

## 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 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 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 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 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.

	<b>Rebuilding Goal Projection (<math>F=0.98XF_{30}</math>)</b>	<b>Continued Moratorium Projection</b>
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 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 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%
<b>TOTAL</b>	<b>420.4</b>	<b>66%</b>

**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).

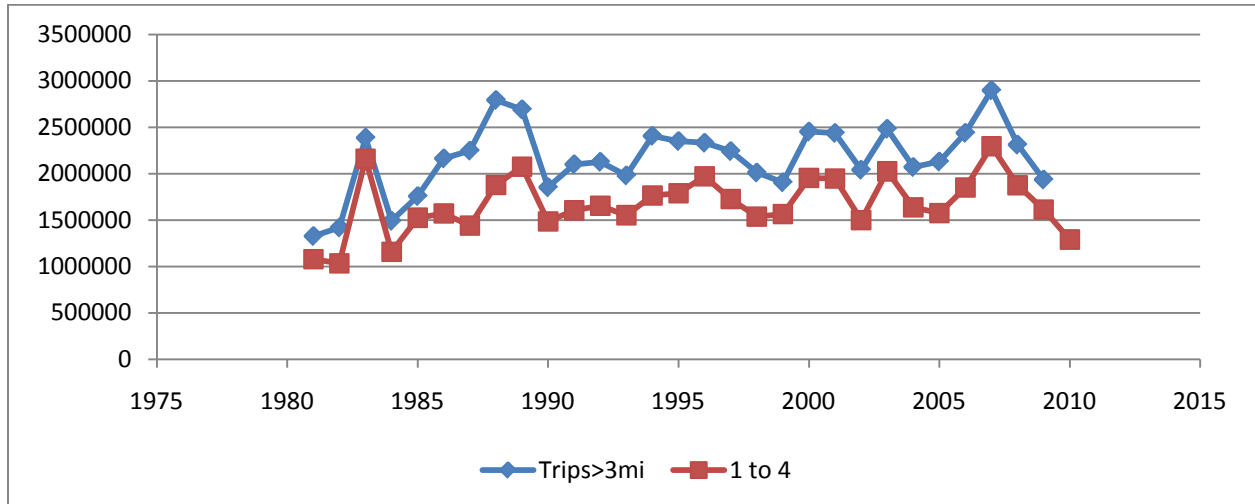
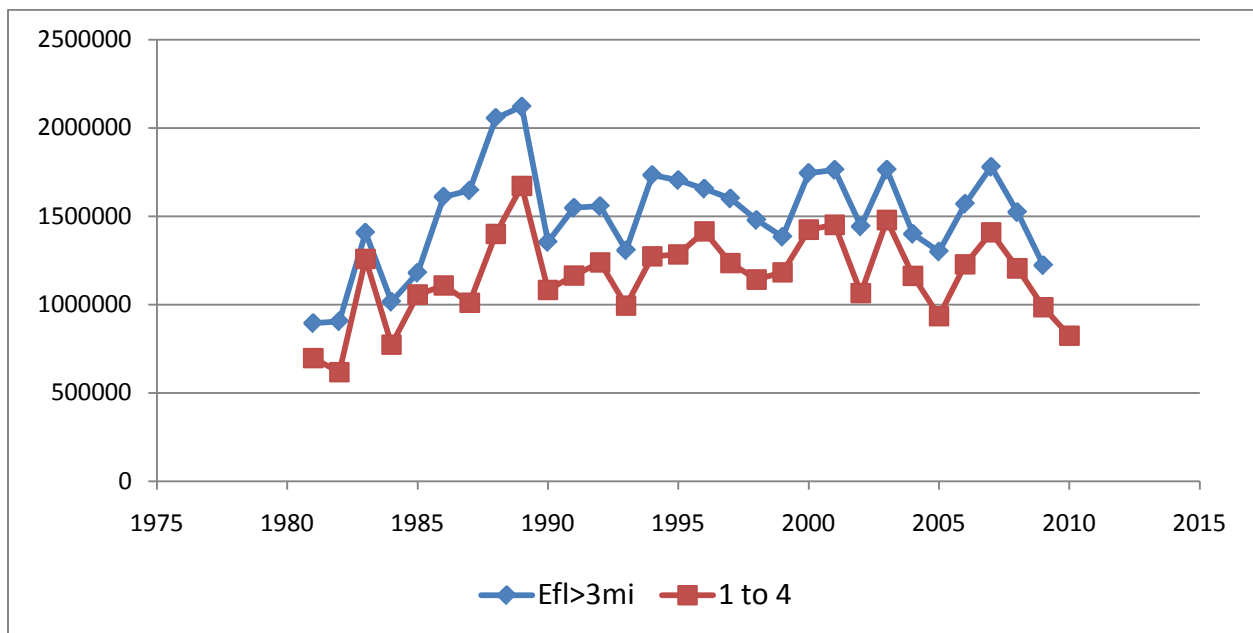


Figure 2. MRFSS estimates of the number of trips off the coast of East Florida for 2010 through Wave 4 (January through August).



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 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 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 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).

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

### **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.