

Historical (1955-1980) Recreational Landings for Gulf of America King Mackerel (*Scomberomorus cavalla*) estimated using the FHWAR Census Method

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Introduction

During previous SEDARs, considerable time and effort has been devoted to developing methods for back-calculating recreational landings for years prior to the implementation of modern data collection programs. The historic period is defined as pre-1981 since 1981 is the first year when the continuous time series for the Marine Recreational Information Program (MRIP) is available. Methods used in past stock assessments to estimate historic recreational landings include: ratios of commercial landings to recreational landings, estimates from the U.S. Fish and Wildlife Saltwater Angling Survey (SWAS), U.S. Census data as a proxy for recreational fishing effort to produce regression estimates of catch, and most recently the FHWAR (National Survey of Fishing, Hunting, and Wildlife-Associated Recreation) method (SEDAR-PW-07).

During the SEDAR best practices workshop, the FHWAR method was determined to be the best practice for estimating recreational landings for the historic time period (SEDAR-PW-07). This paper summarizes the methods used to estimate historical recreational catch for SEDAR 99 Gulf of America King Mackerel (*Scomberomorus cavalla*) and provides landings estimates for the historical (1955-1980) time period.

National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (FHWAR)

The FHWAR survey interviews U.S. residents about their fishing, hunting, and wildlife-associated (e.g. bird watching) activities. The U.S. Fish and Wildlife Service (USFWS) began conducting the FHWAR Survey in 1955 and it is one of the oldest and most comprehensive recreational surveys available. The survey is conducted every 5 years and gathers information on the number of anglers in the United States and the frequency and time spent fishing (FHWAR 1991). For the period from 1955-1985, historical FHWAR estimates of U.S. population, fishing participation, and effort are summarized in tables B-2 and B-3 in the 1991 FHWAR report (FHWAR 1991) and provided as Tables 1 and 2 in this document. FHWAR provides estimates for the number of saltwater anglers, freshwater anglers, and saltwater fishing days for the entire U.S (Tables 1 and 2). Angler estimates are also broken down into nine regions, however, only estimates for total anglers (i.e. saltwater and freshwater combined) are available for these smaller regions.

FHWAR Method

To estimate the number of saltwater anglers in each region, the ratio of U.S. saltwater anglers to total U.S. anglers is applied to the total number of anglers for a given region. For Gulf King Mackerel, the East South Central (ESC) and West South Central (WSC) regions are included to provide estimates for the total number of saltwater anglers from TX-AL. The total number of saltwater anglers in ESC and WSC is then divided by the total number of U.S. anglers to obtain the proportion of saltwater anglers in ESC and WSC. This proportion is then multiplied by the total number of U.S. saltwater days to estimate the number of saltwater days in ESC and WSC, which are used as our effort estimates for TX-AL during the historical period.

Effort for Florida (FL) is calculated separately because in the FHWAR survey FL is included in the South Atlantic (SA) region (Figure 1). The above process is repeated for the SA region to estimate the number of saltwater days in the SA. Then the saltwater days for FL need to be apportioned from the SA. For Gulf King Mackerel, saltwater days in west FL (WFL) are needed in addition to half of the effort for the Winter Mixing Zone (WMZ; i.e. Monroe County) from November-March. Combined effort data from the Marine Recreational Information Program (MRIP) and Southeast Region Headboat Survey (SRHS) from 1984-1986 were used to calculate the mean ratio of WFL and WMZ angler trips to the total number of angler trips in the SA. This ratio is then used to delineate the number of WFL and WMZ saltwater angler days from the SA. WFL and WMZ saltwater angler days were combined with the saltwater angler days from TX-AL for the total number of saltwater days in the Gulf of America.

From 1955-1985, the FHWAR survey was based on a 12-month recall period for respondents. As part of the 1991 FHWAR survey, a study was conducted comparing estimates using the 12-month recall period versus a 4-month recall period, which provided an average estimate of recall bias as 46% for saltwater angler days. To account for recall bias, historic FHWAR estimates for saltwater angler days was reduced by 46%. After adjusting effort for recall bias, the ratio of total MRIP and SRHS 1985 effort (in angler trips) to adjusted FHWAR 1985 effort (in saltwater days) is applied to adjusted saltwater days to calibrate historical FHWAR effort estimates into the same units as the modern surveys.

