Black Seabass Length Frequencies and Condition of Released Fish from At-Sea Headboat Observer Surveys, 2005 to 2016

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SEDAR56-WP07

Submitted: 18 December 2017

Please cite this document as:

Lazarre, D., B. Sauls, C. Wilson, and K. Fitzpatrick. 2017. Black Seabass Length Frequencies and Condition of Released Fish from At-Sea Headboat Observer Surveys, 2005 to 2016. SEDAR56-WP07. SEDAR, North Charleston, SC. 14 pp.

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For:
SEDAR 56, South Atlantic Black Seabass Data Workshop, December, 2017.

From 2004 to 2016, headboats in South Carolina and North Carolina participated in an at-sea observer survey. From 2005 to 2016, headboats along the Atlantic coast of Florida and Georgia also participated in an at-sea observer survey. The purpose of the headboat at-sea survey was to collect detailed information on both harvested and discarded fish during recreational fishing trips on board working headboats. In 2013, Florida expanded their at-sea observer program to include charter vessels. This report is a summary of information collected on the size, release condition, and final disposition of black seabass collected by trained observers during at-sea in the for-hire fleet along the southeast Atlantic coastline.

Sample Methods

Cooperative vessels were randomly selected each month from six sample regions: North Carolina, South Carolina, Georgia, northeast Florida (Broward to Duval counties), southeast Florida (Dade to Indian River counties), and Florida Keys (Monroe County).Funding for the Florida Keys was discontinued after 2007. Operators from selected vessels were contacted by state biologists and a trip was arranged. Dependent upon the number of customers on board, one or two biologists accompanied passengers during the scheduled trip. The captain and mates cooperated by making sure fish caught by their anglers were observed by one of the biologists before they were stored in the fish hold or released overboard. Biologists would assist with dehooking fish for data collection, but were not permitted to influence the decision to keep or release a fish. For each fish, biologists recorded the species, disposition, size (fork length in mm), and the condition of fish that were released (Florida only). Release conditions were not recorded in South Carolina, Georgia, or North Carolina.

A brief interview with each angler observed during a trip was also conducted to collect information on primary and secondary target species, angler avidity, and state and county of residence.

Data Elements

Trip level information for each trip included the area fished, duration of fishing (to the nearest half hour), disposition of fish, release condition of fish, and fishing depth (meters) of each station for fish captured in Florida.

Area fished for North Carolina, South Carolina, southeast and northeast Florida was coded as:
1: 3 miles or less from shore; or
2: more than 3 miles from shore

Area fished for the Florida Keys were coded as:
3: 10 miles or less from shore; or
4: more than 10 miles from shore.

Characterization of Trips duration:
- Half-Day (H): < 6 hours
- Three-Quarter-Day (Q): 6 to 8.5 hours
- Full-day (F): 9 or more hours

Dispostion was coded as:
1: thrown back alive, legal;
2: thrown back alive, not legal;
3: plan to eat;
4: used for bait or plan to use for bait;
5: sold or plan to sell;
6: thrown back dead or plan to throw away.

Release conditions were coded (FL only) as:
Good = 1: fish swam toward bottom immediately upon entry into the water;
Fair = 2: fish was disoriented upon release and slowly swam towards the bottom;
Poor = 3: fish was very disoriented upon release and remained at the surface;
Dead = 4: fish was either dead or unresponsive upon entering the water;
Eaten = 5: fish was eaten by a bird, another fish, or a marine mammal;
Unobserved = 9: unable to observe fish, not applicable.

Sample Weighting

Headboat vessels report fishing effort in logbook trip reports, and effort data were provided by the NMFS Southeast Fisheries Science Center in Beaufort, NC (Table 1). It was important to appropriately weight sample data for headboats before characterizing discards. In Florida, half day headboat trips were over sampled in the fishery observer surveys relative to total effort. The raw Florida discard length frequencies data were first weighted to account for the difference in sampling by trip types (Table 2).

To obtain the trip duration (trip type) sample weight (W_t), proportional fishing effort for a given trip type was divided by the proportional sampling effort for the same trip type:

$$W_t = N_t/N/n_t/n$$

Where N_t/N is the number of trips of type t divided by total number of trips reported on logbook trip reports, and n_t/n is the number of trips of type t sampled during fishery observer surveys divided by the total number of sampled trips. Trip-types with $W_t < 1$ are down-weighted to account for oversampling, and trip-types with $W_t > 1$ are inflated to account for undersampling.

