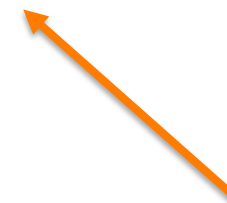# A Comparison of Design and Model-based Survey Indices for the Northern Rockfish Stock in the Gulf of Alaska

Gulf of Alaska, Groundfish Plan Team
September, 2018

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Description of Alternative Models

- Model 15.4
  - 2015 base model fitting design-based index from GOA bottom trawl survey
- Model 15.5
  - Same model structure but fitting the VAST model-based survey index
- Model 15.6
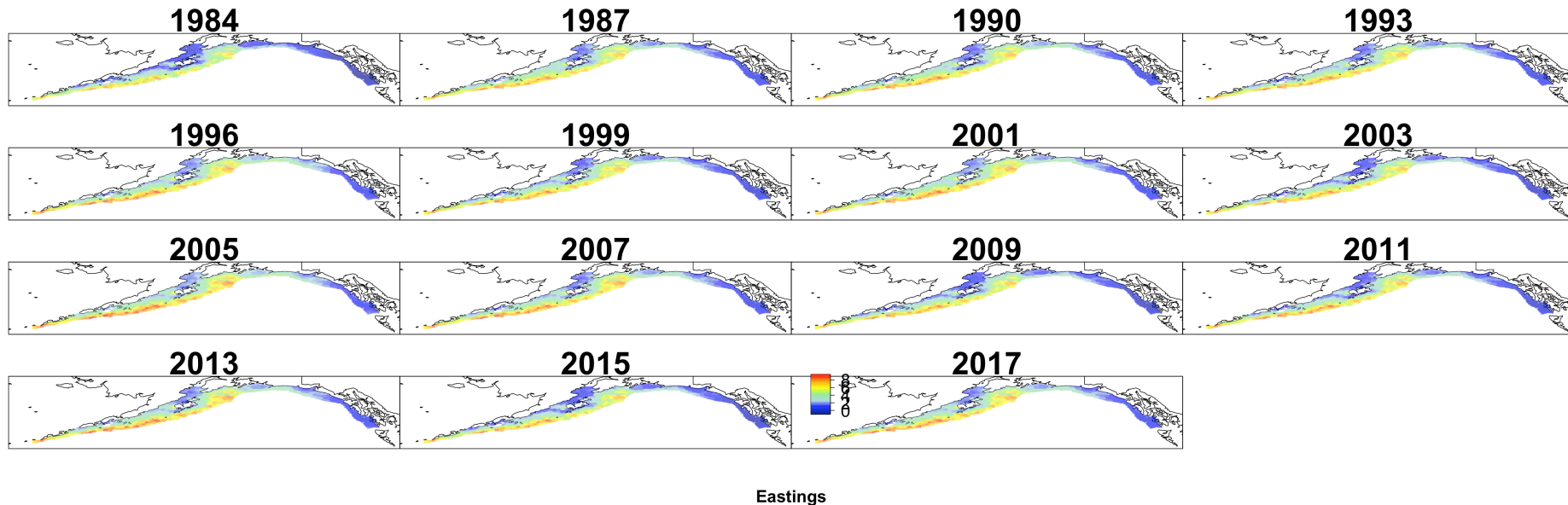 - Fitting model-based index and with likelihood weight for survey index reduced by 50%

