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

Fisheries Ecosystems Branch, National Marine Fisheries Service,
Southeast Fisheries Science Center, Beaufort, NC (contact: Kelly Fitzpatrick)

SEDAR56-WP05

Submited: 21 December 2017

Please cite this document as:

Fisheries Ecosytems Branch, National Marine Fisheries Service, Southeast Fisheries Science Center, Beaufort, NC. 2017. South Atlantic U.S. black sea bass (*Centropristis striata*) age and length composition from the recreational fisheries. SEDAR56-WP05. SEDAR, North Charleston, SC. 32 pp.

Notice on SEDAR Working Papers

This information is distributed solely for the purpose of pre-dissemination peer review under applicable information quality guidelines. It has not been formally disseminated by NOAA Fisheries. It does not represent and should not be construed to represent any agency determination or policy.

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

Fisheries Ecosystems Branch, National Marine Fisheries Service,
Southeast Fisheries Science Center,
101 Pivers Island Rd, Beaufort, NC 28516
December 8, 2017

1 Introduction

The SEDAR 55 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 2016 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 55 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

The SRHS length compositions (Figure 1) showed a wide range of fish (10 to 85 cm TL). Prior to the mid-1980s fish sampled in the headboat fishery generally ranged from 19 cm to 40 cm TL. The minimum length captured increased to approximately 22 cm TL in the early 2000s. The maximum length captured increased to approximately 42 cm TL in the late 2000s. Mode shifts are apparent beginning in 1983 and 1999 when the size limits were set at 8 in and 10 in, respectively.

The MRIP CH/PR mode length compositions showed a smaller range of fish (11 to 70 cm TL). In the early 1980s to mid-1990s fish sampled in the charter/private boat fishery (Figure 2) generally ranged from 18 cm to 40 cm TL, with a small number of samples outside of that range. Beginning in the early 1990s the minimum length captured increased to approximately 20 cm TL with few fish outside that range. There is not a noticeable mode shift in the CH/PR fishery that coincides with the implementation of size limits in 1983 and 1999.

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. A minimum of 30 length measurements was required.

	SRHS		MRIP	
Year	Fish (n)	Trips (n)	Fish (n)	Trips (n)
1973	1	1		
1974	1,137	143		
1975	1,032	147		
1976	942	176		
1977	3,212	328		
1978	2,332	327		
1979	1,655	201		
1980	2,419	277		
1981	3,025	387	209	48
1982	3,689	439	411	91
1983	5,733	624	155	34
1984	6,092	695	278	59
1985	5,843	638	460	88
1986	6,551	683	403	136
1987	6,443	787	686	151
1988	4,256	545	670	165
1989	3,840	427	617	192
1990	5,780	481	438	128
1991	5,380	391	387	94
1992	5,195	400	675	152
1993	3,950	387	500	142
1994	4,223	350	366	122
1995	3,331	283	397	99
1996	3,175	276	537	121
1997	3,665	375	338	112
1998	4,377	460	458	111
1999	4,125	403	751	148
2000	3,432	333	550	109
2001	2,986	329	770	177
2002	1,970	305	514	124
2003	3,274	406	1,003	157
2004	4,236	403	1,291	220
2005	3,818	342	1,043	169
2006	5,075	443	1,046	174
2007	3,060	328	897	128
2008	2,014	281	623	136
2009	2,897	395	667	140
2010	4,558	478	1,123	156
2011	3,255	286	519	69
2012	1,685	141	507	78
2013	2,262	342	528	102
2014	1,905	366	626	127
2015	1,910	284	436	113
2016	1,341	287	312	102

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. A minimum of 10 aged fish was required.

	SRHS		MRIP	
Year	Fish (n)	Trips (n)	Fish (n)	Trips (n)
1973				
1974				
1975				
1976				
1977				
1978				
1979				
1980				
1981				
1982				
1983				
1984				
1985				
1986				
1987				
1988				
1989				
1990	25	11		
1991	85	43		
1992	60	31		
1993				
1994				
1995				
1996	27	12		
1997				
1998	75	9	374	56
1999				
2000				
2001				
2002	23	15	84	36
2003	105	31	77	25
2004	234	53	567	48
2005	480	104	139	45
2006	1,066	247	173	17
2007	671	234	37	4
2008	309	163		
2009	515	214	19	2
2010	1,000	354	23	3
2011	430	131		
2012	540	84	79	8
2013	1,020	242	35	16
2014	906	208	95	27
2015	869	158	30	8
2016	982	258	73	8

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

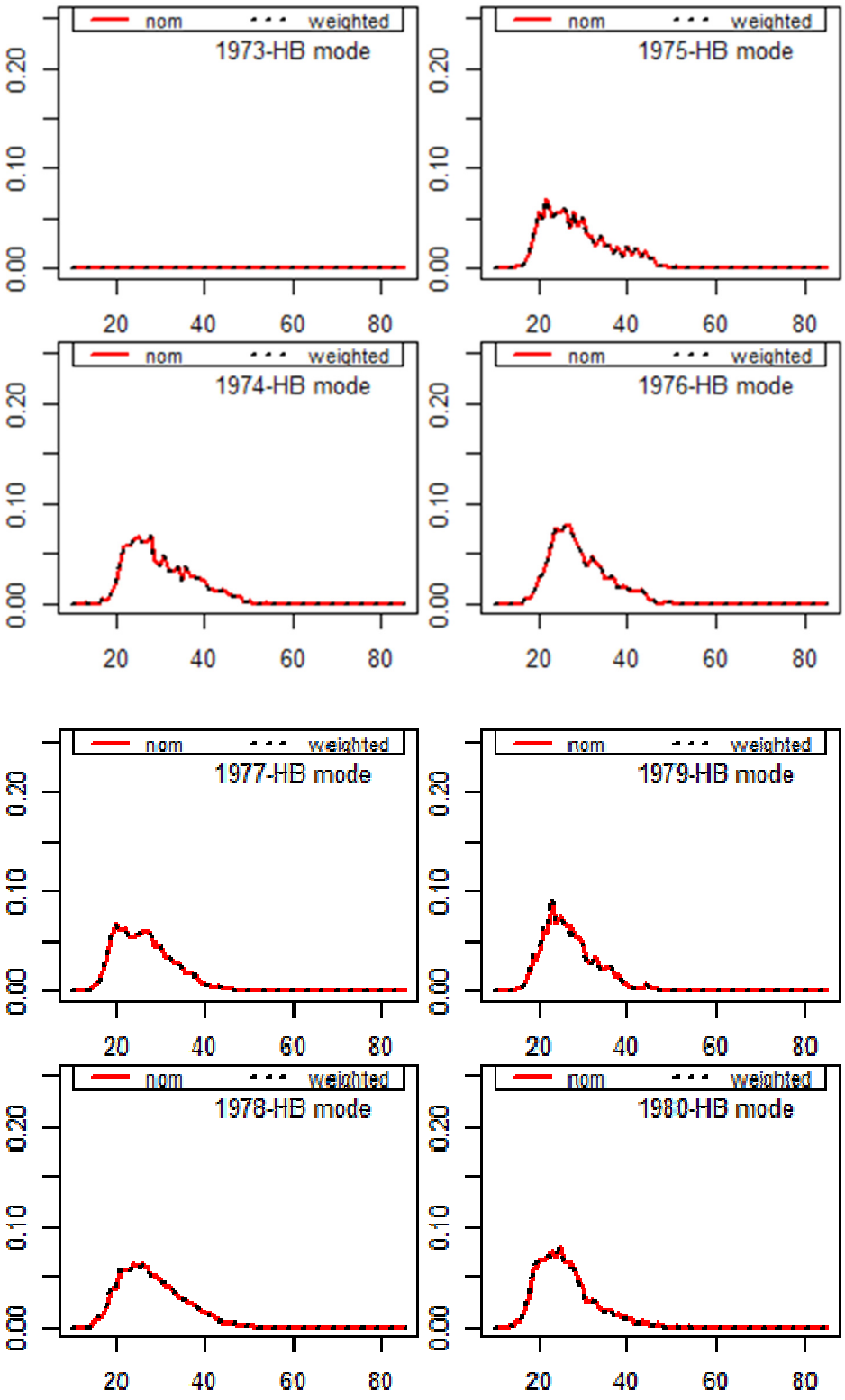

Figure 1: Continued.

