

Appendix N

Methodology and Assumptions in Estimating the Economic Effects of the South Atlantic
Snapper Grouper Amendment 17A on the Recreational Sector
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1.0 Introduction

The South Atlantic Fishery Management Council has developed Snapper Grouper Amendment 17A to reduce the fishing mortality of red snapper. Several alternatives have been considered to achieve the desired fishing mortality reduction, inclusive of discard mortality. **Alternative 1** is the status quo. **Alternative 2** would prohibit harvest, retention, and possession red snapper in the South Atlantic EEZ year round. **Alternative 3** would add to Alternative 2 a year-round prohibition of harvest, retention, and possession of any species in the snapper grouper fishery management unit in an area corresponding to commercial logbook grids 2880, 2980, 3080 and 3180 between a depth of 98 feet and 240 feet. **Alternative 4** is similar to Alternative 3, except it would add the logbook grids 3179, 3278, and 3279 to the banned areas. **Alternative 5** is similar to Alternative 3, except that the depth exemptions are removed; and, **Alternative 6** is similar to Alternative 4 but without the depth exemptions. **Alternative 7** would allow fishing for black sea bass in the closed area using black sea bass pots with endorsements. **Alternative 8** would allow fishing for golden tilefish in the closed areas. **Alternative 9** would allow fishing for snapper grouper in the closed areas using spearfishing gear. **Alternative 10** would allocate the 79,000 lb ACL between the closed area (49,095 lbs) and exempted area (29,905 lbs), consider the exempted area allocation as non-directed removal and closed area allocation as directed removal, allocate the closed area directed removal among the commercial (8,373 lbs), for-hire (8,672 lbs), and private recreational (12,859 lbs) sectors, establish a limited snapper grouper bottom fishing zone in the closed area with (lottery-issued) permits to fish in the zone, and accountability measures for the commercial, for-hire, and private recreational sectors. **Alternative 11** would allow fishing vessels to transit across the closed areas, subject to certain conditions.

This appendix focuses on estimating the economic effects of Alternatives 2 through 6. Alternatives 7 through 11 are not standalone measures and would be combined with any of the Alternatives 2 through 6. In terms of economic effects, they would tend to mitigate the economic effects of Alternatives 2 through 6.

The procedure for calculating the economic effects of these alternatives on the recreational sector involves estimating the expected changes in consumer surplus (CS) to anglers and net operating revenues (NOR) to for-hire vessels. This procedure follows the method employed in previous snapper grouper plan amendments (Amendments 15A and 16) and the red snapper interim rule (NMFS 2008b). It also draws upon the general method used in the economic analysis for the red snapper fishery closure in the Gulf of Mexico (NMFS 2008a). Data, averaged over the years 2005-2008, were used in estimating the economic effects of this amendment. The period 2005-2008 was chosen per agreement among the members of the Interdisciplinary Planning Team. In this document, the economic values are in 2009 dollars.

2.0 Method for Estimating the Expected Economic Effects

The expected change in CS was estimated using the following equation:

$$(1) \quad \Delta(\text{CS})_{i,j,k} = \Delta(\text{TTRIP})_{i,j,k} \times (\text{CS})_{0,0,0} \times (\text{FISH})_{i,j,k}$$

where $\Delta(\text{CS})_{i,j,k}$ is the change in consumer surplus for species i (red snapper, snapper grouper) in area j (Northeast Florida, Southeast Florida, Georgia, South Carolina, North Carolina) using fishing mode k (charterboat, headboat, private). $\Delta(\text{TTRIP})_{i,j,k}$ is the change in target trips per angler for species i in area j using fishing mode k . $(\text{CS})_{0,0,0}$ is the per angler, per target trip consumer surplus of keeping (landing) one fish. $(\text{FISH})_{i,j,k}$ is the average fish kept per angler, per targeted trip of species i in area j using fishing mode k . It may be noted that TTRIP and FISH are 2005-2008 averages.

CS in the present case is the net benefit an angler derives from an additional fish kept on a fishing trip and is equivalent to the difference between the monetized benefit an angler receives and the actual cost. This value is the appropriate measure of economic effects on recreational anglers as a result of changes in fishing regulations. For the current analysis, the CS of keeping one fish per angler trip was assumed constant across species, areas, and modes. Further, this value was assumed to remain constant and unaffected by changes in target trips resulting from changes in regulations.

