

# Chinook salmon mortality and impacts due to bycatch in the EBS pollock fishery



# Components

## **PSC: Prohibited species catch. aka bycatch**

- Observer program sampling at sea and in port, 100% covered

## **Age and growth data**

- With length frequency makeup the Age composition data

## **Model to account for immature Chinook salmon in the bycatch**

- “Adult equivalents” or AEQ

## **Genetics**

- Also adjusted to year of capture

## **In-river estimates**

- For age composition (and oceanic maturation rate needed for AEQ)
- For total run estimates (to estimate impacts)

## **Uncertainty treatment**

- In run-size, AEQ rates, and genetic reporting groups

## **Sensitivities**

- Maturity change, and “what-if” PSC was set artificially at the limit



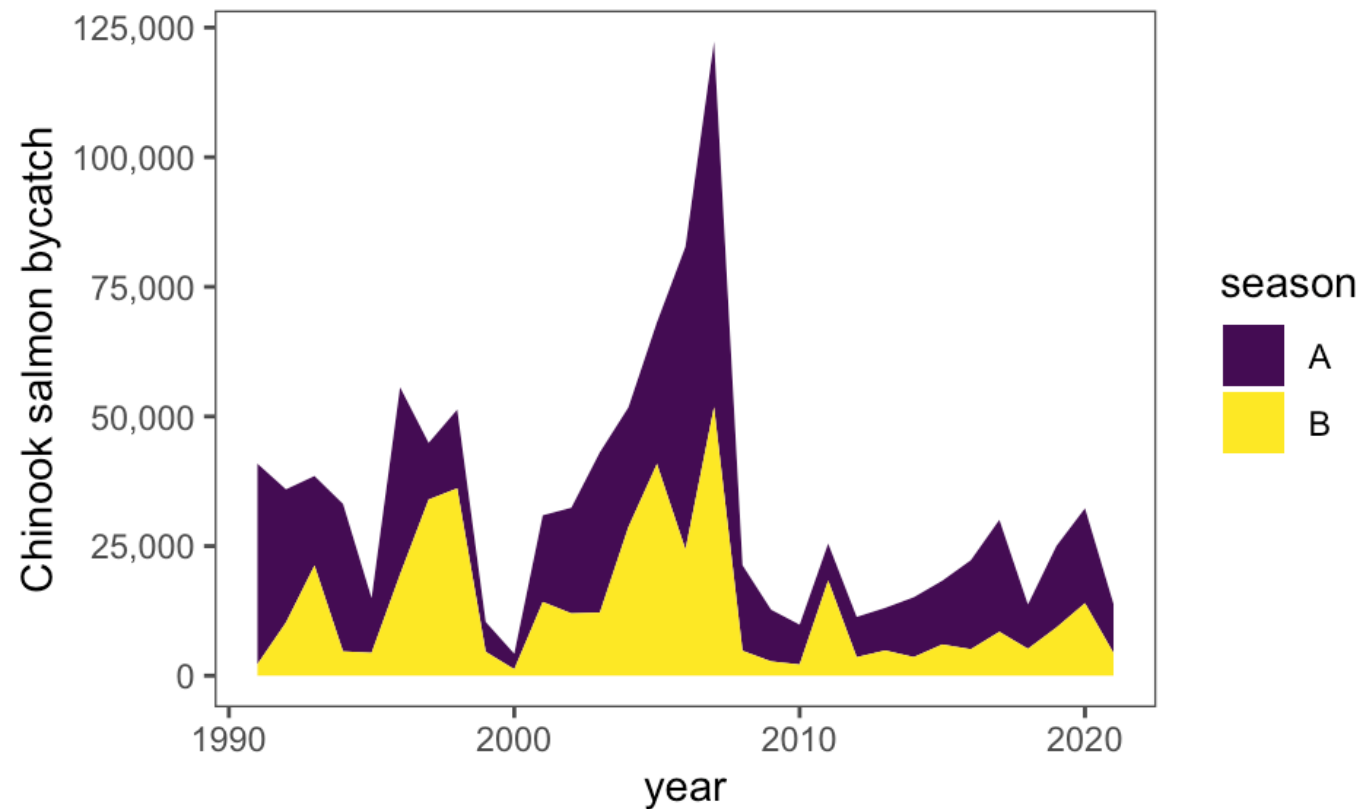
# Steps

1. Stats on Chinook salmon bycatch
  - by region and season in the pollock fishery including
  - Length and sex composition of the bycatch
  - Ages
2. Compile age composition data
  - By strata (season)
3. Use length compositions to get the PSC catch-at-age (Tables 4 and 5)
4. Provide demographic characteristics of Chinook salmon for use in the AEQ model (these include the oceanic survival-at-age and maturity-at-age)
5. Update the season-specific genetics information (Table 6; Fig. 4)
6. Run the AEQ model with these inputs (1994-2021)
7. Compare a subset of AEQ results against run-strength estimates



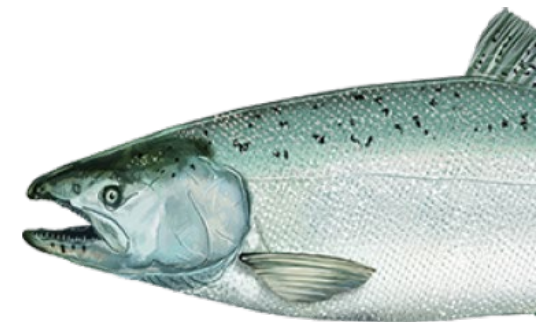
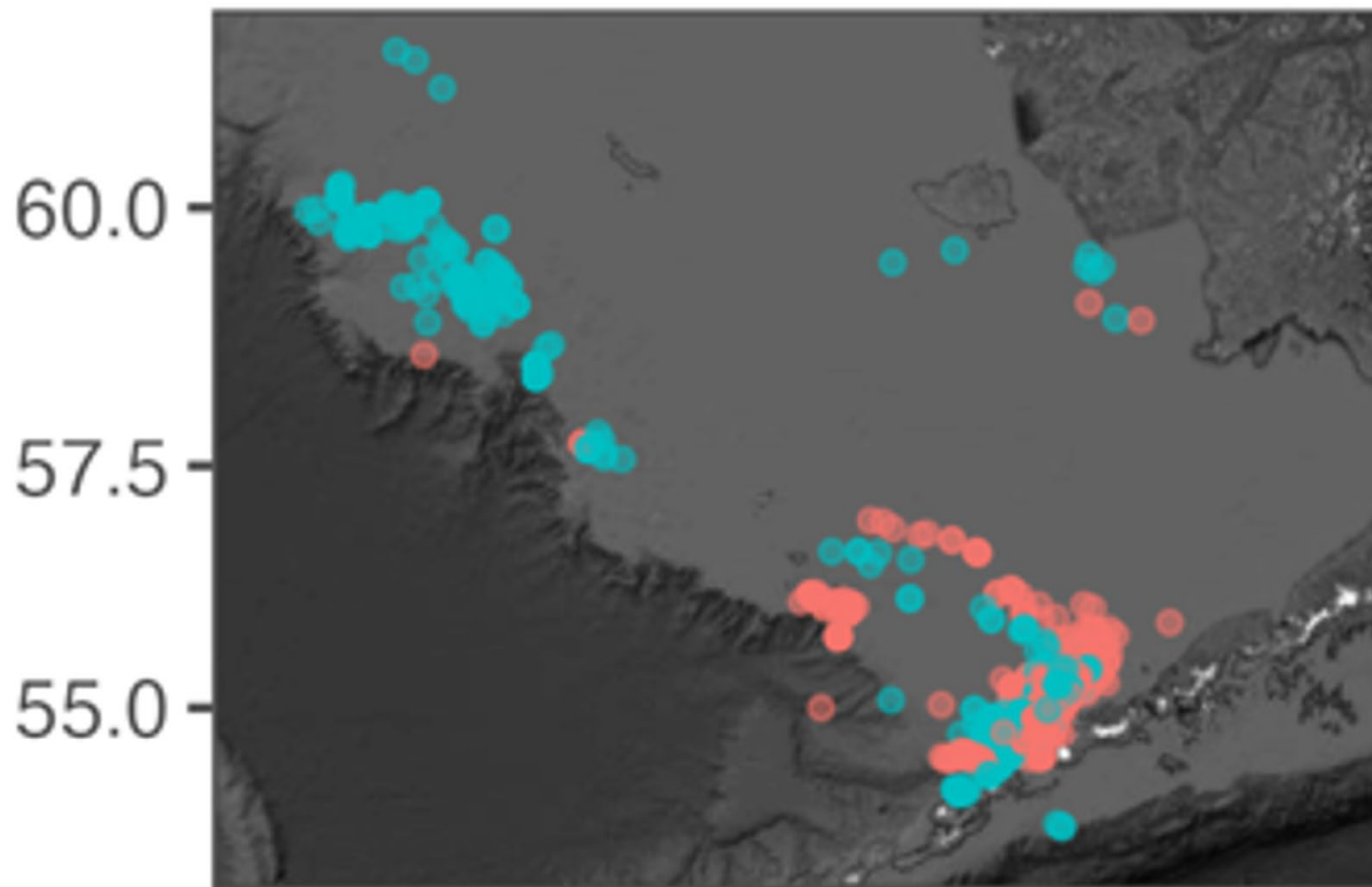
# Chinook salmon bycatch

