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# Evaluating the impact of a lack of recent survey data in Alaska Fisheries Science Center groundfish and crab stock assessment models

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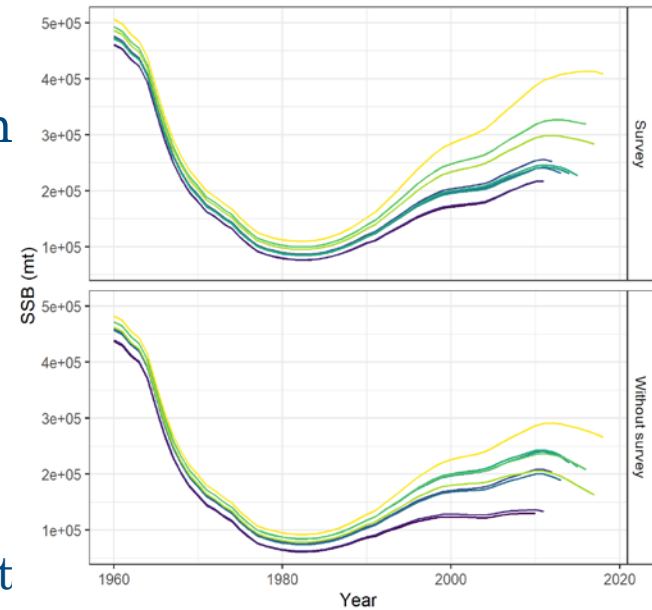
Alaska Fisheries Science Center  
Resource Ecology and Fisheries Management Division  
Status of Stocks and Multispecies Assessments

# Objectives

- Better understand the expected uncertainty with the loss of the most recent survey data for a number of groundfish and crab species
- Identify species that would be more sensitive to the loss of data

# Analysis

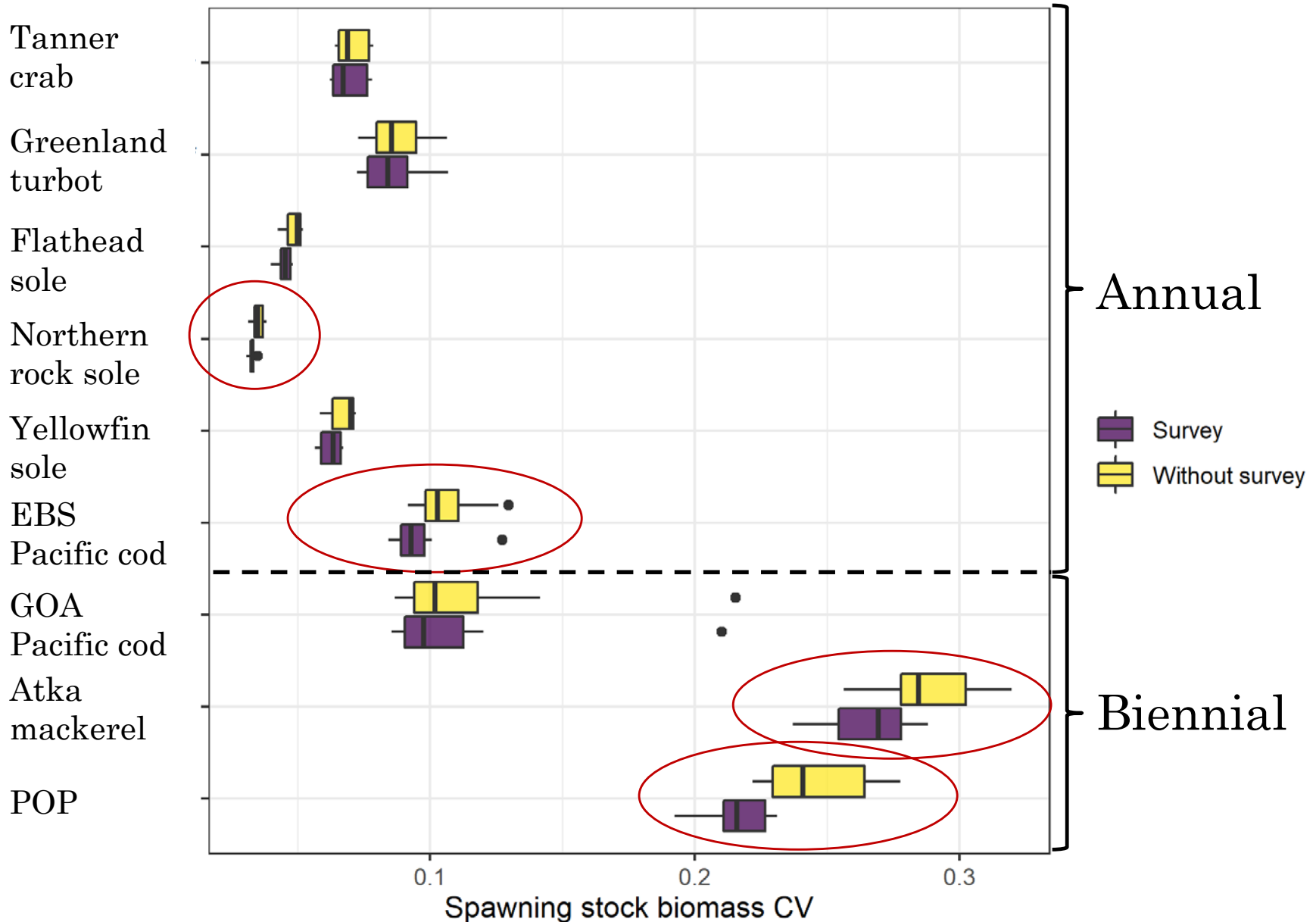
- Standard retrospective
  - Measures consistency of model when new data are available
- Retrospective missing most recent survey data
  - Survey data were down-weighted
    - CV of survey biomass increased
    - Input sample size of composition data lowered
  - Biennial surveys – most recent survey removed even it was the year before the terminal year



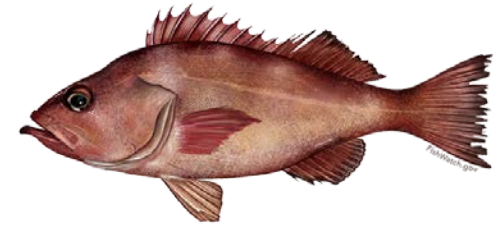
# Statistics

- Model estimated CV
- Mohn's rho ( $\rho$ ) – average relative bias
  - $\rho = \left( \frac{X_{Y-p} - X_{Y-p,full}}{X_{Y-p,full}} \right)$ , where
    - $X$  – quantity of interest,  $Y$  - terminal year,  $p$  – peel,  $full$  – model with full time series
- Ralston sigma (Ralston et al. 2011 )
  - $\sigma_{Ralston} = \sqrt{\frac{1}{\sum_{p=1}^P p-1} \sum_y (\ln[X_{Y-p,i}] - \ln[X_{Y-p,ref} ])^2}$ , where
    - $ref$  - last assessment model
- Additional variance
  - $\sigma^2 = \frac{\sum_{y=0}^Y \left( \frac{X_{no survey,y} - X_y}{X_y} \right)^2}{Y-1}$ , where  $Y$  is the total number of retrospective peels

