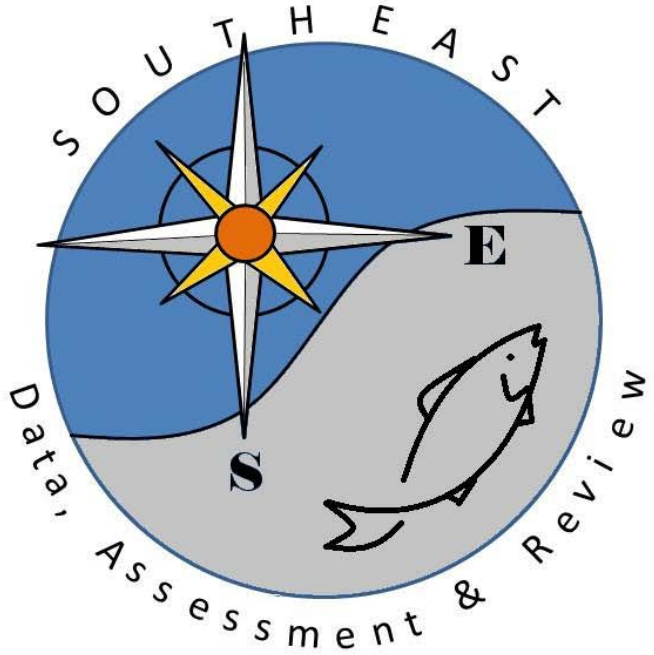
Length frequency distributions for red snappers in the Gulf of Mexico from 1984-2011

Ching-Ping Chih

SEDAR31-DW10

3 August 2012



Please cite as:

Chih, C. 2012. Length frequency distributions for red snappers in the Gulf of Mexico from 1984-2011. SEDAR31-DW10. SEDAR, North Charleston, SC. 22 pp.

Length frequency distributions for red snappers in the Gulf of Mexico from 1984-2011

Ching-Ping Chih

Introduction

This report documents changes in length frequency distributions of red snappers from 1981 to 2011. The length frequency tables are used to calculate catch-at-size which will be used in stock assessment models. Changes in length frequency distributions were analyzed to examine the possible changes in selectivity-on-size.

Materials and Methods

Commercial fisheries samples

Length samples for commercial fisheries were obtained from the Trip Interview Program (TIP) database and the Gulf Fisheries Information Network (FIN) database. All commercial data were grouped into four strata (handline east (HE), handline west (HW), longline east (LE) and longline west (LW)). The eastern Gulf and western Gulf were defined based on Gulf shrimp grids (grids 1 to 12 for the eastern Gulf and 13 to 21 for the western Gulf). Length samples were assigned by fishing area to different strata. When a fishing area was not available, landing area was used. Length frequencies were calculated for each year and season (4 month periods) for each stratum. Length samples were first grouped into 1 inch bins (e.g., if $1 \leq \text{length} < 2$ then length=1). Length frequencies for handline samples collected from the eastern Gulf were further weighted by landings from the northeastern and southeastern Gulf. The southeastern Gulf was defined as grids 1 to 7, and the northeastern Gulf was defined as grids 8-12. All length values in the original data sets were converted to total length by using the equations listed in the SEDAR7 final assessment report.

Recreational fisheries samples

Length samples for recreational fisheries were obtained from (1) the Marine Recreational Fisheries Statistics Survey, (2) the Headboat survey, (3) the Texas Parks and Wildlife Department database, (4) the Gulf FIN database, and (5) the TIP database. All recreational length data were grouped into two strata (recreational east (RE) and recreational west (RW)). The eastern Gulf included Florida, Alabama and Mississippi, while the western Gulf included Louisiana and Texas. Length frequencies were calculated for each year, season (4 month period) and stratum. Like the commercial samples, recreational length samples were also grouped into 1 inch bins. Recreational samples were categorized into two fishing modes, namely headboat and non-headboat. All fishing modes that were not headboat (e.g., charter boat, private boat) were categorized as non-headboat. Length frequencies for each stratum were weighted by landings from the two fishing modes (headboat and non-headboat). All length values in the original data sets were converted to total length by using the same equations noted

above.

For strata that were further weighted by landings of different substrata (e.g. HE, RE, RW), the weighted sample sizes were calculated as follows:

$$\text{Weighted N} = \left(L_{r1,y+}L_{r2,y}\right)^2 \Big/ \left(\frac{{L_{r1,y}}^2}{N_{r1,y}} + \frac{{L_{r2,y}}^2}{N_{r2,y}}\right)$$

where *L* is the landings, N is the sample size, *r1* and *r2* are the regions or modes to be combined and *y* is the year.

Results and Discussion

Changes in length frequency distributions appear to coincide with changes in fishing regulations and fishing behavior. In particular, there were noticeable differences in the length frequency distributions of length samples collected from commercial handline fisheries before and after 2007 (Fig 1b, Fig 2b), when the individual fishing quotas (IFQ) was put into effect. In general, the proportion of larger fish increased after 2007, and this phenomenon appears to be more pronounced in the western Gulf of Mexico than in the eastern Gulf of Mexico. These changes in length frequency distributions may reflect (a) changes in year class strength, (b) changes in fishing behaviors (i.e., fishermen had more time to look for larger fish) and (c) a greater availability of larger fish for fishing. Further analyses of year class changes are needed to confirm these effects.

There is considerable variation in the length frequency distributions of length samples collected from commercial longline fisheries (Fig 3,4). This is due to small sample sizes and possible clustering effects.

Noticeable differences were also found in the length frequency distributions of recreational length samples collected after 2007, when the bag limits per person per boat was cut from 4 to 2 (Fig 5b, 6b). These differences may indicate a change in selectivity-on-size due to the changes in fishing regulations.

Table 1. Samples sizes of length samples collected from commercial handline fisheries from the eastern Gulf of Mexico from 1984 to 2011.

Year	Region	Gear	Landing number	Sample size	Percent sampled	Weighted sample size
1984	E	H	300577	2092	0.70%	1924
1985	E	H	238335	1196	0.50%	561
1986	E	H	327183	1176	0.36%	1071
1987	E	H	263961	807	0.31%	773
1988	E	H	222172	302	0.14%	240
1989	E	H	270412	541	0.20%	322
1990	E	H	204937	2254	1.10%	2219
1991	E	H	158778	3014	1.90%	2547
1992	E	H	209825	1249	0.60%	1202
1993	E	H	143015	2422	1.69%	1689
1994	E	H	188257	4088	2.17%	3611
1995	E	H	42065	2572	6.11%	2017
1996	E	H	67268	2837	4.22%	2825
1997	E	H	53833	2444	4.54%	2437
1998	E	H	120833	4629	3.83%	4581
1999	E	H	149189	5787	3.88%	5603
2000	E	H	166662	5342	3.21%	4862
2001	E	H	220070	5116	2.32%	5070
2002	E	H	296547	5570	1.88%	5494
2003	E	H	323258	5963	1.84%	5934
2004	E	H	294908	5305	1.80%	5168
2005	E	H	239969	5031	2.10%	5004
2006	E	H	237140	4771	2.01%	3775
2007	E	H	359115	5866	1.63%	5217
2008	E	H	277409	5335	1.92%	4108
2009	E	H	291061	5454	1.87%	4288
2010	E	H	377103	5229	1.39%	4988
2011	E	H	440789	7731	1.75%	7724

Table 2. Samples sizes of length samples collected from commercial handline fisheries from the western Gulf of Mexico from 1984 to 2011.