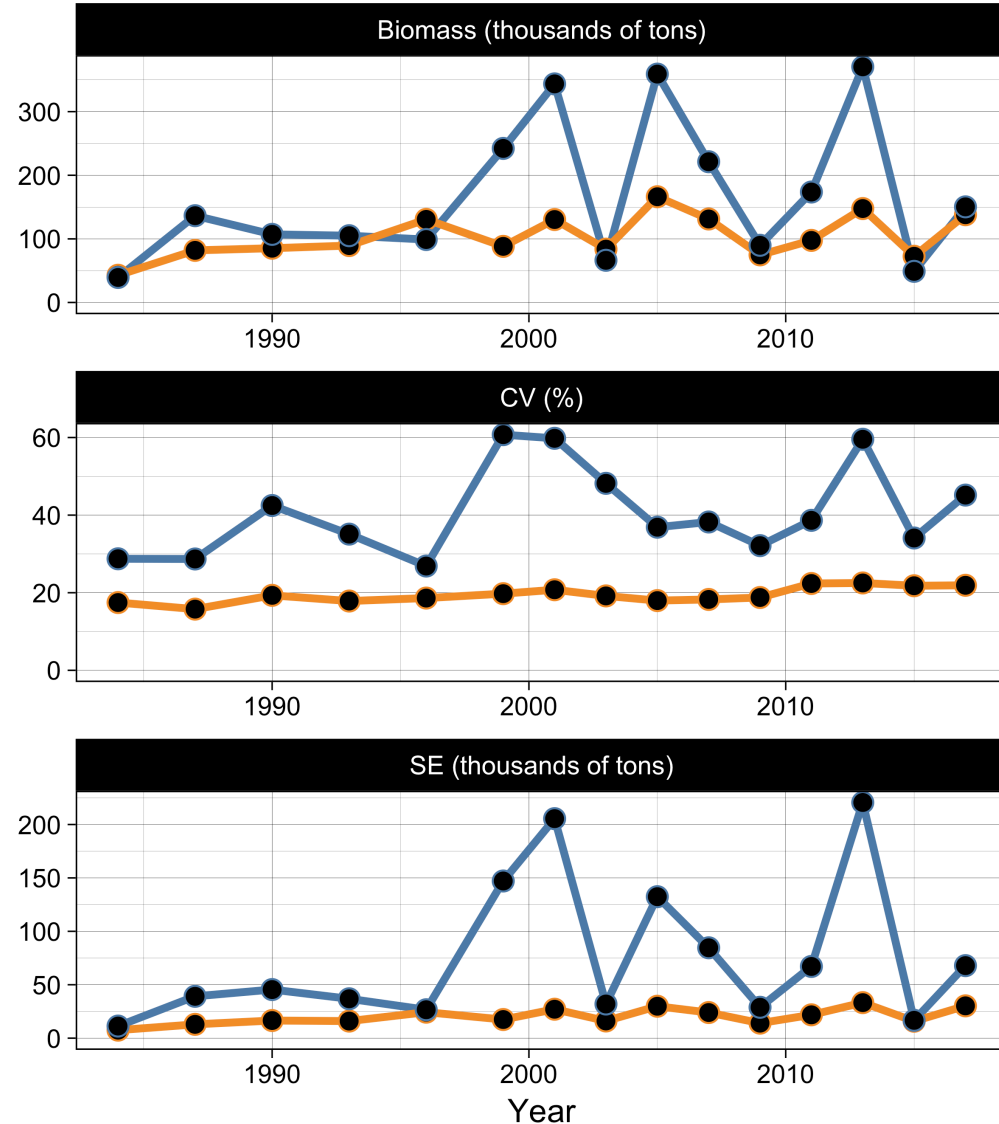An **Intermediate** Option

VAST Model-based Survey Index

Encounter probability vs. frequency

Q-Q plot

Quantile-quantile plot for PCR
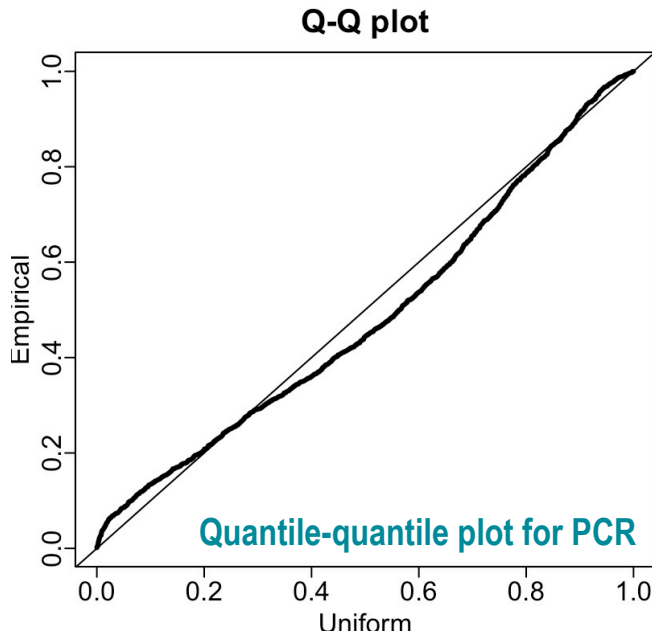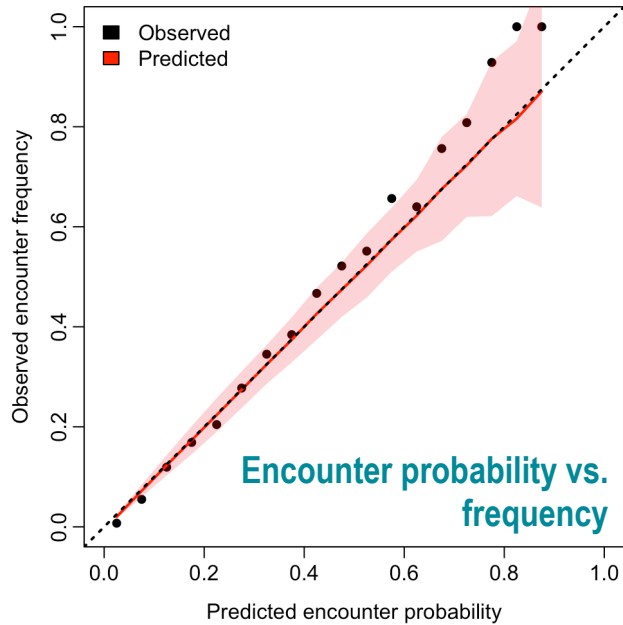
Model Specification

