Supplement to the Draft Environmental Impact Statement (SDEIS) - Amendment 16 for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region

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Need for Preparing This SDEIS:
To analyze new alternatives not previously considered within the Draft Environmental Impact Statement (DEIS) of Amendment 16 to the Snapper Grouper Fishery Management Plan for the South Atlantic Region

Abstract:
Actions currently contained within the DEIS for Amendment 16 include: (1) Implement measures to end overfishing of gag and vermilion snapper; (2) allow the Regional Administrator to adjust management measures pending the outcome of a new benchmark assessment for vermilion snapper; (3) specify the total allowable catch and define interim allocations for gag and vermilion snapper; (4) update management reference points for gag and vermilion snapper; and (5) reduce bycatch of snapper grouper species.

The Notice of Availability (NOA) for the DEIS was published on April 25, 2008, with a comment period ending June 9, 2008. This supplement to the DEIS provides biological, social, and economic analysis for alternatives not considered in the DEIS. These alternatives were proposed by the South Atlantic Fishery Management Council's (Council) Snapper Grouper Advisory Panel during the Council's June 2008 meeting and address item 1 above. Specifically, the alternatives provide additional options to end overfishing of gag and vermilion snapper. The Council indicated these alternatives were reasonable and should be analyzed.

New Alternatives

GAG

- **Establish a 1,000 pound (gutted weight) gag commercial trip limit** with a fishing year start date of May 1. In addition, during March and April no fishing for and/or possession of the following species would be allowed: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney.
- **Establish a 1,000 pound (gutted weight) gag commercial trip limit** with a fishing year start date of January 1. In addition, during February, March and April

no fishing for and/or possession of the following species would be allowed: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney.

- **South of the Miami-Dade/Monroe County line, no fishing for and/or possession of the following species would be allowed during June 1-December 31:** gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney. No fishing for and/or possession of gag would be allowed year-round south of the Miami-Dade/Monroe County line. Fishing for black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney would be allowed January 1 – May 31 for the Southern region. Note: This alternative would apply to both the recreational and commercial fisheries.

VERMILION SNAPPER

- Manage the vermilion snapper commercial quota with a fishing year beginning May 1 and a 1,000 pound trip limit (gutted weight). Assumes after trip limit is met or after quota met there is no directed catch and incidental catch due to targeting co-occurring species. After quota met, assumed 20% of trips would not be made and fishermen can avoid 20% of vermilion snapper.

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Further information:
The SDEIS and DEIS may be accessed electronically through the South Atlantic Fishery Management Council's Web site at http://www.safmc.net, or the e-Rulemaking Portal at http://www.regulations.gov.

2.1 Description of Alternatives

2.1.1 Gag

2.1.1.1 Management Reference Point Alternatives

Maximum Sustainable Yield (MSY) for Gag
Alternatives are shown because the current definition for MSY is being replaced (Table 2-1). In the future, this will not be an action item unless the Council decides to change how MSY is calculated; the value will be updated from the most recent SEDAR assessment.

Optimum Yield (OY) for Gag
Alternatives are shown because the current definition for OY is being replaced (Table 2-1). In the future, this will not be an action item unless the Council decides to change the way OY is calculated; the value will be updated from the most recent SEDAR assessment.

Table 2-1. MSY and OY alternatives for gag.

Alternatives	Equation	F_{MSY} & F_{OY} Values	MSY & OY Values
Alternative 1 (no action)	MSY equals the yield produced by F_{MSY}. $F_{30\%SPR}$ is used as the F_{MSY} proxy for all stocks. OY equals the yield produced by F_{OY}. $F_{45\%SPR}$ is used as the F_{OY} proxy.	**F_{MSY}** = 0.18* **F_{OY}** = 0.11*	Not specified Not specified
Alternative 2 (preferred)	MSY equals the yield produced by F_{MSY}. MSY and F_{MSY} are defined by the most recent SEDAR. OY equals the yield produced by F_{OY}. If a stock is overfished, F_{OY} equals the fishing mortality rate specified by the rebuilding plan designed to rebuild the stock to SSB_{MSY} within the approved schedule. After the stock is rebuilt, F_{OY} = a fraction of F_{MSY}. Gag are not overfished.	0.237** See subalts. below	1,238,000 lbs gutted weight
Alternative 2a		(F_{MSY})(65%)	1,188,000 lbs gutted weight**
Alternative 2b (preferred)		(F_{MSY})(75%)	1,217,000 lbs gutted weight**
Alternative 2c		(F_{MSY})(85%)	1,230,000 lbs gutted weight**
*Source: Powers 1999 ** Source: Table 36. SEDAR 10 (2007)			

The Council has specified the Minimum Stock Size Threshold (MSST) as the biomass using the formula MSST = (1-M)*SSB_{MSY}. This formula is recommended in the Technical Guidance Document developed by NMFS and represents 1 minus the natural mortality multiplied by the spawning stock biomass at maximum sustainable yield. This value from Table 36 in SEDAR 10 (2007) is 6,816,000 pounds gutted weight (Table 2-2).

Table 2-2. Criteria used to determine the overfished and overfishing status of gag. Source: Tables 36 and 44 in SEDAR 10 (2007).

DETERMINATION	SSB_{2005}	MSST	F_{2004}	MFMT	STATUS
OVERFISHED?	7,470,000	6,816,000			Not Overfished (B_{2005}/MSST = 1.096)
OVERFISHING?			0.310	0.237	Overfishing (F_{2004}/MFMT = 1.309)

2.1.1.2 Gag Total Allowable Catch

The Council's Scientific and Statistical Committee (SSC) recommended the Council restrict harvest to the F_{OY} equal to the yield associated with 75% of F_{MSY}. This would correspond to a total allowable catch (TAC) of 694,000 pounds gutted weight for all sectors in 2008 (Table 2-3).

Table 2-3. Gag total allowable catch (TAC).

Alternatives	TAC (pounds gutted weight)
Alternative 1 (no action)	Do not specify a TAC
Alternative 2 (preferred)	Set the TAC* = 694,000 pounds gutted weight for 2009 onwards based on the yield at F_{OY}.
*Source: SEDAR 10 (2007)	

2.1.1.3 Interim Gag Allocation Alternatives and Resulting Commercial Quota & Recreational Allocation

Alternative 1 (no action). Do not define interim allocations for gag. Status quo based on landings from 2004-2005.

Alternative 2 (preferred). Define interim allocations for gag based upon landings from the ALS, MRFSS, and headboat databases. The allocation would be based on landings from the years 1999-2003. The allocation would be 51% commercial and 49% recreational (Table 2-4). This alternative would establish a commercial quota of 353,940 pounds gutted weight and a recreational allocation of 340,060 pounds gutted weight.

Alternative 3. Define interim allocations for gag based upon landings from the ALS, MRFSS, and headboat databases. The allocation would be based on landings from the years 1986-1998. The allocation would be 66% commercial and 34% recreational (Table 2-4). This alternative would establish a commercial quota of 458,040 pounds gutted weight and a recreational allocation of 235,960 pounds gutted weight.

Alternative 4. Define allocations for gag based upon landings from the ALS, MRFSS, and headboat databases. The allocation would be based on landings from the years 1986-2005. The allocation would be 61% commercial and 39% recreational (Table 2-4). This alternative would establish a commercial quota of 423,340 pounds gutted weight and a recreational allocation of 270,660 pounds gutted weight.

Table 2-4. Commercial quotas and recreational allocations* for gag (pounds gutted weight) based on the TAC associated with the yield at 75% of F_{MSY}.

		Alternative 2 (preferred)		**Alternative 3**		**Alternative 4**	
Year	**Catch Level**	**Comm**	**Rec**	**Comm**	**Rec**	**Comm**	**Rec**
2009 Onwards	694,000	353,940	340,060	458,040	235,960	423,340	270,660

Allocation Alternatives 2-4 are compared to the average 2004-2006 landings in Table 2-5 to determine the percentage reduction to each sector (Table 2-6).

Table 2-5. Historical gag landings.

Gag Landings (gutted weight)				**Total**	**Total**
Year	**Commercial**	**Headboat**	**MRFSS**	**Recreational**	**Landings**
2001	532,000	53,000	455,000	508,000	1,040,000
2002	534,000	51,000	266,000	317,000	851,000
2003	560,000	32,000	519,000	551,000	1,111,000
2004	551,000	82,000	517,000	599,000	1,150,000
2005	568,681	71,736	468,814	540,550	1,109,231
2006	520,824	46,537	425,071	471,608	992,432
Avg 04-06	546,835	66,758	470,295	537,053	1,083,888

Note: 2001-2004 data are from the SSC based on gutted weight in the SEDAR Assessment; 2005 and 2006 data are from ALS and converted to gutted weight.

Table 2-6. Percentage reductions by sector across the alternative gag allocations.

Alternative	**Commercial Reduction**	**Recreational Reduction**
2 (**Preferred**)	35%	37%
3	16%	56%
4	23%	50%

2.1.1.4 Management Alternatives

Alternative 1. No action. **Current Regulations:**

(i) Current gag commercial regulations = 24 inch total length size limit; March & April - no harvest above bag limit & no sale; vessels with longlines may only possess deepwater species; limited entry program with 2 for 1provision.

(ii) Current gag recreational regulations = 24 inch total length size limit; within 5 grouper bag limit only 2 may be gag or black grouper; March & April – no sale.

Alternative 2. Gag Spawning Season Closure. [Note: Old Alternative 2 was split into two sub-alternatives with both being preferred.]

Alternative 2A (Preferred). Establish a gag spawning season closure January through April that applies to the commercial (20% reduction) sector; no fishing for and/or possession of gag would be allowed. In addition, no fishing for and/or possession of the following species would be allowed: black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney.

Alternative 2B (Preferred). Establish a gag spawning season closure January through April that applies to the recreational (31% reduction) sector; no fishing for and/or possession of gag would be allowed. In addition, no fishing for and/or possession of the following species would be allowed: black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney.

Alternative 3. Establish a 1,000 pound gutted weight gag commercial trip limit.

Alternative 3a. Establish a 1,000 pound gag gutted weight commercial trip limit with a fishing year start date of May 1. In addition, during March and April no fishing for and/or possession of the following species would be allowed: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney. **[Note: This is a new alternative.]**

Table 2-7. Commercial quotas associated with allocation alternatives for gag taking into consideration estimate of PQBM.

	Preferred Allocation 2	Allocation Alternative 3	Allocation Alternative 4
Commercial quota	353,940	458,040	423,340
PQBM	5,500	0	0
Directed quota	**348,440**	**458,040**	**423,340**

Notes: **Allocation Alternative 2 is preferred.** PQBM is rounded to the nearest 500 lbs. Weight is in pounds gutted weight. Assumes after trip limit is met or after quota met there is no directed catch and incidental catch due to targeting co-occurring species. After quota met, assumed 20% of trips would not be met and fishermen can avoid 20% of gag. (pounds gw)

Alternative 3b. Establish a 1,000 pound gag commercial trip limit with a fishing year start date of January 1. In addition, during February, March and April no fishing for and/or possession of the following species would be allowed: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney. **[Note: This is a new alternative.]**

Table 2-8. Commercial quotas associated with allocation alternatives for gag taking into consideration estimate of PQBM.

	Preferred Allocation 2	Allocation Alternative 3	Allocation Alternative 4
Commercial quota	353,940	458,040	423,340
PQBM	3,500	0	0
Directed quota	**350,440**	**458,040**	**423,340**

Notes: **Allocation Alternative 2 is preferred.** PQBM is rounded to the nearest 500 lbs. Weight is in pounds gutted weight. Assumes after trip limit is met or after quota met there is no directed catch and incidental catch due to targeting co-occurring species. After quota met, assumed 20% of trips would not be met and fishermen can avoid 20% of gag. (pounds gw)

Alternative 4 (Preferred). Directed Commercial Quota. Establish the following directed quota (quota after Post Quota Bycatch Mortality or PQBM has been subtracted) for 2009 onwards until modified. After the commercial quota is met, all purchase and sale of the following species is prohibited and harvest and/or possession is limited to the bag limit: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney.

Table 2-9. Commercial quotas associated with allocation alternatives for gag taking into consideration estimate of PQBM.

With Jan-April Gag Seasonal Closure			
	Preferred Allocation Alternative 2	Allocation Alternative 3	Allocation Alternative 4
Commercial quota	353,940	458,040	423,340
PQBM	1,000	0	0
Directed quota	**352,940**	**458,040**	**423,340**
With no Jan-April Gag Seasonal Closure			
	Preferred Allocation Alternative 2	Allocation Alternative 3	Allocation Alternative 4
Commercial quota	353,940	458,040	423,340
PQBM	7,000	1,000	1,000
Directed quota	**346,940**	**457,040**	**422,340**

Notes: **Allocation Alternative 2 is preferred.** Different values of PQBM could be used in the future. PQBM is rounded to the nearest 500 lbs. Weight is in pounds gutted weight.

Alternative 4. Divide the directed commercial quota into two regions: Allocate 63.3% to North and South Carolina (223,411 pounds gutted weight) and 36.7% to

Georgia and Florida (129,529 pounds gutted weight). Each region's directed quota (after adjustment for PQBM) would be monitored from state trip ticket and logbook data based on state of landing. After the commercial quota is met in either region, all purchase and sale is prohibited in that region and harvest and/or possession is limited to the bag limit in that region.

Alternative 5. Divide the directed commercial quota into two regions: Allocate 63.3% to North and South Carolina (223,411 pounds gutted weight) and 36.7% to Georgia and Florida (129,529 pounds gutted weight). Each region's directed quota (after adjustment for PQBM) would be tracked by dealer reporting. After the commercial quota is met in either region, all purchase and sale is prohibited in that region and harvest and/or possession is limited to the bag limit in that region. **[Note: This is old Alternative 4 renumbered.]**

Alternative 6. South of the Miami-Dade/Monroe County line, no fishing for and/or possession of the following species would be allowed during June 1-December 31: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney. No fishing for and/or possession of gag would be allowed year-round south of the Miami-Dade/Monroe County line. Fishing for black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney would be allowed January 1 – May 31 for the Southern region. Note: This alternative would apply to both the recreational and commercial fisheries. **[Note: This is a new alternative.]**

Alternative 7. Recreational measures: [Note: This is old Alternative 5 renumbered.]

> **Alternative 7a (Preferred).** Reduce the 5-grouper aggregate bag limit to a 3-grouper aggregate bag limit, reduce the existing bag limit from 2 gag or black grouper (combined) to 1 gag or black grouper (combined) within the grouper aggregate bag limit, and exclude the captain and crew on for-hire vessels from possessing a bag limit for **groupers**. This plus the January through April spawning closure would result in a 36% reduction in harvest.
>
> **Alternative 7b.** Close the month of December to recreational harvest and/or possession of gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney. This alternative would retain the existing 5-grouper aggregate bag limit and 2 gag or black grouper (combined) bag limit. The December through April closure plus the reduction in bag limits would result in a 42% reduction in harvest.

2.1.2 Vermilion Snapper

2.1.2.1 Management Reference Point Alternatives

Maximum Sustainable Yield (MSY) for Vermilion Snapper
Alternatives are shown because the current definition for MSY is being replaced (Table 2-10). In the future, this will not be an action item unless the Council decides to change how MSY is calculated; the value will be updated from the most recent SEDAR assessment.

Optimum Yield (OY) for Vermilion
Alternatives are shown because the current definition for OY is being replaced (Table 2-10). In the future, this will not be an action item unless the Council decides to change the way OY is calculated; the value will be updated from the most recent SEDAR assessment.

The value specified for MSY at equilibrium has not been endorsed by the SSC. OY Values for 65% and 85% F_{MAX} (Alternatives 2a and 2c) were determined using the Baranov equation just as the SSC did to calculate the yield at 75% of F_{MAX}. These MSY and OY values will be modified after the new assessment is completed in 2008.

Table 2-10. MSY and OY alternatives for vermilion snapper.

Alternatives	Equation	F_{MSY} & F_{OY} Values	MSY & OY Values
Alternative 1 (no action)	MSY equals the yield produced by F_{MSY}. $F_{30\%SPR}$ is used as the F_{MSY} proxy for all stocks. OY equals the yield produced by F_{OY}. $F_{40\%SPR}$ is used as the F_{OY} proxy.	$\mathbf{F_{MSY}}$ = 0.35* $\mathbf{F_{OY}}$ = 0.25*	Not specified Not specified
Alternative 2 (preferred)	MSY equals the yield produced by F_{MSY}. MSY and F_{MSY} are defined by the most recent SEDAR. OY equals the yield produced by F_{OY}. If a stock is overfished, F_{OY} equals the fishing mortality rate specified by the rebuilding plan designed to rebuild the stock to SSB_{MSY} within the approved schedule. After the stock is rebuilt, F_{OY} = a fraction of F_{MSY}. The overfished status of vermilion snapper is unknown.	$\mathbf{F_{MSY}}$ = 0.355** See subalts. below	2,699,957 lbs whole weight (2,432,394 lbs gutted weight)
Alternative 2a		(65%)(F_{MSY})	547,887 lbs whole weight** (493,592 lbs gutted weight)

Alternative 2b (preferred)		(75%)(F_{MSY})	628,459 lbs whole weight** (566,179 lbs gutted weight)
Alternative 2c		(85%)(F_{MSY})	692,916 lbs whole weight** (624,249 lbs gutted weight)
*Source: Powers 1999 **Source: Recommendation from SEFSC based on the results from SEDAR Update #3 (2007). OY values represent the current yield at F_{OY} and do not represent OY at equilibrium. F_{MAX} used as a proxy for F_{MSY}. *** The Council's SSC did not endorse the estimate of MSY from the vermilion snapper SEDAR Update #3 (2007). This value would represent the MSY at equilibrium.			

