Indian Ocean swordfish management strategy evaluation: Operating model

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Current Operating Model

- An initial grid of model runs was constructed for the Indian Ocean Swordfish **based on the 2017 initial set of options suggested by the WPM in 2017**;

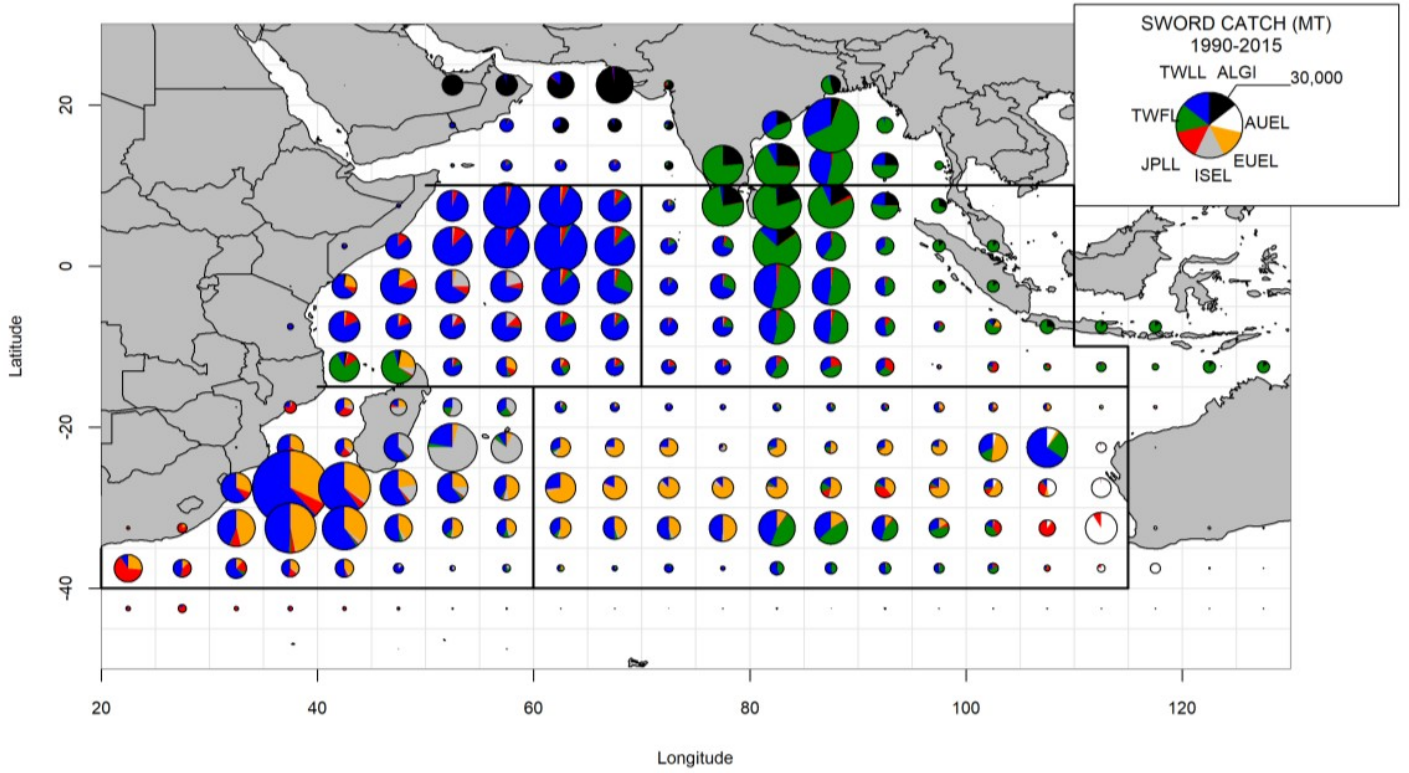
- This resulted in a total of 2,592 model runs.

Variable	Values		
Selectivity	Double Normal	Logistic	
Steepness	0.6	0.75	0.9
Growth + Maturity	Slow growth, late maturity (Wang et al., 2010)	Fast growth, early maturity (Farley et al., 2016, otoliths)	
M	Low = 0.2	High = 0.3	Sex-specific Lorenzen *M* (Farley et al. (2016), otoliths)
ESS	2	20	
CPUE scaling schemes	Area effect x Surface	Catch	Biomass
CPUEs	JPN late + EU.PRT	JPN late	TWN + EU.PRT
Catchability increase	0%	1% / year	

2020 Stock Assessment

- Update and revison of the 2017 Stock Synthesis model;
- Age-based (with ages 0-30), sex explicit, partitioned into four areas
- Period of 1950-2018
- Information on 15 fisheries, defined by fleet and region
  - Final model uses 3 CPUEs (Japan 4 areas, SW - Portugal and South Africa)
  - Length compositions data

