Bering Sea and Aleutian Islands Yellowfin Sole Assessment September 2022

Ingrid Spies

Steve Barbeaux, Maia Kapur, Ian Taylor

Models for 2022

- Model 18.2: (Design based survey indices)
- Model 18.2a: (VAST estimate of survey indices and **age compositions**).
- Model 22.1: Same as Model 18.2 and male and female survey selectivity modeled together (single selectivity curve).

Also

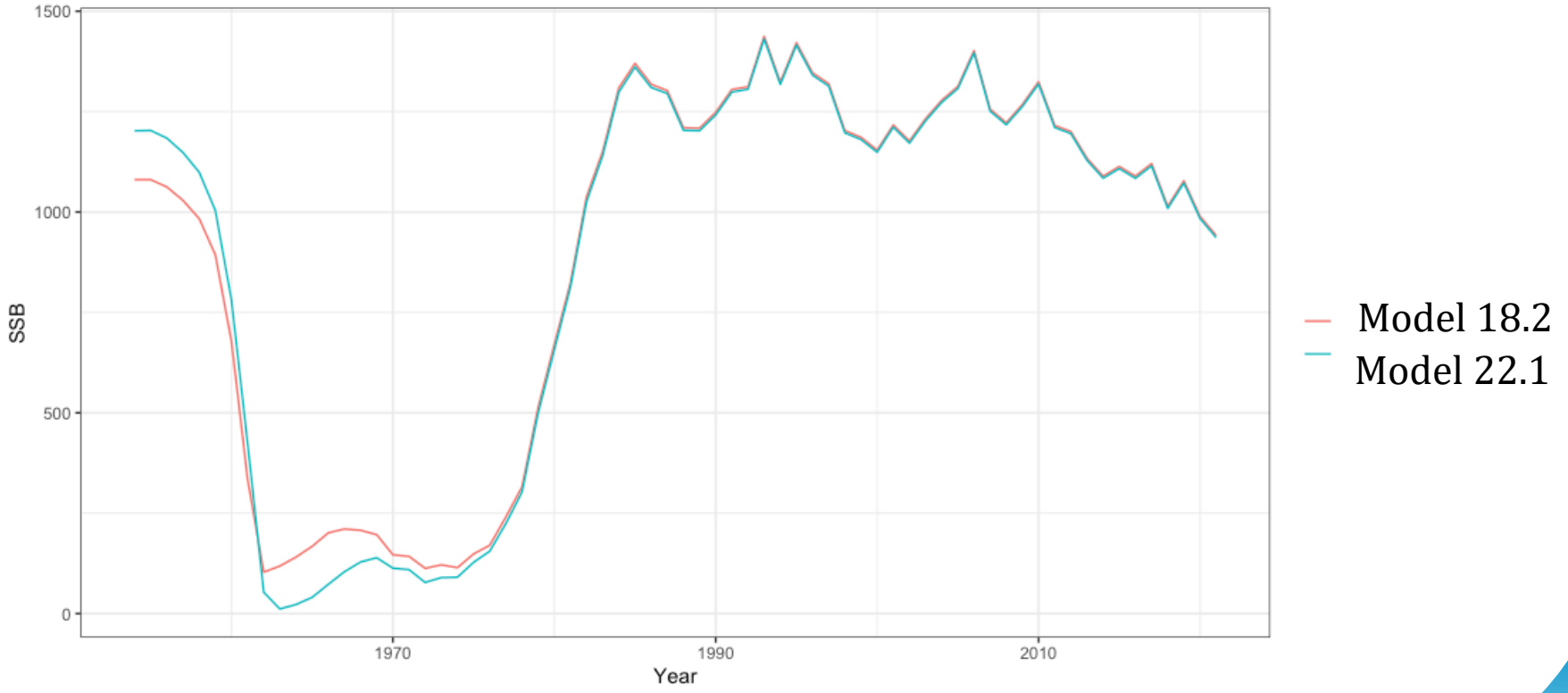
- Growth Model: Model 18.2 but growth (weight at age) covaries with Bering Sea bottom temperature.

NOAA FISHERIES

Model 22.1
A single survey selectivity for males and females.

