APPENDIX I. Report on the Analysis of a Continued Red Snapper Moratorium presented to the South Atlantic Fishery Management Council at their December 2010 Meeting

Prepared by South Atlantic Fishery Management and NMFS Southeast Regional Office

The following appendices are included within this document:

Appendix I-A. SEDAR-24 South Atlantic Red Snapper: Management quantities and projections requested by the SSC and SERO

Appendix I-B. Addendum to Appendix I-A (December 3, 2010)

Appendix I-C. Red snapper estimated reductions

Appendix I-D. Red Snapper Removals in 2010, Reported to MRFSS

ABC Recommendations

The Acceptable Biological Catch (ABC) recommendation from the Council's Scientific and Statistical Committee (SSC) for red snapper in the South Atlantic is the catch level that corresponds to the rebuilding projections based on the rebuilding goal identified by the Council. The rebuilding goal is based on achieving a rate of fishing mortality equal to 98%$F_{30\%SPR}$, which equates to an ABC range of 374,000 to 421,000 pounds in 2011. This ABC range was determined through projections provided by Southeast Fisheries Science Center (SEFSC) and is included in Appendix I-A. ABCs of 374,000, 395,000, and 421,000 correspond to a headboat index weight of 0.20, 0.25, and 0.30, respectively.

The SSC recommended basing ABC values on headboat index catch per unit effort (CPUE) weights of 0.20, 0.25, and 0.30. The headboat index is considered a highly reliable source of information on stock abundance, and the inability of the base run used in SEDAR 24 to match a pronounced increase in headboat CPUE was considered a key point in the assessment. Increasing the weight in the headboat index (ie, 0.30 versus 0.20) implies greater confidence in the observed CPUE value.

Moratorium Evaluations

Additional information was provided by the SEFSC as an addendum to the original projections and is included in Appendix I-B. These projections were completed because moratorium projections may not be directly comparable to harvest projections due to the differences in selectivities. Selectivity is the relationship between retention and size (or age) of fish. Selectivity directly influences reference point values, estimated fishing mortality, and the estimated yield in future years. Changes in selectivity between past years, 2010, and probable future conditions add considerable complexity to the evaluation of this management action. Therefore, the ABC under a red snapper moratorium may differ from the ABC under harvest scenarios.

Future fishing mortality, landings, and discards are predicted through stock assessment models. If mortality is expected to be below the ABC, then it is likely that overfishing is not occurring. As outlined in the original projections (See Appendix I-A), the discard mortalities under a continued red snapper moratorium in 2011 are 384,000, 393,000, and 395,000 pounds. These values correspond to a headboat index weight of 0.20, 0.25, and 0.30, respectively. The discard mortalities under the headboat index weights of 0.25 and 0.30 are lower than the ABCs at corresponding headboat weights (Table 1). However, the ABCs and discard levels under the moratorium may not be directly comparable due to shifts in selectivity that would result from the moratorium as described above.

Table 1. A comparison of the ABCs and discard mortalities (in pounds whole weight) under the red snapper moratorium.

Headboat Index Weight	ABC	Discard Mortalities Under Moratorium
0.20	374,000	384,000
0.25	395,000	393,000
0.30	421,000	395,000

Model projections in Appendix I-A also estimate the red snapper spawning stock biomass expected through various fishing mortality estimates. Despite the changes in selectivity noted above, and the resultant difficulties in comparing findings under the harvest and moratorium scenarios, the red snapper spawning stock biomass is projected to be similar when comparing the rebuilding goal projections and moratorium projections under a headboat index weight of 0.30 (Table 2). This suggests that the moratorium action may meet the rebuilding strategy.

Table 2. The spawning stock biomass (mt) in two projections from the original projections where the headboat weight is 0.30.

	Rebuilding Goal Projection (F=0.98XF30)	**Continued Moratorium Projection**
2010	22.67	22.67
2011	27.74	27.74
2012	31.29	31.72
2013	35.14	35.72
2014	39.3	39.88
2015	43.79	44.24
2016	48.58	48.8
2017	53.72	53.61
2018	59.15	58.67
2019	64.76	63.87

As outlined in Appendix I-B, the SEFSC estimated the rebuilding goal (98%$F_{30\%SPR}$) under a continued moratorium. According to the projection addendum, the moratorium combined with a 10% decrease in effort towards red snapper may still result in overfishing (does not end overfishing). However, should the decrease in effort be greater, then the moratorium alone may achieve a fishing mortality rate that is below the overfishing level. However, as noted above, the evaluation of moratorium projections are problematic as they attempt to compare poundage values from different selectivity scenarios. To address this issue, the NMFS Southeast Regional Office (SERO) estimated the needed reductions in removals (Appendix I-C). This was achieved by comparing the baseline removals estimated by the SEDAR 24 stock assessment (2007-2009) to target removals in 2011 as estimated by the 98%$F_{30\%SPR}$ projections. This analysis suggested that a 70%-75% reduction in red snapper removals is needed, based upon the plausible range of assessment runs identified by the SSC.

An evaluation of predicted moratorium effectiveness using 2007-2009 baseline data indicates that the moratorium will provide a 66% reduction in removals of red snapper based on an Interactive Combined Effects (ICE) Model for South Atlantic Red Snapper (SERO 2010; Table 3). This analysis accounts for reduction in effort in the commercial sector using an economic trip elimination model developed by the SEFSC. It also accounts for reductions in effort in the recreational sector using models that eliminate targeted and directed trips from the MRFSS and headboat baseline (2007-2009) survey data (SERO 2010). These trip elimination models explicitly account for management regulations but do not account for other factors that might reduce effort such as an economic downturn. These trip elimination models are predicated upon the ability of historical data to predict future angler behavior; if angler behavior in 2011 is significantly different from behavior in 2007-2009 in ways

not predicted by the models, then associated reductions in red snapper removals might be different from those indicated in Table 3.

Table 3. ICE Model Results based on predicted effort reductions

FISHERY	R(1000)	PCT REDUCTION
Comm	74.9	71%
Private	216.5	69%
HB	40.5	61%
Charter	88.5	55%
TOTAL	420.4	66%

Effort and Mortality Reduction, Private and Charter Recreational Fishery in 2010

Overall fishing effort in the South Atlantic EEZ (> 3 mi) has declined by 44% since 2007 and by 33% compared to average 2007-2009 South Atlantic EEZ effort (Figure 1). Off the east coast of Florida, effort in the EEZ has declined by 42% since 2007 and by 31% compared to average 2007-2009 east Florida EEZ effort (Figure 2).

