



**NOAA**  
**FISHERIES**

# Preliminary assessment of BSAI Greenland turbot

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# Outline

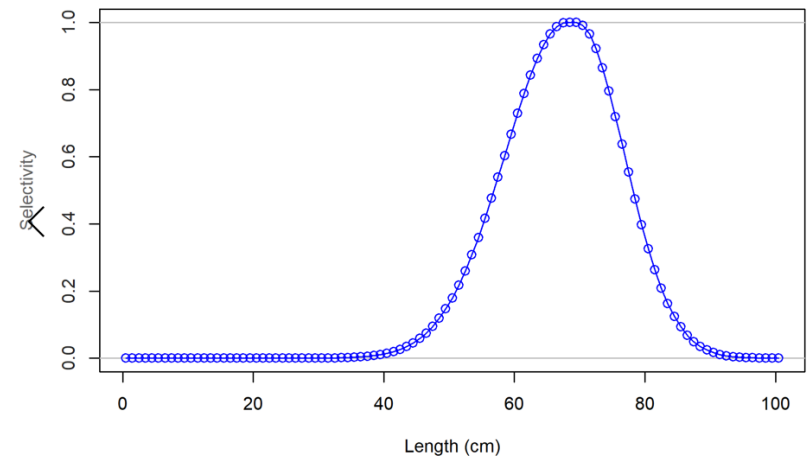
- Brief overview of the change in Stock Synthesis 3
- Review new data inputs
- Review of last accepted assessment's model structure and the models runs that have been completed
- Results

# Stock synthesis version update

- Last accepted assessment used SS3 version SS3.30.12 (Model 16.4a)
- Stock synthesis has been updated multiple times
  - Current version is SS3.30.19
  - Parameterization of the double normal selectivity pattern offset has been changed

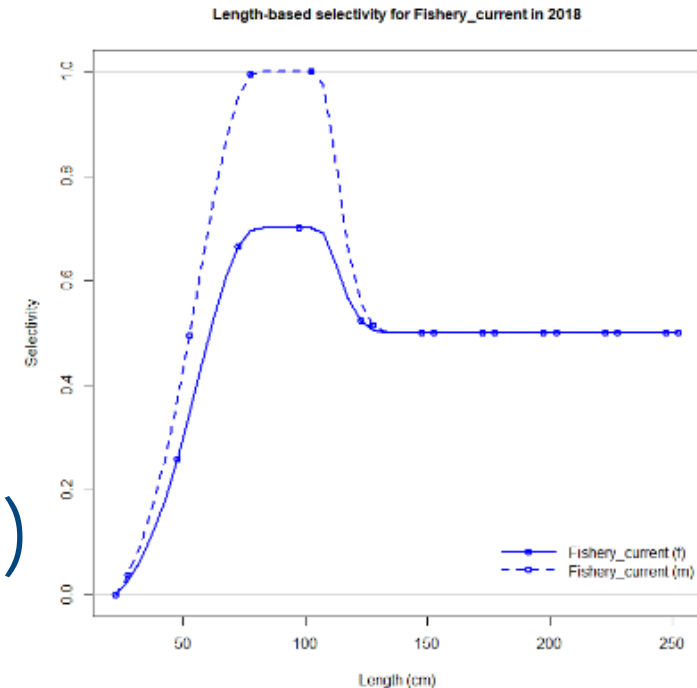
# Double normal selectivity pattern

- A six parameter selectivity pattern. Parameters describe the:
  - Peak
  - Width of the plateau
  - Ascending width
  - Descending width
  - Selectivity of the first bin
  - Selectivity of the last bin (final)



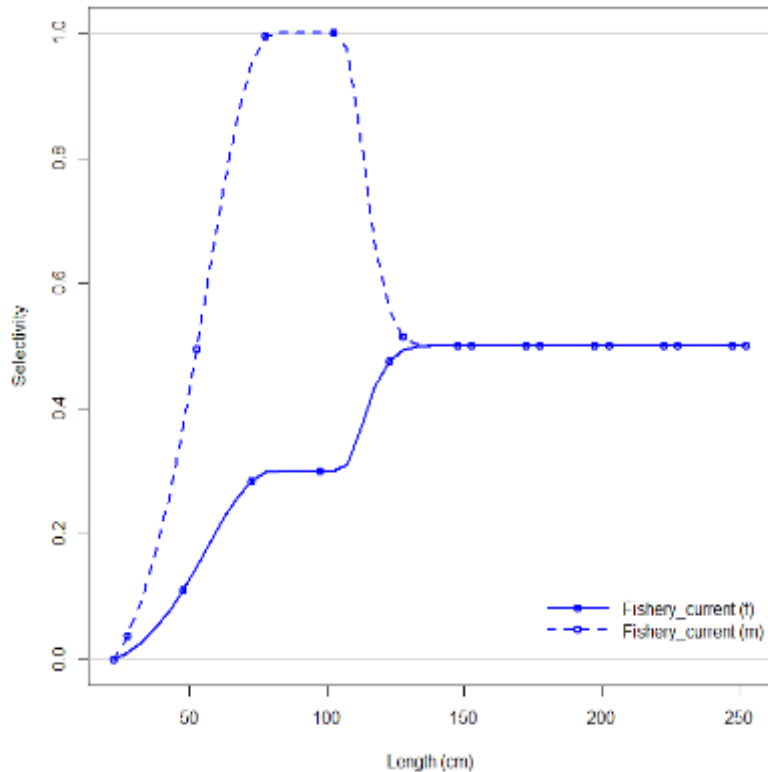
# Double normal offset

- Sex-specific selectivity offset option (five additional parameters):
  - Peak
  - Ascending width
  - Descending width
  - Selectivity of the last bin (final)
  - Apical selectivity (scale)



# Double normal offset

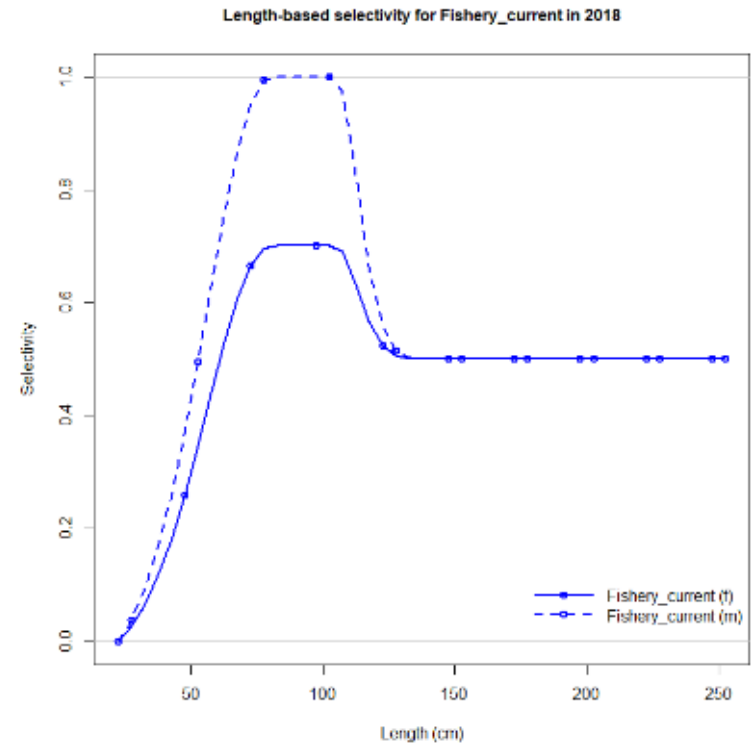
Length-based selectivity for Fishery\_current in 2018



- SS3 developers concerned that in some cases the selectivity offset produced stair-step patterns that could only be exhibited by the offset sex
  - Occurred when the apical selectivity of the offset was less than the final selectivity

# Double normal offset

- Parameterization now constrains final selectivity to be at or lower than the apical selectivity





# Stock synthesis version update

- Compared results from SS3.30.19 to model 16.4a (last accepted model that used SS3.30.12)
  - Changes were not made to the model or the data inputs