A secondary weight was calculated to account for the differences in the number of trips sampled in Florida as compared to the states from North Carolina to Georgia (Table 3). To obtain the sample weights (W_a) for each staste/region, proportional fishing effort for the south Atlantic was divided by the proportional sampling effort for each region (NC – North Carolina, SC-GA – South Carolina and Georgia, SEFL – east coast of Florida including the Florida):

$$W_a = N_a/N/n_a/n$$

Characterization of Headboat Discards:
Fish mid-line lengths were placed in one cm length bin categories (100 cm bin = fish 99.51cm to 100.50cm). Fish in each length bin category were summed by region and trip-type for Florida and multipled by the weight (W_t) for each trip type to generate weighted discard frequencies for each length bin. The weighted frequency of fish in a single length bin (x) was calculated as follows:

$$L_{x_{1\ldots n}} = \sum L_H * W_H + \sum L_Q * W_Q + \sum L_F * W_F$$

Where L_H equals the number of fish in each length bin x for discarded fish collected on half day trips, L_Q correspong with ¾ day trips, and L_F coorespond with full day trips.

The weighted frequencies from Florida and the raw length frequencies from NC to Georgia were then multiplied by the regional weights calculated based on the number of trips by region and year. The proportion of fish in a single length bin (p_x) was calculated as follows:

$$p_x = \frac{\sum L_{NC} * W_{NC} + \sum L_{SC-GA} * W_{SC-GA} + \sum L_{SEFL} * W_{SEFL}}{\sum(bin = i = 1\ldots n[\sum L_{NC} * W_{NC} + \sum L_{SC-GA} * W_{SC-GA} + \sum L_{SEFL} * W_{SEFL}]}$$

Where L_a equals the number of fish in length bin x for a discarded fish; and W_a is the weighting factor for each region: NC= discarded fish from North Carolina, SC-GA=South Carolina to Georgia, and SEFL = discarded fish from the southeast Florida and the Florida Keys. The denominator is the sum of all numerators from length bin 1 to length bin n.

Characterization of Charter Harvest / Discards:
The length frequency for charter vessels was calculated by summing the raw number of fish by disposition (harvest or discard) and length bin and dividing this by the total number of fish by disposition. No weights were generated for the charter fishery.

Results

Summary statistics for harvested and released fish are presented in Table 4. Weighted length frequency histograms for discarded black seabass in the South Atlantic region, by year, are presented in Figure 1. The unweighted proportions of harvested and discarded fish observed in the Florida at-sea observer survey are presented in Figure 2, with summary statistics for the Florida charter fleet described in Table 5. The depth distribution associated with Florida observer trips positive for black seabass are summarized in Table 6. A summary of the proportion of discarded fish by release condition and year are presented in Table 7. The proportions of discarded fish by depth and release condition, with all years pooled are presented in Table 8.

Table 1: Sampled headboat at-sea observer trips by year, state and region.

Year	FL	GA	SC	NC	All
2005	174	6	58	97	335
2006	161	7	45	88	301
2007	165	8	52	91	316
2008	128	3	39	78	248
2009	128	9	34	69	240
2010	142	3	26	83	254
2011	136	3	22	79	240
2012	148	11	36	78	273
2013	147	11	41	55	254
2014	138	12	41	70	261
2015	133	10	27	57	227
2016	160	9	28	76	273
Total	**1760**	**92**	**449**	**921**	**3222**

Table 2. Sample weights applied to Florida headboat discards, based on length of trips (trip types).

Year	Half Day	3/4 Day	Full Day
2005	0.829	0.413	2.673
2006	0.823	0.229	5.397
2007	0.906	0.269	3.765
2008	1.171	0.303	1.466
2009	1.107	0.245	2.920
2010	1.062	0.269	1.768
2011	1.098	0.382	1.690
2012	1.285	0.290	1.419
2013	1.189	0.453	0.926
2014	1.118	0.600	0.760
2015	1.156	0.681	0.513
2016	1.095	0.821	0.652

Table 3. Sample weights applied to South Atlantic discards by region.

