

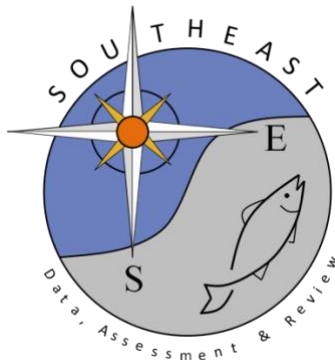
Headboat Data for Mutton Snapper in the Southeast U.S. Atlantic and Gulf of Mexico

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SEDAR79-DW-06

2 August 2023

Updated: 24 August 2023



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Please cite this document as:

Cheshire, Robin T., Kenneth Brennan, and Matthew E. Green. 2023. Headboat Data for Mutton Snapper in the Southeast U.S. Atlantic and Gulf of Mexico. SEDAR79-DW-06. SEDAR, North Charleston, SC. 55 pp.

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2023-06-02

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1 Survey Description

The Southeast Region Headboat Survey (SRHS) estimates landings and effort for headboats in the southeast U.S. Atlantic and Gulf of Mexico. The Headboat Survey began in 1972 in North Carolina and South Carolina. In 1976 the survey expanded to northeast Florida (Nassau-Indian River counties) and Georgia, followed by southeast Florida (St. Lucie-Monroe counties) in 1978 (Chester et al. 1984; Grimes and Hollingsworth 1979; Huntsman 1976; Huntsman, Colby, and Dixon 1978). The SRHS began in the Gulf of Mexico in 1986 and extends from Naples, FL to South Padre Island, TX. The headboat survey generally includes 70-80 vessels participating in each region annually (Table 1). Headboat data are considered confidential and cannot be publicly distributed if less than three vessels contribute to the data product.

The SRHS implemented electronic logbook reporting in the South Atlantic and Gulf of Mexico as of Jan 1, 2013. Headboat operators now have the ability to report trip information via a website or mobile application. A review of the headboat data methodology and validity was conducted in 2015 for the Atlantic waters of the Southeastern U.S. (Fitzpatrick et al. 2017; SEDAR 2015). Panelists agreed the SRHS data products were

the best available information and should be used in stock assessments. The decision should translate to the Gulf of Mexico since the methodology and data collection are identical.

The paper headboat logbook forms varied by region and year due to space limitation on the forms during the early years of the survey. Predominant species listed on the paper forms varied by region. In general, the number of species listed increased in all regions over the early years. There were blank lines to write in species not listed on all forms. In the electronic logbook entry, starting in 2013, all species are available to users. Reporting of discards was added to the form in 2004.

The area definitions for SRHS were modified in 2013 primarily to remove the inshore - offshore component for the Carolinas and create state-specific areas for the Gulf of Mexico. A few other areas were collapsed in the Florida Keys and west Florida (Figures 1 and 2). For this assessment, state is used to define finer scale regions rather than actual states as advised by the assessment staff. The assignment of SRHS areas to states and regions are below:

- Areas 1:6,9,10 - North_of_FL
- Areas 24:28 - West_of_FL
- Areas 23,29 - NW_FL_AL
- Areas 18,21,22 - SW_FL
- Areas 12,17 - Florida Keys
- Area 11= SE_FL
- Areas 7,8 - NE_FL
- Areas 1,2,3,4,5,9,10,6,7,8,11 - East Region
- Areas 12,17,18,21,22,23,29,24,25,26,27,28 - West Region

The SRHS dockside sampling was suspended in March 2020 due to concerns about COVID. No biological samples were collected during this time. During the dockside sampling suspension, port agents continued to monitor reporting compliance to ensure captains continued to report trip level catch and effort data via the electronic logbooks. Reported catch and effort data were used to estimate 2020 headboat landings and effort with no disruption. Converting landings in number to landings in weight requires mean weights by species. The logic for determining mean weights expands across strata and backwards in time until a minimum of 10 fish are available. The 2020 landings estimates in weight were derived by applying mean weights from 2019 to 2020 landings in number. Port agents continued to maintain QA-QC checks and validations in the database for their area of responsibility. Port agents also provided outreach and support to captains regarding the new for-hire reporting requirements and changes to the electronic reporting application. Given that headboat dockside sampling necessarily involves interactions between the sampler and headboat anglers and staff, biological samples were not collected until NMFS/SEFSC approved measures to resume sampling in July 2021. However, some port agents are supported by state agencies and returned to dockside sampling earlier.

2 Methods

2.1 Landings

The SRHS incorporates two components for estimating catch and effort. 1) Information about total catch and effort are collected via a logbook form that is filled out by vessel personnel for individual trips. These logbooks are summarized by vessel to generate estimated landings by species, area, and time strata. The compliance in reporting this information has improved over the years of the survey. Port agents are able to identify missing trip reports by contacting the captain or office associated with the fishing vessel, personal observations, reviewing the weekly compliance report, and other methods. If a missing trip is identified, the catch is estimated using a report from the same vessel when possible or a vessel of similar size over the same time and area. Reporting compliance has been near 100 percent since permits were tied to reporting requirements in 2008. The proportion of trips reported is the primary information used to develop a proxy for uncertainty estimates for landings and discards. 2) The size of the fish landed are collected by port samplers during dockside sampling, where fish are measured to the nearest mm and weighed to the nearest 0.01 kg. The mean weights by species, area, and month are used to convert reported landings in numbers of fish to landings in weight.

2.2 Discards

The Southeast Region Headboat Survey logbook form was modified in 2004 to include a category to collect self-reported discards for each reported trip. This category is described on the form as the number of fish by species released alive and number released dead. Port agents instructed each captain on criteria for determining the condition of discarded fish. A fish was considered “released alive” if it was able to swim away on its own. If the fish floated off or was obviously dead or unable to swim, it was considered “released dead”. As of Jan 1, 2013 the SRHS began collecting logbook data electronically. Changes to the trip report were also made at this time, one of which removed the condition category for discards i.e., released alive vs. released dead. The new form now collects only the total number of fish released regardless of condition. Due to the subjectivity involved in determining the condition of the released fish from 2004 to 2012, live and dead releases are typically combined for 2004 to 2012 as total discards for consistency to match later years.

Some under reporting and misunderstanding of the data requested were identified in the initial years of the discard data collection (2004 - 2007). Observers with the headboat at-sea program collect catch and discard information from a subset of anglers. Annual catch rates from the observer data can be compared to catch rates reported on logbooks to evaluate the validity of logbook discard data for 2004 to 2007. Starting in January 2023, two fields were added to the logbook form, number of discard descended and number vented. These will be used to quantify the prevalence of use and effectiveness of fish descending devices and venting tools which are required to be onboard in both the South Atlantic and Gulf of Mexico.

2.3 Uncertainty

The first attempt to provide uncertainty estimates for headboat landings were developed for the SEDAR 68 scamp research track assessment (Nuttall et al. 2020). The approach was statistically valid but applied the uncertainty of reported SRHS landings (across areas, months, and vessels) as a proxy for uncertainty in SRHS landings estimates, which produced unrealistic coefficients of variation (CV) in some years. For SEDAR 68 scamp, years with only 60 percent of the vessels reporting had CV values of approximately 0.05. As an alternative, a proxy CV method was developed for the SEDAR 74 red snapper research track data workshop that relies on the proportion of trips reported (N) to total estimated trips (n) and adds a buffer of 0.05 to prevent the CV from reaching zero $proxyCV = 1 - \frac{N}{n} + 0.05$ (SEDAR 2022). This proxy CV method was again refined for the SEDAR 82 gray triggerfish research track data workshop to account for any spatial variability in species abundance and reporting compliance. In particular, using the SEDAR 74 approach, high CVs could be estimated for strata that have low compliance rates across most areas, even if compliance was high in the few areas comprising the majority of catch. To address this concern, compliance rates are now weighted (spatially) by the associated landings estimates:

$$proxyCV_i = 1 - \sum_{j=1}^n \left[\left(\frac{N_{i,j}}{n_{i,j}} \right) * \left(\frac{L_{i,j}}{L_i} \right) \right] + 0.05$$

where n is the number of reported trips, N is the number of estimated trips, and L is the landings in number for year i and state/region j.

2.4 Effort

Catch and effort data were reported on logbook forms provided to all headboats in the survey until 2012 and electronically since 2013. The information is entered by the owner, captain, or designated crew member after each trip and the total number of all the species landed on a given trip, along with the total number of fish discarded for each species. Data on effort are provided as number of anglers on a given trip. Effort is standardized as angler days by multiplying the number of hours associated with the type of trip (e.g., 40 anglers on a half-day trip would yield $40 * 0.5 = 20$ angler days). Angler days are summed by month for individual vessels. Each month, port agents collect these logbook trip reports and check for accuracy and completeness. Although reporting via the logbooks is mandatory, compliance is not 100% and is variable by location. To account for non-reporting, a correction factor is developed based on sampler observations, angler numbers headboat booking offices, and all available information. This information is used to provide

estimates of total catch (expanded or corrected for non-reporting) by month and area, along with estimates of effort. The effort estimates for Louisiana in 2004 and 2005 are zero. During this time period only one or two vessels were active and did not report their catch in 2002, 2004, 2005, or 2006. In 2002, 2004 and early 2005 funding and staffing issues prevented the collection of trip information by port agents necessary to estimate effort and catch. In August 2005, Hurricane Katrina impacted Louisiana fishing operations to the extent it was unlikely there was any fishing effort through the end of the year and some of 2006. Alabama was assigned a separate area code in 2013. In prior years, Alabama was combined with northwest Florida. Mississippi was added to the headboat survey in 2010. In earlier years, there was little to no headboat fishing in Mississippi. Angler Days is the best practice unit of effort for headboat data. Angler trips can be calculated to match units for general recreational effort for the purpose of combining effort across sectors. There are some caveats with the method because it does not account for all effort expansions in the standard estimation method.

2.5 Biological Samples

Length data has been collected by SRHS dockside samplers since the initiation of the survey, the collection of which coincides with associated catch count. Weights are typically collected for the same fish measured during dockside sampling. Other biological samples and data (scales, otoliths, spines, stomachs, gonads, and sex determination) are collected routinely and processed for ageing, diet studies, and maturity studies. Lists of priority species are provided to port agents but no specific sampling quotas are directed.

3 Results and Discussion

3.1 Landings

Landings in number are given by state (Table 2) and region (Table 3, Figure 3). Landings in pounds are shown by state (Table 4) and by region (Table 5, Figure 4). The primary area of mutton snapper landings are Southeast Florida and the Florida Keys (Tables 2 - 5).

3.2 Discards

Discards by state and region are primarily from southeast Florida followed by the Florida Keys (Tables 6 - 7, Figure 5). Discards are highest in the East region which includes southeast Florida with an increase starting in about 2014. There is no information within the SRHS on the size of these fish with which to convert the discards in number to weight. However, the at-sea observer size data may be adequate to inform size compositions and average annual weights for converting discards from number to weight if needed for model input.

Comparisons of discard rates between SRHS logbooks and at-sea observer data can inform the validity of logbook discards by region and inform the decision for the year to start using logbook discard data. A method to estimate proxy discards for earlier years will be developed at the data workshop based on recent SEDAR methods.

3.3 Confidentiality

Headboat landings and discards are confidential if fewer than three vessels contributed logbook records for any strata. The number of vessels reporting by state, region, and annually are given in tables 8 - 10. For mutton snapper, only the overall and regional annual catch and discards can be released to the public.

3.4 Uncertainty

Unweighted proxy CV estimates by state, region and overall are provided in tables 11 - 13. Regional proxy CV values weighted by state landings in number and weight are given in tables 14 and 15. Annual weighted proxy CV values weighted by regional landings in number and weight are provided in tables 16 and 17. The weighted proxy CVs should provide the best estimate for uncertainty.

3.5 Effort

Total estimated headboat angler days and angler trips decreased until about 2010 followed by an increase until 2015 after which it has been relatively constant (Tables 18 - 19). The Gulf of Mexico SRHS did not begin until 1986 so the West region effort for 1981 - 1985 is just from the Florida Keys. The same trend is seen in the East for the regional effort estimates (Tables 20 - 21, Figure 7). The finer scale effort estimates by state show the pattern observed in effort is consistent across states (Tables 22 - 23, Figure 6). Reports from industry staff, captains or owners, and port agents indicated fuel prices, the economy and fishing regulations are the factors that most affected the amount of trips, number of passengers, and overall decrease in fishing effort through 2010.

