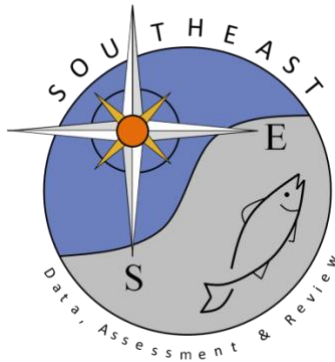


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SEDAR70-WP-13

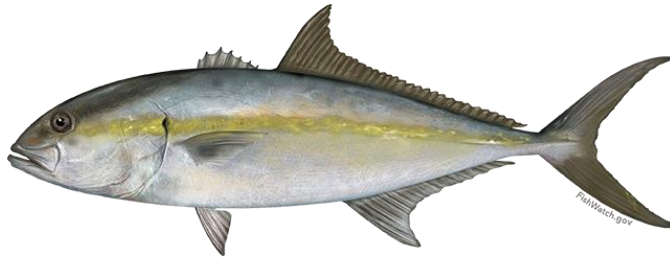
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Gulf of Mexico Greater Amberjack (*Seriola dumerili*) Commercial and Recreational Length and Age Compositions

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Introduction

This document outlines the data and methodologies used to estimate commercial and recreational length and age compositions for the SEDAR 70 Gulf of Mexico Greater Amberjack. These compositions were estimated using the same data sources approved in SEDAR 33 Update and processed using best practices (SEDAR 2015). Because fishery-dependent sampling is typically opportunistic, sampled lengths may not be representative of the true size composition of landings. To account for this potential bias, length samples from commercial fisheries were weighted by their associated landings at the finest spatial and temporal scale available within gear groups without losing data. Recreational length samples were weighted by their associated landings within year and mode where modes were aggregated. Age samples were weighted by their respective fleet's final length composition to remove any potential sampling bias. All approved data sources were updated through 2018 for this assessment.

Data Description

SEDAR 70 assesses all Gulf of Mexico Greater Amberjack in federal waters extending northward from the Texas/Mexico border and eastward to the Florida Keys US1 boundary. 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, 1983-2018) and Accumulated Landings Systems (ALS, 1962-2018). Recreational sources utilized were the Marine Recreational Information Program (MRIP, 2008-2018), formerly Marine Recreational Fisheries Statistics Survey (MRFSS, 1981-2007), Texas Parks and Wildlife Department's Marine Sport-Harvest Monitoring Program (TPWD, 1981-2018), and Southeast Regional Headboat Survey (SRHS, 1979-2018). The Gulf States Marine Fisheries Commission's Fisheries Information Network (GulfFIN) provided both commercial and recreational length and age data from multiple state sources. The SEFSC Panama City Lab and the University of Florida also provided age data for this assessment. Following SEDAR 33 Update, commercial fleets were defined by handline (HL) and longline (LL) gears, and recreational fleets were defined by headboat (HB) and charter/private (CP) modes. These data were aggregated using length bins of 5 centimeters (cm).

Commercial Length Compositions

Samples of Commercial Landings

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. Total length (TL), standard length (SL), core length (CL), and log length (LogL) were converted to fork length (FL) using the following conversion equations:

$$\begin{aligned} FL_{cm} &= -2.47 + 0.912 * TL_{cm} \\ FL_{cm} &= 0.522 + 1.08 * SL_{cm} \\ FL_{cm} &= 8.05 + 1.30 * CL_{cm} \\ FL_{cm} &= 18.5 + 1.32 * LogL_{cm} \end{aligned}$$

Core length is essentially the fork length with the head removed, and log length is approximately the standard length with the head removed. The TL conversion was obtained from SEDAR 33 Update, SL was provided by D.Murie with the University of Florida, and CL and LogL were extracted from Beaver & Cummings 1997. Since 1990, the recreational and commercial fisheries have had minimum size limits exceeding 28" (71cm) and 36" (91cm) FL, respectively. Fish measuring less than 15cm FL were deleted for the recreational fishery, and fish less than 25cm FL were deleted for the commercial fishery, as these were assumed to be unit errors (e.g. fish recorded as 15cm were likely 15"). Considering the current and retired recreational world records from the region range from 150-185cm FL, fish lengths greater than 200cm (6.6ft) FL were also deleted and assumed to be errors.

