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South Atlantic Red Snapper Marine Recreational Fishery Landings: FHS-conversion of Historic MRFSS Charter Boat Catches

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INTRODUCTION

The Marine Recreational Fishery Statistics Survey (MRFSS) was established by the National Marine Fisheries Service (NMFS) in 1979 to create a reliable data base for estimating catch and effort by the marine recreational fishery (http://www.st.nmfs.gov/st1/recreational/ survey/ overview.html). In the traditional MRFSS complementary surveys design, data were collected by a telephone survey of households in coastal counties (CHTS) and by interviewing anglers at fishing access sites. The estimation of effort for the charter boat sector was difficult due to the low incidence of this type of fishing trip by households contacted in the telephone survey and by the likelihood of clustered responses by households reporting charter boat fishing. To reduce the effect of small sample sizes on charter boat effort estimation, data from a 5 year period were combined for estimate production. Pooling data across years provided a larger data set to produce more reliable and precise estimates of effort. However, this approach, referred to as the traditional MRFSS estimation, masked trends in the fishery, annual weather patterns, etc.

The NMFS started testing a new survey design named the For-Hire Survey (FHS) in 1995 to improve the effort estimate for the charter boat mode, and in the fall of 1997 began a pilot test of this design in the four Gulf of Mexico states surveyed by the MRFSS. This new FHS was based on sampling from charter boat directories created by the NMFS and participating state agencies. Approximately 10% of the eligible and active charter boats in the directory are randomly contacted by phone each week and asked relevant information regarding their fishing activities from the previous week (e.g., number of trips, anglers per trip, area of fishing, target species, etc.). It was determined that the FHS produced significantly more efficient, precise, and credible charter angler effort estimates than the traditional MRFSS method. Further, these estimates of effort reflected within year trends that were not previously discernable by the MRFSS due to the multi-year pooling of data.

The FHS was adopted as the official estimator of charter boat fishing effort in the Gulf of Mexico in 2000 and was expanded to the Atlantic Coast in 2004. In all years subsequent to the implementation of the FHS the CHTS has been continued, primarily to survey non-for-hire fishing modes, but also to produce the traditional MRFSS charter boat effort estimates for benchmark comparison purposes. These comparisons were first documented by Diaz and Phares (2004) who produced conversion factors to adjust effort estimates obtained by MRFSS for 1981-2003 in the Gulf of Mexico, and later for king mackerel in the South Atlantic by Sminkey (2008).

METHODS

(from Sminkey 2008)

From 2004 to 2007, the NMFS estimated charter boat effort using both the MRFSS (old) and the FHS (new) protocols. Thus, differences in effort estimates for each stratum between both methodologies can be directly compared only for that period of time. Each stratum is defined by a unique combination of sub-region, state, year, ‘wave’, and fishing-area, where a ‘wave’ is a bimonthly sampling period (Jan.-Feb. = wave 1). The MRFSS defined fishing areas for most states as: a) Inshore waters, b) ocean, state territorial seas (< 3 miles from shore), and c) ocean, EEZ (> 3 miles from shore). For the period 1986-2003, charter boat effort was estimated using only the MRFSS protocol. To calibrate MRFSS charter boat effort estimates (1986-2003) to

FHS levels, conversion factors (ratios) between FHS and MRFSS charter boat effort were estimated using 2003-2007 data and applied to the 1986-2003 MRFSS effort estimates. To estimate the conversion factors, a ratio of FHS/MRFSS effort estimates was calculated for each stratum using only the estimates from the period 2003-2007. A generalized linear model (GLM procedure, SAS Inst.) was used to identify significant factors and to estimate predicted ratios. The factors included in the model were year, wave, fishing area, state and the interaction terms. In the event that a factor was found non-significant ($Pr > 0.05$), it was removed and the regression re-run until all (highest order) model terms were significant (Hocking 1976, Draper and Smith 1981). The predicted ratios are used as the conversion factors (Table 1a).

MRFSS 1981-1985 Conversion

From 1981 to 1985, MRFSS considered charter boat and headboat recreational fishing as a single mode, party-charter mode (PC), which was estimated from CHTS multi-year pooled data. Thus, the conversion factors estimated with 2004-2007 charter boat data (used to calibrate 1986-2003 charter boat effort estimates) could not be used to calibrate the 1981-1985 effort or landings estimates. To calibrate the 1981-1985 South Atlantic red snapper landings, conversion factors were estimated using 1986-1990 South Atlantic red snapper catch estimates from the SouthEast Headboat program (logbook reports) and the MRFSS charter boat catch estimates (instead of 2003-2007) to minimize possible effects of changes in the fishery over time. The headboat and MRFSS charter boat landings estimates were combined (summed) into one estimate for each year and wave, by state when possible (based on aggregation of logbook data) to produce a 'pseudo-PC' landings estimate. This derived PC estimate was regressed against the charter boat only estimates and tested for significance of factors following the same criteria used for 1986-2003 comparisons (GLM procedure, SAS Inst., $Pr < 0.05$ for significance). The only significant factor for this time period was wave (Table 1b.) and these ratios were used to produce adjusted PC mode landings estimates of red snapper for 1981-1985. Additionally, wave 1 of 1981 was not sampled by the MRFSS (the survey began in wave 2, 1981 in FL) so an adjustment of total landings (all modes) was made based on the average percent of landings taken in wave 1 in the South Atlantic sub-region during 1982-2006.

