

**NOAA**  
**FISHERIES**

# **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

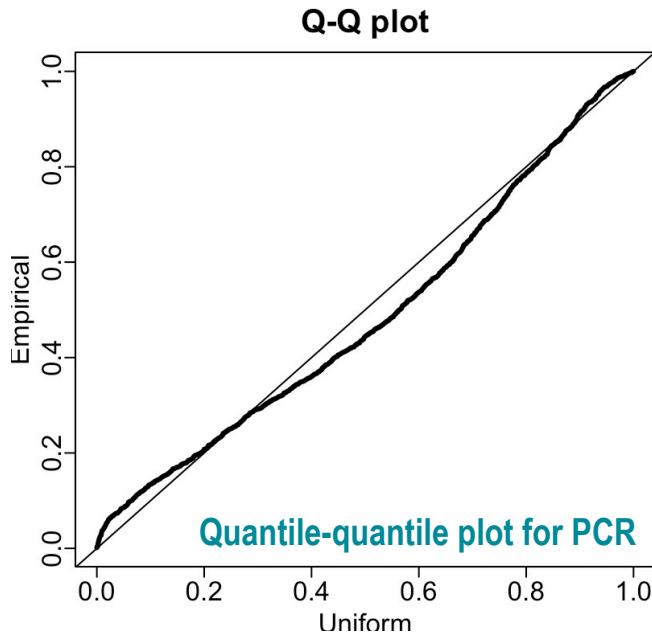
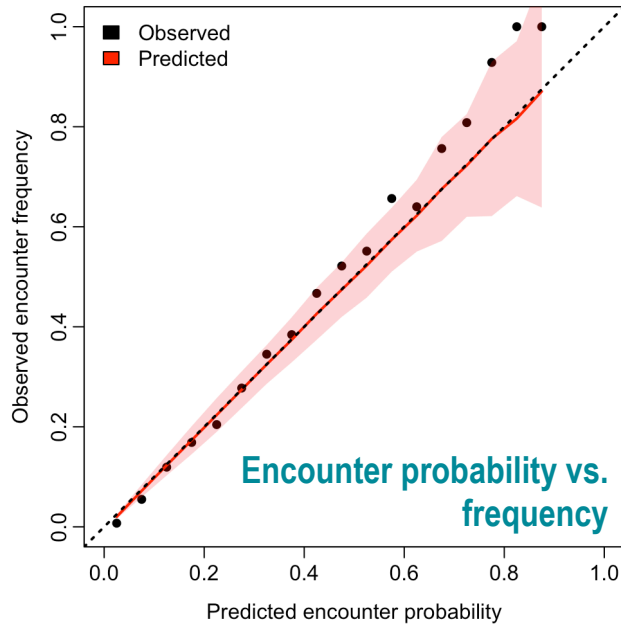
Curry Cunningham  
Pete Hulson, Dana Hanselman, Chris Lunsford

