Length and age distributions of Southeast U.S. Atlantic Black Sea Bass (*Centropristis striata*) from commercial fisheries

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SEDAR56-WP06

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Length and age distributions of Southeast U.S. Atlantic black sea bass (*Centropristis striata*) from commercial fisheries

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Introduction

Sampling effort for biological information from a fishery ideally is representative of the fishing effort from that fishery both temporally and spatially. However, this is rarely the case for fishery-dependent length and age samples in the Southeast U.S. Weighting schemes have been developed to account for disproportionate sampling by year and region. However, there are historical issues in the TIP sampling methods that must be addressed for species that are typically subsampled. Some samplers would measure all fish even in a very large sample (whole-haul sampling). The relative weight of whole-haul lengths need to be reduced to reflect the proportion of that trips contribution to the total landings. In some cases, such as dealer collections, trip-level information is not available so, the catch information about multiple trips is recorded as a single trip. These records are flagged and all were from South Carolina from 1984 - 1995. The number of length samples collected per trip varies dramatically with a trend of more consistent sampling effort in recent years for both handline and trap gears (Figures 1 and 2). Tables of the final length and age compositions are available in the SEDAR 56 data summary workbook.

Observations from EDA

General

- Only a few observations were removed from handline and none from trap length data. Pooling at 60cm total length does not cause a noticeable annual increase in the proportion at the plus group of 60cm. The range of lengths used for SEDAR 25 and the associated update encompasses the range of lengths from the commercial fishery for SEDAR 56 (Figures 3 and 4).
- The percent of the commercial catch sampled for lengths is extremely low for handline and trap gear (Figures 5 and 6).
- There is no pattern to the length distributions of fish where trip catch is known compared to fish from trips where trip catch is unknown and an average catch by year and region is used as a proxy (Figures 7 and 8). Small sample size could explain most of the few large differences in size distributions by gear, year, and region.
- The number of lengths per trip has become more consistent in the last decade with increased consistency in adherence to sampling protocols and communication with TIP port agents (Figure 9 and 10).
- The relatively noisy commercial length compositions (Figures 11 and 12) are likely a result of the skewed distribution of both the number of lengths taken per trip and the trip-level landings.
- The age distributions for both gears are unimodal with the mode of trap ages smaller than handline (Figures 13 and 14)

- The 2011 and 2012 commercial handline length composition was similar to matching length compositions for the 2013 black sea bass update using data through 2012 indicating that any changes to weighting did not have a large impact in the final length composition (Figure 15), there was only one year of length composition pooled across years for commercial traps and was not compared to the new composition
- The 2011 and 2012 commercial ages were re-aged using standardized techniques developed for earlier years. The updated ages show a shift to younger ages for both gears when compared to matching age compositions for the 2013 black sea bass update using data through 2012 (Figures 16 and 17).

Handline

- All regions were represented for handline lengths for most years (Figure 9).

Trap

- The increase in length samples (Figure 8) and landings (confidential) from the Florida trap fishery in recent years (2009-2015) was verified by a TIP port agent and explained as an exploratory fishery.
- Most years have only NC represented for commercial trap length data (Figure 10).

SEDAR 56 methods modified from SEDAR 25 update methods (S25DW21):

- Include lengths from trips where trip catch is unknown and use average strata-level trip catch as weights.
    - Justification:
        - The sample sizes for important regions are reduced to unusable levels for many years. For some of these years small sample sizes for those regions were up-weighted causing spikes in overall length compositions. This is a tradeoff sacrificing potential bias in weighting length samples to remove erroneous spikes due to low sample sizes
        - Limited spatial coverage for important areas if strata with low sample sizes are removed
        - Removes or reduces problem of losing age composition data because there is no associated length bin by strata
- EDA of trips where catch is known but multiple trips contribute is limited to SC over the 1985-1995 time period (846/2413 lengths with multiple trip flags)
- Order operations may differ from the SEDAR 25 update but are consistent with recent SEDAR length and age composition development with a more inclusive trip-level weighting scheme. Specific order of operations for SEDAR 56 are given in Appendix 1.

Research recommendations

- Evaluate variance of trip-level landings and determine appropriate strata for filling in missing catch data (e.g. vessel*year)
- Evaluate ways to be consistent with respect to exclusion of samples between length and age data

Appendix 1. Order of operations for weighting length and age compositions

- 2 files provided from TIP (lengths where trip catch is recorded, lengths removed for various reasons)
- Subset removed trips to just records that were removed because trip catch is not recorded
- Concatenate length record files (with and without trip-level catch)
- Convert to length unit
    - Total length and fork length are the same for BSB, 1 record had a max. total length and was dropped, there were no standard lengths
- Create 1cm bins
- Calculate mean weight from length data by year, gear, and region using length-weight conversion provided.
- Calculate average trip-level landings in pounds by year, gear, and region
- Convert landings in pounds to landings in number for trip-level catch for each record
- Merge trip level landings in number
    - Actual when available, average by year, gear, and region when not available
- For each trip - multiply quantity in length bin * trip-level landings
- Pivot year*weight and then renormalize by region
- Multiply each regions annual landings fraction in number by the regional comps
- Sum proportion at length across regions for final length comp
- Normalize proportion at length for years where all regions are not represented in length composition to sum to 1 across length bins.
- Ages – use Chih re-weighting method: proportion at length (measured fish)/ proportion at length (aged fish)

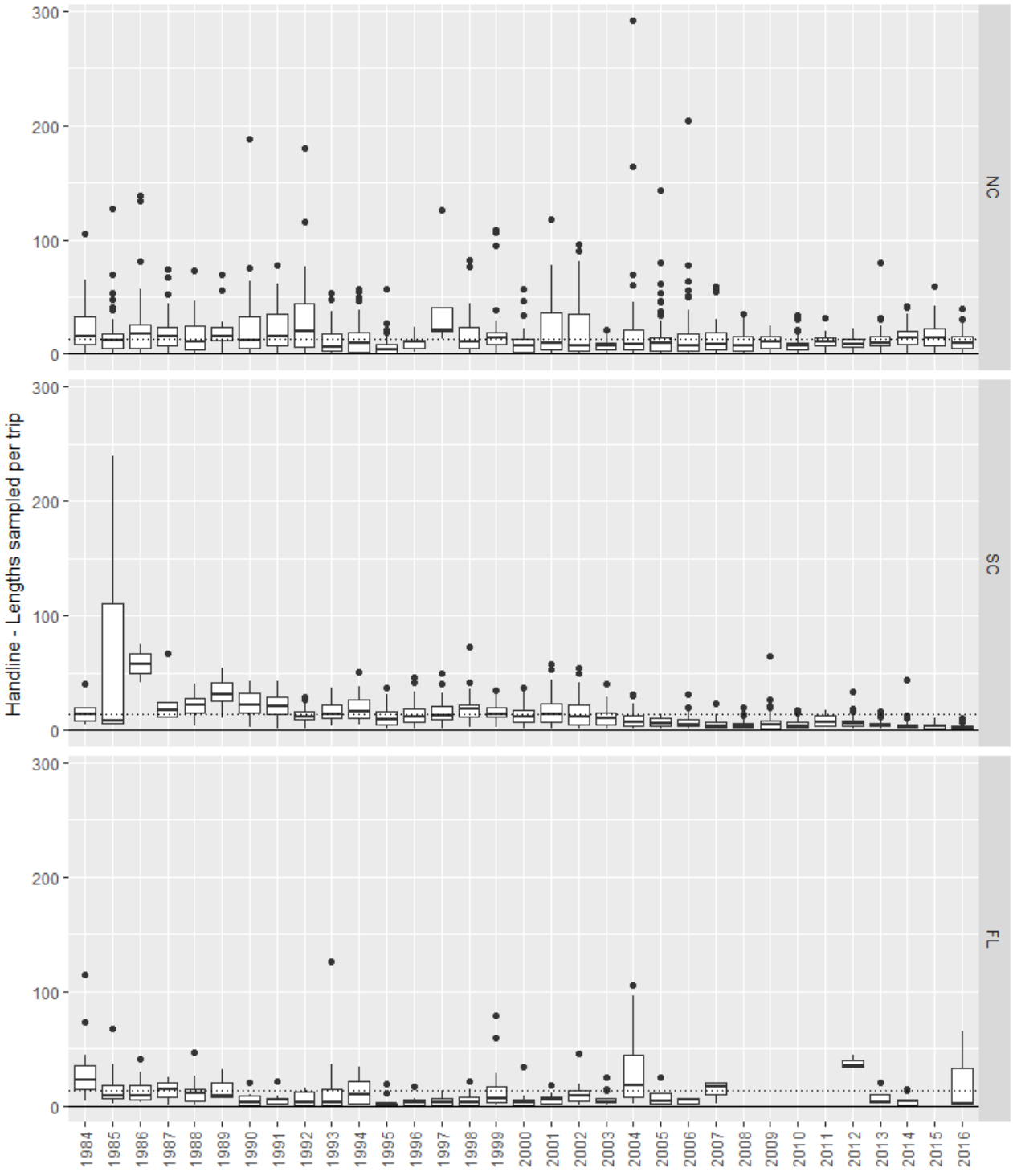

Figure 1. Number of handline samples taken per trip (multiple trips in some cases) by year and region. The Florida region also includes some samples from Georgia. The dotted line represents the mean number of lengths taken per trip.

