Headboat Data for Gray Triggerfish in the US Gulf of America

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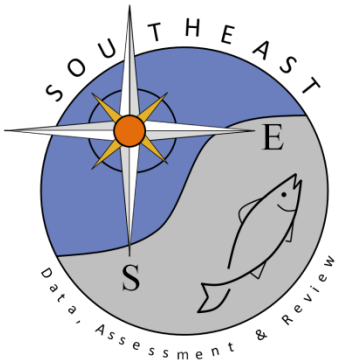

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1 Survey Description

The Southeast Region Headboat Survey (SRHS) estimates landings and effort for headboats in the U.S. South Atlantic and Gulf of America. The survey began in 1972 in North Carolina and South Carolina. It expanded to northeast Florida (Nassau-Indian River counties) and Georgia in 1976, 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 was implemented in the Gulf of Mexico in 1986, extending from Naples, FL, to South Padre Island, TX.

Annually, the survey includes approximately 70-80 participating vessels in each region (Table 1). Headboat data are considered confidential and cannot be publicly distributed if fewer than three vessels contribute to a data product.

The SRHS implemented mandatory electronic logbook reporting in the South Atlantic and Gulf of Mexico as of January 1, 2013. Headboat operators now 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 concluded that the SRHS data products represent the best available information for regional headboat data and recommended their use in stock assessments. This conclusion also applies to the Gulf of Mexico, as the data collection methodology is identical.

Paper logbook forms varied by region and year, primarily due to space limitations in the survey's early years. The predominant species listed on these forms varied by region, and the number of species listed generally increased over time. All forms included blank lines to write in species not explicitly listed. Since the transition to electronic logbooks in 2013, a comprehensive list of all species is available to users.

Reporting of discards was added to the logbook form in 2004. Due to confusion regarding the condition of released fish, only total discards have been reported since 2013. For consistency, data from 2004 to 2012, which originally distinguished between live and dead releases, are typically combined to represent total discards.

The area definitions for the SRHS were modified in 2013, primarily to remove the inshore-offshore distinction for the Carolinas and to create state-specific areas for the Gulf of Mexico. A few other areas were collapsed in the Florida Keys and on the west coast of Florida (Figures 1 and 2).

For this assessment, state defined based on headboat areas is used to define regions rather than actual states. Much of the data at this level is confidential but has been provided to the assessment analysts. The regional based data is available to the public. The assignment of SRHS areas to state and regions is as follows:

- **Texas (TX)**: Areas 25, 26, 27
- **Louisiana (LA)**: Area 24
- **Mississippi (MS)**: Area 28
- **Alabama (AL)**: Area 29 (added in 2013)
- **Florida West/Alabama (FLW_AL)**: Areas 21, 23 (includes AL prior to 2013)

Aggregated Regions:

- **West Region**: Areas 24, 25, 26, 27
- **East Region**: Areas 21, 23, 28, 29

The SRHS dockside sampling was suspended in March 2020 due to the COVID-19 pandemic, and no biological samples were collected during this time. However, port agents continued to monitor reporting compliance to ensure captains submitted trip-level catch and effort data via electronic logbooks. Consequently, reported catch and effort data were used to estimate 2020 landings and effort with no disruption. To convert landings from number of fish to weight, mean weights from 2019 were applied to the 2020 landings numbers. Port agents maintained QA/QC checks and database validations for their areas of responsibility and provided outreach to captains regarding new for-hire reporting requirements. Biological sampling did not resume until the NMFS/SEFSC approved new safety measures in July 2021, though some port agents supported by state agencies returned to dockside sampling earlier.

2 Methods

2.1 Landings

The SRHS uses a two-component system to estimate catch and effort:

1. Logbook Reporting: Vessel personnel complete a logbook for each trip, reporting total catch and effort. Port agents identify missing trip reports by contacting the vessel's captain or office, through personal observations, by reviewing weekly compliance reports, and using other methods. If trips are not reported, the monthly catch estimated for the vessel is increased by the proportion of trips missing. In the early years of the survey, when compliance was low, catch from another similarly sized vessel from the same area was adjusted based on the observed number of trips and substituted when vessels failed to report landings. Reporting compliance has been near 100% since permits were linked to reporting requirements in 2008. The proportion of trips reported is the primary information used to develop a proxy for uncertainty estimates.

2. Dockside Sampling: Port samplers collect fish size data dockside, measuring fish to the nearest millimeter (mm) and weighing them to the nearest 0.01 kg. These data are used to calculate mean weights by species, area, and month, which are then used to convert reported landings from number of fish to total weight.

2.2 Discards

In 2004, the SRHS logbook was modified to collect self-reported discards, categorized as "released alive" or "released dead." Captains were instructed that a fish is "released alive" if it can swim away on its own and "released dead" if it floats or is obviously unable to swim. As of January 1, 2013, with the transition to electronic reporting, the logbook was simplified to collect only the total number of fish released, regardless of condition.

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

2.3 Uncertainty

Uncertainty estimates for headboat landings were initially developed for the SEDAR 68 scamp research track assessment (Nuttall et al. 2020). While statistically valid, the approach used the uncertainty of reported landings (across areas, months, and vessels) as a proxy for uncertainty in total landings estimates, which produced unrealistic coefficients of variation (CVs) in some years. For example, some years with only 60% of vessels reporting had CVs of approximately 0.05. As an alternative, a proxy CV method was developed for the SEDAR 74 red snapper research track data workshop. This method relies on the proportion of reported trips (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 refined for the SEDAR 82 gray triggerfish research track data workshop to account for spatial variability in species abundance and reporting compliance. To address concerns that high CVs could be estimated for strata with low overall compliance even if compliance was high in the areas with the most catch, compliance rates are now weighted by the associated landings estimates:

$$proxyCV_i = 1 - \sum_j \left(\frac{n_{i,j}}{N_{i,j}} \cdot \frac{L_{i,j}}{\sum_j L_{i,j}} \right) + 0.05$$

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 paper logbooks until 2012 and electronically since 2013. After each trip, the owner, captain, or a designated crew member enters the total number of all species landed and discarded. Effort is reported as the number of anglers per trip and is standardized into **angler-day** by multiplying the number of anglers by a trip-length factor (e.g., 40 anglers on a half-day trip yields 40×0.5=20 angler-days).

As with landings, effort is expanded to account for missing trips. Effort estimates for Louisiana are zero for 2004 and 2005. During this time, only one or two vessels were active and did not report catch in 2002, 2004, 2005, or 2006 due to funding and staffing issues. Additionally, Hurricane Katrina severely impacted Louisiana fishing operations from August 2005 through much of 2006. Alabama was assigned a separate area code in 2013; prior to this, it was combined with northwest Florida. Mississippi was added to the survey in 2010.

Angler-day is considered the best practice unit of effort for headboat data. **Angler-trip** is calculated to match units for general recreational effort from the Marine Recreational Information Program (MRIP) for the purpose of combining effort across sectors if required. There are some caveats with the method because it does not account for all effort expansions in the standard estimation method or the duration of the trip.

2.5 Biological Samples

Length data have been collected by SRHS dockside samplers since the survey's inception. Weights are typically collected for the same fish measured during dockside sampling. Other biological samples (scales, otoliths, spines, stomachs, gonads) and data (sex determination) are collected routinely for ageing, diet, and maturity studies. Port agents are provided with lists of priority species, but no specific sampling quotas are assigned.

