**ABT-MSE: an R package for Atlantic bluefin tuna management strategy evaluation**

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*SUMMARY*

To do last

*KEYWORDS*

*Management Strategy Evaluation, bluefin tuna, operating model, management procedure*

# Introduction

A Management Strategy Evaluation (MSE, Butterworth 1999, Cochrane 1998) approach has been proposed for Atlantic bluefin tuna as a suitable framework for providing robust management advice consistent with the precautionary approach (GBYP 2017a). A principal task in the construction of an MSE framework is the development of operating models which represent credible hypotheses for population and fishery dynamics. Operating models are typically fishery stock assessment models which are fitted to data to ensure that model assumptions and estimated parameters are empirically credible (Punt et al. 2014, e.g. CCSBT 2011).

A general approach for testing MPs using MSE established two sets of operating models. The reference trials (‘Base case’) are considered to reflect the most plausible hypotheses and are the primary basis for identifying the best performing management procedure. Robustness trials are used to determine whether the management procedure behaves as intended in scenarios that are less likely.

In this paper the design of the reference set of operating models is described including the fit of these models to data.

# Methods

Installing the package

Loading and initializing the MSE framework

Simulated data

Developing an MP

Testing an MP

# Results

# Discussion

# Acknowledgements

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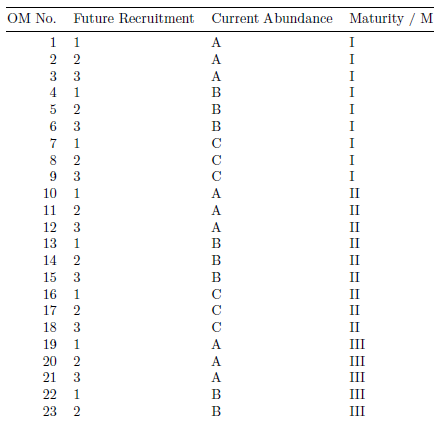
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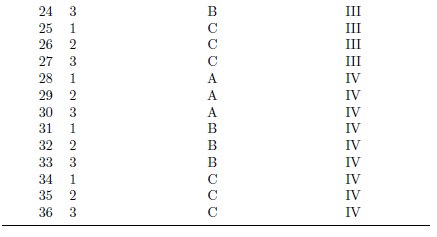
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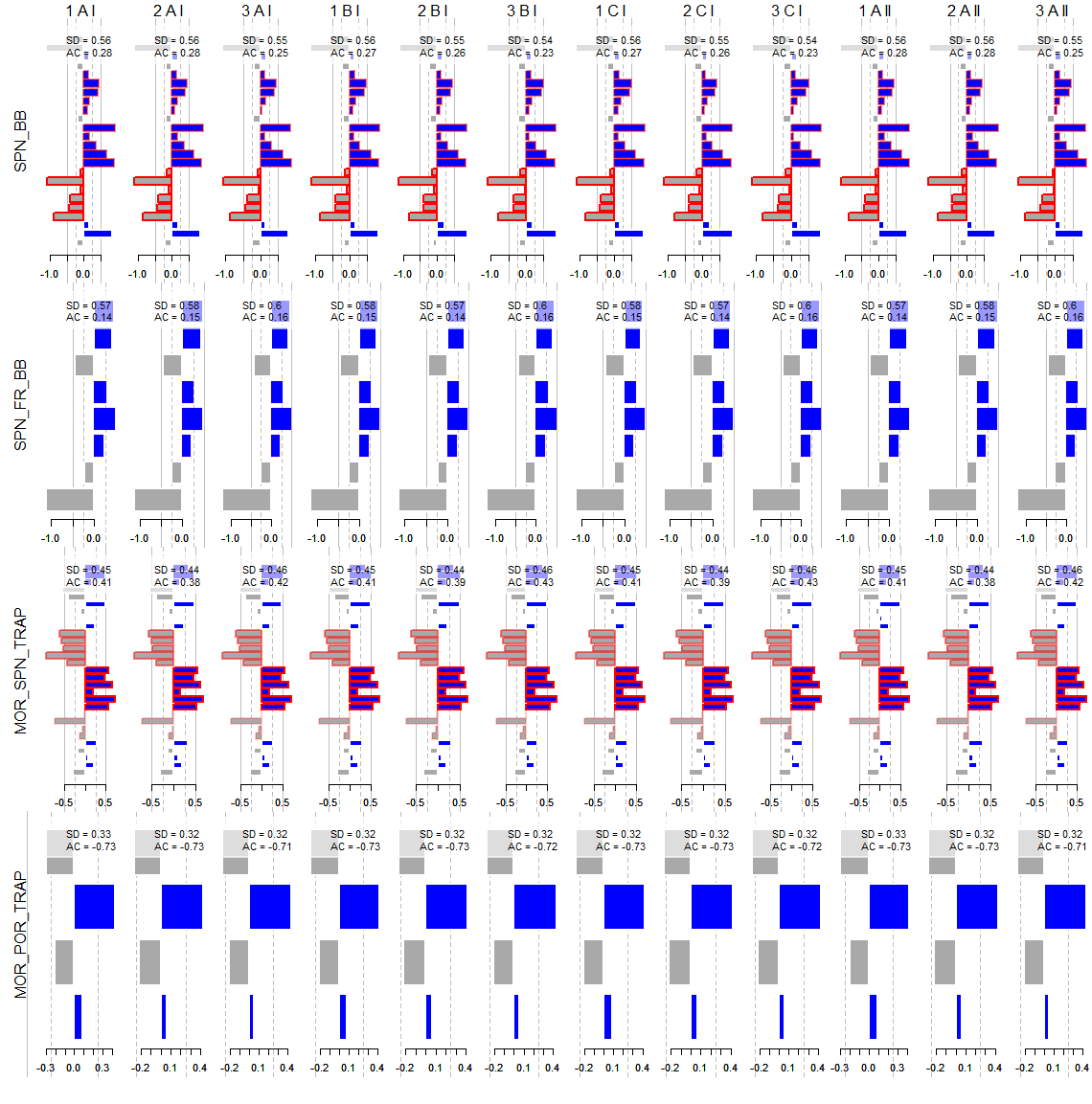
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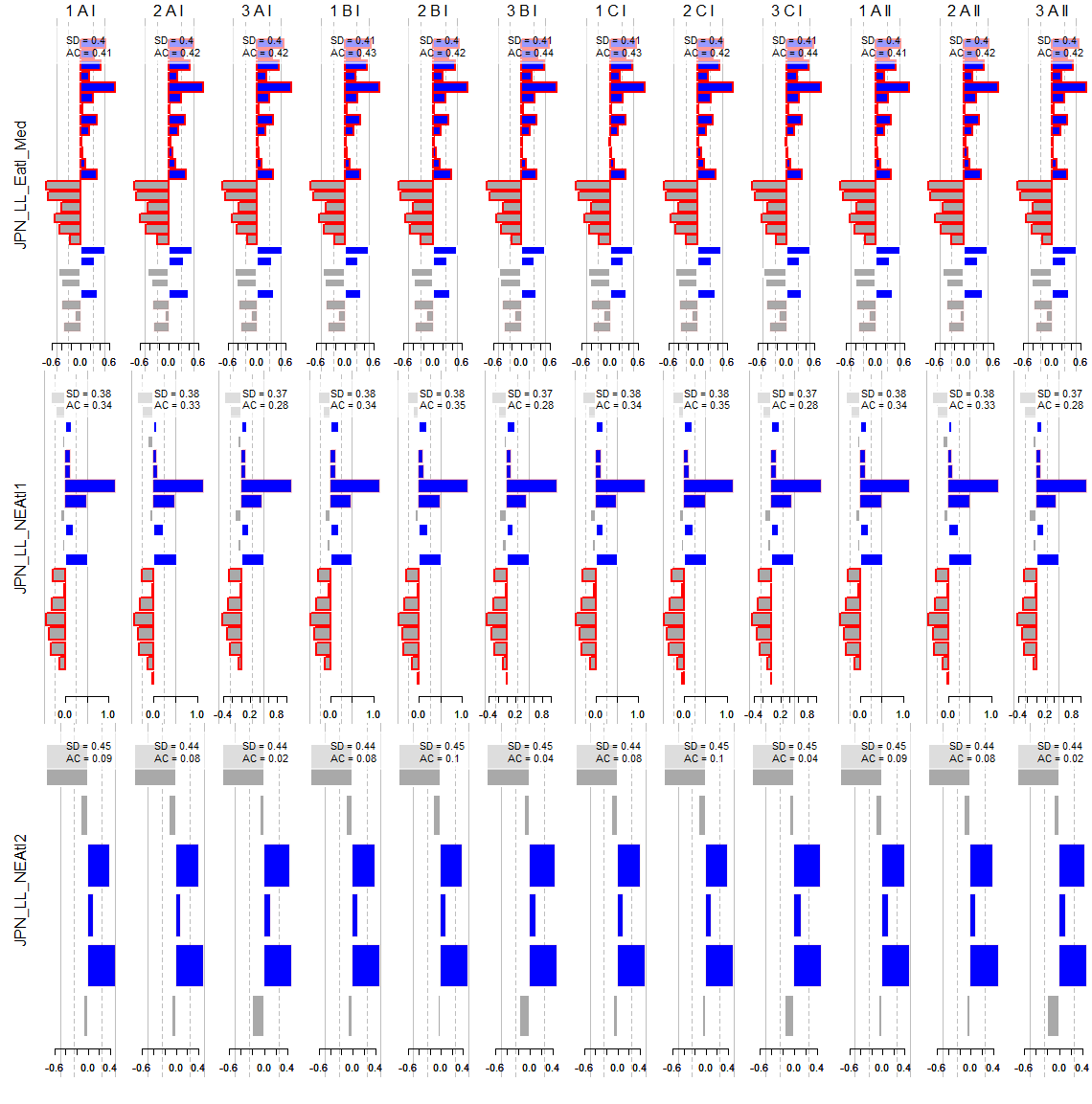
## Table 1. The design of reference operating models. Note, only future recruitment level 1 are presented in this paper since future recruitment scenario is unrelated to fitting of operating models.



