Overview of the Southeast Region Headboat Survey and Data Related to Yellowtail Snapper (*Ocyurus chrysurus*)

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SEDAR64

Introduction

The NMFS Southeast Region Headboat Survey (SRHS), administered by the Southeast Fisheries Science Center Laboratory (SEFSC) in Beaufort, NC, collects catch, effort, and biological information from headboats operating from North Carolina to Texas. Headboats (also referred to as "party boats") are vessels that charge a per-person fee ("by the head") and are licensed to carry 6 or more anglers in the Exclusive Economic Zone (EEZ, 3-200 miles) of the South Atlantic and 15 or more anglers in the EEZ (10- 200 miles) of the Gulf of Mexico. In addition, a vessel participating in the SRHS holds a federal South Atlantic or Gulf of Mexico Charter/Headboat fishing permit. Headboat operators typically target reef fish and coastal migratory pelagic species. Catch by species and effort (numbers of anglers and vessel trips) are collected on vessel trip reports and recorded by a crew member, usually a mate. Biological samples (measurements of length and weight, otoliths, etc.) are collected from anglers' landings during dockside intercepts of a subset of anglers returning from fishing. Data are routinely analyzed for quality, and compliance is monitored through headboat activity reports that include all known information about a vessel's activity (trip date, trip type, and number of anglers), regardless of whether a trip was sampled under the dockside sampling program. The goal of the SRHS is to be a census of catch data for the entire headboat fleet; however, trips and their catches from vessels that do not comply with reporting rules or vessels that forgo federal reef fish permits are not captured in this survey. To some extent, non-compliance can be accounted for by headboat activity reports (O'Hop *et al.* 2012; Fitzpatrick *et al.* 2017).

Program Design

Time Series and Spatial Range

The NMFS Southeast Region Headboat Survey (SRHS) began operation in 1972 on the Atlantic Coast, expanded into Florida's Atlantic coast during the mid-1970's and into the Florida Keys by 1979. The survey began operating in states bordering the Gulf of Mexico in 1986. Mississippi was added in 2010. The SRHS divided the region into discrete geographic/statistical areas to which headboat trips and associated catches are assigned. Figure 1 is a map of the Southeast United States showing the current SRHS geographical areas.

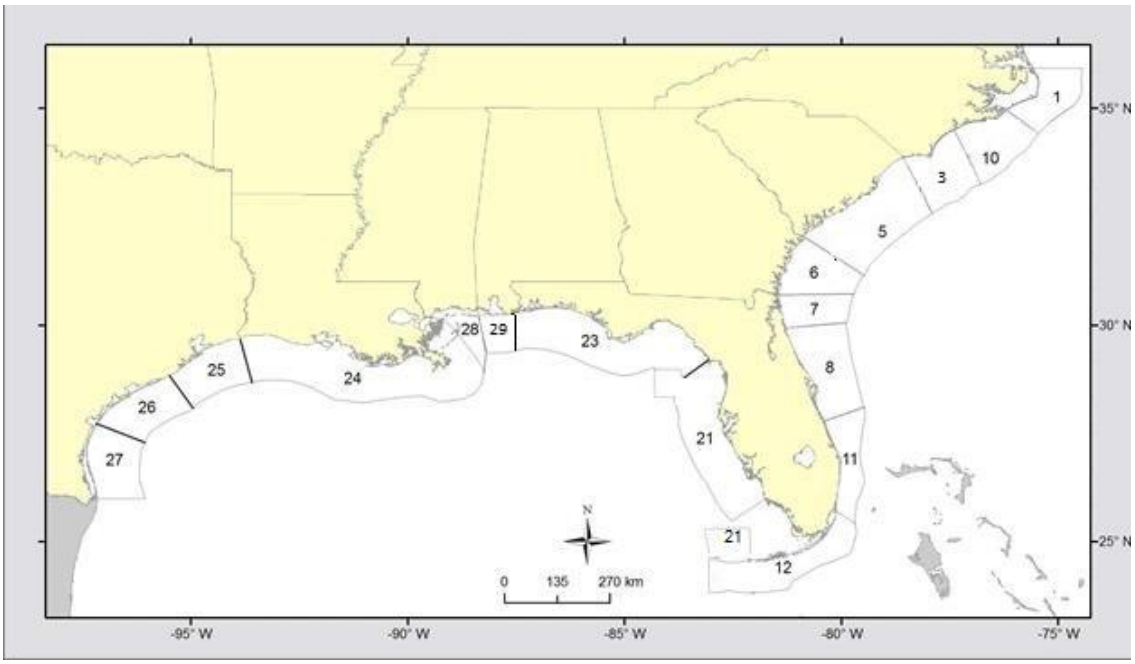

Figure 1. Southeast Region Headboat Survey statistical reporting areas, including 2013 modifications.

Regulatory History

The following regulations are expected to potentially affect the Yellowtail Snapper population or the recreational fishery, a complete listing of regulations can be found in the Management Overview section of the report.

The South Atlantic Fishery Management Council (SAFMC) first established regulations pertaining to Yellowtail Snapper in federal waters of the South Atlantic in August 1983 with a 12 inch (30.5 cm) total length minimum size limit for all harvesters. As of January 1992, the recreational fishery is subject to an aggregate daily bag limit of 10 snappers (excluding lane, vermilion, and allowing no more than two red snappers) and a two-day possession limit[1].

The Florida Fish and Wildlife Conservation Commission (FWC) implemented regulations specific to Yellowtail Snapper in July 1985 (CH 68-14, Florida Administrative Code)[2]. This rule established a 12 inch (30.5 cm) total length minimum size limit for all harvesters. A 10 fish aggregate daily bag limit for snappers (excluding lane, vermilion, and yelloweye snappers) and a two-day possession limit was established December 1986.

Federally permitted for-hire reef fish vessels must comply with the more restrictive of federal or

[1] Specific aspects of these rules can be found at the following website: http://safmc.net/regulations/regulations-by-species/yellowtail-snapper/

[2] The evolution and specific aspects of these rules can be found at the following website: https://www.flrules.org/gateway/ChapterHome.asp?Chapter=68B-14

state reef fish regulations when fishing for reef fish in state waters.

On February 21, 1990, the Gulf of Mexico Fishery Management Council enacted a 12 inch (30.5 cm) total length minimum size limit for all harvesters in federal waters of the Gulf of Mexico, in addition to an aggregate daily bag limit of 10 snappers (excluding lane, vermilion, and yelloweye snappers) and a two-day possession limit for recreational fishers.

Target Species / Assemblages

Reef fish and coastal migratory pelagic species.

Fishing Gear

- Hook and Line

Sampling Methods

The main components of the survey are the logbook or trip report, the headboat activity report, and a dockside intercept sampling program. In recent years the number of headboats has been relatively constant in both the South Atlantic and Gulf of Mexico, with approximately 70-80 vessels operating in each region (SEDAR41-DW46). The number of vessels participating in the SRHS by year in the Gulf of Mexico and South Atlantic waters is listed in Table 1.

The logbook component was originally designed to be a census, but non-compliance in reporting has required corrections to estimates of catch and fishing effort (see Methods section). Logbook reporting became mandatory in 1995 with Amendment 7 to the Snapper-Grouper Fishery Management Plan (Code of Federal Regulations 646.4). This measure was not strictly enforced until 2008 and those reporting requirements have led to considerable improvements in compliance rates (Table 1, Figure 2).

Table 1. Number of Southeast Region Headboat Survey vessels reported and estimated trips, and reporting compliance from the SRHS, 1981-2017. The number of reported and estimated trips were not available in electronic format prior to 1981.

Year	South Atlantic				Gulf of Mexico			
	Number of vessels	Reported Trips	Estimated Trips	Compliance	Number of vessels	Reported Trips	Estimated Trips	Compliance
1981	87	11,395	24,134	0.47				
1982	88	12,353	25,520	0.48				
1983	86	12,195	24,534	0.5				
1984	90	11,280	22,871	0.49				
1985	89	11,187	22,630	0.49				
1986	94	13,990	24,128	0.58	87	4,551	10,608	0.43
1987	94	14,152	25,123	0.56	82	4,595	11,663	0.39
1988	94	12,103	23,457	0.52	72	6,268	11,316	0.55
1989	96	10,982	23,853	0.46	94	6,887	11,203	0.61
1990	93	11,432	24,624	0.46	88	10,316	12,569	0.82
1991	94	10,844	25,382	0.43	79	9,104	10,481	0.87
1992	99	15,154	22,377	0.68	42	10,331	11,576	0.89
1993	94	14,011	20,009	0.7	81	10,759	11,958	0.90
1994	96	12,708	21,412	0.59	84	10,689	12,916	0.83
1995	89	12,405	19,595	0.63	82	8,897	12,141	0.73
1996	91	9,200	19,270	0.48	73	8,287	11,263	0.74
1997	92	6,429	16,559	0.39	70	8,340	10,424	0.80
1998	89	9,372	15,237	0.62	73	7,633	10,732	0.71
1999	86	7,746	15,831	0.49	69	6,655	9,717	0.68
2000	91	7,865	16,980	0.46	71	6,426	9,539	0.67
2001	85	7,002	14,917	0.47	72	6,293	9,333	0.67
2002	77	5,779	13,323	0.43	61	6,426	8,283	0.78
2003	67	5,752	12,086	0.48	64	6,325	9,203	0.69
2004	81	6,509	15,090	0.43	66	6,943	8,698	0.80
2005	76	5,857	14,876	0.39	67	6,543	8,081	0.81
2006	76	6,162	15,363	0.4	62	5,898	7,700	0.77
2007	78	6,608	14,451	0.46	71	5,334	8,175	0.65
2008	83	9,492	11,627	0.82	70	6,611	6,964	0.95
2009	83	10,718	11,670	0.92	71	8,370	8,482	0.99
2010	80	11,489	12,090	0.95	75	6,684	6,887	0.97
2011	77	11,537	12,018	0.96	73	8,383	8,446	0.99
2012	78	12,423	13,222	0.94	71	8,502	8,685	0.98
2013	76	13,764	14,708	0.94	69	8,824	8,824	1.00
2014	76	17,302	17,380	1	67	9,156	9,159	1.00
2015	74	17,132	17,373	0.99	68	9,717	9,726	1.00
2016	80	15,989	18,179	0.88	69	10,077	10,082	1.00
2017	66	11,917	12,013	0.99	70	9,907	9,966	0.99