# 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%

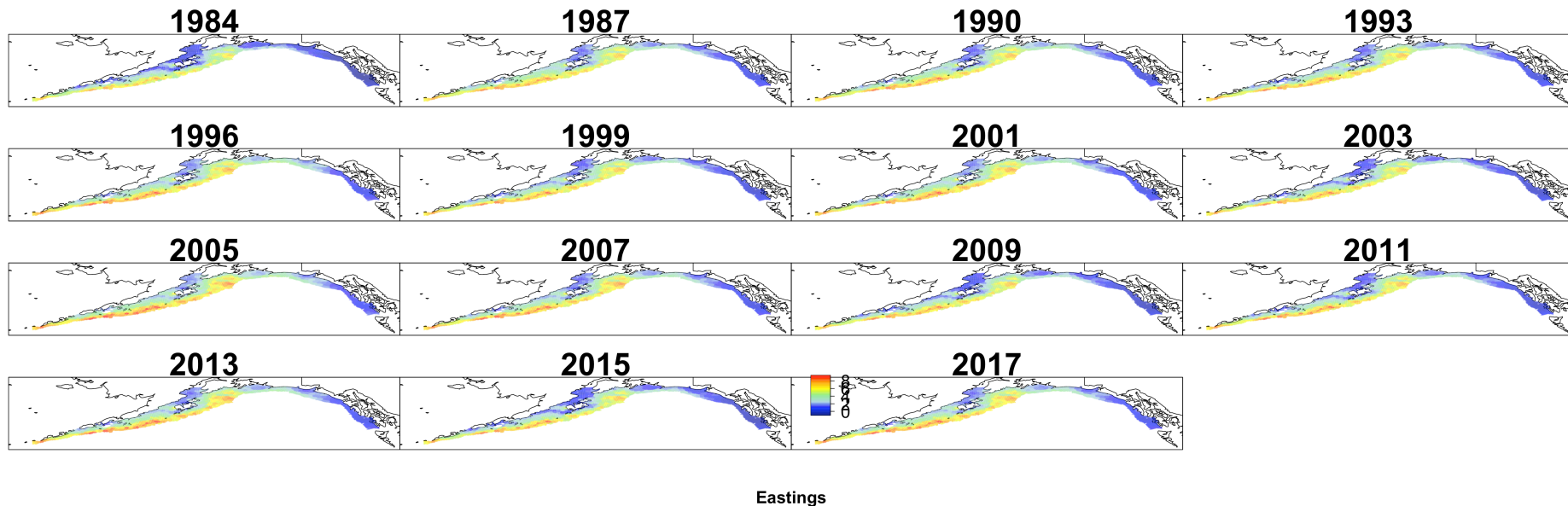
An **Intermediate** Option

# VAST Model-based Survey Index



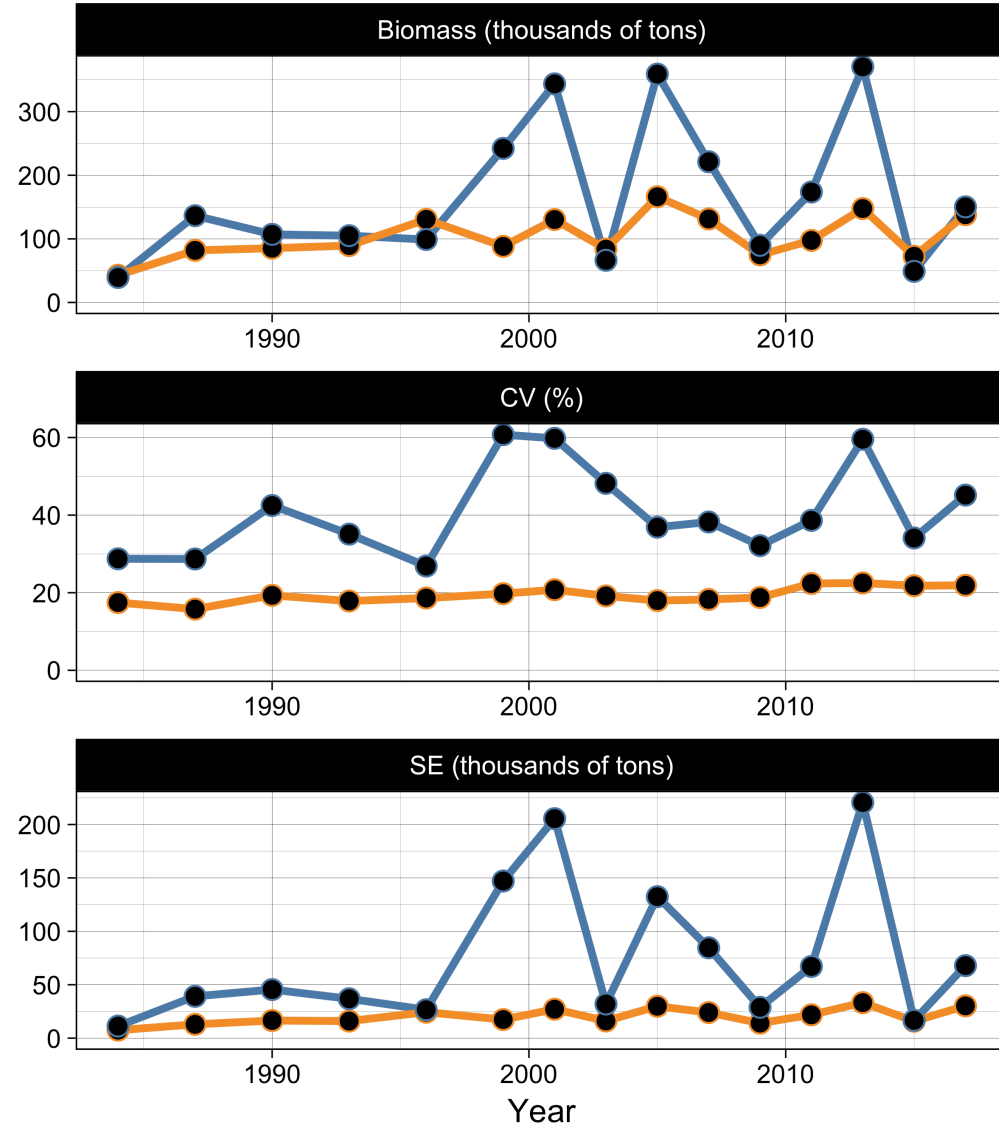
## Model Specification

- 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



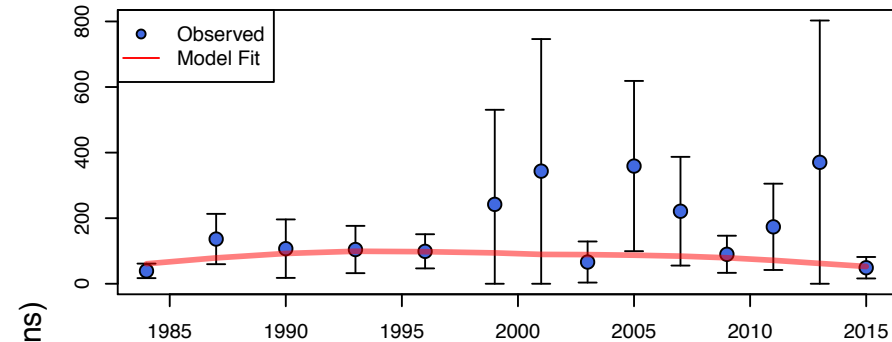
# Comparison of Model Fit to Survey Data

## Model Log-Likelihoods

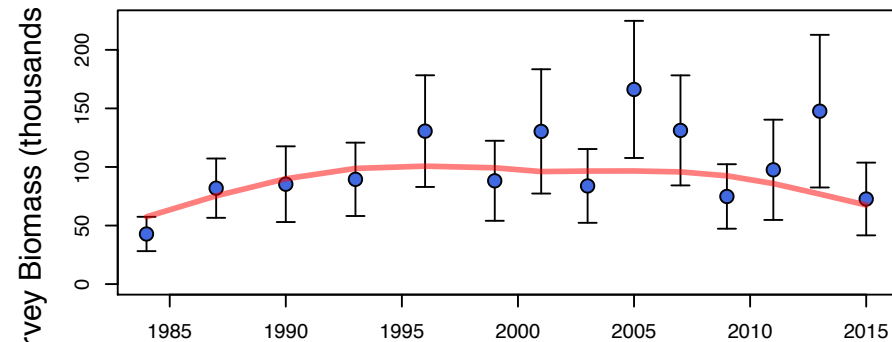
Model	Total	Data	Catch	Survey Biomass	Fish Age	Survey Age	Fish Size
<b>15.4 (2015 Base Model)</b>	228.8	144.6	0.1	10.1	28.5	55.3	50.6
<b>15.5 (2015 Base Model + VAST index)</b>	231.9	146.9	0.2	11.4	28.6	57.3	49.5
<b>15.6 (VAST index + Scaled survey weight)</b>	225.9	141.4	0.1	6.5	28.5	56.0	50.2



