2024 GOA Pcod assessment

September 2024 Plan Team

Background

- Vision for this year was to clean/redevelop input data scripts to then work on modelling analyses
- As you'll soon see, redevelopment of data scripts hit some bumps that required a bit of attention – took much longer than anticipated
- Data code redeveloped, streamlined, and documented
  - A number of redundancies and dead ends removed
  - Resulted in reduction of the number of lines of code and ~30% reduction in run time (8 min vs 12 min)

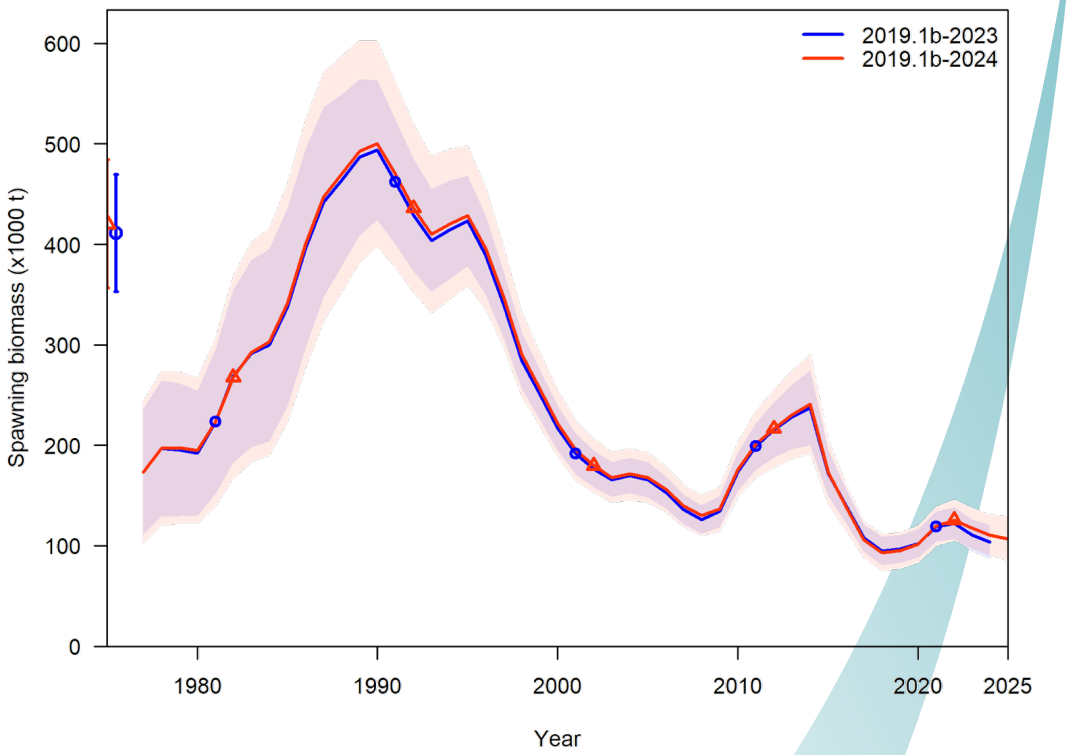
Outline

1. Data updates/recommended base changes to model input files
2. Additional recommended data changes: Update ageing error, fishery length comps, length comp binning
3. Evaluated apportionment changes: inclusion of AFSC longline survey
4. Evaluated model changes: survey/fishery selex, ISS
5. Upcoming assessment work

Forgiveness & permission…

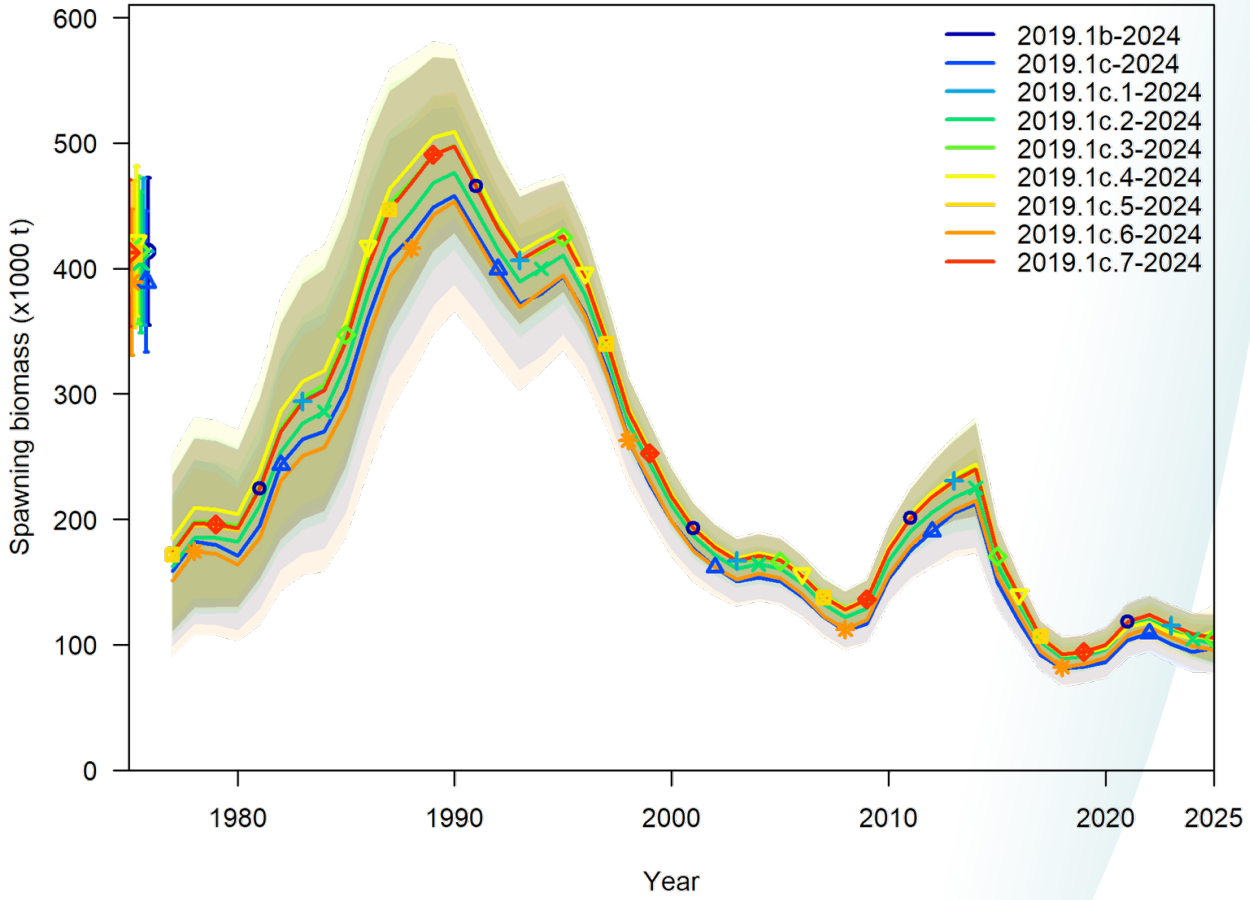
Base data updates (2019.1b-2024)

- Noteworthy difference: Trawl survey
  - GAP cleaned up old haul data, only includes specimen data associated with a haul that is used to compute abundance
  - Resulted in minor differences in early trawl survey time series for abundance and comp data
- Updating fishery data update results in slight uptick in spawning biomass at end of time-series compared to 2023 assessment



Input data file changes

- 7 changes recommended: denoted as 2019.1c.#
- All added 1 at a time to model 2019.1b to evaluate sensitivity of model to each change individually
- BLUF: no substantial changes to trend, but will end up with shift in SSB



Input data file changes

- LL survey:
  - Log-normal computation for RPN SD hadn't been applied (but was applied to bottom trawl survey index), now is applied – 2019.1c.1
  - Length comps off by a cm (i.e., 25 cm fish became 26 cm) – 2019.1c.2
  - Length comps season had been set at 1 (Jan), when should have been set at 7 (Jul) – 2019.1c.3
- Fishery length comps:
  - ISS set at total number of hauls sampled (max 200), but filtered hauls to a certain sample size in expansion, set at number of hauls actually used in expansion (max 200) – 2019.1c.4

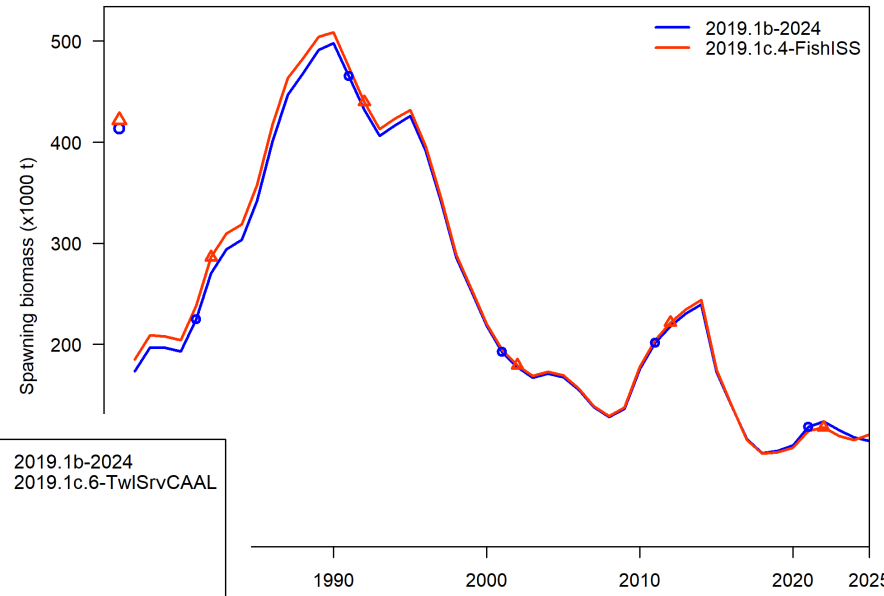
Input data file changes

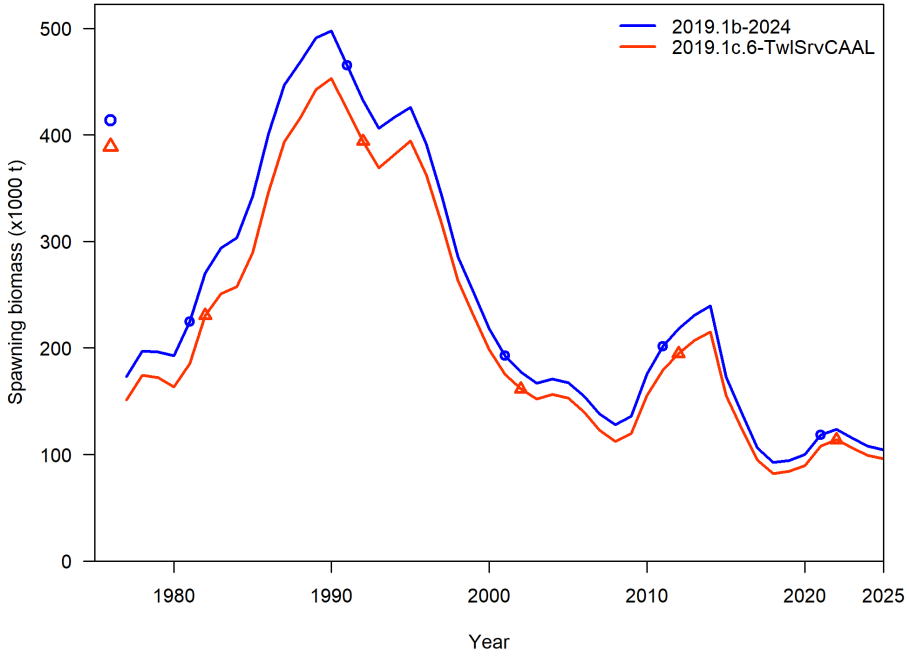
- All length comps:
  - Set plus bin at 104 cm rather than 116 cm (<2% of years ∀ data >0.01) – 2019.1c.5
- Trawl survey conditional age-at-length
  - Season had been set at 1 (Jan), when should have been set at 7 (Jul) – 2019.1c.6
- Consistency across assessments (SSC request):
  - Turn off forecast recruitment parameters – 2019.1c.7

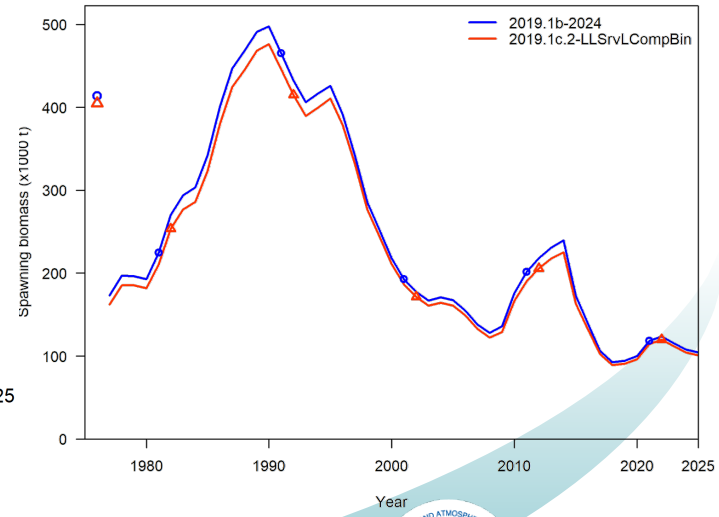
Input data file changes

- Average % difference in SSB (from 2019.1b):

Model	%diff
2019.1c.1	-0.06%
2019.1c.2	**-4.50%**
2019.1c.3	0.20%
2019.1c.4	**1.63%**
2019.1c.5	-0.33%
2019.1c.6	**-10.59%**
2019.1c.7	-0.05%



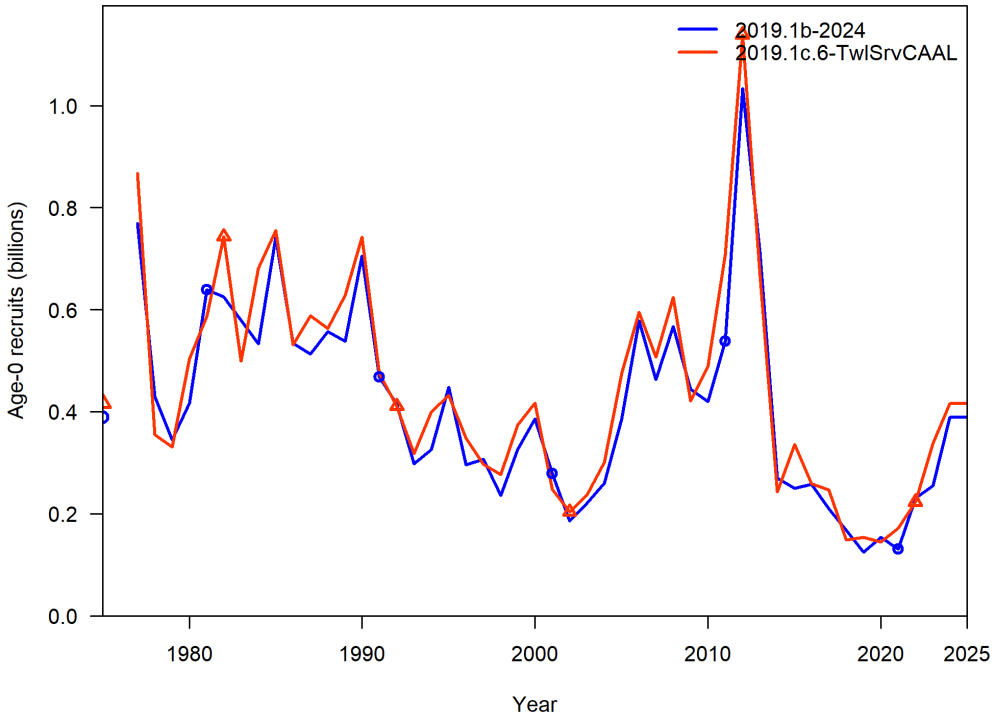


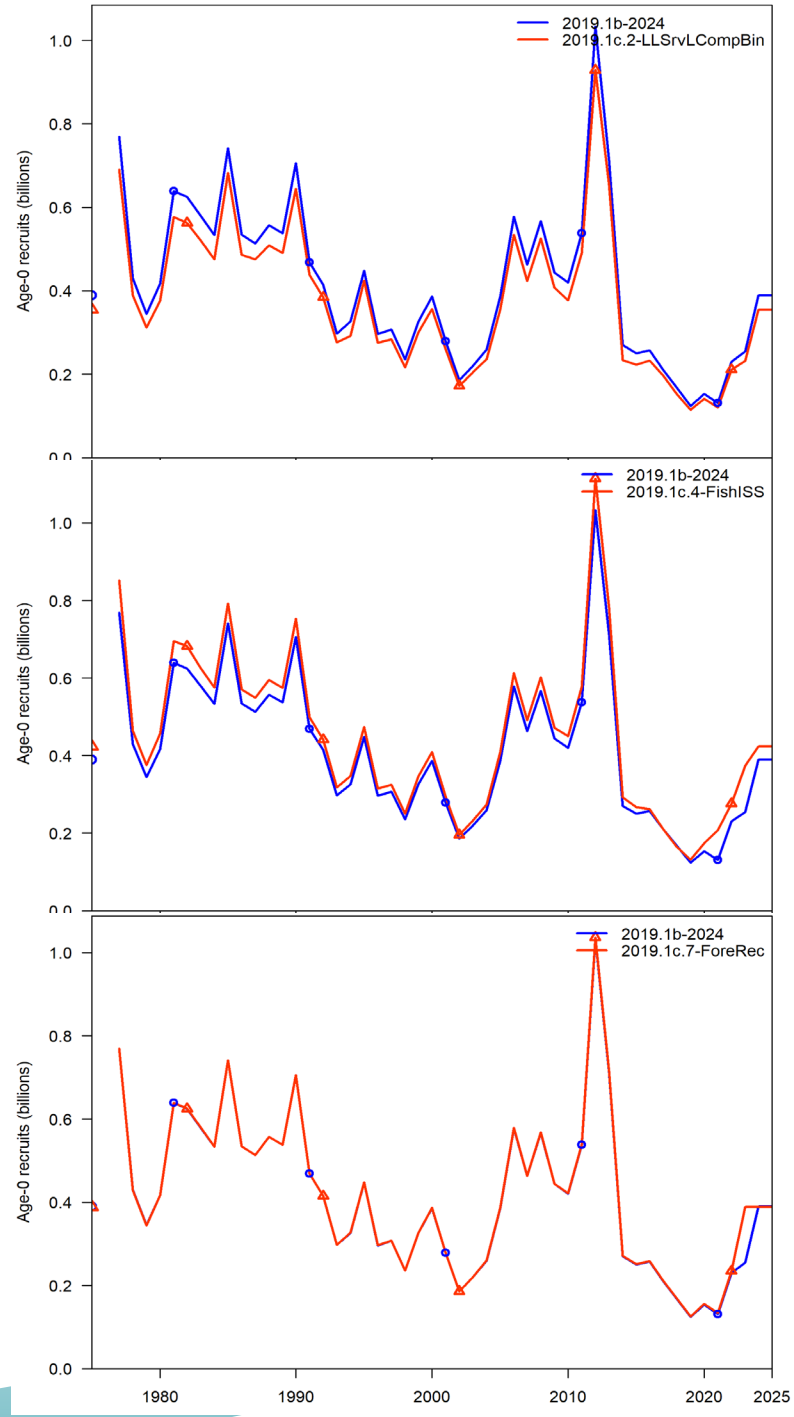


Input data file changes

- Average % difference in Recruitment:

