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Micki Pawluk

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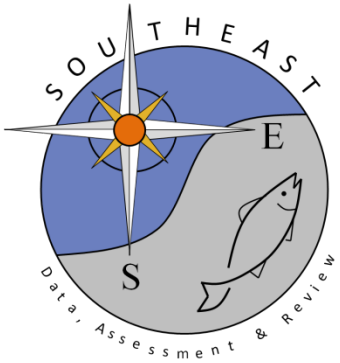

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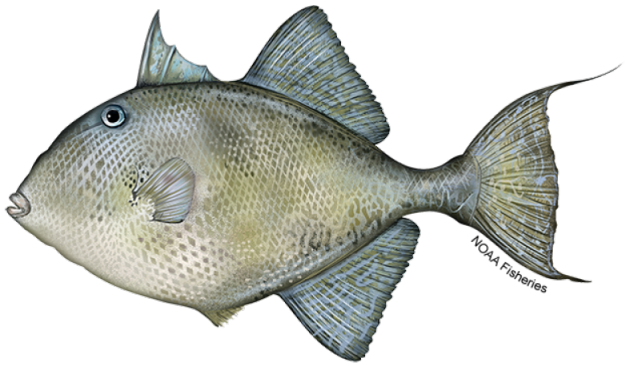

Gulf of America Gray Triggerfish (*Balistes capriscus*) Length and Age Compositions for the Commercial Handline and Longline Fisheries

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*This working paper has been updated following the data workshop to include updated morphometric equations and provide final weighted length and age compositions in Appendix A. Tables, figures, and text in the main part of the working paper have not been updated.

Introduction

This document outlines the data and methodologies used to estimate nominal length and age compositions of the commercial handline and longline fisheries for the SEDAR 100 Gulf of America (formerly Gulf of Mexico, hereafter referred to as "Gulf") Gray Triggerfish Assessment. These compositions were estimated using data sources approved in SEDAR 43. Preliminary annual nominal length and age compositions are presented here, and the final weighted compositions will be added as an appendix after discussion and approval at the data workshop.

Data Description

SEDAR 100 assesses all Gulf Gray Triggerfish in federal waters from the Florida Keys west to the Texas-Mexico border. For this assessment, three fleets are investigated, Commercial Handline East, Handline West, and Longline East. There were insufficient samples from the western region to construct a Longline West fleet. The east and west subregions are defined using statistical zones with the east comprising zones 744, 748, and 1 – 12, and the west comprising zones 13 – 21 and are shown in Figure 1. Additionally, compositions are provided as Commercial Handline and Commercial Longline fleets with no spatial stratification for consideration. For the landings, landings from other gears are combined into the Handline fleet. However, for length and age compositions only handline samples are used and samples from other gears are excluded. This is to avoid bias in the compositions due to the majority of the landings data coming from handline gears. The commercial data source utilized to generate the length and age compositions for the commercial fleets consists of length samples from the Trip Interview Program (Beggerly *et al.* 2022), and age samples collected by federal and state sampling programs.

Commercial Length Compositions of Landings

Length Samples

Length samples of commercial landings were obtained from the TIP database maintained by the NMFS Southeast Fisheries Science Center (SEFSC) and were filtered to remove biases that include samples from pooled trips. Samples from the handline fishery were available from 1989 onward, samples from the longline fishery were available from 1990 onward.

These data were compiled using length bins of 2 centimeters (cm) with the floor of the bin being labeled. Natural total length ($NatTL$), maximum total length (MaxTL), and standard length (SL) were converted to fork length (FL) using the following conversion equations:

$$FL = 2.436 + 0.807 * NatTL$$

$$FL = 2.1282 + 0.791 * MaxTL$$

$$FL = 1.0311 + 1.153 * SL$$

A minimum length bin of 2 cm was used, and a maximum length bin of 78 cm was used, with fish falling outside of this range being pooled in the smallest or largest bin. Any fish lengths greater than 90 cm FL were deleted and assumed to be errors.

Length Compositions

Nominal length compositions for the commercial handline fleet (HL) and commercial longline fleet (LL) were estimated for Gray Triggerfish landings from the GMFMC/SAFMC boundary to the TX/Mexico border for the East and West subregions. Annual nominal length compositions were estimated using length bins of 2 cm, where for each year i, subregion r, and length bin j,

$$LC_{i,\mathrm{r},j} = \frac{n_{i,\mathrm{r},j}}{n_{i,r}}$$

where $n_{i,r,j}$ is the number of samples in year i, subregion r and length bin j; $n_{i,r}$ is the number of samples in year i and subregion r (i.e., summed across length bins); and $LC_{i,\mathrm{r},j}$ is the proportion of the total number of sampled fish in each year i and subregion r within each length bin j.

Annual length compositions by subregion are shown in Figures 2 and 3 for handline and longline, respectively. Annual gulf-wide length compositions are shown in Figure 4. Annual sample sizes of commercial lengths and trips are shown in Tables 1 and 2 for commercial handline and longline, respectively. Years with fewer than 30 length samples or fewer than 10 trips are recommended to be dropped from further analyses. All data are presented in Table 1, regardless of the recommendation to drop.

Commercial Age Compositions of Landings

Age Samples

The majority of the commercial age samples were a subset of the length samples, although some non-TIP (i.e. state collected) are included as well. Age data compiled by the SEFSC Panama City Laboratory were filtered to remove duplicated and biased data. Gray Triggerfish maximum age will be discussed at the data workshop and the use of an age plus group will be determined at that time. For the preliminary age compositions, no plus group is used.

Age Compositions

Nominal age compositions were estimated for the commercial handline fleet (HL) and longline fleet (LL) in each year and subregion. Any strata with fewer than 10 age samples were recommended to be dropped. Nominal age compositions of landings were estimated using the following equation within each year i, subregion r, and age bin k,

$$AC_{i,r,k} = \frac{a_{i,r,k}}{a_{i,r}}$$

where $a_{i,r,k}$ is the number of age samples in year i, subregion r, and age bin k; $a_{i,r}$ is the number of age samples in year i and subregion r; and $AC_{i,r,k}$ is the proportion of the total number of sampled fish in each year i and subregion r within each age bin k. A minimum sample size

threshold was recommended annually within each year stratum, AC_{ir}, where these were recommended to be dropped and excluded from further analyses if $a_{ir} < 10$.

The annual nominal age compositions by subregion are shown in Figures 5 and 6 for the commercial handline and longline fisheries, respectively. Annual gulf-wide age compositions are shown in Figure 7. Bubble plots showing the annual age compositions are shown in Figures 8 and 9 for handline and longline, respectively. Annual sample sizes of commercial ages and trips are shown in Tables 3 and 4 for handline and longline, respectively.

Discussion for data workshop

- **SEDAR 43 split the commercial fleet into East and West; SEDAR 62 retained this structure but treated commercial longline as its own fleet (primarily from the East)** – we will examine sample sizes for handline and longline fleets by subregion (East/West) and as whole gulf fleets, and determine whether it is appropriate to stratify compositions spatially and by gear, or whether a single commercial fleet will be used. Differences in compositions will be explored between regions and gears to help justify whether to split commercial fleets by East or West or combine them into a Gulf-wide fleet.

References

Beggerly, S., M. Stevens, H. Baertlein. 2022. Trip Interview Program Metadata. SEDAR74-DW14. 12pp.

Tables

Table 1. *Annual number of Gulf Gray Triggerfish commercial handline (HL) length samples and associated trips by subregion. Years not meeting the recommended 30 fish or 10 trip minimum filter are highlighted in red.*

	East		West	
YEAR	N fish	N trips	N fish	N trips
1989	1	1	5	1
1990	63	10	276	43
1991	55	8	653	82
1992	105	12	1228	142
1993	449	35	757	115
1994	921	81	718	61
1995	871	80	170	10
1996	787	80	48	4
1997	583	68	301	55
1998	431	64	215	39
1999	437	63	81	11
2000	185	40	56	15
2001	512	55	186	29
2002	230	43	174	33
2003	196	30	211	37
2004	176	23	82	15
2005	255	31	141	43
2006	109	26	14	9
2007	38	16	64	14
2008	74	19	9	3
2009	139	40	8	2
2010	141	30	6	3
2011	266	54	18	1
2012	113	32	278	44
2013	169	51	555	93
2014	130	48	339	56
2015	475	96	549	87
2016	603	109	492	72
2017	562	102	412	64
2018	684	101	188	45
2019	1200	166	149	37
2020	597	140	145	26
2021	386	78	30	14
2022	572	128	172	35
2023	869	189	181	55
2024	566	127	108	31

Table 2. *Annual number of Gulf Gray Triggerfish commercial longline (LL) length samples and associated trips by subregion. Years not meeting the recommended 30 fish or 10 trip minimum filter are highlighted in red. Years with no data have been left blank.*

	East		West	
YEAR	N fish	N trips	N fish	N trips
1990	52	14		
1991	44	15	7	2
1992	23	11	2	2
1993	40	13	2	1
1994	28	16		
1995	5	4		
1996	31	10		
1997	22	6		
1998	52	23		
1999	43	27		
2000	29	25		
2001	32	16		
2002	51	27		
2003	48	34		
2004	24	18		
2005	67	31		
2006	60	35		
2007	49	27		
2008	74	41		
2009	25	16		
2010	28	15		
2011	54	26		
2012	17	11		
2013	33	16		
2014	47	17		
2015	89	24		
2016	77	33		
2017	116	46		
2018	42	24		
2019	123	32	1	1
2020	12	10		
2021	9	3		
2022	47	20	8	3
2023	34	23		
2024	33	16		

Table 3. *Annual number of Gulf Gray Triggerfish commercial handline (HL) age samples and associated trips. Years not meeting the recommended 10 fish or 10 trip minimum filter are highlighted in red.*

	East		West	
YEAR	N fish	N trips	N fish	N trips
2003	41	6		
2004	22	6		
2005	73	11	1	1
2006	20	10		
2007	21	10	5	1
2008	10	6	3	1
2009	17	10	14	3
2010	11	6	2	1
2011	126	30	28	3
2012	56	19	233	39
2013	117	37	337	69
2014	77	31	289	51
2015	178	44	513	85
2016	173	41	418	65
2017	127	29	376	61
2018	217	53	172	43
2019	283	50	129	36
2020	103	36	121	24
2021	37	12	28	16
2022	133	30	122	27
2023	186	42	113	35
2024	132	36	68	19

Table 4. *Annual number of Gulf Gray Triggerfish commercial longline (LL) age samples and associated trips. Years not meeting the recommended 10 fish or 10 trip minimum filter are highlighted in red.*

	East		West	
YEAR	N fish	N trips	N fish	N trips
2003	43	30		
2004	16	15		
2005	53	25		
2006	44	26		
2007	46	25		
2008	63	35		
2009	17	12		
2010	19	9		
2011	52	26		
2012	18	13		
2013	30	15		
2014	41	15		
2015	83	24		
2016	67	28		
2017	85	31		
2018	37	21		
2019	106	26	1	1
2020	6	4		
2022	33	12	5	2
2023	14	7		
2024	21	7		

