2019 Shortraker rockfish assessment:

Application of Random effects model with Longline survey as alternative index

Outline:

- Review of random effects model with alt index

- Reminder of what went down with shortspine thornyhead last year

- Application/development as applied to shortraker rockfish

Random effects model structure:

- Basics of random effects model: Parameters
    - Random effects: estimate unobserved state (biomass)
    - Hyper-parameter: constrains process error in random effects

- Model likelihood: 2 components
    - Observation error: fit of random effects to observed pop'n index

$$\sum_Y \sum_R \sum_S \frac{1}{2} \left[ln(2\pi\sigma^2_{T,y,r,s}) + \frac{1}{\sigma^2_{T,y,r,s}} (\hat{\theta}_{y,r,s} - lnI^T_{y,r,s})^2 \right]$$

    - Process error: constrains how much random effects can vary from year-to-year (random walk structure)

$$\sum_{y=2}^{Y} \sum_R \sum_S \frac{1}{2} \left[ln(2\pi\hat{\sigma}^2_{\theta}) + \frac{1}{\hat{\sigma}^2_{\theta}} (\hat{\theta}_{y-1,r,s} - \hat{\theta}_{y,r,s})^2 \right]$$

Incorporating alt index

- Longline Relative Pop'n Weights (RPW) index available (with estimates of uncertainty) by region

- Scaling regional biomass by an estimated q would provide estimates of RPW index

$$\hat{I}^L_{y,r} = q \sum_S e^{\hat{\theta}_{y,r,s}}$$

- Addition of observation error for Longline index into model likelihood would make regional random effects estimates dependent upon fit to both trawl and longline surveys

