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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Resource Ecology and Fisheries Management Division
Status of Stocks and Multispecies Assessments

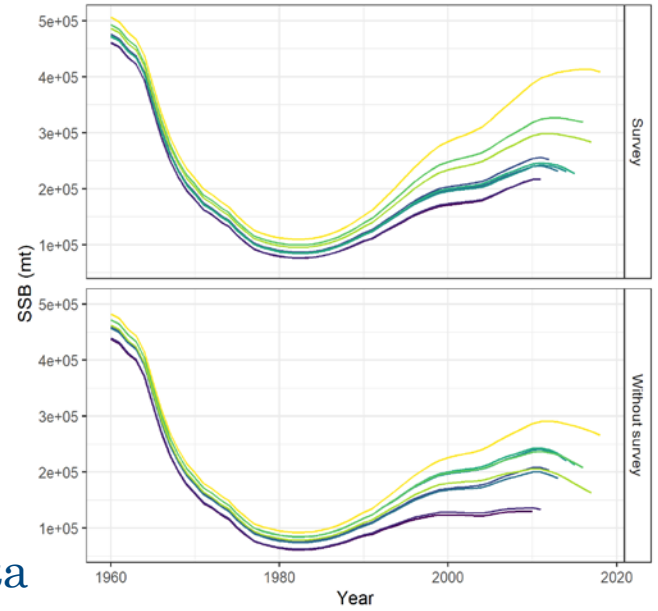
Objectives

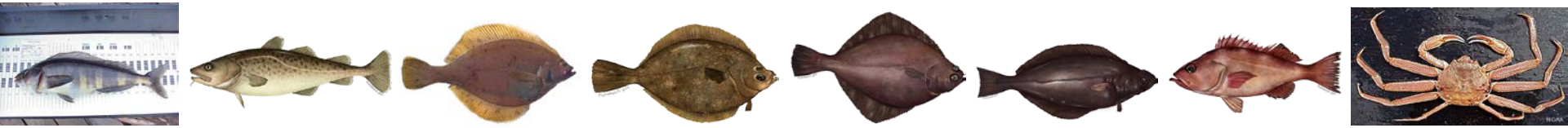
- Evaluate the uncertainty in our assessments due to the loss of the most recent survey data for a number of groundfish and crab species

- 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





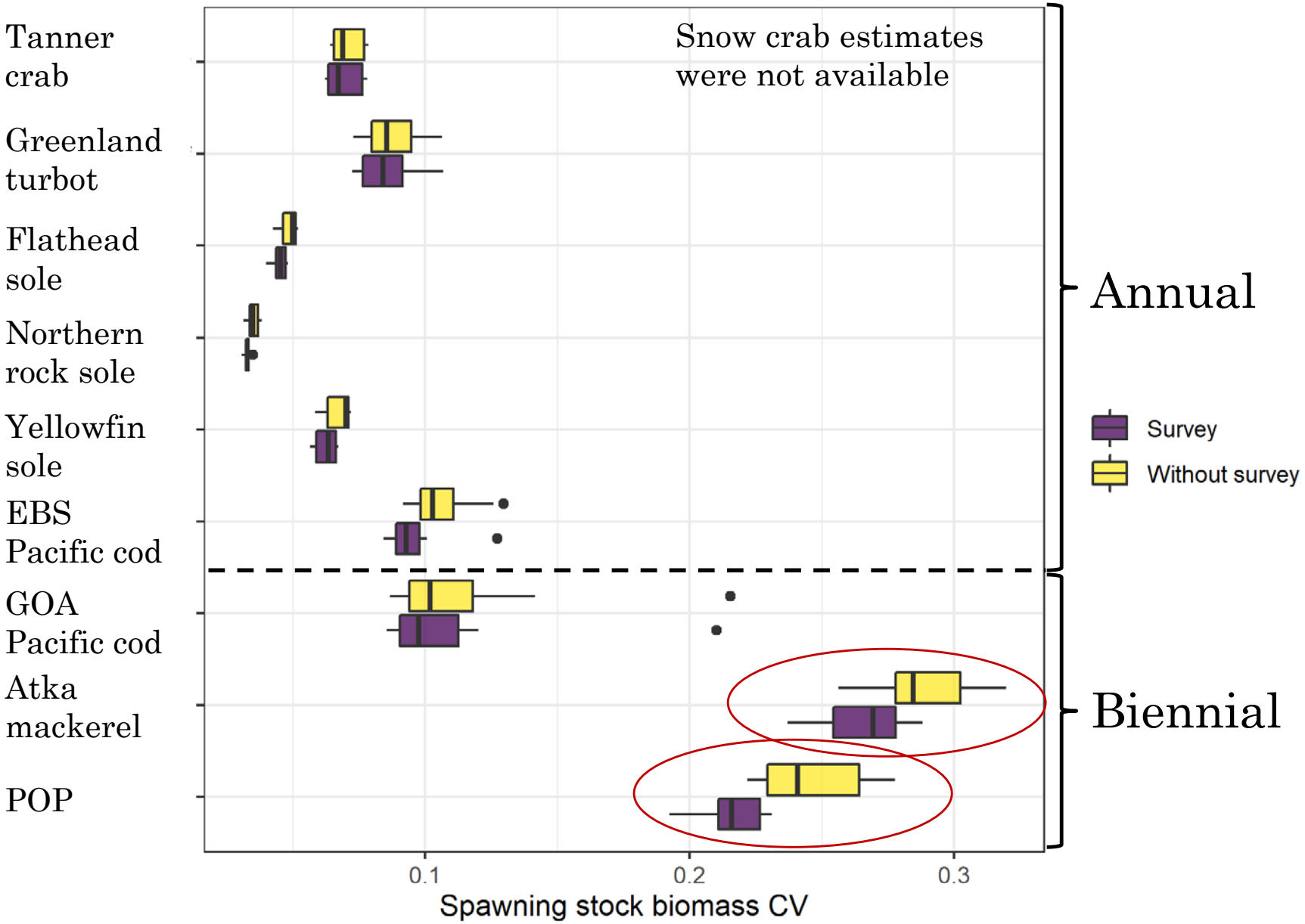
Stocks included in analysis

Species	Year of last full stock assessment	Bottom trawl survey	Time period	Number of peels
EBS Pacific cod	2019 Thompson and Thorson (2019)	Bering Sea shelf	2009-2019	10
EBS Yellowfin sole	2019 Spies et al. (2019)	Bering Sea shelf	2009-2019	10
BSAI Northern rock sole	2018 Wilderbuer et al. (2019)	Bering Sea shelf	2008-2018	10
BSAI Flathead sole	2018 McGilliard et al. (2018)	Bering Sea shelf	2008-2018	10
BSAI Greenland turbot	2018 Bryan et al. (2018)	Bering Sea shelf	2008-2018	10
BSAI Pacific Ocean perch	2018 Spencer and Ianelli (2018)	Aleutian Islands	2010-2018	8
BSAI Atka mackerel	2019 Lowe et al. (2019)	Aleutian Islands	2008-2018	10
GOA Pacific cod	2019 Barbeaux et al. (2019)	Gulf of Alaska	2009-2019	10
EBS Tanner crab	2019 Stockhausen et al. (2019)	Bering Sea shelf	2010-2019	9
EBS snow crab	2019 Szuwalski et al. (2019)	Bering Sea shelf	2012-2019	7