Year	Region	Gear	Landing number	Sample size	Percent sampled
1984	W	H	3206	689785	0.46%
1985	W	H	3611	562093	0.64%
1986	W	H	2147	541486	0.40%
1987	W	H	884	548313	0.16%
1988	W	H	1304	729399	0.18%
1989	W	H	1707	679477	0.25%
1990	W	H	7164	665398	1.08%
1991	W	H	7303	610808	1.20%
1992	W	H	10135	1103297	0.92%
1993	W	H	8576	911100	0.94%
1994	W	H	6145	766990	0.80%
1995	W	H	6116	687179	0.89%
1996	W	H	7998	1134139	0.71%
1997	W	H	10324	1203064	0.86%
1998	W	H	10019	1069132	0.94%
1999	W	H	5465	1041437	0.52%
2000	W	H	3610	1167617	0.31%
2001	W	H	4442	1066223	0.42%
2002	W	H	6395	1087253	0.59%
2003	W	H	5355	983440	0.54%
2004	W	H	4099	949391	0.43%
2005	W	H	5051	927233	0.54%
2006	W	H	5552	1332795	0.42%
2007	W	H	2137	668799	0.32%
2008	W	H	3621	501626	0.72%
2009	W	H	4365	427025	1.02%
2010	W	H	5316	495785	1.07%
2011	W	H	4528	399692	1.13%

Table 3. Samples sizes of length samples collected from commercial longline fisheries from the eastern Gulf of Mexico from 1984 to 2011.

Year	Region	Gear	Landing number	Sample size	Percent sampled
1984	E	L	863	22796	3.79%
1985	E	L	794	8443	9.40%
1986	E	L	1011	4082	24.77%
1987	E	L	397	2936	13.52%
1988	E	L	187	1996	9.37%
1989	E	L	29	570	5.09%
1990	E	L	300	7076	4.24%
1991	E	L	136	1639	8.30%
1992	E	L	161	837	19.23%
1993	E	L	153	1642	9.32%
1994	E	L	102	522	19.55%
1995	E	L	199	809	24.61%
1996	E	L	79	859	9.20%
1997	E	L	68	300	22.69%
1998	E	L	219	371	59.07%
1999	E	L	290	911	31.82%
2000	E	L	283	1029	27.51%
2001	E	L	231	1238	18.66%
2002	E	L	282	1328	21.23%
2003	E	L	312	1592	19.60%
2004	E	L	423	2766	15.29%
2005	E	L	574	3290	17.45%
2006	E	L	240	2319	10.35%
2007	E	L	218	1274	17.11%
2008	E	L	518	3383	15.31%
2009	E	L	80	1868	4.28%
2010	E	L	658	9536	6.90%
2011	E	L	573	11484	4.99%

Table 4. Samples sizes of length samples collected from commercial longline fisheries from the western Gulf of Mexico from 1984 to 2011.

Year	Region	Gear	Landing number	Sample size	Percent sampled
1984	W	L	605	52932	1.14%
1985	W	L	485	78878	0.61%
1986	W	L	124	101392	0.12%
1987	W	L	26	36313	0.07%
1988	W	L	71	290687	0.02%
1989	W	L	260	102850	0.25%
1990	W	L	376	21374	1.76%
1991	W	L	272	9797	2.78%
1992	W	L	111	7106	1.56%
1993	W	L	51	2437	2.09%
1994	W	L	4	102	3.92%
1995	W	L	7	1059	0.66%
1996	W	L	11	1921	0.57%
1997	W	L	63	655	9.62%
1998	W	L	358	2692	13.30%
1999	W	L	218	11617	1.88%
2000	W	L	540	18049	2.99%
2001	W	L	192	8252	2.33%
2002	W	L	705	17271	4.08%
2003	W	L	259	13584	1.91%
2004	W	L	699	52401	1.33%
2005	W	L	356	32435	1.10%
2006	W	L	502	27441	1.83%
2007	W	L	363	13668	2.66%
2008	W	L	382	6085	6.28%
2009	W	L	287	4106	6.99%
2010	W	L	85	5392	1.58%
2011	W	L	14	1116	1.25%

Table 5. Samples sizes of length samples collected from recreational fisheries from the eastern Gulf of Mexico from 1984 to 2011.

Year	Region	Landing number	Sample size	Percent sampled	Weighted sample size
1981	E	749524	224	0.03%	189
1982	E	832368	185	0.02%	161
1983	E	1052117	333	0.03%	180
1984	E	179381	506	0.28%	487
1985	E	474961	60	0.01%	46
1986	E	558034	351	0.06%	196
1987	E	527901	835	0.16%	666
1988	E	509176	576	0.11%	402
1989	E	485366	465	0.10%	187
1990	E	355822	602	0.17%	294
1991	E	531995	2232	0.42%	1728
1992	E	816919	3407	0.42%	2865
1993	E	1222667	1797	0.15%	1449
1994	E	769721	2744	0.36%	1195
1995	E	615190	1047	0.17%	652
1996	E	576888	918	0.16%	446
1997	E	972427	2571	0.26%	1574
1998	E	807118	5435	0.67%	3915
1999	E	754760	9589	1.27%	9588
2000	E	726699	9324	1.28%	9170
2001	E	844311	7830	0.93%	7777
2002	E	1133526	12622	1.11%	12472
2003	E	992881	15723	1.58%	15722
2004	E	1254104	10975	0.88%	10975
2005	E	771454	11232	1.46%	10803
2006	E	841528	8459	1.01%	8442
2007	E	1127783	6586	0.58%	5868
2008	E	655895	3868	0.59%	3002
2009	E	779925	2330	0.30%	1684
2010	E	362956	2075	0.57%	1646
2011	E	558106	2697	0.48%	2232

Table 6. Samples sizes of length samples collected from recreational fisheries from the western Gulf of Mexico from 1984 to 2011.

Year	Region	Landing number	Sample size	Percent sampled	Weighted sample size
1981	W	1165342	66	0.01%	57
1982	W	1012162	290	0.03%	157
1983	W	1800880	1357	0.08%	942
1984	W	683671	698	0.10%	672
1985	W	725135	995	0.14%	854
1986	W	699540	7024	1.00%	2370
1987	W	479817	6715	1.40%	4427
1988	W	707512	5255	0.74%	2680
1989	W	578970	6732	1.16%	2698
1990	W	311533	4936	1.58%	2264
1991	W	514606	5643	1.10%	4278
1992	W	718586	10078	1.40%	6549
1993	W	855855	9324	1.09%	5020
1994	W	797393	8663	1.09%	6439
1995	W	725433	10576	1.46%	6771
1996	W	582436	7052	1.21%	6318
1997	W	587207	5610	0.96%	5238
1998	W	418161	8075	1.93%	6043
1999	W	238638	4234	1.77%	2415
2000	W	262176	4406	1.68%	3036
2001	W	219964	3531	1.61%	3008
2002	W	238770	4500	1.88%	4485
2003	W	267079	4499	1.68%	4229
2004	W	239504	3447	1.44%	2954
2005	W	266175	4082	1.53%	3901
2006	W	357395	4536	1.27%	4161
2007	W	316749	3615	1.14%	3256
2008	W	178322	2118	1.19%	1898
2009	W	207635	2831	1.36%	2784
2010	W	88387	2023	2.29%	1760
2011	W	118136	2545	2.15%	2520

Fig 1a. Length frequency distributions of length samples collected from commercial handline fisheries located in the eastern Gulf of Mexico (HE) from 1992 to 2001.