All stocks



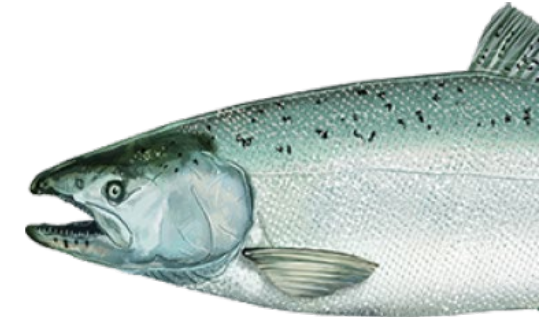
# Chinook salmon age d

1997

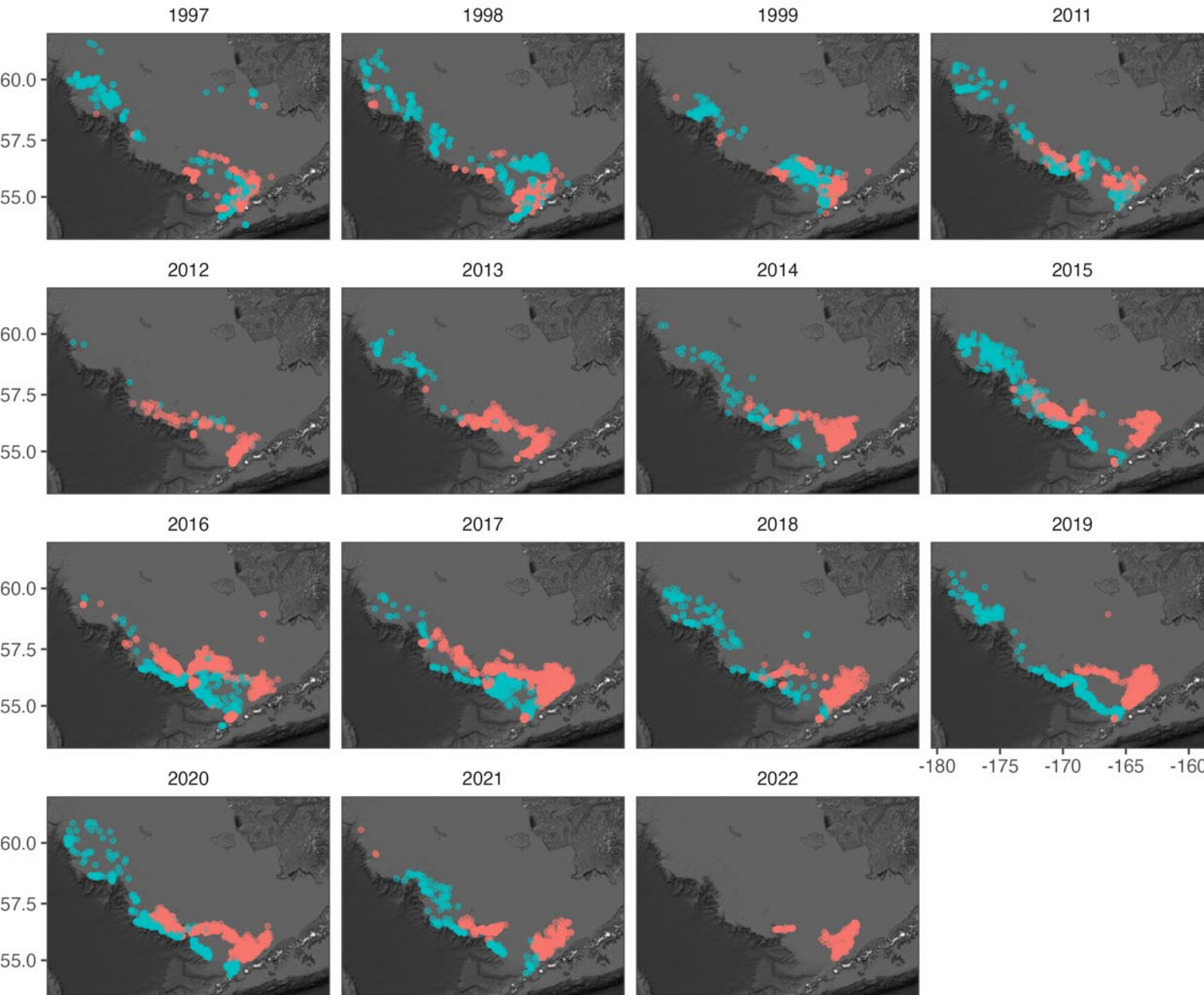


Locales of sampling  
for age data

# Chinook salmon age data



## Locales of sampling for