Recreational Data Changes for Bluefish, 2012-2021

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Major Recreational Data Changes

Estimates of recreational harvest and live releases for bluefish come from the NOAA Fisheries Marine Recreational Information Program (MRIP), which uses a combination of effort surveys and angler-intercept surveys to develop those estimates (Papacostas and Foster 2018). This program was historically known as the Marine Recreational Fishery Statistics Survey (MRFSS), but was renamed in 2013 as NOAA Fisheries began making improvements to the survey design and estimation methods to address concerns identified by a National Academies review of the program (NRC 2006).

In 2013, NOAA Fisheries began the transition from MRFSS to MRIP with changes to the Access Point Angler Intercept Survey (APAIS) methods, with improvements that included making all site assignments fixed and moving to 24-hour sampling instead of daytime sampling only. In addition, the estimation methods were updated to account for the fact that APAIS uses a clustered sample design with site selection weighted by the level of fishing pressure at the site, not a simple stratified random sample design as assumed in the MRFSS estimation method. The historical MRFSS estimates were recalculated for 2004-2012 using the new MRIP estimation methods at this time, but earlier data lacked the site-weight information needed to for the recalculation (Papacostas and Foster 2018).

In 2018, MRIP transitioned from the Coastal Household Telephone Survey (CHTS) of effort to a mail-based survey, the Fishing Effort Survey (FES), following three years of side-by-side benchmarking. The CHTS and the FES only estimate effort for the private angler mode; the for-hire mode is covered by a separate survey, the For-Hire Survey (FHS). The FES produced consistently higher estimates of effort than the CHTS, so MRIP calibrated the historical estimates of catch and effort from the CHTS to the new scale of the FES estimates to provide a consistent time series (Papacostas and Foster, 2018). The calibration model included fixed annual and seasonal effects as well as random effects and included information on trends in state-specific population size for the full time series and the prevalence of wireless/cell phone only households by state from 2007-2014.

The 2013 changes to the APAIS were also incorporated into the calibration process, although resource constraints prevented MRIP from running the old and new APAIS designed concurrently as was done for the effort surveys. The 2013 calibration to account for the historical site weights in the estimation method was also updated to better account for the inconsistencies in the MRFSS intercept survey design and extended back to 1981 (Papacostas and Foster 2018).

For calibration comparisons, MRIP provided the uncalibrated historical estimates, estimates calibrated for APAIS changes only, and the fully calibrated estimates including both the FES and APAIS changes. The uncalibrated time series stops in 2017, since the CHTS was discontinued after that point.

In 2020, the COVID-19 pandemic interrupted APAIS data collection, but the FES was unaffected. As a result of COVID-19, 20 state MRIP partners suspended, reduced, or modified their in-person shoreside and at-sea catch rate surveys between March and August 2020. The degree of interruption varied from state to state. To estimate the 2020 catch, the 2020 intercepts were supplemented with data collected in 2018 and 2019. These proxy data were chosen to match the time, place, and fishing mode combinations that would have been sampled had the APAIS continued uninterrupted.

MRFSS vs. MRIP Estimates

The effects of the new estimation method on harvest and live releases varied from species to species; for bluefish the differences between the MRFSS and MRIP estimates of total catch were generally small and did not have a consistent bias from year to year; MRFSS estimates were within the 95% confidence intervals of the new MRIP estimates (Figure 1). However, the percent standard error (PSE) increased across all years, reflecting the fact that the previous estimation methods underestimated the variance of the catch because they did not correctly account for the clustered sampling design. The previous benchmark assessment for bluefish (NEFSC 2015) used the calibration recommended by the MRIP working group at the time, based on the average MRFSS-MRIP difference from 2004-2012, to adjust the historical MRFSS estimates of catch, but the overall difference in the historical time series was minimal.

APAIS and FES Calibration Comparisons

Coastwide Comparisons

On the Atlantic coast, calibrated estimates of effort were significantly, consistently higher than the uncalibrated estimates. The major driver of the change was the new effort survey; calibrating the estimates for the APAIS changes only produced minor changes from year to year, without any directional patterns (Figure 2). Fully calibrated estimates of effort were 206% higher than the uncalibrated estimates over the full time series, with the difference increasing in recent years (Table 1, Figure 3).

This increase in effort translated into an increase in total catch for bluefish, in both harvest and live releases. The overall trends in harvest and live releases were generally the same between the calibrated and uncalibrated time series, but the calibrated estimates were consistently higher (Figure 4 - Figure 8). The percent difference between calibrated and uncalibrated coastwide estimates of recreational harvest was 155% increase in terms of numbers of fish and a 95% increase in terms of weight, with the difference increasing in recent years (Table 1, Figure 5 and Figure 7). Live releases increased 199% over the time series, again with the difference increasing in recent years (Table 1, Figure 9).

The calibrated estimates of harvest in weight had a lower percent increase in weight because the average length and weight of a landed bluefish decreased due to the calibration process. In this case, the effects of the APAIS calibration were more noticeable, with decreases in length and weight due to the APAIS calibration especially in the early part of the time series; the FES calibrations added on reduced the average length and weight even further (Figure 10). Overall, the calibrated average length of a harvested bluefish was 15.2% lower and the calibrated average weight of a harvested bluefish was 26.4% lower than the uncalibrated estimates; in general, the difference was larger at the beginning of the time series (Figure 11).

Coastwide Comparisons by Mode

The magnitude of the calibration effects differed by mode. The For-Hire Survey was not affected by the transition to the FES. As a result, although there were minor changes due to the APAIS calibration, the overall estimate of for-hire effort did not change significantly due to the calibration process, while the private effort in the boat mode and the shore mode did increase significantly due to the FES transition (Table 2, Figure 12). The calibrated estimates of effort were approximately 5% lower for the for-hire mode, while the calibrated effort estimates were 103% higher for the private/rental boat mode and 355% higher for the shore mode over the time series (Table 2, Figure 13).

The different levels of effort changes by mode translated into different levels of harvest and live releases by mode. The overall trends in harvest and live releases were generally similar between the calibrated and uncalibrated time series, with smaller differences for the for-hire mode and more significant differences for the private/rental boat mode and the shore mode (Table 3 - Table 5, Figure 14 - Figure 19). Over the time-series, harvest from the for-hire mode increased by 31% in terms of numbers of fish (Table 3Table 2) and 48% in terms of weight (Table 4). Harvest from the private/rental boat mode increased by 72% in terms of numbers of fish (Table 3) and 68% in terms of weight (Table 4). Harvest from the shore mode increased by 316% in terms of numbers of fish (Table 3) and 261% in terms of weight (Table 4). Across the time-series, the calibrated estimates of live releases were 21.7% higher in the for-hire mode, 92% higher in the private/rental boat mode, and 335% higher in the shore mode (Table 5). The for-hire differences were greater at the start of the time-series while the differences in the private angler modes were greater at the end of the time series for both harvest and releases (Figure 15, Figure 17, and Figure 19).

The differences between harvest in numbers of fish were larger than the differences in weight of fish for the private angler modes but the reverse was true for the for-hire modes, due to differences in the patterns of changes in the mean size of fish by mode (Figure 20 - Figure 23). The mean size of fish decreased in the private angler modes, ranging from a 2% decrease in weight for the boat mode to a 34% decrease in weight for the shore mode. By contrast, the mean weight of fish increased by 20.8% in the combined party/charter mode, which accounted for the majority of for-hire harvest at the start of the time-series.

Calibration Comparisons by State, All Modes Combined

On a finer geographical scale, the overall pattern is similar: calibrated estimates of effort (Figure 24 and Figure 25), harvest of bluefish in numbers (Figure 26 - Figure 28), harvest of bluefish in weight (Figure 28Figure 29 - Figure 31), and live releases of bluefish (Figure 32 - Figure 34) were all higher than the uncalibrated estimates, with the main source of the difference coming from the FES calibration. However, the patterns and the magnitude of the differences varies from state to state.

Florida had the highest percent difference between calibrated and uncalibrated estimates of effort and total catch (Table 1). Calibrated estimates of total effort in Florida (Atlantic coast only) were 318% higher than uncalibrated estimates over the time series, while the other states' increases ranged from 114% to 247%. Calibrated estimates of recreational bluefish harvest in Florida (Atlantic coast only) were 503% higher than uncalibrated estimates in numbers of fish and 449% higher in weight over the time series, while the other states' percent increases averaged 119% in numbers of fish and 84.1% in weight. Calibrated estimates of recreational bluefish live releases in Florida (Atlantic coast only) were 548% higher than uncalibrated estimates, while the other states' percent increases averaged 146%.

Florida had the largest increases in absolute numbers as well, when averaged over the time series. Using the uncalibrated numbers, Florida ranked fifth for average live releases (697,476 fish per year) and sixth for average harvest (664,417 fish per year) for bluefish. Using calibrated numbers, Florida jumped to the top of the list, ranking first for average live releases (4.52 million fish per year) and second for average harvest (4.01 million fish per year) for bluefish. Other states generally stayed in the same order using calibrated vs. pre-calibrated numbers. New York, New Jersey, and North Carolina were the top three states for numbers of bluefish released alive and harvested using uncalibrated numbers, and remained in the top four along with Florida using the calibrated numbers. On the other hand, South Carolina had the second highest percent difference between calibrated and uncalibrated estimates of effort and total catch, but only moved from 10th most live releases to 9th most and stayed at 10th most harvest for the coast.

States also had different patterns in the increases across the time series. Several states, including Florida and New Jersey, showed a relatively flat percent increase in effort while other states like New York and North Carolina showed more of an increasing trend, with greater differences in the most recent years of the time series (Figure 25). The percent difference between calibrated and uncalibrated numbers for harvest and live releases also varied by state, with some states showing consistent increasing trends in the percent difference and others show high variability or no trend (Figure 28, Figure 31, and Figure 34).

Changes in the mean length and weight of recreationally harvested bluefish varied from state to state (Figure 35 - Figure 38). North Carolina and Connecticut saw a greater than 20% difference between calibrated and uncalibrated estimates in mean length over the time series, with calibrated mean lengths being less than the uncalibrated mean lengths, while the difference in other states was generally less than 10% and varied in direction. Differences in mean weight were greater, with North Carolina and Connecticut again showing the highest percent difference; differences in mean weight were greater than differences in mean length, but states were generally variable over time with few consistent biases.

Calibration Comparisons by State and Mode

Differences between calibrated and uncalibrated estimates of effort by mode at the state level showed similar patterns to the coastwide estimates by mode. Changes to the effort estimates in the for-hire mode were minimal, while changes to the private angler modes were larger, driven by the FES calibration, with the greatest percent increases seen in the shore mode (Table 2, Figure 39 and Figure 40).

Similarly, changes in recreational harvest in numbers, recreational harvest in weight, and live releases of bluefish were greatest in the shore mode across all states, although the overall patterns and magnitude of the changes varied from state to state (Table 3 - Table 5, Figure 41 - Figure 45). Florida had the largest percent increase across all states in catch both the private/rental boat mode and the shore mode, with the difference in harvest averaging 717% for harvest and 840% for live releases in the shore mode across the time series (Table 3 - Table 5).

For states that had significant differences in calibrated and uncalibrated estimates of mean weight and mean length (most notably North Carolina and Connecticut), the difference seems to be driven by changes in the shore mode and driven predominantly by the APAIS calibrations (Figure 47 - Figure 54). At the state and mode level, the FES calibration is not having a significant effect on the mean length or the mean weight; those differences are primarily due to the APAIS calibrations. However, at the coastwide level, the FES calibrations are having an impact (Figure 10), due to the increase in the proportion of bluefish caught in the shore mode in all states (Figure 55), as well as the increase in the proportion of harvest coming from the south Atlantic, especially Florida (Table 2, Figure 56). Bluefish landed from the shore mode and in south Atlantic states are generally smaller than bluefish landed in the other modes and in the north and mid-Atlantic states (Figure 57). Live releases of bluefish showed a similar pattern to harvest with a higher proportion of the total coming from shore mode (Figure 58) and the south Atlantic (Figure 59).

COVID-19 Imputed Data

MRIP reports what proportion of the 2020 estimates of harvest and live releases for each state came from imputed or proxy data (i.e., 2018 and 2019 records from the same strata that were unsampled or under-sampled in 2020). For bluefish, the contribution of imputed data to harvest and release rates varied by state, ranging from 0% for the northern-most states to imputed data contributing 83% of the observed harvest rates in New Jersey and Virginia (Table 6). Coastwide, there was a moderate impact, with 24% of observed harvest catch rates and 33% of live release rates coming from imputed data in 2020 (Table 6).

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National Research Council. 2006. Review of Recreational Fisheries Survey Methods. The National Academies Press, Washington, DC.

Northeast Fisheries Science Center. 2015. 60th Northeast Regional Stock Assessment Workshop (60th SAW) assessment report. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA.

Papacostas, K. J., and J. Foster. 2018. The Marine Recreational Information Program Survey Design and Statistical Methods for Estimation of Recreational Fisheries Catch and Effort. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Office of Science and Technology. Available online at: https://media.fisheries.noaa.gov/2021-09/MRIP-Survey-Design-and-Statistical-Methods-2021-09-15.pdf

Tables

Table 1: Average percent difference* between calibrated and uncalibrated estimates of total effort and bluefish harvest and live releases on the Atlantic coast and by state.

	Effort (Angler Trips)	Harvest (Numbers)	Harvest (Weight)	Live Releases (Numbers)
Coastwide	**206%**	**155%**	**95%**	**199%**
Maine	131%	64%	68%	49%
New Hampshire	114%	13%	10%	69%
Massachusetts	186%	95%	76%	106%
Rhode Island	186%	108%	32%	186%
Connecticut	122%	112%	43%	107%
New York	164%	150%	104%	180%
New Jersey	156%	121%	110%	187%
Delaware	137%	102%	95%	162%
Maryland	158%	46%	50%	90%
Virginia	140%	112%	90%	96%
North Carolina	187%	167%	107%	204%
South Carolina	247%	305%	236%	311%
Georgia	223%	147%	72%	158%
Florida	318%	503%	449%	548%

*Average percent difference is calculated using the ratio of means approach: average percent difference across all years = (sum(Calibrated Estimates) – sum(Uncalibrated Estimates))/sum (Uncalibrated Estimates).

Table 2: Average percent difference* between calibrated and uncalibrated estimates of total effort (in numbers of angler-trips) by mode on the Atlantic coast and by state.

	For Hire	Private/Rental Boat	Shore
Coastwide	**-5%**	**103%**	**355%**
Maine	4%	101%	178%
New Hampshire	-10%	90%	229%
Massachusetts	-1%	87%	334%
Rhode Island	-31%	82%	307%
Connecticut	2%	67%	229%
New York	-1%	102%	304%
New Jersey	-1%	95%	294%
Delaware	-8%	62%	255%
Maryland	-11%	119%	255%
Virginia	8%	85%	258%
North Carolina	-22%	90%	256%
South Carolina	-8%	109%	400%
Georgia	-7%	120%	378%
Florida	-3%	128%	532%

*Average percent difference is calculated using the ratio of means approach: average percent difference across all years = (sum(Calibrated Estimates) – sum(Uncalibrated Estimates))/sum (Uncalibrated Estimates).

Table 3: Average percent difference* between calibrated and uncalibrated estimates of recreational bluefish harvest in numbers by mode on the Atlantic coast and by state.

	For Hire	Private/Rental Boat	Shore
Coastwide	**31%**	**72%**	**316%**
Maine	19%	51%	279%
New Hampshire	-34%	47%	482%
Massachusetts	9%	48%	256%
Rhode Island	-7%	40%	328%
Connecticut	-16%	54%	219%
New York	79%	79%	256%
New Jersey	87%	71%	277%
Delaware	10%	41%	211%
Maryland	-17%	73%	111%
Virginia	110%	57%	232%
North Carolina	-48%	62%	281%
South Carolina	137%	155%	364%
Georgia	-21%	122%	188%
Florida	32%	151%	717%

*Average percent difference is calculated using the ratio of means approach: average percent difference across all years = (sum(Calibrated Estimates) – sum(Uncalibrated Estimates))/sum (Uncalibrated Estimates).

Table 4: Average percent difference* between calibrated and uncalibrated estimates of recreational bluefish harvest in weight by mode on the Atlantic coast and by state.

	For Hire	Private/Rental Boat	Shore
Coastwide	**50%**	**88%**	**286%**
Maine	12%	55%	371%
New Hampshire	-28%	43%	287%
Massachusetts	21%	50%	207%
Rhode Island	9%	37%	202%
Connecticut	-14%	61%	128%
New York	92%	87%	223%
New Jersey	122%	79%	191%
Delaware	52%	37%	213%
Maryland	29%	62%	83%
Virginia	174%	41%	134%
North Carolina	-71%	30%	284%
South Carolina	81%	198%	266%
Georgia	25%	48%	154%
Florida	13%	159%	652%

*Average percent difference is calculated using the ratio of means approach: average percent difference across all years = (sum(Calibrated Estimates) – sum(Uncalibrated Estimates))/sum (Uncalibrated Estimates).

Table 5: Average percent difference* between calibrated and uncalibrated estimates of recreational bluefish live releases in numbers by mode on the Atlantic coast and by state.

	For Hire	Private/Rental Boat	Shore
Coastwide	**22%**	**92%**	**335%**
Maine	-32%	48%	62%
New Hampshire	-24%	50%	391%
Massachusetts	7%	64%	216%
Rhode Island	-4%	86%	330%
Connecticut	13%	70%	198%
New York	19%	93%	283%
New Jersey	67%	112%	292%
Delaware	-11%	62%	221%
Maryland	-28%	85%	121%
Virginia	40%	54%	202%
North Carolina	-5%	80%	281%
South Carolina	62%	120%	442%
Georgia	-8%	114%	298%
Florida	20%	173%	840%

*Average percent difference is calculated using the ratio of means approach: average percent difference across all years = (sum(Calibrated Estimates) – sum(Uncalibrated Estimates))/sum (Uncalibrated Estimates).

Table 6: Percent contribution of imputed data to 2020 bluefish catch rates for the Atlantic coast and by state.

	Observed Harvest Rate (Type A)	Reported Harvest Rate (Type B1)	Released Alive Rate (Type B2)
Coastwide	**24%**	**44%**	**33%**
Maine	.	.	.
New Hampshire	0%	0%	0%
Massachusetts	0%	0%	0%
Rhode Island	1%	0%	0%
Connecticut	32%	3%	11%
New York	18%	11%	4%
New Jersey	83%	58%	23%
Delaware	56%	0%	13%
Maryland	5%	22%	12%
Virginia	83%	76%	64%
North Carolina	63%	63%	52%
South Carolina	32%	59%	81%
Georgia	66%	0%	46%
Florida	11%	9%	21%

Figures

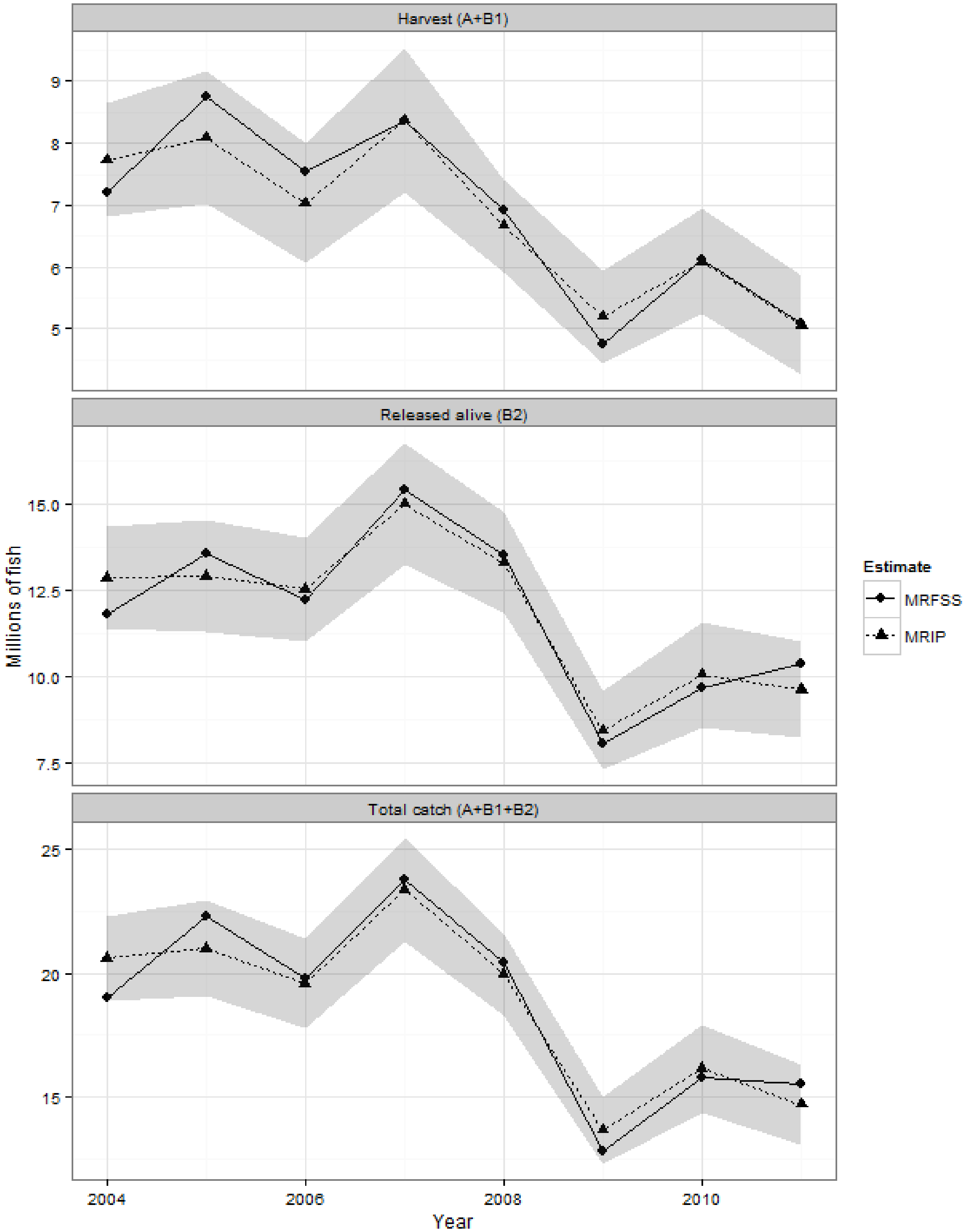

Figure 1: Comparison of MRFSS and MRIP estimates from 2004 - 2011 plotted with the 95% confidence intervals of the MRIP estimates (from NEFSC 2015).

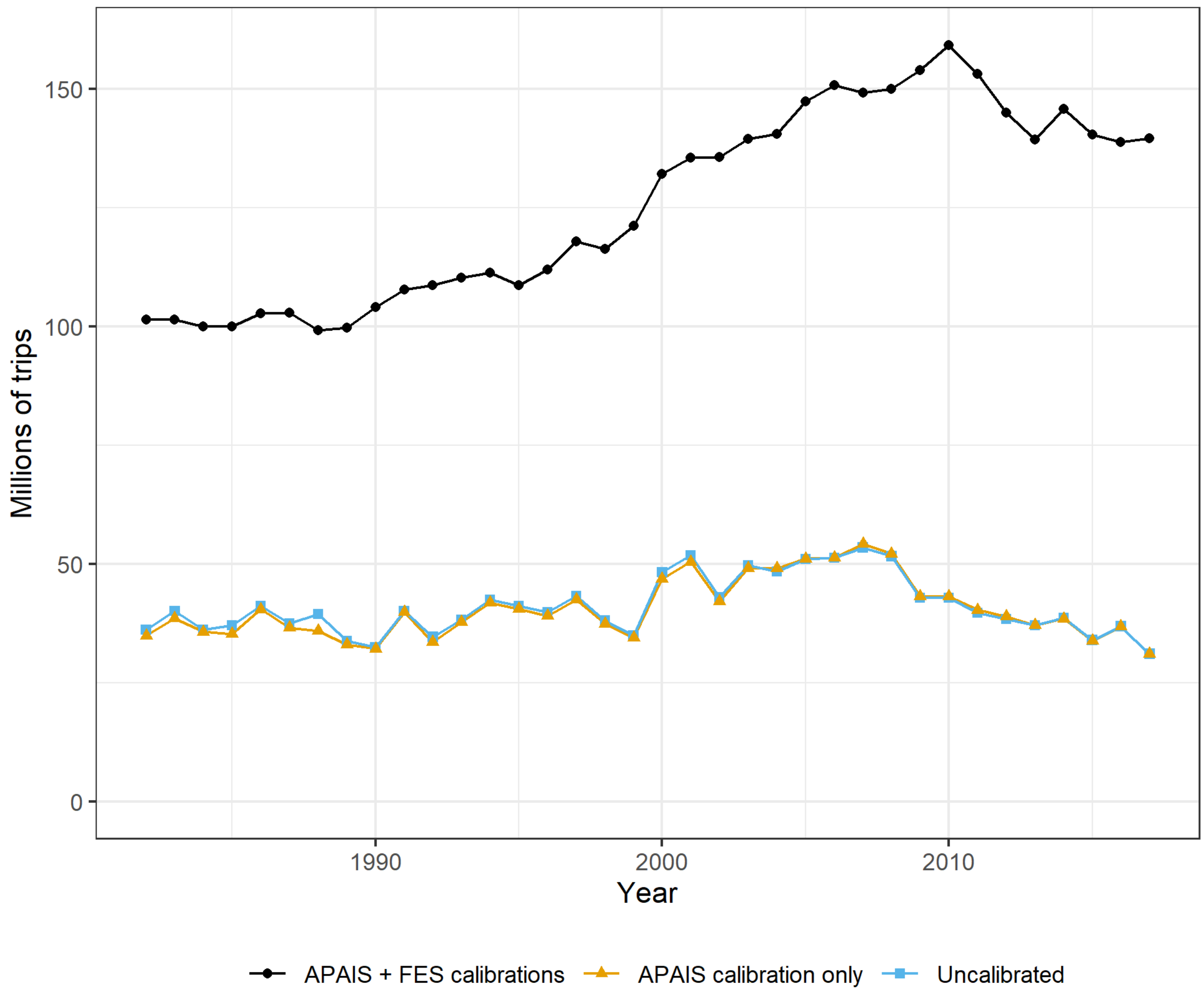

Figure 2: Comparison of calibrated and uncalibrated MRIP estimates of total effort for the Atlantic coast.

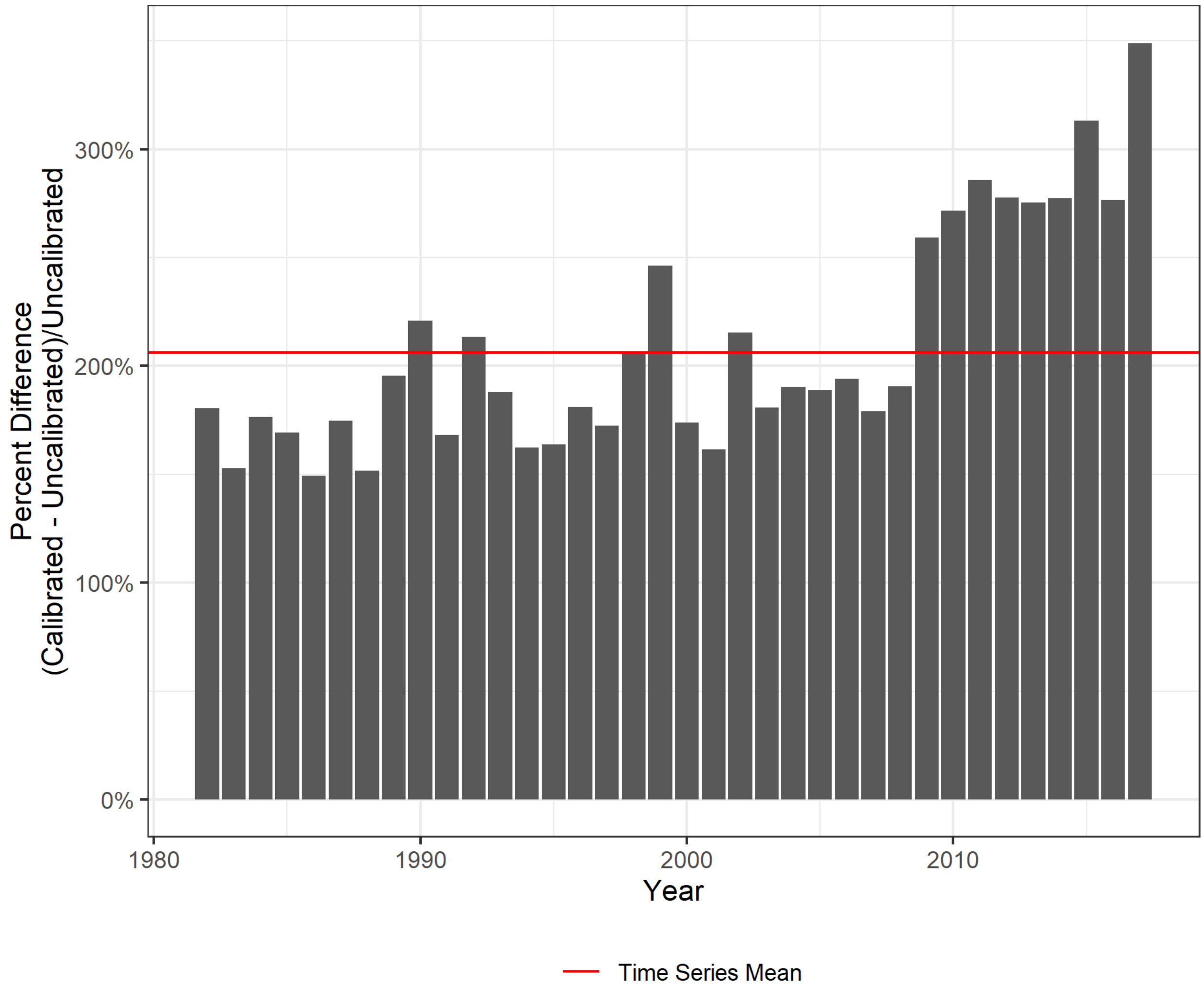

Figure 3: Percent difference between calibrated and uncalibrated MRIP estimates of total effort for the Atlantic coast plotted with the time series mean.

