



**NOAA
FISHERIES**

Alaska Fisheries
Science Center

Assessment of walleye pollock in the Eastern Bering Sea

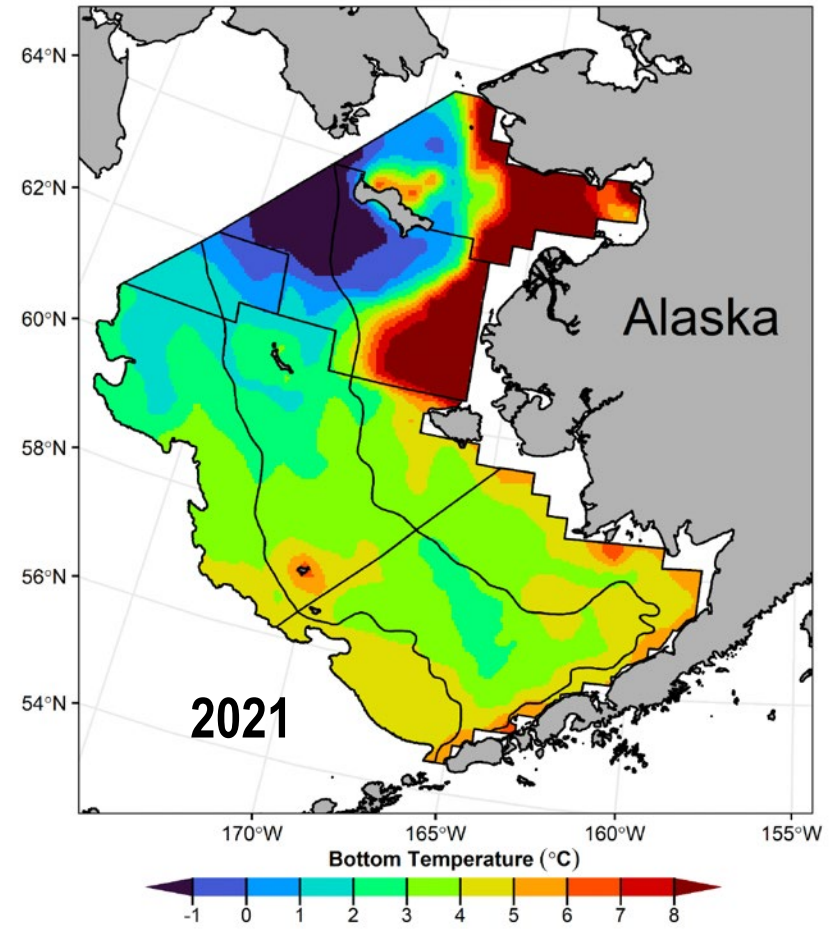
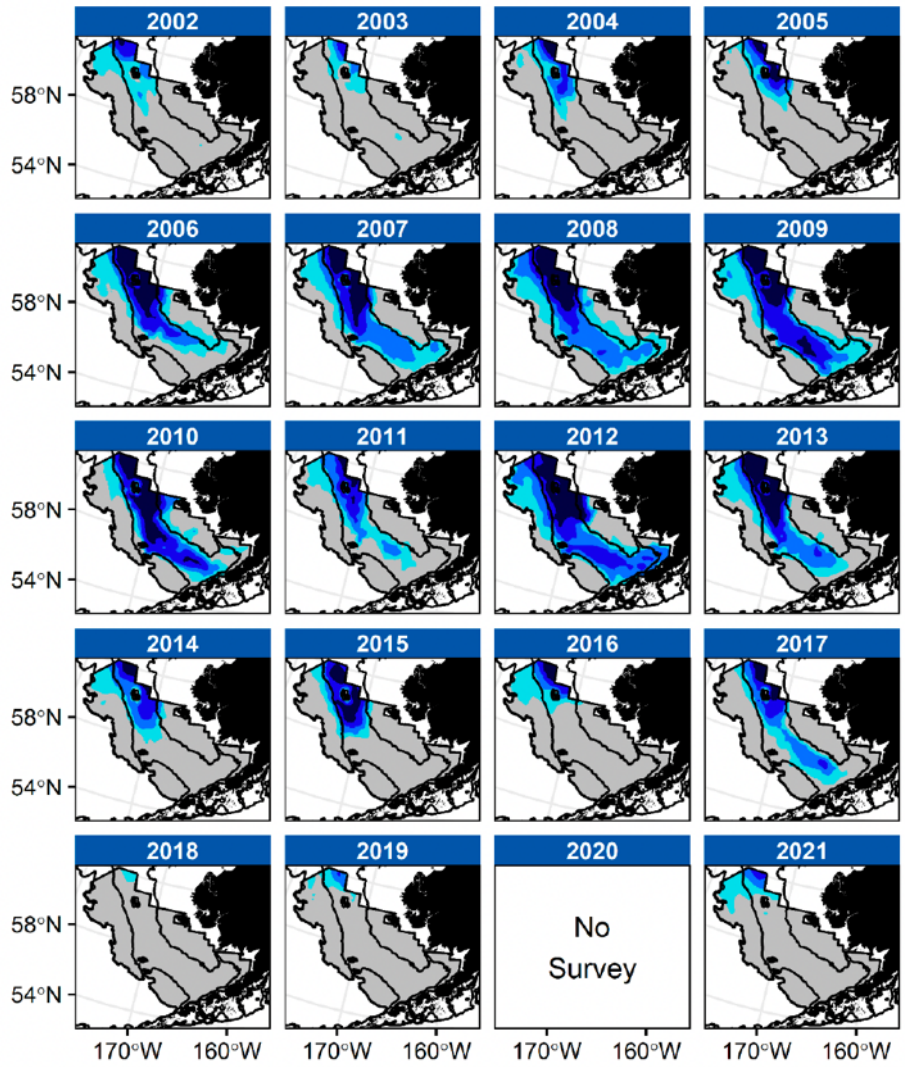
James Ianelli, Ben Fissel,
Sarah Stienessen, Taina Honkalehto,
Elizabeth Siddon, and Caitlin Allen-Akselrud

December 3rd, 2021



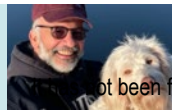
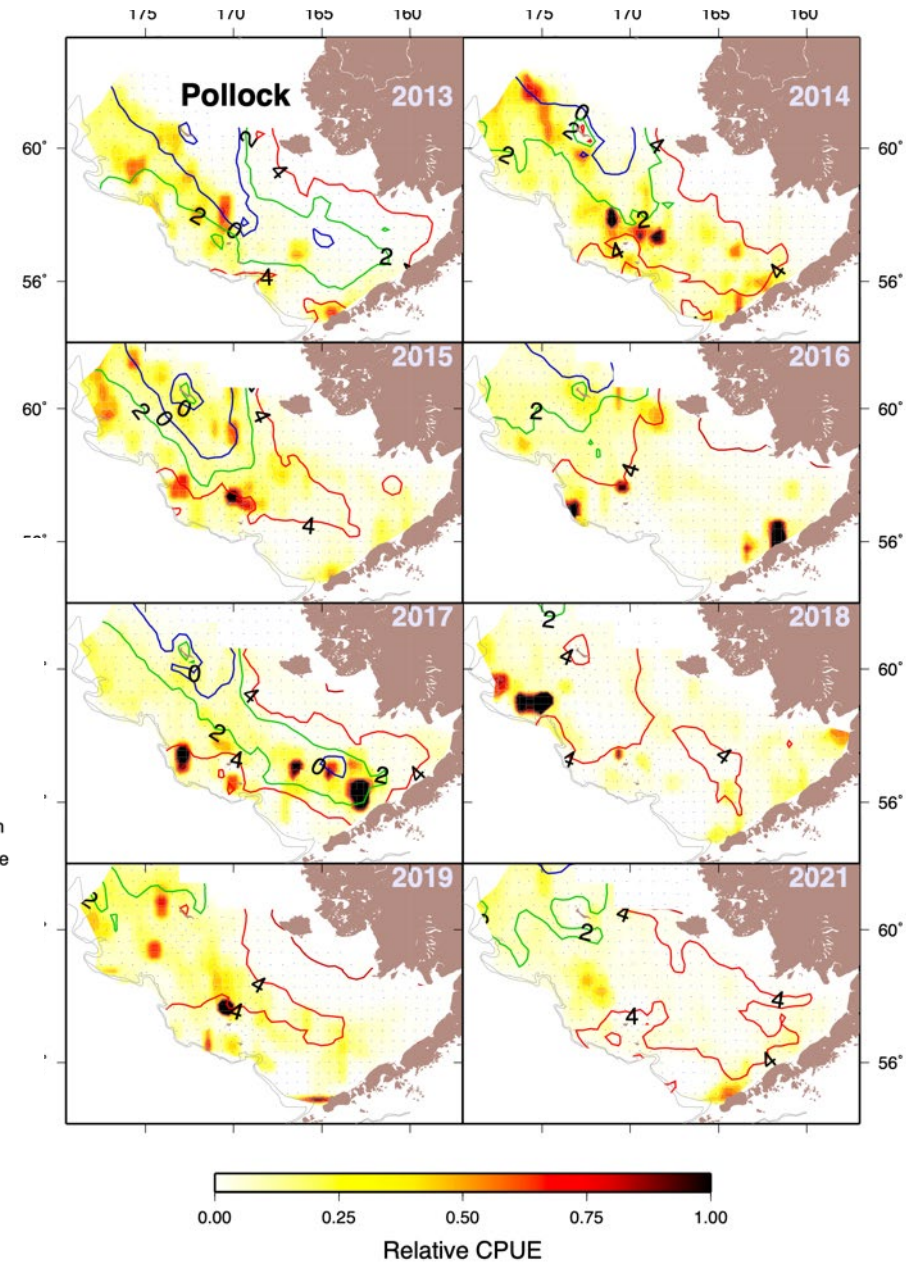
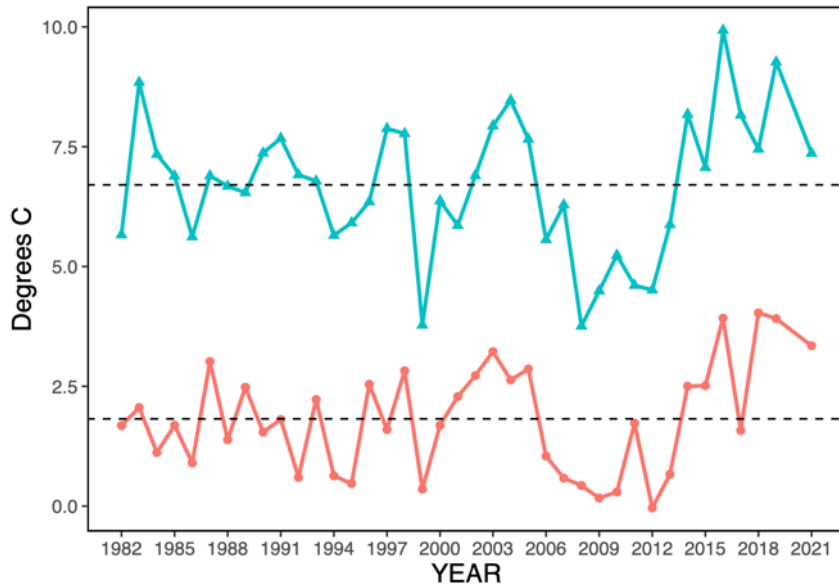
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Pollock density and bottom temperatures

- From the bottom trawl survey



New genetics information

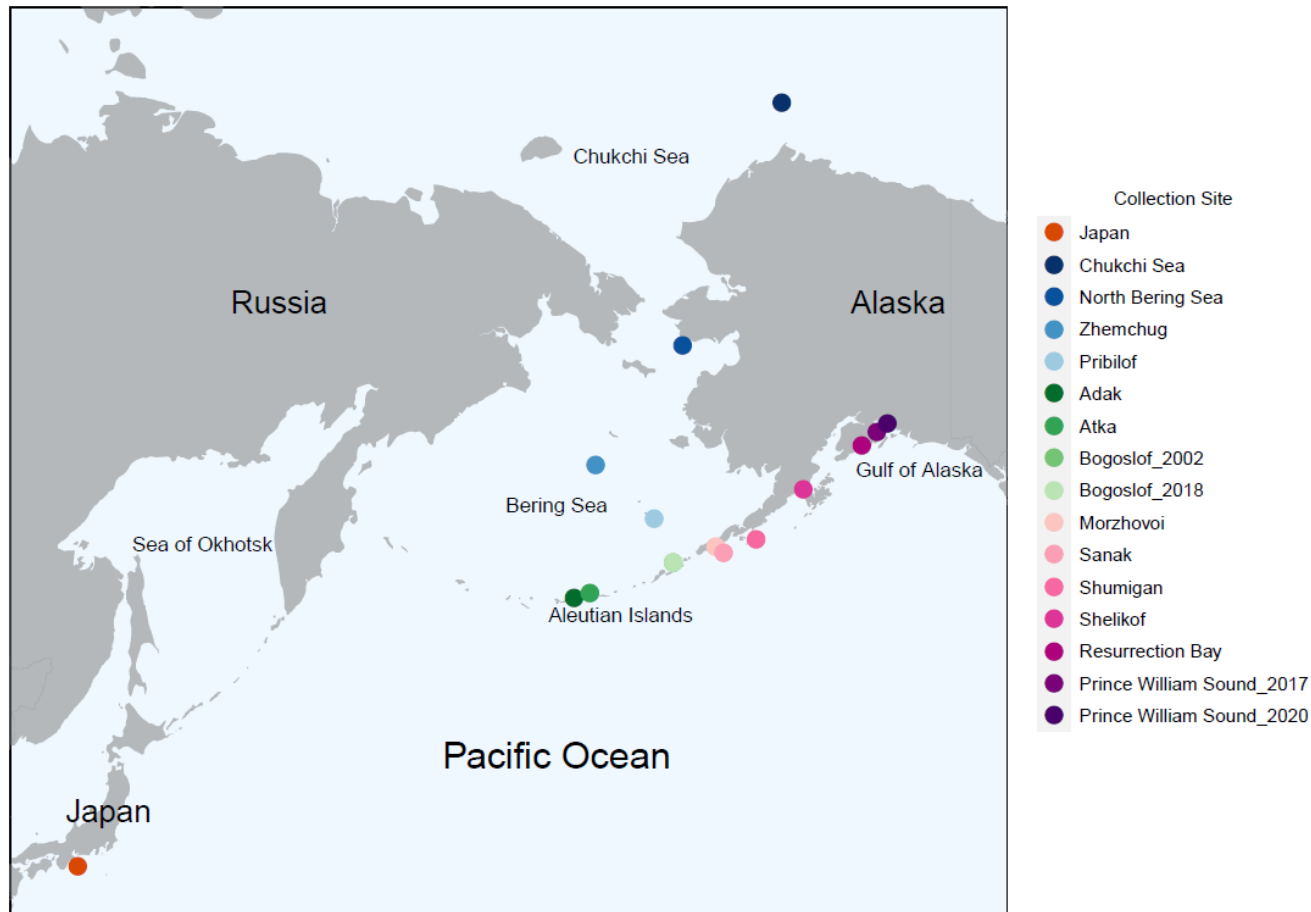
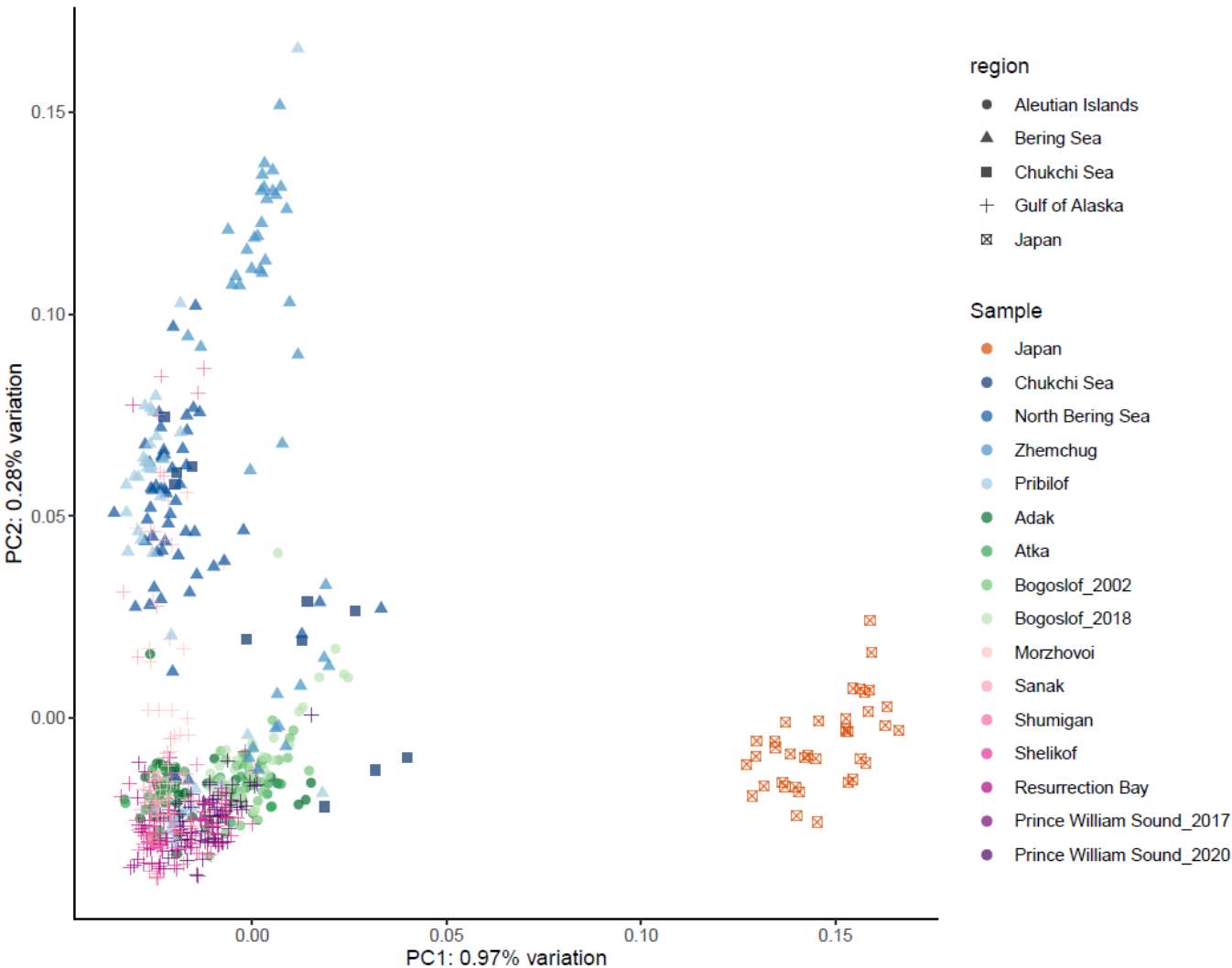


Figure 1. Sampling locations of pollock collected in Japan (orange point), Chukchi Sea and Bering Sea (blue points), Aleutian Islands (green points), Alaska Peninsula and Gulf of Alaska (pink and purple points).



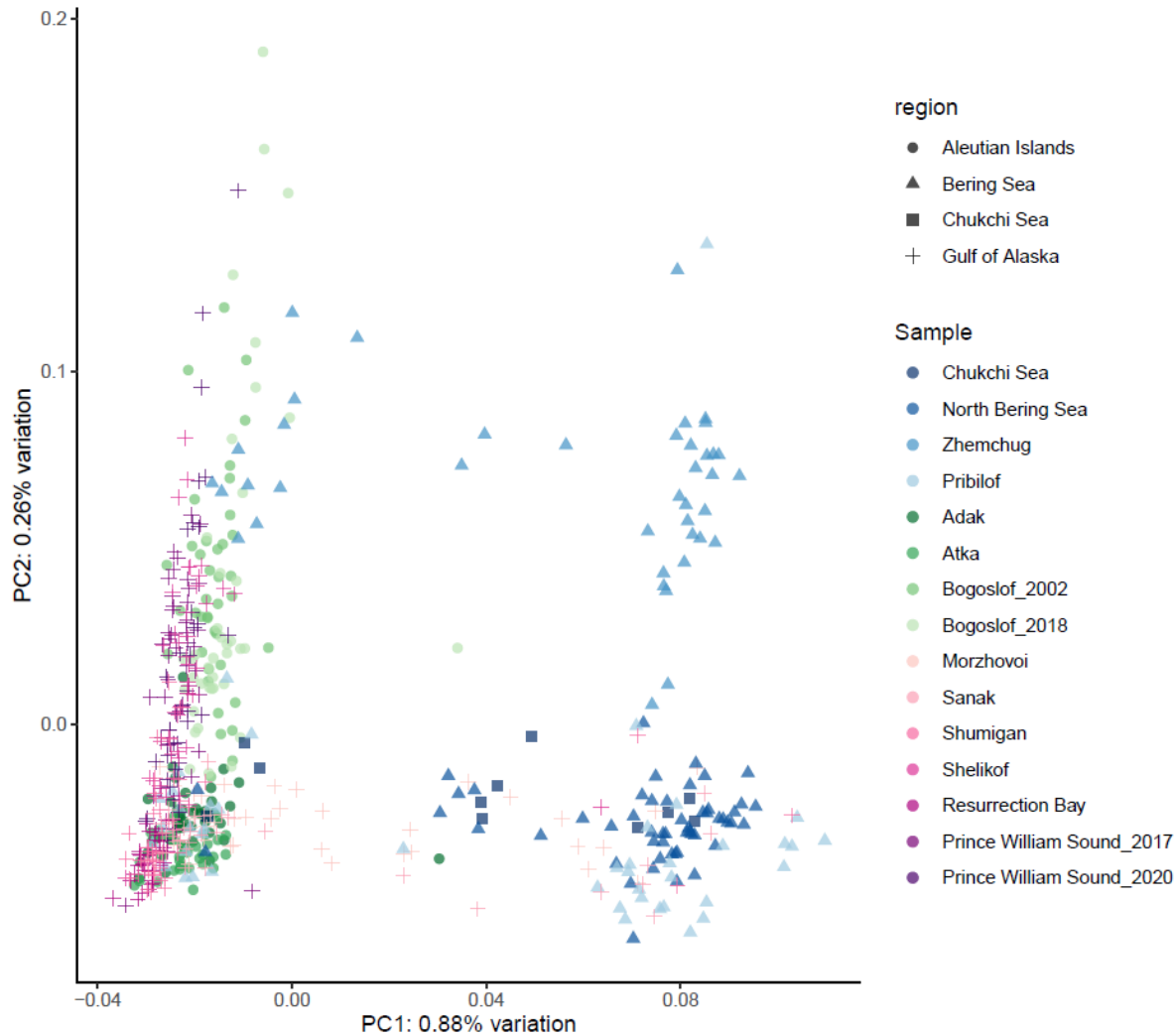
New genetics information



PCA using all samples collected in this study. The color of each point indicates the sampling location and region.



New genetics information



PCA excluding samples collected in Japan. The color of each point indicates the sampling location and region.