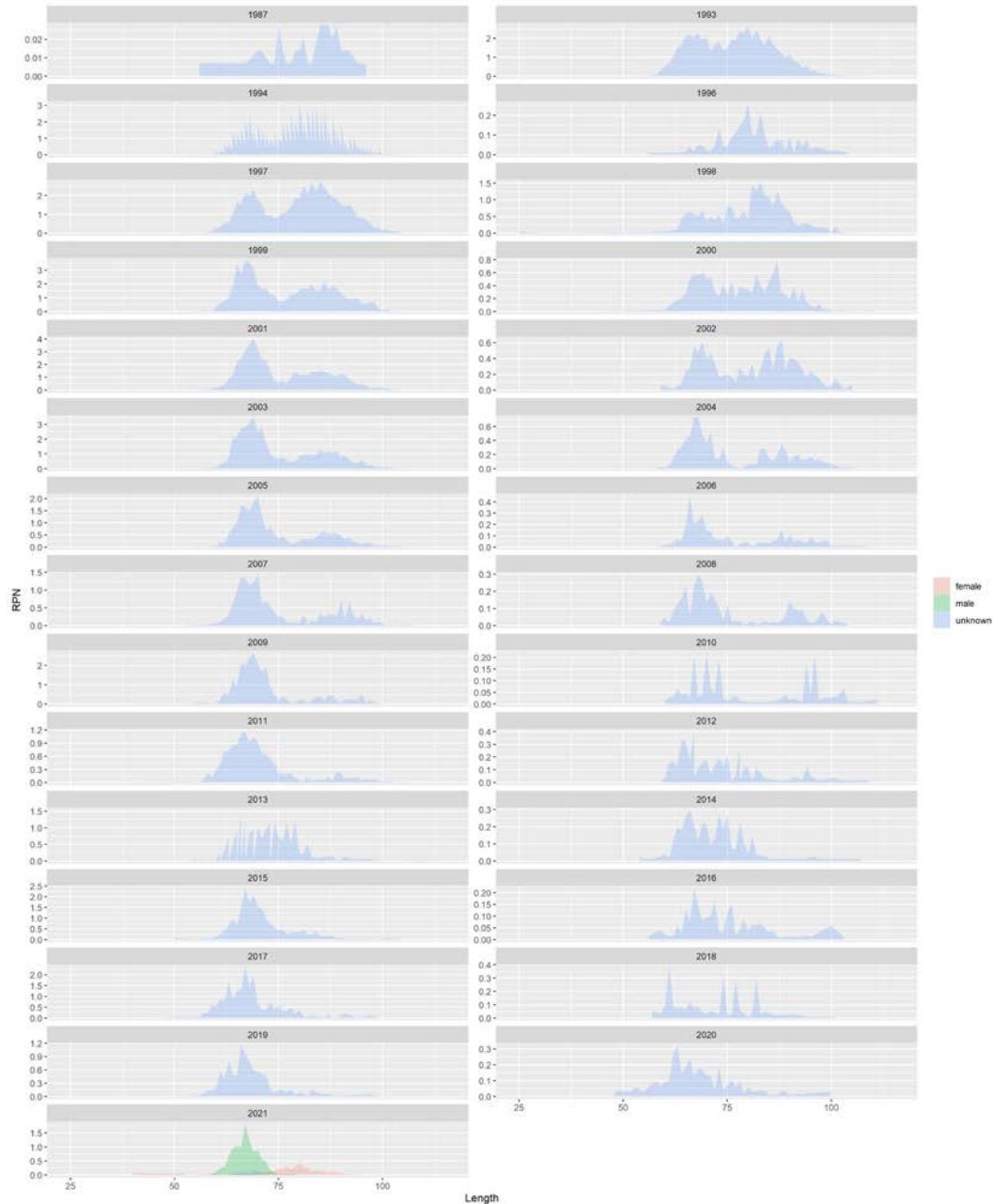




# New data inputs

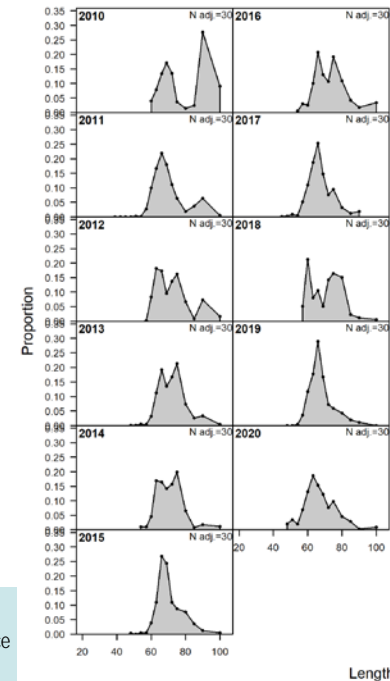
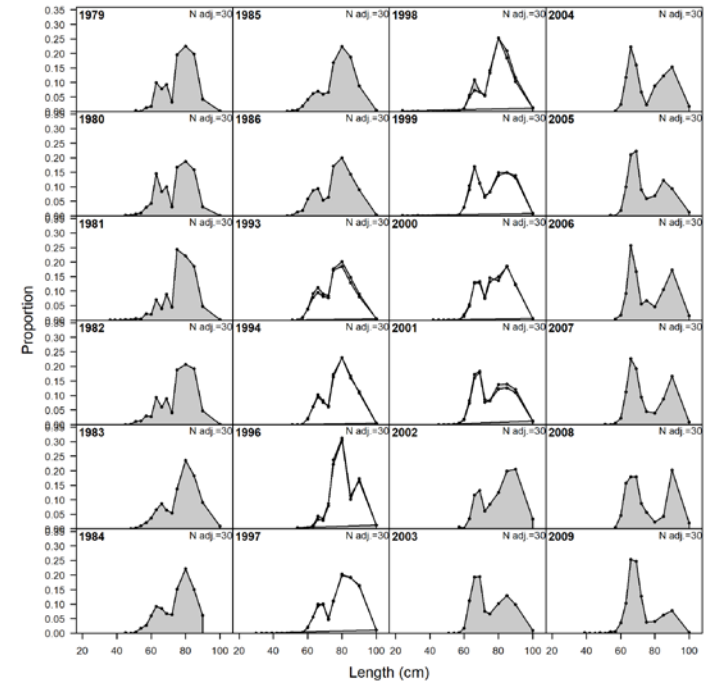
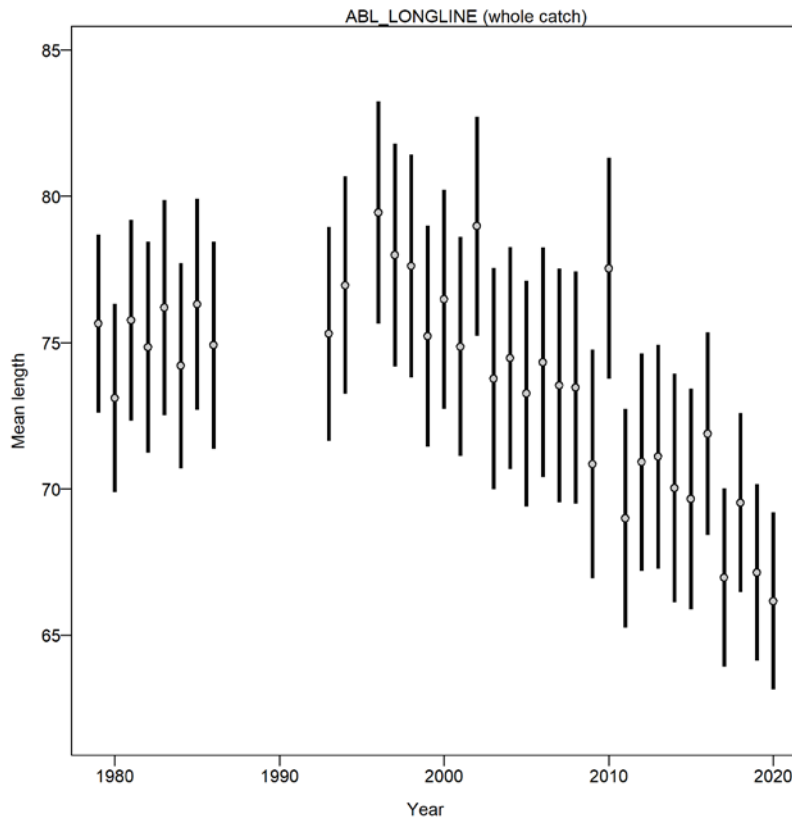
- AFSC longline length data has been used as ghost data in the previous accepted model
  - Not sex-specific

# AFSC longline length data



# AFSC longline length data

Mean length



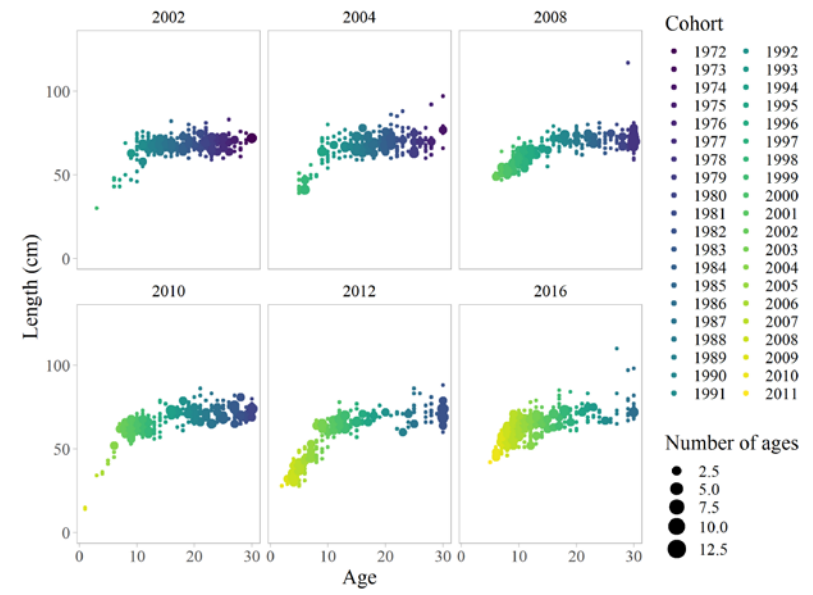
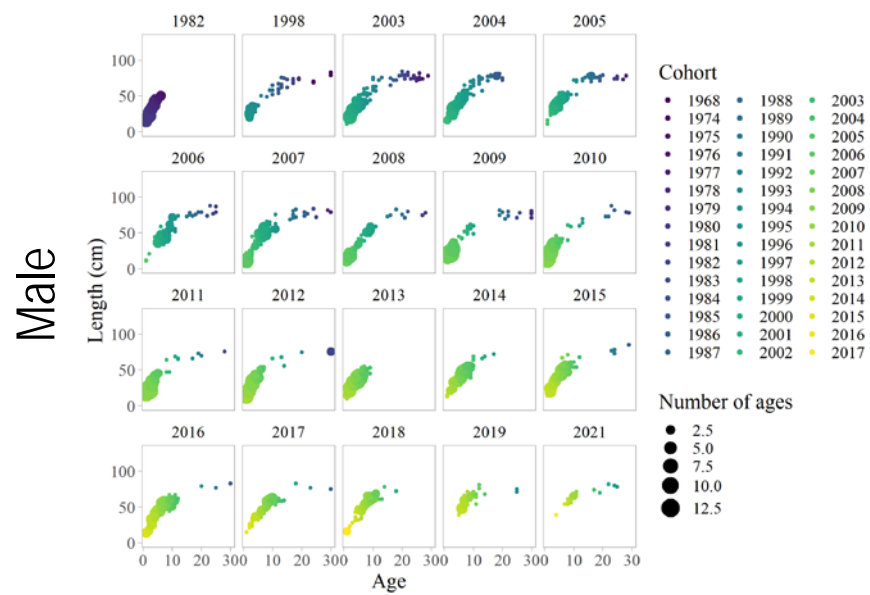
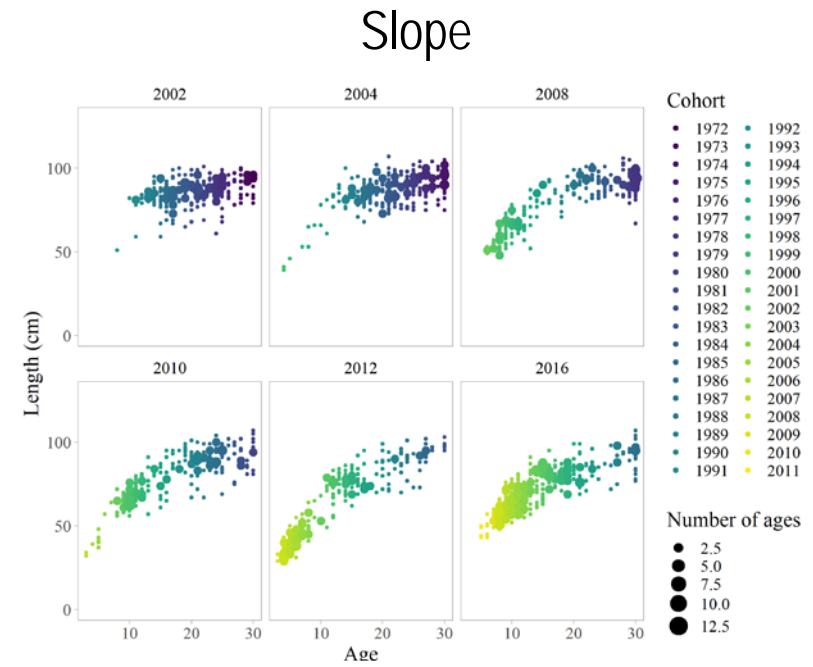
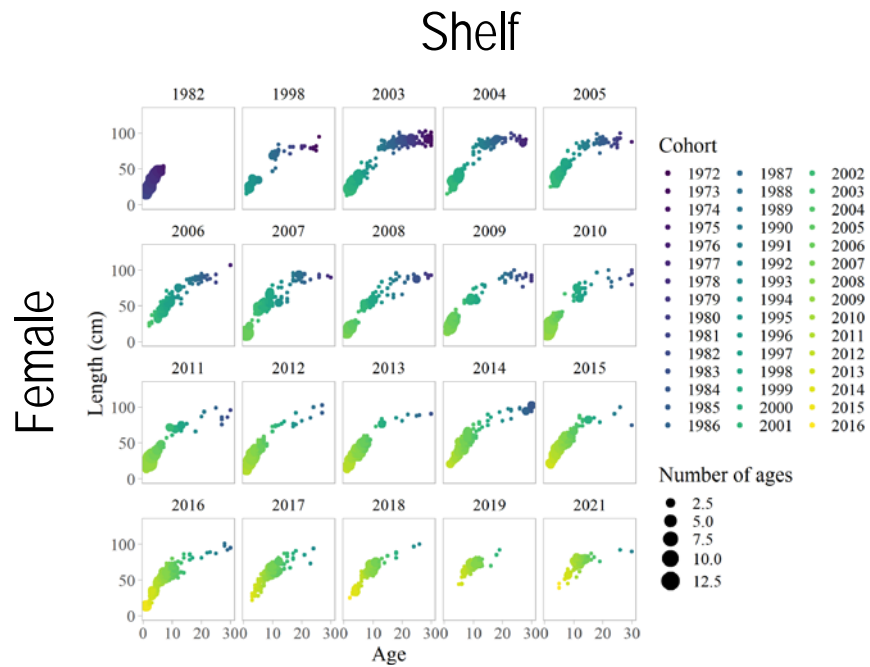
# New data inputs

