Gulf of America Gray Triggerfish (*Balistes capriscus*) length and age compositions from the recreational fishery

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SEDAR100-DW-04

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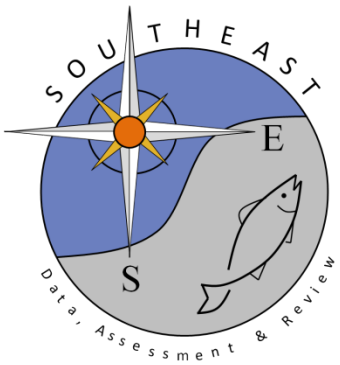

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Updates from Pre-Data Workshop Submission

The recreational compositions presented in this Appendix are the final length and age compositions provided for SEDAR 100. There have been multiple changes to the length and age data that were submitted prior to the Data Workshop. Updated morphometric equations for Gray Triggerfish were provided in Table 3 of SEDAR 100-DW-14 and these equations were recommended for use during the Data Workshop. The algorithm used to assign calendar age was also updated and new ages were assigned to young (age 0-2) fish (see Life History Section of SEDAR 100 Data Workshop report for full details). Three lengths that were previously included in preliminary length compositions were excluded as potential outliers. The final number of length samples included in length compositional analyses is 71,644 (Tables A1 and A2). Five age samples were excluded from the updated age file and the final number of age samples included in age composition analyses is 9,284 (Table A3).

There is a single recreational fleet for SEDAR 100 Gray Triggerfish consisting of the charter, private, and headboat modes. Length and age compositions were requested for two different stock structure scenarios. In the first, the entire Gulf is treated as a single stock. In the second, the Gulf is divided into two stocks with a West stock defined as Texas to Louisiana) and an East stock defined as Mississippi to the west coast of Florida). Prior to the data workshop, nominal length and age compositions, Conditional Age-at-Length (CAAL), and Mean Length-at-Age (MLAA) were provided for discussion. The final outputs of these analyses are provided below, in addition to final weighted length and age compositions.

Introduction

This document provides preliminary nominal length and age compositions, conditional age-at-length (CAAL), and mean length-at-age (MLAA) of recreational landings for the SEDAR 100 Gray Triggerfish (*Balistes capriscus*) assessment. Sample sizes are also included in this document to help facilitate discussion at the Data Workshop about potential options for providing weighted compositions. After the Data Workshop, this Working Paper will be updated with an appendix that contains the final length and age compositions.

Data Description

SEDAR 100 assesses all Gulf of America Gray Triggerfish in federal waters extending from the Texas/Mexico border and eastward to the west coast of Florida at the Collier/Monroe county line. A total of 71,647 lengths from 16 sampling programs (Tables 1 and 2) were included in the nominal length compositions and 9,289 ages from 13 programs (Table 1 and 3) were included in the nominal age compositions, CAAL, and MLAA analyses.

The sampling programs contributing the largest numbers of length and/or age samples are described below.

Marine Recreational Information Program (MRIP)

MRIP (formally known as the Marine Recreational Fishing Statistics Survey, MRFSS) began in March 1981. In the Gulf of America, the MRIP survey is conducted in FL, AL, and MS. MRIP was also conducted in LA from 1981-2013. The access point angler intercept survey (APAIS) component of MRIP collects information on recreational catch and fishing trip characteristics, including fish lengths and weights, from anglers at public marine fishing access sites. In the Gulf of America, APAIS samples recreational fishers from private, shore, and charterboat modes. APAIS sampling was temporarily suspending during Wave 2 in 2020 because of the COVID pandemic. APAIS sampling resumed in all states by August 2020 (Wave 4), however, sampling of fish lengths and weights were reduced due to social distancing guidelines and field officer safety protocols (NMFS OST 2023). For intercepted angler trips where both fish length and weight are missing, MRIP uses hot and cold-deck imputation to impute lengths (NMFS OST 2023). Imputed lengths were excluded from length composition analyses. MRIP provided 29,634 Gray Triggerfish lengths. MRIP dockside samplers do not collect age structures from intercepted fish.

Texas Parks and Wildlife Department Sportfish Monitoring Program (TPWD)

TPWD is a dockside-intercept survey that samples private and charterboat anglers in TX marine waters and began in May 1983. The TX coast is stratified into eight bay systems (Sabine Lake, Galveston Bay, Matagorda Bay, San Antonio Bay, Aransas Bay, Corpus Christi Bay, Upper Laguna Madre, and Lower Laguna Madre) and five Gulf of America strata. Sites are selected randomly based on proportional probability of expected fishing pressure. Within sites, sampling assignments are assigned to ensure that the samples are distributed across seasons (e.g. high-use and low-use) and day type (e.g. weekend, weekday). During the dockside interview, the maximum total lengths from up to 6 individuals per species (from a priority list) are recorded (Nuttall and Matter 2020). TPWD provided lengths from 3,255 Gray Triggerfish. TPWD dockside samplers do not collect aging structures from intercepted fish.

Southeast Region Headboat Survey (SRHS)

The SRHS program estimates landings and effort for headboat vessels. In the Gulf of America, the SRHS program began in 1986 and extends from Monroe County, FL to South Padre Island, TX (Cheshire et al. 2023). Biological samples (e.g. length, weight, and age structures) are collected as part of the SRHS dockside intercept sampling program (DISP) component of the SRHS program (Fitzpatrick et al. 2017). DISP sampling was temporarily suspended in March 2020 due to the COVID pandemic and no biological samples were collected. DISP biological sampling resumed in July 2021 once NMFS/SEFSC approved safety measures were approved (Cheshire et al. 2023). SRHS sampled 29,760 Gray Triggerfish for length and of those fish, 1,988 were also sampled for age.

FIN-BIOSTAT

FIN-BIOSTAT sampling begain in 2003 and the program is administered by the Gulf States Marine Fisheries Commission (GSMFC) through GulfFIN. All recreational fishing modes are sampled through FIN-BIOSTAT (Bray, pers com 2024). FIN-BIOSTAT is conducted in every Gulf state, however, in FL it is called RECFIN from 2001-2018 and RepBio from 2018-2023 (Bray and Cermak, pers com 2023). From TX-AL, 1,919 Gray Triggerfish were sampled for length and of those 1,665 were also sampled for age. RECFIN provided length samples for 2,815 and 2,610 of those samples were also sampled for age. RECFIN sampling assignments were not conducted using a randomized methodology because of trying to maximize the number of biological samples collected, however, fish were not sampled in a biased fashion. A pilot phase for RepBio was initiated in 2018 and was fully implemented in 2019. Fishing access points identified from the MRIP Site Register are assigned weekly, by subregion, using a randomized draw process (Cermak, pers com 2023). RepBio provided approximately 615 samples for length and age compositions.

Stock and Fleet Structure

Prior to the Data Workshop, the stock structure for SEDAR 100 Gulf of America Gray Triggerfish is not defined and length and age compositions were requested for two different stock structures. The first stock structure treats the entire Gulf as a single stock. The second stock structure delineates the Gulf into two stocks with a West (W) stock which includes TX and LA and an East (E) stock that includes MS, AL, and FL. Sample sizes are higher for the E stock compared to the W stock (Table 4).

One recreational fleet is defined for SEDAR 100 that consists of private (PR), charter (CB), and headboat (HB) modes.

Changes from SEDAR 62

Improvements in data provision, facilitated by the Life History Template, allowed unique records (n=5,800) in the age data to be added to the length-only data and included in the length compositions. These additional samples were not included in the length compositions for SEDAR 62.

Morphometric Conversions

Natural total length (NTL), maximum total length (MTL), and standard length (SL) were converted to fork length (FL) using the conversion equations that were provided in Table 2.1.1 of the SEDAR 43 Assessment Process report. The conversion equations used are:

Natural Total Length (NTL) to Fork Length:

$$FL = 24.360 + 0.807 * NTL$$

Maximum Total Length (MTL) to Fork Length:

$$FL = 21.282 + 0.791 * MTL$$

Standard Length (SL) to Fork Length:

$$FL = 10.311 + 1.153 * SL$$

Nominal Length Compositions

Fish were assigned to 2 cm bins with bins ranging from 2 cm - 90 cm. The label represents the floor of the bin. It is recommended to exclude strata where sample size was less than 30 fish. Nominal length compositions for SEDAR 100 are presented in Figure 1. The length distribution of retained Gray Triggerfish in the recreational fleet has shifted towards larger fish through time and this trend is observed in both the East and West stock regions (Figure 2).

Comparison of Length and Age Data

The distribution of length samples included in the length compositions (length-only) and samples with both length and ages included in the age compositions are shown in Figure 3 for the East region and Figure 4 for the West region. In the East region, there is strong overlap between the length distribution of data included in the length compositions and in the age compositions. When sample sizes are sufficient (n > 30) in the West region, there is also strong overlap between the length distributions of the data included in the length compositions and in the age compositions. However, most years sample sizes are low (n < 30) in the West and there is not strong overlap in the length distributions from the data used in the length and age compositions.

Nominal Age Compositions

Gray Triggerfish ages ranged from 1-16 years old, with the majority of fish being aged to less than 7 years old. For age compositions, it is recommended to exclude strata where the sample size was less than 10 fish. A comparison of nominal age compositions for the East, West, and entire Gulf are presented in Figure 5. Bubble plots for each stock are presented

in Figures 6-8. The age structure of Gray Triggerfish is more constricted in the West region, compared to the East, and with the oldest aged fish being 11 years old.

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 age composition 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.

CAAL is calculated as

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

where $a_{i,j,k}$ is the number of age samples in year *i*, length bin *j*, and age class *k* and $a_{i,j}$ is the number of age samples in year *i* and length bin *j*.

Stock-specific CAAL are shown in Figures 9-11. The majority of age samples come from the East stock region, so the CAAL for the East stock region and the entire Gulf are very similar. For these potential stock regions, the later years show a wider spread of lengths and ages than the earlier years. For the West stock region, the spread of ages and lengths is more limited.

Mean Length-at-Age

Mean length-at-age (MLAA) is the average length for each age and is calculated as

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

where *L* are lengths , *a* is the number of associated sample sizes, *i* is year, and *k* is age class. MLAA are provided to aide in model diagnostics and is presented in Figures 12-14.

Evaluating Sample Sizes for Weighting

For the single stock option, where the entire Gulf is treated as a stock, the potential subregions for weighting would be the same East and West regions considered in the two stock scenario. All years have a sufficient (n > 30) number of samples in the East region. However, while the majority of years have a sufficient number of samples in the West region, beginning in 2017, only two years meet the minimum sample size threshold of 30

fish per strata (Table 4). For the majority of years, the length distributions are similar between the East and West regions. Years where the distributions do differ, the number of fish sampled in the West tend to be low (Figure 15). This suggests that weighting would have a minimal influence on the length distributions.

For the two stock option, the weighting subregions for the West stock would be TX and LA. There are 16 years where the sample sizes are not sufficient for weighting, with the majority of those years occuring from 2013 to 2024 (Table 5). There are also two additional years where the sample sizes are sufficient, however, the number of trips in LA do not meet the recommendation of 10 trips per strata. The length distributions for TX and LA are similar for most years where sample sizes are sufficient (n = 30). However, there is a period in the early 2000s where sample sizes are sufficient and the fish sampled in LA are slightly larger than fish sampled in TX. The differences in the length distributions are not large, suggesting that weighting would not have a large impact on the length compositions (Figure 16).

For the East stock region, it is not possible to separate AL and the FL panhandle until 2013. Prior to 2013, that area was combined as a single region in SRHS and it is not possible to separate the AL and FL landings from one another (Cheshire et al. 2023). One potential option for weighting is to split the East into North (MS - FL panhandle) and South (FL peninsula) weighting subregions. For this option, there are 20 years with insufficient samples for weighting and the majority of those years are in the later part of the time series beginning in 2008 (Table 6). For years where sample sizes are sufficient (n > 30) the length distributions between the N and S weighting subregions are similar, suggesting weighting would have a minimal impact on the length compositions (Figure 17). Another potential option is to only weight compositions beginning in 2013 when AL and FL panhandle landings can be delineated. The East would be divided into MSAL (MS and AL) and FL (FL panhandle and peninsula) weighting subregions. The majority of years (beginning in 2013) would have sufficient samples for weighting with this approach (Table 7). The length distributions for MSAL and FL are very similar, suggesting weighting would have a minimal impact on the length compositions (Figure 18).

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Tables

Table 1: Number of fish (nfish) and trips (ntrip) sampled for length and age by each data source.

Sampling_Program	nfish_len	ntrip_len	nfish_age	ntrip_age
CRP	15	14	14	13
DISL/USA	123	11	116	11
FIN-BIOSTAT	1,919	479	1,665	426
FIN-OBS	8	8	5	5
FWRI-OBS	1,550	1,527	714	309
HB	6	6	6	6
LA BIO	70	25	0	0
LA Creel	12	9	0	0
MRFSS	0	0	37	20
MRIP	29,634	6,906	0	0
PCLAB	1,369	428	1,093	336
RECFIN	2,815	1,499	2,610	615
REPBIO	615	227	593	220
SRFS	496	260	440	236
SRHS	29,760	7,709	1,988	621
TIP	0	0	8	1
TPWD	3,255	1,298	0	0

Table 2: Annual number of fish sampled for length by each data source.

Year	CRP	DISL/USA	FIN-BIOSTAT	FIN-OBS	FWRI-OBS	HB	LA BIO	LA Creel	MRIP	PCLAB	RECFIN	REPBIO	SERFS	SRFS	SRHS	TPWD
1981	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	188	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	137	0	0	0	0	0	0	33
1984	0	0	0	0	0	0	0	0	65	0	0	0	0	0	0	40
1985	0	0	0	0	0	0	0	0	49	0	0	0	0	0	0	93
1986	0	0	0	0	0	0	0	0	125	0	0	0	0	0	538	48
1987	0	0	0	0	0	0	0	0	422	0	0	0	0	0	599	72
1988	0	0	0	0	0	0	0	0	299	0	0	0	0	0	665	129
1989	0	0	0	0	0	0	0	0	216	0	0	0	0	0	1,437	88
1990	0	0	0	0	0	0	0	0	319	0	0	0	0	0	2,117	100
1991	0	0	0	0	0	0	0	0	652	0	0	0	0	0	1,661	72
1992	0	0	0	0	0	0	0	0	1,307	0	0	0	0	0	2,364	110
1993	0	0	0	0	0	0	0	0	381	0	0	0	0	0	1,362	110
1994	0	0	0	0	0	0	0	0	383	0	0	0	0	0	2,130	152
1995	0	0	0	0	0	0	0	0	337	0	0	0	0	0	1,755	177
1996	0	0	0	0	0	0	0	0	194	0	0	0	0	0	1,543	129
1997	0	0	0	0	0	0	0	0	489	0	0	0	0	0	1,212	134
1998	0	0	0	0	0	0	0	0	1,375	0	0	0	0	0	1,584	96
1999	0	0	0	0	0	0	0	0	2,120	0	0	0	0	0	801	73
2000	0	0	0	0	0	0	0	0	1,977	0	0	0	0	0	802	123
2001	0	0	0	0	0	0	0	0	2,745	0	0	0	0	0	905	105
2002	0	0	0	0	0	0	0	0	2,369	0	83	0	0	0	1,212	88

Year	CRP	DISL/USA	FIN-BIOSTAT	FIN-OBS	FWRI-OBS	HB	LA BIO	LA Creel	MRIP	PCLAB	RECFIN	REPBIO	SERFS	SRFS	SRHS	TPWD
2003	15	0	62	0	0	0	0	0	2,089	0	31	0	0	0	1,116	90
2004	0	0	68	0	0	0	0	0	2,634	33	57	0	0	0	730	145
2005	0	0	15	7	0	0	0	0	1,995	0	61	0	0	0	488	139
2006	0	0	20	0	0	0	0	0	939	0	85	0	0	0	420	199
2007	0	0	265	1	0	0	0	0	772	3	48	0	0	0	530	117
2008	0	0	130	0	0	0	0	0	717	9	190	0	0	0	345	149
2009	0	0	181	0	53	0	0	0	320	0	196	0	0	0	214	82
2010	0	0	35	0	180	0	0	0	378	5	107	0	0	0	266	14
2011	0	0	178	0	244	0	0	0	862	8	78	0	0	0	230	63
2012	0	0	125	0	96	0	0	0	262	110	2	0	0	0	158	51
2013	0	0	145	0	83	0	0	0	212	22	178	0	0	0	349	35
2014	0	0	44	0	12	6	35	2	152	43	86	0	0	0	187	25
2015	0	0	6	0	7	0	2	5	30	0	9	0	0	4	40	50
2016	0	123	226	0	257	0	5	0	290	84	963	0	0	64	613	14
2017	0	0	0	0	7	0	0	0	40	0	163	0	0	35	4	9
2018	0	0	2	0	247	0	1	1	235	241	478	0	0	97	377	12
2019	0	0	42	0	77	0	0	0	96	100	0	87	0	55	349	17
2020	0	0	100	0	1	0	2	0	179	113	0	119	13	32	66	17
2021	0	0	153	0	12	0	1	0	249	58	0	166	39	1	35	12
2022	0	0	43	0	98	0	9	0	270	74	0	124	63	0	228	5
2023	0	0	71	0	94	0	9	2	349	214	0	93	48	1	165	31
2024	0	0	8	0	82	0	6	2	335	252	0	26	40	4	166	7

Table 3: Annual number of fish sampled for age by each data source.

Year	CRP	MRFSS	RECFIN	SRHS	PCLAB	FIN-OBS	FIN-BIOSTAT	FWRI-OBS	DISL/USA	GRFS	REPBIO	TIP	HB
2003	14	5	29	2	0	0	0	0	0	0	0	0	0
2004	0	10	57	3	33	0	0	0	0	0	0	0	0
2005	0	0	57	0	0	4	0	0	0	0	0	0	0
2006	0	0	77	0	0	0	0	0	0	0	0	0	0
2007	0	3	45	6	2	1	246	0	0	0	0	0	0
2008	0	16	186	6	8	0	160	0	0	0	0	0	0
2009	0	0	164	45	0	0	153	13	0	0	0	0	0
2010	0	0	99	49	5	0	27	1	0	0	0	0	0
2011	0	3	76	20	8	0	177	0	0	0	0	0	0
2012	0	0	0	68	110	0	124	0	0	0	0	0	0
2013	0	0	171	262	22	0	131	0	0	0	0	0	0
2014	0	0	82	81	43	0	7	0	0	0	0	0	0
2015	0	0	2	23	0	0	3	0	1	0	0	0	0
2016	0	0	931	275	77	0	224	162	35	116	0	0	0
2017	0	0	162	0	0	0	0	0	30	0	0	0	0
2018	0	0	472	330	235	0	2	124	93	0	0	0	0
2019	0	0	0	277	97	0	41	110	53	0	83	8	0
2020	0	0	0	55	109	0	105	2	41	0	113	0	0
2021	0	0	0	24	58	0	146	0	39	0	161	0	0
2022	0	0	0	199	73	0	42	118	62	0	121	0	0
2023	0	0	0	127	213	0	69	93	48	0	90	0	6
2024	0	0	0	136	0	0	8	91	38	0	25	0	0

Table 4: Number of fish (nfish) and trips (ntrip) sampled for length and age from the East and West stock regions. Values in red do not meet the recommended threshold of 30 fish per strata for lengths, 10 fish per strata for ages, or 10 trips per strata for lengths or ages.

Year	nfish_len_ West	nfish_len_ East	ntrip_len_ West	ntrip_len_ East	nfish_age West	nfish_age_ East	ntrip_age_ West	ntrip_age_ East
1981	11	69	4	26	0	0	0	0
1982	14	174	3	57	0	0	0	0
1983	44	126	25	53	0	0	0	0
1984	72	33	24	17	0	0	0	0
1985	109	33	39	22	0	0	0	0
1986	361	350	146	169	0	0	0	0
1987	364	729	152	277	0	0	0	0
1988	371	722	148	276	0	0	0	0
1989	494	1,247	147	401	0	0	0	0
1990	638	1,898	140	403	0	0	0	0
1991	499	1,886	133	417	0	0	0	0
1992	1,396	2,385	290	512	0	0	0	0
1993	793	1,060	227	303	0	0	0	0
1994	1,395	1,270	321	332	0	0	0	0
1995	1,094	1,175	292	268	0	0	0	0
1996	976	890	204	213	0	0	0	0
1997	480	1,355	159	376	0	0	0	0
1998	590	2,465	198	513	0	0	0	0
1999	288	2,706	123	642	0	0	0	0
2000	196	2,706	86	611	0	0	0	0
2001	323	3,432	113	567	0	0	0	0
2002	277	3,475	123	669	0	0	0	0
2003	289	3,114	117	568	0	50	0	29
2004	285	3,382	115	678	0	103	0	24
2005	250	2,455	97	544	0	61	0	21
2006	310	1,353	110	414	0	77	0	14
2007	453	1,283	151	446	203	100	61	36
2008	345	1,195	104	494	139	237	23	60
2009	221	825	97	447	115	260	42	75
2010	21	964	13	501	4	177	3	71
2011	136	1,527	55	666	55	229	18	83
2012	125	679	44	276	48	254	15	76

Year	nfish_len_ West	nfish_len_ East	ntrip_len_ West	ntrip_len_ East	nfish_age _West	nfish_age_ East	ntrip_age_ West	ntrip_age_ East
2013	115	909	63	449	50	536	29	154
2014	145	447	29	178	3	210	3	71
2015	64	89	29	35	1	28	1	10
2016	51	2,588	33	667	6	1,814	5	369
2017	13	245	8	66	0	192	0	48
2018	25	1,666	18	598	3	1,253	3	319
2019	25	798	15	259	2	667	2	175
2020	21	621	12	184	2	423	1	121
2021	16	710	11	250	3	425	2	156
2022	31	883	14	392	8	607	3	255
2023	56	1,018	25	441	9	637	7	264
2024	27	901	15	428	8	290	5	159

Table 5: Number of fish (nfish) and trips (ntrip) sampled for length from potential subweighting regions for the West stock. Values in red do not meet the recommended threshold of 30 fish or 10 trips per strata.

Year	nfish_TX	nfish_LA	ntrip_TX	ntrip_LA
1981	0	11	0	4
1982	0	14	0	3
1983	33	11	18	7
1984	40	32	17	7
1985	93	16	36	3
1986	317	44	127	19
1987	302	62	127	25
1988	267	104	110	38
1989	310	184	91	56
1990	515	123	112	28
1991	304	195	85	48
1992	943	453	188	102
1993	516	277	143	84
1994	1,118	277	229	92
1995	855	239	209	83
1996	837	139	160	44
1997	350	130	97	62
1998	317	273	109	89
1999	156	132	61	62
2000	131	65	48	38
2001	259	64	86	27
2002	205	72	96	27
2003	138	151	61	56
2004	247	38	94	21
2005	190	60	77	20
2006	271	39	91	19
2007	269	184	90	61
2008	171	174	72	32
2009	147	74	73	24
2010	18	3	11	2
2011	82	54	38	17
2012	67	58	27	17

Year	nfish_TX	nfish_LA	ntrip_TX	ntrip_LA
2013	94	21	50	13
2014	72	73	23	6
2015	53	11	23	6
2016	40	11	28	5
2017	13	0	8	0
2018	21	4	16	2
2019	22	3	13	2
2020	17	4	11	1
2021	12	4	9	2
2022	14	17	10	4
2023	32	24	18	7
2024	11	16	10	5

Table 6: Number of fish (nfish) and trips (ntrip) sampled for length from potential N (MS, AL, and FL panhandle) and S (FL peninsula) subweighting regions for the East stock. Values in red do not meet the recommended threshold of 30 fish or 10 trips per strata.

Year	nfish_N	nfish_S	ntrip_N	ntrip_S
1981	57	12	16	10
1982	165	9	50	7
1983	97	29	38	15
1984	24	9	9	8
1985	13	20	6	16
1986	260	72	104	54
1987	656	69	220	54
1988	643	77	214	60
1989	1,001	233	286	109
1990	1,712	166	320	73
1991	1,822	58	383	31
1992	2,272	113	449	63
1993	1,034	23	285	16
1994	1,094	176	288	44
1995	1,137	36	243	24
1996	842	48	182	31
1997	1,183	172	297	79
1998	2,257	208	420	93
1999	2,574	132	566	76
2000	2,665	35	585	24
2001	3,375	56	527	39
2002	3,370	70	586	48
2003	3,046	38	515	30
2004	3,289	51	635	38
2005	2,402	53	506	38
2006	1,300	51	380	33
2007	1,233	46	410	34
2008	1,160	26	468	20
2009	810	15	432	15
2010	938	21	480	20
2011	1,492	25	636	24
2012	560	9	240	8

Year	nfish_N	nfish_S	ntrip_N	ntrip_S
2013	880	7	439	6
2014	395	9	161	8
2015	78	5	25	5
2016	1,501	11	421	11
2017	44	8	15	3
2018	840	15	374	12
2019	538	19	167	18
2020	350	3	90	3
2021	445	6	140	6
2022	572	52	238	41
2023	583	84	264	40
2024	530	54	267	40

Table 7: Number of fish (nfish) and trips (ntrip) sampled for length from potential MS/AL (MS and AL) and FL (FL panhandle and peninsula) subweighting regions for the East stock. Values in red do not meet the recommended threshold of 30 fish or 10 trips per strata.

Year	nfish_MSAL	nfish_FL	ntrip_MSAL	ntrip_FL
2013	282	627	71	378
2014	127	320	29	149
2015	20	69	6	29
2016	878	1,710	79	588
2017	5	240	2	64
2018	277	1,389	62	536
2019	151	647	38	221
2020	179	442	41	143
2021	346	364	91	159
2022	231	652	82	310
2023	305	713	121	320
2024	214	687	100	328

Figures

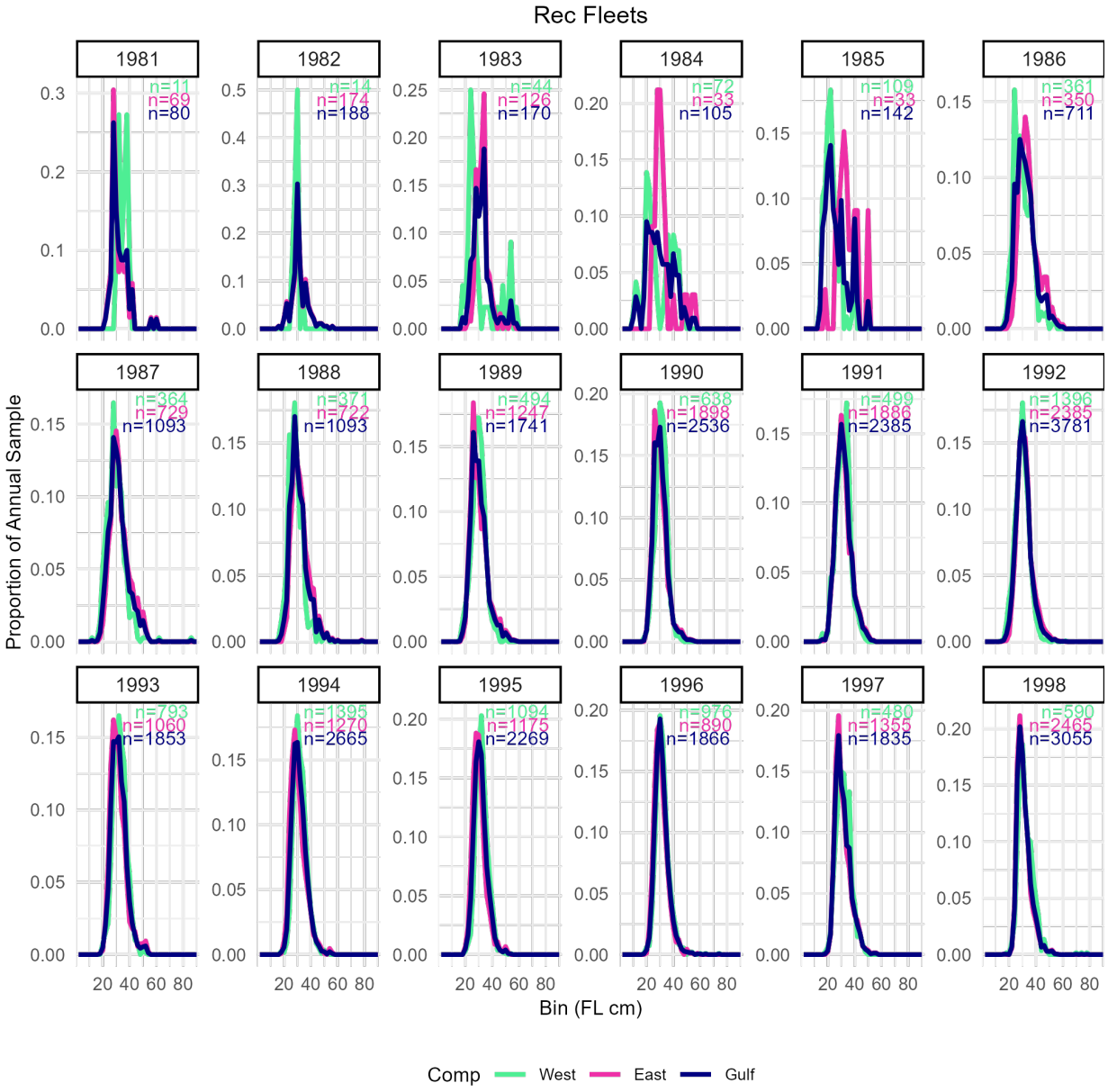

Figure 1. Nominal length distributions of the East, West, and Gulf stocks. The number of fish (n) for each stock is provided in the top right corner of each panel.

