5 ENVIRONMENTAL CONSEQUENCES

5.1 Action 1. Set Gag Thresholds and Benchmarks

5.1.1 Direct and Indirect Effects on Physical Environment

Red grouper and gag are bottom dwelling fish, and fishing methods must consequently place the gear on or near the bottom where it may interact with the habitat. Juvenile gag are found in seagrass beds and oyster shell reefs while adult gag primarily occur over mid-to-high relief natural reef habitat. Red grouper are also associated with hard bottom habitat, but tend to prefer lower relief habitat than gag (see Table 3.2.2.1).

In the commercial fishery, most red grouper are caught with longlines, while most gag are caught with vertical lines (bandit rigs and electric reels). Vertical lines include handlines, rod-and-reels, and multi-hook lines known as bandit gear. Vertical-line gear is used to harvest most (>60 percent) commercial and nearly all recreational gag (SEDAR 10 2006). Prior to 2007, longline gear accounted for 36 percent of the commercial gag landings and 59 percent of the commercial red grouper landings. Vertical line gear accounted for 27 percent of the commercial red grouper landings and nearly all of the recreational red grouper landings. Traps (14 percent of red grouper commercial landings), spears (2.2. percent of gag commercial landings), and other gears accounted for the remainder of landings. Traps became illegal for harvest of reef fish after February 7, 2007.

Longline gear comes in direct contact with the bottom. Its potential for adverse impact is dependent on the type of habitat it is set on, the presence or absence of currents and the behavior of fish after being hooked. In direct observations of longline fishing from submersibles, High (1998)) observed in a halibut longline fishery off of Alaska that the longline gear on the bottom would sometimes take extreme angle turns as currents, snags, and hooked fish would affect its location. Hooked halibut were observed pulling portions of longlines 15 to 20 feet over the bottom. In addition, longlines were observed in contact with or snagged on a variety of objects including coral, and upon retrieval, corals were brought to the surface. In contrast, in a similar submersible study by Grimes et al. (1982) on a tilefish longline fishery off of New Jersey, there was no evidence that longlines shifted significantly even when set in currents. This was attributed to the use of anchors at the ends and weights placed along the line. However, tilefish, once hooked, were observed attempting to enter their burrows.

Vertical-line gear is less likely to contact the bottom than longlines, but still has the potential to snag and entangle bottom structures and cause tear-offs or abrasions (Barnette 2001). If vertical-line gear is lost or improperly disposed of it can entangle marine life (Hamilton 2000; Barnette, 2001). Entangled gear often becomes fouled with algal growth. If this gear becomes entangled on corals, the algae can eventually overgrow and kill the coral.

Anchor damage by vertical-line fishing vessels, particularly by the recreational fishery, is also potentially damaging. Bohnsack (in Hamilton 2000) points out that “favorite” fishing areas such as reefs are targeted and revisited multiple times, particularly with the advent of global positioning technology. The cumulative effects of repeated anchoring could damage the hard bottom areas where fishing for grouper occurs.

Longline gear is deployed over hard bottom habitats using weights to keep the gear on the bottom. This gear, upon retrieval, can abrade, snag and dislodge smaller rocks, corals, and sessile invertebrates (Bohnsack in Hamilton, 2000; Barnette 2001). The damage that this gear inflicts to the bottom depends on currents and the amount of line sweep caused by hooked fish (Barnette 2001).

Fish traps previously accounted for as much as 14 percent of the annual red grouper landings. Traps are often set on live substrate and can cause damage to corals, gorgonians, sponges, and submerged aquatic vegetation. However, the Council phased out this gear in February 2007 and this gear no longer impacts habitat in the Gulf of Mexico. Spear fishing has minimal effects on the bottom, although divers may cause damage by coming in contact with habitat while spearfishing.

Thresholds and benchmarks do not directly impact the physical environment, but indirectly they have impacts by affecting the decisions regarding the fishing regulations and amount of fishing effort necessary to stay within thresholds and achieve target levels.

Alternative 1 would maintain the existing levels. This includes the least restrictive MSST ($SSB_{20\%\ SPR}$), but the MFMT ($F_{30\%\ SPR}$) is intermediate between **Preferred Alternative** 2 and **Alternative 3**. The OY target (yield at $F_{20\%\ SPR}$) exceeds the MFMT overfishing threshold and should therefore never be reached. Under the **Alternative** 1 MFMT, overfishing is occurring, requiring a reduction in gag fishing mortality and effort. Since this will result in less gear being fished, or the existing gear being fished for a lesser amount of time, impacts to the physical environment will be reduced, though to the least amount of any of the alternatives in this action.

Preferred Alternative 2 would set MSST, MFMT, and OY based on maximum yield per recruit (MAX). As shown in Table 2.1.2, MFMT (F_{MAX}) is more conservative than either **Alternative** 1 or **Alternative** 3 (which are both $F_{30\%SPR}$). MSST will provide a more conservative (i.e., higher) equilibrium spawning stock biomass than either of the other two alternatives. The options for OY are also all more conservative the equivalent OY options in **Alternative 3**, or the OY in **Alternative 1**. This alternative results in the smallest amount of fishing gear, or gear being fished for the smallest amount of time, of any of the alternatives, resulting in the greatest reduction in impacts to the physical environment.

Alternative 3 would set MSST, MFMT, and OY based on 30% SPR. MSST is intermediate between **Alternative 1** and **Preferred Alternative 2**. MFMT is identical to **Alternative 1** and less conservative than **Preferred Alternative 2**. The OY options are less conservative than the equivalent options in Alternative 2 but more conservative than the OY in **Alternative 1** (however, the **Alternative 1** OY will be overridden by the more conservative MFMT in that alternative). If management is set based on avoiding overfishing (MFMT), then the impacts of this alternative will be identical to **Alternative 1**. However, the long term management goals are to achieve OY, in which case the impacts will be intermediate between **Alternatives 1 and Preferred Alternative 2**.

5.1.2 Direct and Indirect Effects on the Biological / Ecological Environment

Since overfishing is occurring under any of the alternatives, reductions in fishing mortality and fishing effort need to occur, resulting in positive impacts to the biological/ecological

environment by reducing mortality on the target gag stock as well as incidental bycatch. In addition, reducing the fishing mortality rate for gag will increase the probability of a female gag surviving to transition to a male gag. The proportion of male gag in the population has decreased from historical levels of 17% (Hood and Schlieder 1992) to 2-10% in the 1990s (Coleman et al. 1996, June 8, 1998 memo from Fitzhugh, Collins and White), leading to concerns by the Council's Reef Fish Stock Assessment Panel that the reduction in proportion of males may have a potentially negative consequence on population reproductive potential (GMFMC 1998). However, the relative degree of positive impact will vary among the alternatives.

Alternative 1 would maintain status quo MFMT, which would likely be the primary threshold driving management decisions since it is more conservative that the MSST or OY in the alternative. This is less conservative than **Preferred Alternative 2**. It is identical to **Alternative 3** if management is based on preventing overfishing, but less conservative if management is based on achieving OY. Although gag has only recently been declared to be undergoing overfishing, the estimates of historical fishing mortality rates indicates that this level of MFMT has been exceeded in most years as far back as 1982 (Table Gag-2). Thus, even though the overfishing threshold will not change, the management actions to achieve this threshold will require a reduction in F, benefiting the biological/ecological environment. However, the level of reduction, and benefit to the environment, will be the less than under **Preferred Alternative 2**, and either equal to or less than under **Alternative 3**.

Preferred Alternative 2 would set MSST, MFMT, and OY based on maximum yield per recruit (MAX), which is more conservative than either **Alternative** 1 or **Alternative** 3. Thus, this alternative would require the greatest reduction if F, resulting in the greatest benefit to the biological/ecological environment.

Alternative 3 would set MSST, MFMT, and OY based on 30% SPR. MSST is intermediate between **Alternative 1** and **Preferred Alternative 2**. MFMT is identical to **Alternative 1** and less conservative than **Preferred Alternative 2**. The OY options are less conservative than the equivalent options in **Preferred Alternative 2** but more conservative than the OY in **Alternative 1** (however, the **Alternative 1** OY will be overridden by the more conservative MFMT in that alternative). If management is set based on avoiding overfishing (MFMT), then the impacts of this alternative will be identical to Alternative 1. However, the long term management goals are to achieve OY, in which case the impacts will be intermediate between **Alternatives 1 and Preferred Alternative 2**.

5.1.3 Direct and Indirect Effects on Economic/Social Environment

5.1.3.1 Direct and Indirect Effects on the Economic Environment

Defining the MSY, OY, MFMT and MSST of a species does not alter the current harvest or use of the resource. Specification of these measures merely establishes benchmarks for fishery and resource evaluation from which additional management actions for the species would be based, should comparison of the fishery and resource with the benchmarks indicate that management adjustments are necessary. The impacts of these management adjustments are evaluated at the appropriate sections of this document. As benchmarks, these parameters would not limit how, when, where, or with what frequency participants in the fishery engage the resource. This includes participants who directly utilize the resource (principally, commercial vessels, for-hire

operations, and recreational anglers), as well as participants associated with peripheral and support industries. All entities could continue normal and customary activities under any of the alternative specifications. Participation rates and harvest levels could continue unchanged.

Since there would be no direct effects on resource harvest or use, there would be no direct effects on fishery participants, associated industries or communities. Direct effects only accrue to actions that alter harvest or other use of the resource. Specifying MSY, OY, MFMT and MSST, however, establishes the platform for future management, specifically from the perspective of bounding allowable harvest levels. In this sense, specifying these parameters may be considered to have indirect economic effects.

Fishery management decisions influence public perception of responsible government control and oversight. These perceptions in turn influence the public's response to management. This response may be positive, such as cooperative participation in the management process, public hearings, and data collection initiatives, or negative, such as non-cooperation with data initiatives, or pursuit of political relief from management action. Positive responses support the efficient use of both the natural resource and the economic and human capital resources dedicated to the management process. Negative responses harm the integrity of the information on which management decisions are based, induces inefficient use of management resources, and may prevent or delay efficient use of the natural resource. The specific benefits and costs of these responses cannot be calculated. The various alternatives setting thresholds and benchmarks satisfy the technical guidelines and would establish the required platform from which future action can be taken and, thus, should generally induce satisfaction with the management of the resource. However, the alternatives vary in implications for total allowable harvest and constituents who favor more liberal harvests would likely prefer the alternatives in the decreasing order of the potential harvest implied by the alternative specifications, while those who favor more conservative harvests would likely hold the opposing preferences. The net effect of the behavioral responses from these opposing constituent groups cannot be determined.

In addition to the trigger to subsequent management that MSY and OY may provide, the MSST identifies the stock level below which a resource is determined overfished while the MFMT sets the threshold for considering the stock to be undergoing overfishing or not. Should the evaluation of the resource relative to the benchmark result in said designation, harvest and/or effort controls are mandated as part of a recovery plan. These harvest and effort controls would directly impact the individuals, social networks, and associated industries associated with the resource or fishery, inducing short-term adverse economic impacts until the resource is rebuilt and less restrictive management is allowable. The economic issue with such type of management measures involves a trade-off between short-run economic losses and long-run economic benefits. Losses stem from a reduction in harvest or participation in the fishery while benefits arise from a higher harvest level or fishery participation under a more sustainable environment.

In trading off short-run losses for long-term benefits over time, both the magnitude and timing of losses and benefits are important. The magnitude issue is somewhat self-evident. The timing issue comes into play because economic conditions, along with a host of other factors, change over time so as to alter the valuation of both losses and magnitudes. It is then the interplay of magnitude and timing that is critical in assessing the net results from loss/benefit trade-off over time.

From the discussion on the biological effects of the various measures, it appears that Preferred Alternative 2 is the most conservative and Alternative 1, the least conservative. The term "more conservative" is understood here to imply a higher likelihood of triggering more restrictive management measures but at the same time a higher likelihood of adequately protecting the stock. Under all alternatives, gag would be considered undergoing overfishing but not overfished. Thus, whichever alternative is selected, the trigger for adopting corrective measures would be activated. But being the most conservative, Preferred Alternative 2 may be expected to require stricter measures, and thus would tend to create more short-term losses than the other alternatives. On the other hand, it would also provide the best environment for sustainable stock and therefore more stable, long-term benefits to fishing participants and the nation as a whole. In this sense, Preferred Alternative 2 may also be considered to yield the highest benefits. Under the assumption that all alternatives result in long-term benefits outweighing short-run losses, Preferred Alternative 2 may be considered to provide more stable streams of net benefits than the other alternatives.

Summary

Defining the OY, MFMT and MSST of a species does not alter the current harvest or use of the resource. Since there would be no direct effects on resource harvest or use, there would be no direct effects on fishery participants, associated industries or communities. Specifying OY, MFMT and MSST, however, establishes the platform for future management, specifically from the perspective of bounding allowable harvest levels. In this sense, specifying these parameters may be considered to have indirect economic effects. Restrictive management measures are required by all alternatives, but weighing both short-term losses and long-term benefits, Preferred Alternative 2 appears to provide more stable streams of net benefits over time than any of the other alternatives.

5.1.3 Direct and Indirect Effects on the Social Environment

Alternative 1, no action, will leave the existing definitions unchanged. With this alternative, there would not be any short term impacts, positive or negative, on the fishermen, fishing-dependent businesses, or fishing communities that are involved with the gag grouper fishery. With **Alternative 1**, in the long term, the OY would not be reduced from the MSY. This may require more restrictive measures in the future if the stocks are reduced and declared overfished.

Preferred Alternative 2 and **Alternative 3** will not have any direct impacts on the fishermen, fishing-dependent businesses, or communities that depend on the gag grouper fishery in the short term because this is an administrative action that will set the thresholds and benchmarks. There may be negative impacts on those that depend on this fishery in the future when the thresholds and benchmarks are established if it is determined that more restrictive measures need to be in place to meet the desired definitions. Establishing thresholds and benchmarks for the gag grouper fishery will give fisheries managers a target for managing the fishery with the goal to rebuild the fishery. Once the overfishing of gag grouper is ended then stocks can rebuild. Fishermen, fishing-dependent businesses, and communities that are involved with this fishery will benefit in the future when stocks are rebuilt and there are more fish to harvest.

Summary

Alternative 1 would continue the status quo and would not stop overfishing of gag grouper as required by the SFA. Preferred **Alternative 2** and **Alternative 3** would not have any direct impact on the fishermen, fishing-dependent businesses, or communities that depend on the gag grouper fishery in the short term because this is an administrative action that will set the thresholds and benchmarks. It is important for the council to define MSST and OY to stop overfishing.

5.1.4 Direct and Indirect Effects on Administrative Environment

The Sustainable Fisheries Act of 1996 requires that overfished and overfishing thresholds (MSST and MFMT) be developed for all stocks under management. The Council's initial attempt to do this through a Generic SFA Amendment (GMFMC 1999a) resulted in an adoption of $F_{30\% \text{ SPR}}$ as a default MFMT for most reef fish (goliath grouper and Nassau grouper were given more conservative thresholds). However, the amendment's proposals to set MSST and MSY proxies based on SPR were rejected by NMFS on the basis that SPR is not biomass-based and is not an acceptable proxy for MSY or MSST (letter from NMFS Regional Administrator to Council Chairman dated November 17, 1999). However, at about the same time, NOAA General Counsel stated that SPR is still a viable proxy to SSB_{MSY} in data moderate or data poor situations (e-mail from Michael McLemore to RFSAP October 5, 1999).

As a result of the NMFS rejection of the proposed biomass thresholds, the Council did not have an SFA-approved MSST or OY definition for reef fish. There was a definition from Amendment 1 of 20% SPR for both the overfished threshold and optimum yield, but it these pre-SFA definitions had not been determined to comply with SFA requirements. In addition, the pre-SFA definition of OY as the yield at 20% SPR while a new MFMT was adopted at $F_{30\% \text{ SPR}}$ meant that OY could not be attained since the fishing mortality rate needed to reach OY exceeded MFMT and constituted overfishing.

Alternative 1 is the no action alternative, and will continue the incompatibility between a "yield at 20% SPR" OY and an $F_{30\% \text{ SPR}}$ MFMT. It also leaves the OY biomass level equal to MSST when, under the NMFS National Standard guidelines and technical guidance, OY should be more conservative than MSST. This alternative will therefore continue to create administrative conflicts in determining appropriate management measures and stock status determinations for gag MSY directly.

Alternatives 2 and 3 will both clearly define MSST and OY as well as MFMT and remove any ambiguity. **Alternative 2** bases the thresholds and targets on maximum yield per recruit (MAX). In the case of the gag stock, these coincide with the thresholds and targets based on actual MSY estimates. The National Standard guidelines state that MSY proxies are acceptable "when data are insufficient to estimate MSY directly" (50 CFR 600.310(c)(3). The gag stock assessment (SEDAR 10, 2006) was able to produce actual estimates of MSY, which corresponds to the proxies based on MAX. Therefore, from an administrative perspective, **Alternative 2** complies with the National Standard guidelines more than either of the other alternatives.

Alternative 3 bases thresholds and targets on 30% SPR. This proxy was originally proposed for gag in the Generic SFA Amendment, but only the overfishing threshold was accepted by NMFS. NMFS rejected the use of SPR for biomass-based thresholds and targets, but also indicated that it

might be an acceptable proxy in data-poor situations. Since actual MSY estimates were produced by the gag stock assessment (SEDAR 10, 2006), the stock does not appear to be in a data-poor situation, making this alternative administratively less acceptable than **Alternative 2**, where the MAX-based proxies correspond directly to actual MSY estimates.

The MSST suboptions in **Alternatives 2 and 3** set MSST at a level more conservative than the SSB_{proxy} at MSY, as recommended in the National Standard guidelines. **Option a** uses the formula - yield at (1-M)*proxy to determine MSST. Given a natural mortality rate of M = 0.15, this results in the yield at 85% of proxy. **Option b** is more conservative, setting the MSST at 75% of proxy, and **Option c** is the most conservative, setting the MSST at 50% of proxy. Analyses conducted by the SEFSC indicate there is a 20-28 percent probability that SSB would fall below (1-M)*SSB_{MSY} given natural fluctuations in recruitment and assessment uncertainty if fishing mortality is maintained to achieve MSY. Under **Option a**, if fishing mortality is maintained to achieve an OY of 85% of F_{proxy}, then there would be less than a 0.2 percent probability of SSB falling below MSST (Cass-Calay and Ortiz 2007). Under **Option b**, there is a 2 percent or less probability that SSB would fall below 75% of F_{proxy} if fishing mortality is maintained at MSY and a less than 1 percent probability if fishing mortality is maintained at OY (Cass-Calay and Ortiz 2007). Under **Option c**, there is a less than 1 percent probability that SSB would fall below 50% of F_{proxy} if fishing mortality is maintained at either MSY or OY (Cass-Calay and Ortiz 2007).

The above probabilities are based on an OY level set equal to the yield at 75% of F_{proxy} (**Option e**), which is the recommended level in the NMFS technical guidance (Restrepo et al. 1999). **Alternatives 2 and 3** also contain options to set OY at the yield at 60% of F_{proxy} (**Option d**), and the yield at 90% of F_{proxy} (**Option f**). Probabilities of dropping below MSST were not calculated for these options, but **Option d** is more conservative and would have a lower probability than **Option e**, while **Option f** is less conservative and would have a higher probability than **Option e**.

All of the options satisfy the guideline to have an OY that is more conservative than MSY and thus benefit the administrative environment. For MSST (**Options a,b,c**) the less conservative options decrease the chance that an overfished status declaration will be made, but will require greater rebuilding if that declaration occurs. For OY (**Options d,e,f**) the less conservative options reduce the gap between OY and MFMT and increase the chance that an overfishing status declaration will be made, triggering the need for a plan to end overfishing.

5.2 Action 2. Red Grouper Minimum Stock Size Threshold

This action has been moved to Considered but Rejected.

5.3 Action 3. Set Gag TAC

5.3.1 Direct and Indirect Effects on Physical Environment

The alternatives in this section establish harvest limits and will not directly affect the physical environment. However, specifying gag TAC could indirectly affect the physical environment by defining the level (i.e., the amount of gear in the water at any given time) of commercial fishing effort and the duration and level of recreational fishing effort over the course of the fishing

season. Level and duration of effort together define the total cumulative amount of effort (i.e., gear-hours of soak time), which affects the potential for gear to impact the physical environment.

A description of the gears used in the commercial and recreational grouper fisheries is provided in Section 3.1 and is included herein by reference. A listing of gears and potential impacts is provided below.

The primary gear types used in the commercial grouper fishery are bottom longlines and bandit rigs. Recreational fishermen predominately use rod and reel. Spearfishing also constitutes a small part of both recreational and commercial grouper fishing. Fish traps were used in the commercial fishery until February 7, 2007, when their use became prohibited in the Gulf of Mexico EEZ.

Longlines

Direct underwater observations of longline gear in the Pacific halibut fishery noted that the gear could sweep across the bottom, and its location could be affected by currents, snags, and even the efforts of hooked fish. While the gear was observed in contact with or snagged on a variety of objects including coral, sturdy flexible corals usually appeared unharmed while hard corals often had portions broken off (High 1998). However, another direct underwater observation study of longline gear in the Atlantic tilefish fishery found no evidence that the gear shifted significantly, even when set in currents. This was attributed to anchors set at either end of the longline as well as sash weights along the line to prevent movement (Grimes et al. 1982). Based on the direct observations, it is logical to assume that bottom longline gear would have a minor impact on sandy or muddy habitat areas. However, due to the vertical relief that hardbottom and coral reef habitats provide, it would be expected that bottom longline gear may become entangled, resulting in potential negative impacts to habitat (Barnette 2001).

Bandit Gear

Concentrations of many managed reef fish species are higher on hard bottom areas than on sand or mud bottoms, thus bandit gear fishing generally occurs over hard bottom areas (GMFMC 2004a). In their use, a weighted line is lowered to the bottom, and then the lead is raised slightly off the bottom (Siebenaler and Brady 1952). The gear is in direct contact with the bottom for only a short period of time. Barnette (2001) suggests that physical impacts may include entanglement and minor degradation of benthic species from line abrasion and the use of weights (sinkers).

Spear and Powerhead

Barnette (2001) cited a study by Gomez (1987) that concluded that spearfishing on reef habitat may result in some coral breakage, but damage is probably negligible. In addition, there could be some impacts from divers touching coral with hands or from resuspension of sediment by fins (Barnette 2001). Such impacts should be negligible to non-existent for well-trained and experienced spearfishermen who stay in the water column and avoid contact with the bottom.

Recreational Rod and Reel

Fishing line from hook and line fishing can become entangled on coral and hard bottom outcroppings. The subsequent algal growth can foul and eventually kill the underlying coral (Barnette 2001). Researchers conducting studies in the marine reserve at Madison-Swanson reported seeing lost fishing line on the bottom, much of which appeared to be fairly old and covered with growth(personal communication, Andrew David), a clear indication that bottom fishing has had an impact on the physical environment prior to fishing being prohibited in the reserves (GMFMC 2003). The National Fish and Wildlife Foundation, in issuing grants to remove marine debris, established monofilament fishing line is a priority marine debris issue[4].

Alternative 1 (no action) would leave the gag TAC undefined. Management measures for the recreational fishery would not change as a result of the TAC (or lack thereof), but would likely change due to a need to end overfishing, which has a current definition ($F_{30\% \text{ SPR}}$). Since recreational anglers target gag more often than red grouper, it is likely that this would result in a reduction in rod and reel and recreational spearfishing impacts. Management measures for the commercial fishery would also likely not change as a result of the gag TAC, but would change as a result of a change in the red grouper TAC. Since some commercial fishermen may attempt to target gag in order to delay a closure due to the red grouper quota being filled. Thus, there could be an increase in longline, bandit rig and vertical line impacts.

Preferred Alternative 2 sets the gag TAC based on the projected F_{OY} harvest level for each year from 2009 to 2011. Subsequent increases in TAC would need to be implemented in a future amendment. A TAC based on F_{OY} is more conservative than one based on F_{MAX} (as a proxy for F_{MSY}). Along with **Alternative 3**, this will require the greatest initial reduction in fishing effort from both sectors, and the greatest reduction in physical impacts. As the gag stock rebuilds toward its SSB_{OY} level, and the harvest is expected to keep pace with the increasing biomass and TAC with little change in effort. Thus, impacts to the physical environment should remain at about the 2009 level through 2011.