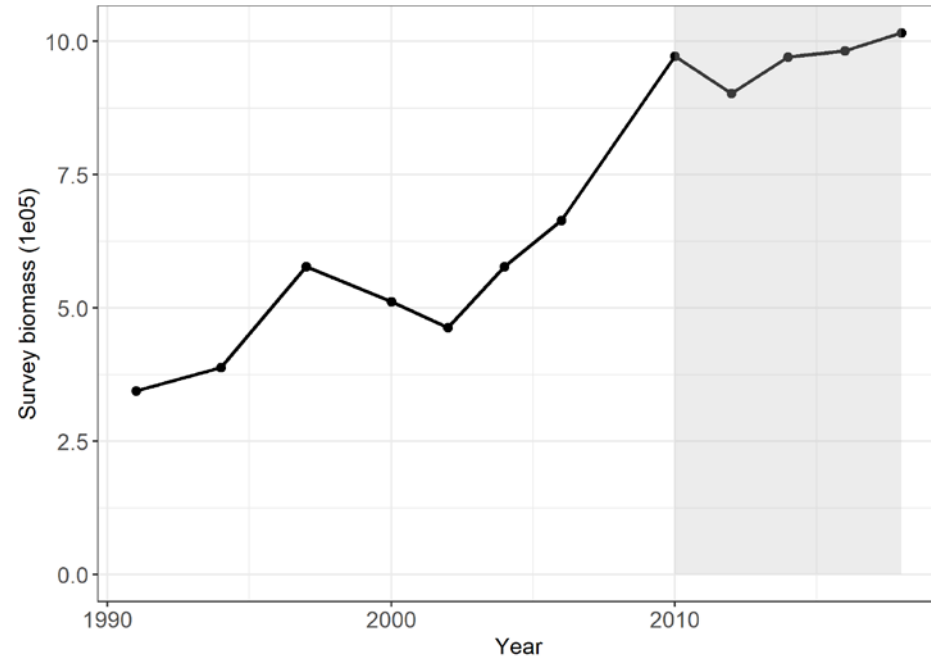
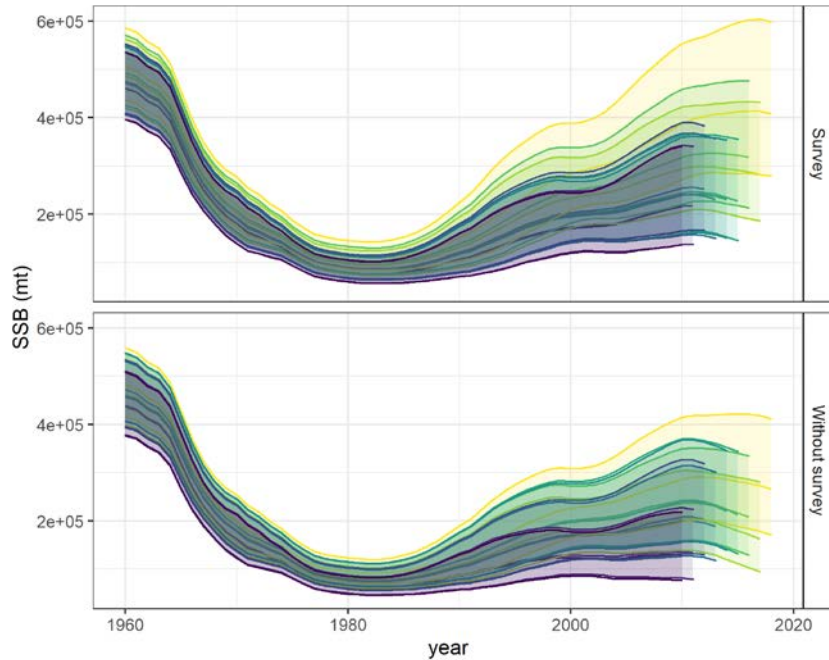
# Model estimated uncertainty



# BSAI Pacific ocean perch

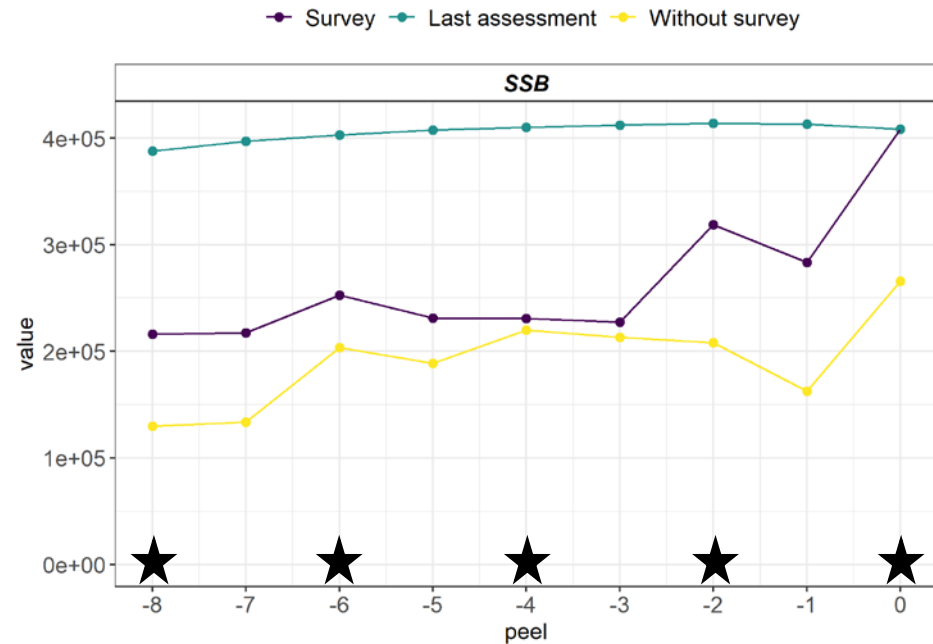
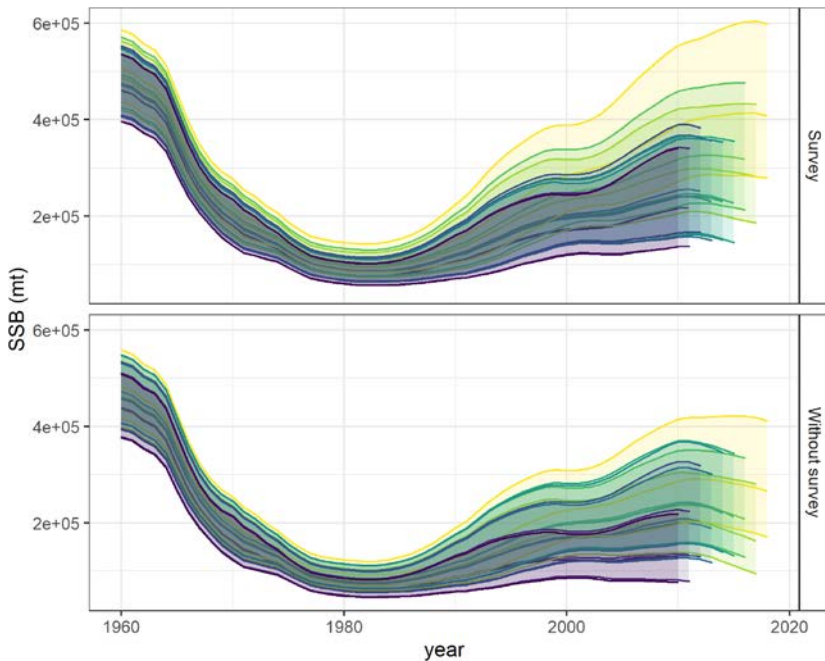