Model	%diff
2019.1c.1	-0.09%
2019.1c.2	**-8.57%**
2019.1c.3	-0.89%
2019.1c.4	**8.93%**
2019.1c.5	0.79%
2019.1c.6	**8.07%**
2019.1c.7	**1.30%**





Input data file changes

- Neg log-likelihood components:

Component	2019.1b	2019.1c.2: LLSrvBin	2019.1c.4: FishISS	2019.1c.6: TwlCAAL
TOTAL	3050.99	3043.46	2915.88	3026.08
Catch	1.21E-12	2.47E-12	1.17E-12	5.19E-12
Survey	-3.78	-5.13	-8.96	-3.44
Length_comp	1868.43	1861.86	1743.21	1866.58
Age_comp	1180.16	1180.36	1177.15	1156.07
Recruitment	-4.86	-4.93	-5.97	-3.95
InitEQ_Regime	3.10	3.45	2.77	3.52
Forecast_Recruitment	0.41	0.41	0.03	0.10
Parm_priors	1.02	0.92	1.12	1.07
Parm_softbounds	0.01	0.01	0.01	0.01
Parm_devs	6.50	6.51	6.51	6.12

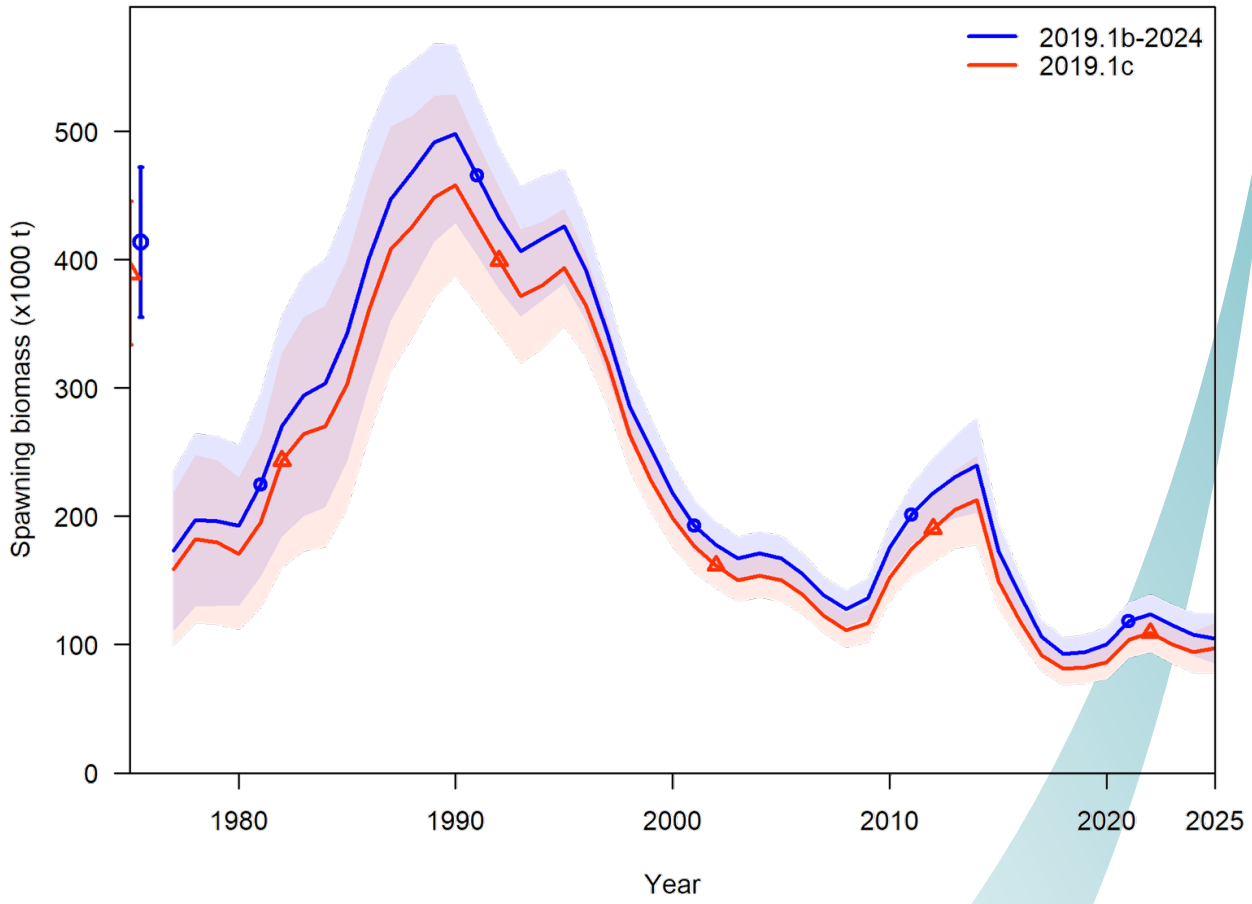
Input data file changes

- Key parameters:

Parameter	2019.1b	2019.1c	2019.1c.2: LLSrvBin	2019.1c.4: FishISS	2019.1c.6: TwlCAAL
NatM	0.46	0.47	0.45	0.47	0.46
NatM: 14-16	0.80	0.82	0.78	0.82	0.81
lnR	12.87	12.99	12.78	12.96	12.94
q_twl	1.07	1.19	1.12	1.07	1.19
q_ll	1.06	1.08	1.04	1.05	1.15
q_llenv	1.46	1.28	1.64	1.55	0.91

Input data file changes

- Input data changes:
  - Provide a number of necessary corrections
  - Starts to increase consistency across cod assessments
- Recommend new model 2019.1c

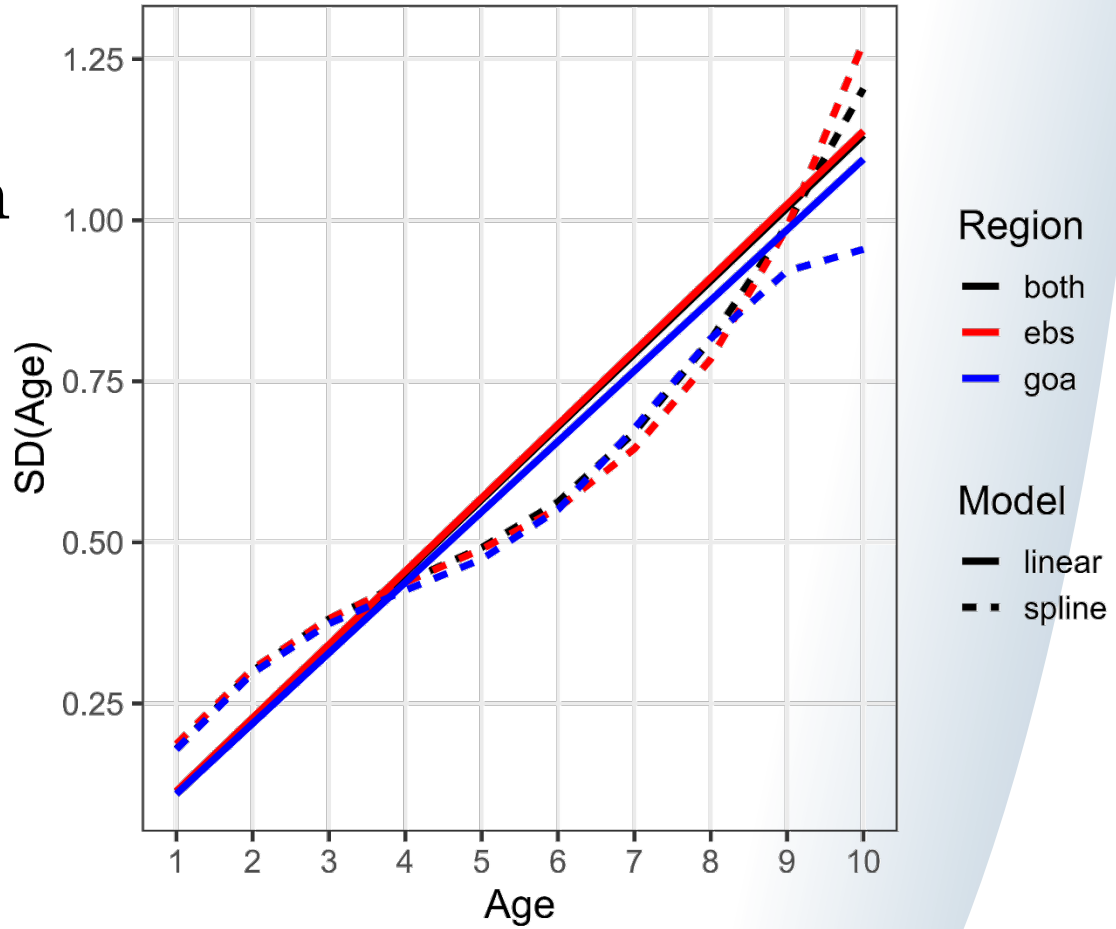


Data updates: ageing error & bias

- Current ageing error:
  - Based on GOA reader-tester data up to 2017
  - No error for age-1 & 2, age-3 SD = 0.57 linear to age-10 SD = 1.16
- Current ageing bias:
  - Bias for data pre-2007 implemented in Barbeaux et al. 2019
  - Estimates bias as unconstrained parameters at age-3 and age-10 (linear between)

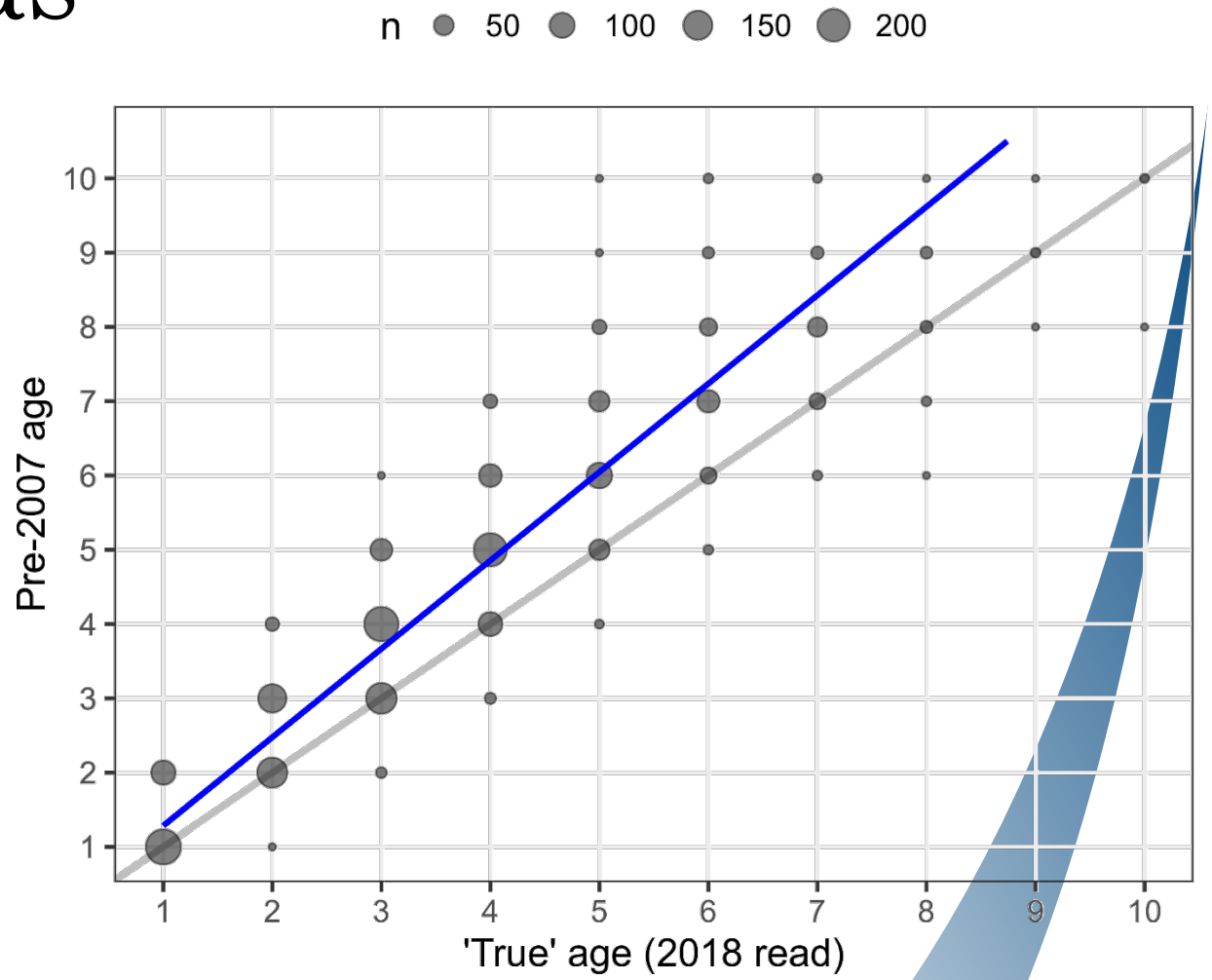
Data updates: ageing error

- Ageing error parameters: Update reader-tester data through 2023 within AgeingError R-package
- **Propose:**
  - Pool GOA-EBS
  - Continue with linear method
  - Change to age-1 (SD = 0.11) → age-10 (SD = 1.13)



Data updates: ageing bias

- Used re-read data in 2018 to estimate ageing bias parameters pre-2007 with AgeingError R-package
- **Propose:** Fix ageing bias parameters (rather than estimated) based on re-read data at 0.24 for age-1 and 2.00 for age-10 with linear bias between



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Model: updating ageing error & bias

- Decreases overall negative log-likelihood (CAAL)
- Slight increase in mean recruitment, increase in trawl survey catchability

Component	2019.1b	2019.1c	2019.1d
TOTAL	3050.99	2805.81	2727.26
Catch	1.21E-12	5.98E-12	3.99E-12
Survey	-3.78	-6.80	-8.03
Length_comp	1868.43	1704.53	1697.31
Age_comp	1180.16	1100.23	1030.48
Recruitment	-4.86	-2.55	-2.96
InitEQ_Regime	3.10	3.16	3.25
Forecast_Recruitment	0.41	--	--
Parm_priors	1.02	1.14	1.15
Parm_softbounds	0.01	0.01	0.01
Parm_devs	6.50	6.08	6.04

Parameter	2019.1b	2019.1c	2019.1d
NatM	0.46	0.47	0.48
NatM: 14-16	0.80	0.82	0.82
lnR	12.87	12.99	13.03
q_twl	1.07	1.19	1.23
q_ll	1.06	1.08	1.11
q_llenv	1.46	1.28	1.37