The Council has specified the Minimum Stock Size Threshold (MSST) as the biomass using the formula MSST = (1-M)*SSB_{MSY}. This formula is recommended in the Technical Guidance Document developed by NMFS and represents 1 minus the natural mortality multiplied by the spawning stock biomass at maximum sustainable yield. **This value is unknown at this time given the high level of uncertainty with the biomass values (Table 2-11).** A new age-based stock assessment will be available in late 2008 and that should provide an estimate of the MSST.

Table 2-11. Criteria used to determine the overfished and overfishing status of vermilion snapper.
Source: SEDAR Update #3 (2007).

DETERMINATION	SSB_{CURR}	MSST	F_{CURR} (Average of 2004-2006)	MFMT	STATUS
OVERFISHED?	Unknown	Unknown			Unknown (B_{CURR}/MSST = Unknown)
OVERFISHING?			0.729*	0.355**	Overfishing (F_{CURR}/MFMT = 2.05)
*F_{CURR} represents the geometric mean of the fishing mortality during 2004-2006. ** F_{MAX} is used as a proxy for F_{MSY} as recommended by the SSC for the SEDAR Assessment Update #3 (2007).					

2.1.2.2 Vermilion Snapper Total Allowable Catch

The Council's SSC recommended the Council restrict harvest to the F_{OY} equal to the yield associated with 75% of F_{MSY}. This would correspond to a TAC of 628,459 pounds whole weight (566,179 pounds gutted weight) for all sectors in 2008 (Table 2-12).

Table 2-12. Vermilion snapper total allowable catch (TAC).

Alternatives	TAC
Alternative 1 (no action)	Do not specify a total allowable catch (TAC).
Alternative 2 (preferred)	Set the total allowable catch (TAC) = 628,459 pounds whole weight* (566,179 pounds gutted weight) for 2009 onwards.
*Source: SSC.	

2.1.2.3 Interim Vermilion Snapper Allocation Alternatives and Resulting Commercial Quota & Recreational Allocation

Alternative 1 (no action). Do not define interim allocations for vermilion snapper.
Alternative 2 (preferred). Define interim allocations for vermilion snapper based upon landings from the NMFS landings (ALS), NMFS Marine Recreational Fisheries Statistics Survey (MRFSS), and NMFS headboat databases. The allocation would be based on landings from the years 1986-2005. The allocation would be 68% commercial and 32% recreational. This alternative would establish a commercial quota of 385,002 pounds gutted weight (427,352 pounds whole weight) and a recreational allocation of 181,177 pounds gutted weight (201,107 pounds whole weight).

Allocation Alternative 2 is compared to the average 2004-2005 landings in Table 2-13 to determine the percentage reduction to each sector. The commercial quota represents a 58% reduction from average 2004-06 landings and the recreational allocation represents a 69% reduction from average 2004-06 landings.

Table 2-13. Historical vermilion snapper landings (gutted weight).

Vermilion Snapper Landings (pounds gutted weight)				Total	Total
Year	**Commercial**	**Headboat**	**MRFSS**	**Recreational**	**Landings**
2001	1,515,535	362,718	222,690	585,408	2,100,943
2002	1,228,928	294,094	159,450	453,544	1,682,472
2003	686,586	258,957	187,733	446,690	1,133,276
2004	1,001,297	342,138	247,219	589,357	1,590,654
2005	1,009,300	281,059	244,385	525,444	1,534,744
2006	765,216	362,476	262,328	624,804	1,390,021
Avg 04-06	925,271	328,558	251,311	579,868	1,505,139
Note: 2001 thru 2005 from SEDAR Update #3 (2007).					

Source: ALS, MRFSS Web site; Headboat survey. Data do not include dead discards and MRFSS data are A+B1; weight not converted from numbers.

2.1.2.4 Management Alternatives

Alternative 1. No action. **Current Regulations:**

(i) Current vermilion snapper commercial regulations = 12 inch size limit; commercial quota = 1,100,000 pounds gutted weight (1,221,000 pounds whole weight); vessels with longlines may only possess deepwater species; limited entry program with 2 for 1 provision.

(ii) Current vermilion snapper recreational regulations = 12 inch size limit; 10 vermilion snapper bag limit.

Alternative 2 (Preferred). Directed Commercial Quota. Establish a directed commercial quota (quota after Post Quota Bycatch Mortality or PQBM has been subtracted) based on an interim allocation of 68% commercial and 32% recreational (Table 2-14). After the commercial quota is met, all purchase and sale is prohibited and harvest and/or possession is limited to the bag limit.

Table 2-14. Commercial quota taking into consideration estimate of PQBM.

	Pounds Gutted Weight
Commercial quota	385,002
PQBM	57,000
Directed quota	**328,002**

Alternative 3. Divide the directed commercial quota into the following seasons:

Alternative 3a (Preferred). Allocate the directed commercial quota 50% to the period January 1st through June 30th and 50% to the period July 1st through December 31st (Table 2-15). Any remaining quota from period 1 would transfer to period 2. Any remaining quota from period 2 would not be carried forward.

Table 2-15. Commercial quotas for January-June (50%) and July-December (50%) taking into consideration estimate of PQBM.

	Pounds Gutted Weight
Commercial quota	**385,002**
Jan-June 50%	192,501
PQBM	24,000
Directed quota Jan-June	**168,501**
July-Dec 50%	192,501
PQBM	37,000
Directed quota July-Dec	**155,501**

Alternative 3b. Allocate the directed commercial quota 40% to the period January 1st through June 30th and 60% to the period July 1st through December 31st (Table 2-16). Any remaining quota from period 1 would transfer to period 2. Any remaining quota from period 2 would not be carried forward.

Table 2-16. Commercial quotas for January-June (40%) and July-December (60%) taking into consideration estimate of PQBM.

	Pounds Gutted Weight
Commercial quota	385,002
Jan-June 40%	154,001
PQBM	27,000
Directed quota Jan-June	**127,001**
July-Dec 60%	231,001
PQBM	35,000
Directed quota July-Dec	**196,001**

Alternative 3c. Allocate the directed commercial quota 50% to the period January 1st through August 31th and 50% to the period September 1st through December 31st (Table 2-17). Any remaining quota from period 1 would transfer to period 2 Any remaining quota from period 2 would not be carried forward.

Table 2-17. Commercial quotas for January-August (50%) and September-December (50%) taking into consideration estimate of PQBM.

	Pounds Gutted Weight
Commercial quota	385,002
Jan-Aug 50%	192,501
PQBM	43,000
Directed quota Jan-Aug	**149,501**
Sept-Dec 50%	192,501
PQBM	21,000
Directed quota Sept-Dec	**171,501**

Alternative 4. Manage the commercial quota with a fishing year beginning May 1 and a 1,000 pound trip limit (gutted weight). [Note This is a new alternative]

Table 2-18. Commercial quota (pounds gutted weight) for vermilion snapper. Assumes after trip limit is met or after quota met there is no directed catch and incidental catch due to targeting co-occurring species. After quota met, assumed 20% of trips would not be met and fishermen can avoid 20% of vermilion snapper. (pounds gw)

Commercial quota	385,002
PQBM with trip limit	10,500
PQBM after quota	40,000
Directed quota	**334,502**

Alternative 5. Adjust recreational bag/size limit and establish a recreational closed season; no fishing for and/or possession of vermilion snapper would be allowed during the closed season; and captain crew on for-hire vessels would not be able to retain vermilion snapper. **[Note: This is old Alternative 4 renumbered.] [Note: No change.]**

Alternative 5a. Increase the recreational size limit to 14" total length and reduce the bag limit to 3 vermilion snapper (Total Reduction = 71%).
Alternative 5b. Increase the recreational size limit to 13" total length and reduce the bag limit to 1 vermilion snapper (Total Reduction = 73%).

Alternative 5c. Increase the recreational size limit to 13" total length and reduce the bag limit to 6 vermilion snapper (53% reduction) and close September & October (16% reduction) (Total Reduction = 61%).

Alternative 5d (Preferred). Retain the 12" total length recreational size limit. Reduce the bag limit from 10 to 4 vermilion snapper (45% reduction) and a season closure (no fishing for and/or possession) of October through May 15th (38% reduction) (Total reduction = 66%). Biological Effects of Vermilion Snapper Management Alternatives.

2.1.3 Reduce Bycatch of Snapper Grouper Species

Alternative 1. No Action. Do not require use of venting tools, dehooking devices, and circle hooks to reduce bycatch.

Alternative 2. Reduce recreational and commercial bycatch mortality by requiring the following for a person on board a vessel to fish for snapper grouper species in the South Atlantic EEZ: (a) use of venting and dehooking tools and (b) use of non-offset, non-stainless steel circle hooks when using natural baits to fish for snapper grouper species in one of the following South Atlantic EEZ fisheries:

Alternative 2a. Commercial snapper grouper fishery.
Alternative 2b. Recreational snapper grouper fishery.
Alternative 2c. Both commercial and recreational snapper grouper **[Note: No longer the Council's preferred.]**

Alternative 3 (Preferred). Reduce recreational and commercial bycatch mortality by requiring the following for a person on board a vessel to fish for snapper grouper species in the South Atlantic EEZ: (a) use of venting and dehooking tools. [Note: This is a new alternative.]

2.1.4 Allow NMFS Regional Administrator (RA) to Make Adjustments to Vermilion Snapper Management Measures

Alternative 1. No Action. Do not allow the Regional Administrator (RA) to make adjustments to the management measures based on outcome of new vermilion snapper SEDAR benchmark assessment.

Alternative 2 (Preferred). Allow the NMFS Regional Administrator (RA) to make adjustments to the management measures as specified in Table 2-16 based the on outcome of new vermilion snapper benchmark assessment.

Table 2-19. Commercial and recreational management measures to be employed by NMFS RA based on reduction harvest needed to achieve the yield at F_{OY}. Quota to be divided into two seasons – January-June and July-December. Recreational measures would eliminate captain and crew.

%REDUCTION	COMMERCIAL	RECREATONAL
Alternative 2A. 10%	**QUOTA ALLOCATED BY SEASON**	**12", 10 FISH & NO CLOSURE**
Alternative 2B. 20%	**QUOTA ALLOCATED BY SEASON**	**12", 10 FISH & NO CLOSURE**
Alternative 2C. 30%	**QUOTA ALLOCATED BY SEASON**	**12", 9 FISH & NO CLOSURE**
Alternative 2D. 40%	**QUOTA ALLOCATED BY SEASON**	**12", 9 FISH & NOV-MARCH CLOSURE**
Alternative 2E. 50%	**QUOTA ALLOCATED BY SEASON**	**12", 5 FISH & NOV-MARCH CLOSURE**
Alternative 2F. 60%	**QUOTA ALLOCATED BY SEASON**	**12", 5 FISH & OCT – APRIL CLOSURE**

4.1.5 Gag Management Alternatives

Analysis in Sections 4.1.5.1, 4.1.5.2, 4.1.5.3, and 4.1.5.4 focuses on new alternatives being considered in this SDEIS to end overfishing of gag (Alternatives 3a, 3b, and 6). The complete list of management measures the Council is considering for gag are listed in Section 2.1.1.4 on page 7 of this document. The new alternatives being analyzed for gag are listed below. Analysis of the other alternatives can be found in the Amendment 16 DEIS, which is available at the Council's Web site (http://www.safmc.net/). References for cited literature can be found in the Amendment 16 DEIS.

New Management Measures for Gag in Amendment 16 SDEIS

Alternative 3. Establish a 1,000 pound gutted weight gag commercial trip limit.

Alternative 3a. Establish a 1,000 pound gag gutted weight commercial trip limit with a fishing year start date of May 1. In addition, during March and April no fishing for and/or possession of the following species would be allowed: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney. **[Note: This is a new alternative.]**

Alternative 3b. Establish a 1,000 pound gag commercial trip limit with a fishing year start date of January 1. In addition, during February, March and April no fishing for and/or possession of the following species would be allowed: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney. **[Note: This is a new alternative.]**

Alternative 6. South of the Miami-Dade/Monroe County line, no fishing for and/or possession of the following species would be allowed during June 1-December 31: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney. No fishing for and/or possession of gag would be allowed year-round south of the Miami-Dade/Monroe County line. Fishing for black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney would be allowed January 1 – May 31 for the Southern region. Note: This alternative would apply to both the recreational and commercial fisheries. **[Note: This is a new alternative.]**

4.1.5.1 **Biological Effects of Gag Management Alternatives**

No action **Alternative 1** would retain the current regulations used to manage catches of gag and perpetuate the existing level of risk to protected species. In general, regulations include a commercial size limit, recreational size limit, recreational bag limit, and commercial seasonal closure. In addition, the *Oculina* Bank HAPC is closed to bottom fishing off of the coast of Florida (an area where the species is known to occur). Furthermore, a limited access system is in place.

Quotas, seasonal closures, bag limits, and trip limits are designed to reduce the number of targeted fishing trips or time spent pursuing a species. When properly designed, these types of measures are generally expected to benefit the environment in the short-term and long-term by limiting the extent to which a stock is targeted. However, the extent to which such benefits are realized depends on what extent fishing effort changes or shifts in response to the select management measure. For example, discard mortality can limit the amount by which fishing mortality is reduced if fishermen continue to target co-occurring species after the catch quota or limit has been achieved, or within the closed area. As a result, proposed management measures for gag in Amendment 16 take into consideration dead discards that would be estimated to occur during a seasonal closure, after a quota is met, or after a trip limit is met. In addition, bag limit analyses takes into consideration the expected increase in dead discards as part of the harvest estimation.

Gag are vulnerable to overfishing because they live for at least 26 years, change sex from female to male later in life, and form spawning aggregations at locations known to fishermen. Similar to gag, other grouper species such as scamp, black grouper, and red grouper are slow growing, long lived, and mature at large sizes, which can result in the capture of large numbers of immature fishes. For example, the minimum size for gag (24” TL) is also the size at which 50% of the fish are mature. Although the average size of gag landed by commercial fishermen is greater than 24 inches TL, immature fish are being caught, particularly in the recreational sector.

Some species, including gag, scamp, and black grouper aggregate annually in the same locations to spawn, making them available for fishermen to target and to remove them in

large numbers (Coleman *et al*. 2000). Furthermore, gag and other grouper species are often associated with structure such as live bottom and rocky outcrops, easily recognized with a fathometer and can be repeatedly located with the use of GPS. The largest members of an aggregation are often the most aggressive and may be the first to be removed by fishing gear (Thompson and Monroe 1974; Gilmore and Jones 1992). Because many grouper species (e.g., gag and scamp) are aggregated for only a portion of the year, the sociodemographic factors responsible for sex change are in place for a short period. Therefore, in the presence of heavy fishing pressure, it may not be possible for protogynous species, which form temporary spawning aggregations, to maintain a natural sex ratio since larger males are removed from the population when aggregations are not intact.

Gag and other grouper species are protogynous, functioning first as females and then transforming to males at older ages and larger sizes (McGovern *et al*. 2000). If protogynous fish are removed from the population at small sizes and young ages, the sex ratio can become abnormally skewed because fish are unable to transform into males. During the 1990s, gag off the Southeastern U.S. was exhibiting many of the symptoms of an exploited population including a lower age at first maturity, a decrease in the size at 50% maturity, and a decrease in the percentage of males (McGovern *et al.* 1998; Harris and Collins 2000). Shapiro (1987) suggested sex change is socially mediated in many protogynous species where the cues for sexual transition may be provided by the loss of larger males in a group of fish.

Increased fishing pressure was suggested as a contributing factor in the described life history changes (Harris and Collins 2000). There is some indication from a more recent life history study the status of the population has improved since the 1990s. The SEDAR 10 (2007) stock assessment also suggested despite continued overfishing, the condition of the gag stock has improved since the middle 1990s, perhaps in response to management measures. Despite the apparent improved condition of the stock, gag is experiencing overfishing and the stock assessment indicates gag is approaching an overfished condition. Adverse trends in the size at age, size/age at maturity, size/age at transition, and percentage of males would be expected for gag if status quo regulations are maintained.

Overfishing also can indirectly affect populations of co-occurring species who share the same habitat. For example, the average size at age, size/age at maturity, size/age at transition, and sex ratio of co-occurring species can change as a result of a reduced need to compete for resources and selective removal of individuals by the fishing gear. Gag are taken with vermilion snapper, scamp, red grouper, red porgy, speckled hind, warsaw grouper, and others. When fishing reduces the abundance of conspecifics or other species that share available resources, the remaining fishes have access to more food and habitat, resulting in higher growth rates and larger size at age (Pitcher and Hart 1982, Rothschild 1986). In addition, management measures that reduce harvest of co-occurring species can have positive effects by reducing bycatch.

All the alternatives to status quo management evaluated for gag are intended to end overfishing. As a result, they are expected to directly and significantly benefit the biological environment by assisting in restoring stock status and population demographics to more natural conditions.