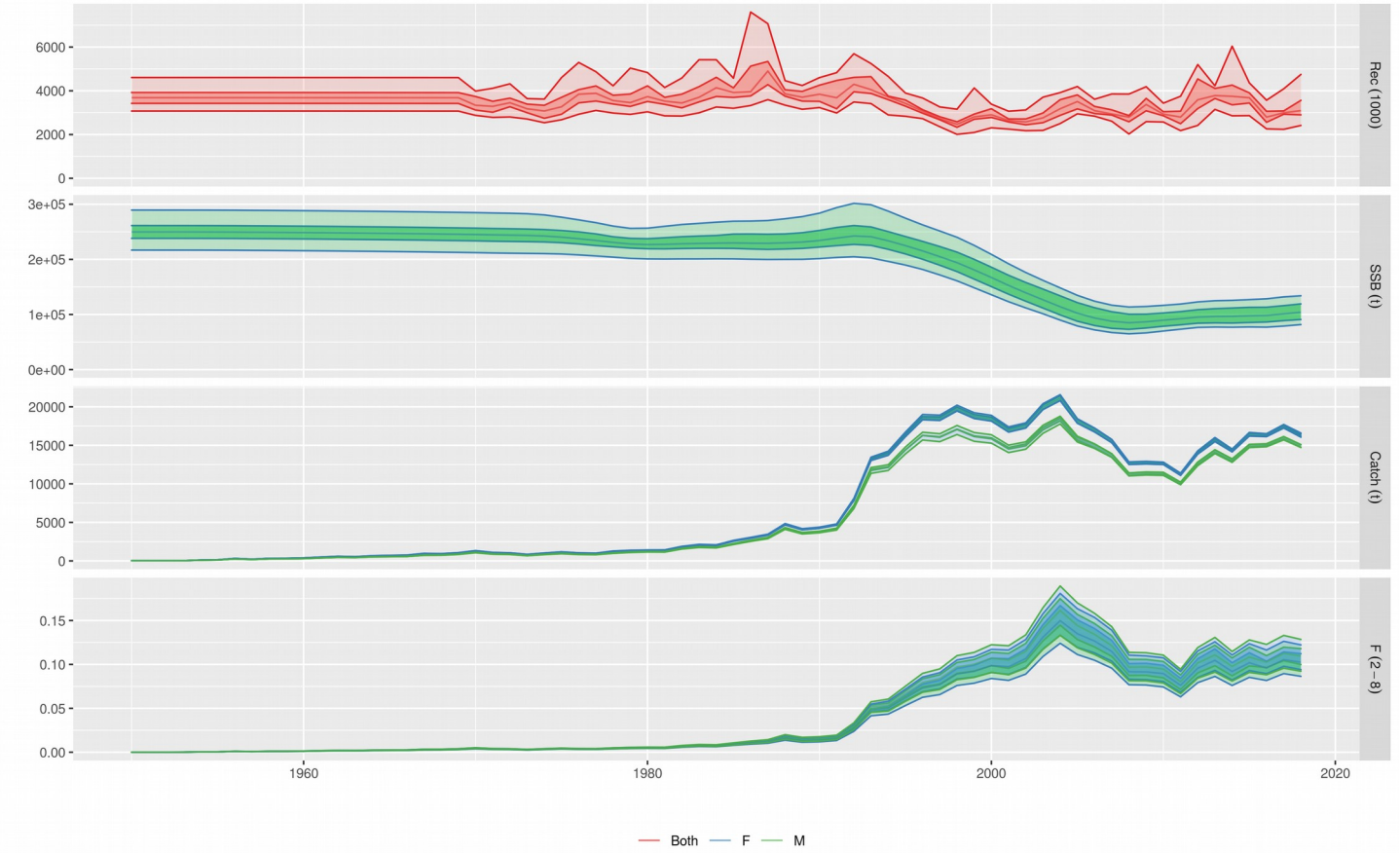
  are available for 14 fisheries

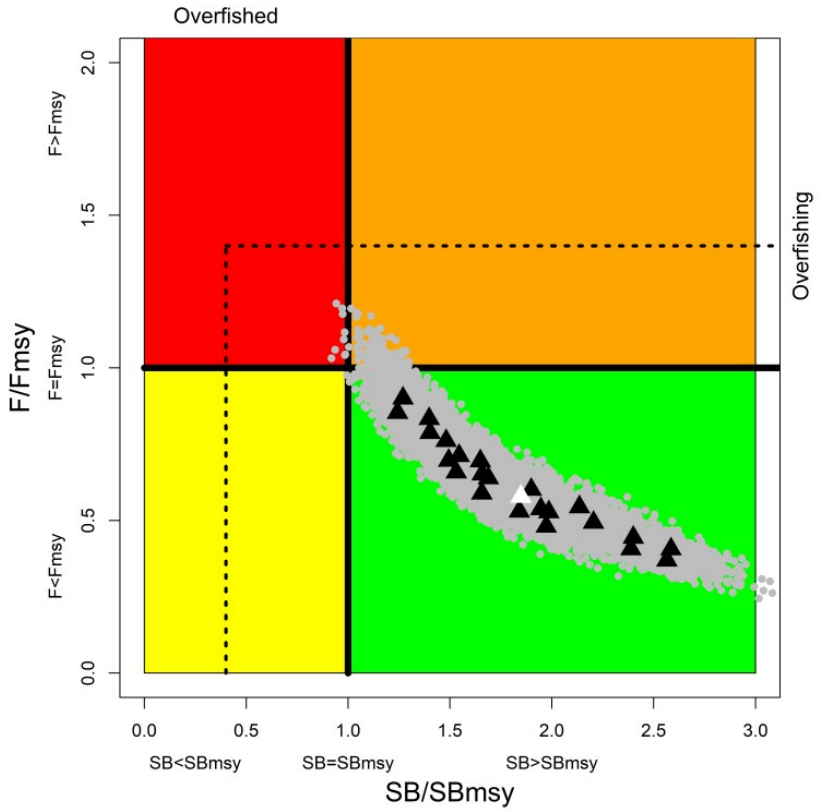


Fu, 2020 - IOTC-2020-WPB18-16
IOTC, 2020 - IOTC-2020-WPB18-RE

2020 Stock Assessment

- Final assessment models based on an ensemble of 24 models:
  - Steepness: 0.7/0.8/.09
  - Growth: Farley et al., 2016/Wang et al., 2010
  - SigmaR: 0.2/0.4
  - ESS: 5/20





