Assessment of the Northern Rockfish Stock in the Gulf of Alaska

Groundfish Plan Team: November, 2018

NOAA
FISHERIES

AFSC
Auke Bay
Laboratories

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"*Evaluate* a VAST model with the spatial-temporal components turned off (i.e., a typical delta-lognormal model) *to determine the effect* of the delta component vs. the spatiotemporal component." – Joint Plan Team, 2017
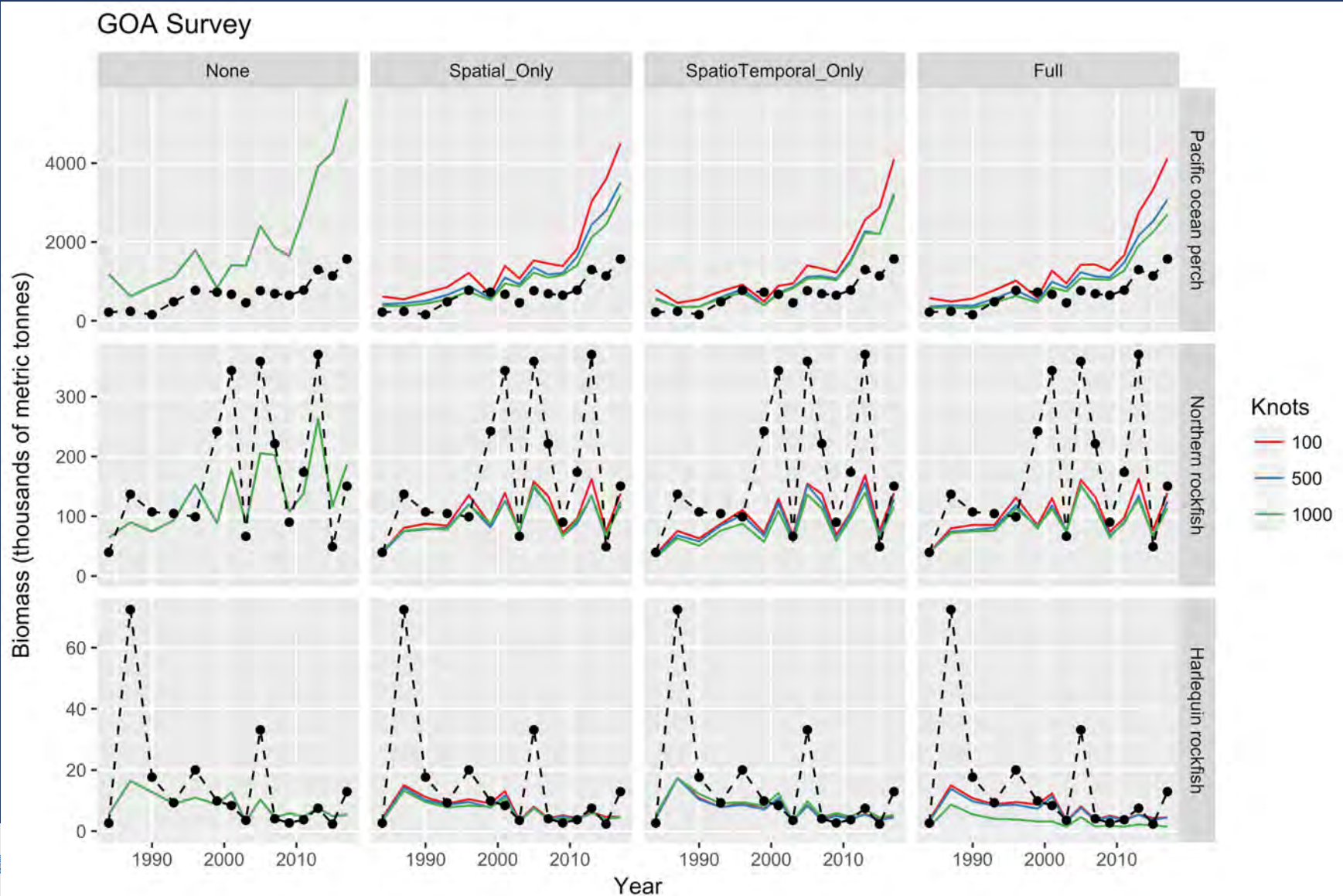
New Data for 2018 Assessment

| Source	Data	Years
Fisheries	Catch	1961-**2018** (2015, 2016, 2017, prelim 2018)
NMFS bottom trawl surveys	Biomass index	1984, 1987, 1990, 1993, 1996, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, **2017**
NMFS bottom trawl surveys	Age	1984, 1987, 1990, 1993, 1996, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, **2015**, **2017**
U.S. trawl fisheries	Age	1998, 1999, 2000, 2001, 2002, 2004, 2005, 2006, 2008, 2010, 2012, **2014**, **2016**
U.S. trawl fisheries	Length	1990,1991,1992, 1993, 1994, 1995, 1996, 1997, 2003, 2007, 2009, 2011, 2013, **2015**, **2017**

Model Alternatives

- M15.4 (2018)
  - 2015 Base Model + Updated data
- M 18.1
  - Updated data + VAST index
- M18.2
  - Updated data + VAST index + Scaled survey weight
  - Survey data weight scaled proportional to the ratio of index variances (1.0 to 0.25)
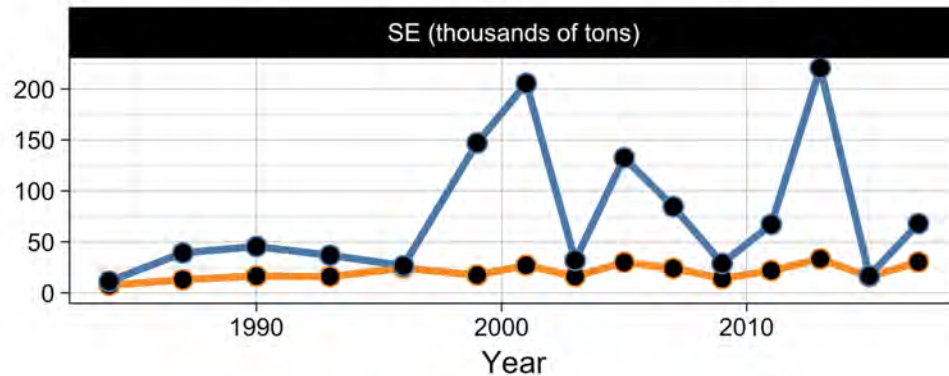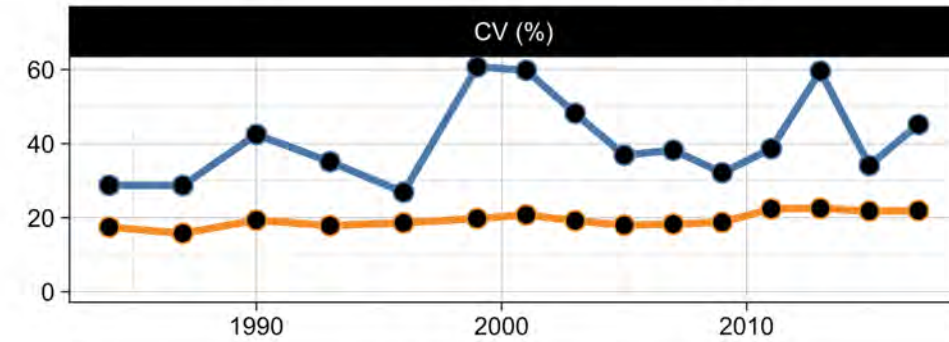
VAST Model-based Survey Index

Encounter probability vs. frequency
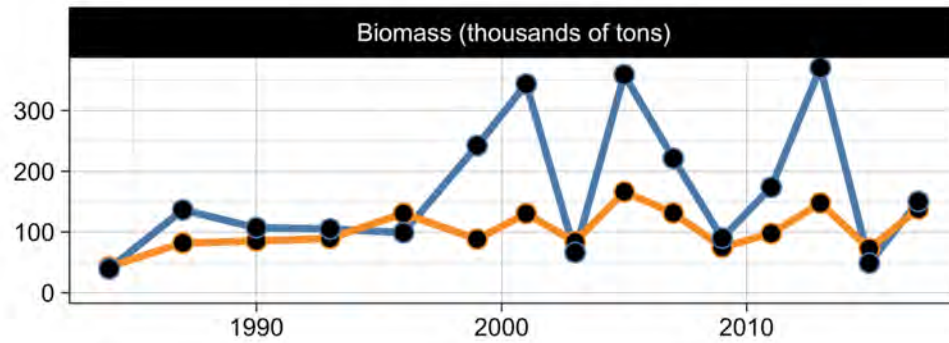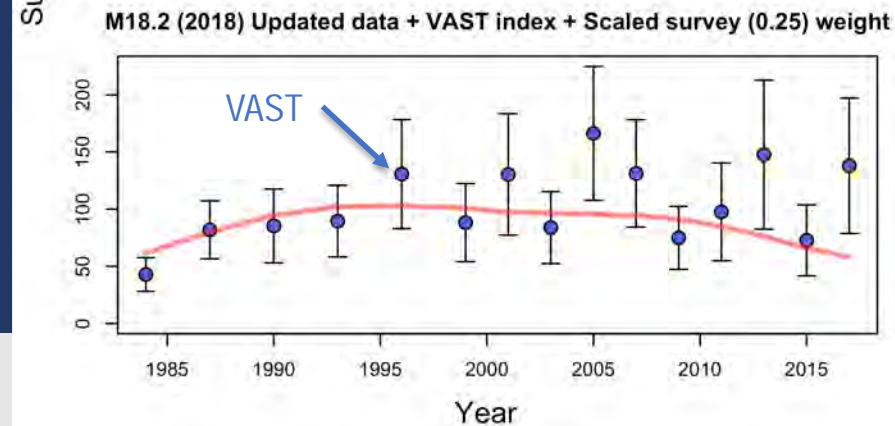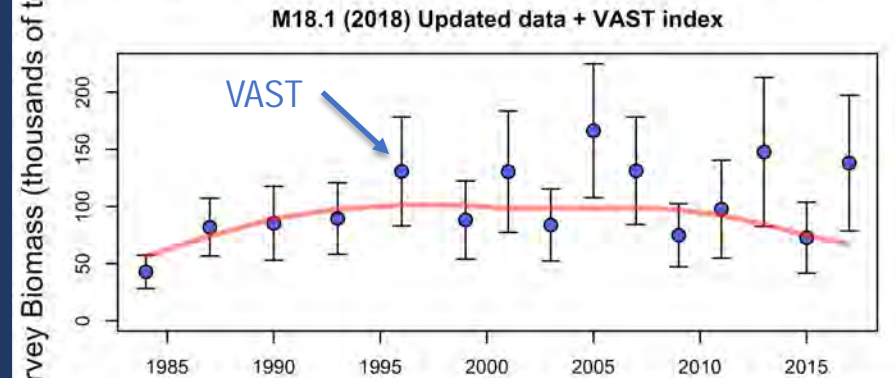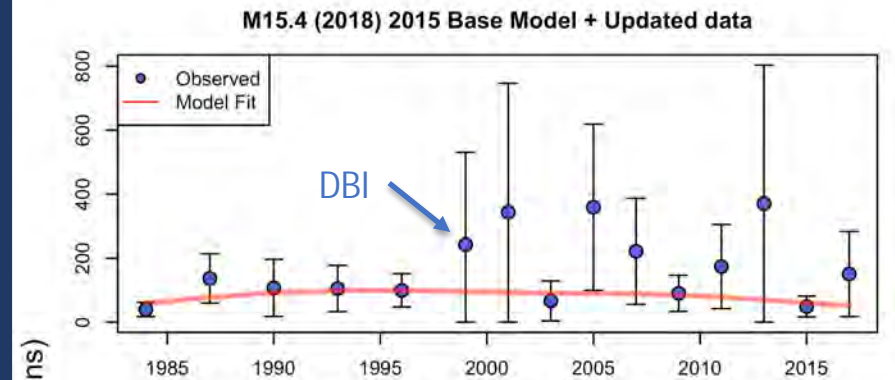

