

4/36 : 1-B-I

ABT-MSE Operating model fitting report

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Operating model scenario is:

1: West - Hockey stick, East - '83+ B-H $h=0.98$

B: Western Area SSB matches VPA

I: Younger spawning, High M

Area definitions for operating model:

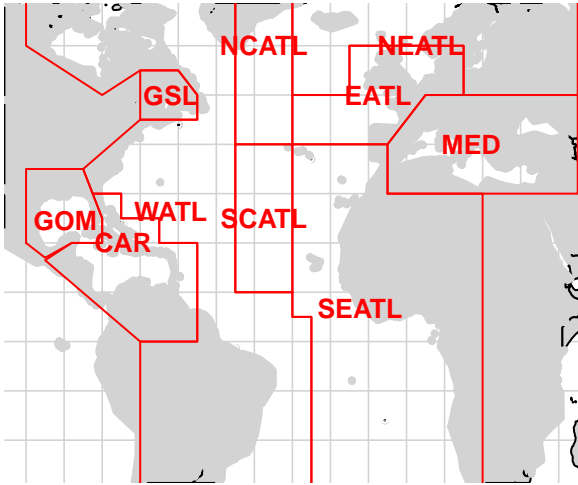
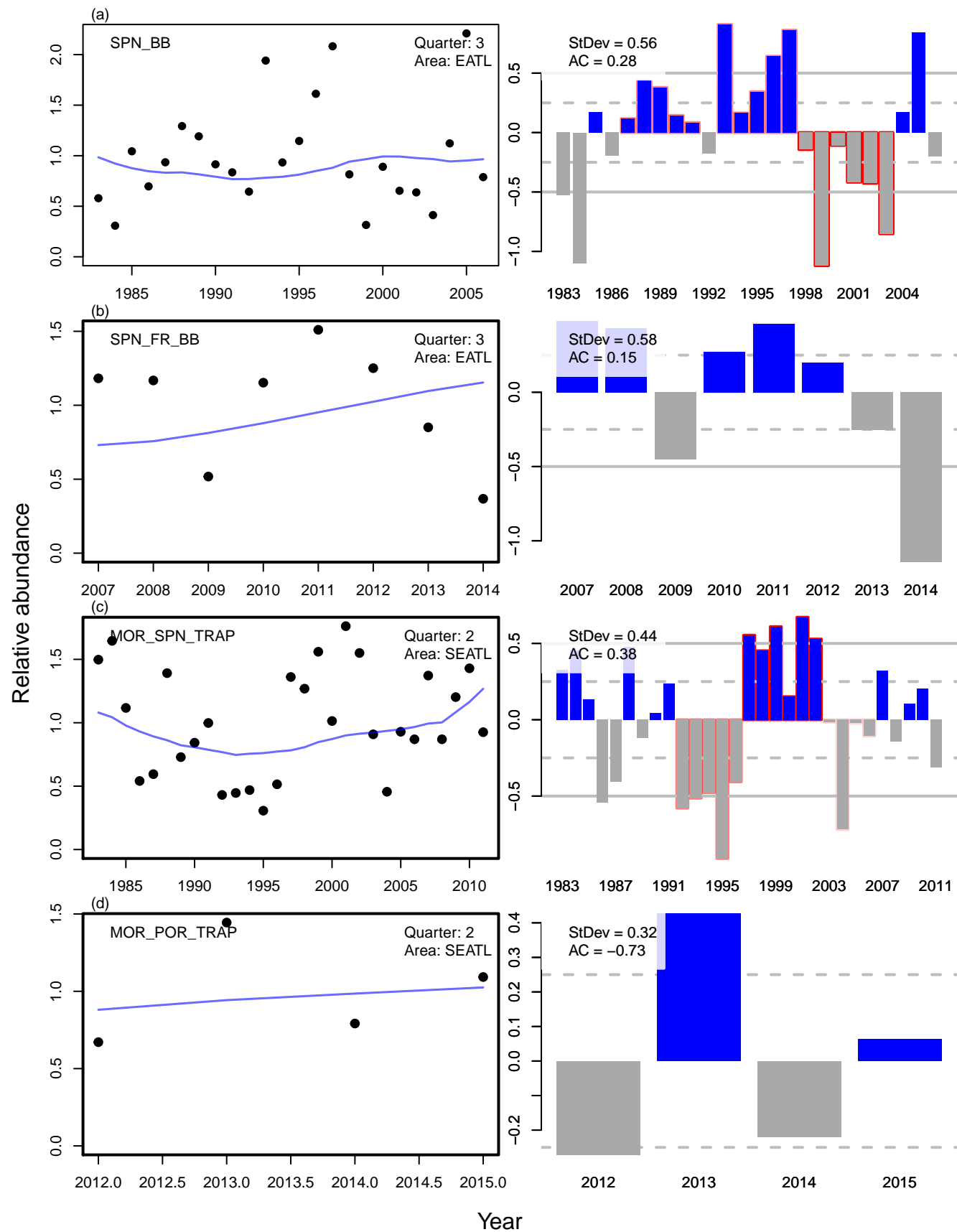
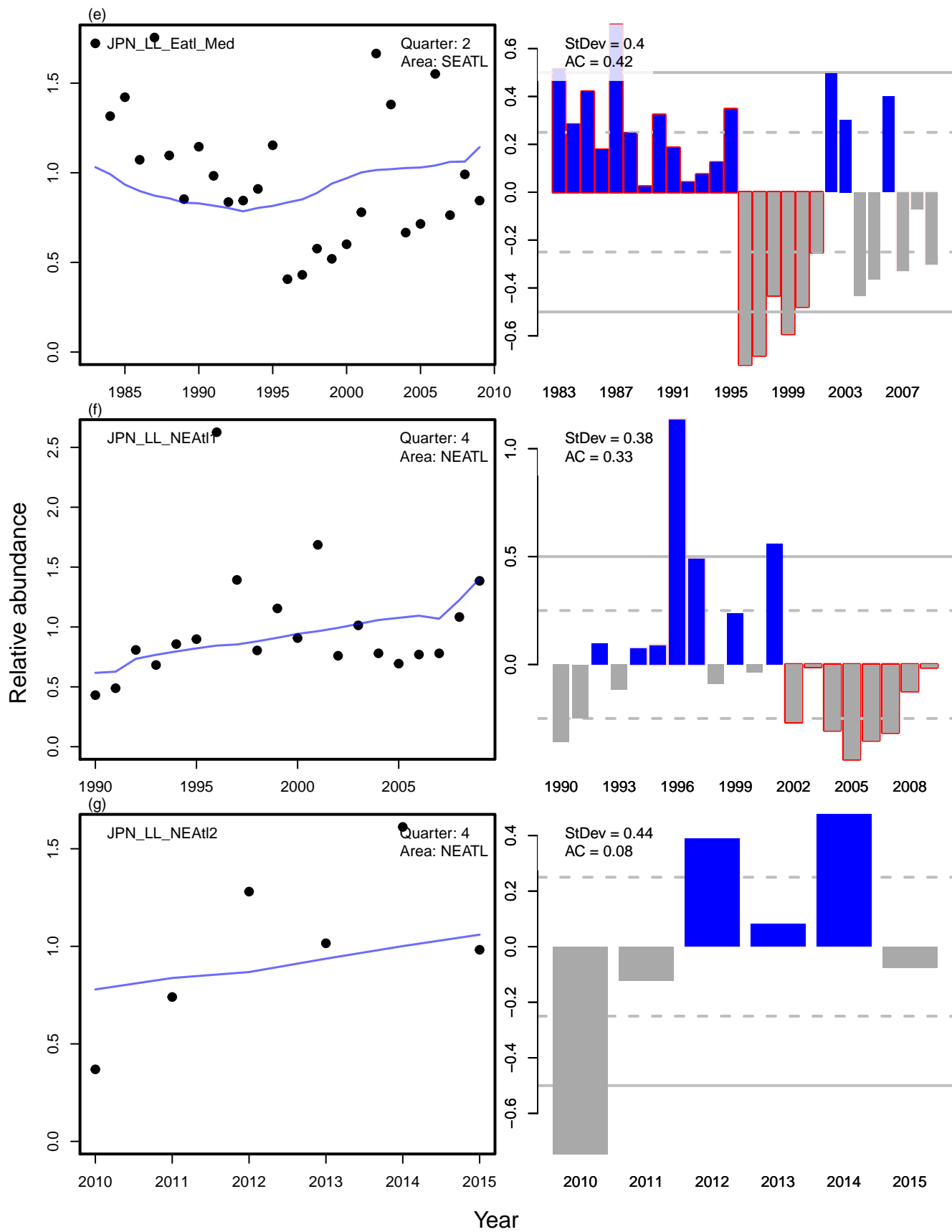