	Mohn's rho ( $\rho$ )	
Species	Survey	No survey
BSAI POP	-0.391	-0.358



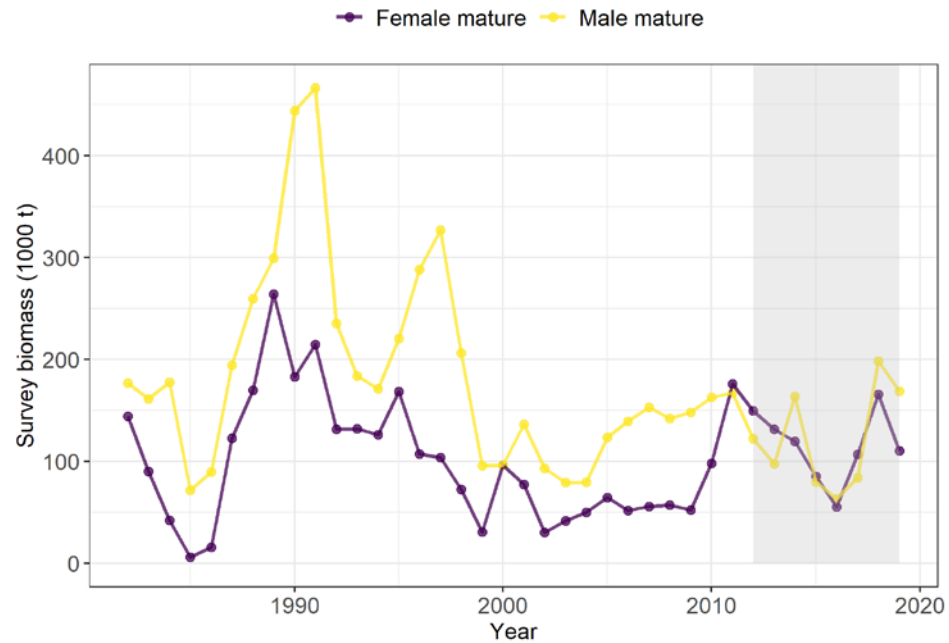
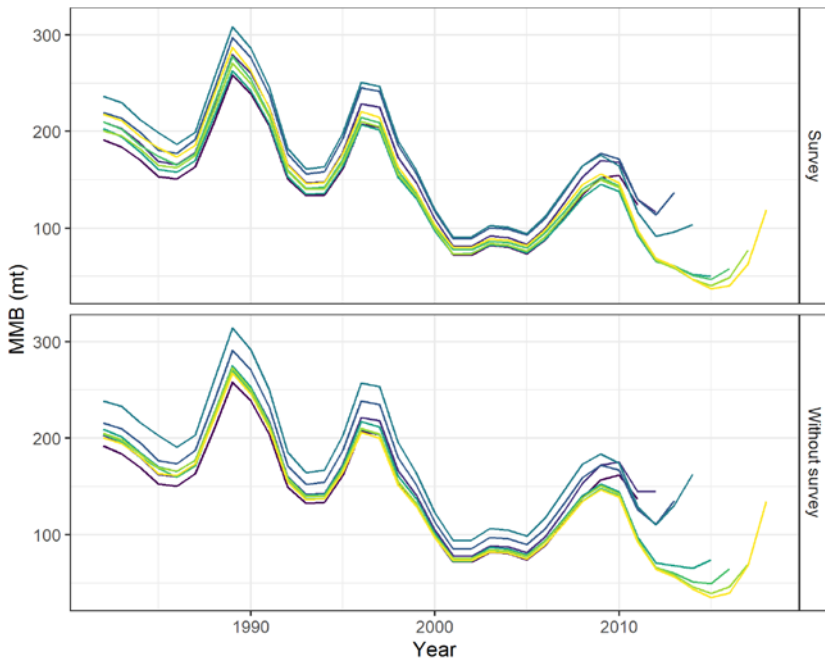
# BSAI Pacific ocean perch

	Mohn's rho ( $\rho$ )		Ralston		Additional $\sigma^2$
Species	Survey	No survey	$\sigma$ Survey	$\sigma$ No survey	
BSAI POP	-0.391	-0.358	0.487	0.789	0.101



# EBS snow crab

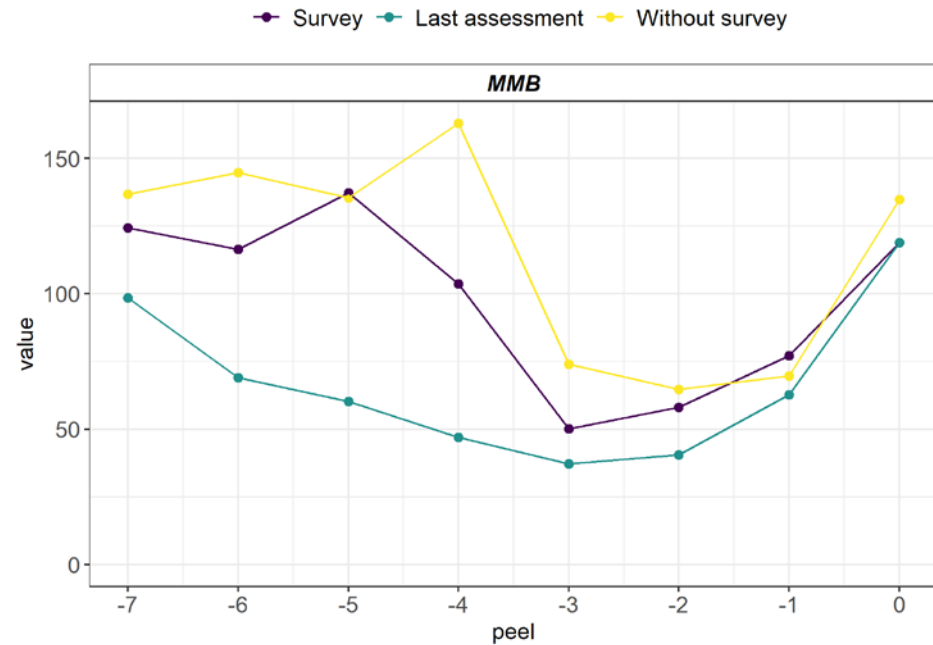
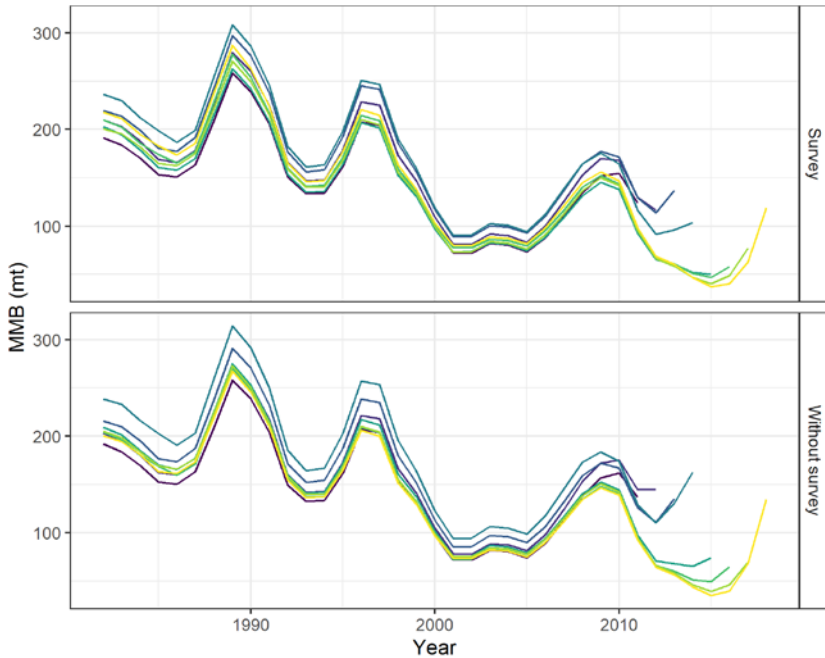
	Mohn's rho ( $\rho$ )	
Species	Survey	No survey
EBS Snow crab	0.635	1.075