New genetics information

- Results promising and consistent with our current management areas
- Future source-spawning ID possible

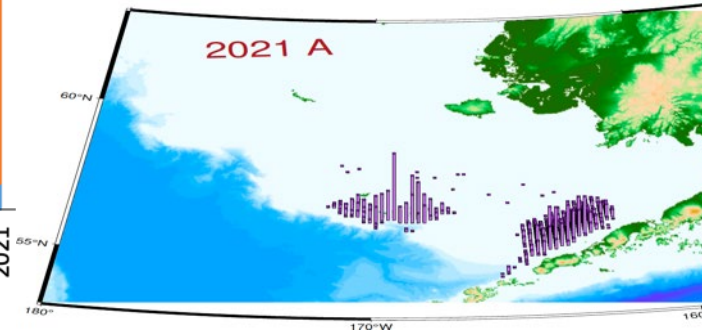
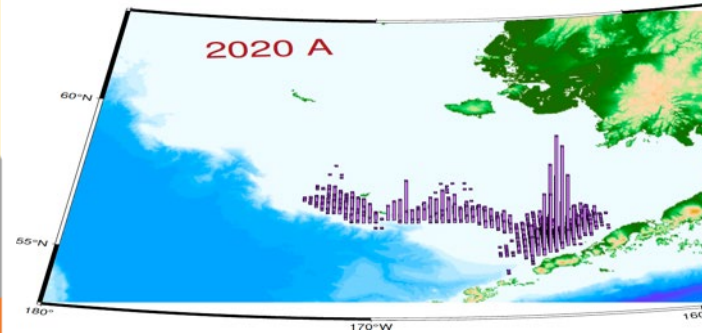
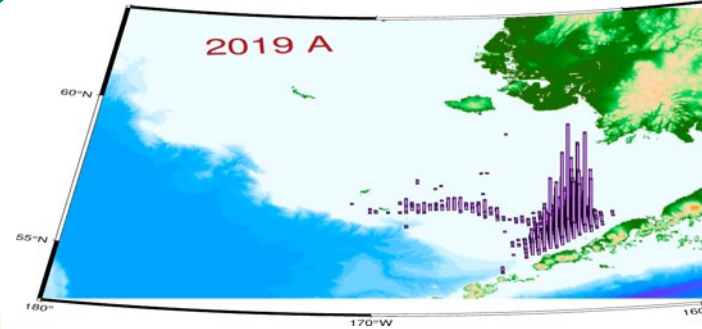
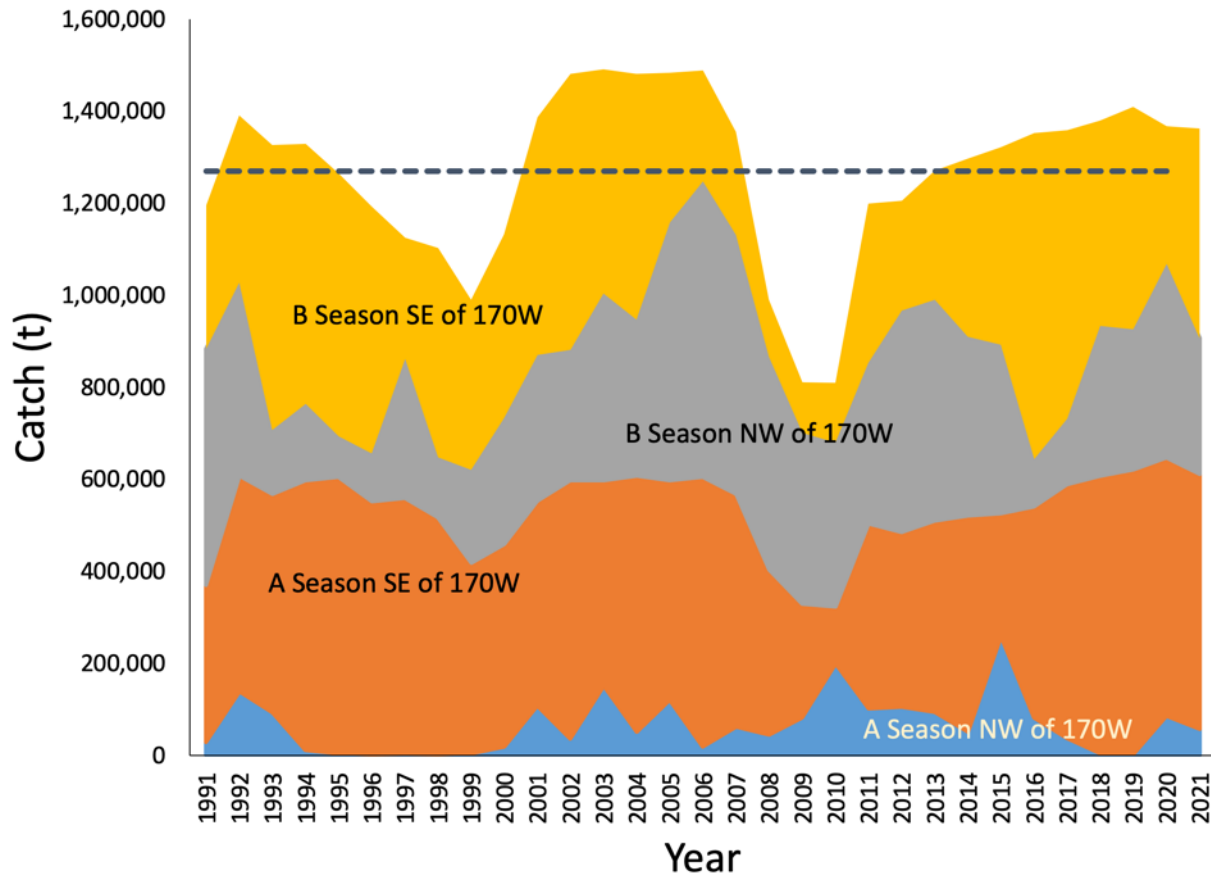


Data

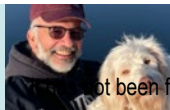
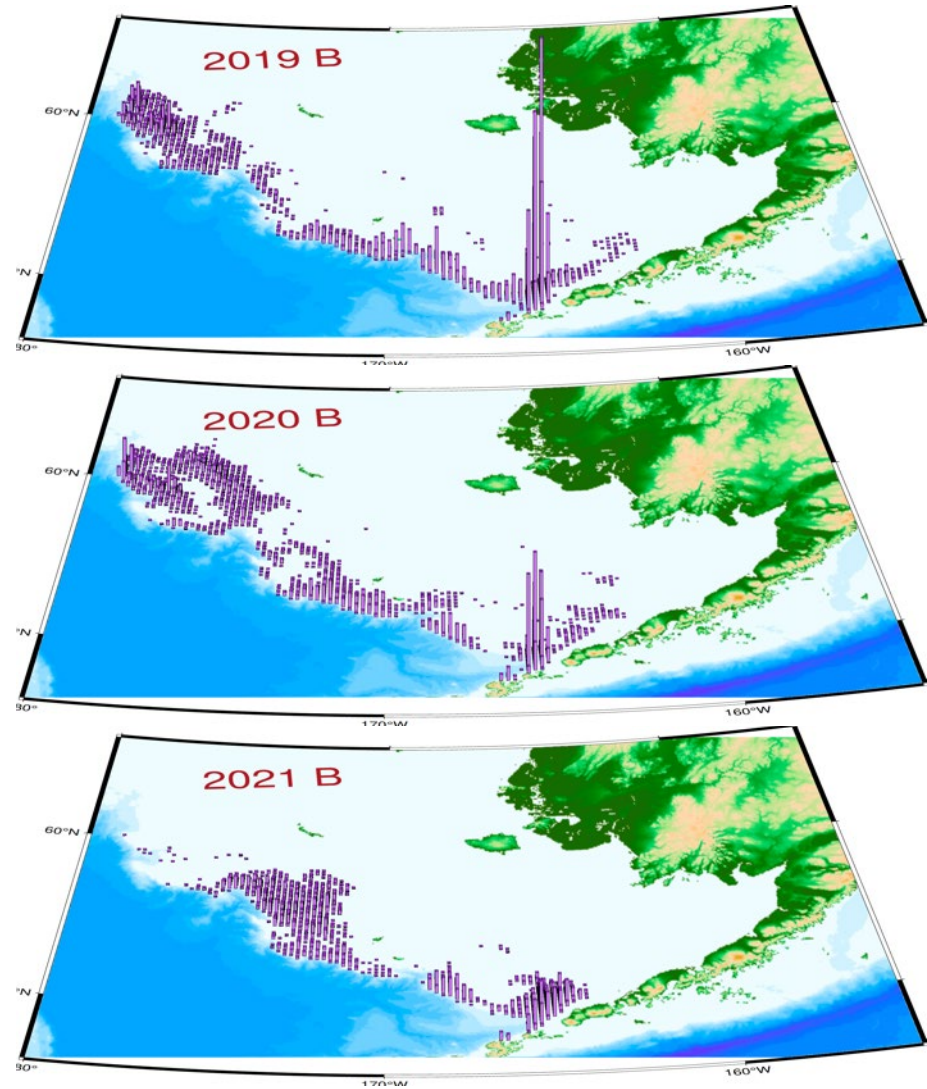


Seasonal and area catch patterns

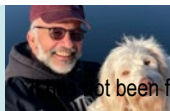
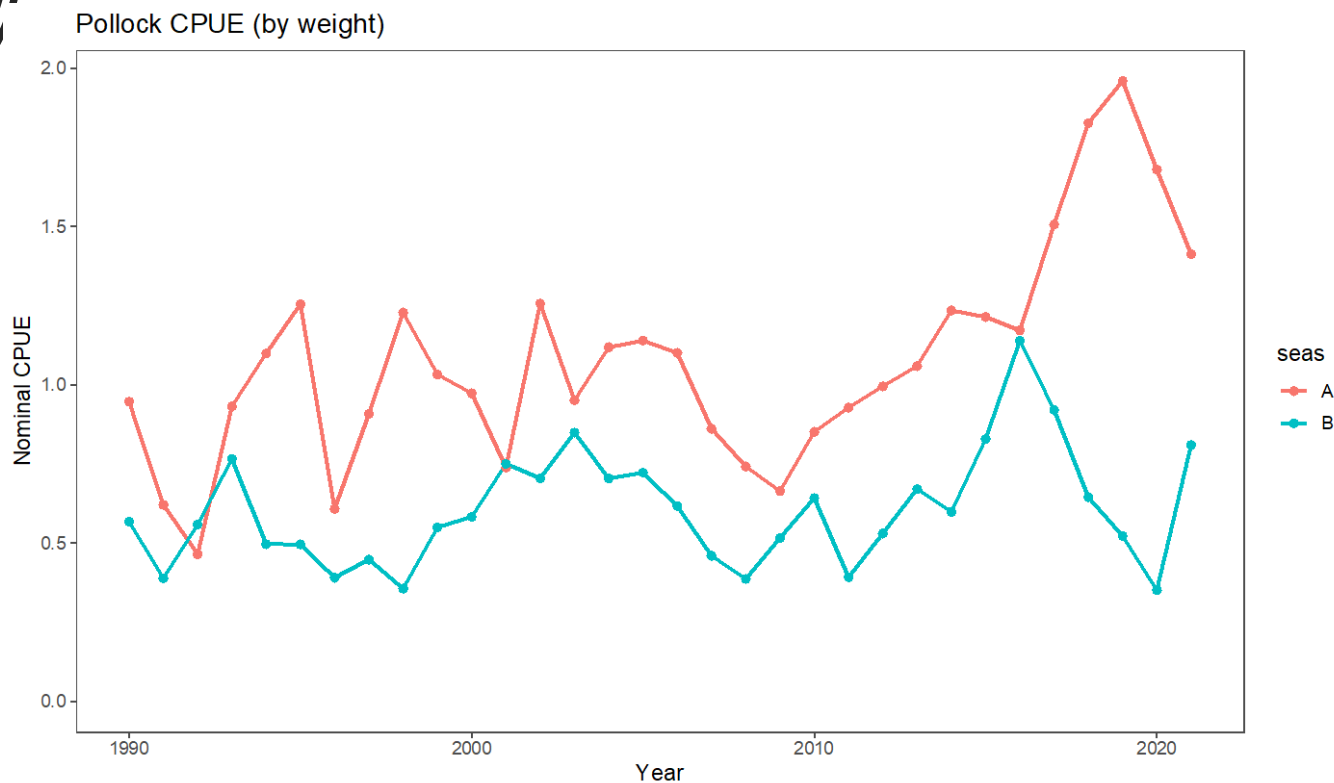
Eastern Bering Sea pollock



B-season fishery distributions



Pollock fishery CPUE season

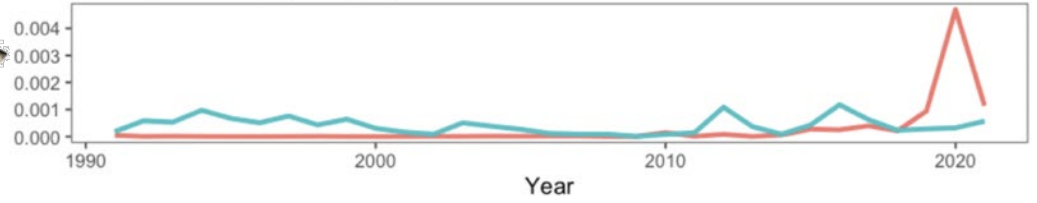


Fishery conditions

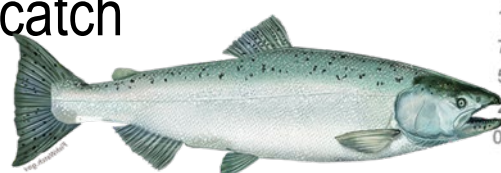
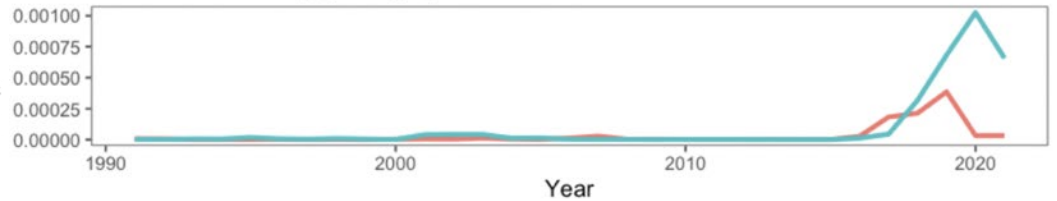
Catch rates of pollock and selected bycatch species



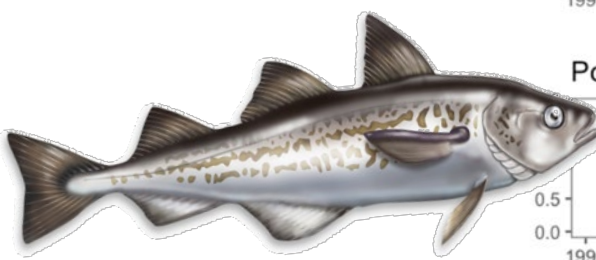
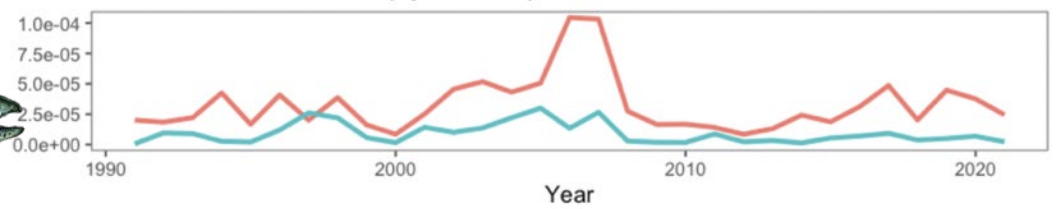
Herring CPUE (by weight)



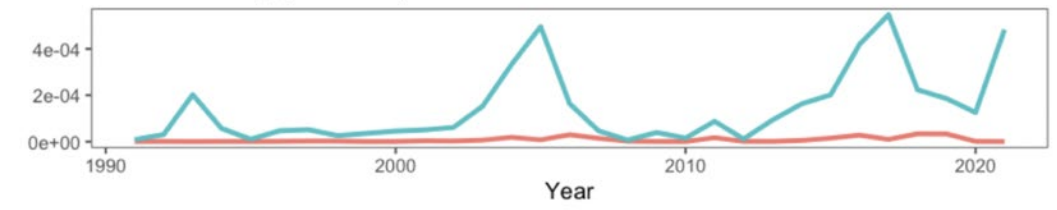
Sablefish CPUE (by weight)



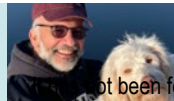
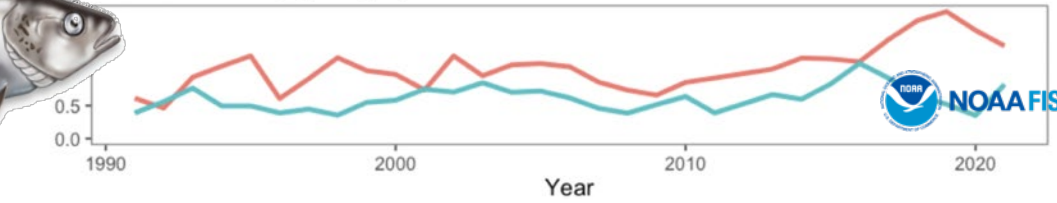
Chinook salmon CPUE (by number)



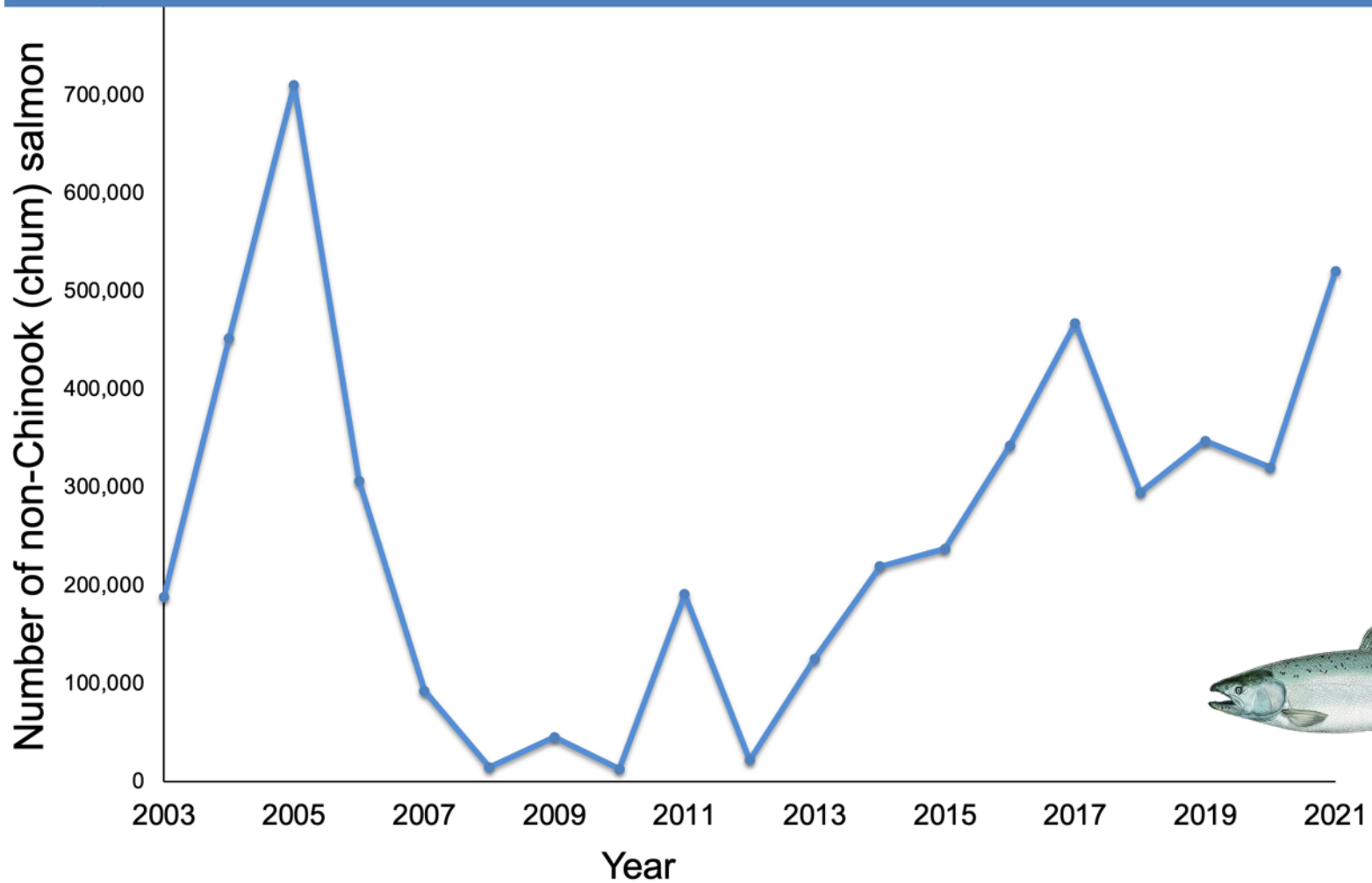
Chum CPUE (by number)



Pollock CPUE (by weight)



2003-2021 Bering Sea Chum Salmon Bycatch



Fish size



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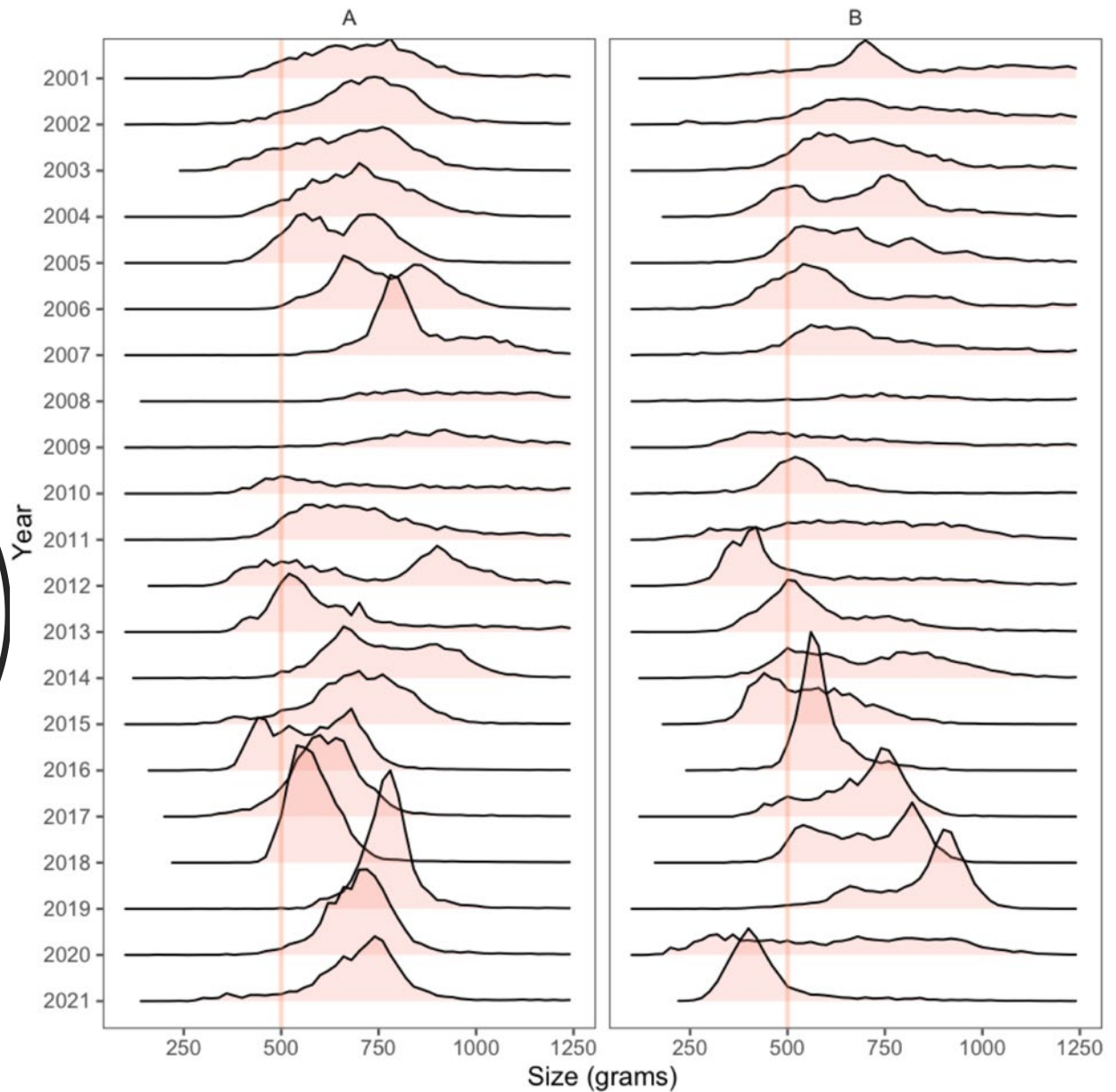


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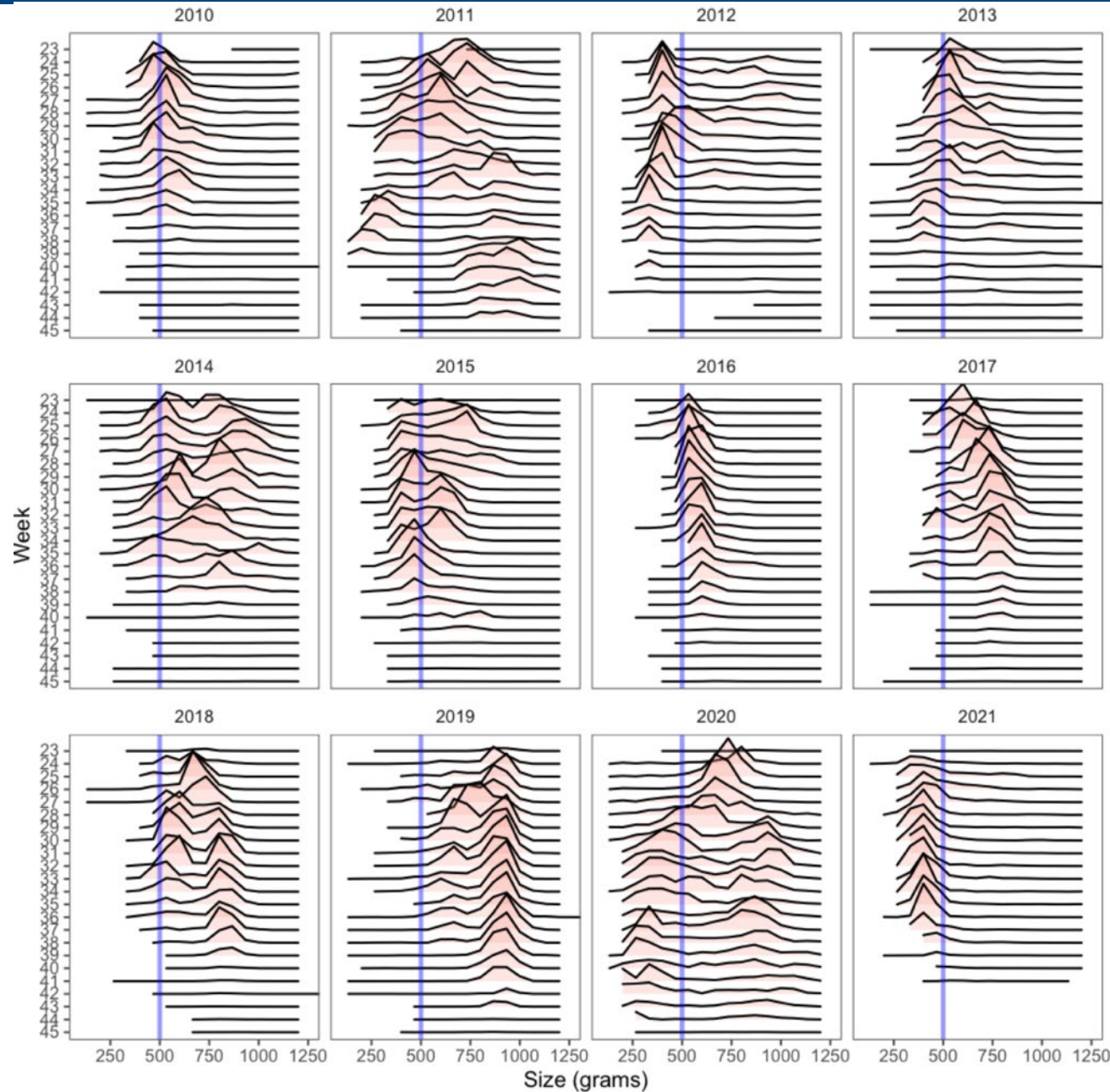
By
season
& year

