Gulf of Mexico Gray Snapper (*Lutjanus griseus*) Commercial and Recreational Landings Length and Age Compositions

Molly H. Stevens

SEDAR75-WP-07
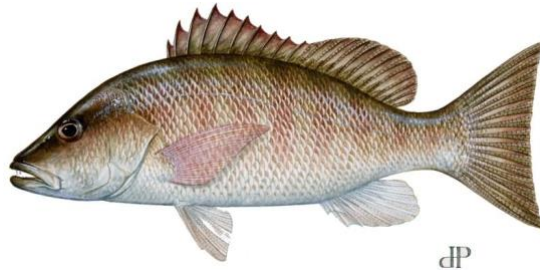
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Introduction

This document outlines the data and methodologies used to estimate length and age compositions of commercial and recreational landings for the SEDAR 75 Gulf of Mexico Gray Snapper Assessment. These compositions were estimated using data sources approved in SEDAR 51. In the previous assessment, nominal length compositions were utilized and age compositions were not incorporated. Within SEDAR 75, a Topical Working Group (TWG) was tasked with considering weighting and incorporating both the length and age compositions if deemed possible. 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 and recreational fleets were weighted by their respective landings at the finest spatial and temporal scale available without losing data, and age samples were weighted by their respective fleet's length compositions (Chih 2009, SEDAR 2015).

Data Description

SEDAR 75 assesses all Gulf of Mexico Gray Snapper in federal waters extending northward from the Texas/Mexico border and eastward to the Atlantic side of Monroe county. The stock boundary uses a line extending due east from the Dade/Monroe County line at the northern end of Key Largo, which includes all of fishing area 748 and some parts of 744 (744.1, 744.6, 744.7 - Florida Bay, Card Sound and Barnes Sound respectively), this extends westward to include fishing areas 1-22 (SEDAR51-DW-09). Length data from the commercial and recreational fisheries of the Gulf of Mexico are collected by multiple state and federal agencies. Commercial data sources utilized to generate length compositions include the Trip Interview Program (TIP, 1983-2020) and Accumulated Landings Systems (ALS, 1962-2020). Recreational sources utilized were the Marine Recreational Information Program (MRIP, 1981-2020), Texas Parks and Wildlife Department's Marine Sport-Harvest Monitoring Program (TPWD, 1983-2020), and the Southeast Region Headboat Survey (SRHS, 1986-2020). The Gulf States Marine Fisheries Commission's Fisheries Information Network (GulfFIN) provided both commercial and recreational length and age data from multiple state sources (2001-2020). Age estimates submitted through GulfFIN, Dauphin Island Sea Lab, and FWRI-Fishery Independent Monitoring were compiled by the SEFSC Panama City Laboratory alongside their age data.

Commercial fleets were defined by vertical line + spear/diving (VL), longline (LL), gillnets + traps (GT), and recreational fleets were defined by private (PR), headboat/charterboat (HC), shore (SH) modes. These data were aggregated using length bins of 2 centimeters (cm) to match SEDAR 51.

Natural total length (TL_{nat}), maximum total length (TL_{max}), and standard length (SL) were converted to fork length (FL) using the following conversion equations:

$$FL = 0.36 + 0.93 * TL_{max}$$
$$FL = -0.25 + 0.96 * TL_{nat}$$
$$FL = 0.77 + 1.17 * SL$$

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

Commercial and Recreational 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 samples of recreational landings were obtained through federal and state sampling programs via SEFSC and GulfFIN, respectively.

Length Compositions
Because fishery-dependent sampling is typically opportunistic, lengths may not be representative of the true landings composition throughout the entire Gulf of Mexico. 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.

Commercial fleets (VL, LL, GT) were aggregated into three subregions in the Gulf of Mexico based on SEDAR51-DW-04 using the NMFS areas fished shown in Figure 1: SouthEast (SE: subareas 744.1, 744.6, 744.7, areas 748, 1-2), NorthEast (NE: areas 3-8), and West (W: areas 9-21). These gears are distinct with increasing size selectivity from GT selecting the smallest fish, to VL, to LL selecting the largest fish (Figure 2). Gear-specific nominal compositions are shown in Figure 3. Annual sample sizes of commercial lengths (Table 1) and trips (Table 2) for each subregion (W, NE, SE) are shown for all fleets, where only VL has sufficient sampling across all subregions to support a weighting procedure.

Recreational fleets (HC, PR, SH) were aggregated into three subregions in the Gulf of Mexico based on county landed, where potential breaks were constrained by MRIP sampling design: SouthEastern (SE: FL Monroe), NorthEast (NE: FL Collier-MS), and Western (W: LA-TX). SRHS data also facilitated this break in their survey design in the Gulf of Mexico shown in Figure 4: SouthEast (SE: 12), NorthEast (NE: 21, 23, 28, 29) and Western (W: 24:27).

Headboat and charter modes were aggregated in SEDAR51, and they display a similar selectivity (Figure 5). Nominal recreational length compositions are shown by mode in Figure 6. Annual sample sizes of recreational fleets by subregions used for weighting were provided for lengths (Table 3) and trips (Table 4), where shore mode had insufficient samples to support the weighting procedure.

Within each commercial and recreational fleet (defined by gear/mode), length compositions were estimated using length bins of 2 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. A minimum sample size threshold was applied annually within each strata, $LC_{i,r}$, where these were dropped and excluded from further analyses if $n_{i,r} < 30$.

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

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

resulting in the final weighted estimates of landings length compositions, $LC_{i,j}$. This procedure would downweight, for example, any instances where 60% of the length samples come from a subregion that only accounts for 20% of the landings for that fleet. Effects of the length composition weighting procedure are shown for VL (Figure 7), HC (Figure 8), and PR (Figure 9).

Commercial and Recreational Age Compositions of Landings

Age Samples
Age data compiled by the SEFSC Panama City Laboratory were filtered to remove duplicated and biased data. Nominal age compositions were estimated for each fleet, and sample sizes of commercial ages (Table 7), commercial trips sampled for age (Table 8), recreational ages (Table 9), and recreational trips sampled for age (Table 10) were provided by subregion. Gray Snapper maximum estimated age was 28 years.

Age Compositions
Nominal age compositions were estimated for each recreational mode (PR, HC, SH) and commercial gear (VL, LL, GT). The weighting process outlined below was applied to PR, HC, and VL. Age compositions were estimated 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 applied annually within each strata, $AC_{i,r}$, where these were dropped and excluded from further analyses if $a_{i,r} < 10$.

To account for potential sampling biases in the data, a reweighting factor was estimated within year i, length bin j, and subregion r. The reweighting 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,

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

where $LC_{i,j,r} * p_{i,r}$ 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 $LC_{i,j,r}$, they were downweighted to zero and effectively dropped from further analysis. The final recreational 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 rescaled to sum to 1 across each year. The reweighting factor will upweight ages from less represented length bins and will generate a more representative estimate of landings' age compositions. Effects of the age composition weighting procedure are shown for VL (Figure 10), HC (Figure 11), and PR (Figure 12).

References

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Tables

Table 1. Annual number of length samples for commercial vertical line (VL) longline (LL), and gillnet/trap (GT) gears by subregion (W, NE, SE). Only VL gear had sufficient samples across all subregions to support the weighting procedure. The length compositions resulting from these samples were dropped from further analyses if n<30 by strata for VL or all strata combined for LL and GT.

Year	W_VL	NE_VL	SE_VL	W_LL	NE_LL	SE_LL	W_GT	NE_GT	SE_GT
1984	41	0	0	0	0	0	0	0	0
1985	59	0	81	8	0	0	0	0	0
1986	6	0	0	0	5	180	0	0	10
1987	1	0	609	0	0	0	0	0	298
1988	1	0	419	0	0	0	0	0	285
1989	4	2	1,952	0	22	10	0	75	816
1990	83	96	951	0	200	5	0	11	300
1991	157	202	1,556	0	308	5	0	54	10
1992	119	437	1,205	0	72	31	0	33	0
1993	49	296	794	0	70	0	1	43	27
1994	100	667	2,132	0	68	3	14	5	18
1995	134	319	1,410	2	33	17	4	22	9
1996	99	1,197	931	0	28	3	0	15	27
1997	166	749	1,210	0	30	0	0	52	32
1998	20	969	934	0	260	4	0	51	50
1999	38	2,080	889	0	229	9	0	25	39
2000	73	1,226	333	0	119	11	0	20	33
2001	72	975	1,308	3	148	4	0	41	12
2002	61	844	571	0	339	11	0	10	4
2003	70	406	671	1	217	15	0	42	1
2004	23	529	468	0	341	0	0	0	0
2005	86	242	368	1	228	2	0	4	0
2006	46	132	362	6	256	3	0	7	0
2007	58	215	327	0	224	1	0	1	0
2008	65	360	562	1	354	5	0	4	0
2009	176	935	611	0	133	0	2	0	0
2010	60	279	376	0	283	9	0	0	1
2011	229	363	185	0	280	4	0	0	0
2012	386	747	686	0	221	2	0	0	0
2013	257	616	766	0	355	1	0	7	0
2014	255	655	737	0	426	4	0	7	0
2015	165	505	326	0	297	2	0	2	1
2016	628	584	230	0	215	0	0	3	0
2017	215	565	117	0	153	5	0	2	0
2018	309	670	415	2	95	1	1	0	0
2019	223	526	269	1	100	2	0	0	0
2020	50	647	151	0	67	0	0	0	0