- Fine spatial res: 500 kt
- Bias corrected index
- Lognormal for PCR

Comparison of Design and Model-based Indices

- Inter-survey variation
  - DBI > MBI
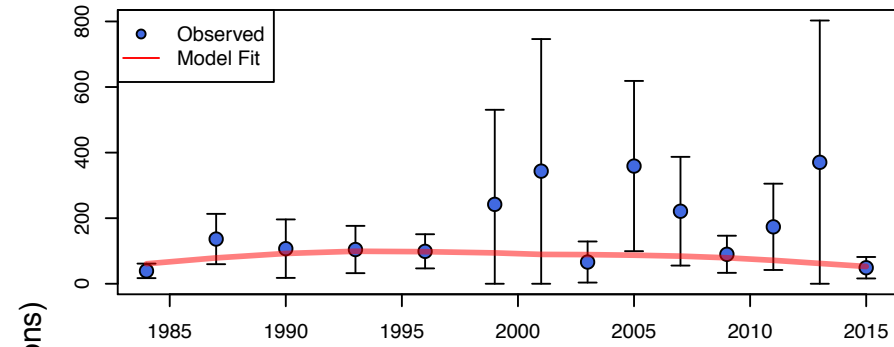- Estimated (model) uncertainty in index
  - DBI > MBI

Comparison of Model Fit to Survey Data
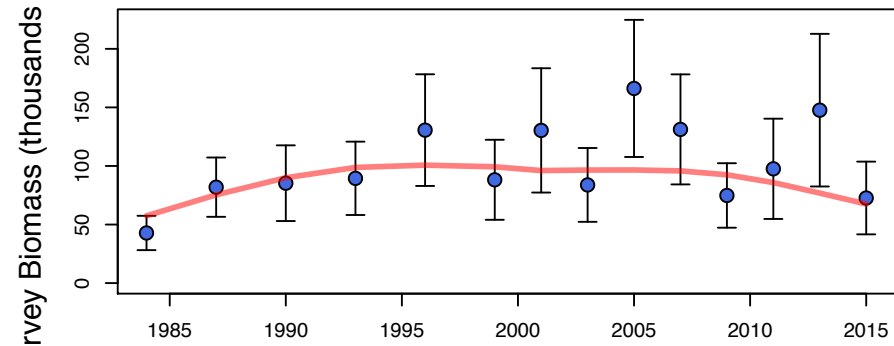
Model Log-Likelihoods

Model	Total	Data	Catch	Survey Biomass	Fish Age	Survey Age	Fish Size
15.4 (2015 Base Model)	228.8	144.6	0.1	10.1	28.5	55.3	50.6
15.5 (2015 Base Model + VAST index)	231.9	146.9	0.2	11.4	28.6	57.3	49.5
15.6 (VAST index + Scaled survey weight)	225.9	141.4	0.1	6.5	28.5	56.0	50.2
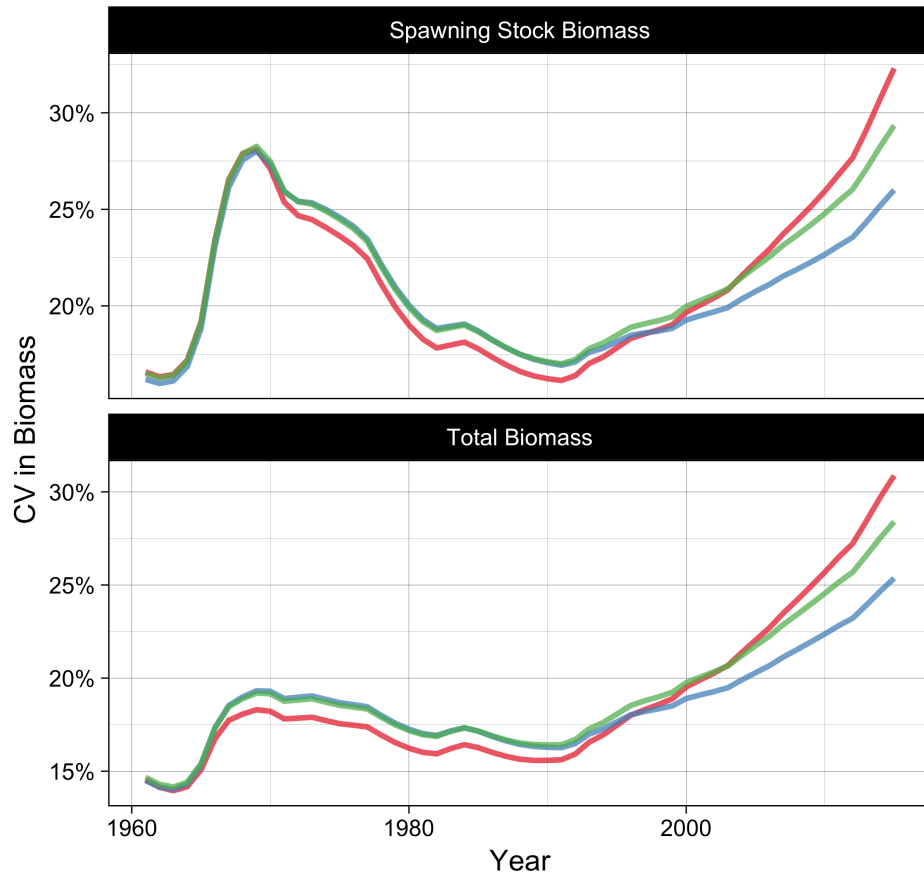
Difference in Biomass Estimates