Gulf King Mackerel are managed using fishing year (FY; July-June) while FHWAR effort estimates are calculated in calendar year. In constructing a time series for FHWAR saltwater days in fishing year linear interpolation was used to produce annual estimates of FHWAR saltwater days in calendar year. The mean proportion of effort from 1981-1985 from MRIP, SRHS, and Texas Parks and Wildlife (TPWD) was then calculated for January-June (0.51) and July-December (0.49) and applied to split the 1955-1981 FHWAR calendar year estimates of saltwater days into two six month periods. Estimates from the appropriate periods were then combined to produce FHWAR effort estimates in fishing year. For example, FHWAR effort estimates for the 1955 fishing year combined estimates from the July-December 1955 January-June 1956 time periods. The mean CPUE for MRIP, SRHS, and TPWD landings from FY1981-FY1985 was then applied to the calibrated FHWAR saltwater days (in fishing year) to estimate historical landings. This time period was chosen because there was a bag limit implemented in 1985 that had the potential to impact recreational angler behavior.

Historical Landings Estimates

Historic recreational landings for the Gulf of America are presented in Table 3 and Figure 2. Historical recreational landings from 1936-1980 were estimated for SEDAR 38/38U using a different method developed during SEDAR 31 (SEDAR31-RD46). This method used the headboat universe in North Carolina as a surrogate for the For-Hire effort from 1971-1980 in the Gulf. Effort estimates prior to 1971 were developed based on historical records (SEDAR 38). Vessel lists and photos from the South Atlantic are available in SEDAR38-DW-17 and SEDAR38-DW-18, respectively. Historical landings estimates in SEDAR 38/38U were lower than estimates for SEDAR 99 (Figure 3). The historical FHWAR estimates for total recreational landings were delineated between the GenRec (GR) and Headboat (HB) fleets using the average proportion of GR and HB landings to total landings from FY1981-FY1985 (Figure 4). The average proportions were 0.978 and 0.023 for the GR and HB fleet, respectively.

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Tables

Table 1: Numbers (in thousands) of sportsman, anglers, and hunters in the United States and by FHWAR Survey region from 1955-1985. Table copied from FHWAR 1991.

(U.S. population 12 years old and older. Numbers in thousands)