- AFSC longline length data was used as ghost data in Model 16.4a
  - Selectivity was fixed
- A run was performed and used the AFSC longline length data as an input and selectivity was estimated
  - Logistic selectivity (2 parameters)

# New data inputs

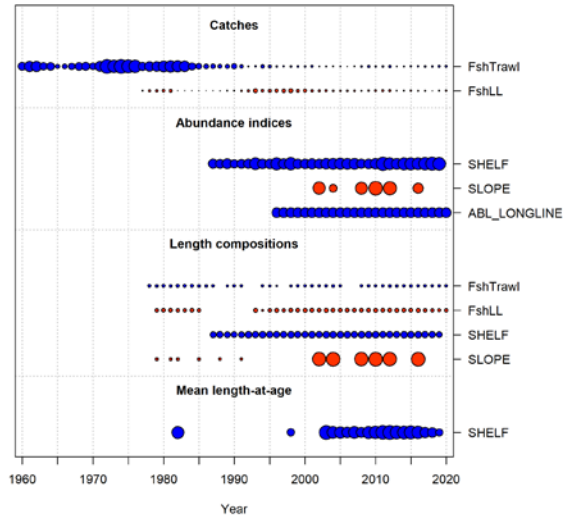
- Mean size-at-age
  - EBS shelf bottom trawl survey (BTS) used in previously accepted models
  - EBS slope BTS mean size-at-age data has not been used (2002, 2004, 2008, 2010, 2012, 2016)
- Performed a model run including the EBS slope BTS mean size-at-age data as an input

# Size-at-age data

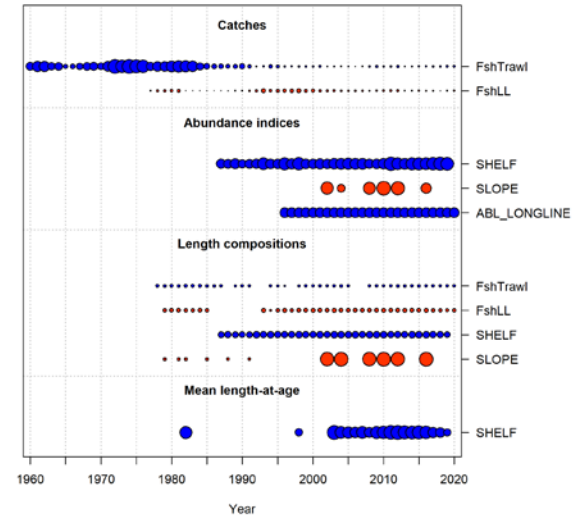


# Models and data inputs

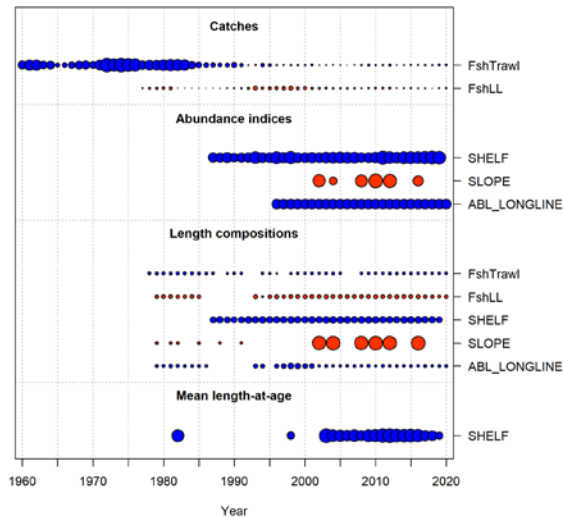
— Model 16.4a



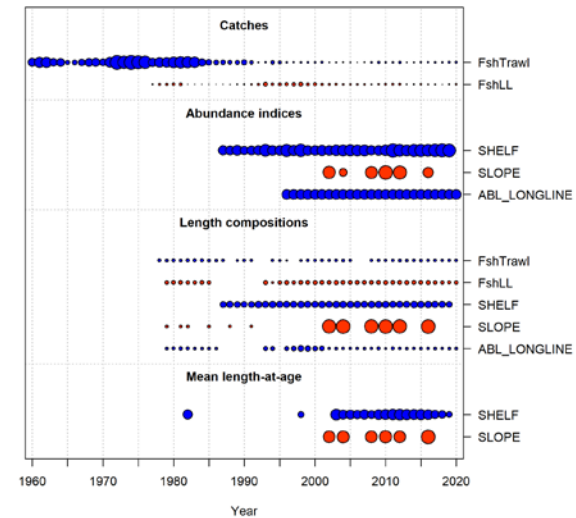
— R1\_SS3.30.19



— R2 AFSC LL



— R3 Slope Mn SAA



# Review of model structure: Model 16.4a

## Parameters estimated independently

Parameter	Estimate	Source
Natural Mortality	0.112	Cooper et al. (2007)
<b>Length at Age</b>		
$L_{\min}$ CV	15%	Gregg et al. (2006)
$L_{\max}$ CV	7%	Gregg et al. (2006)
<b>Maturity and Fecundity</b>		
Length 50% mature	60	D'yakov (1982), Cooper et al. (2007)
Maturity curve slope	-0.25	D'yakov (1982), Cooper et al. (2007)
Eggs/kg intercept	1	D'yakov (1982), Cooper et al. (2007)
Eggs/kg slope	0	D'yakov (1982), Cooper et al. (2007)
<b>Length-weight</b>		
Male		
Alpha	$3.4 \times 10^{-6}$	1977-2011 NMFS Survey data
Beta	3.2189	1977-2011 NMFS Survey data
Female		
Alpha	$2.43 \times 10^{-6}$	1977-2011 NMFS Survey data
Beta	3.325	1977-2011 NMFS Survey data
<b>Recruitment</b>		
Steepness	0.79	Myers et al. (1999)
Sigma R	0.6	Ianelli et al. (2011)



