

Projected Landings of the Recreational Greater Amberjack Fishery in the Gulf of Mexico 2009 and 2010

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Introduction

Recreational fisheries for greater amberjack in the Gulf of Mexico are managed under regulations and quotas established by the Gulf of Mexico Fisheries Management Council and the National Marine Fisheries Service. The quota for 2009 was set at 1.368 million lbs. On October 24, 2009, the National Marine Fisheries Service closed the recreational fishery in response to data from the Marine Recreational Fisheries Statistics Survey (MRFSS) suggesting this quota had been exceeded in-season. The purpose of this analysis is to estimate the total recreational landings of greater amberjack in 2009 up through the quota closure. The accountability measures for the recreational greater amberjack fishery include a payback provision where the next year's quota is reduced by the current year's overage. Therefore, the secondary goal of this analysis is to compute the quota for 2010 and determine when this quota might be exceeded. Several management measures to prevent the quota from being exceeded in 2010 are proposed.

Methods and Results

Projected Landings in 2009

Historical headboat survey (HBS) and Texas Parks and Wildlife Department (TPWD) greater amberjack landings data taken from SEFSC ACL Recreational Landings Dataset (received September 2009). Marine Recreational Fisheries Statistics Survey (MRFSS) landings taken from post-stratified estimates for West Florida with Monroe County landings removed (NMFS OST, October 2009) and added to SEFSC ACL Recreational Landings data for MRFSS from other Gulf states. Landings summarized by year (2000-2008). MRFSS landings averaged $1,401,000 \pm 175,000$ lbs per year (mean \pm SE), HBS landings averaged $102,000 \pm 16,000$ lbs per year, and TPWD landings averaged $22,000 \pm 5,000$ lbs per year (Table 1).

Table 1. Recreational greater amberjack landings (thousands of lbs, whole weight) by recreational fishery data source, 2000-2008.

	2000	2001	2002	2003	2004	2005	2006	2007	2008
HBS	101	89	161	199	109	61	80	59	55
MRFSS	937	1,081	1,747	2,305	2,088	1,312	1,238	797	1,103
TPWD	10	13	44	50	15	14	11	29	11
TOTAL	1,048	1,184	1,951	2,555	2,211	1,387	1,329	886	1,169

Across this time period, MRFSS landings comprise $91.9 \pm 0.7\%$, HBS comprise $6.7 \pm 0.6\%$ and TPWD comprise $1.4 \pm 0.3\%$ of the total landings (Table 2). Differences between the proportional distribution of landings were statistically significant ($F_{2,24} = 7838.7$, $p < 0.001$), with post-hoc tests (Dunnett's C) showing statistically significant difference between all sectors.

Table 2. Percent of total recreational greater amberjack landings by recreational fishery data source, 2000-2008.

	2000	2001	2002	2003	2004	2005	2006	2007	2008
HBS	10%	8%	8%	8%	5%	4%	6%	7%	5%
MRFSS	89%	91%	90%	90%	94%	95%	93%	90%	94%
TPWD	1%	1%	2%	2%	1%	1%	1%	3%	1%

As MRFSS represented ~92% of the landings, and MRFSS data is available more quickly than HBS and TPWD data, partially complete MRFSS data collected in-season may serve as a useful predictor for total landings at later times in the season. In the present context, the goal was to predict total landings in 2009 given that waves 1-4 of MRFSS were available, and the recreational fishery had been closed near the end of wave 5.

Regression models were developed for MRFSS Wave 1-4 landings versus Total Wave 1-5 recreational landings (2000-2008). A linear regression appeared appropriate (Fig. 1), and showed a highly correlated, statistically significant relationship between MRFSS Wave 1-4 landings and Total Wave 1-5 landings ($R^2 = 0.95$; Table 3).