Fu, 2020 - IOTC-2020-WPB18-16
IOTC, 2020 - IOTC-2020-WPB18-RE

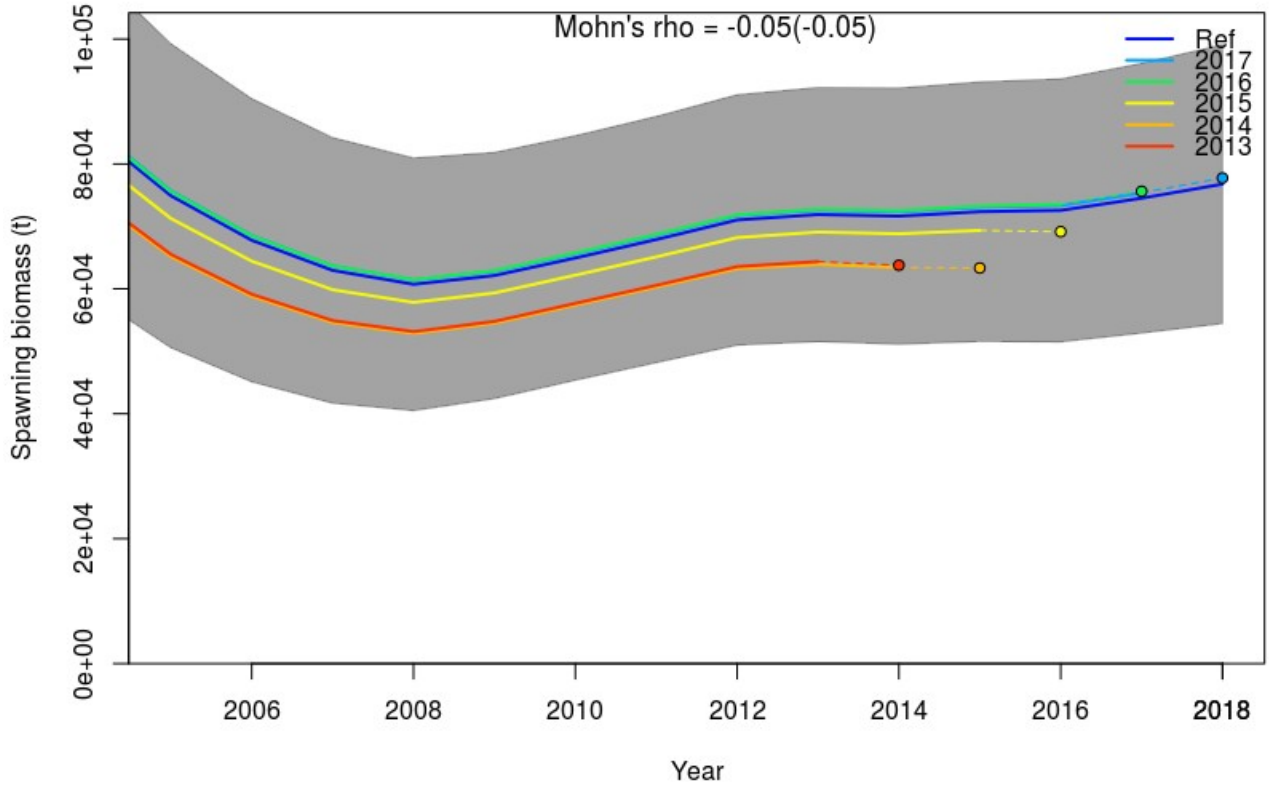
Base Case

- M=0.25;
- h=0.8;
- SigmaR= 0.2;
- Growth&Mat: Farley et al., 2016,
- ESS=5;
- CPUE= JPNlate+PRT;
- Scaling= biomass,
- Selectivity= Double normal for longlines