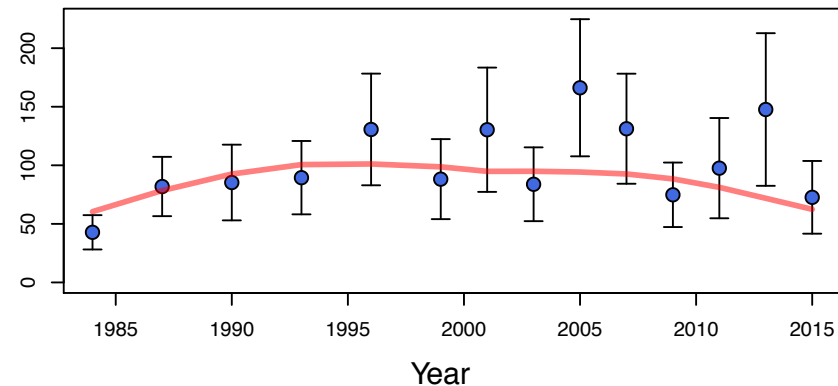
15.4 (2015 Base Model)



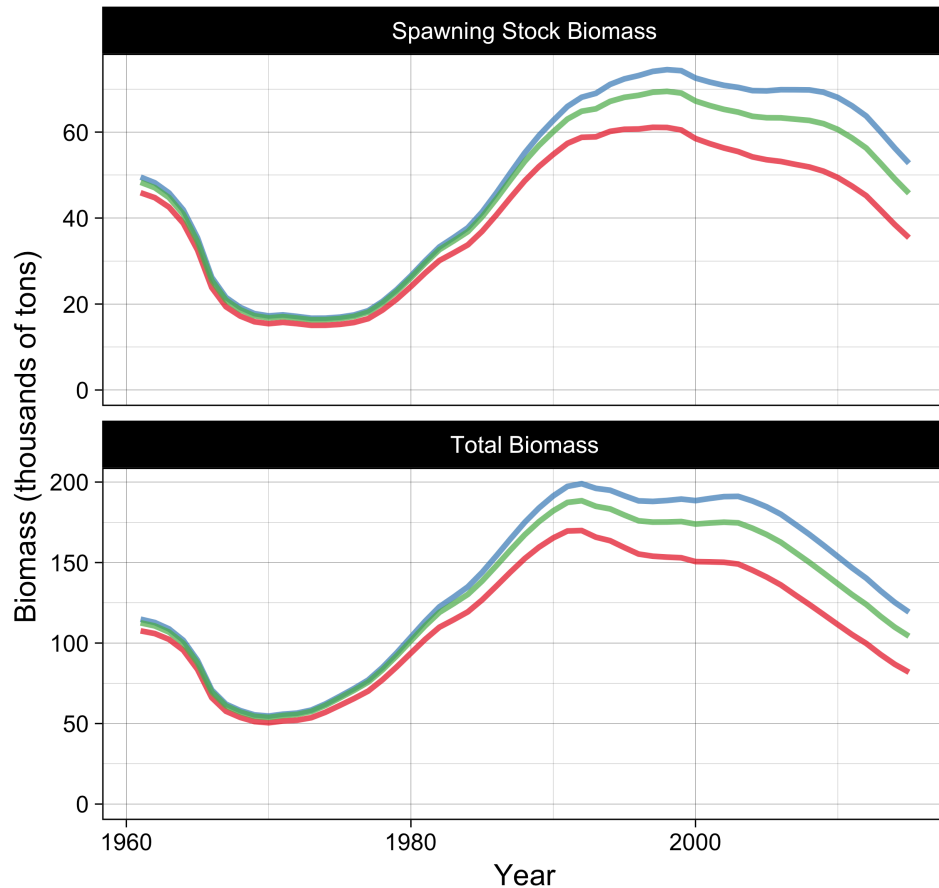
15.5 (2015 Base Model + VAST index)



15.6 (VAST index + Scaled survey weight)