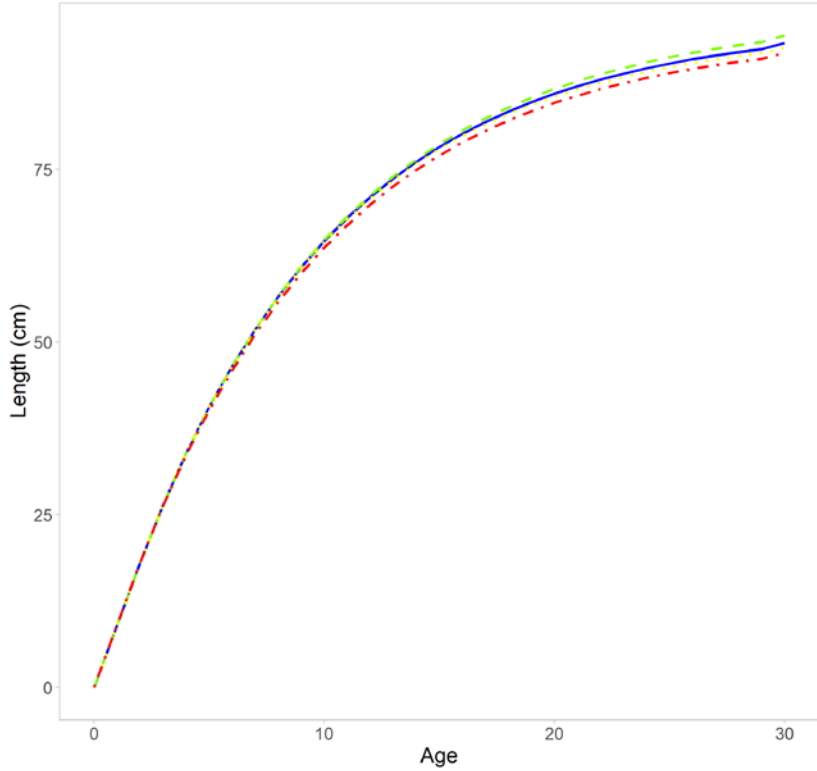


# Review of model structure: Estimated parameters

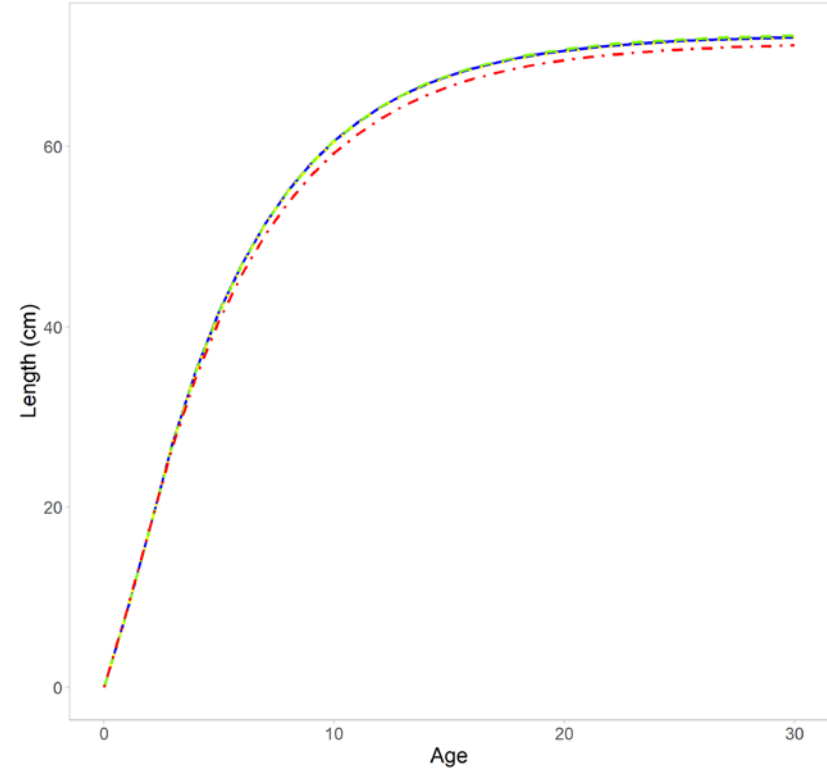
<b>Model 16.4a (2020)</b>		
<b>Recruitment</b>		
Early Rec. Devs	(1945-1970)	25
Main Rec. Devs	(1970-2015)	46
Future Rec. Devs	(2016-2020)	5
$R_0$		1
Autocorrelation $\rho$		1
<b>Natural mortality</b>		
Male		0
Female		0
<b>Growth</b>		
$L_{min}$ (M and F)		2
$L_{max}$ (M and F)		2
Von Bert K (M and F)		2
<b>Catchability</b>		
$q_{shelf}$		0
$q_{slope}$		0
$q_{ABL}$		1
<b>Selectivity</b>		
Trawl fishery		15
Longline fishery		28
Shelf survey		17
Slope survey		19
AFSC longline survey		0
<b>Total Parameters</b>		<b>164</b>