Alternative 1 would perpetuate the existing level of risk to protected species. The impacts of Preferred Alternatives 2a and 2b on protected resources are likely to reduce impacts to protected species; however, the extent of those reductions is uncertain. In the event closed seasons reduce snapper-grouper fishing effort, the likelihood of adverse impacts from the fishery occurring to protected species may be reduced. Regardless, current monitoring programs will allow NOAA Fisheries Service to track and evaluate any increased risk to protected species. If necessary, an ESA consultation can be re-initiated to address any increased levels of risk to ESA-listed species.

Alternative 3 Establish a 1,000 pound gutted weight gag commercial trip limit

Alternative 3a. Establish a 1,000 pound gag gutted weight commercial trip limit with a fishing year start date of May 1. In addition, during March and April no fishing for and/or possession of the following species would be allowed: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney.

Table 4-1. Commercial quotas for Alternative 3a associated with allocation alternatives for gag taking into consideration estimate of Post Quota Bycatch Mortality (PQBM).

	Preferred Allocation Alternative 2	Allocation Alternative 3	Allocation Alternative 4
Commercial quota	353,940	458,040	423,340
PQBM	5,500	0	0
Directed quota	**348,440**	**458,040**	**423,340**

Notes: **Allocation Alternative 2 is preferred.** PQBM is rounded to the nearest 500 lbs. Weight is in pounds gutted weight. Assumes after trip limit is met or after quota met there is no directed catch and incidental catch due to targeting co-occurring species. After quota met, assumed 20% of trips would not be made and fishermen can avoid 20% of gag.

Alternative 3b. Establish a 1,000 pound gag commercial trip limit with a fishing year start date of January 1. In addition, during February, March and April no fishing for and/or possession of the following species would be allowed: gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney.

Table 4-2. Commercial quotas for Alternative 3b associated with allocation alternatives for gag taking into consideration estimate of PQBM.

	Preferred Allocation Alternative 2	Allocation Alternative 3	Allocation Alternative 4
Commercial quota	353,940	458,040	423,340
PQBM	3,500	0	0
Directed quota	**350,440**	**458,040**	**423,340**

Notes: **Allocation Alternative 2 is preferred.** PQBM is rounded to the nearest 500 lbs. Weight is in pounds gutted weight. Assumes after trip limit is met or after quota met there is no directed catch and incidental catch due to targeting co-occurring species. After quota met, assumed 20% of trips would not be made and fishermen can avoid 20% of gag.

Alternative 3 would establish a 1,000 pound gutted weight trip limit for gag and would close the commercial fishery for gag and other shallow water groupers (black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney) after a quota was met. There are different quotas associated with **Alternative 3a** (Table 4-1) and **Alternative 3b** (Table 4-2) depending on which allocation alternative the Council selects. Currently the Council's preferred Alternative 2 would allocate 51% of the total allowable catch to the commercial sector and 49% to the recreational sector. Allocation alternatives for gag are discussed in Section 4.1.4 of the DEIS for Amendment 16.

Alternatives 3a and 3b differ in when the fishing year would start and the length of the spawning season closure for gag and other shallow water groupers. Under **Alternative 3a**, gag and shallow water groupers would be closed during March-April but the fishing year would start on May 1. Assuming there would be no decrease in fishing effort, the biological effects of **Alternative 3a** would be similar to **Alternative 2** because it is expected with a May 1 fishing year start date, the quota would be met sometime in December. Therefore, the commercial fishery for gag and other shallow water groupers would likely be closed during January through April.

Off the southeastern United States, gag spawn from December through May, with a peak in March and April (McGovern *et al.* 1998). There is some evidence spawning may occur earlier off Florida than areas north. Gag probably make annual late-winter migrations to specific locations to form spawning aggregations and many of these locations are known by fishermen. McGovern *et al.* (2005) found gag were capable of extensive movement and suggested movement may be related to spawning. Gilmore and Jones (1992) indicated gag may be selectively removed from spawning aggregations because they are the largest and most aggressive individuals and the first to be taken by fishing gear.

In 1998, the Council took action to reduce fishing mortality and protect spawning aggregations of gag and black grouper. Actions included a March-April spawning season closure for the commercial sector. While a March-April commercial closure may offer some protection to spawning aggregations including the selective removal of males, a January-April spawning season closure that could be provided by **Alternative 3a** would provide greater protection. Although gag spawn during December through May, aggregations are in place before and after spawning activity (Gilmore and Jones 1992). Therefore, males can be removed from spawning aggregations early in the spawning season and this could affect the reproductive output of the aggregation if there were not enough males present in an aggregation for successful fertilization of eggs. Therefore, if effort remained at current levels and the gag fishery closed in November or December, then greater protection would be provided to gag spawning aggregations than in the no-action **Alternative 1**. **Alternative 3a** would also close the fishery after a quota is met and during March-April for other shallow water groupers including black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin

grouper, graysby, and coney, which are also known to spawn during January-April (see Section 3.2.1 of Amendment 16).

Like gag, the other shallow water grouper species are vulnerable to overfishing because they change sex, many are long lived, and some species (e.g., gag, black grouper, scamp, red hind, and tiger grouper) are known to form spawning aggregations at locations known to fishermen (Section 3.2.1 of Amendment 16). In addition, gag are taken on trips with other grouper species including scamp and red grouper. Therefore, closures for shallow water grouper species during the spawning season could have positive biological effects including protecting spawning aggregations, increasing the percentage of males, enhancing reproductive success, and increasing the magnitude of recruitment.

During June 2008, the Snapper Grouper Advisory Panel (AP) recommended the Council consider **Alternative 3a**, which would start the fishing year during May 1 rather than January 1 and establish a 1,000 pound gutted weight trip limit. The AP indicated **Alternative 3a** would have economic benefits as it would allow fishermen to fish for gag through January or February if effort decreased due to increased gas prices but would be identical to **Amendment 2** if effort remained at current levels and the quota was met in November or December. The AP's intent of the 1,000 pound gutted weight trip limit is to extend the duration of the fishing year and reduce the market disruption of closing the fishery early. Although logbook data indicate there were few trips that exceeded 1,000 pounds gutted weight of gag, the 1,000 pound gutted weight trip limit could extend the fishing season to some degree. Trip limits have the potential to increase discards if fishermen continue to pursue co-occurring species after achieving the trip limit; however, since logbook data indicate fishermen infrequently land more than 1,000 lbs gutted weight on a trip, few discards would be expected and high grading is not likely. Nevertheless, the quota proposed in **Alternatives 3a and 3b** takes into consideration dead discards that would be estimated to occur during a seasonal closure, after a quota is met, or after a trip limit is met. The Council's SSC refers to increased dead discards associated with new management measures such as trip limits, quotas, or seasonal closures as post quota bycatch mortality (PQBM).

Tables 4-1 and 4-2 provide estimates of dead discards that could occur with a 1,000 lb gutted weight trip limit and after a quota was met. The SSC and Council approved the methodology for determining the magnitude of PQBM at their December 2007 meeting. However, they recommended the Snapper Grouper Advisory Panel (AP) review the methodology to provide an estimate of the number of trips that might not be taken to target snapper grouper species during a closure for vermilion snapper or gag and provide an estimate of the ability of fishermen to avoid vermilion snapper or gag by modifying fishing techniques. The Council and the Council's AP recommended that estimates for PQBM assume that fishing trips, which previously caught gag or vermilion snapper, would be reduced by 20% after a quota is met and fishermen can avoid 20% of the gag or vermilion snapper by using different techniques.

If effort was reduced, the biological benefits of **Alternative 3a** would be less than **Alternative 2** because fishing would be occurring when gag and other shallow water

grouper species are in spawning condition and more vulnerable to fishing gear than during other times of the year. However, the biological benefits of **Alternative 3a** would be greater than the no action **Alternative** 1 because the quota would be reduced and if fishing extended into January and February then, presumably, effort would be reduced resulting in less impact on shallow water grouper stocks than is currently occurring.

Alternative 3b, which would maintain the January 1 start date but close all shallow water groupers during February through April was also suggested by the AP because there were some fishermen who indicated in south Florida, gag are available on a seasonal basis during January. Work conducted by McGovern *et al.* (2005) indicate gag can move large distances from South Carolina and North Carolina to areas off of South Florida presumably to spawn. Therefore, the seasonal appearance of gag off of South Florida could be related to spawning activity. These fish could be vulnerable to capture in large numbers, particularly if they are in aggregations (Gilmore and Jones 1992). As a result, the biological benefits of **Alternative 3b** would be less than **Alternative 2** since gag and other shallow water species in spawning condition could be targeted by commercial fishermen. The biological benefits of **Alternative 3b** would also be less than **Alternative 3a** under the current level of effort since it is anticipated the fishery would close sometime in November or December with the May 1 start date being considered in **Alternative 3a**. However, if effort were to decrease, the biological effects of **Alternatives 3a** and **3b** could be similar.

The biological effects of **Alternatives 3a and 3b** could be different if combined with **Alternative 5**, which would establish regional quotas. **Alternative 5** would allocate 63.3% of the commercial quota to North and South Carolina, and 36.7% to Georgia and Florida. The rationale for having regional quotas is fishermen off Florida could have an advantage and catch part of the quota early in the year when bad weather would prevent fishermen from catching gag off North Carolina and South Carolina. The Council examined monthly gag landings and found the percentage of annual gag landings among states was similar after the proposed January-April spawning season closure (**Alternative 2**) would take place. However, if the fishing year started on January 1, with a February through April closure (**Alternative 3b**), fishermen in Florida could begin catching gag sooner than fishermen off of North Carolina and South Carolina due to better weather conditions. Therefore, under **Alternative 3b** it might be reasonable to combine it with a regional quota to prevent fishermen in Florida and Georgia from catching more than their historic proportion of the quota.

If effort remained at current levels, the biological effects of **Alternative 3a** would be similar to **Alternative 2** since the quota would likely be met in November or December. Therefore, there would be no need to have regional quotas since proportions of gag harvest in Florida, South Carolina, and North Carolina is similar after May 1. However, if fishing of gag continued into January and February, fishermen in Florida could have an advantage in catching a greater proportion of the quota than fishermen in North Carolina and South Carolina, which could warrant combining **Alternative 3a** with **Alternative 5**.

After the commercial quota was met in a particular region, all purchase and sale would be prohibited in that region and harvest and/or possession would be limited to the bag limit in the region. However, there is a chance that harvest could continue in a closed region and gag would be landed in the region where harvest is still allowed. This could result in some localized depletion but would not be expected to negatively affect the population.

Alternative 6. South of the Miami-Dade/Monroe County line, no fishing for and/or possession of the following species would be allowed during June 1-December 31**:** gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney. No fishing for and/or possession of gag would be allowed year-round south of the Miami-Dade/Monroe County line. Fishing for black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney would be allowed January 1 – May 31 for the Southern region. Note: This alternative would apply to both the recreational and commercial fisheries.

The AP asked the Council to consider **Alternative 6** because gag is a minor species in Monroe County, Florida relative to other shallow water grouper species (i.e. black grouper, red grouper). Fishermen indicated they would be willing to forego any gag landings in Monroe County as long as they could fish for other shallow water grouper species during January 1 through May 31.

Commercial landings

Analysis of ALS commercial data for 2003 through 2007 indicates gag made up 1.2 percent of the landings of shallow water grouper species for the Atlantic side of Monroe County, Florida (Table 4-3). Monroe County shallow water grouper landings are dominated by black grouper and red grouper (Table 4-4). Closure of gag for the whole year and other shallow water groupers during June through December would decrease harvest of all shallow water groupers by 46.8 percent in Monroe County, Florida. Some fishing mortality for shallow water grouper species would still be expected when fishermen target co-occurring species; however, since all shallow water grouper species would be closed during June through December, bycatch would be reduced.

Table 4-3. Commercial landings (lbs gutted weight) of gag and other shallow water grouper species from the Atlantic portion of Monroe County, Florida.

Year	Gag Jan-Dec	Other SWG Jan-Dec	Other SWG June-Dec
2003	1,248	220,471	103,397
2004	5,035	369,342	174,783
2005	3,745	312,564	121,958
2006	1,001	112,282	63,795
2007	2,181	110,867	56,869
Average	2,642	225,105	104,160

Table 4-4. Average landings (lbs gutted weight) of shallow water grouper species from the Atlantic portion of Monroe County, Florida during 2003-2007.

Species	Average lbs gw
Black grouper	100,907
Red Grouper	80,523
Scamp	4,657
Gag	2,202
Red Hind	1,309
Yellowfin Grouper	129
Graysby	46
Rock hind	12
Yellowmouth Grouper	4

Because commercial landings of gag are low in Monroe County, a complete closure of the species would only reduce harvest by 0.005 percent when compared to the magnitude of gag landed in the all of the South Atlantic. Relative to the whole South Atlantic, a June through December closure for other shallow water grouper species in Monroe County, Florida would represent a 12.6 percent reduction in harvest of shallow water grouper species in the South Atlantic (Table 4-5).

Table 4-5. Commercial landings (lbs gutted weight) of gag and other shallow water grouper species from South Atlantic including the Atlantic portion of Monroe County, Florida during 2003-2007.

Year	Gag	Other SWG
2003	547,509	801,298
2004	544,288	848,071
2005	563,620	766,067
2006	517,929	747,797
2007	604,212	964,981
Average	555,512	825,643

Headboat Landings

Headboat landings of gag during 2003 through 2007 were generally very small in Monroe County with the exception of 2004 and 2005, averaging 17,447 lbs gutted weight. Landings of other shallow water grouper species were also low and averaged 41,276 lbs gutted weight (Table 4-6). Red grouper, gag, and black grouper are the most abundant shallow water grouper species taken by headboat fishermen in Monroe County, Florida (Table 4-7). Closure of gag for the whole year and other shallow water groupers during June through December would decrease harvest of shallow water groupers by 72.4 percent for the headboat fishery in Monroe County; however, some bycatch mortality of gag and other grouper species would be expected due to incidental catch when targeting. Since all shallow water grouper species would be closed during June through December, bycatch would likely be reduced.

Table 4-6. Headboat landings (lbs gutted weight) of gag and other shallow water grouper species from the Atlantic portion of Monroe County, Florida during 2003-2007.

Year	Gag Jan-Dec	Other SWG Jan-Dec	Other SWG June-Dec
2003	3,536	20,312	12,853
2004	42,248	66,787	42,711
2005	25,834	62,202	34,936
2006	6,165	30,579	20,187
2007	9,452	26,502	14,814
Average	17,447	41,276	25,100

Table 4-7. Average landings (lbs gutted weight) of shallow water grouper species from Monroe County, Florida during 2003-2007.

Species	Total lbs ww	Average lbs gw
Red Grouper	138,278	23,437
Gag	102,937	17,447
Black grouper	70,256	11,908
Rock Hind	13,993	2,372
Scamp	11,223	1,902
Graysby	4,063	689
Yellowmouth Grouper	2,016	342
Yellowfin Grouper	2,010	341
Red Hind	1,328	225
Coney	362	61

Headboat landings of gag throughout the South Atlantic average 59,023 lbs gutted weight during 2003-2007. A complete closure of the gag taken by headboats in Monroe County would reduce harvest of gag by 29.5 percent when compared to gag landed in the all of the South Atlantic. Relative to the whole South Atlantic, a June through December closure for other shallow water grouper species in Monroe County, Florida would represent an 18.6 percent reduction in harvest of shallow water grouper species in the South Atlantic (Table 4-8).

Table 4-8. Headboat landings (lbs gutted weight) of gag and other shallow water grouper species from South Atlantic including Monroe County, Florida.

Year	Gag	Other SWG
2003	27,536	87,860
2004	82,474	162,478
2005	71,737	148,722
2006	46,537	108,863
2007	66,830	165,213
Average	59,023	134,627

MRFSS

MRFSS landings (A+B1) of gag in number of fish retained in Monroe County during 2003 through 2007 averaged 1,875 fish, whereas, landings of other shallow water grouper species averaged 24,350 fish (Table 4-9). Closure of gag for the whole year and other shallow water groupers during June through December would decrease harvest of shallow water grouper by 66.9 percent for the private and charter fishery in Monroe County; however, some bycatch mortality of gag and other grouper species would be expected due to incidental catch when targeting. Since all shallow water grouper species would be closed during June through December, bycatch would likely be reduced. Black grouper and red grouper were the most commonly caught shallow water grouper species during 2003-2007 (Table 4-10).

Table 4-9. MRFSS landings (number A+B1) of gag and other shallow water grouper species from Monroe County, Florida.

Year	Gag Jan-Dec	Other SWG Jan-Dec	Other SWG June-Dec
2003	3,143	41,914	27,725
2004	2,065	27,731	13,573
2005	328	11,988	10,684
2006	1,880	24,202	20,401
2007	1,960	15,916	5,977
Average	1,875	24,350	15,672

Type A - Fishes that were caught, landed whole, or available for identification and enumeration by the interviewers. Type B - Fishes that were caught but were either not kept or not available for identification. Type B1 - Fishes that were caught and filleted, released dead, given away, or disposed of in some way other than Types A or B2. Type B2 - Fishes that were caught and released alive.

Table 4-10. Percentage of shallow water grouper species taken by fishermen (MRFSS) in Monroe County, Florida during 2003-2007. Based on number of fish inspected rather than expanded values.