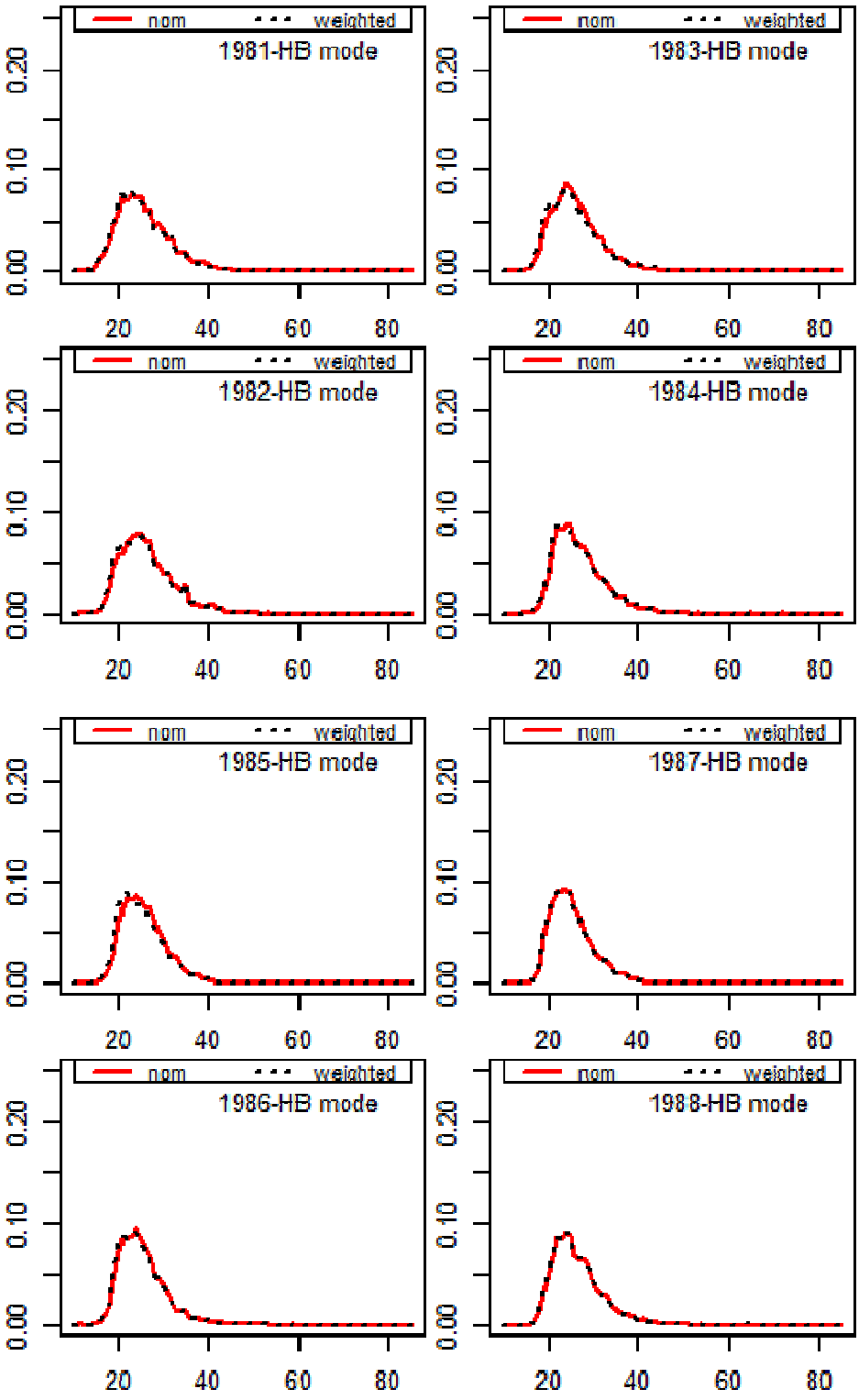

Figure 1: Continued.