Year	NC	SC-GA	SEFL
2005	0.324	1.621	1.148
2006	0.272	2.007	1.073
2007	0.238	1.908	1.090
2008	0.187	1.385	1.369
2009	0.135	1.290	1.369
2010	0.143	2.066	1.283
2011	0.120	2.524	1.231
2012	0.137	1.372	1.337
2013	0.170	0.942	1.331
2014	0.112	0.822	1.519
2015	0.132	0.925	1.393
2016	0.120	1.432	1.318

Table 4. Summary statistics for harvested and discarded Atlantic coast black seabass lengths.

State	Year	HARVEST				DISCARDS			
		Number measured	*Minimum (mm FL)*	*Maximum (mm FL)*	*Mean (mm FL)*	*Number measured*	*Minimum (mm FL)*	*Maximum (mm FL)*	*Mean (mm FL)*
North Carolina	2005	989	239	482	291.1	1343	81	328	195.3
	2006	498	201	510	297.5	1927	88	326	210.0
	2007	354	243	439	308.8	2866	101	393	220.2
	2008	207	234	461	334.6	2290	101	324	216.9
	2009	143	208	400	322.2	2568	95	336	224.9
	2010	810	222	503	335.4	4105	112	355	236.9
	2011	277	304	486	340.2	4653	103	480	242.5
	2012	322	153	480	353.7	5285	102	495	246.3
	2013	116	213	475	365.7	2836	101	453	245.1
	2014	173	193	486	361.8	3123	91	410	237.6
	2015	131	320	438	348.4	4161	97	373	240.5
	2016	171	203	450	354.9	3682	98	370	237.5
South Carolina	2005	216	225	415	288.4	563	117	291	205.4
	2006	231	165	441	283.5	785	99	296	210.3
	2007	100	264	415	315.2	1080	113	331	219.1
	2008	42	258	372	319.3	956	102	311	217.4
	2009	77	301	380	325.0	1404	102	323	230.0
	2010	51	301	405	332.8	924	92	531	229.6
	2011	153	273	444	343.1	1012	101	480	248.1
	2012	71	221	469	340.4	1068	113	510	232.9
	2013	22	234	388	338.3	399	102	365	208.2
	2014	37	314	384	344.8	941	108	340	231.1
	2015	53	330	388	344.7	782	95	339	233.2
	2016	46	295	453	350.8	934	45	375	240.1
Georgia	2005	-	-	-	-	45	170	268	242.9
	2006	103	258	413	297.0	242	164	305	225.9
	2007	19	290	385	325.5	100	180	305	252.7
	2008	14	315	424	344.4	50	169	301	262.4
	2009	170	280	436	331.2	143	197	372	271.5
	2010	45	280	427	336.2	30	184	300	277.9
	2011	-	-	-	-	149	184	433	263.2
	2012	73	303	438	357.5	525	121	535	285.5
	2013	216	298	448	354.8	646	178	498	308.1
	2014	290	310	468	357.8	894	142	452	275.6
	2015	175	316	476	350.7	699	113	356	272.4
	2016	157	311	442	353.7	668	160	518	267.4

Florida	2005	238	123	452	294	828	55	392	218
	2006	259	103	420	292	960	135	372	228
	2007	206	166	432	318	1362	106	374	235
	2008	159	104	497	314	1742	109	401	242
	2009	226	260	483	325	2274	102	363	247
	2010	474	208	521	329	5997	104	395	250
	2011	541	234	449	330	3405	121	435	265
	2012	159	182	425	329	1985	102	452	267
	2013	164	158	433	342	1452	122	452	275
	2014	124	169	450	336	1616	125	398	252
	2015	127	213	466	348	803	143	358	259
	2016	86	120	415	307	358	129	328	252

Table 5. Summary statistics for Atlantic coast black sea bass lengths (fork lengths) in the Florida charterboat fleet.

Year	**HARVEST**				**DISCARDS**			
	Number measured	*Minimum (mm FL)*	*Maximum (mm FL)*	*Mean (mm FL)*	*Number measured*	*Minimum (mm FL)*	*Maximum (mm FL)*	*Mean (mm FL)*
2013	146	214	477	351	783	129	493	259
2014	161	239	546	358	628	171	413	274
2015	81	191	426	353	254	164	325	272

Table 6. Summary statistics for fishing depths on Florida observer trips positive for black seabass.