Figure 1. Area definitions for operating model

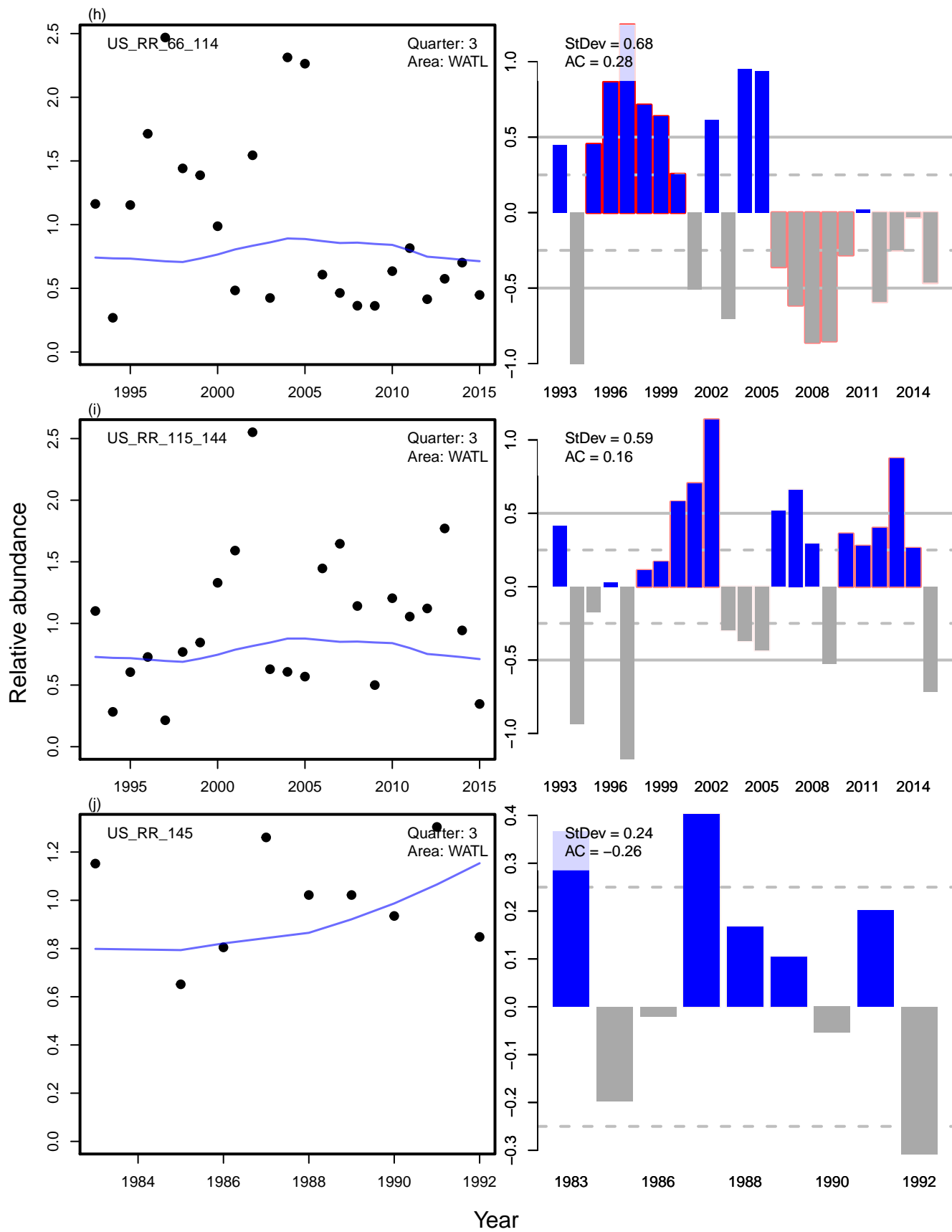
Fits to CPUE indices of relative abundance