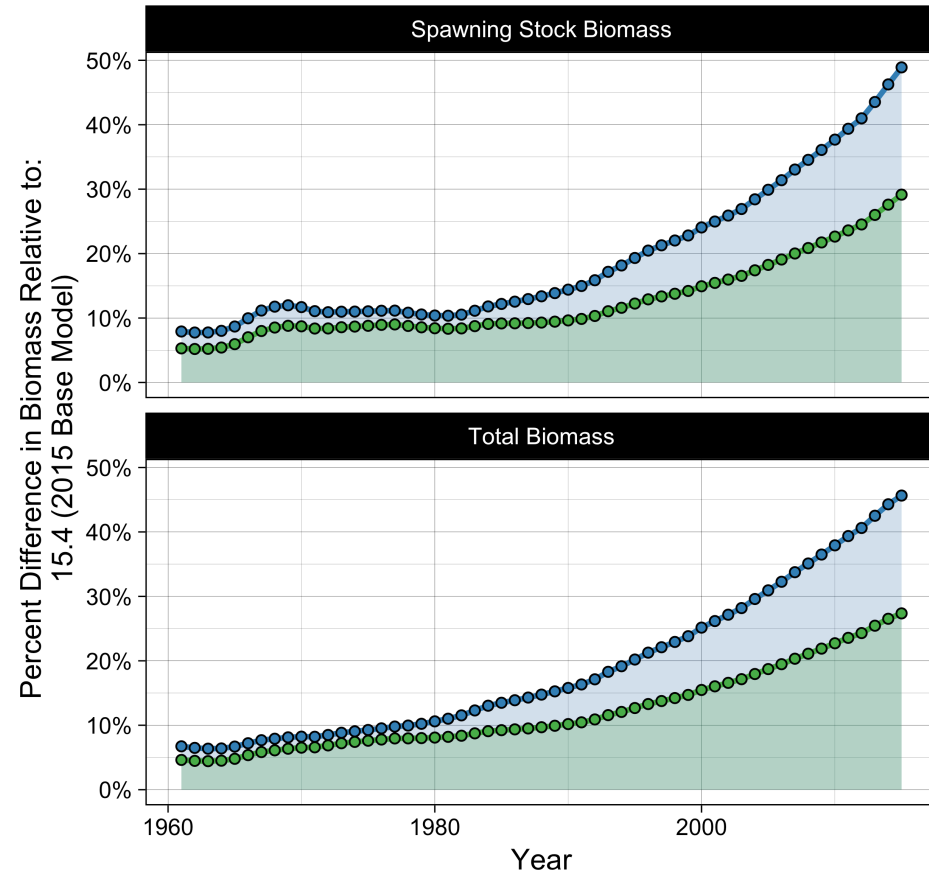
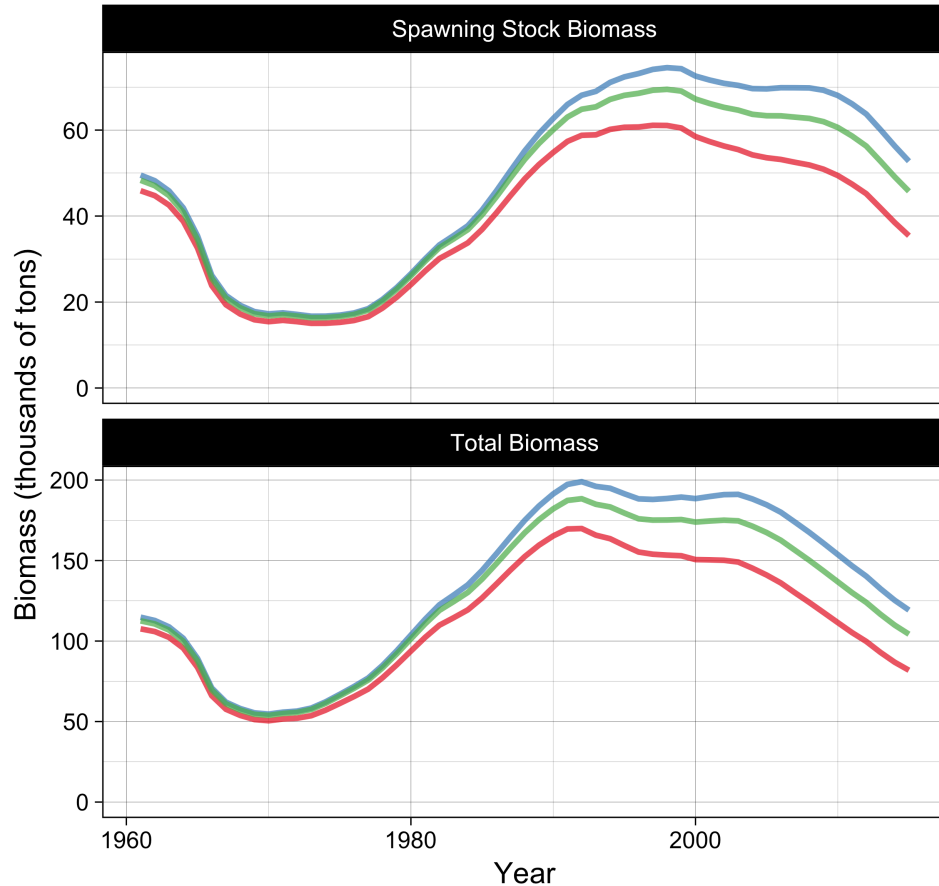
# Difference in Biomass Estimates



