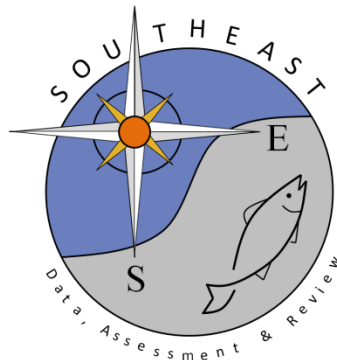


A Summary of Length Frequency and Hook Usage from the Size Distribution of
Gray Triggerfish Discards recorded during Recreational Fishery Surveys in the
South Atlantic

Ellie Corbett, Beverly Sauls

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A Summary of Length Frequency and Hook Usage from the Size Distribution of Gray Triggerfish Discards recorded during Recreational Fishery Surveys in the South Atlantic

Prepared by:

Ellie Corbett, Beverly Sauls
Florida Fish and Wildlife Conservation Commission
Fish and Wildlife Research Institute
Saint Petersburg, Florida

Andrew Cathey, North Carolina Division of Marine Fisheries
Washington, North Carolina

For:

SEDAR 82, South Atlantic Gray Triggerfish Data Workshop, September, 2022.

Detailed information on the size and release condition of discarded fish are not collected in traditional dockside surveys of recreational fisheries. At-sea observer surveys provide valuable information on the size and condition of discarded fish. This report provides a summary of available information on the size composition, release condition, and hook usage information for Gray Triggerfish.

At-Sea Observer Survey Coverage

Headboat vessels have been consistently monitored from North Carolina through Southeast Florida since 2005 with the exception of 2020, when surveys were suspended due to the Covid pandemic (Table 1). In the Florida Keys, headboat coverage was intermittent due to funding availability (Table 1). Charter vessels were also sampled intermittently on the Atlantic coast of Florida as funding was available (Table 1).

At-Sea Observer Survey Methods

Headboat vessels were randomly selected each month throughout the year. 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.

Trip level information collected included the area fished (state or federal waters), region (described below), dock-to-dock hours, duration of fishing (to the nearest half hour), number of anglers, and minimum and maximum depths (feet) fished (FL only). For each fish, biologists recorded the species, disposition, size (fork length in mm), and the condition of fish that were released (FL only). 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.

Florida – 2010 – Present

Starting in 2010 on the Atlantic coast of Florida, methods were modified to collect more detailed information on the capture depth, capture and release methods, and release condition for each discarded fish observed. Hook type, hook size and hook location were recorded for each fish, and information on J-hooks and circle hooks were examined in this analysis. Hook size was determined in the field using a standardized sizing chart (Figure 3).

Data Elements

Trip level information for each trip included the area fished, duration of fishing (to the nearest half hour), and disposition of fish.

Region fished for states of the south Atlantic was coded as:

- North Carolina (NC): headboat area 01, 03, 10
- South Carolina (SC): headboat area 05
- Northeast (NE): Georgia and northeast Florida headboat area 06, 07, 08
- Southeast (SE): southeast Florida headboat area 11
- Keys (KY): Florida Keys headboat area 12, 17 (including Monroe County up to 2013)

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

Disposition was coded as:

1. Discard
 - a. thrown back alive, legal
 - b. thrown back alive, not legal
2. Harvest
 - a. plan to eat
 - b. used for bait or plan to use for bait
 - c. sold or plan to sell
 - d. thrown back dead or plan to throw away

Hook size was coded as:

- Small: < 4 or 4/0
- Medium: 4 or 4/0 to 9 or 9/0
- Large: 8 or 8/0 +

Sample Weighting

Headboat vessels report fishing effort in logbook trip reports through the Southeast Headboat Survey. Logbook effort was provided by the NMFS Southeast Fisheries Science Center in Beaufort, NC (Table 2). Sample data was weighted to account for the difference in sampling by trip types throughout the south Atlantic regions described (Table 5).

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

$$Wt = Nt / N / nt / n$$

Where Nt / N is the number of trips of trip type t divided by total number of trips reported on logbook trip reports, and nt / n is the number of trips of trip type t sampled during fishery observer surveys divided by the total number of sampled trips. Trip-types with $Wt < 1$ are down-weighted to account for oversampling, and trip-types with $Wt > 1$ are inflated to account for under sampling. Weights were calculated including region to account for differences in the number of trips sampled in the south Atlantic.

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 merged with calculated discard weights and summed by year for the south Atlantic jurisdiction. The weighted frequency of fish in a single length bin (x) was calculated as follows:

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

Where L_H equals the number of fish in each length bin x for discarded fish collected on half day trips, L_Q corresponds with $3/4$ day trips, and L_F corresponds with full day trips.

The proportion of fish in a single length bin (p_x) was calculated as follows:

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

Where the numerator is the weighted frequency of fish in a single length bin (x) and the denominator is the sum of all weighted frequencies of fish 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. Data for the charter fleet was available for 2013, 2014, and 2015. Surveying effort did not occur from 2016 to 2020. No weights were generated for the charter fishery.

Results

At-sea headboat observer data

From 2005 to 2020 in the headboat fleet, at-sea biologists observed 5138 trips and 30.43% of those were positive for Gray Triggerfish (Table 2 and Table 3). Southeast Florida had the highest percentage of Gray Triggerfish encounters by trip (57%) and South Carolina had the lowest percentage of encounters (9%). These trends were the same for the percentage of trips with discarded Gray Triggerfish, the highest by region being southeast Florida (46%) and the lowest by region being South Carolina (1%) (Table 3).

Length summaries of harvested and discarded Gray Triggerfish from headboat fleets by region for years 2005-2020 are presented in Tables 6. In total, 4697 harvested Gray Triggerfish were measured, and 3238 discarded Gray Triggerfish were measured, with an average fork length of 342mm and 278mm respectively. It is important to note that prior to 2015, the south Atlantic excluding Florida did not have a minimum size limit on Gray Triggerfish but was set to 12 inches (FL) in 2015. Florida length requirements recently changed from 14 inches (FL) to 12 inches (FL) in 2020. Weighted length frequencies of discarded fish are presented by year for all regions in Figure 1.