The expected change in for-hire NOR was estimated using the following equation:

$$(2) \quad \Delta(\text{NOR})_{i,j,k} = \Delta(\text{TTRIP})_{i,j,k} \times (\text{NOR})_{0,0,k}$$

where $\Delta(\text{NOR})_{i,j,k}$ is the change in net operating revenues for species i (red snapper, snapper grouper) in area j (Northeast Florida, Southeast Florida, Georgia, South Carolina, North Carolina) using fishing mode k (charterboat, headboat). $\Delta(\text{TTRIP})_{i,j,k}$ is the change in target trip per angler for species i in area j using fishing mode k . $(\text{NOR})_{0,0,k}$ is the baseline net operating revenue per angler target trip using mode k (charter, headboat).

NOR is the net operating revenue, expressed on a per angler basis, a charterboat or headboat derives from a fishing trip. NOR was calculated as revenue minus the costs for fuel, ice, bait, and other supplies. Producer surplus is the appropriate measure of economic effects on for-hire operations as a result of changes in fishing regulations. Estimates of the average producer surplus for for-hire operations are not available, and this analysis used NOR as a proxy value. For the current analysis, NOR per angler trip was assumed constant across species and areas but not across modes (charterboat and headboat). In addition, this value was assumed to be invariant to changes in the number of angler target trips.

In assessing the economic effects of each alternative, the change in target trips [$\Delta(\text{TTRIP})_{i,j,k}$] was first estimated, followed by the use of equation (1) to generate the expected change in CS and equation (2) to generate the expected change in NOR. For Alternative 2, the change in target

trips was estimated by assuming cancellation of all red snapper target trips. This approach would overestimate the economic effects of Alternative 2 if anglers continue fishing but shift their effort to target other species. For Alternatives 3-6, the change in target trips was estimated by assuming cancellation of all red snapper target trips (as in Alternative 2) and cancellation of all snapper grouper trips made in the respective grids where fishing would be prohibited. This approach would also overestimate the economic effects of these alternatives if anglers chose to continue fishing for these species in other open areas or target new species in the areas where fishing for red snapper and other snapper grouper species is prohibited.

The economic effects of Alternative 3 cannot be distinguished quantitatively from those of Alternative 5, so the quantitative estimates of Alternatives 3 and 5 are presented as one. A similar situation occurs with Alternative 4 versus Alternative 6. Conceptually, however, we may expect the economic effects of Alternative 3 and Alternative 4 to be less than those of Alternative 5 and Alternative 6, respectively.

3.0 Data, Parameters, and Assumptions

The basic parameters used in estimating the economic effects of Amendment 17A were recreational angler target effort, angler consumer surplus, average fish kept per angler trip, and for-hire vessel net operating revenues.

3.1 Headboat Angler Target Trips

The headboat data does not contain information collected at the angler level, nor does it collect target intent information. Therefore, an alternative approach was used to estimate angler target effort. Since the 1980s, NMFS (Beaufort) has conducted surveys of the headboat sector and has generated a measure of fishing effort in terms of angler days. The method of deriving total angler days from survey reports is a complex process. Here is a brief description of the process from the “Review of Headboat Survey, Questions and Answers” (NMFS 2004):

*“First, reported effort is calculated from catch records. The term “reported” refers to data actually provided by the vessel personnel in the form of catch records. Data on effort are provided as number of anglers on a given trip. Numbers of anglers are standardized, depending on the type of trip (length in hours), by converting number of anglers to “angler days” (e.g., 40 anglers on a half-day trip would yield $40 * 0.5 = 20$ angler days). Angler days are summed by month for individual vessels. Port agents enter the reported anglers from catch records on an internal worksheet called a headboat activity report (HAR). The reported anglers are converted to angler days and totaled. The monthly total of angler days is referred to as catch record angler days (CRADs). We then take every piece of information recorded on the HAR for that vessel for that month and use them to calculate estimated angler days, or EADs. This is the adjustment for non-reporting. This expansion to arrive at estimated angler days is often complex and usually labor intensive. If there is complete reporting by vessel personnel, i.e., a catch record submitted for every trip made, then $CRAD=EAD$ and the process is simple. More often that not, however, there are varying degrees of incompleteness of reporting. The usual estimation procedure involves using sampler observations of activity and developing an adjustment ratio to expand the reported observations.”*