Fleet	Year	Depth (m)	No of Trips	No of Stations	Min Depth	Max Depth	Mean Depth
Headboat	*2011*	11-20	11	15	14	20	19
	2011	21-30	40	67	21	30	25
	2011	31-40	4	7	32	40	36
	2011	41-50	2	3	43	44	44
	2012	11-20	5	9	15	20	18
	2012	21-30	43	60	21	30	25
	2012	31-40	1	2	31	32	32
	2012	41-50	1	2	43	48	46
	2012	51-60	1	1	58	58	58
	2013	11-20	5	13	18	20	19
	2013	21-30	36	56	21	30	24
	2013	31-40	2	4	32	36	33
	2013	61-70	1	1	70	70	70
	2013	71-80	1	1	71	71	71
	2014	11-20	3	5	15	20	18
	2014	21-30	46	63	21	30	24
	2014	31-40	1	2	33	36	35
	2015	11-20	3	4	12	20	17
	2015	21-30	41	47	21	30	25
	2015	31-40	1	3	32	35	34
	2016	11-20	6	8	18	20	19
	2016	21-30	24	32	21	30	25
	2016	31-40	3	4	33	38	35
Charterboat	*2013*	11-20	4	8	15	20	18
	2013	21-30	22	33	21	30	25
	2013	31-40	11	15	31	40	33
	2013	41-50	3	5	41	49	43
	2013	51-60	1	2	52	52	52
	2014	11-20	2	3	16	20	19
	2014	21-30	25	38	21	30	25
	2014	31-40	7	10	31	38	35
	2014	41-50	2	2	45	50	48
	2014	81-90	1	1	88	88	88
	2015	11-20	2	5	17	20	19
	2015	21-30	15	21	21	30	25
	2015	31-40	3	3	32	39	36

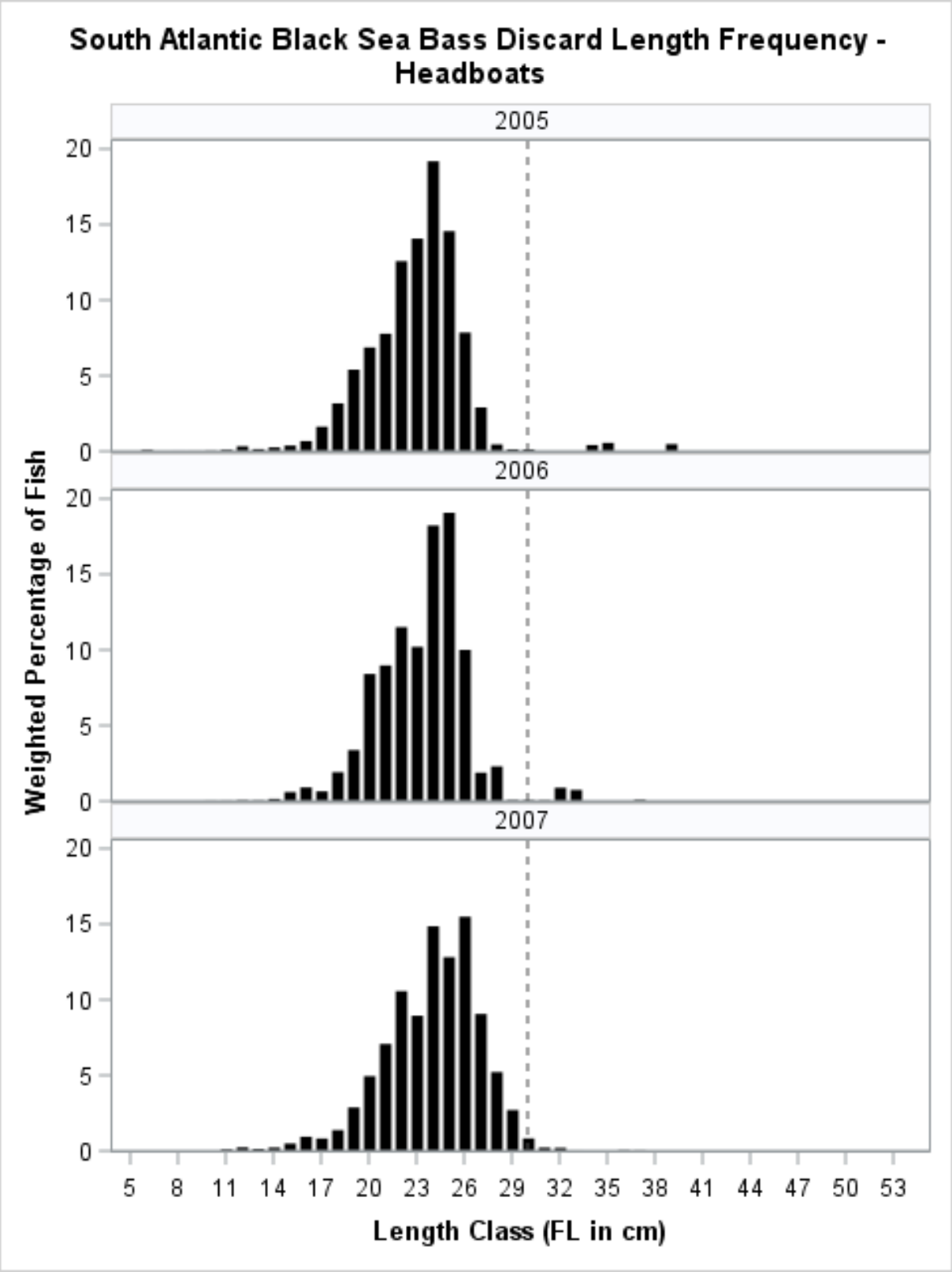
Table 7. Florida Atlantic coast black seabass release conditions, by fishing fleet. Release condition not collected in NC, SC or GA.