Alternative 3, as with **Preferred Alternative 2**, sets the initial TAC at the projected F_{OY} level for 2009, and it will have the same initial physical impacts. However, **Alternative 3** holds the TAC at the 2009 level for three years. Any subsequent increase in TAC would need to be implemented in a future amendment. As the stock rebuilds in each three-year period with no corresponding increase in TAC, the commercial fishery will fill its quota more quickly, resulting in reduced effort and physical impacts. The recreational sector effort will be unaffected after the initial reduction, but may overrun its allocation in subsequent years of each three year period. If accountability measures are implemented in Action 6, this could force reductions in fishing effort resulting in reduced physical impacts.

Alternative 4 sets the gag TAC based on the projected F_{MAX} (as a proxy for F_{MSY}) harvest level for each year from 2009 to 2011. Subsequent increases in TAC would need to be implemented in a future amendment. This is similar to **Alternative 2** except it sets a higher TAC based on the less conservative MSY threshold. Since the gag stock is currently undergoing overfishing, this will result in reductions in recreational and commercial fishing effort, and corresponding reductions in the physical impacts. However, the reductions will not be as great as for

[4] National Fish and Wildlife Foundation 2006 Marine Debris Grants Program Recipients web page, http://www.nfwf.org/Content/ContentFolders/NationalFishandWildlifeFoundation/Programs/MarineDebrisPreventionandRemovalProgram/2006MarineDebrisProjectBriefs.pdf

Alternative 2. As the gag stock rebuilds toward its SSB_{MSY} level, and the harvest is expected to keep pace with the increasing biomass and TAC with little change in effort. Thus, impacts to the physical environment should remain at about the 2009 level through 2011.

Alternative 5, is similar to Alternative 3 except that is sets TAC based on F_{MAX} (as a proxy for F_{MSY}). It will have the same initial physical impacts as Alternative 4, which also sets TAC based on MSY. However, subsequent impacts will be similar to Alternative 3. As the stock rebuilds in each three-year period with no corresponding increase in TAC, the commercial fishery will fill its quota more quickly, resulting in reduced effort and physical impacts. The recreational sector effort will be unaffected after the initial reduction, but may overrun its allocation in subsequent years of each three year period. If accountability measures are implemented in Action 6, this could force reductions in fishing effort resulting in reduced physical impacts.

5.3.2 Direct and Indirect Effects on the Biological / Ecological Environment

The gag stock is undergoing overfishing under both the current MFMT ($F_{30\% \text{ SPR}}$) and the preferred alternative MFMT presented in Action 1 (F_{MAX}). This is not a recent phenomenon. Estimates of F indicate that overfishing has been occurring in most years since 1982 under the current MFMT ($F_{30\% \text{ SPR}}$), and every year since 1976 under the preferred alternative MFMT (F_{MAX}) (Table 1.2.1.3). There is currently no TAC set for gag. In 2001, the Reef Fish Stock Assessment Panel recommended that the gag catches be no higher than about 5 million pounds. However, landings have been above that every year from 1998 through 2005, ranging from 5.8 to 7.4 mp. In 2006 and 2007, landings dropped to 3.3 and 3.7 mp respectively, close to the 2009 OY TAC of 3.38 mp (Table 2.3.4)

Alternative 1 would leave TAC undefined for gag. Although 2006 may turn out to be a low year for catches, there will be no constraints on the fishery to end the long-term trend of overfishing. One possible consequence of this long-term overfishing may be a loss in the proportion of male gag in the population. Gag are protogynous hermaphrodites, initially maturing as females and switching to males later in life. Sex transformation starts in individuals that are 7-8 years old (about 31 inches TL), with 50% transformation occurring by age 13 (about 43 inches TL) (Ortiz 2006). With minimum size limits (22 inches TL recreational/24 inches TL commercial) well below the size of transformation to male, combined with high fishing mortality rates, the likelihood of any individual surviving to become a male is very low. The current percentage of males in the population is about 2% (personal communication, Chris Koenig), much lower than the estimate of 19.4% for samples collected during 1977-82 (McGovern et al. 1998). This alternative would continue to exacerbate the low male to female ratio, and would allow overfishing to continue, and may eventually result in the stock dropping below MSST and entering an overfished state.

Alternatives 2 and 3 set TAC based on F_{OY}. This is a more conservative level than setting TAC based on the $F_{MSY\ proxy}$, and will eventually rebuild the stock to close to its B_{OY} level. Due to the low minimum size limit, it will still be difficult for a fish to reach male maturity, but the percent of males will rise under Alternatives 1, 4 or 5. However, this will not be an immediate benefit. Since male transformation begins at age 7-8 (Ortiz 2006), it will take that long to begin to see any increase in the proportion of males. As the number of males increases, the number of spawning harems will also increase, which may lead to a wider geographic area of spawning or denser spawning aggregations within established spawning areas. **Alternative 3**, which changes

the TAC at 3-year intervals, is slightly more conservative that **Preferred Alternative 2**, which increases TAC every year, but the differences between these alternatives are relatively small compared with the differences to Alternatives 4 and 5.

Alternatives 4 and 5 set TAC based on $F_{MSY\ proxy}$. This is the minimum reduction in catch rate needed to end overfishing. However, given the natural fluctuations in annual year-class strength, fishing right at F_{MSY} is likely to result in exceeding the overfishing threshold half the time. These alternatives will eventually rebuild the stock to close to its B_{MSY} level, but not to its B_{OY} level. The discussion for **Alternatives 2 and 3** relative to size of male maturity and proportion of males applies to these alternatives as well. At a higher fishing mortality rate, the increase in proportion of males will not be as great as with **Alternatives 2 and 3**, although some increase can be expected. **Alternative 5**, which changes the TAC at 3-year intervals, is slightly more conservative that **Alternative 4**, which increases TAC every year, but both alternatives are less conservative than **Alternatives 2 and 3**.

5.3.3 Direct and Indirect Effects on Economic/Social Environment

5.3.3.1 Direct and Indirect Effects on the Economic Environment

The current regulatory regime in the shallow-water grouper fishery includes, among others, a commercial shallow-water grouper quota of 8.8 MP, commercial red grouper quota of 5.31 MP, and recreational red grouper target level of 1.25 MP. The commercial red grouper quota is part of the 8.8 MP for shallow-water grouper. There is no separate quota/allocation for gag. Instead, the commercial segment of gag is part of the overall commercial shallow-water grouper quota. In terms then of TAC provisions, only the red grouper fishery has one; gag and other shallow-water grouper species as well as the entire shallow-water grouper complex do not have one. Hence, output controls apply only to the overall shallow-water grouper fishery and red grouper fishery in particular. And only the commercial segment of these fisheries is effectively subject to output controls. Of course, there are input controls such as bag/size limits, trip limits, and area/season closures designed to limit commercial and recreational catches to some target levels. In a sense, the recreational fishery can harvest any amount of any shallow-water grouper species subject only to input controls. Given the current input controls, the recreational fishery harvest of any shallow-water grouper species is more influenced by such factors as fish stock conditions, economic conditions, and fishing conditions such as weather. Improvements in any of these factors can lead to increases in recreational catches.

Allowable commercial harvest of gag depends on the interplay of red grouper quota and shallow-water grouper quota. Given an overall shallow-water grouper quota, allowable gag harvest to the commercial sector is inversely related to the red grouper quota: increases in red grouper quota results in lower allowable gag harvest and vice-versa. Given a commercial red grouper quota, allowable gag harvest to the commercial sector is directly related to overall shallow-water grouper quota: any increases in shallow-water grouper quota results in higher allowable gag harvest.

Allowable recreational harvest of gag, or of any shallow-water grouper species for that matter, is not directly affected by harvest changes in the commercial sector. There are indirect effects, however, since both sectors harvest the same stock and generally fish in the same area some

commercial boats fish. These indirect effects could also lead to changes in regulations that would have direct effects on the recreational sector.

Part of the intent for setting a gag TAC is to provide a general mechanism for addressing the overfishing status of the stock. There is then the presumption that management measures would become more restrictive and that a recovered stock provides higher benefits to fishery participants. Specific analysis of potential management actions is postponed to the next sections. At this point, the general economic implications of the various TAC levels are explored but this is done under certain assumptions regarding potential regulatory changes provided in other sections of this amendment.

In general, setting a TAC for gag necessitates an explicit or implicit allocation of allowable gag harvest between the commercial and recreational sector. Since regulations proposed for the recreational sector in this amendment are input controls, the interaction of commercial and recreational harvest of gag described above for the current conditions still applies. The general tone of potential effects on the recreational fishery is that of reductions in short-run benefits and increases in long-term benefits. These effects, particularly the net effect, cannot be quantified.

Within the commercial sector, certain changes would occur especially if a commercial gag quota and quota closure were adopted. With a gag quota, changes in the red grouper quota or shallow-water grouper quota would no longer have direct effects on allowable gag harvest. But if quota closures for gag or shallow-water grouper also lead to quota closure for gag, then actual harvest of gag would change due to changes in red grouper or shallow-water grouper quota. Conversely, if the gag quota closure leads to closures in the red grouper or shallow-water grouper fishery, then actual harvests of these species would also change.

In and by itself, a gag TAC has no direct economic effects but it assumes significance when combined with other management measures. For the commercial sector, the economic implications of various TAC alternatives for gag are presented below. Estimates were derived using a simulation model developed by Waters (2008, pers. comm.). Estimates of net operating revenues were generated by subtracting trip costs and opportunity costs of labor from total revenues for all species harvested. Trip costs were predicted based on gear specific cost functions. If trip revenues exceeded trip costs after accounting for the expected effects of proposed regulations on trip-level harvests, then short-term economic losses were measured as the resulting reduction in trip revenues. Conversely, if the combination of proposed alternatives would cause trip revenues to fall below trip costs, then the trip was recorded as not taken, and losses were measured as a reduction in net operating revenues, which included the loss in revenues from all species minus the savings of trip costs not incurred.

It should be noted that this analytical approach may overestimate or underestimate actual impacts. The analysis relies on actual historic trip records. Models of how fishing behavior might change in response to increased restrictions for individual species are not available for shallow-water grouper or other Gulf species. As a result, while changes in grouper harvests and revenues on historic trips can be examined to identify which trips would remain profitable, it is not currently possible to identify how fishing behavior might change, targeting substitute species in order to maintain revenues. In essence, the current model can only eliminate trips, or allow them to occur with decreased revenues, but neither more trips nor trips with substituted revenues can be modeled at this time. The model can also underestimate impacts if observed fishing

activities reflect more restrictive regulations than what are proposed. For example, the quota for red grouper was filled and the fishery closed during the latter months of 2004 and 2005. Observed trips during the closure would not have recorded landings of red grouper, and there may have been fewer recorded trips than if the red grouper fishery were open. Therefore, the full benefits of a proposed larger quota would not be calculated in the model because there would not be observed trips to harvest the larger quota during these months. Since this limitation applies to all of the management measures on the commercial sector, it is not expected to affect ranking of the alternatives. Caution is necessary, however, if an attempt is made to compare these values with those generated for the recreational sector.

For each management alternative considered including the baseline, discounted net operating revenues were calculated and summed over the policy period. For purposes of economic analysis, policy period is defined as the years 2008-2013. Most provisions in this amendment consider this timeframe as the period during which management measures affecting harvest and participation would apply. Those measures could last longer or shorter depending on future Council decisions, but for this amendment the years 2008-2013 compose the relevant period. The model used logbook records, including the economic add-on survey, supplemented by ALS ex-vessel price information and Bureau of Labor Statistics data on price indices. The baseline scenario refers to the model run using the no action alternative for all actions in this amendment.

For **Action 3** (and all other Actions in this amendment), each alternative, including the no action alternative, is analyzed assuming the preferred alternative for all other actions in this amendment. In actions where there is no preferred alternative, the no action alternative takes its place. Each alternative is compared with the baseline to estimate the alternative's resulting economic effects.

Although the measures considered in this amendment for red grouper are mostly favorable to the fishing participants in general and to the commercial sector in particular, some measures for gag and shallow-water grouper are not. In addition, certain actions such as some allocation alternatives could have negative consequences on the expected commercial share and harvest of gag, red grouper, or shallow-water grouper. It is then not surprising that most of the modeling results would turn out negative for the commercial sector. It should also be pointed out that the policy period considered does not go beyond the time when most of the benefits from management are expected to occur.

The baseline scenario, shown in Table 5.3.3.1, states that over the policy period net operating revenues to the commercial harvesting sector from harvest of all reef fish species in the Gulf would amount to $197 million (using a 3% discount rate). About $122.6 million of this would accrue to the hook and line sector, $62.9 million to the longline sector, and $11.7 million to the rest of the harvesting sector. **Alternative 1** is the no action alternative in this section, but it differs from the baseline because it assumes the preferred alternatives in other Actions. The positive values associated with **Alternative 1** indicate that if there were no gag TAC but all other preferred alternatives in other Actions were adopted, the harvesting sector would gain $1.1 million over the policy period. This net gain would not be totally negated by using a higher discount factor of 7 percent ($951 thousand). All other alternatives would result in negative values, indicating that setting a gag TAC, together with all the preferred alternatives in all other Actions, would result in losses to the commercial harvesting sector. Among the alternatives for setting a gag TAC, **Alternative 4** would provide for the least negative impacts of about $8.8

million at the 3 percent discount factor. At the other end is Alternative 3, which would result in a loss of $25.8 million. These results are expected since **Alternative 4** and **Alternative 3** would provide for the highest and lowest TAC, respectively.

On the basis of overall effects, the alternatives may be ranked in descending order as follows: **Alternative 1**, **Alternative 4**, **Alternative 5**, **Preferred Alternative 2**, and **Alternative 3**. This ranking based on net revenue effects is consistent with the ordering of alternatives based on TAC levels.

The distribution of effects by gear type indicates the longline sector would bear a disproportionate share of losses under **Alternatives 2 to 5** (see Table 5.3.3.1). Per baseline results, the hook and line sector would generate $122.6 million in net revenues over the policy period, and the longline sector would generate about $62.9 million. But under **Alternatives 2 to 5**, losses to the longline sector would be higher than those to the hook and line sector, both in terms of absolute number and percentage. Other gear types would incur the smallest absolute losses but highest percent losses. This situation is mainly driven by the fact that among all gear types, this gear group contributed least to net revenues.

Table 5.3.3.1. Net present values of the effects of alternatives to set gag TAC. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Hook and Line	Longline	Other Gears	Total
	3% Discount Rate			
Baseline	122,586	62,855	11,707	197,148
Alternative 1	433	594	81	1,108
Alternative 2	-9,737	-10,638	-2,565	-22,940
Alternative 3	-11,115	-11,781	-2,936	-25,832
Alternative 4	-3,348	-4,897	-547	-8,792
Alternative 5	-4,222	-5,620	-719	-10,561
	7% Discount Rate			
Baseline	107,912	55,343	10,303	173,558
Alternative 1	374	510	67	951
Alternative 2	-8,760	-9,448	-2,274	-20,482
Alternative 3	-9,958	-10,446	-2,596	-23,000
Alternative 4	-3,108	-4,390	-495	-7,993
Alternative 5	-3,869	-5,024	-646	-9,539

The distribution of effects by area is shown in Table 5.3.3.2. Rest of Gulf includes the states of Alabama through Texas (fishing areas 11-21). Northwest FL includes the Florida counties of Levy through Escambia (fishing areas 7-10). West-Central FL includes the Florida counties of Sarasota through Citrus (fishing areas 5-6). Southwest FL includes the Florida counties of Monroe through Charlotte (fishing areas 1-4). Per estimates of the baseline scenario, Florida dominates the reef fish fishery in the Gulf accounting for $122.8 million, or about 62 percent, of all net revenues generated by the fishery over the policy period. Within Florida, the West-Central area is the biggest participant, with about $49.7 million in net revenues. This area has been known as the center of all grouper activities in the entire Gulf. The distribution of effects by area appears to be directly proportional to the area's contribution to total net revenues especially from grouper. For example, **Preferred Alternative 2** would result in losses of about $15.2 million to West-Central Florida, $6.8 million to Northwest Florida, $701 thousand to the rest of the Gulf, and $290 thousand to South Florida. It is interesting to note that although the overall effects of all alternatives (except the no action alternative) would be negative, South Florida would actually gain under both **Alternatives 4 and 5**. This gain would remain so even under a higher discount factor of 7 percent. With Florida broken down into three areas, the rest of the Gulf would show the largest baseline net revenues among the four areas. It would not suffer the largest loss from **Alternatives 2 to 4**, mainly because it generates its revenues more from the harvest of species other than grouper.

Table 5.3.3.2. Net present values of the effects of alternatives to set gag TAC. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Rest of Gulf	Northwest FL	West-Cent FL	South FL	Total
	3% Discount Rate				
Baseline	74,331	39,227	49,667	33,923	197,148
Alternative 1	7	188	641	271	1,107
Alternative 2	-701	-6,756	-15,194	-290	-22,941
Alternative 3	-804	-7,592	-16,992	-444	-25,832
Alternative 4	-236	-2,680	-6,058	182	-8,792
Alternative 5	-281	-3,264	-7,141	125	-10,561
	7% Discount Rate				
Baseline	65,380	34,560	43,761	29,858	173,559
Alternative 1	5	162	552	231	950
Alternative 2	-624	-6,051	-13,515	-295	-20,485
Alternative 3	-715	-6,779	-15,080	-429	-23,003
Alternative 4	-213	-2,453	-5,455	127	-7,994
Alternative 5	-253	-2,959	-6,404	77	-9,539

Summary

Setting a TAC for gag necessitates an explicit or implicit allocation of allowable gag harvest between the commercial and recreational sector. The general tone of potential effects on the recreational fishery is that of reductions in short-run benefits and increases in long-term benefits. These effects, particularly the net effect, cannot be quantified with available information.

Within the commercial sector, certain changes would occur especially if a commercial gag quota and quota closure were adopted. With a gag quota, changes in the red grouper quota or shallow-water grouper quota would no longer have direct effects on allowable gag harvest. But if quota closures for gag or shallow-water grouper also led to quota closure for gag, then actual harvest of gag would change due to changes in red grouper or shallow-water grouper quota. Conversely, if the gag quota closure led to closures in the red grouper or shallow-water grouper fishery, then actual harvests of these species would also change. Using an economic model, estimates of the potential effects of each alternative were generated. Based on overall effects on the commercial sector, the alternatives may be ranked in descending order as follows: **Alternative 1**, **Alternative 4**, **Alternative 5**, **Preferred Alternative 2**, and **Alternative 3**. The effects of **Alternative 1** would be a gain of $1.1 million. Losses from the rest of the alternatives would be $22.9 million for **Preferred Alternative 2**, $25.8 million for **Alternative 3**, $8.8 million for **Alternative 4**, and $10.6 million for **Alternative 5**.

5.3.3.2 Direct and Indirect Effects on the Social Environment

With **Alternative 1**, no action, there will be no short term impacts on the fishermen, fishing-dependent businesses, or communities that depend on this fishery because it will not change the way people currently fish. However, without a TAC, overfishing is likely to continue and it will not be possible to reach OY. If overfishing continues, it will be necessary to reduce fishing pressure in the future to stop overfishing and rebuild the stocks. If it becomes necessary to reduce the annual harvest of gag grouper in the future, more restrictive measures may be needed to reach OY. Implementing more restrictive measures on the fishery in the future could have negative impacts to the fishermen, fishing-dependent businesses, and communities that are involved with the fishery. For the commercial sector, this would include communities such as Madeira Beach, St. Petersburg, and Panama City, Florida. For the recreational sector, communities along the west coast of Florida would be impacted. If a TAC is set now, then it may be possible to achieve OY without drastic reductions in effort in the future.

Preferred Alternative 2 would set the TAC on a yearly basis for gag during 2008 through 2012 at the yield for each year as defined by the constant Foy projection from 2007 assessment and reevaluation. As the stock rebuilds, this alternative will allow the TAC to increase each year based on the projected stock growth. If the TAC can be increased each year, commercial and recreational fishermen, fishing-dependent businesses, and communities that are involved with this fishery will benefit from having more fish to harvest.

Alternative 3 would use a stepped approach increasing the TAC every three years. Under **Alternative 3**, the TAC for the first year of each of the three year intervals would be the same as in **Alternative 2**. The TAC for the second and third years of each three year interval will be a little lower than the TAC would be for the same years under **Alternative 2** because it would not be increasing each year. This approach may help to rebuild the stocks sooner, but may prevent the fishermen from harvesting the optimum yield in year two and three of each three year period.

Alternative 4 would set the directed TAC on a yearly basis for gag during 2008 through 2012 at the yield for each year as defined by the constant Fmax projection from the 2007 assessment and reevaluation. This alternative sets the TAC higher to begin with than the TAC for **Alternatives 2** or **3**. It starts with the same TAC as it would in **Alternative 5**. Overall, **Alternative 4** would have the highest TAC of all of the alternatives for all of the following years through 2013. In the short term, commercial and recreational fishermen, fishing-dependent businesses, and communities that are involved with this fishery will benefit from having more fish to harvest. However, if this level of effort is too high and overfishing continues, then more restrictive measures may be necessary in the future to end overfishing and rebuild stocks which would have a negative impact on the fishermen, fishing-dependent businesses, and communities that depend on the gag grouper fishery. For the commercial sector, this would include communities such as Madeira Beach, St. Petersburg, and Panama City, Florida. For the recreational sector, communities along the west coast of Florida could be impacted.

Alternative 5 would set the directed TAC on a three year stepped basis for gag during 2008 through 2010 and 2011 through 2012 using the first year of each interval as defined by the constant Fmax projection from the 2007 assessments and reevaluations. In the first year, **Alternative 5** would have a higher TAC than **Alternative 2** or **3**, and would have the same TAC as **Alternative 4**. The TAC would stay the same for years two and three of each three year interval. This approach may help to rebuild the stocks sooner, but may prevent the fishermen from harvesting the optimum yield in year two and three of each three year period.

Summary

Preferred Alternative 2 would set the TAC on a yearly basis for gag during 2008 through 2012 at the yield for each year as defined by the constant Foy projection from 2007 assessment and reevaluation. As the stock rebuilds, this alternative will allow the TAC to increase each year based on the projected stock growth. If the TAC can be increased each year, commercial and recreational fishermen, fishing-dependent businesses, and communities that are involved with the fishery will benefit from having more fish to harvest. For the commercial sector, this would have the most benefit for communities such as Madeira Beach, St. Petersburg, and Panama City, Florida. For the recreational sector, communities along the west coast of Florida that are most involved with this fishery would benefit the most.

Although **Alternatives 3** and **5** would help to end overfishing, they use a stepped approach to raising the TAC. As the stock recovers, fishermen would not be able to harvest the maximum amount possible each year because the TAC would not be adjusted on a yearly basis. **Alternative 4** is similar to **Alternative 2** except that it starts with a higher TAC and there is more of a chance with fluctuations in the stock that gag grouper could continue to be undergoing overfishing which could require more drastic management measures in the future to end overfishing.

5.3.4 Direct and Indirect Effects on Administrative Environment

Under the Magnuson-Stevens Fishery Conservation and Management Act, for a stock that has been declared to be undergoing overfishing, the Council must prepare and submit a plan to end overfishing immediately. In addition, National Standard 1 calls for conservation and management measures to prevent overfishing while achieving, on a continuing basis, optimum yield.

Alternative 1 (no action) would not end overfishing or achieve optimum yield. However, it also would not require any regulatory changes and thus would not impose any additional administrative burden.