Figure 1. MRFSS estimates of the number of trips in the South Atlantic for 2010 through Wave 4 (January through August).

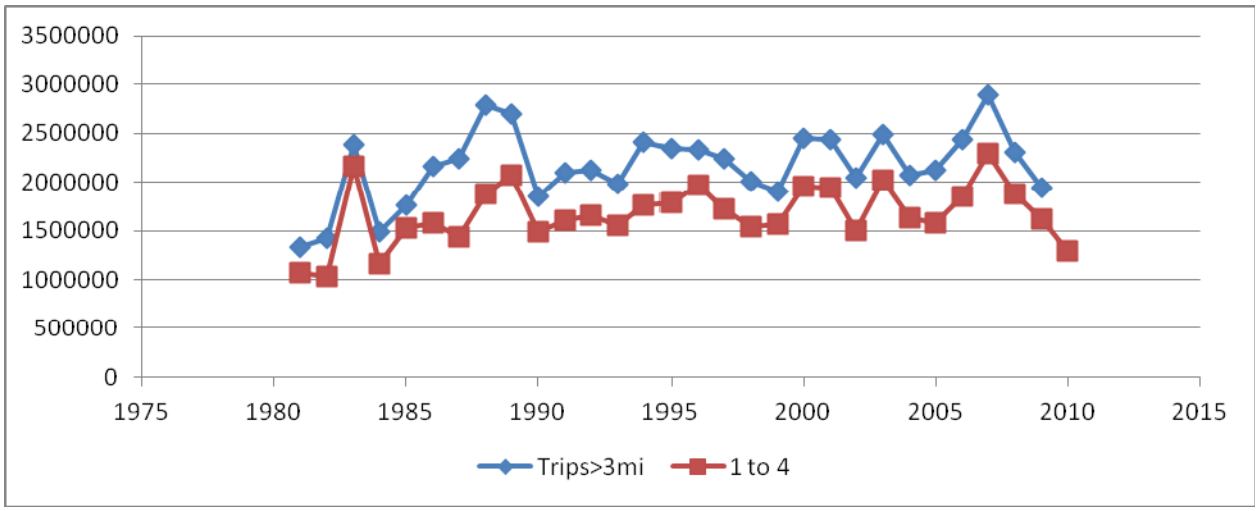
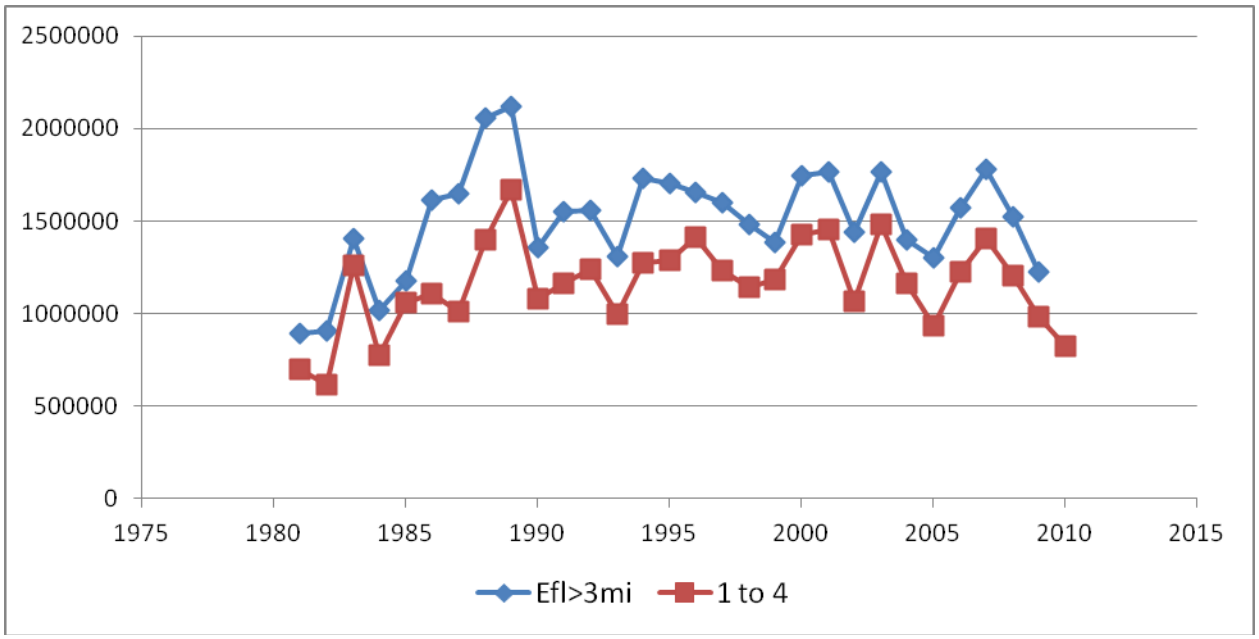


Figure 2. MRFSS estimates of the number of trips off the coast of East Florida for 2010 through Wave 4 (January through August).



MRFSS estimates for waves 1-4 (January - August) were compared between 2010 and earlier years. These waves were used because this is the most recent information available for 2010, and the Marine Recreational Fishing Statistics Survey (MRFSS) was chosen because no 2010 estimates of red snapper encounters are currently available from either the commercial fishery observer program or from the Southeast Fisheries Science Center Headboat Logbook survey. MRFSS estimates provide evidence that fishermen are encountering fewer red snapper, likely due to lower effort and avoidance of red snapper fishing locations (Table 4).

Table 4. The percent reduction in red snapper encounters in 2010, based on MRFSS estimates for waves 1-4.

YEAR	1	2	3	4	total
2007	42,775	42,773	102,377	217,176	405,101
2008	107,601	72,414	130,713	78,881	389,609
2009	80,650	124,421	43,929	37,336	286,336
2010	11,437	9,952	31,469	14,911	67,769
% Reduction (07-09)	0.85	0.88	0.66	0.87	0.81

These data support fishermen reports indicating reduced effort in the snapper grouper fishery, in particular in the North Florida area, where red snapper are most prevalent, as a result of the moratorium during 2010. They support the continued and widely reported decline in overall

recreational effort along the South Atlantic Coast. They also indicate a slightly greater decrease in effort than is estimated by the initial runs of the ICE model and a greater decrease in red snapper encounters, at least in the private and charter fisheries.