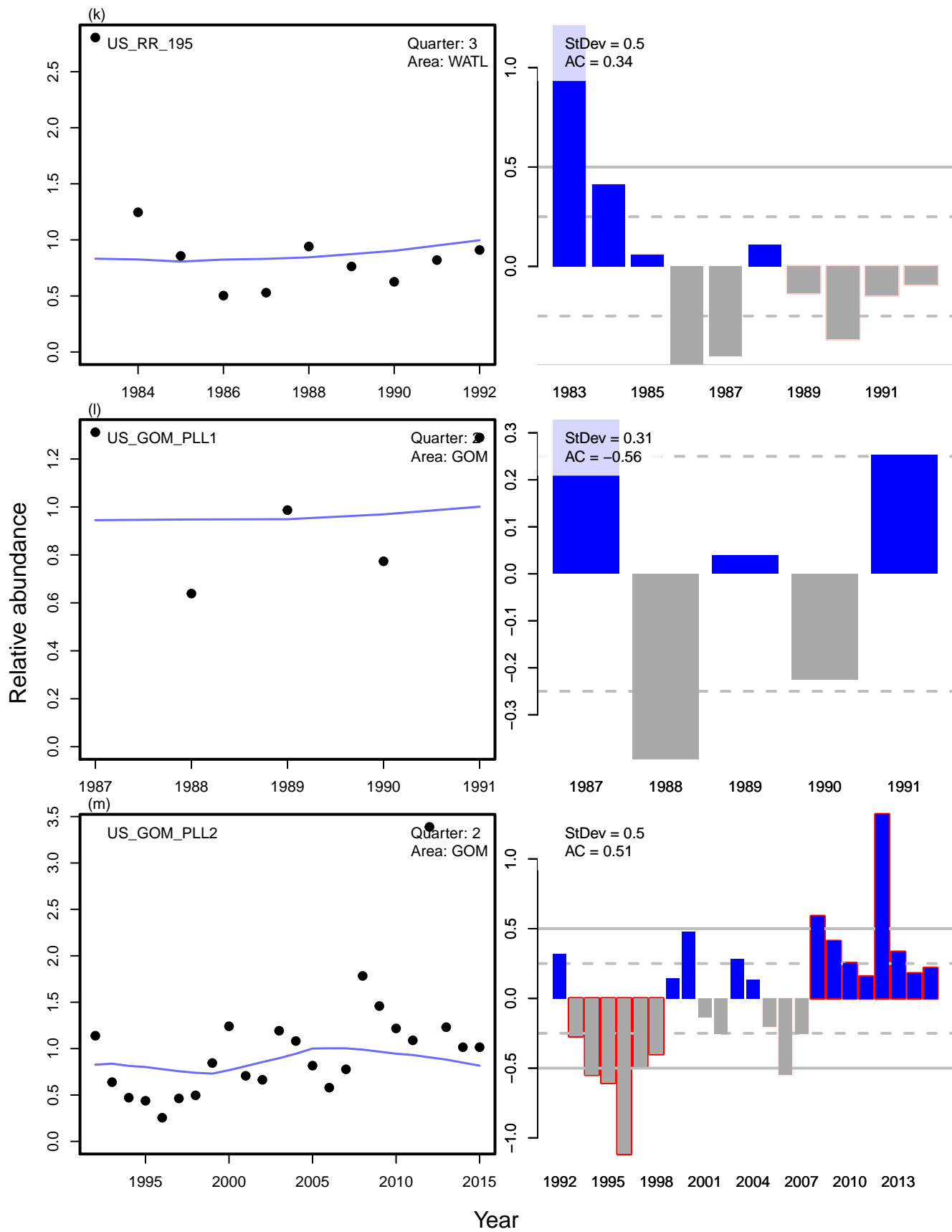
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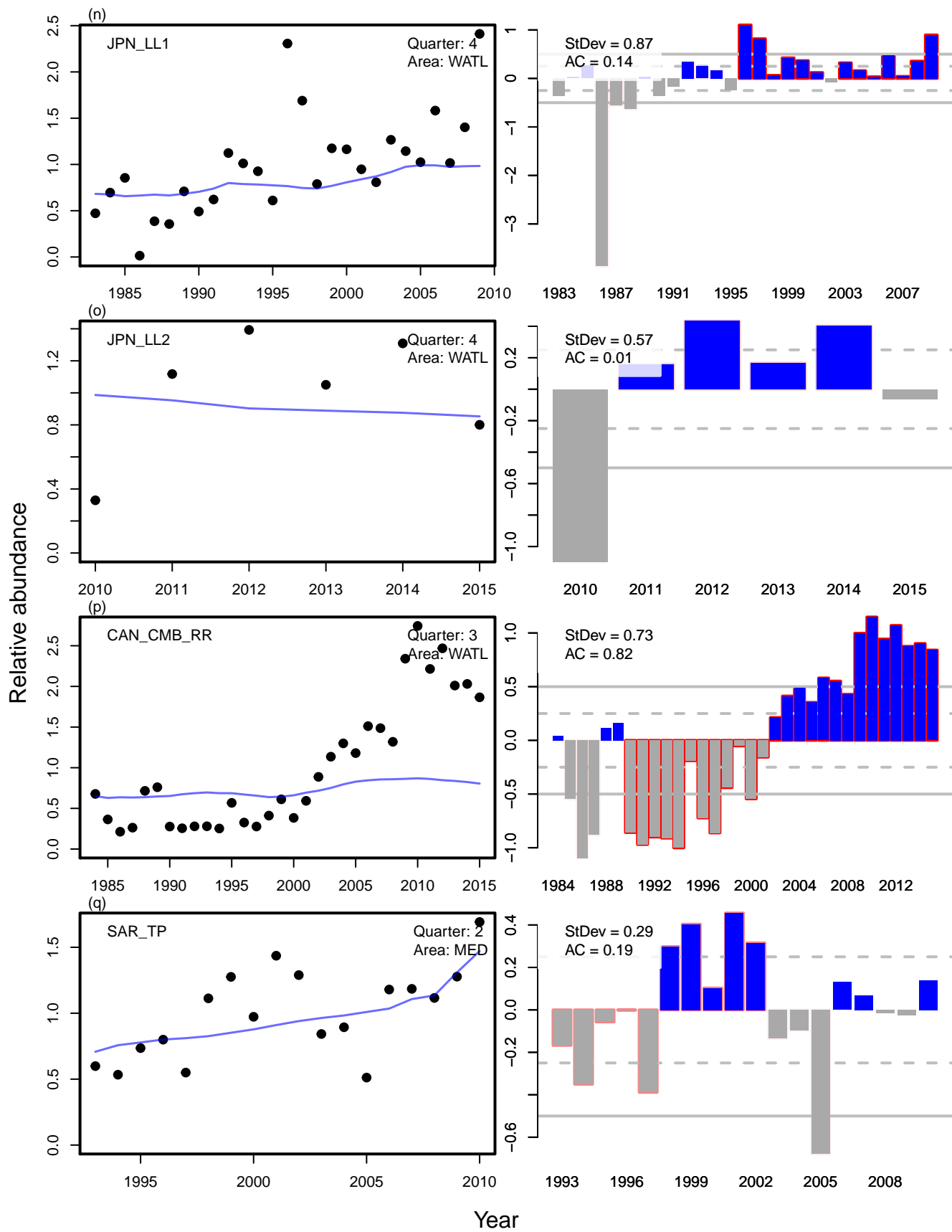
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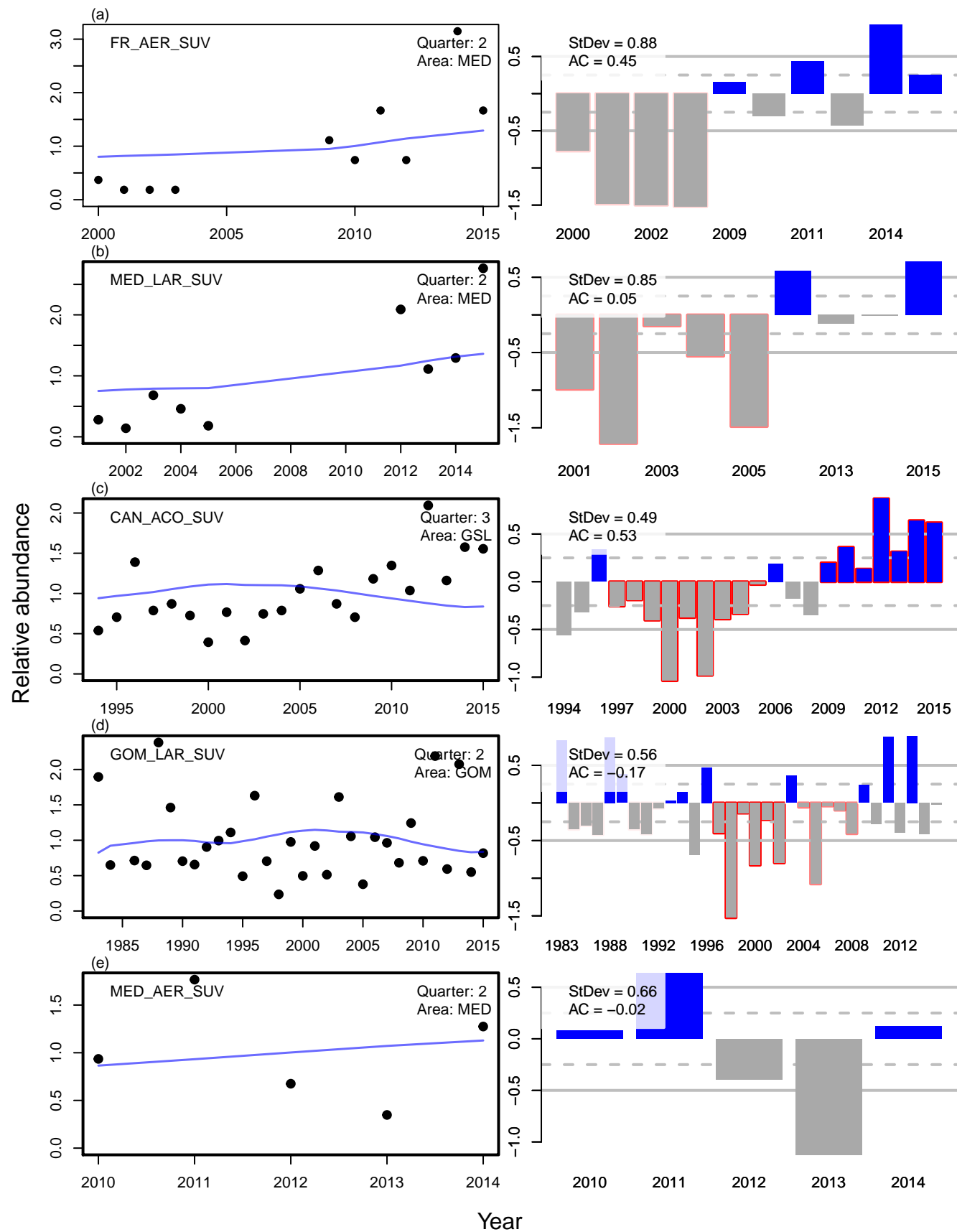


