BSAI Flathead Sole Complex

Cole Monnahan & Rebecca Haehn

November 2020 Plan Team

Brief intro & background

- Tier 3a model, full assessment even years
- Complex comprises flathead sole and Bering flounder (~0.2% catch)
- Caught by non-pelagic trawl primarily, but ~15-30% from pelagic trawl
- The model is very stable and consistent among variants with low retrospective bias

Model Structure

- Sex- and age-structured stock synthesis v3.30 (ages 3-21+)
- Sex-specific selectivity:
  - Fishery: length, dome-shaped, blocks
  - Survey: age, logistic
- Sex-specific growth estimated internally using conditional age-at-length data
- Estimated early recruitments for initial age structure
- Francis data weighting used

Model Structure

Parameters estimated outside the model:

- Natural mortality (M=0.2, both sexes)
- σ_R=0.5
- q=1 (**no temperature link**)
- Maturity (50% at 9.7 yrs, 95% at 12.8)
- Ageing error matrix, length-weight relationship
- 1:1 sex ratio

Executive Summary

Projections based on estimated catch:
8,669 t in 2020
11,519 t in 2021
11,519 t in 2022

62,567 t is 8.17% decrease in ABC from 2020

Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2020	2021	2021*	2022*
M (natural mortality rate)	0.2	0.2	0.2	0.2
Tier	3a	3a	3a	3a
Projected biomass (3+) (t)	684,768	692,915	602,497	608,576
Projected SSB (t)	154,195	160,864	150,433	154,906
$B_{100\%}$	212,060	212,060	203,658	203,658
$B_{40\%}$	84,824	84,824	81,463	81,463
$B_{35\%}$	74,221	74,221	71,280	71,280
F_{OFL}	0.47	0.47	0.46	0.46
$maxF_{ABC}$	0.38	0.38	0.37	0.37
F_{ABC}	0.38	0.38	0.37	0.37
OFL (t)	82,810	86,432	75,863	77,763
maxABC (t)	68,134	71,079	62,567	64,119
ABC (t)	68,134	71,079	62,567	64,119

Changes in assessment inputs

- Updated catch biomass (final for 2018 and 2019; 2020 extrapolated catch)
- Fishery ages (2018-2019)
- Fishery lengths (2020)
- 2019 EBS shelf survey biomass & updated linear regression to predict missing AI years
- Survey ages (1999, 2018-2019)
- Survey lengths (2019)

Changes in assessment methodology

- 2018 model included major improvements and exploration based on CIE review.
- Resulting model is very stable and consistent among alternatives.
- 2018 accepted model: **18.2c**
- No new models considered: **18.2c (2020)**

Changes in assessment methodology

***SSC October 2019**: The SSC recommends the authors complete the risk table and note important concerns or issues associated with completing the table.*

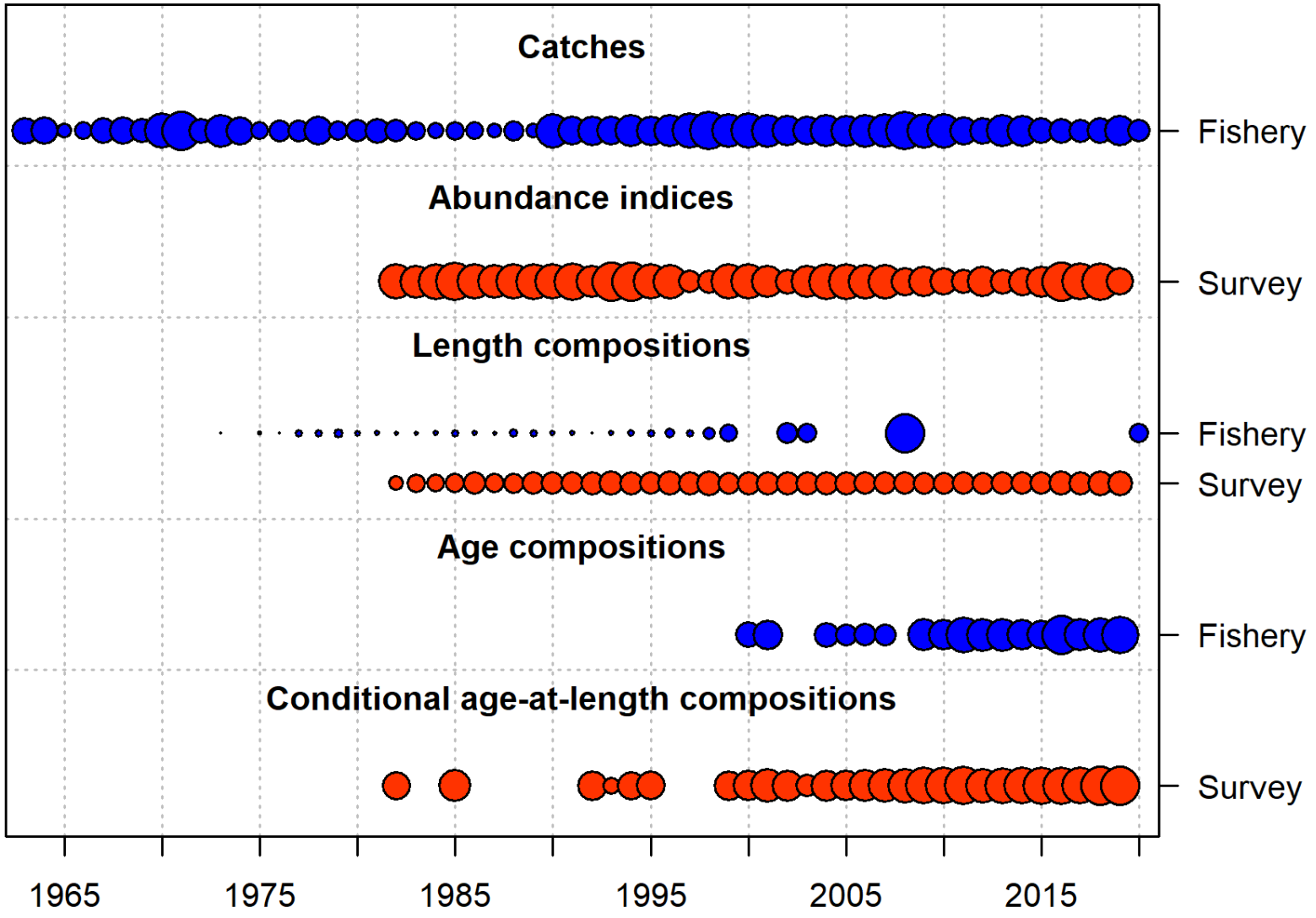
Risk table added, no areas of concern were found (all level 1) so **no reduction from maxABC recommended**