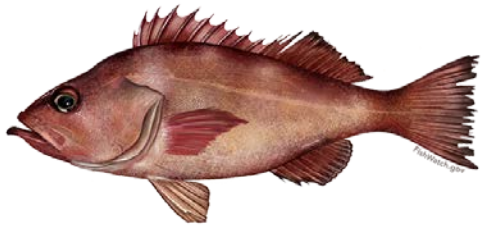
Statistics

- Model estimated CV
- Mohn's rho (ρ) – average relative bias
  - $\rho = \left(\overline{\frac{X_{Y-p} - X_{Y-p,full}}{X_{Y-p,full}}}\right)$, where
    - X – quantity of interest, Y - terminal year, p – peel, $full$ – model with full time series
- Sigma (Ralston et al. 2011)
  - $\sigma_{Ralston} = \sqrt{\frac{1}{P-1}\sum_p \left(ln\left[X_{Y-p,i}\right] - ln\left[X_{Y-p,full}\right]\right)^2}$, where P is the total number of peels
- 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

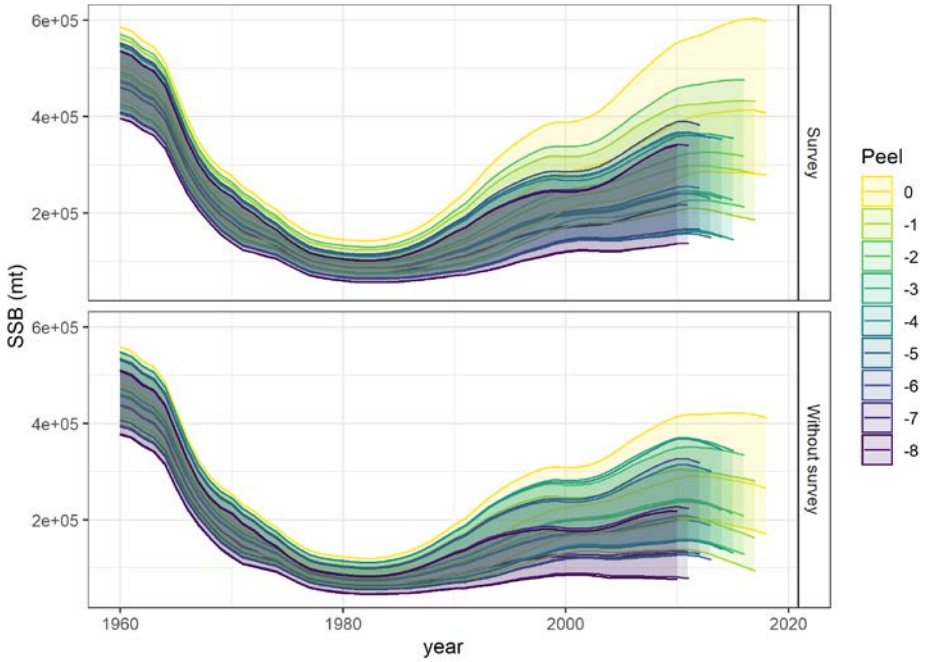
Model estimated uncertainty

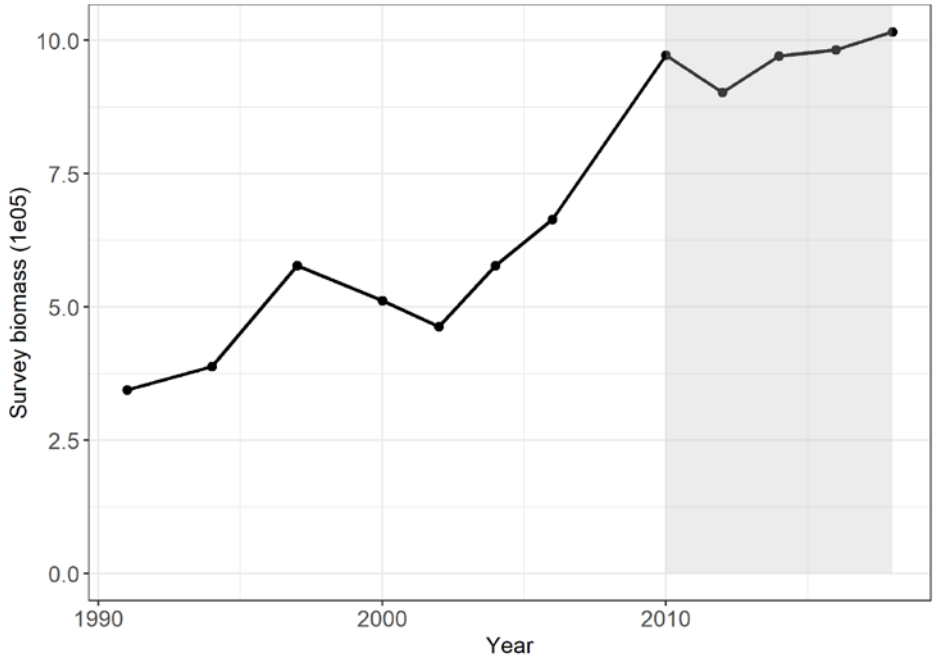


BSAI Pacific ocean perch



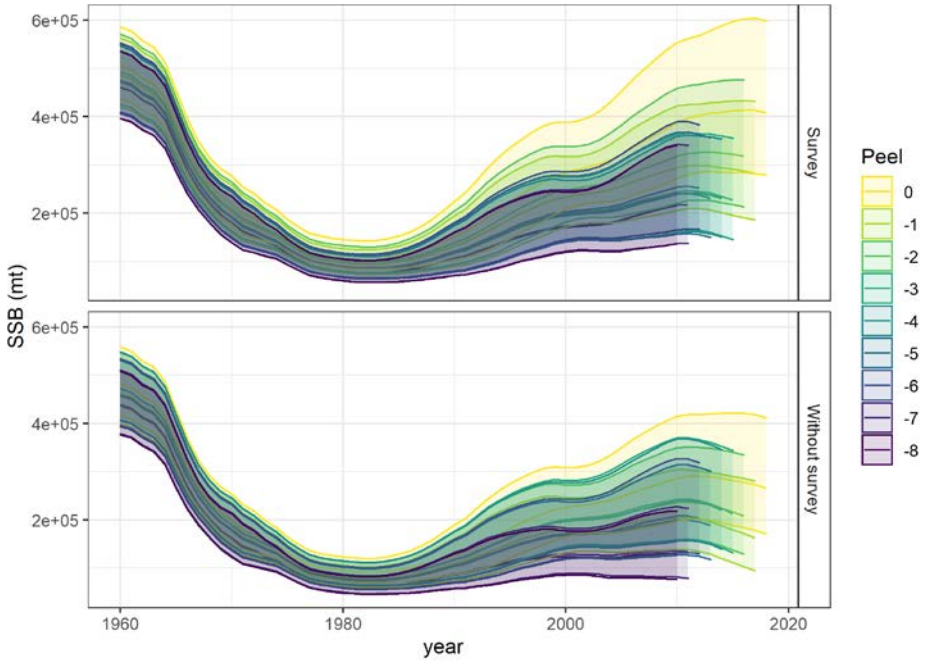
	Mohn's rho (ρ)	
Species	Survey	No survey
BSAI POP	-0.391	-0.551