Quantile-quantile plot for PCR
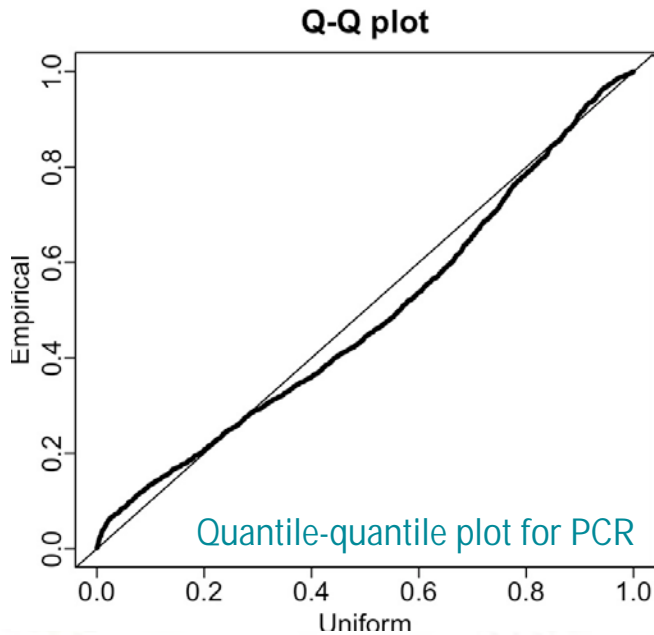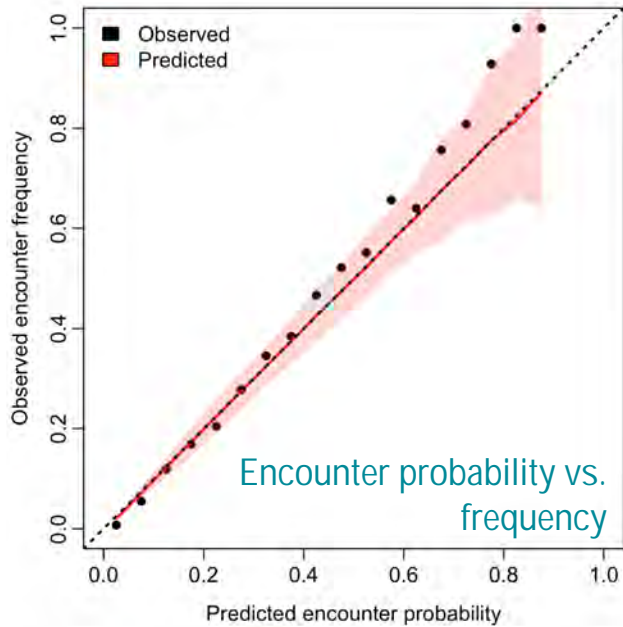
Model Specification

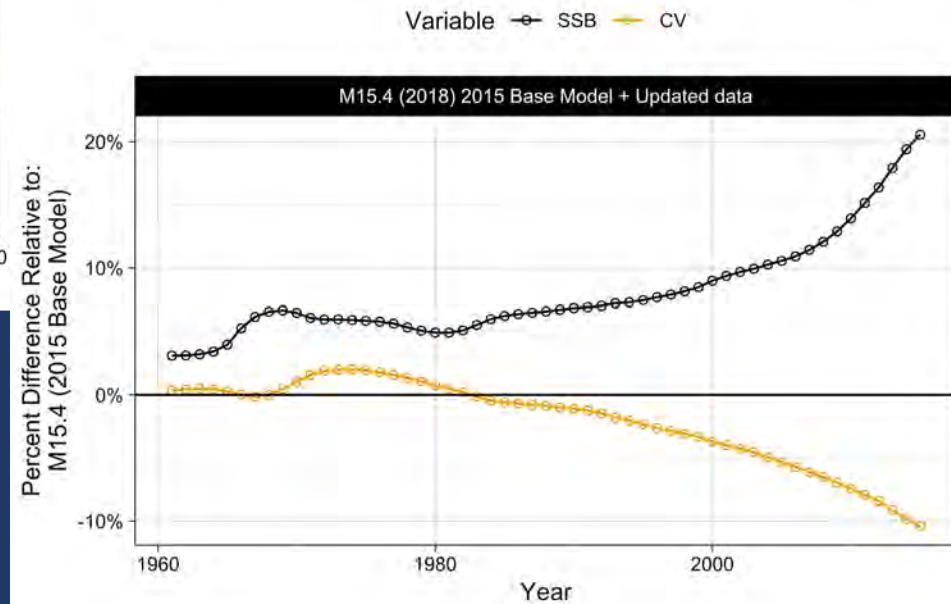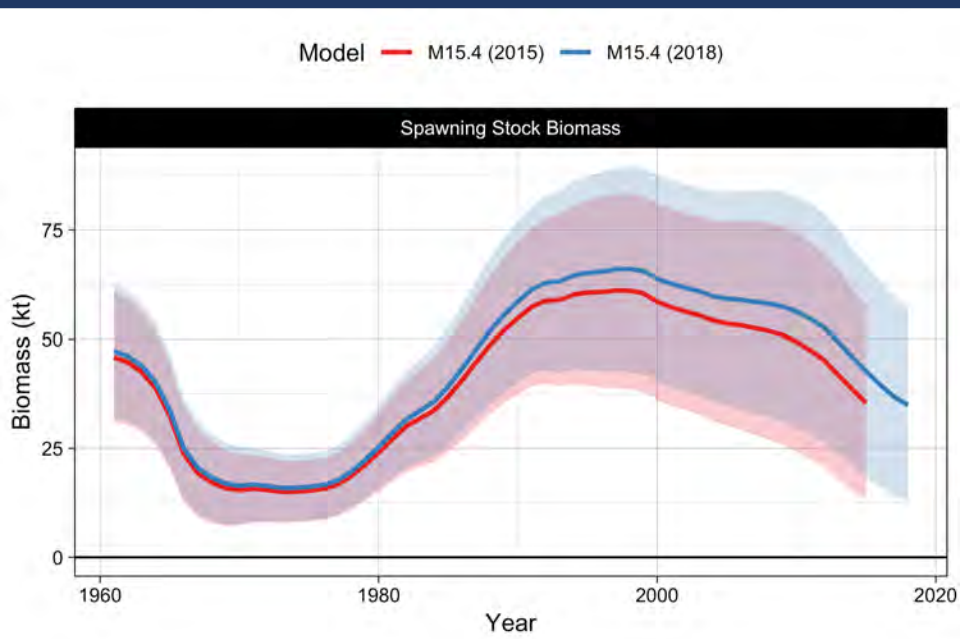- Fine spatial res: 500 kt
- Bias corrected index
- Lognormal for PCR
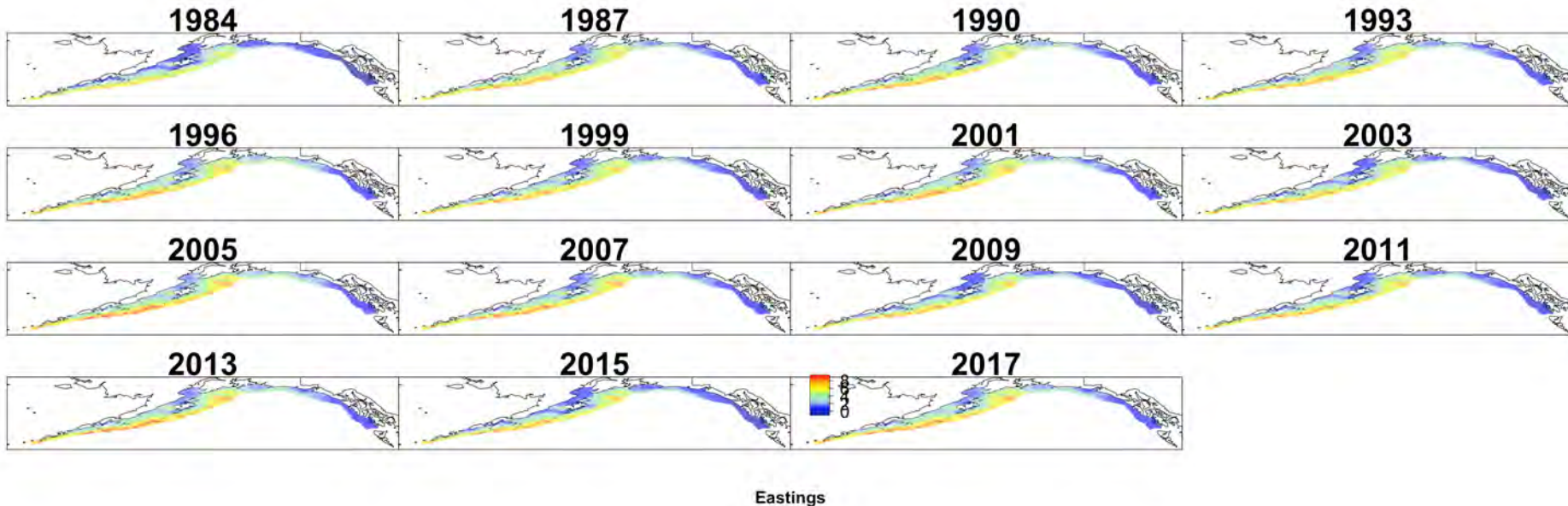
GOA Bottom Trawl Survey Data