- Flexible enough to include other pop'n indices as well (e.g., fishery CPUE)
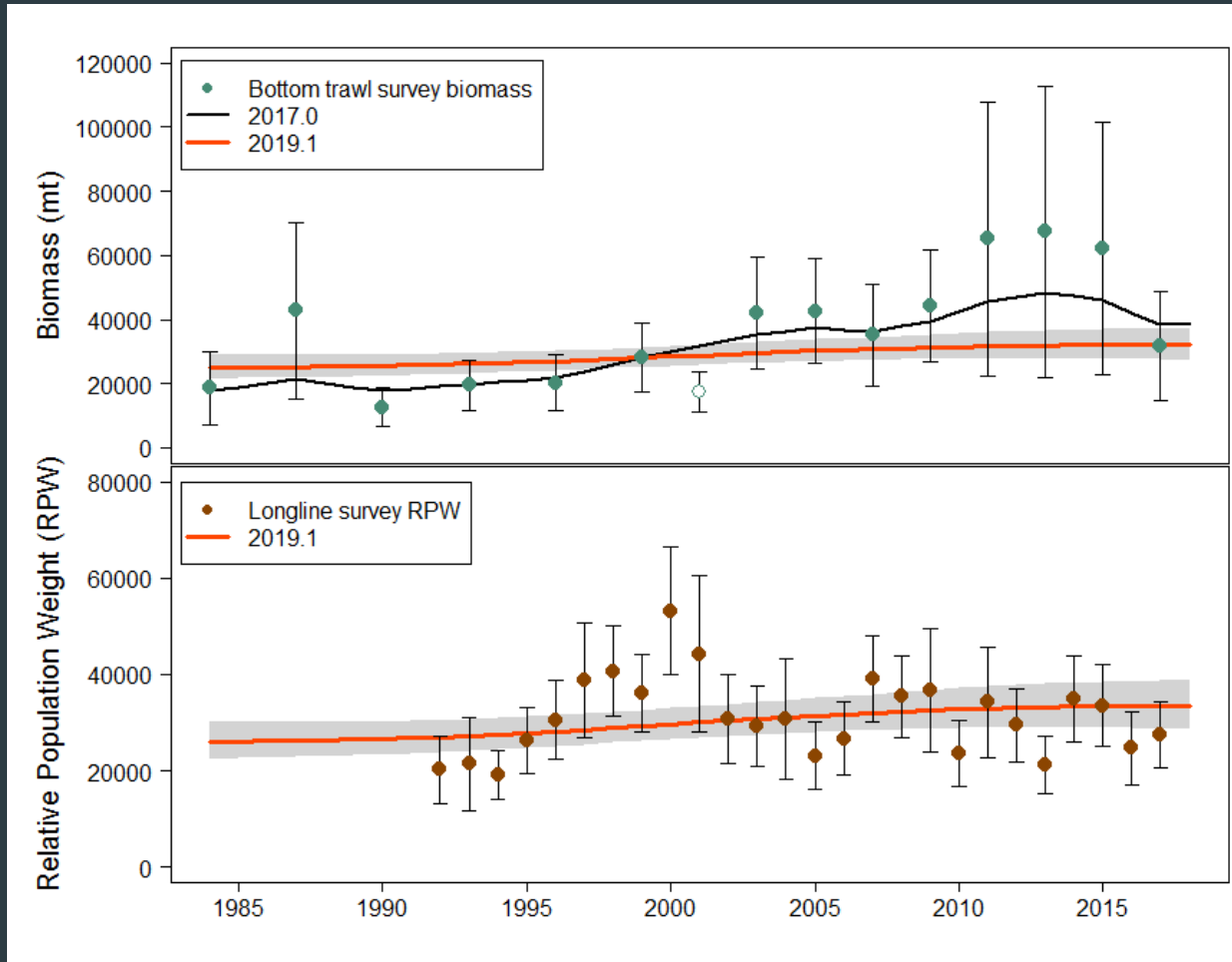
'18 shortspine thornyhead:
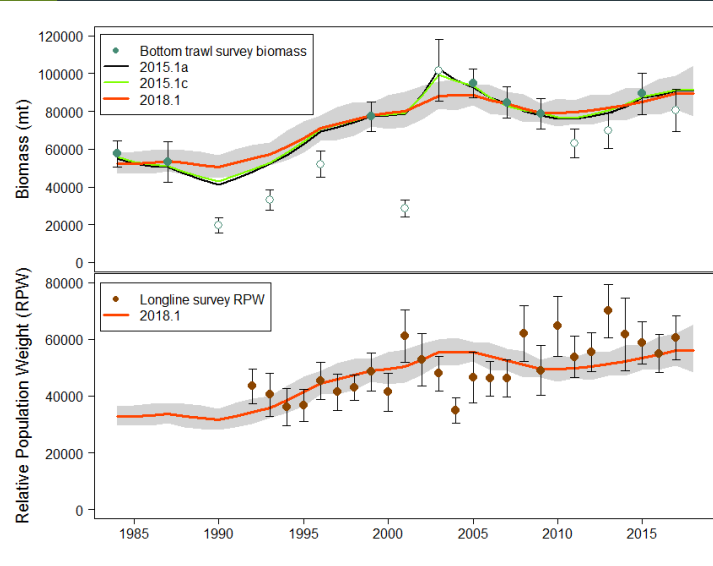
- Provides method to incorporate additional sources of information to assessment