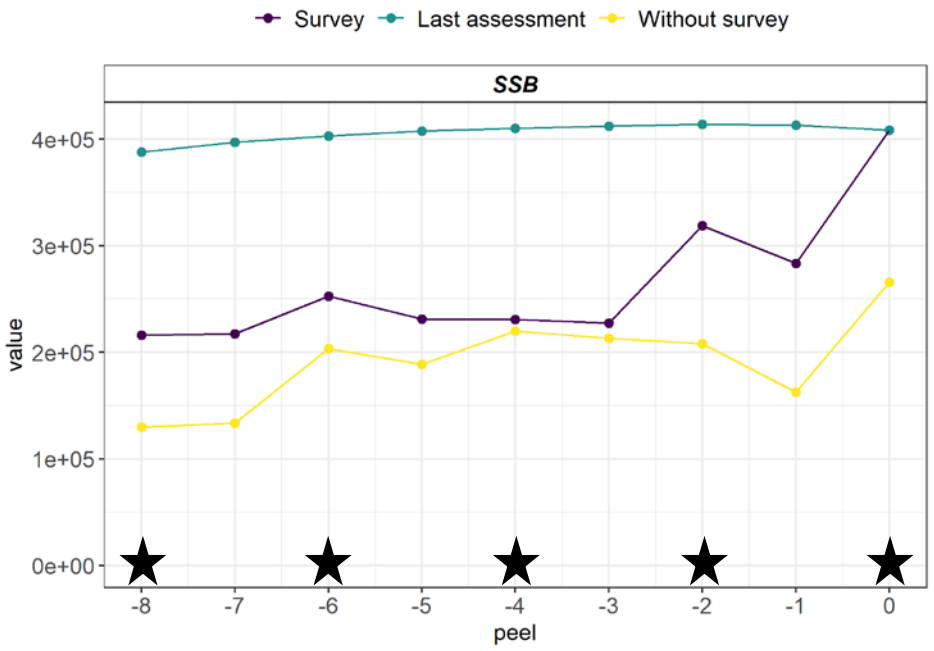




BSAI Pacific ocean perch

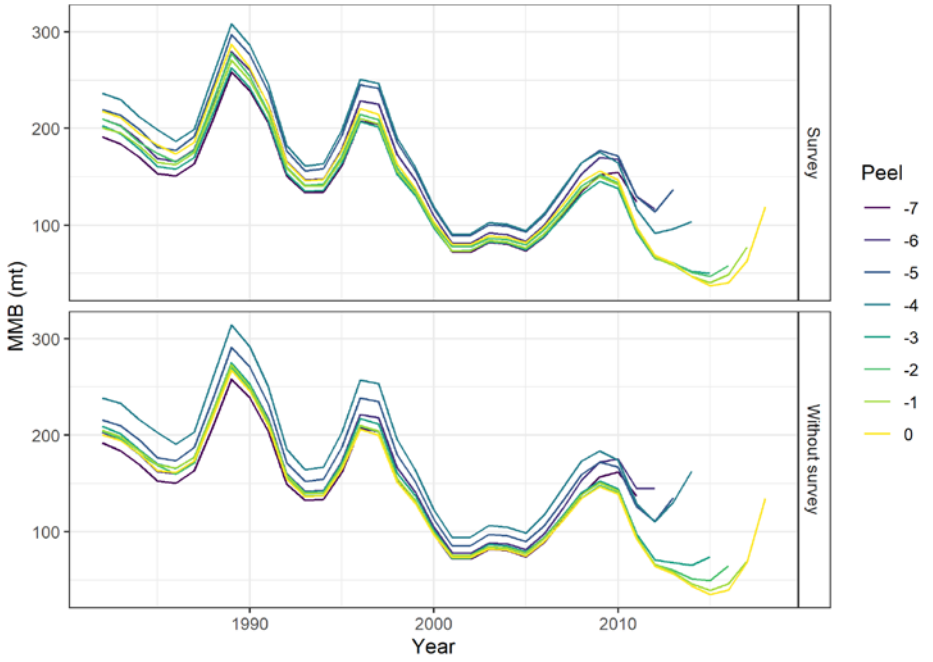
	Mohn's rho (ρ)		Ralston		Additional
Species	Survey	No survey	σ Survey	σ No survey	σ^2
BSAI POP	-0.391	-0.551	0.487	0.789	0.101

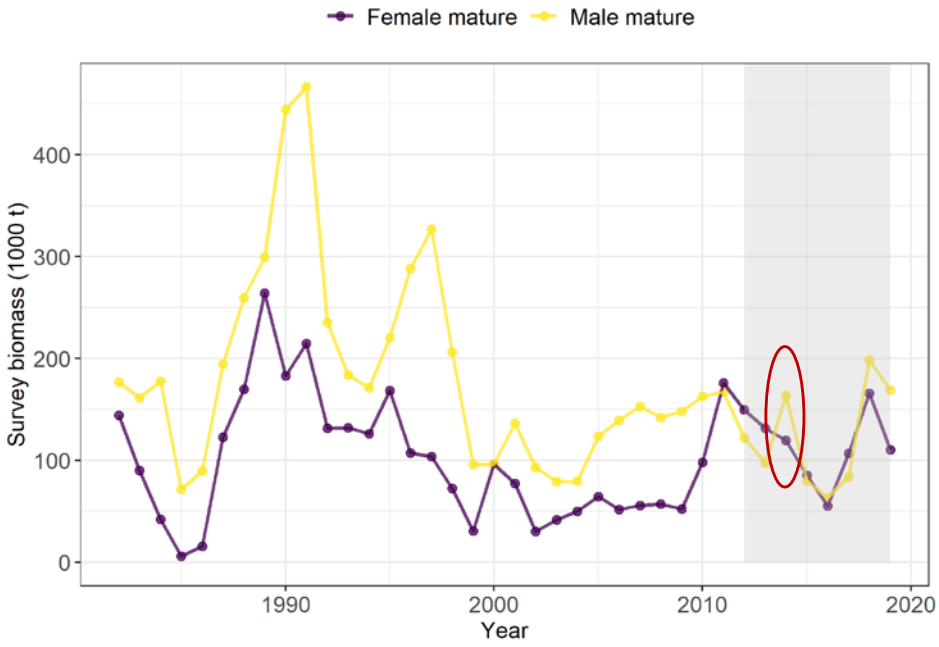




EBS snow crab

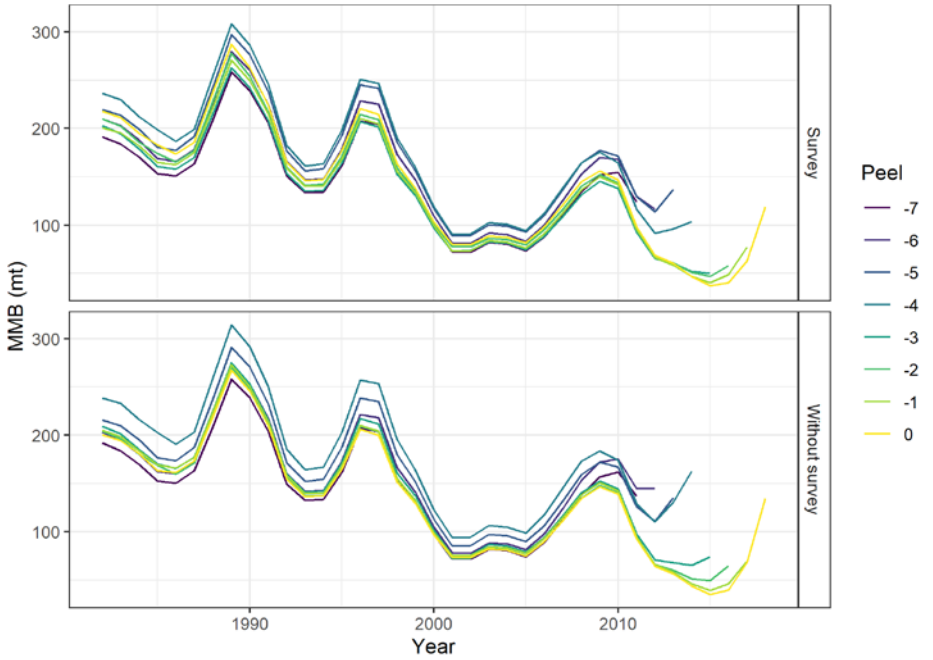
	Mohn's rho (ρ)	
Species	Survey	No survey
EBS Snow crab	0.635	0.985

