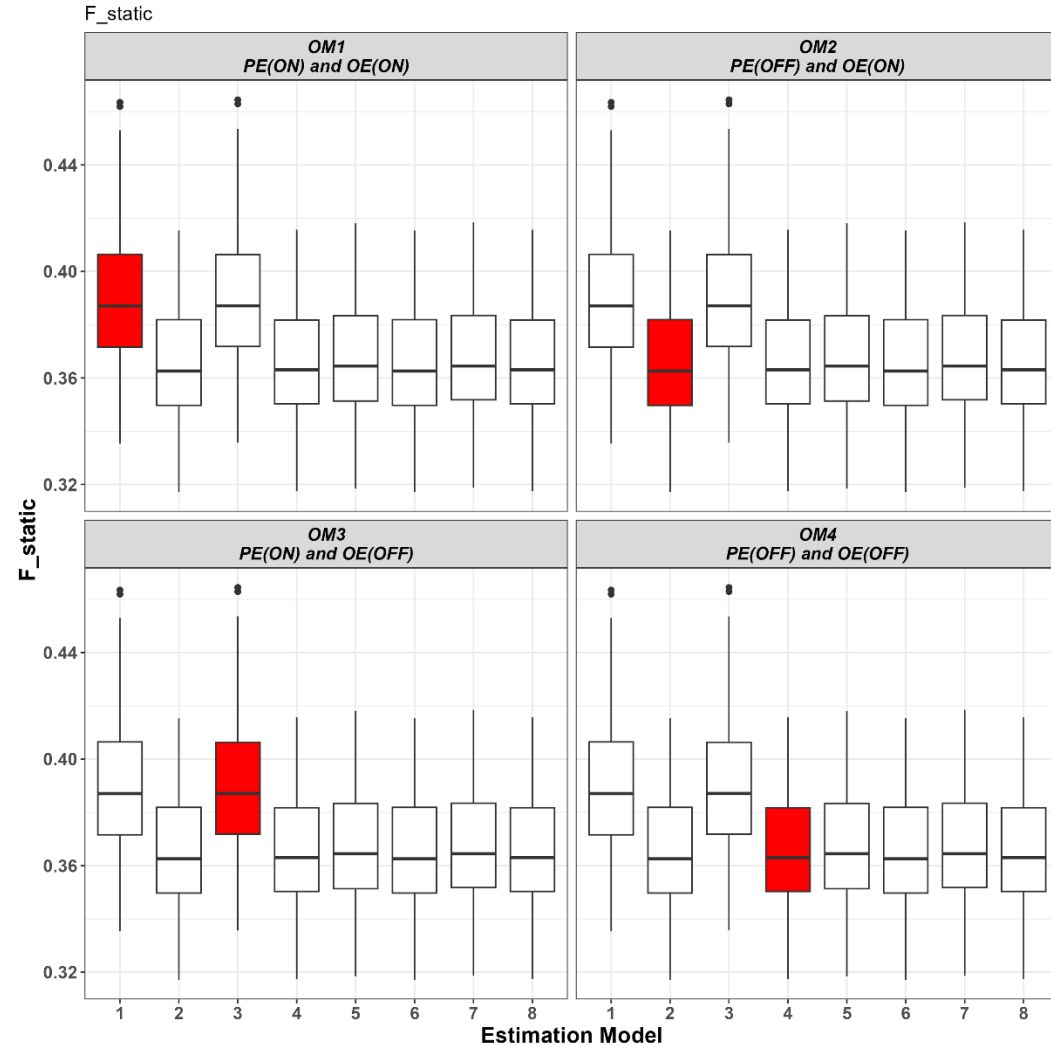


Analytical Brp (SSB40%)