The minimum annual sample size threshold ($n = 15$) was applied to each fleet which resulted in the deletion of no HL data and 9 years of LL data (1984, 1986, 1987, 1989, 2008, 2009, 2010, 2011, 2018). There were insufficient LL samples for spatial weighting, and all years with less than 30 samples were flagged and recommended to be dropped (HL: 1983, 1987 ; LL: 1988, 2005:2007, 2014:2017).

Compositions of Commercial Landings

Because fishery-dependent sampling is typically opportunistic, sampled lengths may not be representative of the true landings composition. Possible sampling bias in the collection of commercial length samples in the TIP data was removed by weighting the length compositions with the associated landings on the finest spatial and temporal scale available without losing data. HL data were aggregated into two major regions based on the area fished: Western Gulf of Mexico (GMW) and Eastern Gulf of Mexico (GME). First, region-specific nominal length compositions were estimating using length bins of 5 cm, where for each year i , length bin j , and region r

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

where $LC_{i,j,r}$ is the proportion of the total number of sampled fish in each year i and region r ($n_{i,r}$) within each lower inclusive length bin j . Next, these region-specific length compositions were weighted using the ALS landings estimates by region. Proportions of annual landings from each region, $p_{i,r}$, were calculated and used to scale the regional length compositions, $LC_{i,j,r}$, which were then summed across regions r

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

resulting in the final weighted estimates of commercial landings length compositions, $LC_{i,j}$. This procedure would downweight, for example, an instance where 60% of the length samples come from a region that only accounts for 20% of the landings. Where there were insufficient samples in any strata ($n < 30$), nominal compositions were supplied instead (Table 1). Longline commercial samples were supplied as nominal compositions only.

Recreational Length Compositions

Samples of Recreational Landings

The recreational sampling program, MRIP, has been redesigned over the last decade to remove sources of potential bias from the sampling process. Included in this new design are imputed lengths and an assigned weighting factor, which accounts for bias associated with nonrepresentative sampling of landings. More detailed information on the MRIP survey can be found in Papacostas & Foster (2018) and more detailed information on MRIP Gulf of Mexico Greater Amberjack data can be found in Matter & Nuttall (2020). Data collected from TPWD and SRHS were converted from total length to fork length using the equation reported above from SEDAR 33 Update.

The minimum annual sample size threshold ($n = 15$) was applied to each fleet which resulted in the deletion of no CP data and 2 years of HB data (1981, 1984). One year of HB data was flagged for having less than 30 samples and was recommended to be dropped (2006).

Composition of Recreational Landings

The recreational fleets in SEDAR 70 were headboat and charter/private. The charter and private modes were combined by weighting the length compositions with their respective landings. First, mode-specific nominal length compositions, $LC_{i,j,s}$, were estimated for each year i , length bin j , and mode s

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

where the sum of all fish within year i and lower inclusive length bin j ($m_{i,j,s}$) were divided by the sum of all fish within each mode annually ($m_{i,s}$). HB length compositions were completed at this phase. The mode-specific charter/private length compositions were aggregated using the proportion of landings from their relative source. Proportions of landings from each mode, $p_{i,s}$, were calculated and used to compile the charter and private length compositions, $LC_{i,j,s}$, which were then summed across modes s

$$LC_{i,j} = \sum_s (LC_{i,j,s} * p_{i,s})$$

resulting in the weighted estimate of recreational CP length compositions, $LC_{i,j}$. Where there were insufficient samples in any strata ($n < 30$), nominal compositions were supplied instead (Table 2). Weighting the charter/private length data by the landings data overall upweighted the

private mode samples and downweighted the charter mode samples because the private mode length samples were generally underrepresented (Figure 1). Headboat recreational samples were supplied as nominal compositions only.