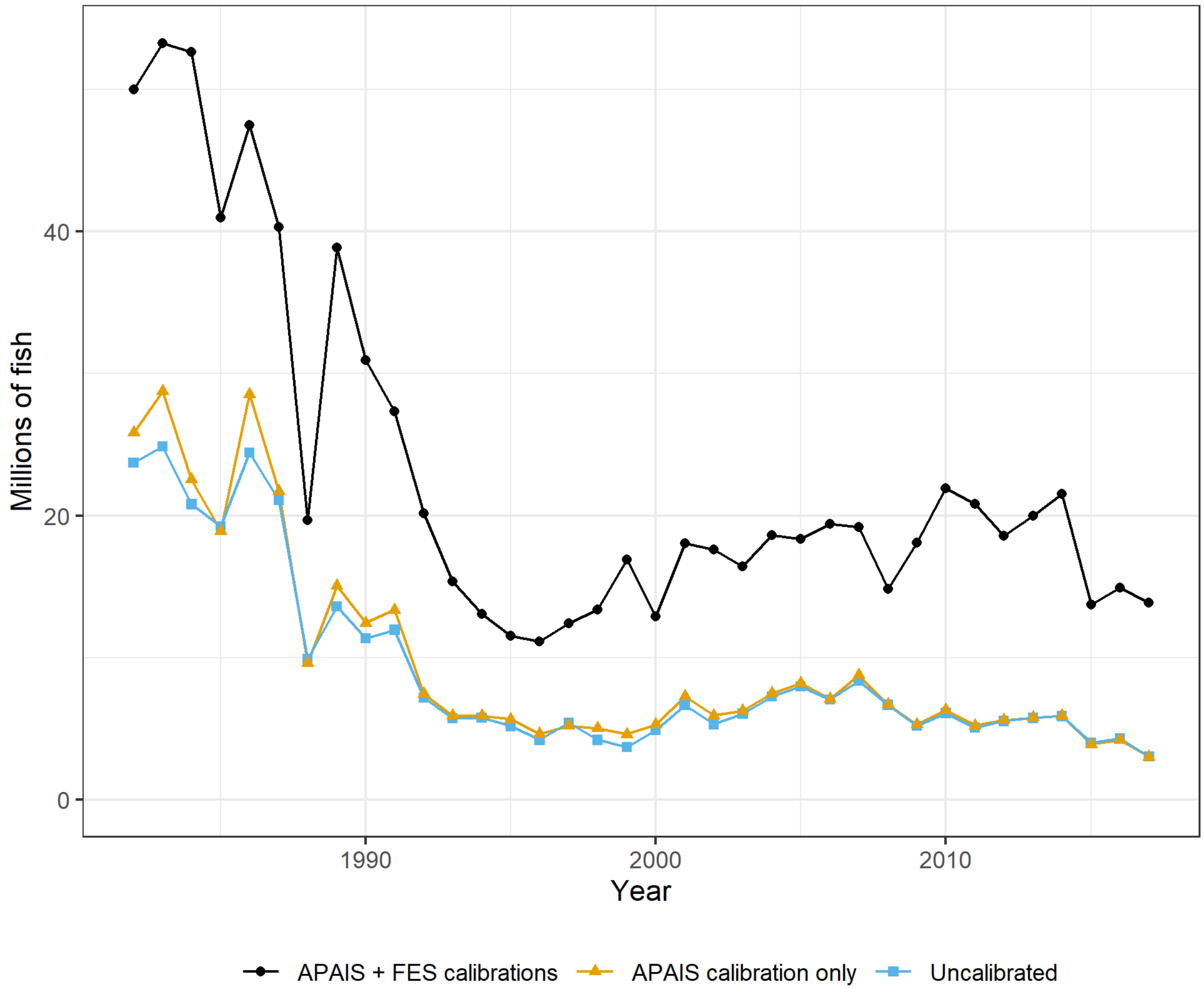

Figure 4: Comparison of calibrated and uncalibrated MRIP estimates of bluefish recreational harvest in numbers of fish for the Atlantic coast.

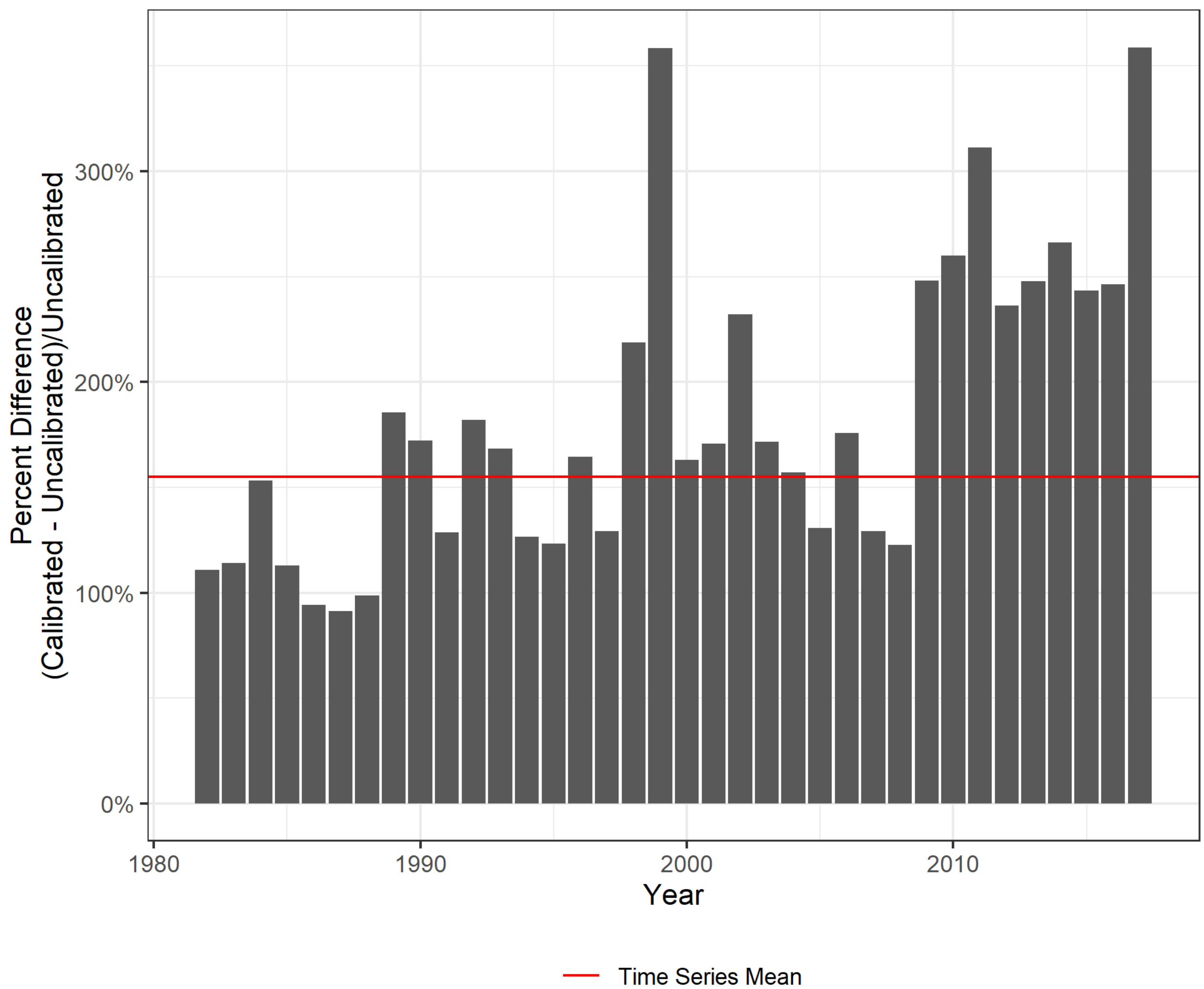

Figure 5: Percent difference between calibrated and uncalibrated MRIP estimates of bluefish recreational harvest in numbers of fish for the Atlantic coast plotted with the time-series mean.

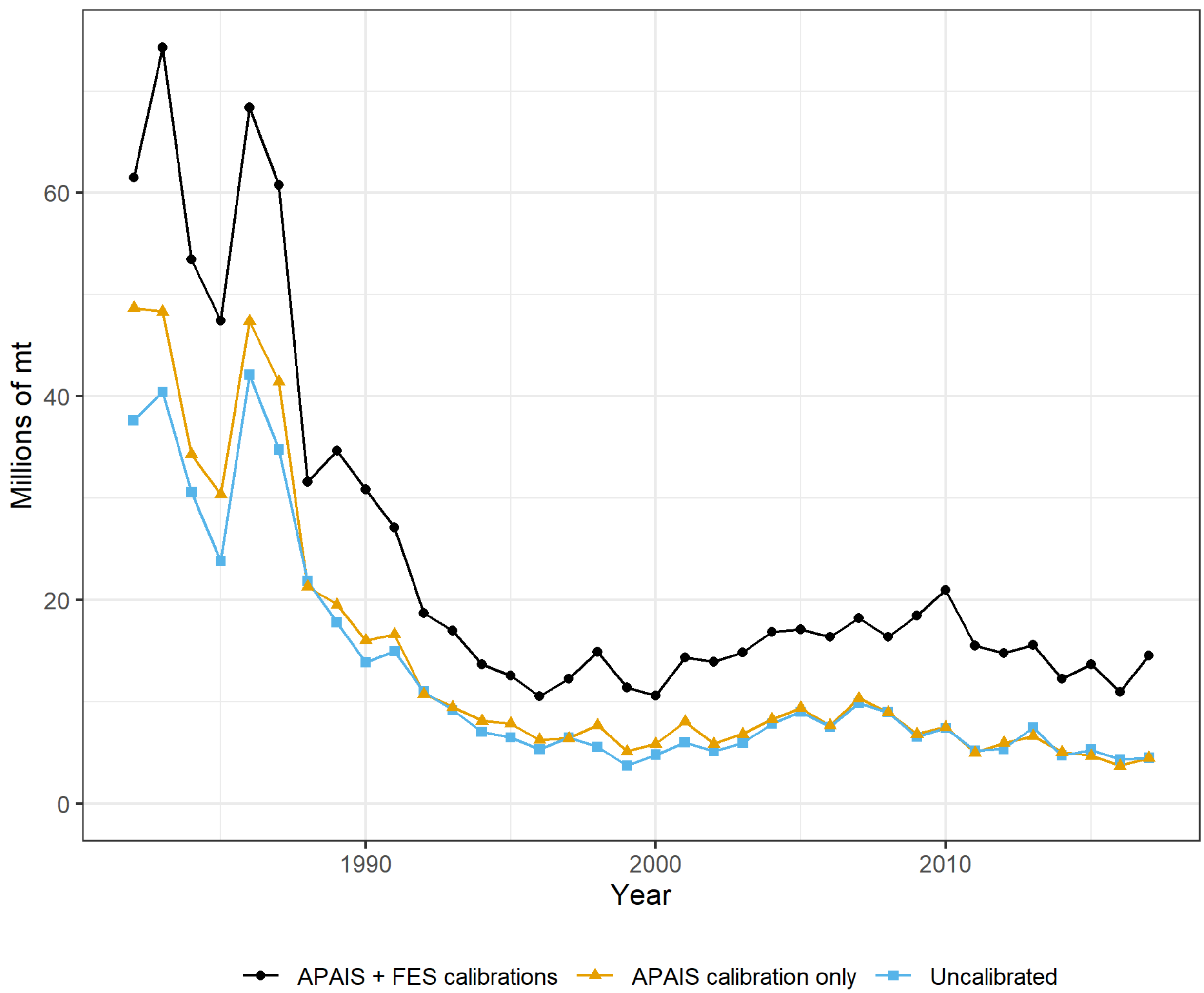

Figure 6: Comparison of calibrated and uncalibrated MRIP estimates of bluefish recreational harvest in weight for the Atlantic coast.

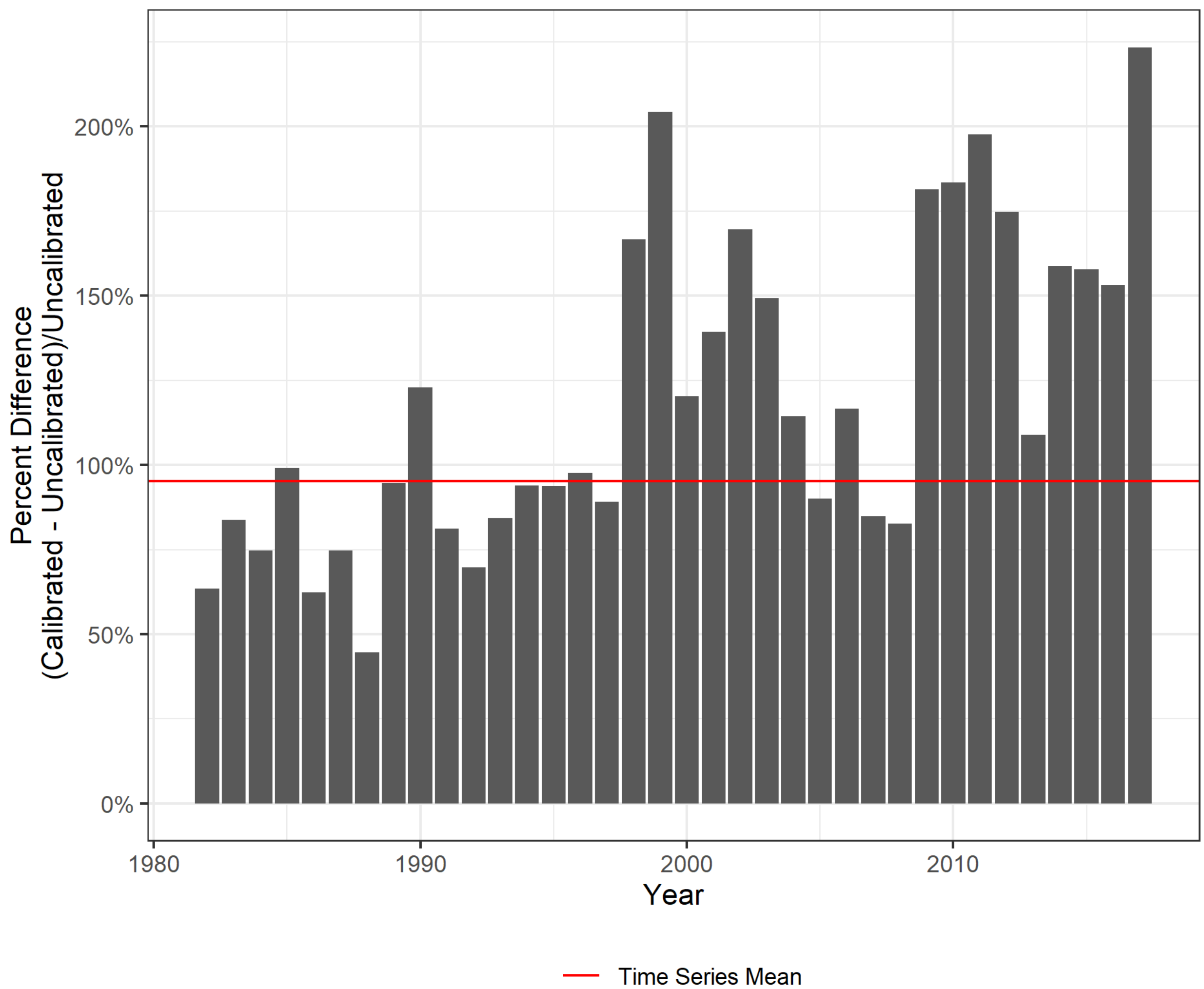

Figure 7: Percent difference between calibrated and uncalibrated MRIP estimates of bluefish recreational harvest in weight for the Atlantic coast plotted with the time series mean.

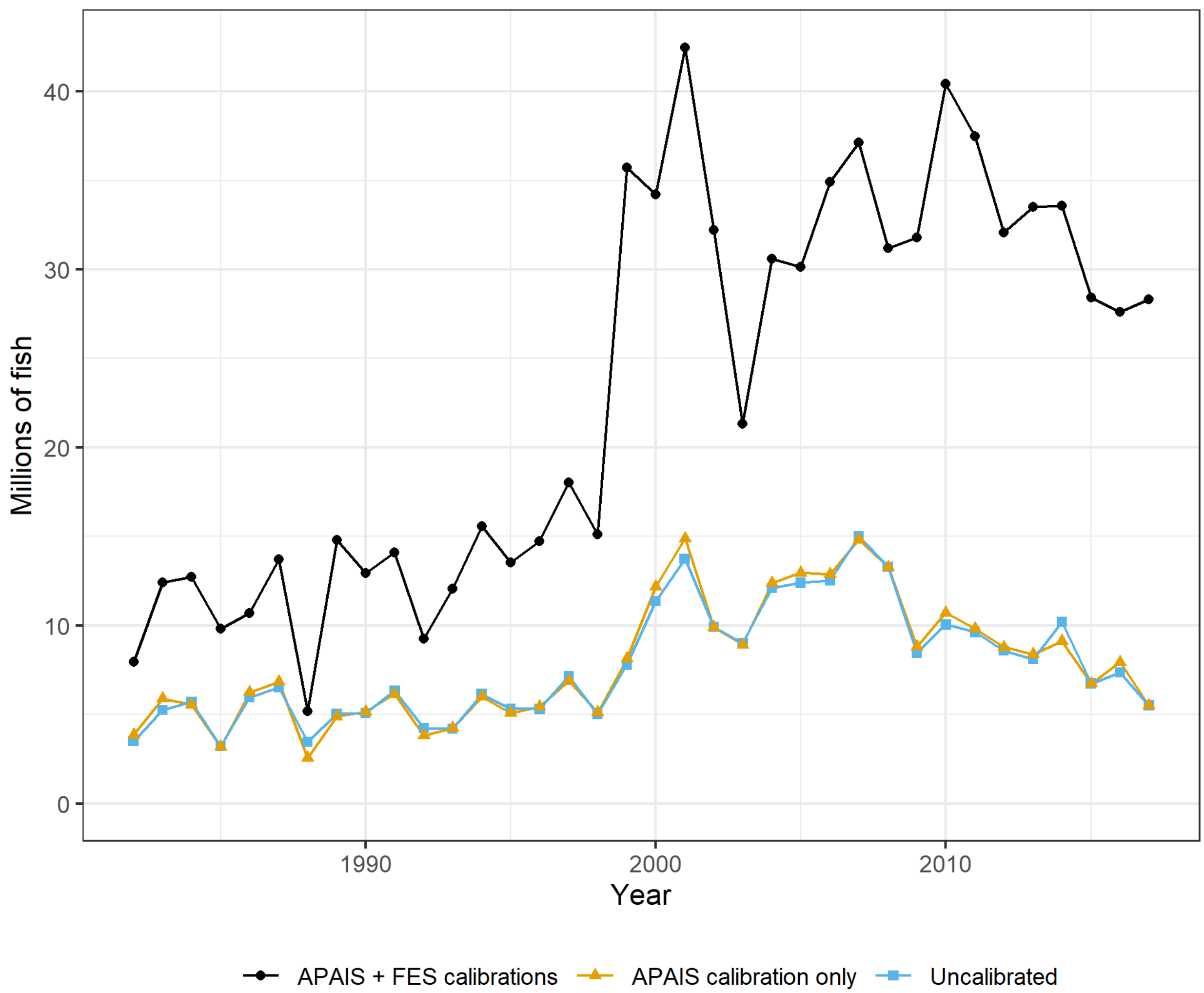

Figure 8: Comparison of calibrated and uncalibrated MRIP estimates of bluefish recreational live releases for the Atlantic coast.

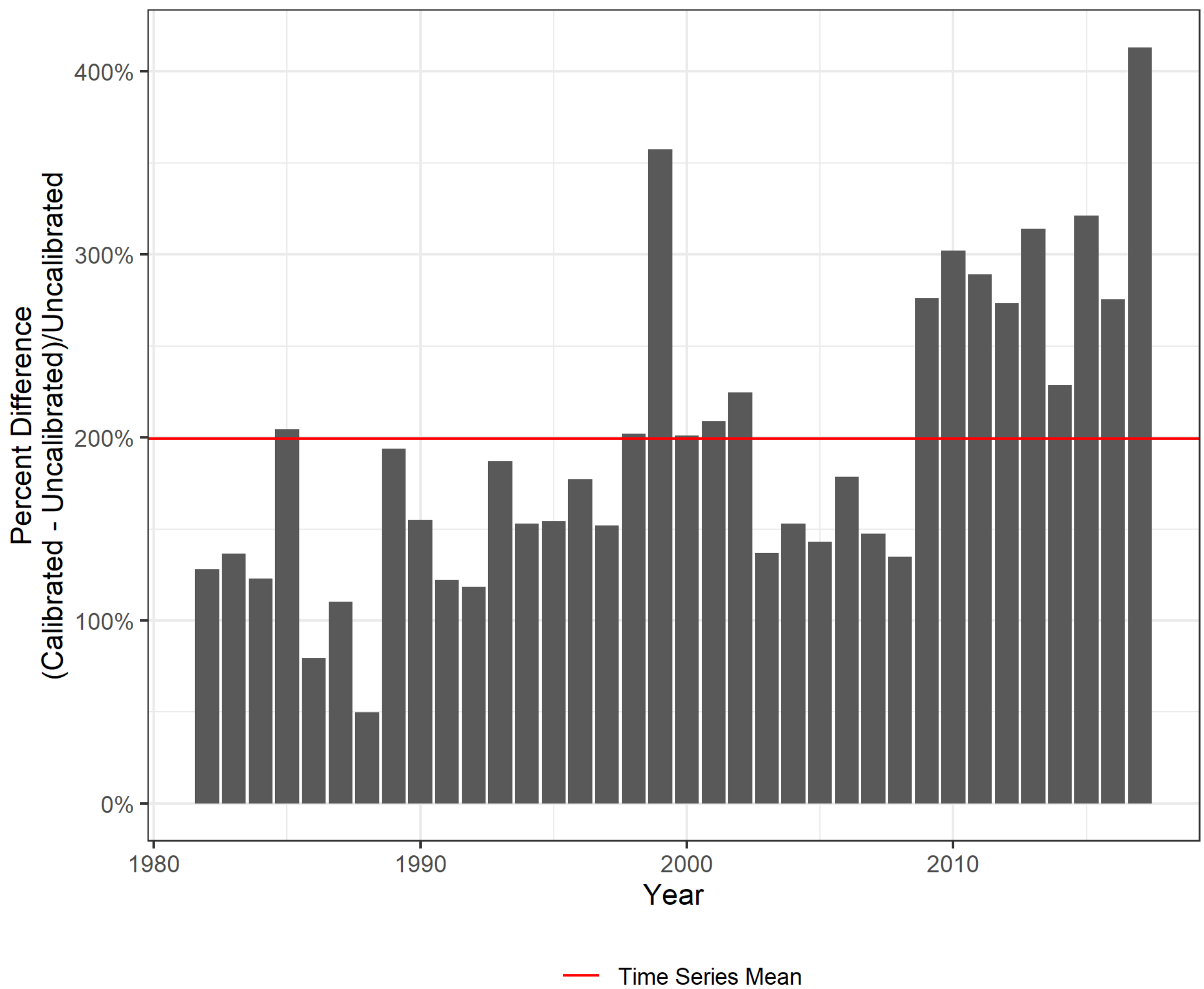

Figure 9: Percent difference between calibrated and uncalibrated MRIP estimates of bluefish recreational live releases for the Atlantic coast plotted with the time series mean.

Figure 10: Comparison of calibrated and uncalibrated MRIP estimates of the average length (top) and the average weight (bottom) of recreationally harvested bluefish for the Atlantic coast.

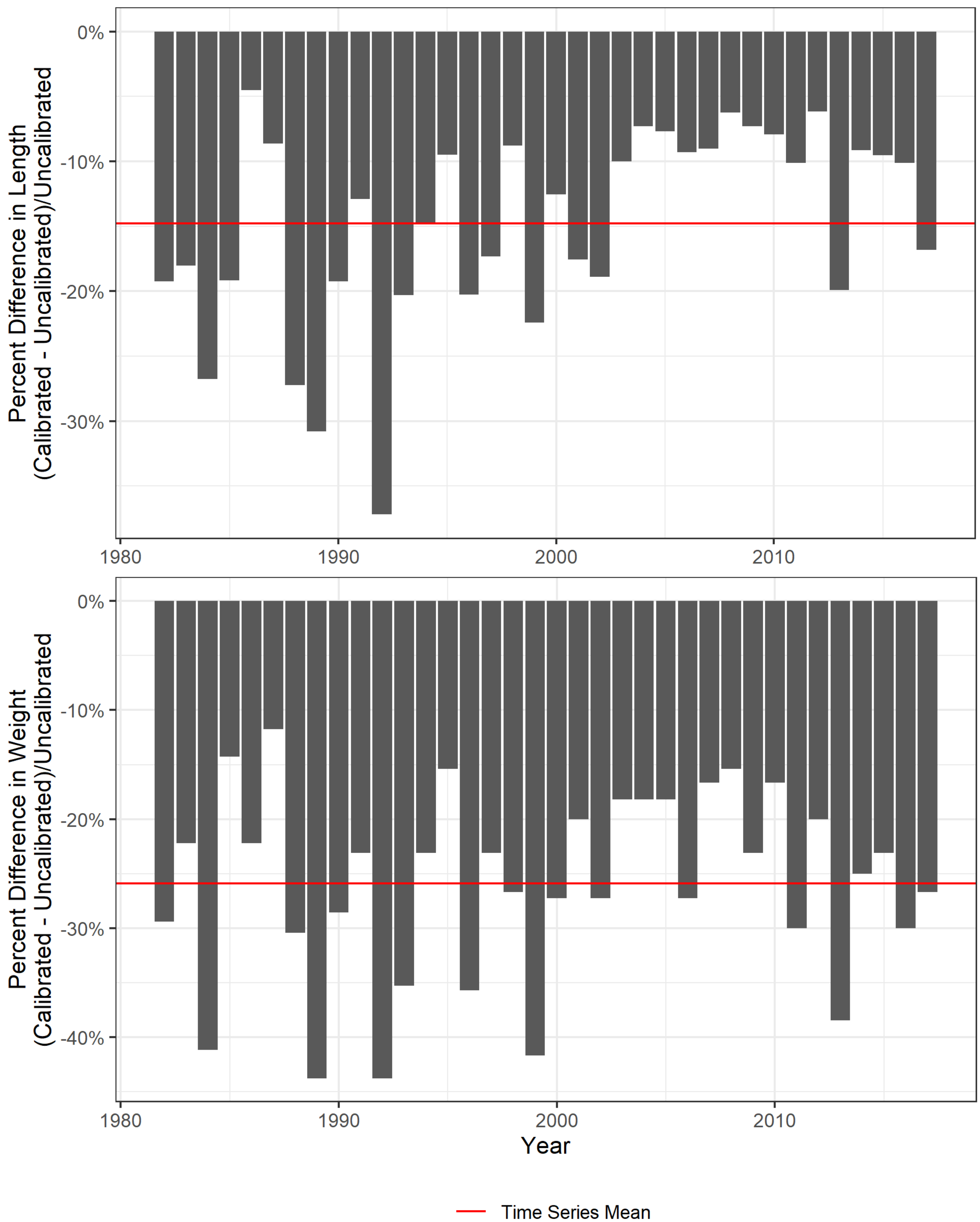

Figure 11: Percent difference between calibrated and uncalibrated MRIP estimates of average length (top) and average weight (bottom) of recreationally harvested bluefish for the Atlantic coast.