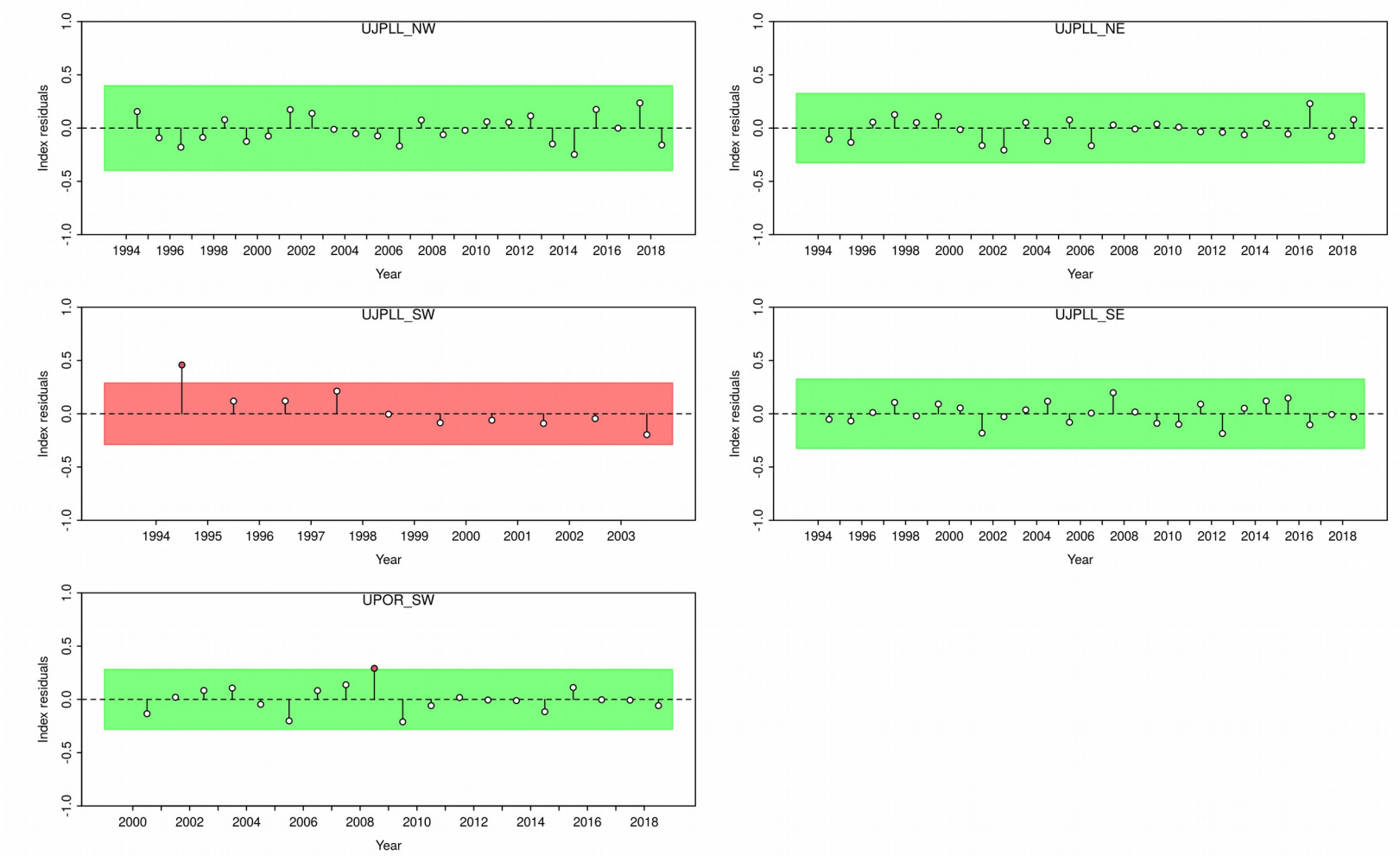
- Turned-off: South Africa CPUE

- First iteration – did not converge; jittered → convergence

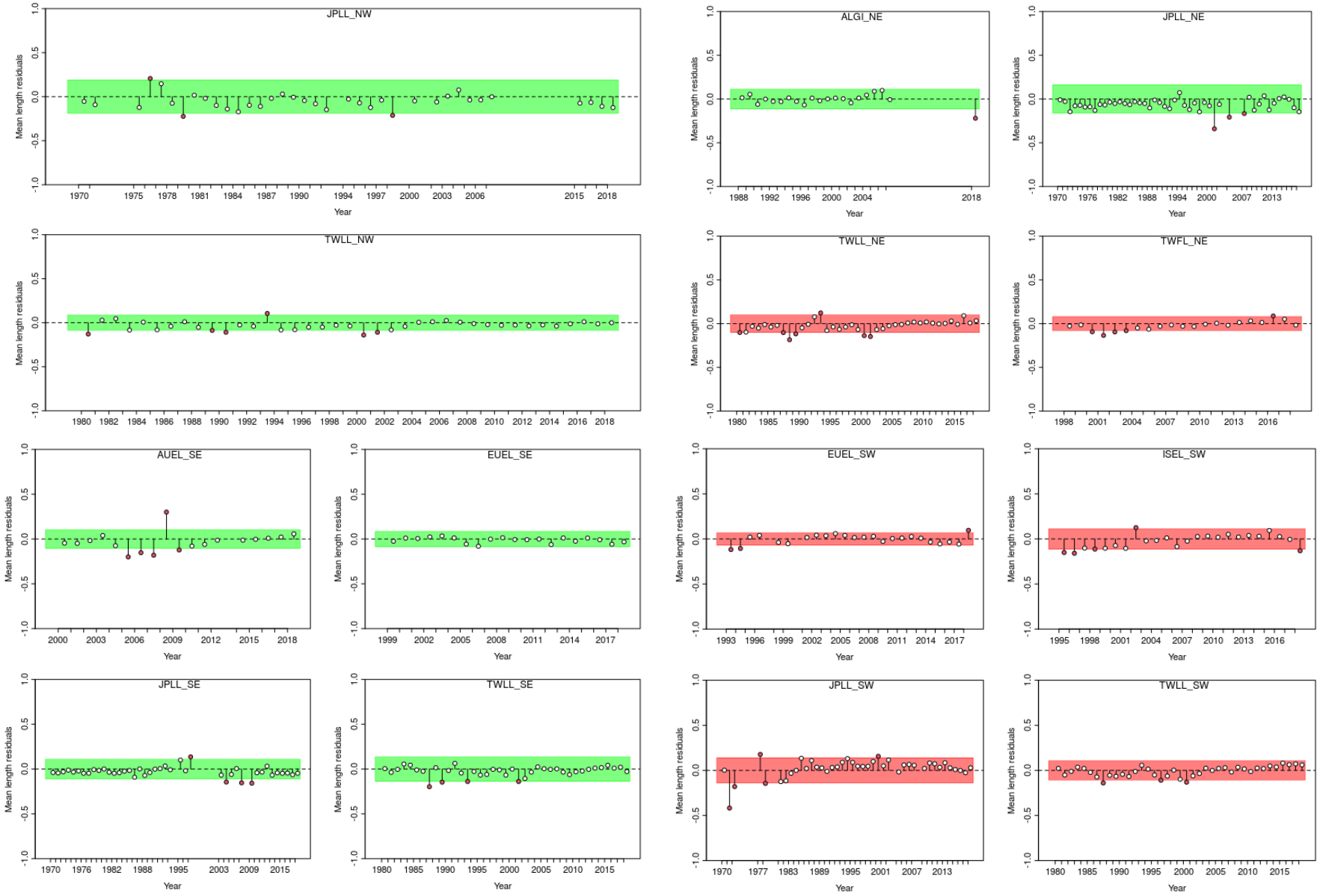
Model diagnostics: Retrospective analysis