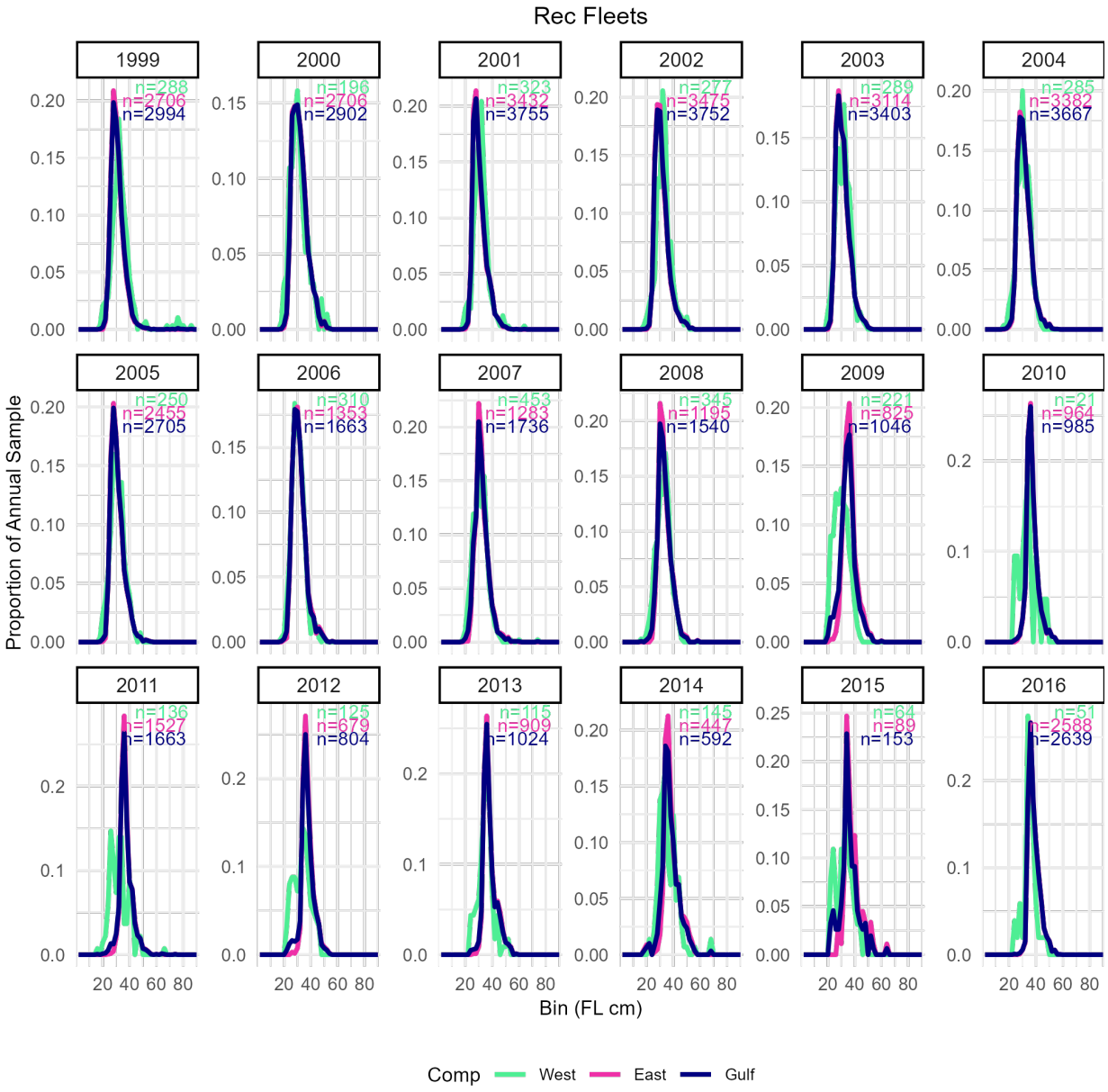

Figure 1 (continued). Nominal length distributions of the East, West, and Gulf stocks. The number of fish (n) for each stock is provided in the top right corner of each panel.

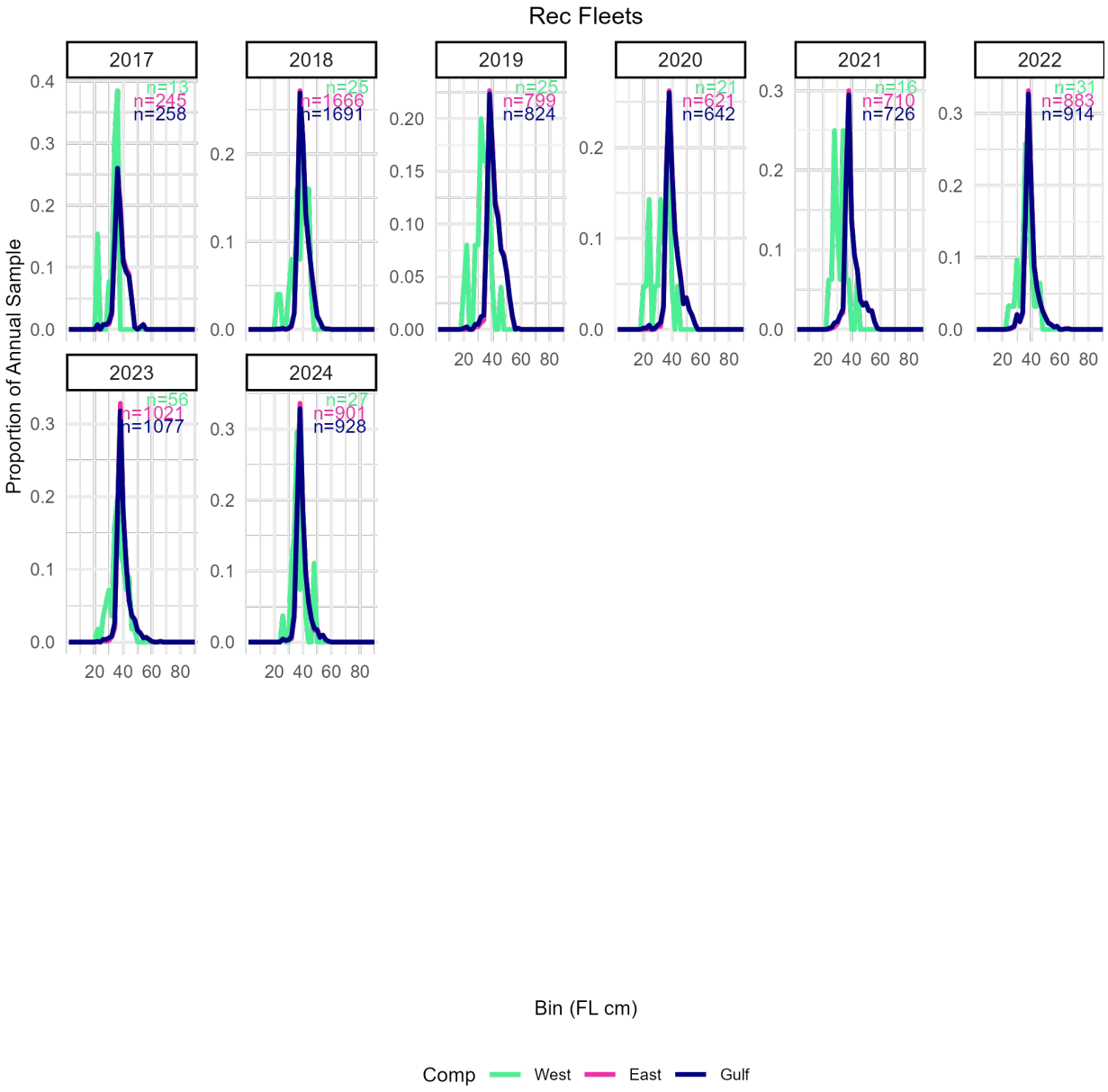

Figure 1 (continued). Nominal length distributions of the East, West, and Gulf stocks. The number of fish (n) for each stock is provided in the top right corner of each panel.

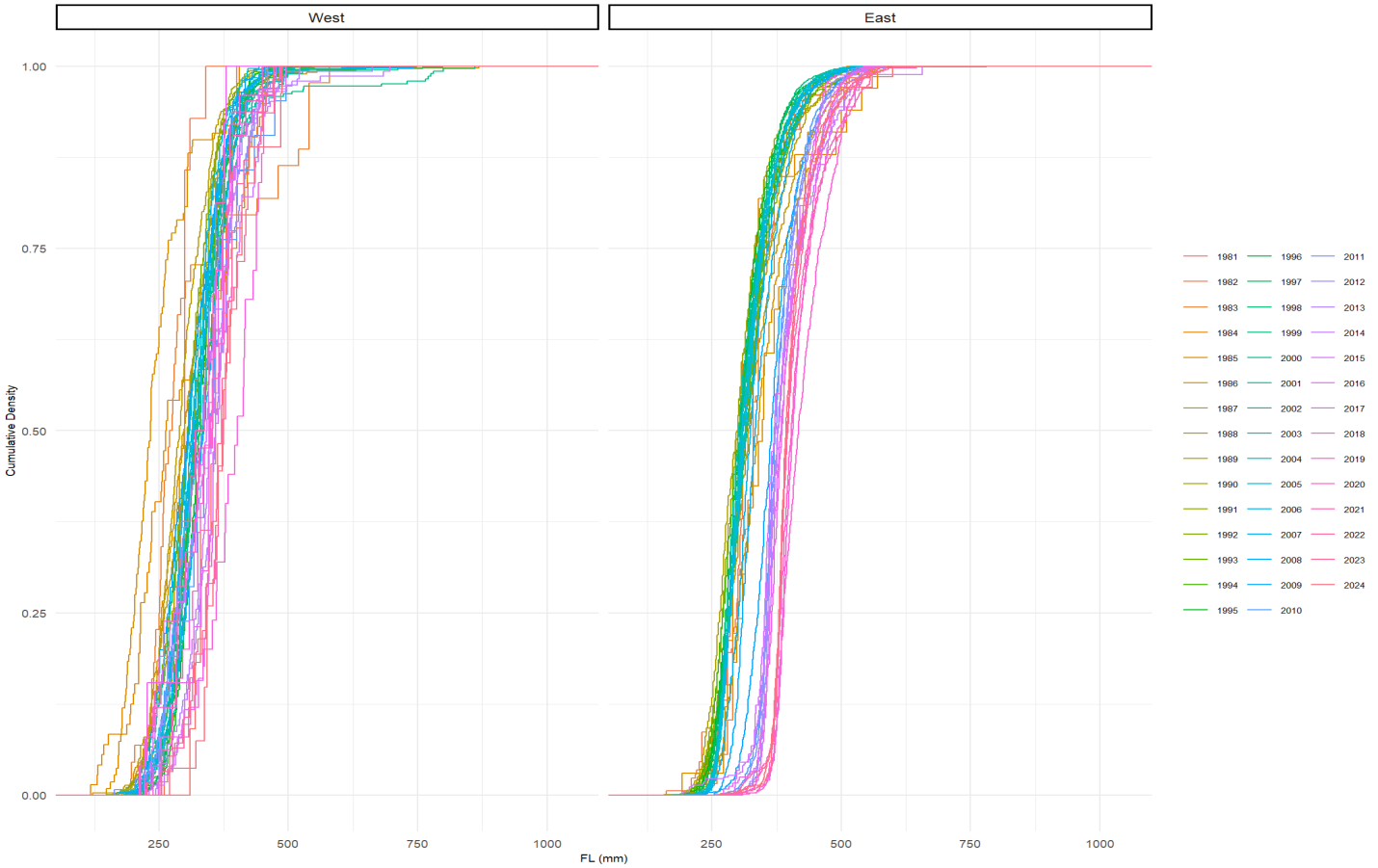

Figure 2. Cumulative distribution curve of the annual nominal lengths for the East and West stocks.

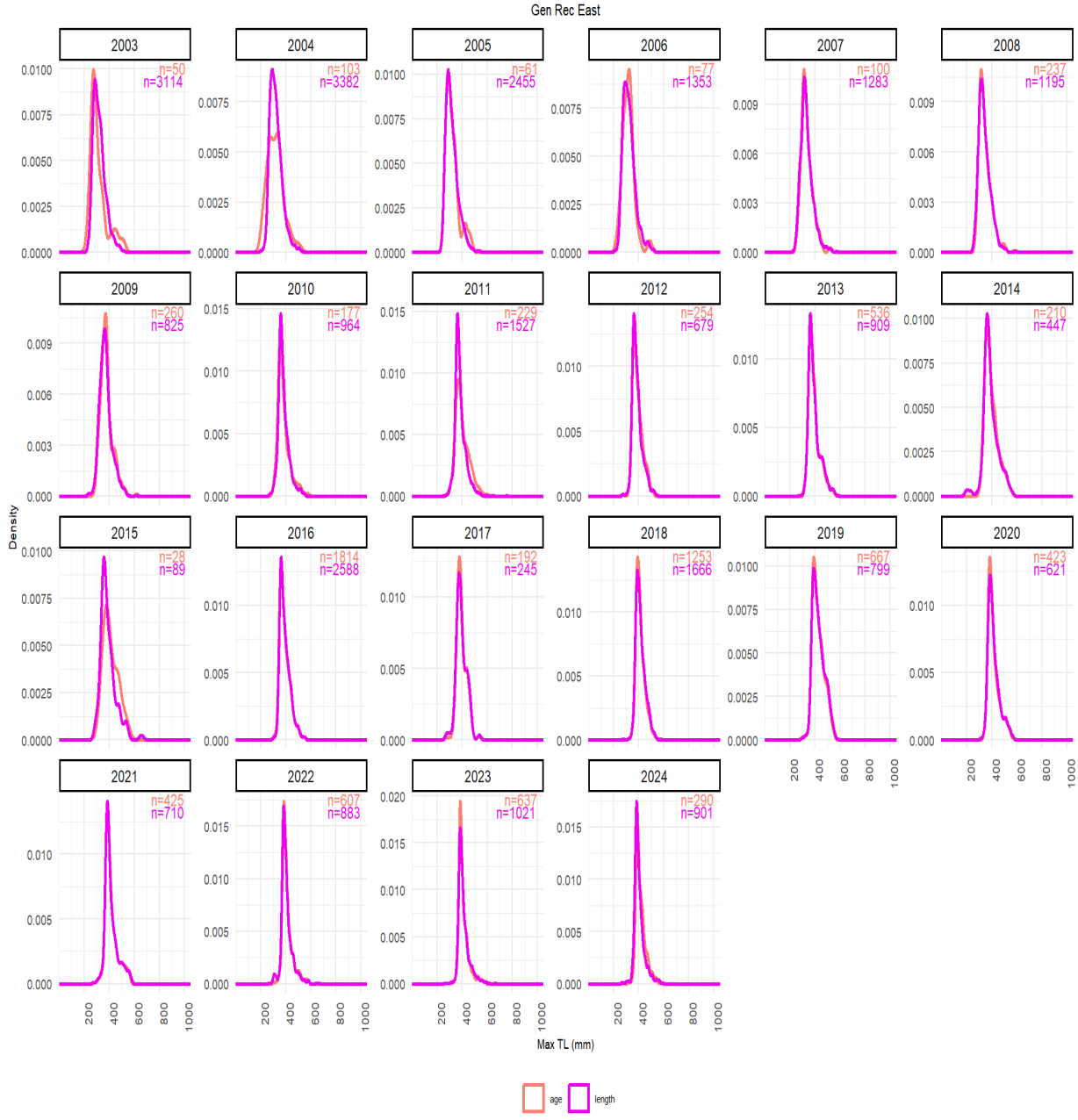

Figure 3. Comparison of the length distribution of samples included in the length compositions and the age compositions for the East region. The number of fish (n) for each composition type is provided in the top right corner of each panel.

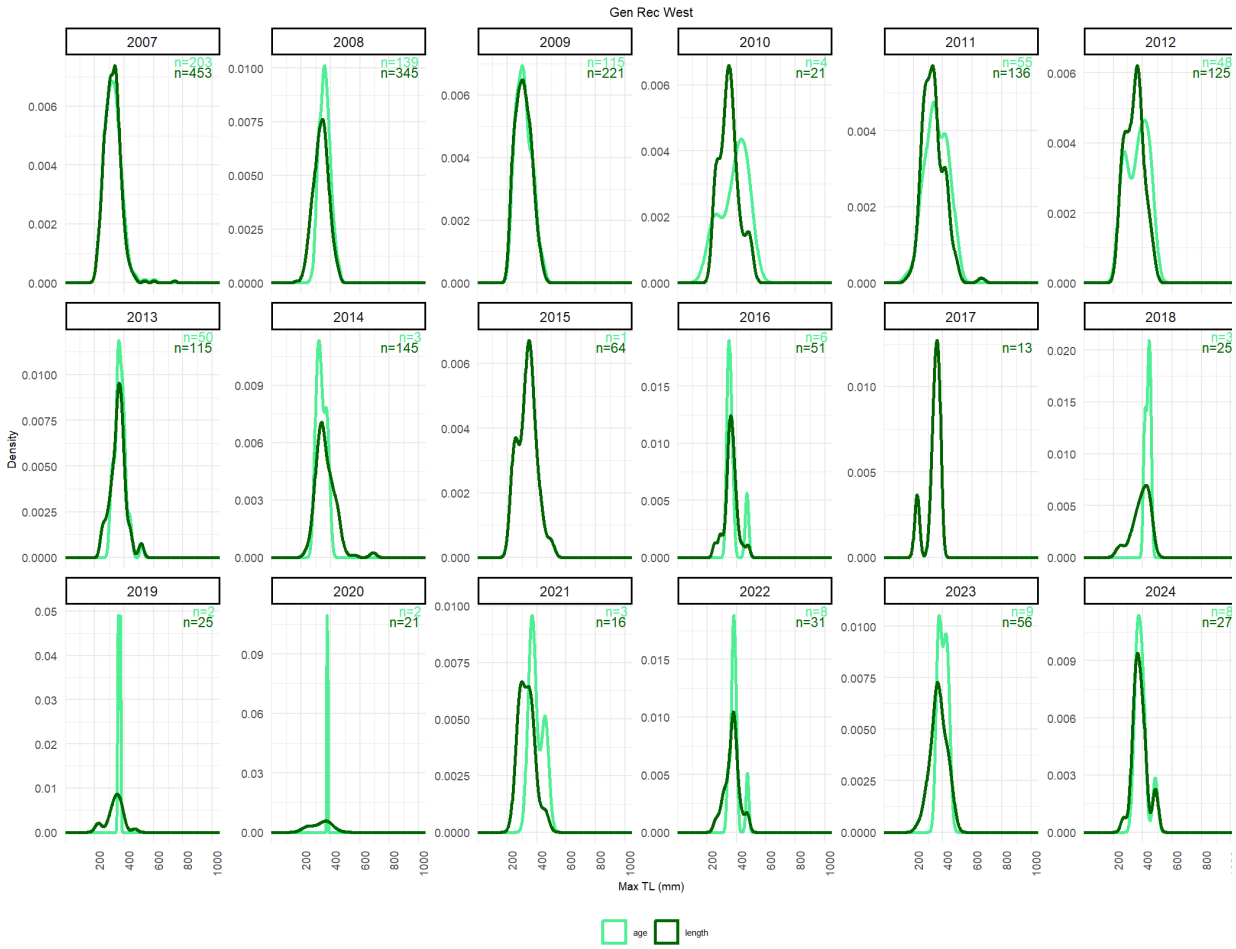

Figure 4. Comparison of the length distribution of samples included in the length compositions and the age compositions for the West region. The number of fish (n) for each composition type is provided in the top right corner of each panel.

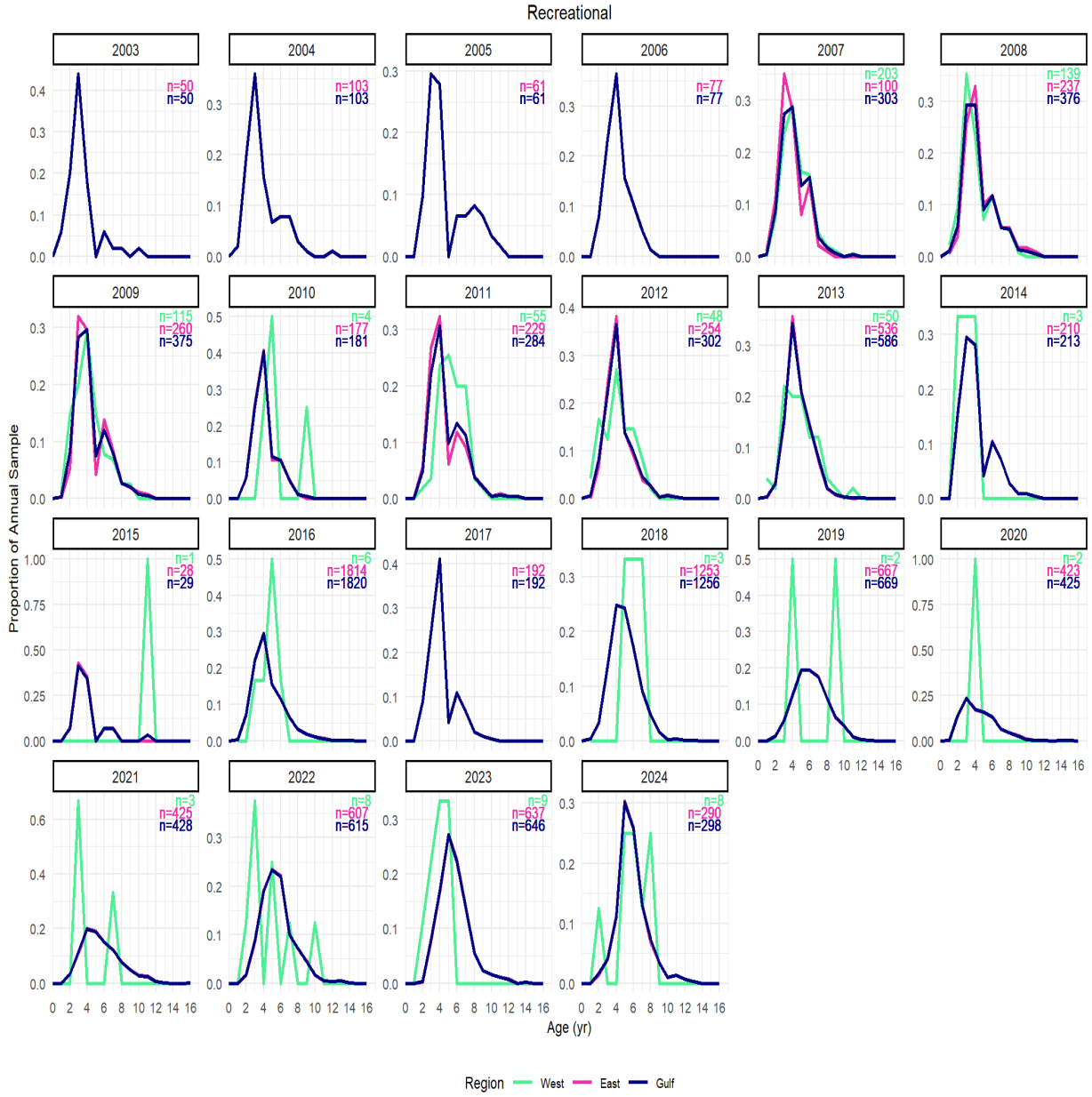

Figure 5. Nominal age distributions of the East, West, and Gulf stocks. The number of fish (n) for each stock is provided in the top right corner of each panel.

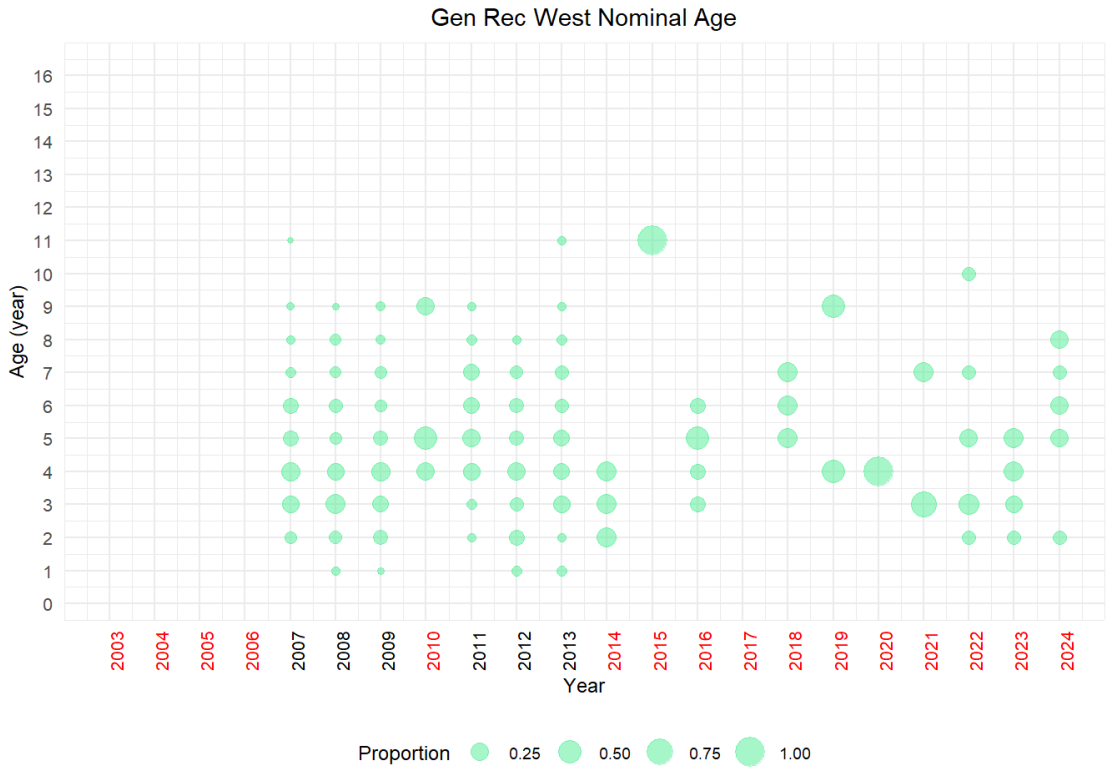

Figure 6. Nominal age composition for fish sampled in the West stock region. Years in red do not meet the threshold of 10 fish per strata.

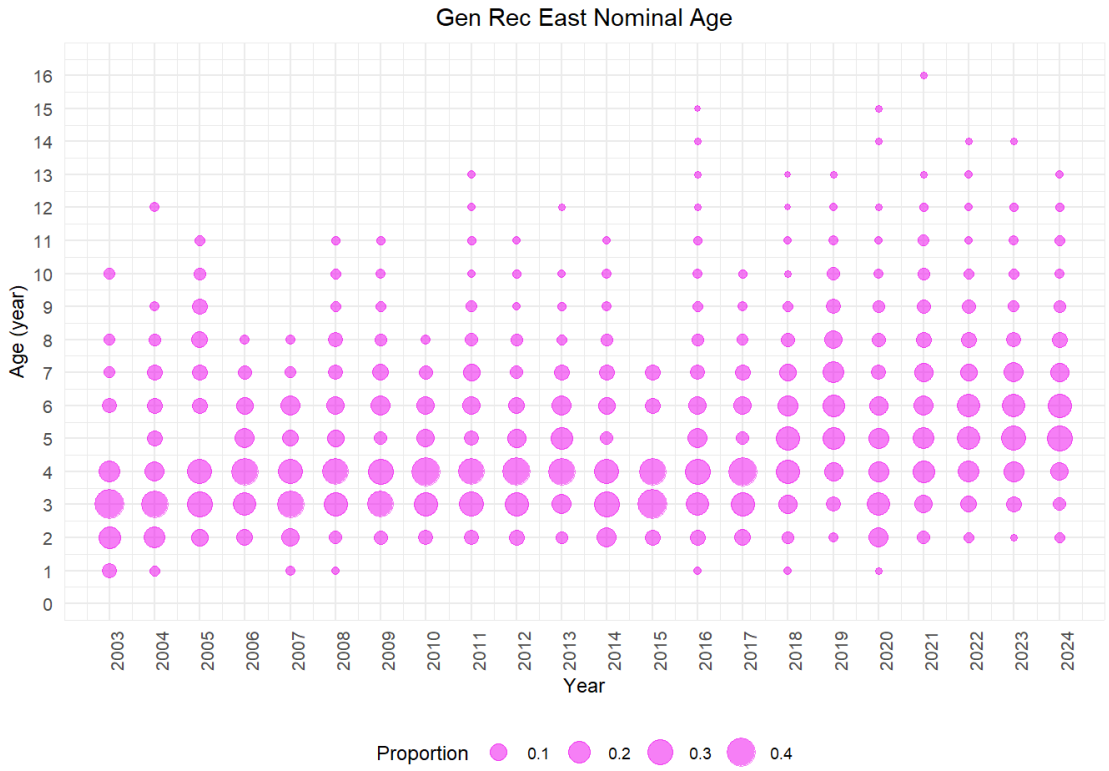

Figure 7. Nominal age composition for fish sampled in the East stock region. Years in red do not meet the threshold of 10 fish per strata.

