A Summary of Observer Data Related to the Size Distribution and Release Condition of Yellowtail Snapper from Recreational Fishery Surveys in Florida

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SEDAR64-DW-16

24 July 2019

Please cite this document as:

Lazarre, D. 2019. A Summary of Observer Data Related to the Size Distribution and Release Condition of Yellowtail Snapper from Recreational Fishery Surveys in Florida. SEDAR64-DW-16. SEDAR, North Charleston, SC. 30 pp.

A Summary of Observer Data Related to the Size Distribution and Release Condition of Yellowtail Snapper from Recreational Fishery Surveys in Florida

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For: SEDAR 64 Southeastern US Yellowtail Snapper Data Workshop, June 2019.

Detailed information on the size and release condition of discarded fish is not collected in traditional dockside surveys of recreational fisheries. At-sea observer surveys provide valuable information on the size and condition of discarded fish, and such surveys have been conducted on for-hire vessels Florida since 2005. For-hire observer surveys have not been consistently funded on both coasts of Florida, which has led to short breaks in the time series in some regions. The majority of these observer trips were conducted on headboat vessels, with charter vessels being surveyed intermittently starting in 2009 (Table 1). This report provides a summary of available information on the size, release condition, and disposition of yellowtail snapper collected by trained observers since 2005 during at-sea surveys on for-hire vessels in the Gulf of Mexico and South Atlantic Ocean.

At-Sea Observer Survey Coverage

In 2005, at-sea observer surveys coverage started on headboats operating from the Gulf coast of Florida from the panhandle through the Florida Keys. The at-sea headboat survey was funded by the Gulf Fisheries Information Network (Gulf FIN) continuously through 2007 and was discontinued in 2008. In June 2009 the state of Florida secured alternative funds to continue at-sea observer coverage on both headboats and charter vessels in the northwestern panhandle and central peninsula, and that coverage has continued through 2017. A three-year MARFIN grant allowed coverage to expand to the east coast of Florida from 2013-2015.

At-Sea Observer Survey Methods

Florida – 2005 to 2007

Headboat vessels from three subregions in Florida were randomly selected each week. Florida's western central region also had a separate sample quota for multi-day trips that fish in areas farther offshore. Operators from selected vessels were contacted by state biologists and a single trip was arranged in a selected week. 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 for each trip included the area fished, duration of fishing (to the nearest half hour), number of anglers, and minimum and maximum depths (feet) of the fishing sites. Area fished was coded differently for the east and west coasts of Florida.

For each fish, biologists recorded the species, disposition, size (fork length in mm), and the condition of fish that were released.

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 – 2009-2016
Similar to methods described above, charter and headboat vessels were randomly selected each week from a list of participating vessels in the northwestern region and central western regions of Florida. Selected vessels are contacted in advance to schedule a single trip during the selected week. Trips are scheduled based on vessel capacity. For example, when 6-pack vessels are selected, a trip is scheduled on a day where the reservation is for a party of 5 or less anglers. If there is no room available on a selected vessel for any reserved trips during the selected week, another vessel is randomly selected. Data from 2014 was omitted from the analysis because it was collected with a special permit, and not representative of the fishery as a whole.

Participating vessel operators permit up to two FWC biologists to board during a scheduled trip, and captains and mates actively assist biologists by permitting them to observe and collect data from fish as they are removed from anglers' gear and before fish are released or placed in the fish box. Vessel operators also provide biologists with information on depth and area fished (commercial statistical area and/or degrees and minutes latitude and longitude) for each fishing station during each observed trip.

For each fish, biologists recorded the species, disposition, size (fork length in mm), and the condition of fish that were released in the same manner as 2005-2007. Additionally, a subset of anglers was tracked by the biologist(s) for the entirety of the trip. For these anglers hook type, hook size and hook location were recorded the fish that they captured.

A project coordinator conducted quality assurance and quality control checks on all field data as it was collected and submitted. Following data entry, electronic data were proofed against field data sheets.

Data Elements

Disposition was coded as:

<u>Discards</u>
1: thrown back alive, legal;
2: thrown back alive, not legal;
<u>Harvest</u>
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.

Area fishes was coded as:

For southeast and northeast Florida:
1: 3 miles or less from shore; or
2: more than 3 miles from shore

For Keys, western peninsula, and northwest Florida:
3: 10 miles or less from shore; or
4: more than 10 miles from shore.

Characterization of Trip Duration:

Sampled trips were categorized into the following trip-types based on the duration of the sampled trip:

- Single-Day Trips (<24 hours)
    - Half-Day: < 6 hours
    - Three-Quarter-Day: 6 – 8 hours
    - Full-day: 9 – 24 hours
- Multi-Day Trips (>24 hours)

Release condition categories were coded as:

Good – Fish that were able to submerge and swim away immediately after release
Fair – Fish that re-submerged and swam away after showing some difficulty
Bad – Fish that demonstrated extreme difficulty re-submerging or swimming away, or floated at the surface after release
Dead – Fish that were released dead, preyed upon by mammals or preyed upon by birds after release

Hook Locations were coded as:

- Lip
- Throat
- Inside Mouth
- Gill
- Foul
- Gut
- Eye

At-Sea Observer Survey Data Analysis

Proportional Fishing Effort

Headboat trips were not sampled proportional to fishing effort. For example, multi-day trips represent less than 3% of headboat fishing effort in Florida but were sampled at a much higher rate in at-sea observer surveys. In the northwestern region of Florida, half-day trips were under-sampled with respect to headboat effort. We generated weighting factors for different trip-types using fishing effort data reported on headboat logbook trip reports for the years 2005 through 2017 (Table 2). Headboat effort data were provided by K. Fitzpatrick from NMFS Southeast Fisheries Science Center in Beaufort, NC.

Proportional fishing effort was calculated as the total numbers of trips reported on logbook trip reports for a given trip-type in a given region, divided by the total number of headboat trips reported in the same region. To obtain the sample weight (W_t):

$$W_t = \frac{N_t/N}{n_t/n}$$

Where N_t/N is the number of trips of type t divided by total trips reported on logbook trip reports, and n_t/n is the number of trips of type t in the sample population divided by the total number of sampled trips in each year. 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 under sampling.

Weights were not generated for samples collected on charter vessels, but trip totals from each region, by year and trip duration are provided (Table 3).

Characterization of Discards:
Fish fork lengths assigned to one cm length bin categories (40 cm bin = fish 40.0 cm to 41.9 cm) and the number of lengths in each length bin category were summed by region, trip-type, and disposition (harvested and discarded).

For fish observed from headboats, counts of fish in each length bin were multiplied times the sample weight (W_t) for each trip-type and sample region. The weighted proportion of fish in a length bin (p_x) was calculated as follows:

$$p_x = \frac{\sum L_H * W_H + \sum L_F * W_F + W_Q * W_Q + W_M * W_M}{\sum(bin = i = 1 \ldots n[\sum L_H * W_H + \sum L_F * W_F + W_Q * W_Q + W_M * W_M]}$$

Where L_H equals the number of fishes in length bin x for a given disposition in a given region observed during half-day trips (H); and W_H is the weighting factor for half-day trips in the same region. Q = ¾-day trips, F = full-day trips, and M = multi-day trips. The denominator is the sum of all numerators for length bin 1 to length bin n. The number of discarded fishes was summed by trip type and multiplied by the weighting factor for each trip-type, by year, to construct the weighted discard length frequency distributed. For charter vessels, the discard length frequency was calculated by summing the raw number of discarded yellowtail snapper in each length bin and dividing this number by the total number of discarded fishes, by year.

Post-Release Characterization

At-Sea Observer coverage has allowed for more detailed information on discards from the for-hire fleet. A summary of station level depth data is provided, including the minimum, mean and maximum station depths for discarded fish. Additionally, observers noted the release condition of discarded fish from 2005-2017, but after 2009 additional information was collected on the hook location of these discarded fish as well. The proportion of fish hook locations associated with the release condition for those fish is provided by for-hire fleet.

Estimates of post-release mortality have been assessed for other reef fish species using tagging data. A number of yellowtail snapper caught in the Florida Keys have been tagged with conventional tags, with a small number being recaptured. The recapture rates, by year, for yellowtail snapper are reported. Additionally, the immediate mortality and discard to harvest ratio are reported by region.

Results

The majority of trips positive for yellowtail snapper occurred in southwest Florida, the Florida Keys, and southeast Florida. Trips outside of these regions yielded few observations of yellowtail snapper harvested or discarded. A summary table describing the size distribution of yellowtail snapper harvested and discarded for each region is provided, by year, for both the headboat and charter fishing fleets (Table 4 & 5). Length frequency histograms for the three regions with substantial yellowtail snapper catch are provided, by region and year for each for-hire fishing fleet (Figure 1 & 2). The largest fish, both discarded and harvested, were observed in Southwest Florida. This is likely due to the multi-day trips occurring in the Dry Tortugas that are encompassed in southwest Florida catch. Discarding of legal sized fish occurred most in southwest Florida for both the charter and headboat fleets. In the Florida Keys and southeast Florida, there is almost a knife-edge division between discards and harvest, associated with the minimum size limit for the species for specimens captured on headboats. There is some discarding of legal-sized yellowtail snapper observed in the charter fleet operating in the Florida Keys and southeast Florida.

Discarded yellowtail snapper were largely captured in depths less than 20 meters, for both the headboat and charter fleets (Table 6). Yellowtail snapper released on headboat and charter trips were observed to have a good release condition, 85.61% and 79.05% respectively. Table 7 shows the cross-section of release condition and hook location, with most fish being hooked in the lip. Hook trauma might provide an additional factor to indicate post-release survivorship of discarded yellowtail snapper. While at-sea data has been used to provide estimates of post-release mortality in the past (Sauls 2014;), the low number of tag returns for yellowtail snapper did not yield enough information to generate a reliable estimate (Table 8). Immediate mortality was calculated, by region, showing less than 2% immediate mortality observed in any region (Table 9).

References

Sauls, B. 2014. Relative survival of gags *Mycteroperca microlepsis* released within a recreational hook-and-line fishery. Application of the Cox Regression Model to control for heterogeneity in a large-scale mark-recapture study. Fisheries Research, 150: 18-27.

Table 1. Coverage of At-Sea Observer coverage between 2005 and 2017 for both the Headboat and Charter fleet. The * indicates only a half year of survey coverage. Additionally, Southwest Florida coverage encompasses sampling off the coast of the Peninsula, with more varied coverage in the southern end of that headboat region (Charlotte – Collier Counties).