At-sea charter observer data

From 2013 to 2015 in the charter fleet, at-sea biologists observed 674 trips on Florida's south Atlantic coast. 24% of those trips were positive for Gray Triggerfish and 15.72% of those trips included Gray Triggerfish discards (Table 4).

Length summaries of harvested and discarded Gray Triggerfish in charter fleets by region for years 2013-2015 are presented in Table 7. A total of 544 fish were measured and harvested and a total of 376 fish were measured and discarded. The average fork length of harvested fish was 372mm and the average fork length of discarded fish was 272mm. Raw length frequencies of discarded fish are presented by year for all regions in Figure 2.

Hook Analysis

From 2010-2020 in the headboat fleet and 2013-2015 in the charter fleet, 4218 Gray Triggerfish were caught using a circle hook or a J-hook. In Northeast Florida 75% of fish were caught with circle hooks. In both southeast Florida and the Florida Keys, J-hooks were used more frequently (87% of fish and 92% of fish respectively) (Table 8). The size of combined hook types used is presented in Table 9. 67% of fish in northeast Florida were caught using a medium size hook (size 4-9) while 59% of fish in southeast Florida and 95% of fish in the Florida Keys were caught using J-hooks. It is important to note that as of January 2021, Florida law requires anglers fishing reef fish on hook and line north of 28 degrees latitude use non-offset, non-stainless steel circle hooks. South of 28 degrees latitude, only non-stainless-steel hooks are required (See Figure 4 for a comparison of hook type by latitude).

Literature Cited

- Germeroth, Rachel and Beverly Sauls. 2019. The Effects of Hook Type on Gray Triggerfish Catch-Per-Unit-Effort. SEDAR62 WP-11. SEDAR, North Charleston, SC. 5pp.
- Sauls, B., A. Gray, C. Wilson, and K. Fitzpatrick. 2015. Size Distribution, Release Condition, and Estimated Discard Mortality of Gray Triggerfish Observed in For-Hire Recreational Fisheries in the South Atlantic. SEDAR41-DW34. SEDAR, North Charleston, SC. 13 pp.
- Vecchio, Julie, Jessica Carroll, Dominique Lazarre, Beverly Sauls. 2022. Size and age information for Mutton Snapper, *Lutjanus analis*, collected in association with fishery dependent monitoring along Florida's coast. SEDAR79-DW-03. SEDAR, North Charleston, SC. 19 pp.

Table 1. Sampling coverage for At-sea observer trips in **Florida** by region and year. The * indicates partial coverage from January to March in 2020 before field work was suspended during the pandemic.

Headboat Areas	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*
Northeast Florida	H	H	H	H	H	H	H	H	H,C	H,C	H,C	H	H	H	H	H
Southeast Florida	H	H	H	H	H	H	H	H	H,C	H,C	H,C	H	H	H	H	H
Florida Keys	H	H	H			H,C	H,C	H,C	H,C	C	C	H,C	H,C	H,C	H,C	H,C

Table 2. South Atlantic sampled headboat at-sea observer trips by year and region for all species. Sampling in 2009 only represents half of the year – June to December and sampling in 2020 represents January to March.

Year	NC	SC	NE	SE	KY	All
2005	152	71	49	95	36	403
2006	104	61	47	71	52	335
2007	129	96	62	71	45	403
2008	129	69	56	76	.	330
2009	121	63	65	76	.	325
2010	165	52	51	74	20	362
2011	143	34	51	73	16	317
2012	145	42	66	72	25	350
2013	116	41	67	82	16	322
2014	145	40	73	83	.	341
2015	100	25	62	82	2	271
2016	115	29	60	71	44	319
2017	130	36	58	79	48	351
2018	95	31	57	84	66	333
2019	109	29	56	80	67	341
2020	1	.	10	16	8	35
Total	1899	719	890	1185	445	5138

Table 3. South Atlantic sampled headboat at-sea observer trips positive for Gray Triggerfish (harvested and/or discarded) and trips where Gray Triggerfish were only discarded.

Year	NC		SC		NE		SE		KEYS	
	Positive Trips	Discard Trips	Positive Trips	Discard Trips	Positive Trips	Discard Trips	Positive Trips	Discard Trips	Positive Trips	Discard Trips
2005	24	.	12	.	27	10	53	30	11	5
2006	15	.	7	.	24	8	30	23	16	12
2007	23	3	9	1	35	10	30	24	7	6
2008	20	1	6	1	31	5	28	23	.	.
2009	20	6	.	.	35	13	44	32	.	.
2010	25	1	.	.	35	7	40	28	13	13
2011	22	1	9	3	25	2	29	18	8	8
2012	29	1	4	1	28	4	36	24	6	6
2013	23	.	.	.	39	5	44	32	7	7
2014	8	.	1	.	27	6	52	43	.	.
2015	5	1	1	.	24	10	64	61	.	.
2016	14	7	6	3	24	18	57	54	15	15
2017	24	13	2	.	24	13	51	48	12	10
2018	17	5	4	2	17	11	52	49	12	12
2019	20	9	2	2	21	11	56	53	12	12
2020	.	.	.	.	1	.	9	9	1	1
<i>Totals</i>	289	48	63	13	417	133	675	551	120	107

Table 4. Charter boat trips sampled in Florida by year and region including number of trips positive for Gray Triggerfish (harvested and/or discarded) and for Gray Triggerfish discards only.

Year	Trips Sampled	Positive Trips	Discard Trips
2013	218	53	30
2014	235	61	42
2015	221	49	34
<i>Totals</i>	674	163	106

Table 5. Sample weights applied to Florida headboat discards, based on length of trips (trip types) and region (North Carolina, South Carolina, Northeast (Georgia and Northeast Florida), Southeast (Southeast Florida), Florida Keys).