Figure 8. Nominal age composition for fish sampled in the Gulf stock region. Years in red do not meet the threshold of 10 fish per strata.

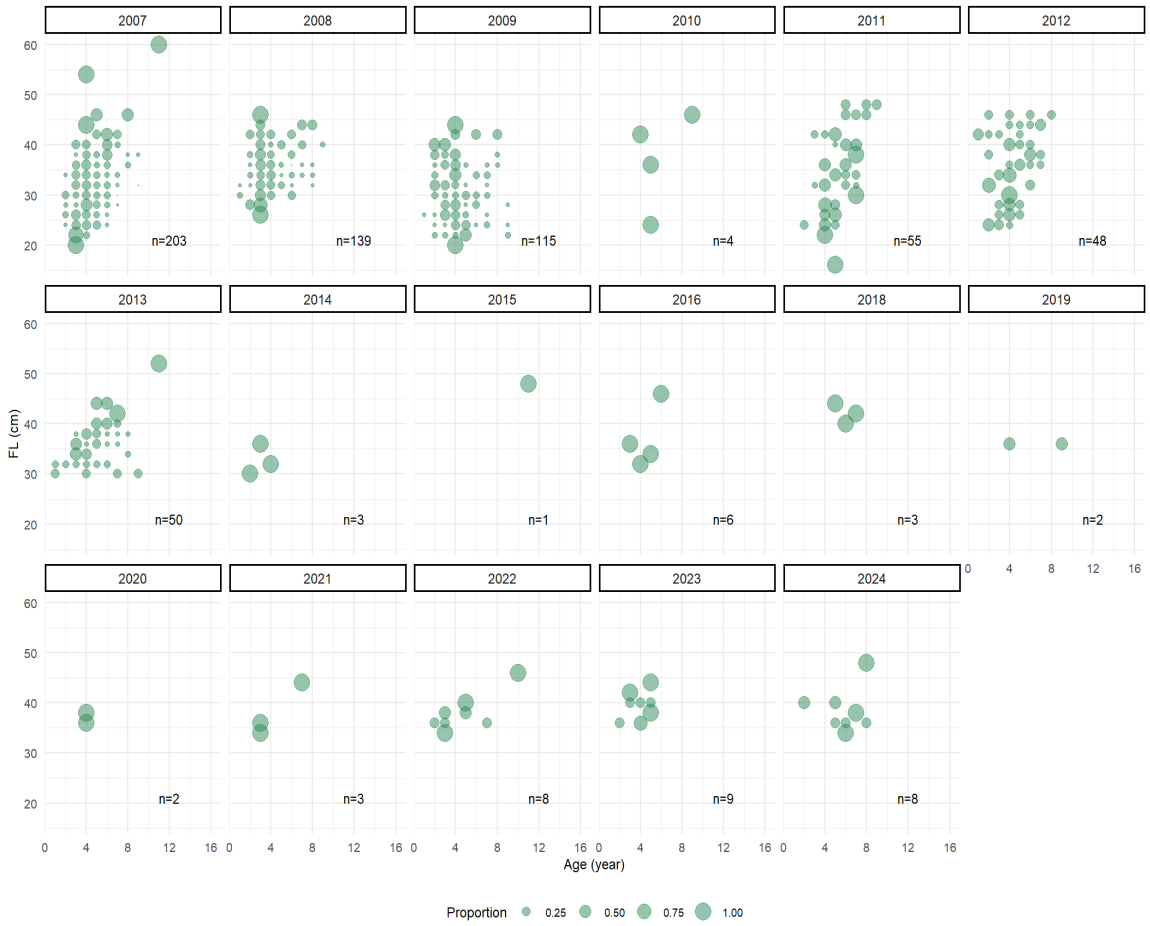

Figure 9. Condition Age-at-Length for fish sampled in the West stock region. The number of fish is included on the bottom right corner of each panel.

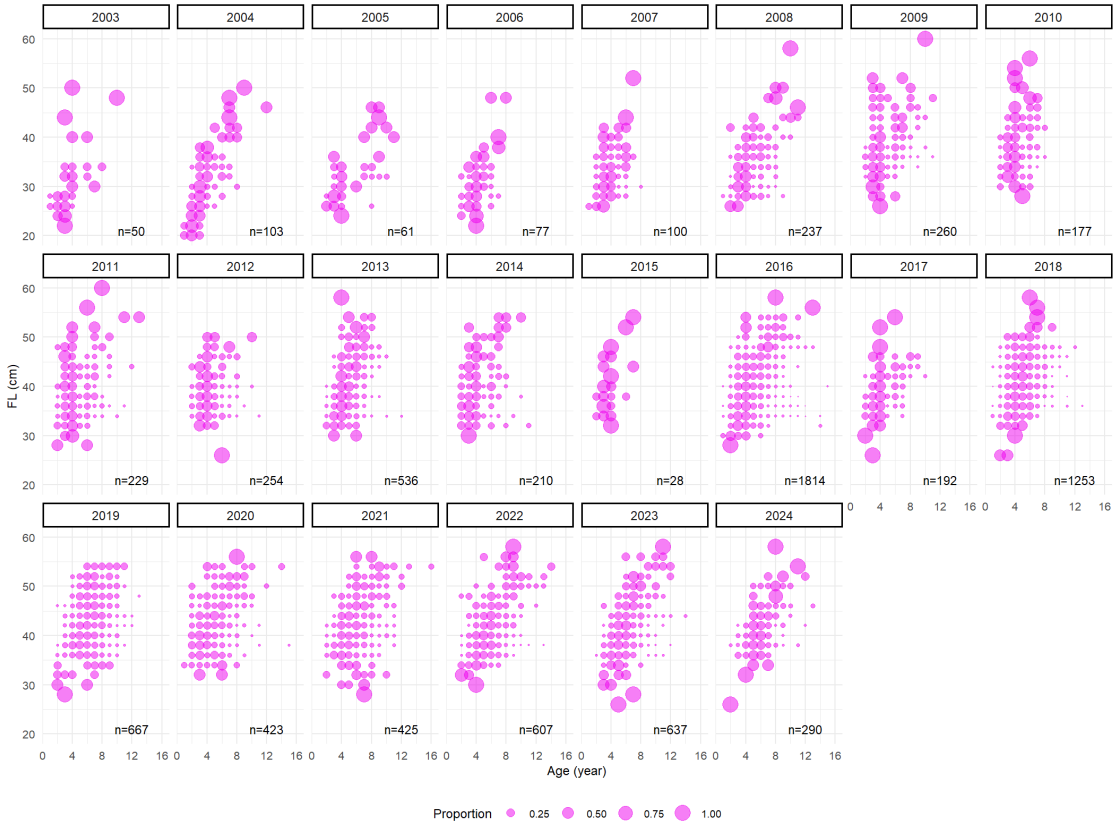

Figure 10. Conditional Age-at-Length for fish sampled in the East stock region. The number of fish is included on the bottom right corner of each panel.

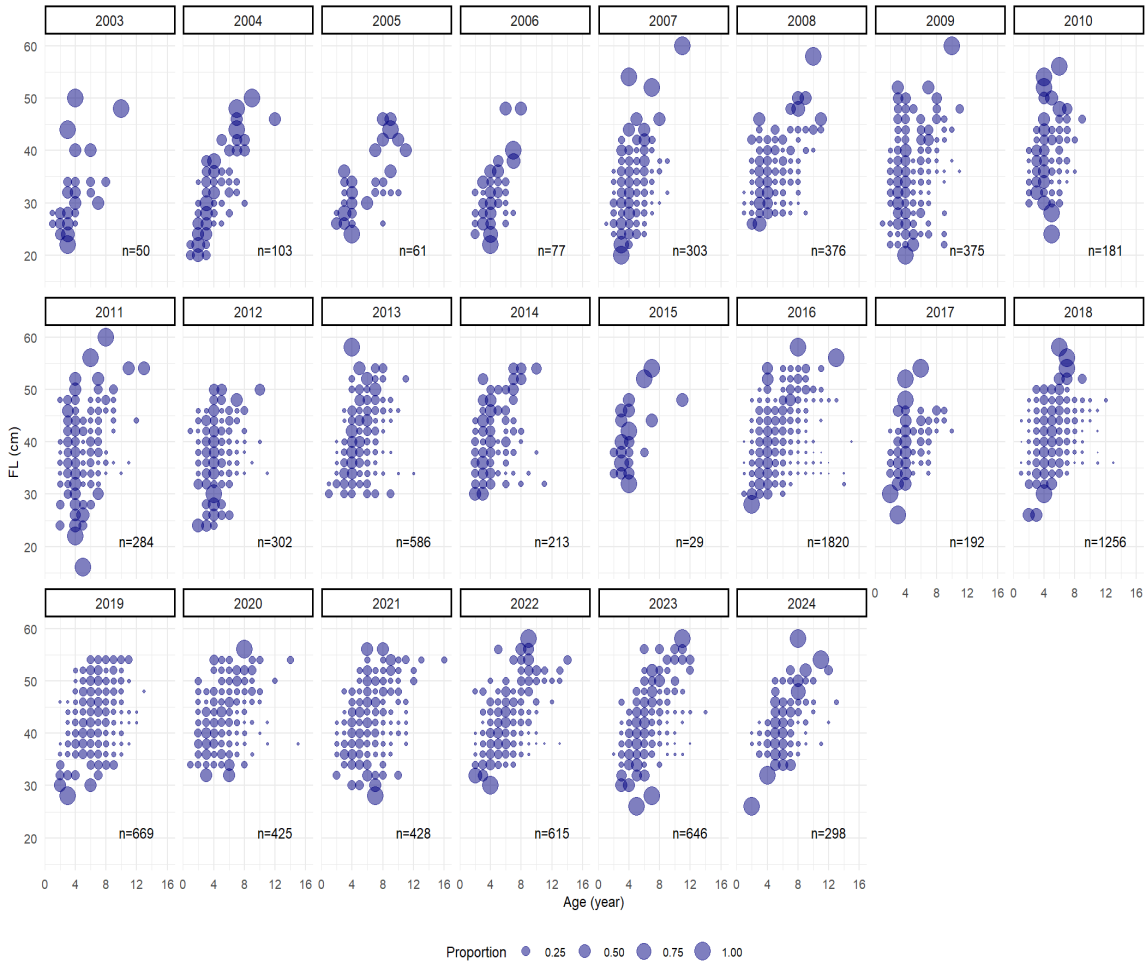

Figure 11. Conditional Age-at-Length for fish sampled in the Gulf stock region. The number of fish is included on the bottom right corner of each panel.

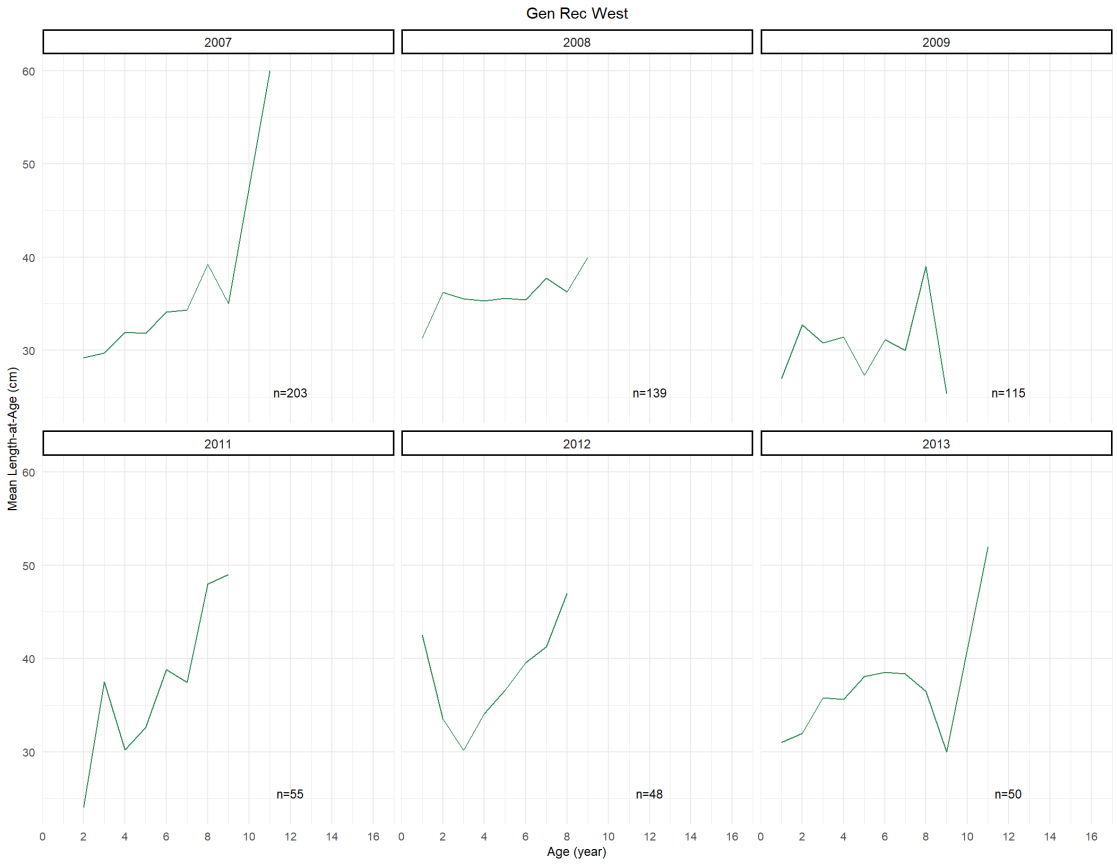

Figure 12. Mean Length-at-Age for fish sampled in the West stock region. The number of fish is included on the bottom right corner of each panel.

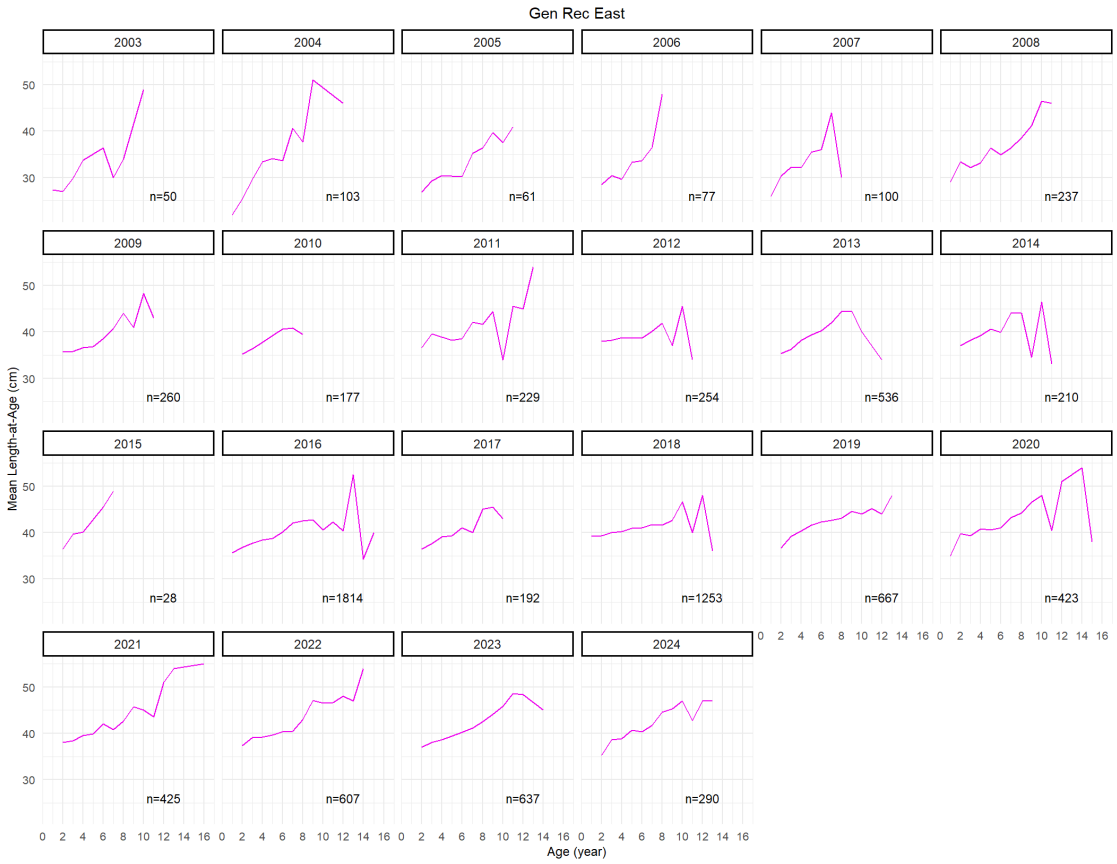

Figure 13. Mean Length-at-Age for fish sampled in the East stock region. The number of fish is included on the bottom right corner of each panel.

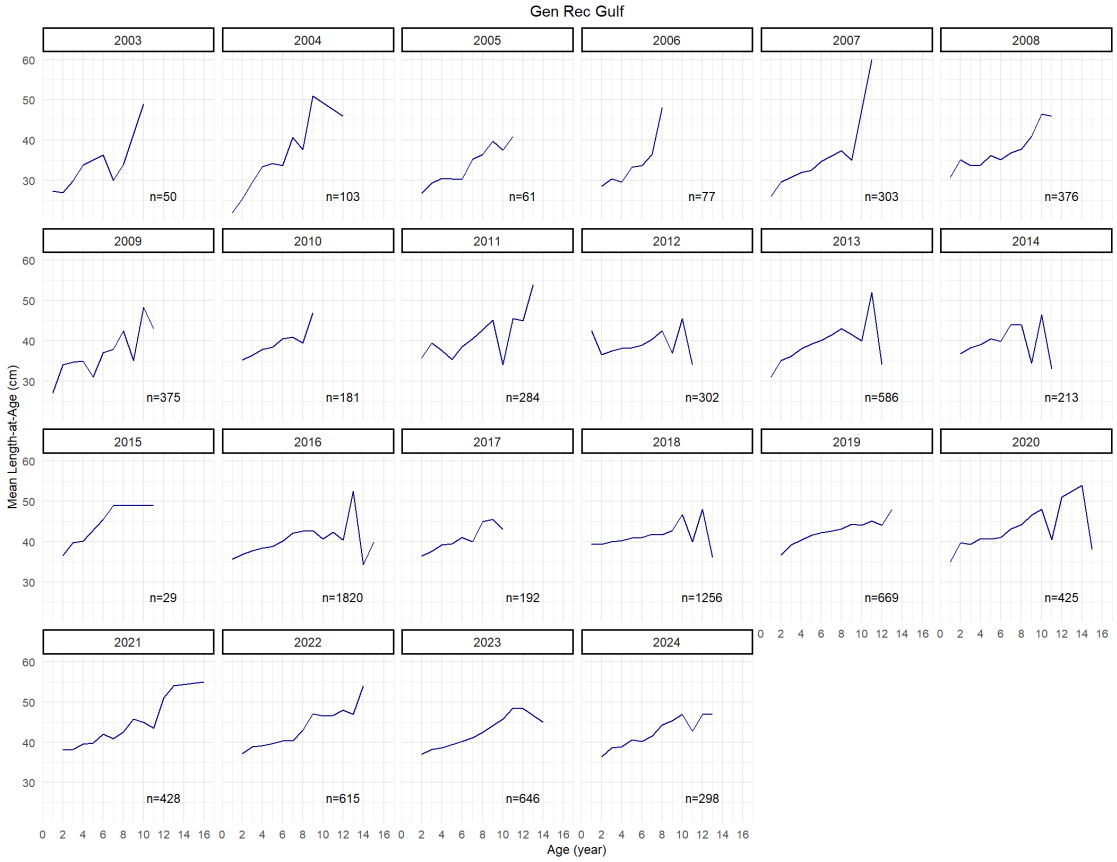

Figure 14. Mean Length-at-Age for fish sampled in the Gulf stock region. The number of fish is included on the bottom right corner of each panel.

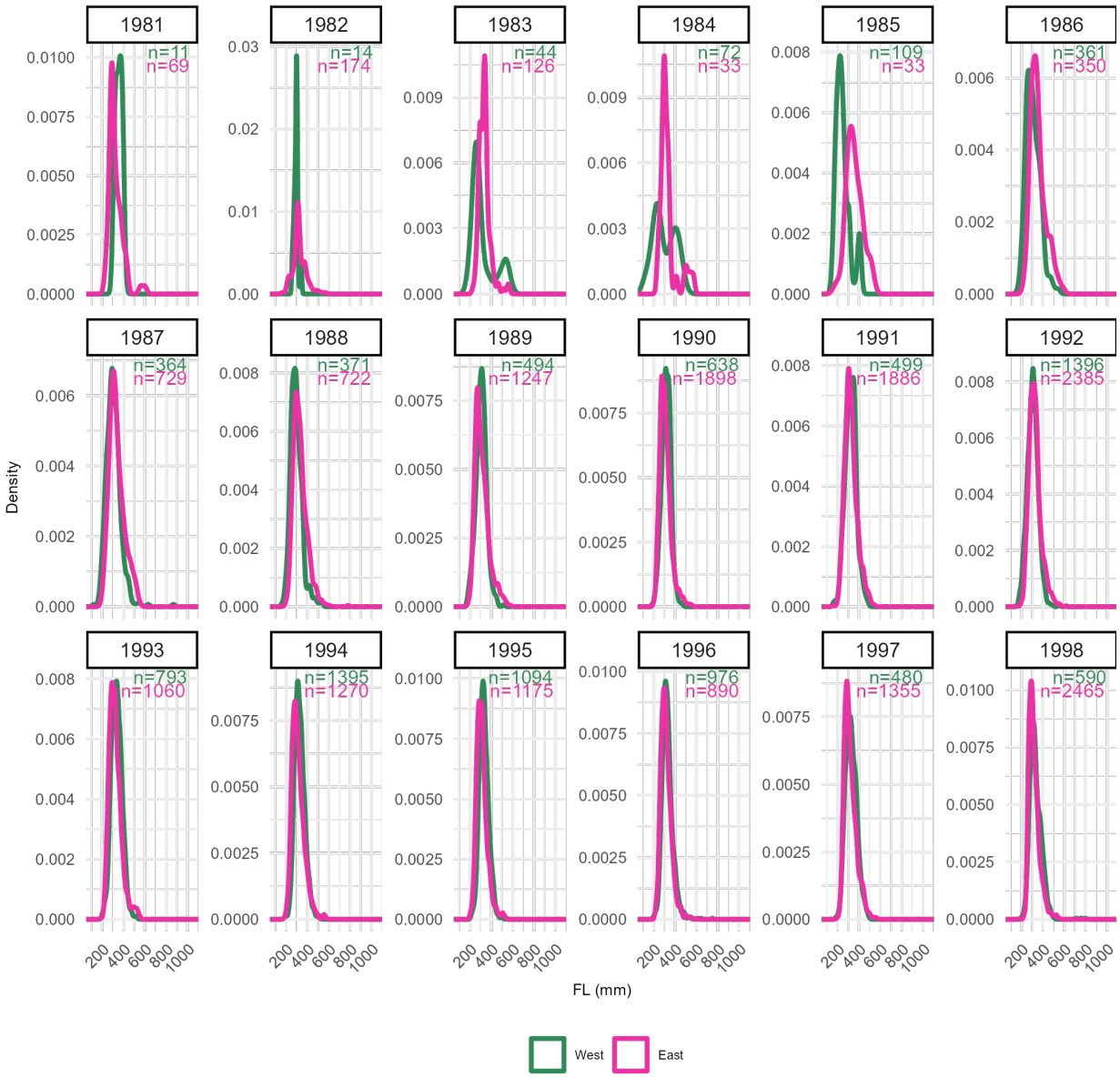

Figure 15. Nominal length distribution of the East and West subweighting regions for the Gulf stock.

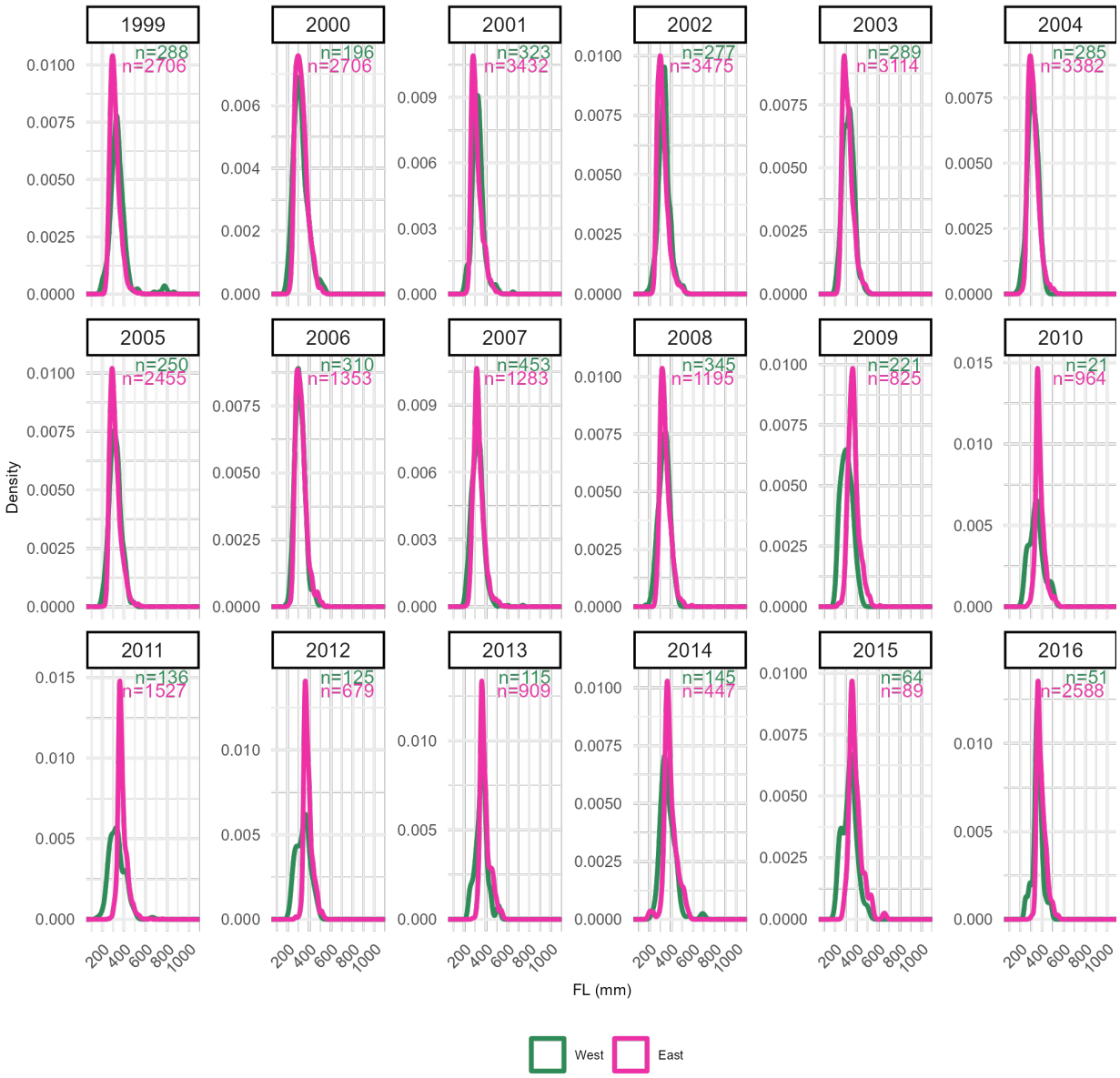

Figure 15 (continued). Nominal length distribution of the East and West subweighting regions for the Gulf stock.

Figure 15 (continued). Nominal length distribution of the East and West subweighting regions for the Gulf stock.