Headboat Areas	**2005**	**2006**	**2007**	**2008**	**2009***	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Northwest	H	H	H		H, C	H, C	H, C	H, C	H, C		H, C	H, C	H, C
Southwest	H	H	H		H, C	H, C	H, C	H, C	H, C		H, C	H, C	H, C
Keys	H	H	H			H, C	H, C	H, C	H, C	C	C	H, C	H, C
Southeast	H	H	H	H	H	H	H	H	H, C	H, C	H, C	H	H
Northeast	H	H	H	H	H	H	H	H	H, C	H, C	H, C	H	H

Table 2. Number of At-Sea observer trips, by region, year and trip duration for the headboat and charter recreational fleets.

Year	**Trip Duration**	**HEADBOAT**						**CHARTER**					
		NWFL	*SWFL*	*KEYS*	*SEFL*	*NEFL*	*Total*	*NWFL*	*SWFL*	*KEYS*	*SEFL*	*NEFL*	*Total*
2005	*Half*	7	15	29	88	9	148	1	1	.	.	.	2
	Three-Quarter	60	41	7	6	13	127	21	8	.	.	.	29
	Full	13	7	.	1	21	42	13	10	.	.	.	23
	Multi	.	19	1	.	.	20	.	.	.	.	.	0
	Yearly Totals	80	82	37	95	43	337	35	19	0	0	0	54
2006	*Half*	10	24	48	64	10	156	9	9	12	2	.	32
	Three-Quarter	60	51	3	7	19	140	39	17	1	.	.	57
	Full	8	7	1	.	9	25	14	12	.	.	.	26
	Multi	.	28	.	.	.	28	.	2	.	.	.	2
	Yearly Totals	78	110	52	71	38	349	62	40	13	2	0	117

2007	*Half*	11	19	32	64	11	137	10	22	12	1	.	79
	Three-Quarter	58	39	13	7	23	140	62	16	1	.	.	19
	Full	5	8	.	.	15	28	7	12	.	.	.	0
	Multi	.	25	5	.	.	30	.	.	.	.	.	0
	Yearly Totals	74	91	50	71	49	335	79	50	13	1	0	98
2008	*Half*	.	.	.	67	9	76	.	.	.	.	.	0
	Three-Quarter	.	.	.	8	24	32	.	.	.	.	.	0
	Full	.	.	.	1	19	20	.	.	.	.	.	0
	Multi	.	.	.	0	0	0	.	.	.	.	.	2
	Yearly Totals	0	0	0	76	52	128	0	0	0	0	0	2
2009	*Half*	4	4	.	69	9	86	1	1	.	.	.	29
	Three-Quarter	24	18	.	7	32	81	21	8	.	.	.	23
	Full	.	13	.	.	11	24	13	10	.	.	.	0
	Multi	.	9	.	.	.	9	.	.	.	.	.	32
	Yearly Totals	28	44	0	76	52	200	35	19	0	0	0	84
2010	*Half*	4	9	15	68	12	108	9	9	12	2	.	57
	Three-Quarter	21	27	5	6	17	76	39	17	1	.	.	26
	Full	8	13	.	.	19	40	14	12	.	.	.	2
	Multi	.	12	.	.	.	12	.	2	.	.	.	45
	Yearly Totals	33	61	20	74	48	236	62	40	13	2	0	130
2011	*Half*	11	19	11	66	13	120	10	22	12	1	.	79
	Three-Quarter	41	25	4	7	20	97	62	16	1	.	.	19
	Full	2	7	1	.	14	24	7	12	.	.	.	0
	Multi	.	14	.	.	.	14	.	.	.	.	.	54
	Yearly Totals	54	65	16	73	47	255	79	50	13	1	0	152
2012	*Half*	14	21	14	62	16	127	16	10	24	4	.	78
	Three-Quarter	37	20	11	10	23	101	53	22	3	.	.	25
	Full	2	3	.	.	12	17	9	16	.	.	.	0

	Multi	.	12	.	.	.	12	.	.	.	.	.	175
	Yearly Totals	53	56	25	72	51	257	78	48	27	4	0	278
2013	*Half*	15	24	12	75	10	136	25	20	44	67	19	89
	Three-Quarter	22	1	4	4	23	54	35	20	11	1	22	81
	Full	7	24	.	3	16	50	17	10	7	6	41	0
	Multi	.	11	.	.	.	11	.	.	.	.	.	167
	Yearly Totals	44	60	16	82	49	251	77	50	62	74	82	337
2014	*Half*	.	.	.	.	.	0	12	11	41	87	16	54
	Three-Quarter	.	.	.	.	.	0	13	.	20	7	14	67
	Full	.	.	.	.	.	0	8	9	10	6	34	0
	Multi	.	.	.	.	.	0	.	.	.	.	.	226
	Yearly Totals	0	0	0	0	0	0	33	20	71	100	64	347
2015	*Half*	24	49	2	80	19	174	40	36	46	92	12	95
	Three-Quarter	63	7	.	1	10	81	49	16	11	3	16	101
	Full	17	20	.	1	19	57	28	33	14	3	23	0
	Multi	.	4	.	.	.	4	.	.	.	.	.	150
	Yearly Totals	104	80	2	82	48	316	117	85	71	98	51	346
2016	*Half*	22	67	31	67	17	204	51	60	38	1	.	92
	Three-Quarter	63	18	11	1	12	105	62	20	10	.	.	63
	Full	18	35	1	1	18	73	15	38	10	.	.	1
	Multi	.	7	.	.	.	7	.	1	.	.	.	101
	Yearly Totals	103	127	43	69	47	389	128	119	58	1	0	257
2017	*Half*	26	78	46	76		226	34	46	21	.	.	77
	Three-Quarter	48	17	2	3		70	37	23	17	.	.	97
	Full	10	29	.	.	.	39	22	44	31	.	.	2
	Multi	.	7	.	.	.	7	.	2	.	.	.	
	Yearly Totals	84	131	48	79	0	342	93	115	69	0	0	176

Table 3. Weights generated to correct length frequencies to account for uneven sampling of trips with different durations, for headboat trips only. Regions with very low numbers of yellowtail snapper were omitted (northwest and northeast Florida).

Headboat Regions	**Year**	**Trip Duration**			
		Half	*Three-Quarter*	*Full*	*Multi*
SWFL	2005	1.928	0.861	2.536	0.002
	2006	1.584	1.310	0.699	0.010
	2007	2.408	0.967	0.935	0.001
	2009	4.957	1.198	0.175	0.037
	2010	3.534	0.994	0.138	0.047
	2011	1.789	1.163	0.200	0.038
	2012	1.477	1.155	0.483	0.037
	2013	1.074	12.183	0.867	0.112
	2015	0.803	2.052	1.215	0.491
	2016	0.964	1.357	0.998	0.439
	2017	0.835	1.516	1.250	0.553
KEYS	2005	0.926	0.600	-	0.734
	2006	0.815	1.409	6.976	-
	2007	1.125	0.620	-	0.269
	2010	0.873	0.558	-	-
	2011	0.963	0.621	2.626	-
	2012	1.386	0.336	-	-
	2013	1.051	0.466	-	-
	2015	0.785	-	-	-
	2016	1.036	0.722	2.442	-
	2017	0.839	3.768	-	-
SEFL	2005	0.909	1.293	7.283	-
	2006	1.055	0.412	-	-
	2007	1.103	0.000	-	-
	2008	1.076	0.240	1.974	-
	2009	1.012	0.430	-	-
	2010	1.019	0.446	-	-
	2011	1.037	0.395	-	-
	2012	1.115	0.228	-	-
	2013	1.043	0.634	0.398	-
	2015	0.984	2.436	0.866	-
	2016	0.977	2.862	0.668	-
	2017	0.941	1.490	-	-

Table 4. Length summaries for discarded and harvested yellowtail snapper observed on head boats trips in Florida, by year and region. N refers to the number of yellowtail snapper measured.

Year	DISCARD				HARVEST			
	N	Min	Mean	Max	N	Min	Mean	Max
	NORTHWEST FLORIDA							
2015	-	-	-	-	1	317	317.0	317
	SOUTHWEST FLORIDA							
2005	87	144	227.9	367	286	190	320.1	487
2006	207	124	231.7	310	674	147	309.5	626
2007	94	184	240.8	333	527	206	315.3	470
2009	-	-	-	-	10	374	409.6	562
2010	-	-	-	-	5	304	357.2	423
2011	-	-	-	-	4	342	387.3	412
2012	-	-	-	-	16	304	411.3	586
2013	-	-	-	-	1	240	240.0	240
2015	26	220	278.9	390	90	242	359.2	530
2016	92	142	256.9	390	425	220	340.6	510
2017	47	180	248.0	320	174	220	327.4	495
	FLORIDA KEYS							
2005	452	109	207.9	336	453	173	310.8	495
2006	592	125	217.9	288	576	165	275.1	416
2007	584	112	214.5	305	1537	123	299.4	470
2010	41	170	223.7	248	132	204	277.8	365
2011	28	202	227.9	317	23	238	275.5	370
2012	258	129	221.1	300	518	150	298.8	450
2013	225	173	219.2	254	242	191	278.8	494
2015	26	208	245.6	300	7	252	277.4	310
2016	735	128	215.7	290	590	222	285.6	501
2017	671	143	211.8	350	247	186	277.4	448
	SOUTHEAST FLORIDA							
2005	125	155	222.9	440	552	212	309.7	415
2006	51	170	225.1	259	349	228	287.5	406
2007	61	132	227.0	279	442	219	293.6	425
2008	81	155	219.2	307	189	220	297.9	449
2009	59	186	226.0	294	267	195	291.6	381
2010	51	180	224.2	251	382	233	301.8	476
2011	9	221	238.0	258	243	237	301.2	431
2012	34	209	231.4	325	381	229	312.8	489
2013	130	157	223.1	362	258	217	297.4	459

2015	199	166	224.4	275	294	235	293.1	400
2016	63	129	227.3	311	273	229	294.8	432
2017	167	127	209.6	328	156	212	282.3	420
	NORTHEAST FLORIDA							
2005	11	186	238.2	271	35	248	318.8	390
2006	3	209	220.7	228	7	254	298.7	327
2007	5	232	240.6	252	51	239	292.4	372
2008	7	217	245.0	268	30	206	267.3	333
2009	1	250	250.0	250	16	231	281.9	355
2010	-	-	-	-	4	251	326.0	461
2011	-	-	-	-	2	244	254.5	265
2012	-	-	-	-	1	291	291.0	291
2013	2	235	236.5	238	12	221	269.3	317
2015	3	244	246.3	251	17	255	284.9	347
2016	-	-	-	-	7	284	358.4	499
2017	3	221	232.7	249	9	182	274.3	364

Table 5. Length summaries for discarded and harvested yellowtail snapper observed on charterboat trips in Florida, by year and region.