Pollock
fishery mean
weight in
tows

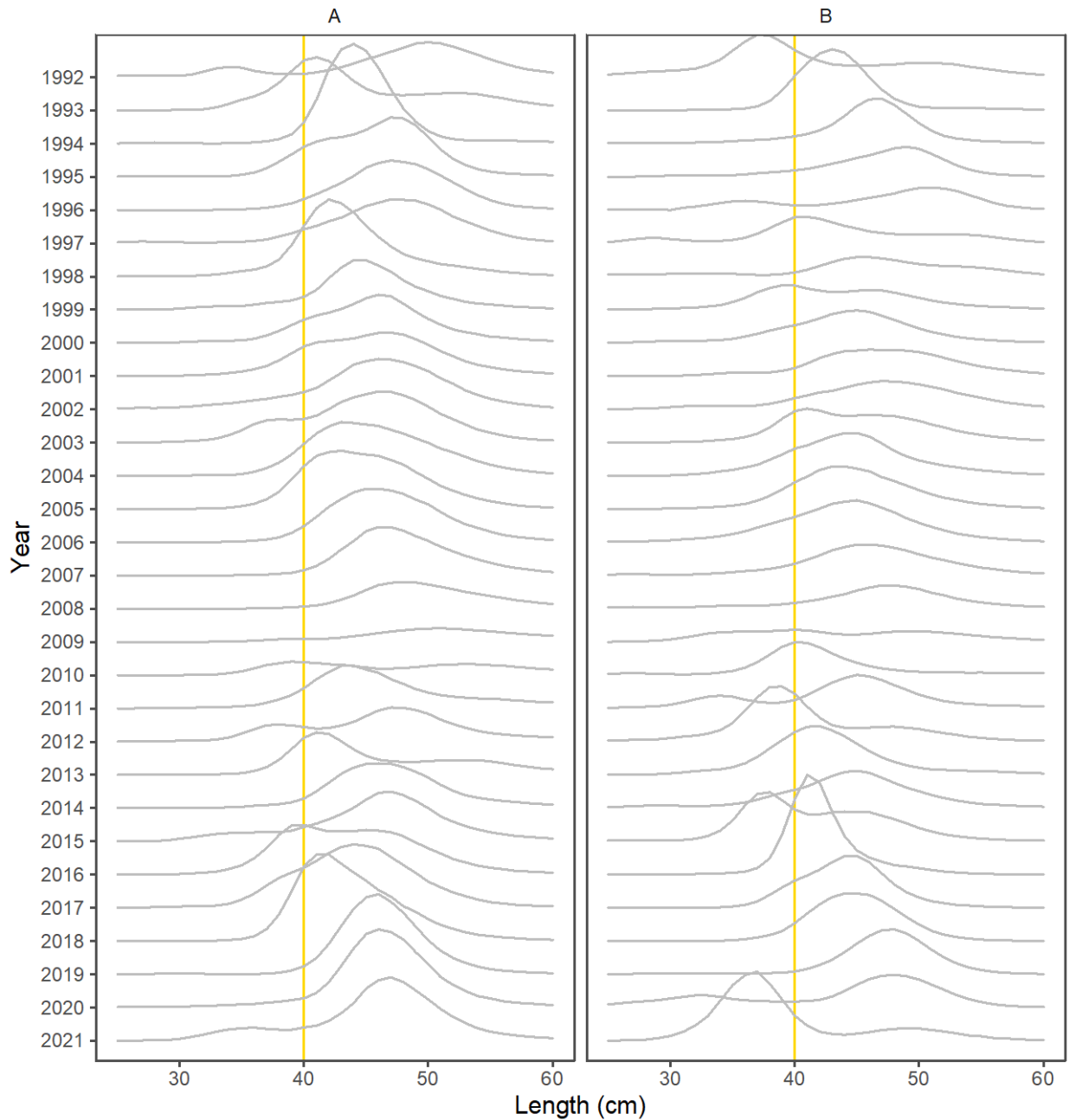


B-season Weekly catch

Pollock
fishery mean
weight in
tows

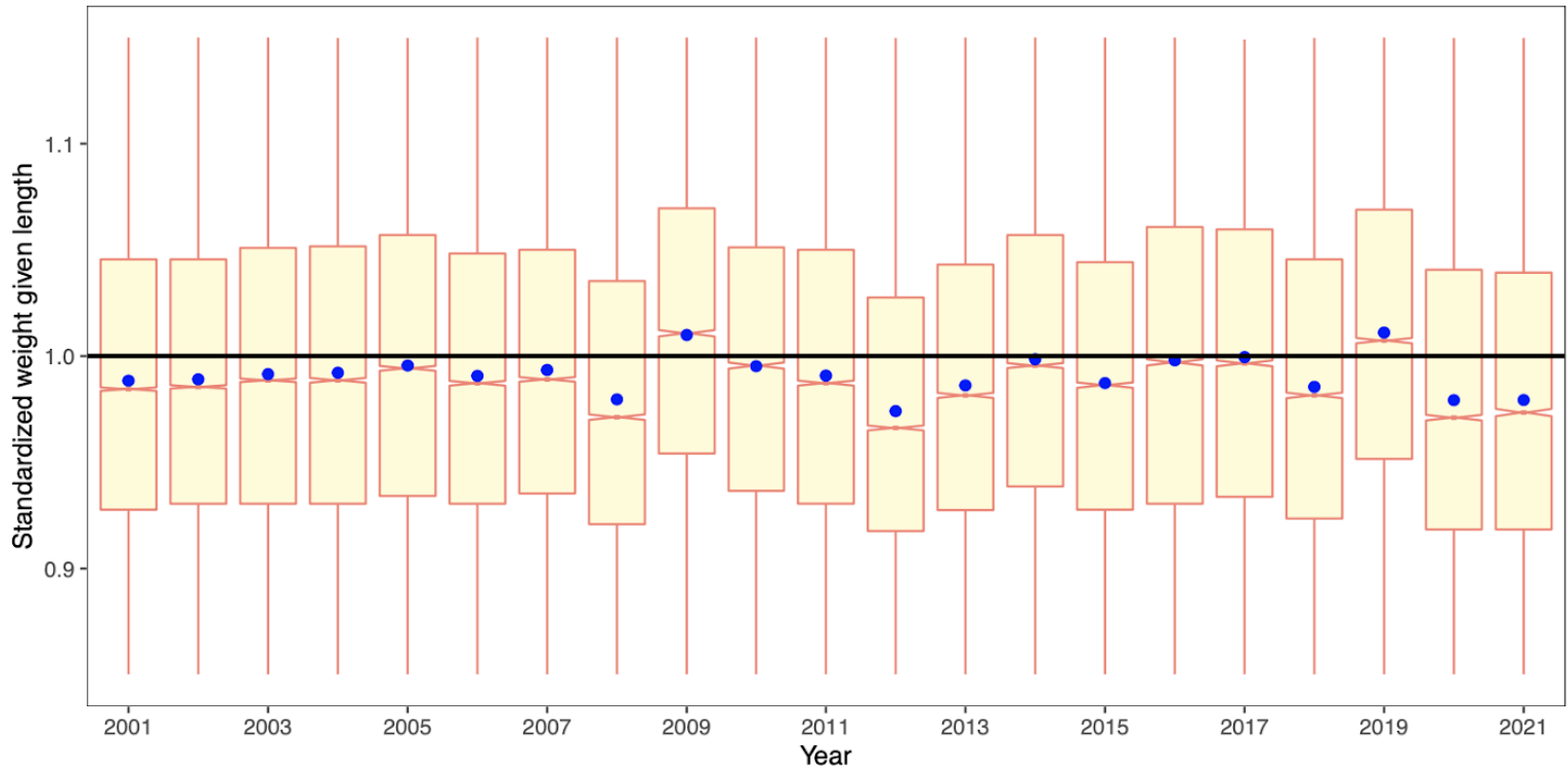


Pollock fishery length frequency by season



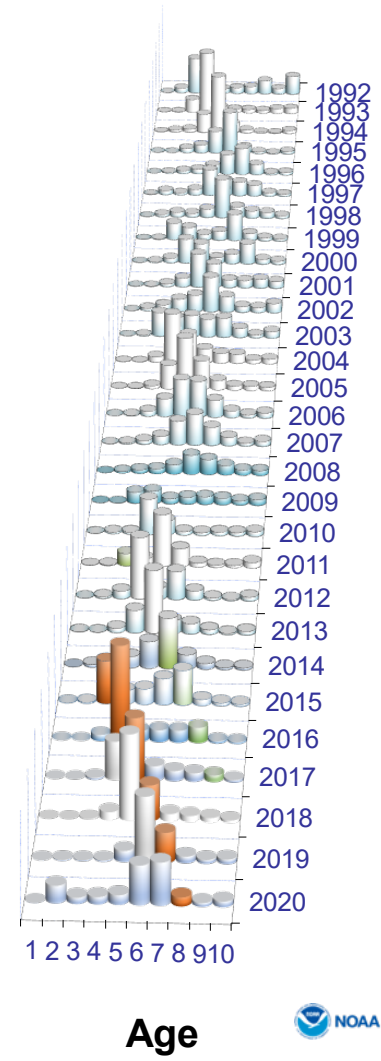
Weight given length—fishery data

Skinny again in 2021!