Difference in Biomass Estimates

Difference in Biomass Estimate Uncertainty

Difference in Biomass Estimate Uncertainty

Difference in Estimated Parameters
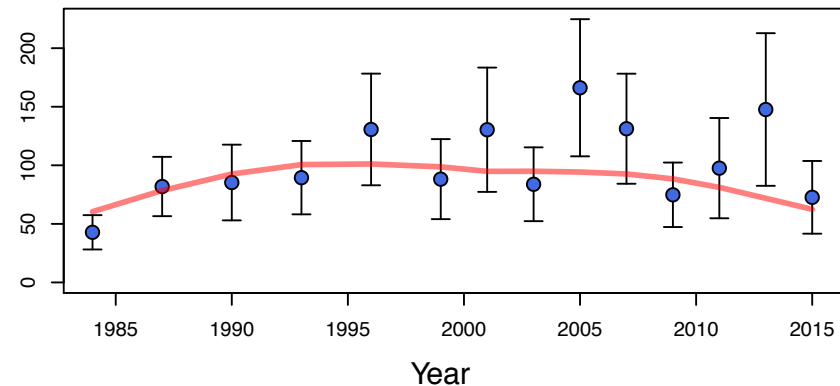
Estimated Parameters
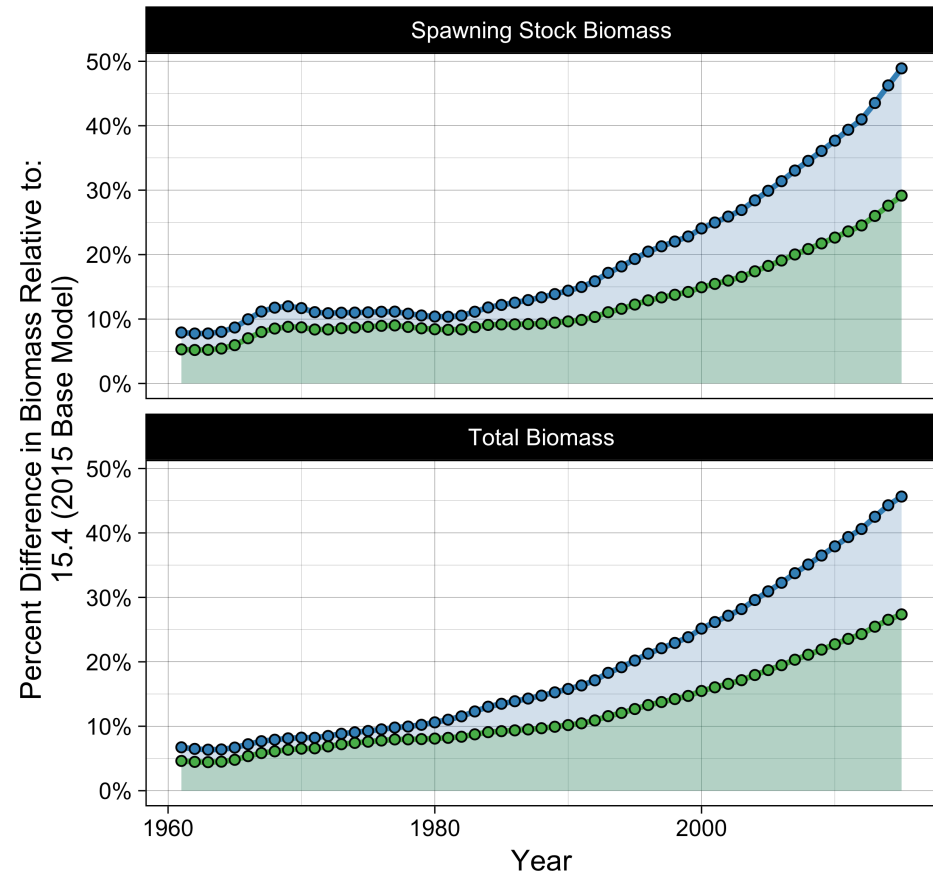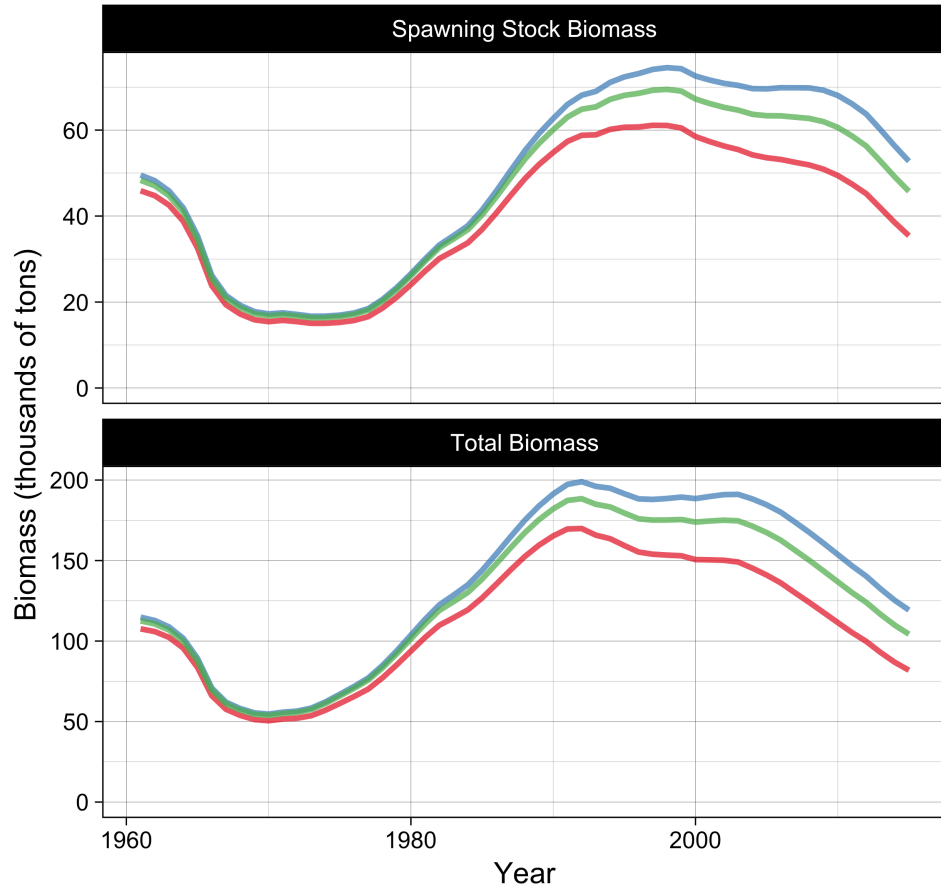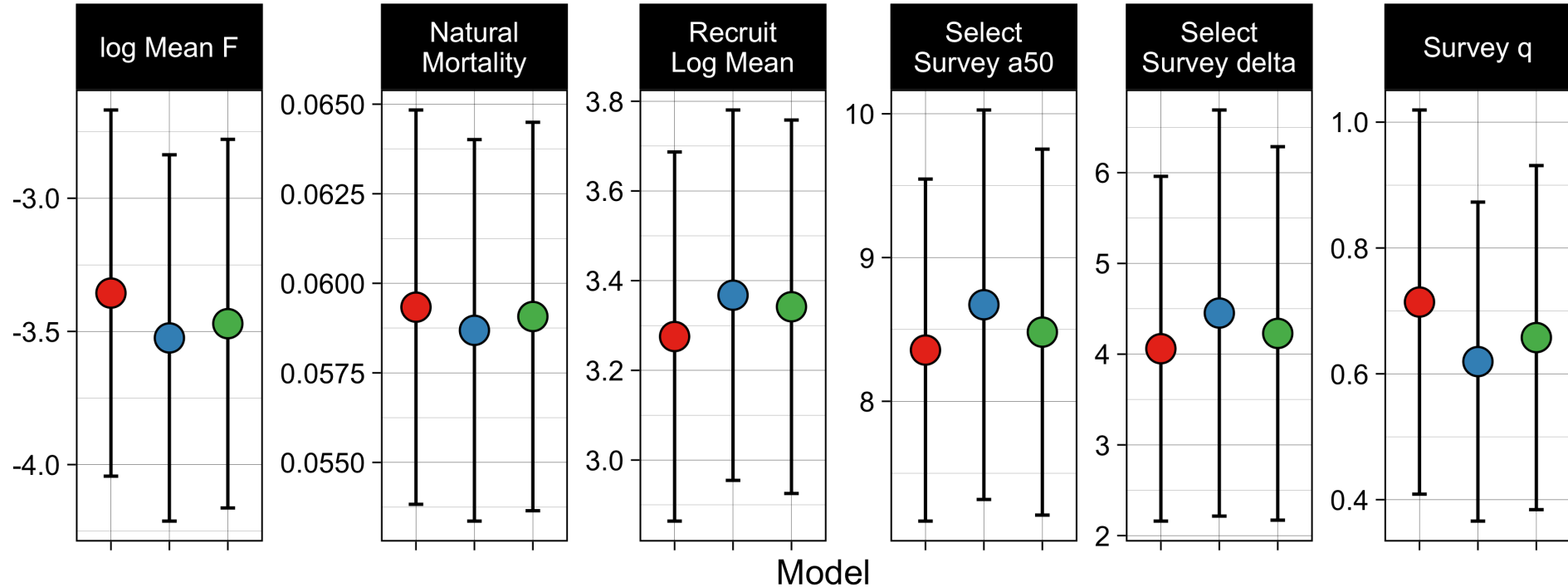

Model

Model
- 🔴 15.4 (2015 Base Model)
- 🔵 15.5 (2015 Base Model + VAST index)
- 🟢 15.6 (VAST index + Scaled survey weight)