Year	DISCARD				HARVEST			
	N	Min	Mean	Max	N	Min	Mean	Max
SOUTHWEST FLORIDA								
2014	1	118	118.0	118	-	-	-	-
2015	17	140	244.0	280	35	220	292.8	373
2016	19	175	218.9	305	9	260	287.0	310
2017	93	165	229.9	395	194	220	323.2	510
FLORIDA KEYS								
2010	5	162	187.2	240	1	259	259.0	259
2011	4	209	256.5	284	5	273	286.4	293
2012	5	194	216.2	234	12	236	298.8	352
2013	51	204	233.5	256	154	248	297.3	426
2014	26	214	233.1	250	240	238	295.5	474
2015	58	204	231.4	253	273	240	296.8	428
2016	-	-	-	-	2	250	258.0	266
SOUTHEAST FLORIDA								
2005	125	155	222.9	440	552	212	309.7	415
2006	51	170	225.1	259	349	228	287.5	406
2007	61	132	227.0	279	442	219	293.6	425
2008	81	155	219.2	307	189	220	297.9	449
2009	59	186	226.0	294	267	195	291.6	381
2010	51	180	224.2	251	382	233	301.8	476
2011	9	221	238.0	258	243	237	301.2	431
2012	34	209	231.4	325	381	229	312.8	489
2013	130	157	223.1	362	258	217	297.4	459
2015	199	166	224.4	275	294	235	293.1	400
2016	63	129	227.3	311	273	229	294.8	432
2017	167	127	209.6	328	156	212	282.3	420
NORTHEAST FLORIDA								
2013	-	-	-	-	1	339	339.0	339
2015	-	-	-	-	1	386	386.0	386

Table 6. Summary of capture depths (in meters) for discarded yellowtail snapper by year and fishing fleet (Headboat / Charterboats).

Year	HEADBOAT				CHARTERBOAT			
	N	**Min**	**Mean**	**Max**	**N**	**Min**	**Mean**	**Max**
2010	41	6	10	27	40	4	8	10
2011	37	7	12	35	42	7	9	11
2012	292	5	12	44	166	3	10	31
2013	358	6	14	45	557	4	11	34
2014	-	-	-	-	644	2	12	37
2015	254	5	26	47	395	2	14	85
2016	890	5	17	48	334	3	12	29
2017	888	4	13	53	200	4	17	58

Table 7. Intersection of release condition and hook position for yellowtail snapper released from the headboat and charter recreational fleets.

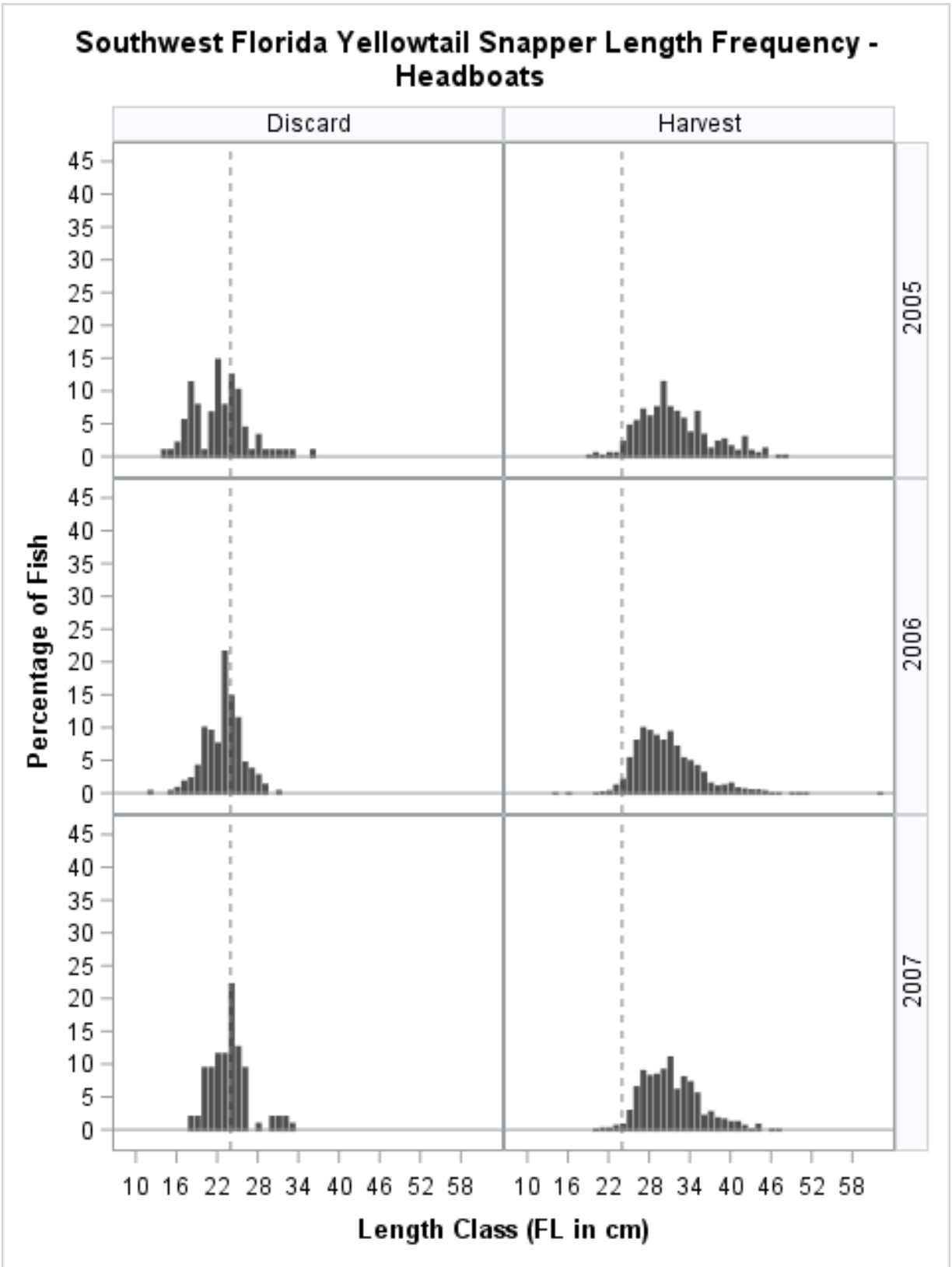
Fleet	Hook Position	Good	%	Fair	%	Bad	%	Dead	%	Total
Headboat	Lip	2179	95.07	171	70.08	52	35.37	19	30.16	2421
	Throat	37	1.61	43	17.62	76	51.70	35	55.56	191
	Inside Mouth	48	2.09	15	6.15	8	5.44	3	4.76	74
	Gill	5	0.22	2	0.82	7	4.76	5	7.94	19
	Foul	22	0.96	9	3.69	1	0.68	1	1.59	33
	Gut	0	0.00	1	0.41	1	0.68	0	0.00	2
	Eye	1	0.04	3	1.23	2	1.36	0	0.00	6
	Total	*2292*	*100.00*	*244*	*100.00*	*147*	*100.00*	*63*	*100.00*	*2746*
Charter	Lip	1727	92.11	86	45.74	44	20.37	20	21.74	1877
	Throat	79	4.21	62	32.98	109	50.46	35	38.04	285
	Inside Mouth	52	2.77	22	11.70	26	12.04	7	7.61	107
	Gill	9	0.48	13	6.91	33	15.28	26	28.26	81
	Foul	7	0.37	3	1.60	1	0.46	0	0.00	11
	Gut	1	0.05	2	1.06	3	1.39	4	4.35	10
	Total	*1875*	*100.00*	*188*	*100.00*	*216*	*100.00*	*92*	*100.00*	*2371*

Table 8. Recapture rates for yellowtail snapper, by year. All fish were tagged and recaptured in the Florida Keys.

Year	Tagged	Recaptured	Total	Recapture Rate
2012	340	19	359	0.0559
2013	548	12	560	0.0219
2014	471	15	486	0.0318
2015	391	2	393	0.0051
2016	974	26	1000	0.0267
2017	829	17	846	0.0205
2018	218	5	223	0.0229

Table 9. Immediate mortality and discard ratios by regions and fishing fleet (Headboat – raw / weighted, Charter – raw), all years combined.

Fleet	Headboat Regions	Immediate Mortality	Discard Ratio	Weighted Immediate Mortality	Weighted Discard Ratio
Headboat	NWFL	0.0016	0.0684	0.0011	0.0709
	SWFL	0.0106	0.0406	0.0000	0.2125
	KEYS	0.0023	0.2572	0.0023	0.2174
	SEFL	0.0054	0.0287	0.0080	0.0294
	NEFL	0.0019	0.0804	0.0017	0.0791
Charter	SWFL	0.0000	0.5083	-	-
	KEYS	0.0000	0.6455	-	-
	SEFL	0.0000	0.2879	-	-
	NEFL	.	0.0000	-	-