Alternatives 2 and 3 have a greater than 50 percent probability of ending overfishing, and a 50 percent probability of eventually achieving OY. Both alternatives would increase the administrative burden by requiring regulatory changes to be developed and implemented, published, and notification made to the public and to enforcement agencies. There will be a period of inconsistency between federal and state regulations until the states can adopt compatible regulations. Typically, these inconsistencies last only a few months, but they can last longer if individual states disagree with the changes and choose to not implement them. **Preferred Alternative 2** will require a change to TAC every year for the next three years, with a regulatory amendment required to set TAC for the subsequent three years (TAC will remain at the 2010 level). **Alternative 3** sets a three-year constant TAC with a subsequent 3-year constant TAC to be set in a future regulatory amendment. Since TAC does not increase over each three year period, there will be an increased likelihood of sectors exceeding their allocations and triggering accountability measures from Action 6.

Alternatives 4 and 5 have a 50 percent probability of ending overfishing, and a less than 50 percent probability of eventually achieving OY. Other than the reduced probabilities of complying with the MSA requirements, the administrative burden would be the same as for **Alternatives 2 and 3**.

5.4 Action 4. Set Red Grouper TAC

5.4.1 Direct and Indirect Effects on Physical Environment

The Alternatives in this Action set red grouper TAC at 6.56 mp gutted weight (**Alternative 1** No Action), 7.56 mp gutted weight (**Preferred Alternative 2**, equilibrium OY), or 7.72 mp gutted weight (**Alternative 3**, equilibrium MSY). The red grouper stock is currently rebuilt and biomass in 2005 was at or slightly above the SSB_{OY} level. These alternatives will have no direct effect on the physical environment because, by themselves, they do not alter characteristics of the fishing fleet. However, if the preferred alternative changes TAC and requires changes in management regulations then the physical environment may be affected. New management measures could indirectly affect the physical environment by defining the level (i.e., the amount of gear in the water at any given time) of commercial fishing effort and the duration and level of recreational fishing effort over the course of the fishing season. Level and duration of effort together define the total cumulative amount of effort (i.e., gear-hours of soak time), which affects the potential for gear to impact the physical environment.

Longline gear is used to catch 70 percent of commercial landings and is deployed over hard bottom habitats using weights to keep the gear on the bottom. This gear, upon retrieval, can abrade, snag and dislodge smaller rocks, corals, and sessile invertebrates (Bohnsack in Hamilton, 2000; Barnette, 2001). The damage that this gear inflicts to the bottom depends on currents and the amount of line sweep caused by hooked fish (Barnette 2001).

Vertical-line gear is used by the remainder of the commercial fishery and most of the recreational fishery and has the potential to snag and entangle bottom structures and cause tear-offs or abrasions (Barnette, 2001). Additionally, if vertical-line gear is lost or improperly disposed of it can entangle marine life (Hamilton 2000; Barnette 2001). Entangled gear often becomes fouled with algal growth. If this gear becomes entangled on corals, the algae can eventually overgrow and kill the coral. However, red grouper are not associated with high relief areas as much as some other reef fish species so the effects of directed hook-and-line fishing for red grouper on the physical environment are expected to be less than those associated with directed fisheries for reef fish species that stay around reefs.

Alternative 1 would not change the current TAC of 6.56 mp gutted weight. If the Council selects a different allocation for red grouper, then commercial management measures could be changed as a result of a lower quota. The red grouper quota was filled in 2004-2005, but commercial landings were below the quota in 2006-2007. Landings for the recreational sector exceeded the recreational target catch level in 2004-2005, but were below the recreational target catch level in 2006-2007 (Table 2.4.1). These recent declines in landings could be due in part to changes in regulations, declines in effort, or a potential drop in stock abundance. It is unknown whether or not management measures approved in 2006 would be sufficient to constrain catch to the target catch level if effort and stock abundance increase in the future. Given that the Council is proposing to allocate more of the red grouper TAC to the recreational fishery in

Action 5 than under the allocation used in Secretarial Amendment 1, small changes in management measures may be implemented under the status quo TAC Any changes would be based on the amount allocation is shifted and other proposed management measures that affect red grouper harvest (e.g., seasonal closure for the entire SWG recreational fishery). If the commercial quota is reduced and the recreational target catch level is increased based on the preferred allocation in Action 5, then small benefits to the physical environment may occur from less longline fishing effort and more vertical line fishing effort.

Preferred Alternative 2 would increase TAC to 7.56 mp gutted weight. The commercial fishery would be allowed to increase landings by approximately 8 percent (note: based on 76:24 commercial to recreational allocation) and could increase effort by a similar amount. This would be expected to affect the benthic environment in deeper waters where longlines are used but would likely have little measurable effect on the benthic environment in shallower waters where commercial vertical line fishery and the recreational fishery are prosecuted. **Alternative 3** would increase effort slightly more than **Preferred Alternative 2** and would have a similar, although slightly greater effect on the physical environment.

5.4.2 Direct and Indirect Effects on the Biological / Ecological Environment

Alternative 1, Status Quo, would maintain the TAC at the current level of 6.56 mp gutted weight. This yield would be at level below equilibrium OY and approximately one mp of landings per year could be forgone. Projections indicate this TAC would allow stock biomass to continue to build above the SSB_{OY} level to a level approximately 33 percent above SSB_{MSY} and twelve percent above SSB_{OY}. This increase is partially the result of a strong 1999 year class entering the fishery. In the near term, stock biomass is projected to decline as the 1999 year class ages and moves through the fishery. Recently updated indices of abundance show a decline from the high of 2004 (Figure 2.4.1). This may suggest that the population abundance has declined since 2004, but is still not as low as it was during the 1990s. Other possible reasons for a decline in the index could be fish moving elsewhere due to red tide or other reasons (GMFMC 2008). A stock assessment for red grouper is scheduled for 2009 and will provide an update on the status of the stock. Relative to **Alternatives 2** and **3**, **Alternative 1** is the most conservative TAC and would have the highest likelihood of preventing overfishing and maintaining the stock biomass above the minimum stock size threshold. Direct effects include an increase in the abundance of red grouper relative to Alternatives 2 and 3. Indirect effects could include an increase in regulatory discards due to increased incidental catch by fishermen targeting other species in the same habitat. In addition, there could be an increase in species richness of benthic habitats due to a behavior of red grouper described as habitat engineering (Coleman and Williams 2002). Their excavations harbor suites of fish and invertebrate species whose abundances may increase as a result, including vermilion snapper *Rhomboplites aurorubens*, black grouper *Mycteroperca bonaci* and spiny lobster *Panulirus argus*.

Preferred Alternative 2 would allow regulations to be modified to attain equilibrium OY, 7.57 mp gutted weight. Red grouper TAC would be managed at the equilibrium OY level at least until the next stock assessment. After completion of the next red grouper stock assessment, red grouper TAC would be set either equal to equilibrium OY or the yield at F_{OY}, whichever is less. Under this proposed TAC, stock biomass is projected to continue to increase although more slowly than **Alternative 1**. As the 1999 year-class moves through the fishery, stock biomass may begin to decline. Recently updated indices of abundance have shown a decline since the

high of 2004 (Figure 2.4.1). This may suggest that the population abundance has declined since 2004, but is still not as low as it was during the 1990s. Other possible reasons for a decline in the index could be fish moving elsewhere due to red tide or other reasons (GMFMC 2008). If SSB has in fact declined, then the risk of overfishing occurring would increase if TAC is increased. Direct effects include an increase in the abundance of red grouper relative to Alternatives 3, but less than Alternative 2. Indirect effects could include a reduction in regulatory discards relative to Alternative 1 by allowing less restrictive management measures, though they would still be greater than Alternative 3. Red grouper perform an ecosystem function by operating as habitat engineers, in which they modify the bottom habitat by creating excavations which may be used by other species including vermilion snapper *Rhomboplites aurorubens*, black grouper *Mycteroperca bonaci* and spiny lobster *Panulirus argus* (Coleman and Williams 2002). Under this alternative, this function would continue to occur to a greater extent than under Alternative 3 but a lesser extent than Alternative 2. The Council chose **Preferred Alternative 2** as preferred because the red grouper stock is at or above SSB_{OY} and this alternative accomplishes their intent to manage all reef fish species at OY levels once rebuilt.

Alternative 3 would allow the fishery-wide yield to increase to equilibrium MSY, 7.72 mp gutted weight. Stock biomass would decline from approximately 27 percent above SSB_{MSY} to SSB_{MSY}. **Alternative 3** is the least conservative of the red grouper TAC Alternatives. If recruitment pulses continue as they have in the past (See Figure 1.2.2), the stock is likely to fluctuate around SSB_{MSY} causing status of the stock to periodically change to an overfishing condition, and frequent changes in annual ACLs. **Alternative 3** is the least conservative of the red grouper TAC Alternatives and would result in the highest probability of overfishing occurring. Regulatory discards would be minimized under this alternative relative to Alternatives 1 and 2, but the habitat engineering ecosystem function of the red grouper stock (Coleman and Williams 2002) would also be minimized.

5.4.3 Direct and Indirect Effects on Economic/Social Environment

5.4.3.1 Direct and Indirect Effects on the Economic Environment

At present, the red grouper TAC of 6.56 MP is divided into a 5.31 MP commercial quota and a 1.25 MP recreational target allocation. The commercial sector is subject to quota closure, and the fishery closed in 2004 and 2005 but not in 2006. Part of the reason for the fishery to remain open throughout 2006 was the reduction in vessel trip limit. On the other hand, the recreational sector is not subject to quota/allocation closure, and input controls on this sector have not been effective enough to limit the sector's harvest to its allocation. At any rate, red grouper is not overfished and not undergoing overfishing so that alternative red grouper TACs considered in this amendment are higher than the current TAC. These higher alternative TACs may be expected to generate larger benefits to both the commercial and recreational sectors if the attendant regulations are accommodating enough to allow both sectors to harvest up to their respective allocations. Considering the relative ineffectiveness of controlling recreational harvest, it is very likely the benefits to the recreational sector of a TAC increase would be realized even if current recreational rules were maintained.

Using the same economic model, the economic implications of the various red grouper TAC alternatives on the commercial sector are presented in the two tables below. One should note that unlike the case for the gag TAC, the no action alternative for setting red grouper TAC would

result in net losses to the commercial sector (see Table 5.4.3.1). Again, it should be stressed that the evaluation of each alternative assumed adoption of the preferred alternatives in other Actions of this amendment, or the no action alternative in the absence a preferred alternative. This then provides the rationale for why **Preferred Alternative 2**, despite raising red grouper TAC about a million pounds, would result in negative effects. Abstracting from all other Actions, **Preferred Alternative 2** may be expected to provide gains to the fishery, but with attendant management measures in other actions of this amendment, the overall effects of this alternative would turn out to be negative. Its presence though would tend to cut down, but not totally offset, the losses due to other restrictive measures in this amendment. Among the alternatives, **Preferred Alternative 2** provides for the lowest amount of losses. Interestingly, **Alternative 3**, which provides for a slightly higher TAC than **Preferred Alternative 2,** would result in slightly higher losses. The reverse is what one would expect, but this can be partly explained by the higher biomass under the Foy (**Preferred Alternative 2**) than under the F_{MSY} (**Alternative 3**) strategy. In its predictions of future landings, the economic simulation model adjusts reported catches from the logbook database to reflect proportional growth in biomass over time. Because biologists estimated that biomass for red grouper would grow faster between 2008 and 2013 for **Preferred Alternative 2** than for **Alternative 3**, **Preferred Alternative 2** actually resulted in slightly higher predictions of catches for red grouper. As with gag, the longline sector would bear the highest losses from setting a red grouper TAC under all alternatives. On the basis of overall effects, the alternatives may be ranked in descending order as follows: **Preferred Alternative 2**, **Alternative 1**, and **Alternative 3**.

As case with Action 1, alternatives in Action 4 would result in more than proportionate losses to the longline sector. Using a 3 percent discount factor, losses to the longline sector would range from $10.6 million under **Alternative 2** to $10.7 million under **Alternative 3**. Losses for the hook and line sector would range from $9.7 million under **Preferred Alternative 2** to $9.8 million under **Alternative 3**. From the magnitudes involved, it would appear that the effects of the various alternatives would not differ substantially from one another and that the distribution of effects by gear type would not differ from one alternative to another.

Table 5.4.3.1. Net present values of the effects of alternatives to set red grouper TAC. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Hook and Line	Longline	Other Gears	Total
		3% Discount Rate		
Baseline	122,586	62,855	11,707	197,148
Alt. 1	-9,771	-10,683	-2,578	-23,032
Alt. 2	-9,737	-10,638	-2,565	-22,940
Alt. 3	-9,806	-10,740	-2,595	-23,141
		7% Discount Rate		
Baseline	107,912	55,343	10,303	173,558
Alt. 1	-8,786	-9,480	-2,284	-20,550
Alt. 2	-8,760	-9,448	-2,274	-20,482
Alt. 3	-8,819	-9,534	-2,300	-20,653

The distribution of effects by area, as shown in Table 5.4.3.2, displays practically similar pattern of results found for the setting of a gag TAC. For all alternatives, West-Central Florida, which is the center of the red grouper fishery, would bear the brunt of the losses from setting red grouper

TAC and other measures in this amendment. Losses for this area would range from $15.2 million to $15.3 million. Northwest Florida would be a far second in terms of net revenue losses. Although the Rest of the Gulf would experience relatively high net revenues in the baseline case, its potential losses would be significantly lower than those of either West-Central or Northwest Florida. The effects of red grouper TAC changes would not affect this area very much, because species other than grouper generally serve as its major source of revenues. Unlike the case with gag, South Florida would not experience any positive results, but it would have the lowest losses. Within each area, the economic effects would not substantially differ from one alternative to another. The difference in effects between the largest (**Alternative 3**) and smallest (**Preferred Alternative 2**) losses would only be about $92 thousand for West-Central Florida, $29 thousand for Northwest Florida, $75 thousand for South Florida, and $1,000 for the Rest of the Gulf.

Table 5.4.3.2. Net present values of the effects of alternatives to set red grouper TAC. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Rest of Gulf	Northwest FL	West-Cent FL	South FL	Total
			3% Discount Rate		
Baseline	74,331	39,227	49,667	33,923	197,148
Alt. 1	-701	-6,771	-15,238	-323	-23,033
Alt. 2	-701	-6,756	-15,194	-290	-22,941
Alt. 3	-702	-6,785	-15,289	-365	-23,141
			7% Discount Rate		
Baseline	65,380	34,560	43,761	29,858	173,559
Alt. 1	-625	-6,062	-13,546	-318	-20,551
Alt. 2	-624	-6,051	-13,515	-295	-20,485
Alt. 3	-625	-6,076	-13,594	-358	-20,653

Summary

In general, setting a TAC for red grouper necessitates an explicit or implicit allocation of allowable gag harvest between the commercial and recreational sector. The general tone of potential effects on the recreational fishery is that of reductions in short-run benefits and increases in long-term benefits. These effects, particularly the net effect, cannot be quantified.

In the commercial sector, certain changes would occur especially if a commercial gag quota and quota closure were adopted. With a gag quota, changes in the red grouper quota or shallow-water grouper quota would no longer have direct effects on allowable gag harvest. But if quota closures for gag or shallow-water grouper also led to quota closure for gag, then actual harvest of gag would change due to changes in red grouper or shallow-water grouper quota. Conversely, if the gag quota closure led to closures in the red grouper or shallow-water grouper fishery, then actual harvests of these species would also change. Using an economic model, estimates of the potential effects of each alternative were generated. Based on overall effects on the commercial sector, the alternatives may be ranked in descending order as follows: **Preferred Alternative 2**, **Alternative 1**, and **Alternative 3**. At a 3 percent discount rate, the losses would amount to $23.0 million for **Alternative 1**, $22.9 million for **Preferred Alternative 2**, and $23.1 million for **Alternative 3**.

5.4.3.2 Direct and Indirect Effects on the Social Environment

With **Alternative 1**, no action, there will be no short term impacts on the fishermen, fishing-dependent businesses, or communities that depend on this fishery because it will not change the way people currently fish. However, if the TAC is not changed, fishermen would potentially be harvesting less than the optimal yield. This would help the stock continue to rebuild but, fishermen, and businesses who are involved in the red grouper fishery would lose out on fish that they could have been harvesting each year as the stock rebounds.

Preferred Alternative 2 would set the red grouper TAC at the constant catch level corresponding to fishing at equilibrium FOY. This would allow for the stock to continue rebuilding while at the same time benefiting commercial and recreational fishermen and businesses involved with the red grouper fishery to benefit from having more fish to harvest. This would benefit the commercial and recreational sectors which will be able to harvest red grouper at the OY level. For the commercial sector, this would benefit communities such as Madeira Beach, St. Petersburg, and Panama City, Florida. For the recreational sector, communities along the west coast of Florida would benefit the most.

Alternative 3 would set the grouper TAC at the constant catch level corresponding to fishing equilibrium FMSY. In the short term, **Alternative 3** will benefit commercial and recreational fishermen and businesses involved with the red grouper fishery the most of the three alternatives because there would be more fish to harvest. In the long term, with a higher TAC, the fishery may undergo overfishing in the future if the stock fluctuates. If this happens, it may be necessary to reduce the TAC level after the new stock assessment in 2011. If the TAC had to be reduced there could be negative impacts on the commercial and recreational fishermen and businesses involved with the red grouper fishery because they would have less fish to harvest.

Summary

Alternative 1 would keep the TAC at current levels and would potentially not allow fishermen to harvest at the OY level. **Preferred Alternative 2** would raise the TAC from current levels and allow fishermen to harvest at the OY level and the stock would continue to rebuild. Commercial and recreational fishermen and businesses involved with the red grouper fishery would benefit from having more fish to harvest. **Alternative 3** would also raise the TAC, but there would be a chance that the stock could undergo overfishing if there are fluctuations in the stock, which may require more restrictive management measures in the future to end overfishing. If the TAC had to be reduced in the future, there would be a negative impact on commercial and recreational fishermen and businesses involved with the red grouper fishery because there would be less fish to harvest.

5.4.4 Direct and Indirect Effects on Administrative Environment

There are no direct effects on the administrative environment from this Action since TAC will be set through this amendment rather than rulemaking. However, the indirect implication is that management measures will have to be implemented that control landings so they are constrained to this harvest level. These will affect enforcement and monitoring. The specific administrative effects change depending on which methods are used to reduce landings (see Sections 5.6.4,

5.7.4, 5.8.4, and 5.9.4). The red grouper fishery's TAC is monitored annually and would likely be adjusted after a stock assessment which occur about every five years .

5.5 Action 5. Red Grouper and Gag Allocations

The alternatives in this action determine the interim allocation of gag and red grouper resources to the recreational and commercial sectors of the fisheries until the Ad Hoc Allocation Committee develops guidance for setting allocations. **Alternative 1** would revert to recreational:commercial allocations as determined under the framework in Amendment 1 to the Reef Fish FMP. The gag allocation would be 65:35; the red grouper allocation would be 23:77. **Alternative 2** would base interim allocations on the average landings during the most recent five-year period for which data are available. During 2001-2005, the allocation was 59:41 for gag and 24:76 for red grouper. **Preferred Alternative 3** would base interim allocations on the average of all years, beginning when grouper landings were identified to species until the most recent year of available landings. During this period, 1986-2005, the average allocation was 61:39 for gag and 24:76 for red grouper.

5.5.1 Direct and Indirect Effects on Physical Environment

The alternatives in this section would not have any direct effect on the physical environment. Indirect effects on the physical environment may occur if the frequency of use of different gear types changes.

Gag are fished by the commercial sector with handlines and bottom longlines. Red grouper are commercially fished primarily with bottom longlines, but also handlines, bandit rigs, and, prior to February 7, 2007, traps (now prohibited in the Gulf of Mexico). Anchors or weights on bottom longlines can impact and damage the bottom habitat. In addition, lines can drag across the surface for considerable distances during retrieval and dislodge lightweight organisms such as invertebrates (Barnette, 2001). The recreational sector catches both species with hook-and-line gear which does not generally interact with bottom habitats, and therefore should have lower impacts on the physical environment. However, both longlines and handlines can entangle in coral reef and other hard bottom and cause physical damage (Barnette, 2001).

Alternative 2 and Preferred Alternative 3 would increase the commercial gag allocation and decrease the commercial red grouper allocation relative to **Alternative 1**. Because the red grouper longline fishery lands nearly four times the amount of fish the gag longline fishery lands, reducing the red grouper commercial allocation could potentially decrease the use of bottom longlines and thus reduce the impacts on the physical environment, although these changes would be minor. The allocations in **Alternative 2** represent the most recent landings data and thus the status quo. Compared to this alternative, the other two alternatives would decrease the gag commercial allocation. **Alternative 1** would slightly increase the red grouper commercial allocation, resulting in a slightly higher potential for impact on the physical environment.

5.5.2 Direct and Indirect Effects on the Biological / Ecological Environment

The alternatives in this action would have no direct effect on the biological environment, but would change only the magnitude of the decrease in gag landings and of the increase in red grouper landings for each sector as considered in Actions 7 and 9. Changes in allocations could

have an indirect effect on the biological environment by changing the amount of discards in each sector.

During 2000-2004, gag dead discards averaged 1,332,000 pounds per year (23.0 percent of total removals) for the recreational sector and averaged 35,800 pounds per year (1.3 percent of total removals) for the commercial sector (Table 1.2.1.1). Despite a lower minimum size for the recreational sector than the commercial sector (22 inches versus 24 inches), the proportional loss due to bycatch is substantially higher for the recreational sector. **Alternative 2** bases allocation on the most recent years of landings and has the lowest proportion allocated to the recreational sector. The other two alternatives would shift a greater proportion of the landings to the recreational sector and produce greater total dead discards.

Table 5.5.1 shows estimated dead discards for 2008 for each sector if discard rates and release mortality remain the same as for 2000-2004. For each alternative in Action 5, total dead discards decrease to 24-35 % of the levels estimated for 2000-2004, provided the Council chooses an alternative for Action 3 (Set Gag TAC) other than No Action.

Table 5.5.1. Estimated gag dead discards for 2008 based on alternatives for setting TAC from Action 3 and allocation alternatives from Action 5.

Action 5 Alternative	Allocation (recreational: commercial)	F_{OY} TAC = 2,360,000 lbs.			F_{MAX} TAC = 3,090,000 lbs.		
		Recreational dead discards	Commercial dead discards	Total dead discards	Recreational dead discards	Commercial dead discards	Total dead discards
1	65:35	352,820	10,738	363,558	461,955	14,059	476,014
2	59:41	320,252	12,579	332,831	419,313	16,470	435,783
3	61:39	331,108	11,965	343,073	433,527	15,666	449,193
2000-2004 Average							
	61:39	1,332,000	36,000	1,368,000			

During 2001-2005, red grouper dead discards averaged 286,673 pounds per year (13.9 percent of total removals) for the recreational sector and averaged 762,514 pounds per year (12.0 percent of total removals) for the commercial sector (Table 1.2.2.1). The proportionally similar dead discards and the small change in the allocation among the three alternatives result in little difference in the total dead discards among the alternatives.

Table 5.5.2 shows estimated dead discards for 2008 for each sector if discard rates and release mortality remain the same as for 2001-2005. Regardless of the alternative chosen for Action 4 to set red grouper TAC, the lowest amount of dead discards would be under **Alternative 1** and the highest would be under **Alternative 2 and Preferred Alternative 3**; however, the difference in dead discard weight under these alternatives is less than one percent. It should be noted that while more harvest would be allocated to the recreational fishery under **Alternative 2 and Preferred Alternative 3**, the total number of dead discards will be greater under these alternatives even though the recreational discard mortality rate is lower. The reason for this difference is because of the high overall number of fish discarded by the recreational fishery relative to the commercial fishery.

Table 5.5.2. Estimated red grouper dead discards for 2008 based on alternatives for setting TAC from Action 4 and allocation alternatives from Action 5.

