AMENDMENT 17A
to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region
and
Draft Environmental Impact Statement

February 2010

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ABBREVIATIONS AND ACRONYMS

ABC	Acceptable biological catch
ACCSP	Atlantic Coastal Cooperative Statistics Program
ACL	Annual Catch Limits
AM	Accountability Measure
ACT	Annual Catch Target
APA	Administrative Procedures Act
ASMFC	Atlantic States Marine Fisheries Commission
B	A measure of stock biomass in either weight or other appropriate unit
B_{MSY}	The stock biomass expected to exist under equilibrium conditions when fishing at F_{MSY}
B_{OY}	The stock biomass expected to exist under equilibrium conditions when fishing at F_{OY}
B_{CURR}	The current stock biomass
CEA	Cumulative Effects Analysis
CEQ	Council on Environmental Quality
CFMC	Caribbean Fishery Management Council
CPUE	Catch per unit effort
CRP	Cooperative Research Program
CZMA	Coastal Zone Management Act
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFH-HAPC	Essential Fish Habitat - Habitat Area of Particular Concern
EIS	Environmental Impact Statement
ESA	Endangered Species Act of 1973
F	A measure of the instantaneous rate of fishing mortality
$F_{30\%SPR}$	Fishing mortality that will produce a static SPR = 30%.
$F_{45\%SPR}$	Fishing mortality that will produce a static SPR = 45%.
F_{CURR}	The current instantaneous rate of fishing mortality
F_{MSY}	The rate of fishing mortality expected to achieve MSY under equilibrium conditions and a corresponding biomass of B_{MSY}
F_{OY}	The rate of fishing mortality expected to achieve OY under equilibrium conditions and a corresponding biomass of B_{OY}
FEIS	Final Environmental Impact Statement
FMP	Fishery management plan
FMU	Fishery management unit
FONSI	Finding of No Significant Impact
GFMC	Gulf of Mexico Fishery Management Council
IFQ	Individual fishing quota
M	Natural mortality rate
MARFIN	Marine Fisheries Initiative
MARMAP	Marine Resources Monitoring Assessment and Prediction Program
MBTA	Migratory Bird Treaty Act

MFMT	Maximum Fishing Mortality Threshold
MMPA	Marine Mammal Protection Act of 1972
MRFSS	Marine Recreational Fisheries Statistics Survey
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
NEPA	National Environmental Policy Act of 1969
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuary Act
NOAA	National Oceanic and Atmospheric Administration
OFL	Overfishing Limit
OY	Optimum Yield
PQBM	Post Quota Bycatch Mortality
PSE	Percent Standard Error
R	Recruitment
RFA	Regulatory Flexibility Act
RIR	Regulatory Impact Review
SAFE Report	Stock Assessment and Fishery Evaluation Report
SAMFC	South Atlantic Fishery Management Council
SDDP	Supplementary Discard Data Program
SEDAR	Southeast Data Assessment and Review
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
SFA	Sustainable Fisheries Act
SIA	Social Impact Assessment
SPR	Spawning Potential Ratio
SSC	Scientific and Statistical Committee
TAC	Total allowable catch
TL	Total length
T_{MIN}	The length of time in which a stock could rebuild to B_{MSY} in the absence of fishing mortality
USCG	U.S. Coast Guard

AMENDMENT 17A TO THE FISHERY MANAGEMENT PLAN FOR THE SNAPPER GROUPER FISHERY OF THE SOUTH ATLANTIC REGION

INCLUDING A DRAFT ENVIRONMENTAL IMPACT STATEMENT, INITIAL REGULATORY FLEXIBILITY ANALYSIS, DRAFT REGULATORY IMPACT REVIEW AND DRAFT SOCIAL IMPACT ASSESSMENT/FISHERY IMPACT STATEMENT

Proposed actions:	Specify a rebuilding plan for red snapper. Implement a red snapper monitoring program, and require use of circle hooks.
Lead agency:	FMP Amendment – South Atlantic Fishery Management Council EIS - NOAA Fisheries Service
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ABSTRACT

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) instructs the Regional Fishery Management Councils and NOAA Fisheries Service to prevent overfishing while achieving optimum yield (OY) from each fishery. When it is determined a stock is undergoing overfishing, measures must be implemented to end overfishing. In cases where stocks are overfished, the Councils and NOAA Fisheries Service must implement rebuilding plans. **The most recent assessment for the red snapper stock in the South Atlantic indicates that the stock is experiencing overfishing and is overfished (SEDAR 15, 2008). A new benchmark assessment for red snapper is scheduled to be completed in December 2010.** The **purpose** of Amendment 17A to the Snapper Grouper Fishery Management Plan (FMP) is to implement long-term management measures expected to end overfishing of the red snapper stock in the South Atlantic immediately upon implementation and to rebuild the stock ultimately achieving optimum yield (OY) while minimizing, to the extent practicable adverse social and economic effects.

Current regulations for red snapper allow for a recreational bag limit of 2 fish per person per day and require a 20" total length minimum size limit for both commercial and recreational fishermen. Through Amendment 17A, the Council is proposing the implementation of a *total prohibition of red snapper*. However, a total prohibition of the fishery alone will not end overfishing because red snapper will still experience bycatch mortality as fishermen pursue other co-occurring species in the snapper grouper complex. The red snapper stock is part of the multi-species fishery; many species occupy the same habitat at the same time. For example, red snapper co-occur with vermilion snapper, tomtate, scup, red porgy, white grunt, black sea bass, red grouper, scamp, and others. This is a significant issue as release mortality rates for red snapper are estimated at 40% for the recreational fishery and 90% for the commercial fishery (due to deeper waters fished and handling practices).

Due to the nature of the fishery and the high release mortality rates, Amendment 17A also includes alternatives that would prohibit the harvest of *all snapper grouper species* in certain areas in addition to a prohibition of red snapper throughout the exclusive economic zone (EEZ). The alternatives for the closed areas focus on locations where concentrated landings of red snapper are reported, primarily off the coasts of Georgia and the north and central east coasts of Florida.

The Council and NOAA Fisheries Service is considering a range of options in Amendment 17A. In general, the positive effects to the stock and ecosystem are greatest with the largest closures and lowest annual catch limits. In turn, negative socio-economic effects increase with such trends. However, there are long-term socio-economic effects from a rebuilt stock. As with any fishing regulations, the economic issue involves the balancing of short-term costs and long-term benefits. There is a wide gag between the current landings (approximately 440 thousand pounds) and potential landings for a rebuild stock (approximately 2.2 million pounds), which has at least two implications.

First, more stringent management measures are needed to rebuild the red snapper stock. Second, there appears a relatively high likelihood that future benefits from the fishery would outweigh the costs of implementing stringent management measures.

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SUMMARY

Background

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) instructs the Regional Fishery Management Councils and NOAA Fisheries Service to prevent overfishing while achieving optimum yield (OY) from each fishery. When it is determined a stock is undergoing overfishing, measures must be implemented to end overfishing. In cases where stocks are overfished, the Councils and NOAA Fisheries Service must implement rebuilding plans.

The most recent assessment for the red snapper stock in the South Atlantic indicates that the stock is experiencing overfishing and is overfished (SEDAR 15, 2008). A new benchmark assessment for red snapper is scheduled for 2010.

Purpose and need of the proposed action

The *purpose* of Amendment 17A to the Snapper Grouper Fishery Management Plan (FMP) is to implement long-term management measures expected to end overfishing of the red snapper stock in the South Atlantic immediately upon implementation, and to rebuild the stock to ultimately achieving optimum yield (OY) while minimizing to the extent practicable adverse social and economic effects.

The *need* for the action is to allow the stock to increase in biomass in order to maximize its reproductive potential so that the population may produce the optimum yield (OY). OY, the ultimate goal of any fishery management plan, is the portion of the fish stock that provides the greatest economic, social, and ecological benefit to the nation.

Description of Alternatives

There are five categories of actions in Amendment 17A:

(1) Maximum sustainable yield proxy for red snapper
(2) Red snapper rebuilding plan
    a. Rebuilding schedule
    b. Rebuilding strategy and optimum yield
(3) Red snapper management measures
(4) Require the use of circle hooks
(5) Establish a red snapper monitoring program

1. Maximum Sustainable Yield Proxy for Red Snapper

Table S-1. MSY and MSY proxy alternatives for red snapper.

Alternatives	**Equation**	**F_{MSY}**	**MSY Values (lbs whole weight)**
Alternative 1 (Status quo)	MSY equals the yield produced by $F_{MSY.}$ $F_{30\%SPR}$ is used as the F_{MSY} proxy.	$F_{30\%SPR}$[1]= 0.148[2]	2,431,000[3]
Alternative 2 (Preferred)	MSY equals the yield produced by F_{MSY} or the F_{MSY} proxy. MSY and $F_{40\%SPR}$ are recommended by the most recent SEDAR/SSC.[4]	$F_{40\%SPR}$= 0.104[2]	2,304,000[5]

[1]Prior to SEDAR 15 (2008), Potts et al. (2001) estimated $F_{30\%SPR}$= 0.40.
[2]Source: Red Snapper Projections V dated March 19, 2009
[3]The value for MSY was not specified in Amendment 11. Based on SEDAR 15 (2008) $F_{30\%SPR}$ = 0.148; yield at $F_{30\%SPR}$ = 2,431,000 lbs whole weight (Table 4.1 from Red Snapper Projections V dated March 19, 2009).
[4]The Review Panel from SEDAR and the SSC recommended a proxy of $F_{40\%SPR}$ for $F_{MSY.}$
[5]The values for MSY and $F_{40\%\ SPR}$ are defined by Red Snapper Projections V dated March 19, 2009. The range of MSY from sensitivity runs is 559,000 lbs whole weight to 3,927,000 lbs whole weight.

2. Red snapper rebuilding plan

a. Rebuilding schedule

Table S-2. Rebuilding schedule alternatives for red snapper.

Alternative	Year One	Time Period Allowed by Law	Years to Rebuild to Goal (SSB_{MSY})
Alternative 1 (Status Quo)	Do not implement a rebuilding plan		
Alternative 2	2010	Shortest (15 years)	2024
Alternative 3	2010	Mid-point (25 years)	2034
Alternative 4 (Preferred)	**2010**	**Longest (35 years)**	**2044**

b. Rebuilding strategy, optimum yield, and accountability measures

Table S-3. Rebuilding strategy alternatives for red snapper.

Alternative	F_{OY} Equal To	ACL in Year 1 of Rebuilding (2010)[1]		OY at Equilibrium (lbs whole weight)
		Sub-Alt. A	Sub-Alt. B	
Alternative 1 (Status Quo)	$F_{45\%SPR}$	Not specified		2,196,000
Alternative 2	$85\%F_{40\%SPR}$	0	89,000	2,199,000
Alternative 3	$75\%F_{40\%SPR}$	0	79,000	2,104,000
Alternative 4	$65\%F_{40\%SPR}$	0	68,000	1,984,000
Alternative 5 (Preferred)	**$97\%F_{40\%SPR}$**	**0**	**101,000**	**2,291,000**
Alternative 6	$85\%F_{30\%SPR}$	0	125,000	2,392,000
Alternative 7	$75\%F_{30\%SPR}$	0	111,000	2,338,000
Alternative 8	$65\%F_{30\%SPR}$	0	97,000	2,257,000
Alternative 9	$98\%F_{30\%SPR}$	0	144,000	2,464,000

[1]For alternative 2-9, the ACL specified for 2010 would remain in effect beyond 2010 until modified.

Alternatives 2-9 all contain the following accountability measures.

(1) Track CPUE of red snapper via a fishery-independent monitoring program (see Section 2.5) to track changes in biomass and take action to end overfishing if assessment indicates progress is not being made.
(2) Track the biomass and CPUE through fishery-dependent sampling as proposed in Section 2.5.
(3) The Council would evaluate the size of the area closures when the dead discards are estimated to exceed the ACL. CPUE would be evaluated every three years and adjustments would be made by the framework action being developed in Amendment 17B.

3. Red snapper management measures

Current regulations for red snapper allow for a recreational bag limit of 2 fish per person per day and require a 20” total length minimum size limit for both commercial and recreational fishermen. Through Amendment 17A, the Council is proposing the implementation of a *total prohibition of red snapper* **(Alternative 2)**. However, a closure of the fishery will not end overfishing because red snapper will still experience bycatch mortality as fishermen pursue other species in the snapper grouper complex. The red snapper stock is part of the multi-species fishery; many species occupy the same habitat at the same time. For example, red snapper co-occur with vermilion snapper, tomtate, scup, red porgy, white grunt, black sea bass, red grouper, scamp, and others. This is a significant issue as release mortality rates for red snapper are estimated at 40% for the recreational fishery and 90% for the commercial fishery (due to deeper waters fished and handling practices).

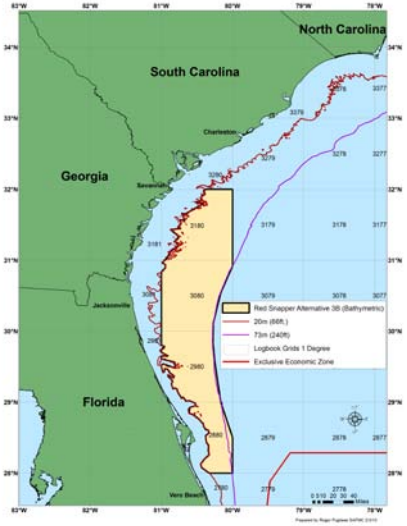
The language for **Alternative 2** is as follows: *Prohibit all commercial and recreational fishing for, harvest, and possession of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat permit or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters.*

Due to the nature of the fishery and the release mortality rates, Amendment 17A also includes alternatives that would prohibit the harvest of *all snapper grouper species* in certain areas in addition to a prohibition of red snapper throughout the EEZ **(Alternatives 3A through 4D)**. The alternatives for the closed areas focus on locations where concentrated landings of red snapper are reported, primarily off the coasts of Georgia and the north and central east coasts of Florida.

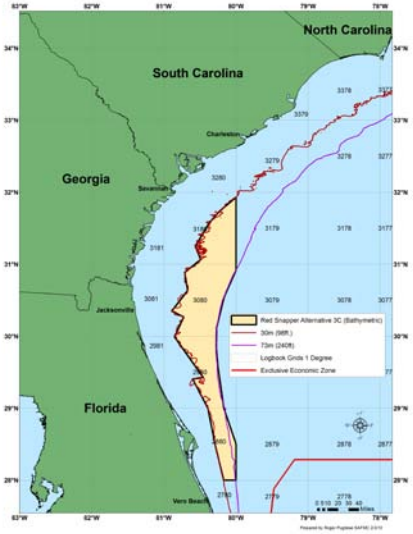
Alternatives 3A through 4D prohibit all commercial and recreational fishing for, harvest, and possession of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. *In addition*, the alternatives prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper fishery management unit year-round in the areas as shown below. See section 1.1 for a list of species in the snapper grouper FMU and section 2.3 for a list of the coordinates for each alternative.

Alternative 3A

Alternative 3B
(66-240ft/Bathymetric)



Alternative 3C
(98-240ft/Bathymetric)



Alternative 3D
(98-300ft/Bathymetric)

Alternative 3B (66-240ft/General)

Alternative 3C
(98-240ft/General)

Alternative 3D
(98-300ft/General)

Alternative 4A

Alternative 4B
(66-240ft/Bathymetric)

Alternative 4C
(98-240ft/Bathymetric)

Alternative 4D (Preferred)
(98-300ft/Bathymetric)

Alternative 4B
(66-240ft/General)

Alternative 4C
(98-240ft/General)

Alternative 4D (Preferred)
(98-300ft/General)

0 lbs landed catch, and define a rebuilding strategy based a constant $F_{REBUILD}$ of 0.145 and 98%F_{MSY} (98%$F_{30\%SPR}$). Under **Alternative 9**, an initial 76% reduction in total kill would be required. **Alternative 9** specifies a fishing mortality rate that has a 53% probability of rebuilding the stock to SSB_{MSY} ($SSB_{30\%SPR}$) in the maximum allowable time of 35 years (2044).

Alternative 4 and **Sub-alternative 4A**, expected to result in the largest biological benefit, is also expected to offer the largest long-term economic benefits but would require the most severe short-term reductions and therefore largest short-term negative economic impacts. **Alternative 9** with **Sub-alternative 9B** is expected to yield the smallest biological benefit. This would likely result in less stringent management measures and therefore the smallest short-term negative economic impacts but also the smallest long-term economic benefits to the fishermen.

Alternative 5 (Preferred) identifies an OY level based on the SSC's F_{MSY} proxy. This alternative has the longest rebuilding period and a higher reduction in total removals (83%) than **Alternatives 6, 7,** and **9** but lower than **Alternatives 1, 2, 3, 4**, and **8**. This alternative could be expected to result in smaller long-term benefits those alternatives with shorter rebuilding periods but might result in less stringent management measures and smaller short-term negative impacts than some alternative.

Alternatives 5 through **8** consider certain fishing practices to occur in the area and transit issues in the closed areas proposed in **Alternatives 3** and **4**.

Alternative 5 (Preferred). Allow fishing for, harvest and possession of snapper grouper species (with exception of red snapper) in the closed area if fish were harvested with black sea bass pots with endorsements.

Alternative 6. Allow fishing for, harvest and possession of snapper grouper species (with exception of red snapper) with bottom longline gear in the closed area deeper than 50 fathoms as specified in CFR §622.35.

Alternative 7 (Preferred). Allow fishing for, harvest and possession of snapper grouper species (with the exception of red snapper) in the closed area if fish were harvested with spearfishing gear.

Alternative 8. Allow transit through areas closed to snapper grouper harvest.

> **Sub-alternative 8a (Preferred).** The prohibition on possession does not apply to a person aboard a vessel that is in transit with snapper grouper species on board and with fishing gear appropriately stowed.
>
> **Sub-alternative 8b.** The prohibition on possession does not apply to a person aboard a vessel that has snapper grouper species onboard if the vessel is in transit.
>
> **Sub-alternative 8c.** The prohibition on possession does not apply to a person aboard a vessel that has wreckfish onboard if the vessel is in transit.

4. Require the use of circle hooks

Alternative 1 (Status Quo). Do not require the use of circle hooks when using hook and line gear for snapper grouper species within any particular area of the South Atlantic EEZ when fishing for snapper grouper species.

Alternative 2 (Preferred). Require the use of non-off set, non-stainless steel circle hooks when fishing for snapper grouper species with hook and line gear north of 28 degrees. It is unlawful to possess snapper grouper species without possessing non-off set, non-stainless steel circle hooks. Apply to the use of natural baits only.

Alternative 3. Require the use of non-off set, non-stainless steel circle hooks when fishing for snapper grouper species with hook and line gear within the South Atlantic EEZ. It is unlawful to possess snapper grouper species without possessing non-off set, non-stainless steel circle hooks. Apply to the use of natural baits only.

5. **Establish a red snapper monitoring program**

Alternative 1. (Status Quo) Utilize existing data collection programs to monitor the rebuilding progress of red snapper. Existing programs include the fishery-dependent Marine Recreational Fisheries Statistical Survey (MRFSS), logbook, discard logbook, headboat logbook, Trip Interview Program (TIP), and dealer reported landings. Fishery-independent methods include Marine Resources Monitoring Assessment and Prediction Program (MARMAP), and the Southeast Area Monitoring and Assessment Program (SEAMAP). Over the course of the next three years MARMAP will be looking for red snapper sampling sites along the north FL, and South GA coast.

Alternative 2 (Preferred) Establish fishery independent monitoring program to track progress of red snapper. Sampling would include deployment of chevron traps, cameras, and hook and line at randomly selected stations. (Report provided by SEFSC in March 2010 will provide additional details.)

Alternative 3. Establish a red snapper fishery-dependent monitoring program involving for-hire vessels (charter boat and headboats). Participating vessels may be authorized to harvest and land fish in excess of Federal possession limits and/or during fishery closures. Retention limits for red snapper would be based upon research objectives. (Report provided by SEFSC in March 2010 will provide additional details.) The trip limits and number of trips per month will depend on the number of selected vessels, available quota, and objectives of the research fishery..

Status of Affected Environment

Biological Environment

Amendment 17A includes alternatives for management measures that could prohibit fishing for or retention of all snapper grouper species in areas off of north Florida, Georgia, and South Carolina to end overfishing of red snapper by reducing the incidental catch. Red snapper are part of a mulit-species fishery and can be incidentally caught and killed when fishermen target co-occurring species. Therefore, snapper grouper species commonly taken with red snapper could be affected by proposed the actions.

The red snapper is found from North Carolina to the Florida Keys, and throughout the Gulf of Mexico to the Yucatan Peninsula (Robins and Ray 1986). It can be found at depths from 10 to 190 m (33-623 feet). Adults usually occur over rocky bottoms. Juveniles inhabit shallow waters and are common over sandy or muddy bottom habitat (Allen 1985). Grimes (1987) found that the spawning season of this species varies with location, but in most cases occurs nearly year round. White and Palmer (2004) reported that the spawning season for female red snapper off the southeastern United States extends from May to October, peaking in July through September. Red snapper eat

fishes, shrimps, crabs, worms, cephalopods, and some planktonic items (Szedlemayr and Lee 2004).

The maximum size reported for this species is 100 cm (40 inches) TL (Allen 1985, Robins and Ray 1986) and 22.8 kg (50 lbs) (Allen 1985). Maximum reported age in the Gulf of Mexico is reported as 53 years by Goodyear (1995) and 57 years by Allman *et al.* (2002). For samples collected from North Carolina to eastern Florida, maximum reported age is 45 years (White and Palmer 2004). McInerny (2007) reports a maximum age of 54 years for red snapper in the South Atlantic.

Socio-economic Environment
Commercial Fishery

Between 2005 and 2008, an average of 220 vessels reported an average of 1,357 trips that landed at least one pound of red snapper. These trips totaled an annual average of 135,000 pounds of red snapper worth $467,000 in current year dollars, and produced an average of 1.93 million pounds (MP) of other species worth $4.58 million.

Red snapper were most commonly caught as a secondary revenue species on trips with vermilion snapper, gag or scamp as the primary revenue species on the trip. On average for 2005-2008, vermilion snapper was the primary source of trip revenue for approximately 31% of the trips that landed red snapper, and accounted for 28% of total red snapper landings. Red snapper was the primary source of trip revenue on an average of 190 trips per year and a lesser source of revenue on 1,167 trips per year. On average from 2005-2008, red snapper was the primary source of trip revenue on less than 15% of the total number of trips on which they were landed.

The proportion of landings from Florida has increased from about 50% in 2002 to 80% in 2008 as landings increased in Florida and the combined landings from North Carolina, South Carolina and Georgia declined.

Recreational Fishery

The South Atlantic recreational fishery is comprised of the private sector and for-hire sector. The private sector includes anglers fishing from shore (all land-based structures) and private/rental boats. The for-hire sector is composed of the charterboat and headboat (also called partyboat) sectors. Charterboats generally carry fewer passengers and charge a fee on an entire vessel basis, whereas headboats carry more passengers and payment is per person.

Private

Recreational snapper grouper harvest in the South Atlantic has been variable during the period 2003-2008, averaging slightly above 11 million pounds (MP). On average, the private/shore mode of fishing accounted for the largest harvests at around 7.62 MP. Well below this harvest level are those of the charter mode at 1.92 MP and headboat at 1.63

MP. Harvests in each state also fluctuated during the same period. On average, Florida accounted for most of the snapper grouper harvest in the South Atlantic at around 6.90 MP, followed by North Carolina at 2.21 MP, South Carolina at 1.51 MP, and lastly by Georgia at 0.62 MP. Peak target trips for red snapper occurred in June-July.

Headboat

The number of for-hire permits issued in the South Atlantic snapper grouper fishery steadily increased over the years, from 1,477 permits in 2003 to 1,811 permits in 2008. The for-hire permit does not distinguish between whether the vessel operates as a charterboat or headboat. Based on a 1997 survey, Holland *et al.* (1999) estimated that a total of 1,080 charter vessels and 96 headboats supplied for-hire services in all South Atlantic fisheries during 1997. The majority of snapper grouper for-hire permitted vessels were home-ported in Florida; a large number of vessels were also home-ported in North Carolina and South Carolina.

Due to very low headboat angler days for Georgia, entries for Georgia are combined with those of Florida. For the period 2003-2008, total headboat angler days fluctuated around the mean of 230,878 days. On average, Florida accounted for the largest number of angler days (157,764), or about 68 percent of all headboat angler days. Nevertheless, the numbers for South Carolina (47,524 days) and North Carolina (25,591 days) are far from being negligible.

The peak for headboat angler days consistently occurred in July-August each year. The troughs occurred in the last two months of the year, except for 2004 and 2008 when troughs occurred in September-October.

Comparison of Alternatives and Effects (Direct, Indirect, and Cumulative)

1. **Maximum Sustainable Yield Proxy for Red Snapper**

Biological

Alternative 2 (Preferred) is based on the SSC's recommendation and would specify an MSY proxy equal the yield at $F_{40\%SPR}$. **Alternative 2 (Preferred)** would establish a new proxy for F_{MSY} not previously used for red snapper, which is more conservative than the status quo proxy of $F_{30\%SPR}$. **Alternative 2 (Preferred)**, which uses $F_{40\%SPR}$ as a proxy for F_{MSY} is more conservative and provides greater assurance overfishing would be ended and the stock would rebuild within the specified time as the rebuilding goal (SSB_{MSY}) is higher (Table S-5). Therefore, the biological benefits of **Alternative 2 (Preferred)** for the red snapper stock would be greater than **Alternative 1 (Status Quo)** because **Alternative 2 (Preferred)** would allow for less harvest and there would be a greater probability overfishing would end and the stock would be rebuilt to SSB_{MSY}.

Table S-4. A comparison of the rebuilding attributes when using two different FMSY proxies.

	F_{MSY} Proxy	
	$F_{30\%SPR}$	$F_{40\%SPR}$
Rebuilding goal (SSB_{MSY})	Lower - 13,283,000 lbs	Higher - 17,863,000 lbs
ACL in Year One (2010)	Higher	Lower
OY at Equilibrium	Higher	Lower
Years to rebuild to SSB_{MSY}	Less time	More time
Probability of rebuilding to SSB_{MSY}	Higher	Lower

SSB_{MSY} = 17,863,000 lbs whole weight for $F_{40\%SPR}$ F_{MSY} proxy.
SSB_{MSY} = 13,283 000 lbs whole weight for $F_{30\%SPR}$ F_{MSY} proxy.

Socio-economic

As the yield at $F_{30\%SPR}$ is greater than the yield at $F_{40\%SPR}$, a F_{MSY} proxy that is too conservative could have unnecessary negative social and economic effects in terms of more restrictive management measures including larger area closures (See **Section 2.3**). In principle, more stringent measures would logically be required under an MSY alternative that is more conservative from a biological standpoint; conversely, less stringent measures would be required under an MSY alternative that is less conservative. As with any fishing regulations, the economic issue involves the balancing of short-term costs and long-term benefits. The economically preferable MSY proxy choice would be one that is expected to result in the highest net economic benefits over time. In 2003-2007, the average combined commercial and recreational red snapper landings were approximately 440 thousand pounds. In contrast, the MSY proxy would be 2.431 MP under **Alternative 1 (Status Quo)** and 2.204 MP under **Alternative 2 (Preferred)**. This wide gap between current landings and potential landings has at least two implications. First, both MSY proxy definitions would require more stringent management measures to rebuild the red snapper stock. Second, there appears a relatively high likelihood that future benefits from the fishery would outweigh the costs of implementing stringent management measures.

2. Red snapper rebuilding plan

a. Rebuilding schedule

Biological

Alternatives 2-4 (Preferred) would establish rebuilding schedules that would rebuild red snapper within the time periods allowed by the reauthorized Magnuson-Stevens Act. These alternatives differ in the length of time prescribed to rebuild the species, ranging from 15 years (**Alternative 2**) to 35 years (**Alternative 4 (Preferred)**). Generally, the shorter rebuilding timeframes translate into higher biological benefits. **Alternative 2**, which would implement the shortest rebuilding schedule, would achieve the goal of rebuilding in the shortest amount of time. However, **Alternative 2** may not be realistic as it would not be expected to rebuild the stock to B_{MSY} because it is not possible to

eliminate incidental mortality on one species in a multi-species complex, without prohibiting fishermen from targeting all associated species wherever the prohibited species occurs. The Council is considering substantial measures to reduce fishing mortality in this amendment including area closures for all snapper grouper species, which could reduce bycatch of red snapper and co-occurring species but it is uncertain to what extent bycatch of red snapper would be reduced. Consequently, the Council has chosen **Alternative 4** as the preferred rebuilding strategy alternative.

Socio-economic

Alternative 3 would incur a level of negative short-term socioeconomic impacts between that of **Alternatives 2** and **4 (Preferred). Alternative 4 (Preferred)** would require the least restrictive harvest limitations in order to achieve a rebuilt status within the 35-year period, and therefore, would incur the least negative socioeconomic impacts relative to **Alternatives 2** and **3**. In addition, **Alternative 4 (Preferred)** would provide a timeframe sufficiently long to rebuild the red snapper stock as well as flexibility in the type of management measures to implement over time. In this sense, **Alternative 4 (Preferred)** may be characterized with a higher likelihood of generating the highest net benefits over time.

b. Rebuilding strategy, optimum yield, and accountability measures

Biological

OY values at equilibrium in the nine alternatives are distinguished from one another by the level of risk (and associated tradeoffs) each would assume. The more conservative the estimate of OY, the larger the sustainable biomass when the stock is rebuilt. The greatest biological benefit would be provided by **Alternative 4**, which would specify an OY at equilibrium equal to 65%$F_{40\%SPR}$ and would require a 91% reduction in total kill relative to 2005-2007. The least amount of biological benefit would be provided by **Alternative 9**, which would specify a rebuilding strategy of 98%$F_{30\%SPR.}$

In general, the greater the percent reduction in red snapper mortality, the greater the positive impact to the stock and associated ecosystem (Table S-5).

Table S-5. Summary of the total kill required, reduction needed in total removals, and probability of rebuilding for Alternatives 1-9.

Alternative	Total Kill	% Reduction	Year Rebuilt (50% Prob)	Prob rebuilt 2044
Alternative 1 (Status Quo) ($F_{45\%SPR}$)	89,000	85%	2035*; 2025**	70%*; 99%**
Alternative 2 (85%$F_{40\%SPR}$)	89,000	85%	2035	70%
Alternative 3 (75%$F_{40\%SPR}$)	79,000	87%	2032	84%
Alternative 4 (65%$F_{40\%SPR}$)	68,000	91%	2029	94%
Alternative 5 (Preferred) (97%$F_{40\%SPR}$)	**101,000**	**83%**	**2044**	**50%**

Alternative	Total Kill	% Reduction	Year Rebuilt (50% Prob)	Prob rebuilt 2044
Alternative 6 (85%$F_{30\%SPR}$)	125,000	79%	2031	78%
Alternative 7 (75%$F_{30\%SPR}$)	111,000	82%	2028	92%
Alternative 8 (65%$F_{30\%SPR}$)	97,000	84%	2026	98%
Alternative 9 (98%$F_{30\%SPR}$)	144,000	76%	2040	53%

*Compared to SSB_{MSY} = 17,863,000 lbs whole weight for $F_{40\%SPR}$ F_{MSY} proxy.
**Compared to SSB_{MSY} = 13,283 000 lbs whole weight for $F_{30\%SPR}$ F_{MSY} proxy.

If the Council chooses to set an ACL based on total removals the Southeast Fisheries Science Center (SEFSC) would be required to monitor discarded red snapper in the commercial and recreational sectors. There are concerns that the monitoring of discards would rely on self-reporting of discards by fishermen. This could create a disincentive for fishermen to report if they know that once a certain level of discarded fish is reached, accountability measures (AMs) would be triggered, which could potentially further restrict their snapper grouper harvest. Because of these concerns with monitoring discards, catch per unit effort (CPUE) of red snapper would be tracked via a fishery-independent monitoring program to identify changes in biomass. Furthermore, the Council is considering the use of fishery-dependent data collection by headboat and charterboat operators to determine if there are changes in CPUE and biomass.

Socio-economic

Alternative 4 and **Sub-alternative 4A**, expected to result in the largest biological benefit, is also expected to offer the largest long-term economic benefits but would require the most severe short-term reductions and therefore largest short-term negative economic impacts. **Alternative 9** with **Sub-alternative 9B** is expected to yield the smallest biological benefit. This would likely result in less stringent management measures and therefore the smallest short-term negative economic impacts but also the smallest long-term economic benefits to the fishermen.

Alternative 5 (Preferred) identifies an OY level based on the SSC's F_{MSY} proxy ($F_{40\%SPR}$). This alternative has the longest rebuilding period and a higher reduction in total removals (83%) than **Alternatives 6, 7,** and **9** but lower than **Alternatives 1, 2, 3, 4**, and **8**. **Alternative 5 (Preferred)** could be expected to result in smaller long-term benefits than those alternatives with shorter rebuilding periods but might result in less stringent management measures and smaller short-term negative impacts than some alternatives.

3. Red snapper management measures

Under **Alternative 1 (Status Quo)**, between a 40% and 58% reduction in total kill could be expected. **Alternative 3A** prescribes a general closure of the red snapper fishery, or

38,000 square kilometers of the South Atlantic EEZ, and a complete closure of the four logbook grids partially closed in **Alternative 3C**. Under **Alternative 3A**, the estimated reduction in total removals is estimated to range from 72% to 90% depending on assumptions such as effects of previous management measures and release mortality (SERO-LAPP-2009-07 REV).

Alternative 3B would close approximately 27,000 square kilometers to fishing for, harvest, and possession of snapper grouper species. Snapper grouper fishing would be prohibited in four consecutive logbook grids between the depths of 66 feet (20 m) and 240 feet (73 m). **Alternative 3B** includes a slightly larger closed area than **Alternative 3C** and **3D**, and includes more inshore area when compared to **Alternatives 3C** and **3D**. Under **Alternative 3B**, estimated reductions in red snapper removals ranges from 69% to 88%. The area closure included in **Alternative 3B** would be more biologically beneficial than **Alternatives 3C** or **3D**, which would be expected to reduce red snapper removals by 63% to 84%. Under **Alternative 3B** the stock could potentially rebuild faster than **Alternatives 3C**, and **3D**, but not as quickly as it would under **Alternatives 3A**, **4A**, or **4B**. **Alternative 3C** prescribes, in addition to a closure of the red snapper fishery, a closure of four logbook grids (2880, 2980, 3080, 3180), or 15,000 square kilometers of the EEZ, between depths of 98 feet (16 fathoms; 30 m) and 240 feet (40 fathoms, 73 m) to harvest, possession, and retention of all species in the snapper grouper fishery management unit (FMU).

Alternative 3D is very similar to **Alternative 3C** in that it closes logbook grids 2880, 2980, 3080, and 3180 beginning at a depth of 98 feet (30 m). The area closure in **Alternative 3D**; however, extends to a depth of 300 feet (91 m); whereas the area closure in **Alternative 3C** extends to 240 feet (73 m). Since **Alternative 3C** does not extend as far east as **Alternative 3D**, there may some, however small, socioeconomic benefits of **Alternative 3C** over **Alternative 3D**. Additionally, Amendment 17B contains an action that would close Federal waters to harvest of deepwater snapper grouper beyond a depth of 240 feet (73 m), creating regulatory redundancy in the deepest part of the **Alternative 3D** closure.

The reduction in total removals from the scenarios examined for **Alternative 4A** range from 86% to 90%. This alternative would establish the year-round closure of seven logbook grids (2880, 2980, 3080, 3179, 3180, 3278, 3279), or 67,000 square kilometers of the EEZ, and therefore includes the most extensive closure of harvest areas. As a result, it is the least sensitive to variations in assumptions. In fact, all but two of the scenarios considered for this alternative achieve a harvest reduction of at least 86%.

Alternative 4B would close a 39,000 square kilometer area to all snapper grouper fishing in the logbook grids 2880, 2980, 3080, 3791, 3180, 3278, and 3279 between 66 feet (20 m) and 240 feet (73 m). This area is smaller than **Alternative 4A**, but larger than the closures included in **Alternatives 3A**, **3B**, **3C**, **3D**, **4C**, and **4D**. Red snapper harvest reductions under **Alternative 4B** could be expected to range from 73% to 91%. The only alternatives that could realistically result in a greater reduction in total removals are **Alternative 3A**, and **Alternative 4A**, which closes seven total logbook grids.

Alternative 4C requires, in addition to a closure of the red snapper fishery, the year-round closure of seven logbook grids (2880, 2980, 3080, 3179, 3180, 3278, 3279) or 24,000 square kilometers of the South Atlantic EEZ, between depths of 98 and 240 feet to the harvest of all members of the snapper grouper FMU. Under this regulatory option, the reduction in total kill in the different scenarios examined in **Appendix E** would range from 66% to 86%.

Preferred **Alternative 4D** is similar to **Alternative 4C** except that in addition to a closure of the red snapper fishery and the year-round closure of seven logbook grids (2880, 2980, 3080, 3179, 3180, 3278, 3279), the bathymetric closure would be between depths of 98 and 300 feet rather than 98 to 240 feet. Under this regulatory option, the reduction in total kill in the different scenarios examined in **Appendix E** would range from 67% to 86%. There is little difference between the magnitude in total removals under **Alternatives 4C** and **4D**, primarily because there is minimal additional area closed by extending the eastern boundary of the closure from 240 feet out to 300 feet.

Under **Alternative 5 (Preferred)**, sea bass pots could be used to target snapper grouper species within the proposed closed areas. Sea bass pots are considered highly selective for black sea bass, and would be able to be deployed within any one of the proposed closed areas in **Alternatives 2-4** without negatively affecting the harvest reductions needed to end overfishing of red snapper. On trips that fished sea bass pots, black sea bass made up over 90% of the catch by weight. Red snapper are rarely taken in sea bass pots (0.22% of trips) and represent less than 0.01% of the catch by weight. Allowing commercial harvest of black sea bass using sea bass pots could alleviate, to some degree, negative socioeconomic effects caused by an area closure without impeding efforts to end overfishing of red snapper. Among **Alternatives 2-4**, **Alternative 2** would be expected to have the least negative social effect on the commercial and recreational snapper grouper fisheries because it would not extend harvest prohibitions beyond the red snapper fishery.

Alternative 6 would allow the harvest of golden tilefish and other deepwater snapper-grouper species with bottom longline within the snapper grouper area closures proposed in **Alternatives 2-4**. Golden tilefish are usually caught over mud habitat in depths of 180 m to 300 m, (Low *et al.* 1983; Able *et al.* 1993), with depths of ~200 m being most common (Dooley 1978). In contrast, red snapper adults usually occur over rocky bottoms, and juveniles inhabit shallow waters and are common over sandy or muddy bottom habitat (Allen 1985) in much shallower water (generally less than 240 ft (73 m)). The difference in preferred habitat and depth of golden tilefish and red snapper would allow for the deployment of bottom longline gear without negatively affecting rebuilding efforts for red snapper. As is the case in allowing black sea bass pot deployment within the closed areas, if chosen as a preferred, allowing the use of bottom longline gear may also help to mitigate some of the negative socioeconomic impact expected as a result of an area closure. Although the Council felt that there would little chance that fishermen targeting golden tilefish would impact red snapper stocks, the Council did not select **Alternative 6** as a preferred alternative because the preferred closure **Alternative 4D**

would extend to a depth of 300 feet and bottom longline gear is already restricted to depths greater than 300 feet.

Alternative 7 (Preferred) would allow the harvest of snapper grouper species, other than red snapper, within a proposed closed area using spearfishing gear. Because it's selectivity as a gear type, spearguns would be the least likely of all fishing gear to produce red snapper bycatch. Allowing the use of spearguns may also help to offset, to a small degree, some of the negative socioeconomic impacts expected from large area closures.

Allowing transit with snapper grouper and or wreckfish on board (**Sub-Alternatives 8a (Preferred), 8b**, and **8c**)) would make enforcement within the closed areas more difficult; however, the enforcement burden may be mitigated by careful drafting of "transit" and "gear stowed" regulations. Additionally, allowing for transit through the closed area would likely eliminate any safety-at-sea concerns that may arise from having to navigate around a closed area in bad weather.

Alternatives 4A, 4B, 4C, and **Alternative 4D (Preferred)** would prohibit the harvest of all species in the snapper grouper management unit off portions of South Carolina in addition to Georgia and northeast Florida. Therefore, these alternatives are expected to generate greater commercial losses than **Alternatives 3A-3D**. Simulation results suggest that the commercial losses are 2.5 times larger for **Alternatives 4A-4D** than **Alternatives 3A-3D** (assuming all are combined with **Alternatives 5 (Preferred)** and **7 (Preferred)**). **Alternative 4A** in combination with **Alternatives 5 (Preferred)** and **7 (Preferred)** would prohibit harvests in all depths (except for the use of black sea bass pots and spearfishing) and is expected to reduce net operating revenues by approximately $1,235,000 (13.7%). The commercial impacts from the combination of **Alternatives 4B** (which prohibits fishing in 66-240 feet), **Alternatives 5 (Preferred),** and **7 (Preferred)** would be slightly lower with losses of $1,125,000 or 12.5%. The combination of **Alternative 4C** (prohibits harvest between 90-240 feet), **5 (Preferred),** and **7 (Preferred)** would result in even lower at losses of $1,081,000 (12%). **Alternative 4D (Preferred)** (prohibits fishing between 98 and 300 feet), in combination with **5 (Preferred)** and **7 (Preferred)** produces losses slightly higher at $1,095,000 (12.1%).

Including the exemptions for black sea bass and spearfishing gear, the predicted reductions in net operating revenues for commercial fishermen in northeast Florida and Georgia are expected to average approximately $693,000 (70.3%) for **Alternatives 4A** and **4B** and $690,000 (70%) for **Alternatives 4C** and **4D (Preferred)**. Losses to South Carolina fishermen from **Alternatives 4A-4D (Preferred)** including mitigating effects of exemptions for black sea bass pots and spearfishing gear, range from $531,000 (34.5%) for **Alternative 4A** to $456,000 (29.6%) for **Alternative 4C**. **Alternative 4D (Preferred)** resulting losses of $463,000 (30%) in combination with **Alternatives 5 (Preferred)** and **7 (Preferred)**.

The magnitude of economic effects on the recreational sector of the various alternatives directly correlates with the size of area closures. **Alternative 4A** would close all depths

within each of the seven statistical grids; hence, it would result in the largest economic effects among the four alternatives. The second largest economic effects would result from **Alternative 4B**, which would close depths from 66 feet to 240 feet. **Alternative 4C**, which would close depths from 98 feet to 240 feet, would result in the lowest economic effects; and, **Alternative 4D (Preferred)**, which would close depths from 98 feet to 300 feet, would have the third largest economic effects on the recreational sector.

4. Require the use of circle hooks

Alternative 2 would require the use of non-offset, non-stainless steel circle hooks within the area north of 28°N; whereas **Alternative 3** would require the use of non-offset, non-stainless steel circle hooks within the South Atlantic EEZ. The intended effect is to reduce discard and bycatch mortality of red snapper.

Studies on the effects of circle hooks and J hooks on retention and survival are limited to a handful of snapper grouper species. Some studies indicate beneficial effects can be gained to species while others are inconclusive. Due to limited data, it may not be possible to quantify the reduction in red snapper release mortality that could be provided by using circle hooks. Furthermore, not all species in the snapper grouper complex have the same mouth morphology and it is possible that circle hooks could negatively impact survival. Alternatively, use of circle hooks could substantially reduce harvest of some species, would have positive biological benefits but have negative social and economic impacts on fishermen dependent upon the species. In general, requiring the use of circle hooks may not substantially increase the cost of fishing to either the commercial or the recreational sectors, though the potential reduction in the harvest of some important species is noted.

The mandatory use of circle hooks was considered in Amendment 16 (SAFMC 2008) but removed after the amendment was reviewed by the Council's SSC. The SSC was concerned that there was not enough published information to quantify the effects of reducing discard mortality for various snapper grouper species, including red snapper. The SSC also expressed concern as did some public comments, that mandatory use of circle hooks could reduce availability of some snapper grouper species such as yellowtail snapper and gray triggerfish, which are not undergoing overfishing or overfished. Yellowtail snapper are primarily taken in South Florida; therefore, if **Alternative 3** was not selected as the preferred alternative, fishermen targeting yellowtail snapper with J-hooks would be able to continue this practice.

5. Establish a red snapper monitoring program

Alternative 1 (Status Quo) would not establish a program to monitor rebuilding of red snapper. However, since some of the alternatives being considered would prohibit fishing for or retention of red snapper as well as area closures for snapper grouper species, traditional fishery-dependent data would be lacking and it would not be possible to track recovery of red snapper in SEDAR updates and future benchmark assessments. Further, existing fishery-independent data collection programs would not be sufficient to

monitor red snapper due to limitations associated with the temporal and spatial range of sampling.

Alternative 2 (Preferred) would utilize fishery-independent sampling to collect data to monitor stock status of red snapper. It is possible that with additional funding, MARMAP or a new program could be established to accomplish the task. The SEFSC is in the process of designing a fishery-independent program to enhance those already in place. A report will be provided to the Council at their March 2010 meeting.

Under **Alternative 2 (Preferred)**, chevron traps would be used to collect information on red snapper. Few red snapper have been taken with chevron trap by the MARMAP program. However, use of chevron traps in the Gulf of Mexico indicates red snapper are readily available to this gear type. It may be that few red snapper have been taken with this gear in the South Atlantic because MARMAP began using the gear when biomass was already at very low levels. In addition, the zone of greatest abundance for red snapper is off north Florida in the South Atlantic, which represents the geographic extreme for sampling by the MARMAP program.

Therefore, under **Alternative 2 (Preferred)**, it would be necessary for an increase in sampling intensity off the north Florida and southern Georgia region beyond what MARMAP has done historically. In addition, reconnaissance work would be needed to identify additional live bottom locations where red snapper occur. This can be accomplished through underwater television studies as well as through cooperative efforts with fishermen and cooperative research programs.

Alternative 3 would employ fishery-dependent data to monitor abundance of red snapper. The advantage in having fishermen collect information is they would have some knowledge about locations where red snapper can be found that might not be available to researchers. The disadvantage would be fishermen could target red snapper where they are most concentrated and therefore, trends in CPUE and mean length might not reflect true population trends. To eliminate this bias, sampling would need to be coordinated through the SEFSC.

Under **Alternative 3**, participating vessels may be authorized to harvest and land fish in excess of Federal possession limits and/or during fishery closures. Retention limits for red snapper would be based upon research objectives. The trip limits and number of trips per month will depend on the number of selected vessels, available quota, and objectives of the research fishery.

Fishery-dependent data from headboats represents the longest continuous time series for snapper grouper species. This time series has been an important index for many assessments including red snapper. Proposed alternatives for red snapper in Amendment 17A include areas where fishing for or retention of all snapper grouper species would be prohibited. To maintain this continuous database, limited headboat trips could be permitted to enter closed areas and fish for snapper grouper species. Under **Alternative 3**, trips would be selected by the SEFSC and could include an observer who would obtain

data on all red snapper caught. Additional information on snapper grouper species could be obtained where possible. Details on design of a fishery-independent program will be provided at the Council's March 2010 meeting.

Additional fishery-dependent data could be obtained by means of grant-funded research through the Cooperative Research Program. Fishermen, working with researchers, could obtain funding from NOAA Fisheries Service to obtain information on red snapper for studies on life history, release mortality, mapping locations of high abundance, etc.

Conclusion

The most recent assessment for the red snapper stock in the South Atlantic indicate that the stock is experiencing overfishing and is overfished (SEDAR 15, 2008). The purpose of Amendment 17A to the Snapper Grouper Fishery Management Plan (FMP) is to implement long-term management measures to end overfishing of the red snapper stock in the South Atlantic immediately upon implementation and to rebuild the stock ultimately achieving optimum yield (OY) while minimizing to the extent practicable adverse social and economic effects.

Current regulations for red snapper allow for a recreational bag limit of 2 fish per person per day and require a 20" total length minimum size limit for both commercial and recreational fishermen. Through Amendment 17A, the Council is proposing the implementation of a *total prohibition of red snapper*. Due to the nature of the red snapper fishery and the high release mortality rates, Amendment 17A also includes alternatives that would prohibit the harvest of *all snapper grouper species* in certain areas to reduce mortality of red snapper that could be incidentally caught when fishermen target co-occurring species. The alternatives for the closed areas focus on locations where concentrated landings of red snapper are reported, primarily off the coasts of Georgia and the north and central east coasts of Florida.

The Council is considering a range of options in Amendment 17A. In general, the positive effects to the stock and ecosystem are greatest with the largest closures and lowest annual catch limits. In turn, negative socio-economic effects increase with such trends. However, there are long-term socio-economic effects from a rebuilt stock. As with any fishing regulations, the economic issue involves the balancing of short-term costs and long-term benefits. There is a wide gap between the current landings (approximately 440 thousand pounds) and potential landings for a rebuild stock (approximately 2.2 million pounds), which has at least two implications. First, more stringent management measures are needed to rebuild the red snapper stock. Second, there appears a relatively high likelihood that future benefits from the fishery would outweigh the costs of implementing stringent management measures.

1 Introduction

1.1 Background

Management of the Federal snapper grouper fishery located off the South Atlantic in the 3-200 nautical mile (nm) U.S. Exclusive Economic Zone (EEZ) is conducted under the Fishery Management Plan for the snapper grouper fishery (SAFMC 1983) (Figure 1-1). The fishery management plan (FMP) and its amendments are developed under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), other applicable Federal laws, and executive orders (E.O.s) and affect the management of 73 species, listed below (Appendix S. Other Applicable Law).

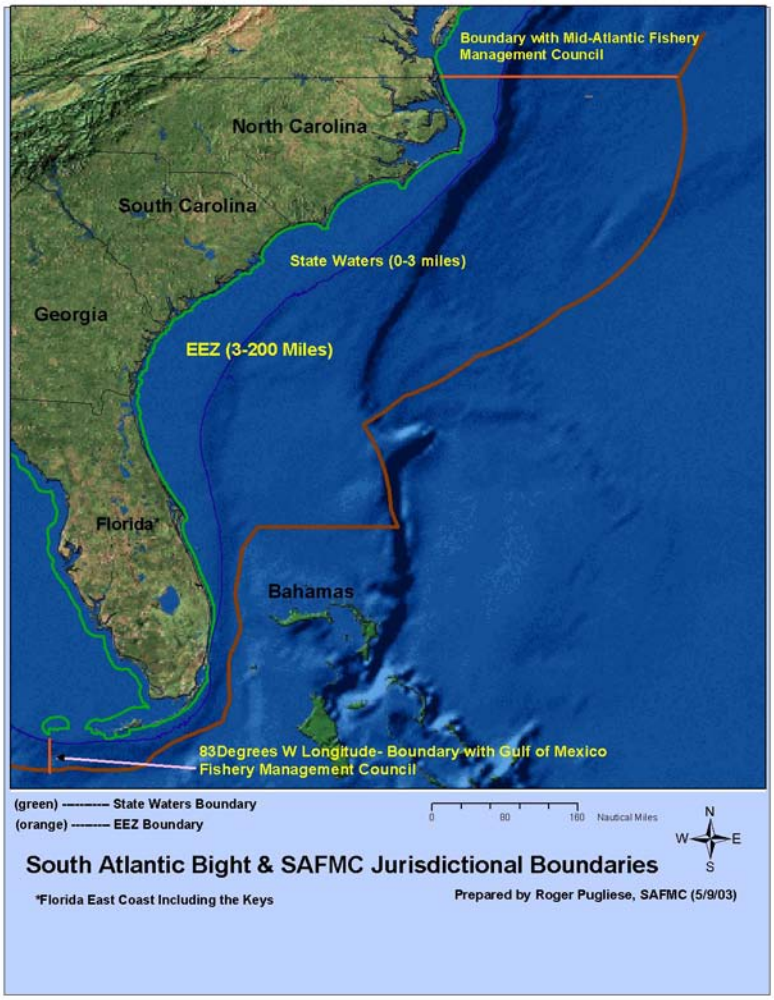


Figure 1-1. Jurisdictional boundaries of the South Atlantic Fishery Management Council.

Almaco jack, *Seriola rivoliana*
Atlantic spadefish, *Chaetodipterus faber*
Banded rudderfish, *Seriola zonata*
Bank sea bass, *Centropristis ocyurus*
Bar jack, *Carangoides ruber*
Black grouper, *Mycteroperca bonaci*
Black margate, *Anisotremus surinamensis*
Black sea bass, *Centropristis striata*
Black snapper, *Apsilus dentatus*
Blackfin snapper, *Lutjanus buccanella*
Blue runner, *Caranx crysos*
Blueline tilefish, *Caulolatilus microps*
Bluestriped grunt, *Haemulon sciurus*
Coney, *Cephalopholis fulva*
Cottonwick, *Haemulon melanurum*
Crevalle jack, *Caranx hippos*
Cubera snapper, *Lutjanus cyanopterus*
Dog snapper, *Lutjanus jocu*
French grunt, *Haemulon flavolineatum*
Gag, *Mycteroperca microlepis*
Golden tilefish, *Lopholatilus chamaeleonticeps*
Goliath grouper, *Epinephelus itajara*
Grass porgy, *Calamus arctifrons*
Gray (mangrove) snapper, *Lutjanus griseus*
Gray triggerfish, *Balistes capriscus*
Graysby, *Cephalopholis cruentata*
Greater amberjack, *Seriola dumerili*
Hogfish, *Lachnolaimus maximus*
Jolthead porgy, *Calamus bajonado*
Knobbed porgy, *Calamus nodosus*
Lane snapper, *Lutjanus synagris*
Lesser amberjack, *Seriola fasciata*
Longspine porgy, *Stenotomus caprinus*
Mahogany snapper, *Lutjanus mahogoni*
Margate, *Haemulon album*
Misty grouper, *Epinephelus mystacinus*
Mutton snapper, *Lutjanus analis*
Nassau grouper, *Epinephelus striatus*
Ocean triggerfish, *Canthidermis sufflamen*
Porkfish, *Anisotremus virginicus*
Puddingwife, *Halichoeres radiatus*
Queen snapper, *Etelis oculatus*
Queen triggerfish, *Balistes vetula*
Red grouper, *Epinephelus morio*
Red hind, *Epinephelus guttatus*
Red porgy, *Pagrus pagrus*
Red snapper, *Lutjanus campechanus*
Rock hind, *Epinephelus adscensionis*
Rock Sea Bass, *Centropristis philadelphica*
Sailors choice, *Haemulon parra*
Sand tilefish, *Malacanthus plumieri*
Saucereye porgy, *Calamus calamus*
Scamp, *Mycteroperca phenax*
Schoolmaster, *Lutjanus apodus*
Scup, *Stenotomus chrysops*
Sheepshead, *Archosargus probatocephalus*
Silk snapper, *Lutjanus vivanus*
Smallmouth grunt, *Haemulon chrysargyreum*
Snowy grouper, *Epinephelus niveatus*
Spanish grunt, *Haemulon macrostomum*
Speckled hind, *Epinephelus drummondhayi*
Tiger grouper, *Mycteroperca tigris*
Tomtate, *Haemulon aurolineatum*
Yellow jack, *Carangoides bartholomaei*
Yellowedge grouper, *Epinephelus flavolimbatus*
Yellowfin grouper, *Mycteroperca venenosa*
Yellowmouth grouper, *Mycteroperca interstitialis*
Yellowtail snapper, *Ocyurus chrysurus*
Vermilion snapper, *Rhomboplites aurorubens*
Warsaw grouper, *Epinephelus nigritus*
White grunt, *Haemulon plumierii*
Whitebone porgy, *Calamus leucosteus*
Wreckfish, *Polyprion americanus*

Stock assessments, through the evaluation of biological and statistical information, provide an evaluation of stock health and directionality of overall stock health under the current management regime and other potential future harvest conditions. More specifically, the assessments provide an estimation of the maximum sustainable yield (MSY) and a determination of the stock status (whether overfishing is occurring and whether the stock is overfished). Following the assessment, the Council's Scientific and Statistical Committee (SSC) reviews the stock assessment information and advises the Council on whether the stock assessment was performed utilizing the best available data and whether the outcome of the assessment is suitable for management purposes.

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) instructs the Regional Fishery Management Councils and NOAA Fisheries Service to prevent overfishing while achieving optimum yield (OY) from each fishery. When it is determined a stock is undergoing overfishing, measures must be implemented to end overfishing. In cases where stocks are overfished, the Councils and NOAA Fisheries Service must implement rebuilding plans.

The most recent assessment for the red snapper stock in the South Atlantic indicates that the stock is experiencing overfishing and is overfished (SEDAR 15, 2008).

Overfishing means that fish are being removed more quickly than the stock can replace them such that the maximum sustainable yield (MSY) cannot be achieved. Biomass shows a sharp decline during the 1950s and 1960s, continued decline during the 1970s, and stable but low levels since 1980. Estimates of annual biomass have been well below the biomass at maximum sustainable yield (B_{MSY}) since the mid-1960s, with possibly some small amount of recovery since implementation of current size limits in 1992 (Figure 1-2).

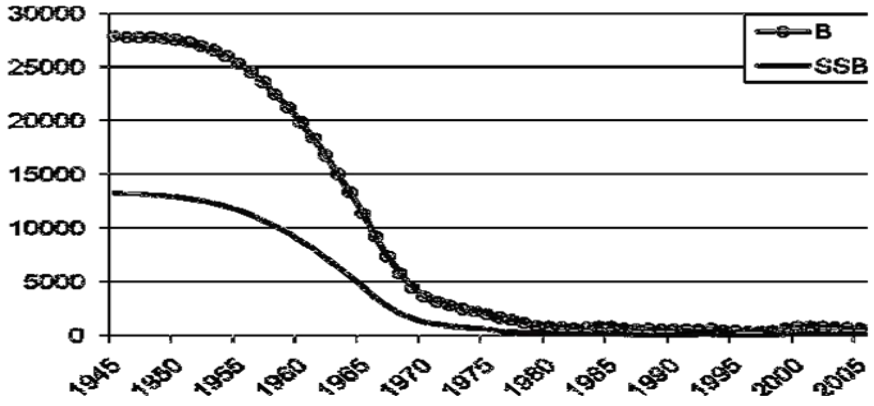


Figure 1-2. Biomass and Spawning Stock Biomass (pounds).

The assessment indicates that in order to rebuild the red snapper stock, the total catch (landings and discards) will need to be reduced, not just the landings. Rebuilding

projections indicate that the total mortality of red snapper must be reduced **83%** from current levels in order to end overfishing.

1.2 Purpose of the Proposed Action

The *purpose* of Amendment 17A to the Fishery Management Plan (FMP) for the Snapper Grouper Fishery of the South Atlantic Region is to implement long-term management measures expected to end overfishing of the red snapper stock in the South Atlantic immediately upon implementation and to rebuild the stock, ultimately achieving optimum yield (OY) while minimizing to the extent practicable adverse social and economic effects.

1.3 Need for the Proposed Action

The *need* of the action is to allow the stock to increase in biomass in order to maximize its reproductive potential so that the population may produce the optimum yield (OY). OY, the ultimate goal of any FMP, is the portion of the fish stock that provides the greatest economic, social, and ecological benefit to the nation.

The effects of fishing pressure have been well-documented (e.g. PDT 1990). As fishing pressure intensifies, individuals with a genetic makeup for achieving large sizes may be selectively removed from the population because of gear selectivity or economic value, leaving behind fishes with a genetic disposition for smaller size and slower growth. The overall effect of this heavy, sustained fishing pressure on a fish population may be as follows: (1) a change in the growth rate; (2) a reduction in size at age; (3) a change in the percentage of males for species that change sex or are sexually dimorphic; (4) a decline in the size and age at maturity and first reproduction; (5) a decrease in the size and age structure of the population; (6) a decrease in population fecundity; and (7) a decline in the number of spawning events. Continued overfishing may ultimately disrupt the natural community structure of the reef ecosystems that support red snapper and co-occurring species.

In a fishery where OY is not being achieved on a consistent basis, the full extent of social and economic benefits is not realized. For example, in the snapper grouper fishery, low stock levels translate into a loss of catch possibilities for commercial and recreational fishermen. Revenues are reduced when fishermen have to fish longer and harder, which may eventually cause participants to exit the fishery. Ending overfishing and rebuilding overfished stocks would allow fishermen to catch more fish with less effort, resulting in higher economic returns in the long-term, as long as effort in the fishery is limited.

1.4 Background

1.4.1 Process for Defining Limits and Targets

The Council is utilizing several tools to end overfishing and rebuild the red snapper stock (Table 1-2). These include utilizing two determinations from the Council's Scientific and Statistical Committee (SSC). These determinations are the overfishing limit (OFL) and acceptable biological catch (ABC). The OFL is an estimate of the catch level above which overfishing is occurring. This value stems largely from the outcome of a stock assessment. The ABC is defined as the level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL and any other scientific uncertainty, and should be specified based on the ABC control rule. Using the ABC as a start, the Council is proposing an annual catch limit (ACL) for the red snapper stock in the South Atlantic. The ACL is the annual catch limit expressed in pounds or numbers of fish that serves as the basis for invoking accountability measures (AMs). AMs are designed to provoke an action once the ACL is reached during the course of a fishing season to reduce the risk overfishing will occur. The Council is proposing the implementation of AMs in Amendment 17A. While AMs act to *prevent overfishing* in a fishery, the Council must specify regulations in order to *end overfishing* (through the implementation of management measures). Figure 1-3 summarizes the generalized process to specify tools to end overfishing and rebuild the stock.

Table 1-1. A summary of the tools being used to prevent overfishing and rebuilding the red snapper stock. Source: National Standard 1 Guidelines (Appendix K) and NMFS Glossary (Appendix B).

Tool	Acronym	Who sets?	Definition
Overfishing Limit	OFL	SSC	An estimate of the catch level above which overfishing is occurring and is expressed in terms of numbers or weight of fish.
Acceptable Biological Catch	ABC	SSC	A level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL and any other scientific uncertainty and should be specified based on the ABC control rule.
Annual Catch Limit	ACL	Council	The level of annual catch of a stock or stock complex that serves as the basis for invoking AMs. ACL cannot exceed the ABC, but may be divided into sector-ACLs.
Annual Catch Target	ACT	Council	The amount of annual catch of a stock or stock complex that is the management target of the fishery, and accounts for management uncertainty in controlling the actual catch at or below the ACL.
Accountability Measures	AM	Council	Management controls to prevent ACLs, including sector-ACLs, from being exceeded, and to correct or mitigate overages of the ACL if they occur.
Allocations	n/a	Council	Distribution of the quantity of catch, effort, or biomass among user groups or individuals.
Management measures	n/a	Council	Actions that affect a resource and its exploitation with a view to achieve certain objectives, such as maximizing the production of that resource. Examples include catch quotas, bag limits, size limits, seasonal closures, and area closures.

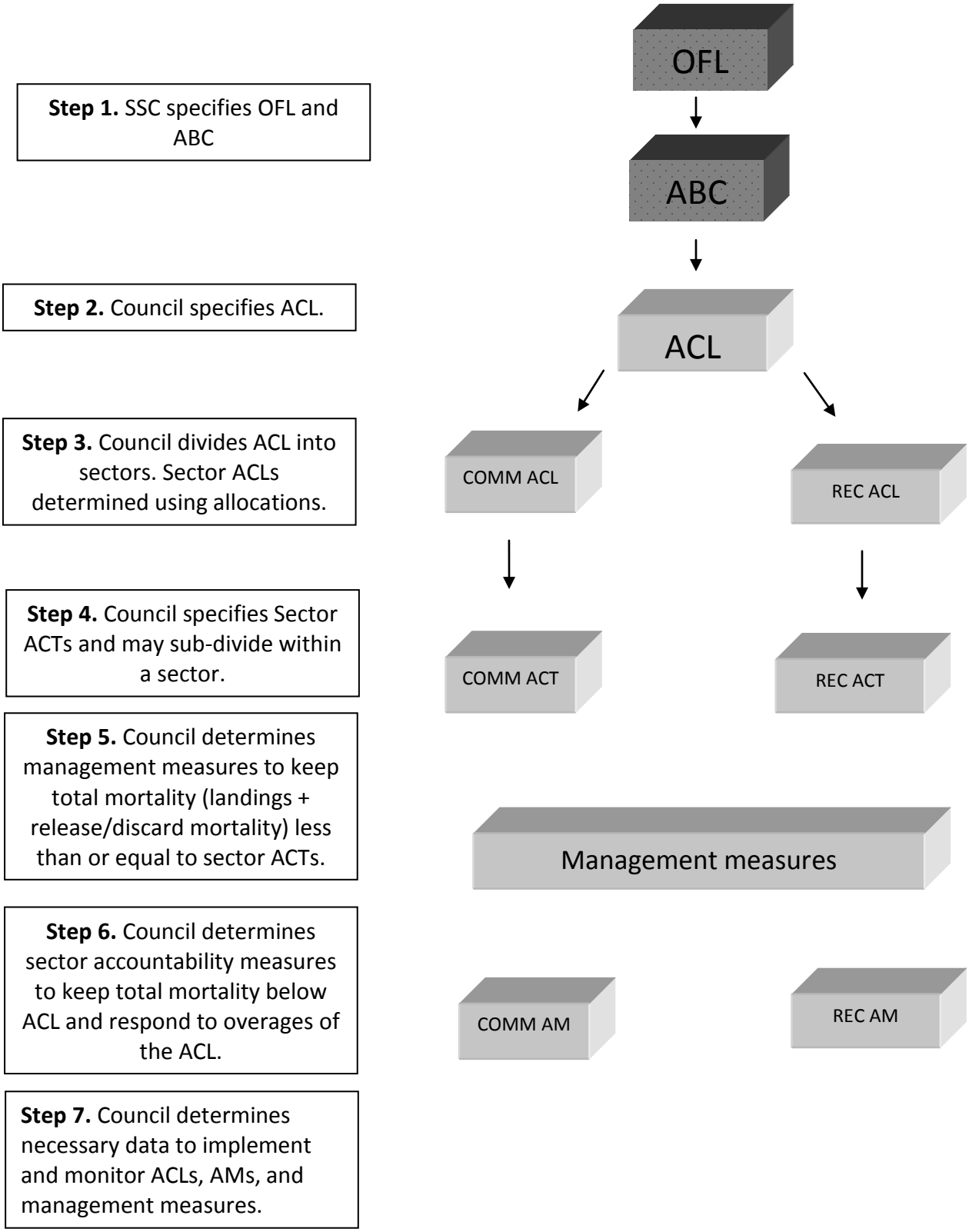


Figure 1-3. The process employed in Snapper Grouper Amendment 17A

1.4.2 SSC Designation of OFL and ABC

The SSC has recommended an overfishing limit (OFL) equal to maximum fishing mortality threshold. In terms of the ABC, the SSC specified, at their December 2008 meeting, a level for red snapper that is consistent with the rebuilding plan until it can be further amended on better scientific information. The SSC met in March and June 2009 and will meet in April 2010 to identify protocol for determining ABCs (commonly referred to an ABC Control Rule), which will be included in the Comprehensive ACL amendment.

The Southeast Fisheries Science Center provided projections of spawning stock biomass, recruitment, landings, discards, and probability of stock recovery, under different fishing mortality rates (**Appendix V**). Projections VII and VIII were provided assuming very high recruitment for red snapper. According to the projections, the likely range of the ABC provided by the SSC will be between 68,000 lbs to 101,000 lbs of total removals.

1.4.3 Development of Alternatives

Current regulations for red snapper allow for a recreational bag limit of 2 fish per person per day and require a 20" total length minimum size limit for both commercial and recreational fishermen. Through Amendment 17A, the Council is proposing the implementation of a *total prohibition of red snapper*. However, a harvest prohibition by itself will not end overfishing because red snapper will still experience bycatch mortality as fishermen pursue other co-occurring species in the snapper grouper complex. The red snapper stock is part of the multi-species fishery; many species occupy the same habitat at the same time. For example, red snapper co-occur with vermilion snapper, tomtate, scup, red porgy, white grunt, black sea bass, red grouper, scamp, and others. This is a significant issue as release mortality rates for red snapper are estimated at 40% for the recreational fishery and 90% for the commercial fishery (due to deeper waters fished and handling practices).

Due to the nature of the fishery and the high release mortality rates, Amendment 17A also includes alternatives that would prohibit the harvest of *all snapper grouper species* in certain areas. The alternatives for the closed areas focus on locations where concentrated landings of red snapper are reported, primarily off the coasts of Georgia and the north and central east coasts of Florida (Figure 1-4).

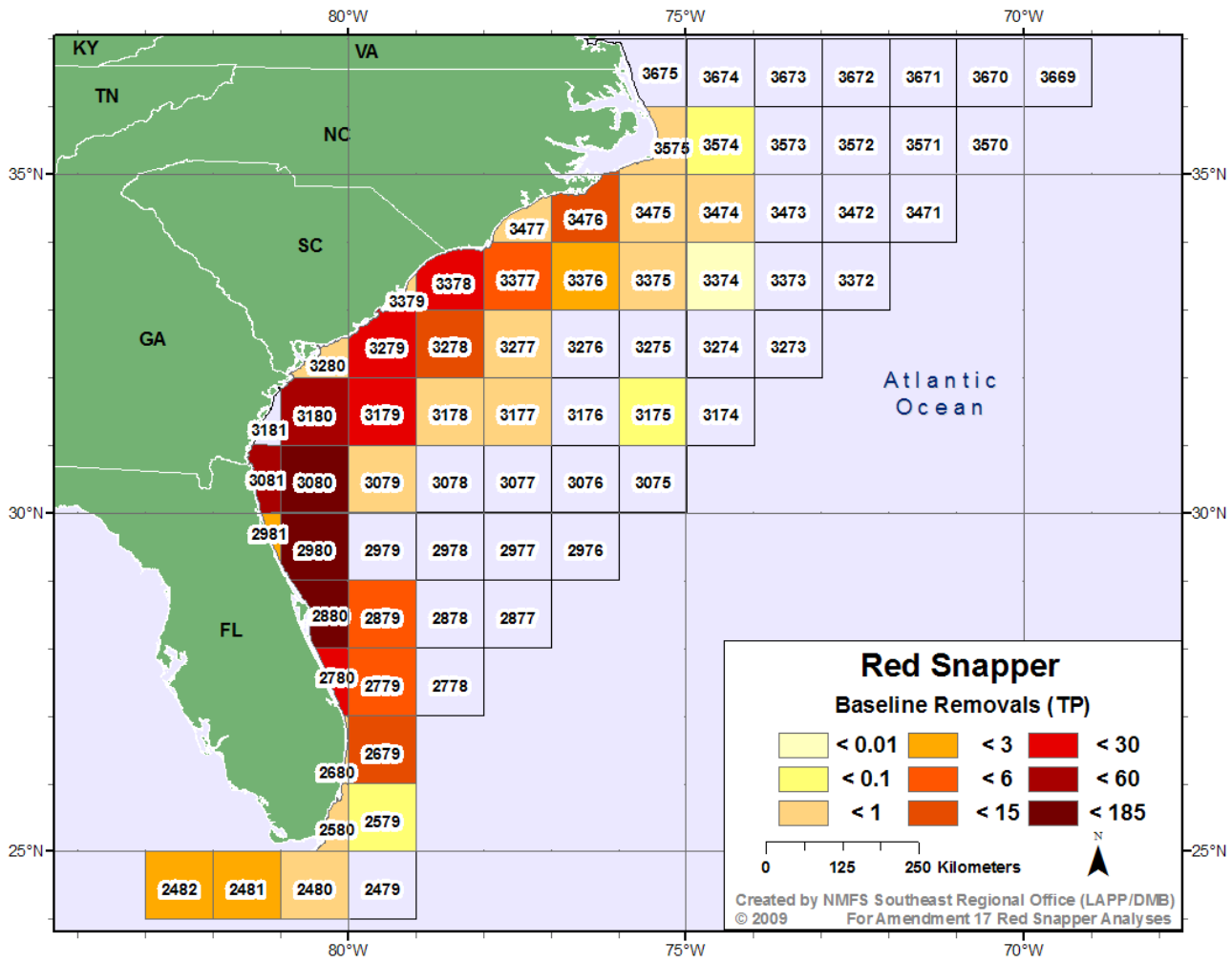


Figure 1-4. Baseline removals of South Atlantic red snapper by logbook grid, 2005-2007. Removals include landings and dead discards in thousands of pounds (TP) from the commercial, headboat and private/charterboat sectors.

1.4.3.1 History of Scoping

The following discussion outlines the evolution of Amendment 17A which was created by taking red snapper actions from two other amendments and creating on amendment that addresses red snapper issues only. First, a Notice of Intent (NOI) to prepare a Draft Environmental Impact Statement (DEIS) for Amendment 17 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region was published January 22, 2008 [73 FR 3701]. In addition to actions addressing red snapper issued, Amendment 17 contained actions to establish annual catch limits (ACLs) and accountability measures (AMs) for the 10 South Atlantic snapper grouper species undergoing overfishing. Scoping meetings for Amendment 17, were held during February 4-8, and February 10-12, 2009. After scoping for ACLs/Amendment 17 was

completed, a NOI for Amendment 18 (also containing red snapper actions) was published (April 7, 2008 [73 FR 18782]) to announce the development of a DEIS to analyze the establishment of a rebuilding plan for the red snapper stock and various management measures to end overfishing. Scoping meetings were held by the Council for Amendment 18 in April and May 2008. After scoping the issue of red snapper overfishing (Amendment 18), the Council decided it would be more appropriate to address all red snapper issues, i.e., ACLs, AMs, *and* overfishing in Amendment 17 even though they had been scoped individually. After this determination was made, the Council decided to split Amendment 17 into Amendments 17A and 17B in order to deal with all actions relating to red snapper separately from the other nine species undergoing overfishing. Thus, Amendment 17A was created to deal only with overfishing, ACLs, and AMs for red snapper, and Amendment 17B was created to establish ACLs, and AMs for gag, vermilion, red grouper, black grouper, snowy grouper, warsaw grouper, black sea bass, speckled hind, and golden tilefish.

To summarize, actions proposed in Amendment 17A would:

- Specify an annual catch limit (ACL) and an accountability measure for red snapper with management measures to end overfishing and reduce the probability that catches will exceed the stocks' ACL.
- Specify status determination criteria for red snapper.
- Specify a rebuilding plan for red snapper.
- Require the use of circle hooks in the snapper grouper fishery.
- Specify a monitoring program for red snapper.

The Regional Administrator determined the newly created Amendment 17B would be analyzed under NEPA through an Environmental Assessment rather than an Environmental Impact Statement (EIS), and Amendment 17A (red snapper) would be analyzed through an EIS. Because all of the actions contained within, what are now Amendments 17A and 17B, were scoped under the original Amendments 17 and 18, NOAA Fisheries Service did not publish any additional or separate NOIs. Issues raised during the scoping process regarding any or all 10 snapper grouper species undergoing overfishing are either addressed and/or analyzed in the supporting NEPA documentation for Amendments 17A and 17B (Appendix M. Scoping Summary for 17A)

1.4.4 Deadlines

Reauthorized Magnuson-Stevens Act

Beginning July 12, 2009, the Reauthorized Magnuson-Stevens Act indicates Councils have two years from the date of an identification or notification to prepare and implement an FMP, FMP amendment, or proposed regulations to end overfishing immediately in the fishery and to rebuild affected stocks. Because the Council received the notification of overfishing on July 8, 2008, the Council is working under the previous version of the Act. The previous version requires the Council to prepare a plan amendment or proposed regulations to end overfishing within one year of notification that a stock is overfished.

Three statutory requirements are driving timelines for Amendment 17A. First, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires the Council to prepare a plan amendment or proposed regulations to end overfishing within one year of being notified that a stock is experiencing overfishing
The Council received notification, in a letter dated July 8, 2008, that the South Atlantic red snapper stock is undergoing overfishing and is overfished. A plan cannot be prepared before the deadline due to the significance of the actions and the extensive analyses required. As a result, the Council requested NOAA Fisheries Service, in March 2009, to establish interim measures to reduce fishing pressure on the red snapper stock. Interim measures to reduce overfishing became effective on January 4, 2010. The interim rule is effective for 180 days, and may be extended for an additional 186 days since the Council is proposing long-term management measures in Amendment 17A to end overfishing of red snapper and rebuild the stock.

Second, the Magnuson-Stevens Act requires that the Council must implement a rebuilding plan for overfished stocks and identify a time period for rebuilding the stock or stock complex based on factors specified in Magnuson-Stevens Act section 304(e)(4). The time period for rebuilding the fishery, as outlined in the Act, must be as short as possible and shall not exceed 10 years except in specific cases. The Act further clarifies that the needs of fishing communities must be considered when designating the time period. More specific guidance on the rebuilding time is provided by the Magnuson-Steven Act's National Standard 1 Guidelines at 50 CFR § 600.310(j)(3)(i)(D) (see text box).

Guidance for Rebuilding Timeframes

The "minimum time for rebuilding a stock" (T_{MIN}) means the amount of time the stock or stock complex is expected to take to rebuild to its MSY biomass level in the absence of any fishing mortality. If T_{MIN} for the stock or stock complex is 10 years or less, then the maximum time allowable for rebuilding (T_{MAX}) that stock to its B_{MSY} is 10 years. If T_{MIN} for the stock or stock complex exceeds 10 years, then the maximum time allowable for rebuilding a stock or stock complex to its B_{MSY} is T_{MIN} plus the length of time associated with one generation time for that stock or stock complex. "Generation time" is the average length of time between when an individual is born and the birth of its offspring. The generation time for red snapper is 25 years.

Finally, revisions to the Magnuson-Stevens Act in 2006 require that by 2010, Fishery Management Plans (FMPs) for fisheries determined by the Secretary to be subject to overfishing must establish a mechanism for specifying ACLs at a level that prevents overfishing and does not exceed the recommendations of the respective Council's SSC or other established peer review processes.

1.5 History of Management

The snapper grouper fishery is highly regulated; some of the species included in this amendment have been regulated since 1983. A detailed history of management for all species in the snapper grouper fishery management unit may be found in **Appendix T**. Below is an annotated list of fishery management plan amendments that contained actions specifically related to red snapper.

Fishery Management Plan for the Snapper-Grouper Fishery of the South Atlantic Region 1983

The original Fishery Management Plan (FMP)included provisions to prevent growth overfishing in thirteen species in the snapper grouper complex and established a procedure for preventing overfishing in other species; established minimum size limits for red snapper, yellowtail snapper, red grouper, Nassau grouper, and black sea bass, a 4" trawl mesh size to achieve a 12" total length minimum size limit for vermilion snapper; and included additional harvest and gear limitations. Regulatory Amendment 1 (1987) implemented special management zones (SMZ) off South Carolina and Georgia.

Amendment 4 to the Fishery Management Plan for the Snapper-Grouper Fishery of the South Atlantic Region 1991

Amendment 4 prohibited the use of various gear, including fish traps, the use of bottom longlines for wreckfish, and powerheads in SMZs off South Carolina; established bag limits and minimum size limits for several species (20” total length minimum size limit and 2 fish bag limit for red snapper); established income requirements to qualify for permits; and required that all snapper grouper species possessed in South Atlantic Federal waters must have heads and fins intact through landing.

Amendment 11 to the Fishery Management Plan for the Snapper-Grouper Fishery of the South Atlantic Region 1998

Amendment 11 amended the FMP to make definitions of maximum sustainable yield, optimum yield, overfishing, and overfished consistent with "National Standard Guidelines". Amendment 11 also identified and defined fishing communities, addressed bycatch management measures, and defined the red snapper F_{MSY} SPR proxy as $F_{30\%SPR}$.

1.6 Management Objectives

Objectives of the Snapper Grouper FMP, as modified by Amendment 8 (SAFMC June 1996), are shown below. In addition, two new objectives as proposed in Amendment 17A are also provided.

1. Prevent overfishing.
2. Collect necessary data.
3. Promote orderly utilization of the resource.
4. Provide for a flexible management system.
5. Minimize habitat damage.
6. Promote public compliance and enforcement.
7. Mechanism to vest participants.
8. Promote stability and facilitate long run planning.
9. Create market-driven harvest pace and increase product continuity.
10. Minimize gear and area conflicts among fishermen.
11. Decrease incentives for overcapitalization.
12. Prevent continual dissipation of returns from fishing through open access.
13. Evaluate and minimize localized depletion.

The existing management program does not currently include objectives to end overfishing and rebuild overfished stocks, actions now required by the Reauthorized Magnuson-Stevens Act. Therefore, the Council has recommended adding the following two new management objectives to the FMP:

14. End overfishing of snapper grouper stocks undergoing overfishing.
15. Rebuild stocks declared overfished.

2 Actions and Alternatives

Section 2 outlines alternatives considered by the Council in this amendment and compares their environmental consequences (described in detail in **Section 4.0**). These alternatives were identified and developed through multiple processes, including the scoping process, public hearings and/or comments, interdisciplinary plan team meetings, and meetings of the Council, the Council's Snapper Grouper Committee, Snapper Grouper Advisory Panel, and Scientific and Statistical Committee (SSC). Species affected by the proposed actions and alternatives below include red snapper and co-occurring species. Alternatives the Council considered but eliminated from detailed study during the development of this amendment are described in **Appendix A**.

All alternatives analyzed in this EIS would achieve the requirements of NEPA outlined in Section 101 and 102 of the Act. Alternatives for the specification of management reference points, the red snapper rebuilding plan, management measures intended to end overfishing of red snapper, and alternatives for a red snapper monitoring program were developed to ensure the long-term sustainability of the red snapper stock for future generations. Actions to end

overfishing of red snapper would require fishery participants to significantly reduce harvest of red snapper, thereby, giving the fishermen ownership in contributing to the preservation and enhancement of the environment. Alternatives for actions affecting red snapper were developed by an interdisciplinary fishery management council and are analyzed by an interdisciplinary planning team who is tasked with drafting the subject EIS. The Amendment 17A EIS provides relevant background information and in-depth analyses of each action alternative considered by the Council. Thus, the subject EIS complies with Section 102 of NEPA by providing the Secretary of Commerce all the information needed to make a prudent decision regarding approval of the amendment and subsequent implementation through the rulemaking process.

2.1 Maximum Sustainable Yield (MSY) proxy for red snapper

Table 2-1. MSY and MSY proxy alternatives for red snapper.

Alternatives	**Equation**	**F_{MSY}**	**MSY Values (lbs whole weight)**
Alternative 1 (Status quo)	MSY equals the yield produced by $F_{MSY.}$ $F_{30\%SPR}$ is used as the F_{MSY} proxy.	$F_{30\%SPR}$[1]= 0.148[2]	2,431,000[3]
Alternative 2 (Preferred)	MSY equals the yield produced by F_{MSY} or the F_{MSY} proxy. MSY and $F_{40\%SPR}$ are recommended by the most recent SEDAR/SSC.[4]	$F_{40\%SPR}$= 0.104[2]	2,304,000[5]

[1]Prior to SEDAR 15 (2008), Potts et al. (2001) estimated $F_{30\%SPR}$= 0.40.
[2]Source: Red Snapper Projections V dated March 19, 2009
[3]The value for MSY was not specified in Amendment 11. Based on SEDAR 15 (2008) $F_{30\%SPR}$ = 0.148; yield at $F_{30\%SPR}$ = 2,431,000 lbs whole weight (Table 4.1 from Red Snapper Projections V dated March 19, 2009).
[4]The Review Panel from SEDAR and the SSC recommended a proxy of $F_{40\%SPR}$ for $F_{MSY.}$
[5]The values for MSY and $F_{40\%\ SPR}$ are defined by Red Snapper Projections V dated March 19, 2009. The range of MSY from sensitivity runs is 559,000 lbs whole weight to 3,927,000 lbs whole weight.

Table 2-2. Criteria used to determine the overfished and overfishing status of red snapper.

Quantity	Units	$F_{40\%}$ Proxy	$F_{30\%}$ Proxy	Status
F_{MSY}	y−1	0.104	0.148	−
SSB_{MSY}	1000 lbs	17,863	13,283	−
D_{MSY}	1000 fish	39	54	−
Recruits at F_{MSY}	1000 fish	693	686	−
Y at 65% F_{MSY}	1000 lb	1984	2257	−
Y at 75% F_{MSY}	1000 lb	2104	2338	−
Y at 85% F_{MSY} Y	1000 lb	2199	2391	−
Y at F_{MSY}	1000 lb	2304	2431	−
MSST	1000 lb	16,470	12,247	−
F_{2006}/ F_{MSY}	–	7.67	5.39	Overfishing
SSB_{2006}/SSB_{MSY}	–	0.02	0.03	−
SSB_{2006}/MSST	–	0.03	0.04	Overfished

Source: Table 4.1 in Red Snapper Projections V dated March 19, 2009.

2.1.1 Comparison of Alternatives

Table 2-2a Summary of effects of MSY Proxy alternatives for red snapper

Alternatives	Biological Effects	Socioeconomic/Administrative Effects
Alternative 1 (Status Quo)	(-) May not be sufficient to end overfishing within the allowable timeframe	(+) Short-term (-) Long-term In the short-term there would be no economic impacts; however, If overfishing is not corrected there may be long-term socioeconomic consequences in the form of reduced harvest and reduced revenue.
Alternative 2 (Preferred). MSY proxy = $F_{40\%SPR}$	(+) Provides greater assurance overfishing would be ended and the stock would rebuild within the specified time.	(-) Short-term (+) Long-term Short-term harvest restrictions needed to end overfishing and manage the stock to the proposed new MSY proxy level would incur negative socioeconomic impacts. In the long-term, ending overfishing will benefit the socioeconomic environment by ensuring a steady and sustainable level of harvest.

(-) overall negative impacts, (+) overall positive impacts, (- +) neutral impacts

MSY in **Alternative 1 (Status Quo)** is defined as the yield produced by F_{MSY} where $F_{30\%SPR}$ is used as the F_{MSY} proxy and represents the overfishing level defined in Amendment 11. In **Alternative 1 (Status Quo)**, MSY was not specified in Amendment 11; however, Table 4.1 from Red Snapper Projections V dated March 19, 2009 provides an estimate of the yield equal to $F_{30\%SPR}$ proxy as 2,431,000 lbs whole weight based on SEDAR 15 (2008). **Alternative 2 (Preferred)** would redefine the MSY of the red snapper stock to equal the value associated with the $F_{40\%SPR}$ proxy (2,304,000 lbs whole weight).

Alternative 2 (Preferred) is based on the SSC's recommendation and would specify an MSY proxy equal the yield at $F_{40\%SPR}$ with a steepness of 0.95. MSY for other species recently assessed through the SEDAR process has been based on the yield at F_{MSY} or the Council's status quo proxy for F_{MSY} ($F_{30\%SPR}$). Therefore, **Alternative 2 (Preferred)** would establish a new proxy for F_{MSY} not previously used for red snapper, which is more conservative than the status quo proxy of $F_{30\%SPR}$. The choice of **Alternative 2 (Preferred)**, which uses $F_{40\%SPR}$ as a proxy for F_{MSY} versus $F_{30\%SPR}$ as proxy for F_{MSY} depends on how much risk the Council and NOAA Fisheries Service is willing to take. If the status quo $F_{30\%SPR}$ (**Alternative 1**) is chosen but is not a proper proxy for F_{MSY}, the Council could have to take corrective actions in the future to rebuild the stock to B_{MSY} within the allowable timeframe. **Alternative 2 (Preferred)**, which uses $F_{40\%SPR}$ as a proxy for F_{MSY} is more conservative and provides greater assurance overfishing would be ended and the stock would rebuild within the specified time. Therefore, the biological benefits of **Alternative 2 (Preferred)** for the red snapper stock would be greater than **Alternative 1 (Status Quo)** because **Alternative 2 (Preferred)** would allow for less harvest increasing the likelihood that overfishing would end and the stock would be rebuilt to SSB_{MSY}.

As the yield at $F_{30\%SPR}$ is greater than the yield at $F_{40\%SPR}$, a F_{MSY} proxy that is too conservative could have unnecessary negative social and economic effects in terms of more restrictive

management measures including larger area closures (See **Section 2.3**). In principle, more stringent measures would logically be required under a MSY alternative that is more conservative from a biological standpoint; conversely, less stringent measures would be required under a MSY alternative that is less conservative. As with any fishing regulations, the economic issue involves the balancing of short-term costs and long-term benefits. The economically preferable MSY proxy choice would be one that is expected to result in the highest net economic benefits over time. In 2003-2007, the average combined commercial and recreational red snapper landings were approximately 440 thousand pounds. In contrast, the MSY proxy would be 2.431 million pounds under **Alternative 1 (Status Quo)** and 2.204 million pounds under **Alternative 2 (Preferred)**. This wide gap between current landings and potential landings has at least two implications. First, both MSY proxy definitions would require more stringent management measures to rebuild the red snapper stock. Second, there appears a relatively high likelihood that future benefits from the fishery would outweigh the costs of implementing stringent management measures.

The Council has specified the Minimum Stock Size Threshold (MSST), which if approved by NOAA Fisheries Service would define the biomass using the formula MSST = (1-M)*SSB_{MSY}. This formula is recommended in the Technical Guidance Document (Restrepo *et al*. 1998) developed by NOAA Fisheries Service and represents 1 minus the natural mortality multiplied by the spawning stock biomass at maximum sustainable yield. The value from Red Snapper Projections V dated March 19, 2009 is 16,469,633 lbs whole weight (7470.5 mt). An in-depth analysis of the impacts of MSY alternatives may be found in **Section 4.1** of this document.

2.2 Red Snapper Rebuilding Plan

2.2.1 Rebuilding Schedule

Alternative 1 (Status Quo). There currently is not a rebuilding plan for red snapper. Snapper Grouper Amendment 4 (regulations effective January 1992) implemented a 15-year rebuilding plan beginning in 1991 which expired in 2006.

Alternative 2. Define a rebuilding schedule as the shortest possible period to rebuild in the absence of fishing mortality (T_{MIN}). This would equal 15 years with the rebuilding time period ending in 2024, 2010 is Year 1.

Alternative 3. Define a rebuilding schedule as the mid-point between the shortest possible and maximum recommended period to rebuild. This would equal 25 years with the rebuilding time period ending in 2034, 2010 is Year 1.

Alternative 4 (Preferred). Define a rebuilding schedule as the maximum recommended period to rebuild if T_{MIN} > 10 years. The maximum recommended period equals T_{MIN} + one generation time. This would equal 35 years with the rebuilding time period ending in 2044 (SEDAR 15 2008 was the source of the generation time). 2010 is Year 1.

2.2.1.1 Comparison of Alternatives

Table 2-3 Summary of effects of rebuilding schedule alternatives for red snapper

Alternatives	Biological Effects	Socioeconomic/Administrative Effects
Alternative 1 (Status Quo)	(- +) If fishing related mortality was limited to the OY level, which would be 75%F_{MSY}, the stock would rebuild with or without a plan.	(-) The rebuilding plan would not comply with the requirements of the Magnuson-Stevens Act
Alternative 2. 15 year rebuilding period	(+) Would achieve the goal of rebuilding in the shortest amount of time	(-) Would incur the highest level of short-term negative socioeconomic impacts
Alternative 3. 25 year rebuilding period	(+) Would achieve the goal of rebuilding in a moderate amount of time.	(-) Would incur a level of socioeconomic impact in between that of Alternative 2 and Alternative 4 (Preferred)
Alternative 4 (Preferred). 35 year rebuilding period	(+) Would rebuild the stock over the longest period of time.	(-) Would incur the lowest level of socioeconomic impact because it would require the least restrictive harvest provisions. (+) Highest net benefits over time

(-) overall negative impacts, (+) overall positive impacts, (- +) neutral impacts

The reauthorized Magnuson-Stevens Act requires amendment actions aimed at ending overfishing of species that are overfished and undergoing overfishing be accompanied by a rebuilding plan for the species. One part of a rebuilding plan is the rebuilding schedule; therefore, if no rebuilding schedule is established for red snapper as specified under **Alternative 1 (Status Quo)**, the rebuilding plan would not comply with the previously mentioned requirements of the Magnuson-Stevens Act. However, if fishing related mortality was limited to the OY level, which would be 75%F_{MSY}, the stock would rebuild with or without a plan. **Alternatives 2-4 (Preferred)** would establish rebuilding schedules that would end within the time periods allowed by the reauthorized Magnuson-Stevens Act. These alternatives differ in the length of time prescribed to rebuild the species, ranging from ranging from 15 years (**Alternative 2**) to 35 years (**Alternative 4 (Preferred)**). The shorter a rebuilding schedule, the more restrictive harvest limitations need to be to achieve the rebuilding goal, and the more negative the short-term socioeconomic impacts. Therefore, it can be assumed that **Alternative 2**, which would implement the shortest rebuilding schedule, would achieve the goal of rebuilding in the shortest amount of time, but would also incur the highest level of short-term negative socioeconomic impacts. **Alternative 2** would not be expected to rebuild the stock to B_{MSY} because it is not possible to eliminate incidental mortality on one species in a multi-species complex, without prohibiting fishermen from targeting all associated species wherever the prohibited species occurs. The Council is considering alternatives in **Section 2.3** that would rebuild red snapper within the timeframe specified in **Alternative 3**. However, the probability that the stock could rebuild within the 25 year timeframe is less certain than longer timeframes due to uncertainties associated with assessment and effectiveness of proposed management measures. The Council is considering substantial measures to reduce fishing mortality in this amendment including area closures for all snapper grouper species. If approved by NOAA Fisheries Service an area closure could reduce bycatch of red snapper and co-occurring species

but it is uncertain to what extent bycatch of red snapper would be reduced. Consequently, the Council has chosen **Alternative 4** as the preferred rebuilding strategy alternative.

Alternative 3 would incur a level of negative short-term socioeconomic impacts between that of **Alternatives 2** and **4 (Preferred). Alternative 4 (Preferred)** would require the least restrictive harvest limitations in order to achieve a rebuilt status within the 35-year period, and therefore, would incur the least negative socioeconomic impacts relative to **Alternatives 2** and **3**. While incidental mortality would still occur under **Alternative 4 (Preferred)**, the associated costs of regulations would not be as high as in the other two alternatives. In addition, this alternative would provide a timeframe sufficiently long to rebuild the red snapper stock as well as flexibility in the type of management measures to implement over time. In this sense, **Alternative 4 (Preferred)** may be characterized with a higher likelihood of generating the highest net benefits over time. Non-use values, like existence and bequest values, would be highest under **Alternative 2** and lowest under **Alternative 1 (Status Quo)** and **Alternative 3**. However, the differences in non-use value between **Alternatives 2, 3,** and **4 (Preferred)** are minimal.

2.2.2 Rebuilding Strategy and Optimum Yield

Note: Projections may be based upon various levels of recruitment in a fishery, ranging from very low to very high recruitment. All alternatives in this analysis are based upon a ***very high recruitment*** *scenario referenced in the most recent SEFSC projections (January 2010,* ***Appendix F****) .*

Table 2-4. Summary of the total kill required, reduction needed in total removals, and probability of rebuilding for Alternatives 1-9.

Alternative	Total Kill	% Reduction	Year Rebuilt (50% Prob)	Prob rebuilt 2044
Alternative 1 (Status Quo) ($F_{45\%SPR}$)	89,000	85%	2035*; 2025**	70%*; 99%**
Alternative 2 (85%$F_{40\%SPR}$)	89,000	85%	2035	70%
Alternative 3 (75%$F_{40\%SPR}$)	79,000	87%	2032	84%
Alternative 4 (65%$F_{40\%SPR}$)	68,000	91%	2029	94%
Alternative 5 (Preferred) (97%$F_{40\%SPR}$)	**101,000**	**83%**	**2044**	**50%**
Alternative 6 (85%$F_{30\%SPR}$)	125,000	79%	2031	78%
Alternative 7 (75%$F_{30\%SPR}$)	111,000	82%	2028	92%
Alternative 8 (65%$F_{30\%SPR}$)	97,000	84%	2026	98%
Alternative 9 (98%$F_{30\%SPR}$)	144,000	76%	2040	53%

*Compared to SSB_{MSY} = 17,863,000 lbs whole weight for $F_{40\%SPR}$ F_{MSY} proxy.
**Compared to SSB_{MSY} = 13,283 000 lbs whole weight for $F_{30\%SPR}$ F_{MSY} proxy.

Alternative 1 (Status Quo). Maintain a yield-based rebuilding strategy for red snapper where $F_{OY} = F_{45\%SPR}$ (equivalent to 85% $F_{40\%SPR}$ and 59%$F_{30\%SPR}$). The value for OY at equilibrium is 2,196,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2035 and a 70% chance of rebuilding to SSB_{MSY} by 2044 based on a $F_{40\%SPR}$ proxy for F_{MSY}. ACL is not specified.

Alternative 2. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 85% F_{MSY} (85%$F_{40\%}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,199,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2035 and 70% chance of rebuilding to SSB_{MSY} by 2044 (Table 2-5a).

Alternative 3. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 75% F_{MSY} (75%$F_{40\%}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,104,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2032 and an 84% chance of rebuilding to SSB_{MSY} by 2044 (Table 2-5b).

Alternative 4. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 65%F_{MSY} (65%$F_{40\%}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 1,984,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2029, and a 94% chance of rebuilding to SSB_{MSY} by 2044 (Table 2-5c).

Alternative 5 (Preferred). Define a rebuilding strategy for red snapper that sets F_{OY} equal to 97% F_{MSY} (97%$F_{40\%}$) and rebuilds in 35 years. The ACL (total removals) specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,291,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2044 (Table 2-5d).

Alternative 6. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 85% F_{MSY} (85%$F_{30\%}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,392,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2031 and 78% chance of rebuilding to SSB_{MSY} by 2044 (Table 2-5e).

Alternative 7. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 75% F_{MSY} (75%$F_{30\%}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,338,000 whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2028 and an 92% chance of rebuilding to SSB_{MSY} by 2044 (Table 2-5f).

Alternative 8. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 65%F_{MSY} (65%$F_{30\%}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,257,000 whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2026, and a 98% chance of rebuilding to SSB_{MSY} by 2044 (Table 2-5g).

Alternative 9. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 98% F_{MSY} (98%$F_{30\%}$) and rebuilds in 35 years. The ACL (total removals) specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,464,000 lbs whole weight. Under this strategy, the fishery would have a 53% chance of rebuilding to SSB_{MSY} by 2044 (Table 2-5h).

The following sub-alternatives would apply to **Alternative 2** through **Alternative 9**.

> **Sub-alternative 2A-9A.** Establish an ACL based on landings. The ACL in 2010 would equal 0.

Establish three AMs:

(1) Track CPUE of red snapper via a fishery-independent monitoring program (see Section 2.5) to track changes in biomass and take action to end overfishing if assessment indicates progress is not being made.
(2) Track the biomass and CPUE through fishery-dependent sampling as proposed in Section 2.5.
(3) CPUE would be evaluated every three years and adjustments would be made by the framework action being developed in Amendment 17B.

Sub-alternative 2B-9B. Establish an ACL based on total removals. The ACL in 2010 would equal the values for total kill specified in Table 2-3 of this section.

Establish three AMs:

(1) Track CPUE of red snapper via a fishery-independent monitoring program (see Section 2.5) to track changes in biomass and take action to end overfishing if assessment indicates progress is not being made.
(2) Track the biomass and CPUE through fishery-dependent sampling as proposed in Section 2.5.
(3) The Council would evaluate the size of the area closures when the dead discards are estimated to exceed the ACL. CPUE would be evaluated every three years and adjustments would be made by the framework action being developed in Amendment 17B.

Table 2-5. Reduction in total removals (landings plus dead discards) needed end overfishing. Determined by comparing expected landings in 2010 to average landings during 2006-2007. Non-shaded areas determined by comparing estimated landings in 2009 with allowable removals in 2010. Shaded areas are estimated by interpolation. Alternatives 2-5 use $F_{40\%SPR}$ as F_{MSY} proxy; Alternatives 6-9 use $F_{30\%SPR}$ as F_{MSY} proxy. Council's preferred choice is to use very high recruitment with $F_{40\%SPR}$ proxy for F_{MSY}.

Fmsy proxy	F40% proxy				F30% proxy			
	Base Estimated Recruitment	High Recruitment	Very High Recruitment	Extremely High Recruitment	Base Estimated Recruitment	High Recruitment	Very High Recruitment	Extremely High Recruitment
Alternative 2 and 6 (85% F_{MSY})	89%	88%	85%	81%	84%	83%	79%	79%
Alternative 3 and 7 (75% F_{MSY})	90%	89%	87%	85%	86%	85%	82%	81%
Alternative 4 and 8 (65% F_{MSY})	91%	90%	89%	87%	88%	87%	84%	83%
Alternative 5 and 9 (97% F_{MSY})	87%	86%	83%	81%	82%	81%	76%	73%

Table 2-5a. Red snapper projections under a fishing mortality rate of 85% F_{MSY} (85%$F_{40\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (Alternative 2).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.088	66	23	89	0.00	overfishing prevented if total kill<105,000 lb
2011	0.088	111	30	141	0.00	overfishing prevented if total kill<164,000 lb
2012	0.088	172	32	204	0.00	overfishing prevented if total kill<235,000 lb
2013	0.088	244	38	282	0.00	overfishing prevented if total kill<322,000 lb
2014	0.088	328	46	374	0.00	overfishing prevented if total kill<426,000 lb
2015	0.088	428	51	479	0.00	overfishing prevented if total kill<542,000 lb
2016	0.088	537	54	591	0.00	overfishing prevented if total kill<665,000 lb
2017	0.088	651	56	707	0.00	overfishing prevented if total kill<793,000 lb
2018	0.088	768	58	826	0.00	overfishing prevented if total kill<922,000 lb
2019	0.088	885	59	944	0.00	overfishing prevented if total kill<1,049,000 lb
2020	0.088	998	60	1058	0.00	overfishing prevented if total kill<1,171,000 lb
2021	0.088	1107	60	1167	0.01	overfishing prevented if total kill<1,288,000 lb
2022	0.088	1210	61	1271	0.01	overfishing prevented if total kill<1,397,000 lb
2023	0.088	1306	61	1367	0.03	overfishing prevented if total kill<1,499,000 lb
2024	0.088	1395	61	1456	0.05	overfishing prevented if total kill<1,592,000 lb
2025	0.088	1477	62	1539	0.08	overfishing prevented if total kill<1,677,000 lb
2026	0.088	1552	62	1614	0.11	overfishing prevented if total kill<1,755,000 lb
2027	0.088	1621	62	1683	0.15	overfishing prevented if total kill<1,824,000 lb
2028	0.088	1683	62	1745	0.19	overfishing prevented if total kill<1,887,000 lb
2029	0.088	1738	62	1800	0.25	overfishing prevented if total kill<1,943,000 lb
2030	0.088	1789	62	1851	0.29	overfishing prevented if total kill<1,993,000 lb
2031	0.088	1834	62	1896	0.35	overfishing prevented if total kill<2,038,000 lb
						SSB > MSST
2032	0.088	1874	62	1936	0.38	overfishing prevented if total kill<2,078,000 lb
2033	0.088	1910	62	1972	0.43	overfishing prevented if total kill<2,113,000 lb
2034	0.088	1943	62	2005	0.48	overfishing prevented if total kill<2,144,000 lb
2035	0.088	1971	62	2033	0.52	overfishing prevented if total kill<2,171,000 lb
						SSB > SSBmsy
2036	0.088	1997	63	2060	0.55	overfishing prevented if total kill<2,196,000 lb
2037	0.088	2020	63	2083	0.58	overfishing prevented if total kill<2,217,000 lb
2038	0.088	2040	63	2103	0.60	overfishing prevented if total kill<2,237,000 lb
2039	0.088	2058	63	2121	0.63	overfishing prevented if total kill<2,2554,000 lb
2040	0.088	2074	63	2137	0.65	overfishing prevented if total kill<2,269,000 lb
2041	0.088	2088	63	2151	0.67	overfishing prevented if total kill<2,282,000 lb
2042	0.088	2101	63	2164	0.68	overfishing prevented if total kill<2,293,000 lb
2043	0.088	2112	63	2175	0.69	overfishing prevented if total kill<2,303,000 lb
2044	0.088	2122	63	2185	0.70	overfishing prevented if total kill<2,312,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=$F_{40\%}$=0.104; MSST=7471mt; SSB_{MSY}=8103mt; Y@F_{MSY}=2,304,000 lb.

Table 2-5b. Red snapper projections under a fishing mortality rate of 75% F_{MSY} (75%$F_{40\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (Alternative 3).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.078	59	20	79	0.00	overfishing prevented if total kill<105,000 lb
2011	0.078	99	26	125	0.00	overfishing prevented if total kill<164,000 lb
2012	0.078	154	29	183	0.00	overfishing prevented if total kill<235,000 lb
2013	0.078	219	34	253	0.00	overfishing prevented if total kill<322,000 lb
2014	0.078	297	41	338	0.00	overfishing prevented if total kill<426,000 lb
2015	0.078	388	45	433	0.00	overfishing prevented if total kill<542,000 lb
2016	0.078	489	48	537	0.00	overfishing prevented if total kill<665,000 lb
2017	0.078	595	50	645	0.00	overfishing prevented if total kill<793,000 lb
2018	0.078	704	51	755	0.00	overfishing prevented if total kill<922,000 lb
2019	0.078	812	52	864	0.00	overfishing prevented if total kill<1,049,000 lb
2020	0.078	919	53	972	0.00	overfishing prevented if total kill<1,171,000 lb
2021	0.078	1022	54	1076	0.01	overfishing prevented if total kill<1,288,000 lb
2022	0.078	1119	54	1173	0.02	overfishing prevented if total kill<1,397,000 lb
2023	0.078	1211	54	1265	0.05	overfishing prevented if total kill<1,499,000 lb
2024	0.078	1296	55	1351	0.08	overfishing prevented if total kill<1,592,000 lb
2025	0.078	1375	55	1430	0.12	overfishing prevented if total kill<1,677,000 lb
2026	0.078	1448	55	1503	0.17	overfishing prevented if total kill<1,755,000 lb
2027	0.078	1514	55	1569	0.22	overfishing prevented if total kill<1,824,000 lb
2028	0.078	1575	55	1630	0.29	overfishing prevented if total kill<1,887,000 lb
						SSB > MSST
2029	0.078	1629	55	1684	0.35	overfishing prevented if total kill<1,943,000 lb
2030	0.078	1679	55	1734	0.41	overfishing prevented if total kill<1,993,000 lb
2031	0.078	1724	55	1779	0.47	overfishing prevented if total kill<2,038,000 lb
2032	0.078	1764	56	1820	0.54	overfishing prevented if total kill<2,078,000 lb
						SSB > SSBmsy
2033	0.078	1800	56	1856	0.59	overfishing prevented if total kill<2,113,000 lb
2034	0.078	1833	56	1889	0.63	overfishing prevented if total kill<2,144,000 lb
2035	0.078	1862	56	1918	0.68	overfishing prevented if total kill<2,171,000 lb
2036	0.078	1888	56	1944	0.71	overfishing prevented if total kill<2,196,000 lb
2037	0.078	1911	56	1967	0.74	overfishing prevented if total kill<2,217,000 lb
2038	0.078	1932	56	1988	0.76	overfishing prevented if total kill<2,237,000 lb
2039	0.078	1951	56	2007	0.79	overfishing prevented if total kill<2,2554,000 lb
2040	0.078	1967	56	2023	0.80	overfishing prevented if total kill<2,269,000 lb
2041	0.078	1982	56	2038	0.81	overfishing prevented if total kill<2,282,000 lb
2042	0.078	1995	56	2051	0.82	overfishing prevented if total kill<2,293,000 lb
2043	0.078	2007	56	2063	0.83	overfishing prevented if total kill<2,303,000 lb
2044	0.078	2018	56	2074	0.84	overfishing prevented if total kill<2,312,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F40%=0.104; MSST=7471mt; SSB_{MSY}=8103mt; Y@F_{MSY}=2,304,000 lb.

Table 2-5c. Red snapper projections under a fishing mortality rate of 65% F_{MSY} (65%$F_{40\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (Alternative 4).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.068	51	17	68	0.00	overfishing prevented if total kill<105,000 lb
2011	0.068	87	23	110	0.00	overfishing prevented if total kill<164,000 lb
2012	0.068	135	25	160	0.00	overfishing prevented if total kill<235,000 lb
2013	0.068	194	30	224	0.00	overfishing prevented if total kill<322,000 lb
2014	0.068	264	36	300	0.00	overfishing prevented if total kill<426,000 lb
2015	0.068	346	40	386	0.00	overfishing prevented if total kill<542,000 lb
2016	0.068	437	42	479	0.00	overfishing prevented if total kill<665,000 lb
2017	0.068	534	44	578	0.00	overfishing prevented if total kill<793,000 lb
2018	0.068	633	45	678	0.00	overfishing prevented if total kill<922,000 lb
2019	0.068	733	46	779	0.00	overfishing prevented if total kill<1,049,000 lb
2020	0.068	831	46	877	0.01	overfishing prevented if total kill<1,171,000 lb
2021	0.068	927	47	974	0.01	overfishing prevented if total kill<1,288,000 lb
2022	0.068	1017	47	1064	0.04	overfishing prevented if total kill<1,397,000 lb
2023	0.068	1103	48	1151	0.08	overfishing prevented if total kill<1,499,000 lb
2024	0.068	1183	48	1231	0.12	overfishing prevented if total kill<1,592,000 lb
2025	0.068	1258	48	1306	0.18	overfishing prevented if total kill<1,677,000 lb
2026	0.068	1327	48	1375	0.25	overfishing prevented if total kill<1,755,000 lb
2027	0.068	1390	48	1438	0.33	overfishing prevented if total kill<1,824,000 lb
						SSB > MSST
2028	0.068	1448	48	1496	0.41	overfishing prevented if total kill<1,887,000 lb
2029	0.068	1501	48	1549	0.49	overfishing prevented if total kill<1,943,000 lb
						SSB > SSBmsy
2030	0.068	1549	49	1598	0.57	overfishing prevented if total kill<1,993,000 lb
2031	0.068	1593	49	1642	0.64	overfishing prevented if total kill<2,038,000 lb
2032	0.068	1633	49	1682	0.70	overfishing prevented if total kill<2,078,000 lb
2033	0.068	1668	49	1717	0.75	overfishing prevented if total kill<2,113,000 lb
2034	0.068	1700	49	1749	0.78	overfishing prevented if total kill<2,144,000 lb
2035	0.068	1729	49	1778	0.81	overfishing prevented if total kill<2,171,000 lb
2036	0.068	1756	49	1805	0.84	overfishing prevented if total kill<2,196,000 lb
2037	0.068	1779	49	1828	0.86	overfishing prevented if total kill<2,217,000 lb
2038	0.068	1800	49	1849	0.89	overfishing prevented if total kill<2,237,000 lb
2039	0.068	1819	49	1868	0.91	overfishing prevented if total kill<2,2554,000 lb
2040	0.068	1836	49	1885	0.91	overfishing prevented if total kill<2,269,000 lb
2041	0.068	1851	49	1900	0.91	overfishing prevented if total kill<2,282,000 lb
2042	0.068	1865	49	1914	0.93	overfishing prevented if total kill<2,293,000 lb
2043	0.068	1877	49	1926	0.94	overfishing prevented if total kill<2,303,000 lb
2044	0.068	1888	49	1937	0.94	overfishing prevented if total kill<2,312,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F40%=0.104; MSST=7471mt; SSB_{MSY}=8103mt; Y@F_{MSY}=2,304,000 lb.

Table 2-5d. Red snapper projections under a fishing mortality rate of Frebuild = 97% F_{MSY} (97%$F_{40\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (Alternative 5).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.101	75	26	101	0.00	overfishing prevented if total kill<105,000 lb
2011	0.101	126	34	160	0.00	overfishing prevented if total kill<164,000 lb
2012	0.101	193	36	229	0.00	overfishing prevented if total kill<235,000 lb
2013	0.101	272	43	315	0.00	overfishing prevented if total kill<322,000 lb
2014	0.101	365	52	417	0.00	overfishing prevented if total kill<426,000 lb
2015	0.101	472	57	529	0.00	overfishing prevented if total kill<542,000 lb
2016	0.101	590	61	651	0.00	overfishing prevented if total kill<665,000 lb
2017	0.101	714	63	777	0.00	overfishing prevented if total kill<793,000 lb
2018	0.101	839	65	904	0.00	overfishing prevented if total kill<922,000 lb
2019	0.101	963	66	1029	0.00	overfishing prevented if total kill<1,049,000 lb
2020	0.101	1084	67	1151	0.00	overfishing prevented if total kill<1,171,000 lb
2021	0.101	1198	68	1266	0.00	overfishing prevented if total kill<1,288,000 lb
2022	0.101	1306	68	1374	0.01	overfishing prevented if total kill<1,397,000 lb
2023	0.101	1406	69	1475	0.01	overfishing prevented if total kill<1,499,000 lb
2024	0.101	1499	69	1568	0.03	overfishing prevented if total kill<1,592,000 lb
2025	0.101	1583	69	1652	0.05	overfishing prevented if total kill<1,677,000 lb
2026	0.101	1660	70	1730	0.07	overfishing prevented if total kill<1,755,000 lb
2027	0.101	1729	70	1799	0.09	overfishing prevented if total kill<1,824,000 lb
2028	0.101	1792	70	1862	0.11	overfishing prevented if total kill<1,887,000 lb
2029	0.101	1848	70	1918	0.14	overfishing prevented if total kill<1,943,000 lb
2030	0.101	1899	70	1969	0.18	overfishing prevented if total kill<1,993,000 lb
2031	0.101	1943	70	2013	0.21	overfishing prevented if total kill<2,038,000 lb
2032	0.101	1983	70	2053	0.24	overfishing prevented if total kill<2,078,000 lb
2033	0.101	2019	70	2089	0.26	overfishing prevented if total kill<2,113,000 lb
2034	0.101	2050	70	2120	0.29	overfishing prevented if total kill<2,144,000 lb
						SSB > MSST
2035	0.101	2078	71	2149	0.33	overfishing prevented if total kill<2,171,000 lb
2036	0.101	2102	71	2173	0.35	overfishing prevented if total kill<2,196,000 lb
2037	0.101	2124	71	2195	0.37	overfishing prevented if total kill<2,217,000 lb
2038	0.101	2143	71	2214	0.39	overfishing prevented if total kill<2,237,000 lb
2039	0.101	2160	71	2231	0.41	overfishing prevented if total kill<2,2554,000 lb
2040	0.101	2175	71	2246	0.44	overfishing prevented if total kill<2,269,000 lb
2041	0.101	2189	71	2260	0.46	overfishing prevented if total kill<2,282,000 lb
2042	0.101	2200	71	2271	0.47	overfishing prevented if total kill<2,293,000 lb
2043	0.101	2211	71	2282	0.48	overfishing prevented if total kill<2,303,000 lb
2044	0.101	2220	71	2291	0.5	overfishing prevented if total kill<2,312,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F40%=0.104; MSST=7471mt; SSB_{MSY}=8103mt; Y@F_{MSY}=2,304,000 lb.

Table 2-5e. Red snapper projections under a fishing mortality rate of 85% F_{MSY} (85%$F_{30\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (Alternative 6).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.126	93	32	125	0.00	overfishing prevented if total kill<146,000 lb
2011	0.126	153	41	194	0.00	overfishing prevented if total kill<224,000 lb
2012	0.126	232	44	276	0.00	overfishing prevented if total kill<315,000 lb
2013	0.126	323	53	376	0.00	overfishing prevented if total kill<425,000 lb
2014	0.126	429	63	492	0.00	overfishing prevented if total kill<533,000 lb
2015	0.126	551	69	620	0.00	overfishing prevented if total kill<690,000 lb
2016	0.126	683	73	756	0.00	overfishing prevented if total kill<836,000 lb
2017	0.126	820	76	896	0.00	overfishing prevented if total kill<986,000 lb
2018	0.126	957	79	1036	0.00	overfishing prevented if total kill<1,132,000 lb
2019	0.126	1092	80	1172	0.01	overfishing prevented if total kill<1,274,000 lb
2020	0.126	1221	82	1303	0.01	overfishing prevented if total kill<1,410,000 lb
2021	0.126	1343	82	1425	0.03	overfishing prevented if total kill<1,536,000 lb
2022	0.126	1457	83	1540	0.06	overfishing prevented if total kill<1,651,000 lb
2023	0.126	1561	84	1645	0.10	overfishing prevented if total kill<1,756,000 lb
2024	0.126	1656	84	1740	0.14	overfishing prevented if total kill<1,851,000 lb
2025	0.126	1742	84	1826	0.19	overfishing prevented if total kill<1,936,000 lb
2026	0.126	1819	85	1904	0.24	overfishing prevented if total kill<2,012,000 lb
2027	0.126	1889	85	1974	0.30	overfishing prevented if total kill<2,079,000 lb
2028	0.126	1950	85	2035	0.36	overfishing prevented if total kill<2,138,000 lb
						SSB > MSST
2029	0.126	2005	85	2090	0.41	overfishing prevented if total kill<2,190,000 lb
2030	0.126	2053	85	2138	0.46	overfishing prevented if total kill<2,235,000 lb
2031	0.126	2096	85	2181	0.51	overfishing prevented if total kill<2,275,000 lb
						SSB > SSB_{MSY}
2032	0.126	2133	86	2219	0.56	overfishing prevented if total kill<2,310,000 lb
2033	0.126	2166	86	2252	0.60	overfishing prevented if total kill<2,340,000 lb
2034	0.126	2195	86	2281	0.63	overfishing prevented if total kill<2,366,000 lb
2035	0.126	2220	86	2306	0.66	overfishing prevented if total kill<2,388,000 lb
2036	0.126	2242	86	2328	0.69	overfishing prevented if total kill<2,408,000 lb
2037	0.126	2261	86	2347	0.71	overfishing prevented if total kill<2,425,000 lb
2038	0.126	2278	86	2364	0.72	overfishing prevented if total kill<2,439,000 lb
2039	0.126	2293	86	2379	0.74	overfishing prevented if total kill<2,452,000 lb
2040	0.126	2305	86	2391	0.75	overfishing prevented if total kill<2,462,000 lb
2041	0.126	2316	86	2402	0.76	overfishing prevented if total kill<2,472,000 lb
2042	0.126	2326	86	2412	0.76	overfishing prevented if total kill<2,480,000 lb
2043	0.126	2335	86	2421	0.77	overfishing prevented if total kill<2,487,000 lb
2044	0.126	2342	86	2428	0.78	overfishing prevented if total kill<2,493,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F30%=0.148; MSST=5555mt; SSB_{MSY}=6205mt; Y@75%F_{MSY}=2,104,000 lb; Y@F_{MSY}=2,430,792 lb.