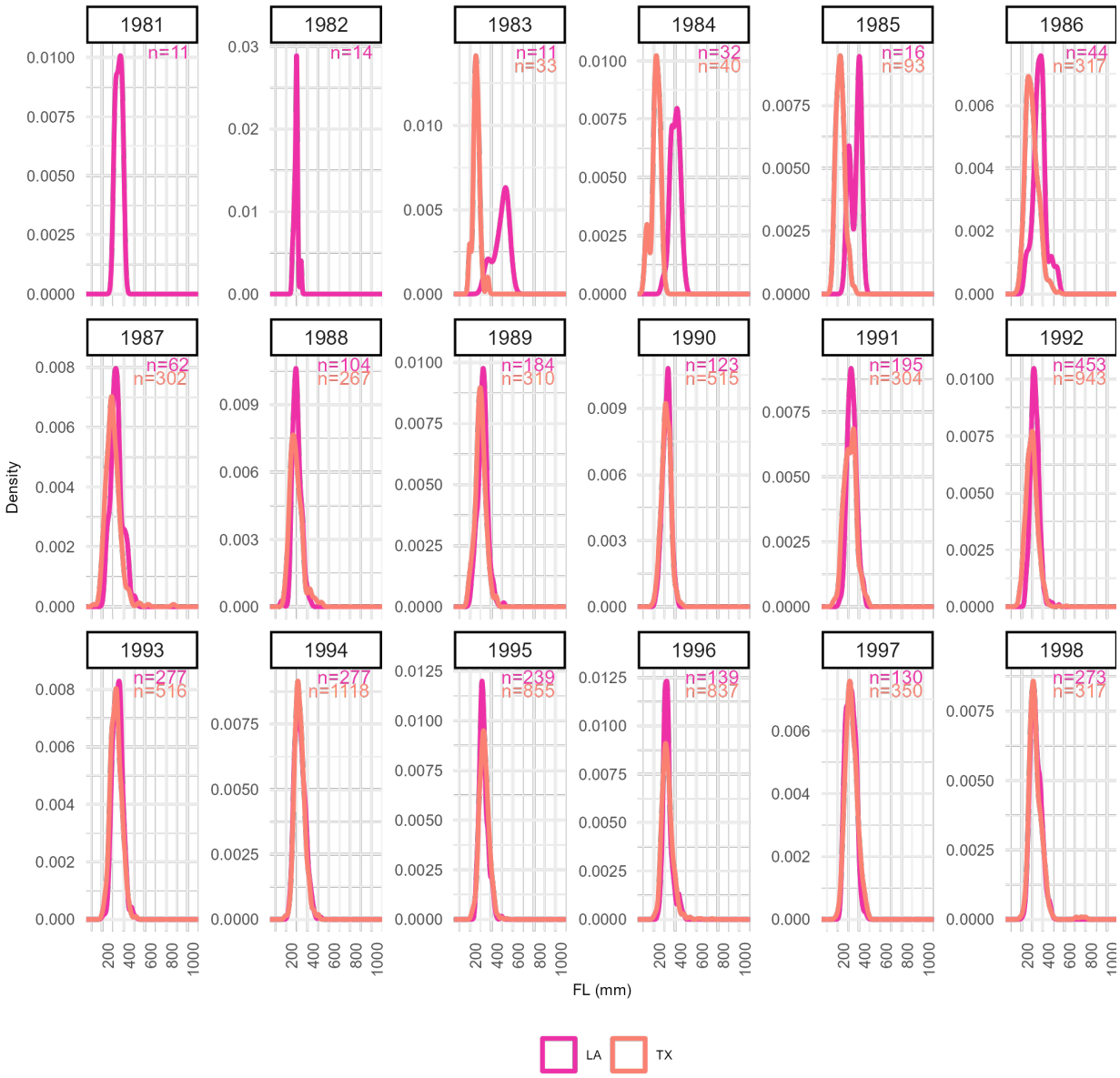

Figure 16. Nominal length distribution of the TX and LA subweighting regions for the West stock.

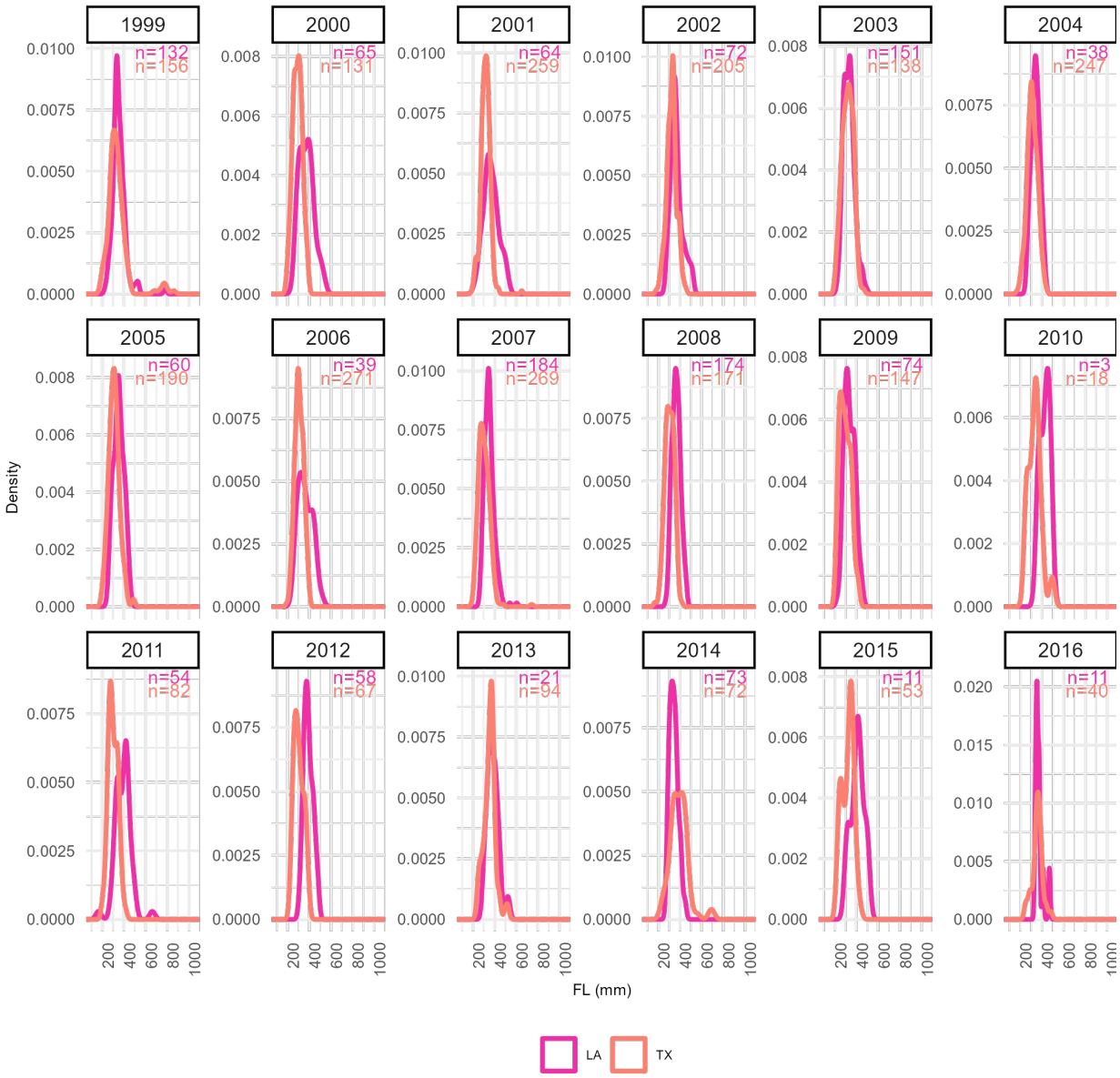

Figure 16 (continued). Nominal length distribution of the TX and LA subweighting regions for the West stock.

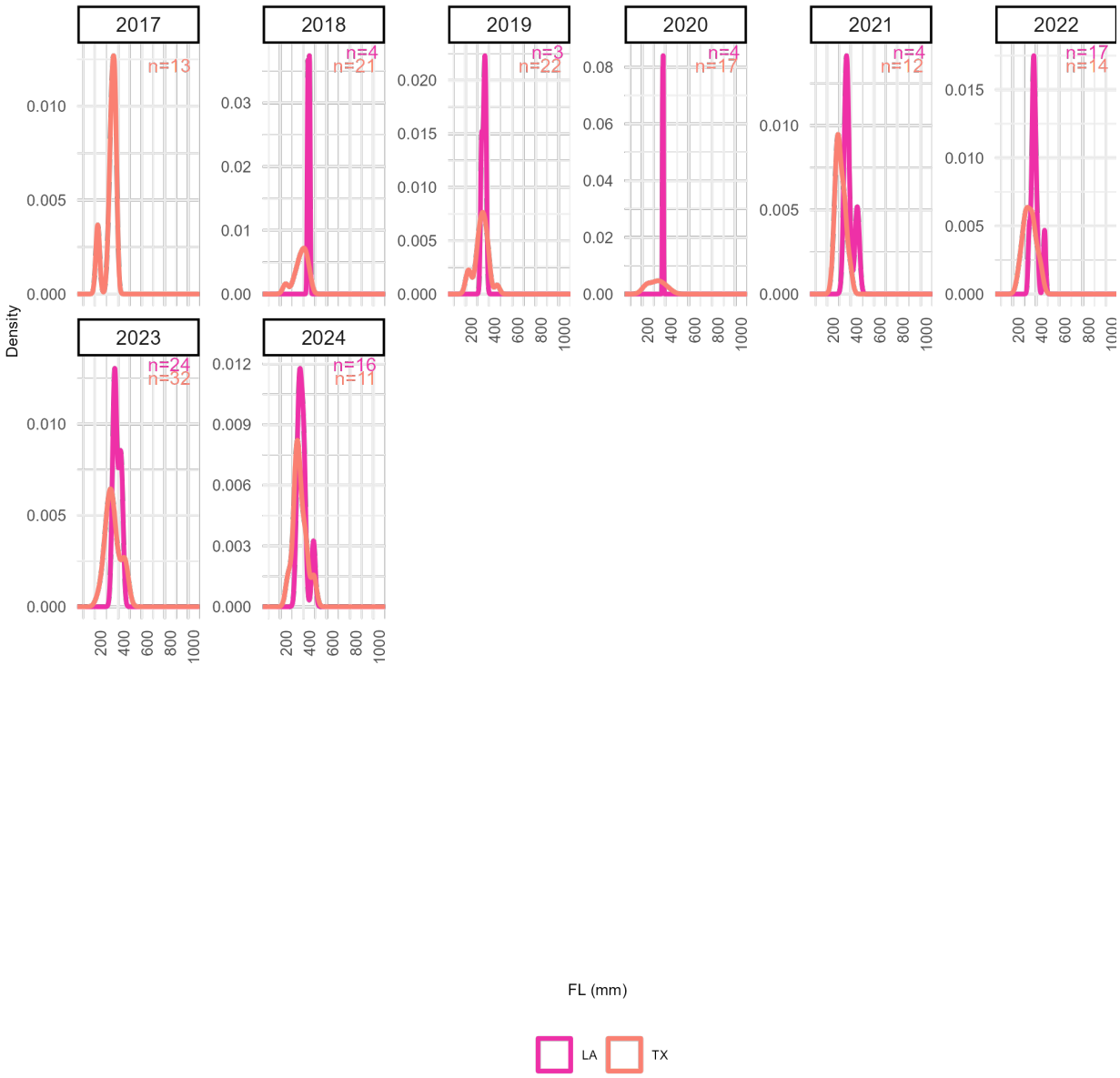

Figure 16 (continued). Nominal length distribution of the TX and LA subweighting regions for the West stock.

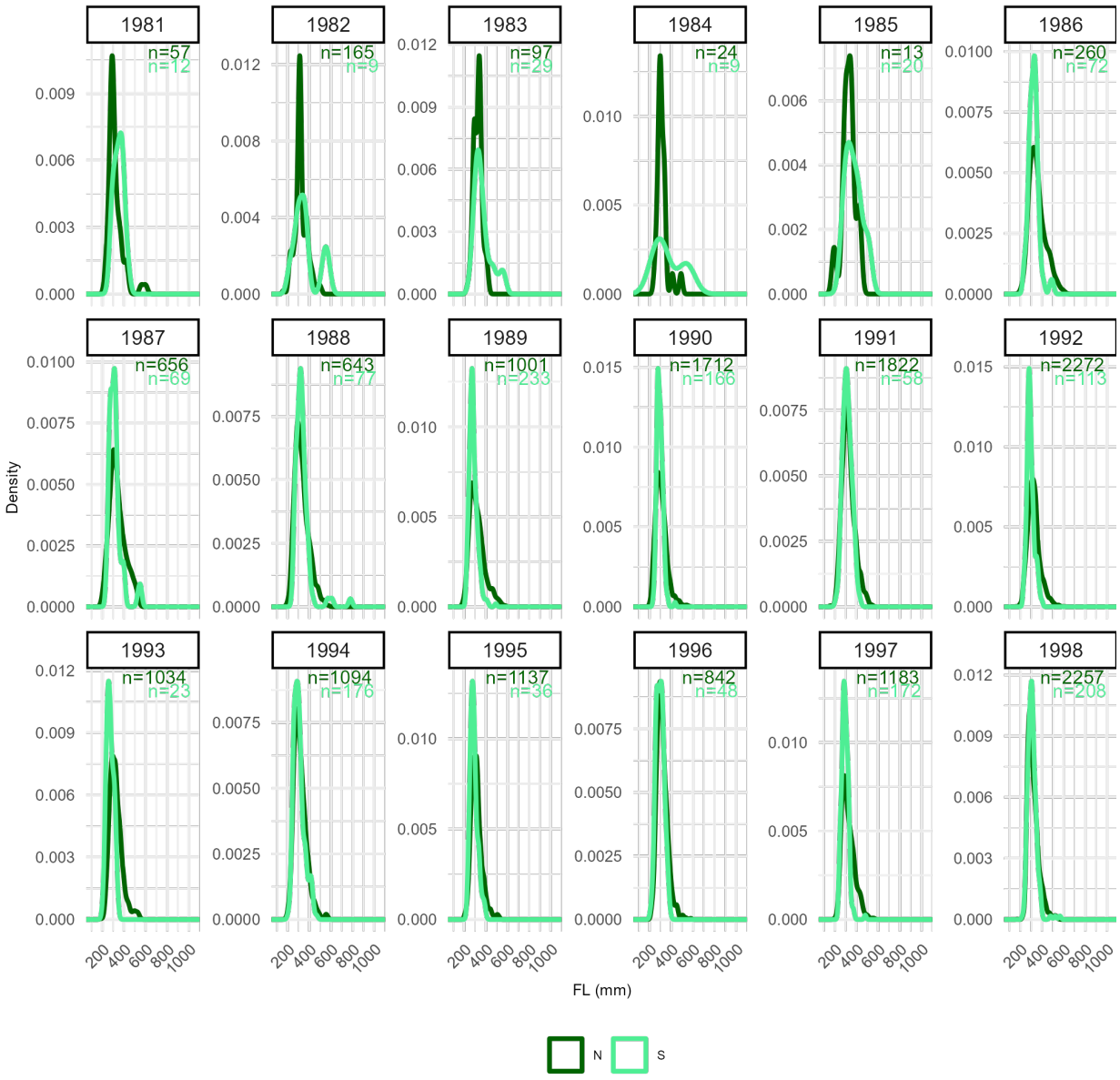

Figure 17. Nominal length distributions for the potential N (MS, AL, and FL panhandle) and S (FL peninsula) weighting subregions for the East stock.

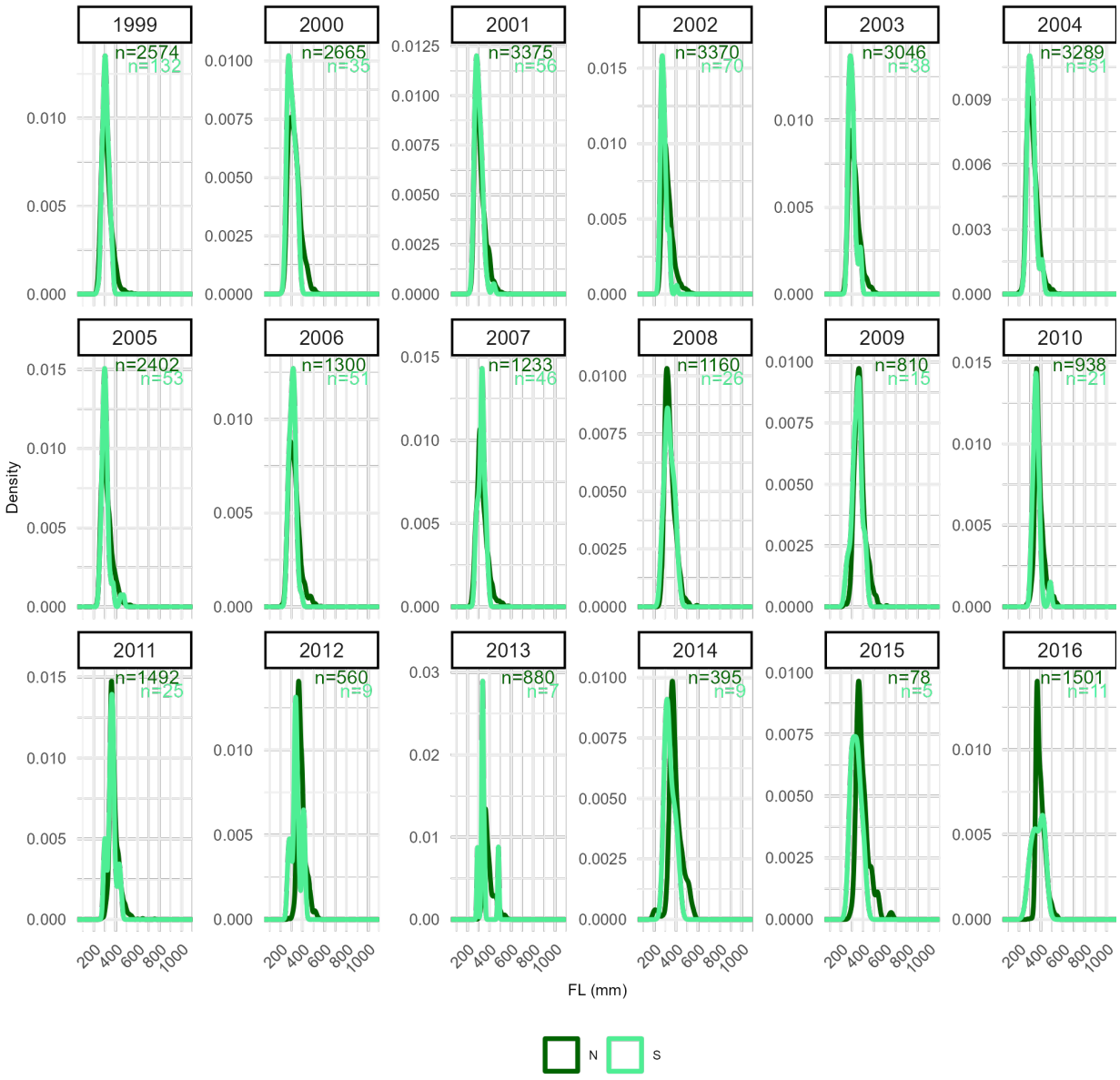

Figure 17 (continued). Nominal length distributions for the potential N (MS, AL, and FL panhandle) and S (FL peninsula) weighting subregions for the East stock.

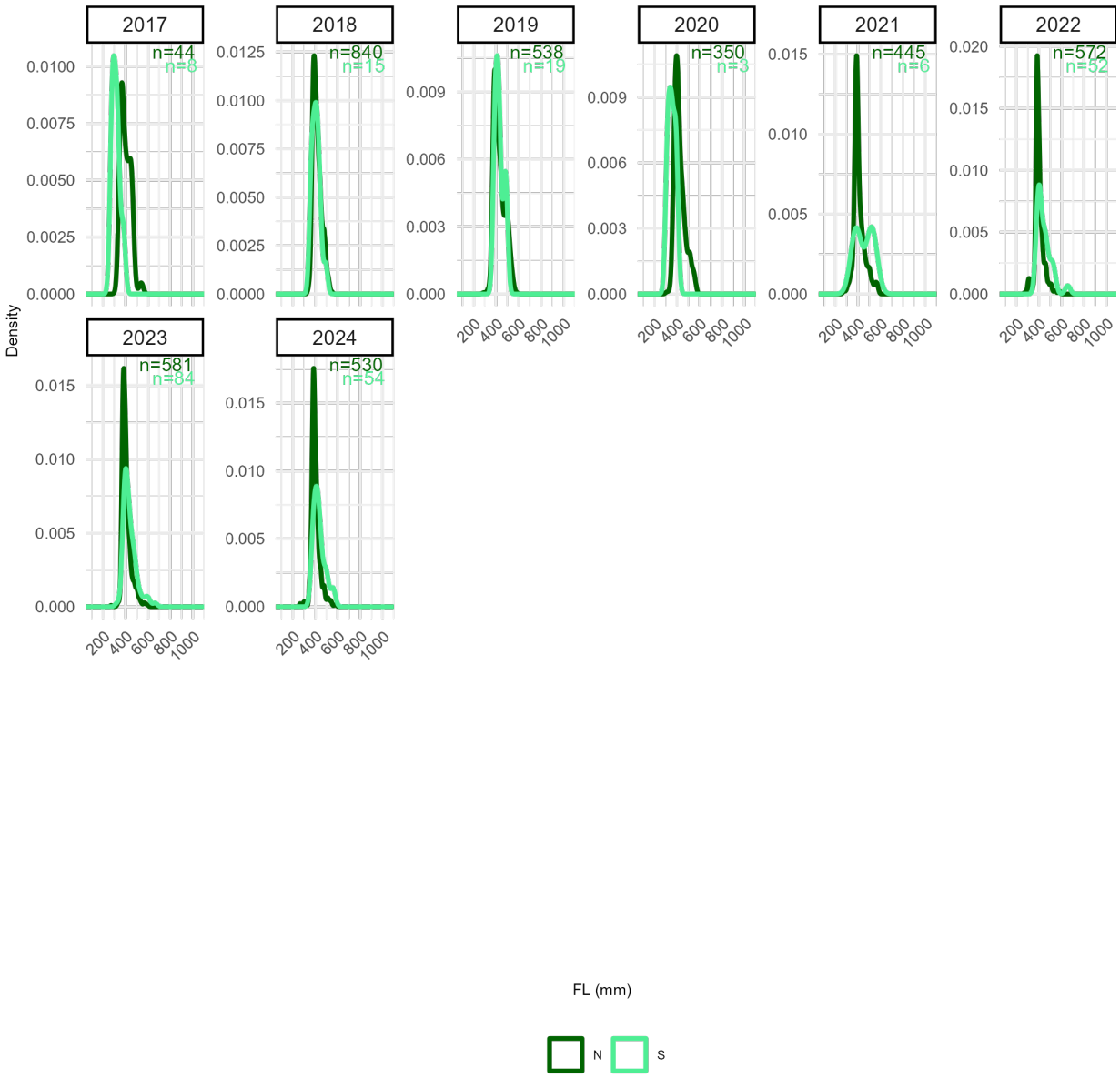

Figure 17 (continued). Nominal length distributions for the potential N (MS, AL, and FL panhandle) and S (FL peninsula) weighting subregions for the East stock.

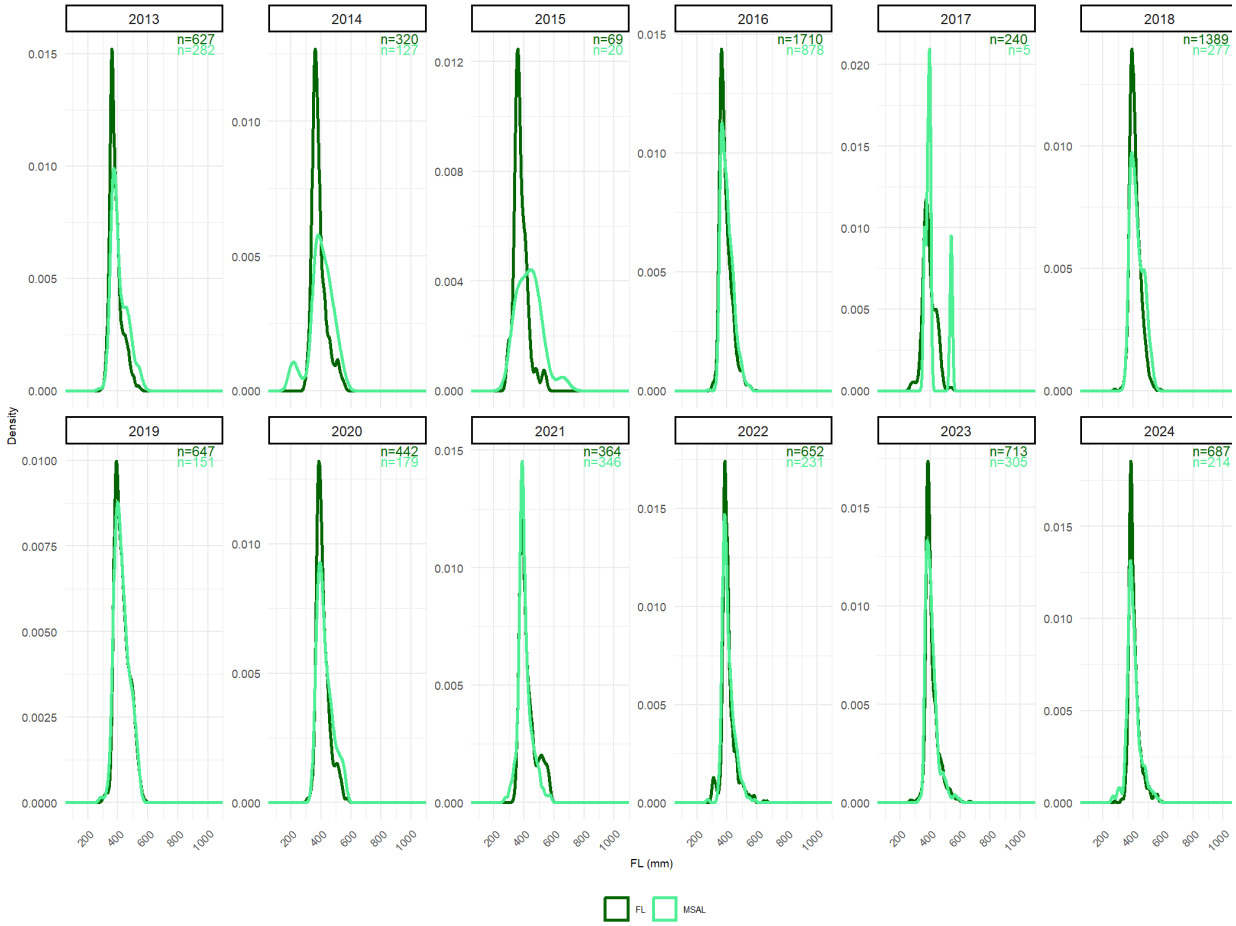

Figure 18. Nominal length distributions for the potential MSAL (MS and AL) and FL (FL panhandle and peninsula) weighting subregions for the East stock.

SEDAR 100 Gray Triggerfish Rec Comps Appendix

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December 10, 2025

Updates from Pre-Data Workshop Submission

The recreational compositions presented in this Appendix are the final length and age compositions provided for SEDAR 100. There have been multiple changes to the length and age data that were submitted prior to the Data Workshop. Updated morphometric equations for Gray Triggerfish were provided in Table 3 of SEDAR 100-DW-14 and these equations were recommended for use during the Data Workshop. The algorithm used to assign calendar age was also updated and new ages were assigned to young (age 0-2) fish (see Life History Section of SEDAR 100 Data Workshop report for full details). Three lengths that were previously included in preliminary length compositions were excluded as potential outliers. The final number of length samples included in length compositional analyses is 71,644 (Tables A1 and A2). Five age samples were excluded from the updated age file and the final number of age samples included in age composition analyses is 9,284 (Table A3).

There is a single recreational fleet for SEDAR 100 Gray Triggerfish consisting of the charter, private, and headboat modes. Length and age compositions were requested for two different stock structure scenarios. In the first, the entire Gulf is treated as a single stock. In the second, the Gulf is divided into two stocks with a West stock defined as Texas to Louisiana) and an East stock defined as Mississippi to the west coast of Florida). Prior to the data workshop, nominal length and age compositions, Conditional Age-at-Length (CAAL), and Mean Length-at-Age (MLAA) were provided for discussion. The final outputs of these analyses are provided below, in addition to final weighted length and age compositions.

Morphometric Equations

The final morphometric equations (SEDAR 100-DW-14) used to convert natural total length (NTL), maximum total length (MTL), and standard length (SL) in mm to fork length (FL) for SEDAR 100 are:

MTL to FL: FL = (0.788 * MTL) + 23.541

NTL to FL: FL = (0.792 * NTL) + 33.477

SL to FL: FL = (1.144*SL) + 13.531

Nominal and Weighted Length Compositions

Nominal length and weighted length compositions were developed for SEDAR 100. Fish were assigned to 2 cm bins with bins ranging from 2 cm - 90 cm fork length (FL). The label represents the floor of the bin. Fishery-dependent sampling is typically opportunistic and sampled lengths may not be representative of the true landings composition of recreational Gray Triggerfish in the Gulf. Possible sampling biases in the collection of length samples are typically removed by weighting the length compositions with the associated landings at the finest spatial and temporal scale available without losing data. When the entire Gulf was treated as a single stock, the weighting subregions were defined as West (TX and LA) and East (MS to the west coast of FL). The weighting subregions for the West stock were defined as TX and LA. During the data workshop, two potential options for defining the East weighting subregions were discussed. The first option split the East stock into MS/AL and FL weighting subregions. The second option split the east stock into North (MS to FL panhandle) and South (FL peninsula) weighting subregions. For the first option, weighting would only be able to occur beginning in 2013. Prior to 2013, AL and the FL panhandle were grouped together as a single region for the Southeast Region Headboat Survey (SRHS) and separate AL and FL panhandle landings estimates are not available from headboat until 2013. The recreational work group recommended using the second weighting option, where the East stock region was split into N and S weighting subregions because this allowed for all years (with sufficient sample sizes) to be weighted and it did not split the area where the fishery is most concentrated. Sample sizes for the single stock weighting subregions are available in Table A1. Sample sizes for the subweighting regions for the two stock scenario are available in Table A2.