- For shortspine, reduced 'over-fit' to trawl survey, resulted in more stable apportionment
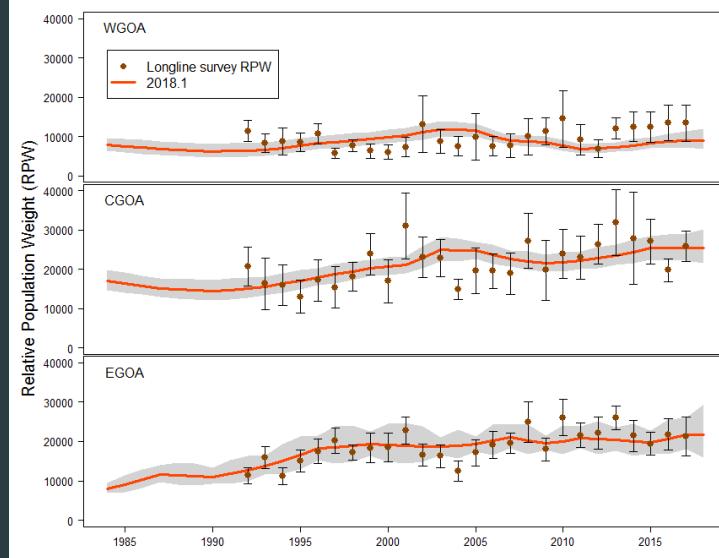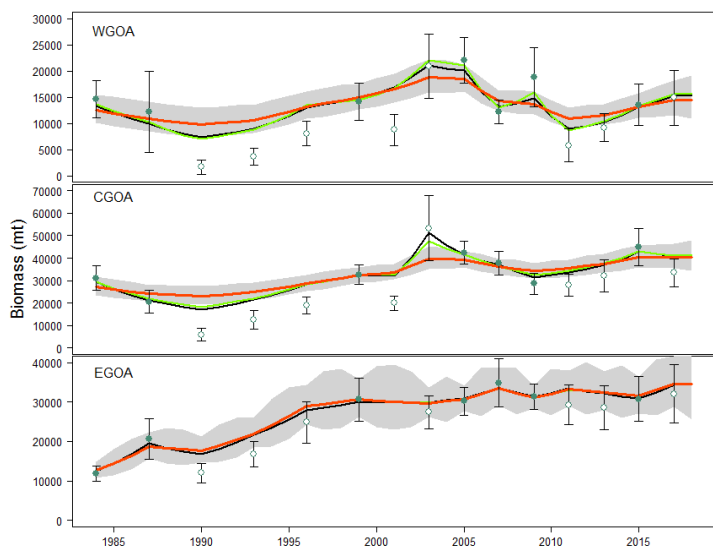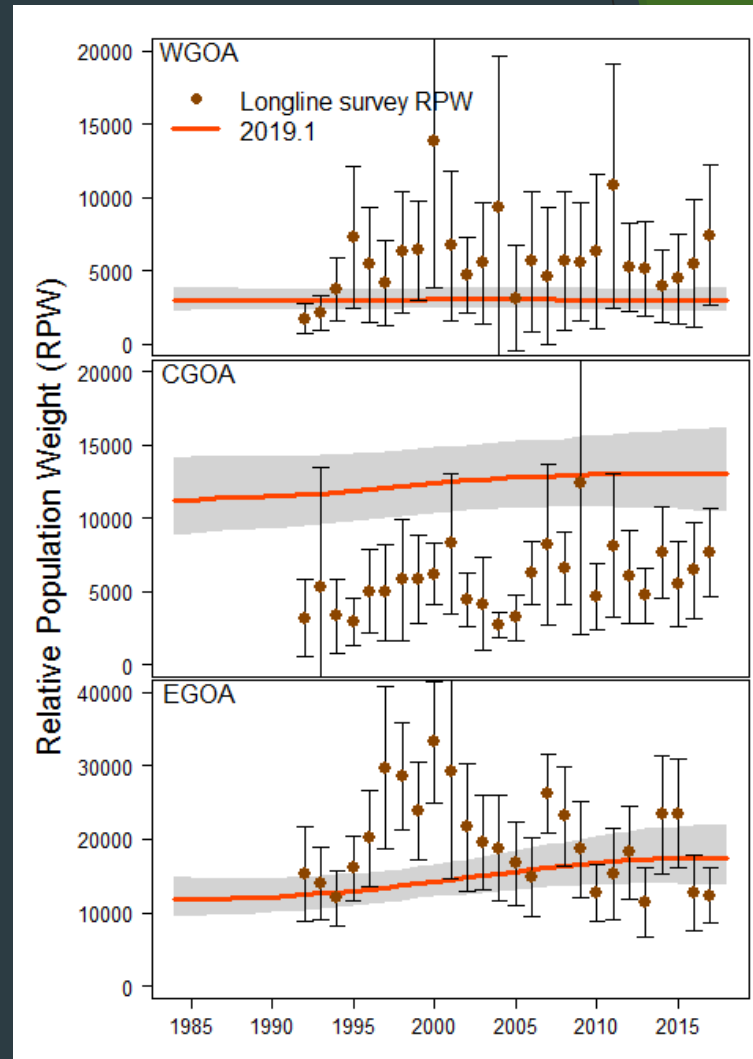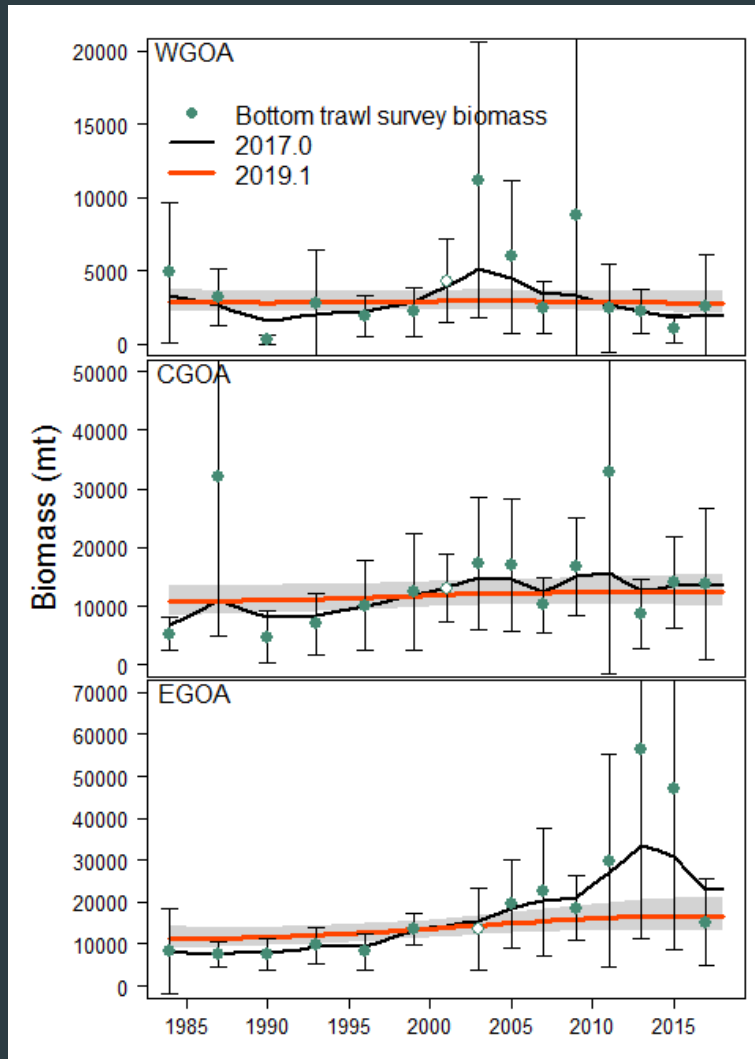
'19 shortraker rockfish:

Apply in same way as '18 shortspine (case 2019.1)
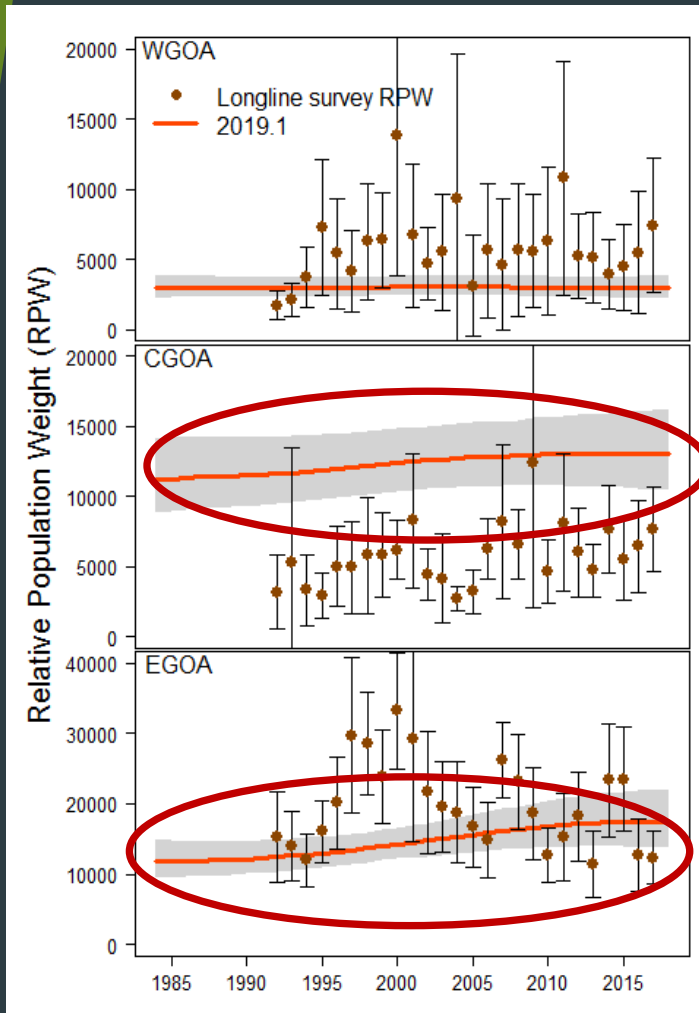
'19 shortraker rockfish:

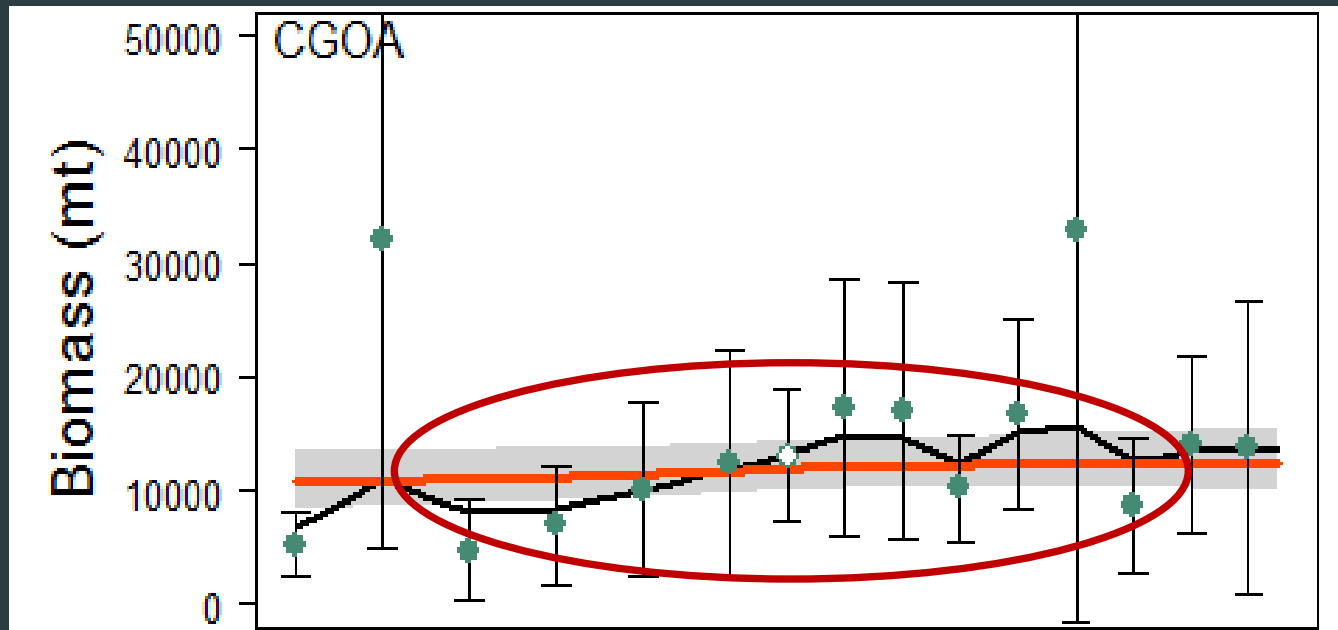Apply in same way as '18 shortspine (case 2019.1)