Species	Percent
Black grouper	49.9%
Red grouper	37.8%
Gag	6.5%
Rock hind	2.6%
Scamp	1.3%
Yellowfin grouper	0.8%
Red hind	0.7%
Yellowmouth grouper	0.2%
Coney	0.1%
Graysby	0.1%

MRFSS landings of gag throughout the South Atlantic averaged 41,695 individuals (A+B1) during 2003-2007. A complete closure of the gag taken by recreational anglers (excluding headboats) in Monroe County would reduce harvest of gag by 4.5 percent

when compared to gag landed in the all of the South Atlantic. Relative to the whole South Atlantic, a June through December closure for other shallow water grouper species in Monroe County, Florida would represent a 21.1 percent reduction in harvest of shallow water grouper species in the South Atlantic (Table 4-11).

Table 4-11. MRFSS landings (lbs gutted weight) of gag and other shallow water grouper species from South Atlantic including Monroe County, Florida.

Year	Gag	Other SWG
2003	42,117	43,411
2004	44,412	61,188
2005	38,157	65,027
2006	36,975	82,685
2007	46,816	119,536
Average	41,695	74,369

While the proposed management measures would represent a substantial reduction in harvest of shallow water grouper species from Monroe County, fishermen could still target shallow water grouper species during January through June when some of the species would be in spawning condition. Black grouper and red grouper dominate commercial and MRFSS catches in Monroe County (Tables 4-4 and 4-10). Species most commonly caught in Monroe County in the headboat fishery are red grouper, gag, and black grouper (Table 4-7). Black grouper, gag, and scamp form spawning aggregations with peak spawning of females occurring from January to March for black grouper and gag (Crabtree and Bullock 1998; McGovern *et al.* 1998). Red grouper do not appear to form spawning aggregations but spawning in the South Atlantic occurs during February-June, with a peak in April (Burgos 2001). Therefore, **Alternative 6** would allow fishermen to harvest black grouper from spawning aggregations making them vulnerable to capture. Further, this alternative would allow capture of red grouper in spawning condition.

Alternatives 2 and 3 would specify different seasonal closures for gag and other shallow water groupers for areas north of Monroe County than those proposed for Monroe County in **Alternative 6**. As a result, there is a chance when shallow water grouper are closed in Monroe County during June through December, fishermen might move north to target grouper species. Similarly, fishermen from areas north might move into Monroe County during January through April when harvest of shallow water grouper species excluding gag, would be allowed in Monroe County but not the rest of the South Atlantic. The degree to which this effort shift is unknown but could result in some localized depletion.

Alternatives 3-7 ultimately seek to alter fishing effort. Therefore, the impacts of these alternatives on protected species will depend on the extent to which these measures reduce fishing effort. If these measures do reduce fishing effort, the likelihood of adverse impacts from the fishery occurring to protected species may be reduced, and these

alternatives may be beneficial to protected species. Regardless, current monitoring programs will allow NOAA Fisheries Service to track and evaluate any increased risk to protected species. If necessary, an ESA consultation can be re-initiated to address any increased levels of risk to ESA-listed species.

4.1.5.2 **Economic Effects of Gag Management Alternatives**

Commercial Sector

The expected economic effects of the new gag management alternatives on the commercial sector were analyzed using NMFS logbook data for 2001-2006. Expected single-year changes in net operating revenues (2005 dollars) for the 2009 fishing year relative to the status quo (baseline) were estimated and are provided in Tables 4-12 through 4-15. Since the changes are single-year, they would be expected to re-occur in subsequent years, as modified by adaptive fishing behavior. Net operating revenues were calculated as trip revenues minus trip costs (e.g., fuel, oil, bait, ice, and other supplies; excludes fixed costs and labor). The analyses generated estimates of economic performance of all vessel trips projected to land at least one pound of gag (Tables 4-12 and 4-14) and trips projected to land at least one pound of any snapper grouper species (SG) (Tables 4-13 and 4-15). Changes in net operating revenues were summarized separately by geographic area (Tables 4-12 and 4-13) and by gear type across all areas (Tables 4-14 and 4-15). Each alternative was evaluated using the alternative 51 percent (**Preferred Alternative 2**), 66 percent (**Alternative 3**), and 61 percent (**Alternative 4**) allocation rates. Because the vertical line sector dominates harvests in the commercial SG fishery, only the geographic area results will be summarized in the following discussion. The geographic area designations indicate where the fish are projected to be landed.

Alternatives 3a and **3b,** which would establish different spawning closures and fishing season start dates, were modeled assuming a single regional quota and a 1,000-lb trip limit (gutted weight). Under these assumptions, **Alternative 3a** (May 1 fishing year start date and March-April spawning closure) is expected to result in an annual reduction in net operating revenues from the status quo of approximately $199,000-$613,000 across the three alternative commercial allocation ratios for trips projected to harvest at least one pound of gag (Table 4-12). The largest reductions in absolute dollars are projected to occur in South Carolina ($108,000-$252,000) and Georgia-Northeast Florida ($45,000-$168,000). In terms of percentage reductions, the Florida Keys (6-29 percent) and Central-South Florida (7-23 percent) are projected to experience the largest reductions in annual net operating revenues. The percentage impacts are calculated by dividing the expected reduction in net operating revenues by the appropriate baseline value. For example, the expected total effect of **Alternative 3a** (51 percent allocation) is a reduction in net operating revenues of $613,000. Compared to the baseline net operating revenues of $4.143 million, **Alternative 3a** is expected to result in a reduction in net operating revenues of approximately 15 percent ($613,000/$4.143 million). Note that the percentage impacts for this alternative and all subsequent alternatives below may not match actual calculations using the numbers reported in the table due to rounding of the results in the tables.

Examining trips projected to harvest at least one pound of SG species (Table 4-13), **Alternative 3a** is expected to result in an annual reduction in net operating revenues from the status quo of approximately $388,000-$737,000 across the three alternative commercial allocation ratios. The largest reductions in absolute dollars are projected to

Table 4-12. Reductions in commercial vessels' net operating revenues due to gag management alternatives, in thousand 2005 dollars, by area, gag trips.

	North Carolina	South Carolina	Georgia and northeast FL	Central and south FL	Florida Keys	Other	Total
Vessel trips landing at least one pound of gag							
Baseline	1,169	1,553	946	456	19	0	4,143
	Single quota, trip limit (1,000 lbs), spawning closure, alternative allocations						
	May 1 start date, March-April closure						
Alt. 3a, 51%	-82	-252	-168	-105	-5	0	-613
Alt. 3a, 66%	-13	-108	-45	-32	-1	0	-199
Alt. 3a, 61%	-18	-127	-56	-39	-2	0	-241
	January 1 start date, February-April closure						
Alt. 3b, 51%	-114	-271	-174	-104	-5	0	-668
Alt. 3b, 66%	-55	-201	-133	-88	-5	0	-482
Alt. 3b, 61%	-56	-202	-133	-89	-5	0	-484
	Regional quotas, trip limit (1,000 lbs), spawning closure, alternative allocations						
	January 1 start date, March-April closure						
Alt. 5a, 51%	-143	-318	-155	-109	-5	0	-730
Alt. 5a, 66%	-18	-120	-67	-49	-1	0	-256
Alt. 5a, 61%	-41	-162	-87	-59	-3	0	-352
	January 1 start date, February-April closure						
Alt. 5b, 51%	-187	-366	-176	-110	-5	0	-843
Alt. 5b, 66%	-55	-201	-133	-88	-5	0	-482
Alt. 5b, 61%	-70	-213	-133	-88	-5	0	-508
	Monroe County Zone, single quota, trip limit (1000 lbs), alternative allocations						
	January-April spawning closure						
Alt. 6a, 51%	-144	-283	-237	-157	-19	0	-839
Alt. 6a, 66%	-117	-235	-214	-149	-19	0	-734
Alt. 6a, 61%	-117	-235	-214	-149	-19	0	-734
	February-April spawning closure						
Alt. 6b, 51%	-113	-270	-174	-104	-19	0	-679
Alt. 6b, 66%	-55	-201	-133	-88	-19	0	-495
Alt. 6b, 61%	-55	-201	-133	-88	-19	0	-496
	March-April spawning closure						
Alt. 6c, 51%	-82	-249	-167	-103	-19	0	-618
Alt. 6c, 66%	-12	-108	-45	-32	-19	0	-215
Alt. 6c, 61%	-18	-125	-55	-38	-19	0	-256

Table 4-13. Reductions in commercial vessels' net operating revenues due to gag management alternatives, in thousand 2005 dollars, by area, snapper grouper trips.

	North Carolina	South Carolina	Georgia and northeast FL	Central and south FL	Florida Keys	Other	Total
Vessel trips landing at least one pound of any snapper grouper species							
Baseline	2,555	2,213	1,352	1,989	2,240	3	10,351
	Single quota, trip limit (1,000 lbs), spawning closure, alternative allocations						
	May 1 start date, March-April closure						
Alt. 3a, 51%	-138	-300	-135	-86	-77	0	-737
Alt. 3a, 66%	-74	-175	-72	-36	-31	0	-388
Alt. 3a, 61%	-81	-191	-78	-41	-39	0	-430
	January 1 start date, February-April closure						
Alt. 3b, 51%	-156	-305	-136	-87	-72	0	-755
Alt. 3b, 66%	-114	-254	-116	-76	-61	0	-621
Alt. 3b, 61%	-115	-256	-116	-76	-62	0	-624
	Regional quotas, trip limit (1,000 lbs), spawning closure, alternative allocations						
	January 1 start date, March-April closure						
Alt. 5a, 51%	-132	-294	-121	-81	-47	0	-675
Alt. 5a, 66%	-76	-181	-80	-44	-30	0	-410
Alt. 5a, 61%	-89	-208	-89	-52	-34	0	-472
	January 1 start date, February-April closure						
Alt. 5b, 51%	-171	-336	-135	-84	-66	0	-794
Alt. 5b, 66%	-114	-254	-116	-76	-61	0	-621
Alt. 5b, 61%	-120	-259	-116	-76	-61	0	-632
	Monroe County Zone, single quota, trip limit (1000 lbs), alternative allocations						
	January-April spawning closure						
Alt. 6a, 51%	-183	-297	-155	-109	-119	0	-864
Alt. 6a, 66%	-166	-262	-145	-104	-119	0	-794
Alt. 6a, 61%	-166	-262	-145	-104	-119	0	-794
	February-April spawning closure						
Alt. 6b, 51%	-156	-304	-135	-86	-119	0	-800
Alt. 6b, 66%	-114	-254	-116	-76	-119	0	-678
Alt. 6b, 61%	-114	-254	-116	-76	-119	0	-679
	March-April spawning closure						
Alt. 6c, 51%	-138	-296	-133	-85	-119	0	-771
Alt. 6c, 66%	-74	-174	-72	-35	-119	0	-474
Alt. 6c, 61%	-81	-190	-78	-41	-119	0	-508

Table 4-14. Reductions in commercial vessels' net operating revenues from various alternatives on gag spawning closure, overall quotas, and regional quotas, in thousand 2005 dollars, by gear type, gag trips.

Model	Diving	Vertical Lines	Longlines	Other Gears	Traps / Pots	Trolling	not recorded	Total
Vessel trips landing at least one pound of gag								
Baseline	486	3,553	35	12	14	43	0	4,143
	Single quota, trip limit (1,000 lbs), spawning closure, alternative allocations							
	May 1 start date, March-April closure							
Alt. 3a, 51%	-94	-500	-6	-4	-2	-7	0	-613
Alt. 3a, 66%	-34	-163	-1	0	0	-1	0	-199
Alt. 3a, 61%	-39	-199	-1	0	0	-1	0	-241
	January 1 start date, February-April closure							
Alt. 3b, 51%	-98	-553	-6	0	-2	-9	0	-668
Alt. 3b, 66%	-76	-394	-6	0	-1	-5	0	-482
Alt. 3b, 61%	-76	-396	-6	0	-1	-5	0	-484
	Regional quotas, trip limit (1,000 lbs), spawning closure, alternative allocations							
	January 1 start date, March-April closure							
Alt. 5a, 51%	-90	-619	-9	0	-3	-9	0	-730
Alt. 5a, 66%	-46	-207	-2	0	0	-1	0	-256
Alt. 5a, 61%	-53	-294	-2	0	0	-2	0	-352
	January 1 start date, February-April closure							
Alt. 5b, 51%	-102	-720	-6	0	-3	-11	0	-843
Alt. 5b, 66%	-76	-394	-6	0	-1	-5	0	-482
Alt. 5b, 61%	-76	-419	-6	0	-1	6	0	-508
	Monroe County Zone, single quota, trip limit (1000 lbs), alternative allocations							
	January-April spawning closure							
Alt. 6a, 51%	-123	-672	-21	-4	-4	-14	0	-839
Alt. 6a, 66%	-111	-582	-21	-4	-3	-12	0	-734
Alt. 6a, 61%	-111	-582	-21	-4	-3	-12	0	-734
	February-April spawning closure							
Alt. 6b, 51%	-98	-560	-10	0	-2	-9	0	-679
Alt. 6b, 66%	-76	-403	-10	0	-1	-5	0	-495
Alt. 6b, 61%	-77	-404	-10	0	-1	-5	0	-496
	March-April spawning closure							
Alt. 6c, 51%	-92	-503	-10	-4	-2	-7	0	-618
Alt. 6c, 66%	-35	-174	-5	0	0	-1	0	-215
Alt. 6c, 61%	-40	-210	-5	0	0	-2	0	-256

Table 4-15. Reductions in commercial vessels' net operating revenues from various alternatives on gag spawning closure, overall quotas, and regional quotas, in thousand 2005 dollars, by gear type, snapper grouper trips.

Model	Diving	Vertical Lines	Longlines	Other Gears	Traps / Pots	Trolling	not recorded	Total
Vessel trips landing at least one pound of snapper grouper								
Baseline	634	8,131	544	388	305	347	3	10,351
	Single quota, trip limit (1,000 lbs), spawning closure, alternative allocations							
	May 1 start date, March-April closure							
Alt. 3a, 51%	-85	-632	-6	-4	0	-10	0	-737
Alt. 3a, 66%	-37	-339	-3	-4	0	-5	0	-387
Alt. 3a, 61%	-43	-375	-3	-4	0	-6	0	-430
	January 1 start date, February-April closure							
Alt. 3b, 51%	-86	-651	-6	-4	1	-10	0	-755
Alt. 3b, 66%	-70	-534	-6	-4	0	-8	0	-621
Alt. 3b, 61%	-70	-537	-6	-4	0	-8	0	-624
	Regional quotas, trip limit (1,000 lbs), spawning closure, alternative allocations							
	January 1 start date, March-April closure							
Alt. 5a, 51%	-76	-582	-5	-4	0	-8	0	-675
Alt. 5a, 66%	-43	-356	-3	-4	0	-5	0	-410
Alt. 5a, 61%	-49	-412	-3	-4	0	-5	0	-472
	January 1 start date, February-April closure							
Alt. 5b, 51%	-81	-693	-6	-4	0	-10	0	-794
Alt. 5b, 66%	-70	-534	-6	-4	0	-8	0	-621
Alt. 5b, 61%	-70	-544	-6	-4	0	-8	0	-632
	Monroe County Zone, single quota, trip limit (1000 lbs), alternative allocations							
	January-April spawning closure							
Alt. 6a, 51%	-111	-729	-11	-3	0	-10	0	-864
Alt. 6a, 66%	-103	-668	-11	-3	0	-9	0	-794
Alt. 6a, 61%	-103	-668	-11	-3	0	-9	0	-794
	February-April spawning closure							
Alt. 6b, 51%	-99	-683	-8	-3	0	-8	0	-800
Alt. 6b, 66%	-85	-576	-8	-3	0	-7	0	-678
Alt. 6b, 61%	-85	-576	-8	-3	0	-7	0	-679
	March-April spawning closure							
Alt. 6c, 51%	-96	-656	-8	-3	0	-8	0	-771
Alt. 6c, 66%	-58	-402	-7	-3	0	-5	0	-474
Alt. 6c, 61%	-62	-431	-7	-3	0	-5	0	-508

occur in South Carolina ($175,000-$300,000) and North Carolina ($74,000-$138,000). In terms of percentage reductions, South Carolina (8-14 percent) and Georgia-Northeast Florida (5-10 percent) are projected to experience the largest reductions in annual net operating revenues.

Alternative 3b (January 1 fishing year start date and February-April spawning closure) is expected to result in an annual reduction in net operating revenues from the status quo of approximately $482,000-$668,000 across the three alternative commercial allocation

ratios for trips projected to harvest at least one pound of gag (Table 4-12). The largest reductions in absolute dollars are projected to occur in South Carolina ($201,000-$271,000) and Georgia-Northeast Florida ($133,000-$174,000). In terms of percentage reductions, the Florida Keys (26-29 percent) and Central-South Florida (19-23 percent) are projected to experience the largest reductions in annual net operating revenues.

Examining trips projected to harvest at least one pound of SG species (Table 4-13), **Alternative 3b** is expected to result in an annual reduction in net operating revenues from the status quo of approximately $621,000-$755,000 across the three alternative commercial allocation ratios. The largest reductions in absolute dollars are projected to occur in South Carolina ($254,000-$305,000) and North Carolina ($114,000-$156,000). In terms of percentage reductions, South Carolina (12-14 percent) and Georgia-Northeast Florida (9-10 percent) are projected to experience the largest reductions in annual net operating revenues.

