South Atlantic U.S. black sea bass (*Centropristis striata*) age and length composition from the recreational fisheries

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SEDAR76 - WP05

Please cite this document as:

Sustainable Fisheries Branch, National Marine Fisheries Service, Southeast Fisheries Science Contact: Eric Fitzpatrick. 2022. South Atlantic U.S. black sea bass (*Centropristis striata*) age and length composition from the recreational fisheries. SEDAR76-WP05. SEDAR, North Charleston, SC. 28 pp.

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South Atlantic U.S. black sea bass (*Centropristis striata*) age and length composition from the recreational fisheries

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December 8, 2017
Updated: August 5, 2022

1 Introduction

The SEDAR 56 data workshop developed raw length and age compositions for each of the recreational fisheries where sufficient data were available. The fishery-dependent data collection for lengths and ages may be biased due to sampling protocols, state-specific sampling effort, or other non-random methods. The selection of fish from which to collect ageing structures may be biased, typically towards larger fish, because the selection process is rarely formally randomized. One technique to overcome bias in the length sampling is to weight samples by the associated landings at a spatial and temporal scale at which the bias is expected. Usually this is unknown and samples are weighted at the finest scale available without losing data (e.g. length samples with no associated landings). This document describes how the length data were weighted and how these weightings are extended to the age data. Similar methods have been used in previous SEDAR assessments and completed between the data and assessment workshops.

2 Data Description

2.1 Lengths

Headboat Survey Biological Sampling
Lengths were collected from 1972 to 2021 by headboat dockside samplers (Table 1). From 1972 to 1975, only North Carolina and South Carolina were sampled whereas Georgia and northeast Florida were sampled beginning in 1976. The Southeast Region Headboat Survey conducted dockside sampling for the entire range of Atlantic waters along the southeast portion of the US from the NC-VA border through the Florida Keys beginning in 1978.

MRFSS/MRIP Biological Sampling
The MRFSS/MRIP angler intercept survey includes the sampling of fish lengths from the harvested (landed, whole condition) catch (Table 1). Up to 15 of each species landed per angler interviewed are measured to the nearest millimeter (mm) along a center line (defined as tip of snout to center of tail along a straight line, not curved over body). Weights are typically collected for the same fish measured. When time is constrained a weight may be collected without a length measurement.

2.2 Ages

Aging structures and other biological samples are not collected during MRFSS/MRIP assignments because of concerns over the introduction of bias to survey data collection. Biological samples (scales, otoliths, spines, stomachs and gonads) are collected by the SRHS and processed for aging, diet studies, and maturity studies. Aging structures provided from the charter boat and private boat modes were collected ad hoc by MRFSS/MRIP state subcontractors and SRHS port agents.

Annual numbers of black sea bass sampled for age and the number of annual trips that were sampled from the recreational fishery are reported in Table 2.

3 Weighting methods

3.1 Lengths

A minimum of 30 fish per region was established to calculate a weighted length composition. The recreational landings estimates for SEDAR 56 were developed at the year and region (2 regions, NC/SC and GA/FL) level in order to consolidate the MRFSS/MRIP and SRHS landings estimates. Therefore, the finest scale to weight the length data was year and region data was by year and region for each of the fleet groupings (SRHS and MRIP). For each year, the region-specific length composition was multiplied by the proportion of landings from that region. The weighted region-specific length compositions were then combined and scaled to sum to one.

3.1.1. Summary of length data treatment

- State/spatial strata cutoff: include region of 30 or more fish sampled
- Region assigned (NC/SC and GA/FL)
- Fleet assigned: 1. Headboat (SRHS) and 2. CH/PR (MRIP)
- Range of lengths: 10 to 85 cm (1 cm bins)

3.2 Ages

A minimum of 10 fish per region was established to calculate a weighted age composition. For black sea bass age could not be determined, therefore the increment count was used and will hereafter be referred to as age. The fishery-dependent age composition estimates were weighted to correct biases in age composition due to non-representative sampling. This weighting method was adapted from a technique to reduce bias associated with non-representative age sampling to produce unbiased growth curves (Chih, 2009) and has been previously used in SEDAR assessments. Lengths are recorded for each fish sampled for age. A reweighting value (RW) associated with the year (j) and length interval (i) of the age sample was assigned to each age sample by fishery as in the formula:

$$RW_{ij} = \frac{LC_{ij}}{OL_{ij}/TO_j}$$

where LC_{ij} is the weighted length composition value associated with the year j and length interval i for each aged fish, OL_{ij} is the number of aged samples in length interval i and year j , and $TO_j$is the total number of aged samples in year j. This weighting corrects for a potential sampling bias of age samples relative to length samples (Chih, 2009). The numerator in this method differs slightly from the method used by Chih (2009) in that the length composition is weighted by the landings.

3.2.1. Summary of age data treatment

- State/spatial strata cutoff: include region of 10 or more fish sampled
- Region assigned (NC/SC and GA/FL)
- Fleet assigned: 1. Headboat (SRHS) and 2. CH/PR (MRIP)
- Range of ages: 1 to 11 (1 increment bins)
- Range of lengths: 11 to 77 cm (1 cm bins)

4 Results

4.1 Lengths

It is important to note that weighting had limited influence on the length compositions (Figure 1), in years that met the 30 fish minimum.

4.2 Ages

The weighted age compositions are very similar to the nominal age compositions. Slightly older fish were encountered in the SRHS (1-11 years, Figure 3) than in the MRIP CH/PR modes (1-9 years, Figure 4). However, the majority of fish encountered in the SRHS were under 8 years and in the MRIP CH/PR modes under 7 years.

5 Discussion

There is minimal influence when weighting the recreational length or age compositions for black sea bass in the SRHS. However, the weighted compositions are recommended for use as a matter of protocol and to remove whatever minimal bias may be present.

Literature Cited

Chih, Ching-Ping. 2009. Evaluation of the sampling efficiency of three otolith sampling methods for commercial king mackerel fisheries. Transactions of the American Fisheries Society. 138:990-999.

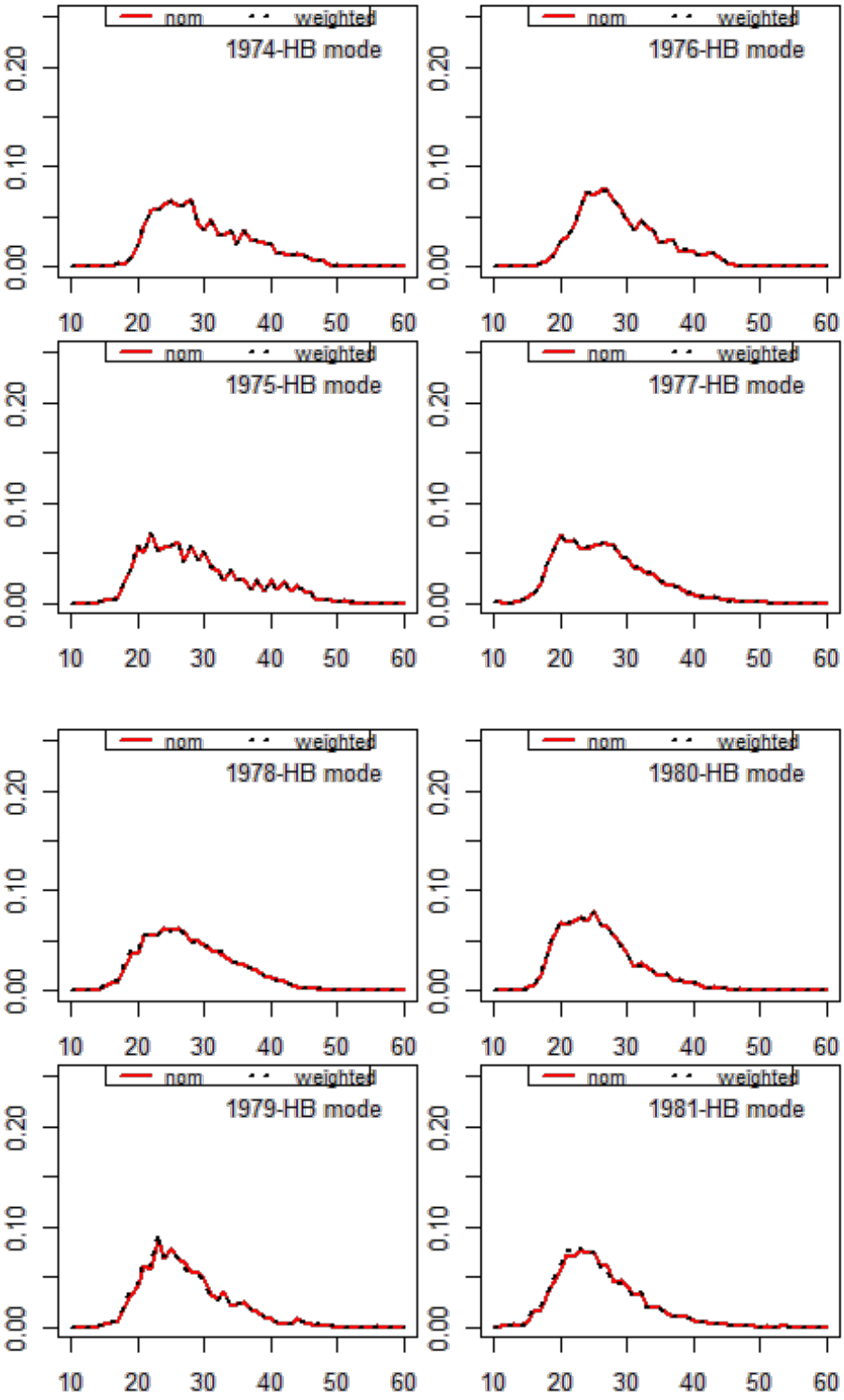
Table 1. Annual number of fish measured and annual number of trips containing measured black sea bass in the recreational fishery.