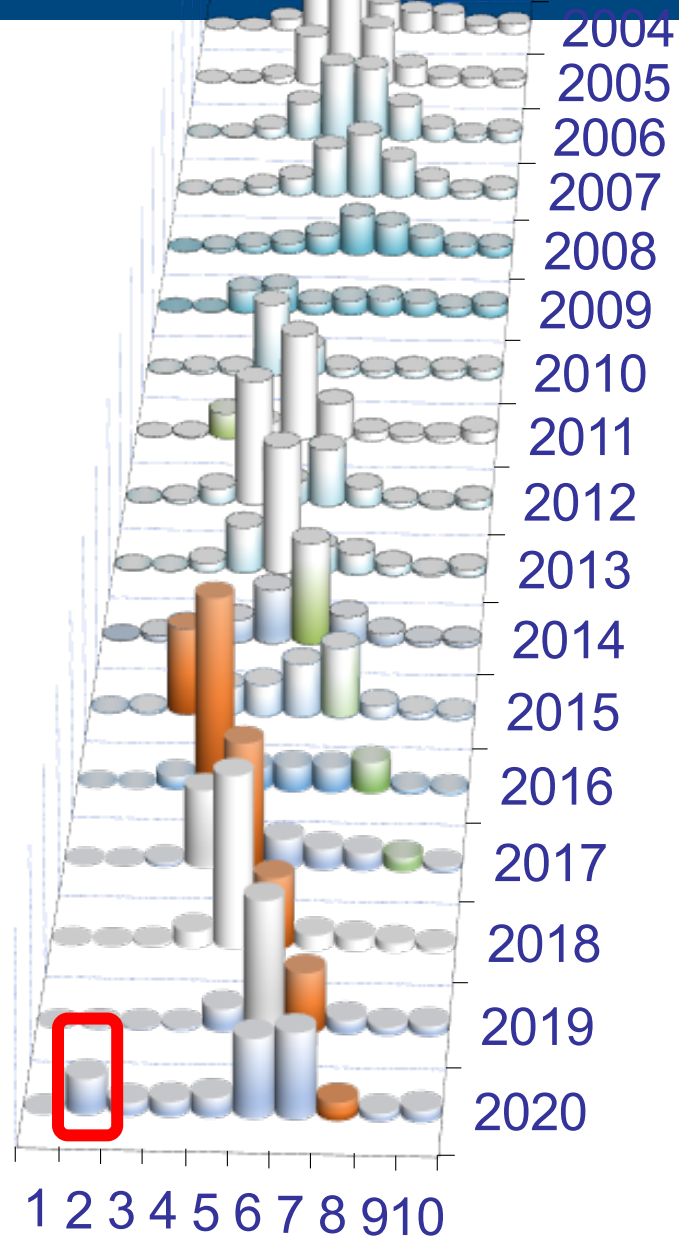




Fishery catch-at-age



Fishery catch-at-age

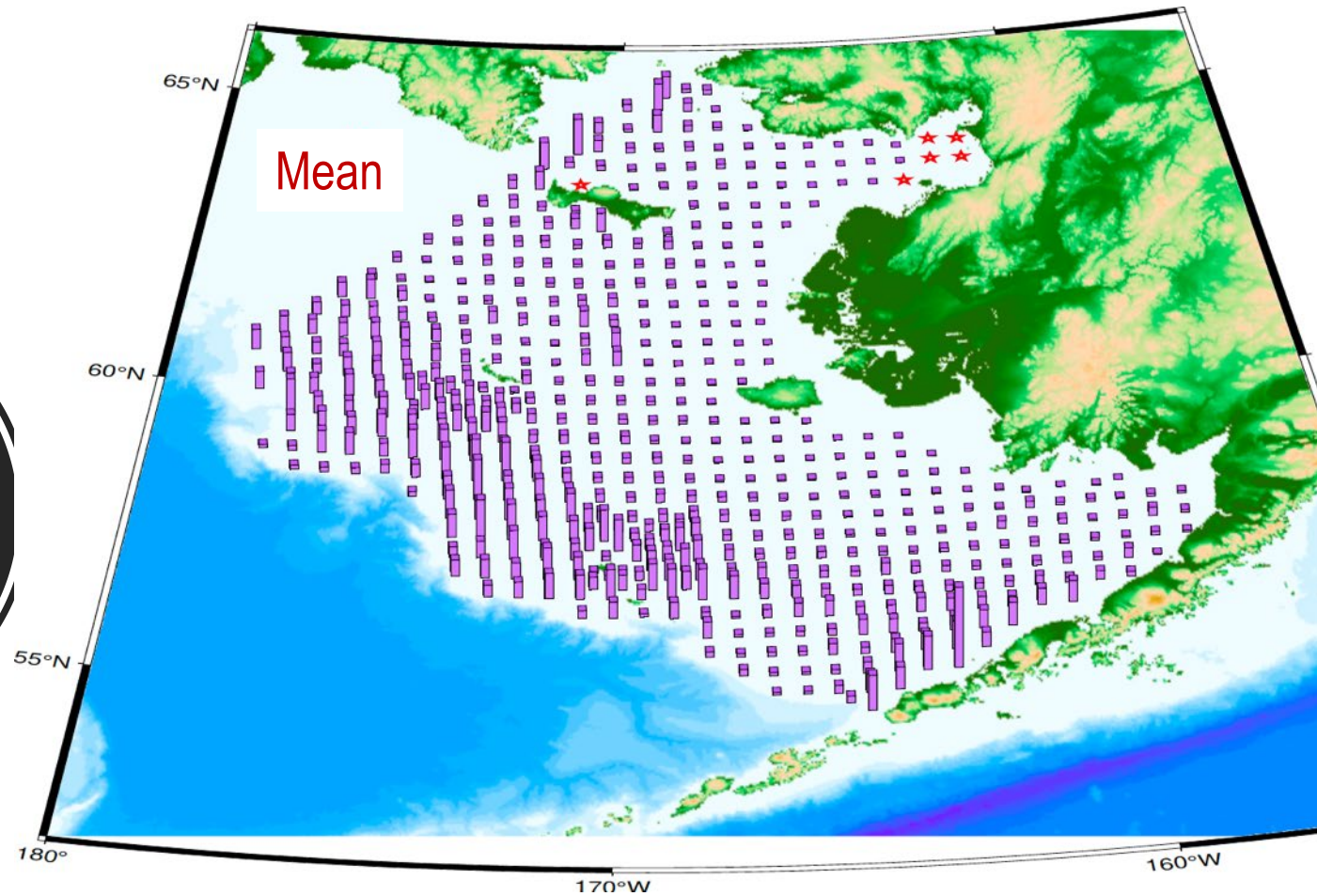


Survey work

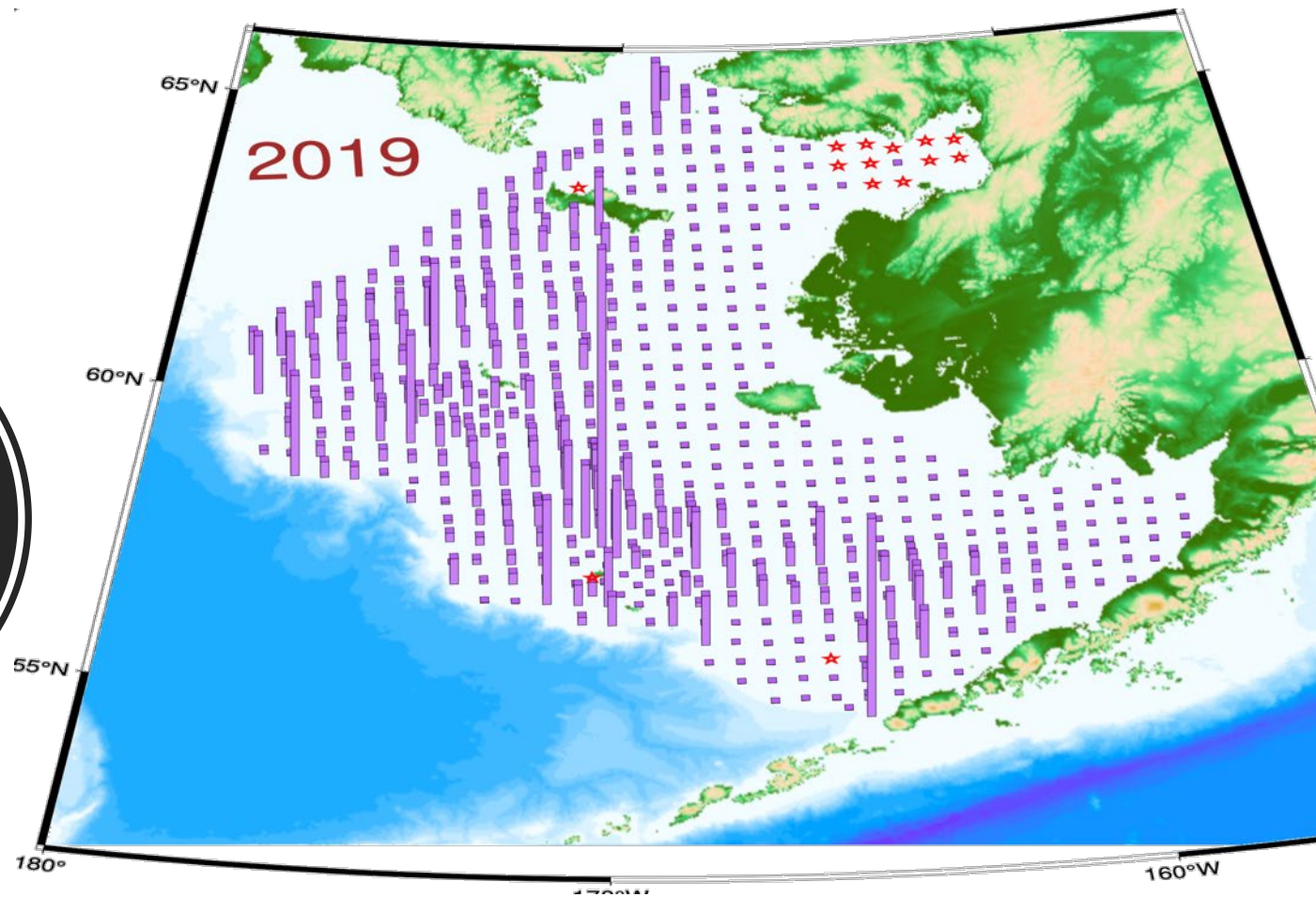
2020 and 2021



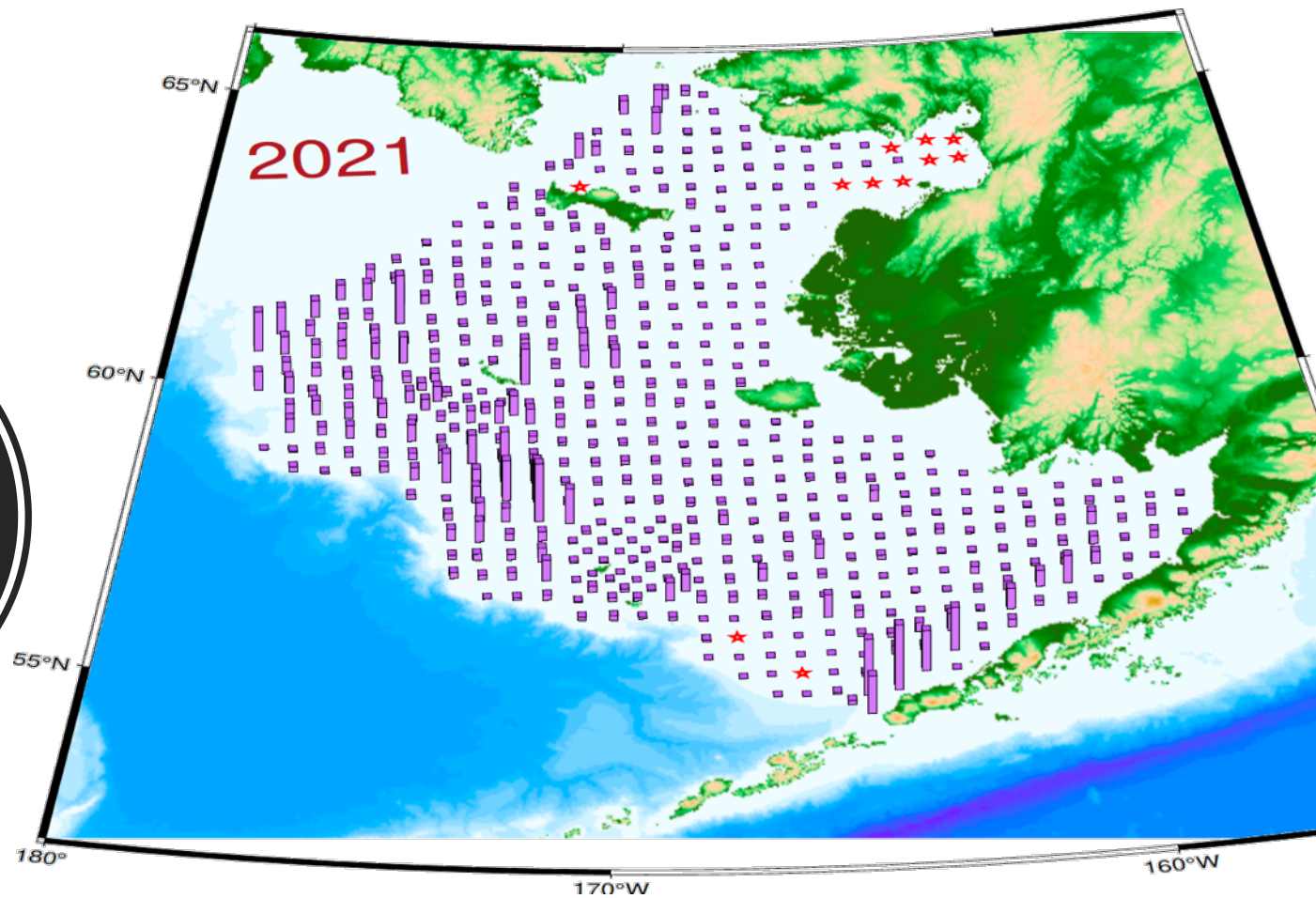
Pollock
survey
mean density
by station



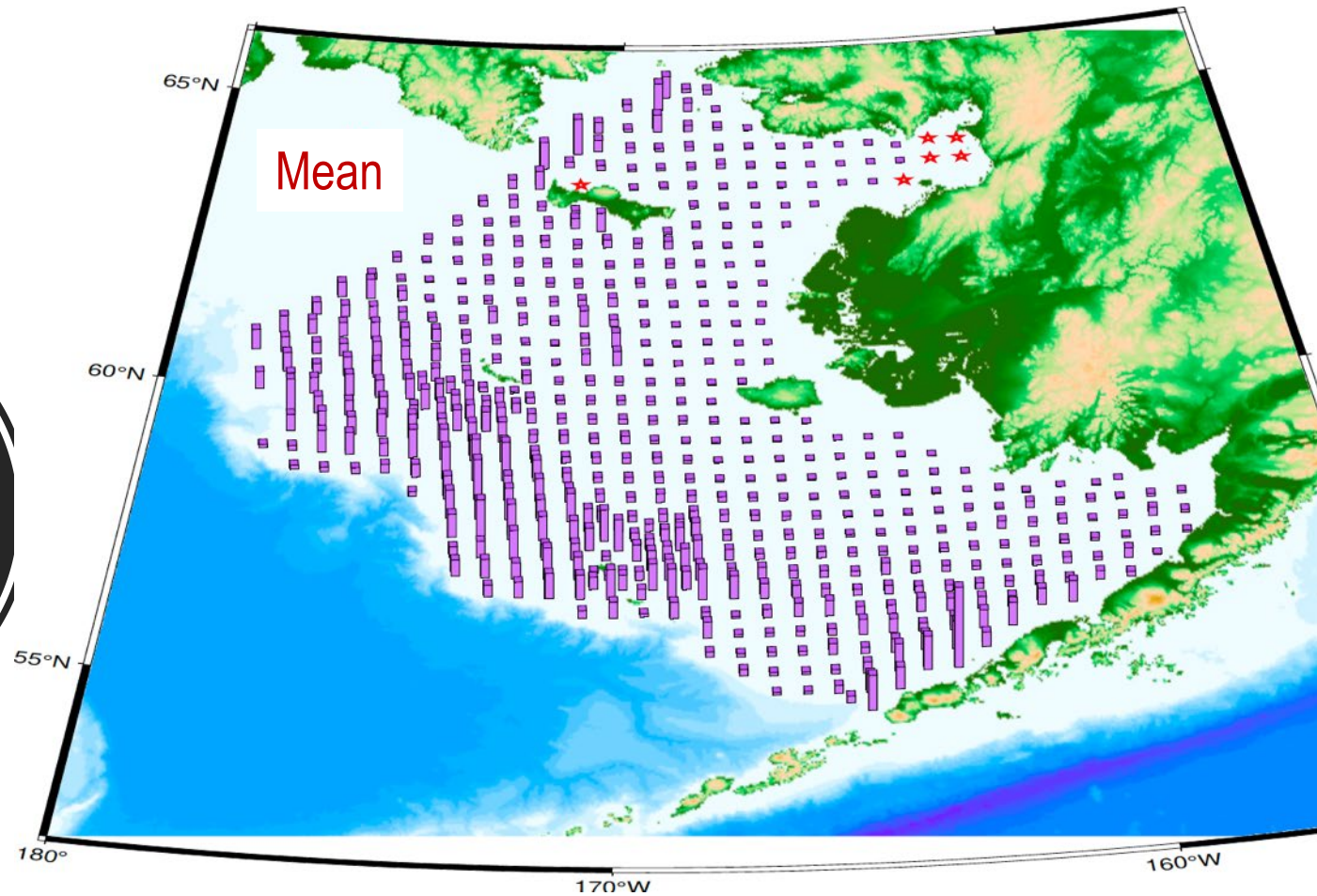
Pollock Survey 2019



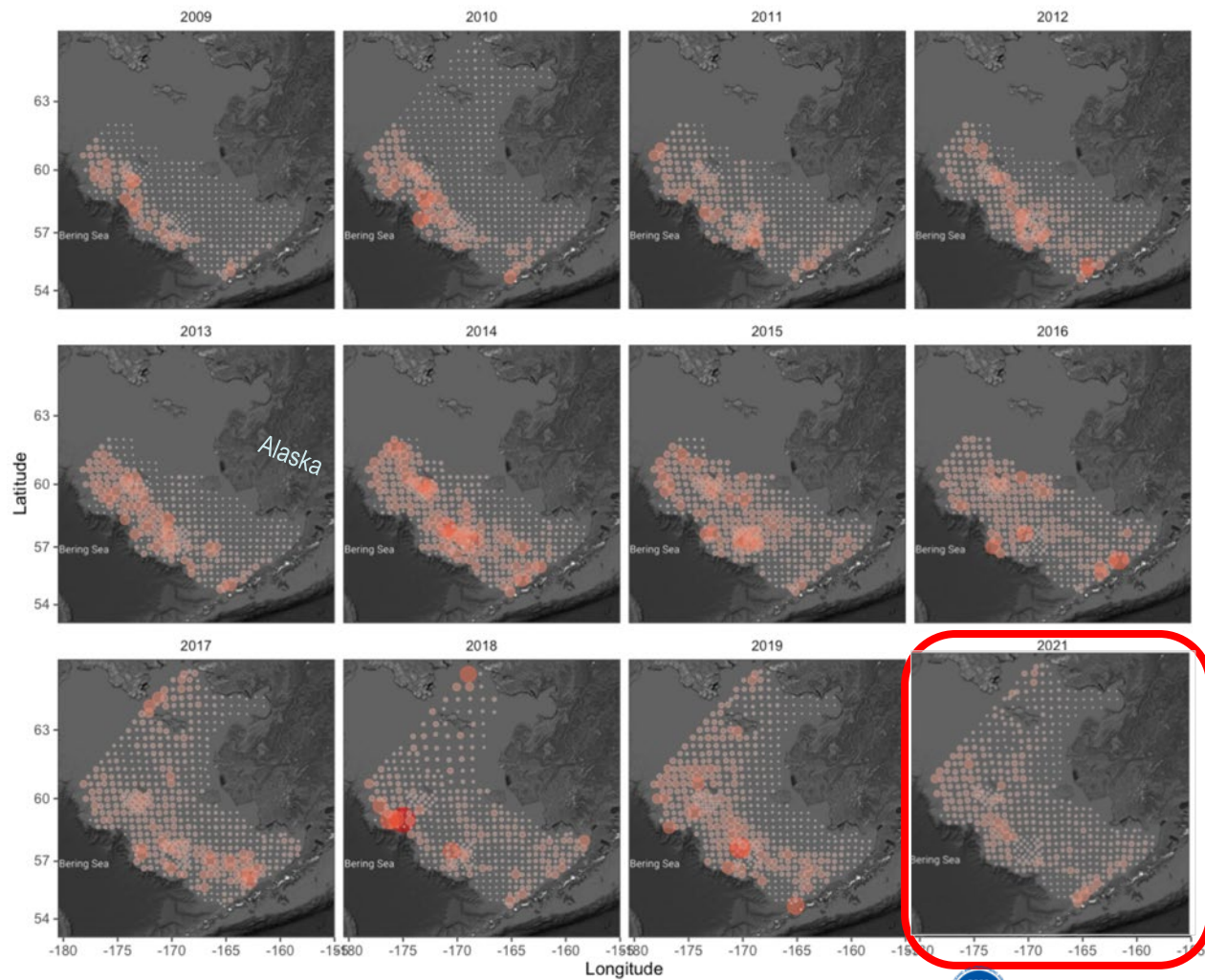
Pollock Survey 2021



Pollock
survey
mean density
by station

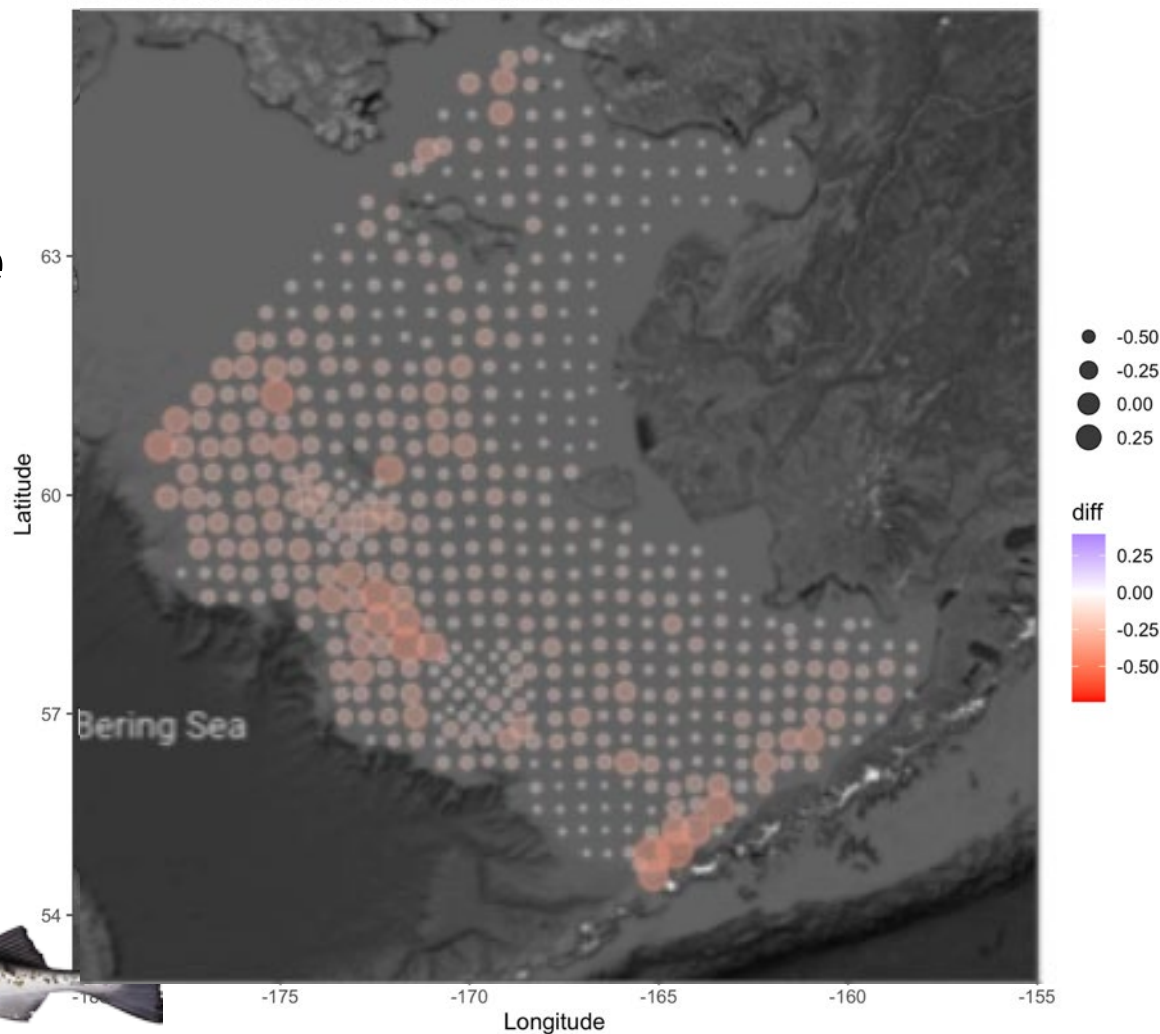


Recent bottom trawl surveys



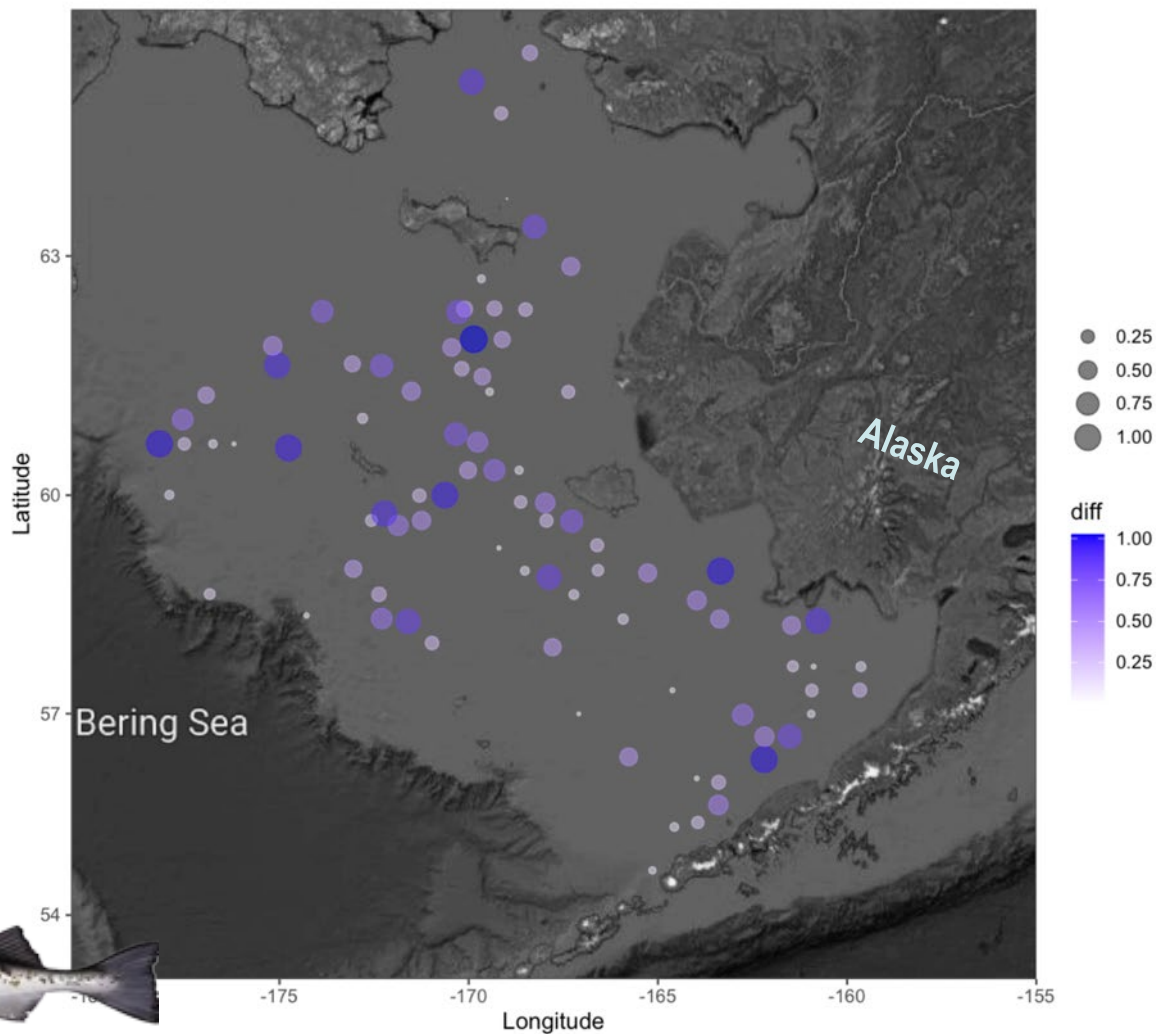
NOAA's 2021 bottom trawl survey relative to the average

2021 survey catch rate difference from mean



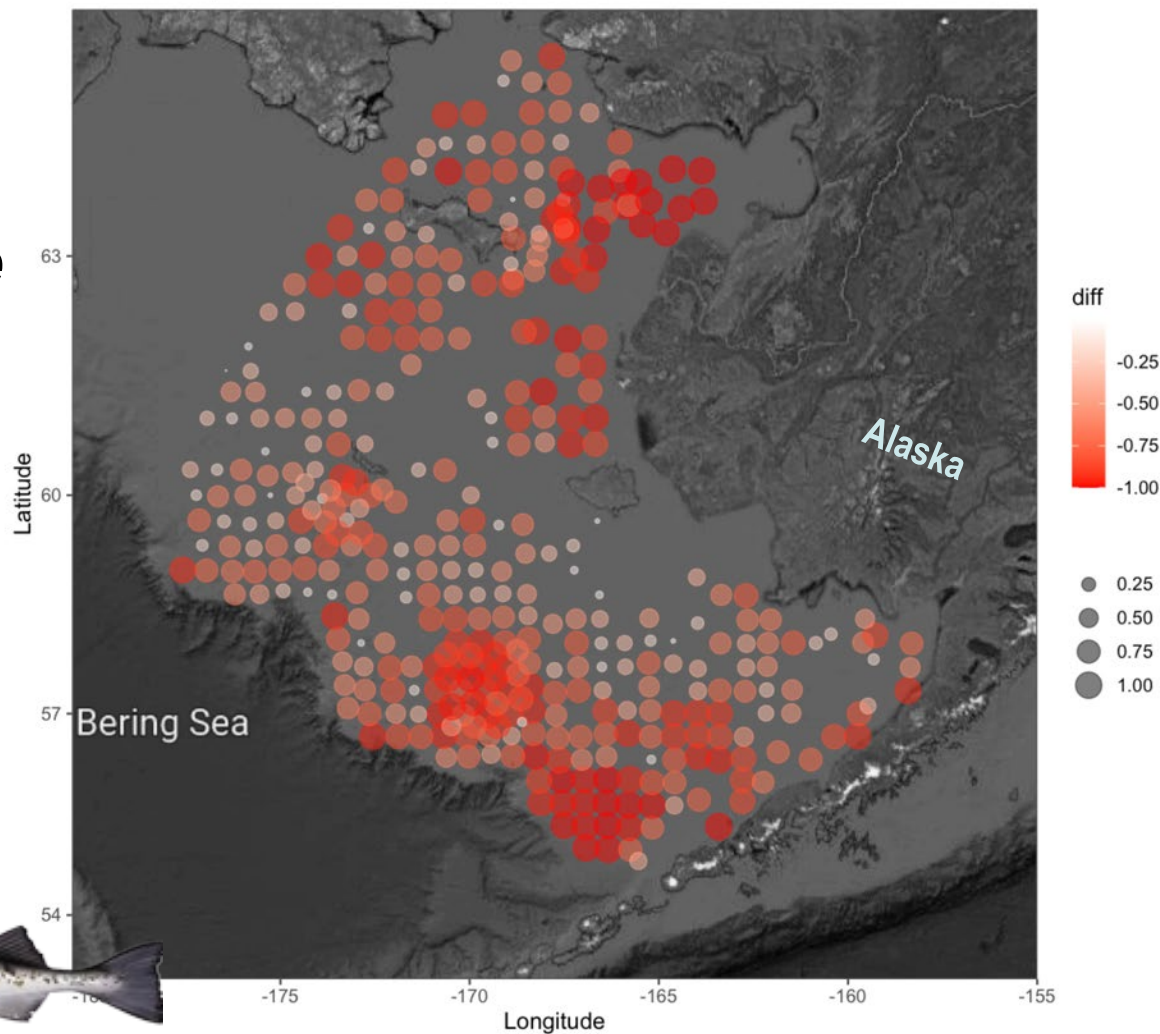
NOAA's 2021 bottom trawl survey relative to the average

2021 survey catch rate difference from mean



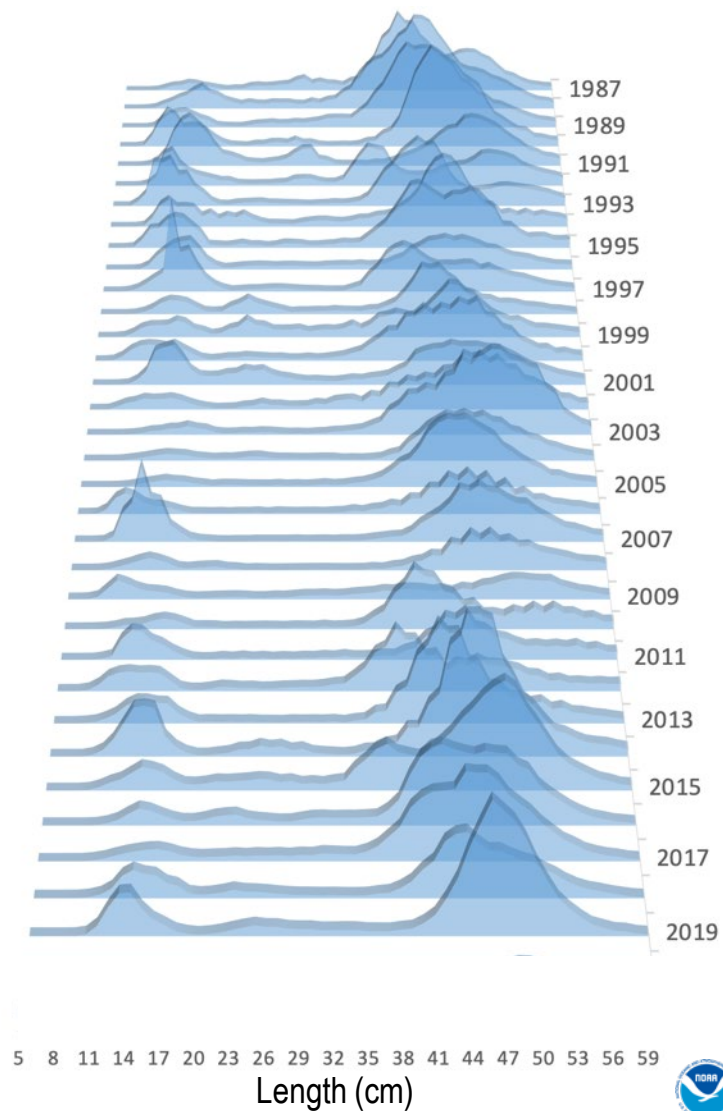
NOAA's 2021 bottom trawl survey relative to the average

2021 survey catch rate difference from mean



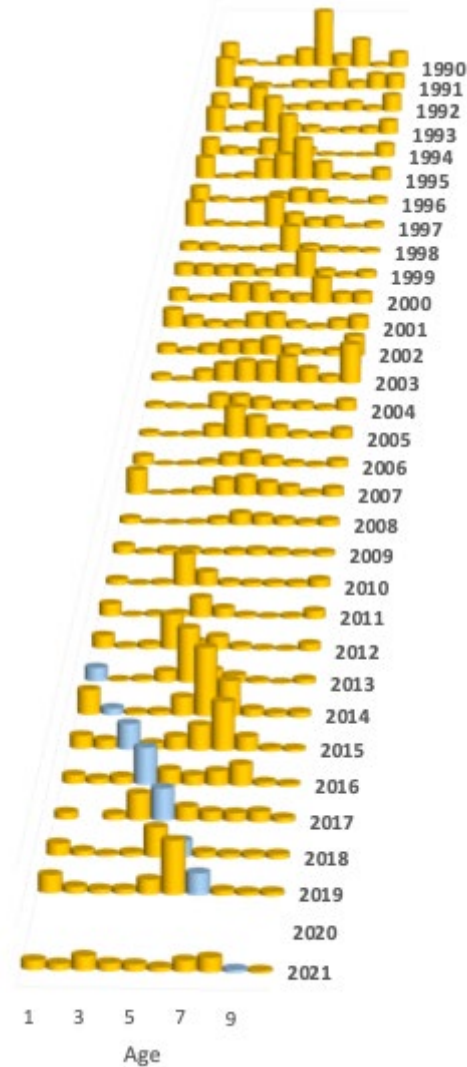
Size distribution

- From NOAA's bottom-trawl survey



Age composition

- From NOAA's bottom-trawl survey

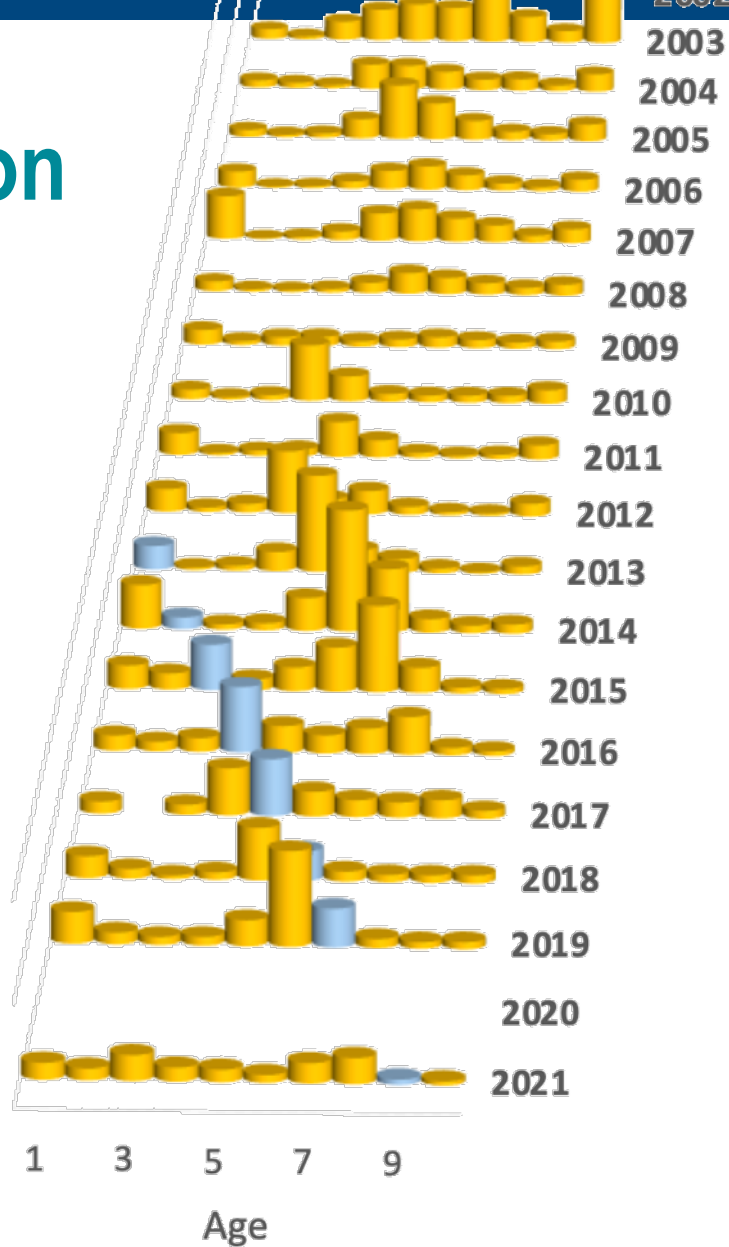


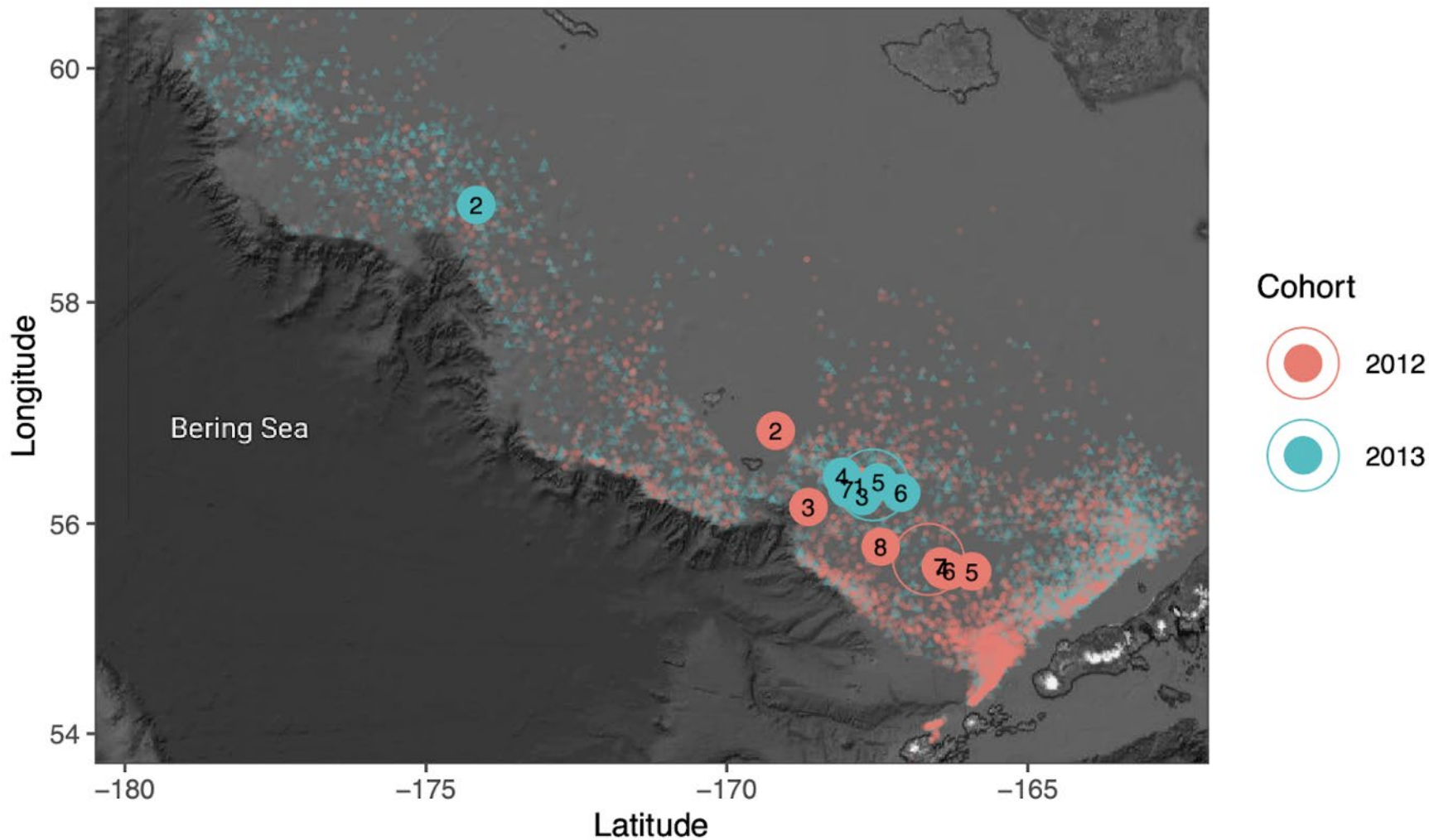
Vertical scale is relative to survey population estimate