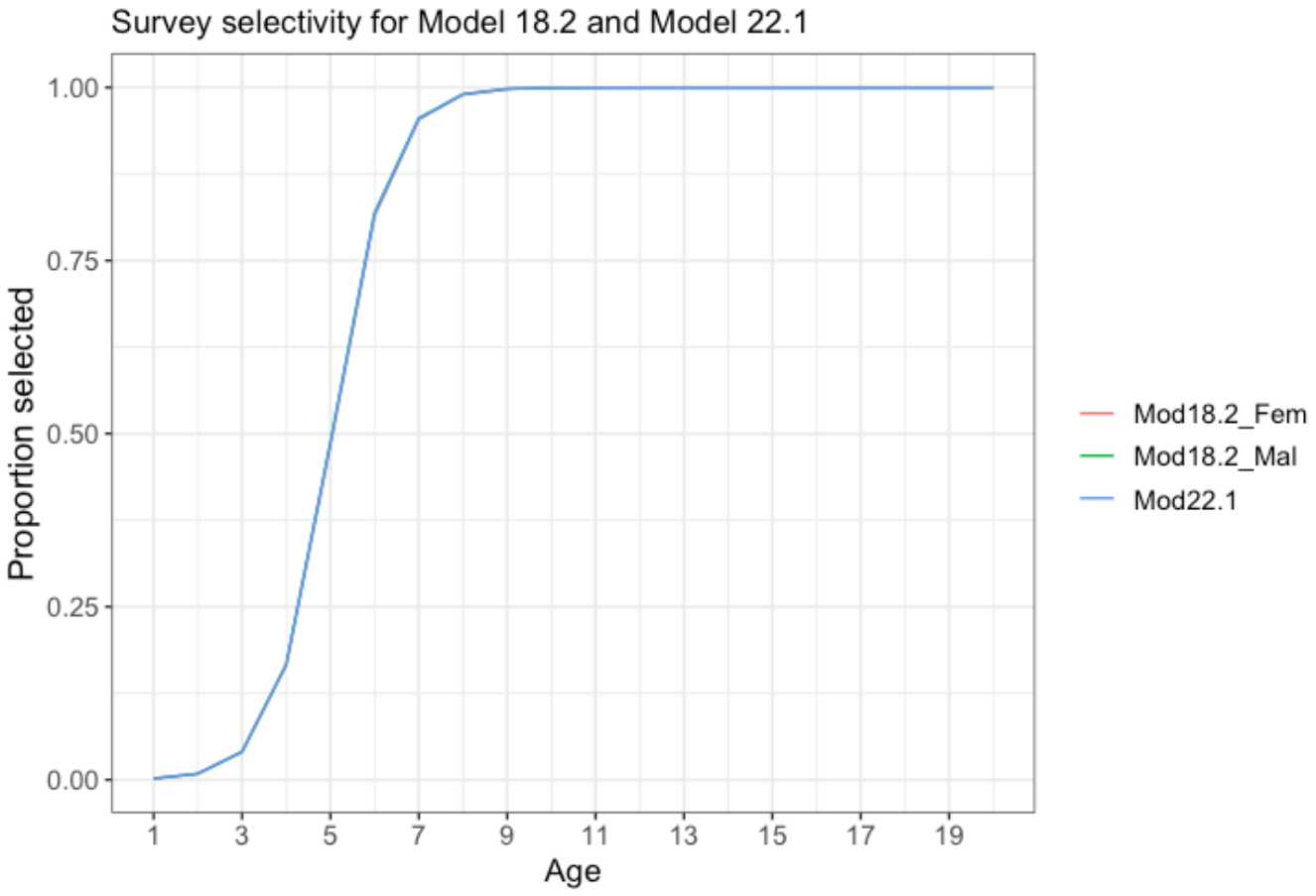
NOAA FISHERIES

Very small change in female spawning biomass using a single survey selectivity.



NOAA FISHERIES

Results indicate that moving to a single selectivity does not result in a change in selectivity.



NOAA FISHERIES

Calculating AIC from the hessian and objective function value (ADMB output)

The hessian (*Hess*)was transformed back into the original parameter space, and the marginal likelihood ($Likelihood_{MAR}$) was estimated as follows:

$$\text{likelihood}_{MAR} = -0.5\,Hess_T - OFV,$$

where OFV is the objective function value from the ADMB .par file. The marginal likelihood can be used to calculate AIC, as follows:

$$AIC = 2k - 2 * likelihood_{MAR},$$

where k is the number of parameters used in the model.

Thorson, J., Hicks, A.C., and Methot, R. 2014. Random effect estimation of time-varying factors in Stock Synthesis. ICES Journal of Marine Science; doi: 10.1093/icesjms/fst211.

NOAA FISHERIES

Lower AIC values indicate a better-fit model, and difference >2 is considered significantly better.