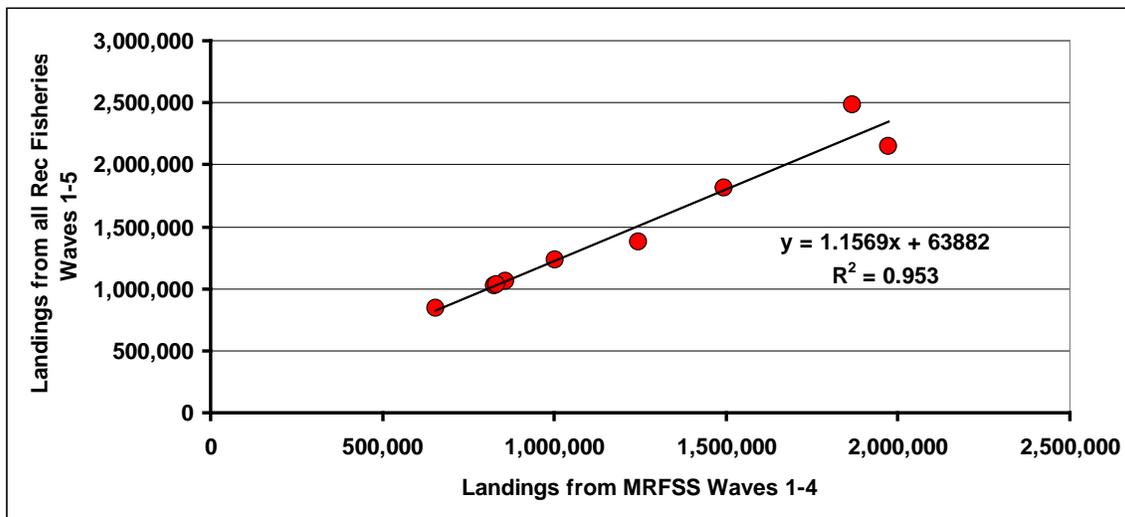


Figure 1. Regression relationship between MRFSS Wave 1-4 landings and landings from all recreational fishery sources (MRFSS, HBS, TPWD) in Waves 1-5.

Table 3. Regression statistics for MRFSS Wave 1-4 landings and landings from all recreational fishery sources (MRFSS, HBS, TPWD) in Waves 1-5.

ANOVA						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Sig.F</i>	
Regression	1	2.49E+12	2.49E+12	141.8	6.7E-06	
Residual	7	1.23E+11	1.76E+10			
Total	8	2.61E+12				

	<i>Coefficients</i>	<i>SE</i>	<i>t Stat</i>	<i>p</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	63882	124255	0.514	0.623	-229934	357697
MRFSS				6.7E-		
1-4	1.157	0.097	11.908	06	0.927168	1.3866

Currently, only MRFSS landings for Waves 1-4 in 2009 are available. Using post-stratified estimates for landings in West Florida, with Monroe County removed, and ACL Recreational Landings data for landings for other Gulf states, the mean landings estimate for MRFSS Waves 1-4 in 2009 was 1,319,000 lbs, with a 95% confidence interval of 554,000 – 2,205,000 lbs derived from MRFSS percent standard error (PSE) estimates (Table 4).

Table 4. MRFSS greater amberjack landings estimates 2009.

	Wave	1	2	3	4	Total
MEAN		176	55	614	473	1,319
LOWER 95%		32	10	331	180	554
UPPER 95%		375	108	944	778	2,205

Applying the regression relationship shown in Figure 1, estimated total landings in 2009 given a closure of Wave 6 was 1,589,798 lbs, with a 95% confidence interval of 704,614 – 2,614,613 lbs derived from MRFSS percent standard error (PSE) estimates.

Projected Landings in 2010

A secondary goal of this analysis was to estimate the landings in 2010. Assuming 2009 landings are 1,589,798 lbs, the recreational fishery has exceeded their quota of 1,368,000 lbs by 221,798 lbs, and the quota for 2010 would be reduced from 1,368,000 lbs to 1,146,202 lbs. This amount was exceeded 5 times between 2000-2008 (Table 1). In order to determine if and when the quota would be exceeded in 2010, the percent total landings by wave was examined. Figure 2 shows a pronounced peak in recreational landings during waves 3 (35% ± 2%) and 4 (24% ± 2%), with little interannual fluctuations in seasonal landings trends.