3 Results and Discussion

3.1 Landings

Landings in number are given by region (Table 2 and Figure 3). Landings in pounds are shown by region (Table 3 and Figure 4). The primary area of gray triggerfish landings was predominantly West Florida - Alabama and Texas over the course of the survey. The landings peak in the early to mid 1990s with a decline until approximately 2010. Shifts in desirability of gray triggerfish most likely account for the increase in landings in the early part of the survey. The special topic group on desirability for gray triggerfish during the recent Atlantic assessment of gray triggerfish found desirability shifts over the same time period (SEDAR (2024), section 9). The group found desirability shifts impacted South Florida first which might coincide with the delayed increase in landings in Texas compared to West Florida.

The SEDAR 88 landings for gray triggerfish were nearly identical to the SEDAR 43 landings for overlapping years (Figure 5).

MRIP did not produce headboat landings estimates for Texas prior to the start of the SRHS in 1986. As in SEDAR 43, the average landings for the Texas SRHS landings from 1986 - 1990 were used as a proxy MRIP landings for each year from 1981 to 1985 (23,279 fish, 31,444 pounds) in previous assessments.

3.2 Discards

Nearly all the discards were from East region with increases that coincide with closures starting in 2012 that impacted a large proportion of the year in some cases (Table 4, Figure 6). There is no information on the size of these fish in the SRHS with which to convert the discards in number to weight. Therefore discard estimates in weight were not provided for the headboat fleet. Observer data may inform the selectivity of these discards.

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 year are given in tables 5 - 7. For gray triggerfish, only the regional (East, West) catch can be released to the public. The assessment analysts are provided with finer scale data and maps of landings.

3.4 Uncertainty

Unweighted proxy CV estimates by region, and overall are provided in Tables 8 - 9. Regional proxy CV values weighted by state landings (in number and weight) are given in Tables 10 and 11. Annual weighted proxy CV values, weighted by regional landings, are provided in Tables 12 and 13. The weighted proxy CVs should provide the best estimate for uncertainty.

3.5 Effort

Estimated headboat angler-days and angler-trips decreased until about 2010, increased until 2015, and have been relatively constant since (Tables 14 - 15). The same trend is seen in the East for the regional effort estimates (Tables 16 - 17, Figure 7). 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. One of the caveats with the expansion of angler trips to account for non-reporting is evident for Louisiana in 2002 where the estimation process for angler days used a non-standard process to account for reporting deficiencies. The estimated

angler trips for LA in 2002 is zero while the estimated angler days is approximately 6000 angler days. This does not dramatically impact regional or Gulfwide estimates but demonstrates an issue with the calculation created to combine with the less informative general recreational effort unit.

3.6 Biological Samples

Annual numbers of gray triggerfish measured for fork length in the headboat fleet are given by region in Table 18. The number of trips from which these samples were measured are summarized in Table 19. Mean fork lengths (mm) and weights (g), with associated CVs, are tabulated by region in Tables 20 - 23. Patterns in length and weight by year and region are shown in Figures 8 and 9.

3.7 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
1980	89	
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
2023	61	68
2024	62	68

Table 2: Gray triggerfish landings by region in number (TX and LA are West; AL, MS, FLW are East).

year	West	East	Total
1986	16018	29024	45042
1987	16697	22033	38730
1988	41438	27123	68561
1989	24891	55618	80509
1990	25565	105336	130901
1991	31128	58119	89247
1992	41752	68924	110676
1993	44184	58787	102971
1994	56712	53467	110179
1995	51841	45825	97666
1996	40329	36195	76524
1997	29227	34458	63685
1998	16103	37085	53188
1999	6836	34143	40979
2000	5978	26245	32223
2001	7494	32561	40055
2002	8996	44858	53854
2003	17013	46468	63481
2004	13114	43101	56215
2005	11318	36952	48270
2006	10821	23087	33908
2007	11953	20796	32749
2008	3730	18852	22582
2009	1102	11002	12104
2010	414	9038	9452
2011	1084	15307	16391
2012	478	5444	5922
2013	532	9294	9826
2014	180	2782	2962
2015	48	1081	1129
2016	370	10638	11008
2017	45	1	46
2018	259	14951	15210
2019	76	5267	5343
2020	44	5167	5211
2021	40	5511	5551
2022	65	5627	5692
2023	72	5367	5439
2024	50	4328	4378

Table 3: Gray triggerfish landings by region in pounds; TX and LA are West; AL, MS, FLW are East).

year	West	East	Total
1986	22725	66581	89307
1987	23492	39871	63363
1988	42930	47179	90108
1989	38167	113347	151514
1990	44505	154292	198797
1991	57080	95971	153051
1992	60167	109888	170054
1993	84727	98341	183068
1994	103706	82332	186038
1995	99680	72062	171742
1996	67315	57578	124893
1997	57069	51962	109032
1998	33306	55318	88624
1999	15562	53919	69481
2000	12812	49184	61996
2001	15400	52129	67529
2002	15304	75649	90952
2003	30944	73467	104410
2004	26251	73816	100067
2005	19662	64469	84130
2006	18755	39424	58178
2007	24398	38287	62685
2008	6082	42502	48584
2009	2939	31676	34615
2010	1102	24654	25756
2011	3058	47391	50449
2012	1384	17322	18706
2013	1468	25644	27112
2014	530	8163	8693
2015	162	3950	4112
2016	1034	28543	29577
2017	94	2	96
2018	904	54387	55291
2019	196	21060	21256
2020	144	17085	17230
2021	116	14697	14813
2022	203	17792	17996
2023	284	20609	20893
2024	153	13564	13718

Table 4: Gray triggerfish discards by region in number of fish (TX and LA are West; AL, MS, FLW are East.

year	West	East	Total
2004	133	188	321
2005	201	470	671
2006	143	1000	1143
2007	163	1249	1412
2008	313	3064	3377
2009	416	10990	11406
2010	372	7572	7944
2011	531	15378	15909
2012	534	29693	30227
2013	163	37185	37348
2014	177	39654	39831
2015	272	85509	85781
2016	263	91277	91540
2017	127	151992	152119
2018	113	88418	88531
2019	134	84113	84247
2020	225	69614	69839
2021	12	126820	126832
2022	934	104937	105871
2023	100	116572	116672
2024	1	88395	88396

Table 5: Gray triggerfish number of vessels by state contributing to landings estimates. Strata with less than 3 vessels reporting are considered confidential.

year	TX	LA	MS	AL	FLW_AL
1986	15	3			40
1987	15	3			39
1988	16	4			41
1989	17	5			52
1990	16	6			58
1991	15	6			52
1992	17	7			48
1993	18	7			50
1994	17	6			54
1995	17	8			45
1996	16	8			43
1997	16	6			44
1998	18	5			42
1999	17	5			38
2000	14	4			33
2001	16	2			35
2002	19				34
2003	18	1			36
2004	19				41
2005	20				41
2006	19				41
2007	19	5			38
2008	11	4			46
2009	16	4			50
2010	12		1		43
2011	15	4	3		46
2012	11	3	1		42
2013	13	2	1	8	32
2014	11	1	1	7	32
2015	9	2	2	8	33
2016	11		2	9	37
2017	6		2	9	33
2018	8	1	1	9	38
2019	8	1	1	10	32
2020	8		2	8	31
2021	7		1	9	33
2022	8			8	33
2023	9			8	33
2024	6			6	34
2025	7			6	30

Table 6: Gray triggerfish number of vessels by region contributing to landings estimates. Strata with less than 3 vessels reporting are considered confidential.

year	West	East
1986	18	40
1987	18	39
1988	20	41
1989	22	52
1990	22	58
1991	21	52
1992	24	48
1993	25	50
1994	23	54
1995	25	45
1996	24	43
1997	22	44
1998	23	42
1999	22	38
2000	18	33
2001	18	35
2002	19	34
2003	19	36
2004	19	41
2005	20	41
2006	19	41
2007	24	38
2008	15	46
2009	20	50
2010	12	44
2011	19	49
2012	14	43
2013	15	41
2014	12	40
2015	11	43
2016	11	48
2017	6	44
2018	9	48
2019	9	43
2020	8	41
2021	7	43
2022	8	41
2023	9	41
2024	6	40
2025	7	36