Modified ICE Model

The ICE Model (SERO 2010) estimates reductions in the private and charter sectors through moratorium and trip elimination of 69% and 55%, respectively. Preliminary catch estimates from MRFSS in 2010 (Waves 1-4) indicate significantly larger reductions than those predicted by the ICE Model. Based on trip elimination from 2007-2009 data, the red snapper moratorium is projected to achieve a 66% reduction in red snapper removals in 2011. This reduction is based on both simulation of a moratorium and elimination of target and/or directed fishing trips due to new management regulations, including the moratorium (i.e., Amendment 16, 17A, and 17B). Evidence provided by MRFSS suggests effort in the South Atlantic is down 33% and total removals in pounds are down 81% when 2010 is compared to the 2007-2009 baseline (Appendix I-D, Table 6A). The differences between the 66% reduction in red snapper removals predicted by the ICE Model and the observed 81% decrease in removals reported to MRFSS may be in part due to several factors, including: 1) inclusion of all sectors for modeling the effects of the moratorium versus use of MRFSS alone, 2) simulation of historical data which may not accurately represent current fishery dynamics, and 3) elimination of recreational fishing effort (trip elimination) based on responses to management regulations exclusive of economic considerations. Given the significant economic downturn, reductions in removals estimated by the SERO decision model may underestimate the total reduction in removals achieved under the moratorium.

To address this, the ICES model was modified to integrate direct observations of the reduction in encounters for the private and charter recreational fisheries with the estimated reductions in the commercial and headboat fisheries. This approach allows the model to incorporate observed data on moratorium impacts where such information is currently available. The 81% overall reduction in red snapper removals was split into mode specific values, indicating that Charter removals of red snapper are down 88% and Private removals are down 79% (Appendix I-D, Tables 6B and 6C). MRFSS discards (N) in 2010 were converted to pounds using the average weight of a discarded fish under a moratorium from the HB=0.3 SEFSC moratorium projection (Appendix I-A, Table 9D). Other aspects of the model are consistent with Council recommendations for Amendment 17A. No adjustments are made for effort shifts as these results do not include any closed area. This approach implicitly incorporates the recruitment signals observed by SEDAR-24 (2010), as it uses the projections to compute the average weight of a discarded fish in 2010.

Including MRFSS Wave 1-4 data for 2010 as a percentage reduction from the 2007-2009 baseline period as noted above, along with the projected trip elimination reductions for the commercial and headboat sector, suggests that an overall reduction in red snapper removals of 77% may have been achieved by the moratorium in 2010 (Table 5).

Table 5. Modified ICES model results, based on including observed 2010 reductions in the Private and Charter sectors (highlighted).

FISHERY	R(1000)	PCT REDUCTION
Comm	74.9	71%
Private	145.0	79%
HB	40.5	61%
Charter	23.7	88%
TOTAL	284.1	77%

Conclusion

Despite differences in selectivities, there is very little difference in the rate that the red snapper biomass rebuilds over the short term when comparing harvest projections and moratorium projections. Nonetheless, initial estimates of moratorium effectiveness indicate that some additional savings are required. The ICE model projections based upon 2007-2009 data indicated the moratorium provides 66% of the 70%-75% required, and the moratorium projections incorporating a 10% decrease in fishing mortality rate suggest overfishing may continue.

The challenge lies in inferring the effectiveness of a moratorium that likely changes fishing behavior significantly and definitely changes fishery selectivity to the extent that direct comparisons between pre- and post-moratorium conditions are not applicable. To address the analytical issues, the needed action was calculated as a percentage reduction in fishing mortality and the ICE model developed as a tool for evaluating the reduction provided by the moratorium and area closures. However, the model does not directly account for the full effort reduction observed in a significant fishery sector and initial results may underestimate the actual effectiveness of the moratorium.

Examination of information available from the private and charter recreational fisheries through June 2010 allows evaluation of assumptions regarding reductions in effort and red snapper for at least a portion of the time when the moratorium has been in place. As this suggests that both effort and encounter reductions are greater than initially estimated, the ICE model was modified to directly include these 2010 observations. These results indicate that the moratorium may provide a 77% reduction in mortality, which exceeds the 70%-75% needed to end overfishing.

References

Southeast Fisheries Science Center. SEDAR-24 South Atlantic Red Snapper: Management quantities and projections requested by the SSC and SERO. November 2010.

Southeast Regional Office. 2010. An Interactive Combined Effects (ICE) Model for South Atlantic Red Snapper. National Marine Fisheries Service, St. Petersburg, FL. 17 pp.

Appendix I-A: SEDAR-24 South Atlantic Red Snapper: Management quantities and projections requested by the SSC and SERO

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Introduction

In the SEDAR-24 CIE report, the Review Panel concluded "The Review Panel suggested using the AW base-case model to provide an assessment of the red snapper stock, but cautions that this was one realization of a number of plausible runs." The SSC followed up on this conclusion to identify three additional plausible runs; all of these runs increased the weighting of the headboat index relative to other data components.

Methods

The weighting given to the headboat index is controlled by the annual CV_t. In the model, the CV applied was,

$$CV_t = CV_t^d / \omega$$

where CV_t^d was the annual CV estimated by the data workshop and ω was a user-supplied weight. Larger values of ω result in smaller CV_t and, consequently, more emphasis on the index.

In the base-case configuration, as reviewed by the SEDAR-24 RW, weighting of data components was accomplished through an iterative re-weighting strategy. That strategy provided a headboat index weight of $\omega = 0.11$. The RW panel requested additional runs using $\omega = 0.20$, $\omega = 0.25$, $\omega = 0.30$, and the SSC selected those runs as plausible alternatives.

In this report, the alternative model runs are labeled wgt11, wgt20, wgt25, and wgt30, with labels indicating the value of ω applied to the headboat index. In addition to management quantities from those runs, this report provides results from 10-year, deterministic projections using four different fishing mortality rates: Fmsy, F30, 98% of F30, and Fcurrent but with a moratorium applied. Projection methods and caveats about results are described in the SEDAR-24 AW report. One caveat worth reiterating is that projections of population and fishery dynamics are highly uncertain. In the deterministic projections of this report, the uncertainty surrounding expected values is not quantified.

Results

Benchmarks and other management quantities from the various runs are presented in Table 1. Predicted landings and discards from the various runs are shown in Tables 2–5. Deterministic projection results from wgt11 are shown in Tables 6a,b,c,d; results from wgt20 in Tables 7a,b,c,d; results from wgt25 in Tables 8a,b,c,d; and results from wgt30 in Tables 9a,b,c,d.