Re-weighted Age Compositions of Commercial and Recreational Landings

Age compositions were estimated for each commercial (HL, LL) and recreational (CP, HB) fleet. The process outlined below was applied to each fleet individually, and any year with less than 10 age samples were dropped. Nominal age compositions of landings were estimated using the following equation for each year i and age bin k .

$$NAC_{i,k} = \frac{a_{i,k}}{a_i}$$

To account for potential sampling biases, a reweighting factor was estimated within year i and length bin j . The reweighting factor, $RW_{i,j}$, 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,

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

where $LC_{i,j}$ is the final length composition, $a_{i,j}$ is the number of age samples in year i and length bin j , and a_i is the number of age samples in year i . The final weighted age compositions were estimated as

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

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. If the length compositions of the length and age data are equal, there will be no effect on the final age compositions (e.g. $RW_{i,j} = 1$). Figures are provided that compare nominal to weighted age compositions for each of the four fleets below (Figures 2-5).

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<https://www.fisheries.noaa.gov/resource/document/survey-design-and-statistical-methods-estimation-recreational-fisheries-catch-and>.

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Tables

Table 3: Annual number of Greater Amberjack commercial handline TIP length samples by region. The length compositions resulting from these samples were weighted with landings where there were more than 30 samples in each strata (Nominal=0).

Year	Nominal	GMW	GME
1983	1	17	0
1984	1	133	0
1985	1	140	9
1986	1	115	0
1987	1	25	0
1988	1	9	40
1989	1	25	64
1990	0	246	324
1991	0	203	187
1992	0	447	301
1993	0	295	428
1994	0	318	638
1995	0	345	381
1996	0	220	199
1997	0	152	408
1998	1	6	466
1999	1	18	655
2000	1	1	705
2001	1	4	383
2002	0	30	698
2003	1	21	449
2004	1	21	253
2005	0	35	104
2006	1	16	36
2007	1	19	102
2008	1	20	13
2009	0	72	31
2010	1	40	9
2011	1	51	26
2012	1	87	13
2013	0	222	183
2014	0	228	174

Year	Nominal	GMW	GME
2015	0	146	122
2016	0	436	146
2017	0	340	100
2018	0	161	42

Table 2: Annual number of Greater Amberjack recreational charterboat (CB) and private (PR) length samples by mode, where MRIP sample size does not include imputed lengths. The length compositions estimated using these data were weighted with landings where there were more than 30 samples in each strata (Nominal=0).

Year	Nominal	CB	PR
1981	1	23	33
1982	0	53	56
1983	0	74	30
1984	1	76	17
1985	1	19	84
1986	0	230	61
1987	0	621	184
1988	0	175	40
1989	1	110	23
1990	1	23	16
1991	1	226	25
1992	0	629	43
1993	1	104	16
1994	0	56	31
1995	1	27	34
1996	0	40	53
1997	0	93	38
1998	1	151	13
1999	0	491	51
2000	0	697	33
2001	0	414	58
2002	0	961	100
2003	0	1046	139
2004	0	640	53
2005	0	283	72
2006	1	495	23
2007	1	345	16

Year	Nominal	CB	PR
2008	0	203	41
2009	1	260	27
2010	0	411	39
2011	0	543	32
2012	0	570	42
2013	1	229	26
2014	0	239	54
2015	0	320	53
2016	1	78	19
2017	1	165	25
2018	0	154	45

Figures

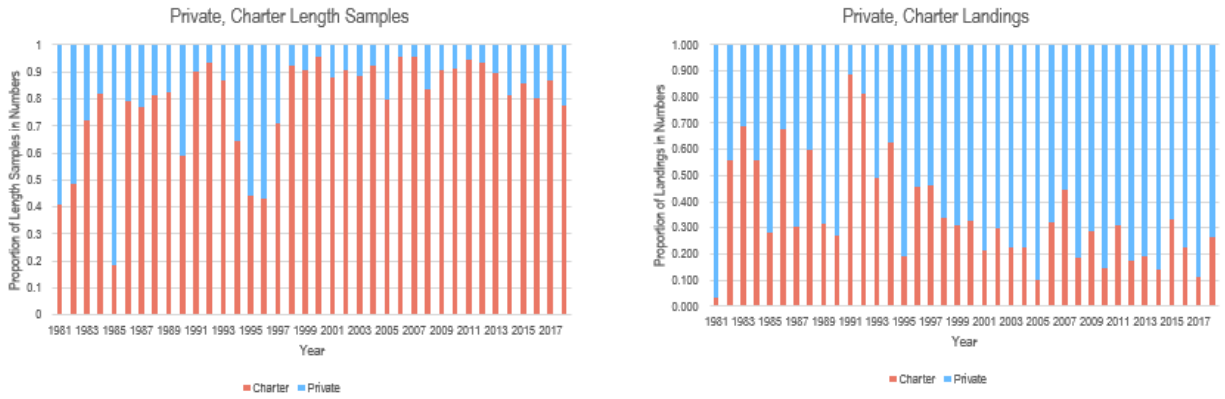


Figure 1: Annual proportions of samples for the charter and private recreational modes within the length data (left panel) and the landings data (right panel).