age data

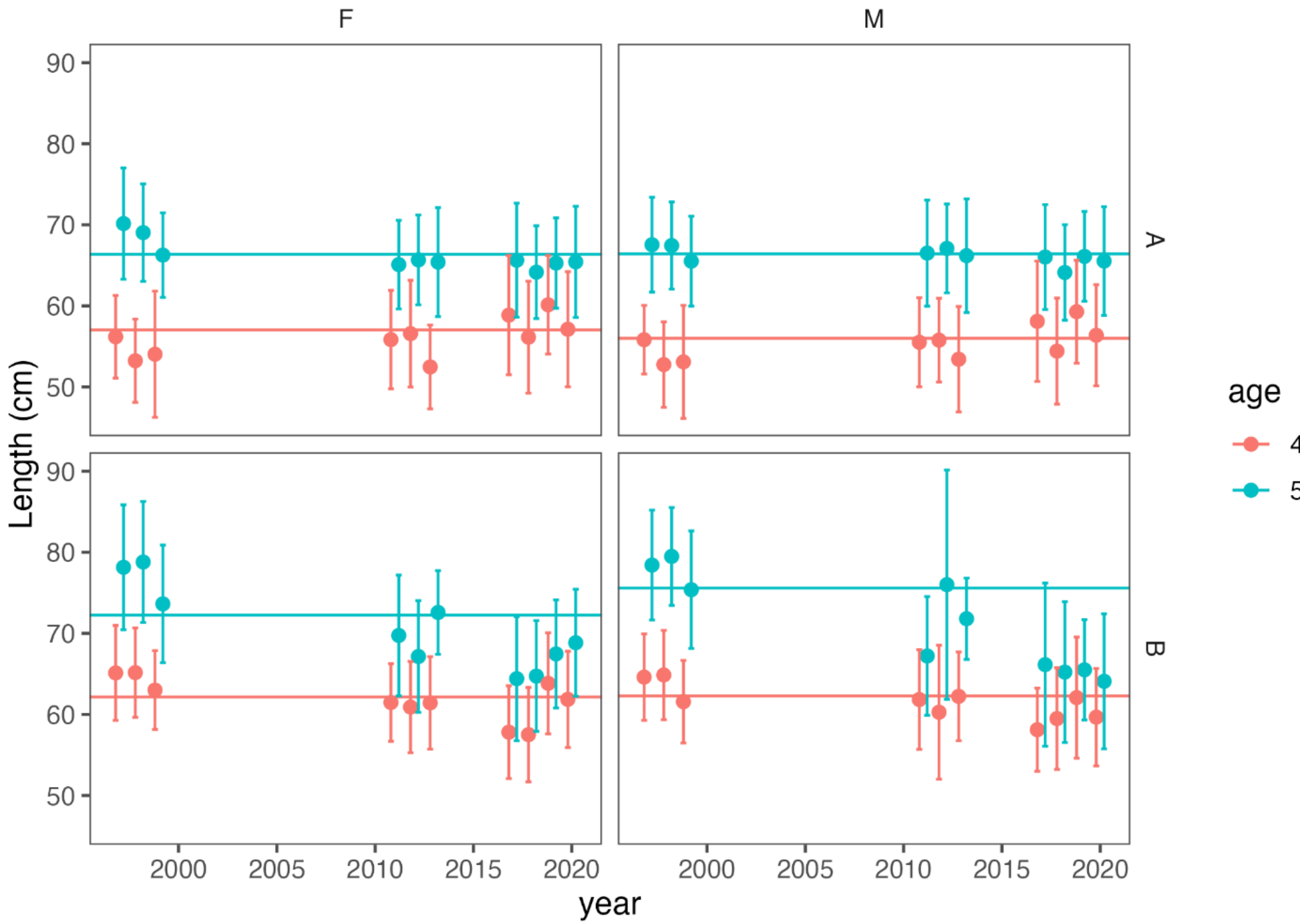


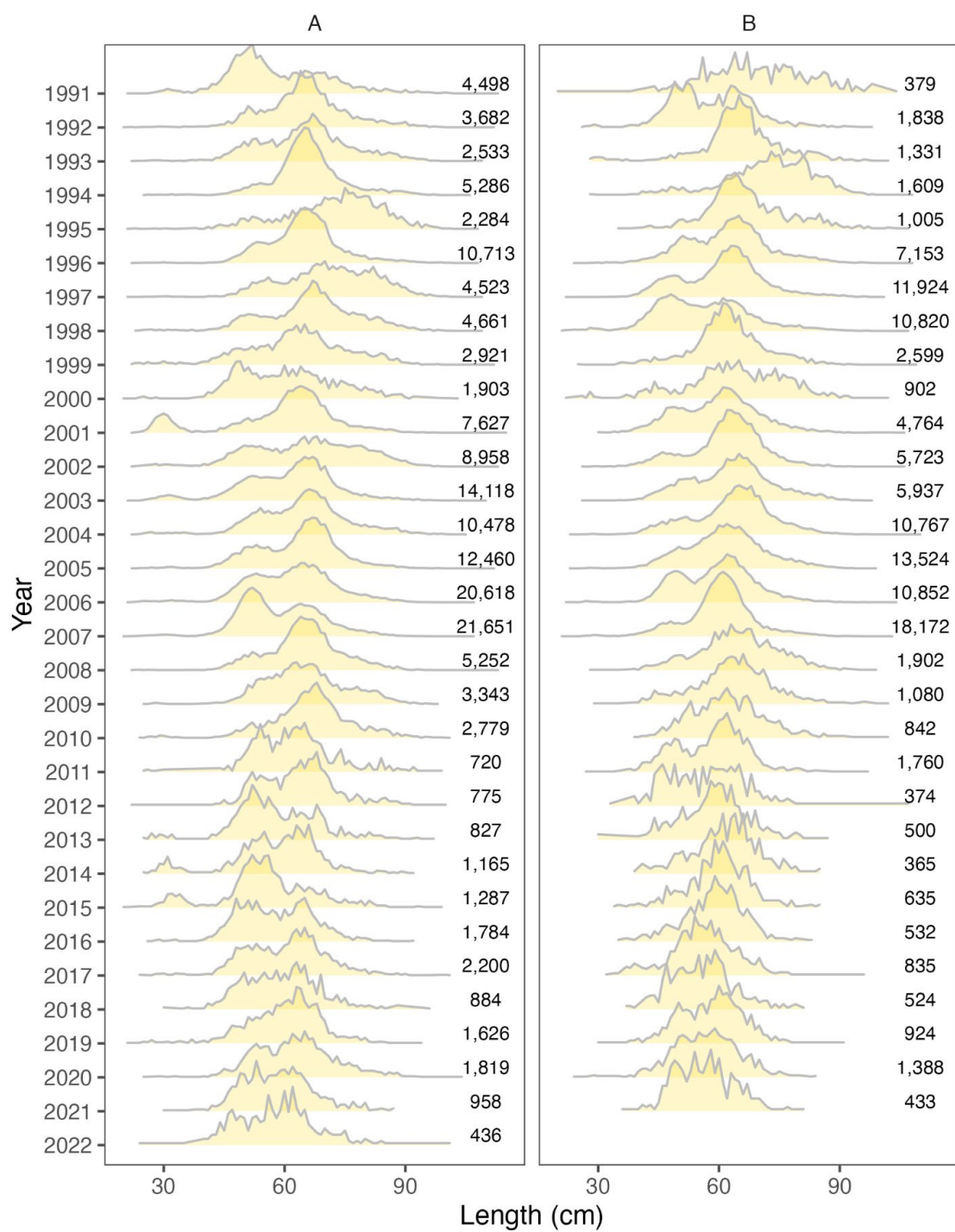
Season

- A
- B

Fig. 5

- Main ages of bycatch
- Changes in size-at-age apparent
- Accounted for in age-comp. estimates