Year	NC			SC			NE			SC			KY		
	Half Day	3/4 Day	Full Day	Half Day	3/4 Day	Full Day	Half Day	3/4 Day	Full Day	Half Day	3/4 Day	Full Day	Half Day	3/4 Day	Full Day
2005	0.255	0.009	0.322	0.878	1.419	0.346	1.126	0.004	1.442	2.087	0.241	4.692	2.376	0.966	.
2006	0.154	0.067	0.303	1.027	0.558	0.73	1.069	0.008	2.175	2.346	0.43	.	1.012	1.495	11.785
2007	0.101	0.131	0.552	0.757	0.293	1.571	0.842	0.243	2.109	2.615	0.645	.	1.203	0.689	.
2008	0.075	0.83	0.286	0.796	2.418	2.171	2.139	0.152	1.932	1.723	0.436	2.775	.	.	.
2009	0.087	0.038	0.717	0.836	0.758	.	2.004	0.079	2.943	1.415	0.614	.	.	.	.
2010	0.108	0.025	0.263	1.205	3.239	.	1.484	0.044	2.254	1.808	0.809	.	2.594	1.651	.
2011	0.111	0.013	0.237	3.268	0.362	11.876	1.25	0.266	2.17	1.587	0.598	.	3.376	2.174	9.093
2012	0.157	0.021	0.165	1.758	1.869	2.068	0.947	0.334	1.313	2.103	0.415	.	3.55	0.971	.
2013	0.096	0.151	0.177	1.03	1.969	.	1.168	0.517	0.689	1.891	1.039	0.645	3.798	1.672	.
2014	0.044	0.15	0.413	0.957	.	.	0.381	0.438	0.689	1.996	.	.	.	.	.
2015	0.06	0.129	0.64	1.088	.	.	0.437	0.374	0.53	1.658	4.007	1.456	21.548	.	.
2016	0.063	0.183	0.25	1.903	1.303	1.511	0.372	0.792	0.626	2.291	5.335	1.338	1.313	0.946	3.574
2017	0.104	0.135	0.302	1.797	0.664	7.754	0.822	0.639	1.043	1.435	2.267	.	1.54	7.036	.
2018	0.077	0.162	0.328	2.579	0.541	3.429	0.941	0.51	0.919	1.252	.	.	1.09	.	.
2019	0.137	0.077	0.21	2.534	2.672	2.742	0.602	0.945	0.858	1.301	1.376	3.771	1.161	.	.
2020	.	.	1.186	.	.	.	0.362	0.187	1.125	0.636	.	.	0.775	.	.

Table 6. Length summaries for discarded and harvested Gray Triggerfish observed on headboat trips in Atlantic waters, by year and region. Sampling in 2009 represents data collected from June through December and sampling in 2020 represents data collected from January through March.

Region	Year	HARVEST				DISCARDS			
		<i>Number Measured</i>	<i>Minimum (mm FL)</i>	<i>Maximum (mm FL)</i>	<i>Mean (mm FL)</i>	<i>Number Measured</i>	<i>Minimum (mm FL)</i>	<i>Maximum (mm FL)</i>	<i>Mean (mm FL)</i>
North Carolina	2005	99	240	442	340.8	.	.	.	.
	2006	27	233	420	331.3	.	.	.	.
	2007	81	228	459	341.2	5	251	364	298.4
	2008	107	256	459	347.4	20	133	444	335.6
	2009	95	257	429	333.7	7	241	295	267.4
	2010	160	255	459	335.5	1	236	236	236
	2011	105	238	444	344.5	1	339	339	339
	2012	138	230	513	362.2	1	232	232	232
	2013	160	246	447	345	.	.	.	.
	2014	73	283	426	349.4	.	.	.	.
	2015	33	231	440	322.3	1	248	248	248
	2016	55	280	426	335	53	237	306	280.2
	2017	142	308	452	348.3	83	246	307	286.1
	2018	58	293	524	364.6	13	270	304	290.8
2019	109	285	440	339.6	72	255	310	285.8	
South Carolina	2005	21	286	428	336.9	.	.	.	.
	2006	12	340	596	419.8	.	.	.	.
	2007	21	275	380	338.1	1	360	360	360
	2008	11	239	393	313.8	1	374	374	374
	2011	91	252	483	369.3	8	280	403	324.5
	2012	38	246	476	342.8	1	266	266	266
	2014	1	370	370	370	.	.	.	.
	2015	1	372	372	372	.	.	.	.
	2016	12	312	428	361	3	265	295	281.3
	2017	28	320	395	355.6	.	.	.	.
	2018	24	309	413	361.6	2	281	303	292
2019	7	310	422	358.4	2	251	297	274	
Northeast (Georgia and Northeast Florida)	2005	122	234	530	332.7	23	175	315	256.6
	2006	80	280	565	347.6	11	232	304	266.1
	2007	158	243	466	342.4	14	216	307	265
	2008	104	236	468	350.6	8	225	284	263
	2009	177	248	520	344.8	19	206	292	267.6
	2010	235	242	684	354.8	16	230	321	286.4
	2011	80	285	456	361.5	2	276	293	284.5
	2012	91	269	494	355.4	4	236	280	263