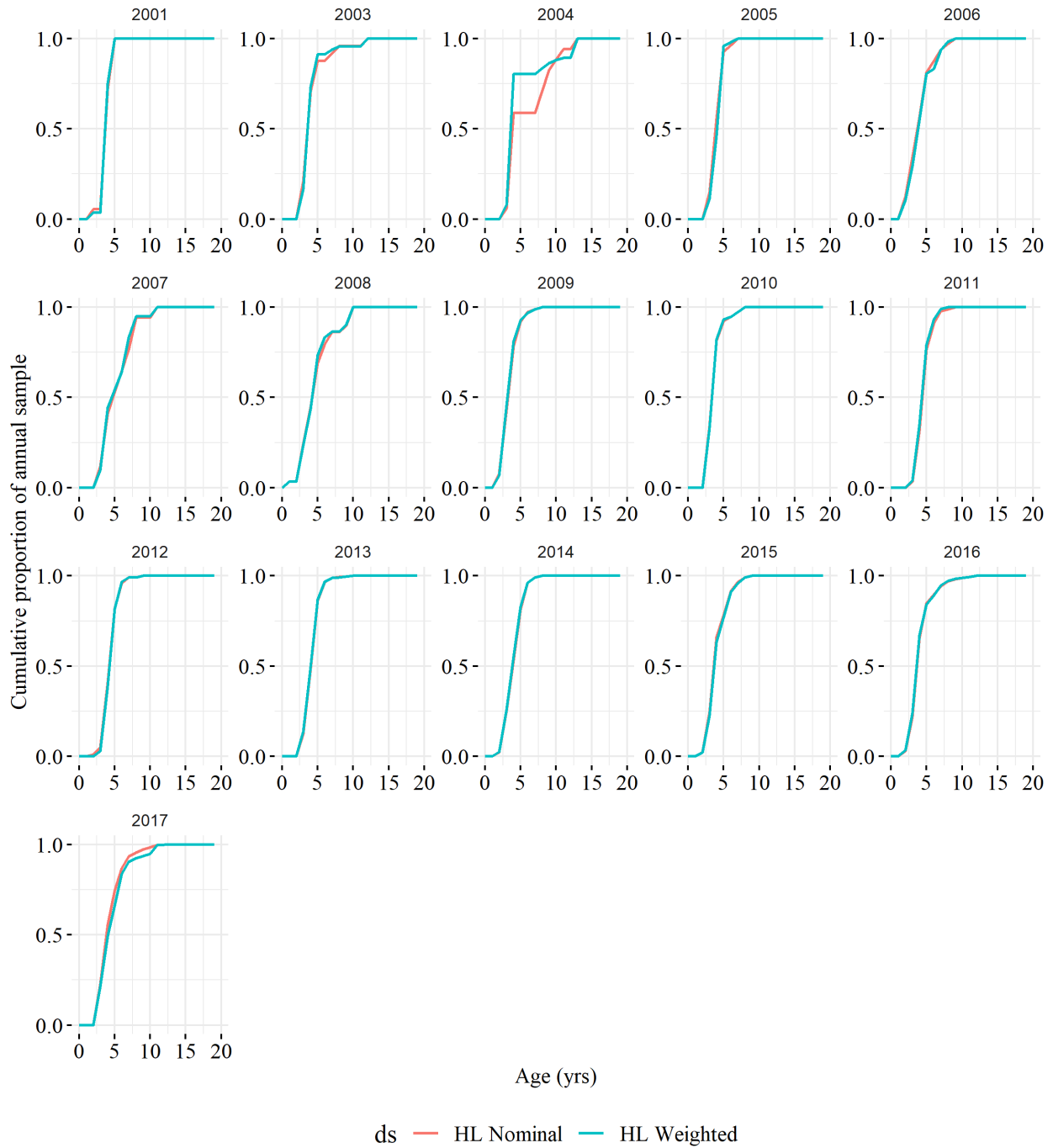


Figure 2: Annual Greater Amberjack commercial HL age compositions, both unweighted (nominal) and weighted with the final length compositions.