Table 2. *Annual number of commercial vertical line (VL) longline (LL), and gillnet/trap (GT) trips sampled for length by subregion (W, NE, SE).*

Year	W_VL	NE_VL	SE_VL	W_LL	NE_LL	SE_LL	W_GT	NE_GT	SE_GT
1984	7	0	0	0	0	0	0	0	0
1985	17	0	1	3	0	0	0	0	0
1986	5	0	0	0	1	6	0	0	1
1987	1	0	18	0	0	0	0	0	4
1988	1	0	17	0	0	0	0	0	5
1989	4	1	38	0	1	1	0	1	19
1990	26	16	57	0	26	2	0	4	15
1991	49	18	60	0	45	3	0	3	1
1992	47	32	55	0	28	8	0	15	0
1993	28	32	46	0	28	0	1	10	3
1994	28	53	55	0	30	1	2	3	1
1995	33	36	67	2	25	3	1	1	3
1996	29	63	59	0	11	2	0	4	4
1997	31	49	70	0	18	0	0	5	2
1998	9	63	75	0	20	3	0	10	4
1999	7	109	56	0	97	5	0	9	3
2000	9	82	33	0	60	6	0	11	1
2001	17	94	60	1	52	3	0	12	4
2002	16	98	51	0	101	7	0	7	2
2003	22	76	53	1	84	8	0	4	1
2004	12	73	29	0	109	0	0	0	0
2005	34	46	23	1	95	2	0	2	0
2006	19	34	24	1	109	3	0	3	0
2007	17	39	31	0	91	1	0	1	0
2008	14	52	43	1	96	2	0	1	0
2009	31	140	48	0	52	0	1	0	0
2010	20	69	47	0	90	5	0	0	1
2011	39	104	33	0	69	2	0	0	0
2012	90	201	50	0	85	1	0	0	0
2013	68	196	66	0	96	1	0	3	0
2014	51	161	51	0	104	2	0	6	0
2015	52	160	33	0	88	1	0	2	1
2016	92	164	14	0	81	0	0	2	0
2017	64	157	23	0	71	2	0	2	0
2018	73	150	29	1	42	1	1	0	0
2019	75	156	25	1	40	2	0	0	0
2020	33	176	18	0	32	0	0	0	0

Table 3. *Annual number of Gray Snapper recreational headboat/charterboat (HC), private (PR), and shore (SH) length samples by subregion (W, NE, SE). SH mode did not have sufficient samples across all subregions to support the weighting procedure. The length compositions resulting from these samples were dropped from further analyses if n<30 by strata for HC and PR or all strata combined for SH.*

Year	W_HC	NE_HC	SE_HC	W_PR	NE_PR	SE_PR	W_SH	NE_SH	SE_SH
1978	0	0	12	0	0	0	0	0	0
1979	0	0	68	0	0	0	0	0	0
1980	0	0	53	0	0	0	0	0	0
1981	0	20	79	0	37	28	0	16	61
1982	0	39	193	0	19	44	0	38	96
1983	12	64	327	12	13	3	0	35	14
1984	0	66	481	6	2	20	0	4	37
1985	1	22	512	3	6	4	0	12	20
1986	41	529	724	12	17	28	0	22	16
1987	30	478	505	25	92	125	0	8	14
1988	12	441	379	12	69	24	0	59	30
1989	24	511	327	14	109	44	0	56	30
1990	50	295	257	7	51	22	0	14	11
1991	56	188	205	10	110	32	0	32	31
1992	169	271	182	21	298	36	3	80	22
1993	161	142	188	103	168	94	4	68	89
1994	199	164	193	160	148	104	5	35	103
1995	200	185	136	166	167	136	3	23	83
1996	204	82	107	97	119	73	0	22	55
1997	451	185	395	37	158	34	0	46	17
1998	757	394	471	73	315	48	0	63	25
1999	605	547	635	230	360	73	0	49	27
2000	341	518	428	315	295	12	1	48	1
2001	615	538	573	84	387	27	0	43	43
2002	663	737	494	151	309	17	0	30	0
2003	783	805	399	186	403	25	3	55	0
2004	189	596	340	403	309	10	1	27	0
2005	261	627	284	569	307	0	0	32	0
2006	451	429	295	696	223	3	0	48	5
2007	518	363	360	313	347	38	0	49	5
2008	387	472	361	443	548	26	0	75	0
2009	379	1,108	385	1,119	589	8	0	88	0
2010	43	1,285	738	99	285	16	0	26	0
2011	340	339	500	132	196	0	0	4	1
2012	388	1,334	1,871	374	170	50	0	59	15
2013	338	696	1,144	714	503	121	0	34	6
2014	252	857	1,692	377	1,202	238	0	32	5
2015	161	702	1,200	166	875	140	0	11	6
2016	191	1,156	1,435	311	868	72	0	46	6
2017	183	1,106	933	772	569	32	0	35	8
2018	205	962	932	305	654	105	0	47	2
2019	226	1,287	830	346	532	100	0	37	14
2020	310	492	163	764	490	127	0	69	2

Table 4. *Annual number of Gray Snapper recreational headboat/charterboat (HC), private (PR), and shore (SH) trips sampled by subregion (W, NE, SE).*

Year	W_HC	NE_HC	SE_HC	W_PR	NE_PR	SE_PR	W_SH	NE_SH	SE_SH
1978	0	0	4	0	0	0	0	0	0
1979	0	0	16	0	0	0	0	0	0
1980	0	0	17	0	0	0	0	0	0
1981	0	14	44	0	8	5	0	7	16
1982	0	20	73	0	14	7	0	14	22
1983	5	29	106	8	7	3	0	12	9
1984	0	25	150	2	2	5	0	3	15
1985	1	16	141	2	5	2	0	8	6
1986	16	136	130	8	12	11	0	5	4
1987	19	157	123	14	35	36	0	3	5
1988	11	135	106	11	36	10	0	20	13
1989	13	111	101	11	34	13	0	30	6
1990	18	75	89	6	27	11	0	11	8
1991	25	80	68	5	42	15	0	13	19
1992	62	89	59	13	119	22	3	29	12
1993	73	51	95	51	76	42	2	31	39
1994	73	89	80	79	74	31	3	23	45
1995	86	73	51	82	61	36	3	15	36
1996	51	43	54	46	58	27	0	15	31
1997	100	94	91	24	62	19	0	21	12
1998	128	145	136	36	126	25	0	31	15
1999	114	234	170	86	152	25	0	25	15
2000	87	244	152	137	121	5	1	23	1
2001	97	187	184	39	159	9	0	25	11
2002	106	239	175	59	151	5	0	17	0
2003	99	272	177	83	175	8	3	32	0
2004	43	217	148	148	130	3	1	13	0
2005	75	249	122	203	138	0	0	21	0
2006	77	158	103	272	100	2	0	16	5
2007	89	129	122	138	137	10	0	27	3
2008	69	153	115	155	204	6	0	36	0
2009	95	749	138	305	199	3	0	36	0
2010	10	931	331	49	113	3	0	10	0
2011	40	78	134	55	91	0	0	3	1
2012	79	1,055	475	146	89	15	0	24	5
2013	63	481	414	272	199	28	0	17	2
2014	49	246	443	107	386	69	0	15	5
2015	36	255	273	58	333	43	0	9	5
2016	53	632	354	118	313	22	0	25	4
2017	63	736	231	247	219	18	0	15	5
2018	63	481	212	129	226	37	0	22	2
2019	65	823	223	138	214	45	0	18	12
2020	76	167	58	268	199	43	0	33	2

Table 5. *Annual number of age samples for commercial vertical line (VL), longline (LL), and gillnet/trap (GT) gears by subregion (W, NE, SE). The age compositions resulting from these samples were dropped from further analyses if n<10 by strata for VL or all strata combined for LL and GT.*