Table 2-5f. Red snapper projections under a fishing mortality rate of 75% F_{MSY} (75%$F_{30\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (Alternative 7).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.111	83	28	111	0.00	overfishing prevented if total kill<146,000 lb
2011	0.111	137	37	174	0.00	overfishing prevented if total kill<224,000 lb
2012	0.111	209	40	249	0.00	overfishing prevented if total kill<315,000 lb
2013	0.111	293	47	340	0.00	overfishing prevented if total kill<425,000 lb
2014	0.111	391	57	448	0.00	overfishing prevented if total kill<533,000 lb
2015	0.111	506	62	568	0.00	overfishing prevented if total kill<690,000 lb
2016	0.111	630	66	696	0.00	overfishing prevented if total kill<836,000 lb
2017	0.111	759	69	828	0.00	overfishing prevented if total kill<986,000 lb
2018	0.111	890	71	961	0.00	overfishing prevented if total kill<1,132,000 lb
2019	0.111	1019	72	1091	0.01	overfishing prevented if total kill<1,274,000 lb
2020	0.111	1144	73	1217	0.02	overfishing prevented if total kill<1,410,000 lb
2021	0.111	1262	74	1336	0.05	overfishing prevented if total kill<1,536,000 lb
2022	0.111	1373	74	1447	0.09	overfishing prevented if total kill<1,651,000 lb
2023	0.111	1475	75	1550	0.15	overfishing prevented if total kill<1,756,000 lb
2024	0.111	1569	75	1644	0.22	overfishing prevented if total kill<1,851,000 lb
						SSB > MSST
2025	0.111	1654	76	1730	0.29	overfishing prevented if total kill<1,936,000 lb
2026	0.111	1732	76	1808	0.38	overfishing prevented if total kill<2,012,000 lb
2027	0.111	1802	76	1878	0.46	overfishing prevented if total kill<2,079,000 lb
2028	0.111	1864	76	1940	0.53	overfishing prevented if total kill<2,138,000 lb
						SSB > SSB_{MSY}
2029	0.111	1920	76	1996	0.60	overfishing prevented if total kill<2,190,000 lb
2030	0.111	1970	76	2046	0.66	overfishing prevented if total kill<2,235,000 lb
2031	0.111	2014	77	2091	0.71	overfishing prevented if total kill<2,275,000 lb
2032	0.111	2053	77	2130	0.76	overfishing prevented if total kill<2,310,000 lb
2033	0.111	2088	77	2165	0.79	overfishing prevented if total kill<2,340,000 lb
2034	0.111	2118	77	2195	0.81	overfishing prevented if total kill<2,366,000 lb
2035	0.111	2145	77	2222	0.83	overfishing prevented if total kill<2,388,000 lb
2036	0.111	2168	77	2245	0.85	overfishing prevented if total kill<2,408,000 lb
2037	0.111	2189	77	2266	0.87	overfishing prevented if total kill<2,425,000 lb
2038	0.111	2208	77	2285	0.88	overfishing prevented if total kill<2,439,000 lb
2039	0.111	2224	77	2301	0.89	overfishing prevented if total kill<2,452,000 lb
2040	0.111	2238	77	2315	0.90	overfishing prevented if total kill<2,462,000 lb
2041	0.111	2250	77	2327	0.90	overfishing prevented if total kill<2,472,000 lb
2042	0.111	2261	77	2338	0.91	overfishing prevented if total kill<2,480,000 lb
2043	0.111	2271	77	2348	0.92	overfishing prevented if total kill<2,487,000 lb
2044	0.111	2279	77	2356	0.92	overfishing prevented if total kill<2,493,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F30%=0.148; MSST=5555mt; SSB_{MSY}=6205mt; Y@75%F_{MSY}=2,104,000 lb; Y@F_{MSY}=2,430,792 lb.

Table 2-5g. Red snapper projections under a fishing mortality rate of 65% F_{MSY} (65%$F_{30\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (Alternative 8).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.096	72	25	97	0.00	overfishing prevented if total kill<146,000 lb
2011	0.096	120	32	152	0.00	overfishing prevented if total kill<224,000 lb
2012	0.096	185	35	220	0.00	overfishing prevented if total kill<315,000 lb
2013	0.096	261	41	302	0.00	overfishing prevented if total kill<425,000 lb
2014	0.096	351	50	401	0.00	overfishing prevented if total kill<533,000 lb
2015	0.096	456	55	511	0.00	overfishing prevented if total kill<690,000 lb
2016	0.096	571	58	629	0.00	overfishing prevented if total kill<836,000 lb
2017	0.096	691	60	751	0.00	overfishing prevented if total kill<986,000 lb
2018	0.096	813	62	875	0.01	overfishing prevented if total kill<1,132,000 lb
2019	0.096	934	63	997	0.01	overfishing prevented if total kill<1,274,000 lb
2020	0.096	1052	64	1116	0.04	overfishing prevented if total kill<1,410,000 lb
2021	0.096	1165	65	1230	0.08	overfishing prevented if total kill<1,536,000 lb
2022	0.096	1271	65	1336	0.16	overfishing prevented if total kill<1,651,000 lb
2023	0.096	1370	66	1436	0.23	overfishing prevented if total kill<1,756,000 lb
2024	0.096	1461	66	1527	0.33	overfishing prevented if total kill<1,851,000 lb
2025	0.096	1545	66	1611	0.43	overfishing prevented if total kill<1,936,000 lb
2026	0.096	1621	67	1688	0.53	overfishing prevented if total kill<2,012,000 lb
2027	0.096	1690	67	1757	0.62	overfishing prevented if total kill<2,079,000 lb
2028	0.096	1753	67	1820	0.70	overfishing prevented if total kill<2,138,000 lb
2029	0.096	1809	67	1876	0.76	overfishing prevented if total kill<2,190,000 lb
2030	0.096	1859	67	1926	0.81	overfishing prevented if total kill<2,235,000 lb
2031	0.096	1905	67	1972	0.86	overfishing prevented if total kill<2,275,000 lb
2032	0.096	1945	67	2012	0.88	overfishing prevented if total kill<2,310,000 lb
2033	0.096	1980	67	2047	0.91	overfishing prevented if total kill<2,340,000 lb
2034	0.096	2012	67	2079	0.93	overfishing prevented if total kill<2,366,000 lb
2035	0.096	2040	67	2107	0.94	overfishing prevented if total kill<2,388,000 lb
2036	0.096	2065	68	2133	0.95	overfishing prevented if total kill<2,408,000 lb
						SSB > MSST
2037	0.096	2088	68	2156	0.96	overfishing prevented if total kill<2,425,000 lb
2038	0.096	2107	68	2175	0.97	overfishing prevented if total kill<2,439,000 lb
2039	0.096	2125	68	2193	0.97	overfishing prevented if total kill<2,452,000 lb
2040	0.096	2140	68	2208	0.98	overfishing prevented if total kill<2,462,000 lb
2041	0.096	2154	68	2222	0.98	overfishing prevented if total kill<2,472,000 lb
2042	0.096	2166	68	2234	0.98	overfishing prevented if total kill<2,480,000 lb
2043	0.096	2176	68	2244	0.98	overfishing prevented if total kill<2,487,000 lb
2044	0.096	2186	68	2254	0.98	overfishing prevented if total kill<2,493,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F30%=0.148; MSST=5555mt; SSB_{MSY}=6205mt; Y@75%F_{MSY}=2,104,000 lb; Y@F_{MSY}=2,430,792 lb.

Table 2-5h. Red snapper projections under a fishing mortality rate of Frebuild = 98% F_{MSY} (98%$F_{30\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (Alternative 9).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.145	107	37	144	0.00	overfishing prevented if total kill<146,000 lb
2011	0.145	173	47	220	0.00	overfishing prevented if total kill<224,000 lb
2012	0.145	259	50	309	0.00	overfishing prevented if total kill<315,000 lb
2013	0.145	358	60	418	0.00	overfishing prevented if total kill<425,000 lb
2014	0.145	472	71	543	0.00	overfishing prevented if total kill<533,000 lb
2015	0.145	603	78	681	0.00	overfishing prevented if total kill<690,000 lb
2016	0.145	743	83	826	0.00	overfishing prevented if total kill<836,000 lb
2017	0.145	887	86	973	0.00	overfishing prevented if total kill<986,000 lb
2018	0.145	1030	89	1119	0.00	overfishing prevented if total kill<1,132,000 lb
2019	0.145	1170	90	1260	0.00	overfishing prevented if total kill<1,274,000 lb
2020	0.145	1303	92	1395	0.01	overfishing prevented if total kill<1,410,000 lb
2021	0.145	1427	93	1520	0.01	overfishing prevented if total kill<1,536,000 lb
2022	0.145	1542	94	1636	0.02	overfishing prevented if total kill<1,651,000 lb
2023	0.145	1647	94	1741	0.04	overfishing prevented if total kill<1,756,000 lb
2024	0.145	1742	95	1837	0.07	overfishing prevented if total kill<1,851,000 lb
2025	0.145	1827	95	1922	0.10	overfishing prevented if total kill<1,936,000 lb
2026	0.145	1903	96	1999	0.12	overfishing prevented if total kill<2,012,000 lb
2027	0.145	1970	96	2066	0.16	overfishing prevented if total kill<2,079,000 lb
2028	0.145	2029	96	2125	0.19	overfishing prevented if total kill<2,138,000 lb
2029	0.145	2081	96	2177	0.23	overfishing prevented if total kill<2,190,000 lb
2030	0.145	2127	96	2223	0.27	overfishing prevented if total kill<2,235,000 lb
2031	0.145	2167	96	2263	0.30	overfishing prevented if total kill<2,275,000 lb
2032	0.145	2202	97	2299	0.33	overfishing prevented if total kill<2,310,000 lb
2033	0.145	2232	97	2329	0.36	overfishing prevented if total kill<2,340,000 lb
2034	0.145	2259	97	2356	0.38	overfishing prevented if total kill<2,366,000 lb
2035	0.145	2282	97	2379	0.40	overfishing prevented if total kill<2,388,000 lb
2036	0.145	2301	97	2398	0.42	overfishing prevented if total kill<2,408,000 lb
						SSB > MSST
2037	0.145	2319	97	2416	0.44	overfishing prevented if total kill<2,425,000 lb
2038	0.145	2333	97	2430	0.46	overfishing prevented if total kill<2,439,000 lb
2039	0.145	2346	97	2443	0.47	overfishing prevented if total kill<2,452,000 lb
2040	0.145	2357	97	2454	0.50	overfishing prevented if total kill<2,462,000 lb
2041	0.145	2367	97	2464	0.50	overfishing prevented if total kill<2,472,000 lb
2042	0.145	2375	97	2472	0.51	overfishing prevented if total kill<2,480,000 lb
2043	0.145	2382	97	2479	0.52	overfishing prevented if total kill<2,487,000 lb
2044	0.145	2389	97	2486	0.53	overfishing prevented if total kill<2,493,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F30%=0.148; MSST=5555mt; SSB_{MSY}=6205mt; Y@75%F_{MSY}=2,104,000 lb; Y@F_{MSY}=2,430,792 lb.

2.2.2.1 Comparison of Alternatives

Table 2-6 Comparison of effects of rebuilding strategy alternatives for red snapper

Alternatives	Biological Effects	Socioeconomic/Administrative Effects
Alternative 1 (Status Quo)	(+) The stock would have a 70% chance of rebuilding by 2044	(-) Would require the third highest reduction in harvest and would increase risk of litigation for not implementing a rebuilding strategy in compliance with the Magnuson-Stevens Act.
Alternative 2. (85%$F_{40\%SPR}$), 50% chance stock rebuilds by 2035	(+) The stock would have a 70% chance of rebuilding by 2044	(-)Would require the third highest reduction in harvest, and result in third highest level of socioeconomic impacts.
Alternative 3. (75%$F_{40\%SPR}$), 50% chance stock rebuilds by 2032	(+) The stock would have a 84% chance of rebuilding by 2044	(-) Would require the second largest harvest reduction, and result in second highest level of socioeconomic impacts.
Alternative 4. (65%$F_{40\%SPR}$), 50% chance stock rebuilds by 2029	(+) The stock would have a 94% chance of rebuilding by 2044, with the greatest biological benefit.	(-) Would require the greatest harvest reductions and would create the largest short-term socioeconomic impact.
Alternative 5 (Preferred) (97%$F_{40\%SPR}$), 50% chance stock rebuilds by 2044	(+) The stock would have a 50% chance of rebuilding by 2044	(-) Represents the midpoint in socioeconomic impacts that could result from the suite alternatives.
Alternative 6. (85%$F_{30\%SPR}$), 50% chance stock rebuilds by 2031	(+) The stock would have a 78% chance of rebuilding by 2044	(-) Would result in the second lowest level of short-term socioeconomic impacts.
Alternative 7. (75%$F_{30\%SPR}$), 50% chance stock rebuilds by 2028	(+) The stock would have a 92% chance of rebuilding by 2044	(-) Represents a mid point in socioeconomic impacts that could result from the suite alternatives
Alternative 8. (65%$F_{30\%SPR}$), 50% chance stock rebuilds by 2026	(+) The stock would have a 98% chance of rebuilding by 2044	(-)Represents a mid point in socioeconomic impacts that could result from the suite alternatives
Alternative 9. (98%$F_{30\%SPR}$), 50% chance stock rebuilds by 2040	(+) The stock would have a 53% chance of rebuilding by 2044, would provide the least amount of biological benefit.	(-) Would require the least harvest reductions and would create the least short-term socioeconomic impact.
Sub-Alternatives 2A-9A ACL = 0	(+) No directed harvest of red snapper would be allowed	(-) No directed harvest would be allowed any of the alternatives.
Sub-Alternatives 2B-9B ACLs specified in table 2-3.	(+) No directed harvest would be allowed and the ACL would = allowable discards.	(-) SEFSC would be required to monitor discarded red snapper in the commercial and recreational sectors.

(-) overall negative impacts, (+) overall positive impacts, (- +) neutral impacts

Optimum Yield at Equilibrium

Choice of the proxy for F_{MSY} in **Section 4.1** has an effect on the magnitude of OY. OY values based on the status quo proxy for F_{MSY} of $F_{30\%\ SPR}$ would be expected to result in higher values for OY (**Alternatives 6-9**) than the use of $F_{40\%SPR}$ proxy for F_{MSY} (**Alternatives 2-5**). For example, the estimated yield at 75%F_{MSY} when the stock is at B_{MSY} is 2,338,000 lbs whole weight and 2,104,000 lbs whole weight for $F_{30\%SPR}$ and $F_{40\%SPR}$, respectively. The Council has selected $F_{40\%SPR}$ as the proxy for F_{MSY}.

Under **Alternative 1 (Status Quo)**, $F_{OY} = F_{45\%SPR}$ (equivalent to 85% $F_{40\%SPR}$) and the value for OY when the stock is at SSB_{MSY} is 2,196,000 lbs whole weight and is extremely similar to **Alternative 2**, which specifies a rebuilding strategy at 85%$F_{40\%SPR}$ with an OY = 2,180,000 lbs whole weight when the stock is at SSB_{MSY} ($SSBF_{40\%SPR}$). OY values at equilibrium in the nine alternatives are distinguished from one another by the level of risk (and associated tradeoffs) each would assume. The more conservative the estimate of OY, the larger the sustainable biomass when the stock is rebuilt. The greatest biological benefit would be provided by **Alternative 4**, which would specify an OY at equilibrium equal to 65%$F_{40\%SPR}$ and would require a 91% reduction in total kill relative to 2005-2007. The least amount of biological benefit would be provided by **Alternative 9**, which would specify a rebuilding strategy of 98%$F_{30\%SPR}$ and a reduction in total kill of 76%. The biological benefits of **Alternative 5 (Preferred)** would be intermediate in value and would consider the social and economic effects of the action.

Rebuilding Strategies

Alternative 1 (Status Quo) would maintain the yield-based, rebuilding strategy for red snapper specified in Amendment 11, which is similar to the rebuilding strategy specified in **Alternative 2**. The difference between **Alternative 1 (Status Quo)** and **Alternative 2** is that **Alternative 1 (Status Quo)** would not specify an ACL or a method to monitor recovery of red snapper.

Under **Alternatives 2-9**, the red snapper stock could rebuild sooner than specified by each rebuilding strategy since the Council's intent is to prohibit all harvest of red snapper during initial rebuilding and actions are being taken to reduce incidental catch of red snapper in **Section 4.3.**

Alternatives 2-9 would prohibit all harvest of red snapper in the commercial and recreational sectors but would set an ACL based either on landings or total removals, which is specified in each of the sub-alternatives for each alternative. If the Council chooses to set an ACL based on total removals the SEFSC would be required to monitor discarded red snapper in the commercial and recreational sectors. At their March 2009 meeting, the SSC indicated their recommendation of ABC = 0 for speckled hind and warsaw grouper was based on landed catch only, due to concern about monitoring discards. The SSC expressed similar concerns when discussing ACLs based on discards for speckled hind and warsaw grouper at their March 2009 meeting. Since monitoring of discards would rely on self-reporting of discards by fishermen, the SSC felt that this could create a disincentive for fishermen to report if they know that once a certain level of discarded fish is reached, AMs would be triggered, which could potentially further restrict their snapper grouper harvest. Because of these concerns with monitoring discards, CPUE of red snapper would be tracked via a fishery-independent monitoring program to identify changes in biomass. Furthermore, the Council is considering the use of fishery-dependent data collection by

headboat and charterboat operators to determine if there are changes in CPUE and biomass. If the ACL was exceeded or if CPUE indicated the stock was not rebuilding, the Council could re-evaluate management measures to ensure overfishing did not occur. CPUE would be evaluated every year using a three year running average, and adjustments would be made by a framework action being developed in Amendment 17B.

Under **Alternative 2**, an initial reduction in total kill of 85% would be required. Therefore, this definition would provide fewer indirect benefits to the biological and ecological environment than **Alternatives 3** and **4**, and could make it more difficult to sustain red snapper over the long term. The ACL would be 89,000 lbs whole weight total kill or 0 landed catch until modified. Under this alternative the stock has a 50% chance of being rebuilt by 2035, five years later than **Alternative 4**, and three years later than **Alternative 3.** There is a 70% chance the stock could rebuild to SSB_{MSY} in the maximum allowable 35 year time frame.

Alternative 3 would establish a rebuilding strategy that maintains fishing mortality at 75% F_{MSY} (75%$F_{40\%SPR}$) with a constant F of 0.078. The ACL would be set at 79,000 lbs whole weight total kill or 0 lbs landed catch and would remain in effect until modified. Under **Alternative 3**, an 87% reduction in total kill would be required. At this rate of recovery, the stock has a 50% chance of rebuilding to SSB_{MSY} by 2032. There is an 84% that the stock could rebuild to SSB_{MSY} by 2044. Under **Alternative 4** the rebuilding strategy would be more conservative than **Alternatives 2** and **3** and would set F_{OY} equal to 65%F_{MSY} (65%$F_{40\%}$). The ACL would be the lowest of all the alternatives at 68,000 lbs whole weight total kill or 0 lbs landed catch, and would remain in effect until modified. An 91% reduction in total kill would be required under **Alternative 4**.

Alternative 5 (Preferred) (Figure 4-6) would establish an ACL of 101,000 lbs whole weight total kill or 0 lbs landed catch, and define a rebuilding strategy based a constant $F_{REBUILD}$ of 0.088 and 97%F_{MSY} (97%$F_{40\%SPR}$). Under **Alternative 5 (Preferred)**, an initial 83% reduction in total kill would be required. **Alternative 5 (Preferred)** specifies a fishing mortality rate that has a 50% probability of rebuilding the stock to SSB_{MSY} in the maximum allowable time of 35 years (2044). The harvest reduction required under **Alternative 5 (Preferred)** is less than reductions needed under **Alternatives 7** and **8**. However, **Alternative 5 (Preferred)** would require less restrictive management measures and therefore, would result in a lower level of socioeconomic impact while still rebuilding stock within the specified timeframe.

Alternative 6 would establish a rebuilding strategy that maintains fishing mortality at 79% F_{MSY} (75%$F_{30\%SPR}$) with a constant F of 0.126. The ACL would be set at 125,000 lbs whole weight total kill or 0 lbs landed catch and would remain in effect until modified. Under this alternative, the stock would have a 50% chance of being rebuilt by 2031 and a 78% chance of reaching SSB_{MSY} by 2044. Under **Alternative 7**, an 82% reduction in total kill would be required. At this rate of recovery, the stock has a 50% chance of rebuilding to SSB_{MSY} by 2028. There is an 92% that the stock could rebuild to SSB_{MSY} by 2044. Under **Alternative 8** the rebuilding strategy would be more conservative than **Alternatives 5 and 6** and would set F_{OY} equal to 65%F_{MSY} (65%$F_{30\%SPR}$). The ACL would be 97,000 lbs whole weight total kill or 0 landed catch, and would remain in effect until modified. An 84% reduction in total kill would be required under **Alternative 8**. **Alternative 9** would establish an ACL of 144,000 lbs whole weight total kill or 0 lbs landed catch, and define a rebuilding strategy based a constant $F_{REBUILD}$ of 0.145 and 98%F_{MSY} (98%$F_{30\%SPR}$). Under **Alternative 9**, an initial 76% reduction in total kill would be

required. **Alternative 9** specifies a fishing mortality rate that has a 53% probability of rebuilding the stock to SSB_{MSY} ($SSB_{30\%SPR}$) in the maximum allowable time of 35 years (2044).

The "**A**" **Sub-Alternatives** e.g., **2A, 3A, 4A**… would establish ACLs based on landings, which would be zero in 2010 and would continue until modified. These sub-alternatives would also include three AMs, all related to tracking CPUE. The CPUE would be monitored via fishery-independent and fishery-dependant sampling methods, and those results would be analyzed every three years after which adjustments to management measures and/or the ACL may be made through a framework action. Establishing an ACL of zero would not require monitoring of dead discards, which the SSC has opposed on several occasions since discard data are self-reported and there is greater uncertainty with discard data than with estimates of landings.

The "**B**" **Sub-Alternatives** e.g.**, 2B, 3B, 4B**… would prohibit all harvest of red snapper in the commercial and recreational sectors but would set an ACL equal to the total kill specified in the rebuilding strategy for each alternative. This would require the SEFSC to monitor discarded red snapper, which subsequently die in the commercial and recreational sectors. At their March 2009 meeting, the SSC indicated their recommendation of ABC = 0 for speckled hind and warsaw grouper was based on landed catch only due to concern about monitoring discards. The SSC expressed concerns when discussing ACLs based on dead discards for speckled hind and warsaw grouper at their March 2009 meeting. The SSC was not only concerned about the accuracy of discard data from the recreational and commercial sector but also the possibility that some members of the fishing community might under report discarded fish if they thought further restrictions might be imposed if levels of discards became elevated.

Alternative 4 and **Sub-alternative 4A**, expected to result in the largest biological benefit, is also expected to offer the largest long-term economic benefits but would require the most severe short-term reductions and therefore largest short-term negative economic impacts. **Alternative 9** with **Sub-alternative 9B** is expected to yield the smallest biological benefit. This would likely result in less stringent management measures and therefore the smallest short-term negative economic impacts but also the smallest long-term economic benefits to the fishermen.

Alternative 5 (Preferred) identifies an OY level based on the SSC's F_{MSY} proxy. This alternative has the longest rebuilding period and a higher reduction in total removals (83%) than **Alternatives 6, 7,** and **9** but lower than **Alternatives 1, 2, 3, 4**, and **8**. This alternative could be expected to result in smaller long-term benefits those alternatives with shorter rebuilding periods but might result in less stringent management measures and smaller short-term negative impacts than some alternatives. An in-depth analysis of the impacts of rebuilding plan alternatives may be found in **Section 4.2** of this document.

2.3 Red Snapper Management Measures

Note: The prohibition of red snapper harvest in **Alternatives 2-6** would remain in effect beyond 2009 until modified.

Alternative 1 (Status Quo). This would continue the 20-inch minimum size limit (commercial & recreational) and the recreational 2 fish bag limit (included in the 10 snapper per person limit).

Alternative 2. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters.

Alternative 3A. Prohibit all commercial and recreational fishing, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, and 3180, for a total of 14,496 mi^2 (37,544 km^2) of the South Atlantic EEZ (Figure 2-1). Coordinates for the closure are shown in Table 2-7.

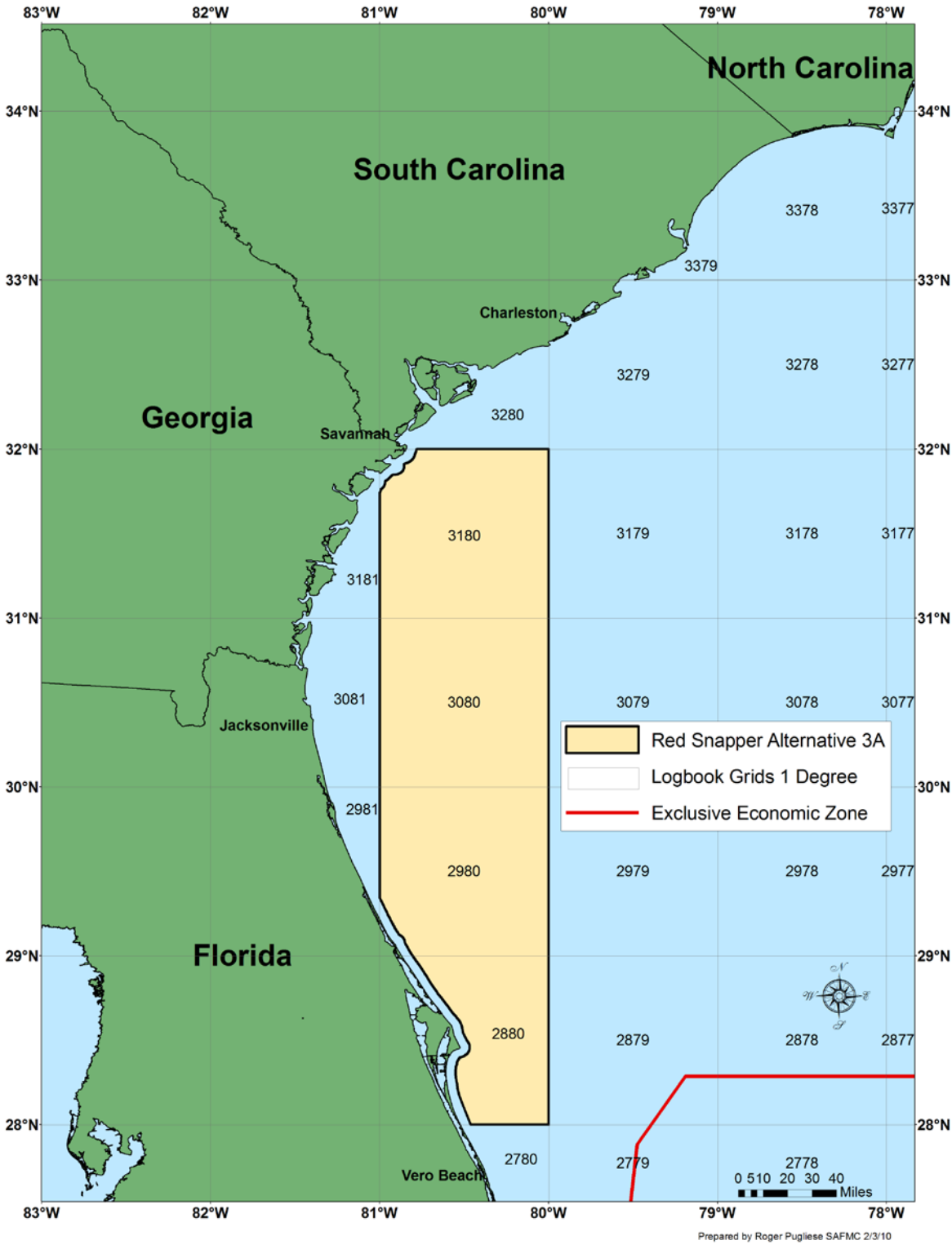


Figure 2-1. Map of proposed closed area under Alternative 3A.

Table 2-7 Waypoints used to delineate Alternative 3A.

ID	LAT_DMS	LON_DMS
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 27' 42"
3	29° 20' 33"	-81° 00' 00"
4	31° 44' 32"	-81° 00' 00"
5	32° 00' 00"	-80° 46' 56"
6	32° 00' 00"	-80° 00' 00"

Between point 2 and point 3, line follows inner boundary of U.S. EEZ.
Between point 4 and point 5, line follows inner boundary of U.S. EEZ.

Alternative 3B. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, and 3180 between an approximate depth of 66 feet (11 fathoms; 20 m) to 240 feet (40 fathoms; 73 m), for a total of 10,567 mi^2 (27,368 km^2) of the South Atlantic EEZ (Figure 2-2). Coordinates for the closure are shown in Table 2-8.

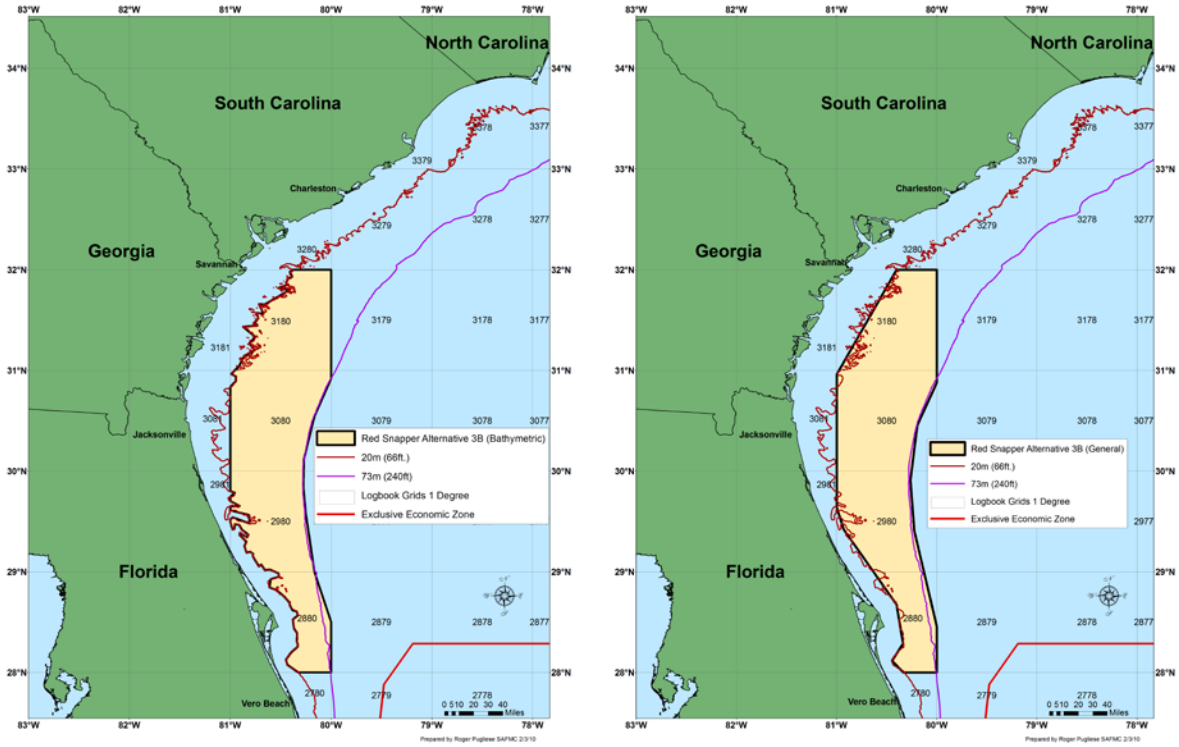


Figure 2-2. Map 1 of proposed closed area under Alternative 3B. Map 2 using generalized boundary for proposed closed area under Alternative 3B

Table 2-8 Waypoints used to delineate Alternative 3B

Map 1 waypoints used to delineate Alternative 3B.			Map 2 waypoints used to delineate the generalized boundary under Alternative 3B.		
ID	**LAT_DMS**	**LON_DMS**	**ID**	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"	1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 19' 30"	2	28° 00' 00"	-80° 20' 01"
3	28° 04' 39"	-80° 26' 11"	3	28° 06' 58"	-80° 26' 49"
4	28° 07' 43"	-80° 26' 56"	4	28° 17' 14"	-80° 20' 19"
5	28° 12' 08"	-80° 23' 46"	5	28° 40' 32"	-80° 24' 09"
6	28° 15' 27"	-80° 19' 50"	6	29° 25' 09"	-80° 55' 44"
7	28° 17' 09"	-80° 19' 58"	7	29° 38' 20"	-81° 00' 00"
8	28° 18' 20"	-80° 20' 27"	8	30° 57' 40"	-81° 00' 00"
9	28° 23' 33"	-80° 20' 17"	9	32° 00' 00"	-80° 24' 12"
10	28° 26' 19"	-80° 22' 08"	10	32° 00' 00"	-80° 00' 00"
11	28° 31' 34"	-80° 22' 48"	11	30° 52' 54"	-80° 00' 00"
12	28° 34' 00"	-80° 19' 50"	12	30° 27' 19"	-80° 11' 41"
13	28° 36' 20"	-80° 20' 28"	13	29° 54' 31"	-80° 15' 51"
14	28° 37' 05"	-80° 22' 58"	14	29° 24' 24"	-80° 13' 32"
15	28° 39' 49"	-80° 24' 28"	15	28° 27' 20"	-80° 00' 00"
16	28° 41' 42"	-80° 24' 48"			
17	28° 45' 40"	-80° 28' 22"			
18	28° 49' 06"	-80° 32' 45"			
19	28° 50' 45"	-80° 36' 51"			
20	28° 55' 31"	-80° 36' 00"			
21	28° 57' 07"	-80° 31' 04"			
22	28° 59' 10"	-80° 31' 19"			
23	29° 01' 21"	-80° 36' 26"			
24	29° 01' 03"	-80° 39' 27"			
25	29° 04' 17"	-80° 41' 32"			
26	29° 03' 10"	-80° 43' 00"			
27	29° 09' 34"	-80° 46' 48"			
28	29° 10' 39"	-80° 46' 17"			
29	29° 12' 00"	-80° 48' 18"			
30	29° 11' 22"	-80° 50' 18"			
31	29° 15' 26"	-80° 51' 39"			
32	29° 17' 59"	-80° 50' 28"			
33	29° 21' 59"	-80° 54' 32"			
34	29° 23' 17"	-80° 54' 17"			
35	29° 20' 34"	-80° 50' 08"			
36	29° 22' 01"	-80° 49' 15"			
37	29° 25' 07"	-80° 53' 04"			
38	29° 28' 06"	-80° 54' 54"			

39	29° 28' 31"	-80° 57' 20"
40	29° 25' 38"	-80° 57' 37"
41	29° 25' 10"	-80° 58' 37"
42	29° 29' 30"	-81° 00' 00"
43	29° 31' 26"	-81° 00' 00"
44	29° 32' 31"	-80° 58' 32"
45	29° 28' 48"	-80° 48' 41"
46	29° 33' 51"	-80° 48' 53"
47	29° 36' 44"	-81° 00' 00"
48	29° 39' 02"	-81° 00' 00"
49	29° 39' 18"	-80° 54' 32"
50	29° 42' 08"	-81° 00' 00"
51	29° 44' 44"	-81° 00' 00"
52	29° 47' 08"	-80° 57' 24"
53	29° 48' 05"	-81° 00' 00"
54	30° 50' 16"	-81° 00' 00"
55	30° 53' 39"	-80° 56' 45"
56	30° 56' 25"	-80° 56' 40"
57	30° 57' 56"	-80° 59' 30"
58	31° 02' 34"	-80° 54' 49"
59	31° 08' 43"	-80° 51' 49"
60	31° 12' 01"	-80° 45' 27"
61	31° 16' 09"	-80° 48' 40"
62	31° 20' 05"	-80° 45' 08"
63	31° 26' 03"	-80° 52' 29"
64	31° 26' 45"	-80° 43' 52"
65	31° 28' 48"	-80° 45' 24"
66	31° 31' 03"	-80° 43' 18"
67	31° 34' 23"	-80° 44' 20"
68	31° 33' 50"	-80° 40' 14"
69	31° 39' 37"	-80° 42' 58"
70	31° 39' 21"	-80° 39' 31"
71	31° 48' 09"	-80° 24' 39"
72	31° 49' 08"	-80° 31' 35"
73	31° 51' 08"	-80° 25' 59"
74	31° 52' 17"	-80° 26' 52"
75	31° 54' 38"	-80° 25' 43"
76	31° 55' 55"	-80° 23' 08"
77	31° 58' 44"	-80° 24' 37"
78	32° 00' 00"	-80° 23' 10"
79	32° 00' 00"	-80° 00' 00"
80	30° 55' 18"	-80° 00' 00"
81	30° 32' 40"	-80° 10' 00"

82	30° 07' 00"	-80° 16' 15"
83	29° 50' 25"	-80° 16' 38"
84	29° 35' 00"	-80° 15' 13"
85	29° 00' 00"	-80° 10' 00"
86	28° 30' 00"	-80° 00' 00"

Alternative 3C. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, and 3180 between an approximate depth of 98 feet (16 fathoms; 30 m) to 240 feet (40 fathoms; 73 m), for a total of 6,375 mi² (16,511 km^2),using bathymetric contours, of the South Atlantic EEZ (Figure 2-3). Coordinates for the closure are shown in Table 2-9.

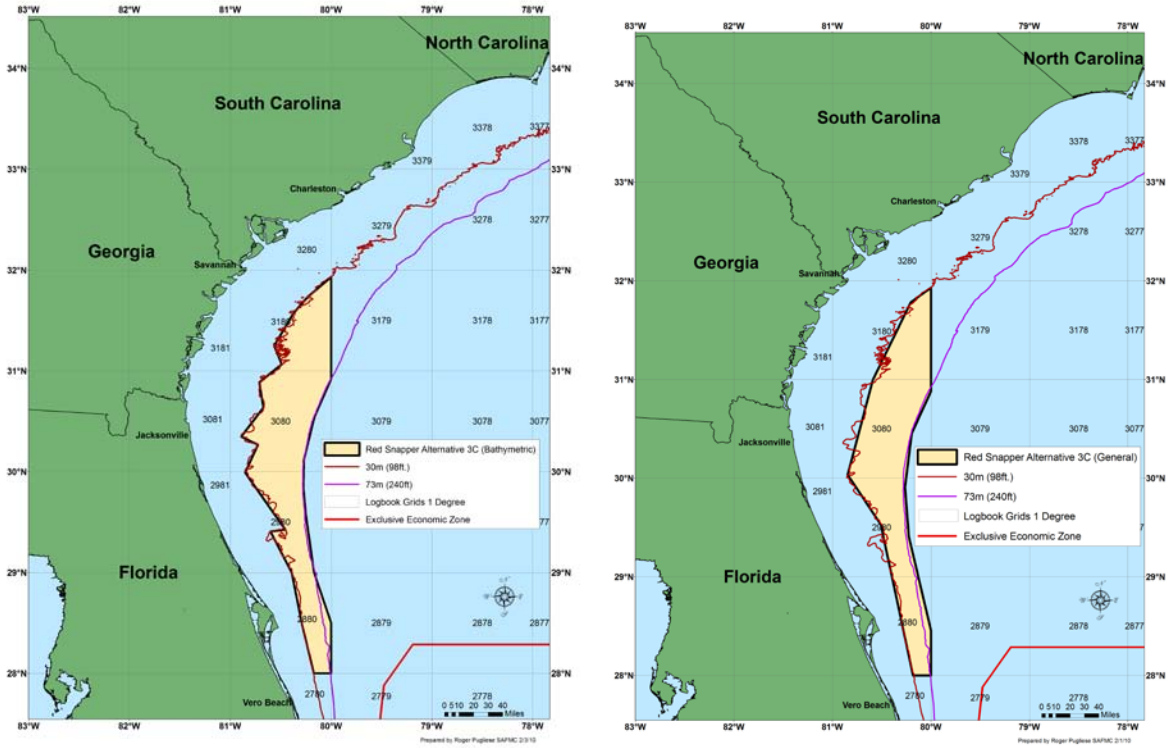


Figure 2-3 Map 1 of proposed closed area under Alternative 3C. Map 2 using generalized boundary for proposed closed area under Alternative 3C.

Table 2-9 Waypoints used to delineate Alternative 3C

Map 1 waypoints used to delineate Alternative 3C			Map 2 waypoints used to delineate the generalized boundary under Alternative 3C.		
ID	**LAT_DMS**	**LON_DMS**	**ID**	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"	1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 10' 15"	2	28° 00' 00"	-80° 10' 57"
3	28° 29' 17"	-80° 17' 23"	3	29° 31' 40"	-80° 30' 34"
4	29° 00' 00"	-80° 23' 30"	4	30° 02' 03"	-80° 50' 45"
5	29° 24' 25"	-80° 36' 07"	5	31° 00' 00"	-80° 35' 19"
6	29° 25' 39"	-80° 27' 21"	6	31° 47' 00"	-80° 12' 15"
7	29° 59' 30"	-80° 51' 10"	7	31° 55' 55"	-80° 00' 00"
8	30° 16' 02"	-80° 43' 36"	8	30° 52' 54"	-80° 00' 00"
9	30° 20' 58"	-80° 53' 34"	9	30° 27' 19"	-80° 11' 41"
0	30° 38' 08"	-80° 40' 18"	10	29° 54' 31"	-80° 15' 51"
11	30° 53' 12"	-80° 42' 45"	11	29° 24' 24"	-80° 13' 32"
12	31° 04' 00"	-80° 29' 29"	12	28° 27' 20"	-80° 00' 00"
13	31° 14' 57"	-80° 33' 55"			
14	31° 34' 11"	-80° 22' 34"			
15	31° 44' 07"	-80° 14' 00"			
16	31° 56' 00"	-80° 00' 00"			
17	30° 55' 18"	-80° 00' 00"			
18	30° 32' 40"	-80° 10' 00"			
19	30° 07' 00"	-80° 16' 15"			
20	29° 50' 25"	-80° 16' 38"			
21	29° 35' 00"	-80° 15' 13"			
22	29° 00' 00"	-80° 10' 10"			
23	28° 30' 00"	-80° 00' 00"			

Alternative 3D. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, and 3180 between an approximate depth of 98 feet (16 fathoms; 30 m) to 300 feet (50 fathoms; 91 m), for a total of 6,567 mi^2 (17, 008 km^2), using the bathymetric boundary, of the South Atlantic EEZ (Figure 2-4). Coordinates for the closure are shown in Table 2-10.

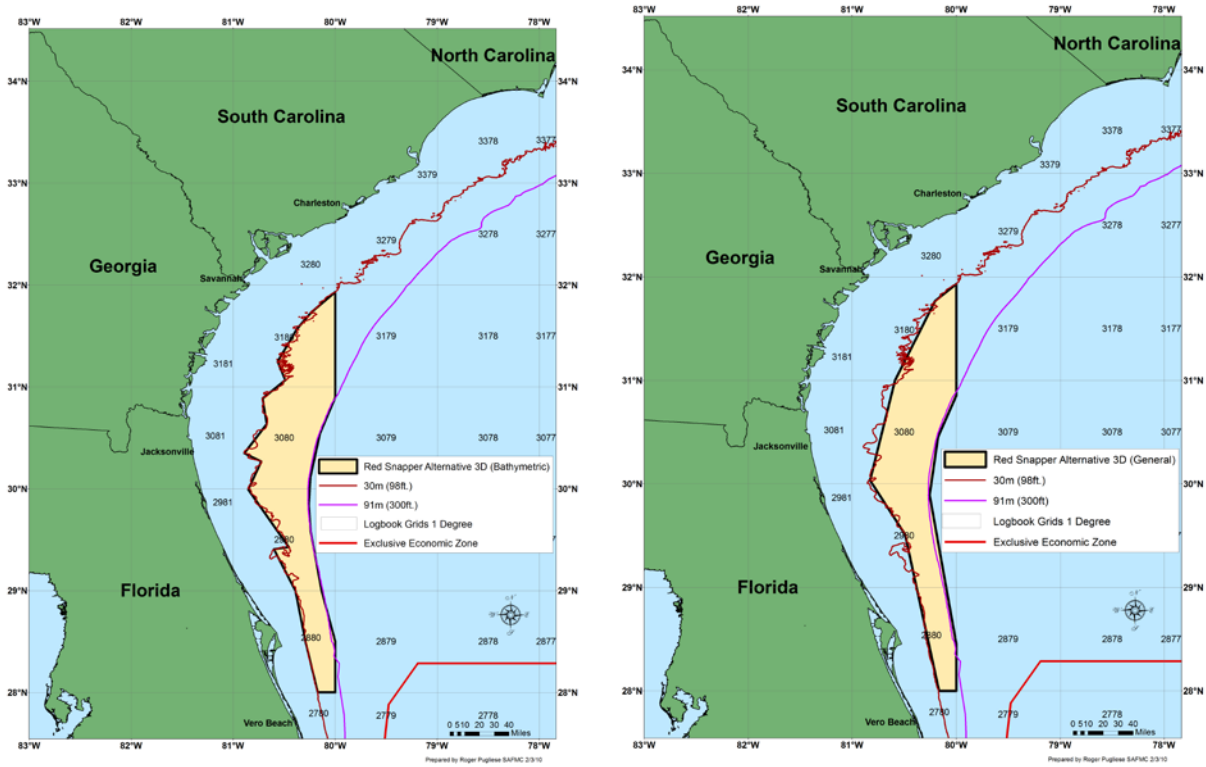


Figure 2-4. Map 1 of proposed closed area under Alternative 3D. Map 2 using generalized boundary for proposed closed area under Alternative 3D.

Table 2-10 Waypoints used to delineate Alternative 3D

Map 1 waypoints used to delineate Alternative 3D.			Map 2 waypoints used to delineate the generalized boundary under Alternative 3D.		
ID	**LAT_DMS**	**LON_DMS**	**ID**	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"	1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 10' 15"	2	28° 00' 00"	-80° 09' 57"
3	28° 29' 17"	-80° 17' 23"	3	29° 30' 40"	-80° 29' 34"
4	29° 00' 00"	-80° 23' 30"	4	30° 02' 03"	-80° 49' 45"
5	29° 24' 25"	-80° 36' 07"	5	31° 00′ 00"	-80° 35' 19"
6	29° 25' 39"	-80° 27' 21"	6	31° 46' 00"	-80° 12' 15"
7	29° 59' 30"	-80° 51' 10"	7	31° 55' 55"	-80° 00' 00"
8	30° 16' 02"	-80° 43' 36"	8	30° 51' 13"	-80° 00' 00"
9	30° 20' 58"	-80° 53' 34"	9	30° 27' 19"	-80° 10' 34"
10	30° 38' 08"	-80° 40' 18"	10	29° 53' 31"	-80° 15' 25"
11	30° 53' 12"	-80° 42' 45"	11	28° 27' 20"	-80° 00' 00"
12	31° 04' 00"	-80° 29' 29"			
13	31° 14' 57"	-80° 33' 55"			
14	31° 34' 11"	-80° 22' 34"			
15	31° 44' 07"	-80° 14' 00"			
16	31° 56' 00"	-80° 00' 00"			
17	30° 53' 50"	-80° 00' 00"			
18	30° 32' 40"	-80° 09' 00"			
19	30° 07' 00"	-80° 14' 39"			
20	29° 50' 25"	-80° 15' 39"			
21	29° 35' 00"	-80° 14' 30"			
22	29° 00' 00"	-80° 08' 04"			
23	28° 30' 00"	-80° 00' 00"			

Alternative 4A. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, 3179, 3180, 3278, and 3279, for a total of 26,001 mi^2 (68,893 km^2) of the South Atlantic EEZ (Figure 2-5). Coordinates for the closure are shown in Table 2-11.

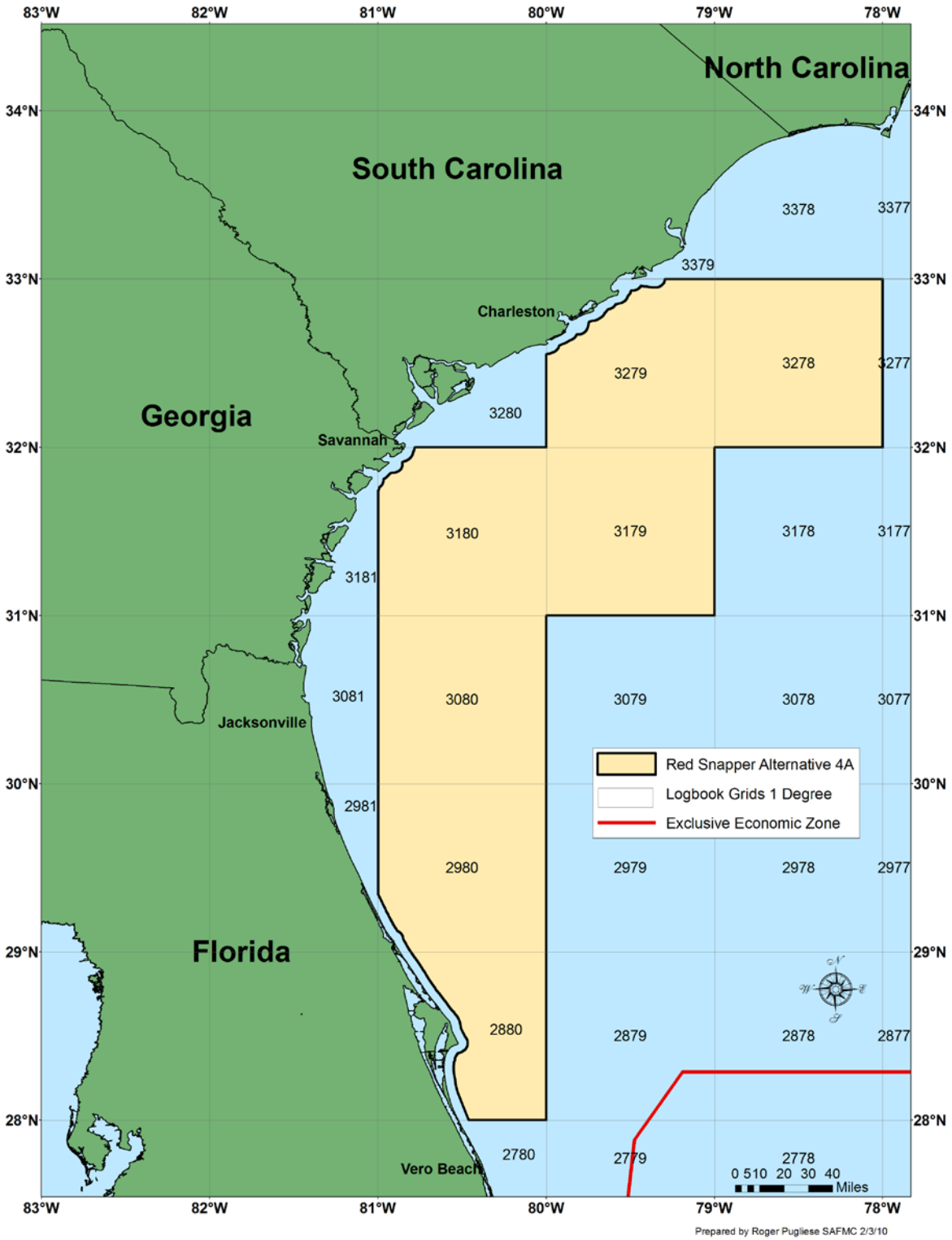


Figure 2-5. Map of proposed closed area under Alternative 4A.

Table 2-11 Waypoints used to delineate Alternative 4A.

ID	LAT_DMS	LON_DMS
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 27' 42"
3	29° 20' 33"	-81° 00' 00"
4	31° 44' 32"	-81° 00' 00"
5	32° 00' 00"	-80° 46' 56"
6	32° 00' 00"	-80° 00' 00"
7	32° 33' 08"	-80° 00' 00"
8	33° 00' 00"	-79° 17' 45"
9	33° 00' 00"	-78° 00' 00"
10	32° 00' 00"	-78° 00' 00"
11	32° 00' 00"	-79° 00' 00"
12	31° 00' 00"	-79° 00' 00"
13	31° 00' 00"	-80° 00' 00"

Between point 2 and point 3, line follows inner boundary of U.S. EEZ.
Between point 4 and point 5, line follows inner boundary of U.S. EEZ.
Between point 7 and point 8, line follows inner boundary of U.S. EEZ.

Alternative 4B. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, 3179, 3180, 3278, and 3279 between an approximate depth of 66 feet (11 fathoms; 20 m) to 240 feet (40 fathoms; 73 m), for a total of 15,269 mi^2 (39, 547 km^2), using the bathymetric boundary, of the South Atlantic EEZ (Figure 2-6). Coordinates for the closure are shown in Table 2-12.

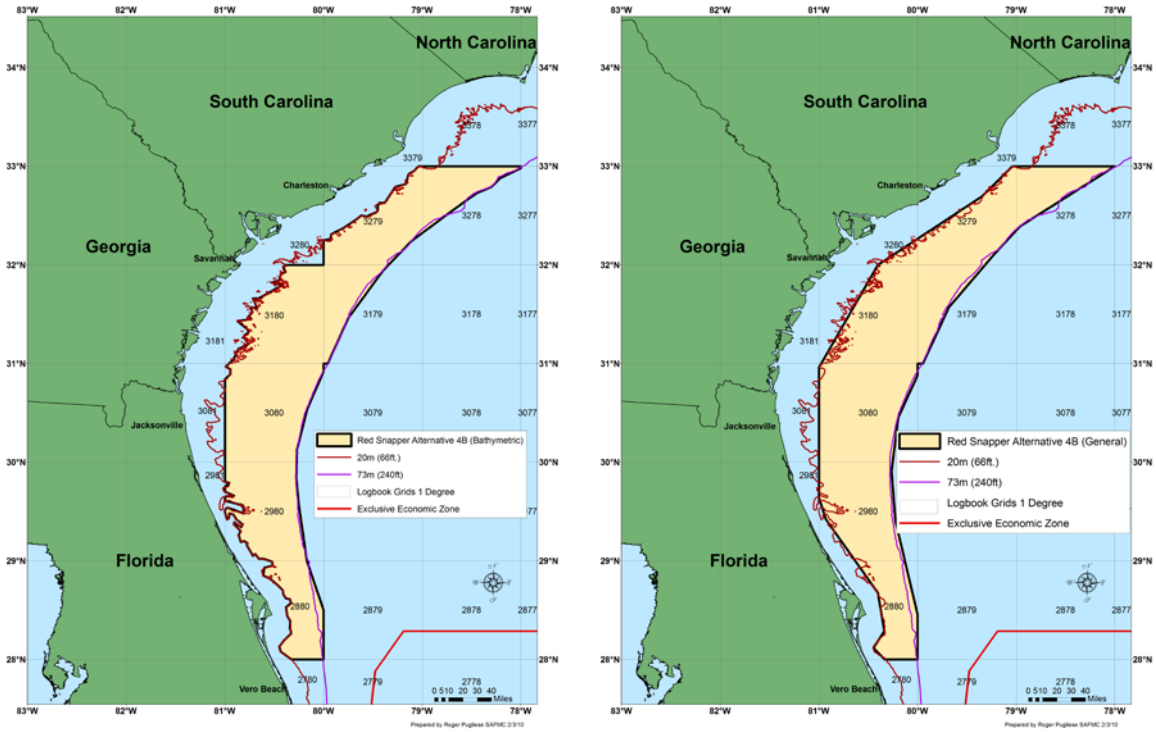


Figure 2-6. Map 1 of proposed closed area under Alternative 4B. Map 2 using generalized boundary for proposed closed area under Alternative 4B.

Table 2-12 Waypoints used to delineate Alternative 4B.

Map 1 waypoints used to delineate Alternative 4B.			Map 2 waypoints used to delineate the generalized boundary under Alternative 4B.		
ID	**LAT_DMS**	**LON_DMS**	**ID**	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"	1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 19' 30"	2	28° 00' 00"	-80° 20' 01"
3	28° 04' 39"	-80° 26' 11"	3	28° 06' 58"	-80° 26' 49"
4	28° 07' 43"	-80° 26' 56"	4	28° 17' 14"	-80° 20' 19"
5	28° 12' 08"	-80° 23' 46"	5	28° 40' 32"	-80° 24' 09"
6	28° 15' 27"	-80° 19' 50"	6	29° 25' 09"	-80° 55' 44"
7	28° 17' 09"	-80° 19' 58"	7	29° 38' 20"	-81° 00' 00"
8	28° 18' 20"	-80° 20' 27"	8	30° 57' 40"	-81° 00' 00"
9	28° 23' 33"	-80° 20' 17"	9	32° 00' 00"	-80° 24' 12"
10	28° 26' 19"	-80° 22' 08"	10	32° 41' 38"	-79° 20' 50"
11	28° 31' 34"	-80° 22' 48"	11	33° 00' 00"	-79° 02' 22"
12	28° 34' 00"	-80° 19' 50"	12	33° 00' 00"	-78° 00' 00"
13	28° 36' 20"	-80° 20' 28"	13	32° 23' 28"	-78° 57' 38"
14	28° 37' 05"	-80° 22' 58"	14	32° 06' 03"	-79° 13' 46"
15	28° 39' 49"	-80° 24' 28"	15	31° 34' 08"	-79° 41' 03"
16	28° 41' 42"	-80° 24' 48"	16	31° 00' 00"	-79° 56' 43"
17	28° 45' 40"	-80° 28' 22"	17	31° 00' 00"	-80° 00' 00"
18	28° 49' 06"	-80° 32' 45"	18	30° 52' 54"	-80° 00' 00"
19	28° 50' 45"	-80° 36' 51"	19	30° 27' 19"	-80° 11' 41"
20	28° 55' 31"	-80° 36' 00"	20	29° 54' 31"	-80° 15' 51"
21	28° 57' 07"	-80° 31' 04"	21	29° 24' 24"	-80° 13' 32"
22	28° 59' 10"	-80° 31' 19"	22	28° 27' 20"	-80° 00' 00"
23	29° 01' 21"	-80° 36' 26"			
24	29° 01' 03"	-80° 39' 27"			
25	29° 04' 17"	-80° 41' 32"			
26	29° 03' 10"	-80° 43' 00"			
27	29° 09' 34"	-80° 46' 48"			
28	29° 10' 39"	-80° 46' 17"			
29	29° 12' 00"	-80° 48' 18"			
30	29° 11' 22"	-80° 50' 18"			
31	29° 15' 26"	-80° 51' 39"			
32	29° 17' 59"	-80° 50' 28"			
33	29° 21' 59"	-80° 54' 32"			
34	29° 23' 17"	-80° 54' 17"			
35	29° 20' 34"	-80° 50' 08"			
36	29° 22' 01"	-80° 49' 15"			
37	29° 25' 07"	-80° 53' 04"			
38	29° 28' 06"	-80° 54' 54"			

39	29° 28' 31"	-80° 57' 20"
40	29° 25' 38"	-80° 57' 37"
41	29° 25' 10"	-80° 58' 37"
42	29° 29' 30"	-81° 00' 00"
43	29° 31' 26"	-81° 00' 00"
44	29° 32' 31"	-80° 58' 32"
45	29° 28' 48"	-80° 48' 41"
46	29° 33' 51"	-80° 48' 53"
47	29° 36' 44"	-81° 00' 00"
48	29° 39' 02"	-81° 00' 00"
49	29° 39' 18"	-80° 54' 32"
50	29° 42' 08"	-81° 00' 00"
51	29° 44' 44"	-81° 00' 00"
52	29° 47' 08"	-80° 57' 24"
53	29° 48' 05"	-81° 00' 00"
54	30° 50' 16"	-81° 00' 00"
55	30° 53' 39"	-80° 56' 45"
56	30° 56' 25"	-80° 56' 40"
57	30° 57' 56"	-80° 59' 30"
58	31° 02' 34"	-80° 54' 49"
59	31° 08' 43"	-80° 51' 49"
60	31° 12' 01"	-80° 45' 27"
61	31° 16' 09"	-80° 48' 40"
62	31° 20' 05"	-80° 45' 08"
63	31° 26' 03"	-80° 52' 29"
64	31° 26' 45"	-80° 43' 52"
65	31° 28' 48"	-80° 45' 24"
66	31° 31' 03"	-80° 43' 18"
67	31° 34' 23"	-80° 44' 20"
68	31° 33' 50"	-80° 40' 14"
69	31° 39' 37"	-80° 42' 58"
70	31° 39' 21"	-80° 39' 31"
71	31° 48' 09"	-80° 24' 39"
72	31° 49' 08"	-80° 31' 35"
73	31° 51' 08"	-80° 25' 59"
74	31° 52' 17"	-80° 26' 52"
75	31° 54' 38"	-80° 25' 43"
76	31° 55' 55"	-80° 23' 08"
77	31° 58' 44"	-80° 24' 37"
78	32° 00' 00"	-80° 23' 10"
79	32° 00' 00"	-80° 00' 00"
80	32° 15' 03"	-80° 00' 01"
81	32° 15' 53"	-79° 55' 54"

82	32° 18' 27"	-79° 55' 19"
83	32° 21' 54"	-79° 48' 17"
84	32° 26' 49"	-79° 40' 58"
85	32° 29' 56"	-79° 37' 06"
86	32° 29' 10"	-79° 33' 22"
87	32° 30' 48"	-79° 31' 41"
88	32° 31' 41"	-79° 28' 11"
89	32° 33' 14"	-79° 27' 05"
90	32° 35' 47"	-79° 27' 04"
91	32° 37' 33"	-79° 26' 02"
92	32° 37' 31"	-79° 22' 41"
93	32° 47' 39"	-79° 16' 27"
94	32° 49' 27"	-79° 09' 53"
95	32° 55' 16"	-79° 08' 22"
96	32° 57' 12"	-79° 05' 14"
97	33° 00' 00"	-79° 02' 23"
98	33° 00' 00"	-78° 00' 00"
99	32° 58' 50"	-78° 00' 00"
100	32° 53' 02"	-78° 12' 38"
101	32° 47' 21"	-78° 17' 49"
102	32° 43' 47"	-78° 26' 40"
103	32° 39' 37"	-78° 32' 45"
104	32° 30' 36"	-78° 45' 00"
105	32° 14' 24"	-79° 06' 36"
106	31° 56' 24"	-79° 24' 00"
107	31° 27' 36"	-79° 45' 00"
108	31° 00' 00"	-79° 57' 28"
109	31° 00' 00"	-80° 00' 00"
110	30° 55' 18"	-80° 00' 00"
111	30° 32' 40"	-80° 10' 00"
112	30° 07' 00"	-80° 16' 15"
113	29° 50' 25"	-80° 16' 38"
114	29° 35' 00"	-80° 15' 13"
115	29° 00' 00"	-80° 10' 10"
116	28° 30' 00"	-80° 00' 00"

Alternative 4C. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, 3179, 3180, 3278, and 3279 between an approximate depth of 98 feet (16 fathoms; 30 m) to 240 feet (40 fathoms; 73 m), for a total of

9,823 mi² (25,441 km^2), using the bathymetric boundary, of the South Atlantic EEZ (Figure 2-7). Coordinates for the closure are shown in Table 2-13.

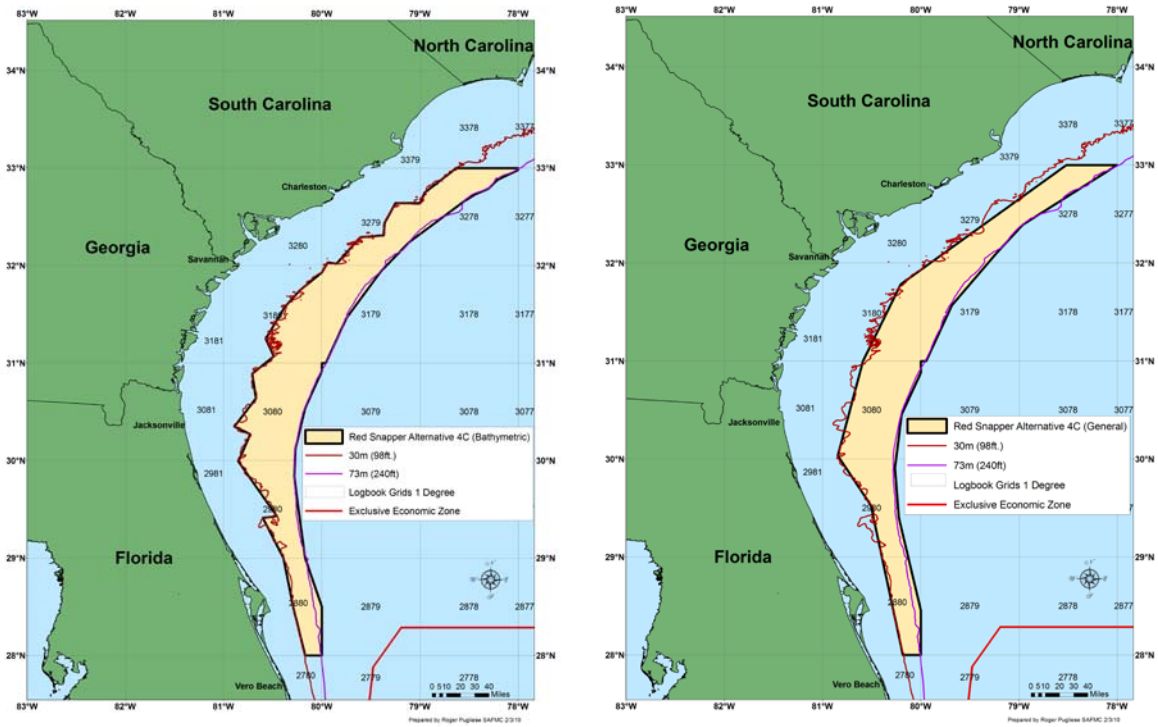


Figure 2-7. Map 1 of proposed closed area under Alternative 4C. Map 2 using generalized boundary for proposed closed area under Alternative 4C.

Table 2-13 Waypoints used to delineate Alternative 4C.

Map 1 waypoints used to delineate Alternative 4C.			Map 2 waypoints used to delineate the generalized boundary under Alternative 4C.		
ID	**LAT_DMS**	**LON_DMS**	**ID**	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"	1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 10' 15"	2	28° 00' 00"	-80° 10' 57"
3	28° 29' 17"	-80° 17' 23"	3	29° 31' 40"	-80° 30' 34"
4	29° 00' 00"	-80° 23' 30"	4	30° 02' 03"	-80° 50' 45"
5	29° 24' 25"	-80° 36' 07"	5	31° 00' 00"	-80° 35' 19"
6	29° 25' 39"	-80° 27' 21"	6	31° 47' 00"	-80° 12' 15"
7	29° 59' 30"	-80° 51' 10"	7	33° 00' 00"	-78° 31' 05"
8	30° 16' 02"	-80° 43' 36"	8	33° 00' 00"	-78° 00' 00"
9	30° 20' 58"	-80° 53' 34"	9	32° 23' 28"	-78° 57' 38"
10	30° 38' 08"	-80° 40' 18"	10	32° 06' 03"	-79° 13' 46"
11	30° 53' 12"	-80° 42' 45"	11	31° 34' 08"	-79° 41' 03"
12	31° 04' 00"	-80° 29' 29"	12	31° 00' 00"	-79° 56' 43"
13	31° 14' 57"	-80° 33' 55"	13	31° 00' 00"	-80° 00' 00"
14	31° 34' 11"	-80° 22' 34"	14	30° 52' 54"	-80° 00' 00"
15	31° 44' 07"	-80° 14' 00"	15	30° 27' 19"	-80° 11' 41"
16	31° 56' 00"	-80° 00' 00"	16	29° 54' 31"	-80° 15' 51"
17	32° 02' 00"	-79° 56' 31"	17	29° 24' 24"	-80° 13' 32"
18	32° 01' 12"	-79° 50' 43"	18	28° 27' 20"	-80° 00' 00"
19	32° 17' 21"	-79° 36' 42"			
20	32° 18' 38"	-79° 22' 01"			
21	32° 26' 25"	-79° 21' 53"			
22	32° 38' 13"	-79° 14' 52"			
23	32° 38' 24"	-79° 00' 00"			
24	32° 45' 05"	-78° 57' 05"			
25	33° 00' 00"	-78° 37' 53"			
26	33° 00' 00"	-78° 00' 00"			
27	32° 58' 50"	-78° 00' 00"			
28	32° 53' 02"	-78° 12' 38"			
29	32° 47' 21"	-78° 17' 49"			
30	32° 43' 47"	-78° 26' 40"			
31	32° 39' 37"	-78° 32' 45"			
32	32° 30' 36"	-78° 45' 00"			
33	32° 14' 24"	-79° 06' 36"			
34	31° 56' 24"	-79° 24' 00"			
35	31° 27' 36"	-79° 45' 00"			

36	31° 00' 00"	-79° 57' 28"
37	31° 00' 00"	-80° 00' 00"
38	30° 55' 18"	-80° 00' 00"
39	30° 32' 40"	-80° 10' 00"
40	30° 07' 00"	-80° 16' 15"
41	29° 50' 25"	-80° 16' 38"
42	29° 35' 00"	-80° 15' 13"
43	29° 00' 00"	-80° 10' 10"
44	28° 30' 00"	-80° 00' 00"

Alternative 4D (Preferred) Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, 3179, 3180, 3278, and 3279 between an approximate depth of 98 feet (16 fathoms; 30 m) to 300 feet (50 fathoms; 91 m), for a total of 10,293 sq miles (26 659 km^2), using the bathymetric boundary, or 9588 mi^2 (24832 km^2), using the general boundary, of the South Atlantic EEZ (Figure 2-8). Coordinates for the closure are shown in Table 2-14.

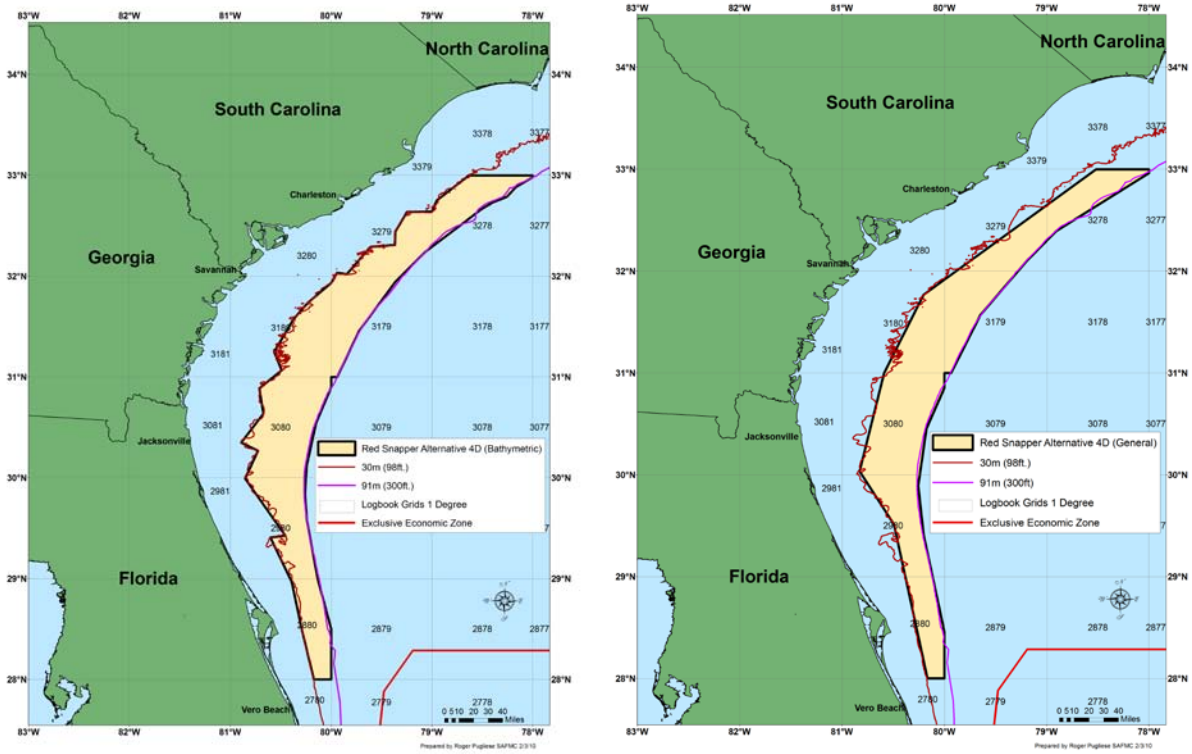


Figure 2-8. Map 1 of proposed closed area under Alternative 4D. Map 2 using generalized boundary for proposed closed area under Alternative 4D.

Table 2-14 Waypoints used to delineate Alternative 4D.

Map 1 waypoints used to delineate Alternative 4D.		
ID	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 10' 15"
3	28° 29' 17"	-80° 17' 23"
4	29° 00' 00"	-80° 23' 30"
5	29° 24' 25"	-80° 36' 07"
6	29° 25' 39"	-80° 27' 21"
7	29° 59' 30"	-80° 51' 10"
8	30° 16' 02"	-80° 43' 36"
9	30° 20' 58"	-80° 53' 34"
10	30° 38' 08"	-80° 40' 18"
11	30° 53' 12"	-80° 42' 45"
12	31° 04' 00"	-80° 29' 29"
13	31° 14' 57"	-80° 33' 55"
14	31° 34' 11"	-80° 22' 34"
15	31° 44' 07"	-80° 14' 00"
16	31° 56' 00"	-80° 00' 00"
17	32° 02' 00"	-79° 56' 31"
18	32° 01' 12"	-79° 50' 43"
19	32° 17' 21"	-79° 36' 42"
20	32° 18' 38"	-79° 22' 01"
21	32° 26' 25"	-79° 21' 53"
22	32° 38' 13"	-79° 14' 52"
23	32° 38' 24"	-79° 00' 00"
24	32° 45' 05"	-78° 57' 05"
25	33° 00' 00"	-78° 37' 53"
26	33° 00' 00"	-78° 00' 00"
27	32° 58' 50"	-78° 00' 00"
28	32° 53' 02"	-78° 10' 01"
29	32° 47' 21"	-78° 15' 20"
30	32° 43' 47"	-78° 24' 06"
31	32° 39' 37"	-78° 30' 52"
32	32° 30' 36"	-78° 42' 43"
33	32° 14' 24"	-79° 04' 07"
34	31° 56' 24"	-79° 22' 00"
35	31° 27' 36"	-79° 43' 17"
36	31° 00' 00"	-79° 56' 27"
37	31° 00' 00"	-80° 00' 00"
38	30° 53' 50"	-80° 00' 00"
39	30° 32' 40"	-80° 09' 00"
40	30° 07' 00"	-80° 14' 39"
41	29° 50' 25"	-80° 15' 39"
42	29° 35' 00"	-80° 14' 30"
43	29° 00' 00"	-80° 08' 04"
44	28° 30' 00"	-80° 00' 00"

Map 2 waypoints used to delineate the generalized boundary under Alternative 4D		
ID	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 09' 57"
3	29° 30' 40"	-80° 29' 34"
4	30° 02' 03"	-80° 49' 45"
5	31° 00' 00"	-80° 35' 19"
6	31° 46' 00"	-80° 12' 15"
7	33° 00' 00"	-78° 31' 05"
8	33° 00' 00"	-78° 00' 00"
9	32° 57' 44"	-78° 00' 00"
10	32° 23' 28"	-78° 54' 32"
11	32° 06' 03"	-79° 11' 41"
12	31° 34' 08"	-79° 38' 57"
13	31° 00' 00"	-79° 56' 05"
14	31° 00' 00"	-80° 00' 00"
15	30° 51' 13"	-80° 00' 00"
16	30° 27' 19"	-80° 10' 34"
17	29° 53' 31"	-80° 15' 25"
18	29° 24' 24"	-80° 12' 13"
19	28° 27' 20"	-80° 00' 00"

Alternative 5 (Preferred). Allow fishing for, harvest and possession of snapper grouper species (with exception of red snapper) in the closed area if fish were harvested with black sea bass pots with endorsements.

Alternative 6. Allow fishing for, harvest and possession of snapper grouper species (with exception of red snapper) with bottom longline gear in the closed area deeper than 50 fathoms as specified in CFR §622.35.

Alternative 7 (Preferred). Allow fishing for, harvest and possession of snapper grouper species (with the exception of red snapper) in the closed area if fish were harvested with spearfishing gear.

Alternative 8. Allow transit through areas closed to snapper grouper harvest.

> **Sub-alternative 8a (Preferred).** The prohibition on possession does not apply to a person aboard a vessel that is in transit with snapper grouper species on board and with fishing gear appropriately stowed.

Vessels (both commercial and recreational) may transit through any snapper grouper closed area in the South Atlantic EEZ with snapper grouper species on board if prohibited fishing gear is appropriately stowed and not available for immediate use. The Council is considering alternatives that could allow fishing for snapper grouper species with spearfishing gear, black sea bass pots, and/or bottom longline within the proposed closed areas.

The term *"transit"* means: Direct, non-stop progression through any snapper grouper closed area in the South Atlantic EEZ on a constant heading, along a continuous straight line course, while making way by means of a source of power at all times.

The term *"Gear appropriately stowed"* includes but is not limited to: **Terminal gear** (i.e., hook, leader, sinker, flasher, or bait) used with an automatic reel, bandit gear, buoy gear, trolling gear, hand-line, or rod and reel must be disconnected and stowed separately from such fishing gear. Rod and reel must be removed from the rod holder and stowed securely on or below deck; **longline gear** may be left on the drum if all gangions and hooks are disconnected and stowed below deck, hooks cannot be baited, all buoys must be disconnected from the gear; however, buoys may remain on deck; **trawl** and **try net gear** may remain on deck, but trawl doors must be disconnected from such net and must be secured; **gill nets**, stab nets, or trammel nets must be left on the drum, any additional such nets not attached to the drum must be stowed below deck; and **crustacean traps,** or **golden crab trap,** cannot be baited, all buoys must be disconnected from the gear; however, buoys may remain on deck. Other methods of stowage authorized in writing by the Regional Administrator, and subsequently published in the *Federal Register* may also be utilized under this definition.

The term *"Not available for immediate use"* means: Gear that is shown to not have been in recent use and that is stowed in conformance with the definitions included under "gear appropriately stowed".

Sub-alternative 8b. The prohibition on possession does not apply to a person aboard a vessel that has snapper grouper species onboard if the vessel is in transit.

Vessels (both commercial and recreational) may transit through any snapper grouper closed area in the South Atlantic EEZ with snapper grouper species.

The term *"transit"* means: Direct, non-stop progression through any snapper grouper closed area in the South Atlantic EEZ on a constant heading, along a continuous straight line course, while making way by means of a source of power at all times.

Sub-alternative 8c. The prohibition on possession does not apply to a person aboard a vessel that has wreckfish onboard if the vessel is in transit.

Vessels (both commercial and recreational) may transit through any snapper grouper closed area in the South Atlantic EEZ with snapper grouper species and/or wreckfish on board.

The term *"transit"* means: Direct, non-stop progression through any snapper grouper closed area in the South Atlantic EEZ on a constant heading, along a continuous straight line course, while making way by means of a source of power at all times.

2.3.1 Comparison of Alternatives

Table 2-15 Comparison of effects of area closure alternatives for red snapper

Alternatives	Biological Effects	Socioeconomic/Administrative Effects
Alternative 1 (Status Quo)	(-) Not prohibiting harvest of red snapper would not end overfishing of red snapper within the allowable timeframe.	(+) short-term (-) long-term If overfishing is allowed to continue future socioeconomic stability in the fishery may be compromised.
Alternative 2 Prohibit all harvest, and possession, of red snapper.	(+) Though prohibiting harvest of red snapper will help to reduce overall mortality it would not end overfishing within the allowable time.	(-) Reduction in commercial net operating revenue = 4.3% This alternative would have the least immediate socioeconomic impact of Alternatives 2-4D.
Alternative 3A grid closures,2880, 2980, 3080, 3180	(+) Reduction in total removals = 72%-90%	(-) Reduction in commercial net operating revenue = 5.4%
Alternative 3B grid closures 2880, 2980, 3080, 3180 from 66-240 ft	(+) Reduction in total removals = 69%-88%	(-) Reduction in commercial net operating revenue = 4.9%
Alternative 3C grid closures 2880, 2980, 3080, 3180 from 98-240 ft	(+) Reduction in total removals = 72%-90%	(-) Reduction in commercial net operating revenue = $438,000
Alternative 3D grid closures 2880, 2980, 3080, 3180, from 98-300 ft	(+) Reduction in total removals = 63%-84%	(-) Reduction in commercial net operating revenue = $445,000
Alternative 4A grid closures 2880, 2980, 3080, 3180, 3179, 3278, 3279	(+) Reduction in total removals = 86%-90% The second largest reduction in total removals of all the alternatives.	(-) Reduction in net commercial operating revenue = 13.7%. The largest socioeconomic impact of all the alternatives.
Alternative 4B grid closures 2880, 2980, 3080, 3180, 3179, 3278, 3279, from 66-240 ft	(+) Reduction in total removals = 73%-91%. The largest reduction in total removals of all the alternatives.	(-) Reduction in commercial net operating revenue = 12.5%. The second largest socioeconomic impacts of all the alternatives.

Alternative 4C grid closures 2880, 2980, 3080, 3180, 3179, 3278, 3279, from 98-240 ft	(+) Reduction in total removals = 66%-86%	(-) Reduction in commercial net operating revenue = 12%
Alternative 4D (Preferred) grid closures 2880, 2980, 3080, 3180, 3179, 3278, 3279, from 98-300 ft	(+) Reduction in total removals = 67%-86%. Represents a midpoint between the highest and lowest level of removal.	(-) Reduction in commercial net operating revenue = 12.1%
Alternative 5 (Preferred) Allows black sea bass pots in closed area	(+-) Black sea bass pots are highly selective for black sea bass, and would be able to be deployed within any one of the proposed closed areas in **Alternatives 2-4** without negatively affecting the harvest reductions needed to end overfishing of red snapper	(+) Allowing the use of black sea bass pots may help mitigate some of the short term socioeconomic impacts associated with an area closure.
Alternative 6 Allows bottom longline gear in closed area	(+-) Golden tilefish are found in different habitats than other snapper grouper species. Allowing this gear type would not be likely to impact recovery of red snapper.	(+) Allowing the use of black sea bass pots may help mitigate some of the short term socioeconomic impacts associated with an area closure
Alternative 7 (Preferred) Allows spearfishing in closed area	(+-) Due to the selectivity of the gear type, spearguns could be allowed within a proposed closed area with little or no impact on recovery of red snapper.	(+) Allowing the use of black sea bass pots may help mitigate some of the short term socioeconomic impacts associated with an area closure
Alternative 8 (8a. Preferred) Allows transit through closed area with snapper grouper onboard	(+-) Allowing transit through a proposed closed area with snapper grouper onboard would not impact the recovery of red snapper.	(+-) Allowing transit through a proposed closed area with legally harvested snapper grouper onboard would address any safety concerns raised by a closed area; however, the provision may be difficult to enforce.

(-) overall negative impacts, (+) overall positive impacts, (- +) neutral impacts

Under **Alternative 1 (Status Quo)**, between a 40% and 58% reduction in total kill could be expected. Based on the preferred rebuilding strategy **Alternative 5 (Preferred)** that considers very high recruitment and a $F_{40\%SPR}$ proxy for F_{MSY}, an 83% reduction in total removals of red snapper is needed to achieve the yield at 97%F_{MSY} and end overfishing.

Alternative 2 would prohibit all commercial and recreational harvest, and possession, of red snapper year-round in the South Atlantic EEZ. The prohibition of red snapper harvest in **Alternatives 2-4D (Preferred)** would remain in effect beyond 2010 until modified. It is anticipated that as the stock rebuilds, the size of the closed area would be decreased and harvest of red snapper would gradually be increased. This determination would be based on results from stock assessment updates conducted by SEDAR. Fishing mortality in 2007 (F_{CURR}) is estimated at 0.797. The proxies for F_{MSY} being considered by the Council are estimated at 0.148 and 0.104 for $F_{30\%SPR}$ and $F_{40\%SPR}$, respectively. Comparing the expected total kill in 2009 to the estimated landings in 2010 indicates an 83% reduction in total kill is needed to end overfishing and rebuild the fishery within 35 years when $F_{40\%SPR}$ with very high recruitment, the preferred alternative, is used as a proxy for F_{MSY} and a 79% in total kill when $F_{40\%SPR}$ with very high recruitment is used as a proxy for F_{MSY}.

Table 2-16. Projected reductions in red snapper landings following implementation of various alternatives proposed by Amendment 17A. Various scenarios illustrate sensitivity of projection model to input parameters (Table 3 from SERO-LAPP-2009-07 Rev).

Alternative	Closed Cells	Closed Depths	Area Closed (1000 km^2)	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
2	None	None	0	29%	39%	52%	55%	60%	60%
3A	2880, 2980, 3080, 3180	All	38	72%	72%	83%	83%	87%	90%
3B	2880, 2980, 3080, 3180	66-240 ft	27	69%	70%	81%	81%	85%	88%
3C	2880, 2980, 3080, 3180	98-240 ft	15	63%	65%	76%	77%	81%	84%
3D	2880, 2980, 3080, 3180	98-300 ft	16	63%	66%	76%	77%	81%	84%
4A	2880, 2980, 3080, 3180, 3179, 3278, 3279	All	67	76%	77%	86%	86%	89%	93%
4B	2880, 2980, 3080, 3180, 3179, 3278, 3279	66-240 ft	39	73%	74%	83%	84%	87%	91%
4C	2880, 2980, 3080, 3180, 3179, 3278, 3279	98-240 ft	24	66%	69%	78%	80%	83%	86%
4D	2880, 2980, 3080, 3180, 3179, 3278, 3279	98-300 ft	25	67%	69%	79%	80%	83%	86%

Scenario 1: No impacts A13C, A16; A17A eliminates targeted trips only; 80% compliance; 60%/60% offshore release mortality; 20%/20% inshore release mortality.

Scenario 2: No impacts A13C, A16; A17A eliminates targeted trips only; 80% compliance; 40%/90% offshore release mortality, 40%/90% inshore release mortality.

Scenario 3: No impacts A13C, A16; A17A eliminates targeted trips only; 85% compliance; 40%/40% offshore release mortality, 20%/20% inshore release mortality.

Scenario 4: Directed and targeted trips eliminated by A13C, A16, A17A; 85% compliance; 40%/90% offshore release mortality; 20%/20% inshore release mortality.

Scenario 5: Directed and targeted trips eliminated by A13C, A16, A17A; 87% compliance; 40%/40% offshore release mortality; 20%/20% inshore release mortality.

Scenario 6: Directed and targeted trips eliminated by A13C, A16, A17A; 100% compliance; 40%/40% offshore release mortality; 20%/20% inshore release mortality.

Alternative 3A prescribes a general closure of the red snapper fishery, or 37,544 sq kilometers of the South Atlantic EEZ, and a complete closure of the four logbook grids partially closed in **Alternative 3C** (Figure 2-3). Various analysis scenarios for **Alternative 3A** are generally the same as for **Alternative 3C**. Under **Alternative 3A**, the estimated reduction in total removals is estimated to range from 72% to 90% depending on assumptions such as effects of previous management measures and release mortality (**Appendix E.** SERO-LAPP-2009-07 REV).

Alternative 3B would close approximately 27,368 square kilometers to fishing for, harvest, and possession of snapper grouper species. Snapper grouper fishing would be prohibited in four consecutive logbook grids between the depths of 66 feet (20 m) and 240 feet (73 m). **Alternative 3B** includes a slightly larger closed area than **Alternative 3C** and **3D**, and included more inshore area when compared to **Alternatives 3C** and **3D**. Under **Alternative 3B**, estimated reductions in red snapper removals ranges from 69% to 88%. The area closure included in **Alternative 3B** would be more biologically beneficial than **Alternatives 3C** or **3D** which would be expected to reduce red snapper removals by 63% to 84%. Under **Alternative 3B** the stock could potentially rebuild faster than **Alternatives 3C**, and **3D**, but not as quickly as it would under **Alternatives 3A**, **4A**, or **4B**. **Alternative 3C** prescribes, in addition to a closure of the red snapper fishery, a closure of four logbook grids (2880, 2980, 3080, 3180), or 16,511 square kilometers of the EEZ, between depths of 98 feet (16 fathoms; 30 m) and 240 feet (40 fathoms, 73 m) to harvest, possession, and retention of all species in the snapper grouper fishery management unit (Figure 2-3). **Alternative 3D** is very similar to **Alternative 3C** in that it closes logbook grids 2880, 2980, 3080, and 3180 beginning at a depth of 98 feet (30 m). The area closure in **Alternative 3D**; however, extends to a depth of 300 feet (91 m); whereas, the area closure in **Alternative 3C** extends to 240 feet (73 m). Since **Alternative 3C** does not extend as far east as **Alternative 3D**, there may some, however small, socioeconomic benefits of **Alternative 3C** over **Alternative 3D**. Additionally, Amendment 17B contains an action that would close federal waters to harvest of deepwater snapper grouper beyond a depth of 240 feet (73 m), creating regulatory redundancy in the deepest part of the **Alternative 3D** closure.

The reduction in total removals from the scenarios examined for **Alternative 4A** range from 86% to 90%. This alternative would establish the year-round closure of seven logbook grids (2880, 2980, 3080, 3179, 3180, 3278, 3279), or 68,893 square kilometers of the EEZ, and therefore includes the most extensive closure of harvest areas. As a result, it is the least sensitive to variations in assumptions. In fact, all but two of the scenarios considered for this alternative achieve a harvest reduction of at least 86%.

Alternative 4B would close a 39,547 square kilometer area to all snapper grouper fishing in the logbook grids 2880, 2980, 3080, 3791, 3180, 3278, and 3279 between 66 feet (20 m) and 240 feet (73 m). This area is smaller than that under **Alternative 4A**, but larger than the closures included in Alternatives **3A**, **3B**, **3C**, **3D**, **4C**, and **4D**. Red snapper harvest reductions under **Alternative 4B** could be expected to range from 73% to 91%. The only alternatives that could realistically result in a greater reductions in total removals are **Alternative 3A**, and **Alternative 4A**, which closes seven total log book grids.

Alternative 4C requires, in addition to a closure of the red snapper fishery, the year-round closure of seven logbook grids (2880, 2980, 3080, 3179, 3180, 3278, 3279) or 25,441 square

kilometers of the South Atlantic EEZ, between depths of 98 and 240 feet to the harvest of all members of the snapper grouper FMU. Under this regulatory option, the reduction in total kill in the different scenarios examined in **Appendix E** would range from 66% to 86%.

Preferred **Alternative 4D** is similar to **Alternative 4C** except that in addition to a closure of the red snapper fishery and the year-round closure of seven logbook grids (2880, 2980, 3080, 3179, 3180, 3278, 3279), the bathymetric closure would be between depths of 98 and 300 feet rather than 98 to 240 feet. Under this regulatory option, the reduction in total kill in the different scenarios examined in **Appendix E** would range from 67% to 86%. There is little difference between the magnitude in total removals under **Alternatives 4C** and **4D**, primarily because there is minimal additional area closed by extending the eastern boundary of the closure from 240 feet out to 300 feet.

Under **Alternative 5 (Preferred)**, sea bass pots could be used to target snapper-grouper species within the proposed closed areas. Sea bass pots are considered highly selective for black sea bass, and would be able to be deployed within any one of the proposed closed areas in **Alternatives 2-4** without negatively affecting the harvest reductions needed to end overfishing of red snapper. Table 4-23 reveals that on trips that fished sea bass pots, black sea bass made up over 90% of the catch by weight. Red snapper are rarely taken in sea bass pots (0.22% of trips) and represent less than 0.01% of the catch by weight. Allowing commercial harvest of black sea bass using sea bass pots could alleviate, to some degree, negative socioeconomic effects caused by an area closure without impeding efforts to end overfishing of red snapper. Among **Alternatives 2-4**, **Alternative 2** would be expected to have the least negative social effect on the commercial and recreational snapper grouper fisheries because it would not extend harvest prohibitions beyond the red snapper fishery.

Alternative 6 would allow the harvest of golden tilefish and other deepwater snapper-grouper species with bottom longline within the snapper-grouper area closures proposed in **Alternatives 2-4**. Golden tilefish are usually caught over mud habitat in depths of 180 m to 300 m, (Low *et al.* 1983; Able *et al.* 1993), with depths of ~200 m being most common (Dooley 1978). In contrast, red snapper adults usually occur over rocky bottoms, and juveniles inhabit shallow waters and are common over sandy or muddy bottom habitat (Allen 1985) in much shallower water (generally less than 240 ft (73 m)). The difference in preferred habitat and depth of golden tilefish and red snapper would allow for the deployment of bottom longline gear without negatively affecting rebuilding efforts for red snapper. As is the case in allowing black sea bass pot deployment within the closed areas, if chosen as a preferred, allowing the use of bottom longline gear may also help to mitigate some of the negative socioeconomic impact expected as a result of an area closure. Although the Council felt that there would little chance that fishermen targeting golden tilefish would impact red snapper stocks, the Council did not select **Alternative 6** as a preferred alternative because the preferred closure **Alternative 4D** would extend to a depth of 300 feet and bottom longline gear is already restricted to depths greater than 300 feet.

Alternative 7 (Preferred) would allow the harvest of snapper grouper species, other than red snapper, within a proposed closed area using spearfishing gear. Because of it selectivity as a gear type, spear guns would be the least likely of all fishing gear to produce red snapper bycatch.

Allowing the use of spear guns may also help to offset, to a small degree, some of the negative socioeconomic impacts expected from large area closures.

Allowing transit with snapper grouper and or wreckfish on board (**Sub-Alternatives 8a (Preferred), 8b**, and **8c**)) would make enforcement within the closed areas more difficult; however, the enforcement burden may be mitigated by careful drafting of "transit" and "gear stowed" regulations. Additionally, allowing for transit through the closed area would likely eliminate any safety-at-sea concerns that may arise from having to navigate around a closed area in bad weather.

Alternatives 4A, 4B, 4C, and **Alternative 4D (Preferred)** would prohibit the harvest of all species in the snapper grouper management unit off portions of South Carolina in addition to Georgia and northeast Florida. Therefore, these alternatives are expected to generate greater commercial losses than **Alternatives 3A-3D**. Simulation results suggest that the commercial losses are 2.5 larger for **Alternatives 4A-4D** than **Alternatives 3A-3D** (assuming all are combined with **Alternatives 5 (Preferred)** and **7 (Preferred)**). **Alternative 4A** in combination with **Alternatives 5 (Preferred)** and **7 (Preferred)** would prohibit harvests in all depths (except for the use of black sea bass pots and spearfishing) and is expected to reduce net operating revenues by approximately $1,235,000 (13.7%). The commercial impacts from the combination of **Alternatives 4B** (which prohibits fishing in 66-240 feet), **Alternatives 5 (Preferred),** and **7 (Preferred)** would be slightly lower with losses of $1,125,000 or 12.5%. The combination of **Alternative 4C** (prohibits harvest between 90-240 feet), **5 (Preferred)**, and **7 (Preferred)** result in even lower at losses of $1,081,000 (12%). **Alternative 4D (Preferred)** (prohibits fishing between 98 and 300 feet), in combination with **5 (Preferred)**, and **7 (Preferred)** produces losses slightly higher at $1,095,000 (12.1%).

Including the exemptions for black sea bass and spearfishing gear, the predicted reductions in net operating revenues for commercial fishermen in northeast Florida and Georgia are expected to average approximately $693,000 (70.3%) for **Alternatives 4A** and **4B** and $690,000 (70%) for **Alternatives 4C** and **4D (Preferred)**. Losses to South Carolina fishermen from **Alternatives 4A-4D (Preferred)** including mitigating effects of exemptions for black sea bass pots and spearfishing gear, range from $531,000 (34.5%) for **Alternative 4A** to $456,000 (29.6%) for **Alternative 4C**. **Alternative 4D (Preferred)** resulting losses of $463,000 (30%) in combination with **Alternatives 5 (Preferred)** and **7 (Preferred)**.

The magnitude of economic effects on the recreational sector of the various alternatives directly correlates with the size of area closures. **Alternative 4A** would close all depths within each of the seven statistical grids; hence, it would result in the largest economic effects among the four alternatives. The second largest economic effects would result from **Alternative 4B**, which would close depths from 66 feet to 240 feet. **Alternative 4C**, which would close depths from 98 feet to 240 feet, would result in the lowest economic effects; and, **Alternative 4D (Preferred)**, which would close depths from 98 feet to 300 feet, would have the third largest economic effects on the recreational sector. An in-depth analysis of the impacts of red snapper management measures alternatives may be found in **Section 4.3** of this document.

2.4 Require the use of Circle Hooks

Alternative 1 (Status Quo). Do not require the use of circle hooks when using hook and line gear for snapper grouper species within any particular area of the South Atlantic EEZ when fishing for snapper grouper species.

Alternative 2 (Preferred). Require the use of non-off set, non-stainless steel circle hooks when fishing for snapper grouper species with hook and line gear north of 28 degrees. It is unlawful to possess snapper grouper species without possessing non-off set, non-stainless steel circle hooks. Apply to the use of natural baits only.

Alternative 3. Require the use of non-off set, non-stainless steel circle hooks when fishing for snapper grouper species with hook and line gear within the South Atlantic EEZ. It is unlawful to possess snapper grouper species without possessing non-off set, non-stainless steel circle hooks. Apply to the use of natural baits only.

2.4.1 Comparison of Alternatives

Table 2-17 Summary of effects of requiring the use of circle hooks alternatives.

Alternatives	Biological Effects	Socioeconomic/Administrative Effects
Alternative 1 (Status Quo)	(-) There would be no reduction in bycatch mortality from a required use of circle hooks.	(+) Fishery participants would not be required to purchase new hooks.
Alternative 2 (Preferred). Circle hooks required north of 28 degrees lat.	(+) May reduce bycatch mortality of incidentally caught red snapper and other non-target species.	(+-) Would not be as likely to reduce harvest of species south of 28 degrees lat. while still reducing bycatch mortality north of 28 degrees. Some cost would be associated with the purchase of the specified hooks.
Alternative 3. Circle hooks required in the entire EEZ.	(+) May reduce bycatch mortality of incidentally caught red snapper and other non-target species. May also reduce harvest of some target species south of 28 degrees lat.	(-) May reduce harvest of other target species, and some cost would be associated with the purchase of the specified hooks.

(-) overall negative impacts, (+) overall positive impacts, (- +) neutral impacts

Alternative 2 would require the use of non-offset, non-stainless steel circle hooks within the area north of 28°N; whereas, **Alternative 3** would require the use of non-offset, non-stainless steel circle hooks within the South Atlantic EEZ. The intended effect is to reduce discard and bycatch mortality of red snapper.

Studies on the effects of circle hooks and J hooks on retention and survival are limited to a handful of snapper grouper species. Some studies indicate beneficial effects can be gained to species while others are inconclusive. Due to limited data, it may not be possible to quantify the reduction in red snapper release mortality that could be provided by using circle hooks. Furthermore, not all species in the snapper grouper complex have the same mouth morphology and it is possible that circle hooks could negatively impact survival. Alternatively, use of circle hooks could substantially reduce harvest of some species, would have positive biological benefits but have negative social and economic impacts on fishermen dependent upon the species. In general, requiring the use of circle hooks may not substantially increase the cost of fishing to either the commercial or the recreational sectors, though the potential reduction in the harvest of some important species is noted.

The mandatory use of circle hooks was considered in Amendment 16 (SAFMC 2008) but removed after the amendment was reviewed by the Council's SSC. The SSC was concerned that there was not enough published information to quantify the effects of reducing discard mortality for various snapper grouper species, including red snapper. The SSC also expressed concern as did some public comments, that mandatory use of circle hooks could reduce availability of some snapper grouper species such as yellowtail snapper and gray triggerfish, which are not undergoing overfishing or overfished. Yellowtail snapper are primarily taken in South Florida; therefore, if **Alternative 3** was not selected as the preferred alternative, fishermen targeting yellowtail snapper with J-hooks would be able to continue this practice. An in-depth analysis of the impacts of the circle hook alternatives may be found in **Section 4.4** of this document.

2.5 Establish a Red Snapper Monitoring Program

Alternative 1. (Status Quo) Utilize existing data collection programs to monitor the rebuilding progress of red snapper. Existing programs include the fishery dependent Marine Recreational Fisheries Statistical Survey (MRFSS), logbook, discard logbook, headboat logbook, Trip Interview Program (TIP), and dealer reported landings. Fishery independent methods include Marine Resources Monitoring Assessment and Prediction Program (MARMAP), and the Southeast Area Monitoring and Assessment Program (SEAMAP). Over the course of the next three years MARMAP will be looking for red snapper sampling sites along the north FL, and South GA coast.

Alternative 2 (Preferred) Establish fishery independent monitoring program to track progress of red snapper. Sampling would include deployment of chevron traps, cameras, and hook and line at randomly selected stations.

Alternative 3. Establish a red snapper dependent monitoring program involving for-hire vessels (charter boat and headboats). Participating vessels may be authorized to harvest and land fish in excess of Federal possession limits and/or during fishery closures. Retention limits for red snapper would be based upon research objectives. The trip limits and number of trips per month will depend on the number of selected vessels, available quota, and objectives of the research fishery.

Administrative Details

NOAA Fisheries Service will annually request applications for participation in the red snapper research fishery through an exempted fishing permit (EFP). The EFP would authorize participation in the red snapper research fishery and the collection of red snapper and other species in the fishery management unit. Participating vessels may be authorized to harvest and land fish in excess of federal possession limits and/or during fishery closures.

NOAA Fisheries Service will review the submitted applications based on the selection criteria as described in a *Federal Register* notice and information provided on the application form to determine which applicants are qualified to participate in the red snapper research fishery.

Qualified applicants are those that:

- possess a valid commercial snapper grouper Federal permit;
- possess a valid United States Coast Guard (USCG) safety inspection decal when the application is submitted;
- have not been charged criminally or civilly (i.e., issued a Notice of Violation and Assessment (NOVA) or Notice of Permit Sanction) for any snapper grouper-related violation;
- have complied with NOAA Fisheries Service observer programs and are able to take a NOAA Fisheries Service-approved observer; and,
- submit a completed application by the posted deadline.

2.5.1 Comparison of Alternatives

Table 2-18 Summary of effects of red snapper monitoring plan alternatives.

Alternatives	Biological Effects	Socioeconomic/Administrative Effects
Alternative 1 (Status Quo)	(-) Traditional fishery dependent data would not be collected for red snapper in the EEZ or other snapper grouper species within a proposed closed area.	(-) It would be more difficult to know when it is appropriate to re-open the red snapper fishery and/or remove or reduce a proposed closed area. This could lead to negative socioeconomic impacts in the long-term.
Alternative 2 (Preferred). Fishery independent sampling program	(+) A fishery independent monitoring program would track rebuilding progress of red snapper through the rebuilding period.	(+-) Would require increased funding and program planning, but may benefit fishery participants in the long-term when data shows harvest may be increased.
Alternative 3. Fishery dependent monitoring program	(+) A fishery dependent monitoring program would track rebuilding progress of red snapper through the rebuilding period. The disadvantage would be fishermen could target red snapper where they are most concentrated and therefore, trends in CPUE and mean length might not	(+-) Would require increased funding and program planning, but may benefit fishery participants in the long-term when data shows harvest may be increased.

	reflect true population trends.	

(-) overall negative impacts, (+) overall positive impacts, (- +) neutral impacts

Alternative 1 (Status Quo) would not establish a program to monitor rebuilding of red snapper. However, since some of the alternatives being considered would prohibit fishing for or retention of red snapper as well as area closures for snapper grouper species, traditional fishery-dependent data would be lacking and it would not be possible to track recovery of red snapper in SEDAR updates and future benchmark assessments. Further, existing fishery-independent data collection programs would not be sufficient to monitor red snapper due to limitations associated with the temporal and spatial range of sampling.

Alternative 2 (Preferred) would utilize fishery-independent sampling to collect data to monitor stock status of red snapper. It is possible that with additional funding, MARMAP or a new program could be established to accomplish the task.

For thirty years, the Marine Resources Research Institute at the South Carolina Department of Natural Resources (SCDNR), through the MARMAP program, has conducted fisheries-independent research on groundfish, reef fish, ichthyoplankton, and coastal pelagic fishes within the region between Cape Lookout, North Carolina, and Cape Canaveral, Florida. The overall mission of the program has been to determine distribution, relative abundance, and critical habitat of economically and ecologically important fishes of the South Atlantic Bight (SAB), and to relate these features to environmental factors and exploitation activities. Research toward fulfilling these goals has included trawl surveys (from 6-350 m depth); ichthyoplankton surveys; location and mapping of reef habitat; sampling of reefs throughout the SAB; life history and population studies of priority species; tagging studies of commercially important species and special studies directed at specific management problems in the region. Survey work has also provided a monitoring program that has allowed the standardized sampling of fish populations over time, and development of a historical database for future comparisons of long-term trends.

The chevron trap has been one of the primary gear types used by MARMAP to monitor reef fish abundance and collect specimens for life history studies. Since 1987, chevron traps baited with clupeids have been deployed at stations randomly selected by computer from a database of approximately 2,500 live bottom and shelf edge locations and buoyed for approximately 90 minutes. This database was compiled from MARMAP visual underwater television studies with additional locations added from catch records from MARMAP and other projects. During the 1990s, additional sites were obtained for the North Carolina and south Florida area from scientific and commercial fisheries sources to facilitate expanding the overall sampling coverage. Sample sites are all located in the central SAB from 27^0 N latitude to 34^0 N latitude. Trapping has occurred to depths as great as 218 m but the majority of trap sampling has occurred at 16 to 91 m. During all years, sampling was conducted during daylight to eliminate light phase as a variable. Conductivity, temperature, and depth profiles were taken after each trap set. Another primary gear type used by MARMAP since 1978 is hook and line. Hook and line stations were fished during dawn and dusk periods, one hour preceding and after actual sunrise and sunset.

Collection of Red Snapper Data

Under **Alternative 2 (Preferred)**, chevron traps would be used to collect information on red snapper. Few red snapper have been taken with chevron trap by the MARMAP program. However, use of chevron traps in the Gulf of Mexico indicates red snapper are readily available to this gear type. It may be that few red snapper have been taken with this gear in the South Atlantic because MARMAP began using the gear when biomass was already at very low levels. In addition, the zone of greatest abundance for red snapper is off north Florida in the South Atlantic, which represents the geographic extreme for sampling by the MARMAP program.

Therefore, under **Alternative 2 (Preferred)**, it would be necessary for an increase in sampling intensity off the north Florida and southern Georgia region beyond what MARMAP has done historically. In addition, reconnaissance work would be needed to identify additional live bottom locations where red snapper occur. This can be accomplished through underwater television studies as well as through cooperative efforts with fishermen and cooperative research programs.

Similar to MARMAP methodology, chevron traps could be baited with clupeids and soaked for 90 minutes at randomly selected stations to capture specimens for examination. Cameras would be attached to these traps to obtain a video record of what is not captured by the traps. In addition, at the same stations, non-destructive sampling would also be conducted with cameras mounted on traps, which are not baited, to obtain a video record of species composition and abundance.

At these same stations standardized hook and line gear could be used to collect information on red snapper. Following MARMAP design, this sampling could consist of rods utilizing Electromate motors powered 6/0 Penn Senator reels and 36 kg test monofilament line. Every effort would be made to minimize handling time and release red snapper and other snapper grouper species alive. Dead specimens could be retained for life history studies. Hard parts and reproductive tissue would be removed and stored for future life history studies. Additional samples could be obtained as needed to conduct stock assessments. Details on number of samples to be collected would be provided by the SEFSC. Additional details on design of a fishery-independent program will be provided at the Council's March 2010 meeting.
Alternative 3 would employ fishery-dependent data to monitor abundance of red snapper. The advantage in having fishermen collect information is they would have some knowledge about locations where red snapper can be found that might not be available to researchers. The disadvantage would be fishermen could target red snapper where they are most concentrated and therefore, trends in CPUE and mean length might not reflect true population trends. To eliminate this bias, sampling would need to be coordinated through the SEFSC.

Under **Alternative 3**, participating vessels may be authorized to harvest and land fish in excess of Federal possession limits and/or during fishery closures. Retention limits for red snapper would be based upon research objectives. The trip limits and number of trips per month will depend on the number of selected vessels, available quota, and objectives of the research fishery. The SEFSC will provide recommendations on the design of a fishery-dependent monitoring program at their March 2009 meeting.

Fishery dependent data from headboats represents the longest continuous time series for snapper grouper species. This time series has been an important index for many assessments including red snapper. Proposed alternatives for red snapper in Amendment 17A include areas where fishing for or retention of all snapper grouper species would be prohibited. To maintain this continuous database, limited headboat and charterboat trips could be permitted to enter closed areas and fish for snapper grouper species. Under **Alternative 3**, trips would be selected by the SEFSC and would include an observer who would obtain data on all red snapper caught. Additional information on snapper grouper species would be obtained where possible. Additional fishery dependent data could be obtained by means of grant-funded research through the Cooperative Research Program. Fishermen, working with researchers, could obtain funding from NOAA Fisheries Service to obtain information on red snapper for studies on life history, release mortality, mapping locations of high abundance, etc. An in-depth analysis of the impacts of red snapper monitoring program alternatives may be found in **Section 4.5** of this document.

3 Affected Environment

3.1 Habitat

3.1.1 Inshore/Estuarine Habitat

Many deepwater snapper grouper species utilize both pelagic and benthic habitats during several stages of their life histories; larval stages of these species live in the water column and feed on plankton. Most juveniles and adults are demersal and associate with hard structures on the continental shelf that have moderate to high relief (e.g., coral reef systems and artificial reef structures, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings). Juvenile stages of some snapper grouper species also utilize inshore seagrass beds, mangrove estuaries, lagoons, oyster reefs, and embayment systems. In many species, various combinations of these habitats may be utilized during diurnal feeding migrations or seasonal shifts in cross-shelf distributions. More detail on these habitat types is found in Sections 3.2.1 and 3.2.2 of the Council's Habitat Plan (SAFMC 1998e).

3.1.2 Offshore Habitat

Predominant snapper grouper offshore fishing areas are located in live-bottom and shelf-edge habitats, where water temperatures range from 11° to 27° C (52° to 81° F) due to the proximity of the Gulf Stream, with lower shelf habitat temperatures varying from 11° to 14° C (52° to 57° F). Water depths range from 16 to 27 meters (54 to 90 feet) or greater for live-bottom habitats, 55 to 110 meters (180 to 360 feet) for the shelf-edge habitat, and from 110 to 183 meters (360 to 600 feet) for lower-shelf habitat areas.

The exact extent and distribution of productive snapper grouper habitat on the continental shelf north of Cape Canaveral is unknown. Current data suggest from 3 to 30 percent of the shelf is suitable habitat for these species. These live-bottom habitats may include low relief areas, supporting sparse to moderate growth of sessile invertebrates, moderate relief reefs from 0.5 to 2

meters (1.6 to 6.6 feet), or high relief ridges at or near the shelf break consisting of outcrops of rock that are heavily encrusted with sessile invertebrates such as sponges and sea fan species. Live-bottom habitat is scattered irregularly over most of the shelf north of Cape Canaveral, Florida, but is most abundant offshore from northeastern Florida. South of Cape Canaveral, the continental shelf narrows from 56 to 16 kilometers (35 to 10 miles) wide, thence reducing off the southeast coast of Florida and the Florida Keys. The lack of a large shelf area, presence of extensive, rugged living fossil coral reefs, and dominance of a tropical Caribbean fauna are distinctive benthic characteristics of this area.

Rock outcroppings occur throughout the continental shelf from Cape Hatteras, North Carolina to Key West, Florida (MacIntyre and Milliman 1970; Miller and Richards 1979; Parker *et al*. 1983), which are principally composed of limestone and carbonate sandstone (Newton *et al*. 1971), and exhibit vertical relief ranging from less than 0.5 to over 10 meters (33 feet). Ledge systems formed by rock outcrops and piles of irregularly sized boulders are also common. Parker *et al*. (1983) estimated that 24% (9,443 km^2) of the area between the 27 and 101 meters (89 and 331 feet) isobaths from Cape Hatteras, NC to Cape Canaveral, FL is reef habitat. Although the benthic communities found in water depths between 100 and 300 meters (328 and 984 feet) from Cape Hatteras, NC to Key West, FL is relatively small compared to the whole shelf, this area, based upon landing information of fishers, constitutes prime reef fish habitat and probably significantly contributes to the total amount of reef habitat in this region.

Man-made artificial reef structures are also utilized to attract fish and increase fish harvests; however, research on man-made reefs is limited and opinions differ as to whether or not these structures promote an increase of ecological biomass or merely concentrate fishes by attracting them from nearby, natural unvegetated areas of little or no relief.

The distribution of coral and live hard-bottom habitat as presented in the SEAMAP Bottom Mapping Project is a proxy for the distribution of the species within the snapper grouper complex. The method used to determine hard bottom habitat relied on the identification of reef obligate species including members of the snapper grouper complex. The Florida Fish and Wildlife Research Institute (FWRI), using the best available information on the distribution of hard bottom habitat in the south Atlantic region, prepared ArcView maps for the four-state project. These maps, which consolidate known distribution of coral, hard/live bottom, and artificial reefs as hard bottom, are included in Appendix E of the Habitat Plan (SAFMC 1998e). These maps are also available on the Internet at the Council's following Internet Mapping System website: http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

The South Carolina Department of Natural Resources, NOAA/Biogeographic Characterization Branch, and the South Atlantic Fishery Management Council cooperatively generated additional information on managed species' use of offshore fish habitat. Plots of the spatial distribution of offshore species were generated from the MARMAP data (Figures 35-41) in the Habitat Plan (SAFMC 1998e). The plots should be considered as point confirmation of the presence of each species within the scope of the sampling program. These plots, in combination with the hard bottom habitat distributions presented in Appendix E of the Habitat Plan (SAFMC 1998e), can be employed as proxies for offshore snapper grouper complex distributions in the south Atlantic region. Maps of the distribution of snapper grouper species by gear type based on MARMAP

data can be generated through the Council's Internet Mapping System at the following web address: http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

3.1.3 Essential Fish Habitat

Essential fish habitat (EFH) is defined in the Magnuson-Stevens Act as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S. C. 1802(10)). Specific categories of EFH identified in the South Atlantic Bight, which are utilized by Federally managed fish and invertebrate species, include both estuarine/inshore and marine/offshore areas. Specifically, estuarine/inshore EFH includes: Estuarine emergent and mangrove wetlands, submerged aquatic vegetation, oyster reefs and shell banks, intertidal flats, palustrine emergent and forested systems, aquatic beds, and estuarine water column. Additionally, marine/offshore EFH includes: Live/hard bottom habitats, coral and coral reefs, artificial and manmade reefs, *Sargassum* species, and marine water column.

EFH utilized by snapper grouper species in this region includes coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings on and around the shelf break zone from shore to at least 183 meters [600 feet (but to at least 2,000 feet for wreckfish)] where the annual water temperature range is sufficiently warm to maintain adult populations of members of this largely tropical fish complex. EFH includes the spawning area in the water column above the adult habitat and the additional pelagic environment, including *Sargassum*, required for survival of larvae and growth up to and including settlement. In addition, the Gulf Stream is also EFH because it provides a mechanism to disperse snapper grouper larvae.

For specific life stages of estuarine dependent and near shore snapper grouper species, EFH includes areas inshore of the 30 meters (100-foot) contour, such as attached microalgae; submerged rooted vascular plants (seagrasses); estuarine emergent vegetated wetlands (saltmarshes, brackish marsh); tidal creeks; estuarine scrub/shrub (mangrove fringe); oyster reefs and shell banks; unconsolidated bottom (soft sediments); artificial reefs; and coral reefs and live/hard bottom habitats.

3.1.4 Habitat Areas of Particular Concern

Areas which meet the criteria for essential fish habitat-habitat areas of particular concern (EFH-HAPCs) for species in the snapper grouper management unit include medium to high profile offshore hard bottoms where spawning normally occurs; localities of known or likely periodic spawning aggregations; near shore hard bottom areas; The Point, The Ten Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump (South Carolina); mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets; all state-designated nursery habitats of particular importance to snapper grouper (e.g., Primary and Secondary Nursery Areas designated in North Carolina); pelagic and benthic *Sargassum*; Hoyt Hills for wreckfish; the *Oculina* Bank Habitat Area of Particular Concern; all hermatypic coral habitats and reefs; manganese outcroppings on the Blake Plateau; and Council-designated Artificial Reef Special Management Zones (SMZs). Areas that meet the criteria for designating essential fish habitat-habitat areas of particular

concern include habitats required during each life stage (including egg, larval, postlarval, juvenile, and adult stages).

In addition to protecting habitat from fishing related degradation though FMP regulations, the Council, in cooperation with NOAA Fisheries Service, actively comments on non-fishing projects or policies that may impact essential fish habitat. The Council adopted a habitat policy and procedure document that established a four-state Habitat Advisory Panel and adopted a comment and policy development process. With guidance from the Advisory Panel, the Council has developed and approved habitat policies on: Energy exploration, development, transportation and hydropower re-licensing; beach dredging and filling and large-scale coastal engineering; protection and enhancement of submerged aquatic vegetation; and alterations to riverine, estuarine and nearshore flows (Appendix C of Habitat Plan; SAFMC 1998e).

3.2 Biological/Ecological Environment

3.2.1 Species Most Impacted By This FMP Amendment

Amendment 17A includes alternatives for management measures that could prohibit fishing for or retention of all snapper grouper species in areas off of north Florida, Georgia, and South Carolina to end overfishing of red snapper by reducing the incidental catch of the species. Snapper grouper species commonly taken with red snapper could be affected by the action. In addition to red snapper, snapper-grouper species most likely to be affected by the proposed actions includes many species that occupy the same habitat at the same time. Therefore, snapper grouper species are likely to be caught when regulated since they will be incidentally caught when fishermen target other co-occurring species. Furthermore, proposed actions in Amendment 17A include provisions, which would allow fishing with spearfish gear, black sea bass pots, and bottom longline. Therefore, in addition to species that co-occur with red snapper, species such as golden tilefish and snowy grouper that commonly occur in deeper water could be affected by the proposed actions. Section 3.2.1 provides descriptions of red snapper and the seven species that most commonly occur with red snapper, as well as golden tilefish and snowy grouper.

3.2.1.1 Gag, *Mycteroperca microlepis*

Gag occur in the Western Atlantic from North Carolina to the Yucatan Peninsula, and throughout the Gulf of Mexico. Juveniles are sometimes observed as far north as Massachusetts (Heemstra and Randall 1993). Gag commonly occur at depths of 39-152 m (131-498 feet) (Heemstra and Randall 1993) and prefer inshore-reef and shelf-break habitats (Hood and Schlieder 1992). Bullock and Smith (1991) indicated gag probably do not move seasonally between reefs in the Gulf of Mexico, but show a gradual shift toward deeper water with age. McGovern *et al.* (2005) reported extensive movement of gag along the Southeast United States. In a tagging study, 23% of the 435 recaptured gag moved distances greater that 185 km (100 nautical miles). Most of these individuals were tagged off South Carolina and were recaptured off Georgia, Florida, and in the Gulf of Mexico.

Gag are probably estuarine dependent (Keener *et al.* 1988; Ross and Moser 1995; Koenig and Coleman 1998; Strelcheck *et al.* 2003). Juveniles (age 0) occur in shallow grass beds along Florida's east coast during the late spring and summer (Bullock and Smith 1991). Sea grass is

also an important nursery habitat for juvenile gag in North Carolina (Ross and Moser 1995). Post-larval gag enter South Carolina estuaries when they are 13 mm (0.5 inches) Total Length (TL) and 40 days old during April and May each year (Keener *et al.* 1988), and utilize oyster shell rubble as nursery habitat. Juveniles remain in estuarine waters throughout the summer and move offshore as water temperatures cool during September and October. Adults are often seen in shallow water 5-15 m (16-49 feet) above the reef (Bullock and Smith 1991) and as far as 40-70 km (22-38 nautical miles) offshore.

Huntsman *et al.* (1999) indicated gag are vulnerable to overfishing since they are long-lived, late to mature, change sex, and aggregate to spawn. The estimated natural mortality rate is 0.14 (SEDAR 10 2007). Maximum reported size for gag is 145 cm (57.5 inches) TL and 36.5 kg (81 pounds) (Heemstra and Randall 1993), and maximum reported age is 26 years (Harris and Collins 2000). Gag is a sequential hermaphrodites, changing sex from female to male with increased size and age (Coleman *et al.* 1996; McGovern *et al.* 1998; Coleman *et al.* 2000). All individuals less than 87.5 cm (34.7 inches) TL are females. At 105.0 cm (41.6 inches) TL, 50% of fishes are males. Almost all gag are males at sizes greater than 120.0 cm (47.5 inches) TL (McGovern *et al.* 1998).

Along the southeastern United States (1994-1995), size at first maturity is 50.8 cm (20.2 inches) TL, and 50% of gag females are sexually mature at 62.2 cm (24.7 inches) (McGovern *et al.* 1998). According to Harris and Collins (2000), age-at-first-maturity is 2 years, and 50% of gag are mature at 3 years. For data collected during 1978-1982 off the southeastern United States, McGovern *et al.* (1998) reported the smallest mature females were 58.0 cm (22.9 inches) TL and 3 years old. Hood and Schlieder (1992) indicated most females reach sexual maturity at ages 5-7 in the Gulf of Mexico. Off the southeastern United States, gag spawn from December through May, with a peak in March and April (McGovern *et al.* 1998). Duration of planktonic larvae is about 42 days (Keener *et al.* 1988; Koenig and Coleman 1998; Lindeman *et al.* 2000). McGovern *et al.* (1998) reported the percentage of male gag landed by commercial fishermen decreased from 20% during 1979-1981 to 6% during 1995-1996. This coincided with a decrease in the mean length of fish landed. A similar decrease in the percentage of males was reported in the Gulf of Mexico (Hood and Schleider 1992; Coleman *et al.* 1996).