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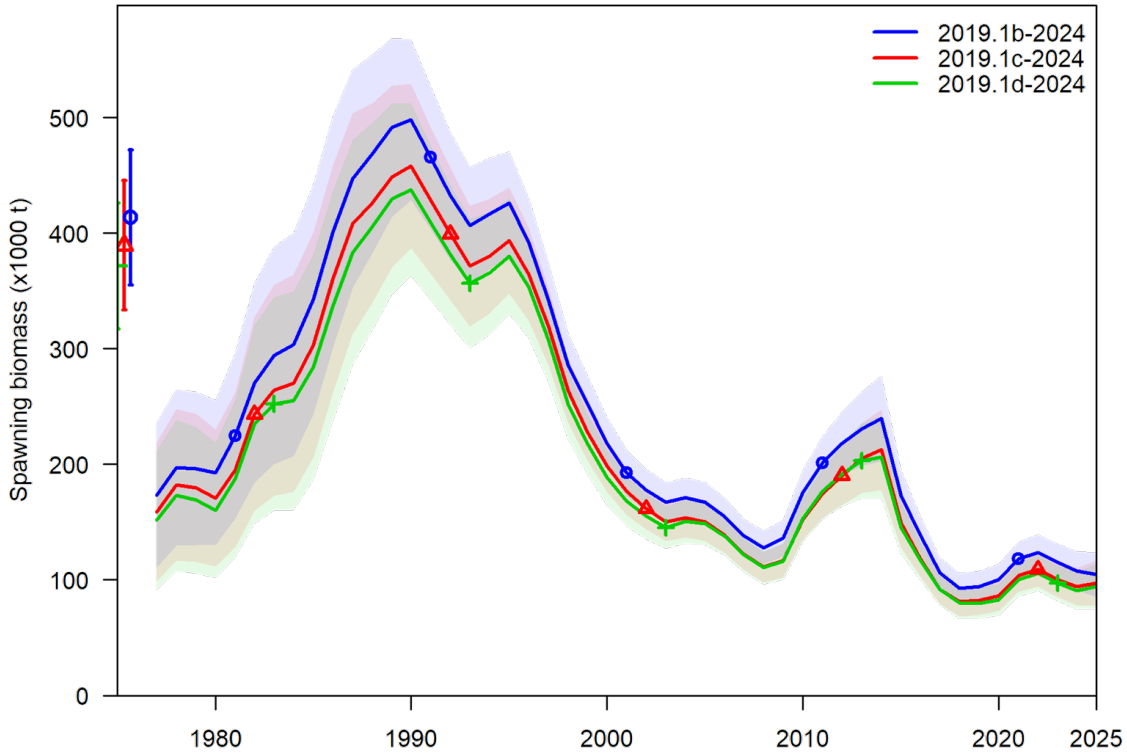
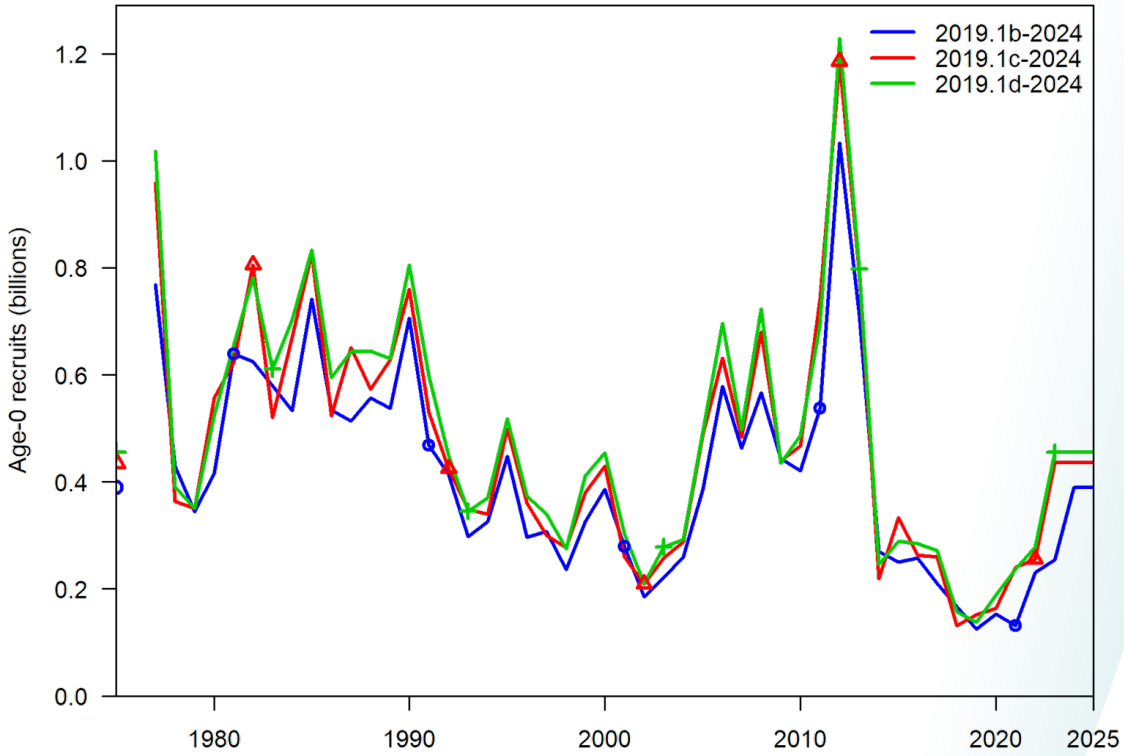
Model: updating ageing error & bias

- Subtle changes to estimated SSB, smooths out some of the year-classes





- Recommend updating ageing error & bias in model 2019.1d

Fishery length comp investigations

- In process of code redevelopment, took time to evaluate how fishery length comps computed
- Reminder: have been having issue with increasing variability in recent data, particularly Pot fishery length comps
- First, will walk through how fishery length comps are computed
- 2 expansion methods used in GOA Pcod assessment:
  - Pre-1991 (includes foreign data)
  - Post-1991 (domestic data only)

Fishery length comp overview

- Pre-1991:
  - Computes weighted length frequencies at haul level for foreign and domestic separately (weighted by extrapolated number in haul)
  - Sums across foreign and domestic weighted length frequencies at year-gear level, standardizes

Fishery length comp overview

- Post-1991:
  - Computes weighted length frequency in a haul across area and gear within each week (weighted by extrapolated number in haul)
  - Sums weighted length frequency within hauls to week-area-gear level, weights by proportion of catch within each week-area-gear / catch by year-gear (catch in tons)
  - Sums to trimester-area-gear, fills in State data where there is no Federal data
  - Sums to year-gear, standardizes

Fishery length comp investigations: filtering

- Post-91 data filtering: >10 per haul: proportion of hauls removed:

	Longline	Pot	Trawl
1991-2012	2%	4%	3%
2013	12%	12%	2%
2014	6%	14%	5%
2015	5%	8%	4%
2016	13%	10%	4%
2017	12%	12%	20%
2018	23%	6%	6%
2019	22%	10%	6%
2020	60%	--	79%
2021	20%	14%	72%
2022	6%	30%	76%
2023	34%	36%	68%

Fishery length comp investigations: filtering

- Post-91 data filtering: >10 per haul in fed data
- **Propose**: remove filter and include all data
- *Why?*
  - Increasing number of hauls that get filtered, don't expect that to change any time soon
  - Increased variability in length comps with smaller number of fish sampled within a haul not a reason to remove data, would be expected and working on methods to be able to capture/quantify that variability
  - Given stock status, need as much data as we can get to understand demographics of fish captured in fishery

Fishery length comp investigations: State data

- State data used to 'fill-in' missing federal observer data:
- 2 steps:
  - Step 1: filters state data to more than 30 lengths observed (at trimester-area-gear level) – very few filtered out, most for 90s trawl data
  - Step 2: uses state data if fed data missing for that trimester-area-gear combo

% data used	Longline	Pot	Trawl
1997-2016	35%	19%	38%
2017	33%	0%	--
2018	40%	33%	--
2019	40%	50%	--
2020	100%	100%	--
2021	67%	67%	--
2022	60%	0%	--
2023	50%	100%	--

Fishery length comp investigations: State data

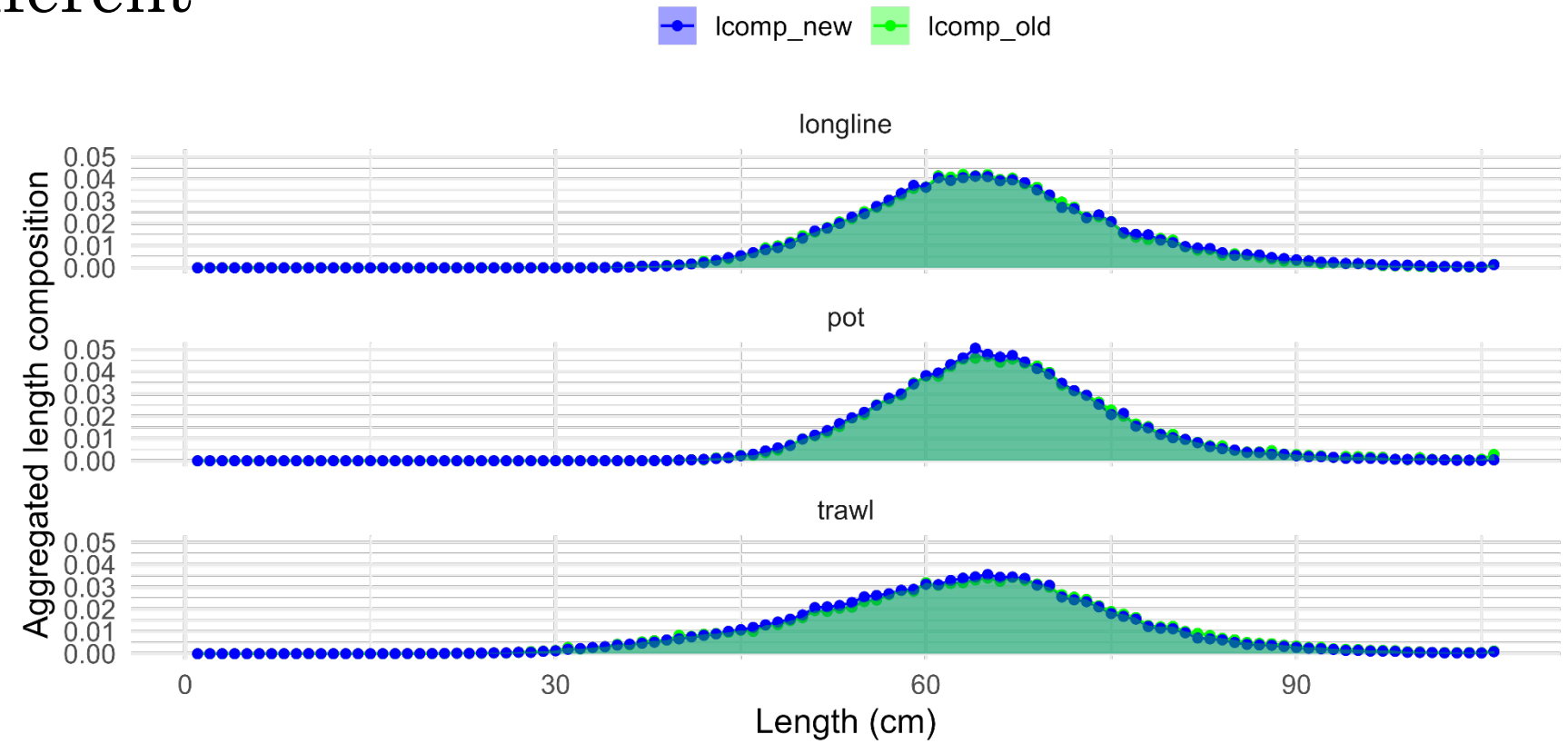
- **Propose**: rather than 'fill-in', merge with fed data
- *Why?*
  - State fishery landings are included within total catch removals fit within assessment model – would want estimated selectivity to be fit to composition data that is reflective of the removal data
  - Hasn't been used: (1) because wasn't really needed given magnitude of federal data, and (2) because it resulted in differences with federal data
  - Increased variability in length comps because of difference in length comp across fleets/sectors not a reason to not use data, would be expected (working on methods to be able to capture/quantify that variability)
  - Given stock status, need as much data as we can get to understand demographics of fish captured in fishery

Fishery length comp investigations

- Current method to expand fishery length comps complex and granular
- **Propose**: simplify and expand from month-area-gear level rather than week-area-gear
- *Why?*
  - To merge State data, requires restructure of how fed length comp data computed: week-area-gear level of granularity not available in state data
  - Granularity due to account for cod growth throughout year, month vs week can still account for that
  - Quantity of data in recent years may not support this level of expansion

Fishery length comp investigations

- Aggregated length comps: some subtle differences, but overall not that different



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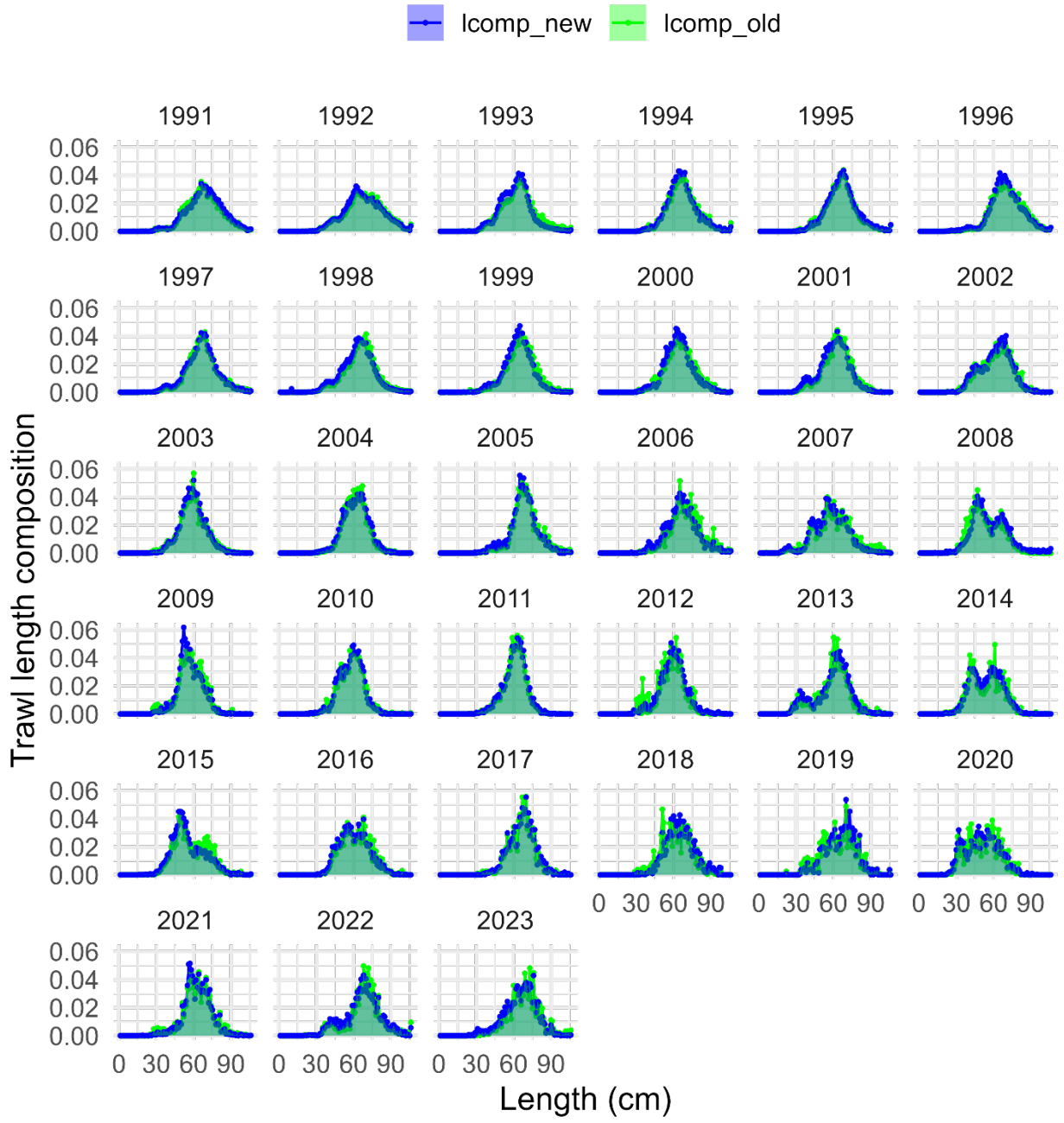