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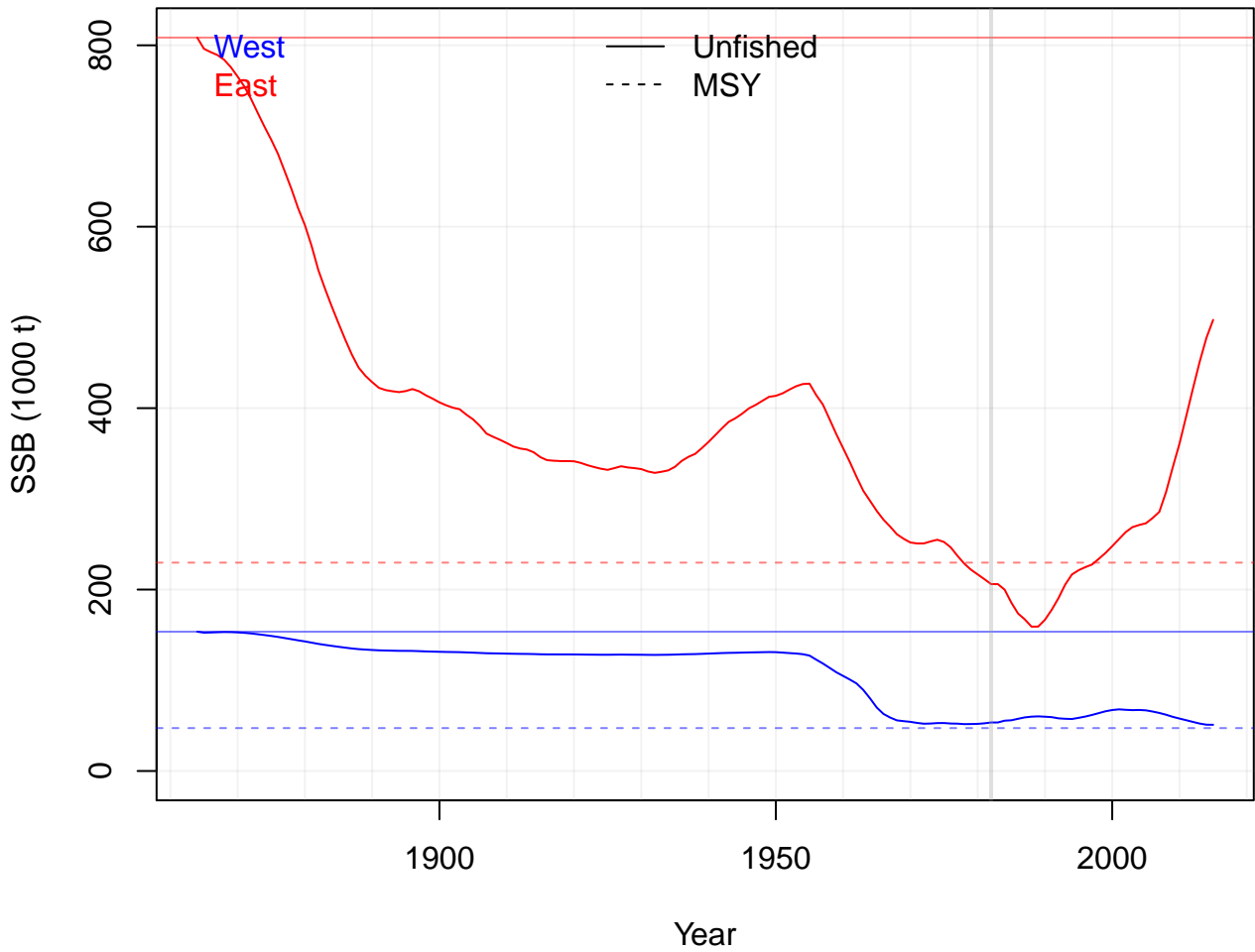
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Fits to FI indices of relative abundance

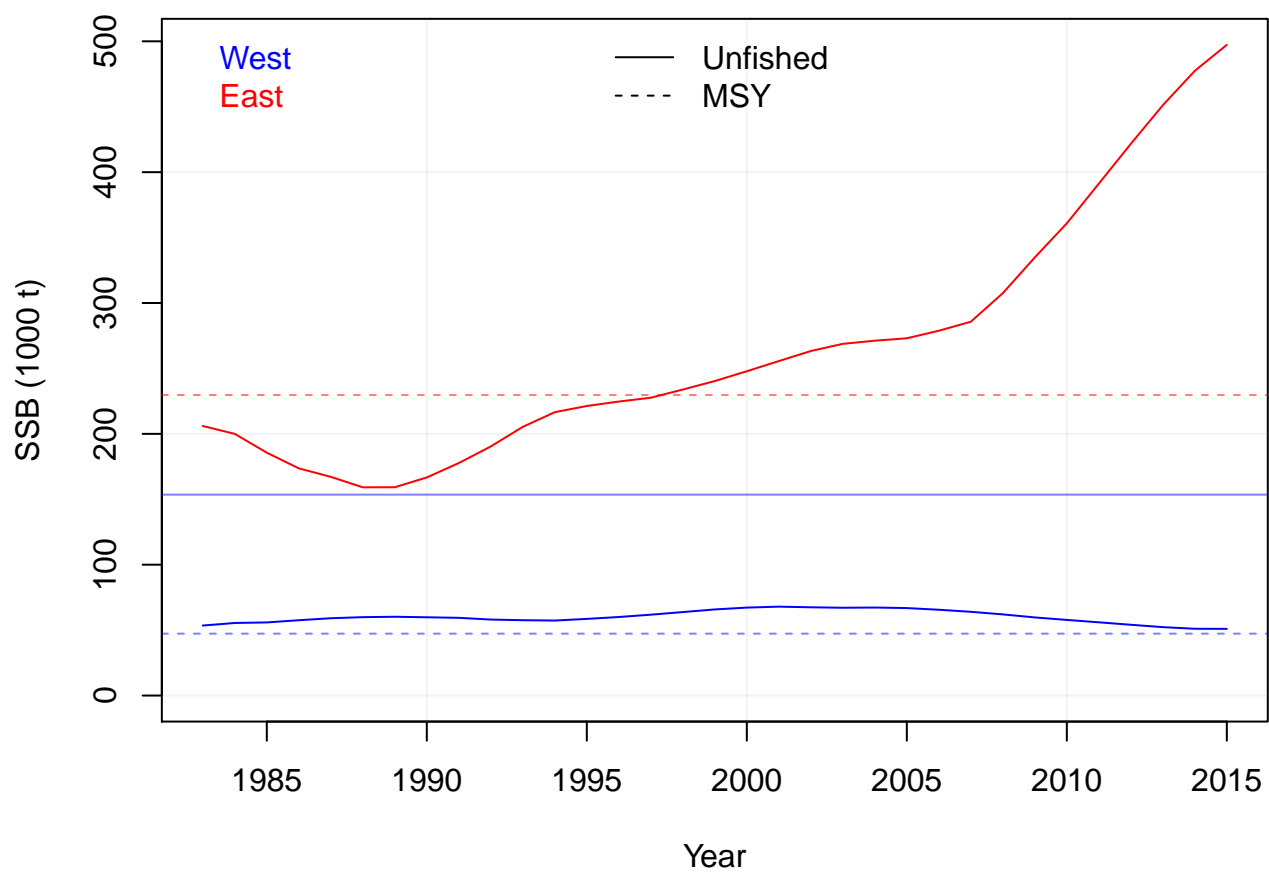


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Historical Spawning biomass



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## Warning in OMI@years:OMI@years[2]: numerical expression has 2 elements:  
## only the first used
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SSB, recruitment and F comparison with 2017 assessment (by East/West area, not East/West stock)