The EADs noted above are for all headboat activities and are not broken down into EADs for

specific species trips. For the current analysis, all headboat angler days (EADs) were assumed to be target angler trips for snapper grouper species. This assumption is expected to overestimate snapper grouper target trips, because some headboat anglers may not target any species while others target species other than snapper grouper (e.g., mackerel, dolphin).

In estimating red snapper target trips, the following formula was used:

$$(3) \quad (\text{TTRED})_j = \left\{ \frac{\text{CRAD}_{\text{RED}}}{\text{CRAD}_{\text{SG}}} \right\}_j \times (\text{EAD})_j$$

where $(\text{TTRED})_j$ is angler target trips for red snapper in area j (Northeast Florida, Southeast Florida, Georgia, South Carolina, North Carolina). $(\text{CRAD}_{\text{RED}})_j$ is red snapper angler days in area j calculated from the catch records. $(\text{CRAD}_{\text{SG}})_j$ is the snapper grouper angler days in area j calculated from the catch records, and $(\text{EAD})_j$ is the estimated angler days in area j .

To derive angler target trips in the various logbook grids included under Alternatives 3 through 6, the following formula was used:

$$(4) \quad (\text{TTSG})_j = \left\{ \frac{\text{CRADSG}_{\text{GRID}}}{\text{CRAD}_{\text{SG}}} \right\}_j \times (\text{EAD})_j$$

where $(\text{TTSG})_j$ is snapper grouper target trip in the subject grids in area j (Northeast Florida, Southeast Florida, Georgia, South Carolina, North Carolina). $(\text{CRADSG}_{\text{GRID}})_j$ is snapper grouper angler days in the subject grids in area j calculated from the catch records. $(\text{CRAD}_{\text{SG}})_j$ is the snapper grouper angler days in area j calculated from the catch records, and $(\text{EAD})_j$ is the estimated angler days in area j .

Alternatives 3 and 5 would include areas corresponding to commercial logbook grids 2880, 2980, 3080, and 3180. Alternatives 4 and 6 would include the four grids under Alternatives 3 and 5 plus grids 3179, 3279, and 3278. Alternative 3 differs from Alternative 5 only in the depth restriction included in Alternative 3. Target trips by depth cannot be estimated, thus the number of target trips under Alternatives 3 and 5 are assumed to be identical for this analysis. In reality, the number of target trips under Alternative 3 would be expected to be less than under Alternative 5. The same conclusions apply with respect to comparing Alternative 4 with Alternative 6.

Estimates of the various types of headboat target trips are provided in Table A.1. EAD is the adjusted number of estimated angler days, as described above. CRADSG is the total number of angler days derived from actual catch records. TTRED is the estimated number of target trips for red snapper. TTSG_{35} is the estimated number of target trips for snapper grouper in the four grids included in Alternative 3 or Alternative 5, and TTSG_{46} is the estimated number of target trips for snapper grouper in the seven grids included in Alternative 4 or Alternative 6. For purposes of estimating the economic effects, the affected target trips used were TTRED for Alternative 2, the sum of TTRED and TTSG_{35} for Alternative 3 or Alternative 5, and the sum of TTRED and TTSG_{46} for Alternative 4 or Alternative 6.

Table A.1. Average headboat target trips, 2005-2008.

Trip Type	FL_NE	FL_SE	GA	SC	NC	TOTAL
EAD	49,378	106,225	1,805	49,532	25,823	232,763
CRADSG	45,930	35,604	1,447	41,976	15,987	140,943
TTRED	37,313	2,403	1,095	3,948	1,475	46,233
TTSG ₃₅	8,226	0	16	0	0	8,241
TTSG ₄₆	8,226	0	16	5,336	0	13,577

EAD = estimated angler days.

CRADSG = snapper grouper angler days calculated from the catch records.