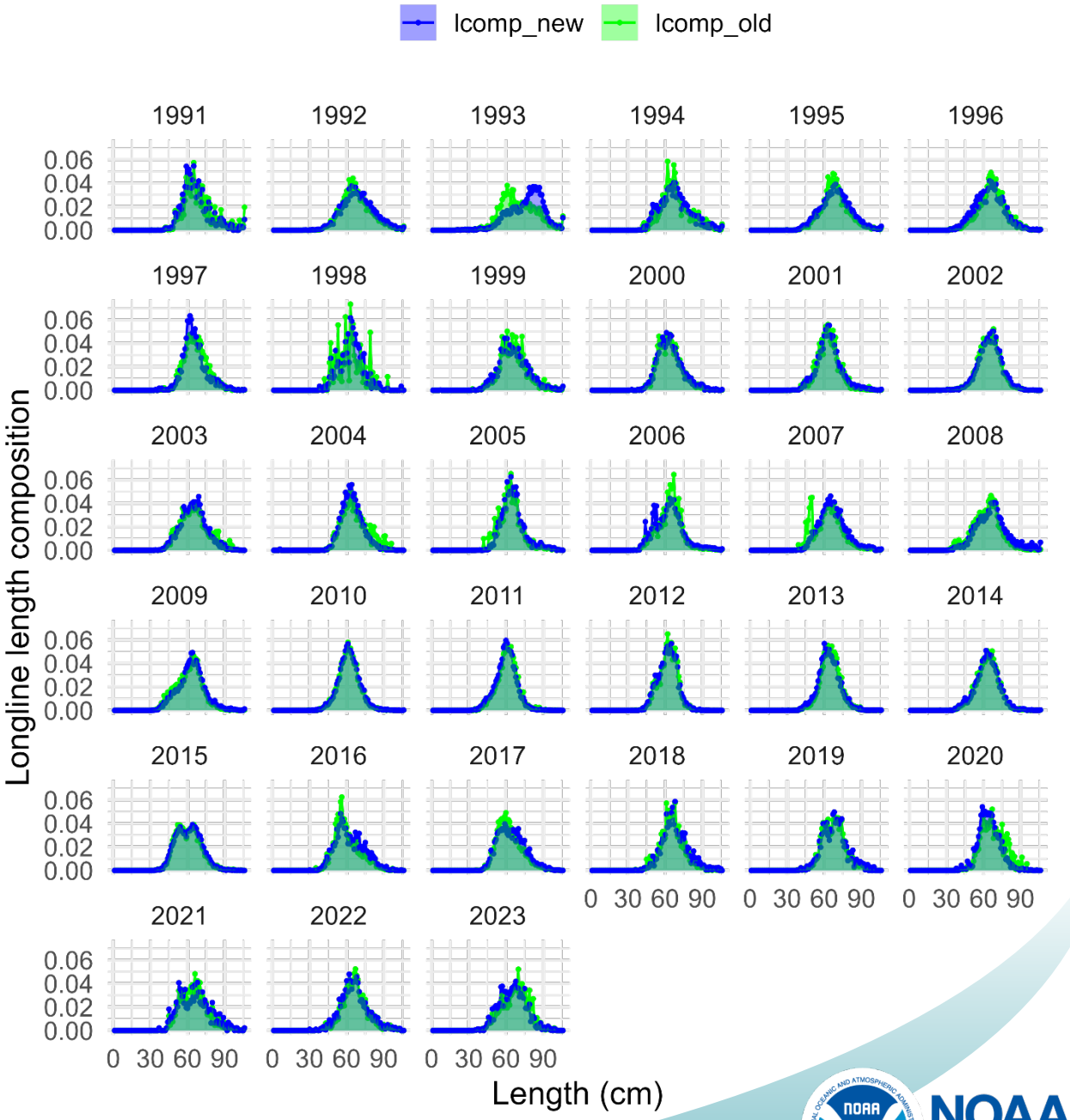

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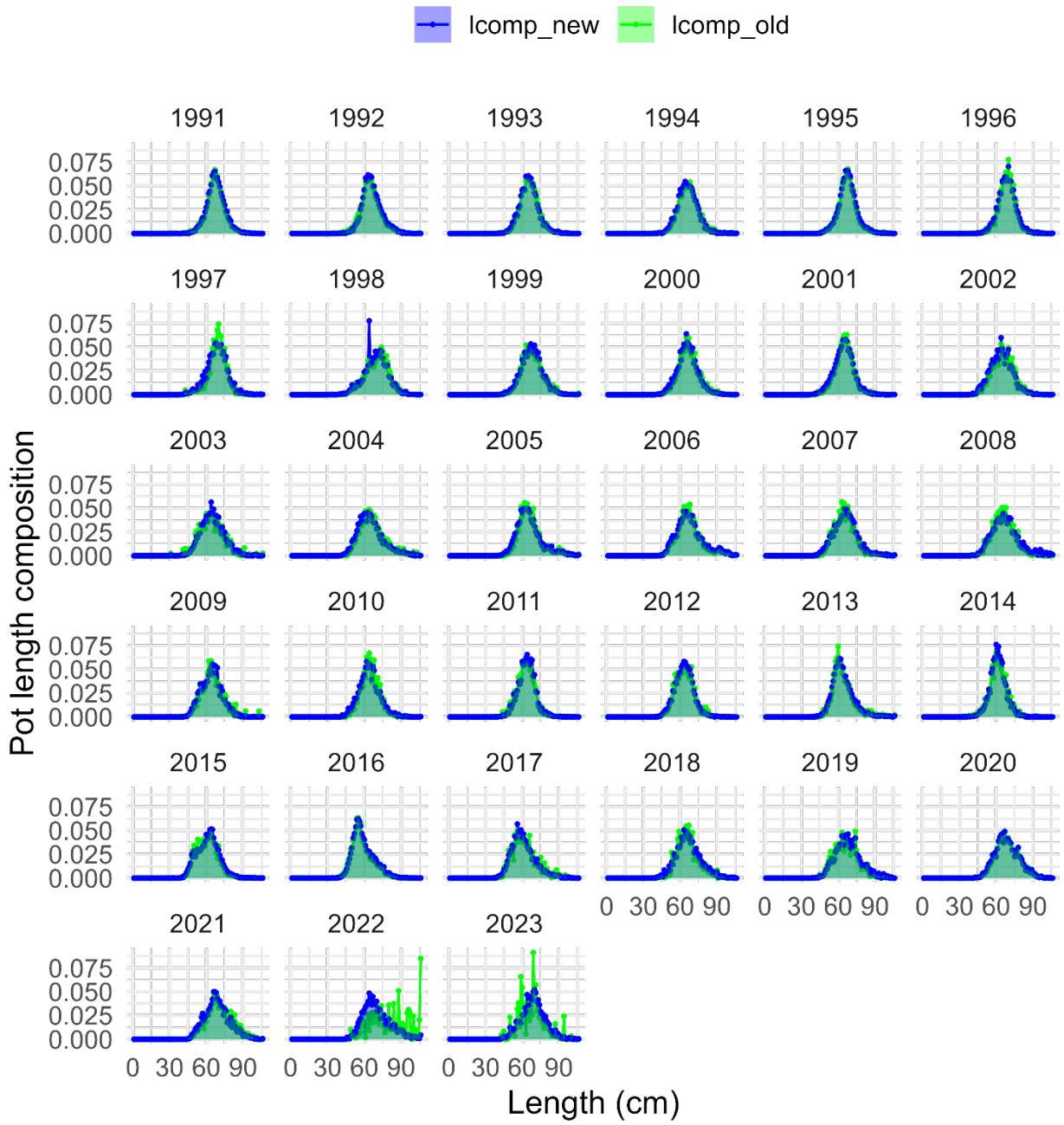

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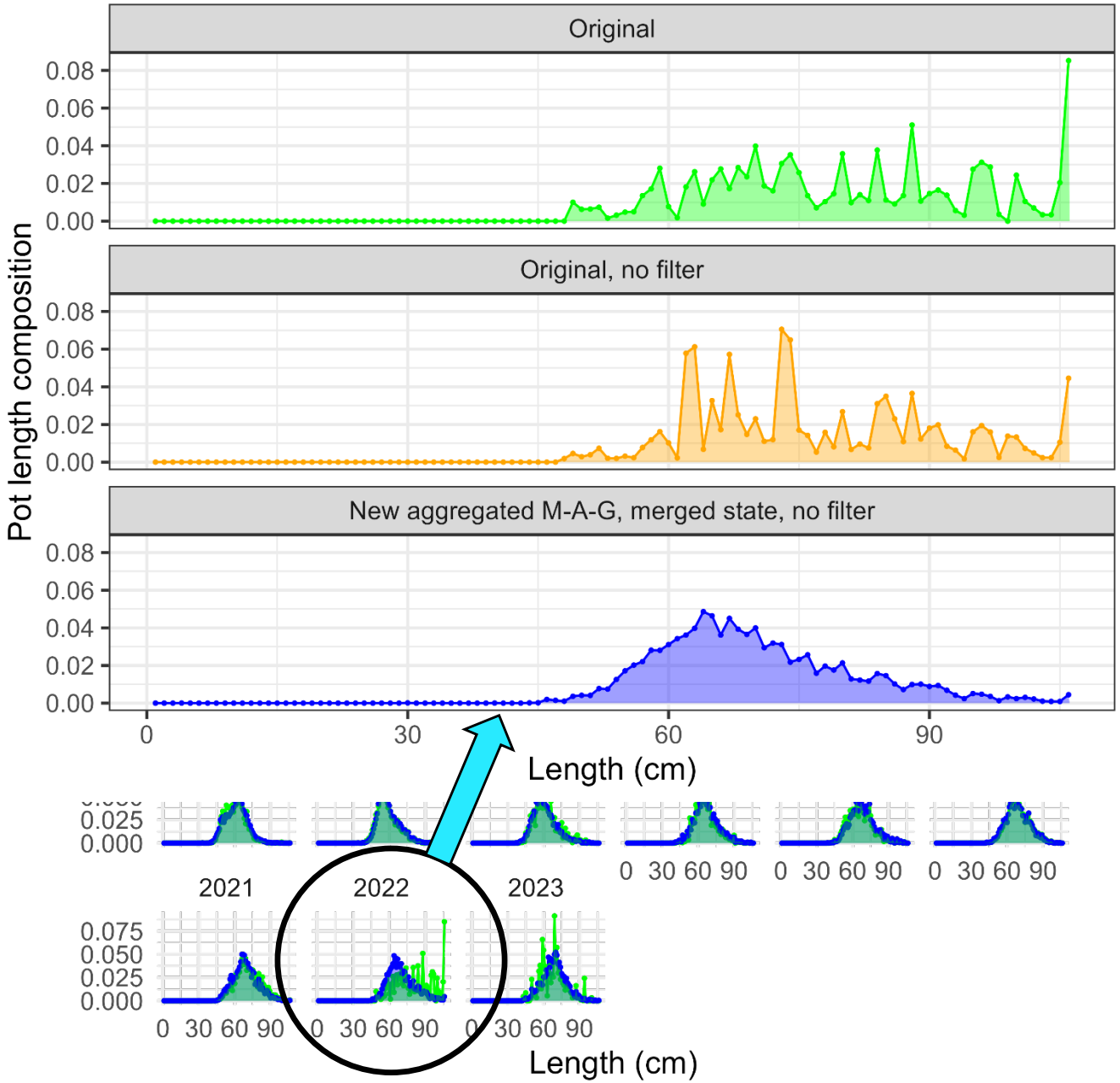

37 hauls
n = 698
No state

53 hauls
n = 794
No state

n = 6417
With state

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Fishery length comp investigations

- In general, removing filters, aggregating at month-area-gear level and merging state data helps to smooth out much of the variability in fishery length comps, particularly in recent years
- Provides a simpler method and leverages all sources of available data to inform model estimates
- In order to remove variability in fishery length comps and leverage information contained within State length sampling data, **Recommend** new fishery length composition in model **2019.1e**

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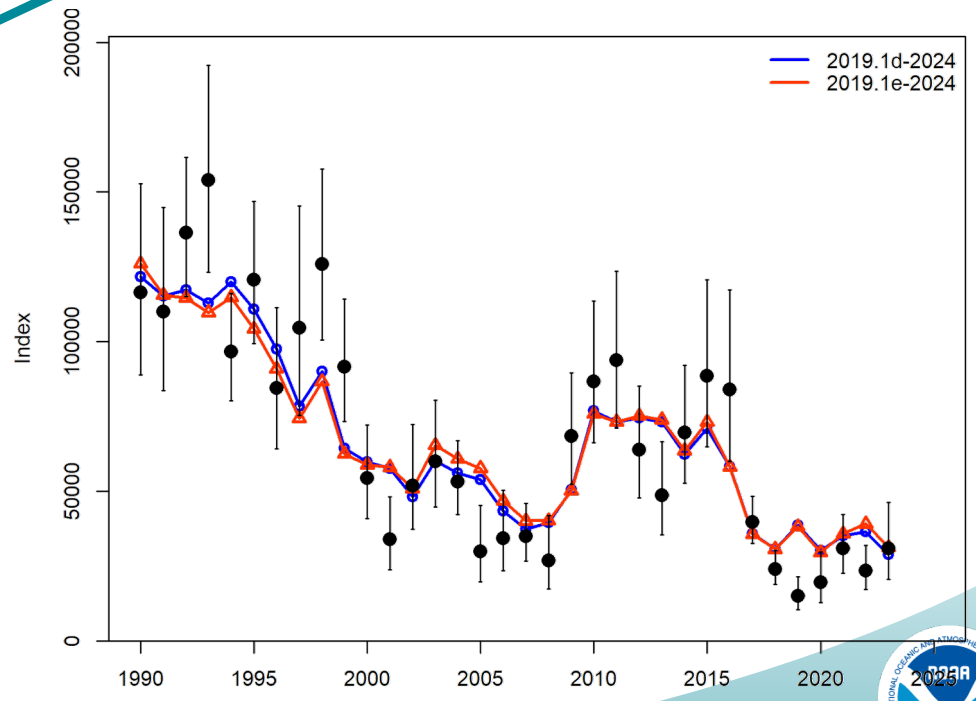
Fishery length comp investigations

- Increase in negative log-likelihood value for surveys (due to longline survey fit), decrease for length comps

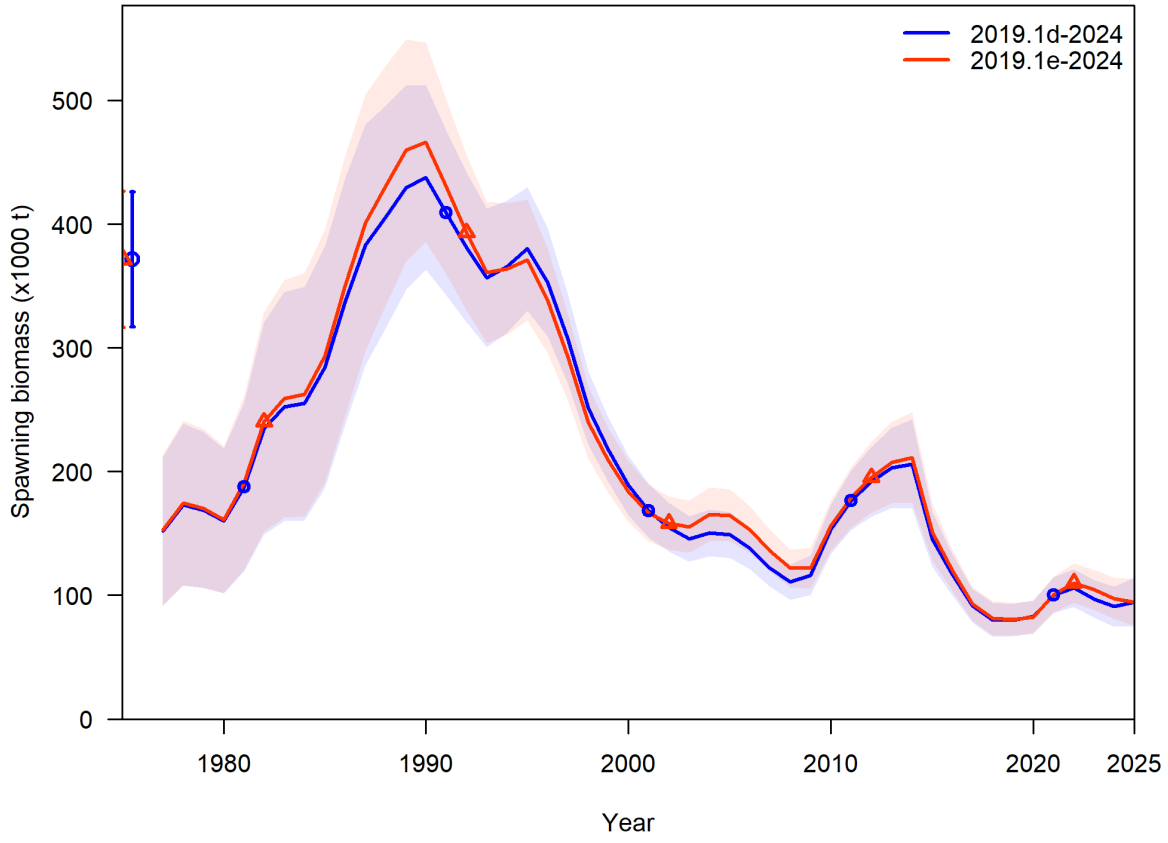
Component	2019.1d	2019.1e
TOTAL	2727.26	2715.80
Catch	3.99E-12	2.44E-12
Survey	-8.03	0.63
Length_comp	1697.31	1676.90
Age_comp	1030.48	1030.97
Recruitment	-2.96	-3.03
InitEQ_Regime	3.25	3.17
Parm_priors	1.15	1.16
Parm_softbounds	0.01	0.01
Parm_devs	6.04	6.00

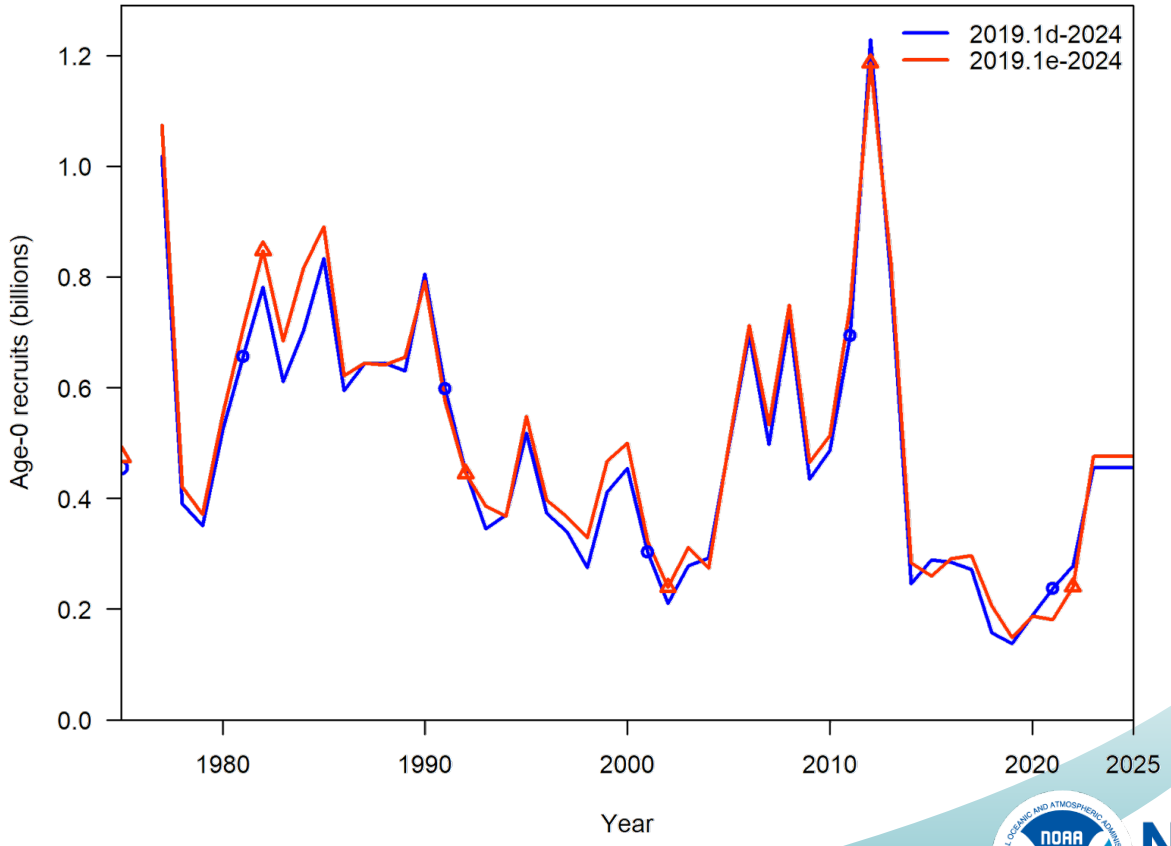
	2019.1d	2019.1e
ALL	-8.03	0.63
Srv	-7.19	-5.23
LLSrv	-0.84	5.86