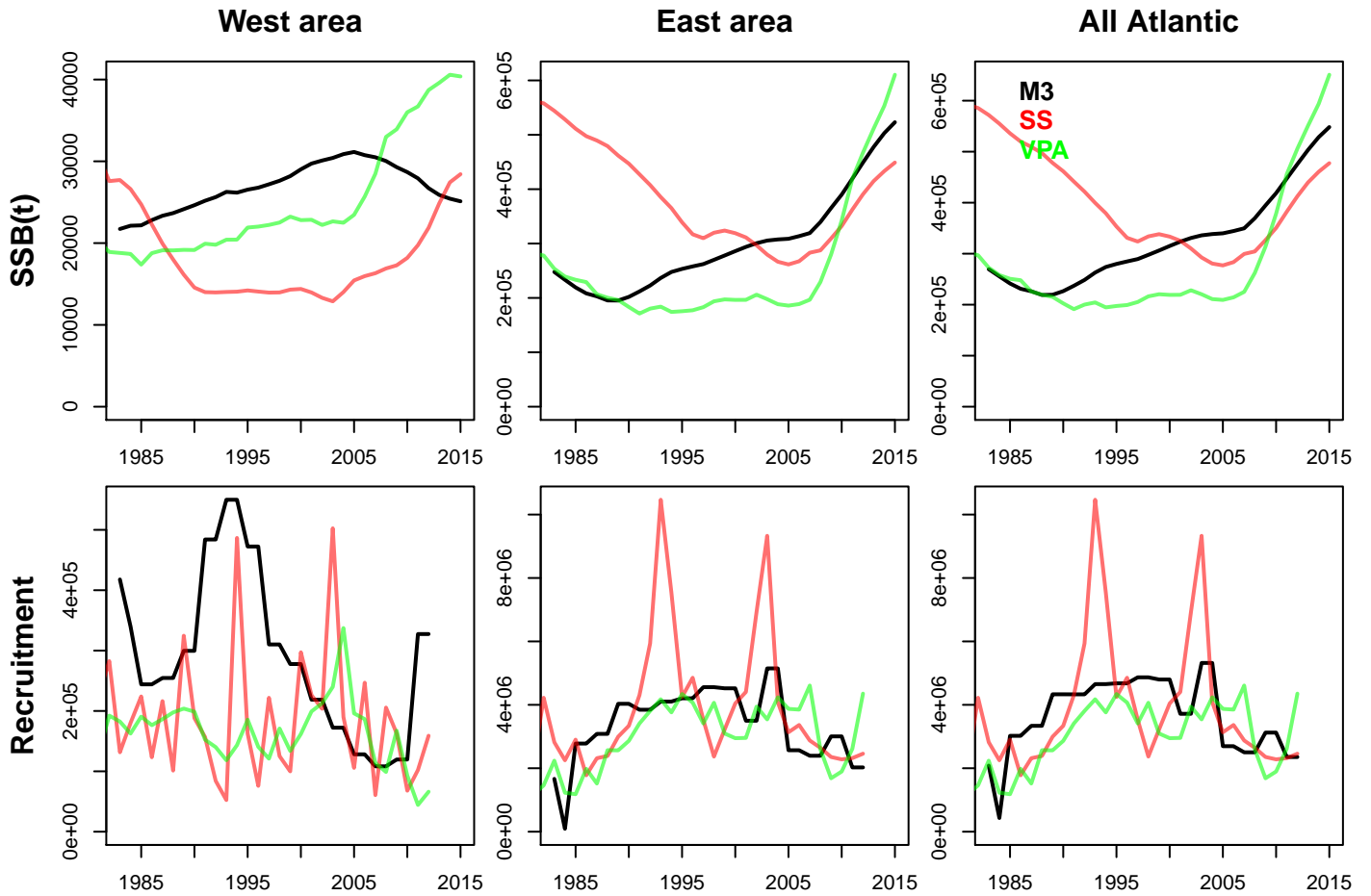


Figure 3. Regional comparisons (45deg W) with 2014 stock assessment. Note that annual estimates from the operating model are calculated from average of the seasonal predictions. Harvest rates from the operating model are based on total stock biomass not vulnerable biomass which is fleet specific (and hence may not be comparable with assessments).

Stock-recruitment relationships (R0 is unfished mean recruitment)

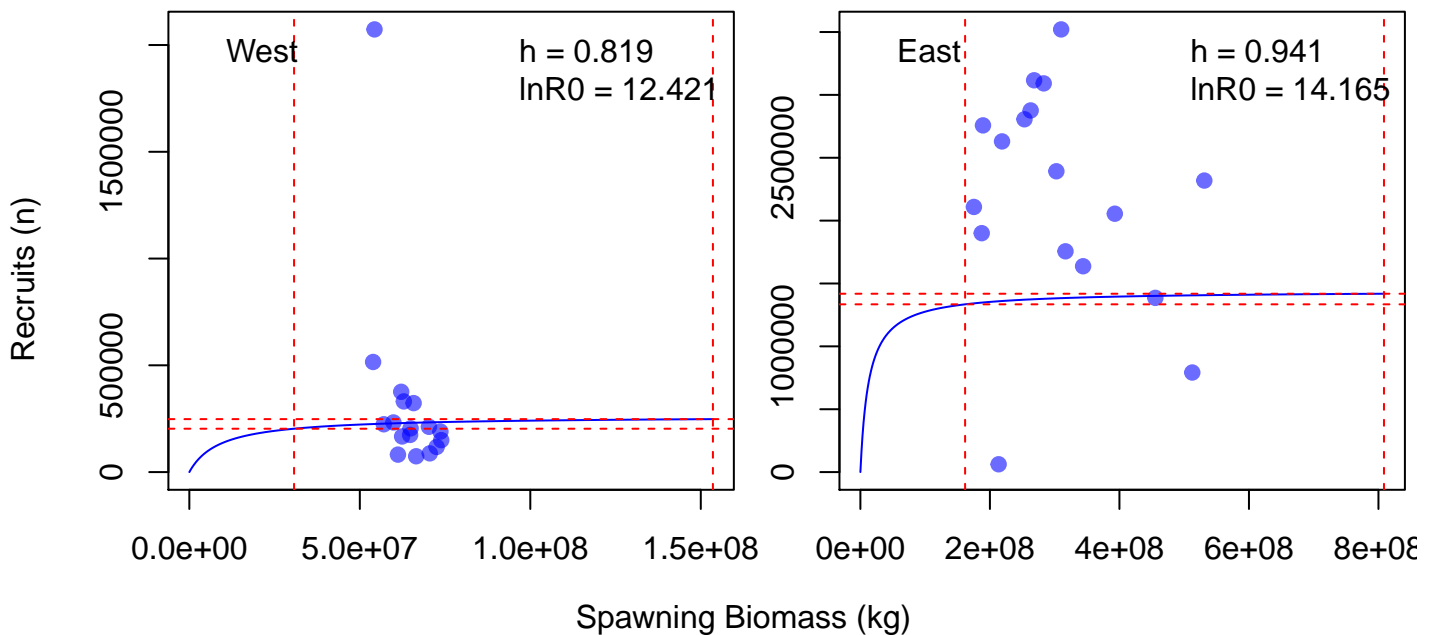


Figure 4. Model predicted pairs of SSB and recruitment(with a fitted Bev Holt for illustration)

MSY reference points (2013 for comparison with previous assessment)

Table 1. Reference points by stock.

| | MSY | FMSY _{ap} | UMSY | BMSY | SSBMSY | BMSY_B0 | SSBMSY_SSB0 | RMSY_R0 | F_FMSY | SSB_SSB0 |
|------|-------|--------------------|-------|--------|--------|---------|-------------|---------|--------|----------|
| East | 34520 | 0.310 | 0.131 | 262779 | 234704 | 0.310 | 0.284 | 0.962 | 0.591 | 0.558 |
| West | 4722 | 0.235 | 0.129 | 36728 | 34387 | 0.324 | 0.308 | 0.890 | 0.714 | 0.341 |

2014 Assessment MSY reference points (by East/West area)

Table 2. Where available, reference points from most recent assessments

| | MSY | FMSY _{ap} | UMSY | BMSY | SSBMSY | BMSY_B0 | SSBMSY_SSB0 | RMSY_R0 | F_FMSY | SSB_SSB0 |
|------|------|--------------------|------|------|--------|---------|-------------|---------|-----------|----------|
| East | - | - | - | - | - | - | - | - | 0.75 | 0.45 |
| West | 3056 | 0.23 | - | - | 13268 | - | - | - | 0.47-0.85 | 0.35-2.1 |

Current annual mean F-at-age profile, all fleets, seasons, areas

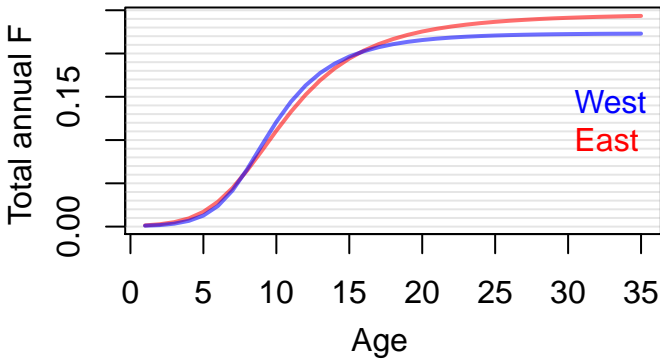


Figure 5. The current profile of F at age summed over all fleets.