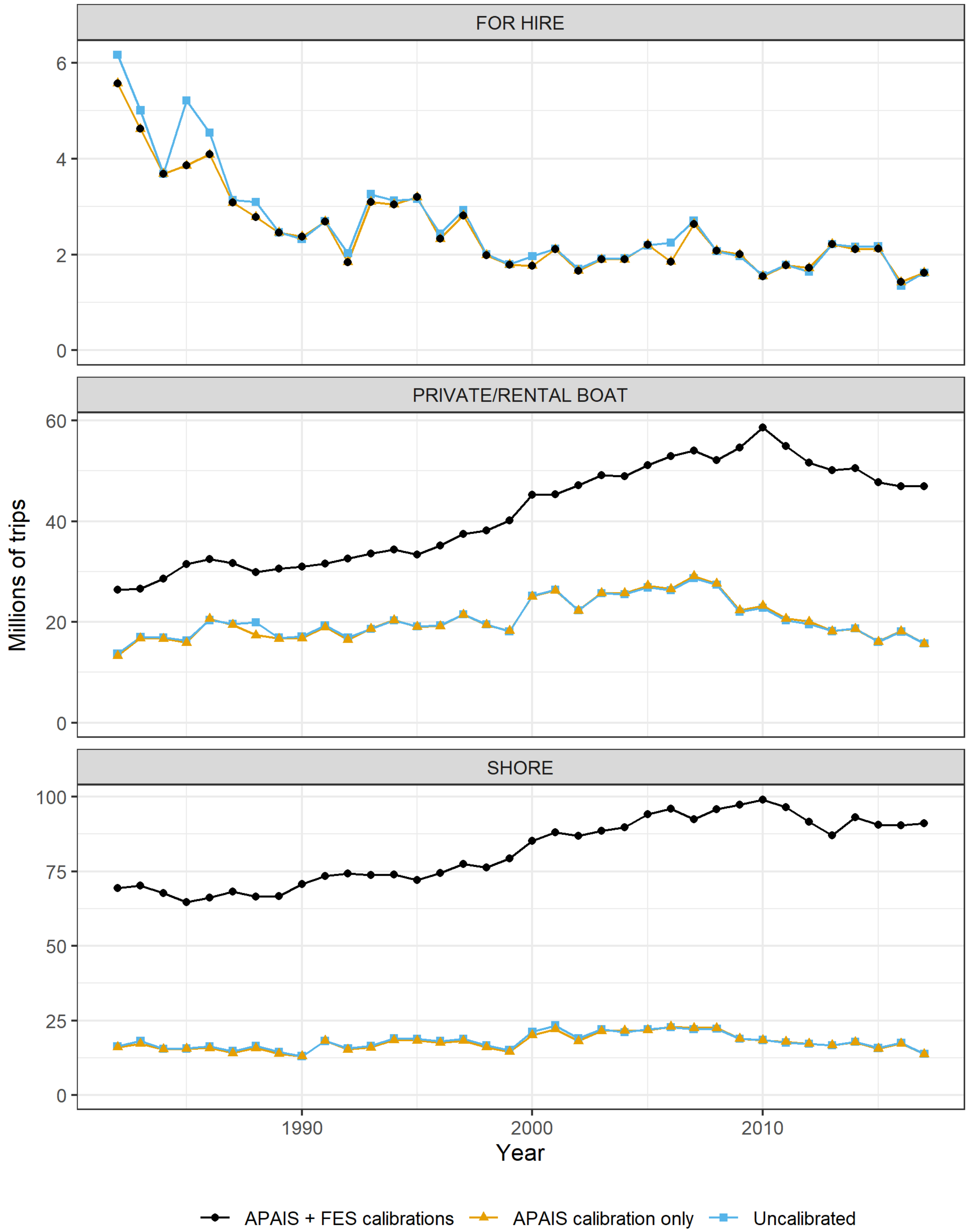

Figure 12: Comparison of calibrated and uncalibrated estimates of total effort on the Atlantic coast by mode of fishing.

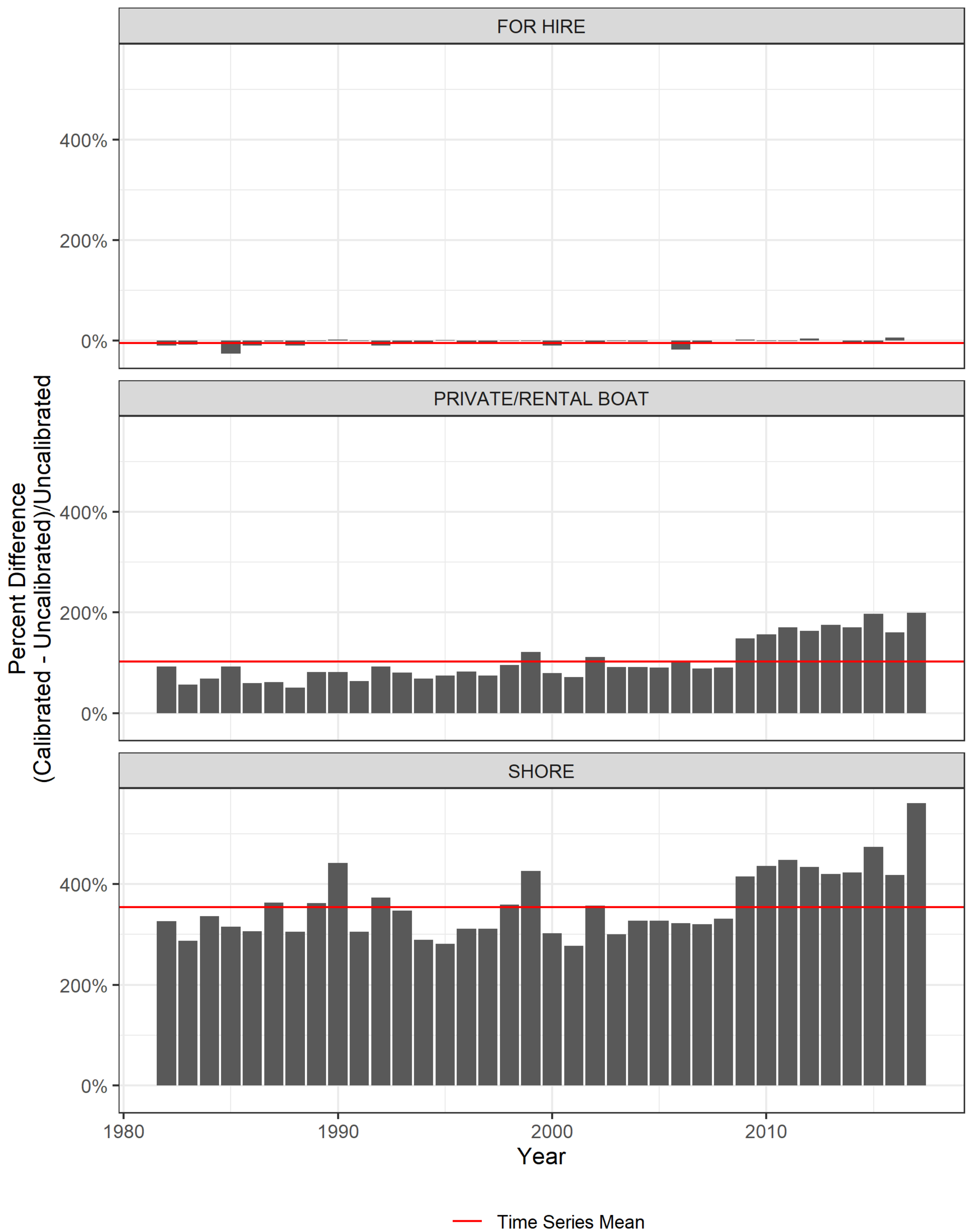

Figure 13: Percent difference between calibrated and uncalibrated estimates of total effort on the Atlantic coast by mode of fishing.

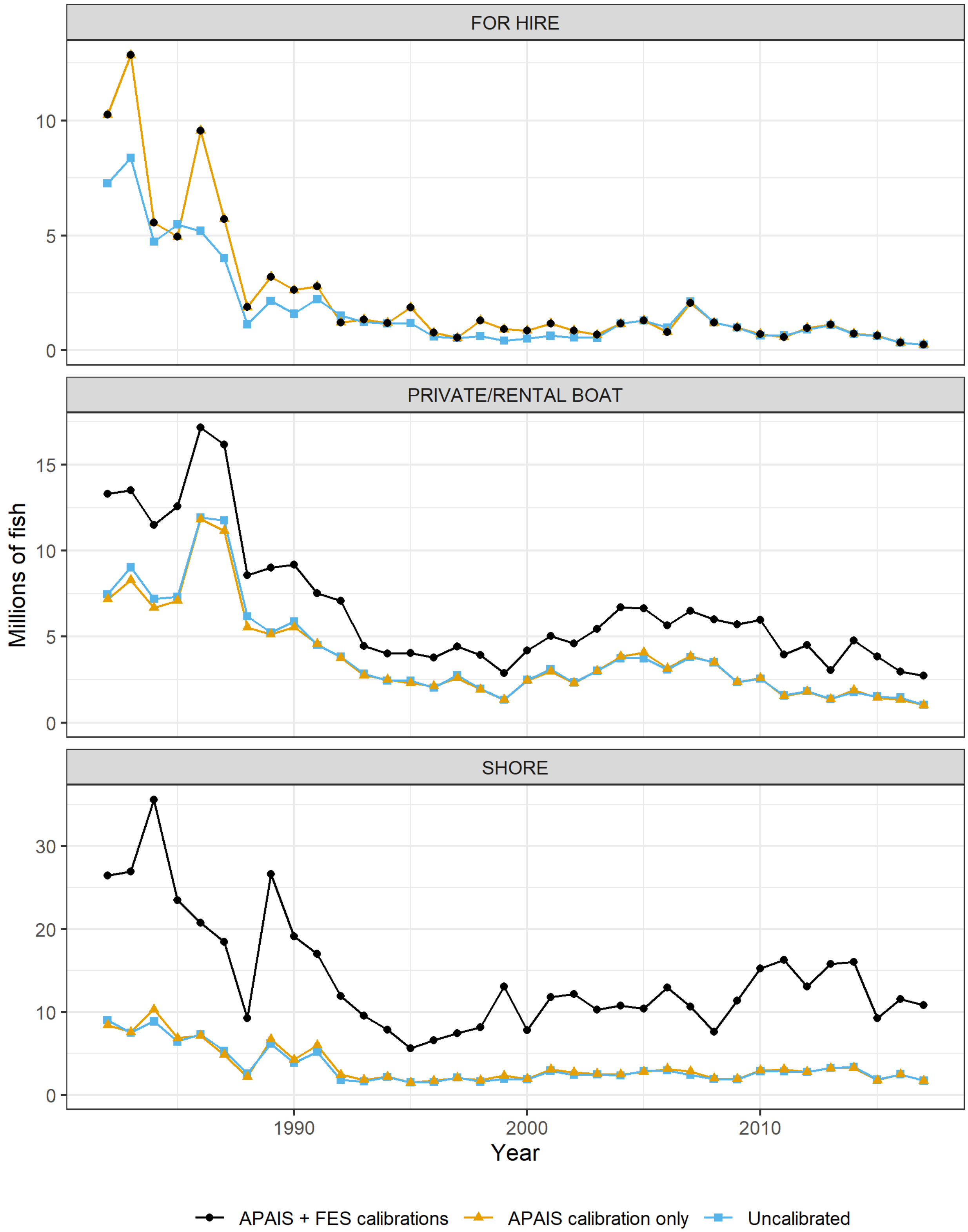

Figure 14: Comparison of calibrated and uncalibrated estimates of bluefish recreational harvest in numbers of fish for the Atlantic coast by mode of fishing.

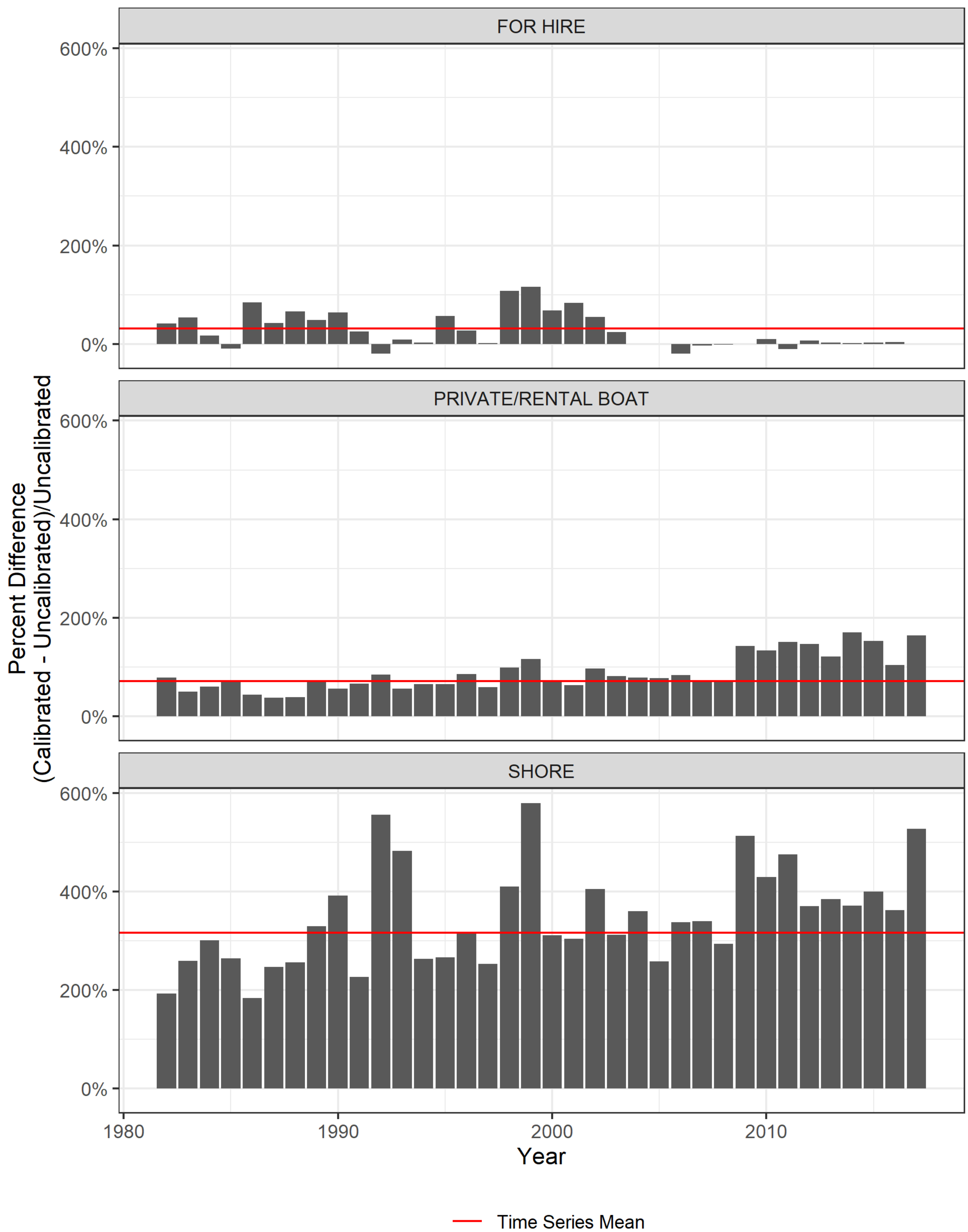

Figure 15: Percent difference between calibrated and uncalibrated estimates of bluefish recreational harvest in numbers of fish for the Atlantic coast by mode of fishing.

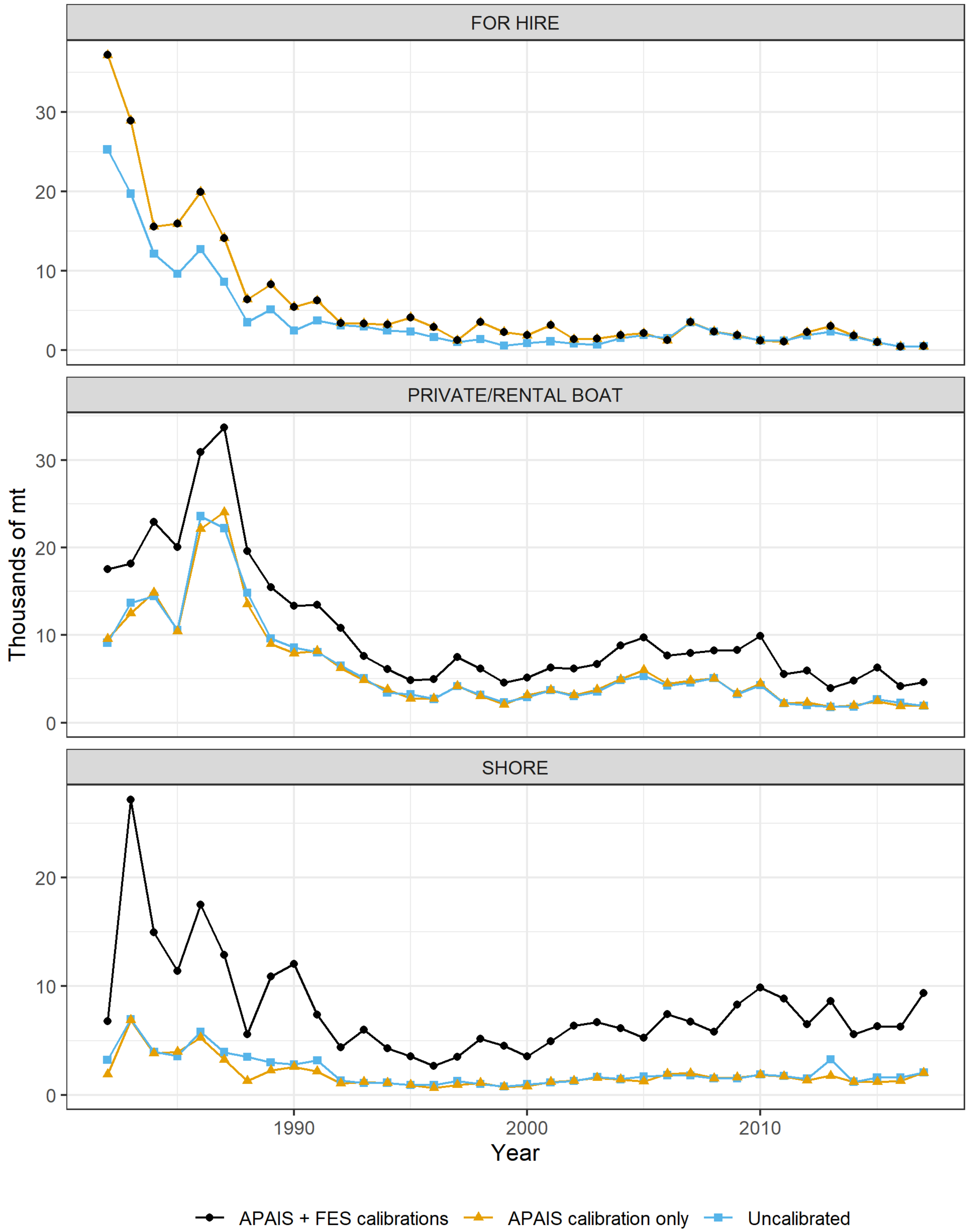

Figure 16: Comparison of calibrated and uncalibrated estimates of bluefish recreational harvest in weight for the Atlantic coast by mode of fishing.

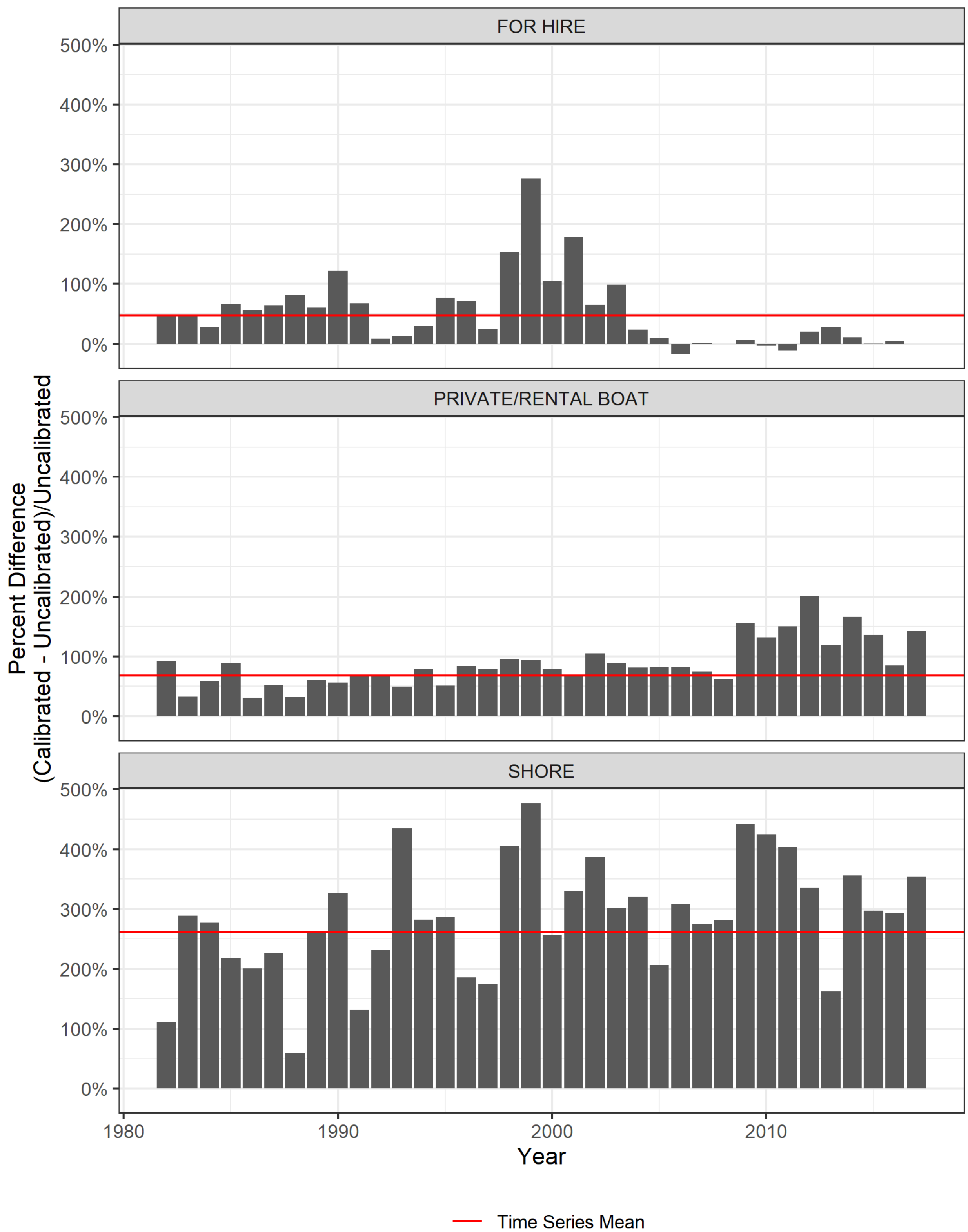

Figure 17: Percent difference between calibrated and uncalibrated estimates of bluefish recreational harvest in weight for the Atlantic coast by mode of fishing.

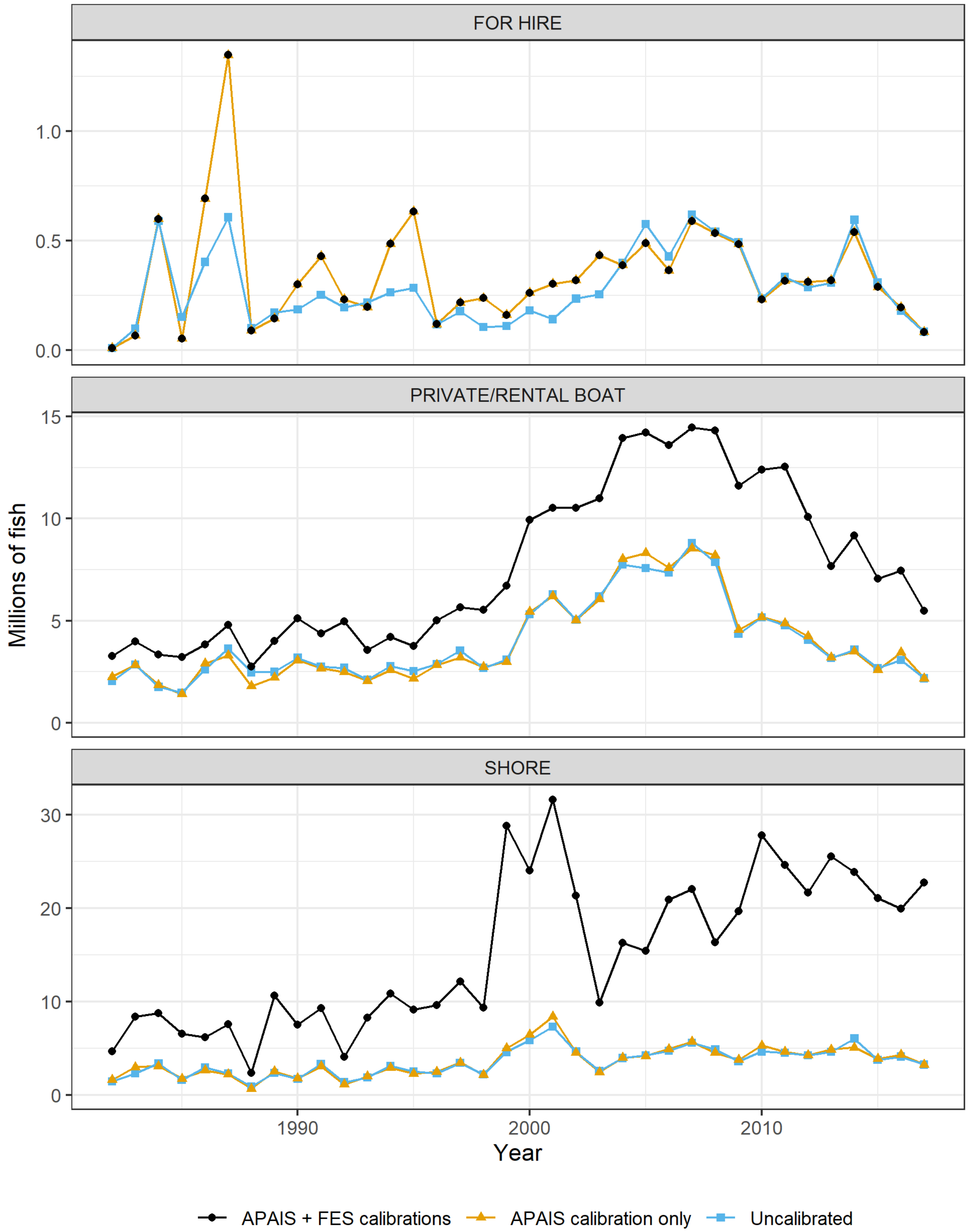

Figure 18: Comparison of calibrated and uncalibrated estimates of bluefish recreational live releases for the Atlantic coast by mode of fishing.

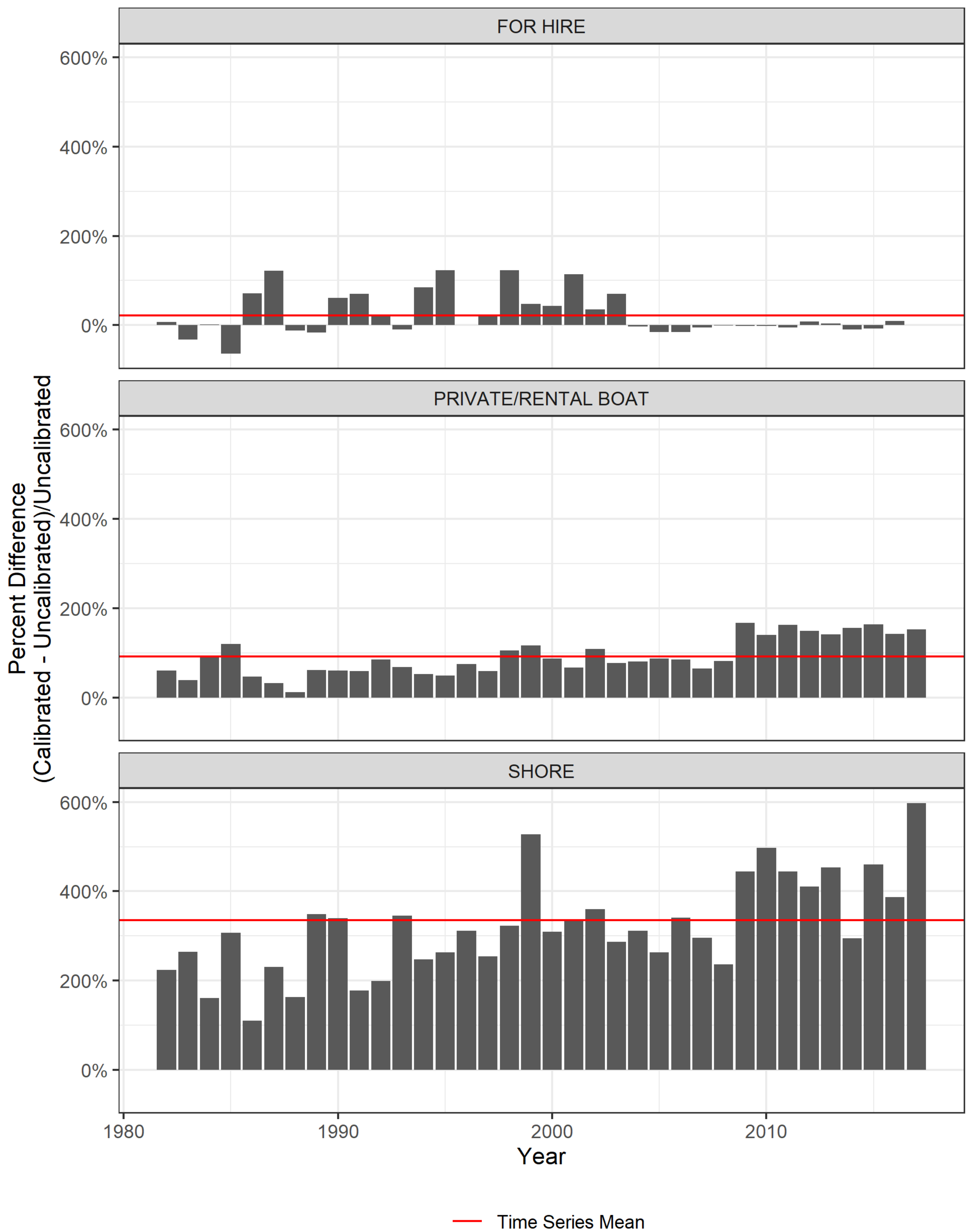

Figure 19: Percent difference between calibrated and uncalibrated estimates of bluefish recreational live releases for the Atlantic coast by mode of fishing.