	SRHS		MRIP	
Year	Fish (n)	Trips (n)	Fish (n)	Trips (n)
1973	1	1		
1974	1137	143		
1975	1032	147		
1976	942	176		
1977	3212	328		
1978	2332	327		
1979	1655	201		
1980	2419	277		
1981	3025	387	184	72
1982	3689	439	414	137
1983	5733	624	166	64
1984	6092	695	275	126
1985	5843	638	482	169
1986	6551	683	379	217
1987	6443	787	610	306
1988	4256	545	490	124
1989	3840	427	467	417
1990	5780	481	402	240
1991	5380	391	291	231
1992	5195	400	635	327
1993	3950	387	466	238
1994	4223	350	333	246
1995	3331	283	323	191
1996	3175	276	420	233
1997	3665	375	257	197
1998	4377	460	447	214
1999	4125	403	752	250
2000	3432	333	525	234
2001	2986	329	760	320
2002	1970	305	511	224
2003	3274	406	992	278
2004	4236	403	1180	378
2005	3820	342	918	334
2006	5080	443	941	310
2007	2961	318	849	233
2008	1661	242	609	202
2009	2473	341	632	211
2010	4049	429	1047	303
2011	2209	208	495	147
2012	1040	109	499	241
2013	1808	322	511	162
2014	1630	352	606	207
2015	1503	268	417	188
2016	1193	282	303	183
2017	1080	235	267	138
2018	1037	261	281	133
2019	504	152	292	127
2020	143	27	365	173
2021	1	1	261	145

Table 2. Annual numbers of black sea bass sampled for age and the number of annual trips containing aged black sea bass in the recreational fishery.

	SRHS		MRIP	
Year	Fish (n)	Trips (n)	Fish (n)	Trips (n)
1988	3	2		
1989	4	2		
1990	29	11		
1991	76	39		
1992	51	26		
1993	7	5		
1994	5	2		
1995	3	1		
1996	13	8		
1997	4	2		
1998	75	9	382	56
2000	1	1		
2001			9	4
2002	23	15	84	29
2003	73	29	77	21
2004	204	54	249	43
2005	465	110	133	37
2006	1075	249	169	17
2007	658	231	36	4
2008	304	161	2	1
2009	551	226	7	1
2010	1034	344	30	5
2011	433	131	8	1
2012	547	89	79	8
2013	1064	246	48	17
2014	908	208	99	28
2015	869	158	90	15
2016	977	261		
2017	936	211	99	28
2018	905	238	73	18
2019	342	112	39	14
2020	26	5		

Figure 1: Nominal and weighted length composition of black sea bass measured in the headboat fishery.



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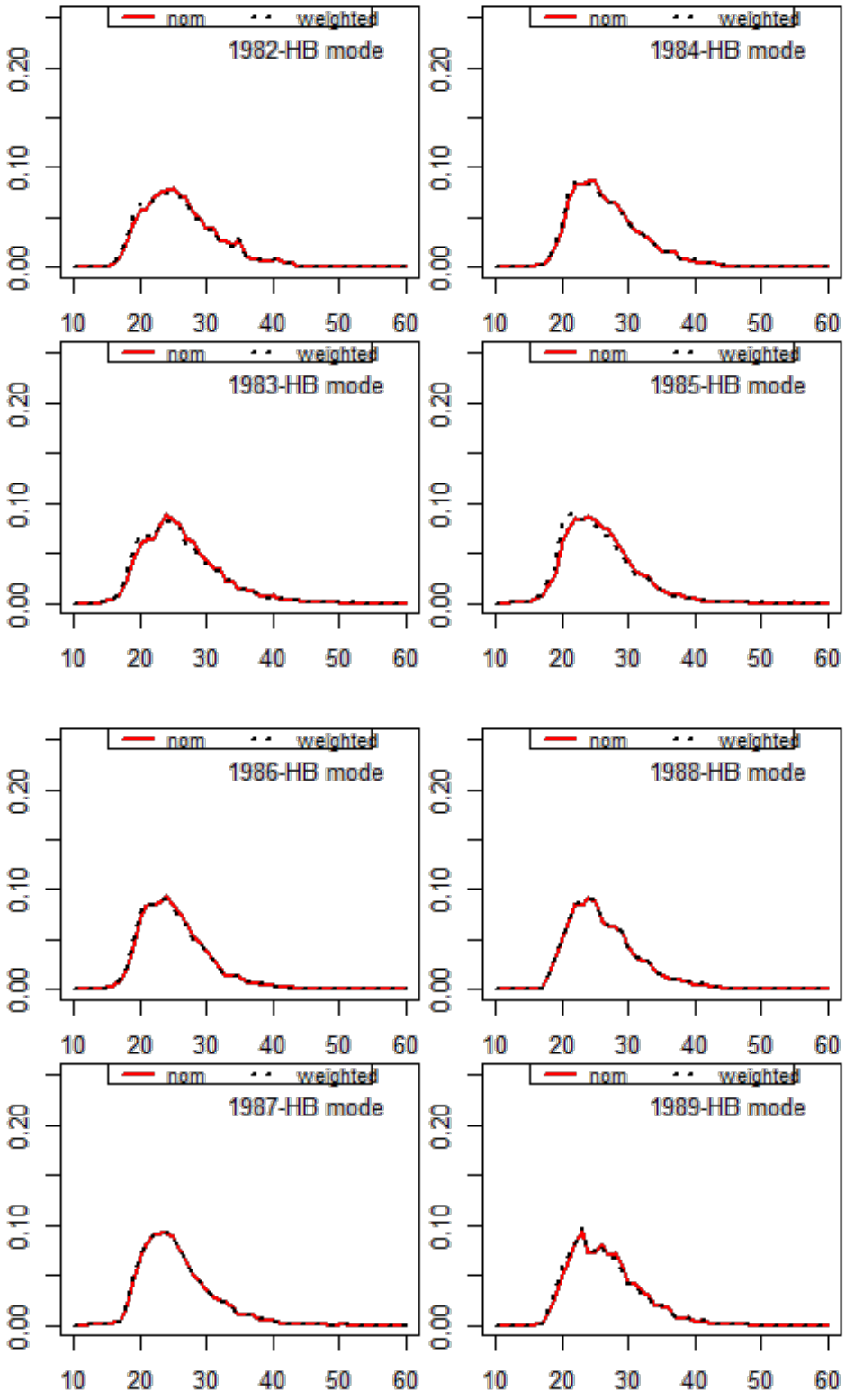

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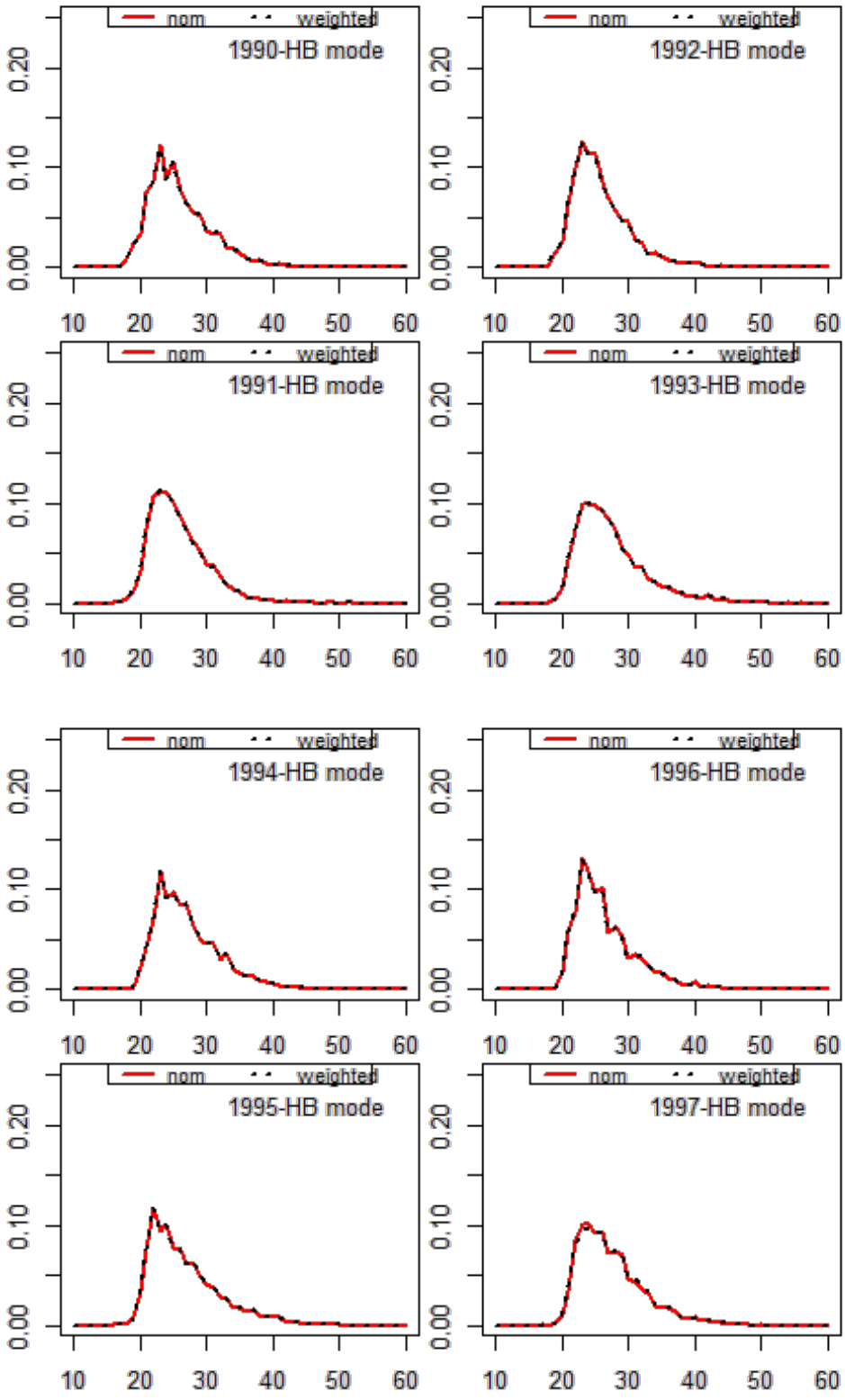