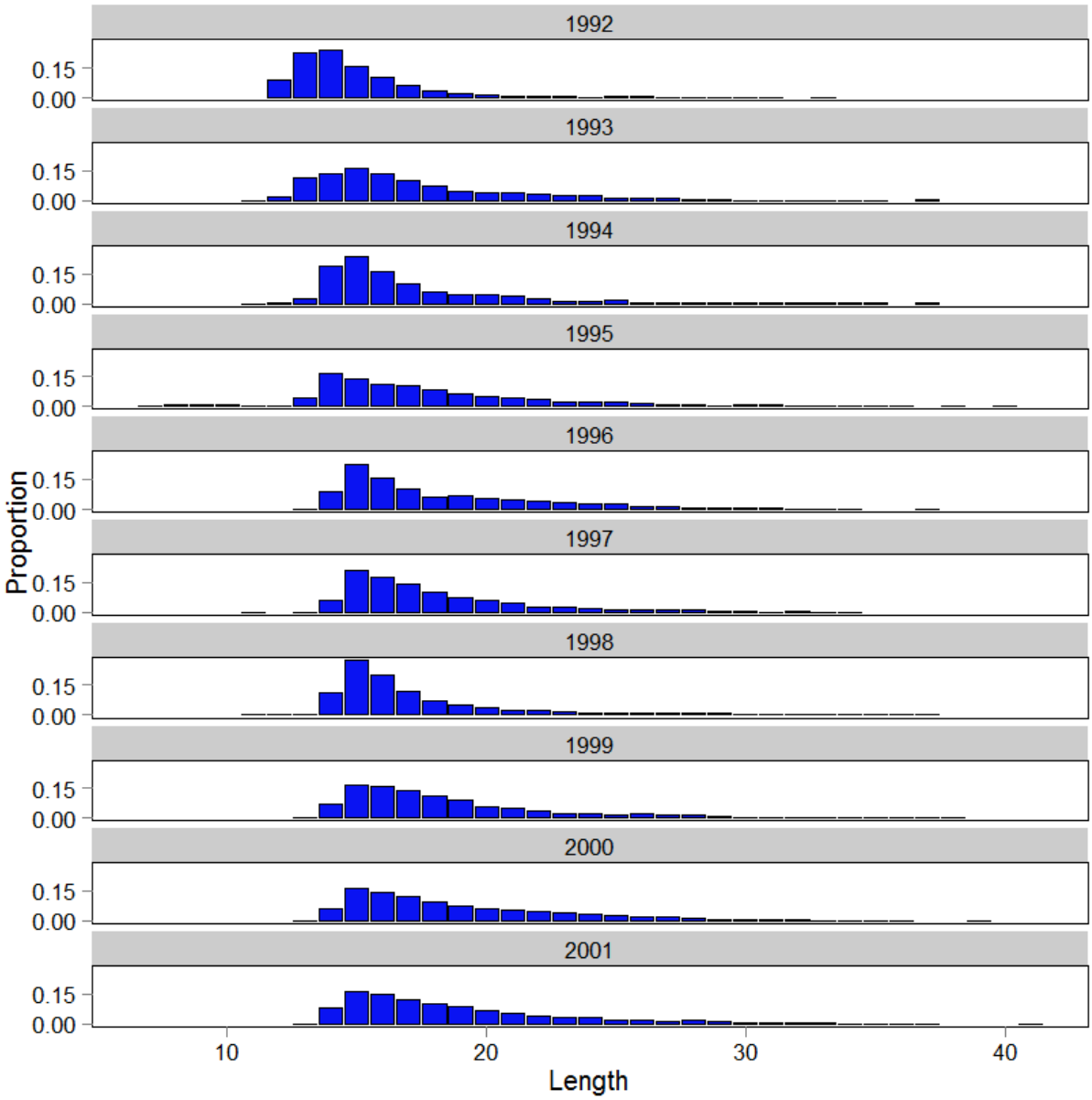


Fig 1b. Length frequency distributions of length samples collected from commercial handline fisheries located in the eastern Gulf of Mexico (HE) from 2002 to 2011.

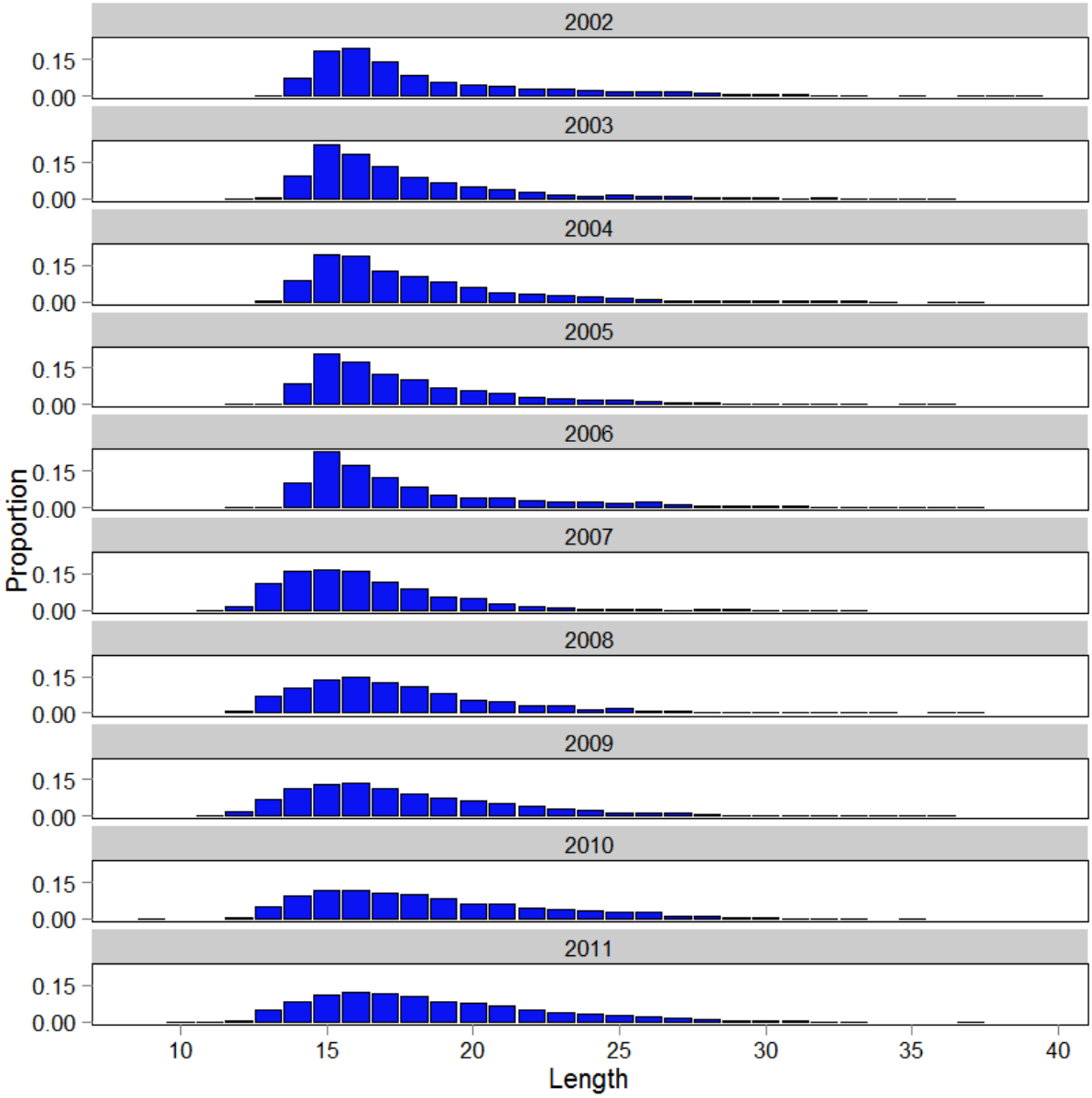


Fig 2a. Length frequency distributions of length samples collected from commercial handline fisheries located in the western Gulf of Mexico (HW) from 1992 to 2001.