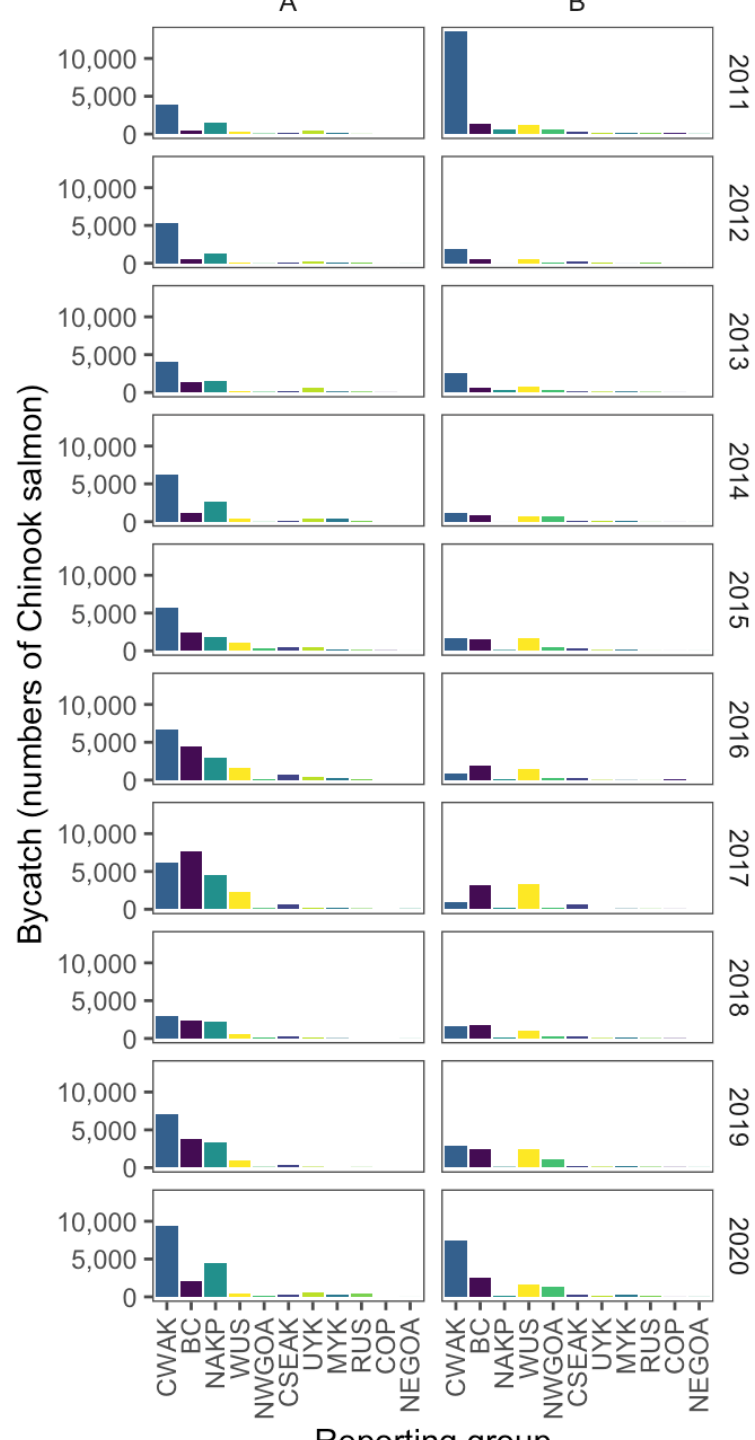
# Length composition

Samples of Chinook salmon  
in bycatch

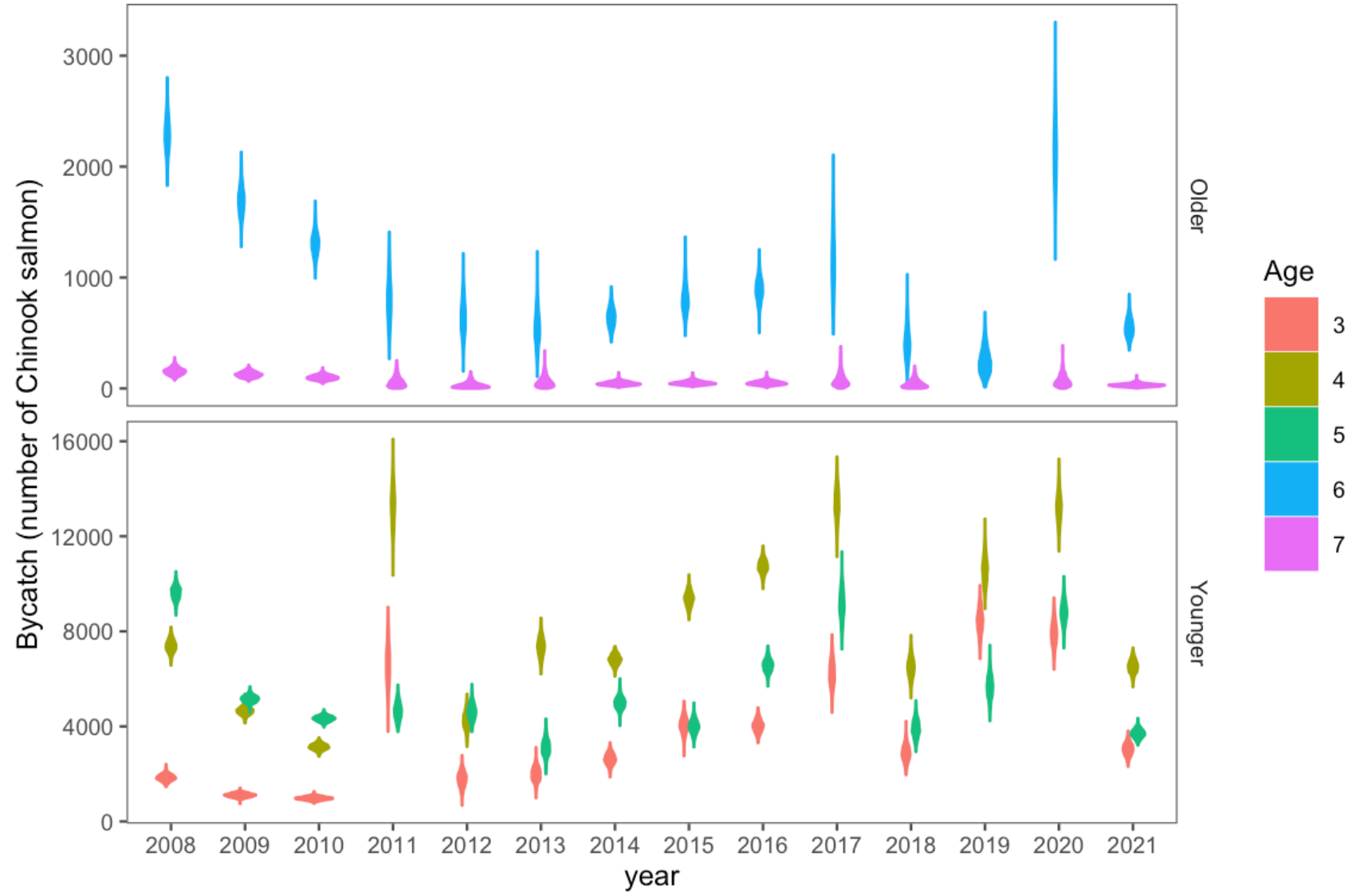




# Genetic stock composition by season bycatch



Age composition estimates of bycatch

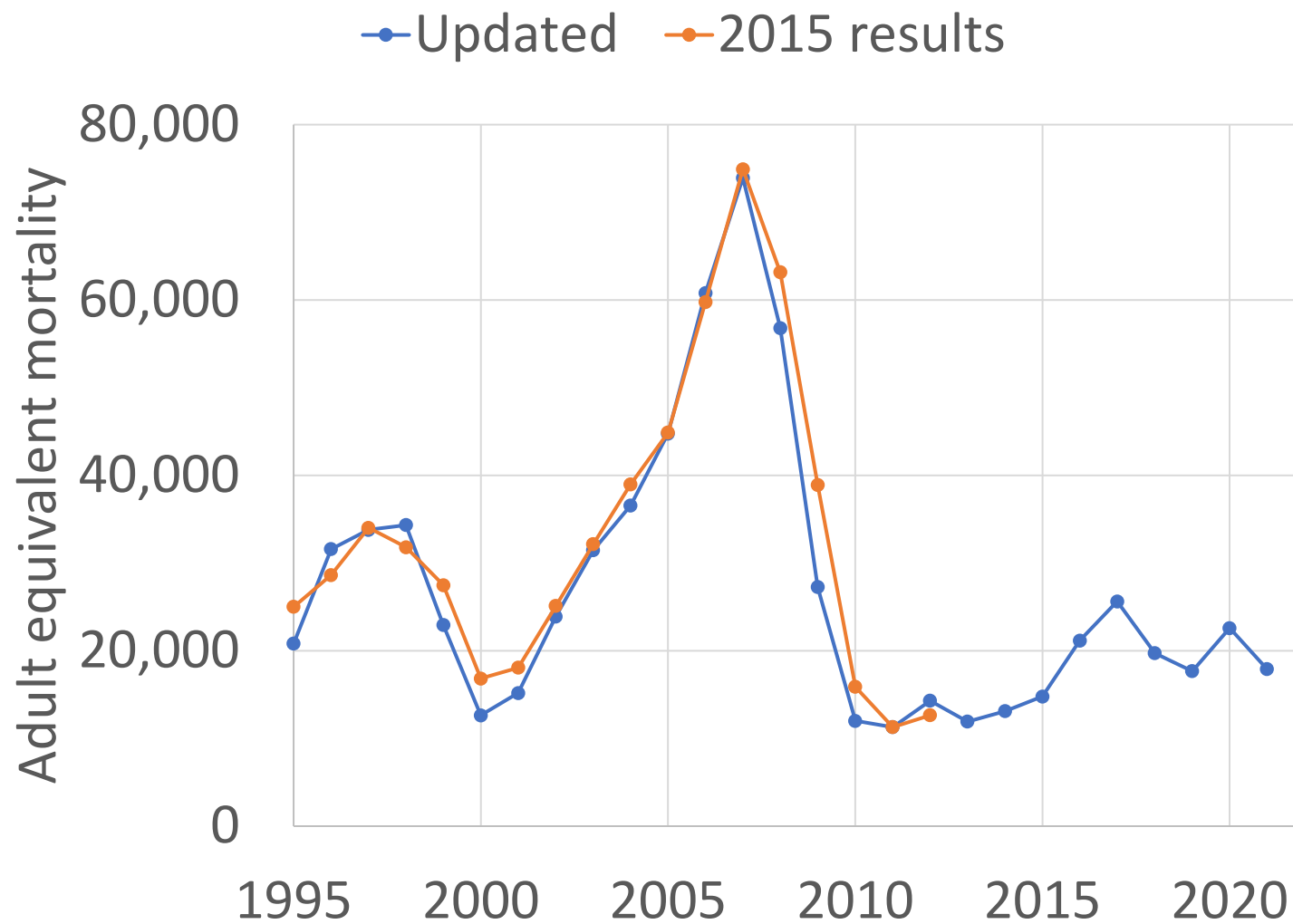


Maturity  
(Table 8)

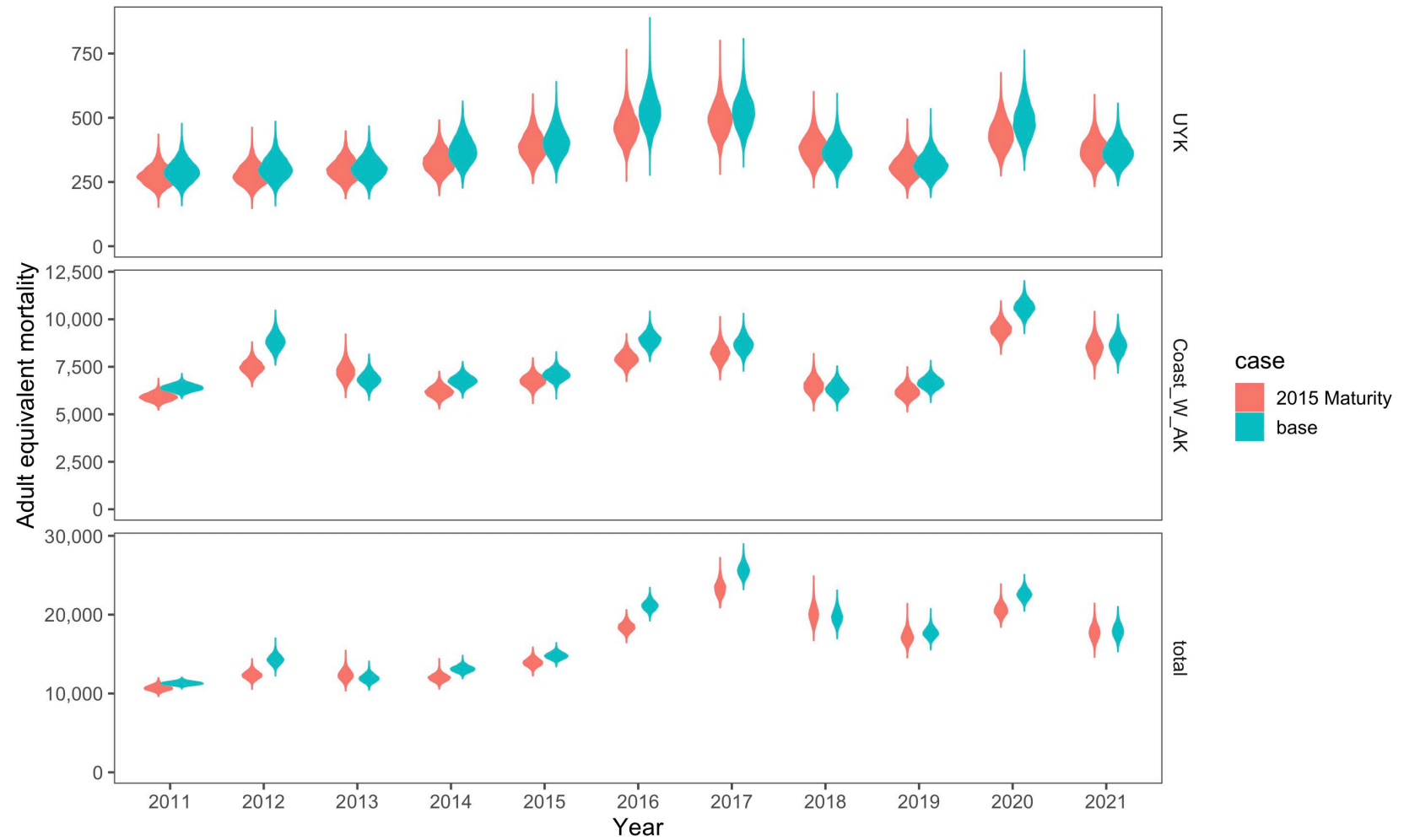
	Age					Mean run size	Weighting factor
	3	4	5	6	7		
Kuskokwim Bay	5.10%	35.10%	36.00%	23.10%	0.60%	40,709	0.077
Kuskokwim River	1.30%	30.00%	42.00%	26.00%	0.60%	124,100	0.2346
Lower Yukon	0.00%	31.70%	48.00%	20.00%	0.30%	57,554	0.1088
Middle Yukon	0.00%	18.20%	45.70%	35.30%	0.80%	46,245	0.0874
Norton Sound and Point Clarence	1.10%	23.30%	51.10%	22.30%	2.20%	9,417	0.0178
Nushagak	1.20%	37.60%	44.70%	16.30%	0.20%	178,144	0.3368
Upper Yukon	0.00%	8.60%	43.40%	45.40%	2.60%	72,836	0.1377
Weighted mean in-river age composition	1.10%	29.10%	43.80%	25.30%	0.70%		
Oceanic natural mortality	0.3	0.2	0.1	0.1	0		
Oceanic maturity (this study)	3%	23%	75%	97%	100%		
Council update from 2018	4%	18%	64%	100%	100%		
Original (Ianelli and Stram 2015)	0%	19%	50%	94%	100%		