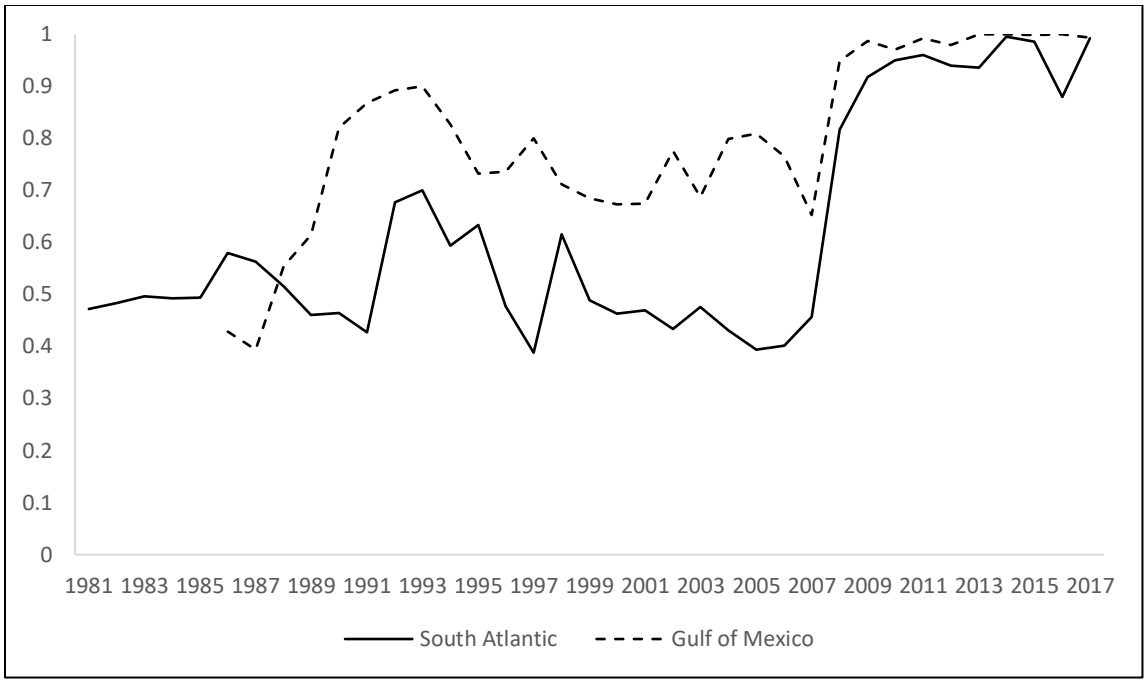

Figure 2. Reporting compliance rates in the South Atlantic and Gulf of Mexico, 1981-2017.

Port agents record information about a vessel's activity (trip date, trip type, and number of anglers) on the headboat activity report, regardless of whether a trip was sampled under the dockside sampling program. Observations are collected by multiple methods, including direct observation, contacting the ticket office to confirm activity, observations made by samplers from other surveys (e.g. MRIP), and in recent years by checking websites for fishing trips. These observations are used to track compliance and to correct for misreporting.

Dockside sampling is used to obtain length and weight data from landings to determine the size distribution and mean size of species landed in the headboat fishery. The survey design for the dockside sampling program can be described as a systematic, opportunistic design. Port agents may collect otoliths and gonads to characterize the age distributions, sex ratios, and reproductive parameters of species landed in the fishery. Port agents may collect other biological samples (e.g., stomachs, fin clips) in support of research or management needs (e.g., trophic interactions and stock structure studies; SEDAR24-RD56). The SRHS Bioprofile information is comprised of these data.

At-sea catch and discard information collected by biologists onboard headboats and charter boats complement the SRHS by providing detailed information on the size and release condition of discarded fish. These programs and associated data are described in Lazarre (2019).

Sample Workup

Samplers were trained to identify approximately 60 of the most common species in each region and were provided with numerous guides and keys to assist them in species identifications. Samplers are instructed to measure and weigh all fishes from selected trips. However, once they have measured 10 fish of a given species, they are not required to measure additional individuals

of that species. Fish sampled for weight were taken most often from catches of vessels that landed the largest numbers of fish.

Sampling Frequency

SRHS port agents are required to sample all headboats within one or more statistical areas, with the goal of sampling each vessel in a systematic rotation one or more times in 10 to 14 days during periods of operation (headboats do not operate year-round in some areas). Highly repetitive sampling from any vessel is to be avoided (SEFSC, 2016).

Variables Recorded

Logbook forms, completed by the vessel captain or designee, collect information about numbers and total weight of individual species caught, landing date, vessel identification, total number of passengers, total number of anglers, location fished (identified to a 10 mile by 10 mile grid), trip duration (e.g., half, ¾, full or multiday trip), and period (morning, afternoon, and night). In 1995 additional trip duration categories were included (e.g., ½ day night, ½ day night - second trip, ½ day AM) nullifying the use of the period variable. In 2004 additional fields were added that included the number of paying customers actively fishing on the trip, the number of fish released alive, and the number of fish released dead. However, since 2013, electronic logbook forms collect only the total number of fish released regardless of condition (dead or alive). Release disposition (live or dead) and weight of catch by species were dropped from the SRHS logbook in 2013. In August 2014, four socioeconomic fields were added: number of paying passengers, number of crew, amount of fuel used, and price per gallon of fuel. Additionally, the location field was dropped in favor of latitude and longitude.

Bioprofile information collected by port agents include the following continuous or categorical fields: Year, Collection (Trip Identifier), ID (Fish Identifier), Month, Day, Area, Vessel, Type (Vessel Type), Species, Length (Total Length), Weight, Sex, FL (Fork Length) and binary fields indicating whether the structure was collected: Scales, Otoliths, Spines, Stomachs, Gonads.

Methods

Estimated landings and effort from non-reported trips

Because of non-reporting, logbook estimates of numbers of fish caught and total effort must be adjusted using headboat activity reports kept by port agents. These reports contain information the port agents have observed or gathered about a vessel's activity for a given month. It is assumed that every trip taken by a vessel is captured in the headboat activity reports and this information is used to calculate total estimated effort. Total estimated effort is then divided by reported effort to calculate a monthly correction factor to adjust reported landings (SEDAR41-DW46). These correction factors are applied to the total number of fish reported landed from logbook forms, by species-vessel-month combinations, to generate total estimated number of fish landed.

To produce a total weight of fish landed for each species-vessel-month combination, these numbers are multiplied by mean weights of fish calculated from the bioprofile database by species-area-month combinations. The adjusted vessel landings are then summed by area to generate total

landings by area (SEDAR24-RD56).

One caveat is that estimates of landings and effort off the Atlantic coast prior to 1986 should not be used in conjunction with MRFSS estimates. The MRFSS survey combined headboat with charterboat in estimates for the mode "Party/charter" for 1979-1985 in all states from TX to NC. Starting in 1986, the SRHS is used for headboat estimates in in TX, LA, AL, and the west coast of FL, while MRFSS and TX Parks and Wildlife estimates are used for charterboats in those states (MRFSS, including a special survey for billfish and tunas, is used exclusively for estimates of all recreational modes in the states north of NC; htbfiles_doc.doc). Mississippi was added to the SRHS in 2010.

Estimating Discards

Discards 2004-present

The SRHS logbook includes self-reported discards since 2004. Discard rates of self-reported data were compared and validated using the Florida At-Sea Observer Sampling (Figure 3). The at-sea observer data for Yellowtail Snapper are most consistent on the east coast of FL. From 2007 to 2014, discard rates are very similar between the two data sources. Since 2014, discard rates have been increasing on trips in the At-Sea Observer program for the east coast of FL. Because of the lack of data on the west coast and general agreement in most years between the two data sources on the east coast, discards from 2004-2017 in the self-reported logbook data are deemed representative of headboat fishing activity.

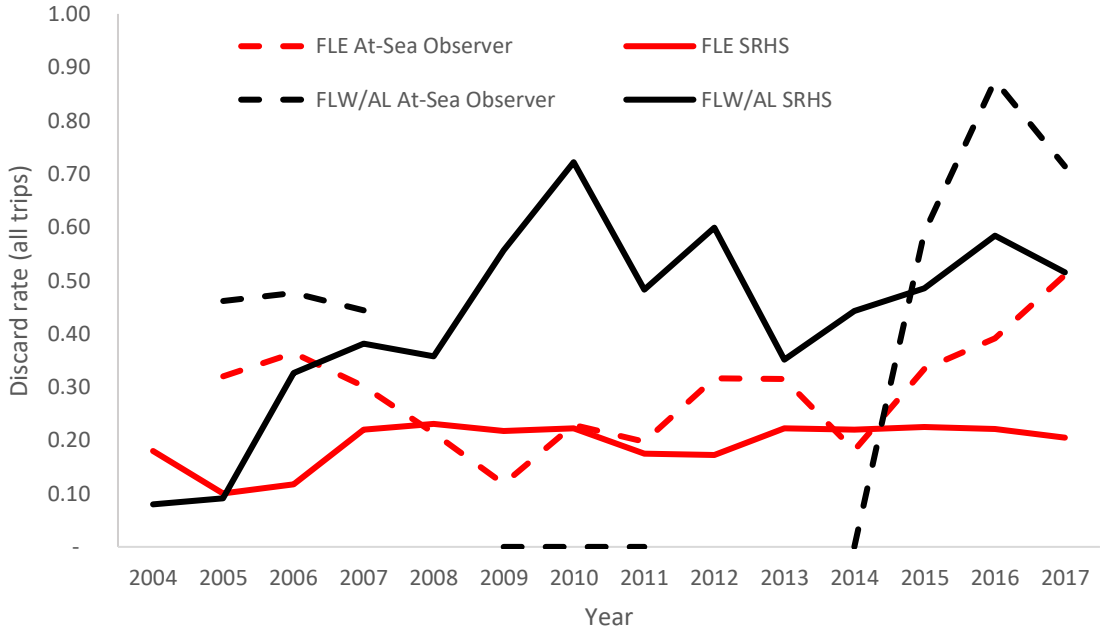

Figure 3. A comparison of discard rates reported in SRHS logbook data (solid lines) to those in trips sampled by the Florida At-Sea Observer Sampling (dashed lines) for the west coast of FL (FLW – black lines) and east coast (FLE - red lines).