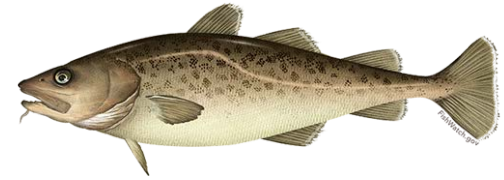


# EBS snow crab

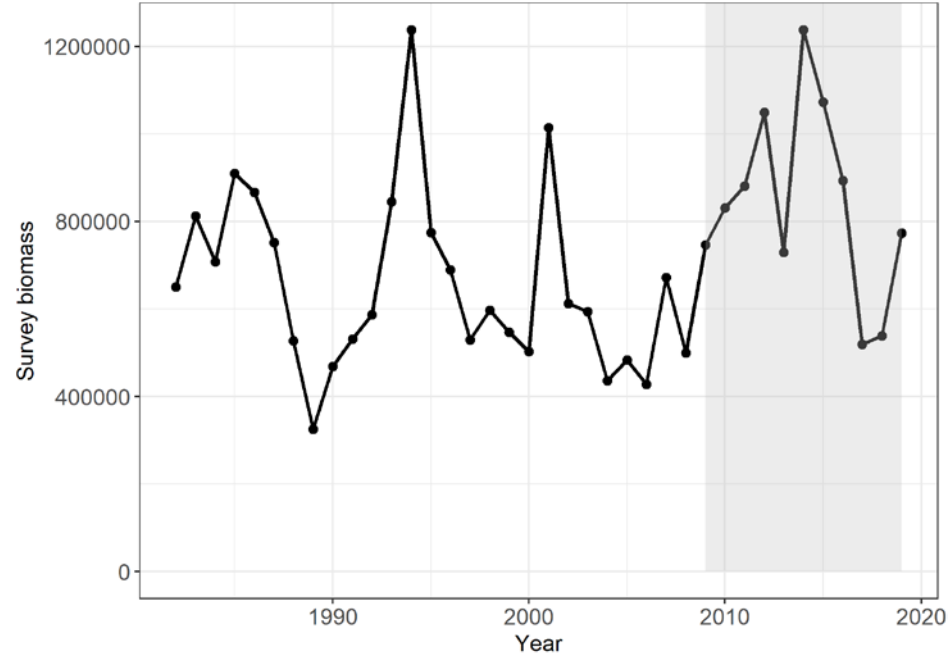
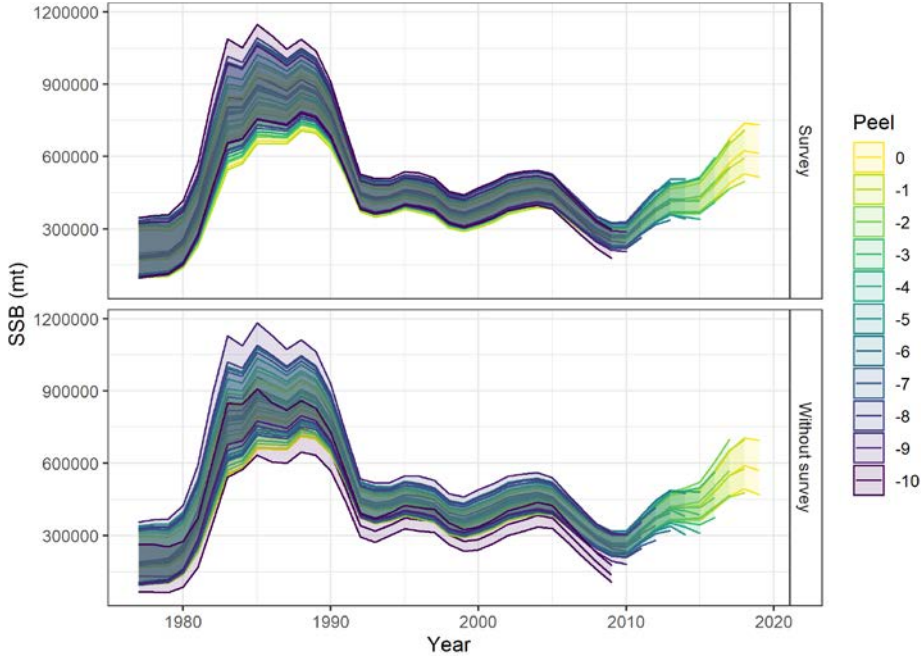
	Mohn's rho ( $\rho$ )		Ralston		Additional $\sigma^2$
Species	Survey	No survey	$\sigma$ Survey	$\sigma$ No survey	
EBS Snow crab	0.635	1.075	0.459	0.629	0.094



# EBS Pacific cod

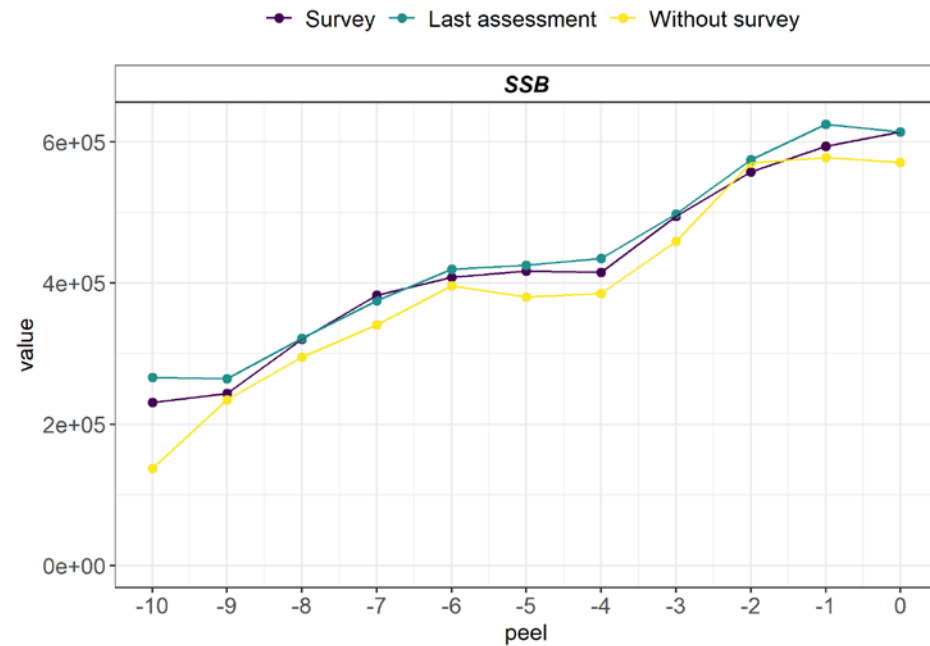
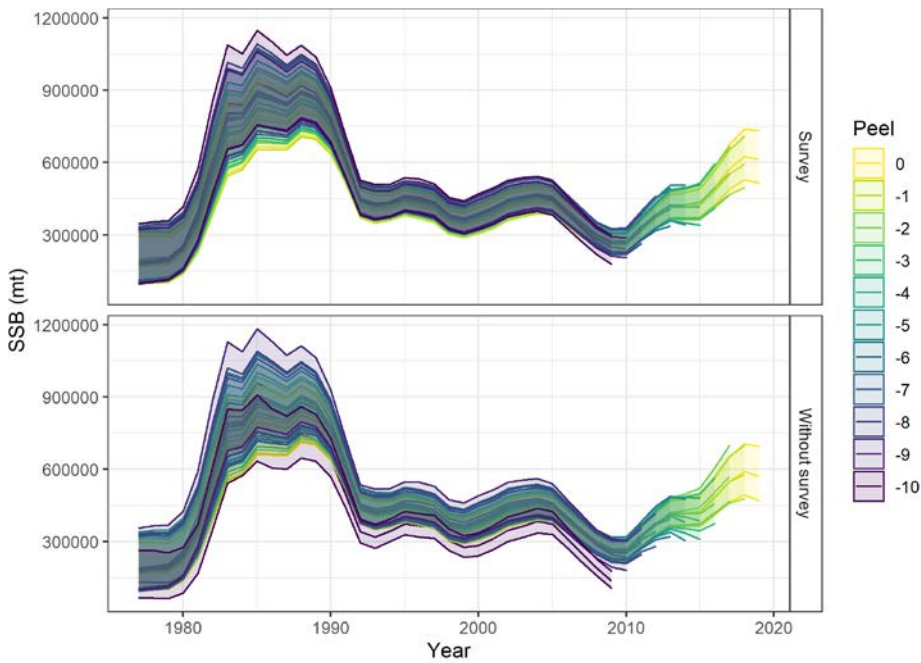