Adults are sometimes solitary, and can occur in groups of 5 to 50 individuals. They feed primarily on fishes, crabs, shrimp, and cephalopods (Heemstra and Randall 1993), and often forage in small groups far from the reef ledge (Bullock and Smith 1991). Juveniles feed primarily on crustaceans, and begin to consume fishes when they reach about 25 mm (1 inch) in length (Bullock and Smith 1991; Mullaney 1994).

3.2.1.2 Scamp, *Mycteroperca phenax*

Scamp occur in the Western Atlantic, from North Carolina to Key West, in the Gulf of Mexico, and in the southern portion of the Caribbean Sea. Juveniles are sometimes encountered as far north as Massachusetts (Heemstra and Randall 1993). Its reported depth range is 30-100 m (98-328 ft) (Heemstra and Randall 1993). Juveniles are found in estuarine and shallow coastal waters (Bullock and Smith 1991; Heemstra and Randall 1993).

Scamp are protogynous, with females dominating sizes less than 70.0 cm (27.8 in) (Harris *et al.* 2002). Scamp live for at least 30 years (Harris *et al.* 2002), and attain sizes as great as 107.0 cm (42.4 in) TL and 14.2 kg (31.3 lbs) (Heemstra and Randall 1993). Natural mortality rate is estimated to be 0.15 (Potts and Brennan 2001). Harris *et al.* (2002) report that the length and age at first spawning of females off North Carolina to southeast Florida was 30.0-35.0 cm (11.9-13.8 in) TL and age 1. Length and age at 50% maturity was 35.3 cm (13.9 in) TL and 1.28 years, respectively (Harris *et al.* 2002). In a study conducted in the eastern Gulf of Mexico, all fish larger than 35.0 cm TL were sexually mature (M. Godcharles and L. Bullock, unpublished data).

Spawning occurs from February through July in the South Atlantic Bight and in the Gulf of Mexico, with a peak in March to mid-May (Harris *et al.* 2002). Hydration of eggs occurs primarily during the morning and late afternoon, which indicates that scamp spawn during late afternoon and evening. Spawning individuals have been captured off South Carolina and St. Augustine, Florida at depths of 33 to 93 m. Scamp aggregate to spawn. Spawning locations and time of spawning overlaps with gag (Gilmore and Jones 1992). Fish are the primary prey of this species (Matheson *et al.* 1986).

3.2.1.3 Red grouper, *Epinephelus morio*

Red grouper is primarily a continental species, mostly found in broad shelf areas (Jory and Iversen 1989). Red grouper occur in the Western Atlantic, from North Carolina to southeastern Brazil, including the eastern Gulf of Mexico and Bermuda, but can occasionally be found as far north as Massachusetts (Heemstra and Randall 1993). Red grouper is uncommon around coral reefs; it generally occurs over flat rock perforated with solution holes (Bullock and Smith 1991), and is commonly found in the caverns and crevices of limestone reef in the Gulf of Mexico (Moe 1969). It also occurs over rocky reef bottoms (Moe 1969).

Adult red grouper are sedentary fish that are usually found at depths of 5-300 m (16-984 feet). Fishermen off North Carolina commonly catch red grouper at depths of 27-76 m (88-249 feet) for an average of 34 m (111 feet). Fishermen off southeastern Florida also catch red grouper in depths ranging from 27-76 m (88-249 feet) with an average depth of 45 m (148 ft) (Burgos 2001; McGovern *et al.* 2002). Moe (1969) reported that juveniles live in shallow water nearshore reefs until they are 40.0 cm (16 inches) and 5 years of age, when they become sexually mature and move offshore. Spawning occurs during February-June, with a peak in April (Burgos 2001). In the eastern Gulf of Mexico, ripe females are found December through June, with a peak during April and May (Moe 1969). Based on the presence of ripe adults (Moe 1996) and larval red grouper (Johnson and Keener 1984) spawning probably occurs offshore. Coleman *et al*. (1996) found groups of spawning red grouper at depths between 21-110 m (70-360 feet). Red grouper do not appear to form spawning aggregations or spawn at specific sites (Coleman *et al.* 1996). They are reported to spawn in depths of 30-90 m (98-295 feet) off the Southeast Atlantic coast (Burgos 2001; McGovern *et al.* 2002).

Red grouper are protogynous, changing sex from female to male with increased size and age. Off North Carolina, red grouper first become males at 50.9 cm (20.1 inches) TL and males dominate size classes greater than 70.0 cm (27.8 inches) TL. Most females transform to males

between ages 7 and 14. Burgos (2001) reported that 50% of the females caught off North Carolina are undergoing sexual transition at age 8. Maximum age reported by Heemstra and Randall (1993) was 25 years. Burgos (2001) and McGovern *et al.* (2002) indicated red grouper live for at least 20 years in the Southeast Atlantic and a maximum age of 26 years has been reported for red grouper in the Gulf of Mexico (L. Lombardi, NMFS Panama City, personal communication). Natural mortality rate is estimated to be 0.20 (Potts and Brennan 2001). Maximum reported size is 125.0 cm (49.2 inches) TL (male) and 23.0 kg (51.1 pounds). For fish collected off North Carolina during the late 1990s, age at 50% maturity of females is 2.4 years and size at 50% maturity is 48.7 cm (19.3 inches) TL. Off southeastern Florida, age at 50% maturity was 2.1 years and size at 50% maturity was 52.9 cm (21.0 inches) TL (Burgos 2001; McGovern *et al.* 2002). These fish eat a wide variety of fishes, octopi, and crustaceans, including shrimp, lobsters, and stomatopods (Bullock and Smith 1991, Heemstra and Randall 1993).

3.2.1.4 Vermilion Snapper, *Rhomboplites aurorubens*

Vermilion snapper occur in the Western Atlantic, from North Carolina to Rio de Janeiro. It is most abundant off the southeastern United States and in the Gulf of Campeche (Hood and Johnson 1999). The vermilion snapper is demersal, commonly found over rock, ledges, live-bottom, gravel, or sand bottoms near the edge of the continental and island shelves (Froese and Pauly 2003). It occurs at depths from 18 to 122 m (59 to 400 ft), but is most abundant at depths less than 76 m (250 feet). Individuals often form large schools. This fish is not believed to exhibit extensive long range or local movement (SEDAR SAR 2 2003).

The maximum size of a male vermilion snapper, reported by Allen (1985), was 60.0 cm (23.8 inches) TL and 3.2 kg (7.1 pounds). Maximum reported age in the South Atlantic Bight was 14 years (Zhao *et al.* 1997; Potts *et al.* 1998). SEDAR 2-SAR2 (2003) recommends that natural mortality (M) be defined as 0.25/year, with a range of 0.2-0.3/year.

This species spawns in aggregations (Lindeman *et al.* 2000) from April through late September in the southeastern United States (Cuellar *et al.* 1996). Zhao *et al.* (1997) indicated that most spawning in the South Atlantic Bight occurs from June through August. Eggs and larvae are pelagic.

Vermilion snapper are gonochorists meaning that all vermilion snapper are mature at 2 years of age and 20.0 cm (7.9 inches) (SEDAR SAR2 2003). Cuellar *et al.* (1996) collected vermilion snapper off the southeastern United States and found that all were mature. The smallest female was 16.5 cm (6.5 inches) FL and the smallest male was 17.9 cm (7.1 inches) FL (Cuellar *et al.* 1996). Zhao and McGovern (1997) reported that 100% of males that were collected after 1982 along the southeastern United States were mature at 14.0 cm (5.6 inches) TL and age 1. All females collected after 1988 were mature at 18.0 cm (7.1 inches) TL and age 1.

This species preys on fishes, shrimp, crabs, polychaetes, and other benthic invertebrates, as well as cephalopods and planktonic organisms (Allen 1985). Sedberry and Cuellar (1993) reported that small crustaceans (especially copepods), sergestid decapods, barnacle larvae, stomatopods,

and decapods dominated the diets of small (< 50 mm (2 inches) SL) vermilion snapper off the Southeastern United States. Larger decapods, fishes, and cephalopods are more important in the diet of larger vermilion snapper.

3.2.1.5Snowy Grouper, *Epinephelus niveatus*

Snowy grouper occur in the Eastern Pacific and the Western Atlantic from Massachusetts to southeastern Brazil, including the northern Gulf of Mexico (Robins and Ray 1986). It is found at depths of 30-525 m (98-1,722 feet). Adults occur offshore over rocky bottom habitat. Juveniles are often observed inshore and occasionally in estuaries (Heemstra and Randall 1993).

The snowy grouper is a protogynous species. The smallest, youngest male examined by Wyanski *et al.* (2000) was 72.7 cm (28.8 inches) TL and age 8. The median size and age of snowy grouper was 91.9 cm (34.5 in) and age 16. The largest specimen observed was 122 cm (48 inches) TL and 30 kg (66 lbs), and 27 years old (Heemstra and Randall 1993). The maximum age reported by Wyanski *et al.* (2000) was 29 years for fish collected off of North Carolina and South Carolina. Radiocarbon techniques indicate that snow grouper may live for as long as 40 years (Harris, South Carolina Department of Natural Resources, personal communication). Wyanski *et al.* (2000) reported that 50% of the females are mature at 54.1 cm (21.3 inches) TL and 5 years of age. The smallest mature female was 46.9 cm (18.5 inches) TL, and the largest immature female was 57.5 cm (22.6 inches) TL.

Females in spawning condition have been captured off western Florida during May, June, and August (Bullock and Smith 1991). In the Florida Keys, ripe individuals have been observed from April to July (Moore and Labinsky 1984). Spawning seasons reported by other researchers are as follows: South Atlantic (north of Cape Canaveral), April through September (Wyanski *et al.* 2000) and April through July (Parker and Mays 1998); and South Atlantic (south of Cape Canaveral), May through July (Manooch 1984). Wyanski *et al.* (2000) reported that snowy grouper spawn at depths from 176 to 232 m (577 to 761 feet) off South Carolina. Adults feed on fishes, gastropods, cephalopods, and crustaceans (Heemstra and Randall 1993).

3.2.1.6 Golden Tilefish, *Lopholatilus chamaeleonticeps*

Golden tilefish are distributed throughout the Western Atlantic, occurring as far north as Nova Scotia, to southern Florida, and in the eastern Gulf of Mexico (Robins and Ray 1986) (Table 3-1). According to Dooley (1978), golden tilefish occurs at depths of 80-540 m (263-1,772 feet). Robins and Ray (1986) report a depth range of 82-275 m (270-900 feet) for golden tilefish. It is most commonly found at about 200 m (656 feet), usually over mud or sand bottom but, occasionally, over rough bottom (Dooley 1978).

Maximum reported size is 125 cm (50 inches) total length and 30 kilograms (66 pounds) (Dooley 1978; Robins and Ray 1986). Maximum reported age is 40 years (Harris *et al.* 2001). Radiocarbon aging indicate golden tilefish may live for at least 50 years (Harris, South Carolina Department of Natural Resources, personal communication). A recent SEDAR assessment

estimate natural mortality (M) at 0.08 (SEDAR 4 2004). Golden tilefish spawn off the southeast coast of the U.S. from March through late July, with a peak in April (Table 3-1; Harris *et al*. 2001). Grimes *et al.* (1988) indicate peak spawning occurs from May through September in waters north of Cape Canaveral. Golden tilefish primarily prey upon shrimp and crabs, but also eat fishes, squid, bivalves, and holothurians (Dooley 1978).

3.2.1.7 Greater amberjack, *Seriola dumerili*

The greater amberjack is a pelagic and epibenthic member of the family Carangidae (Manooch and Potts 1997a). This species occurs in the Indo-West Pacific, and in the Western and Eastern Atlantic Oceans. In the Western Atlantic, it occurs as far north as Nova Scotia, Canada, southward to Brazil, including the Gulf of Mexico (Paxton *et al.* 1989, in Froese and Pauly 2003; Manooch and Potts 1997a; Manooch and Potts 1997b). The greater amberjack is found at depths of 18-360 m (60-1,181 feet). It inhabits deep reefs, rocky outcrops or wrecks and, occasionally, coastal bays. Juveniles and adults occur singly or in schools in association with floating plants or debris in oceanic and offshore waters.

This species is the largest jack (Robins and Ray 1986). Maximum reported size is 190 cm (75 inches) and 80.6 kg (178 pounds) (Paxton *et al.* 1989). Size at maturity and age at first maturity is estimated as 79 cm (31 inches) TL and 2.3 years, respectively. Maximum reported age is 17 years (Manooch and Potts 1997a). The natural mortality rate is estimated to be 0.25 (Legault and Turner 1999).

Greater amberjack are gonochorists (separate sexes). Based on the occurrence of migratory nucleus oocytes and postovulatory follicles, spawning occurs from January through June, with peak spawning in April and May. Although fish in spawning condition were captured from North Carolina through the Florida Keys, spawning appears to occur primarily off south Florida and the Florida Keys (MARMAP unpublished data). Greater amberjack in spawning condition were sampled from a range of depths, although the bulk of samples were from the shelf break. Tagging data indicated that greater amberjack are capable of extensive movement that might be related to spawning activity. Greater amberjack tagged off South Carolina have been recaptured off Georgia, east Florida, Florida Keys, west Florida, Cancun Mexico, Cuba, and the Bahamas (MARMAP, unpublished data). Primary food items include fishes, such as bigeye scad, and invertebrates (Paxton *et al.* 1989).

3.2.1.8 Gray triggerfish, *Balistes capriscus*

Gray triggerfish are found in the Eastern Atlantic from the Mediterranean to Moçamedes, Angola and in the Western Atlantic from Nova Scotia to Bermuda, the northern Gulf of Mexico, and to Argentina. The gray triggerfish is associated with live bottom and rocky outcrops from nearshore areas to depths of 100 m (328 feet). It also inhabits bays, harbors, and lagoons, and juveniles drift at the surface with *Sargassum*.

Maximum reported size is 60 cm (23.76 inches) TL (male/unsexed) and 6.2 kg (14 pounds; Froese and Pauly 2003). Males are significantly larger than females (Moore 2001). The maximum age of gray triggerfish collected from North Carolina to eastern Florida was 10 years (Moore 2001). The maximum age of gray triggerfish collected from the Northeastern Gulf of Mexico was 13 years (Johnson and Saloman 1984). Potts and Brennan (2001) estimated the natural mortality of gray triggerfish to be 0.30.

Gray triggerfish are gonochorists that exhibit nest-building and territorial reproductive behavior. Mature females from fishery-independent samples are found in 0% of age-0, 98 % of age-1 and age-2 fish, and 100% of fish older than age-3. Mature males from fishery-independent samples are present in 63% of age-1, 91% of age-2, 98% of age-3, 99% of age-4 and age-5, and 100% of older age fish. Females reach first maturity at 14.2 cm (5.6 in) FL, with an L_{50} of 15.8 cm (6.3 in) FL. Males first mature at 17.0 cm (6.7 in) FL, with a L_{50} of 18.0 cm (7.1 in) FL (Moore 2001).

Along the southeast United States, Moore (2001) determined that gray triggerfish spawn every 37 days, or 3-4 times per season. In contrast, Ingram (2001) estimated that gray triggerfish spawn every 3.7 days in the Gulf of Mexico. Off the southeast United States, female gray triggerfish are in spawning condition from April-August, with a peak of activity during June-July. Male gray triggerfish are found in spawning condition throughout the year; however, there was a peak in activity during May-September (Moore 2001).

3.2.1.9 Red Snapper, *Lutjanus campechanus*

The red snapper is found from North Carolina to the Florida Keys, and throughout the Gulf of Mexico to the Yucatan (Robins and Ray 1986). It can be found at depths from 10 to 190 m (33-623 feet). Adults usually occur over rocky bottoms. Juveniles inhabit shallow waters and are common over sandy or muddy bottom habitat (Allen 1985).

The maximum size reported for this species is 100 cm (40 inches) TL (Allen 1985, Robins and Ray 1986) and 22.8 kg (50 lbs) (Allen 1985). Maximum reported age in the Gulf of Mexico is reported as 53 years by Goodyear (1995) and 57 years by Allman *et al.* (2002). For samples collected from North Carolina to eastern Florida, maximum reported age is 45 years (White and Palmer 2004). McInerny (2007) reports a maximum age of 54 years for red snapper in the South Atlantic. Natural mortality (M) is estimated to be 0.078 using the Hoenig (1983) method with a maximum age of 53 years (SEDAR 15 2008). Manooch *et al.* (1998) estimated M at 0.25 but the maximum age in their study was 25 years (Manooch and Potts 1997).

Red snapper are gonochorists. In the U.S. South Atlantic Bight and in the Gulf of Mexico, Grimes (1987) reported that size at first maturity is 23.7 cm (9.3 inches) fork length. For red snapper collected along the Southeastern United States, White and Palmer (2004) found that the smallest mature male was 20.0 cm (7.9 inches) TL, and the largest immature male was 37.8 cm (15 in) TL. 50% of males are mature at 22.3 cm (8.8 in) TL, while 50% of females are mature at 37.8 cm (15 in) TL. Males are present in 86% of age 1, 91% of age 2, 100% of age 3, 98% of age 4, and 100% of older age fish. Mature females are present in 0% of age 1, 53% of age 2,

92% of age 3, 96% of age 4, and 100% of older age individuals. Grimes (1987) found that the spawning season of this species varies with location, but in most cases occurs nearly year round. White and Palmer (2004) reported that the spawning season for female red snapper off the southeastern United States extends from May to October, peaking in July through September. Red snapper eat fishes, shrimps, crabs, worms, cephalopods, and some planktonic items (Szedlemayr and Lee 2004).

3.3 Science Underlying the Management of Snapper Grouper Species Most Impacted By This FMP Amendment

The status of gag, vermilion snapper, black sea bass, golden tilefish, snowy grouper, greater amberjack, red snapper has been recently assessed through the Southeast Data, Assessment, and Review (SEDAR) process. Black grouper and red grouper are currently being assessed in SEDAR 19, which will be completed in 2010.

The SEDAR process consists of a series of workshops aimed at ensuring that each assessment is based on the best available scientific information. First, representatives from NOAA Fisheries Service, state agencies, and the South Atlantic Council, as well as experts from non-governmental organizations and academia, participate in a data workshop. The purpose of a data workshop is to assemble and review available fishery-dependent and fishery-independent data and information on a stock, and to develop consensus about what constitutes the best available scientific information on the stock, how that information should be used in an assessment, and what type of stock assessment model should be employed.

Second, assessment biologists from these agencies and organizations participate in a stock assessment workshop, where data from the data workshop are input into one or more stock assessment models (e.g., production, age-structured, length structured, etc.) to generate estimates of stock status and fishery status. Generally, base runs and a number of additional runs to examine sensitivity of results to various assumptions (e.g., different natural mortality rates, different data sets/catch periods, etc.).

Finally, a stock assessment review workshop is convened to provide representatives from the Center for Independent Experts the opportunity to peer review the results of the stock assessment workshop. Representatives from NOAA Fisheries Service, the South Atlantic Council, and constituent groups may attend and observe the review but the actual review is conducted by the Center for Independent Experts. The Council's Scientific and Statistical Committee (SSC) then reviews the report of the stock assessment review workshop.

The review portion of the SEDAR process has helped improve the acceptance of stock assessments. However, continued lack of basic fishery data has resulted in uncertainty in the assessment results. Each SEDAR Review Panel has identified significant shortcomings in data and research (see **Appendix Q** for a detailed list of research and data needs). In addition, not all of the reviews have been completed with 100% consensus.

3.3.1 Gag assessment and stock status

SEDAR assessment

The stock of gag off the United States South Atlantic was assessed during a SEDAR assessment workshop, held at the Wyndham Grand Bay Hotel, Miami, Florida, on May 1–5, 2006. The workshop's objectives were to complete the SEDAR 10 benchmark assessment of gag and to conduct stock projections. Participants in the benchmark assessment included state, Federal, and university scientists, as well as Council members and staff, and various observers. All decisions regarding stock assessment methods and acceptable data were made by consensus (SEDAR 10 2007).

Available data on the stock included abundance indices, recorded landings, and samples of annual size compositions and age compositions from fishery-dependent sources. Three fishery–dependent abundance indices were developed by the data workshop: one from the NOAA Fisheries Service headboat survey, one from the commercial logbook program, and one from the MRFSS survey. There were no usable fishery–independent abundance data for this stock of gag. Landings data were available from all recreational and commercial fisheries. The assessment included data through 2004.

A forward projecting statistical model of catch at age was used as the primary assessment model. In addition, an age-aggregated production model was used to investigate results under a different set of model assumptions. The assessment workshop developed two base runs: one assuming a time-varying catchability and one assuming constant catchability for the fishery dependent indices. Each base run of the catch-at-age model was used for estimation of benchmarks and stock status.

Stock projections were evaluated under five scenarios starting in 2008. Each scenario applied the current fishing mortality rate (F) in years 2005–2007. Starting in 2008, the five projection scenarios included: 1) Current F; 2) F_{MSY}; 3) 85% of F_{MSY}; 4) 75% of F_{MSY}; and 5) 65% of F_{MSY}.

Status

The gag stock in the Atlantic is undergoing **overfishing** as of 2004 (last year of data in the stock assessment). This means fish are being removed more quickly than the stock can replace them such that the maximum sustainable yield (MSY) cannot be achieved. The Council compares the current fishing mortality rate (F) to the level of fishing mortality that would result in overfishing (maximum fishing mortality threshold or MFMT) and if the current F is greater than the MFMT, overfishing is occurring. For gag the most recent estimate of the fishing mortality rate (F) is from 2004 and is = 0.310. The Council is using the fishing mortality rate that would produce the maximum sustainable yield (F_{MSY} = 0.237) as the maximum fishing mortality threshold. Comparing these two numbers:

- F_{2004}/MFMT = 0.310/0.237 = 1.309

This comparison is referred to as the overfishing ratio. If the ratio is greater than 1, then overfishing is occurring.

The gag stock in the Atlantic was not overfished as of the start of 2005. This means that the spawning stock biomass (pounds of spawning fish in the water) has not been reduced below the

level that could produce the maximum sustainable yield. The Council compares the current spawning stock biomass (SSB) to the level of spawning stock biomass that could be rebuilt to the level to produce the MSY in 10 years. This is referred to as the minimum spawning stock biomass or MSST. For gag, the estimated level of spawning stock biomass in 2005 was 7,470,000 pounds gutted weight (gw). The Minimum stock size threshold (MSST) = 6,816,000 pounds gw. Comparing these two numbers:

- SSB_{2005}/MSST = 7,470,000/6,816,000 = 1.096

This comparison is referred to as the overfished ratio. If the ratio is less than 1, then the stock is overfished. The Council took measures to end overfishing in Amendment 16, which was implemented in July 2009.

3.3.2 Vermilion Snapper assessment and stock status

SEDAR assessment

A SEDAR stock assessment workshop was convened at the NOAA Center for Coastal Fisheries and Habitat Research Beaufort, North Carolina, on Monday, April 4, 2007. The workshop's objectives were to conduct an update assessment of the vermilion snapper off the southeastern U.S. and to conduct stock projections based on possible management scenarios. Participants in the update assessment included state and federal scientists, Council AP and SSC members, and various observers. All decisions regarding stock assessment methods and acceptable data were made by consensus (SEDAR Assessment Update #3 2007).

Available data on the species included all those utilized for the benchmark assessment conducted in 2002; no additional data sources were identified during the scoping workshop. These data were abundance indices, recorded landings, and samples of annual size compositions from indices and landings. Four abundance indices were used in the benchmark assessment: one from the NMFS headboat survey and three from the SC MARMAP fishery-independent monitoring program. Landings data were available from all recreational and commercial fisheries. While the MARMAP chevron trap index decreased in recent years, the remaining abundance indices showed neither marked increase nor decline during the assessment period (1976–2006).

The statistical model of catch at length as developed for the benchmark assessment was used as the only assessment model. The assessment workshop provided the base run of the model, identical to that used in the benchmark assessment. This base run was used for the estimation of benchmarks and stock status. The benchmark assessment concluded that the high degree of uncertainty in recruitment and spawning stock biomass estimates meant that reliable biomass based benchmarks could not be developed from the assessment, and this was found to be the case for the update assessment as well.

The ratio of fishing mortality in 2006 to F_{MAX} was 2.05, compared to 1.71 in the benchmark assessment, suggesting that overfishing continues. Projections were used to evaluate the potential of the stock to be rebuilt, but could only be conducted for constant F scenarios. Four projections were considered: $F=F_{MAX}$; $F=85\%F_{MAX}$; $F=75\%F_{MAX}$; and $F=65\%F_{MAX}$. The results of each were very similar.

Recognizing the need for a new benchmark assessment, NOAA Fisheries Service and the state of South Carolina began sampling available vermilion snapper otoliths to enable an age-based assessment. Further, the SEDAR steering committee replaced white grunt in the SEDAR schedule with vermilion snapper. A new age based assessment for vermilion snapper was completed in 2008 (SEDAR 17 2008). Three different model structures were applied: a statistical catch-at-age model; stock reduction analysis; and a surplus production model. In addition, catch curve analysis was used to examine mortality. The primary model was a statistical catch-at-age model implemented with the AD Model Builder software.

Stock Status

The vermilion snapper stock in the Atlantic is undergoing overfishing as of 2006 (last year of data in the stock assessment update). This means fish are being removed more quickly than the stock can replace them such that the maximum sustainable yield (MSY) cannot be achieved. The Council compares the current fishing mortality rate (F) to the level of fishing mortality that would result in overfishing (maximum fishing mortality threshold or MFMT) and if the current F is greater than the MFMT, overfishing is occurring. For vermilion snapper the most recent estimate of the fishing mortality rate is from 2006 and was = 0.729. The Council is using the fishing mortality rate that produces the greatest yield per fish (F_{MAX} = 0.355) as the maximum fishing mortality threshold. F_{MAX} is being used as a proxy for F_{MSY} (F_{MSY} = Fishing mortality rate that would produce maximum sustainable yield) because the SSC did not have confidence in the calculated biomass reference points. The SSC does have confidence in the fishing mortality rate estimates from the SEDAR assessment. Comparing these two numbers:

- F_{2006}/MFMT = 0.729/0.355 = 2.05

This comparison is referred to as the overfishing ratio. If the ratio is greater than 1, then overfishing is occurring.

Whether the vermilion snapper stock in the Atlantic is currently overfished is unknown because the SSC does not have confidence in the biomass reference points from the SEDAR assessment. Recognizing the need for a new benchmark assessment, NMFS and the state of South Carolina began sampling available vermilion snapper otoliths to enable an age-based assessment. Further, the SEDAR steering committee replaced white grunt in the SEDAR schedule with vermilion snapper. Results from an age-based assessment for vermilion snapper will be reviewed by the Council's Scientific and Statistical Committee (SSC) during their November 30 – December 2, 2008 meeting.

SEDAR 17 (2008) confirmed that the stock is experiencing overfishing but indicated the stock is not overfished. The base run of the catch-at-age model estimated the current stock status to be: SSB_{2007}/SSB_{MSY} = 0.86 and SSB_{2007}/MSST = 1.10, both indicating the stock is not overfished. It estimated the current fishery status in 2007 to be: F_{2007}/F_{MSY} = 1.27, indicating the stock was subject to overfishing in 2007.

3.3.3 Black sea bass assessment and stock status

SEDAR assessment

Black sea bass was assessed at the second SEDAR (SEDAR 2 2003b). Data for the SEDAR assessment were assembled and reviewed at a data workshop held during the week of October 7, 2002 in Charleston, South Carolina. The assessment utilized commercial and recreational landings, as well as abundance indices and life history information from fishery-independent and fishery-dependent sources. Six abundance indices were developed by the data workshop. Two CPUE indices were used from the NMFS headboat survey (1978-2001) and the MRFSS recreational survey (1992-1998). Four indices were derived from CPUE observed by the South Carolina MARMAP fishery-independent monitoring program ("Florida" trap index, 1981-1987; blackfish trap index, 1981-1987; hook and line index, 1981-1987; and chevron trap index, 1990-2001) (SEDAR 2 2003b).

Age-structured and age-aggregated production models were applied to available data at the assessment workshop. The age-structured model was considered the primary model, as recommended by participants in the data workshop. The stock assessment indicated black sea bass was overfished and overfishing was occurring.

At the request of the South Atlantic Council, the SEDAR panel convened to update the 2003 black sea bass stock assessment, using data through 2003, and to conduct stock projections based on possible management scenarios (SEDAR Update #1 2005). The update indicated the stock was still overfished and overfishing was still occurring but results showed the stock was much more productive that previously indicated. The stock could be rebuilt to the biomass level capable of producing the maximum sustainable yield in 5 years if all fishing mortality were eliminated; previously this was estimated to take 11 years (SEDAR 2 2003b).

<u>Stock Status</u>
The black sea bass stock in the Atlantic is undergoing overfishing and is overfished as of 2004 (last year of data in the stock assessment update). For black sea bass the most recent estimate of the fishing mortality rate is from 2003 and was = 2.64 and F_{MSY} = 0.429 as the maximum fishing mortality threshold. Comparing these two numbers:

- F_{2003}/MFMT = 0.729/0.355 = 6.15

This comparison is referred to as the overfishing ratio. If the ratio is greater than 1, then overfishing is occurring.

The black sea bass stock in the Atlantic is overfished. For black sea bass, the estimated level of spawning stock biomass in 2005 was 4,099,884 pounds whole weight. The Minimum stock size threshold (MSST) = 10,511,633 pounds whole weight. Comparing these two numbers:

- SSB_{2005}/MSST = 4,099,884/10,511,633 = 0.39

If the ratio is less than 1, then the stock is overfished. An update assessment is scheduled for 2010.

3.3.4 Red snapper assessment and stock status

Assessments conducted in 1988 and 1990, indicated red snapper was experiencing overfishing (NMFS 1991; Huntsman *et al.* 1992). In 1990, scientists recommended size limits for red snapper to achieve reductions necessary to end overfishing. In response, the Council developed

Amendment 4 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. In January 1992, new regulations for red snapper established a 20" TL minimum size limit and an aggregate bag limit of 10 snapper (excluding vermilion snapper) with no more than 2 red snapper included in the aggregate bag limit. These regulations were determined to be sufficient to end overfishing based on the science available at the time.

In 1997, a new red snapper stock assessment was conducted by the NOAA Fisheries Service using landings data from 1986 to 1996. The assessment estimated red snapper reached a maximum age of 25 and noted that few fish over the age of 12 were landed. The assessment concluded that the red snapper stock was in a "transitional" condition. "The status of the stock is less than desirable, but does appear to be responding for the better to something, possibly management, in the most recent years." The Council did not implement any changes to red snapper management at the time based on the assessment conclusions.

The 2008 SEDAR 15 stock assessment concluded red snapper is overfished and undergoing overfishing. The assessment estimated that red snapper reach a maximum age of 54 years, not 25 years as previously estimated. The Council's SSC approved the assessment and indicated it was based on the best available scientific information.

A statistical catch-at-age model (SCA) and a surplus-projection model (ASPIC) were considered in this assessment. Data used assessment consist of records of commercial catch for the handline (hook-and-line) and dive fisheries, logbook data from the recreational headboat fishery, and MRFSS survey data of the rest of the recreational sector. The bulk of landings of red snapper come from the recreational fishery, which have exceeded the landings of the commercial fishery by 2-3 fold over the assessment period. Total landings were variable, with a downward trend through the 1990s.

The Council is considering two proxies for F_{MSY} in Amendment 17A, $F_{30\%SPR}$ and $F_{40\%SPR}$. The ratio of F to the respective proxies for F_{MSY} suggests a generally increasing trend in fishing mortality from the 1950s through the mid-1980s. This indicates that overfishing has been occurring since the early 1970s, with the 2006 estimate of $F/F_{30\%SPR} = 5.39$ and $F/F_{40\%SPR}$ at 7.67 (March 19, 2009 Projection; SEDAR 15 2008).

Estimated abundance-at-age shows truncation of the oldest ages from the 1950s into the 1980s; the age structure continues to be in a truncated condition. Fish of age 10 and above are practically non-existent in the population. Estimated biomass-at-age follows a similar pattern of truncation as seen in the abundance data. Total biomass and spawning biomass show nearly identical trends with a sharp decline during the 1950s and 1960s, continued decline during the 1970s, and stable but low levels since 1980. Numbers of age-1 fish have declined during the same period; however notably strong year classes occurred in 1983 and 1984, and again in 1998 and 1999. Note: Additional detail is presented in **Appendix L** and **Section 4** and is hereby incorporated by reference.

3.4 Other Affected Council-Managed Species

Red snapper are targeted by commercial and recreational fishermen and are commonly taken on trips with red grouper, scamp, gag, red grouper, black grouper, gray triggerfish, greater amberjack, almaco jack, red porgy, black sea bass, and others. A detailed description of the life history of these species is provided in the snapper grouper SAFE report (NMFS 2005) http://sero.nmfs.noaa.gov/sf/safereports/safe.htm.

3.5 Protected Species

There are 31 different species of marine mammals that may occur in the EEZ of the South Atlantic region. All 31 species are protected under the MMPA and six are also listed as endangered under the ESA (i.e., sperm, sei, fin, blue, humpback, and North Atlantic right whales). There are only three known interactions between the South Atlantic snapper grouper fishery and marine mammals. All three marine mammals were likely dolphins, all were caught in Florida on handline gear, and all three animals were released alive. Other species protected under the ESA occurring in the South Atlantic include five species of sea turtle (green, hawksbill, Kemp's ridley, leatherback, and loggerhead); the smalltooth sawfish; and two *Acropora* coral species (elkhorn [*Acropora palmata*] and staghorn [*A. cervicornis*]). A discussion of these species is included below. Designated critical habitat for the *Acropora* corals also occurs within the South Atlantic region.

The impacts of the South Atlantic snapper grouper fishery on ESA-listed species have been evaluated in a biological opinion on the continued authorization of snapper grouper fishing under the South Atlantic Snapper Grouper Fishery Management Plan and Amendment 13C (NMFS 2006), and during subsequent informal ESA section 7 consultations. The biological opinion stated the fishery was not likely to adversely affect any critical habitat or marine mammals (see NMFS 2006 for discussion on these species). However, the opinion did state that the snapper grouper fishery would adversely affect sea turtles and smalltooth sawfish. A discussion of these species is included below.

NOAA Fisheries Service conducted an informal Section 7 consultation on July 9, 2007, evaluating the impacts of the South Atlantic snapper grouper fishery on ESA-listed *Acropora* species. The consultation concluded that the continued operation of the snapper grouper fishery was not likely to adversely affect newly listed *Acropora* species. On November 26, 2008, a final rule designating *Acropora* critical habitat was published in the *Federal Register*. A memo dated December 2, 2008, evaluated the effects of the continued authorization of the South Atlantic snapper grouper fishery on *Acropora* critical habitat pursuant to section 7 of the ESA. The evaluation concluded the proposed actions are not likely to adversely affect *Acropora* critical habitat.

3.5.1 ESA-Listed Sea Turtles

Green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles are all highly migratory and travel widely throughout the South Atlantic. The following sections are a brief overview of the general life history characteristics of the sea turtles found in the South Atlantic region. Several volumes exist that cover the biology and ecology of these species more thoroughly (i.e., Lutz and Musick (eds.) 1997, Lutz *et al.* (eds.) 2002).

Green sea turtle hatchlings are thought to occupy pelagic areas of the open ocean and are often associated with *Sargassum* rafts (Carr 1987, Walker 1994). Pelagic stage green sea turtles are thought to be carnivorous. Stomach samples of these animals contained ctenophores and pelagic snails (Frick 1976, Hughes 1974). At approximately 20 to 25 cm carapace length, juvenile green sea turtles migrate from pelagic habitats to benthic foraging areas (Bjorndal 1997). As juveniles move into benthic foraging areas a diet shift towards herbivory occurs. They consume primarily seagrasses and algae, but are also know to consume jellyfish, salps, and sponges (Bjorndal 1980, 1997; Paredes 1969; Mortimer 1981, 1982). The diving abilities of all sea turtles species vary by their life stages. The maximum diving range of green sea turtles is estimated at 110 m (360 ft) (Frick 1976), but they are most frequently making dives of less than 20 m (65 feet) (Walker 1994). The time of these dives also varies by life stage. The maximum dive length is estimated at 66 minutes with most dives lasting from 9 to 23 minutes (Walker 1994).

The hawksbill's pelagic stage lasts from the time they leave the nesting beach as hatchlings until they are approximately 22-25 cm in straight carapace length (Meylan 1988, Meylan and Donnelly 1999). The pelagic stage is followed by residency in developmental habitats (foraging areas where juveniles reside and grow) in coastal waters. Little is known about the diet of pelagic stage hawksbills. Adult foraging typically occurs over coral reefs, although other hard-bottom communities and mangrove-fringed areas are occupied occasionally. Hawksbills show fidelity to their foraging areas over several years (Van Dam and Diéz 1998). The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Gravid females have been noted ingesting coralline substrate (Meylan 1984) and calcareous algae (Anderes Alvarez and Uchida 1994), which are believed to be possible sources of calcium to aid in eggshell production. The maximum diving depths of these animals are not known, but the maximum length of dives is estimated at 73.5 minutes. More routinely, dives last about 56 minutes (Hughes 1974).

Kemp's ridley hatchlings are also pelagic during the early stages of life and feed in surface waters (Carr 1987, Ogren 1989). Once the juveniles reach approximately 20 cm carapace length they move to relatively shallow (less than 50 m) benthic foraging habitat over unconsolidated substrates (Márquez-M. 1994). They have also been observed transiting long distances between foraging habitats (Ogren 1989). Kemp's ridleys feeding in these nearshore areas primarily prey on crabs, though they are also known to ingest mollusks, fish, marine vegetation, and shrimp (Shaver 1991). The fish and shrimp Kemp's ridleys ingest are not thought to be a primary prey item but instead may be scavenged opportunistically from bycatch discards or from discarded bait (Shaver 1991). Given their predilection for shallower water, Kemp's ridleys most routinely make dives of 50 m or less (Soma 1985, Byles 1988). Their maximum diving range is unknown. Depending on the life stage a Kemp's ridleys may be able to stay submerged anywhere from 167

minutes to 300 minutes, though dives of 12.7 minutes to 16.7 minutes are much more common (Soma 1985, Mendonca and Pritchard 1986, Byles 1988). Kemp's ridleys may also spend as much as 96% of their time underwater (Soma 1985, Byles 1988).

Leatherbacks are the most pelagic of all ESA-listed sea turtles and spend most of their time in the open ocean. Although they will enter coastal waters and are seen over the continental shelf on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherbacks feed primarily on cnidarians (medusae, siphonophores) and tunicates. Unlike other sea turtles, leatherbacks' diets do not shift during their life cycles. Because leatherbacks' ability to capture and eat jellyfish is not constrained by size or age, they continue to feed on these species regardless of life stage (Bjorndal 1997). Leatherbacks are the deepest diving of all sea turtles. It is estimated that these species can dive in excess of 1,000 m (Eckert *et al.* 1989) but more frequently dive to depths of 50 m to 84 m (Eckert *et al.* 1986). Dive times range from a maximum of 37 minutes to more routines dives of 4 to 14.5 minutes (Standora *et al.* 1984, Eckert *et al.* 1986, Eckert *et al.* 1989, Keinath and Musick 1993). Leatherbacks may spend 74% to 91% of their time submerged (Standora *et al.* 1984).

Loggerhead hatchlings forage in the open ocean and are often associated with *Sargassum* rafts (Hughes 1974, Carr 1987, Walker 1994, Bolten and Balazs 1995). The pelagic stage of these sea turtles are known to eat a wide range of organisms including salps, jellyfish, amphipods, crabs, syngnathid fish, squid, and pelagic snails (Brongersma 1972). Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic (Witzell 2002). Here they forage over hard- and soft-bottom habitats (Carr 1986). Benthic foraging loggerheads eat a variety of invertebrates with crabs and mollusks being an important prey source (Burke *et al.* 1993). Estimates of the maximum diving depths of loggerheads range from 211 m to 233 m (692-764ft.) (Thayer *et al.* 1984, Limpus and Nichols 1988). The lengths of loggerhead dives are frequently between 17 and 30 minutes (Thayer *et al.* 1984, Limpus and Nichols 1988, Limpus and Nichols 1994, Lanyan *et al.* 1989) and they may spend anywhere from 80 to 94% of their time submerged (Limpus and Nichols 1994, Lanyan *et al.* 1989).

3.5.2 ESA-Listed Marine Fish

Historically the smalltooth sawfish in the U.S. ranged from New York to the Mexico border. Their current range is poorly understood but believed to have contracted from these historical areas. In the South Atlantic region, they are most commonly found in Florida, primarily off the Florida Keys (Simpfendorfer and Wiley 2004). Only two smalltooth sawfish have been recorded north of Florida since 1963 [the first was captured off North Carolina in 1963 and the other off Georgia in 2002 (National Smalltooth Sawfish Database, Florida Museum of Natural History)]. Historical accounts and recent encounter data suggest that immature individuals are most common in shallow coastal waters less than 25 meters (Bigelow and Schroeder 1953, Adams and Wilson 1995), while mature animals occur in waters in excess of 100 meters (Simpfendorfer pers. comm. 2006). Smalltooth sawfish feed primarily on fish. Mullet, jacks, and ladyfish are believed to be their primary food resources (Simpfendorfer 2001). Smalltooth sawfish also prey

on crustaceans (mostly shrimp and crabs) by disturbing bottom sediment with their saw (Norman and Fraser 1938, Bigelow and Schroeder 1953).

3.5.3 ESA-Listed Marine Invertebrates

Elkhorn (*Acropora palmata)* and staghorn (*A. cervicornis*) coral were listed as threatened under the ESA on May 9, 2006. The Atlantic *Acropora* Status Review (*Acropora* Biological Review Team 2005) presents a summary of published literature and other currently available scientific information regarding the biology and status of both these species.

Elkhorn and staghorn corals are two of the major reef-building corals in the wider Caribbean. In the South Atlantic region, they are found most commonly in the Florida Keys; staghorn coral occurs the furthest north with colonies documented off Palm Beach, Florida (26º3'N latitude). The depth range for these species ranges from <1 m to 60 m. The optimal depth range for elkhorn is considered to be 1 to 5 m depth (Goreau and Wells 1967), while staghorn corals are found slightly deeper, 5 to 15 m (Goreau and Goreau 1973).

All Atlantic *Acropora* species (including elkhorn and staghorn coral) are considered to be environmentally sensitive, requiring relatively clear, well-circulated water (Jaap *et al.* 1989). Optimal water temperatures for elkhorn and staghorn coral range from 25° to 29°C (Ghiold and Smith 1990, Williams and Bunkley-Williams 1990). Both species are almost entirely dependent upon sunlight for nourishment, contrasting the massive, boulder-shaped species in the region (Porter 1976, Lewis 1977) that are more dependent on zooplankton. Thus, Atlantic *Acropora* species are much more susceptible to increases in water turbidity than some other coral species.

Fertilization and development of elkhorn and staghorn corals is exclusively external. Embryonic development culminates with the development of planktonic larvae called planulae (Bak *et al.* 1977, Sammarco 1980, Rylaarsdam 1983). Unlike most other coral larvae, elkhorn and staghorn planulae appear to prefer to settle on upper, exposed surfaces, rather than in dark or cryptic ones (Szmant and Miller 2006), at least in a laboratory setting. Studies of elkhorn and staghorn corals indicated that larger colonies of both species had higher fertility rates than smaller colonies (Soong and Lang 1992).

3.5.4 South Atlantic Snapper Grouper Fishery Interactions with ESA-Listed Species

Sea turtles are vulnerable to capture by bottom longline and vertical hook-and-line gear. The magnitude of the interactions between sea turtles and the South Atlantic snapper grouper fishery was evaluated in NMFS (2006) using data from the Supplementary Discard Data Program (SDDP). Three loggerheads and three unidentified sea turtles were caught on vertical lines; one leatherback and one loggerhead were caught on bottom longlines, all were released alive (Table 3-1). The effort reported program represented between approximately 5% and 14% of all South Atlantic snapper grouper fishing effort. These data were extrapolated in NMFS (2006) to better estimate the number of interactions between the entire snapper grouper fishery and ESA-listed sea turtles. The extrapolated estimate was used to project future interactions (Table 3-2).

The SDDP does not provide data on recreational fishing interactions with ESA-listed sea turtle species. However, anecdotal information indicates that recreational fishermen occasionally take sea turtles with hook-and-line gear. The biological opinion also used the extrapolated data from the SDDP to estimate the magnitude of recreational fishing on sea turtles (Table 3-2).

Smalltooth sawfish are also considered vulnerable to capture by bottom longline and vertical hook-and-line gear based on their capture in other southeast fisheries using such gear (Poulakis and Seitz 2004; Simpfendorfer and Wiley 2004). SDDP data does not include any reports of smalltooth sawfish being caught in the South Atlantic commercial snapper grouper fishery. There are no other documented interactions between smalltooth sawfish and the South Atlantic commercial snapper grouper fishery. However, the potential for interaction, led NOAA Fisheries Service to estimate future interactions between smalltooth sawfish and the snapper grouper fishery in the 2006 biological opinion (Table 3-2).

Regulations through snapper grouper amendment 15B (74 FR 58902; November 16, 2009) require all commercial or charter/headboat vessels with a South Atlantic snapper-grouper permit, carrying hook-and-line gear on board, to possess required literature and release gear to aid in the safe release of incidentally caught sea turtles and smalltooth sawfish.

Table 3-1. Sea turtle incidental take data from the supplementary discard data program (SDDP) for the Southeast U.S. Atlantic.

Reporting Period	Month	Logbook Statistical Grid	Species Caught	Number Caught	Discard Condition
Vertical Hook-and-Line Sea Turtle Catch Data					
8/1/01-7/31/02	April	2482	Unidentified	1	Alive
8/1/01-7/31/02	November	3377	Loggerhead	1	Alive
8/1/02-7/31/03	February	2780	Loggerhead	1	Alive
8/1/02-7/31/03	November	3474	Loggerhead	1	Alive
8/1/02-7/31/03	November	3476	Unknown	1	Alive
8/1/02-7/31/03	December	3476	Unknown	1	Alive
Bottom Longline Sea Turtle Catch Data					
8/1/01-7/31/02	August	3674	Leatherback	1	Alive
8/1/03-7/31/04	January	3575	Loggerhead	1	Unknown

Source: SEFSC Supplementary Discard Data Program

Table 3-2. Three year South Atlantic anticipated takes of ESA-Listed species for snapper grouper gear.

Species	Amount of Take	Total
Green	Total Take	39
	Lethal Take	14
Hawksbill	Total Take	4
	Lethal Take	3
Kemp's ridley	Total Take	19
	Lethal Take	8
Leatherback	Total Take	25
	Lethal Take	15
Loggerhead	Total Take	202
	Lethal Take	67
Smalltooth sawfish	Total Take	8
	Lethal Take	0

Source: NMFS 2006

3.6 Administrative Environment

3.6.1 The Fishery Management Process and Applicable Laws

3.6.1.1 Federal Fishery Management

Federal fishery management is conducted under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801 et seq.), originally enacted in 1976 as the Fishery Conservation and Management Act. The Magnuson-Stevens Act claims sovereign rights and exclusive fishery management authority over most fishery resources within the U.S. Exclusive Economic Zone (EEZ), an area extending 200 nautical miles from the seaward boundary of each of the coastal states, and authority over U.S. anadromous species and continental shelf resources that occur beyond the U.S. EEZ.

Responsibility for Federal fishery management decision-making is divided between the U.S. Secretary of Commerce and eight regional fishery management councils that represent the expertise and interests of constituent states. Regional councils are responsible for preparing, monitoring, and revising management plans for fisheries needing management within their jurisdiction. The Secretary of Commerce (Secretary) is responsible for collecting and providing the data necessary for the councils to prepare fishery management plans and for promulgating regulations to implement proposed plans and amendments after ensuring that management measures are consistent with the Magnuson-Stevens Act and with other applicable laws summarized in Section 7.0. In most cases, the Secretary has delegated this authority to NOAA Fisheries Service.

The South Atlantic Fishery Management Council is responsible for conservation and management of fishery resources in Federal waters of the U.S. South Atlantic. These waters extend from 3 to 200 miles offshore from the seaward boundary of the States of North Carolina, South Carolina, Georgia, and east Florida to Key West. The Council has thirteen voting members: one from NOAA Fisheries Service; one each from the state fishery agencies of North Carolina, South Carolina, Georgia, and Florida; and eight public members appointed by the Secretary. On the South Atlantic Council, there are two public members from each of the four South Atlantic States. Non-voting members include representatives of the U.S. Fish and Wildlife Service, U.S. Coast Guard, State Department, and Atlantic States Marine Fisheries Commission (ASMFC). The South Atlantic Council has adopted procedures whereby the non-voting members serving on the Council Committees have full voting rights at the Committee level but not at the full Council level. Council members serve three-year terms and are recommended by State Governors and appointed by the Secretary of Commerce from lists of nominees submitted by State governors. Appointed members may serve a maximum of three consecutive terms. Public interests also are involved in the fishery management process through participation on Advisory Panels and through council meetings, which, with few exceptions for discussing personnel matters, are open to the public. The Council uses an to review the data and science being used in assessments and fishery management plans/amendments. In addition, the regulatory process is in accordance with the Administrative Procedures Act, in the form of "notice and comment" rulemaking.

3.6.1.2 State Fishery Management

The state governments of North Carolina, South Carolina, Georgia, and Florida have the authority to manage fisheries that occur in waters extending three nautical miles from their respective shorelines. North Carolina's marine fisheries are managed by the Marine Fisheries Division of the North Carolina Department of Environment and Natural Resources. The Marine Resources Division of the South Carolina Department of Natural Resources regulates South Carolina's marine fisheries. Georgia's marine fisheries are managed by the Coastal Resources Division of the Department of Natural Resources. The Marine Fisheries Division of the Florida Fish and Wildlife Conservation Commission is responsible for managing Florida's marine fisheries. Each state fishery management agency has a designated seat on the South Atlantic Council. The purpose of state representation at the Council level is to ensure state participation in Federal fishery management decision-making and to promote the development of compatible regulations in state and Federal waters.

The South Atlantic states are also involved through the Atlantic States Marine Fisheries Commission (ASMFC) in management of marine fisheries. This commission was created to coordinate state regulations and develop management plans for interstate fisheries. It has significant authority, through the Atlantic Striped Bass Conservation Act and the Atlantic Coastal Fisheries Cooperative Management Act, to compel adoption of consistent state regulations to conserve coastal species. The ASMFC also is represented at the Council level, but does not have voting authority at the Council level.

NOAA Fisheries Service' State-Federal Fisheries Division is responsible for building cooperative partnerships to strengthen marine fisheries management and conservation at the

state, inter-regional, and national levels. This division implements and oversees the distribution of grants for two national (Inter-jurisdictional Fisheries Act and Anadromous Fish Conservation Act) and two regional (Atlantic Coastal Fisheries Cooperative Management Act and Atlantic Striped Bass Conservation Act) programs. Additionally, it works with the ASMFC to develop and implement cooperative State-Federal fisheries regulations.

3.7 Enforcement

Both the National Oceanic and Atmospheric Administration (NOAA) Fisheries Office for Enforcement (NOAA/OLE) and the United States Coast Guard (USCG) have the authority and the responsibility to enforce South Atlantic Council regulations. NOAA/OLE agents, who specialize in living marine resource violations, provide fisheries expertise and investigative support for the overall fisheries mission. The USCG is a multi-mission agency, which provides at sea patrol services for the fisheries mission.

Neither NOAA/OLE nor the USCG can provide a continuous law enforcement presence in all areas due to the limited resources of NOAA/OLE and the priority tasking of the USCG. To supplement at sea and dockside inspections of fishing vessels, NOAA entered into Cooperative Enforcement Agreements with all but one of the states in the Southeast Region (North Carolina), which granted authority to state officers to enforce the laws for which NOAA/OLE has jurisdiction. In recent years, the level of involvement by the states has increased through Joint Enforcement Agreements, whereby states conduct patrols that focus on Federal priorities and, in some circumstances, prosecute resultant violators through the state when a state violation has occurred.

NOAA General Counsel issued a revised Southeast Region Magnuson-Stevens Act Penalty Schedule in June 2003, which addresses all Magnuson-Stevens Act violations in the Southeast Region. In general, this Penalty Schedule increases the amount of civil administrative penalties that a violator may be subject to up to the current statutory maximum of $120,000 per violation.

3.8 Human Environment

3.8.1 Economic Description of the Commercial Fishery

Additional information on the commercial snapper grouper fishery is contained in previous amendments [Amendment 13C (SAFMC 2006), Amendment 15A (SAFMC 2007), Amendment 15B (SAFMC 2008), and Amendment 16 (SAFMC 2008)] and is incorporated herein by reference.

3.8.1.1 Gear and Fishing Behavior

The commercial snapper grouper fishery utilizes vertical lines, longlines, black sea bass pots/traps, spears, and powerheads (i.e., spears with spring-loaded firearms). Vertical lines are used from the North Carolina/Virginia border to the Atlantic side of Key West, Florida. The

majority of hook and line fishermen use either electric or hydraulic reels (bandit gear) and generally have 2-4 bandit reels per boat. Historically, the majority of the bandit fleet fished year round for snapper grouper with the only seasonal differences in catch associated with the regulatory spawning season closures in March and April for gag. Recently, Snapper Grouper FMP Amendment 16 implemented a closed season from January through April for shallow water groupers and a commercial quota for vermilion snapper that could result in closures if the spring and/or fall sub-quotas are filled. Most fluctuations in fishing effort during the open seasons in this fishery are a result of the weather. Trips can be limited during hurricane season and during the winter months from December through March. Some fishermen stop bandit fishing to target king mackerel when they are running.

The Council allows the use of bottom longlines north of St. Lucie Inlet, Florida, in depths greater than 50 fathoms. Bottom longline gear is used to target snowy grouper and golden tilefish. Longline boats are typically bigger than bandit boats, their trips are longer, and they cost more to operate because they operate farther offshore. A longline spool generally holds about 15 miles of cable. Longlines are fished from daylight to dark because sea lice eat the flesh of hooked fish at night. The fishery is operated year long with little or no seasonal fluctuation barring hurricane disruption.

Spears or powerheads are most commonly used off Florida and are illegal for killing snapper grouper species in South Carolina and in Special Management Zones.

Black sea bass pots are used exclusively to target black sea bass, though bycatch of other snapper grouper species is allowed. The pots have mesh size, material, and construction restrictions to facilitate bycatch reduction. All sea bass pots must have a valid identification tag attached and more than 87% of tags in April 2003 were for vessels with homeports in North Carolina. Fishing practices vary by buoy practices, setting/pulling strategies, number of pots set, and length of set, with seasonal variations. The South Carolina pot fishery is mainly a winter fishery with short soak times (in some cases about an hour) and relatively few pots per boat. Most trips are day trips with pots being retrieved before heading to port. The North Carolina pot fishery also is primarily a winter fishery with some fishermen continuing to pot through the summer. North Carolina fishermen tend to use more pots than those in South Carolina. Although most North Carolina trips with sea bass pots last one day, more pots are left to soak for several days than in South Carolina. Many participants in the black sea bass fishery are active in other fisheries, including the recreational charter fishery during the summer months. Many snapper grouper permit holders maintain pot endorsements but are not active in the pot fishery.

3.8.1.2 Landings, Revenue and Economic Impact

The NOAA Fisheries southeast logbook database is used to analyze commercial fishing behavior at the boat and trip level (Table 3-3). In 2003-2007, logbook-reported landings for snapper grouper averaged 6.4 million pounds and $13.8 million in 2007 dollars. Adding the $2.3 million for other species landed on the same trips, the trip value comes to $16.1 million (2007 dollars, Table 3-3). For the 890 boats that made these snapper grouper trips, the ex-vessel value for logbook-reported landings for all trips/species averaged $22.8 million. Based on logbook data

during these five years, the comparable annual average gross revenue was in the range of $24,000 to $27,000 per boat (median, $9,650 to $10,740 per boat; maximum, $210,000 to $360,000 per boat, all data in 2007 dollars). Note that adding what was not reported in the logbooks (ALS data, see footnote 1), landings may have been 861,000 pounds and $569,000 higher in 2003-2007.

Estimates of the economic impacts of the commercial snapper grouper fishery are derived using the model developed for and applied in NMFS (2009c). Based on the average annual ex-vessel revenues for all snapper grouper species over the period 2003-2007 of $13.8 million (2007 dollars), the commercial snapper grouper fishery is estimated to support 2,679 full time equivalent (FTE) jobs and generate approximately $182 million in output (sales) impacts and approximately $77 million in income impacts per year to the U.S. economy. Among the jobs supported, 350 FTE jobs are estimated to be in the harvesting sector and 213 FTE jobs are in the dealer/processor sector. Approximately two-thirds of the jobs supported by the commercial snapper grouper fishery are estimated to accrue to the restaurant sector. The estimates of economic activity include the direct effects (effects in the sector where an expenditure is actually made), indirect effects (effects in sectors providing goods and services to directly affected sectors), and induced effects (effects induced by the personal consumption expenditures of employees in the direct and indirectly affected sectors).

Vessels that harvested snapper grouper species also harvested other species, on the trips where snapper grouper were harvested as well as on other trips on which no snapper grouper were harvested. All revenues from all species on all these trips contributed towards making these vessels economically viable and contributed to the economic activity associated with these vessels. The average annual total ex-vessel revenues from all species (including snapper grouper) harvested during this period (2003-2007) by vessels that harvested snapper grouper species was approximately $22.8 million (2007 dollars). The economic activity associated with these revenues is estimated to support 4,426 FTE jobs (578 in the harvesting sector and 352 in the dealer/processor sector) and generate approximately $300 million in output (sales) impacts and approximately $128 million in income impacts.

For the individual species addressed by this amendment, vermilion snapper generated the largest average annual ex-vessel revenues, approximately $2.5 million (2007 dollars) per year from 2003-2007, followed by gag at approximately $1.8 million (2007 dollars). The economic activity associated with these two species is estimated to support 485 FTE jobs (63 in the harvest sector and 39 in the dealer/processor sector) and 352 FTE jobs (46 in the harvest sector and 28 in the dealer/processor sector), respectively. The vermillion snapper revenues are estimated to generate approximately $33 million in output (sales) impacts and $14 million in income impacts, while the gag revenues are estimated to generate approximately $24 million and $10 million in economic output (sales) and income impacts, respectively. All harvests by the respective vessels that harvest these species support approximately 2,000 FTE jobs (260 in the harvest sector and 158 in the dealer/processor sector), and approximately $135 million in output (sales) impacts and approximately $58 million in income impacts, each. It should be noted, however, that the estimates for the economic activity associated with the harvest of all species by vessels that harvest either vermilion snapper or gag are not additive because some, if not many, of these individual vessels likely harvest both species.

Figure 3-1. Commercial landings & revenue, snapper -grouper

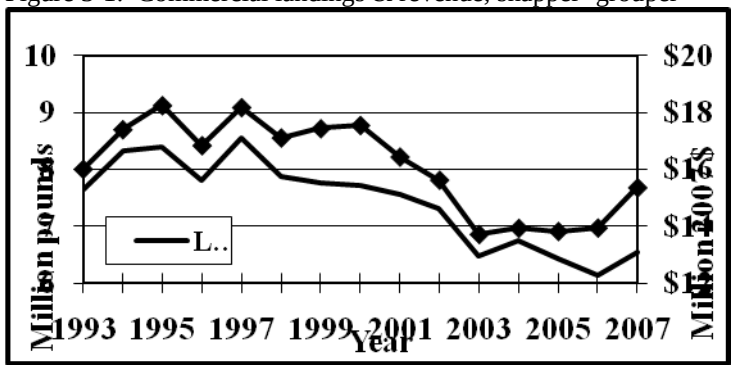


Figure 3-2. Days at sea and trips, snapper grouper

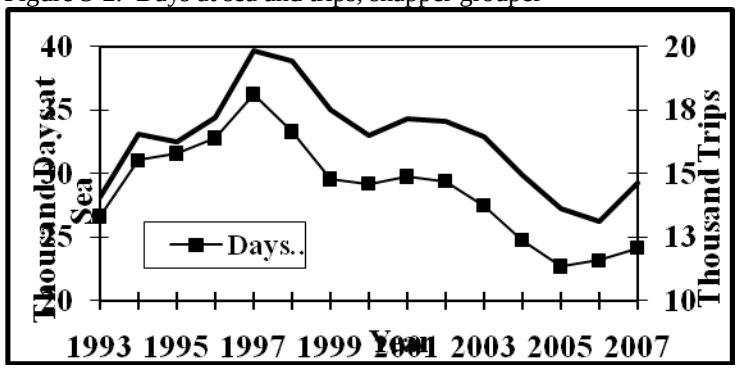


Figure 3-3. Boats and trips, snapper grouper

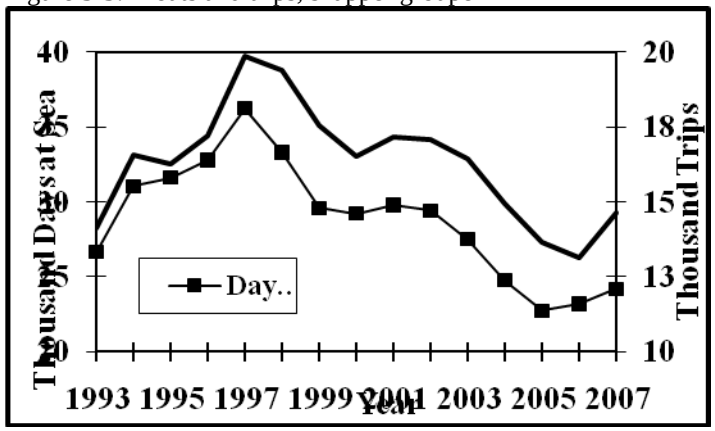
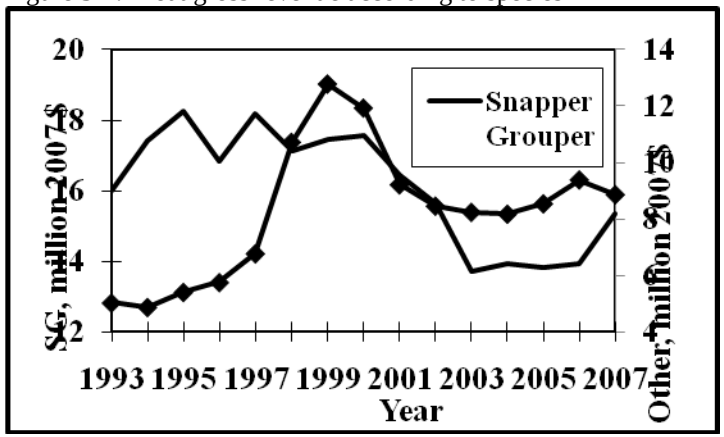


Figure 3-4. Boat gross revenue according to species



Figures 3-1 – 3-4. Commercial landings and revenue, days at sea and trips, days at sea and boats, boat gross revenue.

3.8.1.3 Landings, Ex-vessel Value, Price, and Effort

The landings of snapper grouper declined 28% from a high of ~~8.~~ 8.6 million pounds in 1997 to 6.1 million pounds in 2006, while effort declined by a third (Figures 3-1 to 3-3). The number of boats fell from a high of 1,301 in 1998 to 857 in 2005. Days at sea fell 37% from 36,264 to 22,794 between 1997 and 2005, while trips fell 34% from 19,860 to 13,138 (in 2006).

Counting all of their trips, the boats typically landed more snapper grouper than other species in terms of dollar value. The revenue from species other than snapper grouper rose between 1993 and 1999, peaking at $12.8 million (Figure 3-4). Total boat revenue peaked at $30.2 million in 1999 and averaged approximately the same in 2003-2007 as in 1993-1997 (2007 dollars).

The shallow water groupers and mid-shelf snappers are the largest species groups by volume and value within the snapper grouper fishery. Vermilion snapper in the mid-shelf snapper group is the largest volume species in the fishery, and accounted for 15% of total landings and 18% of dockside revenue on average in 2003-2007 (totals, Table 3-3). Gag is the largest volume shallow-water grouper, and accounted for 9% of total landings and 13% of dockside revenue.

Table 3-3. Annual landings and dockside (ex-vessel) revenues for trips with at least one pound of species in the snapper grouper fishery management unit, 2003-2007, landings in whole weight.

Item	2003	2004	2005	2006	2007	Average
Snapper grouper, 1,000 lbs	6,471	6,693	6,365	6,112	6,528	6,434
Snapper grouper, 1,000 2007 $	$13,762	$13,340	$13,078	$13,431	$15,426	$13,807
Price/lb (whole wt), current $	$1.89	$1.82	$1.93	$2.14	$2.36	$2.03
Price index for #2 diesel fuel	43	54	80	92	100	67
Other spp, same trips, 1,000 lbs	2,092	1,651	1,751	2,116	2,122	1,946
Other spp, same trips, 1,000 2007 $	$2,149	$2,001	$2,225	$2,394	$2,738	$2,301
Boat rev, all spp/trips, 1,000 2007 $	$21,967	$22,120	$22,377	$23,338	$24,232	$22,807

Source: NOAA Fisheries Service, Southeast Fisheries Science Center logbook database as of September 22, 2008, and Accumulated Landings System database as of September 17, 2008. NOAA Fisheries Service, Southeast Regional Office permits database. The BLS Consumer Price Index for all Urban Consumers was used to adjust dockside revenues and average annual prices for inflation. Data in last row computed separately, and results may differ if computed as for the previous rows. BLS Producer price index for #2 diesel fuel, index=100 for 2007.

The number of boats with snapper grouper permits exhibited a downward trend from 1,251 in 1999 to 877 in 2007, averaging 944 in 2003-2007 (Table 3-4). Two types of permits were created with the limited access program for the snapper grouper fishery that was implemented in 1998. The number of transferable permits that allow an unlimited harvest per trip was 938 in

1999 and 718 in 2007. The number of vessels with non-transferable permits with a 225-pound trip limit declined year-by-year from 313 in 1999 to 159 in 2007. The number of transferable permits declined, in part, because new entrants into the fishery must buy two permits and retire one as the condition for entry into the fishery. Furthermore, it is likely that the number of vessels in the snapper grouper fishery declined for economic reasons. For example, fuel prices more than doubled between 2003 and 2007 and continued to increase through mid-2008. By contrast, average annual prices for species in the snapper grouper management unit were relatively flat.

Table 3-4. Fishing effort and distribution of landings for trips with at least one pound of species in the snapper grouper fishery management unit in the South Atlantic, 2003-2007.

Item	2003	2004	2005	2006	2007	Average
Number of trips	16,545	15,045	13,756	13,224	14,753	14,665
Days away from port	27,556	24,820	22,794	23,160	24,216	26,296
Boats landing snapper grouper	931	905	857	868	889	890
Number of permitted boats	1059	1001	909	874	877	944
Boats with transferable permits	828	782	721	697	718	749
Boats with non-transferable permits	231	219	188	177	159	195
	Number of boats according to landings of snapper grouper					
1-100 lbs per boat per year	140	156	138	164	155	151
101-1,000 lbs per boat per year	245	225	242	258	261	246
1,001-5,000 lbs per boat per year	270	263	239	228	225	245
5,001-10,000 lbs per boat per year	104	96	86	64	86	87
10,001-50,000 lbs per boat per year	152	133	123	127	134	134
More than 50,000 lbs per boat per year	20	32	29	27	28	27

Source: Same as first table, this section.

From 2003 through 2007, there were on average 890 boats and 14,665 trips per year on which at least one pound of snapper grouper species was landed (Table 3-4).[1] On average, 493 of the 890 boats landed at least 1000 pounds of snapper grouper species annually; 248 boats landed at least 5,000 pounds; 161 boats landed at least 10,000 pounds; and 27 boats landed at least 50,000 pounds of snapper grouper species.

3.8.1.4 The South Atlantic Snapper Grouper Fishery by State

The following discussion provides annual averages for 2003-2007. To maintain the confidentiality of individual reporting units, summaries are provided for regions defined as North Carolina, South Carolina, Georgia and northeast Florida, and central-southeast Florida. Northeast Florida consists of trips landed in Nassau, Duval, and St. Johns Counties; the central-

[1] Fishermen with a permit to fish in Federal waters are required to submit a logbook report to the NMFS with information about landings, gear type, approximate location of trip and date of landing. Trip revenue was calculated as landings multiplied by average prices from the NMFS Accumulated Landings System. The logbook database does not include landings from trips in state waters by fishermen who do not have Federal permits.

southeast Florida region consists of trips landed in Flagler through Miami-Dade Counties; and the Florida Keys region consists of trips from Atlantic waters landed in Monroe County.

Among the specified regions, snapper grouper landings and trips were not proportional (Table 3-5). For example, boats in central-southeast Florida made 32% of the trips and accounted for 12% of the total snapper grouper harvest. However, the disparity was less for trip revenue and days fished in this and other instances; that is, boats in central-southeast Florida had 19% of the trip revenue and 22% of the days fished. The differences have to do with the greater quantities of lower valued coastal pelagic species on trips in central-southeast Florida and other factors.

Table 3-5. Average annual landings & dockside revenues for trips with at least one pound of species in the snapper grouper fishery, averages for 2003-2007 by state (quantities in whole weight).

Item	North Carolina	South Carolina	Georgia-northeast Florida	Central-southeast Florida	Florida Keys	South Atlantic
Snapper grouper, 1,000 lbs	1,816	1,591	734	790	1,504	6,434
Percent of landings	28%	25%	11%	12%	23%	100%
Snapper grouper, 1,000 2007 $	$3,738	$3,795	$1,651	$1,615	$3,008	$13,807
Other spp, same trips, 1,000 lbs	286	125	54	1,293	188	1,946
Trip revenue, 1,000 2007 $	$4,127	$3,977	$1,774	$3,021	$3,210	$16,108
Percent of trip revenue	26%	25%	11%	19%	20%	100%
Number of boats*	175	64	46	342	294	921
Number of trips	2,607	916	486	4,691	5,964	14,665
Percent of trips	18%	6%	3%	32%	41%	100%
Number of days	4,727	4,702	1,946	5,473	7,661	24,509
Percent of days fished	19%	19%	8%	22%	31%	100%
Trips per boat	14.9	14.2	10.6	13.7	20.3	15.9
Days per trip	1.8	5.1	4.0	1.2	1.3	1.7

Source: Same as first table, this section. *Some boats land in more than one area.

Table 3-6. Average annual landings (in thousands of pounds, whole weight) on trips that landed at least one pound of snapper grouper species: averages for 2003-2007, by state & species group.

Species	North Carolina		South Carolina		Georgia-northeast Florida		Central-southeast Florida		Florida Keys		South Atlantic	
	lbs	%	lbs	%	lbs	%	lbs	%	lbs	%	lbs	%
Shallow-water groupers	504	24%	555	32%	152	19%	107	5%	100	6%	1418	17%
Deep-water groupers	84	4%	78	5%	5	1%	28	1%	59	3%	254	3%
Tilefish	78	4%	112	6%	1	0%	227	11%	12	1%	430	5%
Shallow-water snappers	10	0%	20	1%	21	3%	128	6%	887	52%	1065	13%
Mid-shelf snappers	375	18%	366	21%	347	44%	33	2%	15	1%	1136	14%
Triggerfish / Spadefish	131	6%	77	4%	56	7%	5	0%	2	0%	271	3%
Jacks	111	5%	159	9%	132	17%	240	12%	406	24%	1047	12%
Grunts / porgies	127	6%	92	5%	14	2%	16	1%	24	1%	274	3%
Sea basses	395	19%	133	8%	6	1%	6	0%	0	0%	540	6%
Snapper grouper	1816	86%	1591	93%	734	93%	790	38%	1504	89%	6434	77%
Coastal pelagic spp	216	10%	52	3%	34	4%	1016	49%	81	5%	1399	17%
Sharks	9	0%	19	1%	6	1%	195	9%	77	5%	306	4%
Tunas	22	1%	2	0%	1	0%	1	0%	0	0%	25	0%
Other species	39	2%	54	3%	13	2%	81	4%	30	2%	217	3%

All species	2102	100%	1717	100%	787	100%	2083	100%	1692	100%	8380	100%
Source: Same as first table, this section.												

Reading the percentages down in Table 3-6, coastal pelagic species account for more than 10% of the landings only in central-southeast Florida. Shallow-water groupers and mid-shelf snappers account for more than 10% of the landings in the Carolinas and through Georgia and northeast Florida. Sea bass accounted for more than 10% of the landings in North Carolina only. Jacks account for more than 10% in Georgia and northeast Florida through the Keys.

3.8.1.5 The Snapper Grouper Fishery by Gear

The following discussion provides annual averages from 2003 to 2007. To maintain the confidentiality of individual reporting units, summaries are provided for vertical lines, longlines, black sea bass pots, and all other gears combined. The all-other-gear category includes trolling lines, nets, and other gears. Most of the snapper grouper harvest, including vermilion snapper and gag, is taken by some type of vertical hook-and-line gear. There are exceptions. Black sea bass are harvested primarily with black sea bass pots, while golden tilefish and yellowedge grouper are harvested primarily with bottom longlines. Some species, such as snowy grouper, are harvested by both vertical lines and longlines. Longlines used in the shark fishery may catch snapper grouper as secondary species.

The average quantities of snapper grouper species harvested from 2003-2007 included 5.2 million pounds worth $11.3 million (in 2007 dollars) per year with vertical lines, 0.41 million pounds with longlines, 0.12 million pounds with black sea bass pots, 0.22 million pounds with dive gear, and 0.51 million pounds with other gear (Table 3-7). Vertical lines accounted for 78% of all trips that landed at least one pound of snapper grouper, 81% of the snapper grouper landed, 81% of days fished, and 76% of the trip revenue. Trips with longlines tend to be longer than trips with other gear.

Table 3-7. Annual landings and dockside revenues for trips with at least one pound of species in the snapper grouper fishery by primary gear, 2003-2007, landings in whole weight.

Item	Diving	Hook & Line	Longline	Traps	Other gear	Total
Snapper grouper, 1,000 lbs	219	5,185	408	116	506	6,434
Percentage of landings	3%	81%	6%	2%	8%	100%
Snapper grouper, 1,000 2007$	$571	$11,314	$895	$168	$861	$13,807
Other spp, same trips, 1,000 lbs	49	674	265	941	17	1,946
Percentage of landings, other	3%	35%	14%	48%	1%	100%
Trip revenue, thousand 2007 $	$762	$12,272	$1,048	$1,148	$880	$16,108
Percentage of trip revenue	5%	76%	7%	7%	5%	100%
Number of boats*	65	723	27	50	245	1,110
Number of trips	648	11,405	246	690	1,676	14,665
Percent of trips	4%	78%	2%	5%	11%	100%
Number of days fished	920	19,910	924	944	1,811	24,509
Percent of days fished	4%	81%	4%	4%	7%	100%
Trips per boat	10.0	15.8	9.0	13.8	6.8	13.2
Days per trip	1.4	1.7	3.8	1.4	1.1	1.7

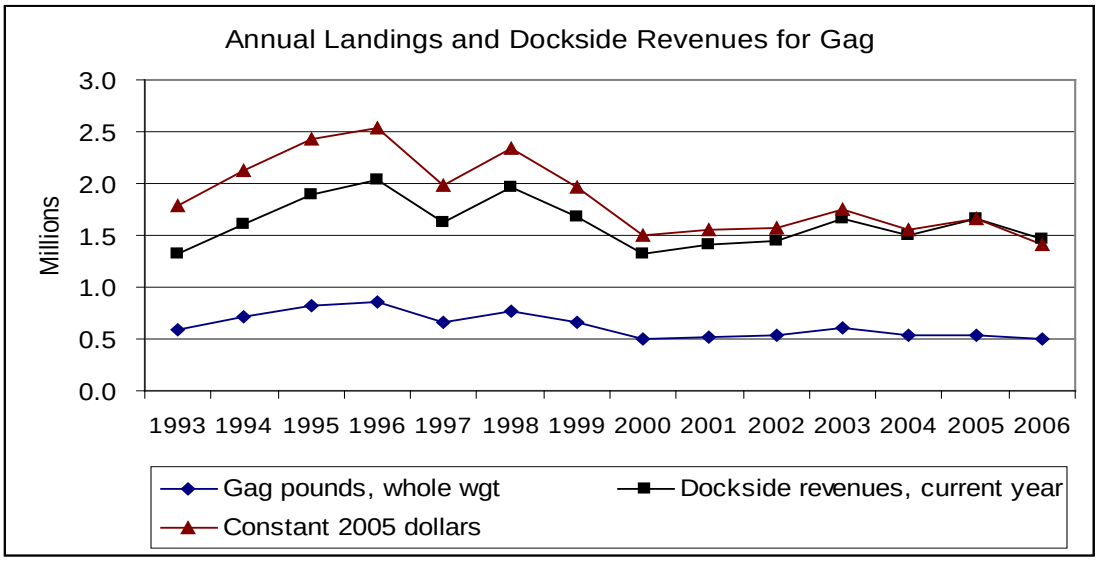
Source: Same as first table, this section.

3.8.1.6 The Commercial Fishery for Gag

According to logbook data, commercial landings of gag ranged from a high of 0.85 million pounds (whole weight) worth approximately $2.03 million in 1996 to a low of 0.50 million pounds worth $1.6 million in 2006 (Figure 3-5). Dockside revenue and pounds landed fluctuate in the same direction, which suggests that ex-vessel demand is price elastic. The policy implication is that regulations that reduce industry landings in the short-term are expected to reduce dockside revenue in the short-term. Conversely, dockside revenue is expected to increase over time if regulation successfully increases biomass and landings.

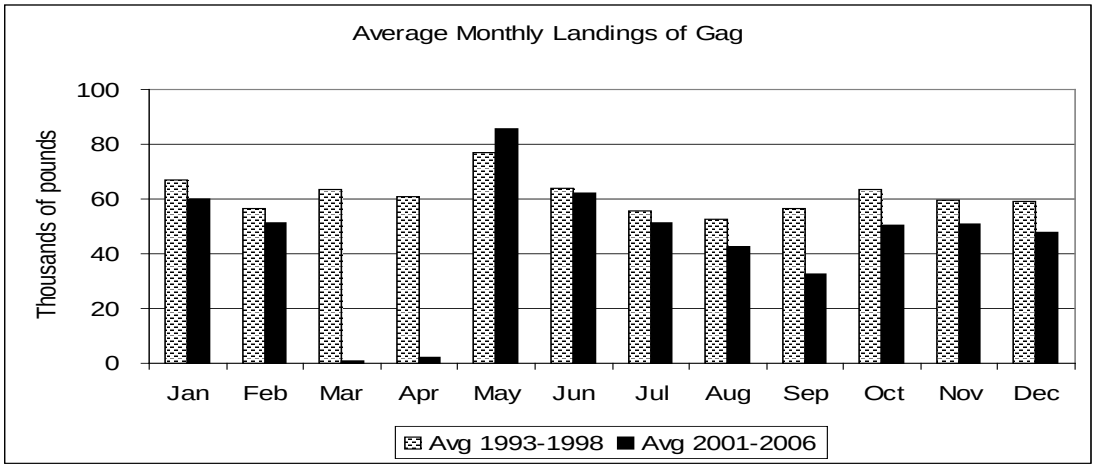
The time series for gag is defined by regulatory periods, with landings between 1993 and 1998 usually exceeding landings between 2001 and 2006. Between 1992 and 1998, the fishery for gag was regulated with a 20-inch minimum size limit. Beginning in 1999, the size limit was increased to 24 inches and the fishery was closed in March and April to protect the spawning stock. Prior to 1999, average monthly landings were highest in May and lowest in August (Figure 3-6). After the closure and larger size limit were implemented, average monthly landings increased in May, but otherwise declined in the remaining open months when compared to the 1993-1998 period, especially in September.

Figure 3-5. Annual landings and dockside revenue for gag, 1993-2006



Source: NOAA Fisheries Service, Southeast Fisheries Science Center logbook database as of October 10, 2007.
NOAA Fisheries Service, Southeast Fisheries Science Center Accumulated Landings System as of October 5, 2007.

Figure 3-6. Monthly average landings of gag, 1993-1998 and 2001-2006.



Source: NOAA Fisheries Service, Southeast Fisheries Science Center logbook database as of October 10, 2007.

On average in 2003-2007, 2,286 trips per year landed at least one pound of gag, and the landings came to 554,000 pounds with a value of $1.8 million in 2007 dollars (Table 3-8). On the same trips, the landings for all species came to 2.6 million pounds and the trip revenue came to $6.0 million. The ex-vessel value for all species and trips by the 292 boats that landed gag came to $10.2 million. The boats were not uniformly productive in the fishery for gag. Ninety-six of the 292 boats landed 100 pounds or less per year on average during 2003-2007, 160 boats landed 101 to 5,000 pounds, and 36 boats landed more than 5000 pounds.

Table 3-8. Annual landings, dockside revenue and fishing effort, trips and boats with landings of at least one pound of gag, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least one pound of gag	2,481	2,182	2,200	2,082	2,487	2,286
Gag, thousand pounds	598	532	541	496	605	554
Gag, thousand current $	$1,636	$1,521	$1,651	$1,617	$2,140	$1,713
Gag, thousand 2007 $	$1,844	$1,668	$1,751	$1,661	$2,136	$1,812
Dockside price, current $ / pound	$2.73	$2.86	$3.05	$3.26	$3.53	$3.09
All spp, same trips, thousand lbs	2,576	2,509	2,584	2,363	2,819	2,570
All spp, same trips, 1,000 2007 $	$5,898	$5,482	$5,845	$5,629	$7,154	$6,001
Boat rev, all spp/trips, 1,000 2007$	$9,923	$9,538	$10,357	$9,238	$12,137	$10,239
Number of boats that landed gag	302	292	302	259	305	292
	Number of boats according to landings of gag grouper					
1-100 lbs per boat per year	99	100	100	90	92	96
101-1,000 lbs per boat per year	89	92	103	74	100	92
1,001-5,000 lbs per boat per year	76	68	64	61	72	68
5,001-10,000 lbs per boat per year	25	19	22	21	30	23
More than 10,000 lbs per boat / year	13	13	13	13	11	13

Source: Same as first table, this section.

Gag was the primary source of revenue on an average of 1,042 trips per year in 2003-2007, and a lesser source of revenue on 1,244 trips (Table 3-9 and Table 3-10). The trips on which gag was the primary source of revenue accounted for approximately 71% (391,000 pounds) of the total

commercial harvest of gag and 470,000 pounds of other species (other groupers, snappers, jacks, grunts, porgies and non-snapper grouper species). On the 1,244 trips for which gag was a lesser source of revenue, landings of gag came to 164,000 pounds with an ex-vessel value of $527,000, compared with 1.5 million pounds for other species and an ex-vessel value of $3.2 million (Table 3-10). Along the Atlantic coast, more of the landings of gag occur in the Carolinas than farther south (Table 3-11). Approximately 81% of the gag is landed with vertical lines, and most of the remainder is landed with dive gear.

Table 3-9. Annual landings and dockside revenue on trips with gag as the top source of trip revenue, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least one pound of gag	1,183	1,011	1,044	904	1,070	1,042
Boats	184	193	188	169	206	188
Gag, thousand pounds	415	385	372	341	440	391
Gag, thousand 2007 $	$1,282	$1,212	$1,213	$1,149	$1,567	$1,284
Other spp, same trips, 1,000 lbs	505	482	432	418	512	470
Other spp, same trips, 1,000 2007 $	$1,015	$935	$877	$861	$1,142	$966

Source: Same as first table, this section.

Table 3-10. Annual landings and dockside revenue on trips with gag as a lesser source of trip revenue, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least one pound of gag	1,298	1,171	1,156	1,178	1,417	1,244
Boats	263	247	253	225	262	250
Gag, thousand pounds	184	147	169	155	166	164
Gag, thousand 2007 $	$562	$456	$538	$512	$569	$527
Other spp, same trips, 1,000 lbs	1,472	1,496	1,611	1,449	1,701	1,546
Other spp, same trips, 1,000 2007 $	$3,039	$2,878	$3,217	$3,107	$3,876	$3,224

Source: Same as first table, this section.

Table 3-11. Annual landings of gag for trips with at least one pound of gag, by region and primary gear, 2003-2007 (landings in thousand pounds, whole weight).

Landing region or primary gear	2003	2004	2005	2006	2007	Average
North Carolina	141	143	175	154	141	151
South Carolina	234	233	216	204	241	226
Georgia and northeast Florida	100	88	90	71	117	93
Central and southeast Florida	120	66	58	66	101	82
Florida Keys	3	2	1	1	4	2
Vertical lines	455	450	467	410	462	447
Diving gear	131	76	67	81	133	98
Other gear	13	7	6	5	11	8

Source: NOAA Fisheries Service, Southeast Fisheries Science Center logbook database as of September 22, 2008.

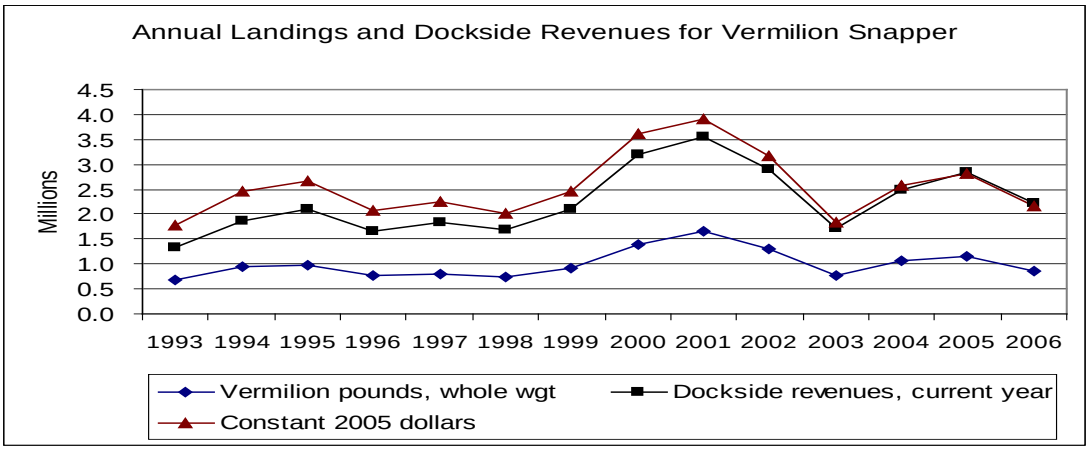
3.8.1.7 The Commercial Fishery for Vermilion Snapper

Logbook-reported commercial landings of vermilion snapper in 1993-2006 ranged from 0.68 million pounds ($1.33 million) in 1993 to 1.65 million pounds ($3.54 million) in 2001 (Figure 3-7). Landings of vermilion snapper began to increase in 1999 coincident with the implementation of more restrictive regulations for gag, peaked in 2001, and then declined through 2003 when

unusually cold-water temperatures reduced the availability of fish in the summer and fall of 2003. Landings of vermilion snapper recovered in 2004 and 2005, but not to the levels of 2001 and 2002. Dockside revenue generally displayed the same trend over time as commercial landings, which suggests that ex-vessel demand for vermilion snapper is price elastic. Hence, regulations that reduce industry landings in the short-term are expected to reduce dockside revenue in the short-term. Conversely, dockside revenue is expected to increase over time if regulation successfully increases biomass and landings.

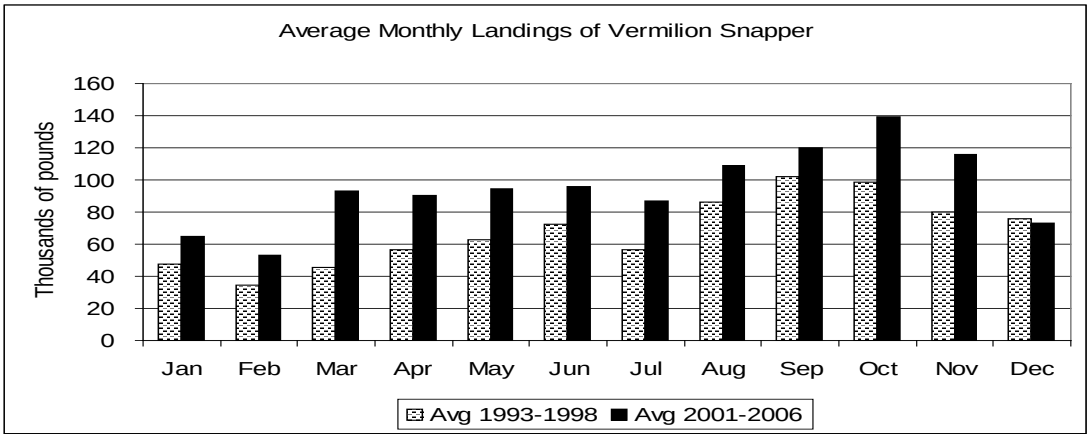
Vermilion snapper are landed throughout the year, with peak months from August through November (Figure 3-8). Average monthly landings were higher for all months except December during 2001-2006 compared with 1993-1998. The greatest relative monthly increases in average landings between the two periods occurred during March and April, which could reflect a shift in fishing effort from gag to vermilion in response to the closed season for gag that was implemented in 1999.

Figure 3-7. Annual landings and dockside revenue for vermilion snapper, 1993-2006.



Source: NOAA Fisheries Service, Southeast Fisheries Science Center logbook database (as of October 10, 2007), and Accumulated Landings System (as of October 5, 2007).

Figure 3-8. Monthly average landings, vermilion snapper, 1993-1998 & 2001-2006.



Source: NOAA Fisheries Service, Southeast Fisheries Science Center logbook database as of October 10, 2007.

Logbook-reported landings of vermilion snapper averaged 993,000 pounds in 2003-2007 and had an ex-vessel value of $2.5 million in 2007 dollars (Table 3-12). An average of 2,230 trips landed one or more pounds of vermilion snapper and landed 3.2 million pounds of all species worth $7.2 million (2007 dollars; Table 3-12).

Table 3-12. Annual landings, dockside revenues and fishing effort, trips and boats with landings of at least one pound of vermilion snapper, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb vermilion snapper	2,171	2,147	2,170	2,107	2,554	2,230
Vermilion snapper, thousand pounds	769	1,071	1,152	865	1,108	993
Vermilion snapper, thousand current $	$1,866	$2,274	$2,552	$2,083	$3,078	$2,370
Vermilion snapper, thousand 2007 $	$2,100	$2,490	$2,704	$2,140	$3,070	$2,501
Dockside price, current $ / pound	$2.43	$2.12	$2.21	$2.41	$2.78	$2.39
All species, same trips, 1000 lbs	2,796	3,131	3,210	3,026	3,777	3,188
All species, same trips, 1,000 2007 $	$6,377	$6,629	$7,012	$6,889	$9,086	$7,199
Boat rev, all spp/trips, 1,000 2007 $	$9,517	$9,383	$9,550	$10,124	$12,741	$10,263
Boats that landed vermilion snapper	248	255	252	233	275	253
	Number of boats according to landings of vermilion snapper					
1-100 lbs per boat per year	91	95	99	89	111	97
101-1,000 lbs per boat per year	66	75	59	63	70	67
1,001-5,000 lbs per boat per year	38	28	38	35	37	35
5,001-10,000 lbs per boat per year	26	13	18	12	18	17
More than 10,000 lbs per boat / year	27	44	38	34	39	36

Source: Same as first table, this section.

Revenue for the 253 boats that landed at least one pound of vermilion snapper came to $10.2 million for all species and all trips, including trips by these boats that did not land vermilion snapper. The boats were not uniformly productive in the fishery for vermilion snapper. Ninety-seven of the 253 boats landed 100 pounds or less, 164 boats landed 1,000 pounds or less, 52 landed 1,001 to 10,000 pounds, and 36 boats landed more than 10,000 pounds (Table 3-12).

Table 3-13. Annual landings and dockside revenues on trips with vermilion snapper as the top source of trip revenue, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb vermilion snapper	956	1024	1059	809	1063	982
Boats	152	159	156	135	147	150
Vermilion snapper, thousand pounds	630	911	992	687	901	824
Vermilion snapper, thousand 2007 $	1716	2126	2329	1717	2496	2077
Other species, same trips, thousand pounds	722	834	963	733	997	850
Other species, same trips, thousand 2007 $	1323	1391	1754	1348	1842	1532

Source: Same as first table, this section.

Vermilion snapper was the primary source of revenue on 982 trips per year on average in 2003-2007 (Table 3-13). These trips accounted 83% of the landings and ex-vessel value for vermilion snapper: 824,000 pounds at $2.1 million (Table 3-13). On these trips, other species accounted for 850,000 pounds and $1.5 million in revenue (groupers, jacks, grunts, porgies, and non-snapper grouper species).

Vermilion snapper were caught as a lesser source of revenue on 1,248 trips for gag, scamp, and red grouper in the shallow-water grouper fishery and snowy grouper in the deep-water grouper fishery (Table 3-14). These trips accounted for an annual average of 169,000 pounds of vermilion snapper ($424,000 in 2007 dollars) and 1.3 million pounds ($3.2 million) of other species. Vermilion snapper is landed mostly in the Carolinas through Georgia and northeast Florida and vertical lines are the leading gear (Table 3-15).

Table 3-14. Annual landings and dockside revenues on trips with vermilion snapper as a lesser source of trip revenue, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb vermilion snapper	1,215	1,123	1,111	1,298	1,491	1,248
Boats	220	221	213	203	255	222
Vermilion snapper, thousand pounds	140	160	160	178	207	169
Vermilion snapper, thousand 2007 $	$385	$364	$376	$423	$574	$424
Other species, same trips, 1,000 lbs	1,304	1,225	1,095	1,428	1,672	1,345
Other spp, same trips, 1,000 2007 $	$2,955	$2,748	$2,554	$3,401	$4,175	$3,166

Source: Same as first table, this section.

Table 3-15. Annual landings of vermilion snapper for trips with at least one pound of vermilion snapper, by region and primary gear, 2003-2007 (landings in whole weight).

Landing region or primary gear	2003	2004	2005	2006	2007	Average
North Carolina	238	311	422	320	522	363
South Carolina	286	414	424	259	264	329
Georgia and northeast Florida	225	331	291	277	312	287
Central and southeast Florida	11	7	10	4	8	8
Florida Keys	9	8	5	5	1	6
Vertical lines	764	1,066	1,145	859	1,098	986
Diving gear	2	2	4	4	5	3
Other gear	4	3	3	2	4	3

Source: Same as first table, this section.

3.8.1.8 The Commercial Fishery for Red Snapper

A small commercial fishery for red snapper along the Atlantic coast has existed at least since 1902 when 155,000 pounds were landed, primarily in Georgia.[2] The fishery continued at relatively low levels until after World War II. Landings jumped to approximately 250,000 pounds in 1945. By 1950, they had reached 363,000 pounds. Then, they fluctuated along a generally increasing trend through 1968, peaking at 974,000 pounds and declining to less than 100,000 pounds in 2006 (Figure 3-9). Fishermen along the east coast of Florida dominated the commercial fishery until the mid-1970s (Figure 3-9). By the late 1970s, the fishery had

[2] NOAA. 1990. Historical catch statistics: Atlantic and Gulf coast states, 1879-1989. Current Fishery Statistics 9010, NMFS Fishery Statistics Division, 107p.

expanded into Georgia, South Carolina and North Carolina, and it declined in Florida. In 1993-2007, logbook-reported commercial landings of red snapper ranged from 202,000 pounds (whole

Figure 3-9. Commercial landings of red snapper

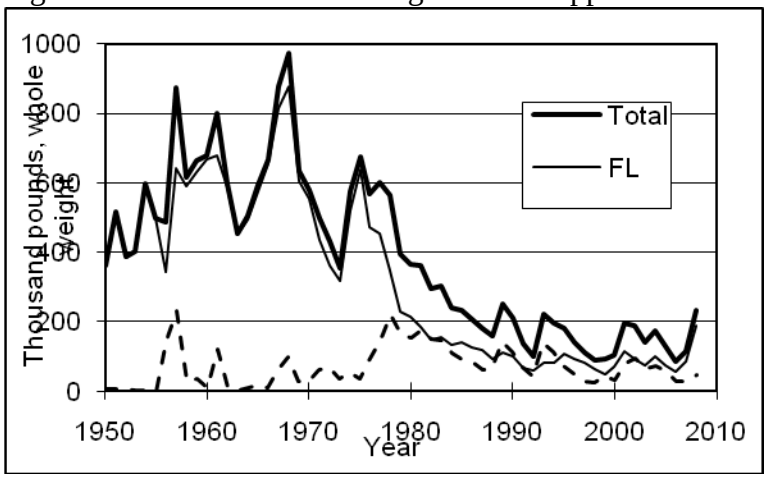


Figure 3-10. Annual landings & revenue, red snapper, 1993-2007

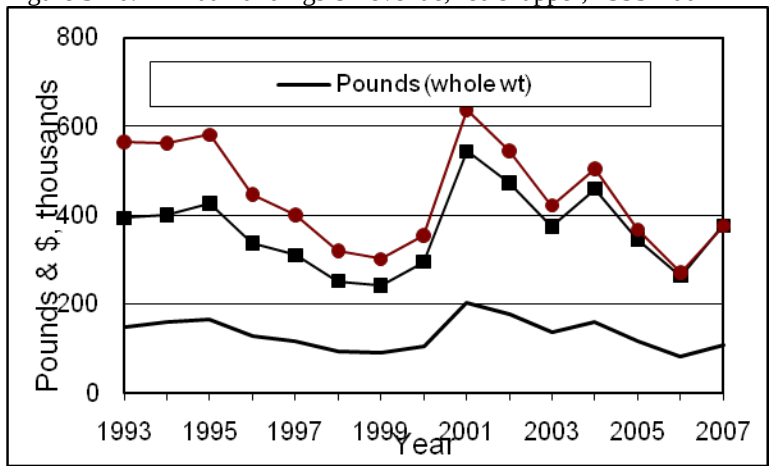


Figure 3-11. Average annual dockside prices, red snapper

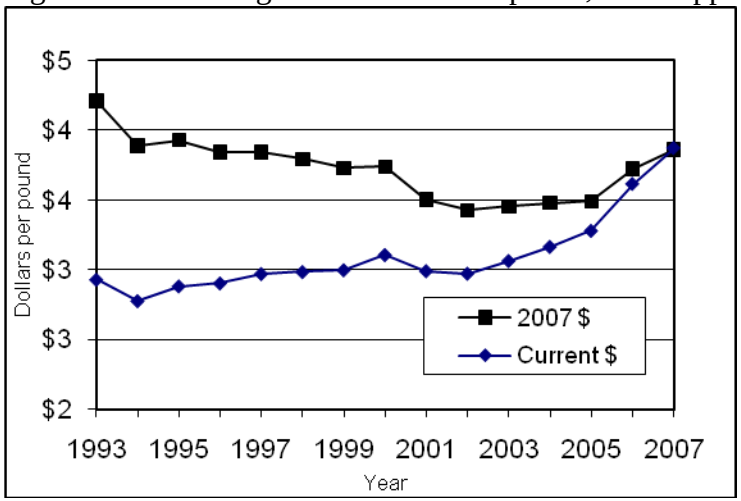
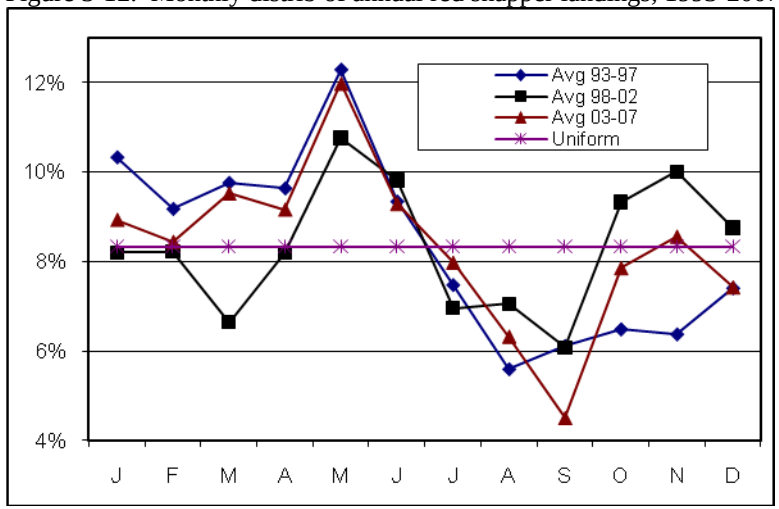


Figure 3-12. Monthly distrib of annual red snapper landings, 1993-2007



weight) worth approximately $544,000 in current year dollars in 2001 to 81,000 pounds worth $263,000 in 2006 (Figure 3-10). Dockside revenue and pounds landed fluctuate in the same direction, which suggests that ex-vessel demand is price elastic. The policy implication is that regulations that reduce industry landings in the short-term are expected to reduce dockside revenue in the short-term. Conversely, dockside revenue is expected to increase over time ifregulations successfully increase biomass and landings. Average annual dockside prices for red snapper increased steadily in current year dollars (Figure 3-11). However, prices in 2007 dollars declined through 2002 before increasing in 2006 and 2007.

Although the seasonal distribution of landings varied during 1993-2007, landings tend to be highest in May and lowest in September (Figure 3-12). During the 5-year period from 2003-2007, landings were above average from March through June, below average in August and September, and about average between October and February when compared to a uniform distribution of landings throughout the year.

According to the NMFS logbook database, on average in 2003-2007, 1,385 trips a year landed 121,000 pounds of red snapper worth $388,000 in 2007 dollars, and 2.0 million pounds of other species worth $4.5 on trips with at least one pound of red snapper (Table 3-16). Clearly, red snapper was not the primary revenue species on most of these trips. Boat revenue for all species and trips came to $9.8 million, with 4% for red snapper. Among the 220 boats that landed at least one pound of red snapper, 102 boats landed less than 100 pounds of red snapper per year, 84 boats landed 101-1000 pounds, and 34 boats landed more than 1000 pounds.

Table 3-16. Annual landings, dockside revenues and fishing effort, trips and boats with landings of at least one pound of red snapper, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb of red snapper	1,639	1,476	1,341	1,153	1,315	1,385
Red snapper, thousand pounds	136	161	117	81	108	121
Red snapper, thousand current $	$374	$459	$346	$263	$377	$364
Red snapper, thousand 2007 $	$422	$505	$368	$271	$376	$388
Dockside price, current $ / pound	$2.76	$2.85	$2.95	$3.25	$3.49	$3.02
All species, same trips, 1,000 lbs	2,252	2,292	2,199	1,679	2,059	2,096
All species, same trips, 1,000 2007 $	$5,190	$5,105	$4,969	$3,990	$5,131	$4,877
Boat rev, all spp/trips, 1,000 2007 $	$9,448	$8,886	$8,992	$9,286	$12,286	$9,780
Boats that landed red snapper	236	217	216	206	225	220
	Number of boats according to landings of red snapper					
1-100 lbs per boat per year	106	87	97	106	114	102
101-1,000 lbs per boat per year	91	86	86	74	81	84
More than 1,000 lbs per boat per year	39	44	33	26	30	34

Source: Same as first table, this section.

Red snapper was the primary source of trip revenue on an average of 163 trips per year, 12% of the trips on which it was landed (Table 3-17). These trips accounted for approximately 31% of the total commercial harvest, with an annual average of 38,000 pounds of red snapper worth $125,000 in 2007 dollars and 49,000 pounds of other species worth $103,000 (Table 3-17). On the 1,222 trips wherein red snapper was a lesser source of trip revenue, it accounted for an

annual average of 82,000 pounds of red snapper ($263,000 in 2007 dollars) and 1.9 million pounds of other species ($4.4 in 2007 dollars) (Table 3-18). Red snapper is part of the mid-shelf snapper grouper complex that includes scamp, gag, vermilion snapper, red porgy, gray triggerfish and red grouper, among other species. Red snapper is most commonly caught on trips with vermilion snapper, gag or scamp as the primary revenue species on the trip. Red snapper is landed mostly in South Carolina, Georgia and northeast Florida, and central-southeast Florida and it is caught mostly with vertical lines (Table 3-19).

Table 3-17. Annual landings and dockside revenues on trips with red snapper as the top source of trip revenue, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb of red snapper	172	198	157	140	149	163
Boats	80	76	66	58	61	68
Red snapper, thousand pounds	43	58	29	27	35	38
Red snapper, thousand 2007 $	$134	$183	$91	$93	$125	$125
Other spp, same trips, 1,000 lbs	63	75	38	29	41	49
Other spp, same trips, 1,000 2007$	$133	$153	$78	$66	$86	$103

Source: Same as first table, this section.

Table 3-18. Annual landings and dockside revenues on trips with red snapper as a lesser source of trip revenue, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb of red snapper	1,467	1,278	1,184	1,013	1,166	1,222
Boats	224	204	199	191	213	206
Red snapper, thousand pounds	93	103	89	54	73	82
Red snapper, thousand 2007 $	$288	$321	$277	$178	$251	$263
Other spp, same trips, 1,000 lbs	2,053	2,057	2,044	1,569	1,910	1,927
Other spp, same trips, 1,000 2007 $	$4,635	$4,447	$4,524	$3,653	$4,669	$4,386

Source: Same as first table, this section.

Table 3-19. Annual landings of red snapper for trips with at least one pound of red snapper, by region and primary gear, 2003-2007 (landings in thousand pounds, whole weight).

Region of landing / primary gear	2003	2004	2005	2006	2007	Average
North Carolina	15	10	7	6	5	9
South Carolina	37	43	38	20	25	33
Georgia and northeast Florida	65	90	46	34	52	58
Central and southeast Florida	16	16	23	17	25	19
Florida Keys	3	1	2	4	1	2
Vertical lines	122	147	103	72	90	107
Diving gear	11	13	11	7	16	12
Other gear	3	1	2	2	1	2

Source: Same as first table, this section.

3.8.1.9 The Commercial Fishery for Black Sea Bass

According to logbook data, black sea bass were landed on an average 2,157 trips per year in 2003-2007, with landings of 540,000 pounds worth $937,000 in 2007 dollars (Table 3-20). Landings of other species on the same trips, 4.0 million pounds, brought trip revenue to $4.5 million in 2007 dollars. Black sea bass were landed by an average of 237 boats in 2003-2007, with 181 of them landing 1,000 pounds or less per year and 23 of them landing more than 5,000 pounds. For these boats, black sea bass accounted for 9.8% of the $9.6 million of the ex-vessel value for all logbook-reported landings of all species on all trips, including trips by these boats that did not land black sea bass.

Table 3-20. Annual landings, dockside revenues and fishing effort, trips and boats with landings of at least one pound of black sea bass, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb black sea bass	2,238	2,372	2,056	2,172	1,949	2,157
Black sea bass, thousand pounds	597	707	460	527	409	540
Black sea bass, thousand current $	$916	$842	$571	$988	$1,089	$881
Black sea bass, thousand 2007 $	$1,033	$927	$611	$1,020	$1,097	$937
Dockside price, current $ / pound	$1.53	$1.19	$1.24	$1.87	$2.66	$1.63
All species, same trips, 1,000 lbs	4,189	4,616	4,441	4,508	4,805	4,512
All species, same trips, 1,000 2007 $	$4,411	$4,643	$4,358	$4,549	$4,594	$4,511
Boat rev, all spp/trips, 1,0000 2007 $	$8,835	$8,961	$9,116	$9,569	$11,441	$9,584
Boats that landed black sea bass	225	243	240	220	256	237
	Number of boats according to landings of black sea bass					
1-100 lbs per boat per year	84	86	104	87	134	99
101-1,000 lbs per boat per year	85	93	81	81	72	82
1,001-5,000 lbs per boat per year	35	34	36	31	27	33
5,001-10,000 lbs per boat per year	7	12	7	6	11	9
More than 10,000 lbs per boat / year	14	18	12	15	12	14

Source: Same as first table, this section.

Black sea bass was the top source of revenue for 765 trips on average in 2003-2007, and a lesser source on 1,392 trips (Table 3-21 and Table 3-22). On the 765 trips for which it was the top source of revenue, black sea bass accounted for 489,000 pounds of landings worth $855,000 in 2007 dollars, and other species accounted for 54,000 pounds worth $68,000 in 2007 dollars. These 765 trips accounted for 35% of all trips that landed at least one pound of black sea bass, 91% of total landings of black sea bass, and 97% of total ex-vessel value for black sea bass.

Table 3-21. Annual landings and dockside revenues on trips with black sea bass as the top source of trip revenue, 2003-2007 (landings in whole weight).

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb black sea bass	858	889	620	811	649	765
Boats	86	94	83	85	88	87
Black sea bass, thousand pounds	546	637	403	482	378	489
Black sea bass, thousand 2007 $	$948	$827	$539	$936	$1,023	$855
Other species, same trips, 1,000 lbs	51	57	38	69	57	54
Other species, same trips, 1,000 2007 $	$62	$66	$43	$94	$76	$68

Source: Same as first table, this section.

Table 3-22. Annual landings and dockside revenues on trips with black sea bass as a lesser source of trip revenue, 2003-2007 (landings in whole weight).						
Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb black sea bass	1,380	1,483	1,436	1,361	1,300	1,392
Boats	195	217	216	194	233	211
Black sea bass, thousand pounds	51	70	57	45	31	51
Black sea bass, thousand 2007 $	$85	$99	$73	$84	$74	$83
Other species, same trips, 1,000 lbs	1,446	1,721	1,674	1,498	1,408	1,549
Other species, same trips, 1,000 2007 $	$3,316	$3,651	$3,704	$3,436	$3,422	$3,506
Source: Same as first table, this section.						

For the 1,392 trips for which it was a lesser source of revenue, landings of black sea bass came to 51,000 pounds worth $83,000 in 2007 dollars, compared with 1.5 million pounds for other species worth $3.5 million. Among South Atlantic states, black sea bass is landed primarily in North Carolina and South Carolina (Table 3-23). The species is landed mostly with black sea bass pots and vertical lines are a distant second.

Table 3-23. Annual landings of black sea bass for trips with at least one pound of black sea bass, by region and primary gear, 2003-2007, landings in thousand pounds whole weight.						
Landing region or primary gear	2003	2004	2005	2006	2007	Average
North Carolina	476	485	324	421	271	395
South Carolina	112	210	120	94	128	133
Georgia and northeast Florida	4	7	8	6	5	6
Central and southeast Florida	4	5	9	7	4	6
Florida Keys			0		0	0
Vertical lines	70	85	63	58	44	64
Traps	521	617	390	466	362	471
Diving gear	0	1	0	0	0	0
Other gear	6	5	6	3	2	4
Source: Same as first table, this section.						

3.8.1.10The Commercial Fishery for Red Grouper

According to the logbook database, red grouper were landed on an average of 2,725 trips per year in 2003-2007, with landings amounting to 319,000 pounds and an ex-value of $787,000 in 2007 dollars (Table 3-24). Landings of other species on these trips came to 2.7 million pounds, 4

Table 3-24. Annual landings, dockside revenue and fishing effort, trips and boats with landings of at least one pound of red grouper, 2003-2007 (landings in whole weight).						
Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb red grouper	2,840	2,670	2,558	2,522	3,035	2,725
Red grouper, thousand pounds	282	245	202	316	551	319
Red grouper, thousand current $	$614	$493	$444	$773	$1,440	$753
Red grouper, thousand 2007 $	$692	$542	$471	$793	$1,436	$787
Dockside price, current $ / pound	$2.18	$2.01	$2.20	$2.45	$2.62	$2.36
All species, same trips, 1,000 lbs	2,806	2,810	2,862	3,012	3,707	3,039

All species, same trips, 1,000 2007 $	$6,132	$5,994	$6,333	$6,922	$9,121	$6,900
Boat rev, all spp/trips, 1,000 2007$	$12,307	$11,646	$11,709	$11,351	$14,284	$12,259
Boats that landed red grouper	461	420	389	347	391	402
	Number of boats according to landings of red grouper					
1-100 lbs per boat per year	232	217	197	183	182	202
101-1,000 lbs per boat per year	158	137	134	94	114	127
1,001-5,000 lbs per boat per year	59	56	53	51	56	55
5,001-10,000 lbs per boat per year	9	9	5	16	23	12
More than 10,000 lbs per boat / year	3	1	0	3	16	5
Source: Same as first table, this section.						

and brought trip revenue to $6.9 million. Red grouper were landed by an average of 402 boats per year; 329 of them landed 1,000 pounds or less per year and 17 of them landed more than 5,000 pounds. The landings of red grouper accounted for 6.4% of the $12.3 million of the ex-vessel value for all logbook-reported landings of all species on all trips by these 402 boats, including trips that did not land red grouper.Red grouper was the top source of revenue for 486 trips on average in 2003-2007, and a lesser source on 2,239 trips (Table 3-25 and Table 3-26). On the 486 trips for which it was the top source of revenue, red grouper accounted for 136,000 pounds of landings (ex-vessel value of $337,000 in 2007 dollars), and other species accounted for 142,000 pounds. These 486 trips accounted for 43% of the totals for the landings and ex-vessel value for red grouper (Table 3-24). For the 2,239 trips for which it was a lesser source of revenue, landings of red grouper came to 183,000 pounds, compared with 2.6 million pounds for other species.

Table 3-25. Annual landings and dockside revenues on trips with red grouper as the top source of trip revenue, 2003-2007.

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb red grouper	476	388	304	430	830	486
Boats	175	143	117	119	157	142
Red grouper, thousand pounds	105	88	49	128	308	136
Red grouper, thousand 2007 $	$256	$191	$115	$322	$803	$337
Other species, same trips, 1,000 lbs	110	109	55	162	275	142
Other sp, same trips, 1,000 2007 $	$247	$221	$109	$343	$637	$311
Source: Same as first table, this section.						

Table 3-26. Annual landings and dockside revenues on trips with red grouper as a lesser source of trip revenue, 2003-2007.

Item	2003	2004	2005	2006	2007	Average
Trips with at least 1 lb of red grouper	2,364	2,282	2,254	2,092	2,205	2,239
Boats	431	399	368	326	365	378
Red grouper, thousand pounds	176	158	153	188	243	183
Red grouper, thousand 2007 $	$436	$350	$356	$471	$633	$449
Other species, same trips, 1,000 lbs	2,415	2,455	2,605	2,534	2,881	2,578
Other sp, same trips, 1,000 2007 $	$5,193	$5,232	$5,753	$5,786	$7,048	$5,803
Source: Same as first table, this section.						

Table 3-27. Annual landings of red grouper for trips with at least one pound of red grouper, by region and primary gear, 2003-2007, landings in thousand pounds, whole

weight.						
Landing region or primary gear	2003	2004	2005	2006	2007	Average
North Carolina	171	139	120	202	374	201
South Carolina	52	49	41	85	142	74
Georgia and northeast Florida	11	9	9	7	9	9
Central and southeast Florida	10	8	7	7	9	8
Florida Keys	38	41	26	15	16	27
Vertical lines	268	223	191	309	540	306
Diving gear	7	7	7	4	8	7
Other gear	6	15	3	3	3	6
Source: Same as first table, this section.						

3.8.1.11 Imports

Imports have been a major source of seafood supply in the United States, and the domestic snapper grouper market is not an exception. During 2003-2007, imports of fresh and frozen snappers and groupers remained at relatively high levels, averaging 48 million pounds, product weight, a year (Table 3-28). By way of comparison, the average logbook-reported landings of snapper grouper caught in South Atlantic waters were 7.8 million pounds, whole weight. The dominance of imports in the snapper grouper market may be expected to exert limits on the movement of domestic ex-vessel prices resulting from changes in domestic landings of snappers and groupers.

Table 3-28. U.S. imports of snapper and grouper (product weight)

	Fresh snapper & grouper		Frozen snapper & grouper		Total	
Year	Million pounds	Million 2007$	Million pounds	Million 2007$	Million pounds	Million 2007$
2003	34	66	10	16	44	82
2004	33	68	10	15	43	83
2005	36	76	14	22	50	99
2006	35	81	13	24	49	104
2007	38	87	14	26	52	113
Ave	35	76	12	21	48	96

Source: NOAA Fisheries, Foreign trade data base; see footnote, first table in this section.

3.8.2 Economic Description of the Recreational Fishery

Additional information on the recreational snapper grouper fishery is contained in previous amendments [Amendment 13C (SAFMC 2006), Amendment 15A (SAFMC 2007), Amendment 15B (SAFMC 2008), and Amendment 16 (SAFMC 2008)] and is incorporated herein by reference.

The South Atlantic recreational fishery is comprised of the private sector and for-hire sector. The private sector includes anglers fishing from shore (all land-based structures) and

private/rental boats. The for-hire sector is composed of the charterboat and headboat (also called partyboat) sectors. Charterboats generally carry fewer passengers and charge a fee on an entire vessel basis, whereas headboats carry more passengers and payment is per person. The type of service, from a vessel- or passenger-size perspective, affects the flexibility to search different fishing locations during the course of a trip and target different species since larger concentrations of fish are required to satisfy larger groups of anglers.

3.8.2.1 Harvest

Recreational snapper grouper harvest in the South Atlantic has been variable during the period 2003-2008, averaging slightly above 11 million pounds (Table 3-29). On average, the private/shore mode of fishing accounted for the largest harvests at around 7.62 million pounds (MP). Well below this harvest level are those of the charter mode at 1.92 MP and headboat at 1.63 MP. Harvests in each state also fluctuated during the same period (Table 3-30). On average, Florida accounted for most of the snapper grouper harvest in the South Atlantic at around 6.90 MP, followed by North Carolina at 2.21 MP, South Carolina at 1.51 MP, and lastly by Georgia at 0.62 MP.

Table 3-29. Harvest (lbs) of snapper grouper species by mode in the South Atlantic, 2003-2008.

Year	Charterboat[1]	Headboat[2]	Shore and Private/Rental Boat[1]	Total
2003	2,301,303	1,375,688	7,265,886	10,942,877
2004	1,517,384	1,889,010	6,688,596	10,094,990
2005	2,313,468	1,649,210	6,123,049	10,085,727
2006	1,998,902	1,648,405	7,282,328	10,929,635
2007	1,697,350	1,893,031	8,777,570	12,367,950
2008	1,720,683	1,306,996	9,572,258	12,601,945
Average	1,924,848	1,627,057	7,618,281	11,170,521

Source: The Headboat Survey, NOAA Fisheries, SEFSC, Beaufort Lab and MRFSS database, NOAA Fisheries, NMFS, SERO.
[1] Pounds of A and B1 fish estimated from the MRFSS Survey.
[2] The total annual estimate of headboat catch derived from data collected through the NMFS headboat survey.

Table 3-30. Harvest (lbs) of snapper grouper species by state in the South Atlantic, 2003-2008.

Year	Florida	Georgia	South Carolina	North Carolina
2003	7,848,011	770,993	1,042,157	1,281,714
2004	5,970,816	763,609	1,625,212	1,735,353
2005	6,696,212	622,302	852,105	1,915,107
2006	6,474,221	746,982	1,466,944	2,241,489
2007	7,173,255	320,927	2,079,880	3,199,767

Year	Florida	Georgia	South Carolina	North Carolina
2008	7,262,726	490,209	1,980,075	2,866,928
Average	6,904,207	619,170	1,507,729	2,206,726

Source: The Headboat Survey, NOAA Fisheries, SEFSC, Beaufort Lab and MRFSS database, NOAA Fisheries, NMFS, SERO.

There are six snapper grouper species most affected by this amendment. The distribution by mode of these species in the South Atlantic is presented in Table 3-31. With the exception of black grouper, all species showed relatively large harvests over the 2003-2008 period. Black sea bass accounted for the largest harvest at an average of 0.78 MP, followed somewhat closely by gag at an average of 0.62 MP and vermilion snapper at an average of 0.60 MP. Except for vermilion snapper, the shore and private mode of fishing dominated in the harvest of the six major species. Headboats dominated in the harvest of vermilion snapper.

Table 3-32 presents the geographic distribution of the six major species. Florida registered harvests of all six species while Georgia and North Carolina did not show any harvests of black grouper. Georgia registered very low landings of red grouper, whereas South Carolina registered relatively low landings of black grouper. In addition, North Carolina showed relatively low landings of red snapper.

Seasonal distribution of the six major species is presented in Table 3-33, with the monthly headboat data aggregated to match the MRFSS two-month wave. Except for black grouper, the peak harvest period for the subject species was May-June. November-December and July-August were the peak months for black grouper. Troughs occurred in January-February for all species, except black grouper whose trough occurred in March-April.