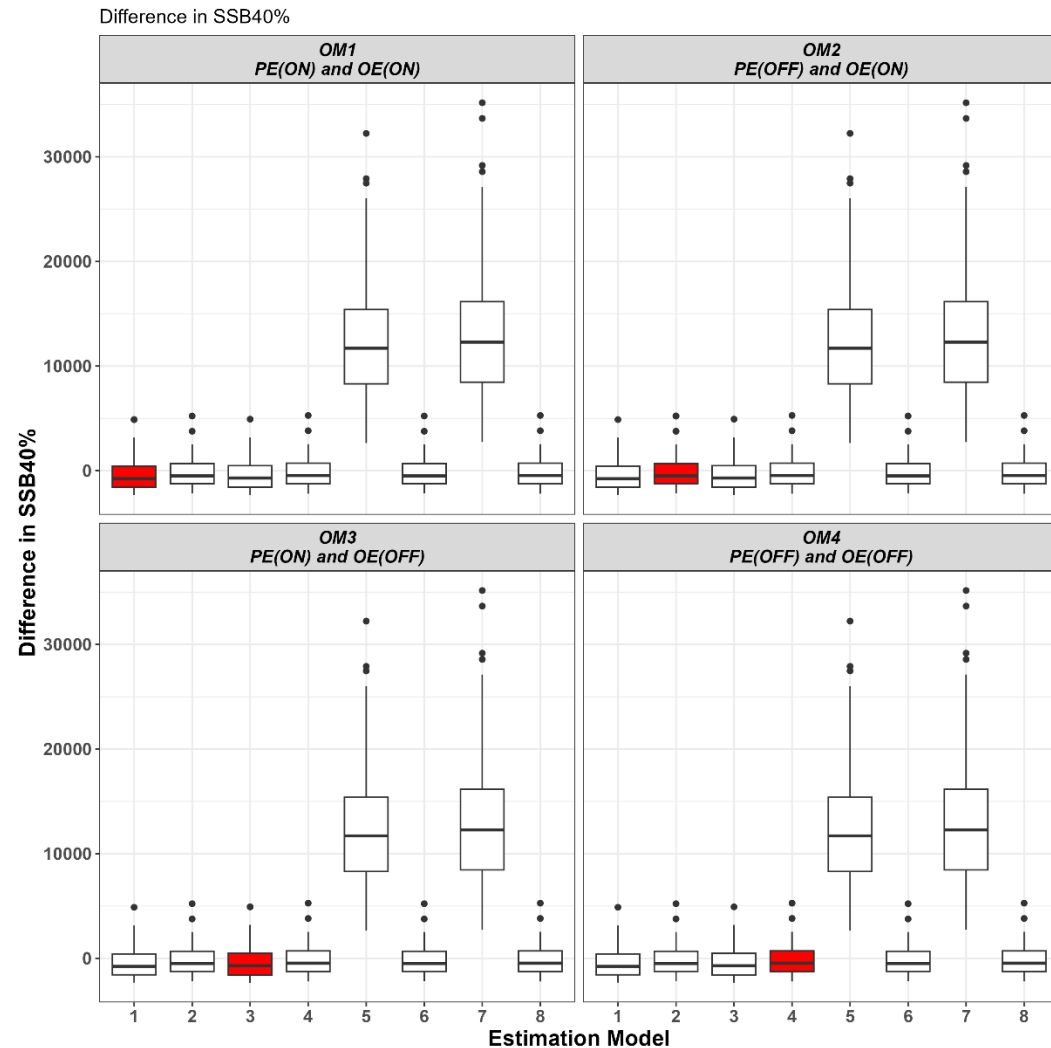
	bias_correct_process	bias_correct_observation	bias_correct_BRPs
1	TRUE	TRUE	TRUE
2	FALSE	TRUE	TRUE
3	TRUE	FALSE	TRUE
4	FALSE	FALSE	TRUE
5	TRUE	TRUE	FALSE
6	FALSE	TRUE	FALSE
7	TRUE	FALSE	FALSE
8	FALSE	FALSE	FALSE

Analytical Brp (F40%)