Discussion

The benchmarks are conditional on selectivities estimated at the end of the assessment period. Changes in relative contributions toward mortality from the various fleets would alter the aggregate selectivity and thus benchmarks. Such changes have likely occurred as a result of the current moratorium, and as a result, moratorium fishing mortality rates are not directly comparable to Fmsy or its proxies.

Table 1. Estimated status indicators, benchmarks, and related quantities from the Beaufort Assessment Model. Values are from runs with component weights as in the base-case model of the AW report (wgt11), and from runs with increased weight on the headboat index (wgt20, wgt25, and wgt30). Estimates of yield do not include discards; Dmsy represents discard mortalities expected when fishing at Fmsy. Spawning stock biomass (SSB) is measured by total gonad weight of mature females.

Quantity	Units	wgt11	wgt20	wgt25	wgt30
Fmsy	y^{-1}	0.178	0.188	0.196	0.206
85%Fmsy	y^{-1}	0.151	0.160	0.166	0.175
75%Fmsy	y^{-1}	0.133	0.141	0.147	0.155
65%Fmsy	y^{-1}	0.115	0.122	0.127	0.134
F30%	y^{-1}	0.170	0.183	0.192	0.204
F40%	y^{-1}	0.125	0.134	0.140	0.149
F50%	y^{-1}	0.092	0.098	0.103	0.109
Bmsy	mt	13632	14180	14429	14634
SSBmsy	mt	156	162	165	168
MSST	mt	144	149	152	154
MSY	1000 lb	1842	1891	1908	1926
Dmsy	1000 fish	67	71	73	75
Rmsy	1000 age-1 fish	584	599	604	608
Y at 85%Fmsy	1000 lb	1821	1870	1887	1905
Y at 75%Fmsy	1000 lb	1780	1829	1846	1863
Y at 65%Fmsy	1000 lb	1712	1760	1777	1794
F(2007-2009)/Fmsy	–	4.12	3.27	2.98	2.76
SSB(2009)/SSBmsy	–	0.09	0.11	0.12	0.14

Table 2a. Estimated recent landings in whole weight (1000 lb) for commercial lines (L.cl), commercial dive (L.cd), for hire (L.hb), and private recreational (L.pvt) from run with headboat index weight of $\omega = 0.11$.

Year	L.cl	L.cd	L.hb	L.pvt	Total
2000	92.13	10.38	146.29	441.08	689.87
2001	175.32	18.24	151.48	280.75	625.78
2002	163.11	22.10	219.31	247.60	652.12
2003	118.79	17.45	202.00	136.94	475.19
2004	149.73	19.65	236.07	244.04	649.48
2005	117.99	9.34	224.78	206.96	559.07
2006	80.29	4.16	183.87	156.50	424.82
2007	104.72	7.51	187.91	366.92	667.06
2008	240.48	6.30	301.94	616.19	1164.92
2009	340.89	8.01	382.32	708.17	1439.40

Table 2b. Estimated recent dead discards in whole weight (1000 lb) for commercial lines (D.cl), for hire (D.hb), and private recreational (D.pvt) from run with headboat index weight of $\omega = 0.11$.

Year	D.cl	D.hb	D.pvt	Total
2000	22.52	24.02	156.32	202.87
2001	25.81	29.15	150.80	205.76
2002	61.00	23.25	90.28	174.53
2003	18.51	15.79	96.22	130.53
2004	6.58	30.99	128.66	166.23
2005	7.12	44.70	68.56	120.38
2006	7.34	9.14	43.31	59.80
2007	15.24	85.09	231.43	331.76
2008	21.44	55.76	310.78	387.97
2009	30.33	34.88	173.44	238.65

Table 3a. Estimated recent landings in whole weight (1000 lb) for commercial lines (L.cl), commercial dive (L.cd), for hire (L.hb), and private recreational (L.pvt) from run with headboat index weight of $\omega = 0.20$.

Year	L.cl	L.cd	L.hb	L.pvt	Total
2000	92.09	10.37	145.95	435.65	684.06
2001	175.23	18.24	148.67	274.31	616.45
2002	163.07	22.10	214.40	241.58	641.14
2003	118.77	17.45	200.25	135.59	472.06
2004	149.70	19.65	227.16	233.93	630.43
2005	117.99	9.34	216.68	199.01	543.03
2006	80.30	4.16	185.58	157.14	427.18
2007	104.72	7.51	195.48	371.14	678.85
2008	240.53	6.30	296.43	601.97	1145.22
2009	340.96	8.01	374.62	692.68	1416.28

Table 3b. Estimated recent dead discards in whole weight (1000 lb) for commercial lines (D.cl), for hire (D.hb), and private recreational (D.pvt) from run with headboat index weight of $\omega = 0.20$.

Year	D.cl	D.hb	D.pvt	Total
2000	22.24	23.65	153.86	199.75
2001	25.54	29.14	150.71	205.39
2002	60.56	22.35	86.77	169.68
2003	17.88	15.69	95.59	129.16
2004	6.67	31.67	131.48	169.82
2005	7.15	45.06	69.10	121.31
2006	7.09	8.93	42.30	58.32
2007	15.08	83.76	227.86	326.70
2008	21.32	56.51	315.08	392.91
2009	30.75	36.51	181.51	248.76

Table 4a. Estimated recent landings in whole weight (1000 lb) for commercial lines (L.cl), commercial dive (L.cd), for hire (L.hb), and private recreational (L.pvt) from run with headboat index weight of $\omega = 0.25$.

Year	L.cl	L.cd	L.hb	L.pvt	Total
2000	92.07	10.37	145.41	432.55	680.40
2001	175.20	18.24	147.28	271.36	612.07
2002	163.06	22.10	211.63	238.31	635.10
2003	118.77	17.45	199.79	135.26	471.26
2004	149.70	19.65	218.49	224.66	612.49
2005	118.00	9.34	210.96	193.59	531.90
2006	80.30	4.16	186.24	157.43	428.14
2007	104.73	7.51	198.55	372.95	683.74
2008	240.55	6.30	296.01	600.35	1143.21
2009	340.99	8.01	372.62	688.71	1410.34

Table 4b. Estimated recent dead discards in whole weight (1000 lb) for commercial lines (D.cl), for hire (D.hb), and private recreational (D.pvt) from run with headboat index weight of $\omega = 0.25$.