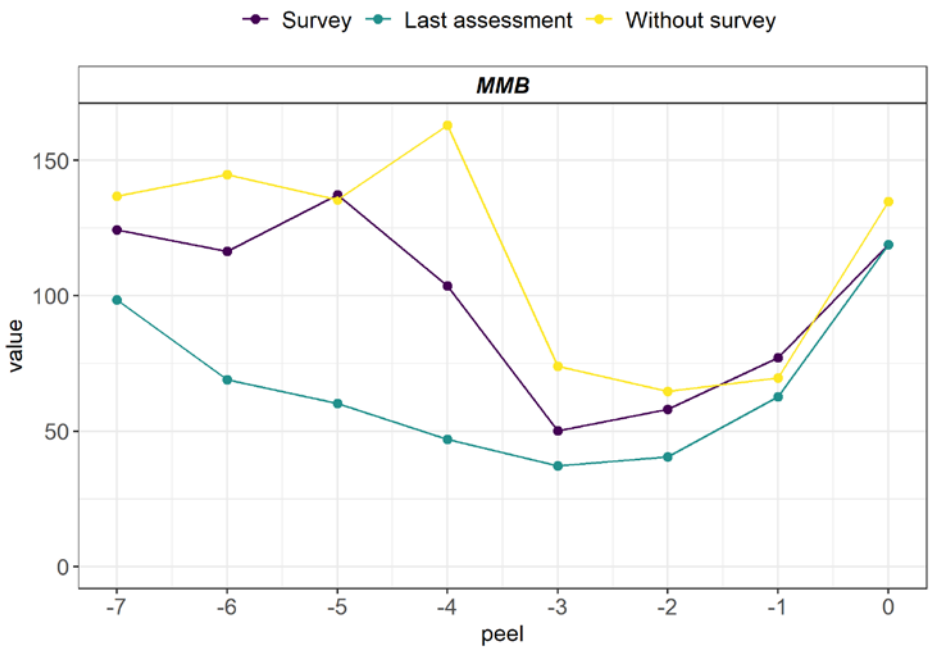




EBS snow crab

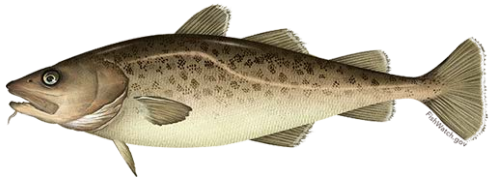
	Mohn's rho (ρ)		Ralston		Additional
Species	Survey	No survey	σ Survey	σ No survey	σ^2
EBS Snow crab	0.635	0.985	0.459	0.629	0.094

