

Estimates of Historic Recreational Landings of Gag Grouper in the Gulf of Mexico Using the FHWAR Census Method

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Introduction

During previous SEDAR Data Workshops considerable time and effort has been devoted to developing methods for back-calculating recreational landings for years before modern data collection programs and landings estimates were implemented. Methods used in past stock assessments included: 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 Survey) Method.

For the SEDAR 72 Workshop for Gulf of Mexico gag grouper, the Recreational Working Group (RWG) will provide historic recreational catch information using the FHWAR Method (Brennan and Fitzpatrick, 2012) to compile historical landings prior to the modern recreational landings time period. For SEDAR 72 this is defined as pre-1981 for the charter, headboat and private boat sectors. This also begins the continuous time series for the Marine Recreational Information Program (MRIP) and Southeast Region Headboat Survey (SRHS). The FHWAR method is presented in this document.

National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey (FHWAR), U.S Fish and Wildlife Service (USFWS).

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey has been conducted every 5 years since 1955 and is one of the oldest and most comprehensive recreational surveys. Among other things, its purpose is to gather information on the number of anglers in the United States, including frequency and time spent fishing (FHWAR 1991).

The FHWAR Surveys published in 1991, 1996, 2001, 2006, 2011, and 2016 provide summary tables of U.S. population estimates, along with estimates of fishing participation and effort from surveys conducted by the USFWS every five years from 1955 to 1985 (Tables 1 and 2). This information was used to develop an alternative method for estimating coast-wide recreational fishing landings prior to 1981.

FHWAR Method

The two key components from the FHWAR surveys used in this census method are the estimates of U.S. saltwater anglers and the estimates of U.S. saltwater fishing days. The first objective was to determine the total saltwater anglers and saltwater days for the Gulf of Mexico (GOM) by using the summary information of U.S. anglers and U.S. saltwater anglers from the FHWAR surveys. The ratio of U.S. saltwater anglers to the total U.S. anglers was applied to the total number of anglers for the East and West South Central (Table 1 and 2) to yield the total saltwater anglers for GOM. The same method was used to calculate the total saltwater days for the SA from the FHWAR surveys from 1955-1985. The FHWAR surveys for the South Atlantic included the entire state of Florida, east and west coasts. In order to address the management boundaries for gag grouper, the saltwater angler days for Florida's west coast (FLW) were separated from the South Atlantic saltwater angler days using the ratio of the MRIP total angler trips for FLW to the MRIP total angler trips for NC to FLW. The mean ratio from 1984-1986 was applied to the total saltwater days for the SA from 1955-1985 to remove FLW effort.

Similar to the SWAS, there was a 12-month recall period for respondents participating in the FHWAR surveys from 1955 – 1985. As part of the 1991 FWHAR, a study was conducted to compare the 12- month recall period to a four-month period. This study revealed that the level of recall bias varies for different types of fishing participation and expenditure (FHWAR, 1991).

Consequently, it was necessary to account for possible reporting bias and adjust the angling effort (saltwater days) in the FHWAR Surveys 1955-1985. In the case of gag grouper in the Gulf of Mexico, the total saltwater days for the GOM 1955-1985 were adjusted for recall bias in the FHWAR surveys using the total effort (MRIP, SRHS) for the US East Coast (NC-FLE) 1985 divided by the total saltwater days from the 1985 FHWAR Survey. This multiplier was then applied to the total GOM saltwater days from 1955-1985 to adjust for recall bias. Using the adjusted saltwater days for GOM from 1955 – 1985, the next step in this process was estimating landings of gag grouper. This was accomplished by calculating the mean CPUE for gag grouper in the Gulf of Mexico from the recreational landings estimates (MRIP, SRHS and TPWD combined) for 1981 to 1985. This mean CPUE was then applied to the adjusted saltwater days for the GOM from 1955-1985 to estimate the historical landings of gag grouper for those years (Table 3). Linear interpolation was used to estimate landings for years that the FHWAR surveys were not conducted during 1955-1980. Since historical recreational landings for gag grouper were only lacking prior to 1981, the 1985 estimated landings using the FHWAR census method were excluded (Table 4).