Comparisons of nominal and weighted length compositions for the Gulf, West, and East stocks are shown in Figures A1-A3, respectively. Weighting had a minimal impact on the length compositions and most years nominal and weighted length distributions are very similar for all stock scenarios. For almost all years from 2017-2024, sample sizes in the West did not meet the recommended threshold of 30 fish per strata and sample sizes were insufficient for both nominal and weighted length compositions. For the entire Gulf stock, weighting did impact the length comps from 1983-1985 and this is also seen for the West-only stock. Comparisons of the weighted length compositions by stock is shown in Figure A4. Generally, the distributions are similar for all 3 stock regions, however, the weighted length distribution for Gray Triggerfish in the West stock does differ from the East and Gulf stocks in a couple of years. This may be a result of lower sample sizes for the West stock as compared to the East stock because the years with the most pronounced differences correspond to years with lower sample sizes for the West.

Nominal and Weighted Age Compositions

Nominal and weighted age compositions were calculated separately for each stock scenario. The age compositions are weighted to account for potential sampling biases associated with fishery-dependent data. The weighting method is adapted from Chih (2009) and a reweighting factor (RW) was estimated within year i and length bin j and corrects the composition of the age data to more closely represent the final length composition of landings. For each fleet and region combination, the reweighting factor $RW_{i,j}$ is calculated as

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

where $LC_{i,j}$ is the length composition from the length-only data, $a_{i,j}$ is the number of age samples in year *i* and length bin *j*, and a_i are the total number of age samples in year *i*. With this method, if there were age samples in $a_{i,j}$ not represented in $LC_{i,j}$ they are down-weighted to zero and effectively dropped from further analysis. The final weighted age compositions, for each fleet and region, 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 age class *k w*ere summed and then rescaled to sum to 1 across each year.

Comparisons of nominal and weighted age compositions for the Gulf, West, and East stocks are shown in Figures A5-A7, respectively. Weighting had a minimal impact on the age compositions and nominal and weighted age distributions are very similar for all stock scenarios. There were only six years where sample sizes (Table A3) were sufficient for weighted age compositions in the West region. There are small differences between the weighted age compositions for the West and East stocks during these years (Figure A8). Bubble plots for the final weighted age compositions are shown in Figures A9-A11. The age distribution of Gray Triggerfish is more truncated in the West stock region compared to the East stock region. The maximum observed age in the West is 11 years while it is 16 years in the East.

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.

CAAL is calculated as

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

where $a_{i,j,k}$ is the number of age samples in year *i*, length bin *j*, and age class *k* and $a_{i,j}$ is the number of age samples in year *i* and length bin *j*.

Stock-specific CAAL are shown in Figures A12-A14. Sample sizes are sufficient for most years for the Gulf and East stocks, but are fairly low most years in the West. For all stock options, the spread in CAAL is poor and may not be informative.

Mean Length-at-Age

Mean length-at-age (MLAA) is the average length for each age and is calculated as

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

where *L* are lengths , *a* is the number of associated sample sizes, *i* is year, and *k* is age class. MLAA are provided to aide in model diagnostics and is presented in Figures A15-A17.

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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.

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Piner, K.R., H.H. Lee, M.N. Maunder. 2016. Evaluation of using conditional age-at-length 484 observations and an equilibrium approximation of the population age structure in fitting 485 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 493 selective fisheries mortality. Fisheries Research. 142:75-85.

Tables

Table A1: Number of fish and trips sampled for **length** in the entire Gulf, West, and East regions. Values in red do not meet the recommended criteria of either 30 fish or 10 trips per strata.

	Number of Fish			Number of Trips		
Year	Gulf	West	East	Gulf	West	East
1981	80	11	69	30	4	26
1982	188	14	174	60	3	57
1983	170	44	126	78	25	53
1984	105	72	33	41	24	17
1985	142	109	33	61	39	22
1986	711	361	350	315	146	169
1987	1,093	364	729	429	152	277
1988	1,093	371	722	424	148	276
1989	1,741	494	1,247	548	147	401
1990	2,536	638	1,898	543	140	403
1991	2,385	499	1,886	550	133	417
1992	3,781	1,396	2,385	802	290	512
1993	1,853	793	1,060	530	227	303
1994	2,665	1,395	1,270	653	321	332
1995	2,269	1,094	1,175	560	292	268
1996	1,866	976	890	417	204	213
1997	1,835	480	1,355	535	159	376
1998	3,055	590	2,465	711	198	513
1999	2,994	288	2,706	765	123	642
2000	2,902	196	2,706	697	86	611
2001	3,755	323	3,432	680	113	567
2002	3,752	277	3,475	792	123	669
2003	3,403	289	3,114	685	117	568
2004	3,667	285	3,382	793	115	678
2005	2,705	250	2,455	641	97	544
2006	1,663	310	1,353	524	110	414
2007	1,736	453	1,283	597	151	446
2008	1,540	345	1,195	598	104	494
2009	1,046	221	825	544	97	447
2010	985	21	964	514	13	501

	Number of Fish			Number of Trips		
Year	Gulf	West	East	Gulf	West	East
2011	1,663	136	1,527	721	55	666
2012	804	125	679	320	44	276
2013	1,024	115	909	512	63	449
2014	593	145	448	208	29	179
2015	153	64	89	64	29	35
2016	2,639	51	2,588	700	33	667
2017	258	13	245	74	8	66
2018	1,691	25	1,666	616	18	598
2019	823	25	798	274	15	259
2020	642	21	621	196	12	184
2021	726	16	710	261	11	250
2022	913	31	882	406	14	392
2023	1,072	56	1,016	466	25	441
2024	927	27	900	443	15	428

Table A2: Number of fish and trips sampled for **length** in weighting subregions for the West (TX and LA) and East (N and S) stock regions. Values in red do not meet the recommended criteria of either 30 fish or 10 trips per strata.

	Number of Fish				Number of Trips			
Year	TX	LA	N	S	TX	LA	N	S
1981	0	11	57	12	0	4	16	10
1982	0	14	165	9	0	3	50	7
1983	33	11	97	29	18	7	38	15
1984	40	32	24	9	17	7	9	8
1985	93	16	13	20	36	3	6	16
1986	317	44	260	72	127	19	104	54
1987	302	62	656	69	127	25	220	54
1988	267	104	643	77	110	38	214	60
1989	310	184	1,001	233	91	56	286	109
1990	515	123	1,712	166	112	28	320	73
1991	304	195	1,822	58	85	48	383	31
1992	943	453	2,272	113	188	102	449	63
1993	516	277	1,034	23	143	84	285	16
1994	1,118	277	1,094	176	229	92	288	44
1995	855	239	1,137	36	209	83	243	24
1996	837	139	842	48	160	44	182	31
1997	350	130	1,183	172	97	62	297	79
1998	317	273	2,257	208	109	89	420	93
1999	156	132	2,574	132	61	62	566	76
2000	131	65	2,665	35	48	38	585	24
2001	259	64	3,375	56	86	27	527	39
2002	205	72	3,370	70	96	27	586	48
2003	138	151	3,046	38	61	56	515	30
2004	247	38	3,289	51	94	21	635	38
2005	190	60	2,402	53	77	20	506	38
2006	271	39	1,300	51	91	19	380	33
2007	269	184	1,233	46	90	61	410	34
2008	171	174	1,160	26	72	32	468	20
2009	147	74	810	15	73	24	432	15
2010	18	3	938	21	11	2	480	20
2011	82	54	1,492	25	38	17	636	24

	Number of Fish				Number of Trips			
Year	TX	LA	N	S	TX	LA	N	S
2012	67	58	560	9	27	17	240	8
2013	94	21	880	7	50	13	439	6
2014	72	73	395	9	23	6	161	8
2015	53	11	78	5	23	6	25	5
2016	40	11	1,501	11	28	5	421	11
2017	13	0	44	8	8	0	15	3
2018	21	4	840	15	16	2	374	12
2019	22	3	538	19	13	2	167	18
2020	17	4	350	3	11	1	90	3
2021	12	4	445	6	9	2	140	6
2022	14	17	572	52	10	4	238	41
2023	32	24	581	84	18	7	264	40
2024	11	16	530	54	10	5	267	40

Table A3: Number of fish and trips sampled for **age** in the entire Gulf, West, and East regions. Values in red do not meet the recommended criteria of either 10 fish or 10 trips per strata.

	Number of Fish			Number of Trips		
Year	Gulf	West	East	Gulf	West	East
2003	50	0	50	29	0	29
2004	102	0	102	24	0	24
2005	61	0	61	21	0	21
2006	77	0	77	14	0	14
2007	303	203	100	97	61	36
2008	375	139	236	83	23	60
2009	375	115	260	117	42	75
2010	181	4	177	74	3	71
2011	283	54	229	100	17	83
2012	302	48	254	91	15	76
2013	586	50	536	183	29	154
2014	214	3	211	75	3	72
2015	29	1	28	11	1	10
2016	1,821	6	1,815	374	5	369
2017	192	0	192	48	0	48
2018	1,256	3	1,253	322	3	319
2019	668	2	666	177	2	175
2020	425	2	423	122	1	121
2021	428	3	425	158	2	156
2022	615	8	607	258	3	255
2023	643	9	634	270	7	263
2024	298	8	290	164	5	159

Figures

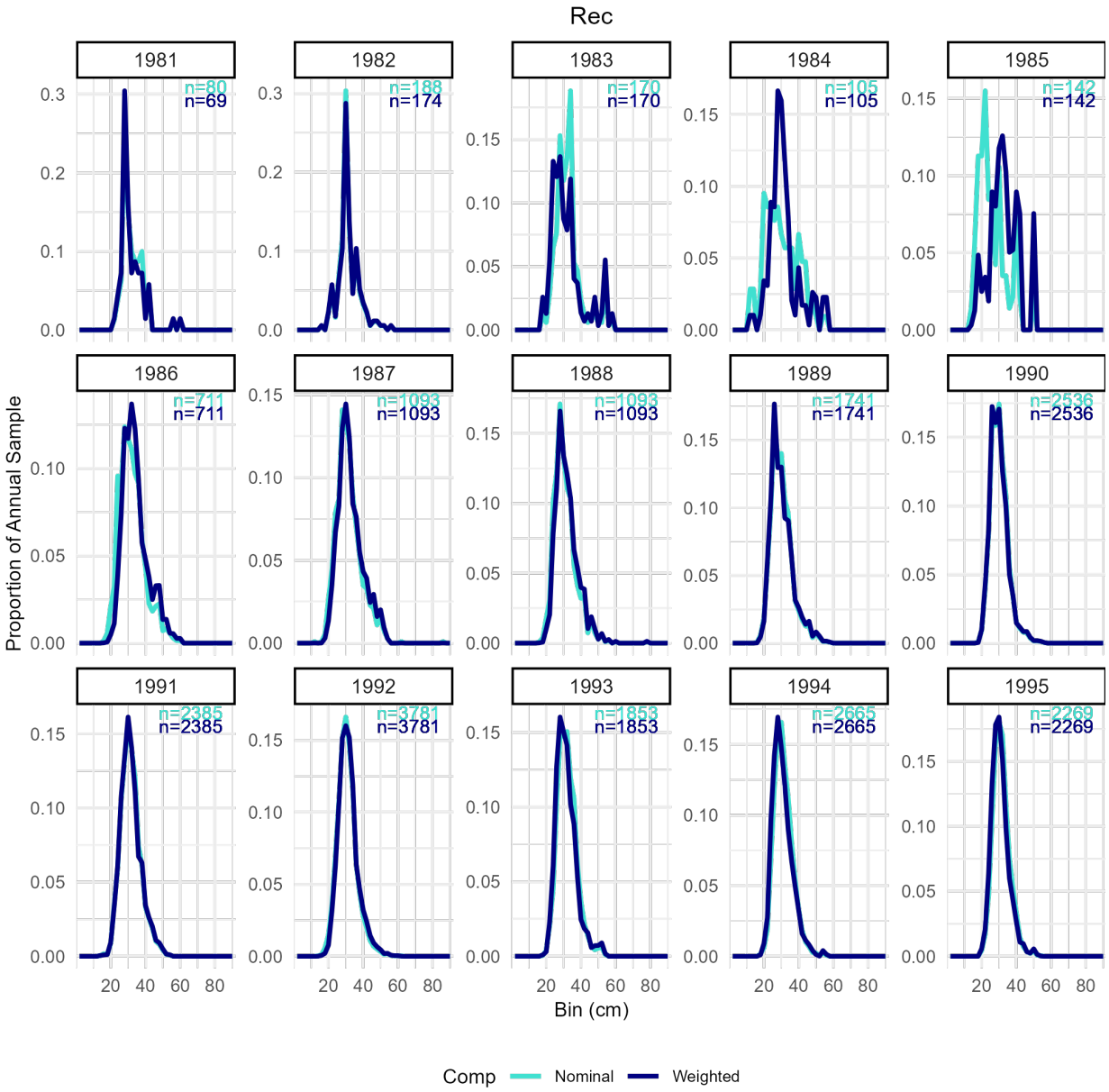

*Figure A1.1. A comparison of nominal and weighted length compositions from the **Gulf** stock from 1981-1995. The number of fish (n) for each composition type is provided in the top right corner of each panel.*

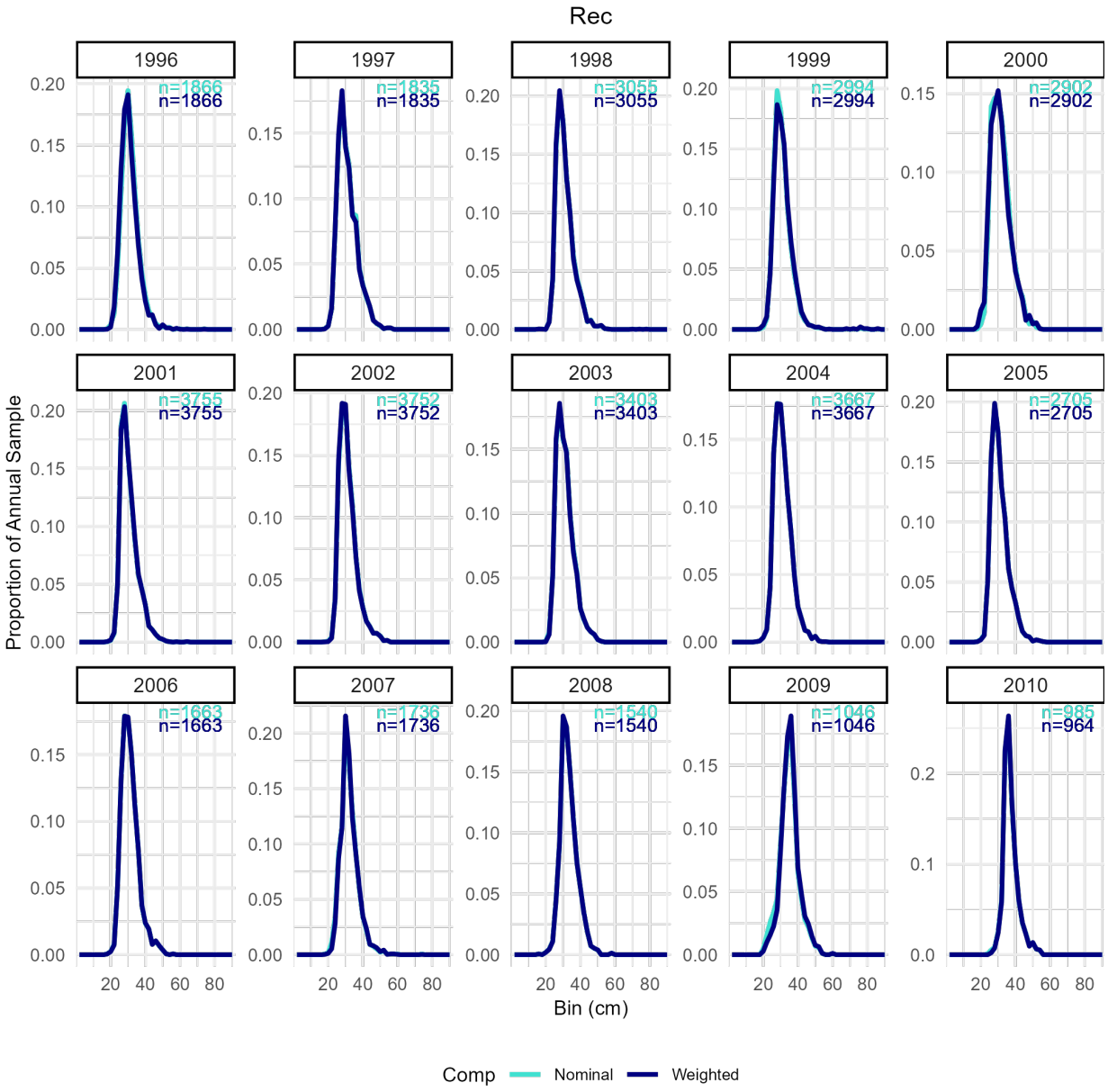

*Figure A1.2. A comparison of nominal and weighted length compositions from the **Gulf** stock from 1996-2010. The number of fish (n) for each composition type is provided in the top right corner of each panel.*

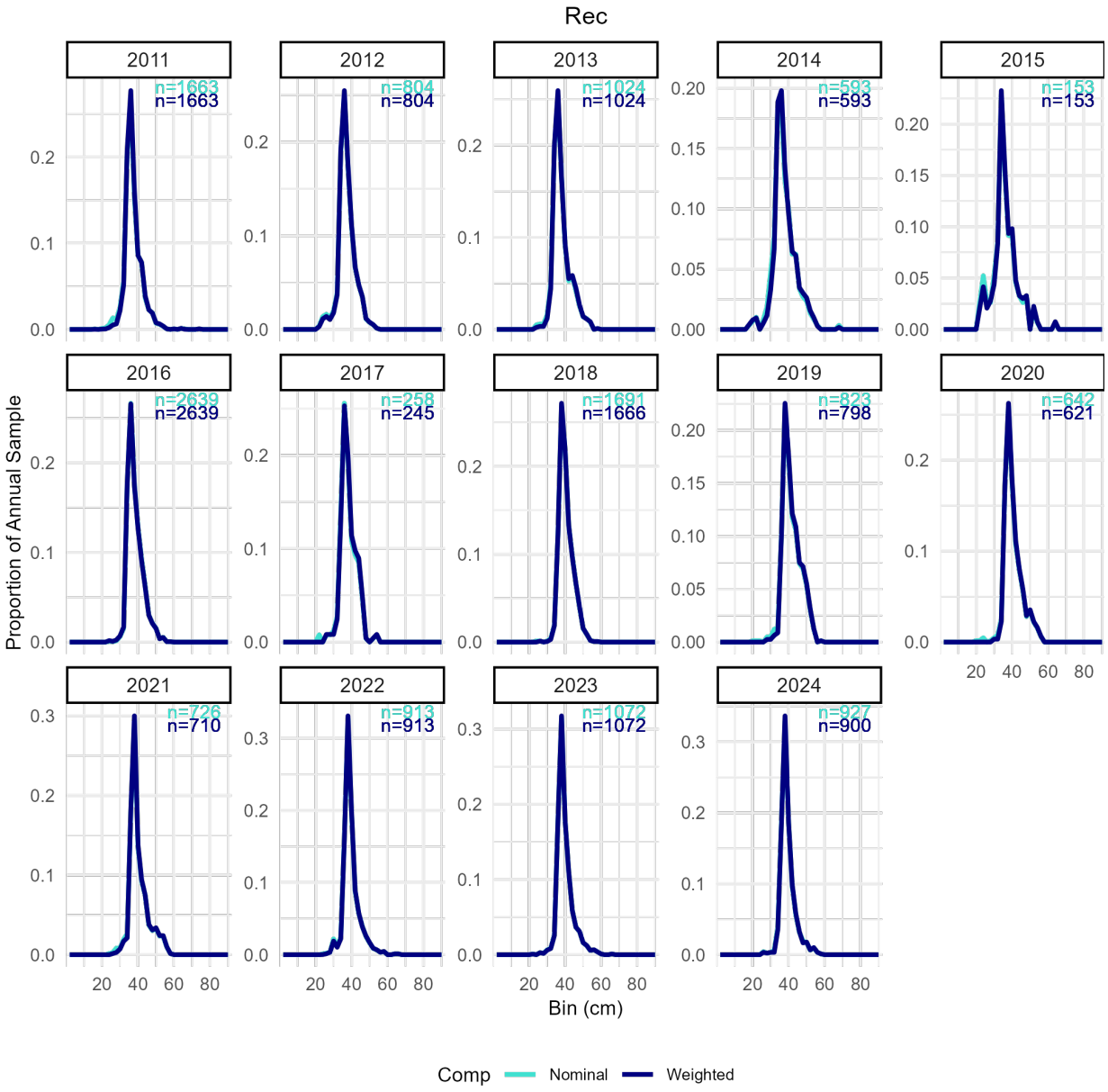

*Figure A1.3. A comparison of nominal and weighted length compositions from the **Gulf** stock from 2011-2024. The number of fish (n) for each composition type is provided in the top right corner of each panel.*

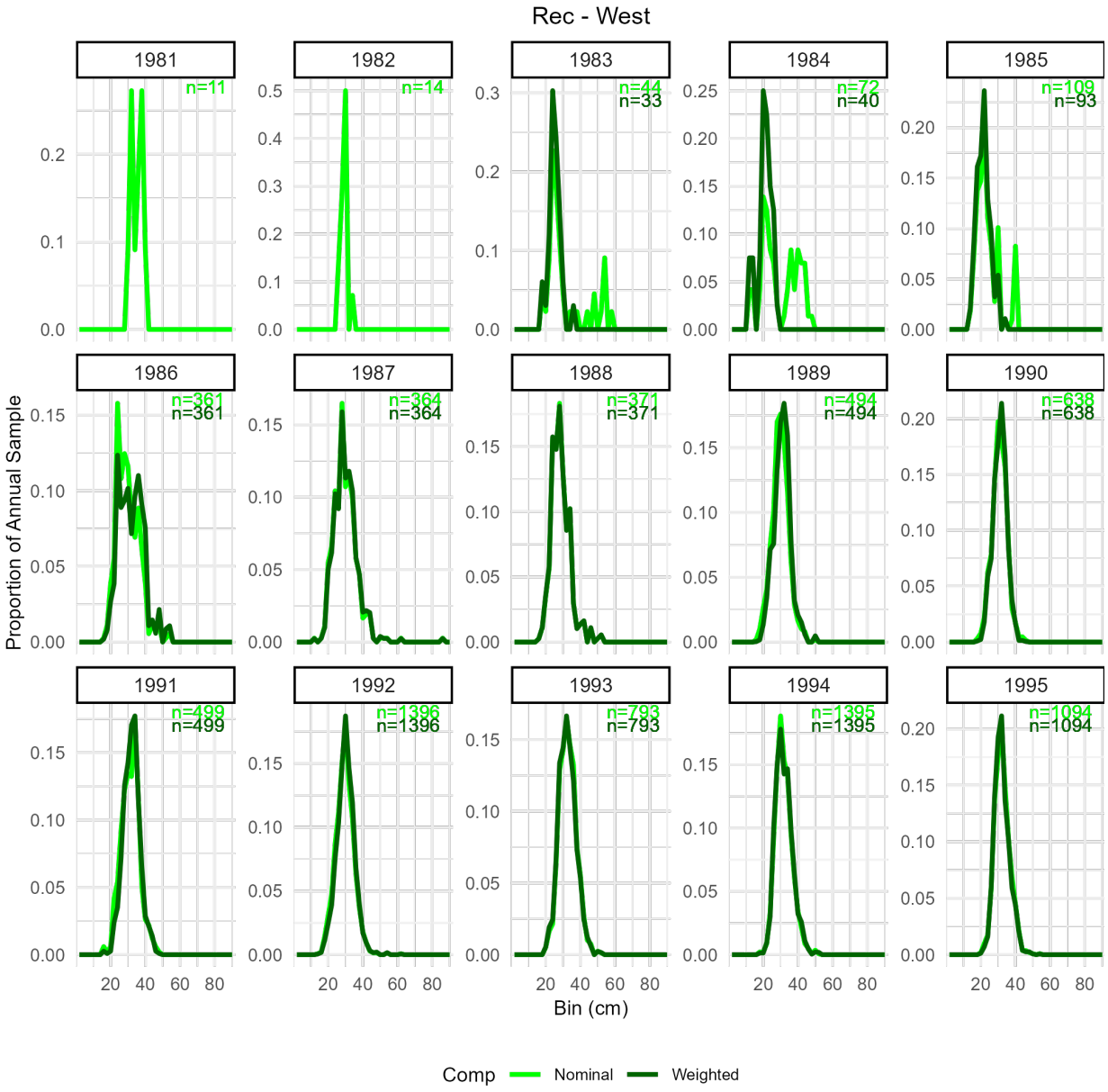

*Figure A2.1. A comparison of nominal and weighted length compositions from the **West** stock from 1981-1995. The number of fish (n) for each composition type is provided in the top right corner of each panel.*

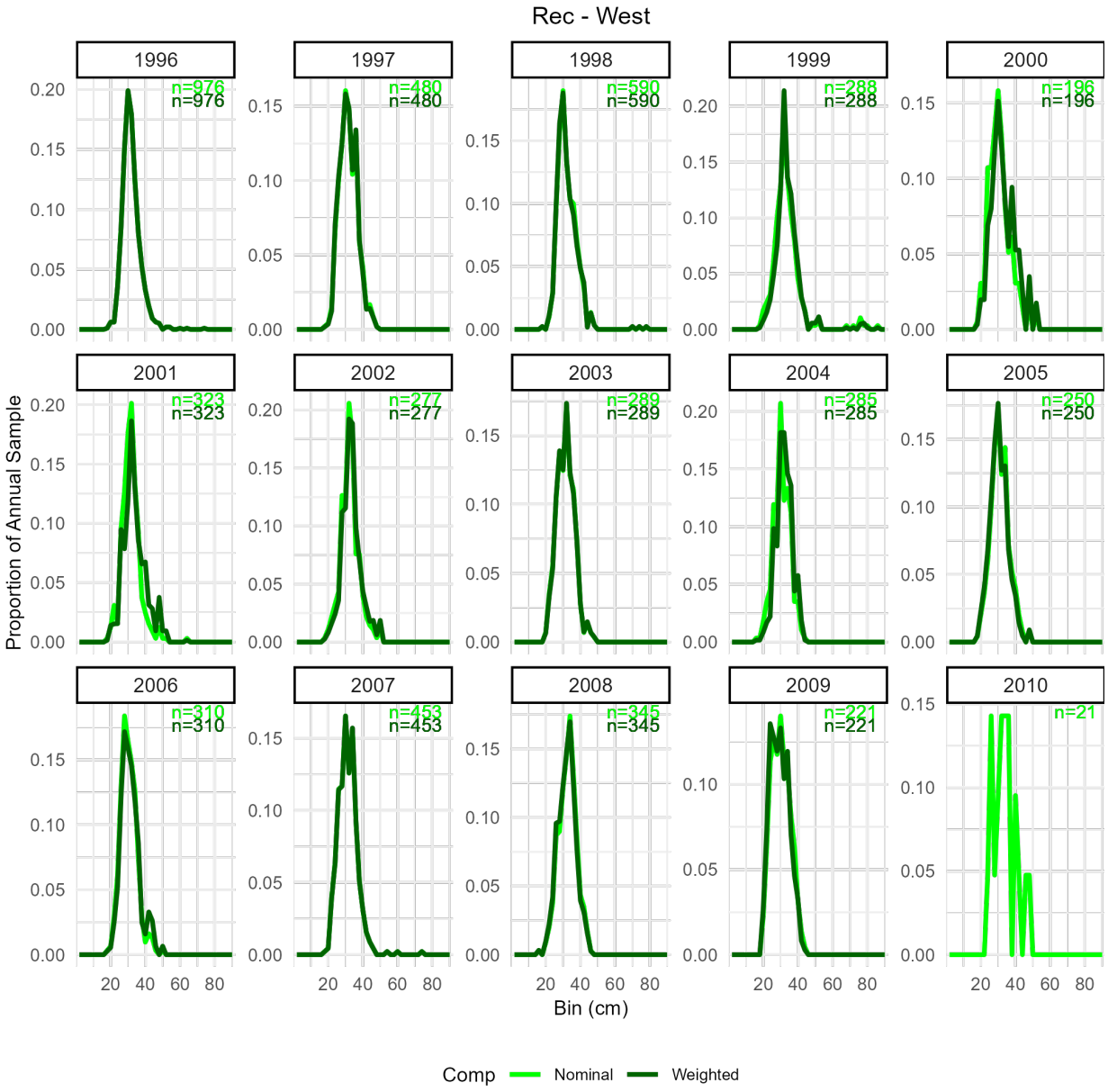

*Figure A2.2. A comparison of nominal and weighted length compositions from the **West** stock from 1996-2010. The number of fish (n) for each composition type is provided in the top right corner of each panel.*

