Estimates of Historic Recreational Landings of Vermilion Snapper in the South Atlantic 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 55 Workshop for South Atlantic vermilion snapper, 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 55 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 Fisheries Statistics Survey (MRFSS) 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 and 2011 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 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 from the South Atlantic (SA) 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 SA to yield the total saltwater anglers for SA. 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 vermilion snapper, the saltwater angler days for Florida's west coast (FLW) were separated from the SA saltwater angler days using the ratio of the MRFSS total angler trips for FLW to the MRFSS 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 vermilion snapper in the South Atlantic, the total saltwater days for the SA 1955-1985 were adjusted for recall bias in the FHWAR surveys using the mean MRFSS total angler trips for the US East Coast (NC-FLE) 1984 to 1986 divided by the total saltwater days from the 1985 FHWAR Survey. This multiplier was then applied to the total SA saltwater days from 1955-1985 to adjust for recall bias. Using the adjusted saltwater days for SA from 1955 – 1985, the next step in this process was estimating landings of vermilion snapper. This was accomplished by calculating the mean CPUE for vermilion snapper in the South Atlantic from the recreational landings estimates (MRFSS and SRHS combined) for 1981 to 1983. This mean CPUE was then applied to the adjusted saltwater days for the SA from 1955-1985 to estimate the historical landings of vermilion snapper 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 vermilion snapper 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 MRFSS and SRHS 1981 – 1983. 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 MRFSS and SRHS to calibrate this adjustment, the effect of the 12-month angler recall period is reduced. The historical landings of vermilion snapper 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 historical landings of vermillion snapper that were calculated for SEDAR 17 using the SWAS method show a similar increase from 1955 to 1975 but at nearly twice the rate, with some fluctuation from 1975-1980 during this time period (Figure 2). 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 MRFSS catch and effort data for a particular species.

Literature Cited:

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U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

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		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	17,094	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

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
Expenditures[1]	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. FWHAR census method adjusted saltwater days and adjusted vermilion snapper landings.

Estimated vermilion snapper landings using the FHWAR census method, 1955-1980.

Year	Total U.S. Saltwater Days	Adjusted Saltwater Days - South Atlantic	Avg CPUE MRFSS & SRHS 81-83	Historic Catch (number)	S.D.	CV
1955	4820112	4241728	0.0378	160530	36750	0.23
1960	7038690	6194089	0.0378	234418	54708	0.23
1965	10225693	8998671	0.0378	340558	79479	0.23
1970	10525159	9262203	0.0378	350532	81807	0.23
1975	15726330	13839265	0.0378	523753	122233	0.23
1980	16613593	14620061	0.0378	553302	129129	0.23

Table 4. Total estimated recreational vermilion snapper landings (1955-2016) using FHWAR census method (1955-1980) MRFSS (1981-2003), MRIP (2004-2016), and SRHS (1981-2016) estimation methods.

Year	Number	Year	Number
1955	157,470	1986	580,163
1956	172,859	1987	859,167
1957	188,249	1988	856,194
1958	203,639	1989	889,642
1959	219,028	1990	789,614
1960	234,418	1991	761,697
1961	255,646	1992	427,798
1962	276,874	1993	425,759
1963	298,102	1994	423,413
1964	319,330	1995	415,146
1965	340,558	1996	407,083
1966	342,553	1997	445,427
1967	344,548	1998	404,741
1968	346,542	1999	504,307
1969	348,537	2000	619,860
1970	350,532	2001	586,079
1971	385,176	2002	468,656
1972	419,820	2003	412,364
1973	454,464	2004	518,371
1974	489,108	2005	379,015
1975	523,753	2006	541,884
1976	529,663	2007	615,059
1977	535,572	2008	488,605
1978	541,482	2009	403,619
1979	547,392	2010	210,191
1980	553,302	2011	205,912
1981	284,518	2012	178,706
1982	496,462	2013	187,724
1983	737,796	2014	334,780
1984	416,121	2015	262,372
1985	874,815	2016	320,682

Figures

Figure 1. Estimated combined recreational vermilion snapper landings (number) using FHWAR census method (1955-1980) and combined MRFSS/MRIP and SRHS landings (1981-2016),

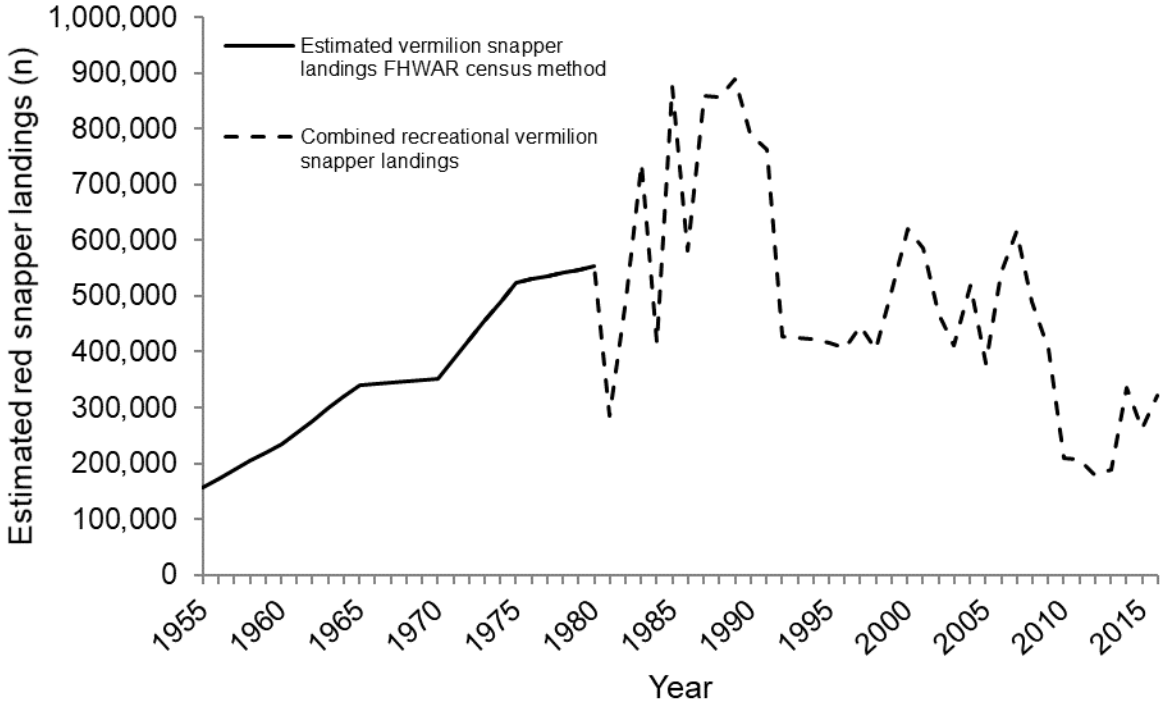

Figure 2. Estimated combined recreational vermilion snapper landings (number) using FHWAR census method (1955-1980) MRFSS and SRHS (1981-2016), SEDAR 17 estimation method 1955-1980).