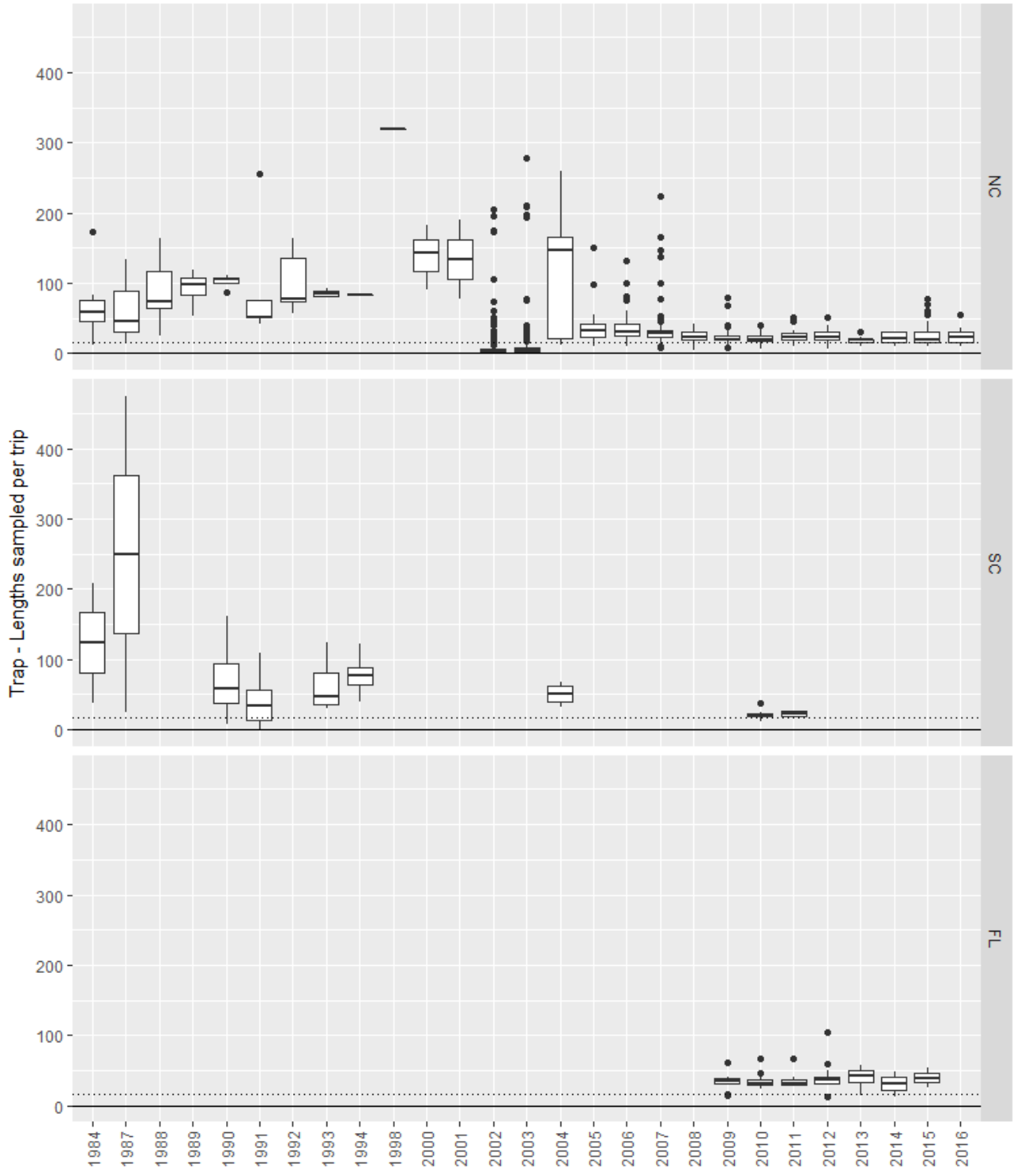

Figure 2. Number of trap samples taken per trip (multiple trips in some cases) by year and region. The Florida region also includes some samples from Georgia. The dotted line represents the mean number of lengths taken per trip.

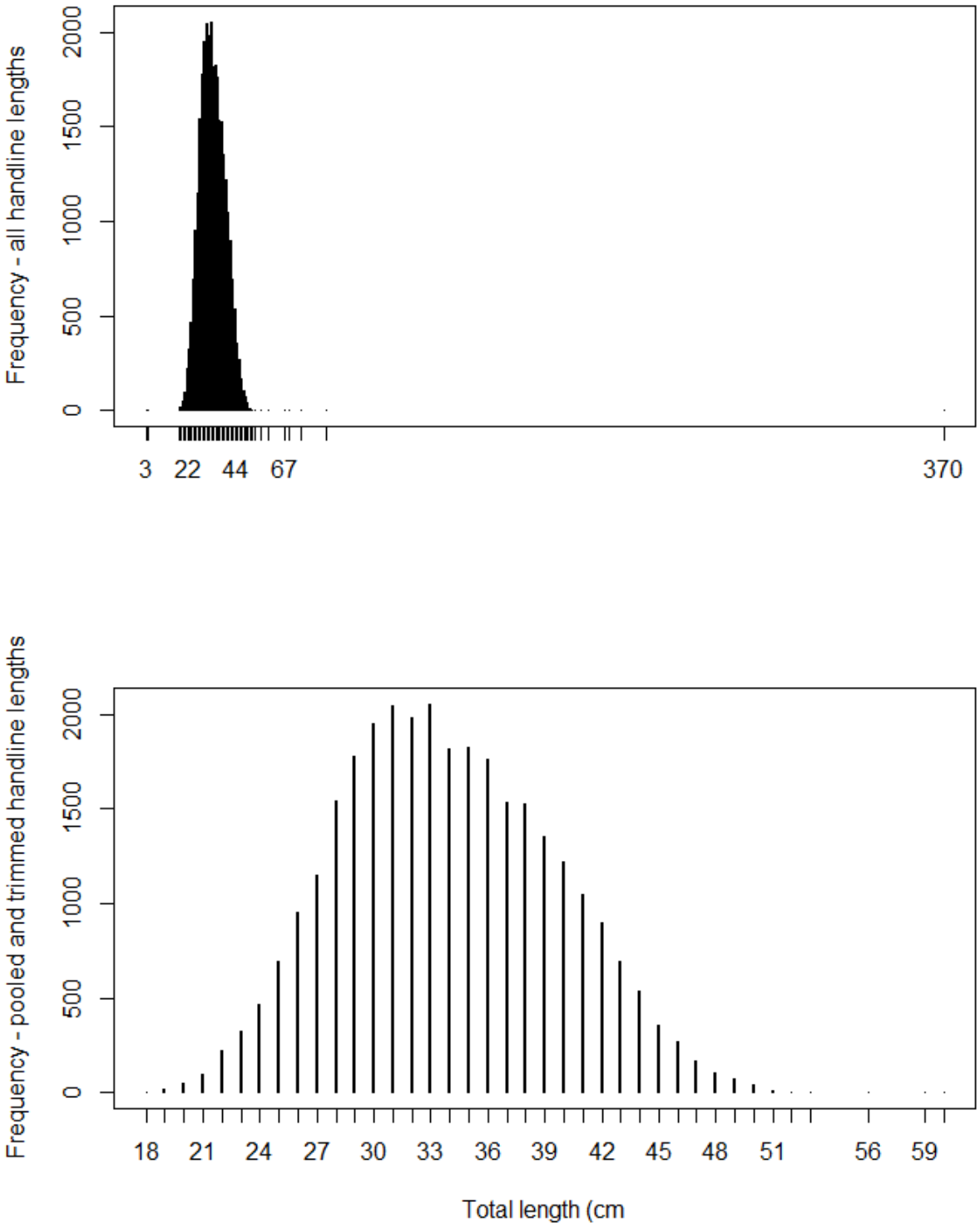

Figure 3. Commercial handline length distribution prior to and after exclusion of samples less than 10cm and greater than 100cm. The upper tail of the distribution was pooled at 60cm.