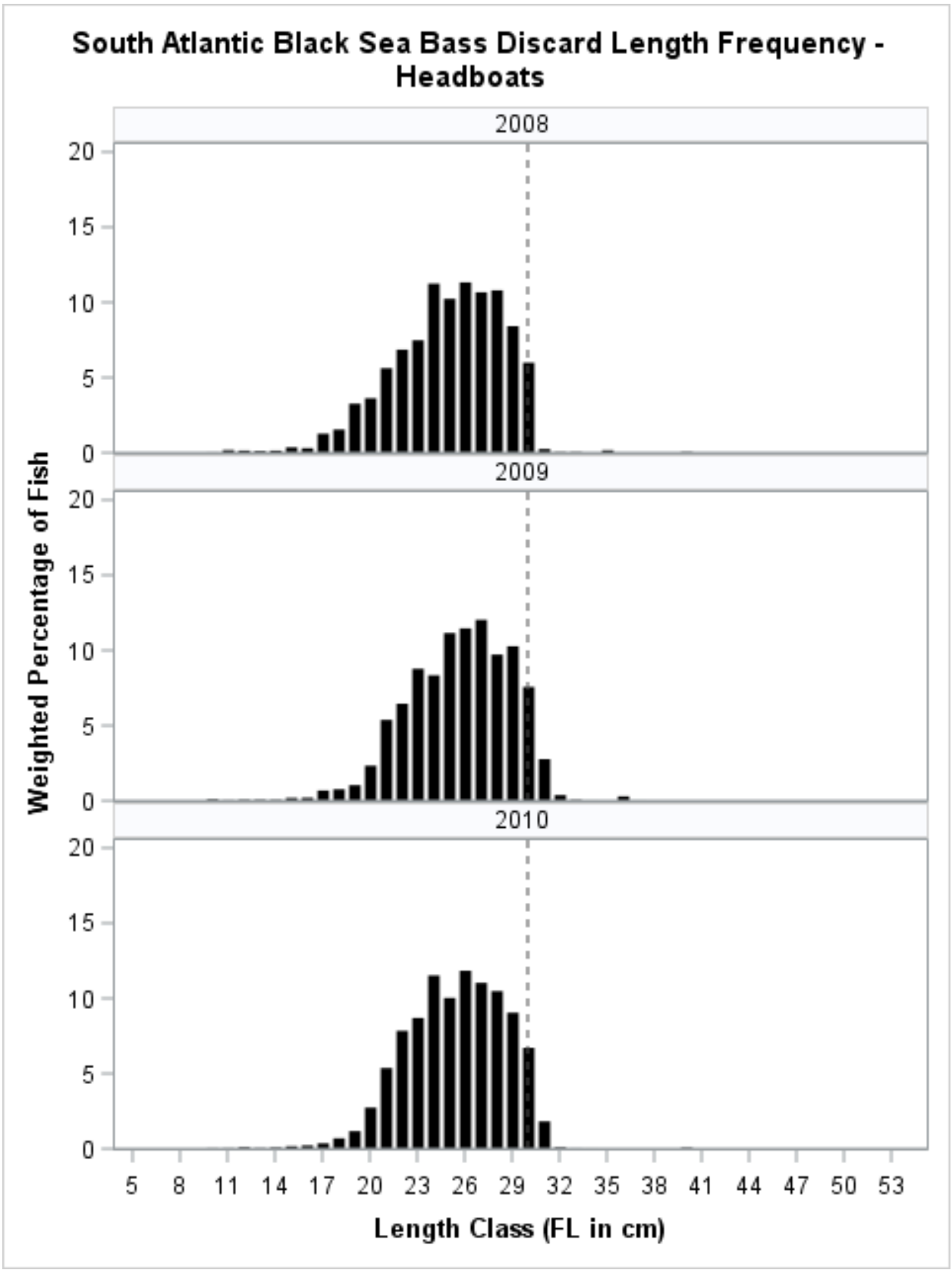
Fleet	Year	Good		Fair		Poor		Eaten		Dead	
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Headboat	*2005*	761	92.1	32	3.9	18	2.2	2	0.2	13	1.6
	2006	887	93.0	41	4.3	21	2.2	0	0.0	5	0.5
	2007	1266	93.4	38	2.8	39	2.9	0	0.0	12	0.9
	2008	1615	93.0	51	2.9	42	2.4	3	0.2	26	1.5
	2009	2164	95.7	29	1.3	47	2.1	0	0.0	21	0.9
	2010	5632	95.6	123	2.1	73	1.2	1	0.0	62	1.1
	2011	3394	97.8	54	1.6	20	0.6	0	0.0	4	0.1
	2012	1968	96.3	25	1.2	49	2.4	0	0.0	1	0.0
	2013	1507	97.5	13	0.8	23	1.5	0	0.0	3	0.2
	2014	1708	98.2	7	0.4	24	1.4	0	0.0	0	0.0
	2015	854	97.8	9	1.0	8	0.9	0	0.0	2	0.2
	2016	354	95.4	7	1.9	10	2.7	0	0.0	0	0.0
Charter	*2013*	816	98.6	6	0.7	6	0.7	0	0.0	0	0.0
	2014	667	98.8	6	0.9	2	0.3	0	0.0	0	0.0
	2015	270	97.5	1	0.4	6	2.2	0	0.0	0	0.0