3.6 Biological Samples

Annual numbers of mutton snapper measured for natural total length in the headboat fleet by state and region are given in tables 24 - 25. The number of trips from which mutton snapper were measured are summarized in Tables 26 - 27. Mean total lengths (mm) and weight (g) and associated CVs for the headboat fishery are tabulated by state and region in Tables 28 - 35. Patterns in length and weight by year and region are shown in Figures 8 and 9. The sample sizes are very small for most years. There is a pattern of smaller fish in southeast Florida which are also seen in the East region. Only southeast Florida and the Florida Keys met the SEDAR best practice minimum sample sizes for compositions development (30 fish and 10 trips). The regional samples sizes are adequate to develop length compositions.

4 Tables

Table 1: Number of vessels in the SRHS by year and region (Gulf - SW Florida to Texas, Atlantic - North Carolina to SE Florida).

year	Atlantic	Gulf
1981	92	
1982	89	
1983	86	
1984	90	
1985	89	
1986	94	87
1987	94	79
1988	94	72
1989	95	95
1990	93	88
1991	94	80
1992	105	80
1993	95	81
1994	95	84
1995	89	82
1996	90	73
1997	92	70
1998	89	73
1999	86	69
2000	89	72
2001	84	72
2002	77	61
2003	68	65
2004	81	65
2005	76	74
2006	76	70
2007	78	69
2008	84	71
2009	82	76
2010	86	78
2011	77	73
2012	78	71
2013	76	68
2014	76	68
2015	73	68
2016	76	69
2017	66	71
2018	65	72
2019	65	72
2020	66	68
2021	62	70
2022	62	68

Table 2: Mutton snapper landings by state in number. Strata with fewer than 3 vessels reporting are confidential ('conf?').

year	West_of_FL	NW_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL	Total
1981	0	0	0	21797	23997	96	conf	45890
1982	0	0	0	13370	17707	50	conf	31136
1983	0	0	0	18006	10667	25	conf	28784
1984	0	0	0	10912	6456	57	conf	17510
1985	0	0	0	11297	10151	44	conf	21492
1986	255	0	80	12080	8482	168	0	21065
1987	190	conf	224	9940	9830	393	conf	20582
1988	1161	conf	128	6450	16648	595	conf	24984
1989	33	conf	144	7207	18419	322	0	26134
1990	88	conf	451	14753	23913	369	6	39585
1991	118	conf	333	5749	12883	492	0	19577
1992	26	conf	178	9449	10376	693	2	20726
1993	21	10	684	8829	15476	438	5	25463
1994	13	0	536	10529	12417	835	9	24339
1995	15	conf	385	6382	8598	540	conf	15927
1996	11	conf	36	4940	3591	218	conf	8801
1997	conf	0	conf	4828	4366	412	conf	9687
1998	43	0	24	4109	2638	356	15	7185
1999	103	0	301	2616	4027	439	conf	7493
2000	conf	conf	197	4811	2900	312	conf	8228
2001	46	conf	194	5499	4336	215	conf	10292
2002	19	conf	14	4025	3215	658	conf	7939
2003	4	0	594	4129	2383	165	conf	7280
2004	13	0	153	3760	3450	57	conf	7434
2005	44	conf	51	6676	9581	132	conf	16500
2006	54	0	4	8558	1764	95	conf	10477
2007	37	0	2172	7259	5839	208	85	15600
2008	57	0	326	5826	5879	764	conf	12853
2009	26	conf	385	9183	7654	1175	conf	18444
2010	conf	conf	253	6535	7391	683	conf	14890
2011	conf	0	223	6725	4429	265	conf	11646
2012	76	conf	659	7043	4414	146	3	12372
2013	7	conf	344	5222	4000	106	conf	9694
2014	conf	0	614	6046	10311	626	17	17618
2015	conf	0	370	8081	11786	761	8	21007
2016	conf	0	407	6889	15002	1122	conf	23427
2017	0	conf	482	7674	4689	842	conf	13690
2018	conf	0	803	8757	3127	426	conf	13116
2019	0	0	829	7157	2974	392	conf	11357
2020	conf	conf	485	7062	2767	538	20	10874
2021	0	0	941	7407	2359	451	conf	11161
2022	0	0	1684	3996	3200	181	conf	9065

Table 3: Mutton snapper landings by region in number. Strata with fewer than 3 vessels reporting are confidential ('conf?').

year	East	West	Total
1981	24093	21797	45890
1982	17766	13370	31136
1983	10778	18006	28784
1984	6598	10912	17510
1985	10195	11297	21492
1986	8650	12415	21065
1987	10224	10358	20582
1988	17244	7740	24984
1989	18741	7393	26134
1990	24288	15297	39585
1991	13375	6202	19577
1992	11071	9655	20726
1993	15919	9544	25463
1994	13261	11078	24339
1995	9139	6788	15927
1996	3813	4988	8801
1997	4846	4841	9687
1998	3009	4176	7185
1999	4473	3020	7493
2000	3213	5015	8228
2001	4552	5740	10292
2002	3880	4059	7939
2003	2553	4727	7280
2004	3508	3926	7434
2005	9728	6772	16500
2006	1861	8616	10477
2007	6132	9468	15600
2008	6644	6209	12853
2009	8838	9606	18444
2010	8079	6811	14890
2011	4697	6949	11646
2012	4563	7809	12372
2013	4118	5576	9694
2014	10954	6664	17618
2015	12555	8452	21007
2016	16129	7298	23427
2017	5532	8158	13690
2018	3555	9561	13116
2019	3371	7986	11357
2020	3325	7549	10874
2021	2813	8348	11161
2022	3385	5680	9065

Table 4: Mutton snapper landings by state in pounds. Strata with fewer than 3 vessels reporting are confidential ('conf?').

year	West_of_FL	NW_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL	Total
1981	0	0	0	137668	70161	366	conf	208195
1982	0	0	0	86738	51092	150	conf	138027
1983	0	0	0	108983	36630	87	conf	146000
1984	0	0	0	59379	24419	228	conf	84367
1985	0	0	0	69125	33235	143	conf	102503
1986	4632	0	1173	87872	32349	640	0	126666
1987	1499	conf	1768	64592	31138	1241	conf	100275
1988	1389	conf	220	40618	51905	2330	conf	96467
1989	164	conf	1056	44576	61908	1103	0	108851
1990	419	conf	4444	96091	54868	1459	24	157349
1991	222	conf	1735	39224	38681	1568	0	81433
1992	62	conf	1269	60084	22459	2081	6	85974
1993	118	56	4489	47969	50034	2232	25	104924
1994	24	0	4922	73181	47491	3205	35	128858
1995	103	conf	2624	38172	25626	2421	conf	68992
1996	96	conf	313	31179	10842	925	conf	43417
1997	conf	0	conf	31286	13177	2613	conf	48215
1998	413	0	216	31237	9954	2014	157	43989
1999	847	0	2511	17782	13660	1903	conf	36734
2000	conf	conf	1658	34278	7678	902	conf	44579
2001	444	conf	1831	31856	13741	683	conf	48570
2002	122	conf	91	22303	10413	3034	conf	36003
2003	33	0	4579	22673	8884	904	conf	37101
2004	84	0	1036	20740	11320	240	conf	33425
2005	264	conf	317	33576	27484	391	conf	62093
2006	455	0	34	65063	4656	302	conf	70516
2007	174	0	10261	29094	16992	631	258	57409
2008	406	0	2171	23909	16086	2223	conf	44797
2009	170	conf	2457	48327	20301	3721	conf	75091
2010	conf	conf	1423	22331	24928	2360	conf	51186
2011	conf	0	1385	36133	15959	1070	conf	54563
2012	773	conf	6066	50359	23424	842	15	81797
2013	44	conf	2706	36370	15124	417	conf	54745
2014	conf	0	4618	40845	40327	2403	73	88288
2015	conf	0	2052	45785	31467	2280	22	81610
2016	conf	0	2520	39299	43498	5953	conf	91312
2017	0	conf	2526	40905	16633	3067	conf	63147
2018	conf	0	4865	46743	11845	1697	conf	65163
2019	0	0	4293	36560	14242	1875	conf	56996
2020	conf	conf	2604	31335	12364	2669	102	49085
2021	0	0	3515	27665	8818	1697	conf	41707
2022	0	0	12321	21528	16503	989	conf	51364

Table 5: Mutton snapper landings by region in pounds. Strata with fewer than 3 vessels reporting are confidential ('conf?').

year	East	West	Total
1981	70527	137668	208195
1982	51289	86738	138027
1983	37017	108983	146000
1984	24988	59379	84367
1985	33378	69125	102503
1986	32989	93676	126666
1987	32383	67892	100275
1988	54239	42228	96467
1989	63012	45840	108851
1990	56352	100998	157349
1991	40248	41185	81433
1992	24546	61428	85974
1993	52292	52632	104924
1994	50731	78127	128858
1995	28053	40939	68992
1996	11820	31596	43417
1997	16836	31379	48215
1998	12124	31865	43989
1999	15594	21140	36734
2000	8583	35996	44579
2001	14429	34141	48570
2002	13481	22522	36003
2003	9816	27286	37101
2004	11565	21861	33425
2005	27930	34162	62093
2006	4964	65552	70516
2007	17881	39529	57409
2008	18312	26485	44797
2009	24060	51031	75091
2010	27314	23872	51186
2011	17039	37525	54563
2012	24281	57515	81797
2013	15602	39142	54745
2014	42803	45485	88288
2015	33769	47840	81610
2016	49484	41828	91312
2017	19703	43444	63147
2018	13550	51612	65163
2019	16142	40853	56996
2020	15135	33950	49085
2021	10527	31180	41707
2022	17515	33850	51364

Table 6: Mutton snapper discards by state in number of fish. Strata with fewer than 3 vessels reporting are confidential ('conf?').

year	West_of_FL	NW_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL	Total
2004	0	0	0	522	45	3	conf	570
2005	0	conf	6	1189	1942	69	conf	3206
2006	0	0	6	1063	18	8	conf	1095
2007	0	0	6	1317	532	48	6	1909
2008	4	0	19	1907	4228	1050	conf	7208
2009	1	conf	11	1949	3817	455	conf	6233
2010	conf	conf	4	1117	1889	263	conf	3280
2011	conf	0	0	454	338	31	conf	823
2012	0	conf	23	999	1062	0	0	2084
2013	0	conf	6	1953	2974	95	conf	5028
2014	conf	0	19	2208	8193	547	20	10987
2015	conf	0	6	2392	8077	690	20	11185
2016	conf	0	10	2463	18256	272	conf	21001
2017	0	conf	13	3606	9421	158	conf	13202
2018	conf	0	60	4408	11888	1247	conf	17603
2019	0	0	61	4272	8463	344	conf	13141
2020	conf	conf	20	3286	9583	488	2	13379
2021	0	0	63	2361	6949	619	conf	9992
2022	0	0	133	3258	8384	342	conf	12117

Table 7: Mutton snapper discards by region in number of fish

year	East	West	Total
2004	48	522	570
2005	2011	1195	3206
2006	26	1069	1095
2007	586	1323	1909
2008	5278	1930	7208
2009	4272	1961	6233
2010	2159	1121	3280
2011	369	454	823
2012	1062	1022	2084
2013	3069	1959	5028
2014	8760	2227	10987
2015	8787	2398	11185
2016	18528	2473	21001
2017	9583	3619	13202
2018	13135	4468	17603
2019	8808	4333	13141
2020	10073	3306	13379
2021	7568	2424	9992
2022	8726	3391	12117

Table 8: Mutton snapper number of vessels by state contributing to landings estimates. Strata with less than 3 vessels reporting are considered confidential.

year	West_of_FL	NW_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1981				16	24	8	1
1982				14	22	6	1
1983				16	20	8	2
1984				17	13	7	1
1985				11	14	7	1
1986	4		9	11	27	10	
1987	3	2	5	11	16	14	1
1988	5	1	5	9	17	11	1
1989	5	2	5	11	16	9	
1990	6	2	16	7	14	9	3
1991	3	2	13	9	16	5	
1992	3	2	9	16	26	17	3
1993	3	4	11	17	27	15	4
1994	3		13	17	28	15	4
1995	6	1	3	16	24	14	1
1996	3	1	5	16	17	15	1
1997	2		2	16	21	13	2
1998	3		7	15	17	15	4
1999	3		6	13	8	13	2
2000	2	1	4	13	12	11	1
2001	6	1	5	10	8	11	1
2002	4	1	3	10	9	11	2
2003	3		3	10	8	8	2
2004	3		6	12	9	9	1
2005	3	1	5	11	6	9	2
2006	3		7	11	5	11	1
2007	5		7	10	5	13	4
2008	3		10	11	18	14	1
2009	3	2	10	11	20	15	2
2010	2	1	3	11	20	14	2
2011	1		3	10	19	8	2
2012	3	2	6	10	20	7	3
2013	3	2	5	10	22	10	1
2014	1		7	11	22	10	4
2015	1		5	12	21	10	4
2016	2		8	10	24	10	2
2017		2	8	13	16	9	2
2018	1		10	11	16	10	1
2019			8	11	16	8	2
2020	1	1	8	11	18	7	5
2021			5	12	16	7	2
2022			10	11	16	5	2