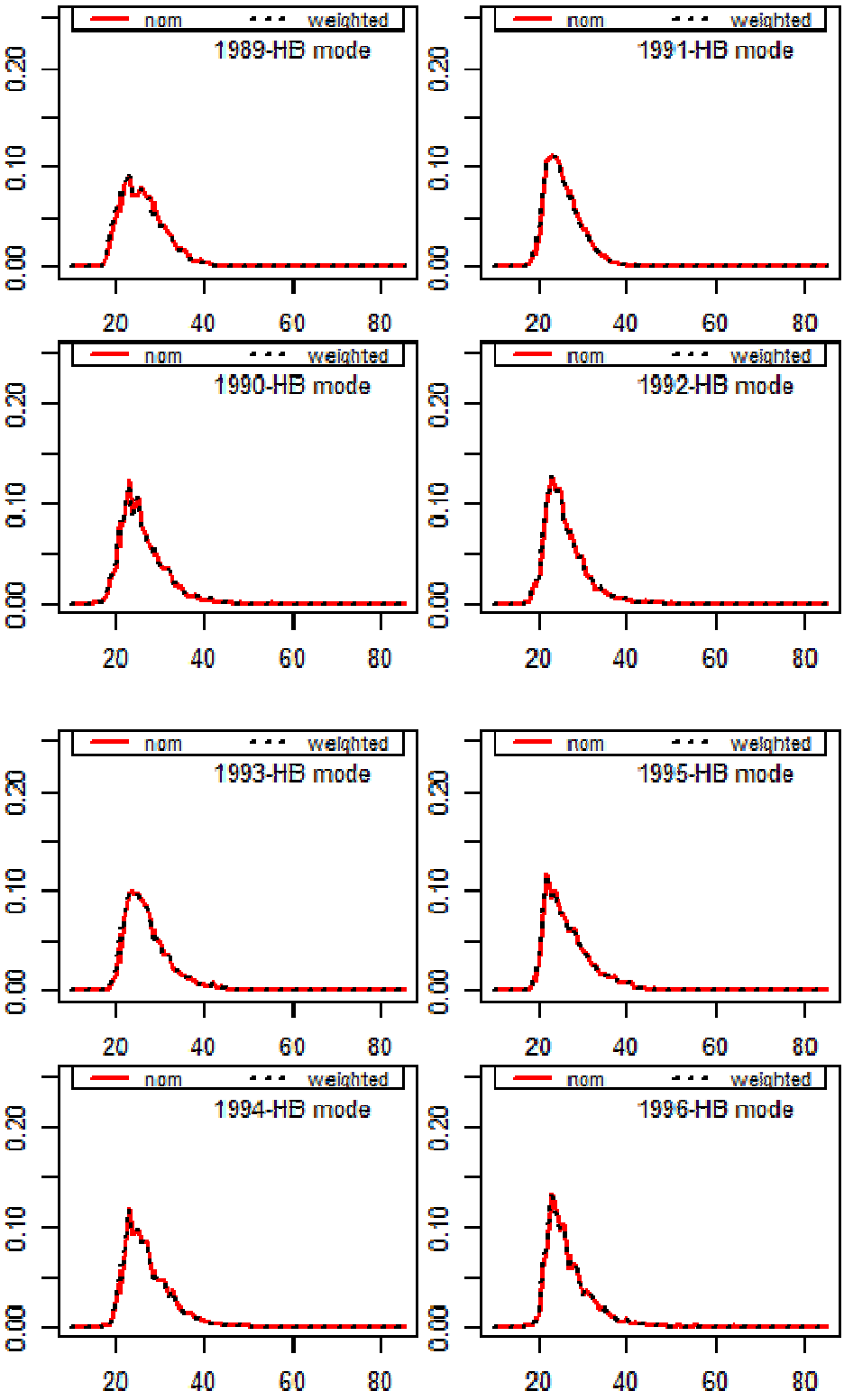

Figure 1: Continued.

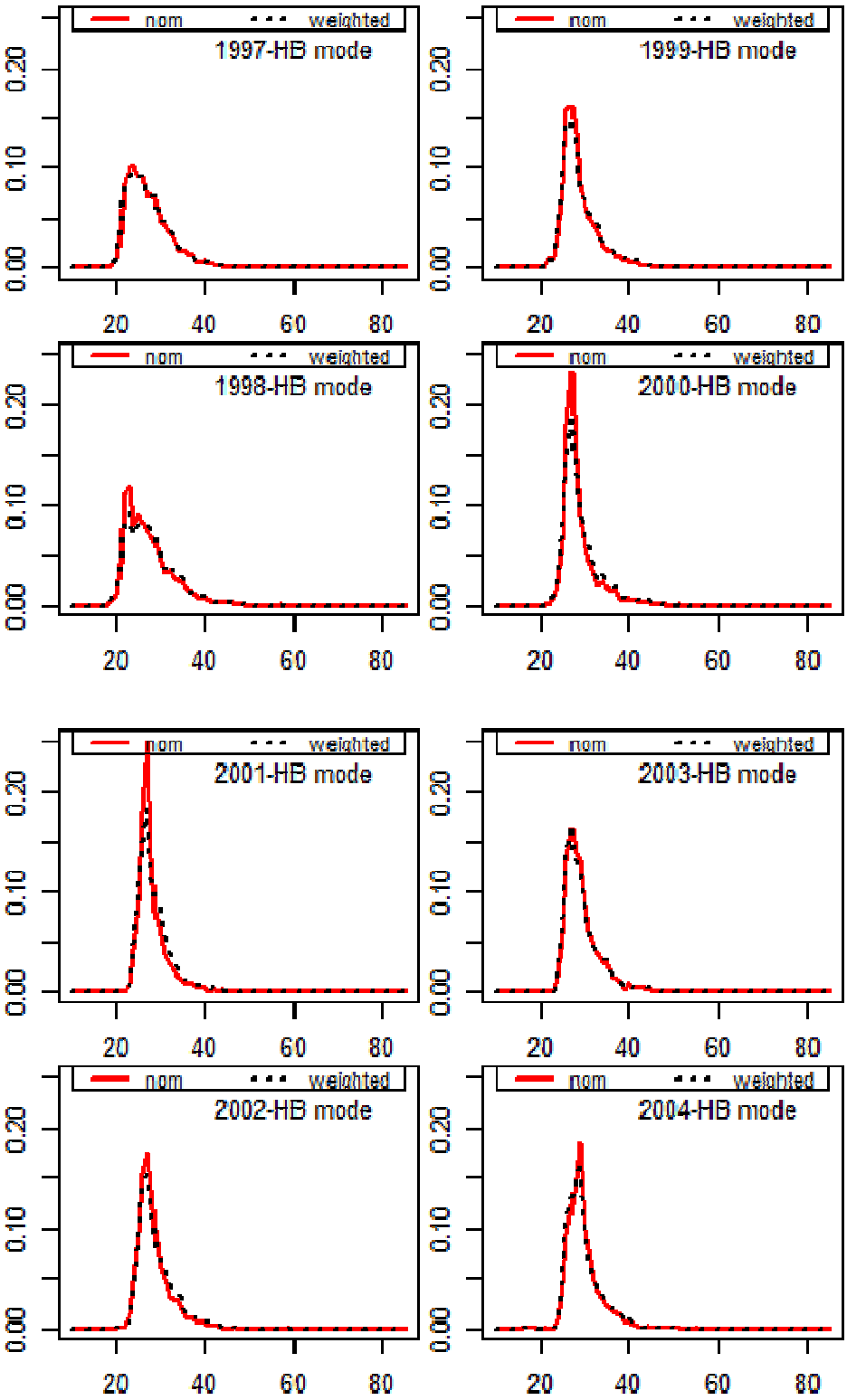

Figure 1: Continued.