Alternative 5 (regional quotas for North Carolina+South Carolina and Georgia+Florida) was re-evaluated to examine the effects of regional quotas in tandem with a 1,000-lb trip limit and alternative spawning closures. Although the consideration of regional quotas is listed as a single alternative, the modeling results are categorized for clarity as **Alternative 5a** (March-April spawning closure) and **Alternative 5b** (February-April spawning closure). Under a March-April spawning closure (**Alternative 5a**), regional quota management is projected to result in an annual reduction in net operating revenues from the status quo of approximately $256,000-$730,000 across the three alternative commercial allocation ratios for trips projected to harvest at least one pound of gag (Table 4-12). The largest reductions in absolute dollars are projected to occur in South Carolina ($120,000-$318,000) and Georgia-Northeast Florida ($67,000-$155,000). In terms of percentage reductions, the Florida Keys (8-27 percent) and Central-South Florida (11-24 percent) are projected to experience the largest reductions in annual net operating revenues.

Examining trips projected to harvest at least one pound of SG species (Table 4-13), **Alternative 5a** is expected to result in an annual reduction in net operating revenues from the status quo of approximately $410,000-$675,000 across the three alternative commercial allocation ratios. The largest reductions in absolute dollars are projected to occur in South Carolina ($181,000-$294,000) and North Carolina ($76,000-$132,000). In terms of percentage reductions, South Carolina (8-13 percent) and Georgia-Northeast Florida (6-9 percent) are projected to experience the largest reductions in annual net operating revenues.

Under a February-April spawning closure (**Alternative 5b**), regional quota management is projected to result in an annual reduction in net operating revenues from the status quo of approximately $482,000-$843,000 across the three alternative commercial allocation ratios for trips projected to harvest at least one pound of gag (Table 4-12). The largest reductions in absolute dollars are projected to occur in South Carolina ($201,000-$366,000) and Georgia-Northeast Florida ($133,000-$176,000), though North Carolina is expected to experience a larger reduction than Georgia-Northeast Florida under a 51-

percent allocation of $187,000. In terms of percentage reductions, the Florida Keys (26-29 percent) and Central-South Florida (19-24 percent) are projected to experience the largest reductions in annual net operating revenues.

Examining trips projected to harvest at least one pound of SG species (Table 4-13), **Alternative 5b** is expected to result in an annual reduction in net operating revenues from the status quo of approximately $621,000-$794,000 across the three alternative commercial allocation ratios. The largest reductions in absolute dollars are projected to occur in South Carolina ($254,000-$336,000) and Georgia-Northeast Florida ($116,000-$135,000). In terms of percentage reductions, South Carolina (12-15 percent) and Georgia-Northeast Florida (9-10 percent) are projected to experience the largest reductions in annual net operating revenues.

Similar to **Alternative 5**, although **Alternative 6** (Monroe County, Florida separate management conditions) is presented as a single alternative, its potential effects were evaluated assuming different spawning season closures in the rest of the South Atlantic. As such, the results were summarized for clarity as **Alternative 6a** (January-April spawning closure), **Alternative 6b** (February-April) spawning closure, and **Alternative 6c** (March-April spawning closure). Each alternative also assumed a single regional quota and a 1,000-lb trip limit. Under a January-April spawning closure (**Alternative 6a**), establishing separate management regulations for Monroe County is projected to result in an annual reduction in net operating revenues from the status quo of approximately $734,000-$839,000 across the three alternative commercial allocation ratios for trips projected to harvest at least one pound of gag (Table 4-12). The largest reductions in absolute dollars are projected to occur in South Carolina ($235,000-$283,000) and Georgia-Northeast Florida ($214,000-$237,000). In terms of percentage reductions, the Florida Keys (100 percent) and Central-South Florida (33-34 percent) are projected to experience the largest reductions in annual net operating revenues. It should be noted that the result for the Florida Keys is so dramatic (100 percent reduction in net annual operating revenues) since the prohibition of gag harvests for the whole year would result in no trips landing at least one pound of gag, hence no revenues would be generated by trips meeting this harvest criteria. Vessels that previously harvested gag would still be expected to operate and harvest other species. However, their performance would be reflected, minus customary gag revenues, in the results for trips projected to harvest at least one pound of SG species.

Examining trips projected to harvest at least one pound of SG species (Table 4-13), **Alternative 6a** is expected to result in an annual reduction in net operating revenues from the status quo of approximately $794,000-$864,000 across the three alternative commercial allocation ratios. The largest reductions in absolute dollars are projected to occur in South Carolina ($262,000-$297,000) and Georgia-Northeast Florida ($145,000-$155,000). In terms of percentage reductions, South Carolina (12-13 percent) and Georgia-Northeast Florida (11-12 percent) are projected to experience the largest reductions in annual net operating revenues.

Under a February-April spawning closure (**Alternative 6b**), establishing separate management regulations for Monroe County is projected to result in an annual reduction in net operating revenues from the status quo of approximately $495,000-$679,000 across the three alternative commercial allocation ratios for trips projected to harvest at least one pound of gag (Table 4-12). The largest reductions in absolute dollars are projected to occur in South Carolina ($201,000-$270,000) and Georgia-Northeast Florida ($133,000-$174,000). In terms of percentage reductions, the Florida Keys (100 percent) and Central-South Florida (19-23 percent) are projected to experience the largest reductions in annual net operating revenues.

Examining trips projected to harvest at least one pound of SG species (Table 4-13), **Alternative 6b** is expected to result in an annual reduction in net operating revenues from the status quo of approximately $678,000-$800,000 across the three alternative commercial allocation ratios. The largest reductions in absolute dollars are projected to occur in South Carolina ($254,000-$304,000) and Georgia-Northeast Florida ($116,000-$135,000). In terms of percentage reductions, South Carolina (12-14 percent) and Georgia-Northeast Florida (9-10 percent) are projected to experience the largest reductions in annual net operating revenues.

Under a March-April spawning closure (**Alternative 6c**), establishing separate management regulations for Monroe County is projected to result in an annual reduction in net operating revenues from the status quo of approximately $215,000-$618,000 across the three alternative commercial allocation ratios for trips projected to harvest at least one pound of gag (Table 4-12). The largest reductions in absolute dollars are projected to occur in South Carolina ($108,000-$249,000) and Georgia-Northeast Florida ($45,000-$167,000). In terms of percentage reductions, the Florida Keys (100 percent) and Central-South Florida (8-23 percent) are projected to experience the largest reductions in annual net operating revenues.

Examining trips projected to harvest at least one pound of SG species (Table 4-13), **Alternative 6c** is expected to result in an annual reduction in net operating revenues from the status quo of approximately $474,000-$771,000 across the three alternative commercial allocation ratios. The largest reductions in absolute dollars are projected to occur in South Carolina ($174,000-$296,000) and the Florida Keys ($119,000), though Georgia-Northeast Florida is also projected to experience reductions of $116,000-$135,000. In terms of percentage reductions, South Carolina (8-13 percent) and Georgia-Northeast Florida (5-10 percent) are projected to experience the largest reductions in annual net operating revenues.

Recreational Sector

Alternative 6 would prohibit all harvest of gag in the EEZ south of the Dade/Monroe County, Florida, line from January through May and all harvest of all species in the SWG complex, which includes gag, from June through December. Thus, gag harvests would be prohibited year-round. Headboat harvest data for 2003-2007 were evaluated to examine the relative importance of gag and SWG to the total harvest of all species in by headboats fishing in the South Atlantic off Monroe County. Harvests from headboat

statistical area 12 (vessels ported in Key Largo – Key West) and statistical area 17 (vessels ported on the east coast that fish off the Dry Tortugas) were summarized and used to approximate South Atlantic Monroe County landings. It is noted that these landings do not necessarily capture the full area-fished considerations of the prohibition since they represent all harvests regardless of whether the fish are captured in state water or EEZ waters, nor do they include harvests by vessels ported north of the Monroe County line that travel south and fish off Monroe County, or vessels that are ported in west Florida ports that may fish in the South Atlantic, nor do they support any determination of what part of the harvests by east coast-ported vessels may come from Gulf of Mexico waters. Attributing all harvests to the EEZ will result in overestimation of affected harvests, though the estimates would be appropriate if compatible state regulations were implemented. Not including harvests by vessels ported north of Monroe County that fish off Monroe County or vessels from the west coast that fish in South Atlantic waters will result in an underestimation of affected harvests. Including harvests from Gulf waters by vessels ported in the Atlantic will result in overestimation of affected harvests. In total, the net effect of these over- and underestimations is unknown. Nevertheless, these data represent the best available tabulation of headboat harvest activity in the area. It should also be noted that all data represent landed fish, so the terms "harvests" and "landings" equally represent landed fish and do not include estimates of fish that are caught and released (alive or dead).

On average, over the 2003-2007 fishing years for the months January through May, gag represented less than 1 percent (0.61 percent; approximately 1,100 fish) of total harvests of all species harvested (approximately 179,000 fish) by the headboat sector in Monroe County in terms of numbers of fish landed and approximately 6 percent in terms of landed weight (approximately 14,000 lbs, whole weight, of approximately 239,000 lbs total weight). On an annual basis, gag represents slightly less of total fish harvests (0.47 percent; approximately 1,600 fish of approximately 343,000 total fish) and approximately 5 percent of total landed weight (approximately 21,000 lbs, whole weight, of approximately 449,000 lbs total weight). As a result, for the purpose of this analysis, gag is characterized as a relatively insignificant species to the headboat sector during January-May and generally throughout the year in terms of numbers of fish harvested, but is relatively more important in terms of pounds harvested. For comparison, yellowtail snapper is the most frequently harvested species by these vessels, accounting for approximately 30 percent of all fish harvested and 28 percent of all pounds harvested annually, followed by white grunt (31 percent and 19 percent, respectively) and gray snapper (9 percent and 11 percent, respectively).

For all SWG species, SWG comprised approximately 2.5 percent of all fish landed by South Atlantic Monroe County headboats on average from 2003-2007 for the June-December months (approximately 3,000 fish of approximately 179,000 total fish) and approximately 12.3 percent in total pounds (approximately 18,500 lbs, whole weight, of approximately 239,000 lbs total weight).

Similar information of the same specificity is not available for shore (which would be included if compatible state regulations were adopted though intercepts of shore

harvested SWG in the South Atlantic are minimal, with only approximately 22,000 pounds and 8,000 pounds recorded in 2007 and 2003, respectively, and no landings recorded in 2004-2006), private angler, and charterboat harvests, which are assessed through the Marine Recreational Fisheries Statistics Survey (MRFSS), due to the manner in which the data is collected and tabulated. Specifically, Monroe County data is treated as a common harvest area, i.e., no separation of Gulf of Mexico harvest versus South Atlantic harvest occurs, and all harvests from Monroe County are included in the Gulf of Mexico sub-region. Nevertheless, estimates of Monroe County gag, SWG, and all species harvested were generated for 2003-2007 using MRFSS post-stratification routines by the Southeast Fisheries Science Center (Steve Turner and Vivian Matter, personal communication). It should be noted that since they are post-stratified estimates, these are not official MRFSS estimates and they encompass harvests from both Gulf of Mexico and South Atlantic waters. Further, weight totals do not include weights for all species because the absence of intercept weights prevented the calculation of average weights for all species (this mostly encompassed grunts, ballyhoo, and scad). Hence, the weight estimates should be viewed with caution. Also, the absence of weight estimates for all species will result in an overestimation of the relative importance of gag or SWG to total harvests since the true harvest weight of all fish will be greater than the estimate generated. The extent of this overestimation is unknown.

Over the 2003-2007 fishing years, gag accounted for approximately 0.2 percent of all MRFSS harvests in terms of numbers of fish (approximately 6,000 fish of approximately 3.6 million total fish) and approximately 0.6 percent in terms of pounds harvested (approximately 49,000 lbs, whole weight, of approximately 8.3 million pounds total weight) for January-May. For the entire year, gag accounted for even smaller portions of total harvest, approximately 0.1 percent (approximately 9,000 fish of approximately 7.6 million total fish) and 0.5 percent (approximately 79,000 lbs, whole weight, of approximately 17.5 million lbs total weight), respectively. For SWG over the same fishing years, total SWG harvests (including gag) in June-December accounted for approximately 1.2 percent of total harvests of all species in terms of numbers of fish (approximately 47,000 fish of approximately 4 million total fish), and approximately 4.7 percent in terms of pounds of fish (approximately 432,000 lbs, whole weight, of approximately 9.3 million lbs total weight). For the entire year, SWG accounted for a larger proportion of total harvests, approximately 1.7 percent and 6.4 percent in terms of numbers of fish (approximately 131,000 fish of approximately 7.6 million total fish) and pounds of fish (approximately 1.1 million lbs, whole weight, of approximately 17.5 million lbs total weight), respectively.

These results are consistent with estimates for the entire South Atlantic where SWG accounted for approximately 0.2 percent of total fish landed per year across all South Atlantic states and modes combined (approximately 116,000 fish of approximately 46.8 million total fish) and approximately 2 percent of total pounds landed (approximately 1.1 million lbs, whole weight, of approximately 53.8 million lbs total weight). These ratios remained unchanged for the June-December months. For the charter sector, SWG was relatively more important in terms of numbers of fish landed, accounting for approximately 1.3 percent (approximately 24,000 fish of approximately 1.8 million total

fish), but somewhat less important in terms of pounds landed, approximately 1.8 percent (approximately 200,000 lbs, whole weight, of approximately 11.1 million lbs total weight). SWG were the most important among all sectors for the private sector, accounting for approximately 2.5 percent in terms of pounds landed (approximately 834,000 lbs, whole weight, of approximately 33.1 million lbs total weight), yet still accounting for only 0.3 percent in terms of numbers of fish (approximately 86,000 fish of approximately 25.1 million total fish). It should be noted that recordings of bait fish species, which also tend to be small fish and, thus, have low average weights, are likely more common for the charter and private angler sectors than for headboats, thus inflating the number of fish recorded for these sectors relative to headboat harvests, while potentially depressing average weight totals.

Despite the caveats to the estimates, all these results support a determination that gag harvests year-round and SWG harvests from June-December off Monroe County are relatively minor in terms of numbers of fish harvested, accounting for less than 3 percent of total fish harvested for the headboat sector and likely less than 2 percent for the shore, charter, and private sectors, but somewhat more important in terms of pounds compared, accounting for approximately 12 percent of headboat harvests, but likely less than 5 percent for the shore, charter, and private sectors. As a result of the expected lack of importance of these species relative to the harvest of other species, any economic losses associated with the prohibition of the harvest of these species would be expected to be minimal. Although some individual anglers fishing off Monroe County may target gag and other SWG species, these species are, in general, likely component species of general bottom fishing activities, with snappers the more common expected harvest, such that few trip cancellations, changes in fishing behavior and expenditures would be expected, and any reduction in recreational value would be expected to be minor. Thus, this alternative may be expected to result in minimal adverse economic effects on the recreational sector.

4.1.5.3 **Social Effects of Gag Management Alternatives**

Impacts from this suite of proposed alternatives will vary depending on sector/fishery, the specific alternative, and whether one looks at the short- or long-term impacts.

In general, by ending overfishing and keeping gag at a sustainable status, long-term benefits are expected to accrue to all sectors, commercial, recreational, and the general public. Alternatives differ in how they would allow the stock to arrive at a long-term sustainable status. As a result, each of these alternatives differs in the degree and type of negative short- and long-term impacts imposed on each fishing and non-fishing sector. Below is a more detailed analysis of the negative and positive short-term impacts of the proposed alternatives. Long-term benefits are discussed throughout the analysis but as there are sparse data to analyze long-term effects of management measures on communities, future conditions of communities cannot be predicted with confidence.

Commercial Fishery

While the **No Action Alternative 1** would pose the least short-term negative impacts, the stock assessment indicates the stock cannot sustain the current rate of fishing mortality over time and still provide maximum sustainable yield. If stock status worsened in the future and more restrictive management measures were needed, adverse impacts to the commercial fishing sector and associated communities would be substantial.

Alternative 2a would establish a spawning season closure January through April for the commercial sector. Short-term social impacts would be negative but long-term benefits would accrue from protecting gag during the spawning season.

Alternatives 3a would establish a 1,000 pound gag commercial trip limit with a fishing year start date of May 1 and a March and April closure for gag and other shallow water groupers. Short-term social impacts would be negative but long-term benefits would accrue from preventing overfishing of gag thereby leading to higher, more sustainable catches. This alternative would have less social impact on the commercial fishery relative to **Alternatives 2a and 3b** because in March and April catches are currently limited to the bag limit and no sale is allowed.

Alternatives 3b would establish a 1,000 pound gag commercial trip limit with a fishing year start date of January 1 and a February through April closures for gag and other shallow water groupers. Short-term social impacts would be negative but long-term benefits would accrue from preventing overfishing of gag thereby leading to higher, more sustainable catches. This alternative would have less social impact on the commercial fishery relative to **Alternative 2a** but more than **Alternative 3a** because an additional month would be closed to commercial harvest; during March and April catches are currently limited to the bag limit and no sale is allowed.