Southwest Florida Yellowtail Snapper Length Frequency - Headboats
Discard
Harvest
2005
2006
2007
Percentage of Fish
0
5
10
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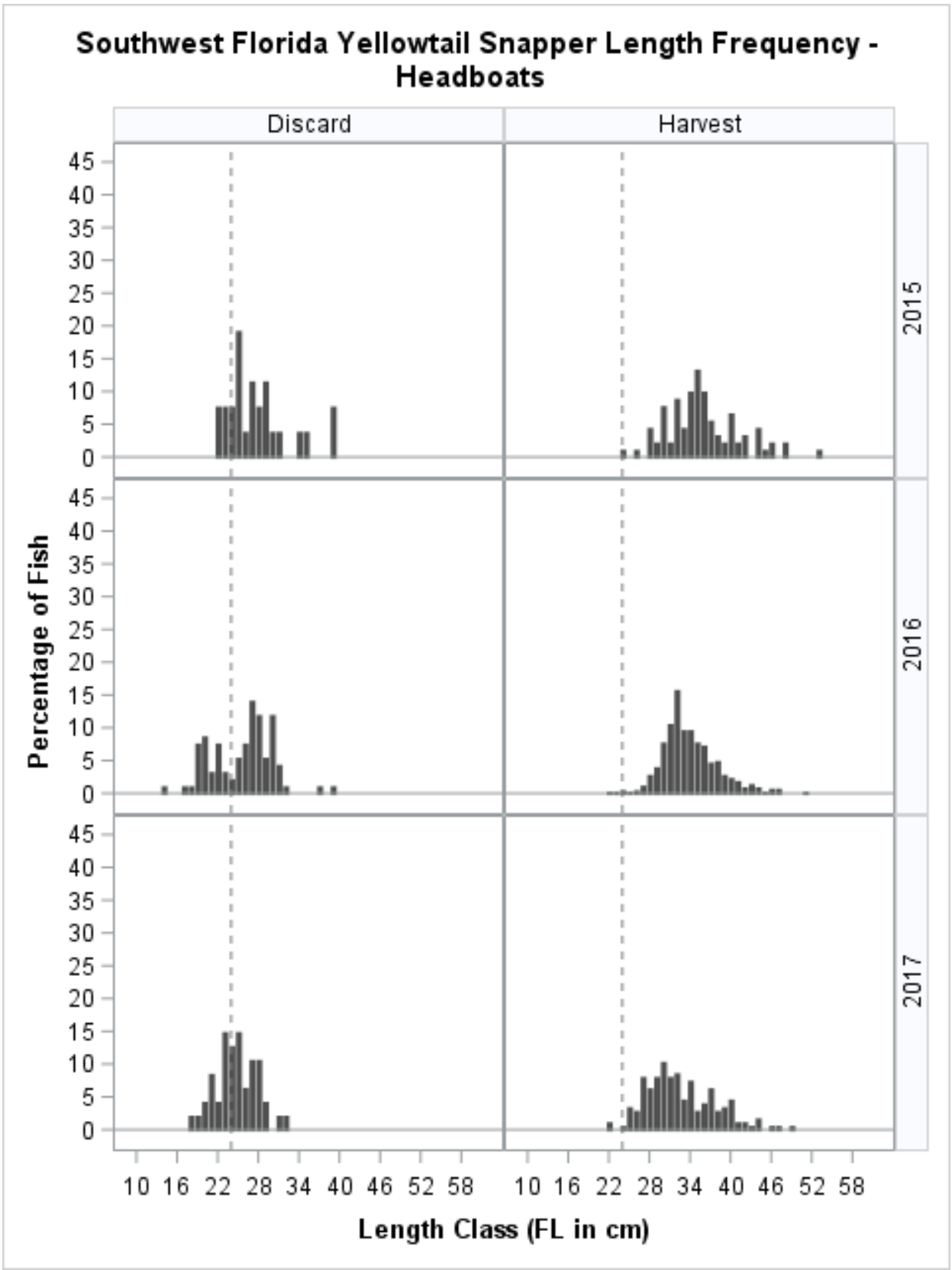
20
25
30
35
40
45
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Southwest Florida Yellowtail Snapper Length Frequency - Headboats
Discard
Harvest
2015
2016
2017
Percentage of Fish
0
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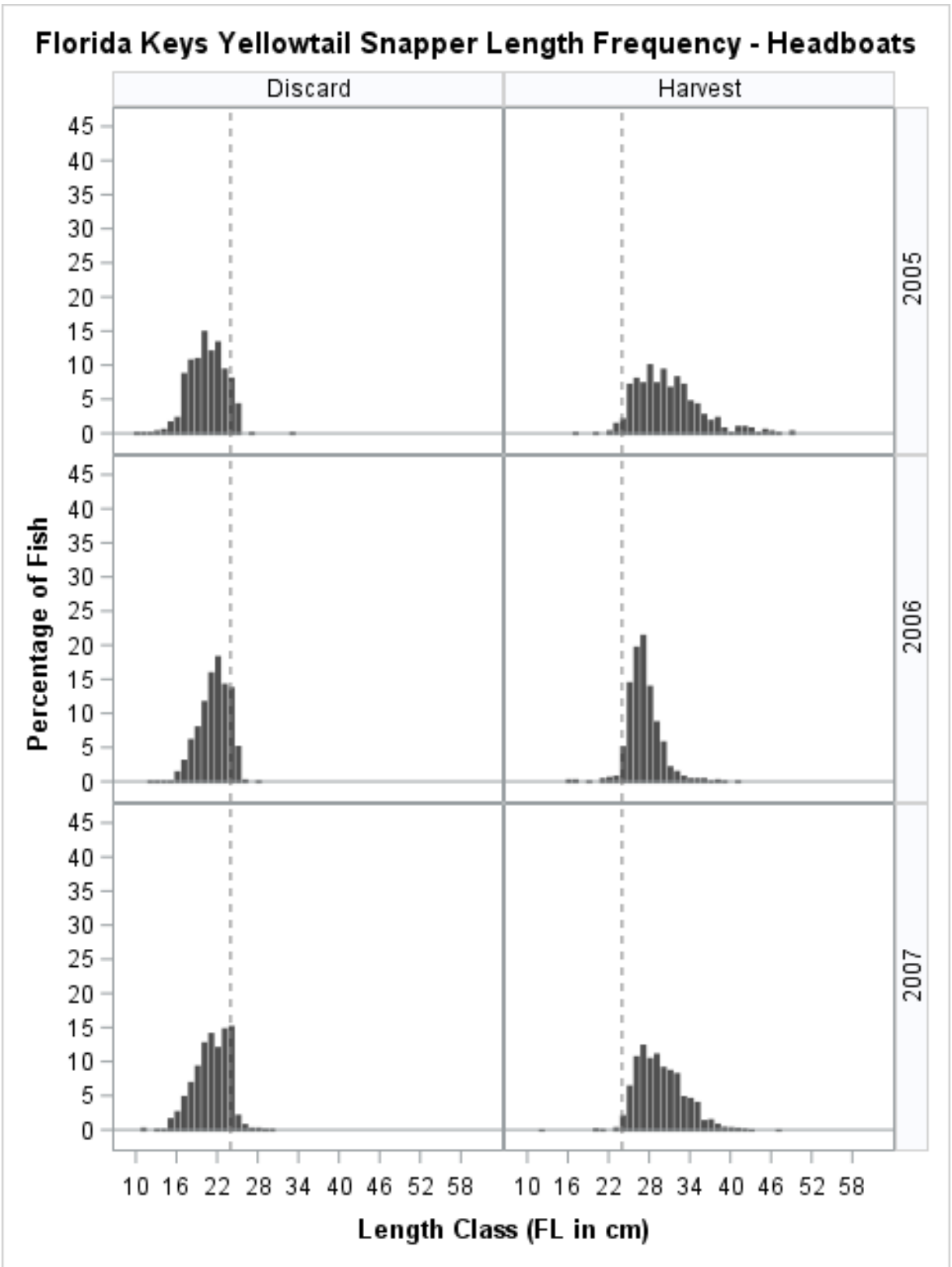
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Florida Keys Yellowtail Snapper Length Frequency - Headboats
Discard
Harvest
2005
2006
2007
Percentage of Fish
0
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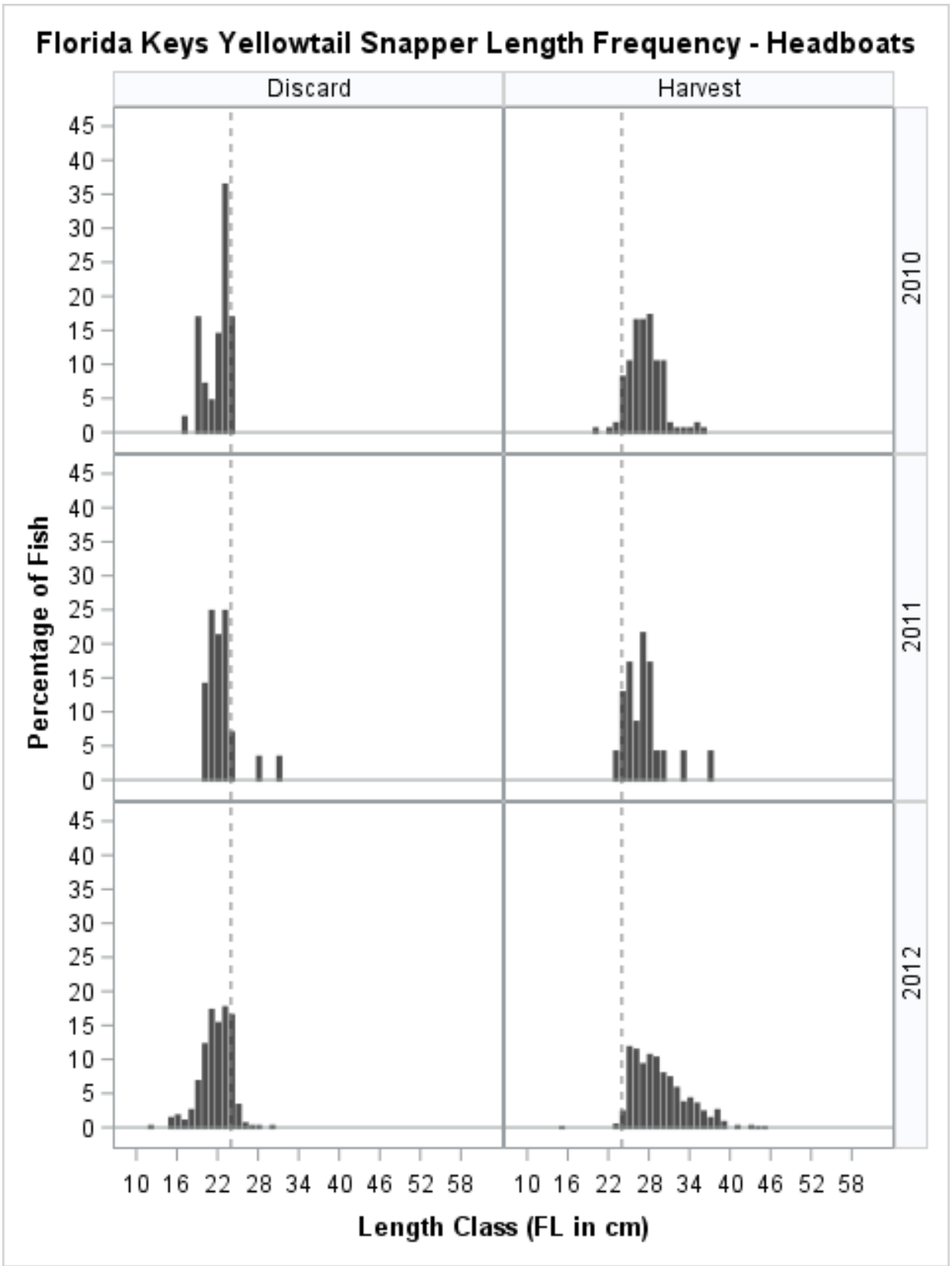
