GOA Thornyhead Complex: Model Updates

NOAA FISHERIES

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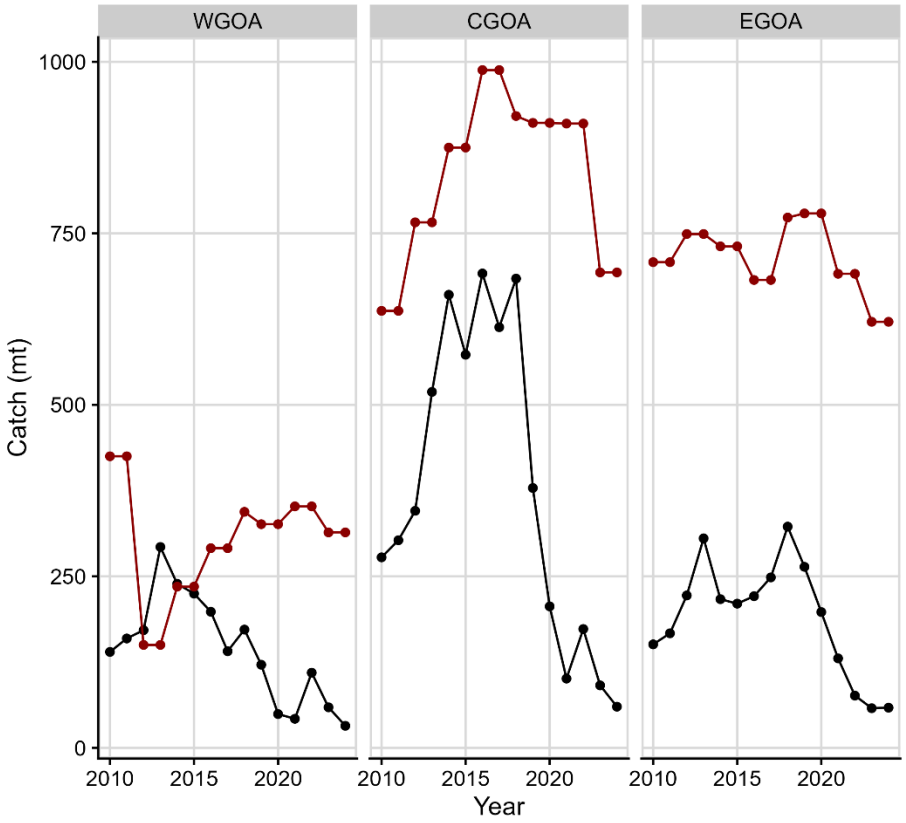
rema