Action 5 Alternative	Allocation (recreational: commercial)	Current TAC = 6,560,000 lbs.			F_{OY} TAC = 7,570,0000 lbs.			F_{MSY} TAC = 7,720,000 lbs.		
		Recreational dead discards	Commercial dead discards	Total dead discards	Recreational dead discards	Commercial dead discards	Total dead discards	Recreational dead discards	Commercial dead discards	Total dead discards
1	23:77	209,723	606,144	815,867	242,013	699,468	941,481	246,808	713,328	960,136
2	24:76	218,842	598,272	817,114	252,535	690,384	942,919	257,539	704,064	961,603
3	24:76	218,842	598,272	817,114	252,535	690,384	942,919	257,539	704,064	961,603
2001-2005 Average										
	24:76	286,673	762,514	1,049,187						

5.5.3 Direct and Indirect Effects on Economic/Social Environment

5.5.3.1 Direct and Indirect Effects on the Economic Environment

Action 5 considers alternative reallocations of gag and red grouper resources between the recreational and commercial sectors. The default gag allocation, using base years specified in **Amendment 1**, grants 65 percent and 35 percent of the gag resource to the recreational and commercial sectors, respectively. Also set in **Amendment 1**, the default red grouper allocation grants 23 percent and 77 percent of the resource to the recreational and commercial sectors, respectively.

In this amendment, red grouper reallocation alternatives considered are relatively close to the status quo; and could, at most, change the commercial and recreational shares by one percentage point each. Measures reallocating gag grouper would result in larger changes. Gag reallocation measures considered could modify the recreational and commercial allocations by 6 percent each.

The evaluation of economic impacts expected to result from various reallocations of gag and red grouper resources between the commercial and recreational sectors assumes that gag and red grouper TACs are set according to **Preferred Alternative 2 - Action 3** and **Preferred Alternative 2-Action 4,** respectively. Comparisons between alternative allocation scenarios are based on changes in economic value expected to result from reallocating resources between sectors. Recent average landings (2001-2005), which correspond to a 59:41 commercial/ recreational split for gag and to a 24:76 commercial/recreational split for red grouper serve as benchmarks for comparison.

The aggregate economic value associated with each alternative is determined by summing estimated commercial and recreational economic values. For the commercial sector, the economic value corresponding to each alternative was derived based on a simulation model developed by Waters. The simulation model is detailed in section 5.3.3.1.

For the recreational sector, the economic value corresponding to each alternative is derived by summing its constituting components, i.e., the producer surplus derived by charter operators, the producer surplus enjoyed by headboat operators, and consumer surpluses derived by anglers on headboats, private, and charter vessels. It is assumed that changes in TAC do not affect the relative proportion harvested by each sub-sector. In other terms, when expressed in percentage points, harvest levels for anglers on headboats, private, and charter vessels remain constant, regardless of the recreational TAC. Based on a 2001-2005 average, private anglers, anglers on charter vessels, and anglers on headboats harvested 73.2 percent, 24.3 percent, and, 2.5 percent of the red grouper recreational quota, respectively. Relative proportions of gag grouper harvested in the recreational sector by private anglers, anglers on charter vessels, and anglers on headboats are estimated at 74.3 percent, 22.5 percent, and 3.2 percent, respectively.

Expected changes in producer surplus in the for-hire sector are approximated by changes in net revenues. For the charter sector, average net revenues per angler trip, excluding payment to owners, captain and crew members, were obtained from a recently analyzed charter survey

conducted by the SEFSC. Preliminary survey results are provided in Joint Reef Fish/ Shrimp Amendment 27/14 (GMFMC, 2007). Estimated at $141 (in $2003), average net revenues per angler trip approximated $150 when updated to 2005 dollars using an All Urban Consumers CPI series from the Bureau of Labor Statistics[5]. For the headboat sector, net revenues per angler day, excluding payments to owner, captain, and crew, averaged $62 (in $2003). Revenue and costs estimates used to derive this average were obtained from the NMFS Headboat survey and are presented in Joint Reef Fish/ Shrimp Amendment 27/14 (GMFMC, 2007). Adjusted for inflation using the Bureau of Labor Statistics CPI series listed above, average net revenues per angler day approximated $66, in $2005.

In evaluating welfare changes in the charter and headboat sectors, a unitary catch elasticity of effort is assumed which means that a one percent increase or decrease in catch is assumed to result in a one percent increase or decrease in effort. This assumption does not fully account for the adverse impact of decreases in catch rates on demand for trips. While the true value of catch elasticities of effort for gag and red grouper are unknown, in general, more than proportional changes in effort are observed in response to changes in catch rates. For example, for red snapper in the Gulf of Mexico, Gillig and al. report catch elasticities between 1.21 and 2.41 (Gillig et al., 2000). It is also assumed that target behavior in the headboat sector is similar to that in the charter boat sector (target effort is not collected for the headboat sector). This assumption, however, could overestimate impacts on the headboat sector, because the greater mobility and smaller passenger load on charter boats may differentially influence target behavior by the two fleets.

Consumer surpluses, as measured by compensating variation (CV), are estimated as the number of fish harvested times the CV per fish. Derived by Haab et al. (1997), the CV estimate of $3.52 per fish per trip was updated to 2005 dollars using an All Urban Consumers CPI series from the Bureau of Labor Statistics. In $2005, an average CV of $3.74 per fish was used in this analysis. Current data does not permit the quantification of changes in fisherman's behavior, including species substitution. Hence, estimates of lost recreational benefits likely overestimate true losses since fishermen can target other species to mitigate the restrictions on a given species. This assessment also assumes that, although some of the management measures alter the characteristics of recreational trips, the value of the trip remained constant and overall changes in economic value were only associated with changes in the number of fish (or pounds) landed. Hence, changes in consumer surplus, measured by changes in compensating variation (CV), were estimated as the changes in number of fish harvested times the CV per fish. As derived by Haab et al. (1997), the CV estimate of $3.52 per fish per trip was updated to 2005 dollars using an All Urban Consumers CPI series from the Bureau of Labor Statistics resulting in an average CV of $3.74 (2005$) per fish. It should be noted that this value was not developed specifically for gag or red grouper. The value is a composite of the average value of many Gulf species and likely reflects the increased value of more highly valued/targeted species, like red snapper.

[5] The Bureau of Labor Statistics Consumer Price Index All Urban Consumer Series can be downloaded from ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt CPI values for 1997, 2003, and 2005 are 160.5, 184.0, and 195.3, respectively.

Alternative 1 would revert the resource allocation specified by **Amendment 1** to the Reef Fish FMP and grant 65 percent of the gag TAC to the recreational sector and 35 percent to the commercial sector. Under this alternative, the red grouper TAC will be allocated as follows: 23 percent to the recreational sector and 77 percent to the commercial sector. Over time, shares of the resources (gag and red grouper) used by each sector have differed from their assigned allocation under **Amendment 1.**

For the commercial sector, the implementation of **Alternative 1** would increase its share of the gag from 35 to 41 percent and decrease its share of the red grouper TAC from 77 to 76 percent. For the 6-year period considered (2008-2013), based on a 7 percent discount rate, a net present value decrease of approximately $7.70 million is expected to result from allocations under **Alternative 1**. Decreases in net economic value would be estimated at approximately $8.77 million if a 3 percent discount rate were used instead. Anticipated decreases in net present value for the commercial sector are presented in Table 5.1.

Table 5.5.3.1: Expected Changes in Net Present Values in the Commercial Sector Allocation Alternatives (2008-2013)

	Commercial Allocation (%)		**Net Present Value Change**	
	Gag Grouper	**Red Grouper**	**7% discount rate**	**3% discount rate**
Alternative 1	35	77	-$7,692,000	-$8,774,000
Alternative 2	41	76	$0	$0
Preferred Alternative 3	39	76	-$2,786,000	-$3,175,000

For the recreational sector, this alternative would correspond to a 65 percent share of the gag resource and to a 23 percent share of the red grouper TAC. For gag grouper, recreational landings and target effort for the charter, private, and headboat sectors are presented in Table 5.5.3.2. Consumer and producer surplus measures as well as nominal and discounted aggregate economic values in the recreational sector are provided in Table 5.5.3.3. Tables 5.5.3.4 and 5.5.3.5, present the same information for red grouper.

Table 5.5.3.2: Gag Grouper - Recreational Landings and Target Effort for the Charter, Private, and Headboat Sectors

GAG	Year	TAC (MP)	Recreational		Charter			Private			Headboat		
			Allocation	Quota (MP)	Landings		Target Effort	Landings		Target Effort	Landings		Target Effort
					Pounds	Fish		Pounds	Fish		Pounds	Fish	
	2008	3.13	0.65	2.03	457,763	57,695	12,610	1,511,634	212,906	154,910	65,104	9,435	4,280
	2009	3.38	0.65	2.20	494,325	62,303	13,617	1,632,371	229,911	167,283	70,304	10,189	4,622
	2010	3.63	0.65	2.36	530,888	66,911	14,624	1,753,109	246,917	179,656	75,504	10,943	4,964
Alternative 1	2011	3.63	0.65	2.36	530,888	66,911	14,624	1,753,109	246,917	179,656	75,504	10,943	4,964
	2012	3.63	0.65	2.36	530,888	66,911	14,624	1,753,109	246,917	179,656	75,504	10,943	4,964
	2013	3.63	0.65	2.36	530,888	66,911	14,624	1,753,109	246,917	179,656	75,504	10,943	4,964
	2008	3.13	0.59	1.85	415,508	52,369	11,446	1,372,098	193,253	140,610	59,094	8,564	3,885
	2009	3.38	0.59	1.99	448,695	56,552	12,360	1,481,691	208,689	151,841	63,814	9,248	4,195
Alternative 2	2010	3.63	0.59	2.14	481,883	60,735	13,274	1,591,283	224,124	163,072	68,534	9,933	4,506
	2011	3.63	0.59	2.14	481,883	60,735	13,274	1,591,283	224,124	163,072	68,534	9,933	4,506
	2012	3.63	0.59	2.14	481,883	60,735	13,274	1,591,283	224,124	163,072	68,534	9,933	4,506
	2013	3.63	0.59	2.14	481,883	60,735	13,274	1,591,283	224,124	163,072	68,534	9,933	4,506
	2008	3.13	0.61	1.91	429,593	54,144	11,834	1,418,610	199,804	145,377	61,098	8,855	4,017
Preferred	2009	3.38	0.61	2.06	463,905	58,469	12,779	1,531,917	215,763	156,989	65,978	9,562	4,338
Alternative 3	2010	3.63	0.61	2.21	498,218	62,794	13,724	1,645,225	231,722	168,600	70,858	10,269	4,658
	2011	3.63	0.61	2.21	498,218	62,794	13,724	1,645,225	231,722	168,600	70,858	10,269	4,658
	2012	3.63	0.61	2.21	498,218	62,794	13,724	1,645,225	231,722	168,600	70,858	10,269	4,658
	2013	3.63	0.61	2.21	498,218	62,794	13,724	1,645,225	231,722	168,600	70,858	10,269	4,658

Table 5.5.3.3: Allocation Alternatives and Recreational Surpluses and Economic Value – Gag Grouper

GAG	Year	Recreational Allocation	Charter Surplus		Private Surplus	Headboat Surplus		Economic Value (EV)	Discounted EV 7%	Discounted EV 3%
			Consumer	Producer	Consumer	Consumer	Producer			
	2008	0.65	$215,779	$1,891,470	$796,269	$35,288	$282,486	$3,221,292	$3,221,292	$3,221,292
	2009	0.65	$233,013	$2,042,546	$859,869	$38,107	$305,048	$3,478,584	$3,251,013	$3,377,266
	2010	0.65	$250,248	$2,193,622	$923,468	$40,925	$327,611	$3,735,875	$3,263,058	$3,521,421
Alternative 1	2011	0.65	$250,248	$2,193,622	$923,468	$40,925	$327,611	$3,735,875	$3,049,587	$3,418,855
	2012	0.65	$250,248	$2,193,622	$923,468	$40,925	$327,611	$3,735,875	$2,850,081	$3,319,277
	2013	0.65	$250,248	$2,193,622	$923,468	$40,925	$327,611	$3,735,875	$2,663,627	$3,222,599
Total			**$1,449,785**	**$12,708,506**	**$5,350,011**	**$237,096**	**$1,897,978**	**$21,643,377**	**$18,298,659**	**$20,080,709**
	2008	0.59	$195,861	$1,716,873	$722,767	$32,031	$256,410	$2,923,942	$2,923,942	$2,923,942
	2009	0.59	$211,505	$1,854,004	$780,496	$34,589	$276,890	$3,157,484	$2,950,919	$3,065,518
Alternative 2	2010	0.59	$227,148	$1,991,134	$838,225	$37,148	$297,370	$3,391,025	$2,961,853	$3,196,367
	2011	0.59	$227,148	$1,991,134	$838,225	$37,148	$297,370	$3,391,025	$2,768,087	$3,103,269
	2012	0.59	$227,148	$1,991,134	$838,225	$37,148	$297,370	$3,391,025	$2,586,997	$3,012,882
	2013	0.59	$227,148	$1,991,134	$838,225	$37,148	$297,370	$3,391,025	$2,417,754	$2,925,128
Total			**$1,315,959**	**$11,535,413**	**$4,856,164**	**$215,211**	**$1,722,780**	**$19,645,527**	**$16,609,552**	**$18,227,105**
	2008	0.61	$202,500	$1,775,072	$747,268	$33,117	$265,102	$3,023,059	$3,023,059	$3,023,059
Preferred	2009	0.61	$218,674	$1,916,851	$806,954	$35,762	$286,276	$3,264,517	$3,050,950	$3,169,434
Alternative 3	2010	0.61	$234,848	$2,058,630	$866,640	$38,407	$307,450	$3,505,975	$3,062,255	$3,304,718
	2011	0.61	$234,848	$2,058,630	$866,640	$38,407	$307,450	$3,505,975	$2,861,920	$3,208,464
	2012	0.61	$234,848	$2,058,630	$866,640	$38,407	$307,450	$3,505,975	$2,674,692	$3,115,014
	2013	0.61	$234,848	$2,058,630	$866,640	$38,407	$307,450	$3,505,975	$2,499,712	$3,024,285
Total			**$1,360,567**	**$11,926,444**	**$5,020,780**	**$222,506**	**$1,781,180**	**$20,311,477**	**$17,172,588**	**$18,844,973**

Table 5.5.3.4: Red Grouper - Recreational Landings and Target Effort for the Charter, Private, and Headboat Sectors

RED	Year	TAC (MP)	Recreational		Charter			Private			Headboat		
			Allocation	Quota (MP)	Landings		Target Effort	Landings		Target Effort	Landings		Target Effort
					Pounds	Fish		Pounds	Fish		Pounds	Fish	
	2008	7.57	0.23	1.74	423,087	66,592	10,731	1,274,485	190,222	110,298	43,528	7,914	2,680
	2009	7.57	0.23	1.74	423,087	66,592	10,731	1,274,485	190,222	110,298	43,528	7,914	2,680
	2010	7.57	0.23	1.74	423,087	66,592	10,731	1,274,485	190,222	110,298	43,528	7,914	2,680
Alternative 1	2011	7.57	0.23	1.74	423,087	66,592	10,731	1,274,485	190,222	110,298	43,528	7,914	2,680
	2012	7.57	0.23	1.74	423,087	66,592	10,731	1,274,485	190,222	110,298	43,528	7,914	2,680
	2013	7.57	0.23	1.74	423,087	66,592	10,731	1,274,485	190,222	110,298	43,528	7,914	2,680
	2008	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
	2009	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
Alternative 2	2010	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
	2011	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
	2012	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
	2013	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
	2008	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
Preferred	2009	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
Alternative 3	2010	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
	2011	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
	2012	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796
	2013	7.57	0.24	1.82	441,482	69,488	11,197	1,329,898	198,492	115,093	45,420	8,258	2,796

Table 5.5.3.5: Allocation Alternatives and Recreational Surpluses and Economic Value – Red Grouper

RED	Year	Recreational Allocation	Charter Surplus		Private Surplus	Headboat Surplus		Economic Value (EV)	Discounted EV 7%	Discounted EV 3%
			Consumer	Producer	Consumer	Consumer	Producer			
	2008	0.23	$249,055	$1,609,609	$711,429	$29,599	$176,874	$2,776,566	$2,776,566	$2,776,566
	2009	0.23	$249,055	$1,609,609	$711,429	$29,599	$176,874	$2,776,566	$2,594,921	$2,695,695
	2010	0.23	$249,055	$1,609,609	$711,429	$29,599	$176,874	$2,776,566	$2,425,160	$2,617,180
Alternative 1	2011	0.23	$249,055	$1,609,609	$711,429	$29,599	$176,874	$2,776,566	$2,266,505	$2,540,951
	2012	0.23	$249,055	$1,609,609	$711,429	$29,599	$176,874	$2,776,566	$2,118,229	$2,466,943
	2013	0.23	$249,055	$1,609,609	$711,429	$29,599	$176,874	$2,776,566	$1,979,653	$2,395,090
Total			**$1,494,330**	**$9,657,652**	**$4,268,574**	**$177,592**	**$1,061,247**	**$16,659,395**	**$14,161,034**	**$15,492,425**
	2008	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,897,286	$2,897,286
	2009	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,707,744	$2,812,899
Alternative 2	2010	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,530,602	$2,730,970
	2011	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,365,049	$2,651,427
	2012	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,210,326	$2,574,201
	2013	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,065,725	$2,499,224
Total			**$1,559,301**	**$10,077,549**	**$4,454,164**	**$185,314**	**$1,107,388**	**$17,383,717**	**$14,776,731**	**$16,166,008**
	2008	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,897,286	$2,897,286
Preferred	2009	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,707,744	$2,812,899
Alternative 3	2010	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,530,602	$2,730,970
	2011	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,365,049	$2,651,427
	2012	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,210,326	$2,574,201
	2013	0.24	$259,884	$1,679,592	$742,361	$30,886	$184,565	$2,897,286	$2,065,725	$2,499,224
Total			**$1,559,301**	**$10,077,549**	**$4,454,164**	**$185,314**	**$1,107,388**	**$17,383,717**	**$14,776,731**	**$16,166,008**

Using a yearly discount rate of 7 percent over the 6-year period and given the reductions needed in gag harvest, decreases in net present economic value expected to result from the allocation considered under **Alternative 1** are estimated at $6.6 million, approximately. With a 3% discount rate, net present value changes associated with the allocation are estimated at $7.6 million, approximately. Given existing data limitations, these values are approximations of expected welfare effect of the proposed allocation. Welfare estimates, i.e., consumer and producer surplus estimates, presented in this amendment must be treated with caution and are only provided as approximations for the magnitude of the expected effects. The ordinal ranking of alternative allocations considered under this action constitutes the primary purpose of these estimates. Aggregate changes in economic values expected to result from the alternative reallocation of gag and red grouper are summarized in Table 5.5.3.6.

Table 5.5.3.6: Aggregate Changes in Economic Values Resulting from Gag and Red Grouper Reallocation Alternatives (2008-2013)

	Discount Rate 7%			**Discount Rate 3%**		
	Recreational	**Commercial**	**Total**	**Recreational**	**Commercial**	**Total**
Alternative 1	$1,073,410	-$7,692,000	**-$6,618,590**	$1,180,020	-$8,774,000	**-$7,593,980**
Alternative 2	$0	$0	$0	$0	$0	$0
Preferred Alternative 3	-$52,661	-$2,786,000	**-$2,838,661**	-$55,716	-$3,175,000	**-$3,230,716**

Alternative 2 would allocate gag and red grouper resources based landings during 2001-2005. Corresponding recreational/commercial proportions for gag and red would be 59:41 and 24:76, respectively. **Alternative 2** is used as a baseline because it parallels current harvesting patterns. Therefore, changes in economic values are not anticipated from this alternative.

Preferred Alternative 3 would allocate gag and red grouper TACs using the longest existing data series. **Preferred Alternative 3** would base reallocation of gag and red grouper on landings from 1986 to 2005. Recreational/commercial proportions for gag and red would be 61:39 and 24:76, respectively. Changes in net present value based on a 7 or 3 percent discount rate were estimated at about -$2.84 million and -$3.23 million, approximately.

Summary

Action 5 considers alternative reallocations of the gag and red grouper TACs between the recreational and the commercial sectors. **Alternative 1** reverts to the repartition of the gag and red grouper resources set in Amendment 1 to the Reef Fish FMP and grant 65 percent of the gag TAC to the recreational sector and 35 percent to the commercial sector. Under this alternative, the red grouper TAC will be allocated as follows: 23 percent to the recreational sector and 77 percent to the commercial sector. **Alternative 1** is associated with changes in economic benefits due to discrepancies observed between the specified allocation and recreational and commercial recorded landings. Under **Alternative 1**, aggregate decreases in net present value based on a 7 percent discount rate, are estimated at $ 6.6 million, approximately. **Alternative 2** would allocate gag and red grouper based on observed landings during 2001-2005. The allocation corresponding

to current landings is used as a benchmark in this analysis and thus, is not associated with changes in economic value. **Preferred Alternative 3** would reallocate gag and red grouper based on the longest existing data series (1986-2005). For gag and red grouper, recreational/commercial splits would be 61:39 and 24:76, respectively. Anticipated changes in net present value based on a 7 percent discount rate are estimated at about -$2.84 million under **Preferred Alternative 3**.

5.5.3.2 Direct and Indirect Effects on the Social Environment

Alternative 1 would revert to the TAC allocation between the recreational and commercial fisheries as specified in Amendment 1 to the reef fish FMP as the average share during the years 1981 through 1987. The recreational to commercial proportions would be gag 65:35, red grouper 23:77. **Alternative 1** would be set allocations according to the share of landings for 1986 and 1987, which are different than the average landings for 2001-2005.

Alternative 1 would provide an additional six percent of gag allocation to the recreational fishery over what the average landings were in 2001-2005. This would benefit the recreational fishermen and fishing dependent businesses involved in the gag grouper fishery because they would have more fish to harvest than the average share they harvested for 2001-2005. Communities along the west coast of Florida would benefit the most because they have the largest share of recreational fishermen who target gag grouper. By reverting to the average share for gag for 1986 through 1987, the commercial sector would lose six percent of the average share they had been harvesting during 2001 through 2005. This could have some negative impacts on the commercial fishermen and fishing-dependent businesses involved in the gag grouper fishery because they would receive a smaller share than they have been harvesting in 2001 through 2005. For the commercial sector, this would have a negative impact on communities such as Madeira Beach, St. Petersburg, and Panama City, Florida that depend on this fishery.

Alternative 1 would have minimal impact of commercial or recreational fishermen and businesses involved in the red grouper fishery because the shares of the average amount that was harvested in 2001 through 2005 was almost the same as the shares for harvest in 1986-1987 with a gain of one percent of the share for the commercial sector and a loss of one percent for the recreational sector.

Alternative 2 would establish the allocation of TAC between the recreational and commercial fisheries as the recent five-year average share during the years of 2001 through 2005. The recreational: commercial shares would be 59:41 for gag grouper and 24:76 for red grouper.

Alternative 2 would have no direct or indirect impacts on the commercial or recreational fishermen, the fishing-dependent businesses, and communities that are involved with the gag and red grouper fisheries because both sectors would continue to have the same share as the average they had been harvesting.

Preferred Alternative 3 would establish the allocation of TAC between the recreational and commercial fisheries as the average share during the years 1986 through 2005. The recreational: commercial shares would be 61:39 for gag grouper and 24:76 for red grouper. This alternative

may have a slight impact on the commercial fishermen and fishing-dependent businesses that are involved with the commercial gag grouper fishery because their share would be two percent less than what their recent average had been. It would have a small benefit for the recreational sector for gag grouper because their share would be two percent higher than it had been in the years 2001 through 2005.

Summary

The differences in these three alternatives are small and any changes to the allocations would have minimal impacts on the recreational or commercial fisheries. **Alternative 2** would have the least impacts on the commercial or recreational fisheries because the allocation would be based on the recent landings for 2001- 2005 so each sector could continue to harvest what they had been harvesting. **Alternative 1** would have the most negative impacts on the commercial fishery because they would lose six percent of the average gag grouper share they harvested in 2001-2005. Although the three alternatives do not change the share allocation very much, in the long term, any shift in allocation could have a negative impact on the sector that loses shares. The cumulative impacts, when they are combined with other actions in the reef fish fishery, can lead to a loss of income and possibly a loss of jobs for the commercial sector. A loss of shares for the recreation sector can have a negative impact on the recreational fishery when combined with other regulations in the reef fish fishery.