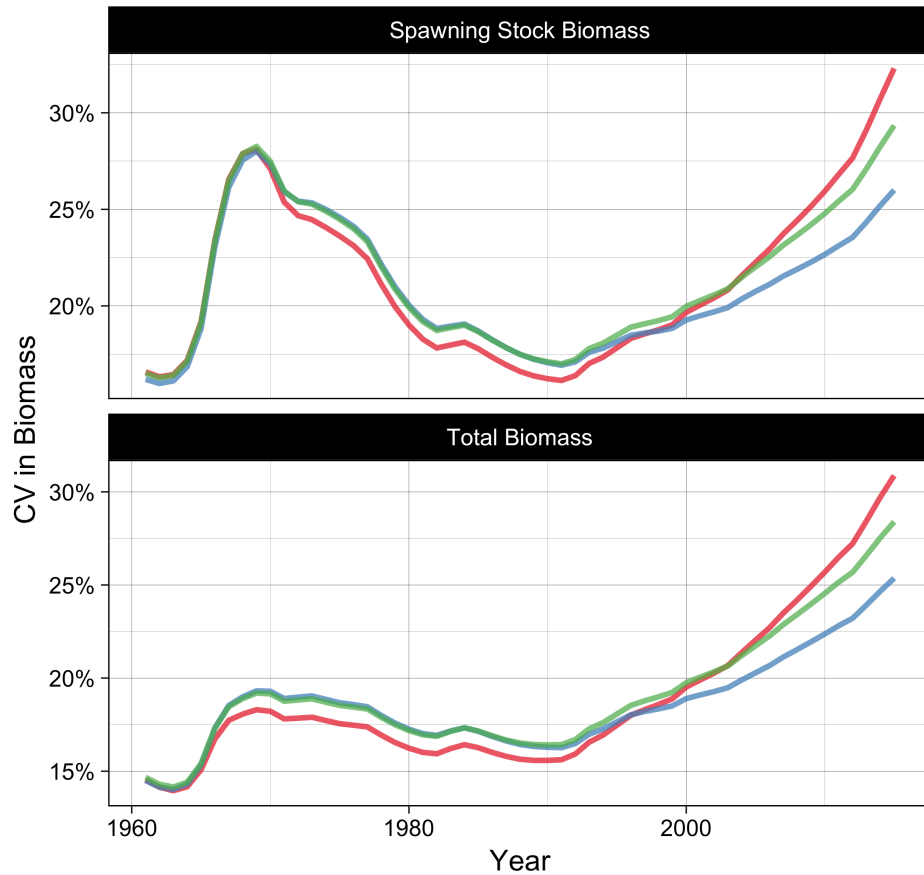
## Model

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

# Difference in Biomass Estimates



# Difference in Biomass Estimate Uncertainty

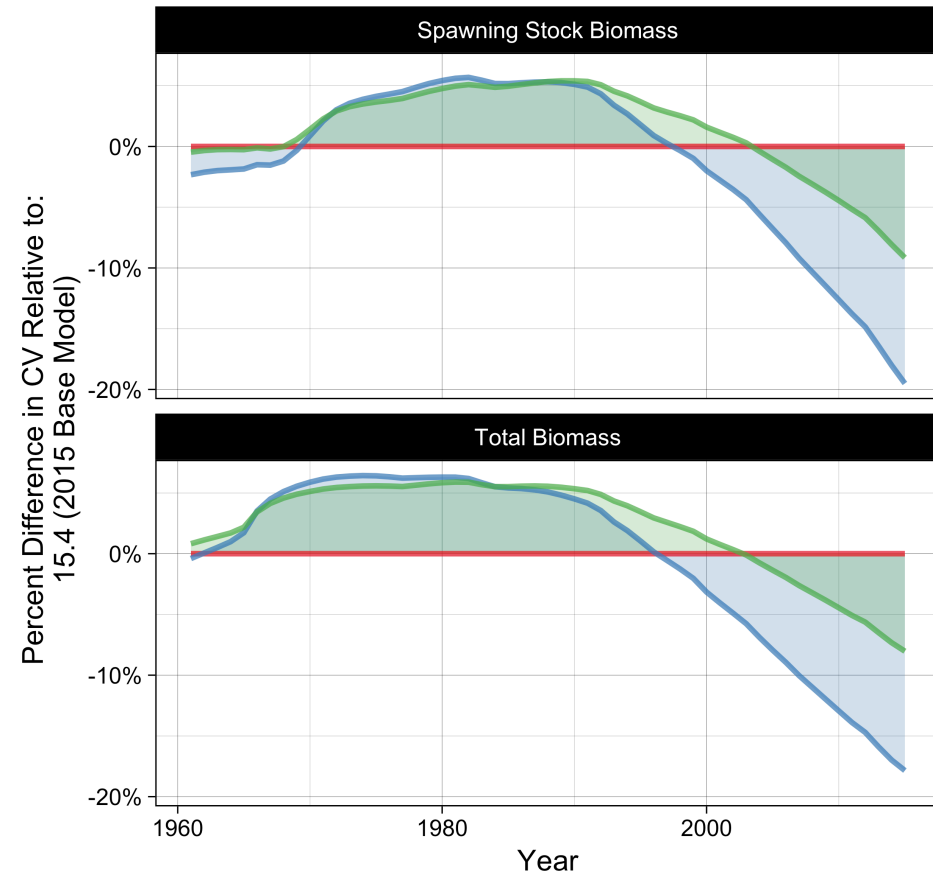
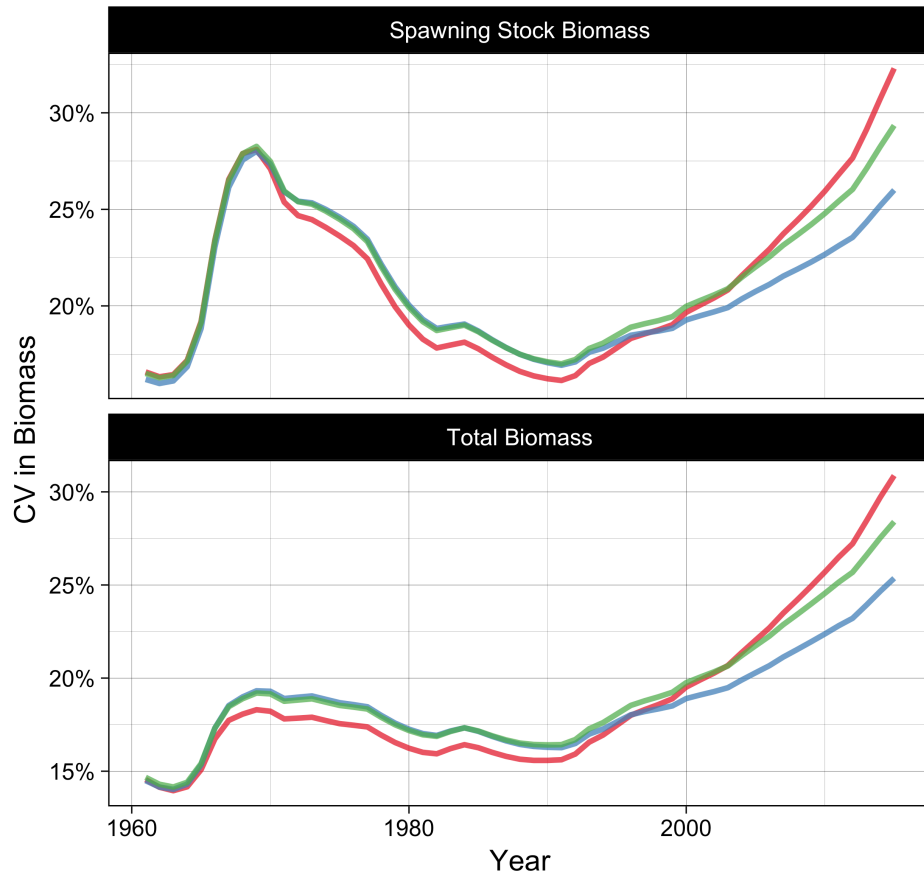