Year	D.cl	D.hb	D.pvt	Total
2000	22.05	23.41	152.30	197.75
2001	25.33	29.19	151.00	205.52
2002	60.19	21.55	83.68	165.43
2003	17.36	15.74	95.87	128.98
2004	6.75	32.27	133.94	172.96
2005	7.15	45.18	69.29	121.63
2006	6.98	8.91	42.19	58.07
2007	14.99	82.71	225.03	322.73
2008	21.13	56.51	315.13	392.77
2009	30.77	37.05	184.23	252.05

Table 5a. Estimated recent landings in whole weight (1000 lb) for commercial lines (L.cl), commercial dive (L.cd), for hire (L.hb), and private recreational (L.pvt) from run with headboat index weight of $\omega = 0.30$.

Year	L.cl	L.cd	L.hb	L.pvt	Total
2000	92.06	10.37	145.64	432.42	680.49
2001	175.19	18.24	146.41	269.52	609.35
2002	163.06	22.09	208.88	235.12	629.15
2003	118.77	17.45	200.15	135.50	471.87
2004	149.71	19.65	210.87	216.60	596.82
2005	118.01	9.34	207.56	190.38	525.29
2006	80.30	4.16	190.37	160.75	435.58
2007	104.73	7.51	203.75	379.58	695.58
2008	240.58	6.30	299.58	607.15	1153.61
2009	341.01	8.01	372.86	688.99	1410.88

Table 5b. Estimated recent dead discards in whole weight (1000 lb) for commercial lines (D.cl), for hire (D.hb), and private recreational (D.pvt) from run with headboat index weight of $\omega = 0.30$.

Year	D.cl	D.hb	D.pvt	Total
2000	21.79	23.06	150.00	194.85
2001	25.01	29.11	150.57	204.69
2002	59.68	20.88	81.08	161.64
2003	16.92	15.75	95.92	128.58
2004	6.77	32.71	135.77	175.25
2005	7.14	45.15	69.25	121.54
2006	6.94	8.98	42.54	58.45
2007	14.85	80.95	220.28	316.08
2008	20.78	56.10	312.89	389.76
2009	30.64	37.34	185.67	253.66

Table 6a. Projection results (expected values) with F=Fmsy, extended from assessment model configuration with component weights as in the AW report, including headboat index weight of $\omega = 0.11$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.416	11.49	235	62	306	0	0	0
2011	0.178	13.76	223	22	39	22	235	235
2012	0.178	15.53	251	26	52	29	278	513
2013	0.178	17.62	270	29	56	35	321	834
2014	0.178	20.11	290	31	62	41	378	1212
2015	0.178	22.98	312	34	66	47	436	1648
2016	0.178	26.17	335	36	71	52	491	2139
2017	0.178	29.71	356	39	76	57	546	2685
2018	0.178	33.56	377	41	81	62	602	3287
2019	0.178	37.68	397	44	86	67	660	3947

Table 6b. Projection results (expected values) with F=F30, extended from assessment model configuration with component weights as in the AW report, including headboat index weight of $\omega = 0.11$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.416	11.49	235	62	306	0	0	0
2011	0.170	13.76	223	21	37	21	226	226
2012	0.170	15.61	251	25	50	28	268	494
2013	0.170	17.76	271	28	54	34	311	805
2014	0.170	20.35	292	30	59	40	367	1172
2015	0.170	23.33	314	33	64	45	425	1597
2016	0.170	26.66	337	35	69	51	480	2077
2017	0.170	30.35	359	38	74	56	535	2611
2018	0.170	34.39	381	40	79	61	591	3202
2019	0.170	38.72	401	42	84	66	649	3851

Table 6c. Projection results (expected values) with F=0.98×F30, extended from assessment model configuration with component weights as in the AW report, including headboat index weight of $\omega = 0.11$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.416	11.49	235	62	306	0	0	0
2011	0.167	13.76	223	20	36	20	222	222
2012	0.167	15.65	251	25	49	27	263	485
2013	0.167	17.83	271	27	53	33	306	791
2014	0.167	20.46	292	30	58	39	362	1153
2015	0.167	23.49	315	32	63	45	420	1573
2016	0.167	26.89	338	34	68	50	474	2047
2017	0.167	30.66	361	37	73	55	529	2576
2018	0.167	34.79	383	39	78	60	585	3162
2019	0.167	39.21	403	42	83	65	643	3805

Table 6d. Projection results (expected values) under continued moratorium, extended from assessment model configuration with component weights as in the AW report, including headboat index weight of $\omega = 0.11$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings. In these projections, the F applied corresponds to F=0.9×Fcurrent (Fcurrent = 0.73) but decreased to reflect potential landings that are discarded and survive.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.416	11.49	235	62	306	0	0	0
2011	0.416	13.76	223	78	344	0	0	0
2012	0.416	15.21	251	91	395	0	0	0
2013	0.416	16.81	267	99	427	0	0	0
2014	0.416	18.59	283	108	473	0	0	0
2015	0.416	20.52	299	116	519	0	0	0
2016	0.416	22.57	316	124	563	0	0	0
2017	0.416	24.77	332	131	606	0	0	0
2018	0.416	27.12	347	139	650	0	0	0
2019	0.416	29.57	362	146	693	0	0	0

Table 7a. Projection results (expected values) with F=Fmsy, extended from assessment model configuration with component weights as in the AW report, but headboat index weight increased to $\omega = 0.20$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.35	16.88	282	65	345	0	0	0
2011	0.188	20.64	286	28	48	29	326	326
2012	0.188	23.27	320	35	67	38	386	711
2013	0.188	26.25	341	38	74	45	438	1149
2014	0.188	29.59	361	41	80	52	501	1650
2015	0.188	33.29	382	43	85	58	563	2213
2016	0.188	37.32	401	46	90	63	624	2837
2017	0.188	41.67	420	48	94	69	685	3522
2018	0.188	46.34	438	50	99	74	747	4269
2019	0.188	51.21	454	52	103	78	808	5077

Table 7b. Projection results (expected values) with F=F30, extended from assessment model configuration with component weights as in the AW report, but headboat index weight increased to $\omega = 0.20$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.35	16.88	282	65	345	0	0	0
2011	0.183	20.64	286	27	47	28	317	317
2012	0.183	23.34	320	34	65	37	376	693
2013	0.183	26.39	341	37	72	44	428	1121
2014	0.183	29.82	362	40	78	51	490	1612
2015	0.183	33.62	383	42	83	57	553	2164
2016	0.183	37.76	403	45	88	62	614	2778
2017	0.183	42.26	422	47	92	67	675	3454
2018	0.183	47.08	440	49	97	73	737	4190
2019	0.183	52.12	457	51	101	77	798	4988