Year	Population		Sportsmen (fished or hunted)		Anglers		Hunters	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total, United States								
1955	118,366	100	24,917	21.1	20,813	17.6	11,784	10.0
1960	131,226	100	30,435	23.2	25,323	19.3	14,637	11.2
1965	141,928	100	32,881	23.2	28,348	20.0	13,585	9.6
1970	155,230	100	36,277	23.4	33,158	21.4	14,336	9.2
1975	171,860	100	45,773	26.6	41,299	24.0	17,084	9.9
1980	184,691	100	46,966	25.4	41,873	22.7	16,758	9.1
1985	195,659	100	49,827	25.5	45,345	23.2	16,340	8.4
New England								
1955	7,919	100	1,224	15.4	1,002	12.7	589	7.4
1960	8,349	100	1,368	16.4	1,205	14.4	517	6.2
1965	9,256	100	1,650	17.8	1,488	16.0	583	6.3
1970	8,652	100	1,579	18.3	1,430	16.5	582	6.7
1975	9,910	100	2,004	20.2	1,861	18.8	566	5.7
1980	10,205	100	1,974	19.3	1,788	17.5	572	5.6
1985	10,554	100	2,058	19.5	1,914	18.1	552	5.2
Middle Atlantic								
1955	24,869	100	3,539	14.2	2,811	11.3	1,608	6.5
1960	26,493	100	3,432	13.0	2,569	9.7	1,723	6.5
1965	27,346	100	3,802	13.2	2,760	10.1	1,631	6.0
1970	28,244	100	4,539	16.1	4,504	14.4	1,731	6.1
1975	30,449	100	5,919	19.4	5,097	16.7	2,096	6.9
1980	30,256	100	5,181	17.1	4,332	14.3	2,001	6.6
1985	31,099	100	5,565	17.9	4,820	15.5	1,972	6.3
East North Central								
1955	25,733	100	5,489	21.3	4,583	17.8	2,538	9.9
1960	26,833	100	6,316	32.5	5,317	19.8	2,985	11.1
1965	28,124	100	6,214	22.1	5,336	19.0	2,563	9.1
1970	31,550	100	7,284	23.1	6,899	21.2	2,812	8.9
1975	32,796	100	9,049	27.6	8,181	24.9	3,392	10.3
1980	33,526	100	8,725	26.0	7,891	23.5	2,955	8.8
1985	33,747	100	8,973	26.6	8,270	24.5	2,814	8.3
West North Central								
1955	9,201	100	2,913	31.7	2,346	25.5	1,534	16.7
1960	10,149	100	3,383	33.3	2,855	28.1	1,709	16.8
1965	11,681	100	3,678	31.5	3,226	27.6	1,620	13.9
1970	12,904	100	4,000	31.0	3,579	27.7	1,783	13.8
1975	13,564	100	4,524	33.3	4,089	30.1	1,863	13.7
1980	13,826	100	4,770	34.5	4,220	30.5	1,965	14.2
1985	14,137	100	5,140	36.4	4,681	33.1	1,971	13.9
South Atlantic								
1955	14,336	100	3,223	22.5	2,805	19.6	1,449	10.1
1960	17,798	100	4,423	24.9	3,895	20.8	2,045	11.5
1965	20,593	100	5,626	27.3	5,054	24.5	1,900	9.2
1970	23,539	100	5,461	23.2	5,129	21.8	1,904	8.1
1975	27,127	100	7,110	26.2	6,479	23.9	2,484	9.1
1980	30,512	100	7,769	25.5	7,086	23.2	2,444	8.0
1985	33,636	100	8,721	25.9	8,056	24.0	2,467	7.3
East South Central								
1955	7,959	100	1,963	24.7	1,665	20.9	989	12.4
1960	9,277	100	2,778	29.9	2,207	23.8	1,510	16.3
1965	9,652	100	2,587	26.8	2,201	22.8	1,294	13.4
1970	9,862	100	2,860	27.0	2,464	25.0	1,162	11.8
1975	10,798	100	3,007	27.8	2,689	24.9	1,355	12.5
1980	11,771	100	3,614	30.7	3,173	27.0	1,567	13.3
1985	12,364	100	3,671	29.7	3,308	26.8	1,441	11.7

Continued

Table 1 (continued): Numbers (in thousands) of sportsman, anglers, and hunters in the United States and by FHWAR Survey region from 1955-1985. Table copied from FHWAR 1991.

(U.S. population 12 years old and older. Numbers in thousands)

Year	Population		Sportsmen (fished or hunted)		Anglers		Hunters	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
West South Central								
1955	10,250	100	2,560	25.0	2,237	21.8	1,165	11.4
1960	11,837	100	3,666	31.0	3,133	26.5	1,750	14.8
1965	12,724	100	3,713	29.2	3,278	25.8	1,571	12.3
1970	14,624	100	4,380	30.0	4,006	27.4	1,918	13.1
1975	16,628	100	5,761	34.8	5,267	31.7	2,563	15.4
1980	19,136	100	5,862	30.6	5,136	26.8	2,456	12.8
1985	21,184	100	6,418	30.3	5,704	26.9	2,572	12.1
Mountain								
1955	4,529	100	1,369	30.2	1,112	24.6	796	17.6
1960	5,222	100	1,646	31.5	1,372	26.3	1,120	21.4
1965	5,029	100	1,565	31.1	1,261	25.1	968	19.6
1970	5,656	100	2,044	36.1	1,769	31.3	980	17.3
1975	7,576	100	2,570	33.9	2,252	29.7	1,159	15.3
1980	9,160	100	2,903	31.7	2,500	27.3	1,268	13.8
1985	10,215	100	3,128	30.6	2,765	27.1	1,241	12.1
Pacific								
1955	13,570	100	2,637	19.4	2,252	16.6	1,116	8.2
1960	15,268	100	3,422	22.4	2,971	19.5	1,279	8.4
1965	17,523	100	4,246	24.2	3,744	21.4	1,433	8.2
1970	20,199	100	4,332	21.4	4,030	20.0	1,466	7.3
1975	23,012	100	5,811	25.2	5,366	23.4	1,607	7.0
1980	26,299	100	6,168	23.5	5,747	21.9	1,531	5.0
1985	38,725	100	6,154	21.4	5,829	20.3	1,310	4.6

Table 2: Comparison of major finding from the 1955-1985 FHWAR surveys. Numbers are in thousands. Table copied from FHWAR 1991.