15.4 (2018) Addition of New Data

Model Alternatives
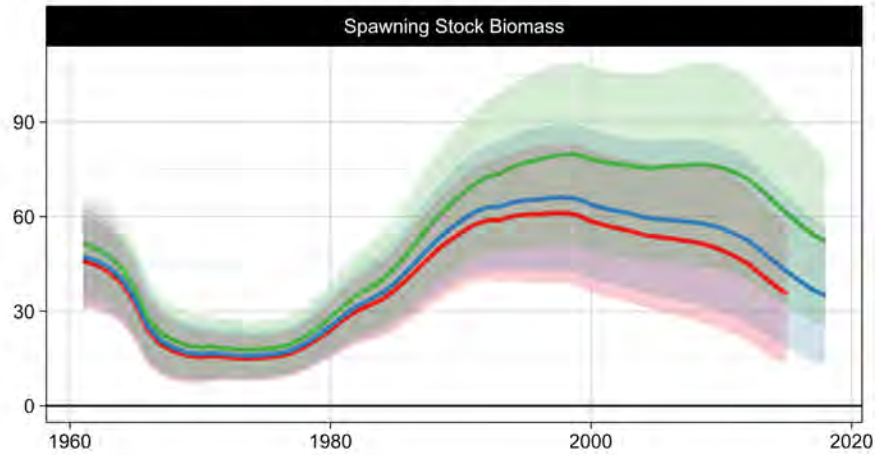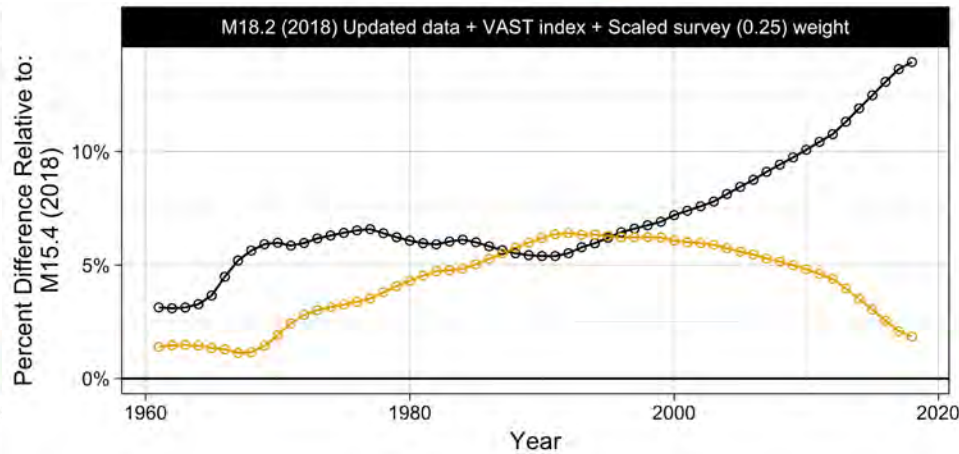
Updated data + VAST index

Model Alternatives

Updated data + VAST index

Updated data + VAST index + Scaled survey weight

Comparison of Model Parameters

Estimated Parameters
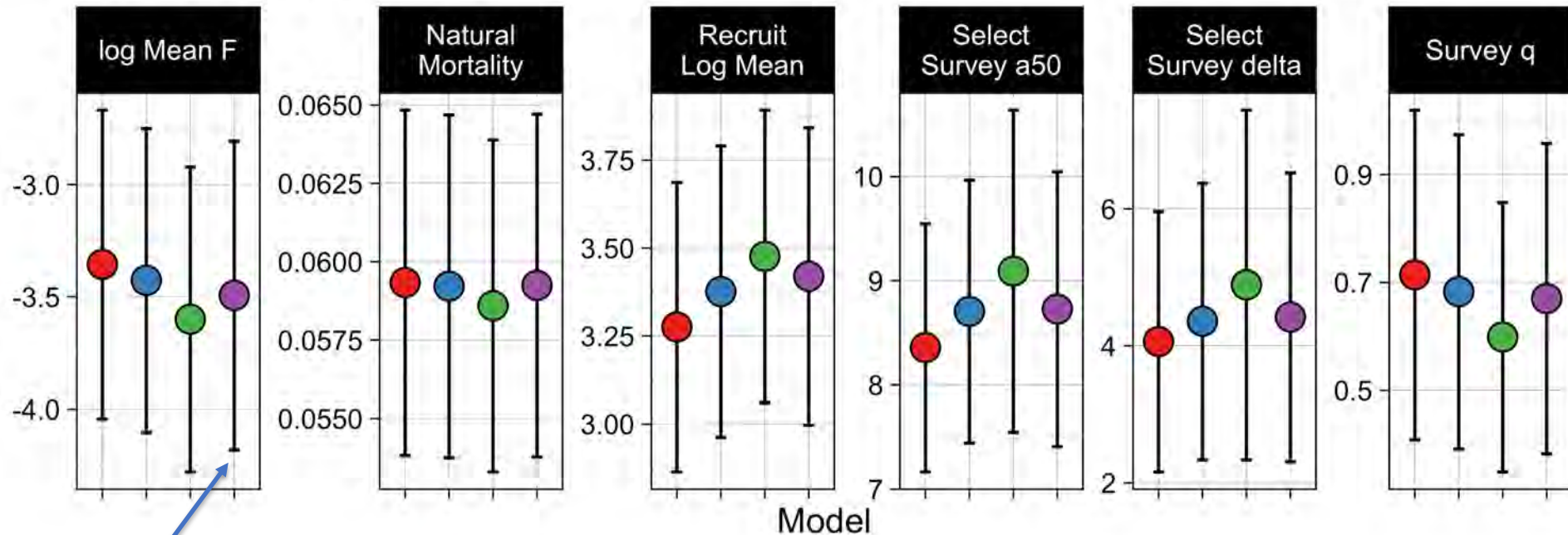
Recommended Model

Model

- 🔴 M15.4 (2015) 2015 Base Model
- 🔵 M15.4 (2018) 2015 Base Model + Updated data
- 🟢 M18.1 (2018) Updated data + VAST index
- 🟣 M18.2 (2018) Updated data + VAST index + Scaled survey (0.25) weight