	2013	240	246	486	361.7	8	235	301	272.3
	2014	173	248	490	363.4	7	270	294	280
	2015	66	273	498	369.3	31	227	348	293.5
	2016	44	265	481	366.7	35	248	351	304.1
	2017	69	294	496	354.1	24	216	371	292.5
	2018	33	310	482	369.6	29	224	454	316.3
	2019	62	295	497	358.1	41	233	354	295.3
	2020	1	369	369	369	.	.	.	.
<i>Southeast Florida</i>	2005	187	243	472	292.7	89	188	365	254.5
	2006	75	248	368	305.4	66	161	385	267.2
	2007	40	273	438	337.3	78	210	316	269.5
	2008	88	251	485	322.5	63	201	341	271
	2009	86	286	453	330.5	103	170	375	268.7
	2010	116	227	560	340.7	74	210	392	273.3
	2011	70	240	459	346.7	34	234	316	279.9
	2012	38	257	418	329.3	43	204	383	270.3
	2013	72	221	438	312.1	127	195	331	270.5
	2014	77	263	386	316.7	205	158	370	273.5
	2015	61	294	458	323.2	346	178	352	269.1
	2016	82	300	415	328.6	326	206	340	275.3
	2017	138	271	440	326.1	287	207	396	277.9
	2018	37	185	366	317.7	286	182	346	269.6
2019	43	282	390	324	303	167	342	274.6	
2020	2	311	387	349	45	207	307	262	
<i>Florida Keys</i>	2005	20	262	490	351.4	10	203	268	243.2
	2006	13	260	531	315.9	26	215	301	250.3
	2007	1	245	245	245	13	231	291	263.1
	2010	1	306	306	306	31	166	321	262.1
	2011	.	.	.	.	14	209	310	264.9
	2012	.	.	.	.	12	215	289	262.6
	2013	.	.	.	.	8	218	286	253.9
	2016	2	304	387	345.5	28	194	315	247.1
	2017	3	317	357	335.3	28	221	320	276.8
	2018	1	352	352	352	28	232	337	281.9
	2019	.	.	.	.	13	194	343	274.7
2020	.	.	.	.	5	270	342	294.4	

Table 7. Length summaries for discarded and harvested Gray Triggerfish observed on charter boat at-sea observer trips in Atlantic waters, by year and region. Data only collected in Southeast Florida for years 2013, 2014, and 2015.

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	219	262	554	374.9	81	182	314	271.6
2014	219	291	529	367.8	149	194	414	269.5
2015	106	281	466	375.4	146	185	368	277.8

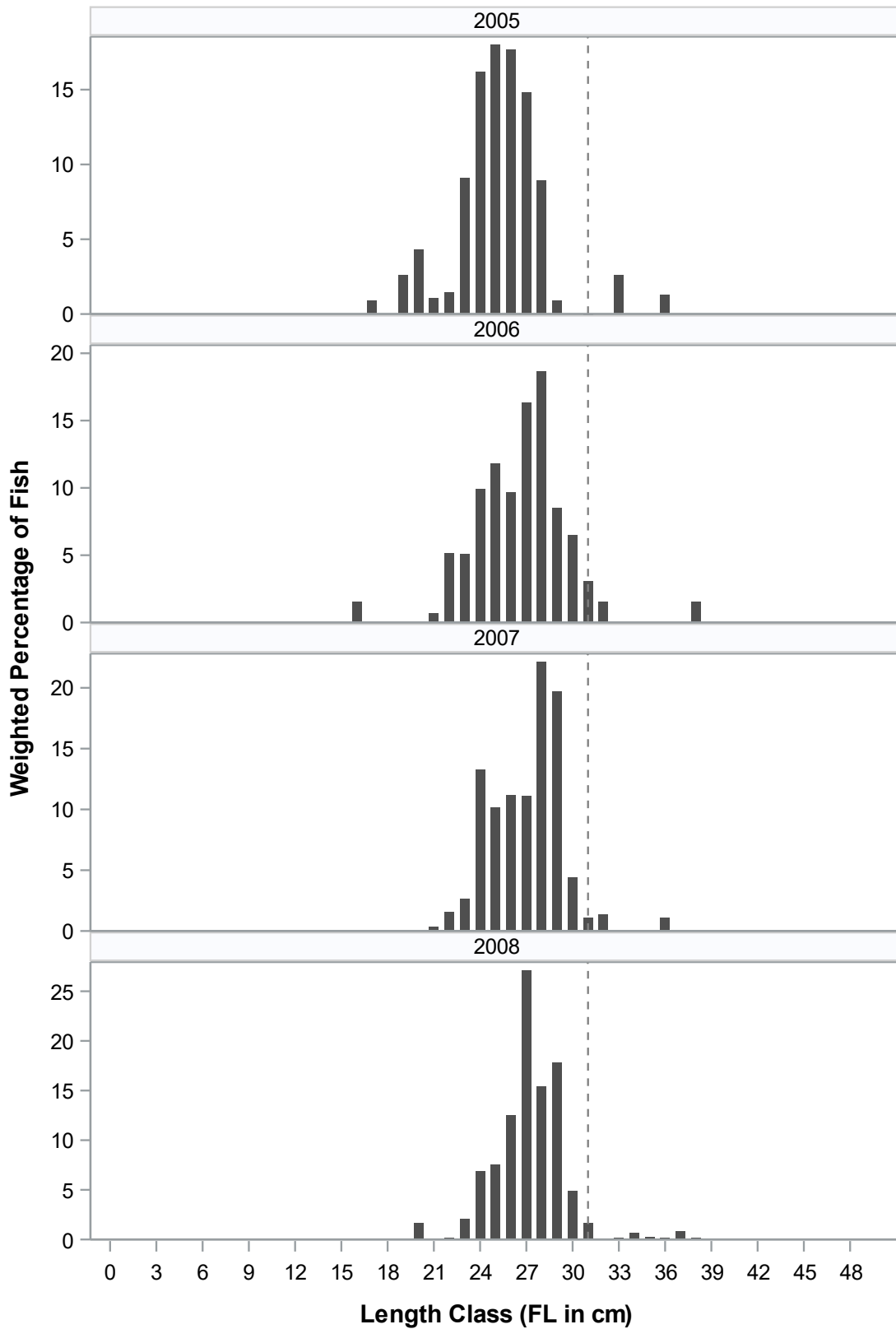
Table 8. Numbers and percentages of Circle and J-Hook use in rods on charter and headboat vessels which caught Gray Triggerfish; by region for years 2010-2020. NEFL distinguished from NE jurisdiction in length frequency analysis to omit the state of Georgia.