(U.S. population 12 years old and older. Numbers in thousands)

Sportsmen, expenditures, and days	1955	1960	1965	1970	1975	1980	1985
Total sportsmen	24,917	30,435	32,881	36,277	45,773	46,966	49,827
Anglers	20,813	25,323	28,348	33,158	41,299	41,873	45,345
Freshwater	18,420	21,877	23,962	29,363	36,599	35,782	39,122
Saltwater	4,557	6,292	8,305	9,460	13,738	11,972	12,893
Hunters	11,784	14,637	13,583	14,336	17,094	16,758	16,340
Small game	9,822	12,105	10,576	11,671	14,182	12,496	11,130
Big game	4,414	6,277	6,566	7,774	11,037	11,047	12,576
Waterfowl	1,966	1,955	1,650	2,894	4,284	3,177	3,201
Expenditures	13,904,225	17,010,944	18,282,320	23,925,058	40,730,094	42,094,416	51,101,515
Anglers	9,336,002	11,882,891	12,137,086	16,706,477	28,656,715	28,521,304	34,731,608
Freshwater	6,951,447	9,117,627	8,819,330	12,580,446	21,138,064	20,321,023	23,014,603
Saltwater	2,384,556	2,765,259	3,317,773	4,126,031	7,518,651	6,807,268	8,737,535
Hunters	4,568,222	5,128,045	4,651,589	7,218,581	12,073,379	13,185,436	12,461,852
Small game	2,409,399	3,206,537	2,552,606	3,185,841	5,519,441	4,068,112	2,846,575
Big game	1,579,704	1,526,565	1,737,452	3,209,185	5,168,708	6,876,092	6,494,911
Waterfowl	579,119	394,927	361,527	823,555	1,385,230	934,186	951,728
Days	566,870	658,308	708,578	909,876	1,459,551	1,300,983	1,415,379
Fishing	397,447	465,769	522,759	706,187	1,058,075	952,420	1,064,986
Freshwater	338,826	385,167	426,922	592,494	890,576	788,392	895,027
Saltwater	58,621	80,602	95,837	113,694	167,499	164,040	171,055
Hunting	169,423	192,539	185,819	203,689	401,476	348,543	350,393
Small game	118,630	138,192	128,448	124,041	269,653	225,793	214,544
Big game	30,834	39,190	43,845	54,536	100,800	117,406	135,447
Waterfowl	19,959	15,158	13,526	25,113	31,223	26,179	25,933

Table 3: Historic recreational landings (n) for SEDAR 99 Gulf of America King Mackerel.

FYear	Effort	Total Landings (n)	CV	GR Landings (n)	HB Landings (n)
1955	14,702,948	249,576	0.14	243,757	5,819
1956	16,201,394	275,012	0.14	268,600	6,412
1957	17,699,839	300,447	0.14	293,442	7,005
1958	19,198,285	325,883	0.14	318,285	7,598
1959	20,696,731	351,318	0.14	343,127	8,191
1960	21,750,783	369,210	0.14	360,602	8,608
1961	22,374,250	379,793	0.14	370,938	8,855
1962	22,997,717	390,377	0.14	381,275	9,102
1963	23,621,185	400,960	0.14	391,611	9,349
1964	24,244,652	411,543	0.14	401,948	9,595
1965	24,962,799	423,733	0.14	413,854	9,879
1966	25,772,682	437,480	0.14	427,280	10,200
1967	26,582,566	451,228	0.14	440,707	10,521
1968	27,392,449	464,975	0.14	454,134	10,841
1969	28,202,333	478,723	0.14	467,561	11,162
1970	29,941,110	508,238	0.14	496,388	11,850
1971	32,579,918	553,030	0.14	540,136	12,894
1972	35,218,725	597,823	0.14	583,885	13,938
1973	37,857,533	642,616	0.14	627,633	14,983
1974	40,496,340	687,408	0.14	671,381	16,027
1975	41,867,731	710,687	0.14	694,117	16,570
1976	42,011,088	713,121	0.14	696,494	16,627
1977	42,154,444	715,554	0.14	698,871	16,683
1978	42,297,801	717,987	0.14	701,247	16,740
1979	42,441,158	720,421	0.14	703,624	16,797
1980	42,743,063	725,546	0.14	708,629	16,916