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Retrospective Pattern: SSB
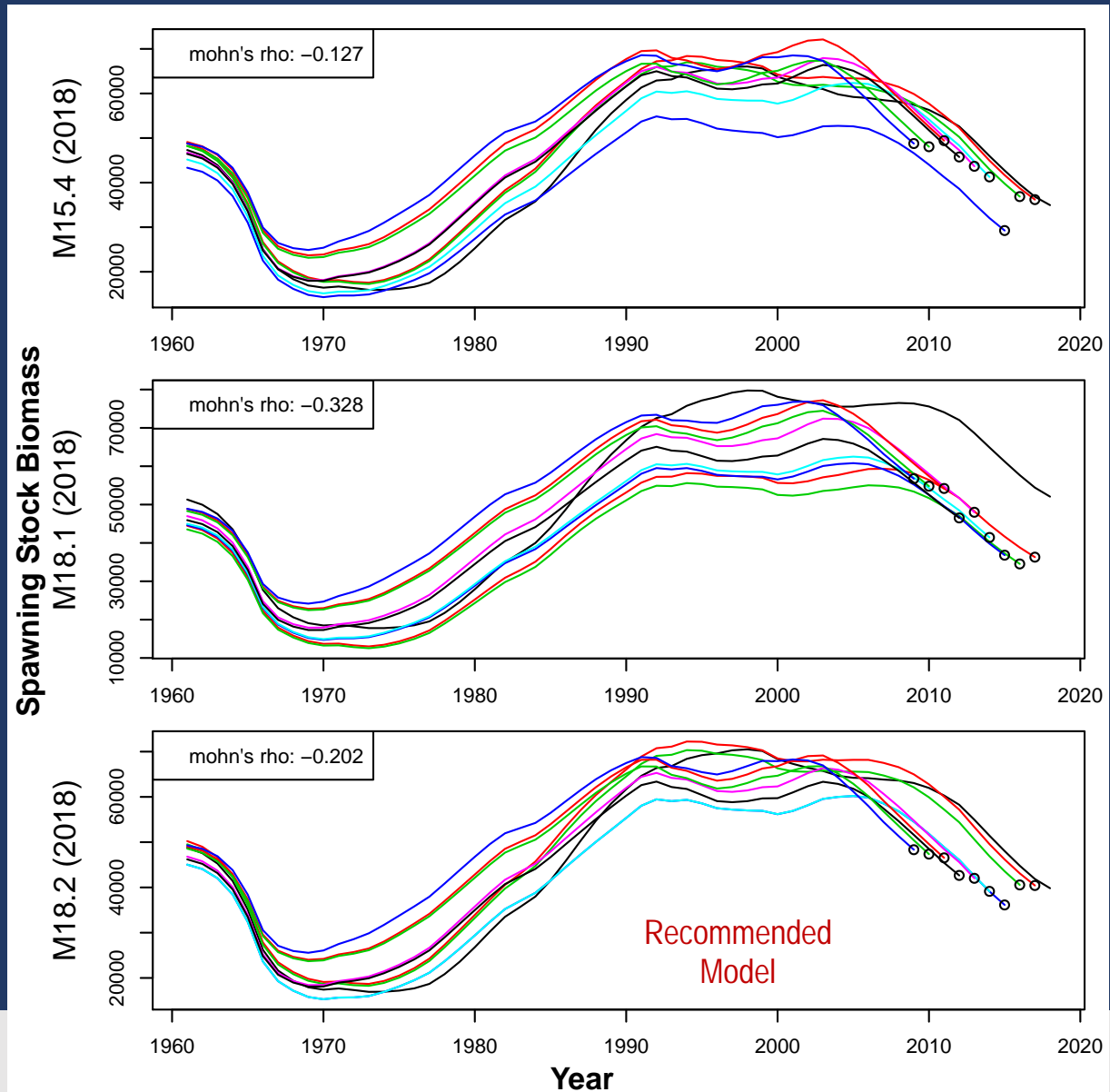
"*The use of the VAST estimates of survey biomass also degraded the retrospective performance of the model, and it would be useful to determine whether this was caused by changes in estimated catchability.*" – GOA Plan Team, 2018
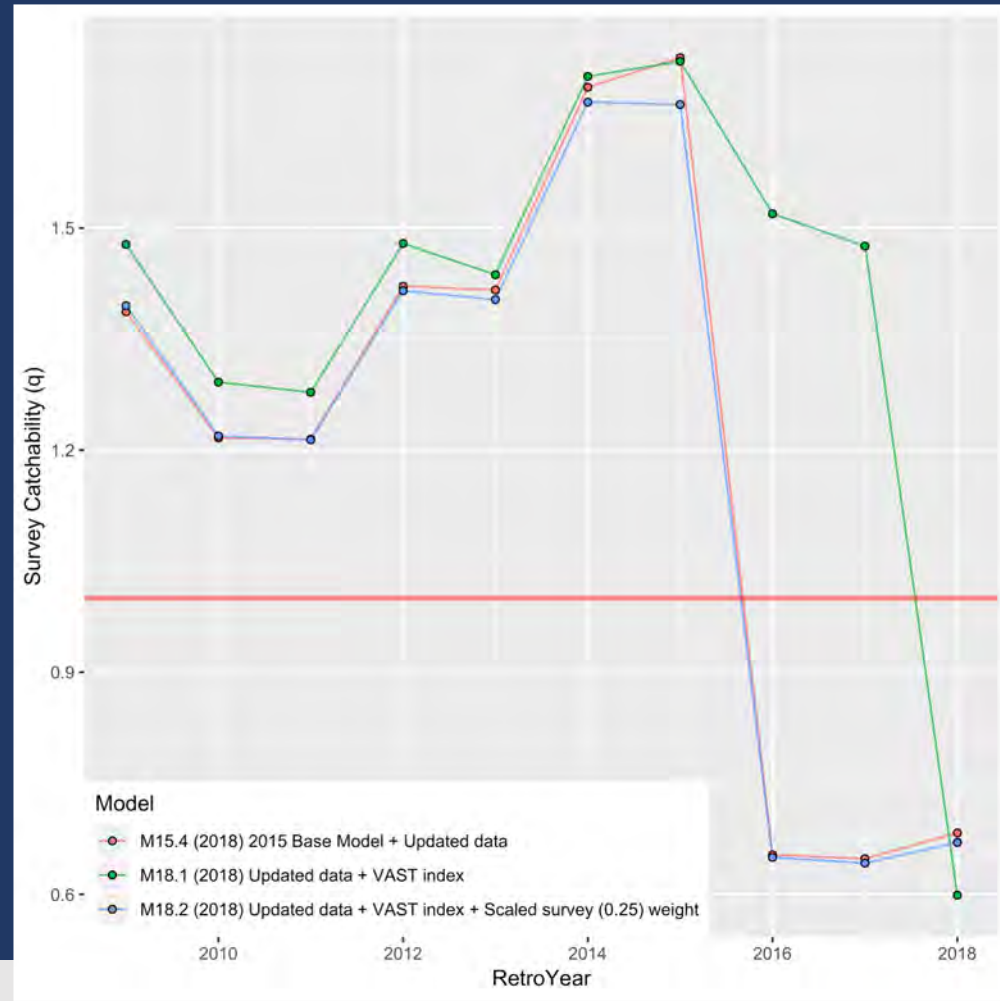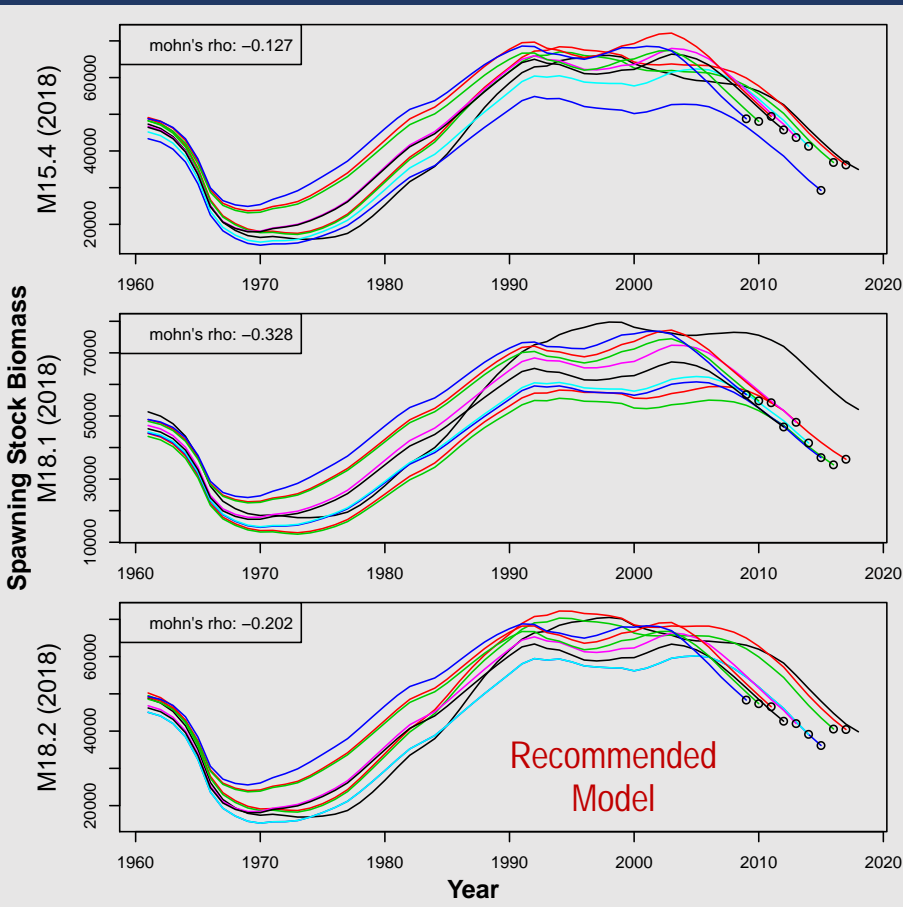
Jones et al. *In Internal Review*

- Purpose: Compare GOA rockfish densities in trawlable and untrawlable grids using LSC and acoustics.

- Northern rockfish q: 0.5-0.6

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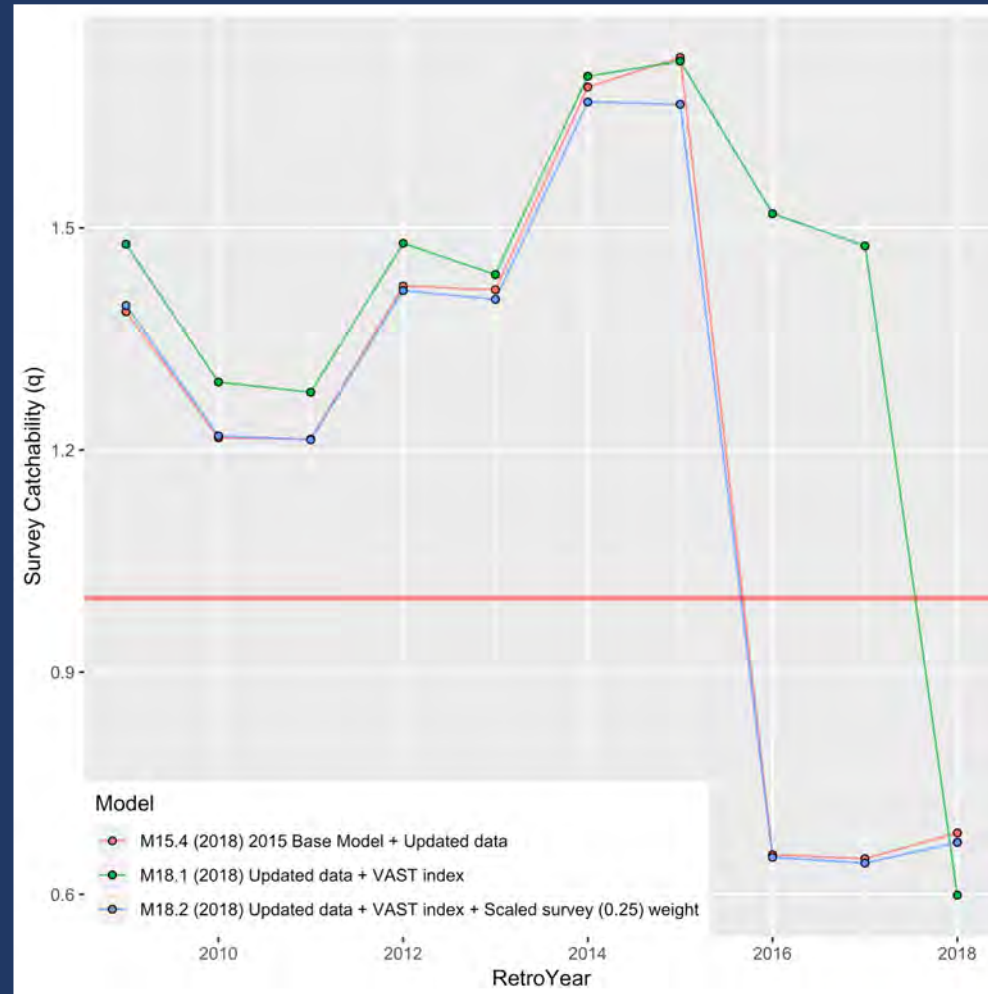
Recruitment