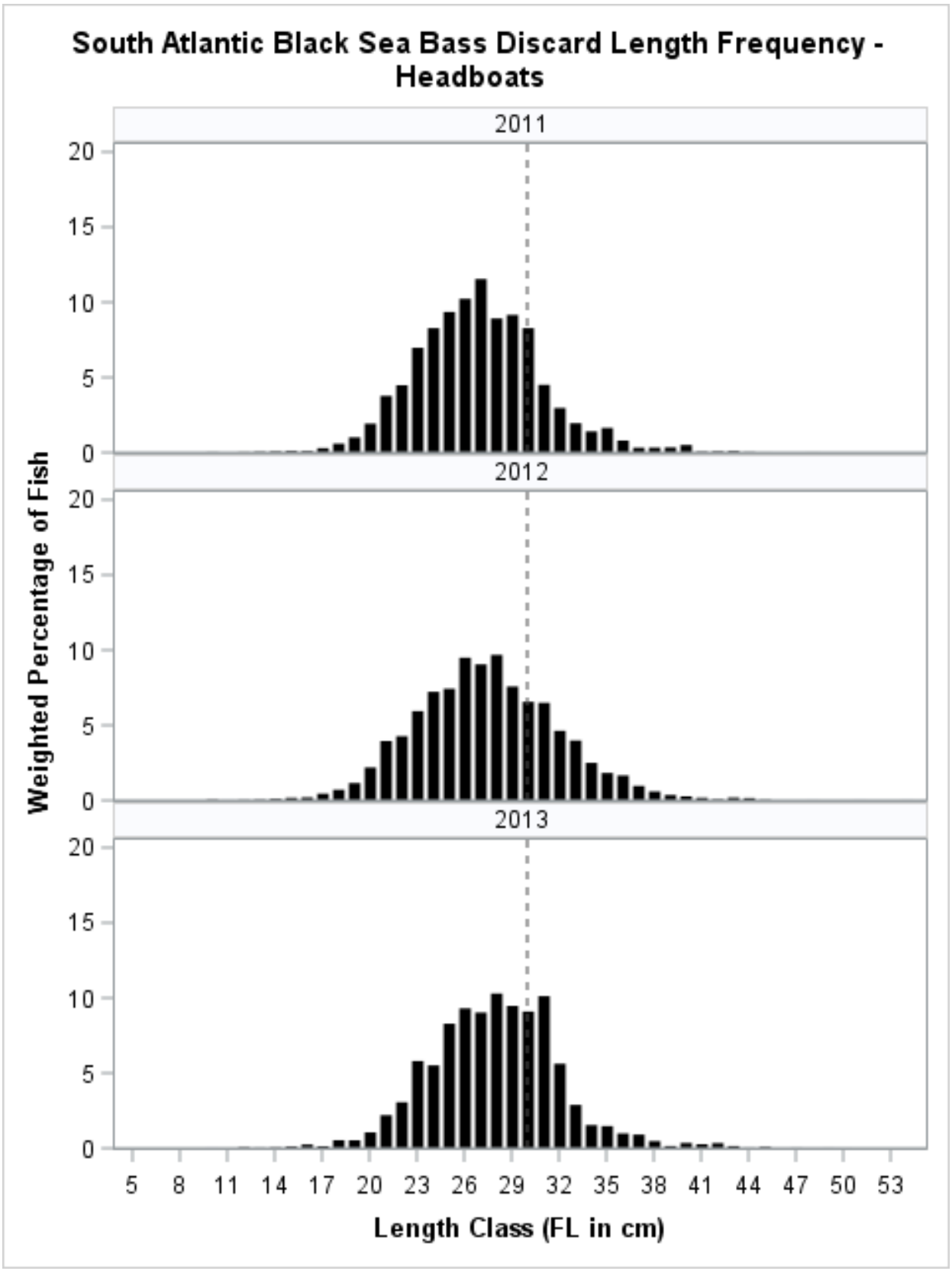
Table 8. Florida Atlantic coast black sea bass release conditions by 20 meter depth bins and fishing fleets. Data is pooled across years from 2011 to 2016. Release condition not collected in NC, SC, GA.