Discards prior to 2004

The MRIP Charterboat:SRHS discard ratio proxy method was applied to estimate discards prior to 2004. First, the yearly MRIP Charterboat discard:landings ratio (1981-2003) was adjusted by a ratio of the mean ratio of SRHS discard:landings (2004-present) and MRIP Charterboat discard:landings (2004 – present). The adjusted ratio is then applied to the SRHS landings (1981-2003) to estimate headboat discards. Discard rates calculated by the adjusted and unadjusted MRIP Charter discard ratios are compared to the discard rates using the logbook data in Figure 4. As shown the adjusted and unadjusted discard ratios provide similar results and mostly overlap with discard rates from logbook data after 2003. Adjusted MRIP Charter discard ratios were used to hindcast SRHS discards prior to 2004.

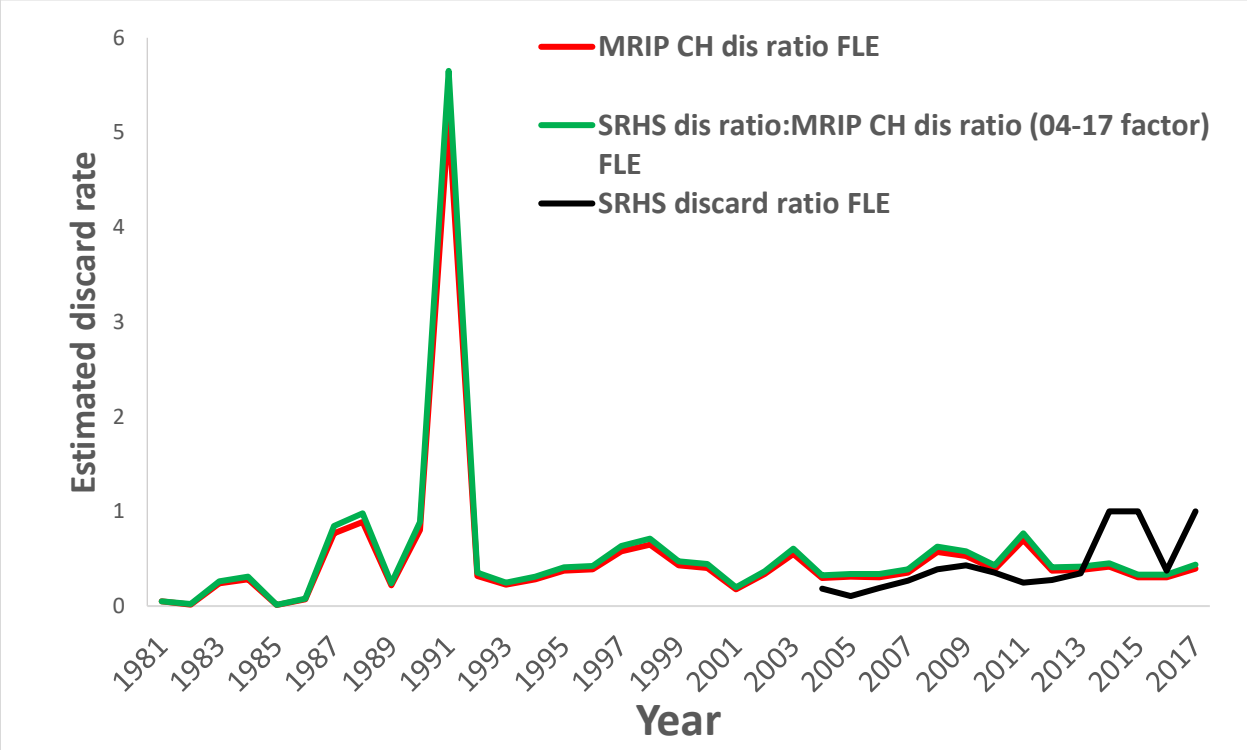

Figure 4. A comparison of discard rates obtained by applying discard ratios to the SRHS landings and the discard rates reported in SRHS logbook data (black line).

Logbook Data Filtering

Per the guidance of the SRHS staff, unique trips were identified by combining select variables within the catch record data set. For years 1981 to 1985 a unique trip was defined as the combination of collection number (itself a combination of date, vessel, period, and trip type) and the number of anglers. For years 1986 to 2012, a unique trip was defined as the combination of year and collection number. For years after 2012, a unique trip was defined by the collection number.

1. Select trips were removed due to possible database corruption issues (238 out of 655,903

trips, per guidance of SRHS staff)[3].
2. A single trip that was coded to have occurred in the Bahamas was removed.
3. 131 trips made after 1991 in SE FL and FL Keys were removed that exceeded the South Atlantic Fishery Management Council (SAFMC) 10 snapper per person per day (with a two- day possession limit) bag limit (resulting in 655,783 trips).
4. 13 trips were removed that reported zero anglers (resulting in 655,639 trips).

Using the possession limit was an effort to remove possible reporting errors within the catch record dataset. We chose to use the SAFMC (http://safmc.net/regulations/regulations-by-species/yellowtail-snapper/) regulation because most trips were made in offshore waters outside of state jurisdiction. This method however does not remove unusually large catches of Yellowtail Snapper prior to 1991 (the maximum number of Yellowtail Snapper landed on a single trip was 5,862 that occurred on a six-day trip in 1986) and lends itself to *ad hoc* and inconsistent treatment of the data.

Results

Landings

Annual landings by region (in numbers) that include estimates for trips not reported in logbooks are shown in Table 2 and Figure 5. Landings outside of Alabama and Florida are not shown due to confidentiality concerns but make up less than 0.1% of overall landings. Alabama landings cannot be separated from Florida landings prior to 2013. The majority of Yellowtail Snapper are landed in the FL Keys and SE FL (constituting approximately 74% and 23% of total landings, respectively). Mean landings by month in the FL Keys generally decline from March to September and increase thereafter, whereas monthly mean landings in southeast FL remain elevated from June to October (Figure 6). Annual landings in pounds are presented in Table 3.

[3] These trips have since been corrected in the SRHS database. The Index Working Group at the Data Workshop decided against using an index of abundance based on the SRHS logbook data, therefore the logbook data was not updated to reflect these corrected trips.

Table 2. Headboat Survey (SRHS) annual landings (numbers of fish) of Yellowtail Snapper by region*, 1981-2017. Regions west of AL or north of FL are not shown due to confidentiality concerns.

Year	AL-SW FL	FL Keys	SE FL	NE FL	Total
1981	0	74,428	84,928	616	159,972
1982	97	140,757	60,071	450	201,375
1983	5,800	170,331	34,177	807	211,115
1984	4,926	122,354	33,557	390	161,227
1985	411	111,863	25,179	590	138,043
1986	3,075	172,544	29,035	1,495	206,149
1987	4,731	193,756	34,736	2,304	235,527
1988	5,559	230,565	53,087	2,161	291,372
1989	6,418	114,977	43,794	1,248	166,437
1990	8,470	161,072	47,198	2,023	218,763
1991	5,415	153,939	51,289	2,146	212,789
1992	7,143	142,733	54,365	1,126	205,367
1993	14,549	158,186	45,274	692	218,701
1994	7,584	158,601	76,348	625	243,158
1995	3,061	118,040	35,954	441	157,496
1996	3,212	110,978	23,378	31	137,599
1997	739	112,110	26,729	260	139,838
1998	3,077	101,312	16,007	130	120,526
1999	7,244	77,243	24,512	224	109,223
2000	2,056	95,029	12,027	188	109,300
2001	2,913	93,943	4,770	243	101,869
2002	536	117,674	2,382	420	121,012
2003	674	97,738	10,267	175	108,854
2004	473	109,363	8,118	468	118,422
2005	1,691	130,487	16,160	749	149,087
2006	2,160	94,199	2,157	458	98,974
2007	5,821	79,927	17,232	1,618	104,598
2008	2,660	68,121	31,857	724	103,362
2009	4,409	63,693	19,329	949	88,380
2010	2,281	61,115	38,577	201	102,174
2011	3,240	66,040	29,310	178	98,768
2012	2,149	73,179	35,265	222	110,815
2013	1,901	79,299	31,146	596	112,942
2014	5,395	92,393	65,601	601	163,990
2015	5,013	94,481	73,498	625	173,617
2016	5,936	80,144	98,313	183	184,576
2017	7,309	76,190	26,861	320	110,680

region*	statistical reporting areas
AL-SW FL	18, 21, 22, 23, 29
FL Keys	12, 17
SE FL	11
NE FL	7, 8

Table 3. Headboat Survey (SRHS) annual landings (pounds of fish) of Yellowtail Snapper by region*, 1981-2017. Regions west of AL or north of FL are not shown due to confidentiality concerns.