## Model

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

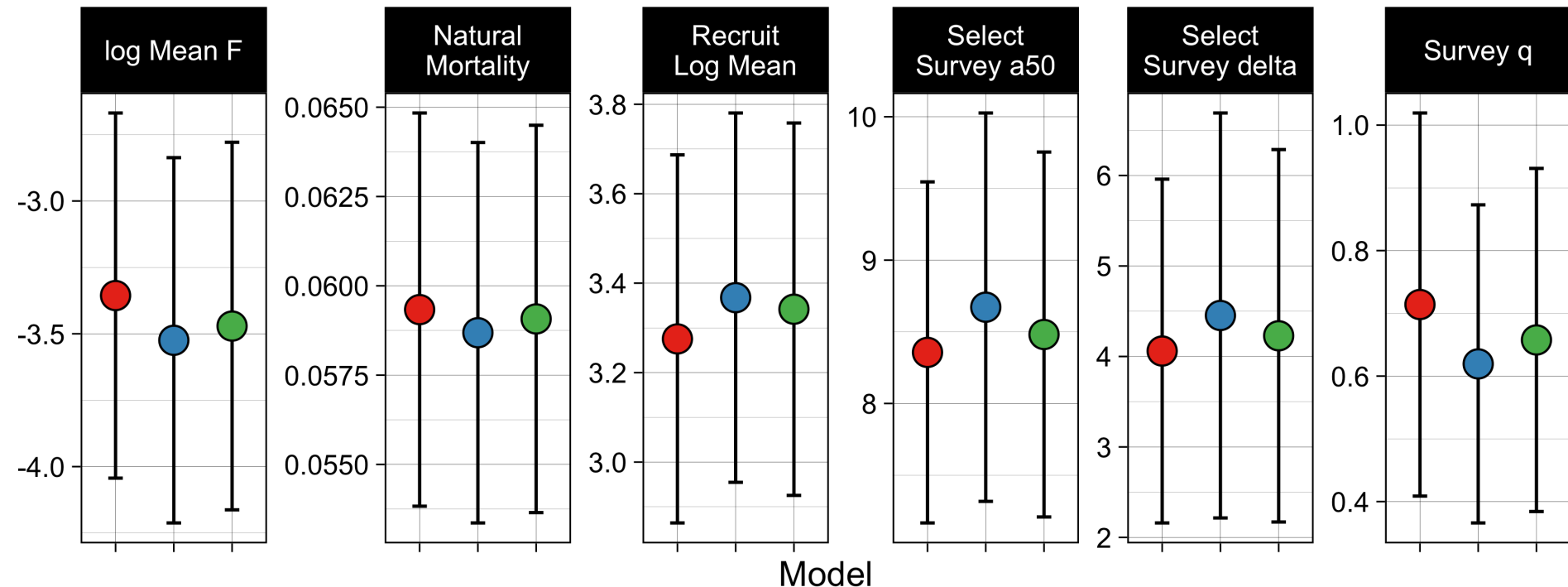


# Difference in Biomass Estimate Uncertainty



# Difference in Estimated Parameters

## Estimated Parameters



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

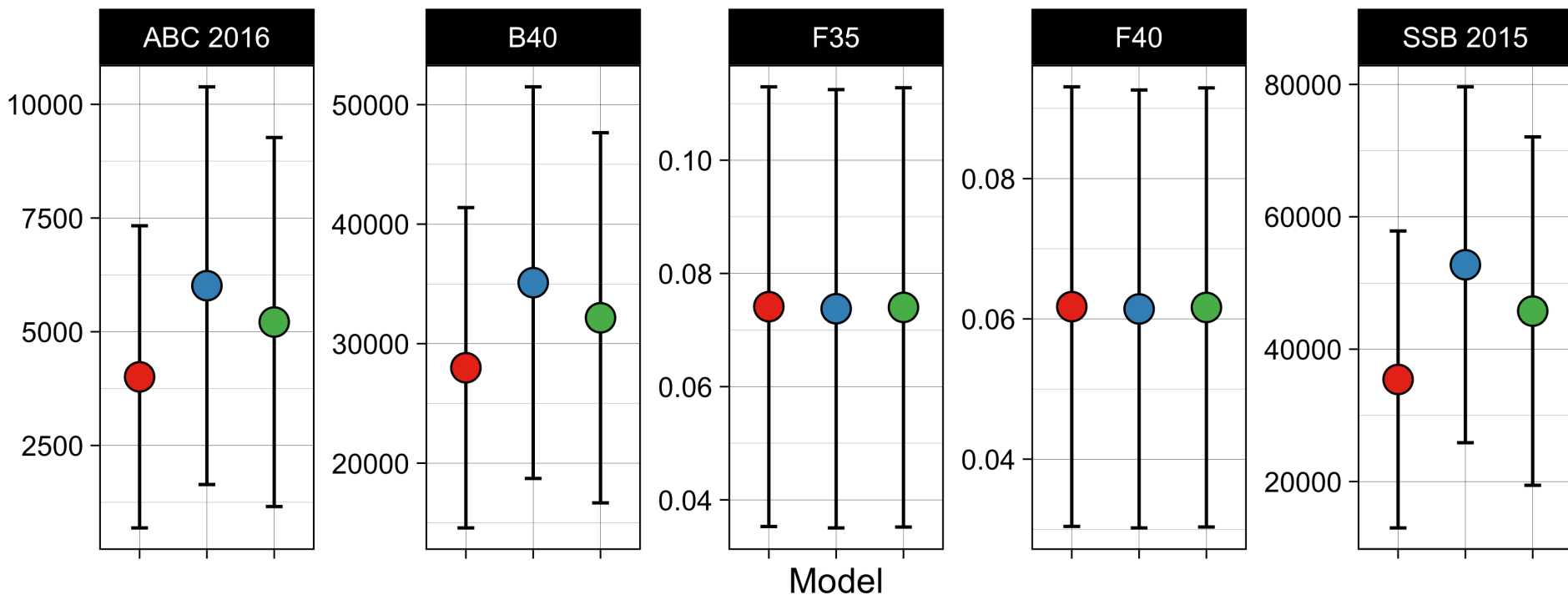