Table 7: Gray triggerfish number of vessels annually contributing to landings estimates. Strata with less than 3 vessels reporting are considered confidential.

year	n_vessel
1986	58
1987	57
1988	61
1989	74
1990	80
1991	73
1992	72
1993	75
1994	77
1995	70
1996	67
1997	66
1998	65
1999	59
2000	51
2001	53
2002	53
2003	55
2004	60
2005	61
2006	60
2007	62
2008	61
2009	70
2010	56
2011	68
2012	57
2013	56
2014	52
2015	54
2016	59
2017	50
2018	57
2019	52
2020	49
2021	50
2022	49
2023	50
2024	46
2025	43

Table 8: Unweighted proxy CV values by region. These values are based on logbook reporting compliance and are consistent across species.

year	West	East
1986	0.399	0.695
1987	0.387	0.746
1988	0.344	0.551
1989	0.233	0.494
1990	0.300	0.209
1991	0.314	0.140
1992	0.209	0.138
1993	0.239	0.115
1994	0.215	0.226
1995	0.185	0.372
1996	0.320	0.312
1997	0.243	0.253
1998	0.138	0.419
1999	0.221	0.419
2000	0.193	0.436
2001	0.211	0.434
2002	0.088	0.346
2003	0.408	0.340
2004	0.119	0.296
2005	0.208	0.254
2006	0.206	0.323
2007	0.571	0.332
2008	0.244	0.074
2009	0.092	0.055
2010	0.055	0.087
2011	0.051	0.059
2012	0.092	0.065
2013	0.050	0.050
2014	0.050	0.050
2015	0.051	0.051
2016	0.052	0.050
2017	0.073	0.052
2018	0.052	0.051
2019	0.059	0.052
2020	0.050	0.050
2021	0.050	0.050
2022	0.050	0.050
2023	0.051	0.050
2024	0.051	0.050

Table 9: Unweighted proxy CV values by year. These values are based on logbook reporting compliance and are consistent across species.

year	cv
1986	0.621
1987	0.656
1988	0.496
1989	0.435
1990	0.229
1991	0.181
1992	0.158
1993	0.150
1994	0.222
1995	0.317
1996	0.314
1997	0.250
1998	0.339
1999	0.365
2000	0.376
2001	0.376
2002	0.274
2003	0.363
2004	0.252
2005	0.240
2006	0.284
2007	0.398
2008	0.101
2009	0.063
2010	0.079
2011	0.057
2012	0.071
2013	0.050
2014	0.050
2015	0.051
2016	0.050
2017	0.056
2018	0.052
2019	0.053
2020	0.050
2021	0.050
2022	0.050
2023	0.050
2024	0.050

Table 10: Regional proxy CV values weighted by state landings of gray triggerfish in number.

year	West	East
1986	0.408	0.695
1987	0.335	0.746
1988	0.287	0.551
1989	0.236	0.494
1990	0.295	0.209
1991	0.303	0.140
1992	0.206	0.138
1993	0.211	0.115
1994	0.198	0.226
1995	0.171	0.372
1996	0.273	0.312
1997	0.247	0.253
1998	0.138	0.419
1999	0.198	0.419
2000	0.172	0.436
2001	0.144	0.434
2002	0.086	0.346
2003	0.476	0.340
2004	0.119	0.296
2005	0.067	0.254
2006	0.058	0.323
2007	0.570	0.332
2008	0.262	0.074
2009	0.095	0.055
2010	0.055	0.086
2011	0.051	0.059
2012	0.087	0.066
2013	0.050	0.050
2014	0.050	0.050
2015	0.051	0.051
2016	0.052	0.051
2017	0.074	0.053
2018	0.052	0.052
2019	0.059	0.052
2020	0.050	0.050
2021	0.050	0.050
2022	0.050	0.050
2023	0.051	0.050
2024	0.051	0.050

Table 11: Regional proxy CV values weighted by state landings of gray triggerfish in weight.

year	West	East
1986	0.407	0.695
1987	0.338	0.746
1988	0.297	0.551
1989	0.235	0.494
1990	0.296	0.209
1991	0.301	0.140
1992	0.208	0.138
1993	0.220	0.115
1994	0.201	0.226
1995	0.172	0.372
1996	0.276	0.312
1997	0.247	0.253
1998	0.138	0.419
1999	0.197	0.419
2000	0.173	0.436
2001	0.146	0.434
2002	0.085	0.346
2003	0.465	0.340
2004	0.119	0.296
2005	0.067	0.254
2006	0.058	0.323
2007	0.570	0.332
2008	0.254	0.074
2009	0.095	0.055
2010	0.055	0.086
2011	0.051	0.059
2012	0.086	0.066
2013	0.050	0.050
2014	0.050	0.050
2015	0.051	0.051
2016	0.052	0.051
2017	0.074	0.053
2018	0.052	0.052
2019	0.058	0.052
2020	0.050	0.050
2021	0.050	0.050
2022	0.050	0.050
2023	0.051	0.050
2024	0.051	0.050

Table 12: Annual proxy CV values weighted by regional landings of gray triggerfish in number.

year	CV
1986	0.589
1987	0.591
1988	0.426
1989	0.413
1990	0.227
1991	0.200
1992	0.165
1993	0.168
1994	0.220
1995	0.273
1996	0.316
1997	0.248
1998	0.334
1999	0.386
2000	0.391
2001	0.392
2002	0.303
2003	0.358
2004	0.255
2005	0.243
2006	0.286
2007	0.419
2008	0.102
2009	0.058
2010	0.085
2011	0.058
2012	0.068
2013	0.050
2014	0.050
2015	0.051
2016	0.050
2017	0.073
2018	0.051
2019	0.052
2020	0.050
2021	0.050
2022	0.050
2023	0.050
2024	0.050

Table 13: Annual proxy CV values weighted by regional landings of gray triggerfish in weight.

year	CV
1986	0.619
1987	0.613
1988	0.453
1989	0.428
1990	0.230
1991	0.205
1992	0.163
1993	0.172
1994	0.220
1995	0.264
1996	0.316
1997	0.248
1998	0.313
1999	0.375
2000	0.386
2001	0.383
2002	0.303
2003	0.360
2004	0.250
2005	0.243
2006	0.286
2007	0.425
2008	0.096
2009	0.058
2010	0.085
2011	0.058
2012	0.067
2013	0.050
2014	0.050
2015	0.051
2016	0.050
2017	0.073
2018	0.051
2019	0.052
2020	0.050
2021	0.050
2022	0.050
2023	0.050
2024	0.050

Table 14: Estimates of total effort in angler - days by year.

year	Angler_Day
1986	302536
1987	286774
1988	274035
1989	274581
1990	278948
1991	240654
1992	270931
1993	300058
1994	317991
1995	283372
1996	257753
1997	240657
1998	270835
1999	242378
2000	222678
2001	218826
2002	215004
2003	225279
2004	223420
2005	190090
2006	199843
2007	203166
2008	174309
2009	196443
2010	158887
2011	207966
2012	217431
2013	233886
2014	245853
2015	253105
2016	257016
2017	251421
2018	247242
2019	240862
2020	193111
2021	270017
2022	230336
2023	223771
2024	216492

Table 15: Estimates of total effort in angler - trips by year.