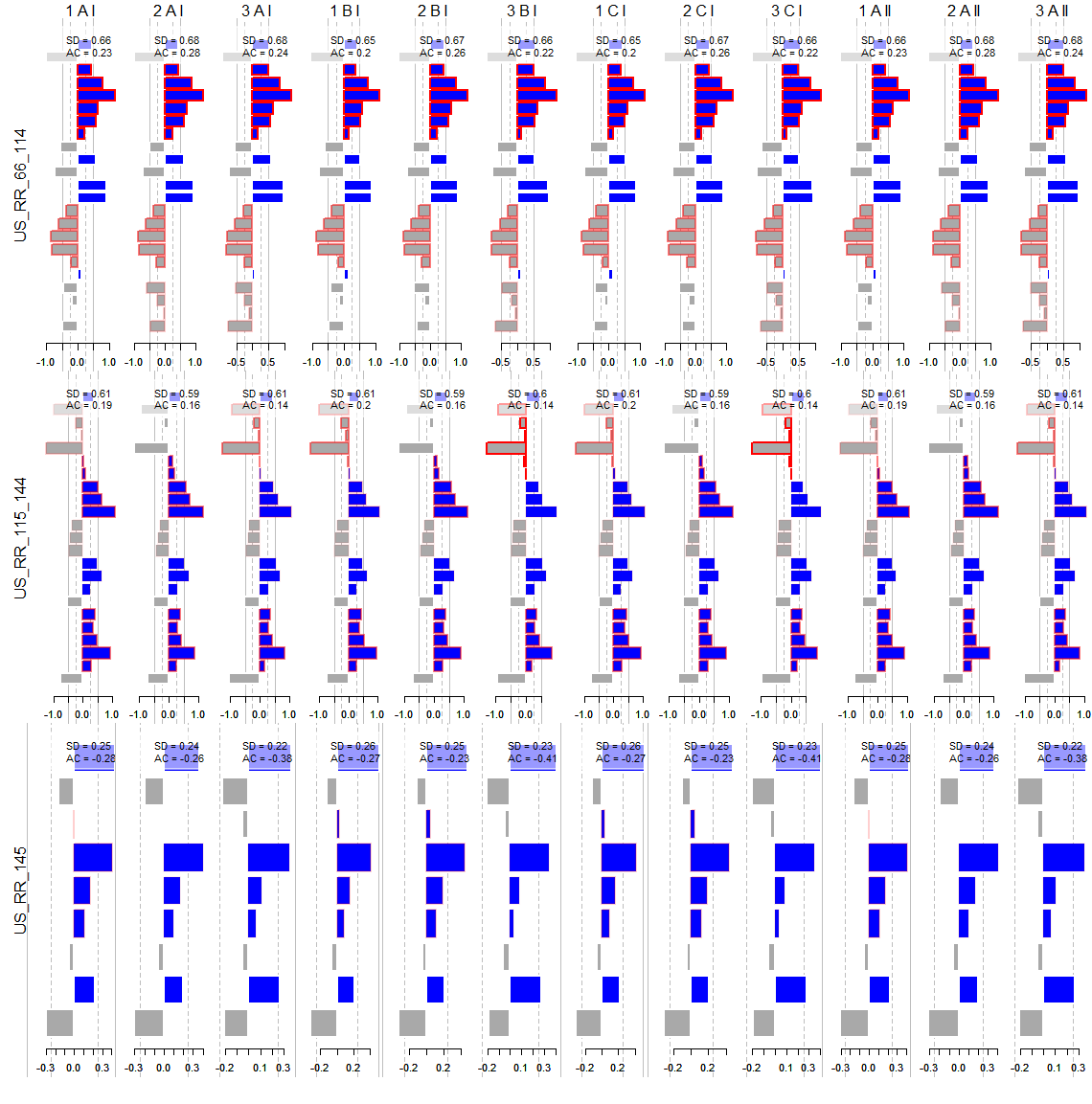


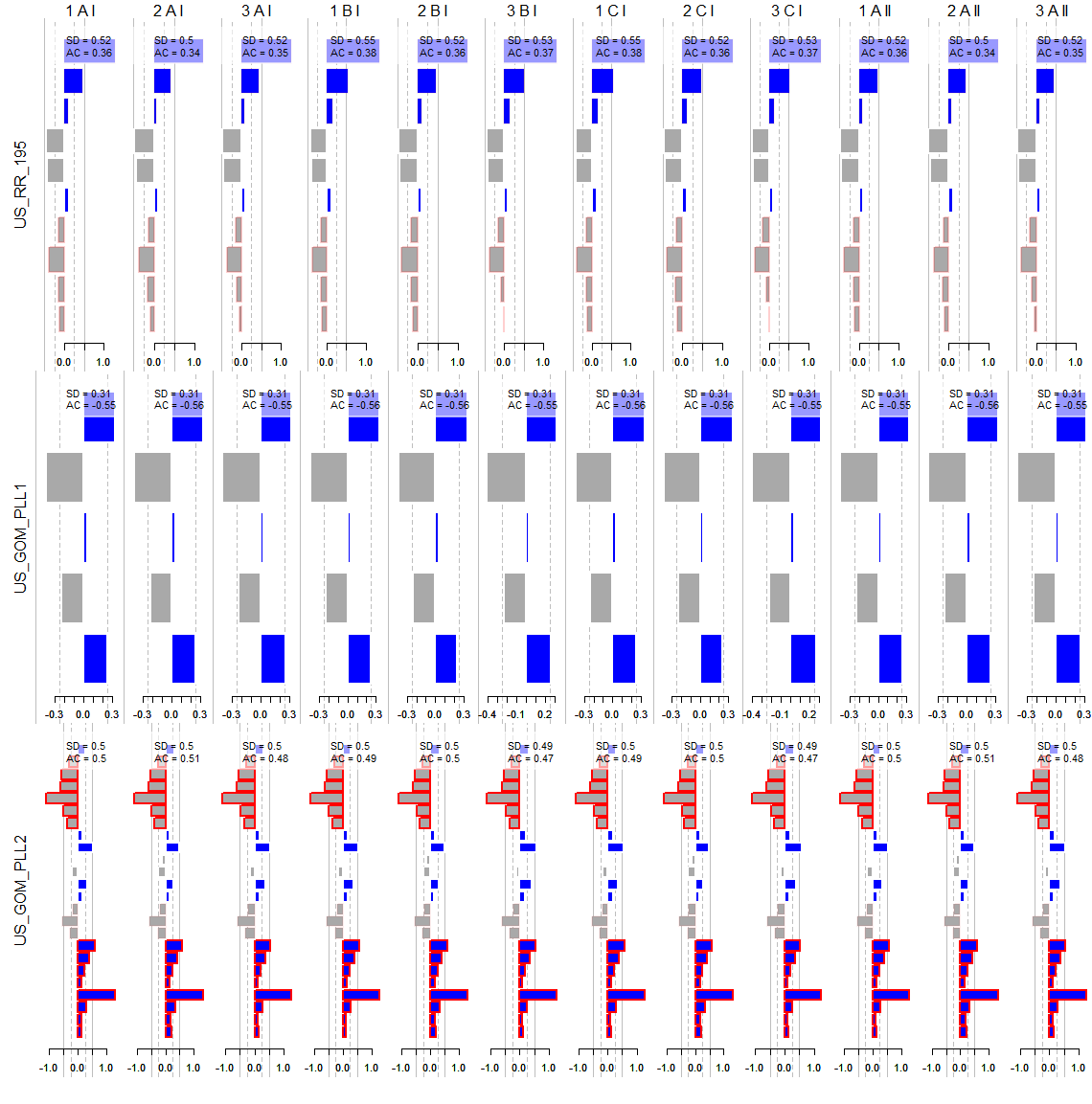


**Figure 1a**. Residuals for operation model fits (columns) to various assessment indices (rows)

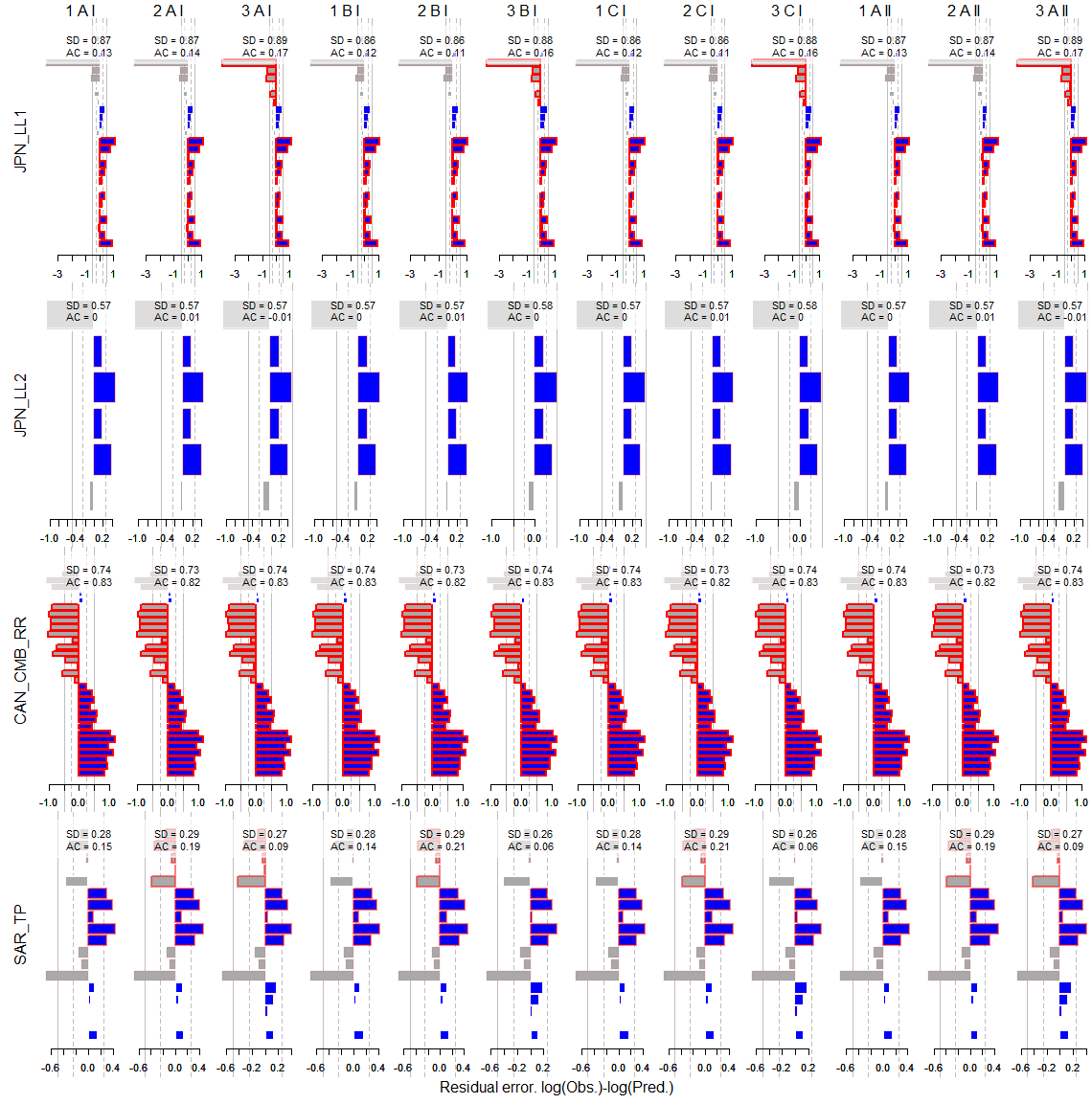


**Figure 1b**. Residuals for operation model fits (columns) to various assessment indices (rows)

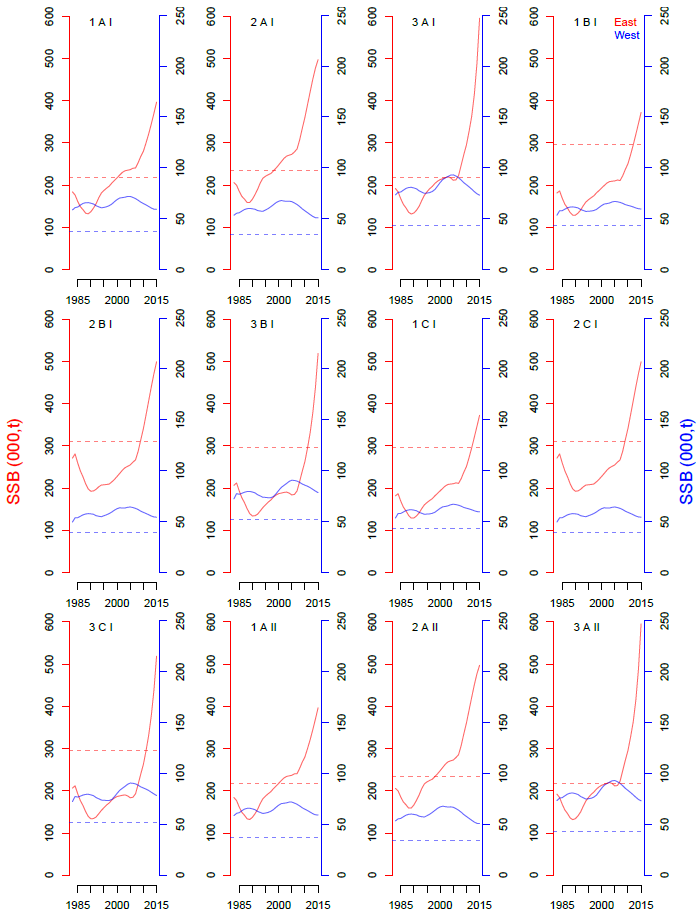
 **Figure 1c**. Residuals for operation model fits (columns) to various assessment indices (rows)



**Figure 1d**. Residuals for operation model fits (columns) to various assessment indices (rows)



**Figure 1e**. Residuals for operation model fits (columns) to various assessment indices (rows)



**Figure 2.** Predicted spawning biomass (East and West stocks) for each operating model (maximum posterior density estimates)

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