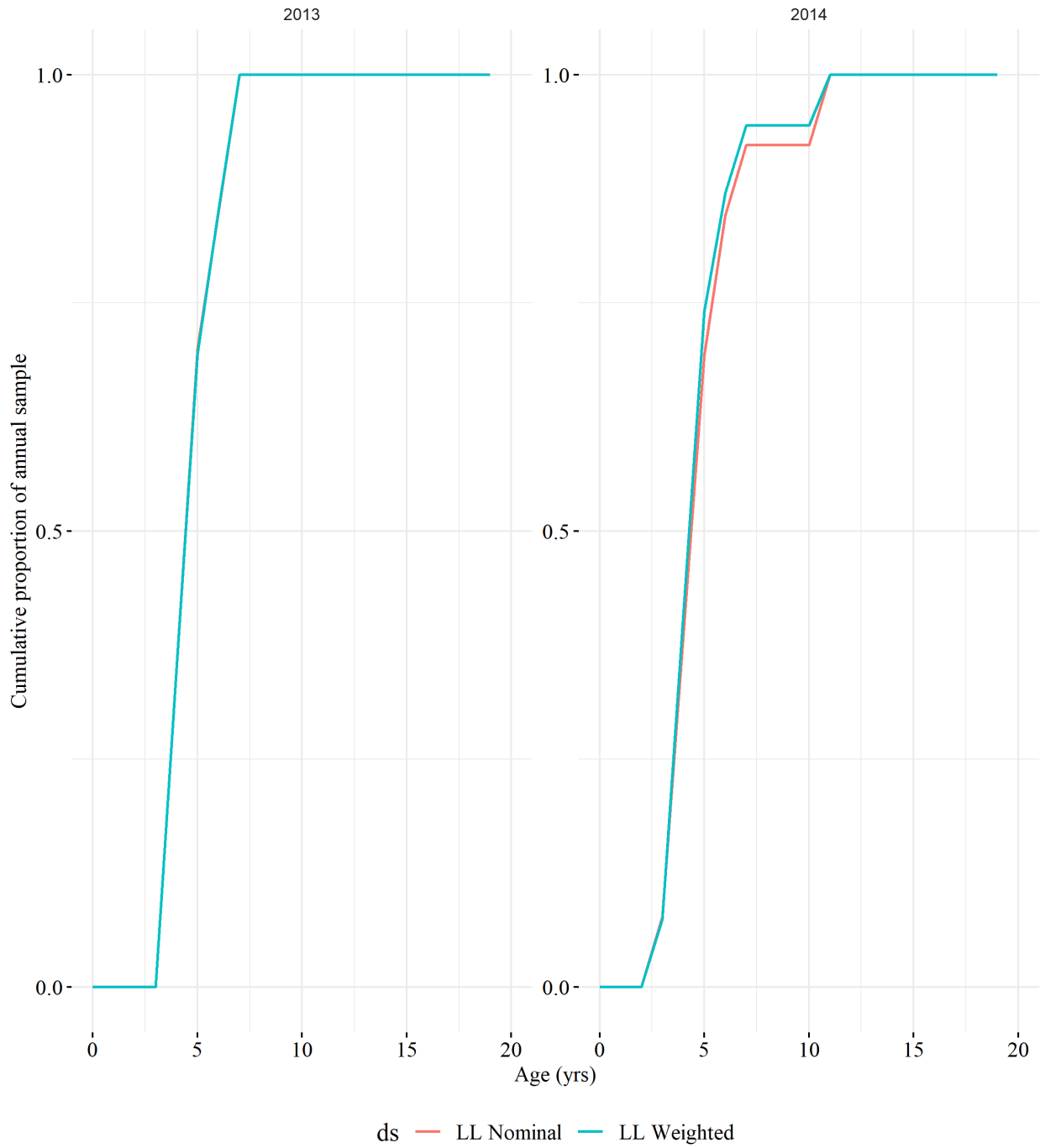


Figure 3: Annual Greater Amberjack commercial LL age compositions, both unweighted (nominal) and weighted with the final length compositions.