Conclusions

The FHWAR method utilizes a combination of information including U.S. angler population estimates and angling effort estimates from 1955 – 1985 FHWAR, along with estimates of recreational effort and landings from the MRIP and SRHS 1981 – 1985. The FWHAR method also used both sources of information to adjust for recall bias, an issue that must be addressed when considering using either the SWAS or the FHWAR Surveys for historical recreational landings. By using data from FHWAR and the MRIP and SRHS to calibrate this adjustment, the effect of the 12-month angler recall period is reduced. The historical landings of gag grouper that were calculated using this method show a gradual increase from 1955 to 1980, which reflects an evolving recreational fishery and technological advancements (Figure 1). The FHWAR method has been used for other species by adjusting the geographic range of the FHWAR surveys to match management boundaries and the associated MRIP and SRHS catch and effort data for a particular species.

Literature Cited:

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Tables

Table 1. Anglers and Hunters, by Census Division: 1955 to 1985 (U.S. population 12 years old and older. Numbers in thousands).

Year	Population		Sportsperson, fished or hunted		Anglers		Hunters	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
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	17,094	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	3,602	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	6,699	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	3,695	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	2,494	9.2
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	2,660	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

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

Year	Population		Sportsperson, 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	5,781	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	988	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	5,386	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 Findings of the National Surveys: 1955 to 1985 (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	21,677	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.....	1,986	1,955	1,650	2,894	4,284	3,177	3,201
Expenditures¹	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	6,807,288	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	1,526,585	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	100,600	117,406	135,447
Waterfowl.....	19,959	15,158	13,526	25,113	31,223	26,179	25,933

Table 3. Estimated gag grouper landings using the FHWAR census method, 1955-1980.

Year	Total U.S. Saltwater Days	Adjusted Saltwater Days - Gulf of Mexico	Avg CPUE MRIP, TPWD, & SRHS 81-85	Historic Catch (number)	CV
1955	58,621,000	11,244,160	0.058	657,323	0.72
1960	80,602,000	17,247,207	0.058	1,008,255	0.72
1965	95,837,000	20,125,911	0.058	1,176,541	0.72
1970	113,694,000	23,207,956	0.058	1,356,715	0.72
1975	167,499,000	33,973,335	0.058	1,986,048	0.72
1980	164,040,000	34,661,688	0.058	2,026,289	0.72

Table 4. Gulf of Mexico -Total estimated recreational gag grouper landings (1955-2018) using FHWAR census method (1955-1980) MRFSS (1981-2003), MRIP (2004-2018), and SRHS (1981-2019) estimation methods.

Year	Number	Year	Number
1955	657,323	1988	1,056,564
1956	727,509	1989	883,009
1957	797,696	1990	578,757
1958	867,882	1991	622,697
1959	938,069	1992	640,858
1960	1,008,255	1993	868,862
1961	1,041,912	1994	528,196
1962	1,075,570	1995	1,024,116
1963	1,109,227	1996	686,655
1964	1,142,884	1997	942,024
1965	1,176,541	1998	1,198,993
1966	1,212,576	1999	1,350,859
1967	1,248,611	2000	1,477,980
1968	1,284,645	2001	1,117,327
1969	1,320,680	2002	1,299,126
1970	1,356,715	2003	993,795
1971	1,482,581	2004	1,567,698
1972	1,608,448	2005	1,287,280
1973	1,734,315	2006	734,533
1974	1,860,182	2007	574,646
1975	1,986,048	2008	968,684
1976	1,994,097	2009	473,821
1977	2,002,145	2010	622,198
1978	2,010,193	2011	323,246
1979	2,018,241	2012	288,150
1980	2,026,289	2013	471,665
1981	863,588	2014	331,850
1982	2,123,921	2015	280,257
1983	4,208,401	2016	214,489
1984	667,396	2017	282,182
1985	1,346,910	2018	306,633
1986	1,268,451	2019	256,390
1987	1,039,374		

Figures

Figure 1. Gulf of Mexico - Estimated combined recreational gag grouper landings (number) using FHWAR census method (1955-1980) and combined MRFSS/MRIP and SRHS landings (1981-2013).