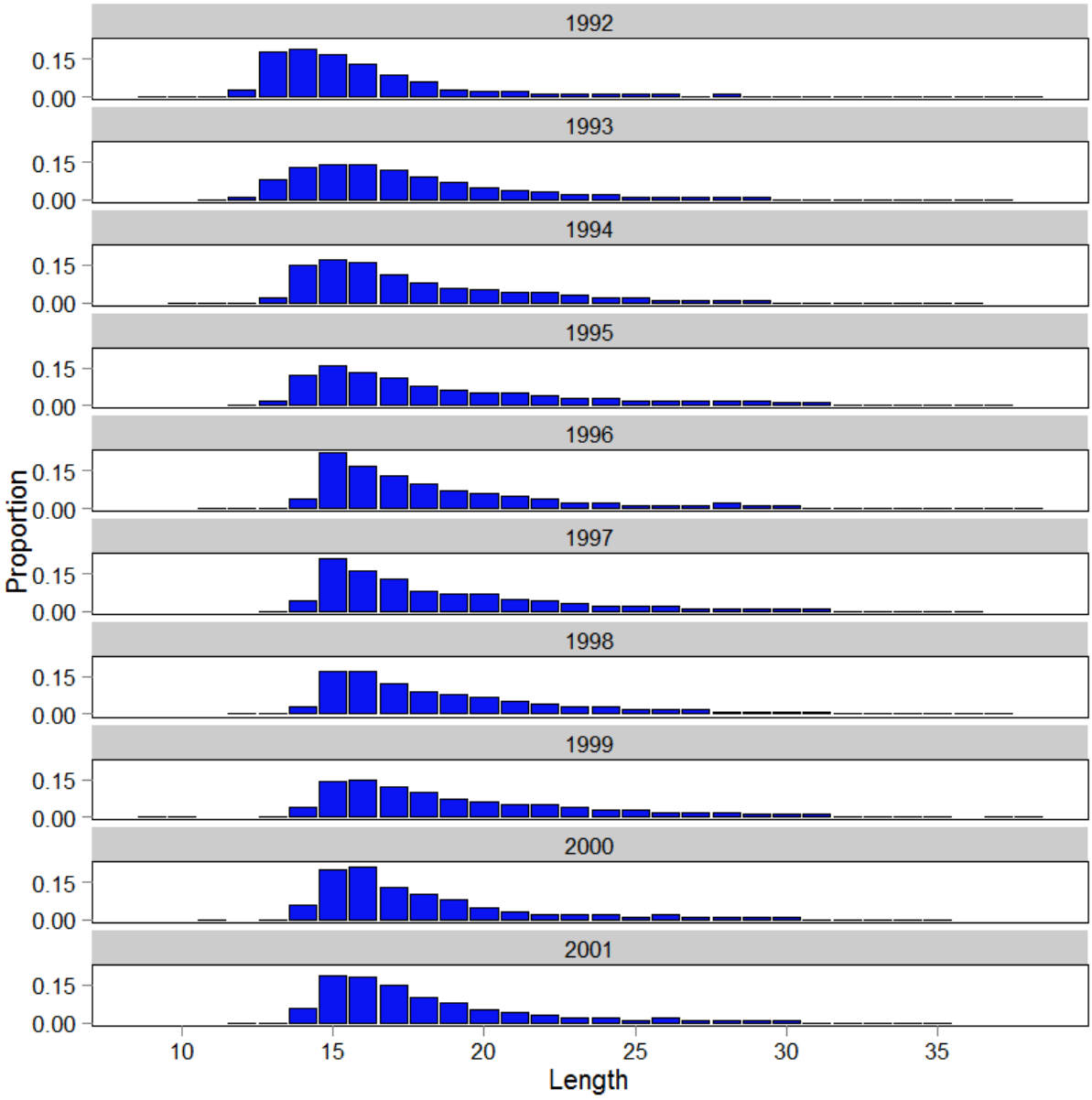


Fig 2b. Length frequency distributions of length samples collected from commercial handline fisheries located in the western Gulf of Mexico (HW) from 2002 to 2011.