	Mohn's rho ( $\rho$ )	
Species	Survey	No survey
EBS Pacific cod	-0.037	-0.097



# EBS Pacific cod

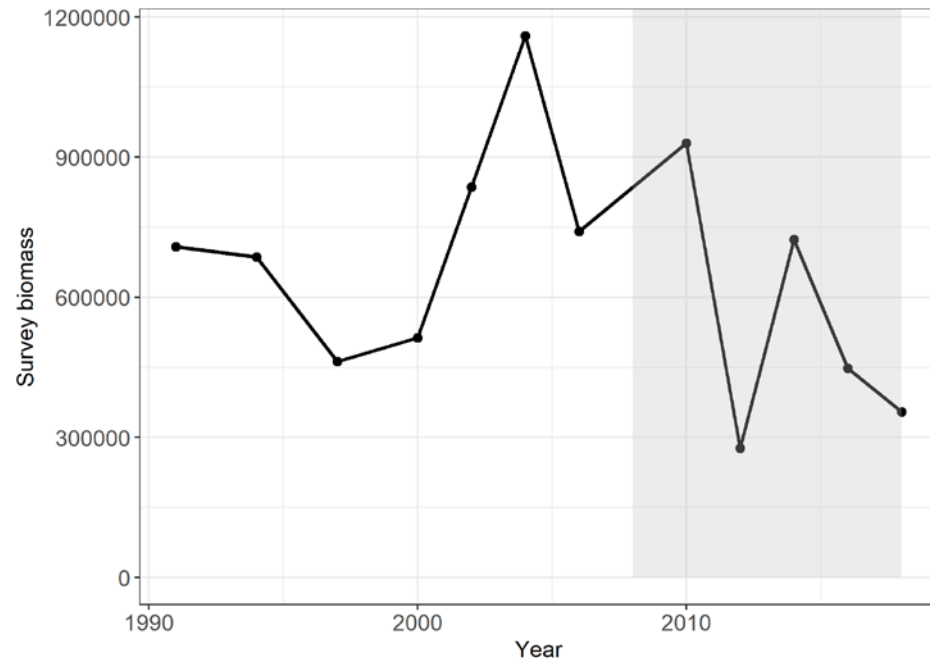
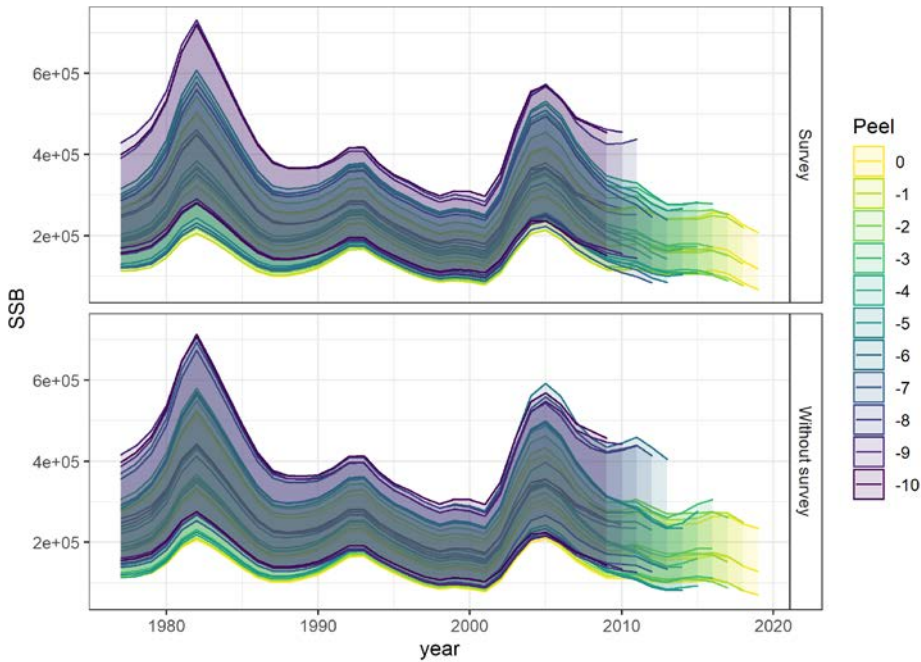
	Mohn's rho ( $\rho$ )		Ralston		Additional $\sigma^2$
Species	Survey	No survey	$\sigma$ Survey	$\sigma$ No survey	
EBS Pacific cod	-0.037	-0.097	0.062	0.238	0.021