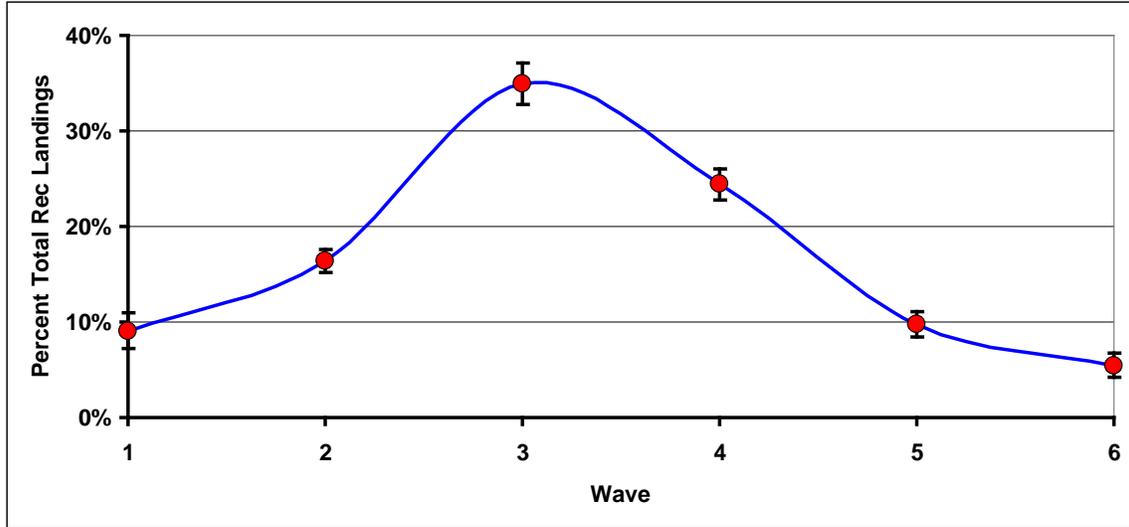


Figure 2. Seasonal trends in recreational landings of greater amberjack expressed as percent of total landed during each wave.

Assuming the recreational greater amberjack fishery proceeds in 2010 as it did in 2009, an estimate of annual landings in 2009, assuming no closure of the fishery for wave 6, is needed. A regression of MRFSS Wave 1-4 landings versus total recreational landings for Waves 1-6 was developed following the methodology described above. A linear regression appeared appropriate (Fig. 3), and showed a highly correlated, statistically significant relationship between MRFSS Wave 1-4 landings and Total Wave 1-6 landings ($R^2 = 0.94$; Table 5).

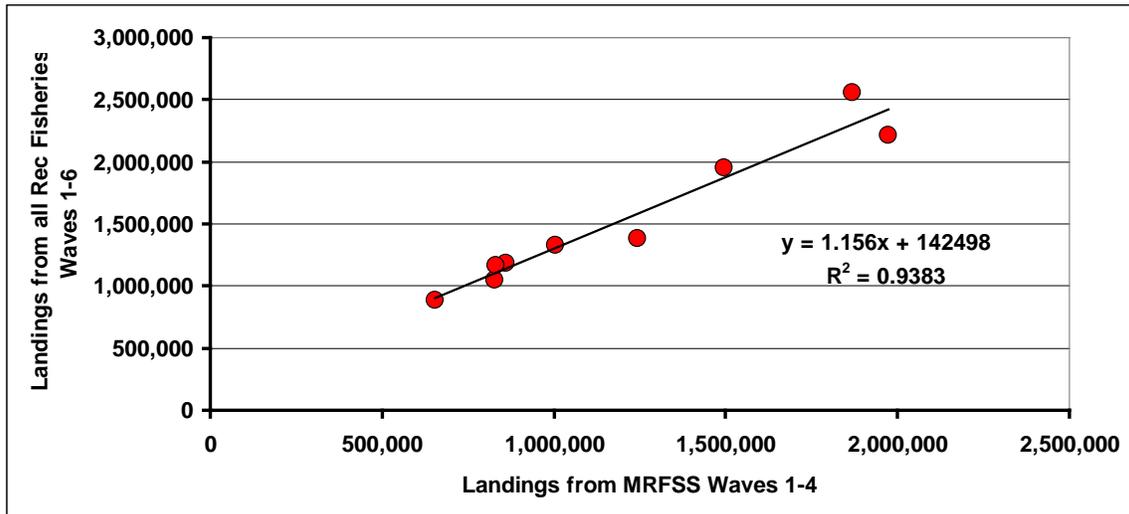


Figure 3. Regression relationship between MRFSS Wave 1-4 landings and landings from all recreational fishery sources (MRFSS, HBS, TPWD) in Waves 1-6.

Table 5. Regression statistics for MRFSS Wave 1-4 landings and landings from all recreational fishery sources (MRFSS, HBS, TPWD) in Waves 1-6.