Fishery length comp investigations

- Not a dramatic change in SSB or recruitment estimate trends, though differences in some years

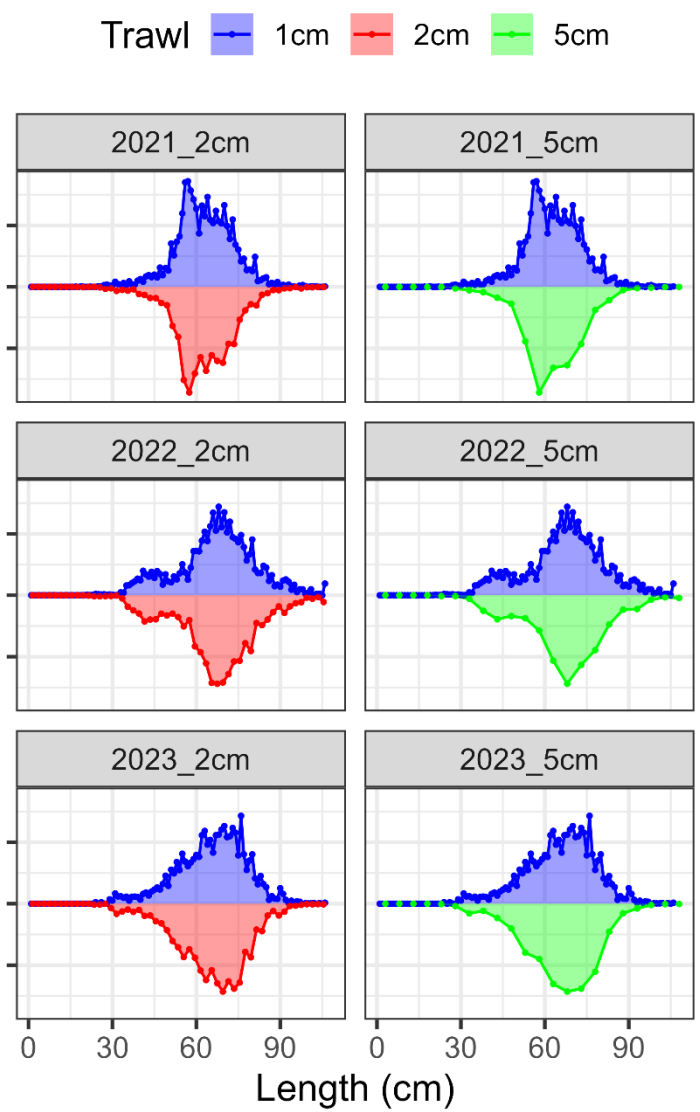


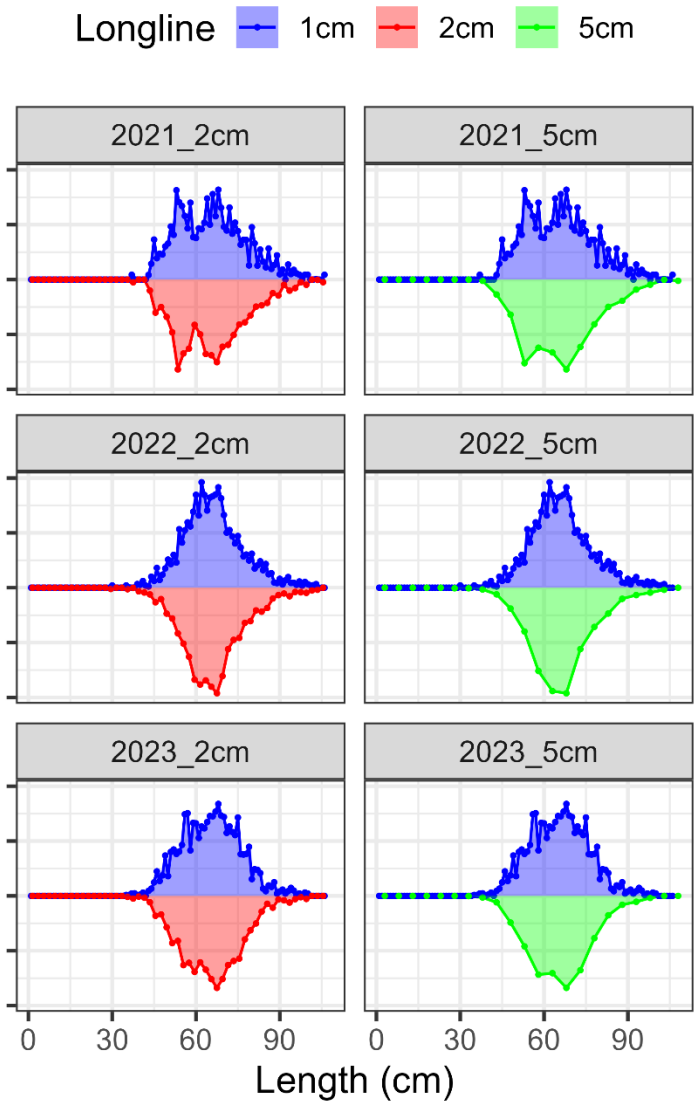


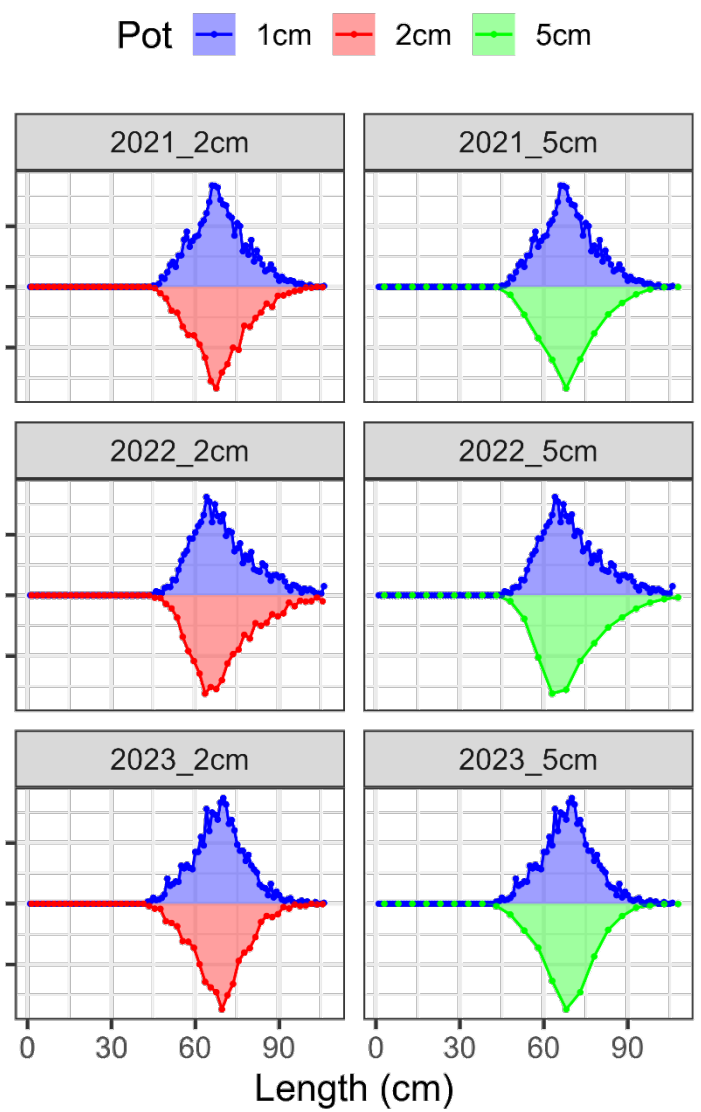
Length composition binning

- But, only gets us so far, there remains variability across lengths in length composition data in general with 1 cm length bins
- Align with EBS cod investigations this year, and investigate binning length data
  - 2 cm bins – 2019.1e.2cm
  - 5 cm bins – 2019.1e.5cm
- Affects: all length composition and CAAL for surveys and fishery fleets

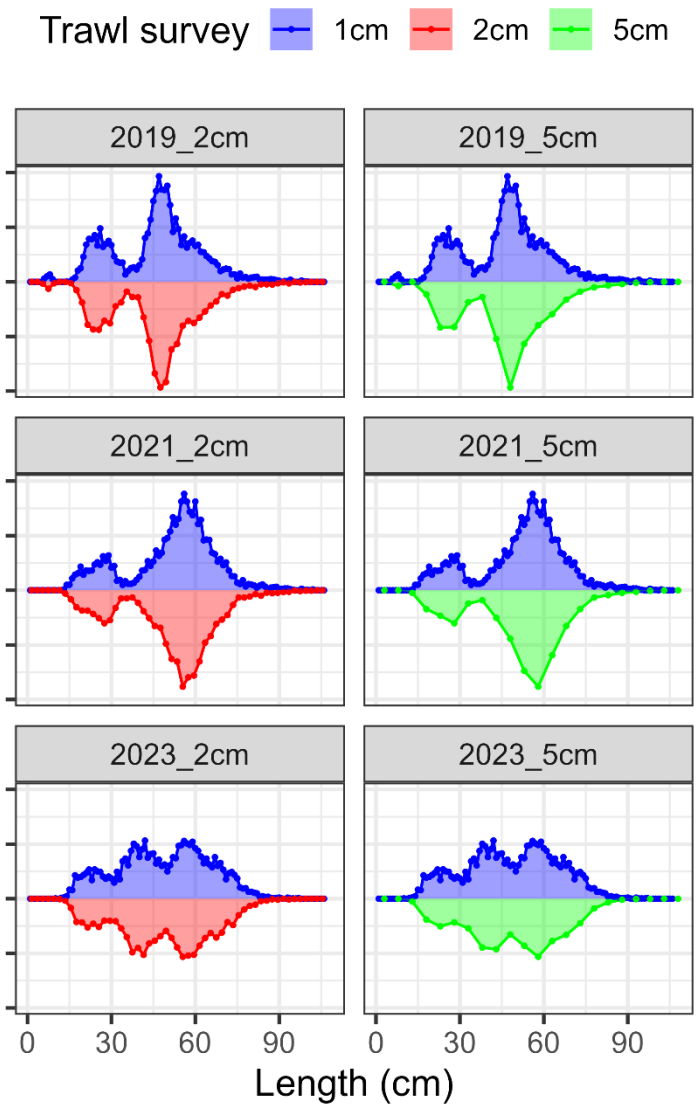
Length comp binning: fishery

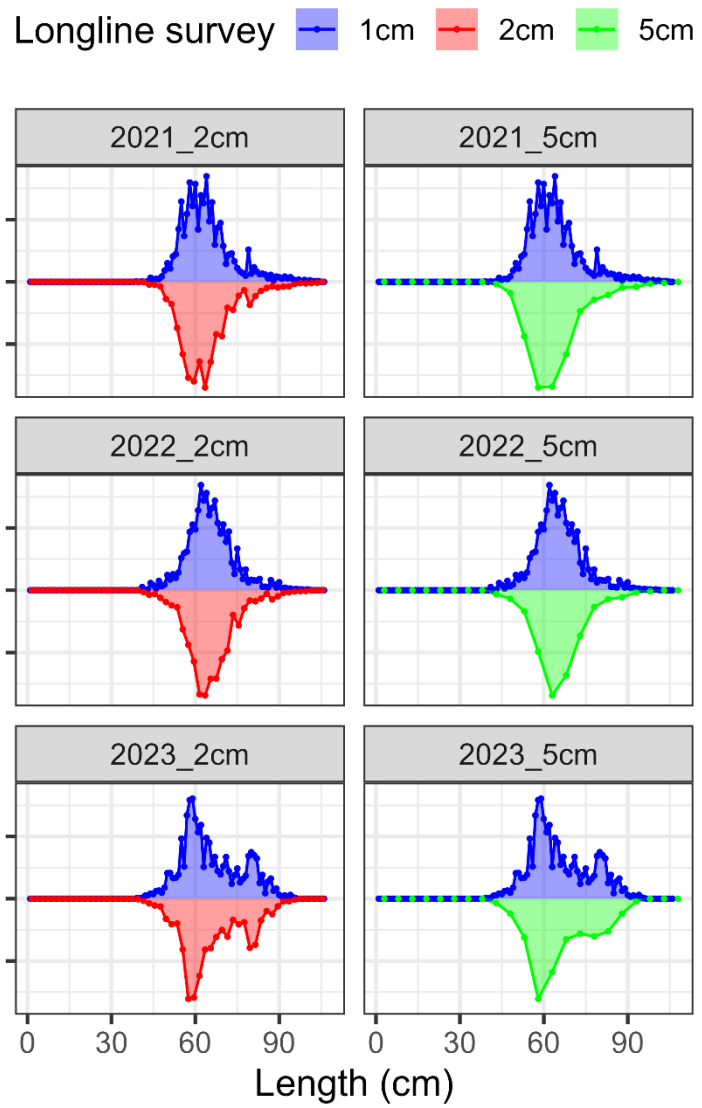






Length comp binning: survey

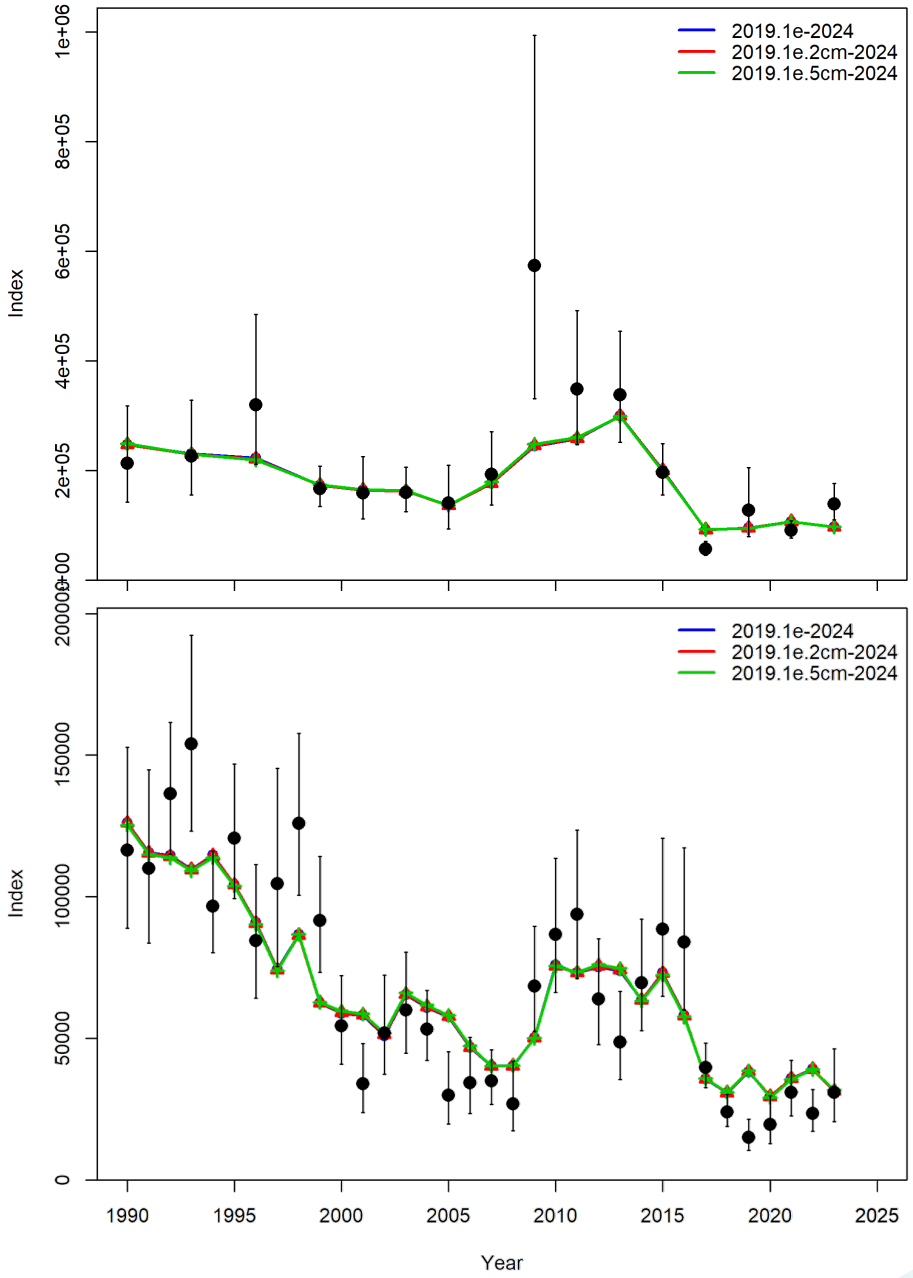




Length comp binning

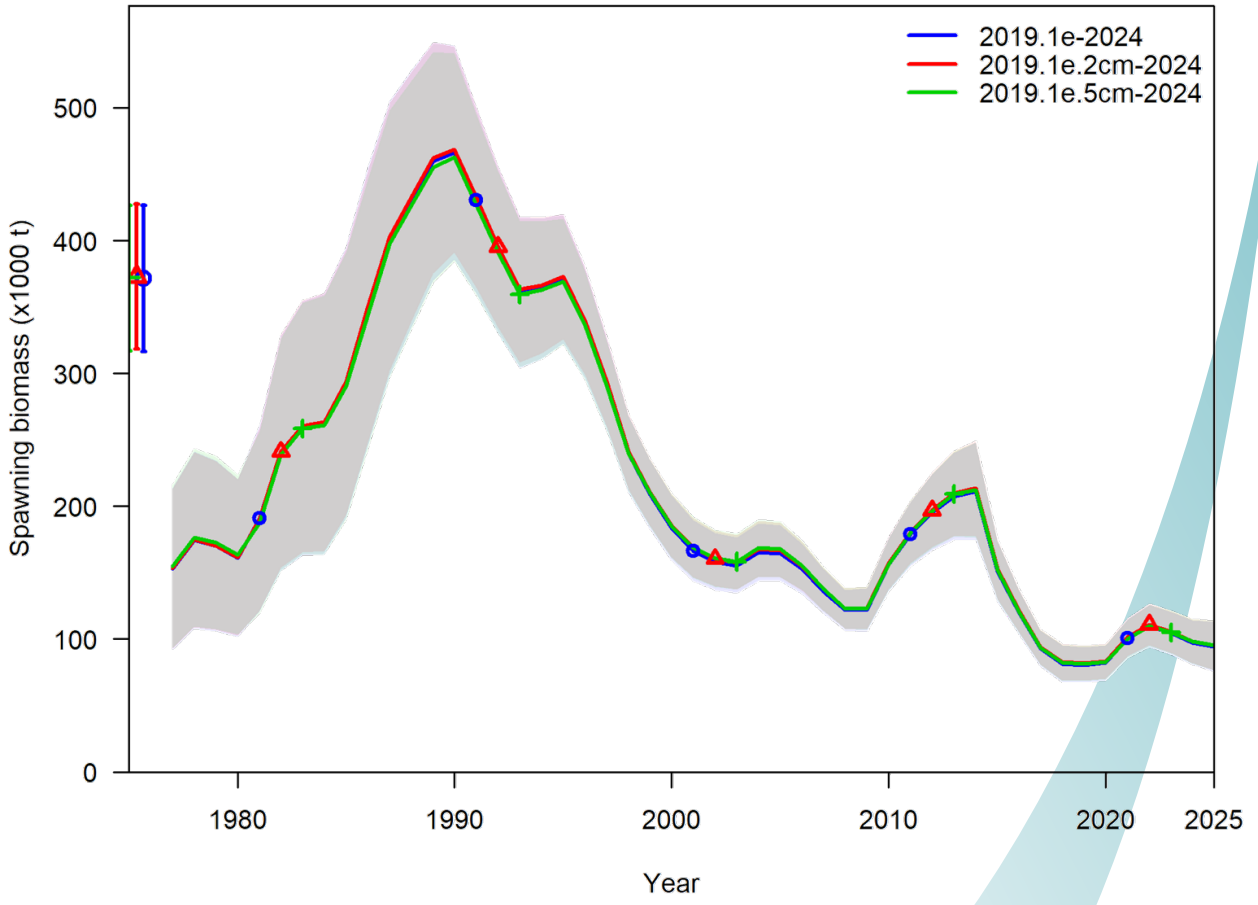
- Data fits:

Component	2019.1e	2019.1e.2cm	2019.1e.5cm
TOTAL	2715.80	2342.31	1974.01
Catch	2.44E-12	1.98E-12	1.91E-12
Survey	0.63	1.46	2.16
Length_comp	1676.90	1507.59	1330.40
Age_comp	1030.97	825.75	633.31
Recruitment	-3.03	-2.74	-1.62
InitEQ_Regime	3.17	3.18	3.02
Parm_priors	1.16	1.13	1.08
Parm_softbounds	0.01	0.01	0.01
Parm_devs	6.00	5.92	5.65



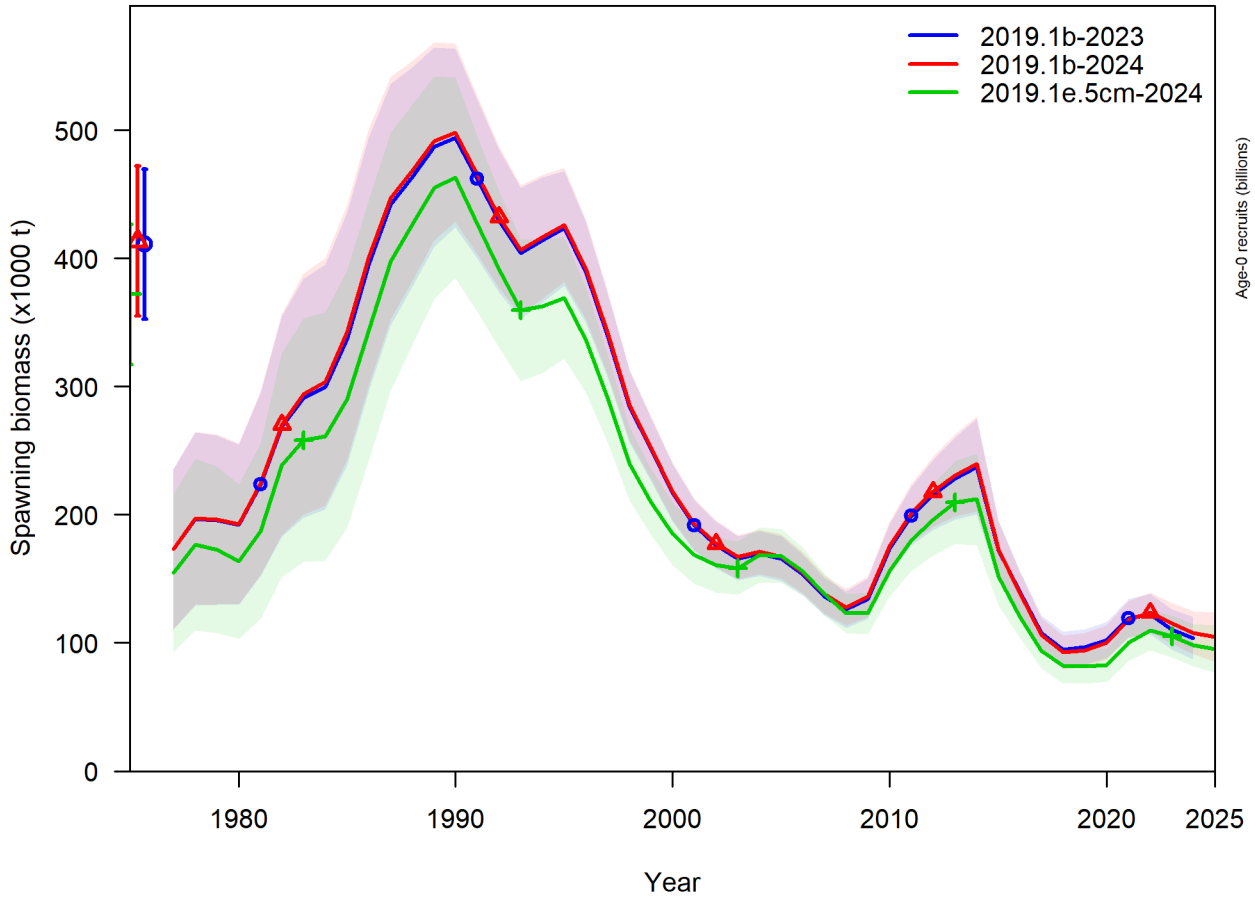
Length comp binning

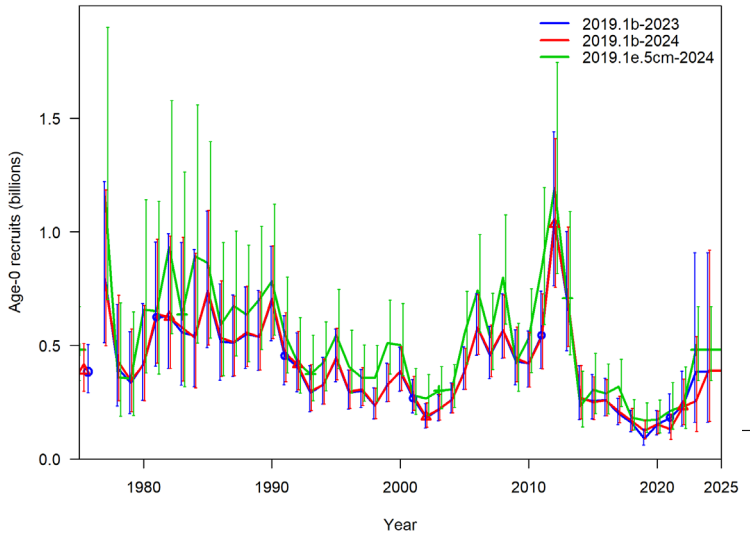
- No significant changes in model estimates duet to length comp binning
- Provides a **more** efficient model, reduces run time by >50%
- Recommend: model 2019.1e.5cm

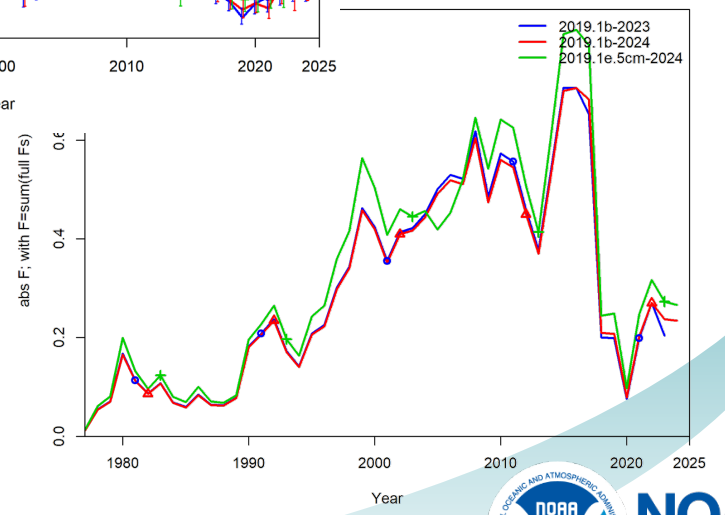


Recommended model 2019.1e.5cm vs base

- Shift to smaller values in SSB, coupled with larger recruitment and F







Recommended model 2019.1e.5cm vs base

- Largest parameter change in survey catchability (but has been as high as 1.46 in 2017 assessment, and was 1.23 after 2019.1d, 1.19 after 2019.1c)

Parameter	2019.1b-23	2019.1b-24	2019.1e.5cm
NatM	0.46	0.46	0.48
NatM: 14-16	0.79	0.80	0.80
lnR	12.86	12.87	13.08
q_twl	1.08	1.07	1.19
q_ll	1.06	1.06	1.08
q_llenv	1.42	1.46	1.28

Summary of significant assessment changes

- Largest single change that caused shift in model estimates: season for trawl survey CAAL, 2nd = longline survey length comp rebinning
- Updating ageing error & bias improves fit to age data (and length comps to some extent)
- Simplifying fishery length comp expansion and merging State data helps to reduce variability in data
- Binning at 5 cm makes model much more efficient

Summary of significant model changes

- **Recommend** new model **2019.1e.5cm**
- To increase model naming efficiency, **Recommend** new model **2019.1e.5cm** be renamed as model **2024**
  - *While the model's formulation is the same as in the accepted 2019 model, significant differences exist in data inputs at this point*

November models

- New data that will be available:
  - Updated catch, fishery length comps
  - 2023 Trawl survey CAAL
  - 2023 Fishery CAAL
- Models to present in November
  - Do I need to present all the c-series models? Or is just saying x, y, and z caused biggest effect good enough?
  - Present building upon 2019.1c with d and e, along with length binning?
  - Ideas for streamlining?

SSC/PT comments

- Several SSC/PT comments were investigated that are worthy enough to get on record now, rather than in November

1. Apportionment with AFSC longline survey
2. Selectivity
3. Maturity update

Apportionment investigation

The SSC reiterates its encouragement for the authors to consider whether information from the IPHC setline survey and NMFS longline survey, alongside the NMFS bottom trawl survey, may provide a superior basis for apportionment recommendations, perhaps through the use of an integrated spatiotemporal model or a multi-survey random effects model.

Apportionment investigation

The SSC reiterates its encouragement for the authors to consider whether information from the IPHC setline survey and ***NMFS longline survey****, alongside the NMFS bottom trawl survey, may provide a superior basis for apportionment recommendations, perhaps through the use of an integrated spatiotemporal model or a* ***multi-survey random effects model.***

Apportionment investigation

- Here, look at including LLS into REMA as an additional index to be used for apportionment
- Step-wise approach:
  - First, look at AIC 'preferred' model when it comes to Process Error (PE) and index scaling (q) parameters
  - Next, with 'preferred' models investigate estimating additional observation error

Apportionment investigation: Step 1

- 4 cases: factorial design of global (1) x regional (3) PE & q parameters
- AIC suggests that regional scaling parameters q are supported (and most influential)
- Whether PE = 1 or 3, no real difference in model

model_name	objective_function	n_parameters	aic	delta_aic
pcod multi survey, pe = 1, q = 3	128.1216	4	264.2	0.0
pcod multi survey, pe = 3, q = 3	126.6045	6	265.2	1.0
pcod multi survey, pe = 3, q = 1	330.2781	4	668.6	404.4
pcod multi survey, pe = 1, q = 1	345.7265	2	695.5	431.3

Apportionment investigation: Step 2

- Factorial design of 2 PE:q cases from step 1 x 3 uncertainty cases (trawl only, longline only, trawl & longline)
- Results in 4 models that are essentially the same, in terms of AIC

model_name	objective_function	n_parameters	aic	delta_aic
pcod multi survey, extra twl cv; pe1q3	98.72707	5	207.5	0.0
pcod multi survey, extra twl cv; pe3q3	96.75070	7	207.5	0.0
pcod multi survey, extra twl & ll cv; pe1q3	98.22145	6	208.4	0.9
pcod multi survey, extra twl & ll cv; pe3q3	96.26182	8	208.5	1.0
pcod multi survey, extra ll cv; pe1q3	109.11688	5	228.2	20.7
pcod multi survey, extra ll cv; pe3q3	108.74400	7	231.5	24.0

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Apportionment investigation: Comparisons

- Comparison of apportionment in 2023, and CV in apportionment over the most recent 5 years:
  - Incorporating LLS shifts 2023 apportionment from central by 1-3% to western/eastern
  - Incorporating LLS doubles to triples CV in apportionment

Model	western	w_cv	central	c_cv	eastern	e_cv
pcod trawl survey	27%	9%	64%	5%	9%	11%
pcod multi survey, extra ll cv; pe1q3	28%	11%	63%	7%	10%	17%
pcod multi survey, extra twl cv; pe1q3	29%	21%	60%	15%	11%	26%
pcod multi survey, extra twl & ll cv; pe1q3	29%	15%	60%	11%	11%	23%
pcod multi survey, extra ll cv; pe3q3	27%	11%	63%	7%	10%	19%

Apportionment investigation: Discussion

- **Recommend**: wait to use REMA until:
  - Environmental link option developed in REMA – we hypothesize that the variability in apportionment that increases with the incorporation of the LLS may be reduced when environmental link used
  - Environmental link developed at sub-region scale
    - Working on environmental index, will be looking towards region indices to potentially be used in apportionment
    - Survey timing is slightly different in each region, whether/if this results in different environmental conditions by region remains to be seen

Apportionment investigation

*The SSC reiterates its encouragement for the authors to consider whether information from the **IPHC setline survey** and NMFS longline survey, alongside the NMFS bottom trawl survey, may provide a superior basis for apportionment recommendations, perhaps through the use of an integrated spatiotemporal model or a multi-survey random effects model.*

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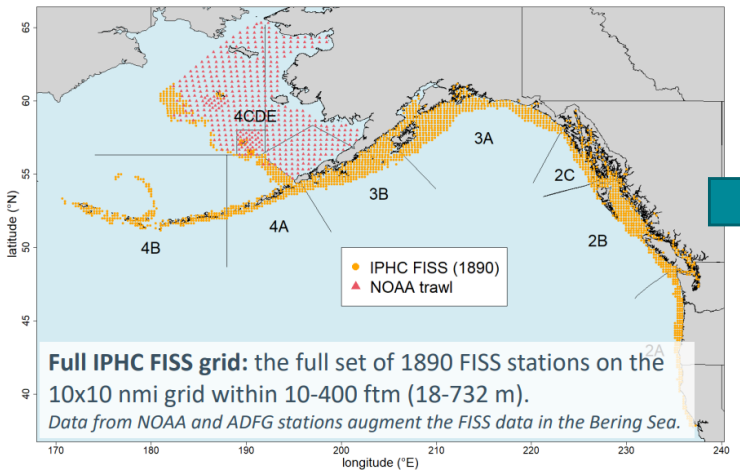
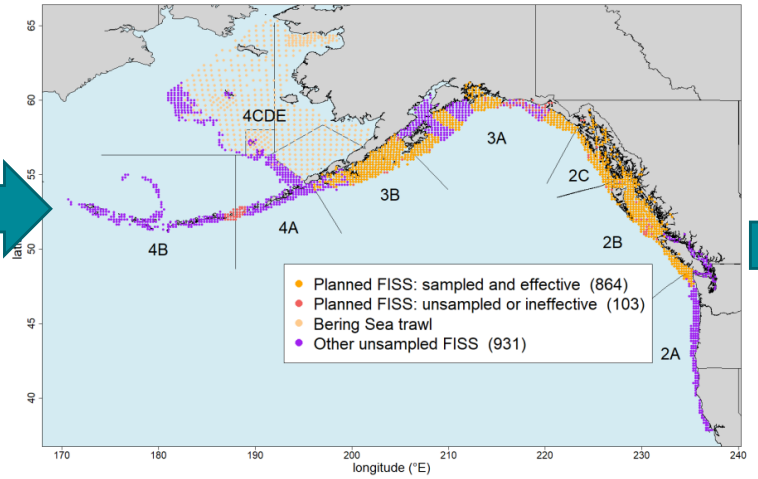
Apportionment investigation: Discussion

- Other indices: IPHC FISS
  - Has always been a promising additional index for apportionment (and assessment), but…

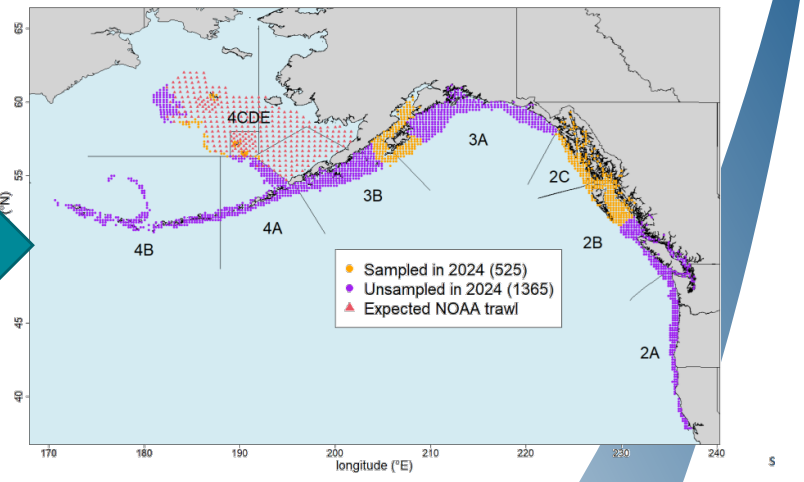
Full FISS grid



Implemented 2023 design



Adopted 2024 design (with added efficiencies)



- **Recommend:** wait and see

Apportionment investigation

The SSC reiterates its encouragement for the authors to consider whether information from the IPHC setline survey and NMFS longline survey, alongside the NMFS bottom trawl survey, may provide a superior basis for apportionment recommendations, perhaps through the use of ***an integrated spatiotemporal model*** *or a multi-survey random effects model.*

Will continue to monitor progress in using VAST for apportionment and multi-survey integration

Trawl and longline survey selectivity

Estimated selectivity for both the bottom trawl survey and the longline survey showed patterns that seemed very unusual. For the bottom trawl survey, which modeled time-varying selectivity blocks, there was a shift from a strongly dome-shaped selectivity in the 1990-1995 time block to asymptotic selectivity in subsequent time blocks. The assessment did not provide a rationale for how a standardized survey could show such extreme changes in selectivity. For the longline survey, a strongly dome-shaped selectivity pattern was estimated for Pacific cod, in contrast to sablefish selectivity, which is estimated to be asymptotic for this survey in the sablefish assessment. In theory, the longline survey's depth range would have selectivity issues for smaller fish at shallower depths, not larger deeper fish. Again, there is no explanation in the assessment as to why this selectivity pattern should be considered a reasonable result.