# BSAI Atka mackerel

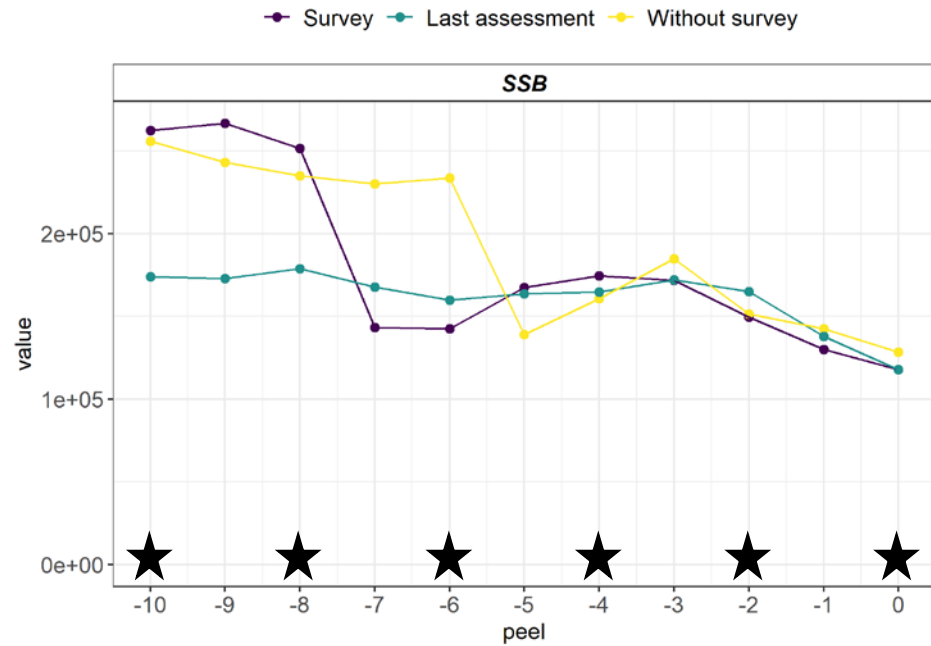
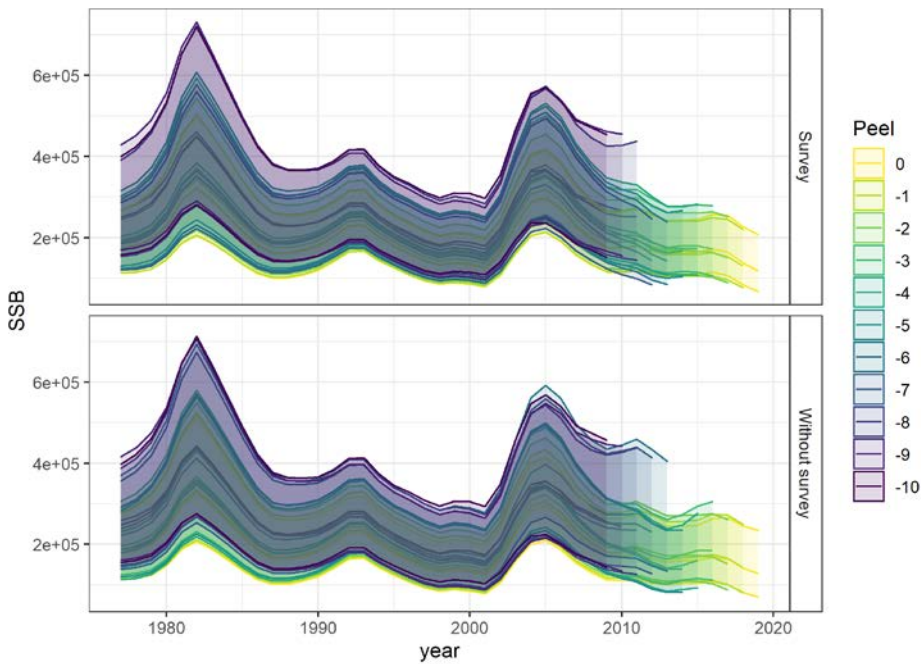


	Mohn's rho ( $\rho$ )	
Species	Survey	No survey
BSAI Atka mackerel	0.114	0.202

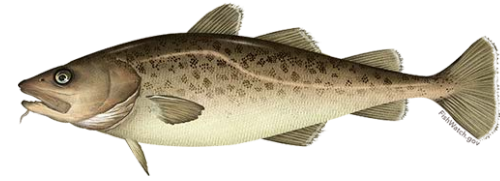


# BSAI Atka mackerel

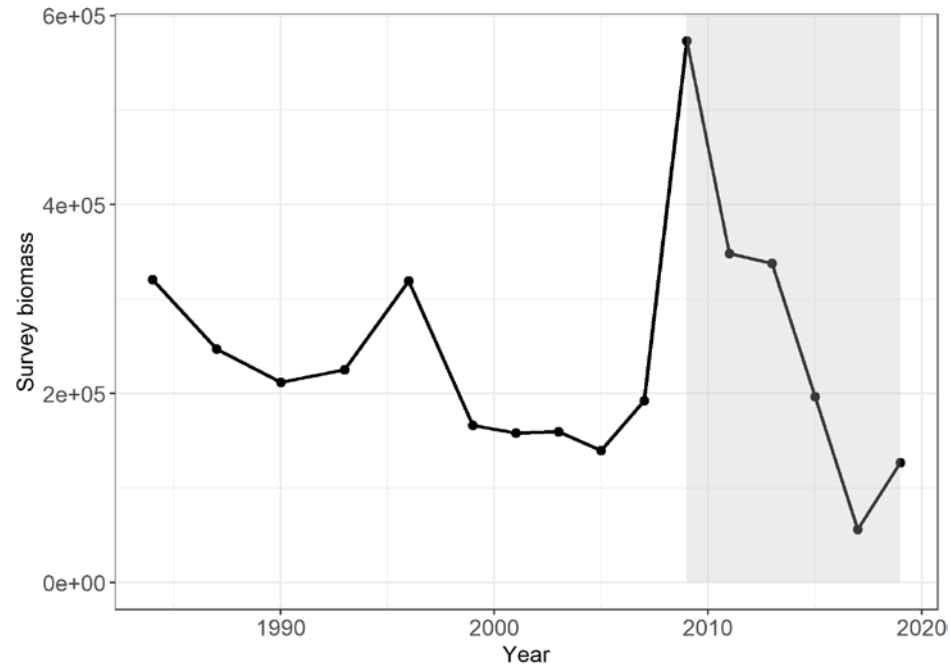
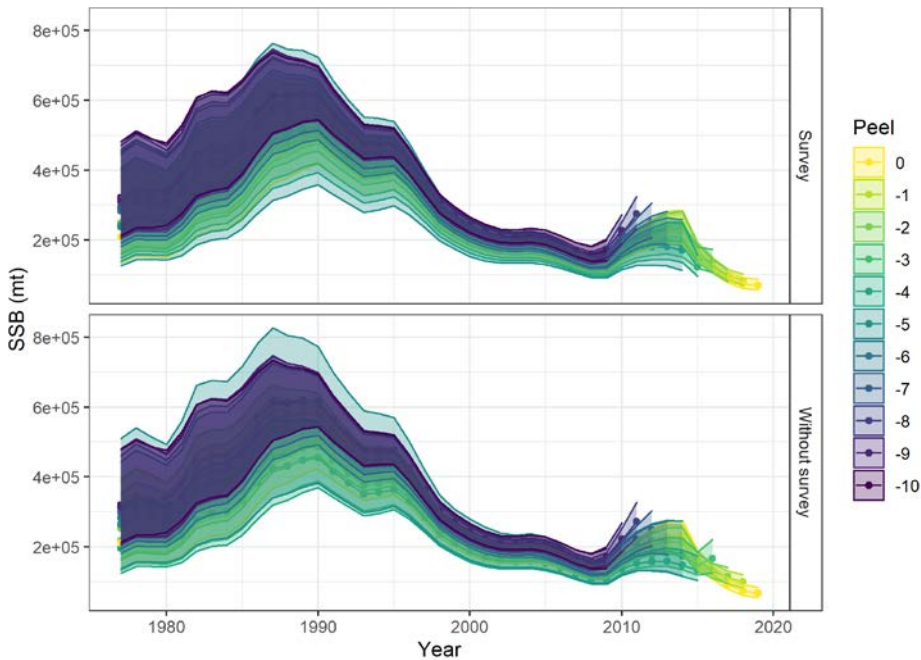
	Mohn's rho ( $\rho$ )		Ralston		Additional
Species	Survey	No survey	$\sigma$ Survey	$\sigma$ No survey	$\sigma^2$
BSAI Atka mackerel	0.114	0.202	0.242	0.264	0.085