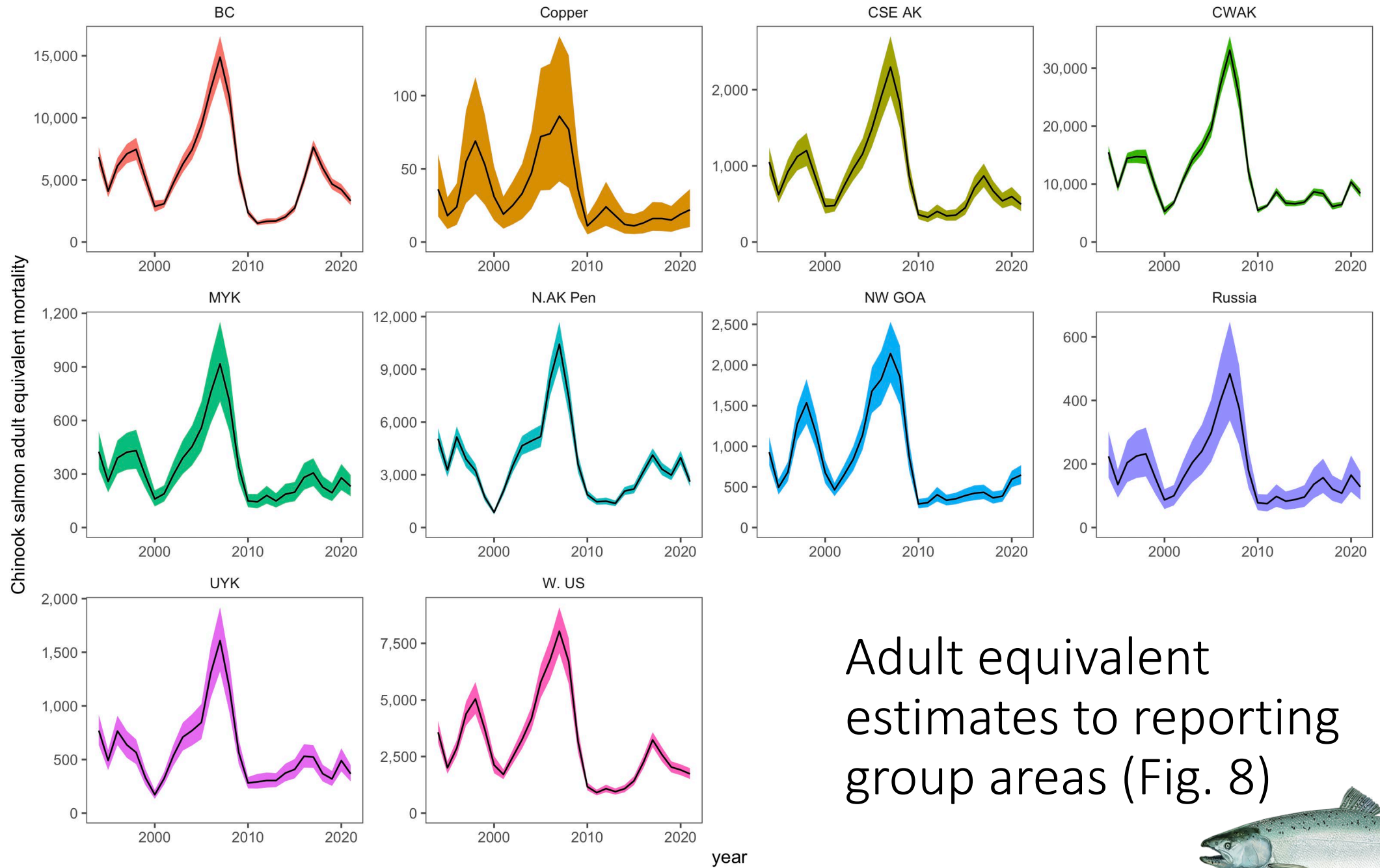


Sensitivity  
to updated  
information  
(Fig 7)



Contrast w/  
old and new  
maturity  
estimates  
(Figure 9)