Table 9: Mutton snapper number of vessels by region contributing to landings estimates. Strata with less than 3 vessels reporting are considered confidential.

year	East	West
1981	33	16
1982	29	14
1983	30	16
1984	21	17
1985	22	11
1986	37	24
1987	31	21
1988	29	20
1989	25	23
1990	26	31
1991	21	27
1992	46	30
1993	46	35
1994	47	33
1995	39	26
1996	33	25
1997	36	20
1998	36	25
1999	23	22
2000	24	20
2001	20	22
2002	22	18
2003	18	16
2004	19	21
2005	17	20
2006	17	21
2007	22	22
2008	33	24
2009	37	26
2010	36	17
2011	29	14
2012	30	21
2013	33	20
2014	36	19
2015	35	18
2016	36	20
2017	27	23
2018	27	22
2019	26	19
2020	30	21
2021	25	17
2022	23	21

Table 10: Mutton snapper number of vessels annually contributing to landings estimates. Strata with less than 3 vessels reporting are considered confidential.

year	n_vessel
1981	49
1982	43
1983	45
1984	38
1985	33
1986	61
1987	52
1988	49
1989	48
1990	57
1991	48
1992	76
1993	81
1994	80
1995	65
1996	58
1997	56
1998	61
1999	45
2000	44
2001	42
2002	40
2003	34
2004	40
2005	37
2006	38
2007	44
2008	57
2009	63
2010	53
2011	43
2012	51
2013	53
2014	54
2015	53
2016	56
2017	50
2018	49
2019	45
2020	51
2021	42
2022	44

Table 11: Unweighted proxy CV values by state. These values are based on logbook reporting compliance and are consistent across species.

year	West_of_FL	NW_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1981	0.000	0.000	0.000	0.546	0.163	0.485	0.268
1982	0.000	0.000	0.000	0.376	0.518	0.469	0.171
1983	0.000	0.000	0.000	0.554	0.334	0.414	0.151
1984	0.000	0.000	0.000	0.543	0.632	0.508	0.318
1985	0.000	0.000	0.000	0.555	0.615	0.535	0.317
1986	0.399	0.888	0.594	0.522	0.533	0.400	0.258
1987	0.387	0.710	0.759	0.448	0.578	0.356	0.272
1988	0.344	0.218	0.668	0.591	0.597	0.438	0.326
1989	0.233	0.241	0.573	0.647	0.627	0.501	0.456
1990	0.300	0.191	0.215	0.583	0.625	0.583	0.441
1991	0.314	0.265	0.081	0.577	0.669	0.604	0.434
1992	0.209	0.190	0.115	0.365	0.472	0.204	0.210
1993	0.239	0.153	0.095	0.253	0.462	0.146	0.196
1994	0.215	0.192	0.241	0.366	0.598	0.216	0.189
1995	0.185	0.144	0.491	0.224	0.612	0.185	0.189
1996	0.320	0.086	0.428	0.311	0.880	0.161	0.155
1997	0.243	0.135	0.334	0.210	0.715	0.143	0.190
1998	0.138	0.140	0.586	0.280	0.748	0.079	0.187
1999	0.221	0.175	0.552	0.287	0.941	0.097	0.210
2000	0.193	0.108	0.608	0.354	0.947	0.244	0.176
2001	0.211	0.128	0.610	0.507	0.909	0.145	0.206
2002	0.088	0.156	0.482	0.626	0.960	0.091	0.239
2003	0.408	0.250	0.413	0.648	0.976	0.085	0.255
2004	0.119	0.246	0.327	0.632	0.970	0.067	0.147
2005	0.208	0.249	0.257	0.617	0.964	0.129	0.239
2006	0.206	0.385	0.264	0.566	0.984	0.083	0.317
2007	0.571	0.427	0.250	0.357	0.915	0.206	0.284
2008	0.244	0.087	0.066	0.138	0.380	0.092	0.190
2009	0.092	0.055	0.055	0.073	0.109	0.176	0.164
2010	0.059	0.059	0.098	0.053	0.099	0.054	0.149
2011	0.051	0.051	0.065	0.081	0.093	0.019	0.108
2012	0.088	0.083	0.054	0.210	0.090	0.051	0.090
2013	0.050	0.050	0.050	0.066	0.161	0.050	0.077
2014	0.050	0.050	0.050	0.053	0.054	0.051	0.060
2015	0.052	0.051	0.050	0.056	0.073	0.054	0.053
2016	0.052	0.051	0.050	0.059	0.277	0.052	0.058
2017	0.071	0.051	0.054	0.059	0.060	0.057	0.055
2018	0.052	0.051	0.052	0.058	0.060	0.054	0.059
2019	0.058	0.053	0.051	0.053	0.057	0.071	0.059
2020	0.050	0.050	0.050	0.050	0.064	0.050	0.050
2021	0.050	0.050	0.050	0.050	0.050	0.050	0.050
2022	0.050	0.050	0.050	0.050	0.050	0.050	0.050

Table 12: Unweighted proxy CV values by region. These values are based on logbook reporting compliance and are consistent across species.

year	East	West
1981	0.219	0.546
1982	0.463	0.376
1983	0.320	0.554
1984	0.560	0.543
1985	0.553	0.555
1986	0.464	0.596
1987	0.484	0.603
1988	0.515	0.519
1989	0.578	0.492
1990	0.590	0.316
1991	0.621	0.290
1992	0.374	0.211
1993	0.343	0.177
1994	0.460	0.256
1995	0.461	0.296
1996	0.648	0.313
1997	0.466	0.239
1998	0.454	0.325
1999	0.620	0.347
2000	0.642	0.371
2001	0.589	0.410
2002	0.612	0.368
2003	0.625	0.433
2004	0.617	0.353
2005	0.662	0.351
2006	0.671	0.364
2007	0.597	0.389
2008	0.254	0.109
2009	0.145	0.065
2010	0.109	0.073
2011	0.085	0.062
2012	0.083	0.102
2013	0.119	0.054
2014	0.055	0.051
2015	0.066	0.052
2016	0.195	0.052
2017	0.058	0.057
2018	0.059	0.053
2019	0.060	0.053
2020	0.056	0.050
2021	0.050	0.050
2022	0.050	0.050

Table 13: Unweighted proxy CV values by year. These values are based on logbook reporting compliance and are consistent across species.

year	cv
1981	0.277
1982	0.450
1983	0.358
1984	0.557
1985	0.553
1986	0.518
1987	0.534
1988	0.517
1989	0.541
1990	0.468
1991	0.488
1992	0.299
1993	0.259
1994	0.360
1995	0.380
1996	0.481
1997	0.347
1998	0.384
1999	0.483
2000	0.513
2001	0.496
2002	0.485
2003	0.516
2004	0.485
2005	0.507
2006	0.528
2007	0.502
2008	0.184
2009	0.103
2010	0.092
2011	0.073
2012	0.093
2013	0.087
2014	0.053
2015	0.059
2016	0.128
2017	0.057
2018	0.055
2019	0.056
2020	0.052
2021	0.050
2022	0.050

Table 14: Regional proxy CV values weighted by state landings of mutton snapper in number.

year	West	East
1981	0.260	0.086
1982	0.161	0.295
1983	0.347	0.124
1984	0.338	0.236
1985	0.292	0.292
1986	0.306	0.218
1987	0.228	0.283
1988	0.172	0.408
1989	0.182	0.448
1990	0.220	0.383
1991	0.173	0.455
1992	0.168	0.243
1993	0.090	0.284
1994	0.164	0.313
1995	0.102	0.337
1996	0.177	0.363
1997	0.105	0.330
1998	0.163	0.279
1999	0.125	0.512
2000	0.222	0.343
2001	0.284	0.386
2002	0.318	0.396
2003	0.402	0.322
2004	0.326	0.451
2005	0.251	0.561
2006	0.463	0.167
2007	0.202	0.347
2008	0.065	0.180
2009	0.038	0.057
2010	0.025	0.052
2011	0.048	0.036
2012	0.123	0.033
2013	0.037	0.067
2014	0.020	0.033
2015	0.023	0.043
2016	0.018	0.180
2017	0.035	0.024
2018	0.042	0.016
2019	0.037	0.017
2020	0.035	0.019
2021	0.037	0.013
2022	0.031	0.019

Table 15: Regional proxy CV values weighted by state landings of mutton snapper in weight.

year	West	East
1981	0.361	0.056
1982	0.236	0.192
1983	0.414	0.084
1984	0.382	0.186
1985	0.374	0.200
1986	0.382	0.138
1987	0.308	0.184
1988	0.255	0.332
1989	0.271	0.362
1990	0.363	0.224
1991	0.281	0.329
1992	0.257	0.128
1993	0.120	0.224
1994	0.217	0.226
1995	0.143	0.234
1996	0.227	0.223
1997	0.137	0.207
1998	0.203	0.174
1999	0.182	0.355
2000	0.295	0.168
2001	0.358	0.259
2002	0.389	0.286
2003	0.448	0.236
2004	0.402	0.329
2005	0.336	0.428
2006	0.523	0.065
2007	0.227	0.274
2008	0.079	0.141
2009	0.049	0.038
2010	0.026	0.051
2011	0.055	0.028
2012	0.134	0.026
2013	0.046	0.045
2014	0.027	0.026
2015	0.033	0.030
2016	0.027	0.135
2017	0.040	0.019
2018	0.045	0.012
2019	0.038	0.017
2020	0.035	0.019
2021	0.037	0.013
2022	0.033	0.017

Table 16: Annual proxy CV values weighted by regional landings of mutton snapper in number.

year	cv
1981	0.346
1982	0.457
1983	0.471
1984	0.575
1985	0.583
1986	0.524
1987	0.511
1988	0.580
1989	0.630
1990	0.604
1991	0.628
1992	0.411
1993	0.374
1994	0.477
1995	0.438
1996	0.540
1997	0.435
1998	0.442
1999	0.637
2000	0.565
2001	0.670
2002	0.715
2003	0.723
2004	0.777
2005	0.812
2006	0.630
2007	0.549
2008	0.245
2009	0.094
2010	0.076
2011	0.084
2012	0.156
2013	0.104
2014	0.053
2015	0.065
2016	0.198
2017	0.059
2018	0.058
2019	0.054
2020	0.053
2021	0.050
2022	0.050

Table 17: Annual proxy CV values weighted by regional landings of mutton snapper in weight.

year	cv
1981	0.417
1982	0.429
1983	0.498
1984	0.568
1985	0.574
1986	0.520
1987	0.492
1988	0.587
1989	0.633
1990	0.587
1991	0.610
1992	0.385
1993	0.344
1994	0.443
1995	0.377
1996	0.451
1997	0.344
1998	0.377
1999	0.537
2000	0.463
2001	0.617
2002	0.675
2003	0.684
2004	0.731
2005	0.763
2006	0.589
2007	0.501
2008	0.220
2009	0.087
2010	0.076
2011	0.083
2012	0.161
2013	0.091
2014	0.053
2015	0.062
2016	0.162
2017	0.059
2018	0.058
2019	0.054
2020	0.053
2021	0.050
2022	0.050

Table 18: Estimates of total effort in angler - days by year.

year	Angler_Day
1981	377287
1982	387611
1983	367426
1984	385173
1985	378230
1986	718008
1987	733882
1988	694699
1989	692831
1990	702234
1991	629594
1992	638420
1993	644274
1994	660694
1995	596120
1996	547681
1997	511269
1998	524917
1999	493525
2000	476569
2001	463259
2002	436618
2003	429844
2004	474838
2005	428538
2006	457175
2007	450047
2008	362697
2009	393250
2010	348571
2011	403560
2012	426899
2013	461075
2014	506459
2015	510502
2016	517448
2017	434631
2018	422226
2019	417596
2020	325350
2021	458011
2022	390213

Table 19: Estimates of total effort in angler - trips by year.

year	Angler_Trip
1981	409948
1982	487640
1983	448099
1984	564835
1985	585054
1986	957114
1987	980861
1988	916889
1989	931066
1990	980461
1991	883789
1992	878875
1993	842752
1994	890817
1995	812611
1996	781325
1997	691428
1998	667718
1999	582906
2000	699279
2001	631267
2002	583933
2003	612389
2004	649270
2005	615152
2006	661832
2007	641983
2008	494441
2009	553257
2010	494183
2011	577057
2012	631146
2013	646881
2014	732514
2015	740269
2016	747817
2017	603493
2018	583255
2019	573857
2020	433308
2021	637126
2022	555612