# GOA Pacific cod

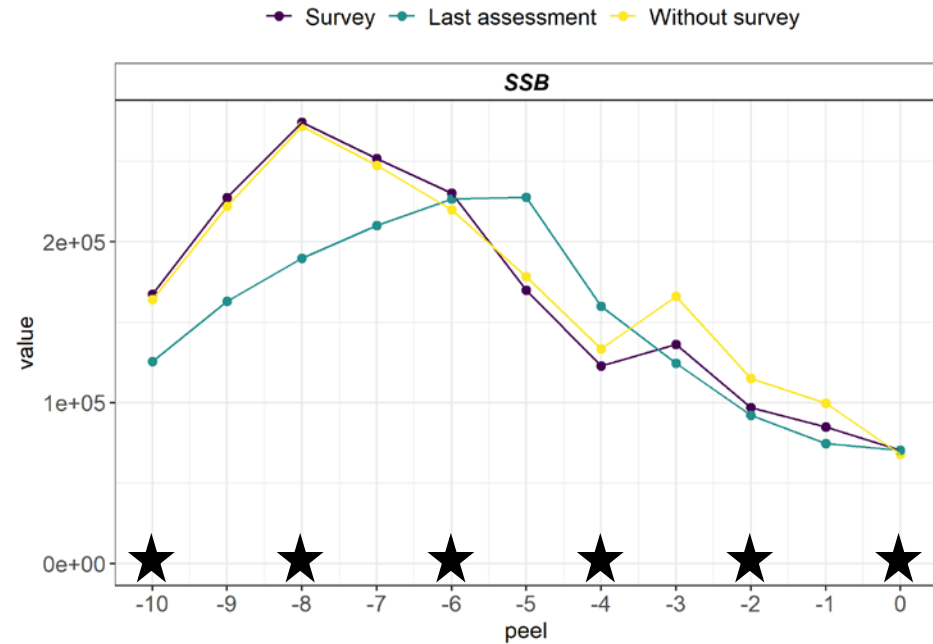
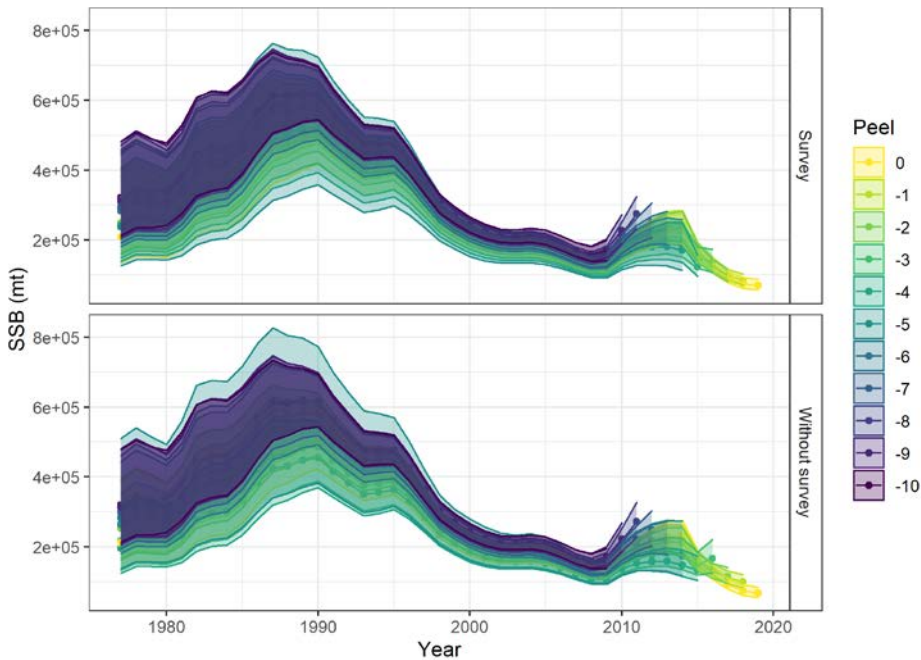


	Mohn's rho ( $\rho$ )	
Species	Survey	No survey
GOA Pacific cod	0.118	0.173



# GOA Pacific cod

	Mohn's rho ( $\rho$ )		Ralston		Additional
Species	Survey	No survey	$\sigma$ Survey	$\sigma$ No survey	$\sigma^2$
GOA Pacific cod	0.118	0.173	0.246	0.265	0.013

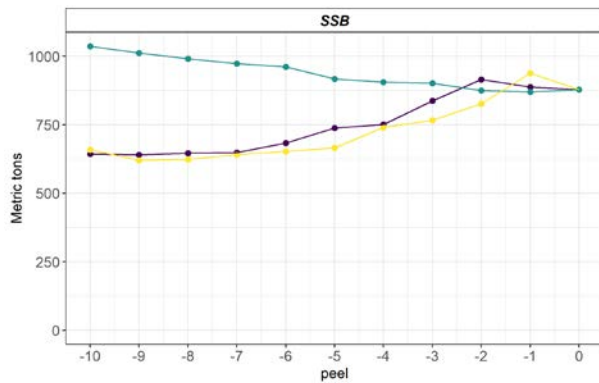




Species	Mohn rho ( $\rho$ )		Ralston		Additional $\sigma^2$
	Survey	No survey	$\sigma$ Survey	$\sigma$ No survey	
BSAI yellowfin sole	-0.209	-0.237	0.332	0.359	0.003
BSAI northern rock sole	0.107	0.106	0.113	0.137	0.001
BSAI flathead sole	-0.046	-0.048	0.069	0.055	0.001
BSAI Greenland turbot	0.098	0.117	0.107	0.112	0.002
EBS Tanner crab	-0.098	-0.107	0.139	0.129	0.001