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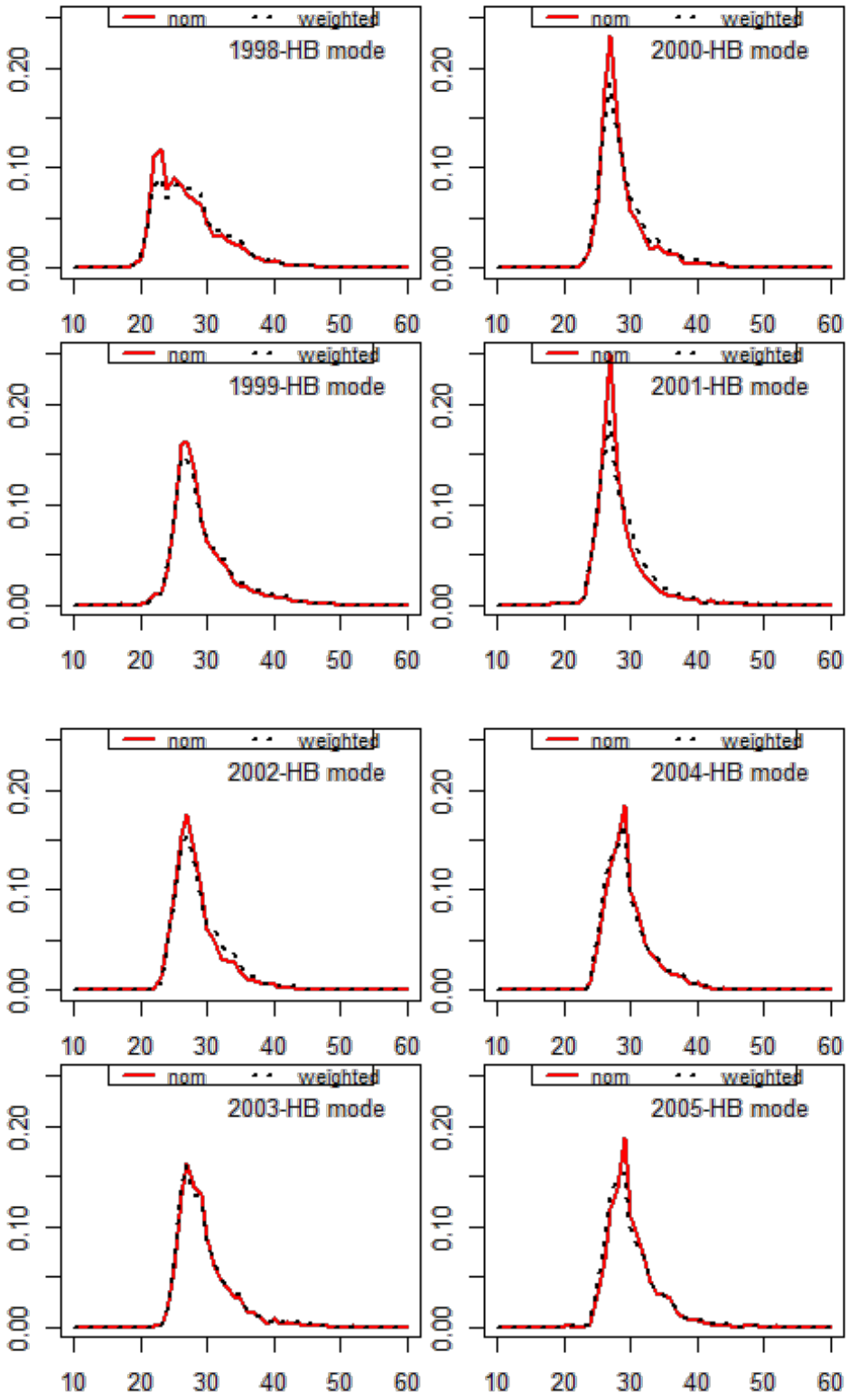

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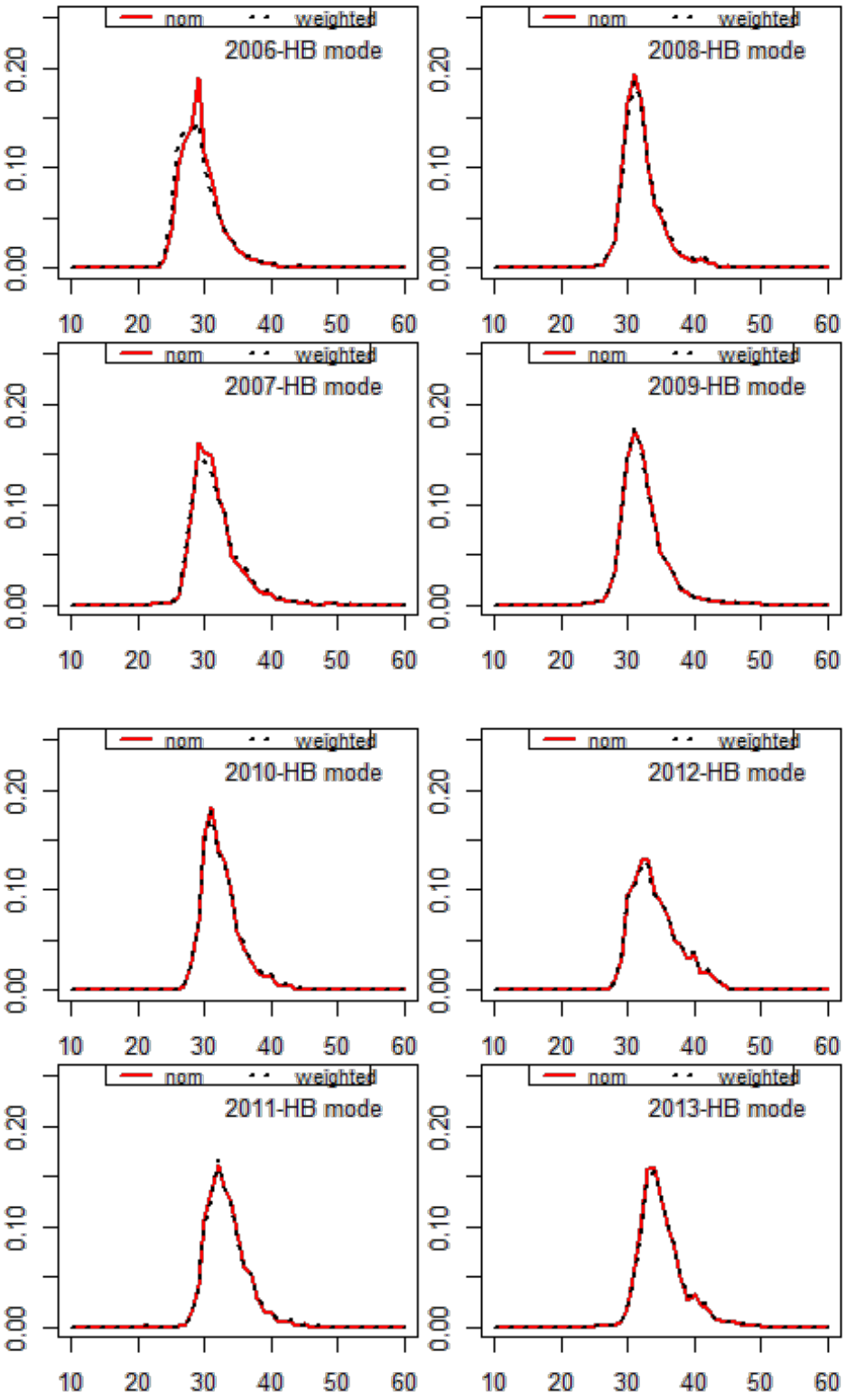