Recruitment

Recruitment

Recruitment

Likelihood Table

Recommended Model: 18.2

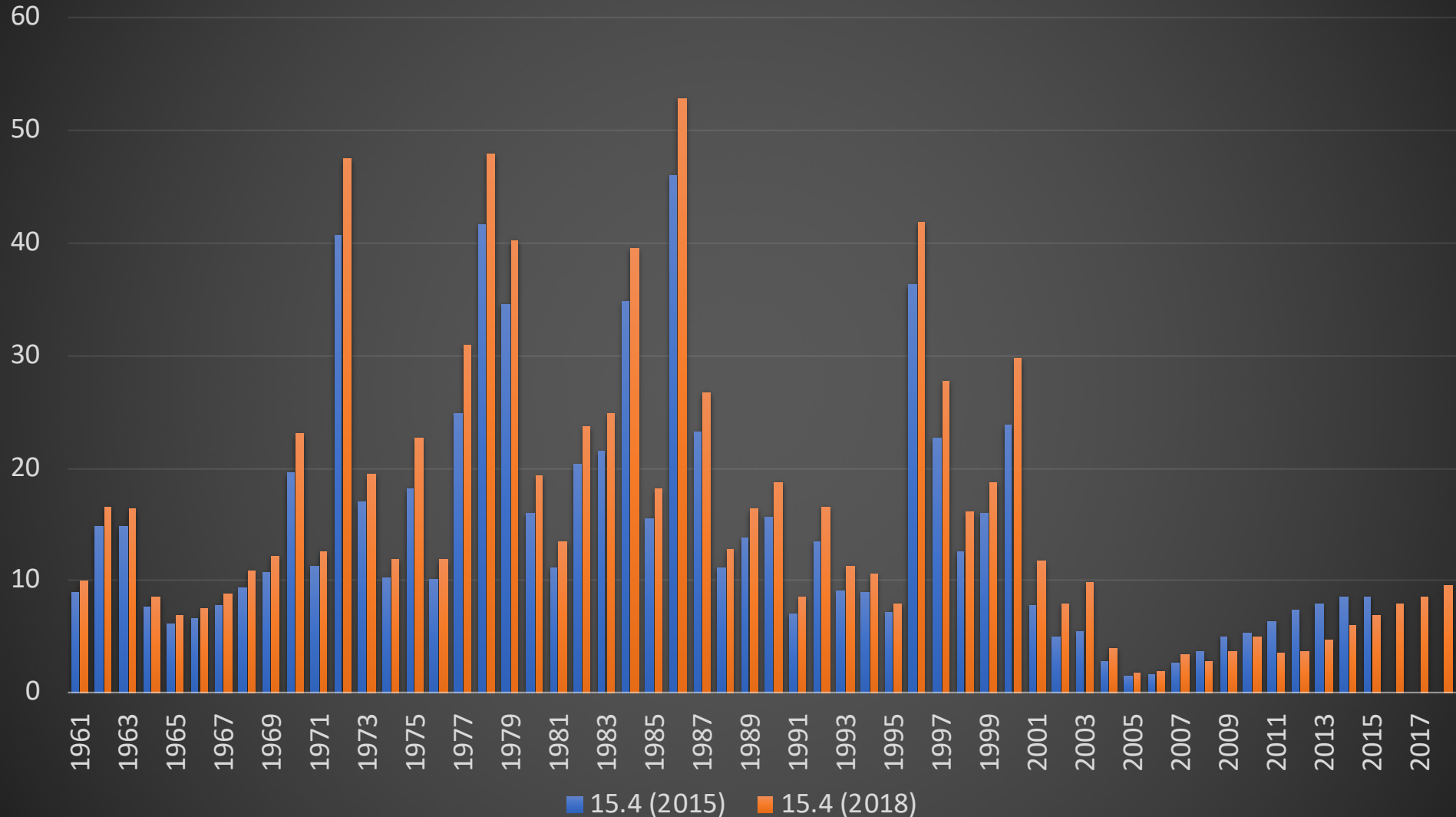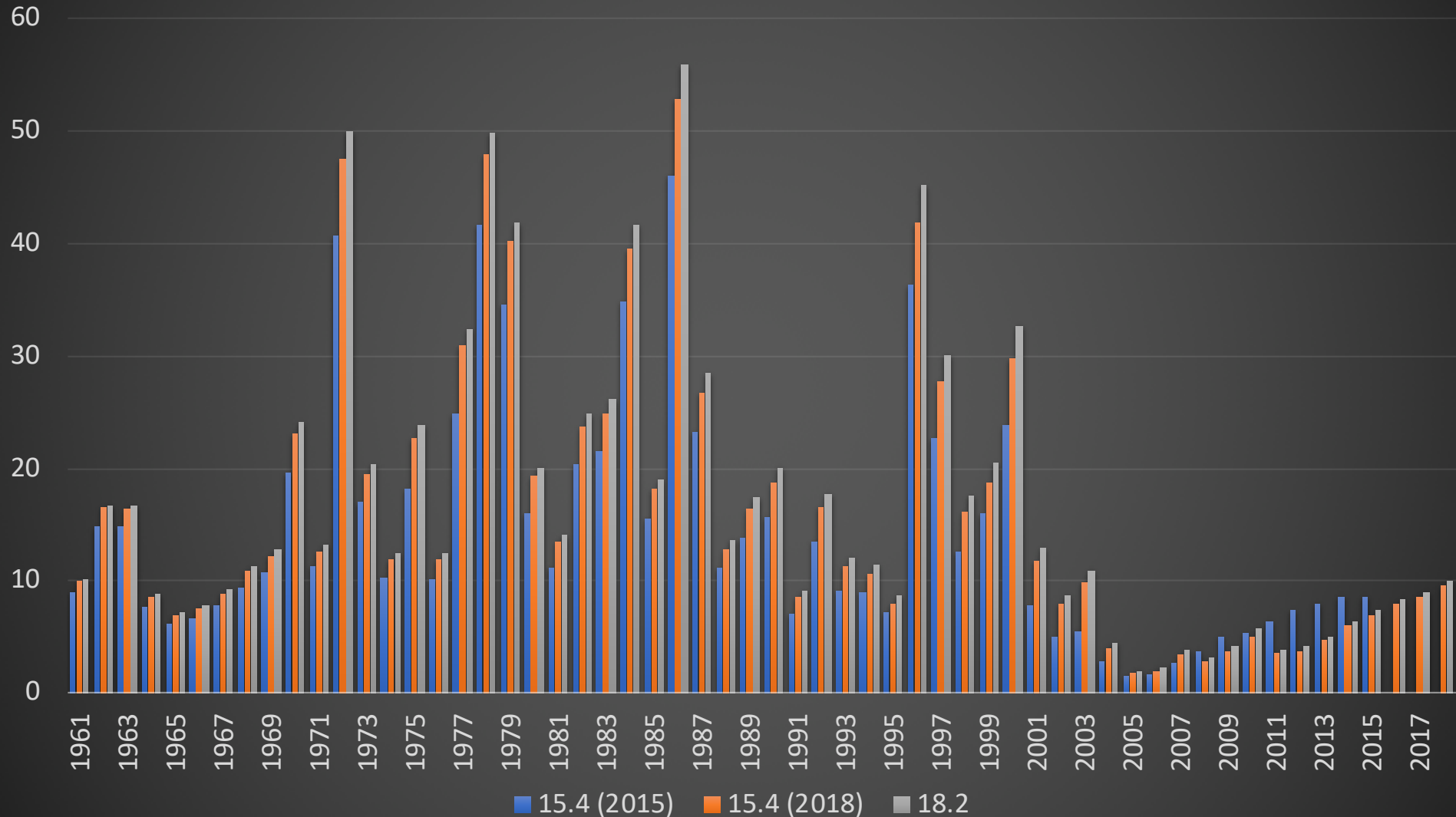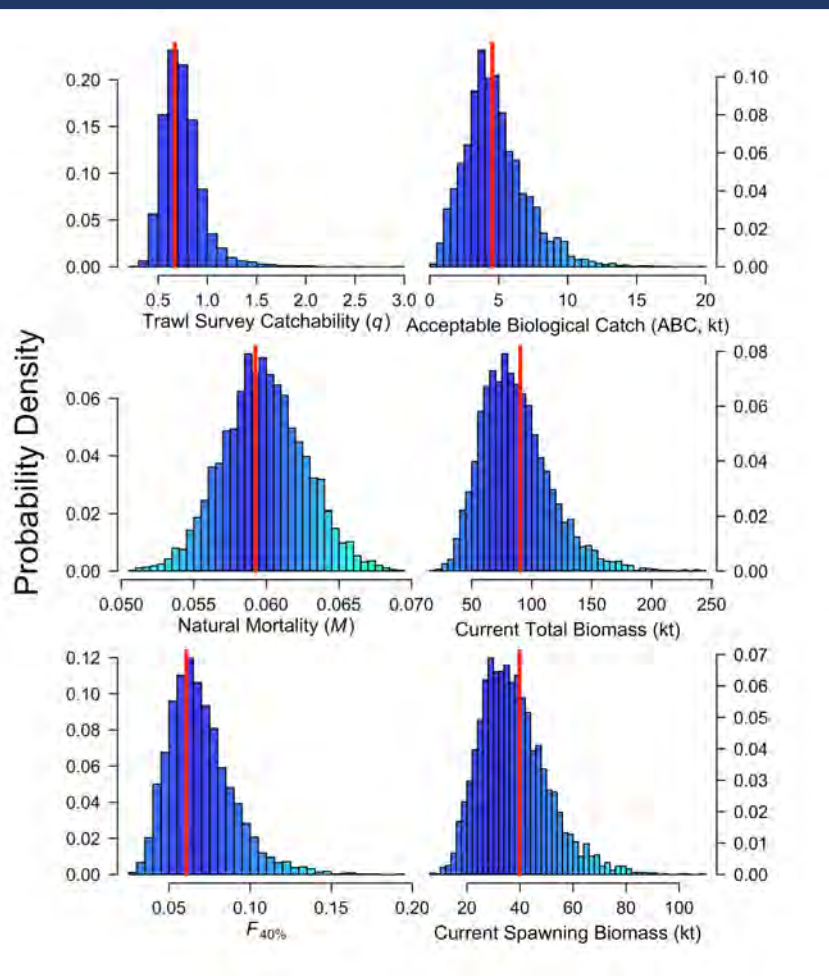|	M 15.4 (2015)	M 15.4 (2018)	M 18.1 (2018)	M 18.2 (2018)
Catch	0.09	0.08	0.15	0.10
Survey Biomass	10.14	10.86	13.46	4.10
Fishery Ages	28.52	33.13	32.68	33.10
Survey Ages	55.27	63.30	65.48	63.25
Fishery Sizes	50.59	45.94	45.20	46.10
Maturity Likelihood	70.23	70.23	70.23	70.23
Data-Likelihood	214.85	223.54	227.19	216.88
Penalties/Priors				
Recruitment Devs	8.12	9.27	9.36	9.22
F Regularity	5.55	5.53	5.61	5.54
q prior	0.28	0.36	0.65	0.40
M prior	0.02	0.03	0.11	0.03
Objective Fun Total	228.83	238.74	242.93	232.06
Parameter Estimates				
Active parameters	170	176	176	176
q	0.71	0.68	0.60	0.67
M	0.06	0.06	0.06	0.06
σ_r	1.50	1.50	1.50	1.50
Mean recruitment (millions)	13.81	15.28	18.79	16.33
$F_{40\%}$	0.06	0.06	0.06	0.06
Total Biomass	77,574	77,043	113,230	87,376
Spawning Biomass	31,347	31,801	47,918	36,363
$B_{100\%}$	69,957	71,359	89,262	76,199
$B_{40\%}$	27,983	28,544	35,705	30,480
ABC ($F_{40\%}$)	4,009	3,962	5,924	4,529
$F_{35\%}$	0.07	0.07	0.07	0.07
OFL ($F_{35\%}$)	4,784	4,726	7,068	5,402