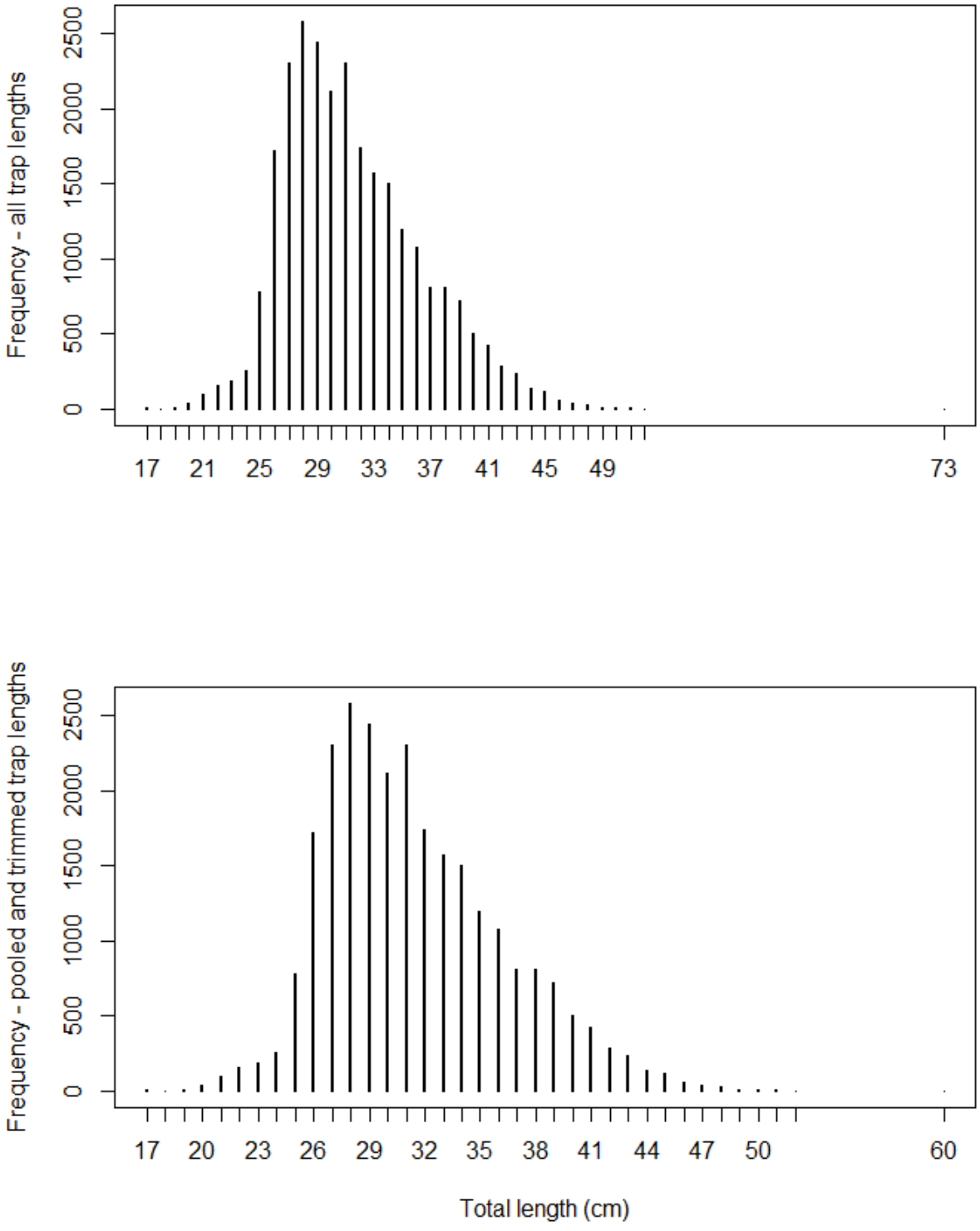

Figure 4. Commercial trap length distribution prior to and pooling of upper tail at 60cm. There were no values below 10cm or above 100cm.

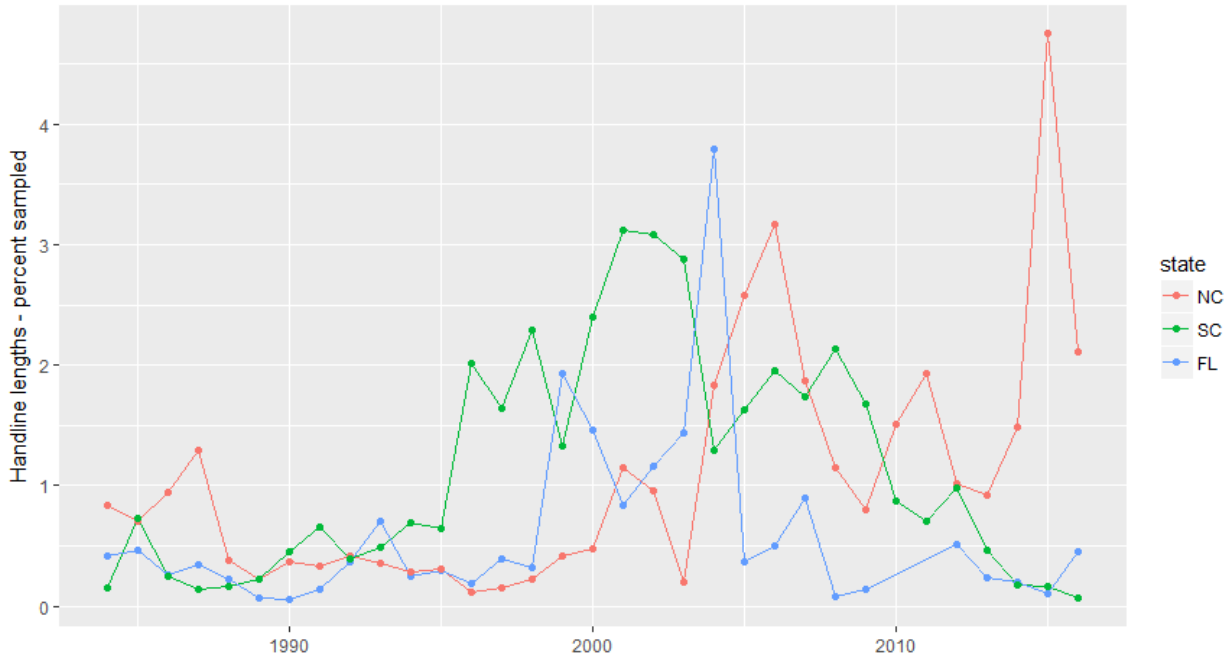

Figure 5. Percent of total handline landings in number (imputed using mean weights) sampled for length data.

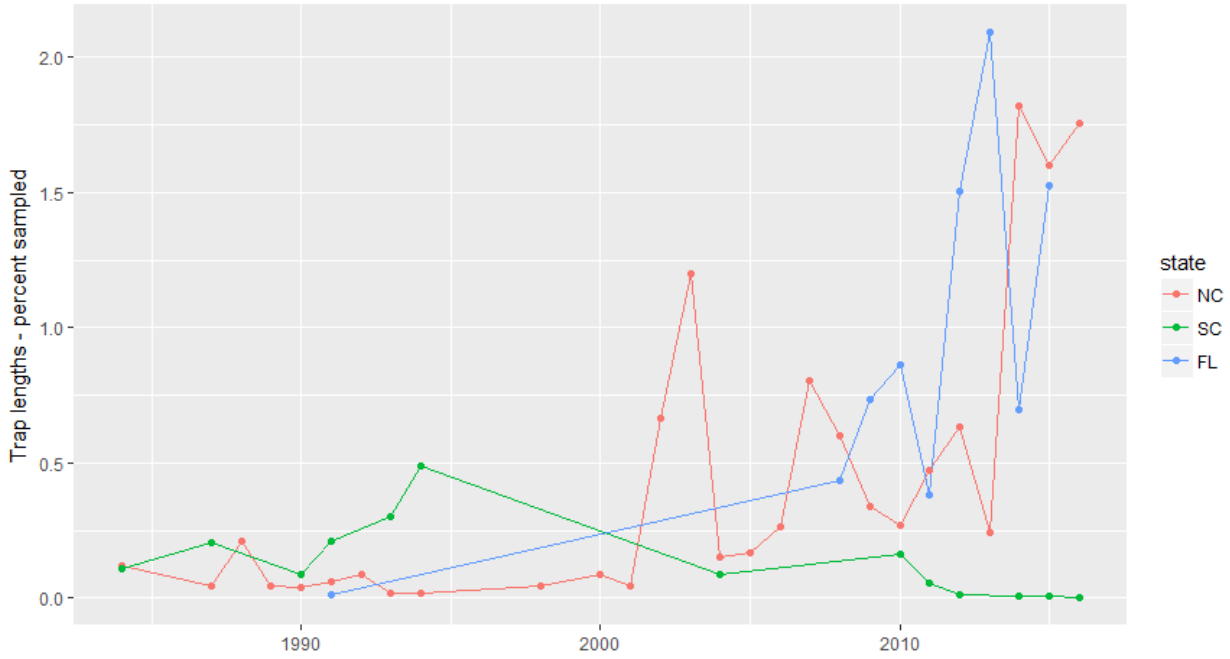

Figure 6. Percent of total trap landings in number (imputed using mean weights) sampled for length data.