Prior on q
Mean: 1
CV: 45%

Difference in Derived Parameters

Derived Parameters

Legend:
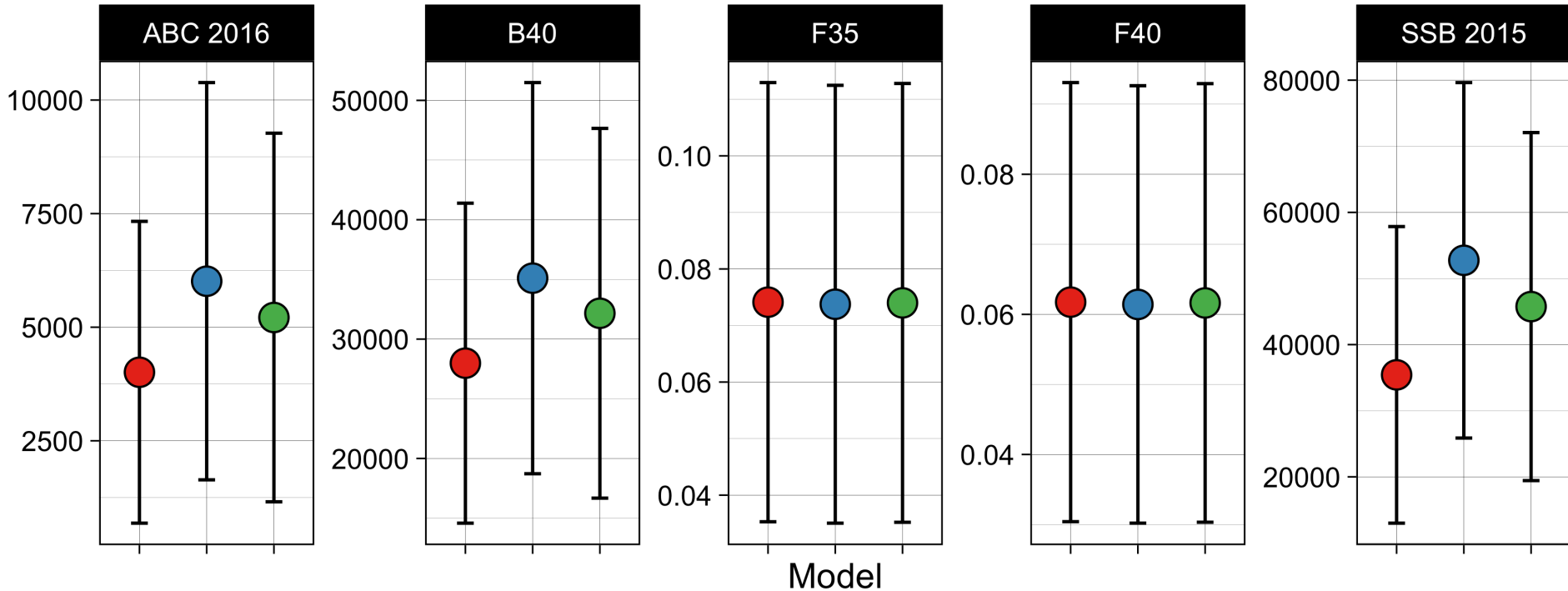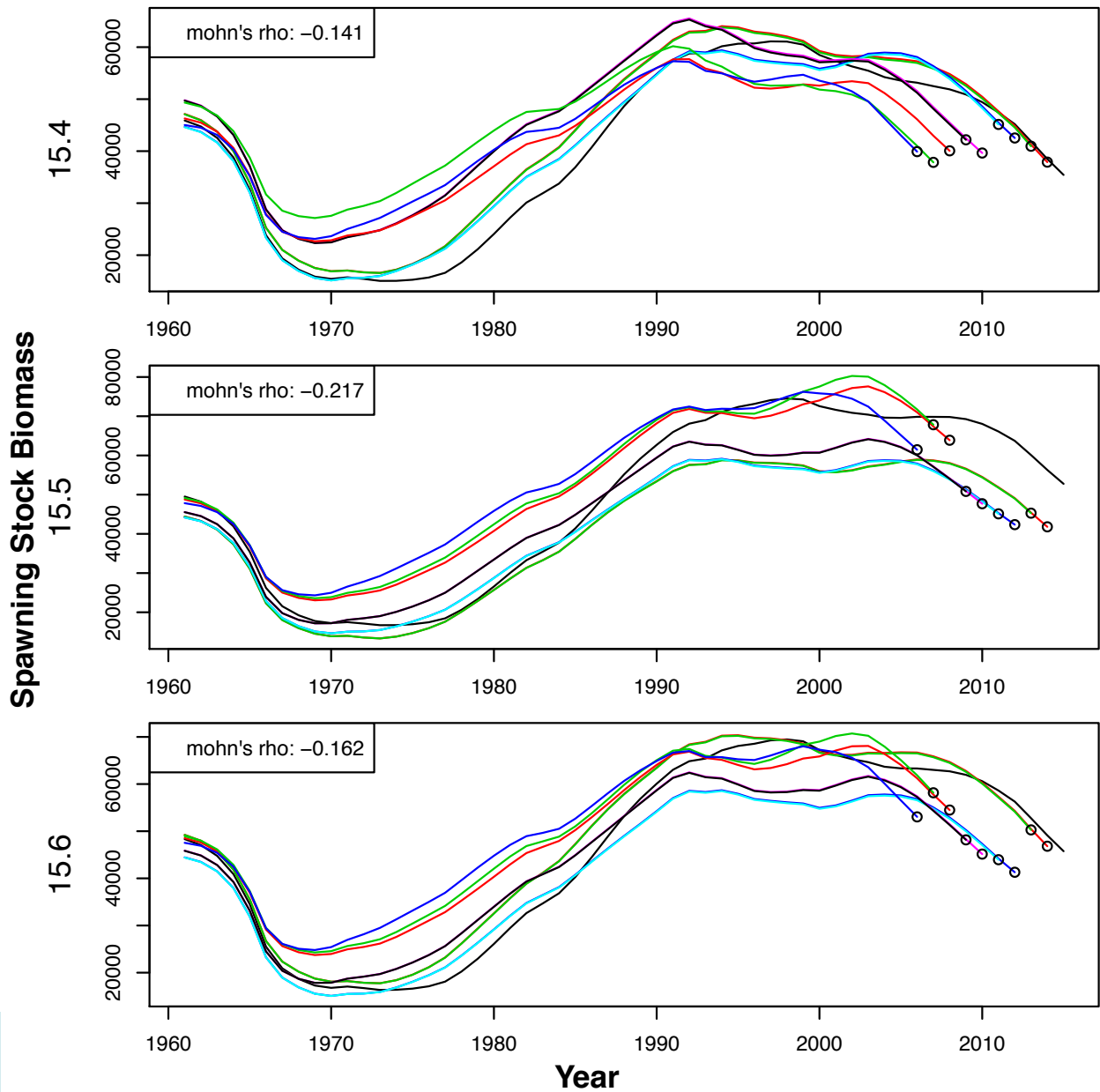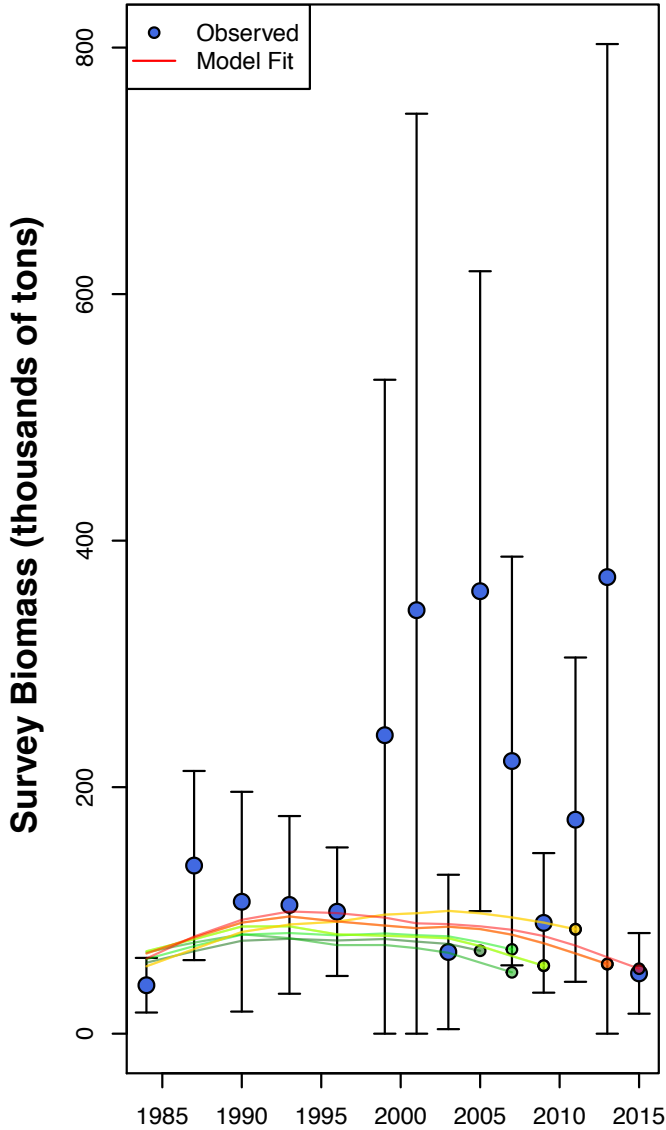- 