Table 3-31. South Atlantic average harvest (lbs) of 6 major species in this amendment, by mode, 2003-2008.

Species	Charterboat	Headboat	Shore and Private/Rental Boat	Total
Gag	101,539	64,547	456,471	622,558
Vermilion Snapper	111,521	379,710	105,005	596,237
Red Snapper	109,882	62,432	230,733	403,048
Black Sea Bass	93,691	164,465	525,001	783,157
Black Grouper	2,568	13,556	33,051	49,174
Red Grouper	51,741	45,662	401,412	498,815

Source: The Headboat Survey, NOAA Fisheries, SEFSC, Beaufort Lab and MRFSS database, NOAA Fisheries, NMFS, SERO.

Table 3-32. South Atlantic average harvest (lbs) of 6 major species in this amendment, by state, 2003-2008.

Species	Florida	Georgia	South Carolina	North Carolina
Gag	385,393	14,042	39,089	184,034
Vermilion Snapper	183,484	45,941	231,503	135,308
Red Snapper	339,374	33,621	20,553	9,499
Black Sea Bass	244,222	87,574	245,727	205,635
Black Grouper	49,082	0	93	0
Red Grouper	128,496	50	8,143	362,127

Source: The Headboat Survey, NOAA Fisheries, SEFSC, Beaufort Lab and MRFSS database, NOAA Fisheries, NMFS, SERO.

Table 3-33. South Atlantic average harvest (lbs) of 6 major species in this amendment, by two-month wave, 2003-2008.

Species	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sept-Oct	Nov-Dec
Gag	83,007	84,466	153,795	116,837	88,176	96,278
Vermilion Snapper	28,129	84,106	190,469	159,457	85,613	48,463
Red Snapper	38,262	65,142	115,309	64,838	57,314	62,183
Black Sea Bass	45,768	144,853	220,940	178,973	62,636	129,988
Black Grouper	9,616	3,080	6,800	13,069	3,176	13,433
Red Grouper	17,380	77,091	199,260	105,223	62,412	37,449

Source: The Headboat Survey, NOAA Fisheries, SEFSC, Beaufort Lab and MRFSS database, NOAA Fisheries, NMFS, SERO.

For the period 2003-2008, the six major species in this amendment accounted for about 26 percent of all recreational harvests of snapper grouper in the South Atlantic.

3.8.2.2 Effort

Recreational effort derived from the MRFSS database can be characterized in terms of the number of trips as follows:

1. Target effort - The number of individual angler trips, regardless of duration, where the intercepted angler indicated that the species or a species in the species group was targeted as either the first or the second primary target for the trip. The species did not have to be caught.
2. Catch effort - The number of individual angler trips, regardless of duration and target intent, where the individual species or a species in the species group was caught. The fish did not have to be kept.
3. Total recreational trips - The total estimated number of recreational trips in the South Atlantic, regardless of target intent or catch success.

Estimates of recreational effort for the entire snapper grouper fishery in the South Atlantic are provided in Table 3-34 for trips by mode and Table 3-35 for trips by state. The total column refers to the total number of trips taken by anglers in the South Atlantic snapper grouper fishery and not to the sum of catch and target trips.

In the South Atlantic, total angler trips were highest for the private mode, followed by the shore mode, and then by the charter mode (Table 3-34). In addition, average catch trips were highest on those taken through the private mode and lowest on those through the charter mode. The same is true with target trips: they were highest for private mode and lowest for charter mode. For the charter mode, target trips rose steadily through the years while catch trips peaked in 2007. Shore mode catch trips dropped from 2003 to 2004 but steadily increased thereafter to a peak in 2007; shore mode target trips fell from 2003 to 2005 and increased thereafter to a peak in 2007. For the private mode, both catch and target trips fell in 2004 but increased thereafter, reaching a peak in 2007.

By far, Florida registered the highest total angler trips, followed in order by North Carolina, South Carolina, and Georgia (Table 3-35). The same pattern holds for catch trips but not quite for target trips, with South Carolina registering slightly higher target trips than North Carolina. For Florida, both catch and target trips fell in 2004, subsequently rose in the following years, and peaked in 2007. Georgia catch trips fluctuated between 2003 and 2006 and remained at relatively high levels in the last two years; target trips fell substantially in 2004, remained at low levels until 2007, and rose in 2008 to a level close to that in 2003. South Carolina catch trips fluctuated at relatively low levels between 2003 and 2005 but at higher levels in subsequent years; target trips fell in 2004 but subsequently rose to a peak in 2007. Catch trips in North Carolina steadily rose over the years and peaked in 2007; target trips, on the other hand, fluctuated throughout the period.

Table 3-34. Recreational effort for the snapper grouper fishery in the South Atlantic, in thousand trips, by mode, 2003-2008.

	Charter Mode Trips			Shore Mode Trips			Private Mode Trips		
	Catch	Target	Total	Catch	Target	Total	Catch	Target	Total
2003	117	24	412	982	247	6,493	2,026	687	9,963
2004	135	33	434	851	199	6,754	1,867	496	9,369
2005	127	32	508	924	192	7,009	2,055	517	10,073
2006	109	31	459	1,151	257	8,211	2,520	556	10,749
2007	136	47	501	1,308	297	7,983	3,163	783	13,137
2008	124	48	439	1,002	270	6,317	2,629	772	11,009
Avg.	125	36	459	1,036	244	7,128	2,377	635	10,717

Man-made and beach/bank trips are excluded.
Source: MRFSS database, NOAA Fisheries, NMFS, SERO.

Table 3-35. Recreational effort for the snapper grouper fishery in the South Atlantic, in thousand trips, by state, 2003-2008.

	Florida	Georgia	South Carolina	North Carolina

	Catch	Target	Total	Catch	Target	Total	Catch	Target	Total	Catch	Target	Total
2003	2,716	761	11,444	92	46	971	141	95	2,098	175	56	2,354
2004	2,342	558	10,660	87	26	936	184	85	2,239	239	59	2,721
2005	2,595	607	12,049	96	26	851	143	58	2,083	272	48	2,607
2006	3,126	627	13,115	66	28	790	214	133	2,629	374	56	2,885
2007	3,780	876	15,169	117	26	926	295	140	2,529	416	86	2,996
2008	2,947	841	11,215	226	42	1,282	246	134	2,528	336	73	2,740
Avg.	2,918	712	12,275	114	32	959	204	108	2,351	302	63	2,717

Source: MRFSS database, NOAA Fisheries, NMFS, SERO.

Estimates of the average (2003-2008) recreational effort for the six species most affected by this amendment are provided in Table 3-36 for trips by mode and Table 3-37 for trips by state. The total column refers to the total number of angler trips by mode or by state and not to the sum of catch trips and target trips.

In terms of total angler trips, the shore mode dominated all other modes for trips catching and/or targeting any of the six major species in this amendment (Table 3-36). However, in terms of catch and target trips, the private mode dominated the other two fishing modes in all six species. Catch trips were highest for black sea bass across all modes. Target trips, on the other hand, varied by mode: black sea bass was highest for charter and private modes while red snapper was highest for the shore mode. The charter mode showed no target trips for black and red grouper and the shore mode registered no target trips for vermilion snapper.

There are also observable regional variations in catch and target trips for the six major species (Table 3-37). In both catch and target trips, Florida dominated all other states for most species. An exception is with respect to black seas bass in which South Carolina registered higher target trips than any other states, although Florida still registered the highest catch trips for this species. Georgia showed no catch and target trips for black grouper and red grouper. South Carolina showed no target trips for both black and red grouper. North Carolina registered no catch and target trips for black grouper and no target trips for red snapper.

The seasonal distribution of recreational effort for the six major species in this amendment is presented in Table 3-37 (catch trips) and Table 3-38 (target trips). The peak period for catch trips matched with peak harvests for the following species: gag, red snapper, black grouper, and red grouper. Catch trips for vermilion snapper and black sea bass peaked in July-August, whereas harvests of these species peaked in May-June. For target trips, the match between peak trips and peak harvests occurred with vermilion snapper, black sea bass, black grouper, and red grouper. Peak target trips for gag and red snapper occurred in June-July, whereas peak harvests for these two species occurred in May-June.

Table 3-36. South Atlantic average recreational effort for 6 major species in this amendment, in thousand trips, by mode, 2003-2008.

	Charter Mode Trips			Shore Mode Trips			Private Mode Trips		
Species	Catch	Target	Total	Catch	Target	Total	Catch	Target	Total
Gag Grouper	7.6	1.8	458.8	9.8	1.7	7,127.8	99.7	37.4	10,716.6
Vermilion	27.6	0.8	458.8	0.9	0.0	7,127.8	58.6	2.2	10,716.6

	Charter Mode Trips			Shore Mode Trips			Private Mode Trips		
Species	**Catch**	**Target**	**Total**	**Catch**	**Target**	**Total**	**Catch**	**Target**	**Total**
Snapper									
Red Snapper	14.7	3.1	458.8	1.5	3.5	7,127.8	72.3	43.7	10,716.6
Black Sea Bass	35.0	3.7	458.8	40.6	0.9	7,127.8	490.8	45.7	10,716.6
Black Grouper	0.8	0.0	458.8	0.8	0.1	7,127.8	14.3	3.4	10,716.6
Red Grouper	9.3	0.0	458.8	1.5	0.4	7,127.8	59.1	3.6	10,716.6

Man-made and beach/bank trips are excluded.
Source: MRFSS database, NOAA Fisheries, NMFS, SERO.

Table 3-37. South Atlantic average recreational effort for 6 major species in this amendment, in thousand trips, by state, 2003-2008.

	Florida			Georgia			South Carolina			North Carolina		
Species	**Catch**	**Target**	**Total**	**Catch**	**Target**	**Total**	**Catch**	**Target**	**Total**	**Catch**	**Target**	**Total**
Gag Grouper	93.1	38.6	12,275.4	3.0	0.0	959.5	5.1	1.3	2,351.0	15.8	1.0	2,717.2
Vermilion Snapper	59.2	1.7	12,275.4	6.0	0.0	959.5	10.5	1.1	2,351.0	11.4	0.3	2,717.2
Red Snapper	78.6	46.2	12,275.4	6.2	1.7	959.5	2.7	2.3	2,351.0	1.0	0.0	2,717.2
Black Sea Bass	197.7	12.0	12,275.4	43.4	5.7	959.5	143.9	23.1	2,351.0	181.4	9.6	2,717.2
Black Grouper	15.7	3.6	12,275.4	0.0	0.0	959.5	0.2	0.0	2,351.0	0.0	0.0	2,717.2
Red Grouper	52.6	3.5	12,275.4	0.0	0.0	959.5	0.8	0.0	2,351.0	16.4	0.4	2,717.2

Man-made and beach/bank trips are excluded.
Source: MRFSS database, NOAA Fisheries, NMFS, SERO.

Table 3-38. South Atlantic average catch trips (all modes) for the 6 major species in this amendment, by two-month wave, 2003-2008.

Species	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sept-Oct	Nov-Dec
Gag	15.3	15.8	19.5	17.6	24.1	24.9
Vermilion Snapper	8.7	15.1	19.5	22.6	12.5	8.7
Red Snapper	9.5	15.7	18.8	17.9	13.1	13.6
Black Sea Bass	27.2	70.4	138.1	148.1	103.0	79.7
Black Grouper	2.5	2.0	3.0	2.9	1.9	3.6
Red Grouper	10.3	10.7	17.3	11.1	8.3	12.3

Source: MRFSS database, NOAA Fisheries, NMFS, SERO.

Table 3-39. South Atlantic average target trips (all modes) for the 6 major species in this amendment, by two-month wave, 2003-2008.

Species	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sept-Oct	Nov-Dec
Gag	6.5	8.4	7.3	8.9	3.4	6.3
Vermilion Snapper	0.7	0.6	0.9	0	0.4	0.4
Red Snapper	4.0	10.3	10.2	12.0	6.7	7.1
Black Sea Bass	3.0	11.8	12.5	8.6	6.0	8.3
Black Grouper	0.5	0.5	0.8	0.7	0.3	0.8
Red Grouper	0.5	0.4	1.1	0.6	0.4	0.9

Source: MRFSS database, NOAA Fisheries, NMFS, SERO.

Similar analysis of recreational effort is not possible for the headboat sector since data are not collected at the angler level. Estimates of effort in the headboat sector are provided in terms of angler days, or the number of standardized 12-hour fishing days that account for the different half-, three-quarter-, and full-day fishing trips by headboats. Despite the inability to associate headboat effort with specific species, the stationary bottom nature of headboat fishing, as opposed to trolling, suggests that most headboat trips and, hence, angler days, are snapper grouper trips by intent, though not necessarily successful.

The state-by-state distribution of headboat angler days is presented in Table 3-40. Due to very low headboat angler days for Georgia, entries for Georgia are combined with those of Florida. For the period 2003-2008, total headboat angler days fluctuated around the mean of 230,878 days. On average, Florida accounted for the largest number of angler days (157,764), or about 68 percent of all headboat angler days. Nevertheless, the numbers for South Carolina (47,524 days) and North Carolina (25,591 days) are far from being negligible.

The seasonal distribution of headboat angler days is presented in Table 3-41. The peak for angler days consistently occurred in July-August each year. The troughs occurred in the last two months of the year, except for 2004 and 2008 when troughs occurred in September-October.

Table 3-40. South Atlantic headboat angler days, 2003-2008.

	Florida	South Carolina	North Carolina	Total
2003	145,011	36,556	22,998	204,565
2004	173,701	50,461	27,255	251,417
2005	171,078	34,036	31,573	236,687
2006	175,522	56,074	25,736	257,332
2007	157,150	60,729	29,002	246,881
2008	124,119	47,287	16,982	188,388
Average	157,764	47,524	25,591	230,878

Source: The Headboat Survey, NOAA Fisheries, SEFSC, Beaufort Lab.

Table 3-41. South Atlantic headboat angler days, by two-month wave, 2003-2008.

	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sept-Oct	

						Nov-Dec
2003	21,805	36,363	48,210	59,982	22,431	15,774
2004	27,593	45,468	59,144	70,141	22,811	26,260
2005	27,672	41,799	54,892	70,369	21,390	20,565
2006	27,432	48,572	60,525	73,413	29,344	18,046
2007	24,285	41,464	57,268	75,900	27,029	20,935
2008	21,587	36,634	49,223	51,635	13,768	15,541
Average	25,062	41,717	54,877	66,907	22,796	19,520

Source: The Headboat Survey, NOAA Fisheries, SEFSC, Beaufort Lab.

3.8.2.3 Permits

For-hire vessels in the South Atlantic are required to have a snapper grouper for-hire permit to fish for or possess snapper grouper species in the EEZ. The number of permitted vessels for the period 2003-2008 is provided in Table 3-44. This sector operates as an open access fishery and not all permitted vessels are necessarily active in the fishery. Some vessel owners have been known to purchase open access permits as insurance for uncertainties in the fisheries in which they currently operate.

The number of for-hire permits issued in the South Atlantic snapper grouper fishery steadily increased over the years, from 1,477 permits in 2003 to 1,811 permits in 2008. Most of the increases would likely be for strictly for-hire business, since permits issued for vessels operating as for-hire and commercial entities remained about flat from 2005 to 2006, fell in 2007, and increased in 2008. The majority of snapper grouper for-hire permitted vessels were home-ported in Florida; a good number of vessels were also home-ported in North Carolina and South Carolina. Interestingly, there were several vessels with homeports in states other than those within the South Atlantic Council's area of jurisdiction. Most of the vessels with both for-hire and commercial permits were home-ported in the South Atlantic Council's area of jurisdiction.

The for-hire permit does not distinguish between whether the vessel operates as a charterboat or headboat. Based on a 1997 survey, Holland *et al.* (1999) estimated that a total of 1,080 charter vessels and 96 headboats supplied for-hire services in all South Atlantic fisheries during 1997.

Table 3-42. South Atlantic snapper grouper for-hire permit holders by home port state, 2003-2008.

	Number of vessels issued for-hire vessel permits							**Number of vessels with both a for-hire permit and a commercial snapper grouper permit**						
Home Port State	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**Avg.**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**Avg.**
Florida	957	1,084	1,119	1,108	1,140	1,125	**1,115**	148	151	148	151	122	128	**141**
North Carolina	206	232	254	284	315	342	**272**	45	42	43	46	40	43	**43**

	Number of vessels issued for-hire vessel permits							Number of vessels with both a for-hire permit and a commercial snapper grouper permit						
South Carolina	122	108	121	119	129	140	**123**	34	33	33	34	24	25	**31**
Georgia	36	27	33	33	30	27	**31**	4	2	2	2	3	4	**3**
Virginia	5	13	10	10	8	18	**11**		4	3	2		0	**2**
Other States	69	48	51	62	69	85	**64**	8	3	5	3	2	3	**4**
Gulf States	82	82	79	65	63	74	**74**							
Total	**1,477**	**1,594**	**1,667**	**1,681**	**1,754**	**1,811**	**1,690**	**239**	**235**	**234**	**238**	**191**	**203**	**224**

Source: Southeast Permits Database, NOAA Fisheries, SERO.

3.8.2.4 Economic Value, Expenditures, and Economic Impacts

Participation, effort, and harvest are indicators of the value of saltwater recreational fishing. However, a more specific indicator of value is the satisfaction that anglers experience over and above their costs of fishing. The monetary value of this satisfaction is referred to as consumer surplus. The value or benefit derived from the recreational experience is dependent on several quality determinants, which include fish size, catch success rate, and the number of fish kept. These variables help determine the value of a fishing trip and influence total demand for recreational fishing trips.

Estimates of the economic value of a day of saltwater recreational fishing in the South Atlantic indicate that the mean value of access per marine recreational fishing trip is $109.31 for the South Atlantic (Haab *et al.* 2001). While this estimate is not specific to snapper grouper fishing trips, it may shed light on the magnitude of an angler's willingness to pay for this type of recreational experience.

Willingness to pay for an incremental increase in catch and keep rates per trip was also estimated to be $3.01 for bottom fish species by Haab *et al.* (2001). Whitehead *et al.* (2001) estimated the marginal willingness to pay to avoid a one fish red snapper bag limit decrease to be $1.06 to $2.20. Finally, Haab *et al.* (2001) provided a compensating variation (the amount of money a person would have to receive to be no worse off after a reduction of the bag limit) estimate of $2.49 per fish when calculated across all private boat anglers that targeted snapper grouper species in the South Atlantic.

In their study of the North Carolina for-hire fishery, Dumas et al. (2009) estimated several measures of consumer surplus for anglers fishing through the for-hire mode. Anglers were distinguished as to whether fishing was their primary or secondary purpose for taking the trip to the coasts. An additional snapper grouper caught and kept would generate consumer surplus of $93.51 per trip for primary purpose anglers and $60.79 per trip for secondary purpose anglers. Consumer surplus per site per trip for primary purpose anglers ranged from $4.88 to $27.03 in

charter trips taken in Federal waters, or from $0.35 to $9.55 in charter trips taken in state waters. The corresponding range of values for secondary purpose anglers were $0.24 to $16.62 for charter trips in Federal waters, or $0.12 to $16.54 for charter trips in state waters. On headboat trips in both state and Federal waters, consumer surplus per site per trip ranged from $0.59 to $4.12 for primary purpose anglers and from $0.48 to $4.76 for secondary purpose anglers. Consumer surplus trip for the opportunity to take a for-hire fishing trip was estimated at $624.02 per angler per trip on charterboats and $101.64 per anger per trip on headboats.

In addition to the above economic values, there are estimates of the economic value of a red snapper and a red snapper trip provided in (NOAA 2008). Although these values are derived for the Gulf of Mexico recreational fishery, they can be used as proxy values for the South Atlantic fishery. It is noted, however, that red snapper is a significantly more important recreational target fishery in the Gulf of Mexico than in the South Atlantic. As a result, the estimates of economic value may overstate the true values for the South Atlantic. The estimated CS to a recreational angler of one red snapper is $6.04, while the estimated CS of a red snapper fishing trip is $53.53. These values were used to estimate the impacts of the red snapper interim rule in the South Atlantic.

Most recently, NOAA Fisheries Service Southeast Science Center (NMFS 2009) developed estimates of consumer surplus per angler trip based on various studies and data in the last ten years (see **Appendix N**). These estimates were culled from various studies – Haab et al. (2009), Dumas et al. (2009), and NOAA SEFSC SSRG (2009). The values/ranges of consumer surplus estimates are (in 2009 dollars) $112 to $128 for red snapper, $123 to $128 for grouper, $11 for other snappers, and $80 for snapper grouper. These values are deemed directly applicable in assessing the changes in consumer surplus due to management measures in Amendment 17A.

While anglers receive economic value as measured by the consumer surplus associated with fishing, for-hire businesses receive value from the services they provide. Producer surplus (PS) is the measure of the economic value these operations receive. PS is the difference between the revenue a business receives for a good or service, such as a charter or headboat trip, and the cost the business incurs to provide that good or service. Estimates of the PS associated with for-hire trips are not available. However, proxy values in the form of net operating revenues are also provided in NMFS (2008). These values are not PS estimates because they are not net of crew costs and returns to the owner. The estimated net operating revenues per angler trip for the for-hire sector are $162 for a charterboat trip and $78 for a headboat trip.

The NOAA Fisheries Service Southeast Science Center recently provided estimates of charterboat and headboat net operating revenues for various areas in the Southeast (NMFS 2009). These estimates were culled from several studies – Liese et al. (2009), Dumas et al. (2009), Holland et al. (1999), and Sutton et al. (1999). Estimates of net operating revenue per angler trip (2009 dollars) on representative charter trips are $135 for east Florida, $146 for Louisiana through east Florida, $156 for northeast Florida, and $128 for North Carolina. For charter trips into the EEZ only, net operating revenues are $141 in east Florida and $148 in northeast Florida. For full day and overnight trips only, net operating revenues are $160 in North Carolina and $155 in central and south North Carolina. Net operating revenues per angler trip are lower for headboats than for charterboats. Net operating revenue estimates for a

representative headboat trip are $48 in the Gulf of Mexico, $63 in North Carolina, and $68 in central and south North Carolina. For full day and overnight headboat trips, net operating revenues are $74 in North Carolina and $77 in central and south North Carolina.

These valuation estimates should not be confused with angler expenditures or economic activity (impacts) associated with these expenditures. While expenditures for a specific good or service may represent a proxy or lower bound of value (a person would not logically pay more for something than it was worth to them), they do not represent the net value (benefits minus cost), nor the change in value associated with a change in the fishing experience.

Estimates of the economic impacts of the recreational snapper grouper fishery were derived using average output (sales) and job (FTE) impact coefficients for recreational angling across all fisheries (species), as derived by an economic add-on to the MRFSS, and described and utilized in USDOC (2009). Estimates of the average expenditures by recreational anglers are provided in USDOC (2009) and are incorporated herein by reference. Estimates of the average snapper grouper effort (2003-2007) and associated economic impacts (2007 dollars) are provided in Table 3-43. Snapper grouper target trips were selected as the measure of snapper grouper effort. More trips catch snapper grouper than target snapper grouper, however, as described in Tables 3-34 and 3-35. Estimates of the economic impacts associated with snapper grouper catch trips can be calculated based on the ratio of catch trips to target trips because the average output impact and jobs per trip cannot be differentiated by trip intent. For example, if the number of catch trips were three times the number of target trips for a particular state and mode, the estimate of the associated output or jobs impacts would equal three times the estimate associated with target trips. The total 2007 output (sales) impacts across all modes and states for trips which targeted snapper grouper was approximately $43.3 million, the value added impact was approximately $25.3 million, and the economic activity associated with these trips supported an estimated 467 FTE jobs. The contributions by private/rental mode anglers were the greatest, accounting for approximately half of the total impacts. It should be noted that output impacts and value added impacts are not additive.

Table 3-43. Summary of snapper grouper target trips (2003-2007 average) and associated economic impacts (2007 dollars). Output and value added impacts are not additive.

	North Carolina	South Carolina	Georgia	East Florida	Total
	Shore Mode				
Target Trips	22,713	12,046	6,650	210,735	252,144
Output Impact	$3,620,977	$1,093,668	$100,261	$5,810,261	$10,625,167
Value Added Impact	$2,016,356	$608,981	$60,119	$3,373,175	$6,058,631
Jobs	44	13	1	62	120
	Private/Rental Mode				
Target Trips	58,883	85,387	22,275	402,804	569,349
Output Impact	$3,209,442	$3,726,440	$337,692	$14,698,955	$21,972,529
Value Added Impact	$1,809,705	$2,174,328	$204,838	$8,783,407	$12,972,278
Jobs	35	42	3	155	234
	Charter Mode				
Target Trips	1,493	3,068	1,543	24,665	30,769
Output Impact	$556,467	$966,706	$91,719	$9,041,651	$10,656,542

	North Carolina	South Carolina	Georgia	East Florida	Total
Value Added Impact	$312,290	$546,149	$53,530	$5,323,074	$6,235,044
Jobs	7	12	1	93	113
	All Modes				
Target Trips	83,089	100,501	30,468	638,204	852,262
Output Impact	$7,386,885	$5,786,815	$529,671	$29,550,867	$43,254,238
Value Added Impact	$4,138,351	$3,329,458	$318,488	$17,479,656	$25,265,953
Jobs	85	68	5	309	467

Source: effort data from the MRFSS, economic impact results calculated by NMFS SERO using the model developed for USDOC (2009).

As noted in the previous paragraph, the values provided in Table 3-47 reflect only effort derived from the MRFSS. Because the headboat sector in the Southeast is not covered in the MRFSS, the results in Table 3-43 do not include estimates of the economic impacts by headboat anglers. Estimates of headboat effort are available, however, from the NMFS Headboat Survey and are provided in Tables 3-42 and 3-41. Species target information, however, is not collected in the Headboat Survey, which prevents the generation of estimates of the number of headboat target trips for individual species. It is assumed for the purpose of this assessment, though, that while some headboat anglers may not care what species they catch, all headboat anglers expect to catch snapper grouper due to the bottom fishing-nature of headboat angling. As a result, using total headboat effort as a proxy for snapper grouper target effort is not expected to be a significant issue for estimating the economic impacts associated with snapper grouper trips in the headboat sector.

Estimates of the economic impacts associated with headboat snapper grouper effort are provided in Table 3-44. Aside from the issue of possibly using too high a measure of target effort, it should be noted that the estimates of economic impacts are expected to be substantially higher than actual impacts because they were generated using the average impact values associated with charter trips. Because the headboat sector is not included in the MRFSS in the South Atlantic, appropriate estimates of the economic impacts per headboat trip in South Atlantic states were not generated in the development of USDOC (2009) and are not available. Estimates of the impacts of charter trips are expected to be substantially greater than those of headboat trips. The difference in fee scale for charter trips compared to headboat trips, where charter trip is rented on a boat basis whereas anglers pay per person for headboat trips, may be the primary determinant in the difference, but other factors, such as different rates of tourist versus local clientele, may also contribute. The headboat (party boat) sector is included in the MRFSS in the mid-Atlantic (and New England) states and the estimated output (sales) impact per trip for charter and party boats combined in the mid-Atlantic states ranges from approximately $140 to $180 (2007 dollars), whereas the output (sales) impact per charter trip across all South Atlantic states is estimated to exceed $300. Further, the mid-Atlantic values may exceed actual values for just headboat (partyboat) trips because they incorporate charter trips as well in their total. Rather than use an alternative value from outside the region, this analysis simply uses the higher South Atlantic charter value and notes that actual impacts could be substantially less than the estimated value.

Table 3-44. Summary of snapper grouper headboat trips (2003-2007 average) and associated economic impacts (2007 dollars). Note: these estimated economic impact values may substantially exceed actual values because they are based on average trip values from charter trips. Output and value added impacts are not additive.

	North Carolina	South Carolina	Georgia+Florida	Total
Trips	27,312	47,571	164,492	239,375
Output Impact	$10,179,650	$14,989,306	$60,299,176	$85,468,133
Value Added Impact	$5,712,840	$8,468,342	$35,499,819	$49,681,001
Jobs	130	191	620	941

Source: effort data from the NMFS Headboat Survey, economic impact results calculated by NMFS SERO using the model developed for USDOC (2009).

As seen in Table 3-36, among the major snapper grouper species, black sea bass, red snapper, and gag have been subject to the most recreational target effort, on average, from 2003-2007. The economic impact contributions of these species are included in the information in Table 3-44. Individually, the economic impacts associated with target trips for black sea bass are estimated to be approximately $3 million (2007 dollars) in output (sales) impacts, approximately $1.7 million in value added impacts, and the economic activity associated with trips for these species is estimated to support 35 FTE jobs (based on the average annual number of black sea bass target trips, 2003-2007; tabular results not shown). It should be noted that because these results are embedded in the results for the entire snapper grouper fishery, they are not additive to the totals in Table 3-43. Across all states, private/rental mode target trips for black sea bass accounted for the largest portion of these impacts, approximately $1.9 million in output (sales) impacts, approximately $1.1 million in value added impacts, and 21 FTE jobs, and across all modes South Carolina led with approximately $1.8 million in output (sales) impacts, approximately $1.0 million in valued added impacts, and 22 FTE jobs. The comparable values for red snapper target trips are approximately $2.3 million (output/sales impacts), $1.3 million (value added), and 24 FTE trips total, led by the private/rental mode sector contributing approximately $1.3 million and $800,000 in output (sales) and value added impacts, respectively, and 14 FTE jobs; and Florida, accounting for approximately $2 million and $1.2 million in output (sales) and value added impacts, respectively, and 21 of the total 24 FTE jobs. Finally, the comparable numbers for gag target trips are approximately $2 million in output (sales) impacts, approximately $1.2 million in value added impacts, and the economic activity associated with this species supports 20 FTE jobs. The private/rental boat mode again contributed the largest portion of these impacts, approximately $1.2 million and $700,000 in output (sales) and value added impacts, respectively, and 13 FTE jobs, and most of the activity occurred in Florida, accounting for approximately $1.9 million and $1.1 million in output (sales) and value added impacts, respectively, and accounted for 19 of the total 20 FTE jobs associated with this species.

For the reasons discussed above on the economic impacts of snapper grouper trips, estimates of the economic impacts of headboat target trips for individual snapper grouper species cannot be produced with available data.

3.8.3 Social and Cultural Environment

A more detailed description of the social and cultural environment of the snapper grouper fishery is contained in Amendment 13C (SAFMC 2006) and is incorporated herein by reference. The following sections summarize key information relevant to this action. Key communities were identified primarily based on permit and employment activity. These data were obtained from the U.S. Bureau of the Census and from state and federal permitting agencies.

Permit trends are hard to determine, since several factors may affect how many vessels are homeported in certain communities, including vessel mobility, shifting stock locations, and resettlement of fishermen due to coastal development. Nevertheless, although vessel location shifts occur, static geographical representations help determine where impacts may be felt.

Data from the US Census Bureau must be used with some caution. Census data is collected every ten years and may not reflect shifting community demographics. Businesses routinely start up and fail or move and the census data collection cycle may fail to capture key changes. Further, census estimates do not include seasonal visitors and tourists, or those that live less than half the year in a surveyed area. Many of the latter group may work as seasonal employees and not be counted. Census data also misses some types of labor, such as day laborers, undocumented crew members, or family members that help with bookkeeping responsibilities.

Permit requirements for the commercial snapper grouper fishery were established in 1998 by Amendment 8 (SAFMC 1997). This amendment created a limited entry system for the fishery and established two types of permits based on the historic landings associated with a particular permit. Those who could demonstrate a certain amount of landings over a certain time period received permits that did not limit the number of pounds of snapper grouper that could be landed from federal waters (hereafter referred to as “unlimited commercial permits”). These permits were transferable. Vessels with verified landings, but did not meet the threshold were issued permits that allowed them to land 225 pounds of snapper grouper species from Federal waters each trip (hereafter referred to as “limited commercial permits”). These permits were not transferable. New entry into the fishery required the purchase of two unlimited permits from existing permit holders for exchange for a new permit. This “two for one” system was intended to gradually decrease the number of permits in the fishery. These restrictions only applied to the commercial snapper grouper permit.

Impacts on fishing communities from coastal development, rising property taxes, decreasing access to waterfront due to increasing privatization of public resources, rising cost of dockage and fuel, lack of maintenance of waterways and ocean passages, competition with imported fish, and other less tangible (often political) factors have combined to put all these communities and their associated fishing sectors under great stress.

While studies on the general identification of fishing communities have been undertaken in the past few years, little social or cultural investigation into the nature of the snapper grouper fishery itself has occurred. A socioeconomic study by Waters *et al.* (1997) covered the general characteristics of the fishery in the South Atlantic, but those data are now almost 10 years old and do not capture important changes in the fishery. Cheuvront and Neal (2004) conducted

survey work of the North Carolina commercial snapper grouper fishery south of Cape Hatteras, but did not include ethnographic examination of communities dependent upon fishing.

To help fill information gaps, members of the South Atlantic Council's Snapper Grouper Advisory Panel, Council members, Advisory Panel members, and representatives from the angling public identified communities they believed would be most impacted by the management measures proposed in Amendment 13C on the species addressed by this amendment. Details of their designation of particular communities, and the factors considered in this designation, can be found in Amendment 13C (SAFMC 2006).

Because so many communities in the South Atlantic benefit from snapper grouper fishing, the following discussion focuses on "indicator communities," defined as communities thought to be most heavily impacted by snapper grouper regulations.

3.8.3.1 North Carolina

Figure 3-14. North Carolina communities with substantial fishing activity, as identified by South Atlantic Advisory Panels.

3.8.3.1.1 Statewide

Overview

Of the four states in the South Atlantic region, North Carolina (Figure 3-14) is often recognized as possessing the most "intact" commercial fishing industry; that is, it is more robust in terms of viable fishing communities and fishing industry activity than the other three states. The state offers a wide variety of fishing opportunities, including sound fishing, trolling for tuna, bottom fishing, and shrimping. Perhaps because of the wide variety of fishing opportunities, fishermen have been better able to weather regulations and coastal development pressures, adjusting their annual fishing patterns as times have changed.

Commercial Fishing

There has been a steady decline in the number of federal commercial snapper grouper permits North Carolina since 1999, with 194 unlimited commercial permits in 1999, but only 139 in 2004. Limited permits similarly declined from 36 to16.

State license sale and use statistics for all types of licenses also indicate an overall decrease since 1994. While the overall number of state licenses to sell any species of fish or shellfish increased from 6,781 in 1994 to 9,712 in 2001/2002, the number of license holders actually reporting sales decreased from 6,710 in 1994/1995 to 5,509 in 2001/2002 (SAFMC 2006).

North Carolina fishermen demographics are detailed in Cheuvront and Neal (2004). Ninety eight percent of surveyed fishermen were white and 58 percent had completed some college or had graduated from college. Of those who chose to answer the question, 27 percent of respondents reported a household income of less than $30,000 per year, and 21 percent made at least $75,000 per year. On average, respondents had been fishing for 18 years, and had lived in their communities for 27 years.

Cheuvront and Neal (2004) also provided an overview of how North Carolina commercial snapper grouper fishermen carry out their fishery. Approximately 65 percent of surveyed fishermen indicated year-round fishing. Gag is the fish most frequently targeted by these fishermen, with 61 percent of fishermen targeting gag at some point in the year, despite the prohibition of commercial sales and limit to the recreational bag limit in March and April, which was extended to January through April in December 2009. Vermilion snapper (36.3 percent) and black sea bass (46 percent) are the next most frequently targeted species. A significant number of fishermen land king mackerel during each month, with over 20 percent of fishermen targeting king mackerel between October and May. During the gag closed season, king mackerel are targeted by about 35 percent of the fishermen. Other snapper/grouper complex species landed by at least 5 percent of the fishermen in any given month were red grouper (39.5 percent), scamp (27.4 percent), snowy grouper (9.7 percent), grunts (14.5 percent), triggerfish (13.7 percent), and golden tilefish (5.6 percent). Non-snapper/grouper complex species landed by at least 5 percent

of the fishermen in any given month included Atlantic croaker, yellowfin tuna, bluefin tuna, dolphin, and shrimp.

By examining the commercial landings data on the snapper grouper complex it is possible to see which communities are involved with the commercial fisheries for these species (Table 3-45). Although rankings can fluctuate from year to year, this can give us a starting point for understanding some of the communities that would be impacted by more restrictive regulations.

Table 3-45. Top commercial cumulative landings for North Carolina for 2003-2007, listed by species, impacted by this amendment. Logbook data, SEFSC 2009.

	Location	Pounds	Location	Pounds	Location	Pounds
Gag	New Hanover County	675,714	Carteret County	640,750	Brunswick County	390,242
Vermillion Snapper	Brunswick County	2,317,534	Carteret County	1,483,802		
Black Sea Bass	Onslow County	2,100,034	Dare County	1,552,624	New Hanover County	1,165,877
Snowy Grouper	Dare County	439,301	Carteret County	387,333	New Hanover County	211,988
Golden tilefish	Brunswick County	117,658	Dare County	13,526		
Red snapper	Carteret County	60,491	Brunswick County	31,007		
Black grouper	Brunswick County	518	Hyde County	406		
Red grouper	Brunswick County	636,262	New Hanover County	602,521	Carteret County	589,856
Warsaw grouper	Onslow County	15				
Speckled hind	Dare County	428	Hyde County	174		

Recreational Fishing

Recreational fishing is well developed in North Carolina and, due to natural geography, is not limited to areas along the coast. Data show that North Carolina is almost on par with east Florida for total recreational fishing participation effort (data not shown; see SAFMC 2006). A brief discussion of public boat ramps and local recreational fishing clubs, as well as sources of information used by these anglers, can be found in SAFMC (2006).

The North Carolina state legislature approved the creation of a state recreational saltwater fishing license in 2004. The license created controversy for both the recreational and commercial sectors, each believing that it will hurt or help their access to marine resources. Possession of the license, subject to exemptions, has been required as of January 1, 2007 (http://www.ncdmf.net/recreational/NCCRFLfaq.htm).

3.8.3.1.2 Hatteras Village, Dare County

A detailed history of this community, from its discovery by Italian explorers in the 16th century to establishment of a National Seashore in 1953, can be found in SAFMC (2006).

Overview

Census data indicate there was not a significant increase in population size in Hatteras Village from 1990 to 2000 (SAFMC 2006). The demographics of the island have shifted, as is evidenced in the decreasing percentage of the population that is actively in the workforce, perhaps reflecting a larger number of retirees in the community, and the increasing proportion of residents with higher education, also reflecting a retired, professional segment of the population. Hatteras Village has also experienced a significant increase in the percent of the population in the farming, fishing, and forestry occupations, from 5.6 percent to 10.8 percent. This may be reflective of the increasing number of persons employed in businesses related to recreational fishing, such as charter boat captains and crew, boat repair and sales, marinas, etc. See SAFMC (2006) for the raw data describing community demographics. Figure 3-15 includes two maps detailing the area.

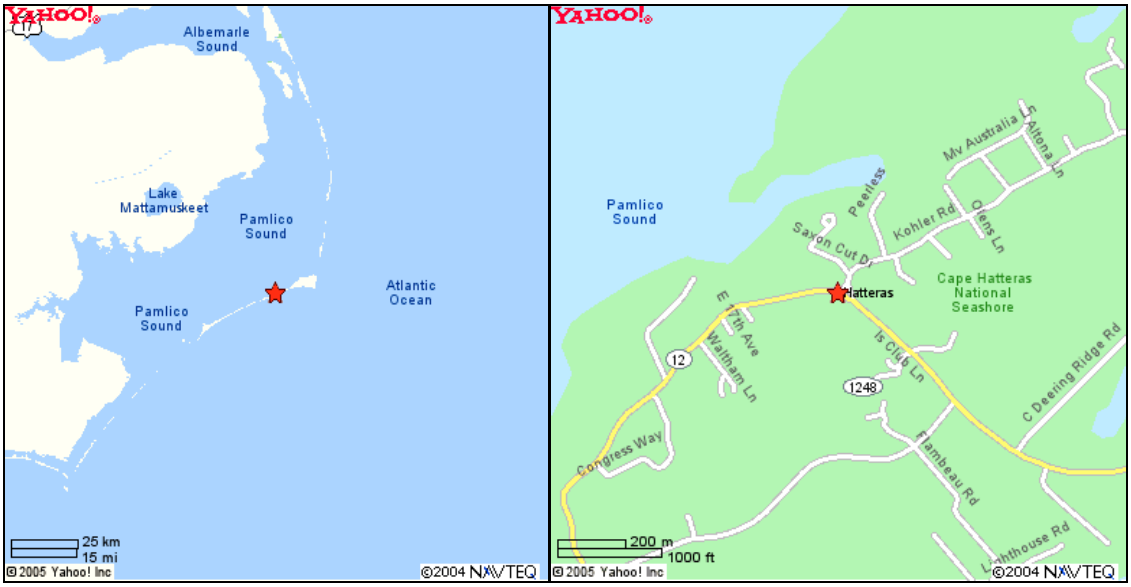


Figure 3-15. Hatteras Island and Village, Outer Banks, North Carolina.
Source: Yahoo Maps, http://www.yahoo.com.

Commercial Fishing

Anecdotal information from Hatteras residents indicates the number of fish houses has decreased as tourism has increased (SAFMC 2006). Residents, however, still promote the fisherman's way of life through festivals and special community designations (SAFMC 2006).

Mirroring the statewide trend, the number of unlimited commercial permits held by residents of Hatteras decreased from 1999 (9 permits) to 2004 (5 permits). The number of limited commercial permits has remained at 3 (SAFMC 2006). Twenty people stated they were employed in fishing related industry in the 1998 census, with 18 of these employed by marinas. A listing of the six marinas and eight bait and tackle stores in Hatteras Village can be found in SAFMC (2006).

Recreational Fishing

Hatteras is host to several prestigious fishing tournaments and is homeport for the island's famous charter fishing fleet. The number of charter/headboat permits held by Hatteras residents has dramatically increased, from one permit in 1999 to 28 in 2004.

3.8.3.1.3 Wanchese, Dare County

A history of this community, and neighboring Manteo, describing its persistence as a small, close-knit community focused on making its living from the sea, can be found in SAFMC (2006).

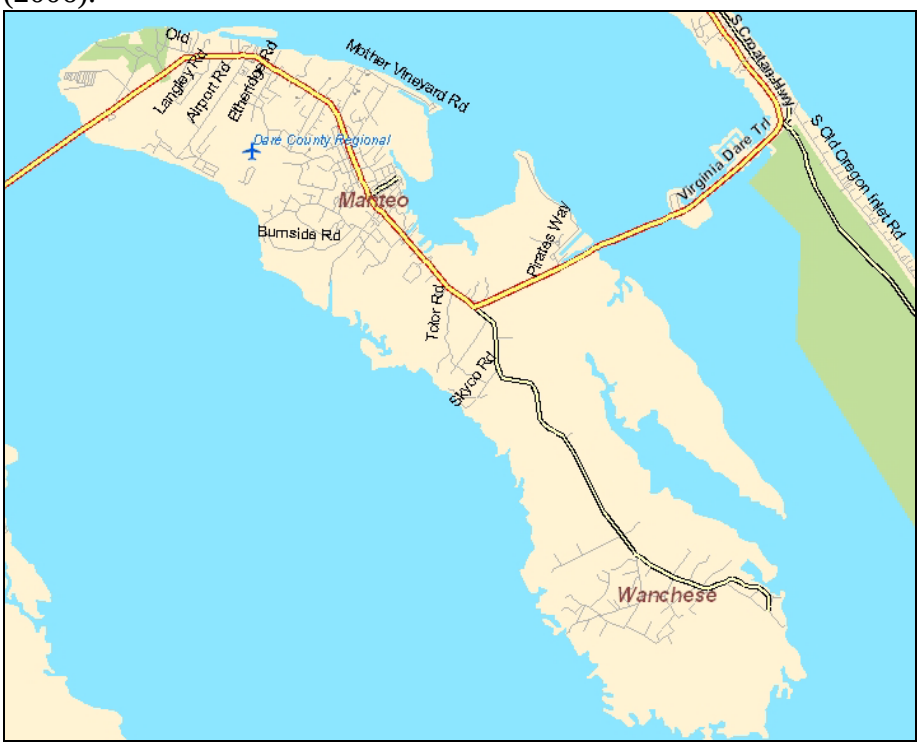


Figure 3-16. Map of Roanoke Island, North Carolina, showing Wanchese and Manteo. Source: Kitner 2005.

Overview

Figure 3-16 provides a map of Roanoke Island, including Wanchese and Manteo. While Wanchese has maintained its identity as a commercial fishing community, it faces continuing pressure from developers in nearby Manteo and other Outer Banks communities. However, the town has recently approved a zoning document that would prevent unplanned growth and would help preserve working waterfronts and residential areas (Kozak 2005). A partial community profile detailing local traffic patterns, businesses, and prominent families can be found in SAFMC (2006).

The largest industrial area in Wanchese is centered on the Wanchese Seafood Industrial Park, built to enhance business opportunities in the seafood and marine trades. Tenants of the park are able to ship products overnight to major domestic and international markets through the airport in Norfolk, Virginia. The park is utilized by fishermen and seafood dealers, as well as boatbuilding and boat maintenance businesses. The park is full of activity and it is common to find large numbers of people, especially Hispanics, working in the marine trade industries.

Census statistics from 2000 show the population of Wanchese is aging and very homogenous, with little ethnic diversity. There has been a slight increase in the Hispanic population since 1990, mirroring most other communities in North Carolina. Education levels have also increased, and the poverty rate has decreased. A higher percentage of people are employed in fishing-related professions in Wanchese than in almost any other community – 10 percent – although even that number has decreased nearly 50 percent since 1990.

Commercial Fishing

Commercial landings and value for Wanchese/Stumpy Point declined from 31.9 million pounds valued at $26.1 million in 2001 to 28.7 million pounds valued at $23.2 million in 2002. In 2001, Wanchese/Stumpy Point was listed as the 28th most prominent United States port based on the value of the product landed, declining to 30th in 2002. While landings increased in 2003, to 33 million pounds, value further declined to $21 million (31st place), with further declines in both poundage (31 million pounds) and value ($20.5 million) in 2004.

Amendment 8, which limited entry into the commercial Snapper Grouper fishery, does not appear to have caused a decrease in the number of commercial permits held by residents of Wanchese (SAFMC 2006). In 1999, seven unlimited commercial permits were held, with eight in 2004. Three limited commercial licenses were held in both 1999 and in 2004.

One hundred twenty residents of Wanchese stated they were employed in fishing related industries in the 1998 census (SAFMC 2006). Sixteen of these were listed as employed in fishing, 56 in fish and seafood, and 40 in boatbuilding.

There were 228 commercial vessels registered and 201 state standard commercial fishing licenses issued in the community in 2002 (SAFMC 2006). Wanchese residents also held 12

dealer licenses. The town is an important unloading port for many vessels transiting to and from the Mid-Atlantic and South Atlantic.

Recreational Fishing

As of 2005, nine boatbuilding businesses were located in Wanchese, building either pleasure yachts, recreational fishing vessels or, less often, commercial fishing vessels. There were two bait and tackle businesses and two marinas in town. All these businesses rely on the fishing industry. Manteo also maintains an active private and for-hire recreational fishing community. From 1999 to 2004, there was an increase in the number of charter/headboat licenses held, from two permits to nine permits. As most of the recreational sector for the region operates out of Manteo and Nags Head, these communities would be more affected by recreational fishing restrictions than would Wanchese.

Figure 3-17. Area of Carteret County, North Carolina, showing Morehead City, Atlantic Beach (at the red star), and Beaufort. Source: Yahoo Maps, http://www.yahoo.com.

3.8.3.1.4 Morehead City, Carteret County

In Carteret County, Morehead City, Beaufort, and Atlantic Beach form a triad of different but complementary communities in close geographic proximity (Figure 3-17). A detailed history of Morehead City, from its founding in the 1840s-1850s to its development as a center for sport and tournament fishing in recent years, can be found in SAFMC (2006).

Overview

Morehead City's economy is currently based on tourism, fishing (commercial and recreational), light industry, government, and other service and professional industries. The town has regained its commercial viability as a modern port terminal, and benefits from its location on the "sound-side" of the Atlantic Beach resort trade. Diving has become an important tourist activity; Rodale's Scuba Diving magazine recently named North Carolina as the best wreck diving destination in North America, and Morehead City as the best overall dive destination. Recreational fishing effort is growing quickly, as new marinas, boat storage areas, boat builders, and marine supply stores open in the city.

Detailed statistics detailing community demographics of Morehead City in 1990 and 2000 can be found in SAFMC (2006). The population of Morehead City increased from 1990 to 2000, with sizable increases in the number of people declaring non-white ethnicities. Median income increased from approximately $20,000 to nearly $29,000 from 1990 to 2000. Median home value nearly doubled, and median rent increased 35 percent. The percentage of those completing high school increased by 10 percent, and there was a seven percent increase in those receiving a bachelor's degree or higher. The poverty level decreased. However, the unemployment rate increased. The occupations of farming, fishing, and forestry employ more than one percent of the population of Morehead City.

Commercial Fishing

In 1998, 100 people were employed in fishing related businesses according to census figures, with 40 employed in marinas and 36 employed in fish and seafood businesses (SAFMC 2006). Over 200 state commercial vessel licenses, 150 state standard commercial fishing licenses, and 14 dealer licenses were issued by the state to residents of Morehead City in 2002. The number of unlimited commercial permits held by Morehead City residents was 15 in 1999 and 14 in 2004, while the three limited commercial permits held in 1999 were no longer held by 2004 (SAFMC 2006). As of 2002, the state had issued 211 commercial vessel registrations, 150 standard commercial licenses, and 14 dealer licenses to Morehead City residents. Residents of Morehead City were primarily employed by marinas (40 percent) and fish and seafood (36 percent), with 16 percent employed in boatbuilding businesses.

A narrative detailing the fishing methods, habits, and observations of a bandit-rig fisherman in Morehead City can be found in SAFMC (2006).

Recreational Fishing

The number of charter/headboat permits held by Morehead City residents nearly doubled, from seven in 1999 to 13 in 2004.

3.8.3.1.5 Beaufort, Carteret County

Beaufort is located on the coast near Cape Lookout, and borders the southern portion of the Outer Banks. Its deep harbor is home to vessels of all sizes, and its marinas are a favorite stop-

over for transient boaters. A detailed history of Beaufort, from its establishment to its importance as a trade center during the 18th and 19th centuries, to its later involvement in the menhaden fishing industry, can be found in SAFMC (2006).

Overview

Tourism, service industries, retail businesses, and construction are important mainstays of the Beaufort area, with many shops and restaurants catering to people from outside the area. Census data show a slight decrease in population size from 1990 to 2000, from 3,808 inhabitants to 3,771, perhaps due to the aging population. Educational attainment rose over the last decade, and the percentage of individuals below the poverty line fell slightly. The percentage of those in the labor force decreased, another possible indication of an aging population. However, the percentage unemployed also decreased. The number of people working in farming, fishing, and forestry remained about the same from 1990 to 2000. According to census business pattern data from 1998, most of the fishing-related employment in Beaufort (total 300 persons) occurs in the boat building industry, which employs 184 residents (SAFMC 2006). Forty-eight people reported working in marinas, while others are employed in fish processing, fish harvesting, and seafood marketing.

Commercial Fishing

There has been a slight decrease in the number of unlimited commercial permits held by residents of Beaufort, from 5 permits in1999 to 4 permits in 2004. In the last two years, the one limited commercial permit held by a Beaufort resident was no longer reported. As of 2002, the state had issued 430 commercial vessel registrations, 294 standard commercial licenses, and 32 dealer licenses to Beaufort residents.

Recreational Fishing

There has been virtually no change in the number of charter/headboat permits, 1 permit in 2003 and 2004, held by residents.

3.8.3.1.6 Atlantic Beach, Carteret County

Atlantic Beach has been a popular resort town since the 1870s. The first bathing pavilion was built on Bogue Banks in 1887. Tourists flocked to the resorts, and ferry service to Atlantic Beach increased. Other resorts and tourism related development occurred over the next century, and the area remains a popular vacation destination (www.atlanticbeach-nc.com/history_part-1.html).

Overview

Atlantic Beach demographic data from 1990 and 2000 show a slight population decline since 1990, as well as decreases in the percent of the population involved in farming, fishing, and

forestry (SAFMC 2006). The median age of the population has increased, perhaps a reflection of the growing number of retirees moving to this area of the coast.

Commercial Fishing

As observed in other areas of North Carolina, since limited access was put into place, the number of commercial permits has decreased from eight unlimited commercial permits in 1999 to four in 2004, and four limited commercial permits to zero (SAFMC 2006). In 1998, 60 residents of Atlantic Beach were employed in fishing related industry, with 93 percent of those employed by the marine sector. In 2002, 56 vessels were registered with the state as commercial fishing vessels, 42 standard commercial fishing licenses were held by Atlantic Beach residents, and there were ten valid dealer licenses issued to community members (SAFMC 2006).

Recreational Fishery

Since 1999, the number of federal charter/headboat permits held by Atlantic City residents has increased from six to 19, though only one permit was recorded in 2002. Of the 60 individuals reporting working in a fishing related industry in 1998, 46 worked in marinas. Two state permits were issued to recreational fishing tournaments to sell licenses in 2002 (SAFMC 2006).

Figure 3-18. General area of Sneads Ferry, North Carolina.
Source: Yahoo Maps, http://www.yahoo.com.

3.8.3.1.7 Sneads Ferry, Onslow County

Sneads Ferry is a historical fishing village located on the New River near the northern tip of Topsail Island (Figure 3-18). The river joins the Intracoastal Waterway at Sneads Ferry, with

easy access to the Atlantic Ocean. A very active commercial fishing community, Sneads Ferry takes in more fish than any other Onslow County port (http://www.cbcoastline.com/areainfo.htm). It also includes Camp Lejeune, a U.S. Marine base. The Sneads Ferry Shrimp Festival has been held annually since 1971. Now grown to a two-day event, the annual shrimp festival is the town's major fund-raiser. From its proceeds, the town established a 14-acre community park and built a 7,200-square foot Shrimp Festival Community Building (www.sneadsferry.com/areahistory/his_sf.htm).

Overview

Census data indicate the population of Sneads Ferry increased by about 10 percent from 1990 to 2000, from 2,031 inhabitants to 2,248. Most new residents were white, and the number of black or African American residents decreased from 159 to 115. Median income increased from about $20,000 to nearly $35,000. Median home value increased from $65,000 to $110,000, but median rent remained about the same. The percentage of those completing high school increased by 10 percent and the percent of residents with at least a Bachelor's degree doubled, from six percent to 12.8 percent. The poverty level decreased from 20.9 percent to 13.5 percent, and the percentage of the population unemployed decreased from 8.3 percent to 2.2 percent. The percentage of residents employed in farming, fishing, and forestry decreased by half from 18.2 percent to 9 percent, while employment in sales and office occupations increased by over 17 percent. It is unclear who may be buying home sites on newly developed land in the town, but the town's current demographics may point to an increase in retirees in Sneads Ferry, as they are better educated, have higher incomes, and are older. The dramatic decline by approximately 50 percent of persons employed in extractive natural resource occupations may be due to increasing job opportunities outside of the community, the changing impacts of regulations, or status of the resources

Commercial Fishing

Sneads Ferry is a small town with little of the large-scale development seen elsewhere on the North Carolina coast. Many houses in the community have fishing vessels docked in front of the house or on the lawn. The white rubber boots worn by commercial fishermen in this community and many other parts of North Carolina are commonly referred to as "Sneads Ferry Sneakers", suggesting the importance of commercial fishing to the area. Most of the fishermen in town are shrimpers and net fishermen who go out daily. There is also a strong contingent of black sea bass pot fishermen resident in the town. The species with the highest consistent landings in the town are black sea bass, button clams, blue crab, flounders, mullet, shrimp, spot, and whiting.

The number of federal charter/headboat permits held by residents increased from six in 1999 to 13 in 2004, while the number of unlimited commercial permits decreased from 22 to 17, and the number of limited commercial permits remained at one (SAFMC 2006). Over 347 commercial fishing vessels were registered with the state in 2002, and 228 residents held state-issued standard commercial fishing licenses. There were also 18 dealer licenses in the community and 169 shellfish licenses. In 1998, 16 persons were employed in fishing related industry, with 75 percent working in fish and seafood.

Recreational Fishing

Recreational fishing in Sneads Ferry is not as prominent an activity as in Morehead City. However, there are a large number of vessels with charter permits for Snapper Grouper homeported there. Little is currently known about recreational fishing out of Sneads Ferry, aside for its advertisement as an important tourist attraction in many websites that discuss the community. At least five marinas cater to recreational fishermen. There are two other marinas at Camp LeJeune Marine Base, just across the Neuse River. Some smaller river and sound fishing charters operating out of the area and one headboat runs from Sneads Ferry. Other than black sea bass, it does not appear that many Snapper Grouper species are frequently caught recreationally from Sneads Ferry.

3.8.3.2 South Carolina

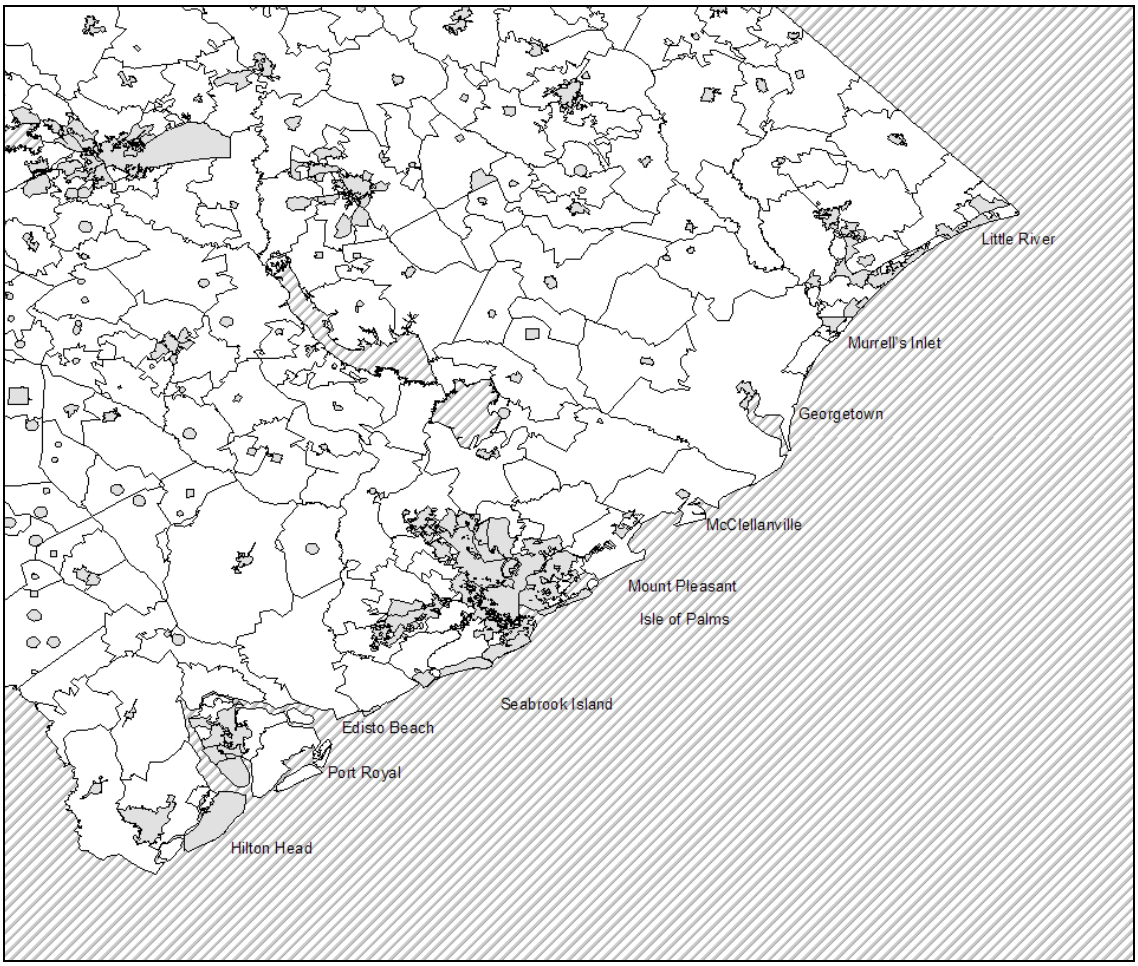


Figure 3-19. South Carolina communities with substantial fishing activity, as identified by South Atlantic Advisory Panels.

3.8.3.2.1 Statewide

Overview

South Carolina communities with substantial fishing activity are less developed than those in North Carolina and, over the past 20 to 30 years, the state has seen much more tourist-oriented development along its coasts than Georgia or North Carolina. In Horry County, the urban area of Myrtle Beach has expanded greatly in the past few decades, and much of the coastal area has been developed as vacation homes, condominiums, and golf courses. The communities most impacted by this development are Little River, Murrells Inlet, Pawleys Island, and Georgetown, although the latter three are located in Georgetown County (Figure 3-19). The same is true of rapid developing Charleston County, and the cities and communities of McClellanville, Mt. Pleasant, Sullivans Island, Wadmalaw and Edisto Islands feel the impact of urban sprawl from the city of Charleston. Further south along the coast, the Hilton Head Island resort development has been the impetus for changing coastal landscapes in the small towns of Port Royal, Beaufort, St. Helena Island, and Bluffton.

For the purpose of this document, only Little River will be singled out as a community with a high concentration of both commercial and recreational fishing, along with other types of coastal oriented leisure pursuits. Other analyses will consider South Carolina as a whole.

Commercial Fishing

While pockets of commercial fishing activities remain in the state, most are being displaced by the development forces and associated changes in demographics. The number of unlimited commercial permits, however, increased from 74 in 1999 to 87 in 2004, while the number of limited commercial permits decreased by 75 percent from 12 to 4 (SAFMC 2006).

Recreational Fishing

Many areas that used to be dedicated to commercial fishing endeavors are now geared towards the private recreational angler and for hire sector. The number of Federal charter/headboat permits held by South Carolina residents increased from 41 in 1999 to 111 in 2004. The majority of saltwater anglers fish for coastal pelagic species such as king mackerel, Spanish mackerel, tunas, dolphins, and billfish. A lesser number focus primarily on bottom fish such as snapper and groupers and often these species are the specialty of the headboats that run out of Little River, Murrells Inlet, and Charleston. There are 35 coastal marinas in the state and 34 sportfishing tournaments (SAFMC 2006).

3.8.3.2.2 Little River, Georgetown County

A history of Little River detailing its settlement in the late 1600s, its popularity as a vacation destination in the 1920s, and the concurrent rise in charter fishing, can be found in SAFMC (2006).

Figure 3-20. Little River, South Carolina, and surrounding area.
Source: Yahoo Maps, http://www.yahoo.com.

Overview

Figure 3-20 shows Little River and the surrounding area. A detailed description of changes in land-use patterns in and near Little River can be found in SAFMC (2006). Nearby Murrells Inlet is gradually transforming into a residential community for Myrtle Beach, and SAFMC (2006) argues this is also true for Little River.

Census data indicate the Little River population more than doubled from 1990 (3,470 persons) to 2000 (7,027 persons) and became more ethnically diverse with more people of American Indian or Alaskan Native, and Hispanic or Latino ethnicities. Median income increased by over 40 percent, from nearly $29,000 to over $40,000. Median home value also increased by over 40 percent, and median rent increased by nearly 35 percent. The percentage of those completing high school and those with a Bachelor's degree remained about the same. The poverty level decreased by nearly two-thirds to 4.7 percent, and the percentage of the population unemployed decreased from 6.6 percent to 3.4 percent. The percentage of residents employed in farming, fishing, and forestry decreased from 3.6 percent to 0.9 percent.

Commercial Fishing

In 1998, 38 residents of Little River were employed in fishing related industry according to the U.S. Census, with 81 percent of those employed by the marina sector. The number of snapper grouper unlimited harvest commercial permits held by community residents remained about the same between 1999 and 2004, from 15 permits to 16 permits, and one resident still held a limited harvest commercial license. Twenty-four Little River residents held state permits, with the most being saltwater licenses (8 permits) or trawler licenses (5 permits) (SAFMC 2006).

The table below (Table 3-46) shows the commercial cumulative landings by pounds and ranking in the South Atlantic for Little River for the years 2005-2207 for major species in this amendment. Little River had little or no landings of black grouper, speckled hind, or warsaw grouper.

Table 3-46 Source: Logbook Data, SEFSC 2009.

Species	Pounds	Ranking in South Atlantic
Gag	409,721	4th
Vermillion Snapper	1,035,287	5th
Black Sea Bass	549,944	6th
Snowy Grouper	289,128	3rd
Golden tilefish	615,373	4th
Red snapper	31,777	11th
Red grouper	21,535	20th

Recreational Fishing

As observed in other coastal communities described herein, the number of charter/headboat permits held by community residents increased from 9 in 1999 to 16 in 2004. Three headboats operated out of Little River, and this part of the for-hire industry has a long and storied past in the community. Recreational fishing, primarily as headboat effort, came about as a way for commercial fishermen to continue fishing in the summer months. A detailed account of how recreational fishing developed in Little River can be found in Burrell (2000). Most of the private recreational fishing effort in this area occurs out of marinas in North Myrtle Beach, Myrtle Beach, and Murrells Inlet.

3.8.3.3 Georgia

3.8.3.3.1 Statewide

Overview

Only one community in Georgia (Townsend) lands a substantial amount of the snapper grouper species addressed in this amendment. Other parts of the state involved in the commercial harvest of seafood are focused on penaeid shrimp, blue crabs, and other finfish such as flounder, shad, croaker, and mullet.

Brunswick, the other community that has a commercial fishing presence, was once a more thriving commercial fishing community but now tourism and other related activities are competing for waterfront in the town. The most commonly harvested species in Brunswick are blue crab and different species of penaeid shrimp. According to the ACCSP website, there have been no snapper grouper species landed in Brunswick in since 2001. Other parts of the state involved in the commercial harvest of seafood are focused on penaeid shrimp, blue crabs, and other finfish such as flounder, shad, croaker, and some mullet.

Commercial Fishing

Unlike the pattern observed in many other areas, the number of unlimited commercial permits and limited commercial permits held by Georgia residents did not decrease from 1999 to 2004, with eight permits and one permit, respectively. In 2002, 947 vessels were registered with the state as commercial fishing vessels, 612 full-time state commercial fishing licenses were held by Georgia residents, and 147 residents held part-time state commercial fishing licenses. Within the commercial fishing fleet, four hundred and eighty two vessels had shrimp gear on board in that year (SAFMC 2006).

The table below (Table 3-48) shows the commercial cumulative landings by pounds and ranking in the South Atlantic for Townsend, Georgia for the years 2003-2207 for major species in this amendment. Townsend had little or no landings of black grouper, speckled hind, golden tilefish, or warsaw grouper.

Table 3-47. Source: Logbook Data, SEFSC 2009.

Species	Pounds	Ranking in South Atlantic
Gag	397,284	5
Vermillion Snapper	1,428,918	4
Black Sea Bass	19,790	14
Snowy grouper	33,619	19
Red snapper	130,553	3
Red grouper	21,797	20

Recreational Fishing

As observed in other areas, the number of charter/headboat permits held by Georgia residents increased markedly from five permits in 1999 to 27 permits in 2004 (SAFMC 2006). Recreational vessels are located at Tybee Island close to Savannah, on the barrier islands off Brunswick, and between Savannah and Brunswick.

3.8.3.3.2 Townsend, McIntosh County

A history of the area, describing its economy before the Civil War, the rise and fall of lumbering, and the building of the railroad, can be found in SAFMC (2006). Townsend is a small, rural community. In 2005, the fish house in this community was relocating inland. It is not known if this relocation was successful and whether that fish house will be handling domestically harvested fish in the future.

Overview

The population of Townsend increased by over 1,000 residents from 2,413 in 1990 to 3,538 in 2000. Although there was a large relative increase in the number of Hispanic or Latino residents, from 2 to 27, most of the new inhabitants were white (1,465 in 1990 and 2,437 in 2000). Median income increased from approximately $23,000 to $35,000. Median home value nearly tripled, from $33,000 in 1990 to $98,100 in 2000, and monthly rent nearly doubled, from $213 to $431. In 1990, 26.9 percent of residents had less than a 9th grade education, but by 2000, that number declined to 11.0 percent. The percentage of those completing high school increased by nearly 15 percent, while the percent receiving a bachelor's degree or higher remained about the same (8.4 percent to 8.9 percent). The percent of the population with an income below the poverty line deceased by four percent, but remained high at 14.6 percent. The percentage of the population unemployed increased from 3.4 percent to 6.5 percent. There has been a sizeable decline in the

percentage of the population employed in manufacturing, from 29.0 percent to 16.2 percent, and the proportion of the population employed in farming, fishing, and industry remained unchanged at approximately three percent.

Commercial Fishing

A comprehensive description of the historic and current fish houses of coastal Georgia and how they operate, focusing on Phillips Seafood of Townsend, can be found in SAFMC (2006). For nearly a decade, only one fish house has consistently handled snapper grouper species. A fish house in Brunswick may have landed these species in the past, but has not reported landings since 2001.

Recreational Fishing

Offshore recreational anglers do not often target or harvest snapper grouper species in Georgia (http://www.st.nmfs.noaa.gov/st1/recreational/overview/overview.html).
Of the snapper grouper species harvested, black sea bass, sheepshead, and vermilion snapper are the most common at five, seven, and two percent, respectively. As of 2004, residents of the Savannah area held 11 charter/headboat permits for snapper grouper, and many of these vessels are docked on Tybee Island. Residents of the area around the city of Brunswick, including Jekyll Island and Sea Island, held four snapper grouper charter/headboat permits. Interestingly, unlike the cities profiled in the Carolinas, the number of federally permitted for-hire vessels has declined dramatically. From 2003 to 2004, the number of snapper grouper permitted for hire vessels declined from 43 to 27 (NMFS 2004). The cause of this decline is unknown.

3.8.3.4 Florida

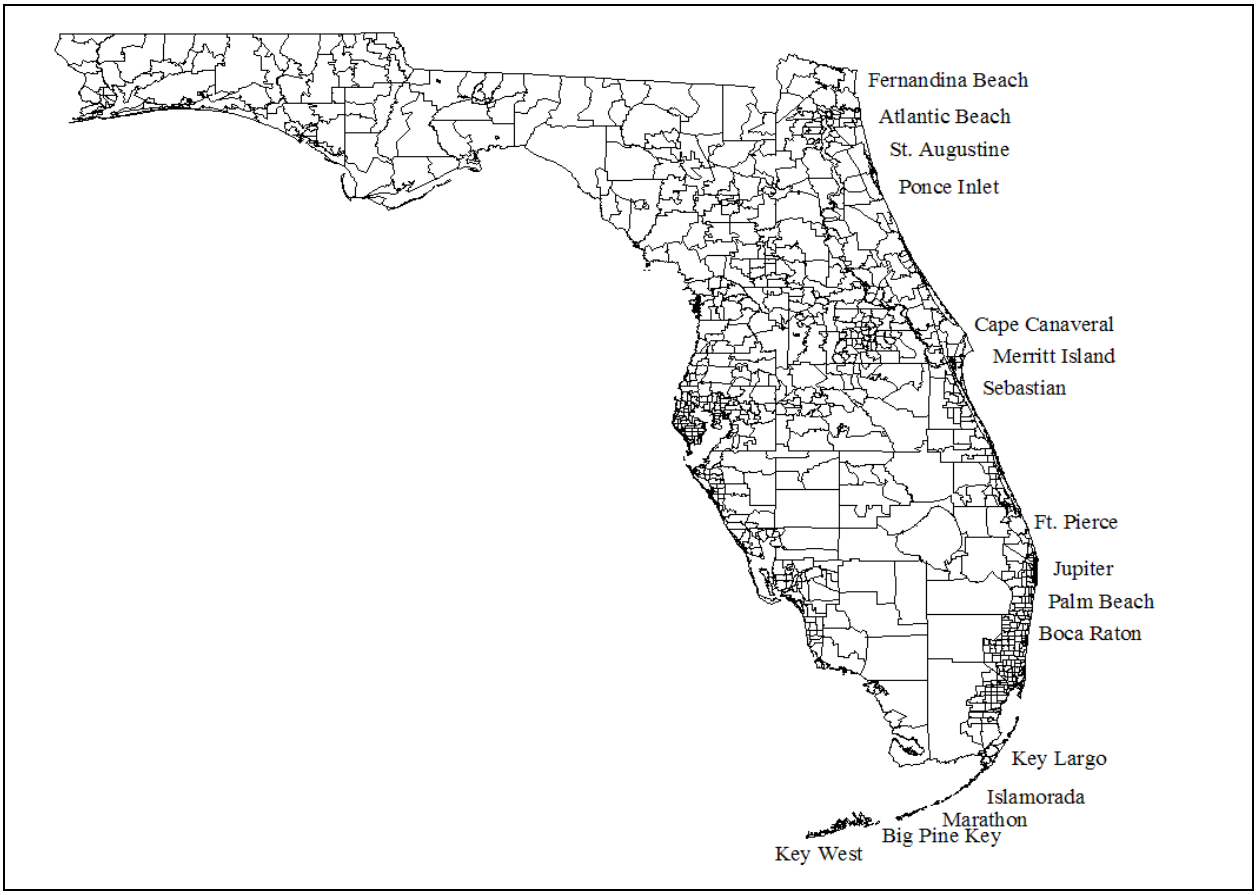


Figure 3-21. Florida communities with substantial fishing activity. Identified by South Atlantic Advisory Panels. Source: Jepson et al. (2005).

3.8.3.4.1 Statewide

Overview

Florida stands apart from other states in the South Atlantic region in fishing behaviors, history, and demographics. Florida has one of the fastest growing populations in the United States, estimated to increase each day by 750 to 1,000 new immigrants. Twenty-five percent of all vacation homes in the United States are located in Florida's coastal counties (Coastal Ocean Resource Economics 2005).

Along with being heavily populated on land, coastal waters off Florida are also heavily used by recreational users of all kinds. This growth of a leisured class occupying coastal areas has led, in part, to conflicts over natural resource access and use-rights. One example of this type of struggle was the conflict over the use of gillnets in state waters. The conflict culminated in a state-wide ban on the use of gillnets, which dealt a resounding blow to many Florida fishermen, ending in the loss of many commercial fishing properties and the displacement of many fishermen. There have also been conflicts between the "environmental community" and

commercial fishermen over the closing of the *Oculina* Bank off of Florida's central coast, and the creation of both the Florida Keys National Marine Sanctuary and the Tortugas Sanctuary, both in the Keys.

The natural geography of Florida also sets it apart from other South Atlantic states, particularly in the area from central Florida through the Keys. The weather is amenable to fishing almost year round, though hurricanes in 2004 were particularly devastating and took a toll on all fisheries in the state, both east and west coast. There was also a cold water event that started near West Palm Beach in 2003, which moved up the east coast causing a substantial decline in snapper grouper fishing that year. The continental shelf is much narrower in Florida than elsewhere in the region, allowing fishermen to access deep waters quickly and return the same day. Finally, the species available to fishermen in southern Florida are somewhat different than further north, with yellowtail snapper, gag and black grouper, and other alternative species such as stone crab, spiny lobster, dolphin, kingfish, and billfish allow a greater variety of both commercial and recreational fishing opportunities. These fisheries are important to many Florida communities identified by the Snapper Grouper Advisory Panel as shown in Figure 3-21.

Commercial Sector

Considering the high population growth rates and emphasis on a tourism economy in Florida, the commercial fishing sector in Florida is still robust in some areas. Although total landings and dollar values of all species landed on the Florida East coast have decreased from 1998 to 2003 (from nearly 30 million pounds worth approximately $44 million to approximately 23 million pounds worth $33 million dollars; SAFMC 2006), there is still a considerable commercial fishing presence in east Florida.

The table below (Table 3-48) shows the cumulative landings for 2005, 2006, 2007 for the top three communities in Florida for each species in this amendment. Although, the rankings can change from year to year, but the cumulative landings over a three year range can suggest which communities are most involved with the commercial harvest of each species.

Table 3-48 Cumulative landings for 2005, 2006, 2007 for the top three communities in Florida for each species in this amendment: Source: Logbook data, SEFSC 2009.

	Location	Pounds	Location	Pounds	Location	Pounds
Gag	Mayport	319,605	Cocoa	265,628	Jacksonville Beach	220,562
Vermillion Snapper	Mayport	833,254	St. Augustine	294,860	Atlantic Beach	124,688
Black Sea Bass	Jacksonville	6,765	Fernandina Beach	6,541	Mayport	5,524
Snowy Grouper	Key West	269,315	Pt. Orange	195,872	Tavernier	114,877
Golden tilefish	Cocoa	1,109,657	Ft. Pierce	933,150	Pt. Orange	678,863
Red snapper	Mayport	173,390	St. Augustine	108,773	Jacksonville Beach	85,461
Black grouper	Key West	951,205	Key Largo	142,787	Summerland Key	142,634
Red grouper	Tavernier	86,261	Summerland Key	75,632	Miami	62,579
Warsaw grouper	Key West	22,781	Cocoa	3,525	Tavernier	2,110
Speckled hind	Key west	77,614	Cocoa	2,528	Tavernier	847

Recreational Sector

While the commercial fishing industry, though still strong, may be in decline, the recreational sector appears to be stable. Excluding the headboat sector, although the number of participants declined in 2004 to approximately 1.9 million from 2.2 million in 2003 and from a high of 2.6 million in 2001, the number of trips taken in 2003 and 2004 remained at approximately 21 million. As may be recalled from Table 3-65, the headboat sector has exhibited a steady decline. In 2004, many homeports hosted at least one vessel holding both federal charter/headboat permits and federal unlimited commercial permits. Key West and Miami stand out, with 35 and 15 such vessels, respectively.

3.8.3.4.2 Cape Canaveral, Brevard County

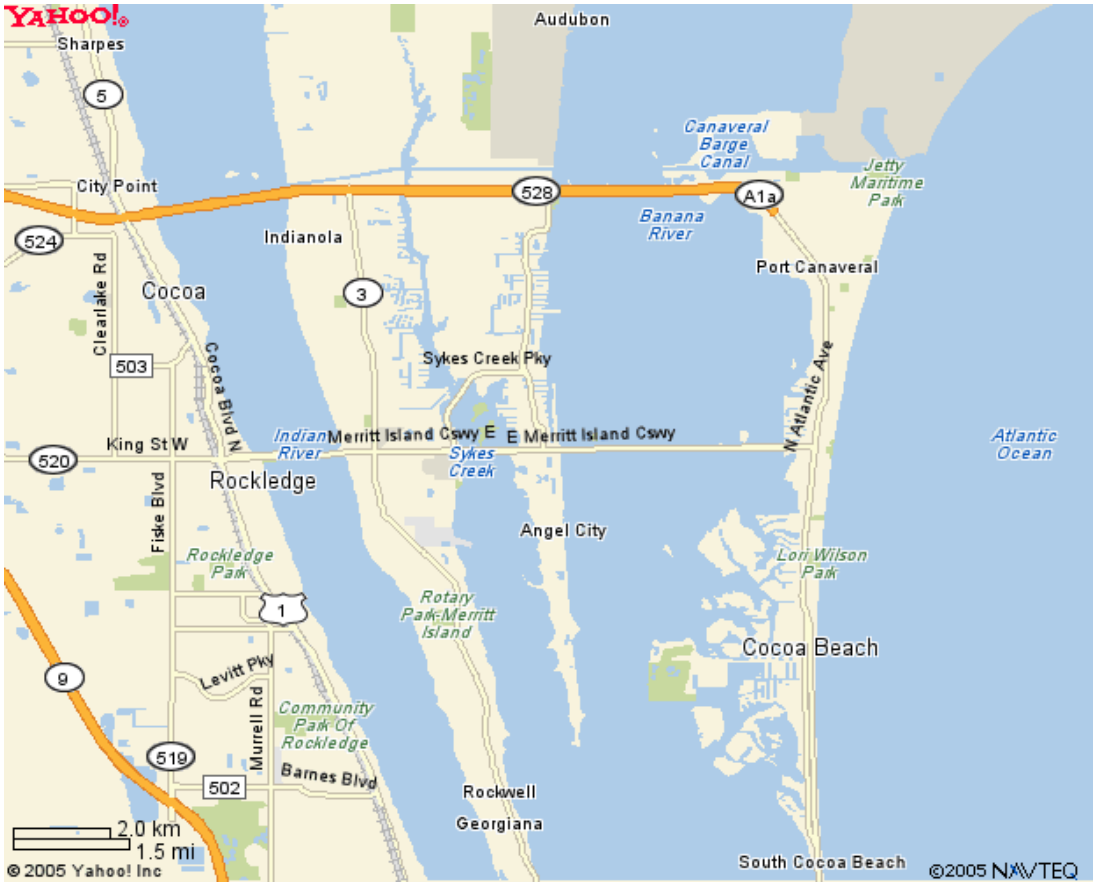


Figure 3-22. Area map of Cape Canaveral, Florida. Source: Yahoo Maps, http://www.yahoo.com.

A detailed history of Cape Canaveral, Florida, from its first habitation 10,000 years ago, its settlement by the United States in the early 1800s, the establishment of the Banana River Naval Air Station in World War II, to NASA's arrival in 1952, can be found in SAFMC (2006). A map of the area is shown in Figure 3-22.

Overview

Cape Canaveral has a fairly homogenous, aging population, with those 65 years and older growing from 16.1 percent of the population to 23.1 percent since 1990. Overall, educational attainment has increased. The number of persons who speak a language other than English at home has increased 2.5 percent, and fewer people have incomes below the poverty line. Unemployment has decreased, but fewer people are in the labor force today than in 1990, perhaps due to an aging population. The percentage of persons in a service occupation has grown from 14.1 percent to 20.4 percent, while there has been a sizeable decline in the percent of

residents employed in forestry, mining, and fishing, from 2.7 percent in 1990 to 0.4 percent in 2000.

Fisheries in central Florida generally operate in two different environments, inshore river or inlet fishing with associated lagoons, which primarily attracts recreational fishing, and offshore areas, where commercial fishing primarily occurs. Popular inshore areas include the Indian, St. Johns, and Banana Rivers and associated lagoons. Commercial exploitation of the rivers and lagoons declined after implementation of the Florida net ban of 1994.

Many commercial fish houses have gone out of business or have shifted to selling imported products to supplement their local supplies. At the same time, the number of businesses possessing Federal dealer permits has increased from about 180 in 1999 to a little over 200 in 2001. There is some industry speculation that the increasing number of dealer permits reflects increased decentralization in the domestic fishing markets and the need to increase profits by self-marketing.

Commercial Fishing

Cape Canaveral draws fishermen from Cocoa/Cocoa Beach, Merritt Island, Melbourne, and Titusville. These fishermen target many snapper grouper species, as well as coastal migratory pelagics such as mackerel, highly migratory species such as sharks and swordfish, and shellfish such as oysters, quahogs, and shrimp. Snowy grouper and tilefish (particularly golden or sand tilefish) landings exceed 10,000 pounds per year. Total commercial landings decreased, however, from 8.9 million pounds to 6.0 million pounds from 1998 to 2004 (SAFMC 2006).

The number of unlimited commercial permits in this area increased from nine in 1999 to 16 in 2004. The number of limited commercial permits fluctuated over this period, but ultimately declined from four permits in 1999 to one in 2004 (SAFMC 2006).

The number of Florida Saltwater Products Licenses issued to residents of Brevard County (where Cape Canaveral is located) decreased from 872 in 1998/99 to 492 in 2004/05 (SAFMC 2006). This license is needed to sell marine species in the state. There have also been declines in license sales for various crustacean fisheries.

Recreational Fishing

In 2004, Brevard county supported 36 bait and tackle stores, with five in Cape Canaveral, and 70 marinas with over 3,000 wet slips, indicating the importance of recreational fishing to the area. Fourteen fishing tournaments consistently occur in the area. Additional details about these businesses and tournaments can be found in SAFMC (2006).

As in other coastal areas of Florida, there is a fairly heavy presence in Brevard County of charter boat businesses, private marinas, and other associated businesses catering to the recreational fishing sector. The number of federally permitted charter/headboat vessels in Cape Canaveral increased from zero to seven from 1999 to 2004. According to Holland *et al.* (1999), there were approximately 32 charter boats and 2 headboats in the Canaveral/Melbourne area. Current

estimates from permit files show at least 38 for-hire vessels with Snapper Grouper permits homeported in Cape Canaveral or Port Canaveral, which includes approximate four headboats. That is likely a low estimate for total the total number of for-hire vessels in the area since it does not include vessels in the nearby Merritt Island and in the Cocoa/Cocoa Beach areas.

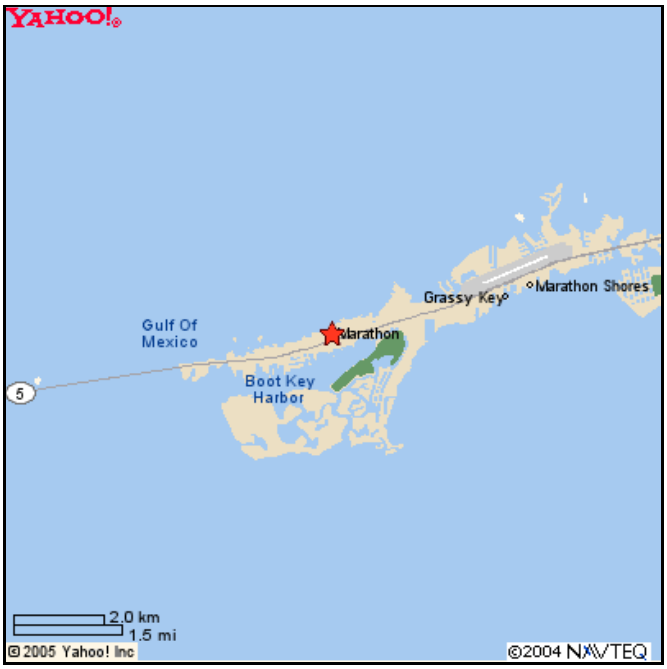


Figure 3-23. Marathon, Florida.
Source: Yahoo Maps, http://www.yahoo.com.

3.8.3.4.3 Marathon, Monroe County

A history of Marathon, detailing its settlement in the 1800s, the rise of industry, the effects of the Great Hurricane of 1935, the rise of tourism, and the importance of commercial fishing, can be found in SAFMC (2005). Figure 3-23 shows a map of Marathon, which lies in Monroe County.

Overview

Census data from 1990 and 2000 show there was an increase in overall population in Marathon from 8,857 in 1990 to 10,255 in 2000. During this period, the Hispanic population more than doubled, increasing from 1,040 to 2,095. This increase accounts for more than two thirds of the total population increase for the area. During this period of time, the median household income increased from approximately $25,000 to over $36,000.

Marathon has maintained a relatively high percentage of the total population, 4.1 percent in 2000, involved in farming, fishing, and forestry, though the percentage has declined from 8.7 percent in 1990. Since there is little commercial farming and forestry occurring in the area, the majority of percentage can be assumed to relate to fishing activities. The percentage of people

that live below the poverty line decreased slightly from 15.1 percent in 1990 to 14.2 percent in 2000.

Commercial Fishing

In 1998, 184 Marathon residents were employed in fishing related industry according to the Census data, with 39 of those in the "fishing" category, 92 employed in "fish and seafood," and 47 employed by marinas (SAFMC 2006). The number of unlimited commercial permits held by community residents decreased from 65 permits to 44 permits between 1999 and 2004. Similarly, the number of limited commercial permits decreased from 43 permits to 31 permits.

Recreational Fishing

While most of the waters around Marathon are open to fishing, some areas have been set aside for eco-tourism and fish-viewing by divers and snorkelers. Sombrero Reef, said to be one of the most beautiful sections of North America's only living coral barrier reef, lies several miles offshore and is protected by the Florida Keys National Marine Sanctuary (http://www.fla-keys.com/marathon).

The importance of recreational boating and fishing to the economy of Marathon is shown by the businesses reliant upon it. As of 2004, there were at least 25 charter boat businesses, two party boat businesses, eight bait and tackle shops, and 27 marinas in the area. The number of vessels holding the Federal charter/headboat permit increased from 16 in 1999 to 30 in 2004. In addition, there were seven fishing tournaments in Marathon. Most tournaments are centered on tarpon fishing. However, there are inshore and offshore fishing tournaments as well. These tournaments begin in February and run through June. Hotels and restaurants fill with participants and charters, guides and bait shops reap the economic benefits of these people coming to the area. These tournaments are positive economic pulses in the local economy, one that thrives on the existence of tourism and recreational fishing.

4 Environmental Impacts

Red Snapper Regulatory Background

The Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (1983) (FMP) imposed minimum size limits on red snapper and five other species to control growth overfishing. Information about growth, age, and mortality was used to form the basis for yield per recruit (YPR) models used in the FMP. According the 1983 Source Document for the FMP, the YPR analysis indicated red snapper were undergoing growth overfishing. At the time, minimum sizes were the preferred method of ending growth overfishing and preventing recruitment overfishing. Implementing a 12 inch total length (TL) minimum size limit was expected to provide an eight percent increase in the yield if recruitment was held constant. It should be noted that at the time, the expected discard survival rate was estimated to be between 60 and 80 percent. Even at the lower end of the discard survivorship range yield was still expected to increase by six percent. Larger size limits were rejected because of potential decreases to inshore availability, and public testimony indicated that all user groups unanimously favored at least a 12 inch TL minimum size limit for red snapper.

Amendment 4 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Amendment 4; SAFMC 1991) implemented management measures to address overfishing of several snapper grouper species including red snapper. Prior the implementation of Amendment 4, NOAA Fisheries Service held an overfishing workshop (February 12-14, 1990) where Dr. Phil Goodyear, a NOAA Fisheries Service population dynamist, presented his work on Gulf of Mexico red snapper. Dr. Goodyear noted the spawning potential ratio (SPR) of 3% for red snapper in the Gulf of Mexico, and the workshop concluded that an SPR of 20% was likely a sufficient target for the Gulf of Mexico red snapper population. Later, the workshop concluded growth parameters and habitat were approximately the same for South Atlantic red snapper as Gulf of Mexico red snapper, and it would be appropriate to apply the same SPR level of 20% to the South Atlantic red snapper stock. Based on proceedings of this workshop, which included SPR recommendations for other snapper grouper species in addition to red snapper, the Council specified 30% SPR as the overfishing level for all species in the snapper grouper management unit except goliath grouper.

During development of Amendment 4, which implemented a 20 inch TL minimum size limit and a 2 red snapper within a 10-fish snapper aggregate bag limit (excluding vermilion snapper), the Plan Development Team (PDT) felt the most appropriate goal for management of red snapper was 40% SPR rather than the 30% SPR value specified by the Council, and the PDT recommended a 21 inch TL size limit for red snapper. However, the Council felt implementing a 20 inch TL minimum size limit would be adequate to reach the goal of 30% SPR. The size limit was expected to produce SPRs of 33% and 40% for the recreational and commercial fisheries, respectively. A provision to closely monitor the red snapper population (for size limit effectiveness) was included in the discussion, as was an allowance to implement larger size limits or additional regulations in the future if needed. At the time, the Council and NOAA Fisheries Service felt a bag limit of 10 snapper, where no more than 2 can be red snapper, would provide additional protection from overfishing, assist in achieving the target level of 30% SPR,

and spread out harvest within the recreational sector. However, it is important to note that at the time these red snapper management measures were implemented, there was no analysis projecting the expected reductions from the combination of size limit and bag limit. Therefore, it was impossible to predict whether or not the combination of size limit and bag limit would achieve the 30% SPR goal. Because of this uncertainty, Amendment 4 specified that the bag limit could be modified as necessary through future framework action.

In 1998, the Comprehensive Amendment Addressing Sustainable Fisheries Act Definitions and Other Required Provisions in Fishery Management Plans of the South Atlantic Region, Amendment 11 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Amendment 11; SAFMC 1998), was implemented. In this amendment, the issue of MSY proxies was addressed. Amendment 11 states that during a meeting of the Snapper Grouper Assessment Group, there was a consensus for the use of 30-40% static SPR as a proxy for F_{MSY} for many snapper grouper species including red snapper where longer lived species would have a F_{MSY} SPR proxy closer to $F_{40\%SPR}$ and moderately long-lived species would have a F_{MSY} proxy closer to $F_{30\%SPR}$. It also stated that for data poor species with a known natural mortality rate (M), such as red snapper, the Council could use M as a proxy for F_{MSY}, and as soon as data are available, an F_{MSY} proxy would be specified. Taking this into account, Amendment 11 specified $F_{30\%SPR}$ as the red snapper proxy for F_{MSY}. At the time, the Council felt management measures being proposed in Amendments 7, 8, and 9 could result in an SPR of 35%, and they concluded those measures were sufficient to rebuild red snapper above the overfished level. Unfortunately the implementation of a limited access fishery, size limit, and bag limit were not enough to end overfishing of the species, and red snapper in the South Atlantic continue to be overfished.

ACL Guidelines

Revisions to the Magnuson-Stevens Act in 2006 require that by 2010, FMPs for fisheries determined by the Secretary to be subject to overfishing must establish a mechanism for specifying annual catch limits (ACLs) at a level that prevents overfishing and does not exceed the recommendations of the respective Council's SSC or other established peer review processes. These FMPs also are required to establish within this timeframe measures to ensure accountability. By 2011, FMPs for all other fisheries, except fisheries for species with annual life cycles, must meet these requirements. Recommended methodologies for specifying ACLs and accountability measures (AMs) are outlined in the final rule implementing National Standard 1 guidelines found in **Appendix K** of this document.

The role of the SSC is very clear. According to the SSC Job Description dated March 2008, the SSC is the Council's primary technical advisory body. The SSC is expected to provide a broad suite of technical recommendation related to all aspects of the Council's management program. Section 101-627(g) of the Magnuson-Stevens Act states: *Each Council shall establish, maintain, and appoint the members of a SSC to assist in the development, collection, evaluation, and peer review of such statistical, biological, economic, social, and other scientific information as is relevant to such Council's development and amendment of any fishery management plan. Each SSC shall provide its Council ongoing scientific advice for fishery management decisions, including recommendations for ABC, preventing overfishing, MSY, and achieving rebuilding*

targets...and other scientific advice. Furthermore, the Reauthorized Magnuson-Stevens Act indicates the Council cannot exceed the fishing level recommendations of its SSC. Although the SSC specifies a level of catch that cannot be exceeded by the Council, it is also tasked with providing the Council with advice on fishery management components, MSY, and other issues. Therefore, while recommendations on MSY, OY, proxies for F_{MSY}, etc. from the SSC are advisory in nature, fishing level recommendations from the Council cannot be exceeded.

NOAA Fisheries Service National Standard 1 guidelines define the following terms:

- Overfishing limit (OFL) means "the annual amount of catch that corresponds to the estimate of MFMT applied to a stock or stock complex's abundance and is expressed in terms of numbers or weight of fish.

- Acceptable biological catch (ABC) means "a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL and should be specified based on the ABC control rule.

- Annual catch limit (ACL) means "the level of annual catch of a stock or stock complex that serves as the basis for invoking accountability measures." Setting the ACL provides an opportunity to divide the total ACL into sector-specific ACLs.

- Annual catch target (ACT) means "an amount of annual catch of a stock or stock complex that is the management target of the fishery. NMFS guidelines indicate that specifying an ACT is optional and up to the discretion of the Council. A stock or stock complex's ACT should usually be less than its ACL and results from the application of the ACT control rule. If sector-ACLs have been established, each one should have a corresponding sector-ACT."

- Accountability measures (AMs) means "management controls that prevent ACLs or sector-ACLs from being exceeded (in-season AMs), where possible, and correct or mitigate overages if they occur."

The SSC provided OFL and ABC recommendations in terms of pounds of fish at their June 2008 meeting but the SSC did not have an ABC control rule to assist them with estimating ABC and indicated that they considered the values to be "interim" until more robust methods for estimating these parameters could be made available. For stock and stock complexes required to have an ABC, NOAA Fisheries Service final National Standard 1 guidelines (**Appendix K**) recommends that each Council should establish an ABC control rule based on scientific advice from its SSC. At their December 2008 SSC meeting, the SSC considered advice from the proposed NS1 guidelines and rescinded all estimates of ABC with the exception of an ABC = 0 for speckled hind and warsaw grouper. Furthermore, the SSC recommended at their December 2008 meeting that the ABC levels for snowy grouper, black sea bass, and red snapper be set consistent with the rebuilding plans for those species until they can be further amended on better scientific information. The SSC met in March and June 2009 to determine ABC control rules for data rich species and will meet in April 2010 to identify protocol for determining ABCs for data poor species, both of which will be included in the Comprehensive ACL Amendment. The SSC produced a document titled "Proposed South Atlantic Council ABC Control Rule Report of the

SAFMC SSC September 2009", which outlines the proposed protocol recommended by the SSC for establishing ABCs for data rich species.

Magnuson-Stevens Act National Standard 1 guidelines includes a section entitled "Exceptions to requirements to prevent overfishing" (§ 600.310(j)(2)(ii)(B)), which is also known as the mixed-stock exception. The Council discussed this provision at its September 2009 meeting. The mixed stock exception allows for limited overfishing of a stock within a species complex if certain criteria are met. In order for the mixed stock exception to be granted the Council must: 1) Justify through analysis that permitting limited overfishing of a particular stock within a species complex will result in long-term net benefits to the nation; 2) that mitigating measures have been considered; and 3) demonstrate that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/configuration, or other technical characteristic in a manner such that no overfishing would occur. Under the exception, fishing-related mortality must be limited to a level that will not lead the stock to fall below its MSST more than 50 percent of the time in the long-term, recognizing that persistent overfishing is expected to cause the affected stock to fall below its B_{MSY} more than 50 percent of the time in the long-term. Furthermore, any stock that drops below its MSST would be subject to the rebuilding requirements of the Magnuson-Stevens Act, which requires that overfishing be ended immediately and that the stock be rebuild to B_{MSY}. The mixed stock exception provides Councils with needed flexibility in terms of the specific mechanisms and measures used to prevent overfishing. However, the final rule implementing the National Standard 1 guidelines (**Appendix K**) is very clear in stating the mixed stock exception may *not* be applied to a species that is overfished. Therefore, the mixed stock exception is not applicable in the case of South Atlantic red snapper, which are overfished and undergoing overfishing.

4.1 Proxy for Maximum Sustainable Yield (MSY) for red snapper

Table 4-1. MSY and MSY proxy alternatives for red snapper.

Alternatives	**Equation**	**F_{MSY}**	**MSY Values (lbs whole weight)**
Alternative 1 (Status Quo)	MSY proxy equals the yield produced by F_{MSY}. $F_{30\%SPR}$ is used as the F_{MSY}.	$F_{30\%SPR}$[1]= 0.148[2]	2,431,000[3]
Alternative 2 (Preferred)	MSY proxy equals the yield produced by F_{MSY} or the F_{MSY} proxy. MSY and $F_{40\%SPR}$ are recommended by the most recent SEDAR/SSC.[4]	$F_{40\%SPR}$= 0.104[2]	2,304,000[5]

[1]Prior to SEDAR 15 (2008), Potts et al. (2001) estimated $F_{30\%SPR}$= 0.40.
[2]Source: Red Snapper Projections V dated March 19, 2009
[3]The value for MSY was not specified in Amendment 11. Based on SEDAR 15 (2008) $F_{30\%SPR}$ = 0.148; yield at $F_{30\%SPR}$ = 2,431,000 lbs whole weight (Table 4.1 from Red Snapper Projections V dated March 19, 2009).
[4]The Review Panel from SEDAR and the SSC recommended a proxy of $F_{40\%SPR}$ for F_{MSY}.
[5]The values for MSY and $F_{40\%\ SPR}$ are defined by Red Snapper Projections V dated March 19, 2009. The range of MSY from sensitivity runs is 559,000 lbs whole weight to 3,927,000 lbs whole weight.

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 NOAA Fisheries Service and represents 1 minus the natural mortality multiplied by the spawning stock biomass at maximum sustainable yield. The value from Red Snapper Projections V dated March 19, 2009 is 16,469,633 lbs whole weight (7,470.5 mt).

4.1.1 Biological Effects

MSY is a reference point used by managers to assess fishery performance over the long term. As a result, redefined management reference points could require regulatory changes in the future as managers monitor the long term performance of the stock with respect to the new reference point. Therefore, these parameter definitions would affect subject stocks and the ecosystem of which they are a part, by influencing decisions about how to maximize and optimize the long-term yield of fisheries under equilibrium conditions and triggering action when stock biomass decreases below a threshold level. Specifying MSY will not impact protected species; however, subsequent regulatory changes implemented to achieve long term performance goals based on MSY could potentially impact protected species. The biological effects of the choice of management reference points are described below.

MSY in **Alternative 1 (Status Quo)** is defined as the yield produced by F_{MSY} where $F_{30\%SPR}$ is used as the F_{MSY} proxy and represents the overfishing level defined in Amendment 11. In **Alternative 1 (Status Quo)**, MSY was not specified in the SFA Amendment 11; however, Table 4.1 from Red Snapper Projections V dated March 19, 2009 provides an estimate of the yield equal to $F_{30\%SPR}$ proxy as 2,431,000 lbs whole weight based on SEDAR 15 (2008). **Alternative 2 (Preferred)** would redefine the MSY proxy of the red snapper stock based on the recommendation of the SEDAR 15 Review Panels and SSC to equal the value associated with the $F_{40\%SPR}$ (2,304,000 lbs whole weight). Therefore, MSY associated with the status quo **Alternative 1 (Status Quo)** is 127,000 lbs whole weight greater than the yield associated with $F_{40\%SPR}$ proxy for F_{MSY} specified in **Alternative 2 (Preferred)**. Using the $F_{40\%SPR}$ proxy for F_{MSY}, sensitivity runs from the SEDAR 15 (2008) assessment indicate MSY ranges from 559,000 lbs whole weight to 3,927,000 lbs whole weight suggesting MSY cannot be reliably estimated.

Table 4-2. Criteria used to determine the overfished and overfishing status of red snapper.

Quantity	Units	$F_{40\%}$ Proxy	$F_{30\%}$ Proxy	Status
F_{MSY}	y−1	0.104	0.148	−
SSB_{MSY}	1000 lb	17,863	13,283	−
D_{MSY}	1000 fish	39	54	−
Recruits at F_{MSY}	1000 fish	693	686	−
Y at 65% F_{MSY}	1000 lb	1984	2257	−
Y at 75% F_{MSY}	1000 lb	2104	2338	−
Y at 85% F_{MSY} Y	1000 lb	2199	2391	−
Y at F_{MSY}	1000 lb	2304	2431	−
MSST	1000 lb	16,470	12,247	−
F_{2006}/ F_{MSY}	–	7.67	5.39	Overfishing
SSB_{2006}/SSB_{MSY}	–	0.02	0.03	−
SSB_{2006}/MSST	–	0.03	0.04	Overfished

Source: Table 4.1 in Red Snapper Projections V dated March 19, 2009.

The Council's SSC discussed whether F30%SPR or F40%SPR should be used as a proxy for FMSY at their December 2008 meeting. The SSC's rationale for this discussion was based on the review workshop for red snapper where the review panel, consisting of individuals from Center for Independent Experts (CIE), stated *"One of the principal difficulties with the SCA model estimate of the stock recruitment parameters is that the steepness estimate appears unrealistically high. In addition, there are no data in the assessment to adequately define the asymptote of the Beverton-Holt function and hence estimates of MSY indicators cannot be considered reliable. It may be preferable, as indicated above, to use the ratio indicators to evaluate stock status or use SPR proxies. The panel suggested that F40% and SSB40% proxies may be used as limit indicators"* (SEDAR 15 2008)." Steepness is a measure of a stock's productivity or ability to produce recruits. In unfished conditions, steepness is the fraction of recruits obtained at spawning stock. If steepness approaches 1 then recruitment is nearly constant over a broad range of spawning stock size, while if steepness is slightly larger than 0.2 then recruitment is proportional to size of the spawning stock. Due to the review panel's concern regarding the high steepness = 0.95 in the base run, the assessment group considered using F40%SPR as a proxy for FMSY, which has an associated steepness equal to 0.68.

However, since the lower steepness value associated with a $F_{40\%SPR}$ proxy differed for F_{MSY} from the base assessment steepness value of 0.95, there was an abrupt change in recruitment estimates between assessment years in the model and recruitment estimates for the projection years. Several alternatives to handle this inconsistency in the projections were provided to the SSC by the assessment group at the December 2008 SSC meeting. These included changing all steepness values in the assessment and projections to 0.68, leaving them both at 0.95, and a hybrid where 0.95 was used for the assessment and 0.68 was used for projections. The SSC chose to keep the estimate of steepness consistent between the model and the projections. The SSC discussed two options for the %SPR proxy for F_{MSY}. Some SSC members argued for following the suggestion from the CIE reviewers (using $F_{40\%SPR}$) and cited literature and examples that showed that $F_{40\%SPR}$ is a more appropriate proxy for F_{MSY}. Other SSC members stated $F_{30\%SPR}$ should be considered because it was approved by the Council for other species (approved by the Council in the Comprehensive SFA Amendment 11) and that its corresponding

steepness value is approximately 0.90, which was close to the estimated valued in the base estimation model. In December 2008, the SSC made a motion, which was approved, recommending that the proxy for F_{MSY} be $F_{40\%SPR}$ with an associated steepness of 0.95. The full Council also voted to use $F_{40\%SPR}$ as the F_{MSY} proxy. The assessment team provided the updated base model (steepness =0.95 in assessment and projections) to produce new projections, MSY estimates, and OY estimates.

Alternative 2 (Preferred) is based on the SSC's recommendation and would specify a MSY proxy equal the yield at $F_{40\%SPR}$ with a steepness of 0.95. MSY for other species assessed through the SEDAR process has been based on the yield at F_{MSY} or the Council's status quo proxy for F_{MSY} ($F_{30\%SPR}$). Therefore, **Alternative 2 (Preferred)** would establish a new proxy for F_{MSY} not previously used, which is more conservative than the status quo proxy of $F_{30\%SPR}$. Furthermore, Amendment 17A is using a tiered approach where OY, rebuilding projections, and management measures are based on decisions made for determining the MSY reference point. The choice of **Alternative 2 (Preferred)**, which uses $F_{40\%SPR}$ as a proxy for F_{MSY} versus $F_{30\%SPR}$ as proxy for F_{MSY} depends on how much risk the Council is willing to take. Rebuilding projections associated with MSY **Alternative 1 (Status Quo)** would indicate the stock could rebuild more quickly and with less restrictive management measures than those associated with **Alternative 2 (Preferred)**. If $F_{30\%SPR}$ is not a proper proxy for F_{MSY}, the Council could have to take corrective actions down the road to rebuild the stock to B_{MSY} within the allowable timeframe. **Alternative 2 (Preferred)**, which uses $F_{40\%SPR}$ as a proxy for F_{MSY} is more conservative and provides greater assurance overfishing would be ended and the stock would rebuild within the specified time. Therefore, the biological benefits of **Alternative 2 (Preferred)** for the red snapper stock would be greater than **Alternative 1 (Status Quo)** because **Alternative 2 (Preferred)** would allow for less harvest and there would be a greater probability overfishing would end and the stock would be rebuilt to SSB_{MSY}. Choice of the F_{MSY} proxy sets the overfishing level and determines the harvest objective. The harvest objective dictates the harvest restrictions needed to manage the fishery to that level. Management measures implemented to achieve the harvest objective set by the F_{MSY} proxy will directly impact the biological environment in the form of reduced fishing effort for red snapper and other closely associated species. However, as explained in **Sections 4.1.2** and **4.1.3**, a choice of a F_{MSY} proxy that is too conservative could have unnecessary negative social and economic effects in terms of more restrictive management measures including larger area closures (**See Section 4.3**).

4.1.2 Economic Effects

Establishing MSY, or its proxy, sets off the basic parameters that condition the determination of OY target and accompanying management measures to achieve the target. In principle, the higher the MSY, the higher would be the expected economic benefits from the fishery so that in the present case, **Alternative 1 (Status Quo)** would be more economically preferred than **Alternative 2**. In practice, additional conditions need to be recognized before applying the aforementioned principle. One such condition is the status of the stock. Red snapper is currently considered severely overfished and undergoing overfishing, thus rebuilding the stock has become an overriding concern. Another condition is the probability of successfully rebuilding the stock and ensuring that, once rebuilt, the stock would not slide back to its prior overfished/overfishing

status. The first condition necessarily implies imposing restrictive management measures in the short-run, and thus sets the economic issue as one involving the balancing of short-term costs and long-term benefits. The second condition determines the expected economic value derivable from the fishery over the long run. These conditions are further discussed below in connection with comparing alternative MSY proxies.

Alternative 1 (Status Quo) provides for $F_{30\%SPR}$ as MSY proxy that would produce MSY value of 2.431 MP while **Alternative 2** provides for $F_{40\%SPR}$ as MSY proxy that would produce MSY value of 2.304 MP. In 2003-2008, the average combined commercial and recreational landings were approximately 474 thousand pounds. This wide gap between current landings and potential landings has at least two implications. First, both MSY proxy definitions would require more stringent management measures to rebuild the red snapper stock. Second, there appears a relatively high likelihood that future benefits from the fishery would outweigh the costs of implementing stringent management measures in the short run.

The economically preferable MSY proxy choice would be one that is expected to result in the highest net economic benefits over time. This choice condition can be rendered more feasible if both the MSY proxy and accompanying regulatory measures are simultaneously considered. At this stage, only the MSY proxy choice is considered, and thus only general discussions of issues can be made. Several scenarios are developed below to aid in the general comparison of MSY proxy alternatives.

Scenario 1: Both MSY proxies have the same rebuilding timeframe, the same stringent management measures during rebuilding period, and the same probability of successfully rebuilding the stock and maintaining it at a sustainable level. Under this scenario, both MSY proxies imply similar costs during the rebuilding period. Since **Alternative 1 (Status Quo)** provides for a higher MSY value, it would allow higher expected future economic benefits, and thus would be the economically preferred alternative.

Scenario 2: Similar to the first scenario, except that the rebuilding timeframe differs between the two MSY proxies. It is likely that **Alternative 1 (Status Quo)** would be associated with shorter rebuilding time frame, so its associated costs would be less than that of **Alternative 2**. With lower costs and higher future benefits, **Alternative 1 (Status Quo)** would be the economically preferred alternative.

Scenario 3: Similar to the first scenario, except that the management measures differ between the two MSY proxies. In all likelihood, the measures under **Alternative 1 (Status Quo)** would be less stringent than those of **Alternative 2**, so its associated costs would be lower. Thus, **Alternative 1 (Status Quo)** would be the economically preferred alternative.

Scenario 4: Similar to the second scenario, except that the management measures differ between the two MSY proxies. Based on conclusions from the first three scenarios, **Alternative 1 (Status Quo)** would be associated with much lower costs and higher future benefits, and thus would the economically preferred alternative.

Scenario 5: Similar to the first scenario, except that the probability of successfully rebuilding the stock and maintaining it at a sustainable level differs between the two MSY proxies. There is good reason to believe that such probability would be higher under **Alternative 2**. If the difference in such probabilities were sufficiently high, **Alternative 2** may turn out to be the economically preferred alternative. A highly simplified example showing **Alternative 2** being economically preferable to **Alternative 1 (Status Quo)**, may aid in clarifying this difference in probabilities. Suppose each MSY level (2.431 MP for **Alternative 1 (Status Quo)** and 2.304 MP for **Alternative 2**) is worth $1 a pound and the associated probabilities of successfully maintaining the stock at a sustainable level are 55% for **Alternative 1 (Status Quo)** (implying 45% failure) and 60% for **Alternative 2** (implying 40% failure). The expected payoff for **Alternative 1 (Status Quo)** would be $0.24 million (55% of $2.431 million minus 45% of $2.431 million). On the other hand, the expected payoff for **Alternative 2** would be $0.46 million (60% of $2.304 million minus 40% of $2.304 million). What is notable in this example is that a relatively small difference in the success rate between the two alternatives may lead to relatively substantial difference in net benefit payoff. In this simplified example, the cost of failure is assumed equal to the forgone benefits. The actual cost may contain other important items than forgone benefits, just as the actual benefit may contain other important items than the value assigned to the potential take from the fishery.

Scenario 6: Similar to the fourth scenario, except that the probability of successfully rebuilding the stock and maintaining it at a sustainable level differs between the two MSY proxies. Based on the conclusions for the fourth scenario, **Alternative 1 (Status Quo)** would be associated with lower costs but based on conclusions for the fifth scenario, **Alternative 2** would likely be associated with higher benefits. Depending on the magnitudes of costs and benefits involved, the economically preferred alternative could be either of the two.

From the various scenarios described above, **Alternative 1 (Status Quo)** may be the economically preferred alternative unless there is a material difference in the success rate of attaining and maintaining MSY between the two alternatives, or the success rate of **Alternative 1 (Status Quo)** is very low. A very low success rate would likely bring about more stringent regulations over time as well as lengthen the actual rebuilding period. This may result in higher costs over time. **Alternative 2** would provide an MSY proxy that is biologically more conservative than **Alternative 1**. In general, this would imply that **Alternative 2** would have a high probability of maintaining the stock at a more sustainable level.

Non-use values, like existence and bequest values, increase with increasing long-term economic benefits. **Alternative 2** would offer a higher level of non-use value if the probability of success in reaching MSY and sustaining it at that level were relatively higher than that of **Alternative 1 (Status Quo)**.

4.1.3 Social Effects

General Concepts

Defining the MSY for a species or species complex provides a management target and threshold needed to assess the status and performance of the fishery. Evaluation of the resource relative to the benchmark may trigger harvest and/or effort controls. In the current case of red snapper, the specification of the MSY or MSY proxy directly determines the immediate level of harvest reduction necessary to achieve the biological goals of stock management. This harvest reduction, as well as any other necessary harvest or effort controls, would be expected to directly impact the individual fishermen, social networks, and associated industries related to the fishery, inducing short-term adverse economic impacts until less restrictive management is appropriate and implemented.

Designation of MSY, therefore, establishes the foundation for regulatory change, as is the case in this amendment, or in subsequent management actions in response to future developments in the resource and fishery. Regulatory change in general may cause some of the following direct and indirect consequences: increased crew and dockside worker turnover; displacement of social or ethnic groups; increased time at sea (potentially leading to increased risk to the safety of life and boat); decreased access to recreational activities; demographic population shifts (such as the entrance of migrant populations replacing or filling a market niche); displacement and relocation as a result of loss of income and the ability to afford to live in coastal communities; increased efforts from outside the fishery to affect fishing related activities; changes in household income source; business failure; declining health and social welfare; and increased gentrification of coastal communities as fishery participants are unable to generate sufficient revenue to remain in the community. Ultimately, one of the most important measurements of social change is how these social forces, in coordination with the strategies developed and employed by local fishermen to adapt to the regulatory changes, combine to affect the local fishery, fishing activities and methods, and the community as a whole.

Additional indirect effect of fisheries management on the fishing community and related sectors is increased confusion and differences between the community and the management sector in levels of understanding and agreement on what is best for both the resource and the community. The fact that “the science” can cause relatively large reductions in harvests is particularly disconcerting to many fishermen and concerned stakeholders. This can induce enforcement problems associated with compliance with current and future regulations, which can lead to inefficient use of resources, ineffectual regulations, and failure to meet management targets, which may precipitate additional restrictions.

Data deficiencies and the complexity of the task make it difficult to determine biological reference points with certainty. The selection of a particular benchmark has potential implications on resource users depending upon its accuracy relative to the true value. Selection of an unnecessarily conservative value (alternative), while protecting the resource, may subject the human environment to overly restrictive regulations, foregone social and economic benefits, and increase the risk to the economic viability of participants in the fishery and associated industries. Alternatively, the erroneous choice of an insufficiently conservative alternative could

result in short term increased social and economic benefits to fishery participants, but lead to reduced stock sustainability, ultimately leading to more severe social and economic disruptions than would occur under more conservative management. In general, however, assuming the "correct" level of conservatism is selected (i.e., the level selected is appropriate to the biological and environmental parameters of the resource, including the nature of the fishery that harvests the resource), the higher the MSY, the greater the allowable, long-term sustainable yield for the fishery and, hence, the greater the long-term social benefits of a sustainable and healthy resource.

Comparison of Fishery with Management Reference Point Alternatives

Although the average annual harvests (all sectors) of red snapper from 2003-2007, approximately 442,000 pounds (whole weight), were substantially less than the MSY values of both **Alternative 1 (Status Quo)** and **Alternative 2 (Preferred)**, red snapper has been determined to be overfished and undergoing overfishing and, as a result, the necessary management measures to address this condition are expected to result in the complete closure of the red snapper fishery (see Sections 4.2.2 and 4.3), as well as additional prohibitions on the harvest of other species to reduce the bycatch mortality of red snapper caught while these other species are targeted. The expected social effects of these alternative prohibitions are discussed in **Sections 4.2.2** and **4.3**. Although **Alternative 1 (Status Quo)** would allow larger annual harvests, upon resource recovery, than **Alternative 2 (Preferred),** the larger harvests would result in a smaller standing stock biomass that would, potentially, be more vulnerable to an unexpected shock and have a greater likelihood of requiring management correction, with attendant adverse social and economic effects. **Alternative 2 (Preferred)**, conversely, would be expected to result in a larger recovered biomass, which would be expected to be better capable of withstanding external shocks, but this augmented protection would come at the expense of smaller equilibrium allowable annual harvests. However, recorded harvests have never approached the MSY of either alternative and the difference in values is less than 130,000 pounds, or approximately five percent. As a result, little to no differential social effects would be expected between the two alternatives from the simple perspective of allowable harvest. Nevertheless, the long-term trade-off between the two alternatives equate to consideration of whether the social and economic benefits of the reduced likelihood of corrective action under **Alternative 2 (Preferred)** exceed the social and economic costs of the reduced harvests that could be allowed relative to **Alternative 1 (Status Quo)**. Further, it should be emphasized that, because of the current status of the resource and necessary closure required under the rebuilding plan, short term social and economic losses are expected under both MSY alternatives.

It should also be noted that in addition to resulting in different levels of sustained biomass (and different sustainable harvest levels), the underlying rule or equation that determines the resultant MSY for each alternative is materially different and, as a result, would be expected to result in different social and economic effects. As discussed in **Section 4.1.1**, rebuilding projections associated with **Alternative 1 (Status Quo)** indicate the stock could rebuild more quickly and with less restrictive management than under **Alternative 2 (Preferred)**. Less restrictive management measures and quicker recovery, where possible, would be expected to result in greater short-term social and economic benefits relative to more restrictive management measures and slower recovery. However, as discussed in the previous paragraph, these short-

term benefits must be considered in tandem with the long-term costs of a potentially less stable or sustainable resource, due to the lower standing biomass that would result.

4.1.4 Administrative Effects

The potential administrative effects of these alternatives differ in that the scenarios defined by each vary in terms of the implied restrictions required to constrain the fisheries to the respective benchmarks. Defining a MSY proxy establishes a harvest goal for the fishery, for which management measures will be implemented. Those management measures would directly impact the administrative environment according to the level of MSY proxy conservativeness and subsequent restrictions placed on the fishery to constrain harvest levels.

4.1.5 Council's Conclusions

The Council has chosen **Alternative 2** as its preferred alternative. **Alternative 2 (Preferred)** is based on the SSC's recommendation and would specify an MSY proxy equal the yield at $F_{40\%SPR}$ with a steepness of 0.95. $F_{40\%SPR}$ is a more conservative proxy for F_{MSY} than used previously. The choice of **Alternative 2 (Preferred)**, which uses $F_{40\%SPR}$ as a proxy for F_{MSY} versus $F_{30\%SPR}$ (**Alternative 1 (Status Quo)**) as proxy for F_{MSY} depends on how much risk the Council is willing to take. The more conservative proxy chosen by the Council assumes less risk than that associated with the status quo F_{MSY} proxy. If the Council had chosen $F_{30\%SPR}$ and it was not a proper proxy for F_{MSY}, the Council could have to take corrective actions in the future to rebuild the stock to B_{MSY} within the allowable timeframe. **Alternative 2 (Preferred)**, which uses $F_{40\%SPR}$ as a proxy for F_{MSY} is more conservative and provides greater assurance overfishing would be ended and the stock would rebuild within the specified time. Therefore, the biological benefits of **Alternative 2 (Preferred)** for the red snapper stock would be greater than **Alternative 1 (Status Quo)** because **Alternative 2 (Preferred)** would allow for less harvest and there would be a greater probability overfishing would end and the stock would be rebuilt to SSB_{MSY}.