	NEFL	SE	KEYS
Hook Type	<i>N=1017</i>	<i>N=2967</i>	<i>N=234</i>
Circle Hook	74.63	15.91	8.12
J-Hook	25.37	84.09	91.88

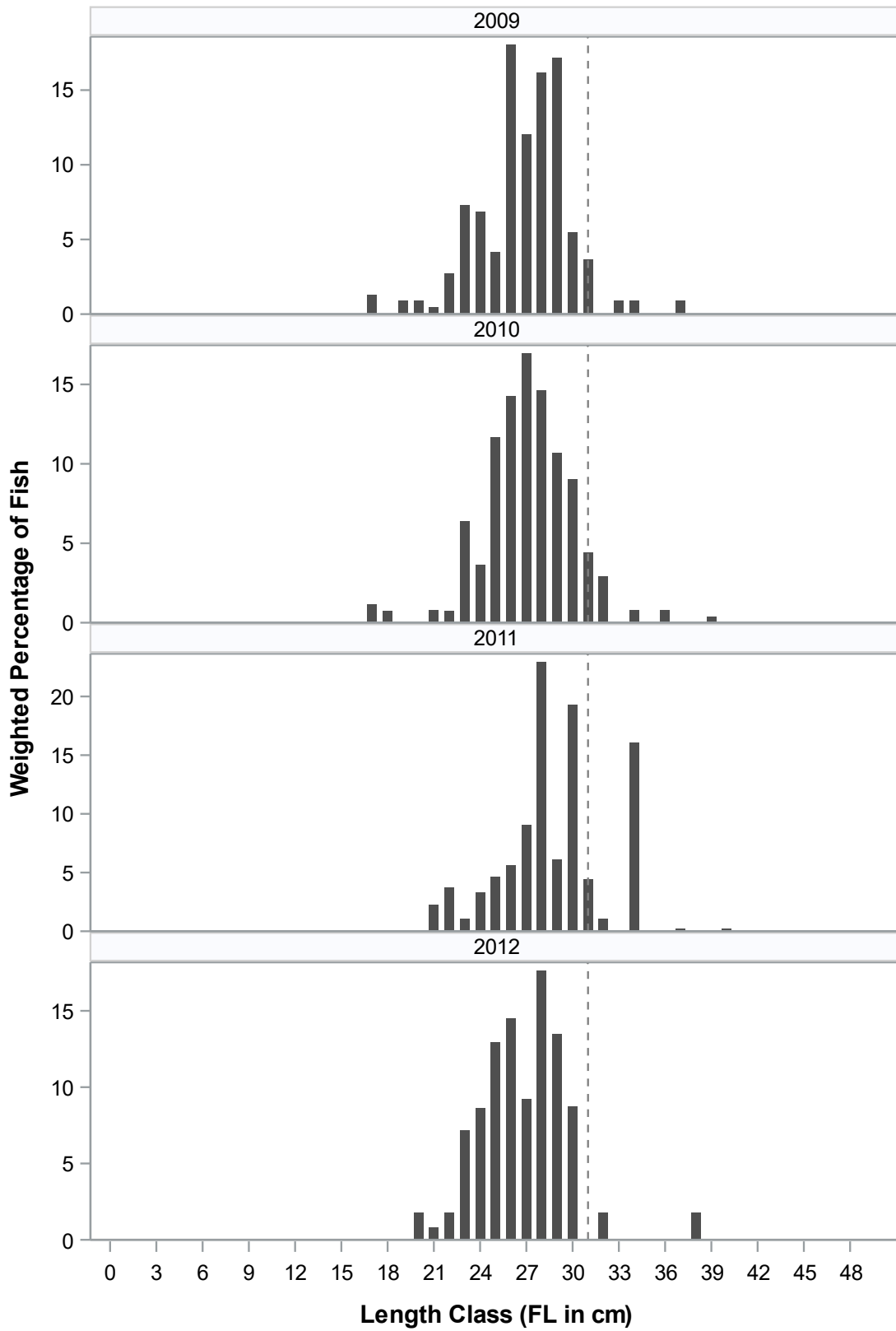
Table 9. Numbers and percentages of hook size use in rods on charter and headboat vessels which caught Gray Triggerfish; by region for years 2010-2020. Hook sizes are further described in Data Elements.

	NEFL	SE	KEYS
Hook Size	<i>N=1017</i>	<i>N=2967</i>	<i>N=234</i>
Small	24.58	58.88	94.87
Medium	66.86	41.12	5.13
Large	8.55	.	.