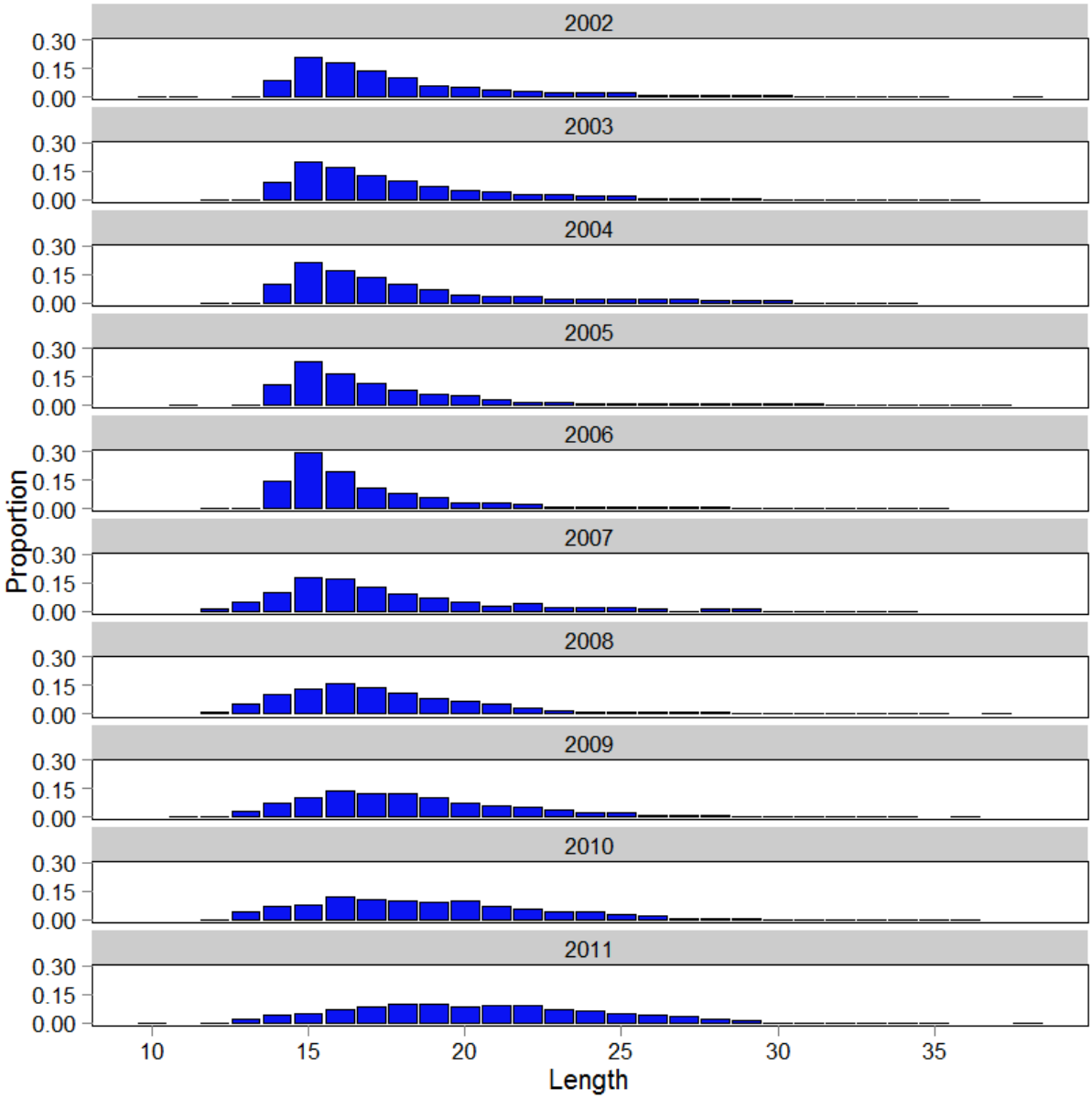


Fig 3a. Length frequency distributions of length samples collected from commercial longline fisheries located in the eastern Gulf of Mexico (LE) from 1992 to 2001.

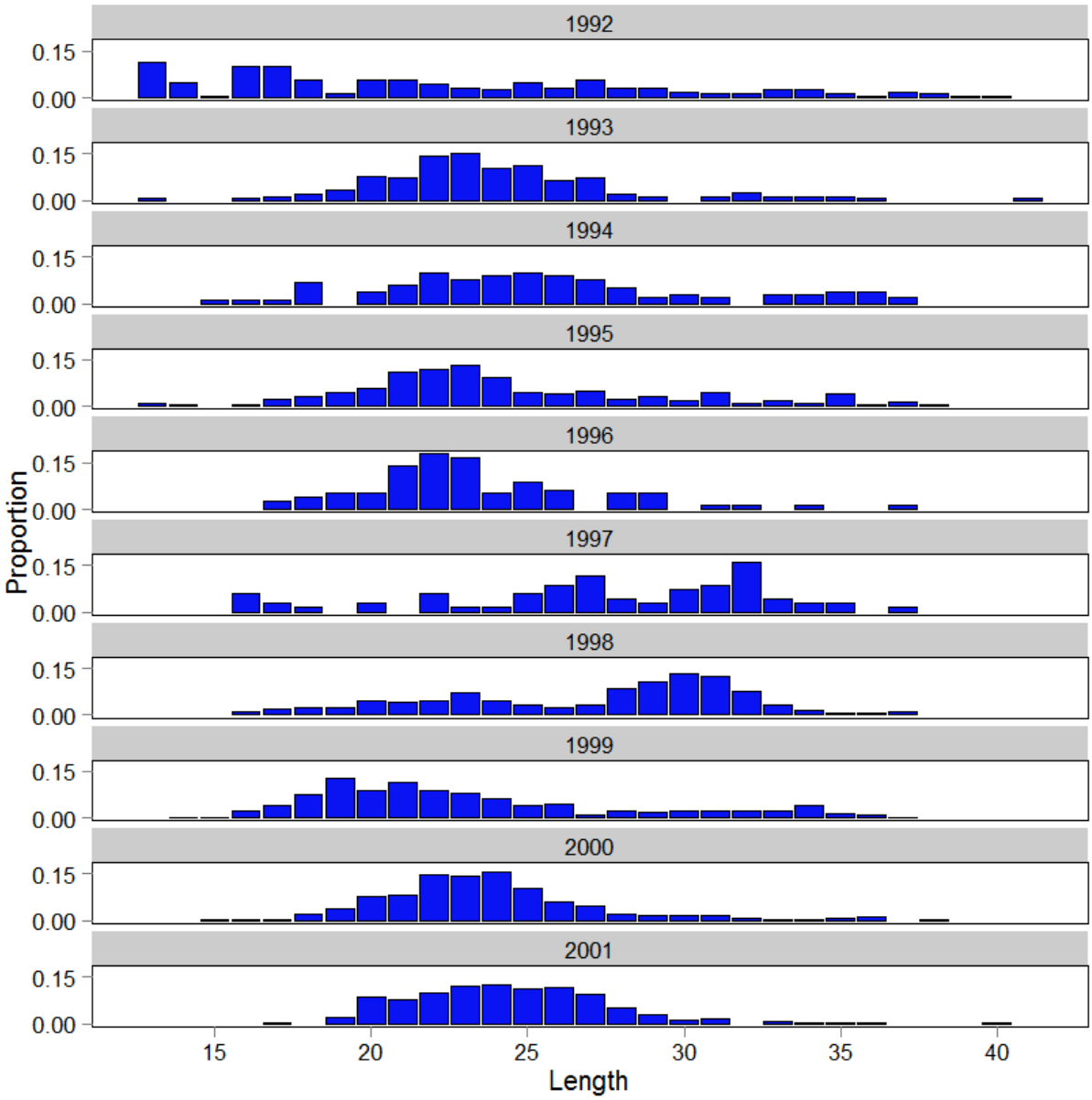


Fig 3b. Length frequency distributions of length samples collected from commercial longline fisheries located in the eastern Gulf of Mexico (LE) from 2002 to 2011.