TTRED = red snapper target angler trips.

TTSG₃₅ = snapper grouper target angler trips in the 4 grids included under Alternative 3 or 5.

TTSG₄₆ = snapper grouper target angler trips in the 7 grids included under Alternative 4 or 6.

3.2 Charter and Private Target Trips

The number of red snapper and all snapper grouper species target trips is calculated using the methods described in Holiman (1996), as modified by SEFSC and SERO staff. Target trips, by fishing mode, in both EEZ and state waters were calculated for each of the four states in the South Atlantic. Total target trips for Florida were partitioned into Northeast Florida and Southeast Florida using the estimated ratio of red snapper landings between the two areas as reported in SERO-LAPP-2009-05. This partitioning assumes red snapper and snapper grouper target trips are directly proportional to red snapper landings. In the absence of information on species targeting by grid, assignment of snapper grouper target trips to the various grids defined under Alternative 3 or 5 and Alternative 4 or 6 was made using the same ratio estimated for headboats. This assignment assumes that charter and private target trips were taken in about the same areas as headboat trips. This approach is analogous to the one used in assigning MRFSS removals of red snapper from the various logbook grids (see SERO-LAPP-2009-05)

Table A.2 presents the estimated average charter and private target trips for the period 2005-2008. TTSG is snapper grouper target trips; TTRED is red snapper target trips; TTSG₃₅ is snapper grouper target trips in the four grids designated under Alternative 3 or Alternative 5; and, TTSG₄₆ is snapper grouper target trips in the seven grids under Alternative 4 or Alternative 6.

In estimating the expected economic effects, the affected target trips used were TTRED for Alternative 2, the sum of TTRED and TTSG₃₅ for Alternative 3 or Alternative 5, and the sum of TTRED and TTSG₄₆ for Alternative 4 or Alternative 6.

Table A.2. Average target trips for snapper grouper and red snapper in state waters and EEZ, by area, by mode, 2005-2008.

	TTSG		TTRED		TTSG ₃₅		TTSG ₄₆	
	Charter	Private	Charter	Private	Charter	Private	Charter	Private
Northeast Florida								
State W.	9,701	280,105	183	1,695	0	0	0	0

EEZ	11,032	67,777	2,716	31,970	1,976	12,138	1,976	12,138
Total	20,732	347,881	2,899	33,665	1,976	12,138	1,976	12,138
Southeast Florida								
State W.	1,894	54,692	36	331	0	0	0	0
EEZ	2,154	13,234	530	6,242	0	0	0	0
Total	4,048	67,926	566	6,573	0	0	0	0
Georgia								
State W.	10	14,992	0	0	0	0	0	0
EEZ	769	5,031	515	1,822	8	54	8	54
Total	778	20,023	515	1,822	8	54	8	54
South Carolina								
State W.	228	72,250	0	0	0	0	0	0
EEZ	3,975	22,157	301	2,971	0	0	505	2,817
Total	4,203	94,407	301	2,971	0	0	505	2,817
North Carolina								
State W.	315	38,344	0	0	0	0	0	0
EEZ	2,775	22,062	0	0	0	0	0	0
Total	3,090	60,406	0	0	0	0	0	0

3.3 Average Fish Landed

Table A.3 presents the 2005-2008 average fish landed per angler target trip by geographic area and fishing mode. These numbers were derived by assigning all landed fish to target trips, that is, total landed fish divided by total target trips by area and fishing mode. In areas and modes where landed fish far exceeded the number of target trips, the averages would be relatively high. Conversely, where the number of target trips far exceeded the number of fish landed, the averages would be relatively low. In the absence of charter and private target trips for red snapper in North Carolina, the corresponding average fish landed was set to zero. To some extent, this method of assigning all landed fish to target trips would mitigate the potential overestimation of changes in CS due to overestimation of target trips.

Table A.3. Average red snapper and snapper grouper landed per angler target trip, by area, by mode, 2005-2008.