4.2 Red Snapper Rebuilding Plan

4.2.1 Rebuilding Schedule

Alternative 1 (Status Quo). There currently is not a rebuilding plan for red snapper. Snapper Grouper Amendment 4 (regulations effective January 1992) implemented a 15-year rebuilding plan beginning in 1991 which expired in 2006.

Alternative 2. Define a rebuilding schedule as the shortest possible period to rebuild in the absence of fishing mortality (T_{MIN}). This would equal 15 years with the rebuilding time period ending in 2024, 2010 is Year 1.

Alternative 3. Define a rebuilding schedule as the mid-point between the shortest possible and maximum recommended period to rebuild. This would equal 25 years with the rebuilding time period ending in 2034, 2010 is Year 1.

Alternative 4 (Preferred). Define a rebuilding schedule as the maximum recommended period to rebuild if T_{MIN} > 10 years. The maximum recommended period equals T_{MIN} + one generation time. This would equal 35 years with the rebuilding time period ending in 2044 (SEDAR 15 2008 was the source of the generation time). 2010 is Year 1.

4.2.1.1 Biological Impacts

Choice of a rebuilding schedule has a direct effect on the biological, ecological, and physical environment by determining the length of time over which rebuilding efforts can be extended. Shorter schedules generally require overfished stocks be provided a greater amount of (and more immediate) relief from fishing pressure. Conversely, longer schedules generally allow overfished stocks to be harvested at higher rates as they rebuild. Extending the rebuilding period beyond the shortest possible timeframe increases the risk that environmental or other factors could prevent the stocks from recovering. As a result, the biological/ecological benefits of a shorter schedule are generally greater than those of the intermediate schedule and the benefits of the intermediate schedule are generally greater than those of the maximum recommended schedule. However, the overall effects of all the actions alternatives are expected to be beneficial because each defines a plan for rebuilding the overfished stock. Regardless of the approach chosen (shorter versus longer schedules), specifying a rebuilding schedule for red snapper will have no immediate effect on species protected under the Endangered Species Act and the Marine Mammal Protection Act because these parameters are not used in determining immediate harvest objectives.

Alternative 1 (Status Quo) would not establish a rebuilding schedule for red snapper. The most recent stock assessment indicates red snapper are overfished and undergoing overfishing. If a stock is overfished, the Magnuson-Stevens Act requires a rebuilding schedule be specified as part of a rebuilding plan. Without a rebuilding schedule, the stock would rebuild to SSB_{MSY} if overfishing was ended; however, there would be no timeframe to specify when the stock would be rebuilt. Therefore, even though this alternative would rebuild the stock, it would not meet the requirements of the Magnuson-Stevens Act. This alternative would also maintain the existing levels of risk to ESA-listed species.

Alternatives 2-4 (Preferred) would establish schedules that would achieve rebuilding within time periods allowed by the Magnuson-Stevens Act, and therefore, **Alternatives 2-4 (Preferred)** would be expected to benefit the ecological environment by restoring a crucial link within the trophic structure of the ecosystem. Results of SEDAR 15 (2007) determined that in the absence of any fishing mortality, the fishery could rebuild to SSB_{MSY} in 15 years (T_{MIN}) **(Alternative 2).** In addition, SEDAR 15 (2007) estimated the mean generation time for red snapper as 20 years (Red Snapper Projections V, March 19, 2009 **Appendix F**). Therefore, the longest allowable time, (T_{MIN} + one generation time), to rebuild would be 35 years **(Alternative 4 (Preferred)).** **Alternative 3** represents a midpoint between **Alternatives 2** and **4 (Preferred).** Theoretically, **Alternative 2** would rebuild the stock to SSB_{MSY} more quickly than other alternatives because it

would require managers to impose the strictest harvest controls. Shorter rebuilding schedules generally provide the greatest biological benefit by allowing biomass, the age and size structure, sex ratio, and community structure to be restored to healthy levels at the fastest possible rate. However, red snapper is part of a multispecies fishery. Even if retention of red snapper is prohibited, red snapper would still be caught since they have temporal and spatial coincidence with other species fishermen target.

If no harvest of red snapper was allowed, as specified in **Alternative 2**, it is still expected that red snapper would be caught and released by commercial and recreational fishermen targeting species that co-occur with red snapper. As release mortality is estimated to be 40% and 90% for the recreational and commercial sectors, respectively (SEDAR 15 2008), the schedule specified in **Alternative 2** is not considered to be realistic since it would require a prohibition on all harvest of snapper grouper species to ensure there was no incidental catch, which would unnecessarily incur greater negative socioeconomic impacts compared to **Alternative 3** or **Alternative 4 (Preferred)**. **Alternative 2** would not be expected to rebuild the stock to B_{MSY} because it is not possible to eliminate incidental mortality on one species in a multi-species complex, without prohibiting fishermen from targeting all associated species wherever the prohibited species occurs. The Council is considering alternatives in **Section 4.3** that would rebuild red snapper within the timeframe specified in **Alternative 3**. However, the probability that the stock could rebuild within the 25 year timeframe is less certain than longer timeframes due to uncertainties associated with assessment and effectiveness of proposed management measures. The Council is considering substantial measures to reduce fishing mortality in this amendment including area closures for all snapper grouper species, which could reduce bycatch of red snapper and co-occurring species but it is unknown to what extent bycatch of red snapper would be reduced. Consequently, the Council has chosen **Alternative 4** as the preferred rebuilding strategy alternative.

4.2.1.2 Economic Effects

Like the MSY proxy, a rebuilding schedule would condition the type of management measures to be implemented to achieve the rebuilding objectives. The actual management measures implemented during the rebuilding period would have direct economic effects on fishing participants. **Alternative 1 (Status Quo)**, which does not provide a rebuilding schedule, would potentially imply the least restrictive regulations. While this alternative may rebuild the red snapper stock, it does not comply with Magnuson-Stevens Act requirements on rebuilding schedule, and thus may be ruled out as a viable alternative.

A major economic issue associated with the choice of a rebuilding schedule relates to the cost/benefit configuration of the various alternatives. This cost/benefit configuration depends on the functional distance between current and target fishery status and the length of the rebuilding schedule. In terms of productive capacity, as noted in the MSY proxy discussions, there exists a wide gap between current and potential production from the fishery, and this gap necessitates the introduction of more stringent measures in order to reach full production capacity. The length of the rebuilding period would determine how stringent the management measure should be; the shorter the rebuilding period, the more stringent would be the required management measures,

but the sooner would the benefits also accrue. Conversely, longer rebuilding periods would require less management measures, but benefits would accrue later. Without actual estimates of costs and benefits over time, it cannot be determined whether a shorter rebuilding period would provide larger net economic benefits than longer rebuilding period, or vice-versa. However, some general statements on costs/benefits may be made based on the respective characteristics of the various rebuilding schedules.

As discussed in the biological effects section, regardless of the presence of incidental mortality of red snapper from fishing for other species, the shorter rebuilding schedules (**Alternatives 2** and **3)** or no rebuilding schedule (**Alternative 1 (Status Quo)**) would allow the red snapper stock to rebuild to SSB_{MSY} within the MSA-allowable timeframe, such as the one specified in **Alternative 3**. These shorter rebuilding schedules, however, may require regulations more restrictive than the ones considered in this amendment. In particular, more areas would be closed to snapper grouper fishing to minimize incidental mortality of red snapper. This would mean that the collateral economic losses to the other fisheries would likely be substantially higher than those estimated for any of the management alternatives considered in this amendment. Not only would more fishing operations, both commercial and recreational, be affected but also the more valuable fisheries would incur losses. Unless those other fish stocks are also rebuilt as to provide substantially higher future benefits, there is a fairly low level of likelihood that future benefits from a fully recovered red snapper stock would outweigh the short-term costs to the red snapper fleet and the larger snapper grouper fleet associated with the more restrictive regulations implied by these shorter rebuilding schedules.

While incidental mortality would still occur under **Alternative 4 (Preferred)**, the associated costs of regulations would not be as high as in the other two alternatives. In addition, this alternative would provide a timeframe sufficiently long to rebuild the red snapper stock within the MSA required timeframe. Moreover, this alternative offers fishery managers more flexibility in the type of management measures to implement over time. In this sense, **Alternative 4 (Preferred)** would be accompanied by the least economic costs, among the alternatives, without necessarily sacrificing the long-term benefits from the fishery.

Regardless of the length of the rebuilding period chosen, the long-term benefits from the fishery would depend on, among others, the regulatory regime adopted over time. Regulatory regimes that promote economic efficiency generally have a higher likelihood of generating higher economic values while preserving the sustainability of the fish stock. Other regulatory regimes could very well erode the economic benefits over time, even at higher stock levels. For example, if regulations proposed in this amendment were successful in rebuilding the red snapper stock, higher levels of harvest approaching the chosen OY would be allowed. But if nothing is done to address overcapacity and other open-access problems in the fishery, the economic status of the fishery could fall back to its current, or possibly worse, condition.

The issue of rebuilding timeframe in fisheries management was explored by Larkin et al. (2006). They constructed a dynamic programming bioeconomic model and applied it to two hypothesized fisheries, one involving moderate-live stock and the other, a long-lived stock. They noted the possibility of generating higher net present values when moving from a 10-year rebuilding timeframe to 20-year and 30-year timeframes, with a higher discounting rate resulting

in larger increases than a lower one. One of the additional regulations they simulated was a 10-year fishery closure within a 40-year rebuilding timeframe. Their results showed minimal changes in net present values and allowable catch under a low discount rate, but an increase in allowable catch with slight reduction in net present value under a higher discount rate.

Non-use values, like existence and bequest values, would be higher under **Alternative 2** and lowest under **Alternative 1 (status quo)**. However, the difference in non-use values between **Alternatives 2**, **3**, and **4** are likely to be minimal.

4.2.1.3 Social Effects

Although defining a rebuilding schedule is an administrative action, the schedule determines the severity of the management measures necessary to rebuild the resource within the allotted timeframe. The severity of these measures, in turn, determines the magnitude of the associated social and economic effects expected to accrue during the recovery period. Generally, the shorter the rebuilding schedule, the more severe the necessary harvest restrictions. The more severe the harvest restrictions, the greater the short term adverse effects associated with business failure, job or living dislocations, and overall adjustments for the social environment. Commercial and recreational fishermen may be able to adjust to the restrictions by switching to other species or by leaving fishing and seeking other employment or recreational pursuits, thereby mitigating any potential adverse social impacts. If other species are also depleted, regulations may prevent switching to another fishery, or if other forms of employment or recreational activities are unavailable or difficult to find, then mitigation opportunities are reduced and net adverse social impacts are potentially more severe.

With respect to individual user groups, depending on the value of the resource and the yield stream of benefits realized upon recovery, particularly severe restrictions may result in losses to current users that cannot be recovered in the long term, or can be recovered, but are realized by different users, particularly if current users choose or are economically forced to exit the fishery due the measures implemented to achieve any required harvest reductions. The social effects of the alternative red snapper rebuilding strategies and management measures are included in **Sections 4.2.2.3** and **4.2.3.3**, respectively.

Because the red snapper resource has been declared overfished, a rebuilding schedule is required. Therefore, **Alternative 1 (Status Quo),** which would not establish a rebuilding schedule, is not a valid alternative and its selection could require subsequent additional management action to adopt a legally compliant rebuilding schedule. Because this subsequent action would merely accomplish what the Council has the opportunity to accomplish with the current action, in addition to the additional expense of repetitive management effort, adoption of **Alternative 1 (Status Quo)** could result in a conclusion by the public that management is not responsibly fulfilling its duties.

Alternatives 2-4 specify rebuilding schedules of different length. Red snapper would be closed during the initial years under each rebuilding schedule and would likely be closed for longer periods for rebuilding schedules of shorter length, which require more restrictive management

measures. While faster recovery conceptually allows faster receipt of the benefits of a recovered resource, it is unlikely that the resource could recover under the shortest schedule, **Alternative 2,** without additional restrictions on other fisheries to prevent incidental catch of red snapper. Therefore, **Alternative 2** would incur greater associated adverse social and economic consequences due to the relatively minor significance of the red snapper fishery for the South Atlantic as a whole compared to other snapper grouper fisheries. As a result, any social gains associated with faster red snapper recovery under **Alternative 2** would be expected to be negated by the losses associated with harsher restrictions on these other fisheries. For the intermediate rebuilding schedule, **Alternative 3**, recovery of the red snapper stock is realistic under the same additional management restrictions proposed in tandem with **Alternative 4 (Preferred)**. However, the probability that the stock could recover within the 25-year timeframe of **Alternative 3** is lower than the probability of recovery under the timeframe specified by **Alternative 4 (Preferred)** (see **Section 4.2.1.1**). **Alternative 4 (Preferred)** would allow the longest possible rebuilding timeframe, is expected to result in the largest probability (with respect to the alternatives considered) of achieving recovery of the stock within the specified timeframe and, as a result, would be expected to allow the greatest flexibility to recover red snapper and minimize the adverse social and economic effects on associated fisheries.

4.2.1.4 Administrative Effects

Under **Alternative 1 (Status Quo)**, no rebuilding timeframe would be established for red snapper. The Magnuson-Stevens Act requires that a rebuilding plan be established for any species that is declared overfished. Part of a rebuilding plan is the timeframe within which the stock would be rebuilt. Therefore, if no rebuilding timeframe is specified, the rebuilding plan could not be considered complete and the agency would not meet the Magnuson-Stevens Act requirement. The rebuilding timeframe alternatives themselves would not affect the administrative environment regardless of the length of time specified in each alternative. **Alternatives 2-4 (Preferred)** would incur an equal, yet minimal administrative burden in the form of notifying the public of which rebuilding schedule was chosen by the Council.

4.2.1.5 Council's Conclusions

The Council chose **Alternative 4** as their preferred rebuilding schedule alternative. **Alternative 4 (Preferred)** defines a rebuilding schedule as the maximum recommended period to rebuild if $T_{MIN} > 10$ years. The maximum recommended period equals T_{MIN} + one generation time. This would equal 35 years with the rebuilding time period ending in 2044 (SEDAR 15 2008 was the source of the generation time). 2010 is Year 1. By choosing the longest rebuilding schedule negative socioeconomic impacts would be mitigated to the greatest extent practicable. More restrictive harvest provision would be needed to rebuild the stock within a rebuilding schedule shorter than that of **Alternative 4 (Preferred)** and could possibly result in unnecessary socioeconomic impacts. Since the stock is still likely to rebuild within the longest rebuilding timeframe using less restrictive harvest prohibitions while incurring the least amount of negative economic impacts, the Council has concluded **Alternative 4 (Preferred)** is the best rebuilding schedule option for red snapper in the South Atlantic.

4.2.2 Rebuilding Strategy and Optimum Yield

*Note: All alternatives are based upon a **very high recruitment** scenario referenced in the most recent SEFSC projections.*

Table 4-3. Summary of the total kill required, reduction needed in total removals, and probability of rebuilding for Alternatives 1-9.

Alternative	Total Kill	% Reduction	Year Rebuilt (50% Prob)	Prob rebuilt 2044
Alternative 1 (Status Quo) ($F_{45\%SPR}$)	89,000	85%	2035*; 2025**	70%*; 99%**
Alternative 2 (85%$F_{40\%SPR}$)	89,000	85%	2035	70%
Alternative 3 (75%$F_{40\%SPR}$)	79,000	87%	2032	84%
Alternative 4 (65%$F_{40\%SPR}$)	68,000	91%	2029	94%
Alternative 5 (Preferred) (97%$F_{40\%SPR}$)	**101,000**	**83%**	**2044**	**50%**
Alternative 6 (85%$F_{30\%SPR}$)	125,000	79%	2031	78%
Alternative 7 (75%$F_{30\%SPR}$)	111,000	82%	2028	92%
Alternative 8 (65%$F_{30\%SPR}$)	97,000	84%	2026	98%
Alternative 9 (98%$F_{30\%SPR}$)	144,000	76%	2040	53%

*Compared to SSB_{MSY} = 17,863,000 lbs whole weight for $F_{40\%SPR}$ F_{MSY} proxy.
**Compared to SSB_{MSY} = 13,283 000 lbs whole weight for $F_{30\%SPR}$ F_{MSY} proxy.

Alternative 1 (Status Quo). Maintain a yield-based rebuilding strategy for red snapper where $F_{OY} = F_{45\%SPR}$ (equivalent to 85% $F_{40\%SPR}$ and 59%$F_{30\%SPR}$). The value for OY at equilibrium is 2,196,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2035 and a 70% chance of rebuilding to SSB_{MSY} by 2044 based on a $F_{40\%SPR}$ proxy for F_{MSY}. ACL is not specified.

Alternative 2. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 85% F_{MSY} (85%$F_{40\%SPR}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,199,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2035 and 70% chance of rebuilding to SSB_{MSY} by 2044 (Table 4-5a).

Alternative 3. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 75% F_{MSY} (75%$F_{40\%SPR}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,104,000 lbs whole weight.

Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2032 and an 84% chance of rebuilding to SSB_{MSY} by 2044 (Table 4-5b).

Alternative 4. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 65%F_{MSY} (65%$F_{40\%SPR}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 1,984,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2029, and a 94% chance of rebuilding to SSB_{MSY} by 2044 (Table 4-5c).

Alternative 5 (Preferred). Define a rebuilding strategy for red snapper that sets F_{OY} equal to 97% F_{MSY} (97%$F_{40\%SPR}$) and rebuilds in 35 years. The ACL (total removals) specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,291,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2044 (Table 4-5d).

Alternative 6. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 85% F_{MSY} (85%$F_{30\%SPR}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,392,000 lbs whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2031 and 78% chance of rebuilding to SSB_{MSY} by 2044 (Table 4-5e).

Alternative 7. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 75% F_{MSY} (75%$F_{30\%SPR}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,338,000 whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2028 and an 92% chance of rebuilding to SSB_{MSY} by 2044 (Table 4-5f).

Alternative 8. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 65%F_{MSY} (65%$F_{30\%SPR}$). The ACL specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,257,000 whole weight. Under this strategy, the fishery would have a 50% chance of rebuilding to SSB_{MSY} by 2026, and a 98% chance of rebuilding to SSB_{MSY} by 2044 (Table 4-5g).

Alternative 9. Define a rebuilding strategy for red snapper that sets F_{OY} equal to 98% F_{MSY} (98%$F_{30\%SPR}$) and rebuilds in 35 years. The ACL (total removals) specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,464,000 lbs whole weight. Under this strategy, the fishery would have a 53% chance of rebuilding to SSB_{MSY} by 2044 (Table 4-5h).

The following sub-alternatives would apply to **Alternative 2** through **Alternative 9**.

Sub-alternative 9A. Establish an ACL based on landings. The ACL in 2010 would equal 0.

Establish three AMs:

1. Track CPUE of red snapper via a fishery-independent monitoring program (see Section 4.5) to track changes in biomass and take action to end overfishing if assessment indicates progress is not being made.
2. Track the biomass and CPUE through fishery-dependent sampling as proposed in Section 4.5.
3. CPUE would be evaluated every three years and adjustments would be made by the framework action being developed in Amendment 17B.

Sub-alternative 9B. Establish an ACL based on total removals. The ACL in 2010 would equal the values specified in Table 4-3 of this section.

Establish three AMs:

1. Track CPUE of red snapper via a fishery-independent monitoring program (see Section 4.5) to track changes in biomass and take action to end overfishing if assessment indicates progress is not being made.
2. Track the biomass and CPUE through fishery-dependent sampling as proposed in Section 4.5.
3. The Council would evaluate the size of the area closures when the dead discards are estimated to exceed the ACL. CPUE would be evaluated every three years and adjustments would be made by the framework action being developed in Amendment 17B.

Table 4-4. Reduction in total removals (landings plus dead discards) needed end overfishing. Determined by comparing expected landings in 2010 to average landings during 2006-2007. Non-shaded areas determined by comparing estimated landings in 2009 with allowable removals in 2010. Shaded areas are estimated by interpolation. **Alternatives 2-5** use $F_{40\%SPR}$ as F_{MSY} proxy; **Alternatives 6-9** use $F_{30\%SPR}$ as F_{MSY} proxy. Council's preferred choice is to use High recruitment with $F_{40\%SPR}$ proxy for F_{MSY}.

Fmsy proxy	F40% proxy				F30% proxy			
	Base Estimated Recruitment	High Recruitment	Very High Recruitment	Extremely High Recruitment	Base Estimated Recruitment	High Recruitment	Very High Recruitment	Extremely High Recruitment
Alternative 2 and 6 (85% F_{MSY})	89%	88%	85%	81%	84%	83%	79%	79%
Alternative 3 and 7 (75% F_{MSY})	90%	89%	87%	85%	86%	85%	82%	81%
Alternative 4 and 8 (65% F_{MSY})	91%	90%	89%	87%	88%	87%	84%	83%
Alternative 5 and 9 (97% F_{MSY})	87%	86%	83%	81%	82%	81%	76%	73%

Table 4-5a. Red snapper projections under a fishing mortality rate of 85% F_{MSY} (85%$F_{40\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (**Alternative 2**).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.088	66	23	89	0.00	overfishing prevented if total kill<105,000 lb
2011	0.088	111	30	141	0.00	overfishing prevented if total kill<164,000 lb
2012	0.088	172	32	204	0.00	overfishing prevented if total kill<235,000 lb
2013	0.088	244	38	282	0.00	overfishing prevented if total kill<322,000 lb
2014	0.088	328	46	374	0.00	overfishing prevented if total kill<426,000 lb
2015	0.088	428	51	479	0.00	overfishing prevented if total kill<542,000 lb
2016	0.088	537	54	591	0.00	overfishing prevented if total kill<665,000 lb
2017	0.088	651	56	707	0.00	overfishing prevented if total kill<793,000 lb
2018	0.088	768	58	826	0.00	overfishing prevented if total kill<922,000 lb
2019	0.088	885	59	944	0.00	overfishing prevented if total kill<1,049,000 lb
2020	0.088	998	60	1058	0.00	overfishing prevented if total kill<1,171,000 lb
2021	0.088	1107	60	1167	0.01	overfishing prevented if total kill<1,288,000 lb
2022	0.088	1210	61	1271	0.01	overfishing prevented if total kill<1,397,000 lb
2023	0.088	1306	61	1367	0.03	overfishing prevented if total kill<1,499,000 lb
2024	0.088	1395	61	1456	0.05	overfishing prevented if total kill<1,592,000 lb
2025	0.088	1477	62	1539	0.08	overfishing prevented if total kill<1,677,000 lb
2026	0.088	1552	62	1614	0.11	overfishing prevented if total kill<1,755,000 lb
2027	0.088	1621	62	1683	0.15	overfishing prevented if total kill<1,824,000 lb
2028	0.088	1683	62	1745	0.19	overfishing prevented if total kill<1,887,000 lb
2029	0.088	1738	62	1800	0.25	overfishing prevented if total kill<1,943,000 lb
2030	0.088	1789	62	1851	0.29	overfishing prevented if total kill<1,993,000 lb
2031	0.088	1834	62	1896	0.35	overfishing prevented if total kill<2,038,000 lb
						SSB > MSST
2032	0.088	1874	62	1936	0.38	overfishing prevented if total kill<2,078,000 lb
2033	0.088	1910	62	1972	0.43	overfishing prevented if total kill<2,113,000 lb
2034	0.088	1943	62	2005	0.48	overfishing prevented if total kill<2,144,000 lb
2035	0.088	1971	62	2033	0.52	overfishing prevented if total kill<2,171,000 lb
						SSB > SSBmsy
2036	0.088	1997	63	2060	0.55	overfishing prevented if total kill<2,196,000 lb
2037	0.088	2020	63	2083	0.58	overfishing prevented if total kill<2,217,000 lb
2038	0.088	2040	63	2103	0.60	overfishing prevented if total kill<2,237,000 lb
2039	0.088	2058	63	2121	0.63	overfishing prevented if total kill<2,2554,000 lb
2040	0.088	2074	63	2137	0.65	overfishing prevented if total kill<2,269,000 lb
2041	0.088	2088	63	2151	0.67	overfishing prevented if total kill<2,282,000 lb
2042	0.088	2101	63	2164	0.68	overfishing prevented if total kill<2,293,000 lb
2043	0.088	2112	63	2175	0.69	overfishing prevented if total kill<2,303,000 lb
2044	0.088	2122	63	2185	0.70	overfishing prevented if total kill<2,312,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=$F_{40\%}$=0.104; MSST=7471mt; SSB_{MSY}=8103mt; Y@F_{MSY}=2,304,000 lb.

Table 4-5b. Red snapper projections under a fishing mortality rate of 75% F_{MSY} (75%$F_{40\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (**Alternative 3**).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.078	59	20	79	0.00	overfishing prevented if total kill<105,000 lb
2011	0.078	99	26	125	0.00	overfishing prevented if total kill<164,000 lb
2012	0.078	154	29	183	0.00	overfishing prevented if total kill<235,000 lb
2013	0.078	219	34	253	0.00	overfishing prevented if total kill<322,000 lb
2014	0.078	297	41	338	0.00	overfishing prevented if total kill<426,000 lb
2015	0.078	388	45	433	0.00	overfishing prevented if total kill<542,000 lb
2016	0.078	489	48	537	0.00	overfishing prevented if total kill<665,000 lb
2017	0.078	595	50	645	0.00	overfishing prevented if total kill<793,000 lb
2018	0.078	704	51	755	0.00	overfishing prevented if total kill<922,000 lb
2019	0.078	812	52	864	0.00	overfishing prevented if total kill<1,049,000 lb
2020	0.078	919	53	972	0.00	overfishing prevented if total kill<1,171,000 lb
2021	0.078	1022	54	1076	0.01	overfishing prevented if total kill<1,288,000 lb
2022	0.078	1119	54	1173	0.02	overfishing prevented if total kill<1,397,000 lb
2023	0.078	1211	54	1265	0.05	overfishing prevented if total kill<1,499,000 lb
2024	0.078	1296	55	1351	0.08	overfishing prevented if total kill<1,592,000 lb
2025	0.078	1375	55	1430	0.12	overfishing prevented if total kill<1,677,000 lb
2026	0.078	1448	55	1503	0.17	overfishing prevented if total kill<1,755,000 lb
2027	0.078	1514	55	1569	0.22	overfishing prevented if total kill<1,824,000 lb
2028	0.078	1575	55	1630	0.29	overfishing prevented if total kill<1,887,000 lb
						SSB > MSST
2029	0.078	1629	55	1684	0.35	overfishing prevented if total kill<1,943,000 lb
2030	0.078	1679	55	1734	0.41	overfishing prevented if total kill<1,993,000 lb
2031	0.078	1724	55	1779	0.47	overfishing prevented if total kill<2,038,000 lb
2032	0.078	1764	56	1820	0.54	overfishing prevented if total kill<2,078,000 lb
						SSB > SSBmsy
2033	0.078	1800	56	1856	0.59	overfishing prevented if total kill<2,113,000 lb
2034	0.078	1833	56	1889	0.63	overfishing prevented if total kill<2,144,000 lb
2035	0.078	1862	56	1918	0.68	overfishing prevented if total kill<2,171,000 lb
2036	0.078	1888	56	1944	0.71	overfishing prevented if total kill<2,196,000 lb
2037	0.078	1911	56	1967	0.74	overfishing prevented if total kill<2,217,000 lb
2038	0.078	1932	56	1988	0.76	overfishing prevented if total kill<2,237,000 lb
2039	0.078	1951	56	2007	0.79	overfishing prevented if total kill<2,2554,000 lb
2040	0.078	1967	56	2023	0.80	overfishing prevented if total kill<2,269,000 lb
2041	0.078	1982	56	2038	0.81	overfishing prevented if total kill<2,282,000 lb
2042	0.078	1995	56	2051	0.82	overfishing prevented if total kill<2,293,000 lb
2043	0.078	2007	56	2063	0.83	overfishing prevented if total kill<2,303,000 lb
2044	0.078	2018	56	2074	0.84	overfishing prevented if total kill<2,312,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F40%=0.104; MSST=7471mt; SSB_{MSY}=8103mt; Y@F_{MSY}=2,304,000 lb.

Table 4-5c. Red snapper projections under a fishing mortality rate of 65% F_{MSY} (65%$F_{40\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (**Alternative 4**).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.068	51	17	68	0.00	overfishing prevented if total kill<105,000 lb
2011	0.068	87	23	110	0.00	overfishing prevented if total kill<164,000 lb
2012	0.068	135	25	160	0.00	overfishing prevented if total kill<235,000 lb
2013	0.068	194	30	224	0.00	overfishing prevented if total kill<322,000 lb
2014	0.068	264	36	300	0.00	overfishing prevented if total kill<426,000 lb
2015	0.068	346	40	386	0.00	overfishing prevented if total kill<542,000 lb
2016	0.068	437	42	479	0.00	overfishing prevented if total kill<665,000 lb
2017	0.068	534	44	578	0.00	overfishing prevented if total kill<793,000 lb
2018	0.068	633	45	678	0.00	overfishing prevented if total kill<922,000 lb
2019	0.068	733	46	779	0.00	overfishing prevented if total kill<1,049,000 lb
2020	0.068	831	46	877	0.01	overfishing prevented if total kill<1,171,000 lb
2021	0.068	927	47	974	0.01	overfishing prevented if total kill<1,288,000 lb
2022	0.068	1017	47	1064	0.04	overfishing prevented if total kill<1,397,000 lb
2023	0.068	1103	48	1151	0.08	overfishing prevented if total kill<1,499,000 lb
2024	0.068	1183	48	1231	0.12	overfishing prevented if total kill<1,592,000 lb
2025	0.068	1258	48	1306	0.18	overfishing prevented if total kill<1,677,000 lb
2026	0.068	1327	48	1375	0.25	overfishing prevented if total kill<1,755,000 lb
2027	0.068	1390	48	1438	0.33	overfishing prevented if total kill<1,824,000 lb
						SSB > MSST
2028	0.068	1448	48	1496	0.41	overfishing prevented if total kill<1,887,000 lb
2029	0.068	1501	48	1549	0.49	overfishing prevented if total kill<1,943,000 lb
						SSB > SSBmsy
2030	0.068	1549	49	1598	0.57	overfishing prevented if total kill<1,993,000 lb
2031	0.068	1593	49	1642	0.64	overfishing prevented if total kill<2,038,000 lb
2032	0.068	1633	49	1682	0.70	overfishing prevented if total kill<2,078,000 lb
2033	0.068	1668	49	1717	0.75	overfishing prevented if total kill<2,113,000 lb
2034	0.068	1700	49	1749	0.78	overfishing prevented if total kill<2,144,000 lb
2035	0.068	1729	49	1778	0.81	overfishing prevented if total kill<2,171,000 lb
2036	0.068	1756	49	1805	0.84	overfishing prevented if total kill<2,196,000 lb
2037	0.068	1779	49	1828	0.86	overfishing prevented if total kill<2,217,000 lb
2038	0.068	1800	49	1849	0.89	overfishing prevented if total kill<2,237,000 lb
2039	0.068	1819	49	1868	0.91	overfishing prevented if total kill<2,2554,000 lb
2040	0.068	1836	49	1885	0.91	overfishing prevented if total kill<2,269,000 lb
2041	0.068	1851	49	1900	0.91	overfishing prevented if total kill<2,282,000 lb
2042	0.068	1865	49	1914	0.93	overfishing prevented if total kill<2,293,000 lb
2043	0.068	1877	49	1926	0.94	overfishing prevented if total kill<2,303,000 lb
2044	0.068	1888	49	1937	0.94	overfishing prevented if total kill<2,312,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F40%=0.104; MSST=7471mt; SSB_{MSY}=8103mt; Y@F_{MSY}=2,304,000 lb.

Table 4-5d. Red snapper projections under a fishing mortality rate of Frebuild = 97% F_{MSY} (97%$F_{40\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (**Alternative 5**).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.101	75	26	101	0.00	overfishing prevented if total kill<105,000 lb
2011	0.101	126	34	160	0.00	overfishing prevented if total kill<164,000 lb
2012	0.101	193	36	229	0.00	overfishing prevented if total kill<235,000 lb
2013	0.101	272	43	315	0.00	overfishing prevented if total kill<322,000 lb
2014	0.101	365	52	417	0.00	overfishing prevented if total kill<426,000 lb
2015	0.101	472	57	529	0.00	overfishing prevented if total kill<542,000 lb
2016	0.101	590	61	651	0.00	overfishing prevented if total kill<665,000 lb
2017	0.101	714	63	777	0.00	overfishing prevented if total kill<793,000 lb
2018	0.101	839	65	904	0.00	overfishing prevented if total kill<922,000 lb
2019	0.101	963	66	1029	0.00	overfishing prevented if total kill<1,049,000 lb
2020	0.101	1084	67	1151	0.00	overfishing prevented if total kill<1,171,000 lb
2021	0.101	1198	68	1266	0.00	overfishing prevented if total kill<1,288,000 lb
2022	0.101	1306	68	1374	0.01	overfishing prevented if total kill<1,397,000 lb
2023	0.101	1406	69	1475	0.01	overfishing prevented if total kill<1,499,000 lb
2024	0.101	1499	69	1568	0.03	overfishing prevented if total kill<1,592,000 lb
2025	0.101	1583	69	1652	0.05	overfishing prevented if total kill<1,677,000 lb
2026	0.101	1660	70	1730	0.07	overfishing prevented if total kill<1,755,000 lb
2027	0.101	1729	70	1799	0.09	overfishing prevented if total kill<1,824,000 lb
2028	0.101	1792	70	1862	0.11	overfishing prevented if total kill<1,887,000 lb
2029	0.101	1848	70	1918	0.14	overfishing prevented if total kill<1,943,000 lb
2030	0.101	1899	70	1969	0.18	overfishing prevented if total kill<1,993,000 lb
2031	0.101	1943	70	2013	0.21	overfishing prevented if total kill<2,038,000 lb
2032	0.101	1983	70	2053	0.24	overfishing prevented if total kill<2,078,000 lb
2033	0.101	2019	70	2089	0.26	overfishing prevented if total kill<2,113,000 lb
2034	0.101	2050	70	2120	0.29	overfishing prevented if total kill<2,144,000 lb
						SSB > MSST
2035	0.101	2078	71	2149	0.33	overfishing prevented if total kill<2,171,000 lb
2036	0.101	2102	71	2173	0.35	overfishing prevented if total kill<2,196,000 lb
2037	0.101	2124	71	2195	0.37	overfishing prevented if total kill<2,217,000 lb
2038	0.101	2143	71	2214	0.39	overfishing prevented if total kill<2,237,000 lb
2039	0.101	2160	71	2231	0.41	overfishing prevented if total kill<2,2554,000 lb
2040	0.101	2175	71	2246	0.44	overfishing prevented if total kill<2,269,000 lb
2041	0.101	2189	71	2260	0.46	overfishing prevented if total kill<2,282,000 lb
2042	0.101	2200	71	2271	0.47	overfishing prevented if total kill<2,293,000 lb
2043	0.101	2211	71	2282	0.48	overfishing prevented if total kill<2,303,000 lb
2044	0.101	2220	71	2291	0.5	overfishing prevented if total kill<2,312,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F40%=0.104; MSST=7471mt; SSB_{MSY}=8103mt; Y@F_{MSY}=2,304,000 lb.

Table 4-5e. Red snapper projections under a fishing mortality rate of 85% F_{MSY} (85%$F_{30\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (**Alternative 6**).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.126	93	32	125	0.00	overfishing prevented if total kill<146,000 lb
2011	0.126	153	41	194	0.00	overfishing prevented if total kill<224,000 lb
2012	0.126	232	44	276	0.00	overfishing prevented if total kill<315,000 lb
2013	0.126	323	53	376	0.00	overfishing prevented if total kill<425,000 lb
2014	0.126	429	63	492	0.00	overfishing prevented if total kill<533,000 lb
2015	0.126	551	69	620	0.00	overfishing prevented if total kill<690,000 lb
2016	0.126	683	73	756	0.00	overfishing prevented if total kill<836,000 lb
2017	0.126	820	76	896	0.00	overfishing prevented if total kill<986,000 lb
2018	0.126	957	79	1036	0.00	overfishing prevented if total kill<1,132,000 lb
2019	0.126	1092	80	1172	0.01	overfishing prevented if total kill<1,274,000 lb
2020	0.126	1221	82	1303	0.01	overfishing prevented if total kill<1,410,000 lb
2021	0.126	1343	82	1425	0.03	overfishing prevented if total kill<1,536,000 lb
2022	0.126	1457	83	1540	0.06	overfishing prevented if total kill<1,651,000 lb
2023	0.126	1561	84	1645	0.10	overfishing prevented if total kill<1,756,000 lb
2024	0.126	1656	84	1740	0.14	overfishing prevented if total kill<1,851,000 lb
2025	0.126	1742	84	1826	0.19	overfishing prevented if total kill<1,936,000 lb
2026	0.126	1819	85	1904	0.24	overfishing prevented if total kill<2,012,000 lb
2027	0.126	1889	85	1974	0.30	overfishing prevented if total kill<2,079,000 lb
2028	0.126	1950	85	2035	0.36	overfishing prevented if total kill<2,138,000 lb
						SSB > MSST
2029	0.126	2005	85	2090	0.41	overfishing prevented if total kill<2,190,000 lb
2030	0.126	2053	85	2138	0.46	overfishing prevented if total kill<2,235,000 lb
2031	0.126	2096	85	2181	0.51	overfishing prevented if total kill<2,275,000 lb
						SSB > SSB_{MSY}
2032	0.126	2133	86	2219	0.56	overfishing prevented if total kill<2,310,000 lb
2033	0.126	2166	86	2252	0.60	overfishing prevented if total kill<2,340,000 lb
2034	0.126	2195	86	2281	0.63	overfishing prevented if total kill<2,366,000 lb
2035	0.126	2220	86	2306	0.66	overfishing prevented if total kill<2,388,000 lb
2036	0.126	2242	86	2328	0.69	overfishing prevented if total kill<2,408,000 lb
2037	0.126	2261	86	2347	0.71	overfishing prevented if total kill<2,425,000 lb
2038	0.126	2278	86	2364	0.72	overfishing prevented if total kill<2,439,000 lb
2039	0.126	2293	86	2379	0.74	overfishing prevented if total kill<2,452,000 lb
2040	0.126	2305	86	2391	0.75	overfishing prevented if total kill<2,462,000 lb
2041	0.126	2316	86	2402	0.76	overfishing prevented if total kill<2,472,000 lb
2042	0.126	2326	86	2412	0.76	overfishing prevented if total kill<2,480,000 lb
2043	0.126	2335	86	2421	0.77	overfishing prevented if total kill<2,487,000 lb
2044	0.126	2342	86	2428	0.78	overfishing prevented if total kill<2,493,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F30%=0.148; MSST=5555mt; SSB_{MSY}=6205mt; Y@75%F_{MSY}=2,104,000 lb; Y@F_{MSY}=2,430,792 lb.

Table 4-5f. Red snapper projections under a fishing mortality rate of 75% F_{MSY} (75%$F_{30\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (**Alternative 7**).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.111	83	28	111	0.00	overfishing prevented if total kill<146,000 lb
2011	0.111	137	37	174	0.00	overfishing prevented if total kill<224,000 lb
2012	0.111	209	40	249	0.00	overfishing prevented if total kill<315,000 lb
2013	0.111	293	47	340	0.00	overfishing prevented if total kill<425,000 lb
2014	0.111	391	57	448	0.00	overfishing prevented if total kill<533,000 lb
2015	0.111	506	62	568	0.00	overfishing prevented if total kill<690,000 lb
2016	0.111	630	66	696	0.00	overfishing prevented if total kill<836,000 lb
2017	0.111	759	69	828	0.00	overfishing prevented if total kill<986,000 lb
2018	0.111	890	71	961	0.00	overfishing prevented if total kill<1,132,000 lb
2019	0.111	1019	72	1091	0.01	overfishing prevented if total kill<1,274,000 lb
2020	0.111	1144	73	1217	0.02	overfishing prevented if total kill<1,410,000 lb
2021	0.111	1262	74	1336	0.05	overfishing prevented if total kill<1,536,000 lb
2022	0.111	1373	74	1447	0.09	overfishing prevented if total kill<1,651,000 lb
2023	0.111	1475	75	1550	0.15	overfishing prevented if total kill<1,756,000 lb
2024	0.111	1569	75	1644	0.22	overfishing prevented if total kill<1,851,000 lb
						SSB > MSST
2025	0.111	1654	76	1730	0.29	overfishing prevented if total kill<1,936,000 lb
2026	0.111	1732	76	1808	0.38	overfishing prevented if total kill<2,012,000 lb
2027	0.111	1802	76	1878	0.46	overfishing prevented if total kill<2,079,000 lb
2028	0.111	1864	76	1940	0.53	overfishing prevented if total kill<2,138,000 lb
						SSB > SSB_{MSY}
2029	0.111	1920	76	1996	0.60	overfishing prevented if total kill<2,190,000 lb
2030	0.111	1970	76	2046	0.66	overfishing prevented if total kill<2,235,000 lb
2031	0.111	2014	77	2091	0.71	overfishing prevented if total kill<2,275,000 lb
2032	0.111	2053	77	2130	0.76	overfishing prevented if total kill<2,310,000 lb
2033	0.111	2088	77	2165	0.79	overfishing prevented if total kill<2,340,000 lb
2034	0.111	2118	77	2195	0.81	overfishing prevented if total kill<2,366,000 lb
2035	0.111	2145	77	2222	0.83	overfishing prevented if total kill<2,388,000 lb
2036	0.111	2168	77	2245	0.85	overfishing prevented if total kill<2,408,000 lb
2037	0.111	2189	77	2266	0.87	overfishing prevented if total kill<2,425,000 lb
2038	0.111	2208	77	2285	0.88	overfishing prevented if total kill<2,439,000 lb
2039	0.111	2224	77	2301	0.89	overfishing prevented if total kill<2,452,000 lb
2040	0.111	2238	77	2315	0.90	overfishing prevented if total kill<2,462,000 lb
2041	0.111	2250	77	2327	0.90	overfishing prevented if total kill<2,472,000 lb
2042	0.111	2261	77	2338	0.91	overfishing prevented if total kill<2,480,000 lb
2043	0.111	2271	77	2348	0.92	overfishing prevented if total kill<2,487,000 lb
2044	0.111	2279	77	2356	0.92	overfishing prevented if total kill<2,493,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F30%=0.148; MSST=5555mt; SSB_{MSY}=6205mt; Y@75%F_{MSY}=2,104,000 lb; Y@F_{MSY}=2,430,792 lb.

Table 4-5g. Red snapper projections under a fishing mortality rate of 65% F_{MSY} (65%$F_{30\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (**Alternative 8**).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.096	72	25	97	0.00	overfishing prevented if total kill<146,000 lb
2011	0.096	120	32	152	0.00	overfishing prevented if total kill<224,000 lb
2012	0.096	185	35	220	0.00	overfishing prevented if total kill<315,000 lb
2013	0.096	261	41	302	0.00	overfishing prevented if total kill<425,000 lb
2014	0.096	351	50	401	0.00	overfishing prevented if total kill<533,000 lb
2015	0.096	456	55	511	0.00	overfishing prevented if total kill<690,000 lb
2016	0.096	571	58	629	0.00	overfishing prevented if total kill<836,000 lb
2017	0.096	691	60	751	0.00	overfishing prevented if total kill<986,000 lb
2018	0.096	813	62	875	0.01	overfishing prevented if total kill<1,132,000 lb
2019	0.096	934	63	997	0.01	overfishing prevented if total kill<1,274,000 lb
2020	0.096	1052	64	1116	0.04	overfishing prevented if total kill<1,410,000 lb
2021	0.096	1165	65	1230	0.08	overfishing prevented if total kill<1,536,000 lb
2022	0.096	1271	65	1336	0.16	overfishing prevented if total kill<1,651,000 lb
2023	0.096	1370	66	1436	0.23	overfishing prevented if total kill<1,756,000 lb
2024	0.096	1461	66	1527	0.33	overfishing prevented if total kill<1,851,000 lb
2025	0.096	1545	66	1611	0.43	overfishing prevented if total kill<1,936,000 lb
2026	0.096	1621	67	1688	0.53	overfishing prevented if total kill<2,012,000 lb
2027	0.096	1690	67	1757	0.62	overfishing prevented if total kill<2,079,000 lb
2028	0.096	1753	67	1820	0.70	overfishing prevented if total kill<2,138,000 lb
2029	0.096	1809	67	1876	0.76	overfishing prevented if total kill<2,190,000 lb
2030	0.096	1859	67	1926	0.81	overfishing prevented if total kill<2,235,000 lb
2031	0.096	1905	67	1972	0.86	overfishing prevented if total kill<2,275,000 lb
2032	0.096	1945	67	2012	0.88	overfishing prevented if total kill<2,310,000 lb
2033	0.096	1980	67	2047	0.91	overfishing prevented if total kill<2,340,000 lb
2034	0.096	2012	67	2079	0.93	overfishing prevented if total kill<2,366,000 lb
2035	0.096	2040	67	2107	0.94	overfishing prevented if total kill<2,388,000 lb
2036	0.096	2065	68	2133	0.95	overfishing prevented if total kill<2,408,000 lb
						SSB > MSST
2037	0.096	2088	68	2156	0.96	overfishing prevented if total kill<2,425,000 lb
2038	0.096	2107	68	2175	0.97	overfishing prevented if total kill<2,439,000 lb
2039	0.096	2125	68	2193	0.97	overfishing prevented if total kill<2,452,000 lb
2040	0.096	2140	68	2208	0.98	overfishing prevented if total kill<2,462,000 lb
2041	0.096	2154	68	2222	0.98	overfishing prevented if total kill<2,472,000 lb
2042	0.096	2166	68	2234	0.98	overfishing prevented if total kill<2,480,000 lb
2043	0.096	2176	68	2244	0.98	overfishing prevented if total kill<2,487,000 lb
2044	0.096	2186	68	2254	0.98	overfishing prevented if total kill<2,493,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F30%=0.148; MSST=5555mt; SSB_{MSY}=6205mt; Y@75%F_{MSY}=2,104,000 lb; Y@F_{MSY}=2,430,792 lb.

Table 4-5h. Red snapper projections under a fishing mortality rate of Frebuild = 98% F_{MSY} (98%$F_{30\%SPR}$). F = fishing mortality rate (per year), LD = landings or new dead discards, DD = dead discards* (**Alternative 9**).

				Total Kill	Probability	
Year	F	LD (1000lb)	DD (1000lb)	LD+DD (1000 lb)	Recovery	Comments
2007	0.930	541	292	833	0.00	
2008	1.220	759	297	1056	0.00	
2009	0.974	579	176	755	0.00	
2010	0.145	107	37	144	0.00	overfishing prevented if total kill<146,000 lb
2011	0.145	173	47	220	0.00	overfishing prevented if total kill<224,000 lb
2012	0.145	259	50	309	0.00	overfishing prevented if total kill<315,000 lb
2013	0.145	358	60	418	0.00	overfishing prevented if total kill<425,000 lb
2014	0.145	472	71	543	0.00	overfishing prevented if total kill<533,000 lb
2015	0.145	603	78	681	0.00	overfishing prevented if total kill<690,000 lb
2016	0.145	743	83	826	0.00	overfishing prevented if total kill<836,000 lb
2017	0.145	887	86	973	0.00	overfishing prevented if total kill<986,000 lb
2018	0.145	1030	89	1119	0.00	overfishing prevented if total kill<1,132,000 lb
2019	0.145	1170	90	1260	0.00	overfishing prevented if total kill<1,274,000 lb
2020	0.145	1303	92	1395	0.01	overfishing prevented if total kill<1,410,000 lb
2021	0.145	1427	93	1520	0.01	overfishing prevented if total kill<1,536,000 lb
2022	0.145	1542	94	1636	0.02	overfishing prevented if total kill<1,651,000 lb
2023	0.145	1647	94	1741	0.04	overfishing prevented if total kill<1,756,000 lb
2024	0.145	1742	95	1837	0.07	overfishing prevented if total kill<1,851,000 lb
2025	0.145	1827	95	1922	0.10	overfishing prevented if total kill<1,936,000 lb
2026	0.145	1903	96	1999	0.12	overfishing prevented if total kill<2,012,000 lb
2027	0.145	1970	96	2066	0.16	overfishing prevented if total kill<2,079,000 lb
2028	0.145	2029	96	2125	0.19	overfishing prevented if total kill<2,138,000 lb
2029	0.145	2081	96	2177	0.23	overfishing prevented if total kill<2,190,000 lb
2030	0.145	2127	96	2223	0.27	overfishing prevented if total kill<2,235,000 lb
2031	0.145	2167	96	2263	0.30	overfishing prevented if total kill<2,275,000 lb
2032	0.145	2202	97	2299	0.33	overfishing prevented if total kill<2,310,000 lb
2033	0.145	2232	97	2329	0.36	overfishing prevented if total kill<2,340,000 lb
2034	0.145	2259	97	2356	0.38	overfishing prevented if total kill<2,366,000 lb
2035	0.145	2282	97	2379	0.40	overfishing prevented if total kill<2,388,000 lb
2036	0.145	2301	97	2398	0.42	overfishing prevented if total kill<2,408,000 lb
						SSB > MSST
2037	0.145	2319	97	2416	0.44	overfishing prevented if total kill<2,425,000 lb
2038	0.145	2333	97	2430	0.46	overfishing prevented if total kill<2,439,000 lb
2039	0.145	2346	97	2443	0.47	overfishing prevented if total kill<2,452,000 lb
2040	0.145	2357	97	2454	0.50	overfishing prevented if total kill<2,462,000 lb
2041	0.145	2367	97	2464	0.50	overfishing prevented if total kill<2,472,000 lb
2042	0.145	2375	97	2472	0.51	overfishing prevented if total kill<2,480,000 lb
2043	0.145	2382	97	2479	0.52	overfishing prevented if total kill<2,487,000 lb
2044	0.145	2389	97	2486	0.53	overfishing prevented if total kill<2,493,000 lb

*LD represents either landed catch or red snapper > 20 inches TL that would be discarded if all red snapper harvest was prohibited. DD represents dead discards for red snapper < 20 inches TL. F_{MSY}=F30%=0.148; MSST=5555mt; SSB_{MSY}=6205mt; Y@75%F_{MSY}=2,104,000 lb; Y@F_{MSY}=2,430,792 lb.

4.2.2.1 Biological Impacts

The SEFSC initially provided two types of projections which (1) allow for some harvest and (2) are based on only discarded red snapper. The Council decided not to use discard-only projections since alternatives are being considered in **Section 4.3** that could potentially allow some level of harvest as the stock rebuilds. At their September 2009 meeting, the Council indicated that projections should consider very high recruitment, which likely occurred in 2006. Additional projections were requested from the SEFSC in October 2009 and completed in November 2009 using a $F_{40\%SPR}$ proxy for F_{MSY} (**Alternatives 2-5**). At their December 2009 meeting, the Council requested additional alternatives based on a $F_{30\%SPR}$ proxy for F_{MSY}. New projections $F_{30\%SPR}$ proxy for F_{MSY} were provided in January 2010 and are incorporated in **Alternatives 6-9**.

The SEFSC notes in the Red Snapper Projections - VII and Addendum: November 2009 that projections incorporating very high recruitment should be interpreted in light of the model assumptions and key aspects of the data. A new assessment update for red snapper will be conducted in 2010, which will provide an estimate of the actual magnitude of recent recruitment. The following text is from the November 2009 red snapper addendum.

• *These projections reflect a belief that the 2006 year-class was strong. However, for now, the actual strength can only be guessed, and thus the scientific merit of these projections is questionable. The real value of these projections may be more qualitative than quantitative.*

• *The projections used a spawner-recruit relationship with steepness of h = 0.95, the value estimated in the assessment but with considerable uncertainty. On this topic, the SEDAR-15 Review Workshop Report stated, "One of the principal difficulties with the SCA model estimate of stock recruitment parameters is that the steepness estimate appears unrealistically high." Such a high value implies that the stock, at its currently low abundance, spawns nearly as many recruits as it would at high abundance. That is, productivity is nearly independent of spawning biomass. If productivity depends on spawning biomass, stock recovery would take longer than projected.*

• *The 2008 recreational landings reported by MRFSS indicate very high levels of landings, which could be due to a very strong 2006 year-class, as explored in these projections. The high landings could also be due, at least in part, to increased fishing effort, which is not accounted for here. If effort has actually increased along with the high landings, these projections could be considered overly optimistic in terms of spawning biomass, recruitment, and landing in subsequent years.*

• *The rebuilding time frame was computed without high 2006 recruitment. If it were recomputed using the high recruitment of these current projections, the rebuilding time frame may be shorter, which would lead to lower estimates of Frebuild. Nonetheless, long-term stock projections, on which Frebuild depends, are highly uncertain.*

• *Initial abundance at age of the projections, other than 2006 age-1 recruits, were based on estimates from the last year of the assessment. If those estimates are inaccurate, rebuilding will likely be affected.*

• *Fleets were assumed to continue fishing at their estimated current proportions of total effort, using the estimated current selectivity patterns. New management regulations that alter those proportions or selectivities would likely affect rebuilding.*

• The projections assumed no change in the selectivity applied to discards. As recovery generally begins with the smallest size classes, management action may be needed to meet that assumption.
• The projections assumed that the estimated spawner-recruit relationship applies in the future and that past residuals represent future uncertainty in recruitment. If changes in environmental or ecological conditions affect recruitment or life-history characteristics, rebuilding may be affected.

On the topic of uncertainty in projections, the SEDAR-15 Review Workshop Report stated in January of 2008, "The panel discussed the value of projections made beyond 5–10 years. Clearly the uncertainty increases rapidly with time as the currently measured stock is replaced by model values into the future. Realistically, the projections beyond the range of the predominant age groups in the stock are highly uncertain. In this assessment, the best that can be concluded is that rebuilding times will be very long." The assessment team concurs with that statement, and would add that uncertainty is even greater now because of the increased duration between the terminal year of the assessment (2006) and any new implementation of management.

Optimum Yield at Equilibrium

Choice of the proxy for F_{MSY} in **Section 4.1** has an effect on the magnitude of OY. OY values based on the status quo proxy for F_{MSY} of $F_{30\%\ SPR}$ would be expected to result in higher values for OY than the use of $F_{40\%SPR}$ proxy for F_{MSY}. For example, the estimated yield at 75%F_{MSY} when the stock is at SSB_{MSY} is 2,338,000 lbs whole weight and 2,104,000 lbs whole weight for $F_{30\%SPR}$ and $F_{40\%SPR}$, respectively. The Council has selected in **Section 4.1**, $F_{40\%SPR}$ as the proxy for F_{MSY}.

Under status quo **Alternative 1 (Status Quo)**, $F_{OY} = F_{45\%SPR}$ (equivalent to 88%$F_{40\%SPR}$ and 59%$F_{30\%SPR}$) and the value for OY when the stock is at SSB_{MSY} is 2,196,000 lbs whole weight and is extremely similar to **Alternative 2**, which specifies a rebuilding strategy at 85%$F_{40\%SPR}$ with an OY = 2,199,000 lbs whole weight when the stock is at SSB_{MSY}. The OY at equilibrium (when stock biomass reached SSB_{MSY}) for **Alternatives 2** through **5** would be based on the rebuilding strategy where OY would equal the yield at 85% F_{MSY}, 75% F_{MSY}, 65% F_{MSY}, and 97% F_{MSY}, respectively using $F_{40\%SPR}$ as a proxy for F_{MSY}. **Alternatives 6** through **9** would also be based on the rebuilding strategy where OY would equal the yield at 85% F_{MSY}, 75% F_{MSY}, 65% F_{MSY}, and 97% F_{MSY}, respectively, but would be determined using $F_{30\%SPR}$ rather than $F_{40\%\ SPR}$, which is a slightly less conservative proxy for F_{MSY}. OY values at equilibrium in the nine alternatives are distinguished from one another by the level of risk (and associated tradeoffs) each would assume.

The more conservative the estimate of OY, the larger the sustainable biomass when the stock is rebuilt. The greatest biological benefit would be provided by **Alternative 4** and **Sub-alternative 4A**, which would specify an OY at equilibrium equal to 65%F_{MSY} based on the F_{MSY} proxy of $F_{40\%SPR}$. Therefore, a larger sustainable biomass associated with a fishing mortality rate at 65%F_{MSY} would be good for the stock, but could have negative social and economic effects, in the short term, because longer and/or more severe short-term reductions in harvest would be needed to achieve larger sustainable biomass. The least amount of biological benefit would be

provided by **Alternative 9** with **Sub-alternative 9B**, which would specify a rebuilding strategy based on the yield at OY equal to 98%F_{MSY} (98%$F_{30\%SPR}$). Therefore, this definition could make it more difficult to rebuild the stock within the preferred rebuilding timeframe; however, there would still be a 53% chance of rebuilding the stock to $SSB_{30\%SPR}$ by 2044.

Alternative 5 (Preferred) would set the rebuilding strategy as well as the OY equal to the yield at 97%F_{MSY} (97%$F_{40\%SPR}$). This definition reduces slightly the safety margin between MSY and OY relative to **Alternatives 2, 3** and **4,** but is more conservative than **Alternatives 6**, **7**, **8** and **9**, which are based on the status quo F_{MSY} proxy of $F_{30\%SPR}$. **Alternative 3** represents a higher level of conservativeness than **Alternatives 2** and **5 (Preferred)** and sets F_{OY} equal to 75%F_{MSY} (75%$F_{40\%SPR}$). Restrepo *et al.* (1998) state "that fishing at 75 percent of F_{MSY} would result in equilibrium yields at 94 percent of MSY or higher, and equilibrium biomass levels between 125 percent and 131 percent of B_{MSY} – a relatively small sacrifice in yield for a relatively large gain in biomass." A simple deterministic model described in Mace (1994) to evaluate the effects of fishing at 75 percent of F_{MSY} indicates that the ratios are consistent across a broad set of life history characteristics ranging from species such as snowy grouper with low natural mortality rates to more productive species like vermilion snapper and black sea bass. Restrepo *et al.* (1998) determined the ratio between the yield fishing at 75 percent of F_{MSY} relative to fishing at F_{MSY} would range from 0.949 and 0.983. Restrepo *et al.* (1998) also indicate fishing at this rate under equilibrium conditions is expected to reduce the risk of overfishing by 20-30 percent. **Alternative 5 (Preferred)** would specify an OY level based on the SSC's recommended F_{MSY} proxy while reducing to the extent practicable negative impacts that would result from management measures needed to manage the stock to a more conservative OY level.

Rebuilding strategies

Alternative 1 (Status Quo) would establish a yield-based, rebuilding strategy for red snapper that is similar to **Alternative 2** (yield at 85%$F_{40\%SPR}$). The difference between status quo **Alternative 1** and **Alternative 2** is that **Alternative 1 (Status Quo)** would not specify an ACL or a method to monitor recovery of red snapper. Under **Alternative 1 (Status Quo)**, the stock would rebuild to $SSB_{30\%SPR}$ sooner than the preferred rebuilding goal of $SSB_{40\%SPR}$ (Figure 4-1).

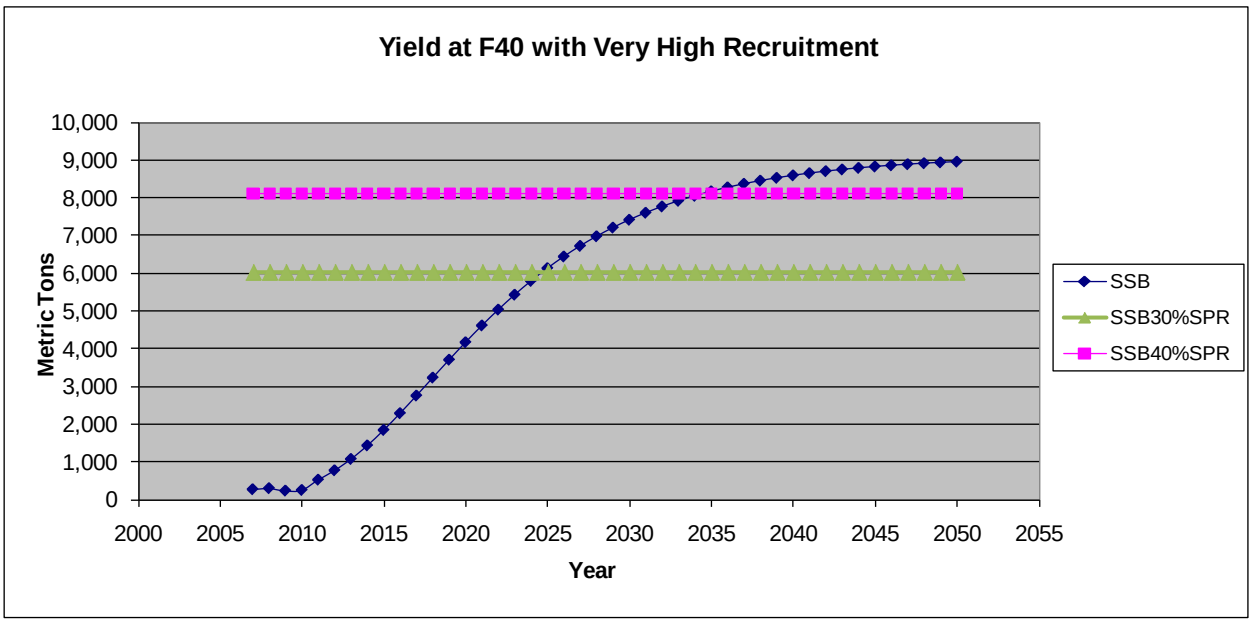


Figure 4-1 Projection results where fishing mortality rate fixed at F = $F_{45\%SPR}$ (**Alternative 1**). Expected values represented by dotted solid line. Thick horizontal line represents the 5555.1 mt and 8102.5 mt SSB_{MSY} benchmark for the yield at $F_{30\%SPR}$ and $F_{40\%SPR}$, respectively.

Under **Alternatives 2-9**, the red snapper stock could rebuild sooner than specified by each rebuilding strategy since the Council's is considering alternatives that would prohibit all harvest of red snapper during initial rebuilding and actions are being taken to reduce incidental catch of red snapper in **Section 4.3.** The probability of rebuilding to SSB_{MSY} by 2044 increases with the level of conservativeness of each of the rebuilding strategy alternative. The rebuilding strategy under **Alternative 4** would have a 94% chance of rebuilding the stock to $SSB_{40\%SPR}$ by 2044 (Table 4-5c). This is the most conservative rebuilding strategy of all the alternatives considered and would require a 94% reduction in total kill but would achieve the same rebuilding goal ($SSB_{40\%SPR}$) of **Alternatives 2**, **3**, and **5 (Preferred)**, but would do so in shortest amount of time. Since **Alternative 4** would also require the most stringent harvest prohibitions in order to manage the fishery to such a conservative level, it would incur the highest level of negative socioeconomic impacts. **Alternatives 6-9**, which have a rebuilding goal of $SSB_{30\%SPR}$, would be less conservative than **Alternatives 2-5**. **Alternative 9** would be least conservative of all alternatives considered, requiring a 76% reduction in total kill and would have a 53% chance of rebuilding the stock to $SSB_{30\%SPR}$ by 2044 (Table 4-5h). As a result, **Alternative 9** would require the least stringent harvest regulations, and would therefore incur the lowest level of negative socioeconomic impacts. All other rebuilding strategy alternatives fall within the range of impacts associated with **Alternative 4** and **Alternative 9**. The long-term biological impacts of **Alternatives 2-5,** are very similar because they would rebuild the stock to $SSB_{40\%SPR}$; however, **Alternatives 2-5** are more conservative than **Alternatives 6-9**, which have a rebuilding goal of $SSB_{30\%SPR}$. Therefore, the main difference between **Alternatives 2-5** and **Alternatives 6-9** are the rates at which red snapper would be rebuilt to the goal of $SSB_{30\%SPR}$ or $SSB_{40\%SPR}$, along with the probability the stock would be rebuilt to the target by end of the rebuilding timeframe of 2044.

The "**A**" **Sub-Alternatives** e.g., **2A, 3A, 4A**… would establish ACLs based on landings, which would be zero in 2010 and would continue until modified. These sub-alternatives would also include three AMs, all related to tracking CPUE. The CPUE would be monitored via fishery-independent and fishery-dependant sampling methods, and those results would be analyzed every three years after which adjustments to management measures and/or the ACL may be made through a framework action. Establishing an ACL of zero would not require monitoring of dead discards, which the SSC has opposed on several occasions since discard data are self-reported and there is greater uncertainty with discard data than with estimates of landings.

The "**B**" **Sub-Alternatives** e.g.**, 2B, 3B, 4B**… would prohibit all harvest of red snapper in the commercial and recreational sectors but would set an ACL equal to the total kill specified in the rebuilding strategy for each alternative. This would require the SEFSC to monitor discarded red snapper, which subsequently die in the commercial and recreational sectors. At their March 2009 meeting, the SSC indicated their recommendation of ABC = 0 for speckled hind and warsaw grouper was based on landed catch only due to concern about monitoring discards. The SSC expressed concerns when discussing ACLs based on dead discards for speckled hind and warsaw grouper at their March 2009 meeting. The SSC was not only concerned about the accuracy of discard data from the recreational and commercial sector but also the possibility that some members of the fishing community might under report discarded fish if they thought further restrictions might be imposed if levels of dead discards became elevated. There could be similar concerns with the need to monitor red snapper dead discards in **Alternatives 2B-6B**. Because of these concerns with monitoring discards, CPUE of red snapper could be tracked via a fishery-independent and/or a fishery-dependent monitoring program to identify changes in biomass. The Council is also considering fishery-dependent data collection by headboat and charterboat operators to determine if there are changes in CPUE and biomass. If the ACL was exceeded or if CPUE indicated the stock was not rebuilding, the Council could re-evaluate management measures to ensure overfishing did not occur. CPUE would be evaluated every three years and adjustments would be made by a framework action being developed in Amendment 17B.

Under **Alternative 2**, an initial reduction in total kill of 85% would be required. Therefore, this definition would provide fewer indirect benefits to the biological and ecological environment than **Alternatives 4** and **5**, and could make it more difficult to sustain red snapper over the long term. However, biological benefits under **Alternative 2** would be greater than those under **Alternatives 6, 7**, and **9** since **Alternative 2** is based on a $F_{40\%\ SPR}$ proxy for F_{MSY}; whereas, **Alternatives 6-9** are based on a F_{MSY} proxy of $F_{30\%SPR}$. The ACL under **Sub-Alternative 2A** would be zero until modified and under **Sub-Alternative 2B** the ACL would be 89,000 lbs whole weight until modified. Under this scenario, SSB increases steadily through time until approximately the year 2030 when those increases begin to level off (Figure 4-2). Under **Alternative 2** the stock has a 50% chance of being rebuilt by 2035, six years later than **Alternative 4**, and three years later than **Alternative 3.** There is a 70% chance the stock could rebuild to SSB_{MSY} in the maximum allowable 35 year time frame. However, the stock could rebuild sooner since the Council is considering management actions that would prohibit all harvest of red snapper during initial rebuilding and actions would be taken to reduce incidental catch. Although **Alternatives 3** and **4** would yield higher biological benefits at a faster rate,

Alternative 2 would rebuild the stock within the rebuilding time frame (Figures 4-2 through 4-4).

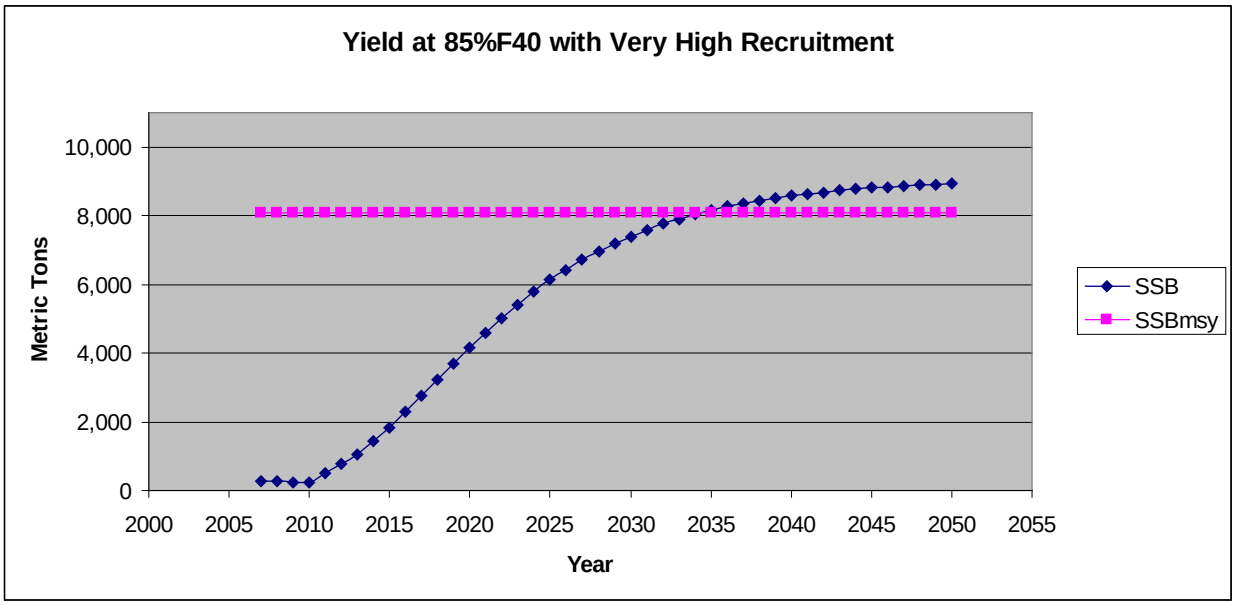


Figure 4-2. Projection results were fishing mortality rate is fixed at F = 85%F_{40SPR} (**Alternative 2**). Expected values represented by dotted solid lines. Thick horizontal line represents SSB_{MSY} = 8102.5 (mt) benchmark. Source: Red Snapper Projections - VII and Addendum: November 2009, Figure 5.4.

Alternative 3 would establish a rebuilding strategy that maintains fishing mortality at 75% F_{MSY} (75%$F_{40\%SPR}$) with a constant F of 0.078. Under **Sub-Alternative 3A** the ACL would be zero, and under **Sub-Alternative 3B** the ACL would be set at 79,000 lbs whole weight and would remain in effect until modified (Figure 4-3). Under **Alternative 3** an 87% reduction in total kill would be required. At this rate of recovery, the stock has a 50% chance of rebuilding to SSB_{MSY} by 2032. There is an 84% that the stock could rebuild to SSB_{MSY} ($SSB_{40\%SPR}$) by 2044. However, the stock could rebuild sooner since the Council is considering management actions to prohibit all harvest of red snapper during initial rebuilding and actions are being considered to reduce incidental catch in **Section 4.3**. This is an intermediate option among **Alternatives 2-5** for stock recovery in terms of time for recovery and removal rate. **Alternative 3** would rebuild the stock more quickly than **Alternative 2**, but would rebuild it three years slower than **Alternative 4**. When considering the expanding margin of error for SSB as it approaches SSB_{MSY}, it is likely a three year difference would be biologically negligible regarding benefits to the stock.

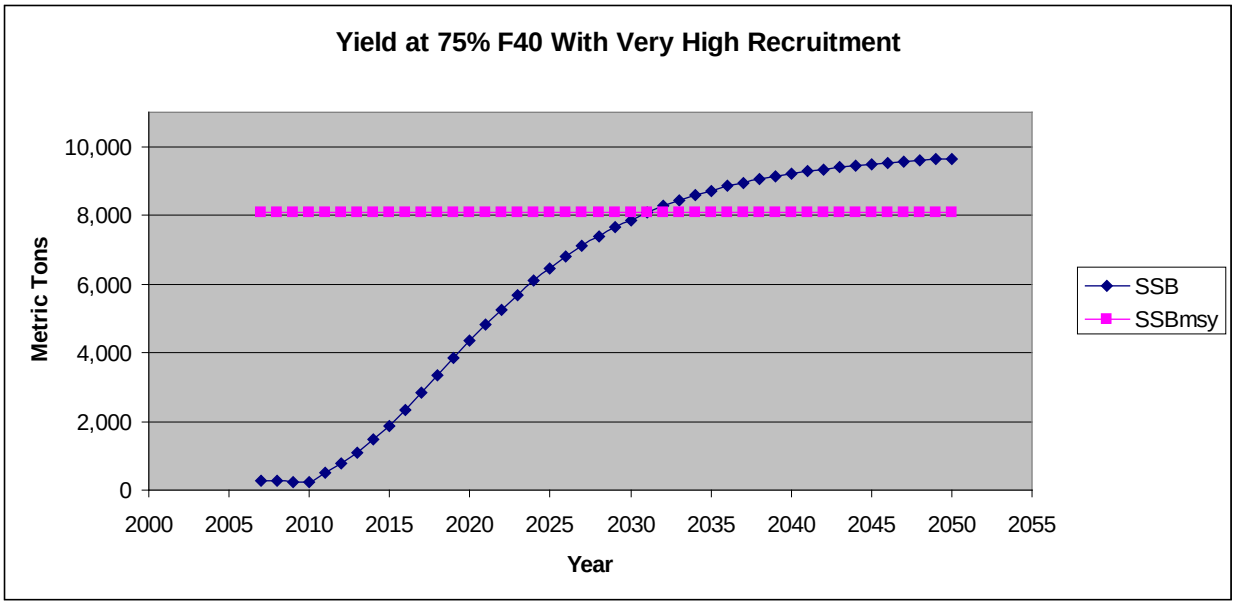


Figure 4-3. Projection results where fishing mortality rate is fixed at F = 75%$F_{40\%SPR}$ (**Alternative 3**). Expected values represented by dotted solid lines. Thick horizontal line represent SSB_{MSY} = 8102.5 (mt) benchmark. Source: Red Snapper Projections - VII and Addendum: November 2009, Figure 5.3.

Alternative 4 would implement the most conservative rebuilding strategy of all the alternatives considered that have a rebuilding SSB_{MSY} target of $SSB_{40\%SPR}$. **Alternative 4** would also require a higher reduction in total kill than **Alternatives 6-9**, which have a rebuilding target of $SSB_{30\%SPR}$. Under **Alternative 4** the rebuilding strategy would set F_{OY} equal to 65%F_{MSY} (65%$F_{40\%SPR}$). Under **Sub-Alternative 4A** the ACL would be zero and under **Sub-Alternative 4B** the ACL would be 68,000 lbs whole weight, and would remain in effect until modified. A 91% reduction in total kill would be required under **Alternative 4**. Because this ACL is the lowest relative to other alternatives, it would be the ACL most likely to be exceeded. According to the November 2009 projections, **Alternative 4** would rebuild the stock the fastest among **Alternatives 2-5**. The stock would have a 50 percent probability of being rebuilt by the year 2029 and a 94% probability of being rebuilt by 2044. However, the stock could rebuild sooner than 2029 since the Council is considering management measures to prohibit all harvest of red snapper during initial rebuilding and actions are being considered to reduce incidental catch in **Section 4.3**. The estimated timeframe of 19 years is the closest to $T_{MIN,}$ and would be the most biologically beneficial for the stock. However, this alternative would also be the most restrictive compared to all the other alternatives under consideration. **Alternative 4** may be viewed as too conservative in light of the fact that **Alternatives 2, 3**, and **5** are also expected to rebuild the stock within the allowable time frame. As Figure 4-4 illustrates, steady progress toward a rebuilt condition is expected under this alternative with no leveling effect before the rebuild condition is reached.

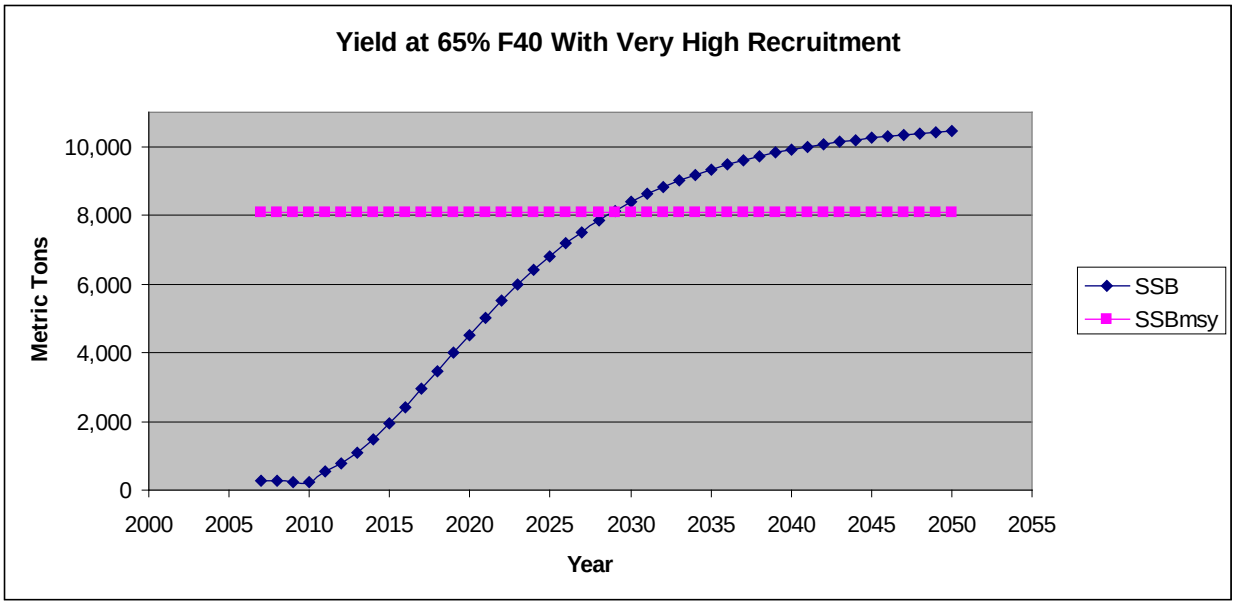


Figure 4-4. Projection where fishing mortality rate is fixed at F = 65%$F_{40\%SPR}$ (**Alternative 4**). Expected values presented by dotted solid lines. Thick horizontal line represents SSB_{MSY} = 8102.5 (mt) benchmark. Source: Red Snapper Projections -VII and Addendum: November 2009, Figure 5.2.

Alternative 5 (Preferred) (Figure 4-5) would set the rebuilding strategy equal to 97%F_{MSY} (97%$F_{40\%SPR}$) based a constant $F_{REBUILD}$ of 0.088. Under **Sub-Alternative 5A** the ACL would be zero and under **Sub-Alternative 5B** the ACL would be 101,000 lbs whole weight, and would remain in effect until modified. Under **Alternative 5 (Preferred)**, an initial 83% reduction in total kill would be required. **Alternative 5 (Preferred)** specifies a fishing mortality rate that has a 50% probability of rebuilding the stock to SSB_{MSY} in the maximum allowable time of 35 years (2044). It is possible the red snapper stock could rebuild sooner that specified in 2044 since the Council is considering management measures to prohibit all harvest during the initial years of rebuilding and actions are being considered to reduce incidental catch. The biological benefits of **Preferred Alternative 5** would be intermediate in value and would consider the social and economic effects of the action.

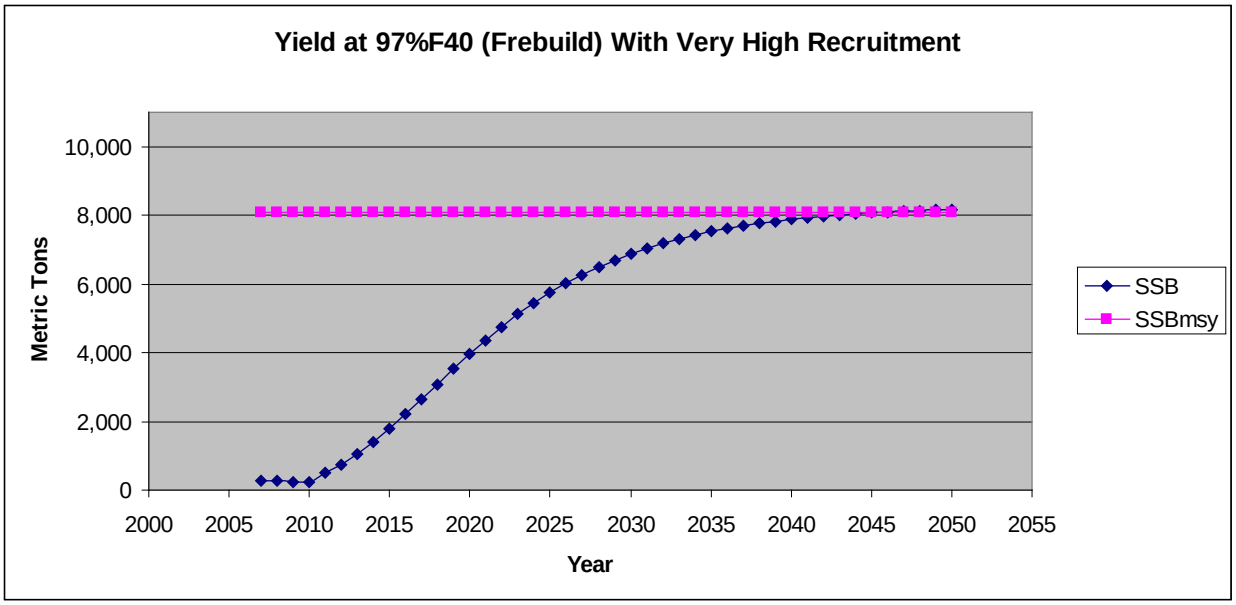


Figure 4-5. Projection where fishing mortality rate is fixed at F = 97%$F_{40\%SPR}$ (**Alternative 5 Preferred**). Expected values presented by dotted solid lines. Thick horizontal line represents SSB_{MSY} = 8102.5 (mt) benchmark. Source: Red Snapper Projections -VII: November 2009, Figure 5.1.

Under **Alternative 6**, an initial reduction in total kill of 79% would be required. Therefore, this definition would provide fewer indirect benefits to the biological and ecological environment than **Alternatives 7** and **8**, since it would not be expected to rebuild as rapidly to $SSB_{30\%SPR}$. However, biological benefits under **Alternative 6** would be greater than those under **Alternative 9** since, which would require a smaller reduction in total kill. The ACL under **Sub-Alternative 6A** would be zero until modified and under **Sub-Alternative 6B** the ACL would be 125,000 lbs whole weight until modified. Under this scenario, SSB increases steadily through time until approximately the year 2025 when those increases begin to level off (Figure 4-6). Under this alternative the stock has a 50% chance of being rebuilt by 2031, five years later than **Alternative 8**, and two years later than **Alternative 7.** There is a 78% chance the stock could rebuild to SSB_{MSY} ($SSB_{30\%SPR}$) in the maximum allowable 35 year time frame. However, the stock could rebuild sooner since the Council is considering management actions that would prohibit all harvest of red snapper during initial rebuilding and actions would be taken to reduce incidental catch.

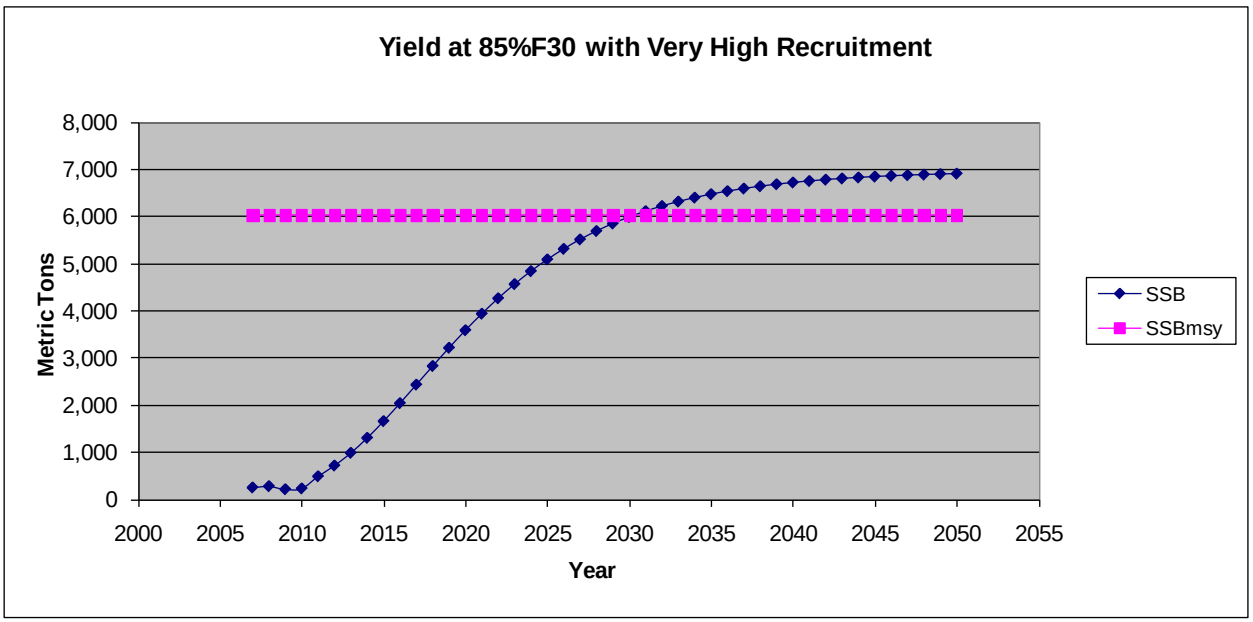


Figure 4-6. Projection where fishing mortality rate is fixed at F = 85%$F_{30\%SPR}$ (**Alternative 6**). Expected values presented by dotted solid lines. Thick horizontal line represents SSB_{MSY} = 6025.1 (mt) benchmark. Source: Red Snapper Projections -VIII and Addendum: January 2010, Figure 6.5.

Alternative 7 would establish a rebuilding strategy that maintains fishing mortality at 75% F_{MSY} (75%$F_{30\%SPR}$) with a constant F of 0.111. Under **Sub-Alternative 7A** the ACL would be zero, and under **Sub-Alternative 7B** the ACL would be set at 111,000 lbs whole weight and would remain in effect until modified (Figure 4-7). Under **Alternative 7** an 82% reduction in total kill would be required. At this rate of recovery, the stock has a 50% chance of rebuilding to SSB_{MSY} ($SSB_{30\%SPR}$) by 2028. There is an 92% that the stock could rebuild to SSB_{MSY} by 2044. However, the stock could rebuild sooner since the Council is considering management actions to prohibit all harvest of red snapper during initial rebuilding and actions are being considered to reduce incidental catch in **Section 4.3**. This is an intermediate option among **Alternatives 6-9** for stock recovery in terms of time for recovery and removal rate. **Alternative 7** would rebuild the stock more quickly than **Alternative 6**, but would rebuild it two years slower than **Alternative 4**.

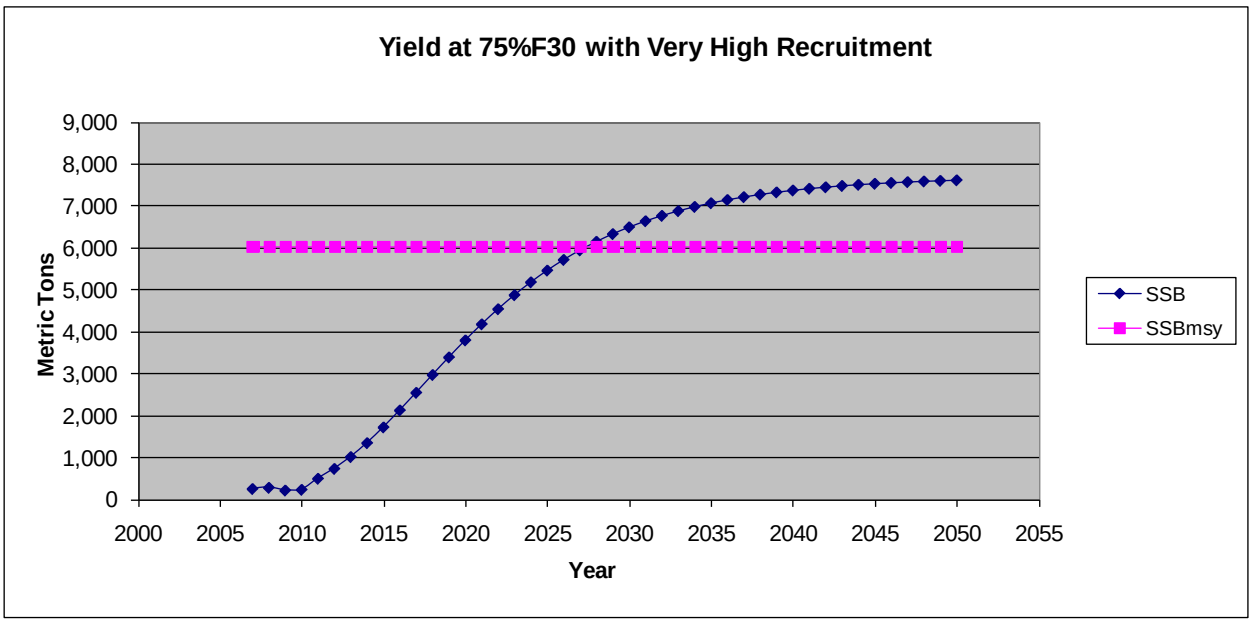


Figure 4-7. Projection where fishing mortality rate is fixed at F = 75%$F_{30\%SPR}$ (**Alternative 7**). Expected values presented by dotted solid lines. Thick horizontal line represents SSB_{MSY} = 6025.1 (mt) benchmark. Source: Red Snapper Projections -VIII and Addendum: January 2010, Figure 6.4.

Alternative 8 (Figure 4-8) would implement the most conservative rebuilding strategy of all the alternatives considered that have a rebuilding SSB_{MSY} target of $SSB_{30\%SPR}$. Under **Alternative 9** the rebuilding strategy would set F_{OY} equal to 65%F_{MSY} (65%$F_{30\%SPR}$). Under **Sub-Alternative 8A** the ACL would be zero and under **Sub-Alternative 4B** the ACL would be 97,000 lbs whole weight, and would remain in effect until modified. An 84% reduction in total kill would be required under **Alternative 8**. **Alternative 8** would rebuild the stock the fastest among **Alternatives 6-9**. The stock would have a 50 percent probability of being rebuilt to $SSB_{30\%SPR}$ by the year 2026 and a 98% probability of being rebuilt by 2044. However, the stock could rebuild sooner than 2026 since the Council is considering management measures to prohibit all harvest of red snapper during initial rebuilding and actions are being considered to reduce incidental catch in Section 4.3.

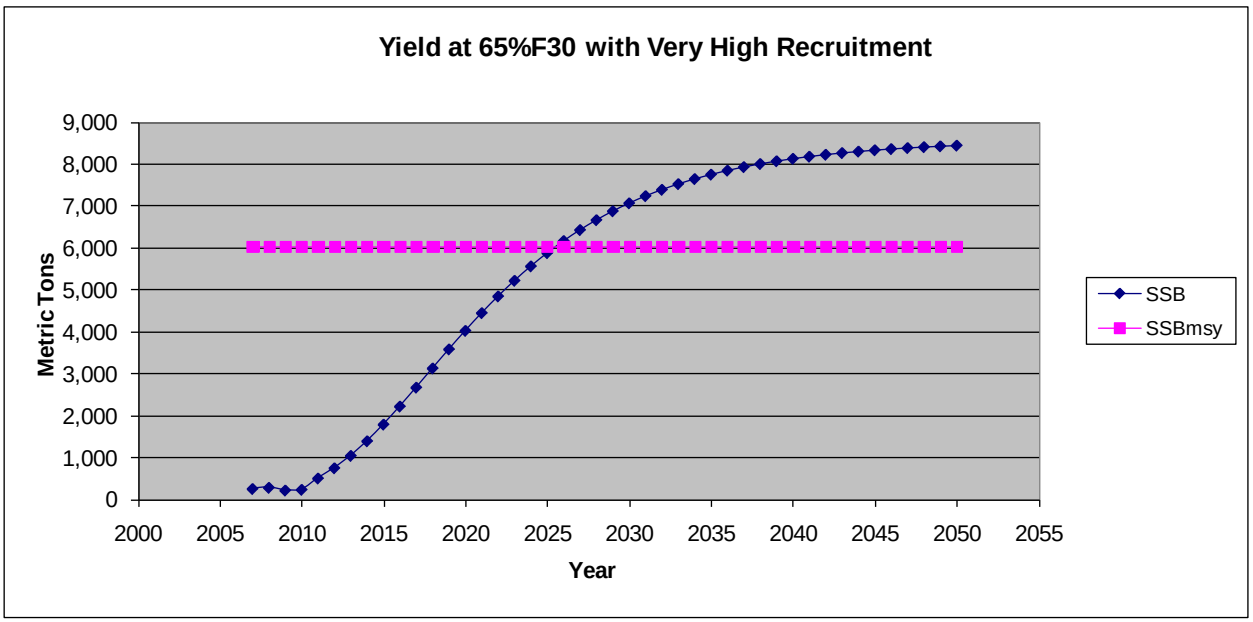


Figure 4-8. Projection where fishing mortality rate is fixed at F = 65%$F_{30\%SPR}$ (**Alternative 8**). Expected values presented by dotted solid lines. Thick horizontal line represents SSB_{MSY} = 6025.1 (mt) benchmark. Source: Red Snapper Projections -VIII and Addendum: January 2010, Figure 6.3.

Alternative 9 (Figure 4-9) would set the rebuilding strategy equal to 97%F_{MSY} (97%$F_{40\%SPR}$) based a constant $F_{REBUILD}$ of 0.145. Under **Sub-Alternative 9A** the ACL would be zero and under **Sub-Alternative 9B** the ACL would be 144,000 lbs whole weight, and would remain in effect until modified. Under **Alternative 9**, an initial 76% reduction in total kill would be required. **Alternative 9** specifies a fishing mortality rate that has a 53% probability of rebuilding the stock to SSB_{MSY} ($SSB_{30\%SPR}$)in the maximum allowable time of 35 years (2044). It is possible the red snapper stock could rebuild sooner that specified in 2044 since the Council is considering management measures to prohibit all harvest during the initial years of rebuilding and actions are being considered to reduce incidental catch. The biological benefits of **Alternative 9** would be less than all other alternatives considered.

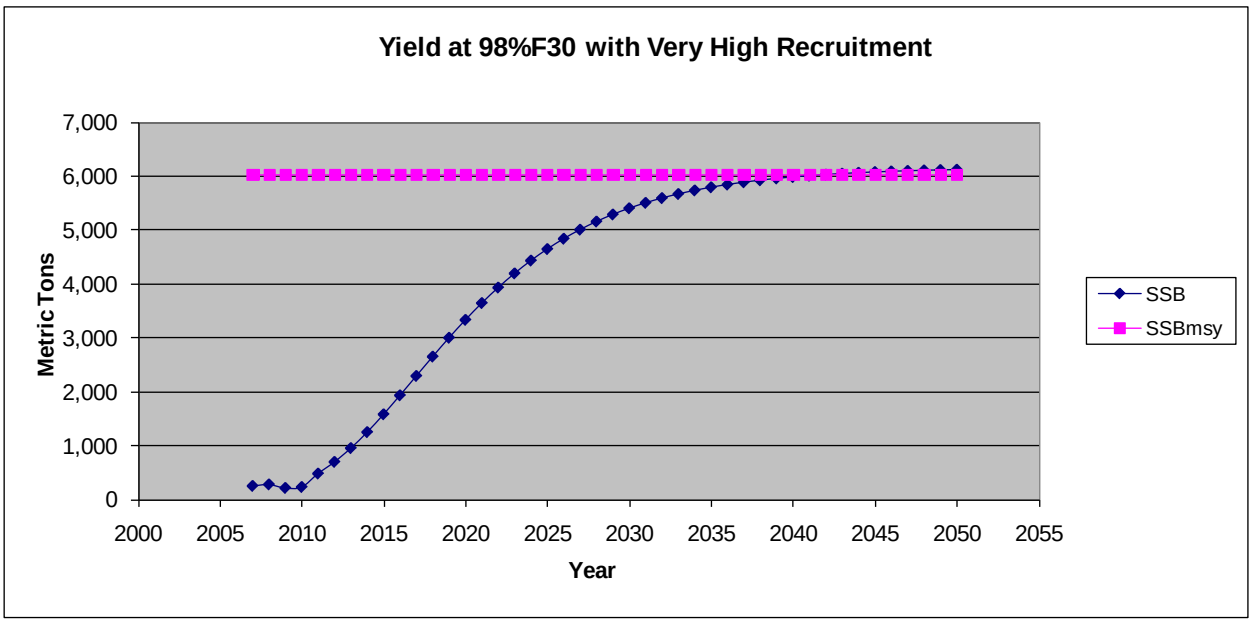


Figure 4-9. Projection where fishing mortality rate is fixed at F = 98%$F_{30\%SPR}$ ($F_{Rebuild}$; **Alternative 9**). Expected values presented by dotted solid lines. Thick horizontal line represents SSB_{MSY} = 6025.1 (mt) benchmark. Source: Red Snapper Projections -VIII and Addendum: January 2010, Figure 6.2.

Under each of the sub-alternatives, the AM would be to track catch per unit effort (CPUE) of red snapper via a fishery-independent monitoring program (see **Section 4.12**) to identify changes in biomass. CPUE would be evaluated every three years and adjustments would be made by the framework action being developed in Amendment 17B. The disadvantage of this strategy is that a monitoring program does not currently exist and baseline data are few. The proposed framework for a fishery-independent monitoring program would continue the long-term data series from MARMAP surveys and add a complementary sampling program to expand needed coverage. The improved sampling plan would increase the (1) spatial footprint (central FL to Cape Hatteras, NC), (2) sample size, and (3) number of gear utilized over current survey levels; thereby, considerably improving program effectiveness. Details of the proposed fishery-independent sampling program are discussed in Section 4.5.

Alternatives 1 (Status Quo)-9 are unlikely to have adverse effects on ESA-listed species, including *Acropora* species. Previous ESA consultations determined the snapper grouper fishery was not likely to adversely affect *Acropora* species (see **Section 3.5** of this document). These alternatives are unlikely to alter fishing behavior in a way that would cause new adverse effects to these species. The impacts from **Alternatives 1 (Status Quo)-9** on sea turtles and smalltooth sawfish are unclear. If they perpetuate the existing amount of fishing effort, but cause effort redistribution, any potential effort shift is unlikely to change the level of interaction between sea turtles and smalltooth sawfish and the fishery as a whole. If these alternatives result in an overall reduction of fishing effort in the snapper grouper fishery, the risk of interaction between sea turtles and smalltooth sawfish will likely decrease.

4.2.2.2 Economic Effects

Commercial Fishery

Optimum Yield at Equilibrium

The more conservative the OY, the larger the sustainable biomass when the stock is rebuilt and therefore greater long-term economic benefits. **Alternatives 2-5** are based on the rebuilding strategy where OY would equal the yield at a range of parentages of F_{MSY} using $F_{40\%SPR}$ as a proxy for F_{MSY}. **Alternatives 6-9** are also based on the rebuilding strategy where OY would equal the yield at the same range of percentages of F_{MSY} but use $F_{30\%SPR}$ as a proxy for F_{MSY}. Because $F_{40\%SPR}$ results in a more conservative proxy for F_{MSY}, and therefore higher values of OY at equilibrium, **Alternatives 2-5** would seem to provide greater long-term economic benefits than **Alternatives 6-9**.

Alternative 4 and Sub-alternative 4A, are expected to result in the largest biological benefit, is also expected to offer the largest long-term economic benefits but would require the most severe short-term reductions and therefore largest short-term negative economic impacts. **Alternative 9 with Sub-alternative 9B** is expected to yield the smallest biological benefit. This would likely result in less stringent management measures and therefore the smallest short-term negative economic impacts but also the smallest long-term economic benefits to the fishermen.

Alternative 5 (Preferred) identifies an OY level based on the SSC's F_{MSY} proxy. This alternative has the longest rebuilding period and a higher reduction in total removals (83%) than **Alternatives 6, 7, and 9** but lower than **Alternatives 1, 2, 3, 4, and 8**. This alternative could be expected to result in smaller long-term economic benefits those alternatives with shorter rebuilding periods but might result in less stringent management measures and smaller short-term negative economic impacts than some of the other alternatives. As stated above, **Alternative 5 (Preferred)** would specify an OY level based on the SSC's recommended F_{MSY} proxy while reducing to the extent practicable negative impacts that would result from management measures needed to manage the stock to a more conservative OY level.

Rebuilding Strategies

The rebuilding strategies, ACLs, and AMs proposed are the background upon which management measures will be imposed. In general, the faster the rebuilding period, the greater the short-term negative impacts and the greater the long-term positive impacts assuming the management measures would be less stringent after rebuilding has been achieved. A lower ACL implies more stringent management measures than a higher ACL and a sufficient AM ensures proper management of the stock and therefore higher long-term economic benefits.

Alternatives 6-9 would be less conservative than **Alternatives 2-5** in that they are based on a rebuilding goal of $SSB_{30\%SPR}$. Therefore, the negative economic impacts under **Alternatives 2-5** would be less than under **Alternatives 6-9**.

Alternative 4 is the most conservative rebuilding strategy but would also require the most restrictive harvest prohibitions. This is expected to result in the greatest short-term negative economic impacts. **Alternative 9** is the least conservative of all alternatives considered. This alternative would require the least restrictive harvest prohibitions and therefore the smallest short-term negative economic impacts.

The **"A" Sub-Alternatives (2A, 3A, 4A, etc.)** would establish ACLs based on landings, which would be zero in 2010 and would continue until modified. The **"B" Sub-Alternatives (2B, 3B, 4B, etc.)** would set an ACL equal to the total kill specified in the rebuilding strategy for each alternative. Therefore, **"B" Sub-Alternatives** might provide less stringent management measures on species other than red snapper now or at some future point in time. **Alternative 9B** would offer the highest ACL while **Alternative 4B** would offer the smallest ACL (among the **"B" Sub-alternatives**) and therefore are expected to result in the smallest short-term negative impacts and largest short-term negative impacts, respectively. Under **Alternative 5B (Preferred)**, the ACL would be 101,000 lbs. The biological benefits of Preferred Alternative 5 would be intermediate in biological value and would consider the social and economic effects of the actions.

With regards to ACLs, the **"A" Sub-Alternatives** would all have the same short-term economic impacts given that they all have ACLs equal to zero. None of the **"A" Sub-Alternatives** would support a commercial fishery for red snapper. It is likely that none of the **"B" Sub-Alternatives** would support fishery as well but they might enable targeting of other species caught in conjunction with red snapper.

Recreational fishery

The alternative rebuilding strategies and their implied OYs and ACLs provide measurable parameters that would delimit the nature and extent of management measures to be implemented over time. In general, a higher OY would be associated with higher long-term benefits. On the other hand, a lower ACL would imply implementation of more stringent management measures and consequently larger adverse economic effects in the short-run but potentially larger benefits in the long run.

Alternative 1 (Status Quo) defines OY and rebuilding strategy that is relatively restrictive. It does not; however, provide for an ACL, and thus may be considered a non-viable alternative. It may also be noted that this alternative would require more stringent regulations in the short run than some of the other alternatives, such as **Alternative 2**. All other alternatives would provide for OY, rebuilding strategy, ACL, and AM; however, the ACL level of each alternative would render the red snapper fishery a bycatch fishery for both the commercial and recreational sectors in the short run. That is, these alternatives would not support either a commercial or a

recreational fishing industry that would depend on red snapper as a major source of vessel revenues and angler benefits in the short run.

The following shows the various OY levels at equilibrium for **Alternatives 2-9**:

Alternative 2: 2.199 million pounds
Alternative 3: 2.104 million pounds
Alternative 4: 1.984 million pounds
Alternative 5: 2.291 million pounds
Alternative 6: 2.392 million pounds
Alternative 7: 2.338 million pounds
Alternative 8: 2.257 million pounds
Alternative 9: 2.464 million pounds

If everything else were the same, **Alternative 9** would provide the largest economic benefits in the future and **Alternative 4**, the lowest. One feature that would make a big difference in the comparison of OY alternatives is the F_{MSY} proxy used as the basis for F_{OY}. **Alternatives 2-5** use $F_{40\%SPR}$ as F_{MSY} proxy and **Alternatives 6-8**, $F_{30\%SPR}$. Considering the relatively higher probability that $F_{40\%SPR}$ affords in maintaining a sustainable stock over the long run, the apparent larger economic benefits of **Alternative 9** than those of some alternatives with relatively close OY level but using $F_{40\%SPR}$ as F_{MSY} proxy, such as **Alternative 5 (Preferred)**, may not be realized.

Among alternatives with the same F_{MSY} proxy, larger economic benefits may be associated with alternatives providing F_{OY} closer to F_{MSY}. In this case, **Alternative 5 (Preferred)** would be better than **Alternatives 2-4** and **Alternative 9** would be better than **Alternatives 6-8**. This would be the case if everything else were the same for all alternatives within each set. Some factors that may help validate the potential economic superiority of alternatives with higher OY within each set of F_{MSY} proxy include the probability and speed of attaining SSB_{MSY}. The probability and speed of attaining MSST also play an important role because regulations could be relaxed much further after reaching this threshold, but for the moment the issue involving MSST can be dispensed with but taken up later in the discussion. For a given timeframe, the higher the probability of reaching SSB_{MSY}, the better would be the alternative; conversely, for a given probability, the faster SSB_{MSY} is reached the better would be the alternative. Based on these criteria, **Alternative 4** would be the best among $F_{30\%SPR}$ alternatives and **Alternative 8** among the other set of alternatives. **Alternative 4** has the highest probability of rebuilding the stock at a given timeframe ending in 2044 and the fastest speed in rebuilding the stock at a given 50% probability.

It may be noted that the comparison of alternatives conducted so far has a long-run outlook. Consideration of short-run regulatory requirements under each alternative would depict an entirely different picture. **Alternative 4**, which appears to provide the best long-run economic condition among the $F_{40\%SPR}$ alternatives, would require the largest short-run cost, with as high as 91% required reduction in total red snapper kill. A similar case happens with **Alternative 8** among the other set of alternatives. **Alternative 4**, in particular, would require much higher reduction in total kill than expected from any of the management alternatives considered in this

amendment. If additional management alternatives were developed to achieve such high a required reduction in total red snapper kill, the accompanying cost would most likely be significantly higher as these alternatives would affect a greater number of snapper grouper recreational and commercial fishing activities. Economic costs and benefits over time would have to be examined to give some resolution to this issue. A highly simplified approach is attempted with the main intent of illustrating the issue of economic valuation over time respecting the various rebuilding alternatives.

Table 4-6 presents the economic values of red snapper for the entire 2010-2044 period. Red snapper data are lifted from Table 4-5a through Table 4-5h. Some simplifying assumptions used in generating the tabulated results include: (1) red snapper landed or new discards in the source tables are assumed to be red snapper landings/harvests; (2) the assumed red snapper harvests are exactly matched with neither over- nor under-harvest; (3) red snapper is valued by the commercial and recreational sectors at $1 per pound; (4) the regulatory regime over the entire period affects only the red snapper fishery; and, (5) 7% and 3% discount rates.

Table 4-6 presents two sets of economic values, one without harvest adjustments and the other with harvest adjustments. The first set of values refers to the economic values of red snapper harvest for the entire 2010-2044 period. The second set of economic values incorporates adjustments made to the red snapper harvests after the spawning stock biomass exceeded the overfishing threshold (MSST). To make these adjustments, the LD values in Tables 4-5a to 4-5h were replaced by the corresponding values for total kill that would prevent overfishing less the dead discards. These adjustments were made each year after the SSB exceeded MSST. Also, the discounting rates of 7% and 3% are used to generate the net present values. These are the rates generally used in fisheries when discounting a stream of values over time.

Among the $F_{30\%SPR}$ alternatives, **Alternative 5 (Preferred)** would provide the highest net present value regardless of the discounting rates used. This would also be the case even if landings were increased after SSB exceeded MSST, although landings were still restricted to the level that would prevent overfishing. The late landing adjustment introduced into **Alternative 5 (Preferred)** did not make a difference in the relative magnitude of results among the alternatives. Landings adjustments were made starting in 2035 for **Alternative 5 (Preferred)**, 2032 for **Alternative 2**, 2029 for **Alternative 3**, and 2028 for **Alternative 4**. The larger landings under **Alternative 5 (Preferred)** in the early years compensated for the later increase in landings relative to the other alternatives. A similar observation may be made of **Alternative 9** relative to the other $F_{40\%SPR}$ alternatives.

One other thing worth noting in Table 4-6 is the relatively large difference in values when using different discount rates. In the present case, the use of a 7% rate as against a 3% rate substantially reduced the economic values, although under either discount rate the relative ranking of alternatives did not change.

Table 4-6. Summary of economic values of red snapper under various rebuilding alternatives, in thousand dollars, 2010-2044.

	Year SSB > MSST	Net Present Value without Landing Adjustments		Net Present Value with Landing Adjustments	
		7%	3%	7%	3%
Alternative 2	2031	$12,078	$25,301	$12,334	$26,048
Alternative 3	2028	$11,246	$23,666	$11,906	$25,467
Alternative 4	2027	$10,294	$21,765	$11,422	$24,778
Alternative 5	2034	$12,948	$26,976	$12,977	$27,067
Alternative 6	2028	$14,283	$29,459	$14,501	$30,044
Alternative 7	2024	$13,543	$28,098	$14,230	$29,761
Alternative 8	2036	$12,633	$26,375	$12,878	$27,176
Alternative 9	2036	$15,023	$30,764	$15,031	$30,790

Year SSB > MSST refers to the rebuilding year when the spawning stock biomass exceeds the overfishing threshold (MSST).

The ACL provision under each rebuilding alternative could materially change the economic scenarios presented in the Table 4-6 at least in the first few years of the rebuilding period. Each of **Alternatives 2-9** provides for two ACL sub-alternatives. The first sub-alternative would impose an ACL = 0 based on landings and the second would impose a non-zero ACL based on dead discards. A landings-based ACL of zero would not alter the relative scenarios depicted in Table 4-6 if under each alternative the same ACL level were implemented for the same length of time, e.g., the first 5 years for each alternative. Varying time length for the zero landings-based ACL would lead to economic outcomes different from the ones shown in the table. Without information on how long a zero ACL would be maintained under each alternative, it is not possible to depict each alternative's economic values over time. It may only be remarked that a zero ACL would likely speed up the rebuilding of the red snapper stock under each alternative.

From the standpoint of economic effects, the dead discards-based ACLs would have implications on management measures affecting snapper grouper fisheries other than the red snapper fishery. They would not affect the economic scenarios shown in Table 4-6 because of the assumption that the regulatory regime during the rebuilding period affects only the red snapper fishery. It may only be stated that the lower the dead discards-based ACL, the greater would be the short-term adverse effects on other snapper grouper fisheries.

The same three sets of accountability measures accompany each of the landings-based ACLs. The first one would track CPUE/biomass of red snapper via a fishery-independent monitoring program; the second would track CPUE/biomass through a fishery-dependent sampling program; and, the third would require evaluation of CPUE every three years and making the necessary regulatory adjustments. The costs to fishing participants associated with the tracking of CPUE and biomass are relatively minimal, but the administrative costs for the fishery-independent data collection could vary from small to large depending on the size of the program. A fishery-dependent data collection program could have lower associated administrative costs, but could also raise issues regarding the validity of the data. Any adjustment involving more stringent management measures would add costs especially to the fishing participants of other fisheries. On the other hand, more favorable adjustments could benefit the red snapper fishery as well as

other snapper grouper fisheries. The costs and potential benefits of these AMs to the fishing participants would be proportionally the same across **Alternatives 2-9**.

The same three sets of accountability measures accompany each of the discards-based ACLs. The first one would track CPUE/biomass of red snapper via a fishery-independent monitoring program; the second would track CPUE/biomass via a fishery-dependent monitoring program involving headboats and charterboats; and, the third would require the Council to evaluate CPUE/biomass every three years and make adjustments to the size of area closures when discards are estimated to exceed the ACL. The costs to fishing participants associated with the tracking of CPUE and biomass are relatively minimal, but the administrative costs for the fishery-independent data collection could vary from small to large depending on the size of the program. Any additional closures based on the collected information would add costs especially to the fishing participants of other fisheries. The costs and potential benefits of these AMs to the fishing participants would be proportionally the same across **Alternatives 2-9**.

4.2.2.3 Social Effects

General Concepts

Although an administrative action, defining the OY for a species or species complex establishes a management target for allowable harvests. If defined as a percentage (less than one) of the MSY, the target would incorporate a protective buffer to help ensure that the biological health of the resource is not threatened, thereby helping support stable environmental, economic, and social benefit streams. The larger the buffer, the greater the certainty of biological protection. However, an excessively large buffer (i.e., a buffer that exceeds the biological variability of the resource, environmental challenges, and potential for fishery-induced problems) would result in overly restrictive harvest allowances, leading to foregone social and economic benefits. While none of the relevant parameters are likely to be known with certainty, the best OY specification would be expected to balance the risk and costs of being insufficiently conservative against the costs of potentially unnecessarily "leaving fish in the water," all decisions on which incorporate best available knowledge of the biology of the resource, environmental challenges, and the capabilities of the harvesting sectors.

Social impacts of management accrue incrementally to fishing regulations and conditions that exist each year, and cumulatively as conditions are compounded over multiple years (single year or short-term restrictions may result in minimal social impacts, whereas persistent restrictions would be expected to result in more significant impacts). In general, smaller harvest levels entail greater short-term dislocations and adjustments for the social environment. Commercial and recreational fishermen may be able to adjust to harvest reductions by switching to other species or by leaving fishing and seeking other employment or recreational opportunities elsewhere. If other species are depleted, regulations may prevent fishermen from freely switching to another fishery or, if other forms of employment or recreational activities are unavailable or difficult to find, then the adjustments would be more severe than if alternatives were readily available.

The rebuilding strategies typically considered are either constant catch or constant fishing mortality rate (F) approaches, with different periods of catch adjustment. The basic principle of a constant catch strategy is to maintain the allowable harvest at a constant amount for the entire rebuilding period. This is a conservative strategy that creates the least socio-economic disruption in the short term to the fishing industry and associated businesses, assuming the allowed harvest level is relatively close to current harvests. However, medium- and long-term problems may arise as catch rates increase with the rebuilding resource and ABC is held constant. While the total catch remains constant, harvest can occur more quickly and/or with the expenditure of fewer resources. Although this may allow these now non-required (for fishing) resources to be put to other uses, with associated benefits, the increased catch rates could induce the perception among fishermen that regulation is too restrictive, particularly if increased bycatch and bycatch mortality occurs, jeopardizing recovery goals. Pressure to increase allowable catches is likely under such events, although the long-term biological recovery may not be complete.

Constant F strategies recognize the limitations of constant catch strategies by allowing catches to increase as the stock recovers and biomass increases. Starting harvest levels under constant F approaches; however, are typically lower than constant catch levels, resulting in greater initial restrictions and short-term social and economic losses, but higher subsequent harvest levels support larger medium- and long-term benefits.

As discussed in **Section 1.2**, ACLs specify the amount of allowable fishing mortality of a species per year and are the amount of harvest that prevents overfishing. Exceeding the ACL, or ACT if such is also specified, triggers the AMs. In tandem or as part of a rebuilding strategy, the ACL is the specific amount of annual fishing mortality, regardless of whether determined by a constant catch or constant F rebuilding strategy, that is allowed each year of the rebuilding period. In general terms, the higher the ACL, the greater the short-term social and economic benefits that would be expected to accrue, assuming long-term recovery and rebuilding goals are not jeopardized. Adhering to stock recovery and rebuilding goals is assumed to result in net long-term positive social and economic benefits. Thus, it is important that short-term decisions, such as allowable annual harvest levels, be consistent with the long-term objectives. Although the net long-term outcome may be positive; however, as with any short-term and long-term trade-off, short-term consequences may be so severe as to result in the long-term benefits accruing to different entities than those who bear the consequences of the short-term actions.

In addition to the above considerations, the preferred rebuilding strategy from the perspective of the social environment would be expected to be influenced by the industries' perception of stock status. If the industry believes that the resource is overfished, then fishermen and associated businesses would be expected to be willing to accept short-term socio-economic losses in exchange for long-term increases in harvest rates, depending, of course, that they also consider when pay-back occurs as reasonable. Constant F strategies may be preferred because the fishermen would more quickly realize the benefits of resource rebuilding through corresponding increases in allowable harvest. However, if fishermen disagree with the stock assessment, then they would be less willing to incur reductions in current harvest rates. In this event, fishermen may prefer constant catch rebuilding strategies because of the reduced short-term socio-economic losses while additional biological information is collected and assessed. Modified

constant F strategies probably would be preferred by fishermen who perceive the stock to be overfished, but who are not certain about the magnitude of potential long-term benefits.

Comparison of Fishery with Management Reference Point Alternatives

Although all of the alternative rebuilding strategy equations (formulas) result in equilibrium (recovered resource) OY specifications that are considerably greater than the recent average annual harvest, because red snapper is overfished, is undergoing overfishing, and the severity of its stock status requires total closure of the red snapper fishery, the alternative OY specifications have no relevance to short term operation of the fishery. From a long-term perspective, while the different alternatives imply different equilibrium harvest levels, suggesting the different social and economic benefits, the total variation between the alternative specifications is small, particularly considering the absence of a demonstrated ability by the combined harvest sectors to actually harvest these quantities. Thus, little to no differential long-term social effects would be expected between the different alternatives based simply on an examination of harvests and equilibrium OY.

All of the rebuilding strategies considered are constant catch strategies, so the potential differences in social and economic benefits between constant catch and constant F strategies discussed above is not relevant to the current discussion.

In addition to each alternative employing a constant catch approach, with the exception of **Alternative 1 (Status Quo)**, each of the alternative rebuilding strategies would impose a directed harvest level of zero pounds and establish a specific ACL that would remain fixed until modified. **Alternative 1 (Status Quo)** would allow the fishery to continue to be managed under the current yield-based rebuilding strategy and the OY established under Amendment 11, but would not specify an ACL or a method to monitor the recovery of red snapper, though the allowable directed harvest level would still likely be set at zero as a result of the proposed management measures discussed for Action 4. Because ACLs are now required components of FMPs, **Alternative 1 (Status Quo)** would not be a viable long-term action, meaning its selection would require redundant subsequent council action to specify an ACL. Thus, while the red snapper fishery could continue unaffected in the short term, at least as constrained by this individual action, such would be temporary and the costs and social impacts of duplicative management action would be incurred. While no direct adverse social effects would accrue to the fishery participants or associated industries and communities, a perception of irresponsible management and waste of public resources might accrue, with associated adverse social outcomes.

Alternatives 2-9 differ in the formula on which the rebuilding strategy would be based. Further, as discussed in **Section 4.2.2.1**, each of **Alternatives 2-9** have an "**A**" sub-alternative that would establish ACLs based on landings, and "**B**" sub-alternative that would prohibit all harvest of red snapper in the directed commercial and recreational sectors, but would set an ACL equal to the total kill arising from incidental or bycatch harvest or resource monitoring activities. The alternative formulas result in different ACLs (except for **Sub-alternatives A**), different OYs (recovered equilibrium), and different rates of recovery and probabilities of achieving rebuilding by 2044. Additionally, in addition to the two AMs common with **Sub-Alternative A**, **Sub-**

alternative B would allow modification of the size of the area closures when total kills are estimated to exceed the ACL. Because the allowable directed red snapper harvest for each of **Alternatives 2-9** would be zero pounds under both **Sub-alternative A** and **B (**other than potential directed harvest as a research set-aside), in functional application, no difference in social effects would be expected across **Alternatives 2-9** based on this perspective. However, the alternative management measures, as described and discussed in Section 4.3, would establish different area closures for other snapper grouper species in order to limit red snapper kill as a result of bycatch and release mortality. As a result, for **Sub-alternative B** under **Alternatives 2-9** the smaller the ACL, the larger the required closure to limit the bycatch or release mortality. The larger the area closure, the greater the short term loss of social and economic benefits.