year	Angler_Trip
1986	330173
1987	351541
1988	359278
1989	358847
1990	374904
1991	318585
1992	343636
1993	362102
1994	390133
1995	364384
1996	337152
1997	299961
1998	326333
1999	219374
2000	298776
2001	271970
2002	260044
2003	276561
2004	275804
2005	240459
2006	248496
2007	329881
2008	214982
2009	264403
2010	209111
2011	281137
2012	301077
2013	293420
2014	312883
2015	320289
2016	326806
2017	321268
2018	316205
2019	303721
2020	237569
2021	352783
2022	317692
2023	275582
2024	244185

Table 16: Estimates of total effort in angler - days by region.

year	West	East
1986	62459	240077
1987	69725	217049
1988	78087	195948
1989	66256	208325
1990	65042	213906
1991	66342	174312
1992	86129	184802
1993	92160	207898
1994	113429	204562
1995	100962	182410
1996	102840	154913
1997	91215	149442
1998	85504	185331
1999	66261	176117
2000	63347	159331
2001	61583	157243
2002	73173	141831
2003	81068	144211
2004	64990	158430
2005	59857	130233
2006	75794	124049
2007	66286	136880
2008	44133	130176
2009	54005	142438
2010	47371	111516
2011	49170	158796
2012	53615	163816
2013	57328	176558
2014	52865	192988
2015	56799	196306
2016	55368	201648
2017	53131	198290
2018	53698	193544
2019	53714	187148
2020	52168	140943
2021	72877	197140
2022	64563	165773
2023	59885	163886
2024	58437	158055

Table 17: Estimates of total effort in angler - trips by region.

year	West	East
1986	70752	259421
1987	81749	269791
1988	83764	275514
1989	75876	282971
1990	76780	298124
1991	81337	237248
1992	96090	247546
1993	100043	262058
1994	118160	271973
1995	105772	258612
1996	107764	229387
1997	94157	205804
1998	90553	235781
1999	48435	170939
2000	72056	226720
2001	64516	207453
2002	69614	190431
2003	82703	193858
2004	65024	210780
2005	62093	178366
2006	77265	171231
2007	144368	185512
2008	29253	185729
2009	58088	206315
2010	49273	159838
2011	51748	229388
2012	61315	239762
2013	60035	233385
2014	56145	256738
2015	60540	259749
2016	58190	268616
2017	56164	265103
2018	55687	260519
2019	54741	248980
2020	52947	184622
2021	86183	266600
2022	79823	237869
2023	64760	210822
2024	56308	187877

Table 18: Gray triggerfish number of fish lengths sampled by region.

year	West	East
1986	274	262
1987	257	340
1988	228	432
1989	384	1037
1990	500	1608
1991	301	1358
1992	1196	1165
1993	662	700
1994	1197	930
1995	882	872
1996	816	706
1997	312	882
1998	464	1119
1999	186	614
2000	54	745
2001	216	687
2002	149	1063
2003	147	968
2004	102	628
2005	101	387
2006	83	336
2007	91	439
2008	24	321
2009	13	201
2010	3	263
2011	11	219
2012	30	128
2013	37	312
2014	47	140
2015	3	37
2016	28	585
2017	4	
2018	9	368
2019	8	341
2020		66
2021	2	33
2022	9	219
2023	3	162
2024	4	162

Table 19: Gray triggerfish number of trips sampled by region.

year	West	East
1986	113	140
1987	112	188
1988	99	213
1989	100	329
1990	90	348
1991	83	315
1992	219	292
1993	177	200
1994	253	230
1995	214	203
1996	143	162
1997	97	218
1998	151	239
1999	80	150
2000	38	173
2001	68	141
2002	71	180
2003	58	178
2004	41	120
2005	36	83
2006	32	104
2007	31	137
2008	13	91
2009	7	73
2010	3	77
2011	6	76
2012	8	40
2013	22	86
2014	12	36
2015	3	7
2016	17	61
2017	2	
2018	6	69
2019	4	62
2020		11
2021	1	11
2022	5	78
2023	3	59
2024	4	76

Table 20: Gray triggerfish mean fork length in mm by region.

year	West	East
1986	309	344
1987	313	314
1988	312	315
1989	318	307
1990	324	302
1991	333	313
1992	305	311
1993	342	315
1994	330	303
1995	336	309
1996	330	312
1997	336	305
1998	339	304
1999	361	311
2000	361	319
2001	336	310
2002	335	314
2003	331	308
2004	330	314
2005	332	316
2006	327	315
2007	345	321
2008	312	345
2009	342	373
2010	423	377
2011	381	391
2012	375	381
2013	390	384
2014	430	404
2015	407	426
2016	384	394
2017	353	
2018	415	414
2019	384	424
2020		417
2021	416	400
2022	370	409
2023	435	415
2024	365	414

Table 21: Gray triggerfish fork length CV in mm by region.

year	West	East
1986	0.20	0.19
1987	0.23	0.20
1988	0.17	0.21
1989	0.14	0.21
1990	0.12	0.17
1991	0.14	0.17
1992	0.17	0.17
1993	0.14	0.18
1994	0.14	0.17
1995	0.13	0.16
1996	0.15	0.15
1997	0.14	0.17
1998	0.18	0.14
1999	0.27	0.14
2000	0.18	0.17
2001	0.16	0.15
2002	0.16	0.15
2003	0.15	0.14
2004	0.12	0.16
2005	0.14	0.17
2006	0.13	0.14
2007	0.15	0.14
2008	0.16	0.14
2009	0.14	0.13
2010	0.15	0.12
2011	0.09	0.13
2012	0.09	0.09
2013	0.11	0.10
2014	0.17	0.19
2015	0.06	0.16
2016	0.09	0.10
2017	0.05	
2018	0.09	0.09
2019	0.10	0.11
2020		0.09
2021	0.13	0.07
2022	0.13	0.10
2023	0.04	0.12
2024	0.12	0.09

Table 22: Gray triggerfish mean weight (g) by region.

year	West	East
1986	739	1021
1987	765	798
1988	723	760
1989	792	737
1990	805	681
1991	875	755
1992	762	744
1993	992	768
1994	869	693
1995	905	725
1996	810	730
1997	893	695
1998	953	676
1999	1087	705
2000	974	807
2001	898	728
2002	848	754
2003	864	712
2004	860	780
2005	924	792
2006	864	769
2007	986	811
2008	690	1004
2009	988	1237
2010		1263
2011	1342	1384
2012	1333	1303
2013	1348	1241
2014	1288	1426
2015	1405	1619
2016	1321	1277
2017	970	
2018	1743	1689
2019	1148	1767
2020		1549
2021	1540	1339
2022	1247	1472
2023	1808	1530
2024	1155	1492

Table 23: Gray triggerfish weight CV in g by region.

year	West	East
1986	0.59	0.66
1987	0.70	0.72
1988	0.54	0.71
1989	0.56	0.78
1990	0.39	0.61
1991	0.39	0.58
1992	0.45	0.64
1993	0.43	0.67
1994	0.50	0.60
1995	0.43	0.57
1996	0.39	0.52
1997	0.45	0.61
1998	0.64	0.52
1999	1.00	0.52
2000	0.42	0.57
2001	0.60	0.50
2002	0.42	0.54
2003	0.45	0.47
2004	0.38	0.56
2005	0.43	0.62
2006	0.40	0.51
2007	0.54	0.46
2008	0.63	0.44
2009	0.45	0.47
2010		0.42
2011	0.29	0.48
2012	0.30	0.29
2013	0.45	0.35
2014	0.62	0.53
2015	0.23	0.51
2016	0.35	0.37
2017	0.11	
2018	0.20	0.28
2019	0.24	0.40
2020		0.31
2021	0.47	0.25
2022	0.46	0.34
2023	0.06	0.36
2024	0.40	0.37