Table 20: Estimates of total effort in angler - days by region.

year	West	East
1981	71709	305578
1982	71614	315997
1983	64721	302705
1984	71314	313859
1985	67227	311003
1986	377980	340028
1987	368948	364934
1988	350676	344023
1989	355581	337250
1990	356603	345631
1991	307800	321794
1992	337601	300819
1993	371517	272757
1994	381701	278993
1995	340687	255433
1996	316574	231107
1997	296716	214553
1998	320440	204477
1999	284159	209366
2000	268906	207663
2001	264147	199112
2002	262908	173710
2003	267823	162021
2004	271739	203099
2005	240875	187663
2006	252521	204654
2007	236573	213474
2008	204958	157739
2009	227535	165715
2010	186411	162160
2011	240943	162617
2012	255201	171698
2013	269773	191302
2014	292149	214310
2015	301220	209282
2016	302199	215249
2017	293077	141554
2018	289934	132292
2019	285266	132330
2020	223030	102320
2021	313615	144396
2022	269832	120381

Table 21: Estimates of total effort in angler - trips by region.

year	West	East
1981	84900	325047
1982	69033	418607
1983	74993	373106
1984	76002	488833
1985	65527	519527
1986	426573	530541
1987	440211	540650
1988	433945	482944
1989	440882	490184
1990	467096	513365
1991	392902	490886
1992	426869	452007
1993	447791	394961
1994	474551	416266
1995	431305	381306
1996	420209	361116
1997	371953	319474
1998	393107	274611
1999	280036	302870
2000	360507	338772
2001	340039	291228
2002	322902	261030
2003	350488	261901
2004	348008	301262
2005	334703	280449
2006	331663	330169
2007	382710	259274
2008	259517	234924
2009	311280	241976
2010	250777	243406
2011	330107	246950
2012	362006	269140
2013	351643	295238
2014	388496	344018
2015	399677	340591
2016	399309	348508
2017	390134	213359
2018	384832	198423
2019	375258	198599
2020	282966	150342
2021	420341	216785
2022	380488	175124

Table 22: Estimates of total effort in angler - days by state.

year	West_of_FL	NW_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1981				71709	154747	72427	78404
1982				71614	154558	66961	94478
1983				64721	129643	83499	89563
1984				71314	122446	95234	96179
1985				67227	119169	94449	97385
1986	62459	101336	138741	75444	128513	113101	98414
1987	69725	76111	140938	82174	136723	114144	114067
1988	78087	67648	128300	76641	115978	109156	118889
1989	66256	57233	151092	81000	132944	102920	101386
1990	65042	60758	153148	77655	147006	98234	100391
1991	66342	62392	111920	67146	127765	85111	108918
1992	86129	66180	118622	66670	107043	90810	102966
1993	92160	73703	134195	71459	91020	74494	107243
1994	113429	69110	135452	63710	113326	65260	100407
1995	100962	67798	114612	57315	94293	55892	105248
1996	102840	64336	90577	58821	93797	44555	92755
1997	91215	65599	83843	56059	64450	49858	100245
1998	85504	66664	118667	49605	53946	49788	100743
1999	66261	60959	115158	41781	65261	55153	88952
2000	63347	57106	102225	46228	76250	57619	73794
2001	61583	55748	101495	45321	62271	53460	83381
2002	73173	55554	86277	47904	54731	46639	72340
2003	81068	62555	81656	42544	49672	51369	60980
2004	64990	63494	94936	48319	74838	50544	77717
2005	59857	52797	77436	50785	72515	47778	67370
2006	75794	66346	57703	52678	73936	46990	83728
2007	66286	67997	68883	33407	69981	51796	91697
2008	44133	62118	68058	30649	40949	50771	66019
2009	54005	65623	76815	31092	38881	64356	62478
2010	47869	40594	70424	27524	42462	51719	67979
2011	50941	77303	79722	32977	44808	53142	64667
2012	55456	77770	84205	37770	51028	57840	62830
2013	59155	79979	94752	35887	63205	64697	63400
2014	54488	88524	102841	46296	88842	58685	66783
2015	58722	86473	107910	48115	92384	52703	64195
2016	57038	90877	109101	45183	98090	51640	65519
2017	54764	88972	107685	41656	36166	46563	58825
2018	55395	91827	100020	42692	34282	41905	56105
2019	55088	84110	101664	44404	32169	42069	58092
2020	53226	68387	71498	29919	23336	29844	49140
2021	74541	85759	109717	43598	29373	46688	68335
2022	66380	75248	88708	39496	31531	33405	55445

Table 23: Estimates of total effort in angler - trips by state.

year	West_of_FL	NW_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1981				84900	133946	83851	107251
1982				69033	215658	80231	122718
1983				74993	167572	86734	118800
1984				76002	248306	108836	131691
1985				65527	264254	117459	137814
1986	68694	113266	161070	83543	263314	132626	134601
1987	85413	81574	186017	87207	264877	121517	154256
1988	88270	89839	170887	84949	208798	112748	161398
1989	75636	83495	189644	92107	235771	119207	135207
1990	78145	86057	212237	90658	253595	127075	132695
1991	77947	91359	148622	74974	238147	111168	141571
1992	96417	93415	155093	81944	204150	113529	134327
1993	104299	103730	158781	80981	170598	86316	138047
1994	120991	95943	175422	82195	211815	76507	127944
1995	107211	99130	154326	70638	184790	66313	130203
1996	112858	88637	137464	81250	190666	53770	116680
1997	93261	92456	111017	75220	133604	61377	124494
1998	90448	94472	140016	68172	89202	58562	126846
1999	50053	60200	111006	58777	122283	66515	114072
2000	73436	81876	143374	61821	152460	67873	118440
2001	66753	77104	131235	64946	116563	65784	108881
2002	69614	78282	114102	60904	101257	55869	103905
2003	88314	88820	104811	68544	93512	64298	104090
2004	65024	89440	121456	72088	130811	62178	108273
2005	73063	70467	108046	83127	124135	59824	96490
2006	85195	93998	78657	73814	147977	58762	123430
2007	144779	97819	91350	48761	73033	63331	122910
2008	28633	86463	99423	44998	74805	62540	97579
2009	57952	95887	110494	46947	73720	75603	92653
2010	50057	55243	103763	41714	81302	60951	101153
2011	53878	108573	118573	49082	85627	64173	97150
2012	63406	112360	125435	60806	96531	75883	96725
2013	62228	109341	121851	58223	120260	80506	94472
2014	58143	121519	133220	75614	173200	72971	97847
2015	63004	117568	139778	79327	178991	67461	94139
2016	60173	122700	143949	72487	183958	66229	98321
2017	57897	121581	141619	69037	68349	59924	85085
2018	57667	127016	131509	68641	63347	52768	82307
2019	56362	117343	129996	71556	60085	52767	85746
2020	54214	93566	89789	45397	42612	36247	71483
2021	88442	122293	142048	67558	54899	59093	102793
2022	82417	109042	126169	62860	50417	41449	83258

Table 24: Mutton snapper number of fish sampled by state.

year	West_of_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1976						19
1977						21
1978			41	225		11
1979			95	282		16
1980			215	379		7
1981			360	624		17
1982			463	310		7
1983			448	457		5
1984			583	342		5
1985			492	520		6
1986		3	605	380		9
1987			491	282		5
1988			421	215		15
1989	12	7	578	438		5
1990	1		252	123		18
1991		4	105	100		14
1992		9	120	72		16
1993			133	146		14
1994			93	74		16
1995	1		76	102		26
1996	1	2	79	9	3	11
1997			110	295	10	12
1998			119	389	12	6
1999	1	2	92	222	18	
2000			79	231	5	
2001			109	360	7	
2002			69	336	62	
2003	1	2	77	392	12	
2004		1	62	380	3	
2005			70	397		
2006		1	84	418	4	2
2007			93	426	3	
2008		3	120	361	33	
2009		4	146	376	36	
2010		11	86	347	36	
2011		6	133	190	11	
2012		15	554	136	3	
2013		1	355	88	11	
2014		20	281	263	150	
2015		3	385	225	83	
2016		4	614	265	106	
2017		9	447	122	57	
2018		2	412	113	32	
2019		16	172	66	58	
2020	4		14	9	21	
2021		2		31		
2022		63	114	68	8	

Table 25: Mutton snapper number of fish sampled by region.

year	East	West
1976	19	
1977	21	
1978	236	41
1979	298	95
1980	386	215
1981	641	360
1982	317	463
1983	463	448
1984	347	583
1985	526	492
1986	389	608
1987	287	491
1988	230	421
1989	443	597
1990	141	253
1991	114	109
1992	88	129
1993	160	133
1994	90	93
1995	128	77
1996	23	82
1997	317	110
1998	407	119
1999	240	95
2000	236	79
2001	367	109
2002	398	69
2003	404	80
2004	383	63
2005	397	70
2006	424	85
2007	429	93
2008	394	123
2009	412	150
2010	383	97
2011	201	139
2012	139	569
2013	99	356
2014	413	301
2015	308	388
2016	371	618
2017	179	456
2018	145	414
2019	124	188
2020	30	18
2021	31	2
2022	76	177

Table 26: Mutton snapper number of trips sampled by state.

year	West_of_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1976						13
1977						17
1978			18	84	8	
1979			29	120	12	
1980			58	156	3	
1981			134	204	12	
1982			176	107	6	
1983			177	188	4	1
1984			192	178	5	
1985			174	229	4	
1986		3	175	187	9	
1987			152	124	5	
1988			95	99	13	
1989	9	3	146	176	3	
1990	1		118	58	10	
1991		2	44	53	9	
1992		2	57	40	11	
1993			59	59	11	
1994			51	42	10	
1995	1		44	57	20	
1996	1	1	43	3	3	7
1997			62	123	7	6
1998			64	164	9	3
1999	1	2	57	87	12	
2000			35	93	4	
2001			68	117	5	
2002			47	98	27	
2003	1	1	47	155	10	
2004		1	33	155	1	
2005			44	141		
2006		1	42	123	3	2
2007			46	178	3	
2008		2	54	117	20	
2009		1	62	115	22	
2010		4	51	89	20	
2011		1	41	85	7	
2012		4	106	73	3	
2013		1	92	55	10	
2014		3	101	104	49	
2015		2	134	101	36	
2016		3	154	125	44	
2017		2	100	61	28	
2018		1	92	50	16	
2019		4	66	35	34	
2020	3		10	7	10	
2021		1		16		
2022		10	46	33	5	

Table 27: Mutton snapper number of trips sampled by region.

year	East	West
1976	13	
1977	17	
1978	92	18
1979	132	29
1980	159	58
1981	216	134
1982	113	176
1983	193	177
1984	183	192
1985	233	174
1986	196	178
1987	129	152
1988	112	95
1989	179	158
1990	68	119
1991	62	46
1992	51	59
1993	70	59
1994	52	51
1995	77	45
1996	13	45
1997	136	62
1998	176	64
1999	99	60
2000	97	35
2001	122	68
2002	125	47
2003	165	49
2004	156	34
2005	141	44
2006	128	43
2007	181	46
2008	137	56
2009	137	63
2010	109	55
2011	92	42
2012	76	110
2013	65	93
2014	153	104
2015	137	136
2016	169	157
2017	89	102
2018	66	93
2019	69	70
2020	17	13
2021	16	1
2022	38	56

Table 28: Mutton snapper mean total length in mm by state.

year	West_of_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1976					528	
1977					617	
1978			541	506	645	
1979			583	492	594	
1980			648	464	567	
1981			543	449	494	
1982			552	453	528	
1983			534	486	551	385
1984			533	496	527	
1985			550	465	525	
1986		782	566	474	528	
1987			555	441	516	
1988			565	445	482	
1989	499	750	580	433	389	
1990	517		528	490	516	
1991		496	557	447	516	
1992		567	564	421	495	
1993			552	461	488	
1994			558	635	517	
1995	367		558	461	521	
1996	706	561	537	457	611	757
1997			565	456	558	789
1998			594	482	539	740
1999	695	468	592	465	529	
2000			597	442	498	
2001			573	464	463	
2002			536	475	522	
2003	477	690	549	487	575	
2004		347	546	475	709	
2005			514	461		
2006		657	551	450	598	670
2007			522	456	484	
2008		711	509	449	465	
2009		626	516	451	471	
2010		613	501	461	466	
2011		529	566	481	498	
2012		650	609	507	577	
2013		685	593	469	496	
2014		682	533	441	436	
2015		586	563	444	452	
2016		518	560	452	512	
2017		546	547	463	506	
2018		610	552	487	521	
2019		541	556	502	554	
2020	564		519	486	565	
2021		504		495		
2022		656	572	504	558	