🔴 15.4 (2015 Base Model)
- 🔵 15.5 (2015 Base Model + VAST index)
- 🟢 15.6 (VAST index + Scaled survey weight)
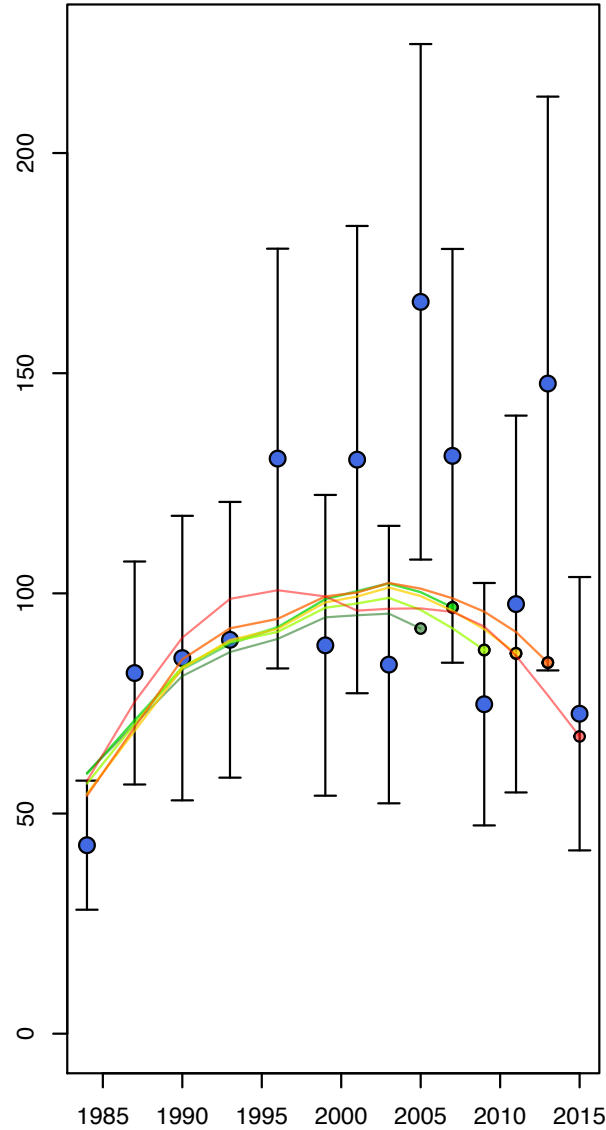
Retrospective Pattern: Spawning Stock Biomass