Prior on q

Mean: 1

CV: 45%

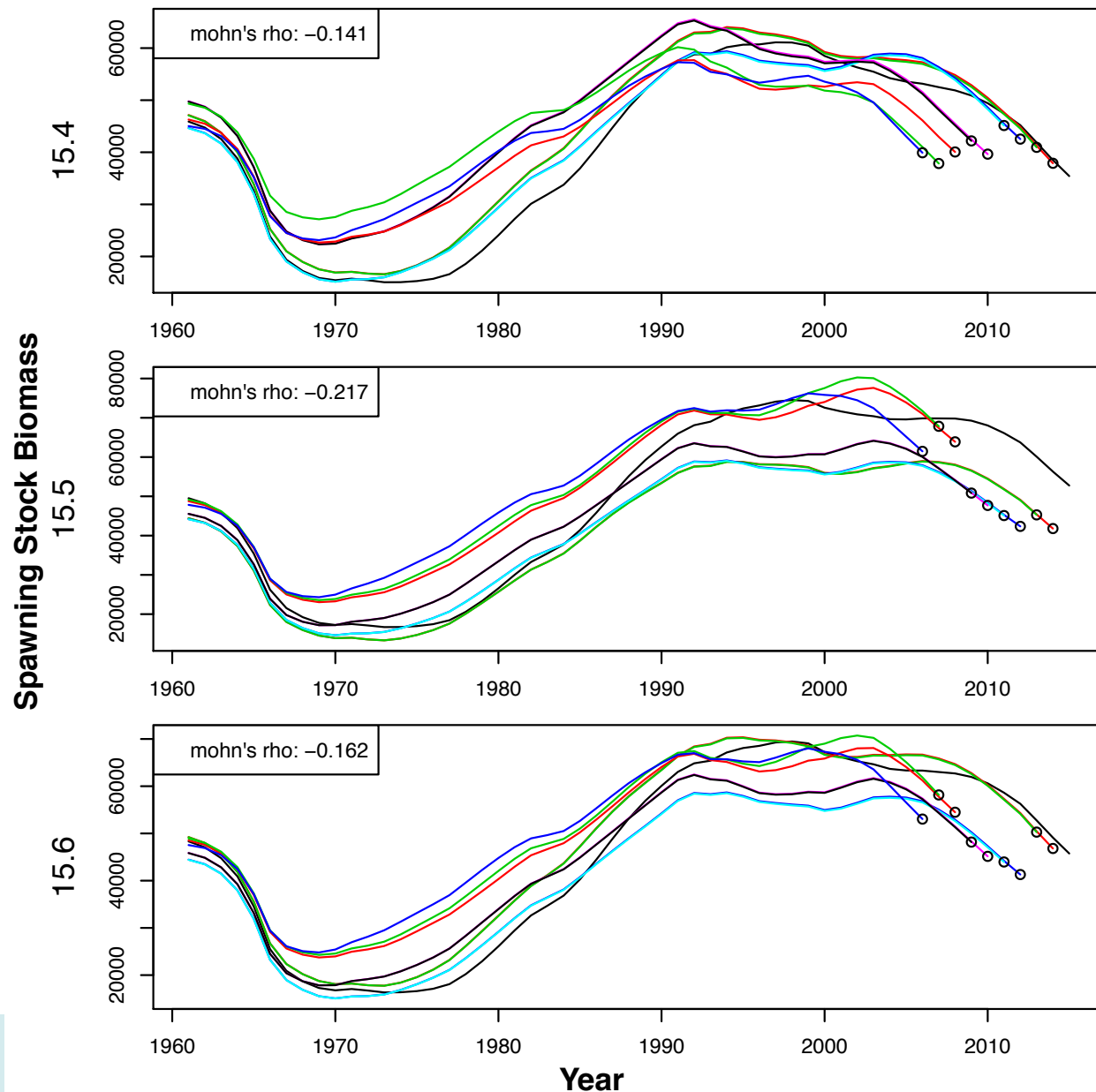
# Difference in Derived Parameters

## Derived Parameters



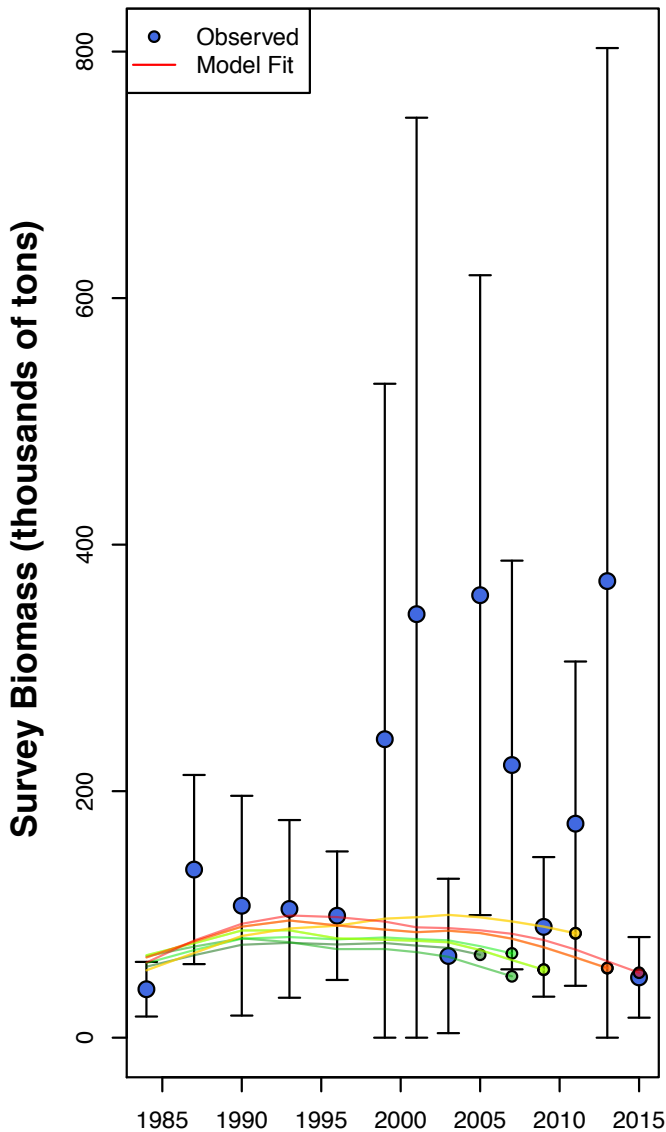
- Model
- 15.4 (2015 Base Model)
  - 15.5 (2015 Base Model + VAST index)
  - 15.6 (VAST index + Scaled survey weight)