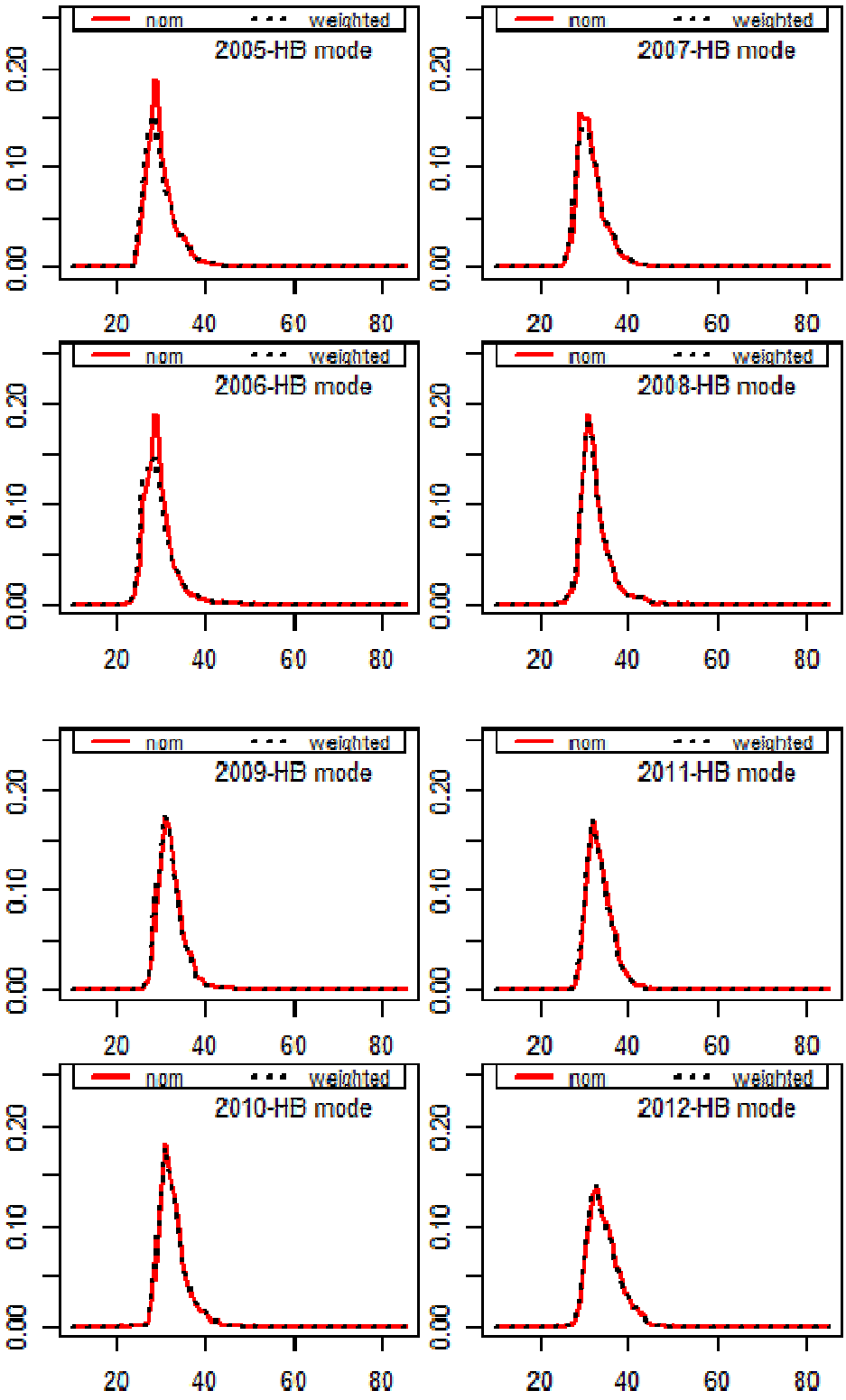

Figure 1: Continued.

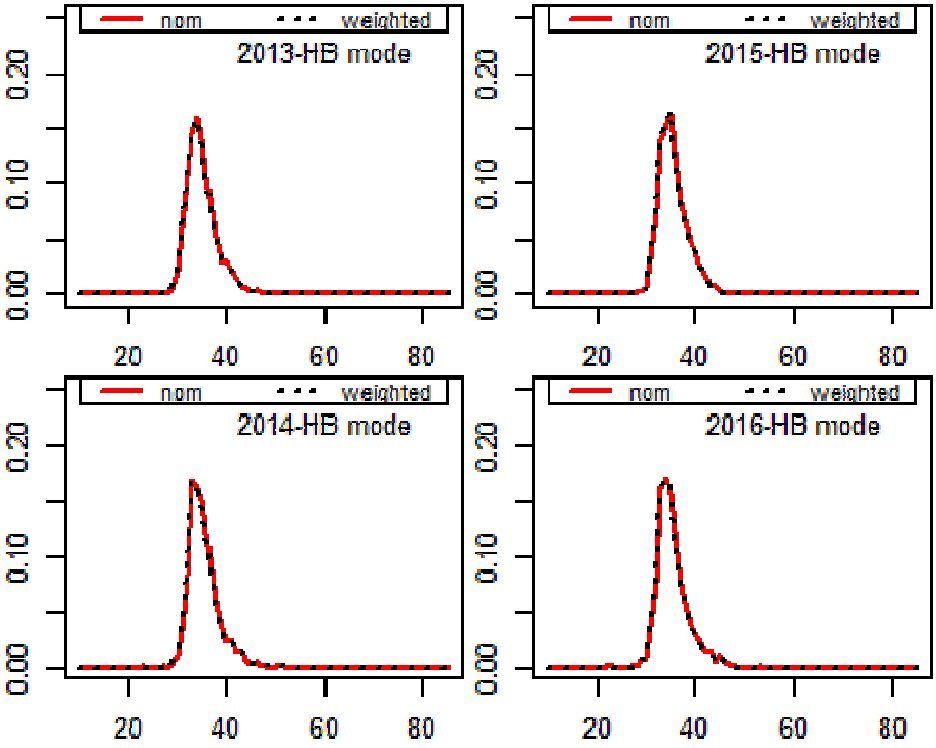

Figure 2: Black sea bass nominal and weighted length composition from the charter and private boat modes.

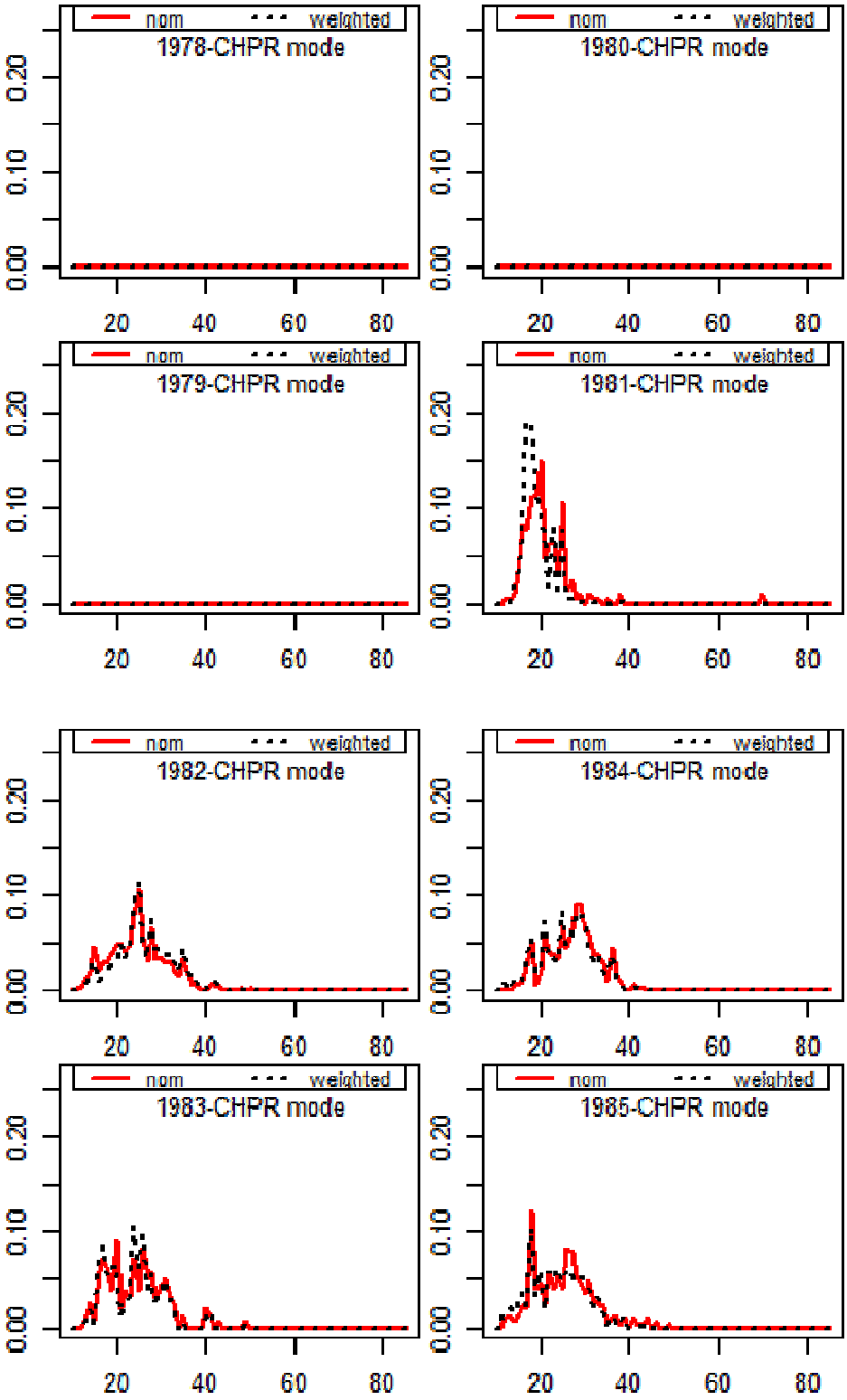

Figure 2: Continued.