Year	W_VL	NE_VL	SE_VL	W_LL	NE_LL	SE_LL	NE_GT	SE_GT
1982	0	0	0	0	195	0	0	0
1983	0	0	0	0	83	0	0	0
1991	32	0	8	0	0	0	0	0
1992	8	0	5	1	0	0	0	0
1993	20	21	3	0	1	0	5	0
1994	0	84	12	0	3	0	2	0
1995	2	16	36	0	0	0	0	0
1996	0	21	33	0	4	0	16	0
1997	0	64	80	0	2	0	0	0
1998	0	6	118	0	4	1	5	0
1999	0	4	103	0	4	1	3	0
2000	3	15	84	0	4	0	6	0
2001	27	30	98	0	33	0	0	2
2002	23	89	48	0	39	0	1	1
2003	4	139	102	1	38	1	6	2
2004	0	169	63	0	134	0	0	0
2005	61	130	55	0	104	0	0	0
2006	43	117	134	0	245	3	7	0
2007	42	207	55	0	196	0	1	0
2008	47	307	111	9	298	4	0	0
2009	153	808	209	7	163	0	4	0
2010	49	277	126	0	249	8	0	0
2011	241	221	7	0	93	2	0	0
2012	319	737	201	0	230	2	0	0
2013	244	565	467	0	355	1	3	0
2014	150	487	83	0	406	7	6	0
2015	203	381	241	0	266	4	2	0
2016	296	451	93	0	190	2	1	0
2017	168	405	5	0	142	5	1	0
2018	160	578	85	2	95	1	0	0
2019	165	522	124	1	89	1	0	0
2020	34	436	1	0	55	0	0	0

Table 6. Annual number of commercial vertical line (VL), longline (LL), and gillnet/trap (GT) gear trips sampled for ages by subregion (W, NE, SE).

Year	W_VL	NE_VL	SE_VL	W_LL	NE_LL	SE_LL	NE_GT	SE_GT
1982	0	0	0	0	15	0	0	0
1983	0	0	0	0	7	0	0	0
1991	14	0	5	0	0	0	0	0
1992	7	0	3	1	0	0	0	0
1993	10	10	1	0	1	0	2	0
1994	0	23	3	0	2	0	1	0
1995	1	6	8	0	0	0	0	0
1996	0	8	4	0	3	0	2	0
1997	0	12	13	0	1	0	0	0
1998	0	1	21	0	2	1	2	0
1999	0	2	16	0	3	1	1	0
2000	2	4	10	0	2	0	2	0
2001	11	11	16	0	19	0	0	1
2002	6	18	12	0	26	0	1	0
2003	4	32	21	1	20	1	1	0
2004	0	37	18	0	73	0	0	0
2005	29	34	7	0	61	0	0	0
2006	20	32	17	0	105	3	3	0
2007	14	70	10	0	101	0	1	0
2008	15	195	54	2	128	1	0	0
2009	27	271	124	1	89	0	4	0
2010	18	192	64	0	204	7	0	0
2011	39	61	4	0	37	1	0	0
2012	84	380	25	0	144	1	0	0
2013	67	306	57	0	221	1	3	0
2014	43	301	33	0	155	7	6	0
2015	54	258	25	0	122	3	2	0
2016	74	416	14	0	161	2	1	0
2017	57	376	4	0	111	3	1	0
2018	57	546	8	1	85	1	0	0
2019	51	512	9	1	79	1	0	0
2020	28	418	1	0	53	0	0	0

Table 7. *Annual number of recreational headboat/charterboat (HC), private (PR), and shore (SH) age samples by subregion (W, NE, SE). The age compositions resulting from these samples were dropped from further analyses if n<10 by strata for HC and PR or all strata combined for SH.*

Year	W_HC	NE_HC	SE_HC	W_PR	NE_PR	SE_PR	W_SH	NE_SH	SE_SH
1981	0	0	21	0	0	0	0	0	0
1982	0	69	30	0	0	0	0	0	0
1983	0	0	4	0	0	0	0	0	0
1990	0	3	0	0	0	0	0	0	0
1991	0	16	33	0	0	6	0	0	0
1992	78	109	2	0	1	22	0	0	0
1993	58	123	1	0	1	17	0	0	0
1994	66	269	5	0	0	8	0	0	0
1995	17	130	39	0	1	3	0	0	0
1996	3	118	23	0	0	0	0	0	0
1997	0	239	43	0	28	2	0	0	0
1998	0	93	0	0	12	10	0	0	0
1999	1	67	1	0	0	2	0	0	0
2000	0	20	4	0	4	7	0	0	0
2001	0	49	19	0	1	21	0	0	0
2002	0	185	71	2	21	24	0	0	0
2003	0	184	18	0	117	58	0	0	0
2004	38	85	49	1	42	38	0	0	0
2005	81	376	140	161	36	30	0	0	0
2006	99	140	116	65	31	26	1	0	4
2007	255	104	125	257	22	69	0	13	0
2008	302	195	165	299	203	63	0	34	8
2009	258	304	364	398	144	62	0	4	0
2010	81	641	275	56	127	62	0	0	0
2011	356	29	238	91	2	26	0	0	0
2012	494	58	723	198	39	0	0	0	0
2013	417	237	460	91	41	3	0	5	0
2014	141	208	861	155	121	28	0	6	5
2015	93	421	896	51	84	9	0	13	0
2016	45	491	929	58	80	1	0	7	0
2017	17	304	620	65	27	54	0	8	0
2018	98	619	663	69	67	92	0	2	0
2019	87	853	802	77	188	168	0	2	0
2020	73	223	55	47	84	23	0	20	2

Table 8. *Annual number of recreational headboat/charterboat (HC), private (PR), and shore (SH) trips sampled for ages by stock.*

Year	W_HC	NE_HC	SE_HC	W_PR	NE_PR	SE_PR	W_SH	NE_SH	SE_SH
1981	0	0	13	0	0	0	0	0	0
1982	0	5	12	0	0	0	0	0	0
1983	0	0	2	0	0	0	0	0	0
1990	0	3	0	0	0	0	0	0	0
1991	0	10	8	0	0	4	0	0	0
1992	33	58	1	0	1	11	0	0	0
1993	31	65	1	0	1	7	0	0	0
1994	25	108	2	0	0	3	0	0	0
1995	9	62	21	0	1	1	0	0	0
1996	2	35	12	0	0	0	0	0	0
1997	0	50	19	0	0	1	0	0	0
1998	0	33	0	0	0	3	0	0	0
1999	1	31	1	0	0	1	0	0	0
2000	0	11	2	0	0	2	0	0	0
2001	0	22	9	0	1	7	0	0	0
2002	0	34	26	1	11	5	0	0	0
2003	0	36	8	0	24	14	0	0	0
2004	6	19	29	1	12	9	0	0	0
2005	18	59	63	35	10	9	0	0	0
2006	24	24	53	14	5	9	1	0	1
2007	50	81	67	52	20	15	0	13	0
2008	47	193	111	37	203	33	0	34	8
2009	50	278	294	47	140	13	0	4	0
2010	11	639	168	17	127	15	0	0	0
2011	41	12	80	15	1	5	0	0	0
2012	49	52	167	27	39	0	0	0	0
2013	57	197	155	20	36	3	0	5	0
2014	23	155	210	24	95	24	0	6	5
2015	24	165	176	12	41	2	0	6	0
2016	14	149	189	18	40	1	0	6	0
2017	5	109	160	11	16	12	0	4	0
2018	24	178	173	12	30	27	0	1	0
2019	13	300	207	23	45	42	0	2	0
2020	11	92	17	10	44	5	0	11	1