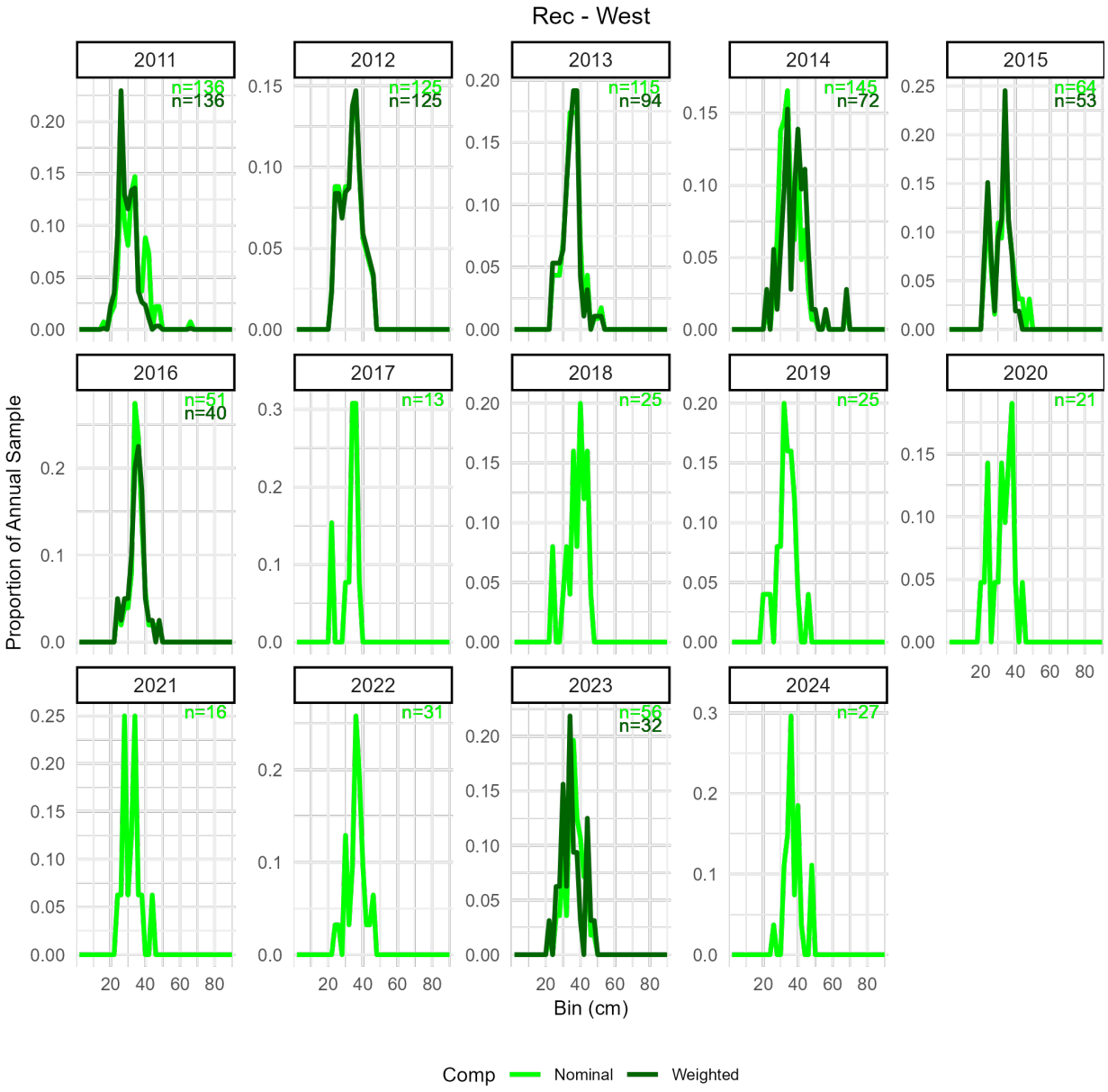

*Figure A2.3. A comparison of nominal and weighted length compositions from the **West** stock from 2011-2024. The number of fish (n) for each composition type is provided in the top right corner of each panel.*

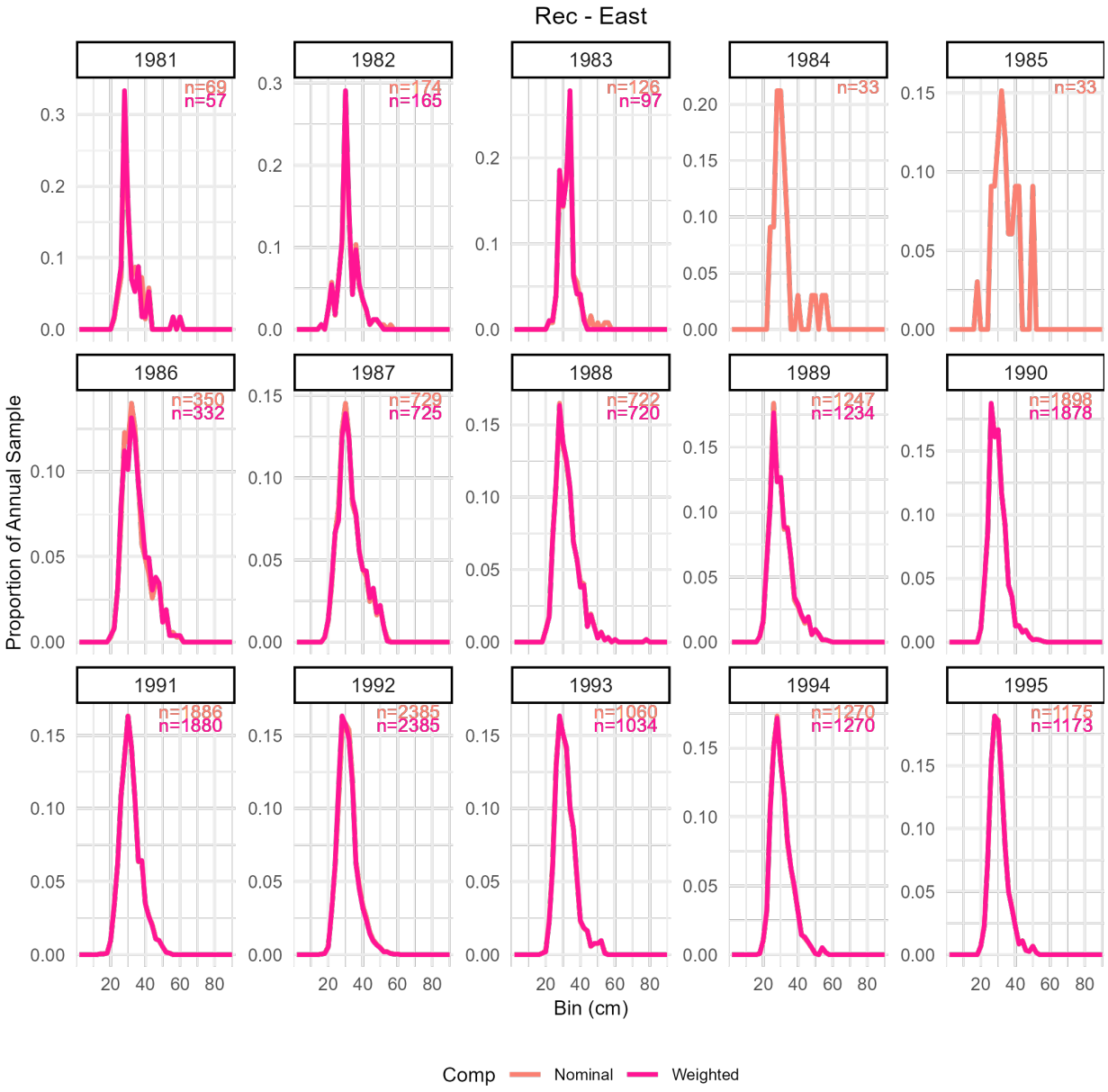

*Figure A3.1. A comparison of nominal and weighted length compositions from the **East** stock from 1981-1995. The number of fish (n) for each composition type is provided in the top right corner of each panel.*

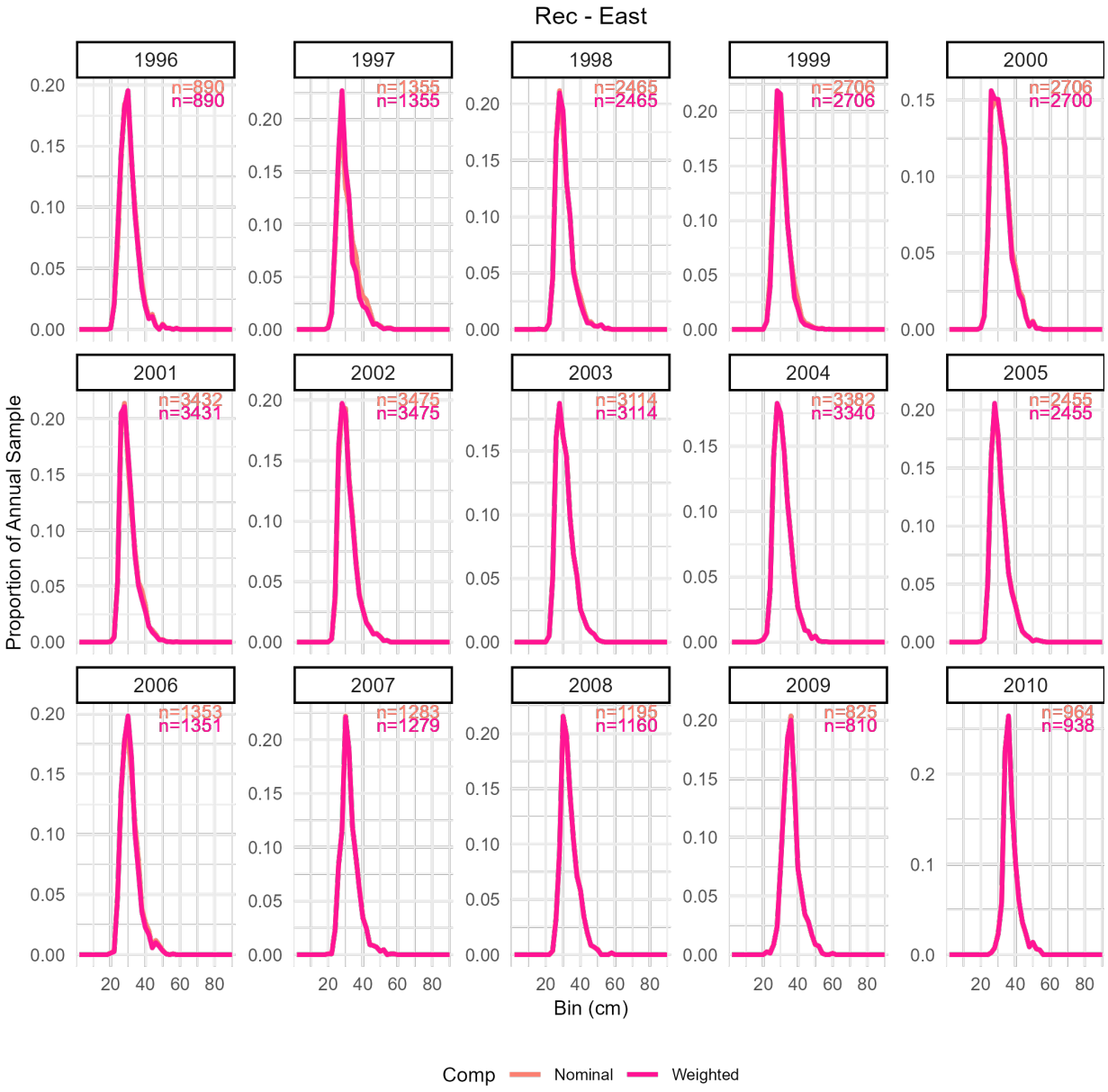

*Figure A3.2. A comparison of nominal and weighted length compositions from the **East** stock from 1996-2010. The number of fish (n) for each composition type is provided in the top right corner of each panel.*

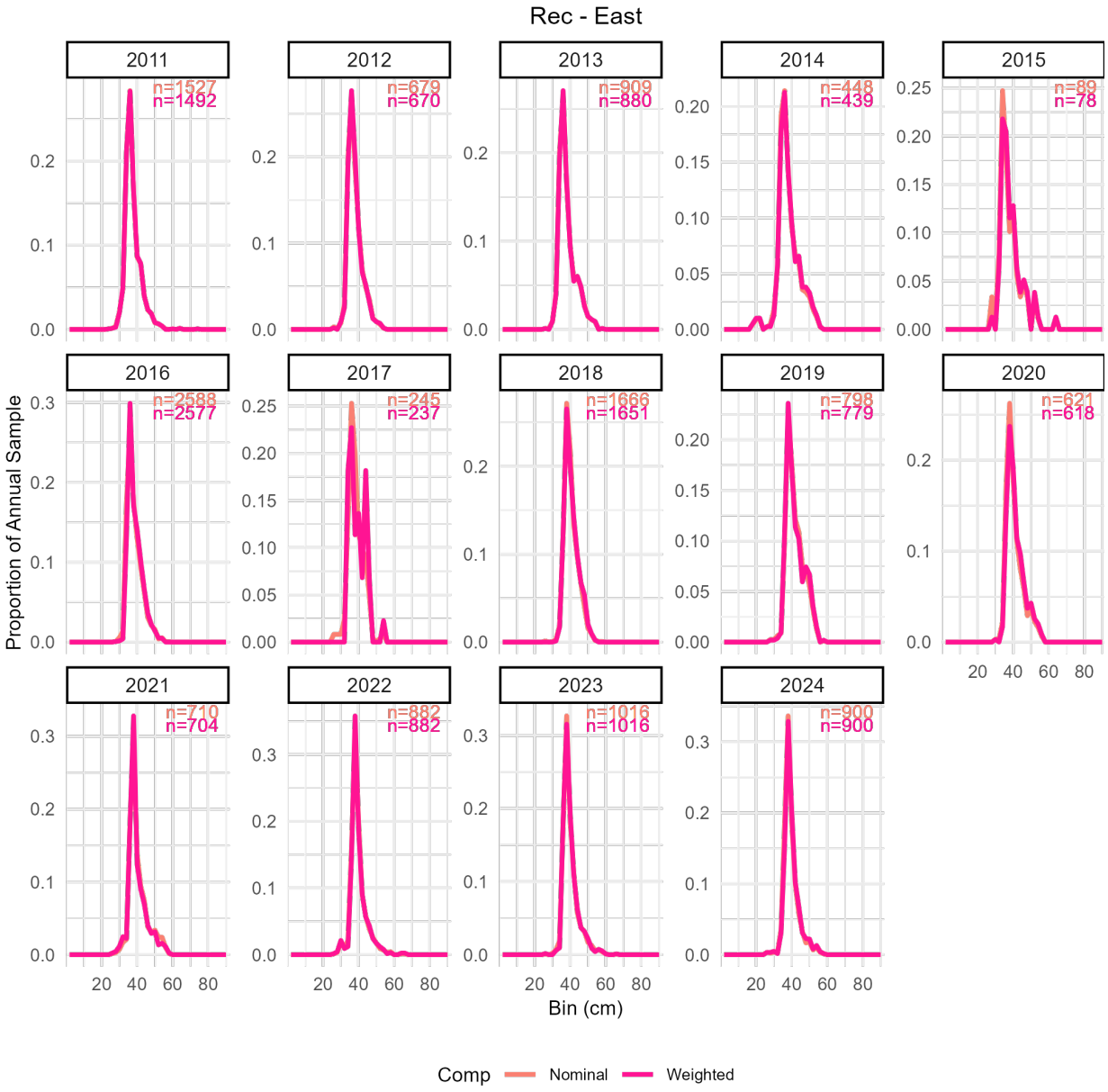

Figure A3.3. A comparison of nominal and weighted length compositions from the East stock from 2011-2024. The number of fish (n) for each composition type is provided in the top right corner of each panel.

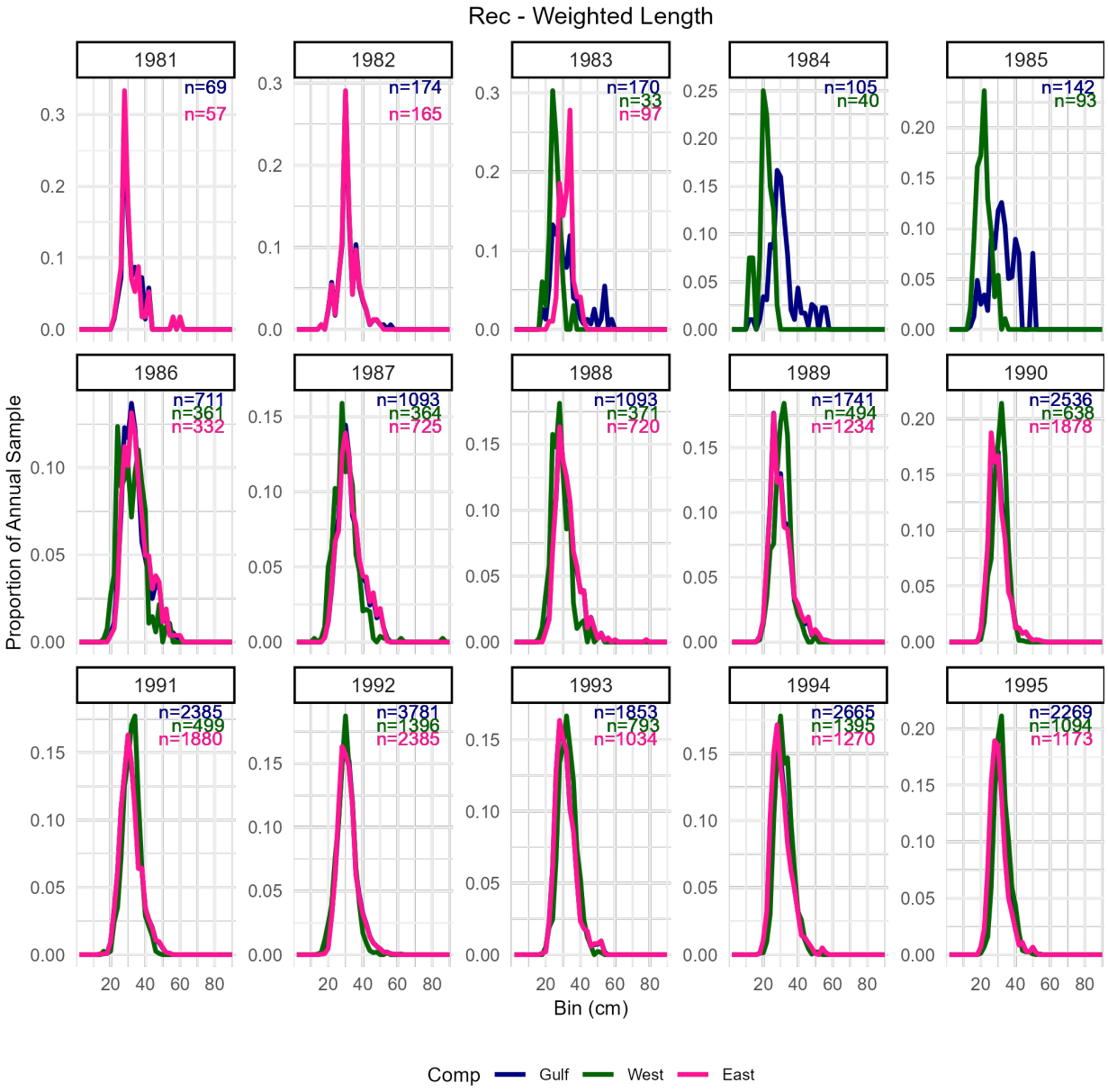

Figure A4.1. A comparison of weighted length compositions from the Gulf (blue), West (green), and East (pink) stocks from 1981-1995. The number of fish (n) for each stock is provided in the top right corner of each panel.

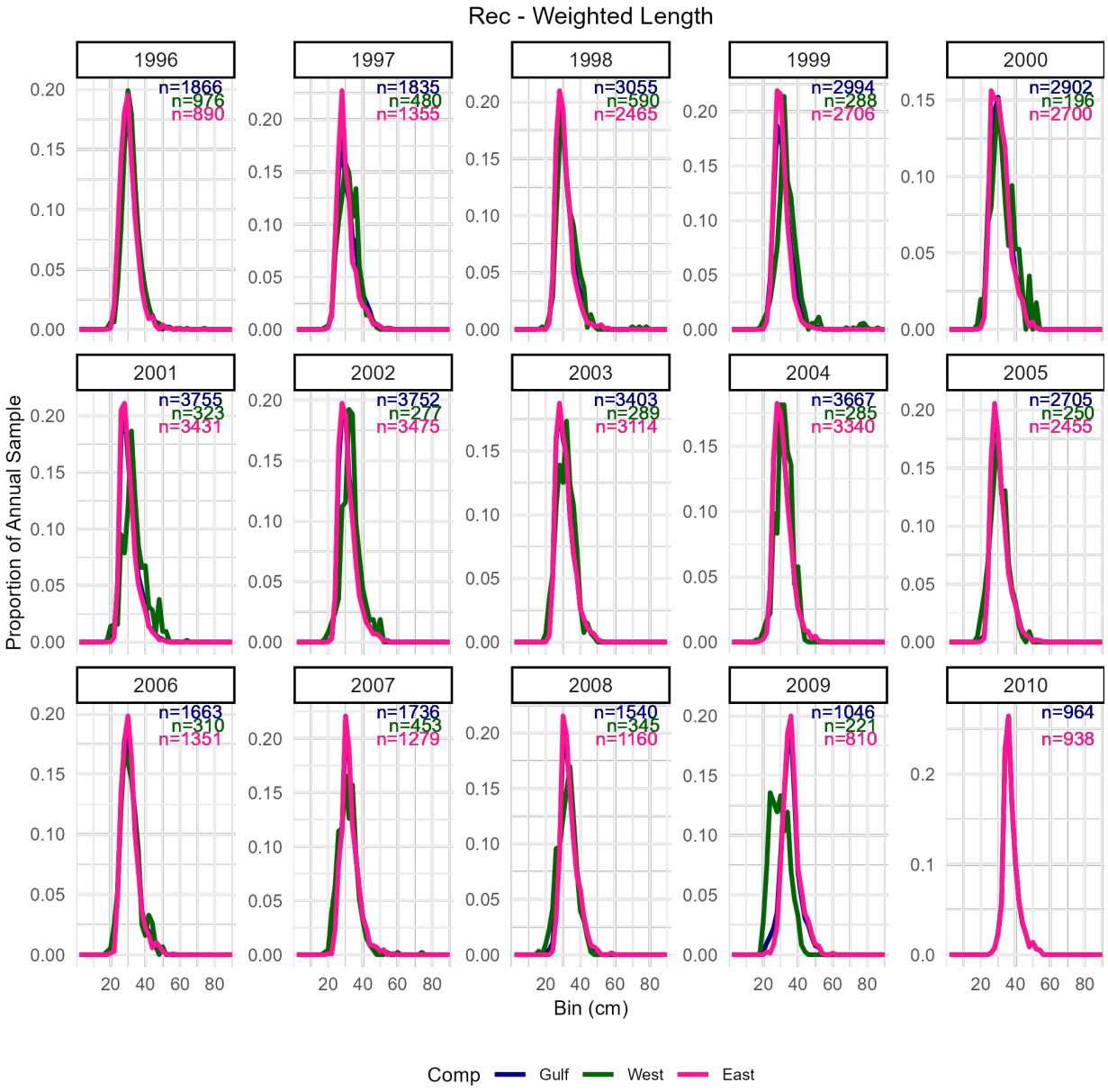

Figure A4.2. A comparison of weighted length compositions from the Gulf (blue), West (green), and East (pink) stocks from 1996-2010. The number of fish (n) for each stock is provided in the top right corner of each panel.

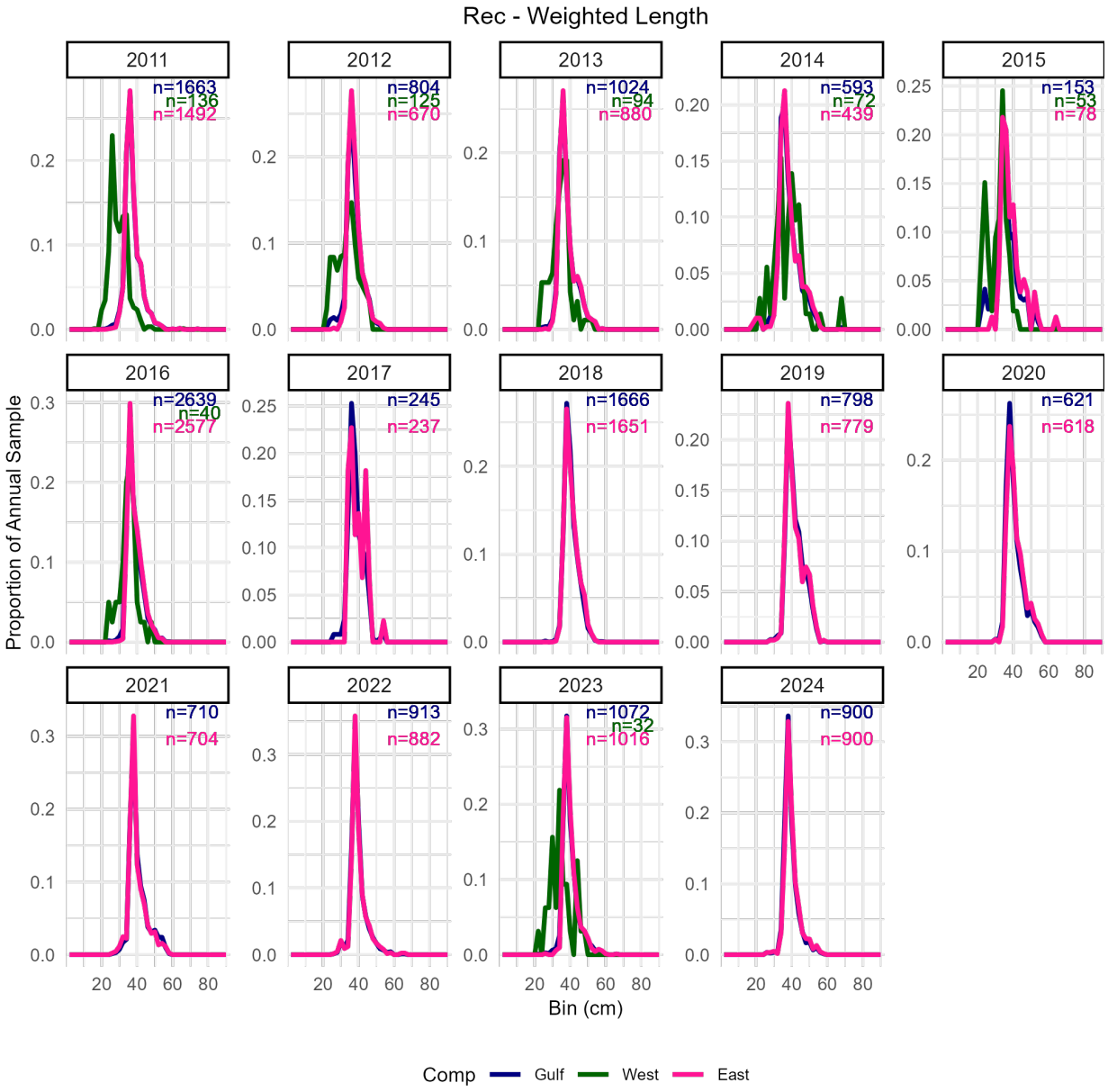

Figure A4.3. A comparison of weighted length compositions from the Gulf (blue), West (green), and East (pink) stocks from 2011-2024. The number of fish (n) for each stock is provided in the top right corner of each panel.