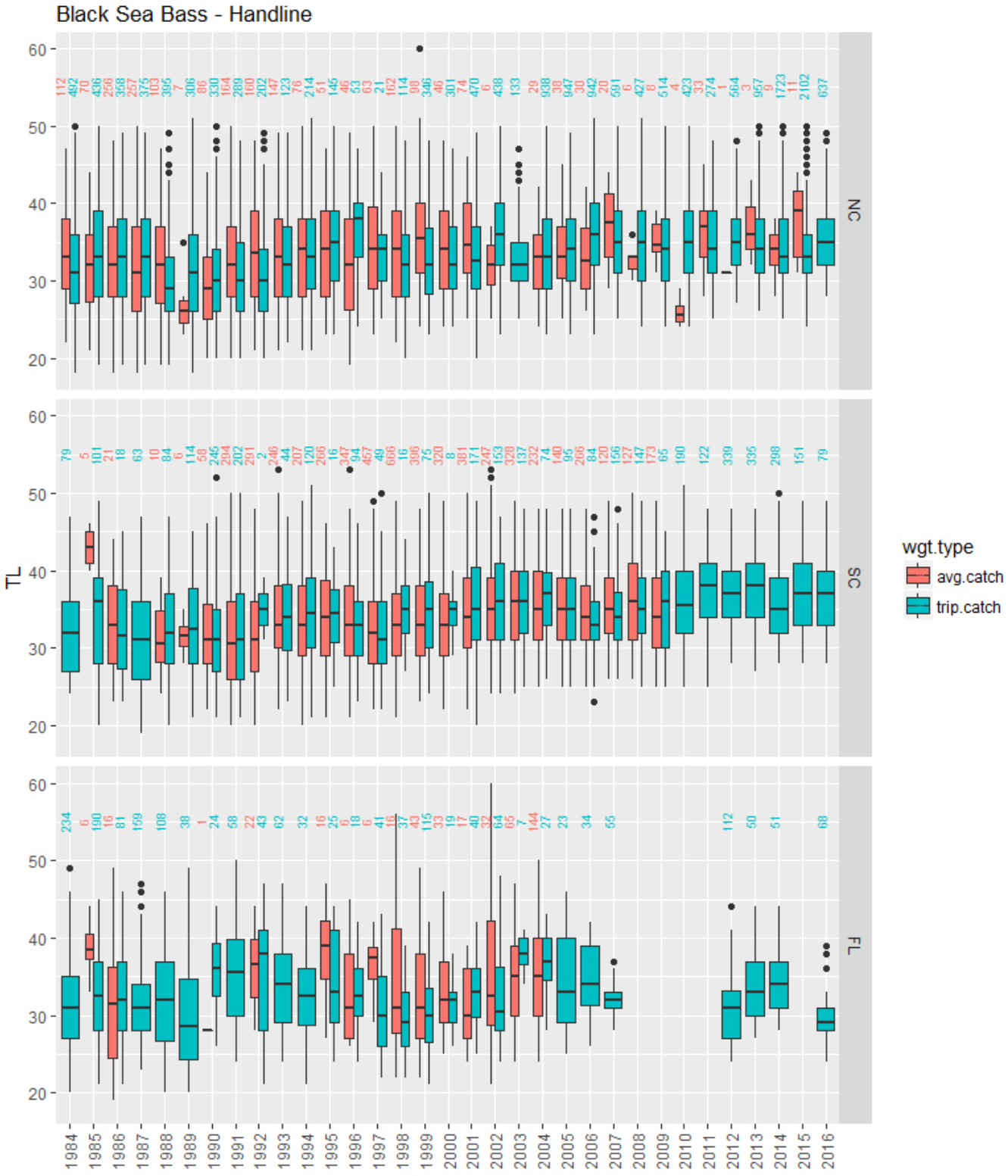

Figure 7. Handline total length (TL) distributions in centimeters by year and region for trips with associated weights (trip.catch) and trips where average catch by year and region was used as a proxy for trip-level catch. Sample sizes are given at the top of each panel.

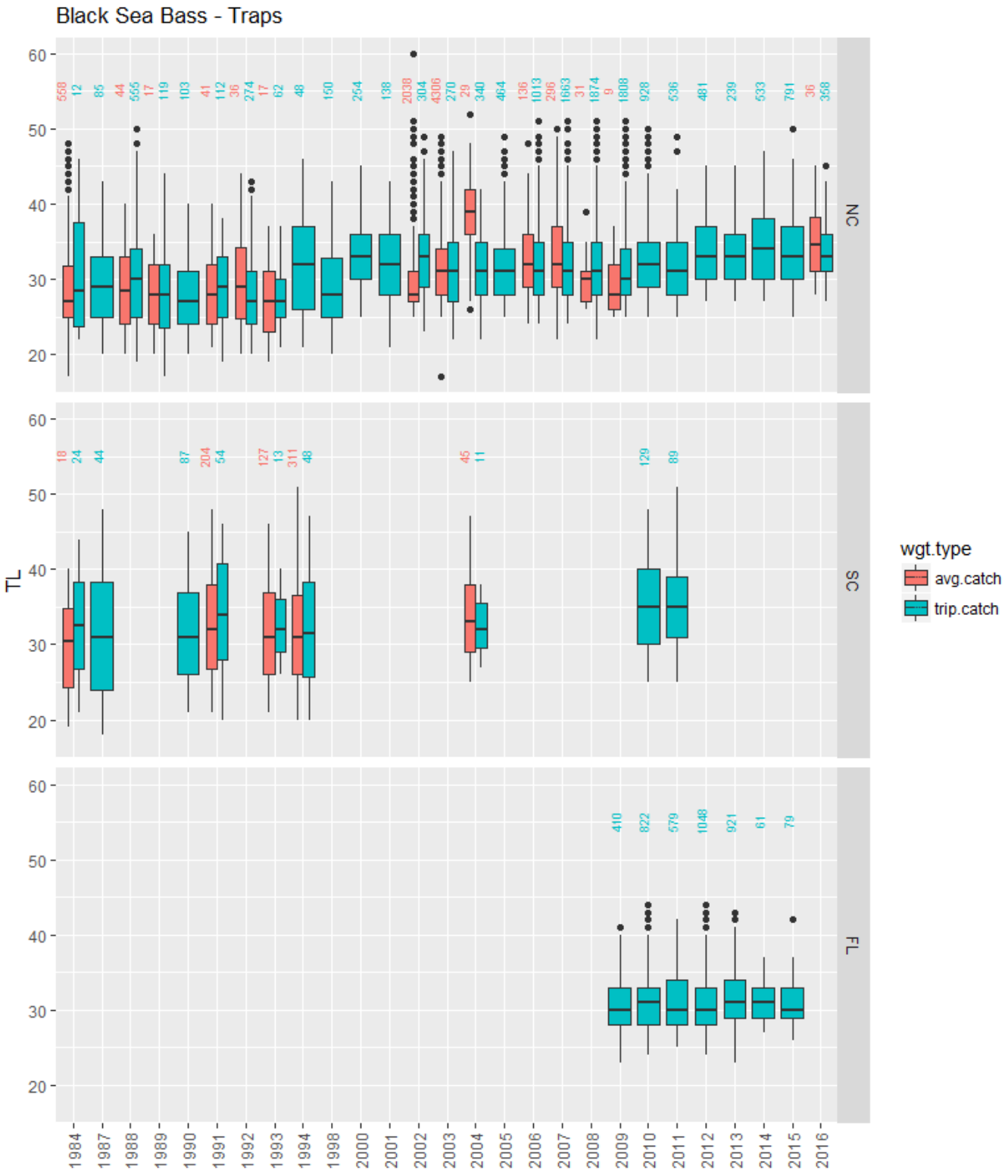

Figure 8. Trap total length (TL) distributions in centimeters by year and region for trips with associated weights (trip.catch) and trips where average catch by year and region was used as a proxy for trip-level catch. Sample sizes are given at the top of each panel.