ANOVA						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	1	2.49E+12	2.49E+12	106.46	0.00	
Residual	7	1.64E+11	2.34E+10			
Total	8	2.65E+12				

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	1.42E+05	1.43E+05	0.99	0.35	-1.96E+05	4.81E+05
MRFSS 1-4	1.16	0.11	10.32	0.00	0.89	1.42

Assuming the recreational fishery for greater amberjack proceeds in 2010 at the same pace as in 2009, projected annual landings for 2010 are 1,667,221 lbs (95% CI: 782,730-2,691,234 lbs). Based upon the seasonal distribution of landings (Fig. 2), the quota would be exceeded early in wave 4 (Table 6). One possible solution would be to close the fishery around 3 weeks into wave 4, which is projected to result in landings of 1,142,296 lbs (95% CI: 536,287-1,843,898). Another solution would be to only allow fishing during waves 3-5, which is projected to result in landings of 1,152,107 lbs (95% CI: 540,893-1,859,736).

Table 6. Projected recreational landings (total lbs) of greater amberjack in 2010 assuming fishery proceeds as in 2009.

Wave	Landings by Wave			Cumulative Total		
	Lower 95%	Total	Upper 95%	Lower 95%	Total	Upper 95%
1	71,027	151,287	244,208	71,027	151,287	244,208
2	128,012	272,667	440,139	199,038	423,954	684,348
3	273,583	582,734	940,652	472,621	1,006,688	1,624,999
4	190,997	406,824	656,697	663,618	1,413,512	2,281,696
5	76,314	162,549	262,388	739,932	1,576,061	2,544,084
6	42,798	91,160	147,150	782,730	1,667,221	2,691,234
TOTAL	782,730	1,667,221	2,691,234			

Assuming the recreational fishery for greater amberjack proceeds in 2010 at a pace approximated by the average landings 2006-2008, projected annual landings for 2010 are 1,127,845 lbs. A 95% confidence interval computed using 1.96 times the standard error between total landings estimates is 873,825-1,381,865 lbs. A confidence interval computed using MRFSS PSE from 2006-2008 with landings from HBS and TPWD held at their mean annual estimates is 456,540-1,875,173 lbs. Although there is a high level of uncertainty, it appears the quota might not be exceeded in 2010 (Table 7).

Table 7. Projected recreational landings (total lbs) of greater amberjack in 2010 assuming fishery proceeds similar to average 2006-2008.

Wave	Landings by Wave			Cumulative Total		
	Lower 95%	Total	Upper 95%	Lower 95%	Total	Upper 95%
1	79,293	102,343	125,393	79,293	102,343	125,393
2	142,910	184,454	225,998	222,203	286,797	351,391
3	305,423	394,209	482,995	527,626	681,006	834,386
4	213,225	275,209	337,194	740,851	956,215	1,171,580
5	85,195	109,962	134,728	826,046	1,066,177	1,306,308
6	47,779	61,668	75,557	873,825	1,127,845	1,381,865
TOTAL	873,825	1,127,845	1,381,865			

Discussion

As with any modeling approach, the projections presented by this analysis are sensitive to the assumptions and the quality of the input data. The primary data source driving the outcomes of these analyses is MRFSS, which suffers from low sampling relative to the total number of recreational trips, and high levels of uncertainty with estimated average weights. The error associated with this lack of precision is captured by the PSE estimates, which for greater amberjack 1998-2008 annual Gulf States estimates range from 11.6-108.4, with a mean of 51.7.

I have tried to capture this imprecision by providing confidence intervals around all the estimates provided. Unfortunately, I was not able to provide estimates of uncertainty around the HBS and TPWD landings estimates. However, the importance of these fisheries to the total landings (~8%) is minimal relative to MRFSS, and the imprecision of MRFSS is probably significantly higher; therefore, a large percentage of the uncertainty in the estimates for 2009 landings is probably captured.

Projecting landings for 2010 introduced additional assumptions, as fisherman behavior was projected for an entire year rather than for just 2 additional months as in the 2009 projection. I projected landings in 2010 under two scenarios: 1) 2010 landings will be similar to 2009 projected landings, and 2) 2010 landings will be similar to 2006-2008 average landings. These approaches suggested landings in 2010 will likely be between 1.1-1.7 million lbs, with a range of uncertainty from 0.7-2.7 million lbs.

Projections suggest landings in 2010 may exceed the recreational quota as reduced by the 2009 overage. Given the uncertainty associated with these projections, it is difficult to estimate when this overage might occur. However, this analysis does indicate that MRFSS landings from early sampling waves may be used to extrapolate landings later in the season, which suggests in-season quota monitoring and closures may be possible. Opening the fishery later in the season, rather than at the start of the year, would help ensure that it would be open during the economically important summer months. However, provisions for doing so would need to be present in the management framework.