Table 7c. Projection results (expected values) with F=0.98×F30, extended from assessment model configuration with component weights as in the AW report, but headboat index weight increased to $\omega = 0.20$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.35	16.88	282	65	345	0	0	0
2011	0.179	20.64	286	27	46	28	311	311
2012	0.179	23.4	320	33	64	37	370	680
2013	0.179	26.49	342	36	71	43	422	1102
2014	0.179	29.98	363	39	77	50	483	1585
2015	0.179	33.85	384	41	81	56	545	2131
2016	0.179	38.08	404	44	86	62	607	2737
2017	0.179	42.67	424	46	91	67	668	3405
2018	0.179	47.6	442	48	95	72	729	4135
2019	0.179	52.76	459	50	100	77	791	4926

Table 7d. Projection results (expected values) under continued moratorium, extended from assessment model configuration with component weights as in the AW report, including headboat index weight of $\omega = 0.20$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings. In these projections, the F applied corresponds to F=0.9×Fcurrent (Fcurrent = 0.61) but decreased to reflect potential landings that are discarded and survive.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.35	16.88	282	65	345	0	0	0
2011	0.35	20.64	286	84	384	0	0	0
2012	0.35	23.4	320	101	458	0	0	0
2013	0.35	26.26	342	112	504	0	0	0
2014	0.35	29.3	361	121	557	0	0	0
2015	0.35	32.53	380	130	610	0	0	0
2016	0.35	35.95	398	138	661	0	0	0
2017	0.35	39.58	414	146	712	0	0	0
2018	0.35	43.43	430	153	762	0	0	0
2019	0.35	47.42	444	160	812	0	0	0

Table 8a. Projection results (expected values) with F=Fmsy, extended from assessment model configuration with component weights as in the AW report, but headboat index weight increased to $\omega = 0.25$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.331	19.77	305	66	351	0	0	0
2011	0.196	24.23	314	31	53	31	358	358
2012	0.196	27.28	349	38	73	43	432	790
2013	0.196	30.68	370	42	82	50	490	1280
2014	0.196	34.4	390	45	88	57	555	1836
2015	0.196	38.45	409	47	92	62	618	2454
2016	0.196	42.81	427	50	97	68	680	3133
2017	0.196	47.48	445	52	102	73	741	3875
2018	0.196	52.46	461	54	106	78	803	4678
2019	0.196	57.61	476	56	110	83	865	5544

Table 8b. Projection results (expected values) with F=F30, extended from assessment model configuration with component weights as in the AW report, but headboat index weight increased to $\omega = 0.25$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.331	19.77	305	66	351	0	0	0
2011	0.192	24.23	314	30	52	31	351	351
2012	0.192	27.34	349	38	72	42	425	775
2013	0.192	30.8	370	41	80	49	482	1258
2014	0.192	34.59	390	44	86	56	547	1805
2015	0.192	38.72	410	47	91	62	610	2415
2016	0.192	43.17	428	49	96	67	671	3086
2017	0.192	47.95	446	51	100	72	733	3819
2018	0.192	53.05	462	53	104	77	795	4615
2019	0.192	58.33	477	55	108	82	857	5472

Table 8c. Projection results (expected values) with F=0.98×F30, extended from assessment model configuration with component weights as in the AW report, but headboat index weight increased to $\omega = 0.25$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.331	19.77	305	66	351	0	0	0
2011	0.188	24.23	314	30	51	30	344	344
2012	0.188	27.4	349	37	71	41	417	761
2013	0.188	30.91	370	41	79	48	475	1236
2014	0.188	34.77	391	43	85	55	539	1775
2015	0.188	38.98	411	46	90	61	602	2377
2016	0.188	43.52	430	48	94	66	663	3040
2017	0.188	48.41	447	50	99	71	725	3765
2018	0.188	53.62	464	52	103	76	787	4552
2019	0.188	59.03	479	54	107	81	849	5402

Table 8d. Projection results (expected values) under continued moratorium, extended from assessment model configuration with component weights as in the AW report, including headboat index weight of $\omega = 0.25$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings. In these projections, the F applied corresponds to F=0.9×Fcurrent (Fcurrent = 0.58) but decreased to reflect potential landings that are discarded and survive.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.331	19.77	305	66	351	0	0	0
2011	0.331	24.23	314	85	393	0	0	0
2012	0.331	27.64	349	105	479	0	0	0
2013	0.331	31.11	372	116	531	0	0	0
2014	0.331	34.76	392	126	586	0	0	0
2015	0.331	38.6	411	134	640	0	0	0
2016	0.331	42.64	428	142	692	0	0	0
2017	0.331	46.91	444	149	743	0	0	0
2018	0.331	51.43	459	156	794	0	0	0
2019	0.331	56.09	473	163	845	0	0	0

Table 9a. Projection results (expected values) with F=Fmsy, extended from assessment model configuration with component weights as in the AW report, but headboat index weight increased to $\omega = 0.30$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.32	22.67	325	65	346	0	0	0
2011	0.206	27.74	338	34	57	32	377	377
2012	0.206	31.18	373	42	79	47	477	854
2013	0.206	34.94	393	46	88	53	539	1393
2014	0.206	38.98	413	49	94	60	603	1996
2015	0.206	43.32	431	51	99	66	664	2660
2016	0.206	47.96	448	53	103	71	725	3385
2017	0.206	52.91	464	55	108	76	787	4171
2018	0.206	58.14	478	57	112	80	849	5020
2019	0.206	63.53	492	59	115	85	912	5932

Table 9b. Projection results (expected values) with F=F30, extended from assessment model configuration with component weights as in the AW report, but headboat index weight increased to $\omega = 0.30$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.32	22.67	325	65	346	0	0	0
2011	0.204	27.74	338	33	57	32	372	372
2012	0.204	31.22	373	41	79	46	472	844
2013	0.204	35.02	394	45	87	53	534	1378
2014	0.204	39.1	413	48	93	60	597	1975
2015	0.204	43.5	431	50	98	65	658	2633
2016	0.204	48.2	448	53	102	70	719	3353
2017	0.204	53.22	464	55	107	75	781	4134
2018	0.204	58.53	479	57	110	80	844	4977
2019	0.204	64	493	58	114	85	907	5884