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Florida Keys Yellowtail Snapper Length Frequency - Headboats
Discard
Harvest
2010
2011
2012
Percentage of Fish
0
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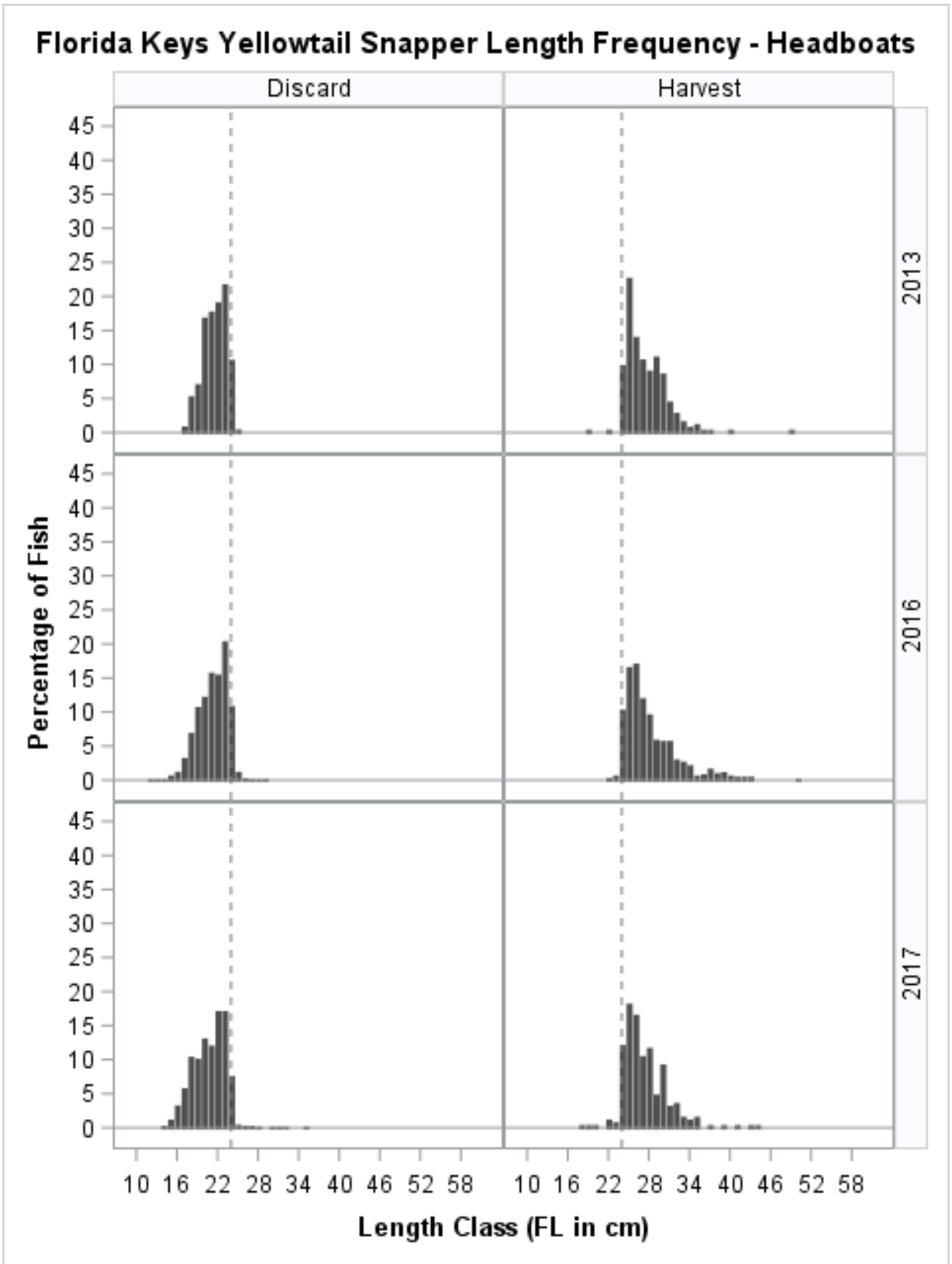
45
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Florida Keys Yellowtail Snapper Length Frequency - Headboats
Discard
Harvest
2013
2016
2017
Percentage of Fish
0
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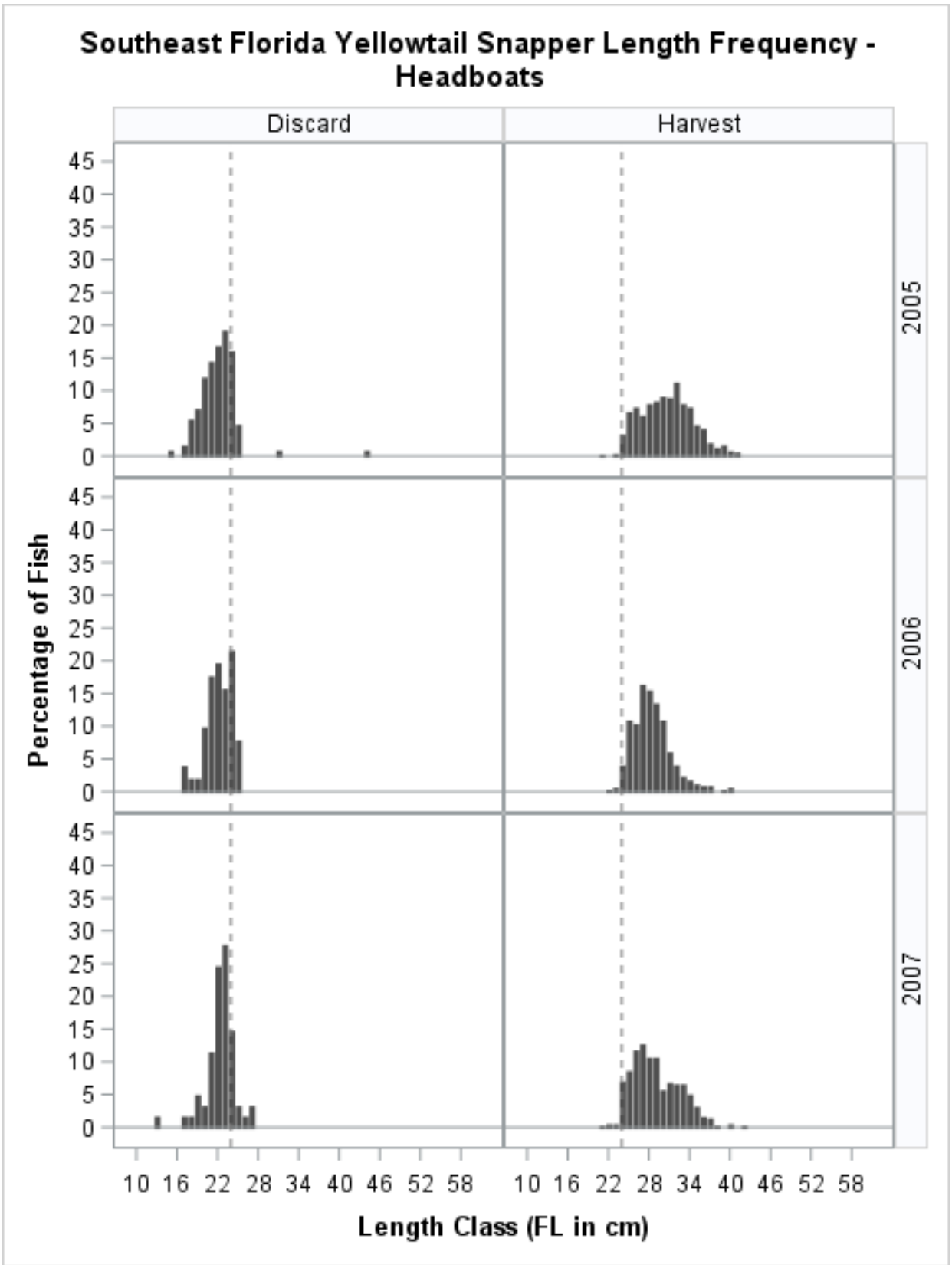
45
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Southeast Florida Yellowtail Snapper Length Frequency - Headboats
Discard
Harvest
2005