Alterative 6 would establish a separate region in Monroe County. This would address many of the social concerns expressed by fishermen in this area. Fishermen in Monroe County report few catches of gag, and this alternative would prohibit any harvest and/or possession of gag year-round while allowing fishing for other shallow water groupers January through May. This alternative would reduce the social stress on fishermen and their families in Monroe County as compared with **Alternatives 2a, 3a, and 3b**. This alternative could be perceived as an inequity by fishermen in other areas if they are not allowed to fish for shallow water groupers. Short-term social impacts would be positive but long-term benefits could be negative if this contributed to continued overfishing of gag thereby leading to more restrictive regulations in the future.

Recreational Fishery

While the **No Action Alternative 1** would pose the least short-term negative impacts, the stock assessment indicates the stock cannot sustain the current rate of fishing mortality over time and still provide maximum sustainable yield. If stock status worsened in the future and more restrictive management measures were needed, adverse impacts to the recreational fishing sector and associated communities would be substantial.

Alternative 2b would establish a spawning season closure January through April for the recreational sector. This would remove a perceived inequity with the current regulations that allow continued recreational fishing during the spawning season closure. However, some in the recreational sector will not be supportive of this change due to the loss of fishing opportunity during this time period. Short-term social impacts would be negative but long-term benefits would accrue from protecting gag during the spawning season.

Alterative 6 would establish a separate region in Monroe County. This would address many of the social concerns expressed by fishermen in this area. Fishermen in Monroe County report few catches of gag, and this alternative would prohibit any harvest and/or possession of gag year-round while allowing fishing for other shallow water groupers January through May. This alternative would reduce the social impacts on recreational fishermen in Monroe County as compared with **Alternative 2b**. This alternative could be perceived as an inequity by fishermen in other areas if they are not allowed to fish for shallow water groupers. Short-term social impacts would be positive but long-term benefits could be negative if this contributed to continued overfishing of gag thereby leading to more restrictive regulations in the future.

General Non-Fishing Public

For the general non-fishing public of the U.S., all the alternatives to status quo offer long-term benefits related to ending overfishing and improving stock status. These alternatives benefit those in the U.S. who derive satisfaction from knowing the marine environment is managed sustainably and is thriving. The U.S. consumer may benefit from potential increased consumption of locally caught fish as the stock recovers.

There is the potential of long-term negative impacts to the general non-fishing public who enjoy coming to the coast to experience a "fishing community," eat locally caught seafood, and enjoy the heritage tourism benefits of many coastal communities. If the infrastructure for commercial fishing in the South Atlantic continues to wane, and the proposed management measures hasten that decline, communities will lose this attraction for their tourist trade, and visitors may have a diminished coastal tourism experience. However, these communities can only be expected to exist and prosper if healthy resources and fisheries also exist. Therefore, ending overfishing of the gag resource, as a component of the marine ecosystem, is essential to the existence and sustenance of these communities.

4.1.5.4 **Administrative Effects of Gag Management Alternatives**

Alternatives 3a and 3b would require standard outreach to the commercial fishing community and coordination with NOAA Fisheries Service office of Law Enforcement. Outreach materials would take the form of fishery bulletins and possible updates to NOAA Fisheries Service Southeast Region's web site. Current regulations would need to be modified to change the fishing year start date to the May 1 fishing year start date under **Alternative 3a.** Regulations would also need to be modified to reflect the

extended spawning season closure (under **Alternative 3b**) to include the month of February in addition to the current seasonal closure months of March and April during which there would be prohibition on fishing for and/or possession of gag and the other shallow water snapper grouper species. Furthermore, ongoing monitoring of the new annual commercial quota would be required (if **Alternative 4 Preferred** under this action is implemented) as it relates to the proposed 1,000 lb gutted weight trip limit. Under this alternative, if the annual quota is met before the beginning of the proposed seasonal closure the fishery would be closed at that time rather than waiting for the seasonal closure to be in effect. Such a closure would be considered routine and would incur a minor impact on the administrative environment due to staff time required to process paperwork to imitate the closure.

Alternative 3a or **3b** discussed above, could be combined with **Alternative 5**, which would split the proposed directed commercial quota under **Alternative 4 (Preferred)** amongst a northern and southern region. If this combination of alternatives were to be implemented the resulting adverse effect on the administrative environment could fall within a rage from moderate to minor dependant upon fishing activity in each region each fishing year. If one region's quota is met before the fixed seasonal closure begins (under **Alternatives 3a** or **3b**) in any given year, the fishery would be closed for that specific region. If the quota is met in each region at different times, but before each seasonal closure begins; the administrative burden, in the form of processing paperwork for the quota closures, would double. If neither region's quota is met before a seasonal closure begins, the administrative burden would be less since fishery participants would only receive notification of the seasonal closure, and not of any additional quota-related closure preceding it.

Currently there is no quota monitoring mechanism in place for gag. In order to monitor the quota throughout the year, each dealer would be required to report the amount of gag purchased on a predetermined basis using a reporting form provided by NOAA Fisheries Service. Reports may be submitted via paper or electronic reporting methods. The dealer reporting requirement portion of the alternative requires compliance with current Paperwork Reduction Act requirements, and therefore adds to the administrative burden of its implementation.

Alternative 6 would require significant coordination between NOAA Fisheries Service Office of Sustainable Fisheries, the Office of Law Enforcement, as well as the Permits Office. In order to enforce provisions related to the creation of a "Southern Region" bounded to the north by the Miami Dade/Monroe County line, some form of permit or new fishing authorization instrument may be necessary to formally designate those fishermen allowed to fish north of the Miami Dade/Monroe County line and those allowed to fish south of it. Otherwise it can be expected that a large number of commercial and/or recreational fishermen located north of the Miami-Dade/Monroe County line would travel to points south of that line in order to fish for shallow water snapper grouper species during the spawning season closure north of the Miami-Dade/Monroe County line. If no special permit were issued for the Southern Region it would stand to reason that anyone located north of the established boundary would be

able to travel south of the boundary and legally fish for species otherwise prohibited in the area north of the proposed boundary during the months of March and April. Such an effort shift could spurn an unsustainable level of fishing for the Southern Region, which may require future management measures be implemented, further adding to the administrative burden.

The creation of a new or renamed permit, as may be needed under this alternative, is a major undertaking by the Permits Office and would require extensive coordination amongst several divisions within NOAA Fisheries. If such a permit was required, it would have to be determined who would qualify for a permit specific to the area south of the Miami Dade/Monroe County line. Then those fishermen would need to be notified of the impending change, along with those fishermen who fish north of the proposed boundary. Next there would need to be a temporary freeze on permit renewal and transfers in the snapper grouper fishery in order to establish the true universe of vessels that qualify for the Southern Region permit. After each qualifying vessel has been identified, a one-time mailing of the new or replacement permit would be conducted by the Permits Office. After a predetermined "effective date" the old permit would no longer be valid when fishing within the Southern Region. It is expected that if **Alternative 6** were implemented and such a permit was established, significant short-term adverse effects would be borne primarily by the Permits Office, and somewhat less significant adverse administrative effects would be borne by the Office of Sustainable Fisheries and the Office of Law Enforcement. Though the administrative burden and cost would be incurred over a very short duration (about three months), enforcement of the boundary and associated take provisions would be ongoing and last the duration of regulations implementing this action.

If this alternative were combined with any other alternative being considered under this action it can be inferred that adverse effects on the administrative environment would likely increase. Administrative impacts from any other alternative could be added to the impacts described under **Alternative 6**.

4.2.5 Vermilion Snapper Management Alternatives

Analysis in Sections 4.2.5.1, 4.2.5.2, 4.2.5.3, and 4.2.5.4 focuses on the new alternative being considered in this SDEIS to end overfishing of vermilion snapper (Alternative 4). Analysis of the other alternatives can be found in Section 2.1.2.4 on page 13 of this document. The new alternatives being analyzed for gag are listed below. Analysis of the other alternatives can be found in the Amendment 16 DEIS, which is available at the Council's Web site (http://www.safmc.net/). References for cited literature can be found in the Amendment 16 DEIS.

New Management Measure for Vermilion Snapper in Amendment 16 SDEIS

Alternative 4. Manage the commercial quota with a fishing year beginning May 1 and a 1,000 pound trip limit (gutted weight).

4.2.5.1 Biological Effects of Vermilion Snapper Management Alternatives

The benchmark SEDAR assessment and the updated SEDAR assessment are based on vermilion snapper lengths. There is uncertainty about the biomass-based conclusions from this length-based assessment, and the SSC has recommended the Council not use these values. The SSC has confidence in the fishing mortality rate values and recommends the Council use those values to reduce harvest and end overfishing. The Council is basing stock status and management decisions on the fishing mortality rate values and not the biomass-based values from the SEDAR Update #3 (2007).

During the scoping process, many individuals commented that what they are seeing on the water does not agree with assessment results. Some individuals believe the vermilion snapper population is in good shape. NOAA Fisheries Service completed aging of otolith samples for vermilion snapper in early 2008, and the SEDAR process is being used to complete a new age-based benchmark assessment by fall 2008.

However, under current law, the Council must move forward based on the information they have in hand (SEDAR Update #3 2007). Section 4.3 of Amendment 16 allows the Regional Administrator to impose less restrictive measures if the new assessment indicates a lower level of reduction or no reduction in harvest is necessary.

Alternative 1 would retain the current regulations used to manage catches of vermilion snapper, perpetuating the existing level of risk to protected species. In general, regulations include a limited access system, a 1.1 million pound gutted weight commercial quota, a 12" total length commercial and recreational minimum size limit, and a 10 fish bag limit. In addition, the *Oculina* HAPC is closed to all bottom fishing off the coast of Florida (an area where vermilion snapper are known to occur).

Limited access systems are designed to limit the type and amount of effort applied to a fishery. Minimum size limits are generally used to maximize the yield of each fish recruited to the fishery and to protect a portion of a stock from fishing mortality. The idea behind maximizing yield is to identify the size that best balances the benefits of harvesting fish at larger, more commercially valuable sizes against losses due to natural mortality. Protecting immature and newly mature fish from fishing mortality provides them increased opportunities to reproduce and replace themselves before they are captured. If the size limit chosen is larger than the size at first reproduction for the species in question, then a sufficient pool of spawners could be retained even if fishing pressure is heavy.

The Science Center conducted an analysis to determine the size limit that maximizes the yield of each fish recruited to the fishery. The analysis indicated that changes in the recreational minimum size limit offer very little changes in yield-per-recruit at F_{MAX}, 65% F_{MAX}, 75% F_{MAX}, and 85% F_{MAX}. Minimum size limits can have detrimental effects on fish stocks because they do not protect the older year classes. Recruitment problems

can occur in a fishery that has fewer age classes than an unfished population. Additionally, minimum sizes encourage the harvest of older, larger fish that have the greatest reproductive potential.

Discard mortality also can limit the amount by which fishing effort and mortality are reduced by limited access systems, trip limits, and minimum size limits if fishermen catch and discard vermilion snapper when targeting co-occurring species. Additionally, the environmental benefits of a closed area management strategy can be reduced or negated if not integrated with some form of control on fishing mortality and effort outside the closed area.

Alternative 1, which retains the status quo management strategy is expected to adversely impact the vermilion snapper stock if results from the vermilion snapper assessment update are correct. Zhao *et al*. (1997) and Zhao and McGovern (1997) report during the middle 1990s, the vermilion snapper stock was exhibiting many of the symptoms of an overexploited population, including a decrease in size at age, possibly caused by fishing pressure. Since these studies were conducted, the Council established a program to limit initial eligibility for the snapper grouper fishery and raised the vermilion snapper recreational size limit to 11" total length in 1999, increased the recreational size limit to 12" total length in 2006, and imposed a 1.1 million pound gutted weight commercial quota. Additionally, the Council recently extended indefinitely the *Oculina* closed area. Although the biological benefits of this area cannot be quantified at this time, evidence indicates there has been an increase in abundance of many species within the area since it was closed (Koenig 2001). Koenig *et al.* (in press) documented the presence of vermilion snapper in the *Oculina* closed area.

These management measures may have reduced fishing mortality (F) during the late 1990s as the SEDAR stock assessment noted a substantial decline in fishing mortality during 1997 and 1998; however, F increased during 1999-2001. The SEDAR Assessment Update #3 (2007) indicates overfishing is still occurring. Such trends are expected to continue if status quo commercial management regulations are maintained, and could have a significant adverse effect on the stocks if allowed to continue indefinitely. The adverse effects of decreasing size and age trends on stock biomass and reproduction, population structure, and the marine ecosystem are described Amendment 13C (SAFMC 2006). However, it must be noted a new age-based benchmark assessment is being conducted for vermilion snapper with a completion date expected in October 2008. Results of the new age-based benchmark assessment could be different from either the SEDAR 2 (2003) benchmark assessment or the 2007 SEDAR Assessment Update, both of which were length based.

All the alternatives to status quo management evaluated for vermilion snapper are intended to reduce fishing mortality. As a result, they are expected to directly and significantly benefit the biological environment by assisting in restoring stock status and population demographics to more natural conditions. The indirect effects of these alternatives on the ecological environment are less certain. Improving the status of the vermilion snapper stock would likely promote more natural ecological functions.

However, competitor, predator, and prey relationships in marine ecosystems are complex and poorly understood.

The snapper grouper ecosystem includes many species which occupy the same habitat at the same time. For example, vermilion snapper co-occur with tomtate, scup, red porgy, white grunt, black sea bass, red grouper, scamp, gag, and others. Therefore, snapper grouper species are likely to be caught when regulated since they will be incidentally caught when fishermen target other co-occurring species. Continued overexploitation of any snapper grouper species may disrupt the natural community structure of the reef ecosystems that support these species. Predator-exploited species could be expected to decrease in abundance in response to a decline of an exploited species. Alternatively, predators would target other species as prey items. Conversely, the abundance of those prey and competitor species of the overexploited species that are not targeted in fisheries (e.g., scup and tomtate) could increase in response to a decline in the abundance of sea bass.

The AP recommended vermilion snapper **Alternative 4** be combined with the May 1 start date and 1,000 lb gutted weight trip limit for the gag commercial fishery. Many snapper grouper fishermen target gag and vermilion snapper fishermen on the same trip and in the same area. Analysis of logbook data indicates gag is the most common species taken on trips where at least one lb whole weight of vermilion snapper was caught (Table 4-16). With a May 1 start date for the vermilion snapper fishing year and a 1,000 lb gutted weight trip limit, it is expected a 334,502 lb gutted weight quota would be met sometime between August and December. Thus, with the current level of effort, gag and vermilion snapper would likely be closed during January through April if the fishing year for both species started on May 1.

A May 1 start date for vermilion snapper and gag could reduce bycatch of both species and benefit gag during its January-April spawning season when it forms aggregations and is particularly vulnerable to capture. In addition, it is anticipated effort would decrease for other snapper grouper species since vermilion snapper and gag are among the top fish targeted by snapper grouper fishermen. Thus, many co-occurring snapper grouper species could benefit from a May 1 start date for both vermilion snapper and gag.

Table 4-16. Species taken on trips when at least 1 pound whole weight of vermilion snapper were taken.

COMMON	Sum	%	Cum
SNAPPER,VERMILION	3,005,272	32.52%	32.52%
GROUPER,GAG	1,031,230	11.16%	43.67%
SCAMP	779,083	8.43%	52.10%
TRIGGERFISH,GRAY	595,067	6.44%	58.54%
AMBERJACK,GREATER	553,829	5.99%	64.53%
GROUPER,RED	490,283	5.30%	69.84%
JACK,ALMACO	407,937	4.41%	74.25%
SNAPPER,RED	326,173	3.53%	77.78%
SEA BASSE,ATLANTIC,BLACK,UNC	231,433	2.50%	80.29%

A May 1 start date would also provide more equitable access among regions to a limited amount of vermilion snapper quota. Weather during winter months can prevent fishermen from northern areas of the South Atlantic from engaging in fishing activities, while fishers to the south generally enjoy greater weather during January through April and can participate in a greater proportion of trips.

Along with the May 1 start date for vermilion snapper, the AP also recommended the Council consider a 1,000 pound gutted weight trip limit. The AP's intent of the 1,000 pound gutted weight trip limit is to extend the duration of the fishing year and reduce the chance of a market disruption from an early closure of the fishery. Logbook data indicate approximately 12% of the trips exceeded 1,000 pounds gutted weight of vermilion snapper; therefore 1,000 pound gutted weight trip limit would be expected to extend the fishing season to some degree. Trip limits have the potential to increase discards if fishermen continue to pursue co-occurring species after achieving the trip limit; however, the quota takes into consideration the increase in dead discards that could be expected to occur with the 1,000 lb gutted weight trip limit (Table 4-17).

Based on data from 2001-2005, the 334,502-lb gutted weight vermilion snapper quota would be achieved sometime between August and December, at which time the fishery would be closed. As a result, the quota could encourage derby conditions, where fishermen compete with each other to catch as many fish as possible before the quota is taken and the fishery is closed for the remainder of the fishing year. Derby fisheries can unnecessarily increase discards by providing participants less flexibility in deciding when, where, and how to fish. Since vermilion snapper are also taken on trips that target gag, scamp, red grouper, and other species some incidental catch could occur after the quota is met. Therefore, the quota might not provide the needed reduction in harvest if dead discards after the quota is met are not accounted for. However, it is likely that fishermen can change fishing methods to decrease the change of hooking vermilion snapper and can avoid "hot spots" where vermilion snapper occur. Furthermore, the directed quota specified in Table 4-17 takes into consideration dead discards that could occur after the quota is met. In addition, a synoptic closure of shallow water grouper species could reduce bycatch and mortality of vermilion snapper.