Figures

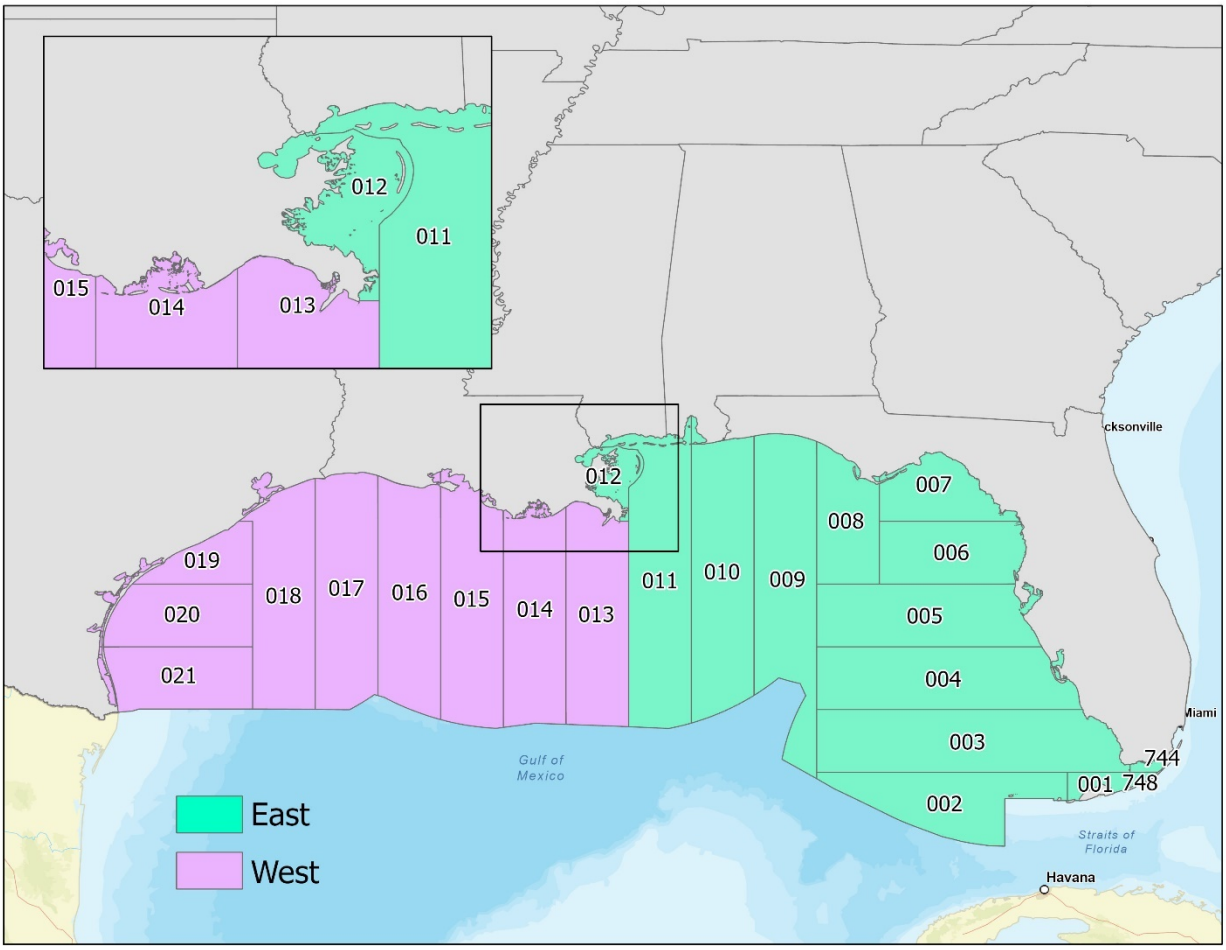

Figure 1. Gulf Gray Triggerfish commercial fisheries subregions as defined by NMFS statistical zones.

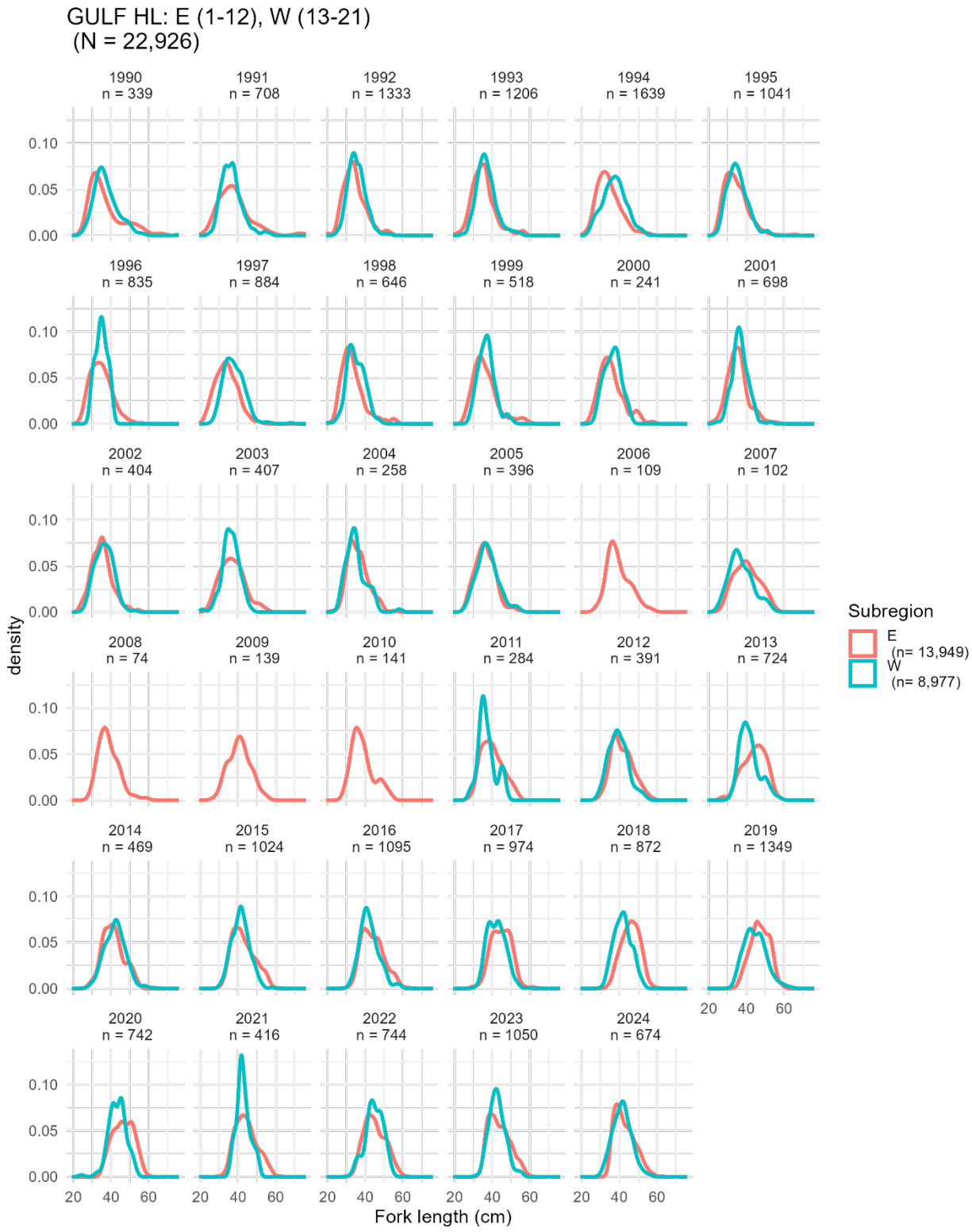

Figure 2. Annual length distributions for the Gulf Gray Triggerfish commercial handline east and handline west fisheries.

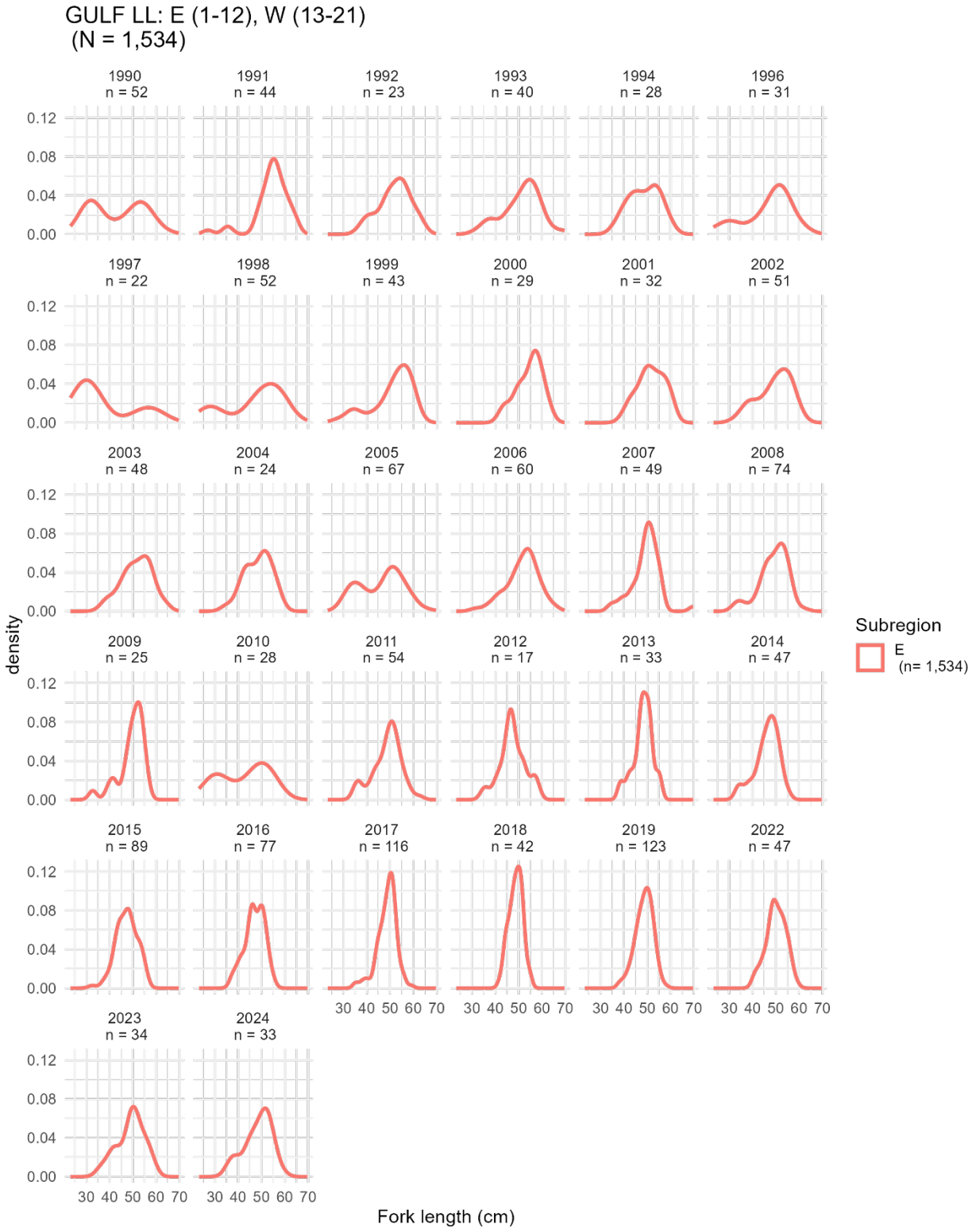

Figure 3. Annual length distributions for the Gulf Gray Triggerfish commercial longline east fishery.