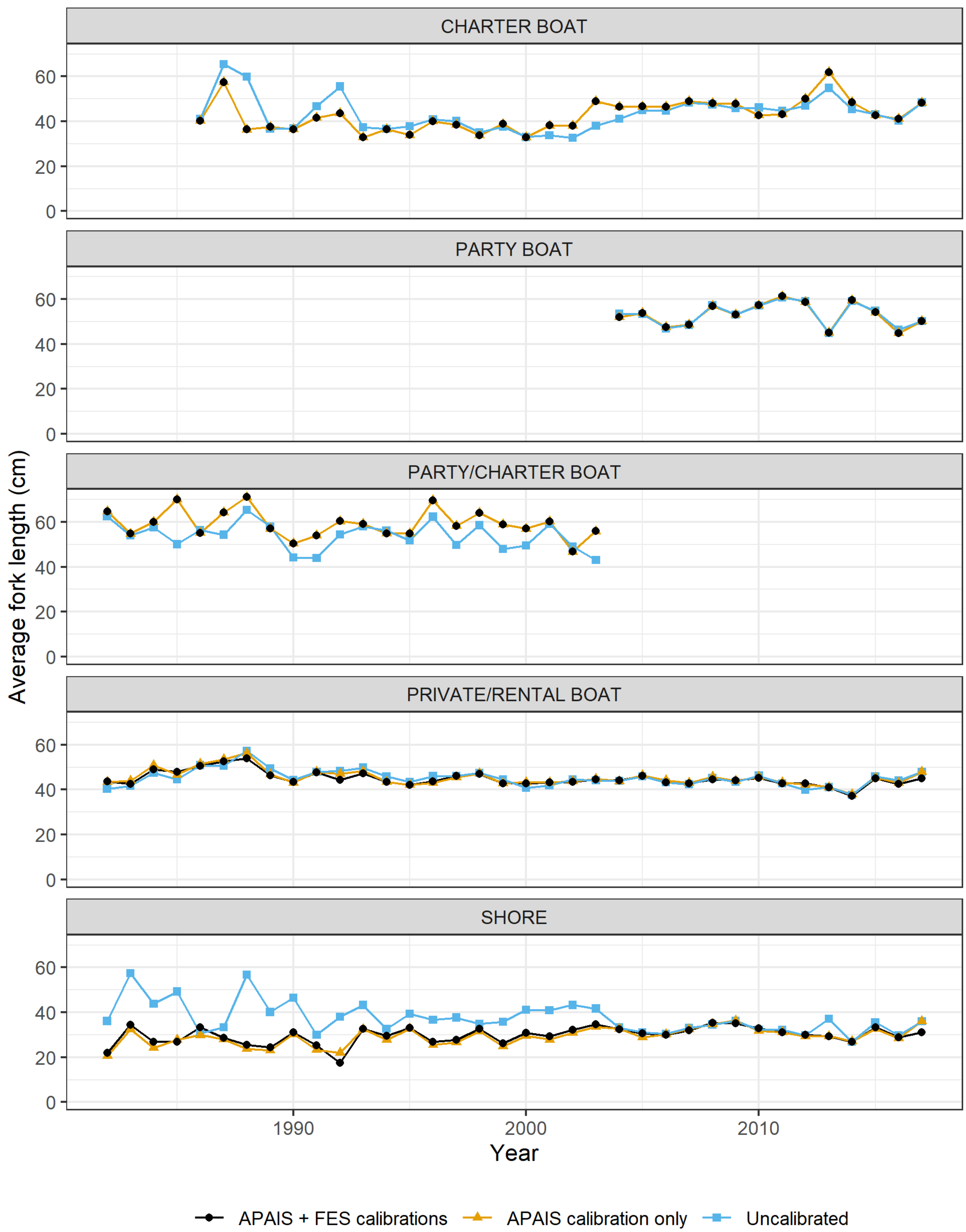

Figure 20: Comparison of calibrated and uncalibrated estimates of the average length of recreationally harvested bluefish for the Atlantic coast by mode of fishing.

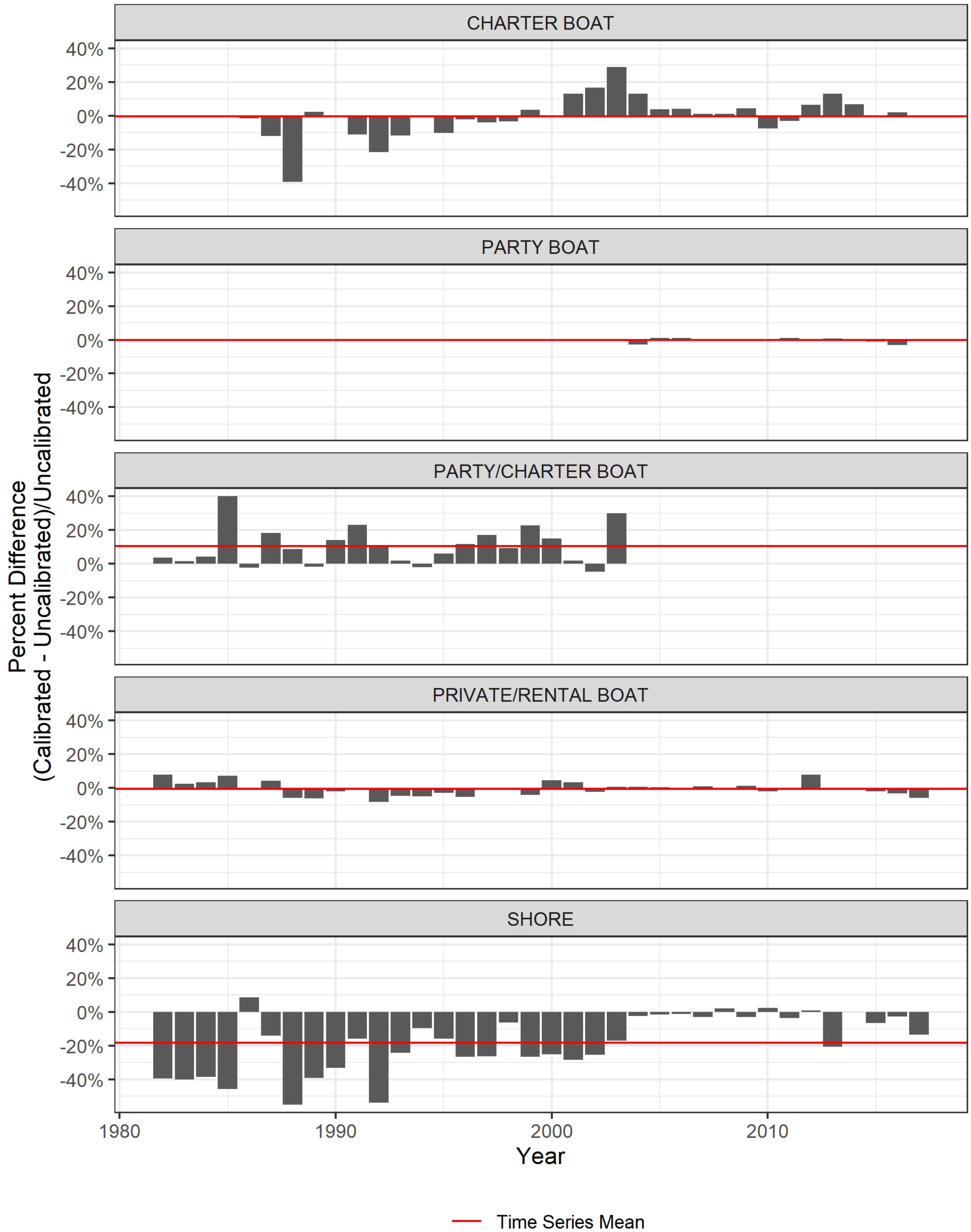

Figure 21: Percent difference between calibrated and uncalibrated estimates of the average length of recreationally harvested bluefish for the Atlantic coast by mode of fishing.

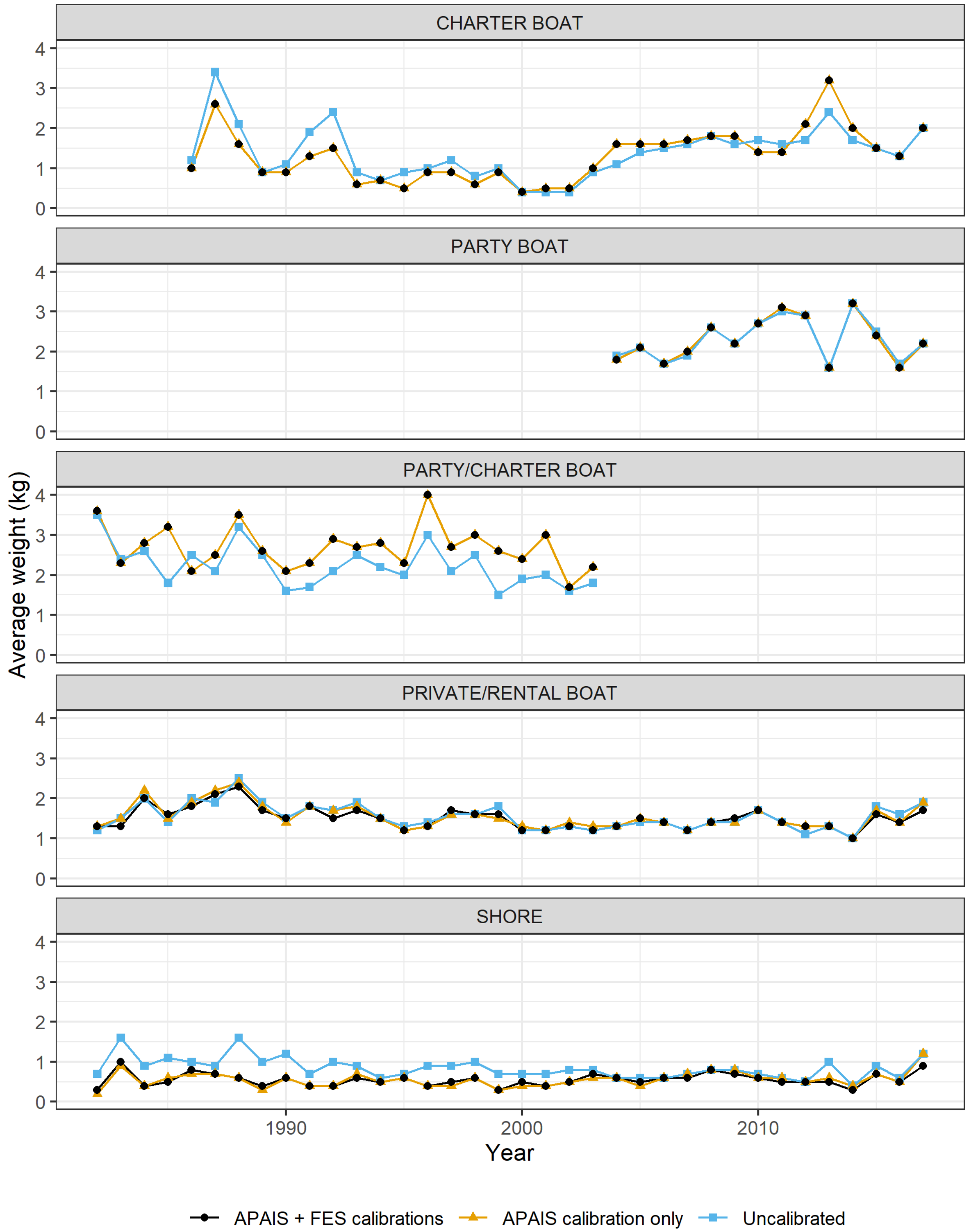

Figure 22: Comparison of calibrated and uncalibrated estimates of the average weight of recreationally harvested bluefish for the Atlantic coast by mode of fishing.

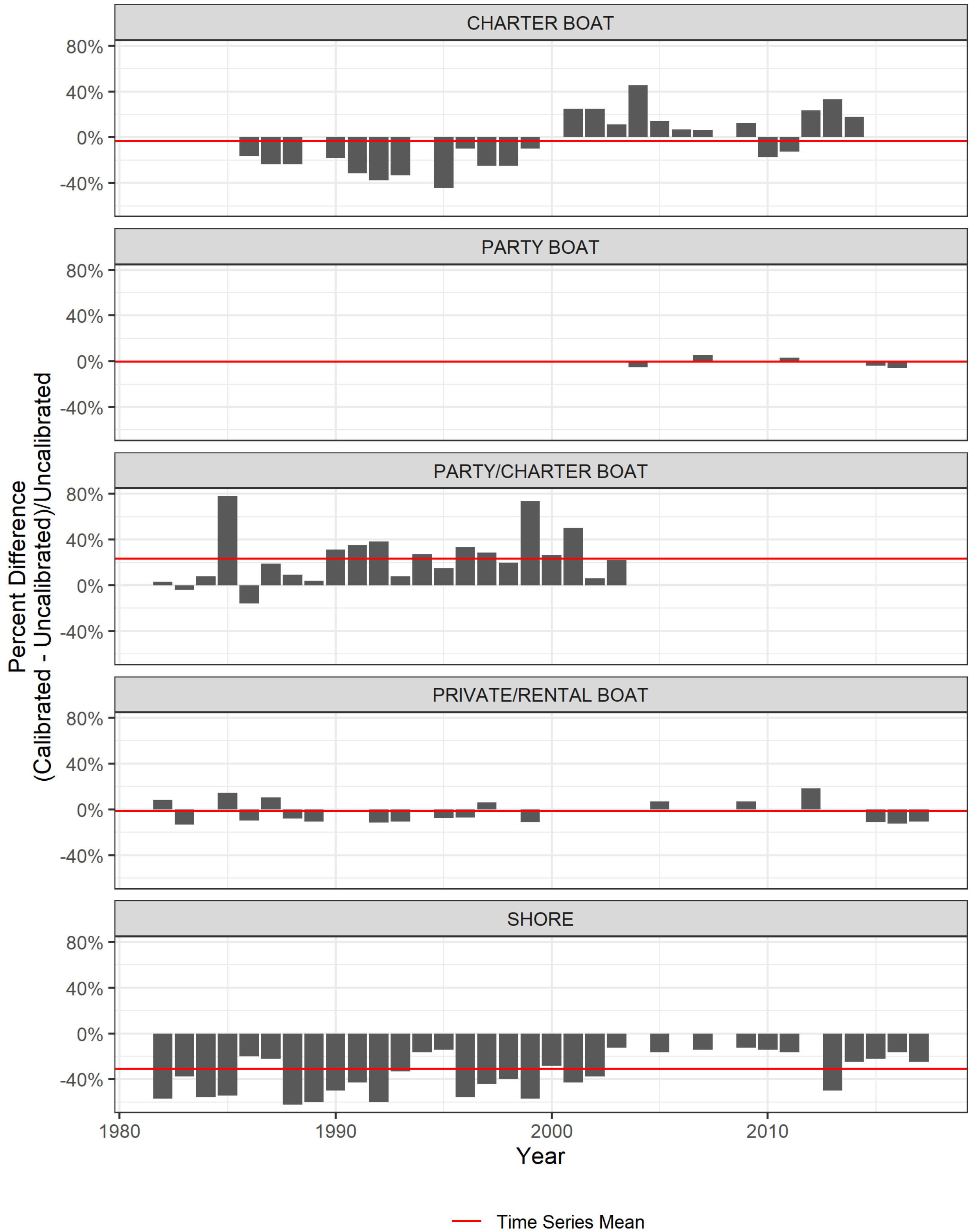

Figure 23: Percent difference between calibrated and uncalibrated estimates of the average weight of recreationally harvested bluefish for the Atlantic coast by mode of fishing.

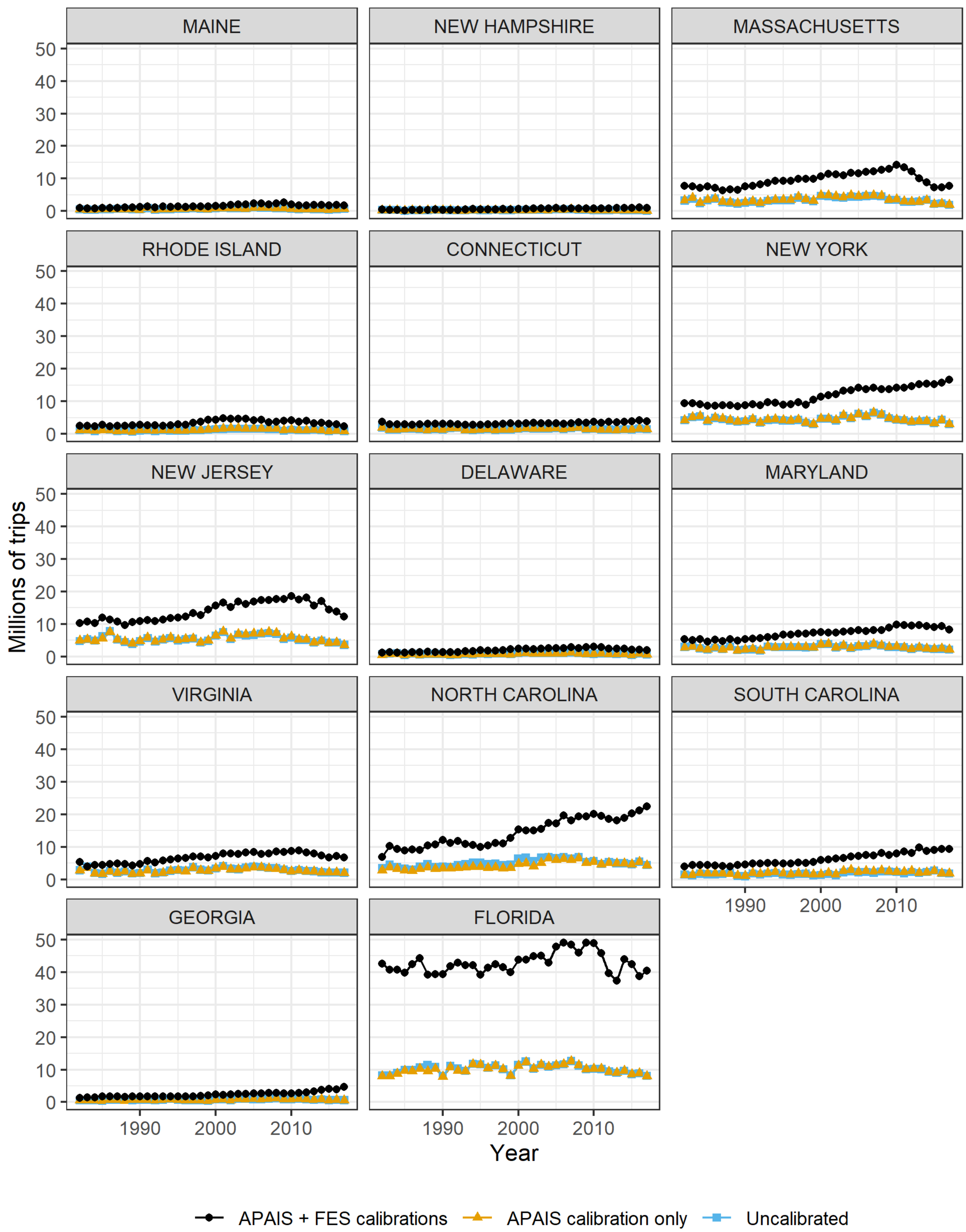

Figure 24: Comparison of calibrated and uncalibrated estimates of total effort by state.

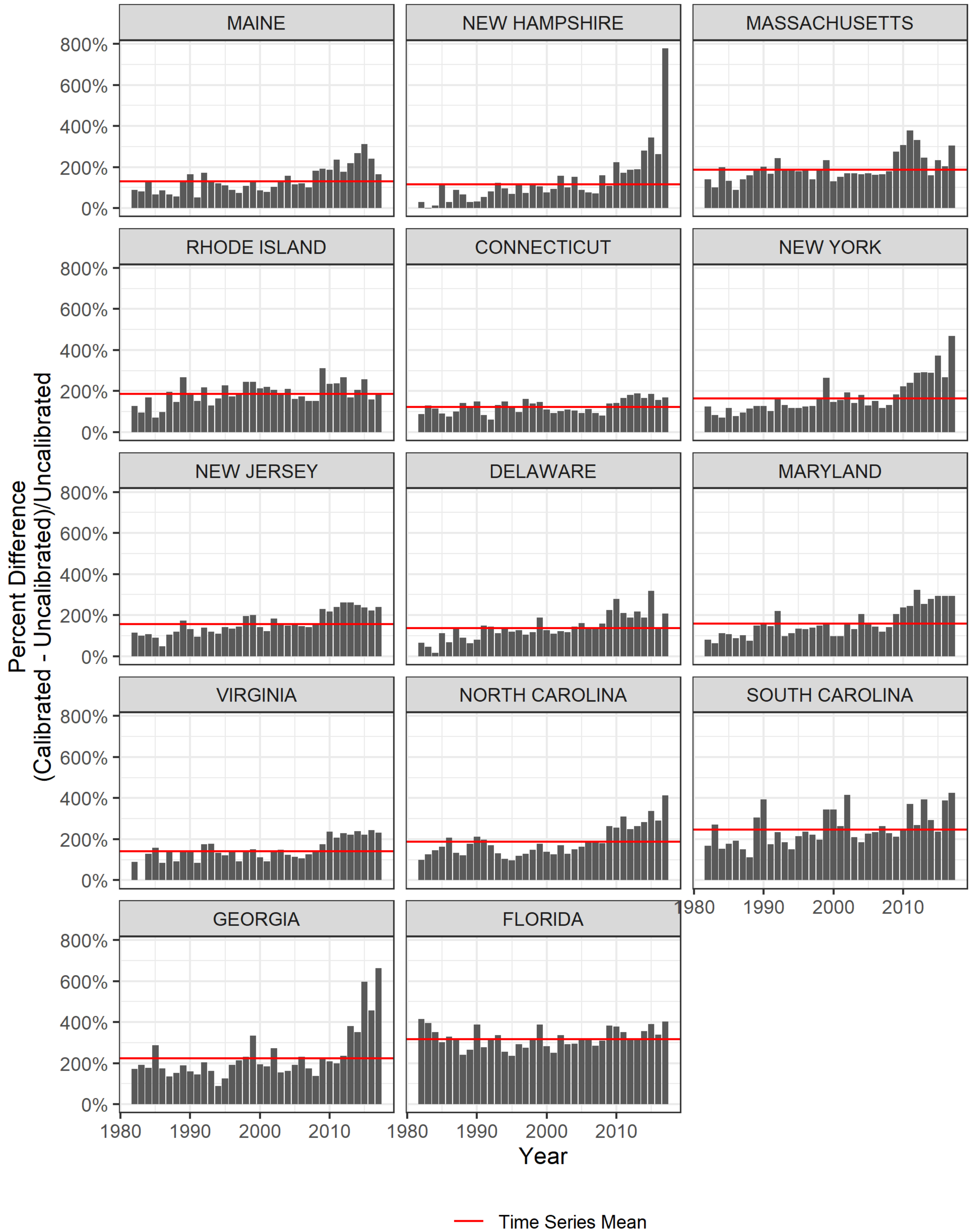

Figure 25: Percent difference between calibrated and uncalibrated estimates of total effort by state plotted with the time series mean difference for each state.

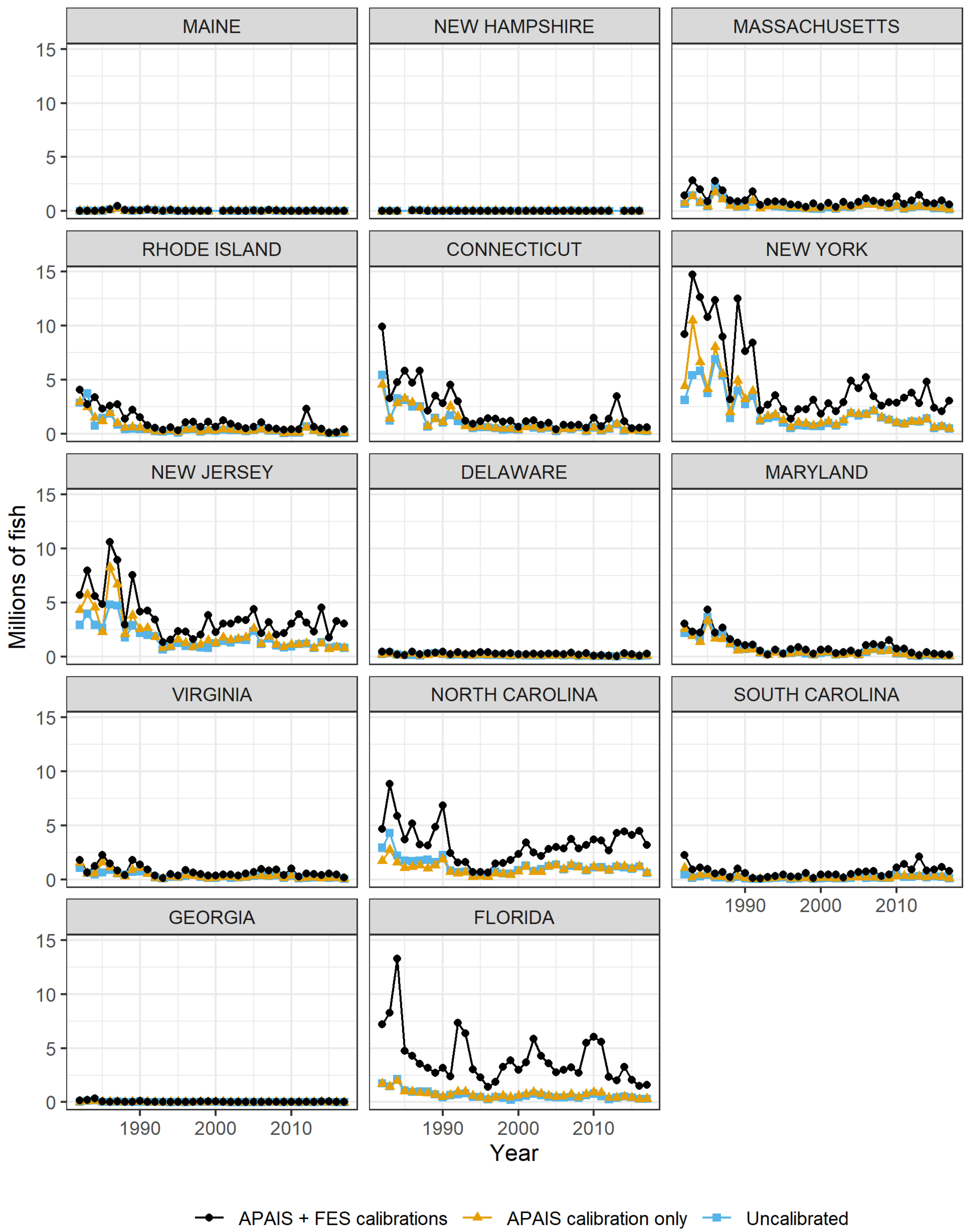

Figure 26: Comparison of calibrated and uncalibrated estimates of bluefish recreational harvest in numbers of fish for the Atlantic coast by state using the same y-axis for all states.

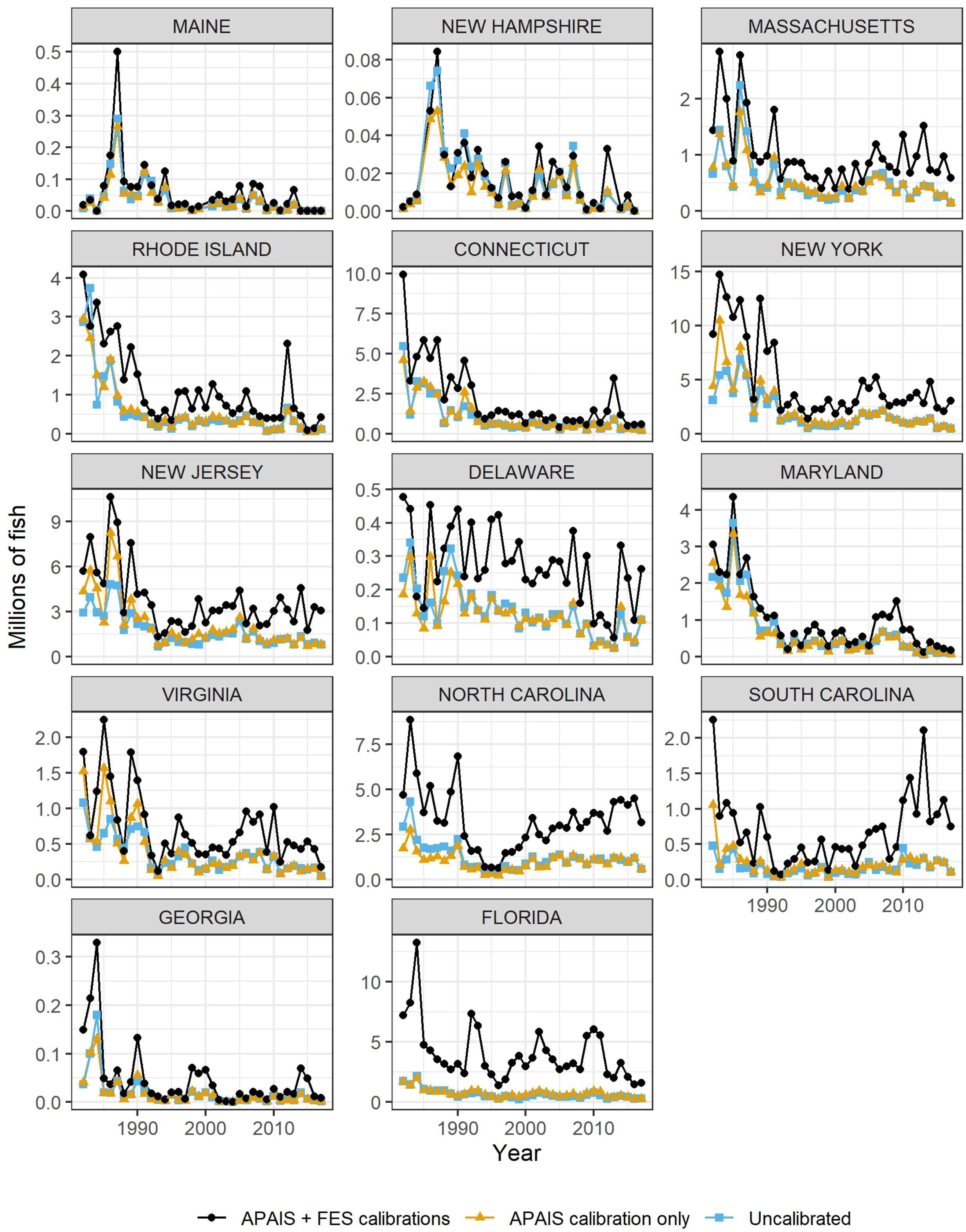

Figure 27: Comparison of calibrated and uncalibrated estimates of bluefish recreational harvest in numbers of fish for the Atlantic coast by state using different y-axes by state.