Figures

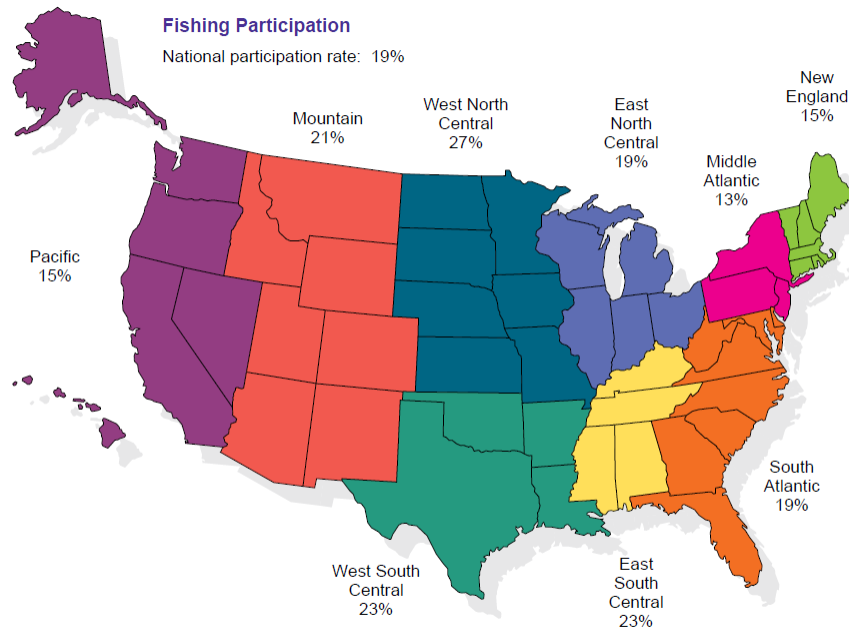


Figure 1. Map of regions defined in the FHWAR survey. Figure is from FHWAR 1991. The numbers show the percentage of anglers by region in the 1991 survey.