Figures
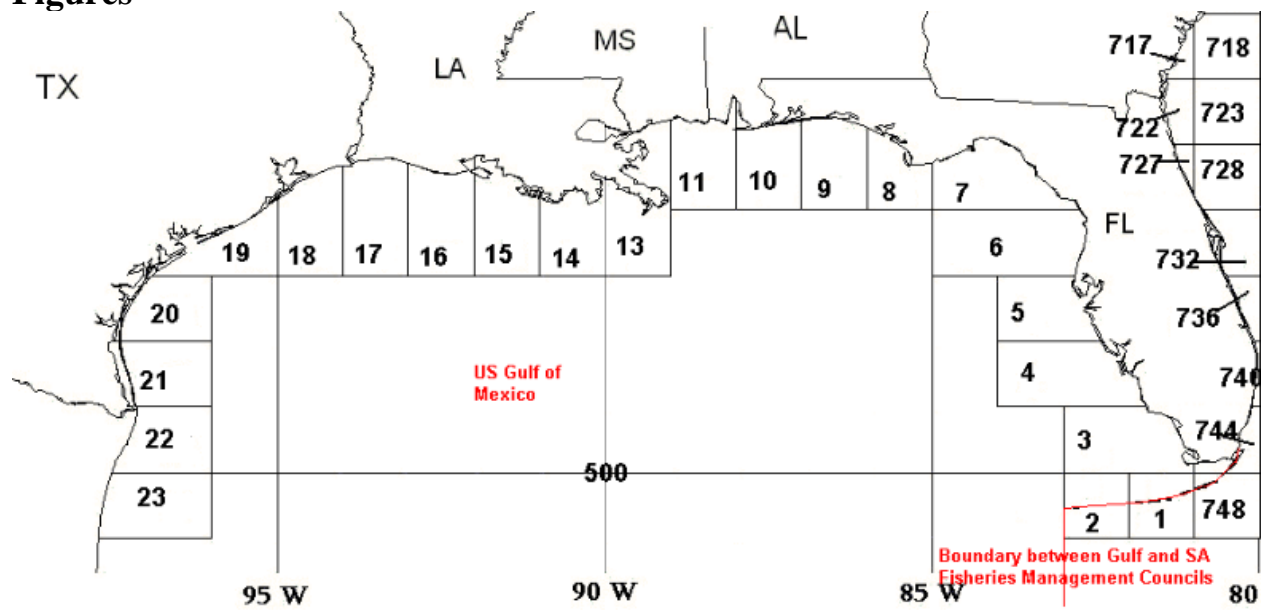
Figure 1: NMFS commercial fishing areas in the Gulf of Mexico used to define stock boundaries.
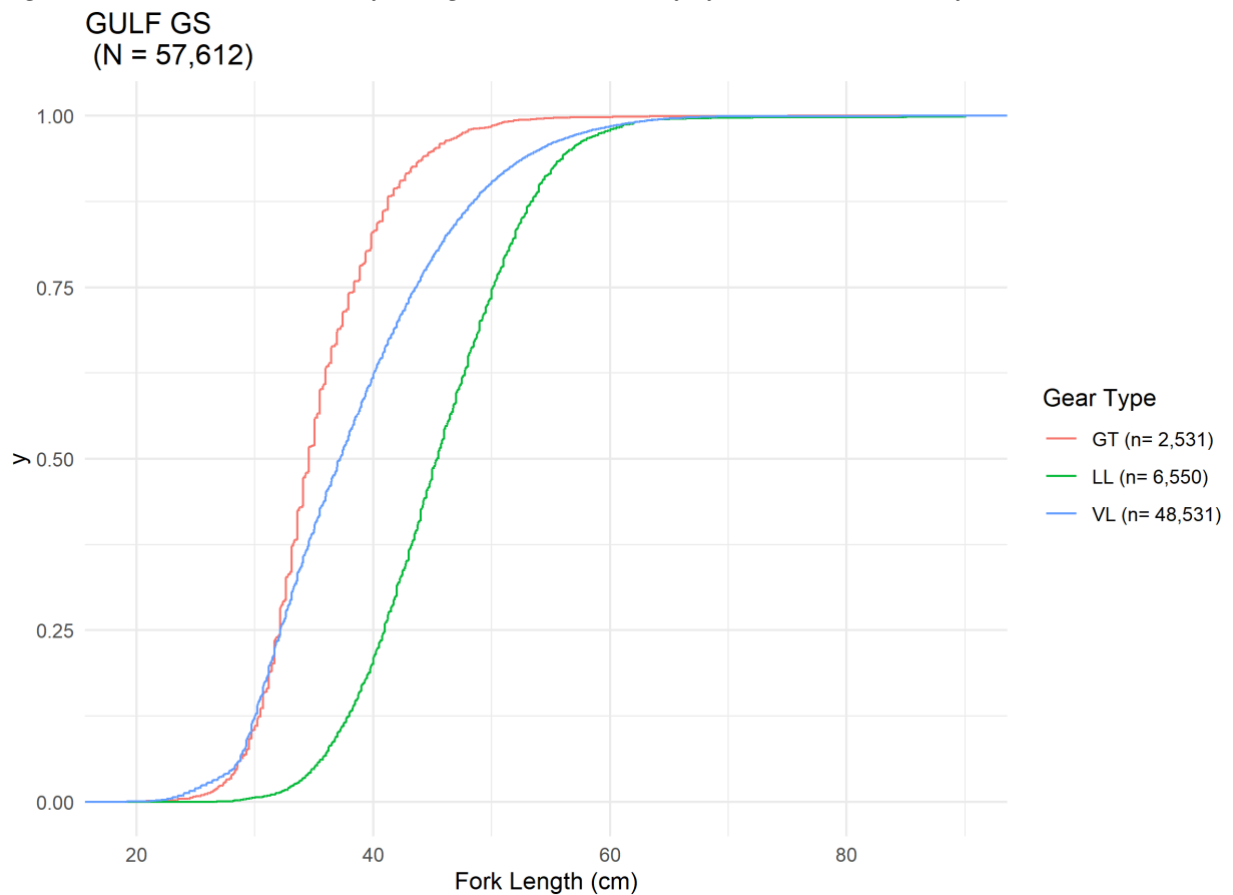
Figure 2: Aggregated commercial gear cumulative length distributions: longline (LL), vertical line (VL), and gillnet/trap (GT) gears.
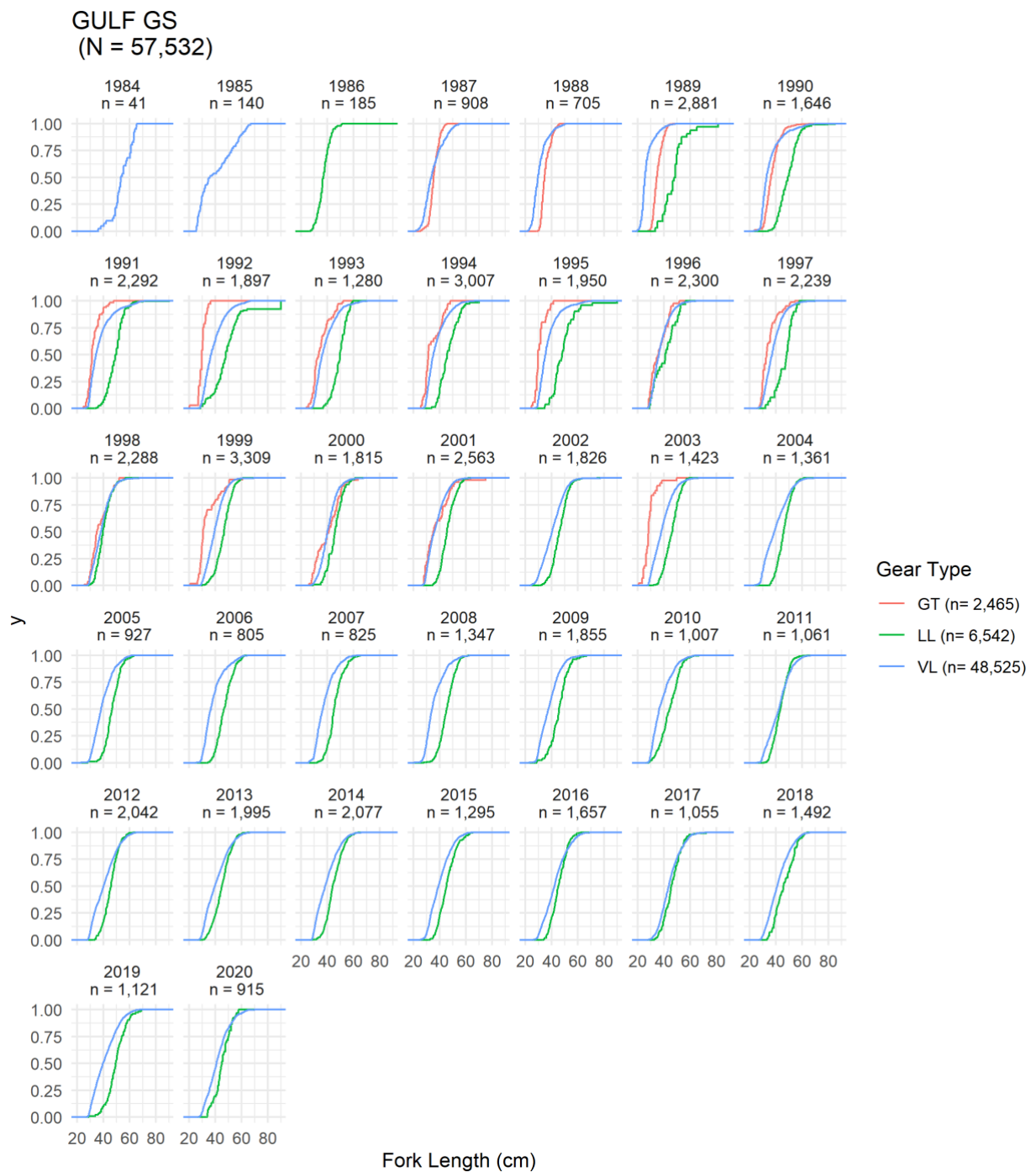
Figure 3: Nominal Gray Snapper commercial gear cumulative length distributions: longline (LL), vertical line (VL), and gillnet/trap (GT) gears. Strata with less than 30 samples were dropped.