2006
2007
Percentage of Fish
0
5
10
15
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30
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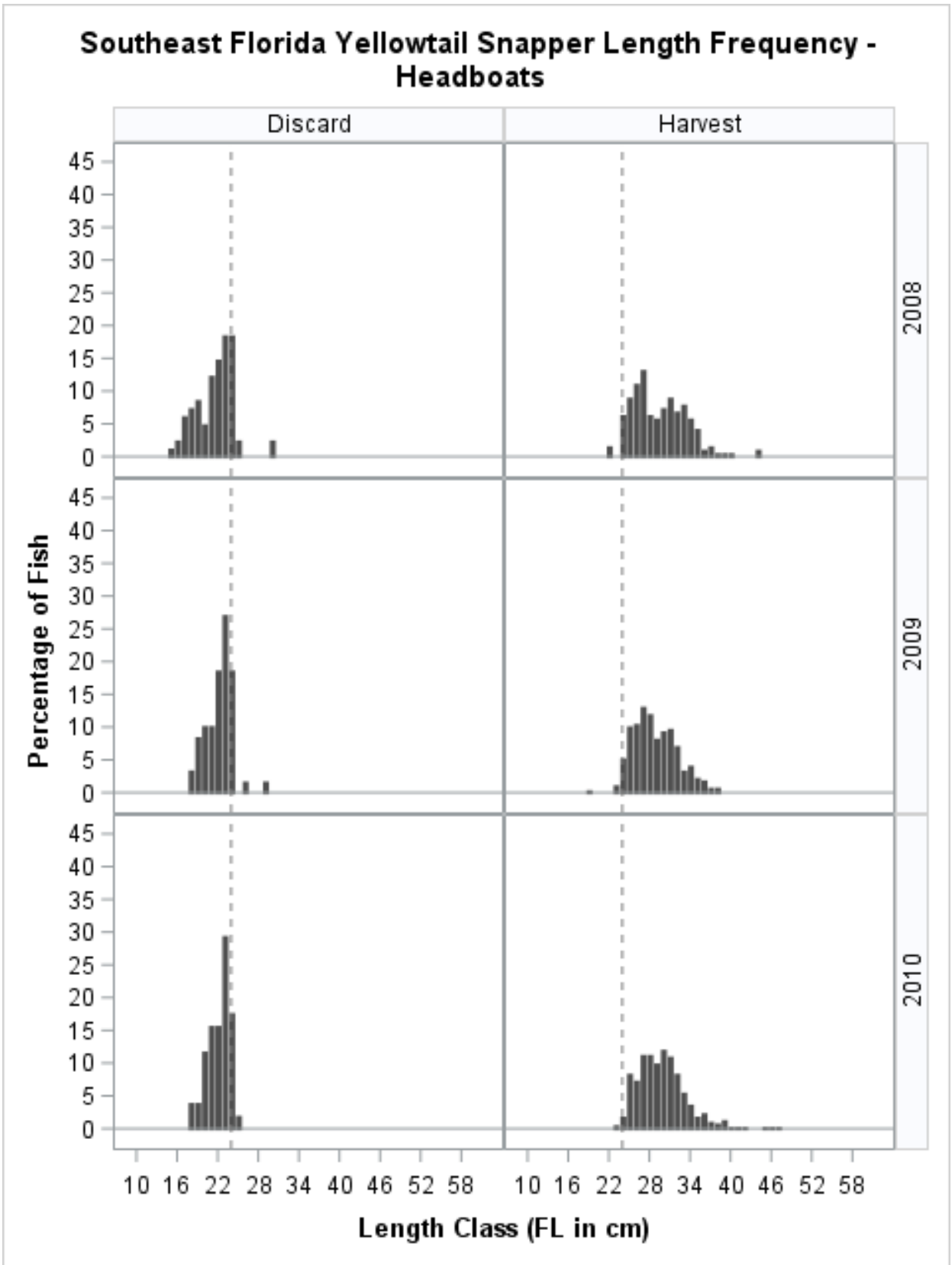
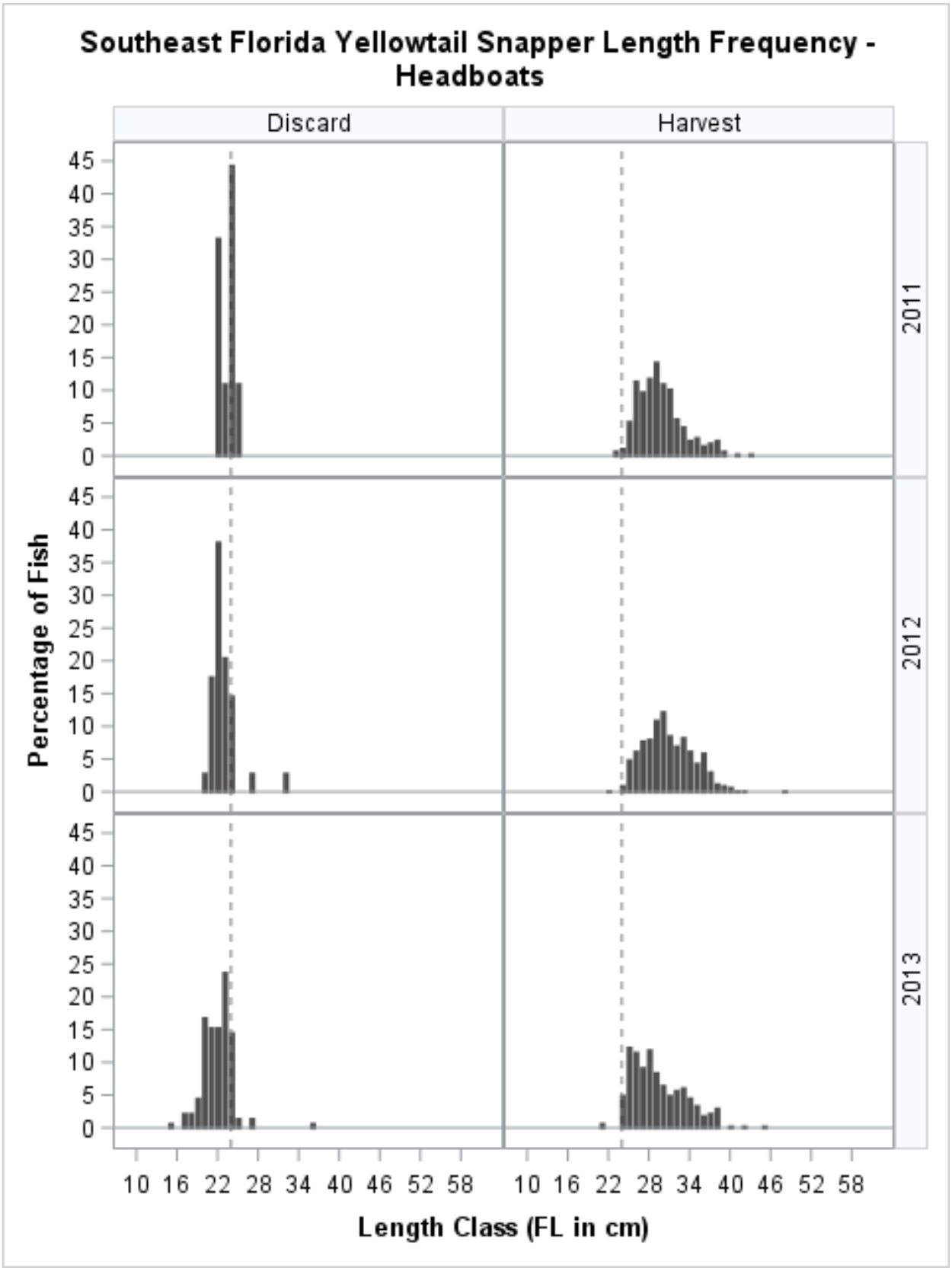
40
45
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Southeast Florida Yellowtail Snapper Length Frequency - Headboats
Discard
Harvest
2008
2009
2010
Percentage of Fish
0 5 10 15 20 25 30 35 40 45
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Southeast Florida Yellowtail Snapper Length Frequency - Headboats
Discard
Harvest
2011
2012
2013
Percentage of Fish
0
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45
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)