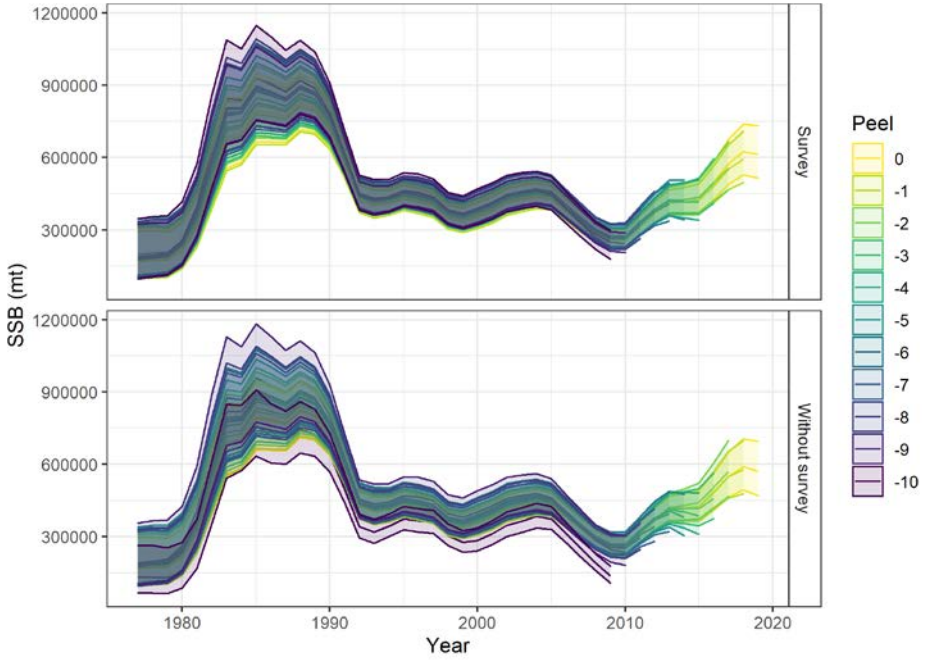


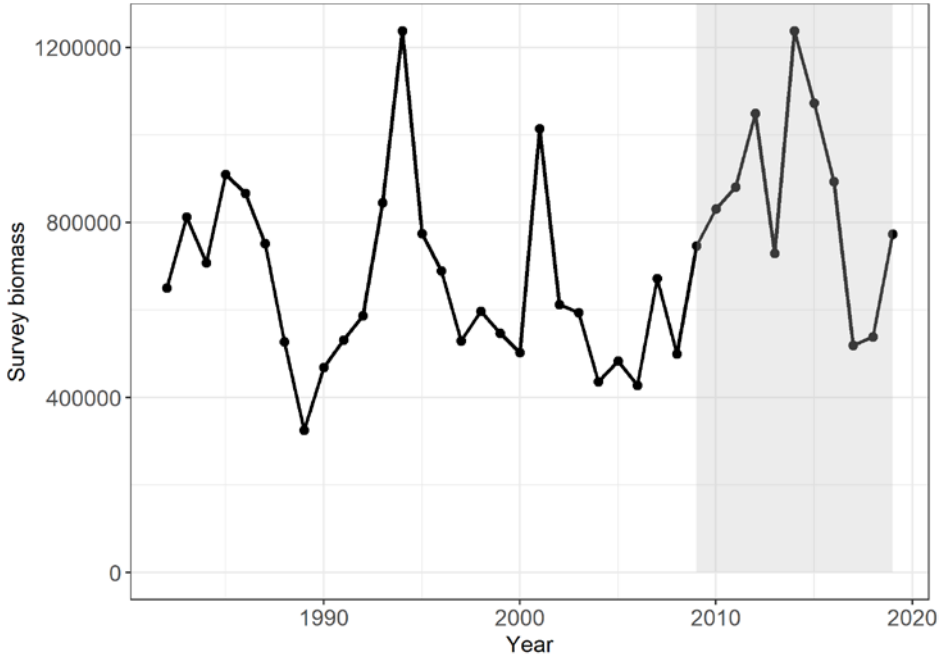


EBS Pacific cod

	Mohn's rho (ρ)	
Species	Survey	No survey
EBS Pacific cod	-0.037	-0.121

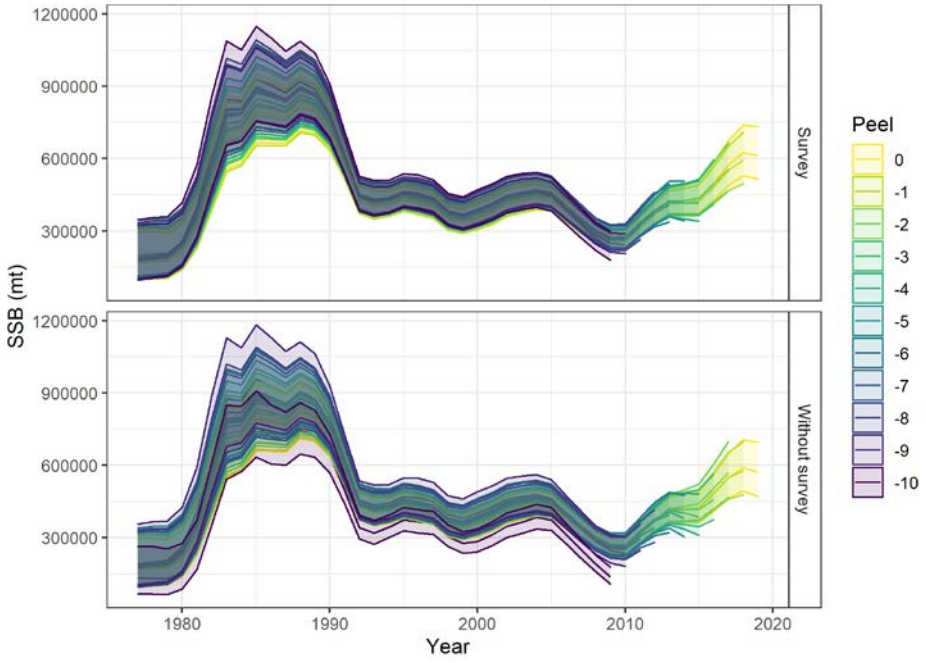


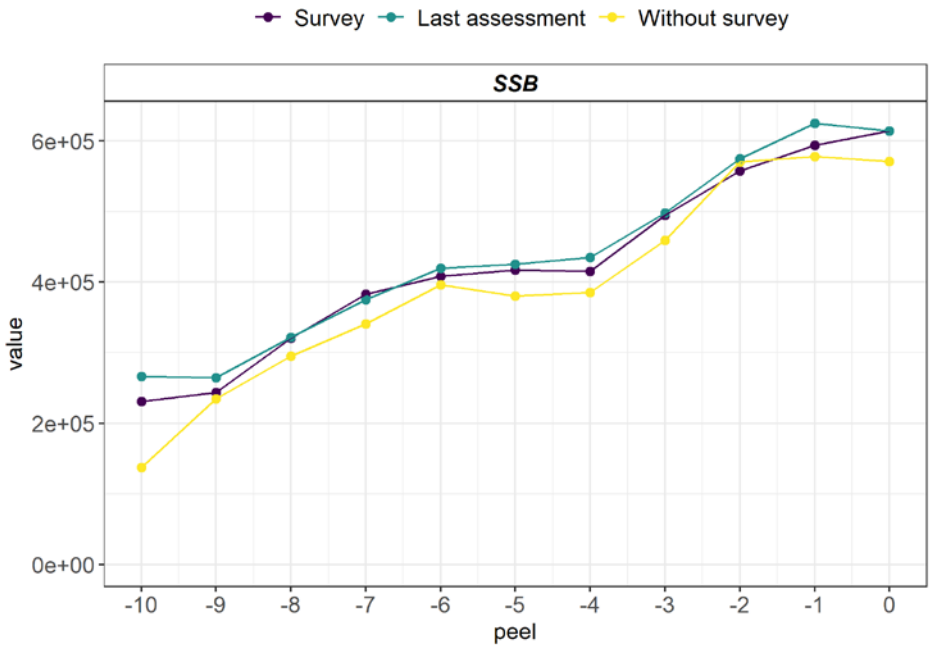




EBS Pacific cod

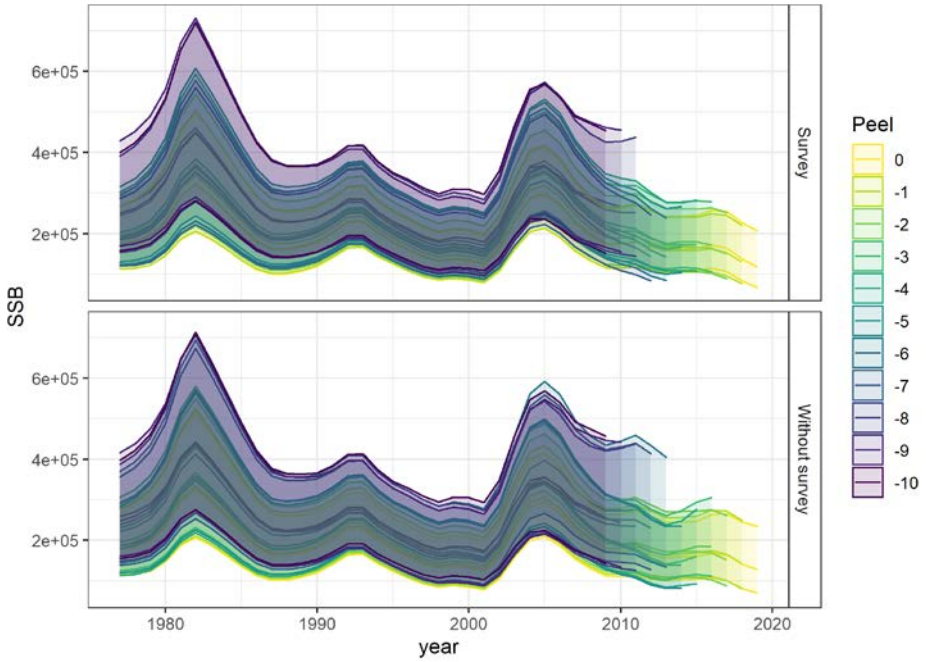
	Mohn's rho (ρ)		Ralston		Additional
Species	Survey	No survey	σ Survey	σ No survey	σ^2
EBS Pacific cod	-0.037	-0.121	0.062	0.238	0.021