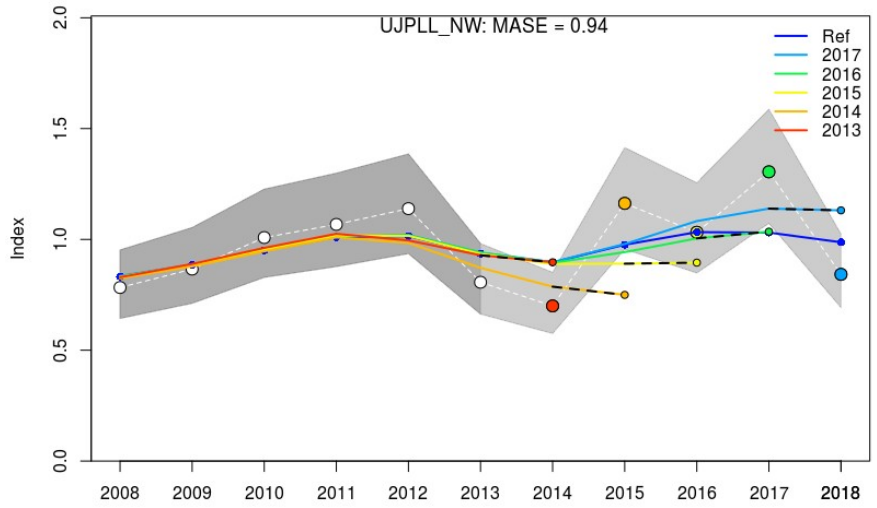
Model diagnostics: CPUE runs test

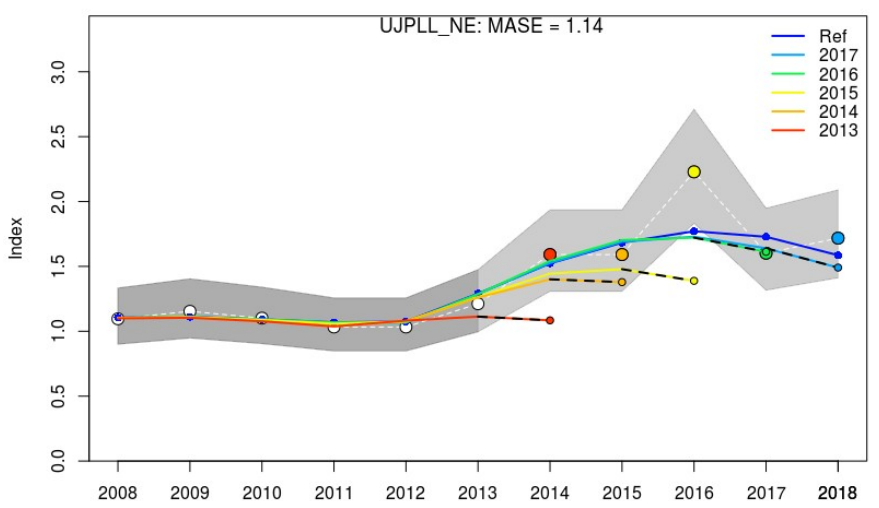


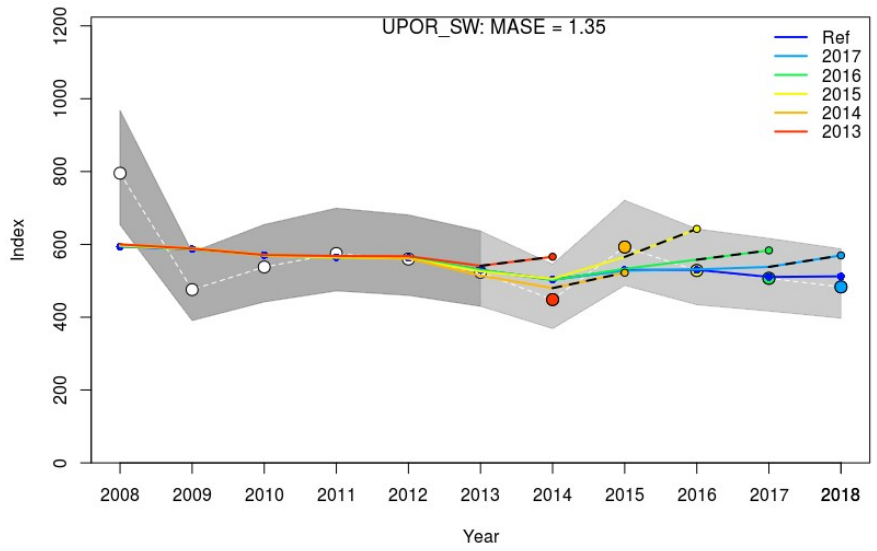
Model diagnostics: Length frequency runs test