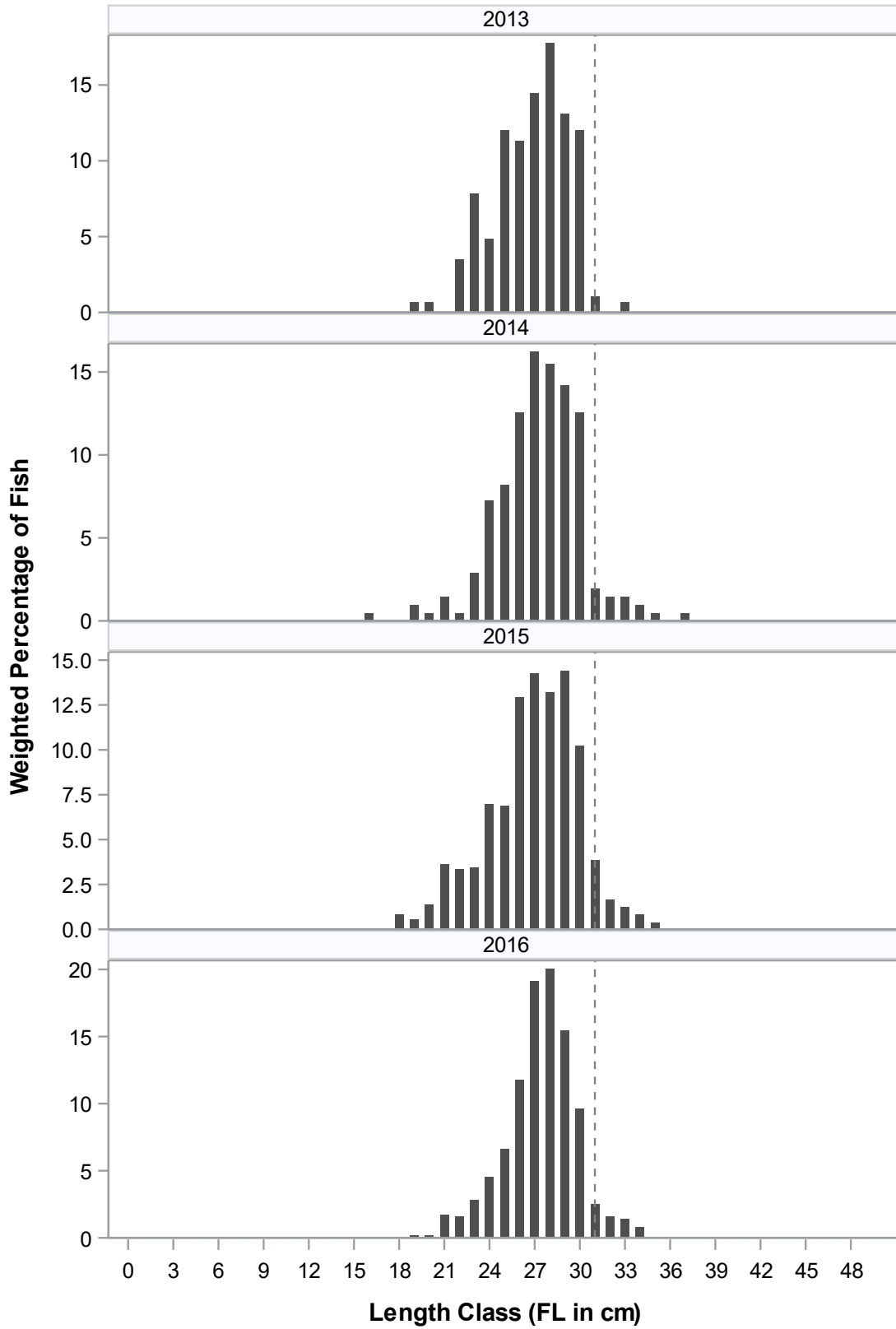
South Atlantic Gray Triggerfish Discard Length Frequency - Headboats