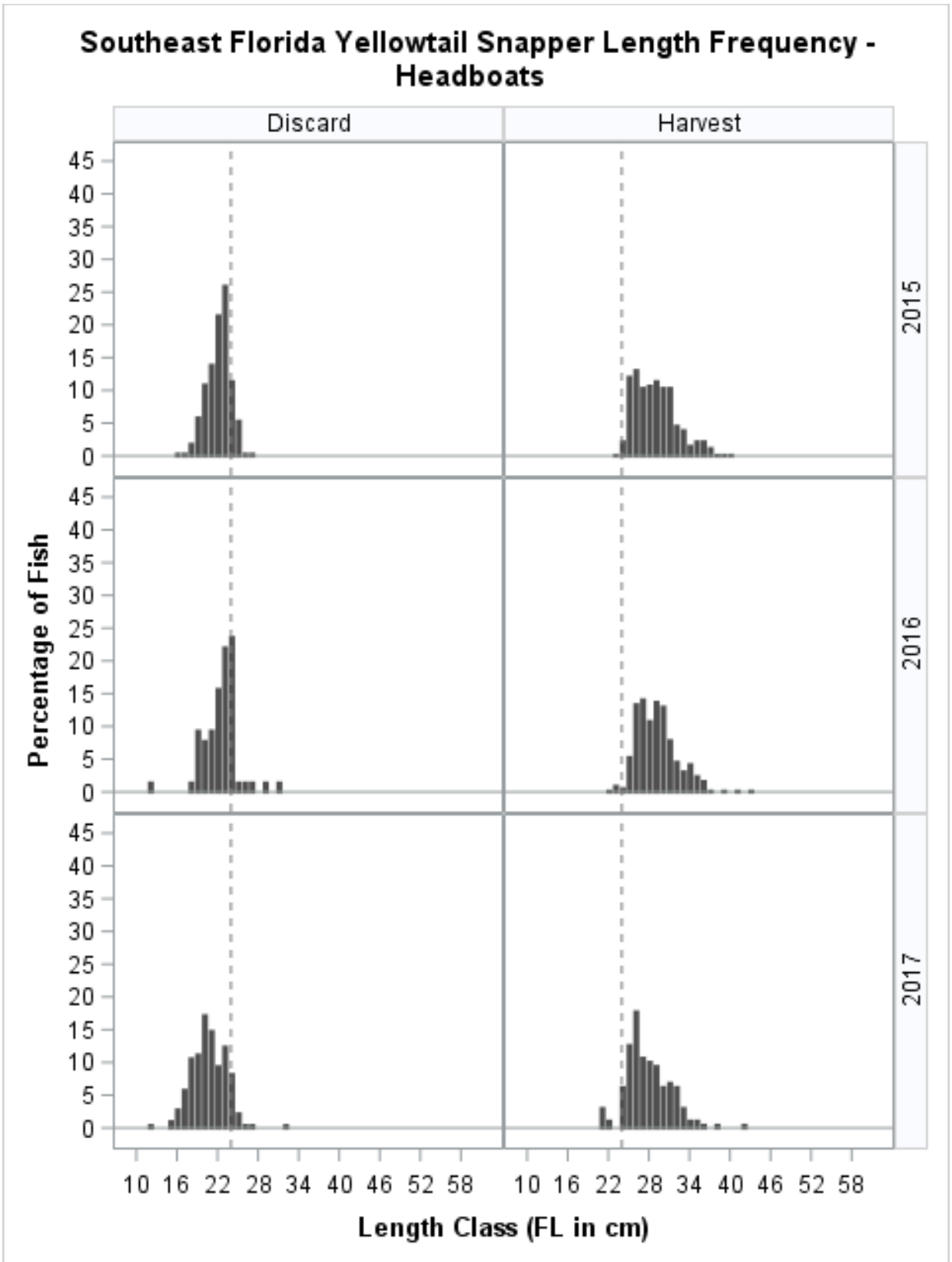
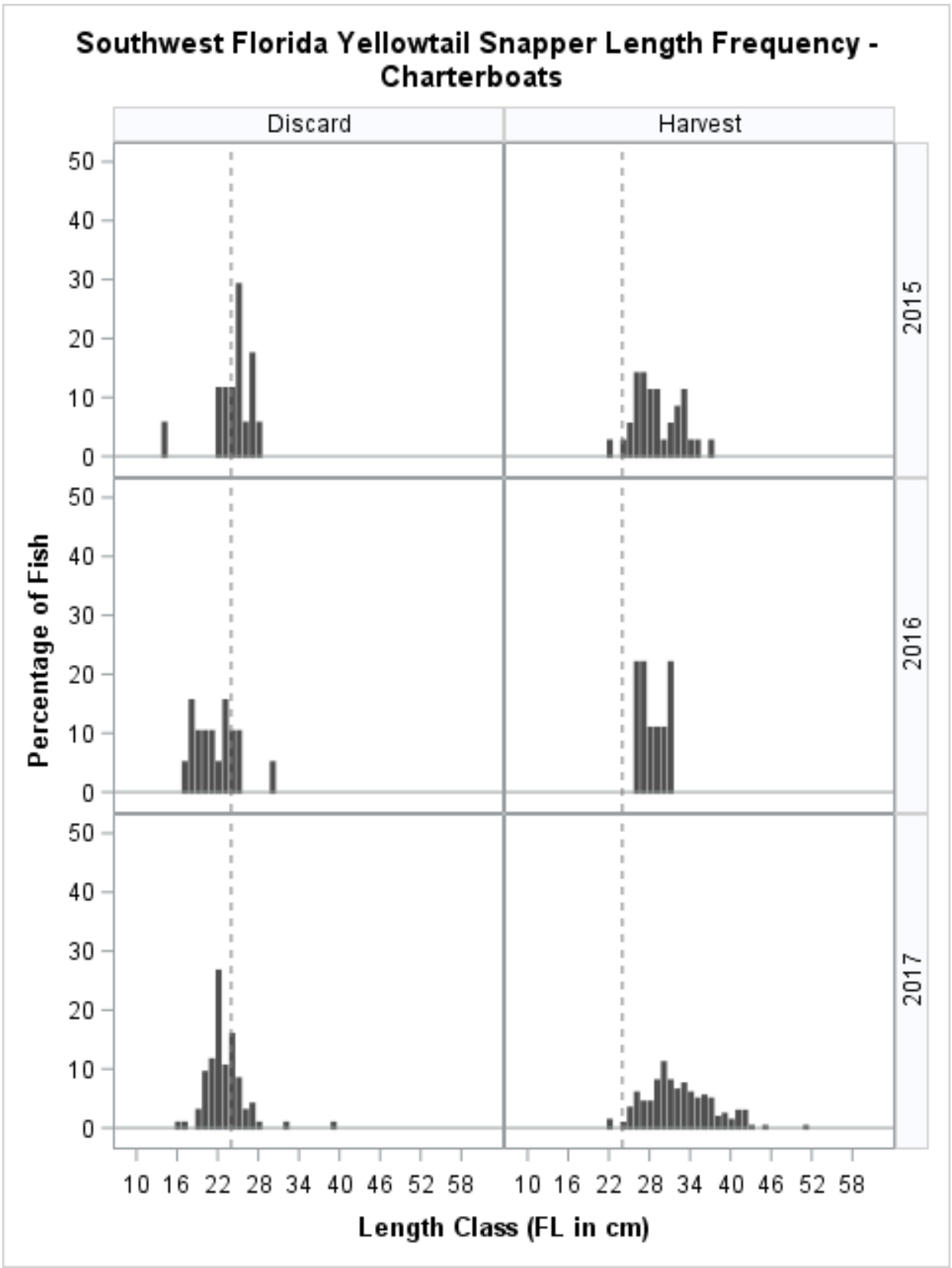
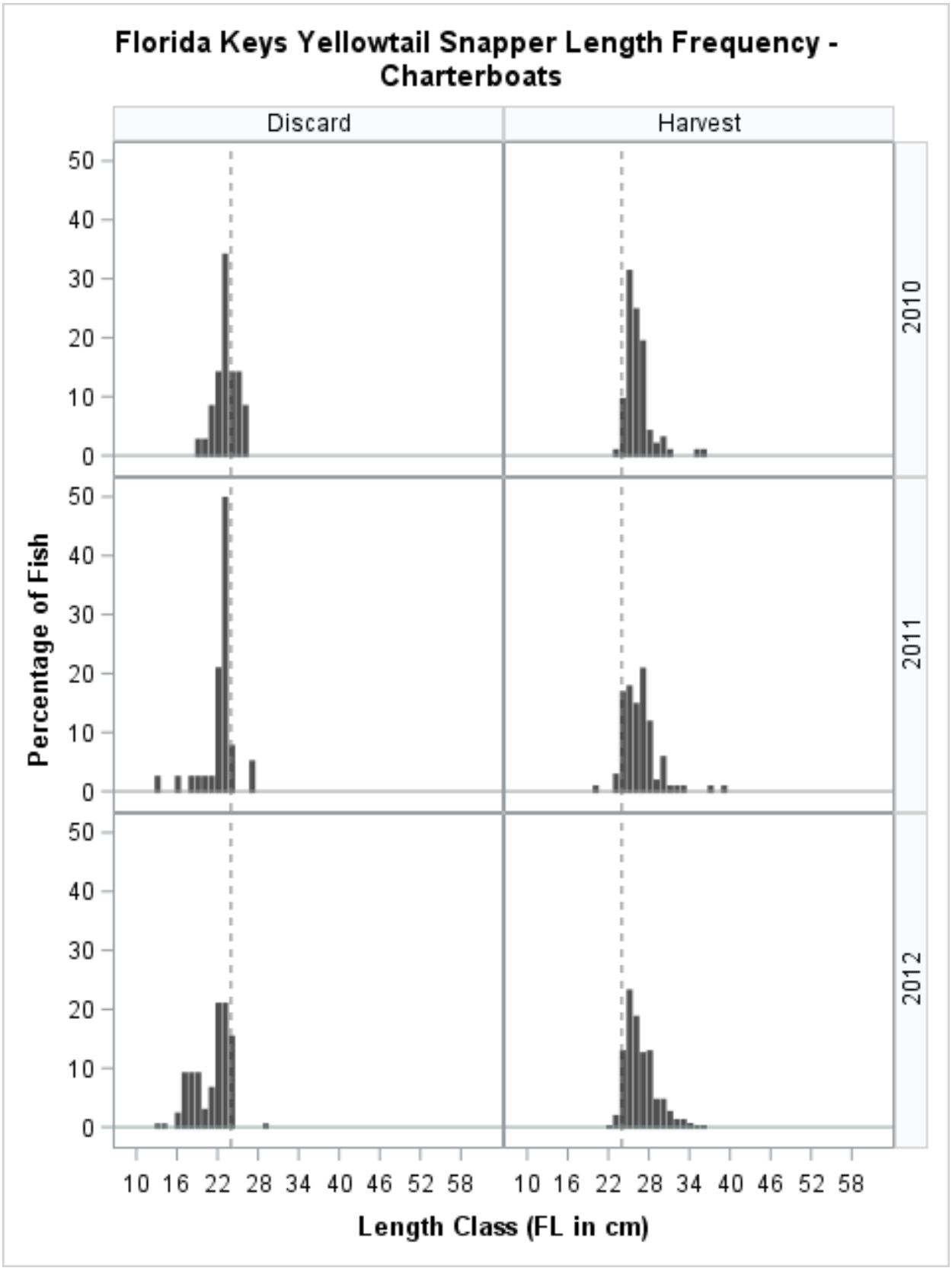
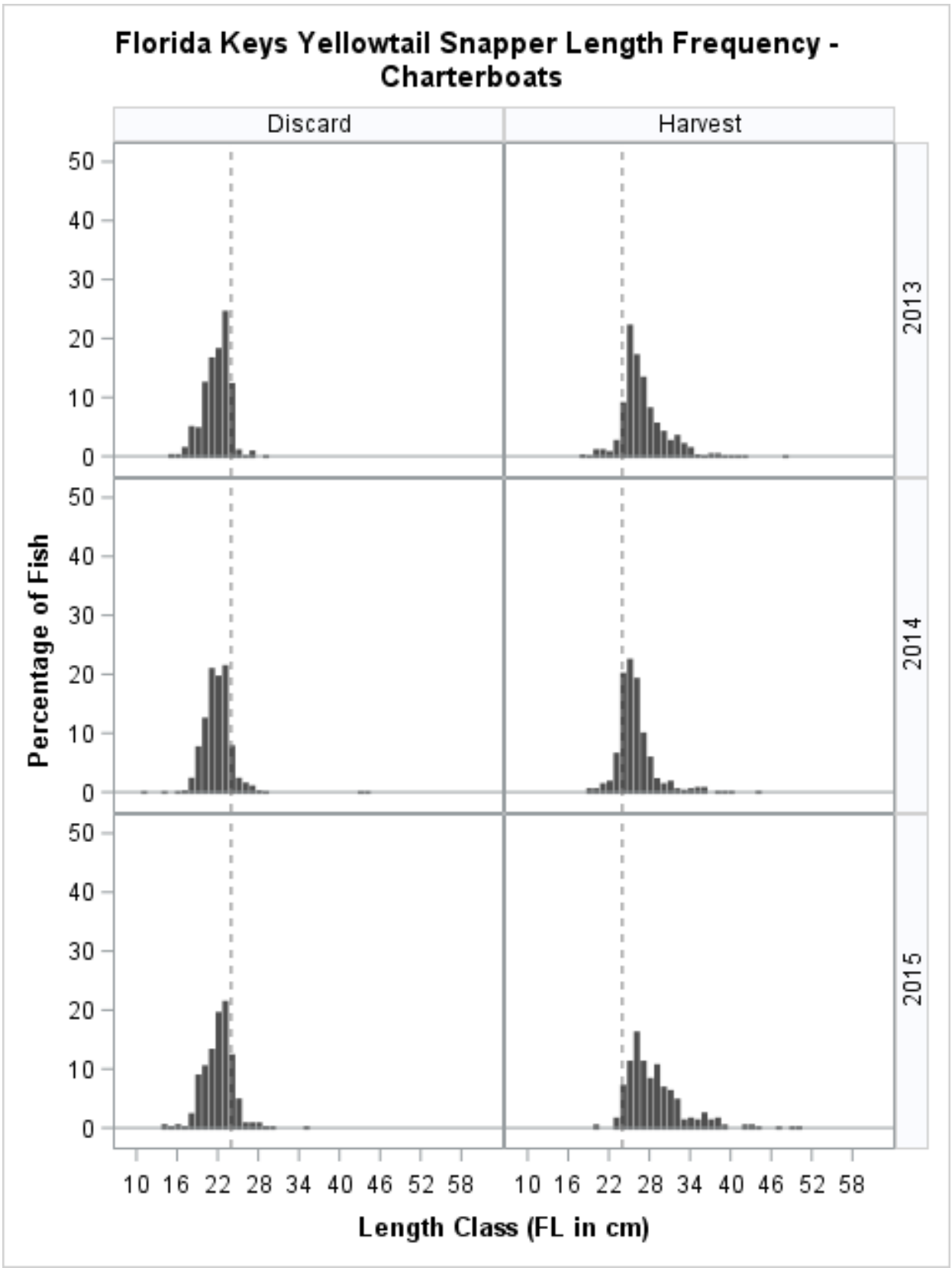