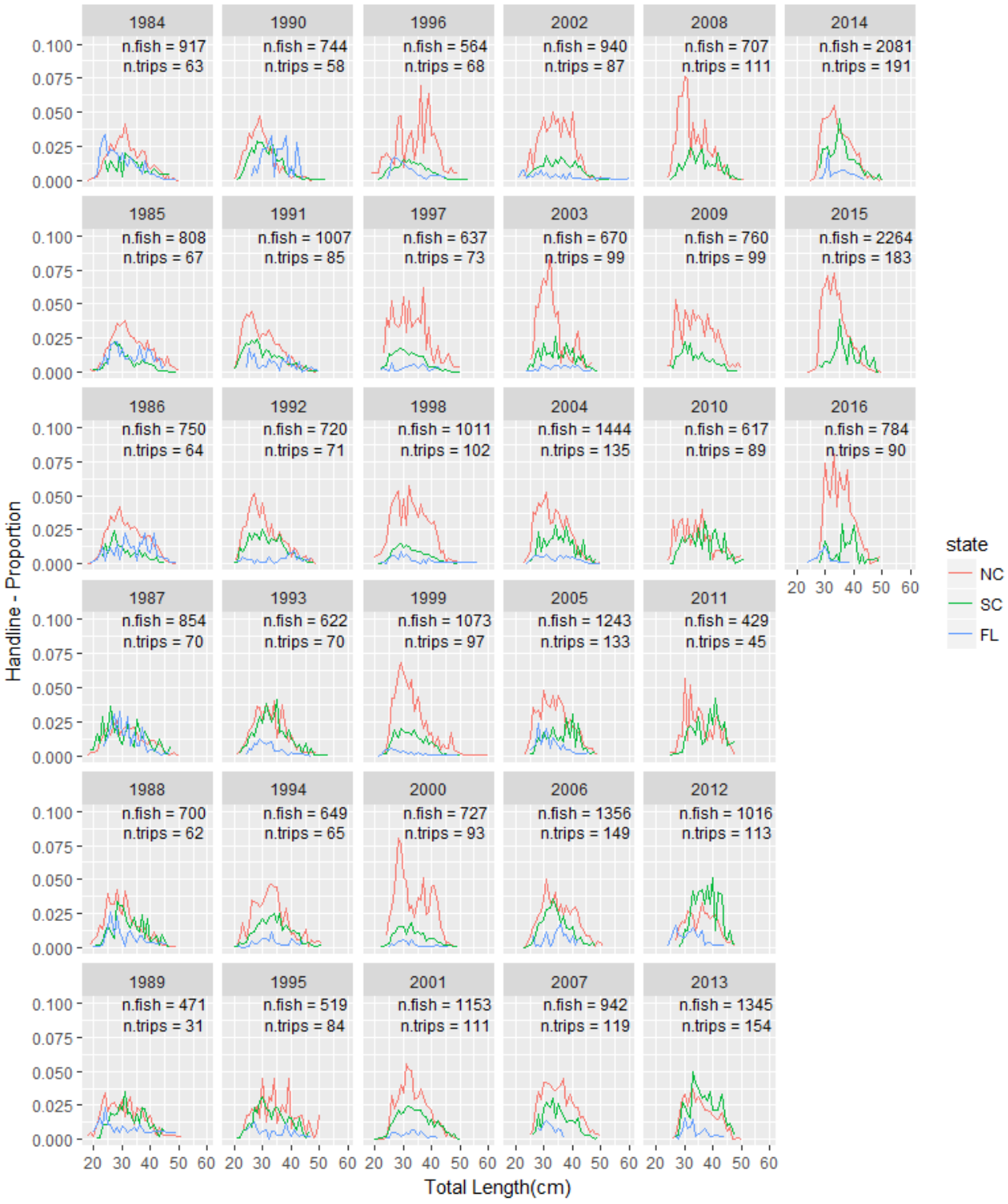

Figure 9. Handline length composition by year and region. Each regions composition is weighted by the proportion landings from that region. The sum of the regional comps sums to 1 if all regions are represented. Final compositions are normalized to sum to 1 across years where all regions are not represented.

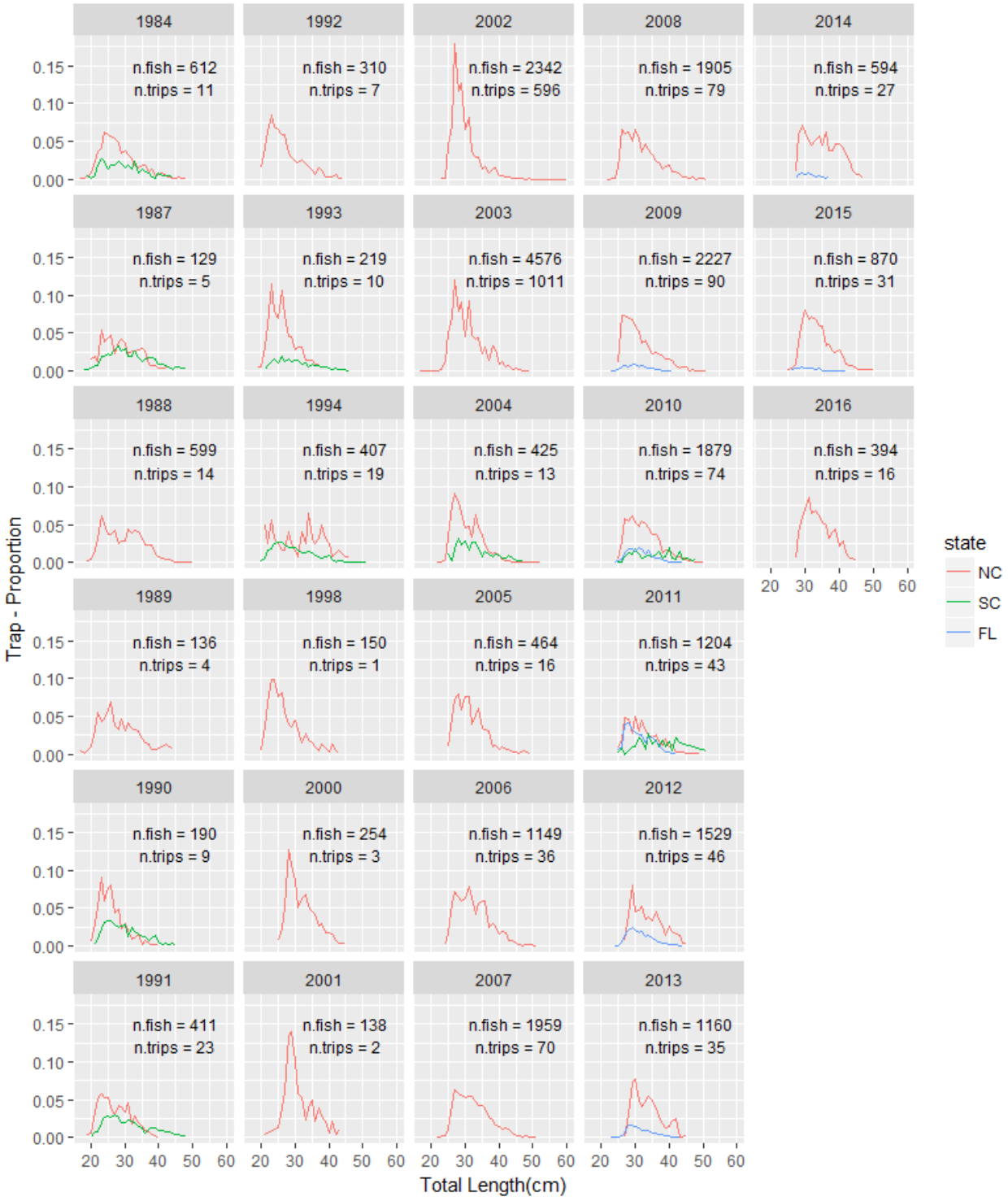

Figure 10. Trap length composition by year and region. Each regions composition is weighted by the proportion landings from that region. The sum of the regional comps sums to 1 if all regions are represented. Final compositions are normalized to sum to 1 across years where all regions are not represented.