	Charterboat		Headboat		Private	
	Red Snapper	Snapper Grouper	Red Snapper	Snapper Grouper	Red Snapper	Snapper Grouper
FL-NE	3.5	9.6	0.2	2.6	0.8	6.3
FL-SE	3.5	9.6	0.1	3.8	0.8	6.3
GA	3.1	80.3	0.6	14.8	1.7	6.8
SC	1.0	12.7	0.3	6.1	0.4	3.3
NC	0.0	49.7	0.0	9.0	0.0	5.7

3.4 Consumer Surplus and Net Operating Revenues

Estimates of recreational CS and for-hire NOR were derived by the SEFSC based on several studies (NMFS 2009a). For the current amendment, a CS value of \$80, charter NOR value of \$128, and headboat NOR value of \$68 were chosen because these are based on a more recent study using data collected from a South Atlantic state (Dumas et al. 2009). These values are expressed in 2009 dollars.

3.0 Results

Estimates of the expected changes in consumer surplus and net operating revenues are presented in Tables A.4-A.7. Estimates of the economic effects of Alternative 2 involved the direct applications of equations 1 and 2 above. The economic effects of Alternatives 3 through 6 were estimated as a two-step process. First, the changes in CS and NOR for snapper grouper target trips in the subject grids were estimated using equations 1 and 2. Second, the resulting numbers were added to the estimates of changes in CS and NOR under Alternative 2. As discussed above, the economic effects of Alternative 3 cannot be quantitatively distinguished from those of Alternative 5, although conceptually Alternative 3 would be expected to result in lower economic effects. This is also the case when comparing Alternative 4 with Alternative 6.

Table A.4. Economic effects of Alternative 2, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida				
CS	761,429	633,891	2,148,532	3,543,852
NOR	347,588	2,727,731		3,075,319
Total	1,109,017	3,361,622	2,148,532	6,619,170
Southeast Florida				
CS	148,673	54,578	419,513	622,764
NOR	67,868	487,576		555,444
Total	216,542	542,153	419,513	1,178,207
Georgia				
CS	126,200	65,035	249,560	440,795
NOR	65,920	92,840		158,760
Total	192,120	157,875	249,560	599,555
South Carolina				
CS	23,560	126,342	93,840	243,742
NOR	38,560	316,766		355,326
Total	62,120	443,108	93,840	599,068
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989	0	161,989
Total	0	168,691	0	168,691

Table A.5. Economic effects of Alternative 3 or Alternative 5, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida				
CS	2,279,495	656,482	8,232,365	11,168,342
NOR	600,474	3,329,048		3,929,523
Total	2,879,969	3,985,531	8,232,365	15,097,865
Southeast Florida				
CS	148,673	54,578	419,513	622,764
NOR	67,868	487,576		555,444
Total	216,542	542,153	419,513	1,178,207
Georgia				
CS	179,074	65,085	278,689	522,848
NOR	66,974	94,154		161,128
Total	246,048	159,239	278,689	683,976
South Carolina				
CS	23,560	126,342	93,840	243,742
NOR	38,560	316,766		355,326
Total	62,120	443,108	93,840	599,068
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989	0	161,989
Total	0	168,691	0	168,691

Table A.6. Economic effects of Alternative 4 or Alternative 6, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida				
CS	2,279,495	656,482	8,232,365	11,168,342
NOR	600,474	3,329,048		3,929,523
Total	2,879,969	3,985,531	8,232,365	15,097,865
Southeast Florida				
CS	148,673	54,578	419,513	622,764
NOR	67,868	487,576		555,444
Total	216,542	542,153	419,513	1,178,207
Georgia				
CS	179,074	65,085	278,689	522,848
NOR	66,974	94,154		161,128
Total	246,048	159,239	278,689	683,976
South Carolina				
CS	537,839	164,762	848,174	1,550,774
NOR	103,231	744,925		848,156
Total	641,069	909,688	848,174	2,398,930

North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989	0	161,989
Total	0	168,691	0	168,691

Table A.7. Summary of economic effects, in 2009 dollars.