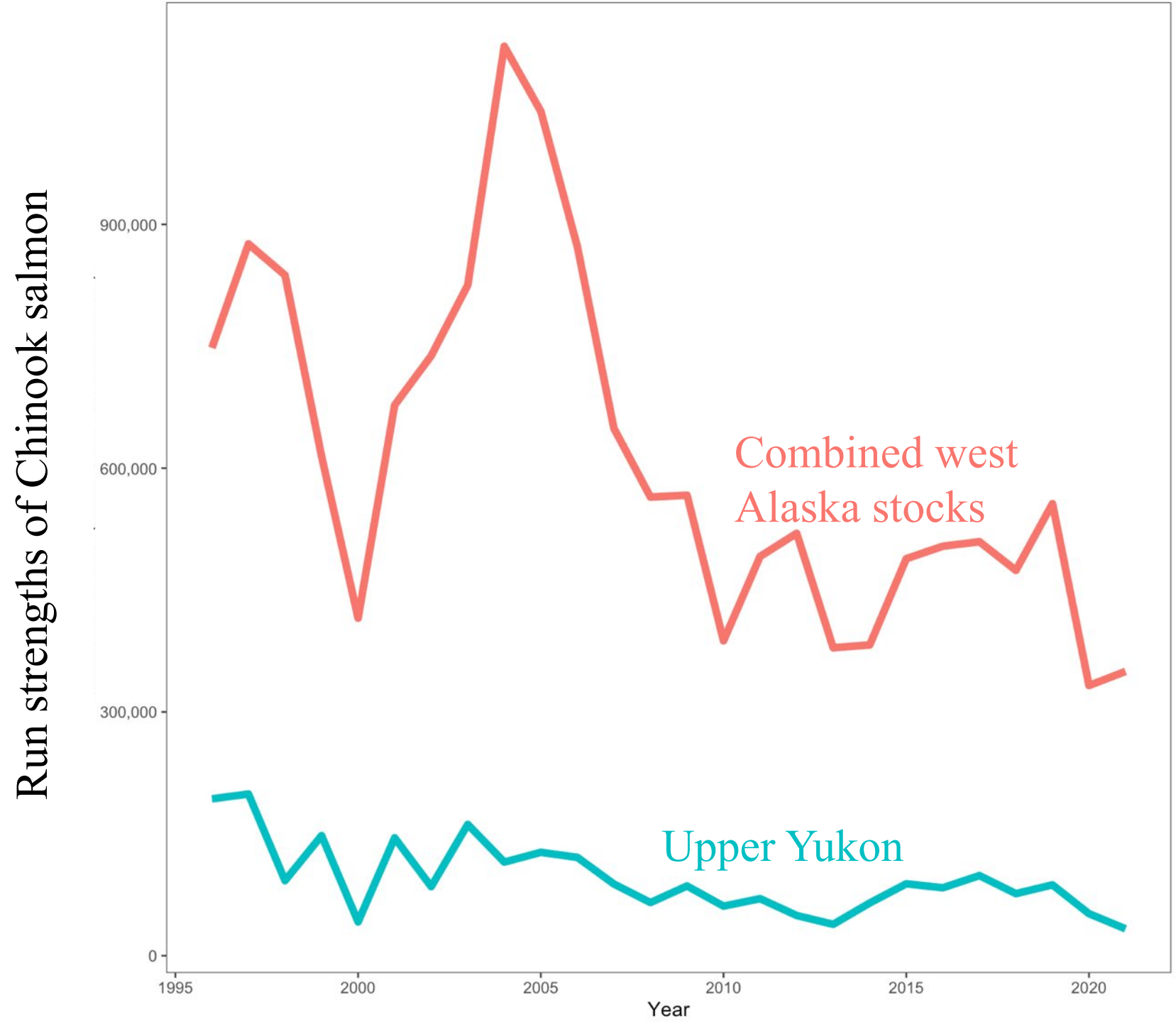




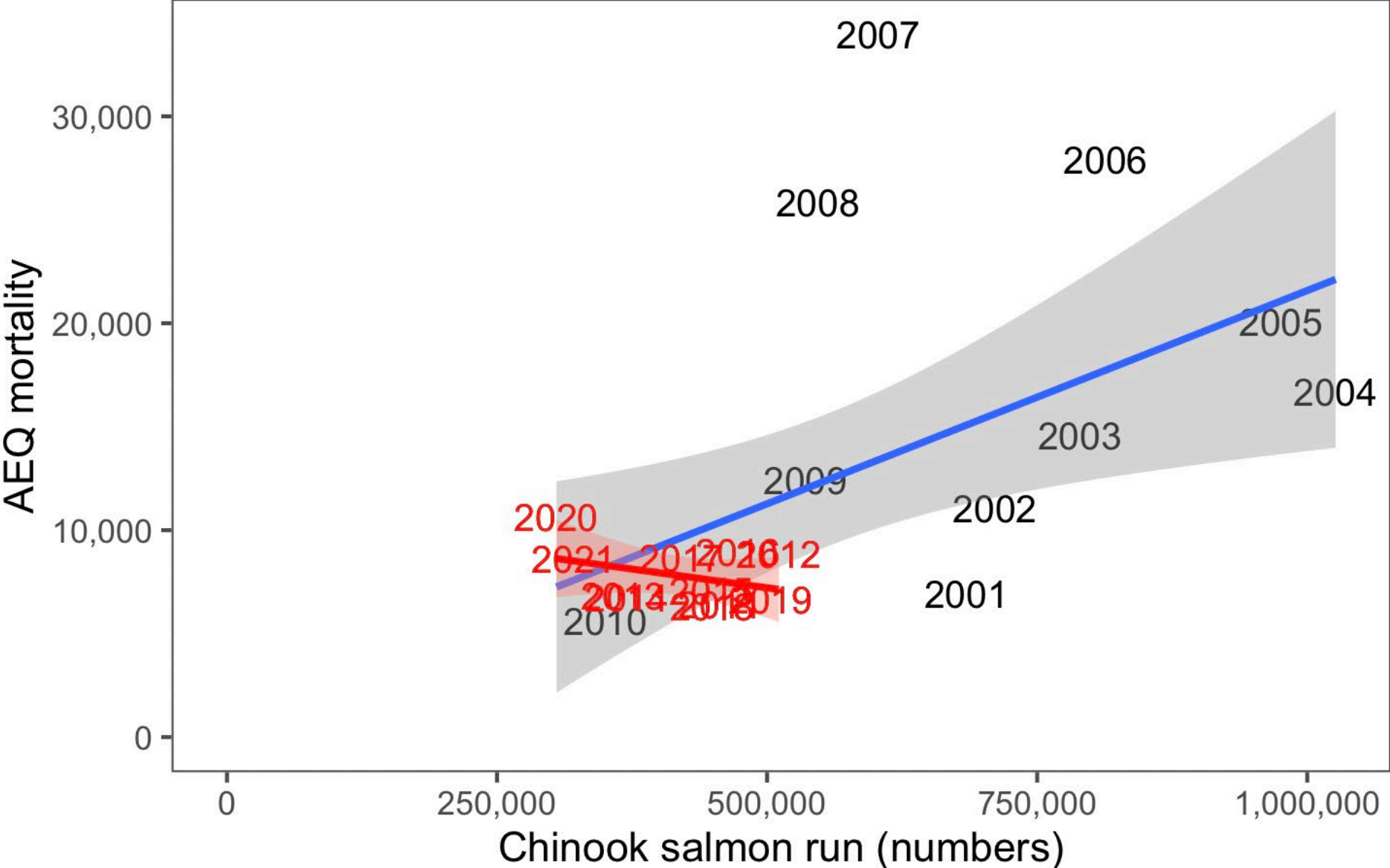
Adult equivalent estimates to reporting group areas (Fig. 8)