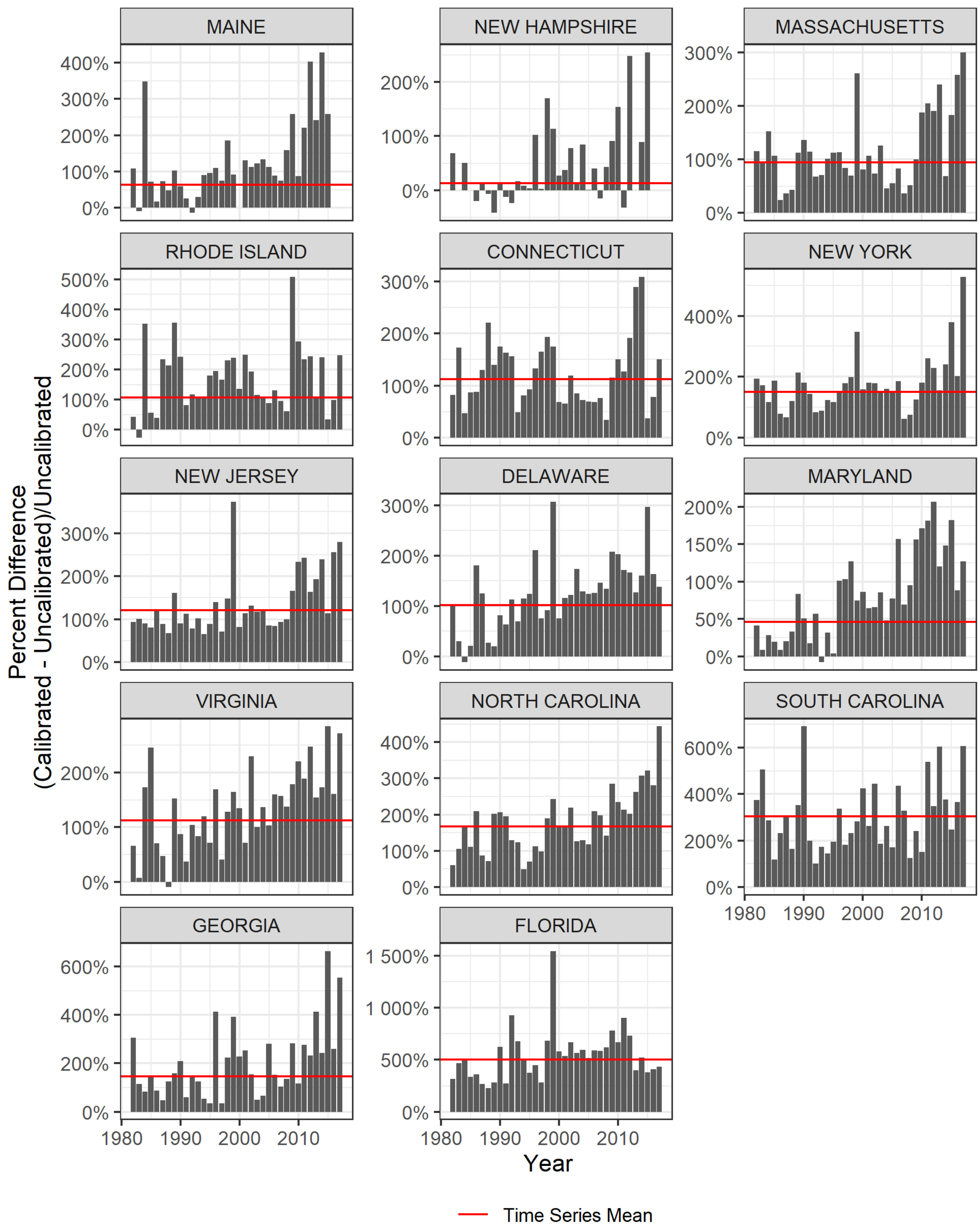

Figure 28: Percent difference between calibrated and uncalibrated estimates of recreational bluefish harvest in numbers of fish for the Atlantic coast by state plotted with the time series mean difference for each state. Note different y-axes for each state.

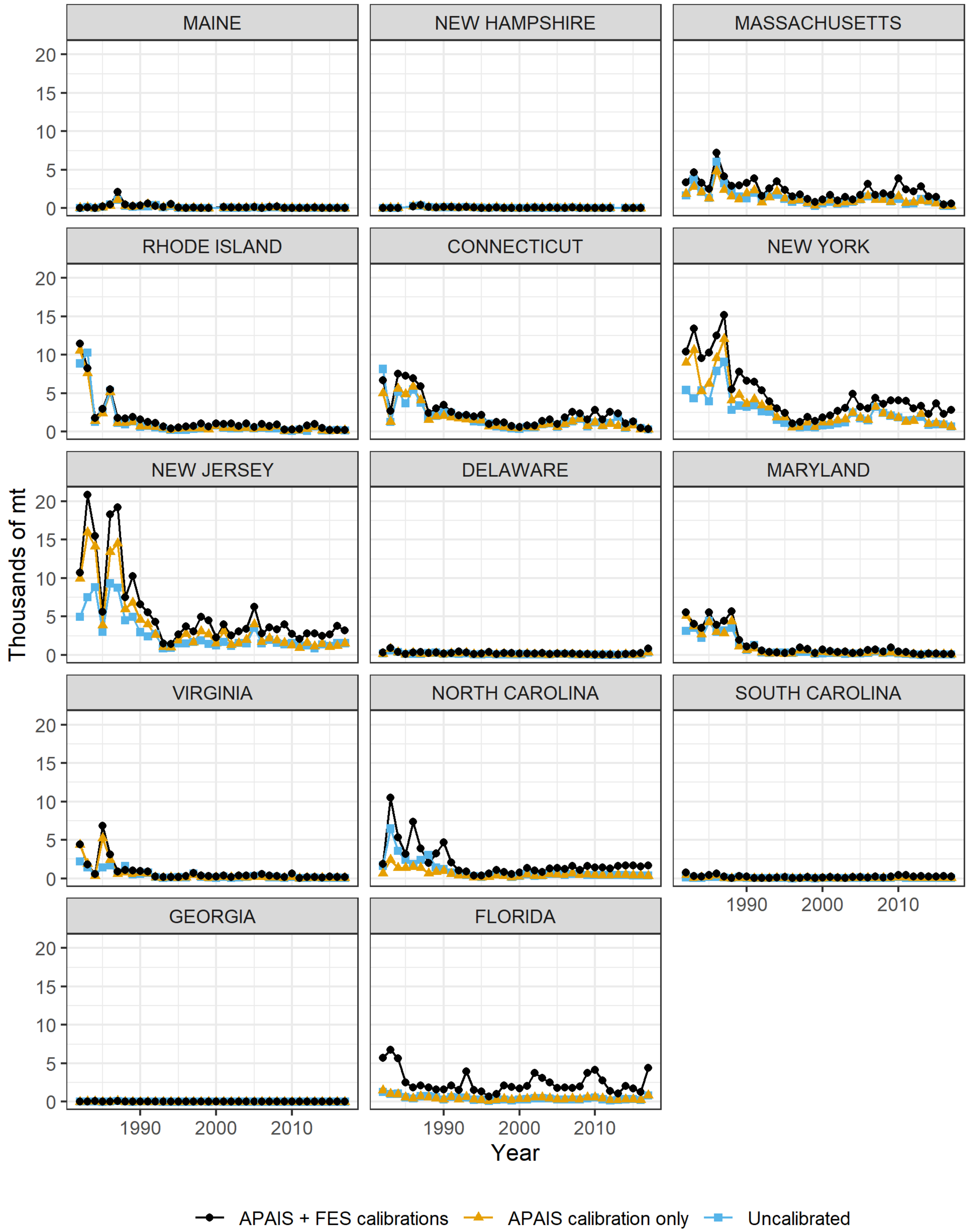

Figure 29: Comparison of calibrated and uncalibrated estimates of bluefish recreational harvest in weight for the Atlantic coast by state using the same y-axis for all states.

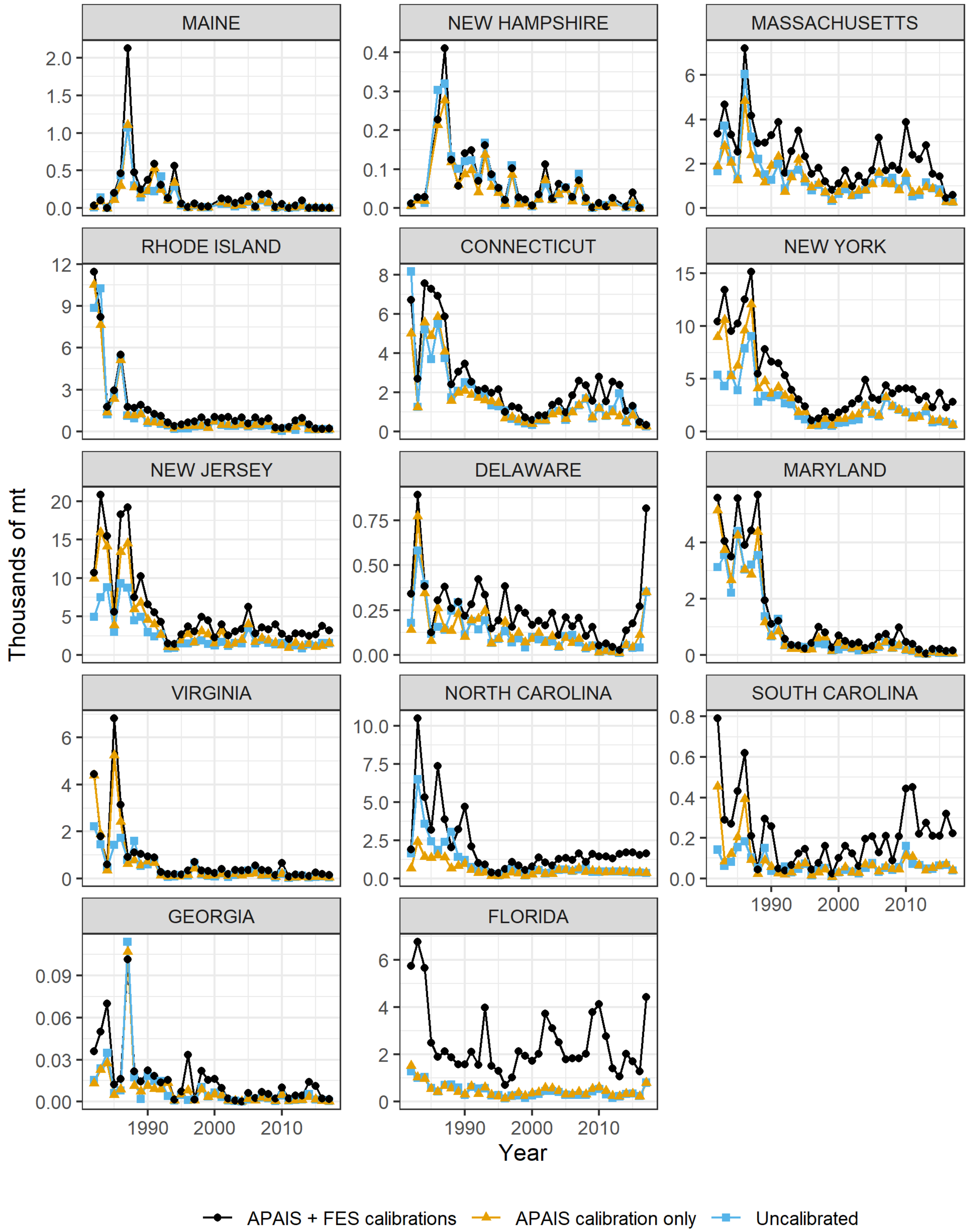

Figure 30: Comparison of calibrated and uncalibrated estimates of bluefish recreational harvest in weight for the Atlantic coast by state using different y-axes by state.

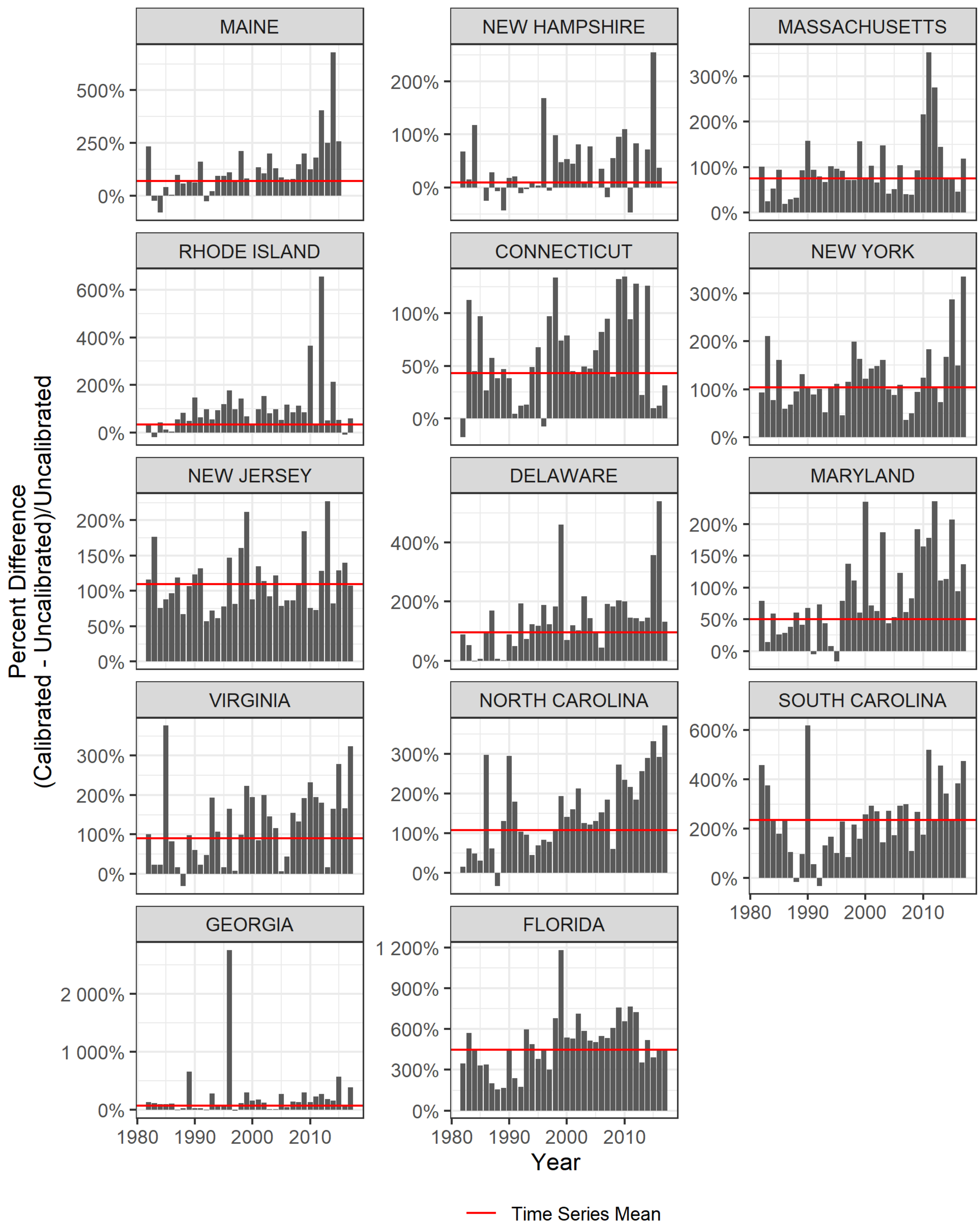

Figure 31: Percent difference between calibrated and uncalibrated estimates of recreational bluefish harvest in weight for the Atlantic coast by state plotted with the time series mean difference for each state. Note different y-axes for each state.

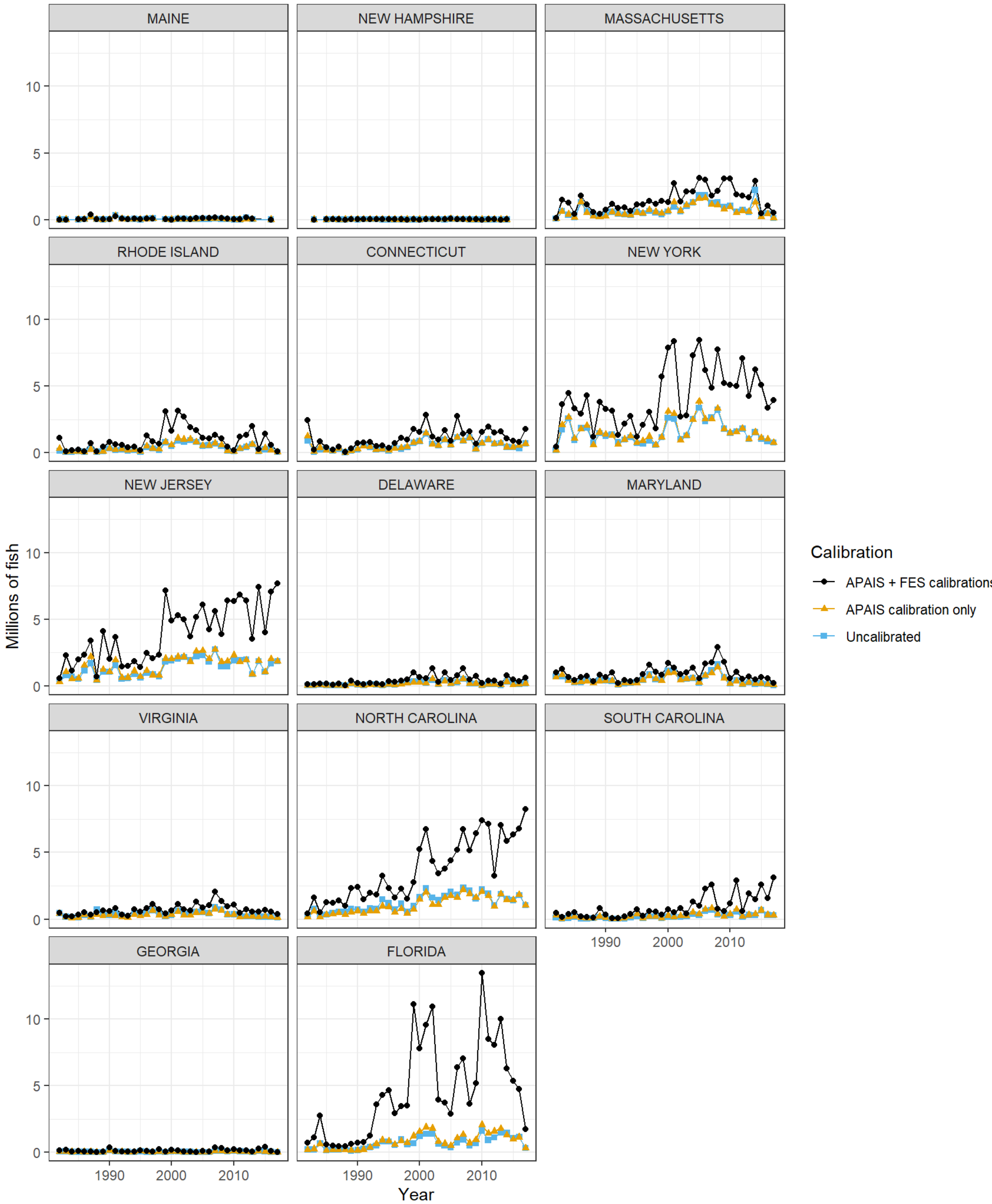

Figure 32: Comparison of calibrated and uncalibrated estimates of bluefish recreational live releases for the Atlantic coast by state using the same y-axis for all states.

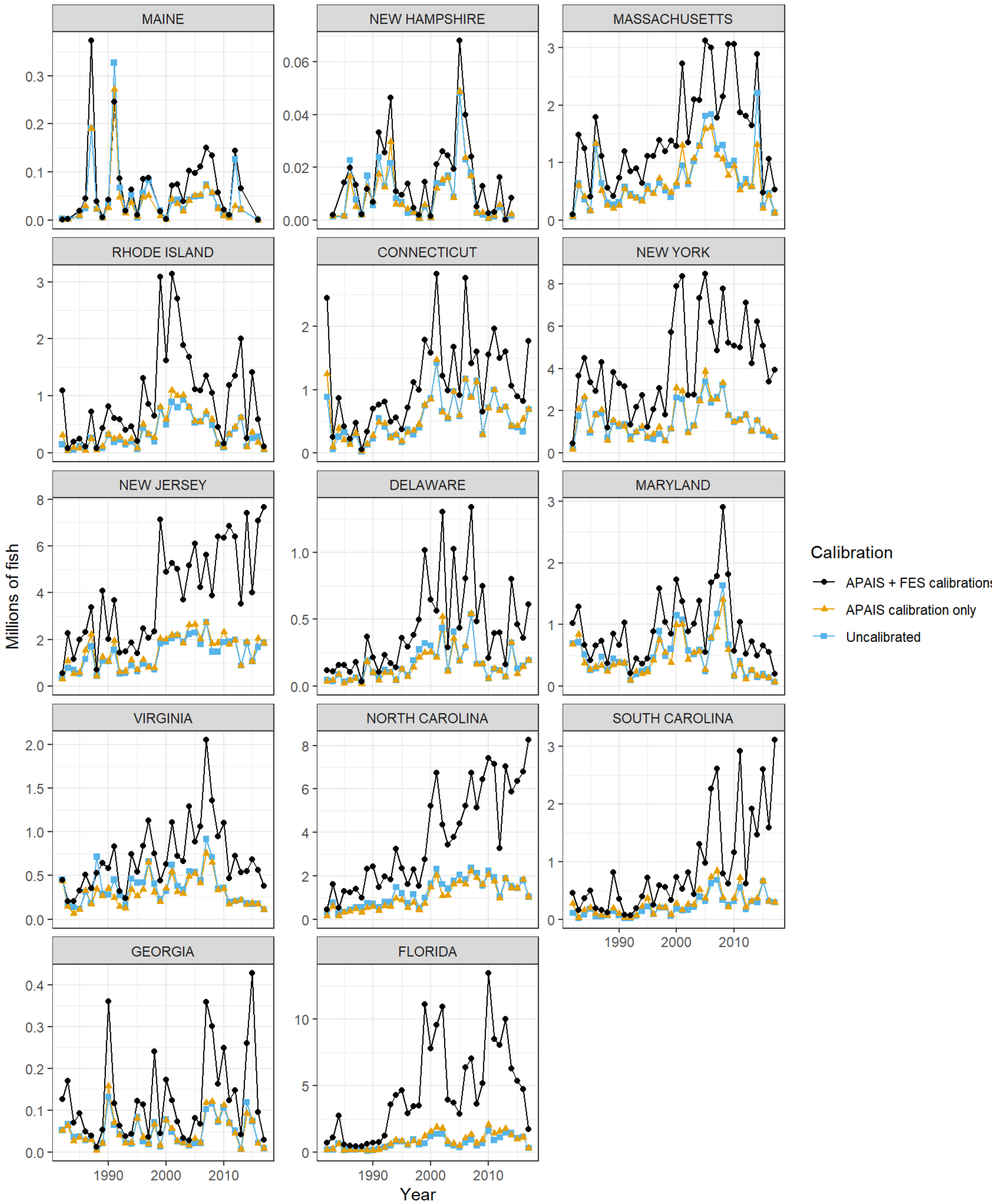

Figure 33: Comparison of calibrated and uncalibrated estimates of bluefish recreational live releases for the Atlantic coast by state using different y-axes by state.

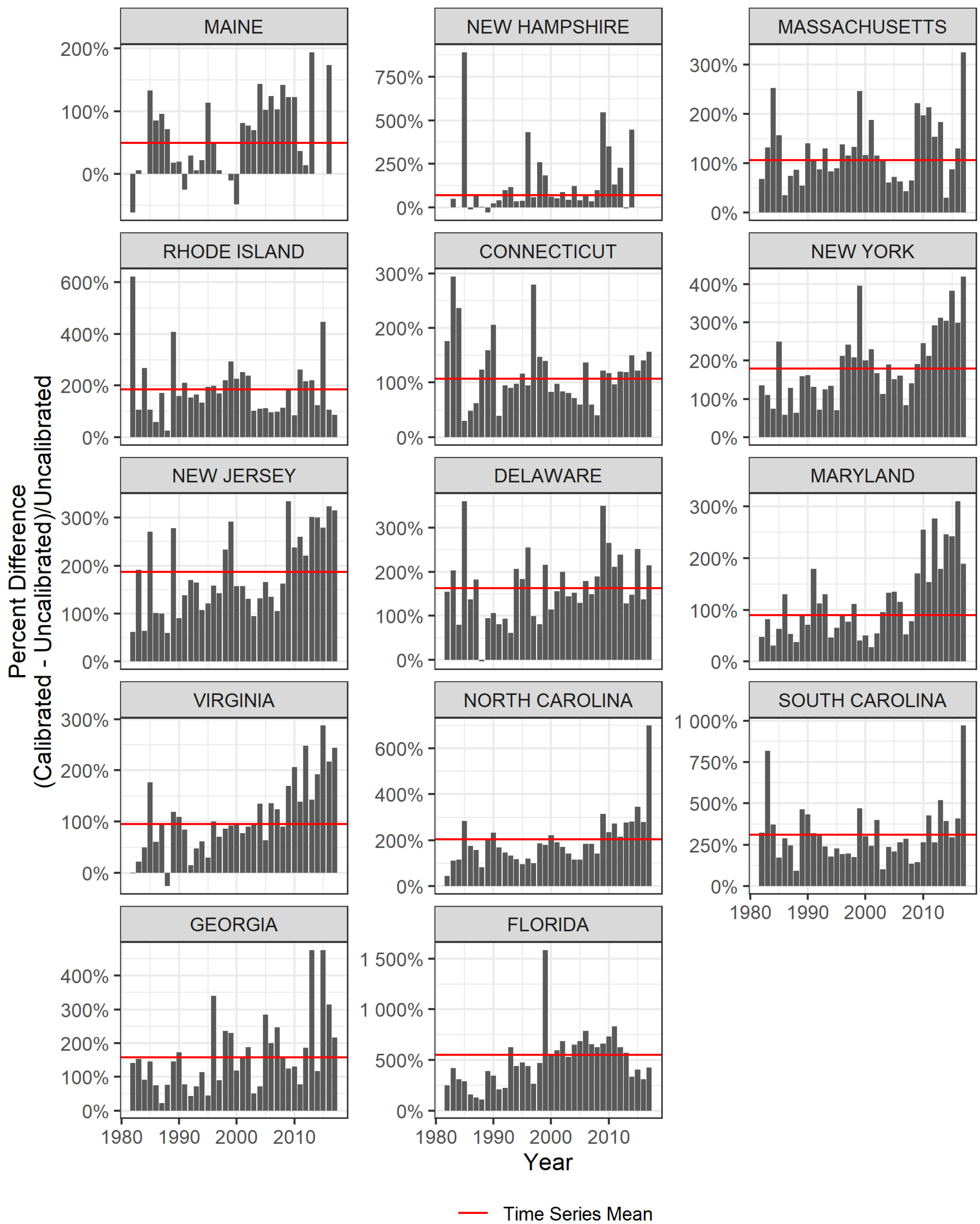

Figure 34: Percent difference between calibrated and uncalibrated estimates of recreational bluefish live releases for the Atlantic coast by state plotted with the time series mean difference for each state. Note different y-axes for each state.

Figure 35: Comparison of calibrated and uncalibrated estimates of the average length of recreationally harvested bluefish for the Atlantic coast by state.