Year	AL-SW FL	FL Keys	SE FL	NE FL	Total
1981	0	94,317	134,400	527	229,243
1982	118	193,275	99,052	463	292,908
1983	6,552	201,179	48,906	859	257,495
1984	6,412	157,894	48,643	428	213,378
1985	913	131,104	33,834	526	166,376
1986	4,068	216,097	42,523	1,165	263,853
1987	4,209	236,538	39,325	2,017	282,088
1988	4,335	329,668	68,559	2,853	405,414
1989	7,082	157,523	60,736	1,241	226,582
1990	11,431	261,811	52,771	1,586	327,600
1991	9,467	218,876	49,403	1,749	279,495
1992	9,389	192,985	55,530	1,046	258,950
1993	23,444	302,217	52,314	832	378,808
1994	7,785	176,961	84,680	444	269,871
1995	3,434	116,472	43,525	504	163,936
1996	2,854	112,199	25,858	24	140,936
1997	1,259	111,823	36,576	252	149,912
1998	3,111	98,947	20,720	117	122,895
1999	7,109	69,760	28,748	312	105,929
2000	2,851	81,824	12,653	192	97,521
2001	3,366	90,755	5,221	205	99,548
2002	637	106,985	2,737	577	110,936
2003	811	84,112	12,080	196	97,199
2004	580	95,258	7,786	446	104,071
2005	1,635	129,396	17,229	676	148,936
2006	2,264	80,537	2,109	489	85,400
2007	5,691	61,587	16,392	1,084	84,753
2008	3,161	56,701	33,441	767	94,070
2009	5,078	54,555	19,261	1,226	80,119
2010	4,201	48,697	36,621	220	89,739
2011	7,559	52,379	32,429	186	92,552
2012	4,900	74,892	41,430	195	121,417
2013	5,968	75,384	32,812	513	114,676
2014	18,081	89,434	69,307	510	177,332
2015	14,574	88,423	74,053	547	177,598
2016	11,524	75,512	100,398	625	188,059
2017	16,701	77,462	23,491	276	117,930

region*	statistical reporting areas
AL-SW FL	18, 21, 22, 23, 29
FL Keys	12, 17
SE FL	11
NE FL	7, 8

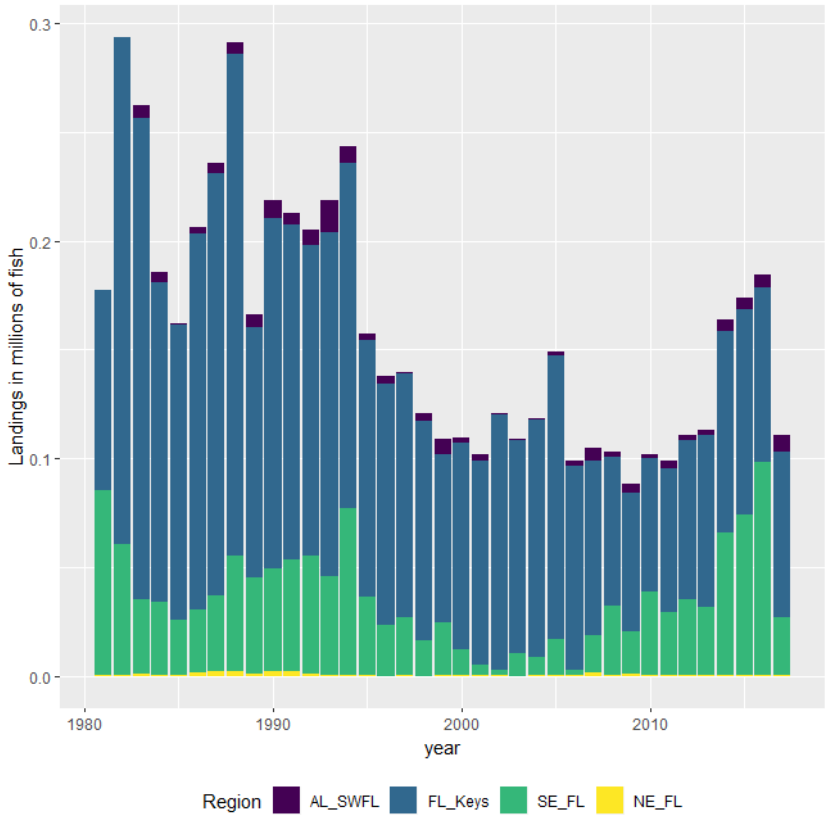

Figure 5. Estimated number of Yellowtail Snapper (in millions) retained in the Headboat Survey (SRHS), 1981-2017.

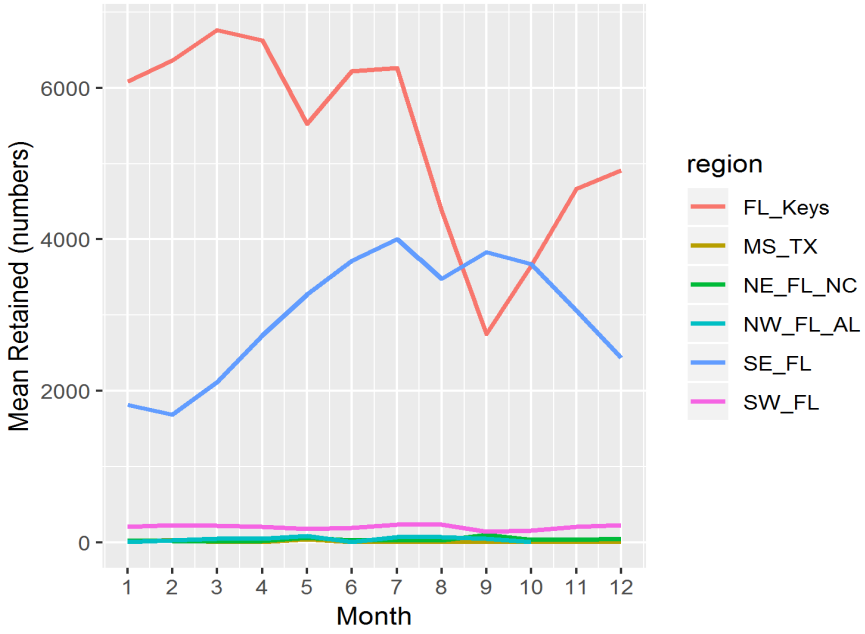

Figure 6. Mean estimated number of Yellowtail Snapper retained in the Headboat Survey (SRHS) by month and region.

Discards

Figure 7 and Table 4 present discards from 1981-2017. Discards from 2004 – 2017 are from SRHS logbook entries, while discards from 1981 – 2003 are estimated via methods described in the text. Discards are negligible outside of Alabama and Florida, making up less than 0.1% over all years.

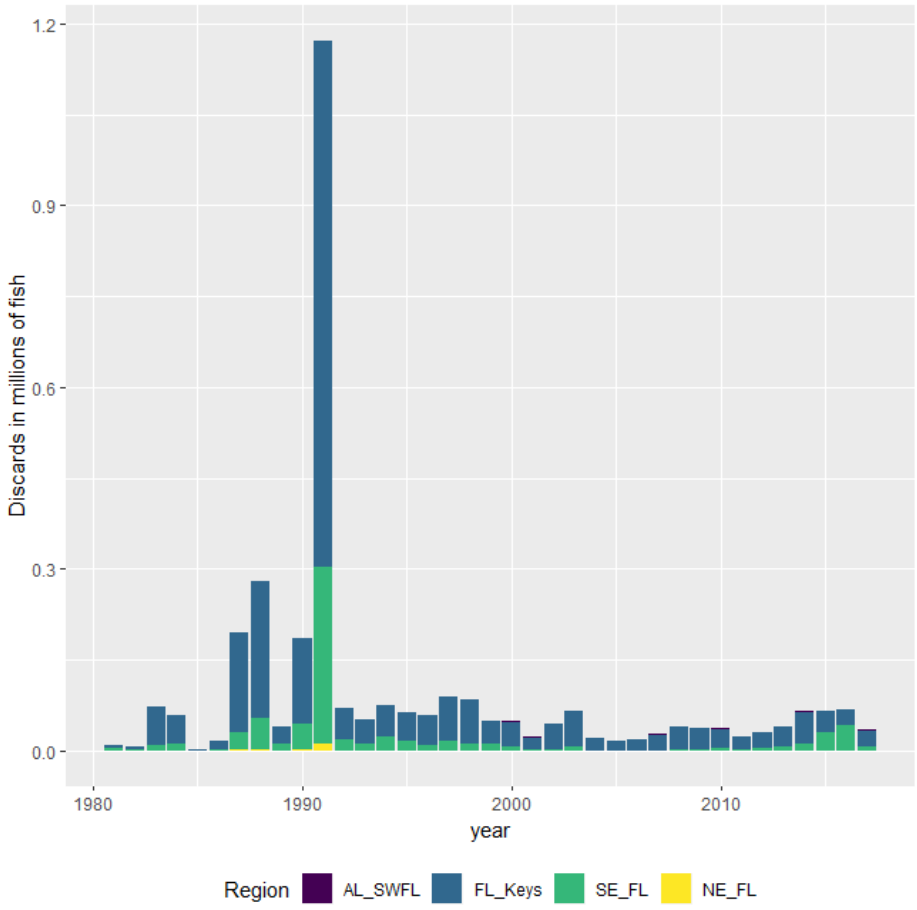

Figure 7. Estimated number of Yellowtail Snapper (in millions) discarded in the Headboat Survey (SRHS), 1981-2017.

Table 4. Headboat Survey (SRHS) annual discards (numbers of fish released) of Yellowtail Snapper by regions, 1981-2017. Regions west of AL or north of FL are not shown due to confidentiality concerns. The overall contribution of these regions is described in the text.