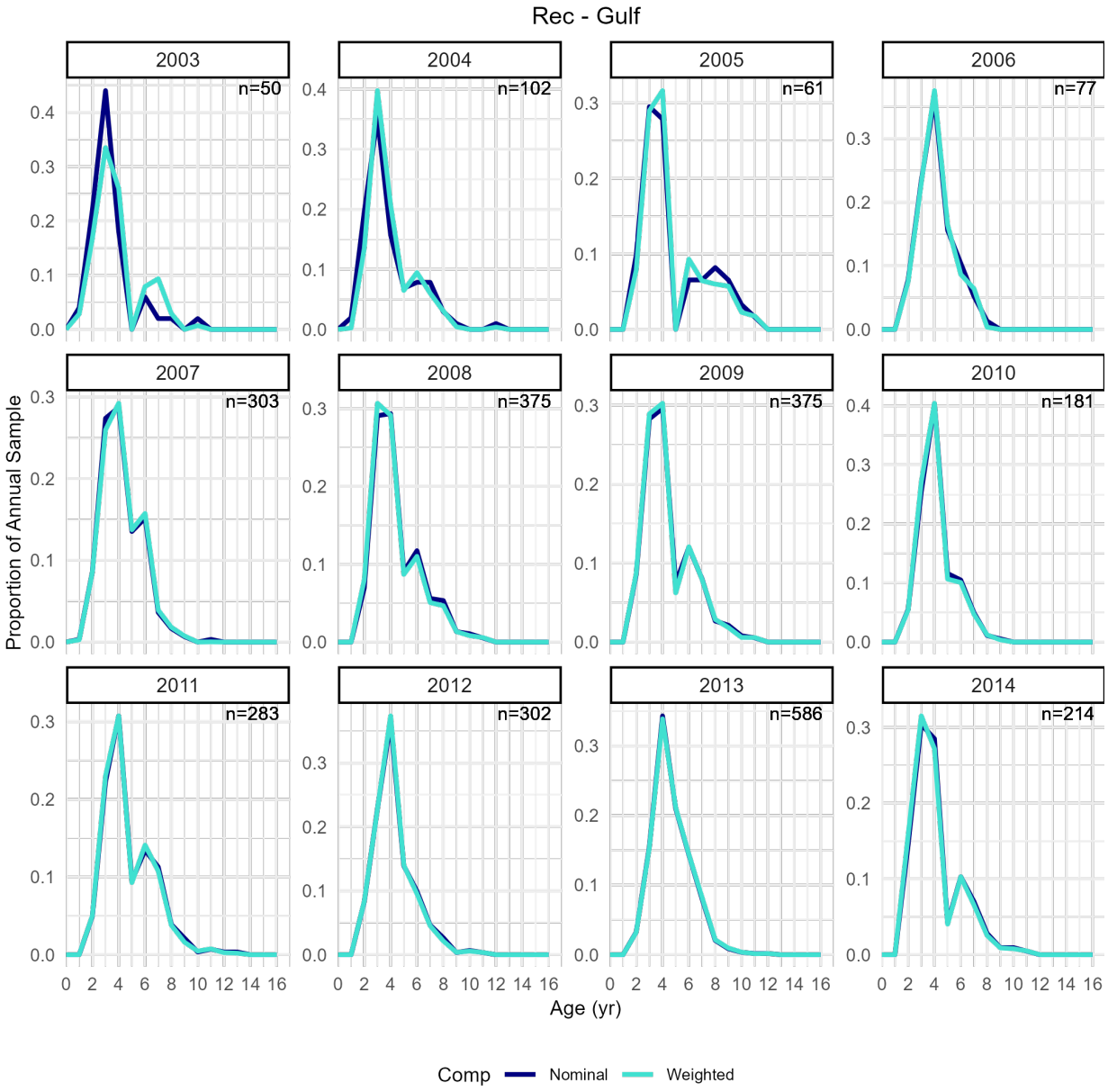

Figure A5.1. A comparison of nominal and weighted age compositions from the Gulf stock from 2003-2014. The number of fish (n) is provided in the top right corner of each panel.

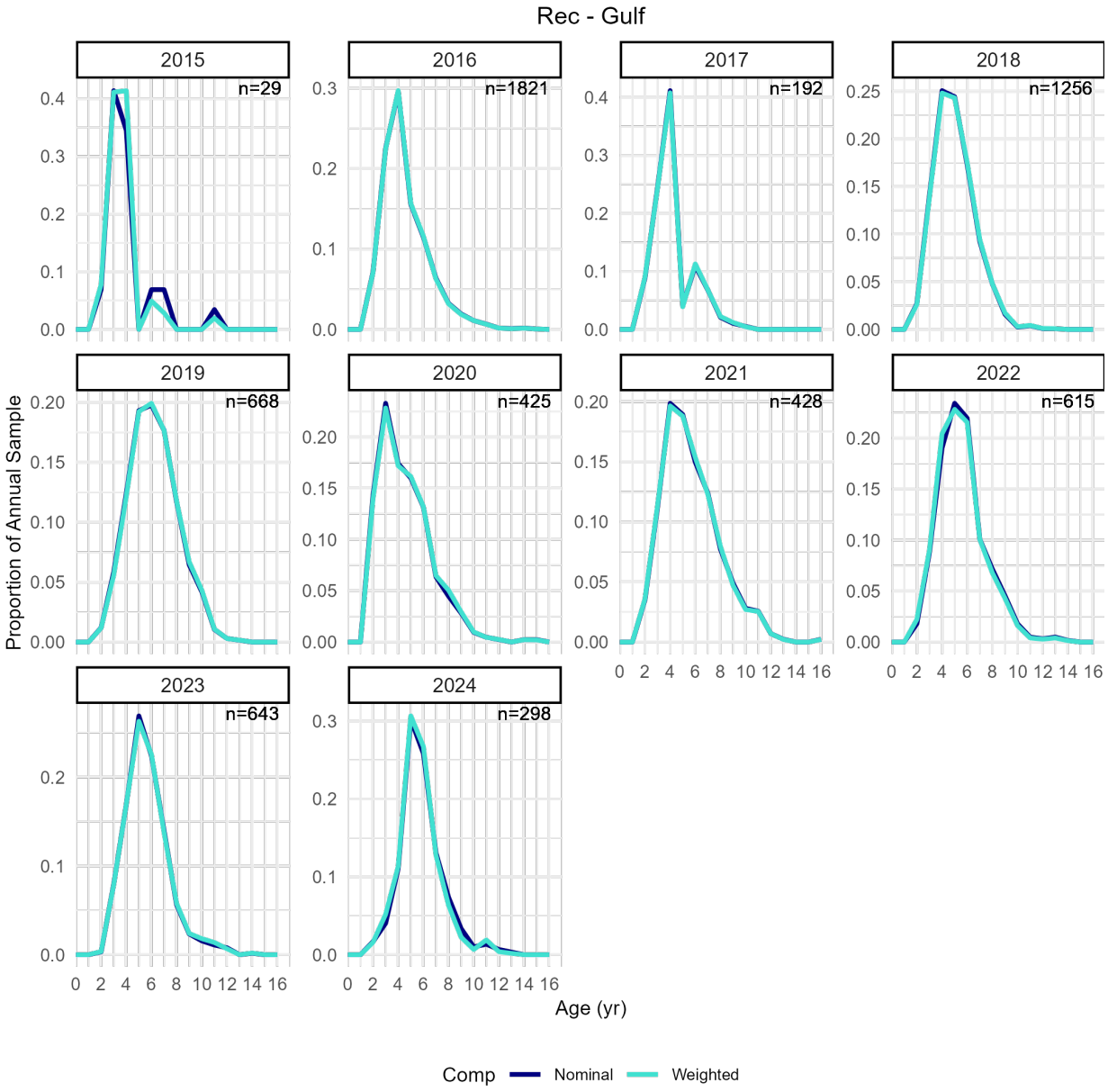

*Figure A5.2. A comparison of nominal and weighted age compositions from the **Gulf** stock from 2015-2024. The number of fish (n) is provided in the top right corner of each panel.*

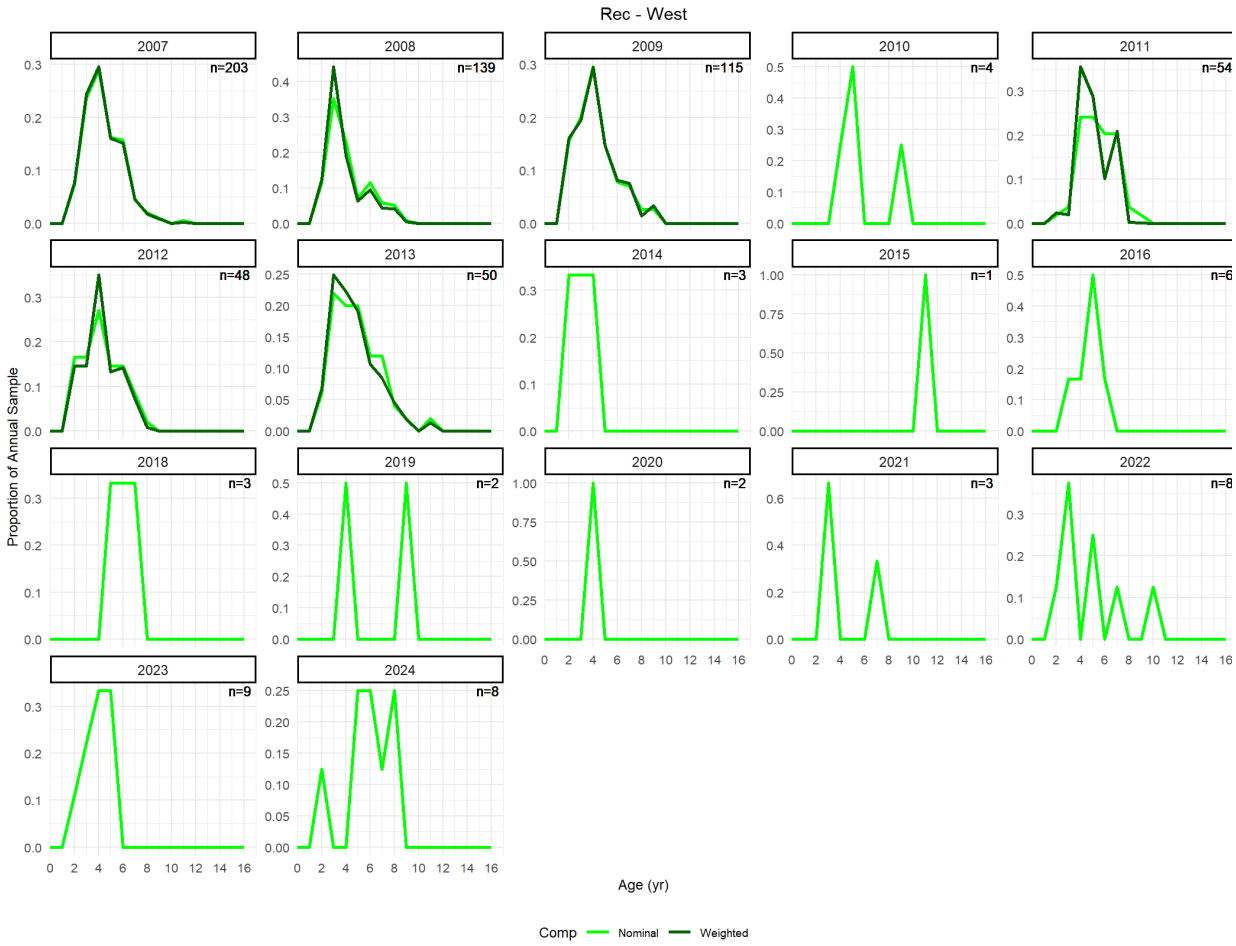

*Figure A6. A comparison of nominal and weighted age compositions from the **West** stock from 2007-2024. The number of fish (n) is provided in the top right corner of each panel.*

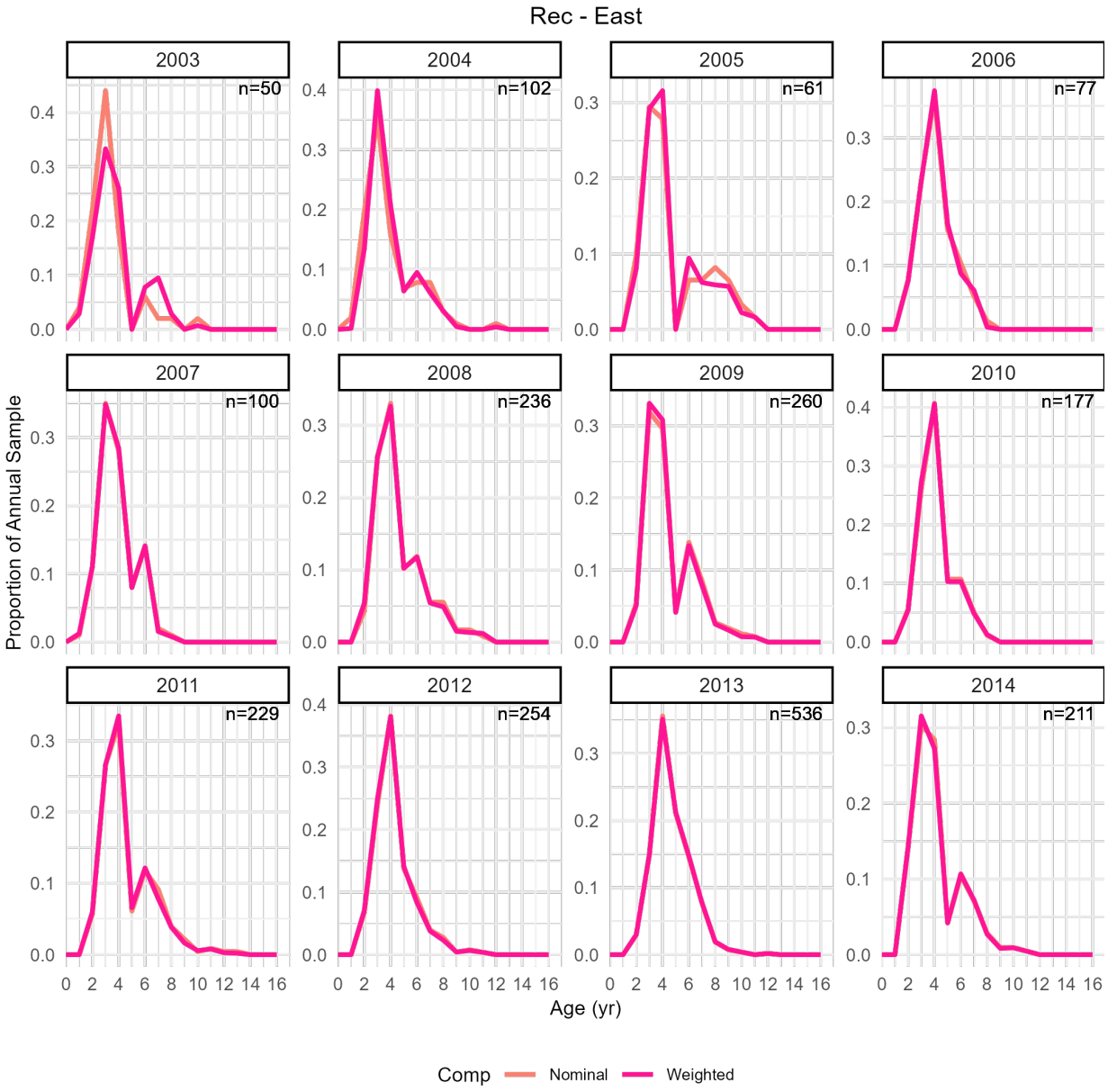

*Figure A7.1. A comparison of nominal and weighted age compositions from the **East** stock from 2003-2014. The number of fish (n) is provided in the top right corner of each panel.*

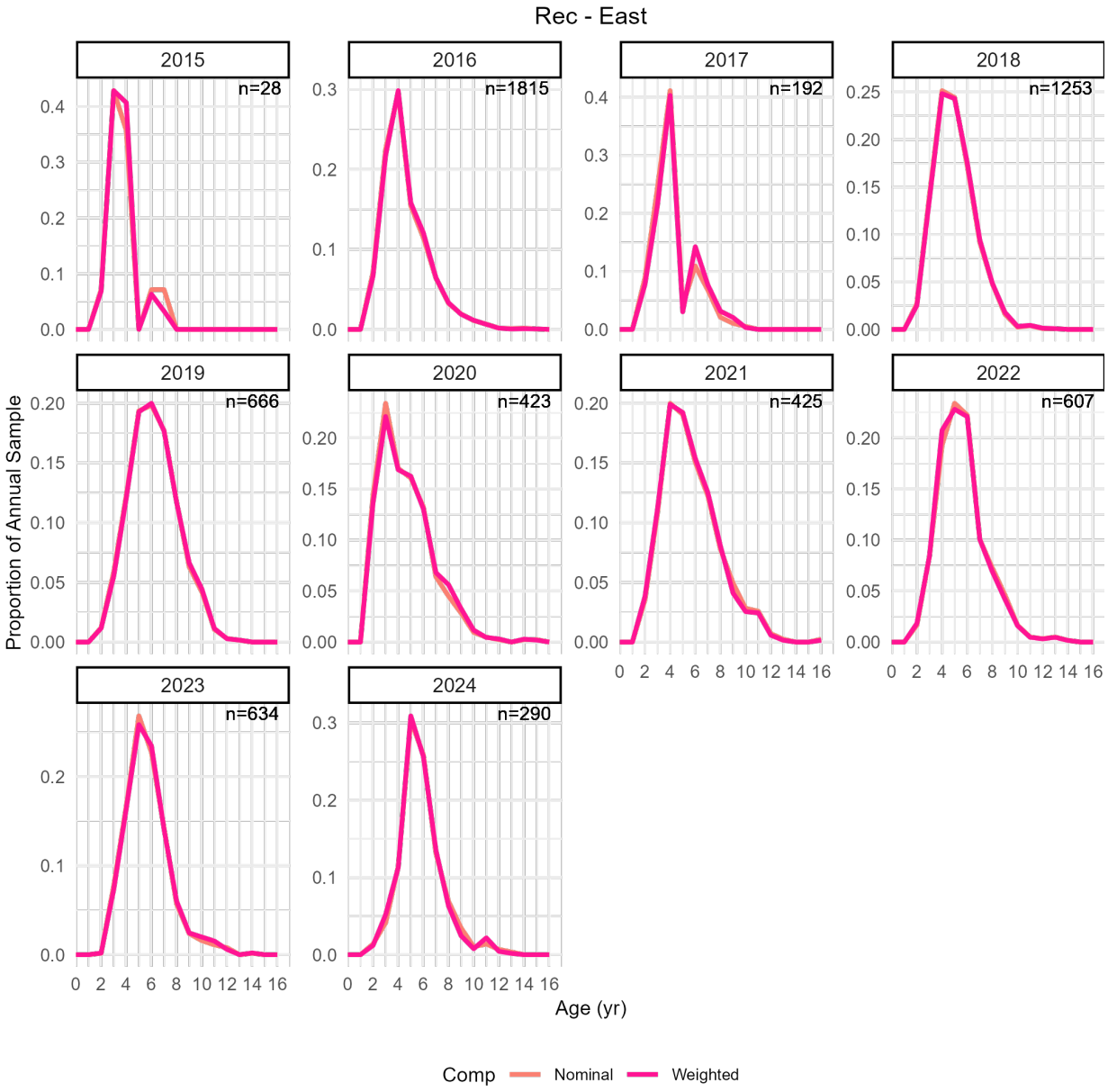

Figure A7.2. A comparison of nominal and weighted age compositions from the East stock from 2015-2024. The number of fish (n) is provided in the top right corner of each panel.

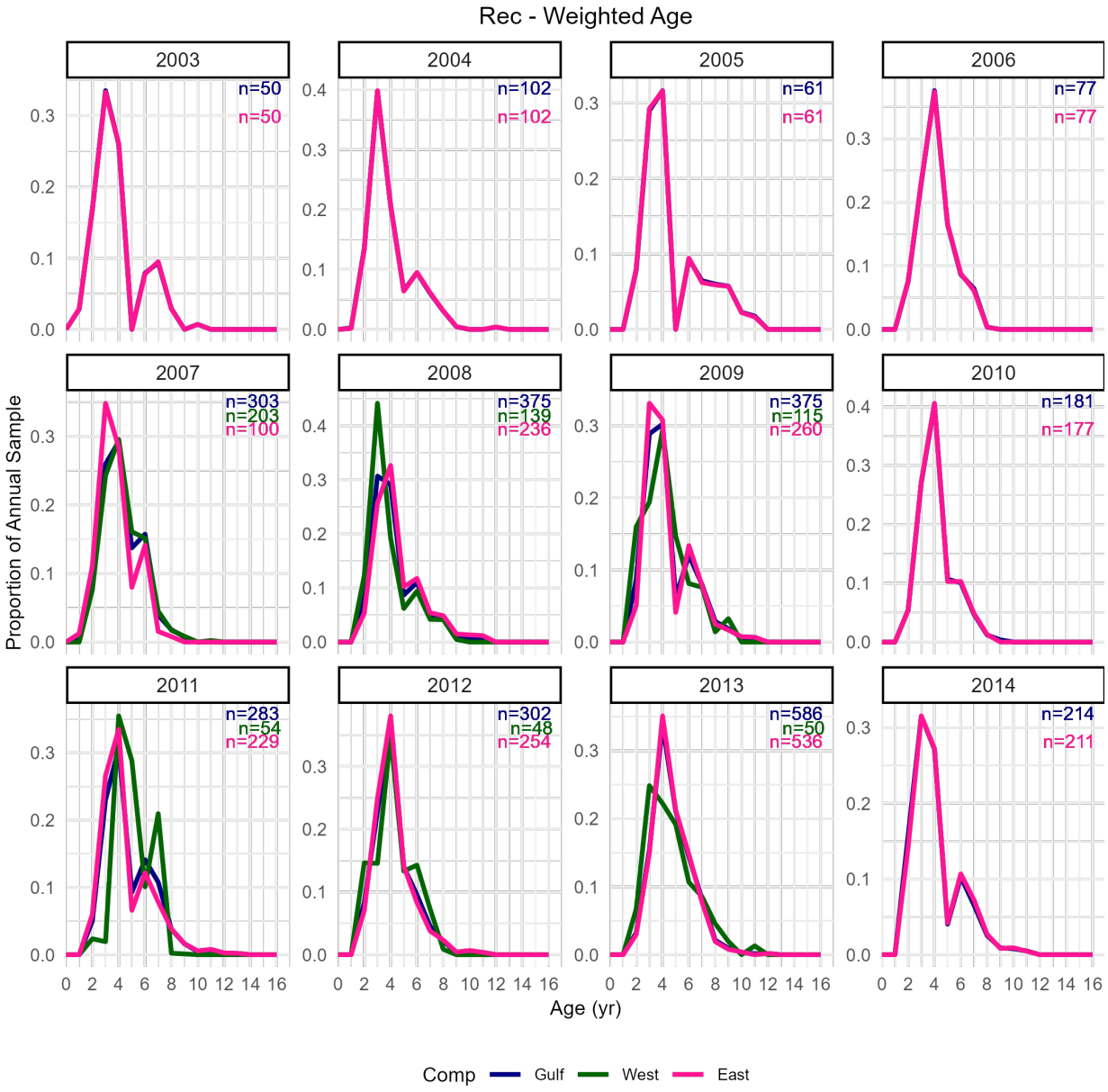

Figure A8.1. A comparison of weighted age compositions from the Gulf (blue), West (green), and East (pink) stocks from 2003-2014. The number of fish (n) for each stock is provided in the top right corner of each panel.

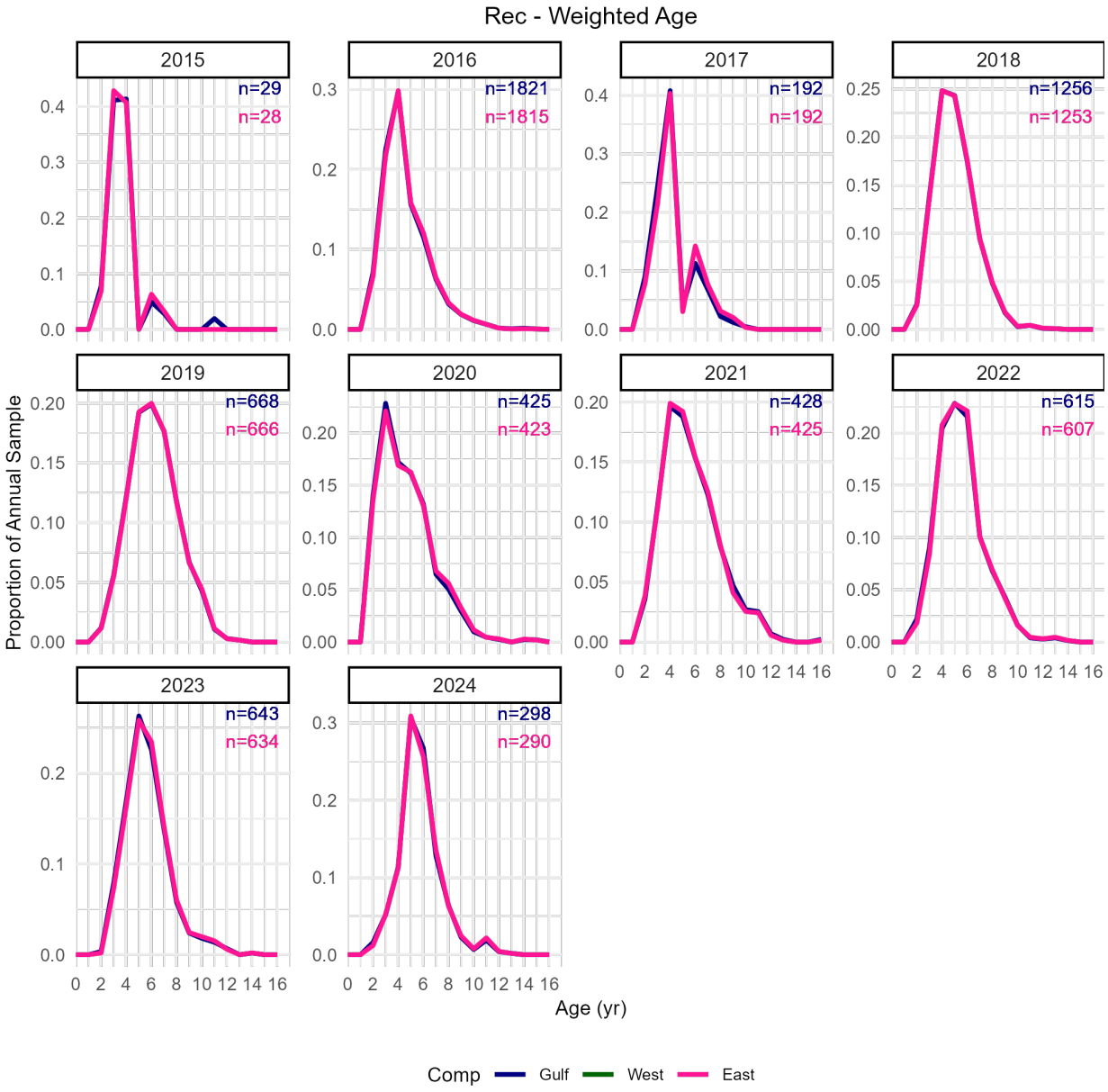

Figure A8.2. A comparison of weighted age compositions from the Gulf (blue), West (green), and East (pink) stocks from 2015-2024. The number of fish (n) for each stock is provided in the top right corner of each panel.