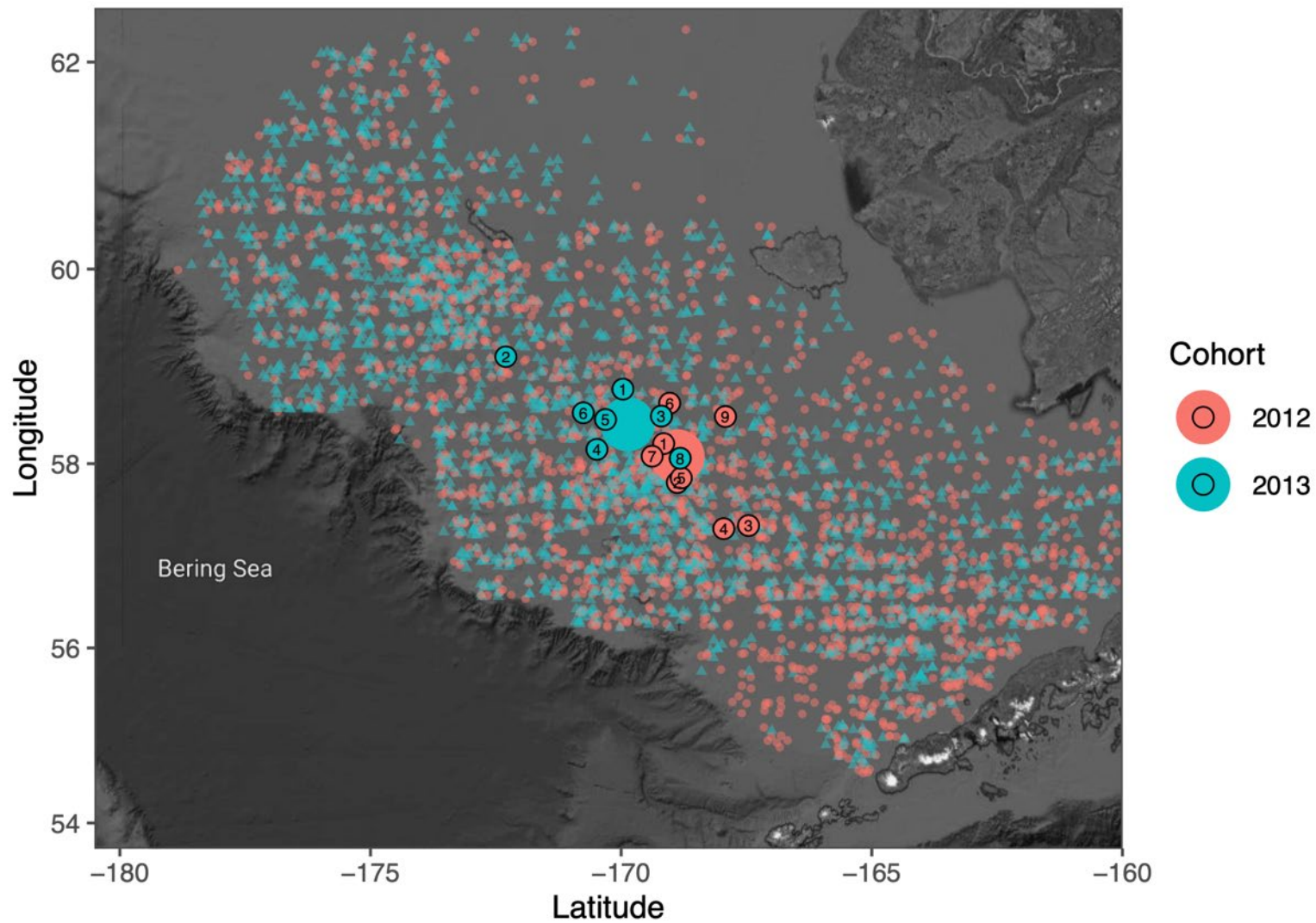


Age composition

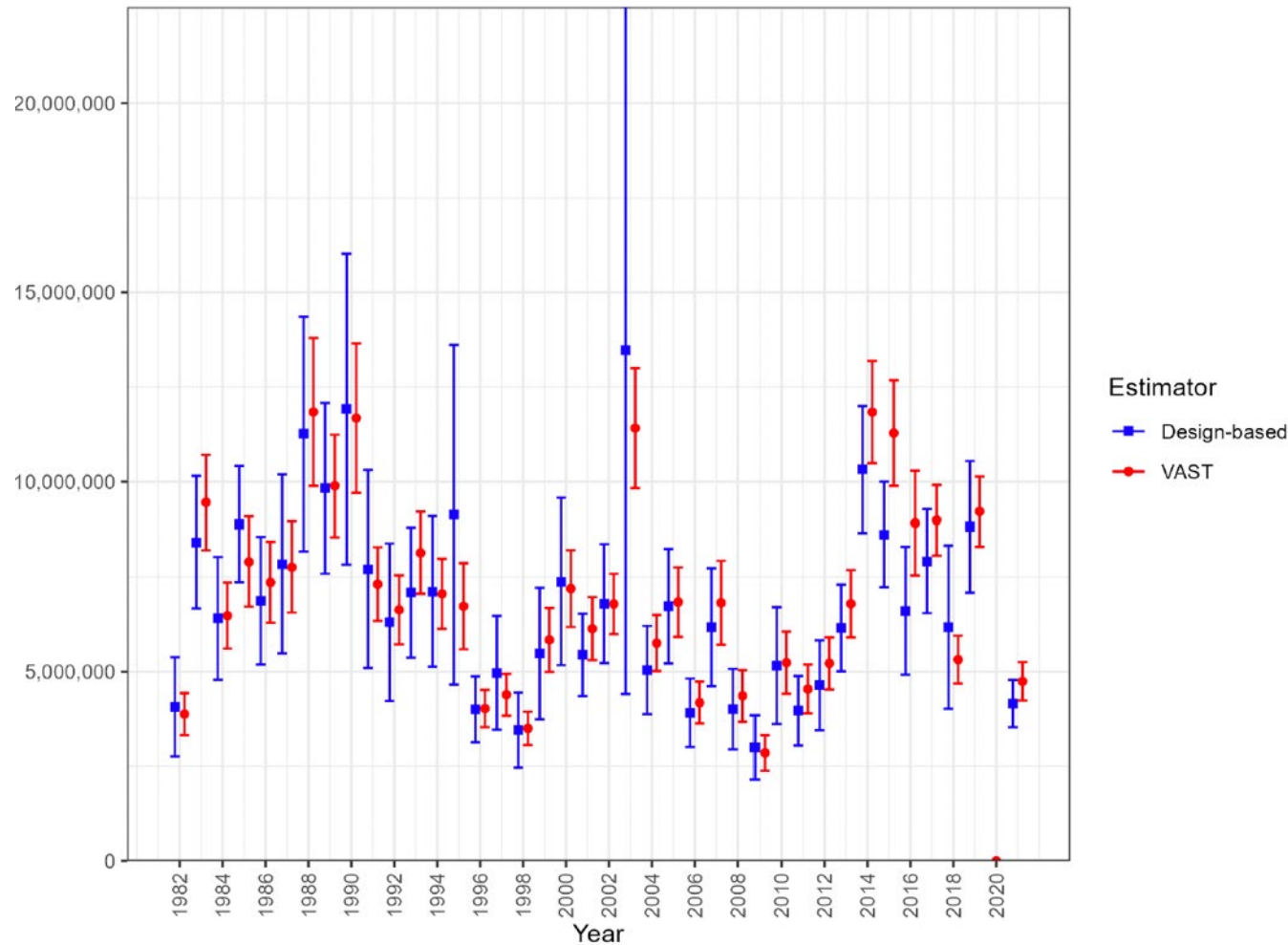
- From NOAA's bottom-trawl survey





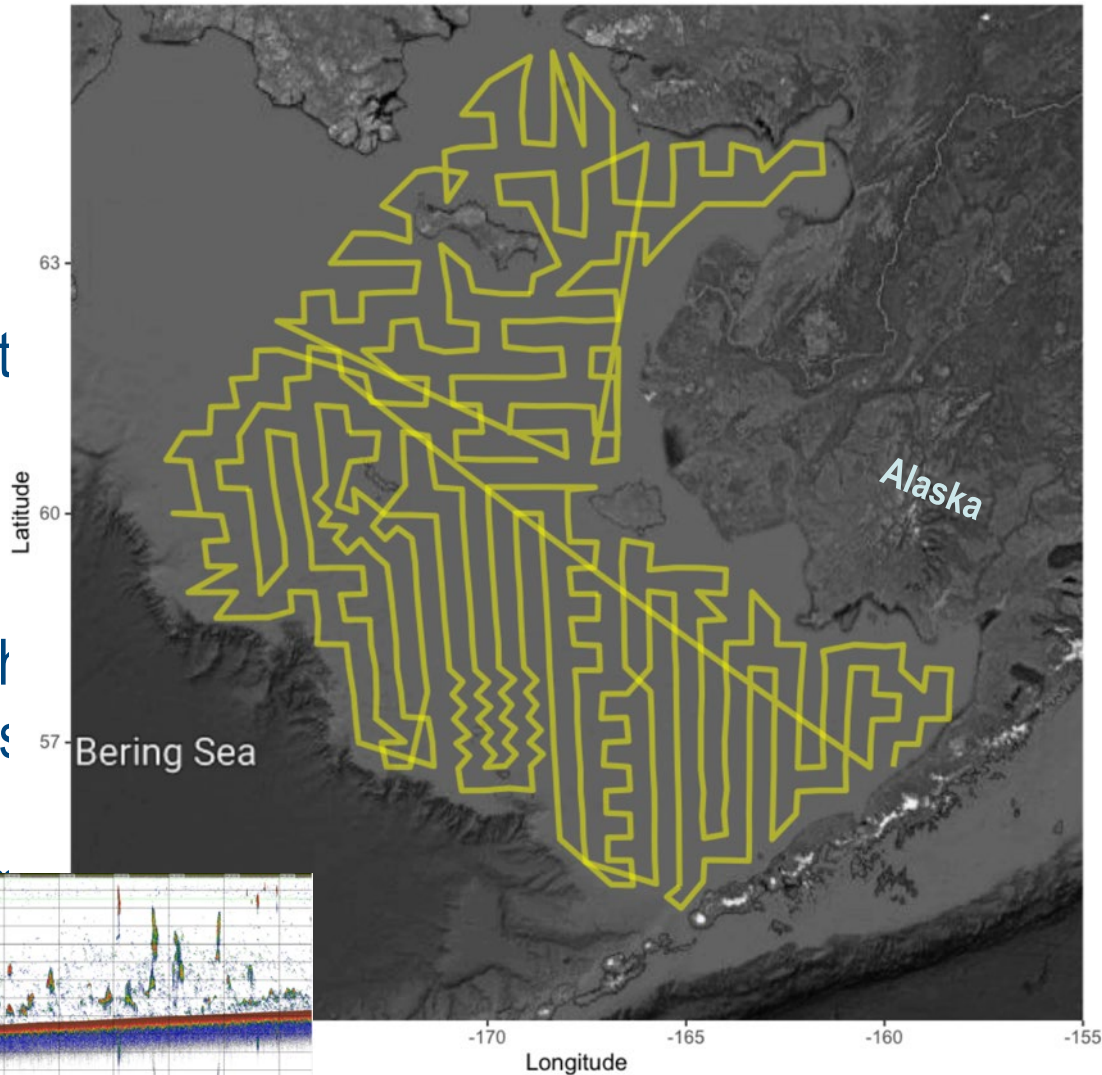


Survey standardizations



Survey

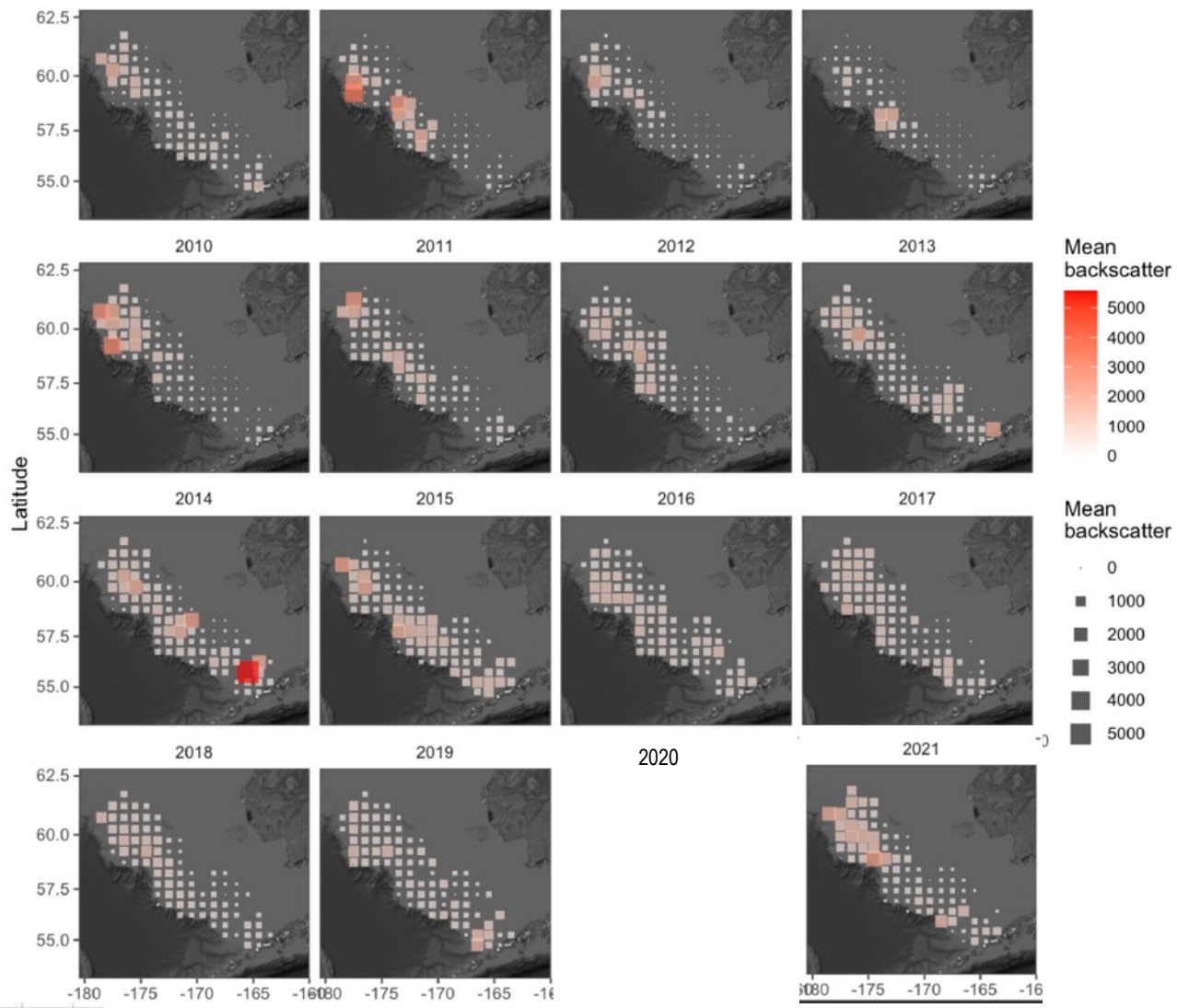
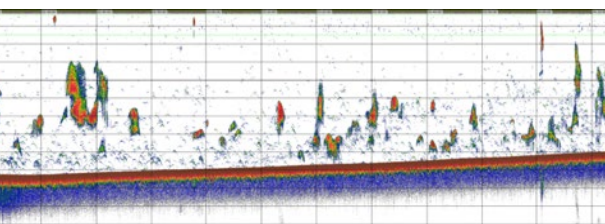
- Opportunist acoustic data collections
- Gives insight on young fish abundance



Opportunistic Acoustic data

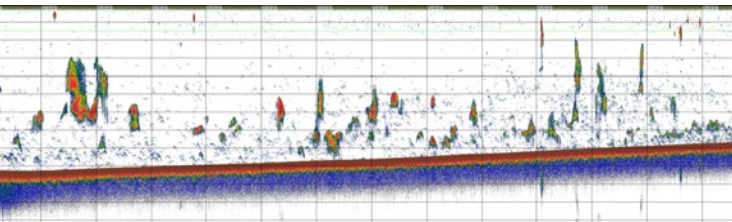
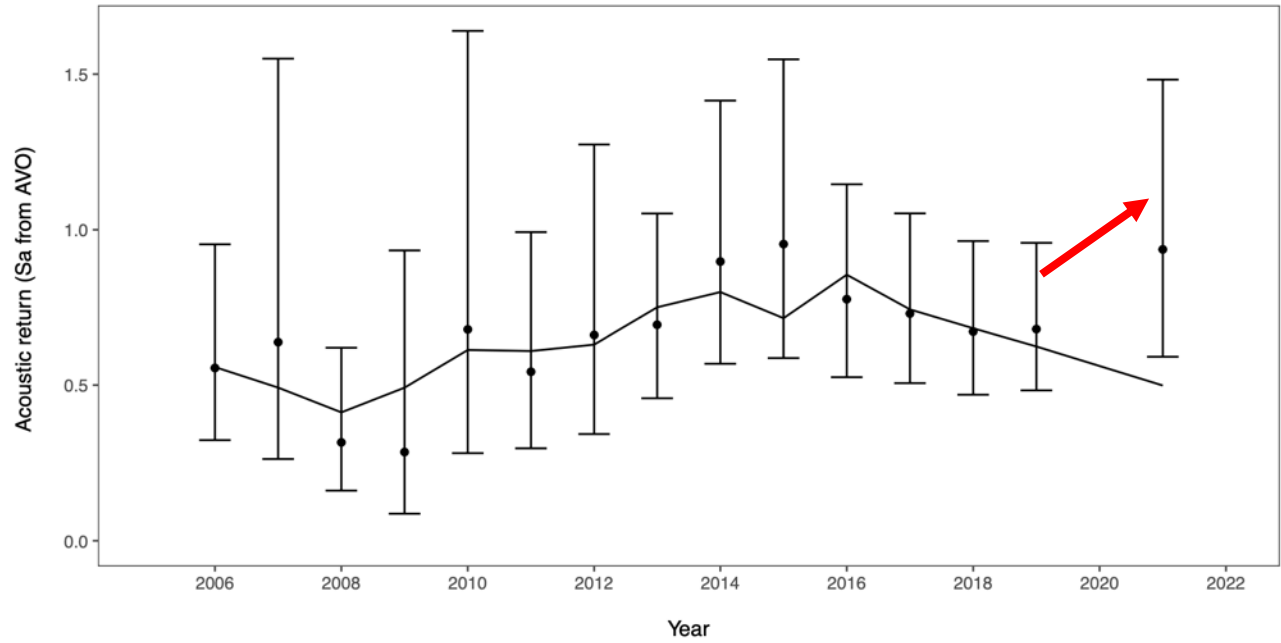
collected from chartered bottom-trawl survey boats

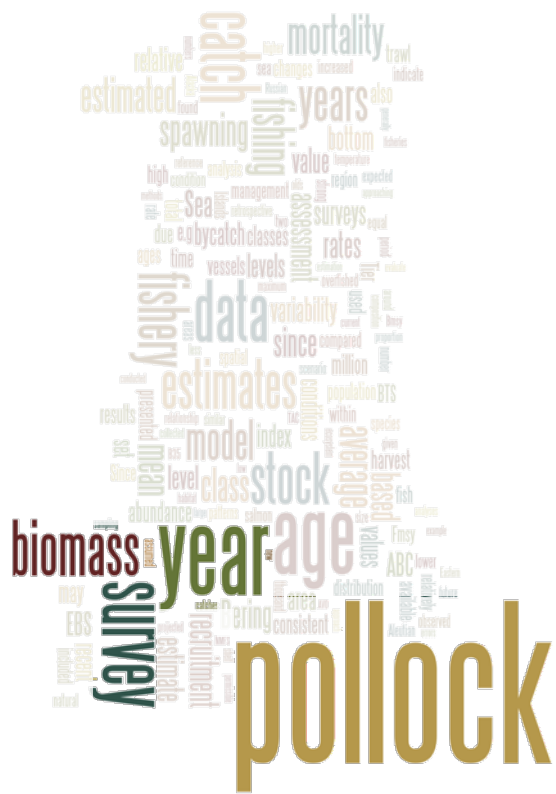
The AVO index



Opportunistic Acoustic data

collected from
chartered bottom-
trawl survey boats
The AVO index





EBS pollock Assessment Results



Model details (1 of 2)

- Tuning indices
 - Acoustic Trawl survey
 - Available biennially (sailing drones used in 2020, next one summer 2022)
 - Annual fixed-station bottom trawl survey (except 2020)
 - Acoustic vessel of opportunity (AVO index)
 - Foreign trawler CPUE (in 1970s)
- Fishery data
 - Total catch
 - Catch-at-age
 - Mean fishery weights-at-age



Model details (2 of 2)

- Age specific schedules
 - Natural mortality
 - Ages 1 and 2 higher, other ages fixed at 0.3
 - Maturity
 - Estimated externally...50% at ~ age 3.5 years
- Other
 - Conditioned on catch biomass (F's estimated)
 - Selectivity varies in fishery
 - Slightly in surveys
 - Stock recruitment model Ricker
 - Affects ABC values, minimal impact on historical trends
 - Projection options built in to evaluate policy trade offs



Model configurations

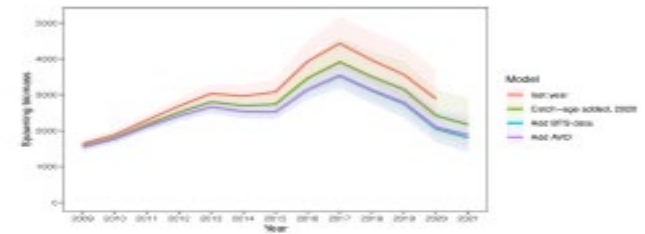
- Base (as in 2020)
- Include preliminary 2021 fishery data