# Retrospective Pattern: Spawning Stock Biomass

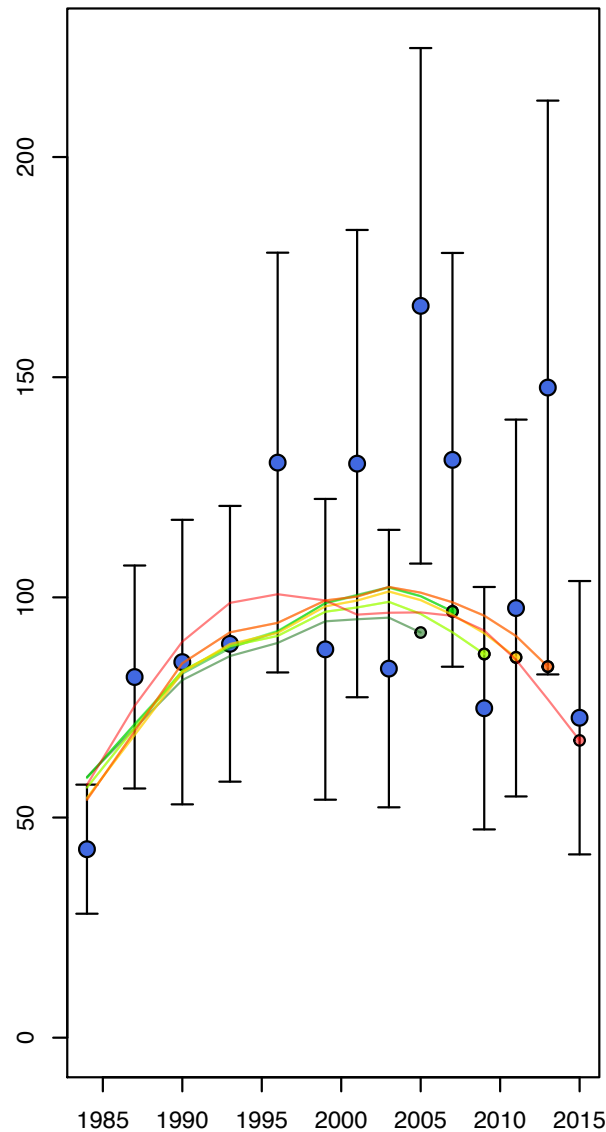


# Retrospective Pattern: Fit to Survey Index

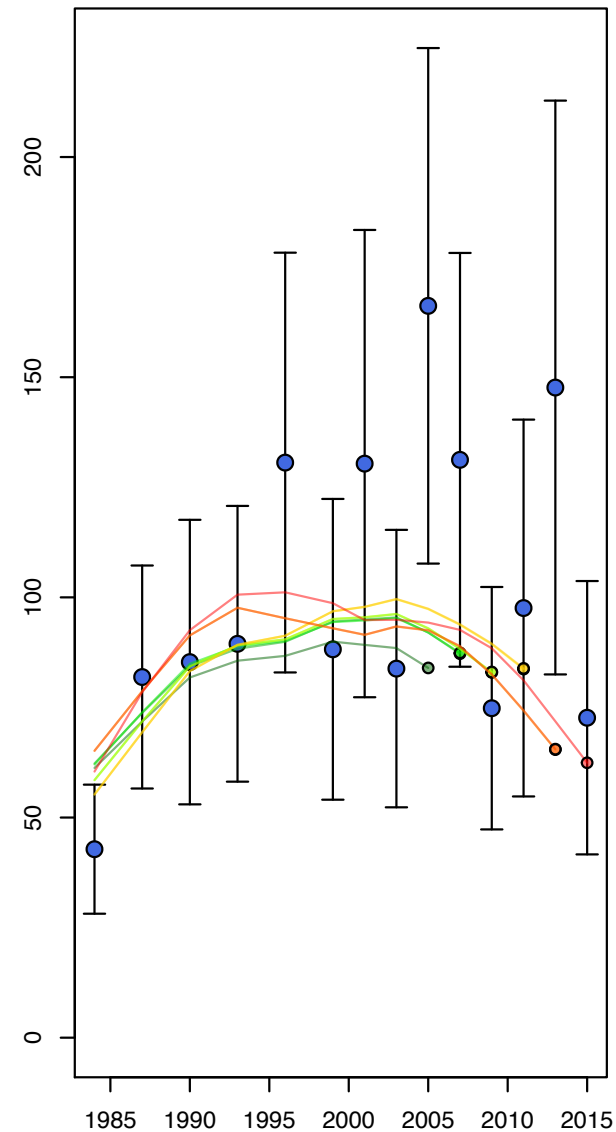
15.4 (2015 Base Model)



15.5 (2015 Base Model + VAST index)



15.6 (VAST index + Scaled survey weight)



Year

# 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