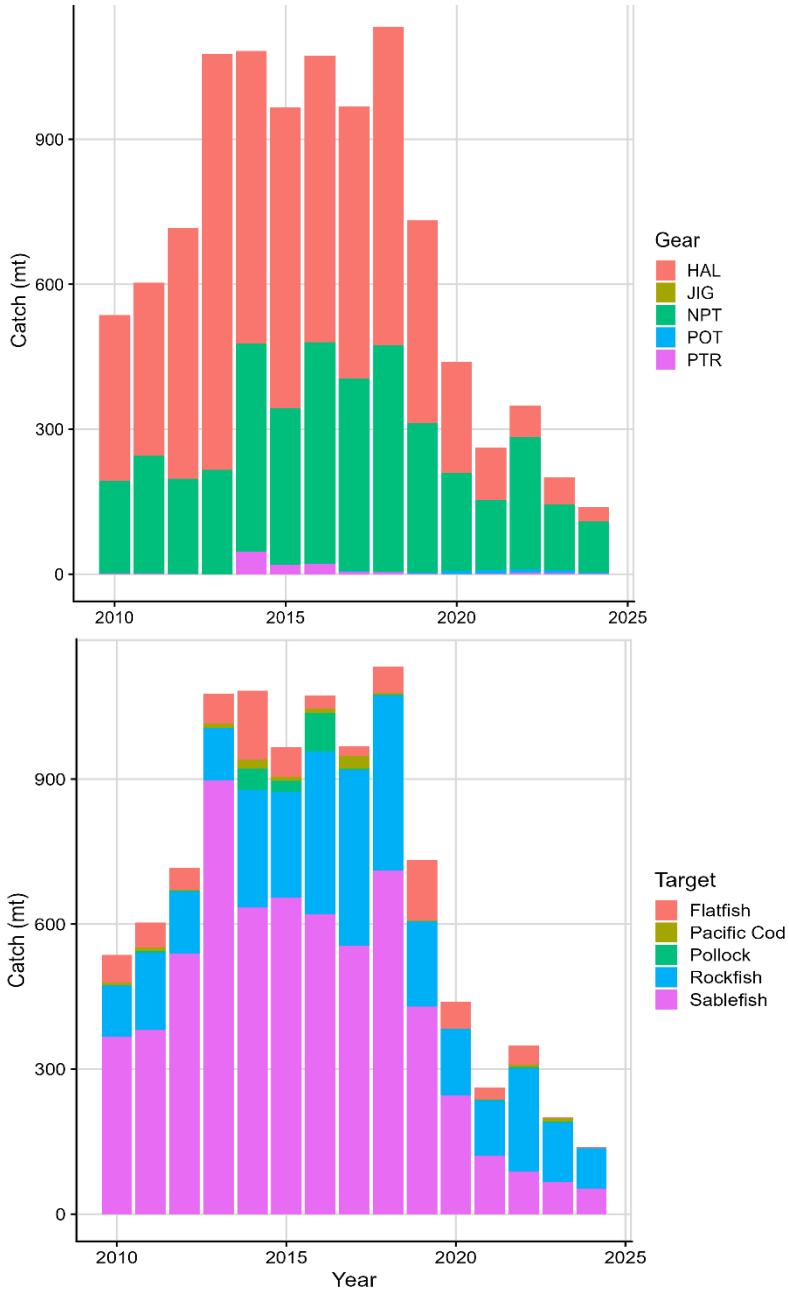
Outline

1. Context of fishery in recent years
2. Overview of model structure and data (Tier 5, 2-year cycle)
3. Alternative models:
    1. Move from 3 area process errors to 1 shared process error
    2. *rema* package model validation work (Balstad et al.)

Context of fishery



ABC = red, Catch = Black



- Declining catch related to pots replacing hook and line for sablefish
- Percent discarded is also substantially down

GOA thornyhead uses the two survey version of the random effects model (REMA) on shortspine thornyhead *Sebastolobus alascanus*