Estimated size selectivity by fleet

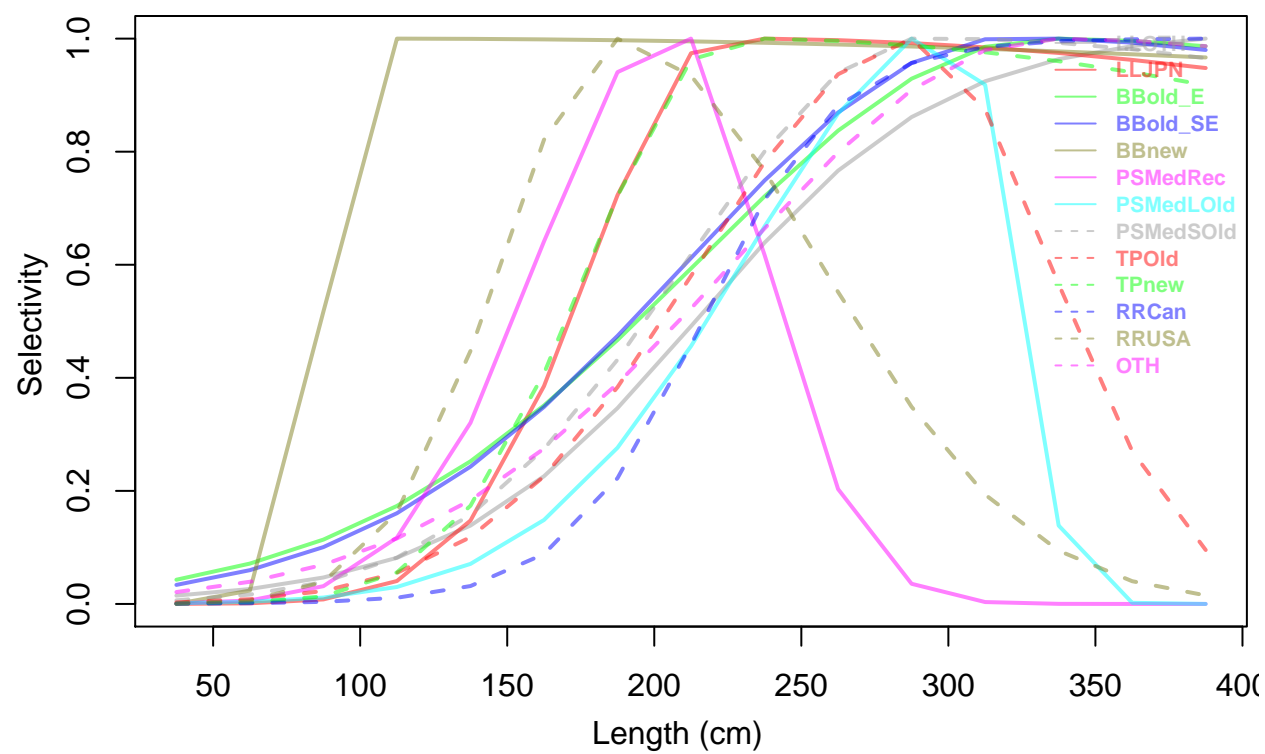


Figure 6.

Fit to aggregate catches

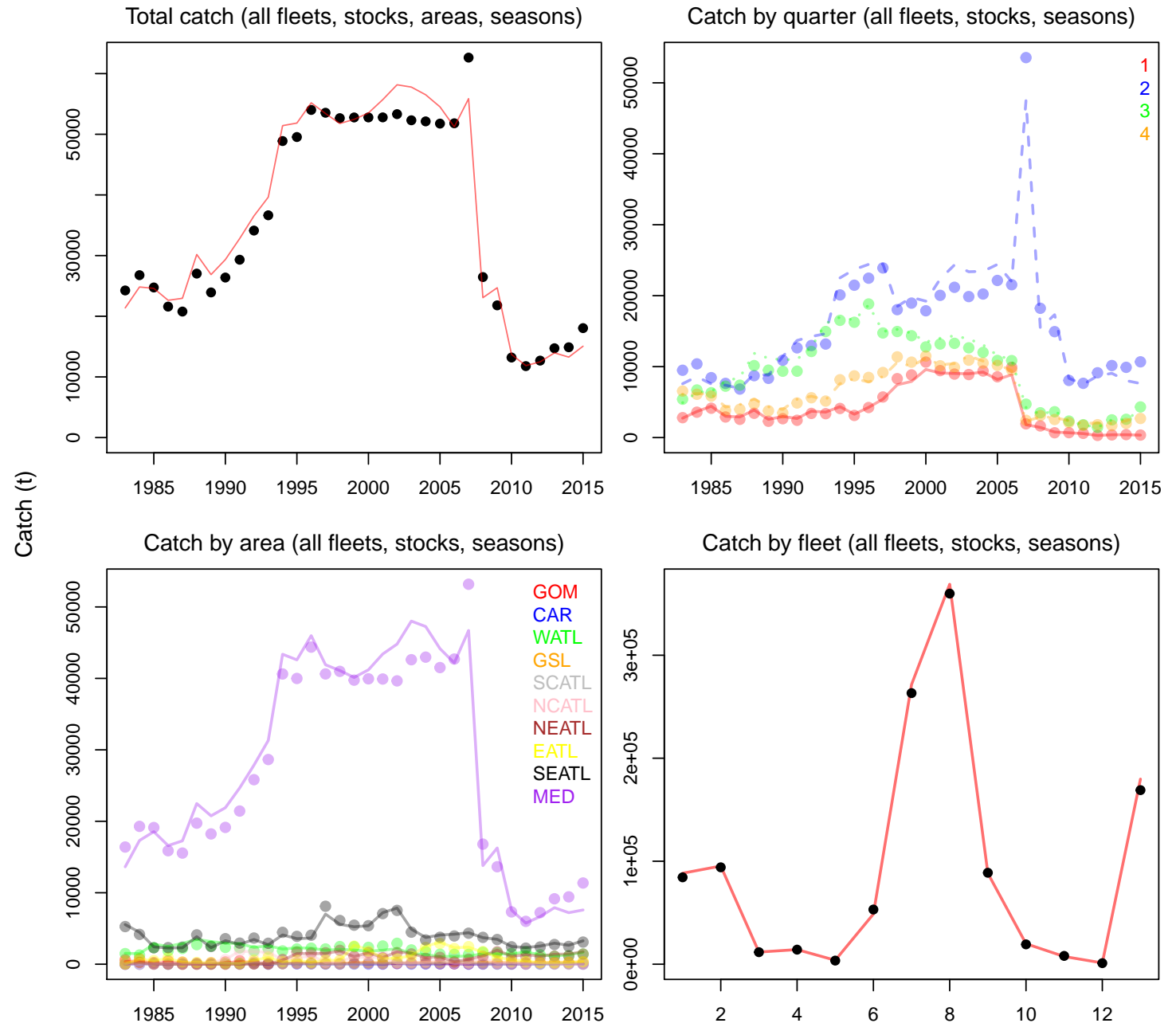


Figure 8. Fit to a observed total catches aggregated over various axes (lines = predicted, points = observed)