Table 4-17. Commercial quota (pounds gutted weight) for vermilion snapper. Assumes after trip limit is met or after quota met there is no directed catch and incidental catch due to targeting co-occurring species. After quota met, assumed 20% of trips would not be made and fishermen can avoid 20% of vermilion snapper.

Commercial quota	385,002
PQBM with trip limit	10,500
PQBM after quota	40,000
Directed quota	**334,502**

Alternative 1 would perpetuate the existing level of risk to protected species. Alternatives 2-5 and their sub-alternatives ultimately seek to alter fishing effort. Therefore, the impacts of these alternatives on protected species are uncertain and will depend on the extent to which these measures reduce fishing effort. If these measures do

reduce fishing effort, the likelihood of adverse impacts from the fishery occurring to protected species may be reduced. Regardless, current monitoring programs will allow NOAA Fisheries Service to track and evaluate any increased risk to protected species. If necessary, an ESA consultation can be re-initiated to address any increased levels of risk to ESA-listed species.

4.2.5.2 Economic Effects of Vermilion Snapper Management Alternatives

The expected economic effects of the new vermilion snapper management alternative on the commercial sector were analyzed using NMFS logbook data for 2001-2006. Expected single-year changes in net operating revenues (2005 dollars) for the 2009 fishing year relative to the status quo (baseline) were estimated and are provided in Table 4-18 and Table 4-19. Since the changes are single-year, they would be expected to re-occur in subsequent years, as modified by adaptive fishing behavior. Net operating revenues were calculated as trip revenues minus trip costs (e.g., fuel, oil, bait, ice, and other supplies; excludes fixed costs and labor). Separate analyses were conducted estimating the economic performance of all vessel trips projected to land at least one pound of vermilion snapper and trips projected to land at least one pound of any SG species. Changes in net operating revenues were summarized separately by geographic area (Table 4-18) and by gear type across all areas (Table 4-19). Because the vertical line sector dominates harvests in the commercial SG fishery, only the geographic area results will be summarized in the following discussion. The geographic area designations indicate where the fish are projected to be landed.

Table 4-18. Reductions in commercial vessels' net operating revenues due to vermilion snapper management alternatives, in thousand 2005 dollars, by area.

Model	North Carolina	South Carolina	Georgia and northeast FL	Central and south FL	Florida Keys	Other	Total
628,459-lbs whole weight TAC, 1,000-lb trip limit, May 1 start to fishing year							
Vessel trips landing at least one pound of vermilion snapper							
Baseline	1,560	1,867	1,123	71	26	0	4,646
Alt. 4	-702	-1,028	-772	-45	-11	0	-2,556
Vessel trips landing at least one pound of any snapper grouper species							
Baseline	2,555	2,213	1,352	1,989	2,240	3	10,351
Alt. 4	-463	-631	-549	-13	-4	0	-1,661

Table 4-19. Reductions in commercial vessels' net operating revenues due to vermilion snapper management alternatives, in thousand 2005 dollars, by gear type.

Model	Diving	Vertical Lines	Longlines	Other Gears	Traps / Pots	Trolling	not recorded	Total
628,459-lbs whole weight TAC, 1,000-lb trip limit, May 1 start to fishing year								
Vessel trips landing at least one pound of vermilion snapper								
Baseline	112	4,478	4	9	18	24	0	4,646
Alt. 4	-63	-2,458	-1	-6	-11	-19	0	-2,556
Vessel trips landing at least one pound of any snapper grouper species								
Baseline	634	8,131	544	388	305	347	3	10,351
Alt. 4	-5	-1,654	0	-1	2	-3	0	-1,661

Alternative 4, which would establish a May 1 start to the fishing year and a 1,000-lb (gutted weight) trip limit, was modeled assuming a regional TAC of 628,459 lbs (whole weight) and a 1,000-lb trip limit (gutted weight). Under these conditions, **Alternative 4** is expected to result in an annual reduction in net operating revenues from the status quo of approximately $2.56 million for trips projected to harvest at least one pound of vermilion snapper and approximately $1.66 million for trips projected to harvest at least one pound of SG (Table 4-18). The fact that the reduction in annual net revenues is greater for trips projected to harvest at least one pound of vermilion snapper than for trips projected to harvest at least one pound of SG may seem puzzling. Similar to the analyses of the alternative gag management measures, these results reflect the expected performance of trips that are projected to harvest at least one pound of the focus species.

The vermilion snapper measures are projected to result in a greater reduction in trips projected to harvest at least one pound of vermilion snapper than the reduction in trips projected to harvest at least one pound of SG. For the analysis of trips projected to harvest at least one pound of vermilion snapper, the economic contributions (associated with all harvested species) of a trip projected to lose all vermilion snapper would be completely deducted from the baseline for vermilion snapper trips (since no vermilion snapper harvest would occur, the trip would no longer be included in trips that harvested vermilion snapper). However, the harvest of other SG, despite losing vermilion snapper harvests and revenues, may allow a trip to continue to be profitable and, thus, continue to be counted in the results for SG trips.

The largest reductions in absolute dollars as a result of **Alternative 4** are projected to occur in South Carolina, $1.03 million and $631,000, and Georgia-Northeast Florida, $772,000 and $549,000 for gag trips and SG trips, respectively. In terms of percentage reductions, Georgia-Northeast Florida is expected to experience the largest reductions in annual net operating revenues for both gag and SG trips, 69 percent and 41 percent, respectively, with Central-South Florida expected to experience the second largest reduction for gag trips, 63 percent, and South Carolina the second largest reduction for SG trips, 29 percent.

4.2.5.3 Social Effects of Vermilion Snapper Management Alternatives

Impacts from this suite of proposed alternatives will vary depending on sector/fishery, the specific alternative, and whether one looks at the short- or long-term impacts.

In general, by ending overfishing and keeping vermilion snapper at a sustainable status, long-term benefits are expected to accrue to all sectors, commercial, recreational, and the general public. Alternatives differ in how they would allow the stock to arrive at a long-term sustainable status. As a result, each of these alternatives differs in the degree and type of negative short- and long-term impacts imposed on each fishing and non-fishing sector. Below is a more detailed analysis of the negative and positive short-term impacts of the proposed alternatives. Long-term benefits are discussed throughout the analysis but as there are sparse data to analyze long-term effects of management measures on communities, future conditions of communities cannot be predicted with confidence.

Commercial Fishery

While the **No Action Alternative 1** would pose the least short-term negative impacts, the stock assessment indicates the stock cannot sustain the current rate of fishing mortality over time and still provide maximum sustainable yield. If stock status worsened in the future and more restrictive management measures were needed, adverse impacts to the commercial fishing sector and associated communities would be substantial.

Alternative 4 sets a commercial trip limit of 1,000 pounds (gutted weight) and a fishing year beginning May 1. This alternative would slow development of a derby fishery, which not only poses a safety hazard (less boat maintenance, continuing to fish in bad weather, more stress and less sleep lead to more accidents) for fishermen, but deteriorates any sense of community between fishermen as they must compete tirelessly against each other to get their historical catch. Therefore, this alternative will have positive short- and long-term social impacts by addressing some of the negative social impacts of a derby fishery.

General Non-Fishing Public

For the general non-fishing public of the U.S., all the alternatives to status quo offer long-term benefits related to ending overfishing and improving stock status. These alternatives benefit those in the U.S. who derive satisfaction from knowing the marine environment is managed sustainably and is thriving. The U.S. consumer may benefit from potential increased consumption of locally caught fish as the stock recovers.

There is the potential of long-term negative impacts to the general non-fishing public who enjoy coming to the coast to experience a “fishing community,” eat locally caught seafood, and enjoy the heritage tourism benefits of many coastal communities. If the infrastructure for commercial fishing in the South Atlantic continues to wane, and the proposed management measures hasten that decline, communities will lose this attraction for their tourist trade, and visitors may have a diminished coastal tourism experience. However, these communities can only be expected to exist and prosper if healthy

resources and fisheries also exist. Therefore, ending overfishing of the snowy grouper resource, as a component of the marine ecosystem, is essential to the existence and sustenance of these communities.

4.2.5.4 Administrative Effects of Vermilion Snapper Management Alternatives

Alternative 4 would incur similar administrative effects as **Alternative 3a** under Management Alternatives for gag, and as is the case with gag, would only be germane if a directed quota alternative is implemented. **Alternative 4** would require standard outreach to the commercial fishing community and coordination with NOAA Fisheries Service office of Law Enforcement. Outreach materials would take the form of fishery bulletins and possible updates to NOAA Fisheries Service Southeast Region's web site. Current regulations would need to be modified to change the fishing year start date to the May 1 fishing year start date. Furthermore, ongoing monitoring of the new annual commercial quota would be required (if **Alternative 2 Preferred** under this action is implemented) as it relates to the proposed 1,000 pound gutted weight trip limit. Under this alternative, once the annual commercial quota is met, fishing for and/or possession of vermillion snapper by a commercial vessel would be prohibited. Such a closure would be considered routine and would incur a minor impact on the administrative environment due to staff time required to process paperwork to imitate the closure. No significant administrative impacts would be expected under these management alternatives since a quota monitoring system is currently in place, and outreach and coordination efforts would create a minimal administrative burden.

4.6 Cumulative Effects

As directed by NEPA, federal agencies are mandated to assess not only the indirect and direct impacts, but the cumulative impacts of proposed actions as well. NEPA defines a cumulative impact as *"the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time"* (40 C.F.R. 1508.7). Cumulative effects can either be additive or synergistic. A synergistic effect is when the combined effects are greater than the sum of the individual effects.

Various approaches for assessing cumulative effects have been identified, including checklists, matrices, indices, and detailed models (MacDonald 2000). The Council on Environmental Quality (CEQ) offers guidance on conducting a Cumulative Effects Analysis (CEA) in a report titled "Considering Cumulative Effects under the National Environmental Policy Act". The report outlines 11 items for consideration in drafting a CEA for a proposed action.

1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.
2. Establish the geographic scope of the analysis.
3. Establish the timeframe for the analysis.
4. Identify the other actions affecting the resources, ecosystems, and human communities of concern.
5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stress.
6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds.
7. Define a baseline condition for the resources, ecosystems, and human communities.
8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.
9. Determine the magnitude and significance of cumulative effects.
10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.
11. Monitor the cumulative effects of the selected alternative and adapt management.

This CEA for the biophysical environment will follow a modified version of the 11 steps. Cumulative effects for the socio-economic environment will be analyzed separately.

4.6.1 Biological

SCOPING FOR CUMULATIVE EFFECTS

1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.

The CEQ cumulative effects guidance states that this step is done through three activities. The three activities and the location in the document are as follows:

I. The direct and indirect effects of the proposed actions **(Section 4.0)**;
II. Which resources, ecosystems, and human communities are affected **(Section 3.0)**; and
III. Which effects are important from a cumulative effects perspective **(information revealed in this CEA)**?

2. Establish the geographic scope of the analysis.

The immediate impact area would be the federal 200-mile limit of the Atlantic off the coasts of North Carolina, South Carolina, Georgia and east Florida to Key West. Since the boundaries are solely political in nature and do not prohibit immigration and emigration of fish, and fish larvae, the geographic scope of the CEA must be expanded. Tagging work conducted by the MARMAP program indicates that there is movement of species (i.e. gag and greater amberjack) between the Gulf of Mexico and South Atlantic (McGovern and Meister 1999; McGovern *et al.* 2005). Large-scale movement of vermilion snapper and other species has not been documented (McGovern and Meister

1999). However, vermilion snapper and shallow water grouper species (red grouper, red hind, rock hind, yellowmouth grouper, tiger grouper, black grouper, yellowfin grouper, graysby, coney, and scamp) have pelagic eggs and larvae that may remain in the water column for extended periods of time and travel long distances before late stage larvae or juveniles assume a demersal existence.

In light of the available information, the extent of the boundaries would depend upon the degree of fish immigration/emigration and larval transport, whichever has the greatest geographical range. The CEA cannot put geographical boundaries in terms of coordinates, but recognize that the proper geographical boundary to consider effects on the biophysical environment is larger than the entire South Atlantic EEZ. The ranges of affected species are described in Section 3.2. The most measurable and substantial effects would be limited to the South Atlantic region.

3. Establish the timeframe for the analysis.

Establishing a timeframe for the CEA is important, when the past, present, and reasonably foreseeable future actions are discussed. It would be advantageous to go back to a time when there was a natural, or some modified (but ecologically sustainable) condition. However, data collection, for many fisheries began when species were already fully exploited. Therefore, the timeframe for analyses should be initiated when data collection began for the various fisheries. In determining how far into the future to analyze cumulative effects, the length of the effects will depend on the species and the alternatives chosen. Gag is not overfished by biomass is less than B_{MSY}. Ending overfishing and fishing at a fishing mortality associated with OY will allow biomass to increase to at least B_{MSY}. The overfished status of vermilion snapper is unknown. However, if the stock is overfished, biomass would be expected to increase and positive changes in the size and age structure would be expected to increase. Long-term evaluation is needed to determine if management measures have the intended effect of improving stock status. Therefore, analyses of effects should extend beyond the time when these overfished stocks are rebuilt. Monitoring should continue indefinitely for all species to ensure that management measures are adequate for preventing overfishing in the future.

4. Identify the other actions affecting the resources, ecosystems, and human communities of concern (the cumulative effects to the human communities are discussed in Section 4).

Listed are other past, present, and reasonably foreseeable actions occurring in the South Atlantic region. These actions, when added to the proposed management measures, may result in cumulative effects on the biophysical environment.

I. Fishery-related actions affecting vermilion snapper, gag, and shallow water grouper.

A. Past

The reader is referred to **Section 1.3 History of Management** for past regulatory activity for the fish species. These include bag and size limits, spawning season closures (gag), commercial quotas (vermilion snapper),

gear prohibitions and limitations, area closures, and a commercial limited access system.

B. Present

The proposed actions would address overfishing of vermilion snapper and gag. Management measures for the commercial sector would include new or adjusted: sector specific allocations, catch quotas; size limits; trip limits; seasonal closures; fishing year start dates; and gear restrictions. Management measures for the recreational sector would include new or adjusted: catch allocations; bag limits; size limits; and seasonal closures.

C. Reasonably Foreseeable Future

Amendment 14 would use marine protected areas (MPAs) as a management tool to promote the optimum size, age, and genetic structure of slow growing, long-lived deepwater snapper grouper species (speckled hind, snowy grouper, warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, blueline tilefish, and sand tilefish).

Amendment 17 would establish Annual Catch Limits (ACL) for snapper grouper species undergoing overfishing and for recently assessed species. Other actions that would be included in Amendment 17 include: (1) SFA parameters for red snapper, greater amberjack, and mutton snapper; (2) interim allocations (if Comprehensive Allocation Amendment is not finalized); (3) management measures to limit recreational and commercial sectors to their ACLs; (4) accountability measures; (5) an action to remove species from the fishery management unit as appropriate; and (6) extend snapper grouper management regulations into the Mid-Atlantic Fishery Management Council's jurisdiction.

Snapper Grouper Amendment 18 is being developed to establish a limited access privilege program for snapper grouper species. In addition, a Comprehensive Allocation Amendment is being developed to address allocation of catch for species covered by the Council's FMPs.

II. Non-Council and other non-fishery related actions, including natural events affecting snowy grouper, golden tilefish, vermilion snapper, black sea bass, and red porgy.

A. Past

B. Present

C. Reasonably foreseeable future

In terms of natural disturbances, it is difficult to determine the effect of non-Council and non-fishery related actions on stocks of vermilion snapper, gag, and shallow water groupers. Annual variability in natural conditions such as water temperature, currents, food availability, predator abundance, etc. can affect the abundance of young fish, which survive the egg and larval stages each year to become juveniles (i.e. recruitment). This

natural variability in year class strength is difficult to predict as it is a function of many interactive and synergistic factors that cannot all be measured (Rothschild 1986). Furthermore, natural factors such as storms, red tide, cold water upwelling, etc. can affect the survival of juvenile and adult fishes; however, it is very difficult to quantify the magnitude of mortality it may have on a stock. Gag occur in estuarine areas along the southeastern United States (Robins and Ray 1986; Heemstra and Randall 1993). Alteration of estuarine habitats could affect survival of juveniles. However, estimates of the abundance of fish, which utilize this habitat, as well as determining the impact habitat alteration may have on juveniles is problematic.

AFFECTED ENVIRONMENT

5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stresses.

In terms of the biophysical environment, the resources/ecosystems identified in earlier steps of the CEA are the fish populations directly or indirectly affected by the regulations. This step should identify the trends, existing conditions, and the ability to withstand stresses of the environmental components.

The SEDAR stock assessment indicates gag biomass is 94% of the biomass at MSY (B_{MSY}) and is approaching an overfished condition. Overfishing is occurring with $F/F_{MSY} = 1.3$. Gag are vulnerable to overfishing because they live for at least 26 years, change sex from female to male later in life, and form spawning aggregations at locations known to fishermen. During the 1990s, gag off the Southeastern U.S. was exhibiting many of the symptoms of an exploited population. Harris and Collins (2000) reported a lower age at first maturity and a significant increase in the observed mean length at age in the South Atlantic gag population in 1994-95 in comparison with data from 1976-82. Increased fishing pressure was suggested as a contributing factor in the described life history changes (Harris and Collins 2000). During the same period McGovern *et al.* (1998) found the sex ratio decreased from 19.6% males in 1976-82, to 5.5% males in 1994-95. The size at 50% maturity also declined in the later period.