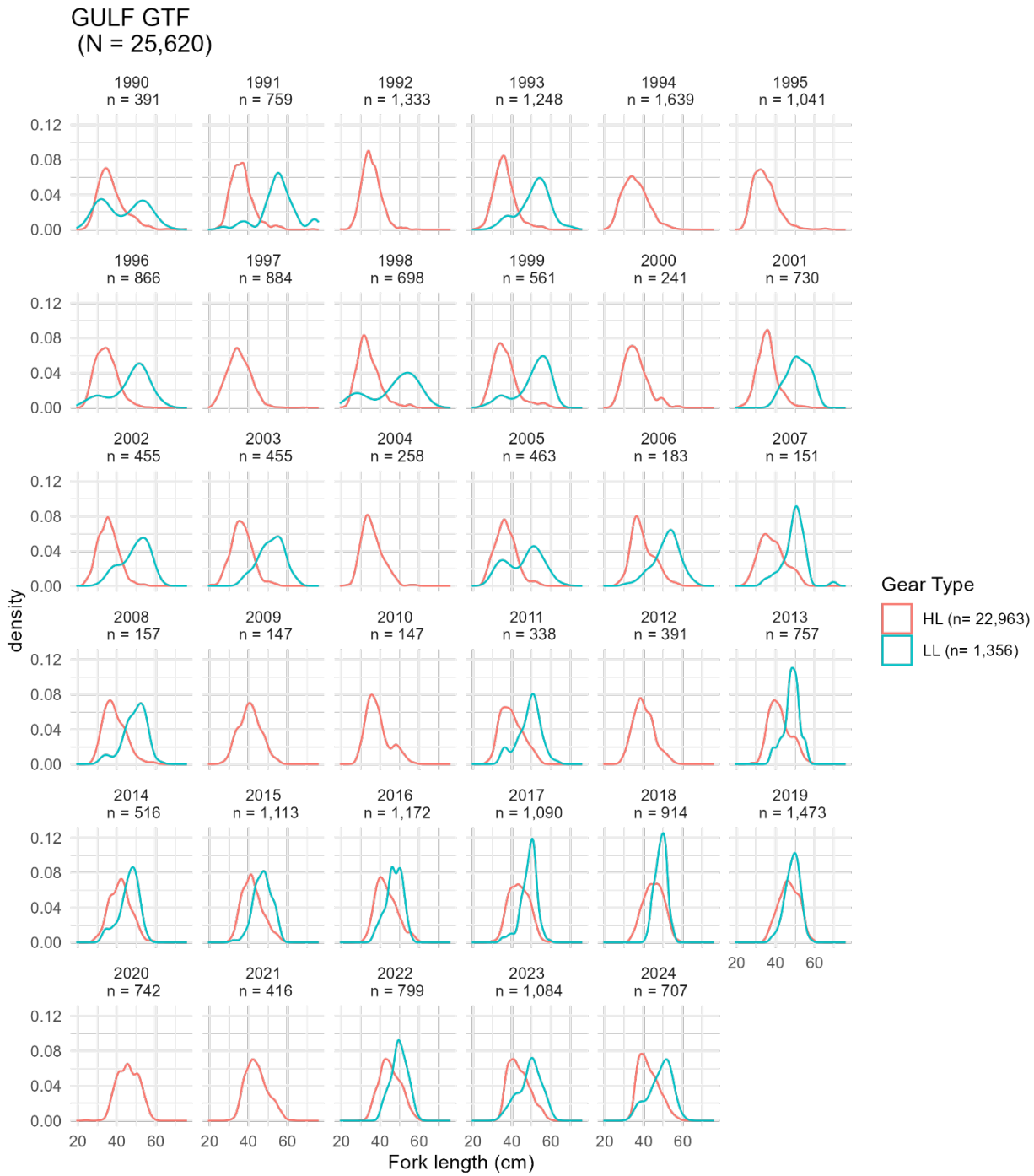

Figure 4. Annual nominal gulf-wide length compositions for the Gulf Gray Triggerfish commercial handline and longline fisheries.

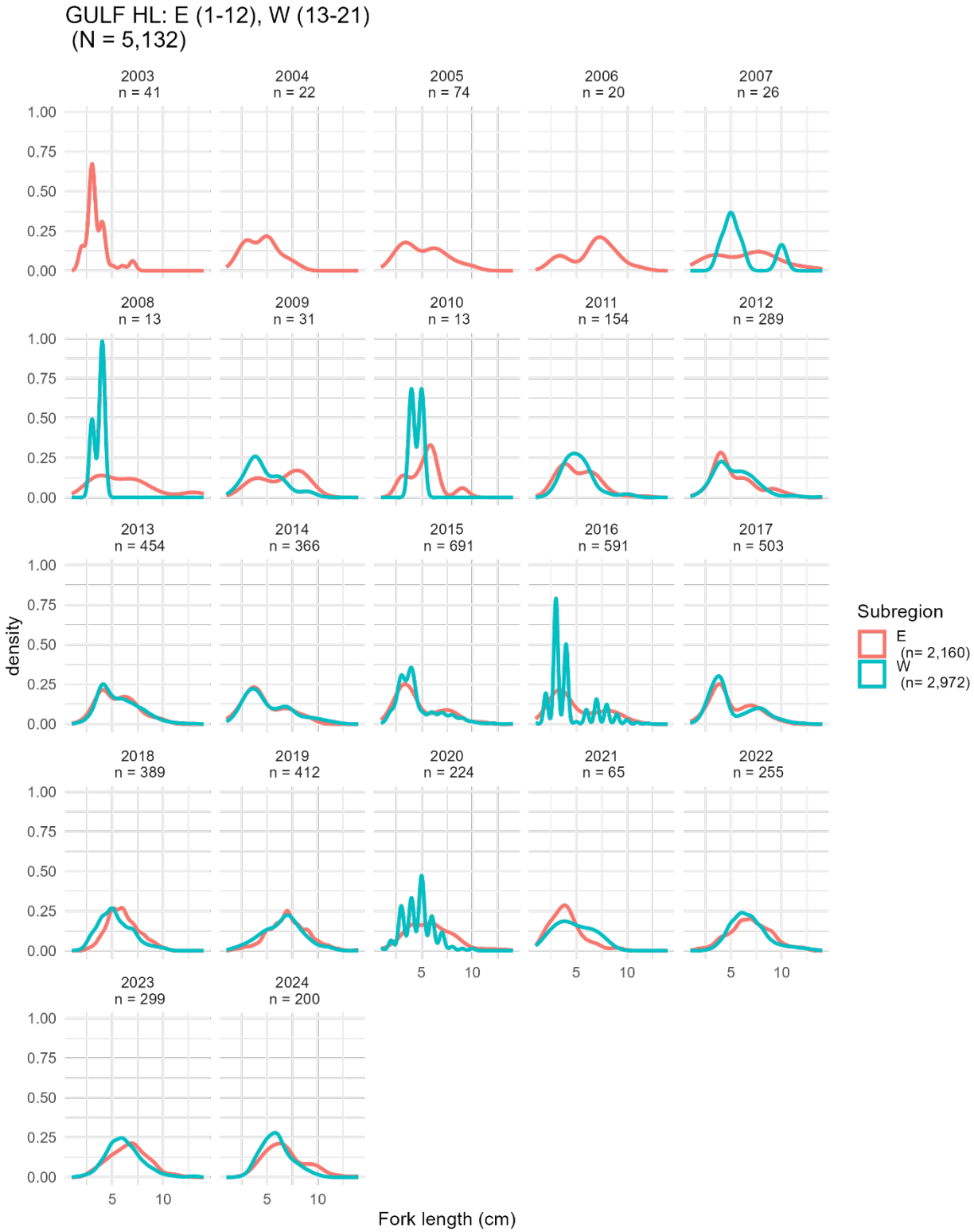

Figure 5. Annual nominal age distributions for the Gulf Gray Triggerfish commercial handline fishery by subregion.

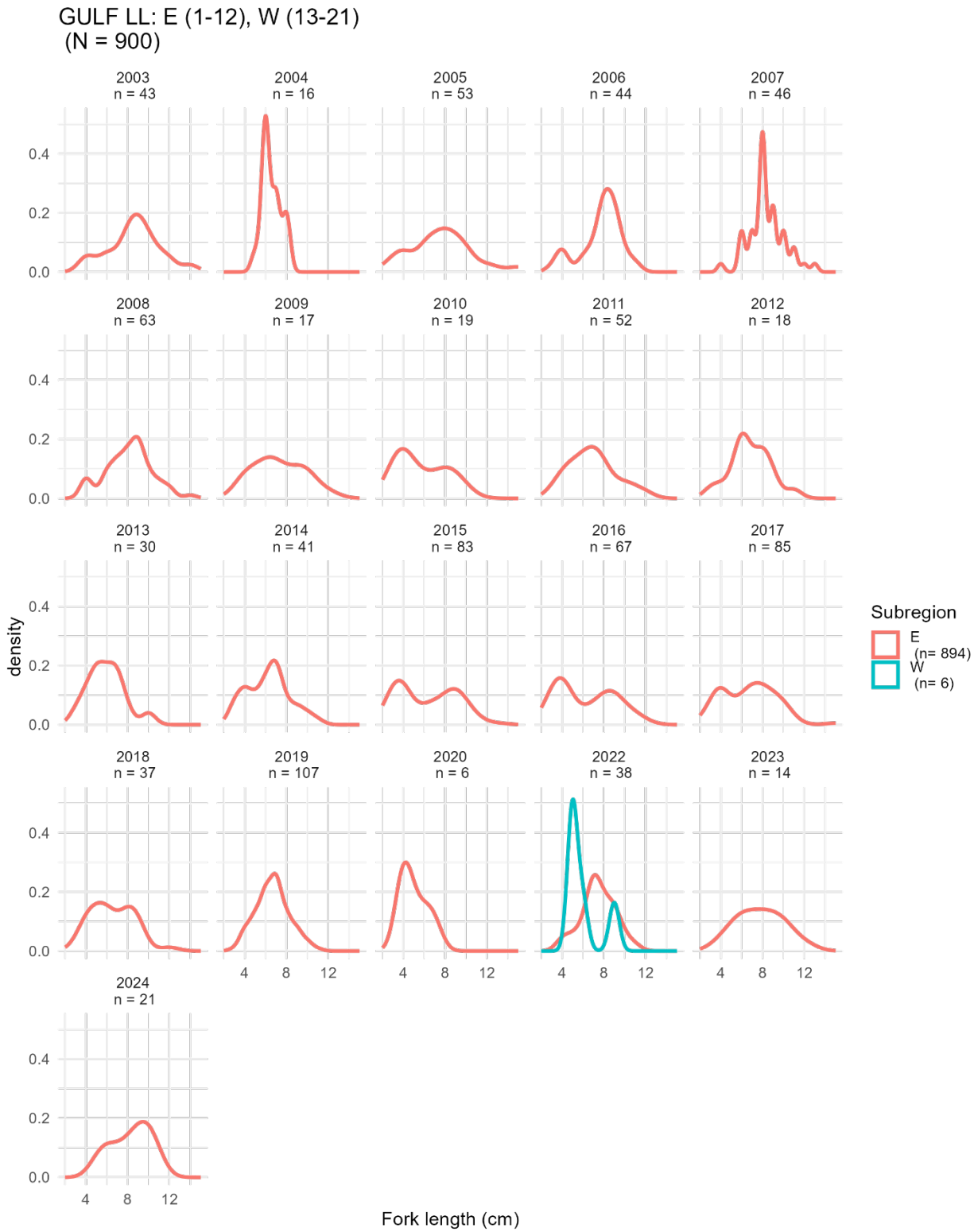

Figure 6. Annual nominal age distributions for the Gulf Gray Triggerfish commercial longline fishery by subregion.

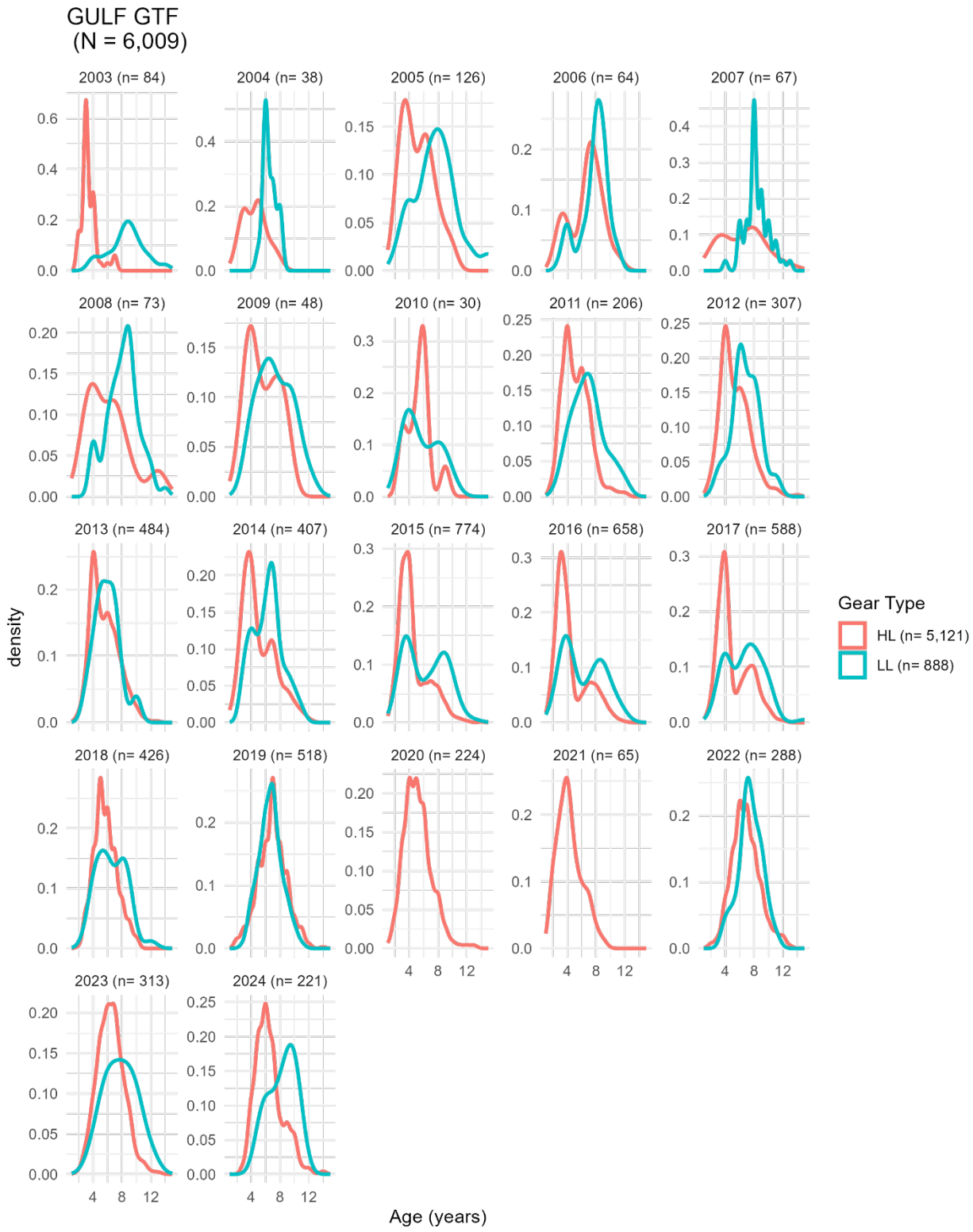

Figure 7. Annual nominal gulf-wide age compositions for the Gulf Gray Triggerfish commercial handline and longline fisheries.

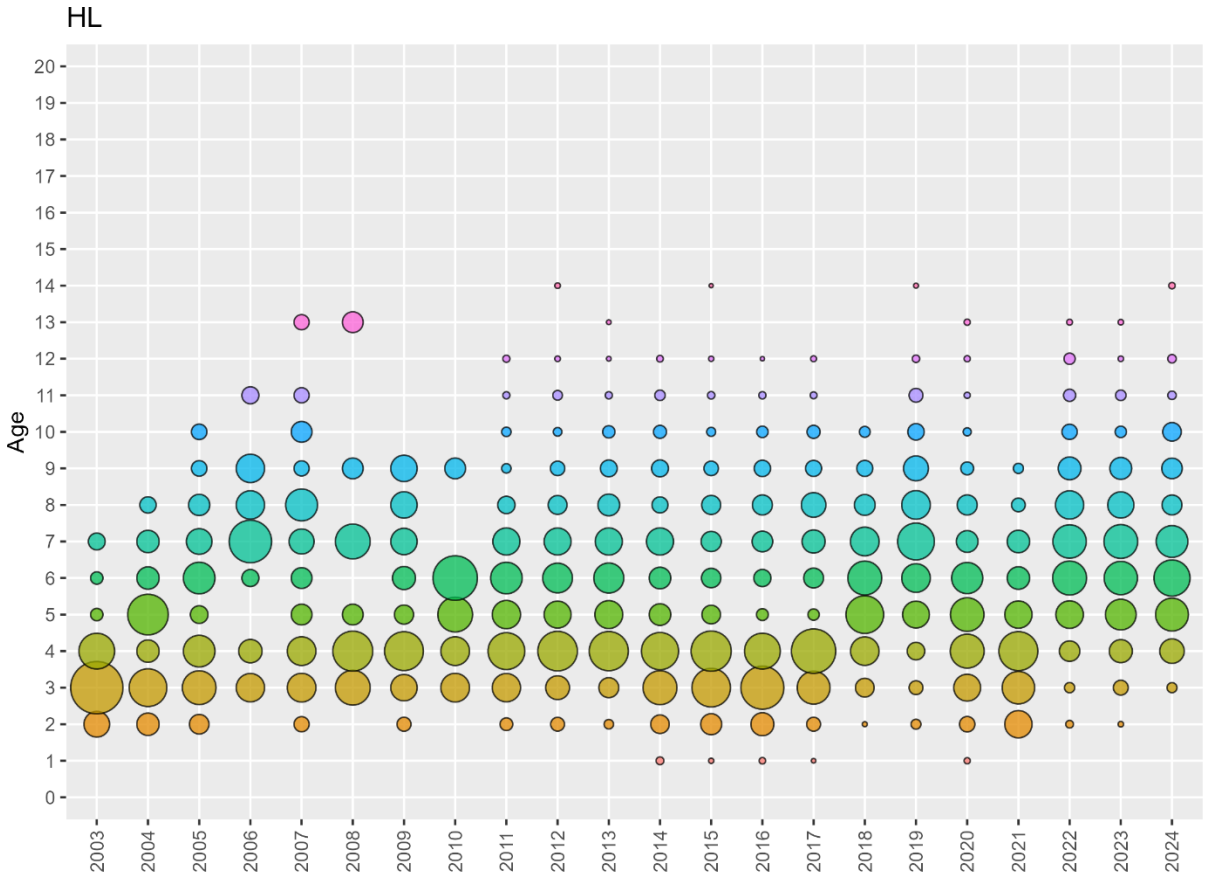

Figure 8. Annual nominal age compositions for the Gray Triggerfish commercial handline fishery. The size of the dots represents the relative proportion at age.

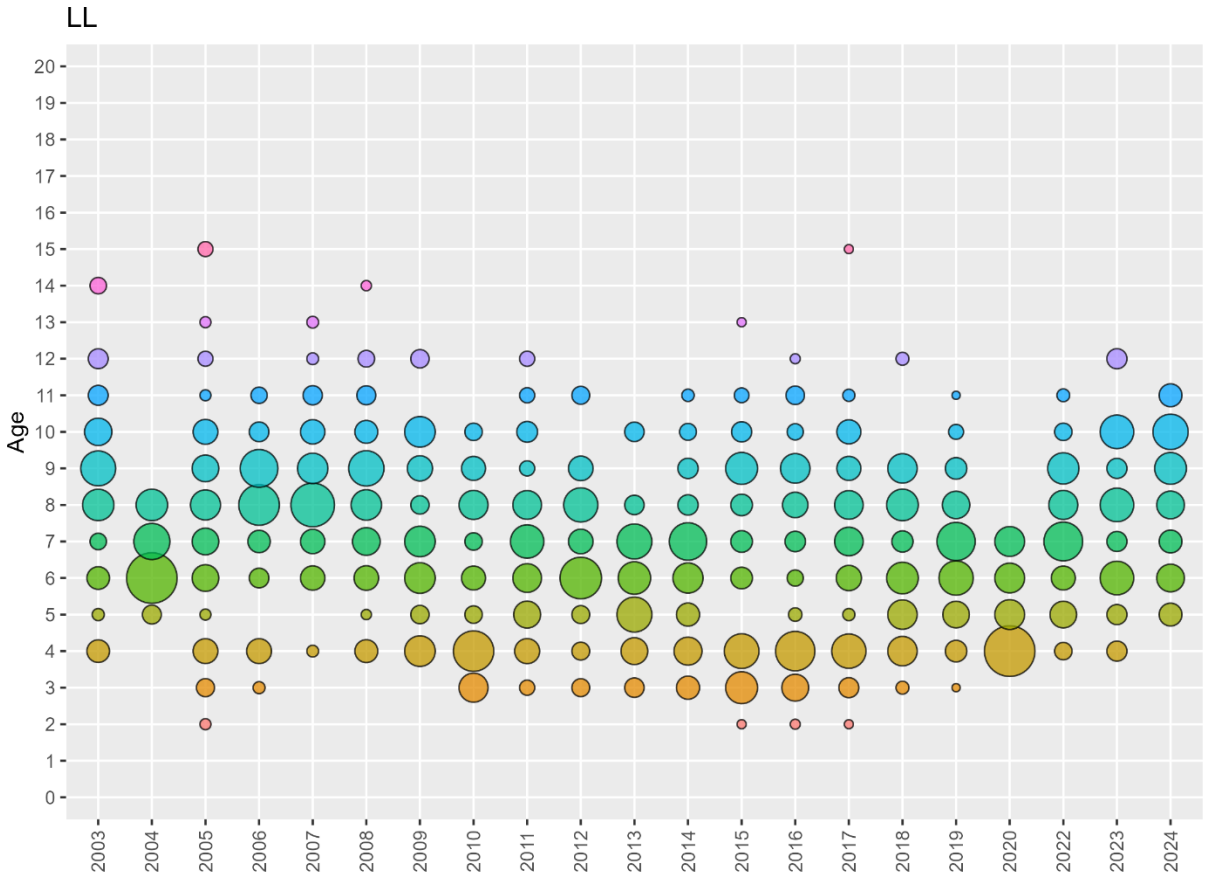

Figure 9. Annual nominal age compositions for the Gray Triggerfish commercial longline fishery. The size of the dots represents the relative proportion at age.

Appendix A.

Decisions from the Data Workshop

Sample sizes of lengths and ages by year, gear (Handline, Longline), and subregion (East, West) were presented at the data workshop, and the feasibility of providing nominal and weighted length and age compositions for each gear and subregion was discussed. Additionally, updates to the morphometric equations were discussed at the data workshop.

The Life History workgroup recommended proceeding with updated morphometrics equations, meaning the final compositions provided below will differ slightly from the preliminary compositions presented above, although the methodology used in producing the nominal compositions remains the same. The updated morphometric equations to convert natural total length in cm (NatTL), maximum total length in cm (MaxTL), and standard length in cm (SL) to fork length in cm (FL) are as follows:

$$FL = 3.3477 + 0.792 * NatTL$$

$$FL = 2.3541 + 0.788 * MaxTL$$

$$FL = 1.3531 + 1.144 * SL$$

Additionally, the workgroup made recommendations regarding the spatial and gear stratifications of the compositions, based on the available length sample sizes and the evidence or lack thereof for spatial/gear differences. There was clear evidence for differences in the size composition between the two gears (Handline and Longline) as shown in Figure 4 above. There was little evidence of spatial differences in size composition between the two regions as shown in Figure 2 above. Therefore, the workgroup recommended proceeding with an All Gulf model, by gear, handline and longline. The following sections detail the methodology used in preparing weighted length and age compositions, and provide final composition results for both nominal and weighted compositions, after accounting for the updated morphometric equations.

Final nominal length compositions

Final nominal length compositions were provided using the updated morphometric equations. The methodology used to update the nominal compositions was the same as what is described above, with only the morphometric conversions changing. The final nominal length compositions after accounting for the updated morphometric equations are shown by year and gear in Figure A.1. As mentioned above, there is a strong difference in compositions between handline and longline, with larger fish captured in the longline fishery.

Weighted length compositions

As mentioned above, the workgroup recommended that commercial handline and longline be modeled as separate fleets, comprising the entire Gulf of America, with weighting done using the

landings proportions by subregion (East: statistical zones 744, 748, and 1 – 12, West: statistical zones 13 – 21; Fig. 1). Final length sample sizes and number of trips are provided by year, gear, and subregion in Tables A.1 and A.2 respectively. Year, gear, and subregion strata with fewer than 30 length samples are recommended to be dropped from further analyses and have been highlighted in **red**. Additionally, at least 10 trips per strata are recommended. Due to the data paucity in the West subregion, no weighted length compositions were appropriate for the commercial longline fleet, and therefore nominal length compositions are recommended (Figure A.1).

For the commercial handline fleet, weighting strata-specific nominal length compositions were estimated using length bins of 2 cm, where for each year i, length bin j, and subregion s

$$LC_{i,j,s} = \frac{n_{i,j,s}}{n_{i,s}}$$

$n_{i,j,s}$ is the number of samples in year i, subregion s, and length bin j; $n_{i,s}$ is the number of samples in year i and subregion s (i.e., summed across length bins); and $LC_{i,j,s}$ is the proportion of the total number of sampled fish in each year i and subregion s within each length bin j. Next, the weighting strata-specific length compositions were weighted based on the proportion of landings in each subregion s and year i.

Proportions of annual landings from each subregion s in year i, $p_{i,s}$, were used to weight the strata-specific length compositions, $LC_{i,j,s}$, which were then summed across subregions s

$$LC_{i,j} = \sum_{s} \left(LC_{i,j,s} * p_{i,s}\right)$$

resulting in the final weighted estimates of landings length compositions, $LC_{i,j}$. This procedure would down-weight, for example, any instances where 60% of the length samples come from a subregion that only accounts for 20% of the landings for that fleet. The proportions of landings by year and subregion, $p_{i,s}$ are presented for commercial handline in Table A.3. No landings proportions are presented for commercial longline as there were insufficient length sample sizes for weighting as mentioned above. The effects of this weighting procedure are shown in Figure A.2., and are minimal in many years. The weighted length compositions for the commercial handline fleet are recommended for use in the model for years with sufficient sample sizes.

Final nominal age compositions

Nominal age compositions were not impacted by the updated morphometric equations, as length is not incorporated into the nominal age composition. However, due to data updates, there was one less age sample in one year, therefore, a new table of sample sizes was provided (Table A.4). The final nominal age compositions are presented as bubble plots in Figures A.3 & A.4 for handline and longline respectively. The methodology used to update the nominal age compositions was the same as what is described above.

Weighted age compositions

In order to account for potential sampling biases in the data, the nominal age compositions for the commercial handline fleet (described above) were re-weighted by the weighted length compositions. In order for the data to be deemed sufficient for weighted age compositions, each stratum must contain a minimum of 10 ages, and there must be a corresponding weighted length composition (i.e. there must be a minimum of 30 lengths in both the East and the West). As there were insufficient data to provide any weighted length compositions for longline, weighted age compositions are provided for handline only, and nominal age compositions are recommended for longline (Figure A.4). The number of handline length samples by subregion, and ages and trips gulf-wide are provided in Table A.5. Strata not meeting the minimum sample size requirements have been highlighted in **red**. Additionally, strata with fewer than 10 trips have been highlighted in red and are recommended to be dropped from further analysis.

In order to weight the nominal age compositions, first a re-weighting factor, $RW_{i,j}$, was calculated within each year i and length bin j to correct the composition of the age data (number of age samples in each length bin divided by the annual total) to more closely represent the final length composition of the landings. The re-weighting factor was calculated as follows,

$$RW_{i,j} = \frac{LC_{i,j}}{a_{i,j}/a_i}$$

where $LC_{i,j}$ is the weighted length composition in year i and length bin j, $a_{i,j}$ is the number of age samples in year i and length bin j, and a_i is the number of age samples in year i. Under this methodology, if there were age samples $a_{i,j}$ not represented in $LC_{i,j}$, they were down-weighted to zero and effectively dropped from further analysis. The final commercial weighted age compositions were estimated as

$$AC_{i,k} = \sum_j \left(RW_{i,j} * \frac{a_{i,j,k}}{a_i} \right)$$

where all length bins j within an age class k were summed, then re-scaled to sum to 1 across each year. The re-weighting factor will up-weight ages from less represented length bins and will generate a more representative estimate of landings' age compositions. Effects of the age composition weighting procedure are shown for the commercial handline fleet in Figure A.5., which shows minimal differences between composition types. Additionally, a bubble plot showing the final weighted age distribution is shown for the commercial handline fleet in Figure A.6.

Commercial Conditional Age-at-Length

Conditional age-at-length (CAAL) is the proportion of fish, at age, in a given length bin. When data are sufficient (i.e. wide spread of ages and lengths represented), CAAL is considered to be more informative than length and age compositions because it can be used to directly estimate the length-at-age process and the variability in length-at-age (Taylor and Methot 2013; Piner et al. 2016; Lee et al. 2019). Another benefit of CAAL is that it avoids double use of fish for both age and length compositions, especially when age compositions are weighted by the length compositions.

For each commercial fleet (Handline, Longline) conditional age-at-length was estimated where for each year i, length bin j, and age class k

$$CAAL_{i,j,k} = \frac{a_{i,j,k}}{a_{i,j}}$$

$a_{i,j,k}$ is the number of age samples in year i, lower inclusive length bin j, and age class k; $a_{i,j}$ is the number of age samples in year i and lower inclusive length bin j; and $CAAL_{i,j,k}$ is the proportion of fish samples in year i and length bin j within age class k**Error! Reference source not found.**. Conditional age-at-length by year is shown in Figures A.7 & A.8 for commercial handline and longline respectively.

Commercial Mean Length-at-Age

Fleet-specific mean length-at-age and associated sample sizes were also provided to the lead analyst to aid in model diagnostics. Mean length-at-age, $MLAA_{i,k}$, was estimated as the sum of all lengths $L_{i,k}$ divided by the associated sample sizes $a_{i,k}$ within each year i and age class k.

$$MLAA_{i,k} = \frac{\sum L_{i,k}}{a_{i,k}}$$

The mean length by year for a given age is shown in Figures A.9 & A.10 for commercial handline and longline respectively.

References

Lee, H., K.R. Piner, I.G. Taylor, and T. Kitakado. 2019. On the use of conditional age at length data as a likelihood component in integrated population dynamics models. Fisheries Research. 216:204-211.

Piner, K.R., H.H. Lee, and M.N. Maunder. 2016. Evaluation of using conditional age-at-length observations and an equilibrium approximation of the population age structure in fitting the von Bertalanffy growth function. Fisheries Research. 180:128-137.

Taylor, I.G., R.D. Methot, Jr. 2013. Hiding or dead? A computationally efficient model of selective fisheries mortality. Fisheries Research. 142:75-85

Tables

Table A.1. Final commercial length sample sizes by year, gear and subregion. Strata highlighted in **red** within the "Total" column have insufficient sample sizes (< 30 fish) for nominal compositions. Strata highlighted in **red** in either the "East" or "West" columns have insufficient sample sizes for weighting (< 30 fish).

	Handline			Longline			
Year	East	West	Total	East	West	Total	Grand Total
1989	**1**	**5**	**6**			**0**	6
1990	63	276	339	52		52	391
1991	55	653	708	44	**7**	51	759
1992	105	1228	1333	**23**	**2**	**25**	1358
1993	449	757	1206	40	**2**	42	1248
1994	921	718	1639	**28**		**28**	1667
1995	871	170	1041	**5**		**5**	1046
1996	787	48	835	31		31	866
1997	583	301	884	**22**		**22**	906
1998	431	215	646	52		52	698
1999	437	81	518	43		43	561
2000	185	56	241	**29**		**29**	270
2001	512	186	698	32		32	730
2002	230	174	404	51		51	455
2003	196	211	407	48		48	455
2004	176	82	258	**24**		**24**	282
2005	255	141	396	67		67	463
2006	109	**14**	123	60		60	183
2007	38	64	102	49		49	151
2008	74	**9**	83	74		74	157
2009	139	**8**	147	**25**		**25**	172
2010	141	**6**	147	**28**		**28**	175
2011	266	**18**	284	54		54	338
2012	113	278	391	**17**		**17**	408
2013	169	555	724	33		33	757
2014	130	339	469	47		47	516
2015	475	549	1024	89		89	1113
2016	603	492	1095	77		77	1172
2017	562	412	974	116		116	1090
2018	684	188	872	42		42	914
2019	1200	149	1349	123	**1**	124	1473
2020	597	145	742	**12**		**12**	754
2021	386	30	416	**9**		**9**	425
2022	572	172	744	47	**8**	55	799
2023	869	181	1050	34		34	1084
2024	566	108	674	33		33	707

Table A.2. Final commercial length trip sample sizes by year, gear and subregion. Strata highlighted in **red** within the "Total" column have fewer trips (< 10) than recommended for nominal compositions. Strata highlighted in **red** in either the "East" or "West" columns have fewer trips (< 10) than recommended for weighting.

	Handline			Longline			
Year	East	West	Total	East	West	Total	Grand Total
1989	**1**	**1**	**2**			**0**	2
1990	10	43	53	14		14	67
1991	**8**	82	90	15	**2**	17	107
1992	12	142	154	11	**2**	13	167
1993	35	115	150	13	**1**	14	164
1994	81	61	142	16		16	158
1995	80	10	90	**4**		**4**	94
1996	80	**4**	84	10		10	94
1997	68	55	123	**6**		**6**	129
1998	64	39	103	23		23	126
1999	63	11	74	27		27	101
2000	40	15	55	25		25	80
2001	55	29	84	16		16	100
2002	43	33	76	27		27	103
2003	30	37	67	34		34	101
2004	23	15	38	18		18	56
2005	31	43	74	31		31	105
2006	26	**9**	35	35		35	70
2007	16	14	30	27		27	57
2008	19	**3**	22	41		41	63
2009	40	**2**	42	16		16	58
2010	30	**3**	33	15		15	48
2011	54	**1**	55	26		26	81
2012	32	44	76	11		11	87
2013	51	93	144	16		16	160
2014	48	56	104	17		17	121
2015	96	87	183	24		24	207
2016	109	72	181	33		33	214
2017	102	64	166	46		46	212
2018	101	45	146	24		24	170
2019	166	37	203	32	**1**	33	236
2020	140	26	166	10		10	176
2021	78	14	92	**3**		**3**	95
2022	128	35	163	20	**3**	23	186
2023	189	55	244	23		23	267
2024	127	31	158	16		16	174

Table A.3. Commercial landings proportions by year and subregion for the commercial handline fleet used in weighting the subregional length compositions.

	Handline	
Year	**East**	**West**
1989	0.804	0.196
1990	0.806	0.194
1991	0.742	0.258
1992	0.747	0.253
1993	0.616	0.384
1994	0.569	0.431
1995	0.580	0.420
1996	0.465	0.535
1997	0.505	0.495
1998	0.551	0.449
1999	0.495	0.505
2000	0.336	0.664
2001	0.563	0.437
2002	0.597	0.403
2003	0.629	0.371
2004	0.610	0.390
2005	0.685	0.315
2006	0.606	0.394
2007	0.480	0.520
2008	0.551	0.449
2009	0.751	0.249
2010	0.833	0.167
2011	0.870	0.130
2012	0.890	0.110
2013	0.925	0.075
2014	0.923	0.077
2015	0.933	0.067
2016	0.932	0.068
2017	0.959	0.041
2018	0.964	0.036
2019	0.970	0.030
2020	0.970	0.030
2021	0.974	0.026
2022	0.967	0.033
2023	0.967	0.033
2024	0.967	0.033

Table A.4. Number of fish and trips sampled for ages by year and gear for the commercial handline and longline fleets. Strata not meeting the age sample size cutoff (<10 ages) or trip sample size cutoff (<10 trips) have been highlighted in **red**.

	Handline		Longline	
Year	N fish ages	N trips ages	N fish ages	N trips ages
2003	41	**6**	43	30
2004	21	**6**	16	15
2005	74	12	53	25
2006	19	10	44	26
2007	26	11	46	25
2008	13	**7**	63	35
2009	31	13	17	12
2010	13	**7**	19	**9**
2011	154	33	52	26
2012	289	58	18	13
2013	454	106	30	15
2014	366	82	41	15
2015	691	129	83	24
2016	591	106	67	28
2017	503	90	85	31
2018	389	96	37	21
2019	412	86	107	27
2020	224	60		
2021	65	28	**6**	**4**
2022	255	57	38	14
2023	299	77	14	**7**
2024	200	55	21	**7**

Table A.5. Number of fish sampled for length by weighting strata (subregion), and the number of available age samples and trips for the gulf-wide commercial handline fishery. Years with insufficient lengths for a weighted length composition (i.e. fewer than 30 lengths in either the East or the West), or insufficient age samples (<10) are recommended to be dropped from further analysis. Strata not meeting the sample size requirement have been highlighted in **red**. Additionally, strata with fewer than 10 trips for the age samples are recommended to be dropped from further analysis.

	East	West	All Gulf	
Year	N fish lengths	N fish lengths	N fish ages	N trips ages
2003	196	211	41	**6**
2004	176	82	21	**6**
2005	255	141	74	12
2006	109	**14**	19	10
2007	38	64	26	11
2008	74	**9**	13	**7**
2009	139	**8**	31	13
2010	141	**6**	13	**7**
2011	266	**18**	154	33
2012	113	278	289	58
2013	169	555	454	106
2014	130	339	366	82
2015	475	549	691	129
2016	603	492	591	106
2017	562	412	503	90
2018	684	188	389	96
2019	1200	149	412	86
2020	597	145	224	60
2021	386	30	65	28
2022	572	172	255	57
2023	869	181	299	77
2024	566	108	200	55

Figures

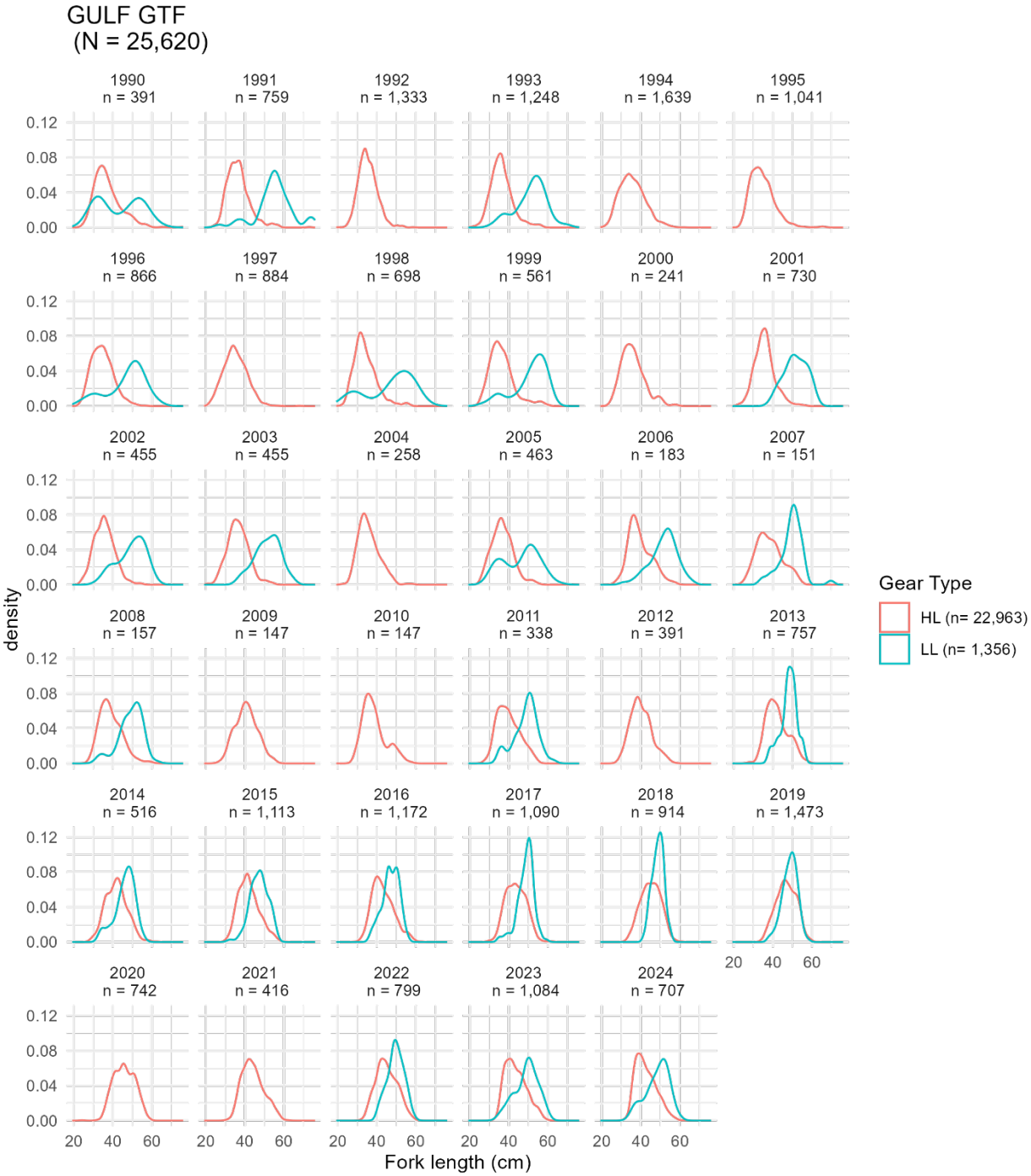

Figure A.1. Annual nominal gulf-wide length compositions for the Gulf Gray Triggerfish commercial handline and longline fisheries.

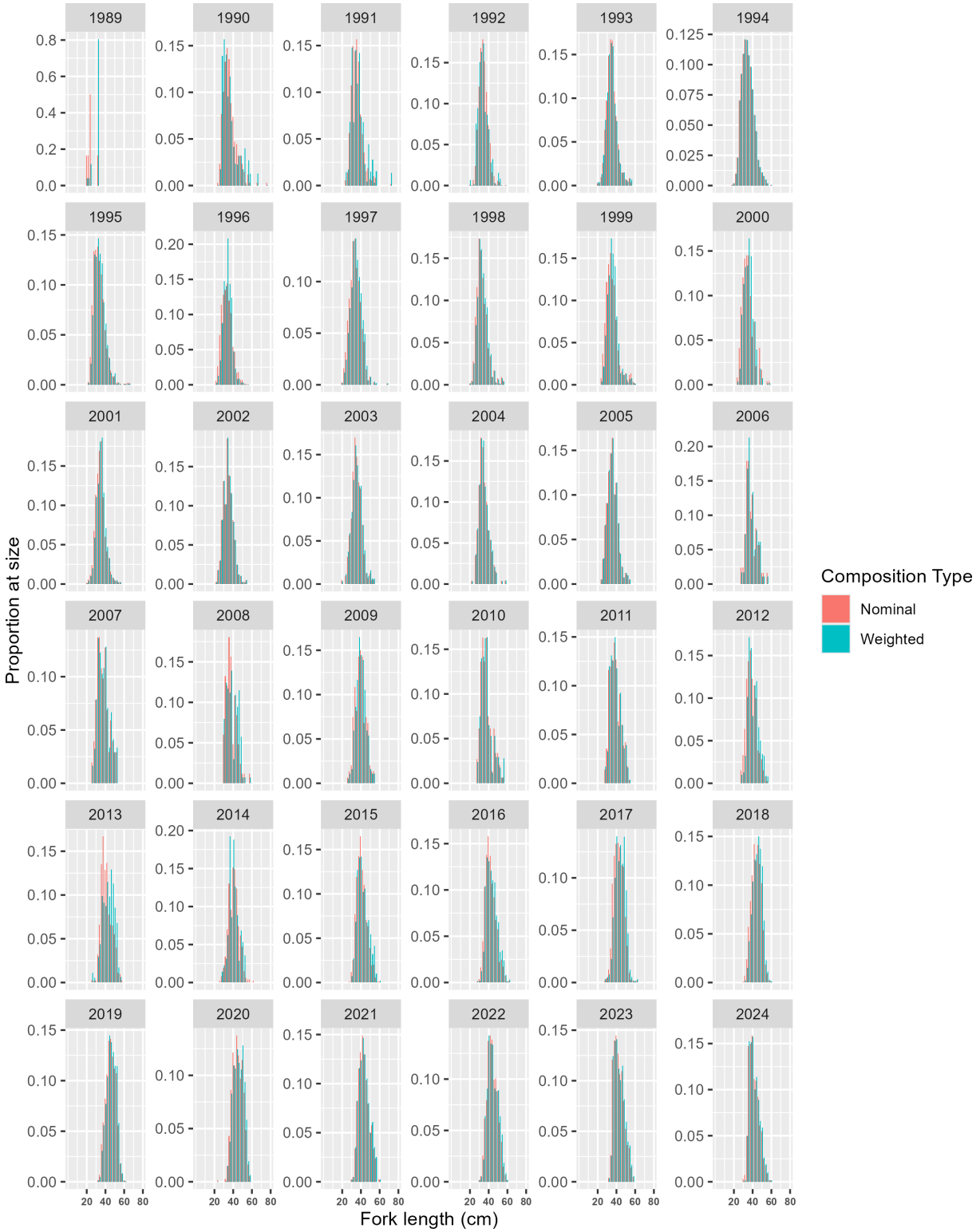

Figure A.2. Annual comparison of the gulf-wide final nominal and weighted length compositions for the Gulf Gray Triggerfish commercial handline fishery.

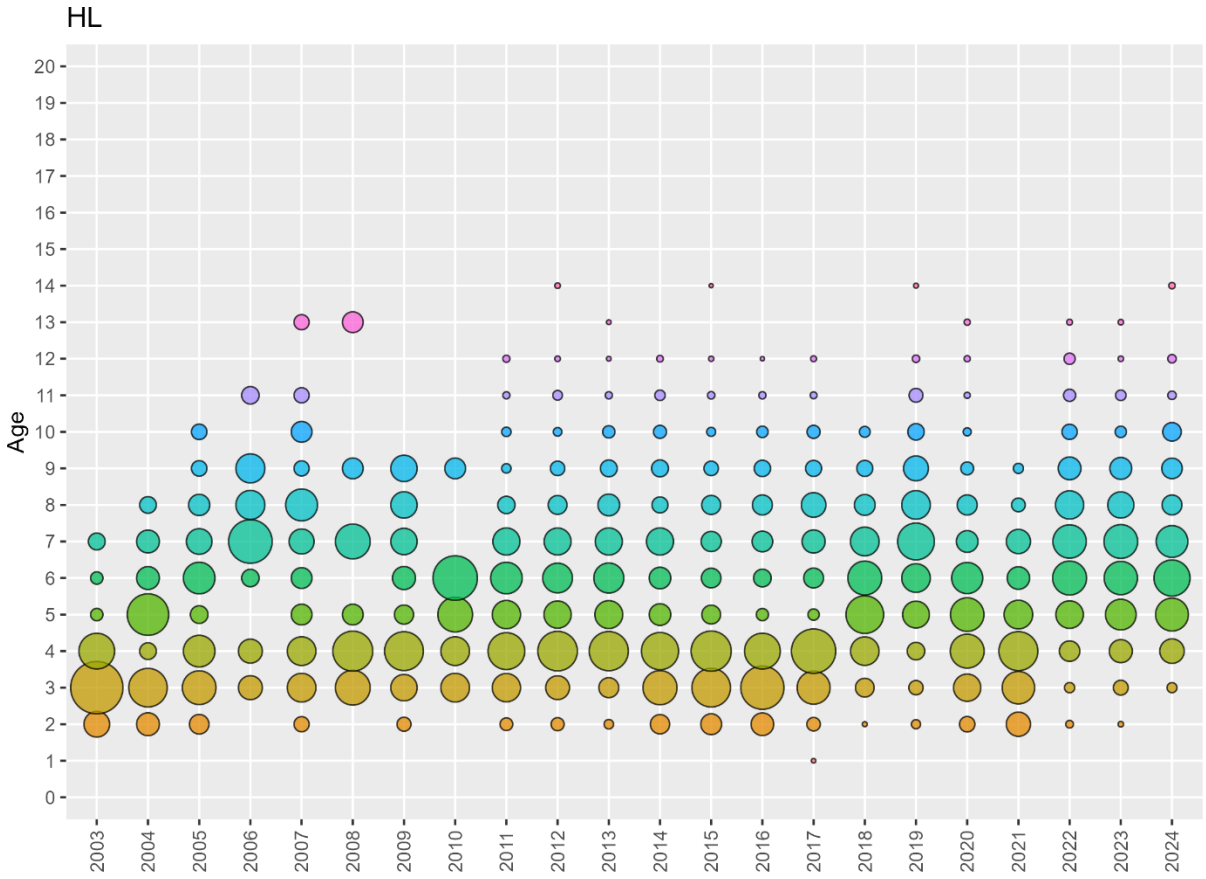

Figure A.3. Final annual nominal age compositions for the Gulf Gray Triggerfish commercial handline fishery. The size of the dots represents the relative proportion at age.

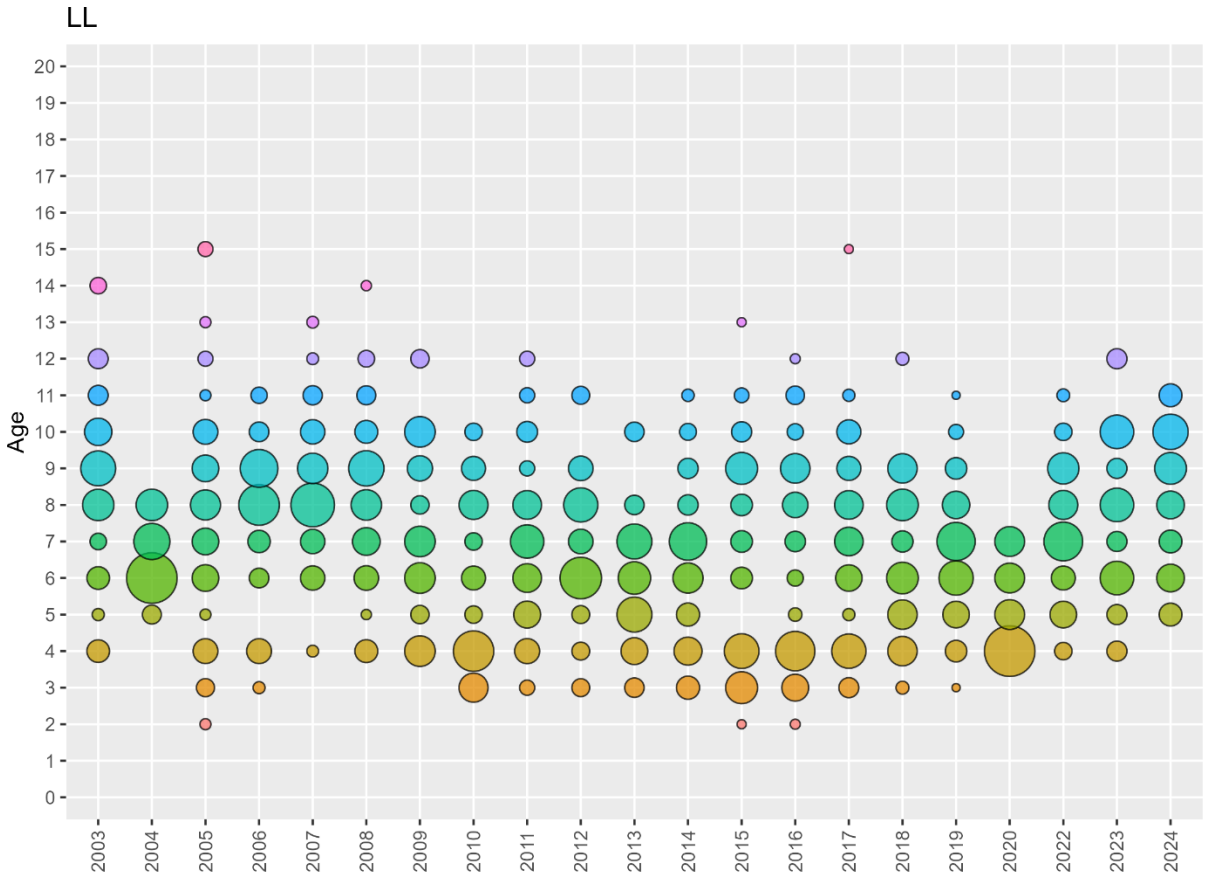

Figure A.4. Final annual nominal age compositions for the Gulf Gray Triggerfish commercial longline fishery. The size of the dots represents the relative proportion at age.

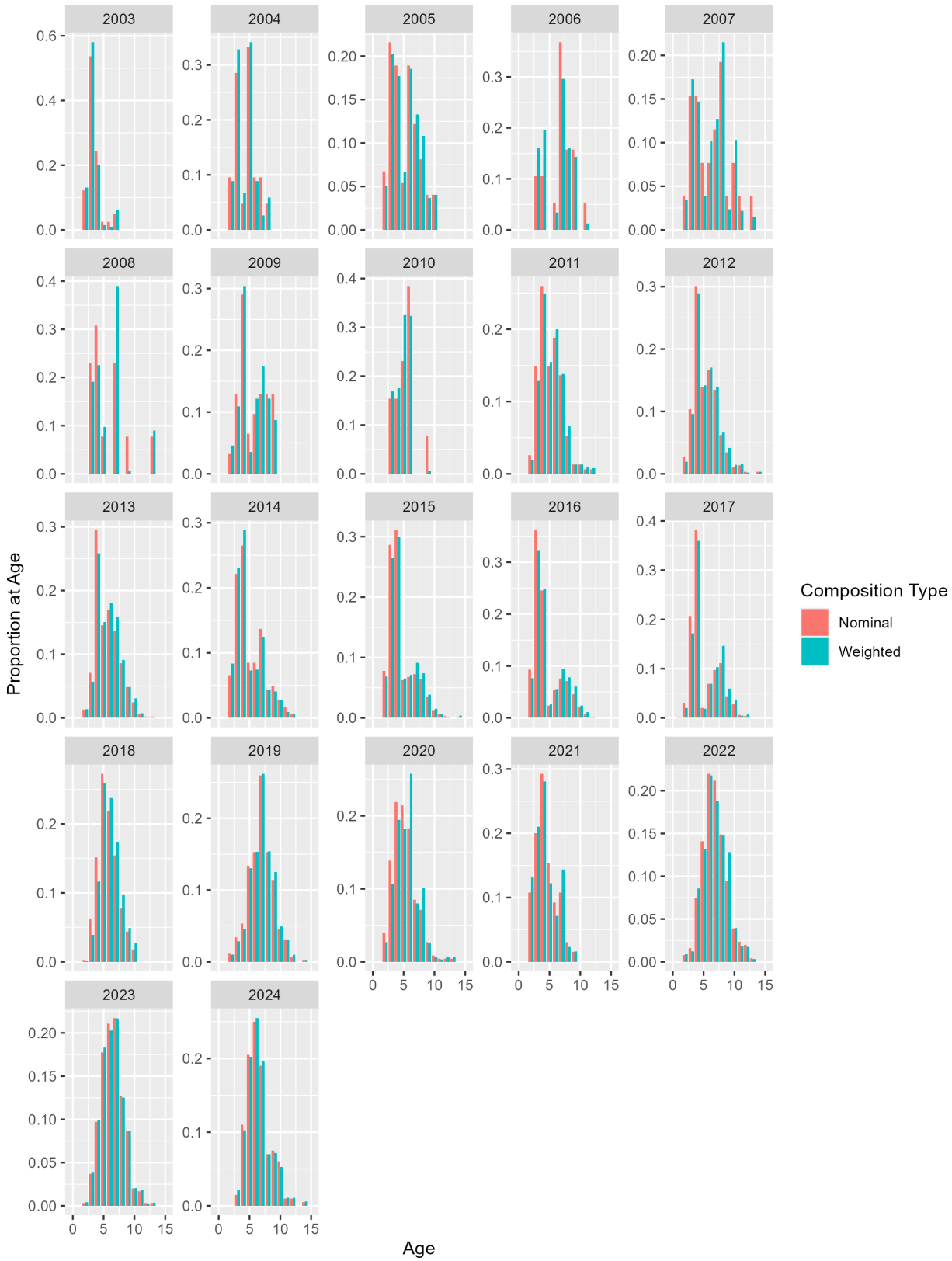

Figure A.5. Annual comparison of the gulf-wide final nominal and weighted age compositions for the Gulf Gray Triggerfish commercial handline fishery.

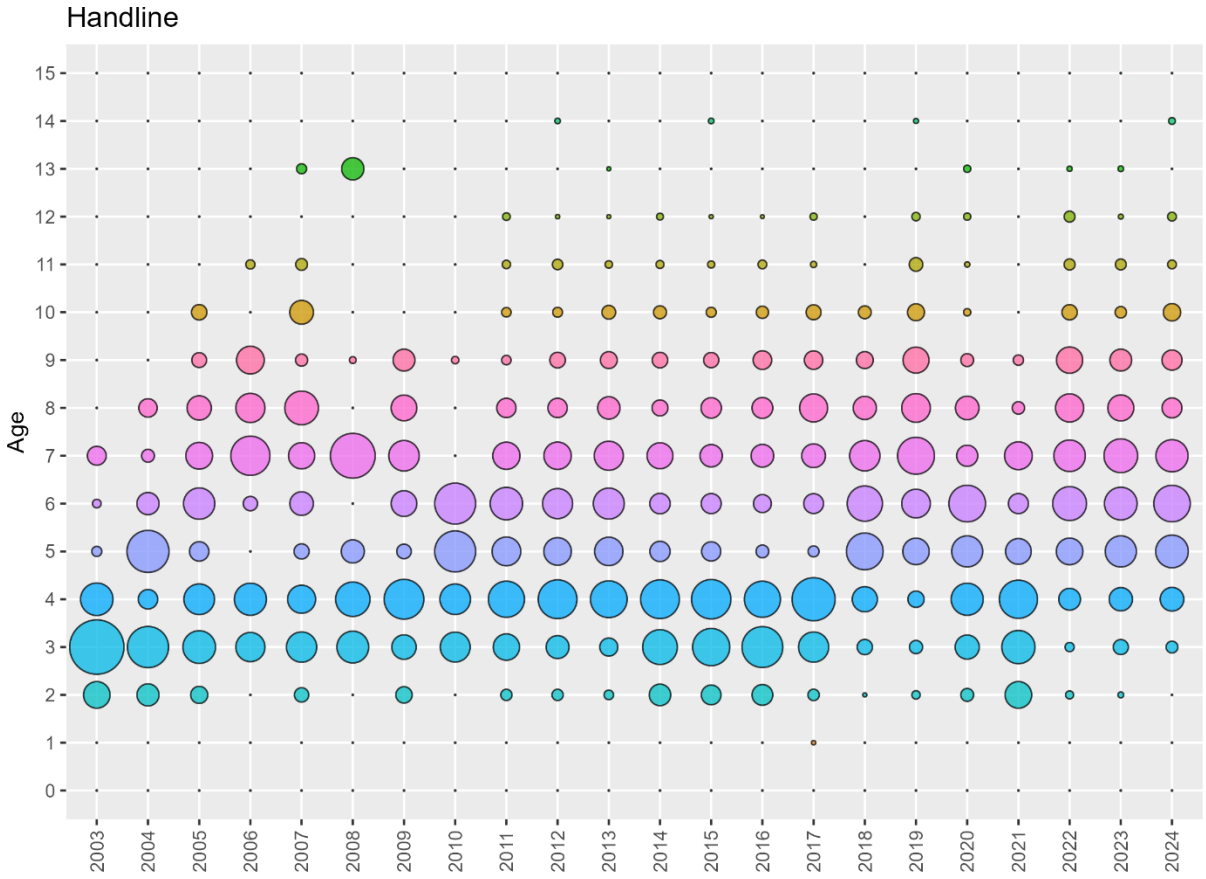

Figure A.6. Final annual weighted age compositions for the Gulf Gray Triggerfish commercial handline fishery. The size of the dots represents the relative proportion at age.