Year	AL-SW FL	FL Keys	SE FL	NE FL	Total
1981	0	3,923	4,476	32	8,432
1982	0	2,778	1,186	9	3,973
1983	0	44,878	9,005	213	54,096
1984	295	37,864	10,385	121	48,370
1985	0	1,451	327	8	1,785
1986	0	13,628	2,293	118	16,039
1987	0	163,177	29,254	1,940	194,371
1988	0	225,602	51,944	2,114	279,661
1989	0	27,696	10,549	301	38,546
1990	0	142,510	41,759	1,790	186,058
1991	213	869,819	289,804	12,126	1,171,961
1992	1,035	50,100	19,082	395	70,613
1993	0	39,451	11,291	173	50,914
1994	0	49,717	23,933	196	73,847
1995	0	48,232	14,691	180	63,104
1996	0	47,216	9,946	13	57,175
1997	0	71,023	16,933	165	88,120
1998	991	71,806	11,345	92	84,235
1999	278	36,406	11,553	106	48,342
2000	189	42,233	5,345	84	47,851
2001	3,085	18,620	945	48	22,699
2002	15	43,455	880	155	44,506
2003	0	59,113	6,210	106	65,429
2004	52	21,391	38	54	21,535
2005	222	15,397	142	51	15,812
2006	607	18,442	96	9	19,154
2007	482	25,875	511	97	26,965
2008	704	36,927	1,870	256	39,757
2009	1,329	34,348	1,645	315	37,637
2010	1,226	32,022	2,913	174	36,335
2011	423	22,168	1,464	156	24,211
2012	742	25,349	4,343	130	30,564
2013	1,018	31,340	6,985	434	39,777
2014	931	51,587	11,930	44	64,492
2015	836	34,987	30,009	12	65,844
2016	1,356	24,950	42,239	92	68,637
2017	2,105	25,455	6,235	23	33,818

region*	statistical reporting areas
AL-SW FL	18, 21, 22, 23, 29
FL Keys	12, 17
SE FL	11
NE FL	7,8

Fishing Effort

Fishing effort is measured in angler days and includes estimates for trips not reported in logbooks (Table 5). The estimated number of angler days in regions with the highest catches of Yellowtail Snapper (southeast FL and FL Keys) have generally declined since 1981, however effort increased markedly from 2010 to 2016 in both areas (Figure 8). Except for 2017, the number of angler days in southeast Florida outnumbered those in the Keys.

The marked decline in angler days in 2017 in southeast Florida may be because some federally permitted headboats previously surveyed by the SRHS have chosen not to renew their federal reef fish permits, relieving them of the requirement to provide logbooks or be sampled by federal headboat port samplers. These vessels, concentrated in southeast Florida (59% of headboats operating in southeast Florida), now target popular reef fish species solely in state waters. No federally administered surveys have absorbed these vessels into their sample frames, eliminating opportunities for these vessels to report landings or fishing effort. State surveys continue to collect biological data through at-sea observer trips and a dockside intercept surveys utilized to collect biological samples.

Hurricanes Irma and Maria struck Florida, Puerto Rico and the U.S. Virgin Islands in September 2017, which could have contributed to the decline in fishing effort in both the Keys and southeast Florida in 2017. According to a NOAA provisional report (NOAA 2018), damages and losses attributed to Irma were widely distributed throughout the Florida peninsula although fishing businesses and operators in the southern part of the state, primarily the Florida Keys and Collier County, suffered much higher levels of damage and loss than other areas.

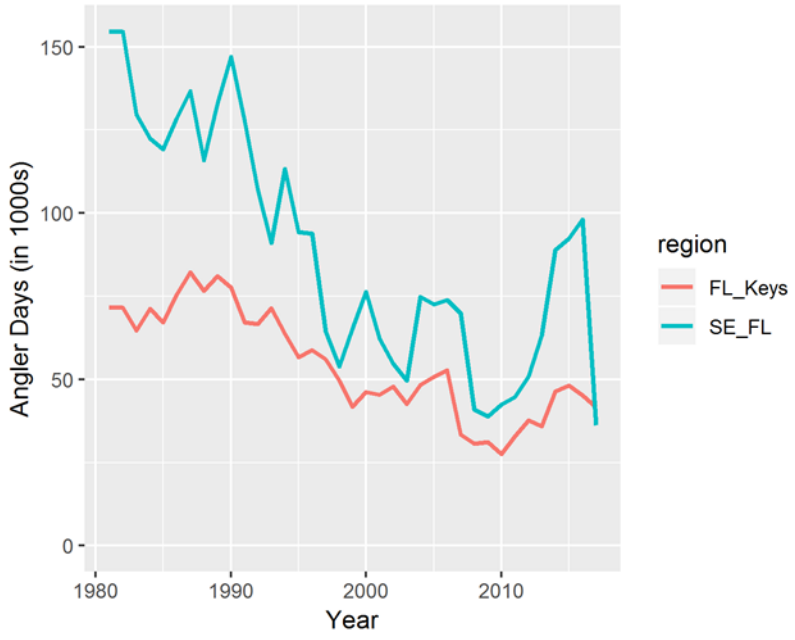

Figure 8. Estimated number of angler days on vessels participating in the Headboat Survey (SRHS) in southeast Florida (SE FL) and the Florida Keys (FL Keys), 1981-2017.

Table 5. Headboat Survey (SRHS) angler days by regions, 1981-2017.

Year	TX- MS	AL-NW FL	SW FL	FL Keys	SE FL	NE FL	GA-NC	Total
1981	-	-	-	71,709	154,747	72,427	78,404	-
1982	-	-	-	71,614	154,558	66,961	94,478	-
1983	-	-	-	64,721	129,643	83,499	89,563	-
1984	-	-	-	71,314	122,446	95,234	96,179	-
1985	-	-	-	67,227	119,169	94,449	97,385	-
1986	62,459	101,336	138,741	75,444	128,513	113,101	98,414	718,008
1987	69,725	76,111	140,938	82,174	136,723	114,144	114,067	733,882
1988	78,087	67,648	128,300	76,641	115,978	109,156	118,889	694,699
1989	66,256	57,233	151,092	81,000	132,944	102,920	101,386	692,831
1990	65,042	60,758	153,148	77,655	147,006	98,234	100,391	702,234
1991	66,342	62,392	111,920	67,146	127,765	85,111	108,918	629,594
1992	86,129	66,180	118,622	66,670	107,043	90,810	102,966	638,420
1993	92,160	73,703	134,195	71,459	91,020	74,494	107,243	644,274
1994	113,429	69,110	135,452	63,710	113,326	65,260	100,407	660,694
1995	100,962	67,798	114,612	57,315	94,293	55,892	105,248	596,120
1996	102,840	64,336	90,577	58,821	93,797	44,555	92,755	547,681
1997	91,215	65,599	83,843	56,059	64,450	49,858	100,245	511,269
1998	85,504	66,664	118,667	49,605	53,946	49,788	100,743	524,917
1999	66,261	60,959	115,158	41,781	65,261	55,153	88,952	493,525
2000	63,347	57,106	102,225	46,228	76,250	57,619	73,794	476,569
2001	61,583	55,748	101,495	45,321	62,271	53,460	83,381	463,259
2002	73,173	55,554	86,277	47,904	54,731	46,639	72,340	436,618
2003	81,068	62,555	81,656	42,544	49,672	51,369	60,980	429,844
2004	64,990	63,494	94,936	48,319	74,838	50,544	77,717	474,838
2005	59,857	52,797	77,436	50,785	72,515	47,778	67,370	428,538
2006	75,794	66,346	57,703	52,678	73,936	46,990	83,728	457,175
2007	66,286	67,997	68,883	33,407	69,981	51,796	91,697	450,047
2008	44,133	62,118	68,058	30,649	40,949	50,771	66,019	362,697
2009	54,005	65,623	76,815	31,092	38,881	64,356	62,478	393,250
2010	47,869	40,594	70,424	27,524	42,462	51,719	67,979	348,571
2011	50,941	77,303	79,722	32,977	44,808	53,142	64,667	403,560
2012	55,456	77,770	84,205	37,770	51,028	57,840	62,830	426,899
2013	59,155	79,979	94,752	35,887	63,205	64,697	63,400	461,075
2014	54,488	88,524	102,841	46,296	88,842	58,685	66,783	506,459
2015	58,722	86,473	107,910	48,115	92,384	52,703	64,195	510,502
2016	57,038	90,877	109,101	45,183	98,090	51,640	65,519	517,448
2017	54,764	88,972	107,685	41,656	36,166	46,563	58,825	434,631

region*	statistical reporting areas
TX-MS	24-28
AL-NW FL	23, 29
SW FL	18, 21, 22,
FL Keys	12, 17
SE FL	11
NE FL	7,8
GA - NC	1,3,5,6,10

Logbook Data

The number of trips (separated by daytime and nighttime fishing) reported in the catch records are presented in Figure 9. Some trips were removed according to data filtering criteria described in the Methods section. As shown, there was a notable reduction in the number of reported trips from 1996 to 2007 in southeast Florida.

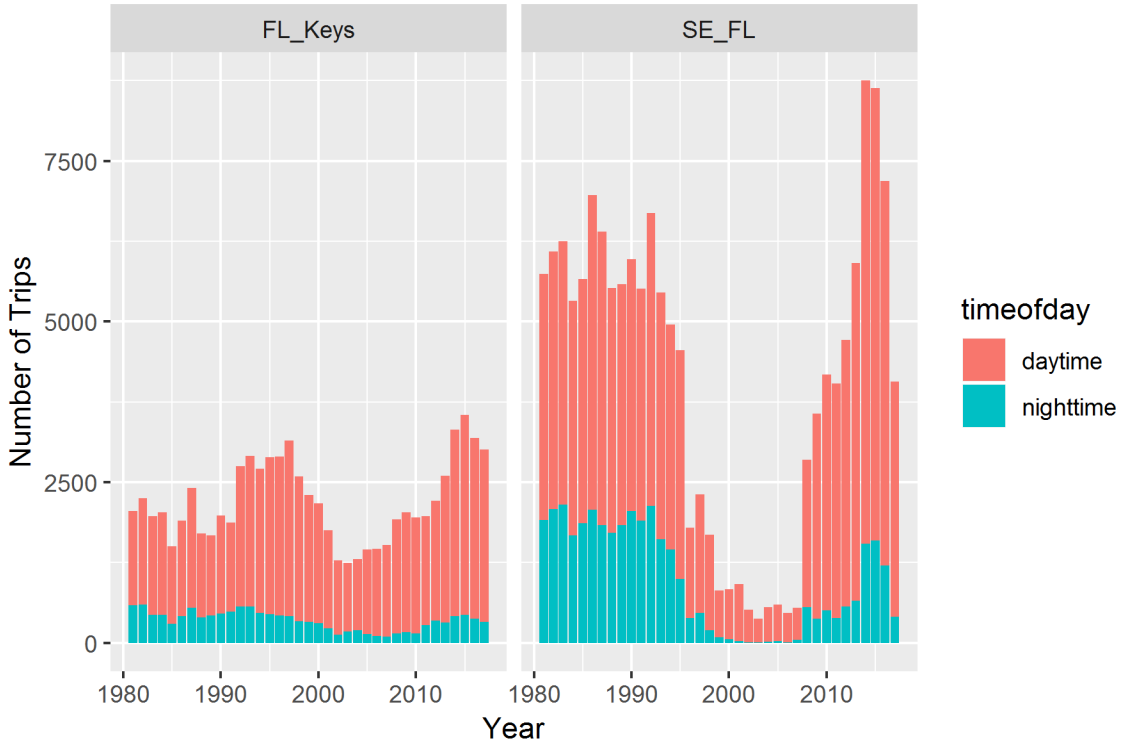

Figure 9. Number of trips reported in the catch records after data filtering in the Headboat Survey (SRHS) in southeast Florida (SE FL) and the Florida Keys (FL Keys), 1981-2017.