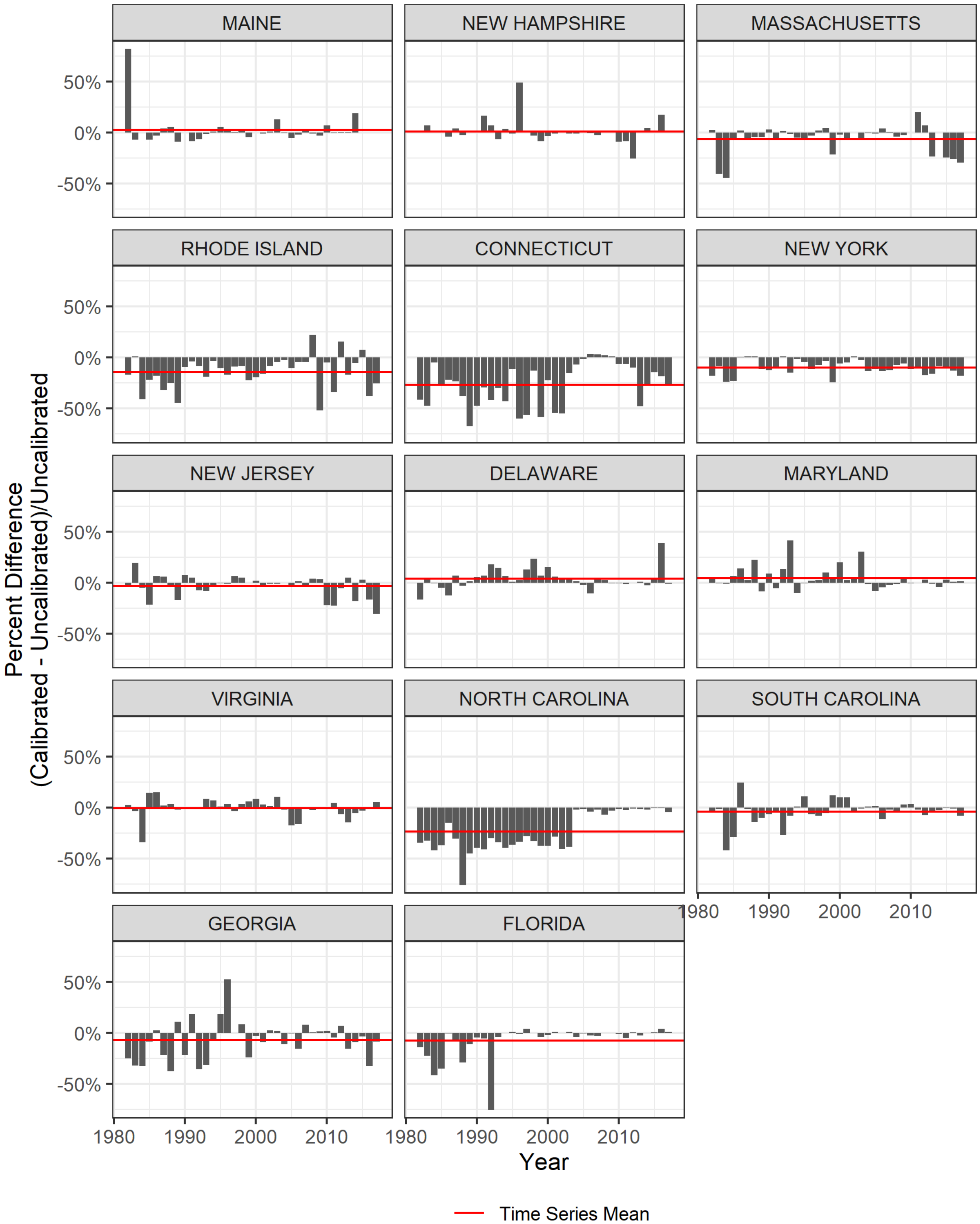

Figure 36: Percent difference between calibrated and uncalibrated estimates of the average length of recreationally harvested bluefish for the Atlantic coast by state plotted with the time series mean difference for each state.

Figure 37: Comparison of calibrated and uncalibrated estimates of the average weight of recreationally harvested bluefish for the Atlantic coast by state.

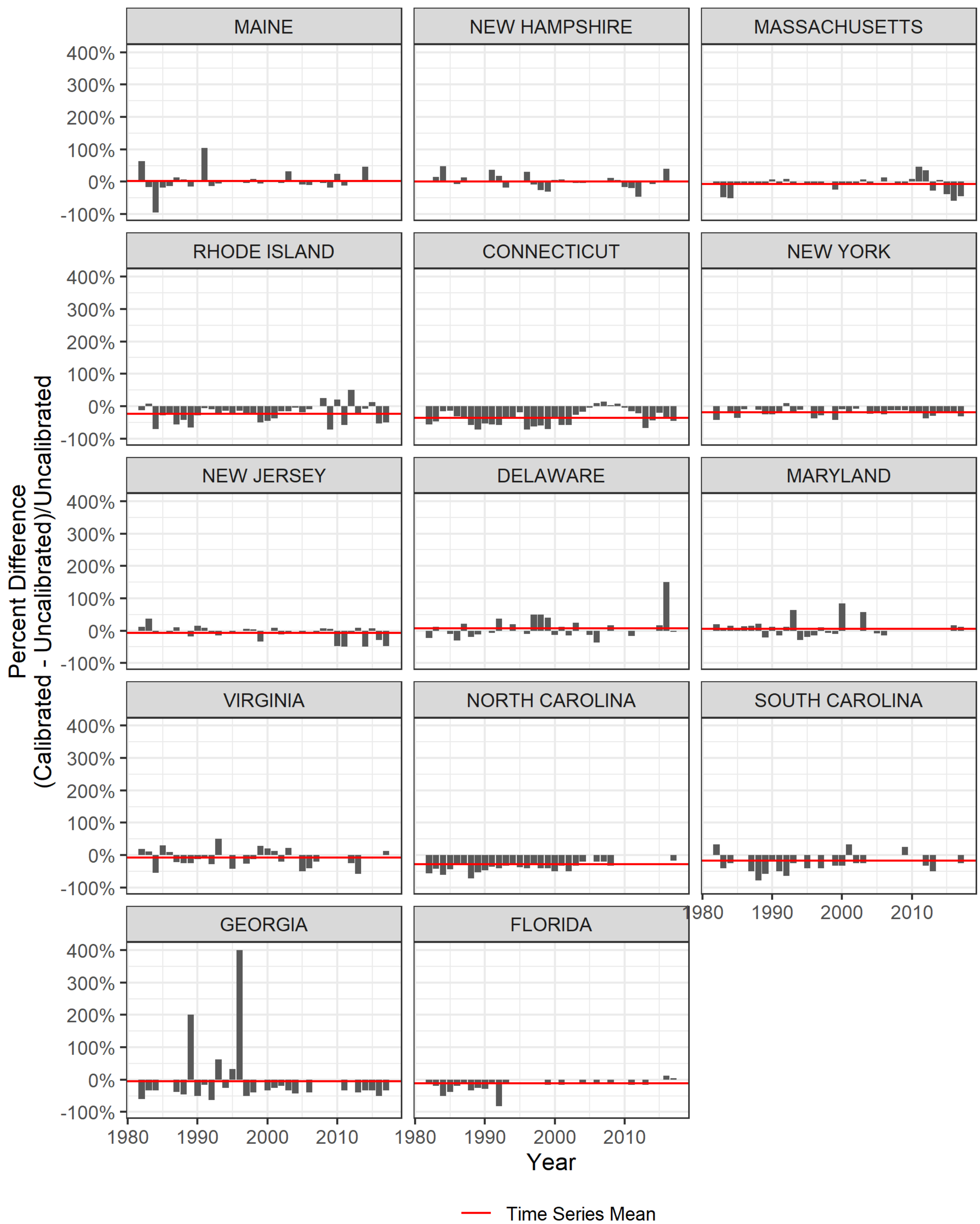

Figure 38: Percent difference between calibrated and uncalibrated estimates of the average weight of recreationally harvested bluefish for the Atlantic coast by state plotted with the time series mean difference for each state.

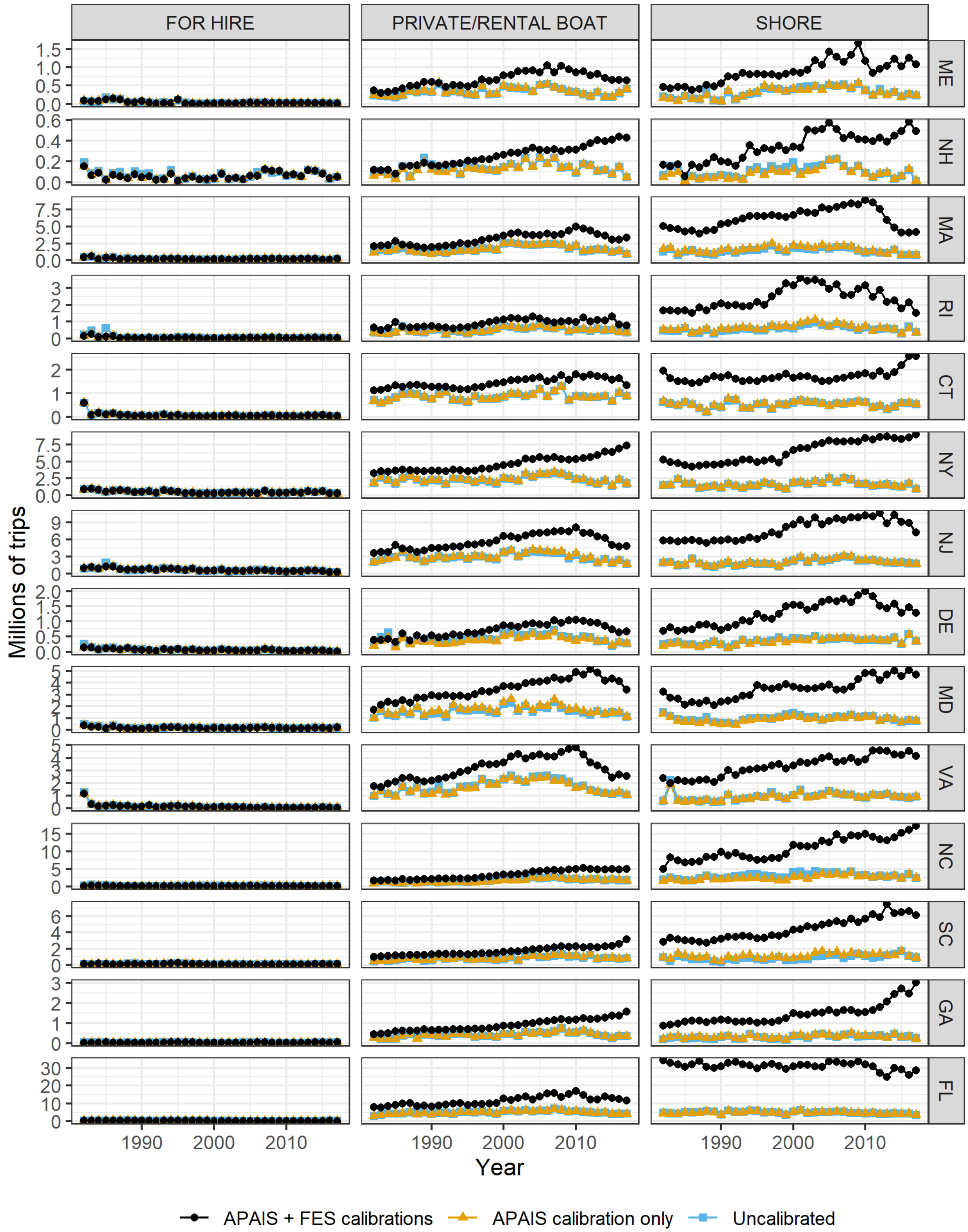

Figure 39: Comparison of calibrated and uncalibrated estimates of total effort by state and mode. Note the different y-axis for each state.

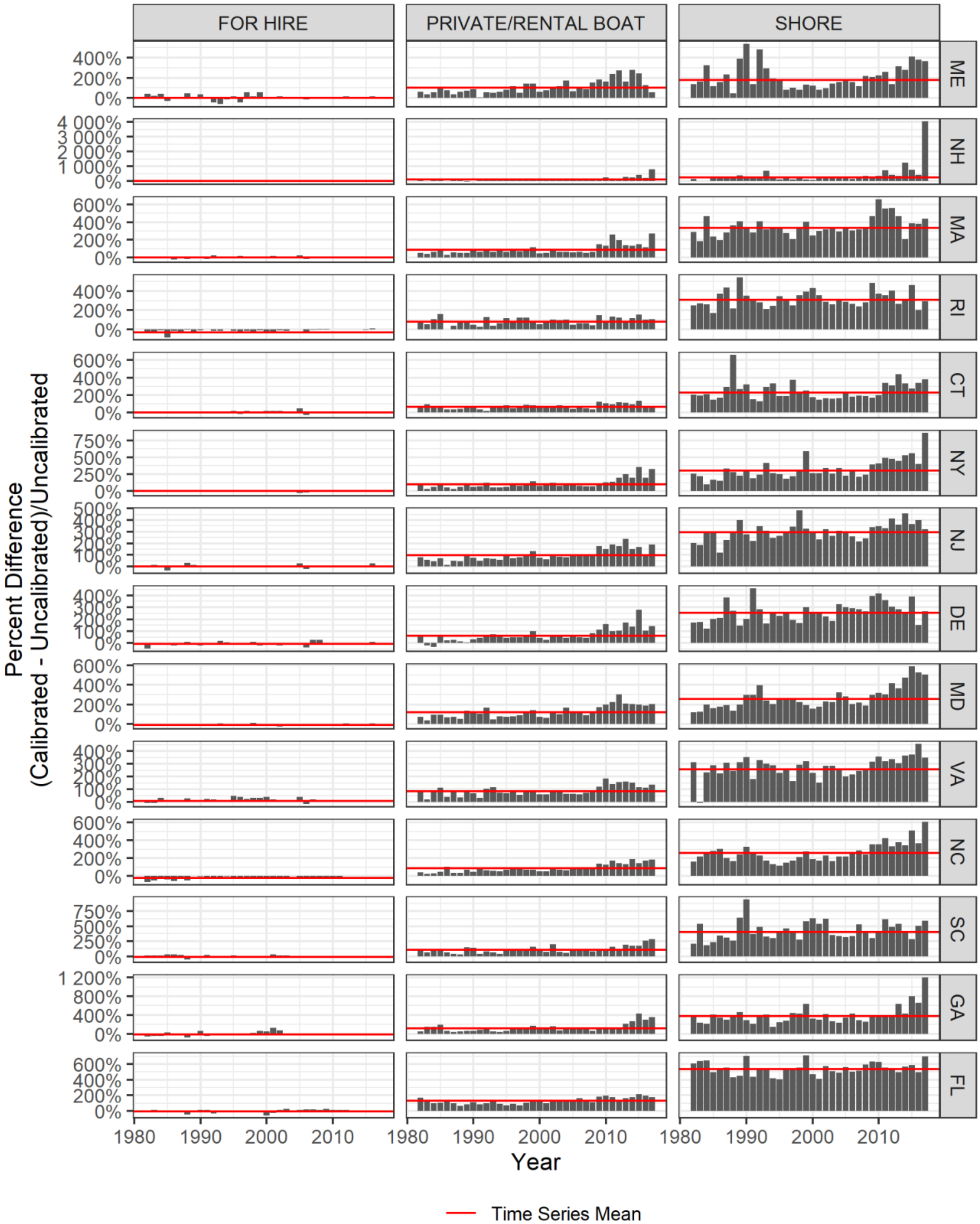

Figure 40: Percent difference between calibrated and uncalibrated estimates of total effort for the Atlantic coast by state and mode, plotted with the time series mean difference for each state and mode. Note the different y-axis for each state.

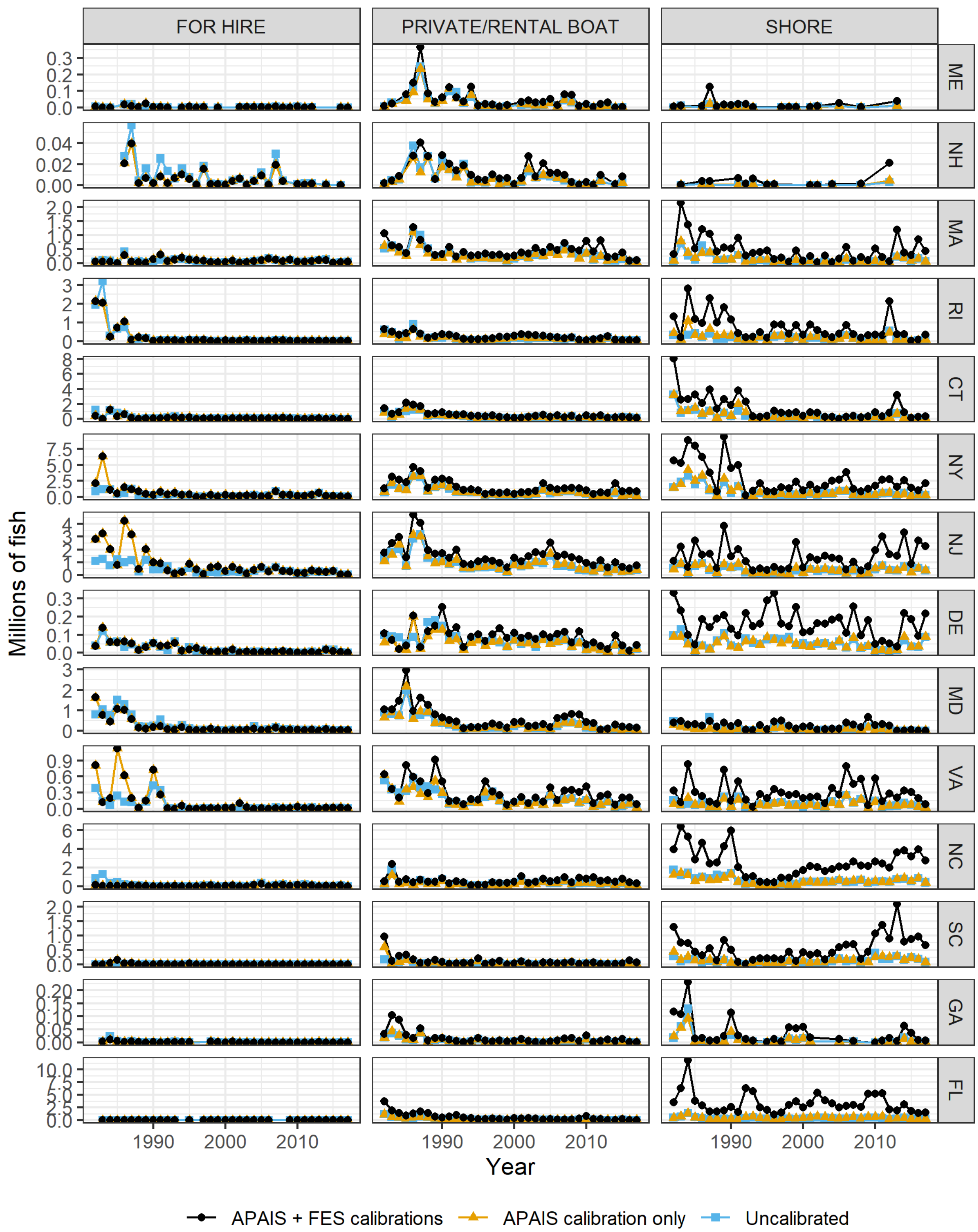

Figure 41: Comparison of calibrated and uncalibrated estimates of bluefish recreational harvest in numbers of fish for the Atlantic coast by state and mode. Note the different y-axis for each state.

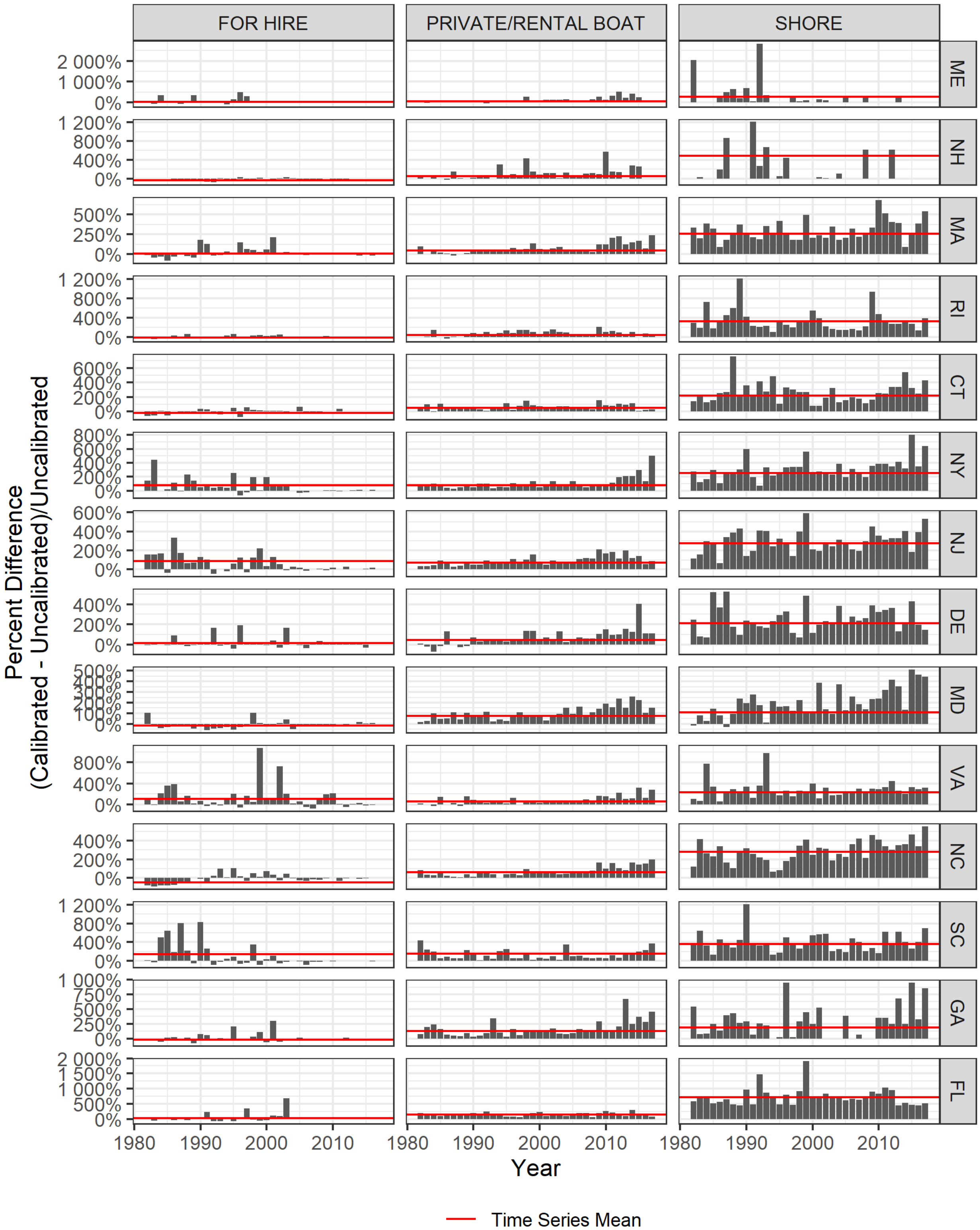

Figure 42: Percent difference between calibrated and uncalibrated estimates of recreational bluefish harvest in numbers of fish for the Atlantic coast by state and mode, plotted with the time series mean difference for each state and mode. Note the different y-axis for each state.

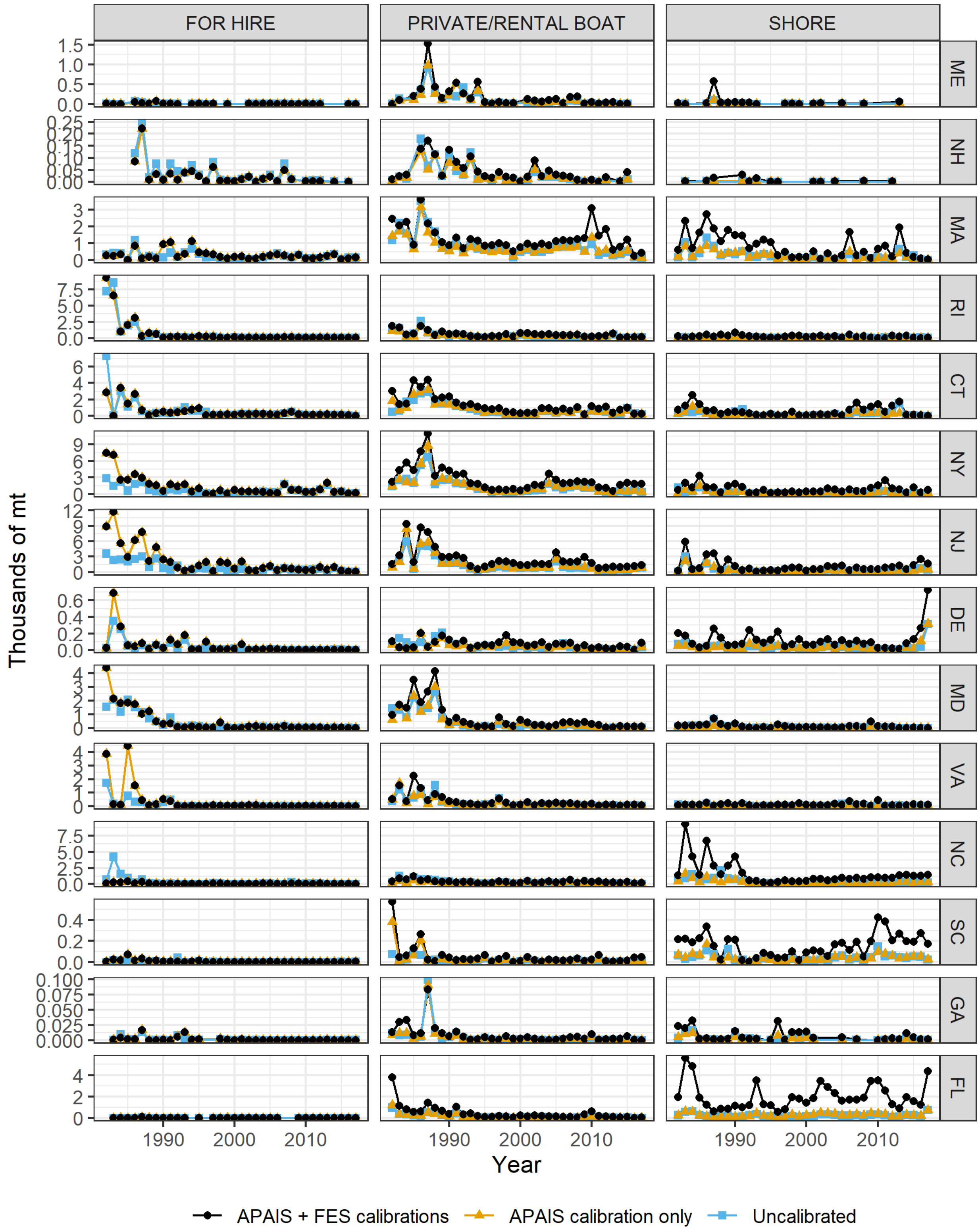

Figure 43: Comparison of calibrated and uncalibrated estimates of bluefish recreational harvest in weight for the Atlantic coast by state and mode. Note the different y-axis for each state.

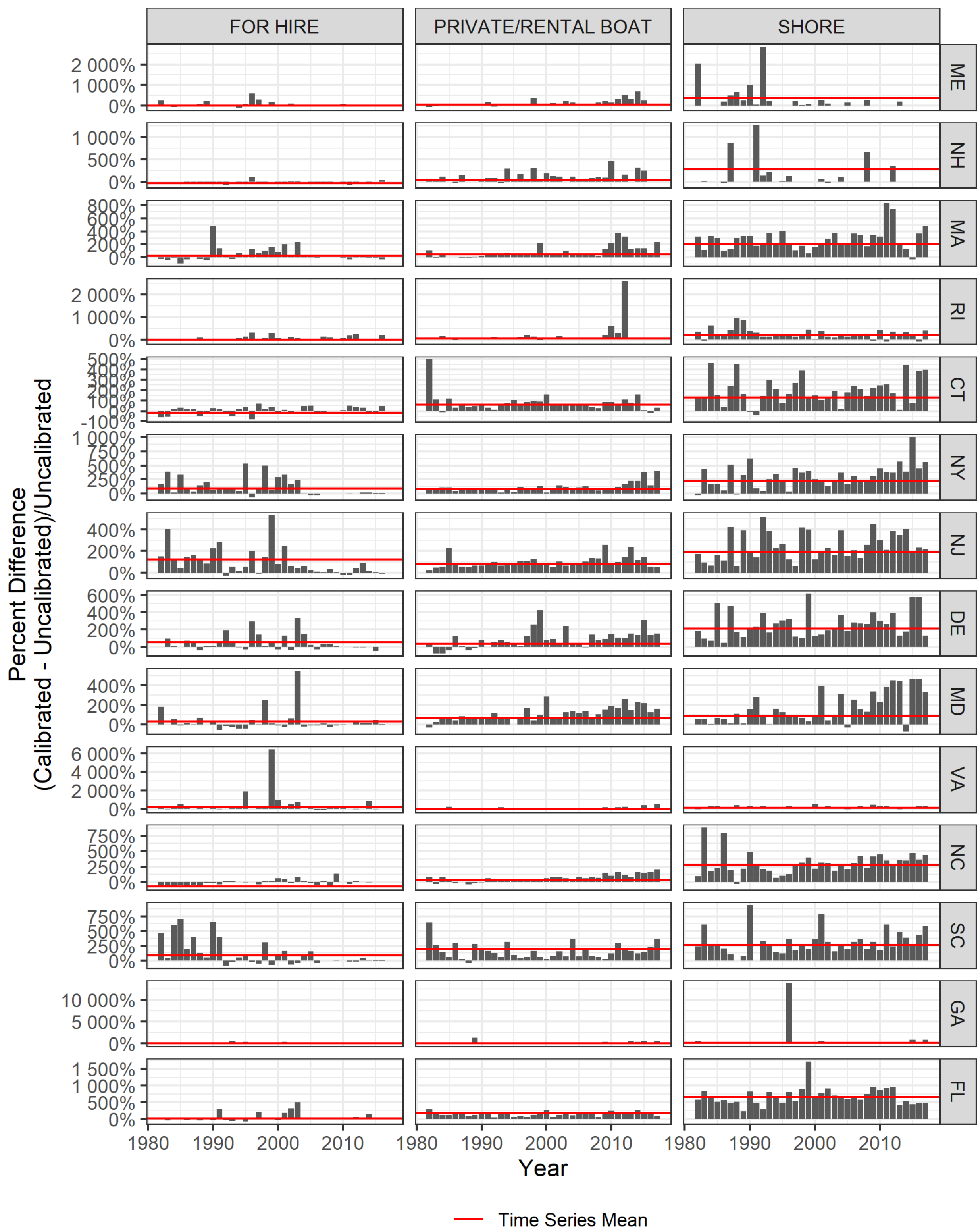

Figure 44: Percent difference between calibrated and uncalibrated estimates of recreational bluefish harvest in weight for the Atlantic coast by state and mode, plotted with the time series mean difference for each state and mode. Note the different y-axis for each state.