Response to SSC comments

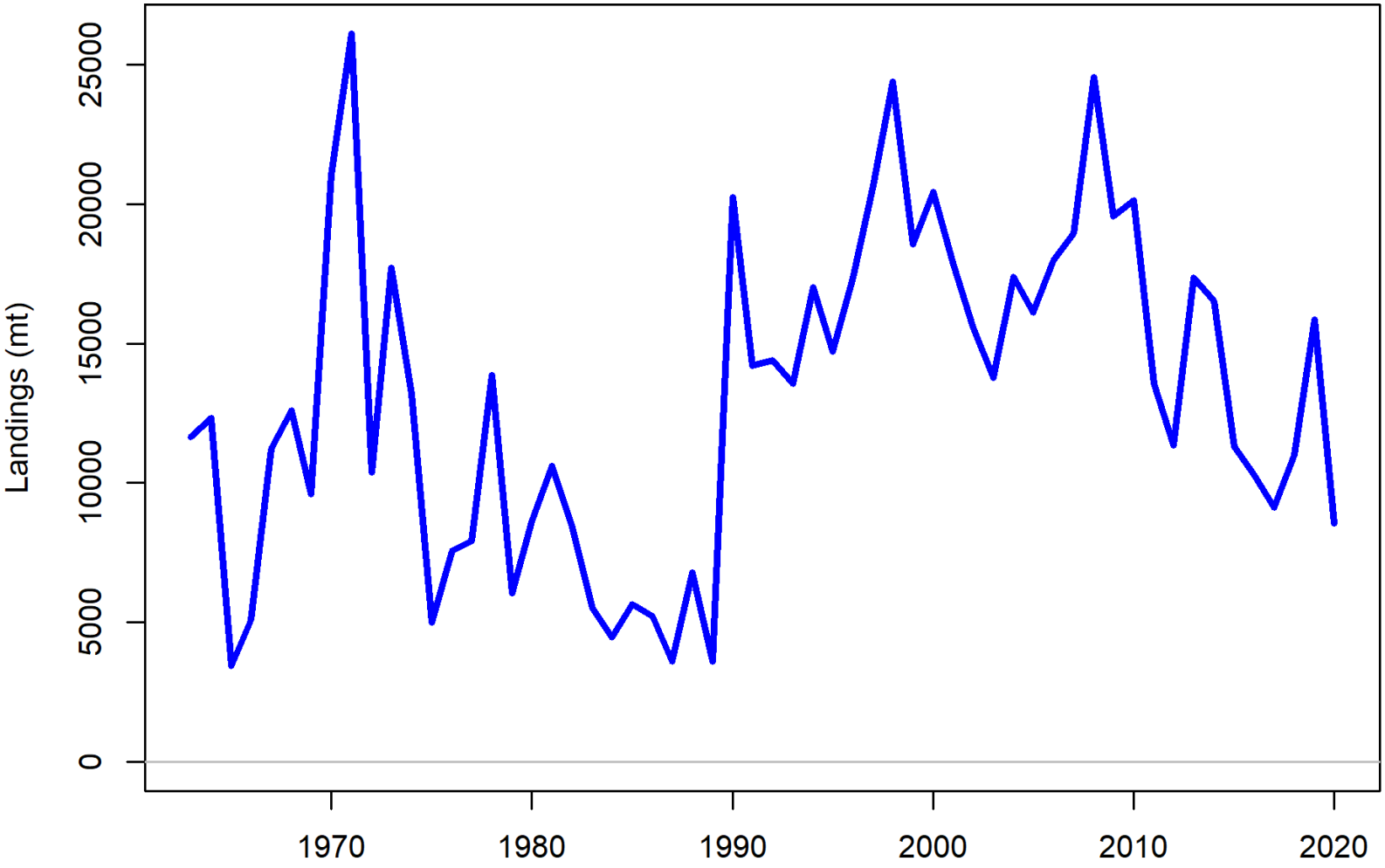
***December 2018 SSC**: The author notes that average summer bottom temperature may not be adequate to describe the relationship among the environmental drivers of flathead sole stock distribution and behavior. The SSC recommends that this continue to be explored.*