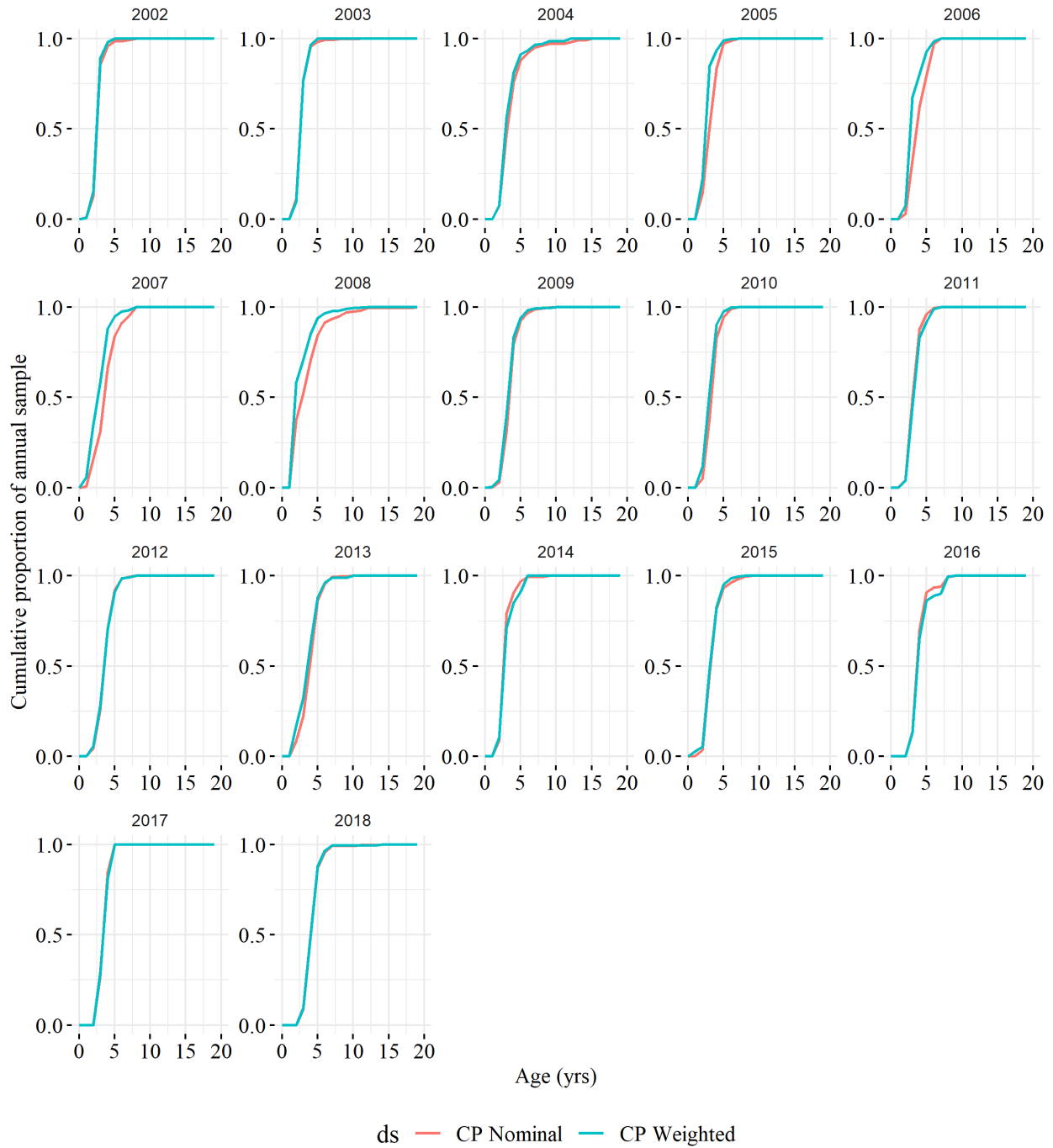


Figure 4: Annual Greater Amberjack recreational CP age compositions, both unweighted (nominal) and weighted with the final length compositions.