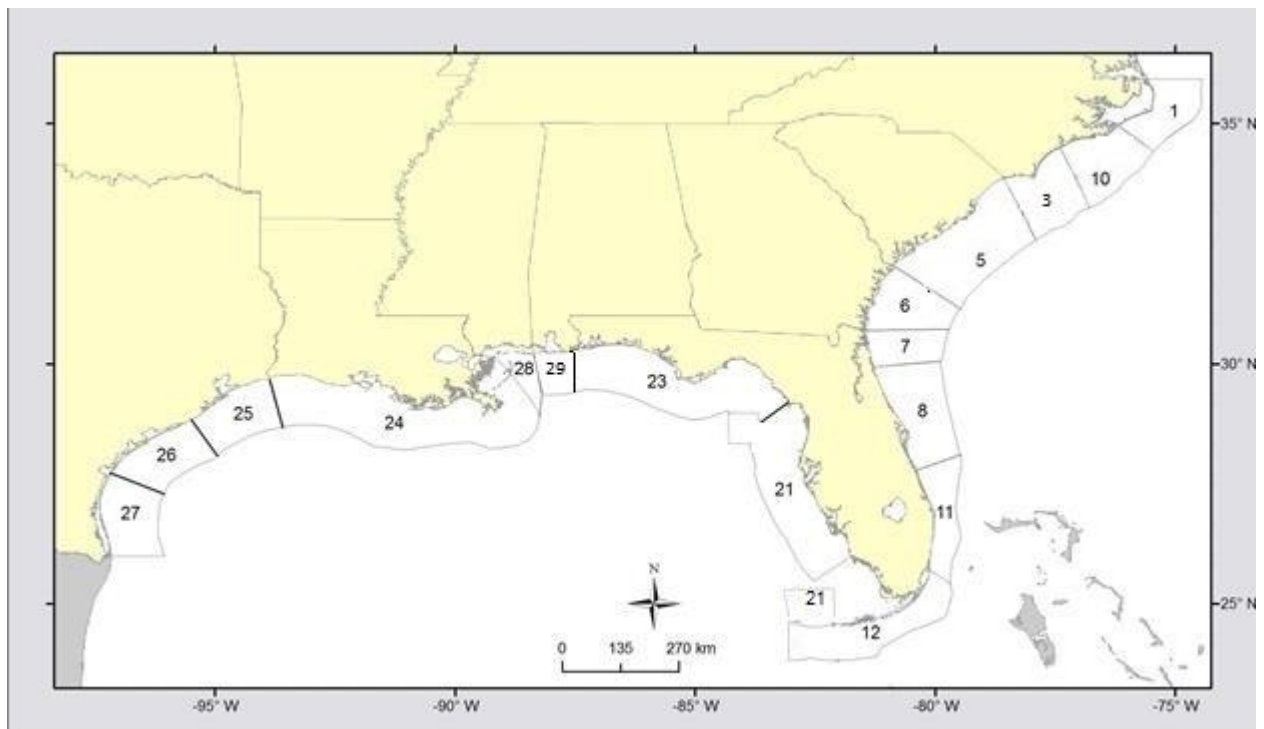
Figure 4: SRHS headboat areas in the Gulf of Mexico used to define stock boundaries. Pre-2013, Alabama could not be distinguished from the Florida panhandle (e.g. area 23 encompassed area 29 in the SRHS survey design).
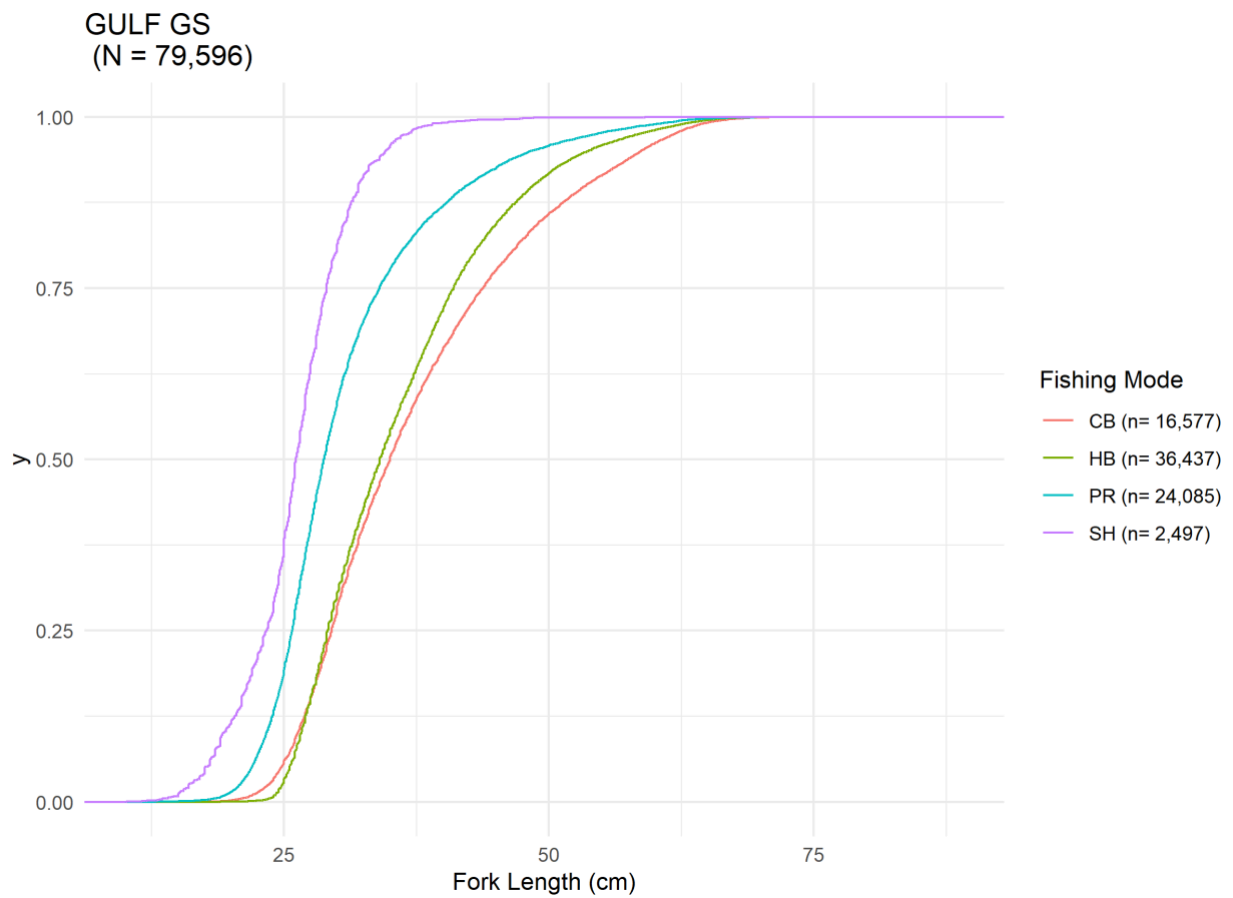
Figure 5: Aggregated Gray Snapper cumulative length distributions by recreational modes: charterboat (CB), headboat (HB), private (PR), and shore (SH) modes, where CB and HB were aggregated for the final model.