Table 29: Mutton snapper total length CV in mm by state.

year	West_of_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1976						0.21
1977						0.10
1978			0.21	0.18		0.07
1979			0.20	0.19		0.11
1980			0.76	0.20		0.18
1981			0.23	0.16		0.24
1982			0.21	0.15		0.20
1983			0.21	0.14		0.08
1984			0.20	0.16		0.12
1985			0.20	0.16		0.18
1986		0.20	0.19	0.21		0.21
1987			0.20	0.22		0.24
1988			0.21	0.20		0.19
1989	0.19	0.24	0.83	0.17		0.15
1990			0.50	1.15		0.19
1991		0.22	0.26	0.18		0.14
1992		0.26	0.25	0.18		0.23
1993			0.21	0.23		0.29
1994			0.23	1.34		0.22
1995			0.21	0.14		0.19
1996		0.03	0.21	0.08		0.16
1997			0.24	0.16		0.23
1998			0.21	0.47		0.14
1999		0.26	0.19	0.17		0.16
2000			0.19	0.14		0.14
2001			0.20	0.14		0.16
2002			0.18	0.15		0.15
2003		0.10	0.19	0.17		0.11
2004			0.20	0.14		0.03
2005			0.18	0.16		
2006			0.25	0.12	0.28	0.11
2007			0.19	0.13	0.10	
2008		0.14	0.18	0.14	0.14	
2009		0.14	0.18	0.13	0.15	
2010		0.18	0.17	0.11	0.16	
2011		0.15	0.18	0.13	0.17	
2012		0.14	0.19	0.15	0.03	
2013			0.19	0.18	0.25	
2014		0.10	0.21	0.11	0.11	
2015		0.42	0.22	0.12	0.11	
2016		0.12	0.20	0.14	0.17	
2017		0.22	0.18	0.14	0.14	
2018		0.19	0.16	0.12	0.18	
2019		0.12	0.18	0.13	0.11	
2020	0.16		0.13	0.11	0.10	
2021		0.07		0.11		
2022		0.16	0.15	0.12	0.18	

Table 30: Mutton snapper mean weight (g) by state.

year	West_of_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1976					2348	
1977					3630	
1978			2425	1840	4427	
1979			3139	1948	3475	
1980			3377	1554	2571	
1981			2603	1321	2155	
1982			2602	1331	2403	
1983			2357	1574	2480	1800
1984			2240	1830	2200	
1985			2537	1515	2409	
1986		8240	2758	1726	2461	
1987			2635	1413	2170	
1988			2796	1472	1720	
1989	2249	7100	2381	1276	834	
1990	2410		2054	1034	1794	
1991		2442	3000	1253	1869	
1992		2840	2785	1042	1950	
1993			2554	1470	2312	
1994			2644	1846	1772	
1995	860		2582	1388	2115	
1996	4170	2135	2371	1192	3520	6076
1997			2785	1453	2877	6976
1998			3309	1676	2596	5938
1999	4290	1545	3071	1486	1999	
2000			3043	1217	1840	
2001			2739	1387	1443	
2002			2200	1532	2151	
2003	1810	4350	2394	1698	2530	
2004		460	2385	1494	6193	
2005			1903	1329		
2006		3540	2573	1198	2727	4625
2007			2031	1284	1375	
2008		5203	1866	1211	1394	
2009		3182	1930	1241	2004	
2010		3371	1673	1306	1698	
2011		2057	2595	1565	2336	
2012		3840	3249	1895	3193	
2013		4230	3042	1546	2431	
2014		4271	2272	1160	1236	
2015		3587	2752	1193	1306	
2016		1882	2784	1292	1994	
2017		2577	2285	1387	1942	
2018		3200	2377	1596	2067	
2019		2211	2523	1788	2289	
2020	2618		3165	1621	2239	
2021		1630		1716		
2022		4096	2655	1735	2660	

Table 31: Mutton snapper weight CV in g by state.

year	West_of_FL	SW_FL	Keys	SE_FL	NE_FL	North_of_FL
1976						0.51
1977						0.31
1978			0.63	0.67		0.25
1979			0.55	0.59		0.29
1980			0.48	0.69		0.46
1981			0.68	0.57		0.81
1982			0.62	0.47		0.62
1983			0.64	0.44		0.37
1984			0.62	0.52		0.38
1985			0.61	0.59		0.54
1986		0.54	0.58	0.69		0.77
1987			0.65	0.79		0.68
1988			0.66	0.82		0.61
1989	0.58	0.53	0.64	0.80		0.48
1990			0.73	0.70		0.57
1991		0.73	0.71	0.81		0.45
1992		0.77	0.71	0.64		0.73
1993			0.66	0.91		1.03
1994			0.69	0.80		0.68
1995			0.68	0.56		0.63
1996		0.09	0.72	0.21	0.55	0.24
1997			0.66	0.68	0.76	0.24
1998			0.61	0.71	0.61	0.43
1999		0.81	0.63	0.70	0.52	
2000			0.57	0.59	0.50	
2001			0.62	0.50	0.46	
2002			0.56	0.62	0.53	
2003		0.36	0.60	0.75	0.31	
2004			0.62	0.56	0.16	
2005			0.68	0.71		
2006			0.82	0.47	0.47	0.42
2007			0.66	0.58	0.19	
2008		0.62	0.64	0.60	0.60	
2009		0.47	0.64	0.51	0.44	
2010		0.48	0.48	0.40	0.56	
2011		0.59	0.58	0.48	0.53	
2012		0.41	0.59	0.69	0.10	
2013			0.62	0.77	0.83	
2014		0.34	0.69	0.51	0.38	
2015		0.79	0.69	0.54	0.39	
2016		0.31	0.65	0.62	0.58	
2017		0.76	0.60	0.51	0.46	
2018		0.52	0.56	0.45	0.47	
2019		0.40	0.62	0.59	0.40	
2020	0.44		1.63	0.51	0.29	
2021		0.31		0.38		
2022		0.52	0.48	0.44	0.69	

Table 32: Mutton snapper mean total length in mm by region.

year	East	West
1976	528	
1977	617	
1978	513	541
1979	497	583
1980	466	648
1981	450	543
1982	454	552
1983	487	534
1984	496	533
1985	465	550
1986	475	567
1987	442	555
1988	447	565
1989	432	580
1990	493	528
1991	456	555
1992	434	565
1993	463	552
1994	614	558
1995	473	556
1996	621	539
1997	472	565
1998	488	594
1999	470	590
2000	443	597
2001	464	573
2002	482	536
2003	490	552
2004	477	543
2005	461	514
2006	452	552
2007	457	522
2008	451	514
2009	453	519
2010	461	514
2011	482	565
2012	508	610
2013	472	593
2014	439	543
2015	446	563
2016	469	560
2017	476	547
2018	494	552
2019	526	555
2020	542	529
2021	495	504
2022	509	602

Table 33: Mutton snapper total length CV in mm by region.

year	East	West
1976	0.21	
1977	0.10	
1978	0.18	0.21
1979	0.19	0.20
1980	0.20	0.76
1981	0.16	0.23
1982	0.15	0.21
1983	0.14	0.21
1984	0.16	0.20
1985	0.17	0.20
1986	0.21	0.19
1987	0.22	0.20
1988	0.20	0.21
1989	0.17	0.82
1990	1.07	0.50
1991	0.18	0.26
1992	0.20	0.25
1993	0.23	0.21
1994	1.26	0.23
1995	0.16	0.22
1996	0.24	0.21
1997	0.21	0.24
1998	0.47	0.21
1999	0.17	0.19
2000	0.14	0.19
2001	0.14	0.20
2002	0.16	0.18
2003	0.17	0.19
2004	0.15	0.20
2005	0.16	0.18
2006	0.13	0.25
2007	0.13	0.19
2008	0.14	0.19
2009	0.13	0.18
2010	0.12	0.18
2011	0.13	0.18
2012	0.15	0.19
2013	0.19	0.19
2014	0.11	0.22
2015	0.12	0.22
2016	0.16	0.20
2017	0.15	0.18
2018	0.14	0.16
2019	0.13	0.18
2020	0.12	0.14
2021	0.11	0.07
2022	0.13	0.17

Table 34: Mutton snapper mean weight (g) by region.

year	East	West
1976	2348	
1977	3630	
1978	1971	2425
1979	2035	3139
1980	1572	3377
1981	1343	2603
1982	1353	2602
1983	1585	2357
1984	1836	2240
1985	1525	2537
1986	1739	2785
1987	1427	2635
1988	1489	2796
1989	1271	2434
1990	1112	2055
1991	1304	2980
1992	1155	2789
1993	1541	2554
1994	1834	2644
1995	1532	2559
1996	3730	2388
1997	1691	2785
1998	1754	3309
1999	1521	3052
2000	1228	3043
2001	1388	2739
2002	1626	2200
2003	1723	2436
2004	1533	2355
2005	1329	1903
2006	1226	2584
2007	1285	2031
2008	1224	1948
2009	1299	1963
2010	1343	1866
2011	1610	2571
2012	1926	3265
2013	1653	3045
2014	1189	2404
2015	1225	2759
2016	1502	2778
2017	1571	2291
2018	1706	2381
2019	2036	2496
2020	2053	3037
2021	1716	1630
2022	1841	3171

Table 35: Mutton snapper weight CV in g by region.

year	East	West
1976	0.51	
1977	0.31	
1978	0.68	0.63
1979	0.59	0.55
1980	0.69	0.48
1981	0.60	0.68
1982	0.50	0.62
1983	0.45	0.64
1984	0.51	0.62
1985	0.59	0.61
1986	0.69	0.59
1987	0.78	0.65
1988	0.80	0.66
1989	0.80	0.68
1990	0.71	0.73
1991	0.78	0.71
1992	0.73	0.71
1993	0.95	0.66
1994	0.78	0.69
1995	0.62	0.68
1996	0.69	0.71
1997	0.88	0.66
1998	0.75	0.61
1999	0.69	0.63
2000	0.59	0.57
2001	0.50	0.62
2002	0.62	0.56
2003	0.74	0.59
2004	0.61	0.63
2005	0.71	0.68
2006	0.52	0.81
2007	0.58	0.66
2008	0.60	0.69
2009	0.53	0.64
2010	0.44	0.58
2011	0.50	0.58
2012	0.68	0.58
2013	0.81	0.62
2014	0.46	0.68
2015	0.50	0.69
2016	0.65	0.65
2017	0.52	0.60
2018	0.47	0.56
2019	0.50	0.60
2020	0.37	1.48
2021	0.38	0.31
2022	0.53	0.56

5 Figures

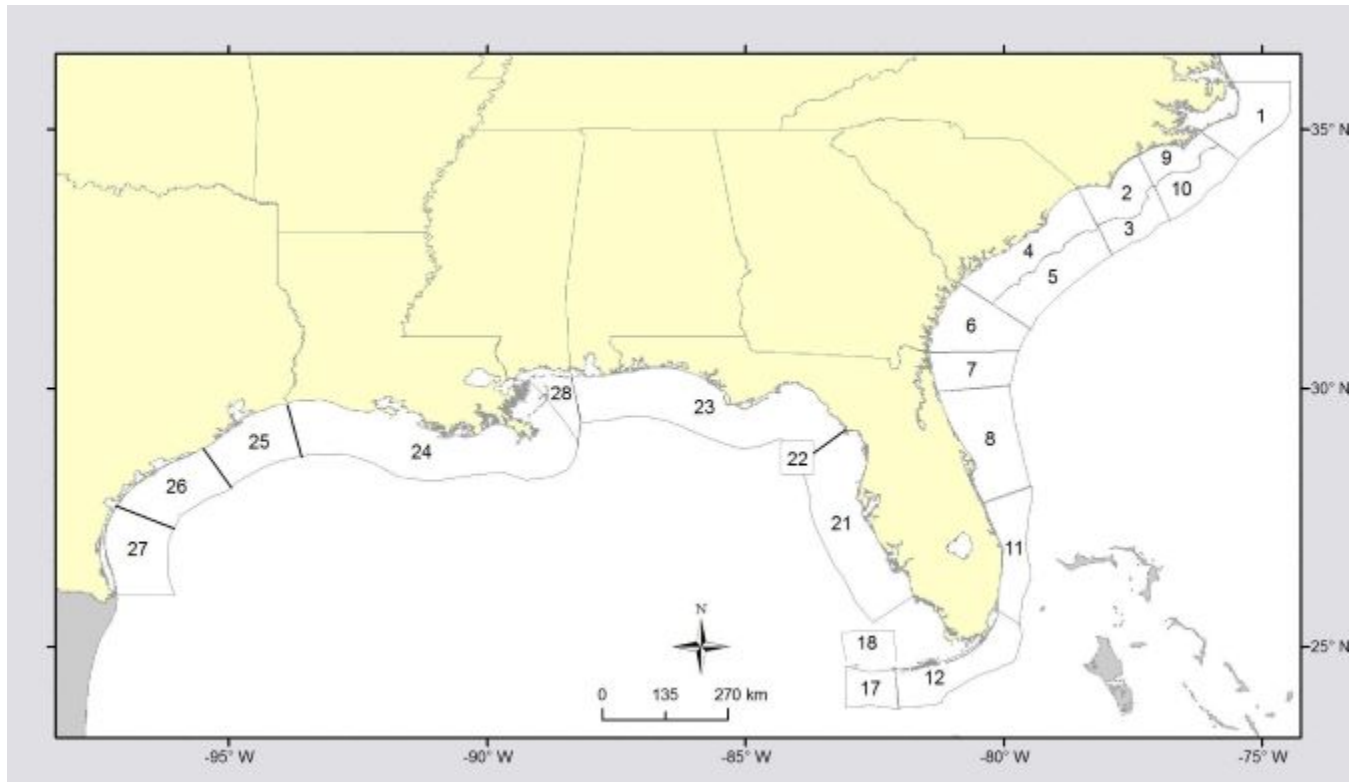


Figure 1: Headboat sampling areas prior to 2013.