Southeast Florida Yellowtail Snapper Length Frequency - Headboats
Discard
Harvest
2015
2016
2017
Percentage of Fish
0
5
10
15
20
25
30
35
40
45
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)

Figure 1. Length frequencies of harvested and released yellowtail snapper measured by at-sea observers on headboats in Florida 2005-2016. Harvest includes fish that were released dead. Reference line represents the fork length associated with a 12 inch fish (TL).


Southwest Florida Yellowtail Snapper Length Frequency - Charterboats
Discard
Harvest
2015
2016
2017
Percentage of Fish
0
10
20
30
40
50
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Florida Keys Yellowtail Snapper Length Frequency - Charterboats
Discard
Harvest
2010
2011
2012
Percentage of Fish
0
10
20
30
40
50
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Florida Keys Yellowtail Snapper Length Frequency - Charterboats
Discard
Harvest
2013
2014
2015
Percentage of Fish
0
10
20
30
40
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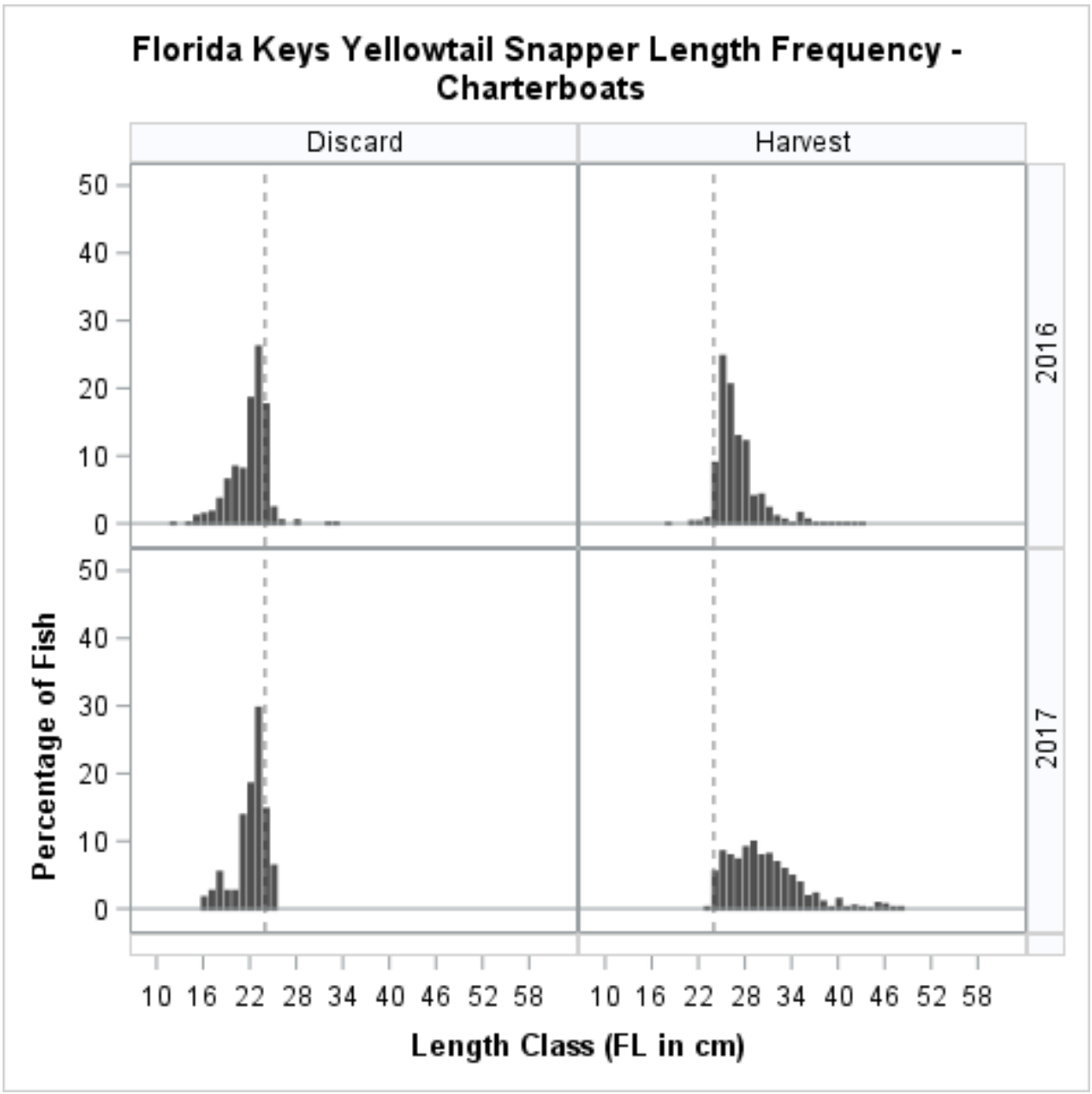
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)


Florida Keys Yellowtail Snapper Length Frequency - Charterboats
Discard
Harvest
2016
2017
Percentage of Fish
0
10
20
30
40
50
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)

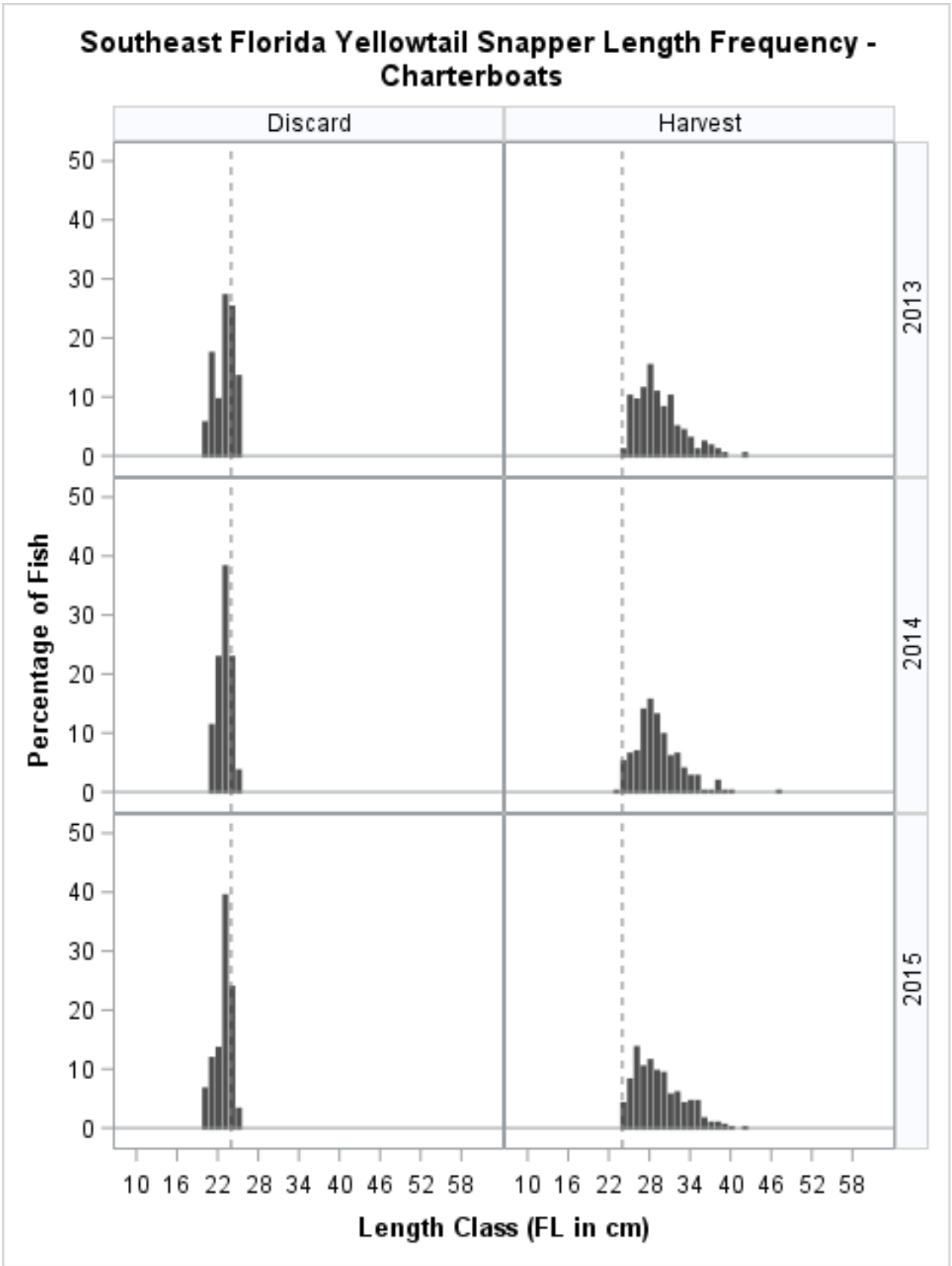

Southeast Florida Yellowtail Snapper Length Frequency - Charterboats
Discard
Harvest
2013
2014
2015
Percentage of Fish
0
10
20
30
40
50
10 16 22 28 34 40 46 52 58
Length Class (FL in cm)

Figure 2. Length frequency of harvested and released yellowtail snapper measured by at-sea observers on charterboats in Florida 2009-2016. Harvest includes fish that were released dead. Reference line represents the fork length associated with a 16 inch fish.