The smaller the ACL, the greater the necessary reduction in total kill, the greater the likelihood of triggering AMs, the quicker the expected achievement of at least a 50 percent probability of rebuilding, and the greater the probability that the resource will be recovered by 2044 (the maximum allowable recovery time). Reducing harvest and triggering AMs results in short term reductions in social and economic benefits. The faster that rebuilding occurs, the sooner the benefits of a rebuilt resource can be obtained, while the higher the probability of being rebuilt, the greater the probability that the benefits of the recovered resource can, in fact, be received. Embedded within comparisons of the alternatives is consideration of the appropriate proxy for $F_{MSY.}$ **Alternatives 2-5** use $F_{40\%SPR}$ as a proxy for F_{MSY}, which is more conservative than using $F_{30\%SPR,}$ which is used for **Alternatives 6-9**. Because of the different basis of analysis, the first decision in the selection of the rebuilding strategy is the selection of the appropriate proxy for F_{MSY}, followed by the selection of the rebuilding strategy consistent with that proxy. As such the comparisons of alternatives should tier off the selection of the appropriate proxy for F_{MSY}.

The selection of the best alternative from a social effects perspective involves trade-offs between these considerations. However, empirical analysis of these trade-offs is not available and qualitative discussion must suffice. Within **Alternatives 2-5**, **Alternative 4** would require the greatest harvest reduction, have the greatest likelihood of triggering AMs, and result in one of the highest probabilities that the resource would be rebuilt by 2044. Thus, **Alternative 4** would be expected to result in the greatest short term adverse social and economic effects, but the benefits and likelihood of a rebuilt resource would be expected to be achieved more quickly than under most other alternatives. **Alternative 5 (Preferred)**, conversely, would require the smallest harvest reduction, have the smallest likelihood of triggering AMs, and result in one of the smallest probabilities that the resource would be rebuilt by 2044. As such, **Alternative 5 (Preferred)** would be expected to result in the least short term adverse social and economic disruption, but the benefits of a recovered resource would be substantially delayed relative to **Alternative 4**. Within **Alternatives 6-9, Alternatives 8** and **9** are the comparable pair of most and least restrictive alternatives. The other alternatives within each group would be expected to have intermediate effects to those described. Within either group; however, the value of fishing for the associated species that must be regulated in order to achieve recovery of red snapper is believed to be sufficiently important relative to the value of the red snapper fishery itself that the slowest recovery of red snapper is believed to be the least disruptive of total fishing activity and, as a result, the preferred alternative.

4.2.2.4 Administrative Effects

Under **Alternative 1 (Status Quo)**, the rebuilding strategy would remain as the yield at $F_{45\%SPR}$, which is similar to **Alternative 3**; however, no ACL would be specified for red snapper, which is required by the reauthorized Magnuson-Stevens Act. If this situation were to occur, NOAA Fisheries Service would incur a substantial litigation risk. Administratively, the impacts of a lawsuit brought against the agency would be moderate and take the form of compiling the administrative record, and drafting case related documents.

Alternatives 2 – 9, would produce similar administrative impacts, which are likely to be minimal to moderate. The impacts would take the form of information dissemination to the fishing public, and tracking the ACL. The "B" sub-alternatives involve tracking dead discards for the ACL, which may be a complicated endeavor, and thus could require the development of some specialized means of doing so. A full description of issues associated with tracking the red snapper ACL is provided in **Section 6.6** Monitoring and Mitigation and is hereby incorporated by reference.

4.2.2.5 Council's Conclusions

The Council has chosen **Alternative 5** as their preferred OY/rebuilding strategy alternative. **Alternative 5 (Preferred)** would define a rebuilding strategy for red snapper that sets F_{OY} equal to 97% F_{MSY} (97%$F_{40\%}$) and rebuilds in 35 years. The ACL (total removals) specified for 2010 would remain in effect beyond 2010 until modified. The Council will review ACL and management measures following the next scheduled assessment for red snapper. OY at equilibrium would be 2,291,000 lbs whole weight. Environmental impacts under **Alternative 5 (Preferred)** may be considered to in the middle range of all impacts analyzed. In choosing **Alternative 5 (Preferred)**, the Council acted on the SSC's recommendation of using $F_{40\%SPR}$ as the F_{MSY} proxy, while choosing the highest level of OY within the parameters of the proposed new F_{MSY} proxy. In doing so, the Council mitigated, to the extent practicable, socioeconomic impacts that would be associated with proposed management measures intended to manage the stock to the new MSY and OY benchmark levels, while following the SSC's F_{MSY} proxy recommendation. Though **Alternative 5 (Preferred)** is not likely to rebuild the stock in the fastest amount of time compared with other alternatives considered, it is expected to rebuild the stock within the specified timeframe, thus having the same overall long-term biological benefits as those alternatives that would have rebuilt the stock sooner.

4.3 Red Snapper Management Measures

*Note: The prohibition of red snapper harvest in **Alternatives 2-6** would remain in effect beyond 2009 until modified.*

Alternative 1 (Status Quo). This would continue the 20-inch minimum size limit (commercial & recreational) and the recreational 2 fish bag limit (included in the 10 snapper per person limit).

Alternative 2. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters.

Alternative 3A. Prohibit all commercial and recreational fishing, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, and 3180, or 14,496 sq miles (37,544 km^2) of the South Atlantic EEZ (Figure 4-10). Coordinates for the closure are shown in Table 4-7.

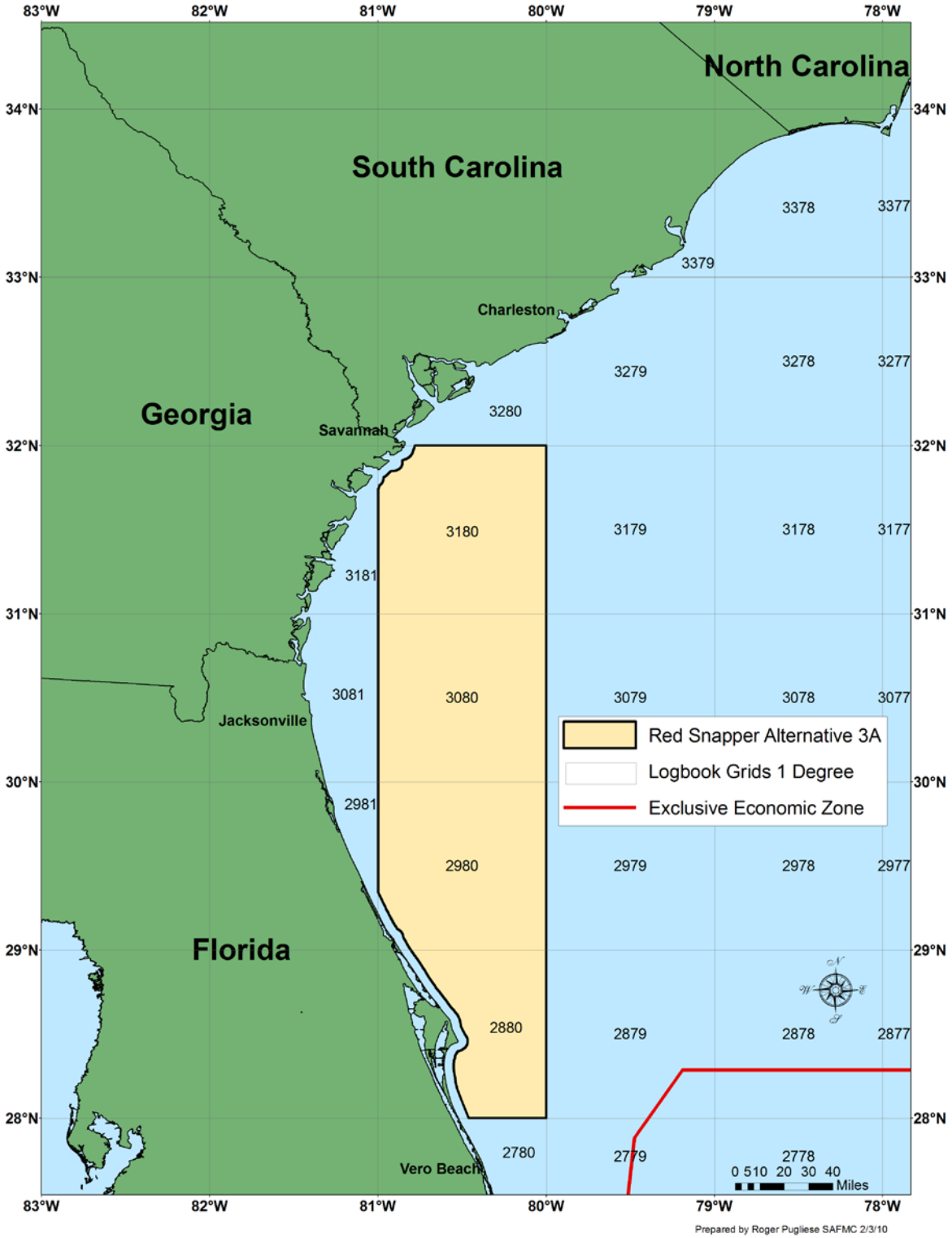


Figure 4-10. Map of proposed closed area under Alternative 3A.

Table 4-7 Waypoints used to delineate Alternative 3A.

ID	LAT_DMS	LON_DMS
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 27' 42"
3	29° 20' 33"	-81° 00' 00"
4	31° 44' 32"	-81° 00' 00"
5	32° 00' 00"	-80° 46' 56"
6	32° 00' 00"	-80° 00' 00"

Between point 2 and point 3, line follows inner boundary of U.S. EEZ.
Between point 4 and point 5, line follows inner boundary of U.S. EEZ.

Alternative 3B. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, and 3180 between an approximate depth of 66 feet (11 fathoms; 20 m) to 240 feet (40 fathoms; 73 m), for a total of 10,567 mi^2 (27,368 km^2) of the South Atlantic EEZ (Figure 4-11). Coordinates for the closure are shown in Table 4-8.

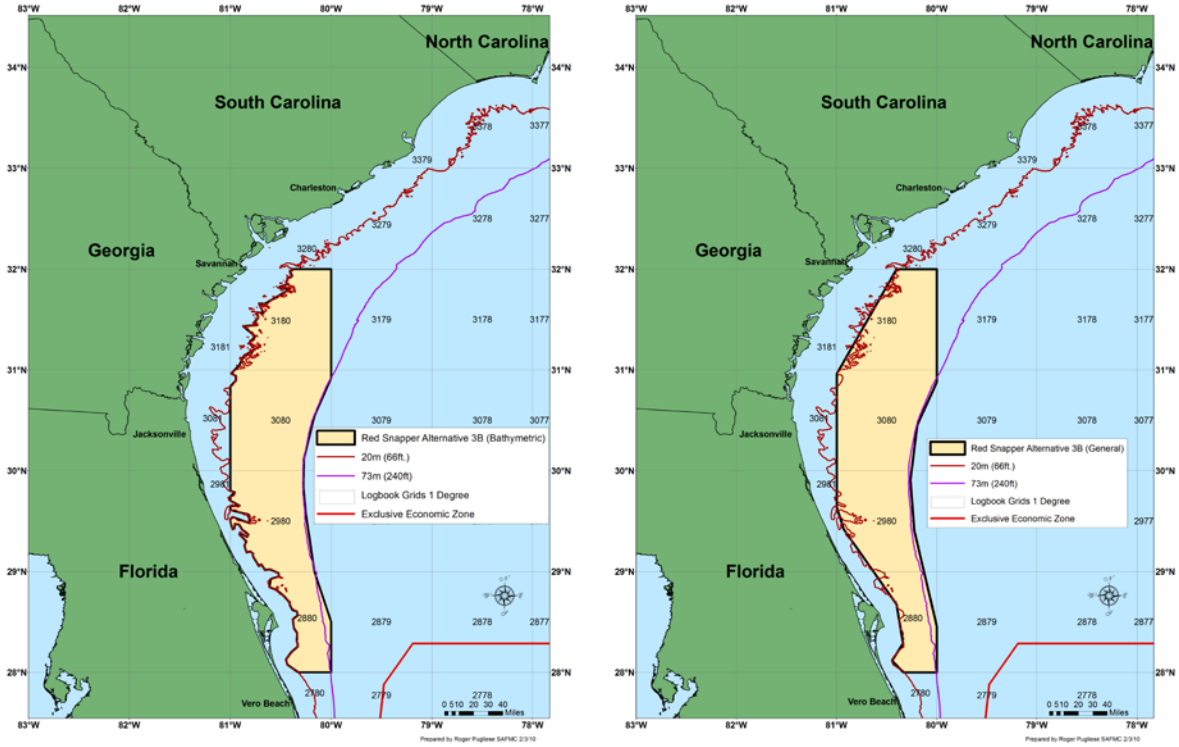


Figure 4-11. Map 1 of proposed closed area under Alternative 3B. Map 2 using generalized boundary for proposed closed area under Alternative 3B

Table 4-8 Waypoints uded to delineate Alternative 3B

Map 1 waypoints used to delineate Alternative 3B.			Map 2 waypoints used to delineate the generalized boundary under Alternative 3B.		
ID	**LAT_DMS**	**LON_DMS**	**ID**	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"	1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 19' 30"	2	28° 00' 00"	-80° 20' 01"
3	28° 04' 39"	-80° 26' 11"	3	28° 06' 58"	-80° 26' 49"
4	28° 07' 43"	-80° 26' 56"	4	28° 17' 14"	-80° 20' 19"
5	28° 12' 08"	-80° 23' 46"	5	28° 40' 32"	-80° 24' 09"
6	28° 15' 27"	-80° 19' 50"	6	29° 25' 09"	-80° 55' 44"
7	28° 17' 09"	-80° 19' 58"	7	29° 38' 20"	-81° 00' 00"
8	28° 18' 20"	-80° 20' 27"	8	30° 57' 40"	-81° 00' 00"
9	28° 23' 33"	-80° 20' 17"	9	32° 00' 00"	-80° 24' 12"
10	28° 26' 19"	-80° 22' 08"	10	32° 00' 00"	-80° 00' 00"
11	28° 31' 34"	-80° 22' 48"	11	30° 52' 54"	-80° 00' 00"
12	28° 34' 00"	-80° 19' 50"	12	30° 27' 19"	-80° 11' 41"
13	28° 36' 20"	-80° 20' 28"	13	29° 54' 31"	-80° 15' 51"
14	28° 37' 05"	-80° 22' 58"	14	29° 24' 24"	-80° 13' 32"
15	28° 39' 49"	-80° 24' 28"	15	28° 27' 20"	-80° 00' 00"
16	28° 41' 42"	-80° 24' 48"			
17	28° 45' 40"	-80° 28' 22"			
18	28° 49' 06"	-80° 32' 45"			
19	28° 50' 45"	-80° 36' 51"			
20	28° 55' 31"	-80° 36' 00"			
21	28° 57' 07"	-80° 31' 04"			
22	28° 59' 10"	-80° 31' 19"			
23	29° 01' 21"	-80° 36' 26"			
24	29° 01' 03"	-80° 39' 27"			
25	29° 04' 17"	-80° 41' 32"			
26	29° 03' 10"	-80° 43' 00"			
27	29° 09' 34"	-80° 46' 48"			
28	29° 10' 39"	-80° 46' 17"			
29	29° 12' 00"	-80° 48' 18"			
30	29° 11' 22"	-80° 50' 18"			
31	29° 15' 26"	-80° 51' 39"			
32	29° 17' 59"	-80° 50' 28"			
33	29° 21' 59"	-80° 54' 32"			
34	29° 23' 17"	-80° 54' 17"			
35	29° 20' 34"	-80° 50' 08"			
36	29° 22' 01"	-80° 49' 15"			

37	29° 25' 07"	-80° 53' 04"
38	29° 28' 06"	-80° 54' 54"
39	29° 28' 31"	-80° 57' 20"
40	29° 25' 38"	-80° 57' 37"
41	29° 25' 10"	-80° 58' 37"
42	29° 29' 30"	-81° 00' 00"
43	29° 31' 26"	-81° 00' 00"
44	29° 32' 31"	-80° 58' 32"
45	29° 28' 48"	-80° 48' 41"
46	29° 33' 51"	-80° 48' 53"
47	29° 36' 44"	-81° 00' 00"
48	29° 39' 02"	-81° 00' 00"
49	29° 39' 18"	-80° 54' 32"
50	29° 42' 08"	-81° 00' 00"
51	29° 44' 44"	-81° 00' 00"
52	29° 47' 08"	-80° 57' 24"
53	29° 48' 05"	-81° 00' 00"
54	30° 50' 16"	-81° 00' 00"
55	30° 53' 39"	-80° 56' 45"
56	30° 56' 25"	-80° 56' 40"
57	30° 57' 56"	-80° 59' 30"
58	31° 02' 34"	-80° 54' 49"
59	31° 08' 43"	-80° 51' 49"
60	31° 12' 01"	-80° 45' 27"
61	31° 16' 09"	-80° 48' 40"
62	31° 20' 05"	-80° 45' 08"
63	31° 26' 03"	-80° 52' 29"
64	31° 26' 45"	-80° 43' 52"
65	31° 28' 48"	-80° 45' 24"
66	31° 31' 03"	-80° 43' 18"
67	31° 34' 23"	-80° 44' 20"
68	31° 33' 50"	-80° 40' 14"
69	31° 39' 37"	-80° 42' 58"
70	31° 39' 21"	-80° 39' 31"
71	31° 48' 09"	-80° 24' 39"
72	31° 49' 08"	-80° 31' 35"
73	31° 51' 08"	-80° 25' 59"
74	31° 52' 17"	-80° 26' 52"
75	31° 54' 38"	-80° 25' 43"
76	31° 55' 55"	-80° 23' 08"
77	31° 58' 44"	-80° 24' 37"

78	32° 00' 00"	-80° 23' 10"
79	32° 00' 00"	-80° 00' 00"
80	30° 55' 18"	-80° 00' 00"
81	30° 32' 40"	-80° 10' 00"
82	30° 07' 00"	-80° 16' 15"
83	29° 50' 25"	-80° 16' 38"
84	29° 35' 00"	-80° 15' 13"
85	29° 00' 00"	-80° 10' 00"
86	28° 30' 00"	-80° 00' 00"

Alternative 3C. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, and 3180 between an approximate depth of 98 feet (16 fathoms; 30 m) to 240 feet (40 fathoms; 73 m), for a total of 6,375 mi^2 (16,511 km^2),using bathymetric contours, of the South Atlantic EEZ (Figure 4-12). Coordinates for the closure are shown in Table 4-9.

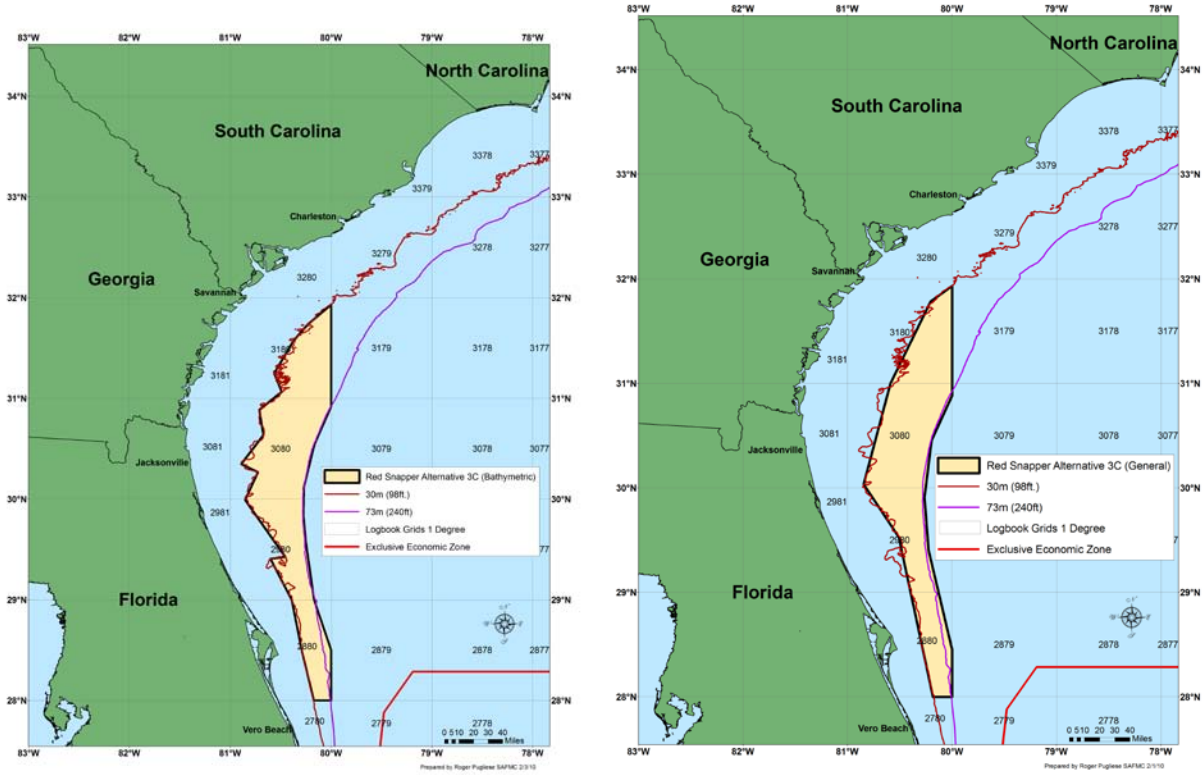


Figure 4-12 Map 1 of proposed closed area under Alternative 3C. Map 2 using generalized boundary for proposed closed area under Alternative 3C.

Table 4-9 Waypoints used to delineate Alternative 3C

Map 1 waypoints using bathymetric boundary, Alternative 3C.

ID	LAT_DMS	LON_DMS
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 10' 15"
3	28° 29' 17"	-80° 17' 23"
4	29° 00' 00"	-80° 23' 30"
5	29° 24' 25"	-80° 36' 07"
6	29° 25' 39"	-80° 27' 21"
7	29° 59' 30"	-80° 51' 10"
8	30° 16' 02"	-80° 43' 36"
9	30° 20' 58"	-80° 53' 34"
10	30° 38' 08"	-80° 40' 18"
11	30° 53' 12"	-80° 42' 45"
12	31° 04' 00"	-80° 29' 29"
13	31° 14' 57"	-80° 33' 55"
14	31° 34' 11"	-80° 22' 34"
15	31° 44' 07"	-80° 14' 00"
16	31° 56' 00"	-80° 00' 00"
17	30° 55' 18"	-80° 00' 00"
18	30° 32' 40"	-80° 10' 00"
19	30° 07' 00"	-80° 16' 15"
20	29° 50' 25"	-80° 16' 38"
21	29° 35' 00"	-80° 15' 13"
22	29° 00' 00"	-80° 10' 10"
23	28° 30' 00"	-80° 00' 00"

Map 2 waypoints using generalized Boundary, Alternative 3C.

ID	LAT_DMS	LON_DMS
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 10' 57"
3	29° 31' 40"	-80° 30' 34"
4	30° 02' 03"	-80° 50' 45"
5	31° 00' 00"	-80° 35' 19"
6	31° 47' 00"	-80° 12' 15"
7	31° 55' 55"	-80° 00' 00"
8	30° 52' 54"	-80° 00' 00"
9	30° 27' 19"	-80° 11' 41"
10	29° 54' 31"	-80° 15' 51"
11	29° 24' 24"	-80° 13' 32"
12	28° 27' 20"	-80° 00' 00"

Alternative 3D. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, and 3180 between an approximate depth of 98 feet (16 fathoms; 30 m) to 300 feet (50 fathoms; 91 m), for a total of 6,567 mi^2 (17, 008 km^2), using the bathymetric boundary, of the South Atlantic EEZ (Figure 4-13). Coordinates for the closure are shown in Table 4-10.

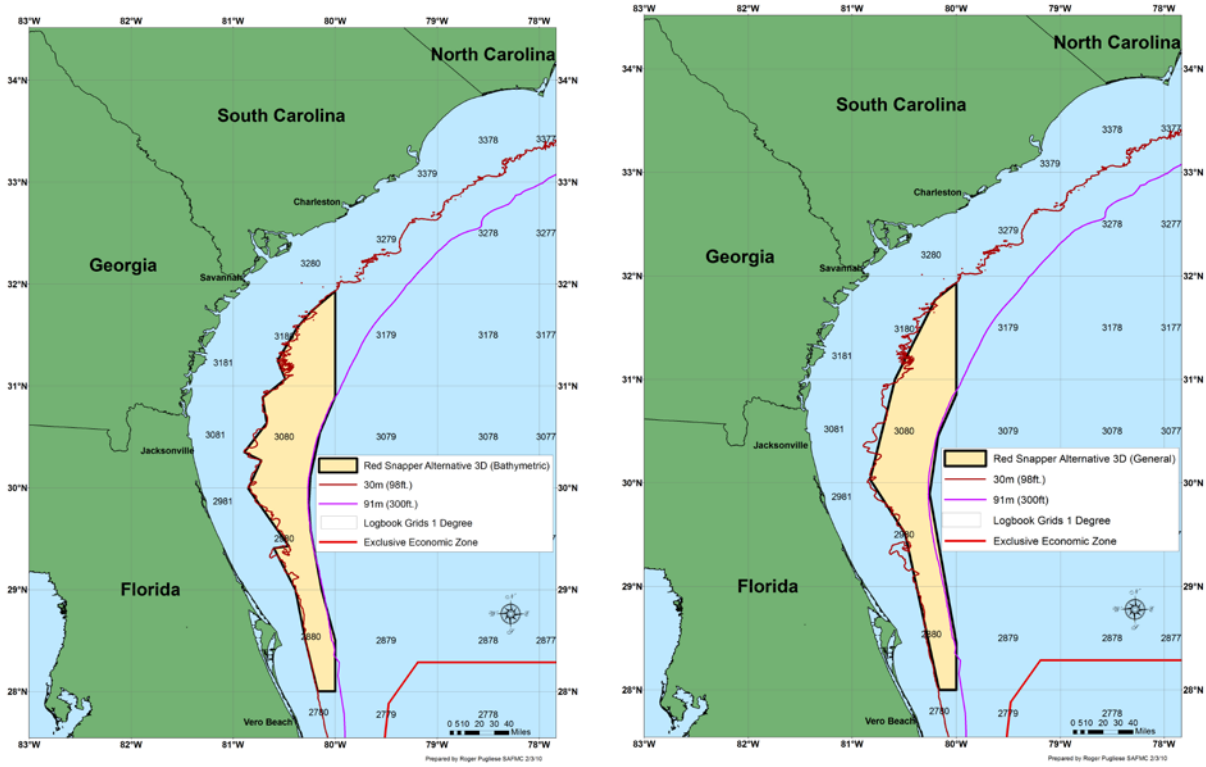


Figure 4-13. Map 1 of proposed closed area under Alternative 3D. Map 2 using generalized boundary for proposed closed area under Alternative 3D.

Table 4-10 Waypoints used to delineate Alternative 3D

Map 1 waypoints used to delineate Alternative 3D.

ID	LAT_DMS	LON_DMS
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 10' 15"
3	28° 29' 17"	-80° 17' 23"
4	29° 00' 00"	-80° 23' 30"
5	29° 24' 25"	-80° 36' 07"
6	29° 25' 39"	-80° 27' 21"
7	29° 59' 30"	-80° 51' 10"
8	30° 16' 02"	-80° 43' 36"
9	30° 20' 58"	-80° 53' 34"
10	30° 38' 08"	-80° 40' 18"
11	30° 53' 12"	-80° 42' 45"
12	31° 04' 00"	-80° 29' 29"
13	31° 14' 57"	-80° 33' 55"
14	31° 34' 11"	-80° 22' 34"
15	31° 44' 07"	-80° 14' 00"
16	31° 56' 00"	-80° 00' 00"
17	30° 53' 50"	-80° 00' 00"
18	30° 32' 40"	-80° 09' 00"
19	30° 07' 00"	-80° 14' 39"
20	29° 50' 25"	-80° 15' 39"
21	29° 35' 00"	-80° 14' 30"
22	29° 00' 00"	-80° 08' 04"
23	28° 30' 00"	-80° 00' 00"

Map 2 waypoints used to delineate the generalized boundary under Alternative 3D.

ID	LAT_DMS	LON_DMS
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 09' 57"
3	29° 30' 40"	-80° 29' 34"
4	30° 02' 03"	-80° 49' 45"
5	31° 00′ 00"	-80° 35' 19"
6	31° 46' 00"	-80° 12' 15"
7	31° 55' 55"	-80° 00' 00"
8	30° 51' 13"	-80° 00' 00"
9	30° 27' 19"	-80° 10' 34"
10	29° 53' 31"	-80° 15' 25"
11	28° 27' 20"	-80° 00' 00"

Alternative 4A. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, 3179, 3180, 3278, and 3279, for a total of 26,001 mi² (68,893 km^2) of the South Atlantic EEZ (Figure 4-14). Coordinates for the closure are shown in Table 4-11.

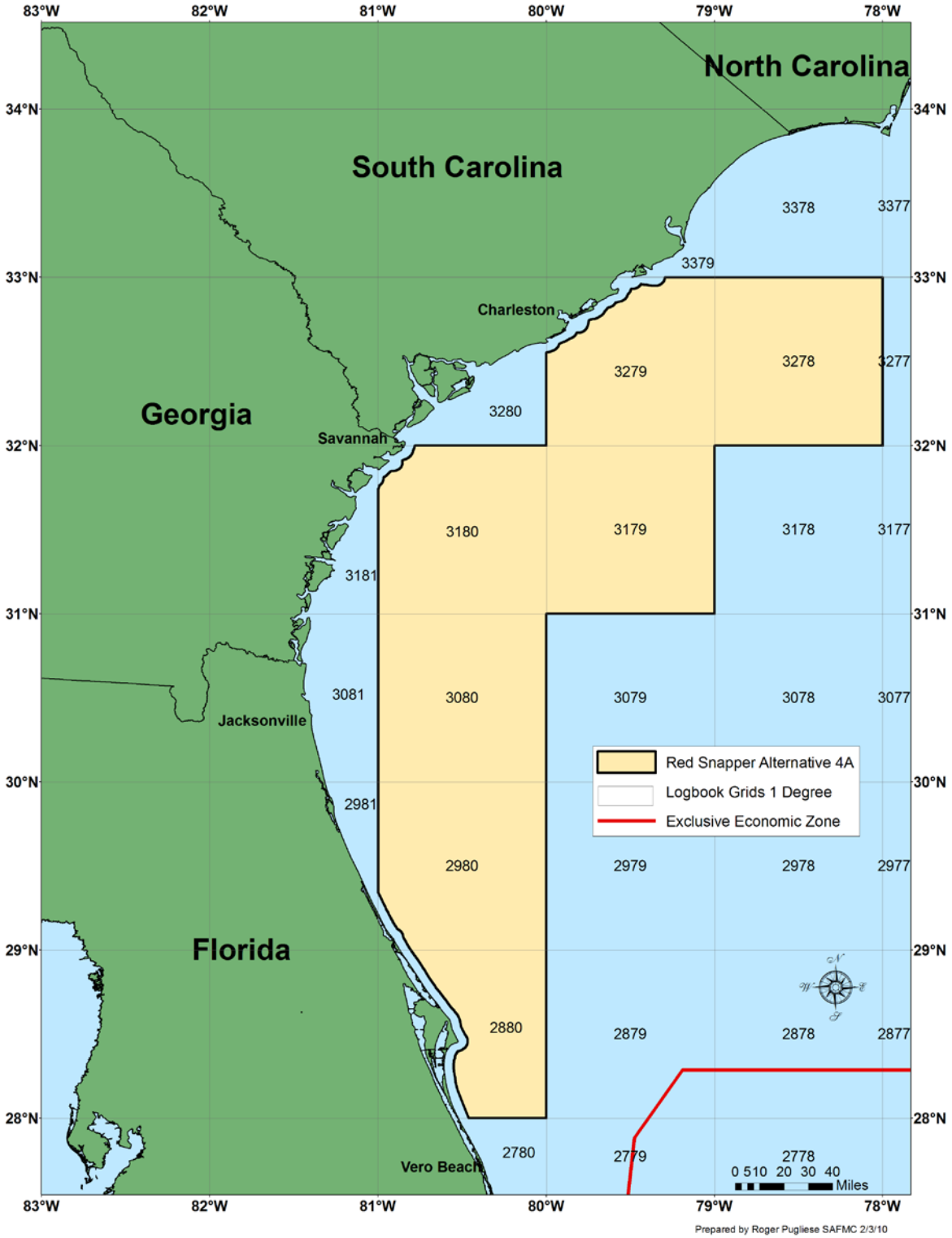


Figure 4-14. Map of proposed closed area under Alternative 4A.

Table 4-11 Waypoints used to delineate Alternative 4A.

ID	LAT_DMS	LON_DMS
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 27' 42"
3	29° 20' 33"	-81° 00' 00"
4	31° 44' 32"	-81° 00' 00"
5	32° 00' 00"	-80° 46' 56"
6	32° 00' 00"	-80° 00' 00"
7	32° 33' 08"	-80° 00' 00"
8	33° 00' 00"	-79° 17' 45"
9	33° 00' 00"	-78° 00' 00"
10	32° 00' 00"	-78° 00' 00"
11	32° 00' 00"	-79° 00' 00"
12	31° 00' 00"	-79° 00' 00"
13	31° 00' 00"	-80° 00' 00"

Between point 2 and point 3, line follows inner boundary of U.S. EEZ.
Between point 4 and point 5, line follows inner boundary of U.S. EEZ.
Between point 7 and point 8, line follows inner boundary of U.S. EEZ.

Alternative 4B. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, 3179, 3180, 3278, and 3279 between an approximate depth of 66 feet (11 fathoms; 20 m) to 240 feet (40 fathoms; 73 m), for a total of 15,269 mi^2 (39, 547 km^2), using the bathymetric boundary, of the South Atlantic EEZ (Figure 4-15). Coordinates for the closure are shown in Table 4-12.

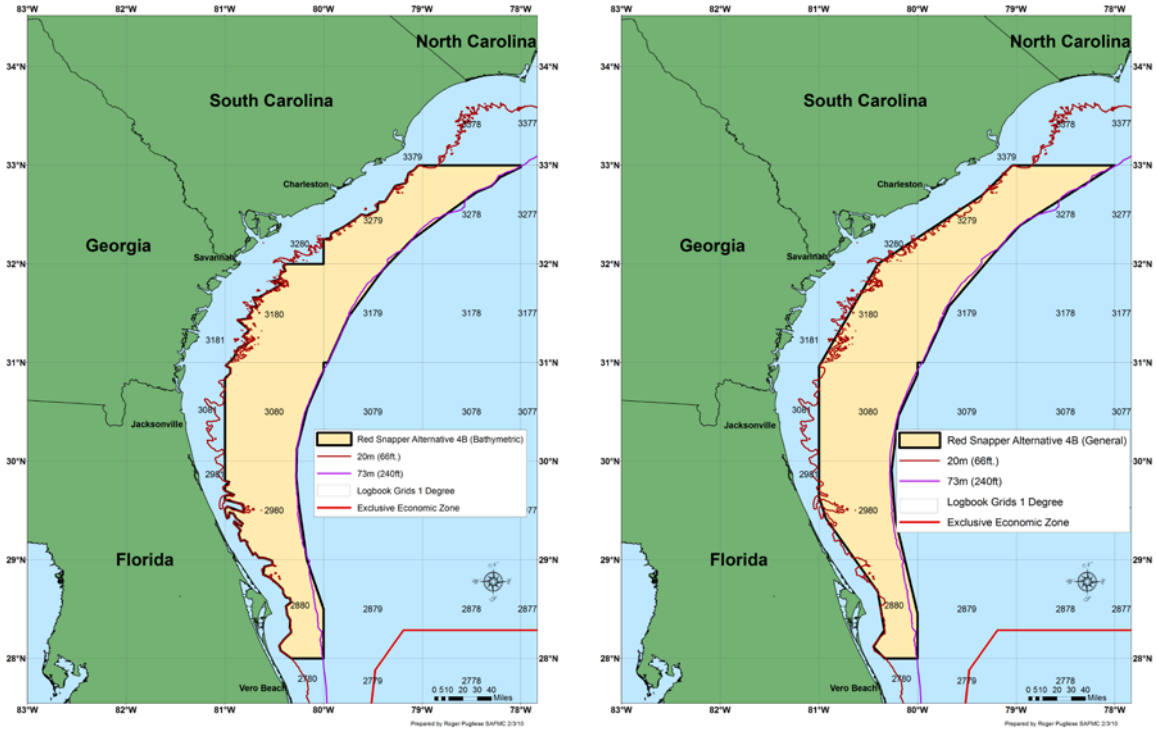


Figure 4-15. Map 1 of proposed closed area under Alternative 4B. Map 2 using generalized boundary for proposed closed area under Alternative 4B.

Table 4-12 Waypoints used to delineate Alternative 4B.

Map 1 waypoints used to delineate Alternative 4B.			Map 2 waypoints used to delineate the generalized boundary under Alternative 4B.		
ID	**LAT_DMS**	**LON_DMS**	**ID**	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"	1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 19' 30"	2	28° 00' 00"	-80° 20' 01"
3	28° 04' 39"	-80° 26' 11"	3	28° 06' 58"	-80° 26' 49"
4	28° 07' 43"	-80° 26' 56"	4	28° 17' 14"	-80° 20' 19"
5	28° 12' 08"	-80° 23' 46"	5	28° 40' 32"	-80° 24' 09"
6	28° 15' 27"	-80° 19' 50"	6	29° 25' 09"	-80° 55' 44"
7	28° 17' 09"	-80° 19' 58"	7	29° 38' 20"	-81° 00' 00"
8	28° 18' 20"	-80° 20' 27"	8	30° 57' 40"	-81° 00' 00"
9	28° 23' 33"	-80° 20' 17"	9	32° 00' 00"	-80° 24' 12"
10	28° 26' 19"	-80° 22' 08"	10	32° 41' 38"	-79° 20' 50"
11	28° 31' 34"	-80° 22' 48"	11	33° 00' 00"	-79° 02' 22"
12	28° 34' 00"	-80° 19' 50"	12	33° 00' 00"	-78° 00' 00"
13	28° 36' 20"	-80° 20' 28"	13	32° 23' 28"	-78° 57' 38"
14	28° 37' 05"	-80° 22' 58"	14	32° 06' 03"	-79° 13' 46"
15	28° 39' 49"	-80° 24' 28"	15	31° 34' 08"	-79° 41' 03"
16	28° 41' 42"	-80° 24' 48"	16	31° 00' 00"	-79° 56' 43"
17	28° 45' 40"	-80° 28' 22"	17	31° 00' 00"	-80° 00' 00"
18	28° 49' 06"	-80° 32' 45"	18	30° 52' 54"	-80° 00' 00"
19	28° 50' 45"	-80° 36' 51"	19	30° 27' 19"	-80° 11' 41"
20	28° 55' 31"	-80° 36' 00"	20	29° 54' 31"	-80° 15' 51"
21	28° 57' 07"	-80° 31' 04"	21	29° 24' 24"	-80° 13' 32"
22	28° 59' 10"	-80° 31' 19"	22	28° 27' 20"	-80° 00' 00"
23	29° 01' 21"	-80° 36' 26"			
24	29° 01' 03"	-80° 39' 27"			
25	29° 04' 17"	-80° 41' 32"			
26	29° 03' 10"	-80° 43' 00"			
27	29° 09' 34"	-80° 46' 48"			
28	29° 10' 39"	-80° 46' 17"			
29	29° 12' 00"	-80° 48' 18"			
30	29° 11' 22"	-80° 50' 18"			
31	29° 15' 26"	-80° 51' 39"			
32	29° 17' 59"	-80° 50' 28"			
33	29° 21' 59"	-80° 54' 32"			
34	29° 23' 17"	-80° 54' 17"			
35	29° 20' 34"	-80° 50' 08"			
36	29° 22' 01"	-80° 49' 15"			

37	29° 25' 07"	-80° 53' 04"
38	29° 28' 06"	-80° 54' 54"
39	29° 28' 31"	-80° 57' 20"
40	29° 25' 38"	-80° 57' 37"
41	29° 25' 10"	-80° 58' 37"
42	29° 29' 30"	-81° 00' 00"
43	29° 31' 26"	-81° 00' 00"
44	29° 32' 31"	-80° 58' 32"
45	29° 28' 48"	-80° 48' 41"
46	29° 33' 51"	-80° 48' 53"
47	29° 36' 44"	-81° 00' 00"
48	29° 39' 02"	-81° 00' 00"
49	29° 39' 18"	-80° 54' 32"
50	29° 42' 08"	-81° 00' 00"
51	29° 44' 44"	-81° 00' 00"
52	29° 47' 08"	-80° 57' 24"
53	29° 48' 05"	-81° 00' 00"
54	30° 50' 16"	-81° 00' 00"
55	30° 53' 39"	-80° 56' 45"
56	30° 56' 25"	-80° 56' 40"
57	30° 57' 56"	-80° 59' 30"
58	31° 02' 34"	-80° 54' 49"
59	31° 08' 43"	-80° 51' 49"
60	31° 12' 01"	-80° 45' 27"
61	31° 16' 09"	-80° 48' 40"
62	31° 20' 05"	-80° 45' 08"
63	31° 26' 03"	-80° 52' 29"
64	31° 26' 45"	-80° 43' 52"
65	31° 28' 48"	-80° 45' 24"
66	31° 31' 03"	-80° 43' 18"
67	31° 34' 23"	-80° 44' 20"
68	31° 33' 50"	-80° 40' 14"
69	31° 39' 37"	-80° 42' 58"
70	31° 39' 21"	-80° 39' 31"
71	31° 48' 09"	-80° 24' 39"
72	31° 49' 08"	-80° 31' 35"
73	31° 51' 08"	-80° 25' 59"
74	31° 52' 17"	-80° 26' 52"
75	31° 54' 38"	-80° 25' 43"
76	31° 55' 55"	-80° 23' 08"
77	31° 58' 44"	-80° 24' 37"

78	32° 00' 00"	-80° 23' 10"
79	32° 00' 00"	-80° 00' 00"
80	32° 15' 03"	-80° 00' 01"
81	32° 15' 53"	-79° 55' 54"
82	32° 18' 27"	-79° 55' 19"
83	32° 21' 54"	-79° 48' 17"
84	32° 26' 49"	-79° 40' 58"
85	32° 29' 56"	-79° 37' 06"
86	32° 29' 10"	-79° 33' 22"
87	32° 30' 48"	-79° 31' 41"
88	32° 31' 41"	-79° 28' 11"
89	32° 33' 14"	-79° 27' 05"
90	32° 35' 47"	-79° 27' 04"
91	32° 37' 33"	-79° 26' 02"
92	32° 37' 31"	-79° 22' 41"
93	32° 47' 39"	-79° 16' 27"
94	32° 49' 27"	-79° 09' 53"
95	32° 55' 16"	-79° 08' 22"
96	32° 57' 12"	-79° 05' 14"
97	33° 00' 00"	-79° 02' 23"
98	33° 00' 00"	-78° 00' 00"
99	32° 58' 50"	-78° 00' 00"
100	32° 53' 02"	-78° 12' 38"
101	32° 47' 21"	-78° 17' 49"
102	32° 43' 47"	-78° 26' 40"
103	32° 39' 37"	-78° 32' 45"
104	32° 30' 36"	-78° 45' 00"
105	32° 14' 24"	-79° 06' 36"
106	31° 56' 24"	-79° 24' 00"
107	31° 27' 36"	-79° 45' 00"
108	31° 00' 00"	-79° 57' 28"
109	31° 00' 00"	-80° 00' 00"
110	30° 55' 18"	-80° 00' 00"
111	30° 32' 40"	-80° 10' 00"
112	30° 07' 00"	-80° 16' 15"
113	29° 50' 25"	-80° 16' 38"
114	29° 35' 00"	-80° 15' 13"
115	29° 00' 00"	-80° 10' 10"
116	28° 30' 00"	-80° 00' 00"

Alternative 4C. Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, and possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, 3179, 3180, 3278, and 3279 between an approximate depth of 98 feet (16 fathoms; 30 m) to 240 feet (40 fathoms; 73 m), for a total of 9,823 mi² (25,441 km^2), using the bathymetric boundary, of the South Atlantic EEZ (Figure 4-16). Coordinates for the closure are shown in Table 4-13.

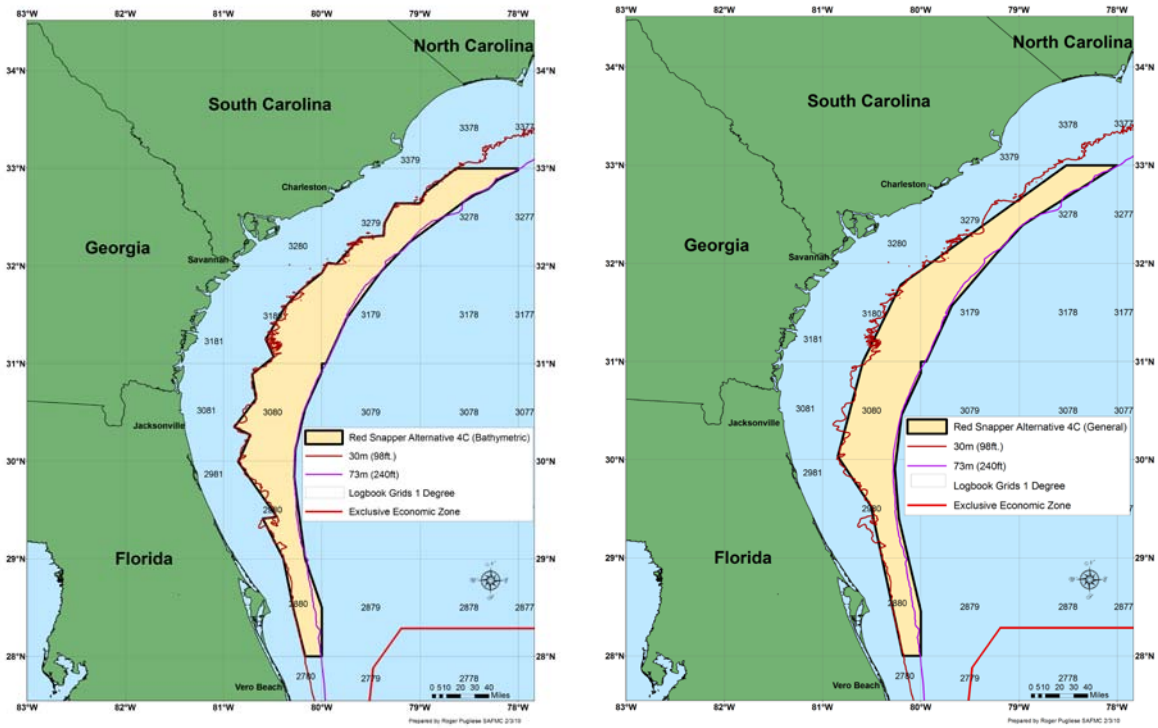


Figure 4-16. Map 1 of proposed closed area under Alternative 4C. Map 2 using generalized boundary for proposed closed area under Alternative 4C.

Table 4-13 Waypoints used to delineate Alternative 4C.
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Map 1 waypoints used to delineate Alternative 4C.			Map 2 waypoints used to delineate the generalized boundary under Alternative 4C.		
ID	**LAT_DMS**	**LON_DMS**	**ID**	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"	1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 10' 15"	2	28° 00' 00"	-80° 10' 57"
3	28° 29' 17"	-80° 17' 23"	3	29° 31' 40"	-80° 30' 34"
4	29° 00' 00"	-80° 23' 30"	4	30° 02' 03"	-80° 50' 45"
5	29° 24' 25"	-80° 36' 07"	5	31° 00' 00"	-80° 35' 19"
6	29° 25' 39"	-80° 27' 21"	6	31° 47' 00"	-80° 12' 15"
7	29° 59' 30"	-80° 51' 10"	7	33° 00' 00"	-78° 31' 05"
8	30° 16' 02"	-80° 43' 36"	8	33° 00' 00"	-78° 00' 00"
9	30° 20' 58"	-80° 53' 34"	9	32° 23' 28"	-78° 57' 38"
10	30° 38' 08"	-80° 40' 18"	10	32° 06' 03"	-79° 13' 46"
11	30° 53' 12"	-80° 42' 45"	11	31° 34' 08"	-79° 41' 03"
12	31° 04' 00"	-80° 29' 29"	12	31° 00' 00"	-79° 56' 43"
13	31° 14' 57"	-80° 33' 55"	13	31° 00' 00"	-80° 00' 00"
14	31° 34' 11"	-80° 22' 34"	14	30° 52' 54"	-80° 00' 00"
15	31° 44' 07"	-80° 14' 00"	15	30° 27' 19"	-80° 11' 41"
16	31° 56' 00"	-80° 00' 00"	16	29° 54' 31"	-80° 15' 51"
17	32° 02' 00"	-79° 56' 31"	17	29° 24' 24"	-80° 13' 32"
18	32° 01' 12"	-79° 50' 43"	18	28° 27' 20"	-80° 00' 00"
19	32° 17' 21"	-79° 36' 42"			
20	32° 18' 38"	-79° 22' 01"			
21	32° 26' 25"	-79° 21' 53"			
22	32° 38' 13"	-79° 14' 52"			
23	32° 38' 24"	-79° 00' 00"			
24	32° 45' 05"	-78° 57' 05"			
25	33° 00' 00"	-78° 37' 53"			
26	33° 00' 00"	-78° 00' 00"			
27	32° 58' 50"	-78° 00' 00"			
28	32° 53' 02"	-78° 12' 38"			
29	32° 47' 21"	-78° 17' 49"			
30	32° 43' 47"	-78° 26' 40"			
31	32° 39' 37"	-78° 32' 45"			
32	32° 30' 36"	-78° 45' 00"			
33	32° 14' 24"	-79° 06' 36"			
34	31° 56' 24"	-79° 24' 00"			
35	31° 27' 36"	-79° 45' 00"			

36	31° 00' 00"	-79° 57' 28"
37	31° 00' 00"	-80° 00' 00"
38	30° 55' 18"	-80° 00' 00"
39	30° 32' 40"	-80° 10' 00"
40	30° 07' 00"	-80° 16' 15"
41	29° 50' 25"	-80° 16' 38"
42	29° 35' 00"	-80° 15' 13"
43	29° 00' 00"	-80° 10' 10"
44	28° 30' 00"	-80° 00' 00"

Alternative 4D (Preferred) Prohibit all commercial and recreational fishing for, harvest, and possession, of red snapper year-round in the South Atlantic EEZ. Prohibition of red snapper applies in the South Atlantic on board a vessel for which a valid Federal charter vessel/headboat or commercial permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Prohibit commercial and recreational fishing for, harvest, possession, of species in the snapper grouper FMU year-round in an area that includes commercial logbook grids 2880, 2980, 3080, 3179, 3180, 3278, and 3279 between an approximate depth of 98 feet (16 fathoms; 30 m) to 300 feet (50 fathoms; 91 m), for a total of 10,293 sq miles (26 659 km^2), using the bathymetric boundary, or 9588 mi^2 (24832 km^2), using the general boundary, of the South Atlantic EEZ (Figure 4-17). Coordinates for the closure are shown in Table 4-14.

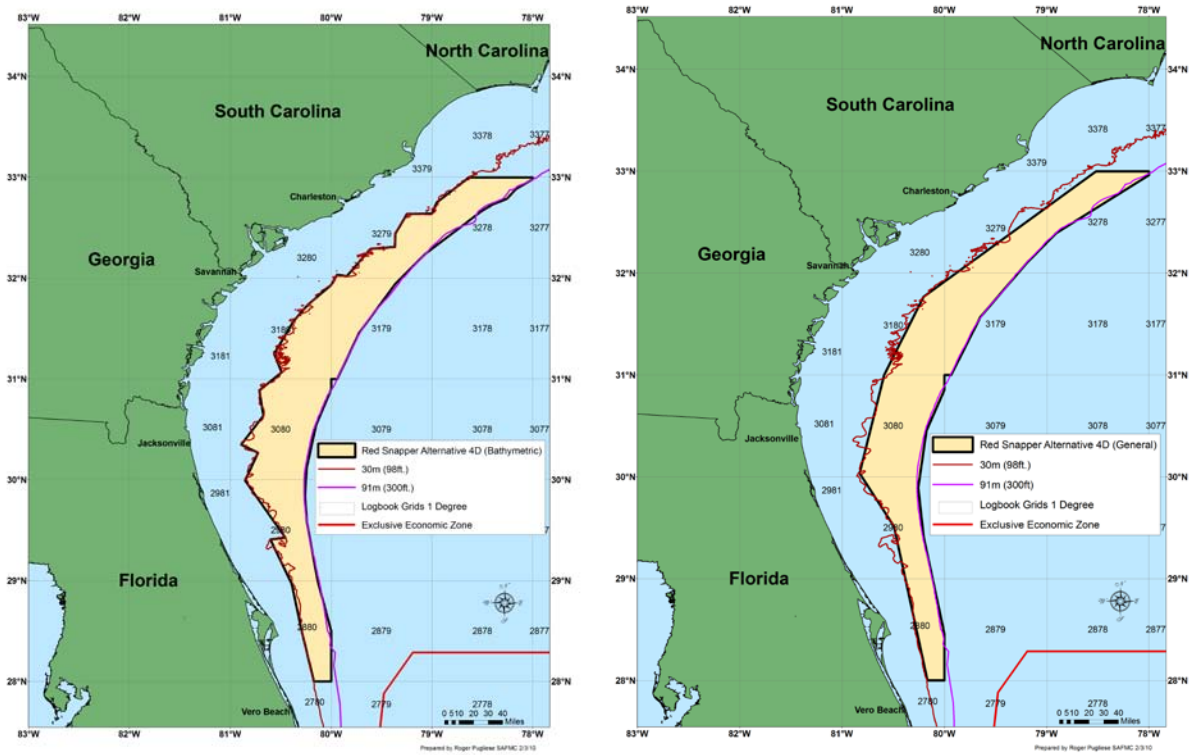


Figure 4-17. Map 1 of proposed closed area under Alternative 4D. Map 2 using generalized boundary for proposed closed area under Alternative 4D.

Table 4-14 Waypoints used to delineate Alternative 4D.

Map 1 waypoints used to delineate Alternative 4D.		
ID	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 10' 15"
3	28° 29' 17"	-80° 17' 23"
4	29° 00' 00"	-80° 23' 30"
5	29° 24' 25"	-80° 36' 07"
6	29° 25' 39"	-80° 27' 21"
7	29° 59' 30"	-80° 51' 10"
8	30° 16' 02"	-80° 43' 36"
9	30° 20' 58"	-80° 53' 34"
10	30° 38' 08"	-80° 40' 18"
11	30° 53' 12"	-80° 42' 45"
12	31° 04' 00"	-80° 29' 29"
13	31° 14' 57"	-80° 33' 55"
14	31° 34' 11"	-80° 22' 34"
15	31° 44' 07"	-80° 14' 00"
16	31° 56' 00"	-80° 00' 00"
17	32° 02' 00"	-79° 56' 31"
18	32° 01' 12"	-79° 50' 43"
19	32° 17' 21"	-79° 36' 42"
20	32° 18' 38"	-79° 22' 01"
21	32° 26' 25"	-79° 21' 53"
22	32° 38' 13"	-79° 14' 52"
23	32° 38' 24"	-79° 00' 00"
24	32° 45' 05"	-78° 57' 05"
25	33° 00' 00"	-78° 37' 53"
26	33° 00' 00"	-78° 00' 00"
27	32° 58' 50"	-78° 00' 00"
28	32° 53' 02"	-78° 10' 01"
29	32° 47' 21"	-78° 15' 20"
30	32° 43' 47"	-78° 24' 06"
31	32° 39' 37"	-78° 30' 52"
32	32° 30' 36"	-78° 42' 43"
33	32° 14' 24"	-79° 04' 07"
34	31° 56' 24"	-79° 22' 00"
35	31° 27' 36"	-79° 43' 17"
36	31° 00' 00"	-79° 56' 27"
37	31° 00' 00"	-80° 00' 00"
38	30° 53' 50"	-80° 00' 00"
39	30° 32' 40"	-80° 09' 00"
40	30° 07' 00"	-80° 14' 39"
41	29° 50' 25"	-80° 15' 39"
42	29° 35' 00"	-80° 14' 30"
43	29° 00' 00"	-80° 08' 04"
44	28° 30' 00"	-80° 00' 00"

Map 2 waypoints used to delineate the generalized boundary under Alternative 4D		
ID	**LAT_DMS**	**LON_DMS**
1	28° 00' 00"	-80° 00' 00"
2	28° 00' 00"	-80° 09' 57"
3	29° 30' 40"	-80° 29' 34"
4	30° 02' 03"	-80° 49' 45"
5	31° 00' 00"	-80° 35' 19"
6	31° 46' 00"	-80° 12' 15"
7	33° 00' 00"	-78° 31' 05"
8	33° 00' 00"	-78° 00' 00"
9	32° 57' 44"	-78° 00' 00"
10	32° 23' 28"	-78° 54' 32"
11	32° 06' 03"	-79° 11' 41"
12	31° 34' 08"	-79° 38' 57"
13	31° 00' 00"	-79° 56' 05"
14	31° 00' 00"	-80° 00' 00"
15	30° 51' 13"	-80° 00' 00"
16	30° 27' 19"	-80° 10' 34"
17	29° 53' 31"	-80° 15' 25"
18	29° 24' 24"	-80° 12' 13"
19	28° 27' 20"	-80° 00' 00"

Alternative 5 (Preferred). Allow fishing for, harvest and possession of snapper grouper species (with exception of red snapper) in the closed area if fish were harvested with black sea bass pots with endorsements.

Alternative 6. Allow fishing for, harvest and possession of snapper grouper species (with exception of red snapper) with bottom longline gear in the closed area deeper than 50 fathoms as specified in CFR §622.35.

Alternative 7 (Preferred). Allow fishing for, harvest and possession of snapper grouper species (with the exception of red snapper) in the closed area if fish were harvested with spearfishing gear.

Alternative 8. Allow transit through areas closed to snapper grouper harvest.

> **Sub-alternative 8a (Preferred).** The prohibition on possession does not apply to a person aboard a vessel that is in transit with snapper grouper species on board and with fishing gear appropriately stowed.

Vessels (both commercial and recreational) may transit through any snapper grouper closed area in the South Atlantic EEZ with snapper grouper species on board if prohibited fishing gear is appropriately stowed and not available for immediate use. The Council is considering alternatives that could allow fishing for snapper grouper species with spearfishing gear, black sea bass pots, and/or bottom longline within the proposed closed areas.

The term *"transit"* means: Direct, non-stop progression through any snapper grouper closed area in the South Atlantic EEZ on a constant heading, along a continuous straight line course, while making way by means of a source of power at all times.

The term *"Gear appropriately stowed"* includes but is not limited to: **Terminal gear** (i.e., hook, leader, sinker, flasher, or bait) used with an automatic reel, bandit gear, buoy gear, trolling gear, hand-line, or rod and reel must be disconnected and stowed separately from such fishing gear. Rod and reel must be removed from the rod holder and stowed securely on or below deck; **longline gear** may be left on the drum if all gangions and hooks are disconnected and stowed below deck, hooks cannot be baited, all buoys must be disconnected from the gear; however, buoys may remain on deck; **trawl** and **try net gear** may remain on deck, but trawl doors must be disconnected from such net and must be secured; **gill nets**, stab nets, or trammel nets must be left on the drum, any additional such nets not attached to the drum must be stowed below deck; and **crustacean traps,** or **golden crab trap,** cannot be baited, all buoys must be disconnected from the gear; however, buoys may remain on deck. Other methods of stowage authorized in writing by the Regional Administrator, and subsequently published in the *Federal Register* may also be utilized under this definition.

The term *"Not available for immediate use"* means: Gear that is shown to not have been in recent use and that is stowed in conformance with the definitions included under "gear appropriately stowed".

Sub-alternative 8b. The prohibition on possession does not apply to a person aboard a vessel that has snapper grouper species onboard if the vessel is in transit.

Vessels (both commercial and recreational) may transit through any snapper grouper closed area in the South Atlantic EEZ with certain snapper grouper species.

The term *"transit"* means: Direct, non-stop progression through any snapper grouper closed area in the South Atlantic EEZ on a constant heading, along a continuous straight line course, while making way by means of a source of power at all times.

Sub-alternative 8c. The prohibition on possession does not apply to a person aboard a vessel that has wreckfish onboard if the vessel is in transit.

Vessels (both commercial and recreational) may transit through any snapper grouper closed area in the South Atlantic EEZ with wreckfish on board.

The term *"transit"* means: Direct, non-stop progression through any snapper grouper closed area in the South Atlantic EEZ on a constant heading, along a continuous straight line course, while making way by means of a source of power at all times.

4.3.1 Biological Effects

To determine the actual environmental effects of the **Alternative 1 (Status Quo)** management alternative on red snapper, one must first examine current trends in harvest levels, stock biomass levels, and life history characteristics, then predict the direction of future trends under status quo management. Expected harvest reductions in total kill stemming from Snapper Grouper Amendment 16 (SAFMC 2008), which among other things, established a January-April shallow water grouper spawning season closure for the commercial and recreational sectors as well as created a five month recreational seasonal closure for vermilion snapper, was factored into the baseline condition of the fishery in order to obtain the correct percent reduction of removals needed for red snapper (**Appendix E,** SERO-LAPP-2009-07 REV). The bulk of landings of red snapper come from the recreational fishery, which have exceeded the landings of the commercial fishery by 2-3 fold in recent years. Total landings were variable, with a downward trend through the 1990s. The recent SEDAR assessment determined the red snapper stock in the South Atlantic is undergoing overfishing and is overfished (SEDAR 15 2008). The Council is considering two proxies for F_{MSY} in Amendment 17A, $F_{30\%SPR}$ and $F_{40\%SPR}$. The ratio of F to the respective proxies for F_{MSY} suggests a generally increasing trend in fishing mortality from the 1950s through the mid-1980s. This indicates that overfishing has been occurring since the early 1970s, with the 2006 estimate of $F/F_{30\%SPR} = 5.39$ and $F/F_{40\%SPR}$ at 7.67 (March 19, 2009 Projection; SEDAR 15 2008). A red snapper assessment, which will include data through 2008, is scheduled for 2010.

Recruitment was predicted from spawning biomass using a Beverton–Holt spawner-recruit model. In years when composition data could provide information on year-class strength (1974–2006), estimated recruitment was conditioned on the Beverton–Holt model with autocorrelated

residuals. In years prior, recruitment followed the Beverton–Holt model precisely (similar to an age-structured production model). There have been several moderately good year classes in 1983, 1998, 1999, and 2000 (Figure 4-18). Examination of landings data indicate a very large spike in recruitment likely occurred around 2005 or 2006, which resulted in a very large increase in the number of released fish that were presumably less than the 20" TL minimum size limit (Figure 4-18a). The spike in recruitment appears to be responsible for the large increase in recent landings reported by fishermen and recorded in the landings. However, if these fish are caught and killed, then the age/size composition and biomass would not continue to improve over time.

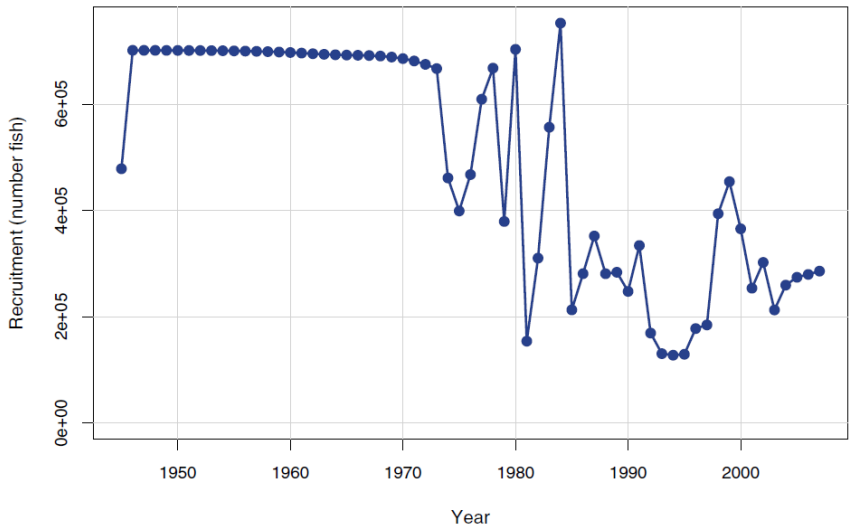


Figure 4-18. Estimated recruitment of age-1 red snapper.
Source: SEDAR 15 2008, Figure 1.23.

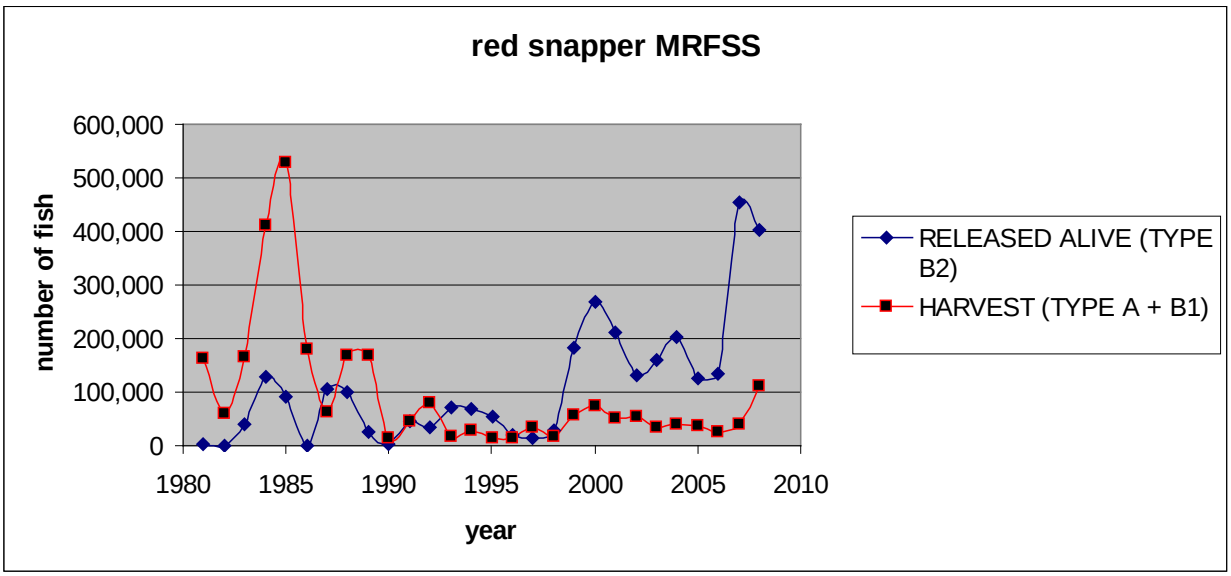


Figure 4-18a. Number of released (B2) and harvested (A+B1) red snapper from MRFSS survey.

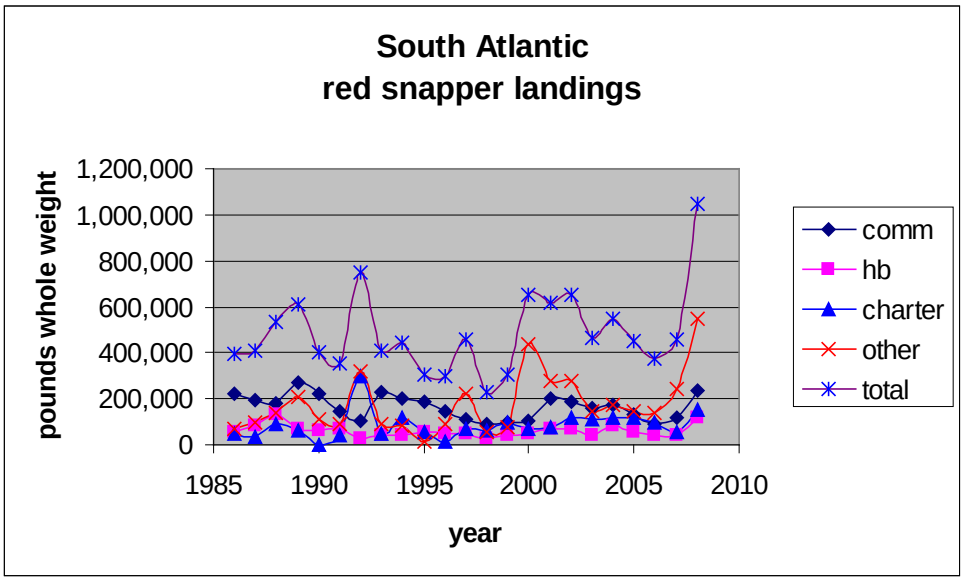


Figure 4-18b. Landed (pounds whole weight) by commercial and recreational sectors.

McInerny (2007) reports a maximum age of 54 years red snapper in the South Atlantic. Natural mortality is estimated to be 0.078 using the Hoenig (1983) method with a maximum age of 53 years (SEDAR 15 2008). Because red snapper are very long-lived and have low natural mortality rates, they are very vulnerable to overfishing. The average age of landed red snapper is currently fairly stable between 5 and 8 with an increase in recent years (SEDAR 15 2008). As shown in Figure 4-13, most of the population is age 10 or younger. This is based on ages from over 7,000 fish. Since red snapper live for at least 54 years, heavy fishing pressure is likely responsible for the truncation in the age structure. Evidence indicates most of the older fish were removed in the 1950s and 1960s and the population has not recovered.

Examination of Table 5.9 from the November 2008 estimation of biomass benchmarks and projections indicates the age structure of the population is truncated as a small percentage of red snapper older than 10 years are being landed. Figure 4-19 demonstrates a larger proportion of red snapper older than age 10 would be expected when the stock is healthy at a $F=F_{40\%}$.

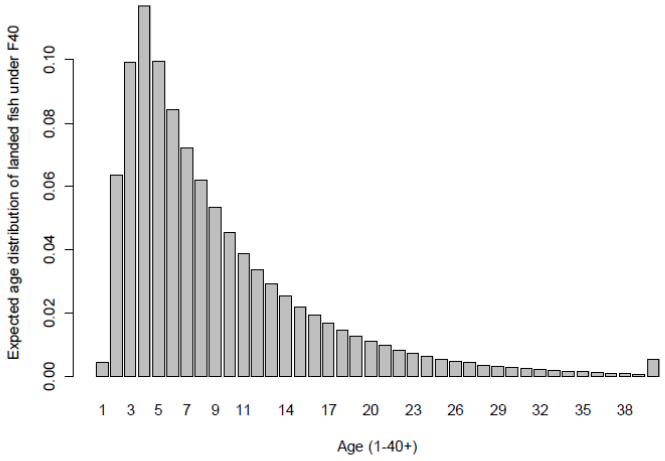


Figure 4-19. Equilibrium age distribution of landed red snapper that could be expected when F=F40%. The distribution is conditional on selectivity patterns estimated in the terminal years of the SEDAR 15 (2008)assessment. The oldest age considered in this analysis (age 40) was treated as a plus group (i.e., an accumulator class). Source: Southeast Fisheries Science Center, September 11, 2009.

Alternative 1 (Status Quo) would retain the current regulations used to manage catches of red snapper. Regulations include a commercial limited access system, a 20 inch TL commercial and recreational minimum size limit, and a 2 fish recreational bag limit. 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 concept 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 increased opportunities for reproduction and recruitment before becoming vulnerable to fishing gear. 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.

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 the appropriateness of a measure when applied to a specific stock, as well as if, and to what extent, fishing effort changes or shifts in response to the select management measure.

Discard mortality also can limit the amount by which fishing effort and mortality is reduced by limited access systems, trip limits, and minimum size limits, if fishermen catch and discard red snapper when targeting co-occurring species. The snapper grouper ecosystem includes many species, which occupy the same habitat at the same time. For example, red snapper co-occur with vermilion snapper, tomtate, scup, red porgy, white grunt, black sea bass, red grouper, scamp, gag, and others. Therefore, red snapper are likely to be caught and suffer some mortality

even when regulated since they will be incidentally caught when fishermen target other co-occurring species. **Appendix R** of this document describes the impacts of Amendment 17A on species commonly caught with red snapper.

In 1983, the Snapper Grouper Fishery Management Plan established a 12 inch TL for red snapper to maximize the yield per recruit (SAFMC 1983). Due to concerns of red snapper overfishing, Amendment 4 (SAFMC 1991) increased the minimum size limit of red snapper taken by recreational fishermen from 12 inches TL to 20 inches TL. As a result of this increased size limit SEDAR 15 (2008) indicates many more red snapper are being released by the recreational sector than are retained (Tables 4-15a and Figure 4-15b). Since release mortality rates are estimated to be 40% for the recreational sector and 90% for the commercial sector, the increased size limit may not have had the intended effect of enhancing stock status. SEDAR 15 (2008) indicates the large number of discards combined with high release mortality rates is one of the major factors contributing to overfishing of red snapper in the South Atlantic. Furthermore, assessment sensitivity runs indicate overfishing of red snapper would still be occurring at lower release mortality rates of 20% for the recreational sector and 70% for the commercial sector.

Table 4-15a. MRFSS landings (number A+B1) of red snapper by state, 2005-2008.

Year	FL	GA	SC	NC
2005	30,798	3,059	924	1,158
2006	20,048	3,028	1233	1,766
2007	35,900	1,949	3220	337
2008	98,121	10,750	1212	1,217
Total	184,867	18,786	6,589	4,478
percent	86.10%	8.75%	3.07%	2.09%

Table 4-15b. MRFSS number of red snapper released alive (B2) among states, 2005-2008.

Year	FL	GA	SC	NC
2005	117,058	3,884	4,797	0
2006	123,175	10,665	333	519
2007	409,593	42,044	1,948	1,820
2008	375,099	18,824	6,383	2,938
Total	1,024,925	75,417	13,461	5,277
percent	91.59%	6.74%	1.20%	0.47%

Since the alternatives to status quo management evaluated for red snapper are intended to reduce fishing mortality, they are expected to 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 red 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 that occupy the same habitat at the same time. For example, red snapper co-occur with vermilion snapper, gag, scamp, greater amberjack, gray triggerfish, black sea bass, red grouper, and others (Tables 4-16 to 4-18). Therefore, snapper grouper species are likely to be caught when regulated since they will be incidentally caught when fishermen target co-occurring species. Management measures implemented through Amendment 16 (SAFMC 2008) are expected to reduce harvest of several of these co-occurring species through seasonal closures, quotas, and bag limit reductions, and will likely reduce, to a small extent, removals of red snapper as an ancillary effect. Although some red snapper harvest reductions may occur as a result of Amendment 16 (SAFMC 2008), those measures would not provide the reductions needed to end overfishing of the stock.

Continued overexploitation of any snapper grouper species may disrupt the natural community structure of the reef ecosystems that support these species. Predator species could be expected to decrease in abundance in response to a decline of an exploited species. Alternatively, predators could 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 a targeted species such as red snapper.

Table 4-16. Species taken on commercial trips when at least 1 pound of red snapper was caught. Based on ALS data from 2003-2008.

COMMON	% by trip	% by wt	cum wt
Snapper, vermilion	67.38%	28.32%	28.32%
Grouper, gag	59.69%	13.23%	41.56%
Scamp	63.24%	8.18%	49.74%
Amberjack, greater	40.77%	7.54%	57.28%
Snapper, red	100.00%	6.44%	63.72%
Triggerfish, red	54.88%	5.50%	69.22%
Grouper, red	52.79%	4.85%	74.07%
Jack, almaco	35.51%	4.30%	78.37%
Grouper, black	10.10%	2.22%	80.59%
Porgy, red,UNC	41.47%	1.67%	82.26%
Sea Bass, Atlantic, black, UNC	39.15%	1.60%	83.86%
King mackerel	27.36%	1.58%	85.43%
Grouper, snowy	17.02%	1.50%	86.93%
137 Other Taxa		13.07%	

Table 4-17. Species taken on headboat trips when at least 1 red snapper was caught. Based on data from 2003-2008.

Species	**% trip**	**% number**	**Cum % number**
Vermilion Snapper	69.21%	44.49%	44.49%
Black Sea Bass	75.54%	16.64%	61.14%
Tomtate	25.65%	5.01%	66.14%

Species	% trip	% number	Cum % number
Gray Triggerfish	63.97%	4.04%	70.19%
Red Snapper	100.00%	3.38%	73.57%
Red Porgy	19.74%	3.35%	76.92%
Banded Rudderfish	12.34%	2.76%	79.68%
White Grunt	11.71%	2.73%	82.41%
Sharpnose Shark	51.87%	2.22%	84.63%
Scamp	27.93%	1.57%	86.19%
Gray Snapper	40.21%	1.52%	87.71%
Lane Snapper	34.85%	0.94%	88.65%
Yellowtail Snapper	11.98%	0.88%	89.53%
Bank Sea Bass	11.28%	0.86%	90.39%
Greater Amberjack	25.28%	0.77%	91.16%
Whitebone Porgy	25.94%	0.74%	91.90%
Almaco Jack	12.54%	0.70%	92.61%
Spot tail Pinfish	5.08%	0.65%	93.26%
128 Other Taxa		6.74%	

Table 4-18. Species taken on MRFSS trips when at least 1 red snapper was caught. Based on data from 2003-2008.

Common	% trip	% number	Cum % number
vermilion snapper	29.81%	29.55%	29.55%
black sea bass	45.17%	24.27%	53.82%
red snapper	100.00%	6.82%	60.64%
gray triggerfish	19.18%	5.40%	66.04%
Tomtate	20.15%	3.24%	69.29%
white grunt	5.42%	2.69%	71.97%
Gag	16.61%	1.83%	73.80%
red porgy	8.34%	1.82%	75.63%
greater amberjack	10.77%	1.82%	77.44%
atlantic sharpnose shark	18.35%	1.67%	79.11%
round scad	2.02%	1.58%	80.70%
king mackerel	7.85%	1.53%	82.22%
gray snapper	5.00%	1.37%	83.60%
Scamp	8.34%	1.26%	84.86%
atlantic menhaden	0.35%	1.06%	85.92%
Spanish sardine	0.63%	1.05%	86.97%
spot tail pinfish	3.75%	0.84%	87.81%
dolphin	4.79%	0.79%	88.60%
scaled sardine	0.56%	0.75%	89.35%
lane snapper	5.21%	0.73%	90.08%
almaco jack	3.27%	0.70%	90.77%
banded rudderfish	1.67%	0.61%	91.39%

Common	% trip	% number	Cum % number
herring family	0.42%	0.58%	91.97%
red grouper	4.73%	0.57%	92.53%
135 Other Taxa		7.47%	

Table 4-19. Percentage (by weight) of red snapper (commercial) landed by month in FL, GA, SC, and NC during 2003-2008 by month for each state. FL and GA combined due data confidentiality

Month	Total	FL &GA	SC	NC
1	7.35%	7.13%	9.02%	5.83%
2	8.18%	8.77%	6.37%	4.50%
3	8.19%	8.74%	6.76%	4.06%
4	8.14%	8.41%	6.52%	8.72%
5	9.64%	9.34%	9.85%	13.58%
6	10.82%	10.99%	9.30%	12.66%
7	9.59%	9.54%	9.83%	9.54%
8	5.71%	4.88%	8.74%	9.60%
9	5.41%	5.30%	6.14%	4.87%
10	6.38%	5.48%	9.11%	12.10%
11	7.81%	7.22%	10.72%	8.34%
12	12.79%	14.20%	7.64%	6.21%

Table 4-20. Percentage (by weight) of red snapper (headboat) landed in FL, GA, SC, and NC during 2003-2008 by month for each state. GA and NFL combined due to data confidentiality

Month	Total	South FL	GA - NFL	SC	NC
1	3.10%	5.29%	3.74%	0.00%	1.02%
2	7.19%	36.38%	7.76%	0.04%	0.31%
3	10.02%	23.30%	9.80%	10.94%	1.98%
4	11.44%	3.90%	11.69%	14.57%	3.39%
5	13.45%	9.77%	12.28%	23.06%	5.55%
6	11.00%	3.37%	11.48%	11.79%	6.18%
7	8.79%	4.17%	8.94%	10.63%	3.99%
8	6.49%	2.08%	5.49%	14.05%	2.54%
9	4.15%	2.09%	3.96%	4.22%	8.31%
10	9.25%	3.68%	9.28%	5.67%	22.89%
11	7.57%	1.21%	8.78%	4.41%	2.49%
12	7.54%	4.75%	6.79%	0.64%	41.37%

Table 4-21. Percentage (by weight) of red snapper (MRFSS) landed in FL, GA, SC, and NC during 2003-2008 by month for each state.

Wave	Total	FL	GA	SC	NC
1	9.29%	10.80%	0.00%	0.00%	0.00%
2	15.21%	15.71%	7.03%	22.03%	14.62%
3	29.40%	27.19%	51.98%	25.19%	38.93%
4	16.33%	15.77%	14.40%	34.68%	14.94%
5	14.32%	14.22%	18.51%	2.47%	22.67%
6	15.46%	16.31%	8.09%	15.63%	8.85%

A report has been produced that estimates the effect of actions proposed in **Alternatives 2-4D** in reducing the total removals of red snapper (**Appendix E**). **Appendix E** provides details regarding the analysis as well as limitations associated with assumptions used in determining reductions in total kill provided by the proposed area closures. This report compares projected removal rates under scenarios with or without: (1) elimination of directed and/or targeted trips due to regulations; (2) changes in overall release mortality, (3) distinct inshore release mortality; and (4) varying compliance rates. Projected reductions in total removals were computed from baseline 2005-2007 data compiled from commercial logbook, MRFSS, and headboat logbook data for the U.S. south Atlantic. In various scenarios, baseline removals were reduced as a function of trip elimination, spatial and bathymetric closures, and changes in release mortality.

Recent and currently proposed management regulations may reduce the number of trips taken in the future that would impact the red snapper stock. This may occur due to economic unprofitability on a trip level or a fisherman permanently going out of business. Projections provided in **Appendix E** considers red snapper harvest reductions as a function of directed and/or targeted trips for species regulated by Amendment 13C (commercial sector only), Amendment 16 (all sectors), and Amendment 17A (all sectors) (**Appendix E**).

Mortality of discarded red snapper has been estimated at 40% for the recreational fishery and 90% for the commercial fishery (SEDAR 15 2008). A significant component of this difference in discard mortality rate between recreational and commercial fisheries results from commercial fishermen generally fishing in deeper water, although longer handling time (longer surface interval) in the commercial fishery can also increase discard mortality rate (SEDAR 15 2009) (**Appendix E**). As discussed in SEDAR 15 (2008), Burns et al. (2004) estimated a red snapper release mortality of 64% following a study on headboats off Florida in the Atlantic and Gulf of Mexico. The majority of acute mortalities in this study (capture depth of 9–42 m) were attributed to hooking (49%), whereas barotrauma accounted for 13.5%. Burns et al. (2002) estimated J-hook mortality at 56% in a similar study. Using barometric chambers, Burns et al. (2004) estimated barometric mortality at 0% for depths of <20, 25, and 30 m; barotrauma-induced mortality increased to 40% at 45 m and 45% at 60 m. A mark-recapture study by Patterson et al. (2001b) in the Gulf of Mexico estimated a discard mortality of 9% at 21 m, 14% at 27 m, and 18% at 32 m. The mean minimum depth in the recreational (charter boat) fishery was 43 m (range 20 to 183 m). The mean maximum depth was 58 m (24 to 274 m) (**Appendix E**).

Several proposed closure alternatives may result in commercial and recreational fishermen moving into shallower water to fish, potentially decreasing discard mortality rates by reducing barotraumas. Additionally, the complete closure of the red snapper fishery should reduce handling time, as fishermen will no longer need to measure fish to determine if they are of legal size. Finally, several studies (Gitschlag & Renaud 1994, Burns et al. 2002, Burns et al. 2004, Rummer 2007, Diamond and Campbell 2009) have found release mortalities ≤20% in waters <20 m. Under all currently proposed Amendment 17A alternatives, four inshore cells (3379, 2981, 3081, and 3181) with no depths <20 m would remain open to fishing, and might also be recipients of some effort shifting from closed areas. Consequently, the projection model described in **Appendix E** was designed to account for reduced inshore release mortality in these cells, in addition to changes in release mortality rates across all other cells. It should be noted that the mean depth of fishing is >40 m for both the recreational and commercial fisheries in the South Atlantic, this results in a delayed mortality estimate of around 60% (Diamond and Campbell 2009), representing an increase from the SEDAR 15 (2008) estimated release mortality for the recreational sector.

Most of the fisheries benefits of spatial closures are dependent on compliance with no-take regulations (Fogarty et al. 2000). Although published data exists to estimate rates of non-compliance (Ward et al. 2001), numerous modeling efforts and case studies have shown that even relatively low levels of poaching can rapidly erode the fisheries benefits of reserves (Tegner 1993, Attwood et al. 1997, Gribble & Robertson 1998, Guzman & Jacome 1998, Murray et al. 1999, Rogers-Bennett et al. 2000; however, see Jennings et al. 1996). As such, the projection model was designed to account for reduced compliance rates (**Appendix E**).

In order to remain economically viable in the face of substantial spatial closures such as those proposed by Amendment 17A, fishermen may be forced to shift fishing effort from closed areas into areas that remain open. The directionality and extent of this effort shifting is difficult to predict; however, its impacts upon projected reductions in red snapper landings can be approximated through modification of the compliance rate. Given that the proposed spatial closures render the core of the red snapper stock inaccessible to fishing, any effort shifting from closed areas to open areas would have a lower proportional encounter rate with red snapper (e.g., a lower catch-per-unit-effort). Additionally, regulations imposed by Amendment 17B (approved by SAFMC in Dec 2009 for submission to the Secretary of Commerce for final review and approval) would prohibit the harvest of deepwater species (snowy grouper, blueline tilefish, yellowedge grouper, warsaw grouper, speckled hind, misty grouper, queen snapper, and silk snapper) beyond 73 m depth and would implement ACLs for gag, red, and black grouper, it stands to reason that effort from Amendment 17A closures would mostly shift inshore. As previously discussed, red snapper landed inshore might be subject to lower release mortality rates than those recommended by SEDAR 15 (2008). As such, it is perhaps safe to assume that noncompliance has a far greater proportional impact on red snapper removals than a similar level of effort shifting (e.g., 10% effort shift ~ ≤5% noncompliance) (**Appendix E**).

Alternative 2 would prohibit all commercial and recreational harvest, and possession, of red snapper year-round in the South Atlantic EEZ. The prohibition of red snapper harvest in **Alternatives 2-4D** would remain in effect beyond 2010 until modified. It is anticipated that as

the stock rebuilds, the size of the closed area would be decreased and some harvest of red snapper would gradually be increased. This determination would be based on results from stock assessment updates conducted by SEDAR. Fishing mortality in 2007 (F_{CURR}) is estimated at 0.797. The proxies for F_{MSY} being considered by the Council are estimated at 0.148 and 0.104 for $F_{30\%SPR}$ and $F_{40\%SPR}$, respectively. Comparing the expected total kill in 2009 to the estimated landings in 2010 indicates an 83% reduction in total kill is needed to end overfishing and rebuild the fishery within 35 years when $F_{40\%SPR}$ with very high recruitment, the preferred alternative, is used as a proxy for F_{MSY} and a 76% in total kill when $F_{30\%SPR}$ with very high recruitment is used as a proxy for F_{MSY}.

Table 4-22. Projected reductions in red snapper landings following implementation of various alternatives proposed by Amendment 17A. Various scenarios illustrate sensitivity of projection model to input parameters (Table 3 from Appendix E).

Alternative	Closed Cells	Closed Depths	Area Closed (1000 km^2)	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
2	None	None	0	29%	39%	52%	55%	60%	60%
3A	2880, 2980, 3080, 3180	All	38	72%	72%	83%	83%	87%	90%
3B	2880, 2980, 3080, 3180	66-240 ft	27	69%	70%	81%	81%	85%	88%
3C	2880, 2980, 3080, 3180	98-240 ft	15	63%	65%	76%	77%	81%	84%
3D	2880, 2980, 3080, 3180	98-300 ft	16	63%	66%	76%	77%	81%	84%
4A	2880, 2980, 3080, 3180, 3179, 3278, 3279	All	67	76%	77%	86%	86%	89%	93%
4B	2880, 2980, 3080, 3180, 3179, 3278, 3279	66-240 ft	39	73%	74%	83%	84%	87%	91%
4C	2880, 2980, 3080, 3180, 3179, 3278, 3279	98-240 ft	24	66%	69%	78%	80%	83%	86%
4D	2880, 2980, 3080, 3180, 3179, 3278, 3279	98-300 ft	25	67%	69%	79%	80%	83%	86%

Scenario 1: No impacts A13C, A16; A17A eliminates targeted trips only; 80% compliance; 60%/60% offshore release mortality; 20%/20% inshore release mortality.

Scenario 2: No impacts A13C, A16; A17A eliminates targeted trips only; 80% compliance; 40%/90% offshore release mortality, 40%/90% inshore release mortality.

Scenario 3: No impacts A13C, A16; A17A eliminates targeted trips only; 85% compliance; 40%/40% offshore release mortality, 20%/20% inshore release mortality.

Scenario 4: Directed and targeted trips eliminated by A13C, A16, A17A; 85% compliance; 40%/90% offshore release mortality; 20%/20% inshore release mortality.

Scenario 5: Directed and targeted trips eliminated by A13C, A16, A17A; 87% compliance; 40%/40% offshore release mortality; 20%/20% inshore release mortality.

Scenario 6: Directed and targeted trips eliminated by A13C, A16, A17A; 100% compliance; 40%/40% offshore release mortality; 20%/20% inshore release mortality.

Analyses suggest that without additional regulations, **Alternative 2** would be inadequate to achieve the level of reduction necessary to end overfishing of red snapper. This is due to the high rate of encounter with red snapper during other snapper grouper fishing operations as well as the high release mortality of red snapper. Depending on the assumptions, prohibiting all harvest of red snapper under **Alternative 2**, could provide between a 29 to 60% reduction in total removals Table 4-22. To achieve an 83% reduction, the interaction rate of South Atlantic fisheries with red snapper must be reduced through the closure of specific areas to harvest of all members of the snapper grouper fishery management unit (FMU), in addition to a general closure of the red snapper fishery.

Alternative 3A prescribes a general closure of the red snapper fishery, or approximately 38,000 square kilometers of the South Atlantic EEZ, and a complete closure of the four logbook grids partially closed in **Alternative 3C** (Figure 4-12). Various analysis scenarios for **Alternative 3A** are generally the same as for **Alternative 3C**. Under **Alternative 3A**, the estimated reduction in total removals is estimated to range from 72% to 90% depending on assumptions such as effects of previous management measures and release mortality (**Appendix E**).

Alternative 3B would close approximately 27,000 square kilometers to fishing for, harvest, and possession of snapper grouper species. Snapper grouper fishing would be prohibited in four consecutive logbook grids between the depths of 66 feet (20 m) and 240 feet (73 m). **Alternative 3B** includes a slightly larger closed area than **Alternative 3C** and **3D**, and included more inshore area when compared to **Alternatives 3C** and **3D**. Under **Alternative 3B**, estimated reductions in red snapper removals ranges from 69% to 88%. The area closure included in **Alternative 3B** would be more biologically beneficial than **Alternatives 3C** or **3D** which would be expected to reduce red snapper removals by 63% to 84%. Under **Alternative 3B** the stock could potentially rebuild faster than **Alternatives 3C**, and **3D**, but not as quickly as it would under **Alternatives 3A**, **4A**, or **4B**.

Alternative 3C prescribes, in addition to a closure of the red snapper fishery, a closure of four logbook grids (2880, 2980, 3080, 3180), or 15,000 square kilometers of the EEZ, between depths of 98 feet (16 fathoms; 30 m) and 240 feet (40 fathoms, 73 m) to harvest, possession, and retention of all species in the snapper grouper fisher management unit (Figure 4-12). **Alternative 3D** is very similar to **Alternative 3C** in that it closes logbook grids 2880, 2980, 3080, and 3180 beginning at a depth of 98 feet (30 m). The area closure in **Alternative 3D**; however, extends to a depth of 300 feet (91 m); whereas, the area closure in **Alternative 3C** extends to 240 feet (73 m). Since **Alternative 3C** does not extend as far east as **Alternative 3D**, there may some, however small, socioeconomic benefits of **Alternative 3C** over **Alternative 3D**. Additionally, Amendment 17B contains an action that would close federal waters to harvest of deepwater snapper grouper beyond a depth of 240 feet (73 m), creating regulatory redundancy in the deepest part of the **Alternative 3D** closure.

The reduction in total removals from the scenarios examined for **Alternative 4A** range from 86% to 90%. This alternative would establish the year-round closure of seven logbook grids (2880, 2980, 3080, 3179, 3180, 3278, 3279), or 67,000 square kilometers of the EEZ, and therefore includes the most extensive closure of harvest areas. As a result, it is the least sensitive to variations in assumptions. In fact, all but two of the scenarios considered for this alternative achieve a harvest reduction of at least 86%.

Alternative 4B would close a 39,000 square kilometer area to all snapper grouper fishing in the logbook grids 2880, 2980, 3080, 3791, 3180, 3278, and 3279 between 66 feet (20 m) and 240 feet (73 m). This area is smaller than that under **Alternative 4A**, but larger than the closures included in Alternatives **3A**, **3B**, **3C**, **3D**, **4C**, and **4D**. Red snapper harvest reductions under **Alternative 4B** could be expected to range from 73% to 91%. The only alternatives that could realistically result in a greater reductions in total removals are **Alternative 3A**, and **Alternative 4A**, which closes seven total log book grids.

Alternative 4C requires, in addition to a closure of the red snapper fishery, the year-round closure of seven logbook grids (2880, 2980, 3080, 3179, 3180, 3278, 3279) or 24,000 square kilometers of the South Atlantic EEZ, between depths of 98 and 240 feet to the harvest of all members of the snapper grouper FMU. Under this regulatory option, the reduction in total kill in the different scenarios examined in **Appendix E** would range from 66% to 86%.

Preferred **Alternative 4D** is similar to **Alternative 4C** except that in addition to a closure of the red snapper fishery and the year-round closure of seven logbook grids (2880, 2980, 3080, 3179, 3180, 3278, 3279), the bathymetric closure would be between depths of 98 and 300 feet rather than 98 to 240 feet. Under this regulatory option, the reduction in total kill in the different scenarios examined in **Appendix E** would range from 67% to 86%. There is little difference between the magnitude in total removals under **Alternatives 4C** and **4D**, primarily because there is minimal additional area closed by extending the eastern boundary of the closure from 240 feet out to 300 feet.

Appendix E indicated the projected reductions outlined in the alternatives are extremely sensitive to changes in recreational release mortality rate, as the recreational sectors (private, charter and headboat) account for the majority of removals, but the influence of this parameter is reduced as encounters with red snapper are minimized through spatial closures. For example, with no closed cells assuming 100% compliance, no trip elimination, and 40% recreational and 90% commercial overall release mortality, the anticipated reduction is 39%; whereas, increasing the recreational release mortality to 60% cuts this projected reduction to 18% (a 21% difference). Under the same input assumptions but given closure in **Alternative 4A**, at 40% recreational release mortality, the projected reduction is 86%; given 60% release mortality, the projected reduction is 82% (a 4% difference).

The projected reductions are also extremely sensitive to the estimated compliance rate. For example, under **Alternative 3A** closures assuming no trip elimination, 40% recreational release mortality, 90% commercial release mortality, and 100% compliance, the projected reduction is 81%; given 80% compliance, the projected reduction is cut to 72% (a 9% difference). Under the same suite of assumptions for **Alternative 4A** closures, 100% compliance generates a projected reduction of 86%; 80% compliance generates a projected reduction of 77% (a 9% difference). The projected reductions due to trip elimination range from approximately 4-13%, with the influence of the trip eliminations decreasing as the scale of closures increases, because trips that would be eliminated economically become prohibited by management instead. Reducing inshore mortality to 20% provides an additional 2-3% reduction in projected removals (**Appendix E**).

There is a high level of uncertainty in the projected reductions associated with bathymetric closures due to a relative lack of fishery-independent data concerning the distribution of the red snapper stock. For lack of a better alternative, the percent stock protected was based on commercial logbook data, which introduces several potential biases into the computations (see **Appendix E**). Basing the impacts of the bathymetric closure upon commercial logbook observations of stock distribution may not be appropriate for recreational and headboat fisheries, as commercial fisheries may operate in deeper waters. Recreational vessels tend to fish closer to shore and are more likely to fish in shallower water since most are making day trips. An

unpublished examination of confidential headboat fishing effort suggests a substantial number of red snapper occur inshore of 98 feet, an observation supported by the logbook as well. The projected reductions associated with a 66-240 feet closure are 2-7% higher than those associated with a 98-240 feet closure under the scenarios explored in Table 4-22. It should also be noted that the additional area covered by extending the closure inshore to 66 feet provides far more comprehensive coverage of red snapper spawning locations identified by Moe (1963) and MARMAP (1977-2008), as illustrated in Figure 4-11.

Appendix E considered scenarios with changes in release mortality. Some level of effort shifting into shallower water, for both the recreational and commercial fisheries, may be expected following implementation of area closures. Although a variety of factors contribute to discard mortality (e.g., fishing depth, surface interval, hook location, predation, water temperature), depth of capture is an important consideration (GMFMC 2007). This is because a substantial component of the mortality experienced by red snapper following capture and release is due to barotrauma (Campbell 2008) and is therefore directly related to depth of capture (Burns et al. 2004, Rummer 2007). Rummer (2007) estimates that discard mortality may be as low as 20% if the fish is caught in waters < 20 m. If red snapper fishing activity does move closer to shore (particularly into areas 2981, 3081, and 3181) as areas farther offshore are closed then reductions in depth-related discard mortality should be realized. It is difficult to predict exactly what those reductions will be, both because the level and pattern of effort shifting is unknown and because higher discard mortality rates will continue to be experienced in areas of the south Atlantic where areal closures are not implemented (**Appendix E**).

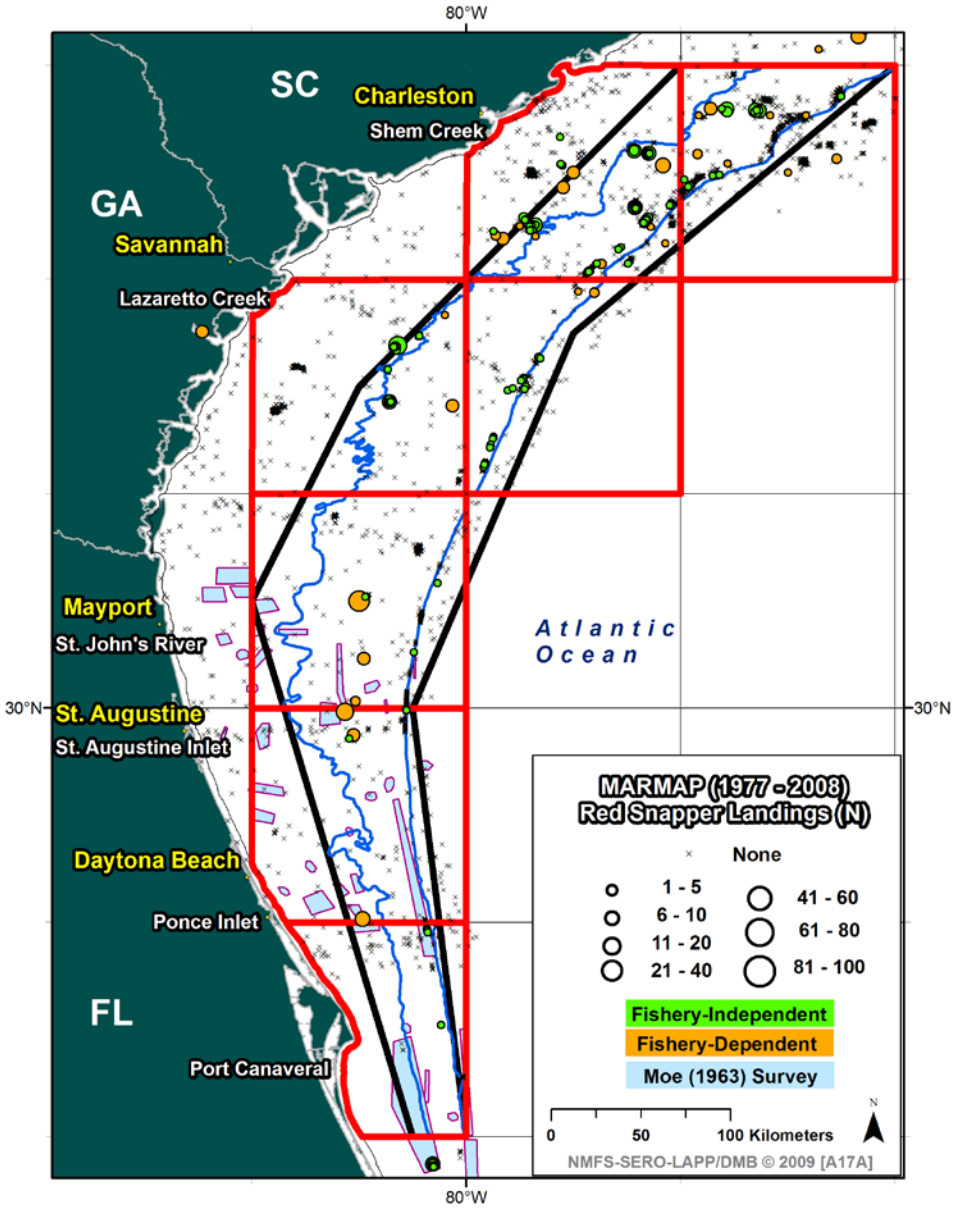


Figure 4-20 Distribution of red snapper taken by MARMAP in fishery-independent and fishery-dependent samples as well as locations where Moe (1963) reported red snapper.

Alternative 5 (Preferred) would allow harvest, and possession, of snapper-grouper species (with the exception of red snapper), if the fish are caught with black sea bass pots, in any of the proposed closed areas outlined in **Alternatives 3A-4D**. Table 4-19 illustrates that most red snapper are harvested from waters off Georgia and Florida. Federal waters off of Georgia and northern Florida are also the approximate locations of proposed snapper grouper area closures in **Alternatives 3A-4D**. If black sea bass pots are allowed within a proposed closed area, red snapper bycatch would be more probable than if black sea bass pot deployment was limited to

locations outside of the closed area where red snapper do not occur as frequently. However, commercial trips with black sea bass pots are likely to produce a lower number of red snapper dead discards compared to recreational trips targeting black sea bass because of the difference in selectivity of the gear types used. The recreational fishery for black sea bass is authorized to use hook and line, spearguns, and powerheads, all of which, except for spearguns, are relatively non-selective. Recreational fishing for black sea bass within the proposed closed area could occur under **Alternative 7 (Preferred)**, which would allow the use of spearguns within the closed area. The commercial fishery for black sea bass is authorized to use specialized black sea bass pots, which must meet certain design standards in order to be legally deployed. Since black sea bass pots are considered highly selective for black sea bass, they could be deployed within any one of the proposed closed areas in **Alternatives 2-4D** without negatively affecting the harvest reductions needed to end overfishing of red snapper. Table 4-23 reveals that on trips that fished black sea bass pots, black sea bass constituted up over 90% of the catch by weight. Red snapper are rarely taken in black sea bass pots (0.22% of trips) and represent less than 0.01% of the catch by weight. However, black sea bass pots are most commonly deployed off of North Carolina where red snapper occur in lower abundance than off Georgia and North Florida. It is possible that the incidental catch of red snapper would be larger if more black sea bass pots were more commonly deployed in the proposed closed areas. Allowing commercial harvest of black sea bass using sea bass pots could alleviate, to some degree, negative socioeconomic effects caused by an area closure without impeding efforts to end overfishing of red snapper.

Table 4-23 Snapper grouper species caught on commercial trips during 2003-2008 when at least one pound of black sea bass was caught using black sea bass pots.

COMMON	% Trip	% Wt
Sea bass, Atlantic, black, UNC	100.00%	91.17%
Pinfish, spot tail	26.16%	1.42%
Octopus	25.23%	0.78%
Grunt, white	23.68%	2.39%
Triggerfish, gray	22.47%	0.97%
Grunts	14.80%	1.32%
Eel, conger	6.15%	0.14%
Eels,UNC	5.02%	0.16%
Snapper, vermilion	4.33%	0.17%
Porgy, red,UNC	3.17%	0.08%
Hake, Atlantic, red and white	2.93%	0.04%
Pigfish	2.66%	0.06%
Triggerfish, ocean	2.34%	0.07%
Tilefish, blueline	2.07%	0.55%
Porgy, knobbed	1.25%	0.03%
Sea bass, rock	1.25%	0.05%
Porgy, whitebone	1.08%	0.05%
Grunt, bluestriped	1.03%	0.04%
Grouper, red	0.89%	0.04%
Porgy, jolthead	0.81%	0.04%
Grouper, gag	0.71%	0.02%
48 other species	8.38%	0.39%
Snapper, red	0.22%	<0.01%

The proposed snapper-grouper area closures could potentially lead to some effort shift into the black sea bass fishery. Currently, Amendment 18 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Amendment 18) contains an action to control fishing effort in the black sea bass fishery in anticipation of effort shifts that may occur as a result of this and other amendments, which will or have already implemented more restrictive management measures. Therefore, any effort shift to the black sea bass fishery that may occur as a result of Amendment 17A may be mitigated by future effort control actions, and thus prevent any long-term negative biological impacts on black sea bass. Furthermore, overfishing of black sea bass due to effort shift is not likely because commercial harvest of black sea bass is controlled by a quota and Amendment 17B will establish accountability measures for the recreational sector to ensure the annual catch limit is not exceeded.

Alternative 6 would allow the harvest of golden tilefish and other deepwater snapper grouper species with bottom longline within the snapper grouper area closures proposed in **Alternatives 2-4D**. Golden tilefish are usually caught over mud habitat in depths of 180 m to 300 m, (Low *et al.* 1983; Able *et al.* 1993), with depths of ~200 m being most common (Dooley 1978). In contrast, red snapper adults usually occur over rocky bottoms, and juveniles inhabit shallow waters and are common over sandy or muddy bottom habitat (Allen 1985) in much shallower water (generally less than 240 ft (73 m)). The difference in preferred habitat and depth of golden tilefish and red snapper would allow for the deployment of bottom longline gear without negatively affecting rebuilding efforts for red snapper. As is the case in allowing black sea bass pot deployment within the closed areas, if chosen as a preferred, allowing the use of bottom longline gear may also help to mitigate some of the negative socioeconomic impact expected as a result of an area closure. Table 4-24 reveals that on trips that fished bottom longline gear, golden tilefish made up over 64% of the catch by weight. Red snapper are rarely taken by bottom longline (0.35% of trips) and represent 0.01% of the catch by weight. Additionally, any effort shift toward the golden tilefish fishery with bottom longline gear may be mitigated by an action currently being proposed in Amendment 18 to limit golden tilefish fishing effort. Furthermore, overfishing of golden tilefish due to effort shift is not likely because commercial harvest of golden tilefish is controlled by a quota. Although the Council felt that there would little chance that fishermen targeting golden tilefish would impact red snapper stocks, the Council did not select **Alternative 6** as a preferred alternative because the preferred closure **Alternative 4D** would extend to a depth of 300 feet and bottom longline gear is already restricted to depths greater than 300 feet.

Table 4-24. Snapper grouper species caught on commercial trips during 2003-2008 when at least one pound of golden tilefish was caught using bottom longline.

COMMON	% Trip	% Wt
Tilefish	100.00%	64.06%
Grouper, Snowy	38.03%	9.54%
Black bellied rosefish	19.10%	8.12%
Shark, sandbar	8.54%	5.07%
Tilefish, blueline	25.79%	4.51%
Grouper, yellowedge	21.83%	2.40%
Shark, Hammerhead	4.75%	0.91%
Dolphin fish	15.40%	0.86%
Hake, Atlantic, red & white	14.61%	0.53%
Shark, Blacktip	2.46%	0.49%
Grouper ,red	1.50%	0.47%
Amberjack, Greater	3.26%	0.33%
Shark, Atlantic sharpnose	2.64%	0.29%
Grouper, black	1.23%	0.27%
Shark, silky	2.02%	0.23%
Hind, speckled	1.67%	0.21%
Eels, UNC	11.80%	0.18%
Snapper, mutton	1.23%	0.14%
Amberjack, lesser	4.05%	0.13%
Scorpionfish-thorneyheads	6.25%	0.12%
Shark, bull	0.97%	0.11%
Shark, tiger	1.41%	0.11%
Shark, great hammerhead	0.35%	0.10%
scamp	1.32%	0.09%
Finfishes,UNC for food	3.61%	0.07%
Snapper, queen	1.41%	0.06%
Cod, Atlantic,UNC	0.44%	0.06%
Triggerfish, gray	0.53%	0.06%
Snapper, silk	1.23%	0.06%
Eel, conger	1.76%	0.06%
Shark, lemon	0.26%	0.05%
Shark, finetooth	0.44%	0.04%
Shark,UNC,fins	1.32%	0.03%
Shark, maco UNC	0.70%	0.03%
cobia	1.06%	0.02%
Grouper, warsaw	0.35%	0.02%
Grouper, yellowfin	0.35%	0.02%
Amberjack	0.09%	0.01%
Wahoo	0.88%	0.01%
Grouper, gag	0.35%	0.01%
Shark, blacknose	0.70%	0.01%
Snapper, red	0.35%	0.01%
31 Other species	8.19%	0.09%

Alternative 7 (Preferred) would allow the harvest of snapper grouper species, other than red snapper, within a proposed closed area using spearfishing gear. Because of its selectivity as a gear type, spearguns would be the least likely of all fishing gear to produce red snapper bycatch. Allowing the use of spearguns may also help to offset, to a small degree, some of the negative socioeconomic impacts expected from large area closures. Some concern has been raised regarding the potential for a massive effort shift to spearfishing in a proposed closed area, and the possible impacts on other species and socioeconomic environment that shift might cause. From a biological perspective, spearguns are the most selective gear type available if the user is well-versed in species identification.

Spearfishing allows fishermen to more effectively select for larger individuals within target species populations (Sadovy et al. 1994; Meyer 2007; Lloret et al. 2008). Spearfishing is an efficient harvesting activity that can significantly alter abundance and size structure of target species toward fewer and smaller fish by selective removal of larger individual fish. The removal of larger individual fish of the target species leaves behind smaller individuals to spawn. Over time this can decrease the size and age at sexual maturity and decrease the average size of the population (Sluka and Sullivan 1998, Chapman and Kramer 1999, Matos-Caraballo et al. 2006; Lloret et al. 2008).

Meyer (2007) reported spearfishing can remove a greater biomass of reef fishes than rod and reel fishing. Frisch et al. (2008) found that free-diving (diving without SCUBA) spear fishermen removed larger fish than rod and reel fishermen. Spearfishing can also impact ecosystem health by altering the composition of the overall natural communities of species (Lloret et al. 2008). Reduction in the larger predatory fishes can have a “top-down” effect on fish assemblages by allowing other fish populations to increase, altering the composition of the overall natural community of species, including invertebrates (Lloret et al. 2008). The largest fish are important as predators in maintaining a balanced and complete ecosystem; their selective removal may cause ecological imbalance (McClanahan and Muthiga 1988; Dulvy et al. 2002).

Spearfishing has been found to alter fish behavior (Schroeder and Parrish 2005) and may cause fish to move to different habitats (Jouvenel and Pollard 2001). These habitats may be less favorable for growth and reproduction. Frisch et al. (2008) and Harper et al. (2000) indicate a small percentage of fish speared are discarded. Frisch et al. (2008) also found that some percentage of fish also escape with spear-induced injuries. There is also little marine debris associated with spearfishing activities compared to rod and reel fishing. Due to the selective nature of spearfishing, allowing the use of spearguns within an area closed to snapper grouper fishing would probably not impede efforts to rebuild the red snapper fishery.

Alternative 8 would allow transit through areas closed to snapper grouper harvest. If the Council chooses to implement one of the proposed area closures for all snapper grouper fishing, snapper grouper that are caught outside a closed area may still need to be transported through a closed area to the vessels’ home port or snapper grouper dealer. In order to reduce safety risks that could result from vessels having to navigate around a closed area in bad weather, the Council is considering allowing such vessels to legally transit through a proposed closed area

under specific conditions. **Alternative 8** would apply to vessels that have onboard legally harvested snapper grouper and/or wreckfish who wish to transit through a proposed closed area. **Alternative 8a (Preferred)** would require that such a vessel must appropriately stow prohibited fishing gear while transiting through the subject area. The Council is considering alternatives which could allow fishing for snapper grouper species with spearfishing gear, black sea bass pots, and bottom longline gear within the proposed closed areas. **Alternative 8a (Preferred)** is the most comprehensive in defining the conductions under which a vessel may transit through a proposed closed area. **Alternative 8b** would allow travel through a closed an area if the vessel is in transit, defined as direct non-stop progression through any snapper grouper closed area on a constant heading, along a continuous straight line course while making way by means of a source of power at all times, and does not require gear to be appropriately stowed. **Alternative 8c** would only apply to vessels wishing to transit through a proposed closed area with wreckfish onboard and does not include a transit provision for other snapper grouper species that may be onboard. **Alternative 8c** also requires that a vessel be in transit, but does not require that fishing gear be appropriately stowed. Allowing transit through a closed area is likely to have negligible negative direct or indirect effects on the biological environment. The efficacy and control of such a provision is largely the responsibility of law enforcement personnel. As with any fishery management provision, there is the chance that some level of non-compliance may occur at any given time. 100 percent compliance is not a realistic expectation for proposed snapper grouper closures; however, with a closer in place the biological impacts of illegal snapper grouper harvest would likely be minimal, and the red snapper stock would rebuild within the proposed rebuilding schedule.

Alternative 1 (Status Quo) will perpetuate the existing level of risk for interactions between ESA-listed species and the fishery. **Alternatives 2-8** and the associated sub-alternatives are unlikely to have adverse effects on ESA-listed species, including *Acropora* species. Previous ESA consultations determined the snapper grouper fishery was not likely to adversely affect *Acropora* species (See **Section 3.5**). These alternatives are unlikely to alter fishing behavior in a way that would cause new adverse effects to these species. The impacts from **Alternatives 2-8** and the associated sub-alternatives on sea turtles and smalltooth sawfish are unclear. If they perpetuate the existing amount of fishing effort, but cause effort redistribution, any potential effort shift is unlikely to change the level of interaction between sea turtles and smalltooth sawfish and the fishery as a whole. If these alternatives reduce the overall amount of fishing effort in the fishery, the risk of interaction between sea turtles and smalltooth sawfish will likely decrease.

4.3.2 Economic Effects

Commercial Sector

A simulation model was used to predict the effects of the proposed red snapper management measures on the commercial fishery using average landings and net operating revenues from 2006-2008 as a base for comparison. The simulation model uses logbook trip reports to predict the short-term economic effects of proposed management alternatives on trip revenues and trip costs. Net operating revenues are calculated as trip revenues from all species caught on a trip

that catches red snapper minus trip costs, which include fuel, oil, bait, ice, and other supplies, and exclude fixed costs and labor.

The method of analysis used has advantages and disadvantages. The advantages are that logbook data are reported by fishermen, and are available in sufficient detail to analyze and compare the proposed alternatives. The disadvantage is that logbook data reflect fishing patterns and strategies given regulations that will no longer apply. Fishermen will modify their fishing patterns and strategies to minimize the effects of new regulations, but the simulation model does not account for these changes. Therefore, it can only approximate the true, but unknown, outcomes of proposed regulations. Nevertheless, the approach provides useful insights about the relative magnitudes of change due to proposed alternatives and the distribution of effects among subgroups within the fishery. **Appendix O** outlines, in detail, the methodology used in the simulation model and is hereby incorporated by reference.

Overview

Under **Alternative 1 (Status Quo)**, the fishery is expected to earn approximately $9.0 million per year after deducting trips costs such as fuel, bait, ice, food and other supplies, but before accounting for fixed costs and labor costs. This number represents income to boat owners, captains, and crew members. This estimate is less than the average of what fishermen actually earned from 2006-08 because it accounts for the predicted effects of Amendment 16, which was not implemented until July 2009.

While **Alternative 2**, the least restrictive proposed management measure, would reduce net operating revenues for the entire commercial snapper grouper fishery by $390,000(4.3%), the combination of **Alternatives 4A, 5 (Preferred)** (black sea bass pot exemption), and **7 (Preferred)** (spearfishing exemption) would reduce net operating revenues by 13.7%. However, red snapper are harvested primarily in northeast Florida and Georgia, and fishermen in these areas are expected to incur reductions in net operating revenues than range from $254,000 (25.7%) under **Alternative 2** up to $693,000 (70.3%) under the combination of **Alternatives 4A, 5 (Preferred), and 7 (Preferred)**. The losses in these areas would increase to 85% without the black sea bass pot and spearfishing gear exemptions.

Results of Alternatives with No Gear Exemptions

Table 4-25 shows the expected losses as a result of **Alternatives 2, 3A-3D,** and **Alternative 4A-4D (Preferred)** compared to the No Action **Alternative 1**, which is expected to result in approximately $9 million in net operating revenue. Impacts range from losses of $390,000 annually with **Alternative 2**, which prohibits all commercial and recreational harvest, possession, and retention of red snapper year round, to $1,485,000 with **Alternative 4A**, which prohibits harvest of red snapper year round and prohibits harvest of all other species in the snapper grouper FMU in 7 logbook grids. **Alternative 4D (Preferred)** is expected to result in losses of $1,304,000.

Table 4-25. Expected Losses as a Result of Alternatives with No Gear Exemptions.

Alternatives	**Expected Losses in Net Operating Revenue (in $1,000s of 2008 dollars)**
Alternative 1 (No Action)	$9,017
Alternative 2	-$390
Alternative 3A	-$521
Alternative 3B	-$476
Alternative 3C	-$457
Alternative 3D	-$463
Alternative 4A	-$1,485
Alternative 4B	-$1,374
Alternative 4C	-$1,289
Alternative 4D (Preferred)	-$1,304

Table 4-26, below, shows the expected losses in net operating revenue from **Alternatives 3A-3D and 4A-4D** in combination with one of the gear exemptions.

Table 4-26. Expected Losses in Net Operating Revenue Assuming Implementation of a Single Gear Exemption.

Alternatives	**Expected Losses in Net Operating Revenue (in $1,000s of 2008 dollars)**
Alternative 1 (No_Action)	$9,017
BSB Pot Exemption Alts	
Alternatives 3A and 5	-$520
Alternatives 3B and 5	-$475
Alternatives 3C and 5	-$457
Alternatives 3D and 5	-$463
Alternatives 4A and 5	-$1,471
Alternatives 4B and 5	-$1,360
Alternatives 4C and 5	-$1,286
Alternatives 4D and 5	-$1,300
Longline Exemption Alts	
Alternatives 3 and 6	-$507
Alternatives 4 and 6	-$1,422
Diving Exemption Alts	
Alternatives 3A and 7	-$490
Alternatives 3B and 7	-$444
Alternatives 3C and 7	-$438
Alternatives 3D and 7	-$445
Alternatives 4A and 7	-$1,249
Alternatives 4B and 7	-$1,139
Alternatives 4C and 7	-$1,084
Preferred Alternatives 4D and 7	-$1,099

Table 4-27, below, shows the expected losses in net operating revenues from **Alternatives 3A-3D and 4A-4D** in combination with the **Alternatives 5 (Preferred)** and **7 (Preferred)**. **Alternatives 3A, 3B, 3C, and 3D** would prohibit the harvest of all species in the snapper grouper management unit in specific depth ranges in logbooks reporting areas 2880, 2980, 3080, and 3180. Water depths between 98 and 240 feet represent the core of the fishery and deviations to encompass shallower or deeper depths result in relatively small additional losses for fishermen. The combination of **Alternatives 3A**, which prohibits harvest in all depths, and **Alternatives 5 (Preferred)** and **7 (Preferred)** is expected to reduce net operating revenues by approximately $489,000 (5.4%). The combinations of **Alternative 3B**, which prohibits harvest between 66 and 240 feet, and **Alternatives 5 (Preferred), and 7 (Preferred)** is expected to reduce net operating revenues by approximately $444,000 (4.9%). The combinations of **Alternative 3C** (prohibits harvest between 98 and 240 ft), **5 (Preferred)**, and **7 (Preferred)** and **Alternatives 3D, 5 (Preferred), and 7 (Preferred)** produce nearly the same results with the

Alternative 3C combination having slightly smaller impacts ($438,000) and the **Alternative 3D** combination producing slightly larger impacts ($445,000).