New data impact on model

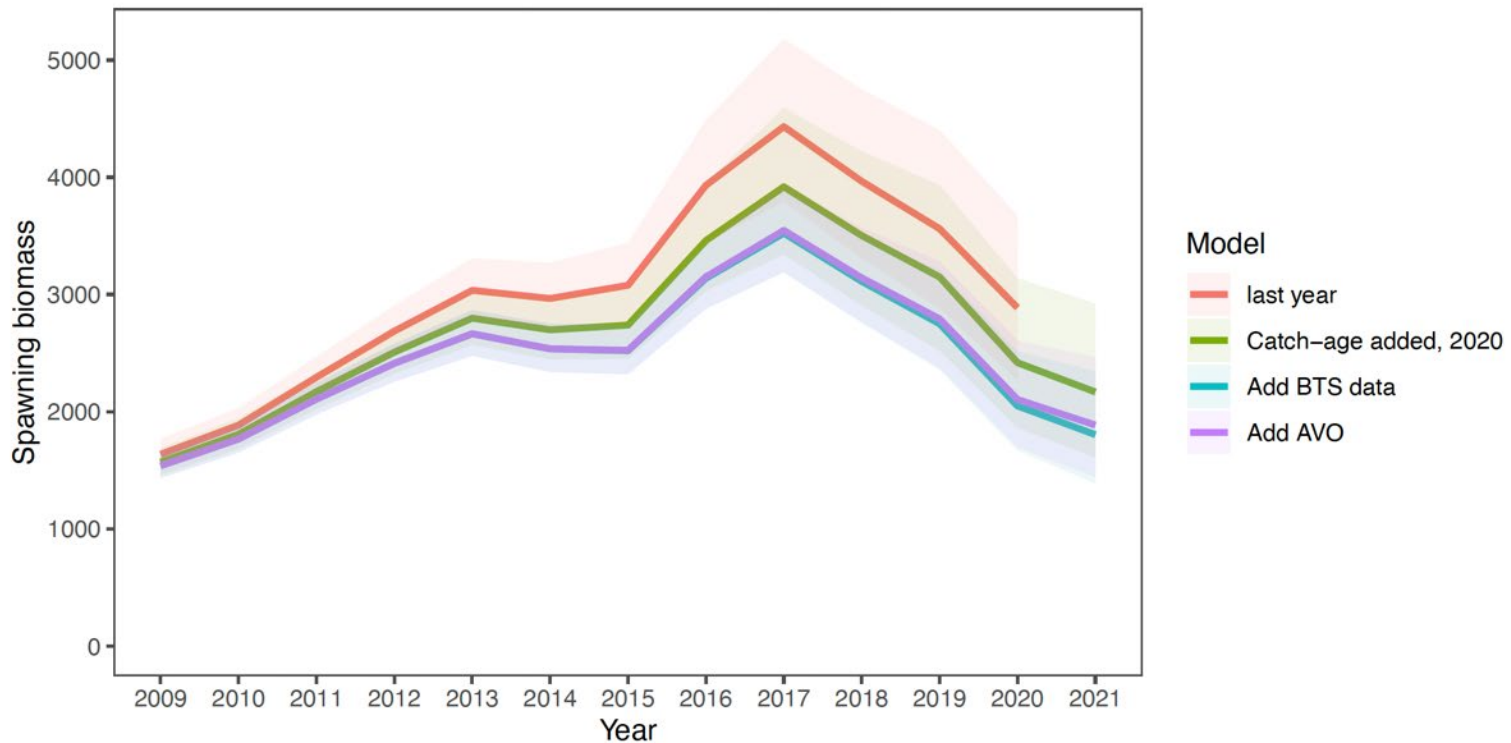
Data considerations

| Name | Updated catch to 2021 | 2020 fishery age data | Bottom trawl survey | Acoustic from Bottom trawl transits (AVO) |
|---------|-----------------------|-----------------------|---------------------|---|
| Fishery | X | X | | |
| + BTS | X | X | X | |
| + AVO | X | X | X | X |



Data
Impact on
Model

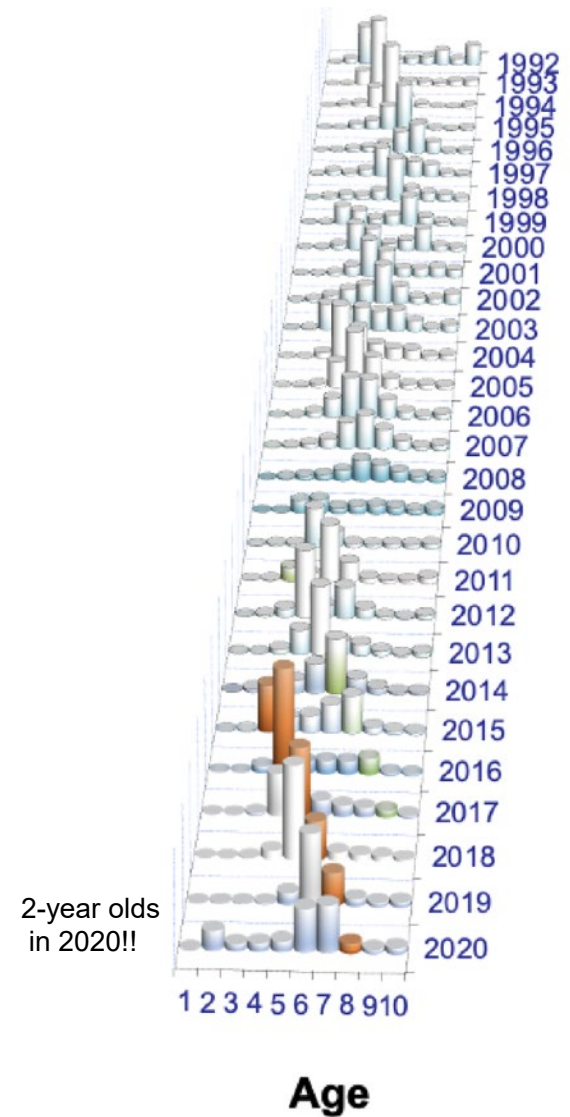
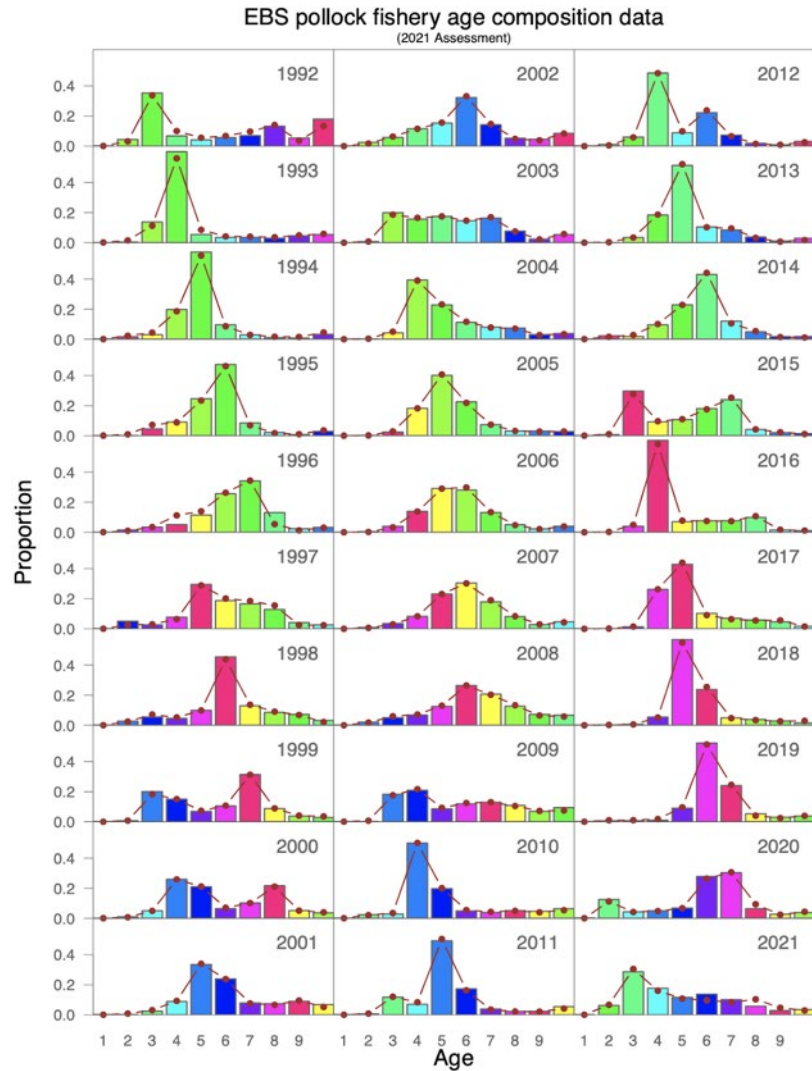




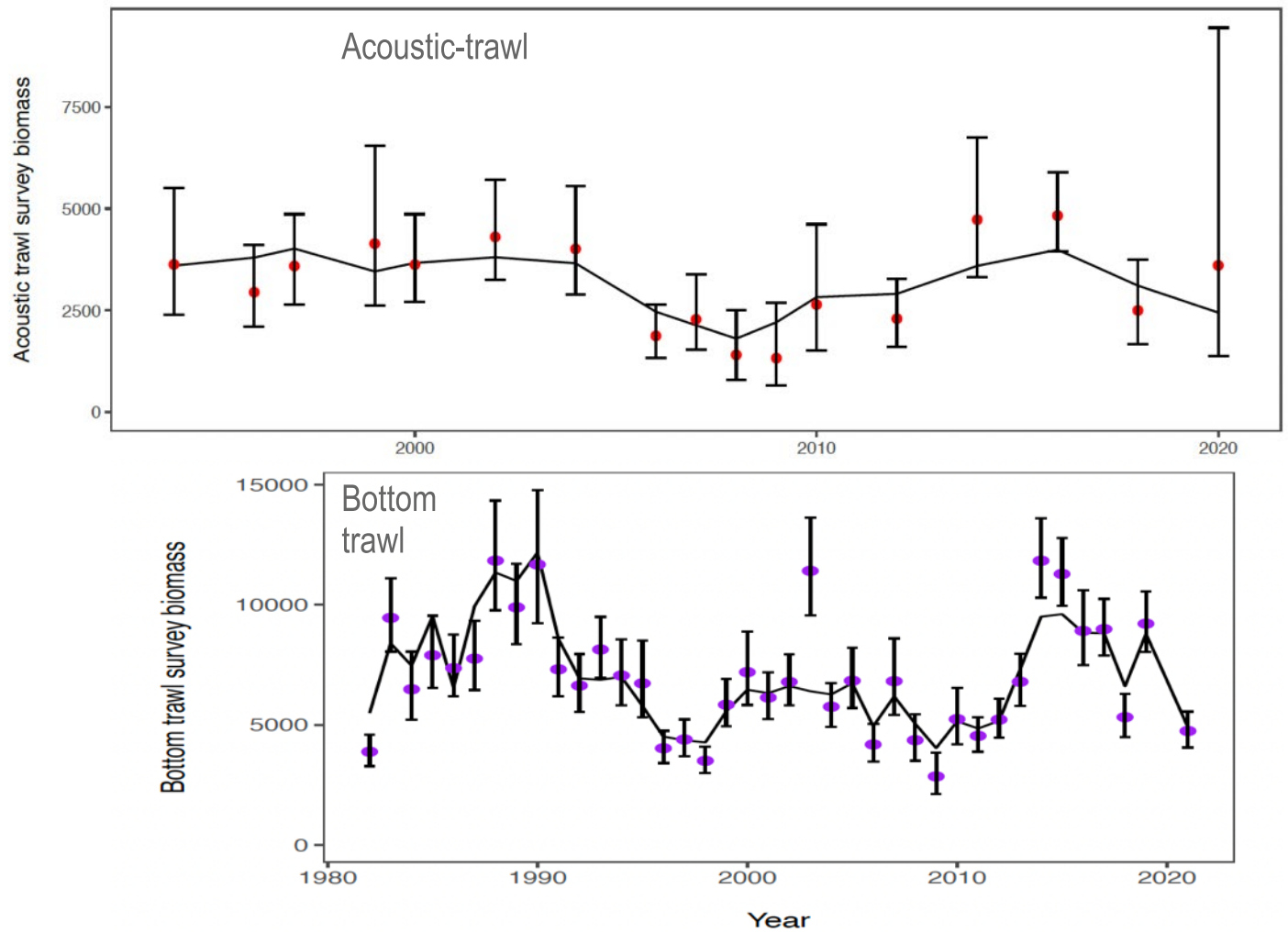
Data
Impact on
Model



Fishery catch-age

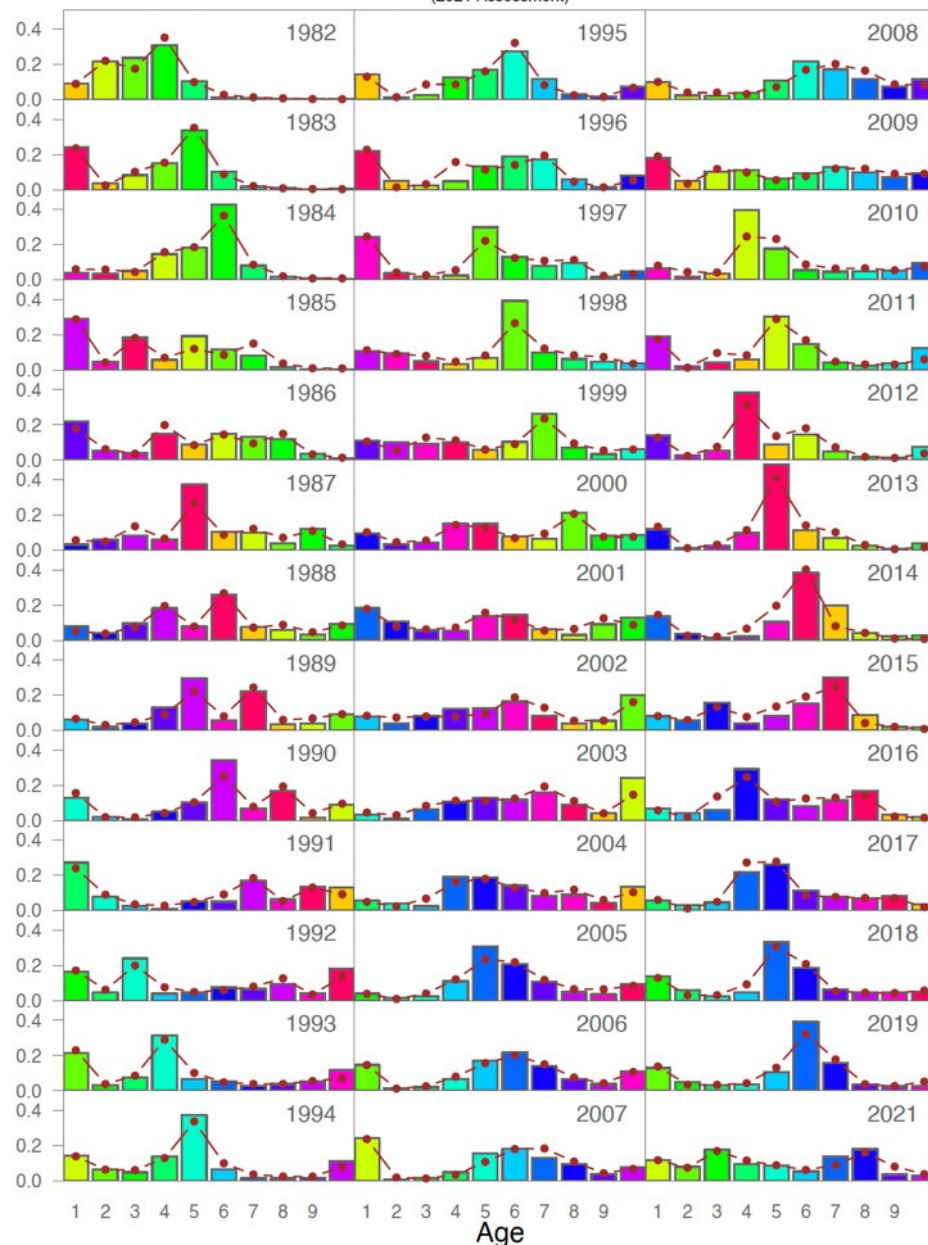


Fit to survey indices

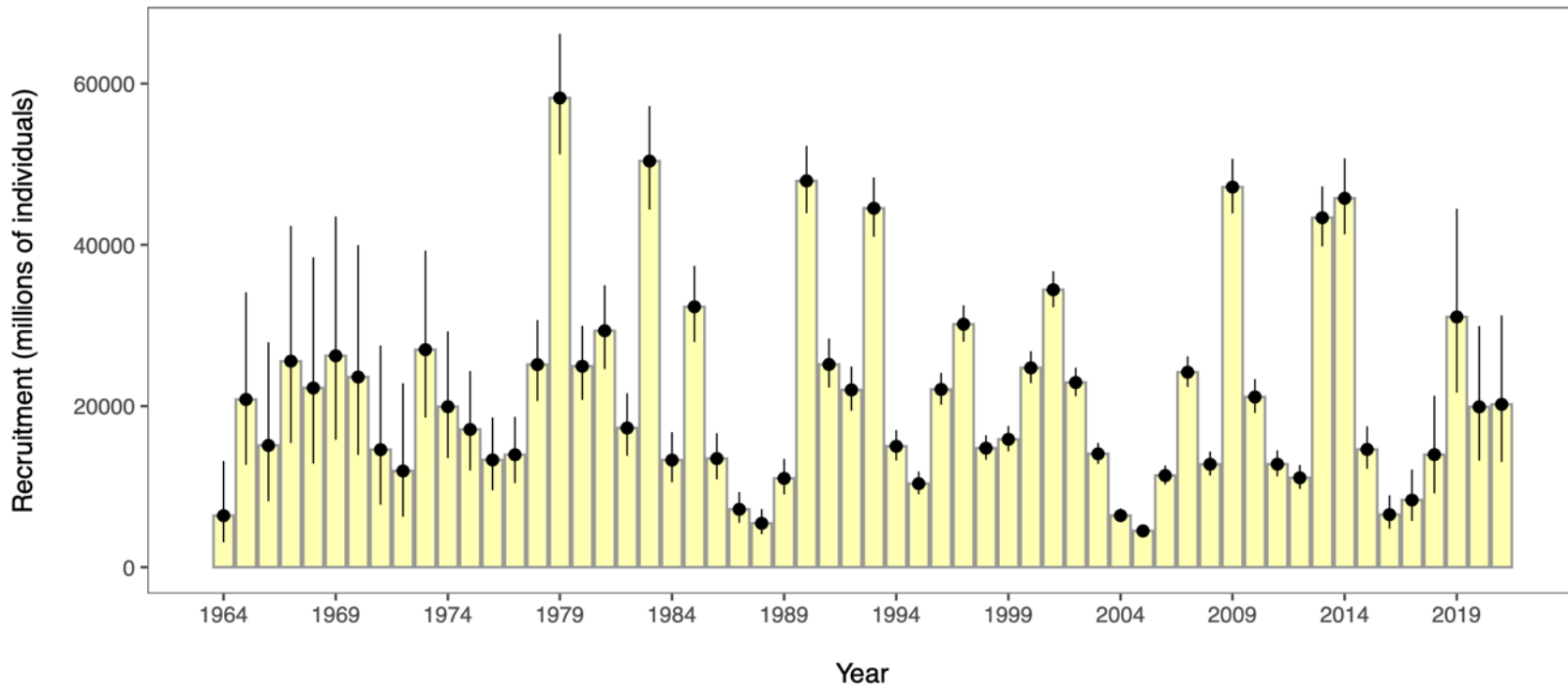


Fit to survey age compositions

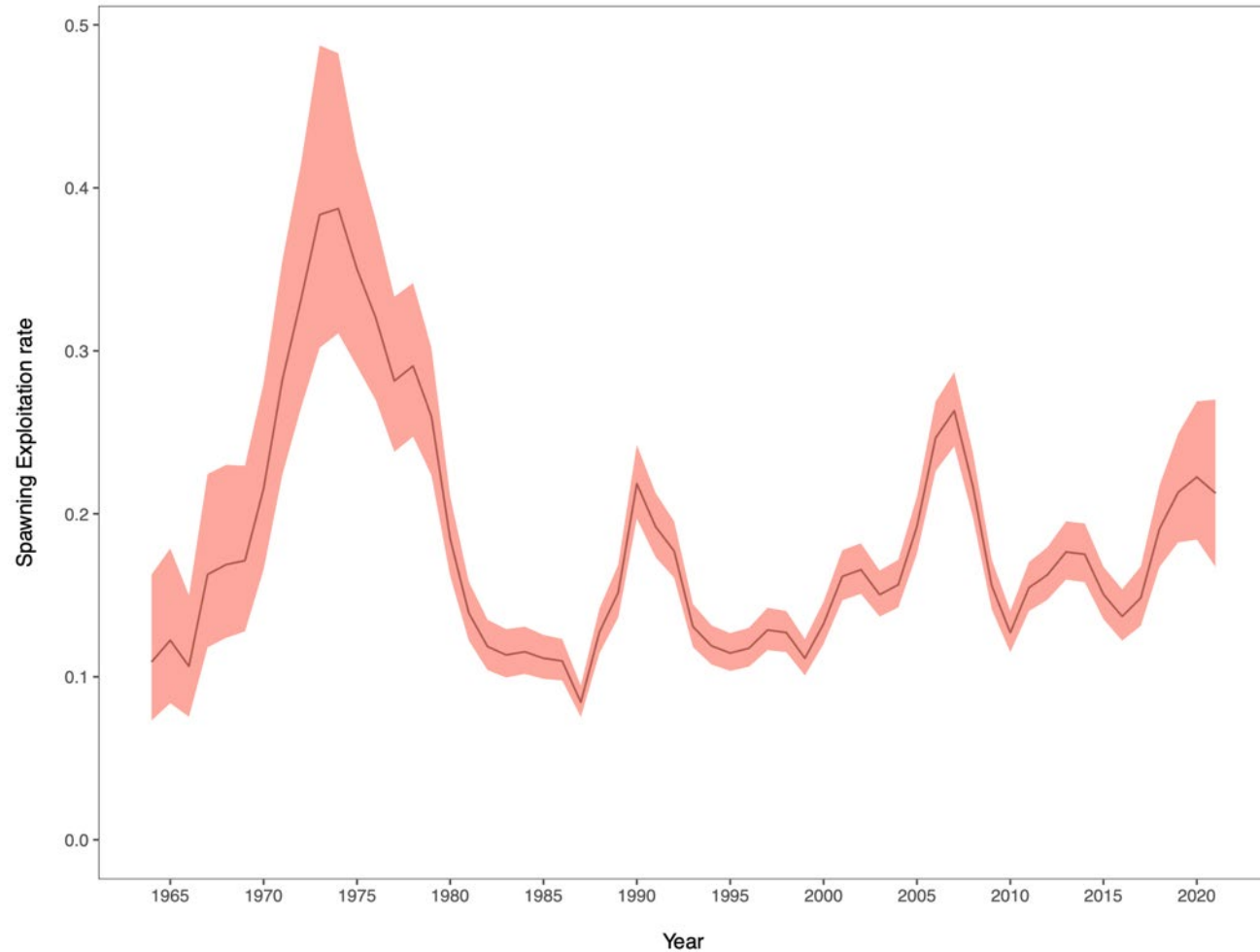
EBS pollock survey age composition data
(2021 Assessment)