3.8 Figures

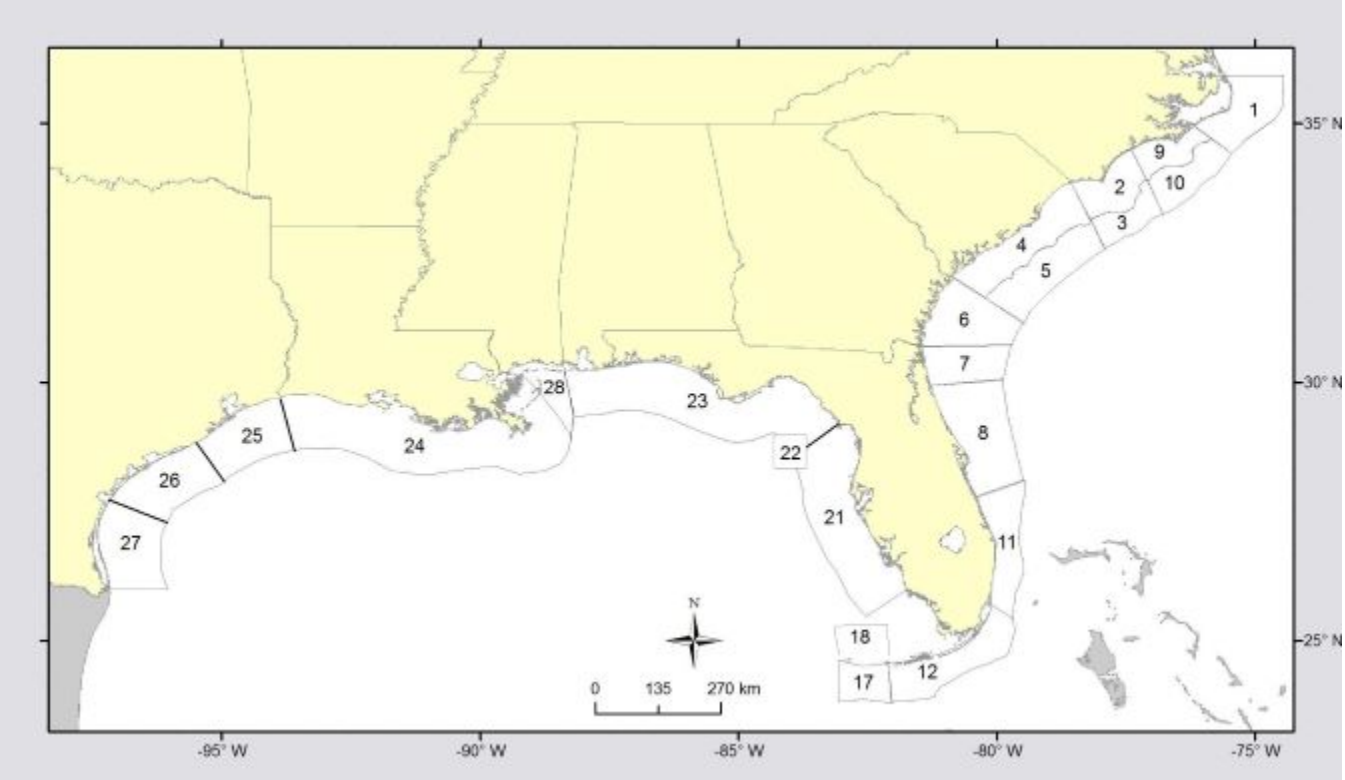

Figure 1: Headboat sampling areas prior to 2013.

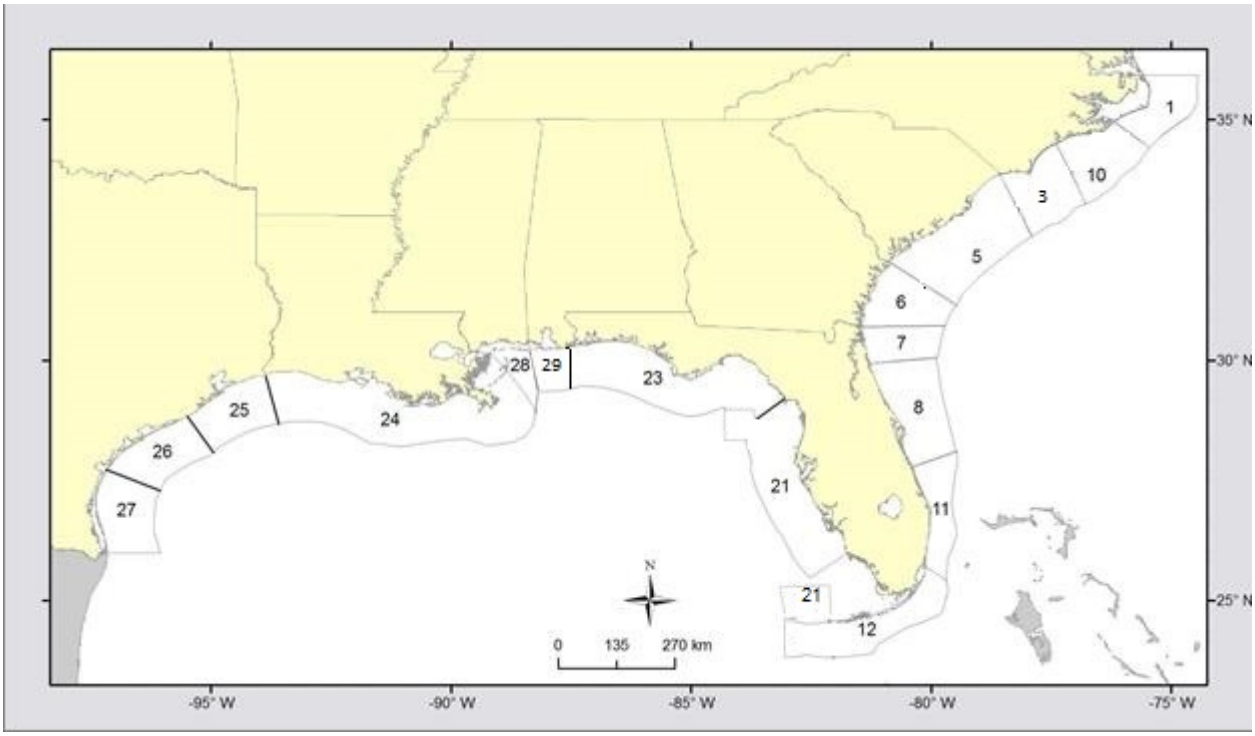

Figure 2: Headboat sampling areas 2013 - present.