# Growth

Female growth curve



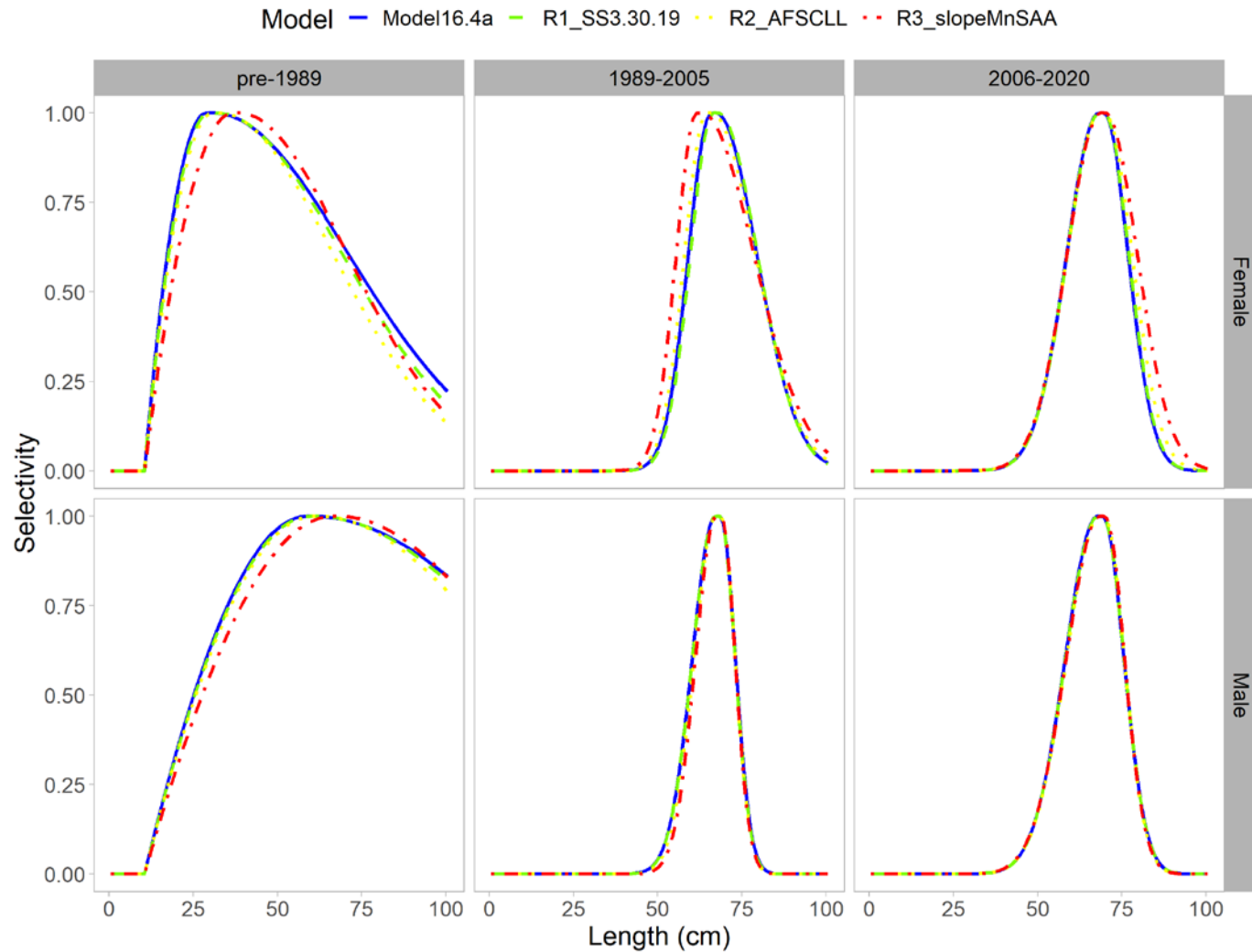
Male growth curve



- Model
- Model16.4a
  - R1\_SS3.30.19
  - R2\_AFSCCL
  - R3\_slopeMnSAA

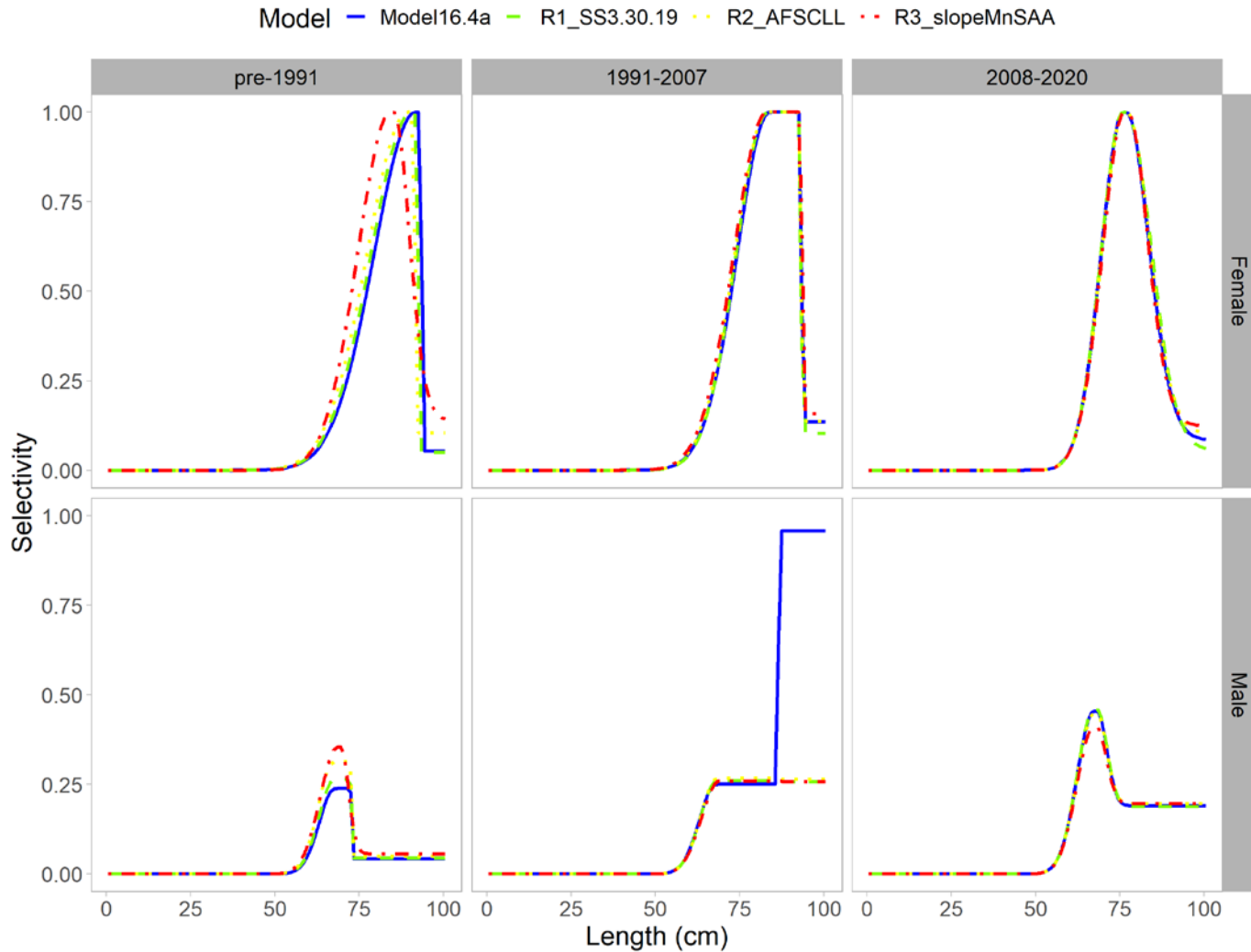
# Selectivity comparison

## Trawl fishery selectivity



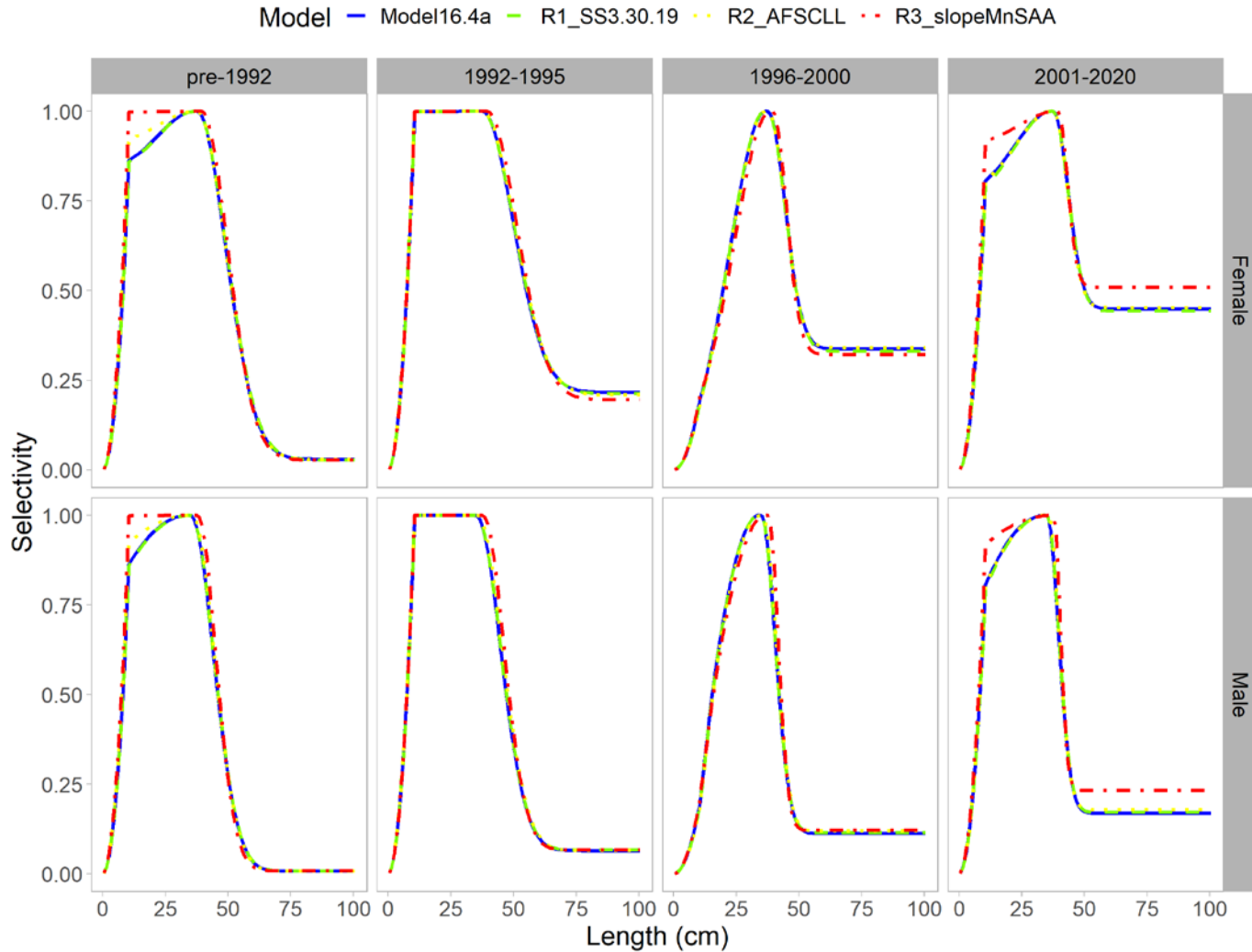
# Selectivity comparison

Fixed gear fishery selectivity



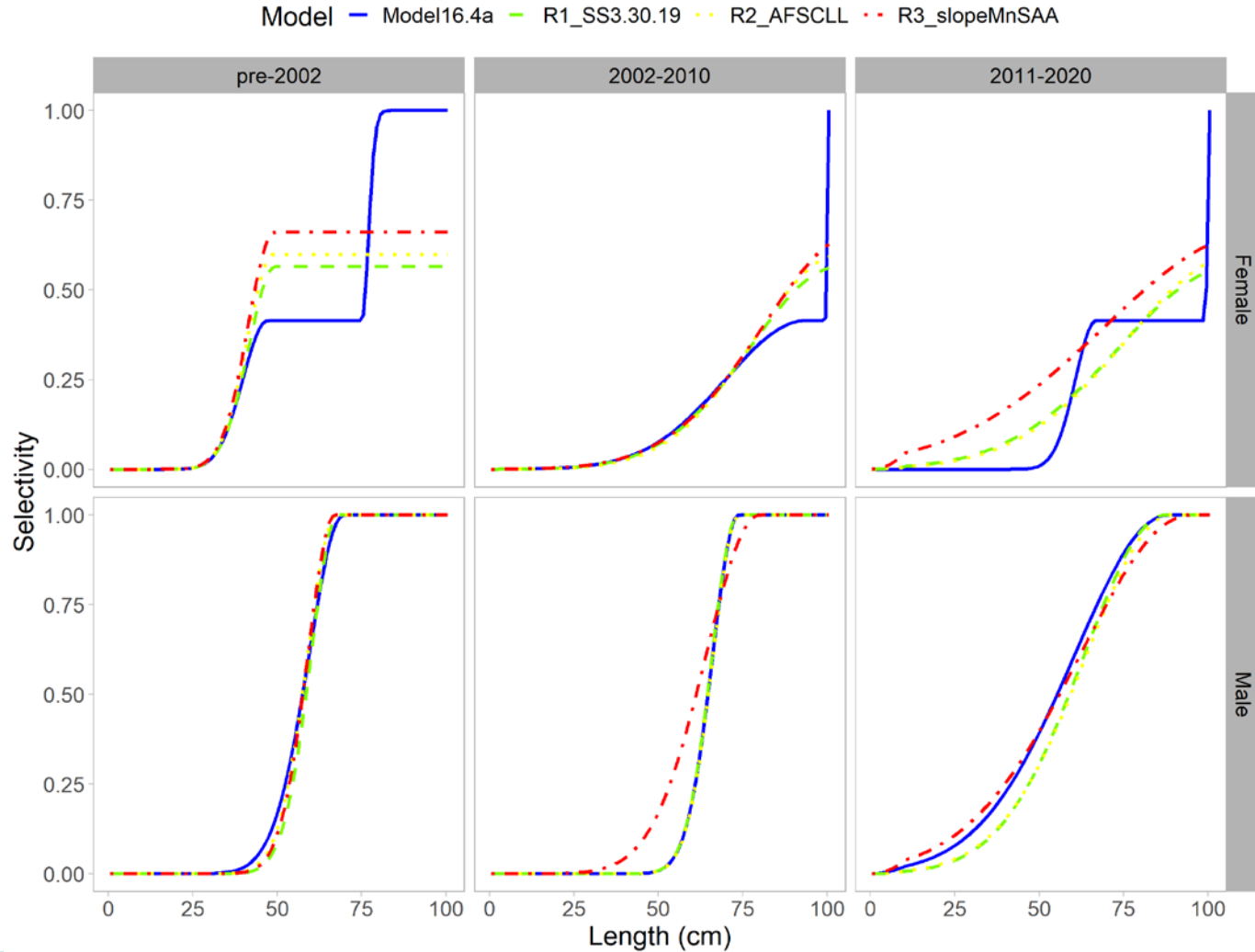
# Selectivity comparison

EBS shelf BTS selectivity



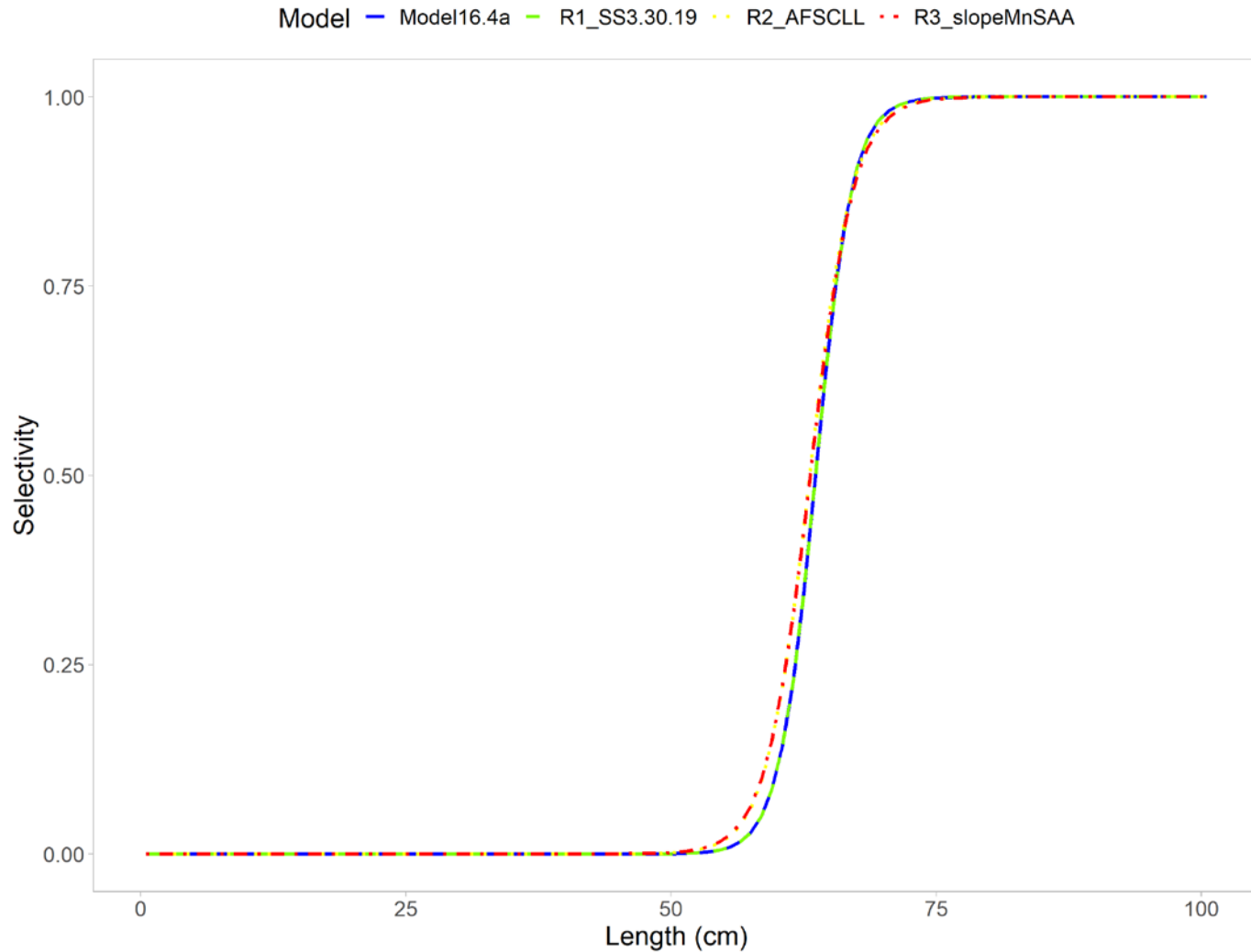