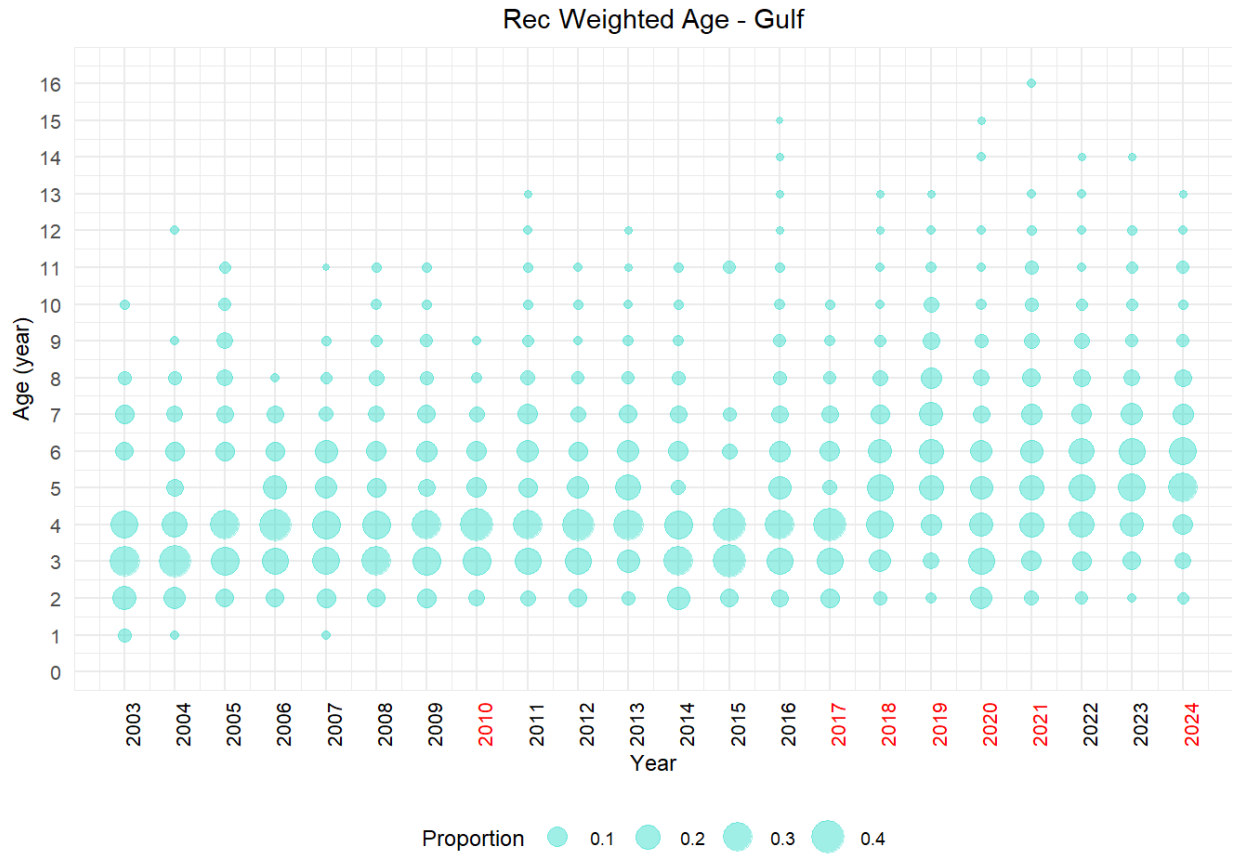

*Figure A9. Weighted age composition for the **Gulf** stock. The corresponding weighted length compositions did not meet the minimum threshold of 30 fish and/or 10 fish per weighting substrata for years in red.*

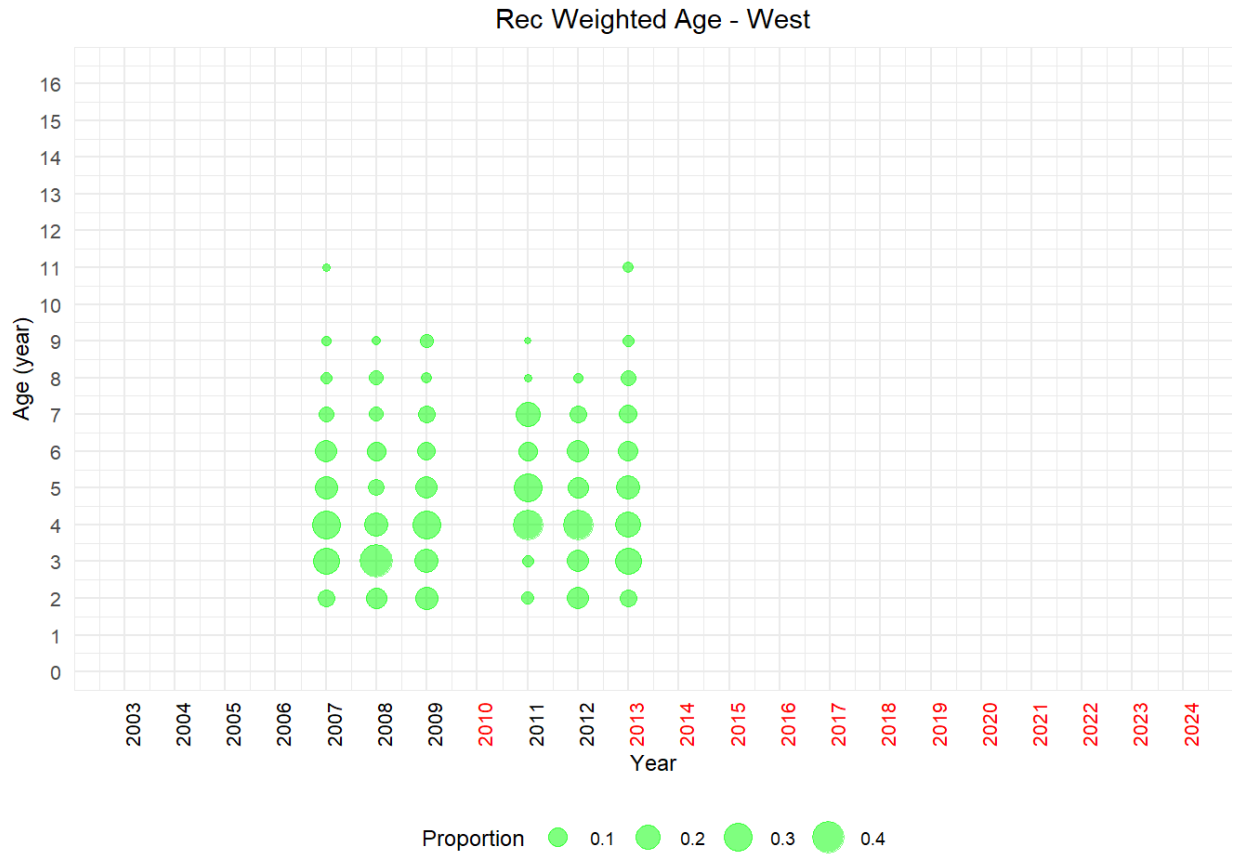

*Figure A10. Weighted age composition for the **West** stock. The corresponding weighted length compositions did not meet the minimum threshold of 30 fish and/or 10 fish per weighting substrata for years in red.*

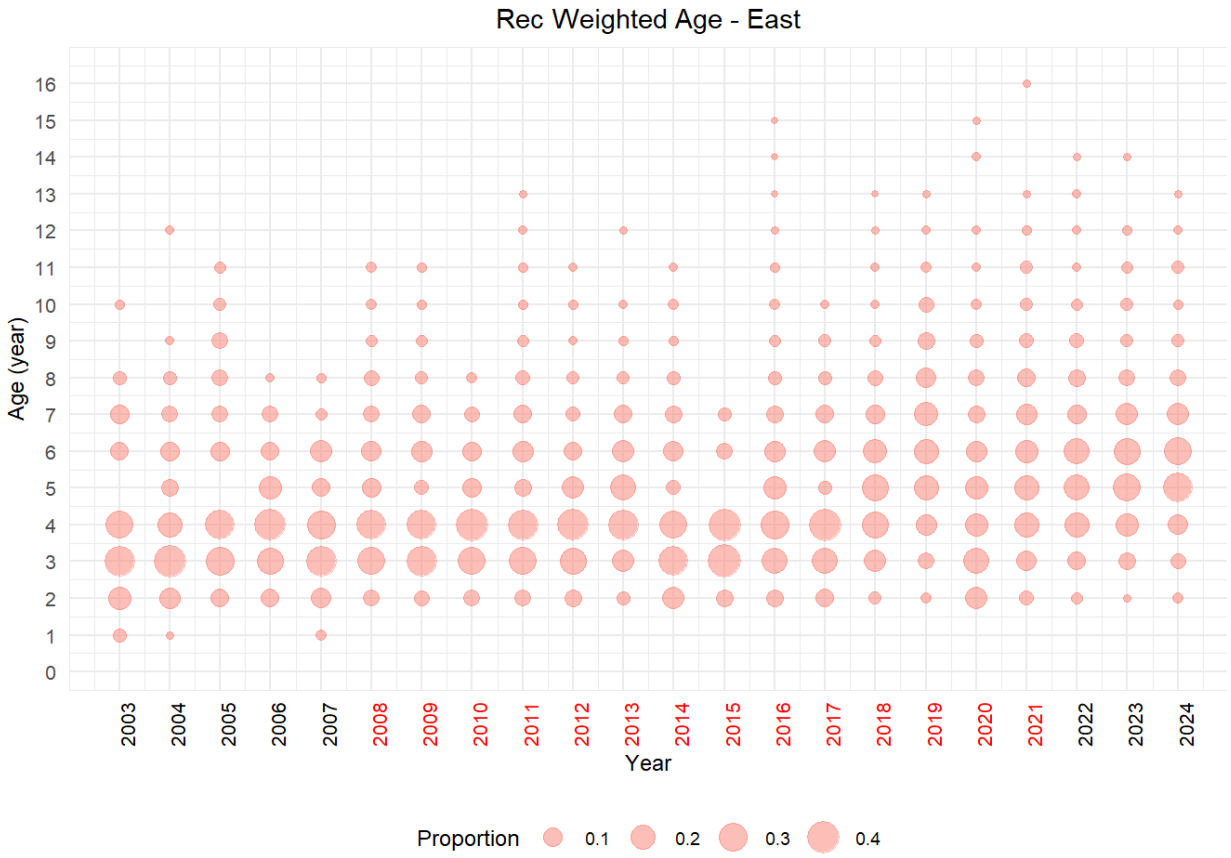

*Figure A11. Weighted age composition for the **East** stock. The corresponding weighted length compositions did not meet the minimum threshold of 30 fish and/or 10 fish per weighting substrata for years in red.*

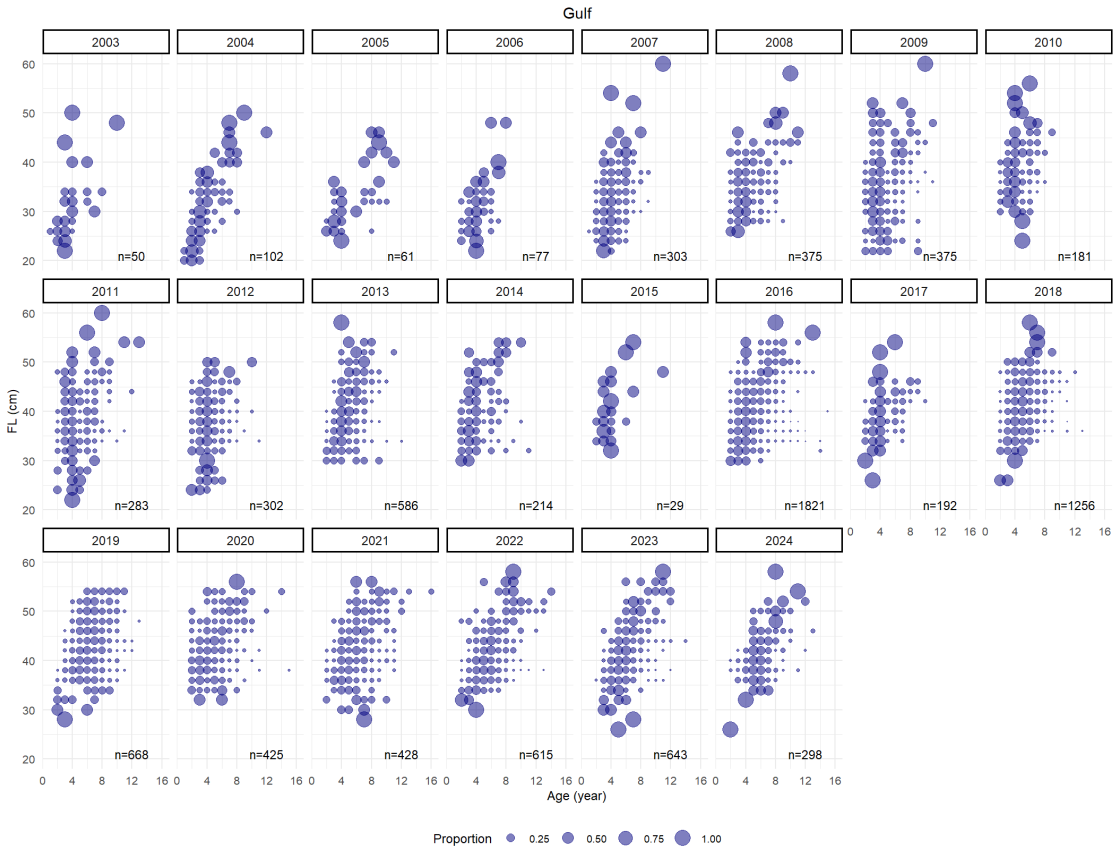

Figure A12. Conditional age-at-length (CAAL) for the Gulf stock. The number of fish is included on the bottom right corner of each panel.

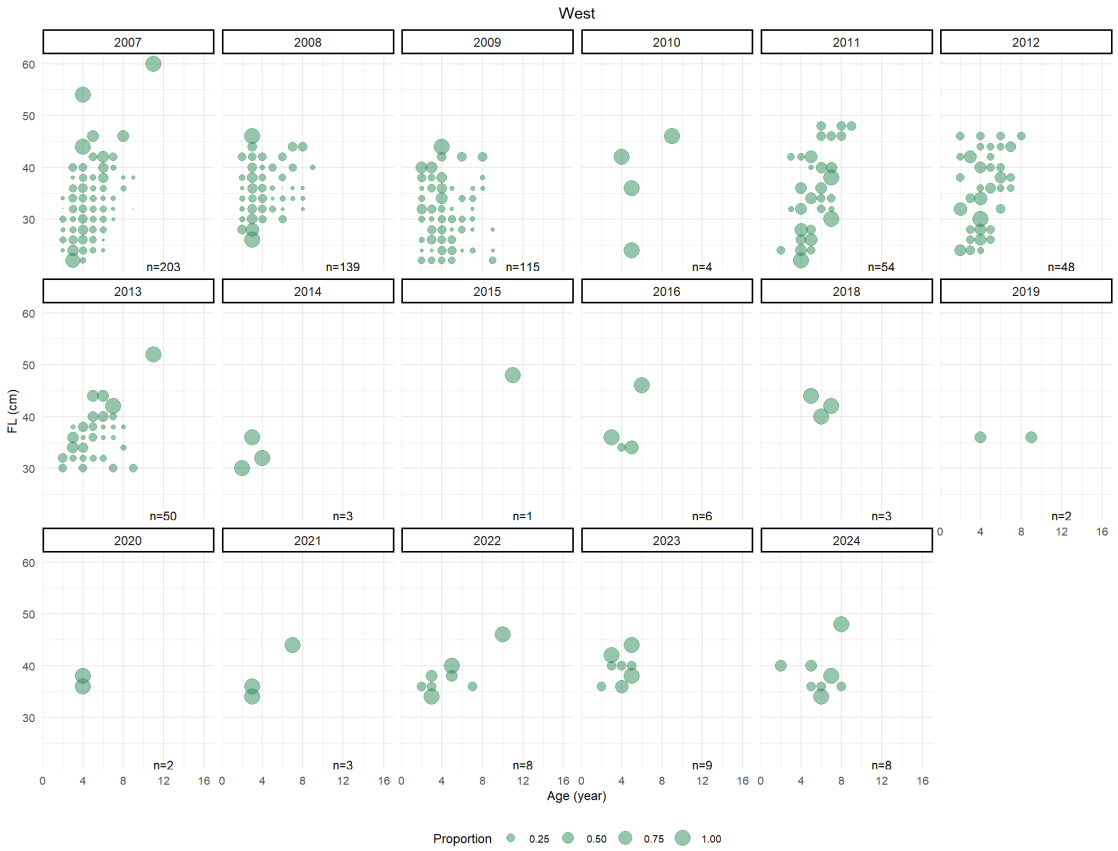

Figure A13. Conditional age-at-length (CAAL) for the West stock. The number of fish is included on the bottom right corner of each panel.

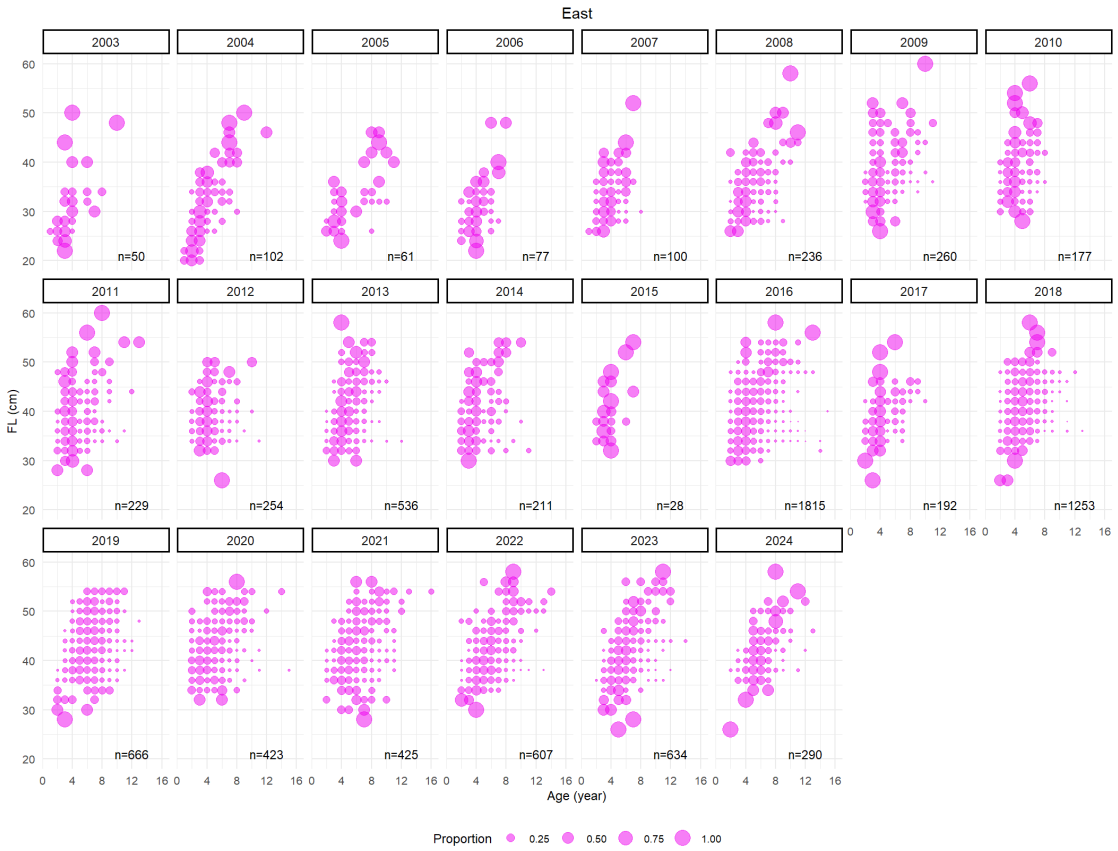

Figure A14. Conditional age-at-length (CAAL) for the East stock. The number of fish is included on the bottom right corner of each panel.

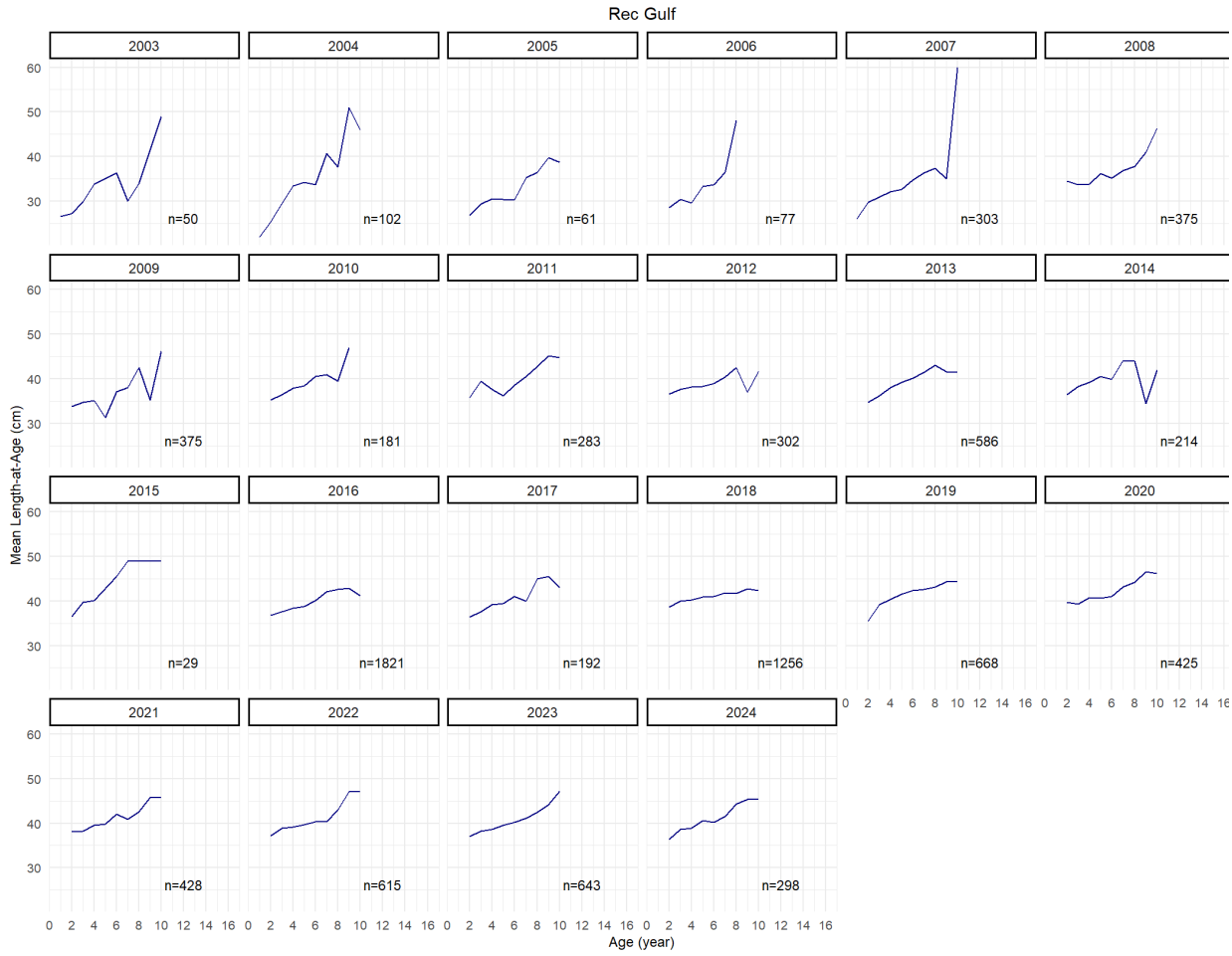

Figure A15. Mean length-at-age (MLAA) for the Gulf stock. The number of fish is included on the bottom right corner of each panel.

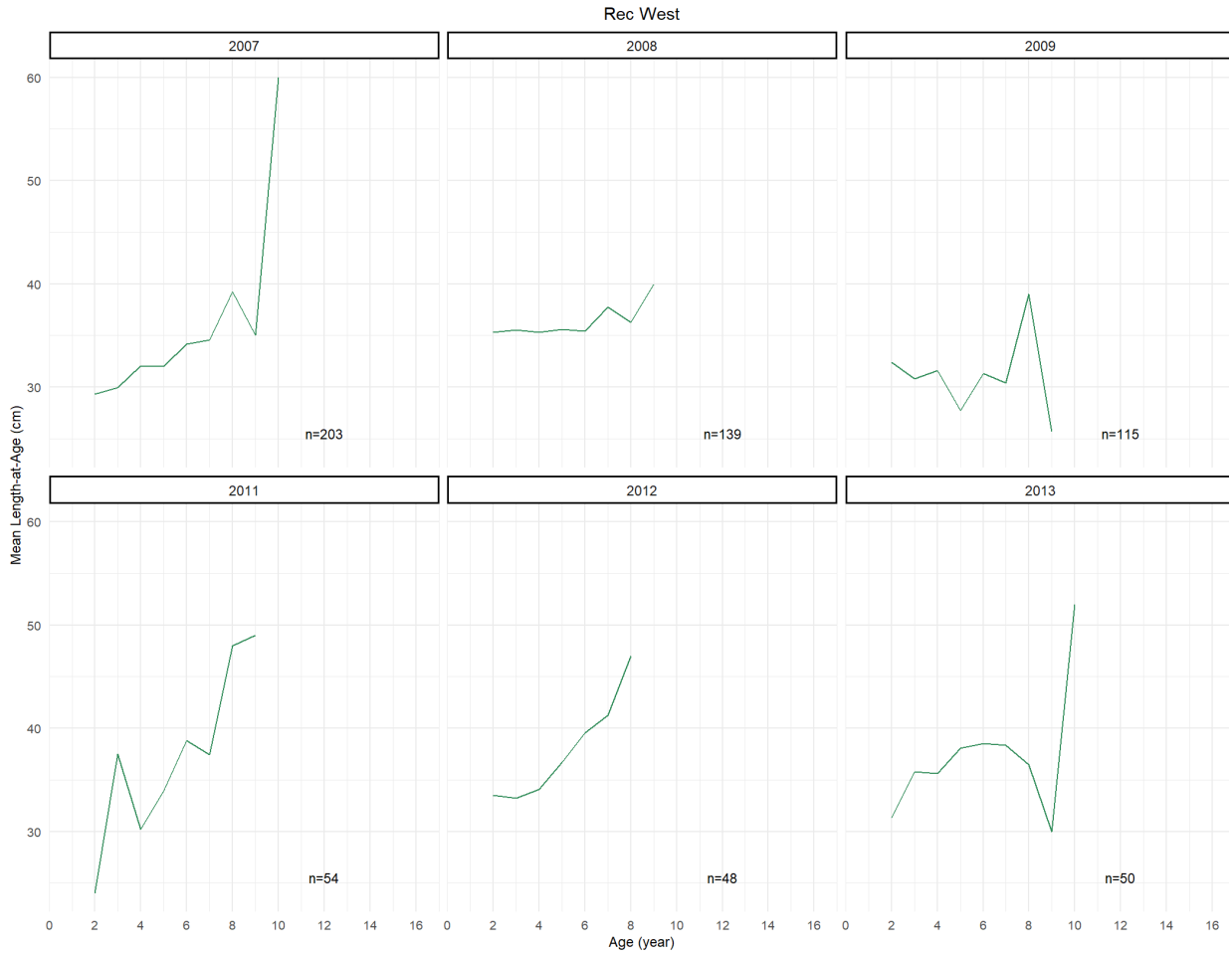

Figure A16. Mean length-at-age (MLAA) for the West stock. The number of fish is included on the bottom right corner of each panel.

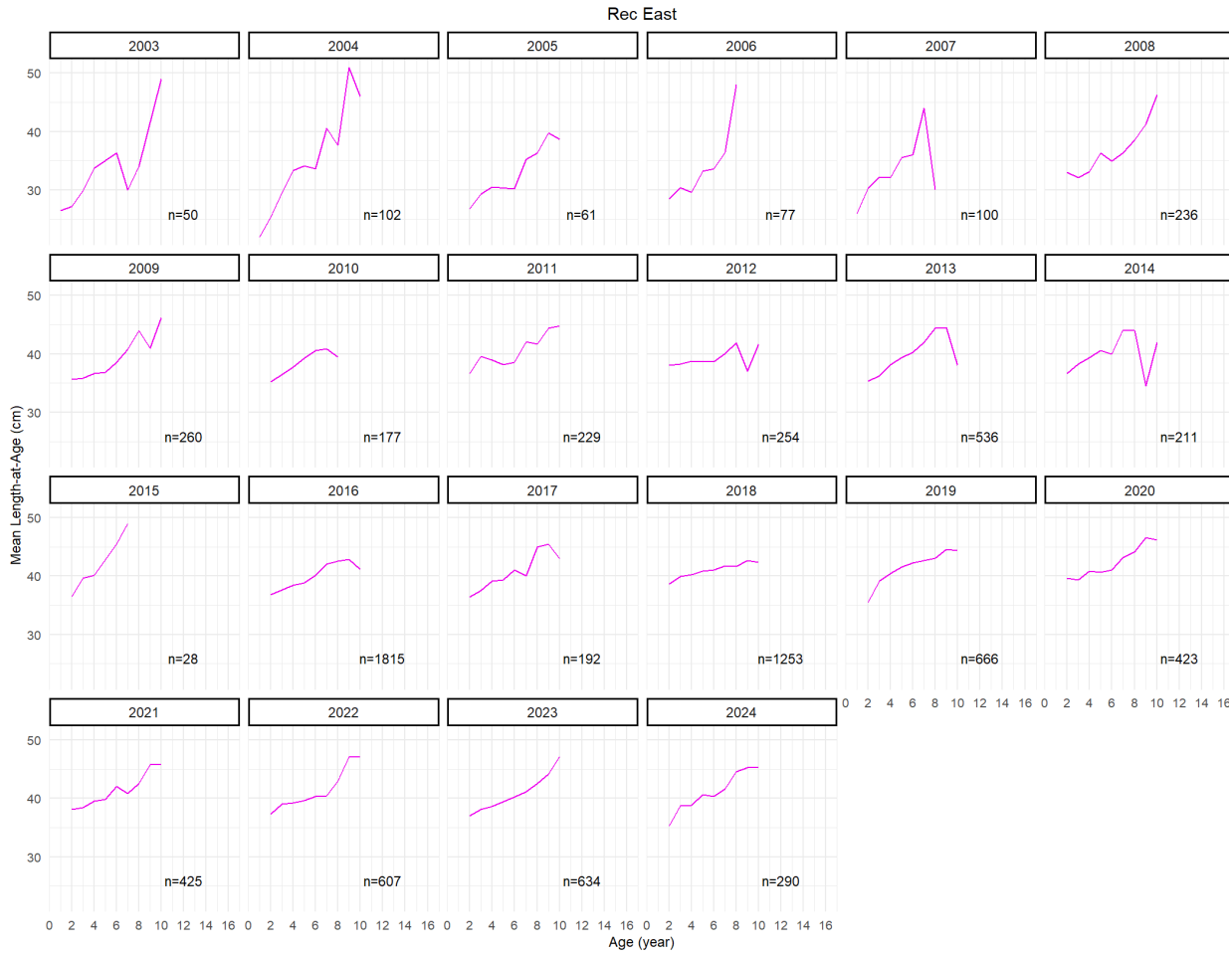

Figure A17. Mean length-at-age (MLAA) for the East stock. The number of fish is included on the bottom right corner of each panel.