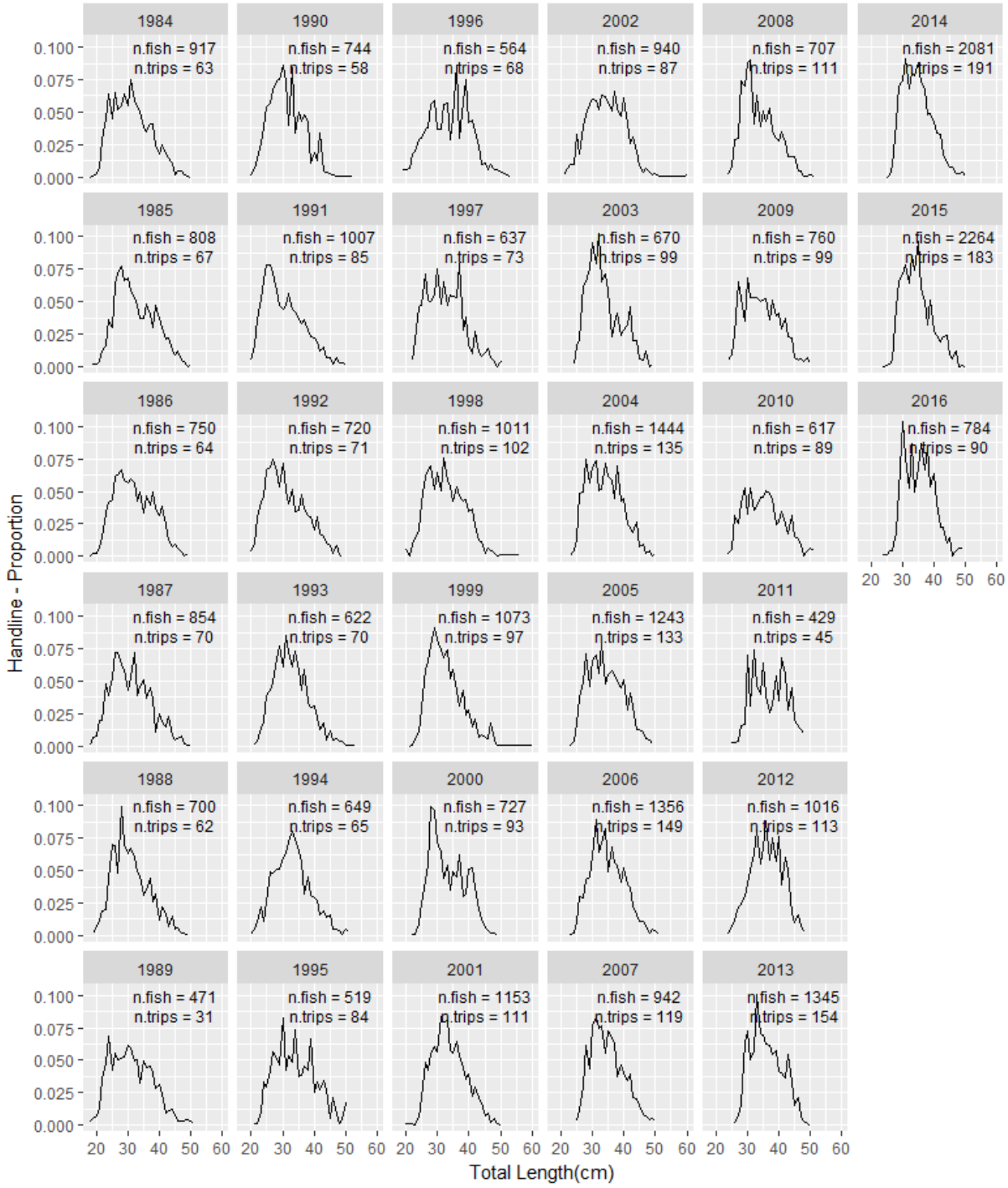

Figure 10. Annual handline weighted length compositions for black sea bass.

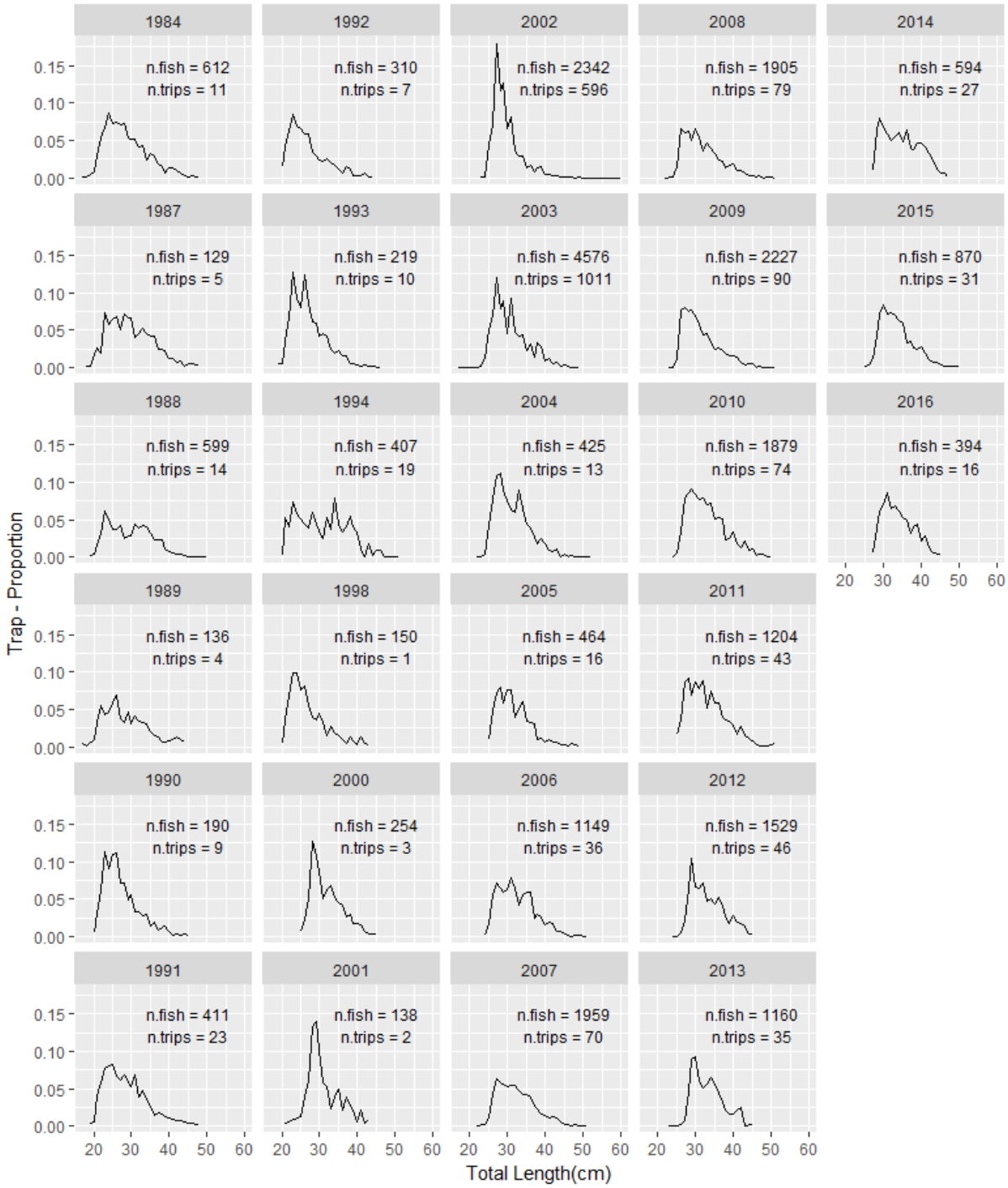

Figure 11. Annual trap weighted length compositions for black sea bass.

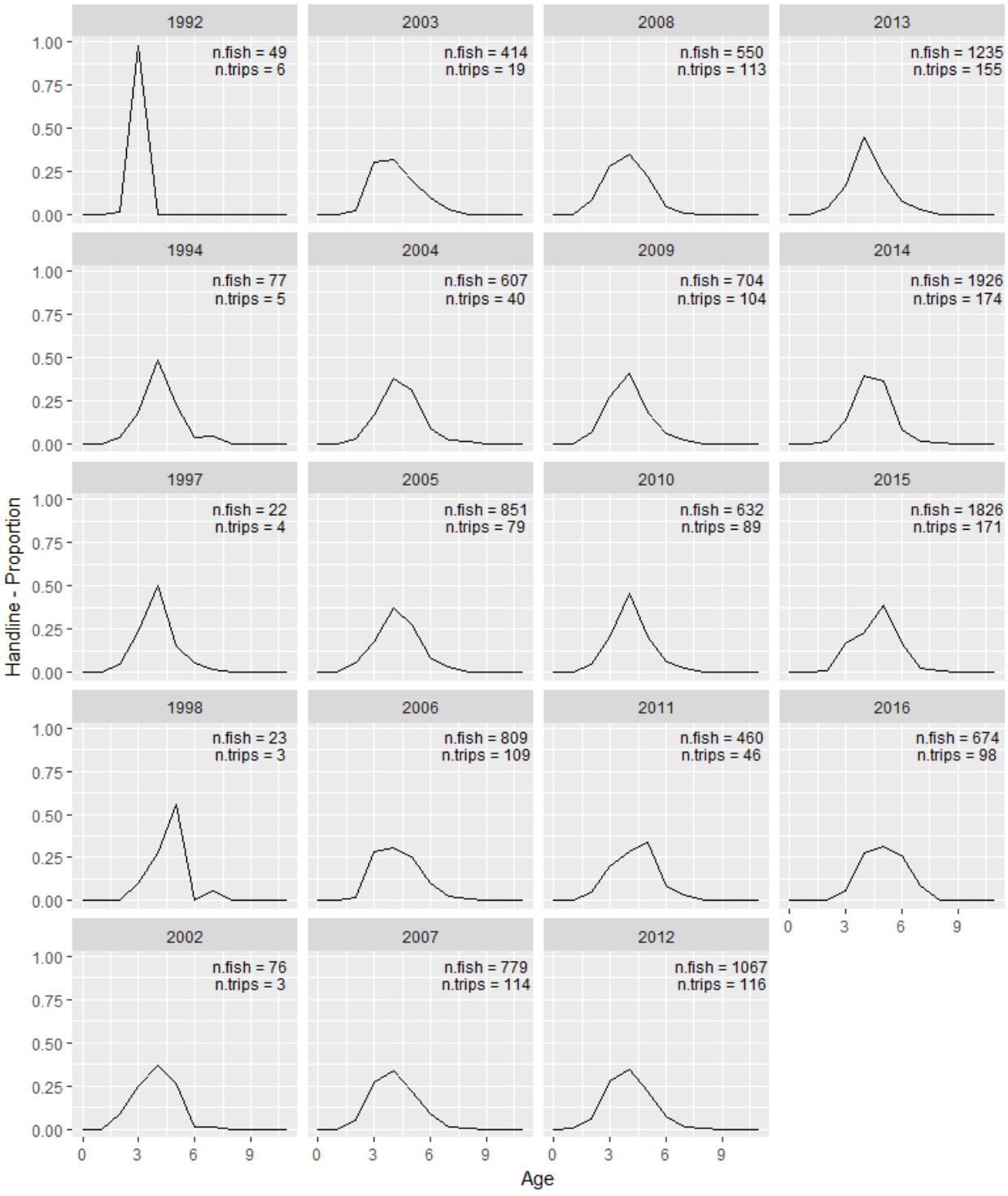

Figure 12. Annual weighted age compositions from the commercial handline fishery for black sea bass.

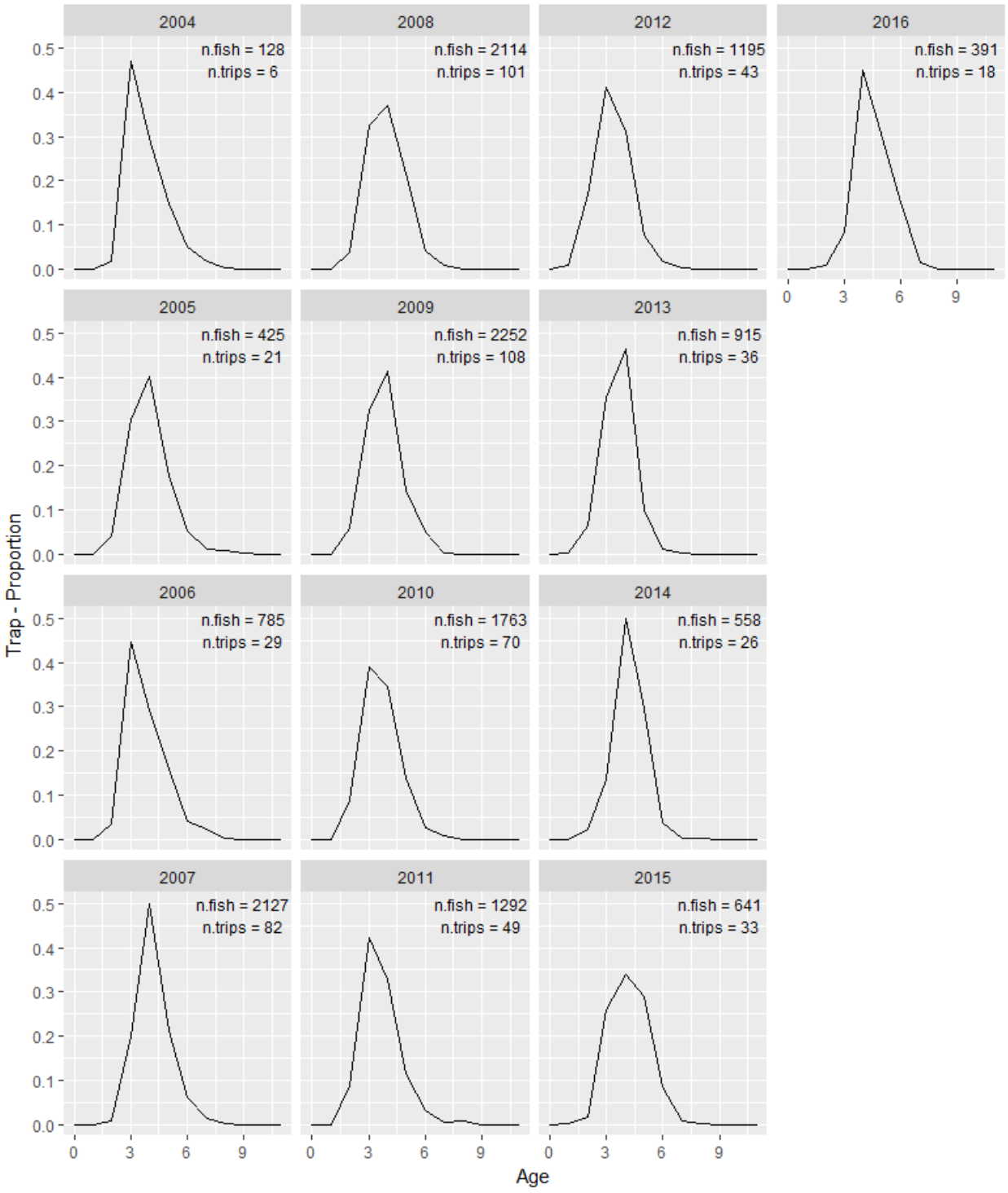

Figure 13. Annual weighted age compositions from the commercial trap fishery for black sea bass.

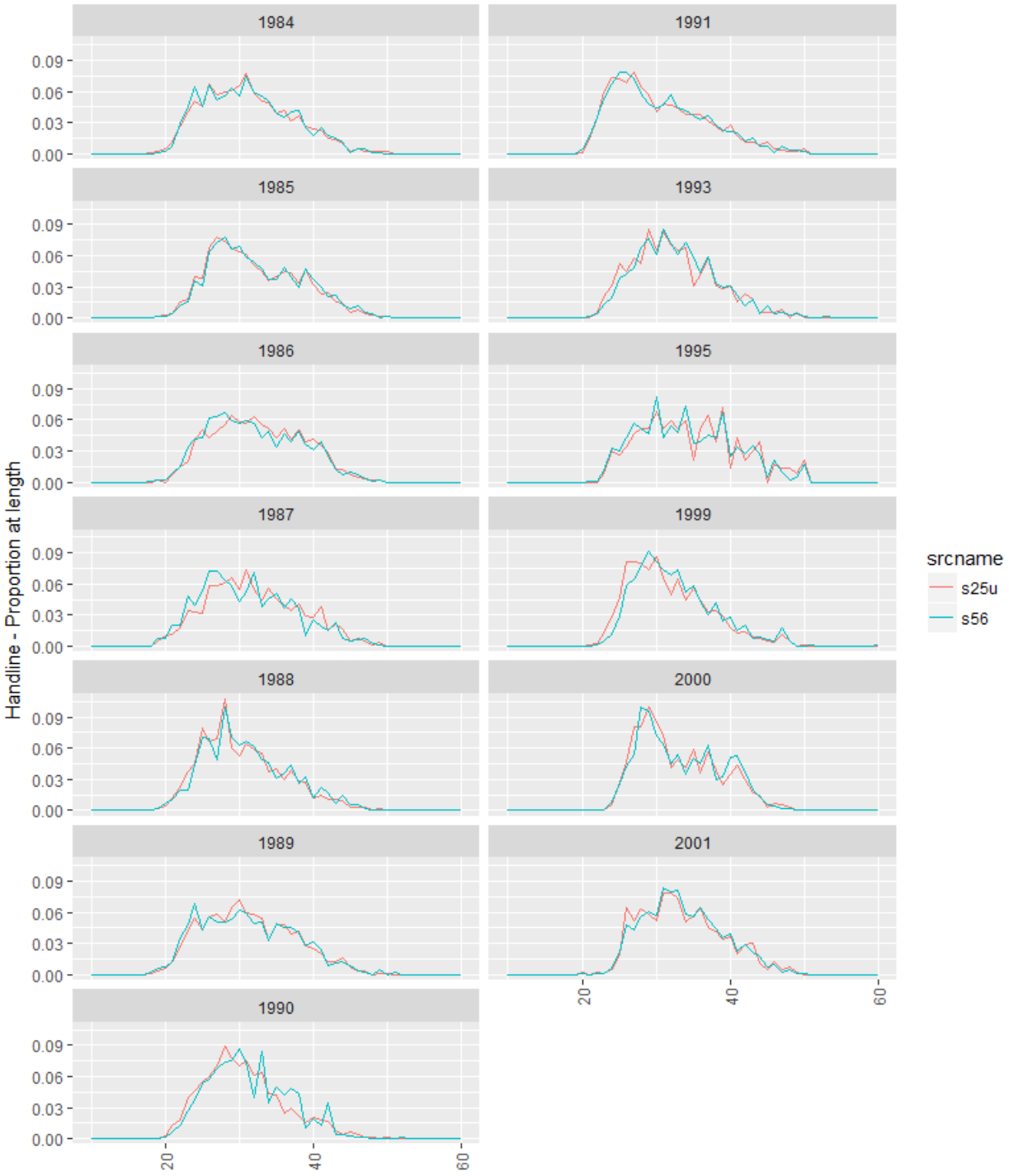

Figure 14. Comparison of the SEDAR 25 update and SEDAR 56 length compositions with overlapping years from commercial handline.