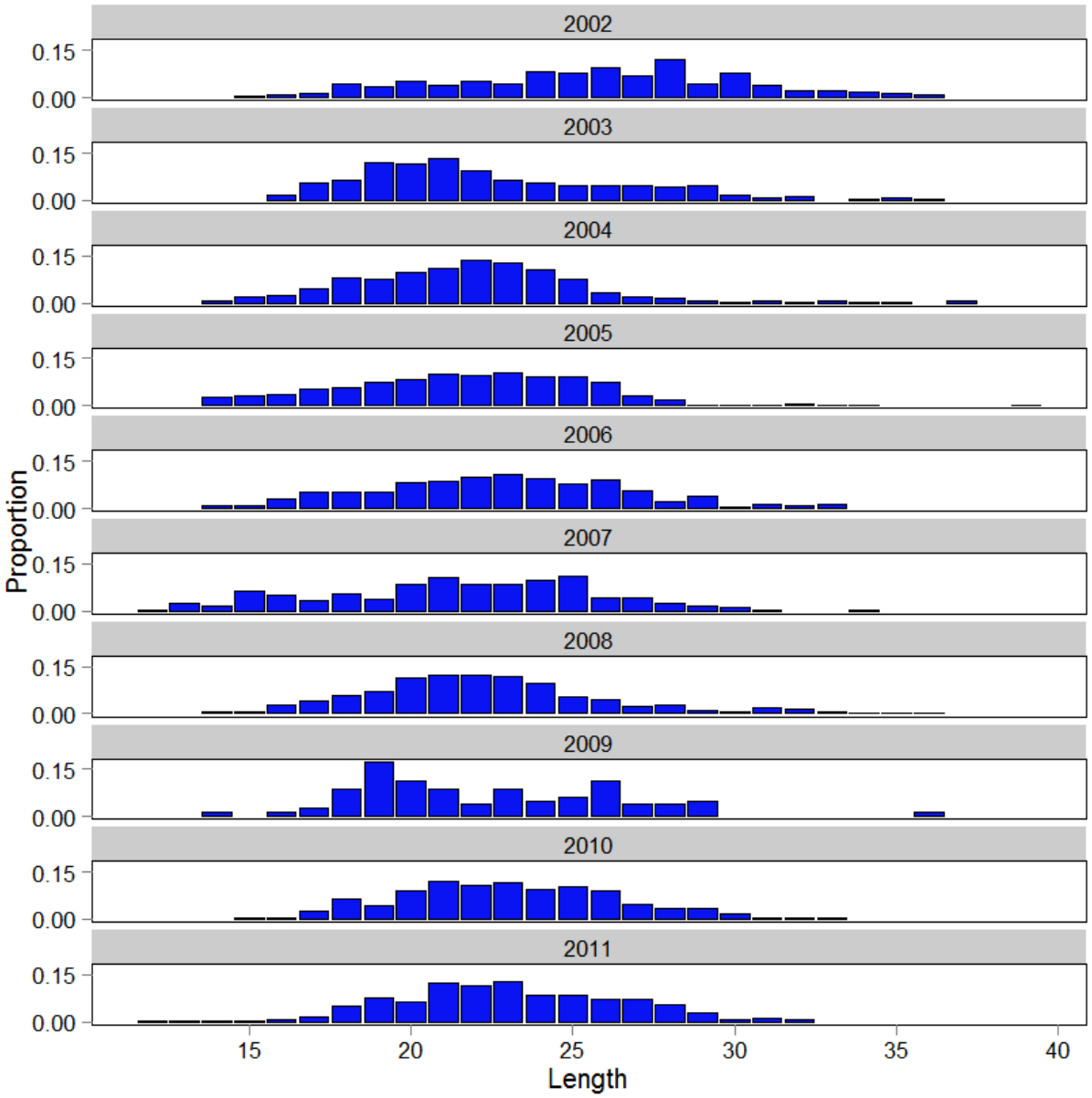


Fig 4a. Length frequency distributions of length samples collected from commercial longline fisheries located in the western Gulf of Mexico (LW) from 1992 to 2001.

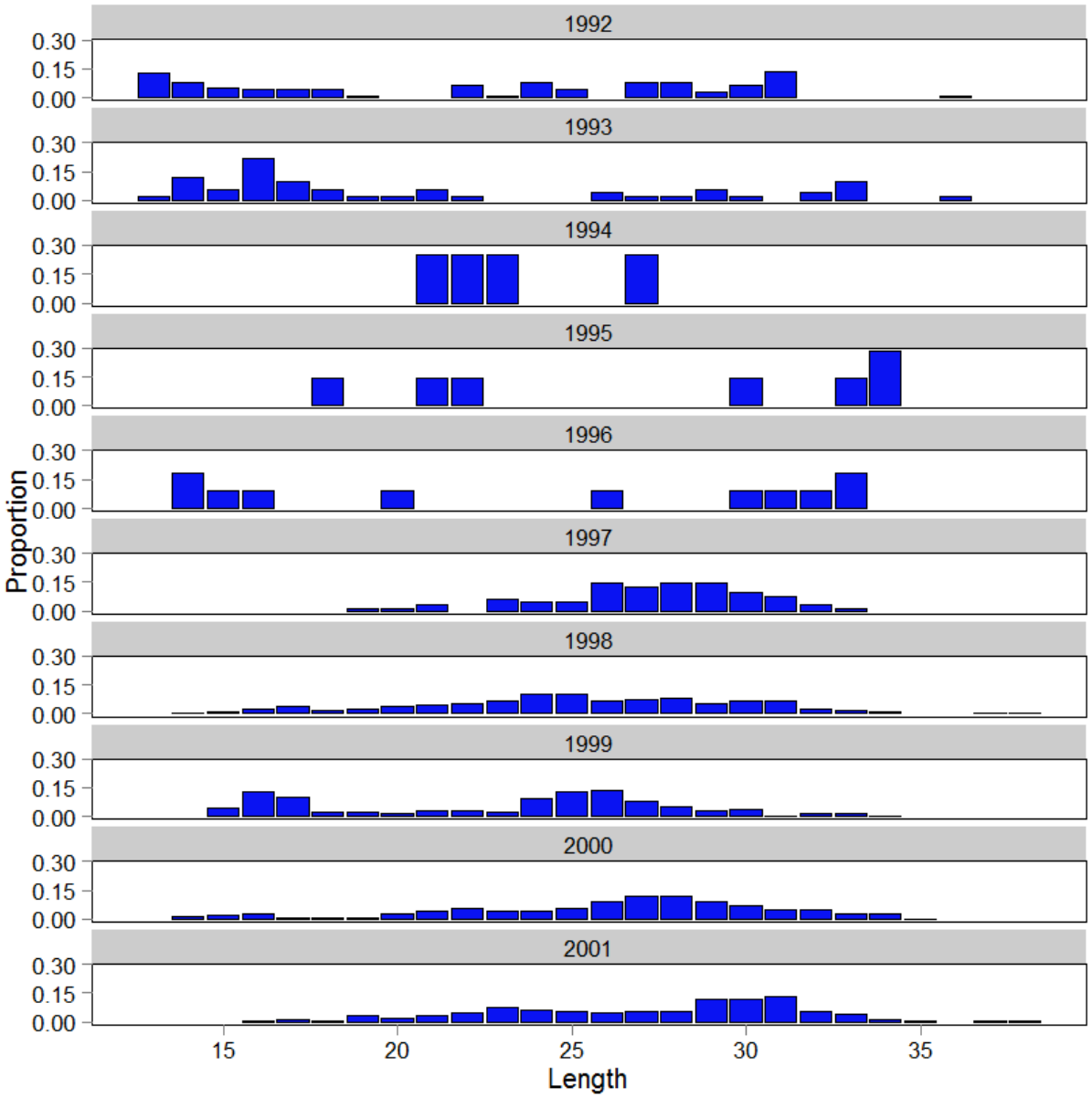


Fig 4b. Length frequency distributions of length samples collected from commercial longline fisheries located in the western Gulf of Mexico (LW) from 2002 to 2011.