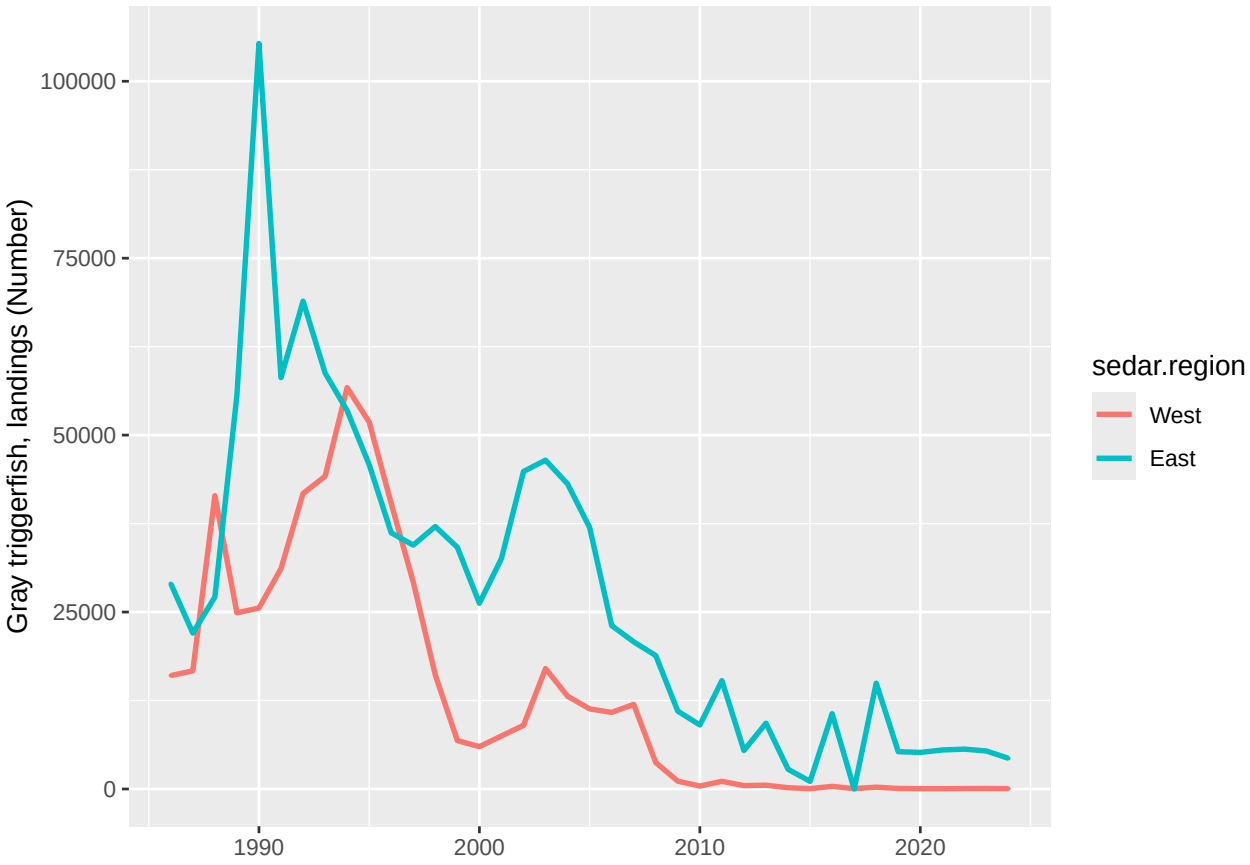

Figure 3: gray triggerfish landings in number

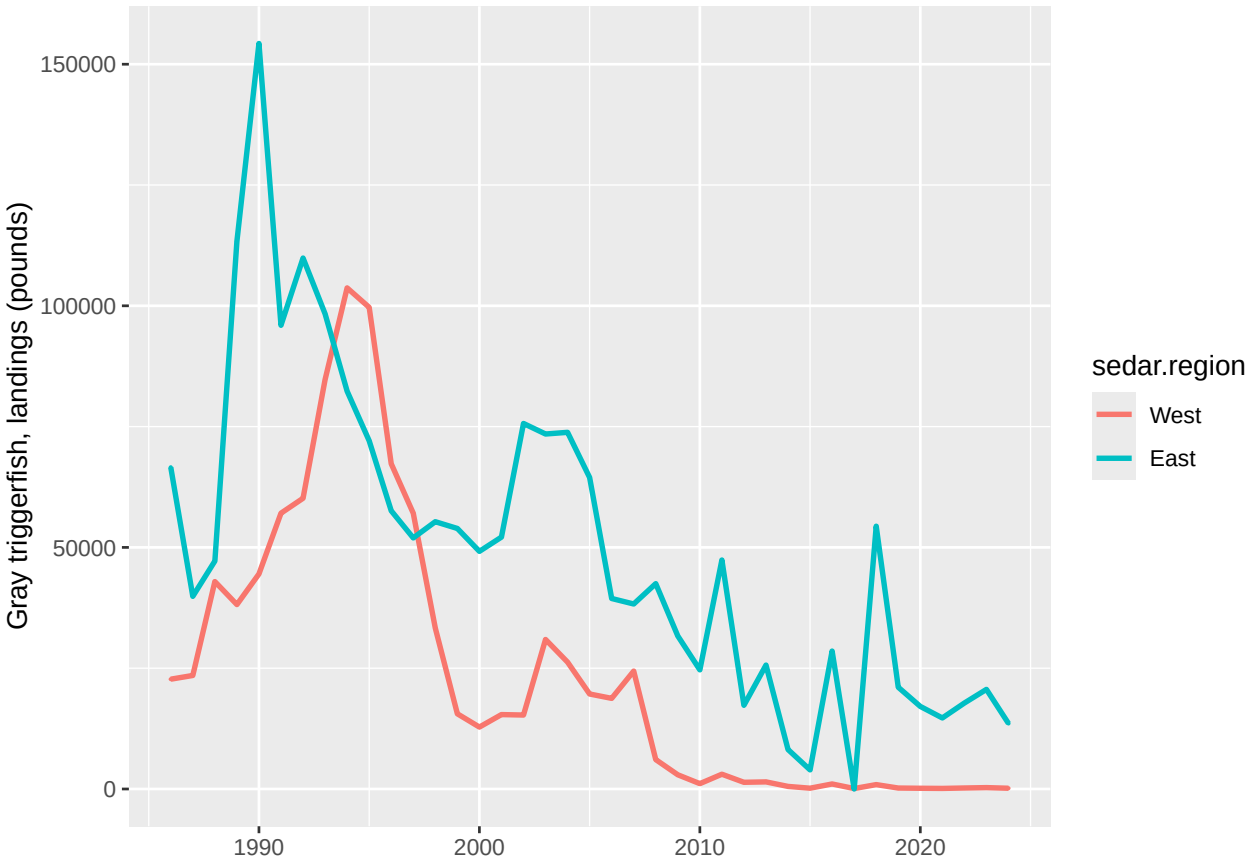

Figure 4: Gray triggerfish landings in pounds.

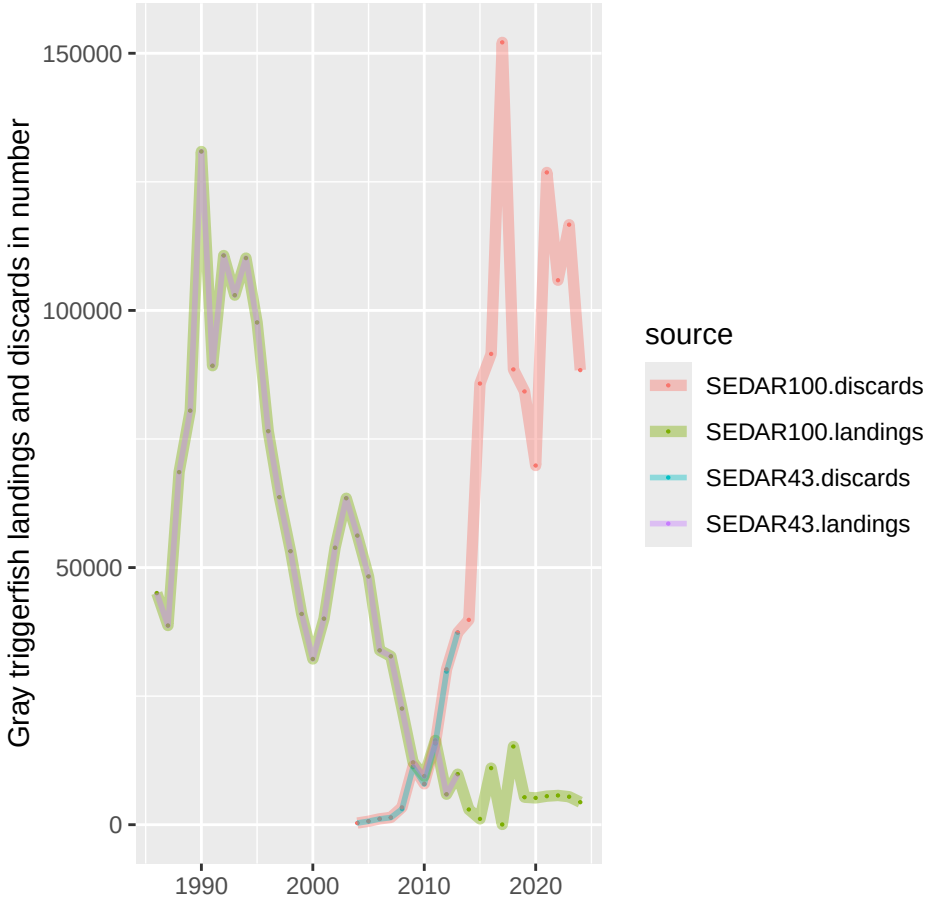

Figure 5: Comparison to SEDAR 43 Gray triggerfish landings and discards.