5.5.4 Direct and Indirect Effects on Administrative Environment

NMFS monitors harvest to ensure landings for each sector of a fishery remain within the allocation. Action 3 would establish a gag TAC within the shallow-water grouper aggregate, and thus would require separate quota monitoring of this species for the first time. NMFS already monitors red grouper, and changes in allocation would not require any new administrative action. If landings for one or both sectors of either fishery exceed the allocation, any accountability measures established through Action 6 would be triggered.

5.6 Action 6. Shallow-water Grouper Annual Catch Limits and Accountability Measures

The reauthorized Magnuson-Stevens Act, as amended through January 12, 2007, requires the Council specify annual catch limits (ACLs) and accountability measures (AMs) by 2010 for each stock/stock complex undergoing overfishing. These regulatory provisions will reduce the likelihood overfishing will occur by ensuring AMs are implemented if ACLs are exceeded. NOAA Fisheries Service is currently drafting guidelines for implementing ACLs and AMs; proposed guidelines were published in early June 2008 for public review and comment. Below is a discussion of the physical, biological, social/economic, and administrative consequences associated with alternatives in Action 6.

5.6.1. Direct and Indirect Effects on Physical Environment

Action 6 has no direct effect on the physical environment. Indirect effects on the physical environment may include reductions in fishing effort and habitat-gear interactions if AMs are implemented to constrain harvest. Impacts to the physical environment resulting from

commercial quotas and seasonal closures are summarized in sections 5.8.1 and 5.9.1, and are incorporated here by reference.

5.6.2 Direct and Indirect Effects on Biological/Ecological Environment

Gag are undergoing overfishing, requiring the Council implement management measures to end overfishing. Red grouper are not undergoing overfishing and are not overfished. The status of the remaining species in the SWG fishery is unknown. Action 6 includes five ACL/AM alternatives. With the exception of **Alternative 1** (status quo), all of the alternatives are intended to prevent or reduce the likelihood of overfishing SWG species.

Alternative 1 would maintain status quo regulations and would not require AMs to ensure harvest is constrained at or near target levels. The Council could implement management measures through framework action to constrain harvest if landings overages occur, but the measures would likely not take effect until several years after the overage because of the time it takes to draft and implement regulatory measures. By not specifying AMs, landings could exceed target fishing mortality and landings levels. If management measures in Actions 7-9 do not adequately reduce or constrain fishing mortality, then overfishing may occur. In particular, if recreational fishing effort increases again in the future, then the Council's preferred recreational management alternative in Action 9 may not sufficiently constrain harvest to achieve the Council's fishery management goals. By exceeding target/threshold landings levels and fishing mortality rates, maximum and optimum yield will not likely be achieved and additional harvest modifications may be required after the next stock assessment(s) if overfishing has not ended or been prevented. **Alternative 1** is the least conservative of any of the alternatives considered in Action 7, and would require the Council to approve AMs in a subsequent amendment by 2010 to meet the reauthorized Magnuson-Stevens Act mandate.

Alternatives 2 and **3** propose mechanisms for implementing AMs for each sector if the ACL (in lbs) for a sector, as summarized in Tables 6.1 or 6.2, is exceeded. The ACLs triggering AMs in **Alternative 2** are based on the yield at F_{OY} for gag and equilibrium OY for red grouper. In **Alternative 3**, ACLs are based on the yield at F_{MSY} for gag and equilibrium MSY for red grouper). After the next red grouper stock assessment, it is the Council's intent to set red grouper ACLs at either equilibrium MSY (**Alternative 2**) or equilibrium OY (**Alternative 3**) levels or the yield at F_{MSY} (**Alternative 2**) or yield at F_{OY} (**Alternative 3**), whichever is less. No recreational ACL would be established for the entire recreational SWG fishery since gag and red grouper represent a majority of SWG landings (95 percent by number during 2004-2006) and other SWG species are infrequently landed. In **Alternative 2**, the commercial ACL for the entire SWG fishery would be the sum of annual yields at F_{OY} for gag and red grouper plus 0.68 million pounds for other SWG (2001-04 average landings from Turner 2006). In **Alternative 3**, the ACL for the entire commercial SWG fishery would be the annual yield at F_{MAX} for gag plus the annual yield at F_{MSY} for red grouper plus 0.68 million pounds for other SWG. The SEFSC would estimate red grouper, gag, and SWG (commercial only) landings by sector and provide this information to the AA annually to determine if landings exceeded the ACLs triggering AMs. If a sector's landings are determined to exceed the ACLs specified in Tables 6.1 and 6.2, the AA would issue a notice maintaining the target landings level/quota in the following fishing year. The commercial grouper fishery would continue to be closed when quotas are met, as specified

in Action 8. The AA could also issue a notice reducing the length of the recreational SWG fishing season if an ACL(s) is exceeded in the prior fishing year. The main difference between these two alternatives is that **Alternative 3** provides a buffer between the target landings/quota and the ACL. For this reason, **Alternative 2** is more conservative and would have the highest likelihood of preventing or ending overfishing of SWG species of any of the alternatives in Action 6. **Alternative 2** would allow landings to exceed the target catch level/quota as long as landings do not exceed the ACL.

Alternative 4 is similar to the preferred ACL/AM approved for gray triggerfish in Amendment 30A to the Reef Fish FMP. ACLs would be based on yield at F_{OY} for gag and equilibrium OY for red grouper (similar to **Alternative 2**) and there would be no buffer between the ACL and annual catch target/quota. However, **Alternative 4** would allow landings to be averaged over multiple years, unlike **Alternatives 2** and **3**. Multiyear landings averages will allow year-to-year fluctuations to occur, without necessarily triggering AMs. Because recruitment of grouper is highly variable from year-to-year, averaging landings across several years will allow managers to account for this variability. If average landings do exceed the ACL, then the AA would not increase the target catch level/quota in the following year for the sector experiencing the overage. Additionally, commercial landings would be constrained by quotas and the AA would reduce the length of the recreational SWG fishing season in the following year by the amount necessary to ensure recreational gag and red grouper landings do not exceed the recreational target catch level for that fishing year. Because **Alternative 4** ACLs are based on the yield at F_{OY} for gag and equilibrium OY for red grouper, this alternative is the second most conservative of any of the alternatives considered in Action 6. Only **Alternative 2** is more conservative and would provide greater biological benefits.

Alternative 5 is similar to **Alternative 4**. The main difference is that ACLs for **Alternative 5** are based on the yield at F_{MAX} for gag and equilibrium MSY for red grouper. Because **Alternative 5** allows multiyear averaging of landings data and provides a buffer between the annual catch target or quota and ACL, it is less conservative than **Alternatives 2-4**. **Alternative 5** would have the lowest probability of triggering AMs of any of the alternatives considered, except **Alternative 1**. It would therefore have the second greatest likelihood of allowing overfishing. If overages occur, AMs would be the same as those described for **Alternative 4**. Overall, **Alternative 2** would provide the greatest benefit to the biological environment, followed by **Alternatives 4**, **3**, **5**, and **1**.

5.6.3 Direct and Indirect Effects on Economic/Social Environment

5.6.3.1 Direct and Indirect Effects on the Economic Environment

In principle, the no-action alternative (**Alternative 1**) does not have direct economic effects in the sense that it does not by itself trigger any change in management actions. This, of course, does not mean that no corrective actions will be undertaken in the event actual harvests deviate from the target harvests substantially enough to prevent the stock to rebuild to its target biomass level. Any corrective actions, however, would be done through existing mechanisms to change regulatory measures. **Alternative 1** then may be considered to have indirect economic impacts

as it allows regulatory changes that can alter the economic conditions in the fishery. All the other 4 alternatives would have direct economic effects on fishing participants.

For the commercial sector, the regulatory type under **Alternatives 2** to **5** would be that of quota closures. Thus, the nature of impacts on the commercial sector would be similar to those measures under this amendment that would implement quotas and quota closures. Estimates of the impacts of quota closures for the commercial sector are presented as part of the analysis of the economic effects of alternatives under Action 8, in conjunction with other pertinent alternatives in this amendment. The interim ACLs under **Alternative 2** and **Alternative 4** would equal those of the respective species commercial quota. The interim ACLs for **Alternative 3** would be higher than the quota for the respective species. Under **Alternative 5**, the ACLs for gag would be higher than the gag quota, but the ACLs for red grouper and shallow-water grouper would be similar to the respective quotas. **Alternatives 2** and **4** then may be considered more stringent than the other alternatives, and between the two, **Alternative 2** would be more stringent as it would not provide a buffer between the ACLs and the respective quotas but require an annual evaluation of ACL. Therefore, there is a good possibility that the economic implications of **Alternatives 2** and **4** would those as described in the discussion of the economic impacts of Action 8. **Alternatives 3** and **5**, on the other hand, would possibly provide slightly less adverse short-run economic impacts than **Alternatives 2 and 4**. On the other hand, the probability of generating more benefits in the future would greater under **Alternatives 2** and **4** because they minimize the probability of overfishing.

For the recreational sector, the general regulatory nature of the alternatives would be that of quota closures under **Alternatives 2 and 3** and shorter seasons the following year under **Alternatives 4 and 5**. The ACLs for **Alternative 2** would equal the target catch for gag and red grouper; the ACLs for **Alternatives 3 and 5** would be higher than target catches. The ACLs for Alternative 4 would equal the target catch for red grouper and the first year target catch for gag but would be higher in subsequent years than target catches for gag. **Alternatives 2 and 3** (more for **Alternative 2** than **Alternative 3**) would very likely bring about more adverse short-run economic impacts on fishery participants. The saving factor of **Alternative 3**, relative to **Alternative 2**, is the provision for higher ACLs than target catches. With higher ACLs, however, there is a higher probability that more stringent measures may be adopted over time.

Summary

This action considers several scenarios for the establishment of interim annual catch limits and accountability measures in the recreational and commercial grouper fisheries. In the commercial sector, Alternatives 2 and 4 may be more stringent than the other alternatives. Alternative 2 is expected to be the most restrictive because it would not provide a buffer between the ACL and the respective quotas and require an annual evaluation of ACL. Alternatives 3 and 5, on the other hand, are anticipated to result in less adverse short-run economic impacts than Alternatives 2 and 4. However, the probability of generating more benefits in the future would greater under Alternatives 2 and 4 because they minimize the probability of overfishing. In the recreational sector, Alternatives 2 and 3 are anticipated to result in more adverse short-run economic impacts on fishery participants. The saving factor of Alternative 3, relative to Alternative 2, is the

provision for higher ACLs than target catches. Higher ACLs are associated with a higher probability that more restrictive measures may be implemented in the future.

5.6.3.2 Direct and Indirect Effects on the Social Environment

There are generally two types of effects that may ensue under **Alternatives 2 to 5**. The first one relates to the rippling effects of changes in the harvest sector on the supporting industries, such as fish dealers/processors and marinas, and on fishing communities. In the short term, losses in the harvest sector will translate into adverse economic consequences on supporting industries and fishing communities. Over the long-term as the stock recovers beyond the overfishing threshold, these adverse economic impacts may be partly, if not fully, compensated by future benefits from a recovered fish stock. For supporting industries, this compensation may be true at the industry level, but those booted out of the business would not likely be compensated. The case with fishing communities may be somewhat different, because the outgoing fishery dependent segment may be replaced by other dependencies and developments in the area. In addition, the fishery dependent segment of the area's population may have already dispersed into other areas or are engaged in other activities whose viability they deem to be more sustainable over the long term. The second type of effects would occur if fishing participants shift effort to other fisheries. In addition to increasing fishing pressure on other fish stock that may also be subject to rebuilding schedules, effort shifts can reduce the benefits derived by the usual participants in that fishery. It is likely that this shift in benefits away from the usual participants in the indirectly affected fishery may result in net losses to the industry, because the new entrants may not be as efficient (commercial and for-hire) or may not derive the same angler benefits as the usual participants.

5.6.4 Direct and Indirect Effects on Administrative Environment

Alternatives in Action 7 would directly affect the administrative environment. **Alternative 1** would not require AMs for grouper. By not imposing AMs, the administrative environment may be negatively affected if harvest is not sufficiently constrained and overfishing of SWG species occurs. This could increase the burden on Council staff and NOAA Fisheries Service to develop amendments in the future to address overfishing and constrain harvest. **Alternatives 2-5** would all provide a procedure for implementing AMs. Each of these alternatives would require NOAA Fisheries Service to monitor landings on an annual or multiyear basis. Currently, NOAA Fisheries Service monitors annual quotas for several commercial species, but recreational landings are not monitored. Therefore, **Alternatives 2-5** would increase the burden on NOAA Fisheries Service to collate and verify recreational landings information. Additionally, **Alternative 2** through **5** would require the AA issue notices if a sector's ACL is exceeded. Currently, *Federal Register* rules and Fishery Bulletins are published by the AA to inform commercial fishermen of quota closures. Filing AM notifications is expected to increase the burden on the AA and Southeast Regional Office. Negative effects on the administrative environment, from greatest to least are **Alternative 1**, **Alternative 5**, **Alternative 3**, **Alternative 4**, and **Alternative 2**.

5.7 Action 7. Shallow-water Grouper, Red Grouper, and Gag Commercial Quotas

The grouper quotas discussed in this section apply to both the interim rule and the subsequent rulemaking from Amendment 30B. Discussions of short-term effects apply to the interim rule as this action would cover the time period between January 1, 2009, and the implementation of rulemaking via Amendment 30B (anticipated to be effective in the summer of 2009 assuming Amendment 30B is approved). Discussions of both short- and long-term effects apply to Amendment 30B. This action addresses long-standing grouper management.

5.7.1. Direct and indirect effects on physical environment

Section 3.2 and GMFMC (2004a) describe the physical environment inhabited by groupers, particularly for red grouper and gag. Groupers are carnivorous bottom dwellers, generally associated (as adults) with hard-bottomed substrates, and rocky reefs. Eggs and larvae for all species are pelagic. Depending on the species, juveniles either share the same habitat as adults, or are found in different habitats and undergo an ontogenetic shift as they mature. For red grouper, juveniles are found in nearshore waters until they reach approximately 16 inches and move offshore (GMFMC 2004a). Adults are associated with rocky outcrops, wrecks, reefs, ledges, crevices, caverns, as well as "live bottom" areas, in depths of 3 to 190 m. Juvenile gag are estuarine dependent and are found in seagrass beds (GMFMC 2004a). Adult gag are associated with hard bottom substrates, including offshore reefs and wrecks, coral and live bottom, and depressions and ledges. Spawning adults form aggregations in depths of 50 to 120 m, with the densest aggregations occurring around the Big Bend area of Florida. Females undergo a migration from shallower waters to the deeper waters where spawning occurs, while males generally stay at the same depths where spawning occurs (Koenig 1999).

The commercial grouper fishery primarily uses various forms of vertical lines (rod-and-reel, electric or hydraulic reels, hand lines) and longlines. For red grouper, vertical lines have accounted for a lower percentage of the landings over time. In the late 1980s, vertical lines accounted for approximately 50 percent of the harvest, but have only accounted for 20-30 percent of annual landings since 1993. Conversely, harvest from longlines has increased from approximately 40 percent of landings in the late 1980's to approximately 60 percent of the harvest in recent years. Red grouper have also been caught with fish traps, which on average have accounted for 13 percent of the harvest between 1986 and 2005. For gag, most commercially caught fish have been landed with vertical gear. Between 1986 and 2004, vertical lines caught between 49 and 64 percent of the annual harvest. This compares to between 19 and 41 percent of the annual harvest caught with longlines over the same period. Additionally, some grouper are harvested by spearfishing, but this gear type harvests minimal numbers of fish.

Vertical gear and longlines can damage habitat through snagging or entanglement. Longlines can also damage hard bottom structures during retrieval as the line sweeps across the seafloor (Barnette 2001). Anchoring over hard-bottom areas can also affect benthic habitat by breaking or destroying hard bottom structures. However, these gears are not believed to have much negative impact on bottom structures and are considerably less destructive than other commercial gears, such as traps and trawls (Barnette 2001). Fish traps have been used to harvest both species, but particularly red grouper. This gear can cause significant damage to corals and other epibenthic organisms. However, this gear was retired from use in the fishery in February 2007.

The effects of the methods to calculate the commercial quota (**Alternatives 1-3**) on the physical environment are expected to be minor for the same reasons described above and in Section 5.1.1; however, the alternatives are expected to differ to some extent. This is because there is an associated level of effort that would allow each quota to be harvested. Alternatives that reduce the quota would likely have a lower level of fishing effort. Therefore, lower levels of effort would result in greater benefits to the physical environment because fishing related interactions with habitat would be reduced. However, a shift to a reduced commercial allocation (**Action 5**) would be accompanied with an increase in the recreational allocation. Consequently recreational effort would increase with an increased recreational share of TAC and create more recreational gear interactions with the physical environment. These effects on the physical environment are discussed in more detail in Section 5.5.1.

Although alternatives in this action would dictate how quotas are set, the actual quota for **Alternative 2 and Preferred Alternative 3** would be set through decisions made in **Actions 3 and 5** for gag, and **Actions 4 and 5** for red grouper. For gag, the actual quota could range from 1.18 to 1.68 mp for 2009, the first year of the TACs to end overfishing (Table 5.7.1). Quotas would then increase through 2011 as stock biomass increases toward its OY or MSY level. Provided that allocations are adhered to during the 2009-2011 period, further quota increases could be implemented through a subsequent amendment until the equilibrium quota is achieved. This equilibrium quota would range between 1.69 to 2.03 mp depending on the allocation chosen in **Action 5**. For red grouper, the quota could range between 4.99 and 5.94 mp depending on the selected **Action 5** allocation alternative (Table 5.7.2). The "other" shallow-water grouper species allowance is either 0.57 mp, which is the average landings from 1999-2001 (**Alternative 2**), or 0.68 mp, the average from the baseline years of 2001-2004 (**Preferred Alternative 3**).

The "other" shallow-water grouper allowance in **Alternative 2** and ***Preferred*** **Alternative 3** is not a quota. Exceeding this allowance will not result in any quota closure action as long as the shallow-water aggregate quota has not been reached. However, exceeding the "other" shallow-water grouper allowance infers that either or both of the gag and red grouper landings will be below their quotas when the aggregate shallow-water grouper quota is reached.

For 2009, the total grouper quota for shallow-water species would range from 6.74 to 8.37 mp (Table 5.7.3). This quota could increase to between 7.24 and 8.65 once the gag stock reaches its OY or MSY equilibrium level.

Given that potential quotas under **Alternative 2** and **Preferred Alternative 3** are below the current 8.80 mp quota provided in the no action **Alternative 1**, **Alternative 1** would negatively affect the physical environment more than **Alternative 2** and **Preferred Alternative 3**. This is because more effort could be directed towards grouper with a higher quota. The potential quotas for **Preferred Alternative 3** are slightly greater than those of **Alternative 2** because of the additional 110,000 pounds in the other shallow-water grouper allowance. Therefore, **Preferred Alternative 3** would have more negative effects on the physical environment than **Alternative 2**.

Table 5.7.1. Range of possible commercial gag quotas (mp) based on proposed TACs from Action 3 and the low (35%) and high (41%) commercial allocation percentage from Action 5.

	Alternative 1 No Action		Alternative 2 F_{OY} annual increase		Alternative 3 F_{OY} 3-yr step increase		Alternative 4 F_{MAX} annual increase		Alternative 5 F_{MAX} 3-yr step increase	
Year	35%	41%	35%	41%	35%	41%	35%	41%	35%	41%
2009	undefined	undefined	1.18	1.39	1.10	1.28	1.49	1.74	1.44	1.68
2010	undefined	undefined	1.27	1.48	1.10	1.28	1.54	1.80	1.44	1.68
2011	undefined	undefined	1.34	1.57	1.34	1.57	1.58	1.85	1.58	1.85
Equilibrium yield	1.59	1.86	1.69	1.98			1.73	2.03		

Table 5.7.2. Range of possible commercial red grouper quotas (mp) based on proposed TACs from Action 4 and the low (35%) and high (41%) commercial allocation percentage from Action 5. Quota is calculated as TAC * percent allocation.

	Alternative 1		Alternative 2		Alternative 3	
Allocation	76%	77%	76%	77%	76%	77%
Quota	4.99	5.05	5.75	5.89	5.87	5.94

Table 5.7.3. Range of possible total commercial grouper quotas (mp) based on proposed TACs from Actions 3, 4, and 5. The quota is the sum of the red grouper and gag quotas, plus the other shallow water grouper allowance for Alternatives 2 and 3. High and low quotas use either the highest or lowest respective red grouper and gag quotas provided in Tables 5.7.1 and 5.7.2.

	Alternative 1 No action	Alternative 2 Other grouper species = 0.57 mp		Alternative 3 Other grouper species = 0.68 mp	
Quota		Low	High	Low	High
2009	8.80	6.74	8.26	6.76	8.37
2010	8.80	6.74	8.31	6.76	8.42
2011	8.80	6.74	8.36	6.76	8.47
Equilibrium yield	8.80	7.24	8.54	7.35	8.65

5.7.2 Direct and indirect effects on biological/ecological environment

Grouper demonstrate the typical life history pattern for managed reef fish species as summarized in Section 3.3, Table 3.3.2.1, and GMFMC (2004a). In general, both eggs and larval stages are planktonic. Larvae feed on zooplankton and phytoplankton. Juvenile and adult grouper are

typically demersal, and are usually associated with bottom topographies on the continental shelf which have high relief, i.e., coral reefs, artificial reefs, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings. Most grouper are protogynous hermaphrodites.

For red grouper, females mature on average at 380 mm (15.0 inches) TL and 3.5 years (Fitzhugh et al. 2006a). The reported size and age of 50 percent transition from females to males of 765 mm (30.1 inches) TL and 10.5 years, respectively. Red grouper have been aged up to 28-years old, but begin to recruit to the fishery at around ages 4 and 5 (Lombardi-Carlson et al. 2006b). The most recent red grouper stock assessment indicated the Gulf of Mexico stock was not overfished nor undergoing overfishing (SEDAR 12 2007).

Gag females mature on average at 585 mm (23.0 inches) TL which corresponds to an age of maturity of 3.7 years (SEDAR 10 2006). SEDAR 10 (2006) used a size and age of 50 percent transition from females to males of 1,025 mm (40.4 inches) TL and 10.5 years, respectively. Gag have been aged to over 30 years, but become fully recruited to the fishery between ages 3 and 6 (Lombardi-Carlson et al. 2006a). The Gulf of Mexico gag stock appears to be undergoing overfishing.

Gag and red grouper are components the shallow-water grouper aggregate, which is managed as a unit. This unit consists of groupers in the *Epinephelus* and *Mycteroperca* genera which share similar habitat and biological characteristics and are targeted as part of the overall shallow-water grouper fishery. Direct effects of **Alternative 2** and **Preferred Alternative 3** on the biological and ecological environment would be to increase the abundance and sustainability of gag as a result of reduced fishing mortality, while maintaining the red grouper stock at or near its optimum yield biomass level. As a result of reduced fishing mortality over habitat preferred by grouper, other shallow-water grouper species and other reef fish that occupy the same habitat as gag and red grouper may also benefit from increased survival.

Indirect effects of these alternatives on the biological and ecological environment are not well understood. Changes in the population size structure as a result of shifting the fishing selectivities and increases in stock abundance could lead to changes in the abundance of other reef fish species that compete with shallow water grouper species for shelter and food. Predators of grouper species could increase if grouper abundance is increased, while species competing for similar resources as groupers could potentially decrease in abundance if less food and/or shelter are less available.

5.7.3 Direct and Indirect Effects on Economic/Social Environment

5.7.3.1 Direct and Indirect Effects on the Economic Environment

The current commercial quota regime consists of a red grouper quota and an overall shallow-water grouper quota (**Alternative 1**). Both quota alternatives to the current regime would establish also a quota for gag in addition to the red grouper quota (**Alternatives 2 and 3**). In these two alternatives, the overall shallow-water grouper quota would not be a pre-set number but would be calculated as the sum of the red grouper and gag quotas, plus the "other" shallow-

water grouper allowance. In other words, these two alternatives would set two commercial quotas, each for red grouper and gag, plus an allowance for "other" shallow-water grouper, with the third quota (that for all shallow-water grouper) merely calculated as the sum of the two sub-quotas and "other" shallow-water grouper allowance.