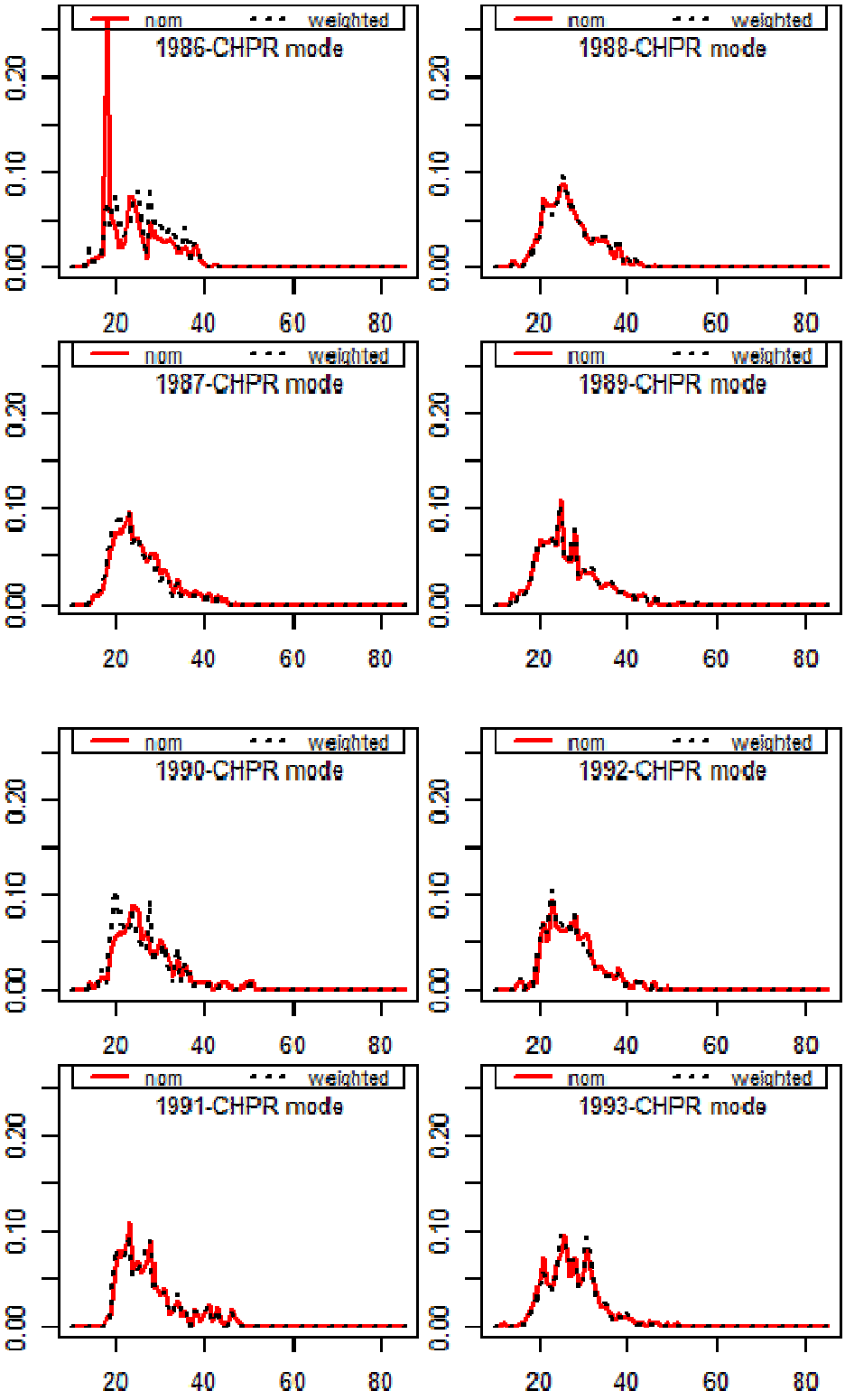

Figure 2: Continued.

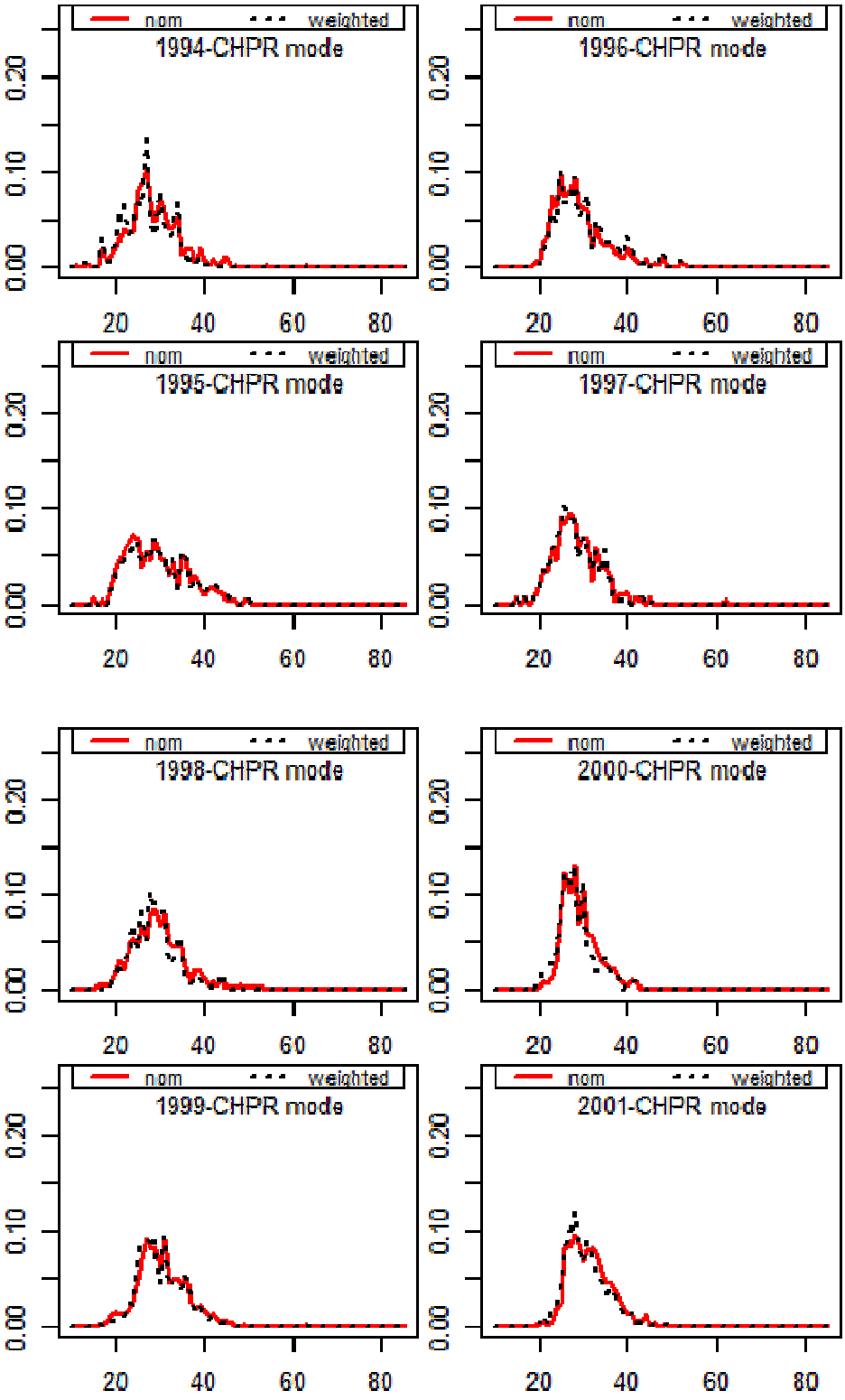

Figure 2: Continued.