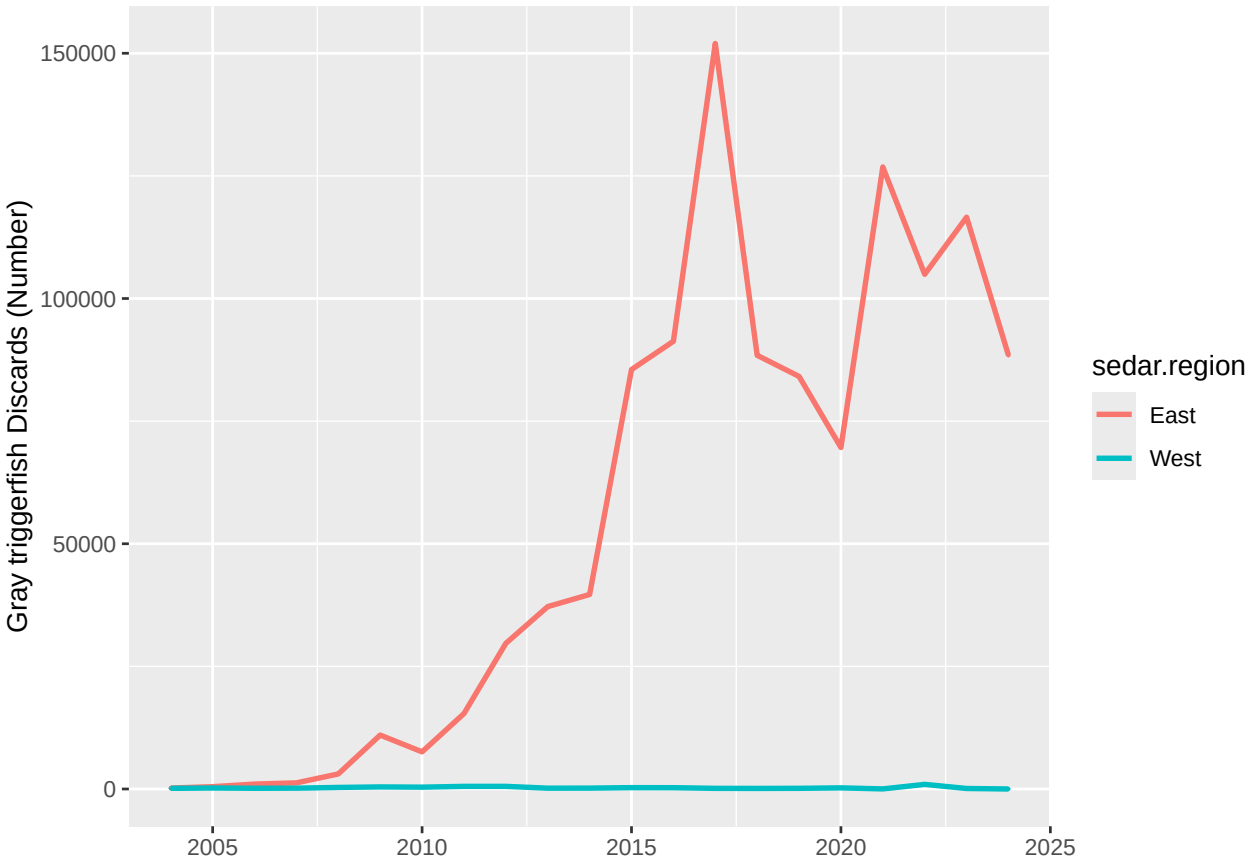

Figure 6: Gray triggerfish discards in number

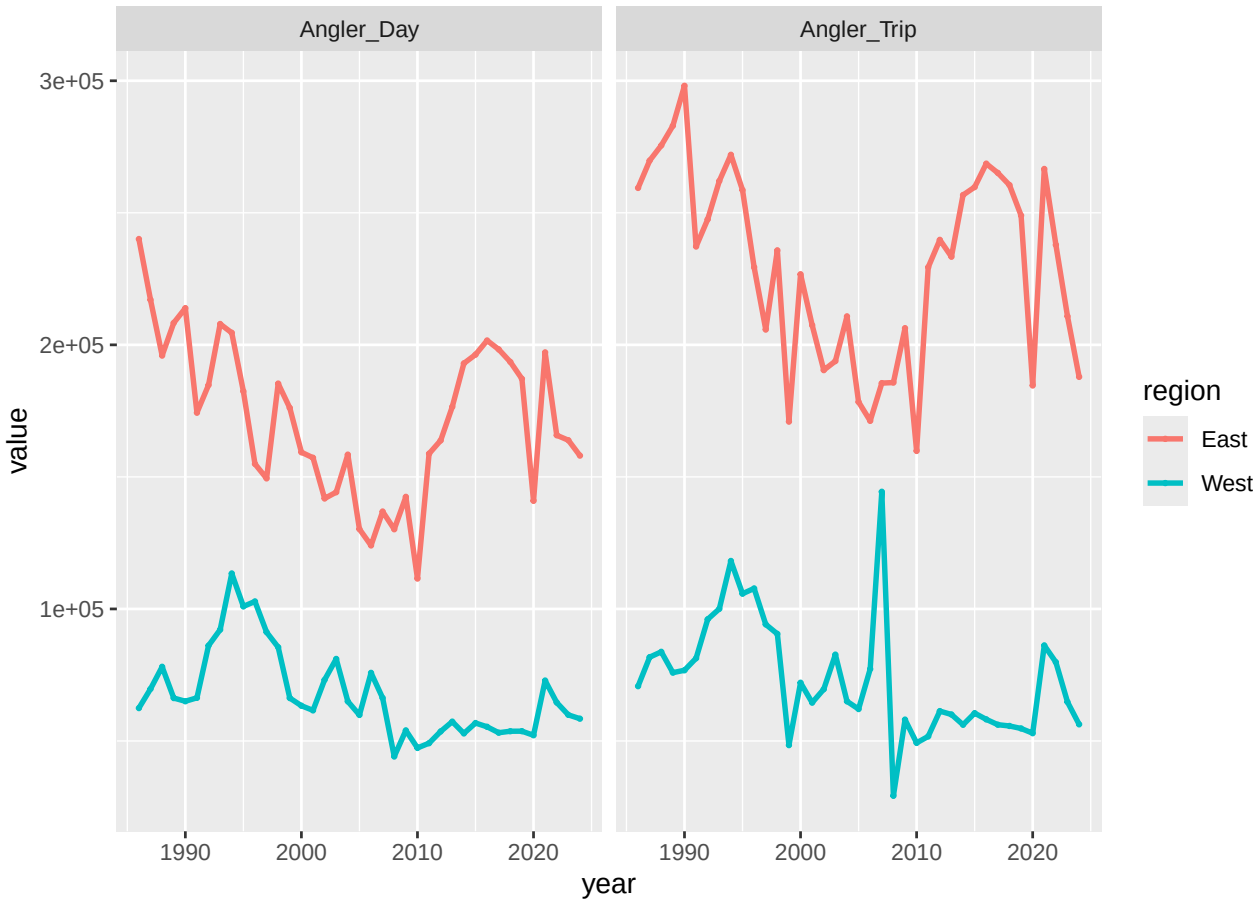

Figure 7: SRHS total estimated angler days and angler trips.