Biological Samples

The number of Yellowtail Snapper sampled for length measurements by dockside port agents are presented in Table 6. Out of state measurements are not shown due to confidentiality concerns, but the overall contribution is very low (< 0.2%). Prior to 2003, natural total length (relaxed tail) was the primary measurement. Since 2003, fork length and total length measurements occur in approximately equal frequency. Length distributions of sampled natural total length and fork lengths are shown in Figures 10 and 11 for SE FL and FL Keys. These length distributions are not weighted by the landings, nor are they corrected for errors.

Summary statistics and figures of fork lengths after removing erroneous measurements and predicting fork length when only total length was measured are presented in Table 7 and Figures 12 and 13. Similarly, Table 8 provides summary statistics for sampled weight measurements. Figure 14 present total length frequencies after removing erroneous measurements and predicting total length when only fork length was measured. Low sample size contributed to an anomalous

length distribution in SE FL in 1996. The change in the length distribution in the FL Keys in 1986 is likely due to the FWC minimum size requirement of 12 inch (30.5 cm) maximum total length (or equivalently 24.8 cm fork length). A comparison of overall distributions of length frequencies between the FL Keys and SE FL in Figure 15 show minor differences.

Table 6. Number of Yellowtail Snapper sampled for length measurements (natural total length and/or fork length) in the Headboat Survey (SRHS) by region*, 1981-2017.

Year	AL-SW FL	FL Keys	SE FL	NE FL	Total
1981	0	1101	641	27	1769
1982	0	2010	425	53	2488
1983	2	1838	961	70	2869
1984	7	1953	991	20	2964
1985	2	1804	920	46	2770
1986	45	2119	1040	49	3253
1987	31	1851	1028	69	2979
1988	69	1115	487	37	1708
1989	37	1511	815	26	2389
1990	75	1052	228	66	1421
1991	10	1335	346	65	1756
1992	39	892	313	108	1352
1993	2	1571	356	85	2014
1994	1	1755	494	42	2292
1995	1	1254	396	34	1685
1996	12	1466	22	10	1510
1997	1	1595	816	14	2426
1998	6	1398	864	22	2290
1999	27	1034	548	51	1660
2000	4	1003	559	23	1589
2001	1	902	515	15	1433
2002	6	1004	692	73	1775
2003	2	1322	1305	32	2661
2004	2	815	1510	7	2334
2005	17	861	1549	12	2439
2006	77	843	1785	3	2708
2007	3	904	2301	31	3239
2008	30	1120	918	60	2128
2009	17	1036	654	47	1754
2010	57	774	538	9	1378
2011	23	1220	770	21	2034
2012	26	2983	478	19	3506
2013	16	3149	589	122	3876
2014	32	2676	785	121	3614
2015	21	3654	630	82	4387
2016	71	4021	745	28	4865
2017	35	3005	459	28	3527

region*	statistical reporting areas
AL-SW FL	23, 29, 18, 21, 22
FL Keys	12, 17
SE FL	11
NE FL	7,8

Table 7. Summary statistics for SRHS intercepted Yellowtail Snapper fork lengths (mm; corrected and predicted) by region and year.

Year	AL-SW FL				FL Keys				SE FL				NE FL			
	n	min	mean	max	n	min	mean	max	n	min	mean	max	n	min	mean	max
1981					1081	180	302	554	629	226	336	494	27	182	308	479
1982					2006	165	319	538	411	232	338	516	52	221	301	536
1983					1828	180	298	540	851	209	332	571	69	210	303	507
1984					1940	181	302	500	893	198	323	555	20	246	321	433
1985					1794	191	311	537	881	207	314	480	46	215	289	445
1986	45	225	312	522	2110	185	316	526	975	211	318	503	48	215	288	425
1987	31	219	270	347	1827	202	321	522	965	202	292	530	64	162	280	436
1988	68	224	264	314	1102	188	312	549	473	216	303	482	37	193	296	452
1989	36	230	309	415	1503	186	323	552	803	170	316	507	26	229	288	361
1990	75	267	339	507	1048	196	333	530	173	216	301	398	57	217	281	397
1991	10	229	298	387	1328	202	330	559	336	229	295	481	53	190	284	359
1992	39	232	331	485	888	155	325	526	270	233	295	529	87	202	310	422
1993	1	338	338	338	1562	193	318	522	250	245	303	441	77	220	318	485
1994	1	287	287	287	1744	200	310	550	487	237	298	436	37	257	289	359
1995	1	424	424	424	1252	201	297	522	395	249	319	434	21	251	320	390
1996	12	192	279	400	1464	190	299	536	22	249	315	350	10	216	270	342
1997	1	245	245	245	1592	188	296	530	815	169	311	546	13	202	291	379
1998	1	253	253	253	1394	188	287	495	856	171	309	457	18	241	305	381
1999	9	200	224	259	1032	202	290	500	548	177	312	516	51	217	314	448
2000	3	252	277	296	1000	220	284	482	504	221	300	465	21	234	291	373
2001	1	240	240	240	900	216	289	467	499	221	304	412	13	252	291	420
2002	6	233	280	318	1001	208	285	502	667	192	312	528	73	242	318	510
2003	2	260	392	524	1319	206	281	517	1291	229	308	477	32	245	303	385
2004	2	330	349	367	814	202	278	502	1502	186	290	547	7	250	268	287
2005	17	252	308	502	861	215	281	455	1534	205	298	440	12	232	276	317
2006	77	240	309	505	841	215	281	480	1778	202	294	455	3	260	272	290
2007	3	290	317	345	903	197	276	517	2289	212	297	460	31	224	267	322
2008	29	272	362	482	1119	212	282	497	915	190	296	432	58	247	294	398
2009	17	245	333	397	1031	202	277	497	654	235	294	475	37	232	290	405
2010	57	257	336	547	773	207	278	460	535	232	293	440	9	242	287	375
2011	23	302	378	485	1218	215	280	480	731	235	303	501	20	232	262	320
2012	26	285	348	460	2962	220	296	522	477	220	307	407	19	240	263	317
2013	16	250	327	515	3125	215	290	510	583	228	297	422	122	235	265	310
2014	32	270	376	582	2662	215	289	472	774	235	297	442	120	245	288	375
2015	21	195	344	470	3616	225	290	510	623	236	294	436	82	235	279	365
2016	71	265	330	467	3974	203	288	585	738	231	294	415	27	237	329	597
2017	35	246	365	445	2982	217	290	564	454	208	277	411	28	236	266	307
All Years	**768**	**192**	**322**	**582**	**59596**	**155**	**298**	**585**	**27581**	**169**	**304**	**571**	**1527**	**162**	**292**	**597**

Table 8. Summary statistics for SRHS intercepted Yellowtail Snapper whole weight (g; corrected and predicted) by region and year.

Year	AL-SW FL				FL Keys				SE FL				NE FL			
	n	min	mean	max	n	min	mean	max	n	min	mean	max	n	min	mean	max
1981					1081	100	574	3000	629	200	726	1950	27	152	477	2800
1982					2006	100	604	2400	411	210	712	2300	52	215	502	2650
1983					1828	100	485	2400	851	140	664	3452	69	178	527	1700
1984					1940	100	483	2600	893	100	652	2852	20	240	637	1500
1985					1794	100	536	2500	881	154	607	1800	46	150	498	2000
1986	45	192	637	3100	2110	140	559	2100	975	200	681	2300	48	160	466	1900
1987	31	220	399	745	1827	150	592	2600	965	195	511	2000	63	120	454	1420
1988	68	230	356	770	1102	160	556	3200	473	170	575	2080	37	160	569	1850
1989	36	180	531	1220	1503	110	605	3210	798	100	630	1760	26	210	453	1180
1990	75	310	653	1980	1048	140	683	2710	173	110	524	1210	57	180	342	660
1991	9	280	500	950	1328	150	643	2980	336	180	452	1810	53	130	375	840
1992	36	220	629	1780	888	130	610	2690	270	101	465	2290	87	210	524	1330
1993	1	680	680	680	1562	100	582	2730	250	180	520	1420	77	200	553	1780
1994	1	670	670	670	1744	140	515	2280	487	210	504	1540	37	240	352	700
1995	1	1200	1200	1200	1252	160	442	2210	395	150	550	1820	21	220	569	1090
1996	12	140	488	1250	1464	160	458	2040	22	260	468	650	10	160	351	710
1997	1	280	280	280	1592	160	446	2060	815	100	600	2990	13	210	453	940
1998	1	280	280	280	1394	180	438	3000	856	130	586	2560	18	230	476	850
1999	9	230	300	340	1031	190	404	3370	548	170	543	1740	44	200	594	1720
2000	3	500	633	750	999	170	384	1640	504	200	477	1720	21	220	461	970
2001	1	260	260	260	900	220	417	1640	499	180	486	1340	13	260	476	1610
2002	6	250	393	540	1001	210	381	1630	667	140	542	2070	68	240	630	2120
2003	2	310	1425	2540	1315	180	378	1940	1284	130	509	1620	30	220	468	1010
2004	2	600	665	730	807	190	369	1910	1366	200	428	2480	6	240	347	570
2005	17	280	528	1960	854	180	363	1620	1392	180	472	1360	9	250	418	750
2006	77	210	506	1700	840	200	363	1850	1591	170	457	1620	2	260	330	400
2007	3	430	550	700	892	170	346	2090	2115	180	452	1540	27	200	308	490
2008	29	340	814	1830	1116	160	369	2000	861	180	460	1330	56	220	431	1560
2009	17	260	621	980	1028	170	351	2040	645	200	459	1720	34	210	481	1350
2010	57	270	679	2760	772	160	353	1280	530	230	442	1190	9	220	448	1000
2011	23	440	920	1860	1218	170	372	1600	606	200	484	1950	20	220	324	490
2012	26	410	727	1610	2927	160	462	2200	405	220	519	1270	19	240	344	580
2013	16	230	690	2190	3063	190	435	2130	484	220	461	1260	121	230	344	720
2014	32	270	973	3170	2521	170	434	1690	606	230	457	1490	120	240	438	970
2015	20	240	812	1860	3376	180	428	2070	583	200	446	1240	82	210	373	820
2016	71	300	589	1600	3292	160	433	3400	632	220	449	1310	26	220	797	3330
2017	35	260	819	1410	2712	195	448	1930	351	170	391	1080	28	210	331	640
All Years	**763**	**140**	**619**	**3170**	**58127**	**100**	**473**	**3400**	**26149**	**100**	**522**	**3452**	**1496**	**120**	**462**	**3330**