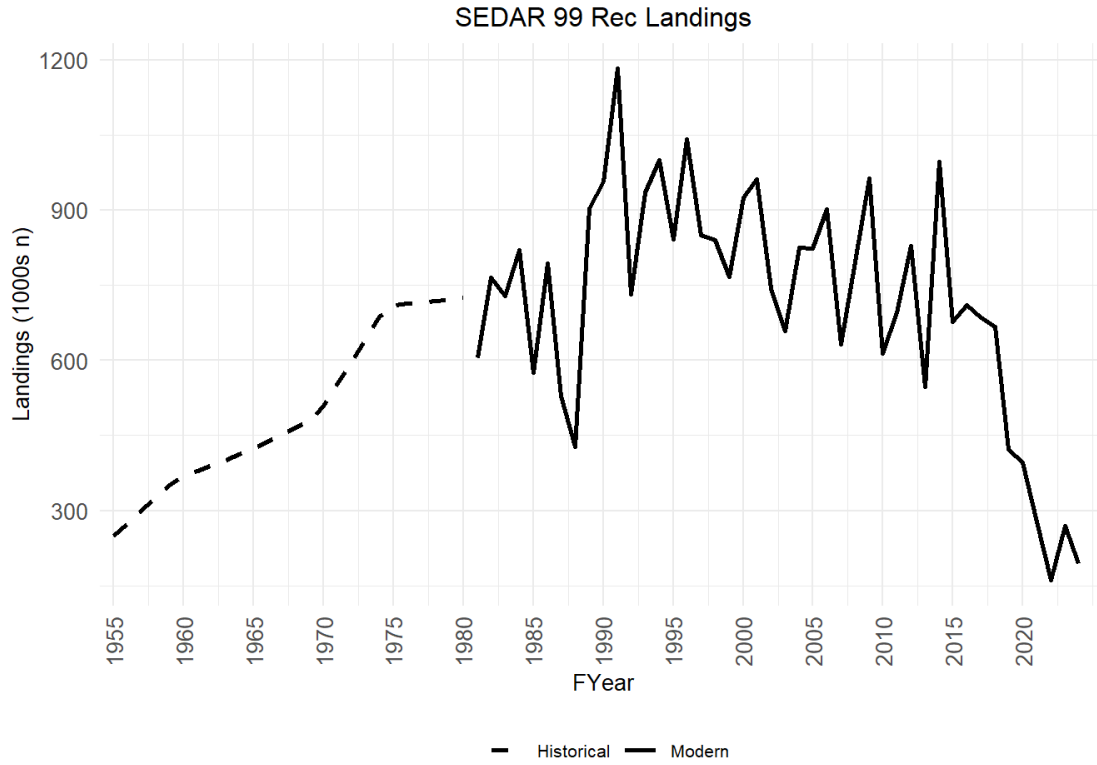


Figure 2. Recreational landings (n) from FY1955-FY2024 for SEDAR 99 Gulf of America King Mackerel. Landings from FY1955-FY1980 were estimated using the FHWAR Census Method.

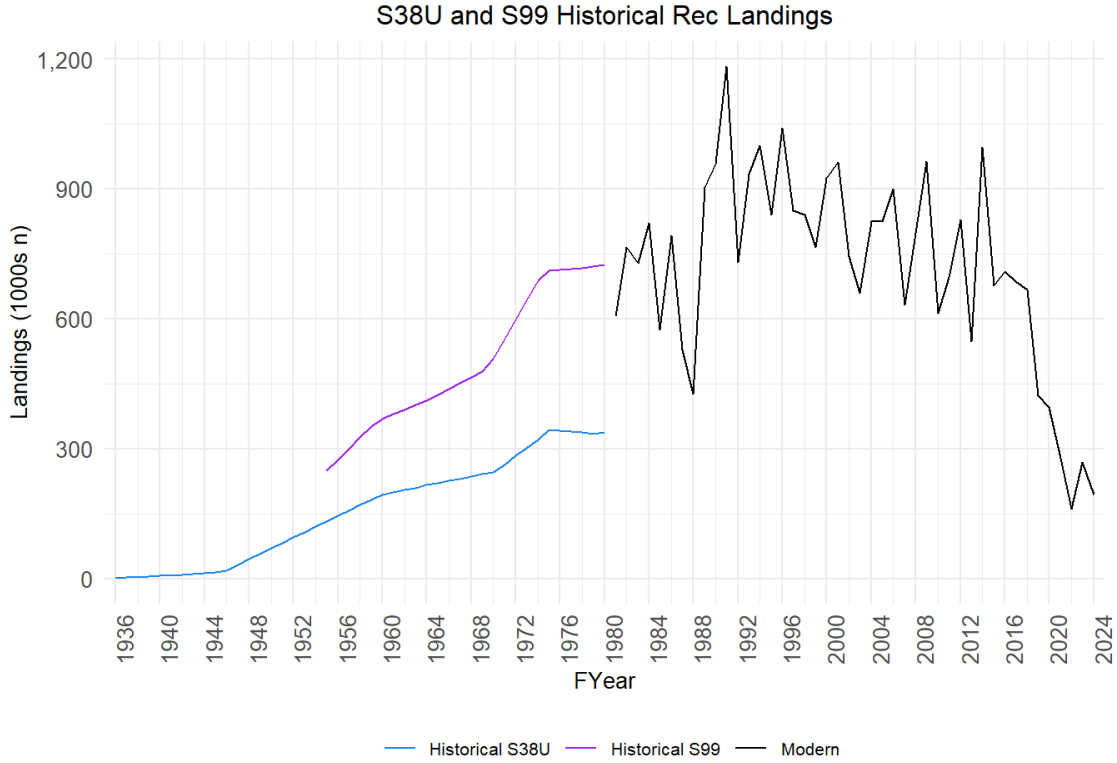


Figure 3. Comparison of historical (FY1955-FY1980) recreational landings (n) for SEDAR 38/38U and SEDAR 99 Gulf of America King Mackerel. Estimates from SEDAR 38/38U were estimated using effort derived from NC Headboats in 1971-1980 as a proxy for For-Hire effort and SEDAR 99 historical catch was estimated using the FHWAR Census Method.