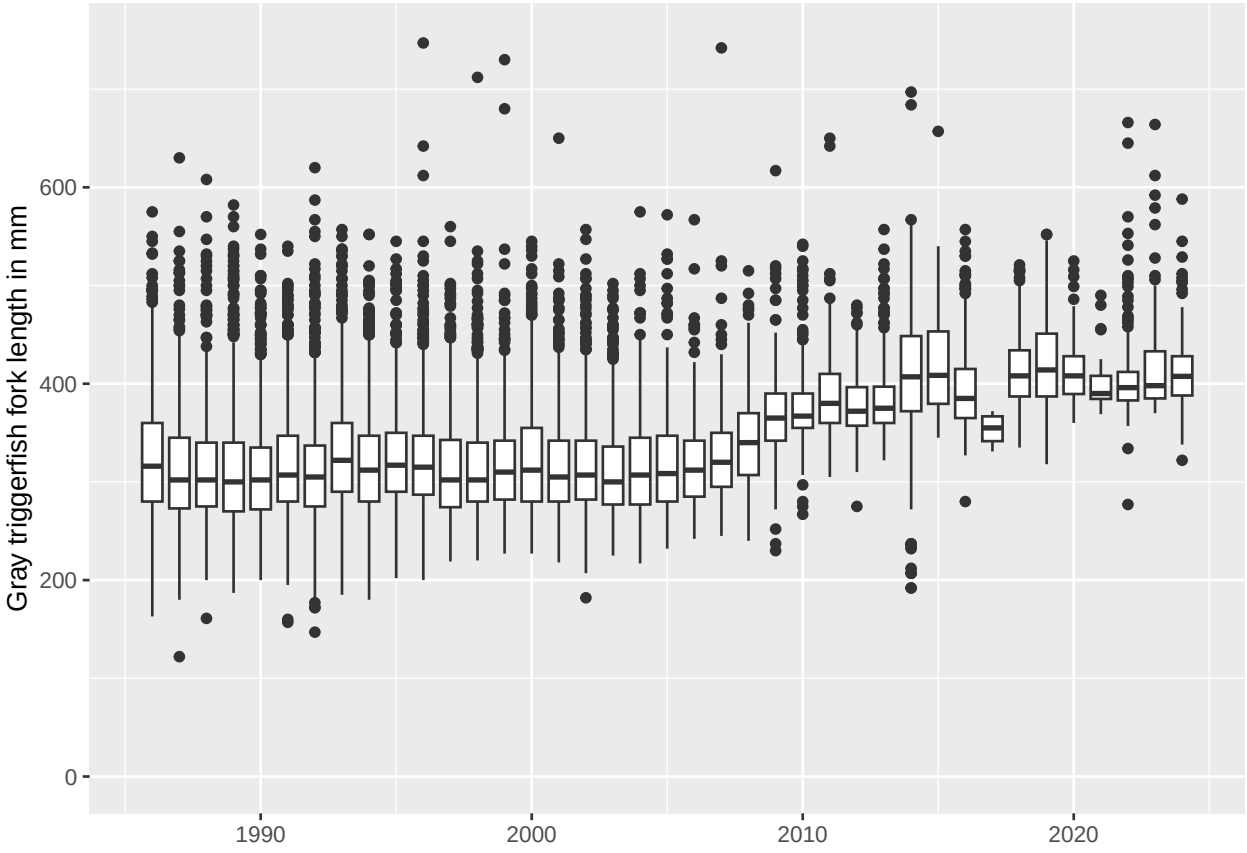

Figure 8: Gray triggerfish fork length.

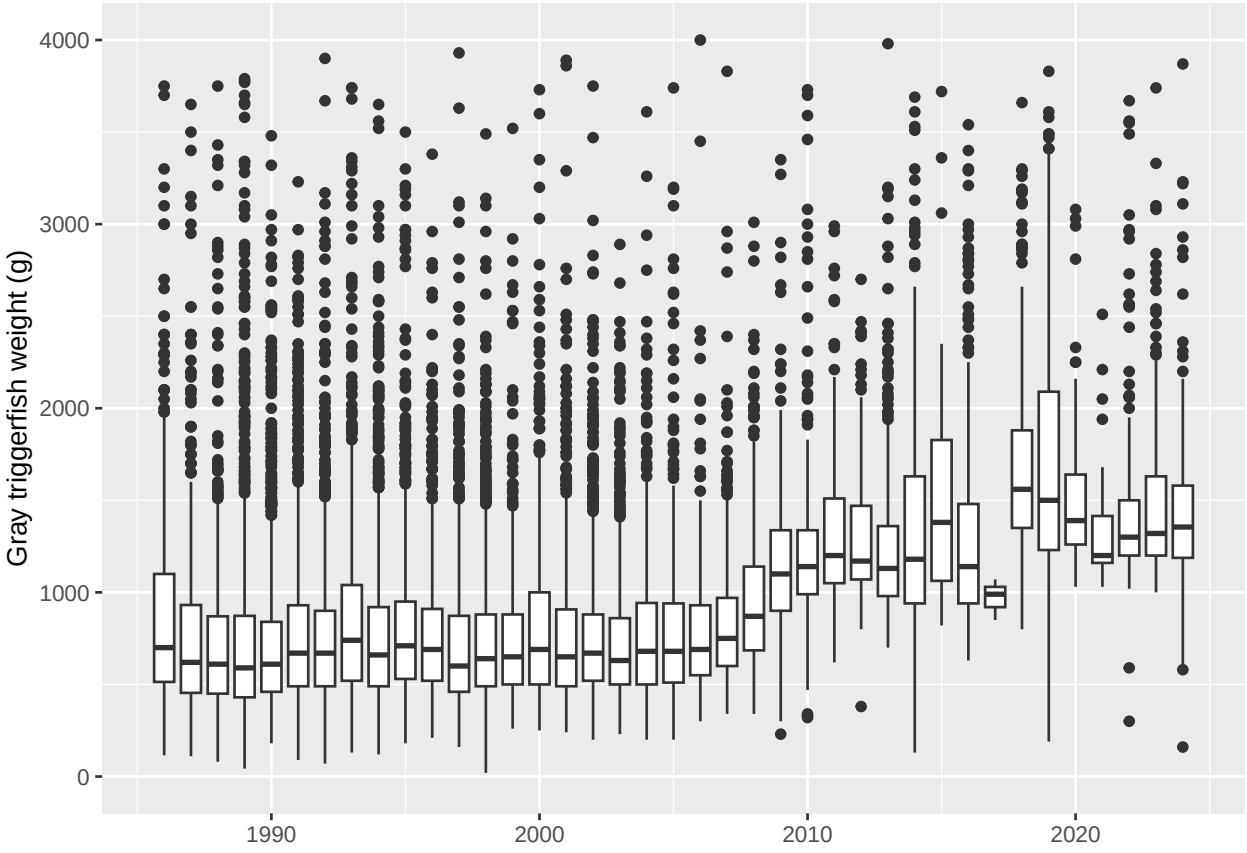

Figure 9: Gray triggerfish weight (g).

3.9 References

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