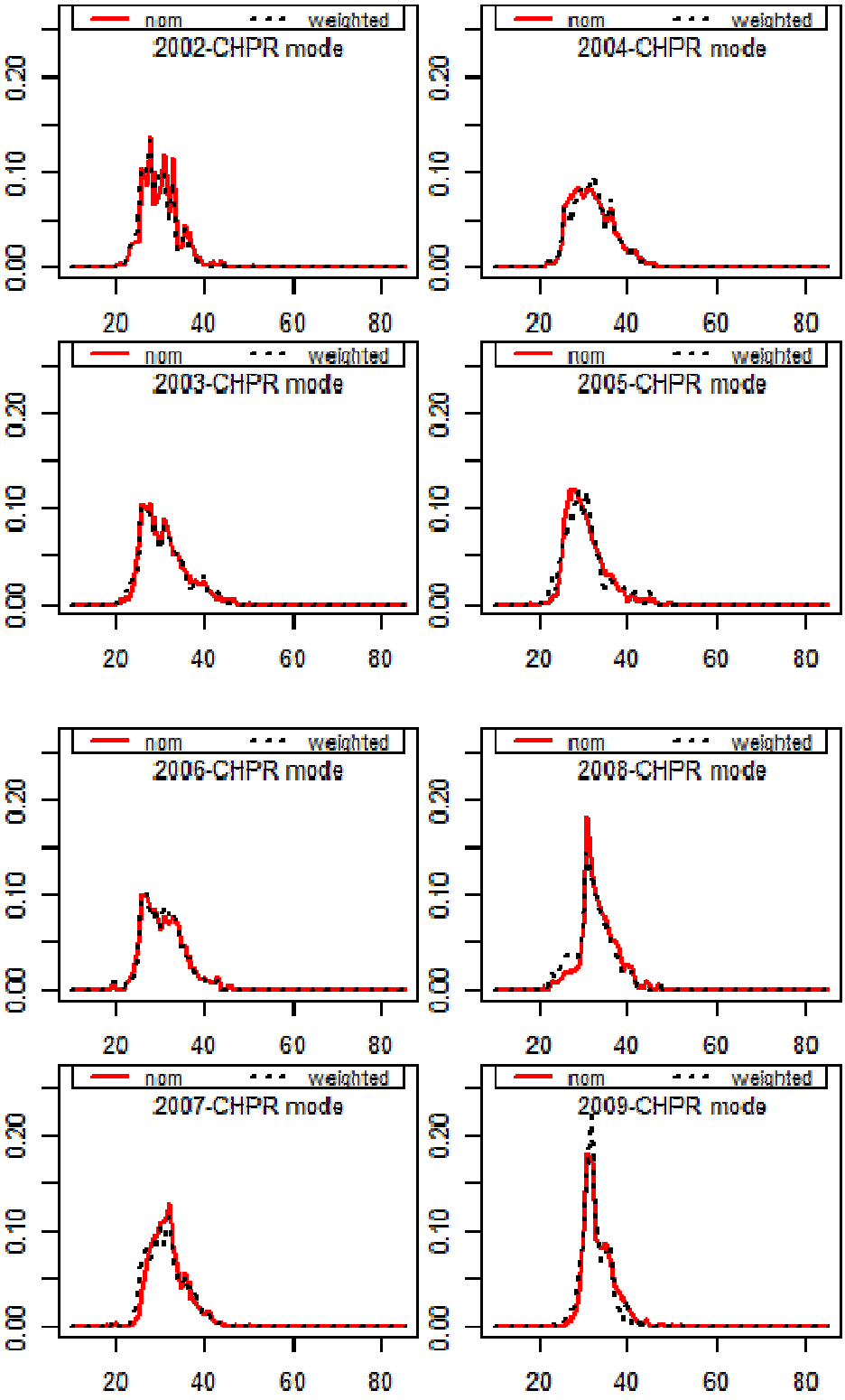

Figure 2: Continued.

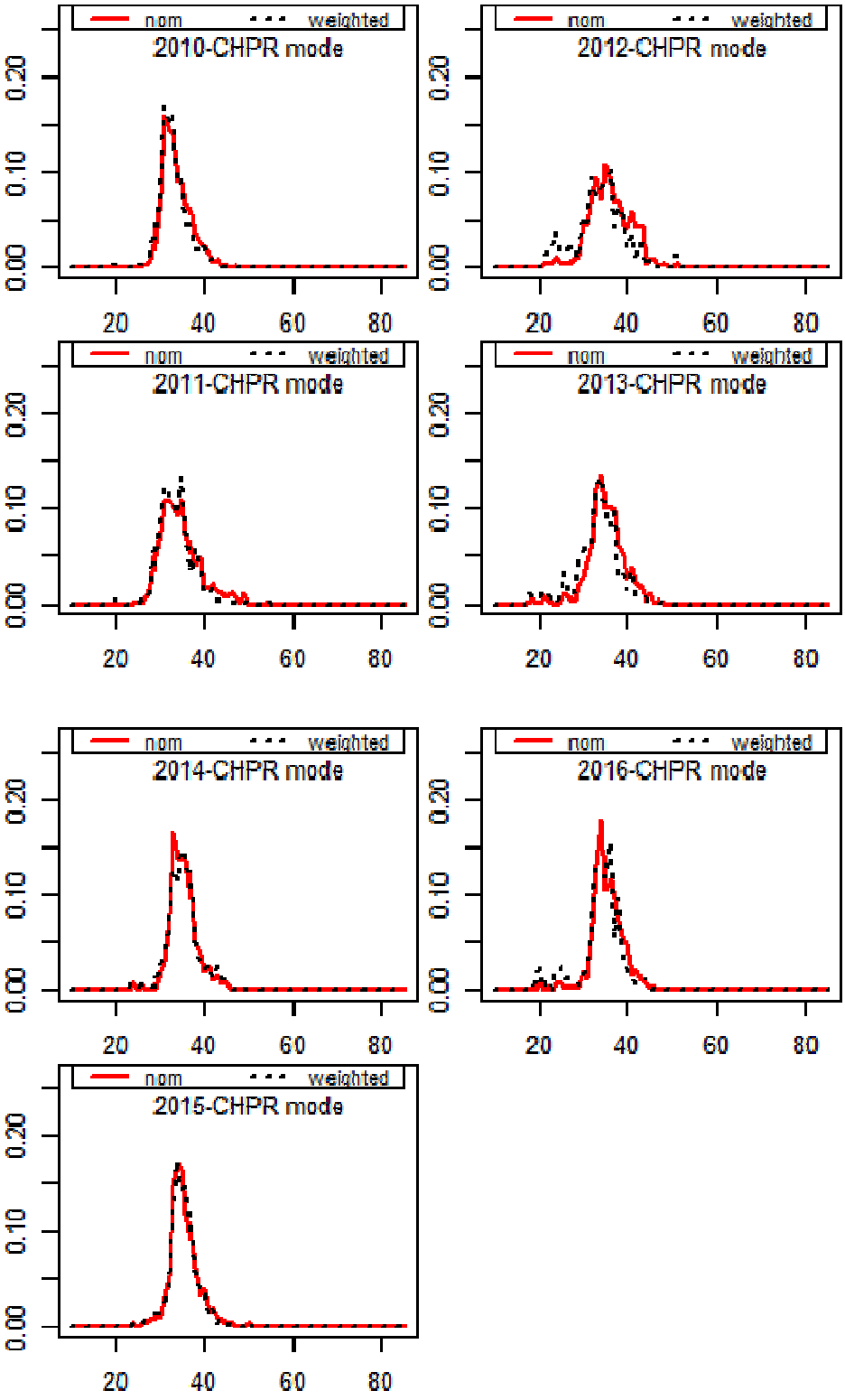

Figure 3: Black sea bass nominal and weighted age composition from the headboat fishery.