Explicitly stated in the two alternatives to the current quota regime is the dependence of the two sub-quotas on the chosen TAC and commercial/recreational allocation ratio. As intimated in the discussions for setting TACs and allocations, the actual economic effects would also depend on the specific regulatory measures adopted for the subject fisheries. Hence, estimation of the economic effects of the quota alternatives was undertaken by assuming not only specific TAC and allocation ratio but also specific management measures contained in other sections of this amendment.

The modeling of various commercial quotas presented some unique problems for the economic model used in this amendment. Some inconsistencies would occur when combining commercial quotas with other actions in this amendment. This was the case with **Alternative 1**, the no action alternative, which would not provide any gag quota. But without such quota, it would be inconsistent with **Preferred Alternative 2** of **Action 3**, which would set a TAC to be allocated according to the alternatives under **Action 5**. Also, under the no action alternative, the current red grouper quota would be maintained, and this would be inconsistent with **Action 4's Preferred Alternative 2**, which would set a TAC to be allocated according to the alternatives under **Action 5**. To resolve this problem, the no action alternative (**Alternative 1**) in this section was considered to be identical to the baseline where all alternatives were no action alternatives.

Being considered similar to the baseline case, **Alternative 1** would have no economic effects (Table 5.7.3.1). **Alternatives 2 and 3** would have negative effects, but the economic model could not distinguish the effects of one alternative from those of the other. **Alternatives 2 and 3** are identical with respect to gag and red grouper quotas; they differ only in the provision for the "other" shallow-water grouper allowance. In principle, **Alternative 3** may be expected to provide larger benefits or lower losses than **Alternative 2**, because it would set the quota for other shallow-water grouper at a higher level. But the fishery would never close on the basis of the "other" shallow-water grouper allowance. Either the red or gag quota would be more binding than the "other" shallow-water grouper allowance. Hence, the model estimated identical effects for **Alternatives 2 and 3**. Losses from either alternative would be about $22.9 million using a 3 percent discount factor.

The distribution of effects by gear type shown in Table 5.7.3.1 follows about the same pattern as that of previous actions. The longline sector would bear the largest cost of all gear users, followed by hook and line, and then by other gear users. Thus, the burden of effects from the commercial quotas in conjunction with other Actions in this amendment would disproportionately fall on the longline sector.

Table 5.7.3.1. Net present values of the effects of alternatives to set commercial red grouper, gag, and shallow-water grouper quotas. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Hook and Line	Longline	Other Gears	Total
		3% Discount Rate		
Baseline	122,586	62,855	11,707	197,148
Alternative 1	0	0	0	0
Alternative 2	-9,737	-10,638	-2,565	-22,940
Alternative 3	-9,737	-10,638	-2,565	-22,940
		7% Discount Rate		
Baseline	107,912	55,343	10,303	173,558
Alternative 1	0	0	0	0
Alternative 2	-8,760	-9,448	-2,274	-20,482
Alternative 3	-8,760	-9,448	-2,274	-20,482

No positive effects would result from **Alternatives 2 and 3** on any fishing area in the Gulf (see Table 5.7.3.2). Most of the losses would be incurred by West-Central Florida, followed by Northwest Florida, then by the Rest of the Gulf ($380 thousand), and lastly by South Florida ($229 thousand). Based on model results, the effects of the various quota alternatives would be proportionately shared by all areas.

Table 5.7.3.2. Net present values of the effects of alternatives to set commercial red grouper, gag, and shallow-water grouper quotas. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Rest of Gulf	Northwest FL	West-Cent FL	South FL	Total
			3% Discount Rate		
Baseline	74,331	39,227	49,667	33,923	197,148
Alternative 1	0	0	0	0	0
Alternative 2	-701	-6,756	-15,194	-290	-22,941
Alternative 3	-701	-6,756	-15,194	-290	-22,941
			7% Discount Rate		
Baseline	65,380	34,560	43,761	29,858	173,559
Alternative 1	0	0	0	0	0
Alternative 2	-624	-6,051	-13,515	-295	-20,485
Alternative 3	-624	-6,051	-13,515	-295	-20,485

Summary

Explicitly stated in the two alternatives to the current quota regime would be the dependence of the two sub-quotas on the chosen TAC and commercial/recreational allocation ratio. The actual economic effects would also depend on the specific regulatory measures adopted for the subject fisheries. Hence, evaluation of the economic effects of the quota alternatives was undertaken by assuming not only specific TAC and allocation ratio but also specific management measures contained in other sections of this amendment. Using this approach necessitated the consideration of the no action alternative (**Alternative 1**) as equivalent to the baseline scenario wherein all alternatives were assumed to be the no action alternative. Model results for **Alternatives 2 and 3** were identical because the two alternatives would differ only on the level set for the "other" shallow-water grouper allowance, which would not be binding. Total losses from **Alternative 2 or 3** would amount to $22.9 million using a 3 percent discount factor.

5.7.3.2 Direct and Indirect Effects on the Social Environment

Alternative 1 is no action. With this action there would be no adjustment to the red-grouper or shallow-water grouper quotas and do not specify a quota for gag grouper. The shallow water grouper quota would remain 8.80 mp and the red grouper would remain 5.31 mp. In the short term, this alternative would not have any impacts on the recreational or commercial red or gag grouper fishery, because it would not adjust the red grouper or shallow water grouper quotas and it would not set a quota for the gag grouper.

Alternative 2 would set the commercial gag and red grouper quotas by multiplying the TAC for each year by each species' commercial allocation. The allowance for the commercial "other" shallow-water grouper will be 0.57 mp which is the average landings for the baseline years used in Secretarial Amendment 1 of 1999-2001. The aggregate commercial shallow-water grouper quota for each year is the sum of the gag and red grouper quotas, plus the "other" shallow-water grouper allowance. For this alternative, the quotas will be based on the TACs chosen in other actions.

If the aggregate quota decreases, there would be negative impacts on the gag and red grouper fisheries because there would be less fish to harvest. When combined with other reductions in the reef fish fishery, fishermen, fishing-dependent businesses, and fishing communities involved in these fisheries may be negatively impacted due to a reduction in catch. This could cause a reduction in profits for the fishermen, and possibly a loss of jobs in the processing sector. For the commercial sector, this would negatively impact communities such as Madeira Beach, St. Petersburg, and Panama City, Florida.

If the aggregate quota increases, then fishermen, fishing-dependent businesses, and fishing communities involved in these fisheries would benefit from an increase in fish to harvest. This could increase the income for the fishermen and for the processing sector in communities such as Madeira Beach, St. Petersburg, and Panama City, Florida.

Preferred Alternative 3 would set the commercial gag and red grouper quotas by multiplying the TAC for each year by each species' commercial allocation. The allowance for the commercial "other" shallow-water grouper will be 0.68 mp which is the average landings for the baseline years of 2001-2004. The aggregate commercial shallow-water grouper quota for each

year is the sum of the gag and red grouper quotas, plus the "other" shallow-water grouper allowance. **Alternative 3** would have a .68 mp allowance for "other" shallow-water grouper. This allowance is higher than the allowance set for **Alternative 2.** As in **Alternative 2**, if the aggregate quota decreases, there would be negative impacts on the gag and red grouper fisheries because there would be less fish to harvest. When combined with other reductions in the reef fish fishery, fishermen, fishing-dependent businesses, and fishing communities involved in these fisheries may be negatively impacted due to a reduction in catch. This could cause a reduction in profits for the fishermen, and possibly a loss of jobs in the processing sector for communities such as Madeira Beach, St. Petersburg, and Panama City, Florida which are substantially involved in this fishery.

If the aggregate quota increases, then fishermen, fishing-dependent businesses, and fishing communities involved in these fisheries would benefit from an increase in fish to harvest. This could increase the income for the fishermen and for the processing sector.

Summary

Alternative 1 in the short term, this alternative would not have any impacts on the recreational or commercial red or gag grouper fisheries, because it would not adjust the red grouper or shallow water grouper quotas and it would not set a quota for the gag grouper. If the aggregate quota decreases for **Alternative 2** and preferred A**lternative 3**, there would be negative impacts on the gag and red grouper fisheries because there would be less fish to harvest. When combined with other reductions in the reef fish fishery, fishermen, fishing-dependent businesses, and fishing communities involved in these fisheries may be negatively impacted due to a reduction in catch. This could cause a reduction in profits for the fishermen, and possibly a loss of jobs in the processing sector.

If the aggregate quota increases, then fishermen, fishing-dependent businesses, and fishing communities involved in these fisheries would benefit from an increase in fish to harvest. This could increase the income for the fishermen and for the processing sector.

5.7.4 Direct and Indirect Effects on Administrative Environment

Section 1.4 outlines the history of management of grouper in the Gulf. Size limits, commercial Gulf reef fish permits, trip limits, quotas, season closures, and area closures are currently used to regulate the commercial harvest of red snapper. The purpose of setting quotas would constrain the commercial shallow-water grouper harvest to its allocation under the TACs selected in Actions 3 and 4. **Alternative 2** and **Preferred Alternative 3** would require administrators to make minor adjustments to the Reef Fish FMP which fall within the scope and capacity of the current management system and are not expected to significantly affect the administrative environment.

Alternative 1 would continue the current quotas and not change current management practices. **Alternative 2** and **Preferred Alternative 3** would require a new segment of the grouper fishery to monitored-gag. This would entail in-season monitoring of trip ticket data for this category and would increase the administrative burden of grouper management. However, this increase

should be minimal because these types of activities already take place and the system for monitoring grouper quotas already exists.

Although the "other" shallow-water grouper species allowance is lower in **Alternative 2** than **Preferred Alternative 3**, exceeding this allowance will not result in any quota closure action as long as the shallow-water aggregate quota has not been reached. However, exceeding the "other" shallow-water grouper allowance infers that either or both of the gag and red grouper landings will be below their quotas when the aggregate shallow-water grouper quota is reached. **Alternative 2** increases the likelihood of the aggregate shallow-water grouper quota being reached even if the individual species quotas have not been. Thus the chance activities associated with quota closures such as filing a *Federal Register* notice, sending Fishery Bulletins, and sending press releases to inform the public are greater. Consequently, the adverse effects to the administrative environment from **Alternative 2** are greater than **Preferred Alternative 3**.

5.8 Action 8. Application of Quota Closures

Alternative 1, no action, closes the commercial SWG fishery when either the red grouper or SWG quotas are reached. No measures are specified for the gag quota, meaning that fishing for gag could continue after the gag quota is filled and until one of the other quotas is filled. In the past, the red grouper quota has been filled before the SWG has been reached. However, with the possibility the red grouper commercial quota may increase while the commercial gag quota is reduced, the reverse may occur. Therefore, this alternative could allow for commercial overfishing of gag. Based on applying quotas of 1.32 mp (2009) for gag, 5.75 mp for red grouper, and 7.64 mp for SWG to 2004-2006 landing data, it is likely the SWG quota will be filled prior to the red grouper quota (Table 5.8.1). This is because gag landed in excess to this species' quota would be added to the SWG quota.

Alternative 2 closes the commercial SWG fishery when either of three quotas is reached, the red grouper quota, the gag quota, or the SWG quota. This is a logical extension of **Alternative 1** to incorporate the gag quota. However, while this would stop commercial overfishing of either gag or red grouper, it would likely result in the fishery not being able to fill the quota for the other species (Table 5.8.1). **Preferred Alternative 3** and **Alternative 4** address the under harvest of SWG species described in the previous alternative by limiting the harvest of the commercial fishery through trip limits. **Preferred Alternative 3** uses a trigger based on a certain percentage of the total quota being filled, after which time an incidental harvest trip limit applied to the species whose harvest first reaches the trigger. **Alternative 4** uses a gag trip limit (the likely "weak link" species) to allow the SWG fishery to stay open longer.

This action only applies to Amendment 30B and subsequent rulemaking, not the interim rule.

Table 5.8.l. Shallow-water grouper and red grouper harvests and cumulative percent landings for bimonthly intervals. Shaded cells indicate when the shallow-water grouper quota of 7.75 mp GW (2009) and the gag (1.32 mp GW) and red grouper quota (5.75 mp GW) quotas are met. See text for details of the analyses.

Year	2004						2005						2006					
Bimonthly Interval	S-W Grouper		Gag		Red		S-W Grouper		Gag		Red		S-W Grouper		Gag		Red	
	Harvest	Cumm %	Harvest	Cumm %	Harvest	Cumm %	Harvest	Cumm %	Harvest	Cumm %	Harvest	Cumm %	Harvest	Cumm %	Harvest	Cumm %	Harvest	Cumm %
Jan 1-15	448,494	6%	175,520	13%	233,094	4%	514,634	7%	172,982	13%	295,890	5%	352,958	5%	108,085	8%	213,488	4%
Jan 16-31	926,888	12%	362,741	27%	481,727	8%	1,063,577	14%	357,496	27%	611,506	11%	729,447	10%	223,375	17%	441,208	8%
Feb 1-14	1,219,860	16%	450,419	34%	660,970	11%	1,482,570	19%	462,638	35%	888,100	15%	889,424	12%	263,084	20%	547,251	10%
Feb 15-28	1,512,832	20%	538,097	41%	840,213	15%	1,901,562	25%	567,780	43%	1,164,693	20%	1,049,401	14%	302,793	23%	653,294	11%
Mar 1-15	1,709,836	22%	633,999	48%	923,796	16%	2,146,818	28%	643,499	49%	1,312,421	23%	1,228,787	16%	354,482	27%	765,040	13%
Mar 16-31	1,919,972	25%	736,295	56%	1,012,951	18%	2,408,425	32%	724,266	55%	1,469,998	26%	1,420,132	19%	409,616	31%	884,236	15%
Apr 1-15	2,386,823	31%	896,067	68%	1,278,517	22%	2,864,433	37%	856,908	65%	1,752,817	30%	1,751,387	23%	481,596	36%	1,114,056	19%
Apr 16-30	2,853,673	37%	1,055,838	80%	1,544,083	27%	3,320,442	43%	989,549	75%	2,035,635	35%	2,082,643	27%	553,576	42%	1,343,875	23%
May 1-15	3,301,757	43%	1,211,184	92%	1,796,976	31%	3,832,159	50%	1,127,478	85%	2,363,920	41%	2,466,978	32%	628,217	48%	1,619,394	28%
May 16-31	3,779,713	49%	1,376,886	104%	2,066,730	36%	4,377,990	57%	1,274,602	97%	2,714,091	47%	2,876,935	38%	707,833	54%	1,913,281	33%
Jun 1-15	4,305,248	56%	1,522,592	115%	2,399,828	42%	4,844,746	63%	1,381,083	105%	3,032,863	53%	3,272,572	43%	780,119	59%	2,201,452	38%
Jun 16-30	4,830,784	63%	1,668,298	126%	2,732,927	48%	5,311,503	70%	1,487,563	113%	3,351,634	58%	3,668,209	48%	852,404	65%	2,489,623	43%
Jul 1-15	5,317,843	70%	1,766,663	134%	3,078,310	54%	5,818,998	76%	1,653,184	125%	3,648,382	63%	3,996,131	52%	908,252	69%	2,732,537	48%
Jul 16-31	5,837,372	76%	1,871,586	142%	3,446,719	60%	6,360,326	83%	1,829,845	139%	3,964,913	69%	4,345,914	57%	967,823	73%	2,991,646	52%
Aug 1-15	6,322,494	83%	1,964,934	149%	3,795,356	66%	6,972,771	91%	1,988,838	151%	4,363,906	76%	4,738,188	62%	1,009,163	76%	3,307,699	58%
Aug 16-31	6,839,957	90%	2,064,504	156%	4,167,235	72%	7,626,046	100%	2,158,430	164%	4,789,498	83%	5,156,615	67%	1,053,259	80%	3,644,823	63%
Sep 1-15	7,143,458	94%	2,147,660	163%	4,360,592	76%	7,951,615	104%	2,267,986	172%	4,976,562	87%	5,428,879	71%	1,085,079	82%	3,861,057	67%
Sep 16-30	7,446,959	97%	2,230,817	169%	4,553,949	79%	8,277,185	108%	2,377,541	180%	5,163,626	90%	5,701,143	75%	1,116,899	85%	4,077,291	71%
Oct 1-15	8,104,679	106%	2,474,168	187%	4,909,833	85%	8,458,311	111%	2,423,353	184%	5,282,833	92%	5,910,988	77%	1,141,515	86%	4,243,860	74%
Oct 16-31	8,806,248	115%	2,733,742	207%	5,289,443	92%	8,651,512	113%	2,472,220	187%	5,409,988	94%	6,134,822	80%	1,167,773	88%	4,421,533	77%
Nov 1-15	9,147,863	120%	2,818,417	214%	5,516,006	96%	8,655,590	113%	2,475,204	188%	5,410,720	94%	6,323,225	83%	1,198,598	91%	4,562,358	79%
Nov 16-30	9,489,477	124%	2,903,091	220%	5,742,569	100%	8,659,668	113%	2,478,188	188%	5,411,451	94%	6,511,628	85%	1,229,423	93%	4,703,183	82%
Dec 1-15	9,495,075	124%	2,906,103	220%	5,744,658	100%	8,666,495	113%	2,482,562	188%	5,413,297	94%	6,754,701	88%	1,276,159	97%	4,877,906	85%
Dec 16-31	9,501,046	124%	2,909,314	220%	5,746,886	100%	8,673,777	114%	2,487,228	188%	5,415,266	94%	7,013,979	92%	1,326,011	100%	5,064,276	88%

5.8.1. Direct and indirect effects on physical environment

Section 3.2 and GMFMC (2004a) describe the physical environment inhabited by groupers, particularly for red grouper and gag. Groupers are carnivorous bottom dwellers, generally associated (as adults) with hard-bottomed substrates, and rocky reefs. Eggs and larvae for all species are pelagic. Depending on the species, juveniles either share the same habitat as adults, or are found in different habitats and undergo an ontogenetic shift as they mature. For red grouper, juveniles are found in nearshore waters until they reach approximately 16 inches and move offshore (GMFMC 2004a). Adults are associated with rocky outcrops, wrecks, reefs, ledges, crevices, caverns, as well as "live bottom" areas, in depths of 3 to 190 m. Juvenile gag estuarine dependent and are found in seagrass beds (GMFMC 2004a). Adult gag are associated with hard bottom substrates, including offshore reefs and wrecks, coral and live bottoms, and depressions and ledges. Spawning adults form aggregations in depths of 50 to 120 m, with the densest aggregations occurring around the Big Bend area of Florida. Females undergo a migration from shallower waters to the deeper waters where spawning occurs, while males generally stay at the same depths where spawning occurs (Koenig 1999).

The fishing gears used in the commercial grouper fishery are discussed in Section 5.7.1. While there is potential for damage to the bottom habitat from vertical gear, longlines, and anchors from snagging, entanglement or by breaking or destroying hard bottom structures, these gears are not believed to have much negative impact on bottom structures and are considerably less destructive than other commercial gears, such as traps and trawls (Barnette 2001). Trawling and other net capture of reef fish was prohibited in 1990 under Amendment 1. Fish traps have been used to harvest both species, but particularly red grouper. This gear can cause significant damage to corals and other epibenthic organisms. However, this gear was retired from use in the fishery in February 2007.

The effects of the application of commercial quota closures (**Alternatives 1-4**) on the physical environment are expected to be minor because current fishing practices have minor impacts as described in section 5.1; however, the alternatives are expected to differ to some extent. This is because there is an associated level of fishing effort needed to fill a quota. Alternatives that close the grouper fishery before a quota is filled would likely have a lower level of fishing effort associated with them. Therefore, lower levels of effort would result in greater benefits to the physical environment because fishing related interactions with habitat would be reduced.

Table 5.8.2 ranks the estimated times to filling gag, red grouper, and total SWG quotas based on 2004-2006 gag and red grouper landings data based on information presented in Tables 2.8.3 and 5.8.1. Lower ranks indicate earlier fishery closures. Based on these analyses, **Preferred Alternative 3** and **Alternative 4** would allow the commercial grouper fishery to stay open the longest for the entire Gulf of Mexico under more restrictive trip limits. If sufficiently restrictive, the fishery could stay open until the red grouper quota is filled, particularly **Alternatives 4ai** and **4b**. Under **Alternative 1**, the SWG quota would have been met before the red grouper quota in 2004 and 2005, thus the fishery would close earlier under this scenario as the overharvest of gag would contribute to the SWG total. Under **Alternative 2**, the fishery would have closed in early May for 2004 and 2005, and late November in 2006. This alternative, because the fishing season

would be the shortest, would have the least impact on and would be most beneficial for the physical environment.

Table 5.8.2. Ranking of quota closure dates for Alternatives 1-4 from Action 8 based on 2004-2006 landings data with respective gag, red grouper, and SWG quotas of 1.32 (2009), 5.75, and 7.64 mp GW. Note that under Alternative 1, there is not a gag quota, so landed gag would be counted toward the shallow-water quota until the fishery is closed. Alternatives within boxes would close the fishery at about the same time (within days) with the exception of 2006 where most alternatives would not close the fishery.

Rank	2004	2005	2006
1	2	2	2
2	3c	3c	3c
3	4d	4d	1
4	3b	1	3a
5	1	3b	3b
6	3a	4c	4ai
7	4c	4aii	4aii
8	4aii	3a	4b
9	4ai	4ai	4c
10	4b	4b	4d

5.8.2 Direct and indirect effects on biological/ecological environment

Grouper demonstrate the typical life history pattern for managed reef fish species as summarized in Section 3.3, Table 3.3.2.1, and GMFMC (2004a). In general, both eggs and larval stages are planktonic. Larvae feed on zooplankton and phytoplankton. Juvenile and adult grouper are typically demersal, and are usually associated with bottom topographies on the continental shelf which have high relief, i.e., coral reefs, artificial reefs, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings. Most grouper are protogynous hermaphrodites.

For red grouper, females mature on average at 380 mm (15.0 inches) TL and 3.5 years (Fitzhugh et al. 2006). The reported size and age of 50 percent transition from females to males of 765 mm (30.1 inches) TL and 10.5 years, respectively. Red grouper have been aged up to 28-years old, but begin to recruit to the fishery at around ages 4 and 5 (Lombardi-Carlson et al. 2006a). The most recent red grouper stock assessment indicated the Gulf of Mexico stock was not overfished nor undergoing overfishing (SEDAR 12 2007).

Gag females mature on average at 585 mm (23.0 inches) TL which corresponds to an age of maturity of 3.7 years (SEDAR 10 2006). SEDAR 10 (2006) used a size and age of 50 percent transition from females to males of 1,025 mm (40.4 inches) TL and 10.5 years, respectively. Gag have been aged to over 30 years, but become fully recruited to the fishery between ages 3 and 6 (Lombardi-Carlson et al. 2006b). The Gulf of Mexico gag stock has been determined to be undergoing overfishing.

The effects of the different commercial quota closures (**Alternatives 1-4**) on the biological/ecological environment are expected to differ to some extent. This is because there is an associated level of F associated with each quota to be harvested. Alternatives that close the fishery sooner would likely have a lower level of F associated with it. Therefore, lower levels of F would result in greater benefits to the biological/ecological environment because fewer fish would be removed from the population.

As discussed in Section 5.8.1, the effects of the different alternatives were compared for season length through 2004-2006 landings data using commercial quotas for gag and red grouper of 1.32 (2009) and 5.75 mp, respectively, and an allowance for other shallow-water species of 0.68 mp. Based on these analyses, **Preferred Alternative 3** and **Alternative 4** under the assumption only non-gag targeted trips would be made, would allow the commercial grouper fishery to stay open the longer than **Alternative 2** for the entire Gulf of Mexico (Table 5.8.2). This is because the trigger to close the fishery would be the red grouper quota rather than gag quota. Reducing gag harvest from the catch once the incidental harvest target is met, or gag trip limits are implemented, postpones when the SWG quota would met. Under 2004-2006 fishery conditions, the shallow-water quota would not have been filled under **Alternative 2** until after the red grouper quota was filled, unlike **Alternative 1**. Because the harvest of red grouper and other SWG species would continue after the gag trigger is met under **Preferred Alternative 3** or the trip limit is met under **Alternative 4**, this would result in gag bycatch. As illustrated in SERO (2008), this bycatch is greater under scenarios where the season length is extended. With an estimated discard mortality rate of 67 percent for this species, this could adversely affect the gag stock. If not taken into affect, this bycatch could lead to further overfishing for this species. This effect may be minimized if commercial fishermen can target other grouper species other than gag as indicated in public testimony.