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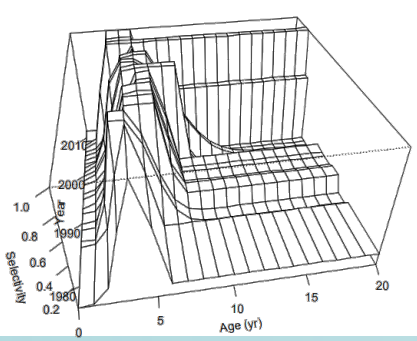
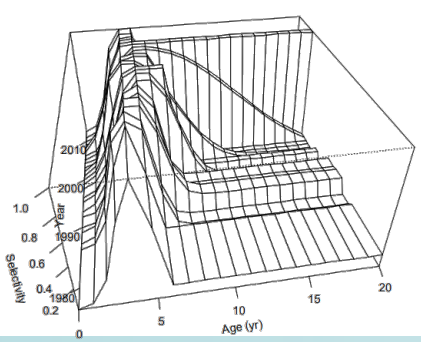
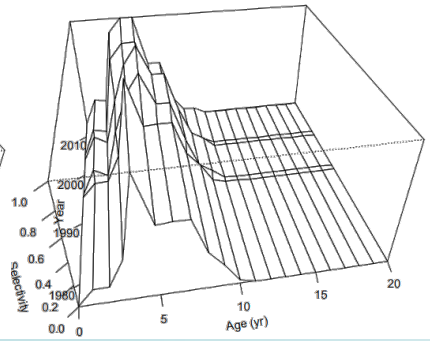
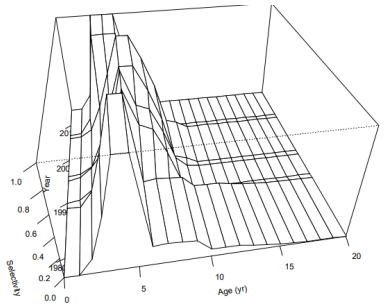
Trawl survey selectivity

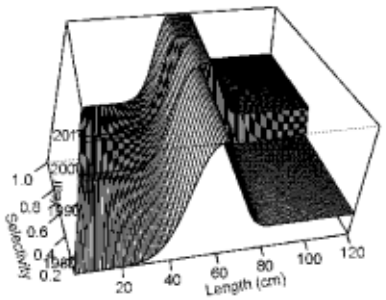
- The current time blocks used for the bottom trawl survey can be traced back to the 2014 approved model (reduced from 12 time-blocks)
  - Pre/post 96 block represents switch from 30 to 15 min tows
- 2016 approved model first set the current time blocks
  - Pre/post 2006 based on improvement in model fit (and switched to length)
- The 2017 approved model switch from dome-shaped selectivity in recent time blocks to asymptotic based on lower AIC

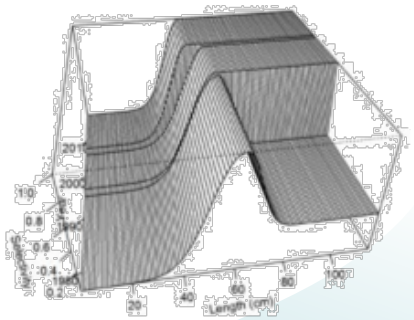










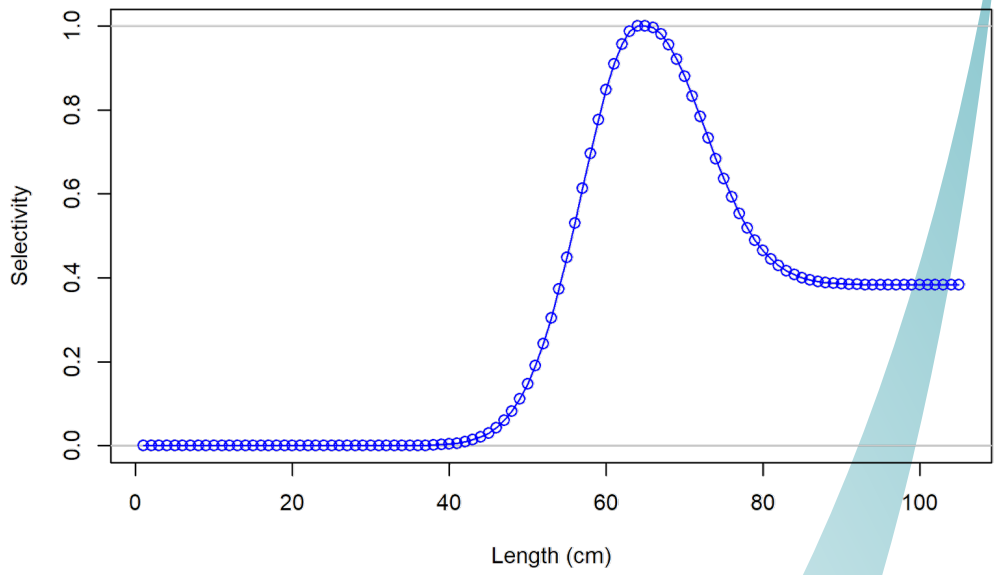


Longline survey selectivity

Estimated selectivity for both the bottom trawl survey and the longline survey showed patterns that seemed very unusual. For the bottom trawl survey, which modeled time-varying selectivity blocks, there was a shift from a strongly dome-shaped selectivity in the 1990-1995 time block to asymptotic selectivity in subsequent time blocks. The assessment did not provide a rationale for how a standardized survey could show such extreme changes in selectivity. *For the longline survey, a strongly dome-shaped selectivity pattern was estimated for Pacific cod, in contrast to sablefish selectivity, which is estimated to be asymptotic for this survey in the sablefish assessment. In theory, the longline survey's depth range would have selectivity issues for smaller fish at shallower depths, not larger deeper fish. Again, there is no explanation in the assessment as to why this selectivity pattern should be considered a reasonable result.*

Longline survey selectivity

- Current shape of longline survey selectivity can be traced back to the 2016 assessment in which the longline survey was first used (dome-shaped after 60ish cm)
- Primary question: is there evidence for the dome-shaped selectivity?
  - Are larger cod deeper and smaller cod shallower?
  - What is the longline survey overlap with cod depth distribution by size?



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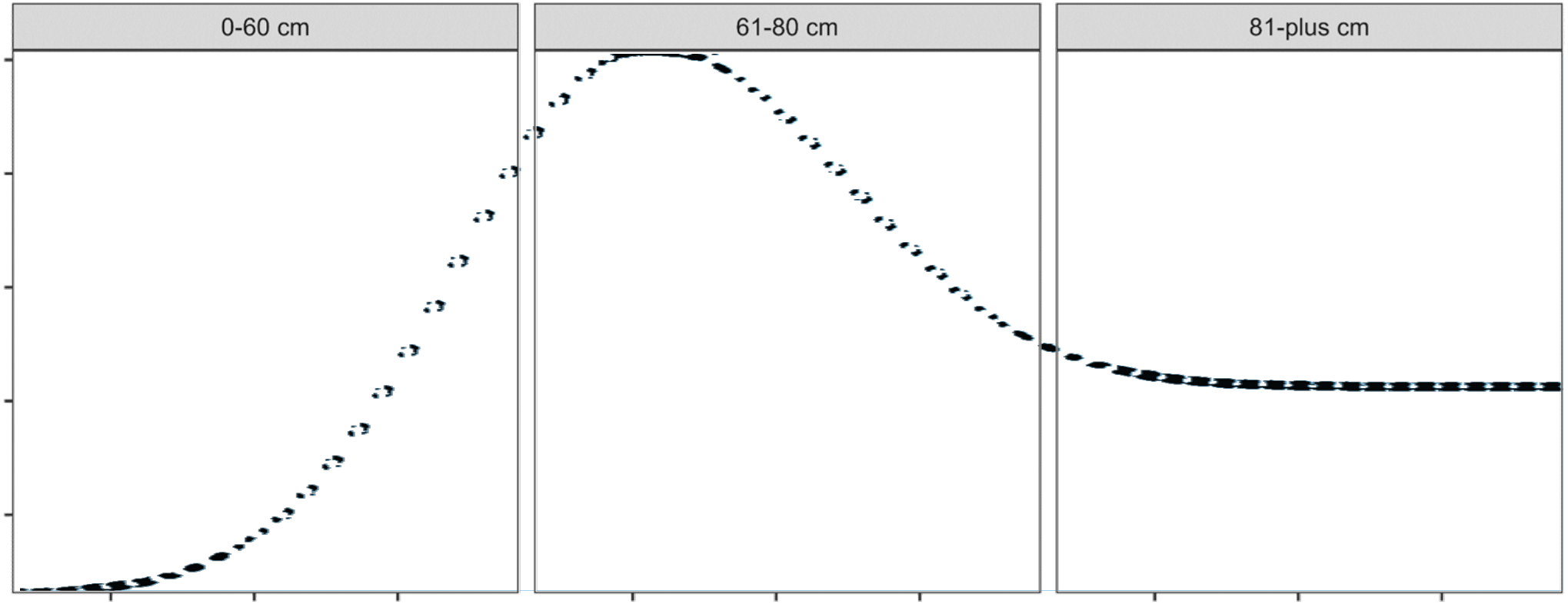
Longline survey selectivity

- What is cod depth distribution by size?



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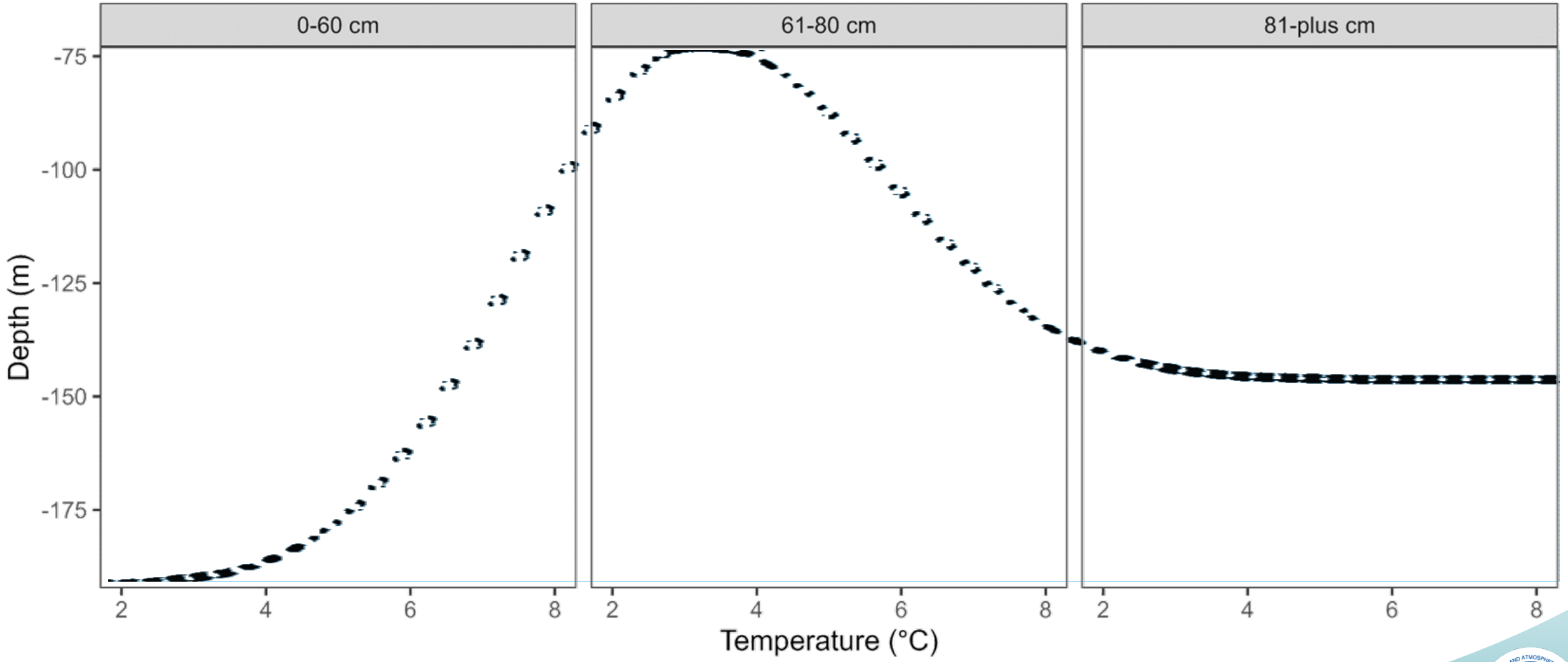

Longline survey selectivity

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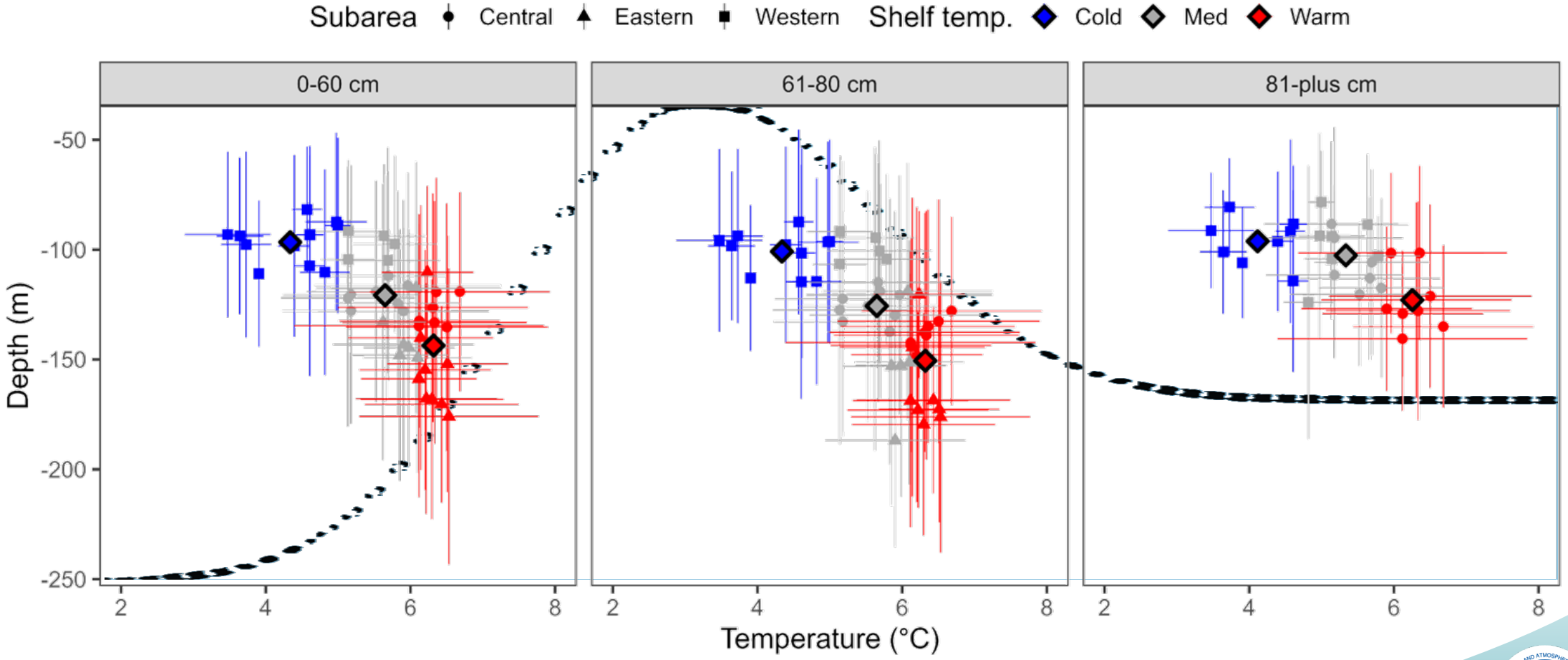
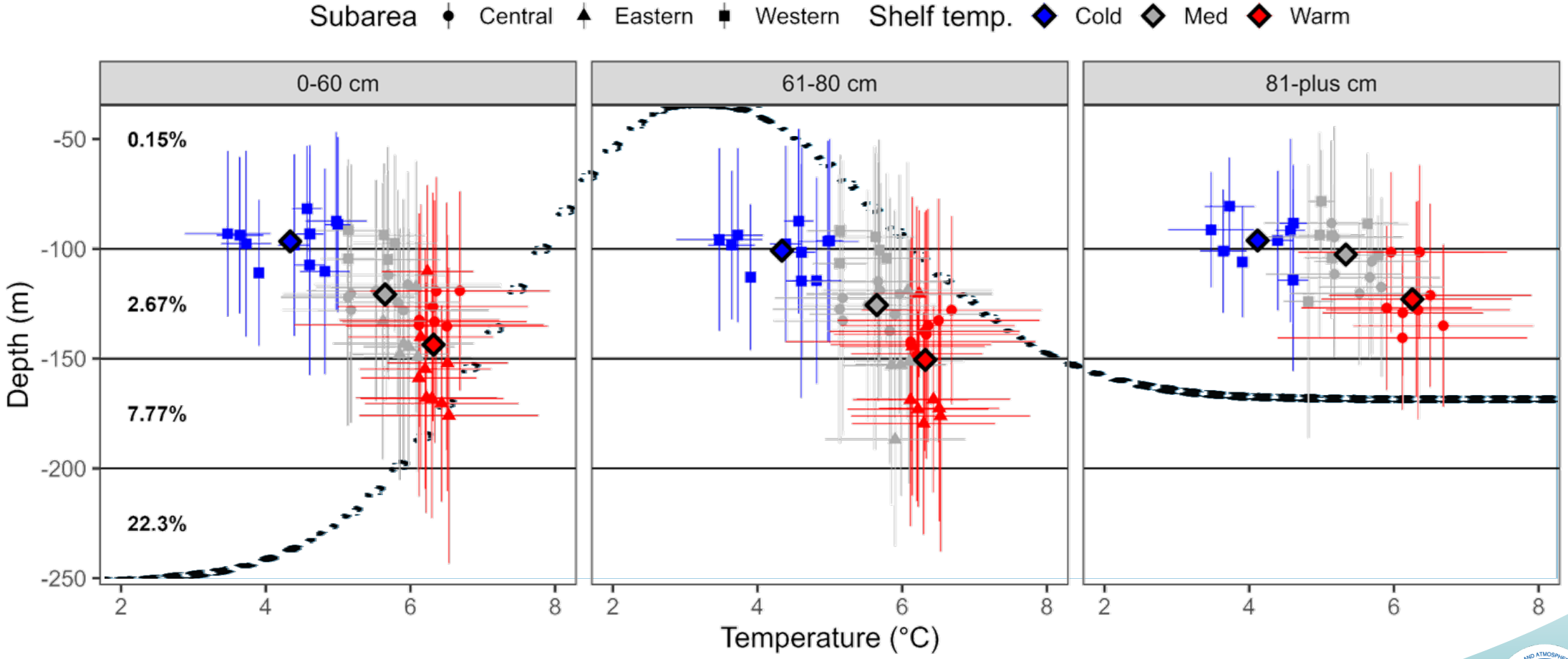