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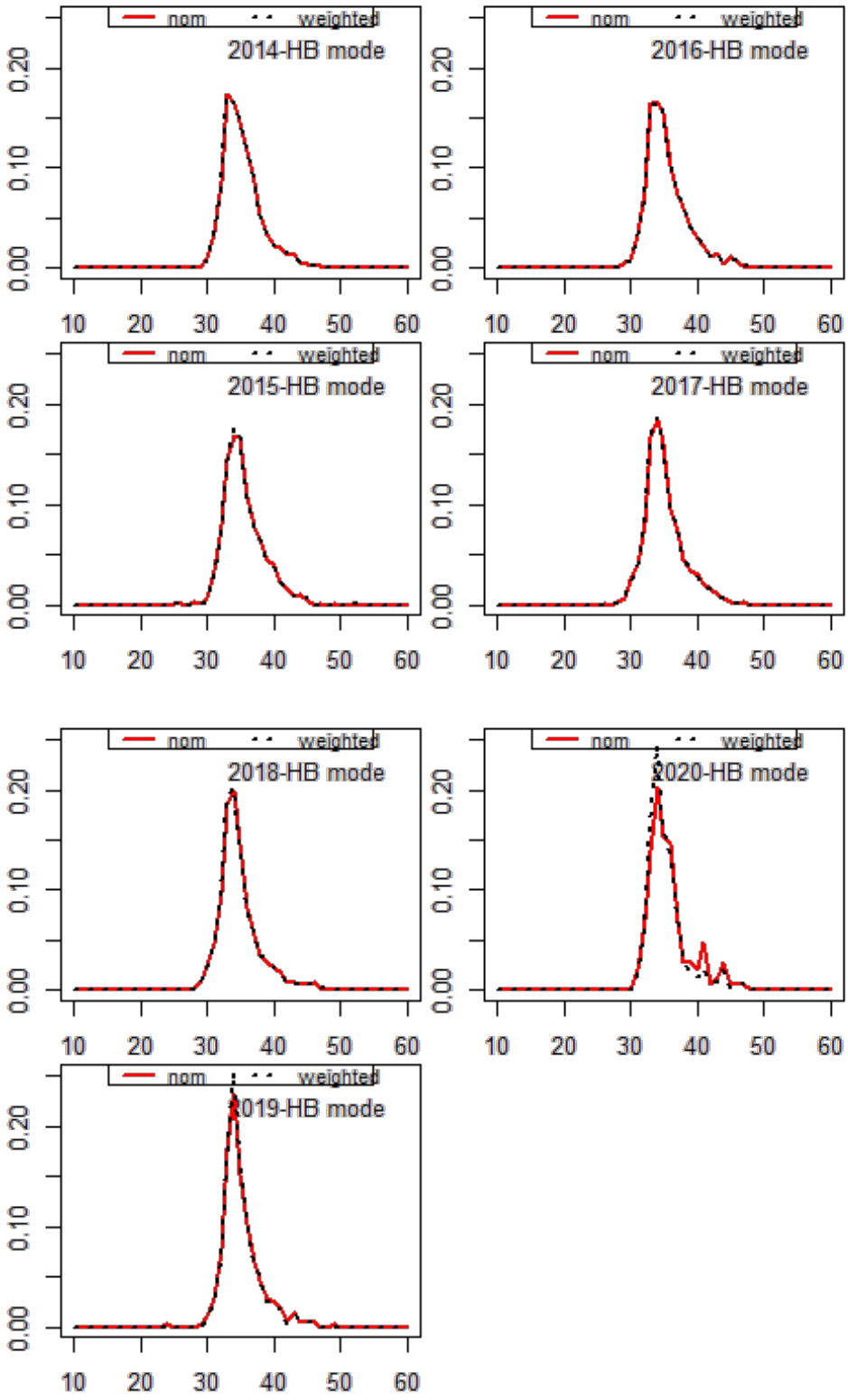
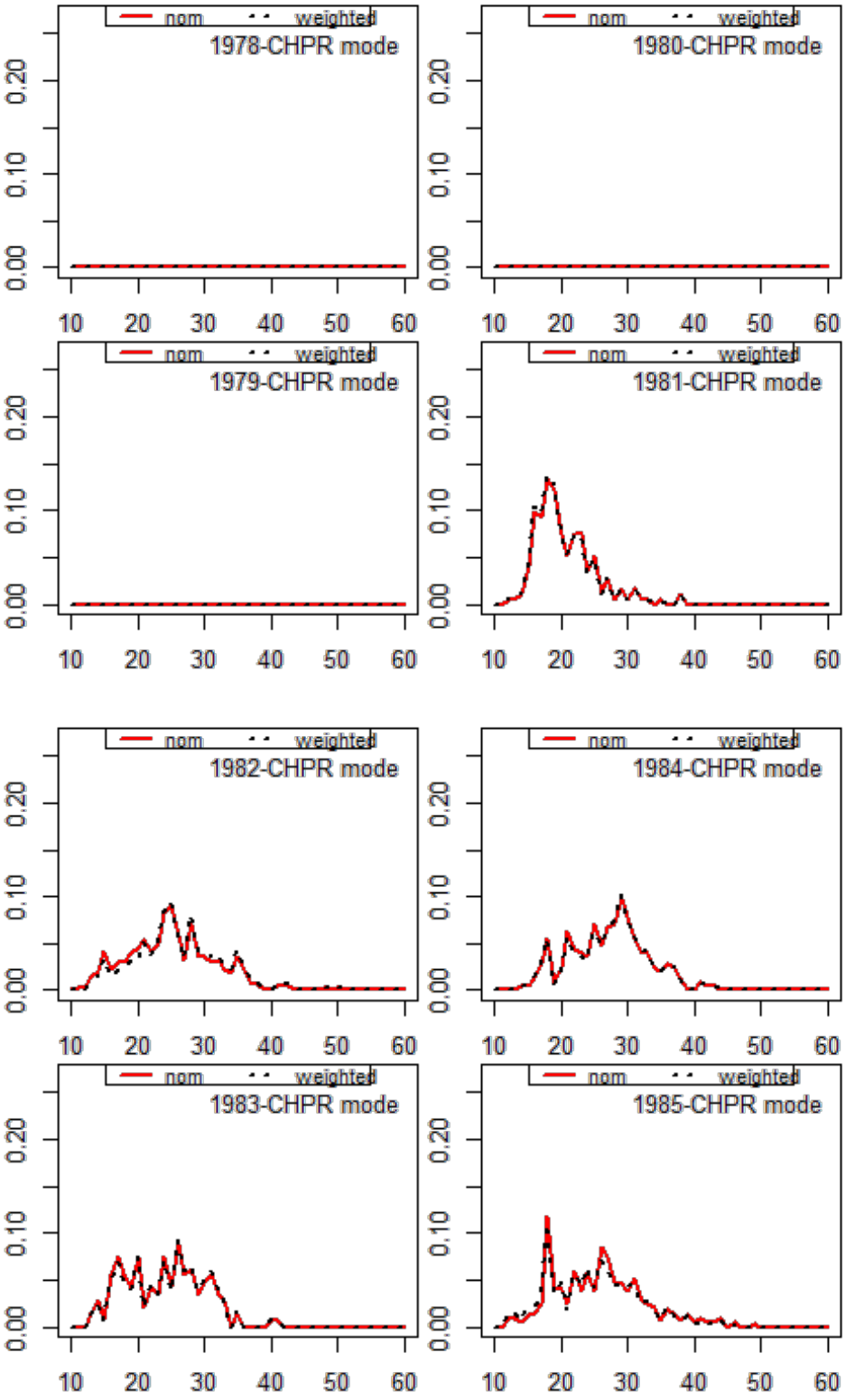


Figure 2: Black sea bass nominal and weighted length composition from the charter and private boat modes.



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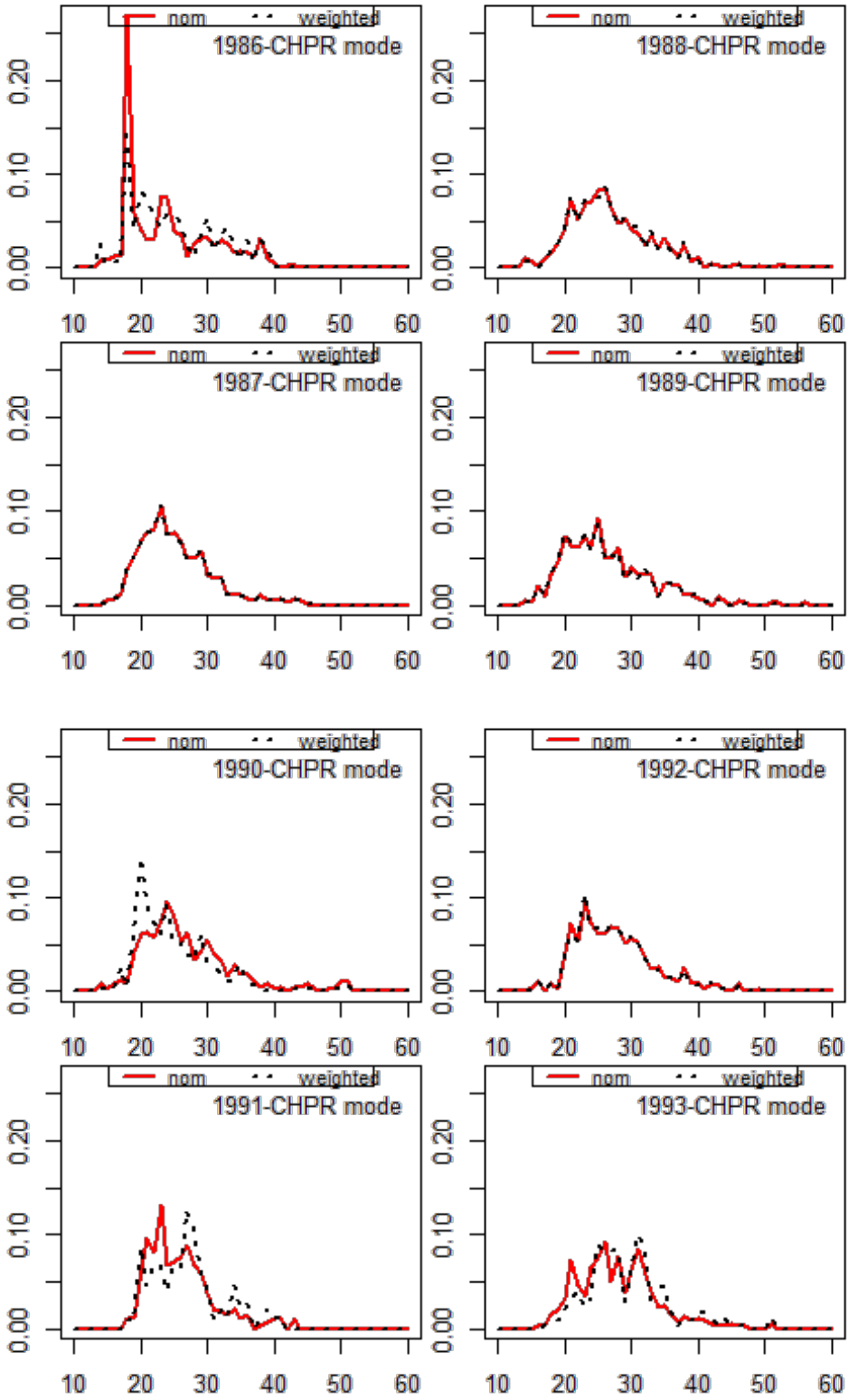