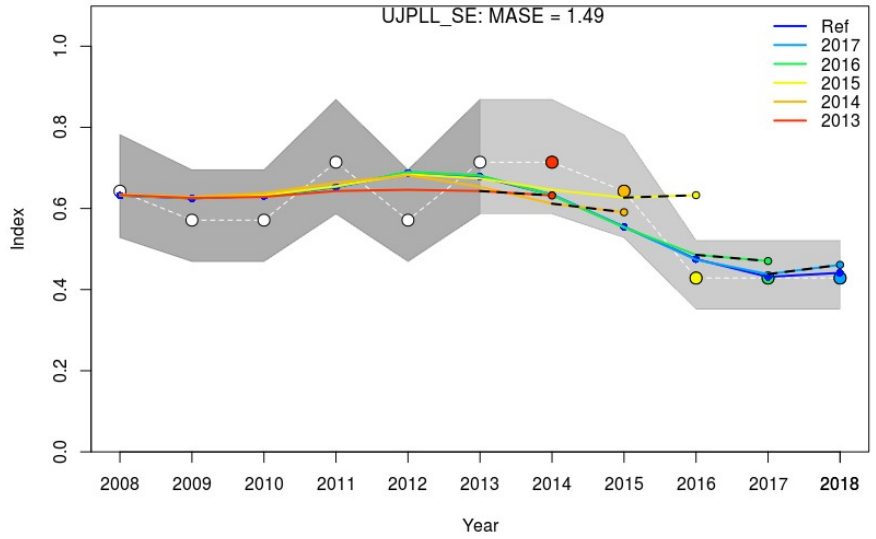


Model diagnostics: Hindcast cross validation







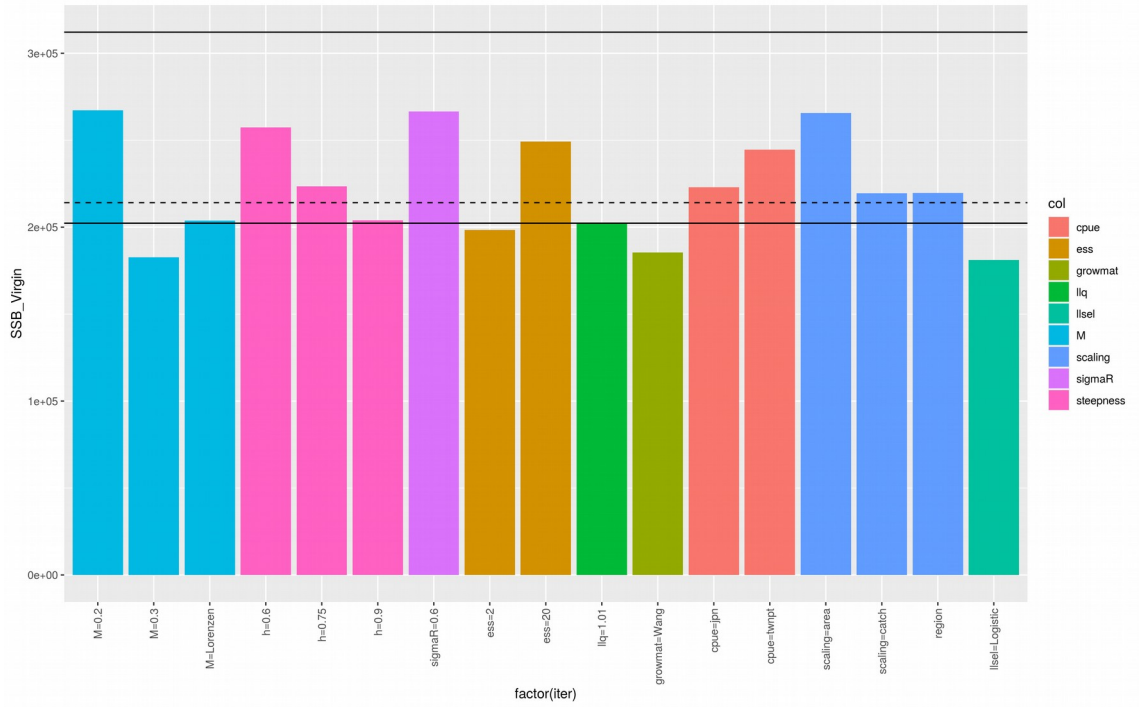


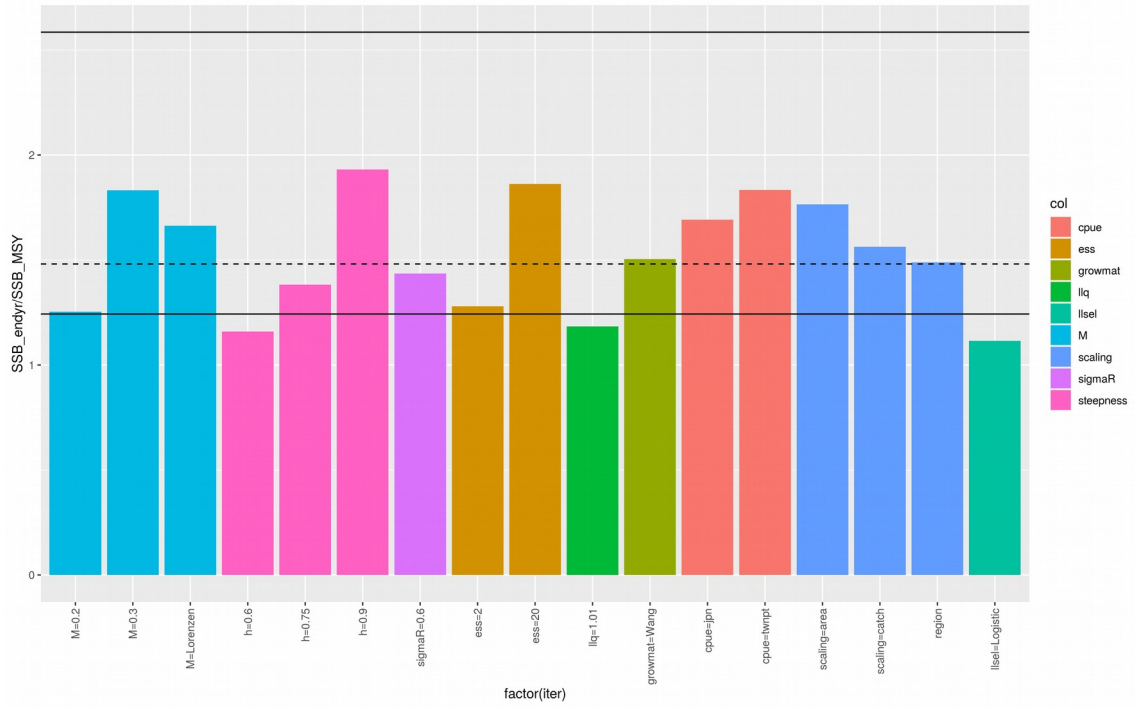
Main effects

- M=0.2, 0.3, Lorenzen
- h=0.6, 0.75, 0.9
- SigmaR= 0.2, 0.6
- Growth&Mat= Farley et al., 2016, Wang et al., 2010
- ESS=2,20
- CPUE= JPNlate+PRT, JPNlate, TWNlate+PRT
- Scaling= biomass, catch (**region?**), area
- Selectivity= Double normal, Logistic

- One by one change to the “base model” model with current grid (16 models)
  - Non convergence in several models – had to be jittered