M18_2: AIC = 5857.69

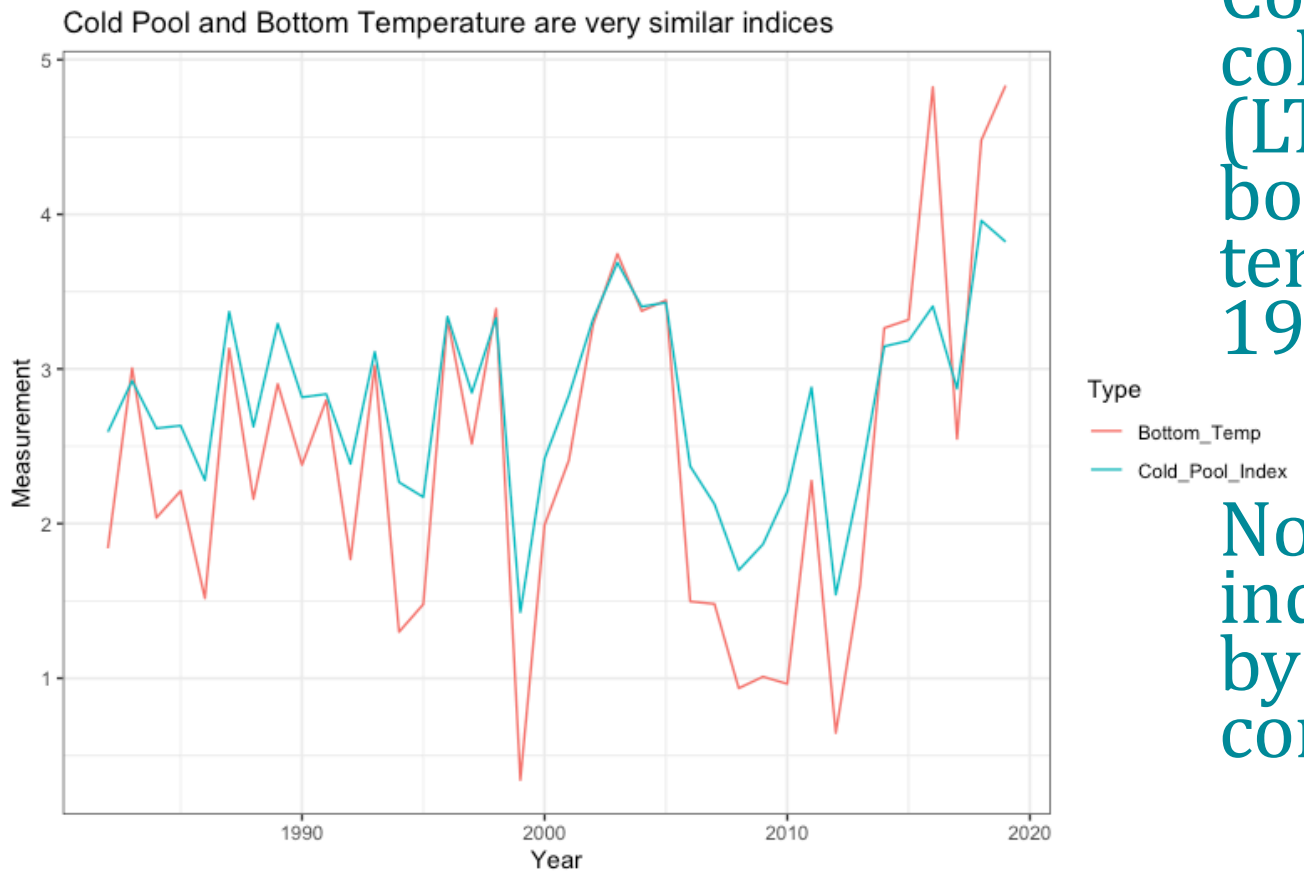
M18_2_1sel: AIC = 5848.57

NOAA FISHERIES

Growth Model

NOAA FISHERIES

Cold pool index and Bering Sea bottom temperature are similar, and bottom temp. was selected as the index of interest.

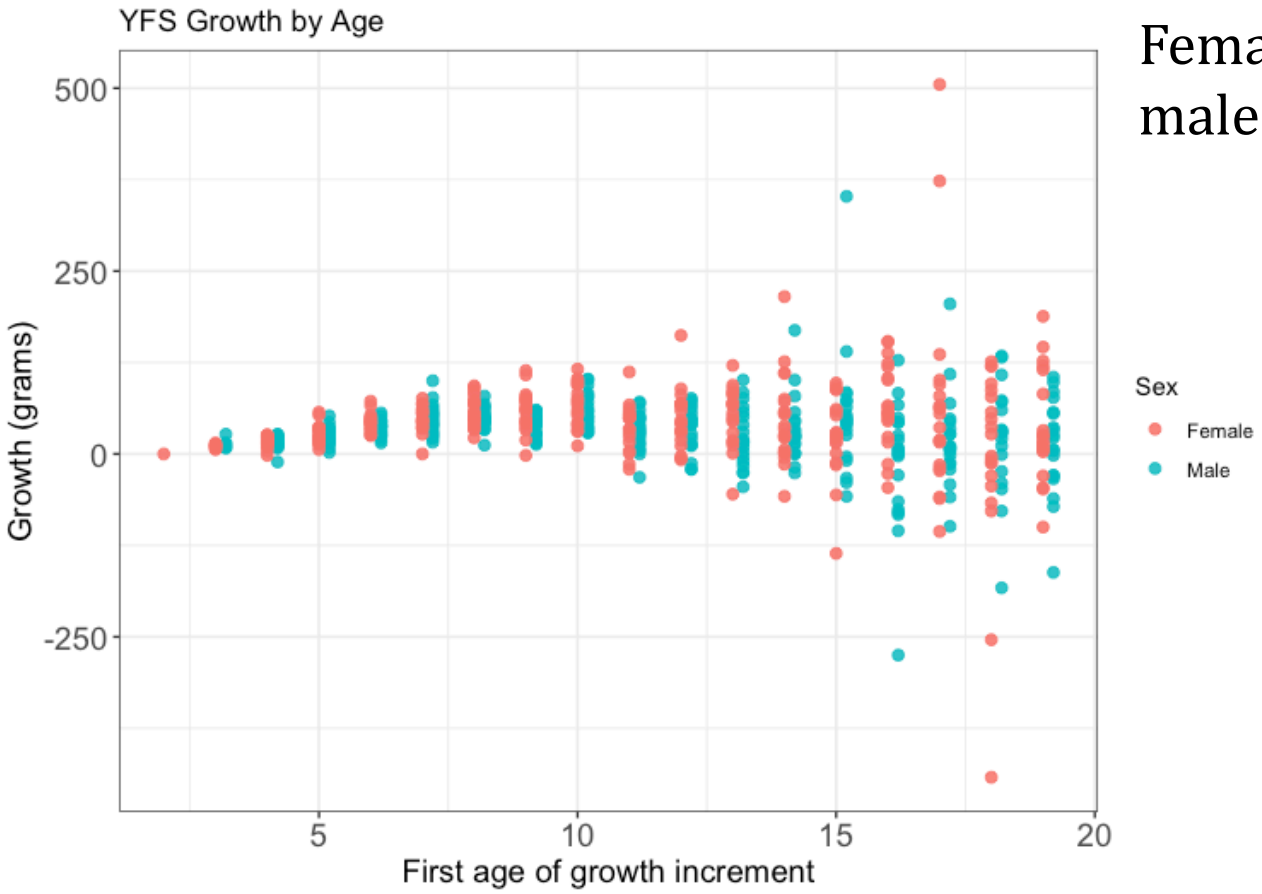


Comparison of the cold pool index (LTE2_KM2) and bottom temperature, 1982-2019.

Note: cold pool index is multiplied by -0.1 for comparison.