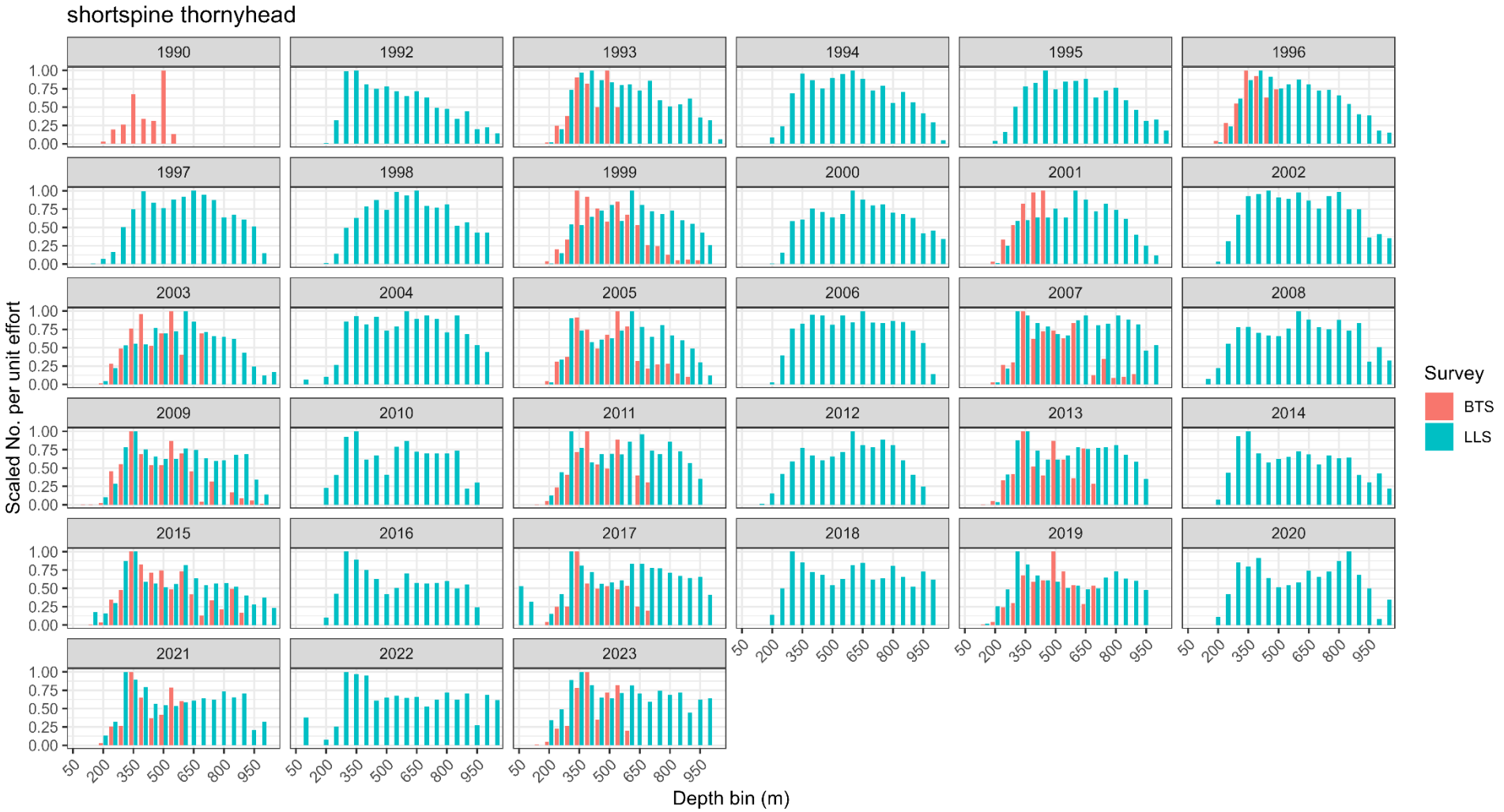
GOA bottom trawl survey (BTS) biomass

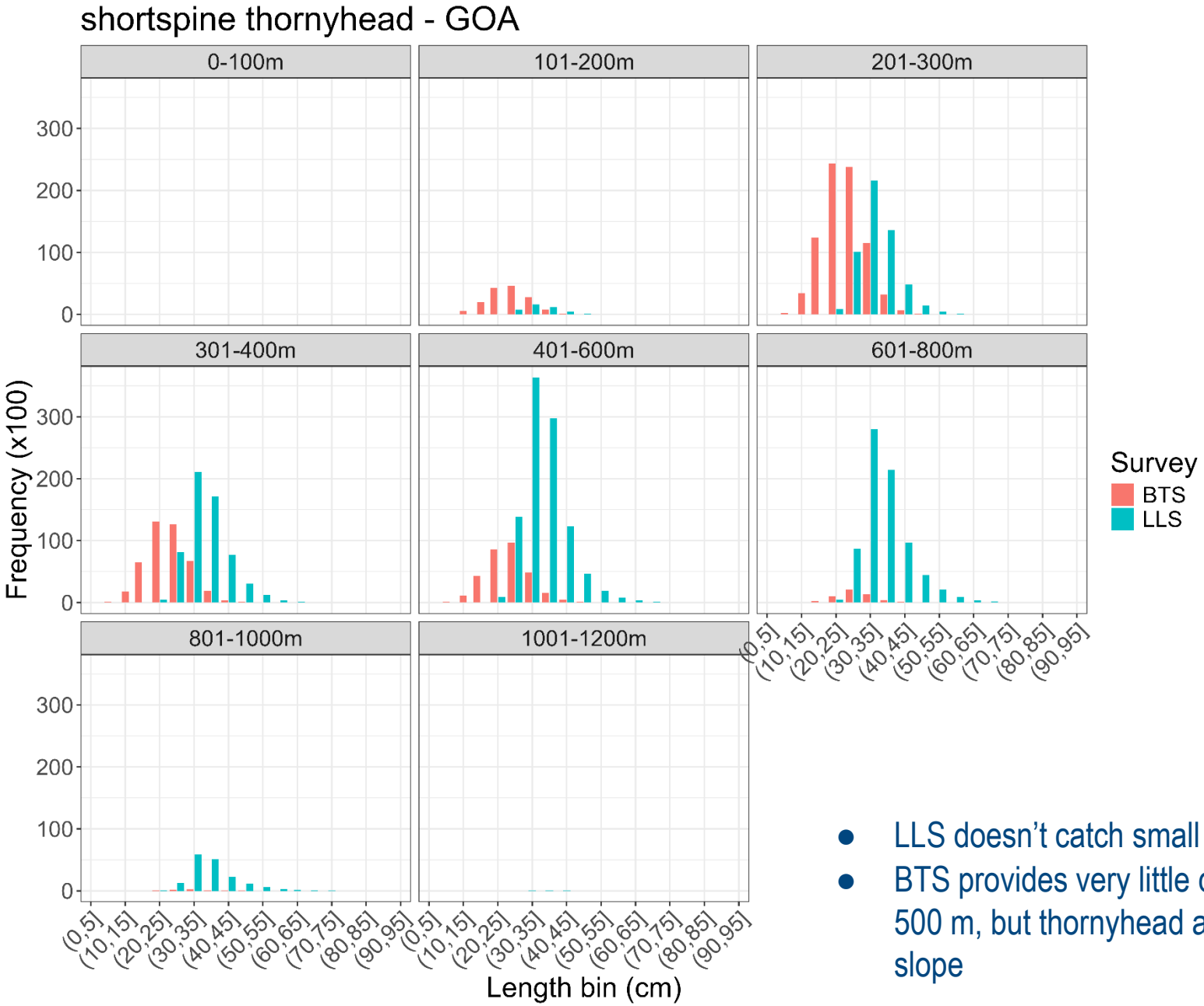
Longline survey (LLS) relative population weights (RPW)