# Selectivity comparison

EBS slope BTS selectivity

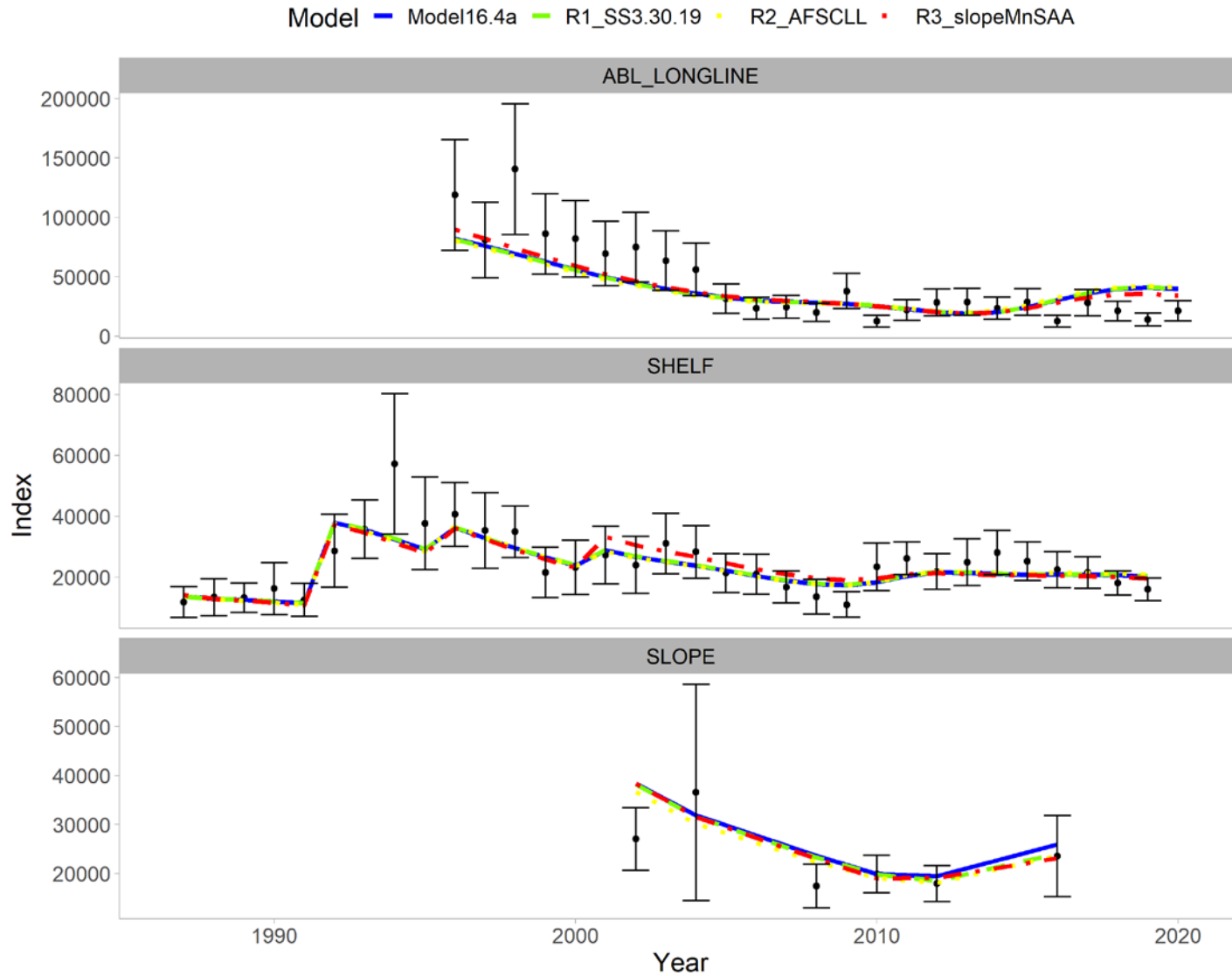


# Selectivity comparison

AFSC longline survey selectivity



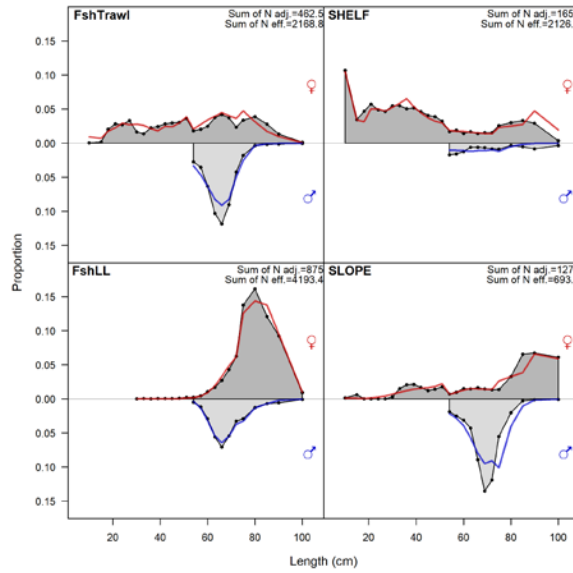
# Fits to survey biomass



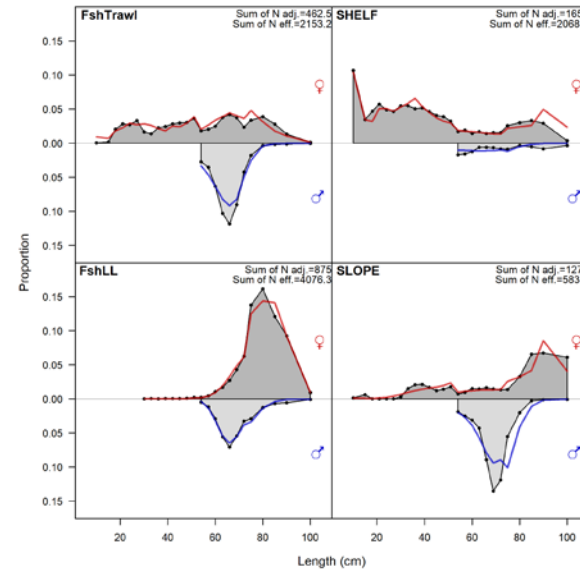


# Overall fit to length composition data

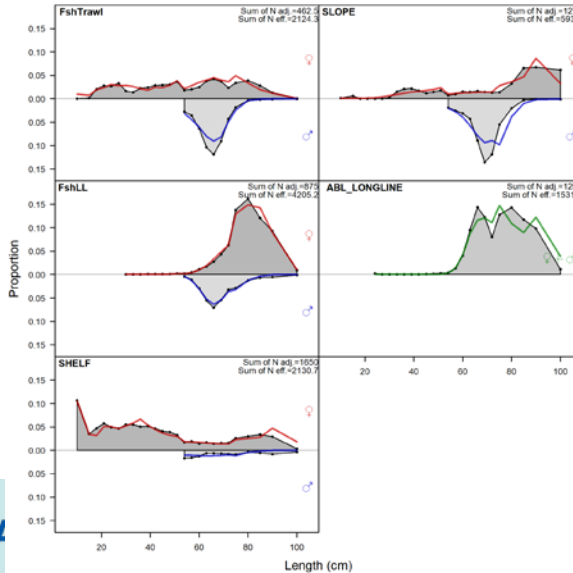
— Model 16.4a



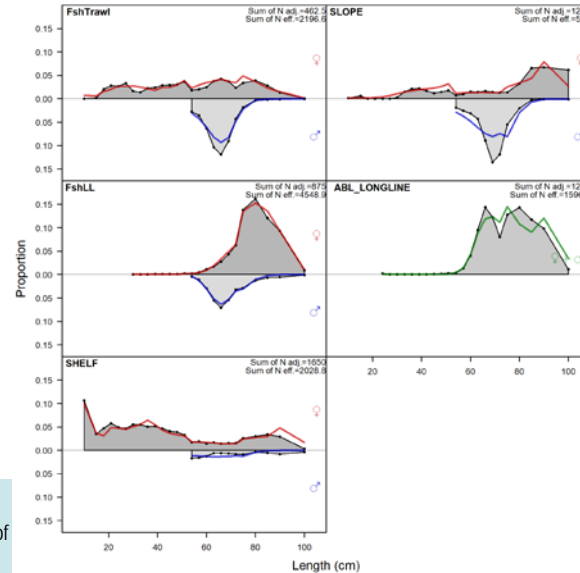
— R1\_SS3.30.19



— R2\_AFSC\_LL



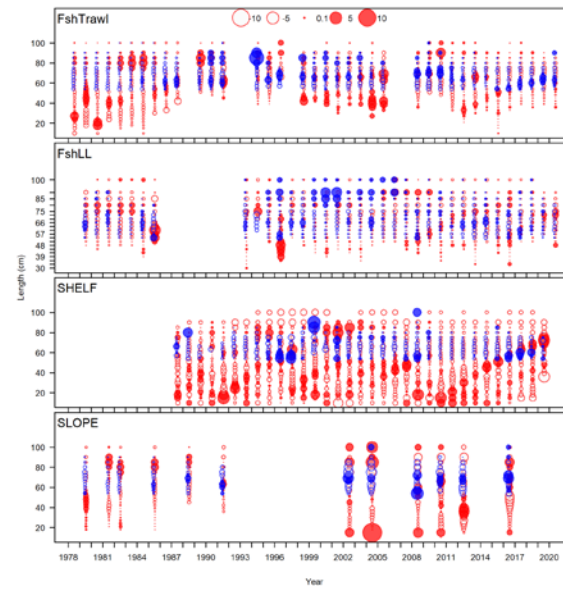
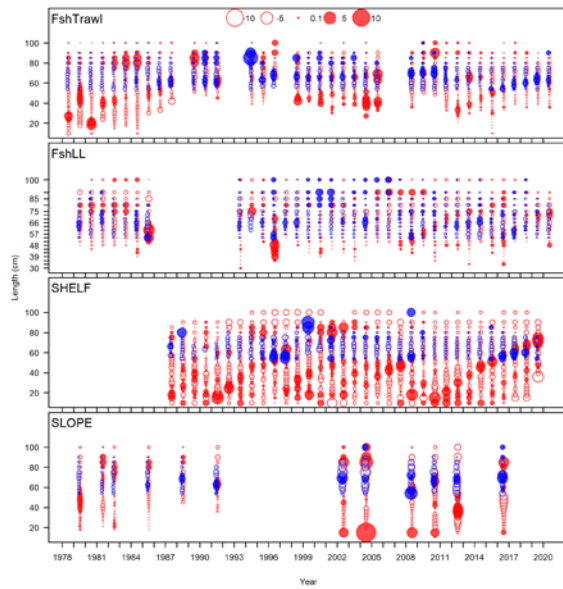
— R3\_Slope\_Mn\_SAA



# Length composition residuals

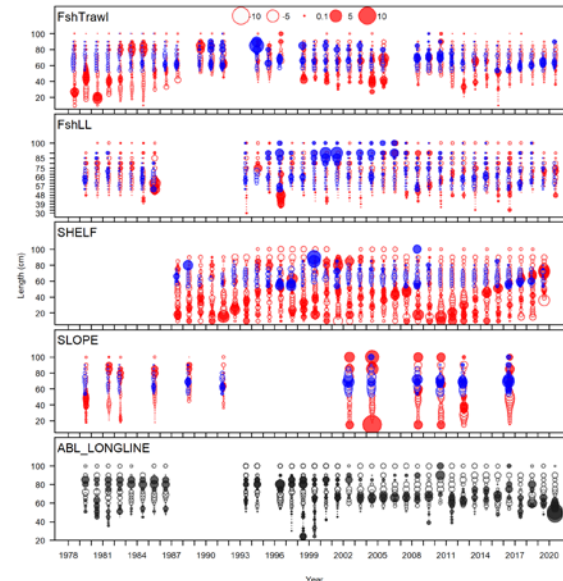
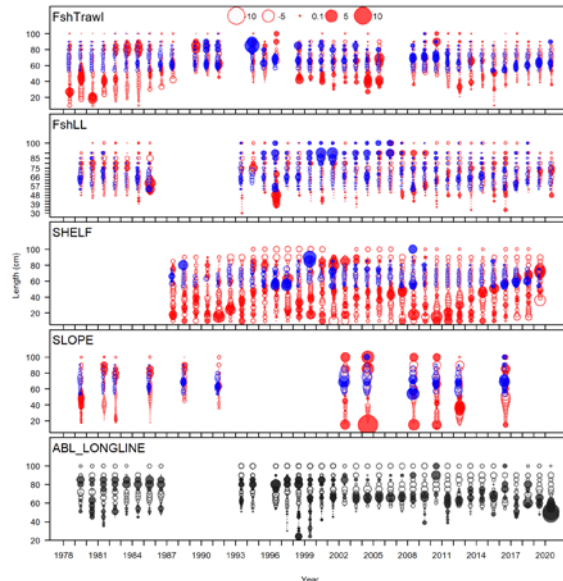
— Model 16.4a

— R1\_SS3.30.19



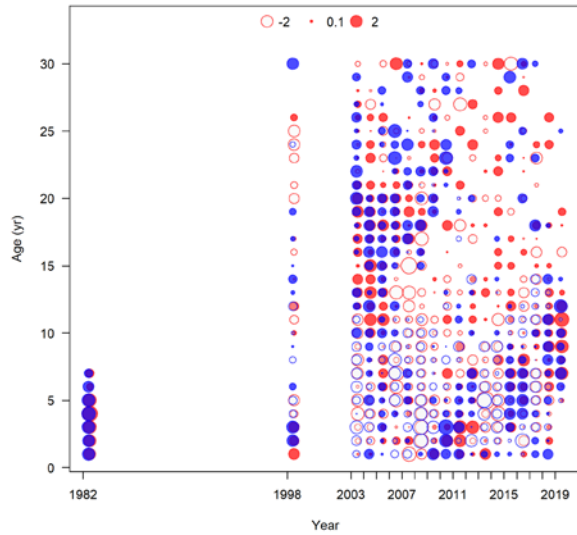
— R2\_AFSC\_LL

— R3\_Slope\_Mn\_SAA

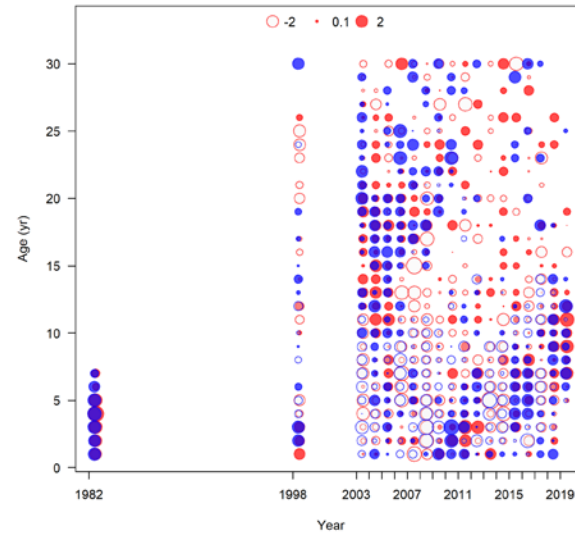


# Mean size-at-age EBS shelf BTS

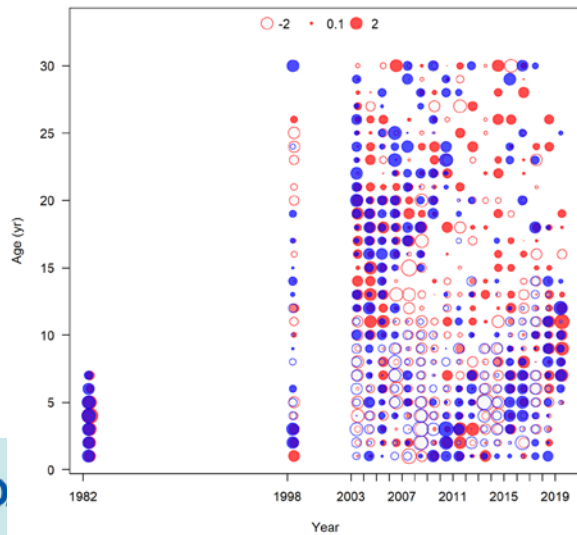
— Model 16.4a



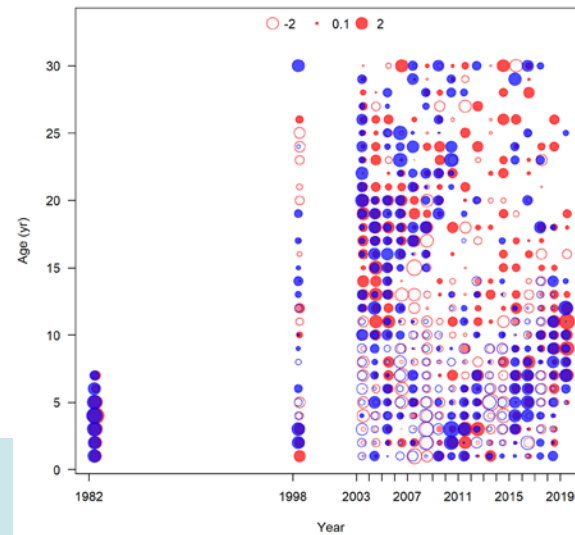
— R1\_SS3.30.19



— R2\_AFSC\_LL

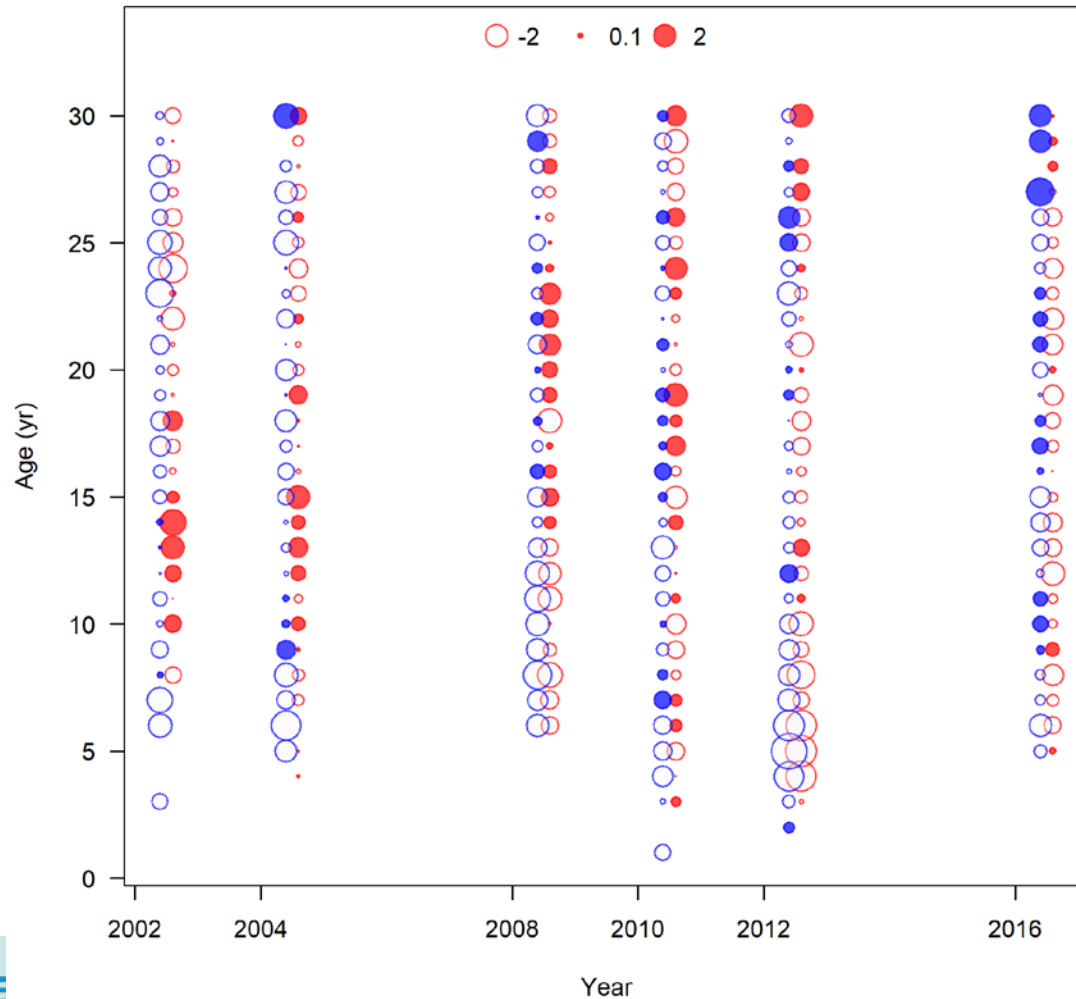


— R3\_Slope\_Mn\_SAA

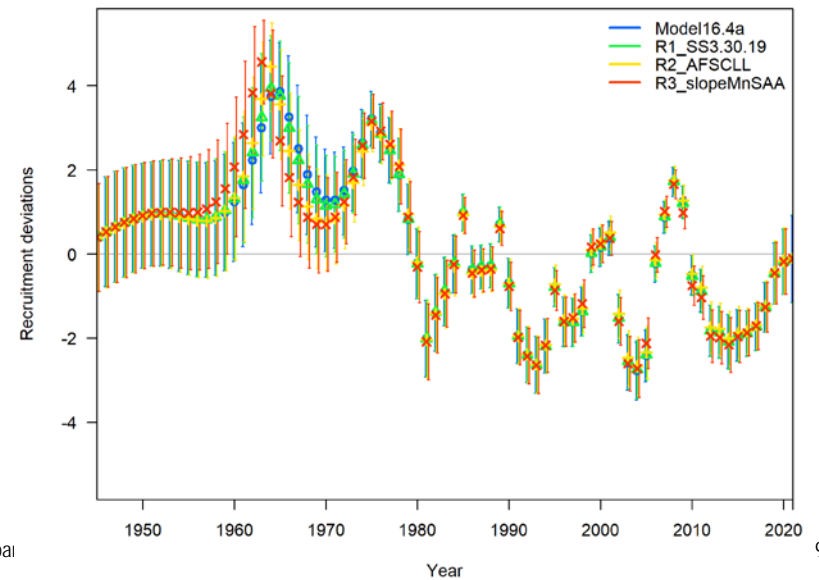
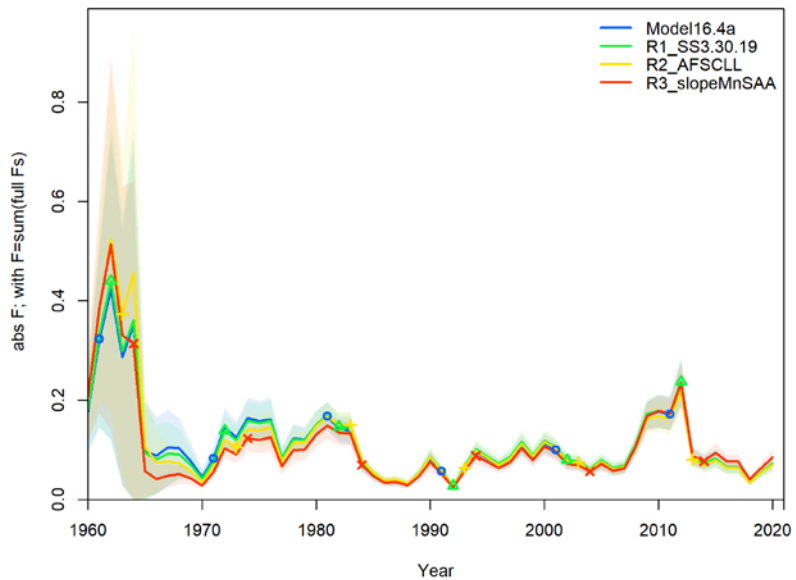
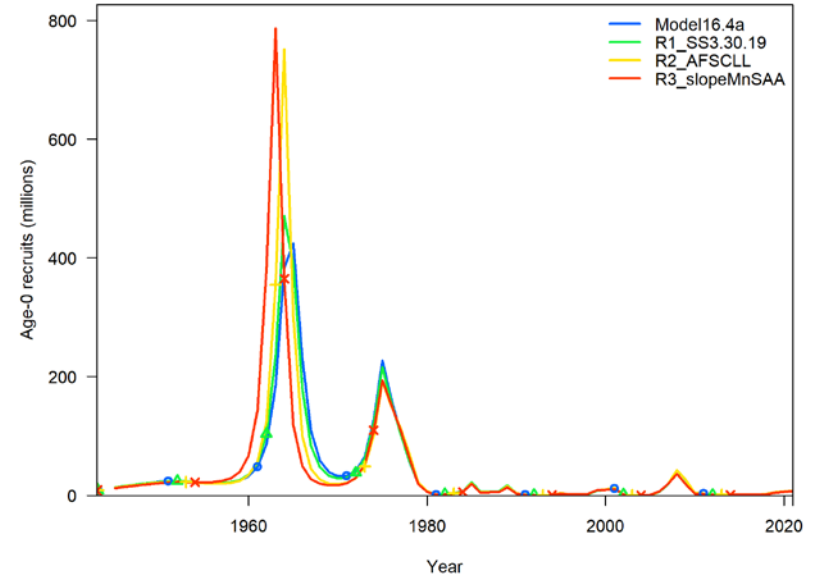
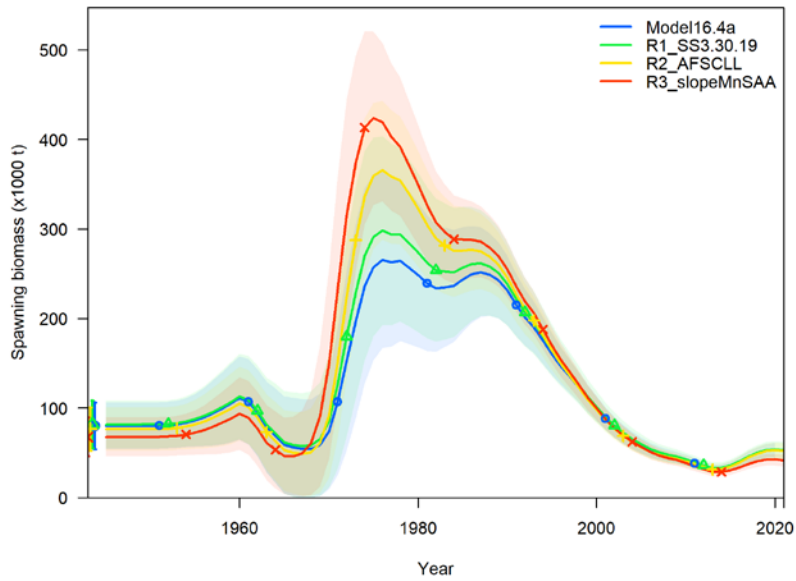


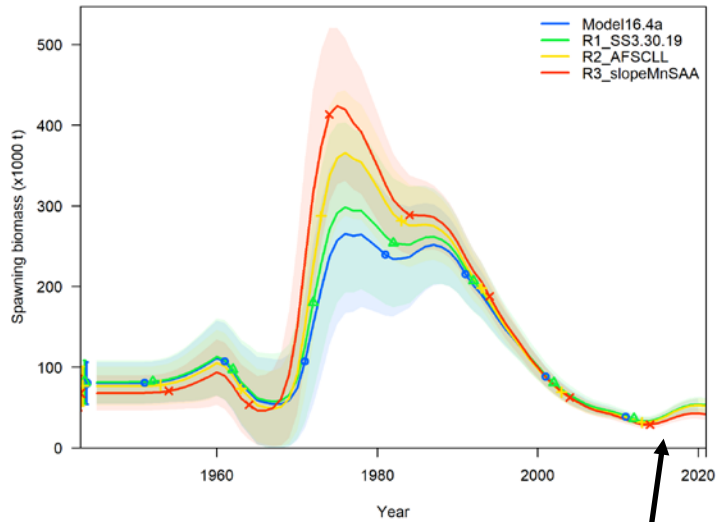
# Mean size-at-age EBS slope BTS

— R3\_Slope\_Mn\_SAA

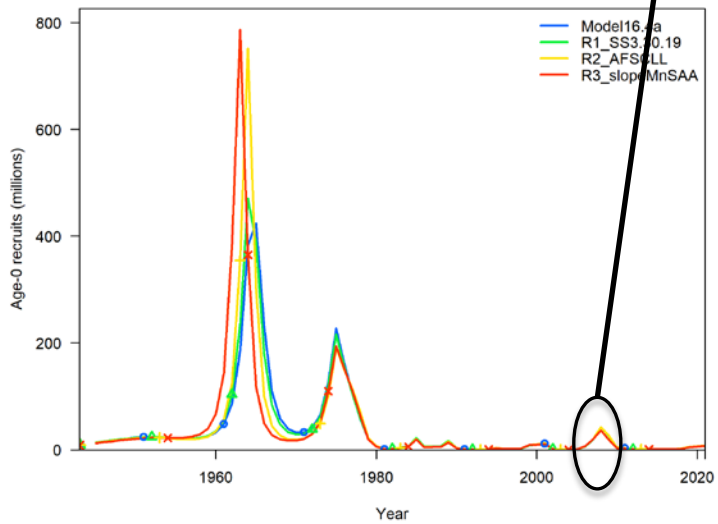
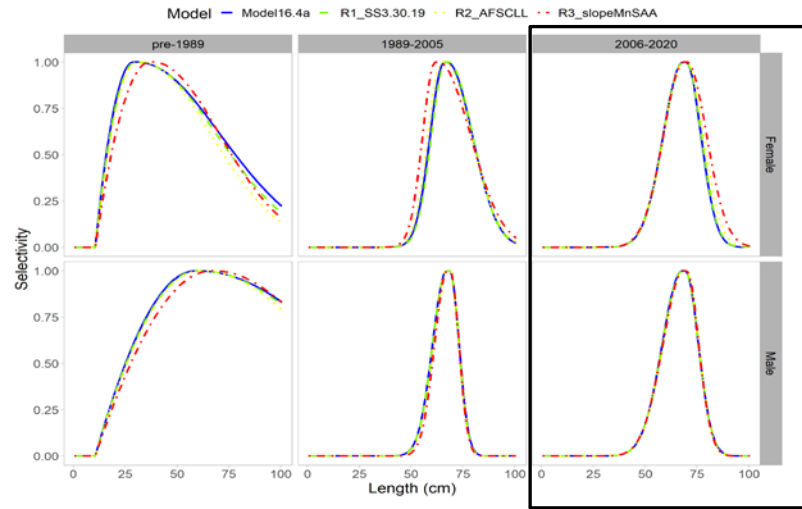


# Time series comparisons

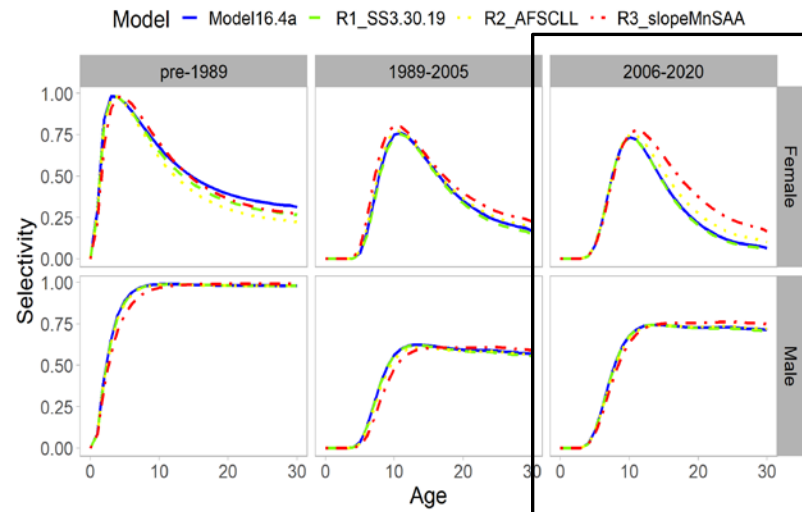




Trawl fishery selectivity



Trawl fishery derived age selectivity



# Projections

	Model 16.4a	Run 3	Proportion change
B100%	89,054	79,840	-0.10
B40%	35,622	31,936	-0.10
B35%	31,169	27,944	-0.10
Fofl	0.22	0.20	-0.09
Fabc	0.18	0.17	-0.06
OFL	8,568	6,971	-0.19
ABC	7,326	5,927	-0.19

# Recommendations

- Use newest version of SS3
  - Improvement on double normal parameterization
- Use the AFSC longline length data as an input and estimate selectivity
  - Result is similar to fixing selectivity and using as ghost data
- Use EBS slope BTS mean size-at-age data as data inputs
  - Provides more information about growth at older ages



# Divider Title

Additional Divider Information

# Mean size-at-age data