Longline survey selectivity

- What is cod depth distribution by size? What is overlap with LLS?



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More on selectivity

The SSC requests a thorough revaluation of the current modeling approach for survey selectivity and catchability, including alternatives to the current selectivity blocks in the trawl survey, and alternatives to a strongly dome-shaped selectivity in the longline survey, and whether selectivity rather than catchability is more appropriately modeled with a time-varying temperature covariate.

More on selectivity

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Trawl and longline survey selectivity

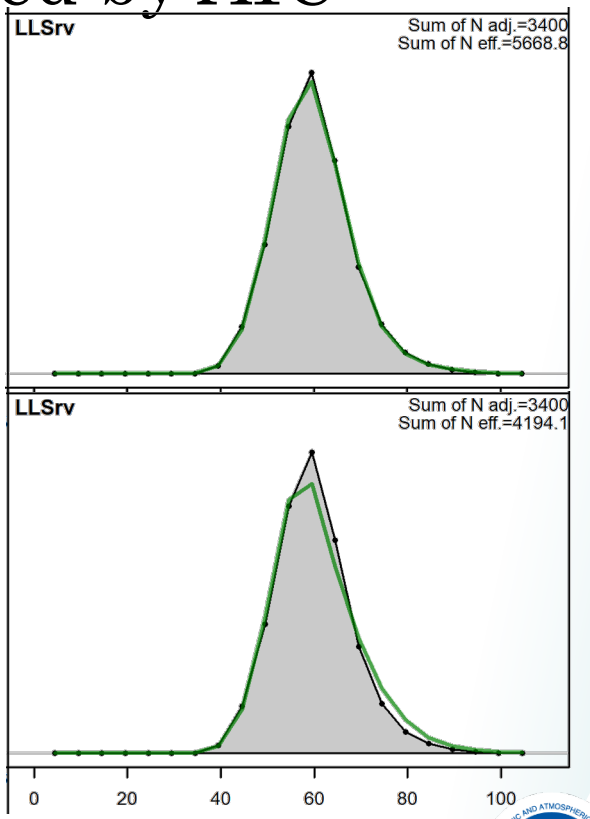
- Two model sensitivities run to start addressing these SSC comments:

1. Force trawl survey to be time-invariant and asymptotic
2. Force longline survey to be asymptotic

Trawl and longline survey selectivity

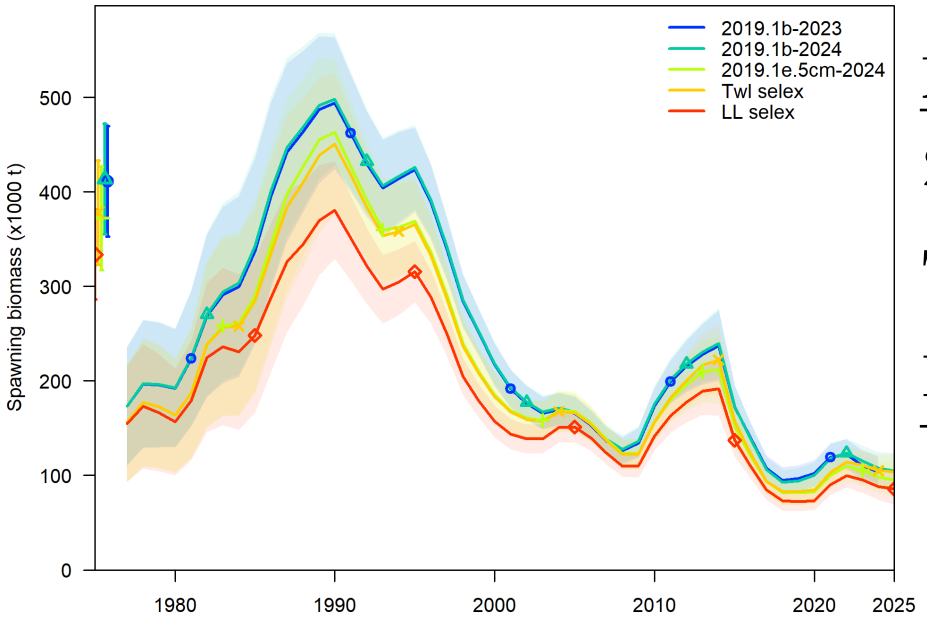
- Both sensitivities indicate that current modeling of selectivity provides better data fit and is preferred by AIC

	2019.1e.5cm-2024	Trawl	Longline
# parameters	194	183	193
AIC	4336.02	4343.20	4427.46
ΔAIC	0.00	*7.18*	**91.44**
TOTAL	1974.01	1988.6	2020.73
Catch	1.91E-12	1.69E-12	6.91E-12
Survey	2.16	8.53	4.81
Length_comp	1330.40	*1339.59*	**1379.19**
Age_comp	633.31	633.89	630.94



Trawl and longline survey selectivity

- But, are differences in model estimates… and management quantities (in a non-linear way)



Model	2025 SSB	SSB_PER	SB100	F40
2019.1e.5cm-2024	47,580	29.9%	158,893	0.42
Twl selex	51,767	32.6%	158,851	0.47
LL selex	42,799	30.0%	142,462	0.50

Trawl and longline survey selectivity

- When it comes to trawl survey selectivity, not a whole lot gained by adding time-dependence, but there are consequences to investigate further
- May produce an 'unusual' shape, but dome-shaped longline survey clearly helps model fit better, and looks to be supported by data
  - But, this form of dome-shaped not only selectivity form out there
  - And, adding plot/text that explains how dome-shaped selectivity supported by data will be added to SAFE
- But wait, there's more…

More on selectivity

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Longline survey selectivity

- Part 2 of starting investigations:
- Compare between environmental link with selectivity parameters vs catchability
- 5 estimated selectivity parameters, applied environmental link one-at-a-time

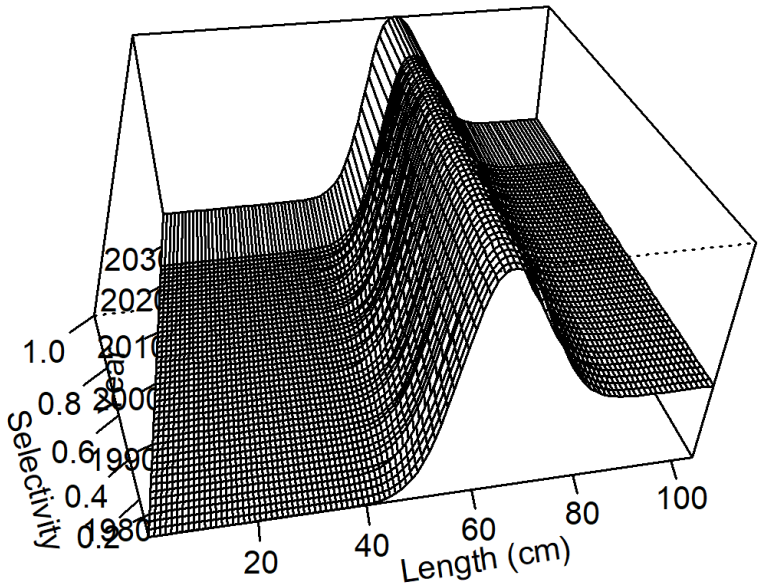
Longline survey selectivity

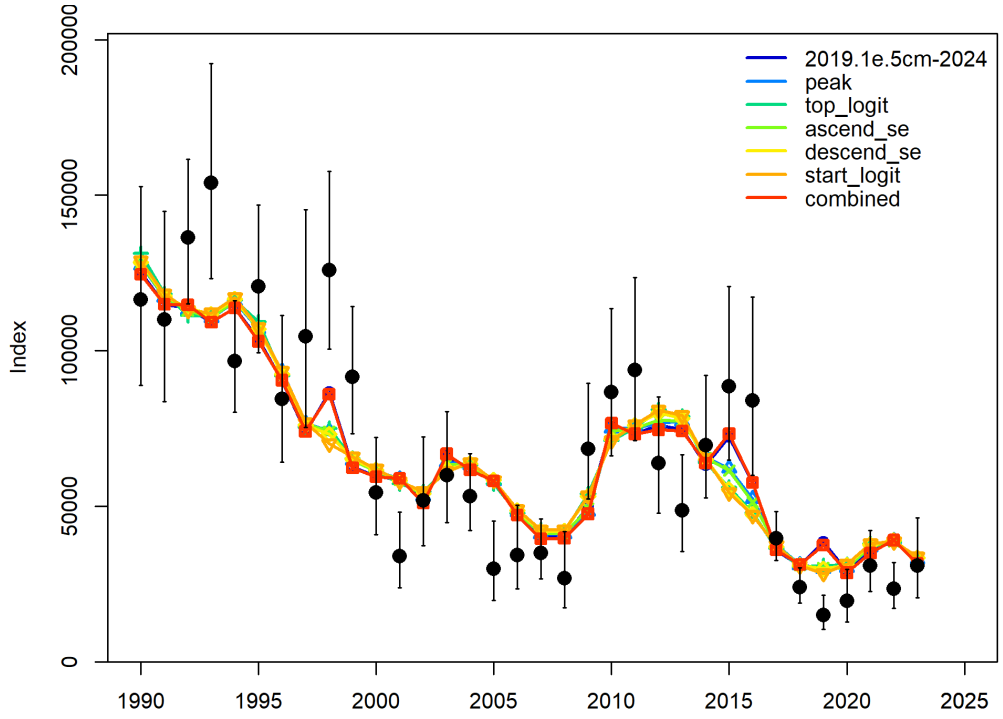
- Some selectivity parameters have lower total objective
- Combining results in AIC 'preferred' model overall

	2019.1e.5cm-2024	peak	top_logit	ascend_se	descend_se	start_logit	combined
# params	194	194	194	194	194	194	196
AIC	4336.02	4332.84	4344.14	4331.54	4343.72	4346.78	4328.52
ΔAIC	**7.50**	**4.32**	15.62	**3.02**	15.20	18.26	**0.00**
TOTAL	1974.01	1972.42	1978.07	1971.77	1977.86	1979.39	1968.26
Catch	1.91E-12	2.46E-12	2.19E-12	2.47E-12	2.24E-12	2.19E-12	1.36E-12
Survey	2.16	5.81	8.92	6.31	9.73	11.58	2.00
Length	1330.40	1325.67	1327.02	1324.28	1326.17	1326.05	1324.75
Age	633.31	632.93	634.22	633.18	634.03	633.84	633.33

Longline survey selectivity

- But, doesn't resolve the shape of selectivity
- And back-and-forth in terms of fitting the LL survey the 'best'
- Work is on-going to investigate environmental links (Krista Oke)





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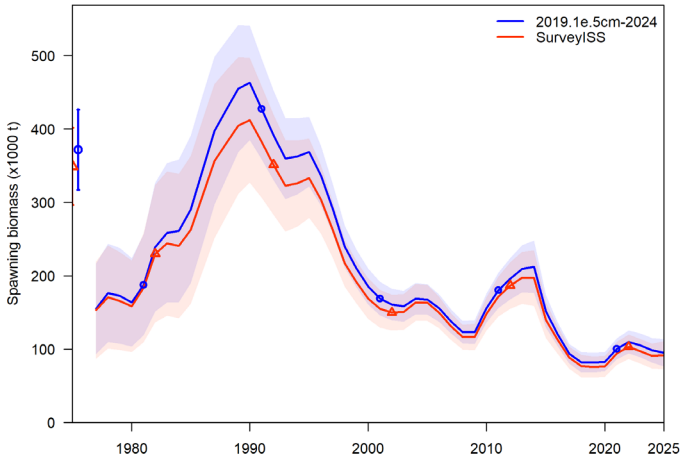
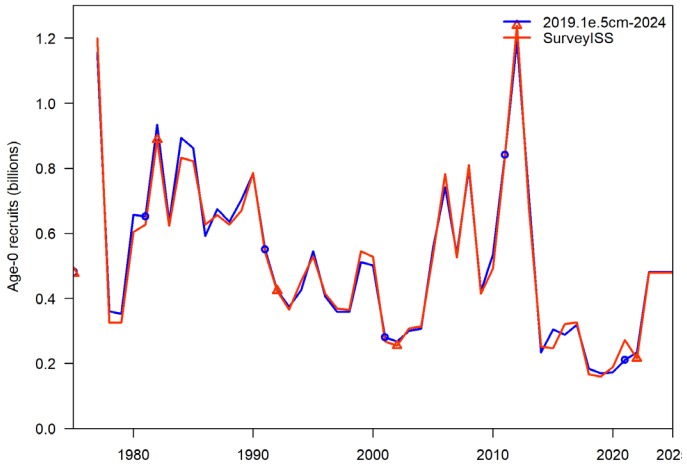
Selectivity vs catchability

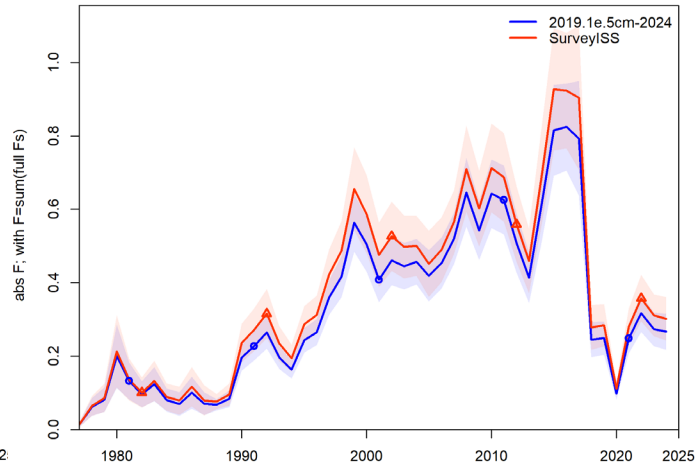
- Looking through the history of this assessment, it's a continual story of investigating selectivity vs catchability
  - Catchability has been fixed, estimated, informed
  - Selectivity has come in all shapes and forms across age/length and time
- What we may have now that they didn't have then, is an objective way to define input sample size for age/length/CAAL data
  - Does it matter?

Selectivity vs catchability

- Relative ISS between surveys/fishery fleets has direct implications on model estimates of selectivity, recruitment, catchability…
- **Recommend:** Get composition data ISS set up first (Longline survey, Fishery-Brett Stacy), then start digging into selectivity vs catchability







Maturity

The SSC supports the GOA GPT recommendation to work up the backlog of maturity data, and further to evaluate trends in maturity, as well as relationships between growth and maturity.

Maturity

- Recent tagging studies have provided potential information to update maturity ogive in assessment (Charlotte Levy)
- Winter maturity histological collections currently being read, estimated to be completed in mid-November (Sandi Neidetcher)
- Observer data used in assessment, Stark (2007) data also available
- Looking towards 2025 assessment to update maturity information