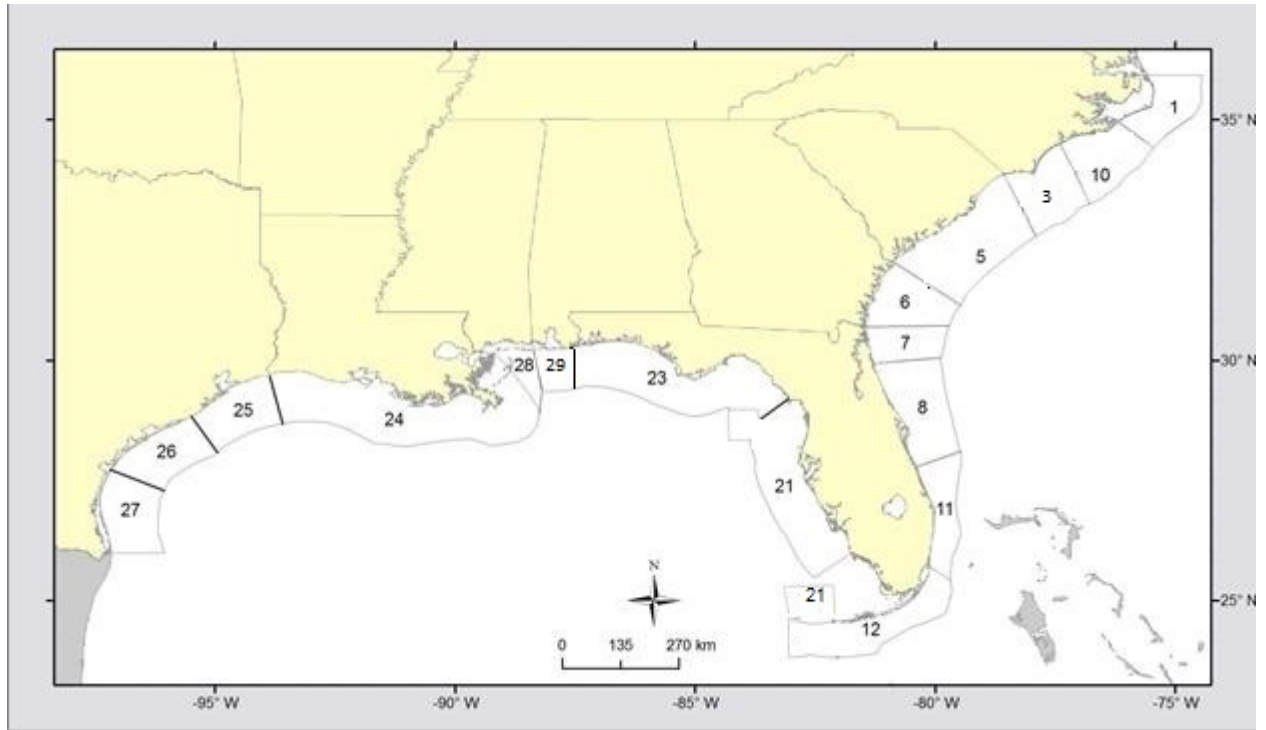


Figure 2: Headboat sampling areas 2013 - present.

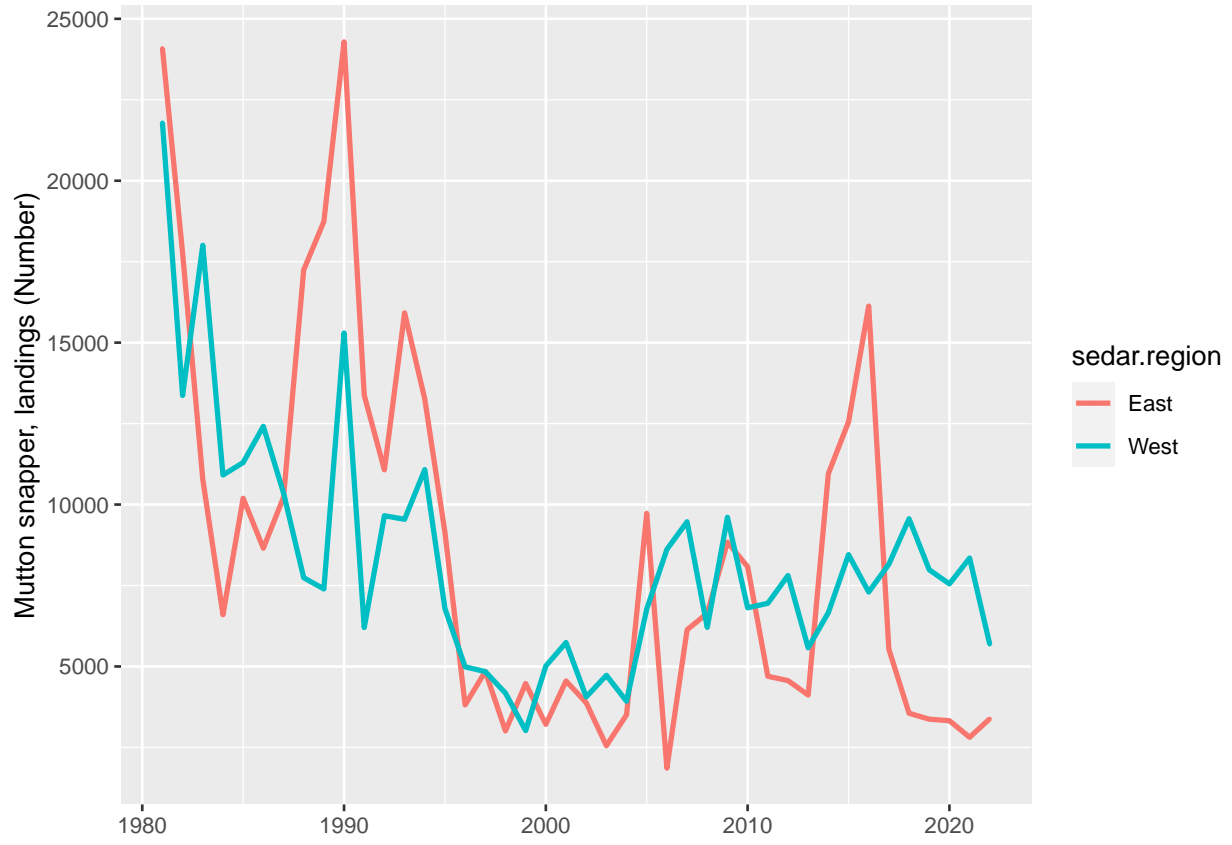


Figure 3: Mutton snapper landings in number by region

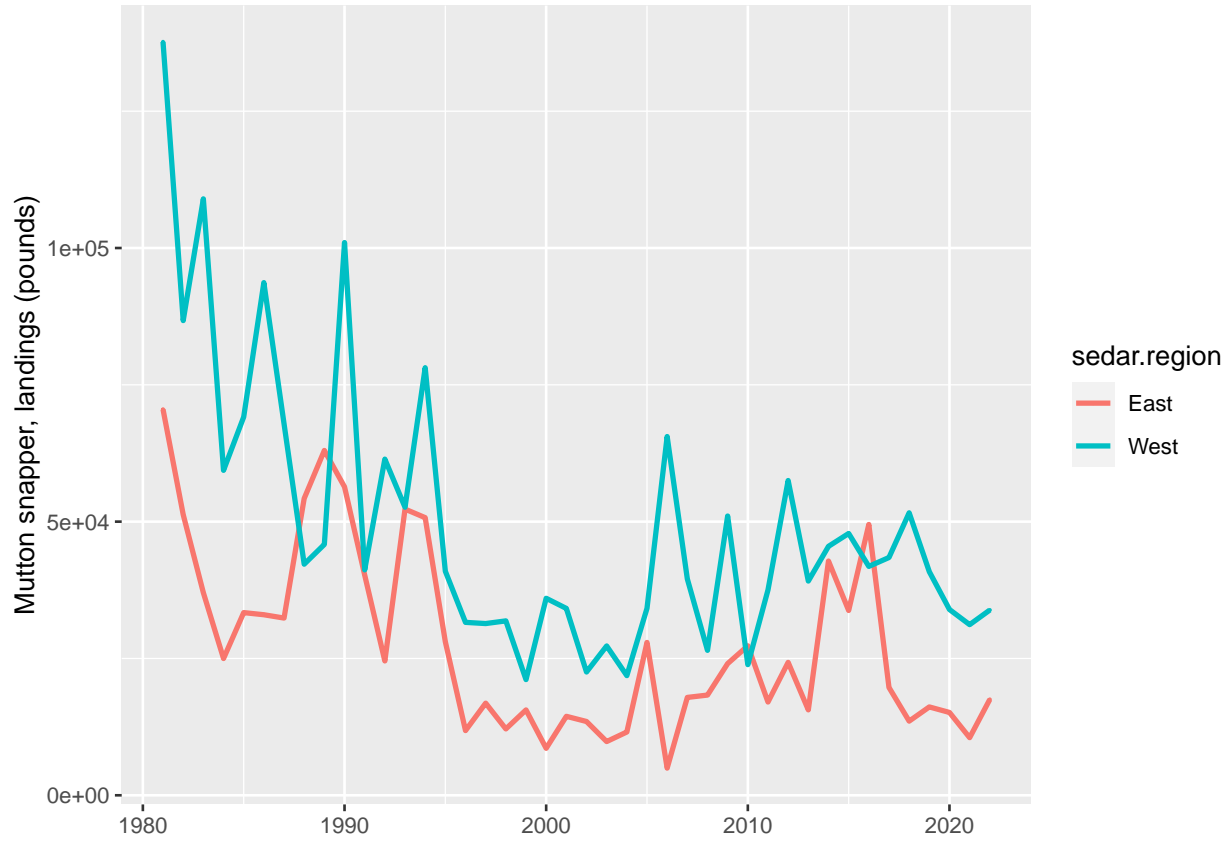


Figure 4: Mutton snapper landings in pounds by region.