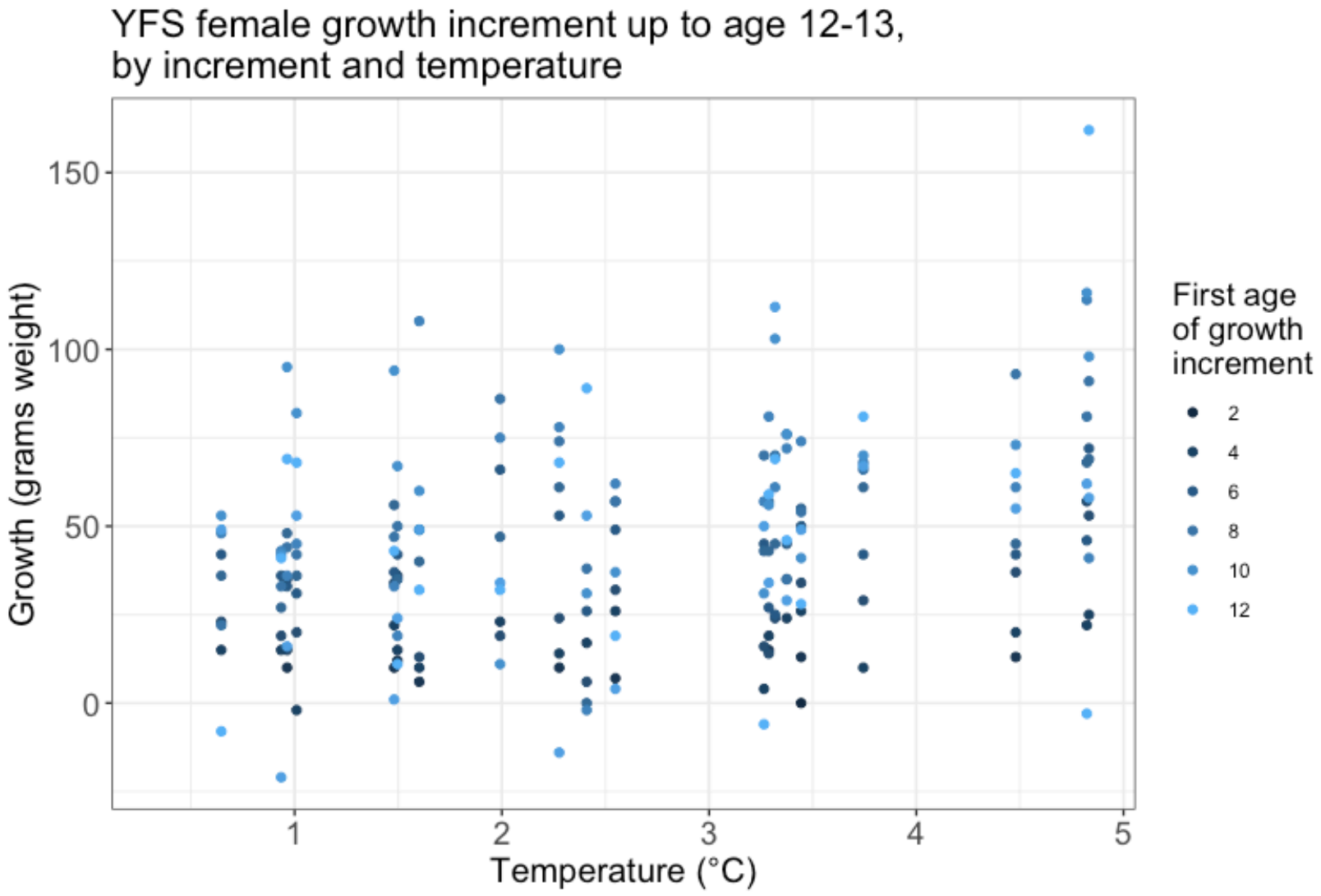
NOAA FISHERIES

Variance in growth by age increases, and was only used for ages in which CV>1.



Females CV<1 up to age 13, males CV<1 up to age 12.