WGOA 0-500 m	WGOA 501-700 m	WGOA 701-1000 m	WGOA
CGOA 0-500 m	CGOA 501-700 m	CGOA 701-1000 m	CGOA
EGOA 0-500 m	EGOA 501-700 m	EGOA 701-1000 m	EGOA

- 1996 and 2001 BTS did not survey the depths >500 m
- 2003, 2011, 2013, 2017, 2019, 2021, and 2023 BTS did not survey depths >700 m
- 2001 BTS no sampling in EGOA

Differences between surveys





- LLS doesn't catch small fish (< 20 cm)
- BTS provides very little data deeper than 500 m, but thornyhead are primarily on the slope

Updated CVs for single haul strata

Can not calculate variance when there is only one haul in a survey strata, so we added a CV of 0.5 when this occurred. Should be resolved in future with GAP updated stratification.

Year	Strata	CV Old	CV New	CV Diff
1999	WGOA (701-1000 m)	0.100	0.500	0.400
2009	EGOA (701-1000 m)	0.019	0.451	0.432
2015	EGOA (701-1000 m)	0.005	0.452	0.447
2019	CGOA (501-700 m)	0.167	0.340	0.173
2021	EGOA (501-700 m)	0.219	0.409	0.180

5 others not shown where change < 0.02

Model 22 (Echave et al. 2022)

Six parameters estimated:

1. Three process errors: WGOA, CGOA, and EGOA
2. One scaling parameter *q* shared across all LLS strata
3. Two additional observation errors: BTS and LLS