RESULTS

Red snapper harvest by year for the South Atlantic (numbers of fish) using the ratio-converted charter boat effort estimates for 1986-2003 (Sminkey 2008), the PC ratio-adjusted landings for 1981-1985, and the wave 1 adjusted landings in 1981 are presented in Table 2 and Figure 1. The original MRFSS produced landings estimates are included on Figure 1 for reference. Landings for 2004-2009 were produced using the FHS-derived effort and the MRFSS angler intercept survey catch-rates (Table 2). Similar to the landings estimates, the live release estimates (B2 catch; numbers of fish) were produced using the FHS-ratio conversions for 1986-2003 and the PC ratio-adjustments for 1981-1985 (Table 3).

REFERENCES

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LSMEAN RATIOS - South Atlantic Charter Boat Angler Effort – Survey Conversion Ratios

Table 1a. Predicted ratios and standard errors (in parenthesis) between FHS and MRFSS charter boat effort estimates (to be applied to 1986-2003) for the South Atlantic states (note header for specific state application).

EAST FLORIDA

	Wave					
Area	1	2	3	4	5	6
INSHORE	2.051 (0.73)	3.357 (0.73)	1.919 (0.73)	3.302 (0.73)	0.887 (0.73)	1.281 (0.82)
OCEAN	0.671 (0.12)	0.980 (0.12)	0.805 (0.12)	1.036 (0.12)	0.520 (0.12)	0.616 (0.14)

NORTH CAROLINA

	Wave				
Area	2	3	4	5	6
INSHORE	12.182 (3.68)	13.291(3.68)	7.966(4.25)	0.973 (4.25)	6.134 (5.20)
OCEAN	1.660 (0.45)	1.947 (0.45)	1.116 (0.48)	1.075 (0.48)	0.684 (0.52)

SOUTH CAROLINA, GEORGIA

	Wave				
Area	2	3	4	5	6
INSHORE	2.083 (1.56)	4.881 (1.56)	2.887 (1.56)	1.252 (1.56)	0.618 (1.80)
OCEAN	1.018 (0.54)	1.708 (0.52)	2.812 (0.52)	0.940 (0.54)	0.652 (0.74)

Table 1b. Predicted ratios and standard errors (in parenthesis) between the MRFSS charter boat red snapper landings estimates and the combined (PC) charter boat plus headboat (Southeast Headboat logbook) red snapper landings estimates from 1986-1990 to be applied to the 1981-1985 MRFSS PC landings estimates.

	Wave					
	1	2	3	4	5	6
SATL	0.672 (0.23)	1.124 (0.10)	1.200 (0.11)	1.195 (0.09)	1.003 (0.08)	0.629 (0.13)

Table 2. Red snapper harvest estimates for the South Atlantic sub-region (numbers of fish, A+B1 catch), 1981-2009. See text for conversion adjustment methods.

ALL MODES (adj. CH & PC)

Year	**Numbers**	**pse**	variance
1981	194,141	25.2	1,840,637,510
1982	60,598	30.5	342,562,005
1983	175,031	20.3	1,261,180,709
1984	433,191	17.5	5,747,118,314
1985	564,470	18.8	11,215,853,082
1986	151,608	29.5	1,994,695,176
1987	66,228	20.0	176,275,655
1988	162,745	23.2	1,421,166,173
1989	167,767	19.0	1,015,035,012
1990	16,279	29.9	23,708,393
1991	50,844	30.6	242,650,112
1992	79,314	18.9	224,744,452
1993	18,884	21.1	15,877,649
1994	28,902	27.2	61,960,901
1995	15,968	28.6	20,890,518
1996	14,784	40.3	35,457,797
1997	60,691	58.4	1,256,704,179
1998	20,986	24.9	27,390,745
1999	64,905	28.1	333,001,897
2000	71,353	20.9	223,163,205
2001	50,663	16.8	72,126,218
2002	51,512	16.3	70,309,548
2003	34,191	18.7	40,706,893
2004	39,477	14.1	31,043,664
2005	35,349	18.2	41,420,485
2006	25,918	19.1	24,459,122
2007	41,252	20.0	67,822,292
2008	110,782	15.2	285,160,800
2009	122,175	14.8	328,705,487

Table 3. Red snapper live release catch (discard) estimates for the South Atlantic sub-region (numbers of fish, B2 catch), 1981-2009. See text for conversion adjustment methods.

TOTAL LIVE RELEASE CATCH
ALL MODES (Adj. CH & PC)

Numbers of Fish	PSE
2,325	100.0
0	
42,281	37.1
144,513	30.9
91,276	44.2
0	
106,718	57.8
100,493	54.2
26,738	40.1
2,498	100.0
44,571	43.9
38,067	27.2
76,494	27.3
67,981	27.4
61,400	20.3
20,445	37.1
24,185	29.5
29,283	31.1
177,674	15.6
258,458	15.1
205,283	14.0
126,049	18.9
158,912	16.3
203,273	13.6
125,204	13.3
134,605	18.6
453,517	12.8
400,615	10.6
210,004	12.4

Figure 1. Total annual landings (numbers of fish) of red snapper from the South Atlantic sub-region; adjusted for-hire landings in 1981-2003 vs original MRFSS estimated landings. 2004-2009 include the FHS-derived charter boat landings.