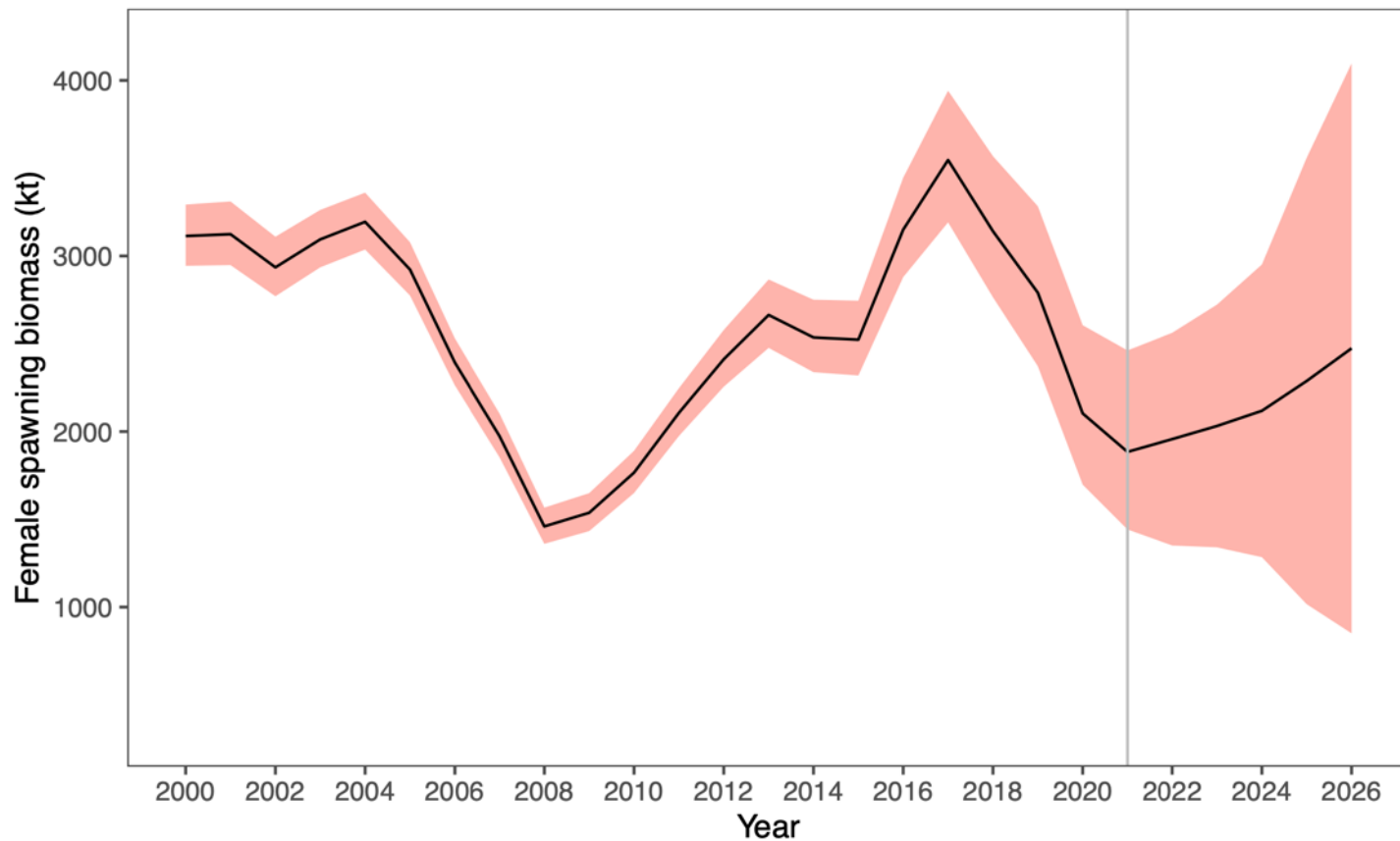
Recruitment



Exploitation rate trend

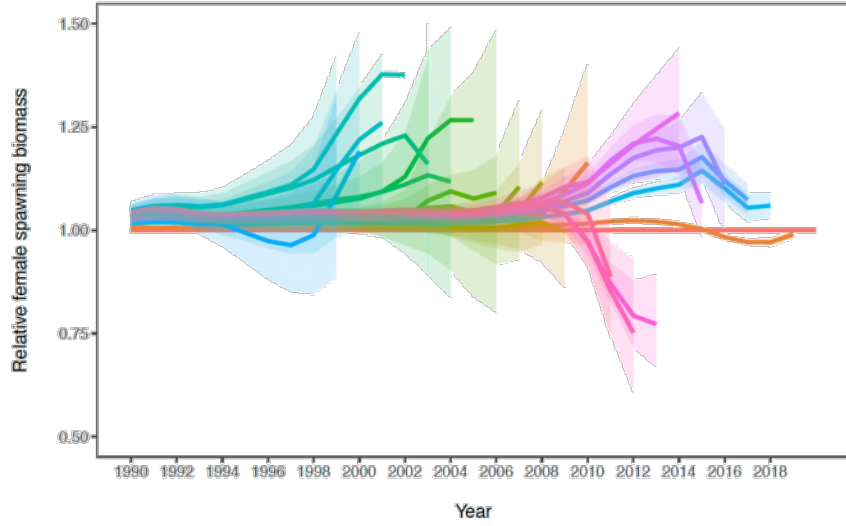
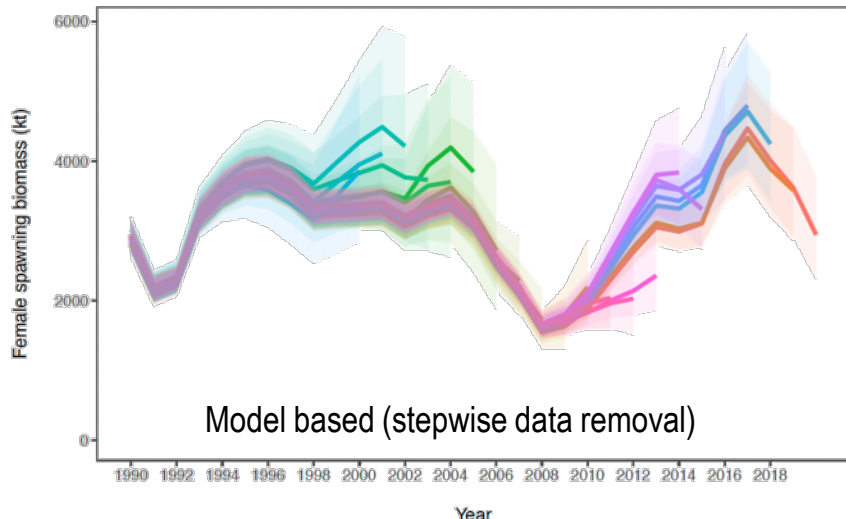


Biomass trend



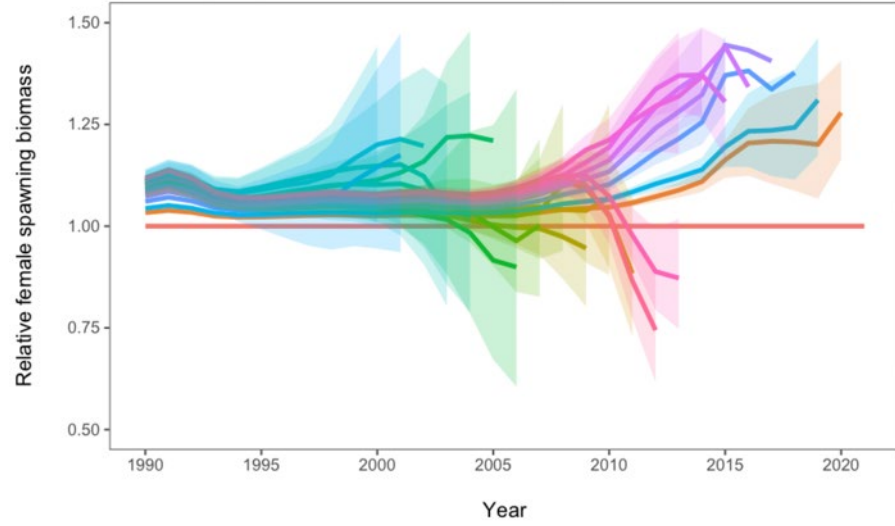
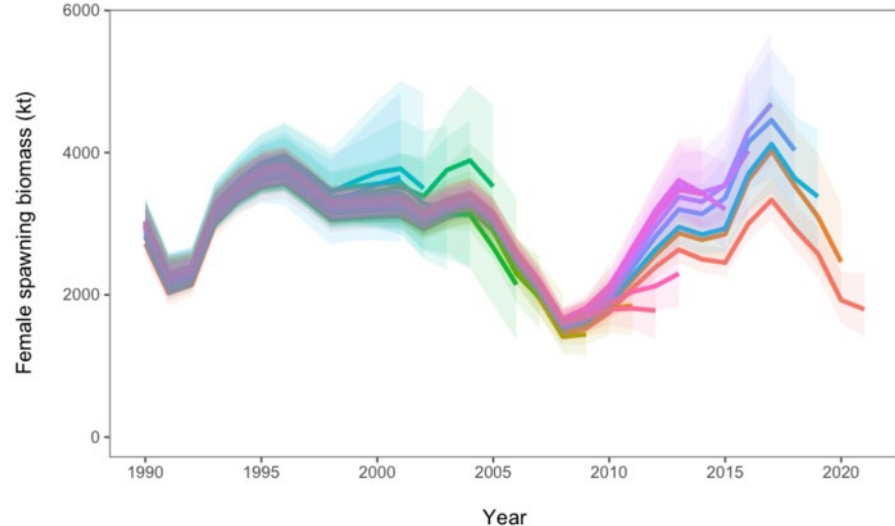
Retrospectives

2020 assessment



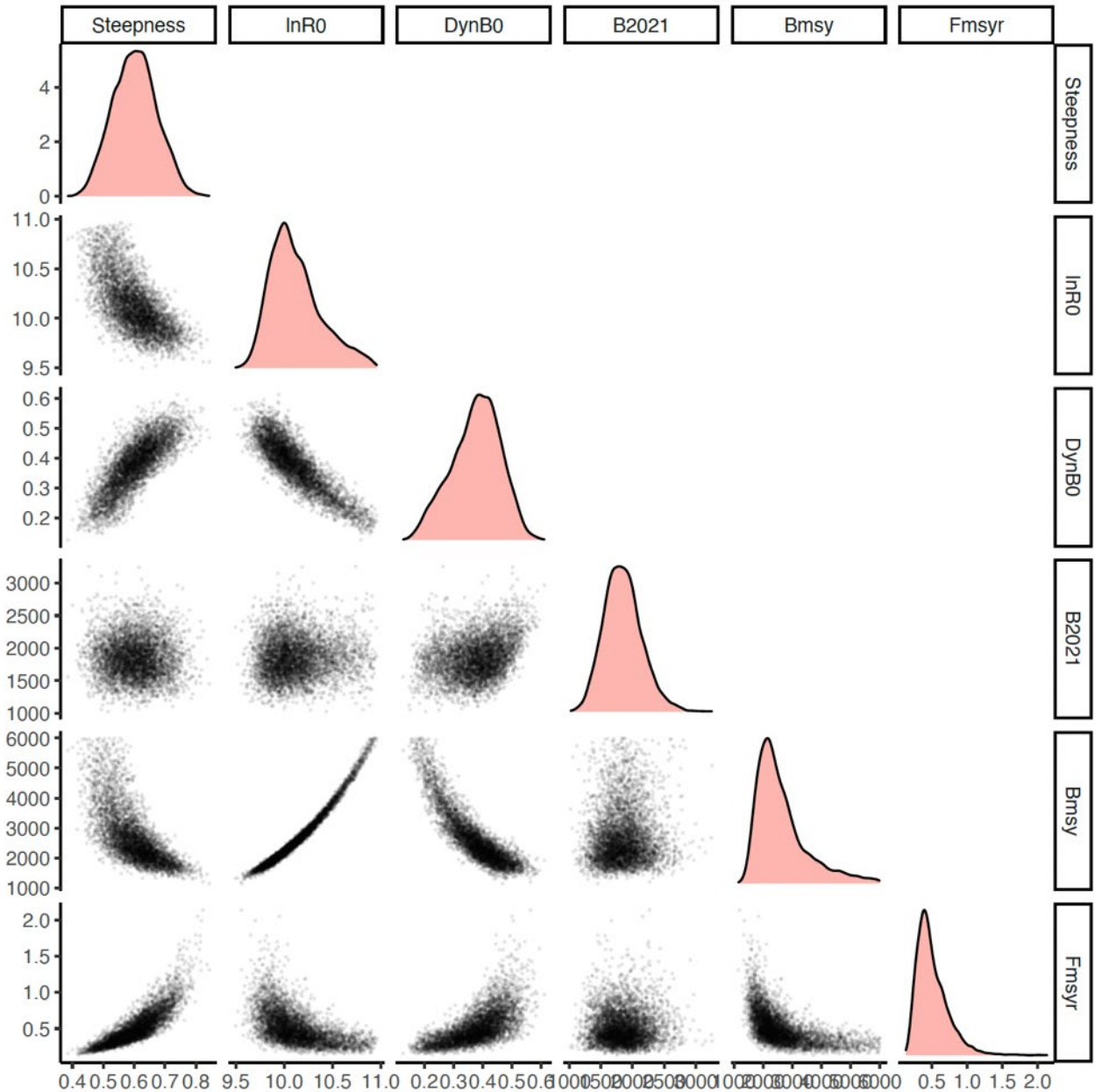
Retrospectives

This year!



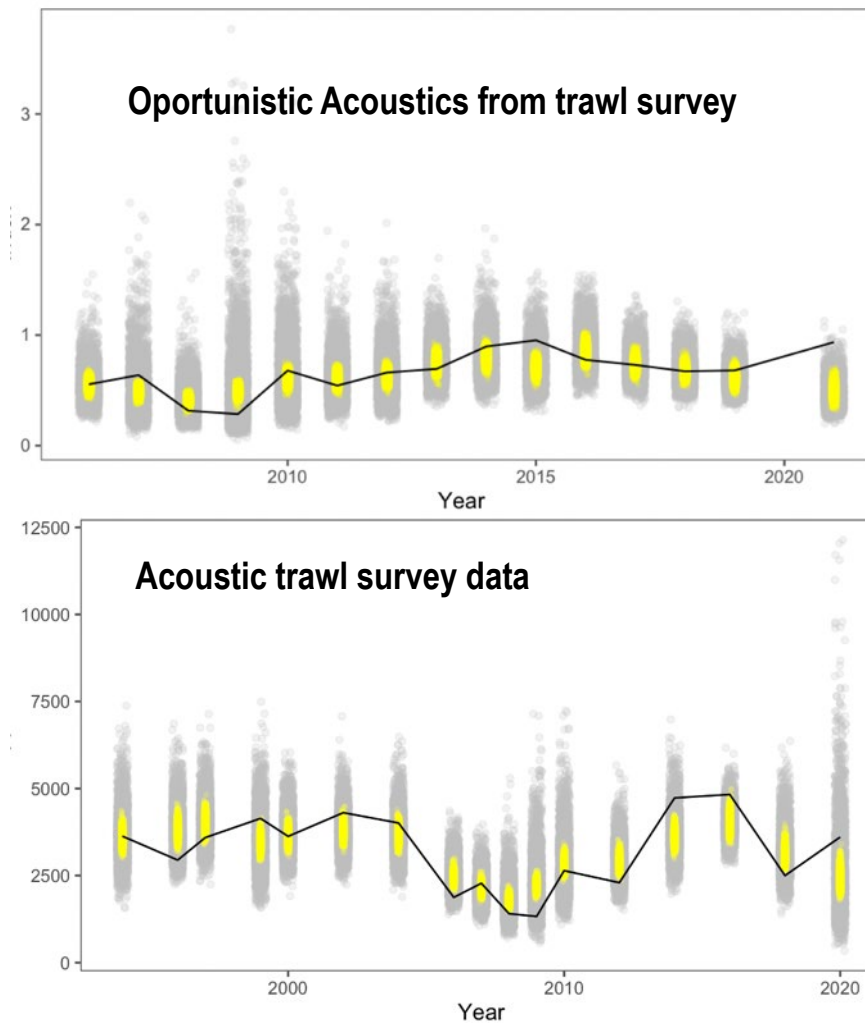
More on uncertainty evaluations

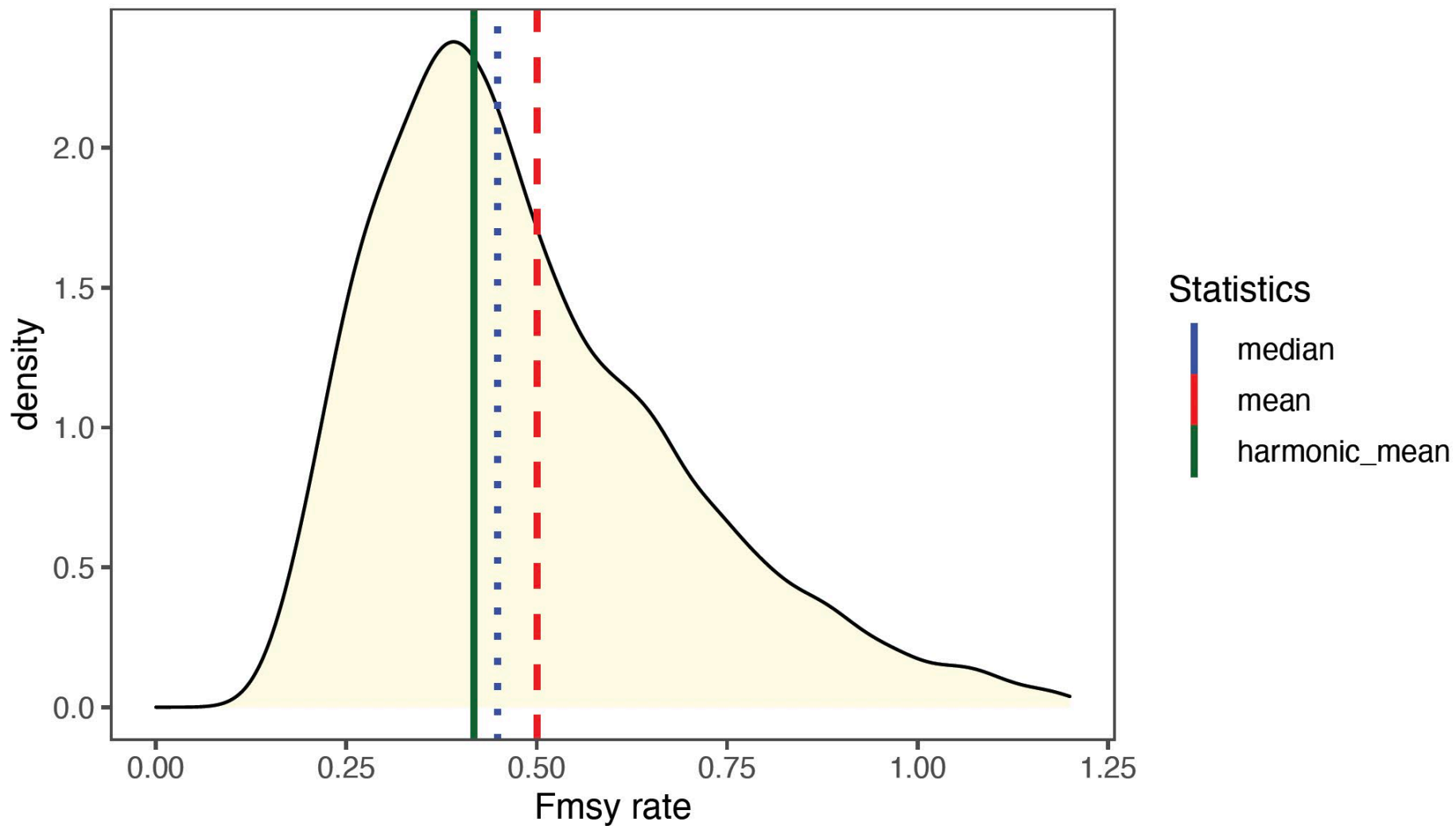




Diagnostics

Posterior predictive distributions





What things affect FMSY?



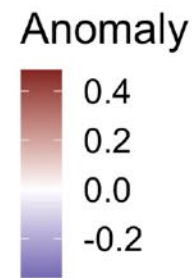
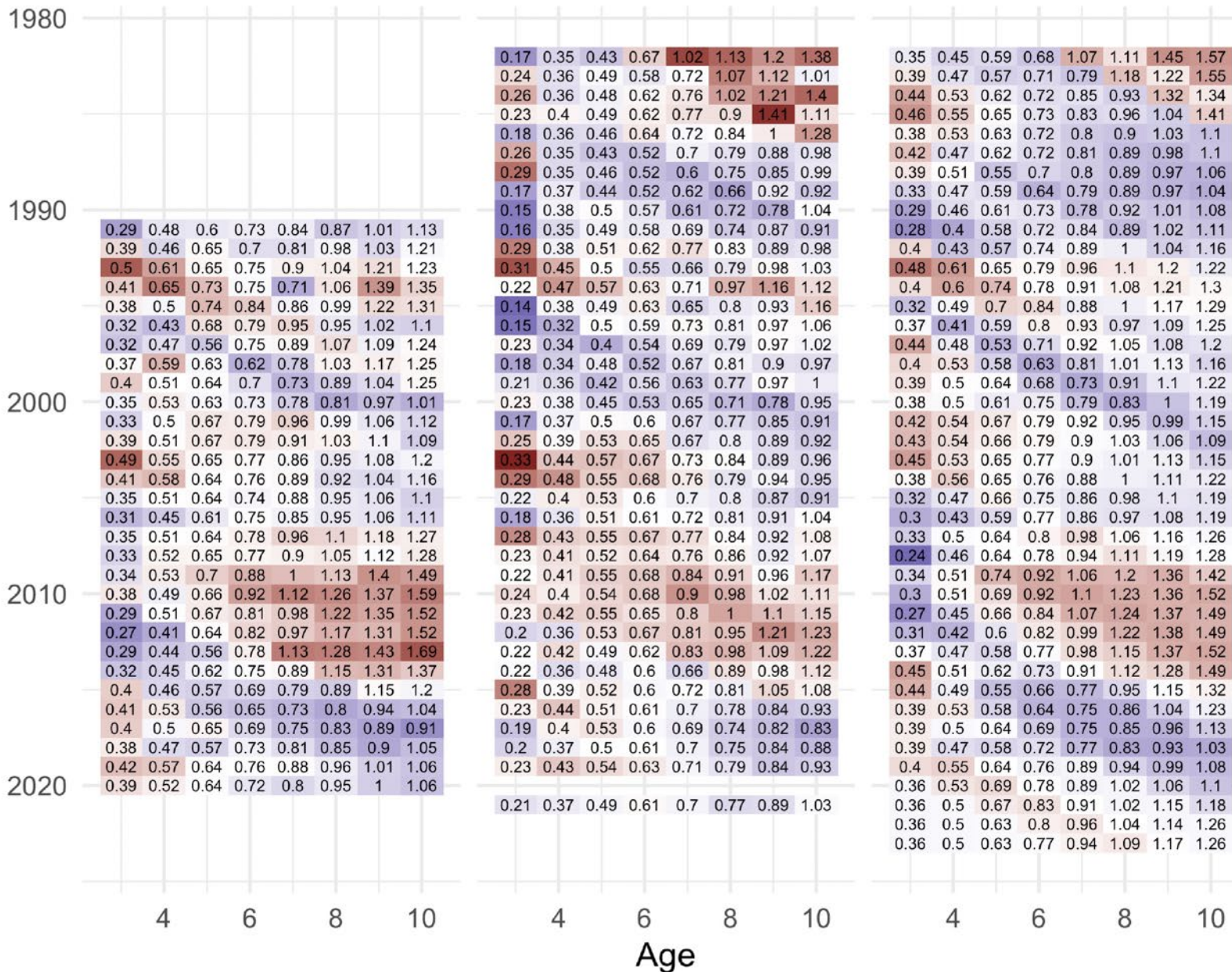
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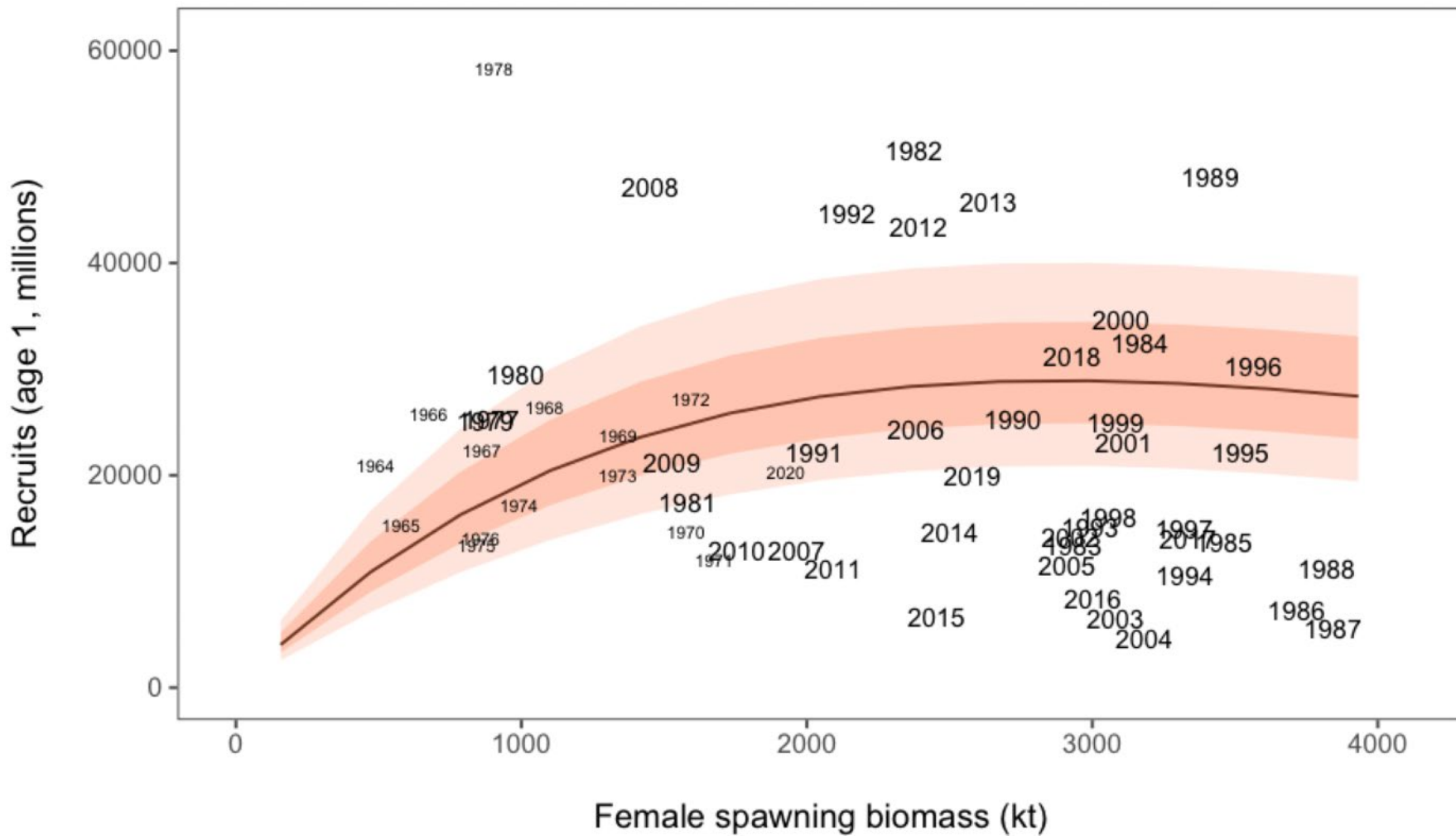