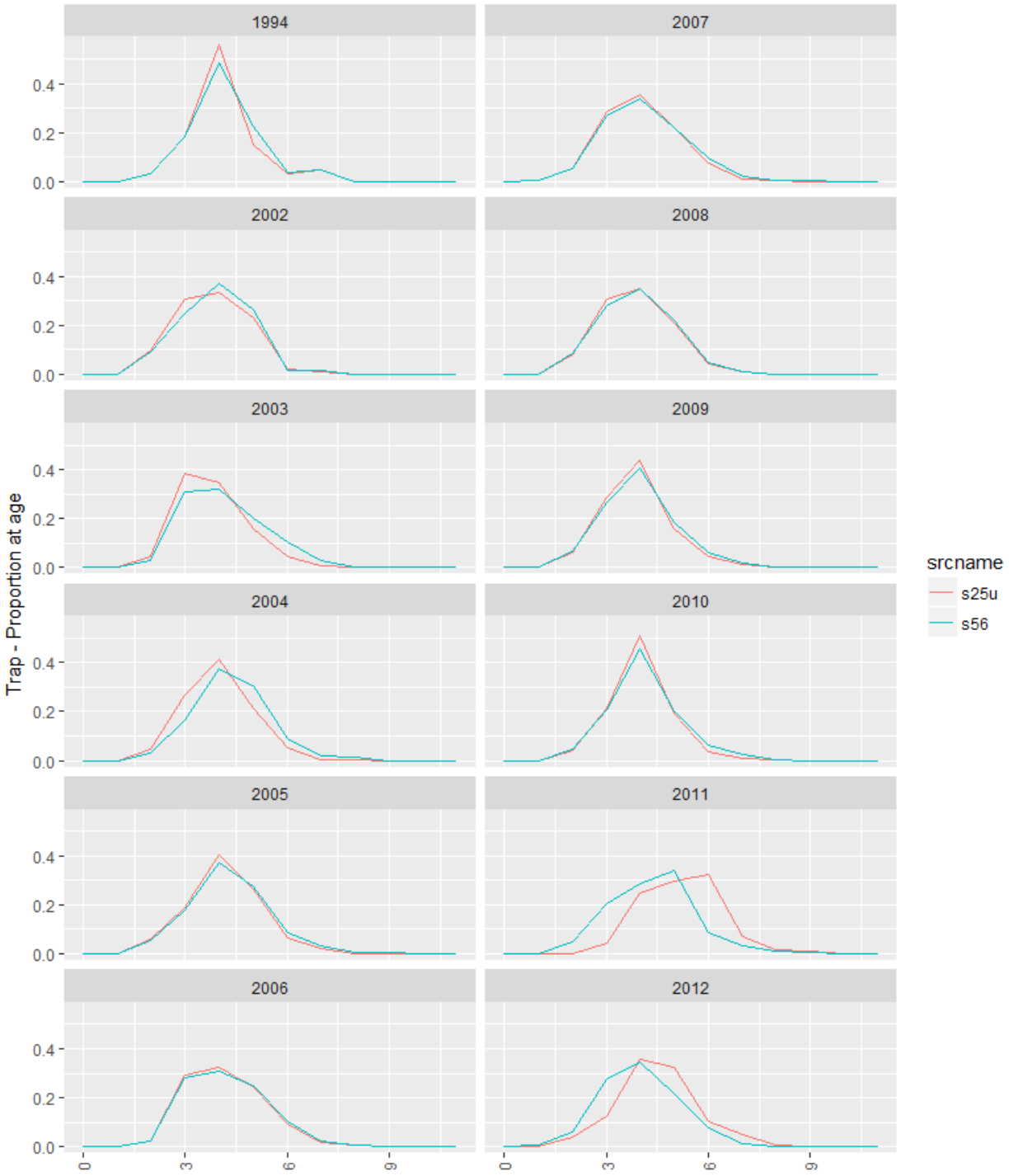

Figure 15. Comparison of the SEDAR 25 update and SEDAR 56 age compositions with overlapping years from commercial handline.

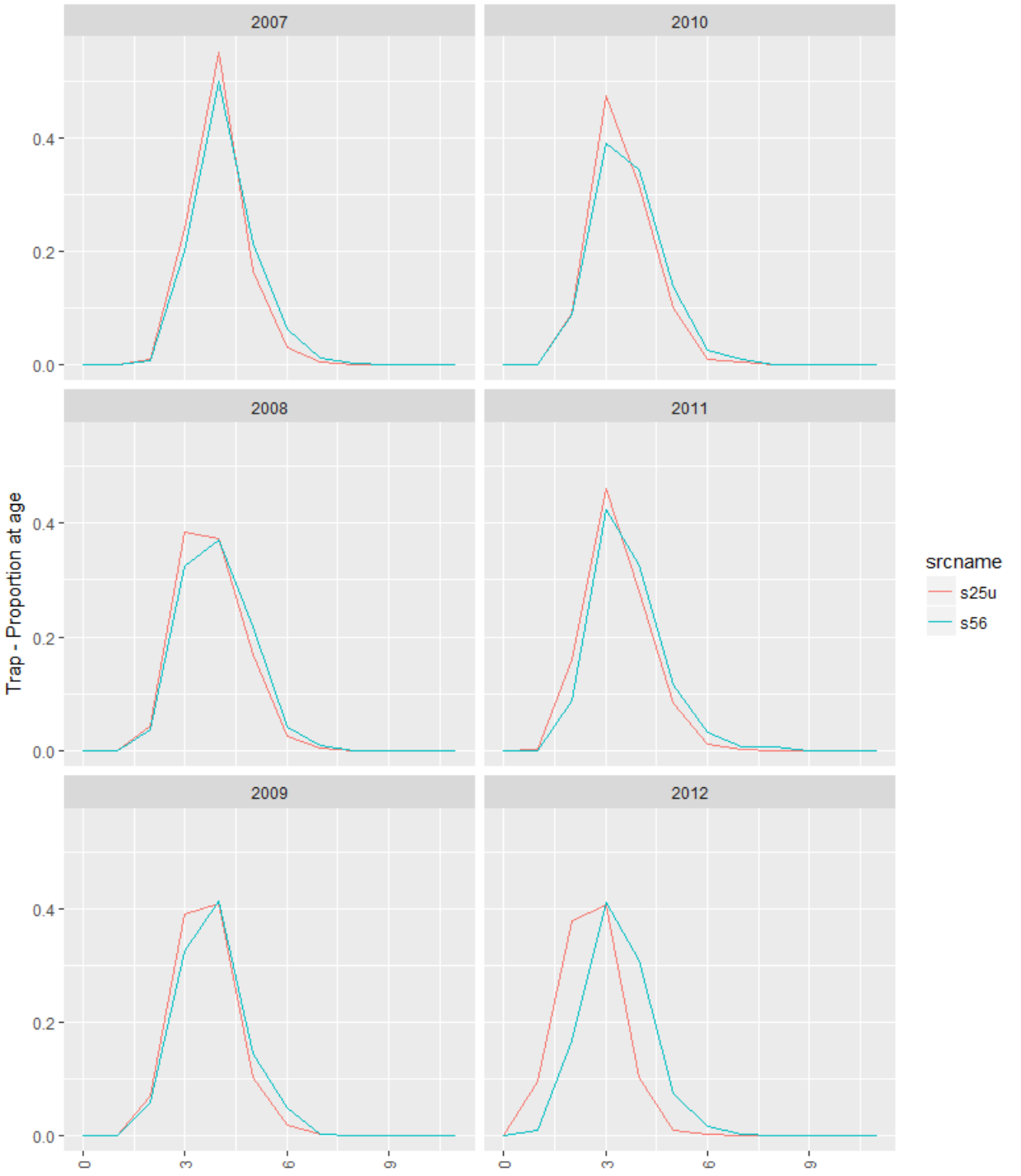

Figure 16. Comparison of the SEDAR 25 update and SEDAR 56 age compositions with overlapping years from commercial traps.