# Age Compositions

Fishery

Survey
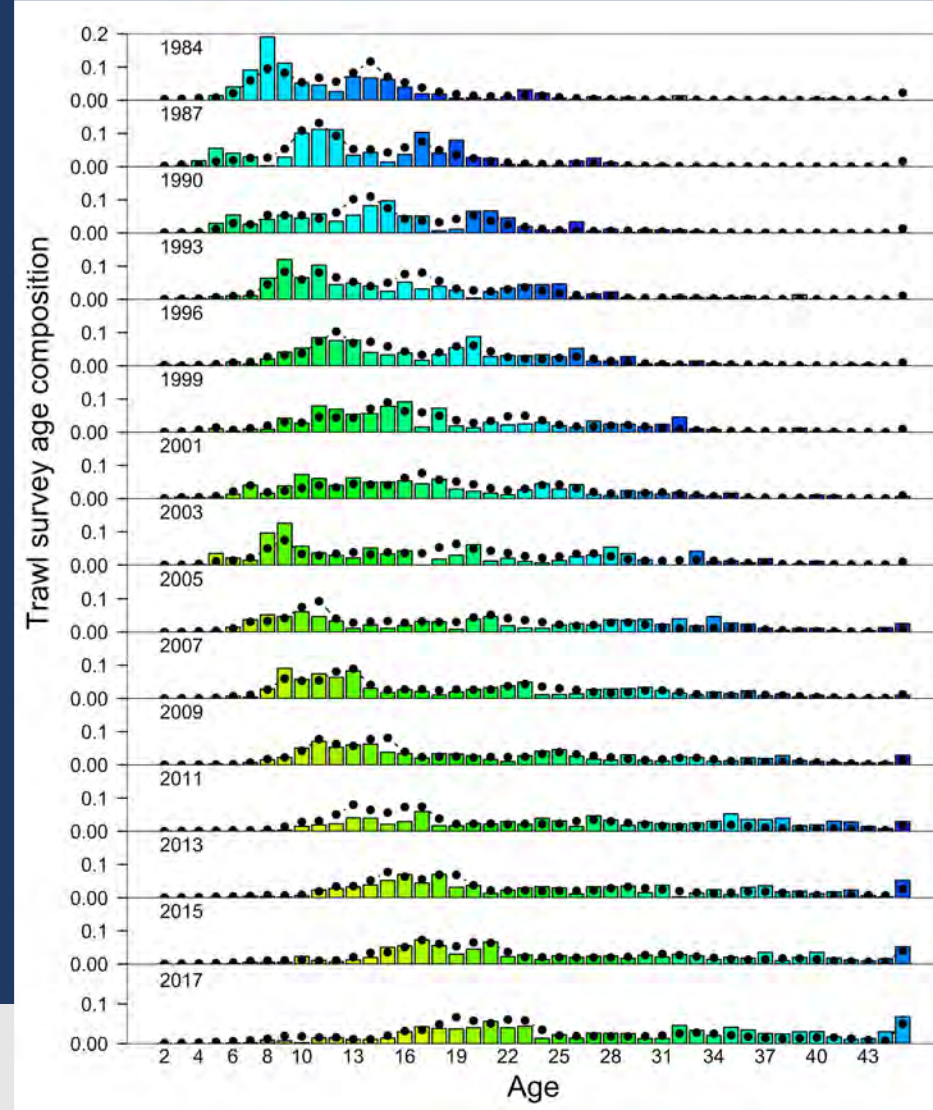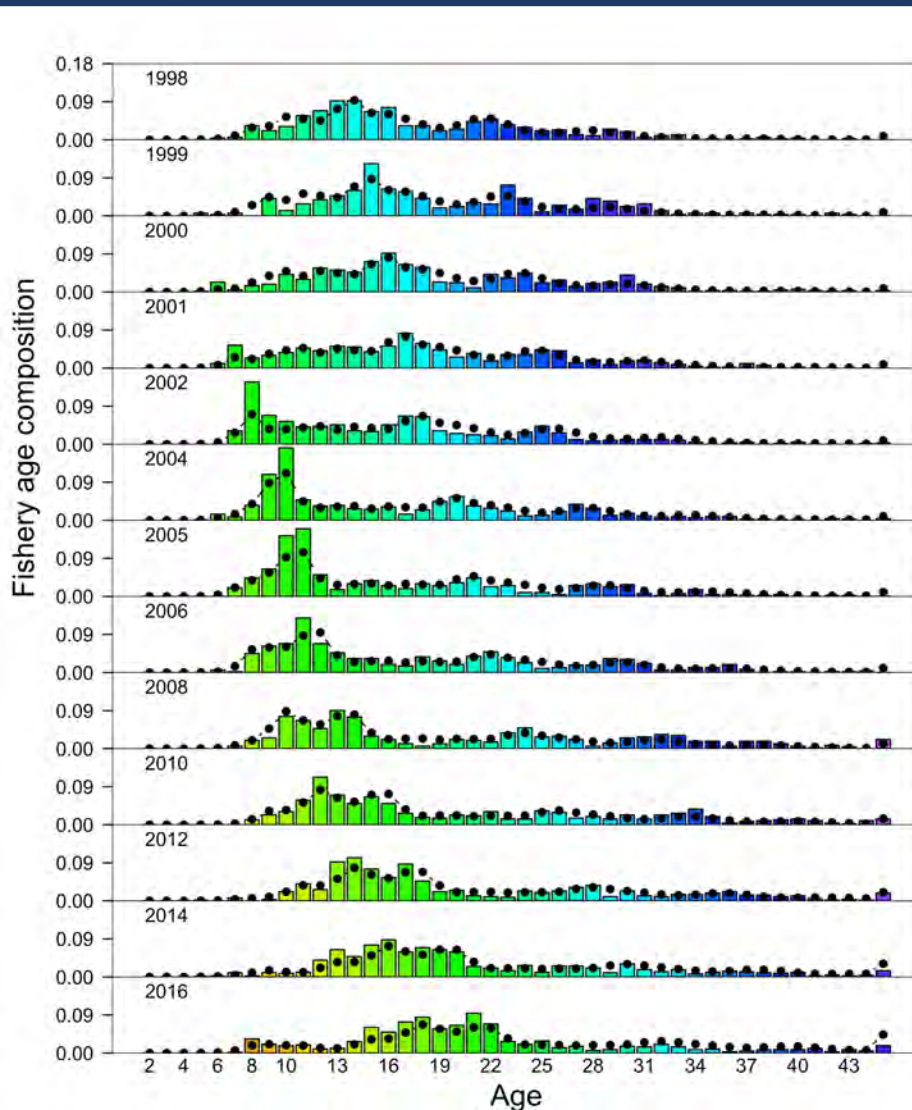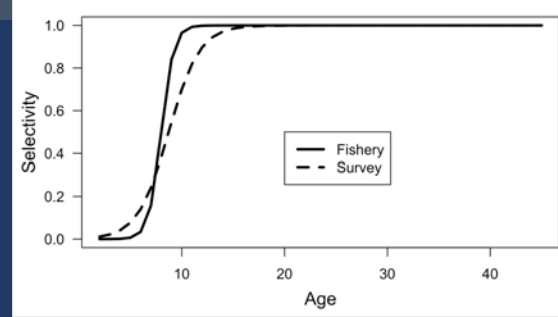
Model 18.2 Plan Team Summary

| Quantity	As estimated or specified *last* year for: 2018	2019	As estimated or recommended *this* year for: 2019*	2020*
M (natural mortality)	0.059	0.059	0.059	0.059
Tier	3a	3b	3a	3a
Projected total (age 2+) biomass (t)	74,748	73,814	87,409	84,326
Projected Female spawning biomass	28,017	26,512	36,365	34,046
$B_{100\%}$	69,957	69,957	76,199	76,199
$B_{40\%}$	27,983	27,983	30,480	30,480
$B_{35\%}$	24,485	24,485	26,670	26,670
F_{OFL}	0.074	0.070	0.073	0.073
$maxF_{ABC}$	0.062	0.058	0.061	0.061
F_{ABC}	0.062	0.058	0.061	0.061
OFL (t)	4,380	3,984	**5,402**	5,093
maxABC (t)	3,685	3,350	4,529	4,270
ABC (t)	3,685	3,350	**4,529**	**4,270**
Status	As determined *last* year for: 2016	2017	As determined *this* year for: 2017	2018
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