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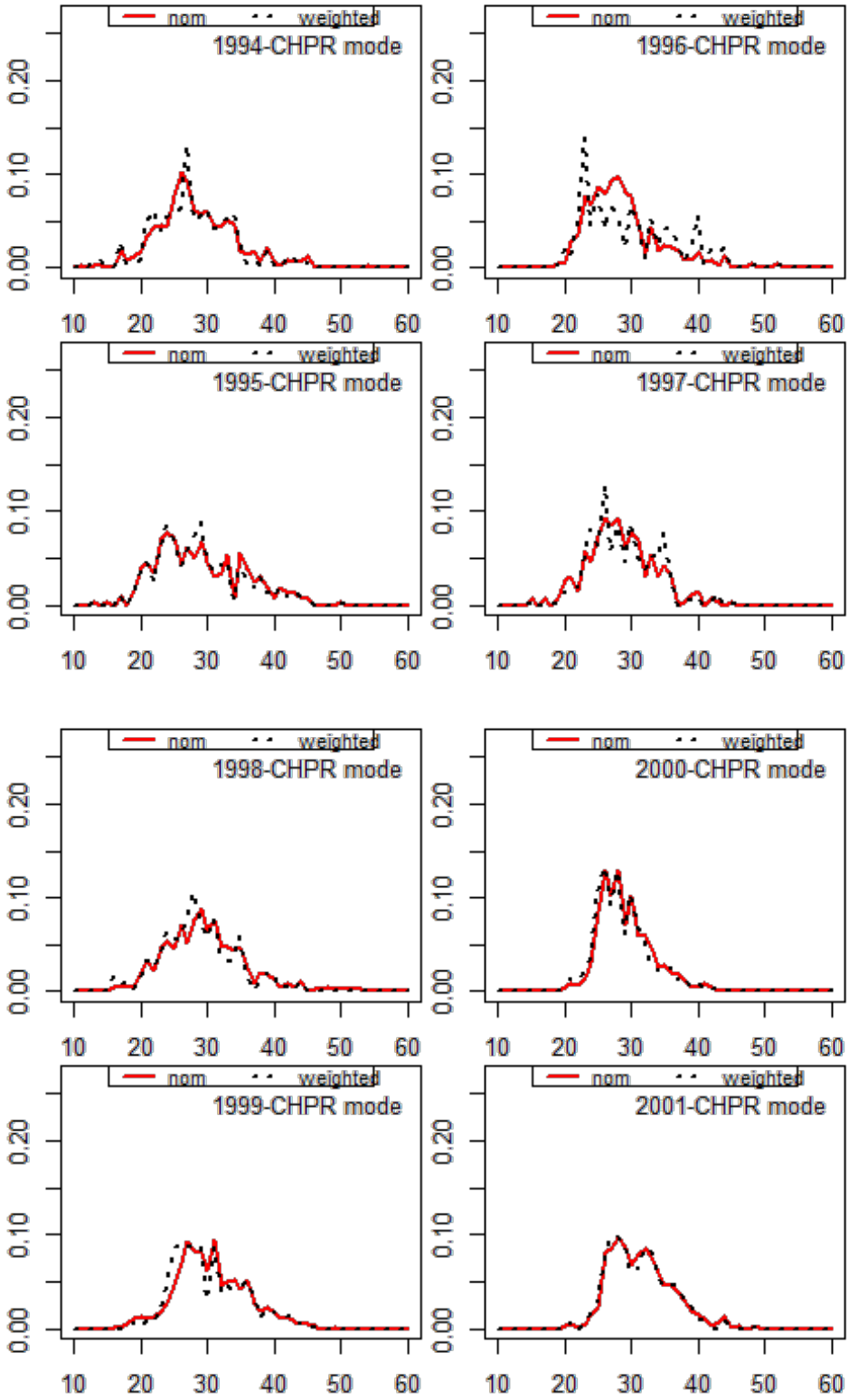

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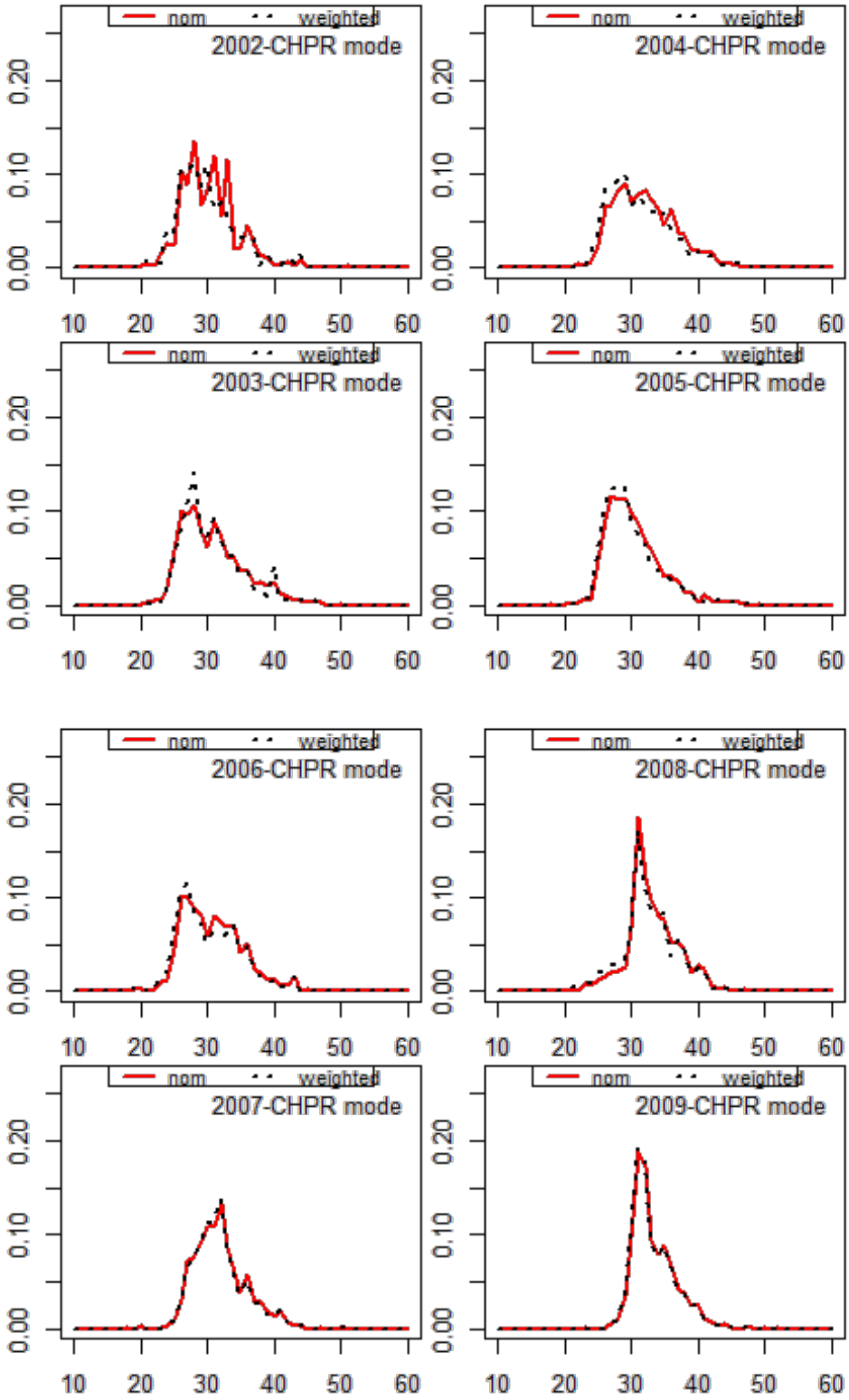

