South Atlantic U.S. gray triggerfish (*Balistes capriscus*) age and length composition from the commercial fisheries

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Length and age distributions of Southeast U.S. Atlantic gray triggerfish (*Balistes capriscus*) from commercial fisheries

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Introduction

The fishery-dependent data collection for lengths and ages may be biased due to sampling protocols, state-specific sampling effort, or other non-random methods. The selection of fish from which to collect ageing structures may be biased because the selection process is rarely randomized. One technique to overcome bias in the length sampling is to weight samples by the associated landings at a spatial and temporal scale at which the bias is expected. Usually this is unknown and samples are weighted at the finest scale available without losing data (e.g. length samples with no associated landings). In this document we describe how the length data were weighted and how these weightings are extended to the age data. These methods have been used in previous SEDAR assessments and completed between the data and assessment workshops.

Data Description

Commercial – general

Biological sample data were obtained from the NMFS/SEFSC Trip Interview Program (TIP). Data were filtered to eliminate those records: 1) that included a size or effort bias, 2) where lengths were collected using a non-random method, 3) were not from commercial trips, 4) were selected by quota sampling, or 5) the data was not collected shore-side. These data were further limited to those that could be assigned a year, gear, and state. Length samples were assigned a state based on landing location or sample location if there was no landing location assigned.

Commercial-Lengths

The number of fish sampled are listed in Table 1.

The length data and landings data were initially grouped into two categories; 1) handlines and 2) other.

Commercial Ages

The number of commercial trips sampled for gray triggerfish ages can be found by year and gear can be found in Table 2.

Weighting methods

The finest scale to weight the SEFSC-TIP length data was by year and state for each of the gear groupings (handline). For each year, the state-specific length composition was multiplied by the proportion of landings from that state. The weighted state-specific length compositions were then combined and scaled to sum to one.

The fishery-dependent age composition estimates were weighted to correct biases in age composition due to non-representative sampling. This weighting method was adapted from a technique to reduce bias associated with non-representative age sampling to produce unbiased growth curves (Chih, 2009) and has been previously used in SEDAR assessments. Lengths are recorded for each fish sampled for age. A reweighting value (RW) associated with the length interval (i) and year (j) of the age sample was assigned to each age sample by fishery as in the formula:

$$RW_{ij} = \frac{LC_{ij}}{OL_{ij}/TO_j}$$

where LC_{ij} is the weighted length composition value associated with the year j and length interval i of each aged fish, OL_{ij} is the number of aged samples in length interval i and year j, and TO_j is the total number of aged samples in year j. This weighting corrects for a potential sampling bias of age samples relative to length samples (Chih, 2009). The numerator in this method differs slightly from the method used by Chih in that the length composition is weighted by the landings. The minimum sample size cutoff for length and age compositions was 30 fish per area and 10 trips per area.

Results

Commercial Lengths

Following the minimum size in 1992, the commercial handline and other length compositions were similar in size spatially for most years (Figure 1 and 2). The weighting of the length composition for the handline fishery had little influence. The lengths from the other gear were not weighted due to limited spatial and temporal sampling.

Commercial Ages

The weighted age compositions are very similar to the nominal age compositions for handline (Figure 3 and Figure 4). The ages from the other gear were not weighted due to limited spatial and temporal sampling.

Discussion

There is minimal influence when weighting the commercial length or age composition for gray triggerfish. However, the weighted compositions are recommended for use as a matter of protocol and to remove whatever minimal bias may be present.

Tables

Table 1. Number of fish and trips sampled for lengths for gray triggerfish by year and gear for the commercial handline and other gears.

	Commercial			
	handline		other	
Year	n.fish	n.trips	n.fish	n.trips
1981				
1982				
1983	10	7		
1984	311	46	2	1
1985	650	62	11	2
1986	208	35		
1987	404	46		
1988	201	30	38	4
1989	328	36		
1990	644	37	9	2
1991	558	35	88	8
1992	492	36		
1993	1072	74	27	5
1994	1472	69	1	1
1995	2986	135	8	5
1996	1748	76	3	1
1997	660	38	5	2
1998	1019	55	27	3
1999	1738	100	23	5
2000	2474	153	1	1
2001	1930	136	10	1
2002	1390	100	128	61
2003	2207	81	131	55
2004	3453	148	45	3
2005	2743	135	12	3
2006	2652	216	28	9
2007	2042	282	146	18
2008	1687	285	84	25
2009	1730	240	257	30
2010	2467	270	121	25
2011	3172	296	89	16
2012	1940	199	255	13
2013	1585	146	76	14
2014	1735	133	66	10
2015	2391	213	95	12
2016	2442	240	62	12
2017	2643	264	198	28
2018	1304	185	95	19
2019	1568	188	75	12
2020	1791	208	82	10
2021	1158	178	49	11

Table 2. Number of fish and trips sampled for ages for gray triggerfish by year and gear for the commercial handline and other gears.

	Commercial			
	handline		other	
Year	n.fish	n.trips	n.fish	n.trips
1990				
1991				
1992				
1994				
1997				
2001				
2002	8	2		
2003				
2004	190	2		
2005	385	1		
2006	461	76	4	2
2007	673	106	11	4
2008	734	94	27	12
2009	687	84	59	16
2010	976	98	28	12
2011	1262	104	34	8
2012	760	2		
2013	563	38	4	1
2014	435	25	32	7
2015	677	72	5	2
2016	470	76	25	7
2017	565	63	24	11
2018	485	48	43	12
2019	512	41	20	7
2020	636	34	28	6

Figures

Figure 1. Weighted and un-weighted gray triggerfish length composition for handline gear by region by year.

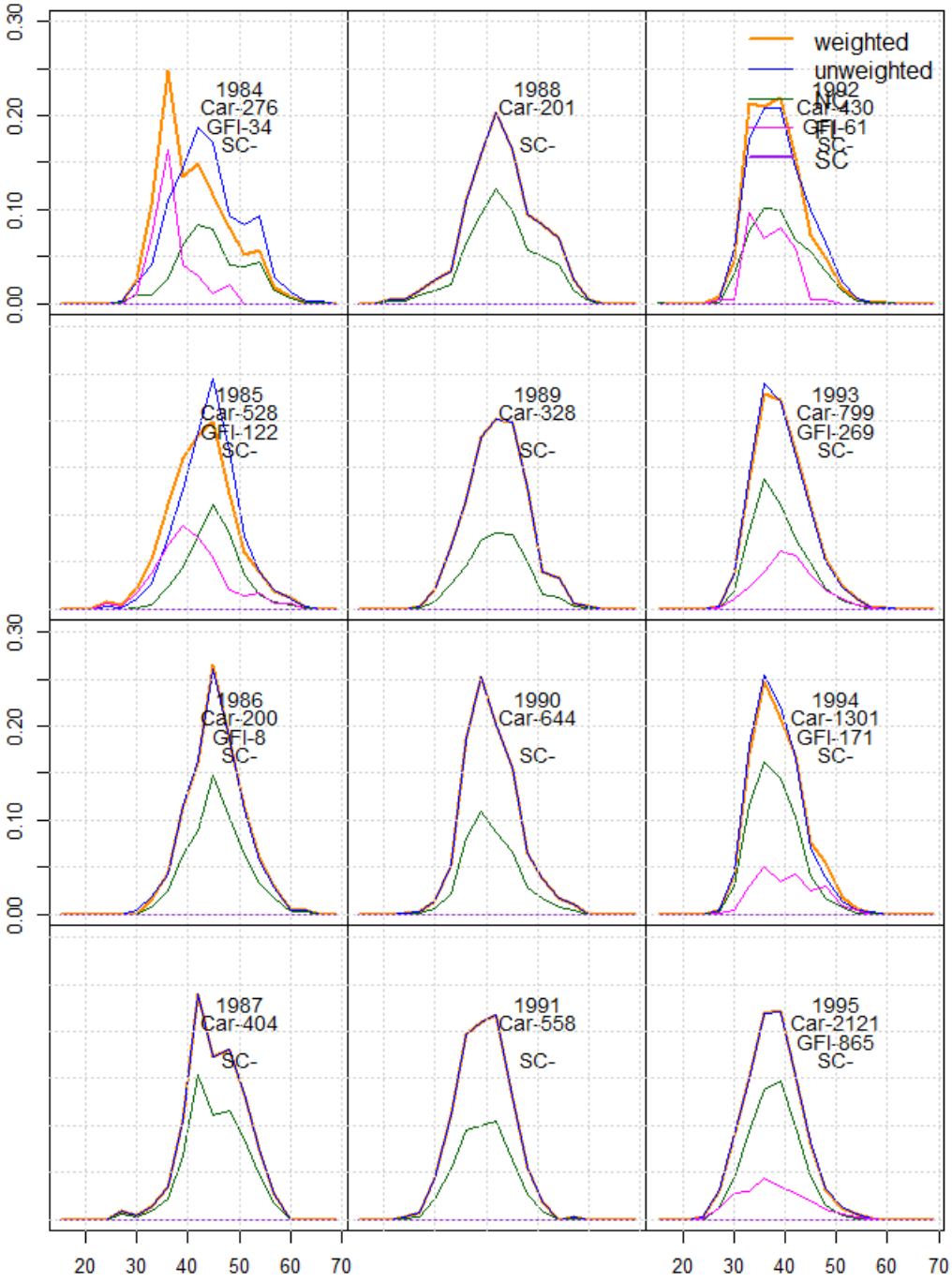

Figure 1. (Continued).

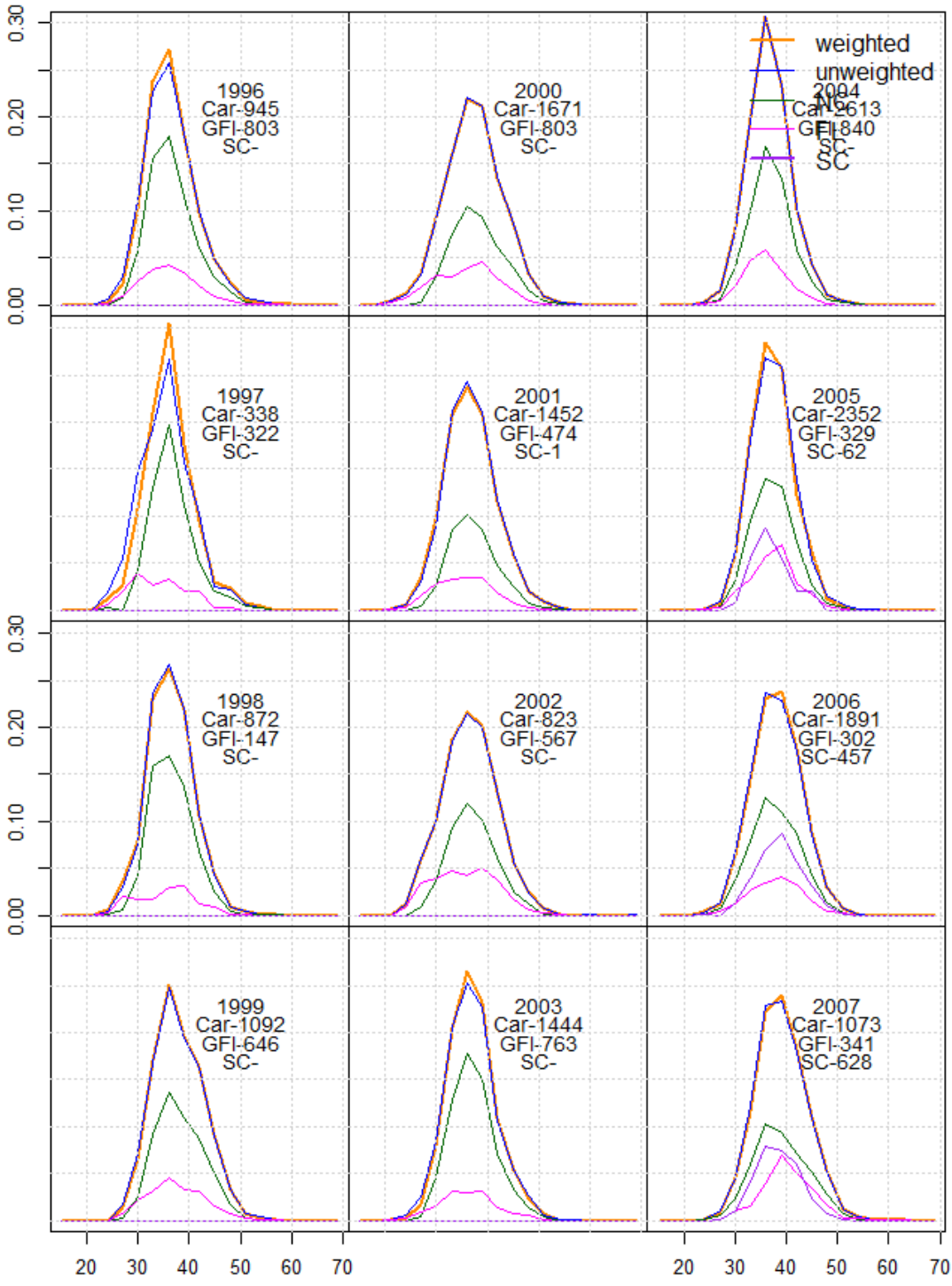

Figure 1. (Continued).

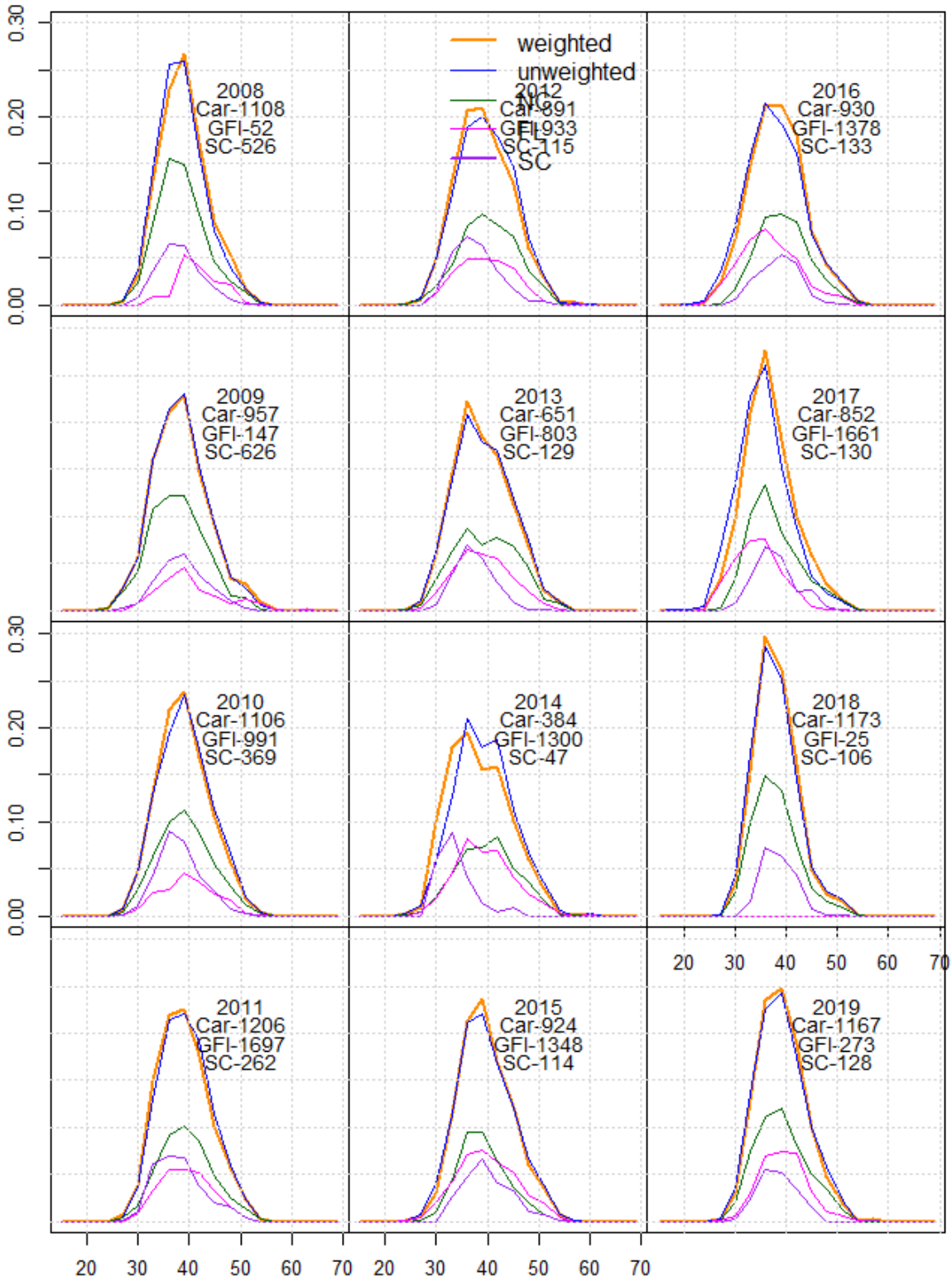

Figure 1. (Continued).

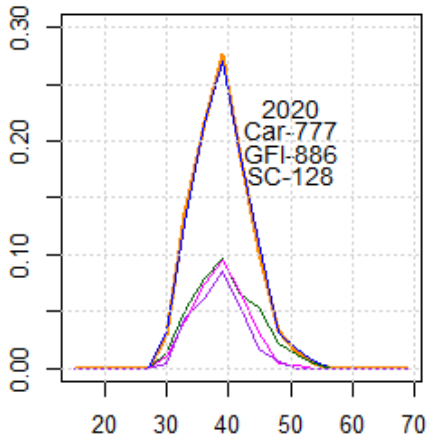

Figure 2. Nominal gray triggerfish length composition for other gear by year.

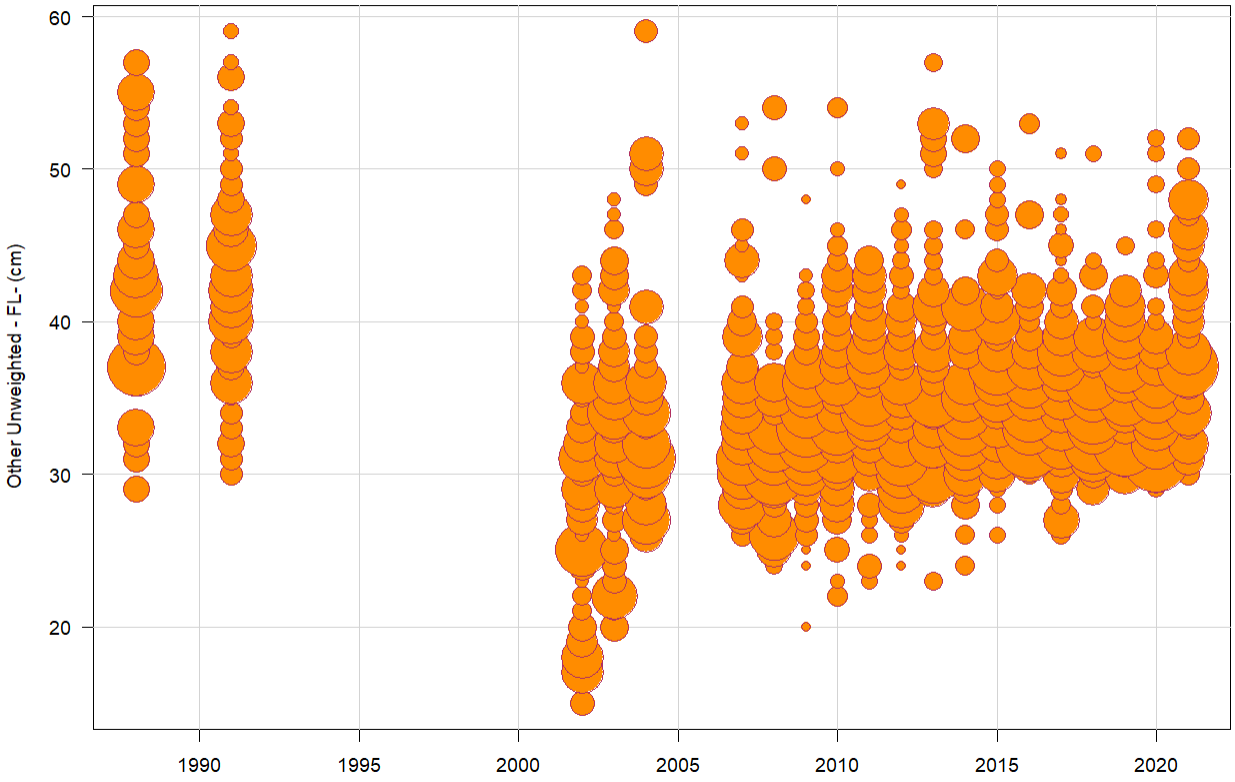

Figure 3. Weighted and un-weighted gray triggerfish age composition for handline gear.

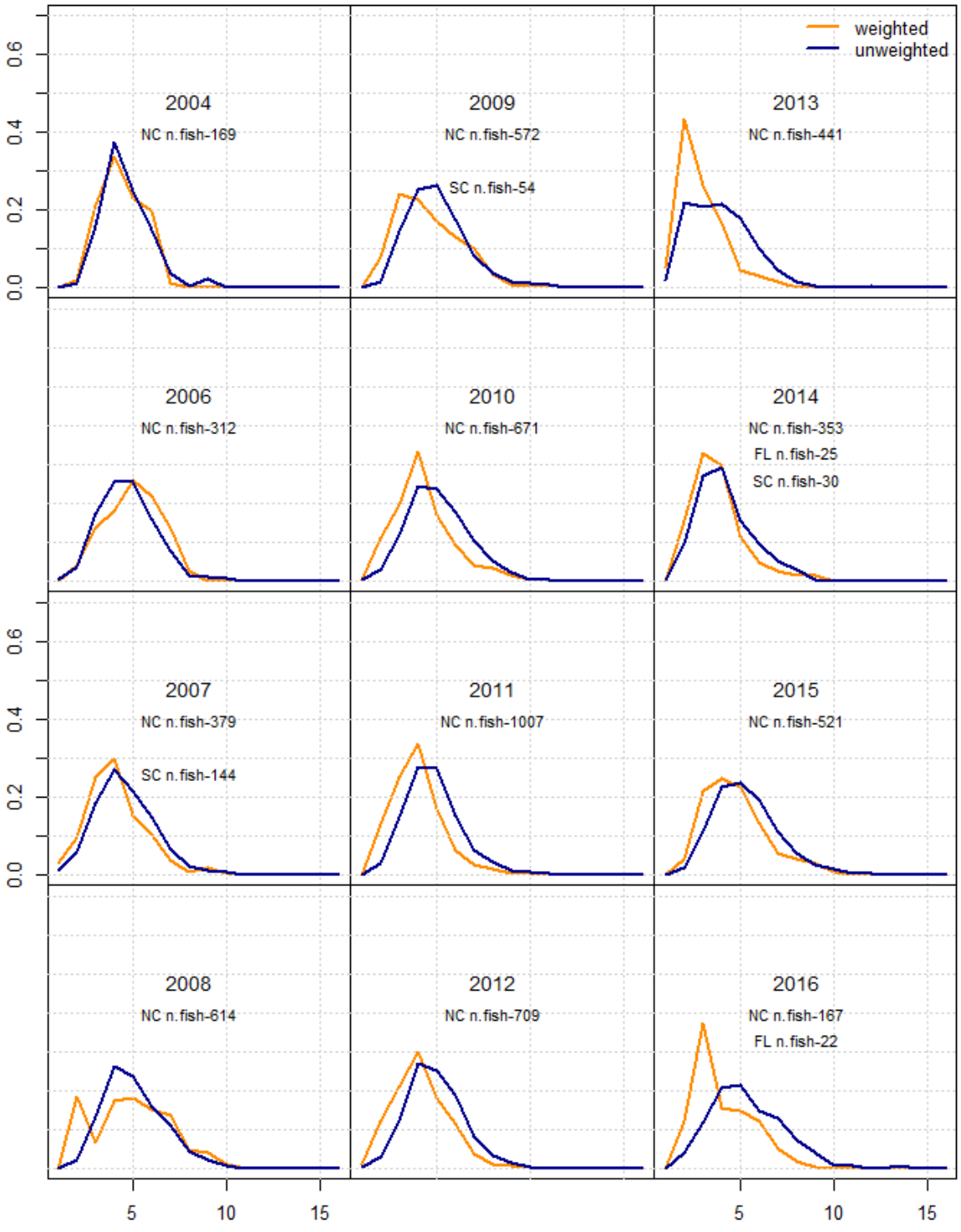

Figure 3. (Continued).

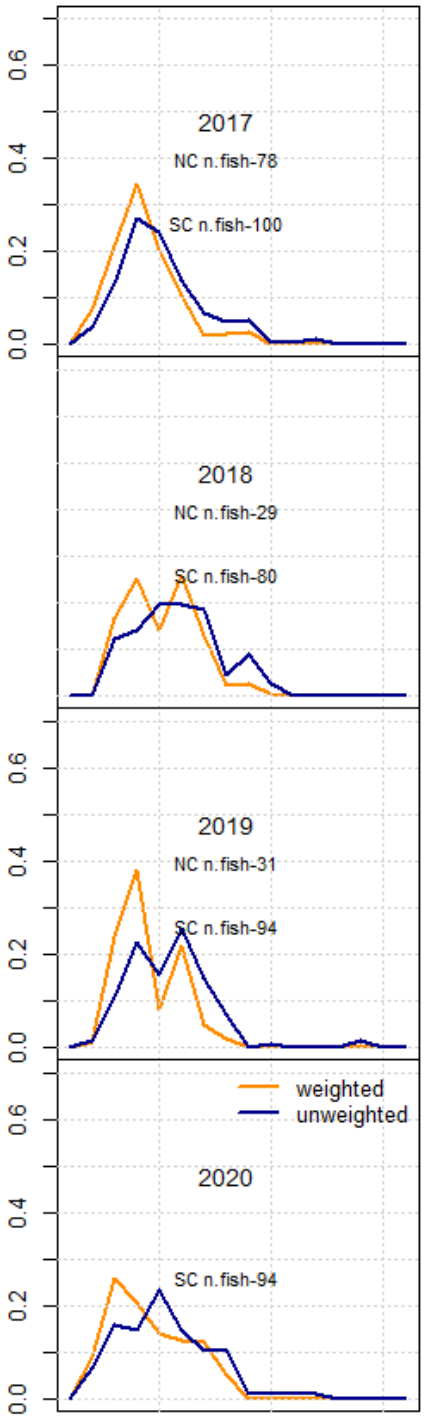

Figure 4. Nominal gray triggerfish age composition for other gear.