- No exploration of environmental drivers were done this year. Using spatially-varying coefficient models in VAST seem promising alternative

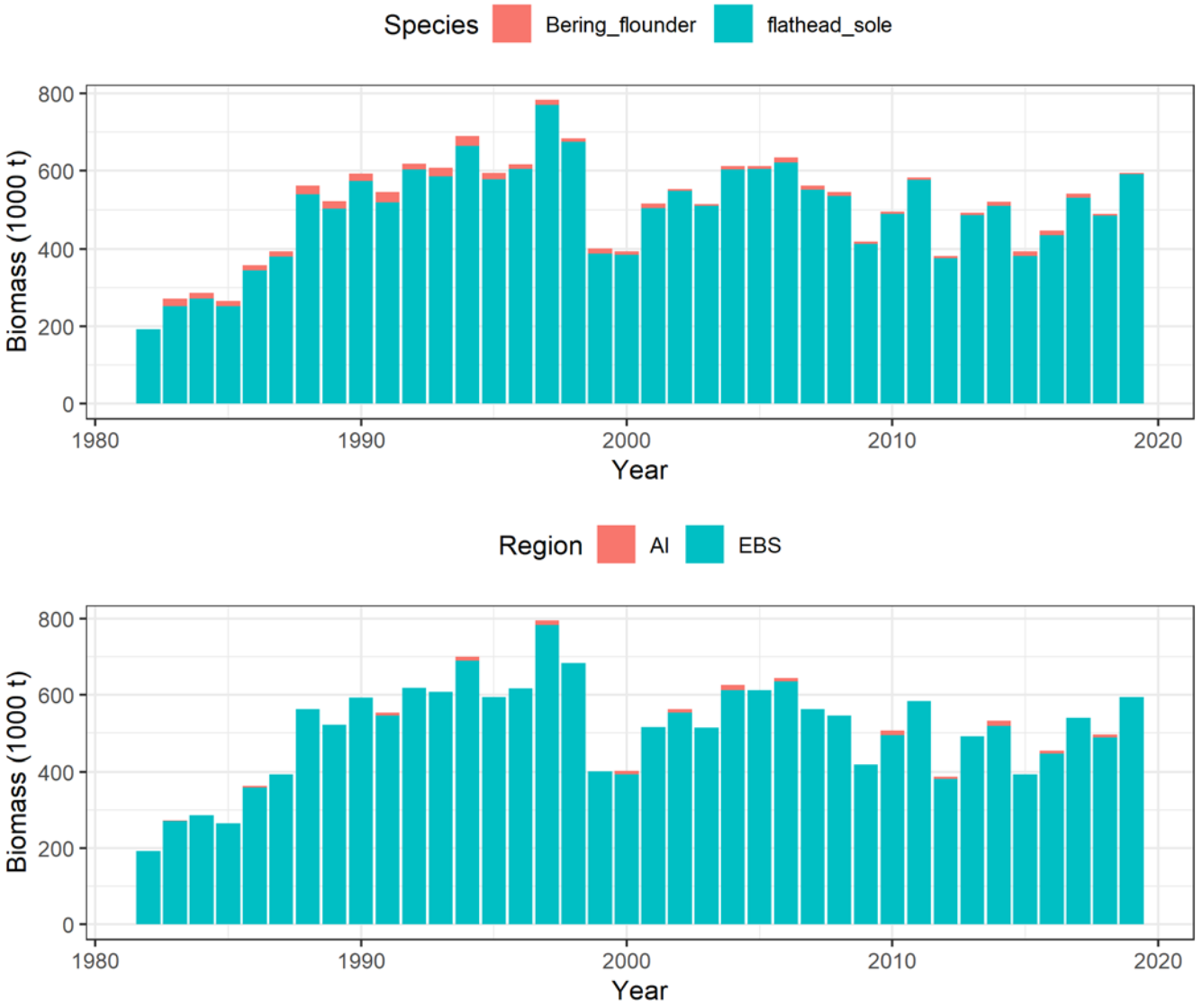
Data inputs


Catches
Fishery
Abundance indices
Survey
Length compositions
Fishery
Survey
Age compositions
Fishery
Conditional age-at-length compositions
Survey
1965
1975
1985
1995
2005
2015