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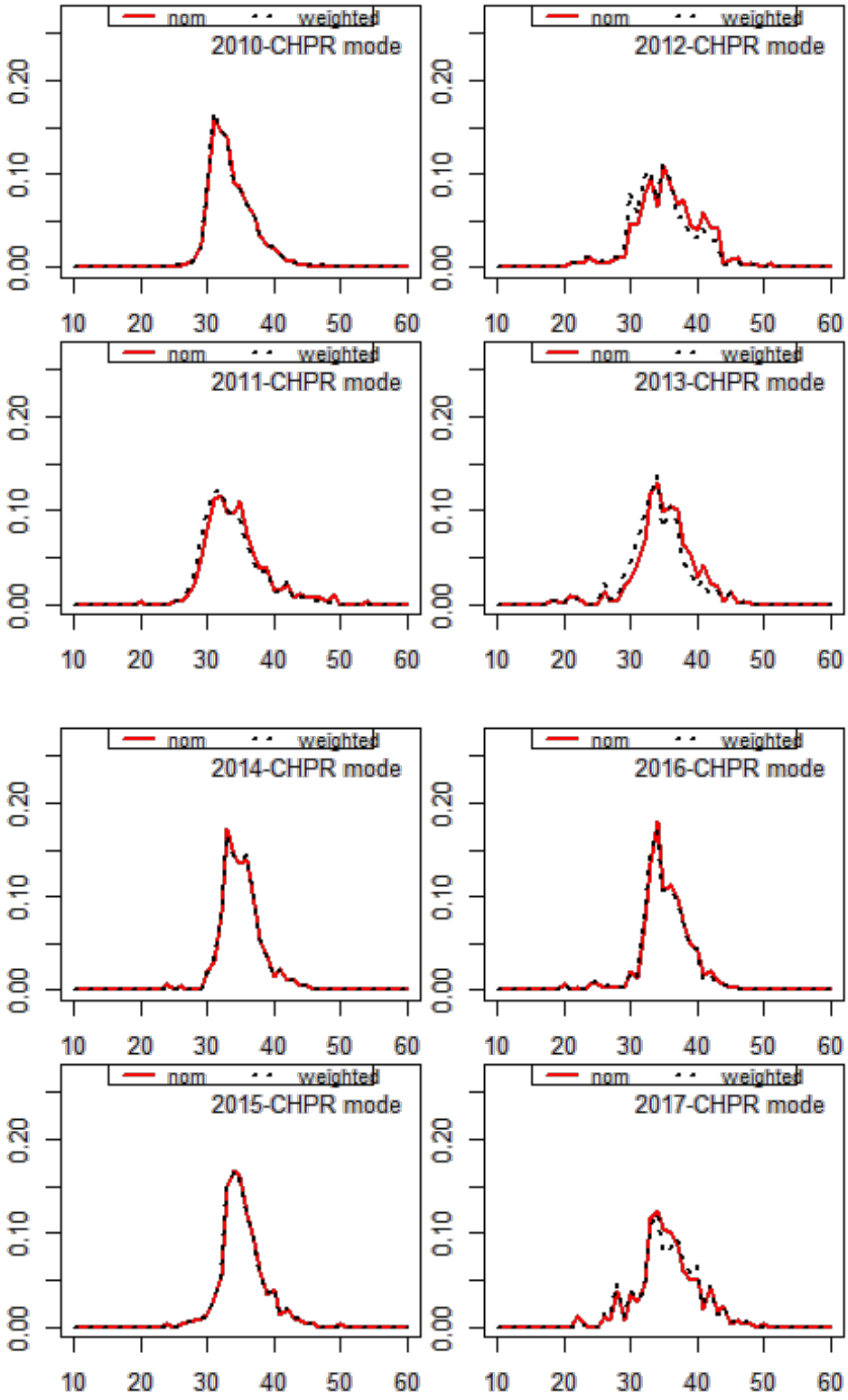

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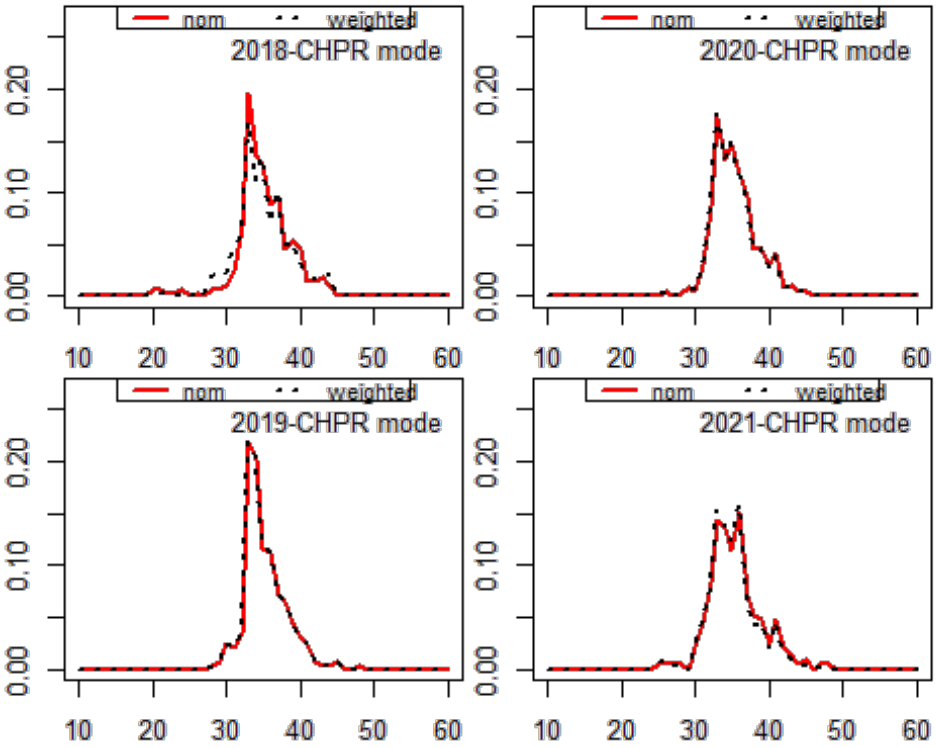
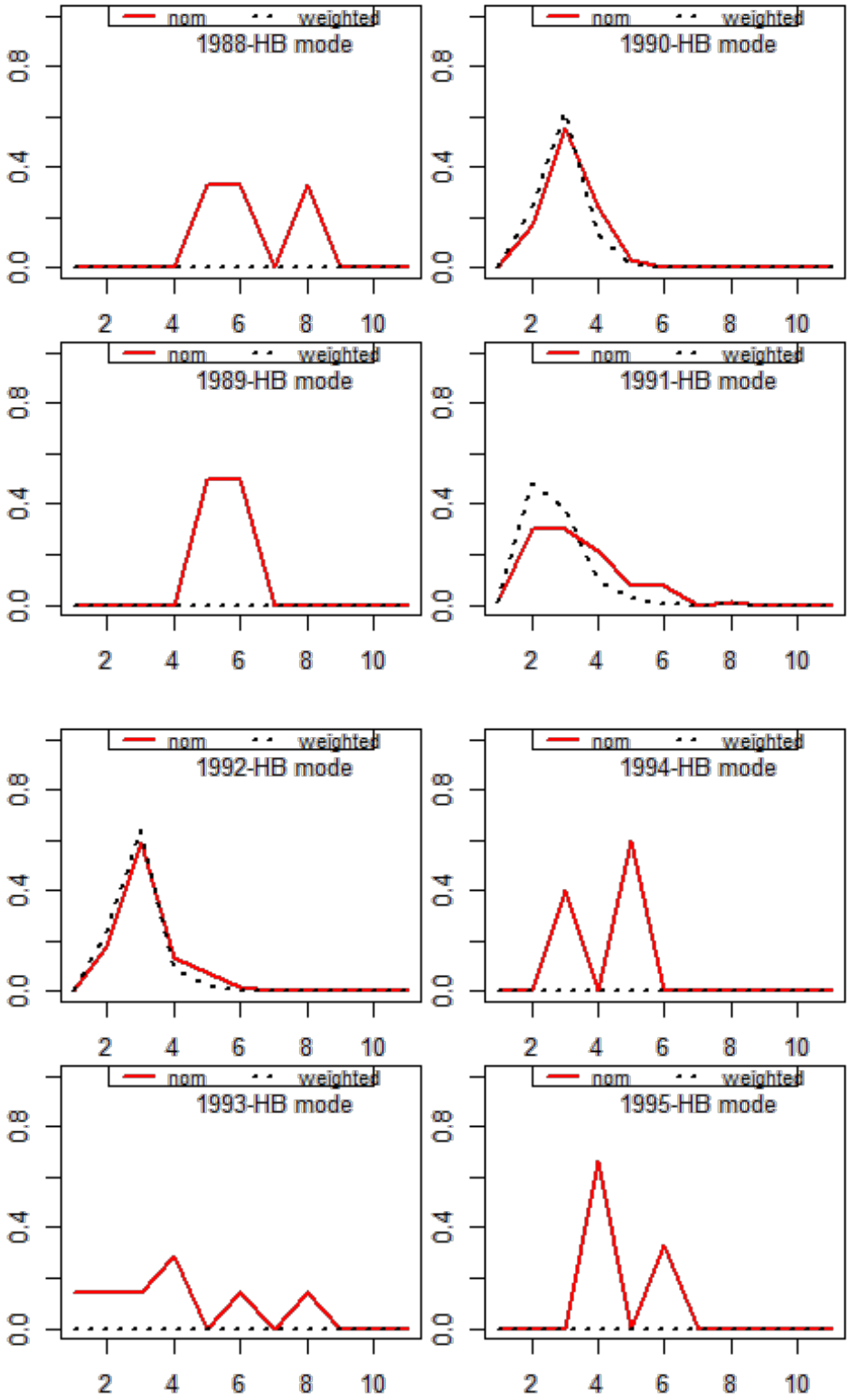


Figure 3: Black sea bass nominal and weighted age composition from the headboat fishery.