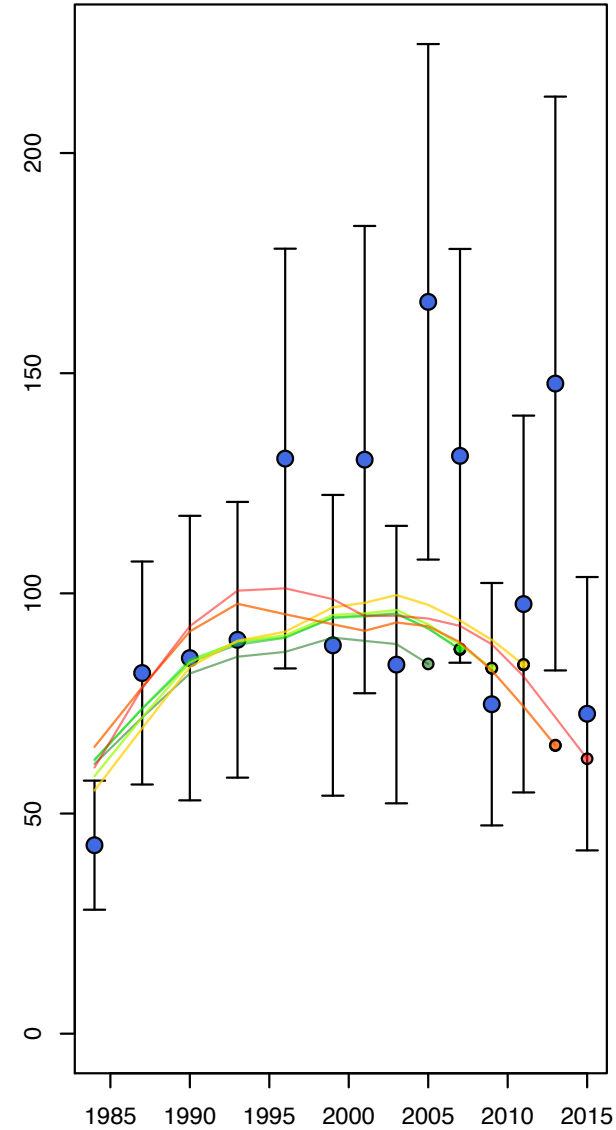# Retrospective Pattern: Fit to Survey Index

Inclusion of the Model-based Index

- MBI: lower uncertainty and less inter-survey variation
  - Perhaps more reasonable given life history?
- Model appears to fit MBI better than DBI
- Likelihood comparison does not suggest conflict with survey age composition
- Assessed SSB and TB higher on average
  - CV in biomass estimates lower after 2000
- Difference in parameter estimates
  - Mean F ⬇, M ⬇, Mean rec. ⬆, q ⬇, and Selectivity ➔
- Difference in derived quantities
  - 2015 SSB ⬆, $B_{40\%}$ ⬆, and 2016 ABC ⬆
- Rather poor retrospective pattern in SSB becomes worse

Retrospective Pattern: Recruitment