Table 4-27. Expected Losses in Net Operating Revenues Assuming Implementation of Pot and Dive Exemptions (Preferred Alternatives 5 and 7)

Alternatives	**Expected Losses in Net Operating Revenue (in $1,000s of 2008 dollars)**
Alternative 1 (No_Action)	$9,017
Combined Alternatives	
Alternatives 3A, 5, and 7	-$489
Alternatives 3B, 5, and 7	-$444
Alternatives 3C, 5, and 7	-$438
Alternatives 3D, 5, and 7	-$445
Alternatives 4A, 5, and 7	-$1,235
Alternatives 4B, 5, and 7	-$1,125
Alternatives 4C, 5, and 7	-$1,081
Preferred Alternatives 4D, 5, and 7	-$1,095

Alternatives 4A, 4B, 4C, and **Alternative 4D (Preferred)** would prohibit the harvest of all species in the snapper grouper management unit off portions of South Carolina in addition to Georgia and northeast Florida. Therefore, these alternatives are expected to generate greater losses than **Alternatives 3A-3D**. Simulation results suggest that the losses are 2.5 times larger for **Alternatives 4A-4D** than **Alternatives 3A-3D** (assuming all are combined with **Alternatives 5 (Preferred)** and **7**). **Alternative 4A** in combination with **Alternatives 5 (Preferred)** and **7 (Preferred)** would prohibit harvests in all depths (except for the use of black sea bass pots and spearfishing) and is expected to reduce net operating revenues by approximately $1,235,000 (13.7%). The impacts from the combination of **Alternatives 4B** (which prohibits fishing in 66-240 feet), **Alternatives 5 (Preferred),** and **7 (Preferred)** would be slightly lower with losses of $1,125,000 or 12.5%. The combination of **Alternative 4C** (prohibits harvest between 90-240 feet), **5 (Preferred),** and **7 (Preferred)** and even lower at losses of $1,081,000 (12%). **Alternative 4D (Preferred)** (prohibits fishing between 98 and 300 feet), in combination with **5 (Preferred),** and **7 (Preferred)** produces losses slightly higher at $1,095,000 (12.1%).

Geographical Impacts

Including the exemptions for black seabass and spearfishing gear, the predicted reductions in net operating revenues for fishermen in northeast Florida and Georgia are expected to average approximately $693,000 (70.3%) for **Alternatives 4A** and **4B** and $690,000 (70%) for **Alternatives 4C and 4D**. Losses to South Carolina fishermen from **Alternatives 4A-4D** including mitigating effects of exemptions for black sea bass pots and spearfishing gear, range from $531,000 (34.5%) for **Alternative 4A** to $456,000 (29.6%) for **Alternative 4C**. **Alternative 4D (Preferred)** resulting losses of $463,000 (30%) in combination with **Alternatives 5 (Preferred)** and **7 (Preferred)**.

An unexpected finding of the analysis was that **Alternatives 3A-3D, 4A, 4B,** and **Alternative 4D (Preferred)** in combination with **Alternatives 5 (Preferred)** and **7 (Preferred)** would increase catches of red grouper and other species during the fourth quarter of the year compared to the status quo. The model predicts that restrictions on gag, red snapper, and other species would enable the fishery for shallow water groupers to remain open longer than the status quo. Therefore, while the commercial fishery would still land its quota for gag, landings of red grouper and other shallow water groupers and species commonly caught with them could be greater than with the status quo. This might be partially offsetting the overall losses that normally would be expected from the alternatives for red snapper in the model. Fishermen in North Carolina would be the primary beneficiaries of a longer season for shallow water groupers. Net operating revenues could increase in North Carolina somewhat under **Alternatives 3A-3D** because these areas would not close areas off of South Carolina.

Table 4-28. Expected Losses in Net Operating Revenues by Geographic Region By Gear Exemptions.

	NC	**SC**	**GA-NEFL**	**SEFL**	**KEYS**	**TOTAL**
Alternative 1 (No Action)	$2,498	$1,542	$985	$2,245	$1,746	$9,017
Alternative 2	$17	-$57	-$254	-$93	-$4	-$390
Pot and Dive Exemption Alternatives	**NC**	**SC**	**GA-NEFL**	**SEFL**	**KEYS**	**TOTAL**
Alternatives 3A, 5, and 7	$281	$121	-$673	-$218	-$1	-$489
Alternatives 3B, 5, and 7	$279	$112	-$672	-$163	-$1	-$444
Alternatives 3C, 5, and 7	$278	$109	-$669	-$154	-$1	-$438
Alternatives 3D, 5, and 7	$278	$108	-$670	-$161	-$1	-$445
Alternatives 4A, 5, and 7	$179	-$531	-$693	-$198	$8	-$1,235
Alternatives 4B, 5, and 7	$179	-$487	-$693	-$133	$8	-$1,125
Alternatives 4C, 5, and 7	$179	-$456	-$690	-$124	$8	-$1,081
Preferred Alternatives 4D, 5, and 7	$179	-$463	-$690	-$131	$8	-$1,095
BSB Pot Exemption Alternatives	**NC**	**SC**	**GA-NEFL**	**SEFL**	**KEYS**	**TOTAL**
Alternative 3A and 5	$329	$188	-$793	-$252	$6	-$520
Alternative 3B and 5	$329	$177	-$793	-$196	$6	-$475
Alternative 3C and 5	$317	$172	-$789	-$164	$6	-$457
Alternative 3D and 5	$318	$172	-$789	-$171	$6	-$463
Alternative 4A and 5	$179	-$562	-$840	-$258	$8	-$1,471
Alternative 4B and 5	$179	-$517	-$839	-$192	$8	-$1,360
Alternative 4C and 5	$179	-$486	-$834	-$154	$8	-$1,286
Preferred Alternative 4D and 5	$179	-$493	-$835	-$161	$8	-$1,300
Longline Exemption	**NC**	**SC**	**GA-**	**SEFL**	**KEYS**	**TOTAL**

Alternatives			**NEFL**			
Alternative 3A and 6	$329	$178	-$793	-$229	$6	-$507
Alternative 4A and 6	$179	-$547	-$840	-$224	$8	-$1,422
Diving Exemption Alternatives	**NC**	**SC**	**GA-NEFL**	**SEFL**	**KEYS**	**TOTAL**
Alternative 3A and 7	$281	$121	-$673	-$218	-$1	-$490
Alternative 3B and 7	$279	$112	-$673	-$163	-$1	-$444
Alternative 3C and 7	$278	$109	-$669	-$154	-$1	-$438
Alternative 3D and 7	$278	$108	-$670	-$161	-$1	-$445
Alternative 4A and 7	$179	-$545	-$694	-$199	$8	-$1,249
Alternative 4B and 7	$179	-$500	-$693	-$133	$8	-$1,139
Alternative 4C and 7	$179	-$459	-$690	-$124	$8	-$1,084
Preferred Alternative 4D and 7	$179	-$466	-$690	-$131	$8	-$1,099
No Gear Exemption Alternatives	**NC**	**SC**	**GA-NEFL**	**SEFL**	**KEYS**	**TOTAL**
Alternative 3A	$329	$188	-$793	-$252	$6	-$521
Alternative 3B	$329	$177	-$793	-$196	$6	-$476
Alternative 3C	$317	$172	-$789	-$164	$6	-$457
Alternative 3D	$318	$172	-$789	-$171	$6	-$463
Alternative 4A	$179	-$575	-$840	-$258	$8	-$1,485
Alternative 4B	$179	-$531	-$840	-$192	$8	-$1,374
Alternative 4C	$179	-$489	-$834	-$154	$8	-$1,289
Preferred Alternative 4D	$179	-$496	-$835	-$161	$8	-$1,304

Impacts on Different Gear Users

Net operating revenues are expected to decline for all gear types with **Alternative 2**, for all gear types except black sea bass pots given **Alternatives 3A-D** combined with **Alternatives 5 (Preferred)** and **7 (Preferred)**, and for all gear types except black sea bass pots and spearfishing gear given **Alternatives 4A-D** combined with **Alternatives 5 (Preferred)** and **7 (Preferred)**. However, trips with vertical lines would incur almost all of the expected reductions in net operating revenues because this is the primary gear used in the commercial snapper grouper fishery.

Gear exemptions are expected to mitigate the economic effects of the alternatives because some fishing activity would be exempt from the proposed closures. The exemption for black sea bass pots (**Alternative 5 (Preferred)**) is small because most pot fishing occurs in fishing areas that would not be affected by the proposed closures. When compared to the effects of the same alternatives without the gear exemption, the expected benefit of an exemption for pots is approximately $14,000 for **Alternatives 4A** and **4B**, and about $3,000 for the deeper waters associated with **Alternative 4C** and **Alternative 4D (Preferred)**. When compared to the status quo alternative, the net effect of an exemption for pots is a small gain for fishermen with black

sea bass pots. There is virtually no benefit for **Alternatives 3A, 3B, 3C** or **3D** because the fishery for pots primarily occurs in South Carolina and North Carolina rather than Georgia and northeast Florida.

The exemption for longlines in waters deeper than 300 feet (**Alternative 6**) applies only to **Alternatives 3A** and **4A** because the other alternatives would prohibit fishing only in waters shallower than 300 feet. The simulation analysis found that an exemption for longlines could be either positive or negative for the conditions associated with individual fishing years, with the outcome dependent on whether an exemption would increase landings of tilefish quickly enough to trigger the lower 300 pound trip limit on September 1 of each year.[3] If the 300 pound trip limit is triggered, then total landings of tilefish could be less than without an exemption for longlines and the full trip limit of 4000 pounds for tilefish. When compared to the same alternatives without the gear exemption, the expected benefit of an exemption for longlines would be approximately $14,000 for **Alternative 3A** and $63,000 for **Alternative 4A**. An exemption for longlines is not one of the Council's preferred alternatives, and trips with longlines are expected to incur reductions in net operating revenues of approximately 11.9 percent with **Alternative 4A** in combination with **Alternatives 5 (Preferred)** and **7 (Preferred)**.

The potential benefit of a gear exemption is greatest for spearfishing gear (**Alternative 7 (Preferred9)**, and is expected to add an average of approximately $32,000 for **Alternatives 3A** and **3B**, and $235,000 for **Alternatives 4A** and **4B** when compared with alternatives without gear exemptions. The potential benefit of an exemption for spearfishing gear is smaller for alternatives that restrict fishing in deeper depths where commercial diving is less common: about $19,000 for **Alternatives 3C** and **3D** and $205,000 for **Alternative 4C** and **Alternative 4D (Preferred)**. When compared to the status quo alternative, the net effect of the exemption is a small reduction in net operating revenues for spearfishing gear with **Alternatives 3A-3D**, and a small gain in net operating revenues with **Alternatives 4A-4D** when combined with **Alternatives 5 (Preferred)** and **7 (Preferred)**.

Table 4-29. Expected Losses in Net Operating Revenues by Gear Group By Gear Exemption.

Alternatives	**Dive**	**Vert Lines**	**Longlines**	**Pots/Traps**	**Other**	**TOTAL**
Alternative 1 (No Action)	$474	$7,125	$529	$276	$613	$9,017
Alternative 2	-$40	-$349	$0	-$1	$0	-$390
Pot and Dive Exemption Alternatives	**Dive**	**Vert Lines**	**Longlines**	**Pots/Traps**	**Other**	**TOTAL**
Alternatives 3A, 5, and 7	-$15	-$437	-$16	$1	-$23	-$489
Alternatives 3B, 5, and 7	-$16	-$426	$0	$1	-$3	-$444
Alternatives 3C, 5, and 7	-$16	-$421	$0	$1	-$2	-$438
Alternatives 3D, 5, and 7	-$16	-$427	-$2	$1	-$2	-$445
Alternatives 4A, 5, and 7	$23	-$1,174	-$63	$2	-$22	-$1,235

[3] The commercial fishery for golden tilefish is managed with an annual quota and a 4,000 pound trip limit. The trip limit is reduced to 300 pounds after 75% of the quota is taken, but only if this occurs on or before September 1.

Alternatives 4B, 5, and 7	$23	-$1,147	-$1	$2	-$2	-$1,125
Alternatives 4C, 5, and 7	$23	-$1,104	$0	$2	-$1	-$1,081
Preferred Alternatives 4D, 5, and 7	$23	-$1,117	-$2	$2	-$1	-$1,095
BSB Pot Exemption Alternatives	**Dive**	**Vert Lines**	**Longlines**	**Pots/Traps**	**Other**	**TOTAL**
Alternative 3A and 5	-$183	-$301	-$16	$1	-$22	-$520
Alternative 3B and 5	-$182	-$292	$0	$1	-$3	-$475
Alternative 3C and 5	-$155	-$302	$0	$1	-$1	-$457
Alternative 3D and 5	-$155	-$307	-$2	$1	-$1	-$463
Alternative 4A and 5	-$213	-$1,174	-$63	$2	-$22	-$1,471
Alternative 4B and 5	-$213	-$1,147	-$1	$2	-$2	-$1,360
Alternative 4C and 5	-$182	-$1,104	$0	$2	-$1	-$1,286
Preferred Alternatives 4D and 5	-$182	-$1,117	-$2	$2	-$1	-$1,300
Longline Exemption Alternatives	**Dive**	**Vert Lines**	**Longlines**	**Pots/Traps**	**Other**	**TOTAL**
Alternative 3A and 6	-$183	-$302	-$1	$1	-$22	-$507
Alternative 4A and 6	-$213	-$1,175	$1	-$13	-$22	-$1,422
Diving Exemption Alternatives	**Dive**	**Vert Lines**	**Longlines**	**Pots/Traps**	**Other**	**TOTAL**
Alternative 3A and 7	-$15	-$437	-$16	$1	-$23	-$490
Alternative 3B and 7	-$16	-$426	$0	$1	-$3	-$444
Alternative 3C and 7	-$16	-$421	$0	$1	-$2	-$438
Alternative 3D and 7	-$16	-$427	-$2	$1	-$2	-$445
Alternative 4A and 7	$23	-$1,174	-$63	-$13	-$22	-$1,249
Alternative 4B and 7	$23	-$1,147	-$1	-$12	-$2	-$1,139
Alternative 4C and 7	$23	-$1,104	$0	-$2	-$1	-$1,084
Preferred Alternative 4D and 7	$23	-$1,117	-$2	-$2	-$1	-$1,099
No Gear Exemption Alternatives	**Dive**	**Vert Lines**	**Longlines**	**Pots/Traps**	**Other**	**TOTAL**
Alternative 3A	-$183	-$301	-$16	$1	-$22	-$521
Alternative 3B	-$182	-$292	$0	$1	-$3	-$476
Alternative 3C	-$155	-$302	$0	$1	-$1	-$457
Alternative 3D	-$155	-$307	-$2	$1	-$1	-$463
Alternative 4A	-$213	-$1,174	-$63	-$13	-$22	-$1,485
Alternative 4B	-$213	-$1,147	-$1	-$12	-$2	-$1,374
Alternative 4C	-$182	-$1,104	$0	-$2	-$1	-$1,289
Alternative 4D	-$182	-$1,117	-$2	-$2	-$1	-$1,304

Recreational Sector

The methodology employed in this assessment follows the methodology employed in NMFS (2008a and 2008b). NMFS (2008a) analyzed the expected economic effects of a recreational closure of the red snapper fishery in the Gulf of Mexico in 2008. The methodology for that assessment is thoroughly documented in that report and is incorporated herein by reference. NMFS (2008b) analyzed the expected economic effects of the interim rule to close the red snapper fishery in the South Atlantic, and the methodology described in that document is incorporated herein by reference. A general description of the methodology employed for the current amendment is provided below. **Appendix N** provides more details on the method used to estimate the economic effects of this amendment on the recreational sector.

This assessment evaluated the expected change in economic value relative to the status quo to fishers and for-hire vessels in response to the proposed alternatives. The change in economic value is measured in terms of the consumer surplus (CS) to recreational anglers and net operating revenues (NOR) to for-hire vessels. CS in the present case is the net benefit an angler derives from an additional fish kept on a fishing trip and is equivalent to the difference between the monetized benefit an angler receives and the actual cost. This value is the appropriate measure of economic effects on recreational anglers as a result of changes in fishing regulations. NOR is the net operating revenue, expressed on a per angler basis, a charterboat or headboat derives from a fishing trip. NOR is calculated as revenue minus the costs for fuel, ice, bait, and other supplies.

The economic effects of the various alternatives whose effects can be quantified are presented in the tables below. The CS values are computed by multiplying the number of red snapper target trips by the CS per trip and average fish per angler per trip. The NOR values are computed by multiplying the number of affected for-hire angler trips by the NOR per angler, per trip.

Several limitations, discussed in **Appendix N**, characterize the estimated changes in CS and NOR. One such limitation is the possible overestimation of affected target trips and hence also the economic effects. The headboat data collection program does not collect target intent, much less on a species-specific basis, so an alternative estimation approach was used which generated red snapper and snapper angler trips from the estimated total angler days. Moreover, charter and private target trips were assigned by statistical grid using similar information from distribution of headboat trips by statistical grid. In addition, headboat and MRFSS data do not contain depth information, so the assignment of target trips by depth made use of similar information from the commercial logbook program. Furthermore, the analysis does not take into account possible effort shift due to area or species substitution. Leaving the fishery altogether remains an option for some for-hire owners/operators, but given the relatively low level of local and national economic activities, there's a good chance these persons would remain in the fishing industry. If so, they would have to fish for other snapper grouper species, fish in the open areas, move their operations to other areas in the South Atlantic or nearby locations, or offer other services to make up for their revenue and profit losses. These options may not totally compensate for their profit losses if they incur higher operating cost and/or additional fixed costs or generate lower revenues; nevertheless, these options would imply the economic effects on the for-hire sector

would be less than currently estimated. Private anglers may also shift their effort to target other species or the same species (except red snapper) in the open areas rather than stop fishing altogether. Again, this would imply the current estimates of CS reductions to be overestimates.

Another limitation pertains to the use of CS and NOR values. The CS value used is uniform across all fishing modes and areas, and this may not necessarily be the case. Headboat anglers may value red snapper differently, on average, than private and charterboat anglers. The direction and magnitude of such difference are unknown, though the higher cost of fishing to charterboat anglers suggests the CS to headboat anglers would be less than that to charterboat anglers. The NOR value used is uniform across all areas, and thus does not account for area variations in charter and headboat operations that could result in varying NOR values.

One other limitation worth noting here is the one-year horizon considered in the analysis. Many of the regulations proposed in this amendment are likely to remain in effect for the next several years, noting that a rebuilding schedule is being proposed in this amendment. One possible way to address this issue is to extrapolate the estimates to the future after duly accounting for a discount factor. However, future changes in stock status, regulations, and socioeconomic conditions, among others, need to be addressed for a more reasonable estimation of long-term economic effects.

Table 4-30a presents the economic effects of **Alternative 2**. The bulk of the red snapper fishery is in northeast Florida and Georgia, so it is no surprise anglers and for-hire vessels in this area would experience most of the economic effects from the ban on red snapper fishing. Southeast Florida and South Carolina are also expected to experience a relatively sizeable amount of economic loss. A good amount of red snapper targeting by charterboat and private anglers in southeast Florida would explain the relatively large losses in CS in this area (see **Appendix N**). In South Carolina, headboat anglers would account for more than half of the CS losses, and this could be partly due to the possible overestimation of headboat angler trips. The absence of red snapper targeting by charterboat and private anglers in North Carolina would explain the relatively low CS reductions in this area from the red snapper fishing ban. In terms of NOR reductions, the headboat sector would account for most of the effects but this could be partly due to the possible overestimation of affected angler trips on headboats. The distribution, though, of headboat NOR changes follow that of the CS reductions. That is, headboats in northeast Florida and Georgia would experience the largest NOR reductions, followed by those in southeast Florida, South Carolina, and North Carolina.

Table 4-30a. Reductions in consumer surplus (CS) and for-hire net operating revenues (NOR) due to Alternative 2, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida/Georgia				
CS	904,548	663,664	2,162,682	3,730,893
NOR	413,508	2,820,571		3,234,078
Total	1,318,056	3,484,235	2,162,682	6,964,972
Southeast Florida				
CS	148,462	54,578	419,513	622,552
NOR	67,868	487,576		555,444

Total	216,330	542,153	419,513	1,177,996
South Carolina				
CS	23,560	126,342	93,840	243,742
NOR	38,560	316,766		355,326
Total	62,120	443,108	93,840	599,068
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989		161,989
Total	0	168,691	0	168,691

The economic effects of closing to snapper grouper fishing statistical grids 2880, 2980, 3080, and 3180, in addition to the red snapper fishing ban, are presented in Tables 4-30b, 4-30c, 4-30d, and 4-30e for **Alternatives 3A, 3B, 3C,** and **3D**, respectively. The tabulated estimates combine the economic effects of the red snapper fishing ban, as shown in Table 4-30a, and the economic effects of the area closures.

As noted earlier, **Alternatives 3A, 3B, 3C,** and **3D** vary only in the depths subject to closure. Closure of the four grids, regardless of depths considered, would affect only the fishing participants in northeast Florida and Georgia. Fishing activities in other areas (southeast Florida, South Carolina, and North Carolina) would not be directly affected by the closure, although these other areas may be indirectly affected if fishers shift to the nearby open areas. The economic effects in these other areas, shown in the tables, would be due only to the fishing ban on red snapper. The magnitude of economic effects of the various alternatives directly correlates with the size of area closures. **Alternative 3A** would close all depths within each of the four grids; hence it would result in the largest economic effects among the four alternatives. The second largest economic effects would result from **Alternative 3B**, which would close depths from 66 feet to 240 feet. **Alternative 3C**, which would close depths from 98 feet to 240 feet, would result in the lowest economic effects; and, **Alternative 3D**, which would close depths from 98 feet to 300 feet, would have the third largest economic effects. It should be noted here that the assignment of recreational trips by depth was done using the depth distribution of commercial vessel trips. The extent of bias introduced by this technique is unknown, although it may be remarked that in general recreational vessels fish in shallower waters than commercial vessels. This may have particular significance when comparing **Alternative 3C** and **Alternative 3D**.

Table 4-30b. Reductions in consumer surplus (CS) and for-hire net operating revenues (NOR) due to Alternative 3A, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida/Georgia				
CS	2,428,190	2,507,009	8,307,352	13,242,550
NOR	667,448	3,423,203		4,090,651
Total	3,095,638	5,930,212	8,307,352	17,333,201
Southeast Florida				
CS	148,462	54,578	419,513	622,552
NOR	67,868	487,576		555,444
Total	216,330	542,153	419,513	1,177,996
South Carolina				

CS	23,560	126,342	93,840	243,742
NOR	38,560	316,766		355,326
Total	62,120	443,108	93,840	599,068
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989		161,989
Total	0	168,691	0	168,691

Table 4-30c. Reductions in consumer surplus (CS) and for-hire net operating revenues (NOR) due to Alternative 3B, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida/Georgia				
CS	2,358,390	2,422,316	8,025,388	12,806,094
NOR	655,815	3,395,515		4,051,329
Total	3,014,205	5,817,830	8,025,388	16,857,423
Southeast Florida				
CS	148,462	54,578	419,513	622,552
NOR	67,868	487,576		555,444
Total	216,330	542,153	419,513	1,177,996
South Carolina				
CS	23,560	126,342	93,840	243,742
NOR	38,560	316,766		355,326
Total	62,120	443,108	93,840	599,068
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989		161,989
Total	0	168,691	0	168,691

Table 4-30d. Reductions in consumer surplus (CS) and for-hire net operating revenues (NOR) due to Alternative 3C, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida/Georgia				
CS	2,222,476	2,257,712	7,477,923	11,958,111
NOR	633,162	3,341,702		3,974,864
Total	2,855,638	5,599,414	7,477,923	15,932,975
Southeast Florida				
CS	148,462	54,578	419,513	622,552
NOR	67,868	487,576		555,444
Total	216,330	542,153	419,513	1,177,996
South Carolina				
CS	23,560	126,342	93,840	243,742
NOR	38,560	316,766		355,326
Total	62,120	443,108	93,840	599,068
North Carolina				
CS	0	6,702	0	6,702

NOR	0	161,989		161,989
Total	0	168,691	0	168,691

Table 4-30e. Reductions in consumer surplus (CS) and for-hire net operating revenues (NOR) due to Alternative 3D, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida/Georgia				
CS	2,231,794	2,269,089	7,516,041	12,016,924
NOR	634,715	3,345,421		3,980,137
Total	2,866,509	5,614,511	7,516,041	15,997,061
Southeast Florida				
CS	148,462	54,578	419,513	622,552
NOR	67,868	487,576		555,444
Total	216,330	542,153	419,513	1,177,996
South Carolina				
CS	23,560	126,342	93,840	243,742
NOR	38,560	316,766		355,326
Total	62,120	443,108	93,840	599,068
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989		161,989
Total	0	168,691	0	168,691

The economic effects of closing to snapper grouper fishing statistical grids 2880, 2980, 3080, 3180, 3179, 3278, and 3279, in addition to the red snapper fishing ban, are presented in Tables 4-30f, 4-30g, 4-30h, and 4-30i for **Alternatives 4A, 4B, 4C,** and **4D (Preferred)**, respectively. Estimates in these tables combine the economic effects of the red snapper fishing ban, as shown in Table 4-30a, the economic effects of the closing four statistical grids, as shown in Tables 4-30b, 4-30c, 4-30d, and 4-30e, and the additional closure of three more statistical grids.

Alternatives 4A, 4B, 4C, and **4D (Preferred)** vary from one another only in the depths subject to closure. Closure of the seven grids, regardless of depths considered, would affect only the fishing participants in northeast Florida, Georgia, and South Carolina. Fishing activities in southeast Florida and North Carolina would not be directly affected by the closure, although these other areas may be indirectly affected if fishers shift to the nearby open areas. The economic effects in these other areas, shown in the tables, would be due only to the fishing ban on red snapper. The magnitude of economic effects of the various alternatives directly correlates with the size of area closures. **Alternative 4A** would close all depths within each of the seven statistical grids; hence, it would result in the largest economic effects among the four alternatives. The second largest economic effects would result from **Alternative 4B**, which would close depths from 66 feet to 240 feet. **Alternative 4C**, which would close depths from 98 feet to 240 feet, would result in the lowest economic effects; and, **Alternative 4D**, which would close depths from 98 feet to 300 feet, would have the third largest economic effects. As may be expected, the relative magnitudes of economic effects of these four alternatives closely mimic those of **Alternatives 3A, 3B, 3C,** and **3D**. It should be reiterated here that the assignment of recreational trips by depth was done using the depth distribution of commercial vessel trips. The

extent of bias introduced by this technique is unknown, although it may be remarked that in general recreational vessels fish in shallower waters than commercial vessels. This may have particular significance when comparing **Alternative 4C** and **Alternative 4D**.

Table 4-30f. Reductions in consumer surplus (CS) and for-hire net operating revenues (NOR) due to Alternative 4A, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida/Georgia				
CS	2,428,190	2,507,009	8,307,352	13,242,550
NOR	667,448	3,423,203		4,090,651
Total	3,095,638	5,930,212	8,307,352	17,333,201
Southeast Florida				
CS	148,462	54,578	419,513	622,552
NOR	67,868	487,576		555,444
Total	216,330	542,153	419,513	1,177,996
South Carolina				
CS	537,839	3,199,953	848,174	4,585,965
NOR	103,231	744,925		848,156
Total	641,069	3,944,878	848,174	5,434,121
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989		161,989
Total	0	168,691	0	168,691

Table 4-30g. Reductions in consumer surplus (CS) and for-hire net operating revenues (NOR) due to Alternative 4B, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida/Georgia				
CS	2,358,390	2,422,316	8,025,388	12,806,094
NOR	655,815	3,395,515		4,051,329
Total	3,014,205	5,817,830	8,025,388	16,857,423
Southeast Florida				
CS	148,462	54,578	419,513	622,552
NOR	67,868	487,576		555,444
Total	216,330	542,153	419,513	1,177,996
South Carolina				
CS	478,680	2,846,388	761,401	4,086,469
NOR	95,791	695,673		791,465
Total	574,471	3,542,061	761,401	4,877,934
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989		161,989
Total	0	168,691	0	168,691

Table 4-30h. Reductions in consumer surplus (CS) and for-hire net operating revenues (NOR) due to Alternative 4C, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida/Georgia				
CS	2,222,476	2,257,712	7,477,923	11,958,111
NOR	633,162	3,341,702		3,974,864
Total	2,855,638	5,599,414	7,477,923	15,932,975
Southeast Florida				
CS	148,462	54,578	419,513	622,552
NOR	67,868	487,576		555,444
Total	216,330	542,153	419,513	1,177,996
South Carolina				
CS	475,902	2,829,786	757,326	4,063,014
NOR	95,442	693,361		788,803
Total	571,344	3,523,146	757,326	4,851,817
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989		161,989
Total	0	168,691	0	168,691

Table 4-30i. Reductions in consumer surplus (CS) and for-hire net operating revenues (NOR) due to Alternative 4D, in 2009 dollars.

	Charterboat	Headboat	Private	Total
Northeast Florida/Georgia				
CS	2,231,794	2,269,089	7,516,041	12,016,924
NOR	634,715	3,345,421		3,980,137
Total	2,866,509	5,614,511	7,516,041	15,997,061
Southeast Florida				
CS	148,462	54,578	419,513	622,552
NOR	67,868	487,576		555,444
Total	216,330	542,153	419,513	1,177,996
South Carolina				
CS	477,273	2,837,981	759,338	4,074,592
NOR	95,615	694,502		790,117
Total	572,888	3,532,483	759,338	4,864,708
North Carolina				
CS	0	6,702	0	6,702
NOR	0	161,989		161,989
Total	0	168,691	0	168,691

For purposes of the succeeding discussions, Table 4-30j is presented below. This table summarizes the more detailed tables presented above.

Table 4-30j. Summary of CS and NOR reductions, in 2009 dollars.

		FL_NE/GA	FL_SE	SC	NC	TOTAL
ALT. 2	CS	3,730,893	622,552	243,742	6,702	4,603,890
	NOR	3,234,078	555,444	355,326	161,989	4,306,837
	TOTAL	6,964,972	1,177,996	599,068	168,691	8,910,728
ALT. 3A	CS	13,242,550	622,552	243,742	6,702	14,115,547
	NOR	4,090,651	555,444	355,326	161,989	5,163,410
	TOTAL	17,333,201	1,177,996	599,068	168,691	19,278,957
ALT. 3B	CS	12,806,094	622,552	243,742	6,702	13,679,090
	NOR	4,051,329	555,444	355,326	161,989	5,124,088
	TOTAL	16,857,423	1,177,996	599,068	168,691	18,803,179
ALT. 3C	CS	11,958,111	622,552	243,742	6,702	12,831,108
	NOR	3,974,864	555,444	355,326	161,989	5,047,623
	TOTAL	15,932,975	1,177,996	599,068	168,691	17,878,731
ALT. 3D	CS	12,016,924	622,552	243,742	6,702	12,889,921
	NOR	3,980,137	555,444	355,326	161,989	5,052,896
	TOTAL	15,997,061	1,177,996	599,068	168,691	17,942,817
ALT. 4A	CS	13,242,550	622,552	4,585,965	6,702	18,457,770
	NOR	4,090,651	555,444	848,156	161,989	5,656,239
	TOTAL	17,333,201	1,177,996	5,434,121	168,691	24,114,009
ALT. 4B	CS	12,806,094	622,552	4,086,469	6,702	17,521,817
	NOR	4,051,329	555,444	791,465	161,989	5,560,227
	TOTAL	16,857,423	1,177,996	4,877,934	168,691	23,082,044
ALT. 4C	CS	11,958,111	622,552	4,063,014	6,702	16,650,380
	NOR	3,974,864	555,444	788,803	161,989	5,481,100
	TOTAL	15,932,975	1,177,996	4,851,817	168,691	22,131,480
ALT. 4D	CS	12,016,924	622,552	4,074,592	6,702	16,720,771
	NOR	3,980,137	555,444	790,117	161,989	5,487,686
	TOTAL	15,997,061	1,177,996	4,864,708	168,691	22,208,457

Under **Alternative 1 (Status Quo)**, the red snapper recreational fishery could continue to operate as it currently does, with no short-term reductions in the number of harvested fish, trips taken, or changes in economic values from the calculated baseline. Because the resource is overfished, these conditions would not be expected to persist, nor could they legally be allowed to continue.

Biological conditions in the resource would be expected to worsen, requiring more stringent harvest restrictions as stipulated in the rest of the alternatives.

Alternative 2 would prohibit all harvest of red snapper in the South Atlantic EEZ as well as red snapper harvested by federally permitted for-hire vessels that fish in state waters. At present, it is not known how long this prohibition would last. Assuming trip cancellations, this alternative may be expected to result in a total CS reduction of approximately $4.6 million (2009 dollars).

Under the assumption that the prohibitions of **Alternative 2** result in the cancellation of all trips wherein red snapper was targeted, this alternative would be expected to result in a NOR reduction of approximately $520 thousand to charterboats, and a NOR reduction of approximately $3.8 million to headboats, or a total reduction in economic values of approximately $4.3 million. The assumption that all red snapper target trips would be cancelled is expected to result in overestimation of the actual number of trips affected and thus of the economic values lost to the recreational sector. In reality, most red snapper anglers would be expected to continue to fish but shift their effort to other species.

There is little expectation that all red snapper target trips would be cancelled under **Alternative 2**. On average, red snapper is only the third most important species in terms of the number of fish caught on private and charter trips and the fifteenth most important species in terms of the number of pounds of fish harvested on headboat trips (NMFS 2008b). Hence, most of the historic trips that previously targeted red snapper would be expected to continue to be taken but would target other species. Target effort for grouper, dolphin, and king mackerel was projected to increase from 13 percent (grouper) to 31 percent (dolphin) in response to the red snapper closure in the Gulf of Mexico (NMFS 2008a). Absent specific data to suggest the proportion of red snapper target trips expected to be cancelled, this analysis simply assumes the cancellation of all red snapper target trips constitutes an upper bound of the expected change in economic value to the recreational fishery as a result of **Alternative 2**. Overall, **Alternative 2** is expected to reduce short-term economic value by $8.9 million (CS + NOR). If the prohibition is permanent, reductions in economic value could top approximately $127 million under a 7 percent discount rate.

As shown in Table 4-30j, northeast Florida/ Georgia would experience the largest economic effects, followed by southeast Florida, South Carolina, and lastly by North Carolina. The reported absence of target trips for red snapper in North Carolina is primarily responsible for the zero effects of red snapper fishing prohibition for this state. North Carolina landed some red snapper, but apparently, there has been very low demand for red snapper trips in this state. The headboat sector appears to be the largest target mode, but this is very likely due to the assessment assumptions and, as noted above, the estimates of headboat effort are believed to exceed actual totals. Private and charterboat modes are a relatively large component of the red snapper recreational sector.

Alternatives 3A, 3B, 3C, and **3D** would prohibit recreational harvest of species in the Snapper Grouper FMU year-round in certain areas in the South Atlantic, in addition to the red snapper fishery closure. As noted earlier, each of these alternatives would result in economic losses in addition to the losses estimated for **Alternative 2**. These losses would mainly come from

reductions in economic values derived from snapper grouper species other than red snapper. In addition, the assumption on trip cancellations mentioned with respect to **Alternative 2** would become more valid under any of these four alternatives. The issue of trip cancellation that would affect other snapper grouper species would also arise under any of these four alternatives, although more so under **Alternative 3A**, which closes all depths within each of the four grids. It is likely that fishing effort would shift to the open areas or to species whose harvest is allowed in areas considered in any of these four alternatives, but effort shifting would carry certain costs that could be relatively high for some fishing participants.

Alternative 3A may be expected to result in a total CS reduction of approximately $14.1 million and a total NOR reduction of $5.2 million ($774 thousand to charterboats and $4.4 million to headboats). Overall, **Alternative 3A** may be expected to reduce short-term economic values by $19.3 million. The overall expected reductions in economic values for the other three alternatives are: $18.8 million for **Alternative 3B**, $17.88 million for **Alternative 3C**, and $17.94 million for **Alternative 3D**. Among these four alternatives, **Alternative 3C** would result in the lowest reduction in economic values while **Alternative 3A,** the highest. This is probably as expected since **Alternative 3C** would close the smallest areas and **Alternative 3A**, the largest. If the regulations from these alternatives were permanent, economic losses could top $276 million for **Alternative 3A**, $269 million for **Alternative 3B**, $255 million for **Alternative 3C**, and $256 million for **Alternative 3D** at a 7% discount rate.

The pattern of economic effects of **Alternatives 4A through 4D** follows that of **Alternatives 3A through 3D**. That is, economic losses would be lowest for **Alternative 4C** and highest for **Alternative 4A**. The overall economic losses would be $24.1 million for **Alternative 4A**, $23.1 million for **Alternative 4B**, $22.1 million for **Alternative 4C**, and $22.2 million for **Alternative 4D**. If regulations were permanent, economic losses could reach $344 million, $330 million, $316 million, and $317 million, respectively, for **Alternative 4A**, **Alternative 4B**, **Alternative 4C**, and **Alternative 4D** at a 7% discount rate.

There are at least five additional features worth noting in the tabulated results. First and already noted earlier, northeast Florida and Georgia would experience the largest economic effects of each alternative and North Carolina, the least. This generally reflects the fact that the bulk of the affected fishery is in the northeast Florida/Georgia area. On the other end, North Carolina reported low landings of red snapper and apparent absence of red snapper targeting by the charter and private anglers. In addition, North Carolina is located relatively remotely from the proposed closed areas.

Second, each alternative would result in larger reduction in CS than NOR, even more so for alternatives with area closures. To some extent, this is as expected because CS is derived from three modes of fishing, namely, private, charter, and headboat while NOR is generated only by charterboat and headboat operations. In all alternatives, except **Alternative 2**, CS reductions dominate by far the NOR reductions, resulting in big jumps in total economic effects. For example, total economic effects would rise from $8.9 million under **Alternative 2** to $19.3 million under **Alternative 3A**, with an increase in CS from $4.6 million to $14.1 million and NOR from $4.3 million to $5.2 million. Additional losses from these other alternatives would come from losing trips for snapper grouper other than red snapper. These additional lost trips are

less than the lost red snapper trips in all fishing modes but the CS valuation of these additional trips would be much higher. In a sense, this would reflect the greater importance of some of the other species, but an examination of the estimating procedure used shows that a large part of the additional CS effects comes from the use of a much higher average number of snapper grouper harvest. Considering the large number of snapper grouper species harvested, it is likely that the average number of these species caught per trip is higher than the average number of red snapper harvested per trip. The sensitivity of the results to the use of average number of snapper grouper species per trip is explored below.

Third, although the magnitude of increase in total economic effects from closing four areas to closing seven areas is not as large as from no closure to closing four areas, the magnitude of additional effects is still relatively large. For example, the total economic effects of **Alternative 3A** would be $19.3 million while those of **Alternative 4A** would be $24.1 million, or about a 25% increase. On the other hand, the percent change in reducing red snapper removal between **Alternative 3A** and **Alternative 4A** would be much smaller under any of the six scenarios considered in **Appendix E**. This implies that additional area closures designed to further reduce red snapper removal would be accompanied by more than proportionate increase in economic costs, at least to the recreational sector.

Fourth, as may possibly be expected, the size of area closures does determine the magnitude of economic effects. For example, **Alternative 3A** would result in larger economic effects than any of **Alternative 3B**, **Alternative 3C**, or **Alternative 3D** because it would cover a larger area. However, an alternative with a larger area closure in absolute value would not necessarily yield larger economic losses than one with smaller area closure. For example, **Alternative 3A** is estimated to close about 38 thousand square kilometers while **Alternative 4C** would close about 24 thousand square kilometers; yet, the expected economic effects of **Alternative 3A** ($19.3 million) would be less than those of **Alternative 4C** ($22.1 million). At least in the present case, the specific location of areas to be closed would also determine the magnitude of economic effects.

Fifth, the economic effects of **Alternative 3C** and **Alternative 4C** may be considered not too different from those of **Alternative 3D** and **Alternative 4D**, respectively. This is but reflective of the small difference in the size of area closure between the respective alternatives. On the other hand, **Alternative 3B** would have relatively larger economic effects than either **Alternative 3C** or **Alternative 3D**. A similar situation holds true for **Alternative 4B** relative to **Alternative 4C** and **Alternative 4D**. What this condition would seem to imply is that closing a smaller but shallower area would result in larger economic effects than closing a larger but deeper area. This may have greater significance for the recreational sector which is thought to fish in shallower waters than commercial vessels.

The next two tables are results of exploring the sensitivity of economic effects to the assumptions underlying the method used in estimating the economic effects of the various alternatives. One important assumption and noted by the SSC is the 100% cancellation of affected recreational trips.

Table 4-30k shows the results of assuming different levels of trip cancellation. The estimates show relatively substantial differences in the estimates of economic effects under different assumptions of trip cancellation. It is possible the proposed regulations would severely limit the opportunities for recreational fishing, particularly for for-hire vessels, given current economic conditions and recently implemented regulations affecting the snapper grouper fishery. In a sense, this would support a higher level of trip cancellation. Over time, however, as economic conditions improve and anglers as well as for-hire operators adjust to the regulations, fishing activities may return to their higher levels. It is possible then that trip cancellations may be high in the short-term but increase over time. One other feature in the tabulated estimates is that, for a given level of trip cancellation, the area closures, in addition to the red snapper fishing ban, would still result in relatively larger reductions in economic values when compared with the alternative that would only close the red snapper fishery. This issue is partly addressed in the second set of sensitivity analysis.

Table 4-30l shows the overall economic effects of each alternative when assuming the average number of snapper grouper per angler trip fish harvested for snapper grouper to be the same as that for red snapper. For each mode and area, the estimated average number of snapper grouper harvest per trip far exceeded the corresponding average for red snapper. Largely because of this higher average number of snapper grouper harvest, the area closures were estimated to result in relatively substantial reductions in CS despite affecting fewer trips than the red snapper fishing ban. This analysis was conducted without implying that, in actuality, the average number of red snapper harvested per trip would be equal to or higher than the corresponding average for snapper grouper.

The results in Table 4-30l still show the same pattern as those in Table 4-30k. This time, however, the introduction of area closures would not result in very large reductions in CS and in total economic values under each level of trip cancellation. For example, under the assumption of 100% trip cancellation, total economic effects would increase from $8.9 million under **Alternative 2** to $19.3 million under **Alternative 3A** (Table 4-30k). As shown in Table 4-30l, the corresponding economic effects would increase from $8.9 million to $11.2 million – the increase would still be substantial but not by a very large margin. It appears that the estimated changes in CS and total economic values are quite sensitive to the average number of fish used.

Table 4-30k. Summary of economic effects under different levels of trip cancellation, in 2009 dollars.

		Percent of Trips Cancelled			
		100%	75%	50%	25%
ALT. 2	CS	4,603,890	3,452,918	2,301,945	1,150,973
	NOR	4,306,837	3,230,128	2,153,419	1,076,709
	TOTAL	8,910,728	6,683,046	4,455,364	2,227,682
ALT. 3A	CS	14,115,547	10,586,660	7,057,774	3,528,887
	NOR	5,163,410	3,872,557	2,581,705	1,290,852
	TOTAL	19,278,957	14,459,218	9,639,478	4,819,739
ALT. 3B	CS	13,679,090	10,259,318	6,839,545	3,419,773
	NOR	5,124,088	3,843,066	2,562,044	1,281,022
	TOTAL	18,803,179	14,102,384	9,401,589	4,700,795
ALT. 3C	CS	12,831,108	9,623,331	6,415,554	3,207,777
	NOR	5,047,623	3,785,717	2,523,812	1,261,906
	TOTAL	17,878,731	13,409,048	8,939,365	4,469,683
ALT. 3D	CS	12,889,921	9,667,441	6,444,960	3,222,480
	NOR	5,052,896	3,789,672	2,526,448	1,263,224
	TOTAL	17,942,817	13,457,112	8,971,408	4,485,704
ALT. 4A	CS	18,457,770	13,843,327	9,228,885	4,614,442
	NOR	5,656,239	4,242,180	2,828,120	1,414,060
	TOTAL	24,114,009	18,085,507	12,057,005	6,028,502
ALT. 4B	CS	17,521,817	13,141,363	8,760,909	4,380,454
	NOR	5,560,227	4,170,170	2,780,113	1,390,057
	TOTAL	23,082,044	17,311,533	11,541,022	5,770,511
ALT. 4C	CS	16,650,380	12,487,785	8,325,190	4,162,595
	NOR	5,481,100	4,110,825	2,740,550	1,370,275
	TOTAL	22,131,480	16,598,610	11,065,740	5,532,870
ALT. 4D	CS	16,720,771	12,540,578	8,360,385	4,180,193
	NOR	5,487,686	4,115,765	2,743,843	1,371,922
	TOTAL	22,208,457	16,656,343	11,104,228	5,552,114

Table 4-30l. Summary of economic effects under different levels of trip cancellation and assuming the same average number of fish harvested for red snapper and snapper grouper, in 2009 dollars.

		Percent of Trips Cancelled			
		100%	75%	50%	25%
ALT. 2	CS	4,603,890	3,452,918	2,301,945	1,150,973
	NOR	4,306,837	3,230,128	2,153,419	1,076,709
	TOTAL	8,910,728	6,683,046	4,455,364	2,227,682
ALT. 3A	CS	6,081,456	4,561,092	3,040,728	1,520,364
	NOR	5,163,410	3,872,557	2,581,705	1,290,852
	TOTAL	11,244,866	8,433,649	5,622,433	2,811,216
ALT. 3B	CS	6,013,688	4,510,266	3,006,844	1,503,422
	NOR	5,124,088	3,843,066	2,562,044	1,281,022
	TOTAL	11,137,777	8,353,333	5,568,888	2,784,444
ALT. 3C	CS	5,881,955	4,411,466	2,940,978	1,470,489
	NOR	5,047,623	3,785,717	2,523,812	1,261,906
	TOTAL	10,929,578	8,197,184	5,464,789	2,732,395
ALT. 3D	CS	5,891,068	4,418,301	2,945,534	1,472,767
	NOR	5,052,896	3,789,672	2,526,448	1,263,224
	TOTAL	10,943,964	8,207,973	5,471,982	2,735,991
ALT. 4A	CS	6,380,711	4,785,533	3,190,356	1,595,178
	NOR	5,656,239	4,242,180	2,828,120	1,414,060
	TOTAL	12,036,951	9,027,713	6,018,475	3,009,238
ALT. 4B	CS	6,278,520	4,708,890	3,139,260	1,569,630
	NOR	5,560,227	4,170,170	2,780,113	1,390,057
	TOTAL	11,838,746	8,879,060	5,919,373	2,959,687
ALT. 4C	CS	6,145,170	4,608,877	3,072,585	1,536,292
	NOR	5,481,100	4,110,825	2,740,550	1,370,275
	TOTAL	11,626,269	8,719,702	5,813,135	2,906,567
ALT. 4D	CS	6,155,081	4,616,310	3,077,540	1,538,770
	NOR	5,487,686	4,115,765	2,743,843	1,371,922
	TOTAL	11,642,767	8,732,075	5,821,383	2,910,692

Alternative 5 (Preferred), which would allow fishing for snapper grouper other than red snapper in the closed area using black sea bass pots with endorsements, would affect only the commercial sector and thus would not introduce any change to the economic effects on the recreational sector presented in the tables above.

Alternative 6, which would allow fishing for snapper grouper other than red snapper in the closed areas using bottom longlines, would mitigate the negative economic effects of the closed areas on the commercial sector. It would not introduce any change to the economic effects on the recreational sector presented above.

The economic effects of **Alternative 7 (Preferred)**, which would allow fishing for snapper grouper other than red snapper in the closed areas using spearfishing gear, cannot be ascertained due to the absence of information regarding recreational spearfishing in the closed areas. The general tone of this alternative is that of mitigating the negative economic effects of the closure, if spearfishing is practiced by some recreational anglers.

Alternative 8 is mainly an enforcement measure that would provide anglers some cushion from being unduly penalized. This would also allow anglers to save on fishing costs by not being compelled to possibly take a longer route to and from a fishing area. The mitigating effects of this alternative would be minimal relative to the economic effects of any of the restrictive management measures discussed above. **Alternatives 8a (Preferred)** and **8b** would affect recreational anglers more than **Alternative 8c** given the general absence of recreational fishing for wreckfish.

4.3.3 Social Effects

Alternative 1 (Status Quo) would not be expected to result in any direct short-term adverse social effects because no new restrictions on the fishery would occur. As a result, all entities could continue normal and customary behaviors in the fishery. Participation rates and harvest levels could continue unchanged. Since there would be no direct effect on resource harvest or use, there would be no direct effects on fishery participants, associated industries, or communities. However, the long-term adverse social effects would be expected to be increased because status quo regulations would result in the continued overfishing of red snapper, which would be expected to require stricter future regulations than those currently under consideration.

In general, the other alternatives vary by species, area coverage, and exemptions. The expected social effects of these alternatives would be expected to be proportional to the magnitude of expected economic effects (see Section **4.3.2** for a discussion of the expected magnitude and regional or sector distribution of economic effects). In general, the more extensive the expected harvest restrictions the greater the resultant short-term adverse social effects. Persistence of these effects may be sector/entity specific, with some sectors/entities having greater flexibility to adjust to the restrictions and find alternate sources or income, product, recreation, etc. The varying severity of the short-term effects at the different entity level may also create variable levels of urgency to adapt or adjust behavior. While the long-term social effects of resource recovery are expected to be positive, with net overall increased social benefits relative to the

status quo, it is emphasized that those who bear the short-term losses in social or economic benefits may not be the same entities that receive the benefits of the recovered resource.

Because **Alternatives 2-4** would prohibit all commercial and recreational harvest of red snapper in the South Atlantic EEZ, *and harvests in state waters by federally permitted vessels,* none of these alternatives would be expected to have any differential social effects from the perspective of the red snapper fishery. Instead, these alternatives vary in the severity of restrictions on the harvest of other snapper grouper species. A general description of social effects expected to accrue to regulatory change is provided in **Section 4.1.1.3**. As the severity of restrictions imposed by each alternative increases, the likelihood and severity of these social effects would be expected to increase.

Among **Alternatives 2-4**, **Alternative 2** would be expected to have the least negative social effects on the commercial and recreational snapper grouper fisheries because **Alternative 2** would not extend the prohibitions beyond red snapper. Cumulative effects on entities that harvest other species would depend on the relative significance of red snapper activity (harvest of or fishing for) to the overall activity or production profile of the entity, business, or community. Overall, any effects of the red snapper prohibition would be concentrated in the north Florida and Georgia communities due to the concentration of red snapper harvest off these coasts. Because red snapper is a relatively minor species in the commercial fishery, adverse social effects on this sector and associated industries and communities, as well as cumulative effects on other fisheries, under **Alternative 2** may be minor, particularly compared to possible effects on the recreational industry. While data does not suggest that red snapper is a significant target species for the recreational sector as a whole, including the charterboat sector, red snapper appears to be more important to the headboat sector, particularly in Georgia and north Florida, based on public testimony. However, even within the charterboat sector, especially where red snapper harvests are concentrated, individual businesses may have developed client bases that more heavily target red snapper than available data would indicate, increasing the potential adverse effects to these businesses and associated communities.

The prohibitions on the harvest of other snapper grouper species in **Alternatives 3** and **4** would be expected to result in increased adverse social effects relative to **Alternative 2.** As discussed in the economic effects section, in addition to the waters off North Carolina not being subject to any of the proposed prohibitions in **Alternatives 3** and **4**, North Carolina commercial fishermen could benefit under these alternatives due to potential lengthening of the shallow water grouper season**.** South Carolina commercial fishermen could similarly benefit under **Alternative 3**, but would be expected to suffer adverse social and economic effects under **Alternative 4**. Although harvest opportunities would continue off North Carolina or areas off Florida not included in the alternative prohibitions, effort shift by vessels would be expected to result in increased costs, increased stock pressures at these locations, and likely changes in landings patterns if landing locations shift in tandem with changes in the area fished. As a result, while some harvest mitigation may be possible at the vessel level, adverse shore-side effects may still occur in former ports. Additionally, cumulative effects could be increased as the harvest of other snapper grouper species affected by the prohibition may be proportionally more important to affected fishermen and associated businesses and communities. As a result, the likelihood of business failure, with associated adverse social effects, would be expected to increase.

Similar to the general effects of **Alternatives 3** and **4**, the social effects of the alternative depth specifications would be expected to be proportional to their geographic scope; the larger the area of prohibition, the greater the expected adverse affect on harvests and associated social benefits. However, actual effects would be determined by where fishing activity occurs; a smaller area may traditionally be subject to more fishing effort than a larger area such that inclusion of a smaller area in the prohibition while removing a larger area may result in increased reduction in harvests. The "**B**" and "**D**" alternatives allow the possibility of such to occur as the "**D**" alternatives would remove the more extensive shallower waters from the affected area while adding less extensive deeper waters. As seen by the results of the economic effects analysis of the commercial sector, this phenomena – a geographically smaller prohibition resulting in a larger effect than a geographically larger prohibition – appears in the comparison of the expected effects of **Alternative 3D** with **Alternative 3B**. The adverse social effects of these two alternatives would be expected to mirror the order of the economic effects, though additional social effects could accrue to disbelief in the results. Other than this exception, the adverse social effects of the depth variations of **Alternatives 3** and **4** would be expected to increase or decrease consistent with changes in the size of geographic coverage.

The "**A**" versions of **Alternatives 3** and **4** would not impose depth limitations on the area prohibitions and would, therefore, be expected to adversely affect the greatest amount of harvest and associated social benefits. Additionally, by not incorporating any consideration of differential depth-associated release mortality, the "**A**" versions may be viewed by some as overly restrictive, an unjustified and unnecessary reduction in the harvests and associated benefits of other snapper grouper species and, as a result, induce increased dissatisfaction with the management process. The depth considerations of the "**B**"-"**D**" alternatives would be expected to mitigate, though not necessarily eliminate, some portion of these adverse social effects.

For the recreational sector, while the effects of management measures on angler satisfaction are not inconsequential, particularly because decreased satisfaction can lead to reduced fishing, anglers, as with any recreational group, have greater opportunities or flexibility to choose alternative recreational pursuits than businesses have to start a new business or attract a new type of clientele. Further, even where alternative business opportunities exist, the ability to rapidly transform a business and maintain profitability is usually limited; changes take time, yet financial obligations must be met. As a result, the adverse social effects on the commercial component of the recreational sector – for-hire operations, bait and tackle shops, etc. – may mirror those of the commercial harvest sector if angler demand substantially declines as a result of the proposed harvest prohibitions. The effects on recreational businesses could also be worse than those in the commercial sector due to more limited flexibility. While commercial vessels, to some extent, have the ability to go to the fish; a commercial vessel may be able to sail from a north Florida, Georgia, or South Carolina port, fish off North Carolina (or south Florida), land its catch in North Carolina (or south Florida), and eventually return to its original port. Recreational businesses, however, start with anglers coming to them, then go find the fish. If the proposed prohibitions decrease angler traffic, convincing historic clientele they will be just as happy purchasing a different service (new species, more catch and release, etc.) may be difficult, and finding new anglers may require business relocation to another port, which is a substantially

different action, both economically and socially, than fishing elsewhere up or down the coast a few days or weeks at a time before returning home.

Based on the general conclusions in the discussion above, and mirroring the estimates of the economic effects, from a ranking perspective, all variations of **Alternative 4** would be expected to result in greater adverse social effects than all variations of **Alternative 3**, with the greatest expected adverse social effects accruing to the "**A**" alternatives. Within each nested set of alternatives (variations of **Alternative 3** and variations of **Alternative 4),** with the exception of the comparison of **Alternative 3B** with **Alternative 3D** discussed above for the commercial effects, the larger the affected area in the proposed prohibition, the greater the expected adverse social effects.

Alternatives 5-7 would be expected to mitigate some of the adverse social and economic effects of **Alternatives 3** and **4** by allowing exemptions to the harvest prohibitions of these alternatives. The exemptions of **Alternatives 5-7** would not be relevant under **Alternative 2** because **Alternative 2** would only restrict red snapper harvests. Because **Alternatives 5-7** address either a different species or gear, they should be viewed independently. Each alternative would be expected to result in increased social and economic benefits relative to **Alternatives 3** and **4**. **Alternatives 5-7** would also be expected to result in increased social benefits accruing to the perception of more rational management decision by allowing the continued harvest of species, or harvest of species with a particular gear, that would not be expected to adversely affect the red snapper resource or recovery goals.

The transit allowances of **Alternative 8** would allow fishermen, both commercial and recreational, to reduce the costs associated with harvest outside the proposed restricted areas by not requiring extensive rerouting of their trip to avoid the closed areas. Also, absent transit provisions, considerably larger areas may be effectively removed from allowable fishing than encompassed by the area prohibitions themselves as it may not be economically feasible to travel around the prohibited areas to reach the open areas. As a result, greater adverse social and economic effects would occur. Allowing transit would eliminate both the additional travel costs and the additional adverse social and economic effects of a functionally expanded prohibition zone. In general, it is assumed that the greater the ability to maintain or increase harvests of other species (assuming any increased harvest does not result in resource issues for these other species), reduce costs, and reduce the likelihood of functionally expanded areas where harvest is prohibited, the greater the social benefits. While increased labor would be required to satisfy the transit conditions, this is presumed preferable than reduced harvests. **Alternative 8A (Preferred)** would allow any legal species (species with non-zero allowable harvest levels) to be possessed, but all gear would have to be stowed, effectively eliminating the ability to troll for non-snapper grouper species when transiting the restricted areas. **Alternative 8B** is less encompassing from a species perspective than **Alternative 8A (Preferred)**, but would allow trolling to continue while transiting, thus increasing the allowable fishing area for trolling species. **Alternative 8C** would be the least accommodating of the sub-alternatives, allowing only wreckfish on board (except for the species and gear harvest allowances of **Alternatives 3-6**) while in transit. Available data does not support a determination of whether the benefits of the trolling allowance of **Alternative 8B** would result in a better social outcome than the broader species allowance of **Alternative 8A (Preferred)**, nor is a strong qualitative argument obvious.

However, both would be expected to be better than the more narrow allowance of **Alternative 8C**.

4.3.4 Administrative Effects

Alternative 1 (Status Quo) would retain the current regulations used to manage catches of red snapper and therefore would not implement additional measures to end overfishing and rebuild the stock faster than it would under current harvest restrictions. If this situation were to occur, NOAA Fisheries Service would incur a substantial litigation risk. Administratively, the impacts of a lawsuit brought against the agency would be moderate and take the form of compiling the administrative record, and drafting case related documents.

Alternatives 2-4D would involve extensive coordination amongst various divisions within NOAA Fisheries Service as well as Coast Guard and State law enforcement officials. Enforcement of **Alternative 2** is expected to be somewhat less burdensome since there are no area boundaries to monitor other than that of the EEZ. Though each closure alternative would limit harvest in different areas and in different amounts, their impacts on the administrative environment is largely the same. For any one of the closure alternatives outreach materials would need to be developed including waypoint coordinates outlining the closed area boundaries. An indirect impact on the administrative environment may be the long-term effort shifts into different fisheries, which may require processing permit transfers, and new permit applications.

Alternatives 5 (Preferred) through **7 (Preferred)** are intended to be implemented along with one or more the closure alternatives and therefore their impacts on the administrative environment should be added to those of **Alternatives 2-4D (Preferred)**. **Alternatives 5 (Preferred), 6,** and **7 (Preferred)** would allow fishing for snapper grouper using black sea bass pots, bottom longline gear, and spearfishing, respectively. The administrative impacts of each of these alternatives is very similar in that they would each require enforcement of specific permitted activities within a closed area, which is considered a significant burden. Allowing both activities to occur within a proposed closed area would double the burden on law enforcement personnel than if only one activity were permitted within a closed area. Additionally, it is anticipated, that with every activity allowed within a proposed closed area the incidence of non-compliance by those illegally harvesting snapper grouper would increase. The same enforcement concerns extend to **Alternative 8**, which would allow transit of vessels with snapper grouper and/or wreckfish onboard, through a proposed closed area. This alternative would serve to further impact the administrative environment via increased or re-allocated enforcement efforts.

4.3.5 Council's Conclusion

The Council has concluded the closed area under **Alternative 4D (Preferred)**, along with exemptions for fishing within the closed area using black sea bass pots, and spearfishing gear are likely to end overfishing of red snapper within the rebuilding period, and minimize to the extent

practicable socioeconomic impacts. The Council and the SSC supported the selection of a closed area smaller than the total logbook grids under **Alternatives 3A**, and **4A,** and they felt the closure under **Alternative 4D (Preferred)** would be adequate to end overfishing of red snapper while incurring the lowest possible level of economic impact. Because black sea bass pot gear is not likely to capture a significant number of red snapper the Council concluded the use of this gear type within the closed area could be permitted without negatively affecting the rebuilding process for red snapper. The Council reached the same conclusion regarding the use of spearfishing gear within the proposed closed area. Spearfishing gear is a highly selective gear type, and those using spearguns within the proposed closed area could easily targets species other than red snapper. Therefore, **Alternatives 5** and **7** were also chosen as preferred alternatives.

Because the closed area extends over a large portion of the South Atlantic EEZ, the Council felt it was important to allow transit through the area with snapper grouper species onboard that were caught legally outside of the closed area. Allowing transit under very specific provisions included in **Alternative 8A (Preferred)** would mitigate any safety at sea issues that could arise in poor weather conditions without impacting the rebuilding efforts for red snapper.

4.4 Require the use of Circle Hooks

Alternative 1 (Status Quo). Do not require the use of circle hooks when using hook and line gear for snapper grouper species within any particular area of the South Atlantic EEZ when fishing for snapper grouper species.

Alternative 2 (Preferred). Require the use of non-off set, non-stainless steel circle hooks when fishing for snapper grouper species with hook and line gear north of 28 degrees. It is unlawful to possess snapper grouper species without possessing non-off set, non-stainless steel circle hooks. Apply to the use of natural baits only.

Alternative 3. Require the use of non-off set, non-stainless steel circle hooks when fishing for snapper grouper species with hook and line gear within the South Atlantic EEZ. It is unlawful to possess snapper grouper species without possessing non-off set, non-stainless steel circle hooks. Apply to the use of natural baits only.

4.4.1 Biological Effects

Alternative 2 (Preferred) would require the use of circle hooks when using hook and line gear north of 28°N; whereas **Alternative 3** would require the use of circle hooks for hook and line gear within the entire South Atlantic EEZ . The intended effect is to reduce discard and bycatch mortality of red snapper. Burns *et al.* (2004) reported use of J hooks was the leading cause of red snapper mortality when the effects of hook versus depth related trauma were examined; however, no comparison was made with J-hooks. A comparison of red snapper recaptures from fish caught on circle and J hooks tagged and released at various depths showed no difference in

the percentage of recaptures for a particular depth category (Burns *et al.* 2004). Among depth zones, Burns *et al.* (2004) hook trauma accounted for the largest source of mortality in 91 to 140 feet, which is where the largest number of red snapper were caught. Barotrauma was likely the major source of mortality in deeper water.

Cooke and Suski (2004) examined hooking mortality rates in a number of studies and found mortality rates were generally lower for circle hooks than for J-style hooks (Table 4-30). Hooking depth, anatomical hooking location, amount of bleeding, and ease of hook removal were identified as major contributors to mortality. In many cases, circle hooks were found capture the maxilla and were less likely to be swallowed. Additionally, circle hooks were found less likely to result in bleeding than J-hooks, which tend to deep hook fish at a higher frequency (Cooke and Suski 2004). Cooke and Suski (2004) determined hooking mortality ranged between 0 and 33.8% of fish caught for circle hooks, and 0 and 46% for J-style hooks. A statistical comparison indicated the use of circle hooks resulted in significantly lower hooking mortality than with other hook types. Cooke and Suski (2004) reported consistently higher mortality for J-hook-caught fish in the majority of the studies examined.

Table 4-31. Mortality (percentage dead) of fish caught on circle hooks and J-hooks. From Cooke and Suski (2004). Shaded areas represent studies with higher mortality associated with J hooks.

Species	C-Hook	J-Hook	Reference
White Seabass	9.70%	10.20%	Aalbers et al (2003)
Red drum	9%	3%	Aguliar et al. (2002)
Smallmouth bass	3%	6%	Barthel and Cooke (unpublished)
Striped bass	3%	15.50%	Carusso (2000)
Pumpkinseed	0%	0%	Cooke et al. (2003c)
Rock bass	0%	0%	Cooke et al. (2003a)
Bluegill	0.20%	1.20%	Cooke et al. (2003c)
Largemouth bass	5.10%	6.60%	Cooke et al. (2003b)
Coho salmon	14%	14%	Grover (unpublished data)
Chinook salmon	31%	46%	Grover et al. (2002)
Rainbow trout	0%	0%	Jenkins (2003)
Striped bass	0.80%	9.10%	Lukacovic (1999)
Striped bass	1.90%	8.70%	Lukacovic (2001)
Summer flounder	14%	14%	Malchoff et al. (2002)
Coho salmon	3%	24%	McNair (1997)
Rainbow trout	10.4%	19.0%	Parmenter (2001)
Rainbow trout	10.1%	15.9%	Pecora (unpublished data)
Brown trout	6.1%	10.0%	Pecora (unpublished data)
Brook char	25.0%	23.8%	Pecora (unpublished data)
Atlantic bluefin tuna	4%	28%	Skomal et al. (2002)
Bluegill	0%	0%	Suski and Cooke (unpublished data)
Red drum	3%	7%	Thomas et al. (1997)
Silver perch	33.8%	35.3%	Van der Walt and Faragher (2005)

For studies on red drum in Louisiana, hooking mortality rates were 3% for circle hooks and 7% for conventional hooks (Thomas et al., 1997). Striped bass have also consistently shown reduced mortality rates when captured on circle hooks relative to other hook types in studies from Massachusetts (Caruso, 2000: 3% circle, 15.5% J), Maryland (Lukacovic, 1999: 0.8% circle, 9.1% J; Lukacovic, 2000: 1.9% circle, 8.7% J), and North Carolina (Hand, 2001: 5.9% circle, 18.2% J). Salmonids exhibited similar patterns, with coho salmon (McNair, 1997: 3% circle, 24% J) and Chinook salmon (McNair, 1997: 0% circle, 15% J; Grover et al., 2002: 31% circle, 46% J) having reduced hooking mortality rates when captured on circle hooks. Atlantic bluefin tuna also had reduced mortality rates when circle hooks (4%) were used instead of conventional J-hooks (28%; Skomal et al., 2002).

Cooke et al. (2003a) noted no mortality for rock bass captured using circle hooks or any of three other conventional hook designs. Cooke et al. (2003c) also assessed mortality in bluegill and pumpkinseed and found that mortality was negligible for all hook types tested. Mortality rates were also similar for a study of largemouth bass in Illinois between fish captured on circle (5.1%) and conventional hooks (6.6%; Cooke et al., 2003b). In a study of summer flounder, Malchoff et al. (2002) reported mortality was similar between circle and conventional hooks.

Barnes et al. (unpublished) compared circle hooks and J-hooks with and without wire appendages and their effects on reducing the catch of small and gut hooked snapper *(Pagrus auratus)* by recreational fishers in the Hauraki Gulf of New Zealand. In a comparison between J and circle hooks without wire appendages Barnes et al. (unpublished) demonstrated larger hook sizes appeared to slightly reduce the overall incidence of gut hooking. The 4/0 circle with no appendages gut hooked 13% of the catch while the 4/0 J hook with no appendages gut hooked 26% of the catch. The 5/0 circle hook with no appendages gut hooked 11% of the fish and the 5/0 J hook with no appendages gut hooked 21% of the snapper. Circle hooks fitted with appendages had the best overall anti-gut hooking performance from 12% to 0.2% of the total catch. The J hooks with appendages also performed well with gut hooking being reduced from 21% to around 2% of the total catch.

Removal of deeply ingested hooks often results in mortality (Warner 1979; Muoneke and Childress 1994), with vital organs being damaged from penetration into the pericardium or body cavity (Diggles and Ernst 1997). Kaimmer and Trumble (1997) found circle hooks caught the jaw of Pacific halibut in more than 95 percent of the observations, while J-hooks caught the jaw about 80 percent of the time.

Bacheler and Buckel (2004) determined the proportion of grouper and smaller grunt and porgy species that bled varied across hooking locations, with more fish bleeding from gut and gill hooking than jaw hooking. Circle hooks were more likely to hook the species they studied in the jaw, and jaw hooked fish were much less likely to bleed (Bacheler and Buckel (2004). Burns *et al.* (2002) found more red snapper caught with rod-and-reel gear died from hook mortality than all other causes combined, including depth, stress, and handling. Acute J-hook mortalities occurred when the hook penetrated or slit the esophagus, heart, or liver.

Bacheler and Buckel (2004) evaluated the ability of four hook types and sizes to reduce catches of sublegal grouper and non-target species in Onslow Bay, North Carolina (Figure 4-21). Catch

rates for undersized grouper, non-target individuals, and sharks varied across hook treatments, while catch rates for large grouper did not. Bacheler and Buckel (2004) concluded that changes made to hook sizes or type within the ranges used in their study would have very little effect on the catch and size of grouper.

While hook type and size did not affect catches of grouper species, Bacheler and Buckel (2004) found catch rates of other species such as white grunt and red porgy were much higher for the small J hooks than for the large J hook or the circle hook. These results suggest there are limitations to gape size for smaller grunt and porgy species.

Bacheler and Buckel (2004) found circle hooks significantly reduced gut hooking in all grouper species (gag, red grouper, and scamp) as well as smaller grunt and porgy species (Table 4-32). Large J hooks were also determine to reduce gut hooking in smaller grunt and porgy species.

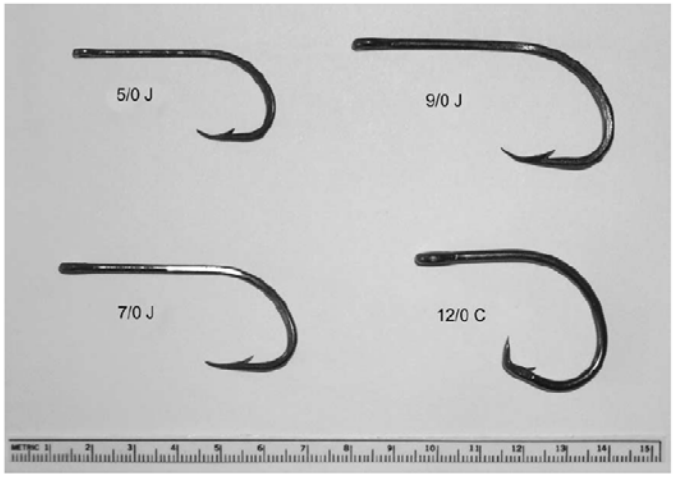


Figure 4-21. Figure 1 from Bachelor and Buckell (2004) showing hook types used in experimental fishing trips.

Table 4-32. Table 2 from Bachelor and Buckel (2004). Proportions of various hooking locations across hook treatments in grouper and non-target species caught between 14 May 2003 and 20 August 2003 in Onslow Bay, North Carolina, USA

Species	Hook Treatment	Jaw	Gut	Gills	Body	Eye
Grouper	5/0J	0.833	0.167	0	0	0
Grouper	7/0 J	0.829	0.145	0.026	0	0
Grouper	9/0 J	0.818	0.159	0.011	0.006	0.006
Grouper	12/0 C	0.985	0.008	0	0.008	0
Non-target	5/0 J	0.855	0.097	0.005	0.043	0
Non-target	7/0 J	0.925	0.034	0.023	0.017	0
Non-target	9/0 J	0.937	0.013	0	0.051	0
Non-target	12/0 C	0.905	0.018	0	0.018	0

Circle hooks have also been found to reduce gut hooking in bluegill, rainbow trout, and striped marlin, juvenile bluefin tuna, striped bass sailfish, yellowfin tuna, and Pacific halibut (Domeier *et al.* 2003; Falterman and Graves 2002; Lukacovic and Uphoff 2002; Jenkins 2003; Prince et al. 2002; Skomal et al. 2002; Trumble *et al.* 2002). In the Portugal longline fishery, Erzini *et al.* (1998) found the smallest J hooks sparids than larger hooks (size 13 and 11).

If circle hooks increase catch rates as suggested by Henwood *et al.* (2006), a negative effect on the biological environment is possible. Because the recreational sector is managed with size limits, bag limits, and closed seasons, it is more susceptible to increased catch rates. If recreational anglers catch the bag limit more frequently and land larger fish, landings could increase beyond current levels. However, if catch rates increase the number of legal size fish landed and reduce discard mortality, a net benefit would be expected. Therefore, exclusion of smaller individuals or an increase in survival of regulatory discards would be considered to be a positive biological effect.

Similarly, if circle hooks decrease CPUE and/or reduce the incidence of fatal hooking events, then a net benefit to the stock could occur. In addition, circle hooks could reduce regulatory discards, thereby providing additional benefits. Modifying gear to reduce bycatch and bycatch mortality could also have beneficial effects on the biological and ecological environment of non-targeted species. Some incidentally caught species in the directed gag and vermilion snapper fishery include red grouper, scamp, red snapper, and greater amberjack have similar mouth morphology, which is an important factor in the effectiveness of circle hook use (Cooke and Suski 2004). As a result, hooking mortality on these species could be reduced. Discard mortality rates of snapper grouper stocks that are either overfished or are undergoing overfishing could decrease with the use of circle hooks. Therefore, the mandatory use of circle hooks specified in **Alternatives 2 (Preferred)** and **3** has the potential to reduce red snapper fishing mortality and help stock return to a healthy sustainable level.

Nevertheless, studies on the effects of circle hooks and J hooks on retention and survival is limited to a handful of snapper grouper species. Due to limited data, it may not possible to quantify the reduction in red snapper mortality that could be provided by using circle hooks. Further, circle hooks are currently used by some commercial and recreational fishermen but the

proportion of the fishing population using fishing hooks cannot be determined. Not all species in the snapper grouper complex have the same mouth morphology and it is possible that circle hooks could negatively impact survival. Alternatively, use of circle hooks could substantially reduce harvest of some species, would have positive biological benefits but have negative social and economic impacts on fishermen dependent upon the species.

The mandatory use of circle hooks was considered in Amendment 16 but removed after the amendment was reviewed by the Council's SSC. The SSC was concerned that there was not enough published information to quantify the effects of reducing discard mortality for various snapper grouper species, including red snapper. The SSC also expressed concern as did some public comments, that mandatory use of circle hooks could reduce availability of some snapper grouper species such as yellowtail snapper and gray triggerfish, which are not overfishing or overfished. Yellowtail snapper are primarily taken in South Florida; therefore, if **Alternative 3** was not selected as the preferred alternative, fishermen targeting yellowtail snapper with J-hooks would be able to continue this practice.

Alternative 1 (Status Quo) will perpetuate the existing level of risk for interactions between ESA-listed species and the fishery. **Alternatives 2 (Preferred)** and **3** are likely to reduce the severity of injuries associated with the incidental hooking of ESA-listed species. The use of large circle hooks has been shown to significantly reduce the rate of hook ingestion in loggerhead sea turtles, reducing post-hooking mortality. Circle hook design typically result in hooking of a sea turtle's lower jaw when bitten, and even smaller circle hooks that are swallowed are shaped such that they hook the esophageal or digestive tract with much lower frequency than J-hooks (Watson et al. 2003). Because hooking location is one of the primary factors influencing post-release mortality in all species of sea turtles, circle hooks are generally thought to increase post-release survival. **Alternatives 2 (Preferred)** and **3** would likely reduce the severity of interactions between the fishery and ESA-listed species.

4.4.2 Economic Impacts

Alternative 1 (Status Quo) would not introduce any changes in the fishing gear employed by fishermen, and thus would not introduce any additional cost to fishing operations.

Alternative 2 (Preferred) would introduce some fishing gear change to fishing participants operating essentially in the major area for red snapper fishing while **Alternative 3** would introduce such changes to all fishing within the South Atlantic EEZ.

The general benefits from **Alternatives 2 (Preferred)** and **3** would come in the form of enhancing the various measures in place for the recreational and/or commercial sectors by lowering incidental take of managed species. The general short-term effects; however, of requiring circle hooks if these devices were not used at all by any vessels would be to increase fishing costs. Those vessels that already use these devices would not experience any increase in fishing costs. By reducing bycatch, the use of circle hooks would possibly free up some crew effort that otherwise would be spent culling the vessel's catch of unwanted fish. Freed up labor hours could be devoted to other activities that could generate more catch/revenues. On the other

hand, it is possible that intended harvest could be reduced by using circle hooks. Depending on the physical structure of a fish's mouth, and the way that they take bait, circle hooks may make it difficult to harvest desired species, reducing revenues to commercial fishermen and consumer surplus to recreational anglers, as well as potential losses in net operating revenues to for-hire businesses if angler demand for for-hire trips is adversely affected.

In the Gulf, many fishermen using vertical lines used circle hooks, and if the same were to hold true for the South Atlantic, then the economic effect of requiring circle hooks on commercial fishermen (**Alternatives 2 (Preferred)** and **3)** would be relatively low. In addition, the use of circle hooks has gained popularity among Gulf for-hire operators and private anglers, and if this were also true among for-hire operators and private anglers in the South Atlantic, then the economic effects of requiring circle hooks on the recreational sector (**Alternatives 2 (Preferred)** and **3)** would also be relatively low. Moreover, fishing equipment suppliers and large-scale retailers currently offer a wide variety of comparably priced hooks, including circle hooks.

In general then, requiring the use of circle hooks may not substantially increase the cost of fishing to either the commercial or the recreational sectors, though the potential reduction in the harvest of some important species is noted.

4.4.3 Social Impacts

Because the assumption behind the imposition of circle hook restrictions is that they would be expected to support a healthier snapper grouper resource (reduced hook-related mortality of fish not retained, quicker rebuilding, larger biomass, etc.), as well as possible higher allowable harvest levels, such restrictions would be expected to result in greater social benefits. These higher benefits could be received in the short term (to the extent that harvests limits are a function of total fishing mortality, including both landings and the mortality of fish not retained, reduced hook-related mortality of fish not retained could support higher landing levels) and long term (the increased social benefits of a recovered stock supporting higher harvest levels). Some anglers may object to the loss of personal choice in hook types, especially if they feel they will experience a reduction in catch rates. Social benefits would be reduced if catch success in general or for individual species is adversely affected. Specific species of note are gray triggerfish and yellowtail snapper. Because **Alternative 1 (Status Quo)** would not require the use of circle hooks, no change in social benefits would be expected. As a result, the benefits of current harvests of species for which circle hook may be a problem would not be reduced, while the social benefits of reduced hook-related mortality of fish not retained, quicker rebuilding, and potential larger biomass and harvest levels would be forgone. Because of the limited geographic application of **Alternative 2 (Preferred),** the harvest problems and associated loss of social benefits associated with yellowtail snapper could be substantially reduced if not eliminated, while some problems with gray triggerfish and other species that might experience reductions in catch rates, should such occur, would continue. However, some increased social benefits associated with reduced hook-related mortality of fish not retained would be expected. **Alternative 3** would be expected to result in the full increased social benefits associated with decreased hook-related mortality of fish not retained, while generating the full lost benefits

associated with the reduced harvests of species where circle hooks may not be appropriate. Because of the resource benefits of circle hooks, both **Alternatives 2 (Preferred)** and **3** would be expected to result in increased social benefits relative to **Alternative 1 (Status Quo).** It is speculative; however, which of **Alternatives 2 (Preferred)** and **3** would be expected to result in the better social outcome, though the implicit recognition in **Alternative 2 (Preferred)** that variance for some species is appropriate should not be overlooked.

4.4.4 Administrative Impacts

Alternatives 2 (Preferred) and **3** would incur a significant administrative burden on NOAA Fisheries Service as well as enforcement personnel. These alternatives would require the preparation of fishery bulletins or other publications outlining specific hook, requirements, and would require outreach and ongoing enforcement of gear compliance standards. **Alternative 2 (Preferred)** would be slightly more burdensome in term of law enforcement since it would require circle hooks be used north of 28 degrees, which would create a boundary for gear type that would need to be enforced. Requiring the use of circle hooks in the entire South Atlantic EEZ would be less burdensome on law enforcement personnel since there would be no special boundary to monitor within the Council's area of jurisdiction.

4.4.5 Council Conclusion

The Council has chosen **Alternative 2** as their preferred circle hook alternative. **Alternative 2 (Preferred)** would require the use of non-off set, non-stainless steel circle hooks when fishing for snapper grouper species with hook and line gear north of 28 degrees. It would also make it unlawful to possess snapper grouper species without possessing non-off set, non-stainless steel circle hooks. Few studies on the effects of using circle hooks with snapper grouper species have been completed, though some do support the use of circle hooks as means of decreasing bycatch mortality. One study found circle hooks significantly reduced gut hooking in all grouper species (gag, red grouper, and scamp) as well as smaller grunt and porgy species. Overall, circle hooks could reduce regulatory discards, thereby providing additional benefits to snapper grouper species including red snapper. Based on the little data that does exist, the Council felt taking advantage of any method to reduce red snapper bycatch mortality is warranted considering its overfished condition. The Council is also aware that use of circle hooks could substantially reduce harvest of some species, which would have positive biological benefits but have negative social and economic impacts on fishermen dependent upon the species. Most of the species that fishermen are concerned about not being able to catch with circle hooks occur south of 28 degrees latitude. Therefore, the Council felt it was important to limit the circle hook requirement to South Atlantic areas north of 28 degrees, and felt it could do so with little impact to red snapper rebuilding efforts.

4.5 Establish a Red Snapper Monitoring Program

Note: The Council made the following motions at their December 2009 meeting. Analysis for this action will be completed when information is provided.

MOTION #18: REQUEST THE SEFSC TO PROVIDE A FISHERY INDEPENDENT MONITORING PLAN FOR RED SNAPPER AT OUR MARCH 2010 MEETING.

MOTION #20: REQUEST THE SEFSC TO PROVIDE A FISHERY DEPENDENT MONITORING PLAN FOR RED SNAPPER AT OUR MARCH 2010 MEETING

Alternative 1. (Status Quo) Utilize existing data collection programs to monitor the rebuilding progress of red snapper. Existing programs include the fishery-dependent Marine Recreational Fisheries Statistical Survey (MRFSS), logbook, discard logbook, headboat logbook, Trip Interview Program (TIP), and dealer reported landings. Fishery-independent methods include Marine Resources Monitoring Assessment and Prediction Program (MARMAP), and the Southeast Area Monitoring and Assessment Program (SEAMAP). Over the course of the next three years MARMAP will be looking for red snapper sampling sites along the north FL, and South GA coast.

Alternative 2 (Preferred). Establish fishery-independent monitoring program to track progress of red snapper. Sampling would include deployment of chevron traps, cameras, and hook and line at randomly selected stations.

Alternative 3. Establish a red snapper fishery-dependent monitoring program involving for-hire vessels (charter boat and headboats). Participating vessels may be authorized to harvest and land fish in excess of Federal possession limits and/or during fishery closures. Retention limits for red snapper would be based upon research objectives. The trip limits and number of trips per month will depend on the number of selected vessels, available quota, and objectives of the research fishery (Table 4-22).

<u>Administrative Details</u>

NOAA Fisheries Service will annually request applications for participation in the red snapper research fishery through an Exempted Fishing Permit (EFP). The EFP would authorize participation in the red snapper research fishery and the collection of red snapper and other species in the Fishery Management Unit. Participating vessels may be authorized to harvest and land fish in excess of Federal possession limits and/or during fishery closures.

NOAA Fisheries Service will review the submitted applications based on the selection criteria as described in a Federal Register notice and information provided on the application form to determine which applicants are qualified to participate in the red snapper research fishery.

Qualified applicants are those that:

- possess a valid commercial snapper grouper Federal permit;
- possess a valid United States Coast Guard (USCG) safety inspection decal when the application is submitted;

- have not been charged criminally or civilly (i.e., issued a Notice of Violation and Assessment (NOVA) or Notice of Permit Sanction) for any snapper grouper-related violation;
- have complied with NMFS observer programs and are able to take a NMFS-approved observer; and,
- submit a completed application by the posted deadline.

4.5.1 Biological Effects

If the red snapper fishery is closed, as would be the case under several of the red snapper management alternatives, a dedicated data collection program would need to be implemented to monitor the status of red snapper in the South Atlantic throughout the rebuilding time frame. Under **Alternative 1 (Status Quo),** existing fishery-dependent and fishery-independent data collection programs would be utilized to gather abundance and life history data on red snapper in the South Atlantic. Fishery-independent programs include the SEAMAP and the MARMAP. Fishery-dependent data collection programs include the MRFSS, logbook, discard logbook, headboat logbook, TIP, and dealer reported landings. Sampling methods of these programs are described in detail below. Additionally, the Southeast Fisheries Science Center (SEFSC) has developed a detailed proposed framework for fishery-dependent and fishery-independent monitoring programs. This document entitled Red Snapper Monitoring Plan, May 8, 2009 is included in this document as **Appendix P**, and is hereby incorporated by reference. An independent monitoring workshop was held in November 2009. A report on the workshop proceedings is forthcoming and a presentation on the workshop will be made to the Council at their March 2010 meeting. The selection of a monitoring program will have no immediate effect on protected species because it will not immediately affect fishing effort. However, any additional information regarding protected species interactions with the fishery, collected during one of these monitoring programs, may improve NOAA Fisheries Service capacity to evaluate the frequency and severity of those interactions.

MARMAP reef fish sampling program includes a sample domain ranging from Cape Lookout, North Carolina to St. Lucie Inlet, Florida. Habitats sampled include; natural hardbottom areas along the continental shelf and shelf break ranging from ~ 15 to 230 m depth, with depth ranges differing by gear type. Sampling is conducted from May–September each year with supplemental sampling in other months. Three types of gear are used to collect CPUE and length frequency data and/or biological samples (e.g. otoliths and gonads) to assess relative densities, age, and sex structure of population: 1) Chevron traps used in depths of 13-100 m; 2) short bottom long-line (used to survey sloping hardbottom areas where it is difficult to use chevron traps; depths = 25 – 223 m); and 3) rod and reel (depths = 15 – 230 m). Several methodologies of rod and reel sampling (including the use of commercial snapper reels) are utilized to collect species-specific CPUE data and biological samples.

Chevron traps are used to sample between 600 and 700 randomly chosen sites from a total of 2,500 known hard-bottom sites. About 330 to 500 of the selected sites are sampled annually. Short bottom long-lines are used to sample between 100-200 randomly selected sites are sampled from a total of 1,000 sampling sites. Rod and reel sampling occurs opportunistically over natural hardbottom habitat. MARMAP has used traps to sample and monitor hardbottom-associated reef fish populations (including red snapper) in the US South Atlantic since 1978, and chevron traps

since 1990. Short bottom long-lining and rod and reel sampling has occurred since 1978. Thus, an extended time series exists on which to build an improved sampling program.

Some limitations to current fishery independent sampling efforts do exist. While the MARMAP sampling domain covers a large area of the southeast US continental shelf, logistical, weather, and funding constraints result in relatively low levels of sampling effort in the northern and southern regions of the survey area. Additionally, and regardless of spatial focus of sampling, greater sample sizes are required to develop robust indices of abundance for many federally managed species. Finally, multiple species of management interest require the use of multiple gears for effective sampling, and some are not effectively sampled with traps and longline gear. While MARMAP historically has utilized a variety of gear types, currently only chevron traps and short bottom long line gear are used consistently to develop abundance trends. Thus, as a likely combined result of (1) insufficient realized spatial coverage, (2) insufficient survey sample size, and (3) lack of appropriate gears to effectively sample some species, MARMAP surveys alone cannot generate effective abundance indices for stock assessments for all species of management interest. *An improved fishery-independent survey program is needed to support stock assessments and management actions.*

Proposed framework for an improved sampling program focusing on red snapper
Alternative 2 (Preferred) would establish a fishery-independent monitoring program to track progress of red snapper. Sampling would include deployment of chevron traps, cameras, and hook and line at randomly selected stations. This alternative is similar in the sampling methodologies discussed under **Alternative 1 (Status Quo)**; however, **Alternative 2 (Preferred)** would not implement a dedicated fishery-dependant data collection program to monitor red snapper.

This proposed framework continues the long-term data series from MARMAP surveys and adds a complementary sampling program to expand needed coverage. The improved sampling plan would increase the (1) spatial footprint (central FL to Cape Hatteras, NC), (2) sample size, and (3) number of gear utilized over current survey levels, thereby considerably improving program effectiveness. The spatial and sample size expansions would be made possible by the participation of NOAA-SEFSC (Beaufort Laboratory) staff. The core aspects of the current sampling program (survey design, chevron trap, short bottom long-line and rod and reel sampling) would remain the core of the improved program, enabling comparisons of data collected in the improved program with those collected during previous years by MARMAP. Additional gear could be added and utilized by both NOAA-SEFSC and MARMAP (detailed below), with gear effectiveness research performed by NOAA-SEFSC. NOAA-SEFSC could coordinate with MARMAP to plan annual survey efforts (e.g., spatiotemporal focus of sampling) as guided by SAFMC and NMFS (SERO and SEFSC) data needs.

An improved program could include a geographic sampling range from Cape Hatteras, North Carolina to St. Lucie Inlet, Florida with targeting of specific geographical areas (e.g., offshore of northern FL and southern GA where the majority of red snapper landings occur) would be anticipated and would be guided by specific management actions. Four gear types could be

utilized, each resulting in a CPUE estimate or proxy for abundance that could be compared across time and space to assess responses of red snapper and other reef fish populations to management actions. Chevron traps and short bottom long-lines could continue to be utilized following current MARMAP protocols. These gear are effective for sampling many reef fish species. Combined trap-camera studies in the Gulf of Mexico suggest chevron traps efficiently sample red snapper (D. DeVries, personal communication). The SEFSC is in the process of designing a fishery-independent program to enhance those already in place. A report will be provided to the Council at their March 2010 meeting.

Fishery-Dependent Data Collection

Alternative 3 would establish a fishery-dependent monitoring program, involving for-hire vessels (charter boat and headboats). Participating vessels could be authorized to harvest and land fish in excess of Federal possession limits and/or during fishery closures. Retention limits for red snapper would be based upon research objectives. The trip limits and number of trips per month would depend on the number of selected vessels, available quota, and objectives of the program.

Fishery-dependent data could be employed to monitor abundance of red snapper and other snapper grouper species. The advantage of having fishermen collect information is they would have some knowledge about locations where red snapper can be found that might not be available to researchers. The disadvantage would be fishermen could target red snapper where they are most concentrated and therefore, trends in CPUE and mean length might not reflect true population trends. To eliminate this bias, sampling would need to be coordinated through the SEFSC.

Fishery-dependent data from headboats represents the longest continuous time series for snapper grouper species. This time series has been an important index for many assessments including red snapper. Proposed alternatives for red snapper in Amendment 17A include areas where fishing for or retention of all snapper grouper species would be prohibited. To maintain this continuous data base, limited headboat trips could be permitted to enter closed areas and fish for snapper grouper species. Trips could be selected by the SEFSC and would include an observer who would obtain data on all red snapper caught. Additional information on snapper grouper species would be obtained where possible. Dead red snapper could be retained for life history studies. The SEFSC would indicate if additional samples were needed for stock assessments.

The SEFSC is in the process of designing a fishery-dependent program to enhance those programs already in place. A report will be provided to the Council at their March 2010 meeting. The SEFSC previously provided information in the utility of including headboats in some sort of program to monitor CPUE, a summary of which follows (in italics) and is provided in **Appendix P**.

The Southeast Region Headboat Survey (SRHS) is a relatively reliable fishery dependent data source for abundance indices primarily because of the manner in which the fishing activity occurs. Often fishery *dependent abundance indices are biased because of the targeting nature of fishing for profit. Headboats tend to target habitat areas and types, often attempting to*

maximize the fishing experience for their patrons, rather than targeting individual species. This property lends itself to producing nearly unbiased measures of abundance. An ideal fishery independent survey would most likely be based on a stratified random sampling design, in which the habitat was stratified and random samples collected within each strata proportional to the fish abundance in each strata. Headboats do not operate randomly, but the most productive habitat areas do get fished (sampled) and most importantly they cover these habitats based on overall fish catches, not necessarily focusing on one particular species. This is not to say that headboats will always produce a reliable abundance index. Catch-per-unit effort from headboats is a 'relative' measure of abundance and can be affected by management regulations and economics. For example, if bag limits are low enough so that anglers are reaching the limit on almost every trip, then the CPUE tells us nothing about relative abundance of that species. An example of economics affecting CPUE may have been realized in 2008 when fuel prices reached all time highs. Some headboat captains reported traveling shorter distances relative to past years for some of their trips in 2008. If headboats are not fishing the more productive areas or fishing in shallower waters, then this can impact the relative CPUE for some species.

In the case of red snapper, the headboat survey produced an index of relative abundance used in the SEDAR 15 stock assessment. Ideally, we would keep this index intact by eliminating any forces that might alter the behavior of the fleet, which in turn could affect the relationship between CPUE and abundance. Some of these forces are out of our control. Ideally, it would be best to allow headboats to operate in the same manner year after year. Therefore, if headboats are to be used as a monitoring tool, it would be best to leave the fishery unencumbered by any regulations, other than those already in existence.

If the relationship between CPUE from the headboats and fish abundance is altered too much, then it will not be useful from a monitoring stand point. An important feature of the usefulness of the headboat CPUE index for monitoring is that we have estimates from the past to compare with future values. Without this relative comparison, we would be starting a brand new index, which may be of little utility with only a few years of data. If there are significant changes in headboat effort or behavior it may be better to start a new fishery-independent index.

*As was mentioned above, the ideal situation would be to allow the headboat fishery to continue as is. However, an important question is: Can the headboat fishery operate at full capacity and still allow red snapper recovery? To answer this question the SEFSC ran several projection scenarios. The results of this analysis are shown in Report 2 of the Red Snapper Monitoring Plan, May 8, 2009 drafted by Southeast Fisheries Science Center staff, and is hereby incorporated by reference (**Appendix P**). The results suggest that the headboat fishery cannot operate at full capacity. Without other sectors operating (coast wide shut down for non-headboats), the headboat fishery could operate at 70% of capacity and still allow for recovery of red snapper. This does not seem like a realistic management scenario, so we analyzed trade-offs between the percent capacity in other sectors and headboats (see Table 1 in Report 2 **Appendix P**). There is a steep trade-off between the fishing mortality rate (F) allowed for headboats and the other sectors. For example, the headboats would have to be scaled back to 30 percent in order to allow just 10 percent of the remaining sectors to operate. At this point it is not known what size area might need to be closed to reduce the other sectors to 10 percent. It is important to keep in mind that this 10 percent is mortality directed toward red snapper. So, areas where*

red snapper are infrequently encountered may only account for a small percentage, thereby allowing larger areas to remain open.

An important question is: Can a usable abundance index be obtained with a reduced headboat fishery? To answer this question we analyzed the delta-GLM model for estimating the red snapper index from the SEDAR 15 stock assessment in Report 3 of the Red Snapper Monitoring Plan ***(Appendix P)****. The results of this analysis suggest the obvious; there is a trade-off between the amount of potential error and the amount of trips which are allowed to run. Figures 2-5 from Report 3* ***(Appendix P)*** *suggest the main trends of the index remain intact with low numbers of trips. However, the ratio of the index in the terminal year to that in the initial year (which could be viewed as a good proxy for stock status), indicates a steeply increasing amount of error with decreasing trips in the headboat fishery. In the case of computing an index with 30% of the trips, the error on the ratio mentioned above goes to CV = 0.18, which would suggest an error in stock status of +/- 36 percent. Furthermore, this analysis assumes trips are randomly selected coast wide and follow the area, month, and trip type distributions shown in Tables 1-3 (Report 3 of* ***Appendix P****). Implementing this type of trip allocation may be difficult. Note: The report did not take into account the number of grids closed or the number of vessels that would available in nearby areas to participate, or the location/biomass of RS in each of the proposed grids. Once the Council selects the area to close, it may be necessary to have the Science Center repeat their analysis since only vessels that operate in the closed area would be affected.*

Critical Issues Associated With Fishery Dependent Monitoring

As has been shown above, it is technically possible to maintain a reliable, but noisy CPUE abundance index from a greatly reduced headboat fishery; but can it be put into practice? A few critical issues that arise when dealing with a reduced headboat fishery are: (1) Allocating trips following a statistical design, and (2) forces that may affect the relationship between CPUE and true abundance.

Allocating trips following a statistical design that follows past patterns may prove difficult. On average, headboats tend to operate at about 50-60 percent of passenger capacity. If trips were reduced by 70 percent or more, it is likely these trips will be run at near full capacity, or we would have to consider capping the number of passengers on any trip. How would trips be allocated? To follow the statistical design, which matches patterns observed in the past, we would have to allocate trips by area, month, and trip type. It is very unclear how this would operate, and there are many economic and social considerations involved in this. It seems highly likely headboat captains might change the way they run trips based on the allocation mechanism. Assuming the allocation could be worked out, there are still issues with avoiding forces mentioned in (2) above. Most notable is Amendment 16, which added more regulations for shallow water grouper and vermilion snapper. This may affect fishing behavior enough to change the current relationship between headboat CPUE and true abundance.

The current method for collecting data from headboats in the SRHS is through self-reported catch records (logbooks) and dockside intercepts. The total catch and discards in numbers are entirely self reported. The dockside samples provide average weights, length measurements, and otolith samples from landed fish for selected trips. This current sampling design would be

woefully inadequate under a 30% or less capacity fishery. It is probably not a good idea to have a species recovery monitoring be based entirely on self reported data. The catch and discard numbers would have to be recorded independently, at-sea. One advantage of using headboats for monitoring, as opposed to private, charter, or even commercial boats, is they constitute some of the largest vessels fishing for snapper grouper. The large size makes it easier for putting observers on board and efficiently collecting large amounts of data. If headboats were used as the sole source for monitoring red snapper, then sampling would likely have to be at a high rate (i.e. observer coverage would need to be near 100% of trips). There are many details that would need to be worked out if observers were to be used for collecting data aboard headboats. Some decisions would have to be made about the following: (1) The type of data to be collected (e.g. numbers, lengths, weights, and discards), (2) the percentage of trips to be covered, and (3) the degree of sub-sampling of fish on a given trip, just to name a few. Those details have not been worked out here because the amount of sampling and total costs would have to considered first. It should be noted that any reduction in the headboat fishery will affect data collection for all other snapper grouper species. Forcing a statistical design of headboat trips based on red snapper by definition will be insufficient or inadequate for other species in the snapper grouper complex.

The most biologically beneficial data collection scenario would be to designate both **Alternatives 2 (Preferred)** and **3** as preferred alternatives to ensure a balanced data collection approach. However, funding for both a fishery-independent program and a fishery-dependent program may not be available on a continuing basis. Both of these alternatives differ from **Alternative 1 (Status Quo)** in that they establish a monitoring program dedicated solely to gathering data on red snapper throughout a specific time period during which all harvest of the species could be prohibited. Further, **Alternative 2** would be designed to enhance information collected on other snapper grouper species. It is true that the programs under **Alternative 1 (Status Quo)** may conduct research related to red snapper and co-occurring species; however, these programs are not focused only on red snapper for the purposes of this amendment. Furthermore, the possibility that those programs listed under **Alternative 1 (Status Quo)** would be required to shift their focus to other more critical species in the future would always exist. **Alternatives 2 (Preferred)** and **3**, would establish dedicated, long-term programs, designed to fulfill the need to accurately track red snapper abundance throughout the rebuilding process.

Alternative 1 (Status Quo) would perpetuate the existing level of risk for interactions between ESA-listed species and the fishery. **Alternatives 2 (Preferred)** and **3** are unlikely to have adverse affects on ESA-listed *Acropora* species. Previous ESA consultations determined the snapper grouper fishery was not likely to adversely affect these species (See **Section 3.5**). The effects of **Alternative 2 (Preferred)** and **3** on sea turtles and smalltooth sawfish are unclear. If monitoring is conducted by commercial or research vessels, using fishing methods similar or identical to those of the snapper grouper fishery, the types and rates of interactions with ESA-listed species would be expected to be similar to those already occurring in the fishery; no increase in the likelihood of adverse affects occurring would be anticipated.

4.5.2 Economic Effects

Commercial Sector

While the short-term economic effects associated with the monitoring programs outlined under **Alternatives 2 (Preferred)** and **3** cannot be estimated at this time due to a lack of sufficient detail about these programs, it is likely that the positive long-term economic benefits from **Alternatives 2 (Preferred)** and **3** will exceed those provided under **Alternative 1 (Status Quo)**. Non-use values are expected to rise with the accumulation of additional biological and economic information. Therefore, **Alternatives 2 (Preferred)** and **3** would provide an increase in non-use values over **Alternative 1 (Status Quo)**.

Alternatives 1, 2 (Preferred), and 3 would not have any expected short-term economic impacts on the commercial fishery since they would not involve the commercial sector in additional data gathering activities. However, the long-term economic impacts of **Alternatives 1, 2 (Preferred), and 3** are expected to be positive since they would contribute to better management of the fishery in general and aid in actions taken by the Council with regard to rebuilding and allowing for future participation in the red snapper and related fisheries.

Non-use values are expected to rise with the accumulation of additional biological and economic information. Therefore, **Alternatives 2 (Preferred)** and **3** would provide an increase in non-use values over **Alternative 1 (Status Quo)**.

Recreational Sector

Alternatives 1 and **2 (Preferred)** would not have any short-term economic effects on the recreational sector, as they would not necessarily require any changes to the current data collection program for the recreational sector. Considering that some vital information on red snapper will no longer be available under the proposed total closure of the red snapper fishery, data collection involving the recreational sector through some other means would be necessary. The data collection approach under **Alternative 2 (Preferred)** may be considered an improvement over that of the status quo. Such data collection; however, would not be able to gather information on the actual operations of the anglers and for-hire sectors with respect to red snapper fishing and thus, on the possible valuation of red snapper fishing activities. **Alternative 3** would partly supply such information about anglers and for-hire operations even though at very limited level. In addition, selected for-hire vessels could derive some benefits from the data collection program.

4.5.3 Social Effects

Alternatives 1 (Status Quo) and **2 (Preferred)** are administrative actions and would not be expected to have any direct short-term effects on fishermen or associated businesses and communities. Under these alternatives, although some minimal directed harvest may continue, monitoring should entail the least mortality, resulting in the quickest red snapper recovery and receipt of the long-term benefits of a recovered resource.

Alternative 3 would allow continued red snapper directed harvest for research. Any directed harvest would be expected to result in direct short-term social and economic benefits for those

entities allowed to participate in the program and harvest red snapper. Participation; however, would be limited and those not able to participate in the program may raise issues of fairness and equity, particularly given that participants would be able to profit (carry paying customers) from a research endeavor. Details of the qualification and selection process that would be utilized are not available. From the long-term perspective, continued directed harvest, even minimal quantities for research purposes, could delay red snapper recovery and the receipt of the long-term social benefits of a recovered resource. Additional discussion of expected social effects will be completed when/if details of the research fishery program are provided.

4.5.4 Administrative Effects

Alternative 1 (Status Quo) would incur no additional administrative impacts. **Alternative 2 (Preferred)** would simply supplement and build upon a MARMAP sampling program which already exists, and would thus incur less of an administrative burden than **Alternative 3**. **Alternative 3** would require a higher level of administrative support than **Alternative 2 (Preferred)** since it would be creating an entirely new fishery program. Under **Alternative 3** qualifying criteria for participation would need to be developed and cleared through appropriate channels **Alternative 2 (Preferred)** would require coordination with the SEFSC to create an expanded sample design that would include additional sample locations, and commensurate funding, needed to supplement current MARMAP sampling activities to obtain information on red snapper abundance within any of the proposed closed areas. **Alternatives 2 (Preferred)** and **3**, would require the issuance of some form of authorization or acknowledgement such as an exempted fishing permit, letter of acknowledgement, or a scientific research permit. The administrative burden for processing these authorizations can range from moderate to minor depending upon what type of NEPA documentation is required. The most time intensive of the three is an exempted fishing permit, and the least time consuming is a letter of acknowledgement. **Alternative 3** would also require coordination with the SEFSC to create an appropriate sample design that would minimize bias associated with fishery-dependent sampling as well as locating funding needed to support such as program.

4.5.5 Council's Conclusion

The Council has chosen **Alternative 2** as their preferred red snapper monitoring alternative. **Alternative 2 (Preferred)** would establish an enhanced fishery-independent monitoring program to track progress of red snapper and other snapper grouper species. Sampling would likely include deployment of chevron traps, cameras, and hook and line at randomly selected stations but specifics of such a program are currently being developed by the SEFSC. This option would build upon the existing MARMAP sampling program, which already exists. The program would be expanded and sampling made more specific for monitoring red snapper and better monitoring of other snapper grouper species. The improved sampling plan would likely increase the (1) spatial footprint (central FL to Cape Hatteras, NC), (2) sample size, and (3) number of gear utilized over current survey levels, thereby considerably improving program effectiveness. The core aspects of the current sampling program (survey design, chevron trap, short bottom long-line and rod and reel sampling) would remain the core of the improved program, enabling

comparisons of data collected in the improved program with those collected during previous years by MARMAP. The disadvantage to using a fishery-independent monitoring program alone is that there is a potential for fishermen to feel like they are being excluded from participating in data collection efforts. However, this amendment does not preclude the use of fishery-dependent data for monitoring red snapper in the future, as NOAA Fisheries Service and SEFSC are constantly working toward improved data gathering and methods of analysis. Additional fishery dependent data could be obtained by means of grant-funded research through the Cooperative Research Program. Fishermen, working with researchers, could obtain funding from NOAA Fisheries Service to obtain information on red snapper for studies on life history, release mortality, mapping locations of high abundance, etc.

5. 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.

5.1 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 cumulative Effects Analysis (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, which is also the South Atlantic Fishery Management Council's area of jurisdiction. 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. Therefore, 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 3.2.1**. 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. 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. The Council has chosen a 35-year rebuilding schedule with management measures that would reduce harvest of red snapper in order to rebuild the stock within the preferred timeframe. Monitoring should continue indefinitely for all species to ensure that management measures are adequate for preventing overfishing in the future. A complete description of monitoring methods that would be employed under this amendment appears in **Sections 4.5** of this document.

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 speckled hind, warsaw grouper, golden tilefish, snowy grouper, and red snapper.

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

Amendment 13C to the FMP for the Snapper Grouper Fishery of the South Atlantic Region became effective October 23, 2006. The amendment addresses overfishing for snowy grouper, golden tilefish, black sea bass and vermilion snapper. The amendment also allows for a moderate increase in the harvest of red porgy as stocks continue to rebuild. Amendment 13C 2006 is hereby incorporated by reference. Analysis found in **Appendix E** show minimal reductions (< 2%) in commercial red snapper removals resulting from Amendment 13C. Therefore, ancillary effort reductions in the red snapper fishery due to management measures in Amendment 13C would not result in any significant reduction in harvest of red snapper that could be counted toward the overall harvest reductions needed to end overfishing of the specie.

Amendment 14 to the FMP for the Snapper Grouper Fishery of the South Atlantic Region was implemented on February 12, 2009. Implementing regulations for Amendment 14 established eight Type 2 Marine Protected Areas (MPAs) (see Figure 5-1) within which, all fishing for snapper grouper species is prohibited as is the use of shark bottom longline gear. Within the MPAs trolling for pelagic species is permitted. The MPAs range in area from 50 to 506 square nautical miles and are located off of North Carolina, South Carolina, Georgia and Florida. The MPAs are expected to enhance the optimum size, age, and genetic structure of slow-growing, long-lived, deepwater snapper-grouper species. A Type 2 MPA is an area within which fishing for or retention of snapper grouper species is prohibited but other types of legal fishing, such as trolling, are allowed. The prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed. MPAs are being used 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. Because of the small sizes of the MPAs, it is unlikely that any significant reductions in overall mortality of species also affected by Amendment 17A would occur. Therefore, biological effects of the MPAs would not significantly add to or reduce the anticipated biological benefits of management actions in Amendment 17A.

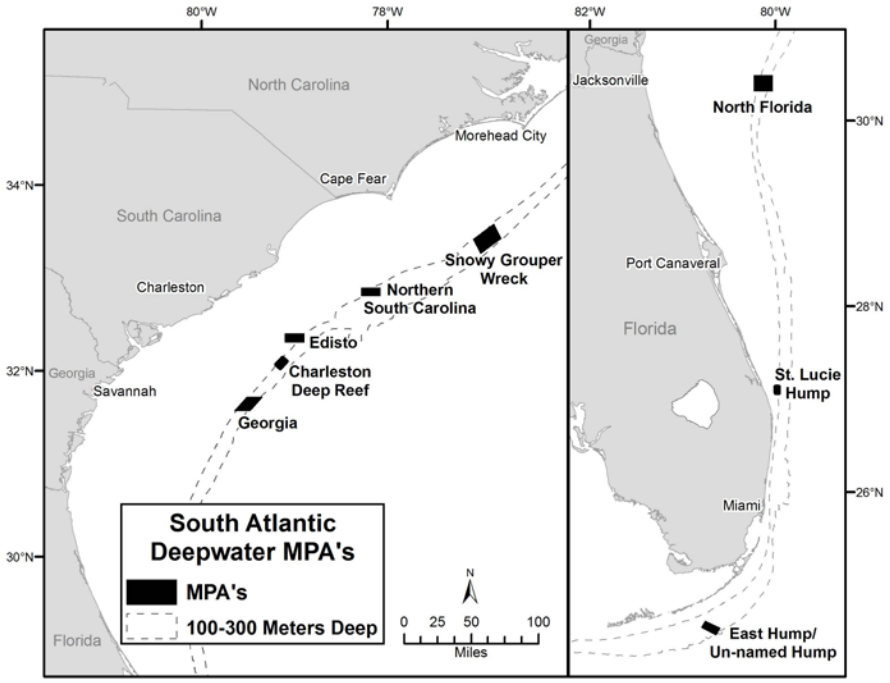


Figure 5-1 Marine protected areas implemented under Snapper Grouper Amendment 14 (SAFMC 2007).

B. Present

In addition to snapper grouper fishery management issues being addressed in this amendment, several other snapper grouper amendments have been developed concurrently and are in the process of approval and implementation. Current closures, including quota closures, seasonal closures, and area closures are outlined in **Appendix I.** of this document.

Most recently, Amendment 16 to the FMP for the Snapper Grouper Fishery of the South Atlantic Region (SAFMC 2008c) was partially approved by the Secretary of Commerce. Amendment 16 includes provisions to extend the shallow water grouper spawning season closure, create a five month seasonal closure for vermilion snapper, require the use of dehooking gear if needed, reduce the aggregate bag limit from five to three grouper, and reduce the bag limit for black grouper and gag to one gag or black grouper combined within the aggregate bag limit. The expected effects of these measures include significant reductions in landings and overall mortality of several shallow water snapper grouper species including, gag, black grouper, red grouper, and vermilion snapper. Specifically, the use of dehooking tools may reduce the release mortality of red snapper that are incidentally caught while fishing for other snapper grouper species. Model output in **Appendix E** shows that Amendment 16 could contribute up to a 16% reduction in commercial red snapper harvest, which has been included in the

baseline conditions upon which the needed red snapper reductions have been derived.

On September 1, 2009, Amendment 15B to the FMP for the Snapper Grouper Fishery of the South Atlantic Region was approved by the Secretary. Management measures in Amendment 15B that affect red snapper in Amendment 17A include prohibition of the sale of bag limit caught snapper grouper species for fishermen not holding a federal commercial permit for South Atlantic snapper grouper, an action to adopt, when implemented, the Atlantic Coastal Cooperative Statistics Program (ACCSP) release, discard and protected species module to assess and monitor bycatch, allocations for snowy grouper, and management reference points for golden tilefish.

Since some recreational fishermen may intentionally catch more fish than they can consume with the intent to sell, prohibiting the sale of those fish by recreational fishermen could decrease fishing effort; and therefore, may have small biological benefits. Adopting a bycatch monitoring method would not yield immediate biological benefits, but may help to inform future fishery management decisions with increased certainty using data collected from the ACCSP. Biological benefits from Amendment 15B are not expected to result in a significant cumulative biological effect when added to anticipated biological impacts under Amendment 17A.

Amendment 17B to the FMP for the Snapper Grouper Fishery of the South Atlantic Region is currently under development and is expected to include a deepwater snapper grouper closure seaward of 240 ft. The closures proposed in Amendment 17A, if implemented through rulemaking, would enhance the expected biological benefits of the spawning season closure for shallow water grouper in Amendment 16, and the proposed deepwater snapper grouper closure in Amendment 17B. It is possible that a snapper grouper closure proposed in Amendment 17A could overlap, to some degree, the deepwater closure proposed in Amendment 17B, and would therefore, enhance the biological benefit to red snapper and other deepwater species. Even greater biological benefit may accrue in the proposed Amendment 17A areas that would extend into the proposed 17B deepwater closure area (**Alternative 4 (Preferred)**) since no snapper grouper fishing would be allowed, rather than only prohibiting the harvest of deepwater species.

C. Reasonably Foreseeable Future

Amendment 18 to the FMP for the Snapper Grouper Fishery of the South Atlantic Region is currently under development. Measures in Amendment 18 would extend the snapper grouper FMP northward, limit effort in the black sea bass and golden tilefish fisheries, separate snowy grouper quota into regions/states, change the golden tilefish fishing year, improve the accuracy and timing of fisheries statistics, and designate EFH in the proposed snapper grouper northern area. The actions currently contained in Amendment 18, which affect red snapper, are intended to prevent overcapitalization while allowing fishery participants to achieve optimum yield benefits for those species. The actions to limit participation in the black sea bass and golden tilefish fisheries in Amendment 18 could hedge against any foreseeable effort shifts to those fisheries that might result from an area closure in Amendment 17A.

The Comprehensive Annual Catch Limit (ACL) Amendment would establish Annual Catch Limits (ACLs) and Annual Catch Targets (ACTs) for other federally managed South Atlantic species not experiencing overfishing in other FMPs including Snapper Grouper. Other actions contained within the ACL Amendment may include: (1) choosing ecosystem component species; (2) allocations; (3) management measures to limit recreational and commercial sectors to their ACTs; (4) accountability measures; and (5) any necessary modifications to the range of regulations. It is unlikely any of the management measures for the species being addressed in the Comprehensive ACL Amendment would directly affect red snapper in Amendment 17A. However, several species are co-occurring, and are included in species groupings e.g., the shallow water snapper grouper complex and the deepwater snapper grouper complex. Therefore, if regulations are implemented in the future that may biologically benefit one species in a species complex, it is likely others in the same complex may also realize biological benefits.

Finally, the space industry in Florida centered on Cape Canaveral is experiencing severe difficulties due to the ramping down and cancellation of the Space Shuttle Program. This program's loss coupled with additional fishery closures will negatively impact this region. However, declining economic conditions due to decline in the space industry may lessen the pace of waterfront development and associated adverse social and economic pressures on fishery infrastructure.

II. Non-Council and other non-fishery related actions, including natural events affecting speckled hind, warsaw grouper, golden tilefish, snowy grouper, and red snapper.

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 snapper grouper species. 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 these factors may have on a stock. Alteration of preferred habitats for snapper grouper species could affect survival of fish at any stage in their life cycles. However, estimates of the abundance of fish, which utilize any number of preferred habitats, as well as, determining the impact habitat alteration may have on snapper grouper species, is problematic.

The snapper grouper ecosystem includes many species, which occupy the same habitat at the same time. For example, red snapper co-occur with vermilion snapper, tomtate, scup, red porgy, white grunt, black sea bass, red grouper, scamp, gag, and others. Therefore, red snapper are likely to be caught and suffer some mortality when regulated since they will be incidentally caught when fishermen target other co-occurring species. Red snapper recruitment has been measured from the 1950's to the present time and shows a decline from the earliest years to a low in the mid-1900s. Since then there have been several moderately good year classes in 1998, 1999, and 2000, and then another decline through 2003, with an apparent strong year class occurring in 2006. These moderately good year classes have grown and entered the fishery over the past couple years and are likely responsible for the higher catches being reported by recreational and commercial fishermen. Other natural events such as spawning seasons, and aggregations of fish in spawning condition can make some species especially vulnerable to targeted fishing pressure. Such natural behaviors are discussed in further detail in **Section 3.2** of this document, and is hereby incorporated by reference.

AFFECTED ENVIRONMENT

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

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 trends in condition of gag, vermilion snapper, black sea bass, snowy grouper, golden tilefish, and red snapper are documented through the Southeast Data, Assessment and Review (SEDAR) process. Warsaw grouper, and speckled hind have not been recently assessed. Assessments for red grouper and black grouper will be completed in 2010. However, given the best available science, each of these stocks has been determined to be undergoing overfishing, meaning that fishing related mortality is greater than the maximum fishing mortality threshold. The status of each of these stocks is described in detail in **Section 3.3** of this document.

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

This step is important in outlining the current and probable stress factors on snapper grouper species 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

Numeric values of overfishing and overfished thresholds are being updated in this amendment for red snapper. 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).

Definitions of overfishing and overfished for species addressed in this amendment can be found in the most recent stock assessment sources included in **Table 1-2** of this document. Applicable stock assessment sources include SEDAR 4 (2004) for golden tilefish and snowy grouper; Potts and Brennan (2001) for speckled hind, black grouper, and red grouper; Huntsman *et al.* (1993) for warsaw grouper; SEDAR Update 1 (2005) for black sea bass; SEDAR 10 (2006) for gag; SEDAR Update #3 (2007) for vermilion snapper; and SEDAR 15 (2008) for red snapper. Of these species, snowy grouper, black sea bass, and red snapper have been declared overfished. All others have been determined to be undergoing overfishing according to their respective overfishing and overfished definitions. Detailed discussions of the science and processes used to determine the stock status of these species is contained in the previously mentioned information sources and are hereby incorporated by reference.

Climate change

Global climate changes could have significant effects on South Atlantic fisheries. However, the extent of these effects is not known at this time. Possible impacts include temperature changes in coastal and marine ecosystems that can influence organism metabolism and alter ecological processes such as productivity and species interactions; changes in precipitation patterns and a rise in sea level which could change the water balance of coastal ecosystems; altering patterns of wind and water circulation in the ocean environment; and influencing the productivity of critical coastal ecosystems such as wetlands, estuaries, and coral reefs (Kennedy et al. 2002).

Actions from this amendment could decrease the carbon footprint from fishing if some fishermen stop or reduce their number and duration of trips due to the proposed area closure. It is unclear how climate change would affect snapper grouper species in the South Atlantic. Climate change can affect factors such as migration, range, larval and juvenile survival, prey availability, and susceptibility to predators. In addition, the distribution of native and exotic species may change with

increased water temperature, as may the prevalence of disease in keystone animals such as corals and the occurrence and intensity of toxic algae blooms. Climate change may significantly impact snapper grouper species in the future, but the level of impacts cannot be quantified at this time, nor is the time frame known in which these impacts will occur. Actions in this amendment are expected to reduce harvest of red snapper and may also decrease fishing mortality of other co-occurring species; thus these actions may partially mitigate the negative impacts of global climate change on snapper grouper species.

7. Define a baseline condition for the resources, ecosystems, and human communities. 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. For red snapper, estimates of annual biomass have been well below the biomass at maximum sustainable yield (B_{MSY}) since the mid-1960s, with possibly some small amount of recovery since implementation of current size limits in 1992 (Figure 5-2).