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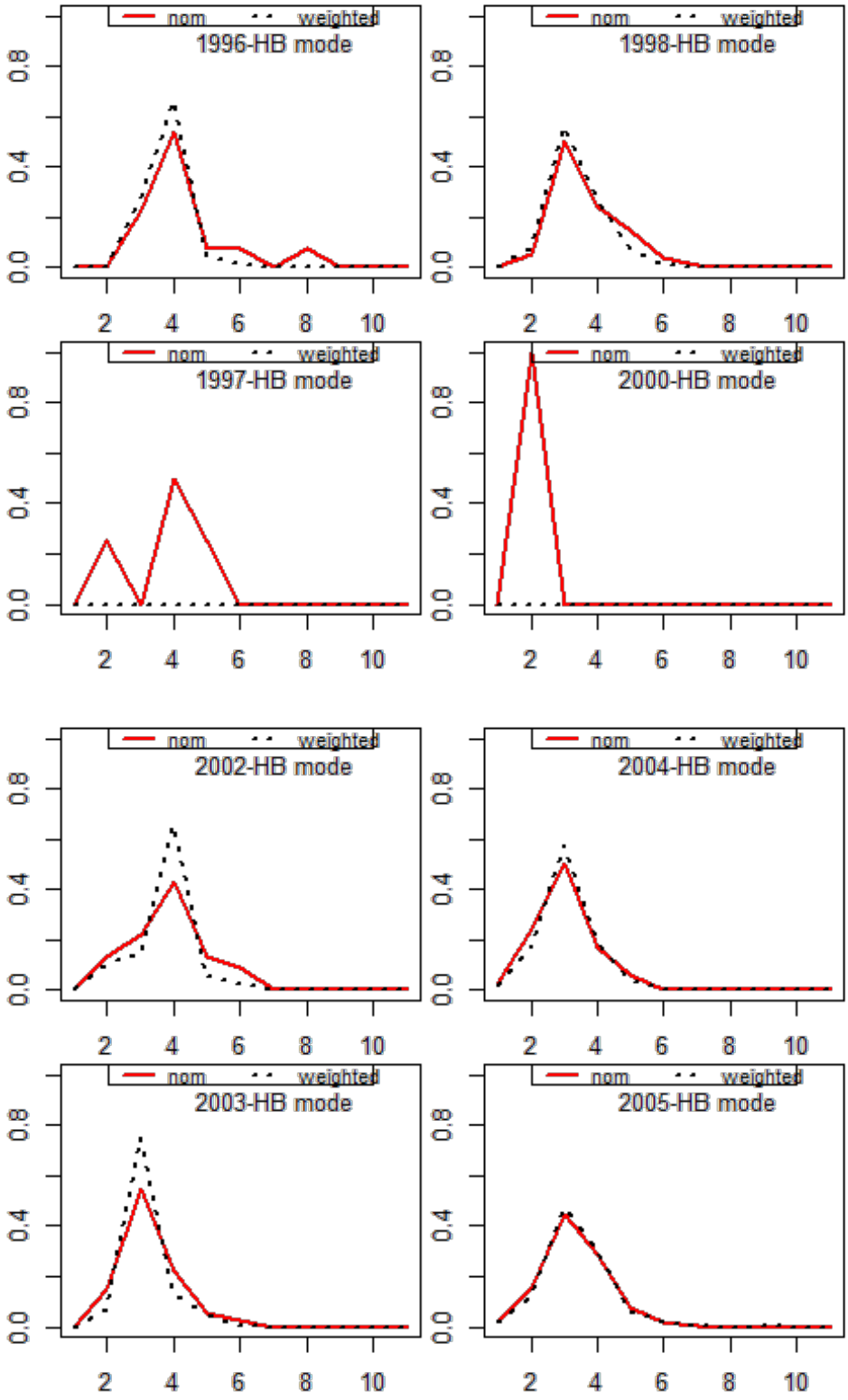

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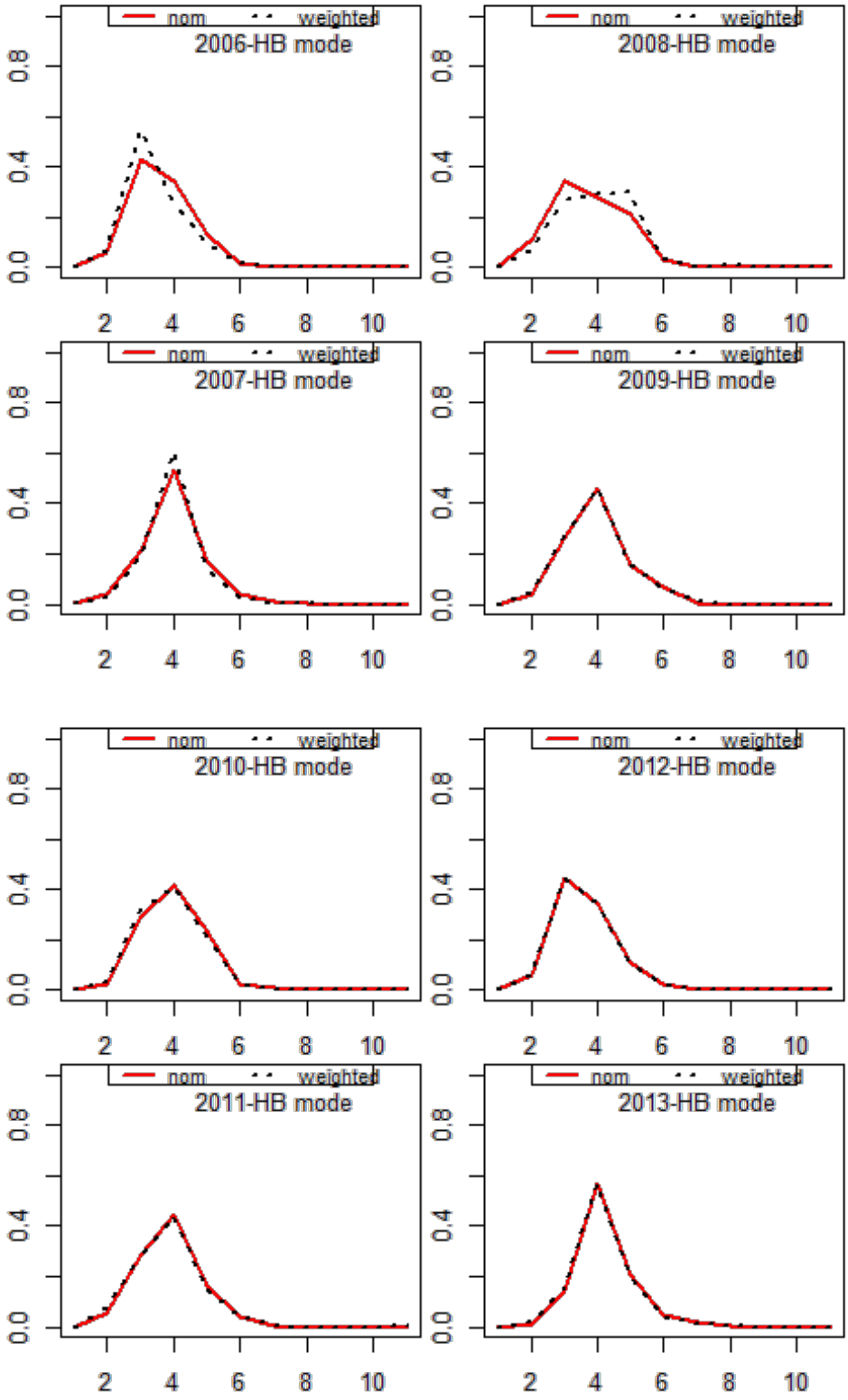