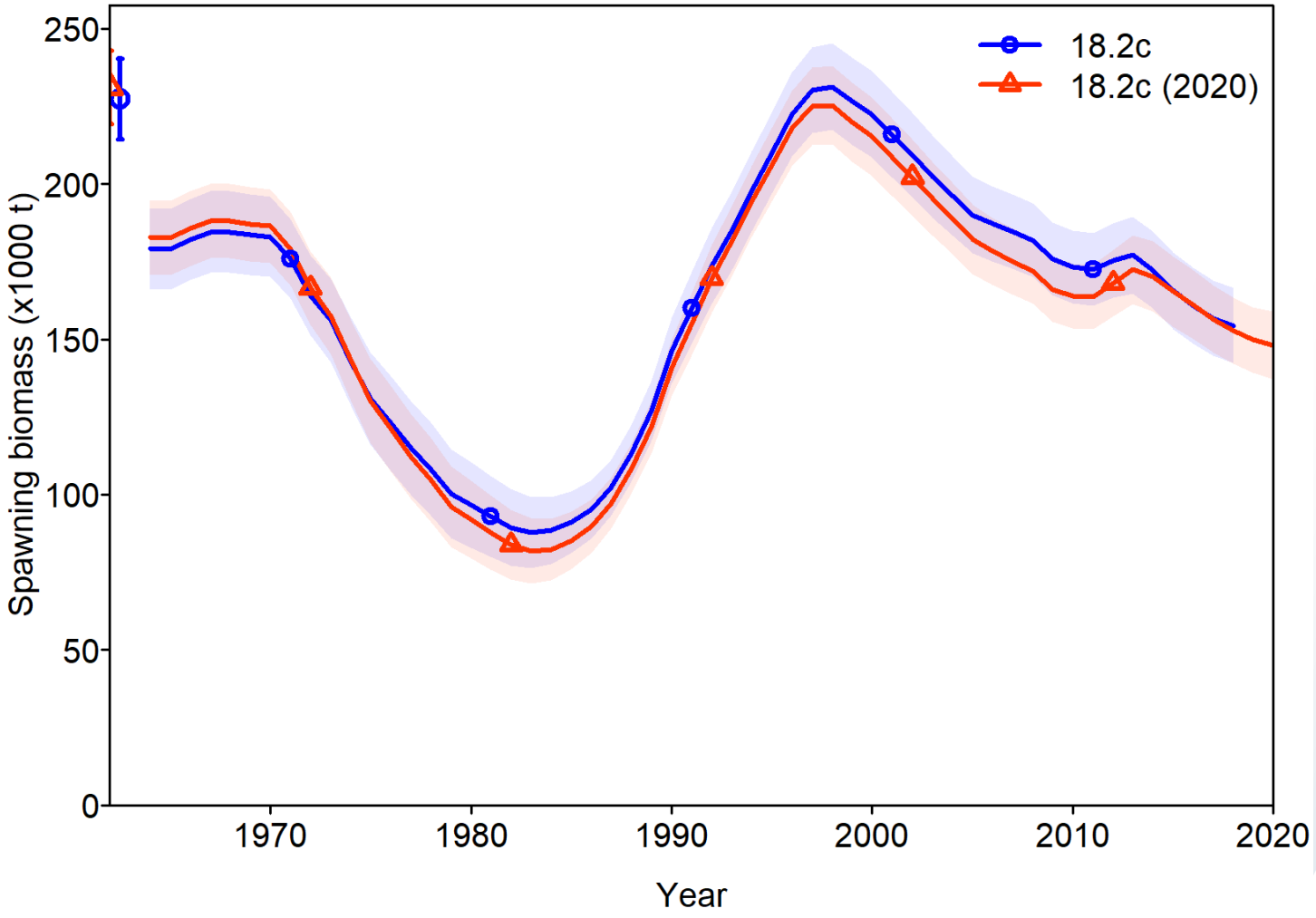
Data inputs: catch history



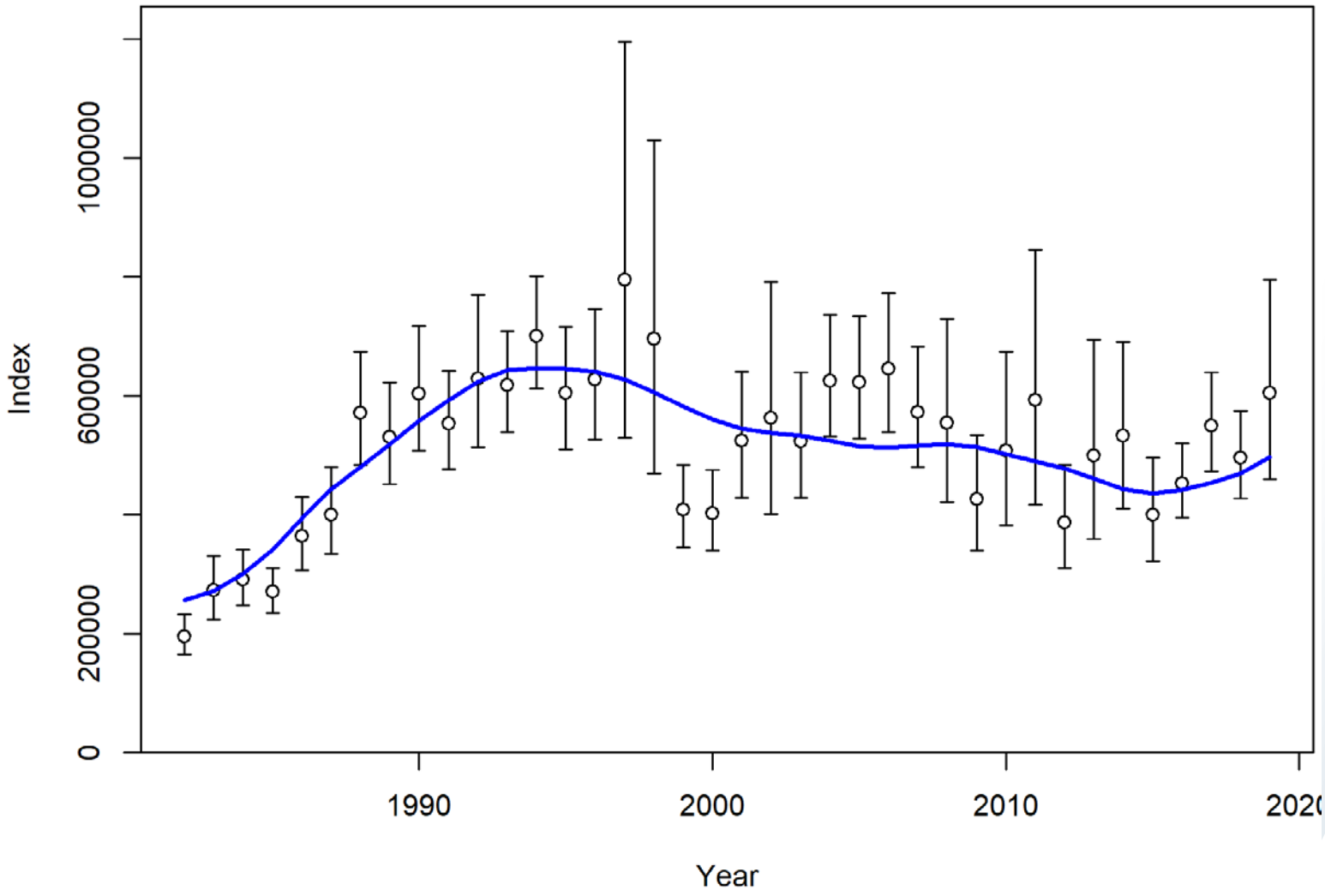
Catch distribution



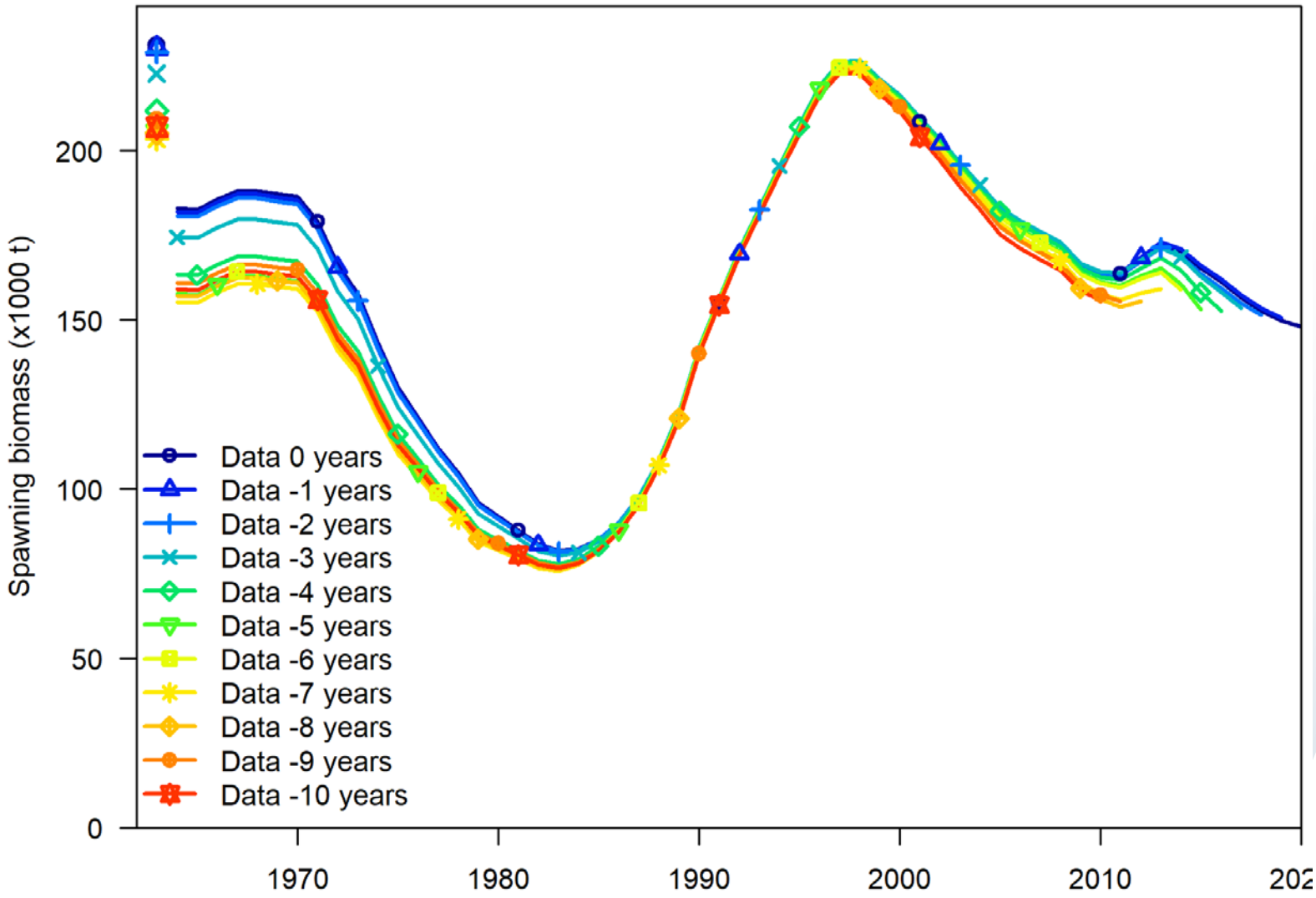
Stable SSB trends



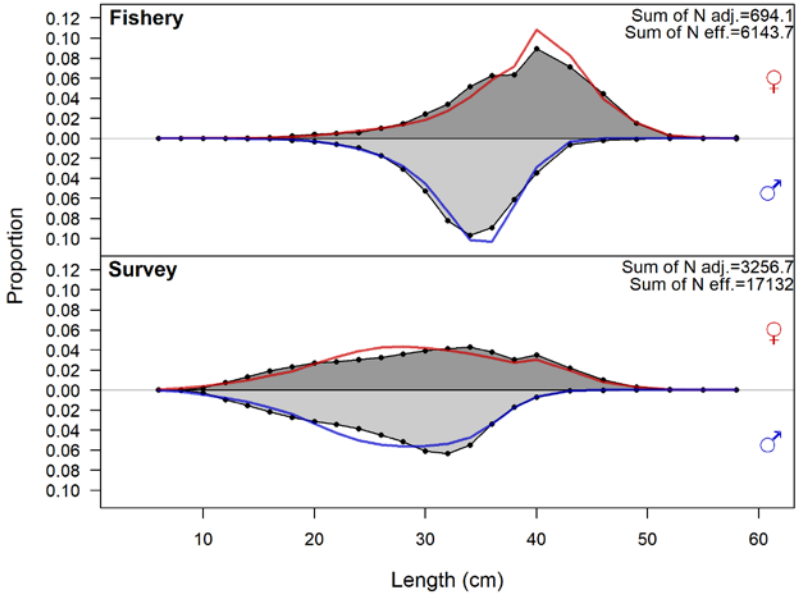
Good fit to index

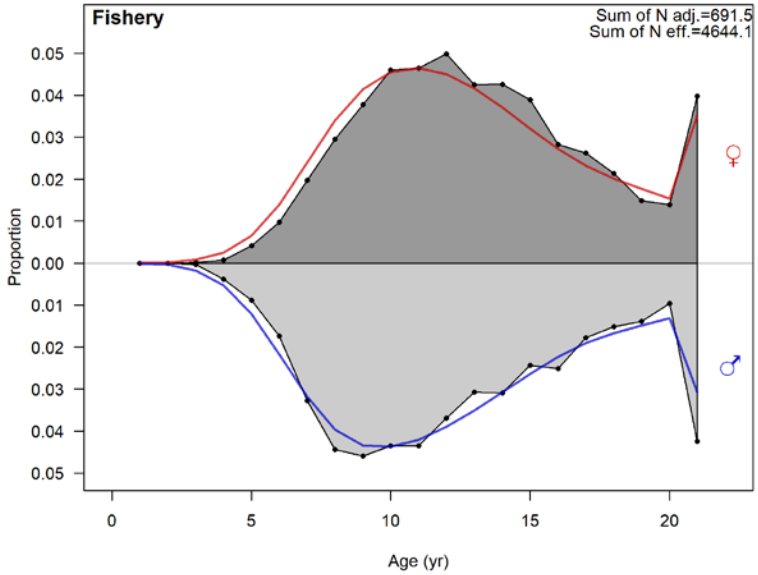


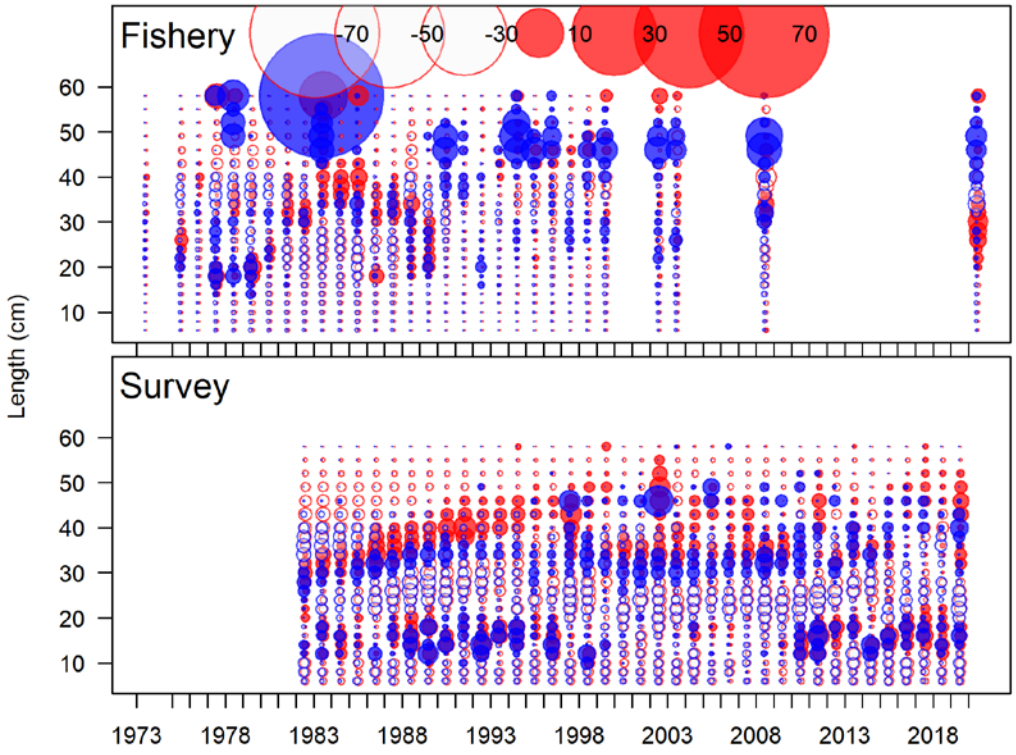