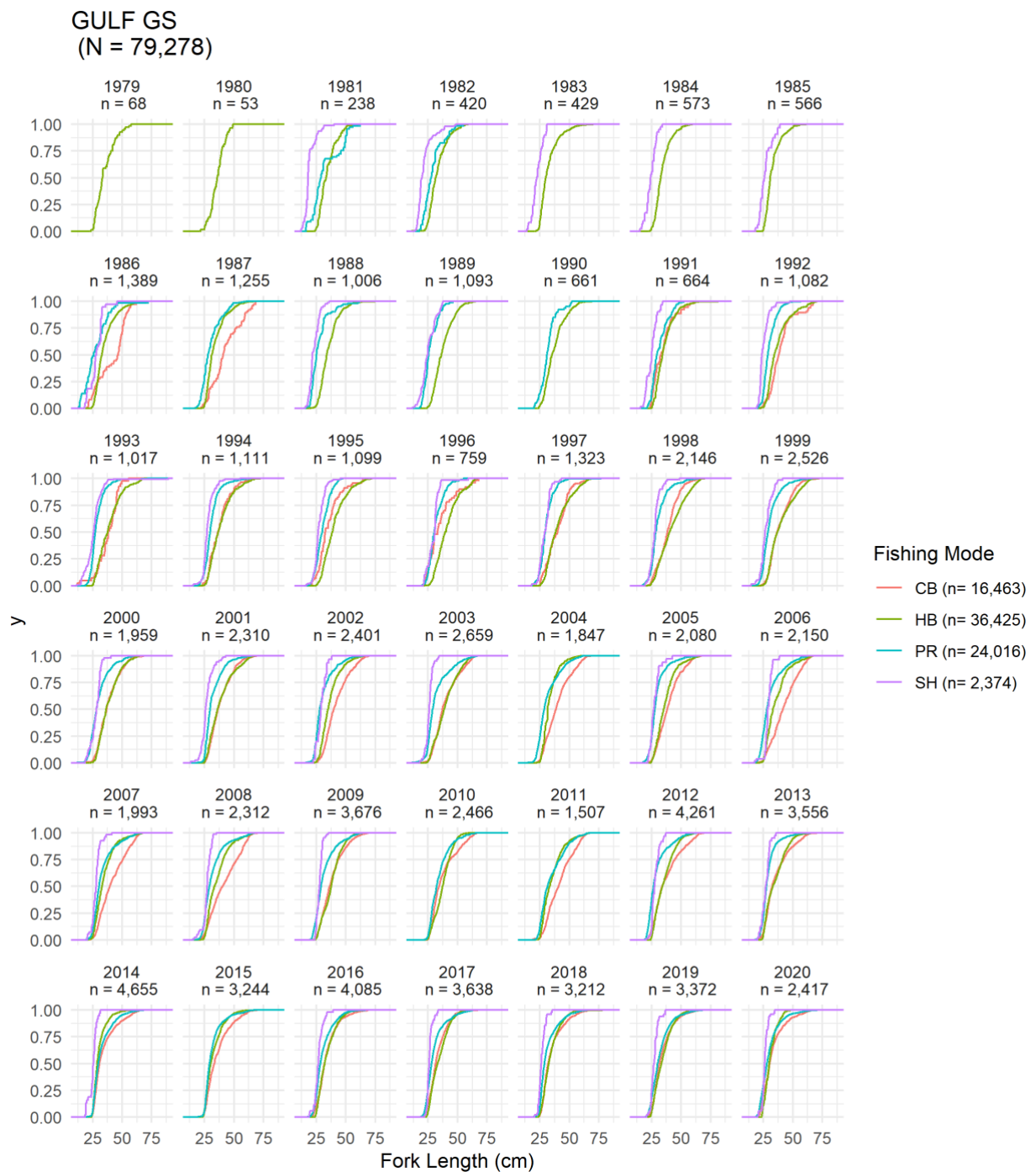
Figure 6: Nominal Gray Snapper cumulative length distributions by recreational modes: charterboat (CB), headboat (HB), private (PR), and shore (SH) modes, where CB and HB were aggregated for the final model. Strata with less than 30 samples were dropped.
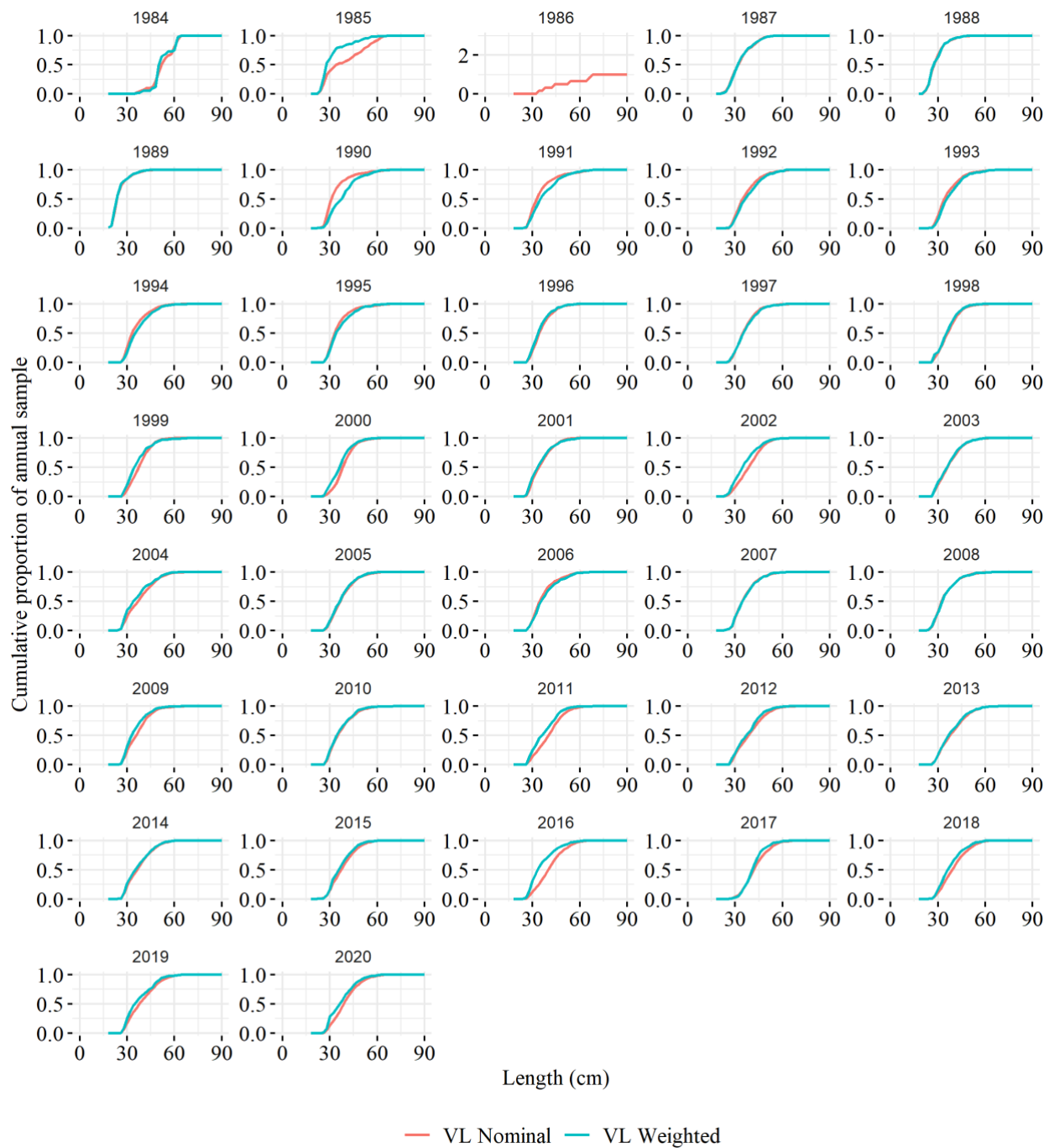
Figure 7: Weighted and nominal Gray Snapper commercial VL cumulative length distributions. Strata with less than 30 samples were dropped for the weighting procedure.