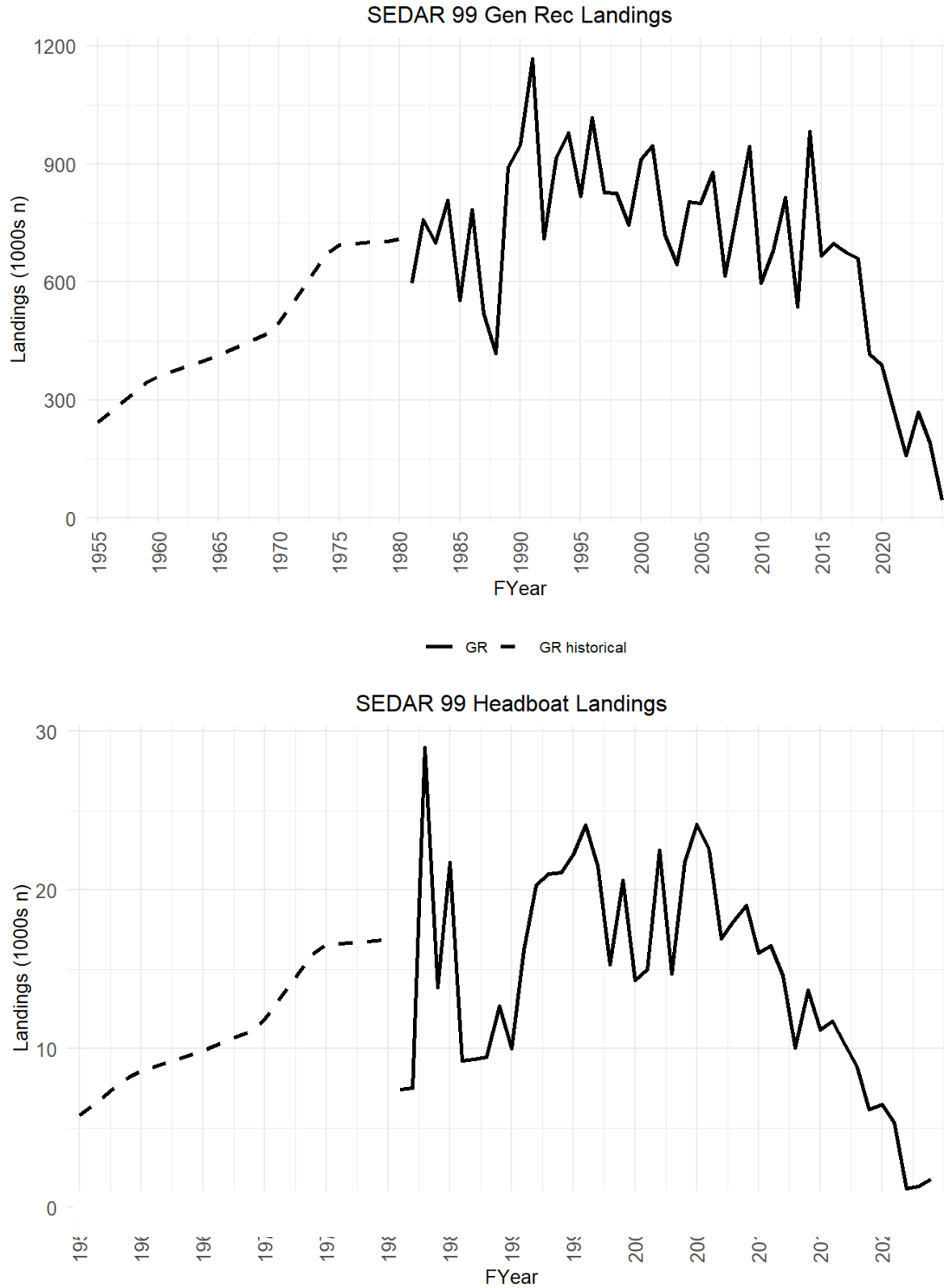


Figure 4. Recreational landings (n) from FY1955-FY2024 from the (a) Gen Rec (GR) and (b) Headboat (HB) fleets for SEDAR 99 Gulf of America King Mackerel. Landings from FY1955-FY1980 were estimated using the FHWAR Census Method. Note the difference in y-scale.