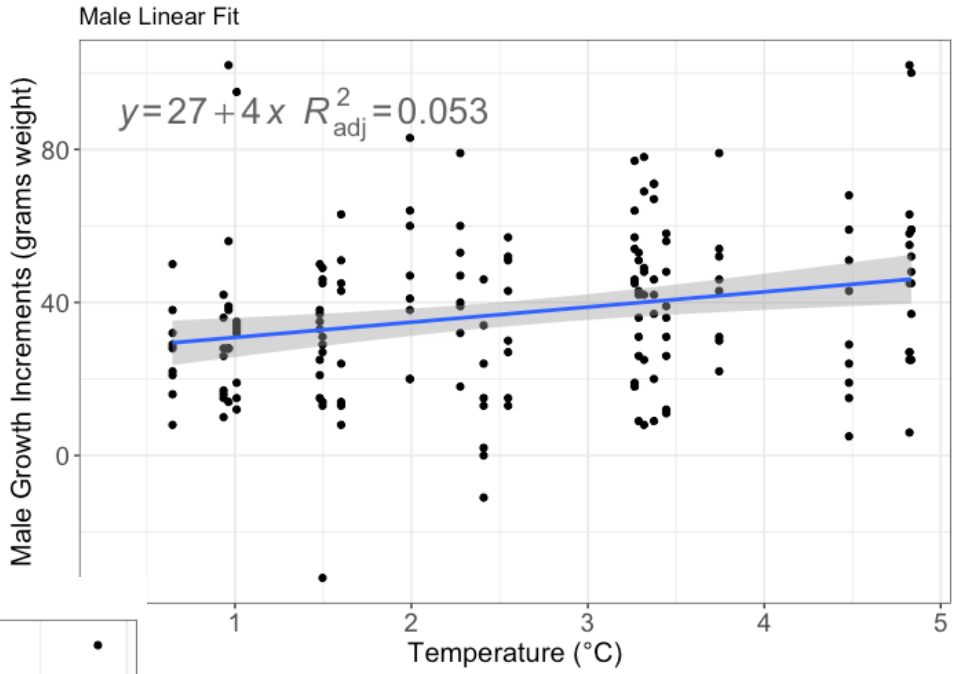
NOAA FISHERIES

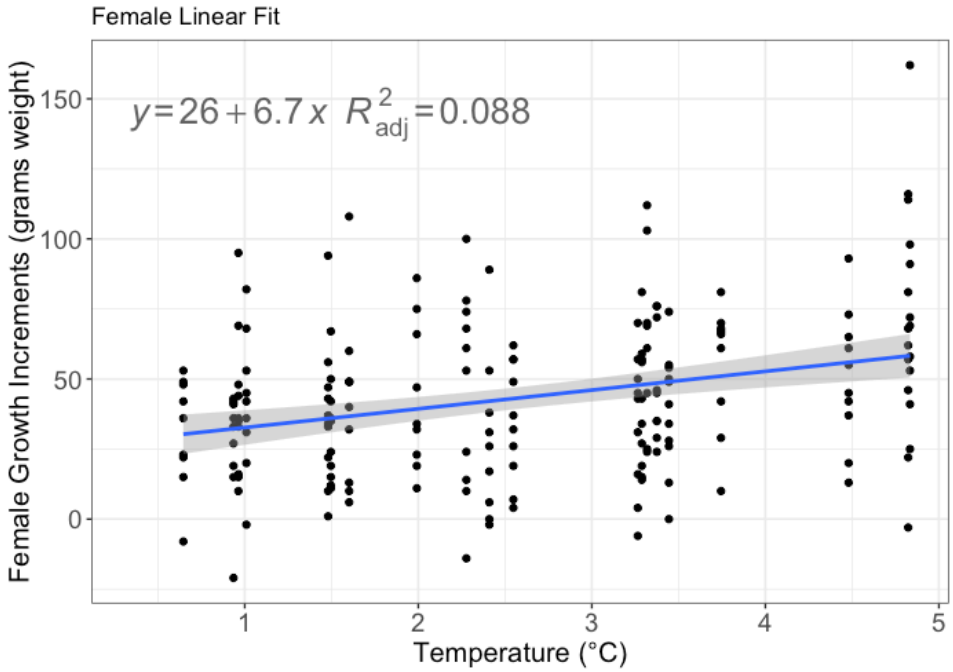


(Bering Sea Bottom Temperaure)