Issues:

Regional RPW scale is off → check out regional-specific q's

Justification: could be regional differences in availability to each gear type (and/or effectiveness of gear type), which causes issues when applying single q across regions

Issues:

Flat line within regions → evaluate relative weighting between BTS & LL

Justification: information from each source shouldn't cancel inter-annual changes out
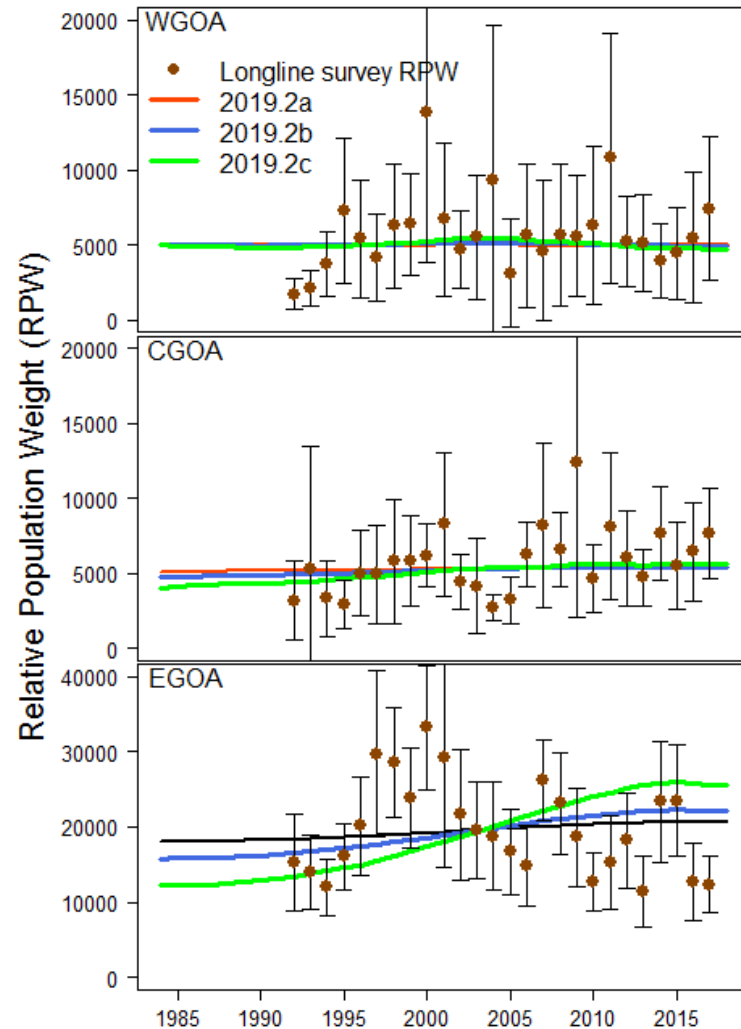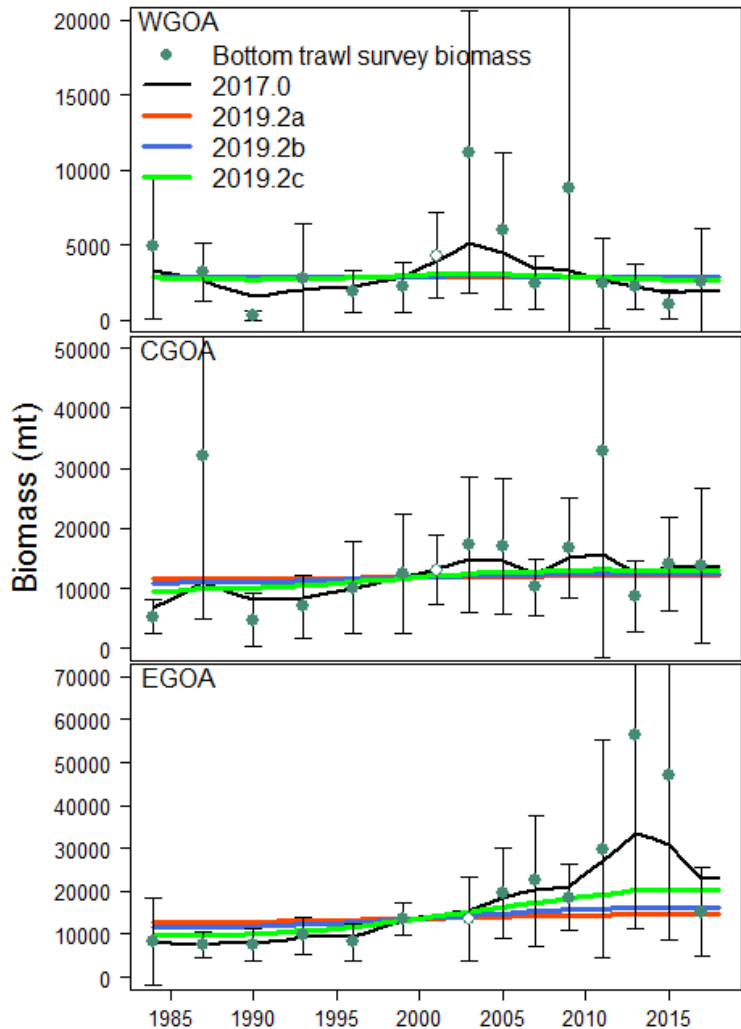
Shortraker model cases:

- Regional RPW scale is off → check out regional-specific q's

  - 2019.2

- Flat line within regions → evaluate relative weighting between BTS & LL

  - 2019.2a – $\lambda_{BTS} = \lambda_{LL} = 1$
  - 2019.2b – $\lambda_{LL} = 0.5$
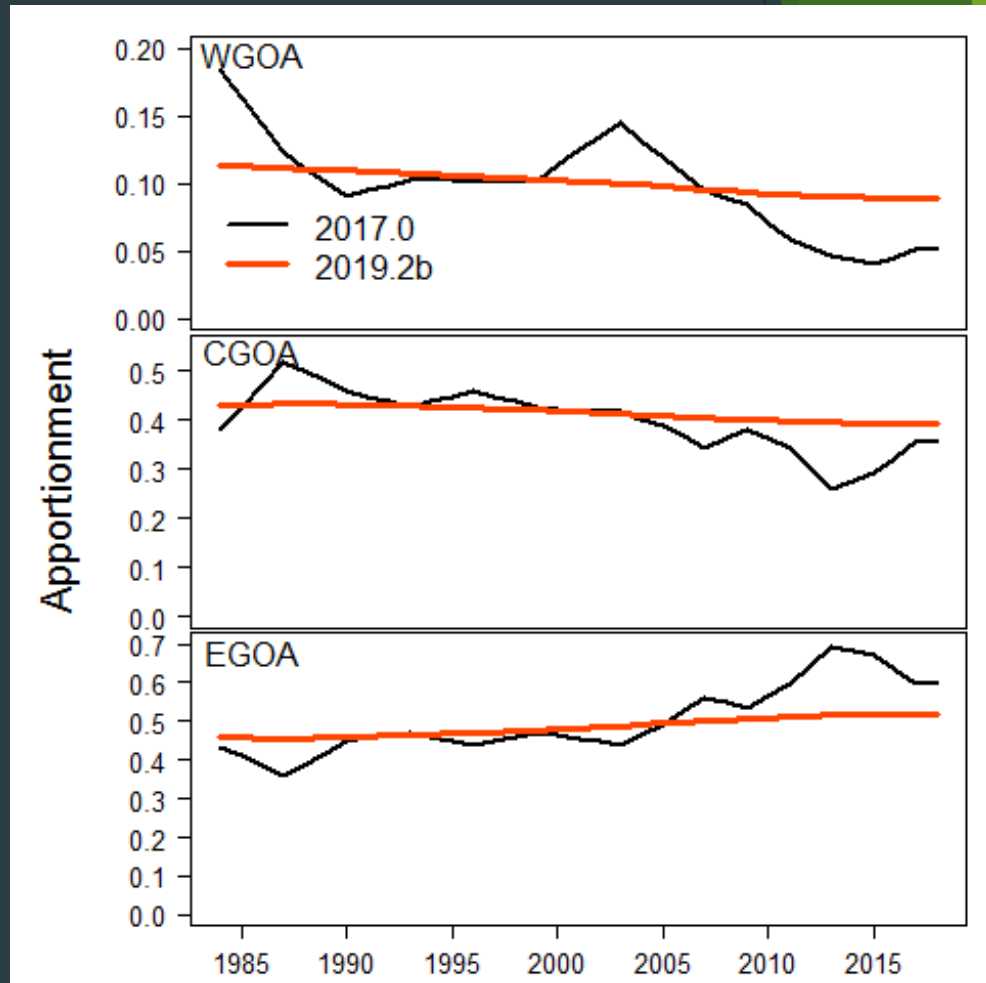 - 2019.2c – $\lambda_{LL} = 0.25$
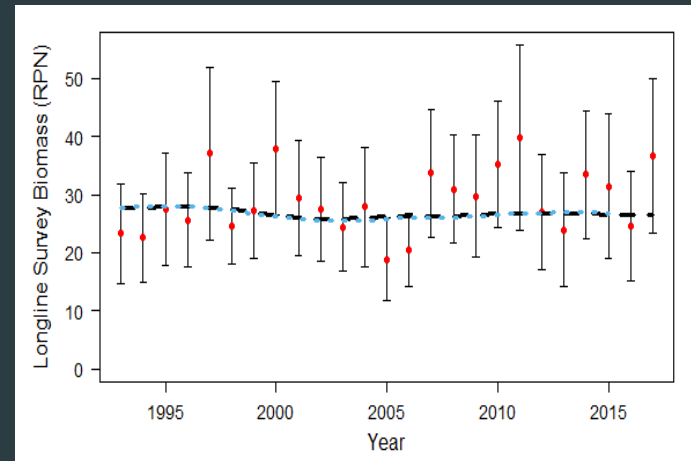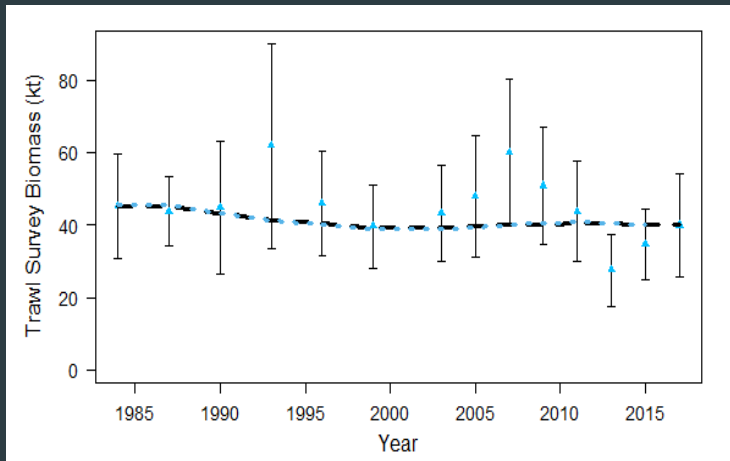
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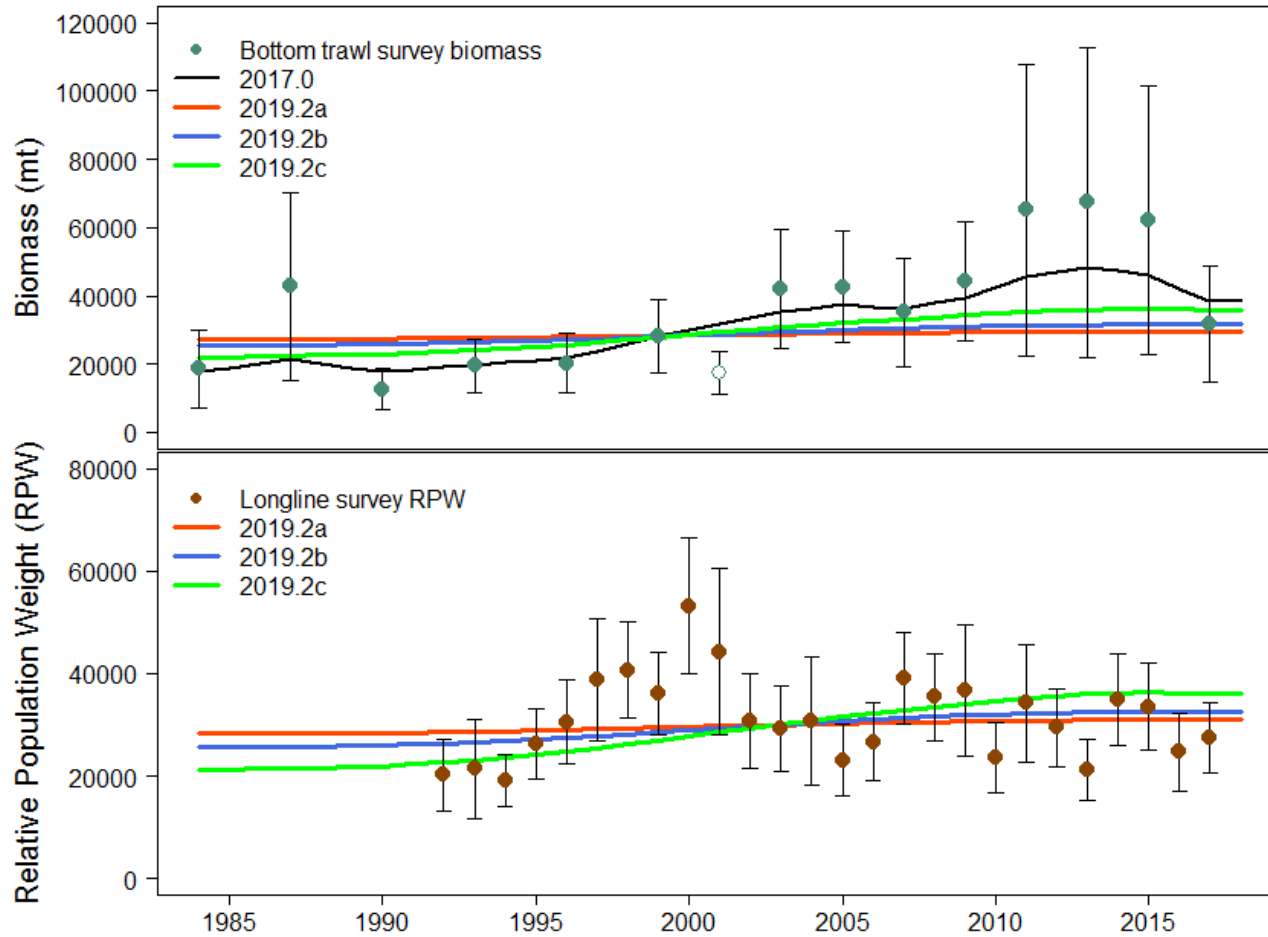
Results:

Results:

- Stabilizes apportionment

- Shifts apportionment from EGOA to C & WGOA

Cases 2019.2a-c:

- Estimating regional-specific q's resolves scaling issue

- Actually looks a lot like the biomass estimates from Tier 3 rockfish assessments (in particular Rougheye/Blackspotted)

- Quasi recommendation, λ_{LL} = 0.5 seems reasonable
  - Stated above, replicates rockfish Tier 3 assessments
  - Somewhat takes care of flatline issue

Questions?