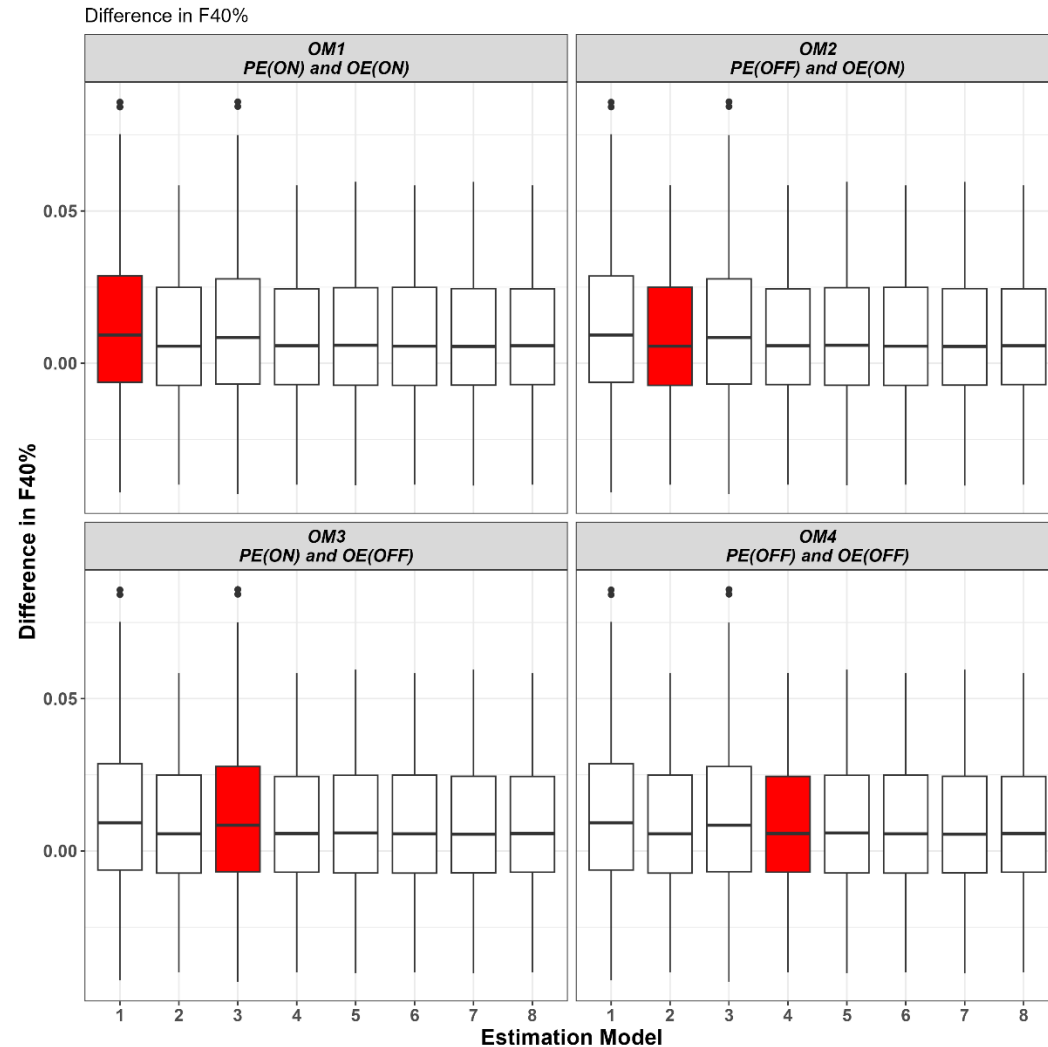
	bias_correct_process	bias_correct_observation	bias_correct_BRPs
1	TRUE	TRUE	TRUE
2	FALSE	TRUE	TRUE
3	TRUE	FALSE	TRUE
4	FALSE	FALSE	TRUE
5	TRUE	TRUE	FALSE
6	FALSE	TRUE	FALSE
7	TRUE	FALSE	FALSE
8	FALSE	FALSE	FALSE

Analytical (SSB40%) – Projected (SSB40%)



	bias_correct_process	bias_correct_observation	bias_correct_BRPs
1	TRUE	TRUE	TRUE
2	FALSE	TRUE	TRUE
3	TRUE	FALSE	TRUE
4	FALSE	FALSE	TRUE
5	TRUE	TRUE	FALSE
6	FALSE	TRUE	FALSE
7	TRUE	FALSE	FALSE
8	FALSE	FALSE	FALSE

Analytical (F40%) – Projected (F40%)



	bias_correct_process	bias_correct_observation	bias_correct_BRPs
1	TRUE	TRUE	TRUE
2	FALSE	TRUE	TRUE
3	TRUE	FALSE	TRUE
4	FALSE	FALSE	TRUE
5	TRUE	TRUE	FALSE
6	FALSE	TRUE	FALSE
7	TRUE	FALSE	FALSE
8	FALSE	FALSE	FALSE

Takeaways

- AIC always prefers models with bias correction OFF for OE.
- Mean rec is much higher when bias correction is ON for PE
- Large difference in analytical brp and projected brp only occurs in the situation where bias correction is ON for PE but OFF for brp.

Things to consider

- Bias correction is also used for deviations of NAA (age 2-9+)!
- But in our case σ (age 2-9+) is small ($\sigma \sim 0.2$)...

$$\varepsilon_{a,y} \sim \begin{cases} \mathcal{N}\left(-\frac{\sigma_R^2}{2}, \sigma_R^2\right), & \text{if } a = 1 \\ \mathcal{N}\left(-\frac{\sigma_a^2}{2}, \sigma_a^2\right), & \text{if } a > 1 \end{cases}$$

- Autocorrelation structure is not included in our study!

$$\varepsilon_{1,y+1} \sim \mathcal{N}\left(\rho_{\text{year}}\varepsilon_{1,y} - \frac{\sigma_R^2}{2(1-\rho_{\text{year}}^2)}, \sigma_R^2\right)$$

- Projection use the mode ($\mu - \sigma^2$), median (μ), and mean ($\mu + \frac{\sigma^2}{2}$) may quantify the uncertainty?
- Change the magnitude of OE (small in our case)?