		FL-NE	FL-SE	GA	SC	NC	TOTAL
ALT. 2	CS	3,543,852	622,764	440,795	243,742	6,702	4,857,855
	NOR	3,075,319	555,444	158,760	355,326	161,989	4,306,837
	TOTAL	6,619,170	1,178,207	599,555	599,068	168,691	9,164,692
ALT. 3,5	CS	11,168,342	622,764	522,848	243,742	6,702	12,564,398
	NOR	3,929,523	555,444	161,128	355,326	161,989	5,163,410
	TOTAL	15,097,865	1,178,207	683,976	599,068	168,691	17,727,808
ALT. 4,6	CS	11,168,342	622,764	522,848	1,550,774	6,702	13,871,430
	NOR	3,929,523	555,444	161,128	848,156	161,989	5,656,239
	TOTAL	15,097,865	1,178,207	683,976	2,398,930	168,691	19,527,670

4.0 Discussion and Caveats

The following provides some discussion and caveats on the model and assumptions, in addition to those already noted in the preceding section. These are not listed in any implied order of importance.

- a. MRFSS target trips – there are several potential measures of effort and thus of trips potentially affected by this amendment. Effort may be measured, generally in ascending magnitude, as target trips, harvest trips, catch trips, and directed trips. Target trips are those trips for which the angler stated a specific primary or secondary target species. Harvest trips are those trips for which the recreational catch was comprised of Types A or B1 fish. Type A refers to fish that were caught, landed whole, and available for identification and enumeration by the interviewers. Type B1 refers to fish that were caught and filleted, released dead, given away, or disposed of in some way other than being landed or released alive. Catch trips are those trips which caught the species and for which the recreational catch was comprised of Types A, B1, and B2 fish. Type B2 refers to fish caught and released alive. Directed trips are a combination of two or more of the other trips noted above but are generally a combination of target and catch trips. The use of target trips in estimating economic effects is premised on the contention that these trips are closely related to recreational angler expectations and thereby carries more information generally embodied in angler demand functions (demand studies, and the estimated values they produce, generally are based on target trips). The other types of trip, particularly the directed

trips, may also be relevant for economic analysis since they embody both intent and the fact that anglers caught the species of interest. The use of target trips may not fully capture the economic effects of this amendment. However, the use of other types of trips (i.e., non-target trips) would probably result in lower estimates of the value per trip or per fish as someone less interested in catching a particular species would be expected to value that species less.

Another issue with MRFSS target trips pertains to estimating the number of target trips by grids. Effort by grid is not directly available in the recreational data. Instead, target trips by grid were derived using the same ratio of snapper grouper trips in those grids assigned to headboat trips. The possible differences in fishing areas between headboats and charterboats as well as between headboats and private boats would introduce bias of unknown magnitude into the estimates of MRFSS target trips by grids. It is likely, however, that this bias would not significantly alter the ranking of alternatives or the distribution of economic effects by areas.

- b. Headboat target trips – unlike MRFSS, the headboat survey does not collect target intent information. Target trips (TTRED and TTSG) were derived using equations (3) and (4). Vital to the derivation of TTRED are three terms: EAD, $CRAD_{red}$, and $CRAD_{sg}$. NMFS (Beaufort) derived EAD by adjusting CRAD for missing information. CRAD was calculated from the catch records by adding up all angler days per trip, and angler days per trip were calculated by multiplying the number of anglers per trip by the length of the trip. The length of the trip was normalized to 12 hours as one angler day. For the current analysis, CRAD is identical to $CRAD_{sg}$. A similar approach was used here to calculate $CRAD_{red}$ by including only those trips with catches of red snapper. For most trips, the number of anglers far exceeded the number of red snapper caught, resulting in relatively low average red snapper per angler. This method of calculation assumed that all anglers in a trip with catches of red snapper would be uniformly affected by the red snapper ban proposed in this amendment. To the extent that some anglers did not expect to catch red snapper, this method of calculation would overestimate the number of angler days (trips) affected by the red snapper ban. Overestimation of affected target trips would also result if anglers who normally catch or expect to catch red snapper chose some other species to target. Other methods of calculating $CRAD_{red}$ also exist. For one method, the number of anglers per trip could be restricted to equal the number of red snapper caught in that particular trip. Another method would be to include only those trips showing an average catch of at least one, or some other level, of red snapper per angler. These and other possible methods would also be accompanied by their own implicit assumptions. For example, restricting the number of anglers to the number of red snapper caught would assume a zero value of the opportunity to catch red snapper afforded to the uncounted anglers. These other methods were not explored in this analysis.