Table 9c. Projection results (expected values) with F=0.98×F30, extended from assessment model configuration with component weights as in the AW report, but headboat index weight increased to $\omega = 0.30$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.32	22.67	325	65	346	0	0	0
2011	0.199	27.74	338	33	56	31	365	365
2012	0.199	31.29	373	41	77	45	464	829
2013	0.199	35.14	394	44	86	52	525	1354
2014	0.199	39.3	414	47	92	59	589	1942
2015	0.199	43.79	432	50	96	64	649	2592
2016	0.199	48.58	449	52	101	69	710	3302
2017	0.199	53.72	466	54	105	74	772	4074
2018	0.199	59.15	481	56	109	79	835	4909
2019	0.199	64.76	495	58	112	84	898	5807

Table 9d. Projection results (expected values) under continued moratorium, extended from assessment model configuration with component weights as in the AW report, including headboat index weight of $\omega = 0.30$. F is fishing mortality rate (per yr), SSB is mid-year spawning stock (mt), R is recruits (1000 age-1 fish), D is discard mortalities (1000 fish or 1000 lb whole weight), L is landings (1000 fish or 1000 lb whole weight), and sum L is cumulative landings. In these projections, the F applied corresponds to F=0.9×Fcurrent (Fcurrent = 0.57) but decreased to reflect potential landings that are discarded and survive.

Year	F	SSB(mt)	R(1000)	D(1000)	D(klb)	L(1000)	L(klb)	Sum L(klb)
2010	0.32	22.67	325	65	346	0	0	0
2011	0.32	27.74	338	87	395	0	0	0
2012	0.32	31.72	373	109	500	0	0	0
2013	0.32	35.72	396	120	555	0	0	0
2014	0.32	39.88	416	129	611	0	0	0
2015	0.32	44.24	434	137	663	0	0	0
2016	0.32	48.8	451	145	715	0	0	0
2017	0.32	53.61	466	152	766	0	0	0
2018	0.32	58.67	480	158	817	0	0	0
2019	0.32	63.87	494	164	868	0	0	0

APPENDIX I-B

December 3, 2010

Addendum to:
SEDAR-24 South Atlantic Red Snapper:
Management quantities and projections requested by the SSC and SERO

In 2010, a moratorium on red snapper was implemented. This was modeled in a three-step process. First, the current fishing rates by fleet, discounted by expected reductions in fishing effort, were applied to estimate landings by fleet. Second, all caught fish were assumed released, and fleet-specific discard mortality probabilities were applied to convert the potential landings to dead discards. Third, an optimization procedure was used to estimate the fishing mortality rates that produce those dead discards, as well as the mortality rates associated with undersized fish. That is, six mortality rates were estimated: the Fs of legal sized discards and undersized discards from commercial lines, for-hire, and private recreational fleets. These rates were then applied to compute the total dead discards and total mortality rates used to project the population forward in time. For most projection scenarios (described in the projection document), these mortality rates applied only in 2010, but one projection scenario (Scenario 7 in the projection document) applied the moratorium mortality rates throughout.

For computing the F30 discard equivalents, the same procedure was applied, except that F=F30 (rather than 90% Fcurrent) and the abundance at age was assumed equal to that expected under F=F30. For the four model runs with different headboat weights, the F30 discard equivalents are the following:

wgt11: F30 discard equivalent is 0.112
wgt20: F30 discard equivalent is 0.119
wgt25: F30 discard equivalent is 0.124
wgt30: F30 discard equivalent is 0.130

These F30 discard equivalent rates can be directly compared to the 2010 discard only estimates of F shown in the projection report Tables 6-9. These F rates suggest that a moratorium management action alone does not reduce the F rate below the overfishing levels (the F30 discard equivalents). An important assumption made in the projection document was that the moratorium management action resulted in a 10% reduction in F. This percent reduction is highly uncertain because no data existed at the time of this analysis to ground truth this assumption. Should this percent reduction be significantly higher, then the moratorium alone may achieve an F rate that is below the overfishing level.

APPENDIX I-C

FISHING MORTALITY RATES

	SEDAR 24 RW BASE CASE (ω = 0.11)	SSC SCENARIO 1 (ω = 0.2)	SSC SCENARIO 1 (ω = 0.25)	SSC SCENARIO 1 (ω = 0.3)
Fcurrent	0.733	0.615	0.584	0.569
Fmsy	0.178	0.188	0.196	0.206
Frebuild	0.167	0.179	0.188	0.199

BASELINE ESTIMATED REMOVALS FROM BAM OUTPUT

SEDAR 24 RW BASE CASE (ω = 0.11)

	Landings	Ddiscards	Total
2007	667	332	999
2008	1165	388	1553
2009	1439	239	1678
Average	1090	319	1410

SSC SCENARIO 1 (ω = 0.2)

	Landings	Ddiscards	Total
2007	679	327	1006
2008	1145	393	1538
2009	1416	249	1665
Average	1080	323	1403

SSC SCENARIO 1 (ω = 0.25)

	Landings	Ddiscards	Total
2007	684	323	1006
2008	1143	393	1536
2009	1410	252	1662
Average	1079	323	1402

SSC SCENARIO 1 (ω = 0.3)

	Landings	Ddiscards	Total
2007	696	316	1012
2008	1154	390	1543
2009	1411	254	1665
Average	1087	320	1407

TARGET REMOVALS IN 2011 BASED ON F = 98%F30% REBUILDING PROJECTIONS

SEDAR 24 RW BASE CASE (ω = 0.11)

	Landings	Ddiscards	Total
2011	222	36	258
2012	263	49	312

SSC SCENARIO 1 (ω = 0.2)

	Landings	Ddiscards	Total
2011	311	46	357
2012	370	64	434

SSC SCENARIO 1 (ω = 0.25)

	Landings	Ddiscards	Total
2011	344	51	395
2012	417	71	488

SSC SCENARIO 1 (ω = 0.3)

	Landings	Ddiscards	Total
2011	365	56	421
2012	464	77	541

PERCENT REDUCTION NEEDED TO END OVERFISHING AND ACHIEVE REBUILDING TARGET

	Percent Redux from Base	
Model Run	2011	2012
SEDAR 24 RW BASE CASE (ω = 0.11)	82%	78%
SSC SCENARIO 1 (ω = 0.2)	75%	69%
SSC SCENARIO 2 (ω = 0.25)	72%	65%
SSC SCENARIO 3 (ω = 0.3)	70%	62%

APPENDIX I-D: Red Snapper Removals in 2010, Reported to MRFSS

Table 1. Average release mortalities of discarded red snapper.

Mode	Release Mortality	Source
For-Hire (Charter)	41.3%	SEDAR-24-DW (2010)
Private	38.9%	SEDAR-24-DW (2010)

Table 2. Average weights (lbs) of discarded red snapper.