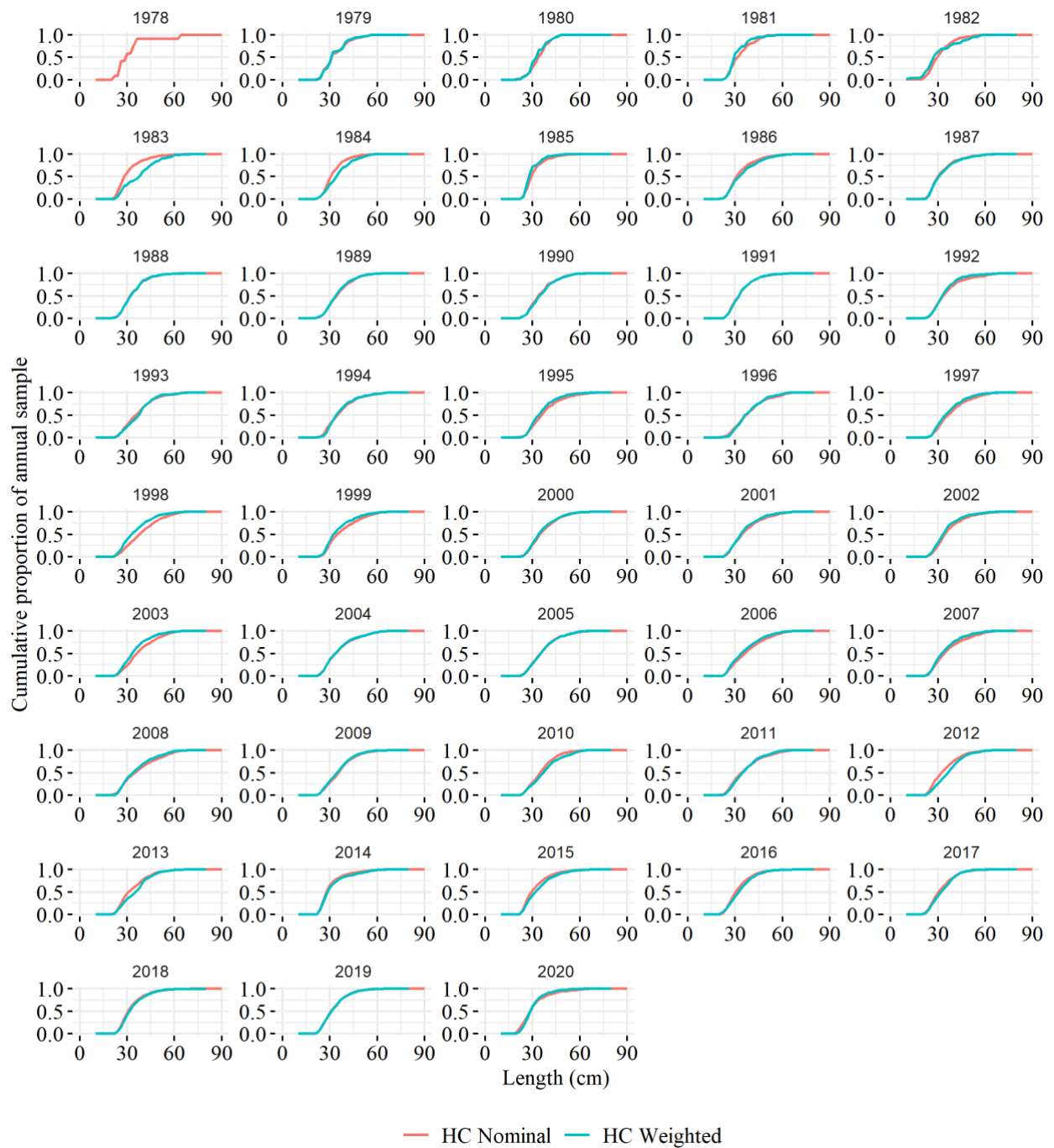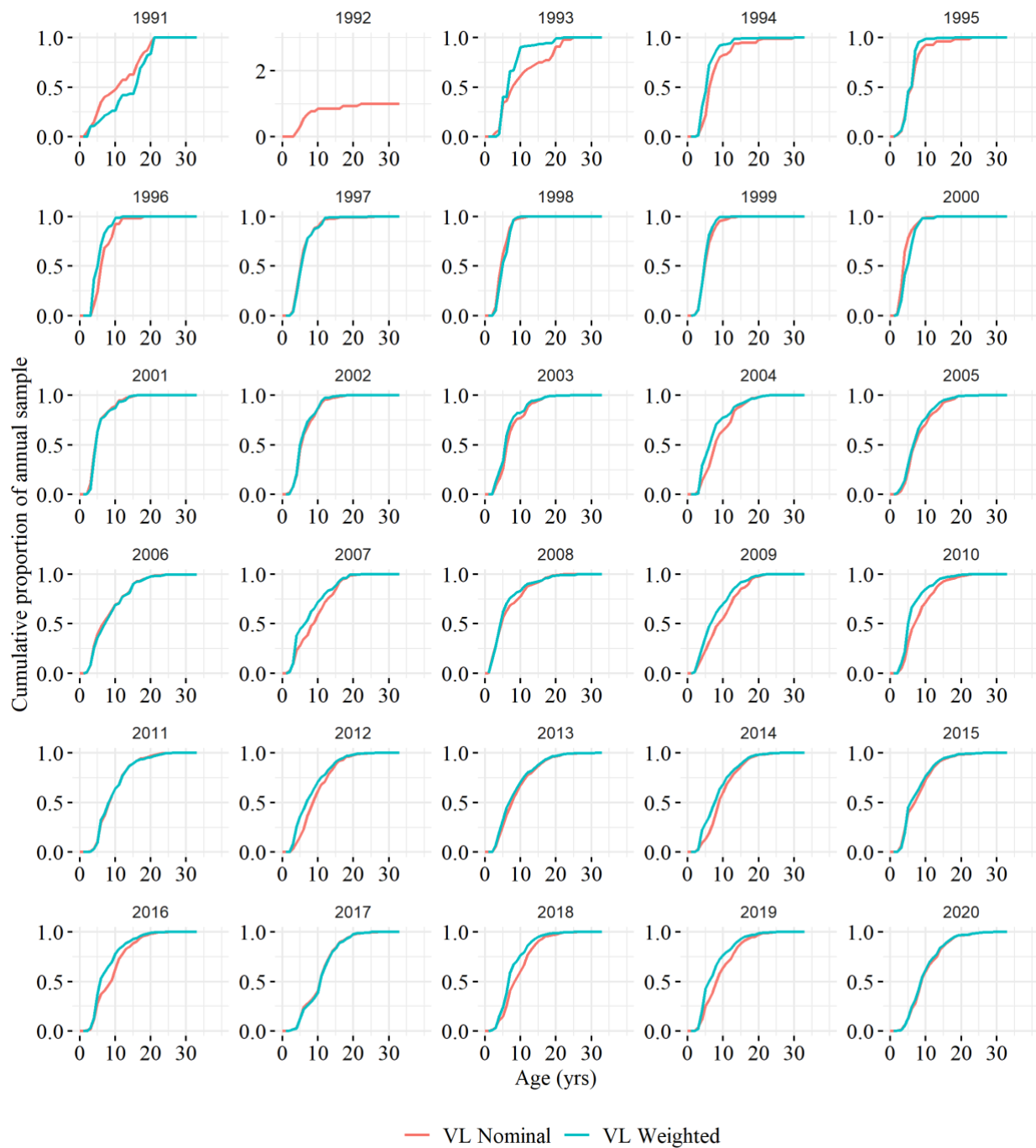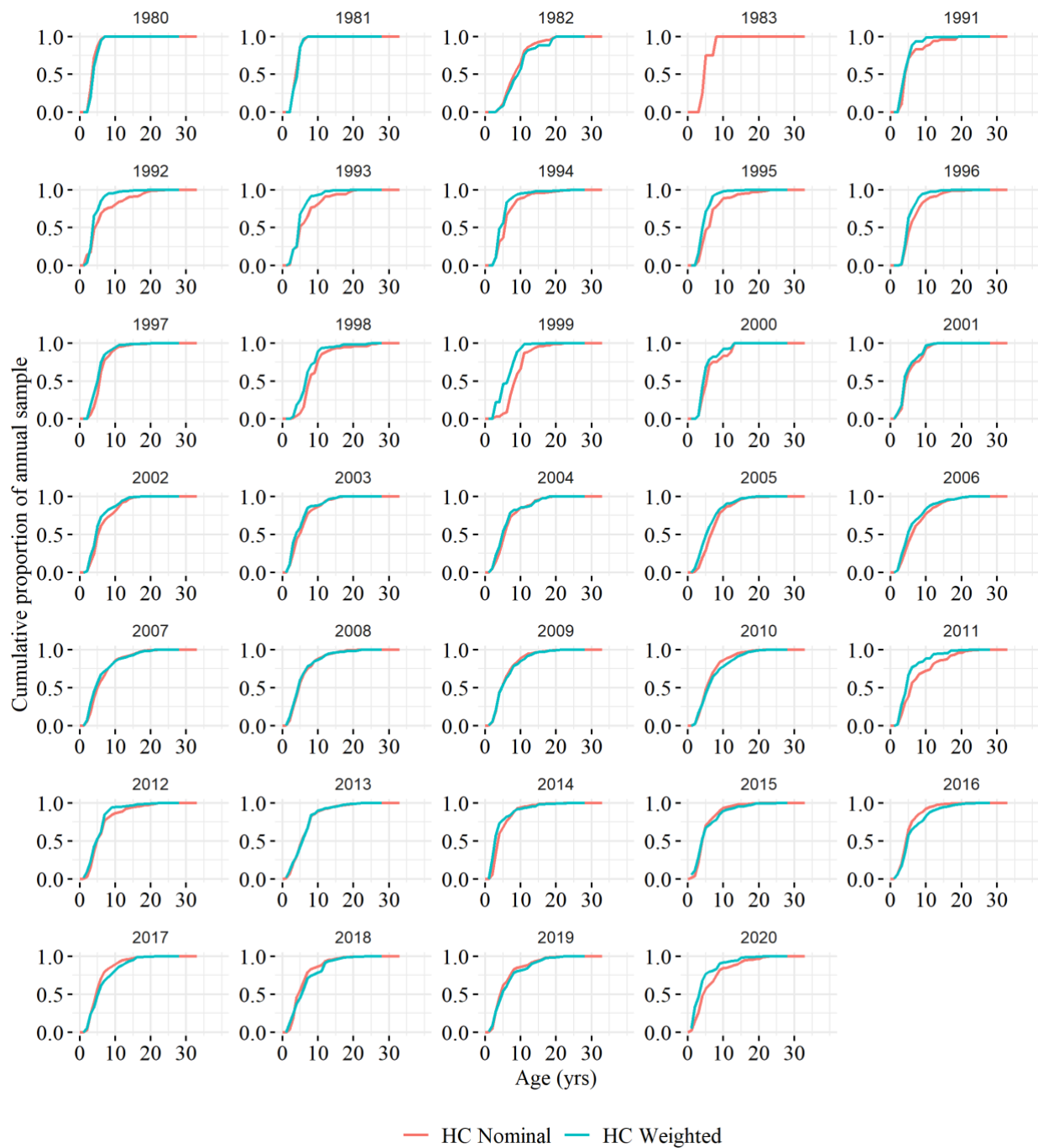
Figure 8: Weighted and nominal Gray Snapper recreational HC cumulative length distributions. Strata with less than 30 samples were dropped for the weighting procedure.
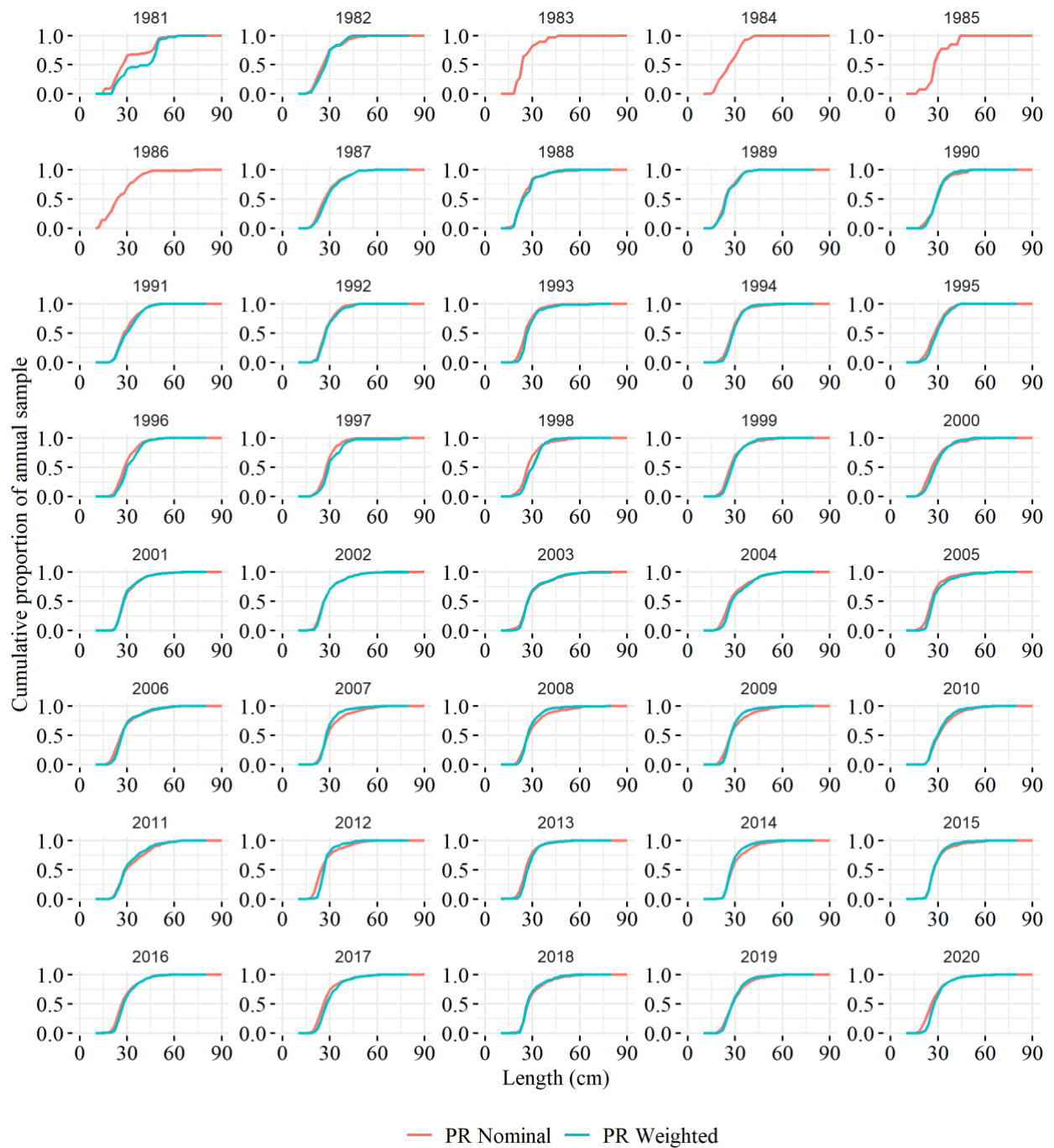
Figure 9: Weighted and nominal Gray Snapper commercial PR cumulative length distributions. Strata with less than 30 samples were dropped for the weighting procedure.