NOAA FISHERIES

Growth Model

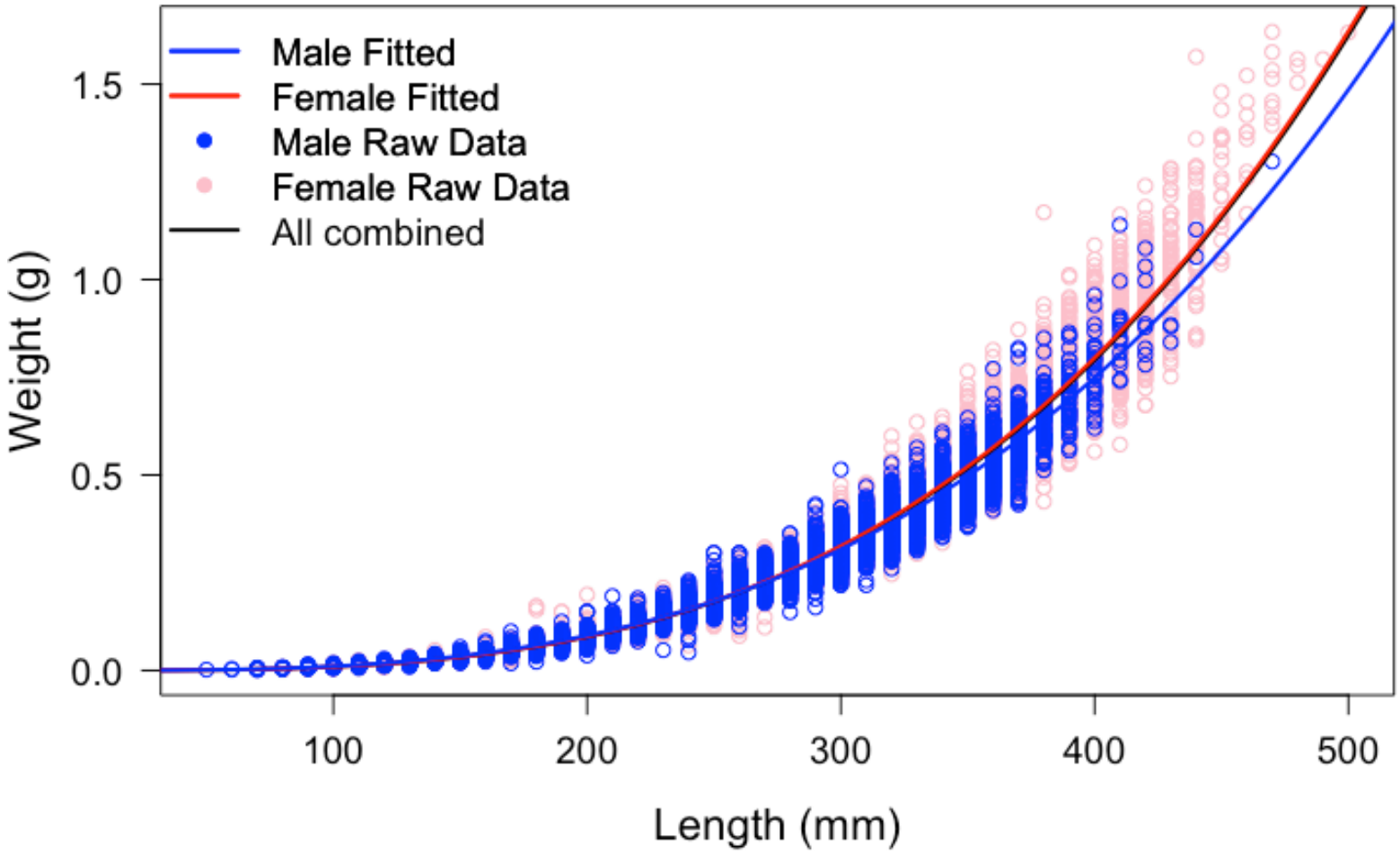




NOAA FISHERIES

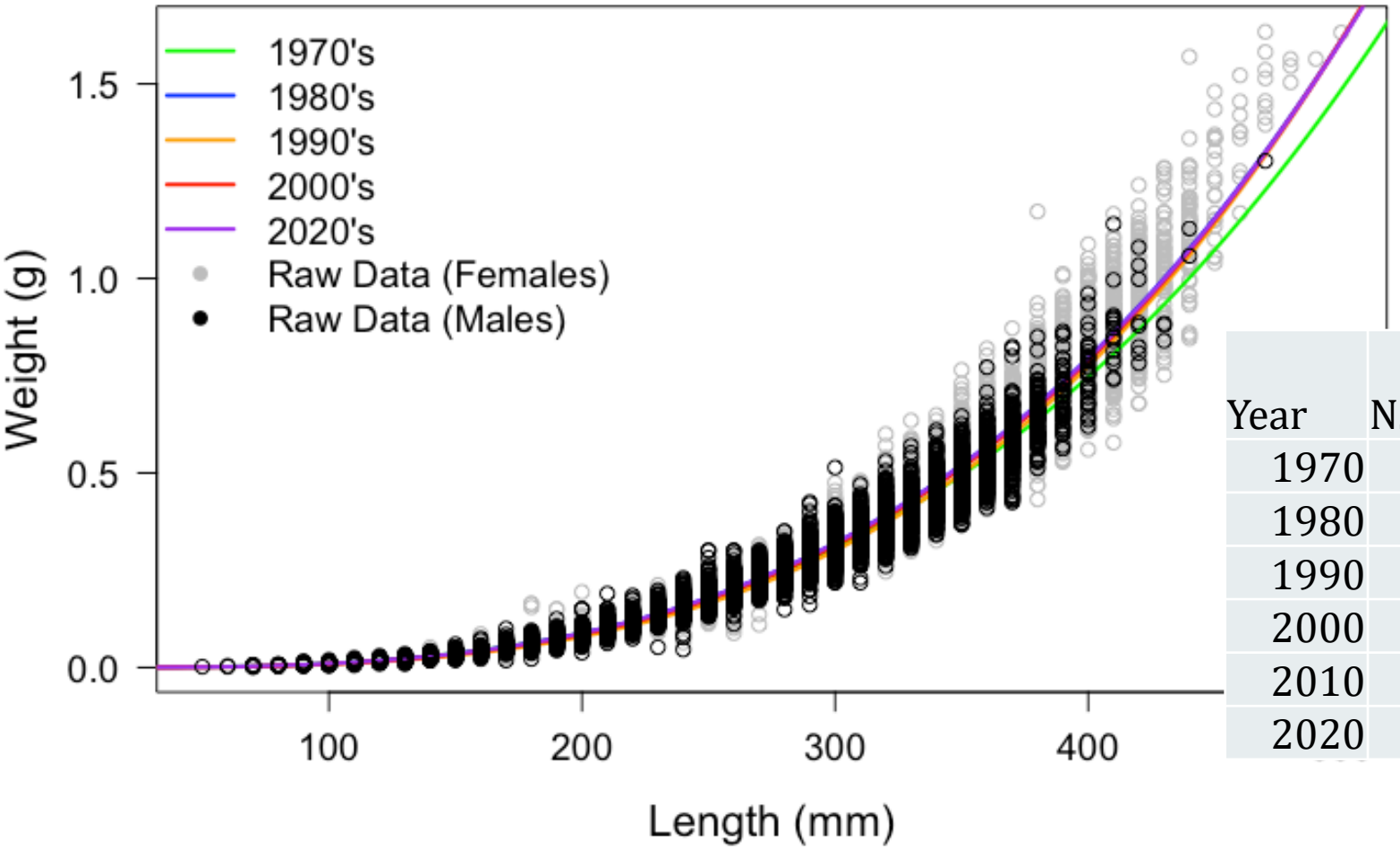
Male and Female Growth

Used nonlinear least squares fit to weight at length data, with nonlinear least squares (nls) method.
Male and female weight at age are different curves in the YFS model.



NOAA FISHERIES

Yellowfin sole weight at length has not changed throughout the time series.



Year	N. Observations
1970	9,388
1980	8,385
1990	6,818
2000	7,755
2010	9,900
2020	1,440

NOAA FISHERIES

Growth model details.

- Dataset consisted of 32,590 ages, lengths and weights from 1982-2021.
- Missing weights (roughly 23%) were filled in with the length-weight relationship.
- This was not a conflict because length also increased with temperature.
- There was a minimum of 433 records in 2006, and a maximum of 1,437 in 2017. The mean was 820 per year (sd = 217).
- Growth intervals from age 2 to 3 through age 19 to 20 were calculated for males and females separately, and were on average 0.23 cm higher in females than males.