Main effects

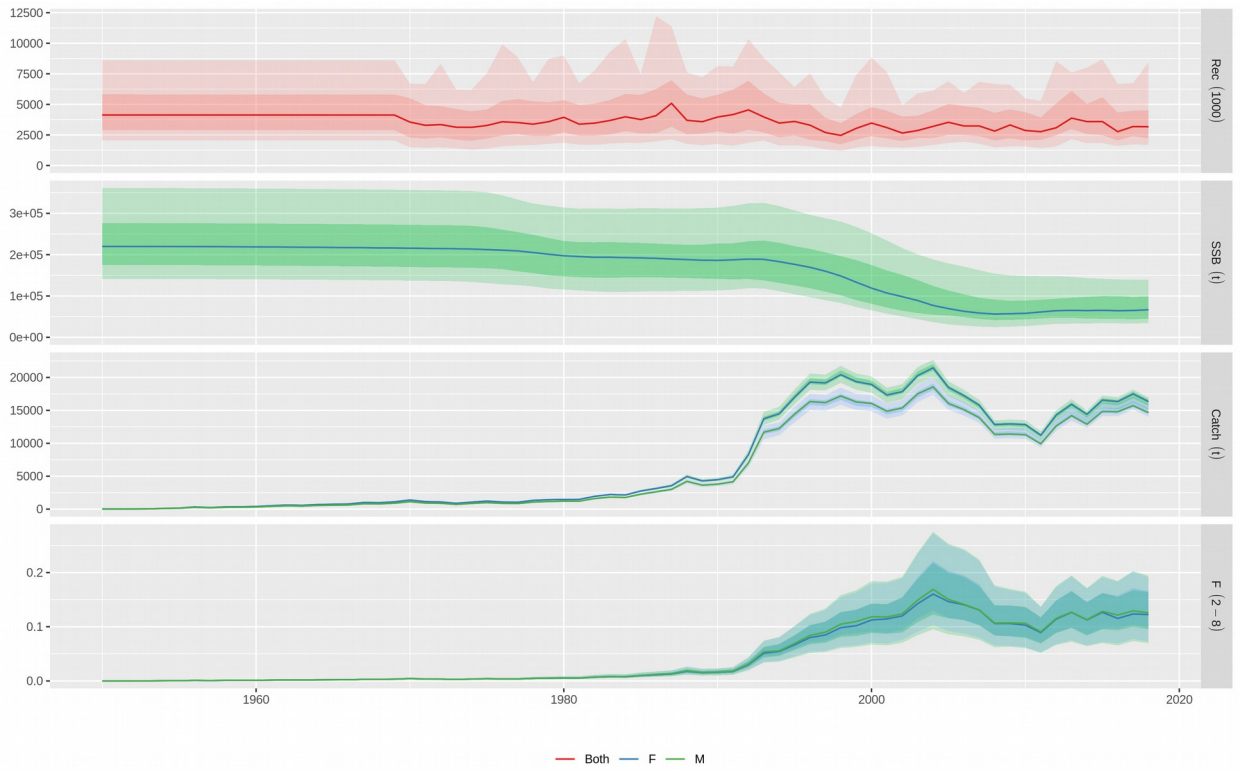




Partial factorial

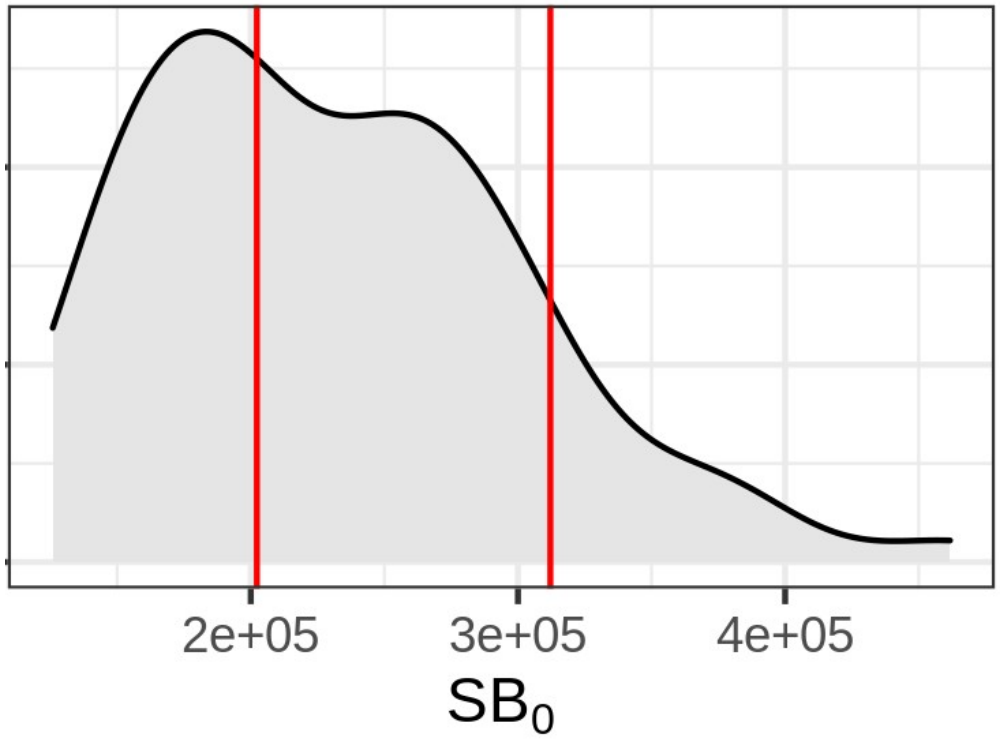
- 108 models
- Convergence level <0.001
- MASE score for NW area < 1

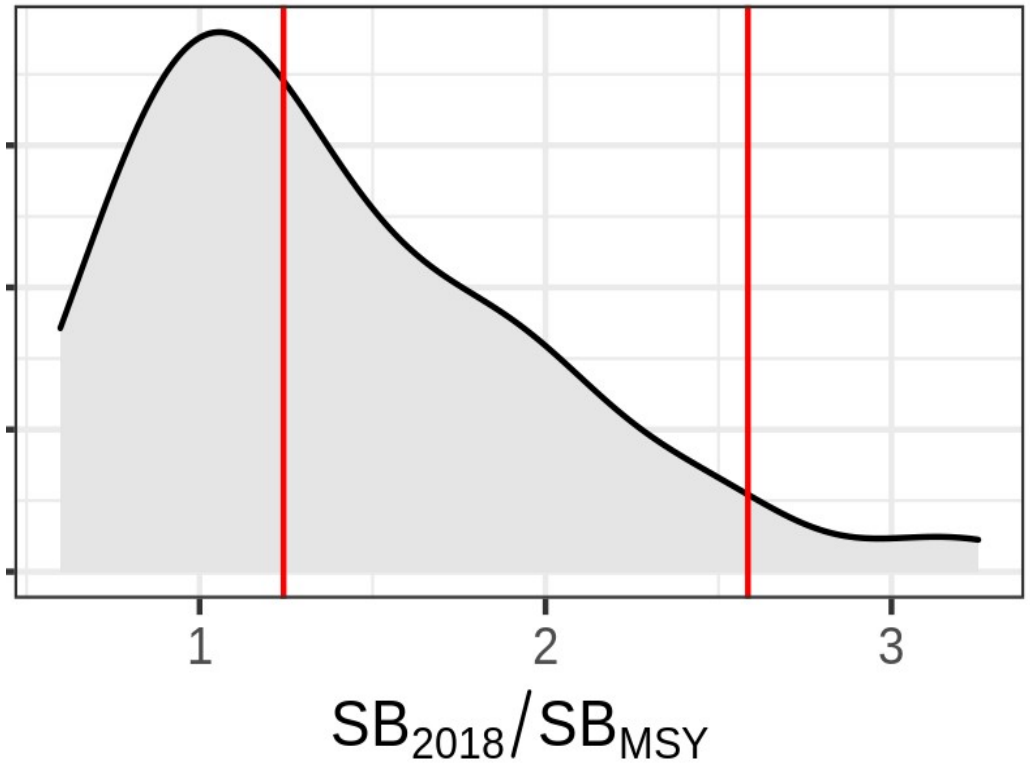
- Final 70 models



Partial factorial

Unrealistic SSB Virgin (125,866t- 461,701t) and stock status (0.5-3.25)?