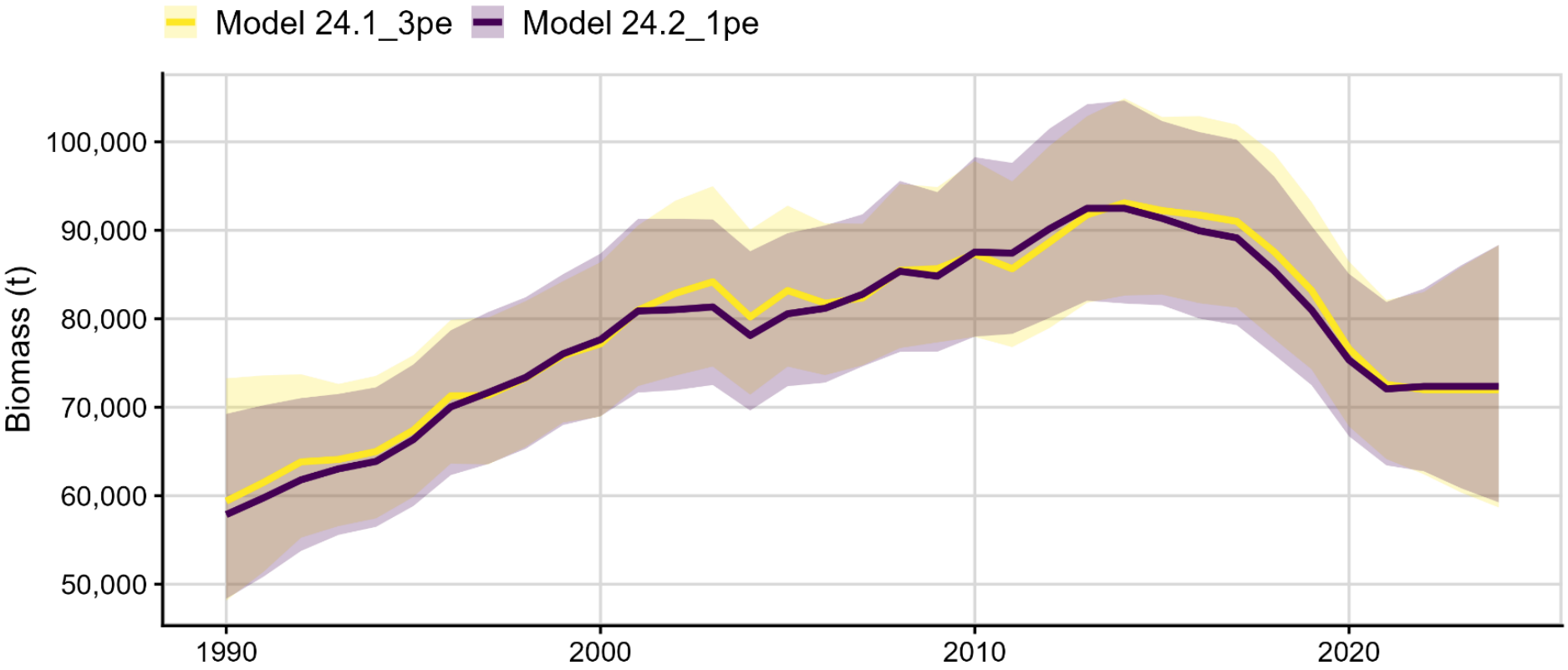
Reasons for updating model:

1. GOA GPT/SSC: "The Team recommended the use of a common process error across the GOA, and would like to see a comparison of that approach with the current approach that allows process error to vary by subregion. If process errors are treated separately by sub-region, then justification for that decision should be provided."
2. Laplace approximation validation with MCMC found issues with estimation of additional observation error for each survey (Balstad et al.)