# Run sizes

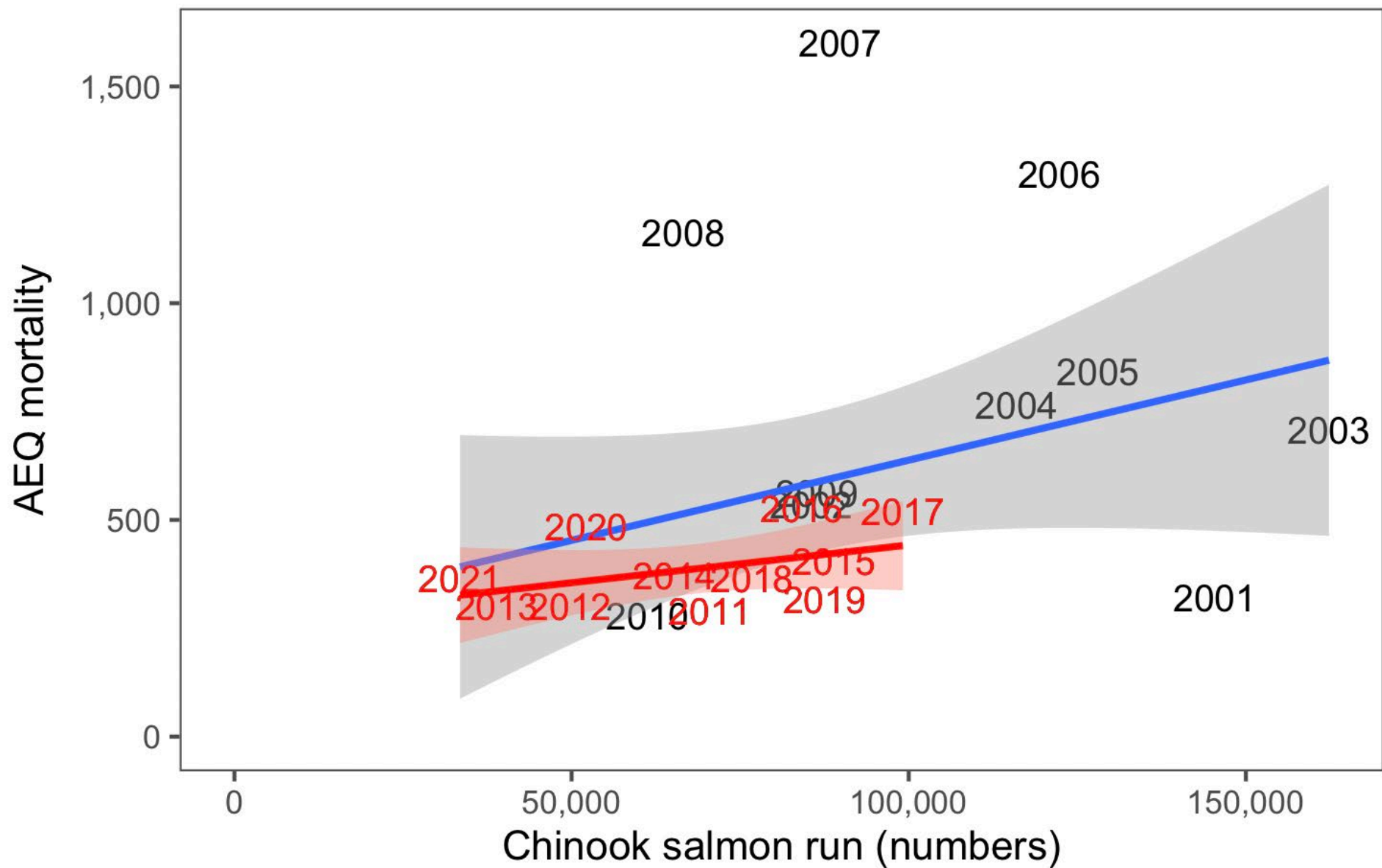


# Combined west Alaska



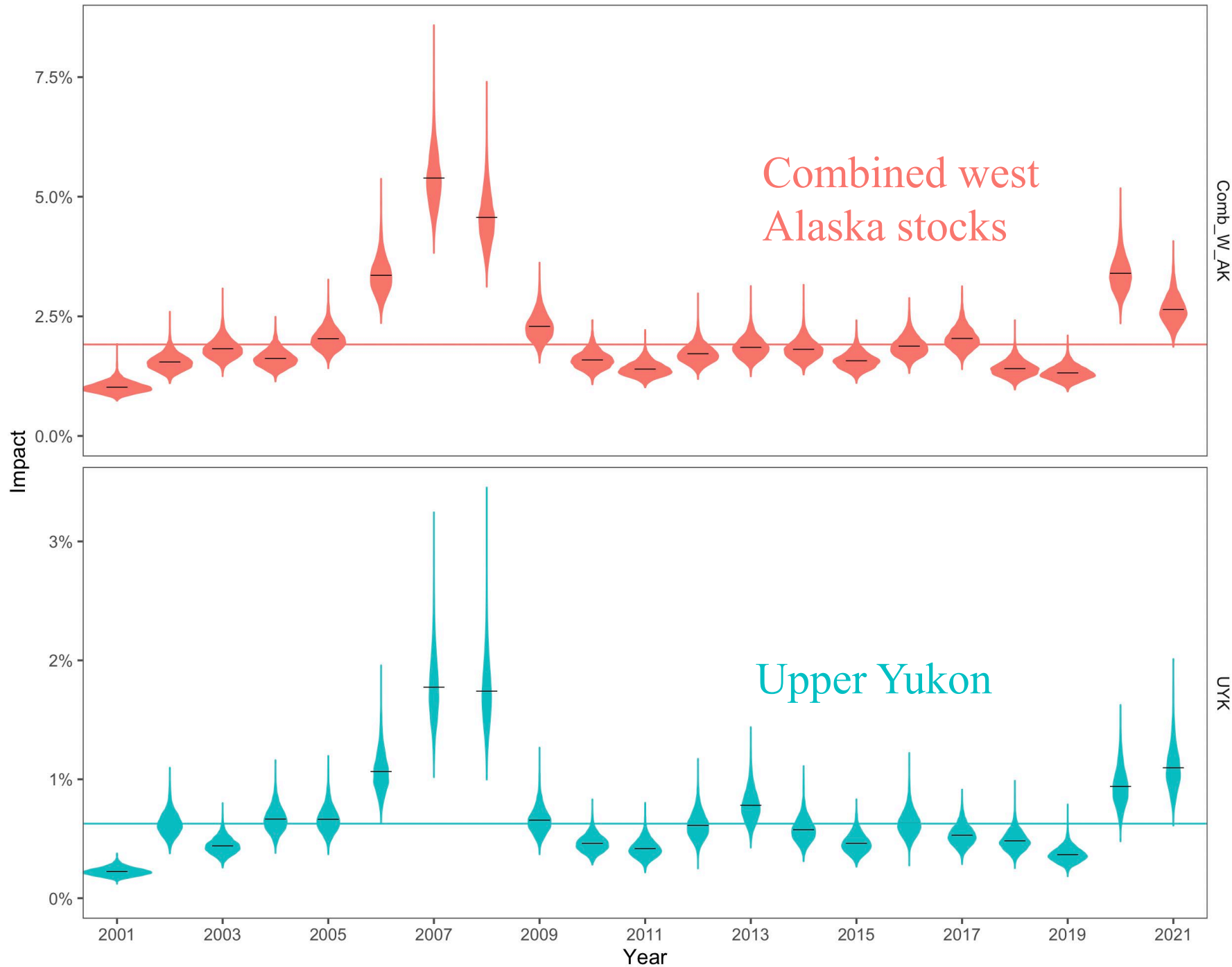


# Upper Yukon



# Impact estimates

$$\frac{\text{AEQ}}{\text{(run size + AEQ)}}$$



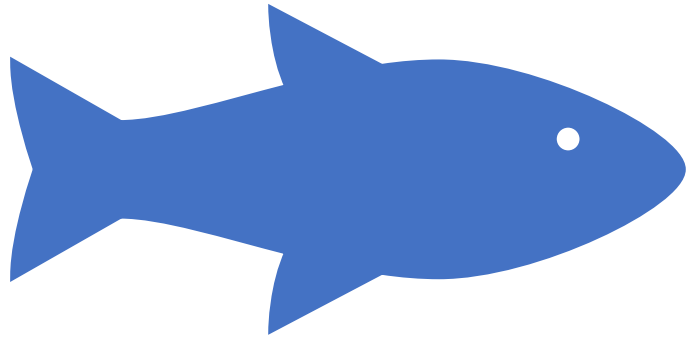
# Impact rates

Response to Council request on "what-if" current limit had been caught...

Year	Combined W. Alaska		Upper Yukon	
	base	PSC=45k cap	base	PSC=45k cap
2011	1.40%	2.1%	0.42%	0.6%
2012	1.72%	4.0%	0.61%	1.6%
2013	1.85%	4.9%	0.78%	2.3%
2014	1.81%	4.8%	0.58%	1.6%
2015	1.57%	3.5%	0.46%	1.0%
2016	1.88%	3.1%	0.63%	1.1%
2017	2.04%	2.9%	0.53%	0.8%
2018	1.41%	2.5%	0.48%	0.9%
2019	1.32%	2.4%	0.37%	0.7%
2020	3.40%	5.0%	0.94%	1.4%
2021	2.64%	4.9%	1.10%	2.2%
Mean	1.91%	3.6%	0.63%	1.3%

# Summary

- Impact rates which has averaged 1.9% since 2011 for the combined coastal western Alaska stocks
  - 0.6% for the Upper Yukon
- The rate for the western Alaska stocks increased in 2020 to an estimate of 3.4% but dropped in 2021 to 2.6%
  - 0.9% and 1.1% for the Upper Yukon
- The increase is due to lower returns overall with the biggest decrease for Combined western Alaska from the Nushagak River



Chum salmon  
impact  
recommendations

Total chum salmon bycatch, (prohibited species catch (PSC)), in the BSAI pollock fishery ranged from 24,000 to 535,000 total catch annually between 2011-2021.

Chum salmon PSC in the last two years (2020-2021):

lower proportions of W. Alaska and Yukon River fall chum salmon (~9% total) compared to the previous nine (~16-25%).

Contributions from the Yukon River fall chum stocks especially low in 2020 and 2021 (1% or less of total PSC).

Number of chum salmon PSC is larger than the number of chum salmon adults that would have returned to Western Alaska rivers

# Assessing impacts

## AEQ for chum

- a coarse estimate of an AEQ but several assumptions would need to be made where data are not available (i.e., maturity and natural mortality rate).

## Impact rate for chum

- For CWAK this is not possible.
- Run reconstructions are currently only available for Yukon River summer and fall chum salmon and Kwiniuk River chum salmon. This excludes large populations in Kuskokwim River and throughout Bristol Bay, Kotzebue Sound, and Norton Sound. Unlike Chinook salmon, the lack of run reconstructions for large populations of W. Alaska chum salmon means that a good approximation of total W. Alaska chum salmon abundance cannot be provided at this time.
- Impact rate for Yukon fall would be possible but may not reflect trends across all western AK chum stocks

## Other recommendations

Summarize spatial and temporal location of Western Alaska chum stocks in bycatch. This would provide clarity to whether spatial restrictions could be used to better avoid chum salmon PSC of these stocks.

Work toward developing estimates of the chum ages in PSC for each of W. Alaska and Upper/Middle Yukon (Yukon River fall chum salmon) stock genetic reporting groups.