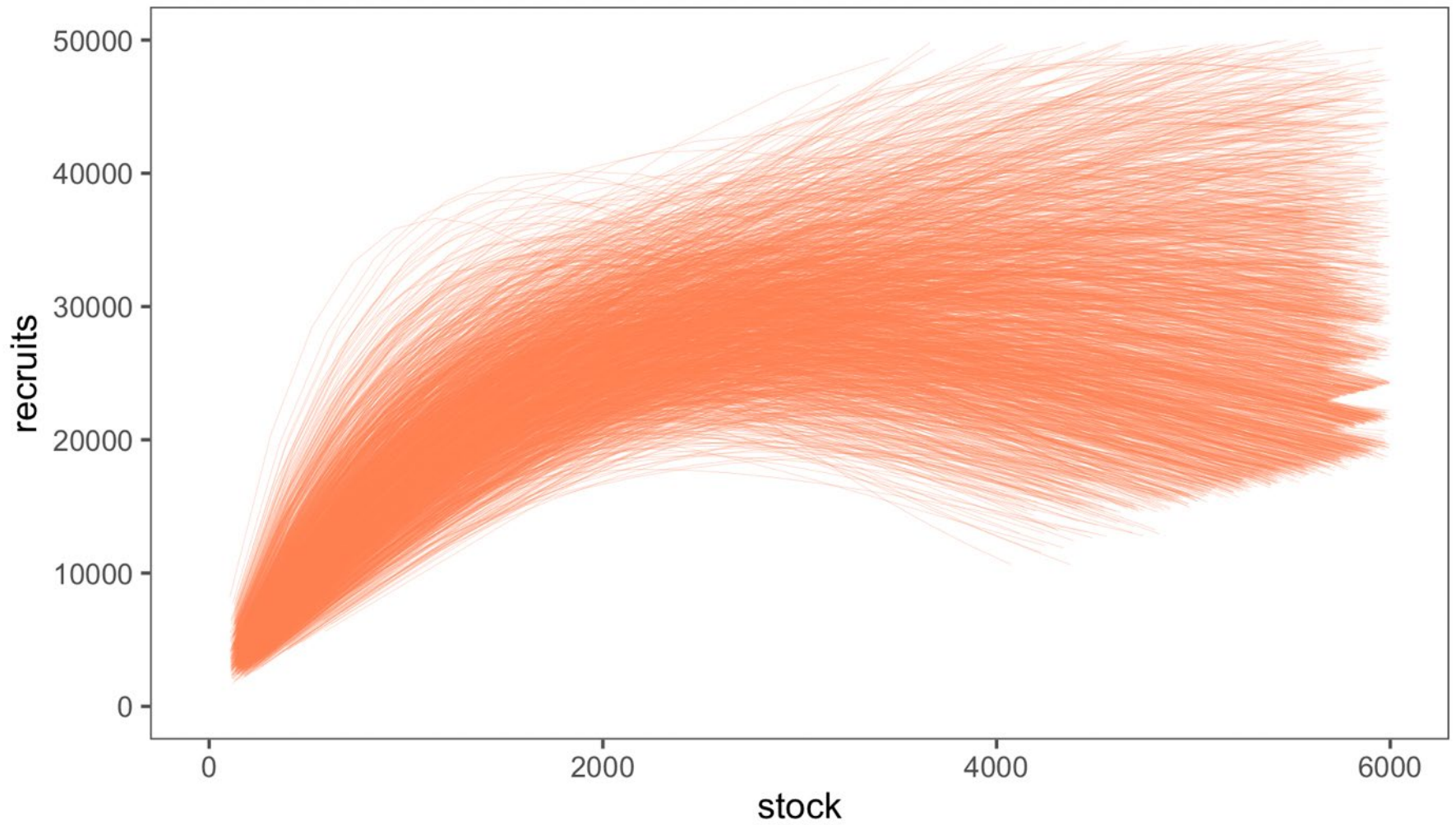
fishery

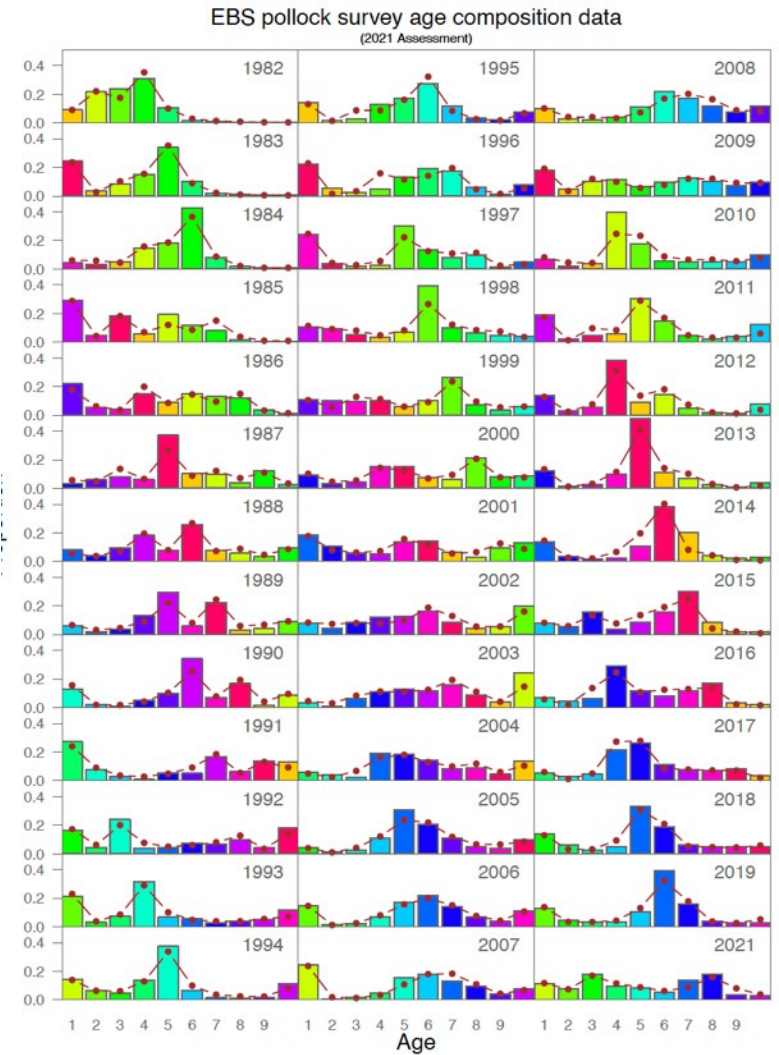
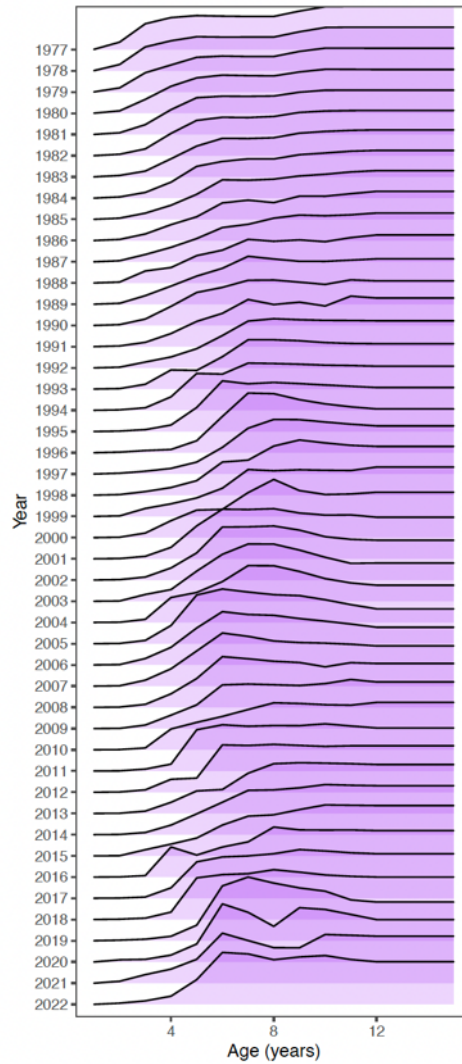
index

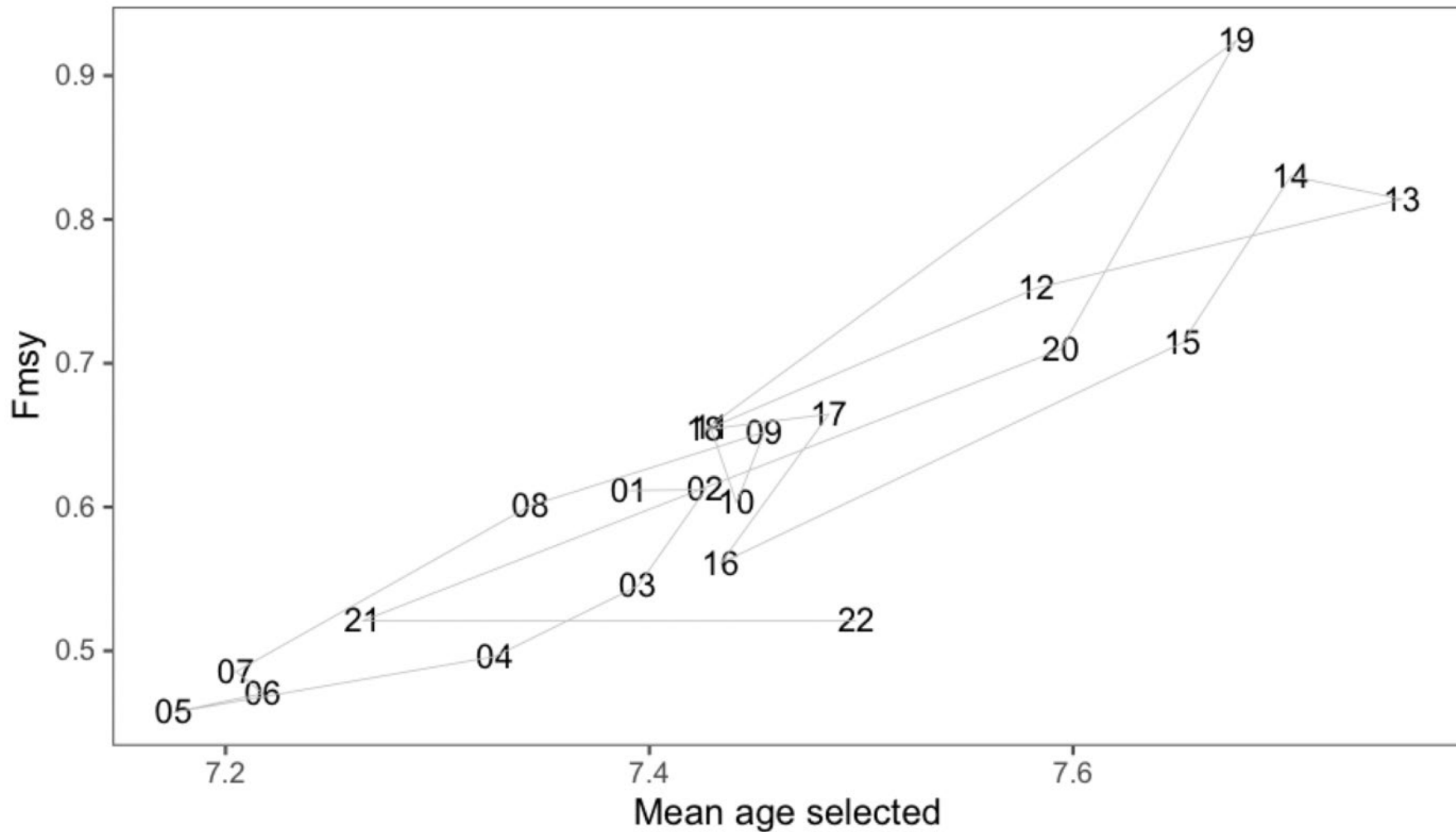
model



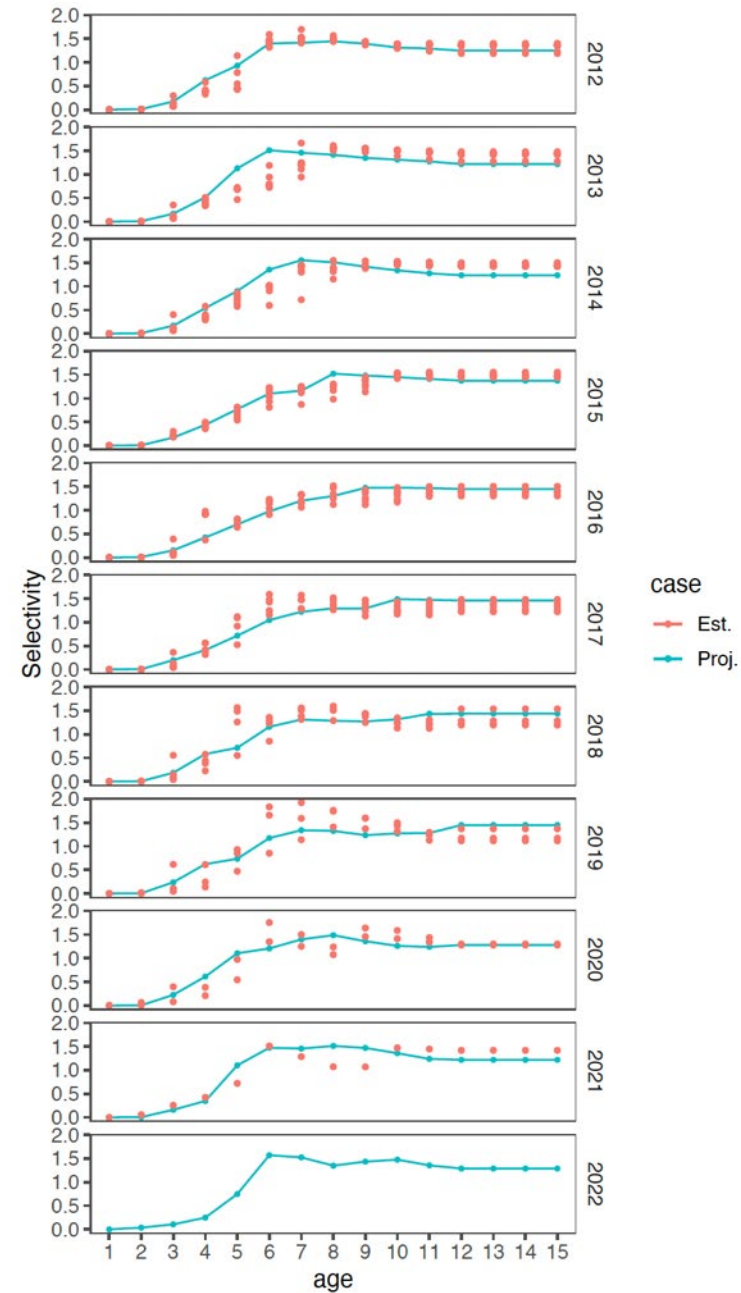






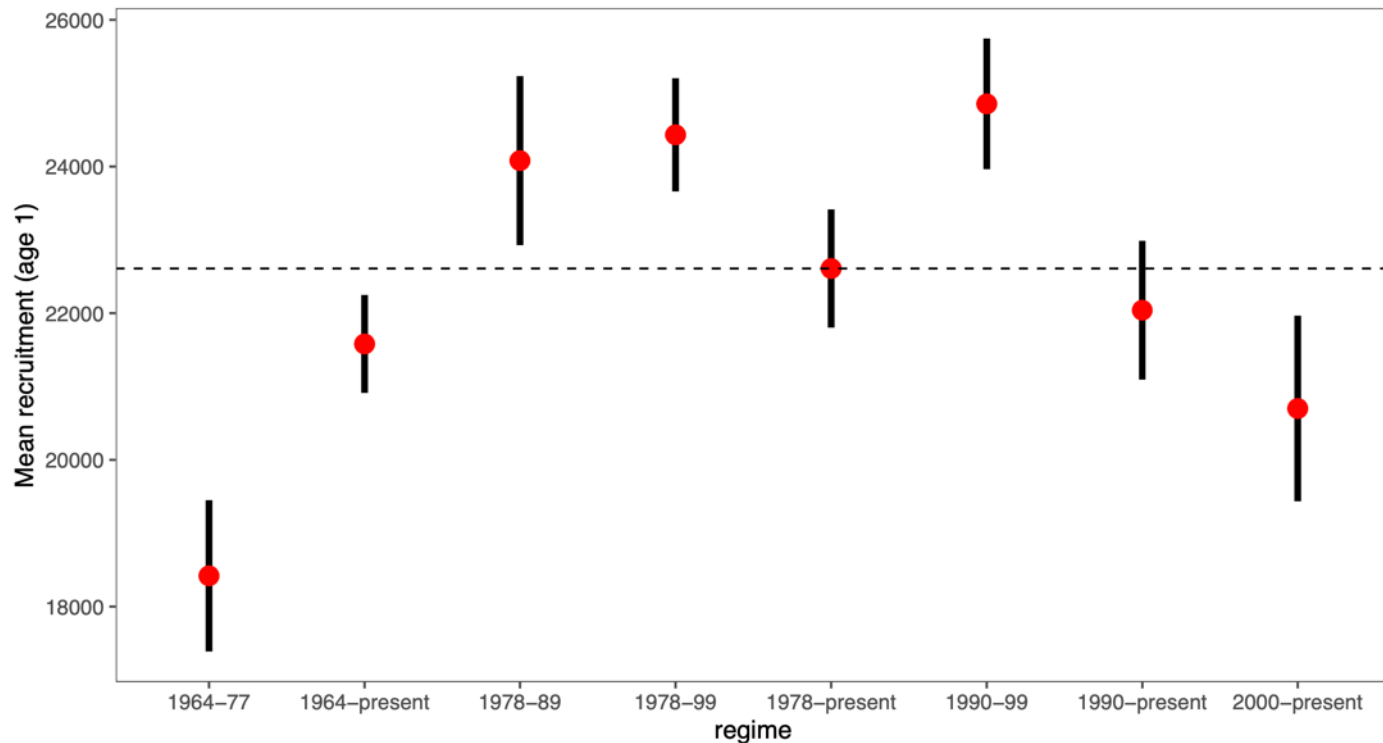


Can we predict selectivity?

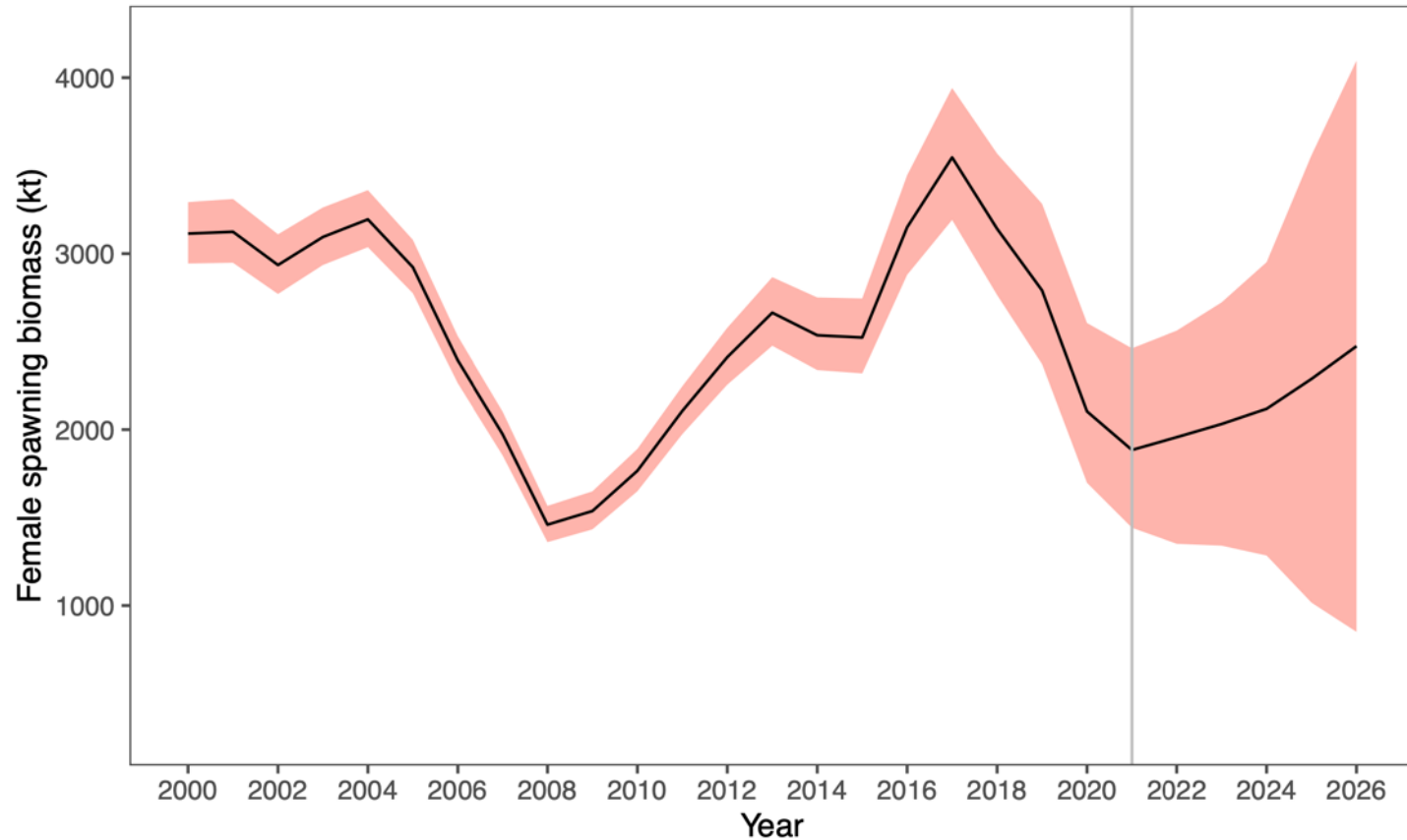


Recruitment pattern

- By “regime”



Biomass trend



Summary

- New data for 2021:
 - Bottom trawl survey ~65% of mean (8th lowest since 1982)
 - Mid-water pollock (young fish) **Indicate potentially strong recruitment**
 - Fishery 2020 showed poor conditions, improved this year but **small fish**
- Results combining disparate data pending; but
 - Expect decline in spawning biomass through 2022



Recommendations



Risk table summary

| Assessment-related | Considerations | | |
|---|---|---|---|
| | Population dynamics | Environmental or ecosystem | Fisheries |
| Level 2: Substantially increased concerns | Level 2: Substantially increased concerns | Level 2: Substantially increased concerns | Level 2: Substantially increased concerns |

| Tier | Year | MaxABC | OFL |
|------|------|-----------|-----------|
| 1b | 2022 | 1,251,000 | 1,469,000 |
| 1b | 2023 | 1,451,000 | 1,704,000 |
| 2b | 2022 | 1,111,060 | 1,469,000 |
| 2b | 2023 | 1,288,610 | 1,704,000 |
| 3b | 2022 | 904,000 | 1,128,000 |
| 3b | 2023 | 1,067,000 | 1,327,000 |

Coincidentally same (similar to) constant F from 2021



Decision table considerations

Table 1-43. Outcomes of decision (expressed as chances out of 100) given different 2022 catches (first row, in kt). Note that for the 2019 and later year-classes average values were assumed. Constant Fs based on the 2022 catches were used for subsequent years.

| | 10 | 850 | 1000 | 1150 | 1375 | 1300 | 1450 | 1600 |
|------------------------------------|----|-----|------|------|------|------|------|------|
| $P [F_{2022} > F_{MSY}]$ | 0 | 1 | 5 | 15 | 33 | 27 | 39 | 50 |
| $P [B_{2023} < B_{MSY}]$ | 28 | 53 | 58 | 63 | 71 | 68 | 73 | 78 |
| $P [B_{2024} < B_{MSY}]$ | 14 | 43 | 50 | 57 | 68 | 64 | 71 | 77 |
| $P [B_{2023} < \bar{B}]$ | 51 | 92 | 95 | 97 | 99 | 98 | 99 | 100 |
| $P [B_{2026} < \bar{B}]$ | 3 | 45 | 54 | 62 | 73 | 70 | 76 | 82 |
| $P [B_{2026} < B_{2021}]$ | 0 | 16 | 21 | 26 | 34 | 31 | 37 | 42 |
| $P [B_{2024} < B_{20\%}]$ | 1 | 3 | 4 | 5 | 8 | 7 | 9 | 11 |
| $P [p_{a_5,2024} > \bar{p}_{a_5}]$ | 10 | 72 | 78 | 82 | 86 | 85 | 87 | 89 |
| $P [D_{2023} < D_{1994}]$ | 2 | 13 | 19 | 25 | 37 | 33 | 42 | 52 |
| $P [D_{2026} < D_{1994}]$ | 0 | 15 | 24 | 35 | 54 | 48 | 60 | 72 |
| $P [E_{2022} > E_{2021}]$ | 0 | 1 | 14 | 49 | 87 | 78 | 92 | 97 |



Aleutian Islands Walleye pollock (partial)



Steven J. Barbeaux, Jim Ianelli, and Wayne Palsson

- 19,000 t cap
- 2021 catch = 1,695 t
- Catch has been less than 4,000 t since 1999

| | As estimated or specified last year for: | | As estimated or recommended this year for: | |
|-----------------------------|--|---------|--|---------------|
| | 2021 | 2022 | 2022 | 2023* |
| Quantity | | | | |
| M (natural mortality rate) | 0.21 | | 0.21 | |
| Tier | 3a | | 3a | |
| Total (age 1+) biomass (t) | 292,967 | 308,671 | 308,525 | 330,375 |
| Female spawning biomass (t) | | | | |
| Projected | 89,906 | 85,785 | 89,516 | 87,650 |
| B _{100%} | 185,475 | | 185,475 | |
| B _{40%} | 74,190 | | 74,190 | |
| B _{35%} | 64,916 | | 64,916 | |
| F _{OFL} ** | 0.390 | 0.390 | 0.390 | 0.390 |
| maxF _{ABC} | 0.313 | 0.313 | 0.313 | 0.313 |
| F _{ABC} | 0.313 | 0.313 | 0.313 | 0.313 |
| OFL (t) | 61,856 | 61,308 | 61,264 | 61,379 |
| maxABC (t) | 51,241 | 50,789 | 50,752 | 50,825 |
| ABC (t) | 51,241 | 50,789 | 50,752 | 50,825 |
| | As determined this year for: | | As determined this year for: | |
| Status | 2019 | 2020 | 2020 | 2021 |
| Overfishing | no | no | no | n/a |
| Overfished | n/a | n/a | n/a | no |
| Approaching overfished | n/a | n/a | n/a | no |