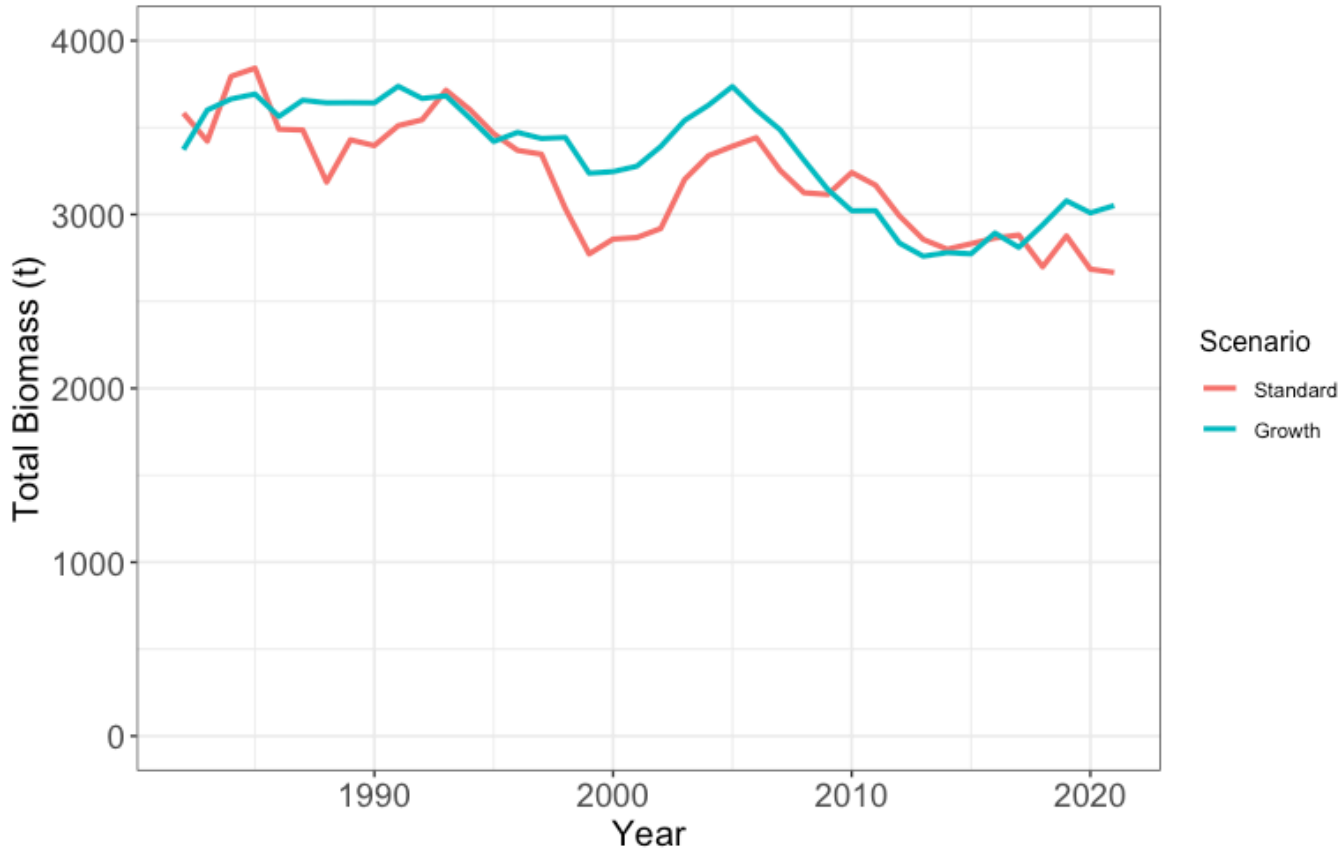
Growth model shows similar trend in total biomass as Model 18.2.

Model 18.2

NOAA FISHERIES

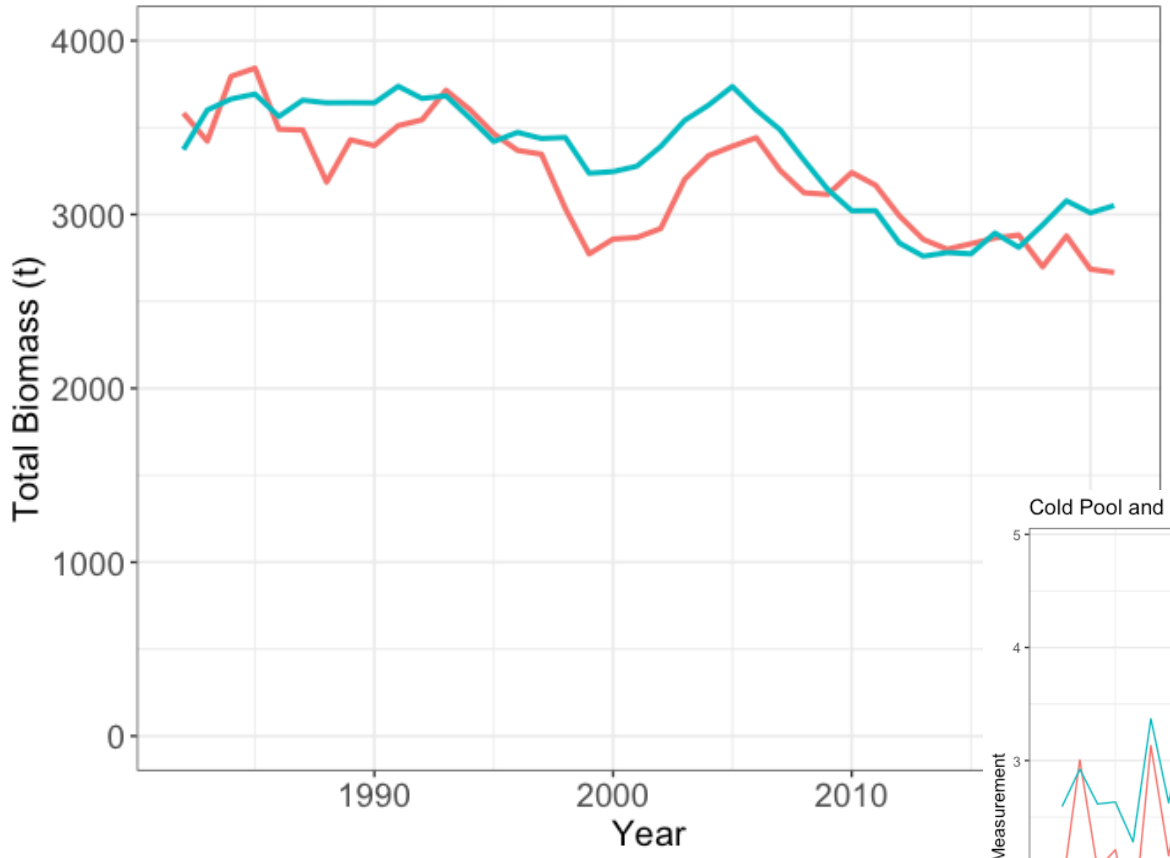
Growth model shows similar trend in total biomass as Model 18.2.