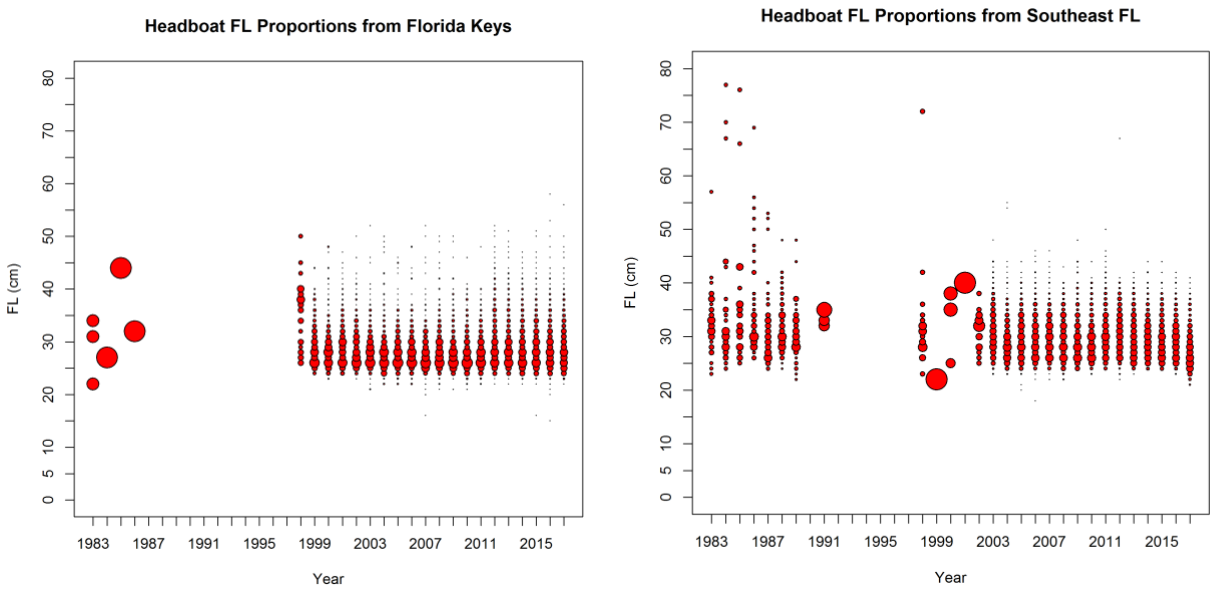

Figure 8. Raw (uncorrected and not predicted) fork length (FL) proportions in SE FL and the FL Keys in the Headboat Survey, 1981-2017.

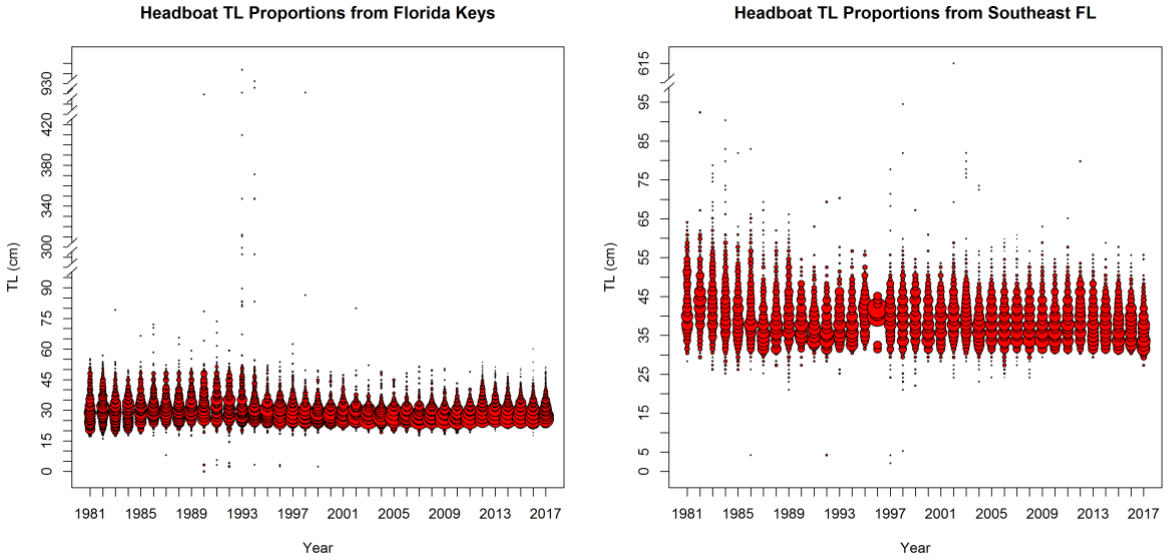

Figure 9. Raw (uncorrected and not predicted) natural total length (TL) proportions in SE FL and the FL Keys in the Headboat Survey, 1981-2017. Note the broken Y axes.

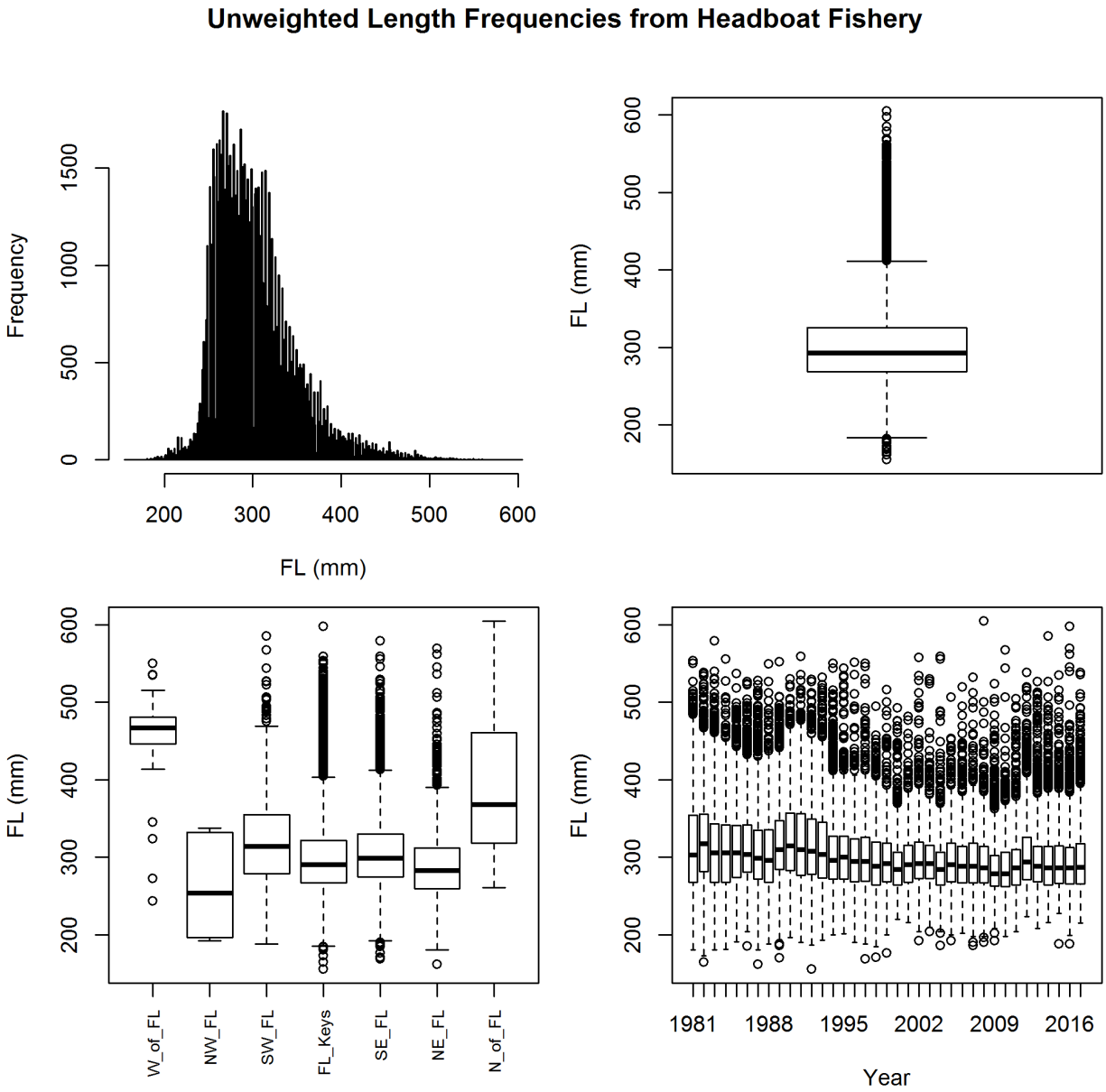

Figure 10. An overview of unweighted fork lengths (FL) (including FL measurements predicted by TL measurements when FL measurements were unavailable) in the Headboat Survey, 1981-2017.