Fleet	Depths (m)	Good		Fair		Poor		Dead	
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Headboat	*11-20*	1350	98.2	13	0.9	11	0.8	1	0.1
	21-30	7844	97.5	87	1.1	103	1.3	9	0.1
	31-40	449	97.0	10	2.2	4	0.9	0	0.0
	41-50	65	80.2	1	1.2	15	18.5	0	0.0
	51-60	9	69.2	3	23.1	1	7.7	0	0.0
	61-70	3	100.0	0	0.0	0	0.0	0	0.0
	71-80	1	100.0	0	0.0	0	0.0	0	0.0
Charterboat	*11-20*	306	98.7	3	1.0	1	0.3	0	0.0
	21-30	1198	98.9	5	0.4	8	0.7	0	0.0
	31-40	222	97.4	3	1.3	3	1.3	0	0.0
	41-50	23	85.2	2	7.4	2	7.4	0	0.0
	51-60	4	100.0	0	0.0	0	0.0	0	0.0

Figure 1. Weighted Florida Atlantic coast black seabass length frequencies from at-sea headboat observer trips.




South Atlantic Black Sea Bass Discard Length Frequency - Headboats
2008
2009
2010
Weighted Percentage of Fish
0
5
10
15
20
5 8 11 14 17 20 23 26 29 32 35 38 41 44 47 50 53
Length Class (FL in cm)


South Atlantic Black Sea Bass Discard Length Frequency - Headboats
2011
2012
2013
Weighted Percentage of Fish
0
5
10
15
20
5 8 11 14 17 20 23 26 29 32 35 38 41 44 47 50 53
Length Class (FL in cm)

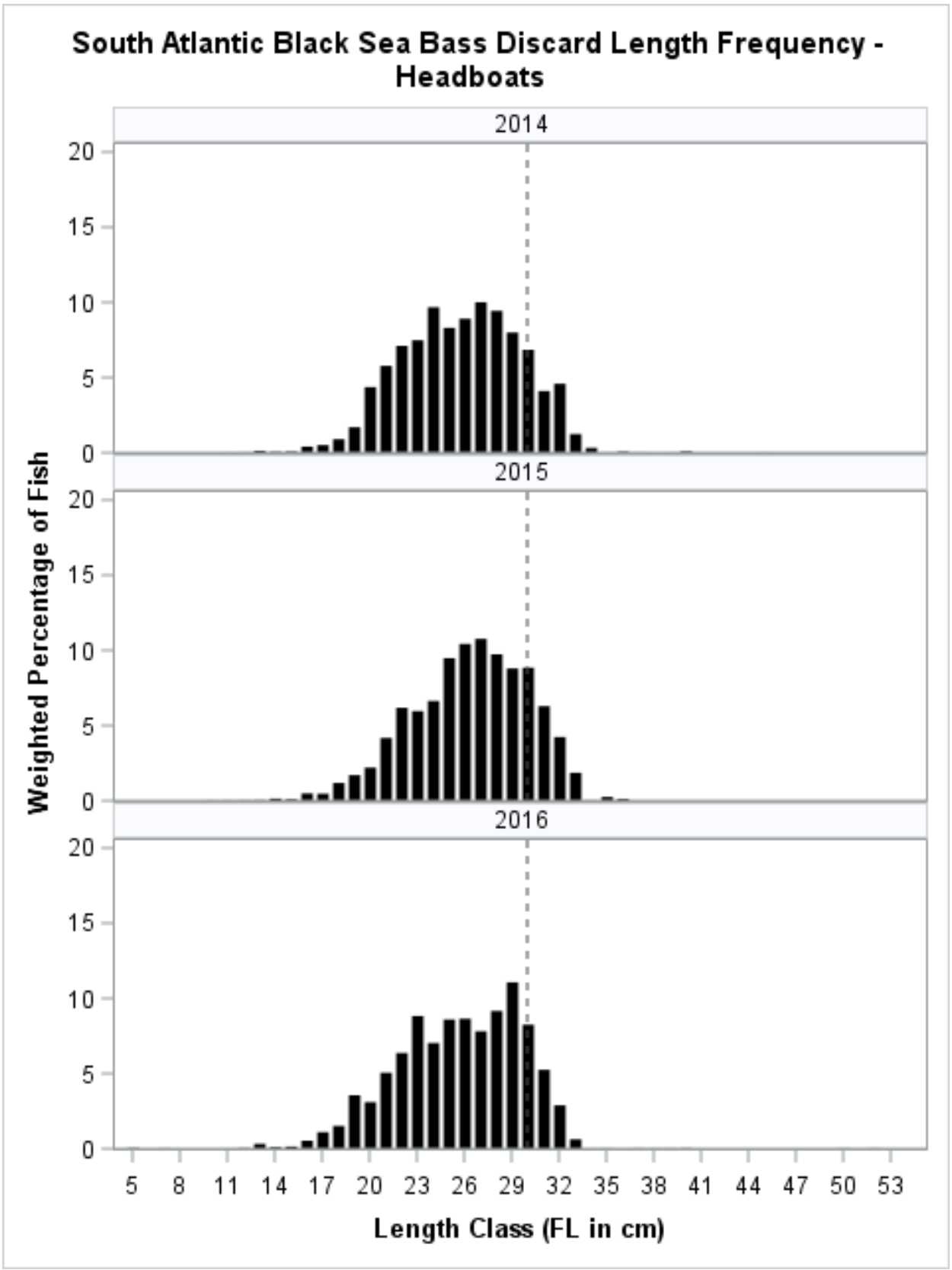

South Atlantic Black Sea Bass Discard Length Frequency - Headboats
2014
2015
2016
Weighted Percentage of Fish
0
5
10
15
20
5 8 11 14 17 20 23 26 29 32 35 38 41 44 47 50 53
Length Class (FL in cm)

Figure 2. Florida Atlantic coast black seabass length frequencies from at-sea charter boat observer trips.