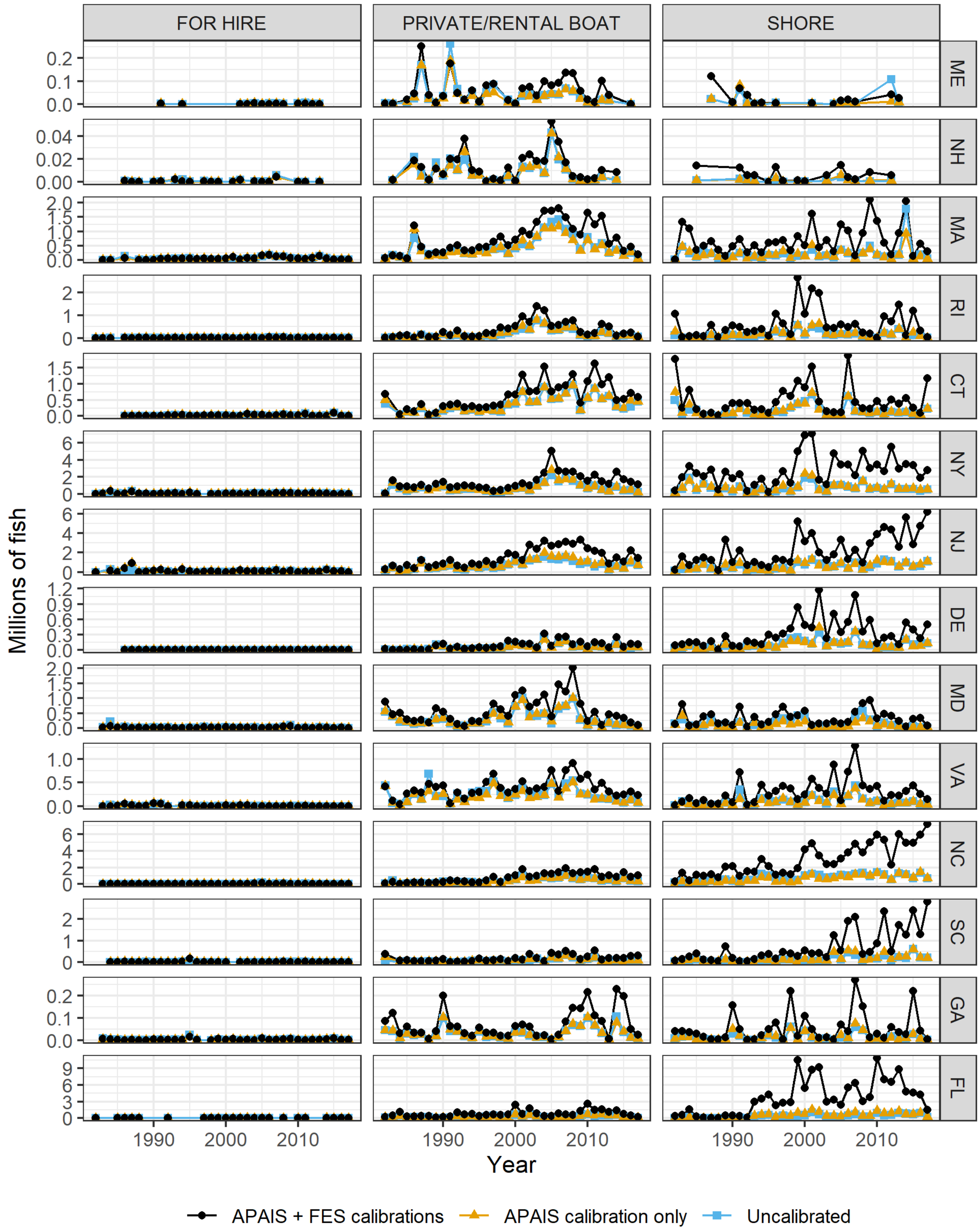

Figure 45: Comparison of calibrated and uncalibrated estimates of bluefish recreational live releases for the Atlantic coast by state and mode. Note the different y-axis for each state.

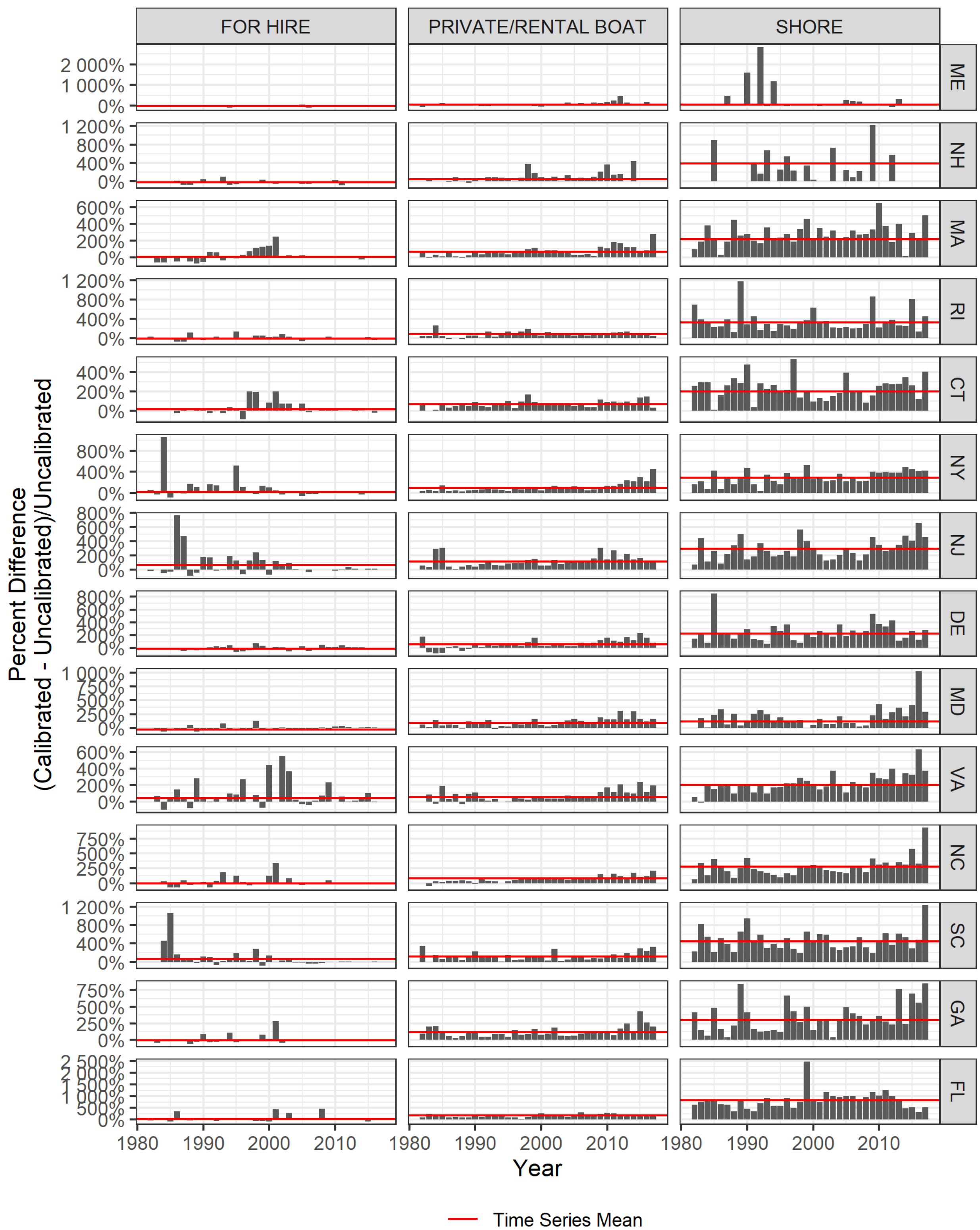

Figure 46: Percent difference between calibrated and uncalibrated estimates of recreational bluefish live releases for the Atlantic coast by state and mode, plotted with the time series mean difference for each state and mode. Note the different y-axis for each state.

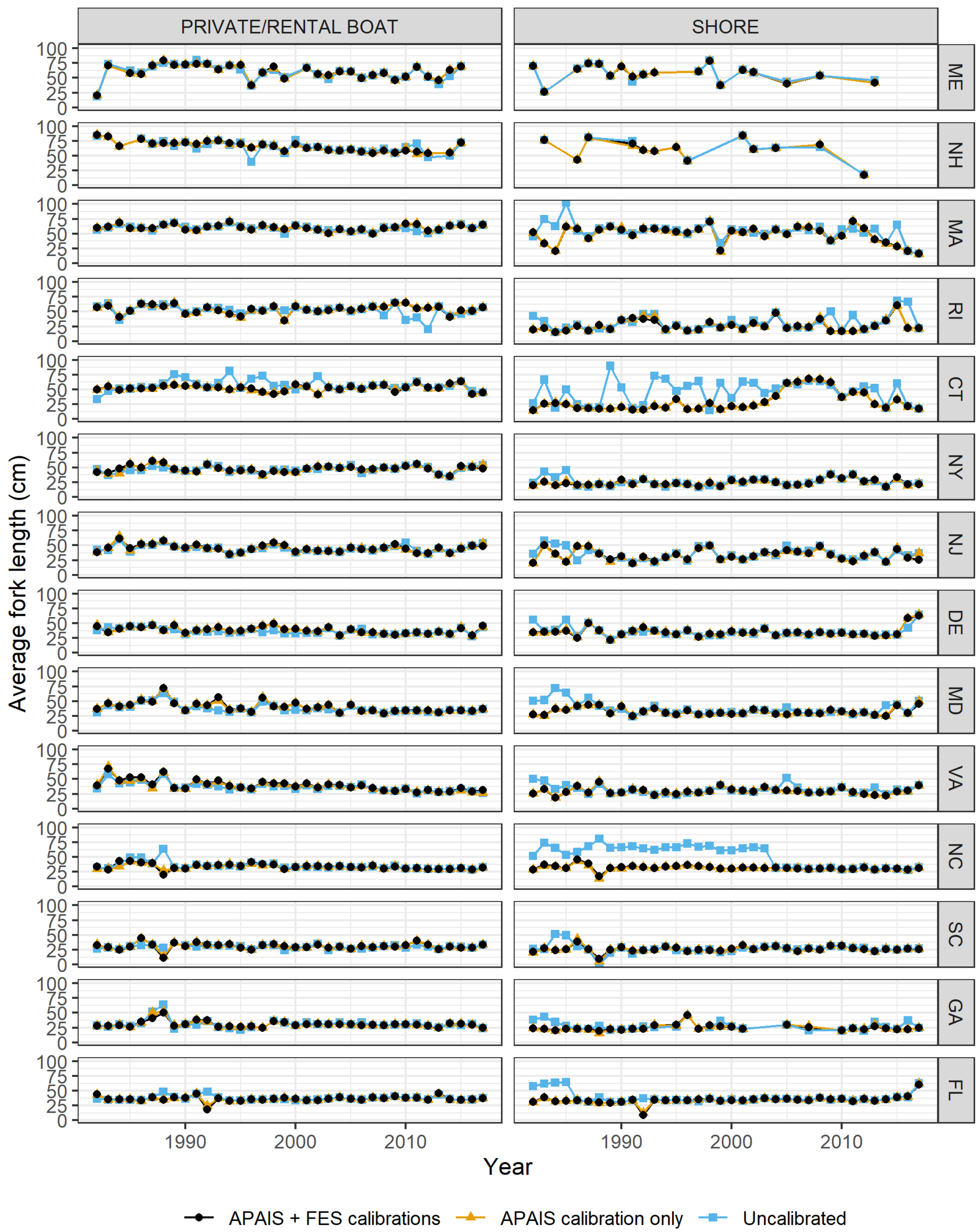

Figure 47: Comparison of calibrated and uncalibrated estimates of the average length of recreationally harvested bluefish for the Atlantic coast by state and private angler mode.

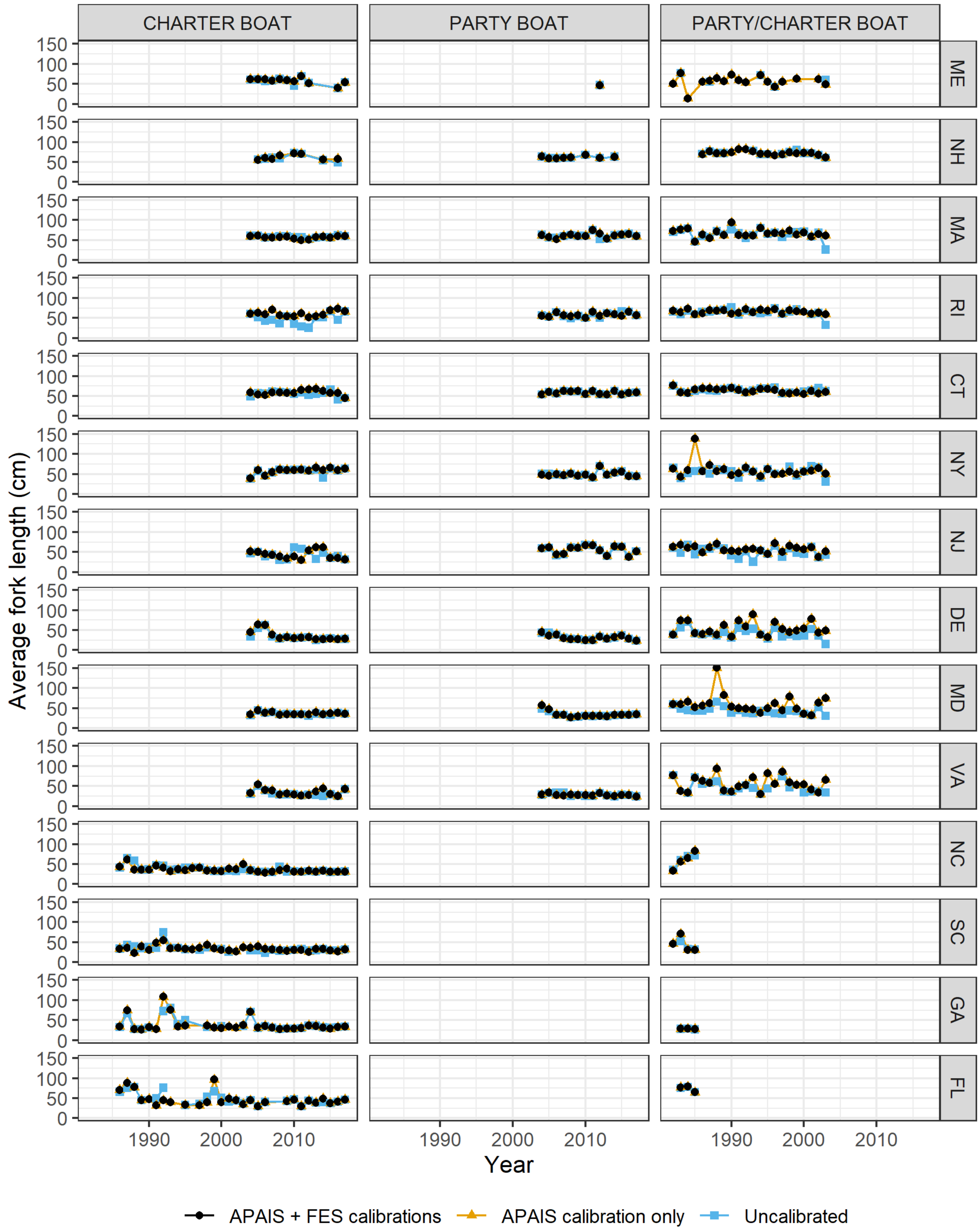

Figure 48: Comparison of calibrated and uncalibrated estimates of the average length of recreationally harvested bluefish for the Atlantic coast by state and for-hire mode.

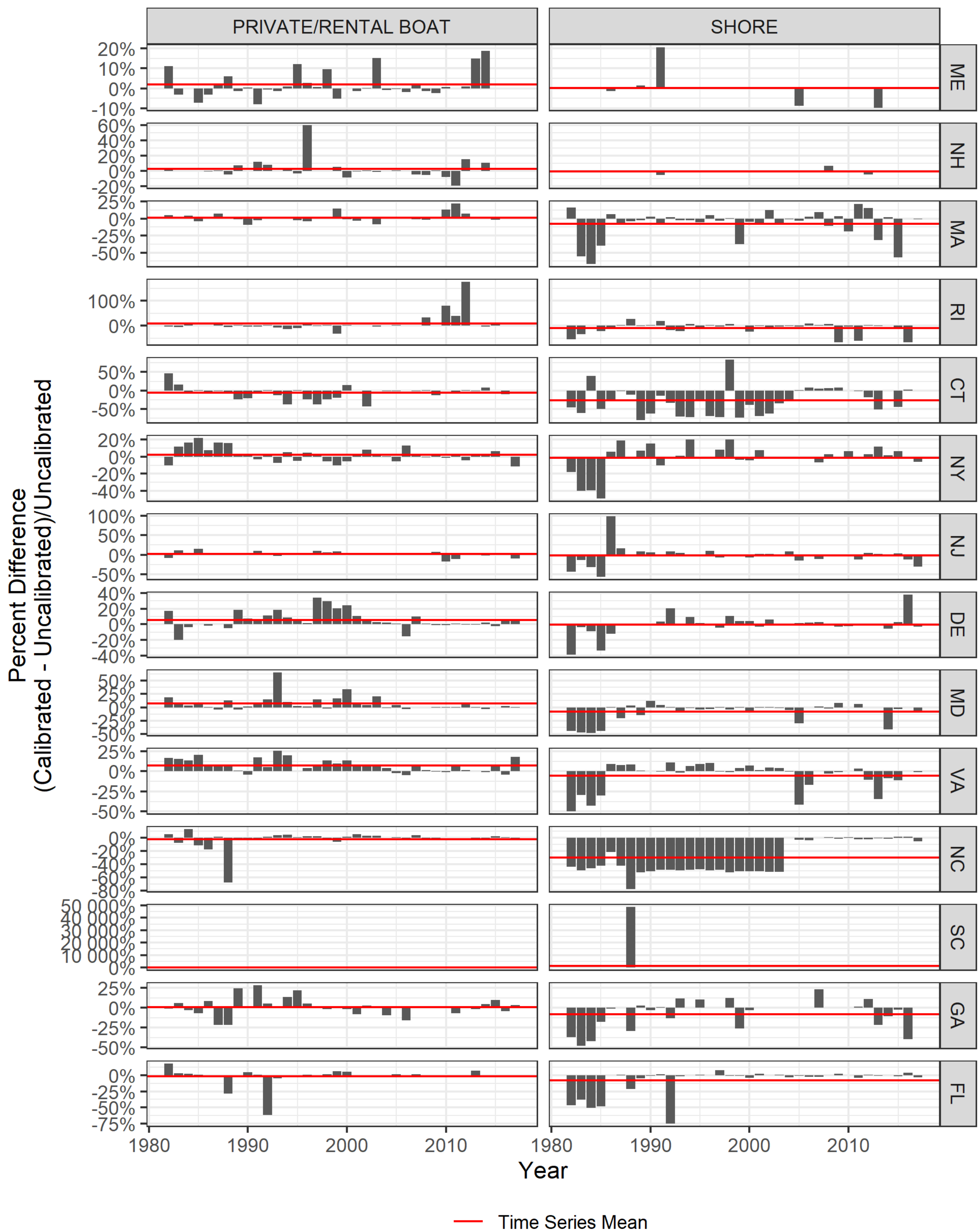

Figure 49: Percent difference between calibrated and uncalibrated estimates of the average length of recreationally harvested bluefish for the Atlantic coast by state and private angler mode, plotted with the time series mean difference for each state and mode. Note the different y-axis for each state.

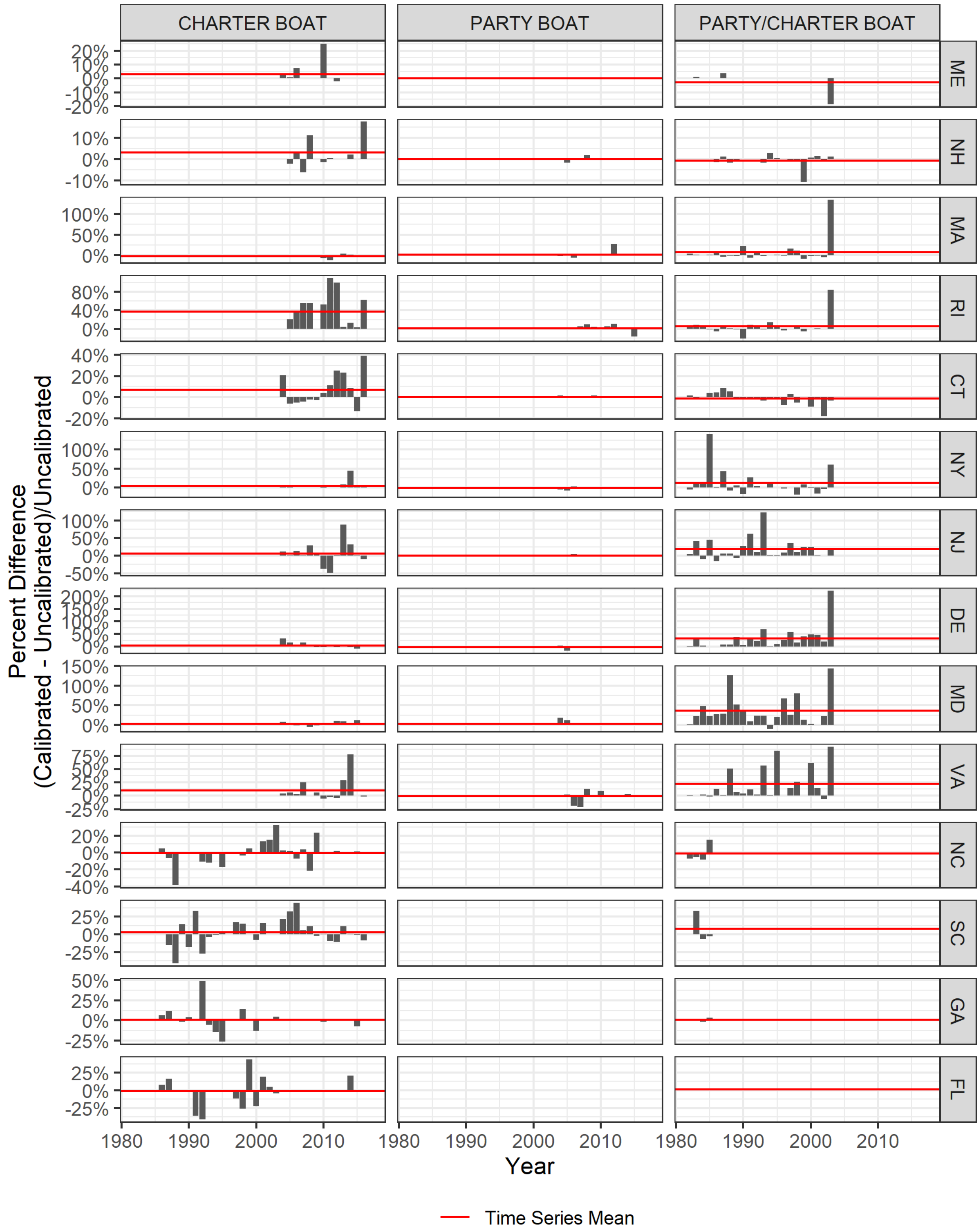

Figure 50: Percent difference between calibrated and uncalibrated estimates of the average length of recreationally harvested bluefish for the Atlantic coast by state and for-hire mode, plotted with the time series mean difference for each state and mode. Note the different y-axis for each state.

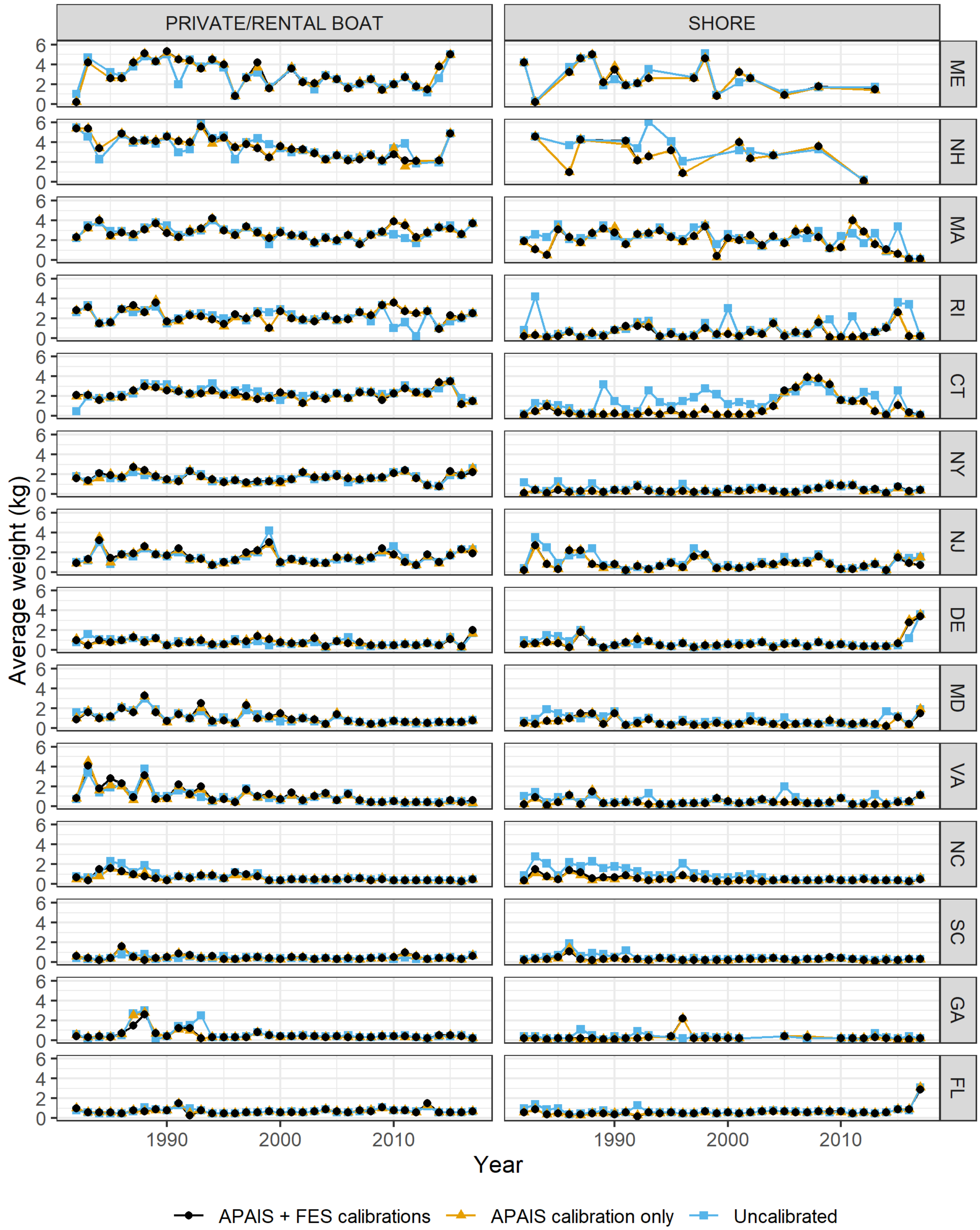

Figure 51: Comparison of calibrated and uncalibrated estimates of the average weight of recreationally harvested bluefish for the Atlantic coast by state and private angler mode.