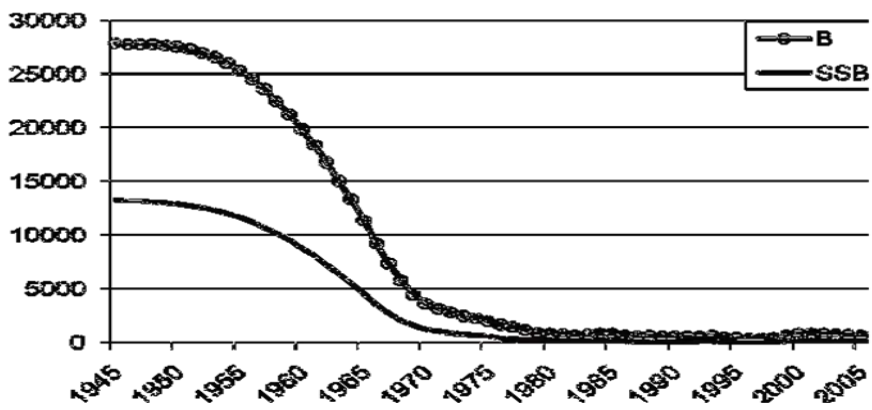


Figure 5-2. Biomass and Spawning Stock Biomass (pounds).

For a detailed discussion of the baseline conditions of each of the species addressed in this amendment the reader is referred to those stock assessment and stock information sources referenced in **Item Number 6** of this CEA.

DETERMINING THE ENVIRONMENTAL CONSEQUENCES OF CUMULATIVE EFFECTS

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

Table 5-1. The cause and effect relationship of fishing and regulatory actions within the time period of the Cumulative Effects Analysis (CEA).

Time period/dates	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	4" trawl mesh size to achieve a 12" TL commercial vermilion snapper minimum size limit (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. Size/Bag limits: 10" TL vermilion snapper (recreational only); 12" TL vermilion snapper (commercial only); 10 vermilion snapper/person/day; aggregate grouper bag limit of 5/person/day; and 20" TL gag, red, black, scamp, yellowfin, and yellowmouth grouper 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
July 1994	Prohibition of fishing for and retention of snapper grouper species (HAPC renamed OECA; SAFMC 1993)	Initiated the recovery of snapper grouper species in OECA.
1992-1999	Declining trends in biomass and overfishing	Spawning potential ratio for vermilion snapper and gag is less than 30% indicating

Time period/dates	Cause	Observed and/or Expected Effects
	continue for a number of snapper grouper species including vermilion snapper and gag.	that they are overfished.
February 24, 1999	Gag and black: 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 20 fish/person/day for all snapper grouper species without a bag limit (1998c).	F for gag vermilion snapper remains declines but is still above F_{MSY}.
October 23, 2006	Snapper grouper FMP Amendment 13C (SAFMC 2006)	Commercial vermilion snapper quota set at 1.1 million lbs gutted weight; recreational vermilion snapper size limit increased to 12" TL to prevent vermilion snapper overfishing
Effective February 12, 2009	Snapper grouper FMP Amendment 14 (SAFMC 2007)	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 (e.g., speckled hind, snowy grouper, warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, blueline tilefish, and sand tilefish). Gag and vermilion snapper occur in some of these areas.
Effective March 20, 2008	Snapper grouper FMP Amendment 15A (SAFMC 2008a)	Establish rebuilding plans and SFA parameters for snowy grouper, black sea bass, and red porgy.
Effective Dates Dec 16, 2009, to Feb 16, 2010.	Snapper grouper FMP Amendment 15B (SAFMC 2008b)	End double counting in the commercial and recreational reporting systems by prohibiting the sale of bag-limit caught snapper grouper, and minimize impacts on sea turtles and smalltooth sawfish.
Effective Date July 29, 2009	Snapper grouper FMP Amendment 16 (SAFMC 2008c)	Protect spawning aggregations and snapper grouper in spawning condition by increasing the length of the spawning season closure, decrease discard mortality by requiring the use of dehooking tools, reduce overall harvest of gag and vermilion snapper to end overfishing.

Time period/dates	Cause	Observed and/or Expected Effects
Effective Date January 4, 2010	Red Snapper Interim Rule	Prohibit commercial and recreational harvest of red snapper from January 4, 2010, to June 2, 2010 with a possible 186-day extension. Reduce overfishing of red snapper while long-term measures to end overfishing are addressed in Amendment 17A.
Target 2010	Snapper Grouper FMP Amendment 17A.	SFA parameters for red snapper; ACLs and ACTs; management measures to limit recreational and commercial sectors to their ACTs; accountability measures. Establish rebuilding plan for red snapper.
Target 2010	Snapper Grouper Amendment 17B	ACLs and ACTs; management measures to limit recreational and commercial sectors to their ACTs; accountability measures, for species undergoing overfishing.
Target 2010	Snapper Grouper FMP Amendment 18	Extend the snapper grouper FMU northward, review and update wreckfish ITQ system, prevent overexploitation in the black sea bass and golden tilefish fisheries, improve data collection timeliness and data quality.
Target 2010	Snapper Grouper FMP Amendment 19	Amend the FMP to present spatial information of Council-designated Essential Fish Habitat and Essential Fish Habitat-Habitat Areas of Particular Concern.
Target January 1, 2011	Comprehensive ACL Amendment.	ACLs, ACTs, and accountability measures for species not experiencing overfishing; accountability measures; an action to remove species from the fishery management unit as appropriate; and management measures to limit recreational and commercial sectors to their ACTs.
Target 2011	Amendment 20 (Wreckfish)	Review the current ITQ program and update the ITQ program as necessary to comply with MSA LAPP requirements.

9. Determine the magnitude and significance of cumulative effects.

Proposed management actions, as summarized in **Section 2** of this document, would establish ACLs and AMs and establish management measures to end red snapper overfishing and are expected to have a beneficial, cumulative effect on the biophysical environment. These management actions are expected to protect and increase stock biomass, which may affect other stocks. Detailed discussions of the magnitude and significance of the preferred alternatives appear in **Section 4** of this consolidated document. Below is a short summary of the biological significance and magnitude of each of the preferred alternatives chosen, and a brief discussion of their combined effect on the snapper grouper FMU and the ecosystem.

The red snapper rebuilding plan and management measures in this amendment would result in a slow rebuilding of the stock over the course of many years. One ancillary benefit of restricting red snapper harvest are reductions in fishing related mortality of other species associated with red snapper. It is not possible to eliminate incidental mortality of red snapper, since it is part of a multi-species complex, without prohibiting fishermen from targeting all associated species wherever red snapper occur. Therefore, biological benefits are expected for all species associated with red snapper, especially in the specific areas of regulatory implementation.

When viewed in totality, the actions in this amendment would benefit shallow water species currently undergoing overfishing as well as the ecosystem in which they reside. Since the snapper grouper FMU and species complexes therein include a host of co-occurring species, proposed management measures may also benefit those associated species in addition to the ten addressed here. Predator prey relationships would likely approach balanced conditions over time, and the protections put in place under this amendment may enhance the natural sex ratio and protect easily targeted fish that may aggregate to spawn. Although it is difficult to quantify the cumulative effects of the proposed actions, 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 adopt management.

The effects of the proposed action are, and will continue to be, monitored through collection of data by NOAA Fisheries Service, states, stock assessments and stock assessment updates, life history studies, and other scientific observations. **Section 4.5** of this document contains a full discussion and analysis of monitoring program alternatives for red snapper.

5.2 Socioeconomic

A description of the human environment, including a description of commercial and recreational snapper grouper fisheries and associated key fishing communities is contained in **Section 3.0**. A description of the history of management of the snapper grouper fishery is contained in **Section 1.3**. 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 ex-vessel fish prices due to imports, increased operating costs (e.g., gas, ice, insurance, dockage fees, etc.), and increased waterfront/coastal value leading to

development pressure for non-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 variability of species availability, the sale of a fish house or docking space for condominium development, or even simply fishermen behavioral changes unrelated to the regulation.

The establishment of ACLs and AMs for species undergoing overfishing is expected to help protect and sustain harvest at the OY level. 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**. Current and future amendments are expected to add to this cumulative effect. Snapper Grouper Amendment 15B prohibited the sale of bag-limit caught snapper grouper species for those who do not hold a Federal commercial permit for snapper grouper. This would eliminate the ability of the recreational angler to subsidize the cost of a fishing trip through the sales of snapper grouper, and may therefore, decrease recreational demand. This action would have more pronounced effects on the for-hire sector which often uses the sale of bag-limit caught fish to pay crew members. The cumulative impacts of eliminating the ability to sell bag limit caught snapper grouper and the restrictions on red snapper specifically in this amendment could be perceived as being significant to this sector.

Snapper Grouper Amendment 16 addressed overfishing in the gag and vermilion snapper fisheries. The corrective action in response to overfishing always requires harvest reductions and more restrictive regulation. Thus, additional short-term adverse social and economic effects would be expected. These restrictions will hopefully prevent; however, the stocks from becoming overfished, which would require recovery plans, further harvest restrictions, and additional social and economic losses. A red snapper interim rule was put in place from January 4, 2010, to June 2, 2010, to reduce overfishing of red snapper while Amendment 17A is developed and can be extended for an additional 186 days.

Snapper Grouper Amendment 17B will establish ACLs, AMs, and ACTs for a number of snapper grouper species, and specify golden tilefish allocations. Some of these actions are expected to result in additional harvest restrictions on the snapper grouper fishery, and additional short-term adverse social and economic effects. Alternatives for the management of red snapper could interact with additional alternatives proposed in Amendment 17B that are not considered in the present analyses. In particular, the proposed alternatives considered in Amendment 17A do not include any commercial quotas for red grouper or black grouper, while Amendment 17B proposes to limit the aggregate harvest of gag, red grouper and black grouper. In addition, the exemptions for Amendment 17A would allow bottom longline gear in restricted areas in waters

deeper than 300 feet, while Amendment 17B proposes to prohibit fishing for deep water species other than golden tilefish in waters deeper than 240 feet. The effects of both amendments considered simultaneously will be greater than presented here. See **Appendix O** for a completed description of the economic analysis methodology.

Snapper-grouper Amendment 17B is being developed simultaneously with Amendment 17A, and preferred alternatives have been selected to set annual catch limits (ACLs) for speckled hind and warsaw grouper, golden tilefish, and red grouper and black grouper. See Table 4-34.

If Amendment 17B is implemented, annual catch limits will be set to zero for speckled hind and warsaw grouper. In addition, the harvest, possession and sale of snowy grouper, yellowedge grouper, misty grouper, blueline tilefish, queen snapper, and silk snapper will be prohibited in waters deeper than 240 feet as a means of minimizing the incidental catch and discard of speckled hind and warsaw grouper. See model *A17b_SpHind_ALT4* in Appendix Table 1.

If implemented, the total allowable catch for golden tilefish will be redefined in terms of Foy rather than F_{MSY}. Furthermore, the commercial allocation will be formally established as 97 percent of total allowable catch. The result will be a reduction in the commercial ACL from 295,000 pounds (gutted weight) to 282,819 pounds. See model *A17b_Tilefish_alloc3_ACL2* in Appendix Table 1.

If implemented, an aggregate catch limit of 662,403 pounds (gutted weight) will be established for gag, red grouper and black grouper. The commercial fishery for shallow water groupers will be closed when either the individual ACL for gag (353,940 pounds) or the aggregate ACL for gag, red grouper and black grouper is reached. See model *A17b_RedGrouperACL_ALT2b* in Appendix Table 1.

Table 5-2. Preferred alternatives in snapper-grouper Amendment 17B for the management of speckled hind, golden tilefish, and red grouper. (This table paraphrases rather than includes a verbatim statement of alternatives from Amendment 17B.)

Model Name	*Description*
Amendment 17b, Speckled Hind Action, Alternative 4	*Alternative 4 (Preferred)*: Establish an ACL = 0 for speckled hind and warsaw grouper. Prohibit all commercial and recreational fishing for, possession, and retention of speckled hind and warsaw grouper. Prohibit all fishing for, possession, and retention of snowy grouper, yellowedge grouper, misty grouper, blueline tilefish, queen snapper, and silk snapper beyond a depth of 240 feet (40 fathoms; 73 m).
Amendment 17B, Golden Tilefish Allocation Alternative 3 and ACL Alternative 2	*Allocation Alternative 3 and ACL Alternative 2 (Preferred)*: The total allowable catch would be determined at the Foy level of 291,566 lbs gw. The commercial ACL would be 282,819 lbs gw based on a commercial allocation of 97 percent. Prohibit harvest, possession, retention and sale of golden tilefish when the quota is met. Retain existing trip limits.
Amendment 17B, Red Grouper	*Alternative 2b (Preferred)*: Retain the current commercial

Model Name	*Description*
ACL Action, Alternative 2b	ACL for gag of 353,940 lbs gw and establish an aggregate commercial ACL for gag, red grouper and black grouper of 662,403 lbs gw. The commercial fishery for shallow water groupers, including red grouper and black grouper, is closed from January through April and when the commercial ACL for gag is filled or when the aggregate ACL for gag, red grouper and black grouper is filled. Retain the existing 12 inch minimum size limit for red grouper and 24 inch minimum size limit for black grouper.

Simultaneous Effects of Amendments 17A and 17B

The predicted economic effects for the simultaneous evaluation of proposed management measures for red snapper in Amendment 17A and the preferred alternatives for Amendment 17B appear in Table 5-2. The *additional* reductions in net operating revenues due to the preferred alternatives for Amendment 17B range from approximately $392,000 (an extra 4.3 percent) for combined **Alternatives 4A and Preferred Alternatives 5 and 7** to $506,000 (an extra 5.6 percent) for combined **Alternatives 3C and Preferred Alternatives 5 and 7**. The baseline conditions were defined by average conditions from 2006-2008, given the expected effects of Amendment 16.

Table 5-3. Predicted economic effects of proposed management measures for red snapper in Amendment 17A given (a) status quo (no action) for Amendment 17B and (b) Preferred Alternatives for Amendment 17B. Economic effects are measured in terms of net operating revenues for commercial trips reported to the SEFSC fishery logbook system.

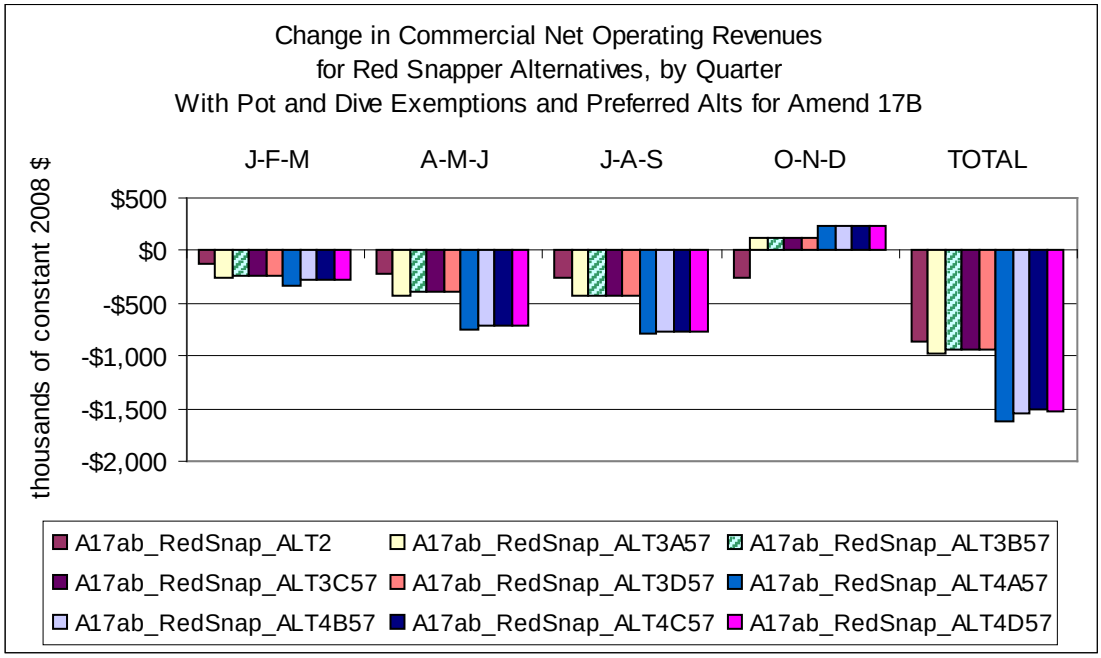
	Amendment 17A and No Action for Amendment 17B (thousands of constant 2008 $)		Amendment 17A and Preferred Alternatives for Amendment 17B (thousands of constant 2008 $)		Additional Reductions in Net Operating Revenues due to the Preferred Alternatives for Amendment 17B	
BASELINE (simulated conditions with Amendment 16)	$9,017	100%	$9,017	100%	$9,017	100%
Proposed red snapper management measure alternative in Amendment 17A	Change from baseline	Percentage change from baseline	Change from baseline	Percentage change from baseline	Change from baseline	Percentage change from baseline
Alternative 2	-$390	-4.3%	-$859	-9.5%	-$469	-5.2%
Alternatives 3A, 5, and 7	-$489	-5.4%	-$978	-10.9%	-$490	-5.4%
Alternatives 3B, 5, and 7	-$444	-4.9%	-$947	-10.5%	-$503	-5.6%
Alternatives 3C, 5, and 7	-$438	-4.9%	-$943	-10.5%	-$506	-5.6%
Alternatives 3D, 5, and 7	-$445	-4.9%	-$947	-10.5%	-$502	-5.6%

	Amendment 17A and No Action for Amendment 17B (thousands of constant 2008 $)		Amendment 17A and Preferred Alternatives for Amendment 17B (thousands of constant 2008 $)		Additional Reductions in Net Operating Revenues due to the Preferred Alternatives for Amendment 17B	
Alternatives 4A, 5, and 7	-$1,235	-13.7%	-$1,626	-18.0%	-$392	-4.3%
Alternatives 4B, 5, and 7	-$1,125	-12.5%	-$1,547	-17.2%	-$422	-4.7%
Alternatives 4C, 5, and 7	-$1,081	-12.0%	-$1,511	-16.8%	-$431	-4.8%
Preferred Alternatives 4D, 5, and 7	-$1,095	-12.1%	-$1,521	-16.9%	-$425	-4.7%

Amendment 17B is not expected to have a large effect on commercial landings of red snapper. If Amendment 17A were never implemented, Amendment 17B would be expected to reduce landings of red snapper by an extra 1 percent compared to regulatory conditions with Amendment 16. However, the preferred alternatives in Amendment 17B would affect landings of other species in the snapper-grouper management unit, especially the shallow water groupers.

The aggregate ACL on the harvest of gag, red grouper and black grouper in Amendment 17B would dampen the prediction in the analysis of Amendment 17A of a longer season for shallow water groupers, and would limit the ability of fishermen to benefit from a longer open season by harvesting larger quantities of red grouper, black grouper and other shallow water groupers given the alternatives proposed in Amendment 17A. When Amendments 17A and 17B are considered jointly, the open season for shallow water groupers still is predicted to last longer than with Amendment 16, but would close sooner than if the ACL had not been specified in Amendment 17B. Therefore, the expected increase in net operating revenues during the fourth quarter will not be as large as was predicted in the analysis of Amendment 17A given the status quo for Amendment 17B, and the overall losses due to the alternatives in Amendment 17A will be larger than originally predicted.

Figure 5-3. Predicted changes in net operating revenues by calendar quarter for red snapper alternatives compared to the status quo (no action) alternative for Amendment 17A, given preferred Alternatives for Amendment 17B.



Note: The legend indicates joint simulation runs of Amendments 17A and 17B for red snapper management measures. The last 4 digits of the legend labels indicate the alternatives considered. For example, ALT3C57 indicates Alternative 3C run in combination with Alternatives 5 and 7.

Assuming gear exemptions for black seabass pots and dive gear (**Alternatives 5 (Preferred)** and **7 (Preferred)**), the effect of the aggregate ACL would have a greater effect on net operating revenues for Alternatives 3A-3D than for **Alternatives 4A-4D (Preferred)**, primarily in South Carolina, North Carolina and the Florida Keys. The consideration of preferred alternatives in Amendment 17B did not appear to add significantly to the predicted economic effects of the alternatives on fishermen in northeast Florida and Georgia, and had only small effects on fishermen in central and southeast Florida.

Assuming black seabass pot and dive gear exceptions (**Alternatives 5 (Preferred)** and **7 (Preferred)**), the snapper-grouper fishery would not be closed off the coast of South Carolina with **Alternatives 3A-3D**, but would be closed with **Alternatives 4A-4D (Preferred)**. Consequently, net operating revenues for fishermen in South Carolina were expected to increase by between 7.0 and 7.9 percent with **Alternatives 3A-3D** given the status quo for Amendment 17B, and were expected to decline by between 29.6 and 34.5 percent with **Alternatives 4A-4D (Preferred)**. After accounting for the effects of the preferred alternatives for Amendment 17B, net operating revenues are expected to remain relatively unchanged with **Alternatives 3A-3D**, and are expected to decline by between 32.5 and 36.4 percent with **Alternatives 4A-4D (Preferred)**.

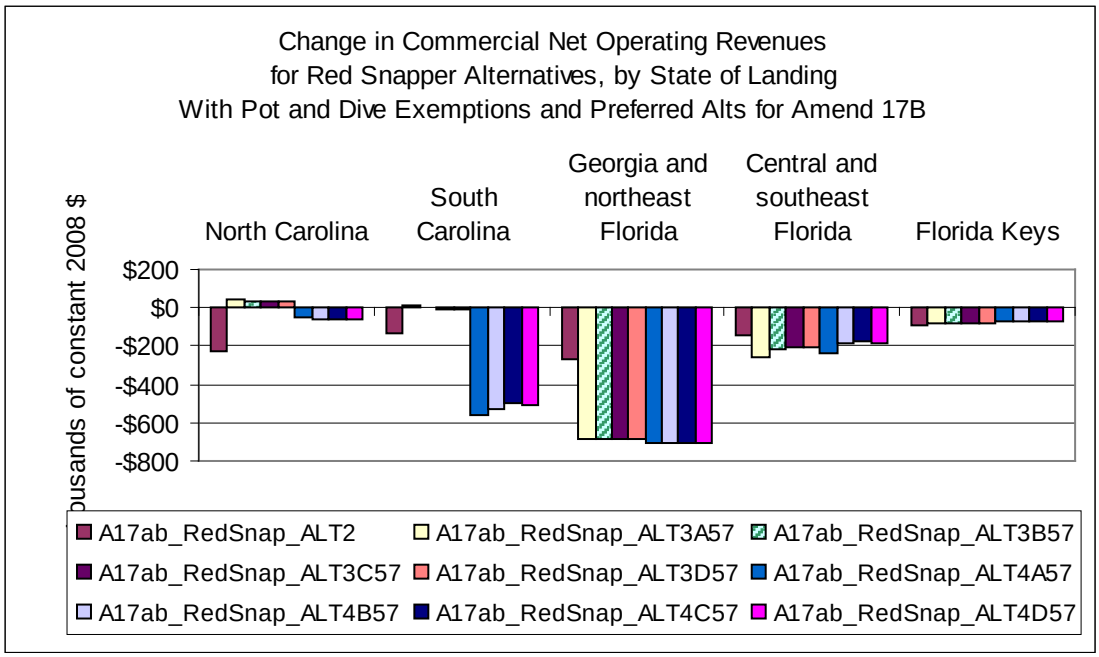
Based on the prediction of a longer open season for shallow water groupers, net operating revenues for fishermen in North Carolina were predicted to increase by approximately 11 percent

for **Alternatives 3A-3D** and by 7 percent for **Alternatives 4A-4D (Preferred)** given the status quo for Amendment 17B. However, after accounting for the effects of preferred alternatives for Amendment 17B, net operating revenues for fishermen in North Carolina are expected to increase by approximately 1.5 percent for **Alternatives 3A-3D**, and are expected to decline by slightly more than 2 percent with **Alternatives 4A-4D (Preferred)**.

Similarly, fishermen in the Florida Keys were predicted to be relatively unaffected by proposed regulations in Amendment 17A. However, the proposed aggregate ACL for shallow water groupers would result in a reduction in net operating revenues of slightly less than 5 percent for **Alternatives 3A-3D** and approximately 4 percent for **Alternatives 4A-4D (Preferred)**.

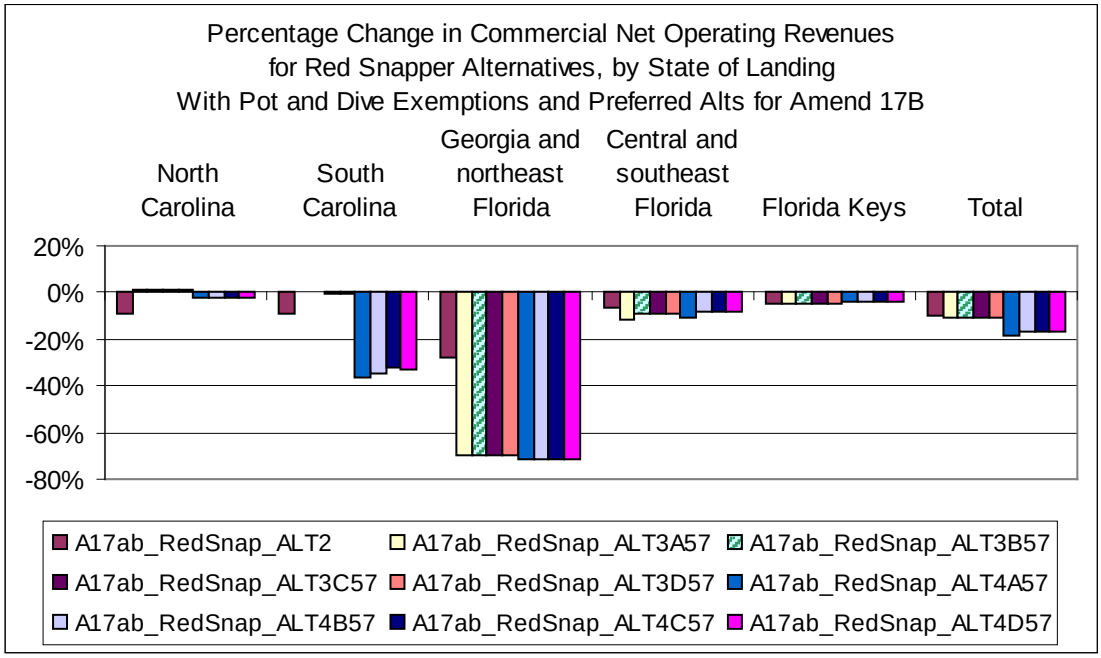
Amendment 17B would prohibit the harvest of snowy grouper, other deep water groupers and blueline tilefish in waters deeper than 240 feet, and would have overridden the effects of an exemption for longlines in waters deeper than 300 feet (except for golden tilefish) had it been a preferred alternative for Amendment 17A. The preponderance of economic losses due to Amendments 17A and 17B still would be incurred by fishermen that use vertical line gear because that is the most widely used gear in the fishery. However, the losses expected for fishermen with bottom longline gear are greater both in dollar and percentage terms than when the expected effects of Amendment 17B are not considered.

Figure 5-3a. Predicted changes in net operating revenues by state of landing for red snapper alternatives compared to the status quo (no action) alternative for Amendment 17A, given preferred alternatives for Amendment 17B.



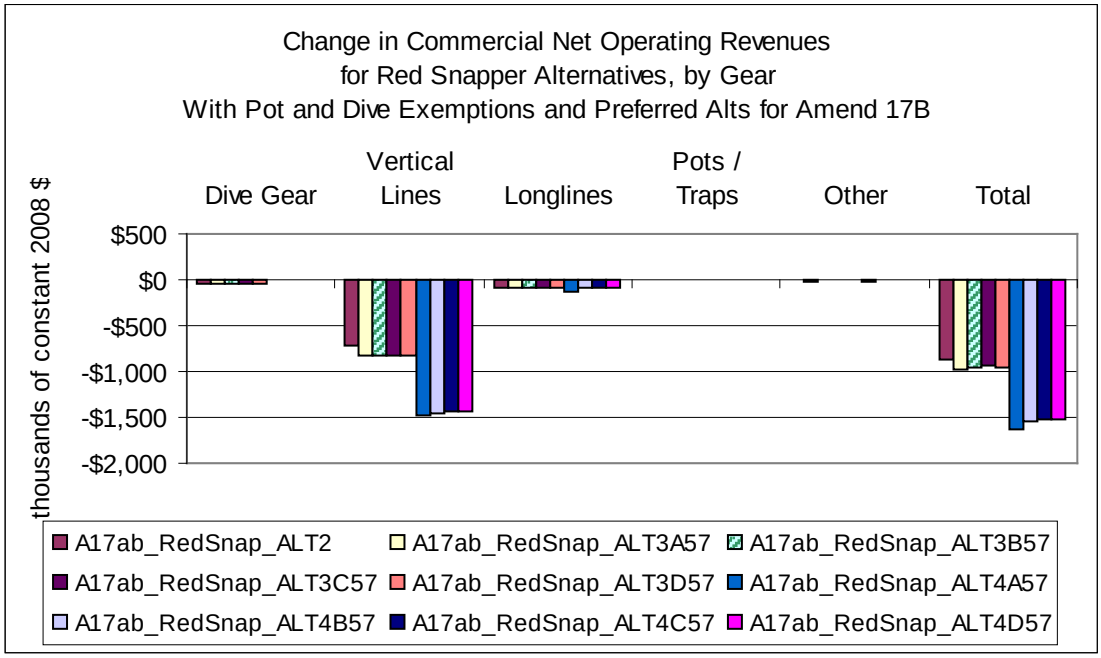
Note: The legend indicates joint simulation runs of Amendments 17A and 17B for red snapper management measures. The last 4 digits of the legend labels indicate the alternatives considered. For example, ALT3C57 indicates **Alternative 3C** run in combination with **Alternatives 5 (Preferred)** and **7 (Preferred)**.

Figure 5-3b. Predicted percentage changes in net operating revenues by state of landing for red snapper alternatives compared to the status quo (no action) alternative for Amendment 17A, given preferred alternatives for Amendment 17B.



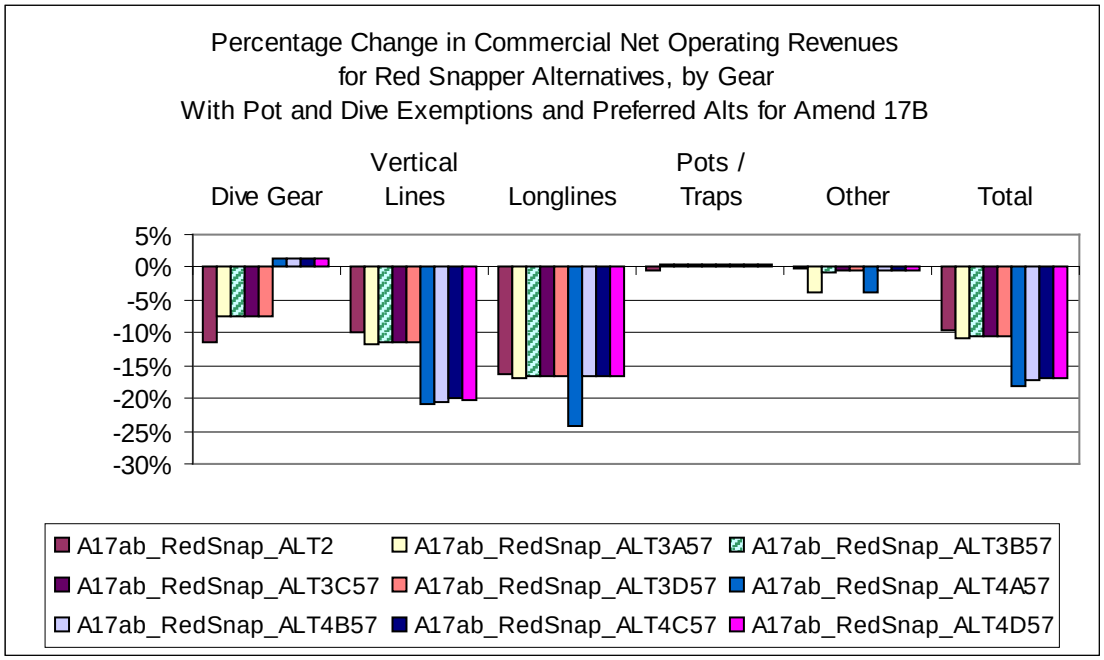
Note: The legend indicates joint simulation runs of Amendments 17A and 17B for red snapper management measures. The last 4 digits of the legend labels indicate the alternatives considered. For example, ALT3C57 indicates Alternative 3C run in combination with Alternatives 5 and 7.

Figure 5-4a. Predicted changes in net operating revenues by gear type for red snapper alternatives compared to the status quo (no action) alternative for Amendment 17A, given preferred alternatives for Amendment 17B.



Note: The legend indicates joint simulation runs of Amendments 17A and 17B for red snapper management measures. The last 4 digits of the legend labels indicate the alternatives considered. For example, ALT3C57 indicates **Alternative 3C** run in combination with Alternatives 5 and 7.

Figure 5-4b. Predicted percentage changes in net operating revenues by gear type for red snapper alternatives compared to the status quo (no action) alternative for Amendment 17A, given preferred alternatives for Amendment 17B.



Note: The legend indicates joint simulation runs of Amendments 17A and 17B for red snapper management measures. The last 4 digits of the legend labels indicate the alternatives considered. For example, ALT3C57 indicates **Alternative 3C** run in combination with **Alternatives 5** and **7**.

Snapper Grouper Amendment 18 will examine limiting participation and effort in the golden tilefish and black sea bass pot fisheries, consider extending the range of the FMP north through the Mid-Atlantic and New England Council areas, and consider separating the allowable harvests for snowy grouper in regional or state totals, among other actions. While restrictions of this nature would in theory allow status quo total harvests for the respective species to continue, these restrictions may result in the redistribution of harvests among traditional users, resulting in those who are able to increase their harvests, and associated social and economic benefits, and those who suffer reduced harvests, with associated losses in benefits. For those who would be expected to experience a possible reduction in harvests, these reductions may occur on top of declining benefits as a result of other recent or developing management action.

6. Other Things to Consider

6.1 Unavoidable Adverse Effects

Actions in Amendment 17A that may have unavoidable and adverse effects include updating management reference points, establishing a rebuilding plan for red snapper, closing an area to all snapper grouper fishing, and requiring the use of circle hooks north of 28 degrees latitude. These unavoidable and adverse effects are socioeconomic in nature.

According to the NEPA definitions of direct and indirect effects, defining an MSY proxy for red snapper would not directly affect the biological or ecological environment, including ESA-listed species, because these parameters are not used in determining immediate harvest objectives. The MSY proxy is a reference point used by fishery managers to assess fishery performance over the long term. As a result, redefined management reference points could require regulatory changes in the future as managers monitor long-term performance of the stock with respect to the new MSY proxy. Therefore, this parameter definitions will indirectly affect red snapper and ecosystem of which they are a part, by influencing decisions about how to maximize and optimize the long-term yield of fisheries under equilibrium conditions and triggering action when stock biomass decreases below the threshold level.

Since red snapper are overfished and undergoing overfishing, Amendment 17A specifies a rebuilding plan according to which the stock will be returned to a rebuild condition. The rebuilding schedule portion of the rebuilding plan defines the time within which the stock should be rebuilt. The Council has chosen the longest timeframe for rebuilding red snapper in order to avoid having to implement more restrictive management measures that would be required to rebuild the stock within a shorter time frame. Though immediate unavoidable adverse impacts on the socioeconomic environment will still accrue under the chosen rebuilding schedule, those impacts would not be as great as they would have been if the Council had chosen a shorter rebuilding schedule.

The rebuilding strategy portion of the rebuilding plan would set the rebuilding strategy as well as the OY equal to the yield at 97%F_{MSY} (97%$F_{40\%}$). The ACL under **Sub-Alternative 5A** would be zero and under **Sub-Alternative 5B** the ACL would equal 101,000 lbs whole weight and would remain in effect until modified (Figure 4-5d). OY at equilibrium would be 2,291,000 lbs whole weight. Under the proposed rebuilding strategy, a 83% reduction in total kill would be required. At this rate of recovery, the stock has a 50% chance of rebuilding to SSB_{MSY} by 2044. However, the stock could rebuild sooner since the Council is considering management actions to prohibit all harvest of red snapper during initial rebuilding and actions are being considered to reduce incidental catch in **Section 4.3**. This is an intermediate option for stock recovery in terms of time for recovery and removal rate, and is not likely to produce an unavoidable adverse effects on the biological environment.

Proposed management measures for red snapper would adversely affect the commercial and recreational sectors of the snapper grouper fishery. Although the average overall expected reductions in net operating revenues are expected to be 12 percent for the entire commercial snapper grouper fishery, the effects of Amendment 17A would be highly focused on fishermen in northeast Florida and Georgia because that region represents the center of the red snapper fishery. Fishermen there would incur the largest losses in absolute and relative terms. The predicted reductions in net operating revenues for fishermen in northeast Florida and Georgia are expected to be 30% with the spearfishing and black sea bass pot exemptions.

For the recreational sector the various alternatives would entail consequent effects on the industries supporting the fishing industry and on the regional economies, in addition to overall short-term headboat/charter boat revenue losses would be 22.2 million dollars (**Section 4.3.2**). Gentner and Steinback (2008) estimated the economic impacts of the recreational sector's expenditures on the regional economies of the South Atlantic states, showing the level of employment, among others, generated by angler expenditures. They estimated that in 2006, angler expenditure on saltwater trips supported 16,212 jobs in Florida (east coast), 2,435 jobs in Georgia, 2,435 in South Carolina, and 11,316 jobs in North Carolina. Dumas et al. (2009) estimated the economic impacts of the for-hire industry in North Carolina, showing that for-hire fishing expenditures supported about 10,200 jobs in North Carolina. Thus, any reductions in angler trips and expenditures would have repercussions on the region's employment and other socioeconomic environment.

Requiring circle hooks for vessels associated with South Atlantic Unlimited Snapper Grouper Permits or South Atlantic 225 lb Trip Limit Permits for snapper grouper would not be expected to yield any unavoidable adverse effects on the biological environment; in fact the action is intended to positively affect the biological environment. In general, requiring the use of circle hooks may not substantially increase the cost of fishing to either the commercial or the recreational sectors, though the potential reduction in the harvest of some important species is noted in **Section 4.4.1**.

Unavoidable adverse affects of implementing a monitoring program for red snapper would be associated with the use of administrative resources to implement and maintain the subject monitoring program. Under both alternatives being considered by the Council, a substantial

amount of funding, time, and personnel would be required to either supplement the existing MARMAP program, or establish a new fishery-dependent monitoring program. Furthermore, these costs would be recurring (likely annually) for the duration of the red snapper rebuilding schedule. Each year funding would need to be secured and personnel would need to be dedicated to collecting and analyzing the data gathered.

6.2 Effects of the Fishery on the Essential Fish Habitat

The biological impacts of the proposed actions are described in Section 4.0, including impacts on habitat. No actions proposed in this amendment are anticipated to have any adverse impact on EFH or EFH-HAPCs for managed species including species in the snapper grouper complex. Any additional impacts of fishing on EFH identified during the public hearing process will be considered, therefore the Council has determined no new measures to address impacts on EFH are necessary at this time. The Councils adopted habitat policies, which may directly affect the area of concern, are available for download through the Habitat/Ecosystem section of the Council's website: http://map.mapwise.com/safmc/Default.aspx?tabid=56.

NOTE: The Final EFH Rule, published on January 17, 2002, (67 FR 2343) replaced the interim Final Rule of December 19, 1997 on which the original EFH and EFH-HAPC designations were made. The Final Rule directs the Councils to periodically update EFH and EFH-HAPC information and designations within fishery management plans. As was done with the original Habitat Plan, a series of technical workshops were conducted by Council habitat staff and a draft plan that includes new information has been completed pursuant to the Final EFH Rule.

6.3 Damage to Ocean and Coastal Habitats

The alternatives and proposed actions are not expected to have any adverse effect on the ocean and coastal habitat.

Management measures implemented in the original Snapper Grouper Fishery Management Plan through Amendment 7 combined have significantly reduced the impact of the snapper grouper fishery on EFH. The Council has reduced the impact of the fishery and protected EFH by prohibiting the use of poisons and explosives; prohibiting use of fish traps and entanglement nets in the EEZ; banning use of bottom trawls on live/hard bottom habitat north of Cape Canaveral, Florida; restricting use of bottom longline to depths greater than 50 fathoms north of St. Lucie Inlet; and prohibiting use of black sea bass pots south of Cape Canaveral, Florida. These gear restrictions have significantly reduced the impact of the fishery on coral and live/hard bottom habitat in the South Atlantic Region.

Additional management measures in Amendment 8 (SAFMC 1997), including specifying allowable bait nets and capping effort, have protected habitat by making existing regulations more enforceable. Establishing a controlled effort program limited overall fishing effort and to the extent there is damage to the habitat from the fishery (e.g. black sea bass pots, anchors from

fishing vessels, impacts of weights used on fishing lines and bottom longlines), limited such impacts.

In addition, measures in Amendment 9 (SAFMC 1998b), that include further restricting longlines to retention of only deepwater species and requiring that black sea bass pot have escape panels with degradable fasteners, reduce the catch of undersized fish and bycatch and ensure that the pot, if lost, will not continues to "ghost" fish. Amendment 13C (SAFMC 2006) increased mesh size in the back panel of pots, which has reduced bycatch and retention of undersized fish. Amendment 15B (SAFMC 2008b), which has been approved by the Secretary of Commerce includes an action that would implement sea turtle bycatch release equipment requirements, and sea turtle and smalltooth sawfish handling protocols and/or guidelines in the permitted commercial and for-hire snapper grouper fishery.

Amendment 16 (SAFMC 2008c), includes an action, which is intended to reduce bycatch by requiring fishermen use dehooking devices. Limiting the overall fishing mortality reduces the likelihood of over-harvesting of species with the resulting loss in genetic diversity, ecosystem diversity, and sustainability.

Measures adopted in the Coral and Shrimp FMPs have further restricted access by fishermen that had potential adverse impacts on essential snapper grouper habitat. These measures include the designation of the *Oculina* Bank HAPC and the Rock Shrimp closed area (see the Shrimp and Coral FMP/Amendment documents for additional information).

The Council's Comprehensive Habitat Amendment (SAFMC 1998b) contains measures that expanded the *Oculina* Bank HAPC and added two additional satellite HAPCs. Amendment 14 (SAFMC 2007), established marine protected areas where fishing for or retention of snapper grouper species would be prohibited.

6.4 Relationship of Short-Term Uses and Long-Term Productivity

The relationship between short-term uses and long-term productivity will be affected by this amendment. The proposed actions could significantly restrict the harvest of red snapper, and co-occurring snapper grouper species in the short-term for both the commercial and recreational sectors of the fishery. However, reductions in harvest are expected to benefit the long-term productivity of these species.

6.5 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments are defined as commitments that cannot be reversed, except perhaps in the extreme long-term, whereas irretrievable commitments are lost for a period of time. There are no irreversible commitments for this amendment. While the proposed actions would result in irretrievable losses in consumer surplus and angler expenditures, failing to take action would compromise the long-term sustainability of the South Atlantic red snapper stock.

Since the Snapper Grouper FMP and its implementing regulations are always subject to future changes, proceeding with the development of Amendment 17A does not represent an irreversible or irretrievable commitment of resources. NOAA Fisheries Service always has discretion to amend its regulations and may do so at any time, subject to the Administrative Procedures Act.

6.6 Unavailable or Incomplete Information

The Council on Environmental Quality, in its implementing regulations for the National Environmental Policy Act, addressed incomplete or unavailable information at 40 CFR 1502.22 (a) and (b). That regulations has been considered. There are two tests to be applied: 1) Does the incomplete or unavailable information involve "reasonable foreseeable adverse effects…;" and 2) is the information about these effects "essential to a reasoned choice among alternatives…".

A stock assessment has been conducted for red snapper using the best available data available. Status determinations for red snapper were derived from the SEDAR process, which involves a series of three workshops designed to ensure each stock assessment reflects the best available scientific information. The findings and conclusions of each SEDAR workshop are documented in a series of reports, which are ultimately reviewed and discussed by the Council and their SSC. SEDAR participants, the Council advisory committees, the Council, and NOAA Fisheries Service staff reviewed and considered any concerns about the adequacy of the data. **Appendix Q** lists data needs that resulted from the most recent snapper grouper assessments. The Council's SSC determined that the red snapper assessment is based on the best available data, and additional data is not available at this time because the SEDAR assessment scheduled for 2010 has not yet been initiated. This assessment will include the effect of a recent wave of recruits entering the fishery on overall abundance and subsequent harvest reductions need to rebuild the stock.

The Council's Snapper Grouper Committee acknowledged, while stock assessment findings can be associated with different degrees of uncertainty, there is no reason to assume such uncertainty leads to unrealistically optimistic conclusions about stock status. Rather, the stocks could be in worse shape than indicated by the stock assessment. Uncertainty due to unavailable or incomplete information should not be used as a reason to avoid taking action. Therefore, there are reasonable foreseeable significant adverse effects of not taking action to end overfishing. Failure to take action could result in a worsening of stock status, persistent foregone economic benefits, and more severe corrective actions to end overfishing in the future.

Where information is unavailable or incomplete, such as is the case with estimates of dead discards that could occur when a species is incidentally caught during a seasonal closure or after a quota is met, management measures have been designed to adopt a conservative approach to increase the probability overfishing does not occur. None of the impacts of decisions made despite the above mentioned unavailable and incomplete information would be catastrophic in nature as described in Section 1502.22(4) of implementing regulations for NEPA. It should also be noted that a benchmark assessment for red snapper is scheduled to be completed in December 2010. This assessment may provide some analysis that was not available during the

development of Amendment 17A. Any changes to red snapper management that may result from the outcome of the 2010 assessment would be analyzed in a separate NEPA document.

7 Social Impact Assessment

7.1 Introduction

Mandates to conduct Social Impact Assessments (SIA) come from both the National Environmental Policy Act (NEPA) and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). NEPA requires Federal agencies to consider the interactions of natural and human environments by using a "...systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences...in planning and decision-making" [NEPA section 102 (2) (a)]. Under the Council on Environmental Quality's (CEQ, 1986) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, a clarification of the terms "human environment" expanded the interpretation to include the relationship of people with their natural and physical environment (40 CFR 1508.14). Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects which may be direct, indirect or cumulative (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment, 1994).

Under the Magnuson-Stevens Act, fishery management plans (FMPs) must "...achieve and maintain, on a continuing basis, the optimum yield from each fishery" [Magnuson-Stevens Act section 2 (b) (4)]. When considering "…a system for limiting access to the fishery in order to achieve optimum yield…" the Secretary of Commerce and Regional Fishery Management Councils are to consider both the social and economic impacts of the system [Magnuson-Stevens Act section 303 (b) (6)]. Recent amendments to the Magnuson-Stevens Act require that FMPs address the impacts of any management measures on the participants in the affected fishery and those participants in other fisheries that may be affected directly or indirectly through the inclusion of a fishery impact statement [Magnuson-Stevens Act section 303 (a) (9)]. National Standard 8, requires that FMPs must consider the impacts upon fishing communities to assure their sustained participation and minimize adverse economic impacts upon those communities [Magnuson-Stevens Act section 301 (a) (8)].

7.2 Problems and Methods

Social impacts are generally the consequences to human populations that follow from some type of public or private action. Those consequences may include alterations to "...the ways in which people live, work or play, relate to one another, organize to meet their needs and generally cope as members of a society..." (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment, 1994:1). Social impact analyses can be used to determine possible consequences management actions may have on fishing dependent communities. In order to do a full social impact analysis it is necessary to identify community participants who depend upon the fisheries in that area and to identify the amount

of dependency they have upon a given fishery. Further it is necessary to understand the other opportunities for employment that exist within the community should fishery management measures become so restrictive that participants must switch their focus to other fisheries or other jobs outside of the fishing industry. Public hearings and scoping meetings may provide input from those concerned with a particular action, but they do not constitute a full overview of those that depend on the fishing industry.

In attempting to assess the social impacts of the proposed amendment it must be noted that there is not enough data on all participants who are involved with the snapper grouper fishery at the community level to do a complete overview of the fishery; therefore, analyses cannot predict all social impacts. However, secondary data such as landings data, license data, permits data, and information on communities such as Census data, can help to describe the communities involved in the snapper grouper fishery in the South Atlantic.

Today, more fisheries are managed by quotas and/or have restrictions on the number of participants. This limits the other opportunities fishermen who fish for species in the snapper-grouper complex to target other species to make up for reduced harvests of the snapper-grouper species.

Based on an analysis of secondary data, there are not any communities in the South Atlantic region that are completely dependent on the snapper grouper fisheries, although several are heavily involved with the commercial or recreational snapper grouper fishery. Any reduction in harvest has the potential to put fishermen and fishing dependent businesses out of business. Some recreational and commercial fishermen may decide it is not worth fishing for very limited bag limits, reduced total allowable catches or for only a few species. Decisions on whether to stay in the fishery or to leave for another type of employment often depends on the circumstances of the individual such as whether or not they own their fishing boat, how much longer they intended to fish before retirement, if there is other family income, etc. At this time, there is insufficient information on fishermen to be able to fully describe what they may do with reduced catches, shorter fishing seasons, and/or closed areas.

In the future, fishermen, fishing dependent businesses, and communities involved in the snapper grouper fisheries will benefit when overfishing is stopped and the fishery is rebuilt. However, for the short-term, the closing of specified areas, seasonal closures, reduced catch limits, and other measures that are necessary to stop overfishing and rebuild stocks, will all have negative impacts on those involved in the fishery. The average age of commercial fishermen is increasing, and fewer young people are becoming commercial fishermen. A fishery that is rebuilt in 15, 20, or even 25 years may be of no help to fishermen who will be impacted now by new regulations because they may be too old to fish when the fishery is rebuilt. Because fewer young people are choosing to fish, there may be the possibility that there may not be many commercial fishermen to harvest quotas once the fishery is rebuilt.

Communities that depend on the fishing industry throughout the South Atlantic are facing increasing challenges due to increased regulations that reduce catch for both the recreational and commercial fishing sector. If commercial catches are reduced, there can be a reduction in fish houses and processors, or a loss of jobs in the processing sector. Some fishermen may

decide they can no longer make a living in the fishing industry and leave the industry for other jobs. Overall, fewer young people are becoming fishermen due to the difficulty of making a living fishing. If the harvest levels are reduced for recreational sector, this will have a negative impact on charter and party boat operators, private boat owners, and businesses such as bait shops, marinas, hotels, and restaurants that cater to recreational fishermen.

Communities are also facing increasing challenges due to development and gentrification. As more water front property is developed for non-fishing uses such as locations for condominiums, hotels, restaurants, etc., fishing related businesses are in competition over land. Development often increases taxes which make it difficult for fishing docks, processors, and other businesses to stay near the water. In the last few decades more fishermen have had to move inland due to the rising cost of housing and taxes for water front property. This has changed the dynamics of some areas that were once built around the fishing industry.

Profiles of the communities expected to be affected by the actions in this proposed amendment are provided in **Section 3.8.3**, while a discussion of the expected social effects of each alternative considered is provided in **Section 4**.

7.3 Environmental Justice Considerations

Executive Order 12898 requires federal agencies conduct their programs, policies, and activities in a manner to ensure individuals or populations are not excluded from participation in, or denied the benefits of, or subjected to discrimination because of their race, color, or national origin. In addition, and specifically with respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence. Executive order 12898, February 11, 1994, is entitled Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations.

Persons employed in the snapper-grouper fishery and associated businesses and communities along the South Atlantic coast would be expected to be affected by this proposed action. Information on the race and income status for groups at the different participation levels (vessel owners, crew, dealers, processors, employees, employees of associated support industries, etc.) is not available. County level data, however, for the communities profiled in **Section 3.8.3** have been assessed to examine potential EJ concerns. Because this proposed action would be expected to affect fishermen and associated industries in numerous communities along the South Atlantic coast and not just those profiled, it is possible that other counties or communities have poverty or minority rates that exceed the EJ thresholds.

In order to identify the potential for EJ concern, the rates of minority populations (non-white, including Hispanic) and the percentage of the population that was below the poverty line were examined. The threshold for comparison that was used was 1.2 times the state average such that, if the value for the community or county was greater than or equal to 1.2 times the state average, then the community or county was considered an area of potential EJ concern. Census data for

the year 2000 was used Estimates of the state minority and poverty rates, associated thresholds, and community rates are provided in Table 7-1.

Based on available demographic information, only the poverty rate for Beaufort, North Carolina suggests potential EJ concern, with a poverty rate of 16.6 percent, which exceeds the state threshold of 14.76 percent. This single instance might suggest potential EJ concerns are minimal. As noted above, however, additional communities beyond those profiled would be expected to be affected by the actions in this proposed amendment. Because these communities have not been profiled, the absence of additional potential EJ concerns cannot be assumed and the total number of communities that exceed the thresholds in unknown.

However, while some communities expected to be affected by this proposed amendment may have minority or economic profiles that exceed the EJ thresholds and, therefore, may constitute areas of concern, no EJ issues have been identified during the scoping process nor are any expected to arise as a result of this proposed amendment (See **Appendix M**, Scoping Comments Summary). No negative environmental consequences are expected to accrue to this proposed amendment. While adverse social and economic consequences are expected to accrue to fishermen in the snapper-grouper fishery and associated industries and communities due to the reduction of expenditures and revenues associated with changes in fishing behavior and harvest levels, the environmental consequences of this proposed amendment are expected to be positive. This proposed amendment is expected to reduce the take and mortality of an overfished species, red snapper, and also result in the possible reduction in the mortality of other species. Protection of red snapper would be expected to assist in the rebuilding of this resource and the reduced mortality of additional species would be expected to increase the environmental benefits these species contribute to the marine environment and the general health and condition of this environment. These measures are also not expected to result in increased risk of exposure of affected individuals to adverse health hazards.

Table 7-1. Environmental Justice Thresholds (2000 U.S. Census data).

State	Community	Minority Rate	Minority Threshold*	Poverty Rate	Poverty Threshold*
Florida		34.60	41.52	12.50	15.00
	Cape Canaveral	8.10		11.60	
	Marathon	26.70		14.20	
Georgia		37.40	44.88	13.00	15.60
	Townsend**	39.10		14.60	
South Carolina		33.90	40.68	14.10	16.92
	Little River	9.10		7.50	
North Carolina		29.80	35.76	12.30	14.76
	Atlantic City	2.60		7.30	
	Beaufort	25.40		16.60	
	Hatteras Village	6.60		10.00	
	Morehead City	19.20		14.60	
	Sneads Ferry	9.70		13.50	
	Wanchese	3.30		8.10	

*Calculated as 1.2 times the state rate.
**Values are for entire McIntosh County.

8 List of Preparers

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NMFS = National Marine Fisheries Service, SAFMC = South Atlantic Fishery Management Council, SF = Sustainable Fisheries Division, PR = Protected Resources Division, SERO = Southeast Regional Office, HC = Habitat Conservation Division, GC = General Counsel

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9 List of Agencies, Organizations, and Persons To Whom Copies of the Statement Are Sent

Responsible Agency

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List of Agencies, Organizations, and Persons Consulted

SAFMC Law Enforcement Advisory Panel
SAFMC Snapper Grouper Advisory Panel
SAFMC Marine Protected Areas Advisory Panel
SAFMC Scientific and Statistical Committee
SAFMC Education and Outreach Advisory Panel
North Carolina Coastal Zone Management Program
South Carolina Coastal Zone Management Program
Georgia Coastal Zone Management Program
Florida Coastal Zone Management Program
Florida Fish and Wildlife Conservation Commission
Georgia Department of Natural Resources
South Carolina Department of Natural Resources
North Carolina Division of Marine Fisheries
North Carolina Sea Grant
South Carolina Sea Grant
Georgia Sea Grant
Florida Sea Grant
Atlantic States Marine Fisheries Commission
Gulf and South Atlantic Fisheries Development Foundation
Gulf of Mexico Fishery Management Council
National Marine Fisheries Service
- Washington Office
- Office of Ecology and Conservation
- Southeast Regional Office
- Southeast Fisheries Science Center

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Appendix A. Alternatives the Council considered but eliminated from detailed study, and a brief discussion of the reasons for their elimination.

This section describes alternatives to the proposed actions that the Council considered in developing this document, but decided not to pursue. The description of each alternative is followed by a summary statement of why it was eliminated from more detailed summary. Note that some actions were removed when red snapper was included in Amendment 17, which addressed 10 species experiencing overfishing. The Council subsequently placed only red snapper in its own Amendment 17A.

Rejected Alternatives 1. Modify the Council's current definition of Optimum Yield (OY) for red snapper undergoing overfishing by using the sum of the sector ACTs (Table 1).

Table 1. OY alternatives for ten species undergoing overfishing.

Alternatives	OY equation	F_{OY} equals
Alternative 1.	OY equals the sum of the sector ACTs.	_____ pounds (will be added after the Committee & Council specify ACTs.)

Rationale for elimination: The Council had considered this action because of concern that the ACL and ACT could be at or below the ABC. Amendment 17A includes an action to specify OY for red snapper. The Council is not considering establishing ACTs for red snapper at this time.

Rejected Alternatives 2 and 3. Modify the Council's current definition of minimum stock size threshold (MSST) for red snapper (Table 2).

Table 2. MSST alternatives for red snapper.

Alternatives	MSST equation
Alternative 3.	MSST equals $SSB_{MSY}(0.5)$.
Alternative 4.	MSST equals $SSB_{MSY}(0.75)$.

Rationale for elimination: The Council has modified the definition of MSST for snowy grouper and golden tilefish over concern that recruitment fluctuations could cause a reoccurring overfished status determination for these species. The low value for natural mortality creates a numerical similar value for MSST and SSB_{MSY}. Despite a low natural mortality rate for red snapper, the Council is not considering modifying MSST at this time.

This was an action in the original Amendment 17 when 10 species were being considered and not just red snapper in Amendment 17. The natural mortality rate (M) for most of the species is not on the scale of snowy grouper (M = 0.12) and golden tilefish (M = 0.08). However, the M for red snapper is also very low (M = 0.08). The Council did not feel it was necessary to address MSST at this time since biomass is currently at very low levels. Based on the SEDAR 15

(2008) stock assessment and the Council's preferred rebuilding schedule, it will be more than 30 years before stock biomass is close is close to MSST of B_{MSY}. The Council felt it was more appropriate to delay discussion and analysis of MSST to a future amendment and deal with more pressing issues of ending overfishing and rebuilding the red snapper stock in Amendment 17A.

Rejected Alternatives 4-7. Define allocations for red snapper (Table 3).

Alternative 4. Define allocations based upon landings from the ALS, MRFSS, and headboat databases. The allocation would be based on landings from the years 1986-2007.

Alternative 5. Define allocations based upon landings from the ALS, MRFSS, and headboat databases. The allocation would be based on landings from the years 2005-2007.

Alternative 6. Define allocations based upon landings from the ALS, MRFSS, and headboat databases. The allocation would be based on the following formula for each sector:
Sector apportionment = (50% * average of long catch range (lbs) 1986-2007) + (50% * average of recent catch trend (lbs) 2005-2007)

Alternative 7. Split the allocation equally among the three sectors.

<u>Rationale for elimination</u>: Council is considering allocations based on historic catch between the commercial, for-hire, and recreational sectors as part of one of the management alternatives, which would allow some harvest of red snapper. This alternative has been moved to considered but rejected appendix. For other alternatives, which would allow no harvest or an allowable level of red snapper discards, the Council has decided that implementing a single ACL is a preferable way to manage as red snapper. The Council's preferred management measure prohibits all commercial and recreational harvest until modified in the future. As the stock rebuilds, management measures will likely be adjusted by the Council to allow harvest of red snapper. At that point, the Council may want to reconsider allocations for red snapper.

Table 3. Percent allocations from allocation alternatives for red snapper. CM = Commercial, RC = Recreational, FH = For Hire, PR = Private Recreational, NS=Not Specified.

Species	**Alt. 1. No Action**		**Alt. 2. 1986-2007**			**Alt. 3. 2005-2007**			**Alt. 4. Equation**			**Alt. 5. Split Evenly**		
	CM	**RC**	**CM**	**FH**	**PR**	**CM**	**FH**	**PR**	**CM**	**FH**	**PR**	**CM**	**FH**	**PR**
Red snapper	NS	NS	30%	30%	40%	26%	33%	41%	28%	31%	41%	33%	33%	33%

Rejected Alternative 8. Prohibit commercial and recreational harvest, possession, and retention of species in the Snapper Grouper FMU in an area that includes commercial logbook grids 2880, 2980, 2981, 3179, 3080, 3081, 3180, 3181, 3278, 3279, 3280, 3378, and 3379.

Rejected Alternative 9. Prohibit commercial and recreational harvest, possession, and retention of species in the Snapper Grouper FMU in an area that includes commercial logbook grids 2880, 2980, 2981, 3179, 3080, 3081, 3180, 3181, 3278, 3279, 3280, 3378, and 3379. Allow commercial black sea bass pots, commercial harvest of golden tilefish by vessels with a hook-and-line or longline endorsement, and spearfishing.

<u>Rationale for elimination</u>: The Council believes that spatial management will be a component of the management measures to end overfishing and rebuild the red snapper stock in the South Atlantic. However, one of the Council's stated objectives is to minimize the economic and social effects of a snapper and grouper prohibition in an area by proposing an area that is no larger than necessary to achieve reductions in fishing mortality. In order to accomplish this, the Council proposes to prohibit snapper grouper harvest in locations where the majority of the red snapper abundance and fishing mortality occurs (Figure 1). Some of the grids listed in Rejected Alternatives 8 and 9 include locations where only a small amount of red snapper are caught.

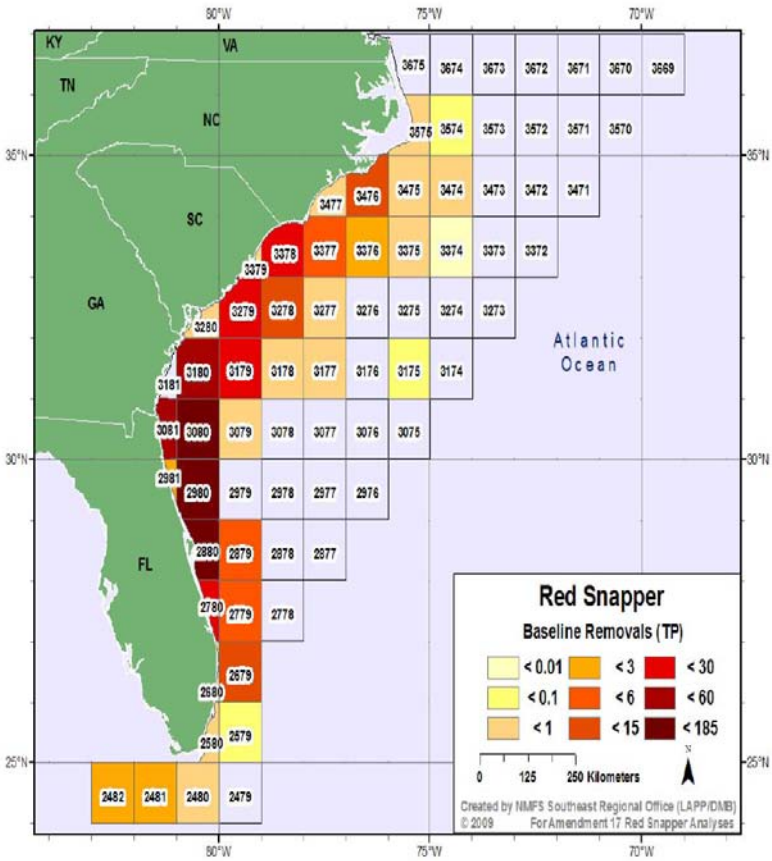


Figure 1. Baseline removals of South Atlantic red snapper by logbook grid, 2005-2007. Removals include landings and dead discards in throusands of pounds (TP) from the commercial, headboat and private/charterboat sectors.

Rejected Alternative 10. Modify the bag and/or size limit.

> **Sub-alternative 10a.** Remove the existing commercial and recreational 20 inch size limit.
> **Sub-alternative 10b.** Reduce the bag limit to 1.

Rationale for elimination: The Council's preferred rebuilding strategy would require an 83% reduction in total removals. Neither a reduction in bag limit to 1 fish per person or a removal of the size limit will achieve this reduction (Table 4).

Table 4. Reduction in harvest associated with reducing the bag limit for red snapper to 1 fish per person per day. Includes non-compliance with bag limit, and 40% release mortality. Based on data from 2003-2007.

Sector	Bag limit 1 % reduction
Private	1.96
Charter	5.00
Private/Charter Combined	3.26
Headboat	3.12
All rec	3.22

Annual Catch Limits

Rejected Alternative 11. ACL equals ABC.
Rejected Alternative 12. ACL equals 90% of the ABC.
Rejected Alternative 13. ACL equals 80% of the ABC.

Annual Catch Targets for the Commercial Sector

Rejected Alternative 14. The commercial sector ACT equals the commercial sector ACL.
Rejected Alternative 15. The commercial sector ACT equals 90% of the commercial sector ACL.
Rejected Alternative 16. The commercial sector ACT equals 80% of the commercial sector ACL.

Annual Catch Targets for the Recreational Sector

Rejected Alternative 17. The recreational sector ACT equals 85% of the private recreational sector ACL.
Rejected Alternative 18. The recreational sector ACT equals 75% of the private recreational sector ACL.

Rejected Alternative 19. The recreational sector ACT equals sector ACL[(1-PSE) or 0.5, whichever is greater].

Accountability Measures for the Commercial Sector

Rejected Alternative 20. Implement Accountability Measures for the commercial sector for **species undergoing overfishing**. If the sector ACT is projected to be met, prohibit the harvest and retention of species or species group. If the sector ACL is exceeded, the Assistant Administrator shall publish a notice to **reduce the sector ACT** in the following year by the amount of the overage.

Rejected Alternative 21. Implement Accountability Measures for the commercial sector for **species undergoing overfishing**. If the sector ACT is projected to be met, prohibit the harvest and retention of species or species group. If the sector ACL is exceeded, the Assistant Administrator shall publish a notice to **reduce the length of the following fishing year** by the amount necessary to recover the overage from the prior fishing year.

Rejected Alternative 22. Implement Accountability Measures for the commercial sector **for species undergoing overfishing**. **If the species is overfished or not overfished and the sector ACT** is projected to be met, prohibit the harvest and retention of species or species group. **If the species is overfished and the sector ACL is exceeded**, the Assistant Administrator shall publish a notice to reduce the sector ACT in the following year by the amount of the overage. **If the species is not overfished and the sector ACL** is exceeded, the Assistant Administrator shall publish a notice to reduce the length of the following fishing year by the amount necessary to recover the overage from the prior fishing year.

Accountability Measures for the Recreational Sector

Rejected Alternative 23. Implement Accountability Measures (AMs) for the recreational sector for species undergoing overfishing. **The AM would not vary depending on stock status.**

> **Sub-alternative 23A**. Do **not implement *in season* AMs if the sector ACT is projected to be met**. If the sector ACL is exceeded, the Assistant Administrator shall publish a notice to **reduce the length of the following fishing year** by the amount necessary to ensure landings do not exceed the sector ACT for the following fishing year.
>
> **Sub-alternative 23B. Do not implement *in season* AMs if the sector ACT is projected to be met**. If the sector ACL is exceeded, the Assistant Administrator shall publish a notice to **reduce the sector ACT** in the following year by the amount of the overage.

Sub-alternative 23C. If the sector ACT is projected to be met, prohibit the harvest and retention of species or species group. If the sector ACL is exceeded, the Assistant Administrator shall publish a notice to **reduce the length of the following fishing year** by the amount necessary to recover the overage from the prior fishing year.

Sub-alternative 23D. If the sector ACT is projected to be met, prohibit the harvest and retention of species or species group. If the sector ACL is exceeded, the Assistant Administrator shall publish a notice to **reduce the sector ACT** in the following year by the amount of the overage.

Alternative 24. Implement Accountability Measures for the recreational sector for species undergoing overfishing. **The AM would vary depending on stock status.**

Sub-alternative 24A. Do not implement ***in season*** AMs if the sector ACT is projected to be met. **If the species is overfished and the ACL is exceeded**, the Assistant Administrator shall publish a notice to reduce the sector ACT in the following year by the amount of the overage. **If not overfished and the ACL is exceeded**, the Assistant Administrator shall publish a notice to reduce the length of the following fishing year by the amount necessary to ensure landings do not exceed the sector ACT for the following fishing year.

Sub-alternative 24B. If the sector ACT is projected to be met, prohibit the harvest and retention of species or species group. **If the species is overfished and the ACL is exceeded**, the Assistant Administrator shall publish a notice to reduce the sector ACT in the following year by the amount of the overage. **If not overfished and the ACL is exceeded**, the Assistant Administrator shall publish a notice to reduce the length of the following fishing year by the amount necessary to ensure landings do not exceed the sector ACT for the following fishing year.

Alternative 25. Compare ACL in Alternatives 2 and 3 with recreational landings over a range of years. For 2010, use only 2010 landings. For 2011, use the average landings of 2010 and 2011. For 2012 and beyond, use three year running average.

<u>Rationale for elimination</u>: During the development process of Amendment 17, which subsequently became Amendments 17A and 17B, the Council considered a system that would establish allocations, annual catch limits (ACLs), annual catch targets (ACTs), and accountability measures (AMs) for the ten species undergoing overfishing (including red snapper) with the SSC's ABC recommendation as an upper limit. Under this system, the Council would then evaluate whether current regulations would be expected to keep the mortality below the ACT for each of these species. If not, the Council would propose regulatory changes.

Due to the variability in recreational landings data, the Council is using a running average of landings over a series of years to compare with the recreational ACL to

invoke AMs. However, since the intent of the Council is to prohibited harvest of recreational and commercial harvest of red snapper, the Council did not feel that this alternative was necessary at this time. It is anticipated that red snapper harvest will be allowed in the near future as the stock rebuilds and the Council may want to consider the use of a three year running average in the future for comparison with a recreational ACL.

Rejected Alternative 26. Allow red snapper harvest, based on a quota for the commercial fishery, a quota for the for-hire fishery (utilizing electronic logbooks), and a quota for the private recreational fishery (based on a quota tag system administered by the states).

Once the catch limits are reached in Georgia, South Carolina, and Florida, bottom fishing is prohibited beyond 98 feet. Dead discards inshore of 98 feet must be taken off the top before quotas are established. Possibly eliminate the 20-inch size limit.

Rationale for elimination:

This analysis will use two sets of allocations for comparison (Table 5) and evaluates two ACLs

Table 5. Allowable total removals or red snapper for commercial, private, and for-hire sectors based on landings data from 2003-2008.

	ALT 2 - 60% rec./40% Comm. Where 36% Private; 24% for-hire.		**ALT 3 - EQUATION (.50)(86-08)+(.50)(06-08). Comm = 28%; Private 43%; For-Hire 29%.**	
ACL	**ACL=61,000**	**ACL=82,000**	**ACL=61,000**	**ACL=82,000**
Commercial				
FL & GA	18,034	24,242	12,624	16,970
SC	4,544	6,109	3,181	4,276
NC	1,822	2,449	1,275	1,714
Totals	24,400	32,800	17,080	22,960
Private Recreational				
FL	20,218	27,178	24,149	32,463
GA	1,089	1,464	1,301	1,749
SC	390	524	466	626
NC	263	354	314	422
Totals	21,960	29,520	26,230	35,260
For Hire (Headboat & Charter)				
FL	10,632	14,292	12,847	17,270
GA	1,325	1,781	1,601	2,152
SC	1,656	2,226	2,001	2,689
NC	1,027	1,381	1,241	1,668
Totals	14,640	19,680	17,690	23,780

According to the proposed alternative, estimates of total removals inside of 98 feet would have to be subtracted from Table 5 above before quotas would be established. A small percentage of red snapper harvest/interactions occur outside the proposed closed areas. NMFS developed a program where various parameters could be adjusted (e.g., areas closed, release mortality, depth) to evaluate the change in percent reduction in projected red snapper mortality. It may be possible to roughly estimate the amount of total removals inside of 98 feet using the program. Regardless, as values in Table 5 are very small, this would leave an even smaller amount of allowable total removals for the commercial, private, and for-hire sectors.

Based on catch rates of landed and discarded red snapper in 2007 and 2008, the allowable catch for each sector would be estimated to be met in less than one month (Tables 6-10). The approach would require extensive observer coverage, implementation of electronic logbooks, and establishment of some sort of tagging system. Additionally, not all states possess the administrative resources to implement such a tagging program. Discarded red snapper would have to be closely tracked in addition to harvests and release mortality rates would need to be applied to the discards to ensure total removals allocated to state and sector is not exceeded. The SSC has strongly opposed tracking discards as a means of monitoring fishery catch levels, and depending on self reported discards may create a disincentive for reporting if the fishery were close a result of them doing so.

Table 6. Monthly commercial landings (pounds whole weight) of red snapper.

Month	2007	2007 cumulative	2008	2008 cumulative
1	7,646	7,646	12,072	12,072
2	6,666	14,312	17,064	29,136
3	4,688	19,000	20,247	49,383
4	6,751	25,751	17,804	67,187
5	8,038	33,789	20,322	87,509
6	18,234	52,023	23,557	111,066
7	7,408	59,431	26,829	137,895
8	9,608	69,039	9,065	146,960
9	8,443	77,482	12,394	159,354
10	8,663	86,145	14,054	173,408
11	12,225	98,370	16,884	190,292
12	18,564	116,934	42,975	233,267

Table 7. Monthly headboat and MRFSS for-hire landings (pounds whole weight) of red snapper.

Year	2007	2007 cumulative	2008	2008 cumulative
1	7,342	7,342	14,446	14,446
2	6,733	14,075	24,720	39,166

Year	2007	2007 cumulative	2008	2008 cumulative
3	4,928	19,003	18,459	57,625
4	5,904	24,908	17,332	74,957
5	13,964	38,872	39,791	114,748
6	14,661	53,533	36,198	150,946
7	5,800	59,333	49,851	200,797
8	5,748	65,081	43,596	244,394
9	2,178	67,259	3,979	248,373
10	1,863	69,122	6,658	255,031
11	13,042	82,164	10,986	266,017
12	14,689	96,853	9,319	275,336

Table 8. MRFSS non for-hire landings (pounds whole weight) of red snapper by wave.

Wave	2007	2007 cumulative	2008	2008 cumulative
1	12,390	12,390	42,227	42,227
2	5,946	18,336	53,693	95,920
3	131,202	149,538	201,827	297,747
4	44,528	194,066	72,690	370,437
5	43,618	237,684	76,744	447,181
6	6,067	243,751	94,661	541,842

Table 9. Red snapper landings and discards (numbers) from for-hire fishery (headboat and MRFSS) for 2008.

Month	number caught	number discarded
1	2,338	13,600
2	3,310	16,865
3	3,338	10,020
4	2,817	13,696
5	5,612	15,075
6	5,428	13,814
7	7,511	11,626
8	6,614	8,987
9	747	3,045
10	1,076	4,767
11	1,959	5,624
12	1,547	5,132

*Discards are only available in numbers of fish.

Table 10. Red snapper landings and discards (numbers) from non for-hire fishery (MRFSS) for 2008.

Wave	number caught	number discarded
1	9,764	72,086
2	9,772	54,883
3	28,986	85,734
4	11,612	43,470
5	11,112	35,181
6	16,700	60,860

*Discards are only available in numbers of fish.

Rejected Alternative 27. Implement the following:

(1) Buy-out Georgia commercial fishermen. No red snapper sale allowed.
(2) For the recreational sector. Bag limit = 1/person/day (not including captain/crew).
(3) Remove size limit.
(4) Off a portion of the coast, prohibit bottom-fishing for six months (Oct.1 to March 31).
(5) During April 1 to September 30, when 12,000 lbs is harvested, enact the same prohibition mentioned above.
(6) Monitor discards through self-reporting.
(7) Begin construction of artificial habitat.
(8) Between 98-240 feet, only single hook rigs are permitted and prohibit electric reels.

Rationale for elimination:

An 83% reduction in total removals is needed for the preferred rebuilding strategy (97%$F_{Rebuild}$) (Table 11). The alternative proposed would not end overfishing of red snapper without larger areas closed off of Florida and South Carolina. Therefore, the Georgia proposal represents a partial alternative since the other affected states would have to develop their alternatives and combine them with the Georgia proposal in order to achieve the necessary reductions in red snapper mortality.

Table 11. Reduction in total removals (landings plus dead discards) needed end overfishing. Determined by comparing expected landings in 2010 to average landings during 2006-2007. Non-shaded areas determined by comparing estimated landings in 2009 with allowable removals in 2010. Shaded areas are estimated by interpolation. Alternatives 2-5 use $F_{40\%}$ as F_{MSY} proxy; Alternatives 6-9 use $F_{30\%}$ as F_{MSY} proxy. Council's preferred choice is to use very high recruitment with $F_{40\%SPR}$ proxy for F_{MSY}.

Fmsy proxy	F40% proxy				F30% proxy			
	Base Estimated Recruitment	High Recruitment	Very High Recruitment	Extremely High Recruitment	Base Estimated Recruitment	High Recruitment	Very High Recruitment	Extremely High Recruitment
Alternative 2 and 6 (85% F_{MSY})	89%	88%	85%	81%	84%	83%	79%	79%
Alternative 3 and 7 (75% F_{MSY})	90%	89%	87%	85%	86%	85%	82%	81%
Alternative 4 and 8 (65% F_{MSY})	91%	90%	89%	87%	88%	87%	84%	83%
Alternative 5 and 9 (97% F_{MSY})	87%	86%	83%	81%	82%	81%	76%	73%

Development of a buy-out program for the commercial fishermen would require time, a currently unidentified source of funds, and would need to be agreed to by those affected. There would be concerns about using self-reporting catches when this information would be used to trigger a fishery closure. While elimination of the size limit would be expected to reduce the number of discarded red snapper, the total removals (harvested plus discarded fish) would be expected to increase (Tables 12 and 13). This assumes fishermen who caught at least two red snapper would now be expected to retain those fish and the current level of non-compliance would continue. It also assumes that red snapper that were regulatory discards would now be retained by fishermen who did fill their two fish bag limit. The tables do not reflect the effect of area closures but do show that elimination of the size limit would not reduce the magnitude of total removals.

Construction of artificial reefs, reducing the bag limit to one fish, and prohibiting captain and crew from retaining red snapper would provide a small reduction in harvest. It is expensive to create artificial habitat on the scale needed to mimic natural habitat. In addition, artificial reefs can attract both fish and fishermen so there might not be much benefit to the species. Since the bag limit of red snapper is currently two fish per person per day and few fishermen obtained the two fish bag during 2005-2008, a reduction in the bag limit to one fish per day would provide little reduction in harvest (~5% when 40% release mortality is included). Exclusion of captain and crew is included in the estimate.

Therefore, the reduction needed for ending overfishing of red snapper can primarily be obtained from a combination of a harvest prohibition for red snapper and area closures for all snapper-grouper species that reduces red snapper discards. It is not clear if the proposed 12,000 lbs is landed catch or total kill. Either way, it would require monitoring of discards, which the SSC opposes due to the possibility of under reporting discards. In addition, it is likely that 12,000 lbs would reached not long after the start of the fishing year.

Commercial logbook grids 3080 and 3180 represent the 3rd and 5th highest concentrations of red snapper, respectively. Partial closures of grids 3080 and 3081 may require full or partial closures of eight additional grids in order to end overfishing of red snapper.

The proposed alternative could have National Standard 4 concerns since they would allow some harvest for Georgia recreational fishermen, but Georgia commercial fishermen would not be allowed to harvest any fish. Furthermore, harvest would have to be prohibited in all other states for red snapper along with larger closed areas from other states.

It is not clear whether the proposal intends to close the open area after a quota/allocation is met. It is also unclear who is responsible for reporting harvest from the for-hire sector.

Table 12. Number harvested, released, and total removals of red snapper taken by recreational fishermen during 2003-2006 (SEDAR 15 2008). Dead discards determined by applying 40% release mortality to discarded fish. Total removals = harvest (landed fish) + dead discards. Total removals in closed fishery, where red snapper harvest is prohibited is determined by applying a 40% release mortality rate to the total of landed plus discarded fish.

Year	landed	discarded	dead discards	total removals	Total removals in closed fishery
2003	41,367	184,646	73,858	115,225	90,405
2004	49,728	242,306	96,922	146,650	116,814
2005	42,615	155,576	62,230	104,845	79,276
2006	32,962	168,126	67,250	100,212	80,435
average	41,668	187,664	75,065	116,733	91,733

Table 13. Expected number harvested, released, and total removals of red snapper taken by recreational fishermen during 2003-2006 if there was no size limit and a 2 fish bag limit. Dead discards determined by applying 40% release mortality to discarded fish. Total removals = harvest (landed fish) + dead discards.

Year	landed	discarded	dead discards	total removals
2003	100,508	125,506	50,202	150,711
2004	124,129	167,906	67,162	191,292
2005	106,053	92,141	36,856	142,909
2006	81,252	119,833	47,933	129,185
average	102,986	126,346	50,539	153,524

Table 14. Monthly headboat and MRFSS for-hire landings (pounds whole weight) of red snapper.

Year	2007	2007 cumulative	2008	2008 cumulative
1	7,342	7,342	14,446	14,446
2	6,733	14,075	24,720	39,166
3	4,928	19,003	18,459	57,625
4	5,904	24,908	17,332	74,957
5	13,964	38,872	39,791	114,748
6	14,661	53,533	36,198	150,946
7	5,800	59,333	49,851	200,797
8	5,748	65,081	43,596	244,394
9	2,178	67,259	3,979	248,373
10	1,863	69,122	6,658	255,031
11	13,042	82,164	10,986	266,017
12	14,689	96,853	9,319	275,336

Table 15. MRFSS non for-hire landings (pounds whole weight) of red snapper by wave.

Wave	2007	2007 cumulative	2008	2008 cumulative
1	12,390	12,390	42,227	42,227
2	5,946	18,336	53,693	95,920
3	131,202	149,538	201,827	297,747
4	44,528	194,066	72,690	370,437
5	43,618	237,684	76,744	447,181
6	6,067	243,751	94,661	541,842

Table 16. Red snapper landings and discards (numbers) from for-hire fishery (headboat and MRFSS) for 2008.

Month	number caught	number discarded
1	2,338	13,600
2	3,310	16,865
3	3,338	10,020
4	2,817	13,696
5	5,612	15,075
6	5,428	13,814
7	7,511	11,626
8	6,614	8,987
9	747	3,045
10	1,076	4,767
11	1,959	5,624
12	1,547	5,132

*Discards are only available in numbers of fish.

Table 17. Red snapper landings and discards (numbers) from non for-hire fishery (MRFSS) for 2008.

Wave	number caught	number discarded
1	9,764	72,086
2	9,772	54,883
3	28,986	85,734
4	11,612	43,470
5	11,112	35,181
6	16,700	60,860

*Discards are only available in numbers of fish.

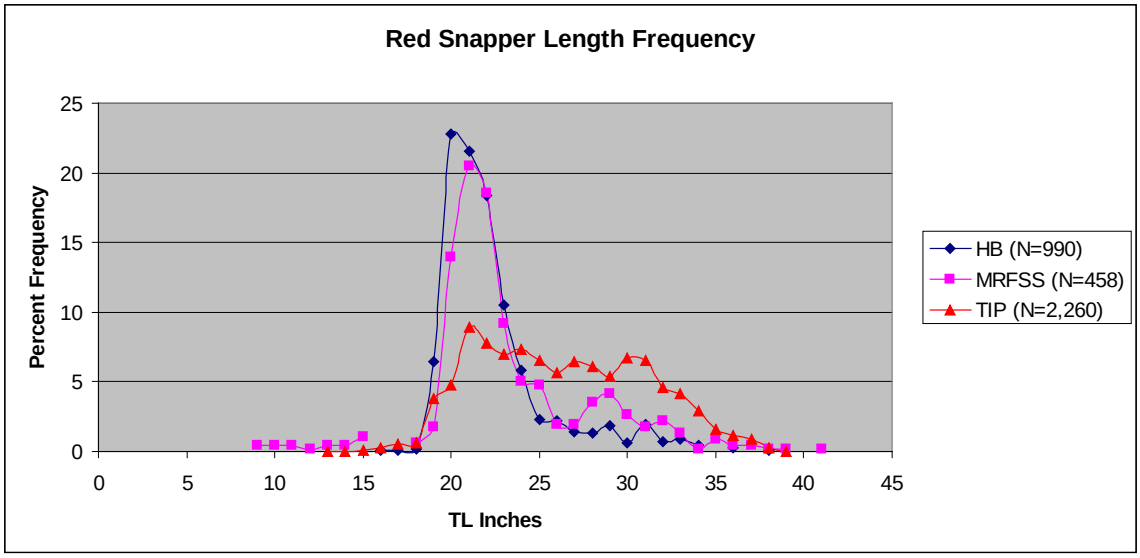
Rejected Alternative 28. Implement the following as recommended by the Snapper Grouper Advisory Panel at their August 2009 meeting:

Motion 1: In Amendment 17A, recommend that the council analyze the following recreational management measures off the coast of Georgia:
--6 month closure starting Oct 1
--bag limit to 1, excluding captain and crew (keep 1st fish caught)
--no min size limit
--max size limit 28”
--close 50% of live bottom to all snapper grouper harvest where red snapper are year-round (reconsider closure following next stock assessment)
--one hook per rod and reels, manual rod and reel only

Motion 2: 31 20 latitude line to be the northern end of the GA closure (northern section open to fishing).

Rationale for elimination:

This is very similar to Rejected Alternative 27. The major differences are Rejected Alternative 31 specifies the portion of the area to be closed and specifies maximum size limit of 28 inches. Most (92% headboat; 82% MRFSS; 66% commercial) of the red snapper taken by recreational and commercial fishermen during 2005-2008 were less than 28 inches TL. Therefore, the combination of eliminating the 20 inch TL size limit and establishing a maximum 28 inch size limit would likely increase total removals.


Red Snapper Length Frequency
Percent Frequency
25
20
15
10
5
0
0
5
10
15
20
25
30
35
40
45
TL Inches
HB (N=990)
MRFSS (N=458)
TIP (N=2,260)

Rejected Alternative 29. Implement the following as recommended by the Snapper Grouper Advisory Panel at their August 2009 meeting:

Motion 5: Recommend the Council investigate methods to reduce recreational limits through vessel limits (1/person or 4/vessels whichever is more restrictive) with adjustments to vessel limits following the next assessment. Also investigate a reduction in red snapper minimum size to 16"

Rationale for elimination:

Reductions in the bag limits to 1 fish per person and vessels limits of 4 red snapper would not be sufficient to end overfishing (Tables 19 and 20). Reduction in the bag limit from two fish per person per day to one fish per person per day would be expected to provide a five percent reduction in harvest when non-compliance and a 40% release mortality is considered (Table 19). Reductions in harvest with a 4 person vessel limit would be expected to provide reduction in harvest ranging from 3% for private recreational to 34% for headboats.

Reduction or elimination of a minimum size limit would increase the total removals because previously 60% of the fish less than 20 inches TL were believed to have survived the trauma of capture. With the establishment of a 16 inch TL size limit, a greater proportion (up to the two fish bag limit) of the red snapper between 16 and 20 inches would die.

Table 19. Bag limit analysis for red snapper with 40% release mortality and elimination of captain and crew based on data from 2005 to 2008.

Sector	Bag limit 1
Private	5.21
Charter	4.05
MRFSS	4.72
Headboat	7.05
All rec	5.30

Table 20. Reduction in red snapper harvest associated vessel limits for red snapper. Assumes 40% release mortality based on data from 2005-2008.

Vessel Limit Number	Charter	Private	Headboat
50	0	0	2.73
45	0	0	3.06
40	0	0	3.55
35	0	0	4.36
30	0	0	5.57
25	0.22	0	7.41
20	0.49	0	9.88
15	0.81	0	13.47
10	1.68	0.3	19.24
9	2.12	0.37	20.99
8	2.82	0.45	22.91
7	3.58	0.75	25.14
6	4.51	1.27	27.63
5	5.70	2.09	30.66
4	7.38	3.06	34.26
3	9.99	4.55	38.59
2	13.36	6.56	43.89
1	18.19	10.21	50.72

Rejected Alternative 30. Implement the following as recommended by the Snapper Grouper Advisory Panel at their August 2009 meeting:

Motion 8: Move SAFMC investigate alternative effort controls to achieve multi-species management objectives. The days-at-sea concept involves controlling multispecies harvest pressure (hooks in the water) by time rather than closure of areas.

Rationale for elimination:

The Council previously considered and rejected an alternative for Amendment 13C that would retain all commercial regulations currently in place for South Atlantic snapper grouper species. The alternative would allow each permit holder to designate two months when no commercial fishing for snapper grouper species would occur. These months would be printed on the permit or on a sticker to aid enforcement.

The Council rejected this alternative because it is not possible to determine if this strategy would end overfishing of snowy grouper, black sea bass, vermilion snapper, and black sea bass without knowing which months each fisherman would choose to refrain from fishing. Little reduction in harvest would be achieved if all fishermen selected months of historically lowest catches. The Council examined average aggregate snapper grouper landings by month for all permit holders to determine if the two months of lowest catch would provide an adequate reduction in harvest. If December and January (anecdotally the months when fishing is least desirable) were closed

for all permit holders, approximately a 14% reduction in snapper grouper landings would result, which is not adequate to end overfishing for any of the species (black sea bass, vermilion snapper, snowy grouper, and golden tilefish).

To effectively end overfishing of red snapper, fishing for all species would need to be closed for a period of time to prevent incidental catch. Examination of Table 21 indicates that 10 month closure of red snapper (for all sectors combined) could be needed to reduce harvest of red snapper or red snapper by 85%.

Other forms of effort control could be considered by the Council such as restrictions on the number of trips or days at sea. Tables 22 shows current effort levels for red snapper (with the exception of angler days for red snapper) and the number of trips/angler days if effort was reduced by 85%. The Council indicated that it could consider some other form of effort control such as a days at sea program in a future amendment.

Table 21. Average monthly catch (pounds whole weight) of red snapper during 2007 and 2008.

Month	comm	Headboat	MRFSS	Total	Percent	Cum Perc
1	9,859	2,115	22,433	34,407	4.58%	4.58%
2	11,865	6,948	22,433	41,246	5.49%	10.07%
3	12,468	9,409	17,194	39,071	5.20%	15.27%
4	12,278	9,334	17,194	38,806	5.16%	20.43%
5	14,180	9,206	98,371	121,757	16.20%	36.63%
6	20,896	10,316	98,371	129,582	17.24%	53.88%
7	17,119	6,270	50,860	74,248	9.88%	63.76%
8	9,337	3,117	50,860	63,313	8.43%	72.19%
9	10,419	2,980	30,189	43,588	5.80%	77.99%
10	11,359	4,161	30,189	45,709	6.08%	84.07%
11	14,555	6,515	30,681	51,751	6.89%	90.96%
12	30,770	6,505	30,681	67,955	9.04%	100.00%

Table 4-36. Average number of commercial trips that caught red snapper during 2005-2008, average number recreational trips (MRFSS all modes) that targeted red snapper during 2003-2007, and average number of angler days during 2003-2007 from Amendment 17A. Number of trips and angler days if reduced by 85%.

	Comm trips	Red snapper rec targeted trips	Headboat angler days
current avg	1,357	43,469	240,980
85% reduction	204	6,520	36,147

Rejected Alternative 31. Implement the following as recommended by the Snapper Grouper Advisory Panel at their August 2009 meeting:

(a) VMS (all vessels that harvest snapper grouper species in the EEZ)
(b) Consider recommendations from LAPP Workgroup
(c) Smaller closures closed to all fishing and target closures to spawning locations
(d) Closures that change throughout the year and location changes
(e)

Close 50% of live bottom off GA coast
6 month closure (Nov 1 through March 31) for for-hire and pr. rec
Bag limit to 1/person excluding captain and crew
Eliminate 20" size limit
Maximum of 28" size limit for red snapper
Restrict to 1 hook per angler for hook and line fishing
Prohibit use of electric reel for recreational fishermen
Create mid-shelf spawning area with no fishing allowed
Artificial reef placement

Rationale for elimination:

The Council feels that actions to require VMS for snapper-grouper vessels should be delayed. New regulations and LAPP programs are being proposed that could affect the number of participants in the snapper grouper fishery. The Council feels that the effects of these measures should be realized before considering the requirement of VMS. The Council and the LAPP workgroup has discussed a LAPPs for the snapper grouper fishery and is considering LAPPs for golden tilefish and golden crab in other snapper grouper amendments. The Council is also revaluating the wreckfish individual transferable quota system in compliance with the Reauthorized Magnuson-Stevens Act. The Council discussed smaller area closures and closures that change during the year but rejected them because they would not be sufficient to end overfishing of red snapper.

Rejected Alternative 32. Implement the following in waters off the state of Florida as recommended by the Snapper Grouper Advisory Panel at their August 2009 meeting:

For Florida red snapper regulations:
1/person
4/vessel
excluding capt/crew
keep size limit
closure areas to protect spawning areas
one hook per rod and reels, manual rod and reel only

Rationale for elimination:

As discussed under Rejected Alternative 29, reductions in the bag limits to 1 fish per person and vessels limits of 4 red snapper would not be sufficient to end overfishing (Tables 10 and 11). Reduction in the bag limit from two fish per person per day to one fish per person per day would be expected to provide a five percent reduction in harvest when non-compliance and a 40% release mortality is considered (Table 10). Reductions in harvest with a 4 person vessel limit would be expected to provide reduction in harvest ranging from 3% for private recreational to 34% for headboats. Excluding captain and crew as well as requiring one hook rod and reels would provide small reductions in total removals but would not be sufficient to end overfishing when combined with other components of the action.

Rejected Alternative 33. Implement the following:

Red Snapper Allocation Alternatives

Alternative 1 (Status Quo). Do not define allocations for red snapper.

Alternative 2. Allocate the red snapper ACL by state and sector as described in the table below. The sector allocation would be based upon 40% commercial, 24% for-hire (headboat & charter), and 36% private recreational (This is based upon a 40% commercial and 60% recreational allocation). The allocation between the for-hire and private recreational sectors would be based upon landings from the commercial, MRFSS, and headboat databases based on the following formula for each sector:
Sector apportionment = (50% * average of long catch range (lbs) 1986-2008) + (50% * average of recent catch trend (lbs) 2006-2008).

The state allocation would be based upon landings from the commercial, MRFSS, and headboat databases based on the following formula for each sector:
State apportionment = (50% * average of long catch range (lbs) 1986-2007) + (50% * average of recent catch trend (lbs) 2006-2008).

The allocations specified for 2010 would remain in effect beyond 2010 until modified. Could remove X lbs (X%) off top to account for expected red snapper mortality off the coasts of North Carolina and South Florida.

Table 23. Estimated catch limit by sector state with a 61,000 lb whole weight ACL. Percent represents proportion of 61,000 lbs whole weight taken by each sector and state.

	North Carolina		South Carolina		Georgia		Florida	
Sector	%	lbs	%	lbs	%	lbs	%	lbs
Commercial	3.0	1,822	7.4	4,544	30%; 18,034 lbs			
For-Hire	1.7	1,027	2.7	1,656	2.2	1,325	17	10,632
Private Recreational	.43	263	.64	390	1.8	1,089	33	20,218

The sector allocation would be based upon 40% commercial, 24% for-hire (headboat & charter), and 36% private recreational (This is based upon a 40% commercial and 60% recreational allocation).

Alternative 3. Allocate the red snapper ACL by state and sector as described in the table below. The sector allocation would be based upon landings from the commercial, MRFSS, and headboat databases based on the following formula for each sector:
Sector apportionment = (50% * average of long catch range (lbs) 1986-2008) + (50% * average of recent catch trend (lbs) 2006-2008).

The state allocation would be based upon landings from the commercial, MRFSS, and headboat databases based on the following formula for each sector:
State apportionment = (50% * average of long catch range (lbs) 1986-2008) + (50% * average of recent catch trend (lbs) 2006-2008).

The allocations specified for 2010 would remain in effect beyond 2010 until modified. Could remove X lbs (X%) off top to account for expected red snapper mortality off the coasts of North Carolina and South Florida.

Table 24. Estimated catch limit by sector state with a 61,000 lb whole weight ACL. Percent represents proportion of 61,000 lbs whole weight taken by each sector and state.

	North Carolina		South Carolina		Georgia		Florida	
Sector	%	lbs	%	lbs	%	lbs	%	lbs
Commercial	2.1	1,275	5.2	3,181	21%; 12,624 lbs			
For-Hire	2.0	1,241	3.3	2,001	2.6	1,601	21	12,847
Private Recreational	.51	314	.76	466	2.1	1,301	40	24,149

The sector allocation would be based upon landings from the commercial, MRFSS, and headboat databases based on the following formula for each sector: Sector apportionment = (50% * average of long catch range (lbs) 1986-2008) + (50% * average of recent catch trend (lbs) 2006-2008).

Rationale for elimination:
Since the intent of the Council is to prohibited harvest of recreational and commercial harvest of red snapper, the Council did not feel that this alternative was necessary at this time. It is anticipated that red snapper harvest will be allowed in the near future as the stock rebuilds and the Council may want to consider an action that will allocate the allowable catch among sectors.

Red Snapper Management Measure Alternative

Alternative 1 (Status Quo). Do not modify management regulations red snapper.

Alternative 2. Implement the following management regulations for red snapper.

Commercial Sector

Implement the following monitoring devices: VMS, real-time electronic bycatch reporting, and observers. If mortality is greater than x lbs (landings and dead discards), prohibit fishing for, possession, and retention of species in the snapper grouper fishery management unit for the commercial sector off the coast of that state.

For-Hire Sector

Implement the following monitoring devices: VMS, real-time electronic bycatch reporting, and observers. If mortality is greater than x lbs (landings and dead discards), prohibit fishing for, possession, and retention of species in the snapper grouper fishery management unit for the for-hire sector off the coast of that state.

Private Recreational

Implement a card and tag system for the private recreational sector. X number of cards and tags will be distributed each year based upon a lottery system. The tags would be referenced to the cards which are issued. The proposed tags are numbered strips at the bottom of the cards which would be separated and attached to the fish by the fishermen.

Prohibit fishing for, possession, and retention of all snapper grouper species in an area off the coast of Georgia and North Florida (need to specify area). Specify an allowable red snapper fishing area off the coast of Georgia (need to specify area). Only those individuals with a tag may fish in that area. Each red snapper caught would need to be retained and have a tag applied. Once all the tags are used, prohibit fishing for, possession, and retention of species in the snapper grouper fishery management unit for the private recreational sector off the entire coast of Georgia.

Alternative 3. Allow harvest and retention of snapper grouper species in depths of 98 feet or less for 6 months (need to specify time of year).

Alternative 4. Remove red snapper bag and size limit restrictions for all sectors.

Rationale for elimination:

Based on catch rates of landed and discarded red snapper in 2007 and 2008, the allowable catch for each sector, with some as low as 390 lbs for some sectors/states, would be met would be met in less than one month (Tables 25-30). The approach would require extensive observer coverage, implementation of electronic logbooks, and establishment of some sort of tagging system. Development of an electronic reporting program for the commercial and for-hire fishermen would take time and require a currently unidentified source of funds. There would be concerns about using self reporting catches when this information would be used to close a fishery.

*For the commercial and for-hire sectors under **Management Alternative 2**, catch of red snapper would be monitored by means of VMS, real-time electronic bycatch reporting, and observers. If total removals (landings and discards) are greater than specified in Tables 15 and 16 for **Allocation Alternatives 2 and 3**, respectively, fishing for, possession, and retention of species in the snapper grouper fishery management unit for the commercial sector off the coast of that state would be prohibited. Based on monthly commercial landings provided in Tables 3 and 4, the commercial and for-hire catch limits for red snapper could be met in a month.*

For the private recreational sector, a closed area would be established off Georgia and Florida where no snapper grouper fishing would be allowed. Tags would be issued to allow some fishermen to target red snapper within a closed area off of Georgia. Once all the tags are used, fishing for, possession, and retention of species in the snapper grouper fishery management unit would be prohibited for the private recreational sector off the entire coast of Georgia. Development of a tag program for the private recreational sector would take time. There would be concerns about using self-reporting catches when this information would be used to close a fishery.

This alternative could prevent overfishing if all fishing for snapper grouper species was prohibited once the limits were met. However, ***Management Alternative 2*** *would allow fishing for snapper grouper species by private recreational fishermen outside of Georgia after tags are depleted. If red snapper were incidentally taken and killed after limits for all three sectors had been met, overfishing would be occurring.*

Management Alternative 3 *would allow harvest and retention of snapper grouper species in depths of 98 feet or less for 6 months. It is assumed that all fishing for snapper grouper species would be prohibited at depths greater than 98 feet. Red snapper are known to occur in depths shallower than 98 feet but there are not good estimates of what proportion of the population occurs in those depths (Moe 1962). Therefore, data are not adequate, at this time, to determine if this alternative would end overfishing of red snapper. If Proposed* ***Management Alternative 3*** *is adopted (allow harvest in depths of 98 feet or less), the state/sector ACLs would need to be lowered to incorporate the estimated red snapper mortality.*

Table 25. Number harvested, released, and total removals of red snapper taken by recreational fishermen during 2003-2006 (SEDAR 15 2008). Dead discards determined by applying 40% release mortality to discarded fish. Total removals = harvest (landed fish) + dead discards. Total removals in closed fishery, where red snapper harvest is prohibited is determined by applying a 40% release mortality rate to the total of landed plus discarded fish.

Year	landed	discarded	dead discards	total removals	Total removals in closed fishery
2003	41,367	184,646	73,858	115,225	90,405
2004	49,728	242,306	96,922	146,650	116,814
2005	42,615	155,576	62,230	104,845	79,276
2006	32,962	168,126	67,250	100,212	80,435
average	41,668	187,664	75,065	116,733	91,733

Table 26. Expected number harvested, released, and total removals of red snapper taken by recreational fishermen during 2003-2006 if there was no size limit and a 2 fish bag limit. Dead discards determined by applying 40% release mortality to discarded fish. Total removals = harvest (landed fish) + dead discards.

Year	landed	discarded	dead discards	total removals
2003	100,508	125,506	50,202	150,711
2004	124,129	167,906	67,162	191,292
2005	106,053	92,141	36,856	142,909
2006	81,252	119,833	47,933	129,185
average	102,986	126,346	50,539	153,524

Table 27. Monthly headboat and MRFSS for-hire landings (pounds whole weight) of red snapper.

Year	2007	2007 cumulative	2008	2008 cumulative
1	7,342	7,342	14,446	14,446
2	6,733	14,075	24,720	39,166
3	4,928	19,003	18,459	57,625
4	5,904	24,908	17,332	74,957
5	13,964	38,872	39,791	114,748
6	14,661	53,533	36,198	150,946
7	5,800	59,333	49,851	200,797
8	5,748	65,081	43,596	244,394
9	2,178	67,259	3,979	248,373
10	1,863	69,122	6,658	255,031
11	13,042	82,164	10,986	266,017
12	14,689	96,853	9,319	275,336

Table 28. MRFSS non for-hire landings (pounds whole weight) of red snapper by wave.

Wave	2007	2007 cumulative	2008	2008 cumulative
1	12,390	12,390	42,227	42,227
2	5,946	18,336	53,693	95,920
3	131,202	149,538	201,827	297,747
4	44,528	194,066	72,690	370,437
5	43,618	237,684	76,744	447,181
6	6,067	243,751	94,661	541,842

Table 29. Red snapper landings and discards (numbers) from for-hire fishery (headboat and MRFSS) for 2008.

Month	number caught	number discarded
1	2,338	13,600
2	3,310	16,865
3	3,338	10,020
4	2,817	13,696
5	5,612	15,075
6	5,428	13,814
7	7,511	11,626
8	6,614	8,987
9	747	3,045
10	1,076	4,767
11	1,959	5,624
12	1,547	5,132

*Discards are only available in numbers of fish.

Table 30. Red snapper landings and discards (numbers) from non for-hire fishery (MRFSS) for 2008.

Wave	number caught	number discarded
1	9,764	72,086
2	9,772	54,883
3	28,986	85,734
4	11,612	43,470
5	11,112	35,181
6	16,700	60,860

*Discards are only available in numbers of fish.

Rejected Alternative 34. Define a rebuilding strategy for red snapper that sets fishing mortality at F_{MSY} ($F_{40\%SPR}$) in year 1. The ACL (total removals) for 2010 would be 105,000 lbs whole weight. The ACL specified for 2010 would remain in effect beyond 2010 until modified. Under this strategy, the fishery would have a 44% chance of rebuilding to SSB_{MSY} within the allowable 35 year timeframe. Since this alternative specifies the fishing mortality rate that produces MSY, OY at equilibrium would not be specified. The Council will review ACL and management measures following the next scheduled assessment for red snapper.

Rationale for elimination: The National Standard 1 Guidelines at 50 CFR § 600.310(j)(3)(i)(A) specify the following guidance in terms of probability of overfishing: The ''minimum time for rebuilding a stock'' (Tmin) means the amount of time the stock or stock complex is expected to take to rebuild to its MSY biomass level in the absence of any fishing mortality. In this context, the term ''expected'' means to have at least a 50 percent probability of attaining the Bmsy.

Under this strategy, the red snapper stock would have a 44% chance of rebuilding to SSB_{MSY} within the allowable 35 year timeframe. The Council believes that a rebuilding program with a 44% probability is a strategy that contains a level of risk that is unacceptable. Future adverse impacts to the stock and fishery would be expected if the rebuilding goals were not achieved.

Rejected Alternative 35. Define a rebuilding strategy for red snapper that sets the ACL at 0 (directed landings only). The AM would be to track catch per unit effort (CPUE) of red snapper via a fishery-independent monitoring program to track changes in biomass. CPUE would be evaluated every three years and adjustments would be made by the framework action being developed in Amendment 17B.

Rationale for elimination: The alternatives for the rebuilding strategy in the amendment were restructured. The alternative that would establish ACL equal to zero is no longer a separate action. The ACL equal to zero option is now a sub-alternative under each rebuilding strategy alternative. The Council believes that setting ACL to 0 versus a poundage will affect the accountability measures chosen and needs to be an option that is analyzed under each alternative.

Rejected Alternative 36. Allow harvest, possession, and retention of snapper grouper species in the closed area from 28 degrees north (Stuart, Florida) to 33 degrees north (Cape Romain, South Carolina) if fishermen possess a red snapper permit. Once the allowable harvest of red snapper for a permitted fishermen is reached all harvest, possession, and retention of snapper grouper species would be prohibited within the closed area. All harvest, possession, and retention of red snapper outside the closed area would be prohibited.

Allocation

Allocate a portion of the 79,000 lb whole weight ACL as non-directed removals; i.e., bycatch mortality, between the closure area and outside the closure area.

Sub-Alternative 10A. Define allocations for red snapper based upon landings from the ALS, MRFSS, and headboat databases. The allocation would be based on the following formula for each sector: Sector apportionment = (50% * average of long catch range (lbs) 1986-2008) + (50% * average of recent catch trend (lbs) 2006-2008). The allocation would be 28% commercial; 28% for-hire commercial; and 43% private recreational.

Sub-Alternative 10B. Define allocations for red snapper based upon landings from the ALS, MRFSS, and headboat databases. The allocation would be based on landings from the years 2006-2008. The allocation would be 23% commercial and 76% recreational.

Sub-Alternative 10c. Define allocations for red snapper based upon landings from the ALS, MRFSS, and headboat databases. Allocate 40% commercial and 60% recreational.

Table 4-9. Red snapper landings by sector in Sub-Alternatives 10A, 10B, and 10C.

Allocation Alternative	Commercial	For-Hire	Private Rec
Sub-Alt 10a	8,373	8,672	12,859
Sub-Alt 10b	6,878	21,831	
Sub-Alt 10c	11,962	17,943	

Number of Permits

Establish designate vessels to fish in closed area. (Details to be inserted; see GA DNR's rules for administering a lottery system). NMFS-SERO shall issue permits in the initial or any subsequent permit year by lottery devised and operated by the agency. Council to consider alternatives on number of permits issued. Allocation action would be used to divide the number of permits among sectors.

Sub-Alternative 10D. Set number of red snapper permits at 1,000 (This is the maximum number Law Enforcement indicates it can monitor). Use allocation action to divide the number of permits among sectors.

Sub-Alternative 10B. Set number of red snapper permits at 500.

Sub-Alternative 10c. Set number of red snapper permits at 150.

Table 4-10 Allocations under Alternative 10

	Commercial	For-Hire	Private Rec	Total
Allocation	28%	29%	43%	100%
Allowable catch	8,373.4	8,672.5	12,859.2	29,905.0
Number or Permits Alt 10D	280	290	430	1,000
Catch per vessel lbs ww	30	30	30	30
Number or Permits Alt 10E	140	145	215	500
Catch per vessel lbs ww	60	60	60	60
Number or Permits Alt 10F	42	43	65	150
Catch per vessel lbs ww	199	199	199	199

Requirements of Permitted Fishermen
The following requirements would apply to fishermen with red snapper permits.

Table 4-11 Tracking and accountability measures for fishermen possessing red snapper permits.

Tracking and Accountability Measures	Commercial	For-Hire	Private Rec
Circle hooks	X	X	X
Bio sampling (if selected)	X	X	X
RS permit taken if violation	X	X	X
VMS Required	X	X	X
Electronic logbooks or similar	X	X	-
Real time message reporting	-	-	X
Video monitoring	X	X	-
Observers (if selected)	X	X	X

Outside the closure area: Subtract poundage allotment for area south of 28 degrees north and north of 33 degrees north (Cape Romain), off the 79,000 lb whole weight ACL.

South of 28 degrees (approx. Stuart FL) – 25,048 lbs whole weight
North of 33 degrees (Cape Romain SC) – 24,047 lbs whole weight
49,095 lbs whole weight (non-directed removals)
subtracted from the 79,000 lbs whole weight ACL.
Closure area: Using sub-alternative 10A, allocate the remaining poundage (79,000 – 49,095 lbs = 29,905 lbs whole weight) as directed removals to the three sectors based on Table 2, Alternative 3; Attachment 30:

28% - commercial 8,373 lbs
29% - for hire 8,673 lbs
43% - recreational 12,859 lbs

The IPT has recommended an allocation action for red snapper be included in the amendment, from which this portion of Alternative 10 could be derived. Couldn't the allocation just be part of the alternative?

(Team to verify numbers and convert to numbers of fish where appropriate)

(Determine number of fish) Problem with using number of fish is that average weight would increase as stock rebuilds.

Commercial

The red snapper commercial ACL within the closed area is 8,373 lbs whole number. Make X number of permits available to those that hold a Federal Snapper Grouper Commercial Permit that would allow the permit holder to fish for species in the Snapper Grouper FMU inside of the limited, designated snapper-grouper bottom fishing zone(s) using circle hooks. Commercial permit holders selected to fish the designated fishing zone would be selected by a lottery system. (Details to be inserted; see GA DNR's rules for administering a lottery system). NMFS-SERO shall issue permits in the initial or any subsequent permit year by lottery devised and operated by the agency. A subset would be selected by the SEFSC to bring in red snapper for biological sampling. If real-time reporting requirements are violated, the permit holder would be subjected to severe sanctions, up to and including permit revocation. Once the real-time monitoring indicates the poundage [i.e., red snapper discards] allocated to the commercial sector has been taken, all permits for that sector are rescinded.

The following tracking and accountability measures would be required for those with a permit to fish in the zone:

- VMS
- Real time electronic catch (directed and non-directed) reporting via electronic logbooks or team alternative real time reporting technology
- Video monitoring or observers (if selected)
- (The Council discussed requiring observers in at least in the first year to validate the video monitoring.)

For-Hire (Headboat and Charterboat)

The red snapper for-hire ACL within the closed area is 8,673 lbs whole weight. Make X number of permits available to those that hold a Federal Snapper Grouper For-Hire Permit that would allow the permit holder to fish for species in the Snapper Grouper FMU inside of the limited, designated snapper-grouper bottom fishing zone(s) using circle hooks. For-hire permit holders selected to fish the designated fishing zone would be selected by a lottery system. (Details to be inserted; see GA DNR's rules for

administering a lottery system). NMFS-SERO shall issue permits in the initial or any subsequent permit year by lottery devised and operated by the agency. A subset would be selected by the SEFSC to bring in red snapper for biological sampling. If real-time reporting requirements are violated, the permit holder would be subjected to severe sanctions, up to and including permit revocation. Once the real-time monitoring indicates the poundage [i.e., red snapper discards] allocated to the for-hire sector has been taken, all permits for that sector are rescinded.

The following tracking and accountability measures would be required for those with a permit to fish in the zone:

- Mandatory species ID training
- VMS
- Real time catch (directed and non-directed) reporting via logbooks??
- Video monitoring or Observers (if selected)
- (The Council discussed requiring observers in at least in the first year to validate the video monitoring.)

Private Recreational

The red snapper private recreational ACL within the zone is 12,859 lbs weight. Make X number of permits available that would allow the permit holder to fish for species in the Snapper Grouper FMU inside of the limited, designated snapper-grouper bottom fishing zone using circle hooks. Private recreational permit holders selected to fish the designated fishing zone would be selected by a lottery system. (Details to be inserted; see GA DNR's rules for administering a lottery system). NMFS-SERO shall issue permits in the initial or any subsequent permit year by lottery devised and operated by the agency. A subset would be selected by the SEFSC to bring in red snapper for biological sampling. If real-time reporting requirements are violated, the permit holder would be subjected to severe sanctions, up to and including permit revocation. Once the real-time monitoring indicates the poundage [i.e., red snapper discards] allocated to the private recreational sector has been taken, all permits for that sector are rescinded.

The following tracking and accountability measures would be required for those with a permit top fish in the zone:

- Mandatory species ID training
- VMS
- Real time text message reporting of catch (B1s and B2s)
- Video monitoring

Permit Numbers

At the September 2009 Council meeting, NMFS Law Enforcement personnel indicated that they could adequately monitor up to 1,000 vessels, using VMS. Under that scenario, the following number of permits would be distributed each year:

28% - commercial	280 boats
29% - for hire X 10 to obtain boat #	290 boats
43% - recreational	430 boats
	1000 boats

These calculations were brought forward by a Council member. It may not be possible to divvy this small number of fish among this many boats. Perhaps you can, if fishermen can really stay off the snapper, as the commercial guys assert that they can.

There was discussion that attrition in the commercial and for hire sectors would be so substantial as to allow everyone remaining to participate, so that a lottery wouldn't be necessary for that sector.

Costs

Applicant to procure the monitoring technology. VMS can be reimbursed; other technology such as video monitoring, electronic logbooks, etc. would be responsibility of the applicant.

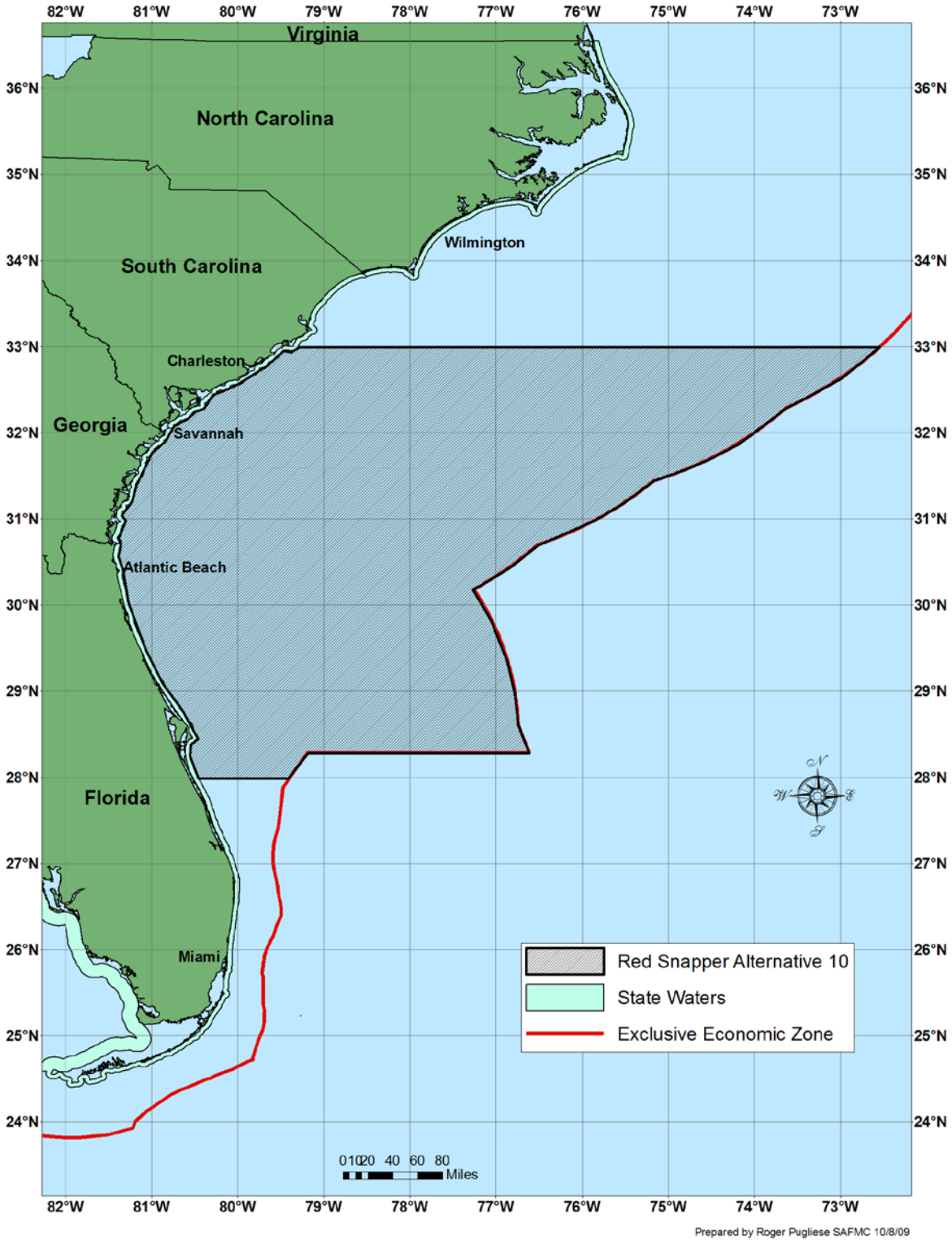


Figure 4-11 Map of proposed lottery program area under Alternative 10.

<u>Rational for elimination:</u> Examination of historical landings during 2003-2008 suggest the individual allocations among fishermen could be filled very quickly if there is no reduction in harvest (Table 4-25).

Table 4-25. Average red snapper landings during 2003-2008, average pounds caught per day during 2003-2008, allowable catch within proposed closed area, and estimated number of days to fill allocation for each sector assuming no reduction in effort or ability to avoid red snapper.

Landings	Commercial	For-Hire	Private
Pounds gw	78,418	149,020	206,674
pounds/day	215	408	566
Allowable landed catch	8,373	8,673	12,859
# days to fill allocation	39	21	23

Table 4-26 shows fishing in the closed area would last for a longer period of time if all red snapper were discarded. However, tracking discards would require fishermen to record weight or length, which would be converted to weight, prior to discarding a red snapper.

Table 4-26. Average red snapper landings during 2003-2008, average pounds caught per day during 2003-2008, allowable discards within proposed closed area, and estimated number of days to fill allocation for each sector assuming no reduction in effort or ability to avoid red snapper. Assumes 40% and 90% release mortality rates for the commercial and recreational sectors, respectively.

Landings	Commercial	For-Hire	Private
Pounds gw	78,418	149,020	206,674
pounds/day	215	408	566
Allowable catch	9,303	21,683	32,148
# days to fill allocation	43	53	57

Landings and discards of red snapper would be tracked for each of the sectors via real time electronic reporting, which would require the instillation of electronic log books and additional administrative personnel to track the data provided. Permit holders assigned a red snapper allocation would be required to estimate the length and weight of all discarded red snapper. In order to accurately record the weight discarded red snapper the instillation of a scale onboard each vessel may be necessary, but not practical. Not only would each vessel fishing under the lottery system be required to install electronic logbook equipment, they would also be required to carry VMS, and carry observers, if selected. Both of which may be cost prohibitive for fishery participants or NOAA Fisheries Service.

This alternative could result in a substantial reduction in the number of historical participants and also result in the fishery for snapper grouper species being closed for a large part of the year. Additionally, fishermen could choose to split their allocation and auction off portions of it to the highest bidders, which could increase the number of boats on the water and possibly increase bycatch. It is unlikely a program this complex could be implemented by the time a final rule for Amendment 17A is published or even shortly thereafter.