Year	Weight (lbs)	Source
2007	1.77	SEDAR-24-DW (2010)
2008	1.87	SEDAR-24-DW (2010)
2009	2.17	SEDAR-24-DW (2010)
2010	5.32	SEFSC Moratorium Projections (hb=0.3)

Table 3A. Red snapper landings reported to MRFSS Waves 1-4, 2007-2010 (Private and Charter Modes, SAFMC waters, in lbs).

	Wave				
LANDINGS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
2007	22,990	8,770	150,977	50,559	233,296
2008	66,740	59,061	241,617	151,048	518,466
2009	316,060	266,078	178,225	60,492	820,855
Avg. 2007-2009	**135,263**	**111,303**	**190,273**	**87,366**	**524,206**
2010	0	0	0	205	205

Table 4A. Red snapper dead discards (N) reported to MRFSS Waves 1-4, 2007-2010 (Private and Charter Modes, SAFMC waters, in lbs), expanded to lbs using average weights from Table 1.

	Wave				
DISCARDS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
2007	28,171	27,767	62,757	141,744	260,439
2008	69,442	44,721	68,695	40,569	223,427
2009	32,931	71,033	20,338	22,082	146,385
Avg. 2007-2009	**43,515**	**47,840**	**50,597**	**68,132**	**210,084**
2010	23,682	20,475	65,899	30,019	140,076

Table 5A. Red snapper removals (lbs) reported to MRFSS Waves 1-4, 2007-2010 (Private and Charter Modes, SAFMC waters, in lbs), with discards expanded to lbs using average weights from Table 1.

	Wave				
REMOVALS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
2007	51,161	36,537	213,734	192,303	493,735
2008	136,182	103,782	310,312	191,617	741,893
2009	348,991	337,111	198,563	82,574	967,240
Avg. 2007-2009	**178,778**	**159,143**	**240,870**	**155,498**	**734,289**
2010	23,682	20,475	65,899	30,224	140,281

Table 6A. Difference in red snapper removals (lbs) between 2007-2009 baseline (Waves 1-4) and 2010 Waves 1-4 during moratorium.

	Wave				
REMOVALS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
Avg. 2007-2009	178,778	159,143	240,870	155,498	734,289
2010	23,682	20,475	65,899	30,224	140,281
2010	87%	87%	73%	81%	81%

Table 3B. Red snapper landings reported to MRFSS Waves 1-4, 2007-2010 (Private mode, SAFMC waters, in lbs).

	Wave				
LANDINGS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
2007	12,388	5,948	131,202	44,528	194,066
2008	42,227	53,695	201,825	72,688	370,435
2009	171,597	229,814	170,435	37,394	609,240
Avg. 2007-2009	**75,404**	**96,486**	**167,821**	**51,537**	**391,247**
2010	0	0	0	0	0

Table 4B. Red snapper dead discards (N) reported to MRFSS Waves 1-4, 2007-2010 (Private mode, SAFMC waters, in lbs), expanded to lbs using average weights from Table 1.

	Wave				
DISCARDS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
2007	24,769	19,638	35,837	100,335	180,579
2008	52,437	39,924	62,365	31,621	186,346
2009	29,659	60,117	19,322	19,131	128,229
Avg. 2007-2009	**35,621**	**39,893**	**39,175**	**50,363**	**165,051**
2010	23,682	20,081	46,762	28,693	119,219

Table 5B. Red snapper removals (lbs) reported to MRFSS Waves 1-4, 2007-2010 (Private mode, SAFMC waters, in lbs), with discards expanded to lbs using average weights from Table 1.

	Wave				
REMOVALS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
2007	37,157	25,586	167,039	144,863	374,645
2008	94,664	93,619	264,190	104,309	556,781
2009	201,256	289,931	189,757	56,525	737,469
Avg. 2007-2009	**111,025**	**136,378**	**206,995**	**101,899**	**556,298**
2010	23,682	20,081	46,762	28,693	119,219

Table 6B. Difference in private mode red snapper removals (lbs) between 2007-2009 baseline (Waves 1-4) and 2010 Waves 1-4 during moratorium.

	Wave				
REMOVALS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
Avg. 2007-2009	111,025	136,378	206,995	101,899	556,298
2010	23,682	20,081	46,762	28,693	119,219
2010	79%	85%	77%	72%	79%

Table 3C. Red snapper landings reported to MRFSS Waves 1-4, 2007-2010 (charter mode, SAFMC waters, in lbs).

	Wave				
LANDINGS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
2007	10,602	2,822	19,775	6,031	39,230
2008	24,513	5,366	39,792	78,360	148,031
2009	144,463	36,264	7,790	23,098	211,615
Avg. 2007-2009	**59,859**	**14,817**	**22,452**	**35,830**	**132,959**
2010	0	0	0	205	205

Table 4C. Red snapper dead discards (N) reported to MRFSS Waves 1-4, 2007-2010 (charter mode, SAFMC waters, in lbs), expanded to lbs using average weights from Table 1.

	Wave				
DISCARDS(LBS)	**1**	**2**	**3**	**4**	**Grand Total**
2007	3,402	8,130	26,920	41,409	79,861
2008	17,005	4,798	6,330	8,948	37,081
2009	3,273	10,916	1,016	2,950	18,155
Avg. 2007-2009	**7,894**	**7,948**	**11,422**	**17,769**	**45,032**
2010	0	394	19,137	1,326	20,857

Table 5C. Red snapper removals (lbs) reported to MRFSS Waves 1-4, 2007-2010 (charter mode, SAFMC waters, in lbs), with discards expanded to lbs using average weights from Table 1.

REMOVALS (LBS)	Wave 1	2	3	4	Grand Total
2007	14,004	10,952	46,695	47,440	119,091
2008	41,518	10,164	46,122	87,308	185,112
2009	147,736	47,180	8,806	26,048	229,770
Avg. 2007-2009	**67,753**	**22,765**	**33,874**	**53,599**	**177,991**
2010	0	394	19,137	1,531	21,062

Table 6C. Difference in charter mode red snapper removals (lbs) between 2007-2009 baseline (Waves 1-4) and 2010 Waves 1-4 during moratorium.

REMOVALS(LBS)	Wave 1	2	3	4	Grand Total
Avg. 2007-2009	67,753	22,765	33,874	53,599	177,991
2010	0	394	19,137	1,531	21,062
2010	100%	98%	44%	97%	88%