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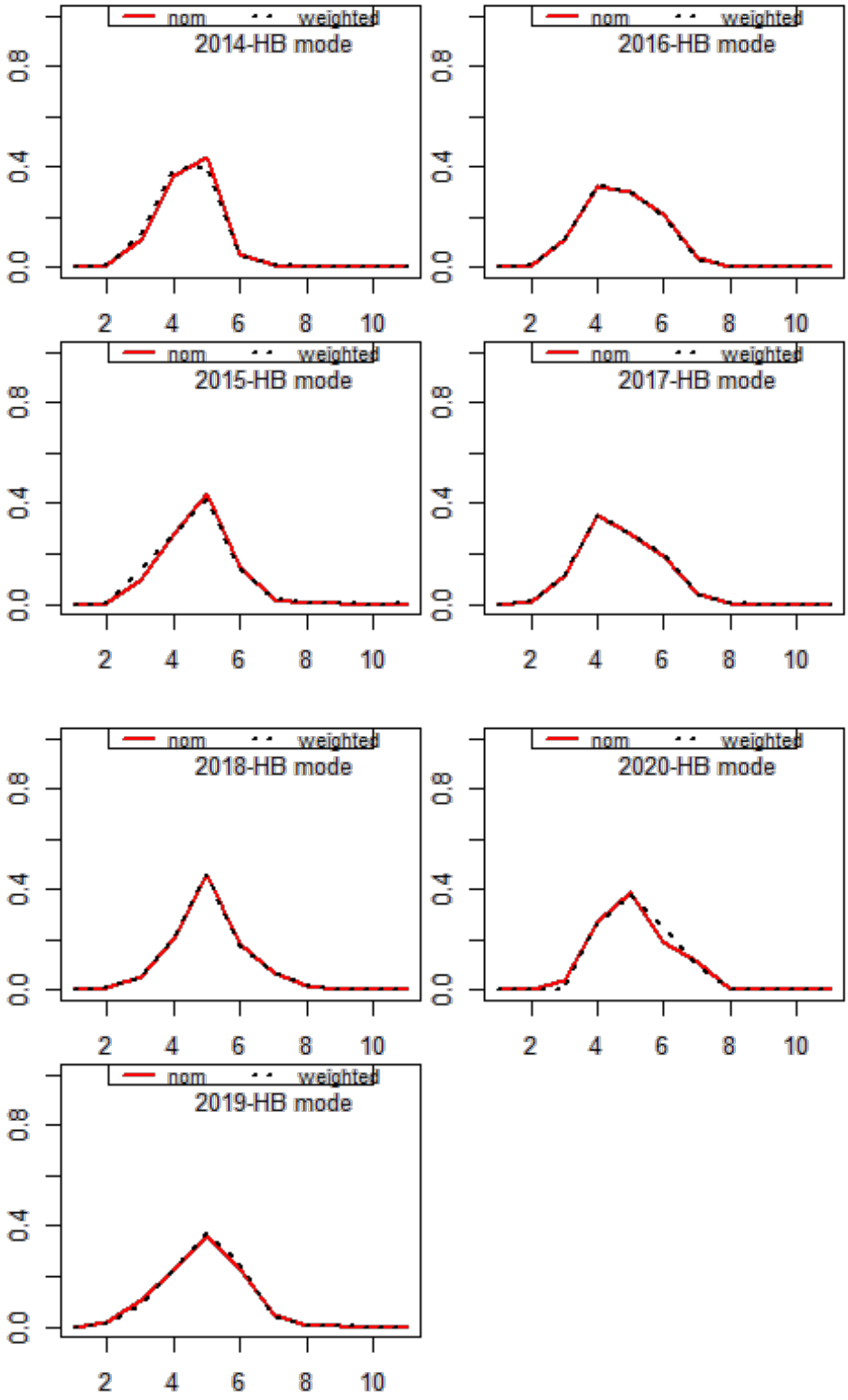
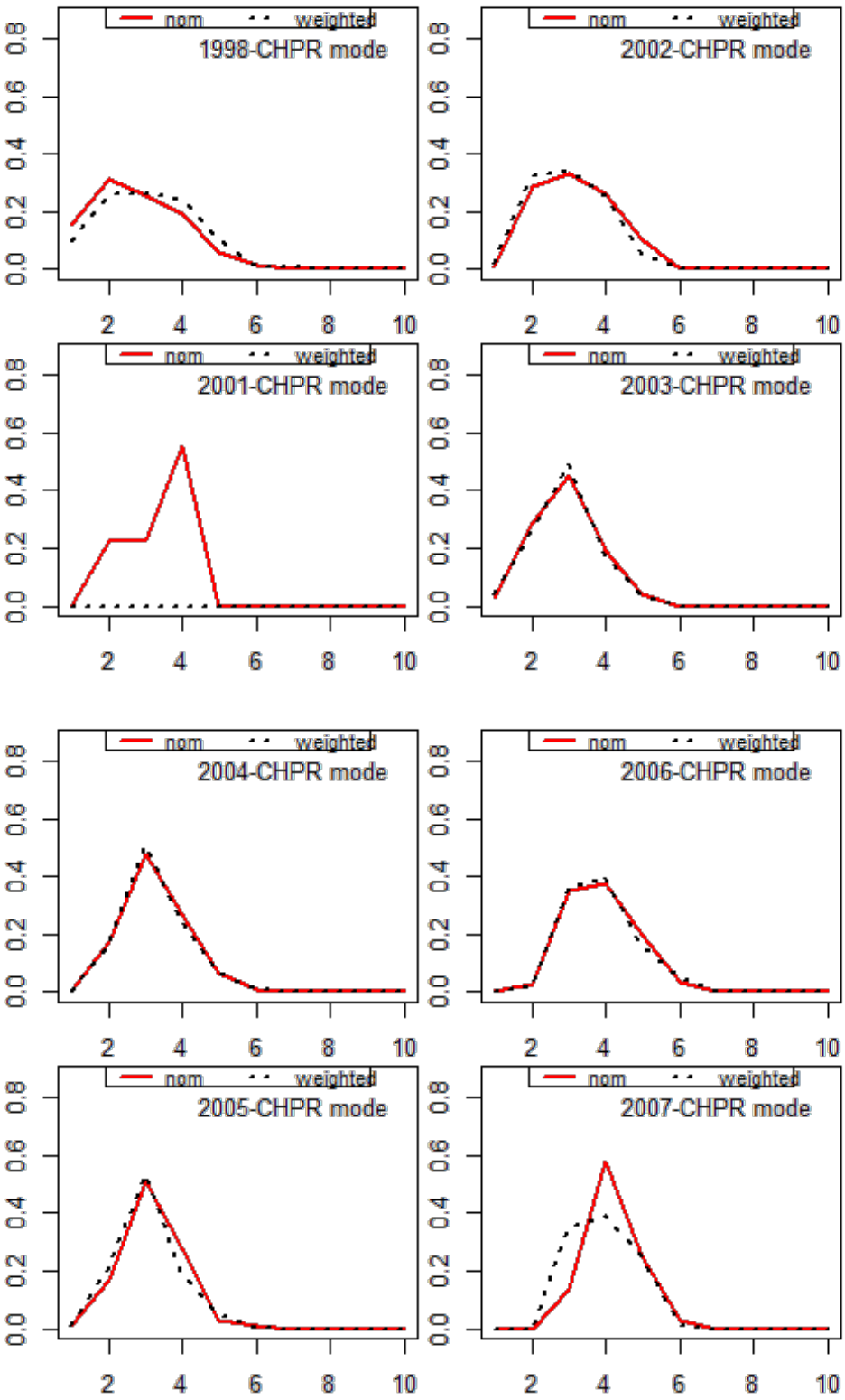


Figure 4: Black sea bass nominal and weighted age compositions from the charter and private boat modes.



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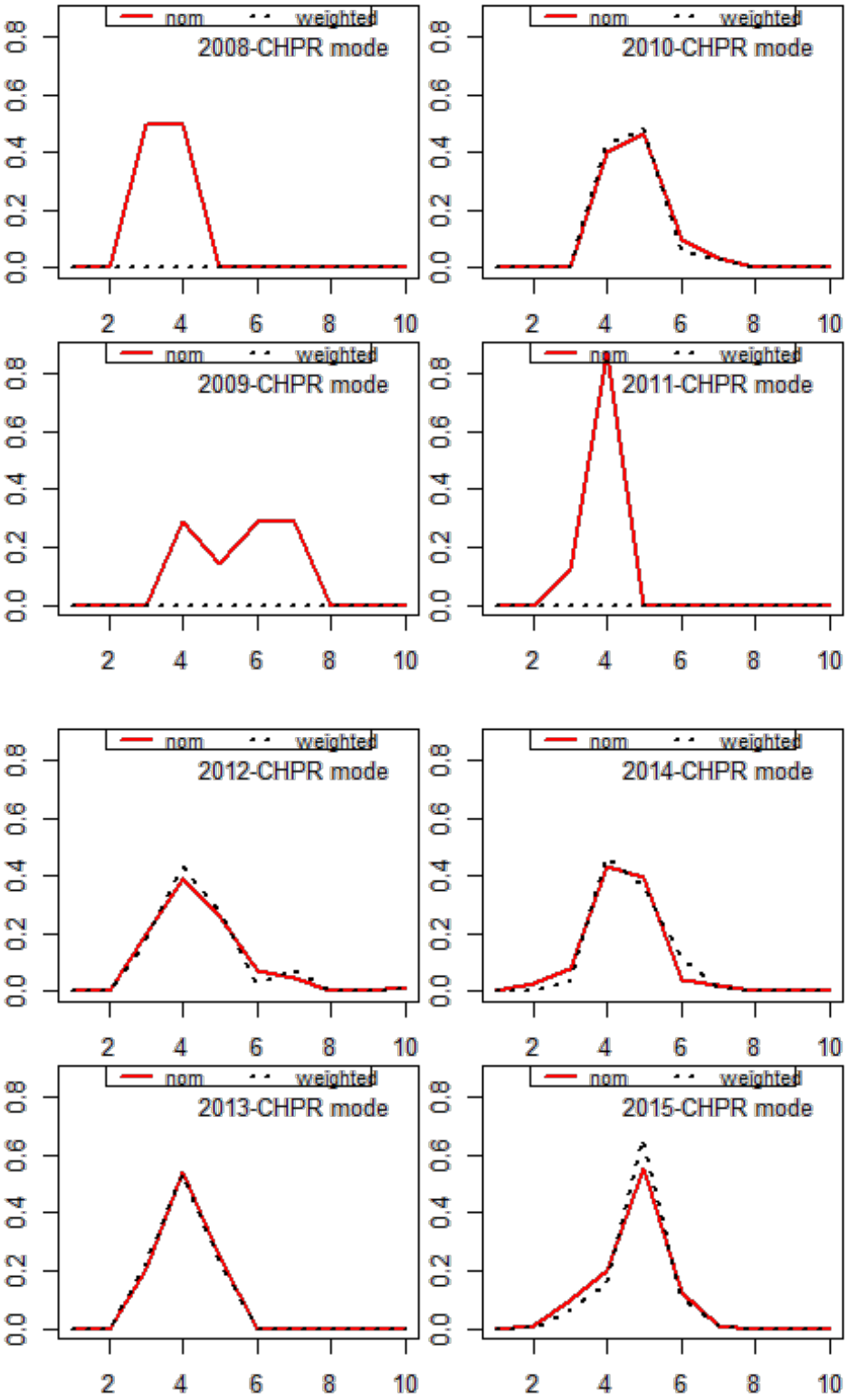

Figure 4. Continued.