For **Alternative 1**, the SWG quota would have been met before the red grouper quota under 2004 and 2005 conditions, thus the fishery would have closed sooner under this scenario than **Preferred Alternative 3** and **Alternative 4** if trips landing gag are reduced (Table 5.8.3). However, because fishing for gag would be allowed beyond when the gag quota was filled (early May for 2004 and 2005, and late November for 2006), this would result in overfishing for this species. **Alternative 1** would be beneficial for red grouper because the fishery could close before this species' quota is filled, reducing the chance for overfishing.

Under **Alternative 2**, the fishery would have closed in early June under 2004 conditions, late June under 2005 conditions, and late November under 2006 conditions. This alternative would protect gag from overfishing, and because the red grouper quota would not be filled, would benefit the red grouper stock. Because all grouper fishing would be halted, bycatch could be reduced if the overall number of reef fish trips were reduced as a result of the closure. However, if reef fish fishing were to continue as commercial fisherman targeted other reef fish species, bycatch of grouper species would increase and result in overfishing. Discard mortality rates are estimated at 67 percent for gag by all gear types, 45 percent for red grouper caught with longlines, and 10 percent for red grouper caught with handlines (SEDAR 10 2006; SEDAR 12 2007).

Indirect effects of these alternatives on the biological and ecological environment are not well understood. Changes in the population size structure as a result of shifting the fishing selectivities and increases in stock abundance could lead to changes in the abundance of other reef fish species that compete with red snapper for shelter and food. Predators of grouper species could increase if grouper abundance is increased, while species competing for similar resources as groupers could potentially decrease in abundance if less food or shelter are available.

5.8.3 Direct and Indirect Effects on Economic/Social Environment

5.8.3.1 Direct and Indirect Effects on the Economic Environment

Alternatives in this section share the common provision of fishery closure once the quota is reached. They differ mainly on whether to close only the fishery whose quota is reached or the entire shallow-water grouper fishery when one or more sub-quotas are reached and in the timing of the closure.

Alternative 1, which is the current regime, would close the entire shallow-water grouper fishery when either the red grouper quota or the overall shallow-water grouper quota is reached. **Alternative 2** would add to the current regime the consideration of gag quota for closure of the entire shallow-water grouper fishery. **Preferred Alternative 3** would provide for closure of a fishery whose quota is 80 percent taken, but would allow incidental harvest of the closed fishery until either the gag, red grouper, or shallow-water grouper quota is taken, upon which the shallow-water grouper fishery would close. Options for incidental harvest in the form of trip limits include 100 pounds (**Alternative 3a**), 200 pounds (**Preferred Alternative 3b**), and 500 pounds (**Alternative 3c**). The incidental harvest provision would apply only if the quota for the subject species is projected to be taken prior to the end of the fishing year. **Alternative 4** is similar to **Alternative 2**, but would provide for a gag trip limit commencing at the start of the fishing year. Options for trip limits include 300 pounds with sub-options of either 15 percent (**Alternative 4ai**) or 20 percent (**Alternative 4aii**) of the grouper caught in a trip, 300 pounds (**Alternative 4b**), 500 pounds (**Alternative 4c**), and 1,000 pounds (**Alternative 4d**). The percent sub-option would apply if harvests of the subject species exceed 300 pounds, with the base for the percent being the harvest of all grouper in a trip.

A fishery closure would have direct effects on the commercial sector, but in evaluating its economic effects the current model also took into account other relevant actions in this amendment, such as TAC, allocations, quotas, and size limit. Model results presented in Table 5.8.3.1 show the differing economic effects of the various alternatives. Among the alternatives, **Alternative 1** would result in the largest positive effects of about $5.3 million under a 3 percent discount rate, or $4.4 million under a 7 percent discount rate. Although **Alternative 1** is a no action alternative, it differs from the baseline by assuming the preferred alternatives for all other relevant Actions in this amendment. Specifically, it assumes the preferred TAC for gag and red grouper, preferred allocation ratio for gag and red grouper, preferred commercial quota for red, gag, and shallow-water grouper, and 18-inch size limit for red grouper. The positive result indicates that given the above-mentioned preferred alternatives in this amendment, the commercial fishery would be better off if the current quota closure were maintained. Although model simulation of **Alternative 1** indicates that for 2009 the gag quota would be reached

between the first week of July and the last week of August, the entire shallow-water grouper fishery would remain open longer, since reaching the gag quota would not trigger a fishery-wide closure. Under this alternative, the shallow-water grouper quota would be reached around the second week of November. This relatively late closure, however, would not to negate the positive effects of an increase in the quota and reduction in size limit for red grouper. Model simulations of all alternatives also indicate that the gag quota would be the limiting factor in any potential quota closure.

All other alternatives would provide for a shallow-water grouper closure upon reaching the gag quota in addition to quotas for red grouper and shallow-water grouper. With the gag quota being the limiting factor, all other alternatives would impose trip limits in order to slow down the harvest of gag. All these other alternatives would result in overall negative economic effects. One exception is **Alternative 4c**, and more will be discussed about this alternative below. In the meantime, it is instructive to consider the alternatives in sequence.

Alternative 2 would result in the largest negative effects of about $15.4 million under a 3 percent discount rate, or $13.9 million under a 7 percent discount rate. Similar to case with Alternative 1, model simulation of Alternative 2 assumed the preferred alternatives for all other relevant Actions. With fishery-wide closure around July or August upon reaching the gag quota, the large negative economic effects of **Alternative 2** could be expected.

Under **Alternative 3a**, no fishery-wide closure would result as the gag quota would not be reached. For 2009, the 100-pound trip limit for gag would commence around May or June upon reaching 80 percent of the gag quota. This relatively low trip limit would not allow reaching the gag quota during the fishing year. However, it would be constraining enough on vessel catch and profitability as to result in overall negative effects of about $6.1 million under a 3 percent discount rate, or $5.6 million under a 7 percent discount rate. **Preferred Alternative 3b** is similarly structured as **Alternative 3a** but with a higher gag trip limit of 200 pounds. Again the trip limit would start around May or June upon reaching 80 percent of the gag quota. The higher trip limit for gag would improve the performance of the fishery so as to result in lower negative effects of about $5.1 million under a 3 percent discount rate, or $4.8 million under a 7 percent discount rate. This would be the case despite the expected fishery-wide closure upon reaching the gag quota sometime the first week of October or the first week of December. **Alternative 3c** is also similarly structured as the other two but now with a 500-pound trip limit. As with the other two alternatives, the trip limit would start around May or June. Under this much higher trip limit, a fishery-wide closure would ensue upon reaching the gag quota as early as the first week of August or as late as the second week of October. Hence, this alternative would result in larger negative effects of about $10.3 million under a 3 percent discount rate, or $9.5 million under a 7 percent discount rate.

All sub-options of **Alternative 4** would result in lower negative effects than the other alternatives, except **Alternative 1**. **Alternative 4** would provide for the same closure trigger as **Alternative 2** so that the significantly lower negative effects of **Alternative 4** can mainly be ascribed to the gag trip limit provision. Both **Alternative 4ai** and **Alternative 4aii** would constrain the gag harvest so that the gag quota would not trigger a fishery-wide closure. In both alternatives, the shallow-water grouper quota would be met. Fishery-wide closure would occur

late in the first week of December for **Alternative 4ai** and early in the second week of December for **Alternative 4aii**. This closure difference of a few days would not result in substantial difference in vessel profitability but the difference in trip limits would. This generally explains why the adverse economic effects of **Alternative 4aii**, which would allow a higher trip limit, would be lower than those of **Alternative 4ai**. **Alternative 4b** would substantially constrain gag harvest so that the gag quota would not trigger a closure. However, the shallow-water grouper quota would be met sometime late in the second week or early in the third week of December. This relatively late closure of, or conversely longer open season for, the fishery would not compensate for the constraining effects of the gag trip limit so that **Alternative 4b** would result in larger economic loss than either **Alternative 4ai** or **Alternative 4aii**. **Alternative 4c** is different from the other sub-options of **Alternative 4** as it would result in positive economic effects of about $420 thousand under a 3 percent discount rate, or $159 thousand under a 7 percent discount rate. This alternative would still result in fishery-wide closure because of the shallow-water grouper quota (not gag quota) being reached in the first week of December. Benefits derived from a higher gag trip limit of 500 pounds would outweigh the negative effects of a relatively early closure. **Alternative 4d** would provide on average the highest trip limit among the **Alternative 4** sub-options. This alternative would trigger a fishery-wide closure due to the gag quota being met as early as the third week of August or as late as the third week of November. The relatively substantial negative effects of an early fishery-wide closure would outweigh the benefits of a higher gag trip limit.

Several generalizations can be made on the basis of the overall economic impacts of the various alternatives. First and quite obvious, the fishery would be better off if no closures were to occur, or if the closure were to occur, it should happen very late in the fishing year. Simulation results would show this to be the case with **Alternative 1** in which the closure trigger would only involve the red grouper and shallow-water grouper quotas. It should be noted that part of the reason for either trigger not to result in an early fishery closure would be the increase in red grouper quota. Second, a partial fishery closure as in **Alternatives 3 and 4** would provide a better economic scenario than a total fishery closure as in **Alternative 2**. Third, if the limiting gag quota were included as one of the closure triggers, some form of trip limits (or other measures) to slow down the harvest of gag would result in lower economic losses. Fourth, introduction of measures to slow down the harvest of gag early in the fishing year would produce lower economic losses than when such measures were introduced later in the year. Fifth, there appears to be some gag trip limit levels, such as the 500 pounds, that would tend to minimize the sum of negative effects from the gag trip limit and fishery closure. A relatively low trip limit, such as 100 pounds, would be too limiting as to result in larger economic losses although no fishery closure or a closure very late in the fishing year would occur. On the other hand, a relatively high trip limit, such as 1,000 pounds, would likely result in early fishery closure and thus larger economic losses.

Based on total economic effects, the various alternatives may be ranked in descending order as follows: **Alternative 1**, **Alternative 4c**, **Alternative 4d**, **Alternative 4aii**, **Alternative 4ai**, **Alternative 4b**, **Preferred Alternative 3b**, **Alternative 3a**, **Alternative 3c**, and **Alternative 2**. The use of either a 3 percent or 7 percent discount rate would not affect the ranking of alternatives.

As can be partly inferred from Table 5.8.3.1, the distributional pattern of effects by gear type would not be totally similar to that of the previous Actions. **Alternative 1** would provide the largest benefits, in dollar terms, to hook-and-line vessel trips, next to longline vessel trips, and then to trips with other gear types. Relative to the baseline, the effects would be only 1.7 percent for hook-and-line vessel trips whereas they would be 2.8 percent and 13.1 percent for longline and other gear trips, respectively. Without quota closure under **Alternative 1**, benefits from a higher red grouper quota and lower size limit would benefit most those trips using other gear types. It is highly possible in this situation that the lower gag quota would constrain the harvest of hook-and-line vessel trips more than trips using longline or other gear types, particularly that hook-and-line vessels harvested more gag than vessels using longlines or other gear types.

Alternative 2 would result in more losses, in dollar terms, to longline vessel trips, next to hook-and-line vessel trips, and last to vessel trips using other gear types. Relative to the baseline, losses would be 4.3 percent for hook-and-line vessel trips, 13.7 percent for longline vessel trips, and 13.9 percent for vessel trips using other gear types. With the gag quota triggering a fishery-wide closure around July or August, practically all vessel trips using any gear type would be significantly affected. While the losses from forgoing harvest of red grouper and other shallow-water grouper would be shared by all gear types, the heaviest toll would fall on longline vessel trips. These vessel trips would have to forgo harvest of red grouper more than trips using other gear types.

Although **Alternative 3a** would not result in fishery-wide closure, the 100-pound trip limit commencing May or June would be particularly limiting to longline vessel trips than to trips using other gear types. Longline vessel trips would lose more than others both in dollar and percentage terms. The trip limit would be beneficial to hook-and-line vessel trips and more so to trips using other gear. Positive results for other gear trips would come from more profitable trips, since vessel trips using hook-and-line and longline would be constrained by the trip limit. The higher trip limit under **Preferred Alternative 3b** would be more beneficial to hook-and-line vessel trips than other vessel trips. The effects on longline vessel trips would be a slight reduction in losses and the positive effects on other gear vessel trips would also be relatively small, relative to the effects of **Alternative 3a**. The higher trip limit under **Alternative 3c** would lead to an early closure of the shallow-water grouper fishery, and this would negatively affect longline vessel trips more than others. The negative effects on longline vessel trips would only be slightly lower than those of **Alternative 2**. This longer closure would also result in slightly negative impacts on trips using other gear types.

The distributional effects of all **Alternative 4** sub-options, with the possible exception of **Alternative 4d**, would generally be different from those of the other alternatives. Both **Alternatives 4ai and 4aii** would result in more losses to the hook-and-line vessel trips than to longline vessel trips. In both alternatives, more longline vessel trips would avail of the percent rather than the fixed pound trip limit. A 20 percent trip limit would even positively affect longline vessel trips, but hook-and-line vessel trips would still lose big under this higher percent trip limit. **Alternative 4b** would result in about the same percentage loss to both hook-and-line and longline vessel trips, indicating the highly constraining effects of a 300-pound trip limit on both types of trips. A higher fixed trip limit under **Alternative 4c** would reduce the negative effects of trip limits on hook-and-line vessel trips more than on longline vessel trips.

Alternative 4d would trigger a fishery-wide closure due to the gag quota being met as early as the third week of August or as late as the third week of November. Although the total effects of this alternative would be negative, the negative effects would only fall on longline vessel trips. The negative effects of fishery closure would not totally negate the relatively large positive effects of a high trips limit on hook-and-line vessel trips. Under all sub-options of **Alternative 4**, vessel trips using other gear types would positively benefit from the gag trip limit, indicating these vessel trips' highly competitive status under a gag trip limit.

Several general conclusions can be inferred from resulting distributional effects of the various alternatives. First, a long fishery closure would affect longline vessel trips more than trips using other gear types. Second, relatively low trip limits on gag would adversely affect hook-and-line vessel trips than trips using other gear types. Third, a variable trip limit, such as the percentage-based trip limit, would be more beneficial to longline vessel trips than hook-and-line vessel trips. Fourth, some form of trip limits on gag that would result in no fishery closure or closure very late in the fishing year would benefit trips using other gear types more than hook-and-line or longline vessel trips.

Table 5.8.3.1. Net present values of the effects of alternatives on the application of quota closures. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Hook and Line	Longline	Other Gears	Total
		3% Discount Rate		
Baseline	122,586	62,855	11,707	197,148
Alternative 1	2,076	1,741	1,528	5,345
Alternative 2	-5,184	-8,617	-1,623	-15,424
Alternative 3a	-1,198	-5,685	812	-6,071
Alternative 3b	-461	-5,512	833	-5,140
Alternative 3c	-2,864	-7,379	-87	-10,330
Alternative 4ai	-3,887	-157	1,661	-2,383
Alternative 4aii	-3,897	712	1,655	-1,530
Alternative 4b	-3,843	-1,980	1,663	-4,160
Alternative 4c	-292	-1,051	1,763	420
Alternative 4d	657	-3,013	1,276	-1,080
		7% Discount Rate		
Baseline	107,912	55,343	10,303	173,558
Alternative 1	1,644	1,456	1,332	4,432
Alternative 2	-4,767	-7,689	-1,456	-13,912
Alternative 3a	-1,222	-5,067	703	-5,586
Alternative 3b	-607	-4,920	719	-4,808
Alternative 3c	-2,740	-6,616	-105	-9,461
Alternative 4ai	-3,541	-195	1,451	-2,285
Alternative 4aii	-3,551	567	1,447	-1,537
Alternative 4b	-3,498	-1,787	1,453	-3,832
Alternative 4c	-398	-982	1,539	159
Alternative 4d	362	-2,769	1,099	-1,308

The geographic distributions of the effects of the various alternatives are presented in Table 5.8.3.2. **Alternative 1**, which would result in overall positive economic effects, would result in positive economic effects for all areas in Florida, but not in other areas. The largest positive effects of approximately $3.0 million, using a 3 percent discount rate, would occur in West-Central Florida, which would benefit most from the increase in red grouper quota and reduction in size limit for red grouper. The second area to benefit the most would be South Florida and the third one would be Northwest Florida. The slightly negative effects on other areas would possibly come from losing other species on trips which would become unprofitable when the shallow-water grouper fishery closed toward the end of the fishing year.

Alternative 2, which would result in an early fishery closure, would result in large negative effects on all areas, with West-Central Florida being hit hard the most. South Florida would come in next as the hardest hit area, followed by Northwest Florida, and lastly by areas outside of Florida. This distribution of effects would closely follow the importance of shallow-water grouper, particularly red grouper, in the respective areas.

Alternative 3a, which would not result in fishery-wide closure, would result in relatively large negative effects on all areas in Florida due to the low gag trip limit. Areas outside of Florida would slightly benefit from the non-closure of the shallow-water grouper fishery. P**referred Alternative 3b** would result in lower negative effects on all areas in Florida, relative to Alternative 3a, because of higher gag trip limit. Closure of the shallow-water grouper fishery late in the year would not totally negate the positive impacts of a relatively higher trip limit on areas outside of Florida. An early fishery closure under **Alternative 3c** would totally negate the positive effects of a higher trip limit, and this would be true for all areas.

As noted earlier, the overall negative effects of a gag trip limit implemented at the start of the fishing year would be lower than those when a trip limit was adopted late in the fishing year. This result is also true for the various geographic areas. Relative to all **Alternative 3** options, **Alternative 4ai** would result in lower negative effects on Northwest Florida and West-Central Florida. The negative effects on these two areas would be even lower under **Alternative 4aii**. Both **Alternative 4ai** and **Alternative 4aii** would result in positive effects on South Florida and areas outside of Florida. The negative effects of **Alternative 4b** on Northwest Florida and West-Central Florida would also be lower than those of any options for **Alternative 3**. South Florida and areas outside of Florida would still experience positive effects under **Alternative 4b**. A relatively higher trip limit under **Alternative 4c** would result in much lower negative effects on both Northwest Florida and West-Central Florida, and positive effects on South Florida and areas outside of Florida. The effects of an early fishery closure triggered by the gag quota under **Alternative 4d** would be reflected in the negative effects on all areas, except on areas outside of Florida. A somewhat interesting case is presented by the effects of the various Alternative 4 options on South Florida and areas outside of Florida. All Alternative 4 sub-options, except **Alternative 4d**, would result in positive effects on both areas. But in moving from one alternative to another, the positive effects would rise in one area but fall on the other. No ready explanation can be provided here.

Table 5.8.3.2. Net present values of the effects of alternatives on the application of quota closures. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Rest of Gulf	Northwest FL	West-Cent FL	South FL	Total
			3% Discount Rate		
Baseline	74,331	39,227	49,667	33,923	197,148
Alternative 1	-80	574	2,965	1,886	5,345
Alternative 2	-444	-3,690	-7,237	-4,053	-15,424
Alternative 3a	120	-1,233	-3,380	-1,578	-6,071
Alternative 3b	48	-883	-2,815	-1,489	-5,139
Alternative 3c	-225	-2,518	-4,865	-2,722	-10,330
Alternative 4ai	213	-2,368	-1,305	1,076	-2,384
Alternative 4aii	197	-2,297	-727	1,298	-1,529
Alternative 4b	230	-2,468	-2,457	535	-4,160
Alternative 4c	195	-646	-179	1,050	420
Alternative 4d	24	-441	-636	-27	-1,080
			7% Discount Rate		
Baseline	65,380	34,560	43,761	29,858	173,559
Alternative 1	-77	404	2,484	1,621	4,432
Alternative 2	-399	-3,360	-6,528	-3,626	-13,913
Alternative 3a	99	-1,175	-3,088	-1,423	-5,587
Alternative 3b	32	-887	-2,603	-1,351	-4,809
Alternative 3c	-207	-2,336	-4,457	-2,462	-9,462
Alternative 4ai	179	-2,151	-1,231	917	-2,286
Alternative 4aii	165	-2,090	-726	1,112	-1,539
Alternative 4b	195	-2,237	-2,236	445	-3,833
Alternative 4c	164	-646	-250	890	158
Alternative 4d	11	-507	-722	-92	-1,310

Summary

Although by itself a fishery closure would have direct effects on the commercial sector, evaluation of its economic effects would still have to consider other relevant actions in this amendment, such as TACs, allocations, quotas, and size limit. Based on simulation results of the various alternatives several generalizations can be made. First, the fishery would be economically better off if no closures were to occur, or if a closure were to occur, it should happen very late in the fishing year as in **Alternative 1**. Second, a partial fishery closure as in **Alternatives 3 and 4** would provide a better economic scenario than a total fishery closure as in **Alternative 2**. Third, if the limiting gag quota were included as one of the closure triggers, some form of trip limits (or other measures) to slow down the harvest of gag would result in lower economic losses. Fourth, introduction of measures to slow down the harvest of gag early in the fishing year would produce lower economic losses than when such measures were introduced later in the year. Fifth, there appears to be some gag trip limit levels, such as the 500 pounds, that would tend to minimize the sum of negative effects from the gag trip limit and fishery closure.

Based on total economic effects, the various alternatives may be ranked in descending order as follows: **Alternative 1**, **Alternative 4c**, **Alternative 4d**, **Alternative 4aii**, **Alternative 4ai**, **Alternative 4b**, **Preferred Alternative 3b**, **Alternative 3a**, **Alternative 3c**, and **Alternative 2**. The use of either a 3 percent or 7 percent discount rate would not affect the ranking of alternatives.

5.8.3.2 Direct and Indirect Effects on the Social Environment

Alternative 1 is no action. The commercial shallow-water grouper fishery closes when either the red grouper quota or the shallow-water grouper quota is reached, whichever comes first. In the short term, this alternative will not have any impacts on the commercial shallow-water grouper fishery because it does not change the way closures are determined now. If the red grouper allocation increases while the gag allocation decreases, gag grouper may continue to be undergoing overfishing and the stocks would not be rebuilt. This could require stricter regulations in the future, such as long closures, reduced TACs, etc., to correct for the overfishing which would have a negative impact on the fishermen, fishing-dependent businesses, and fishing communities involved in these fisheries. Negative impacts could include loss of income for the captain and crew, and loss of jobs in the processing sector in communities such as Madeira Beach, St. Petersburg, and Panama City, Florida which are substantially involved in this fishery.

With Alternative 2 the commercial shallow-water grouper fishery would close when either the red grouper quota, gag quota, or shallow-water grouper quota is reached. This alternative includes the gag grouper quota as a trigger for closure. This may cause an early closure of the shallow-water grouper even if the red grouper or shallow-water grouper quota has not been met. If there is an early closure, due to quota for gag grouper being met, then fishermen will miss out on the opportunity to harvest the rest of the quota for red grouper or shallow-water grouper. This will result in a reduction in harvest which could lead to a loss of income for the captain and crew as well as processors and dealers of grouper in communities such as Madeira Beach, St. Petersburg, and Panama City, Florida which are substantially involved in this fishery.

Alternative 3: when 80 percent of the gag or red grouper quota is reached or projected to be reached, the directed fishery for the applicable species would be closed; however, and incidental harvest trip limit would be allowed until either the gag, red grouper, or shallow-water grouper quota is reached or projected to be reached, upon which the shallow-water grouper fishery would close. The incidental harvest trip limit provision would not be implemented unless the quota for the applicable species is projected to be harvested prior to the end of the fishing year. If implemented, the incidental harvest trip limit would be: Option A: 100 pounds, Preferred Option B: 200 pounds, or Option C: 500 pounds.