The estimation of $CRADSG_{grid}$ utilized three important terms: EAD, $CRAD_{sg}$, and $CRADSG_{grid}$. The first two terms are similar to those used to calculate TTRED. $CRADSG_{grid}$ was estimated in the same way as $CRAD_{red}$ but this time only trips assigned to the subject grids were included. Catch records reported by headboat

operators contain grid information, but not all reported trips contain grid information. No adjustments were made to this missing grid information, and only trips with grid information were included in estimating $CRADSG_{grid}$. This approach would likely underestimate, to an unknown extent, the number of trips actually taken in those various grids.

- c. Average fish landed – considering the various types of trips discussed above, there is no one-to-one correspondence between landed fish and target trips. Some species of fish are landed without being targeted and some target trips do not catch the targeted species. Under the methodology of assigning economic values to target trips only and of putting an economic value to each fish landed, the derivation of average fish per angler target trip resulted in very low numbers in some cases and very high numbers in others. To some extent, this approach would compensate for over- and under-estimation of target trips in calculating the changes in CS due to the various alternatives. Since the methodology was consistently applied across all alternatives, the ranking of alternatives would not be affected.
- d. Consumer surplus (CS) – a value of \$80 (2009 dollars) per fish, per angler, per trip was used for this amendment. This value is for a snapper grouper trip and is derived from a study conducted in North Carolina (Dumas et al. 2009). Other estimates are provided by other studies, some higher and others lower. The value used was chosen because it was derived from a study using more recent data collected from a state in the South Atlantic. The chosen value is comparable to the values used in earlier amendments and is also close, on average, to the value generated in a recent study re-analyzing earlier survey data. It should be noted that the use of a constant value of consumer surplus across all areas and fishing modes does not take into account possible differences in valuation across areas and modes. In addition, the value used is based on an estimate of a unit increase in targeted catch and keep and, thus, may not fully reflect the CS loss when the entire red snapper fishery is closed, or certain areas are closed to snapper grouper fishing. However, because the value and methodology was used consistently across all alternatives, the ability to rank alternatives should not be affected.
- e. Net operating revenue (NOR) – The values of \$128 and \$68, respectively, for charter and headboat NOR per angler trip were used in this amendment. Other estimates are provided by other studies, some higher and others lower. The NOR values used were chosen because they were derived from a study using more recent data collected from a state in the South Atlantic (Dumas et al. 2009). The values used are comparable to the values used in earlier amendments as well as to the values from other studies. In addition, the use of these values as opposed to other values should not affect the ranking of alternatives and the relative distribution of changes in NOR. However, it is noted that the use of these values does not take into account differences in charter and headboat operations by area.
- f. Economic effects – the economic effects of the fishing ban on red snapper in the EEZ and snapper grouper in certain grids were estimated under the assumption that the affected trips would be cancelled. This assumption would rule out the possibility that

anglers may opt to target other species in the affected areas or snapper grouper species in areas that remain open. This assumption, however, should not alter the ranking of alternatives or the distribution of economic effects by area, unless the likelihood of these behaviors differs by alternative.

- g. Period of analysis – although the proposed alternatives would establish management measures that would remain in effect for a number of years until lifted or replaced by other management measures, the estimated economic effects of the alternative prohibitions represent single year, annual effects. As such, they would be expected to re-occur in each subsequent year. However, as the measures remain in effect, anglers and fishing businesses would be expected to adapt to these measures, with anglers learning to target alternative species in the open areas and for-hire operations developing new services or different for-hire experiences to offer, thereby reducing the adverse effects in subsequent years. However, it is noted that some anglers may elect to substitute completely different recreational activities and some fishing businesses may not be able to adequately adapt to the new regulations and survive as viable business operations.
- h. Effects of recent and pending amendments – several amendments have been recently implemented or are in the process of being implemented. The effects of these amendments are not explicitly considered in estimating the economic effects of this current amendment. The overall economic effects of this amendment may be less than described if the effects of these other amendments reduce the baseline of the fishery from that used in this analysis. While such would not affect the cumulative effect of all these amendments, the incremental effect of this amendment would be reduced.

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