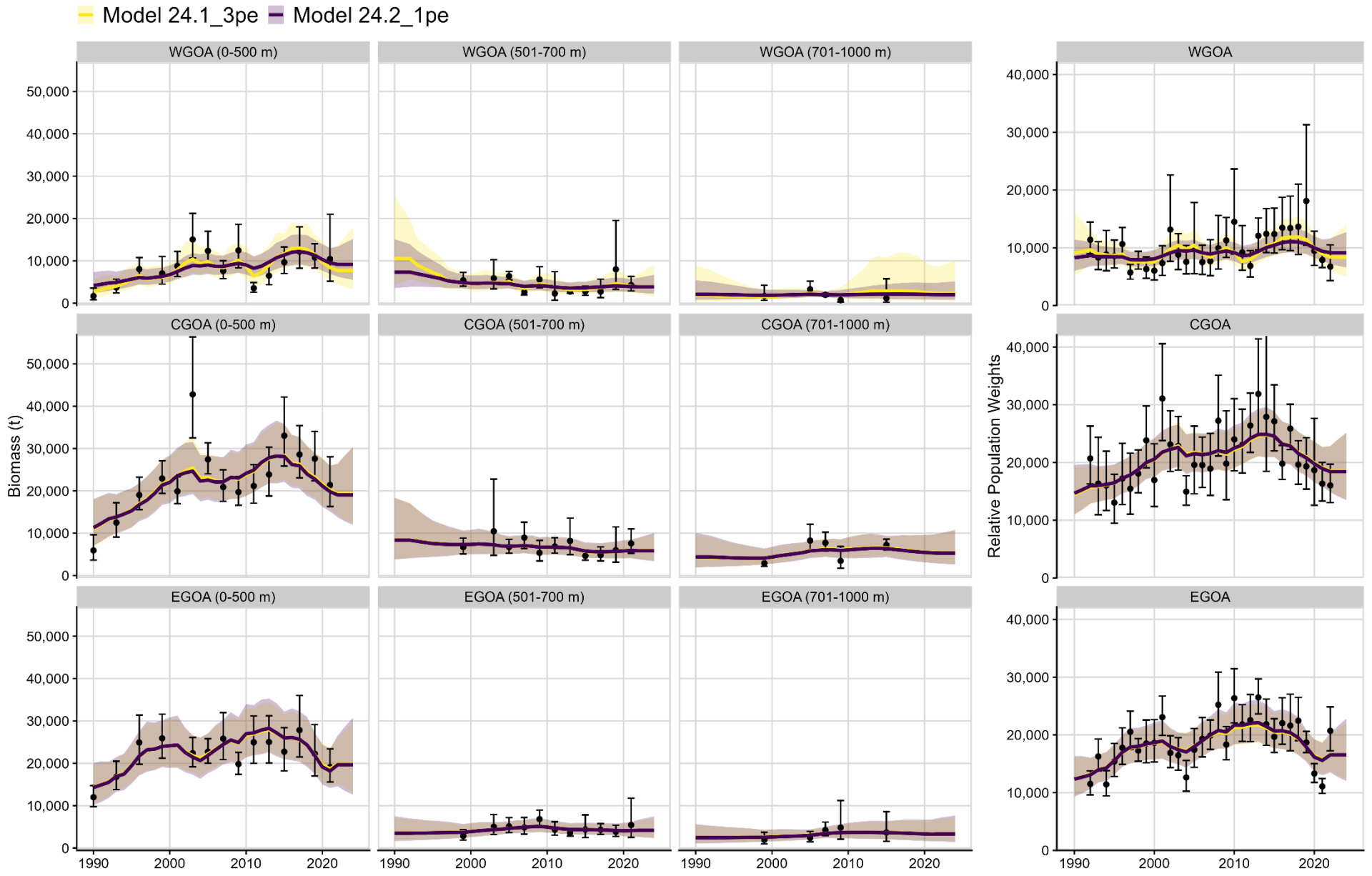
Alternative models

1. Model 24.1 – same as Model 22, but logit to log in *rema* package for estimating additional observation error (Balstad et al.)
    - *rema* change does not change parameter/error estimates
    - Updated CVs does change estimates very slightly
2. Model 24.2 – same as 24.1 but single process error

3-region specific process errors to single shared



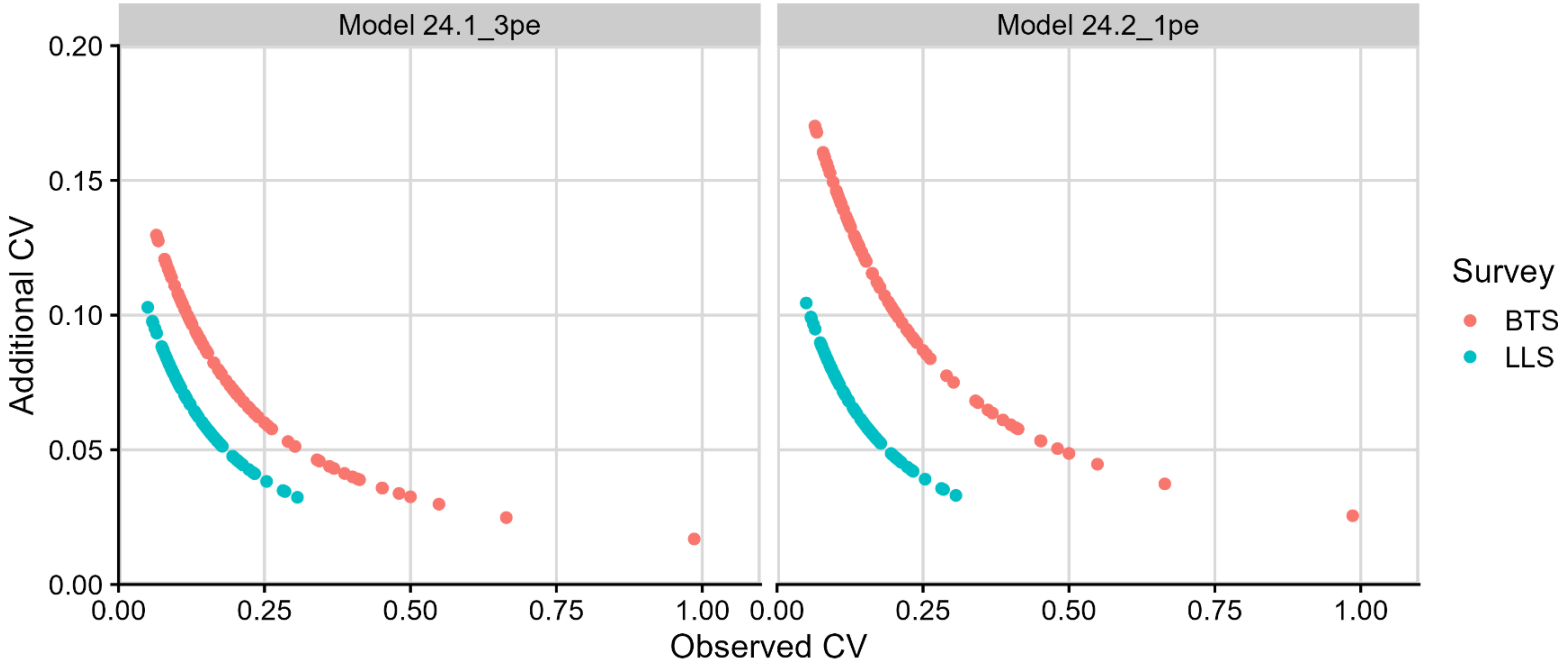
3-region specific process errors to single shared