South Atlantic Gray Triggerfish Discard Length Frequency - Headboats



South Atlantic Gray Triggerfish Discard Length Frequency - Headboats



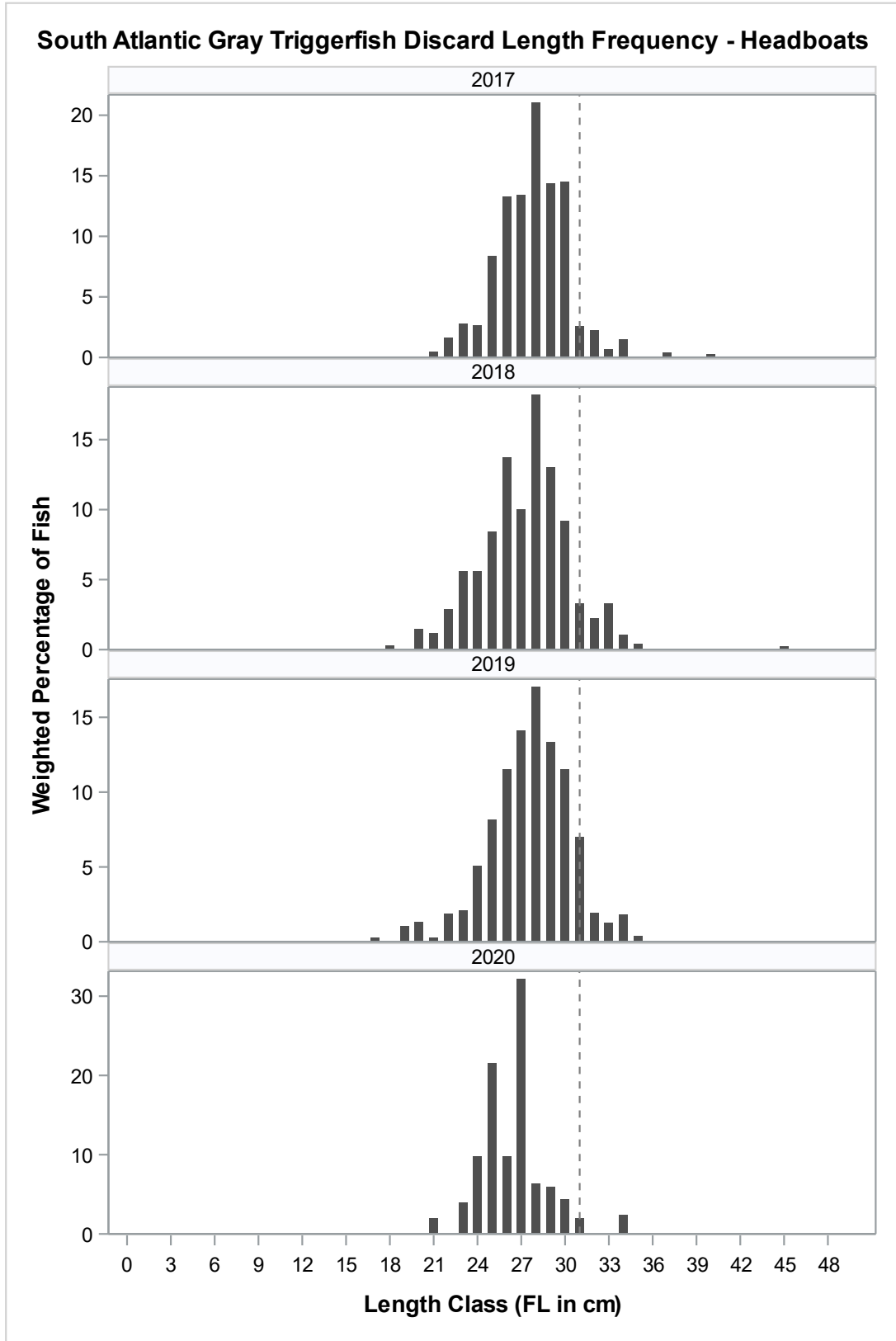


Figure 1. Weighted length frequencies of discarded Gray Triggerfish measured by at-sea observers on headboats along the South Atlantic from 2005-2020.

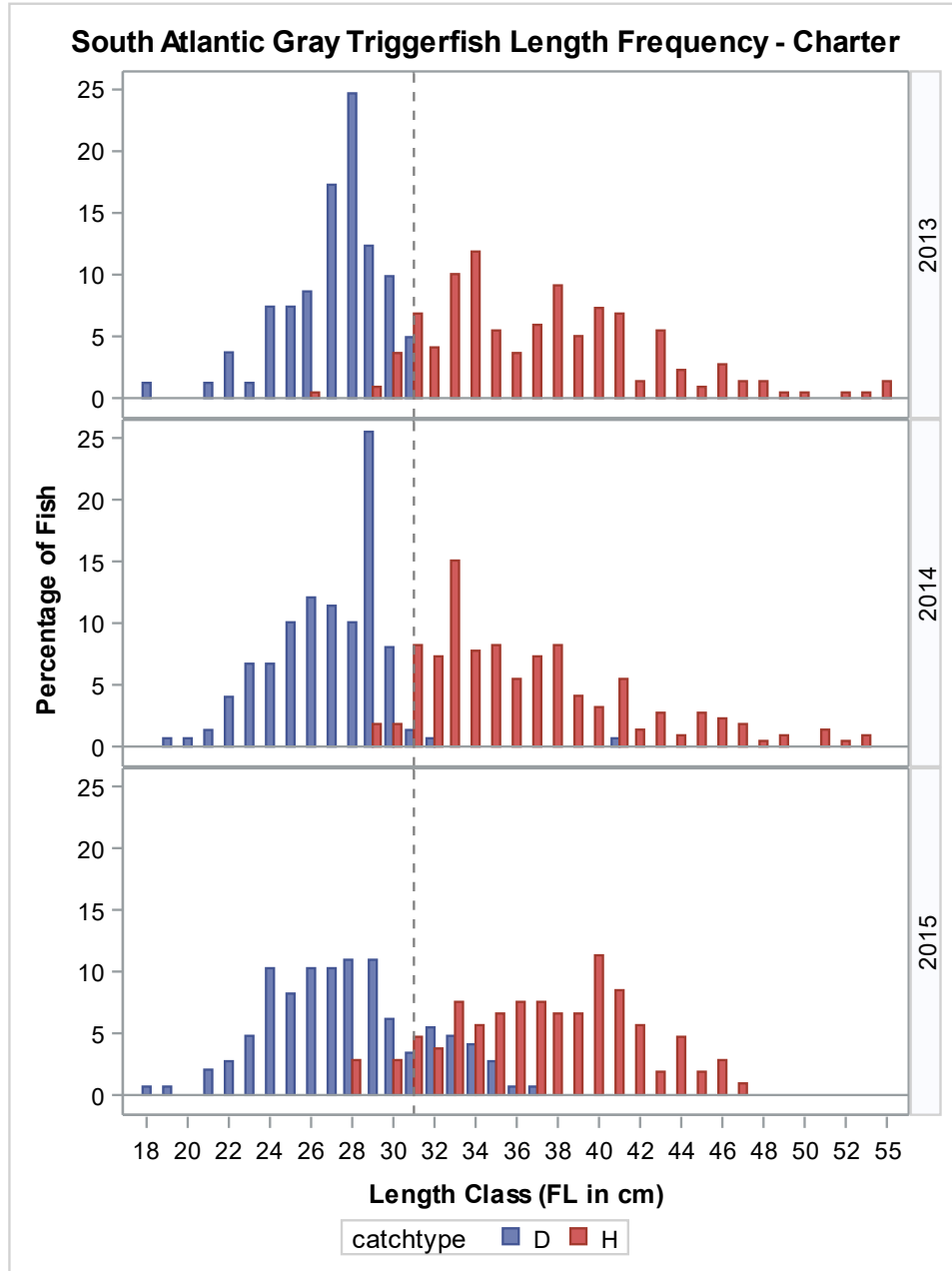


Figure 2. un-weighted (raw) length frequencies of harvested and discarded Gray Triggerfish measured by at-sea observers on charter boats in south Atlantic Florida only waters from 2013-2015.

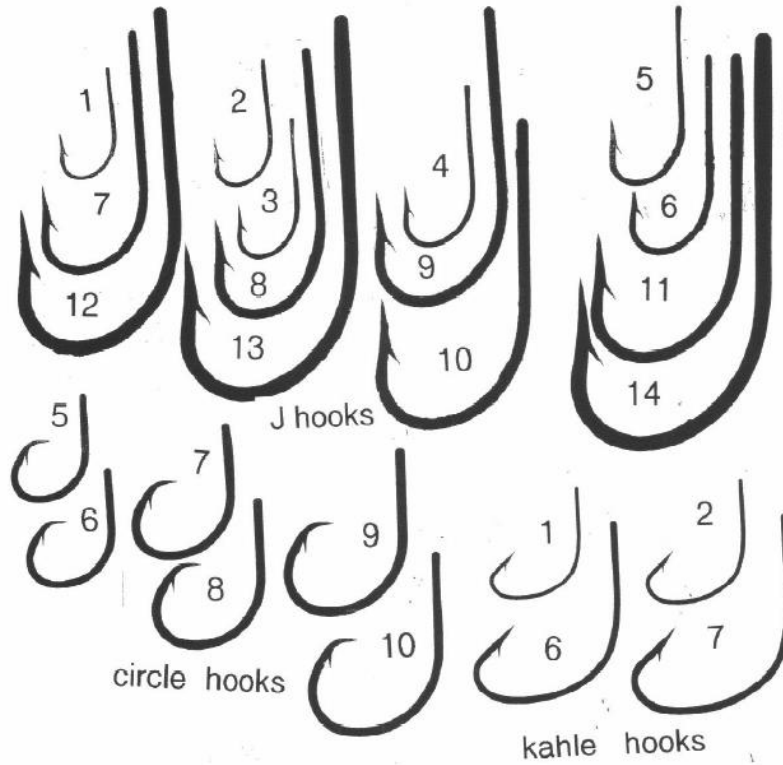


Figure 3. Hook sizing chart used in the field. Only circle hooks and J-hooks were used in analysis. Hook sizing categories assigned based on hook width explained in Data Elements chart. Taken from Germeroth & Sauls (2019).

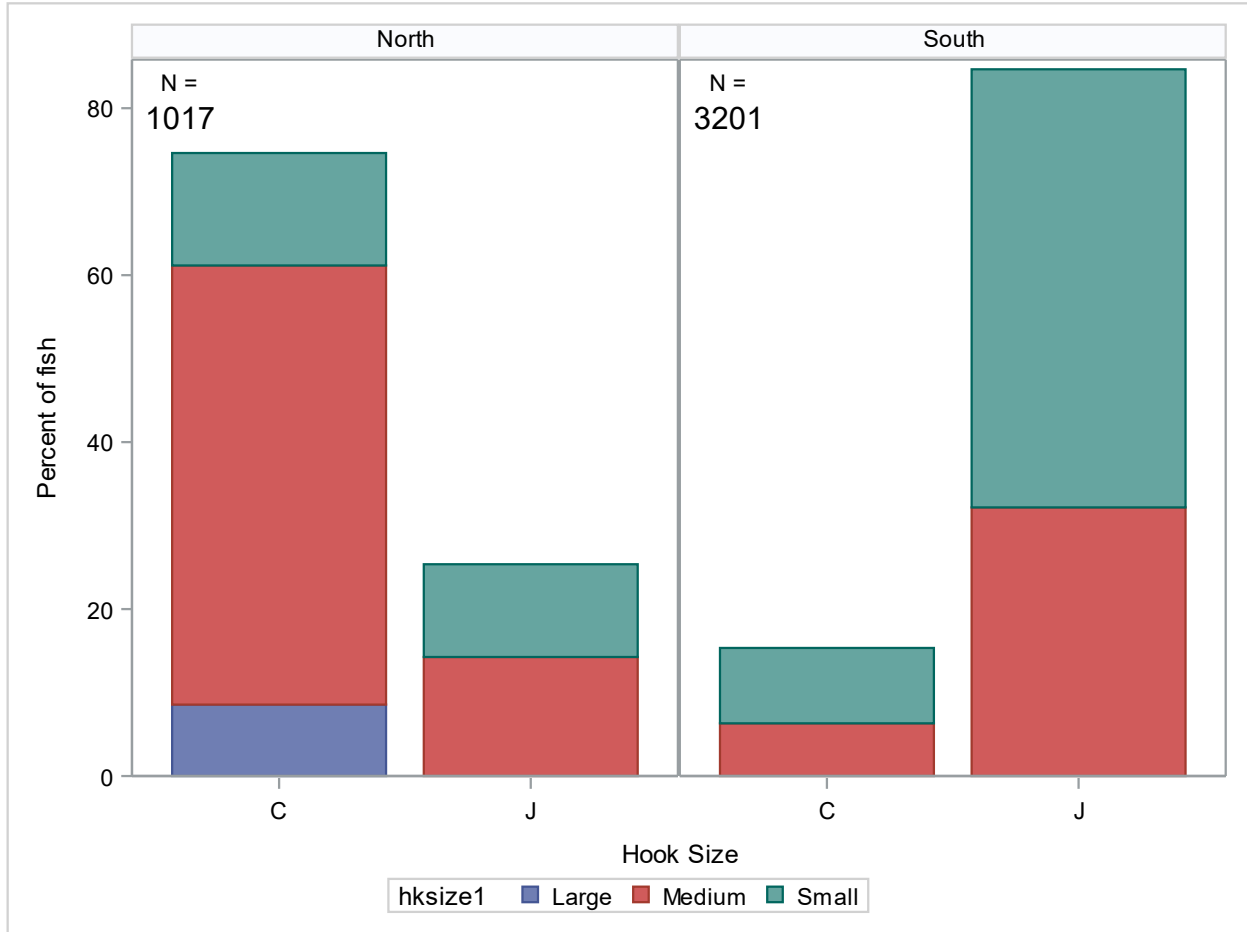


Figure 4. Percentages of Circle and J-Hook use by size in rods on charter and headboat vessels which caught Gray Triggerfish from 2010-2020. Jurisdiction **North**=north of 28 degrees latitude (Nassau through **all of** Brevard county statistical zone 722, 728, 732) Jurisdiction **South**=south of 28 degrees latitude (Indian River to Miami/Dade county statistical zone 736, 741, 744, and Florida Keys (excluding Monroe county and south of US 1 748, 1, 2)). N=numbers of fish by jurisdiction.