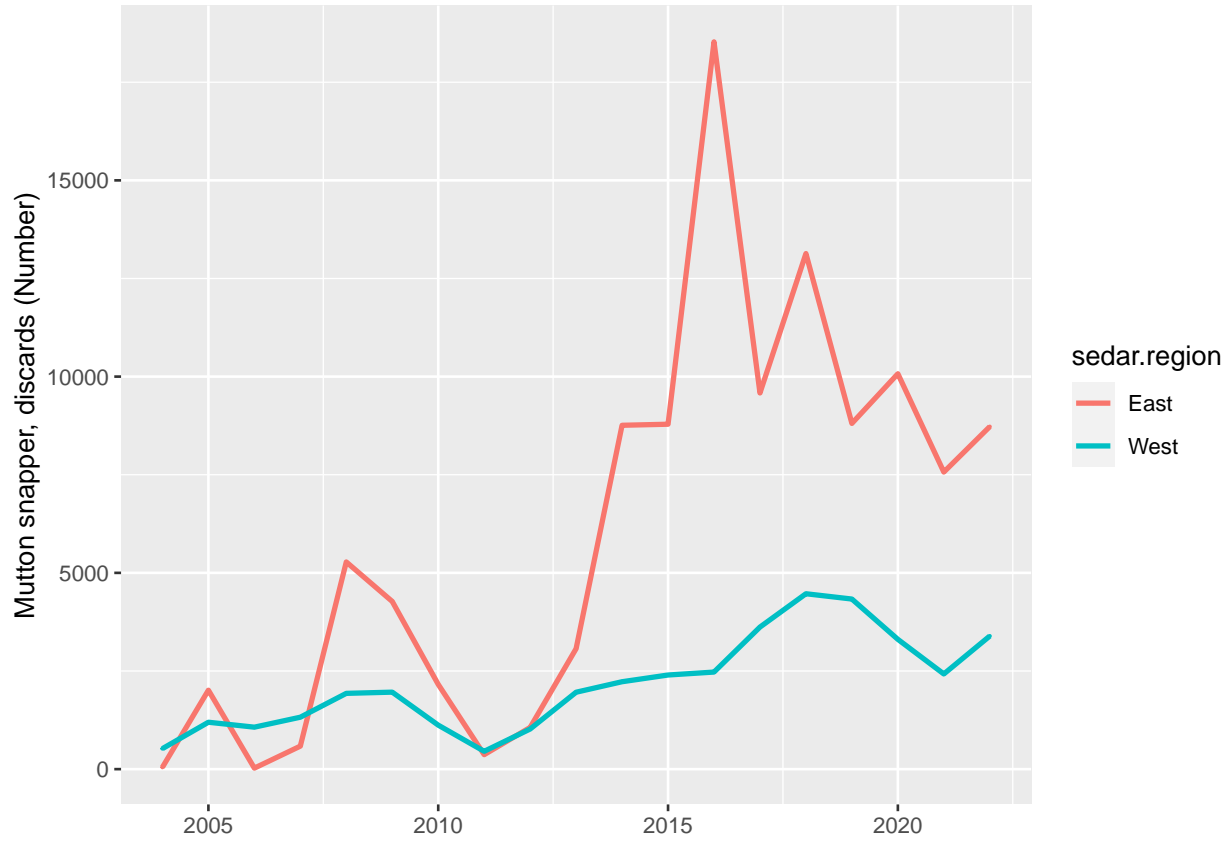


Figure 5: mutton snapper discards in number by region

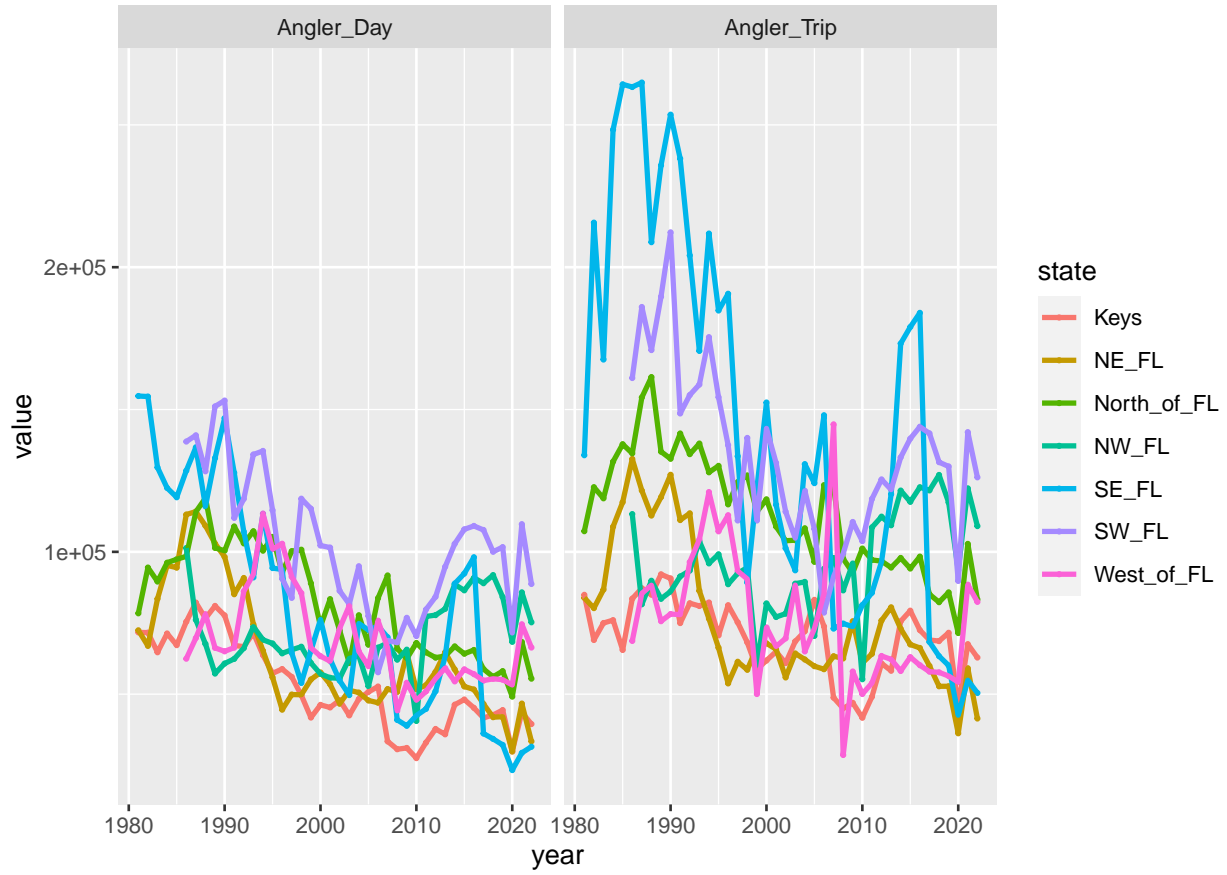


Figure 6: SRHS total estimated angler days and angler trips by state.

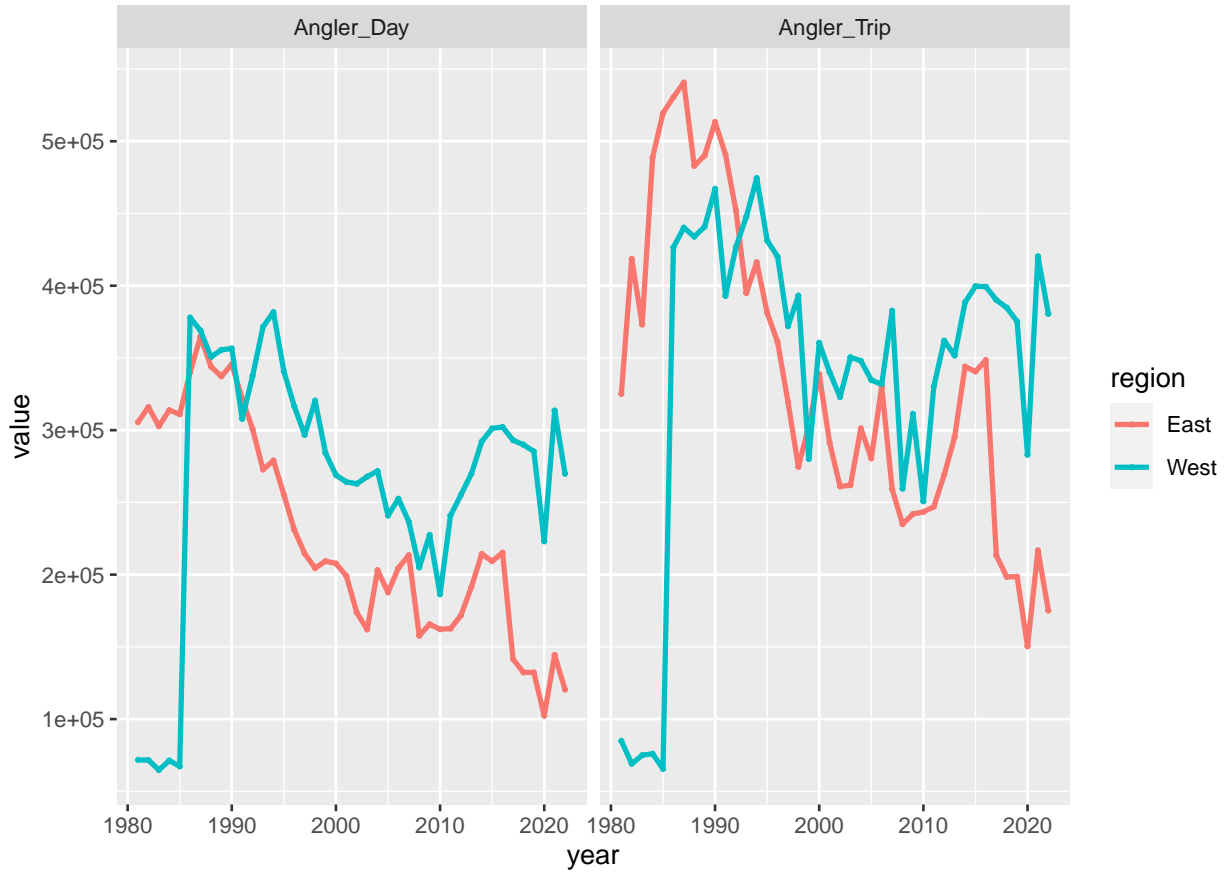


Figure 7: SRHS total estimated angler days and angler trips by region. East represents the Atlantic from NC to FL, West represents the Gulf of Mexico and the Keys.

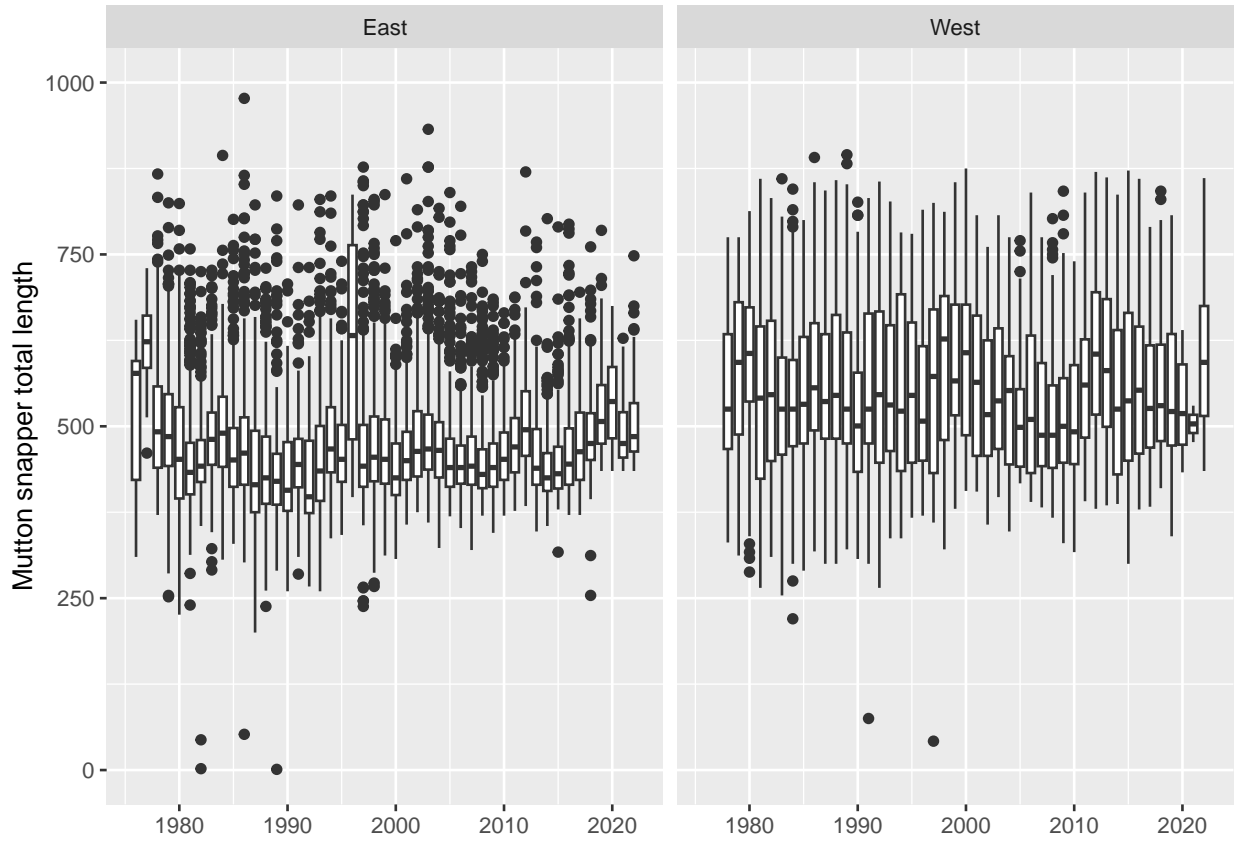


Figure 8: Mutton snapper total length by SEDAR region. East represents the Atlantic from NC to FL, West represents the Gulf of Mexico and the Keys.