Changes to Parameters

Model	Process Error(s)	Scaling (q)	Addt'l Obs. Err.
22	WGOA: 0.224 CGOA: 0.115 EGOA: 0.105	0.602	BTS: 0.180 LLS: 0.145
24.1	WGOA: 0.225 CGOA: 0.116 EGOA: 0.104	0.604	BTS: 0.183 LLS: 0.144
24.2	Shared: 0.119	0.610	BTS: 0.226 LLS: 0.146

Additional observation error considerations



$$\sigma_{ln(B_{y,r})} = \sqrt{ln\left(CV_{B_{y,r}}{}^2 + \sigma_\tau{}^2 + 1\right)}$$

Observed

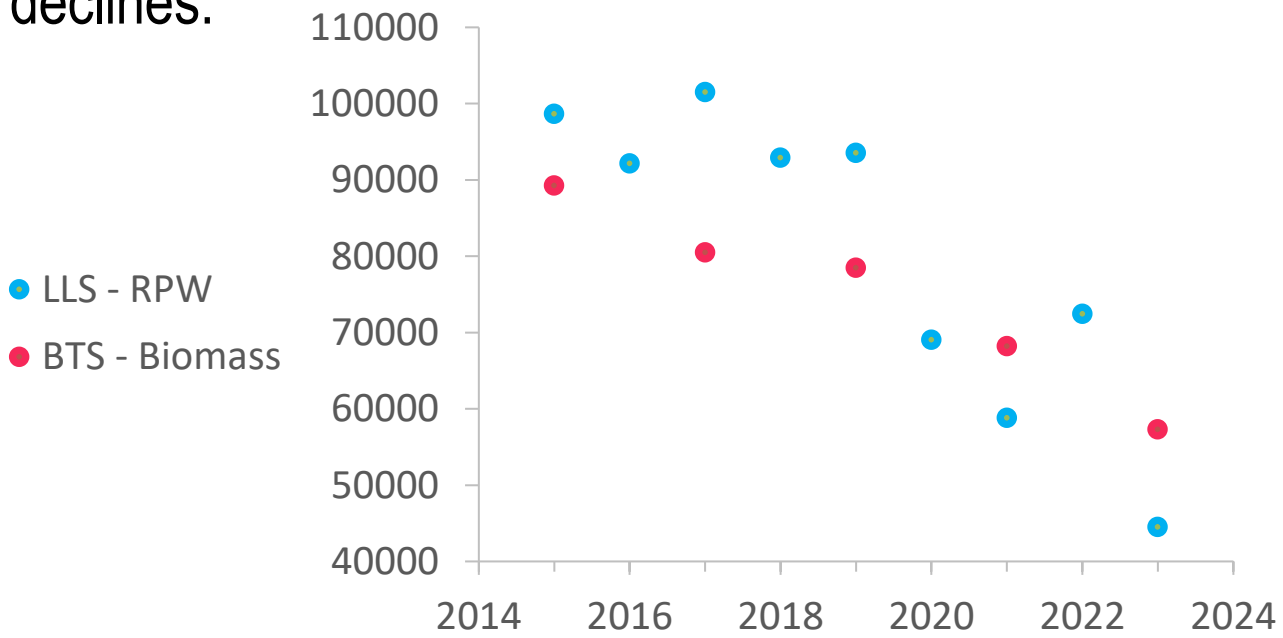
Estimated

Alternatives:

- Different parameterization
- Priors
- Add to variance/SD instead of CV

Authors' Recommendation/Comments

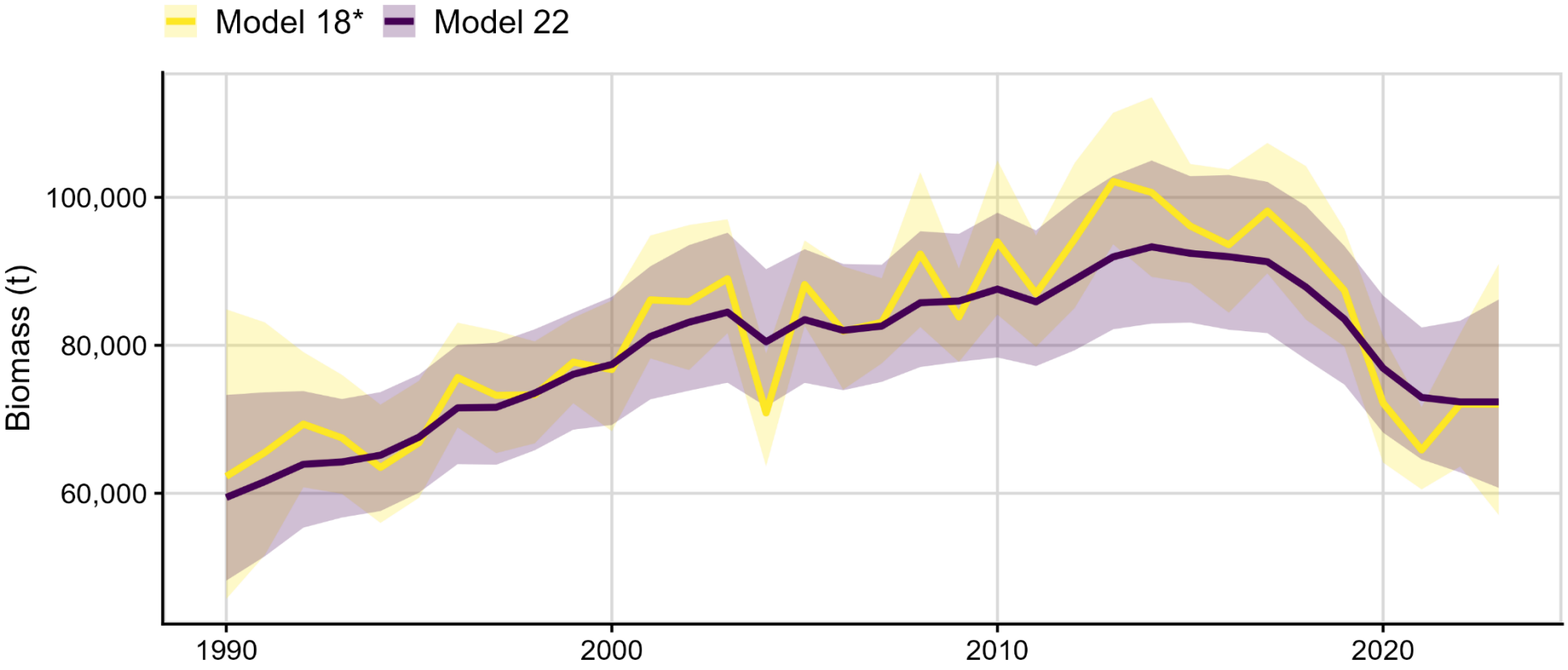
- Estimate single process error, single scaling coefficient, and additional observation error for both surveys (M24.2).
- Look into alternative methods for estimating additional observation error in the future.
- No new data in 2024, and 2023 surveys (not included in these models) showed declines:



Thank You

Feedback and Questions?

From 2022 For Reference:



Model 18* had no additional obs. error, and estimating additional obs. error for either survey alone still results in high variability from year to year…

From 2022 For Reference: