Gulf of America Red Snapper (*Lutjanus campechanus*) Commercial Landings Preliminary Length and Age Compositions

Michaela Pawlik and Samantha M. Binion-Rock

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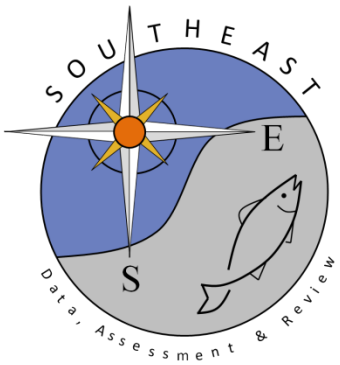

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Gulf of America Red Snapper (*Lutjanus campechanus*) Commercial Landings Preliminary Length and Age Compositions

Michaela Pawluk[1] and Samantha Binion-Rock
[1]*NOAA Southeast Fisheries Science Center, 4700 Avenue U, Galveston TX 77551*

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Update to the Working Paper

An appendix has been added that provides the final nominal length and weight compositions, conditional age-at-length, and mean length-at-age that were presented during the data workshop and post data workshop webinar.

As of March 10, 2025, all efforts are made to use "Gulf of America" per E.O. 14172. However, previous NOAA reports (cited herein) may have referred to this water body as the "Gulf of Mexico".

Introduction

This document outlines the data and methodologies used to estimate length and age compositions of commercial landings for the SEDAR 98 Gulf of America (formally Gulf of Mexico) Red Snapper Assessment. These compositions were estimated using data sources approved in SEDAR 74. Because fishery-dependent sampling is typically opportunistic, sampled lengths may not be representative of the true size composition of landings (and, by extension, sampled otoliths may not be representative of the true age composition of the landings). To account for these potential biases, length samples from commercial fleets were weighted by their respective landings at the finest spatial and temporal scale available without losing data. The resultant weighted length compositions were then used to weight the age compositions as lengths are more heavily sampled and provide a clearer picture of the size distribution. Additionally, conditional age-at-length (CAAL) and mean length-at-age (MLAA) were estimated because these data contain more detailed information on the relationship between size and age while avoiding double use of fish (Thorson *et al.* 2017, Methot *et al.* 2020). Resulting analyses, data limitations, and research recommendations are discussed below.

Data Description

SEDAR 98 assesses all Gulf of America Red Snapper in federal waters extending northward from the Texas/Mexico border and eastward to the Florida Keys US1 boundary. Commercial data sources utilized to generate length compositions include length samples from the Trip Interview Program (Beggerly *et al.* 2022) and landings data from the Accumulated Landings Systems from 1984 until state trip ticket programs came into effect (Atkinson and Pawluk 2024). Age estimates from the Gulf States Marine Fisheries Commission Fisheries Information Network (GulfFIN) were compiled by the SEFSC Panama City Laboratory alongside their age data.

Commercial fleets were defined by handline (HL), and longline (LL) gears. These data were compiled using length bins of 1 centimeters (cm) which differs from SEDAR 74 which used length bins of 2 cm. This change was requested by the lead analysts to allow for the most flexibility in analyzing the data. Natural total length (TL), maximum total length (MTL), and standard length (SL) in cm were converted to fork length (FL) in cm using the following conversion equations:

$$FL = -0.0851 + 0.93 * TL$$

$$FL = 0.138 + 0.926 * MTL$$

$$FL = 1.756 + 1.137 * SL$$

Fish landings measuring less than 10 cm FL were removed as these were assumed to be unit errors (e.g. fish recorded as 10 cm were likely 10"). Fish lengths greater than 120 cm FL were removed and assumed to be errors.

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.

Length Compositions

Because fishery-dependent sampling is typically opportunistic, lengths may not be representative of the true landings composition throughout the entire Gulf. Possible sampling bias in the collection of length samples are typically removed by weighting the length compositions with the associated landings on the finest spatial and temporal scale available without losing data.

Each commercial fleet (handline, longline) was modeled for each of the three subregions of the Gulf defined as**11**: East (E: areas 744.0001, 748.0001, 1 – 6), Central (C: areas 7 – 12), and West (W: areas 13 – 21) with weighting done by further sub-dividing each subregion into two "sub-subregions". The eastern subregion was split into E1: areas 744.0001, 748.0001, 1 – 3, E2: areas 4 – 6. The central subregion was split into C1: areas 7 – 9, C2: areas 10 – 12. The western subregion was split into W1: areas 13 – 17, W2: areas 18 – 21 (Figure 1). The handline and longline gears were sufficiently distinct to remain separate fleets (Figure 2)**2** and gear-specific annual compositions are shown in Figure 3**33**. Samples labeled as 'other' gear (Figure 2) were excluded from analyses because of their small number of samples (n=2,580) and because the majority of these samples did not have any gear information listed, so it is possible these samples may actually be from HL or LL and not an 'other' (e.g. trap) gear. Length distributions were shown by fishing areas grouped by sub-region (E,C,W) for HL Figure 4**44**, and LL Figure 5**55**. Sample sizes of commercial lengths for handline (Table 1) and longline (Table 2) **Error! Reference source not found.** and trips for handline (Table 3) and longline (Table 4)**Error! Reference source not found.** were provided for each weighting stratum (year, gear, and sub-subregion) for each fleet. Generally, weighting strata with less than 30 length samples, or less than 10 trips are recommended to be dropped from further analyses, however, many strata do not meet the trip filter. Therefore, for the current analysis, only strata not meeting the sample size filter are recommended to be excluded.

Within each fleet, subregion-specific nominal length compositions were estimated using length bins of 1 cm, where for each year i, length bin j, and subregion r

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

$n_{i,j,r}$ is the number of samples in year i, subregion r, and lower inclusive length bin j; $n_{i,r}$ is the number of samples in year i and subregion r; and $LC_{i,j,r}$ is the proportion of the total number of sampled fish in each year i and subregion r within each lower inclusive length bin j. At the request of the lead analysts, the minimum sample size threshold was not applied annually within each strata, $LC_{i,r}$, meaning these were not dropped or excluded from further analyses if $n_{i,r} < 30$. While the strata not meeting the sample size threshold are presented below, it is our recommendation that these samples be excluded from the assessment model. Next, nominal length compositions for each fleet and "sub-subregion" s were constructed following the same methodology as above, and those sub-subregion specific length compositions were then weighted based on the distribution of the landings estimates among sub-subregions (i.e. the weighted composition for the East region was weighting by taking the nominal compositions from E1 and E2 and weighting them by the relative proportions of landings between E1 and E2 within the east region).

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

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

resulting in the final weighted estimates of landings length compositions, $LC_{i,j,r}weighted$. The proportion of landings, $p_{i,s}$, for each year i and sub-subregion s are aggregated into time periods and shown in Table 5 (handline) and Table 6 (longline)**Error! Reference source not found.**. This procedure would down-weight, for example, any instances where 60% of the length samples come from a stratum that only accounts for 20% of the landings for that fleet. The effects of this weighting procedure are shown for handline in Figures 6 – 8**Error! Reference source not found.**, and longline Figures 9 – 11**Error! Reference source not found.**.

Commercial Age Compositions of Landings

Age Samples

Commercial age samples were a subset of the length samples. Age data compiled by the SEFSC Panama City Laboratory were filtered to remove duplicated and biased data. Sample sizes of commercial ages for handline (Table 7) and longline (Table 8) and commercial trips sampled for age for handline (Table 9) and longline (Table 10) are provided. Red Snapper maximum age was estimated to be 57 years, with a plus group for age 20 plus used in modeling.

Age Compositions

Nominal age compositions were estimated for each commercial gear (HL, LL) within each subregion. The process outlined below was applied to each fleet individually, and any strata with less than 10 age samples are recommended to be dropped. Nominal age compositions of landings were estimated for all gears using the following equation within each year i, age bin k, and subregion r.

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

$a_{i,k,r}$ is the number of age samples in year i, subregion r, and lower inclusive age bin k; $a_{i,r}$ is the number of age samples in year i and subregion r; and $AC_{i,k,r}$ is the proportion of the total number of sampled fish in each year i and subregion r within each lower inclusive age bin k. A minimum sample size threshold was recommended annually within each strata, $AC_{i,r}$, where these were recommended to be dropped and excluded from further analyses if $a_{i,r} < 10$.

To account for potential sampling biases in the data, a re-weighting factor was estimated within year i, length bin j, and subregion r. The re-weighting factor, $RW_{i,j,r}$, corrects 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 landings,

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

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

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

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. The distribution of lengths for the length only data, compared to the lengths from the age data are shown in Figures 12 – 14 for handline and Figures 15 – 17 for longline. Effects of the age composition weighting procedure are shown in Figures 18 – 20 for handline**Error! Reference source not found.** and Figures 21 – 23 for longline**Error! Reference source not found.**. Final weighted age compositions are shown as bubble plots in Figures 24 – 26 for handline, and 27 – 29 for longline.

Commercial Conditional Age-at-Length

Within each commercial fleet (HL, LL) and subregion (E,C,W) 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.**. Plots of the conditional-age-at-length by year, gear, and subregion are shown in Figures 30 – 32 for handline and Figures 33 – 35 for longline.

Fleet-specific mean length-at-age and associated sample sizes were also provided to aide 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.

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

Data Limitations

The results presented in this working paper are preliminary and contingent upon discussions to be had at the data workshop. As this assessment uses a 3-area model, providing weighted compositions for each area required further sub-dividing each of the three regions in order to weight the length compositions by the landings. This resulted in many strata having insufficient sample sizes, meaning they will have to be dropped from the model. In order to overcome this issue, discussion will need to be had at the data workshop as to the best way to address this issue, potentially using unweighted compositions for strata with insufficient samples for weighting. Another potential solution would be to incorporate information from both the length compositions and age compositions into the model, however, this requires some estimate of the independence of the length and age data. As most of the ages used are a subset of the length data, the datasets are likely to be highly dependent. Approximately 18.87% of the lengths appear in the age data, while 90.29% of the ages come from the length data. The lead analysts will plan to discuss the possibility of utilizing both datasets within the model at the data workshop, and the decisions will be documented in the final report.

The previous length and age composition provision suffered from various issues with the age data submission, for example, rounding errors for the fishing area led to some samples being mis-assigned to the wrong subregion. Additionally, data updates to the TIP data extraction process have resulted in some samples that have changed in their assignment of bias type or randomness – resulting in differing numbers of total samples being included in this data provision. Furthermore, one data source – a cooperative research project by Will Ward from 2009, has been excluded from the current provision due to inappropriateness of the samples. The samples from this special study, while taken from commercial fishing trips, represent only regulatory discards and therefore are not appropriate for representing the compositions of retained catch. Exclusion of the Ward samples resulted in 863 fewer lengths and ages in the East region in 2009.

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Tables

Table 1. *Annual number of Red Snapper commercial handline (HL) length samples by weighting strata (E1,E2,C1,C2,W1,W2). The length compositions resulting from these samples were recommended to be dropped from further analyses if n<30.*

Year	HL_E1	HL_E2	HL_C1	HL_C2	HL_W1	HL_W2
1984	202	616	1,133	246	2,355	466
1985	55	839	183	98	2,719	229
1986	31	344	0	912	1,577	278
1987	27	161	0	655	802	25
1988	18	96	46	195	1,048	111
1989	0	78	32	518	1,313	163
1990	10	315	402	1,589	4,280	3,278
1991	18	20	201	1,610	5,297	1,620
1992	13	112	249	872	4,951	142
1993	15	52	604	1,730	2,784	4,300
1994	13	69	470	3,357	1,997	275
1995	31	28	304	2,198	2,807	1,684
1996	2	107	227	2,293	2,183	396
1997	136	62	278	3,007	6,537	250
1998	7	297	901	3,140	7,389	463
1999	39	874	623	3,444	4,009	571
2000	47	128	859	3,987	3,427	125
2001	16	165	1,215	3,586	4,110	0
2002	9	256	1,104	3,826	5,049	467
2003	35	346	1,355	3,531	4,336	716
2004	0	225	2,547	2,119	2,196	368
2005	56	181	2,321	1,847	3,120	504
2006	15	259	1,793	1,604	3,563	591
2007	3	321	3,852	1,337	1,352	700
2008	36	154	1,581	3,105	2,684	742
2009	0	400	1,104	3,480	3,039	1,019
2010	13	490	1,441	2,800	3,844	1,056
2011	21	777	2,987	3,557	3,750	662
2012	18	1,082	4,668	5,465	6,457	2,866
2013	64	1,351	5,211	7,319	6,446	4,732
2014	15	1,341	3,768	6,081	10,841	5,880
2015	215	835	5,068	12,073	15,127	4,192
2016	140	917	5,046	13,688	14,713	2,498
2017	132	1,175	4,444	10,584	14,081	3,696
2018	106	815	5,635	10,550	8,073	5,103
2019	265	936	3,793	14,901	8,055	6,033
2020	144	1,306	3,660	7,564	4,383	3,417
2021	28	1,083	1,635	7,964	4,287	2,031
2022	43	1,750	3,474	9,222	7,424	6,397
2023	174	1,810	6,646	8,742	13,273	8,830

Table 2. *Annual number of Red Snapper commercial longline (LL) length samples by weighting strata (E1,E2,C1,C2,W1,W2). The length compositions resulting from these samples were recommended to be dropped from further analyses if n<30.*

Year	LL_E1	LL_E2	LL_C1	LL_C2	LL_W1	LL_W2
1984	128	618	118	0	610	216
1985	56	694	0	16	1,072	0
1986	43	962	6	0	403	10
1987	95	299	0	0	47	0
1988	52	126	12	0	180	0
1989	11	18	0	0	404	0
1990	26	221	34	17	361	15
1991	32	47	51	0	109	0
1992	18	104	34	2	52	62
1993	49	95	0	0	51	0
1994	25	53	0	18	0	0
1995	43	90	0	0	72	0
1996	25	54	0	0	6	0
1997	38	19	11	0	63	0
1998	33	98	115	0	253	0
1999	75	215	0	0	76	142
2000	62	221	0	0	330	210
2001	35	149	23	24	180	0
2002	27	215	40	0	464	78
2003	23	256	14	19	96	163
2004	24	326	3	0	78	320
2005	21	430	66	0	67	111
2006	71	151	0	0	238	144
2007	18	100	93	0	106	257
2008	1	336	152	32	35	347
2009	1	209	2	29	67	198
2010	25	991	1	0	1	84
2011	28	541	23	0	0	14
2012	3	193	37	0	32	125
2013	44	644	14	0	83	65
2014	55	1,144	4	0	53	20
2015	38	829	28	0	337	3
2016	26	713	16	11	108	26
2017	45	463	30	15	181	2
2018	47	485	128	14	386	2
2019	74	717	82	22	778	146
2020	53	299	43	16	134	0
2021	20	414	89	0	439	7
2022	70	1,688	237	0	1,168	7
2023	88	1,158	290	0	951	110

Table 3. *Annual number of Red Snapper commercial handline (HL) trips sampled for lengths by weighting strata (E1,E2,C1,C2,W1,W2).*

Year	HL_E1	HL_E2	HL_C1	HL_C2	HL_W1	HL_W2
1984	3	20	15	3	46	3
1985	3	45	8	6	62	4
1986	6	25	0	17	34	8
1987	5	27	0	16	39	1
1988	1	10	2	9	50	5
1989	0	2	1	23	50	4
1990	4	17	12	35	149	62
1991	4	2	10	35	169	32
1992	4	10	5	18	160	4
1993	3	11	21	22	103	62
1994	2	14	29	71	69	3
1995	4	6	28	52	34	23
1996	1	11	11	39	28	4
1997	15	3	12	54	151	5
1998	3	17	28	53	202	17
1999	3	39	28	82	164	13
2000	3	14	44	130	136	2
2001	6	12	47	137	156	0
2002	2	22	51	124	211	11
2003	1	21	51	126	179	16
2004	0	16	107	76	102	11
2005	3	21	92	50	143	18
2006	5	24	58	48	148	21
2007	2	18	128	46	54	22
2008	3	22	63	106	84	26
2009	0	39	42	101	82	19
2010	1	66	65	87	100	27
2011	8	91	178	121	122	19
2012	3	146	235	185	183	94
2013	12	141	258	236	197	107
2014	4	155	189	188	193	118
2015	11	116	194	253	201	82
2016	8	117	219	291	235	58
2017	11	130	190	267	199	75
2018	16	91	205	241	168	80
2019	25	105	182	341	138	72
2020	19	103	157	183	79	33
2021	4	61	79	232	94	16
2022	7	207	114	249	124	40
2023	37	200	160	234	198	54

Table 4. *Annual number of Red Snapper commercial longline (LL) trips sampled for lengths by weighting strata (E1,E2,C1,C2,W1,W2).*

Year	LL_E1	LL_E2	LL_C1	LL_C2	LL_W1	LL_W2
1984	4	28	4	0	15	7
1985	5	33	0	2	40	0
1986	10	92	1	0	17	1
1987	8	33	0	0	7	0
1988	6	14	2	0	9	0
1989	1	5	0	0	18	0
1990	9	35	4	2	6	2
1991	6	19	5	0	8	0
1992	3	24	1	1	3	2
1993	9	26	0	0	3	0
1994	6	17	0	2	0	0
1995	5	27	0	0	2	0
1996	3	18	0	0	1	0
1997	5	6	1	0	1	0
1998	3	22	1	0	6	0
1999	11	45	0	0	2	3
2000	13	33	0	0	13	4
2001	10	30	2	1	8	0
2002	10	38	2	0	21	3
2003	7	38	2	1	5	8
2004	7	42	1	0	4	13
2005	5	64	3	0	4	4
2006	15	28	0	0	9	5
2007	4	13	5	0	5	9
2008	1	32	6	2	2	16
2009	1	11	1	2	4	12
2010	7	94	1	0	1	4
2011	5	66	2	0	0	1
2012	2	34	2	0	5	5
2013	8	66	1	0	5	5
2014	8	66	1	0	3	5
2015	6	96	3	0	15	1
2016	7	105	2	1	12	3
2017	13	68	8	1	18	1
2018	13	67	13	2	21	1
2019	15	82	6	1	37	5
2020	9	36	5	2	8	0
2021	5	44	3	0	9	1
2022	11	151	10	0	18	1
2023	21	121	19	0	17	2

Table 5. *Distribution of commercial handline (HL) landings by weighting strata and management period, where these were estimated as the proportion of landings by sub-subregion within subregion for all years aggregated.*

mgmt_per	HL_C1	HL_C2	HL_E1	HL_E2	HL_W1	HL_W2
1984 - 2006	0.31	0.69	0.19	0.81	0.69	0.31
2007 - 2023	0.42	0.58	0.13	0.87	0.48	0.52

Table 6. *Distribution of commercial longline (LL) landings by weighting strata and management period, where these were estimated as the proportion of landings by sub-subregion within subregion for all years aggregated.*

mgmt_per	LL_C1	LL_C2	LL_E1	LL_E2	LL_W1	LL_W2
1984 - 2006	0.51	0.49	0.21	0.79	0.23	0.77
2007 - 2023	0.69	0.31	0.09	0.91	0.67	0.33

Table 7. *Annual number of commercial handline (HL) age samples by subregion.*

Year	HL_E	HL_C	HL_W
1991	0	178	25
1992	18	119	214
1993	12	139	344
1994	28	122	507
1995	7	85	97
1996	0	9	0
1997	31	1	0
1998	11	186	1,173
1999	70	908	1,792
2000	29	1,382	695
2001	66	1,241	1,027
2002	14	1,155	2,421
2003	9	1,474	1,395
2004	113	970	1,892
2005	68	1,101	2,318
2006	150	1,146	2,599
2007	54	1,077	1,447
2008	24	933	1,578
2009	328	918	2,126
2010	451	1,149	2,042
2011	906	2,471	1,665
2012	940	3,226	2,914
2013	766	1,798	1,500
2014	961	1,500	1,101
2015	641	2,208	1,622
2016	908	2,545	1,671
2017	1,282	2,961	1,235
2018	921	3,931	1,458
2019	1,018	4,310	1,109
2020	1,117	3,208	908
2021	720	2,912	810
2022	1,729	2,653	1,052
2023	496	887	1,028

Table 81. *Annual number of commercial longline (LL) age samples by subregion.*

Year	LL_E	LL_C	LL_W
1991	12	0	0
1992	15	0	0
1993	31	0	29
1994	4	4	0
1995	19	0	0
1996	6	0	0
1997	7	3	0
1998	25	0	348
1999	102	0	76
2000	84	0	345
2001	77	14	179
2002	167	11	340
2003	170	27	259
2004	235	18	640
2005	311	34	252
2006	202	0	556
2007	124	93	352
2008	315	183	344
2009	96	20	271
2010	1,005	1	84
2011	551	22	14
2012	230	51	149
2013	706	14	116
2014	1,139	14	64
2015	846	23	106
2016	830	31	108
2017	528	36	120
2018	537	116	307
2019	803	53	681
2020	291	51	126
2021	411	86	175
2022	1,659	146	420
2023	821	173	406

Table 9. *Annual number of commercial handline (HL) trips sampled for ages by subregion.*

Year	HL_E	HL_C	HL_W
1991	0	12	1
1992	6	4	16
1993	6	16	33
1994	6	23	54
1995	2	16	9
1996	0	3	0
1997	2	1	0
1998	3	7	46
1999	3	30	75
2000	4	56	37
2001	4	57	43
2002	5	55	105
2003	3	385	56
2004	11	51	71
2005	8	52	85
2006	40	53	80
2007	29	180	55
2008	23	110	108
2009	69	146	54
2010	179	367	68
2011	293	1,786	55
2012	301	1,653	115
2013	450	1,469	238
2014	427	1,250	217
2015	298	1,796	252
2016	705	2,109	247
2017	1,041	2,455	226
2018	732	3,405	239
2019	940	3,902	216
2020	1,042	2,908	112
2021	656	2,612	79
2022	1,630	2,406	147
2023	342	600	161

Table 10. *Annual number of commercial longline (LL) trips sampled for ages by subregion.*

Year	LL_E	LL_C	LL_W
1991	2	0	0
1992	4	0	0
1993	10	0	2
1994	3	1	0
1995	7	0	0
1996	4	0	0
1997	2	1	0
1998	6	0	10
1999	12	0	2
2000	8	0	14
2001	19	1	9
2002	37	2	15
2003	38	2	13
2004	40	2	24
2005	51	2	10
2006	40	0	17
2007	27	5	15
2008	81	36	25
2009	32	9	17
2010	614	1	5
2011	266	22	1
2012	114	16	9
2013	128	14	10
2014	113	14	8
2015	162	3	15
2016	713	12	15
2017	471	18	19
2018	511	69	20
2019	669	28	33
2020	160	29	8
2021	350	86	9
2022	1,510	130	18
2023	570	143	15

Figures

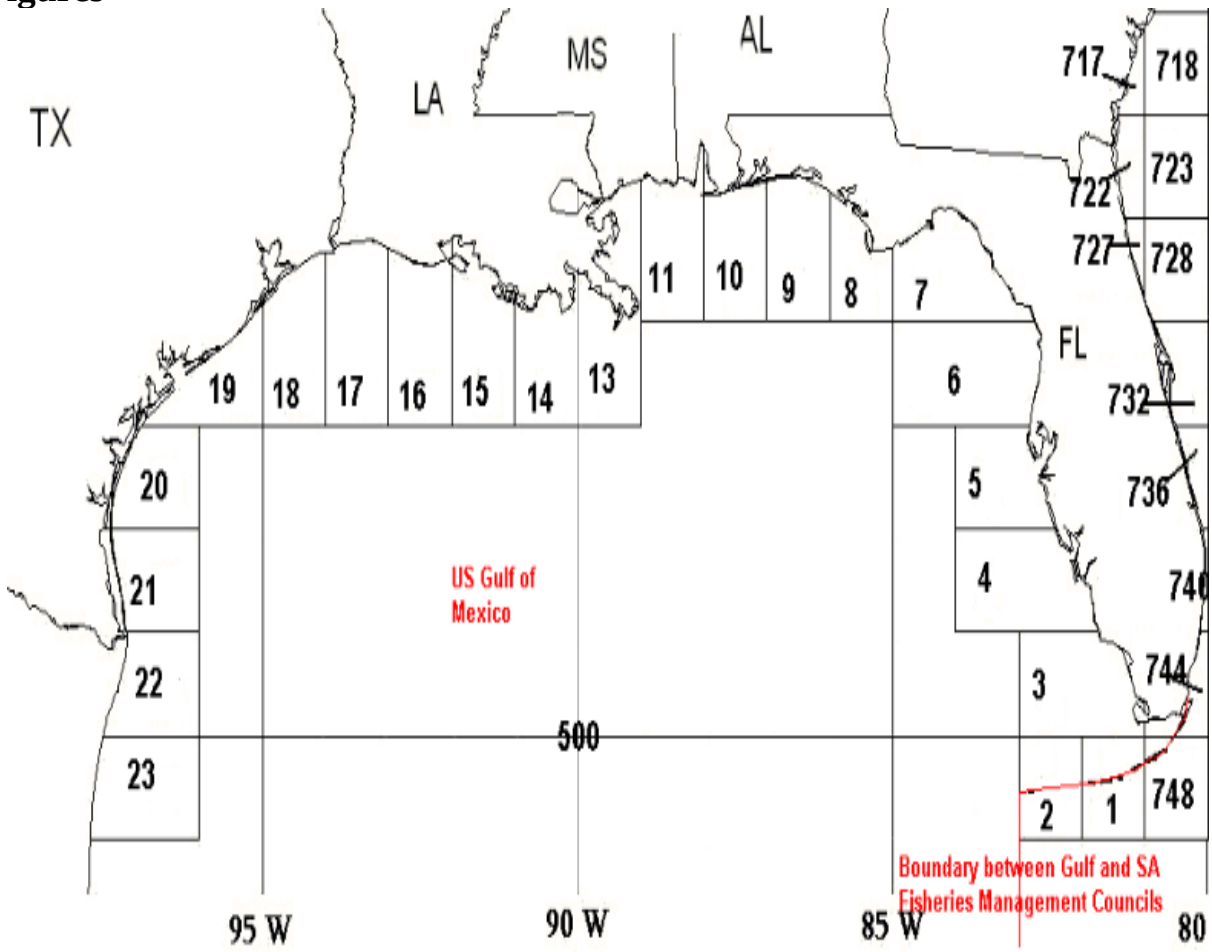

Figure 11. *NMFS commercial fishing areas in the Gulf of America used to define stock boundaries.*

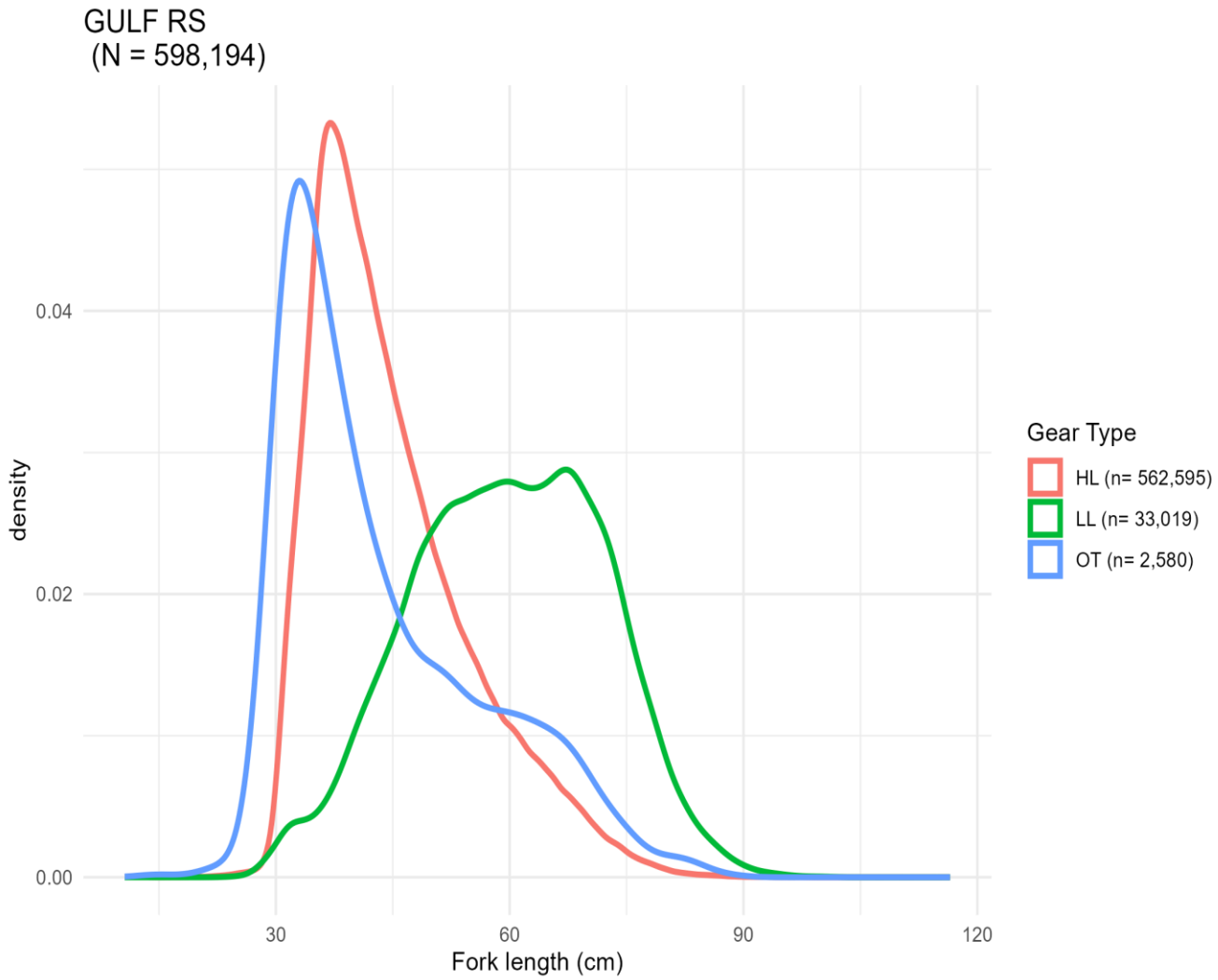

Figure 22. *Annually and spatially aggregated commercial gear length distributions: Handline (HL), and longline (LL) gears.*

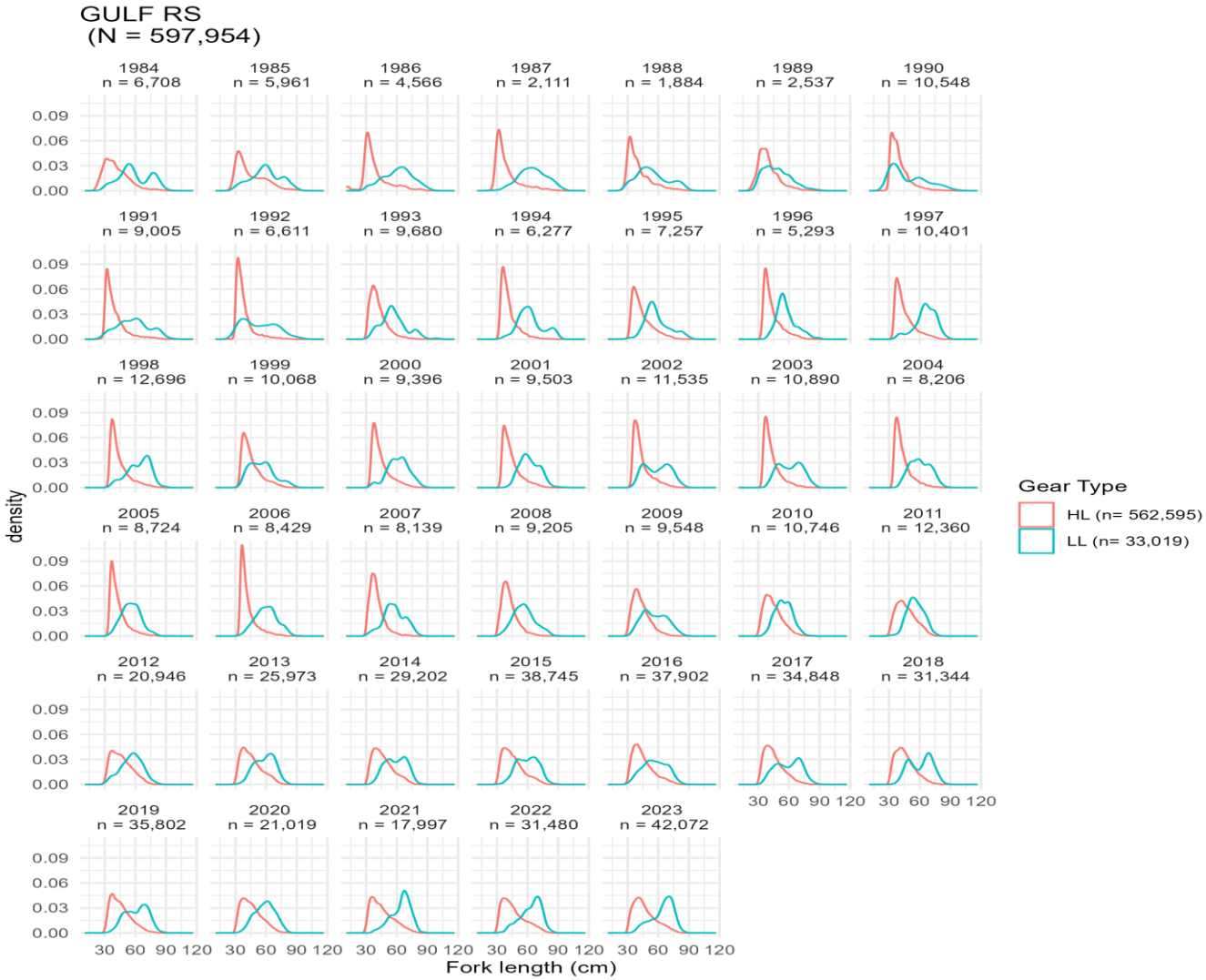

Figure 33. *Spatially aggregated Red Snapper commercial gear length distributions: handline (HL) and longline (LL) gears.*

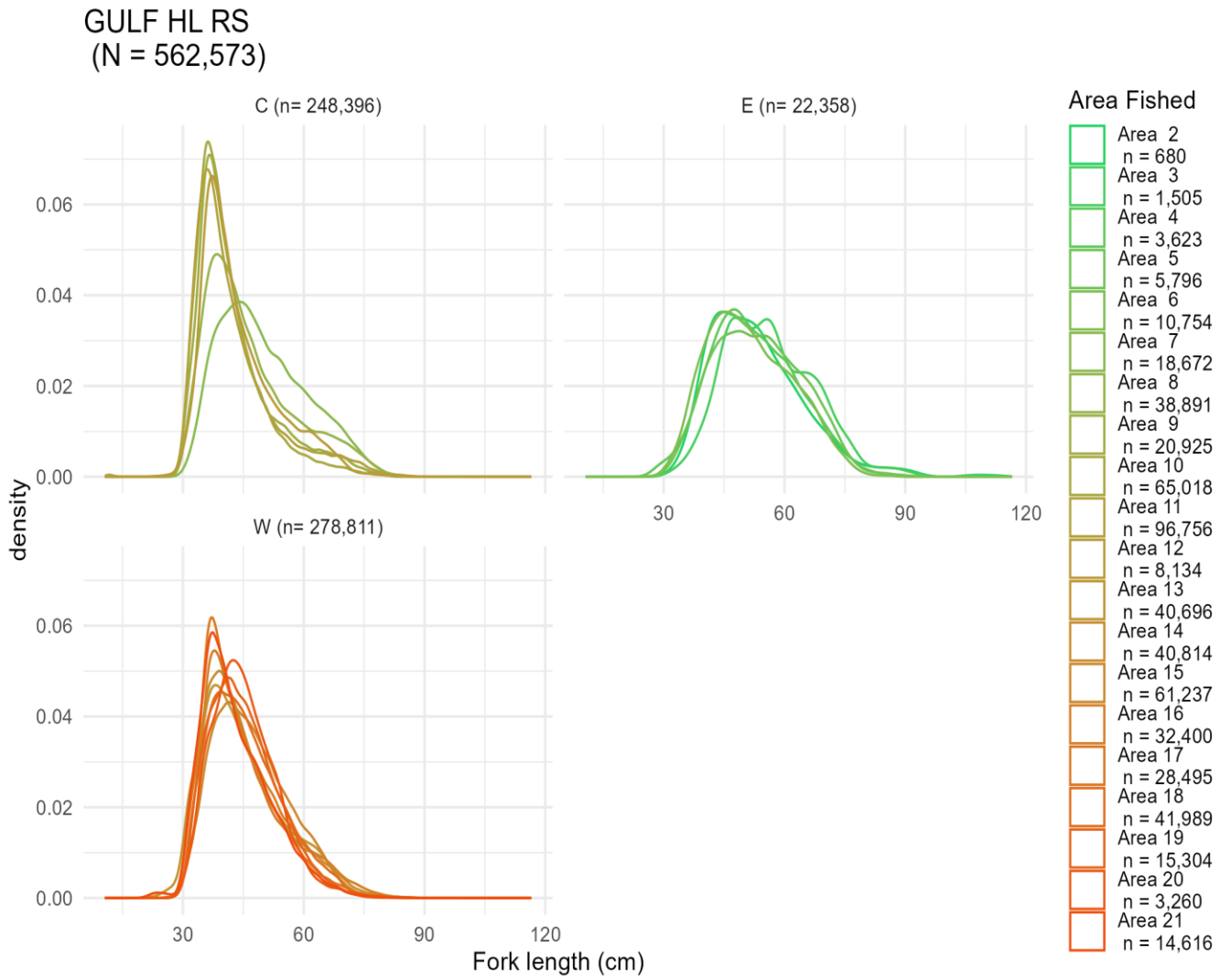

Figure 44. *Annually aggregated Red Snapper commercial HL length distributions by area fished for each subregion: East (E: 748, 1 - 6), Central (C: 7 - 12), and West (W: 13 - 21).*

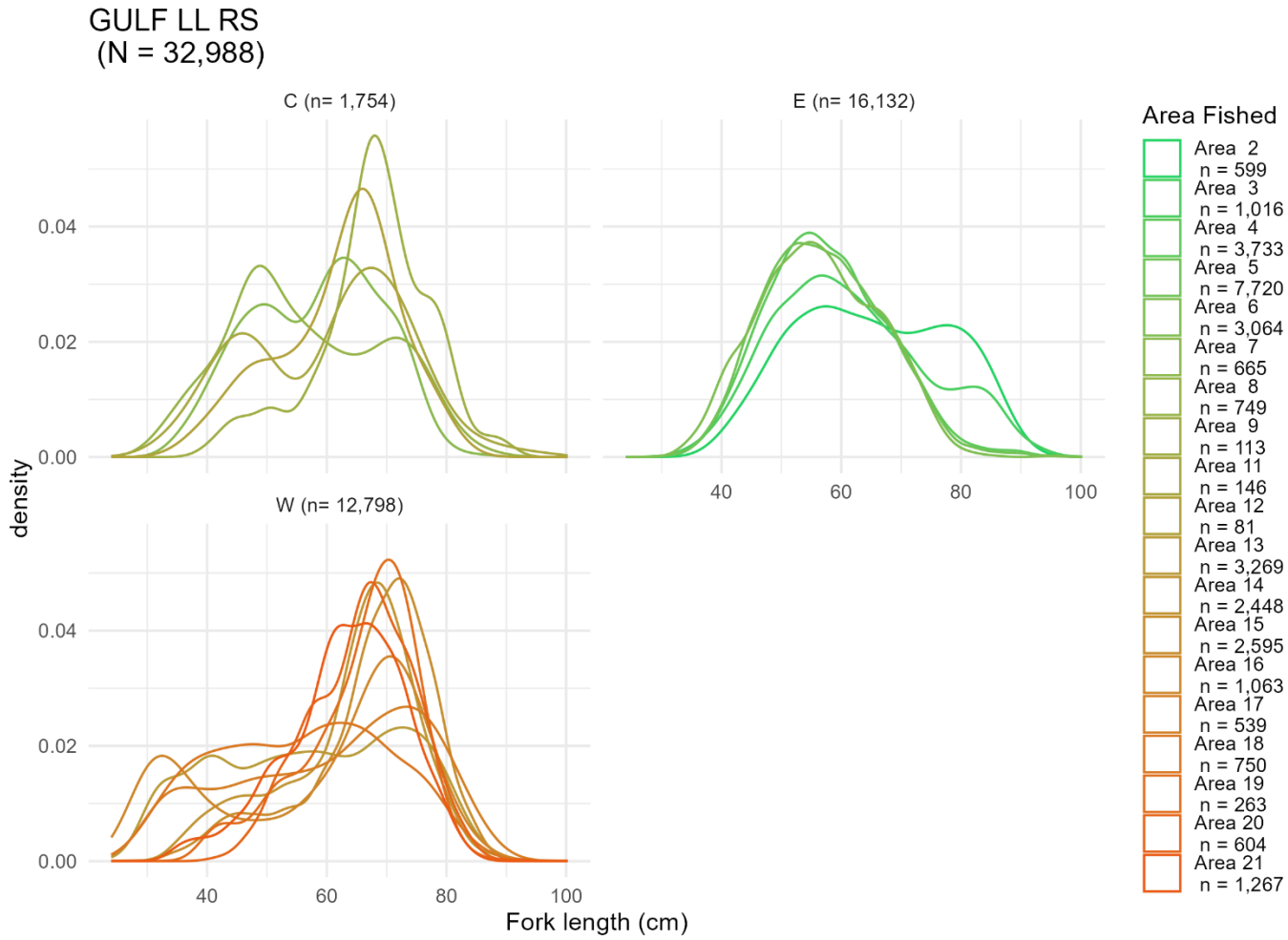

Figure 55. *Annually aggregated Red Snapper commercial LL length distributions by area fished for each subregion: East (E: 748, 1 - 6), Central (C: 7 - 12), and West (W: 13 - 21).*

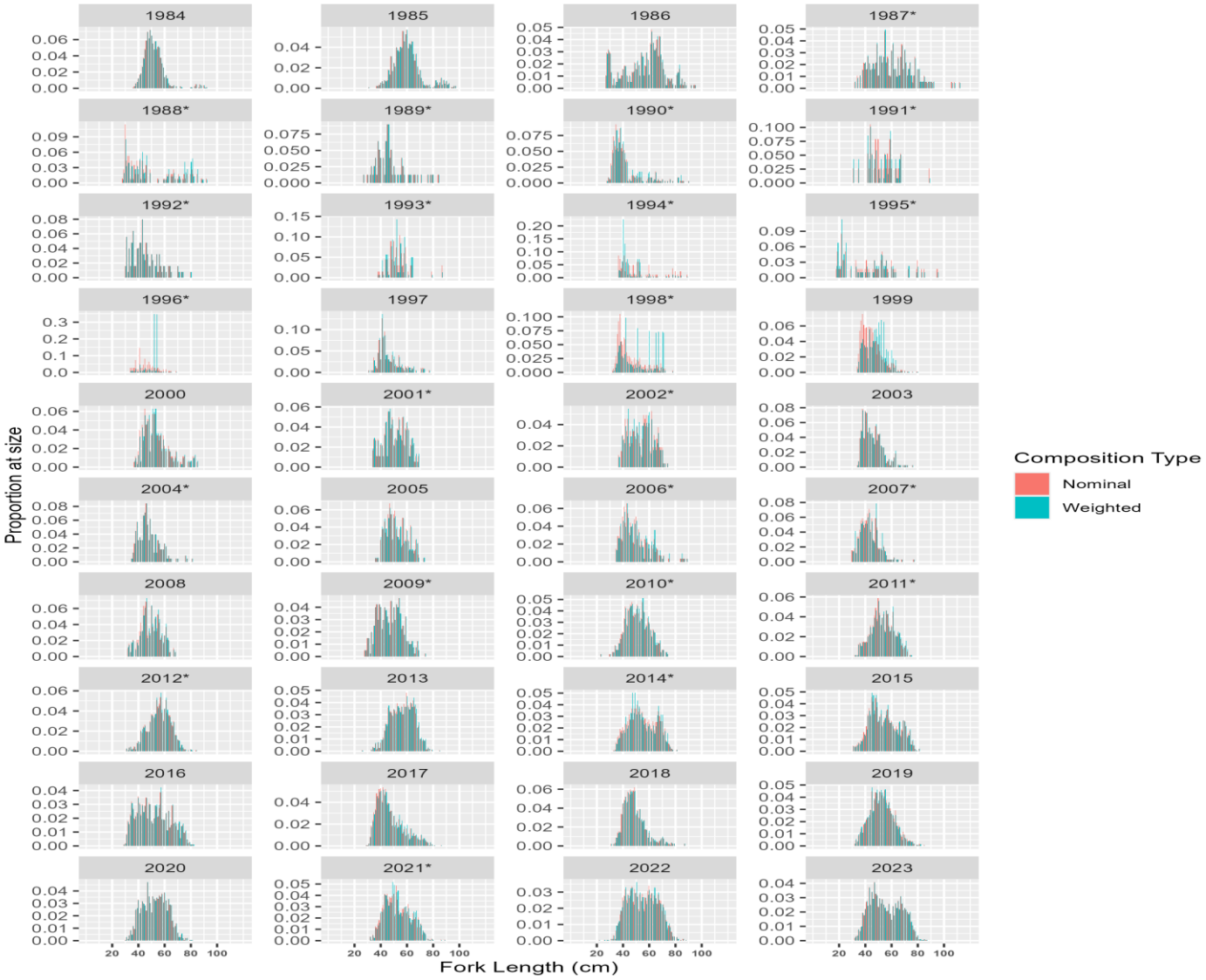

Figure 66. *Nominal and weighted Red Snapper length compositions from the commercial handline east fleet. Years that are recommended to be dropped are denoted with an *.*

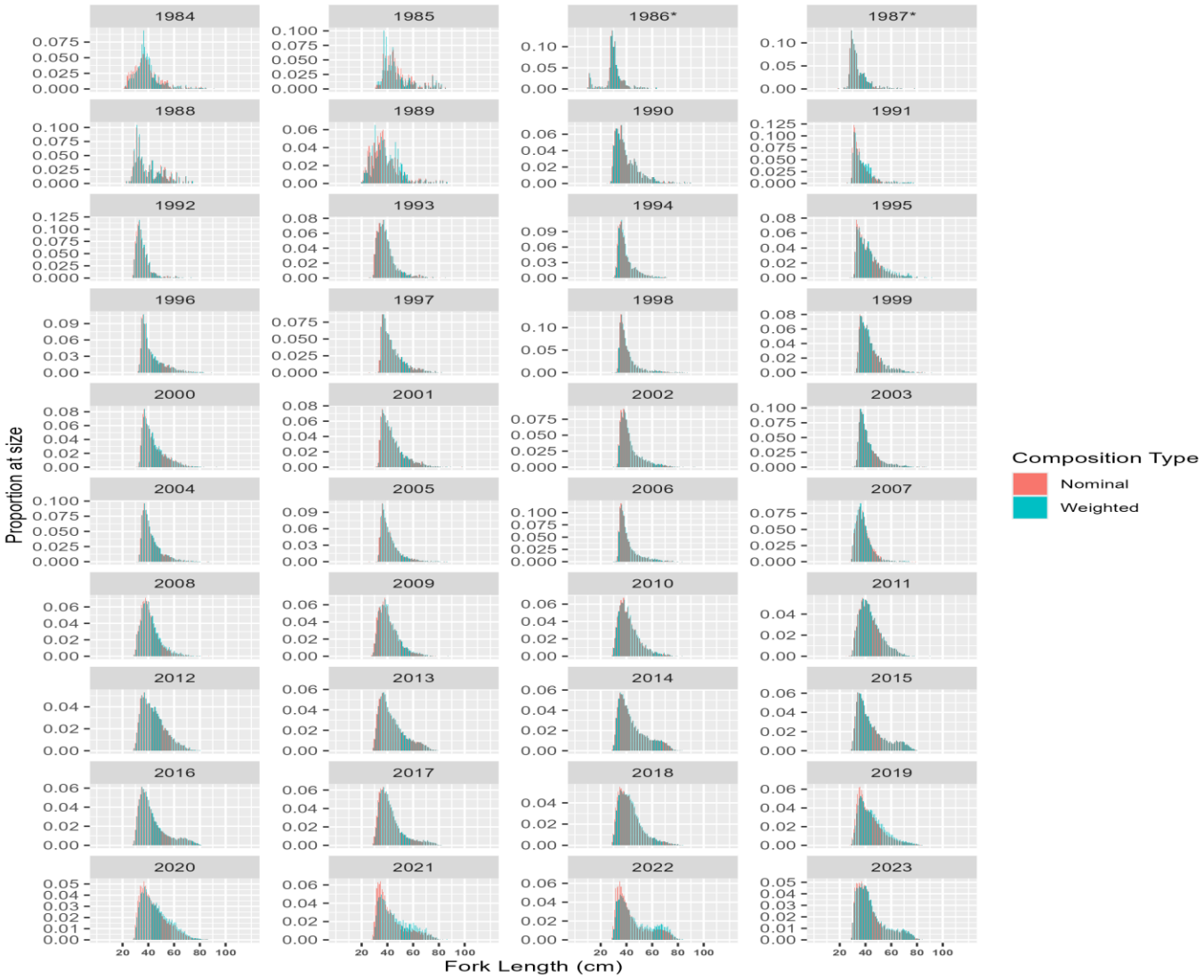

Figure 77. *Nominal and weighted Red Snapper length compositions from the commercial handline central fleet. Years that are recommended to be dropped are denoted with an *.*

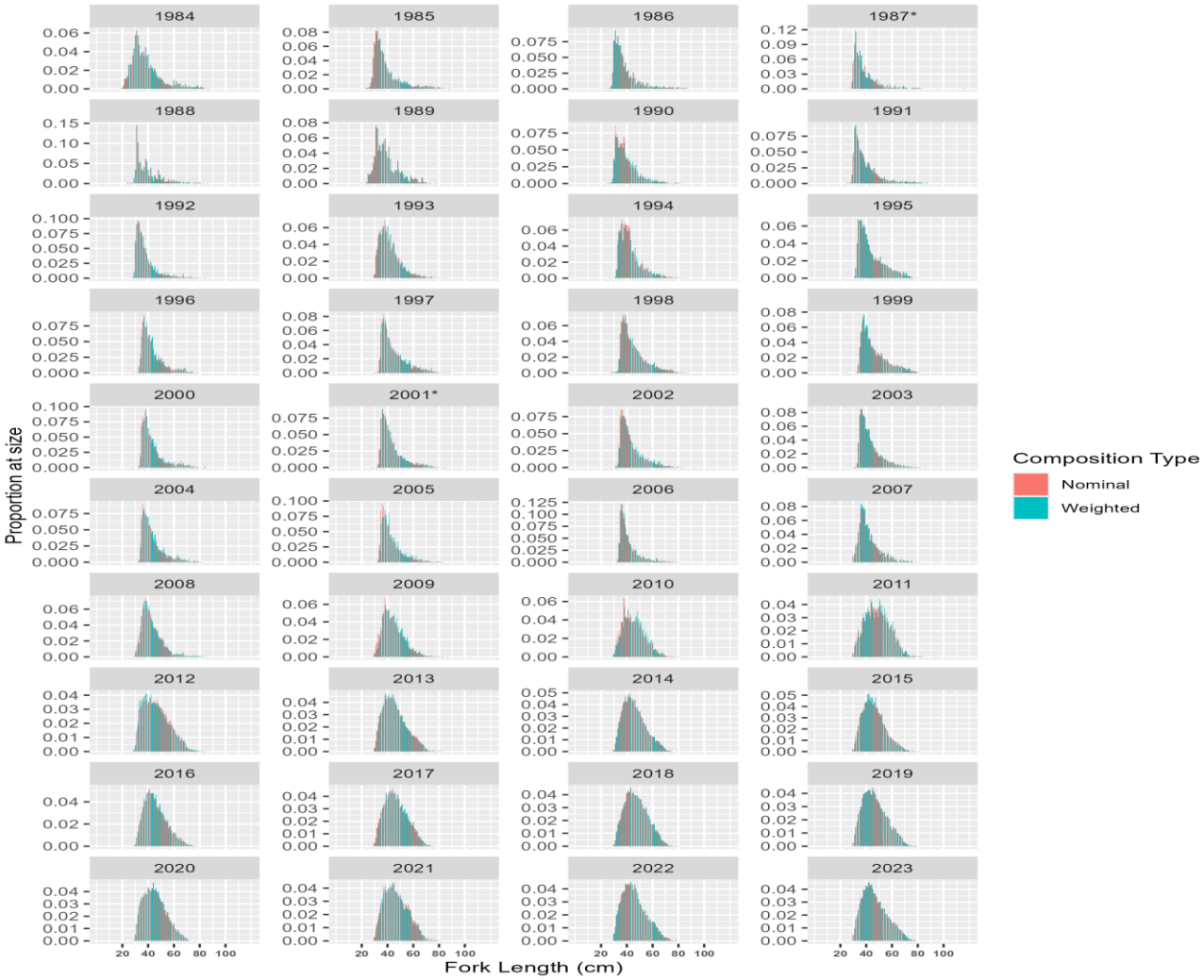

Figure 88. *Nominal and weighted Red Snapper length compositions from the commercial handline west fleet. Years that are recommended to be dropped are denoted with an *.*

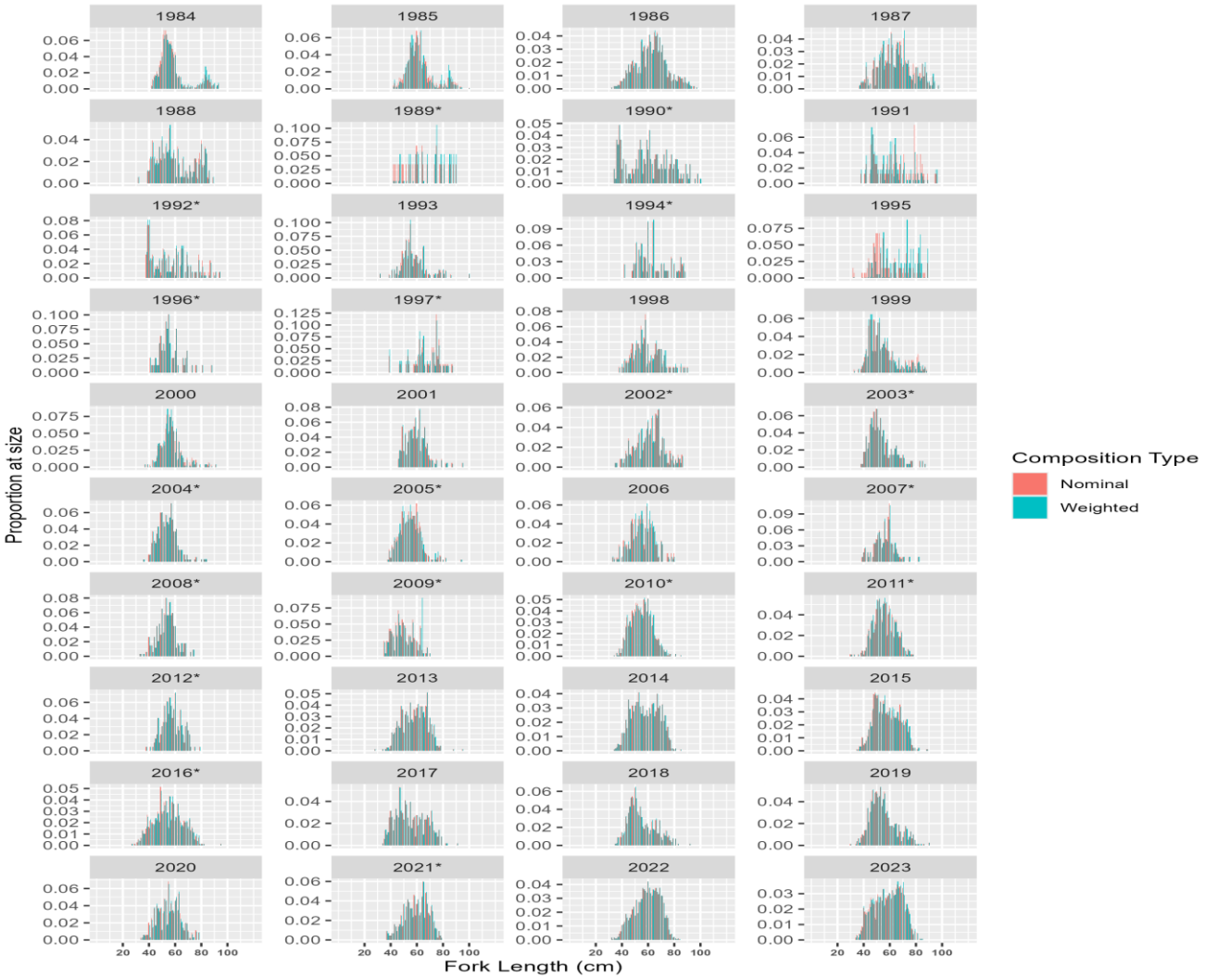

Figure 99. *Nominal and weighted Red Snapper length compositions from the commercial longline east fleet. Years that are recommended to be dropped are denoted with an *.*

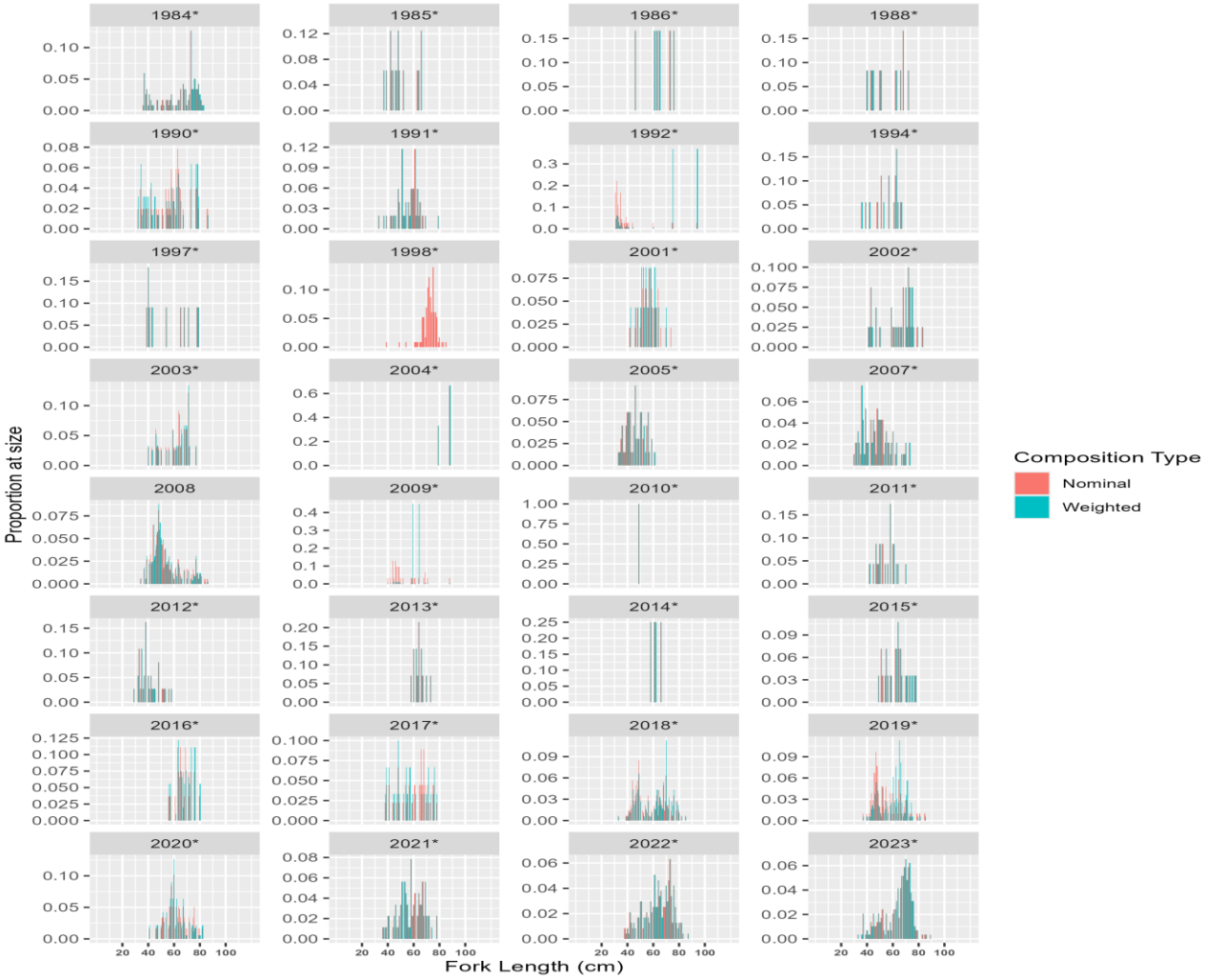

Figure 1010. *Nominal and weighted Red Snapper length compositions from the commercial longline central fleet. Years that are recommended to be dropped are denoted with an *.*

Figure 1111. *Nominal and weighted Red Snapper length compositions from the commercial longline west fleet. Years that are recommended to be dropped are denoted with an *.*

Figure 1212. *Red Snapper length compositions for the length only (Lengths) and age data (Ages) from the commercial handline east fleet. Years that are recommended to be dropped are denoted with an *.*

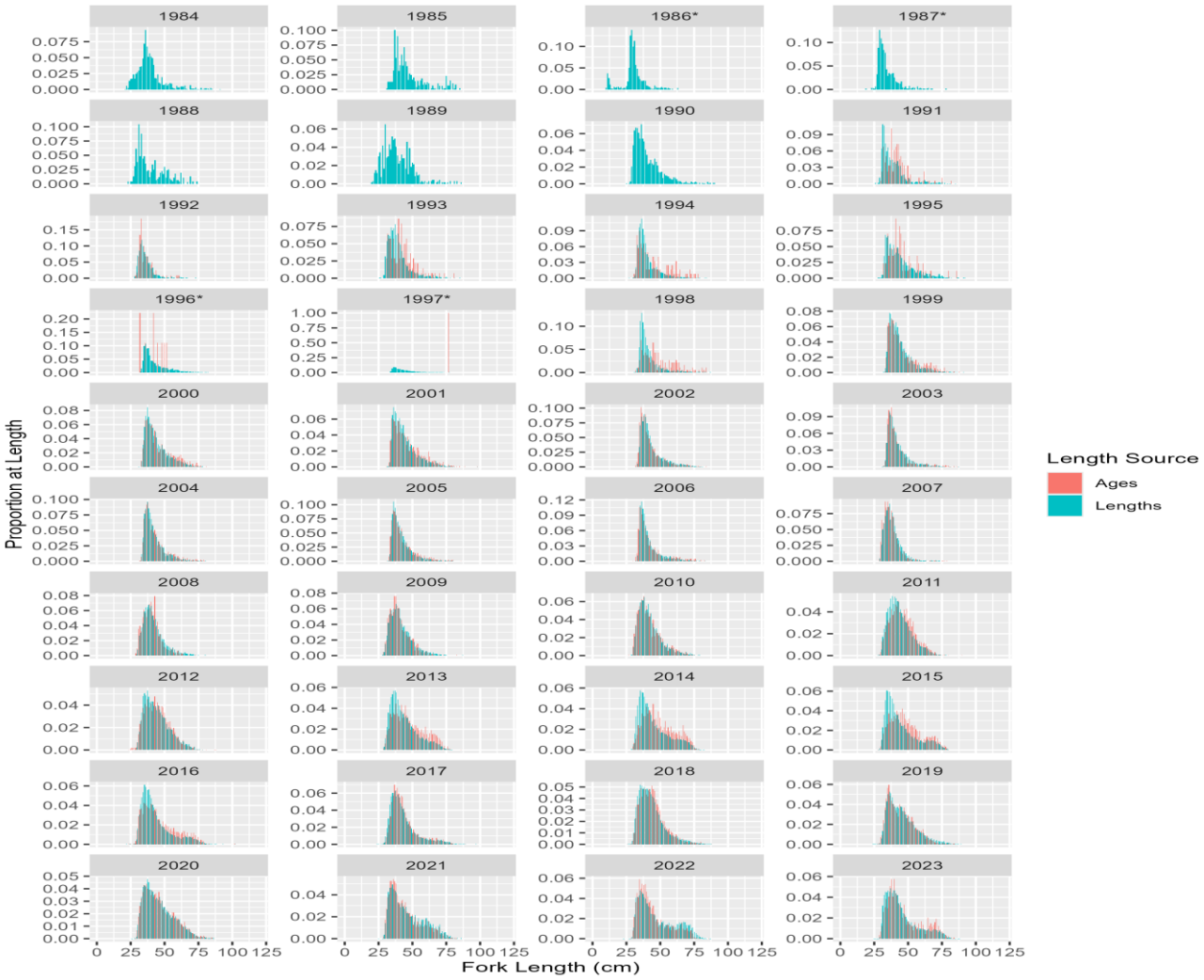

Figure 1313. *Red Snapper length compositions for the length only (Lengths) and age data (Ages) from the commercial handline central fleet. Years that are recommended to be dropped are denoted with an *.*

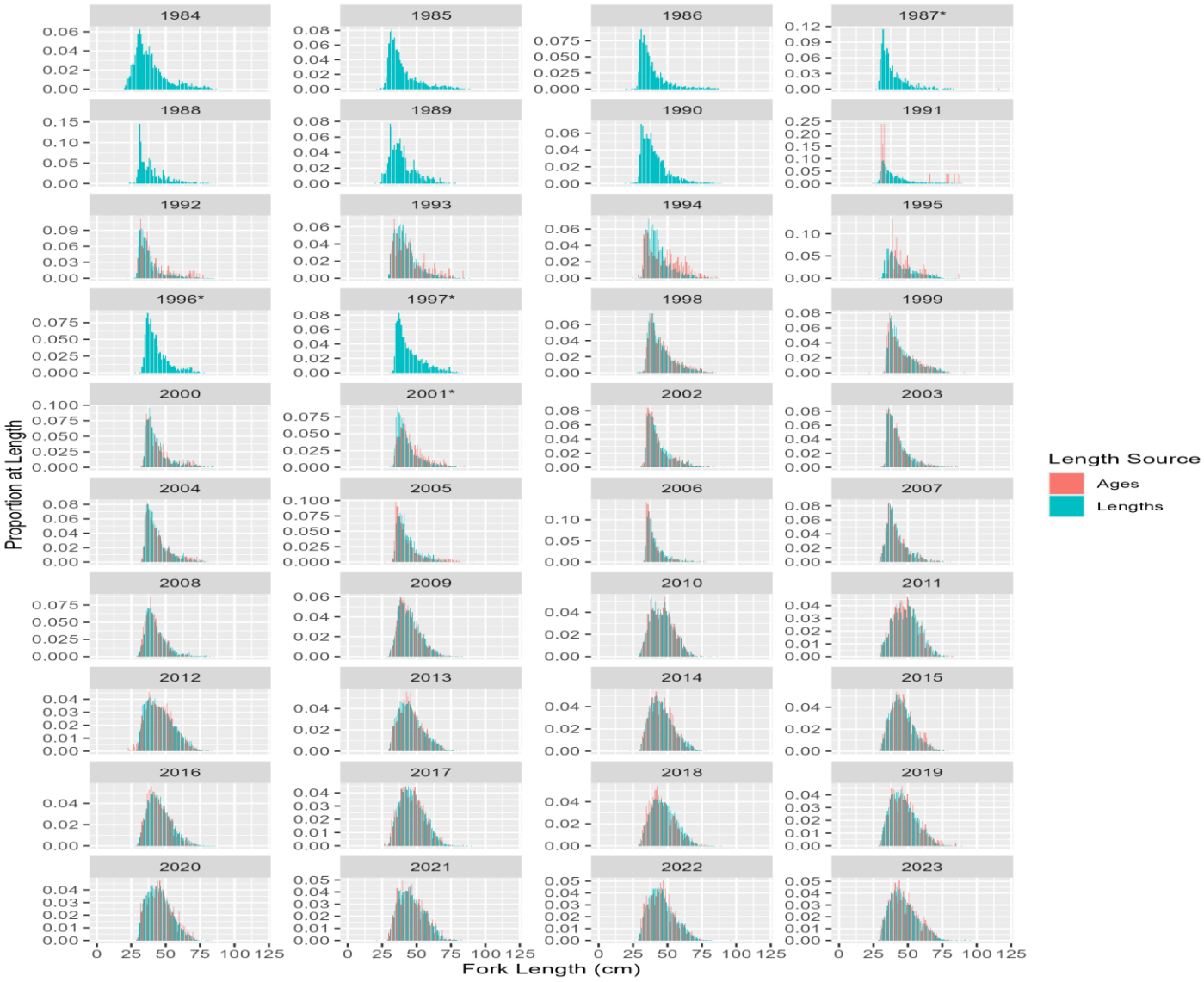

Figure 1414. *Red Snapper length compositions for the length only (Lengths) and age data (Ages) from the commercial handline west fleet. Years that are recommended to be dropped are denoted with an *.*

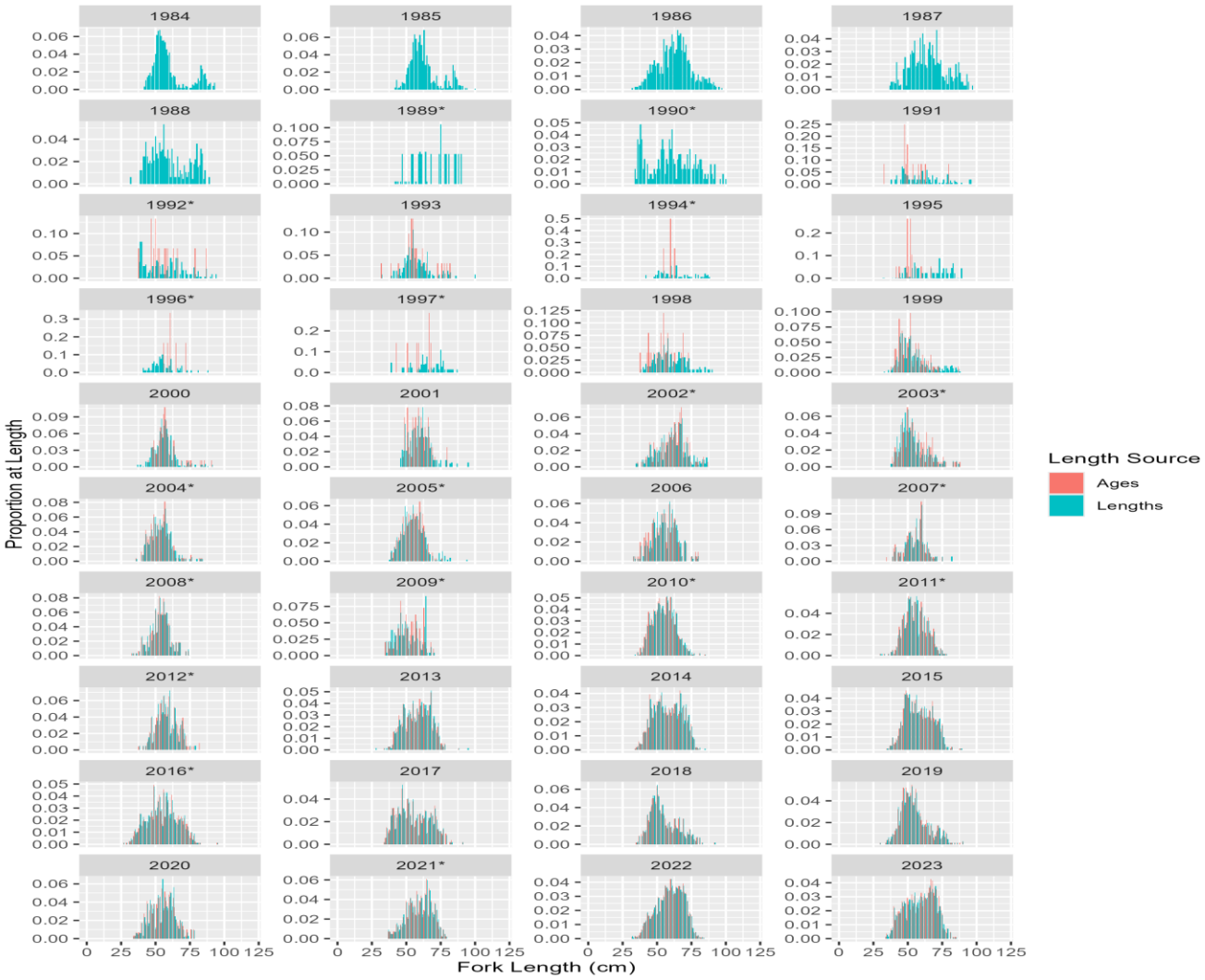

Figure 1515. *Red Snapper length compositions for the length only (Lengths) and age data (Ages) from the commercial longline east fleet. Years that are recommended to be dropped are denoted with an *.*

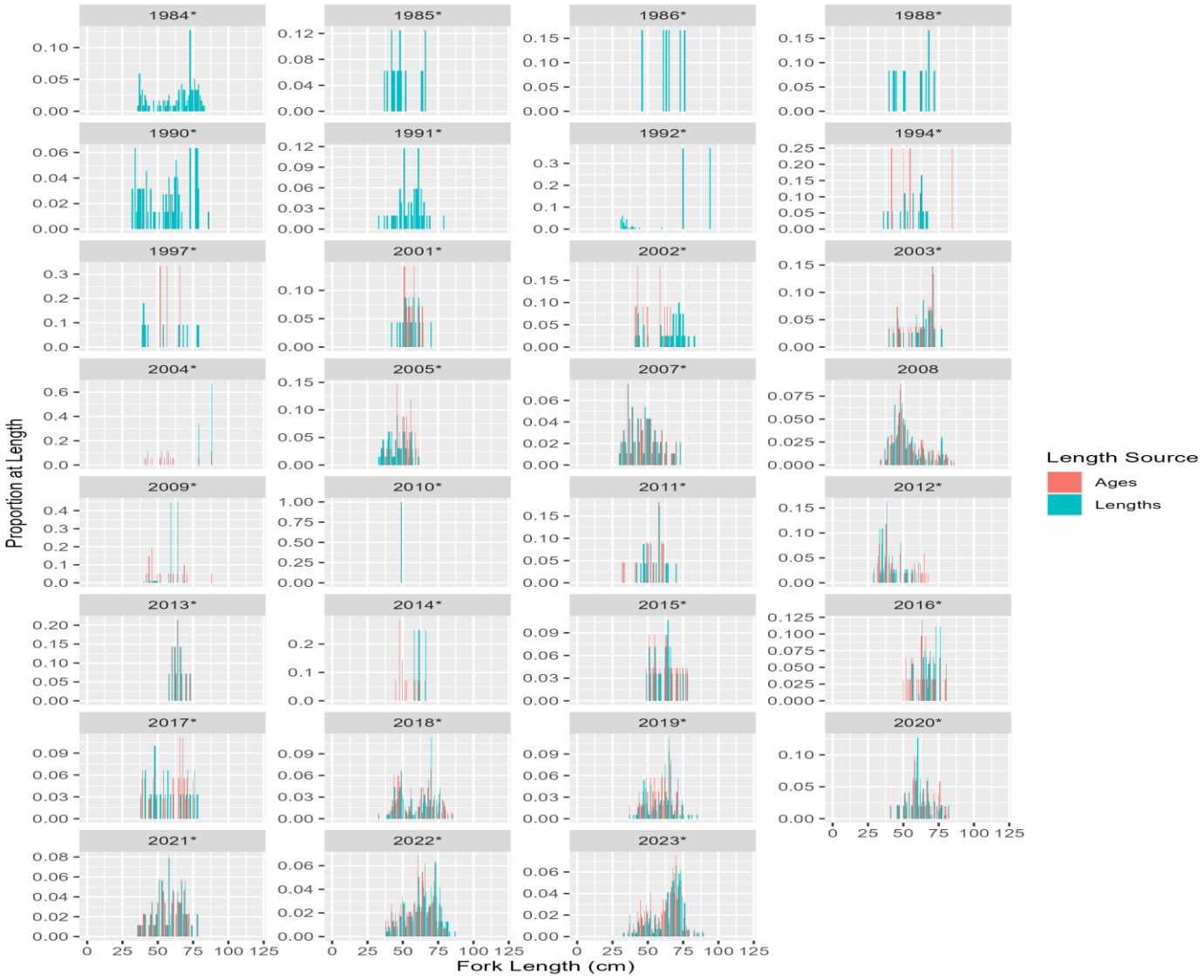

Figure 1616. *Red Snapper length compositions for the length only (Lengths) and age data (Ages) from the commercial longline central fleet. Years that are recommended to be dropped are denoted with an *.*

Figure 1717. *Red Snapper length compositions for the length only (Lengths) and age data (Ages) from the commercial longline west fleet. Years that are recommended to be dropped are denoted with an *.*

Figure 1818. *Nominal and weighted Red Snapper age compositions from the commercial handline east fleet. Years that are recommended to be dropped are denoted with an *.*

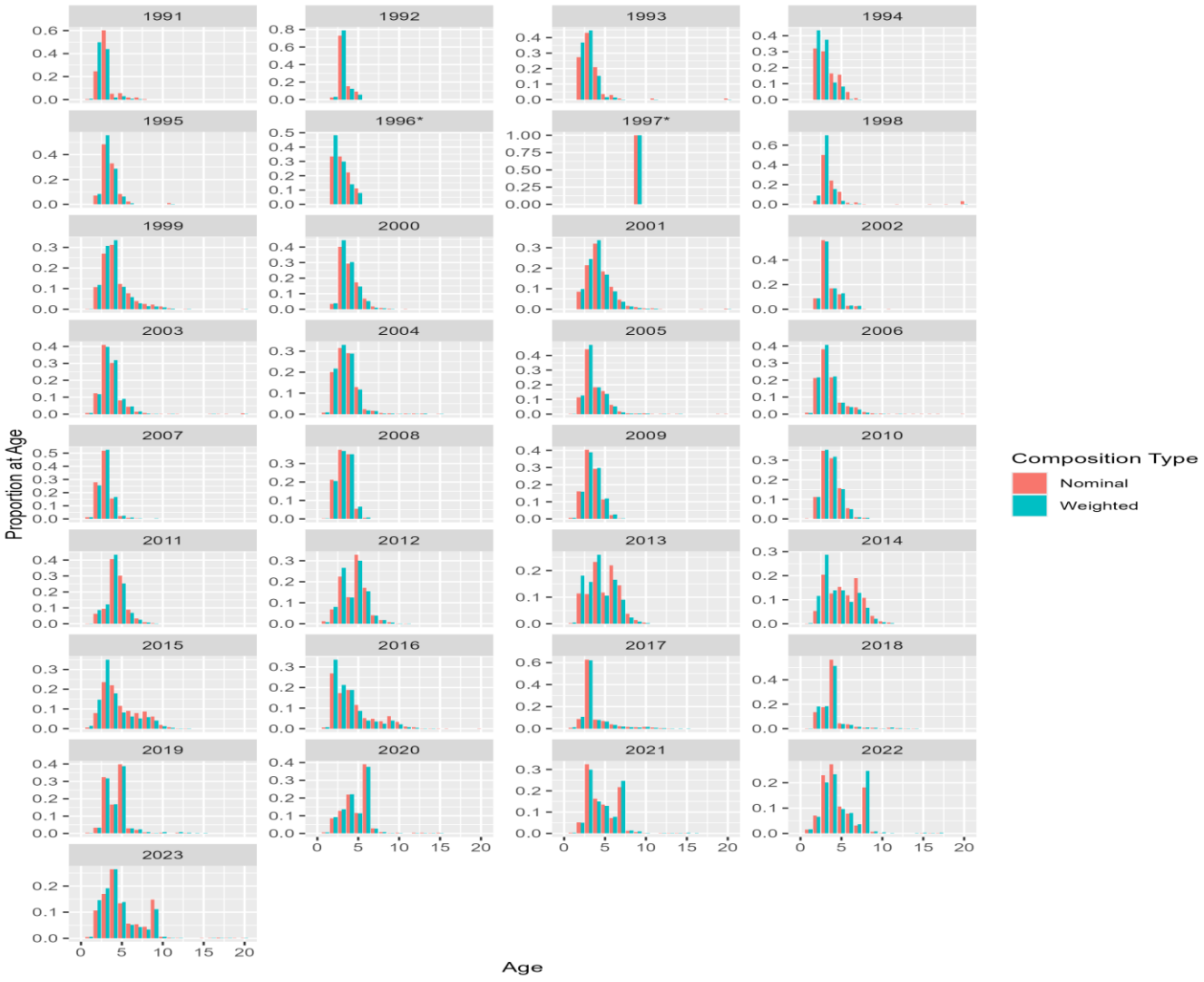

Figure 1919. *Nominal and weighted Red Snapper age compositions from the commercial handline central fleet. Years that are recommended to be dropped are denoted with an *.*

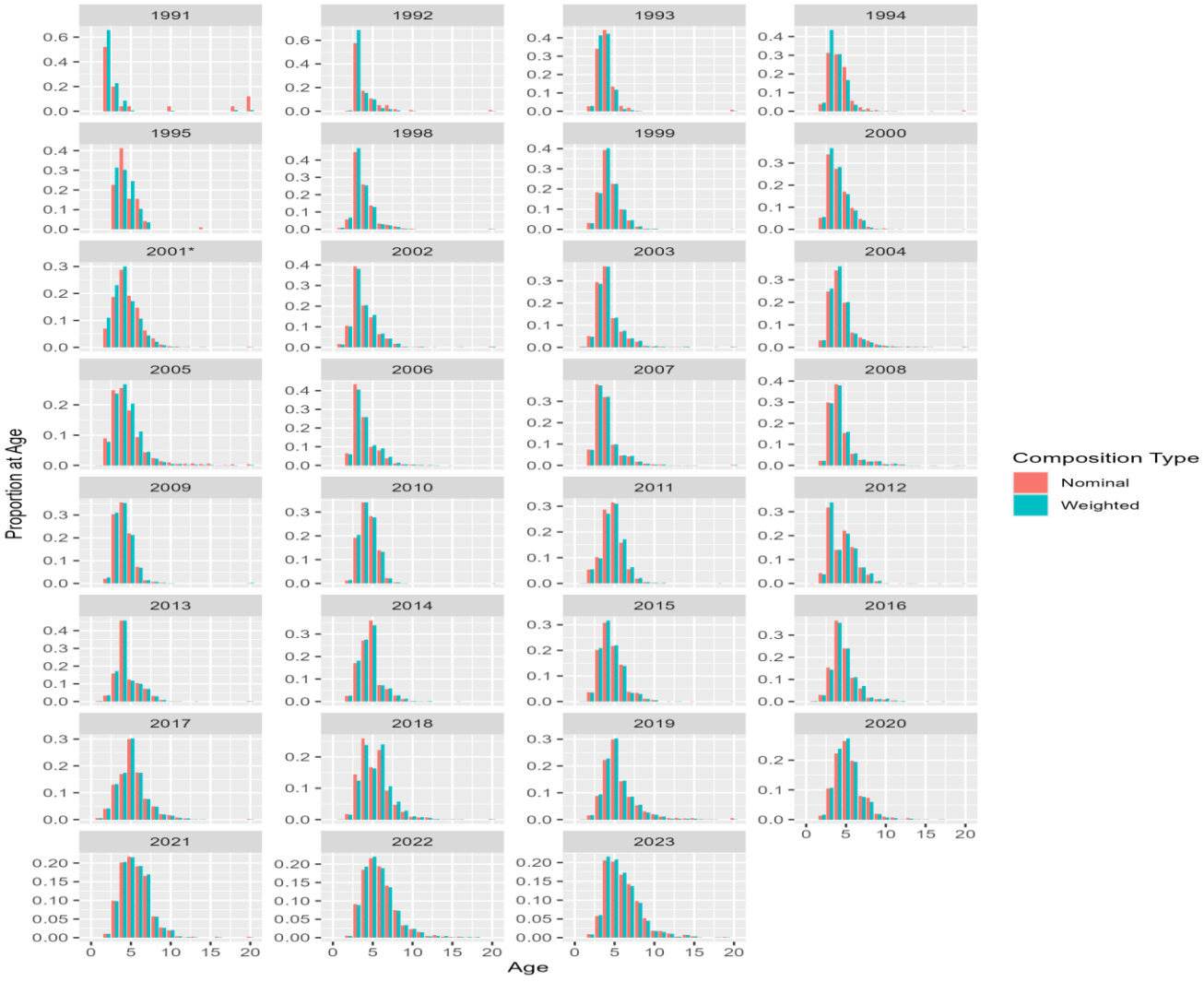

Figure 2020. *Nominal and weighted Red Snapper age compositions from the commercial handline west fleet. Years that are recommended to be dropped are denoted with an *.*

Figure 2121. *Nominal and weighted Red Snapper age compositions from the commercial longline east fleet. Years that are recommended to be dropped are denoted with an *.*

Figure 2222. *Nominal and weighted Red Snapper age compositions from the commercial longline central fleet. Years that are recommended to be dropped are denoted with an *.*

Figure 2323. *Nominal and weighted Red Snapper age compositions from the commercial longline west fleet. Years that are recommended to be dropped are denoted with an *.*

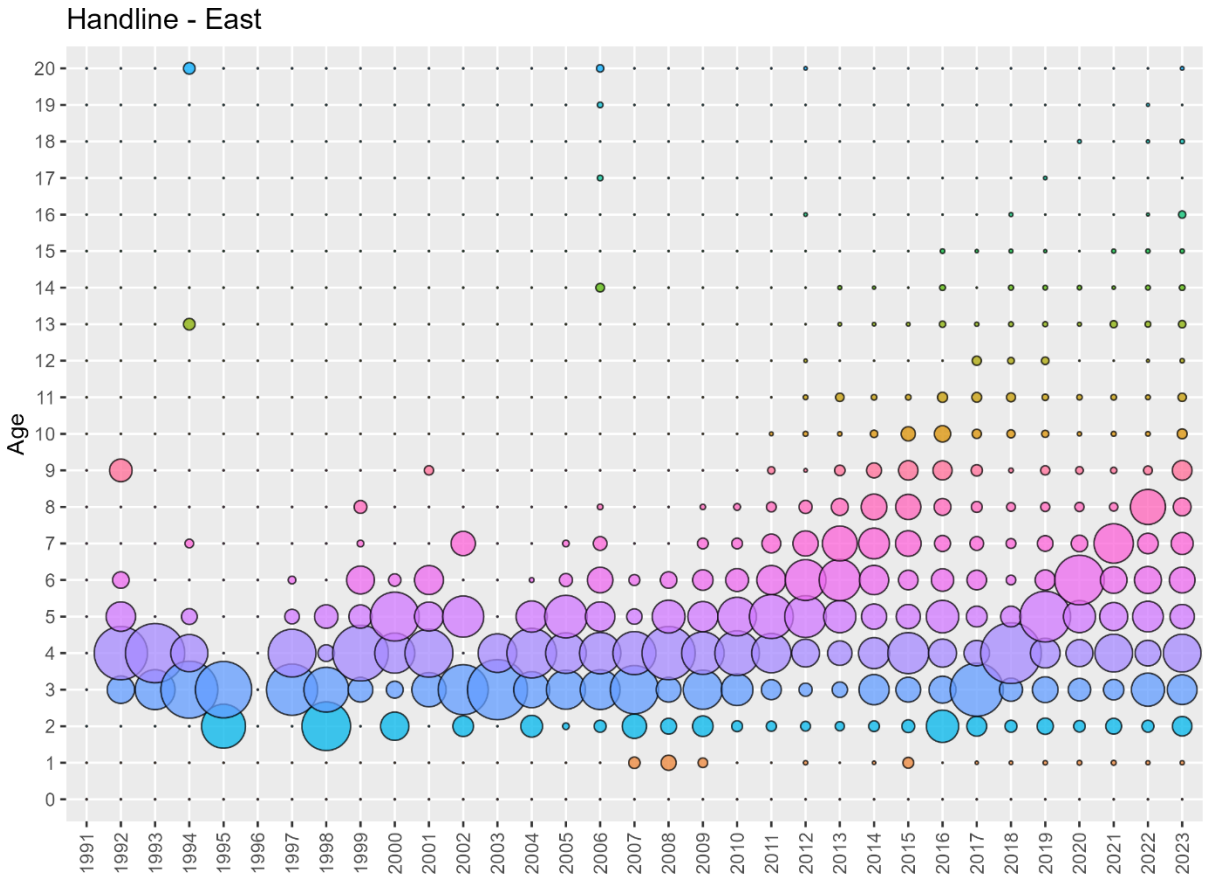

Figure 24. *Final weighted age compositions for the Red Snapper commercial handline east fleet by year.*

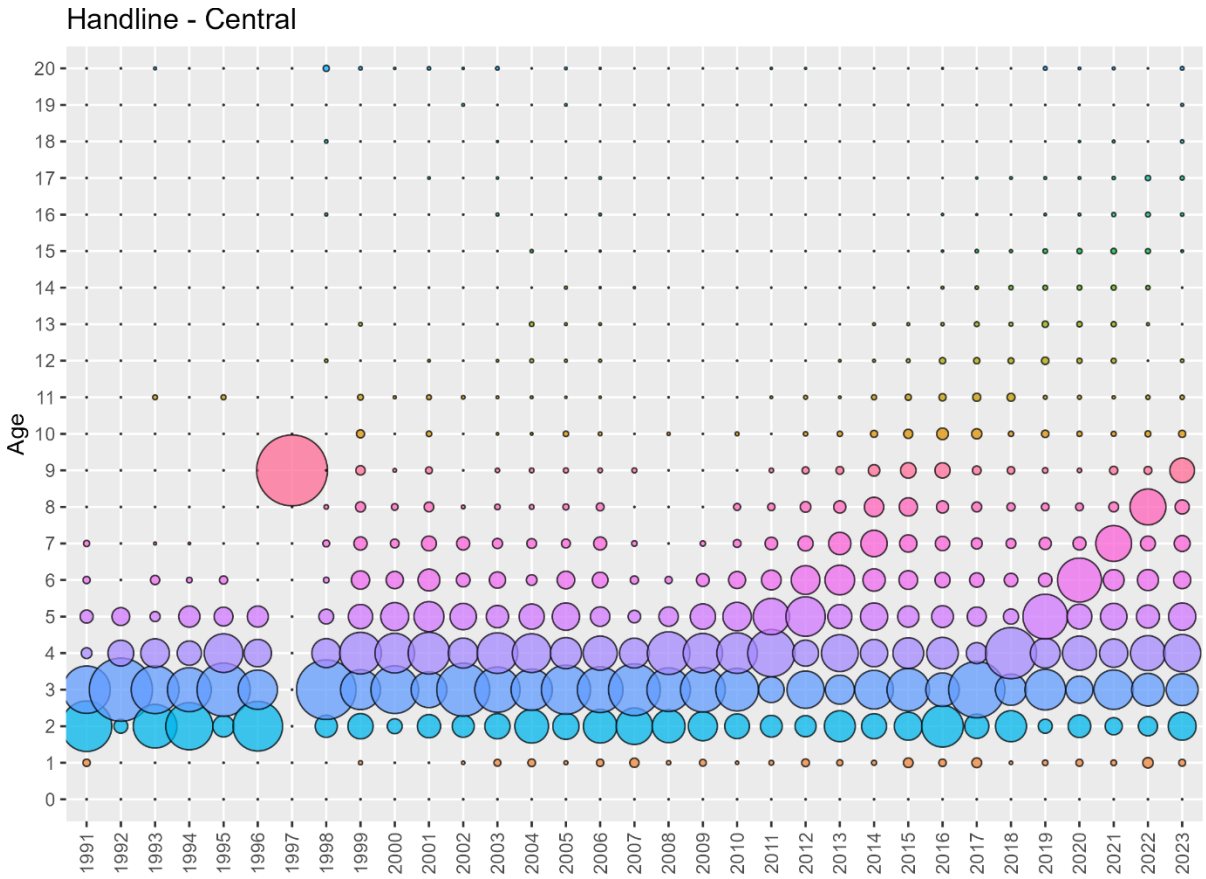

Figure 25. *Final weighted age compositions for the Red Snapper commercial handline central fleet by year.*

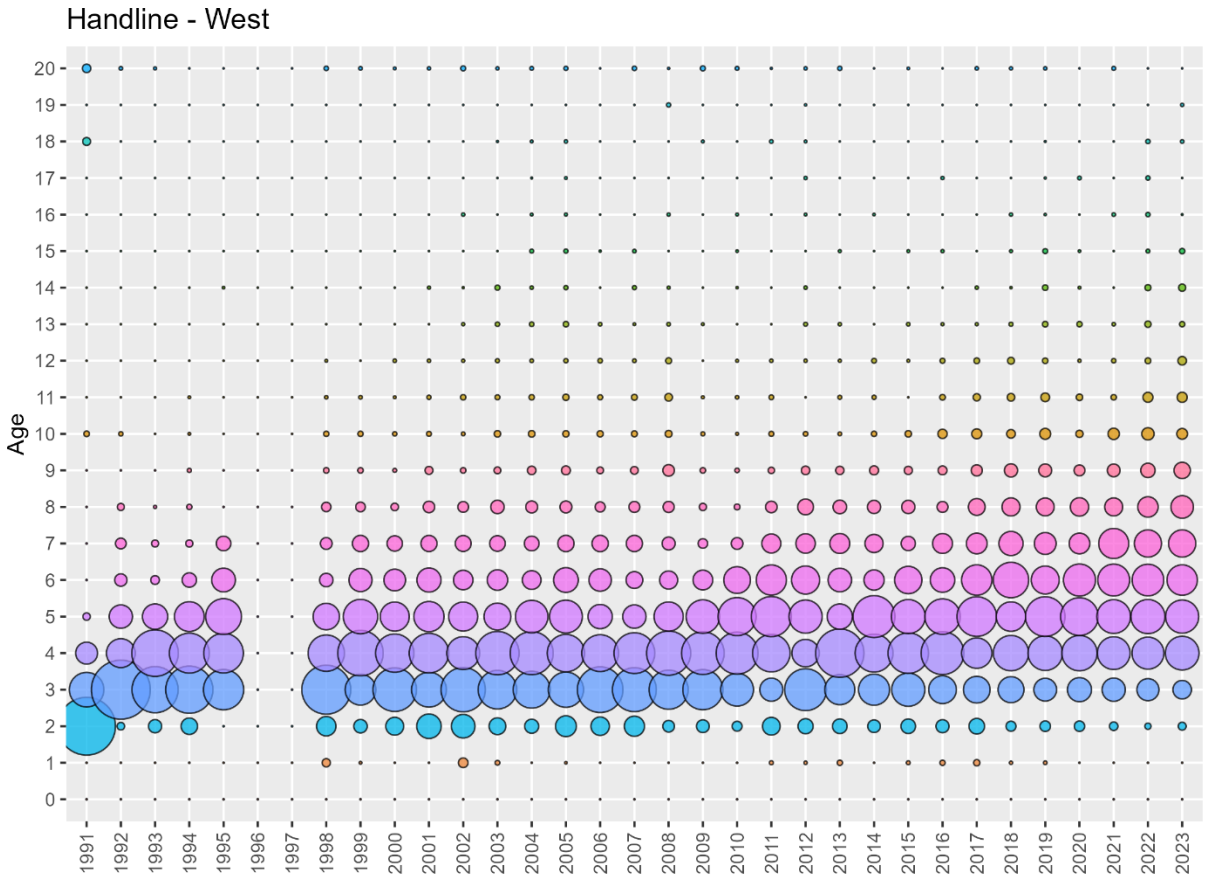

Figure 26. *Final weighted age compositions for the Red Snapper commercial handline west fleet by year.*

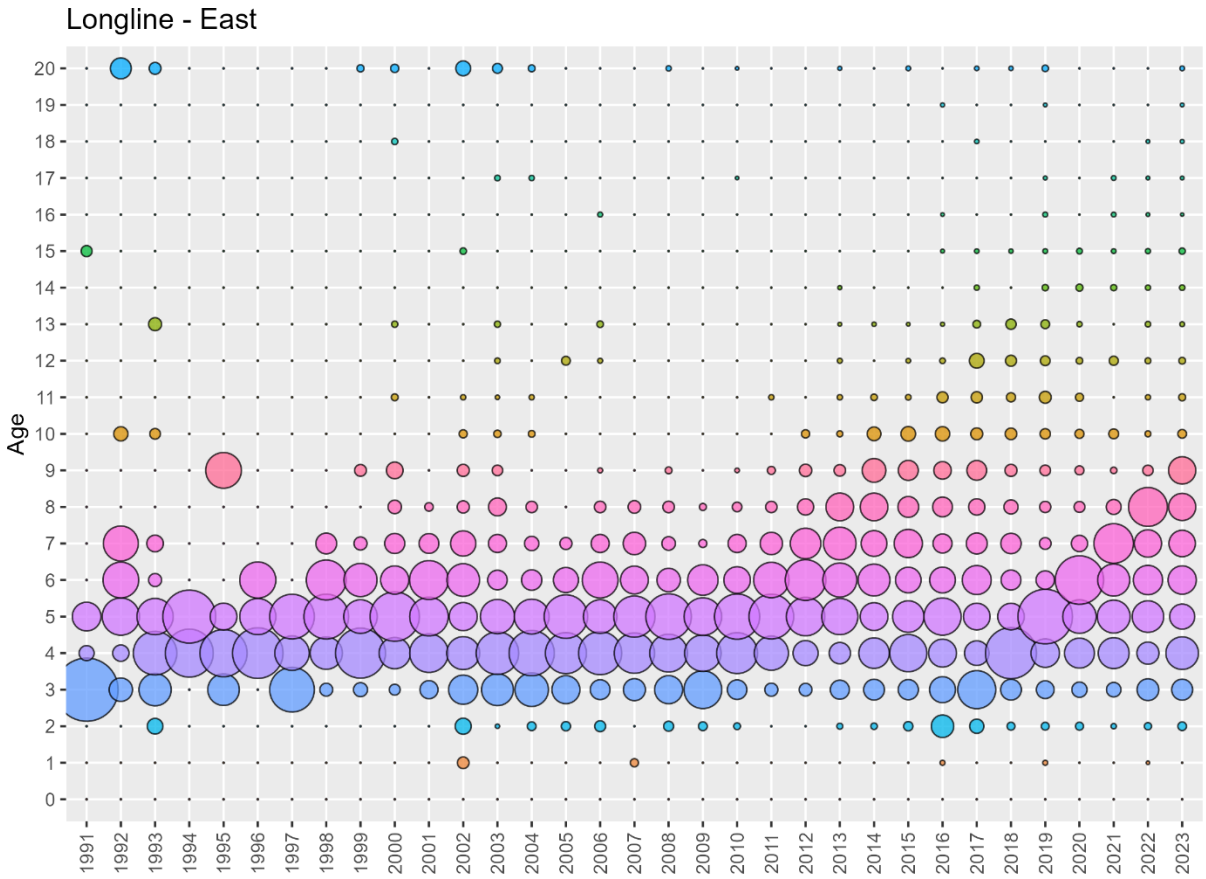

Figure 27. *Final weighted age compositions for the Red Snapper commercial longline east fleet by year.*

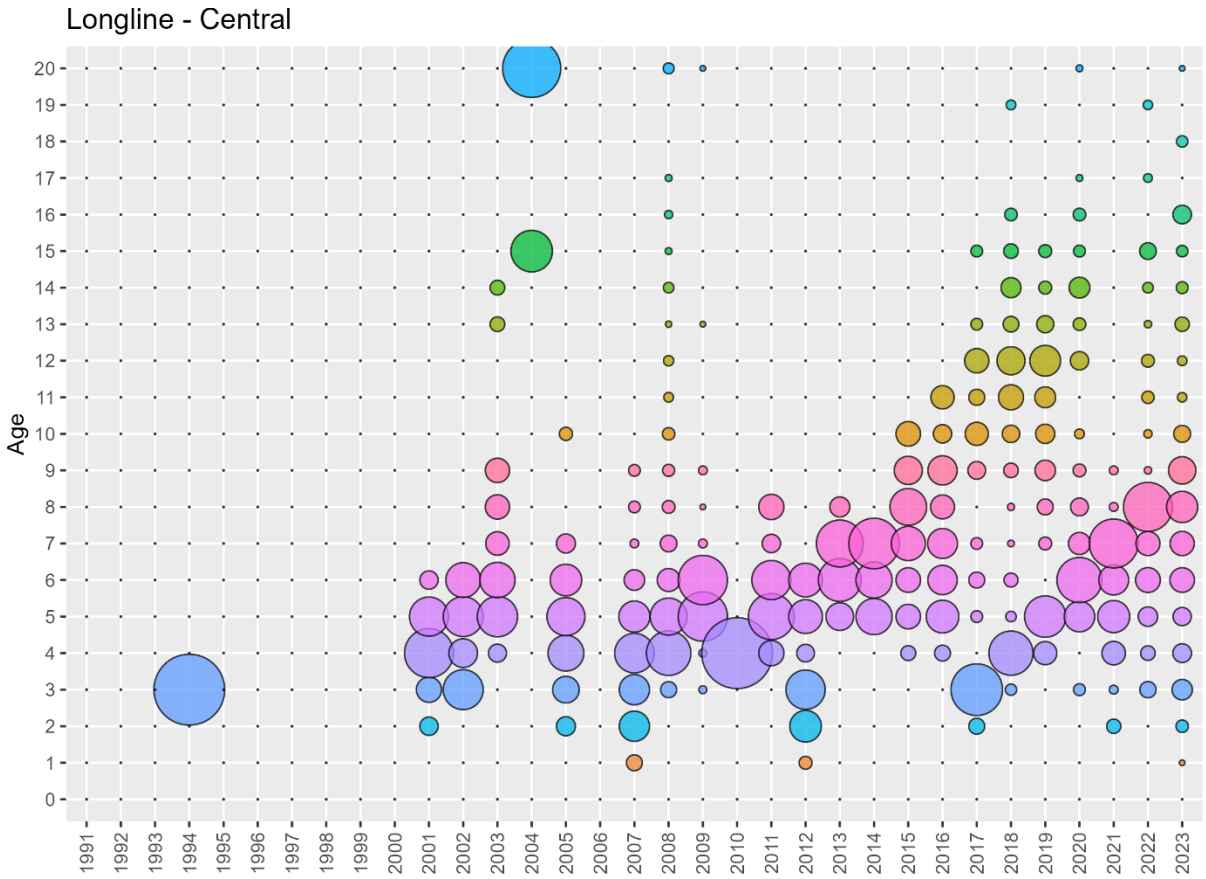

Figure 28. *Final weighted age compositions for the Red Snapper commercial longline central fleet by year.*

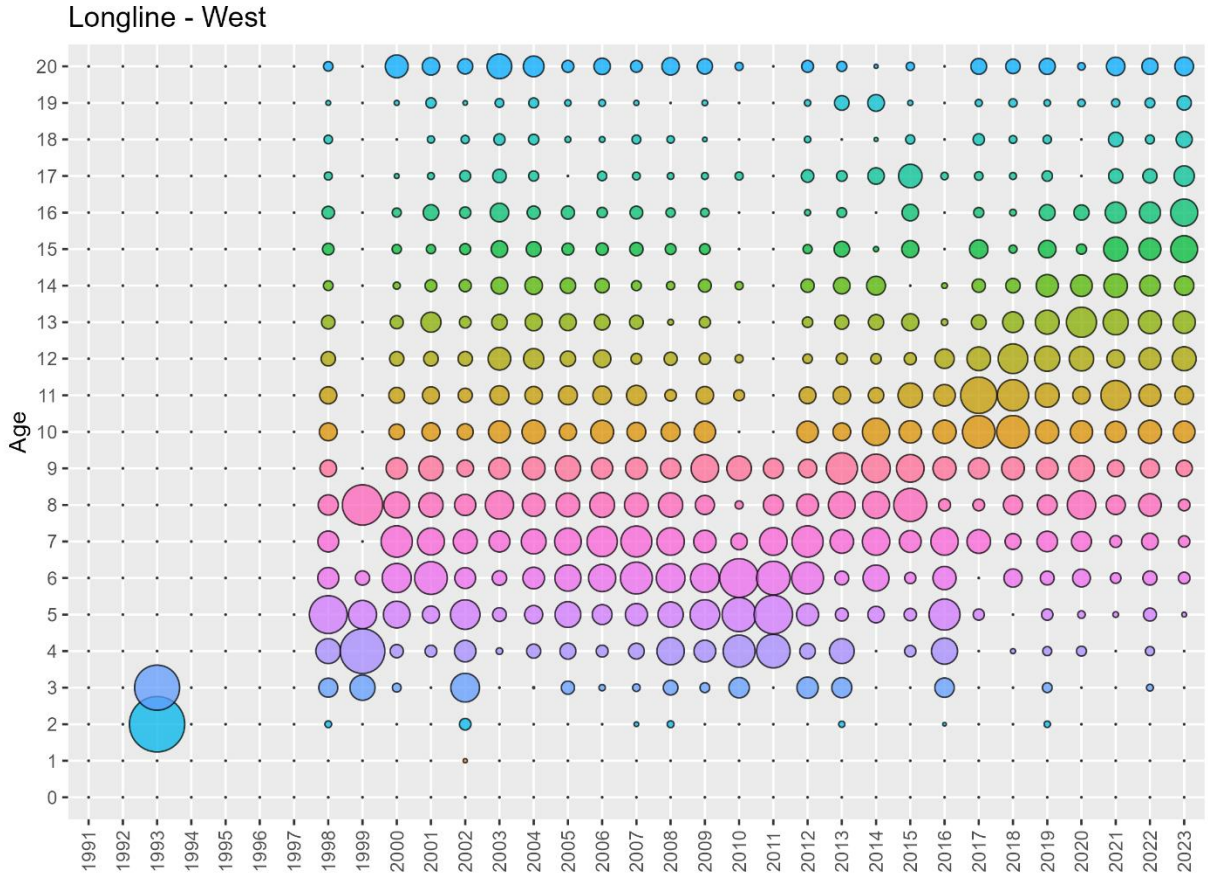

Figure 29. *Final weighted age compositions for the Red Snapper commercial longline west fleet by year.*

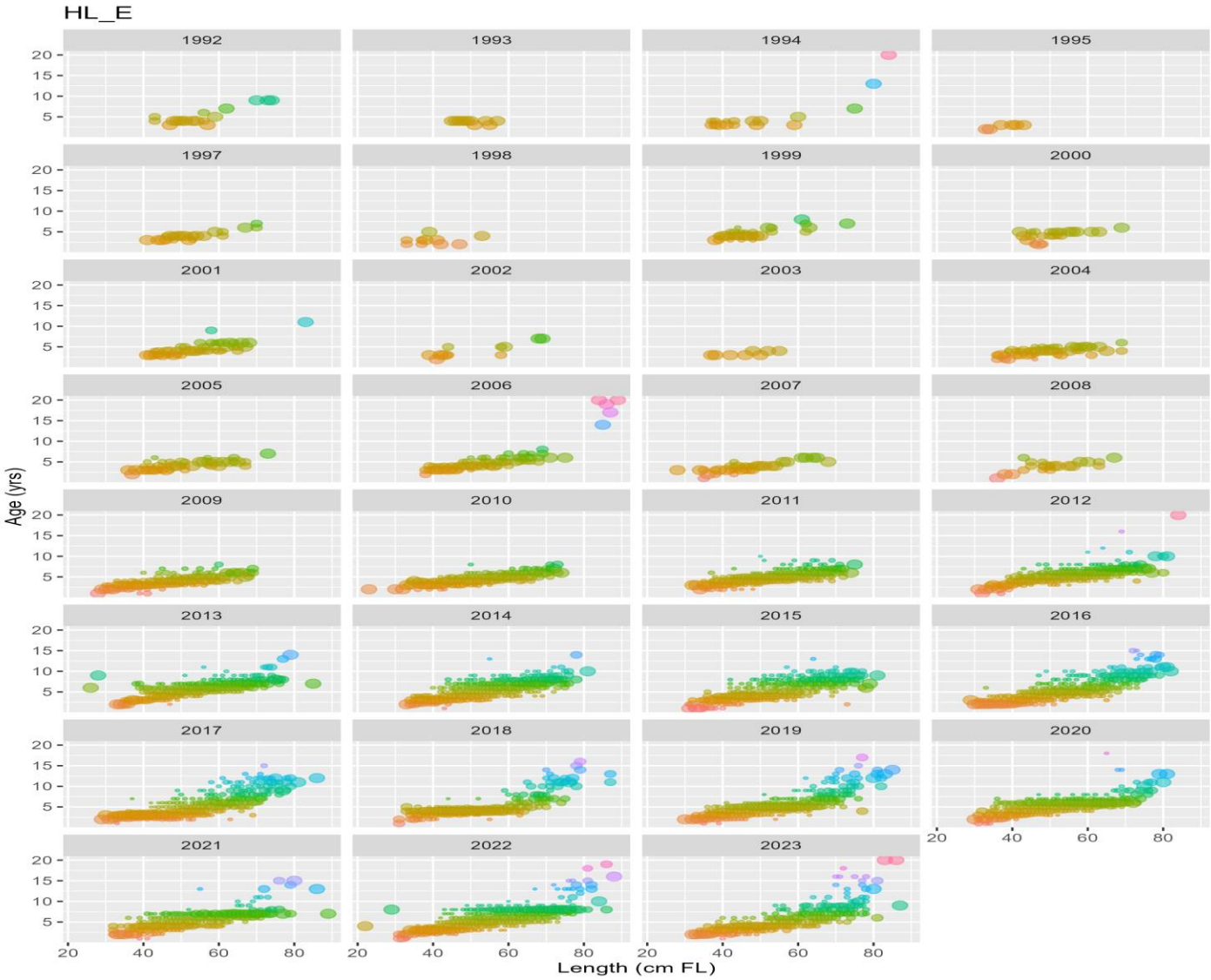

Figure 3024. *Annual Red Snapper conditional age-at-length estimates from the commercial handline east fleet.*

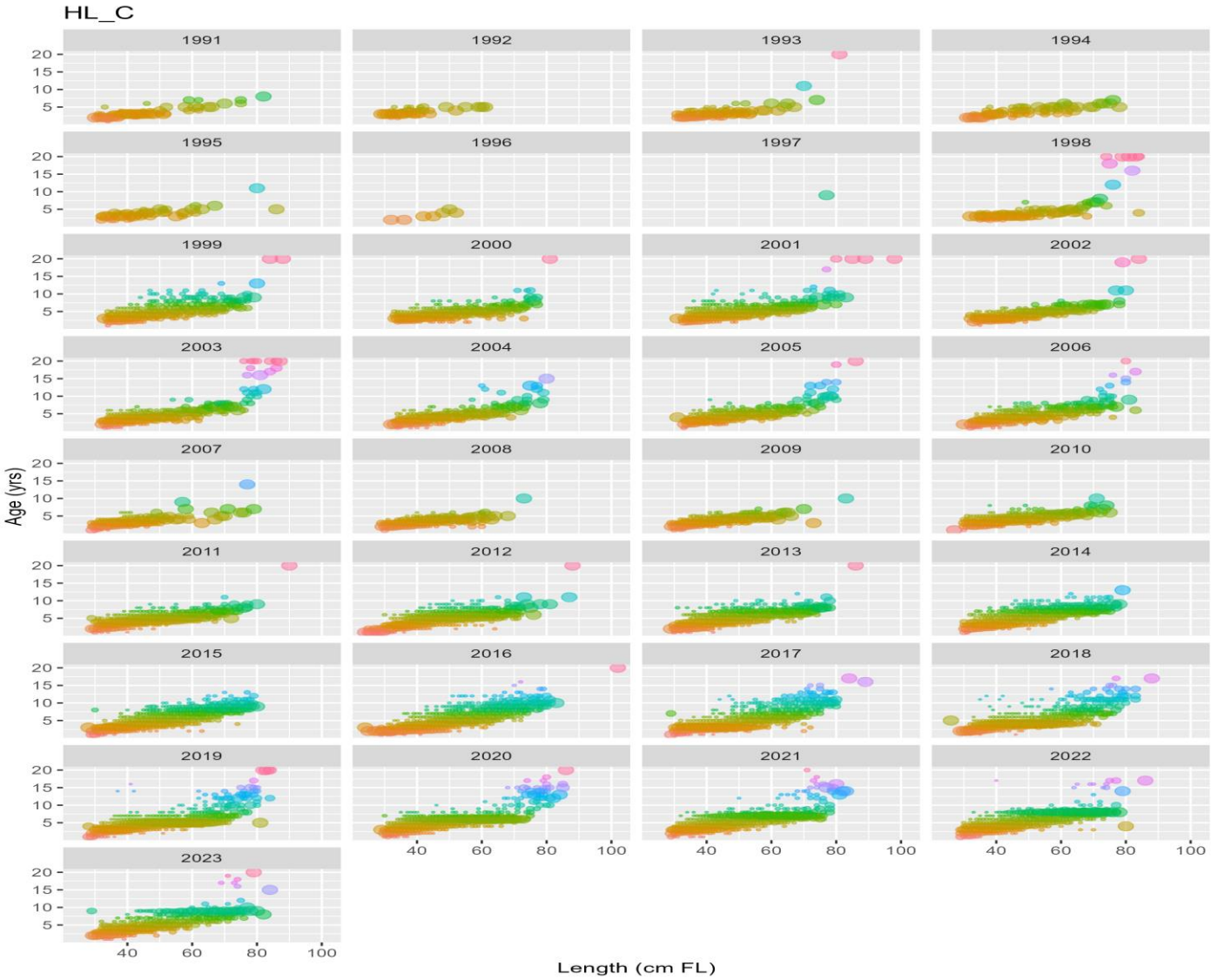

Figure 3125. *Annual Red Snapper conditional age-at-length estimates from the commercial handline central fleet.*

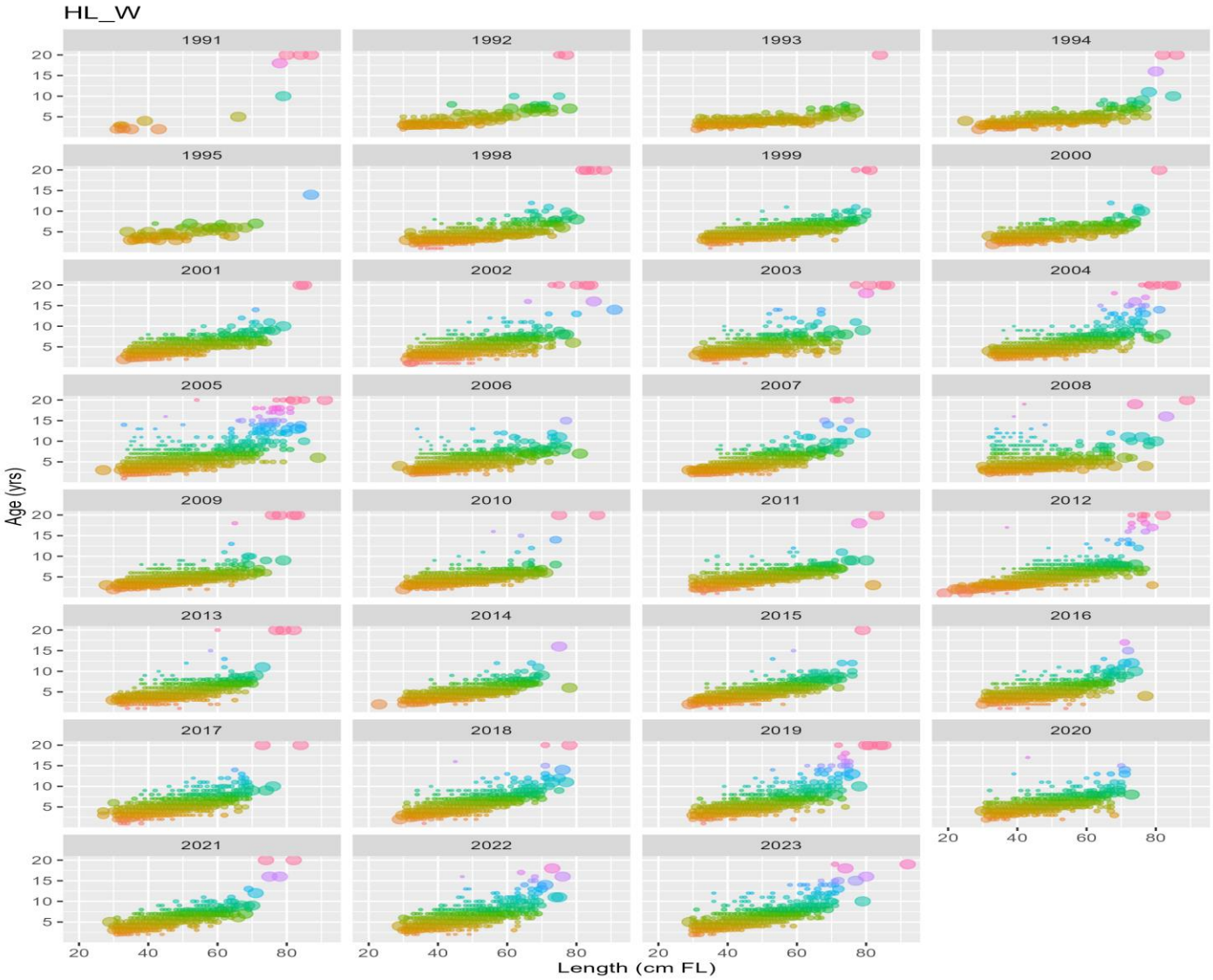

Figure 3226. *Annual Red Snapper conditional age-at-length estimates from the commercial handline west fleet.*

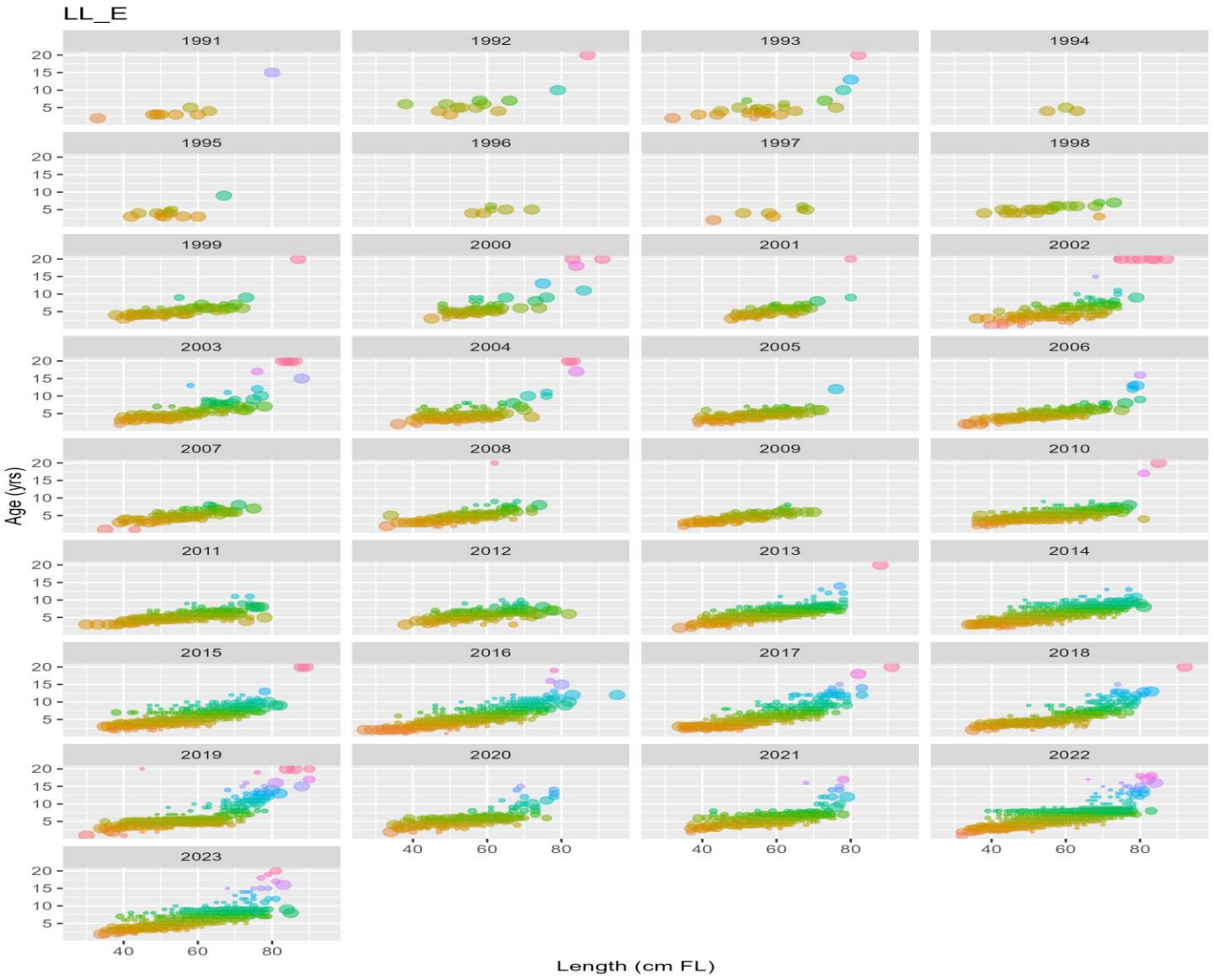

Figure 3327. *Annual Red Snapper conditional age-at-length estimates from the commercial longline east fleet.*

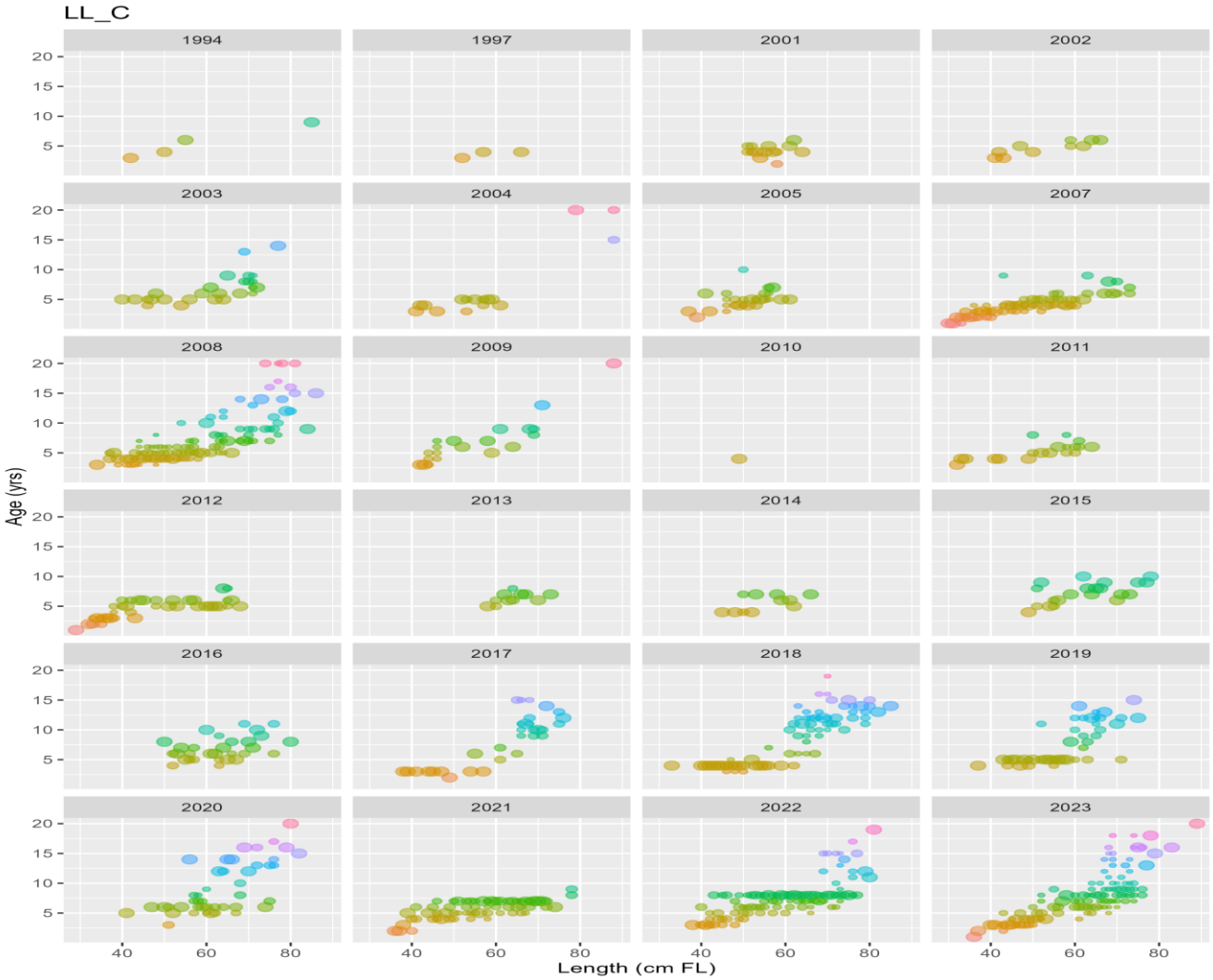

Figure 3428. *Annual Red Snapper conditional age-at-length estimates from the commercial longline central fleet.*

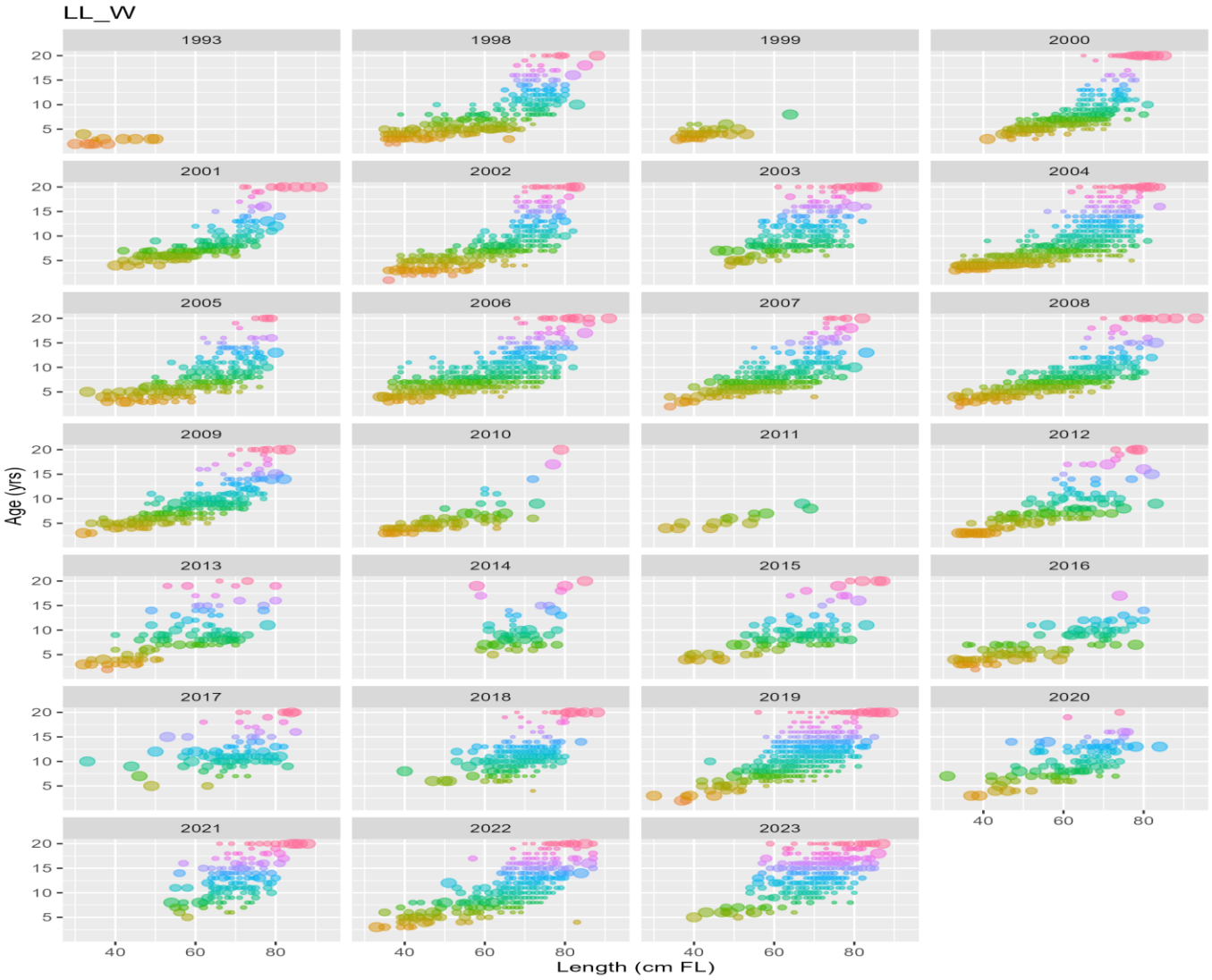

Figure 3529. *Annual Red Snapper conditional age-at-length estimates from the commercial longline west fleet.*

Appendix

Updates from Pre-Data Workshop Submission

The commercial compositions and data products presented in this Appendix are the final length and age data products submitted for SEDAR 98. All of these compositions and data products were presented and discussed during the data workshop and/or post data workshop webinar. There are two commercial fleets (handline (HL) and longline (LL)) and compositions, for each fleet, were produced for each region (West (W), Central (C), and East (E)).

Commercial landings and the raw age data were both updated after the preliminary length and age compositions were submitted. The changes to these files were minimal. For commercial landings the conversion factor used to convert gutted weight to whole weight was updated (Pawluk and Atkinson 2024). For the raw age data, 5 samples were added to the E region.

Nominal and Weighted Length Compositions

Samples sizes for nominal handline (HL) and longline (LL) length compositions are presented in Tables A1 and A2, respectively. For the final weighted length compositions, how the regions were further subdivided for weighting was not changed for the W (W1: areas 13-17; W2: areas 18-21) and C (C1: areas 7-9; C2: areas 10-12) regions. As recommended during the Data Workshop, the weighting subregions were updated for the E region and the new subregions were defined as areas 744.0001, 748.001, and 1-4 for E1 and areas 5-6 for E2. Previously, area 4 was assigned to E2. Moving area 4 from E2 to E1 reduced the number of years where there were insufficient samples (nfish < 30) in one of the weighting subregions from 21 (Table 1) to 8 (Table A3) for the HL fleet and from 17 (Table 2) to 5 (Table A4) for the LL fleet. However, there are still several strata where there were less than 10 trips sampled, even when the minimum threshold of 30 fish sampled was met (Tables A3 & A4). For the LL fleet, there are many strata in the W and C regions that do not meet the minimum sizes of 30 fish and 10 trips per strata (Table A4). Comparisons of the number of fish sampled for length and the number of trips sampled for length for both HL (Fig. A1) and LL (Fig. A2) suggests that fish are generally sampled from a large number of trips.

Nominal and weighted length compositions are presented in Figures A3-A5 for the HL fleet and Figures A6-A8 for the LL fleet.

Nominal and Weighted Age Compositions

The number of age samples available for HL and LL age compositions are shown in Tables A5 and A6, respectively. For the HL fleet in the W region, the number of trips sampled for length remains low through time, while in the C and E regions, the number of trips sampled increases as the number of fish sampled increases (Figure A1). A similar pattern is observed for the LL fleet (Figure A2) where there is not a corresponding increase to the number of trips sampled for ages

in the W, although the number of fish sampled increases. In the C region, both landings and number of fish and trips sampled are generally low.

The length distributions of fish sampled for length-only and fish sampled for age are compared in Figures A9-A11 for the HL fleet and Figures A12-A14 for the LL fleet. For the HL fleet, the length distributions between the length-only and age data are very similar for most years. There are some years where the overlap is poor and these years generally have lower sample sizes. Similar trends are observed for the LL fleet and the overlap is generally poor in the Central region where sample sizes are low.

Nominal age and weighted age distributions are compared for the HL fleet in Figures A15-A17 and the LL fleet in Figures A18-A20. Nominal and weighted age distributions for the HL fleet are very similar and weighting had minimal impacts. There are differences for the LL fleet, especially in the C region which has low sample sizes. Nominal and weighted age bubble plots, which show the tracking of cohorts through time, are shown in Figures A21-32.

Conditional Age-at-Length

Final conditional age-at-length (CAAL) figures are shown in Figures A33-A38. In general, greater spread in the data by both age and length are shown in more recent years.

Mean Length-at-Age

Final mean length-at-age (MLAA) are shown in Figures A39-A44.

Works Cited

Pawluk, Micki and Sarina Atkinson. 2024. Commercial Landings of Gulf of Mexico Red Snapper (*Lutjanus campechanus*) from 1964-2023. SEDAR98-DW-02. SEDAR, North Charleston, SC. 17 pp.

Tables

Table A1: Number of fish (nfish) and trips (ntrip) sampled from the handline fleet for length by stock region. Values in red do not meet the recommended criteria of either 30 fish or 10 trips per strata.

Year	nfish_W	nfish_C	nfish_E	ntrip_W	ntrip_C	ntrip_E
1984	2,821	1,379	818	49	18	23
1985	2,948	281	894	66	14	48
1986	1,855	912	375	42	17	31
1987	827	655	188	40	16	32
1988	1,159	241	114	55	11	11
1989	1,476	550	78	54	24	2
1990	7,558	1,991	325	211	47	21
1991	6,917	1,811	38	201	45	6
1992	5,093	1,121	125	164	23	14
1993	7,084	2,334	67	165	43	14
1994	2,272	3,827	82	72	100	16
1995	4,491	2,502	59	57	80	10
1996	2,579	2,520	109	32	50	12
1997	6,787	3,285	198	156	66	18
1998	7,852	4,041	304	219	81	20
1999	4,580	4,067	913	177	110	42
2000	3,552	4,846	175	138	174	17
2001	4,110	4,801	181	156	184	18
2002	5,516	4,930	265	222	175	24
2003	5,052	4,886	381	195	177	22
2004	2,564	4,666	225	113	183	16
2005	3,624	4,168	237	161	142	24
2006	4,154	3,397	274	169	106	29
2007	2,052	5,189	324	76	174	20
2008	3,426	4,686	190	110	169	25
2009	4,058	4,584	400	101	143	39
2010	4,900	4,241	503	127	152	67
2011	4,412	6,544	798	141	299	99
2012	9,323	10,133	1,100	277	420	149
2013	11,178	12,530	1,415	304	494	153
2014	16,721	9,849	1,356	311	377	159

Year	nfish_W	nfish_C	nfish_E	ntrip_W	ntrip_C	ntrip_E
2015	19,319	17,141	1,050	283	447	127
2016	17,211	18,734	1,057	293	510	125
2017	17,777	15,028	1,307	274	457	141
2018	13,176	16,185	921	248	446	107
2019	14,088	18,694	1,201	210	523	130
2020	7,800	11,224	1,450	112	340	122
2021	6,318	9,599	1,111	110	311	65
2022	13,821	12,696	1,793	164	363	214
2023	22,103	15,388	1,984	252	394	237

Table A2: Number of fish (nfish) and trips (ntrip) sampled from the longline fleet for length by stock region. Values in red do not meet the recommended criteria of either 30 fish or 10 trips per strata.

Year	nfish_W	nfish_C	nfish_E	ntrip_W	ntrip_C	ntrip_E
1984	826	118	746	22	4	32
1985	1,072	16	750	40	2	38
1986	413	6	1,005	18	1	102
1987	47	0	394	7	0	41
1988	180	12	178	9	2	20
1989	404	0	29	18	0	6
1990	376	51	247	8	6	44
1991	109	51	79	8	5	25
1992	114	36	122	5	2	27
1993	51	0	144	3	0	35
1994	0	18	78	0	2	23
1995	72	0	133	2	0	32
1996	6	0	79	1	0	21
1997	63	11	57	1	1	11
1998	253	115	131	6	1	25
1999	218	0	290	5	0	56
2000	540	0	283	17	0	46
2001	180	47	184	8	3	40
2002	542	40	242	24	2	48
2003	259	33	279	13	3	45
2004	398	3	350	17	1	49
2005	178	66	451	8	3	69
2006	382	0	222	14	0	43
2007	363	93	118	14	5	17
2008	382	184	337	18	8	33

Year	nfish_W	nfish_C	nfish_E	ntrip_W	ntrip_C	ntrip_E
2009	265	31	210	16	3	12
2010	85	1	1,016	5	1	101
2011	14	23	569	1	2	71
2012	157	37	196	10	2	36
2013	148	14	688	10	1	74
2014	73	4	1,199	8	1	74
2015	340	28	867	16	3	102
2016	134	27	739	15	3	112
2017	183	45	508	19	9	81
2018	388	142	532	22	15	80
2019	924	104	791	42	7	97
2020	134	59	352	8	7	45
2021	446	89	434	10	3	49
2022	1,175	237	1,758	19	10	162
2023	1,061	290	1,246	19	19	142

Table A3: Number of fish (nfish) and trips (ntrip) sampled from the handline fleet for length by weighting subregion. Values in red do not meet the recommended criteria of either 30 fish or 10 trips per strata.

Year	nfish_W1	nfish_W2	nfish_C1	nfish_C2	nfish_E1	nfish_E2	ntrip_W1	ntrip_W2	ntrip_C1	ntrip_C2	ntrip_E1	ntrip_E2
1984	2,355	466	1,133	246	325	493	46	3	15	3	7	16
1985	2,719	229	183	98	97	797	62	4	8	6	6	42
1986	1,577	278	0	912	87	288	34	8	0	17	8	23
1987	802	25	0	655	41	147	39	1	0	16	8	24
1988	1,048	111	46	195	39	75	50	5	2	9	7	4
1989	1,313	163	32	518	0	78	50	4	1	23	0	2
1990	4,280	3,278	402	1,589	29	296	149	62	12	35	11	10
1991	5,297	1,620	201	1,610	37	0	169	32	10	35	6	0
1992	4,951	142	249	872	16	109	160	4	5	18	6	8
1993	2,784	4,300	604	1,730	32	35	103	62	21	22	6	8
1994	1,997	275	470	3,357	31	51	69	3	29	71	7	9
1995	2,807	1,684	304	2,198	31	28	34	23	28	52	4	6
1996	2,183	396	227	2,293	35	74	28	4	11	39	6	6
1997	6,537	250	278	3,007	165	32	151	5	12	54	15	2
1998	7,389	463	901	3,140	7	297	202	17	28	53	3	17
1999	4,009	571	623	3,444	97	816	164	13	28	82	6	36
2000	3,427	125	859	3,987	52	123	136	2	44	130	5	12
2001	4,110	0	1,215	3,586	42	136	156	0	47	137	10	8
2002	5,049	467	1,104	3,826	44	221	211	11	51	124	6	18
2003	4,336	716	1,355	3,531	121	260	179	16	51	126	6	16
2004	2,196	368	2,547	2,119	26	199	102	11	107	76	2	14
2005	3,120	504	2,321	1,847	133	104	143	18	92	50	8	16
2006	3,563	591	1,793	1,604	44	230	148	21	58	48	10	19

Year	nfish_W1	nfish_W2	nfish_C1	nfish_C2	nfish_E1	nfish_E2	ntrip_W1	ntrip_W2	ntrip_C1	ntrip_C2	ntrip_E1	ntrip_E2
2007	1,352	700	3,852	1,337	5	319	54	22	128	46	3	17
2008	2,684	742	1,581	3,105	49	141	84	26	63	106	7	18
2009	3,039	1,019	1,104	3,480	64	336	82	19	42	101	7	32
2010	3,844	1,056	1,441	2,800	89	414	100	27	65	87	8	59
2011	3,750	662	2,987	3,557	96	702	122	19	178	121	18	81
2012	6,457	2,866	4,668	5,465	112	988	183	94	235	185	13	136
2013	6,446	4,732	5,211	7,319	255	1,160	197	107	258	236	32	121
2014	10,841	5,880	3,768	6,081	319	1,037	193	118	189	188	36	123
2015	15,127	4,192	5,068	12,073	476	574	201	82	194	253	43	84
2016	14,713	2,498	5,046	13,688	319	738	235	58	219	291	32	93
2017	14,081	3,696	4,444	10,584	331	976	199	75	190	267	40	101
2018	8,073	5,103	5,635	10,550	280	641	168	80	205	241	50	57
2019	8,055	6,033	3,793	14,901	578	623	138	72	182	341	73	57
2020	4,383	3,417	3,660	7,564	431	1,019	79	33	157	183	46	76
2021	4,287	2,031	1,635	7,964	126	985	94	16	79	232	14	51
2022	7,424	6,397	3,474	9,222	250	1,543	124	40	114	249	42	172
2023	13,273	8,830	6,646	8,742	521	1,463	198	54	160	234	92	145

Table A4: Number of fish (nfish) and trips (ntrip) sampled from the longline fleet for length by weighting subregion. Values in red do not meet the recommended criteria of either 30 fish or 10 trips per strata.

Year	nfish_W1	nfish_W2	nfish_C1	nfish_C2	nfish_E1	nfish_E2	ntrip_W1	ntrip_W2	ntrip_C1	ntrip_C2	ntrip_E1	ntrip_E2
1984	610	216	118	0	182	564	15	7	4	0	7	25
1985	1,072	0	0	16	89	661	40	0	0	2	9	29
1986	403	10	6	0	215	781	17	1	1	0	24	78
1987	47	0	0	0	118	276	7	0	0	0	11	30
1988	180	0	12	0	69	109	9	0	2	0	9	11
1989	404	0	0	0	18	11	18	0	0	0	3	3
1990	361	15	34	17	74	173	6	2	4	2	24	20
1991	109	0	51	0	46	33	8	0	5	0	14	11
1992	52	62	34	2	61	61	3	2	1	1	17	10
1993	51	0	0	0	94	50	3	0	0	0	21	14
1994	0	0	0	18	54	24	0	0	0	2	14	9
1995	72	0	0	0	79	54	2	0	0	0	16	16
1996	6	0	0	0	48	31	1	0	0	0	9	12
1997	63	0	11	0	47	10	1	0	1	0	8	3
1998	253	0	115	0	79	52	6	0	1	0	11	14
1999	76	142	0	0	104	186	2	3	0	0	21	35
2000	330	210	0	0	121	162	13	4	0	0	25	21
2001	180	0	23	24	50	134	8	0	2	1	17	23
2002	464	78	40	0	76	166	21	3	2	0	20	28
2003	96	163	14	19	62	217	5	8	2	1	17	28
2004	78	320	3	0	104	246	4	13	1	0	24	25
2005	67	111	66	0	168	283	4	4	3	0	25	44
2006	238	144	0	0	102	120	9	5	0	0	21	22

Year	nfish_W1	nfish_W2	nfish_C1	nfish_C2	nfish_E1	nfish_E2	ntrip_W1	ntrip_W2	ntrip_C1	ntrip_C2	ntrip_E1	ntrip_E2
2007	106	257	93	0	25	93	5	9	5	0	5	12
2008	35	347	152	32	64	273	2	16	6	2	10	23
2009	67	198	2	29	4	206	4	12	1	2	3	9
2010	1	84	1	0	213	803	1	4	1	0	31	70
2011	0	14	23	0	196	373	0	1	2	0	29	42
2012	32	125	37	0	105	91	5	5	2	0	18	18
2013	83	65	14	0	121	567	5	5	1	0	20	54
2014	53	20	4	0	402	797	3	5	1	0	30	44
2015	337	3	28	0	210	657	15	1	3	0	33	69
2016	108	26	16	11	234	505	12	3	2	1	36	76
2017	181	2	30	15	145	363	18	1	8	1	31	50
2018	386	2	128	14	281	251	21	1	13	2	46	34
2019	778	146	82	22	259	532	37	5	6	1	43	54
2020	134	0	43	16	141	211	8	0	5	2	21	24
2021	439	7	89	0	90	344	9	1	3	0	17	32
2022	1,168	7	237	0	500	1,258	18	1	10	0	53	109
2023	951	110	290	0	322	924	17	2	19	0	52	90

Table A5: Number of fish (nfish) and trips (ntrip) sampled from the handline fleet for age by stock region. Values in red do not meet the recommended criteria of either 10 fish or 10 trips per strata.

Year	nfish_W	nfish_C	nfish_E	ntrip_W	ntrip_C	ntrip_E
1991	25	178	0	1	12	0
1992	214	119	18	16	4	6
1993	344	139	12	33	16	6
1994	507	122	28	54	23	6
1995	97	85	7	9	16	2
1996	0	9	0	0	3	0
1997	0	1	31	0	1	2
1998	1,173	186	11	46	7	3
1999	1,792	908	70	75	30	3
2000	695	1,382	29	37	56	4
2001	1,027	1,241	66	43	57	4
2002	2,421	1,155	14	105	55	5
2003	1,395	1,474	9	56	385	3
2004	1,892	970	113	71	51	11
2005	2,318	1,101	68	85	52	8
2006	2,599	1,146	153	80	53	43
2007	1,447	1,077	54	55	180	29
2008	1,578	933	23	108	110	22
2009	2,126	918	328	54	146	69
2010	2,042	1,149	451	68	367	179
2011	1,665	2,471	906	55	1,786	293
2012	2,914	3,226	951	115	1,653	303
2013	1,500	1,798	767	238	1,469	451
2014	1,112	1,500	987	218	1,250	429
2015	1,640	2,208	644	253	1,796	299
2016	1,680	2,545	909	248	2,109	706
2017	1,235	2,961	1,282	226	2,455	1,041
2018	1,488	3,931	925	240	3,405	733
2019	1,109	4,310	1,018	216	3,902	940
2020	908	3,208	1,117	112	2,908	1,042
2021	810	2,912	720	79	2,612	656
2022	1,052	2,653	1,729	147	2,406	1,630
2023	1,028	887	501	161	600	343

Table A6: Number of fish (nfish) and trips (ntrip) sampled from the longline fleet for age by stock region. Values in red do not meet the recommended criteria of either 10 fish or 10 trips per strata.

Year	nfish_W	nfish_C	nfish_E	ntrip_W	ntrip_C	ntrip_E
1991	0	0	12	0	0	2
1992	0	0	15	0	0	4
1993	29	0	31	2	0	10
1994	0	4	4	0	1	3
1995	0	0	19	0	0	7
1996	0	0	6	0	0	4
1997	0	3	7	0	1	2
1998	348	0	25	10	0	6
1999	76	0	102	2	0	12
2000	345	0	84	14	0	8
2001	179	14	77	9	1	19
2002	340	11	167	15	2	37
2003	259	27	170	13	2	38
2004	640	18	235	24	2	40
2005	252	34	311	10	2	51
2006	556	0	202	17	0	40
2007	352	93	124	15	5	27
2008	344	183	315	25	36	81
2009	271	20	96	17	9	32
2010	84	1	1,005	5	1	614
2011	14	22	551	1	22	266
2012	149	51	230	9	16	114
2013	116	14	705	10	14	127
2014	77	14	1,128	10	14	102
2015	106	23	846	15	3	162
2016	108	31	828	15	12	711
2017	120	36	528	19	18	471
2018	307	116	537	20	69	511
2019	681	53	804	33	28	670
2020	126	51	291	8	29	160
2021	175	86	417	9	86	351
2022	420	146	1,659	18	130	1,510
2023	406	173	822	15	143	571

Figures

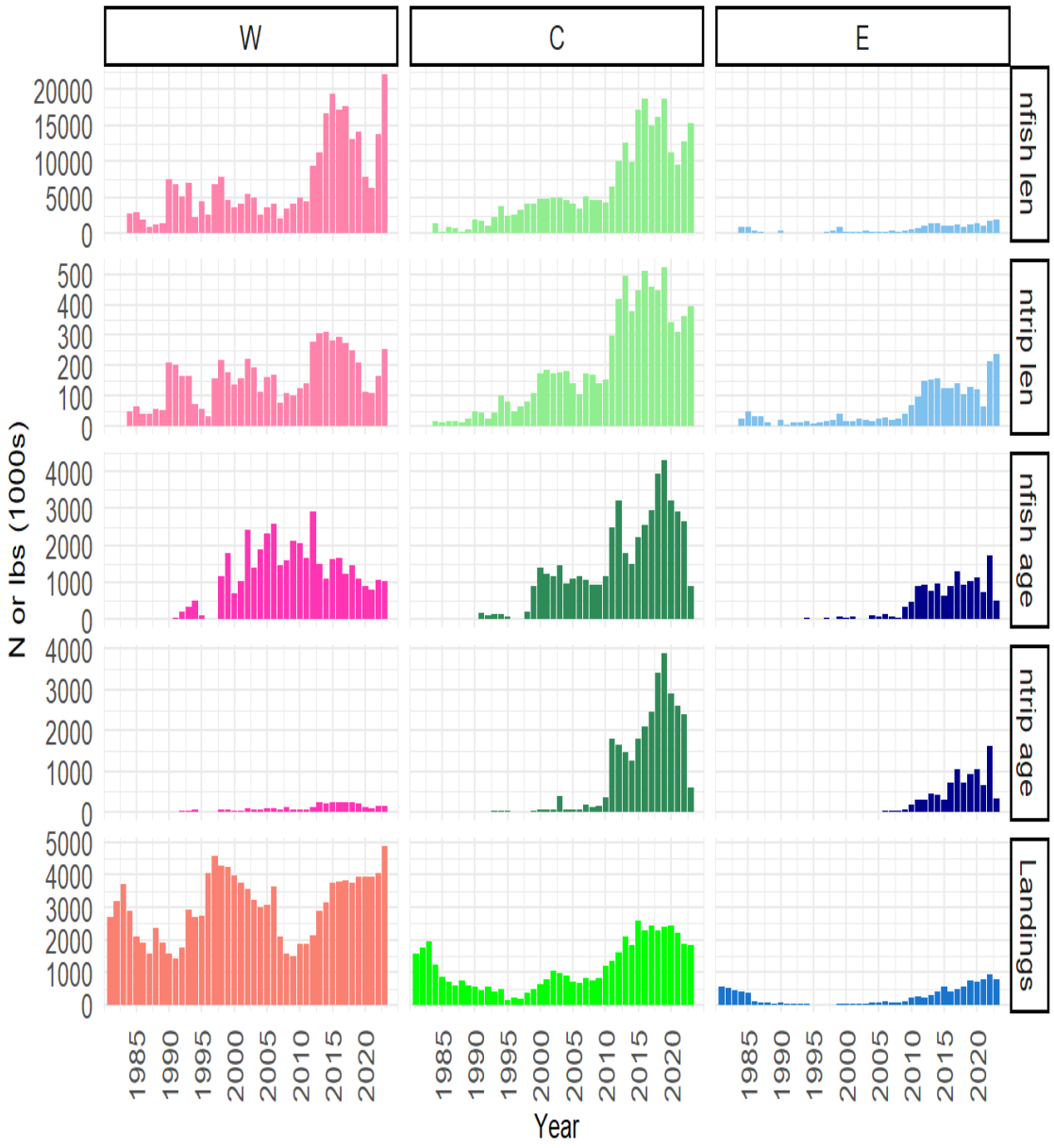

Figure A1: Summary of the number of fish and trips sampled for length and ages and the corresponding landings from the **handline fleet** by stock region. The top row shows the number of fish sampled for length, the second row shows the number of trips sampled for length, the third row shows the number of fish sampled for age, the fourth row shows the number of trips sampled for ages, and the bottom row shows landings in thousands (pounds whole weight).

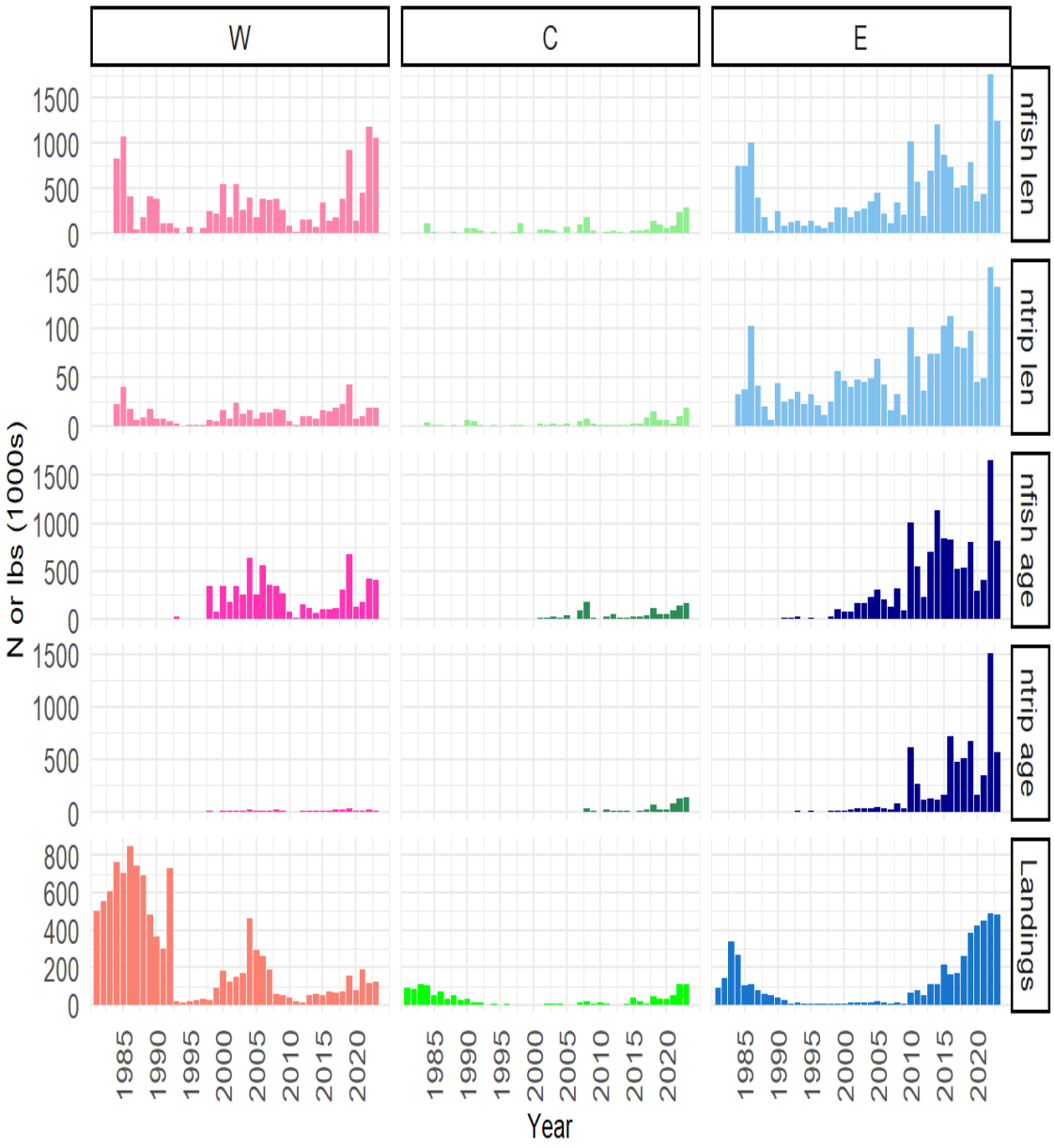

Figure A2: Summary of the number of fish and trips sampled for length and ages and the corresponding landings from the **longline fleet** by stock region. The top row shows the number of fish sampled for length, the second row shows the number of trips sampled for length, the third row shows the number of fish sampled for age, the fourth row shows the number of trips sampled for ages, and the bottom row shows landings in thousands (pounds whole weight).

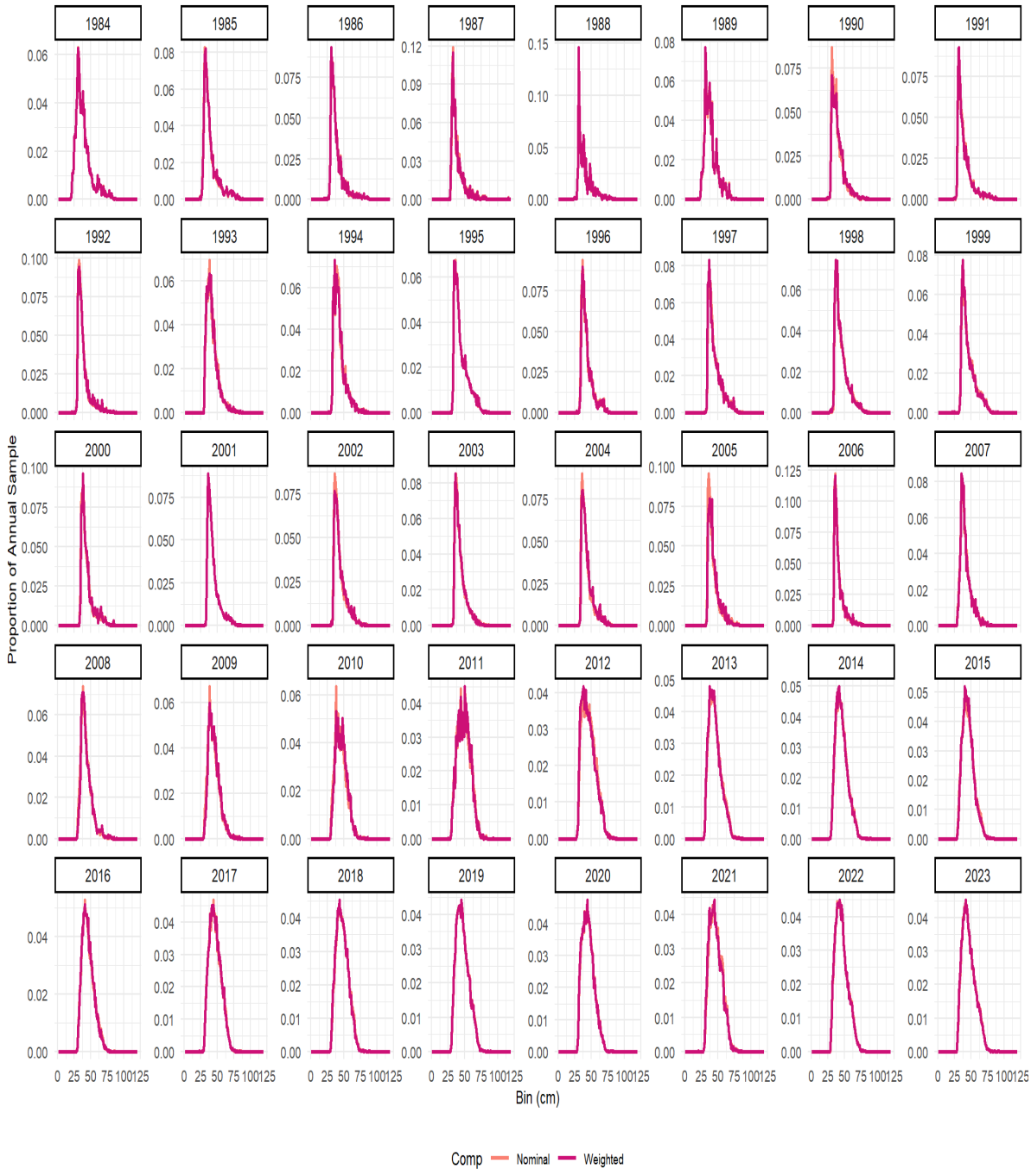

Figure A3: Nominal and weighed length distributions for the **HL West** fleet.

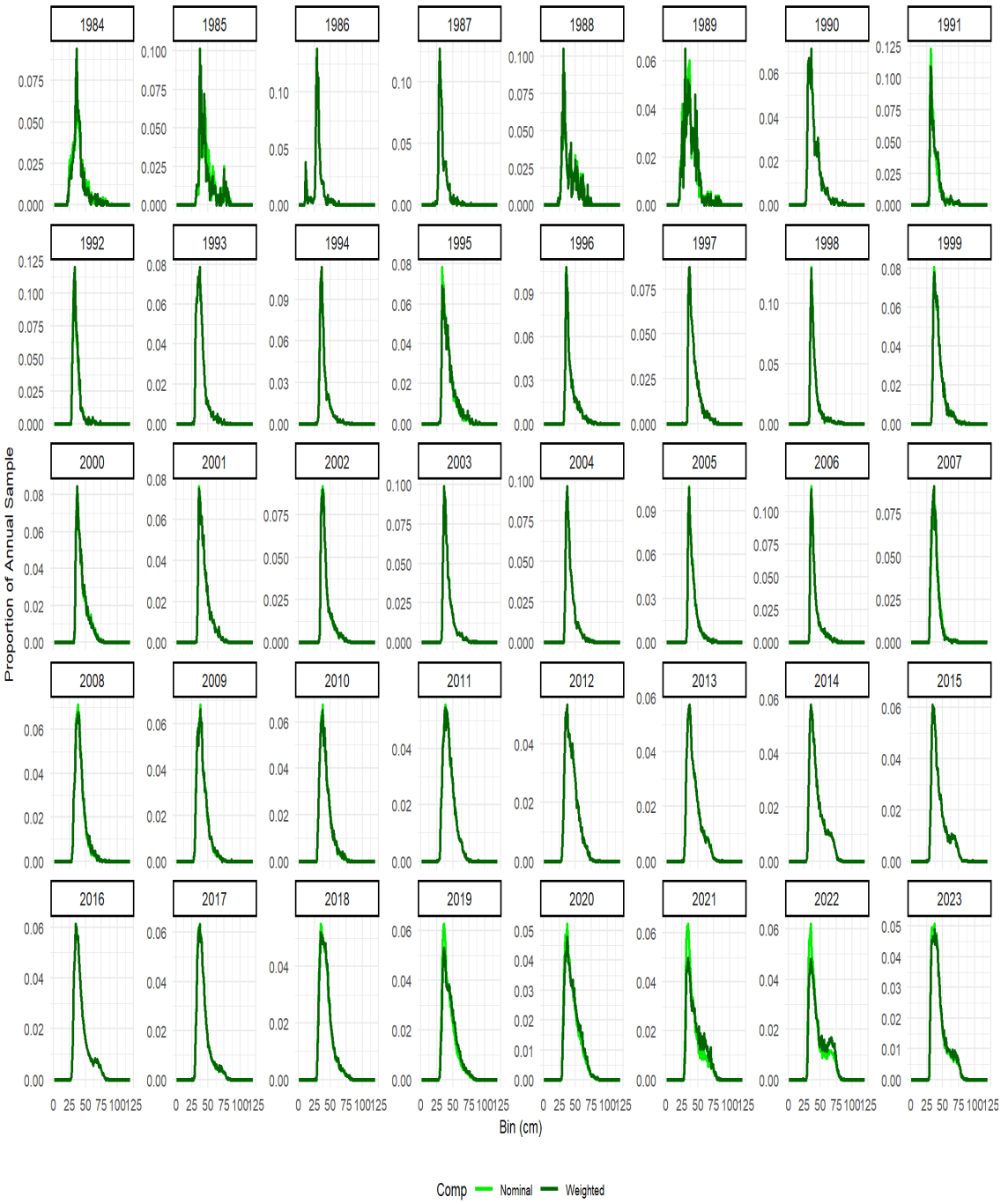

Figure A4: Nominal and weighted length distributions for the **HL Central** fleet.

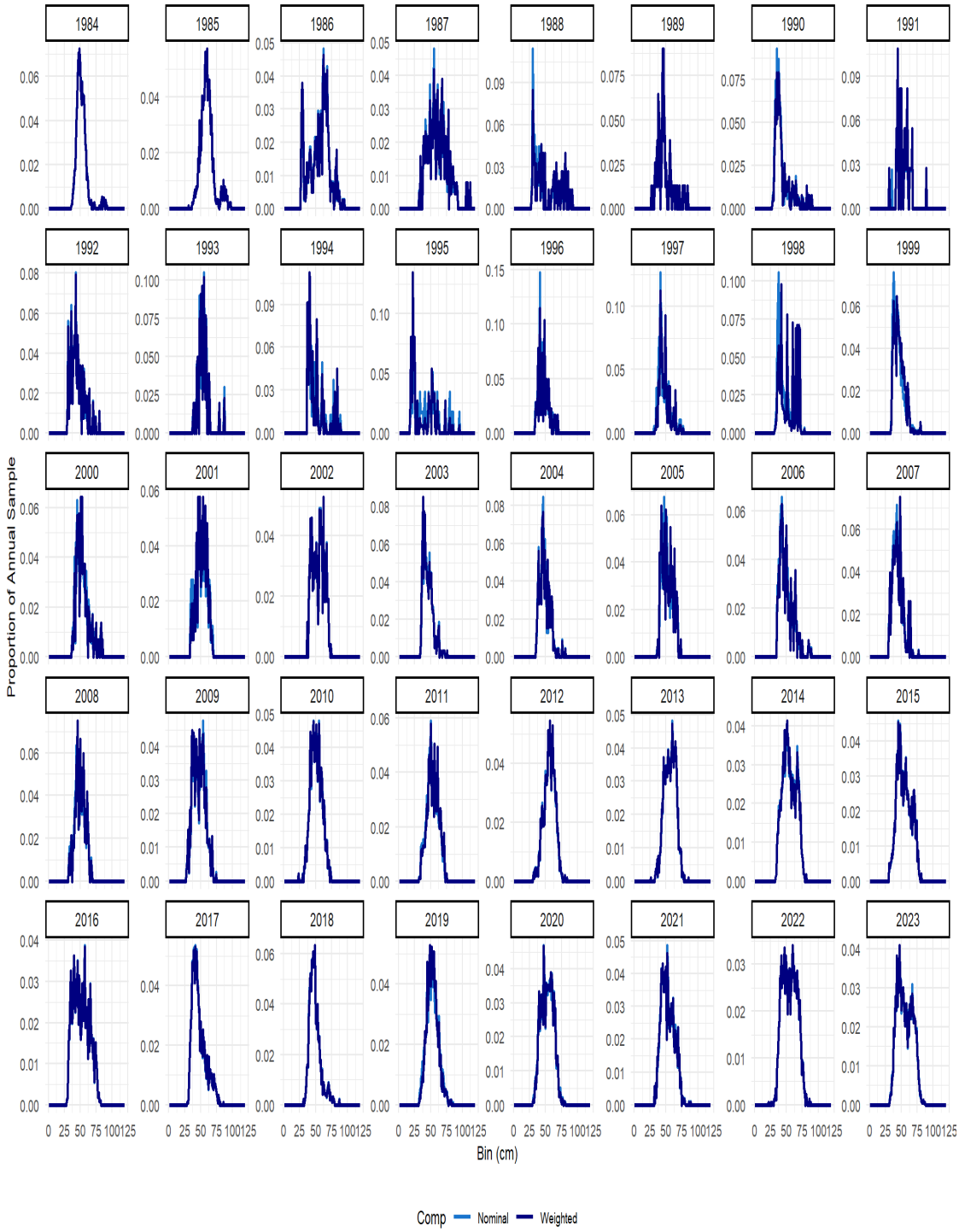

Figure A5: Nominal and weighted length distributions for the **HL East** fleet.

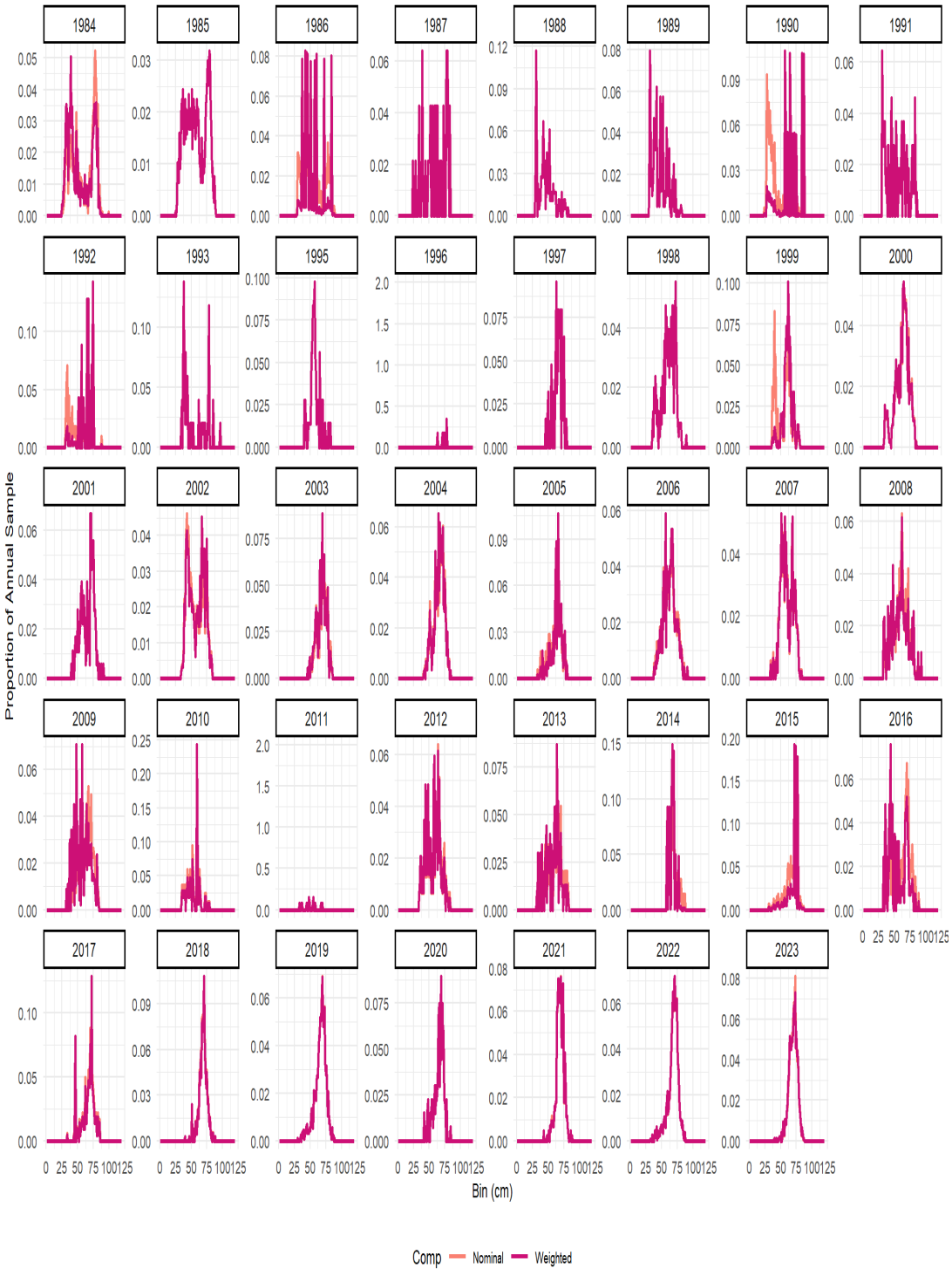

Figure A6: Nominal and weighted length distributions for the **LL West** fleet.

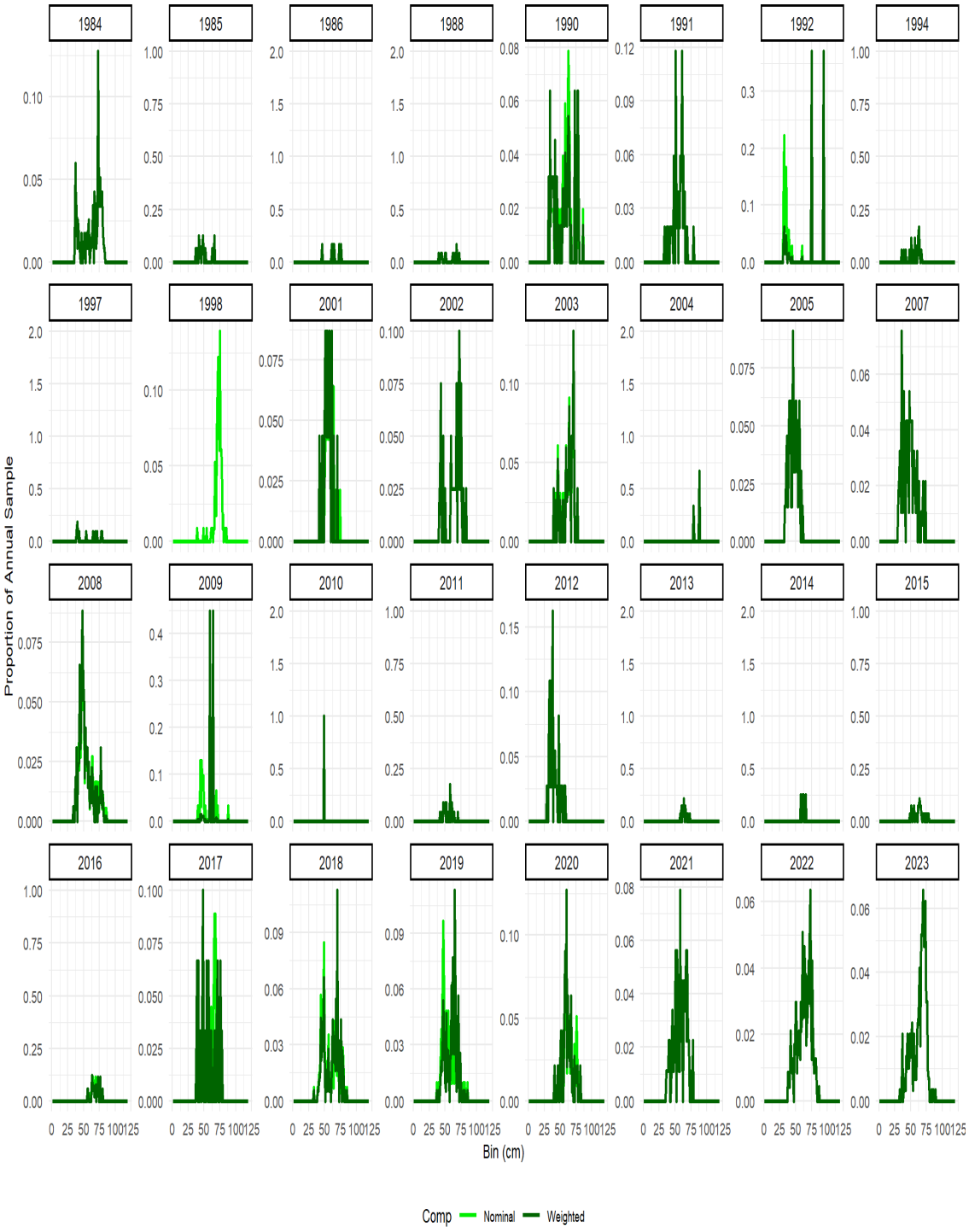

Figure A7: Nominal and weighted length distributions for the **LL Central** fleet.

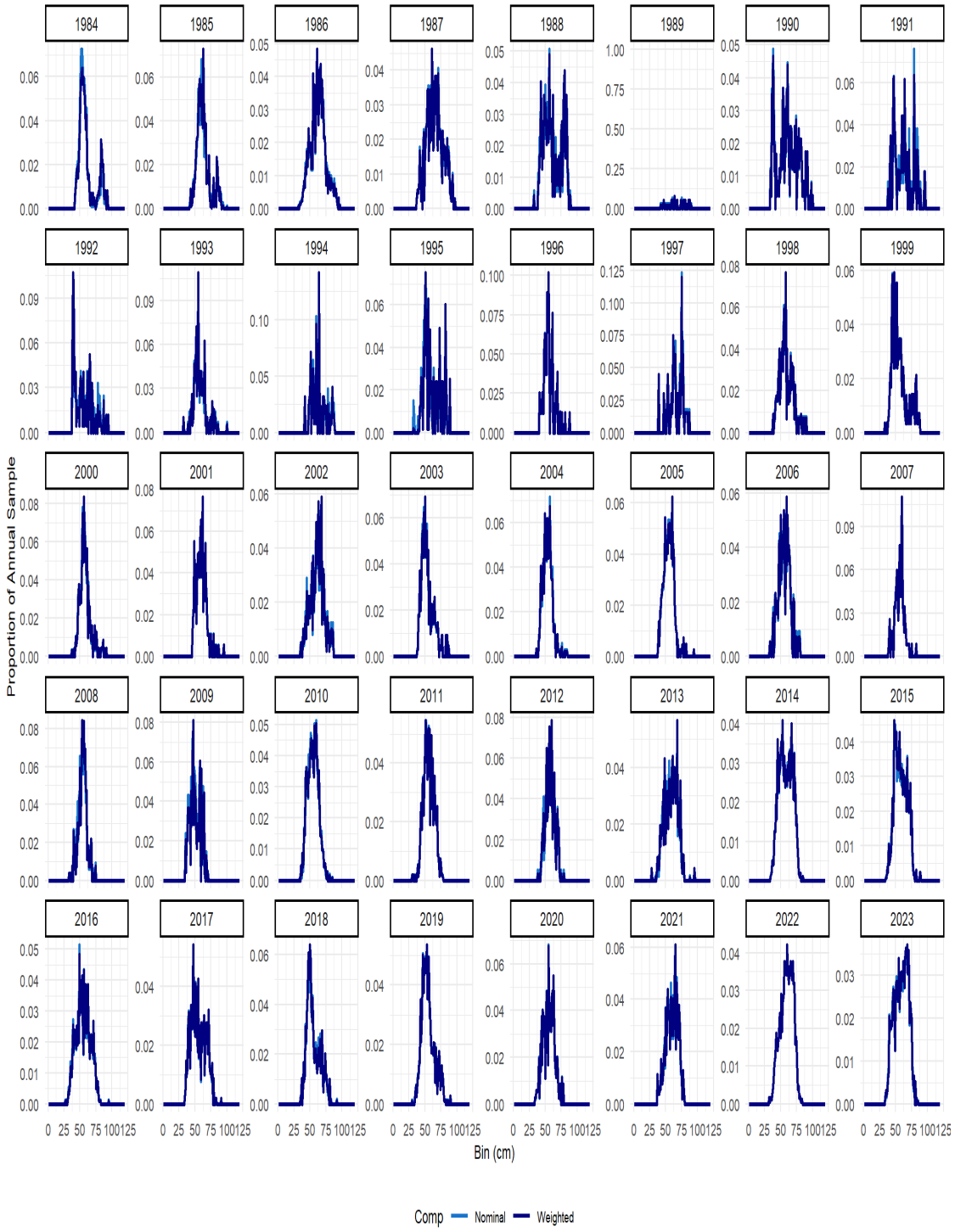

Figure A8: Nominal and weighted length distributions for the **LL East** fleet.

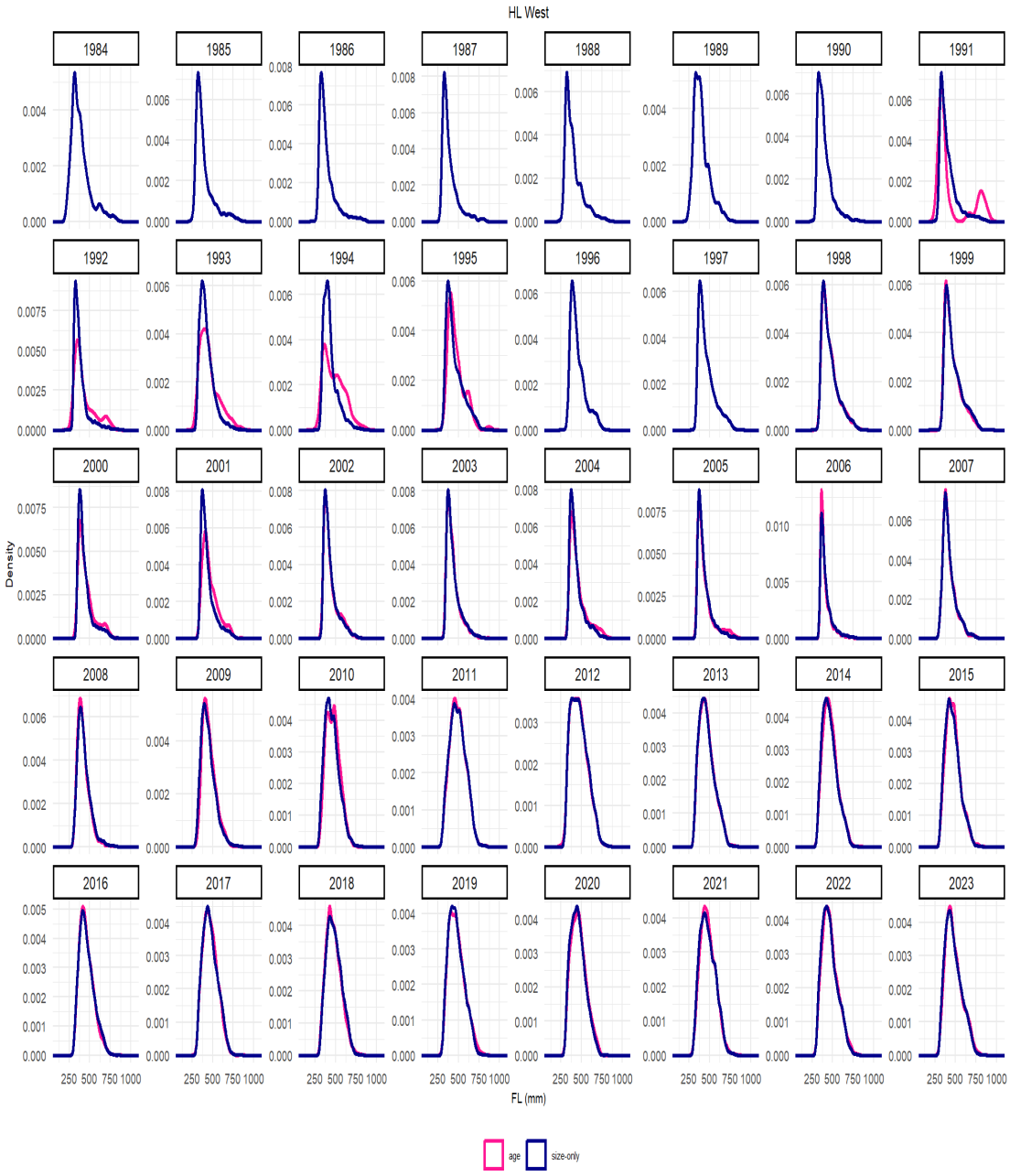

Figure A9: Comparison of the length distributions from the length-only samples and samples with ages from the **HL West** fleet.

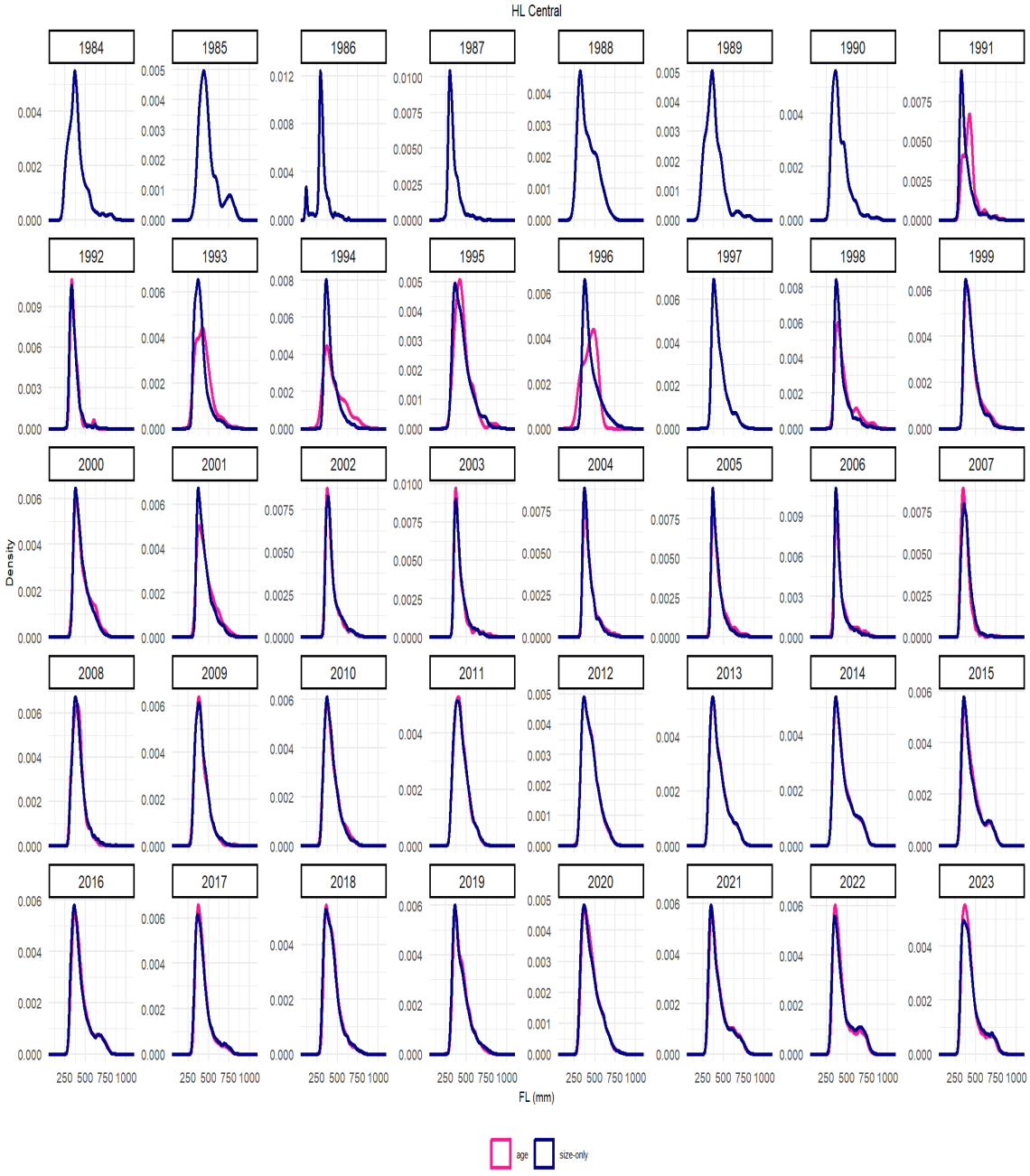

Figure A10: Comparison of the length distributions from the length-only samples and samples with ages from the **HL Central** fleet.

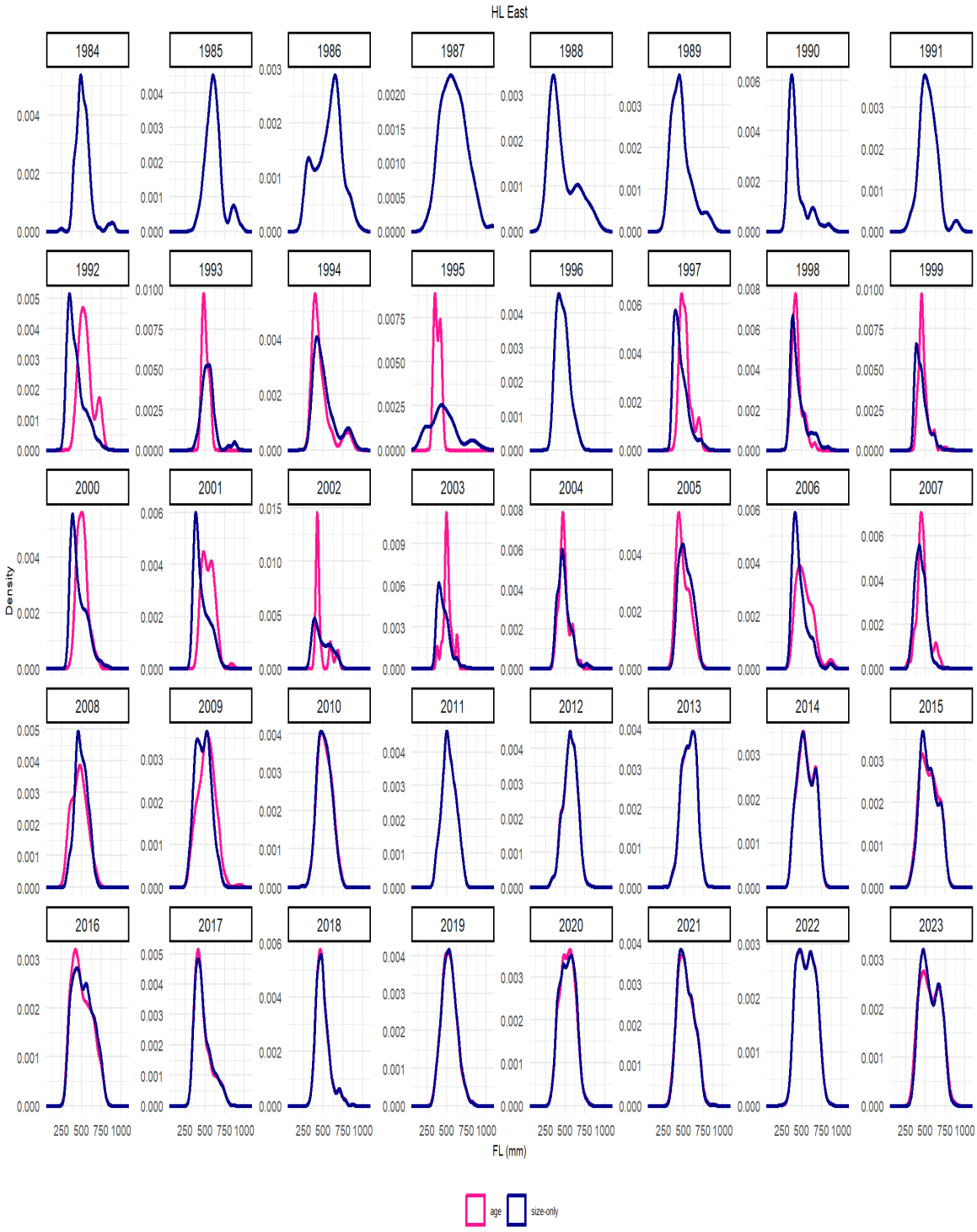

Figure A11: Comparison of the length distributions from the length-only samples and samples with ages from the **HL East** fleet.

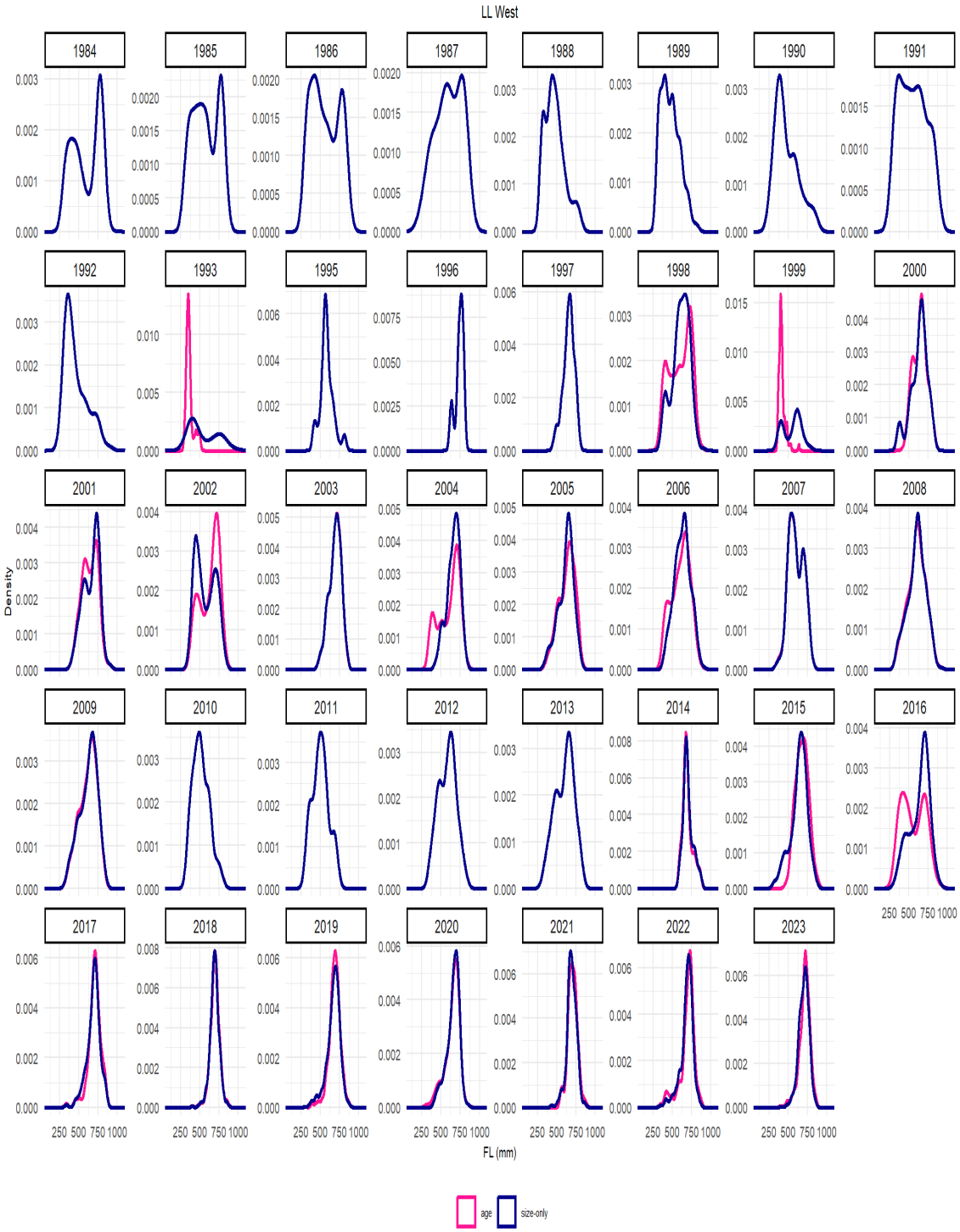

Figure A12: Comparison of the length distributions from the length-only samples and samples with ages from the **LL West** fleet.

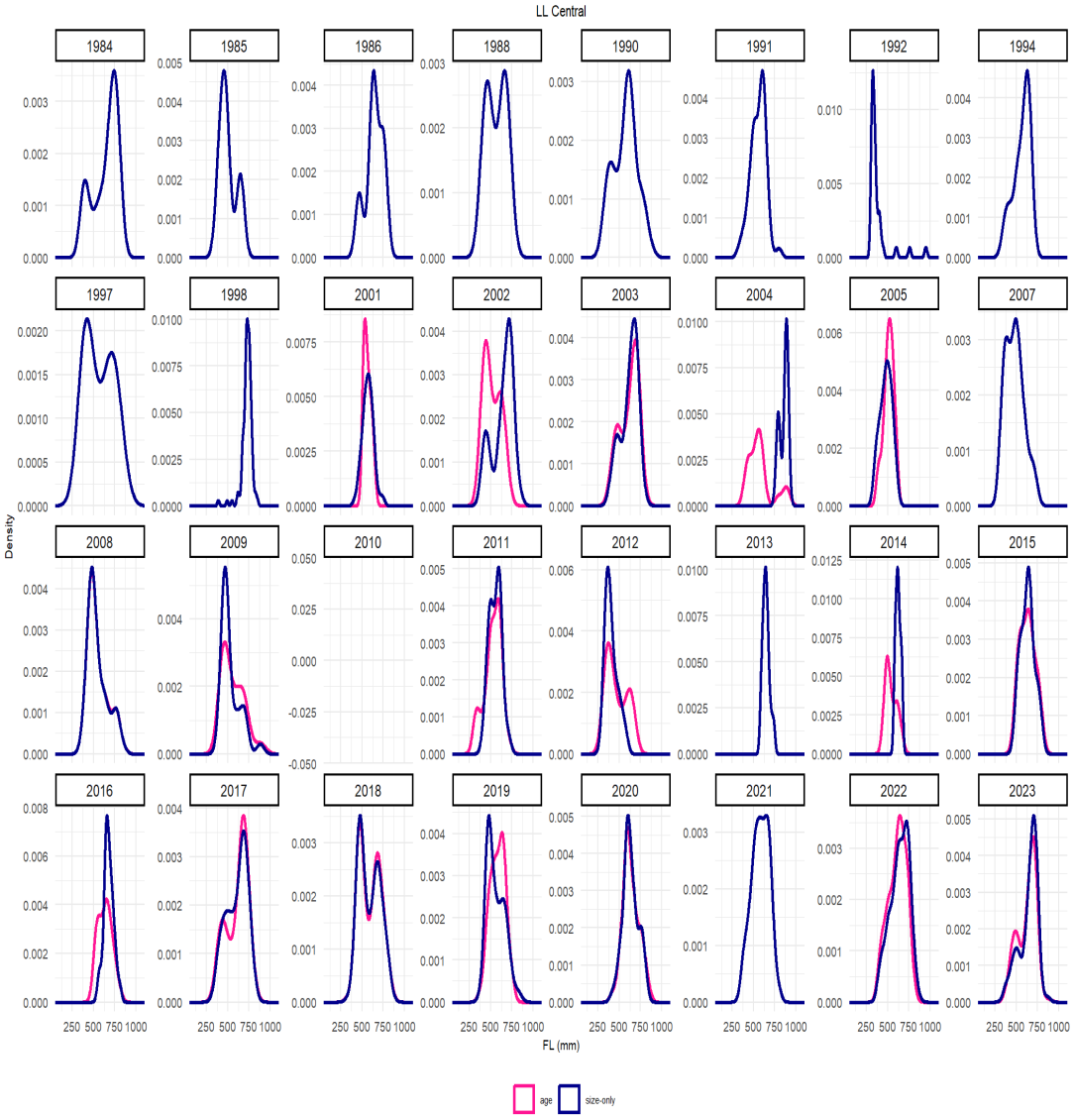

Figure A13: Comparison of the length distributions from the length-only samples and samples with ages from the **LL Central** fleet.

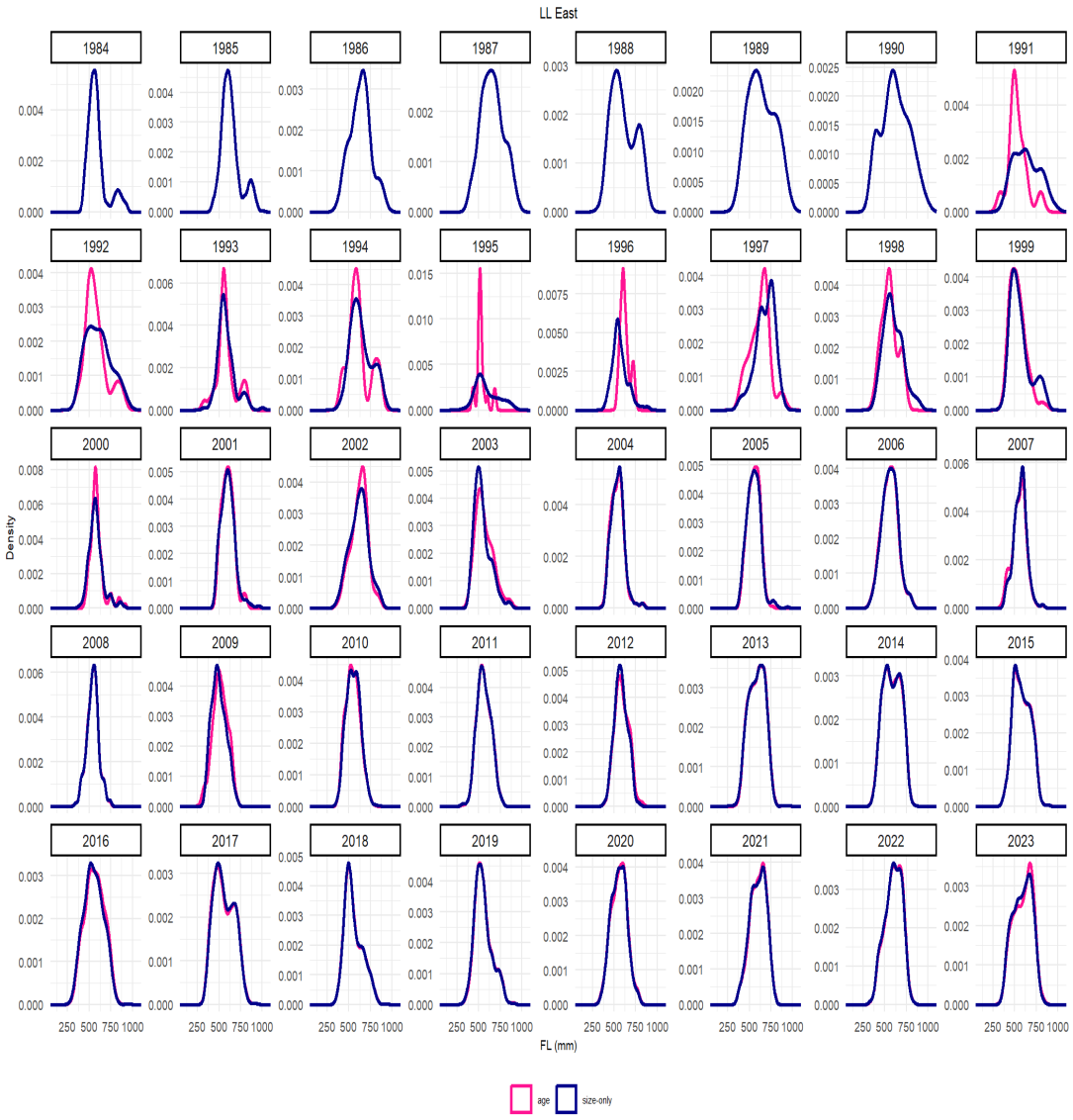

Figure A14: Comparison of the length distributions from the length-only samples and samples with ages from the **LL East** fleet.

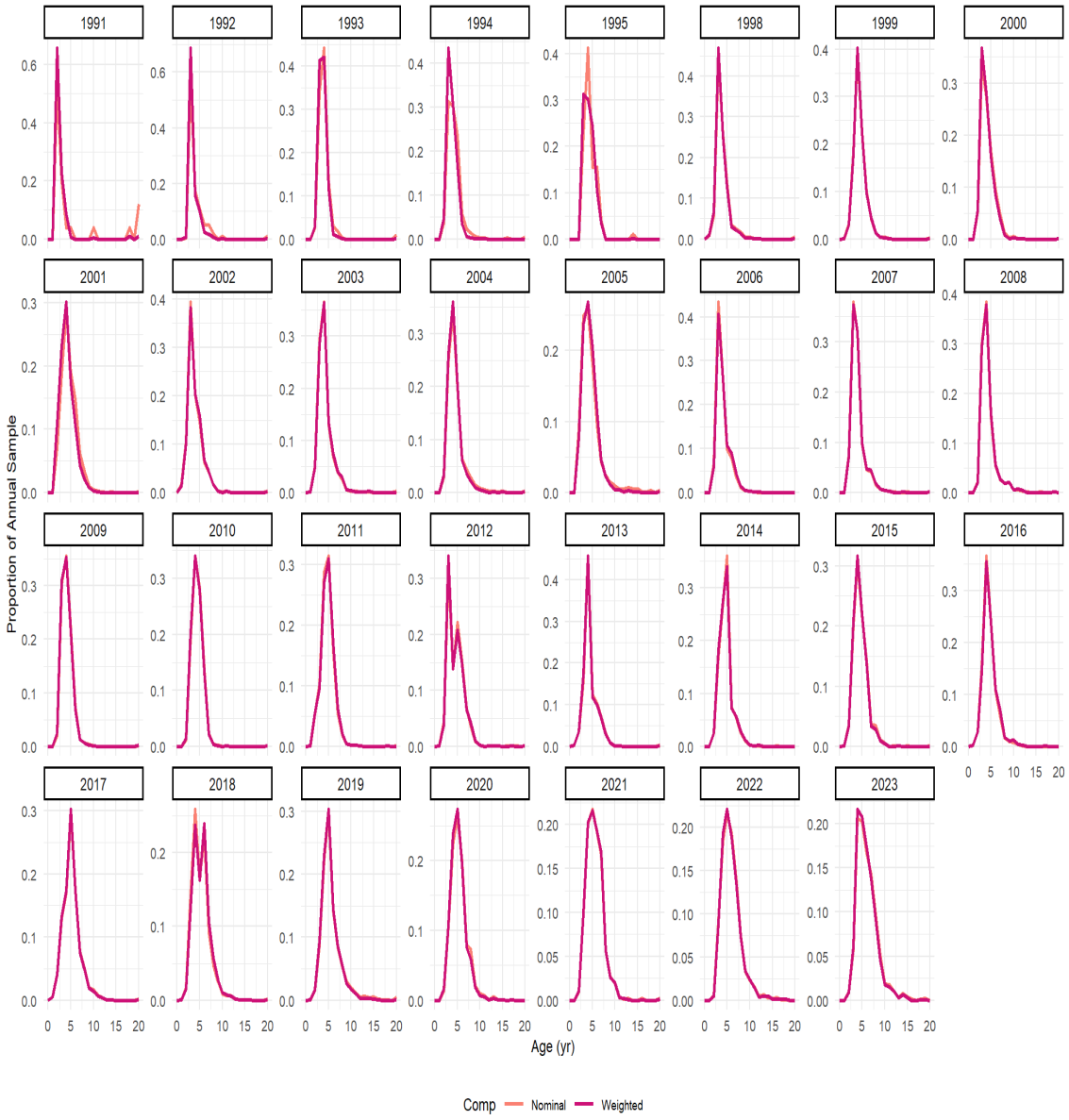

Figure A15: Comparison of nominal and weighted age compositions for the **HL West** fleet.

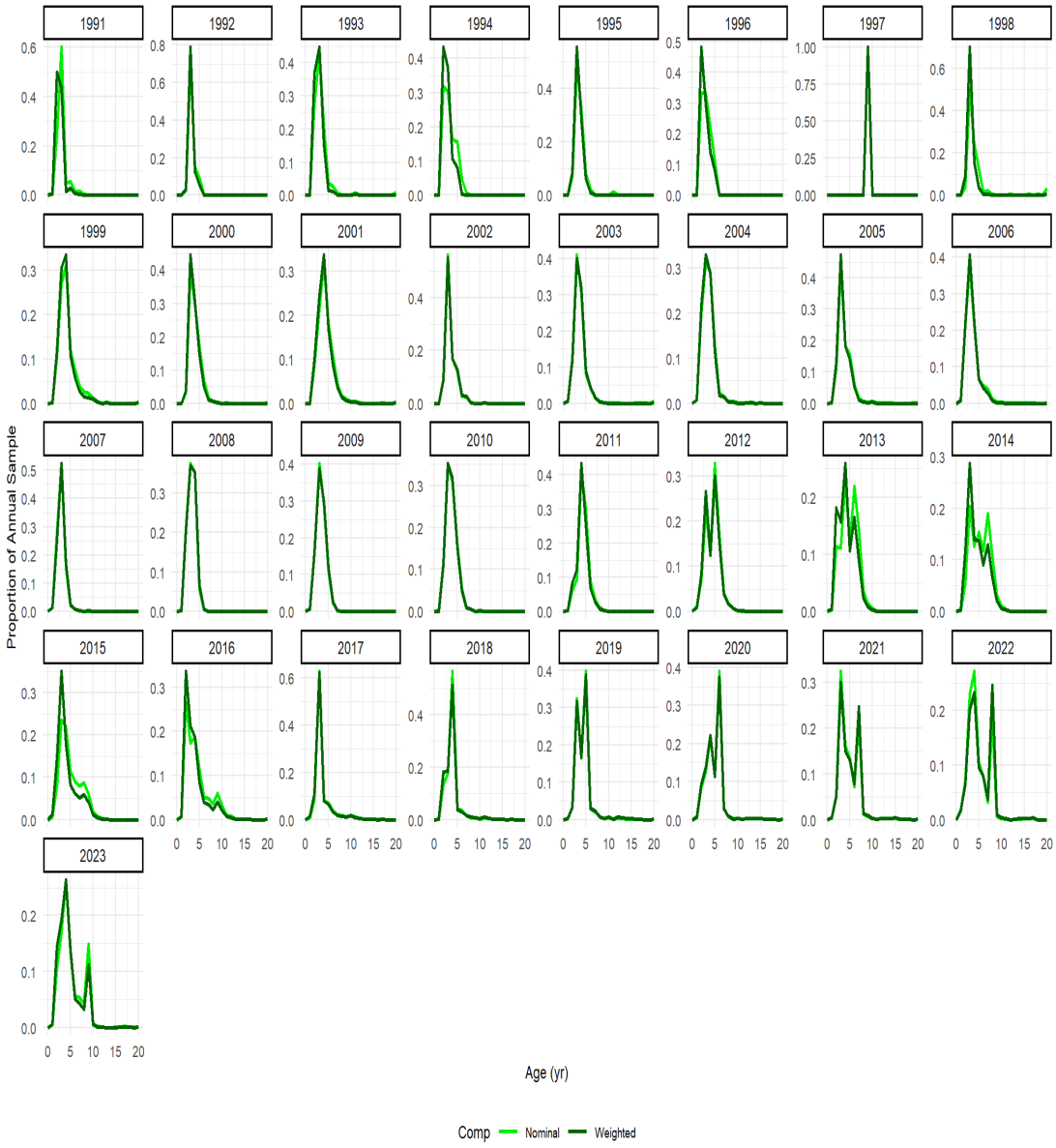

Figure A16: Comparison of nominal and weighted age compositions for the **HL Central** fleet.

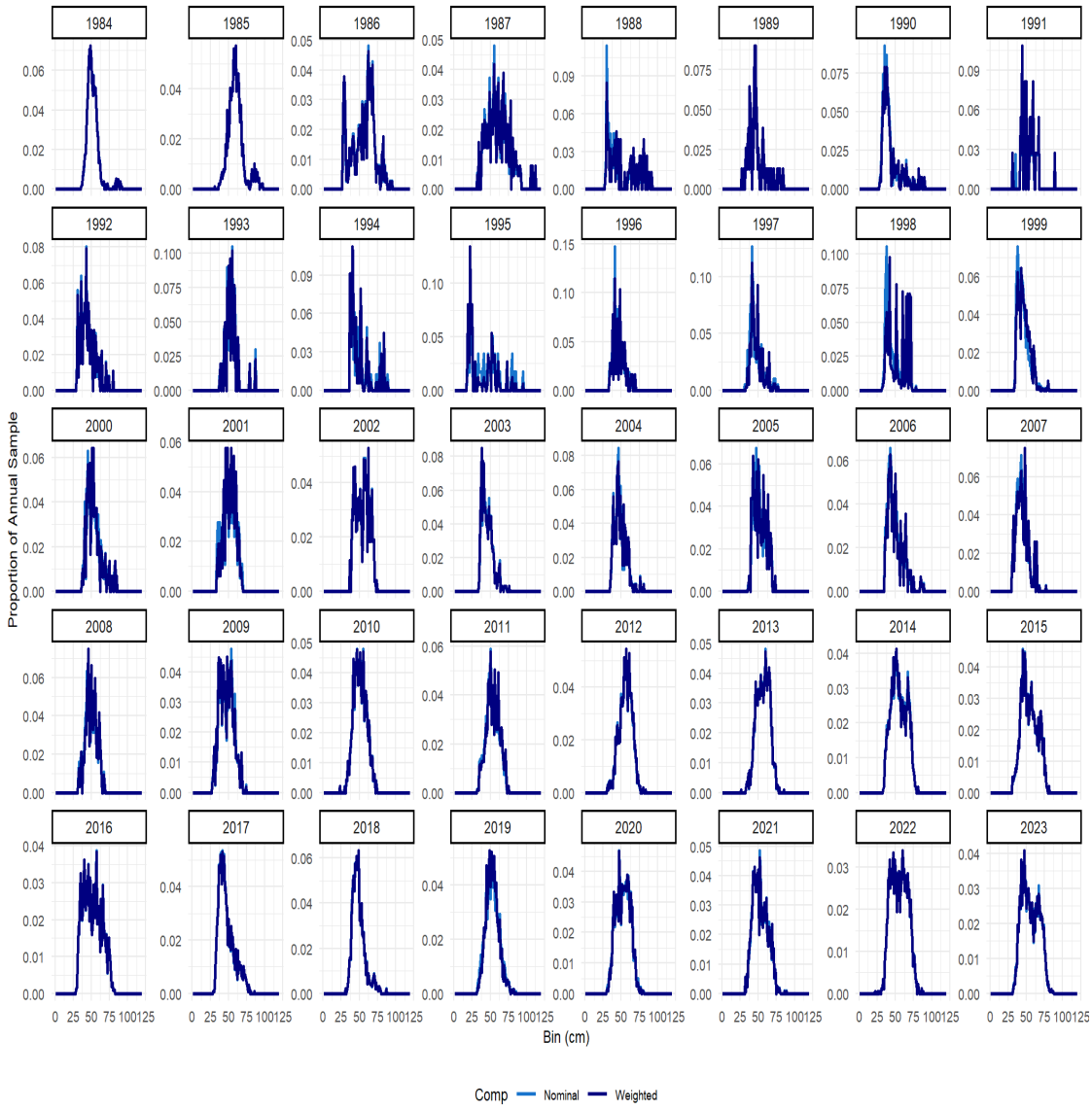

Figure A17: Comparison of nominal and weighted age compositions for the **HL East** fleet.

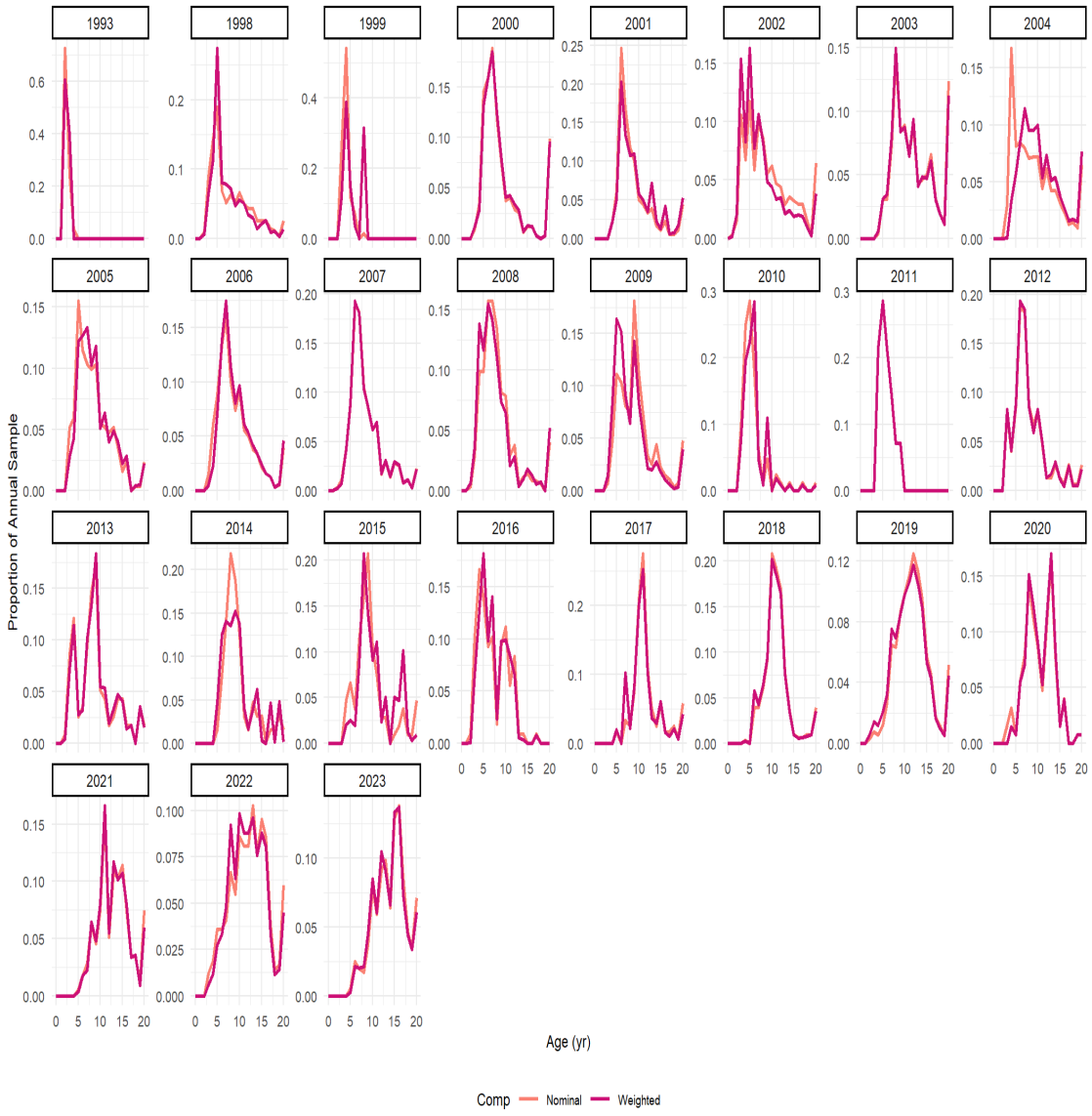

Figure A18: Comparison of nominal and weighted age compositions for the **LL West** fleet.

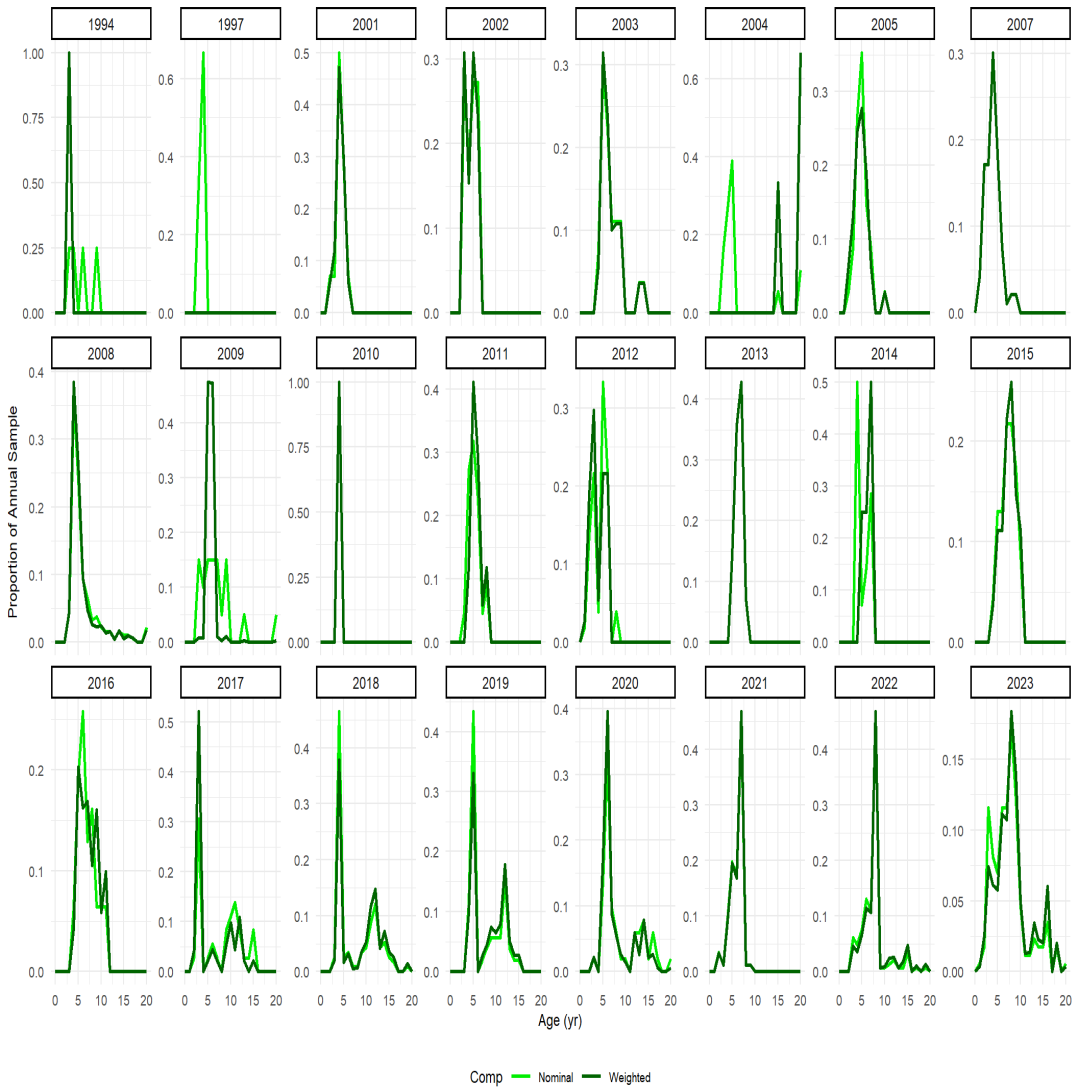

Figure A19: Comparison of nominal and weighted age compositions for the **LL Central** fleet.

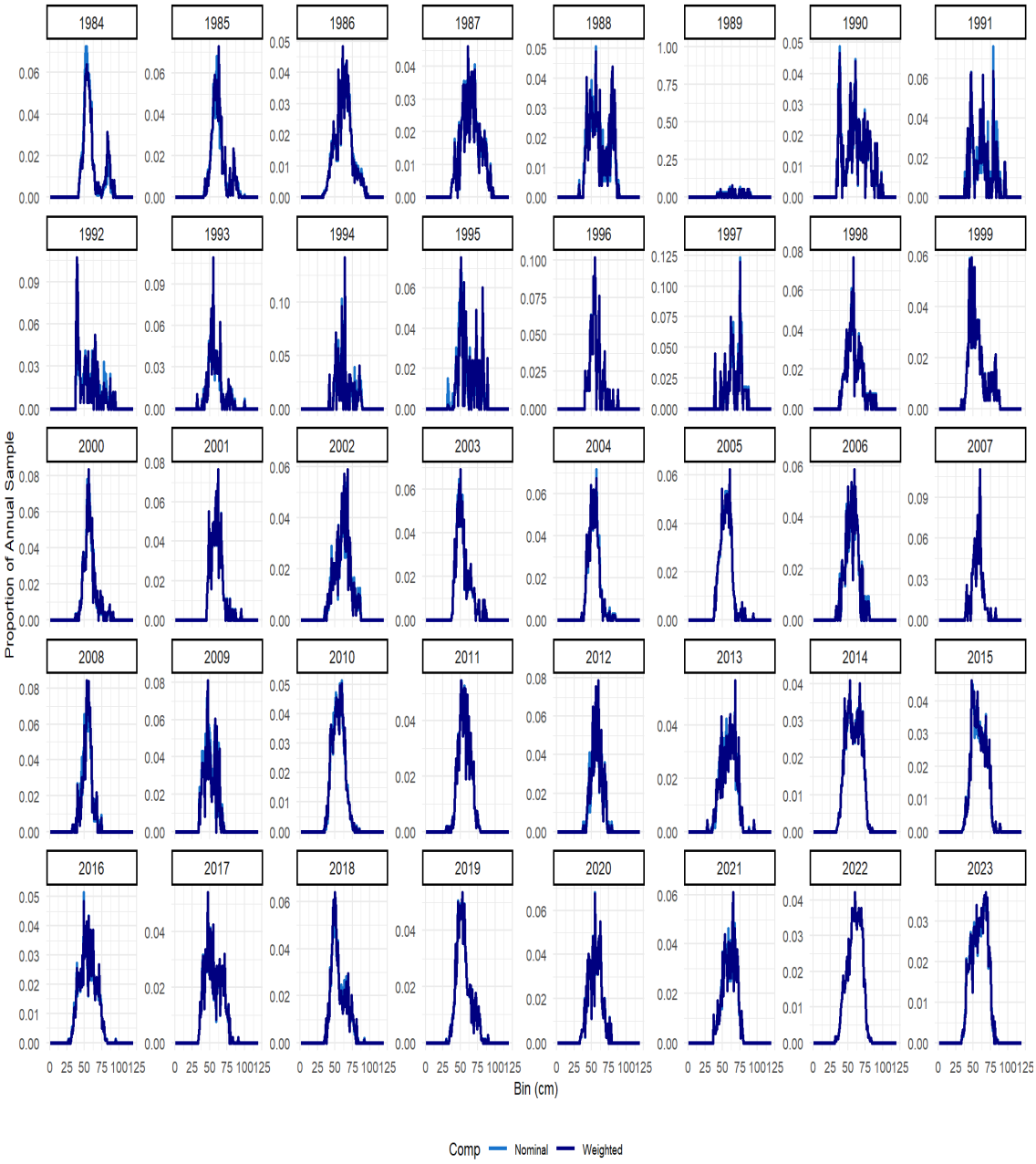

Figure A20: Comparison of nominal and weighted age compositions for the **LL East** fleet.

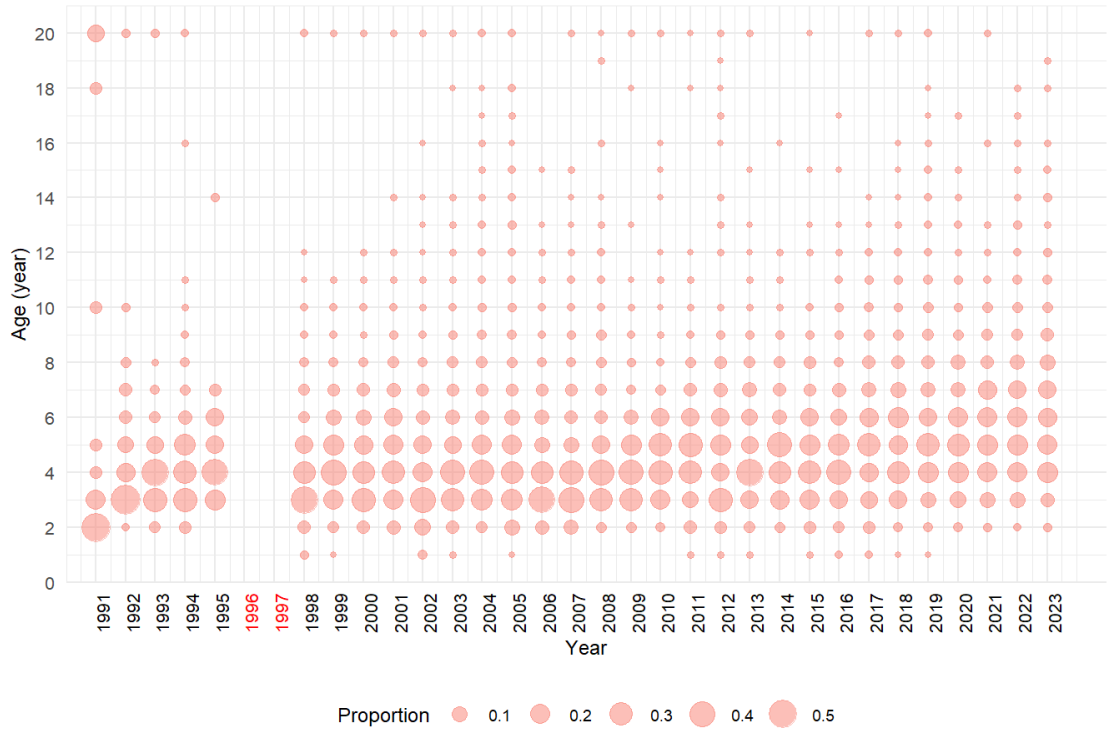

Figure A21: Nominal age compositions from the **HL West** fleet. Years in red do not meet the minimum threshold of 10 fish per strata.

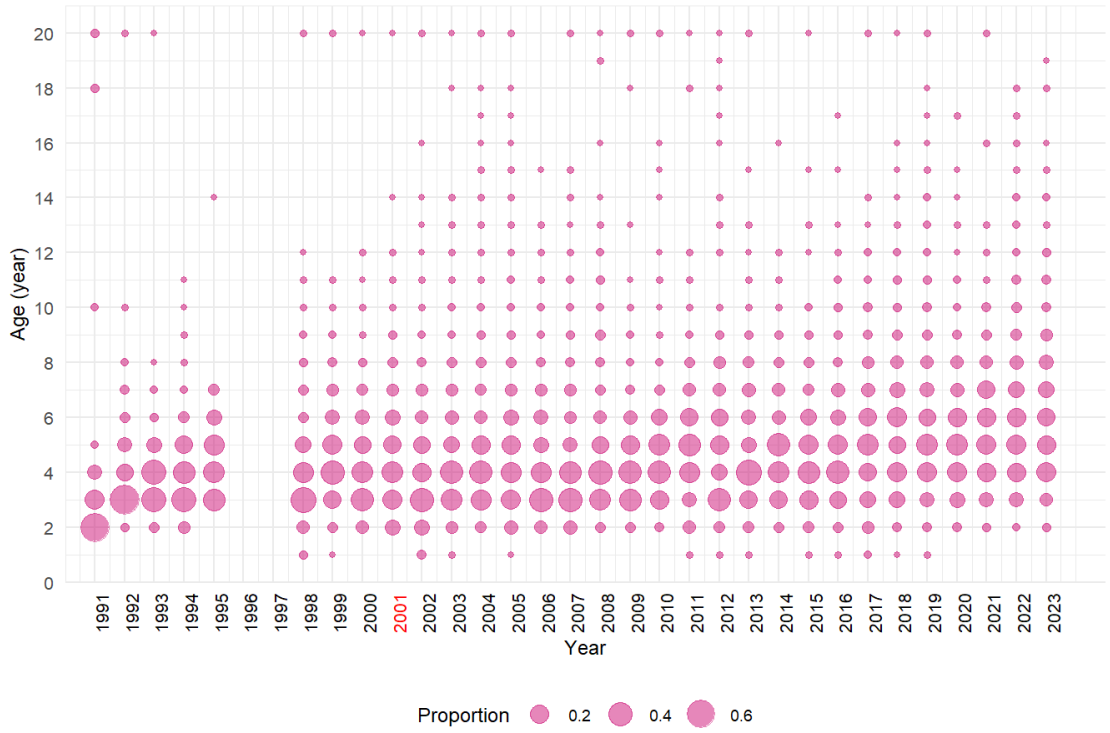

Figure A22: Weighted age compositions from the **HL West** fleet. Years in red do not meet the minimum threshold of 30 fish per at least 1 sub-weighting strata when calculating the weighted length compositions which are used to weight the age compositions.

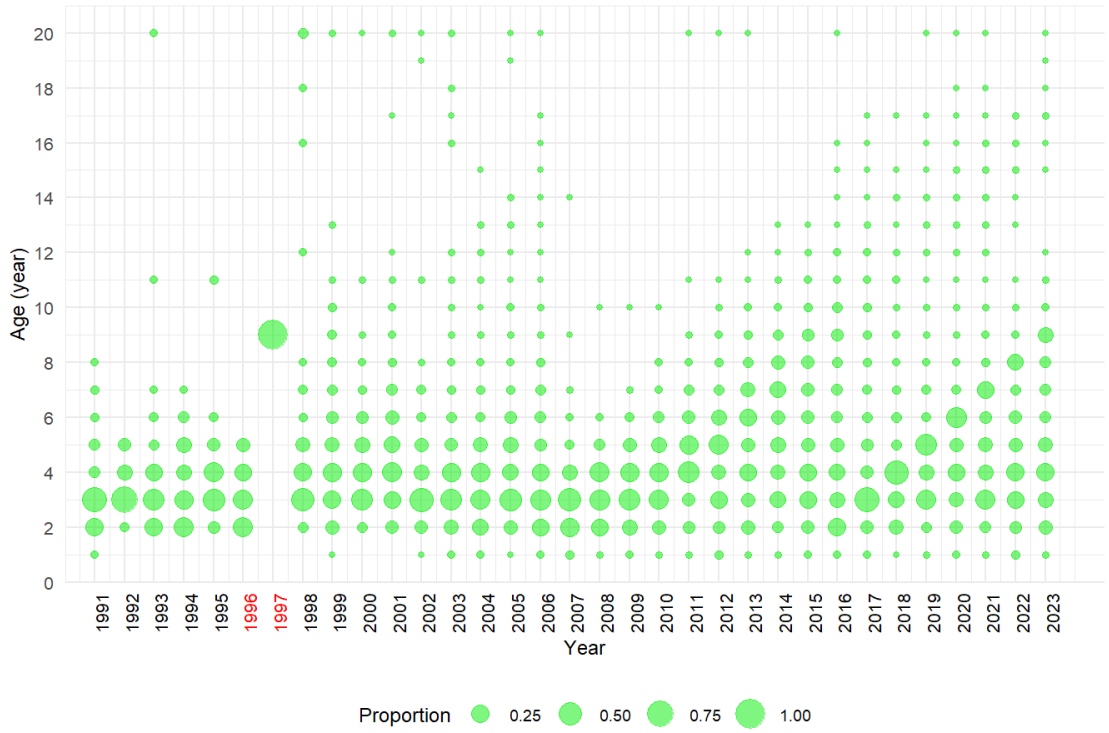

Figure A23: Nominal age compositions from the **HL Central** fleet. Years in red do not meet the minimum threshold of 10 fish per strata.

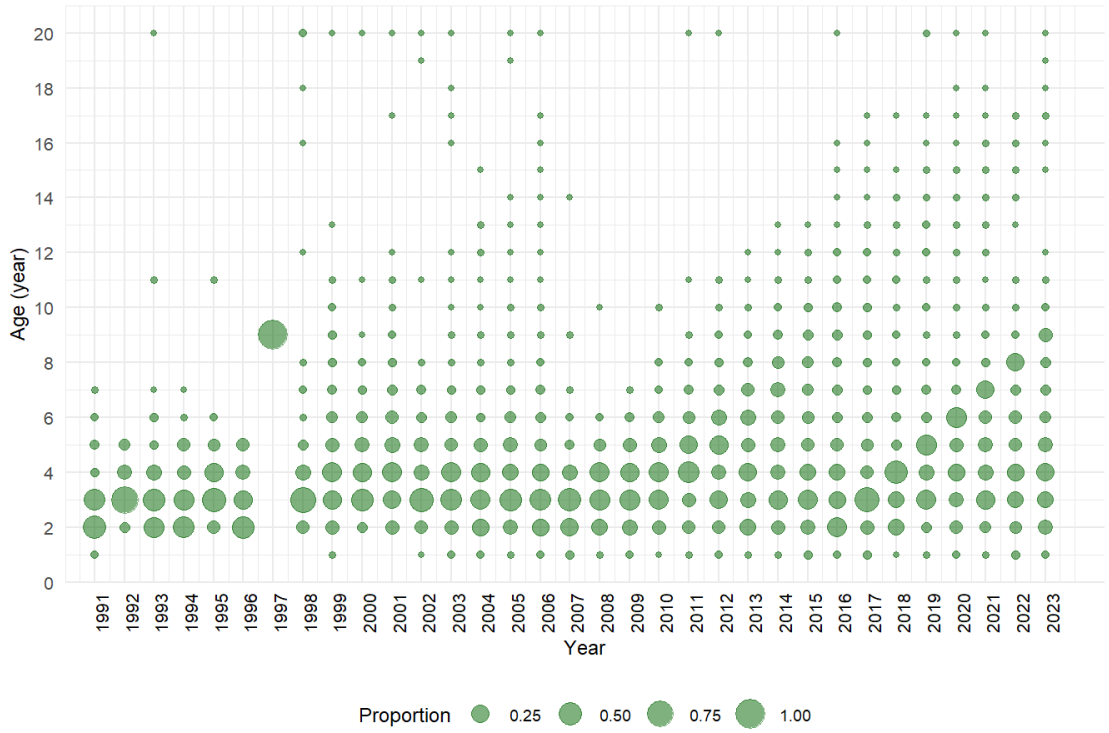

Figure A24: Weighted age compositions from the **HL Central** fleet. Years in red do not meet the minimum threshold of 30 fish per at least 1 sub-weighting strata when calculating the weighted length compositions which are used to weight the age compositions.

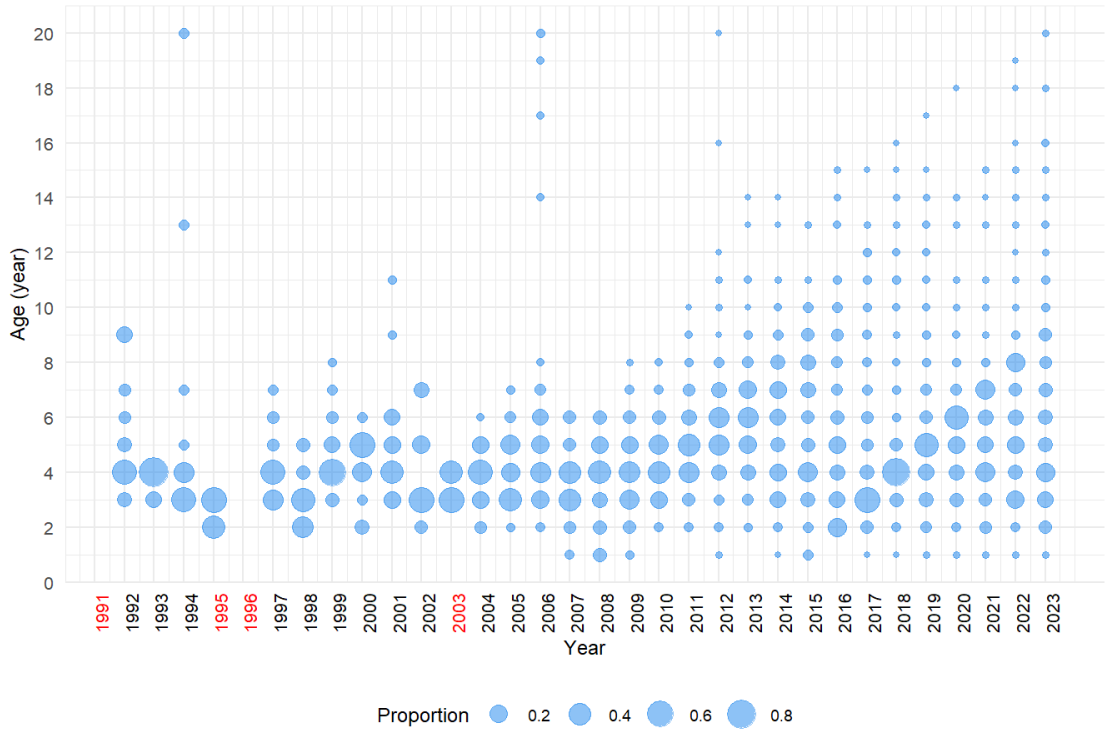

Figure A25: Nominal age compositions from the **HL East** fleet. Years in red do not meet the minimum threshold of 10 fish per strata.

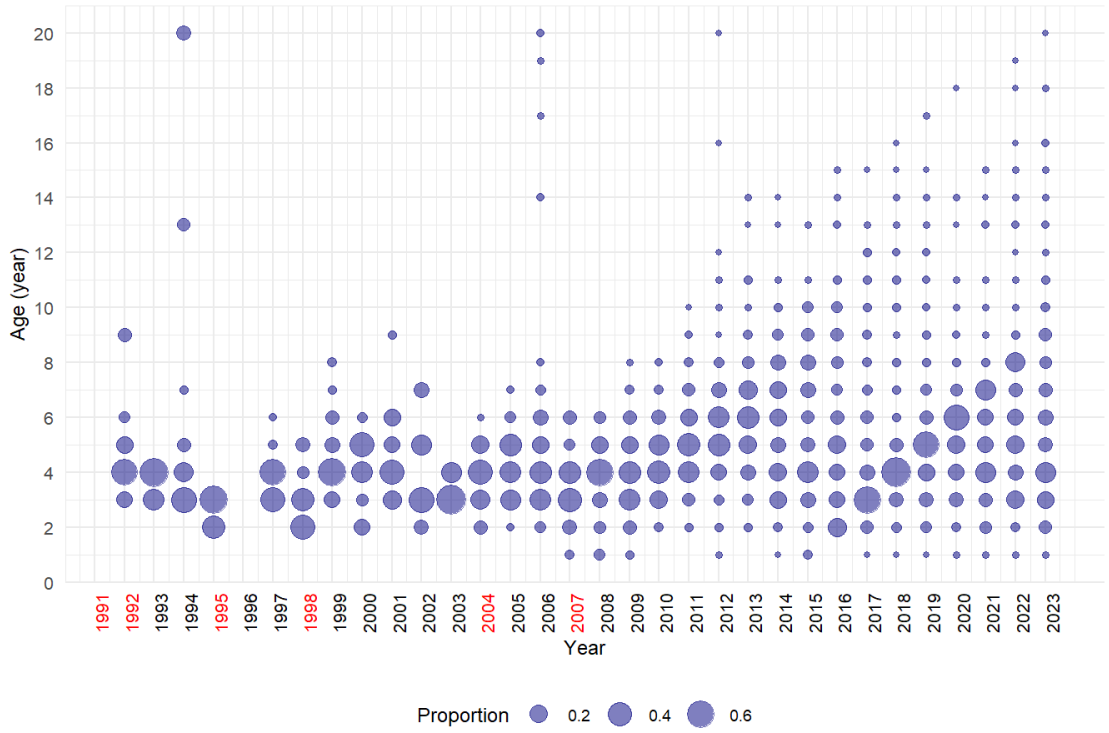

Figure A26: Weighted age compositions from the **HL East** fleet. Years in red do not meet the minimum threshold of 30 fish per at least 1 sub-weighting strata when calculating the weighted length compositions which are used to weight the age compositions.

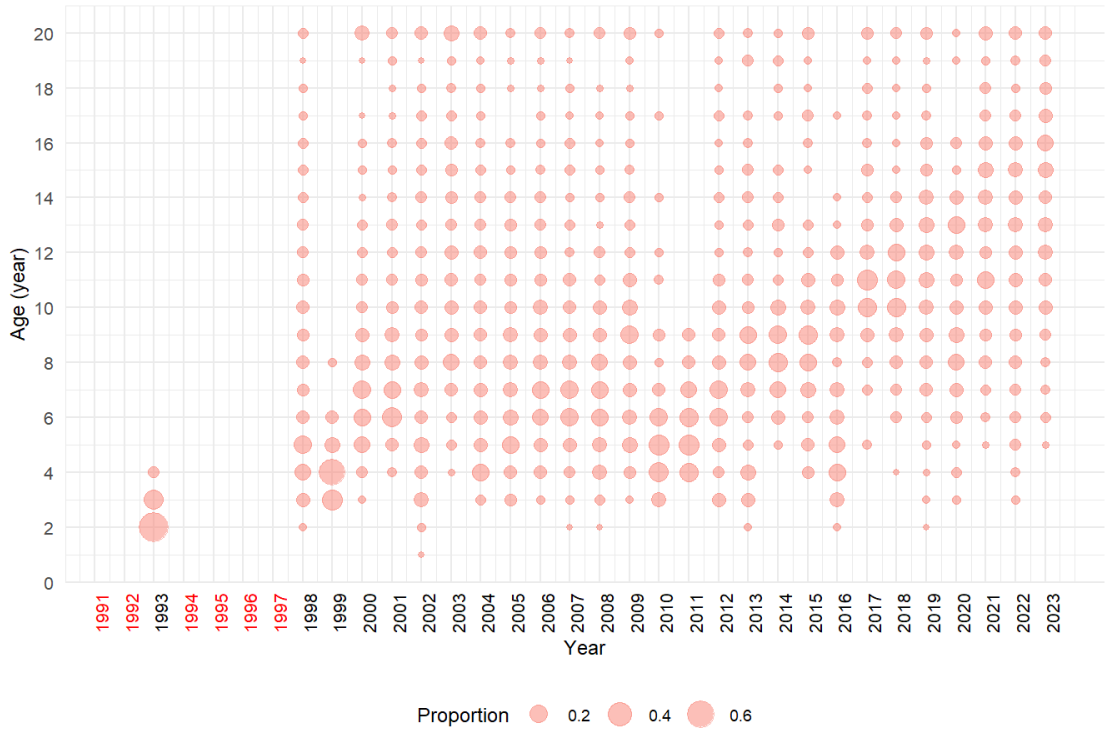

Figure A27: Nominal age compositions from the **LL West** fleet. Years in red do not meet the minimum threshold of 10 fish per strata.

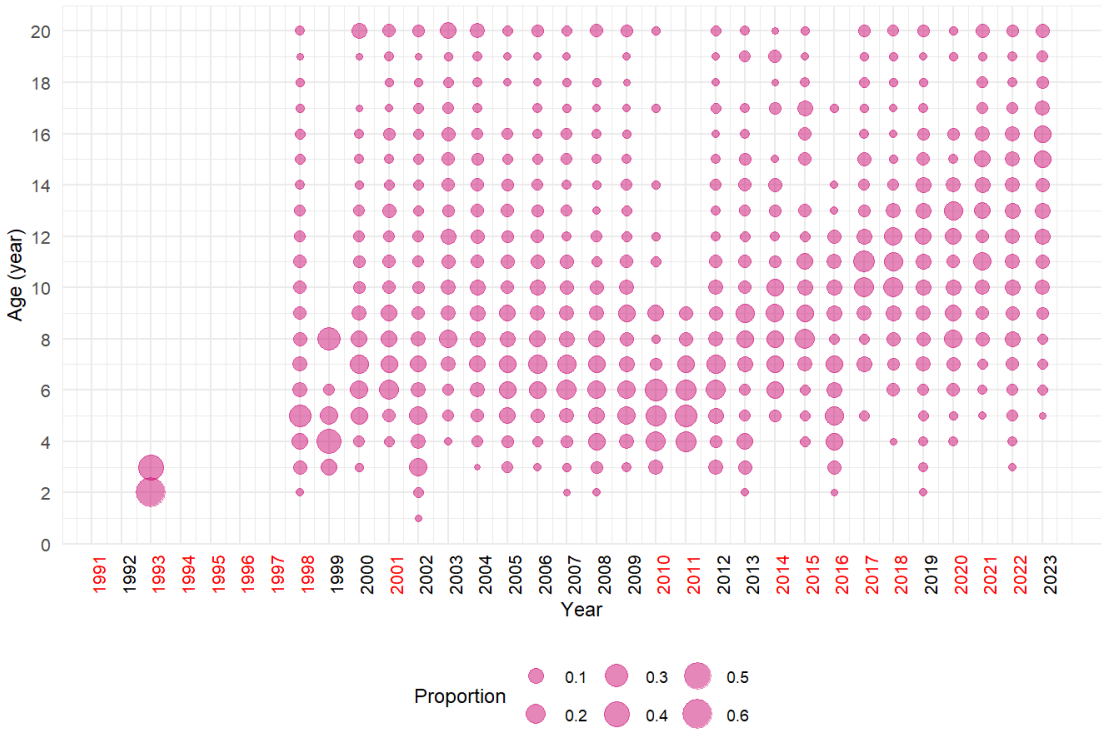

Figure A28: Weighted age compositions from the **LL West** fleet. Years in red do not meet the minimum threshold of 30 fish per at least 1 sub-weighting strata when calculating the weighted length compositions which are used to weight the age compositions.

Figure A29: Nominal age compositions from the **LL Central** fleet. Years in red do not meet the minimum threshold of 10 fish per strata.

Figure A30: Weighted age compositions from the **LL Central** fleet. Years in red do not meet the minimum threshold of 30 fish per at least 1 sub-weighting strata when calculating the weighted length compositions which are used to weight the age compositions.

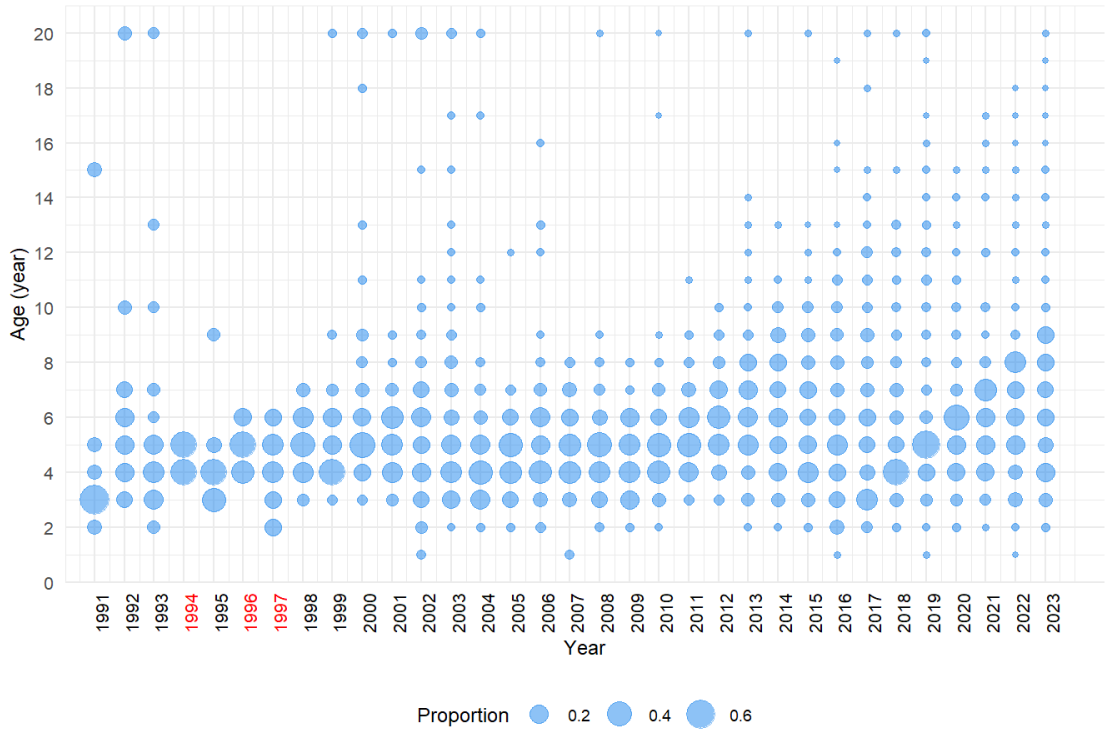

Figure A31: Nominal age compositions from the **LL East** fleet. Years in red do not meet the minimum threshold of 10 fish per strata.

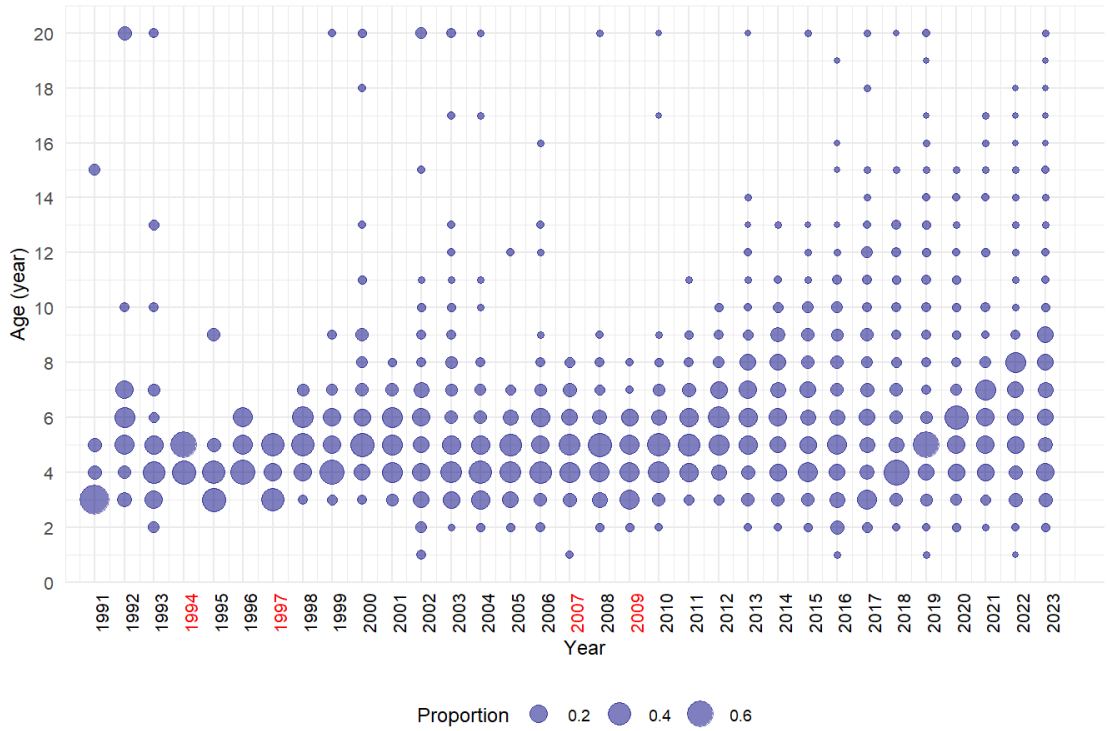

Figure A32: Weighted age compositions from the **LL East** fleet. Years in red do not meet the minimum threshold of 30 fish per at least 1 sub-weighting strata when calculating the weighted length compositions which are used to weight the age compositions.

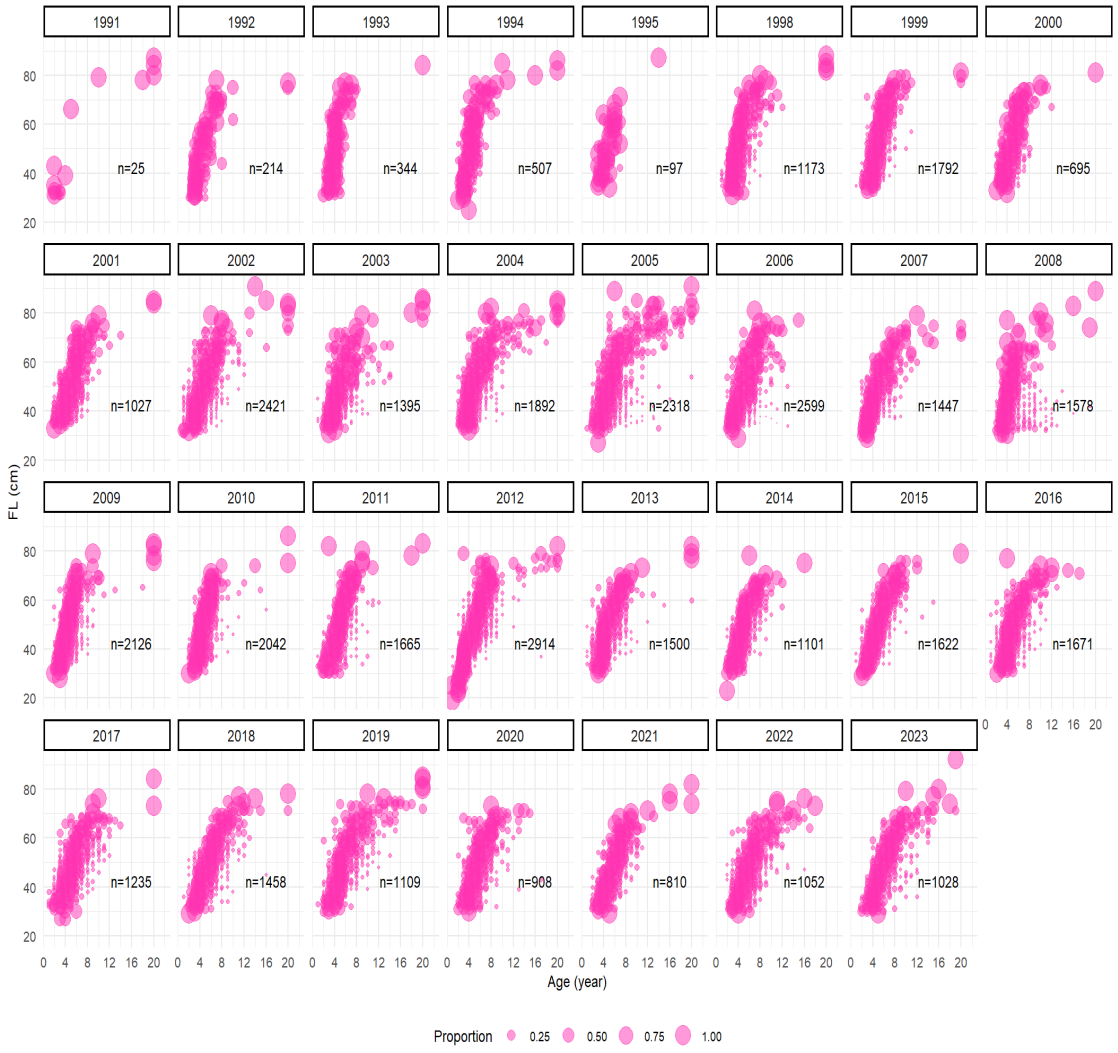

Figure A33: Conditional Age-at-Length (CAAL) for the **HL West** Fleet.

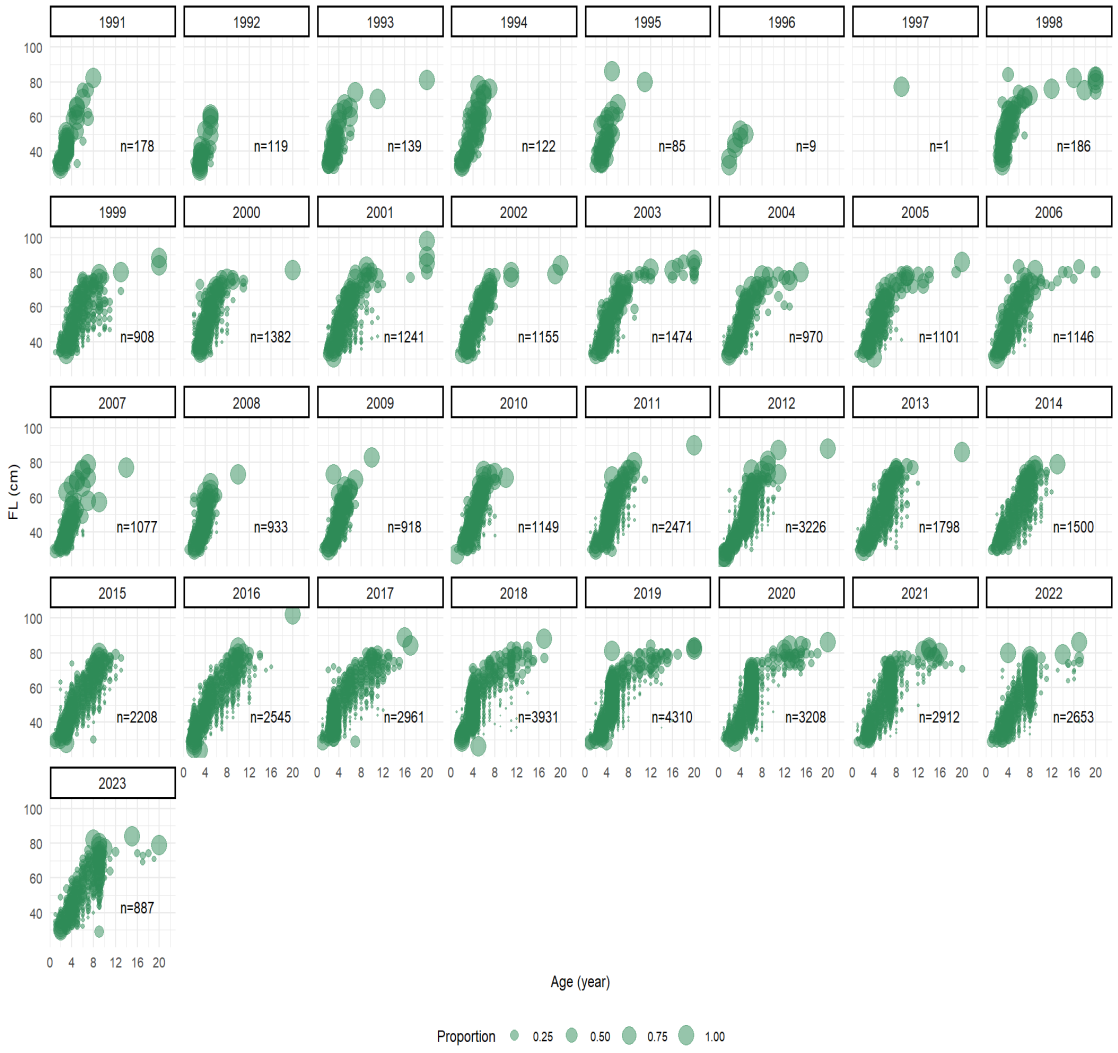

Figure A34: Conditional Age-at-Length for the **HL Central** Fleet.

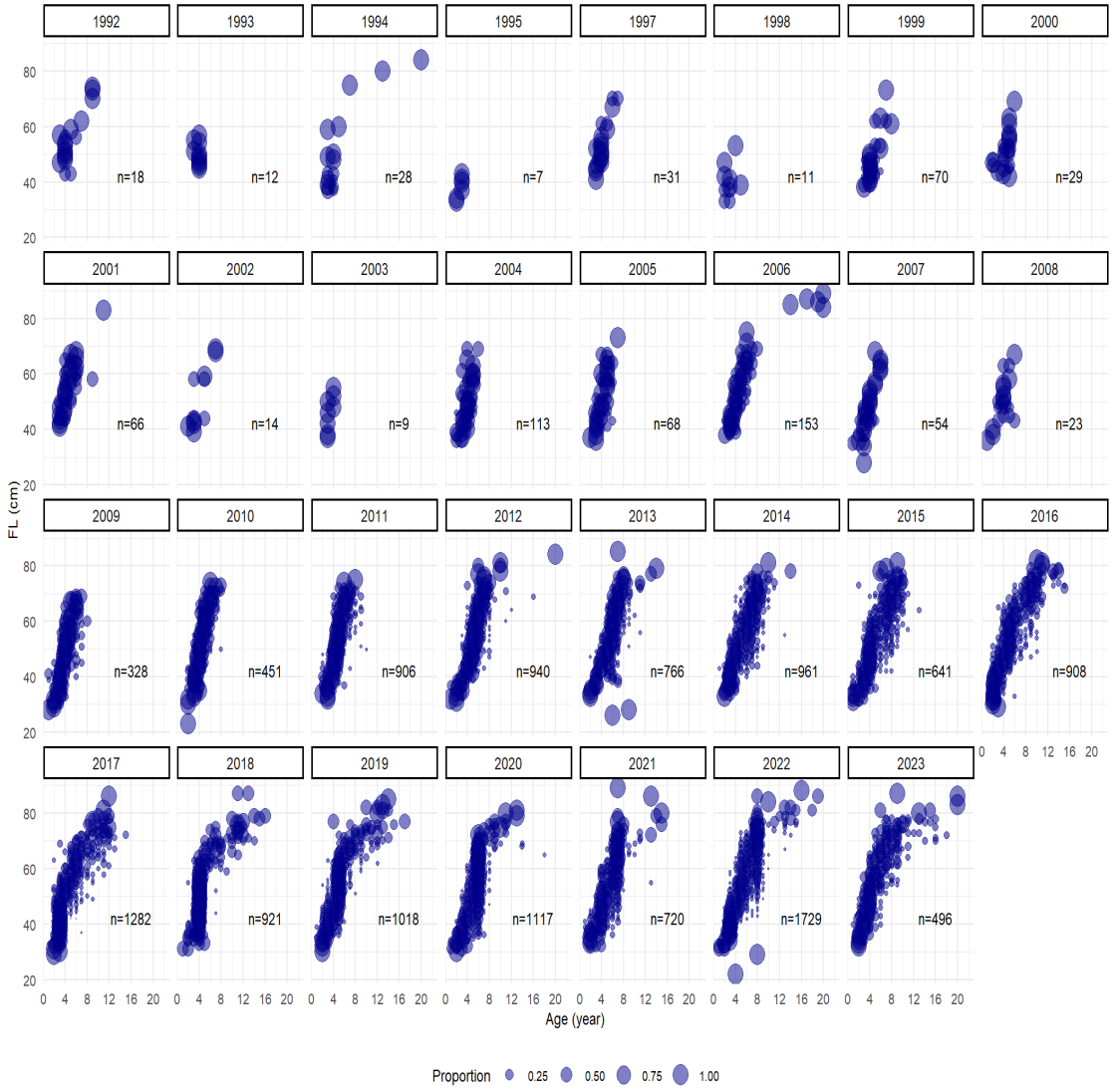

Figure A35: Conditional Age-at-Length for the **HL East** Fleet.

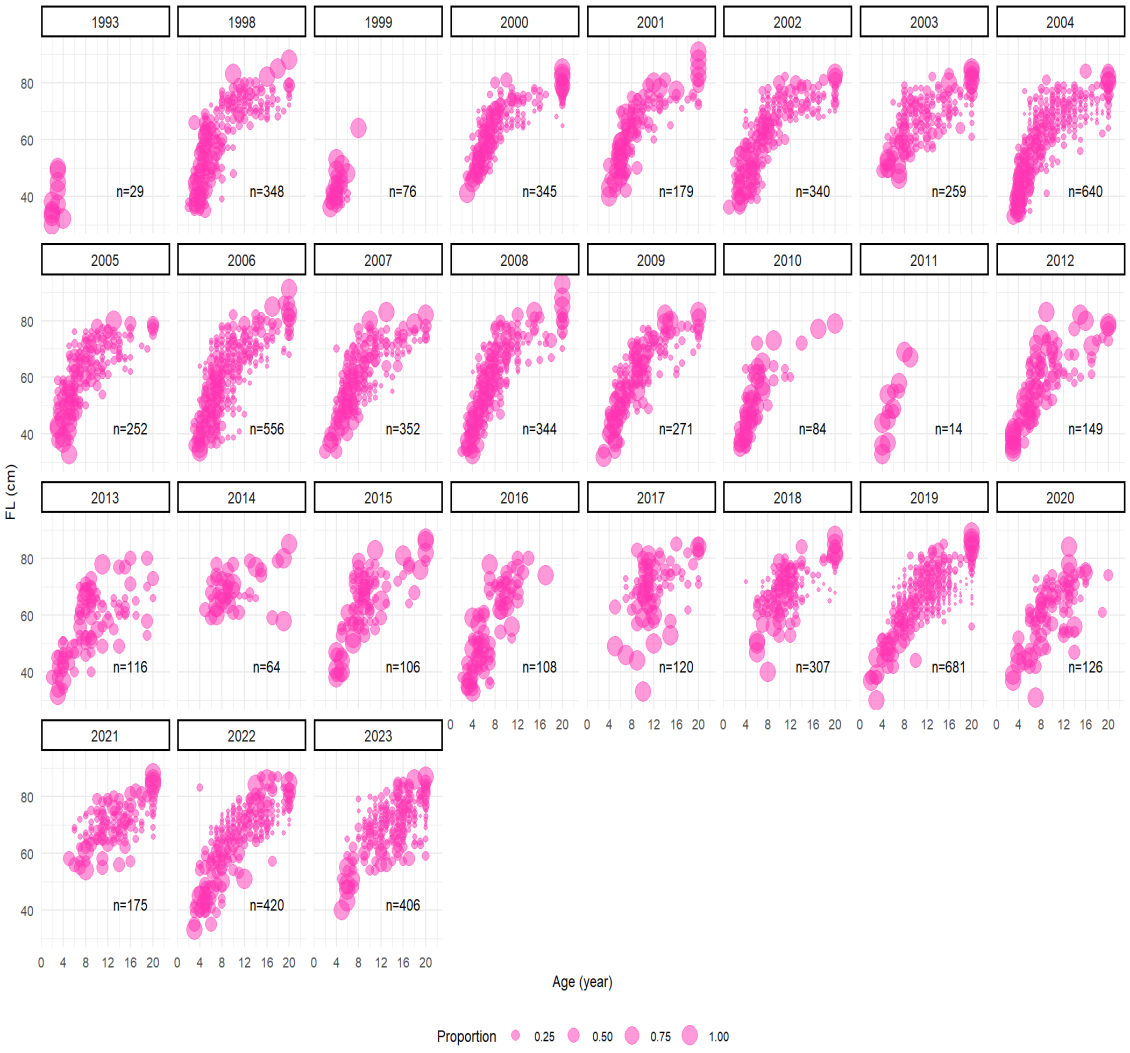

Figure A36: Conditional Age-at-Length for the **LL West** Fleet.

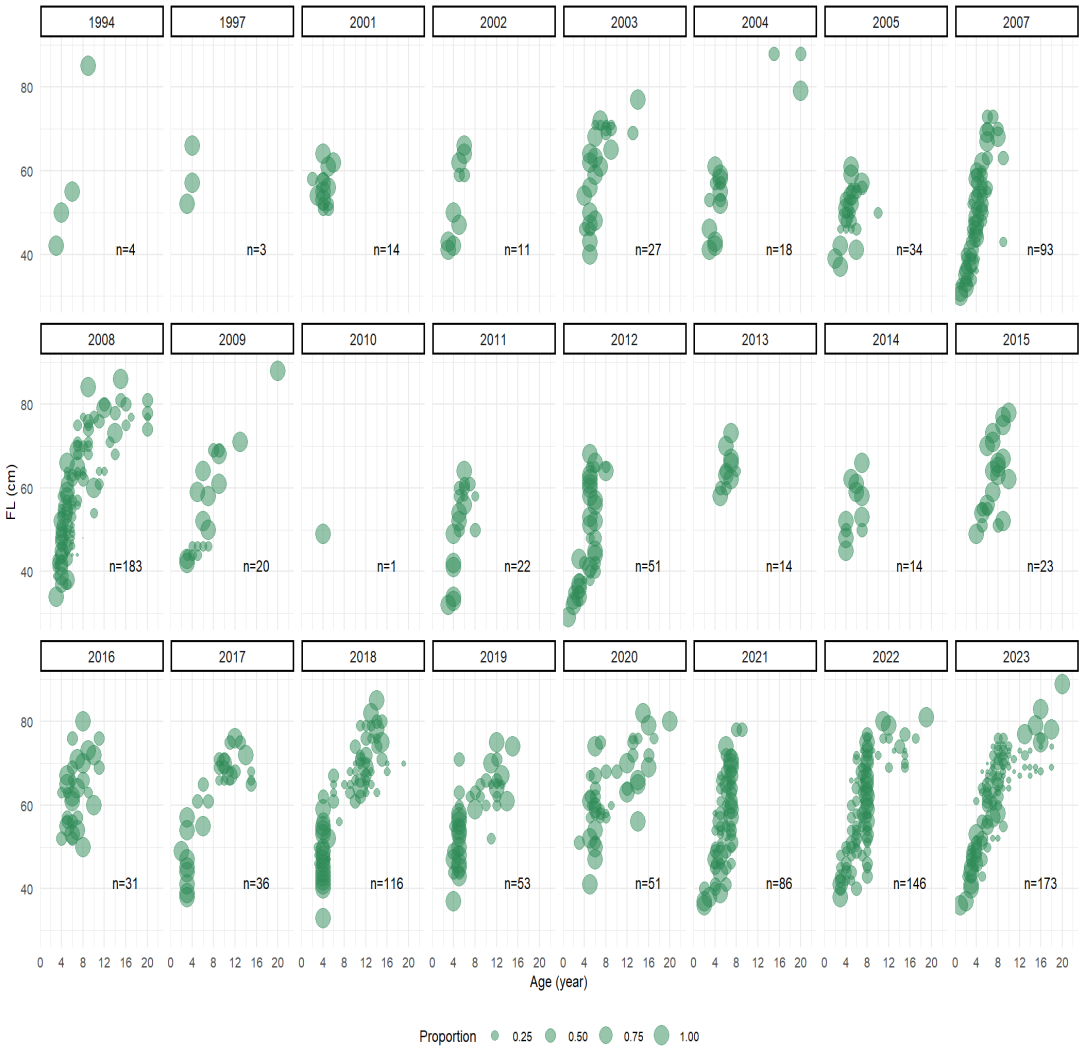

Figure A37: Conditional Age-at-Length for the **LL Central** Fleet.

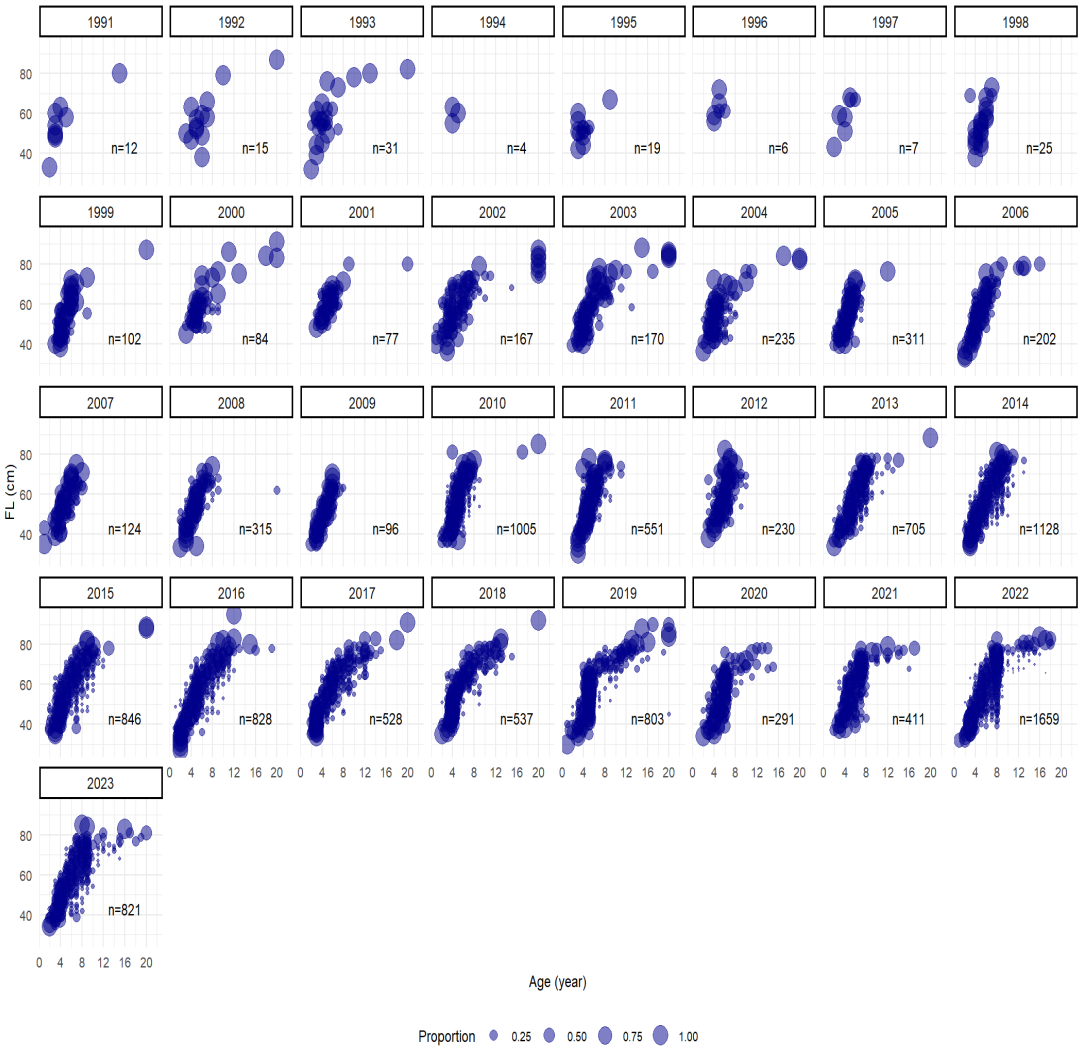

Figure A38: Conditional Age-at-Length for the **LL East** Fleet.

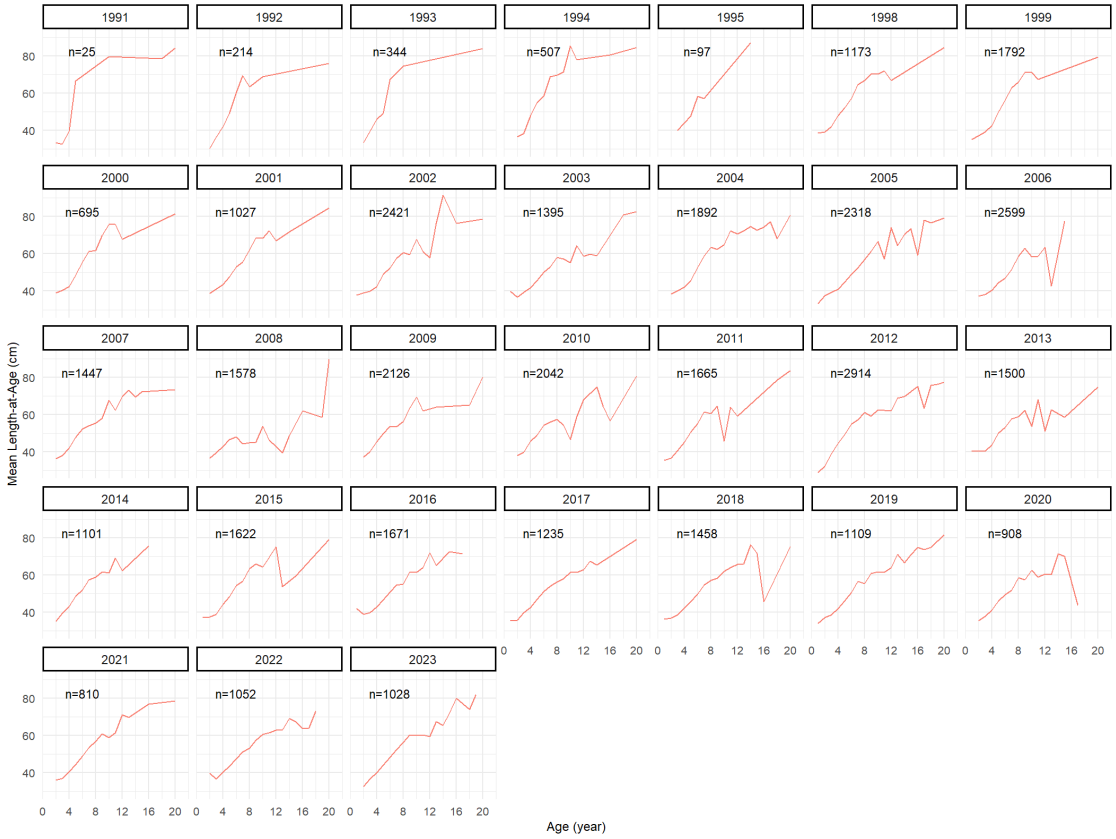

Figure A39: Mean Length-at-Age for the **HL West** Fleet.

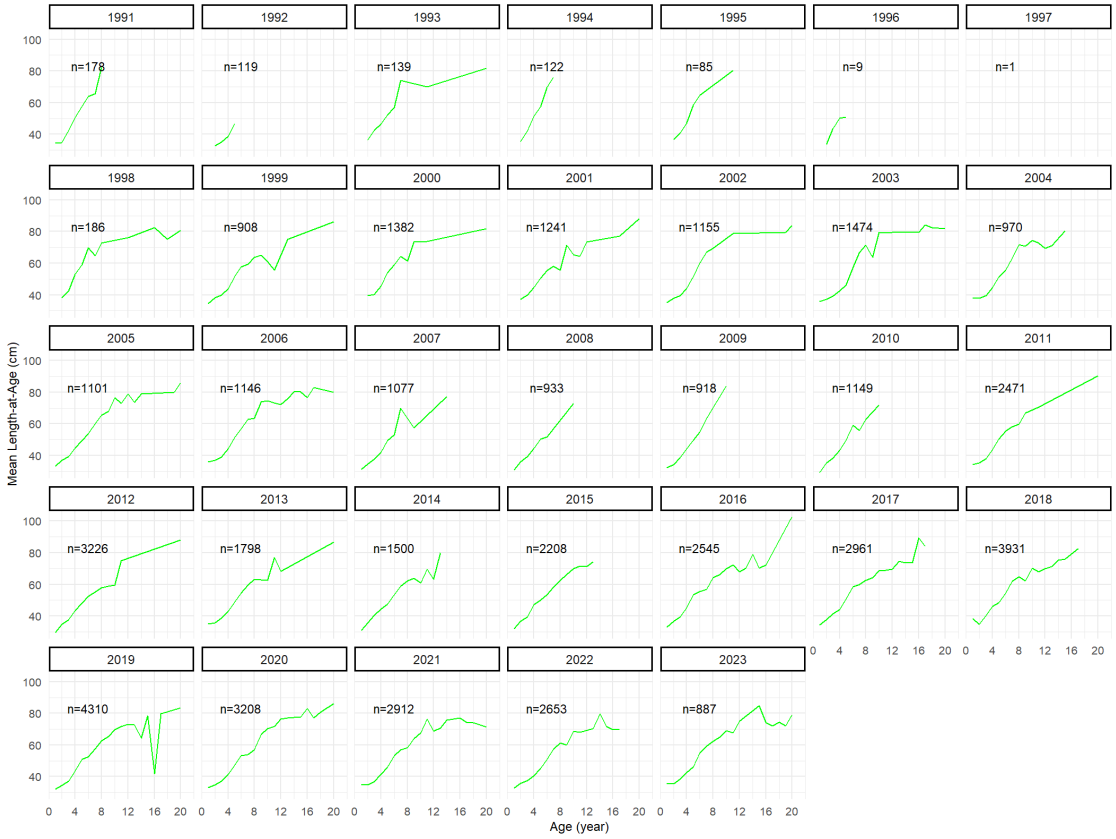

Figure A40: Mean Length-at-Age for the **HL Central** Fleet.

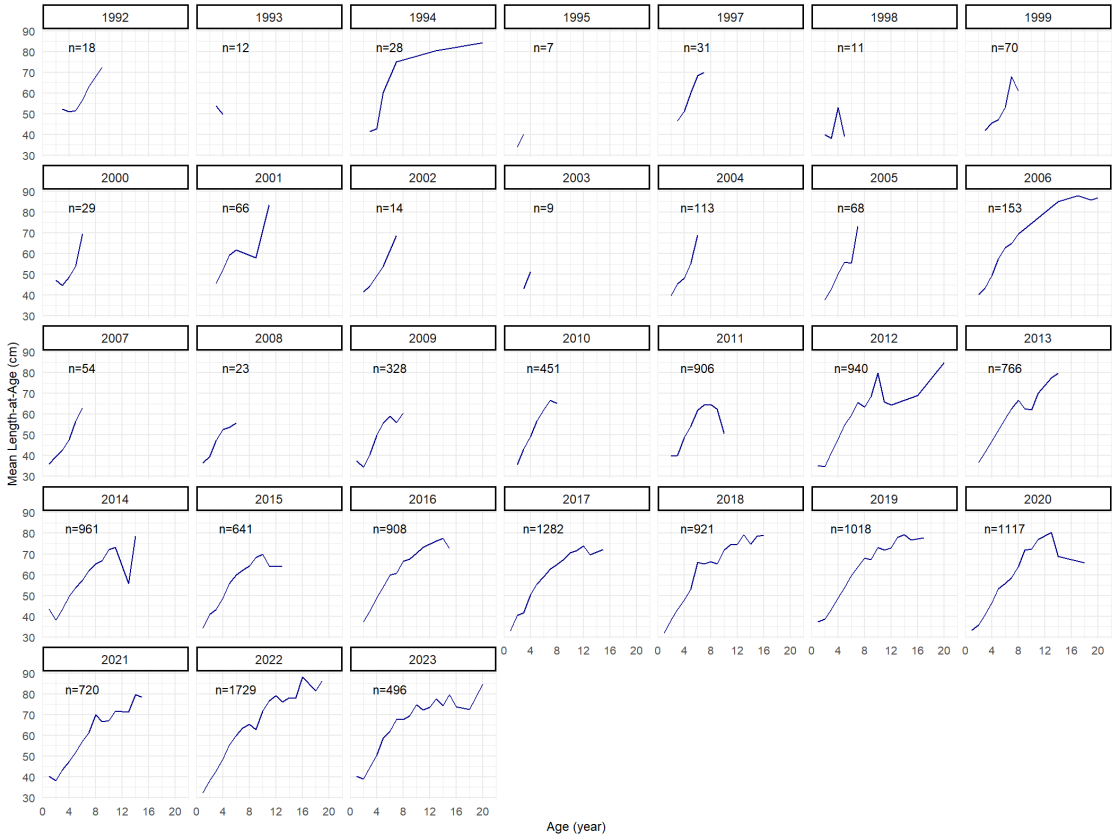

Figure A41: Mean Length-at-Age for the **HL East** Fleet.

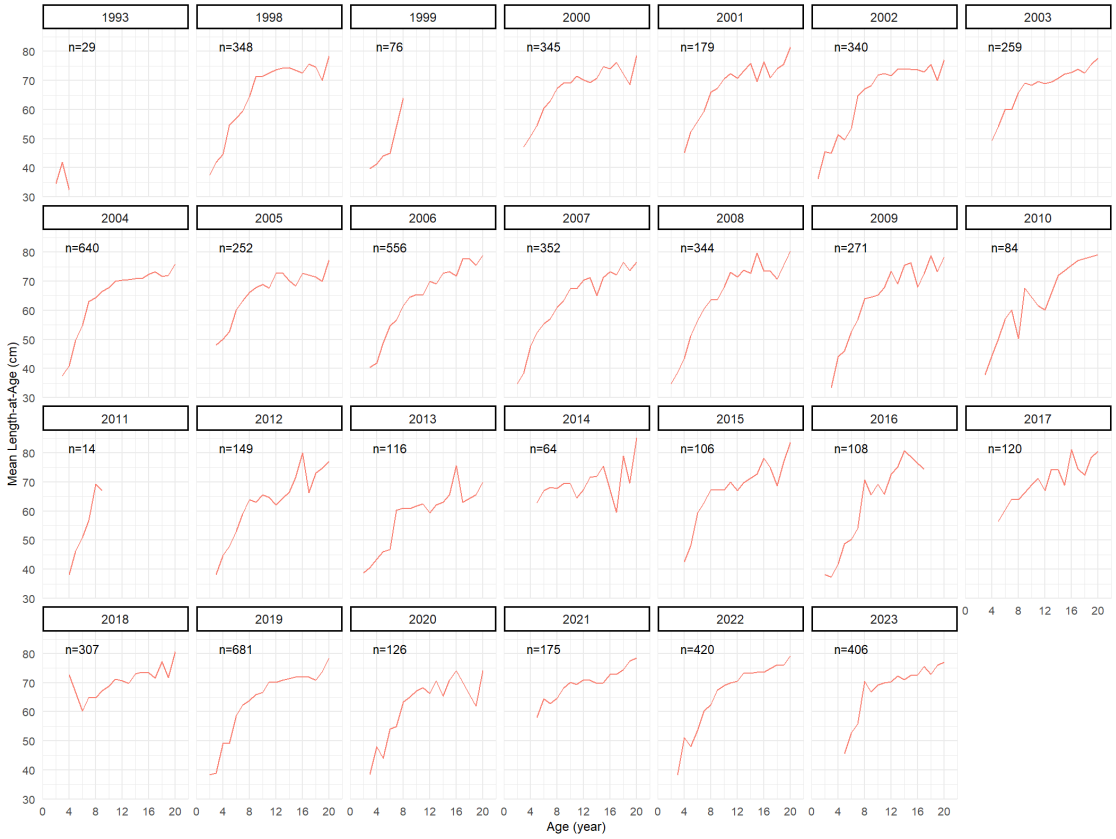

Figure A42: Mean Length-at-Age for the **LL West** Fleet.

Figure A43: Mean Length-at-Age for the **LL Central** Fleet.

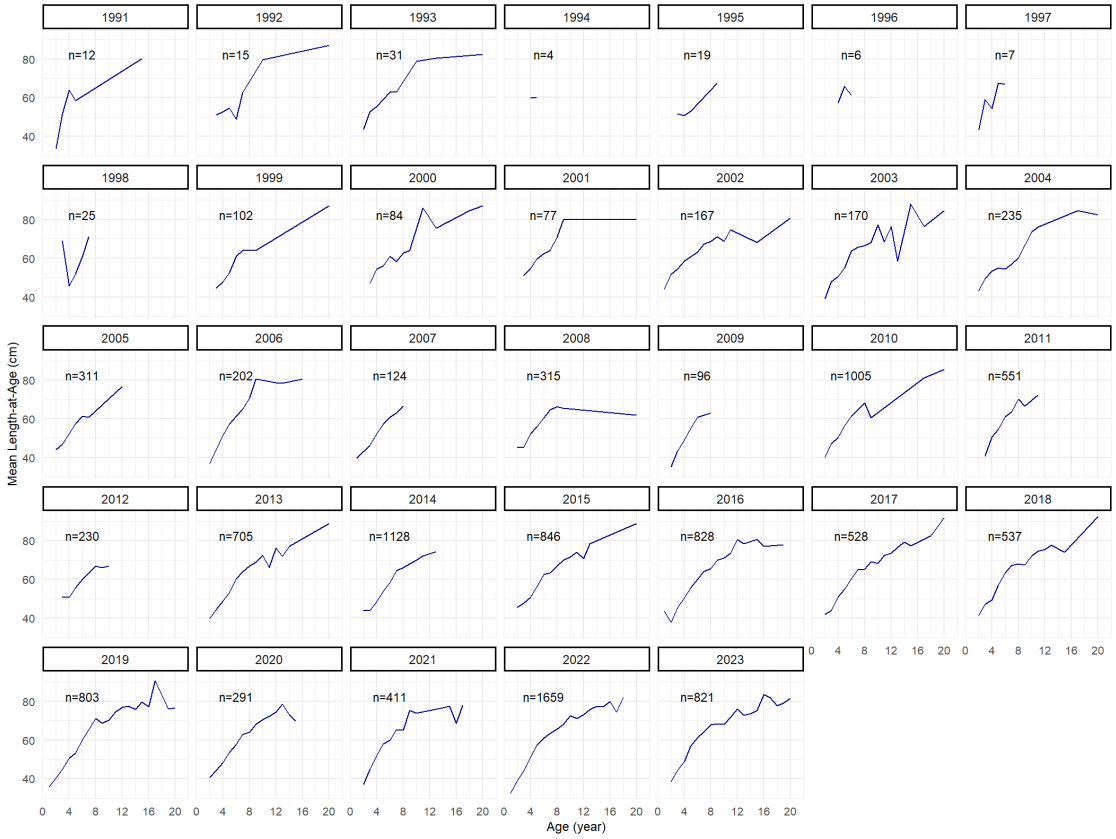

Figure A44: Mean Length-at-Age for the **LL East** Fleet.