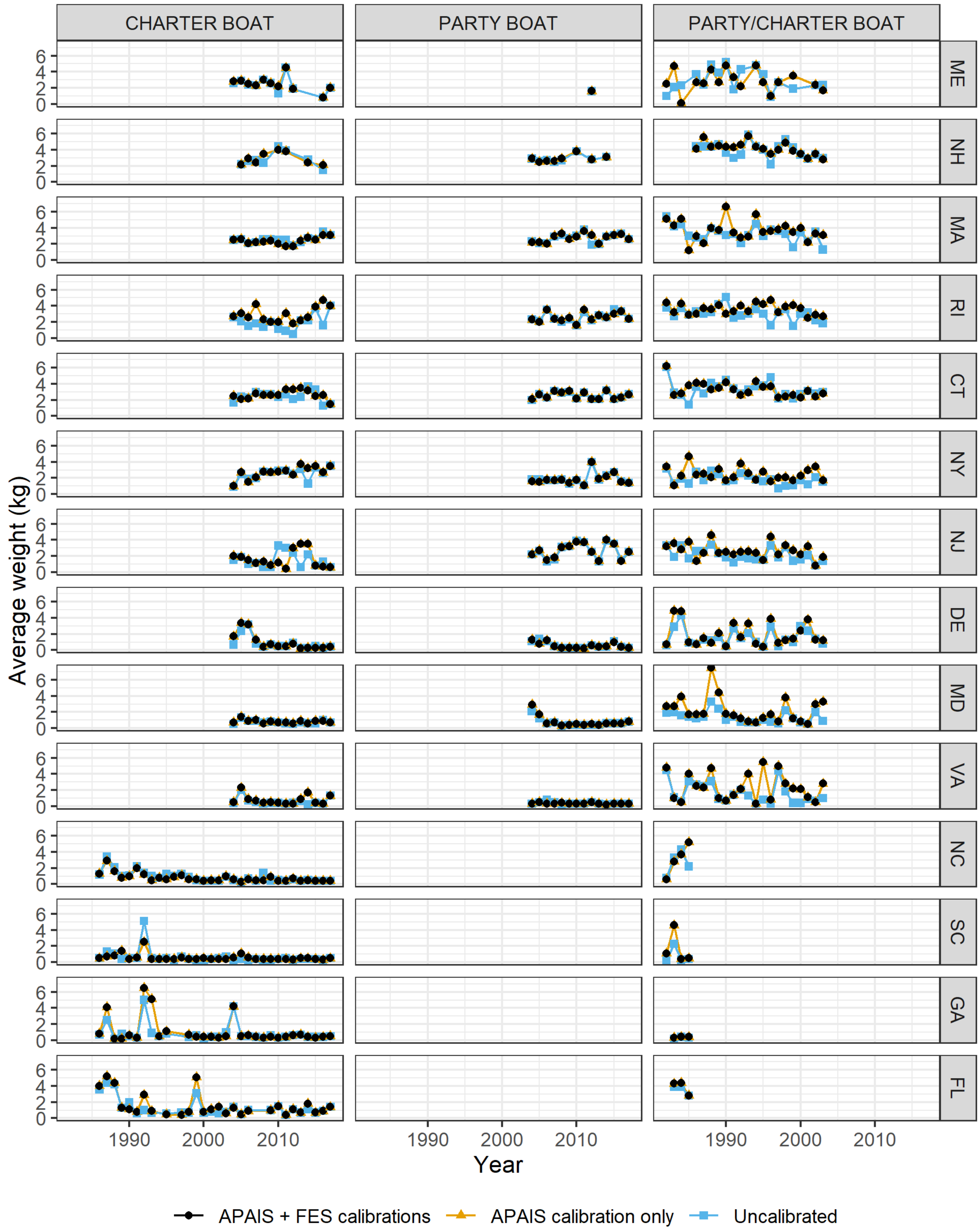

Figure 52: Comparison of calibrated and uncalibrated estimates of the average weight of recreationally harvested bluefish for the Atlantic coast by state and for-hire mode.

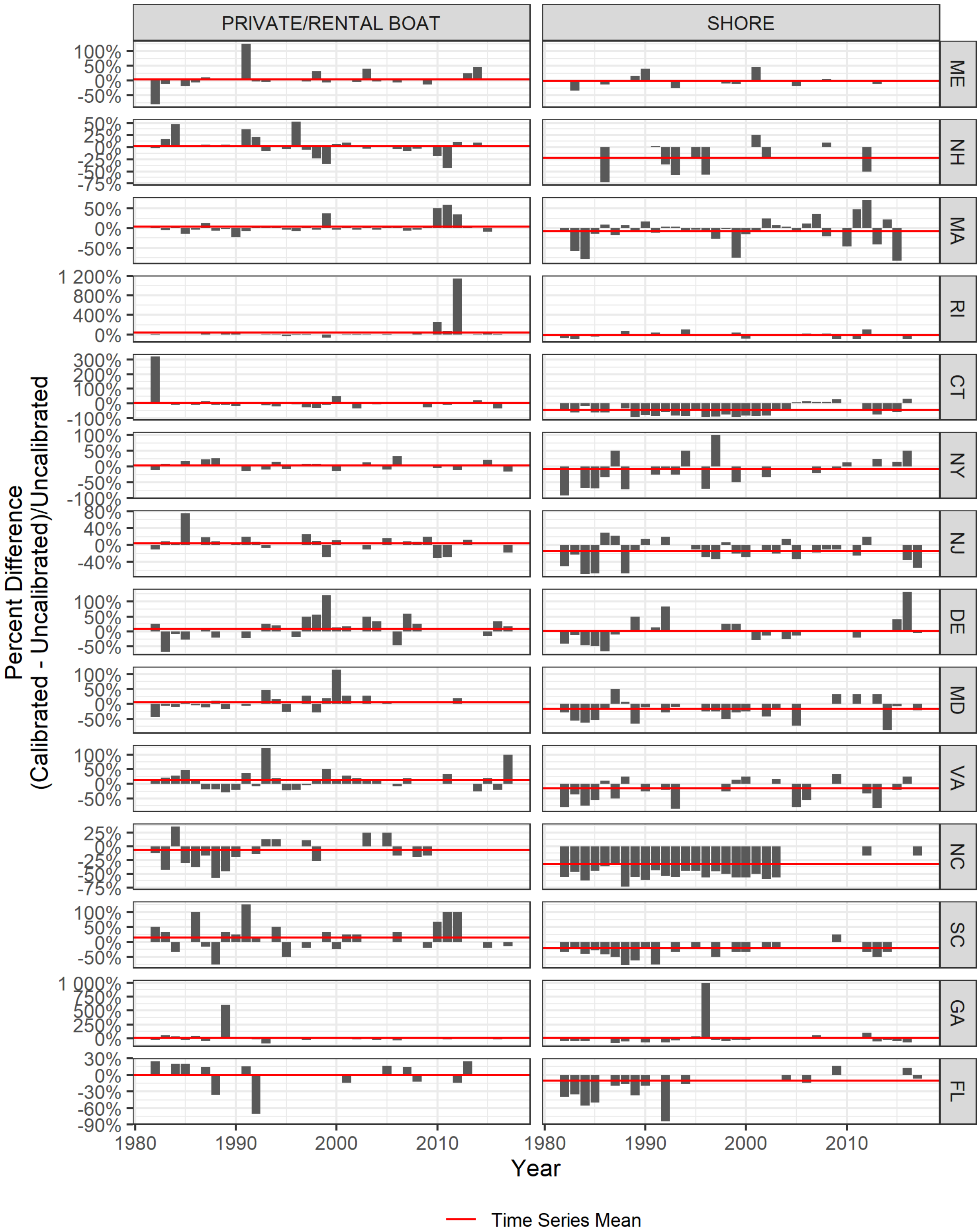

Figure 53: Percent difference between calibrated and uncalibrated estimates of the average weight of recreationally harvested bluefish for the Atlantic coast by state and private angler mode, plotted with the time series mean difference for each state and mode. Note the different y-axis for each state.

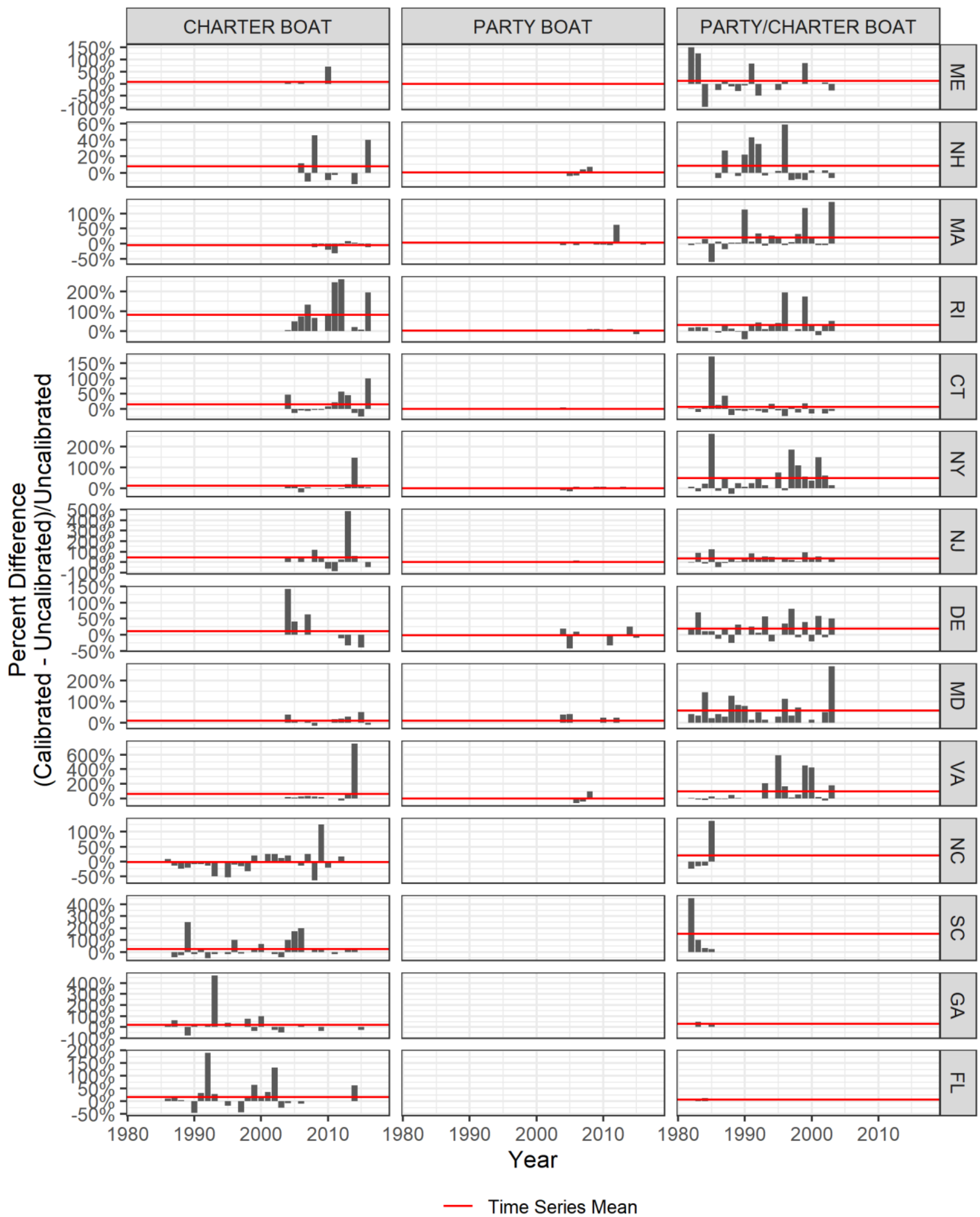

Figure 54: Percent difference between calibrated and uncalibrated estimates of the average weight of recreationally harvested bluefish for the Atlantic coast by state and for-hire mode, plotted with the time series mean difference for each state and mode. Note the different y-axis for each state.

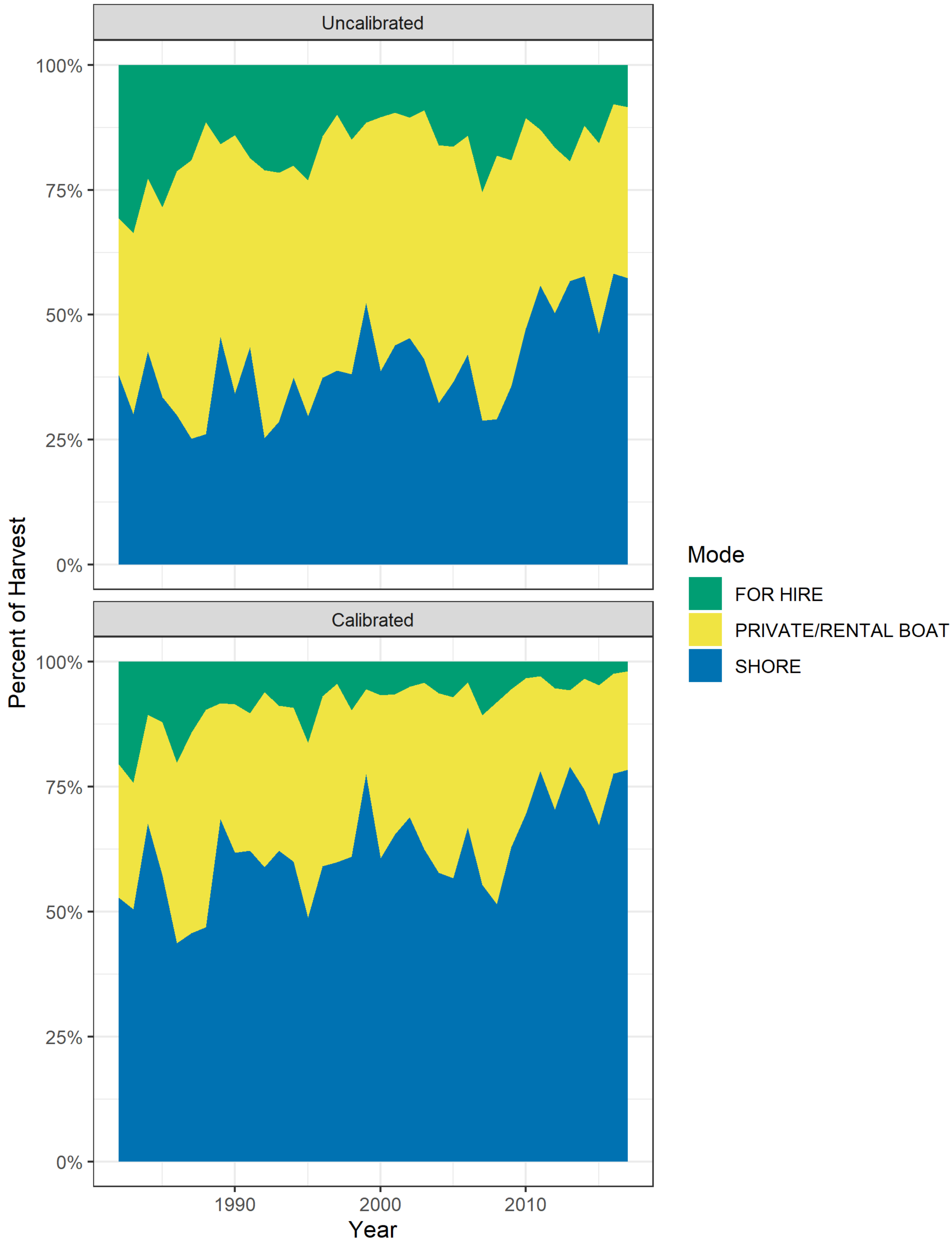

Figure 55: Proportion of uncalibrated (top) and calibrated (bottom) recreational harvest of bluefish in numbers by mode on the Atlantic coast.

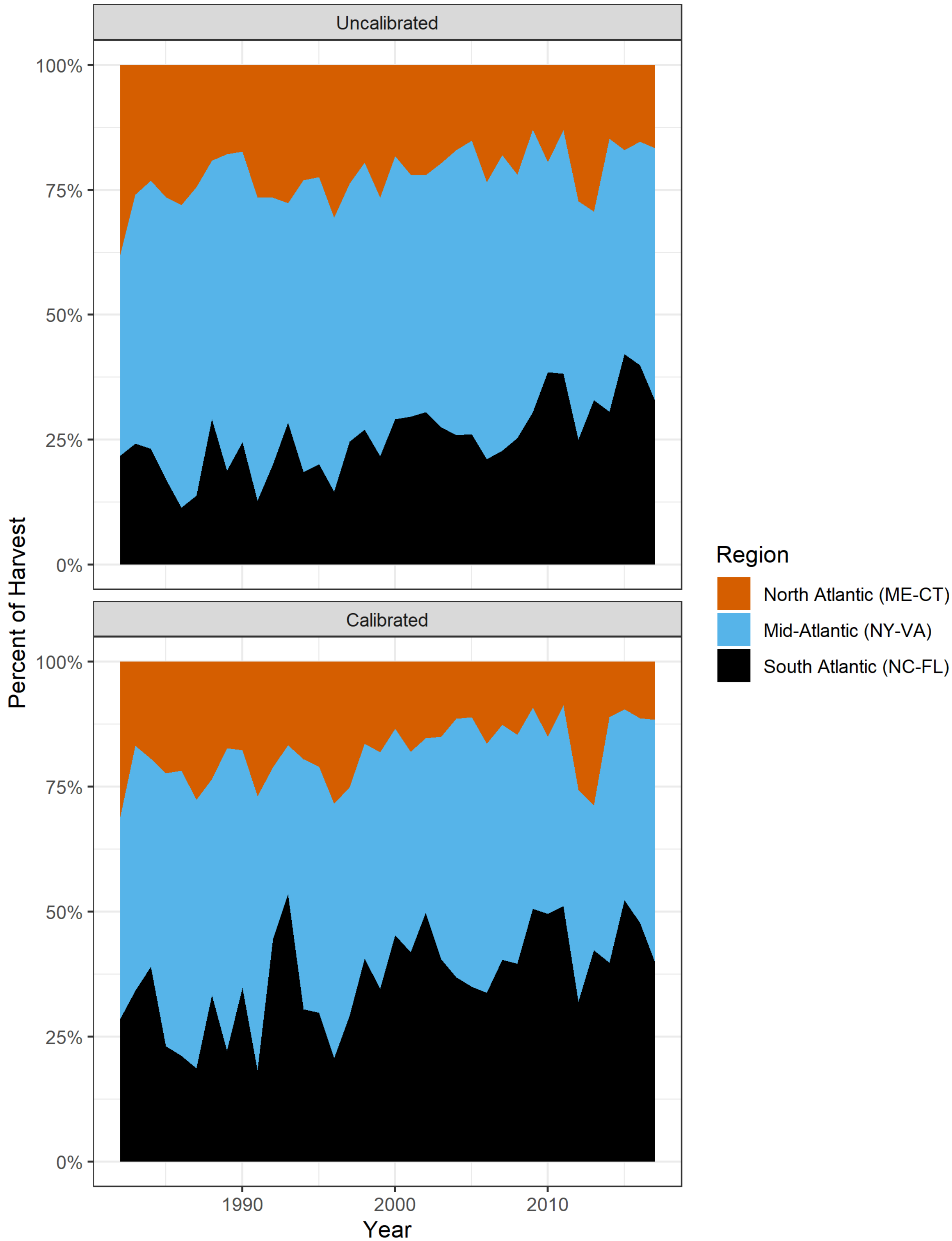

Figure 56: Proportion of uncalibrated (top) and calibrated (bottom) recreational harvest of bluefish in numbers by region on the Atlantic coast.

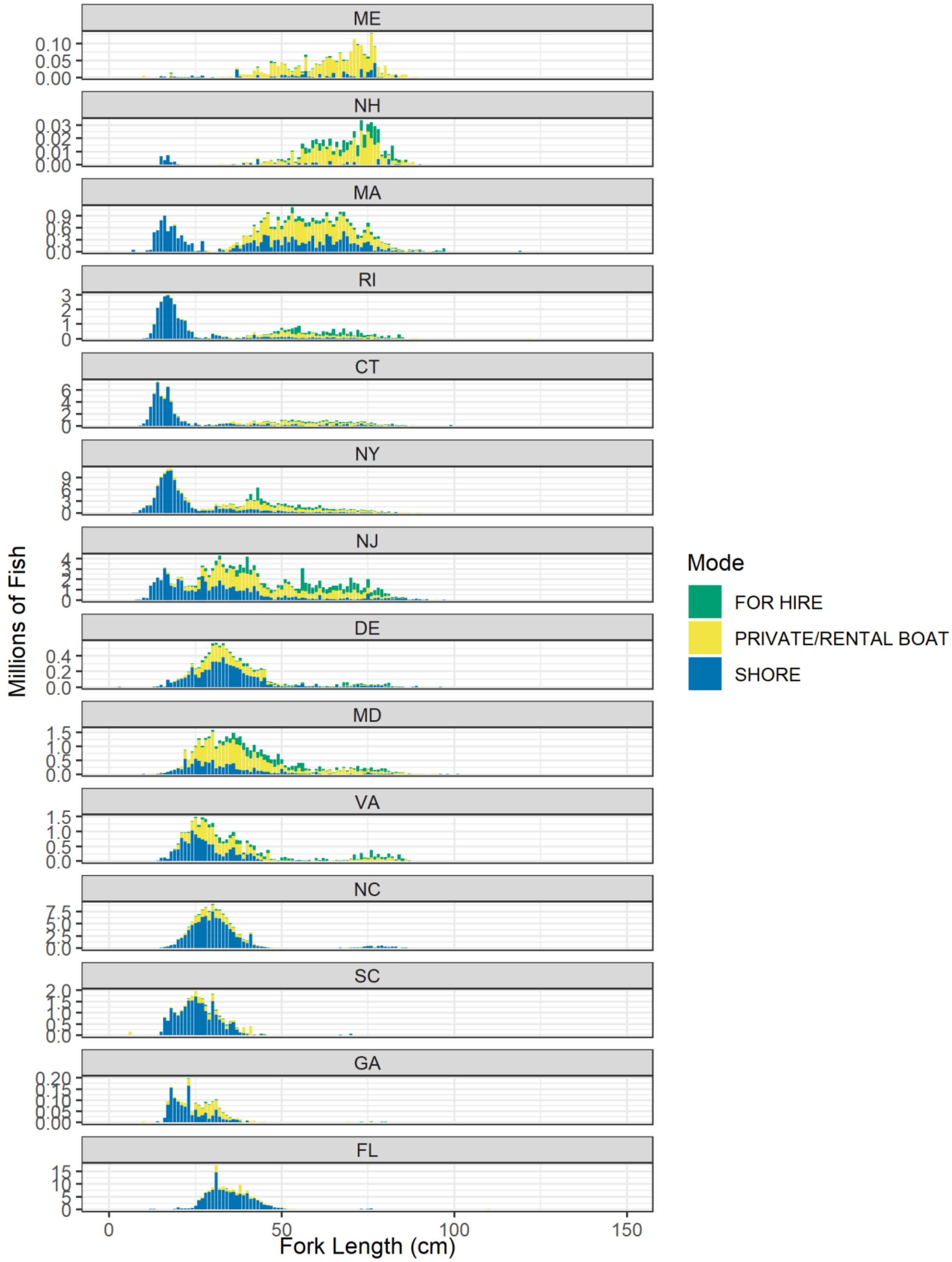

Figure 57: Length frequencies of harvested bluefish by state and mode (calibrated data only, 1982-2021).

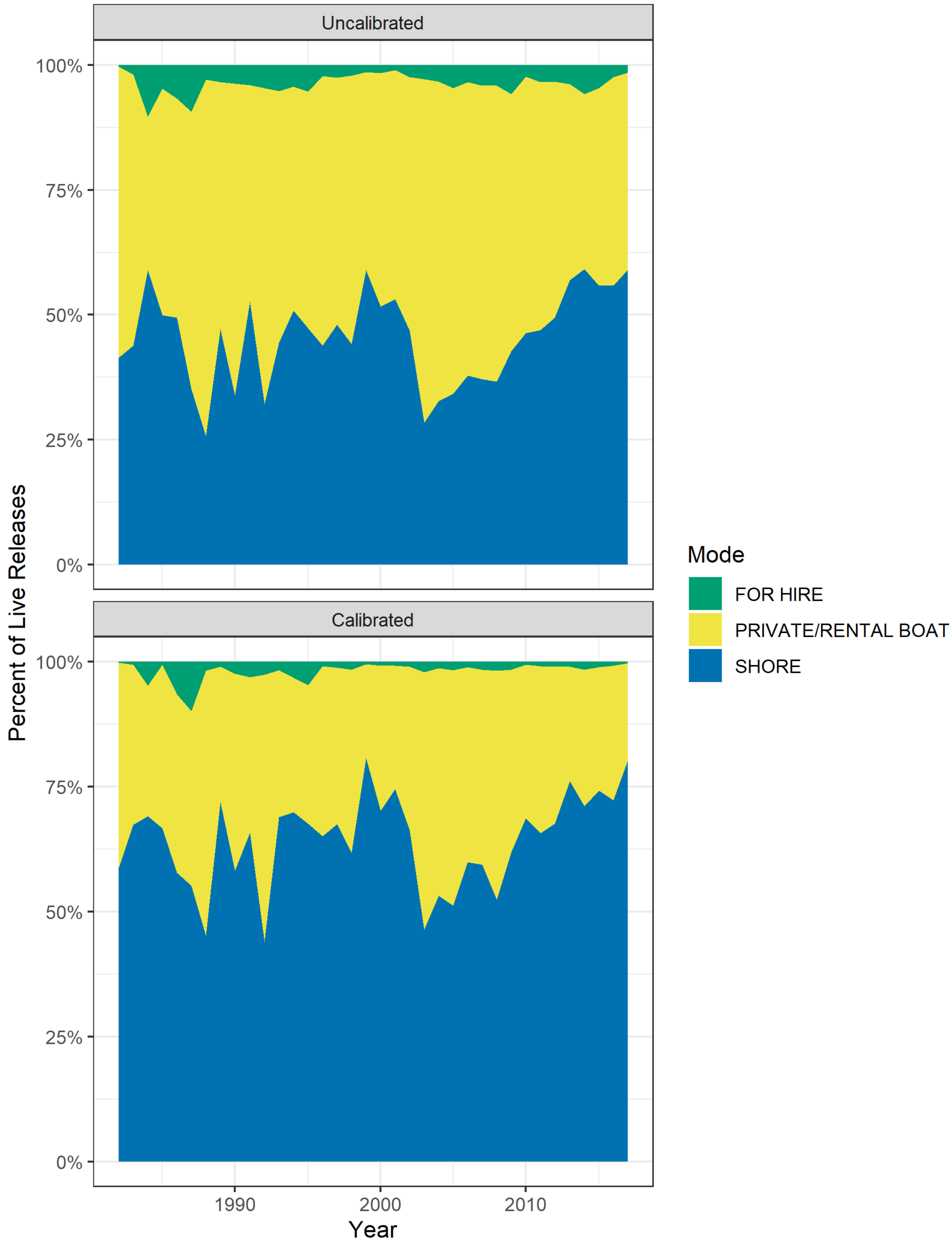

Figure 58: Proportion of uncalibrated (top) and calibrated (bottom) recreational live releases of bluefish in numbers by mode on the Atlantic coast.

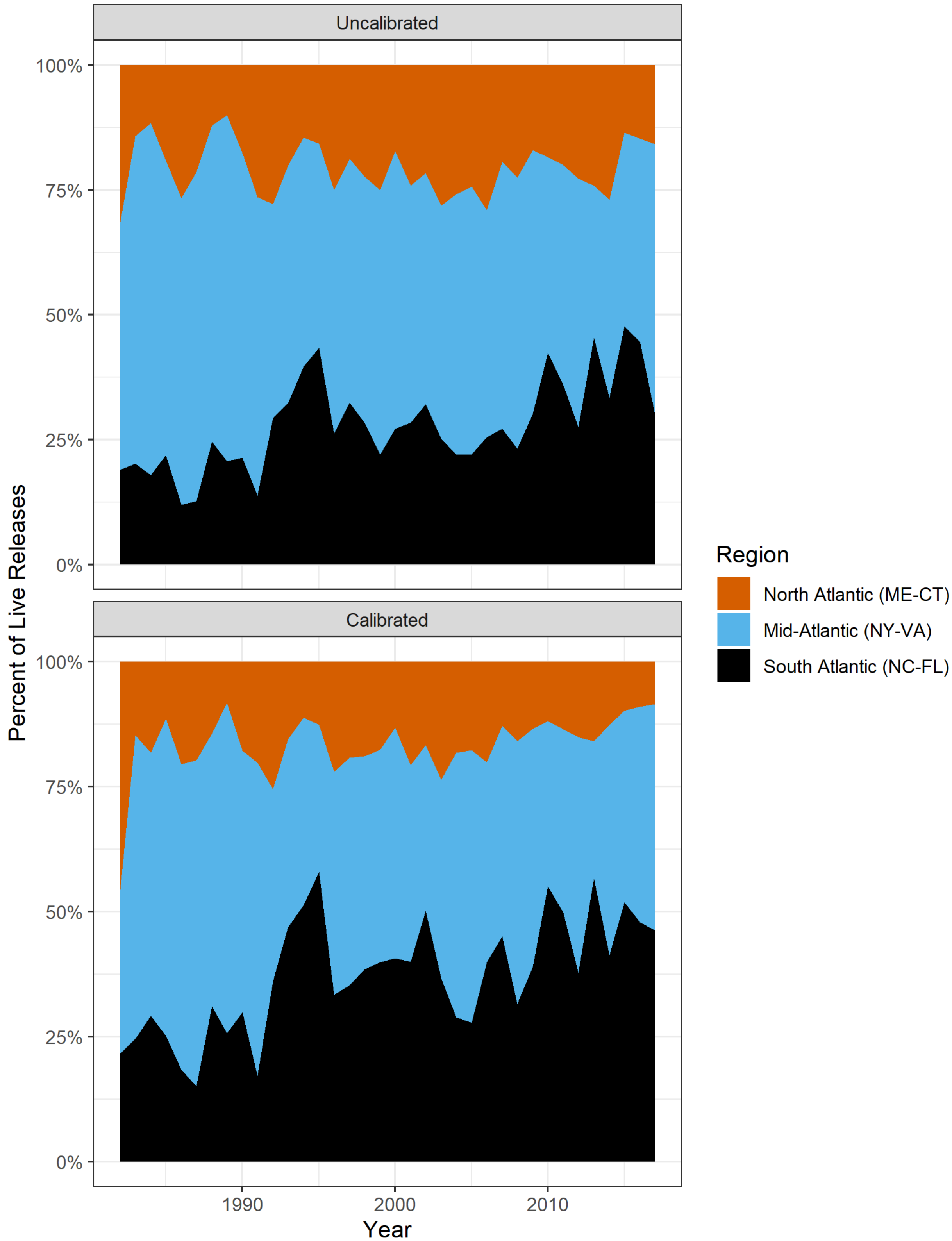

Figure 59: Proportion of uncalibrated (top) and calibrated (bottom) recreational live releases of bluefish in numbers by region on the Atlantic coast.