Fit to aggregate length composition

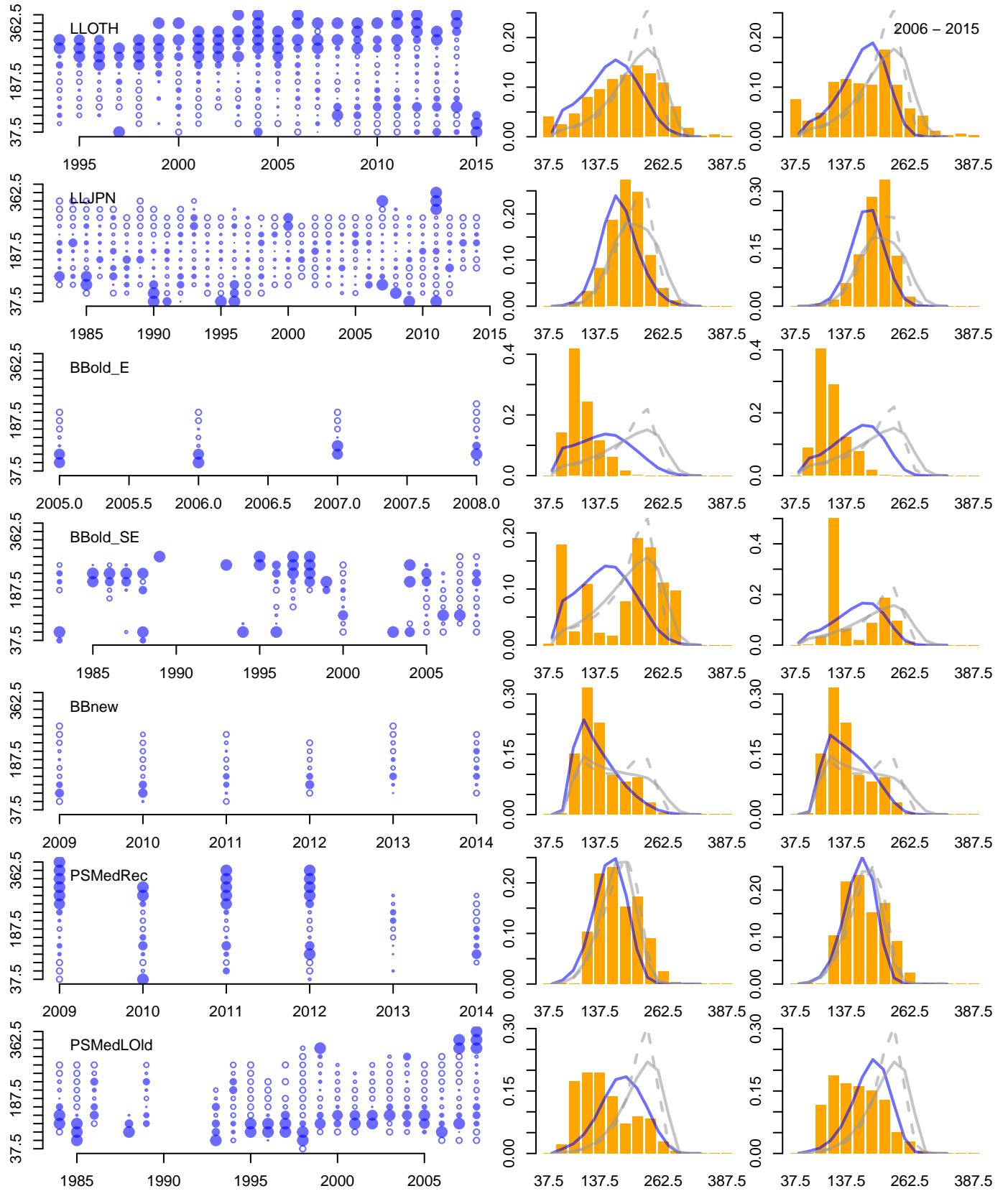


Figure 9a.Length composition residuals. Red points are negative Pearson residuals (predicted is higher than observed), blue circles are positive (predicted is lower than observed). Orange bars are observed, blue lines are model predictions.

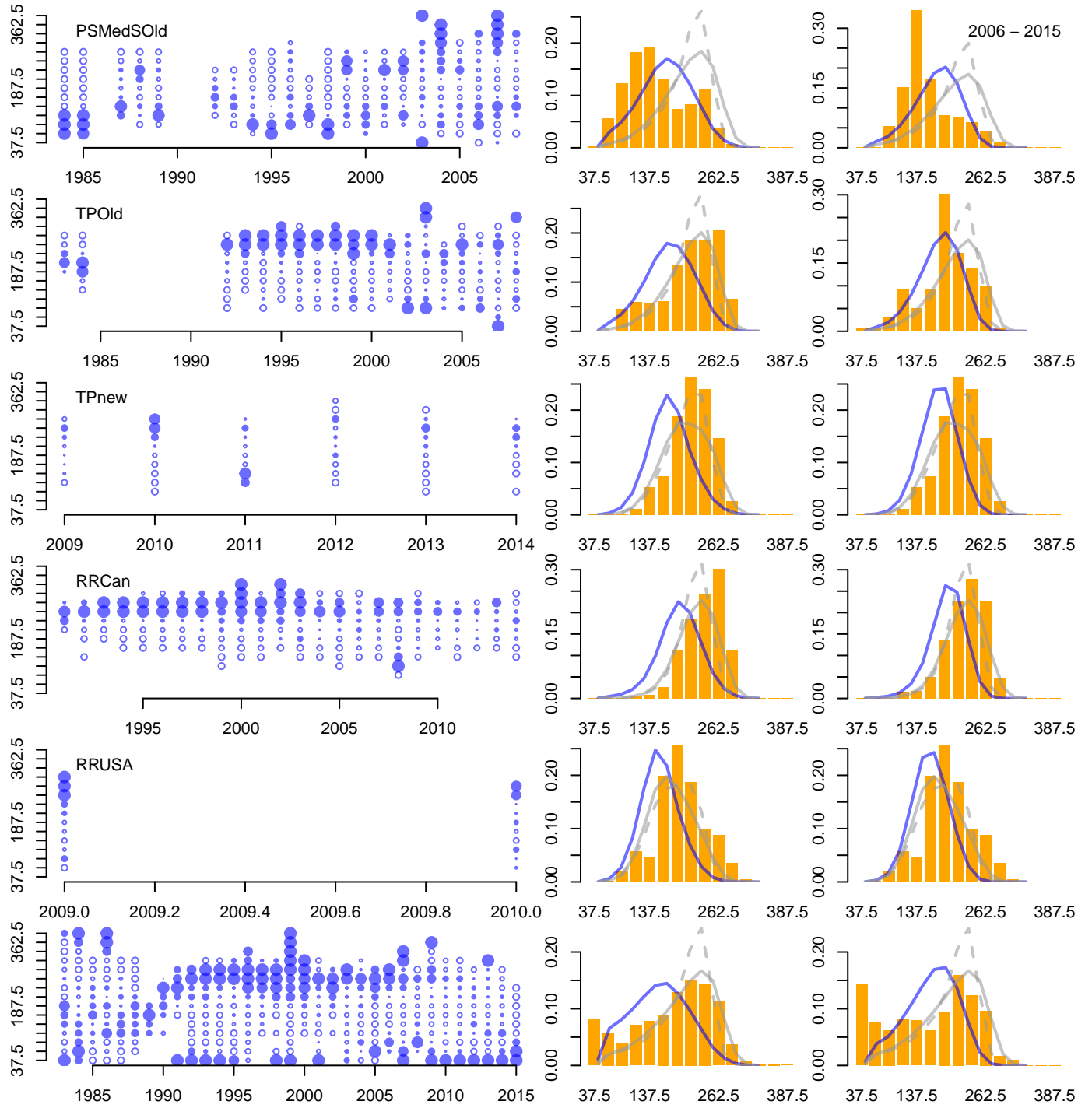
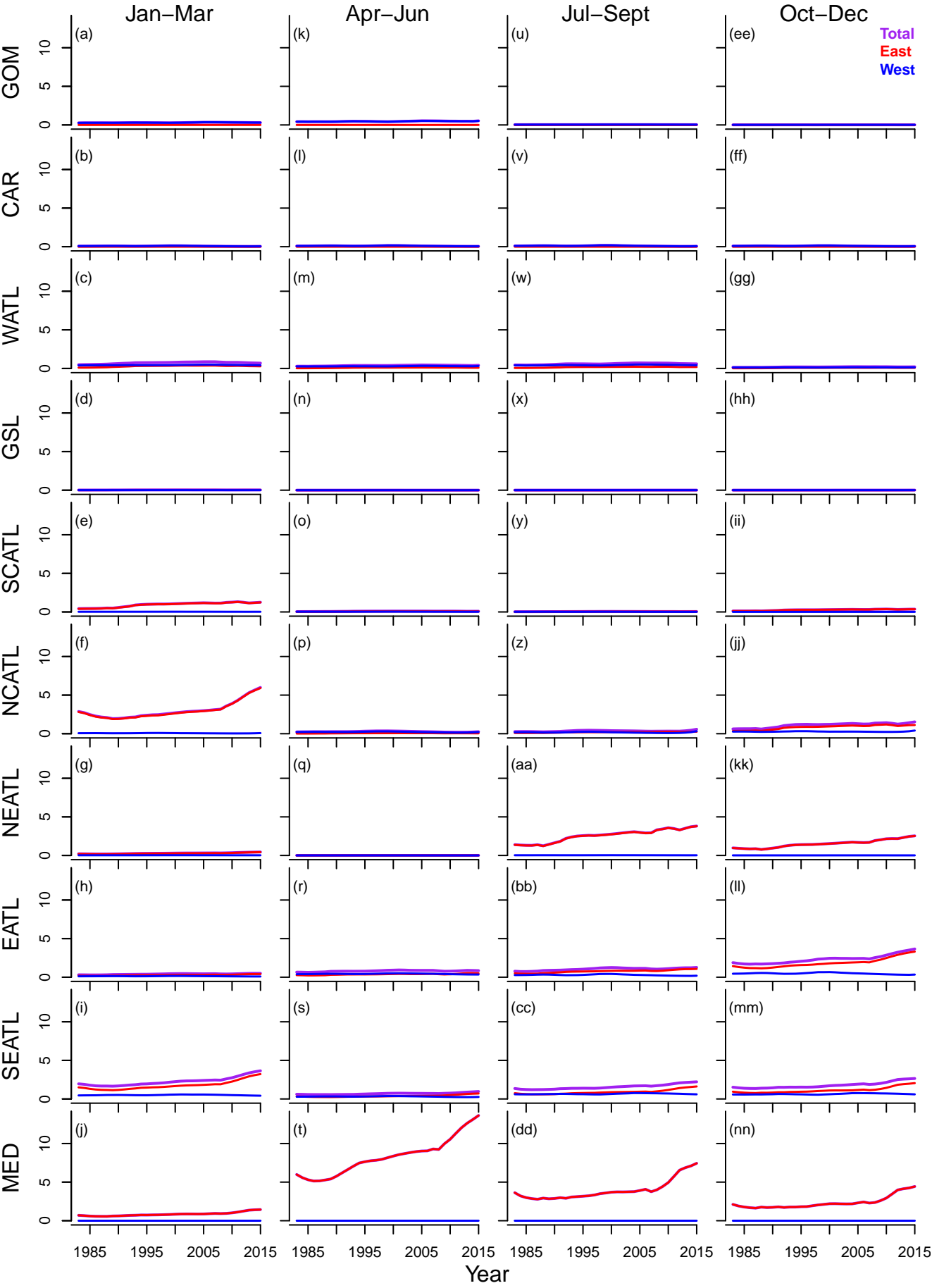