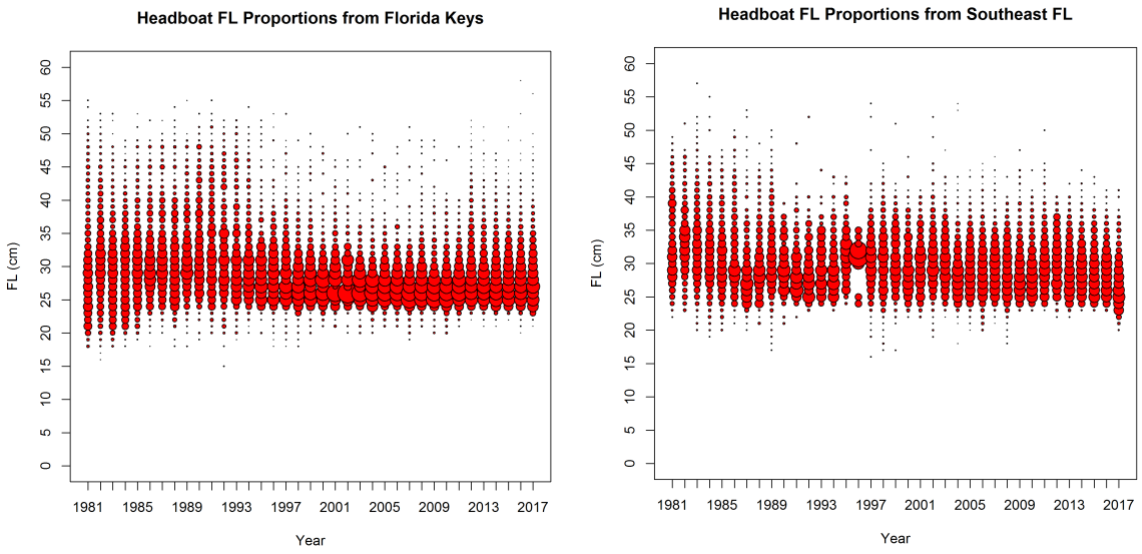

Figure 11. Unweighted fork length (FL) proportions (including FL measurements predicted by TL measurements when FL measurements are unavailable) in SE FL and the FL Keys in the Headboat Survey, 1981-2017.

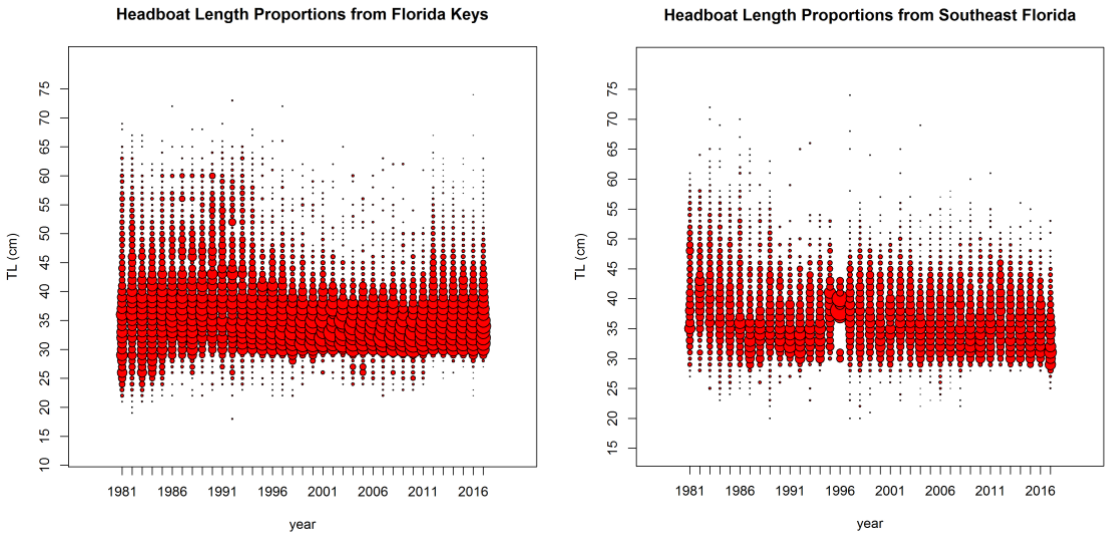

Figure 12. Unweighted natural total length (TL) proportions (including TL measurements predicted by FL measurements when TL measurements are unavailable) in SE FL and the FL Keys in the Headboat Survey, 1981-2017.

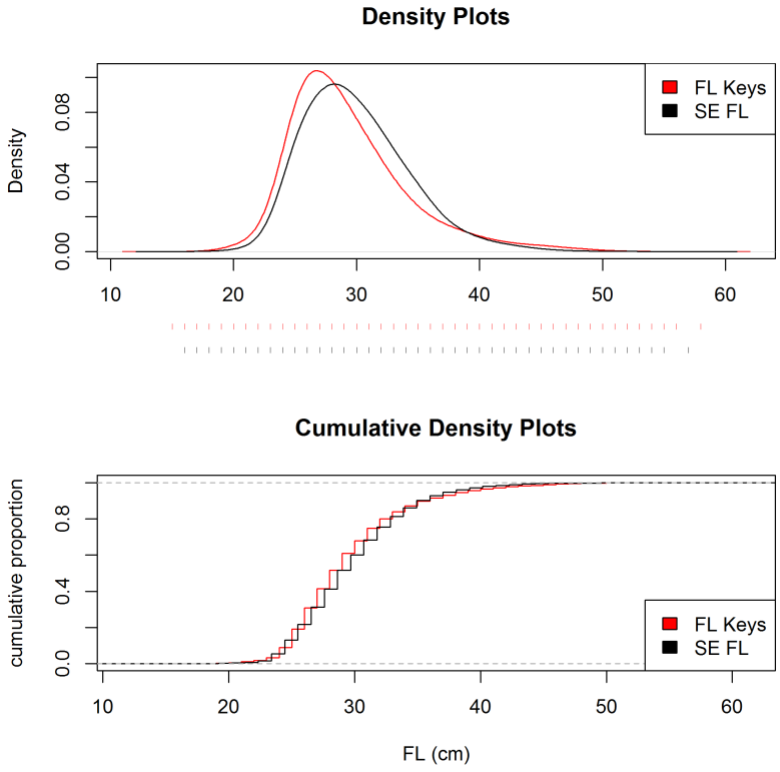

Figure 13. Fork length density and cumulative proportions in SE FL and the FL Keys in the Headboat Survey, 1981-2017. Lines under the density plot indicate non-empty length bins in each region.

Program Evaluation

Fitzpatrick et al. (2017) explored the reliability of the SRHS data collected from federal waters in the southeast U.S. Atlantic coast. Areas were grouped into the Carolinas, Georgia and northeast Florida (Nassau-Indian River counties), and southeast Florida (St. Lucie- Monroe counties). The misreporting analysis focused on data collected from 1972 to 2013 and involved two main components: 1) analysis of industry-reported catch records to identify outliers, which might be indicative of misreporting, and 2) comparison of trip-level catch records with data collected by SRHS port agents during dockside sampling surveys.

Dockside samples represent a subsample of the catch and therefore should always have fewer fish than what is recorded in logbooks. An indication of underreporting is if dockside samples show more fish than the catch record. Comparison of catch records and dockside surveys were limited to full-day trips (because of matching issues).

Overall there is low correlation between Yellowtail Snapper landings and the number sampled in southeast FL (Figure 14, rho=0.01). This may be due to low reporting rates in this area prior to 2009. Additionally, because there are few full-day trips in southeast Florida, it is possible that the single-day trips that do occur are atypical in some way.

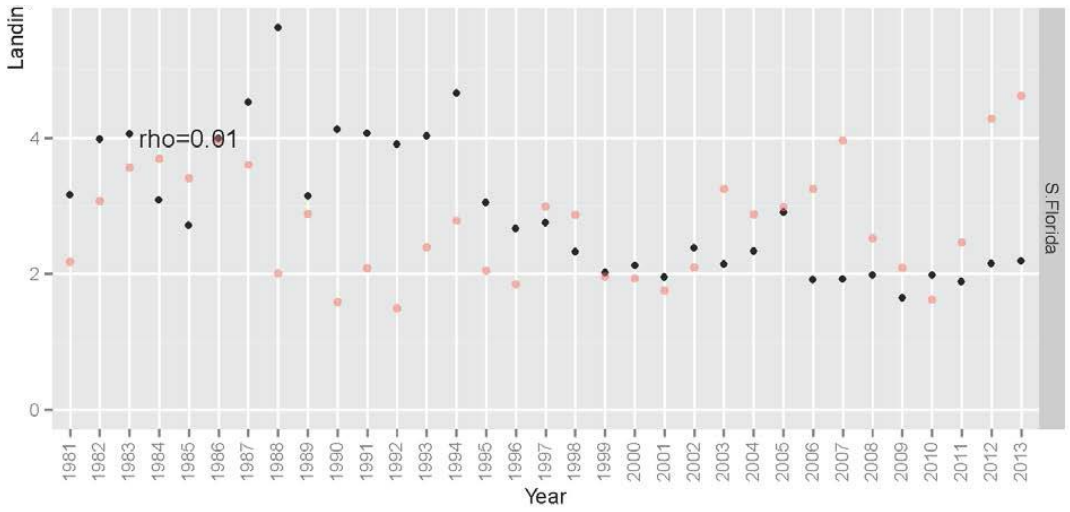

Figure 14. Estimated landings of Yellowtail Snapper (black) and number sampled (red) scaled to mean. Spearman rank correlation coefficient ρ values indicate degree of correlation between landings and the number of fish sampled.

Dataset Information

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