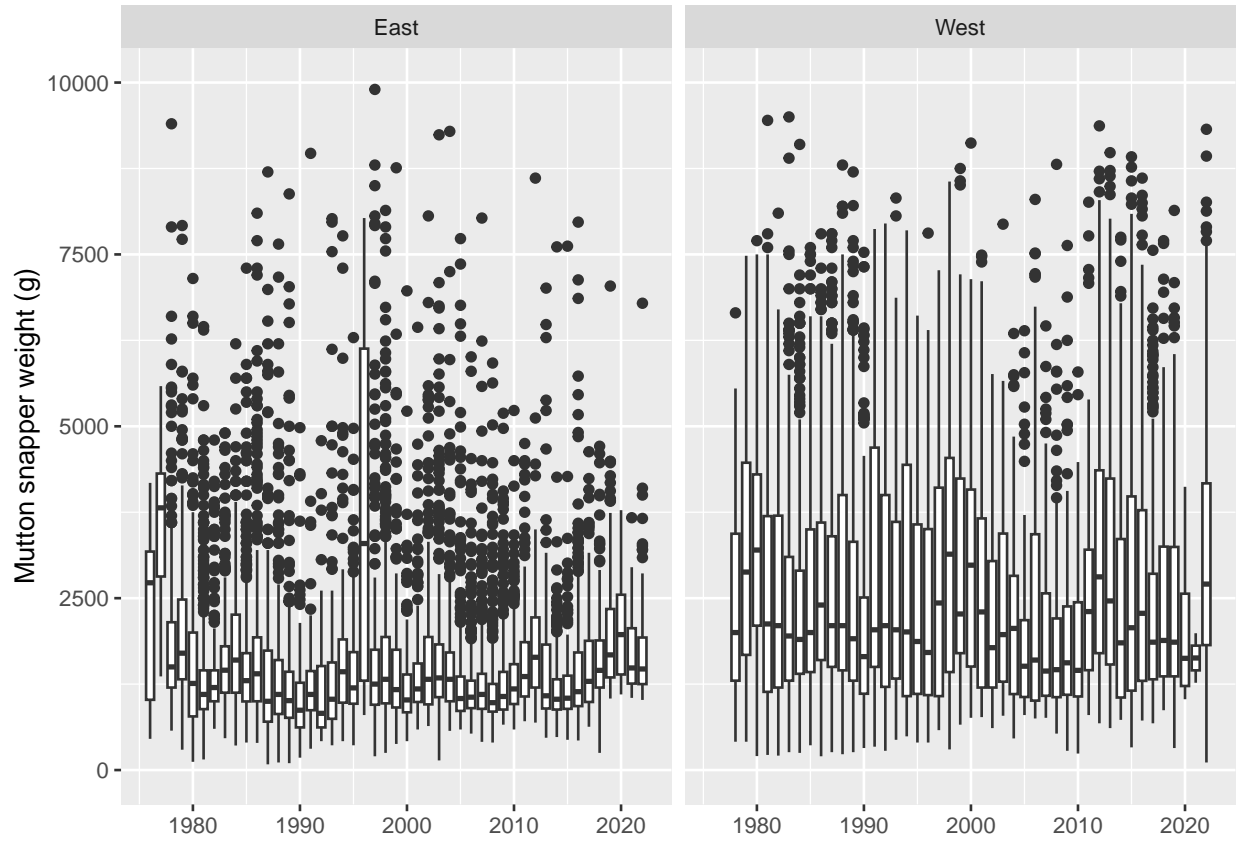


Figure 9: Mutton snapper weight (g) by SEDAR region. East represents the Atlantic from NC to FL, West represents the Gulf of Mexico and the Keys.

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Appendix 1. Validation of logbook discard estimates and development of headboat proxy discards during the SEDAR 79 DW

Validation of headboat logbook discard estimates

The SEDAR 79 evaluated the catch rates and discard estimates to determine the year to switch from proxy discard to the estimated values from logbooks. Discards were added to the logbook forms in 2004 but the reporting of discards was low in the early years for some vessels and areas. The SEDAR 79 DW panel decided to exclude logbook discard estimates in 2004 - 2007 based on the high variability in the early years in the East region, specifically SE Florida, and some indication from the observer data comparison of lower than average discard rates (Figures A1, and Table 6). Logbook discard estimates should be used from 2008 – 2022.

The comparison of headboat logbook discard rates to headboat at-sea observer discard rates showed under reporting of discards in the Florida Keys (Figure A1, lower right panel). Discard rates were used for the comparison instead of direct discards because observers can only collect information on a subset of anglers. A calibration factor was developed from the catch rates and applied to the discard estimates from the West region. The average annual proportion of the West discards from the Keys is 0.99. The under reporting in the Keys is fairly consistent across years so a single calibration factor was calculated from 2008 to 2022 (mean observer discard rate/mean logbook discard rate) as 3.45 (Figure A2).

Proxy discards for headboats prior to 2008

Recent SEDARs have used a method to develop headboat discards prior to valid logbook estimates. This method assumes headboat discard rates are similar to MRIP Charter discard rates annually and that any management or fishing behavior with respect to discards are similar between the two fleets. For example, a discard rate change in the MRIP charter fleet because of a size limit implementation would be reflected in the calculated headboat discards. MRIP Charter discard rates were calculated for each year available. Prior to the 1992 size limit increase, there were few or no MRIP Charter discards (SEDAR 79 DW2, Table 2). For 1992 -2007 the MRIP Charter discard rates were applied to the headboat landings to get an estimate of headboat discards. This value was then scaled to account for potential differences in MRIP Charter discard rates and headboat discard rates. Ratios of 2008 -2012 average discard rates between and headboat logbook to MRIP Charter calculated for each region (0.55 for the East, 0.83 for the West) and applied to the 1992-2007 calculated headboat discard estimates. The 1992 – 2022 regional headboat discard estimates are shown in Table A1 and Figure A3.

Figure A1. Final headboat mutton snapper discard estimates. West is the Gulf of Mexico and Florida Keys, East is North Carolina to East Florida.

Year	East	West
1992	4448	7806
1993	0	1441
1994	0	2081
1995	975	0
1996	421	1555
1997	0	9861
1998	437	1388
1999	9150	326
2000	1170	459
2001	564	358
2002	496	3743
2003	1014	1783
2004	263	1672
2005	2507	1364
2006	789	3497
2007	3488	3358
2008	5278	6659
2009	4272	6765
2010	2159	3867
2011	369	1566
2012	1062	3526
2013	3069	6759
2014	8760	7683
2015	8787	8273
2016	18528	8532
2017	9583	12486
2018	13135	15415
2019	8808	14949
2020	10073	11406
2021	7568	8363
2022	8726	11699



Figure A1. Comparison on headboat logbook (logbook) and headboat at-sea observer (observer) discard rates by region. Gulf of Mexico headboat at-sea observer data was limited to Southwest Florida, which was sparse and not included here.

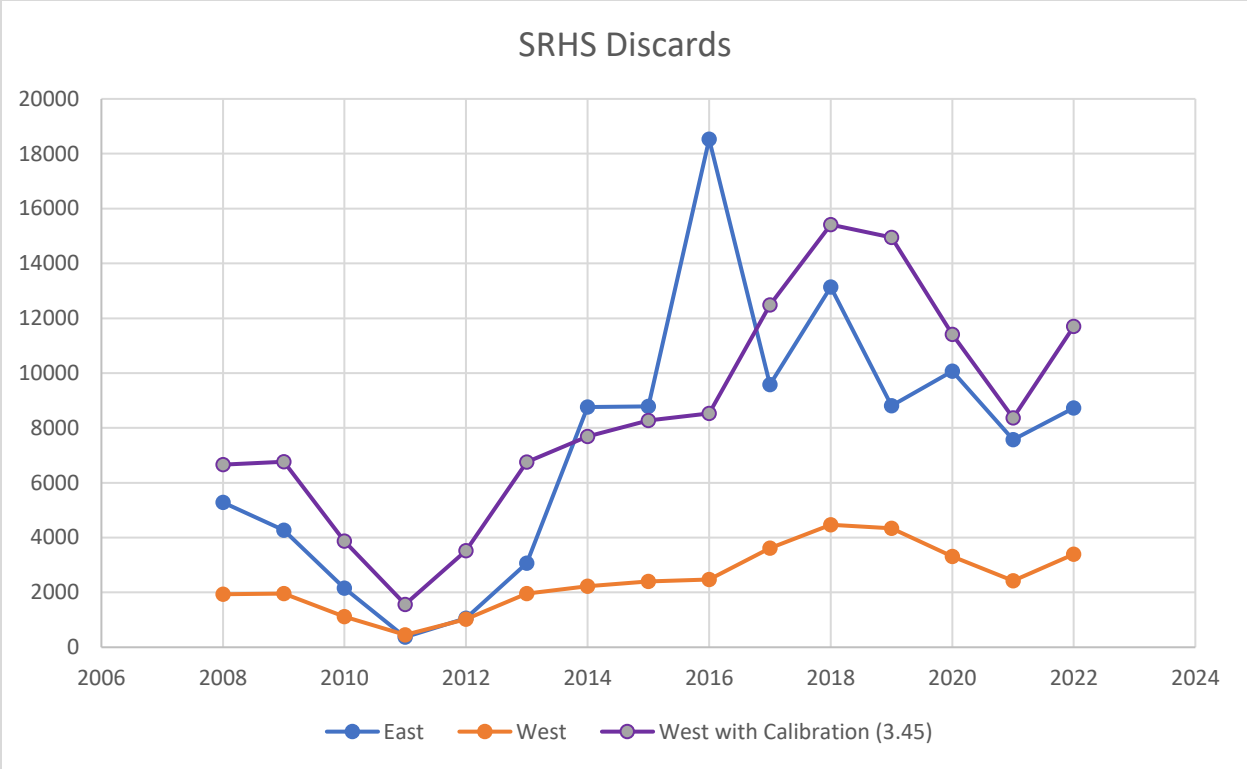


Figure A2. Calibration of headboat West discards based on headboat observer comparison. West is the Gulf of Mexico and Florida Keys, East is North Carolina to East Florida.

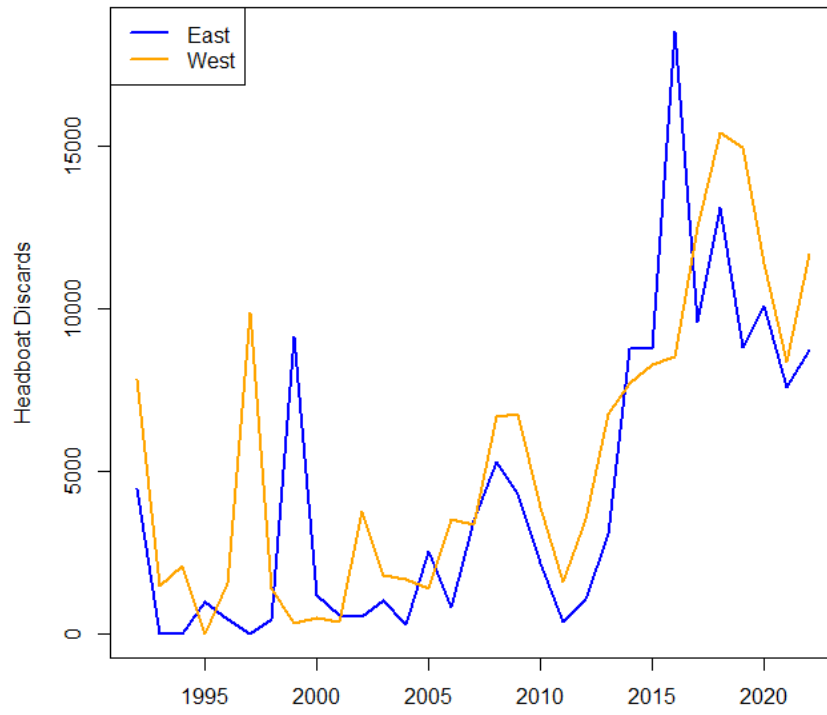


Figure A3. Final headboat discard estimates for mutton snapper. West is the Gulf of Mexico and Florida Keys and East is North Carolina through East Florida.