Catch / 6+ Biomass
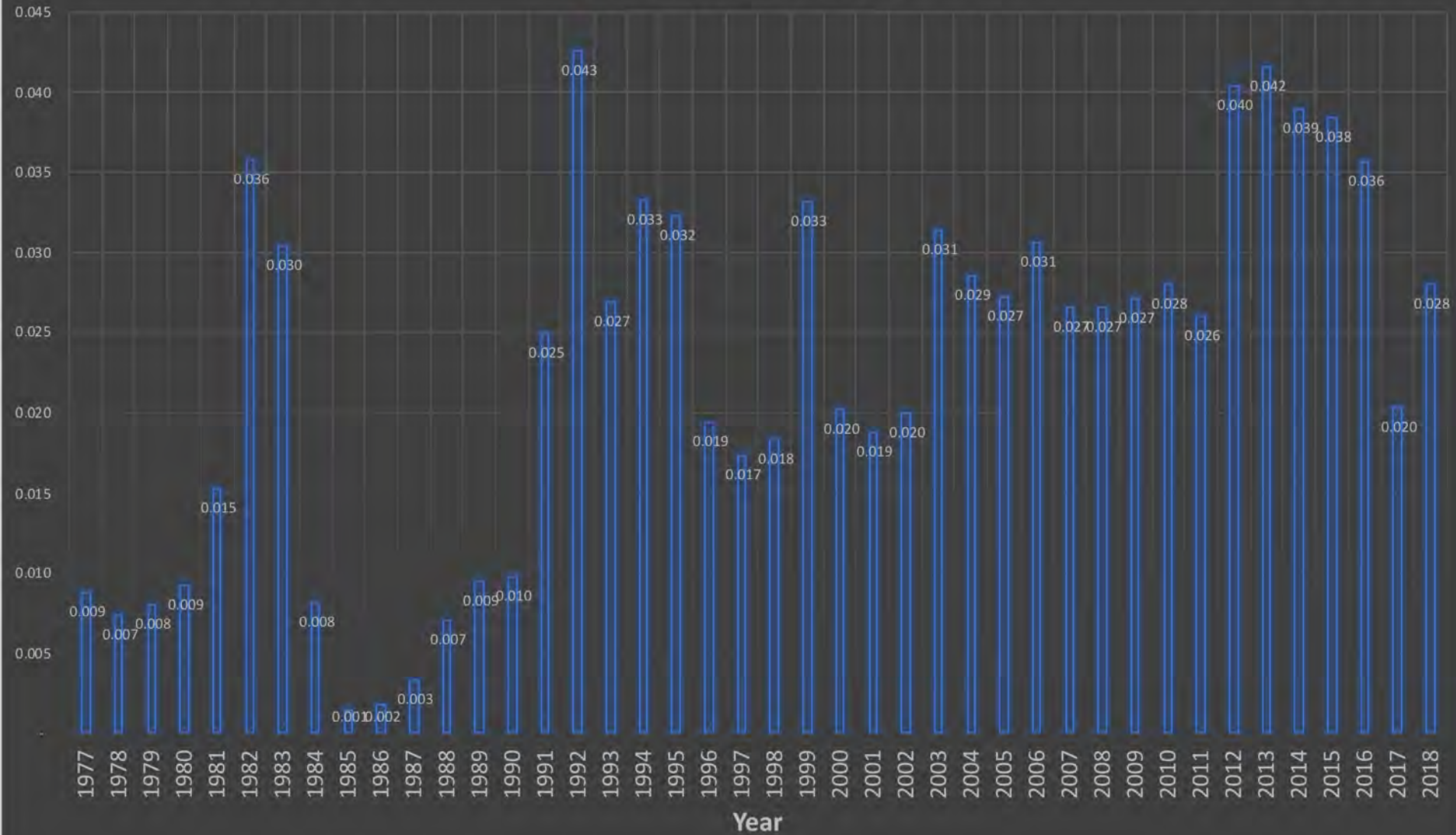
Apportionment (Design-based Index)

- *Increase* in WGOA
  - 26.3%
  - 2015: 11.4%
- *Decrease* in CGOA
  - 73.7%
  - 2015: 88.5%
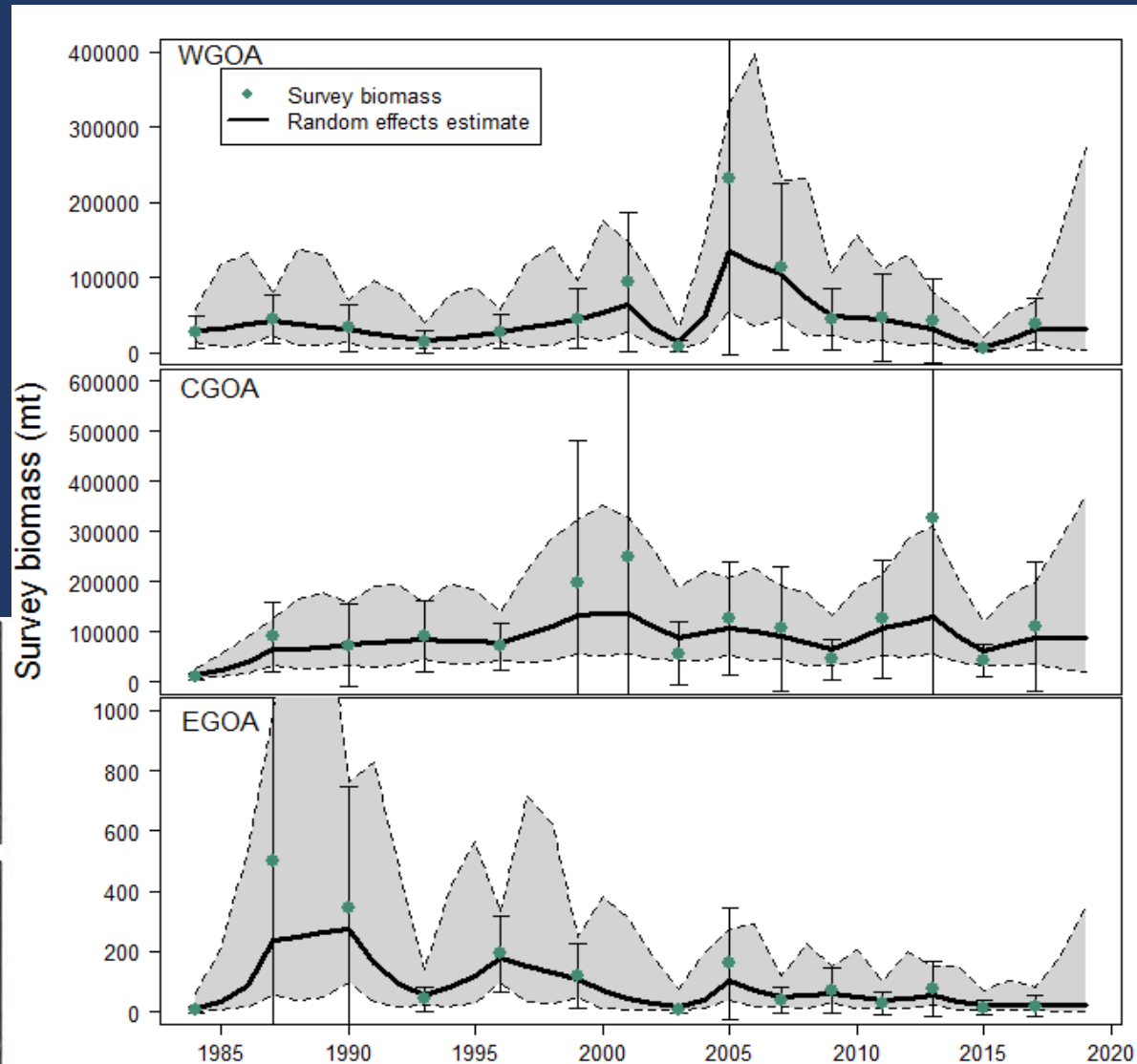
Suggestions from Internal Reviewer (J. Thorson)