Figure 10: Weighted and nominal Gray Snapper commercial VL cumulative age distributions. Strata with less than 10 samples were dropped for the weighting procedure.

Figure 11: Weighted and nominal Gray Snapper recreational HC cumulative age distributions. Strata with less than 10 samples were dropped for the weighting procedure.
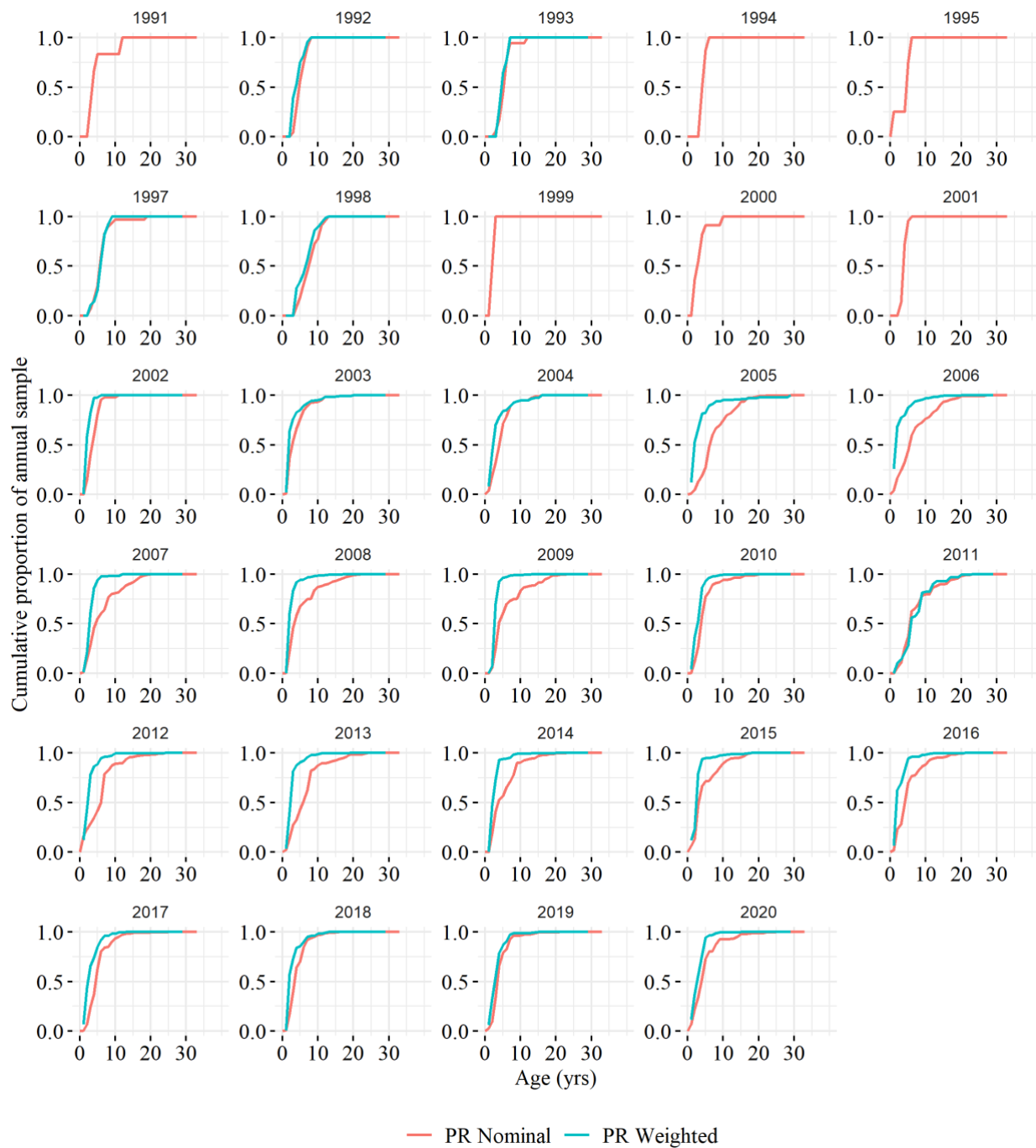
Figure 12: Weighted and nominal Gray Snapper commercial PR cumulative age distributions. Strata with less than 10 samples were dropped for the weighting procedure.