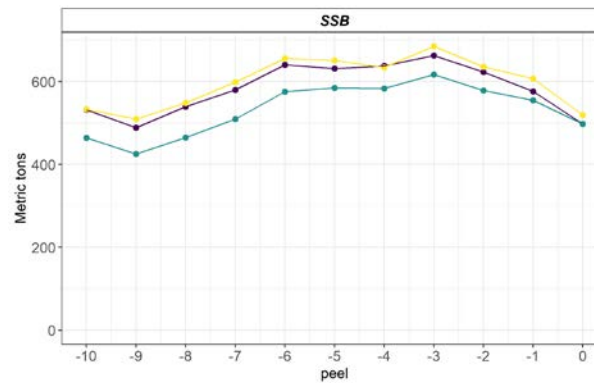
Yellowfin sole

Survey Last assessment Without survey



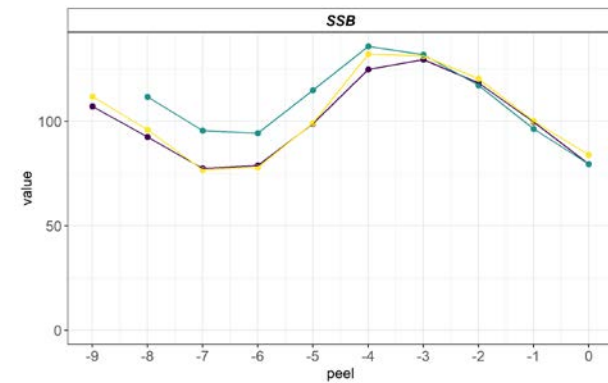
Northern rock sole

Survey Last assessment Without survey



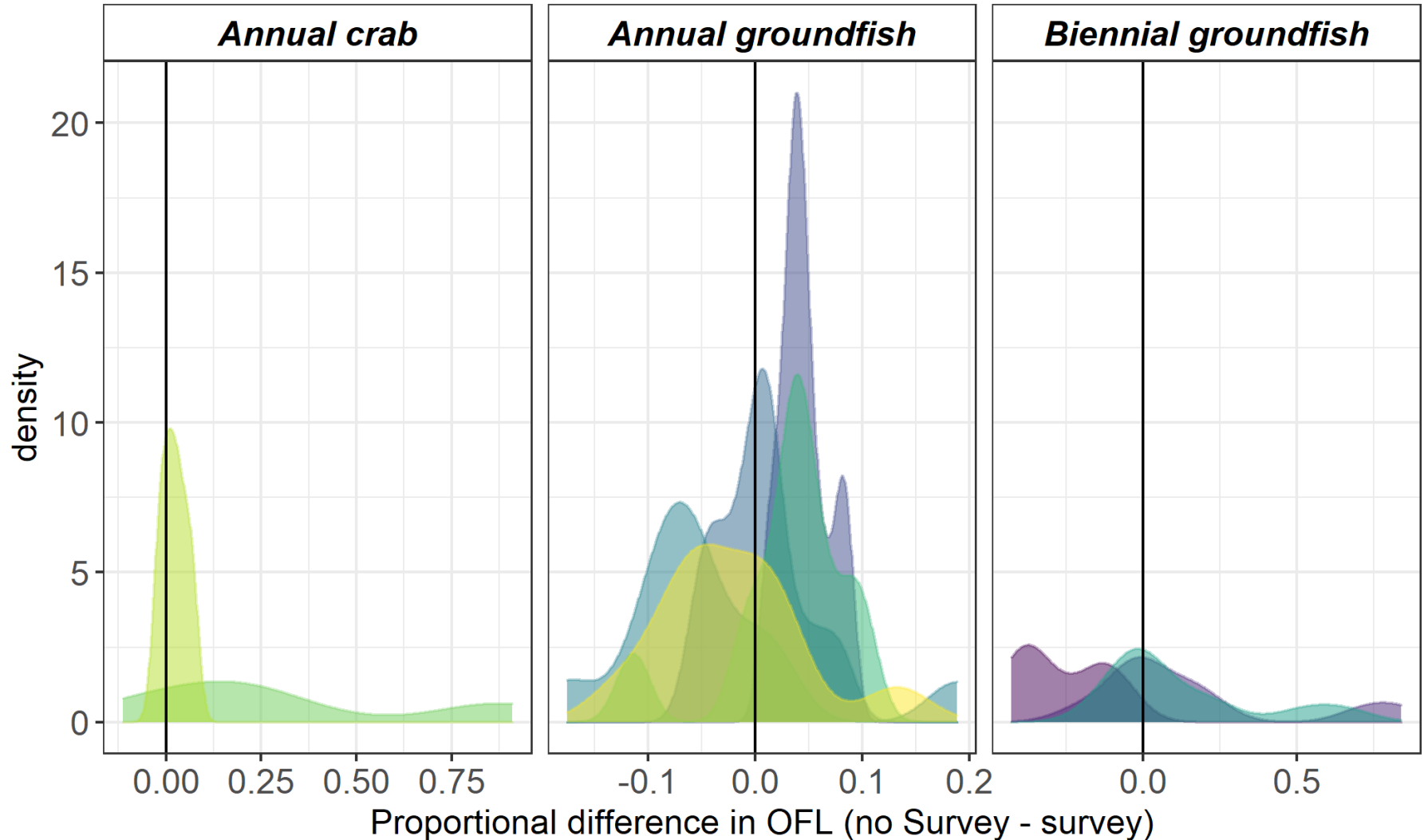
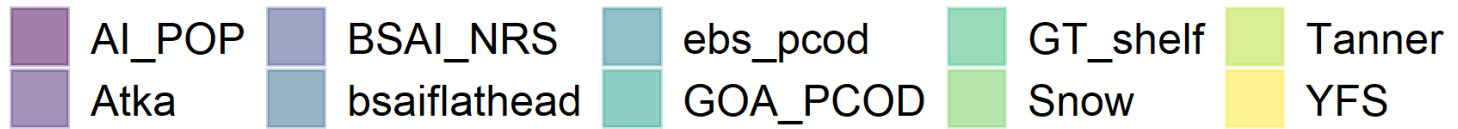
Tanner crab

Survey Last assessment Without survey





# Overfishing limits



# Conclusions

- Analysis provides us with a range of expected uncertainty for age structured assessment models
- Assessments with consistent retrospective bias exhibited greatest uncertainty
- Survey frequency may be a contributing factor

# Acknowledgments

- Survey value work group
  - RACE, REFM, FMA, ABL, HEPR
- Anne Hollowed
- Dana Hanselman
- Chris Lunsford
- Pete Hulson



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# Questions?



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# Comparison of spawning biomass coefficients of variation in “on” and “off” survey years

Grant G. Thompson

# Methods

- Focused on stocks using the GOA and AI bottom trawl surveys
  - SSB and standard error estimates from a total of 29 stocks were submitted by stock assessment authors
- Average coefficient of variation computed separately for “on” and “off” years
- Ratio of CV in “on-year plus one” to CV in the preceding “on” year

# Results

Stat:	Pooled CV								CV(on_yr+_1)/CV(on_yr)			
Tier(s):	1-3				5				1-3		5	
Year(s):	All			Endyr	All			Endyr	On+1	Endyr	On+1	Endyr
Survey:	On	Off	Both	Off	On	Off	Both	Off	Off	Off	Off	Off
N:	13	13	13	3	9	9	9	1	13	3	9	1
Mean:	0.117	0.127	0.124	0.170	0.145	0.227	0.191	0.440	1.006	1.074	1.419	2.465
Sdev:	0.089	0.083	0.085	0.103	0.084	0.210	0.152	N/A	0.018	0.050	0.535	N/A

- Pooled CV was 8% higher on average in “off” years for Tier 1 – 3 stocks
- For the 3 cases in which the time series terminated in an “off” year, the pooled CV was 35% higher on average than it was for those same 3 stocks overall.
- For the 3 cases in which the time series terminated in an “off” year, the pooled CV was 35% higher on average than it was for those same 3 stocks overall
- Pooled CV of 56% higher on average when comparing “off” years to “on” years for the 9 Tier 5 stocks showed an average increase in

# Results

Stat:	Pooled CV								CV(on_yr+_1)/CV(on_yr)			
Tier(s):	1-3				5				1-3		5	
Year(s):	All			Endyr	All			Endyr	On+1	Endyr	On+1	Endyr
Survey:	On	Off	Both	Off	On	Off	Both	Off	Off	Off	Off	Off
N:	13	13	13	3	9	9	9	1	13	3	9	1
Mean:	0.117	0.127	0.124	0.170	0.145	0.227	0.191	0.440	1.006	1.074	1.419	2.465
Sdev:	0.089	0.083	0.085	0.103	0.084	0.210	0.152	N/A	0.018	0.050	0.535	N/A

- The 13 stocks/complexes managed under Tiers 1-3 showed an average increase of only about 1% between “on+1” and “on” years for the time series overall.
- For the 3 cases in which the time series terminated in an “off” year, the CV ratio was about 7% higher on average than it was for those same 3 stocks overall.
- The 9 stocks managed under Tier 5 showed an average increase of about 42% between “on+1” and “on” years for the time series overall.
- For the 1 case in which the time series terminated in an “off” year, the CV ratio was 146% higher than it was for that same stock overall.