- Investigate model-based data weighting out of cycle
  - Estimate variance inflation factor for survey index, in place of data re-weighting
  - Probability-based re-weighting of comps
    - Bootstrap or est. input SS
    - Use DM or other method to estimate SS within model
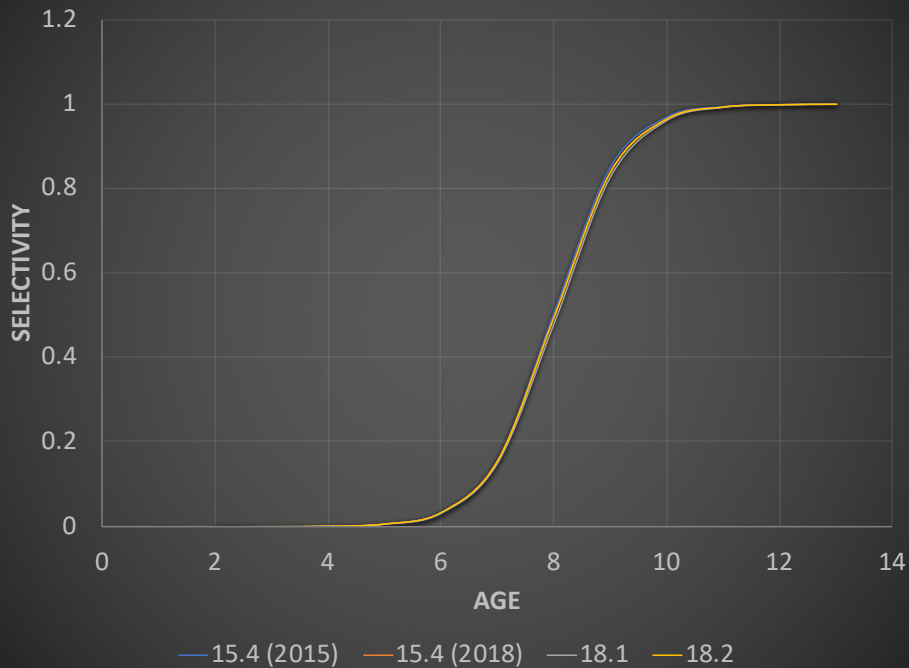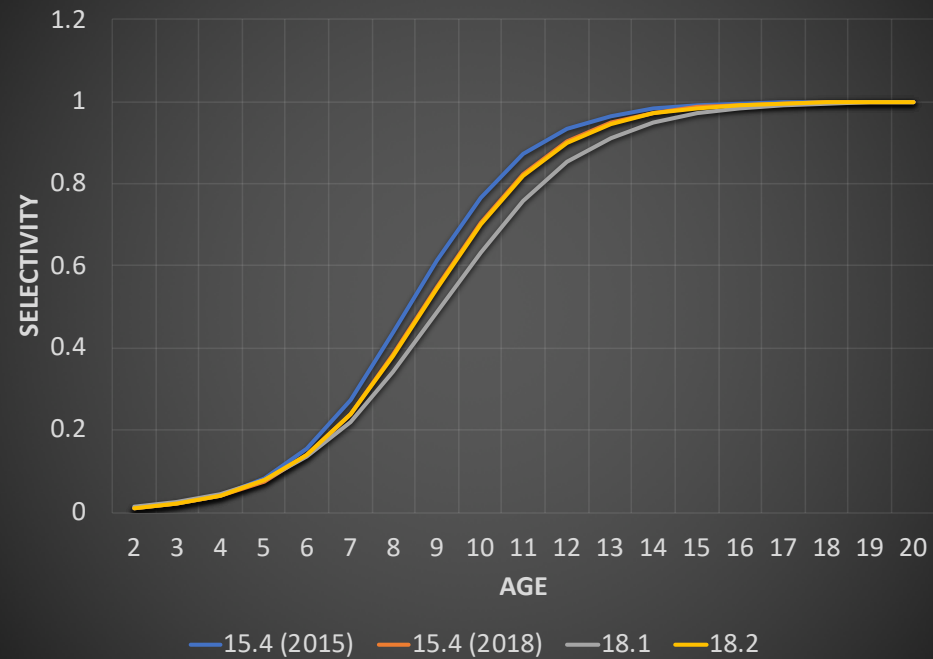 - Adding PE to selex to account for down-weighting of compositions

Extra Slides

Status and Spawning Biomass

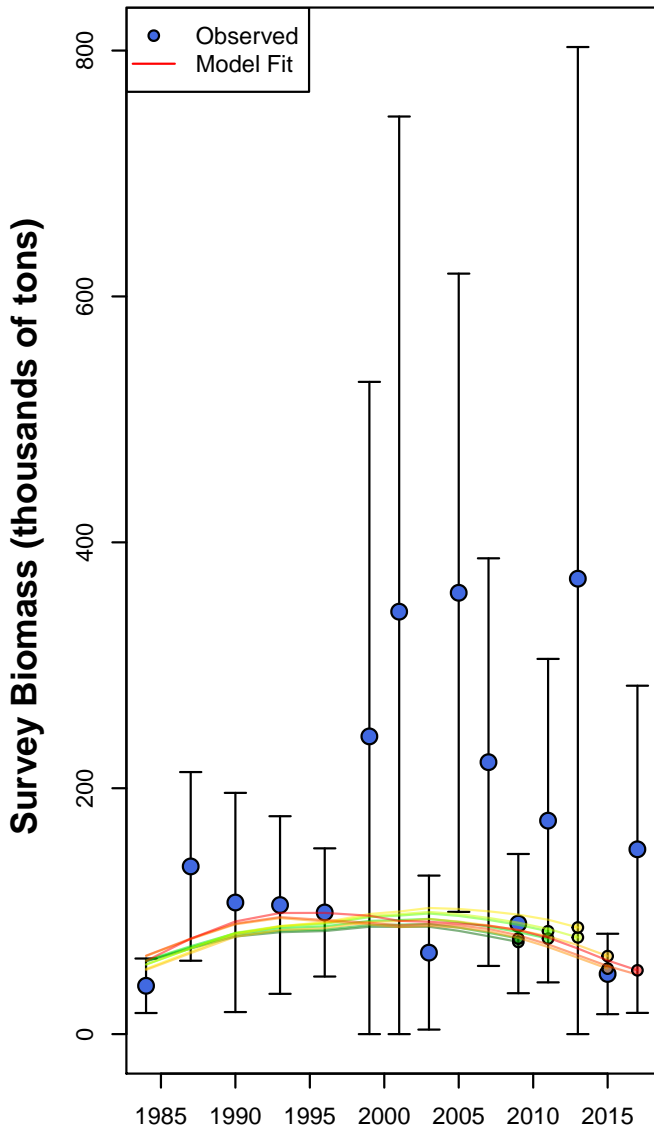
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Selectivity

Fishery

Survey

Fishery Selectivity — SELECTIVITY vs AGE; legend: 15.4 (2015), 15.4 (2018), 18.1, 18.2

Survey Selectivity — SELECTIVITY vs AGE; legend: 15.4 (2015), 15.4 (2018), 18.1, 18.2

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Retrospective: Survey Fit
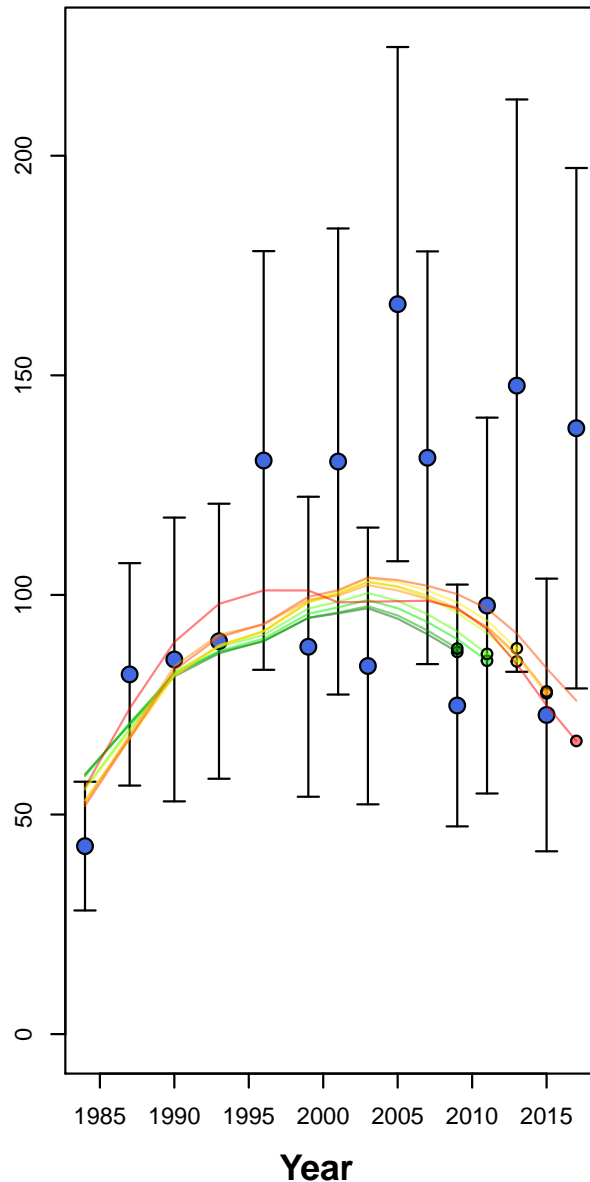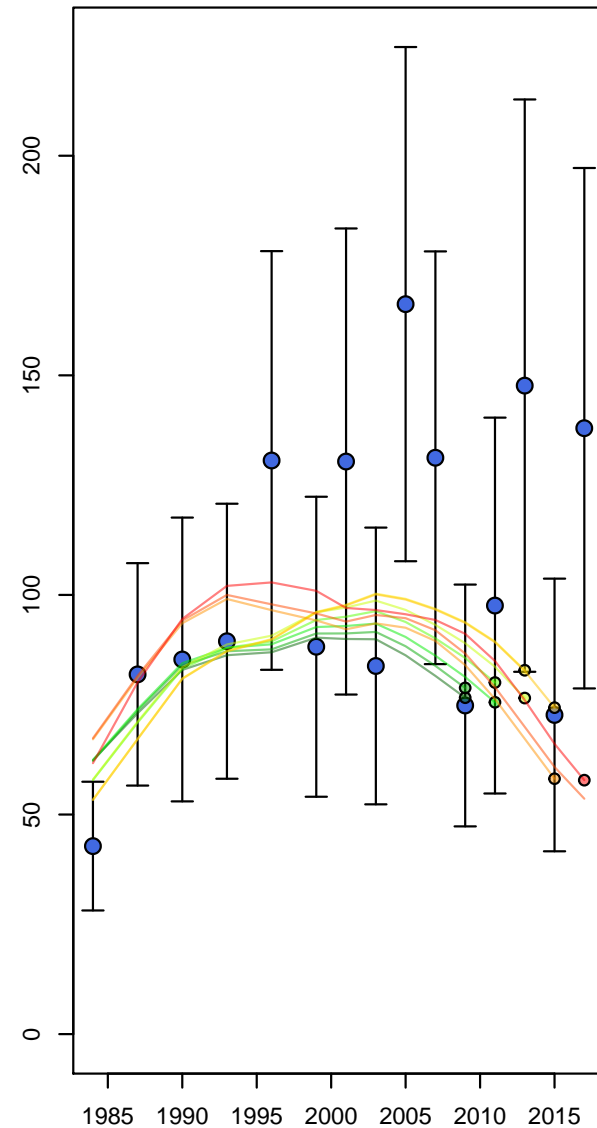
Length Compositions

Fishery

Survey

VAST Model-based Survey Index