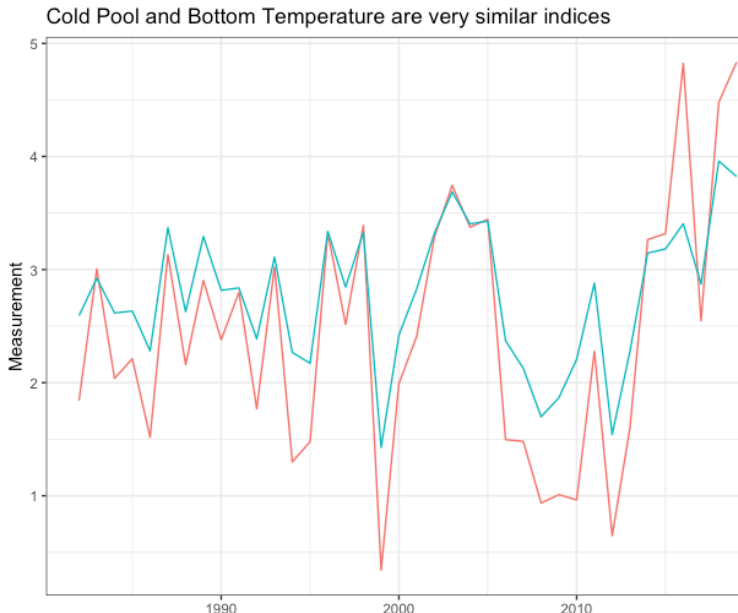
Growth is cumulative in this model.



Growth model shows similar trend in total biomass as Model 18.2.

Growth is cumulative in this model.





Lower AIC values indicate a better-fit model, and difference >2 is considered significantly better.

M18_2: AIC=5857.69

M18_2_1sel:AIC=5848.57

M18_2_growth: AIC=5948.70

NOAA FISHERIES

Recommendations for November

- Model 18.2 (with design-based and VAST biomass and age composition estimates) = two models.
- Model 22.1 (1 survey selectivity)
- Growth model will not be put forward as a model for Plan Team consideration this year.

NOAA FISHERIES

Questions?

NOAA FISHERIES

Estimating climate-driven phenology shifts and survey availability using fishery-dependent data

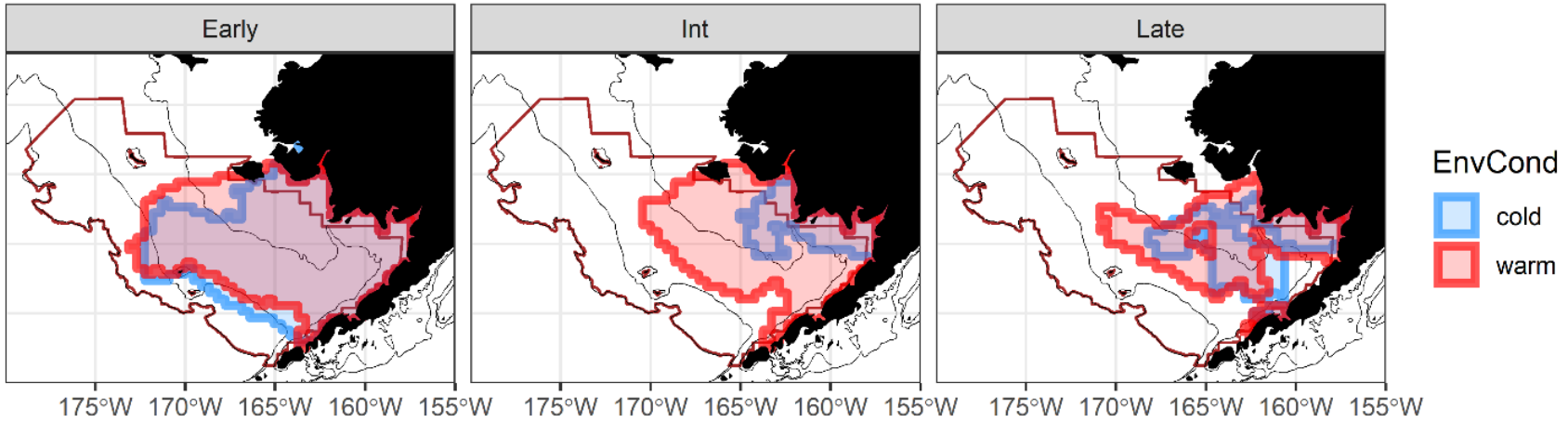
Maxime Olmos[1,2*], Jim Ianelli[2], Lorenzo Ciannelli[1], Ingrid Spies[2], Carey McGilliard[2*], James T. Thorson[2*]

[1]College of Earth, Ocean and Atmospheric Sciences, Oregon State University, Corvallis, OR, USA

[2]Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 7600 Sand Point Way NE, Seattle, WA 98115, USA

NOAA FISHERIES

Spatio-temporal model using seasonal distribution to explain summer survey availability, movement timing as impacted by environmental conditions.



1. Spawning movement more progressed during warm than cold years.
2. Spatial distribution more constrained, biomass lower during cold years.
3. Fish more available to summer survey during warm years than cold years.
4. Males stayed longer on the spawning grounds than females.

Early (March 19-May 21), Intermediate (May 22-July 30), Late (August-September)