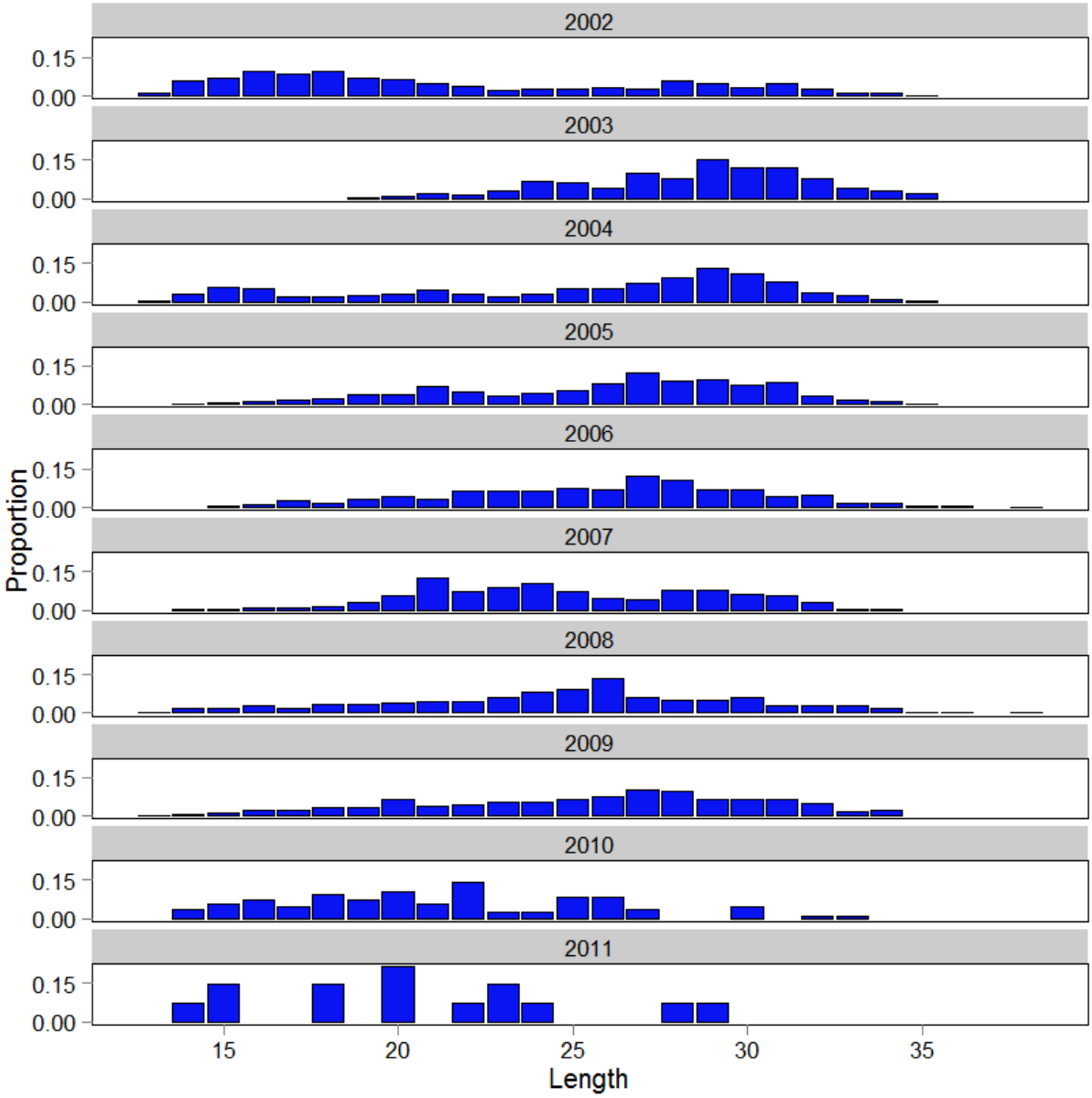


Fig 5a. Length frequency distributions of length samples collected from recreational fisheries located in the eastern Gulf of Mexico (RE) from 1992 to 2001.

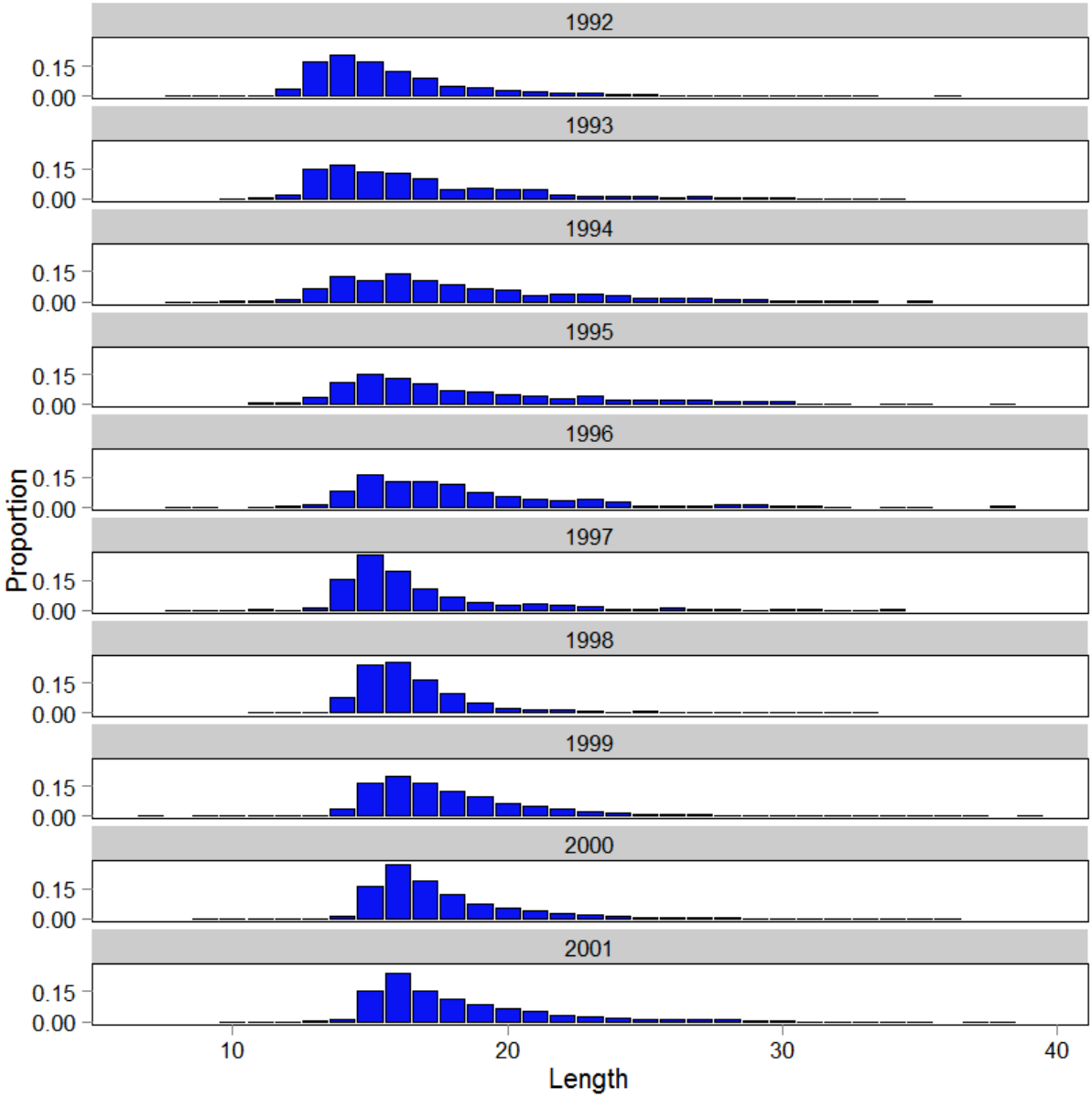


Fig 5b. Length frequency distributions of length samples collected from recreational fisheries located in the eastern Gulf of Mexico (RE) from 2002 to 2011.