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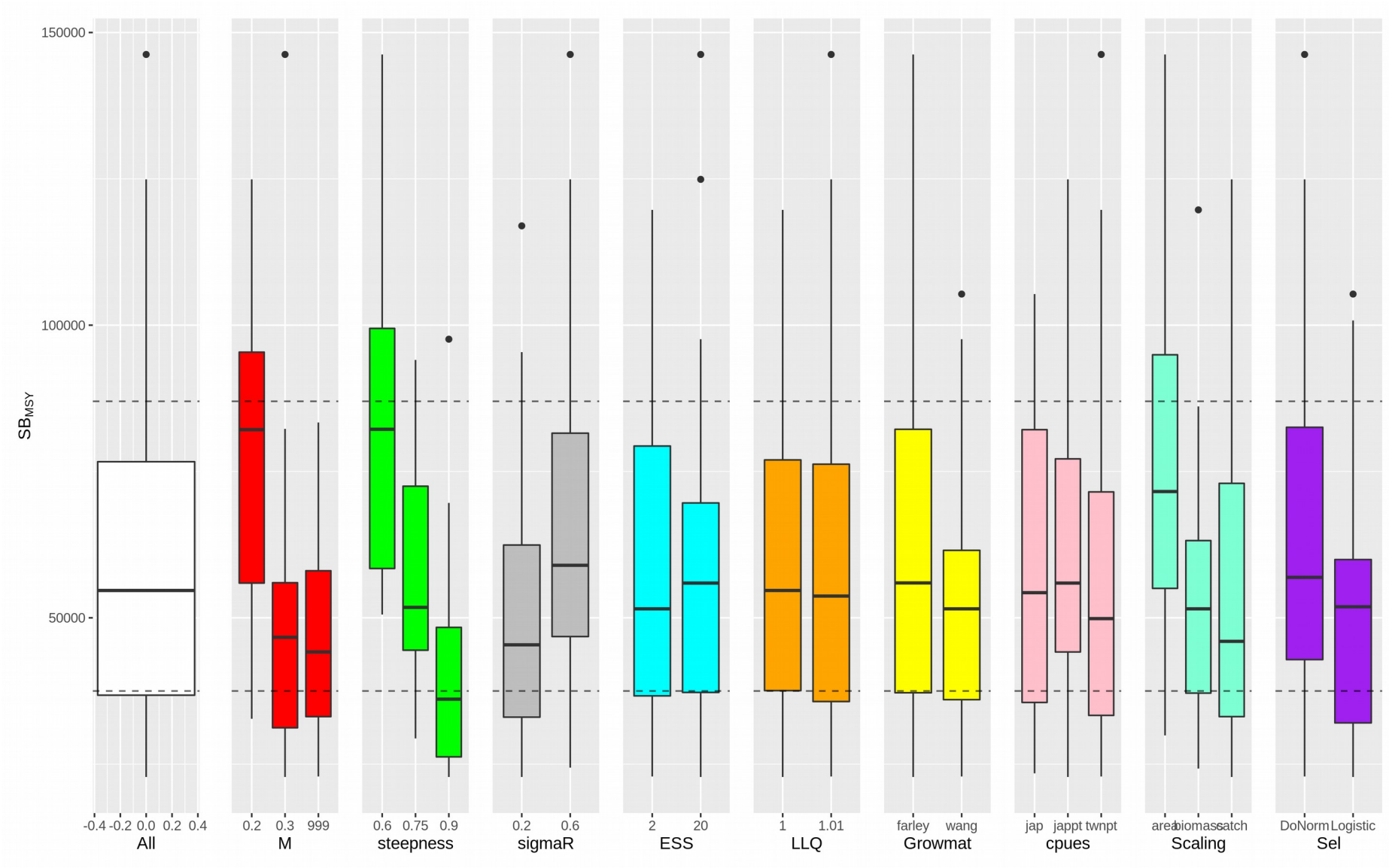
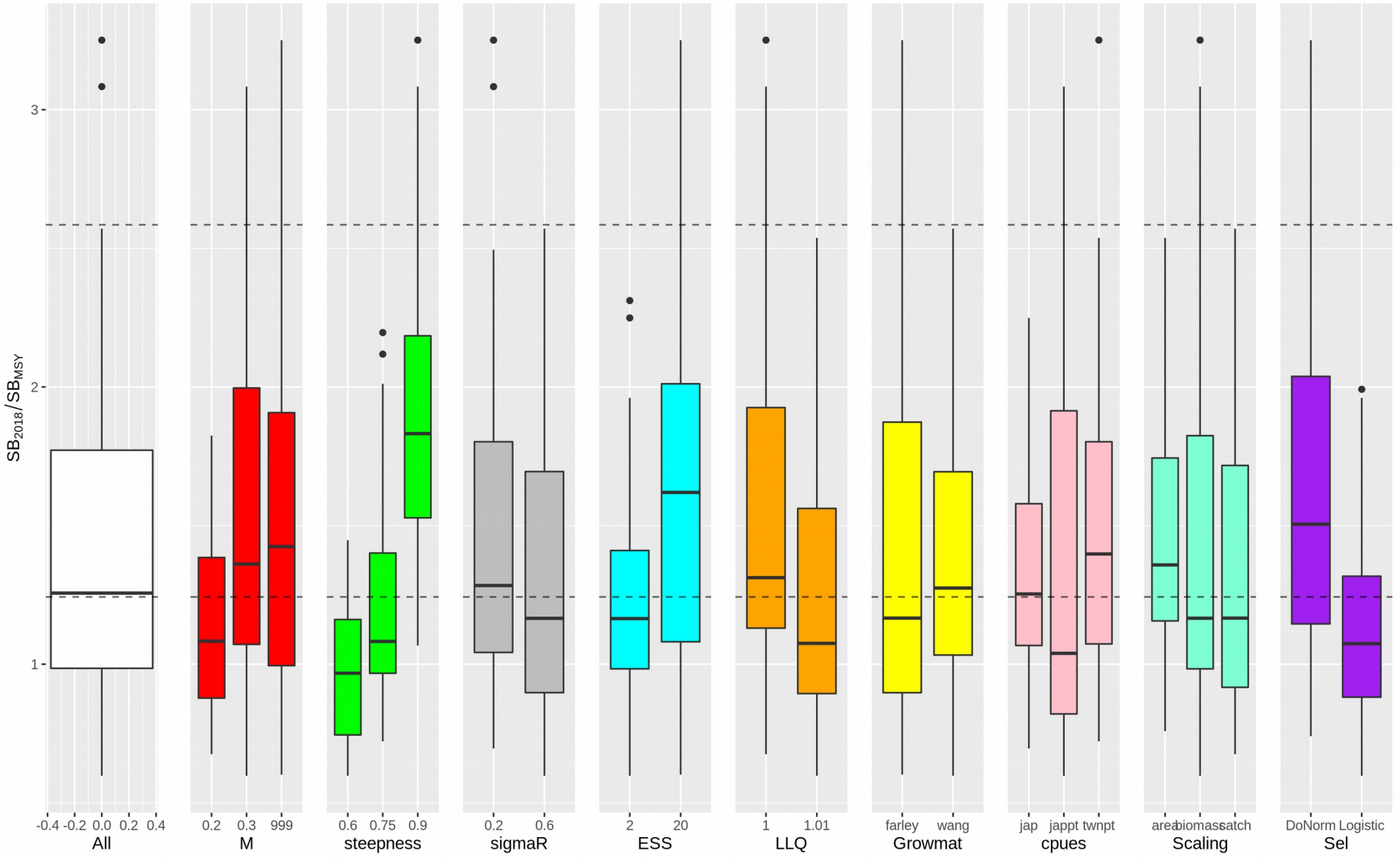


Partial factorial



Management Procedure testing

- Planned to be presented at WPM
- Model weighting based MASE using p-value from Diebold-Mariano test
- Incorporating feedback from TCPM with the following tunning objectives:
  - TS1: Pr(Kobe green zone 2029:2033) = 0.5.
  - TS2: Pr(Kobe green zone 2029:2033) = 0.6.
  - TS3: Pr(Kobe green zone 2029:2033) = 0.7.
  - Additional guidance:
    - TAC is to be set every 3 years.
    - A maximum of 15% change to the TAC (increase or decrease)
    - A 3 year lag between data and TAC implementation.

Robustness tests

- Planned to be presented at WPM
  - Continued low recruitment
  - CPUE overcompensation bias
  - Reported and not reported overcatch
  - Using SW CPUE

Feedback needed

- Is the current uncertainty grid still acceptable?
- Is using the NW CPUE for projections an acceptable approach?
  - The selection of CPUEs for projection will also influence the selection of OMs through MASE score
- Any suggestion on robustness tests to be implemented?

Thank you