Figure A.7. Conditional Age-at-Length for the Gulf Gray Triggerfish commercial handline fishery. The size of the dots represents the relative proportion at age for a given length bin.

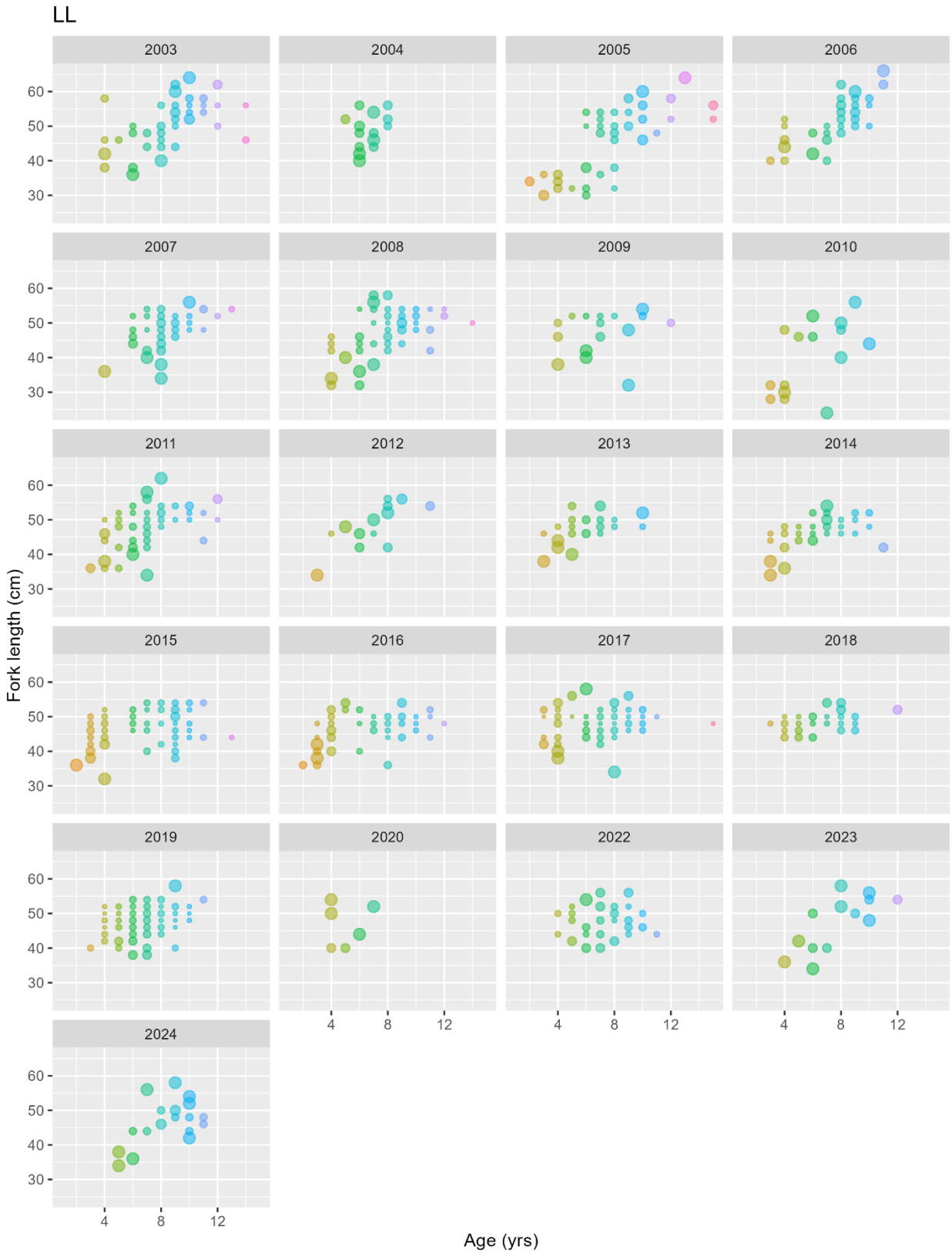

Figure A.8. Conditional Age-at-Length for the Gulf Gray Triggerfish commercial longline fishery. The size of the dots represents the relative proportion at age for a given length bin.

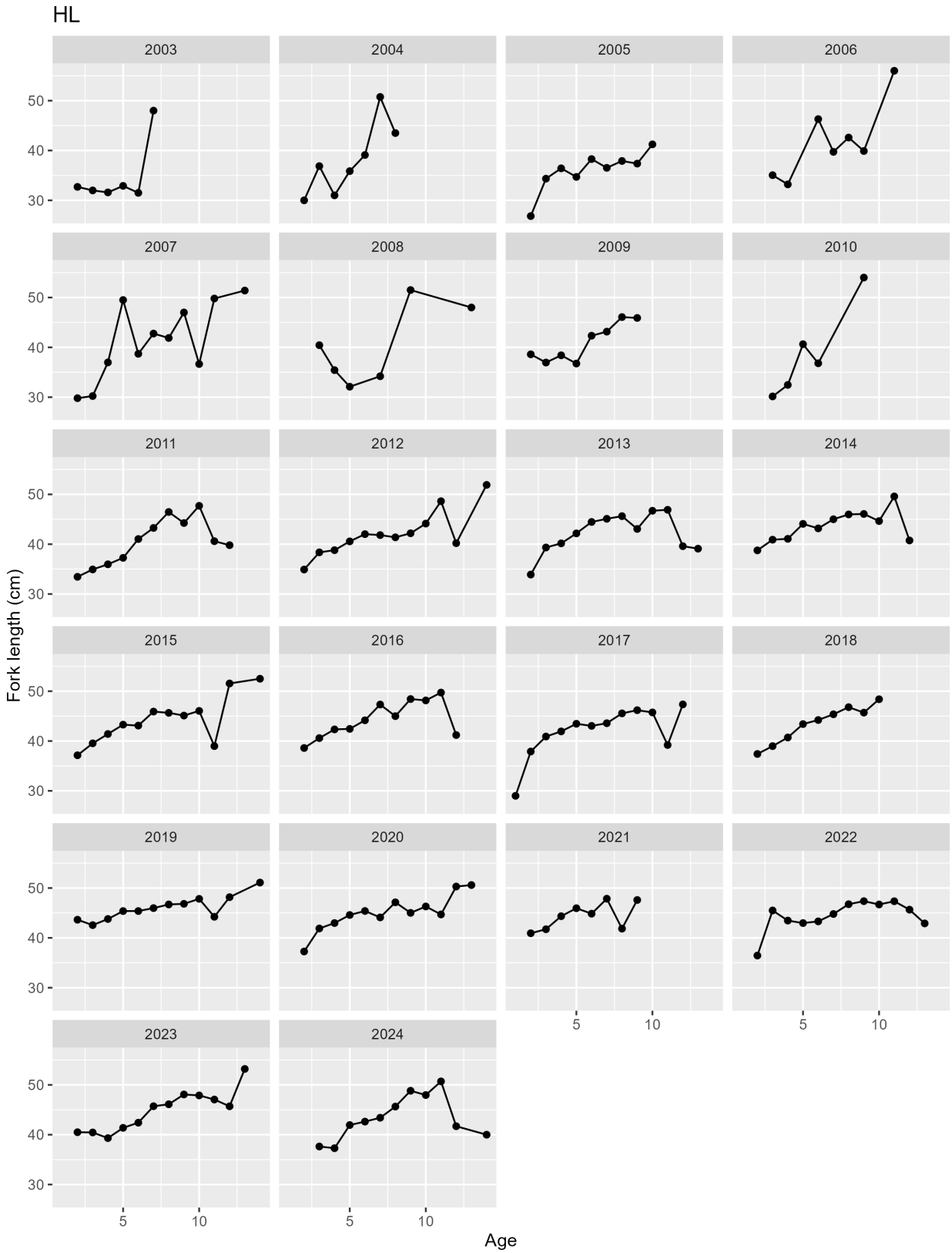

Figure A.9. Annual mean fork length at age for the commercial handline fishery.

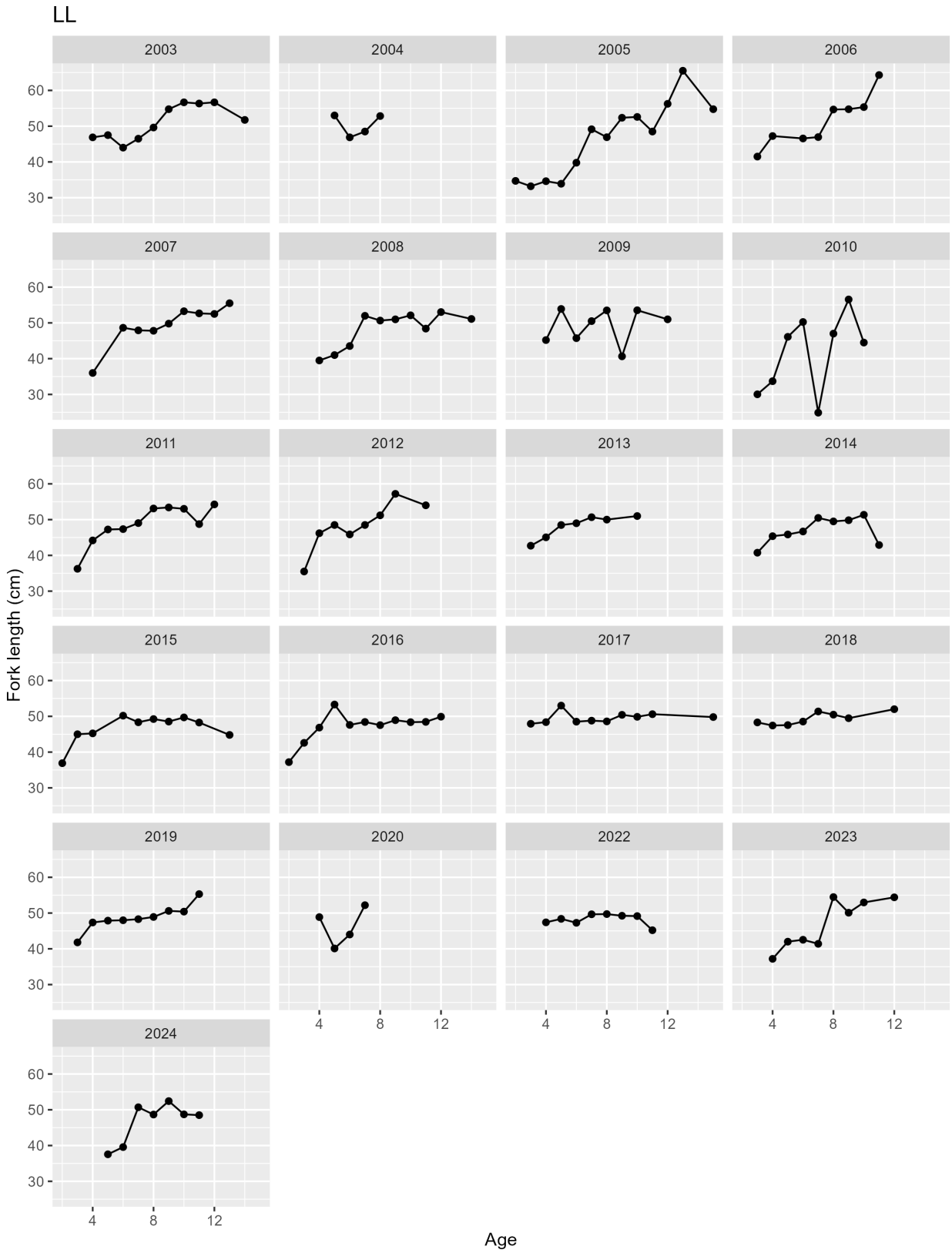

Figure A.10. Annual mean fork length at age for the commercial longline fishery.