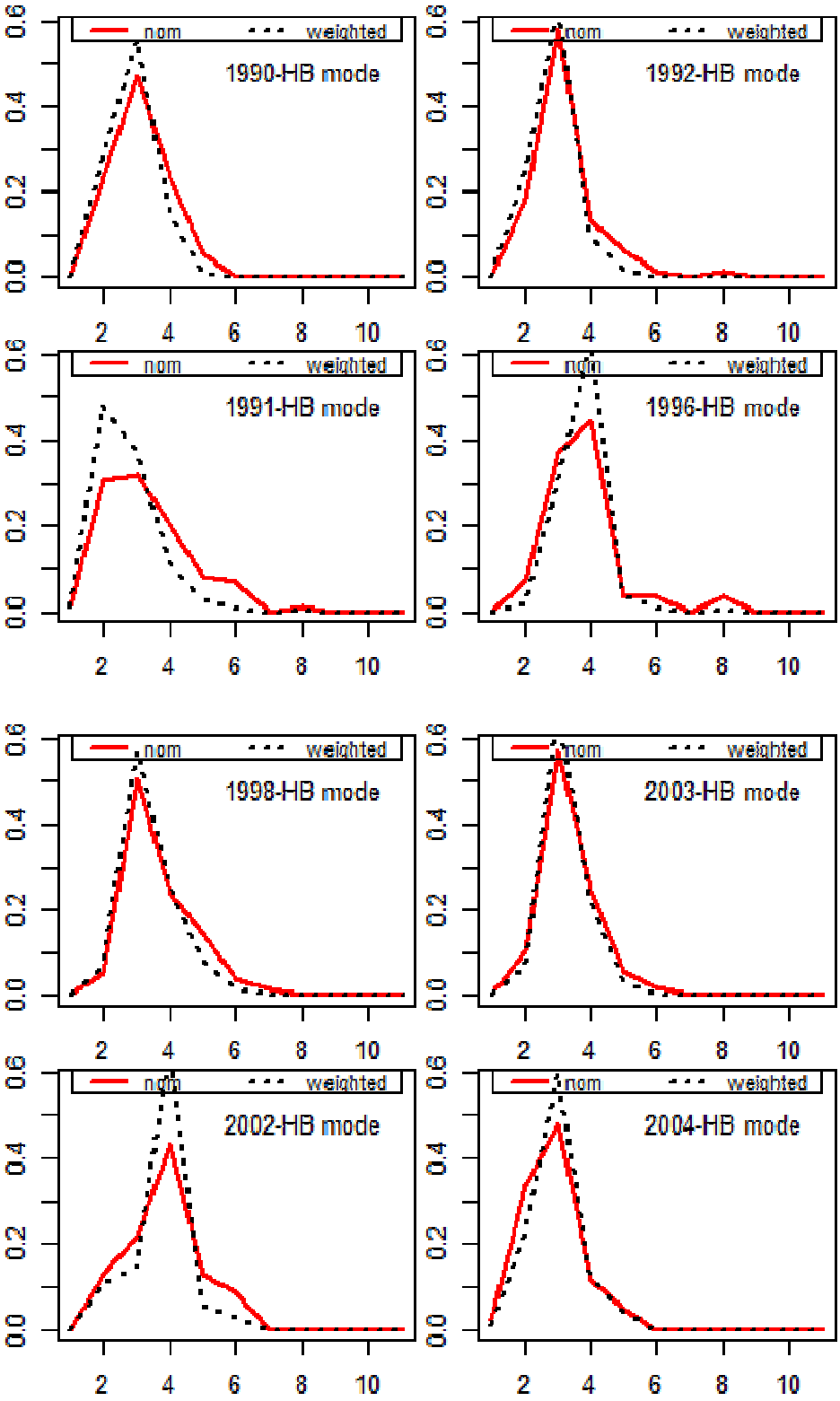

Figure 3: Continued.

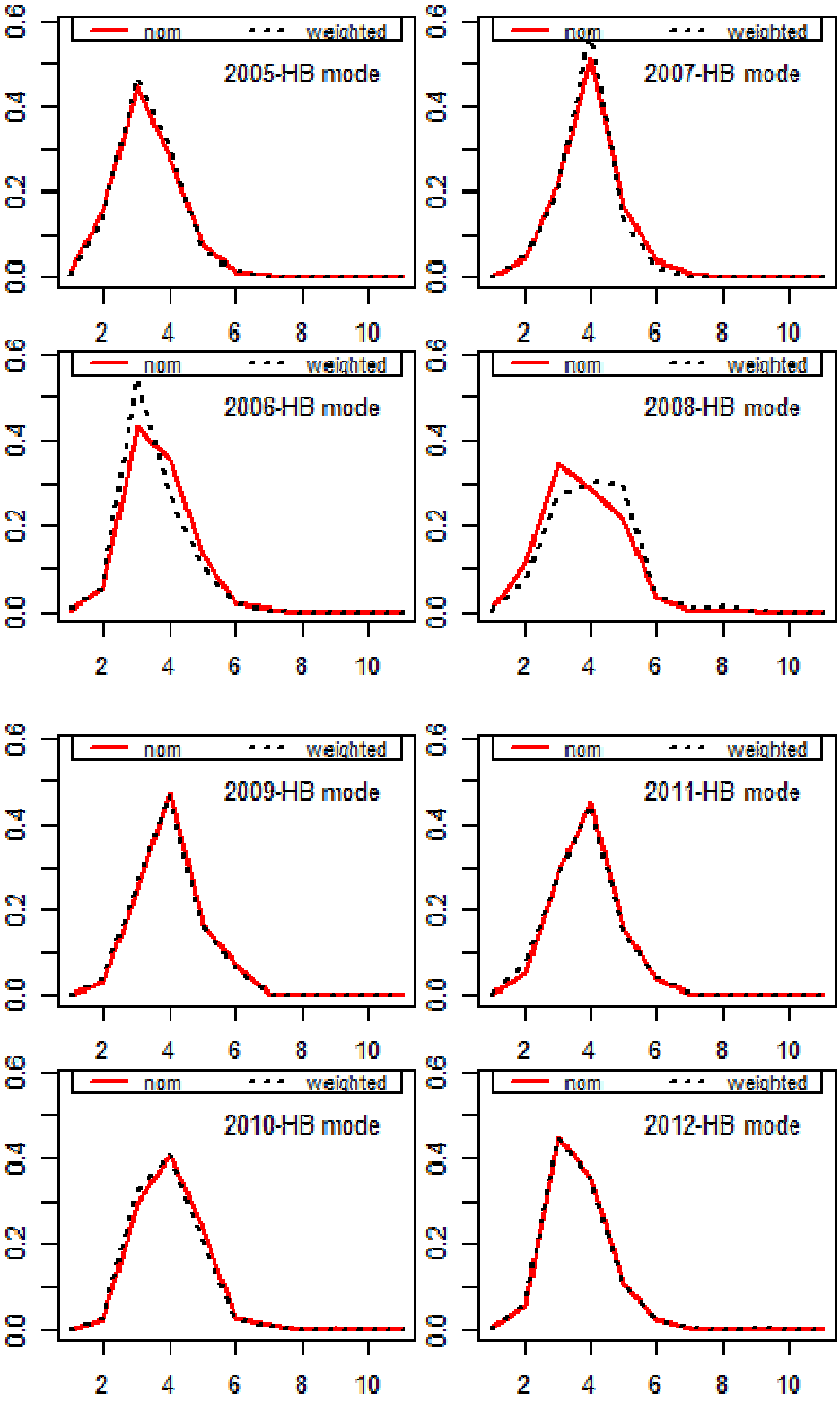

Figure 3: Continued.

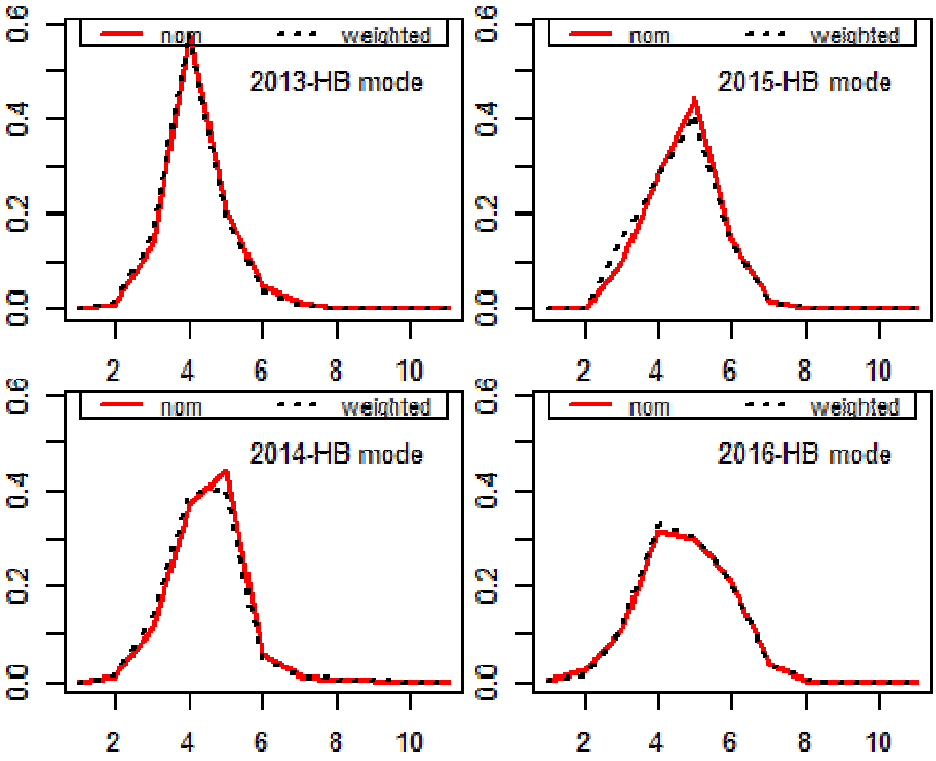

Figure 3: Continued.

Figure 3: Continued.

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

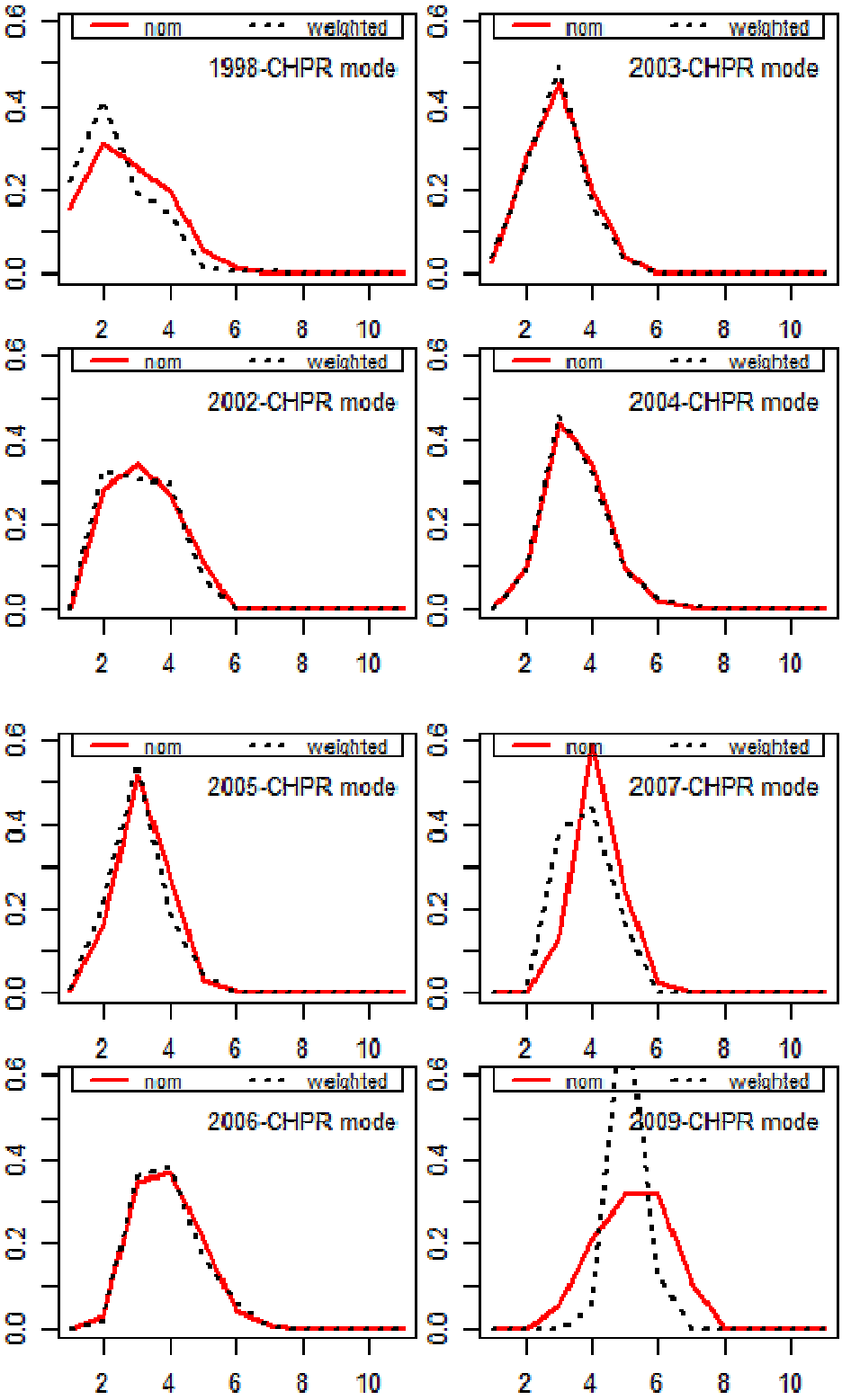

Figure 4: Continued.