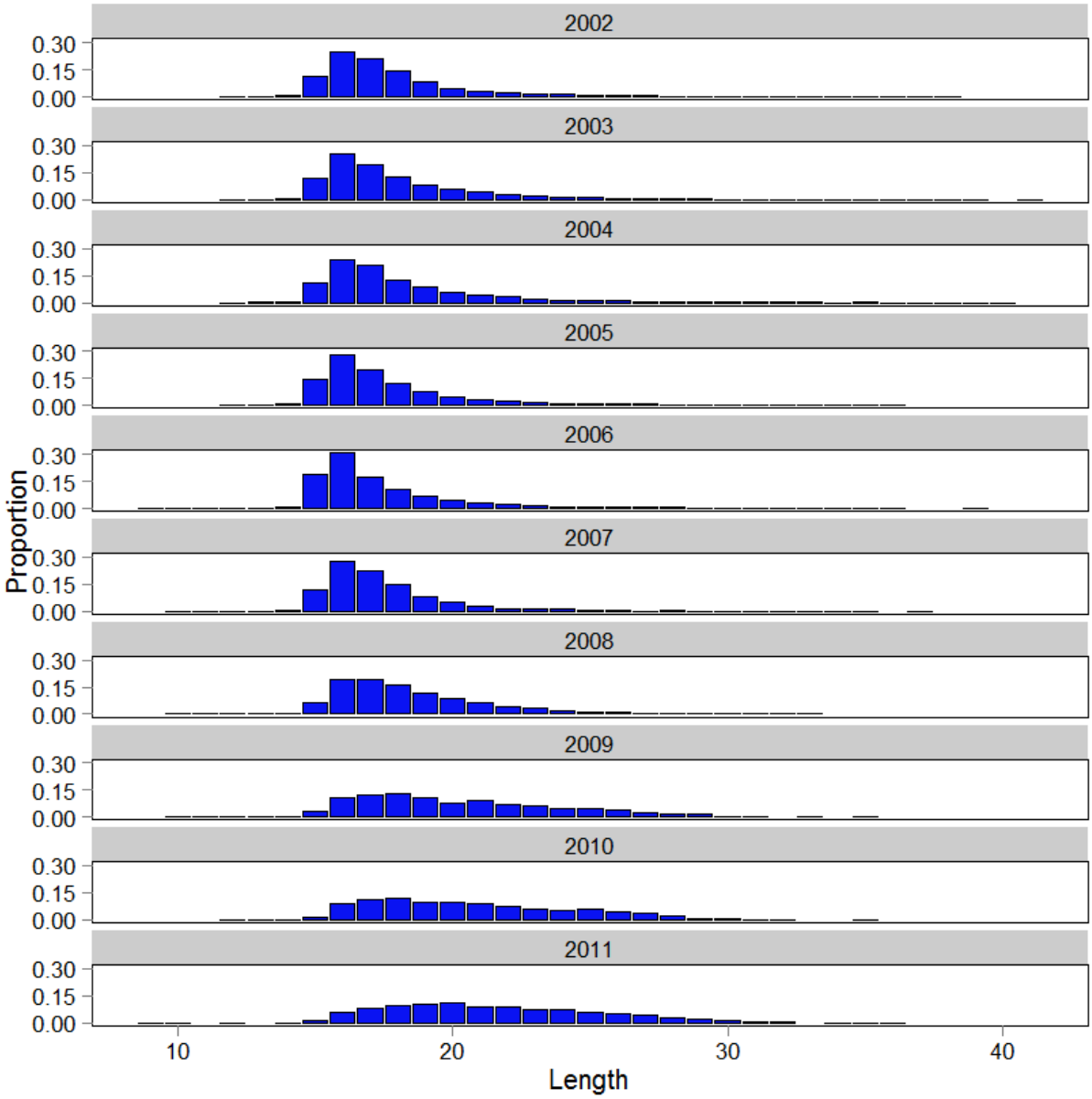


Fig 6a. Length frequency distributions of length samples collected from recreational fisheries located in the western Gulf of Mexico (RW) from 1992 to 2001.

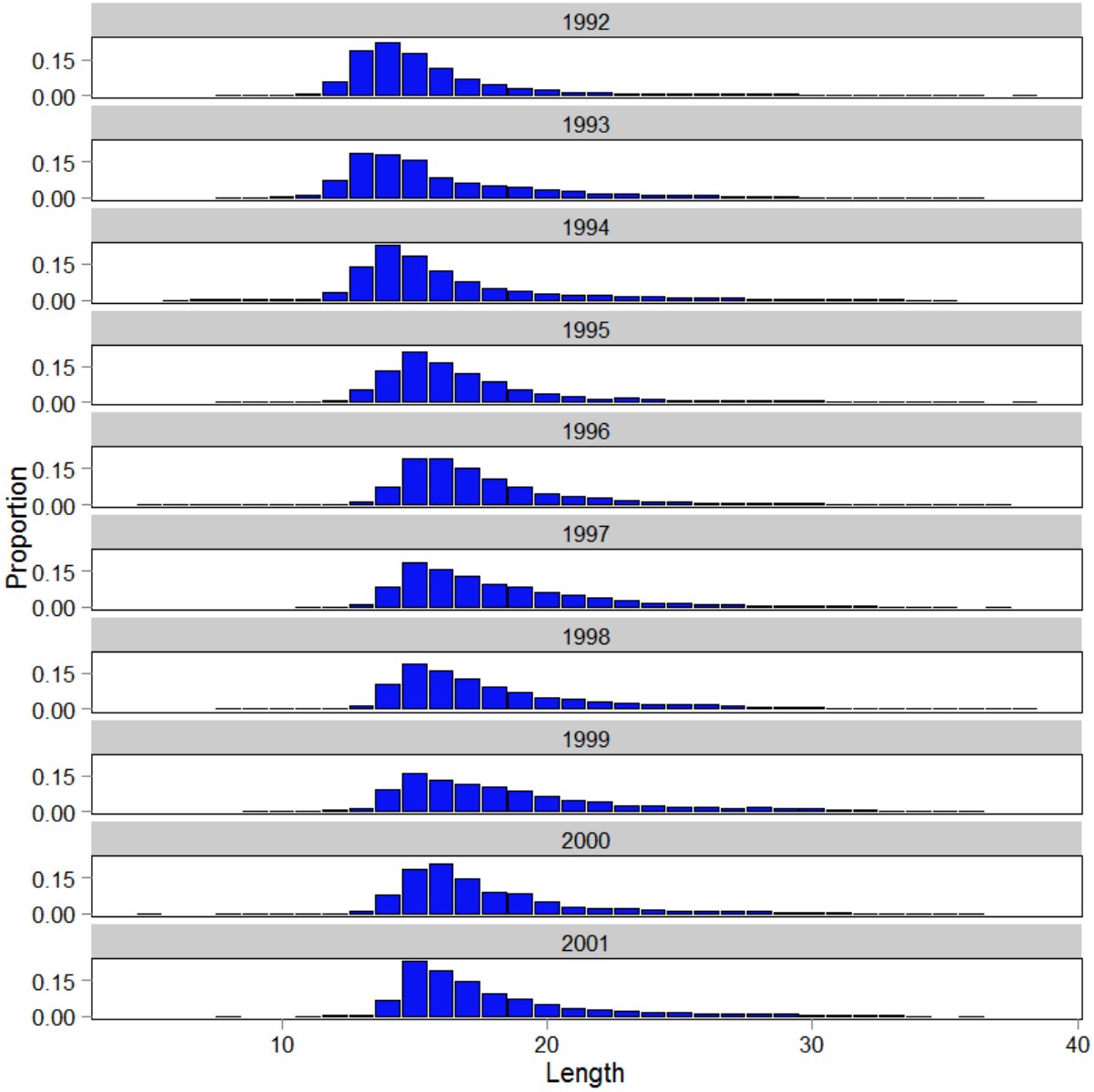


Fig 6b. Length frequency distributions of length samples collected from recreational fisheries located in the western Gulf of Mexico (RW) from 2002 to 2011.