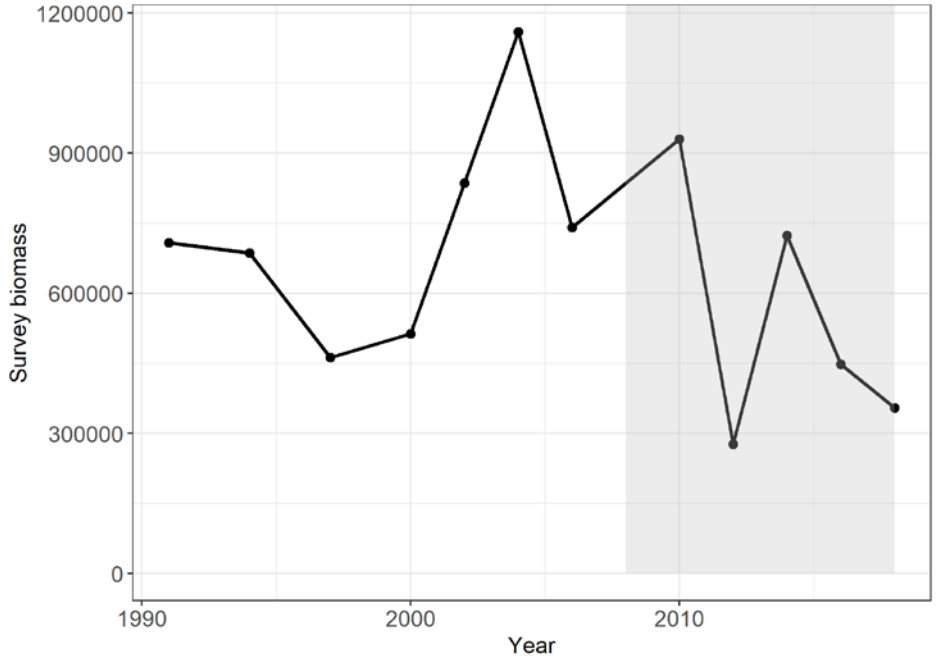




BSAI Atka mackerel

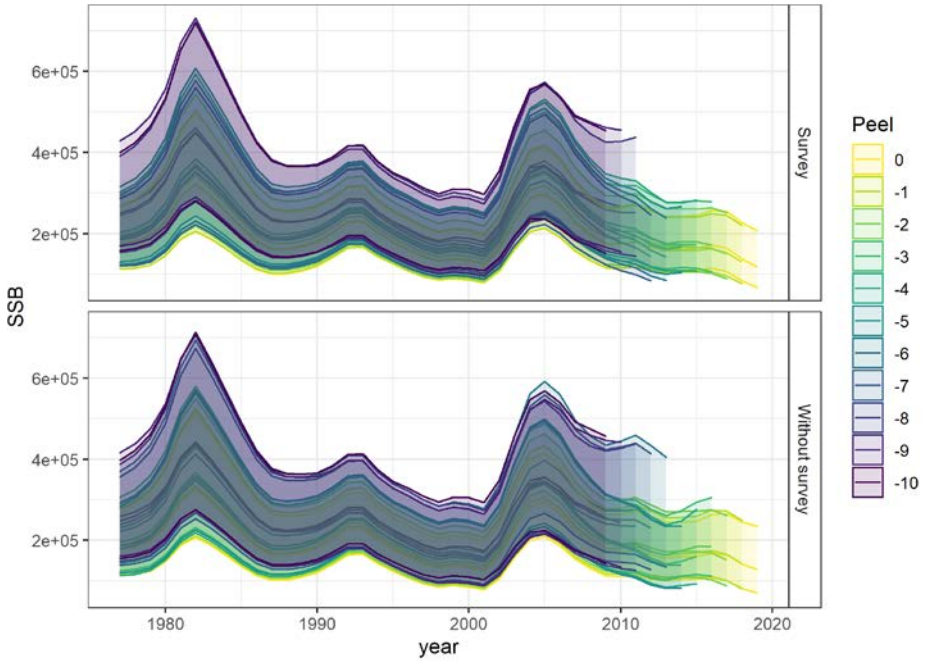
	Mohn's rho (ρ)	
Species	Survey	No survey
BSAI Atka mackerel	0.114	0.188

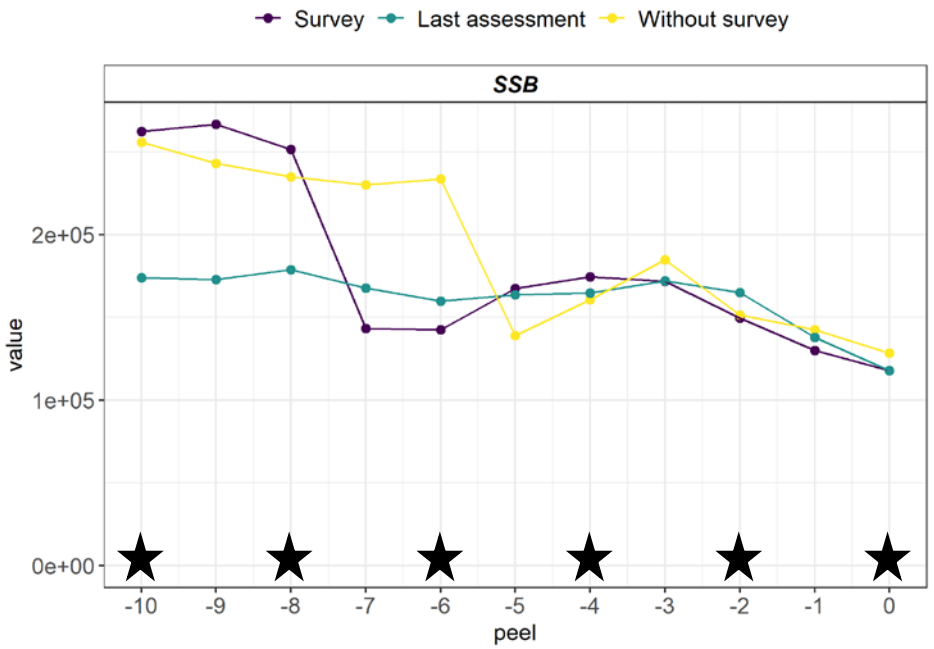




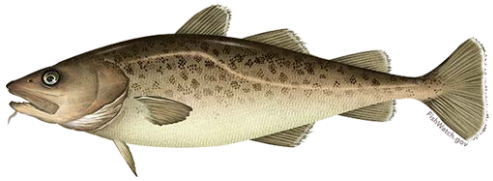
BSAI Atka mackerel

	Mohn's rho (ρ)		Ralston		Additional
Species	Survey	No survey	σ Survey	σ No survey	σ^2
BSAI Atka mackerel	0.114	0.188	0.242	0.264	0.085