There is some indication from a more recent life history study the status of the population has improved since the 1990s. Reichert and Wyanski (2005) found size at maturity during 2004-05 occurred at significantly larger sizes than during 1994-95. Age at maturity also increased since 1994-95, albeit less dramatically than for size at maturity. The percentage of males and individuals undergoing transition in the population increased from 5.5% in 1994-95 to 8.2%; however, the current percentage is still much lower than the revised estimate of 19.4% for samples collected during 1976-82. Sex transition has occurred at progressively larger sizes and younger ages since 1977-82, a trend that is also probably related to the increasing growth rates over time.

The SEDAR 10 (2007) stock assessment also suggested despite continued overfishing, the condition of the gag stock has improved since the middle 1990s, perhaps in response to management measures. A substantial decline in fishing mortality has occurred since 1990 with a second decline occurring after 1998 when the minimum size limit was

increased to 24 inches TL and a two-month commercial spawning season closure was put into place.

The recent SEDAR assessment update (2007) determined the vermilion snapper stock in the South Atlantic is undergoing overfishing. The SSC, in June 2007, recommended the Council not adopt the biomass and yield benchmarks used to determine whether the stock is overfished, as they were deemed unreliable for management purposes.

Commercial landings of vermilion snapper rose from 743,000 to 954,000 lbs whole weight during 1992 to 1995. Landings declined to 718,000 lbs whole weight followed by a large increase to 1,682,000 lbs whole weight in 2001. A sharp decline in landings to 760,000 lbs whole weight occurred in 2003 followed by a modest increase to 1,095,000 lbs whole weight in 2004. Landings decreased further in 2005. The CPUE of vermilion snapper taken with MARMAP trapping gear showed similar trends to commercial landings with an increase during 1994-1996 from 5.8 to 6.2 fish caught per hour followed by a decrease to 2.2 fish caught per hour in 1999. CPUE increased to 4.7 fish caught per hour in 2001 with a sharp decrease in 2003 to 0.35 fish per trap hour, the lowest value recorded since 1988. Low CPUE in 2003, as well as low commercial catches, was probably due to a prolonged cold-water upwelling event. A slight increase in CPUE occurred in 2004 and 2005-2006 values were similar to 2004. Headboat CPUE increased during 1992-2002, decreased in 2003 and then increased again during 2004-2006 (SEDAR assessment update 2007).

Zhao *et al*. (1997) and Zhao and McGovern (1997) report during the middle 1990s, the vermilion snapper stock was exhibiting many of the symptoms of an overexploited population, including a decrease in size at age, possibly caused by fishing pressure. Since these studies were conducted, the Council established a program to limit initial eligibility for the snapper grouper fishery and raised the vermilion snapper recreational size limit to 11" total length in 1999, increased recreational size limit to 12" total length in 2006, and imposed a 1.1 million pound gutted weight commercial quota. Additionally, the Council recently extended indefinitely the *Oculina* closed area. Although the biological benefits of this area cannot be quantified at this time, evidence indicates there has been an increase in abundance of many species within the area since it was closed (Koenig 2001).

Some of these management measures may have reduced fishing mortality (F) during the late 1990s as the SEDAR stock assessment noted a substantial decline in fishing mortality during 1997 and 1998; however, F increased during 1999-2001. The SEDAR assessment update (2007) indicates overfishing is still occurring. Such trends are expected to continue if status quo commercial management regulations are maintained, and could have a significant adverse effect on the stocks if allowed to continue indefinitely. The adverse effects of decreasing size and age trends on stock biomass and reproduction, population structure, and the marine ecosystem are described Amendment 13C (2006). A new benchmark assessment is being conducted for vermilion snapper with a completion date expected in late 2008. Results of the new age-based benchmark

assessment could be different from either the SEDAR 2 (2003) benchmark assessment or the 2007 SEDAR Assessment Update, both of which were length based.

6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds concern.

This step is important in outlining the current and probable stress factors to gag and vermilion snapper identified in the previous steps. The goal is to determine whether these species are approaching conditions where additional stresses could have an important cumulative effect beyond any current plan, regulatory, or sustainability threshold (CEQ 1997). Sustainability thresholds can be identified for some resources, which are levels of impact beyond which the resources cannot be sustained in a stable state. Other thresholds are established through numerical standards, qualitative standards, or management goals. The CEA should address whether thresholds could be exceeded because of the contribution of the proposed action to other cumulative activities affecting resources.

Fish populations

Definitions of overfishing and overfished for gag and vermilion snapper are identified in Amendment 11 to the Snapper Grouper FMP (SAFMC 1998d). Numeric values of thresholds overfishing and overfished thresholds are being updated in this amendment. These values includes maximum sustainable yield (MSY), the fishing mortality rate that produces MSY (F_{MSY}), the biomass or biomass proxy that supports MSY (B_{MSY}), the minimum stock size threshold below which a stock is considered to be overfished (MSST), the maximum fishing mortality threshold above which a stock is considered to be undergoing overfishing (MFMT), and optimum yield (OY). Based on these definitions, gag is approaching an overfished condition (SEDAR 10 2007). The overfished condition of vermilion snapper is unknown due to uncertainties associated with biomass estimates; however, the stock is experiencing overfishing. A new benchmark assessment is being conducted for vermilion snapper, which could provide biomass estimates and update fishing mortality values.

7. Define a baseline condition for the resources, ecosystems, and human communities concern.

The purpose of defining a baseline condition for the resource and ecosystems in the area of the proposed action is to establish a point of reference for evaluating the extent and significance of expected cumulative effects. The SEDAR assessments show trends in biomass, fishing mortality, fish weight, and fish length going back to the earliest periods of data collection. For some species such as gag and snowy grouper, assessments reflect initial periods when the stocks were above B_{MSY} and fishing mortality was fairly low. However, some species such as vermilion snapper and black sea bass were heavily exploited or possibly overfished when data were first collected. As a result, the assessment must make an assumption of the biomass at the start of the assessment period thus modeling the baseline reference points for the species.

DETERMINING THE ENVIRONMENTAL CONSEQUENCES OF CUMULATIVE EFFECTS

8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.

The relationship between human activities and biophysical ecosystems within the context of this CEA is solely related to extractive activities and the installment of regulations as outlined in Table 4-60.

Table 4-60. The cause and effect relationship of fishing and regulatory actions within the time period of the Cumulative Effects Analysis (CEA).

Time period/dates (Table 4-60)	Cause	Observed and/or Expected Effects
1960s-1983	Growth overfishing of many reef fish species.	Declines in mean size and weight of many species including black sea bass.
August 1983	8" total length black sea bass; 4" trawl mesh (SAFMC 1983).	Protected youngest spawning age classes.
Pre-January 12, 1989	Habitat destruction, growth overfishing of vermilion snapper.	Damage to snapper grouper habitat, decreased yield per recruit of vermilion snapper.
January 1989	Trawl prohibition to harvest fish (SAFMC 1988).	Increase yield per recruit of vermilion snapper; eliminate trawl damage to live bottom habitat.
Pre-January 1, 1992	Overfishing of many reef species including vermilion snapper, and gag.	Spawning stock ratio of these species is estimated to be less than 30% indicating that they are overfished.
January 1992	Prohibited gear: fish traps south of Cape Canaveral, FL; entanglement nets; longline gear inside of 50 fathoms; powerheads and bangsticks in designated SMZs off SC; 10" total length vermilion snapper (recreational only); 12" total length vermilion snapper and red grouper (commercial only); 10 vermilion snapper/person/day, aggregate grouper bag limit of 5/person/day, 20" TL gag size limit (SAFMC 1991).	Protected smaller spawning age classes of vermilion snapper.
Pre-June 27, 1994	Damage to *Oculina* habitat.	Noticeable decrease in numbers and species diversity in areas of *Oculina* off FL
June 1994	Prohibition of fishing for and retention of snapper grouper species (HAPC renamed OECA; SAFMC	Initiated the recovery of snapper grouper species in OECA.

Time period/dates (Table 4-60)	Cause	Observed and/or Expected Effects
	1994)	
1992-1999	Declining trends in biomass and overfishing continue for a number of snapper grouper species including vermilion snapper and gag.	Spawning potential ratio for vermilion snapper and gag is less than 30% indicating that they are overfished.
June 24, 1999	Gag: 24" total length (recreational and commercial); 2 gag or black grouper bag limit within 5 grouper aggregate; March-April commercial closure. Vermilion snapper: 11" total length (recreational). Aggregate bag limit of no more than 10 fish/person/day (1998c).	F for gag vermilion snapper remains declines but is still above F_{MSY}.
October 23, 2006	Snapper Grouper FMP Amendment 13C.	Commercial quota set at 1.1 million lbs gutted weight; recreational size limit increased for 12" TL.
In development	Snapper Grouper FMP Amendment 14.	Use marine protected areas (MPAs) as a management tool to promote the optimum size, age, and genetic structure of slow growing, long-lived deepwater snapper grouper species (speckled hind, snowy grouper, warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, blueline tilefish, and sand tilefish).
In development	Snapper Grouper FMP Amendment 17.	SFA parameters for red snapper, greater amberjack, and mutton snapper; interim allocations (if Comprehensive Allocation Amendment is not finalized); management measures to limit recreational and commercial sectors to their ACLs; accountability measures; an action to remove species from the fishery management unit as appropriate; and extend snapper grouper management regulations into the Mid-Atlantic Fishery Management Council's jurisdiction.
In development	Snapper Grouper FMP Amendment 18	Limited Access Privilege Program for the Snapper Grouper Fishery.
In development	Comprehensive ACL Amendment.	ACLs and accountability measures for species not experiencing overfishing.
In development	Comprehensive Allocation	Sector specific allocation for species in

Time period/dates (Table 4-60)	Cause	Observed and/or Expected Effects
	Amendment.	Council's FMPs.

9. Determine the magnitude and significance of cumulative effects.

Current management actions, as summarized in Section 2 in the Amendment 16 DEIS, should reduce fishing mortality in gag and vermilion snapper and are expected to have a beneficial, cumulative effect on the biophysical environment. These management actions are expected to increase stock biomass, which may affect other stocks. Because gag, and to a certain extent, vermilion snapper are upper level predators preying primarily on fish, benthic invertebrates, and squid, the degree of competition for food resources between these species and other co-occurring species may increase as stock abundance increases. In addition, gag, red porgy, vermilion snapper, black sea bass, greater amberjack, red snapper, white grunt and other co-occurring species may begin to compete for habitat as they increase in abundance.

Restrictions in the catch of gag and vermilion snapper could result in fishermen shifting effort to other species. The snapper grouper ecosystem includes many species that occupy the same habitat at the same time. For example, vermilion snapper and gag co-occur with tomtate, scup, red porgy, white grunt, red grouper, scamp, and others. Therefore, restricted species are likely to still be caught since they will be incidentally caught when fishermen target other co-occurring species. Continued overexploitation of any snapper grouper species could disrupt the natural community structure of the reef ecosystems that support these species. However, some fishermen may choose to use different gear types and target species in different fisheries such as mackerel and dolphin.

Complex models are needed to better understand competition between resources and the effect of effort shifting of fishermen to other species and fisheries. The Council is working with a number of partners to develop an Ecopath model for the South Atlantic ecosystem. Full development of this model will assist in better understanding these linkages. The Council is also developing an Ecosystem FMP that will address the cumulative effects of management regulations, fishing effort, and biomass of all species in the marine ecosystem. Delaying implementation of proposed actions until these tools are completed could adversely affect gag and vermilion snapper. However, although the cumulative effects of proposed actions cannot be quantified, it is expected that the effects will be positive and synergistic.

10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.

The cumulative effects on the biophysical environment are expected to be positive. Avoidance, minimization, and mitigation are not applicable.

11. Monitor the cumulative effects of the selected alternative and modify management as necessary.

The effects of the proposed action are, and will continue to be, monitored through collection of data by NMFS, stock assessments and stock assessment updates, life history studies, and other scientific observations.

4.6.2 Socioeconomic

A description of the human environment, including a description commercial and recreational snapper grouper fisheries and associated key fishing communities is contained in Section 3.4 of the Amendment 16 DEIS and incorporated herein by reference. A description of the history of management of the snapper grouper fishery is contained in Section 1.3 of the Amendment 16 DEIS and is incorporated herein by reference. Participation in and the economic performance of the fishery have been effected by a combination of regulatory, biological, social, and external economic factors. Regulatory measures have obviously affected the quantity and composition of harvests, through the various size limits, seasonal restrictions, trip or bag limits, and quotas. Gear restrictions, notably fish trap and longline restrictions, have also affected harvests and economic performance. The limited access program implemented in 1998/1999 substantially affected the number of participants in the fishery. Biological forces that either motivate certain regulations or simply influence the natural variability in fish stocks have played a role in determining the changing composition of the fishery. Additional factors, such as changing career or lifestyle preferences, stagnant to declining prices due to imports, increased operating costs (gas, ice, insurance, dockage fees, etc.), and increased waterfront/coastal value leading to development pressure for other than fishery uses have impacted both the commercial and recreational fishing sectors.
Given the variety of factors that affect fisheries, persistent data issues, and the complexity of trying to identify cause-and-effect relationships, it is not possible to differentiate actual or cumulative regulatory effects from external cause-induced effects. For each regulatory action, expected effects are projected. However, these projections typically only minimally, if at all, are capable of incorporating the variety of external factors, and evaluation in hindsight is similarly incapable of isolating regulatory effects from other factors, as in, what portion of a change was due to the regulation versus due to input cost changes, random species availability variability, the sale of a fish house for condominium development, or even simply fishermen behavioral changes unrelated to the regulation. In general, it can be stated, however, that the regulatory environment for all fisheries has become progressively more complex and burdensome, increasing, in tandem with other adverse influences, the pressure on economic losses, business failure, occupational changes, and associated adverse pressures on associated families, communities, and industries. Some reverse of this trend is possible and expected. The adoption of limited access privilege programs would allow a simplified regulatory environment since trip or seasonal restrictions may no longer be needed and effort issues should be addressed by internal access-rights transfer, while rebuilding plans and the recovery of stocks would allow harvest increases. However, certain pressures would remain, such as total effort and total harvest considerations, increasing input costs, import induced price pressure, and competition for coastal access.

A detailed description of the expected social and economic impacts of the actions in this amendment are contained elsewhere in Section 4, and in Sections 5 and 6 of the Amendment 16 DEIS, and is incorporated herein by reference. The greatest potential substantive adverse impact of any of the proposed measures is likely associated with the proposed prohibition on recreational sales (see Section 5.5.4).

Current and future amendments are expected to add to this cumulative effect. Snapper Grouper Amendment 14 would restrict fishing at a series of MPA sites. The expected economic impacts of these MPAs are unknown since available data cannot identify the incidence or magnitude of harvests from these areas, not is it possible to forecast how fishing behavior or harvests may change to compensate for these restrictions. In the short term, some additional economic losses may occur as a result of this amendment, but in the long term, the stocks are expected to benefit from this increased protection, with spill-over benefits to the fishery.

Snapper Grouper Amendment 15A specifies management reference points and status determination criteria for snowy grouper, red porgy, and black sea bass; rebuilding schedules for snowy grouper and black sea bass; and rebuilding strategies for snowy grouper, red porgy, and black sea bass. The management reference points, status determination criteria, and rebuilding schedules are not expected to have direct economic or social impacts. The reference point and status determination criteria actions, however, may precipitate future impacts if the resources are evaluated and it is determined that further restrictions on the fisheries are required. The rebuilding schedules also induce indirect impacts by determining the pace of recovery and the overall restrictiveness of measures required to recover the resource, since the faster the recovery period the greater harvest must be restricted. The rebuilding strategies define the annual yield during the recovery period. Although in general yield increases over the course of the recovery period and net cumulative benefits increase across the fisheries, initial yield reductions at the beginning of the recovery periods are likely to have short term adverse impacts on some participants or sectors of the fisheries, thereby increasing the general cumulative burden.

Snapper Grouper Amendment 16 (this amendment) will address overfishing in the gag and vermilion snapper fisheries. The expected impacts of this action have not been determined at this time because the Council has not specified preferred alternatives for all actions. Preliminary analyses are presented in Section 4 of the Amendment 16 DEIS. The corrective action in response to overfishing always requires harvest reductions and more restrictive regulation. Thus, additional short-term social and economic impacts would be expected. These restrictions are expected to prevent the stocks from becoming overfished, which would require recovery plans, further harvest restrictions, and additional social and economic losses.

Snapper Grouper Amendment 17 is expected to contain a number of actions addressing general snapper grouper sector overages, annual catch limits and accountability measures for species experiencing overfishing, and the deepwater snapper grouper fishery. The full suite of actions and alternatives for this amendment has not been determined at this time.

While these actions would be expected to aid long-term protection and recovery efforts for snapper grouper, these actions are likely to increase the regulatory burden for some segments of the fishery, with associated increased short term economic and social hardships for fishery participants and associated industries and communities.