Good retrospective patterns

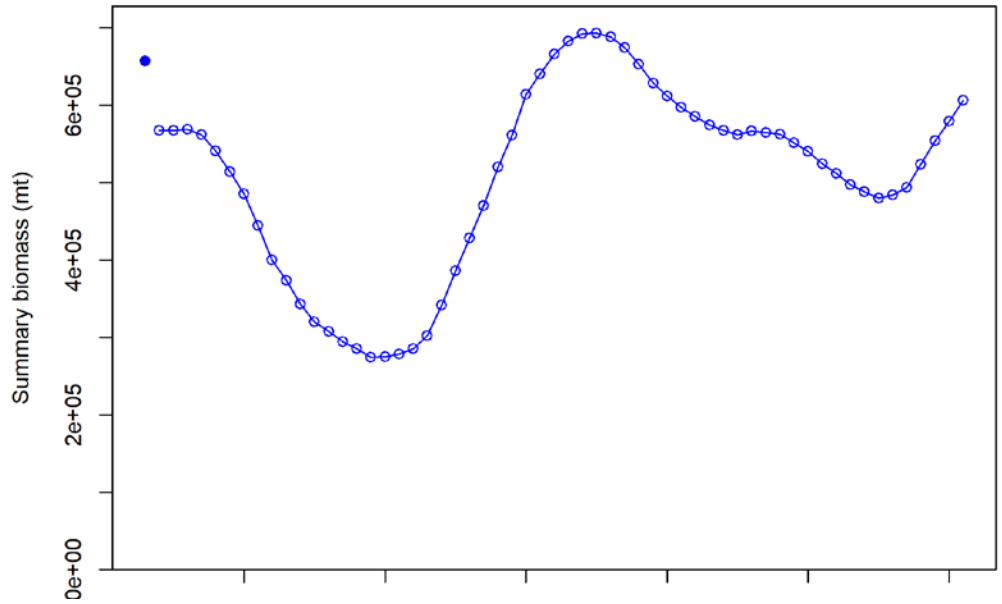


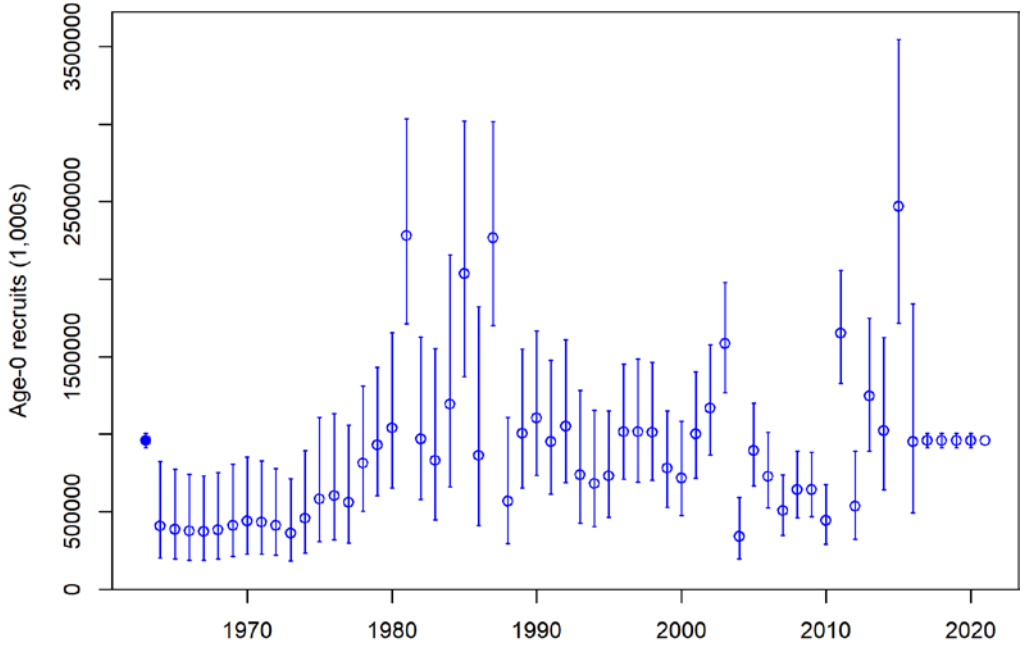
Pretty good composition fits







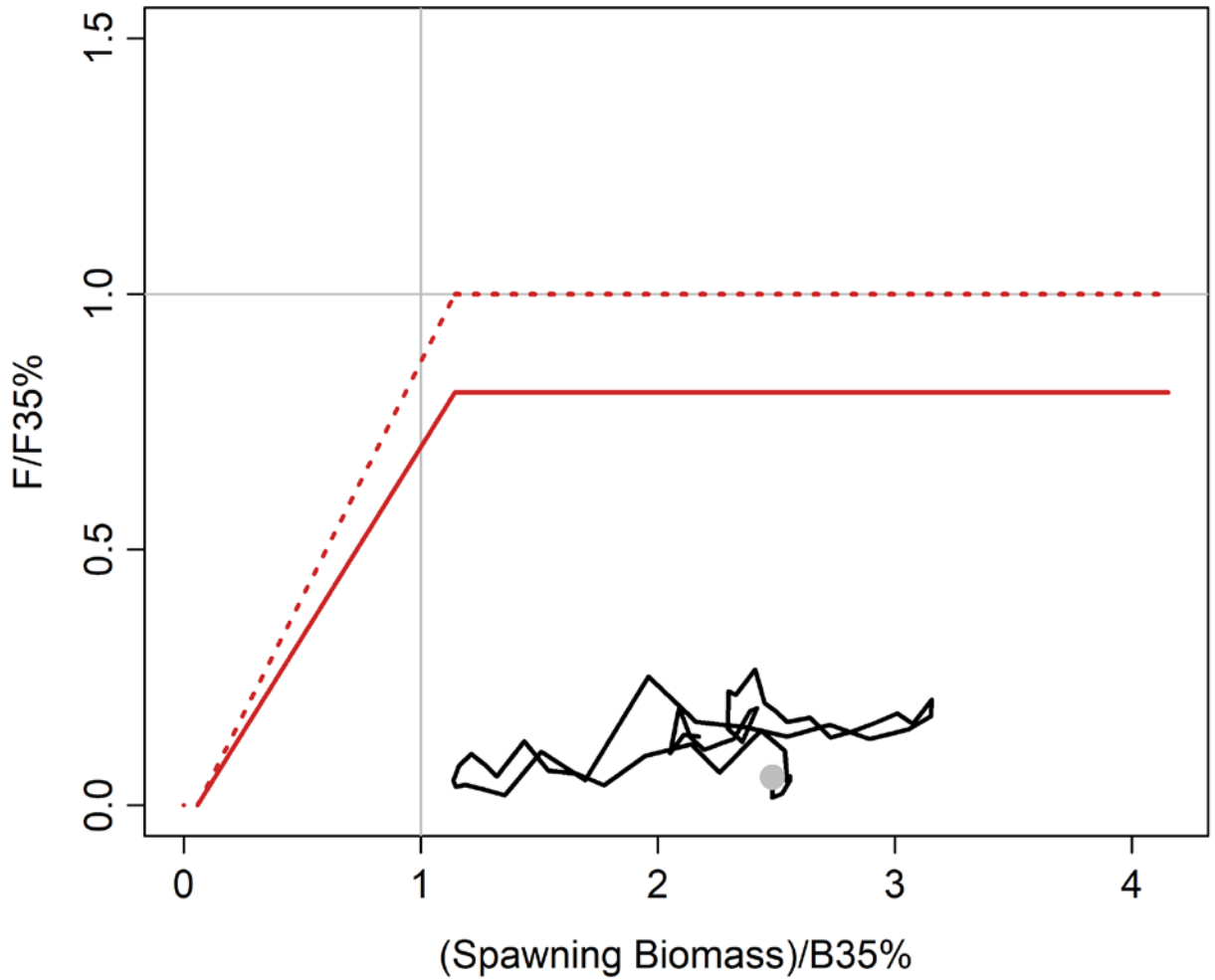




Total biomass (age 3+) is increasing due to recent large recruitments

Have not matured so SSB declining but projected to increase w/ similar catches

Status trends



Risk table

- Model fits well, consistently above target biomass
- Data suggest no apparent ecosystem concerns, although predation pressure may be rising (E. Siddon)
- No ESP, but catches fraction of ABC (~16%)

Assessment-related considerations	*Population dynamics considerations*	*Environmental/ ecosystem considerations*	*Fishery Performance considerations*
Level 1: no increased concerns	Level 1: no increased concerns	Level 1: no increased concerns	Level 1: no increased concerns

Future work

- Explore estimation of natural mortality (& catchability?)
- Revisit temperature/catchability relationship using VAST, which would allow for more sophisticated relationships (e.g., spatially-varying cold pool effect)
- Split pelagic trawl fishery off and estimate separate selectivity
- Use VAST to estimate BS & AI joint index, replacing the linear regression approach used

Questions? Discussion?

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