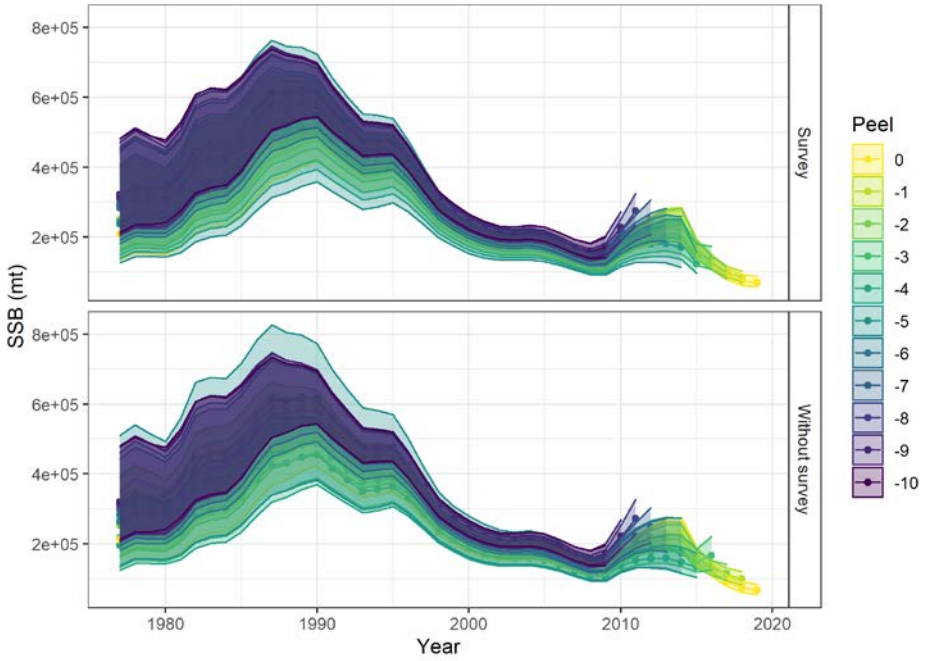


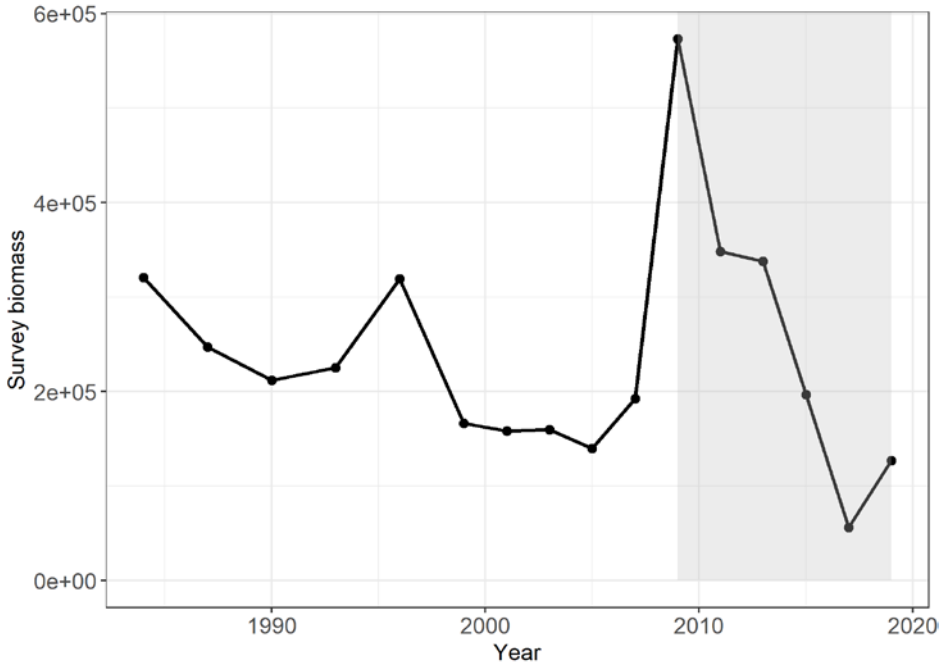


GOA Pacific cod



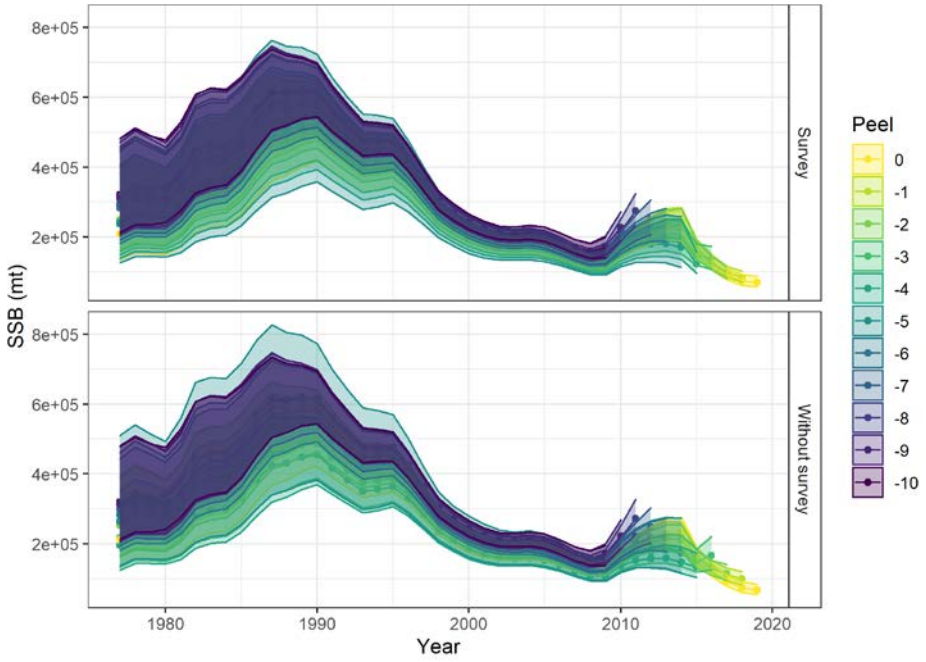
	Mohn's rho (ρ)	
Species	Survey	No survey
GOA Pacific cod	0.118	0.178

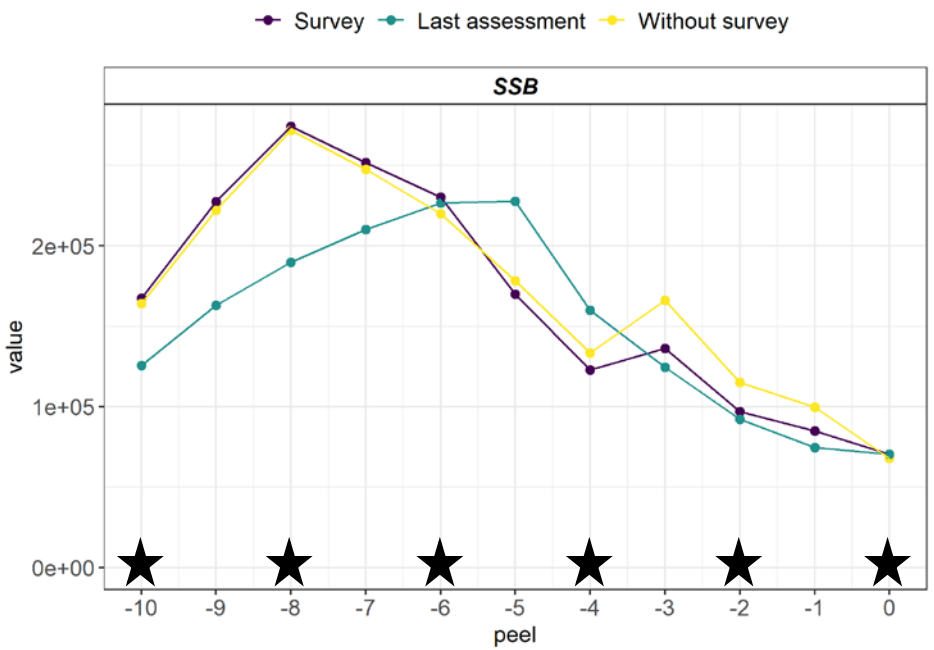




GOA Pacific cod

	Mohn's rho (ρ)		Ralston		Additional
Species	Survey	No survey	σ Survey	σ No survey	σ^2
GOA Pacific cod	0.118	0.178	0.246	0.265	0.013