Figure 9b.Length composition residuals. Red points are negative Pearson residuals (predicted is higher than observed), blue circles are positive (predicted is lower than observed).Orange bars are observed, blue lines are model predictions.

Predicted seasonal and spatial biomass of Atlantic bluefin tuna



Estimated unfished movement

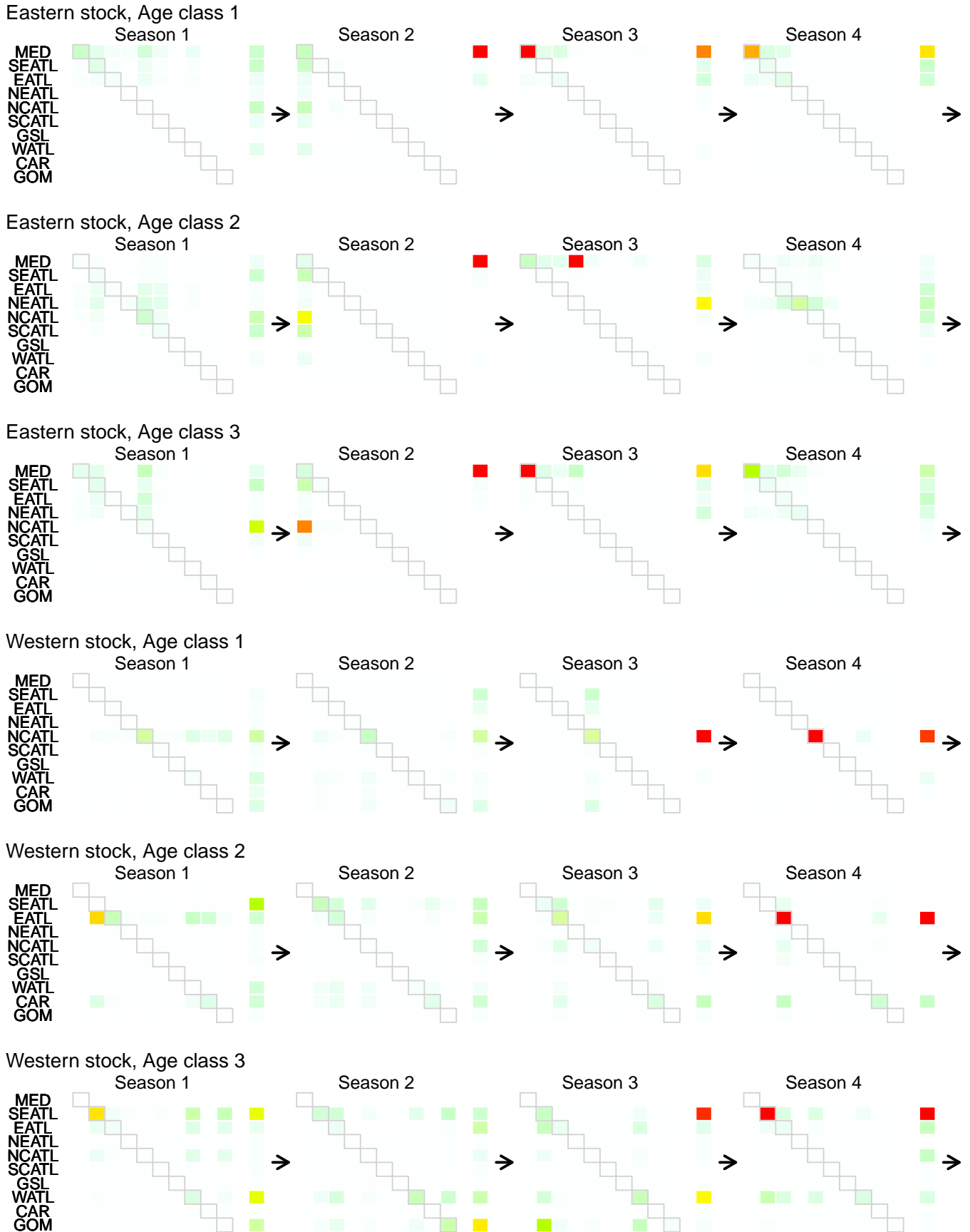


Figure 7. The implied asymptotic distribution of fish under unfished conditions (red-orange-green-white, more to less)