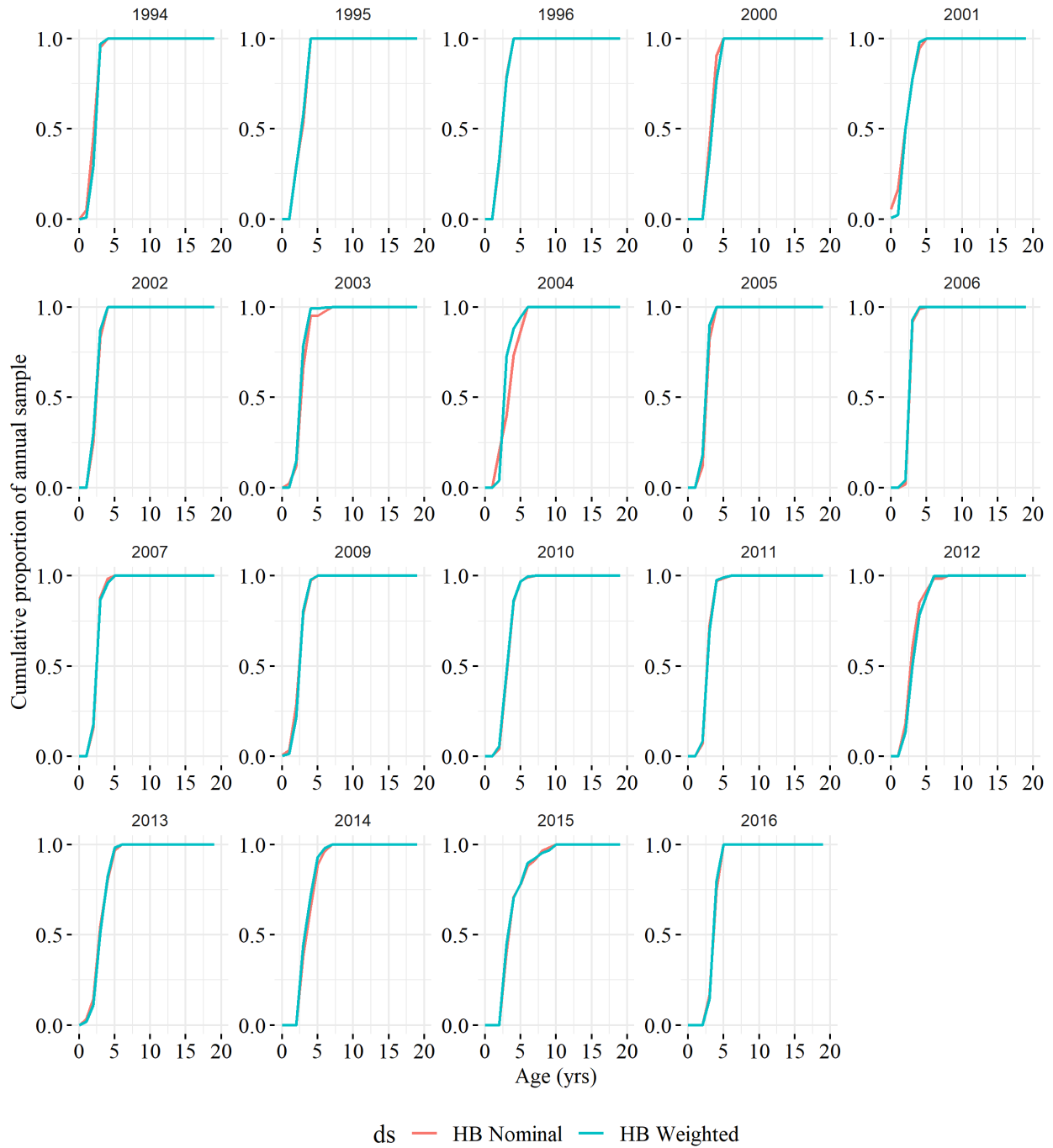


Figure 5: Annual Greater Amberjack recreational headboat age compositions, both unweighted (nominal) and weighted with the final length compositions.