Summary statistics

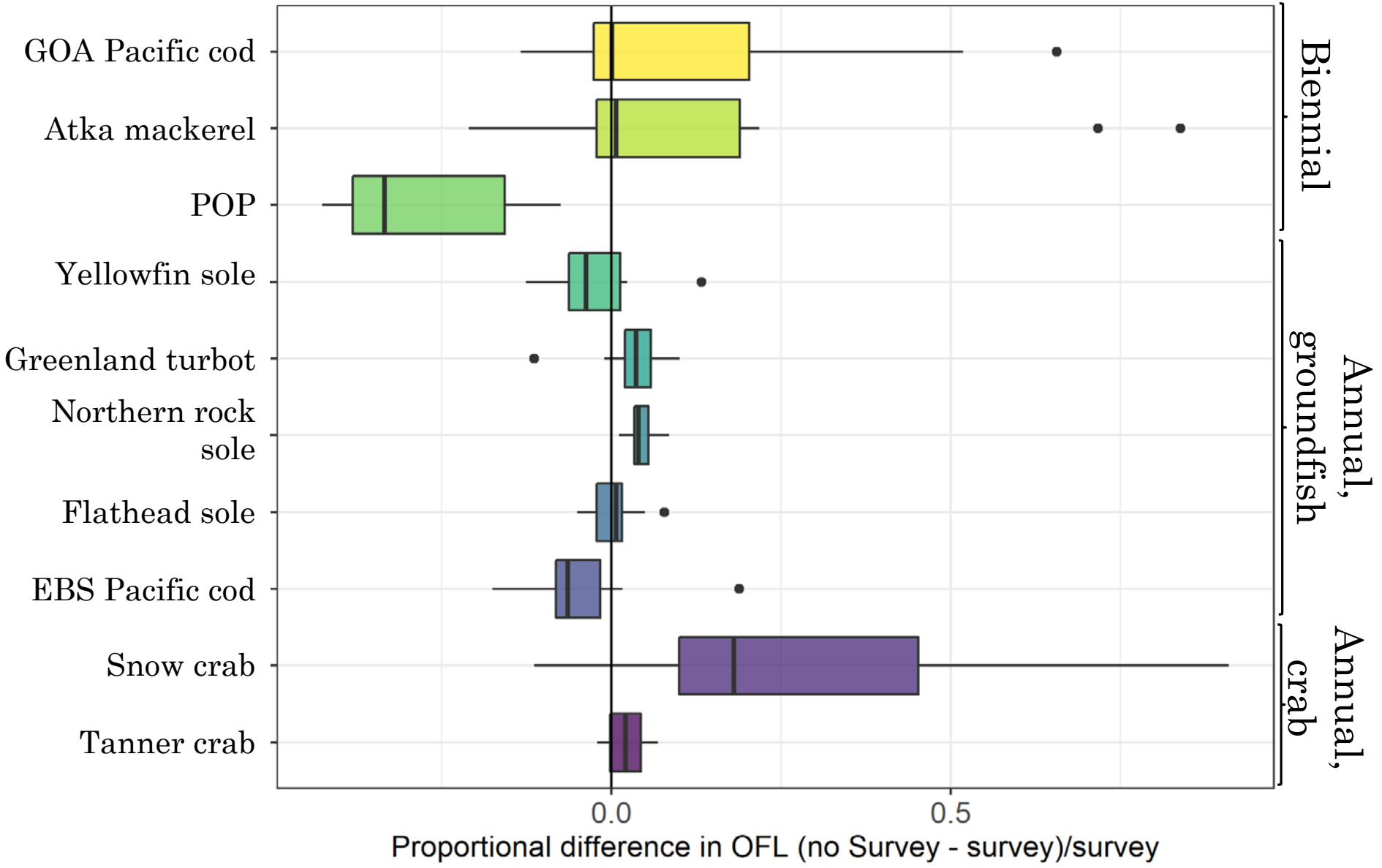
- Column color scales: red=low, green = high

	Mohn's rho (ρ)			Ralston sigma			Additional
Stock/complex	Survey	No survey	Change	Survey	No survey	Change	σ^2
BSAI POP	-0.391	-0.551	-0.160	0.487	0.789	0.302	0.101
BSAI Atka mackerel	0.114	0.188	0.074	0.242	0.264	0.022	0.085
GOA Pacific cod	0.118	0.178	0.060	0.246	0.265	0.019	0.013
EBS Pacific cod	-0.037	-0.121	-0.084	0.062	0.238	0.176	0.021
BSAI yellowfin sole	-0.209	-0.237	-0.028	0.332	0.359	0.027	0.003
BSAI northern rock sole	0.107	0.134	0.027	0.113	0.137	0.024	0.001
BSAI flathead sole	-0.046	-0.045	0.001	0.069	0.055	-0.014	0.001
BSAI Greenland turbot	0.098	0.11	0.012	0.107	0.112	0.005	0.002
EBS Tanner crab	-0.098	-0.082	0.016	0.139	0.129	-0.01	0.001
EBS Snow crab	0.635	0.985	0.350	0.459	0.629	0.17	0.094
Average	0.029	0.056	0.027	0.226	0.298	0.072	0.032





Overfishing limits



Conclusions

- Analysis provides us with an indication of the impact of losing the most recent survey data in our age structured assessment models for a wide range of species
- Assessments with largest retrospective bias exhibited greatest uncertainty
  - Direction of bias is important to consider
- Impact on the majority of stocks was relatively small

Acknowledgments

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

NOAA FISHERIES

Thank you

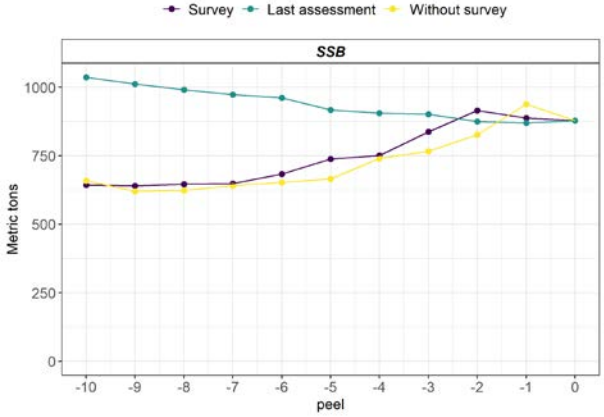
Extra slides



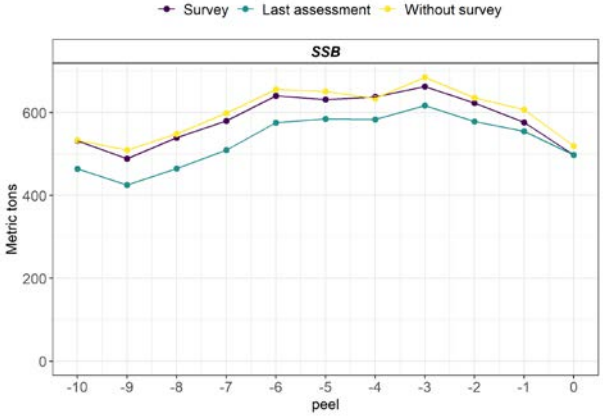


	Mohn rho (ρ)		Ralston		Additional
Species	Survey	No survey	σ Survey	σ No survey	σ^2
BSAI yellowfin sole	-0.209	-0.237	0.332	0.359	0.003
BSAI northern rock sole	0.107	0.134	0.113	0.137	0.001
BSAI flathead sole	-0.046	-0.045	0.069	0.055	0.001
BSAI Greenland turbot	0.098	0.110	0.107	0.112	0.002
EBS Tanner crab	-0.098	-0.082	0.139	0.129	0.001

Yellowfin sole



Northern rock sole



Tanner crab