This alternative would allow fishermen to continue to harvest incidental catch of gag or red grouper at a given level once 80 percent of the gag or red grouper quota is reached and the harvest of that species closed. This alternative would only be applicable if it is projected that the quota would be reached before the end of the year. This would allow fishermen to continue to harvest a certain amount of the applicable species of the fish they catch while fishing for other species in the complex. This would provide more income for the fishermen and more fish for the processors to process. It would also prevent the waste of fish that would be returned to the water

but would not survive. Option A would be the least beneficial to the fishermen and processing sector in the short term because they would be allowed to keep less incidental catch than with Option B or C. Under Option A, the quota may be reached slower than under Option B or C. Preferred Option B would allow fishermen to keep 200 pounds which is more than A but less than C. Option C would allow fishermen to keep the most incidental catch, but the quota could be reached sooner than in Option A or B.

Summary
In the short term, Alternative 1 will not have any impacts on the commercial shallow-water grouper fishery because it does not change the way closures are determined now. Alternative 2 would close the shallow-water grouper fishery if the quota of any of the individual species is met. This would prevent fishermen from harvesting at the optimum yield and could reduce the income they would have made if they could have harvested the full quota of the other species. This could have a negative impact on the processors and dealers who would have less fish from the other species in the shallow-water grouper complex. Alternative 3 would allow fishermen to continue to harvest incidental catch of gag or red grouper at a given level once 80 percent of the gag or red grouper quota is reached and the harvest of that species closed. This alternative would only be applicable if it is projected that the quota would be reached before the end of the year. This would allow fishermen to continue to harvest a certain amount of the applicable species of the fish they catch while fishing for other species in the complex. Option A would allow fishermen to keep 100 pounds of incidental catch, less than Preferred Option B or Option C. The quota may be met slower under Option A. Preferred Option B would allow fishermen to keep 200 pounds, more than Option A, but less than Option C. Option C would allow fishermen to keep 500 pounds of incidental catch but the quota could be met sooner under this option than under Option A or Preferred Option B.

5.8.4 Direct and Indirect Effects on Administrative Environment

Section 1.4 outlines the history of management of grouper in the Gulf. Size limits, commercial Gulf reef fish permits, trip limits, quotas, season closures, and area closures are currently used to regulate the commercial harvest of red snapper. The purpose of applying quota closures would be to constrain the commercial SWG harvest to its allocation under the TACs selected in Actions 3 and 4. **Alternatives 1-4** would require administrators to make minor adjustments to the Reef Fish FMP. These alternatives fall within the scope and capacity of the current management system which monitors quotas and closes fisheries as quotas are met. These actions are not expected to significantly affect the administrative environment.

Alternative 1 would continue the current quotas and not change current management practices; therefore, no changes from current quota monitoring would be needed. **Alternative 2, Preferred Alternative 3**, and **Alternative 4** would require additional monitoring of the SWG complex by breaking out gag landings. This would entail inseason monitoring of trip ticket data for these two categories and would increase the administrative burden of grouper management. However, this increase should be minimal because these types of activities already take place and the system for monitoring grouper quotas already exists. **Preferred Alternative 3** and **Alternative 4** would require increased enforcement to ensure commercial fishermen were restricting their landings of incidental harvest grouper once the trigger has been met.

Because **Alternative 2, Preferred Alternative 3**, and **Alternative 4** would require monitoring gag landings and this species is more likely to reach its respective quota, there is a greater chance this segment of the fishery may need to be closed. Thus the chance activities associated with quota closures such as filing a *Federal Register* notice, sending Fishery Bulletins, and sending press releases to inform the public are greater. Consequently, the adverse effects to the administrative environment from these alternatives are greater than **Alternative 1**.

5.9 Action 9. Recreational Harvest of Gag and Red Grouper

5.9.1 Direct and Indirect Effects on Physical Environment

Fishery management actions that affect the physical environment mostly relate to the interactions of fishing with bottom habitat, either through gear impacts to bottom habitat or through the incidental harvest of bottom habitat. The degree a habitat is affected by fishing gear depends largely on the vulnerability of the affected habitat to disturbance, and on the rate that the habitat can recover from disturbance (Barnette 2001). For example, the complex structure and vertical growth pattern of coral reef species makes reef habitat more vulnerable to adverse impacts from fishing gear and slower to recover from such impacts than is sand and mud bottom habitat (Barnette 2001). Juvenile gag are found in seagrass beds and oyster shell reefs while adult gag primarily occur over mid-to-high relief natural reef habitat. Red grouper are also associated with hard bottom habitat, but tend to prefer lower relief habitat than gag (see Table 3.2.2.1).

The primary effects of the recreational grouper fishery on the physical environment generally result from fishing gear interactions with the sea floor. Most grouper are caught with hook-and-line fishing gear, although some spearfishing does occur. Fishing gear can damage or disturb bottom structures and occasionally incidentally harvest such habitat. **Alternative 1** would maintain status quo regulations, which include minimum size limits, bag limits, and a closed season. Direct effects resulting from **Alternative 1** include physical damage to habitat associated with hook-and-line tear-offs and abrasions, and anchoring (Barnette 2001). Long-term indirect effects would result if hook-and-line gear is not removed and causes marine life to become entangled or overgrown with algae (Hamilton 2000; Barnette 2001). In the short-term, the effects of **Alternative 1** are not likely to be different than current fishery conditions.

Alternative 2 would modify gag, red grouper, and aggregate grouper bag limits and establish a three-month closed season during winter and early spring. This alternative could result in short-term beneficial effects to the physical environment if anglers stop fishing once reaching their gag bag limit or aggregate bag limit. Because the grouper aggregate bag limit would be reduced to three, fishing effort may be slightly reduced for those trips that typically catch 3 or more grouper per angler. Extension of the closed season would likely deter recreational effort because few reef fish species (e.g., vermilion snapper, greater amberjack, gray snapper) would be available to target when the grouper fishery is closed. Overall, the benefits to the physical environment of **Alternative 2** are expected to be small and unquantifiable when compared to **Alternatives 1.**

Alternative 3 would modify the gag and red grouper bag limits, reduce the aggregate bag limit, and close the recreational grouper fishery for three months. Effects on the physical environment

for this alternative are expected to be similar to **Alternative 2**. Few trips on average harvest more than three grouper per angler per trip, so the aggregate bag limit is not expected to be a limiting factor affecting effort. Similar to the closed season in **Alternative 2**, recreational effort may be reduced because few species would be available to target. The benefits of **Alternative 3** to the physical environment are small and similar to **Alternative 2**.

Alternative 4 would modify gag, red grouper, and aggregate grouper bag limits and establish the third longest recreational closed season of the alternatives proposed. The gag bag limit would be two fish and is expected to affect 2-4 percent of all trips (SERO 2007). Because few trips are expected to be affected by this bag limit, effort and habitat interactions are not likely to be greatly reduced. The 4 ½ month closed season is expected to significantly deter recreational fishing effort. As mentioned above, few reef fishes would be available to target during the closed season. **Alternative 4** is expected to provide greater benefit to the physical environment than **Alternatives 1-3,** and **7**, but slightly less benefits than **Alternatives 5** and **6**. However, benefits are expected to be small and unquantifiable relative to the status quo because the recreational grouper fishery represents only a small portion of the overall reef fishery and vertical line gear has less impacts than other, less selective gear types (e.g., longlines, traps, trawls).

Alternatives 5 would not specify species specific bag limits for red grouper or gag, but would reduce the aggregate grouper bag limit to three and extend the closed season from January 1 to May 21. As mentioned above, the lower aggregate bag limit may reduce effort and corresponding impacts to the physical environment for those trips that typically harvest three or more fish. However, a relatively small number of trips would be affected by this action. The 141 day closed season would deter fishing trips from occurring, especially since few other species are open during the late winter and spring. This would reduce fishing effort and habitat-gear interactions. Benefits to the physical environment would be small because of the dominant geartype used (i.e., vertical line gear) and the percentage of effort/landings the grouper fishery represents relative to overall Gulf-wide fishing effort/landings.

Alternative 6 would reduce the aggregate grouper bag limit to three, reduce the gag size limit to 20 inches TL, eliminate the red grouper bag limit, and establish a five-month closed season (Dec 1 – Apr 30). The lower gag bag limit and aggregate grouper bag limit would reduce fishing effort and habitat-gear interactions if fishermen stop fishing once obtaining their bag limits. However, because few trips currently harvest the three fish aggregate bag limit, this action is not expected to greatly reduce fishing effort. The one fish gag bag limit may deter recreational anglers from conducting fishing trips, especially private anglers. If this occurs than fishing effort and habitat-gear interactions would be reduced. Similarly, the long closed season would deter effort and benefit the physical environment. **Alternative 6** has the longest closed season of any of the alternatives considered. Because this closed season occurs more during winter than **Alternatives 4** or **5**, it may have slightly less benefits because fishing effort is lower in winter and increases in late spring through summer. Overall, benefits to the physical environment are expected to be similar for all alternatives considered. Alternatives with the longest grouper closed seasons are expected to have the greatest benefits to the physical environment.

Preferred Alternative 7 would reduce the aggregate grouper bag limit to four, establish a bag limit of two gag, increase the red grouper bag limit to two, and establish a February 1 to March 31 closure for the recreational SWG fishery. The lower gag bag limit and aggregate grouper bag limit may reduce fishing effort and habitat-gear interactions if fishermen stop fishing once obtaining their bag limits. However, similar to the other alternatives this action is not expected to greatly reduce fishing effort because few trips currently harvest four fish per angler. Extension of the closed season would deter effort and benefit the physical environment. **Alternative 7(a)** and **Preferred Alternative 7(e)** would extend the existing closed season by 17 to 31 days, while **Alternatives 7(b-d)** would establish 61-62 day closed seasons during summer or fall. **Alternative 7(b)**, which would establish a June-July closed season is likely to affect fishing effort the most, since recreational effort peaks during the summer months. Therefore, this alternative would likely have the greatest benefit to the physical environment relative to the other sub-options in **Alternative 7**. With the exception of **Alternative 1**, **Alternative 7(a-e)** has the shortest closed seasons of any of the alternatives considered. Overall, benefits to the physical environment are expected to be greater than **Alternative 1**, but less than **Alternatives 2-6**. Alternatives with the longest grouper closed seasons are expected to have the greatest benefits to the physical environment.

5.9.2 Direct and Indirect Effects on the Biological / Ecological Environment

Alternative 1 would maintain status quo recreational regulations, which include a 20-inch TL red grouper minimum size limit, 22-inch TL gag minimum size limit, one red grouper bag limit, 5-grouper aggregate bag limit, and February 15 to March 15 recreational grouper closure. Gag fishing mortality has been stable and well above F_{MAX} since the early 1980s. High fishing mortality rates and lower gag recruitment in the 1980s resulted in SSB remaining relatively low when compared to historical levels. Beginning in the mid-1990s, multiple strong year-classes of gag entered the fishery allowing SSB to increase until 2003 when SSB began to decline. SSB currently is 99 percent of SSB at Fmax. In contrast, the latest red grouper stock assessment indicates fishing mortality is close to the fishing mortality rate producing OY and SSB has increased, due once again to strong recruitment, since the early 1990s. Landings, abundance indices indicate red grouper catch rates and landings have declined since 2004/2005. SSB in 2005 was well above MSST and 1.27 times greater than SSB at F_{MSY}.

The 20-inch red grouper size limit and 5-fish aggregate bag limit were implemented in 1990. The 22-inch gag minimum size limit was implemented in 2000 to reduce fishing mortality in the recreational fishery. In 2005, the one-red grouper bag limit was first implemented through temporary regulations to reduce recreational harvest after very high landings were reported in 2004. The February 15 to March 15 recreational grouper closure was implemented in 2006 and the fishery was closed for the first time in 2007. The closure applies to gag, black, and red grouper and is intended to reduce fishing mortality and minimize bycatch, especially since these three species co-occur with one another and are commonly caught on the same fishing trips. The closure was estimated to reduce gag harvest by 8 percent and red grouper harvest by 4-5 percent. Maintaining status quo gag regulations will allow overfishing to continue, potentially resulting in decreases in population abundance and less fish for anglers to catch and land. Overfishing will also reduce the size and age distribution of fish in the population. In comparison, maintaining red grouper regulations may result in forgone recreational yield since current regulations may

prevent anglers from harvesting TAC necessary to achieve OY. Although this would provide a net biological benefit to the stock and reduce the likelihood of overfishing occurring, recreational red grouper anglers would experience economic losses. Under status quo conditions, dead discards in both the directed gag and red grouper recreational fisheries would remain high. During 2000-2004, an average of 561 thousand gag and 271 thousand red grouper were discarded dead by recreational anglers (SEFSC 2007; SEDAR 12 2007).

Alternative 2 would eliminate the recreational red grouper bag limit, establish a one gag grouper bag limit, establish a three month recreational closure (January 15 to April 15), and reduce the grouper aggregate bag limit to three fish. **Alternative 2** is estimated to reduce gag harvest by 45 percent. This reduction would end overfishing of gag immediately and reduce harvest to the Council's target fishing mortality level (F_{OY}). This reduction in fishing mortality would allow SSB to gradually increase over time to SSB_{OY}. Reducing fishing mortality would allow more gag to survive to older ages and larger sizes. Red grouper harvest would increase by 14 percent, increasing the probability recreational anglers would harvest their portion of the TAC. The three month closure would include important spawning seasons for gag and red grouper, as well as black grouper. Gag spawn in the Gulf of Mexico from mid-January until mid-April, with a peak in spawning during March (SEDAR 10 2006). Red grouper spawn from February until mid-July, with peak spawning occurring in March, April and May (Fitzhugh et al. 2006). The closure would protect all eight shallow-water grouper species during peak spawning periods for gag and red grouper. Prohibiting fishing during the spawning season would allow more fish to successfully spawn and reproduce before being harvested. The lower gag bag limit would also reduce fishing mortality. It is estimated a one-fish gag bag limit would reduce harvest by 26.3 percent. This bag limit would affect 14-17 percent of fishing trips, which reported landing on average greater than one gag per angler per trip (SERO 2007). The three grouper aggregate bag (includes shallow- and deep-water grouper) limit is only expected to affect a small percentage of all trips (4-7 percent; SERO 2007) because few trips currently retain 3 or more grouper per angler. Eliminating the red grouper bag limit will reduce bycatch for those trips that discard red grouper after the bag limit is met. Similarly, discards are expected to increase for gag if anglers continue fishing after the one fish bag limit is met. Extending the closed season may also negatively affect bycatch if trips continue targeting other reef fishes co-occurring in similar areas as shallow-water grouper. Collectively, the measures proposed in **Alternative 2** are estimated to increase gag dead discards (relative to status quo) by as much as 9.2 percent and decrease red grouper dead discards (relative to status quo) by 3 percent.

Alternative 3 would double the recreational red grouper bag limit to two fish per angler, establish a one gag grouper bag limit, reduce the aggregate grouper bag limit to three fish, eliminate the red grouper bag limit, and establish a three month recreational closure (February 1 to April 30). **Alternative 3** is estimated to reduce gag harvest by 46 percent and increase red grouper harvest by 8 percent. Like **Alternative 2**, this alternative would end overfishing of gag, allowing SSB to increase and the size and age-structure of the population to expand. The closure would protect all eight shallow-water grouper species during peak spawning periods for gag and red grouper (see **Alternative 2** discussion above). The one gag bag limit would affect a small percentage of trips (14-17 percent; SERO 2007) that currently land greater than one fish per angler. A three grouper aggregate bag limit is only expected to affect a small percentage of all trips (4-7 percent; SERO 2007) because few trips currently retain 3 or more grouper per angler.

The elimination of the red grouper bag limit would allow red grouper harvest to expand and increase the likelihood that anglers harvest OY. However, the increase in harvest resulting from the bag limit is partially offset by an extension to the closed season, which would apply to red grouper in addition to other shallow-water grouper species. **Alternative 3** is slightly more conservative than **Alternative 2** and would constrain recreational red grouper harvest more, especially during high periods of recruitment. The more restrictive measures would therefore increase the likelihood that overfishing would not occur, but may result in some forgone yield if they are not liberal enough to allow OY to be met. Collectively, the measures proposed in **Alternative 3** are estimated to increase bycatch (relative to status quo) of gag by as much as 9.4 percent and decrease bycatch of red grouper by 1 percent.

Alternative 4 would establish a two gag grouper bag limit, reduce the aggregate grouper bag limit at three fish, eliminate the red grouper bag limit, and establish a 4½ month recreational shallow-water closure (January 1 to May 15). **Alternative 4** is estimated to reduce gag harvest by 45 percent and reduce red grouper harvest by 21 percent. This alternative would end overfishing of gag, allowing SSB to increase and the size and age-structure of the population to expand. The two gag bag limit would allow recreational anglers to retain on average more fish per trip, but would require a longer closed season to achieve the necessary reductions in harvest. Approximately 2-4 percent of trips during 2003-05 landed on average more than 2 gag per angler (SERO 2007). There would be only a small effect on fishing trips from the aggregate bag limit, since few trips harvest on average more than 3 grouper per angler. Elimination of the red grouper bag limit would allow harvest to expand and increase the likelihood that anglers harvest OY. However, this increase in harvest would be offset entirely by extension of the closed season, resulting in a net reduction in total harvest. Relative to the other alternatives in Action 9, **Alternative 4** is the most environmentally conservative for red grouper. The alternative would likely result in forgone yield, would have the highest probability of preventing red grouper overfishing, and would potentially prevent OY from being achieved in the recreational fishery on a continuing basis. The seasonal closure would be the longest of any of the alternatives in Action 9 and provide the longest period of protection for shallow-water grouper. The closure would cover nearly the entire spawning season for all three species. Overall, the measures in **Alternative 4** are estimated to increase gag dead discards by as much as 9.2 percent and increase red grouper dead discards by 2 percent.

Alternative 5 would maintain the gag minimum size limit at 22-inches TL, reduce the aggregate grouper bag limit to three fish, eliminate the red grouper bag limit, and expand the recreational closure from January 1 through May 21. **Alternative 6** would reduce the gag minimum size limit to 20-inches TL, establish a one gag bag limit, reduce the aggregate grouper bag limit to three fish, and expand the recreational closed season from December 1 through April 30. Both alternatives would reduce gag harvest by 45 percent or more. **Alternative 6** would allow a 1 percent increase in recreational red grouper harvest, while **Alternative 5** would decrease red grouper harvest by 5 percent. These alternatives would result in closed seasons of 141 and 151 days, respectively. The closed seasons would occur during critical spawning seasons for both gag and red grouper. Both gag and red grouper spawn during late winter and spring. Establishing a closed season during this time would reduce recreational shallow-water grouper landings and discards and allow more grouper to survive and spawn before being harvested. Because gag aggregate to spawn, the spawning closure would also protect gag during a

vulnerable life history stage. Applying the closure to all shallow-water grouper rather than a single species will reduce bycatch and help the Council to better achieve the objectives of National Standard 9. If the closure is only applied to a single species, such as gag, then bycatch may compromise the Council's ability to control fishing mortality and end overfishing. For example, in November-December 2005 when only the red grouper recreational fishery was closed, MRFSS estimated nearly 100,000 red grouper were released by recreational anglers, resulting in 10,000 dead discards.

Lowering the gag minimum size limit is estimated to reduce gag discards by approximately 14 percent. However, the decrease in discards would allow CPUE to increase, especially in those sectors that on average harvest less than the proposed gag bag limit. The lower minimum size limit combined with a one fish gag bag limit is estimated to reduce gag recreational harvest by 9 percent. Ortiz (2007) estimated that lowering the minimum size limit by 2-inches would decrease dead discards per recruit (in pounds) by 50 percent or more and decrease yield-per-recruit by 6 percent. These decreases are based on lowering both the commercial and recreational minimum size limit of 20-inches TL. Gag are mature by 3.7 years of age and 23 inches TL (58.5 cm TL). Therefore, lowering the minimum size limit may reduce the number of gag that reach sexual maturity and spawn. Ortiz (2007) estimated that reducing the gag minimum size limit to 20-inches fishery wide would reduce SPR from 35.8 percent (status quo) to 33.2 percent.

The lower aggregate bag limit is estimated to affect a small fraction of trips, but would provide additional protection for shallow-water grouper species without species-specific bag limits. Both **Alternatives 5** and **6** would eliminate the red grouper bag limit and **Alternative 5** would not specify a gag bag limit. Lowering the aggregate bag limit from five to three fish would allow the Council to constrain fishing mortality, especially for gag and red grouper, which represent approximately 90 percent or more of the shallow-water grouper landings.

Preferred Alternative 7 would reduce the aggregate grouper bag limit to four fish, increase the red grouper bag limit to two fish, establish a two gag bag limit, and establish a 45-62 day closed season. Proposed closed seasons would either be during late winter and early spring (**Alternative 7(a)** and **Preferred Alternative 7(e)**), during summer (**Alternative 7(b)**), or during late fall and early winter (**Alternatives 7(c)** and **7(d)**). **Preferred Alternative 7(e)** would extend the existing closed season to include February 1 through March 31. The closed season would also be applied to all SWG and not just gag, black grouper, and red grouper. The two month closure would include important spawning seasons for gag, black grouper, and red grouper. Gag spawn in the Gulf of Mexico from mid-January until mid-April, red grouper spawn during March through May, and black grouper spawn during December through March. Applying the closure to all shallow-water grouper rather than a single species will reduce bycatch and help the Council to better achieve the objectives of National Standard 9. The effects of the two gag bag limit would be similar to those described in **Alternative 4** and the effects of the two red grouper bag limit would be similar to those described in **Alternative 3**. Reducing the aggregate bag limit from 5 to 4 is estimated to affect only 2-4 percent of all angler trips. **Alternative 7** would end overfishing of gag, but would result in the smallest reduction (23-26 percent) of any of the alternatives considered in Action 9, except **Alternative 1**. The Council expects additional reductions from reduced fishing effort will contribute toward meeting the 41 percent F_{OY}

reduction target. In 2007, offshore fishing effort in the EEZ off West Florida had declined by 12 percent relative to the 2004-06 baseline and 25 percent relative to the 2004 West Florida EEZ effort level.

During the June 2008 Council meeting, the Council requested NOAA Fisheries Service prepare an interim rule for 2009 to address gag overfishing. The Council requested the interim rule be based on the preferred management measures for gag in **Preferred Alternative 7(e)**. A two fish gag bag limit and a seasonal closure from February 1 to March 31 would be implemented under the interim rule. These regulations are estimated to reduce gag harvest by approximately 26 percent. The seasonal closure would only pertain to gag from February 1-14 and March 15-31. From February 15-March 14, the existing recreational seasonal closure for red grouper, black grouper, and gag would remain in place. Because interim regulations would only pertain to gag for approximately half of the seasonal closure, bycatch of gag may be higher than described above if fishermen choose to fish for red grouper, black grouper, or other shallow water grouper during early February or late March when gag is closed. The interim rule would not include measures for adjusting the red grouper bag limit or the aggregate bag limit; therefore, effects on the biological environment would be similar to those described in **Alternative 1** (status quo).

5.9.3 Direct and Indirect Effects on Economic/Social Environment

5.9.3.1 Direct and Indirect Effects on the Economic Environment

Action 9 considers recreational management measures that would reduce recreational gag grouper landings by at least 46 percent. Adjustments to recreational red grouper landings considered could increase landings by as much as 14 percent or decrease landings by up to 21 percent. Measures under consideration include adjustments to the minimum size limit, species-specific and aggregate bag limits, and to the recreational fishing season, including seasonal closures. The expected economic effects of these measures are analyzed in this section.

The evaluation of economic impacts expected to result from recreational management measures considered in this amendment relies on computed changes in economic values. Changes in economic values resulting from recreational management measures are composed of producer surplus changes affecting charterboat and headboat operators, consumer surplus changes experienced by for-hire consumers and, consumer surplus changes in the private recreational sector. Expected changes in consumer and producer surpluses were estimated based on methods and assumptions detailed in the evaluation of alternative gag and red grouper allocations (Section 5.5.3.1). Therefore, the same limitations apply. However, it is worth reemphasizing that these estimated changes in economic value are approximations for the welfare changes expected to result from management alternatives considered. These estimates are exclusively presented for the purpose of ranking the management alternatives under consideration.

Alternative 1 would maintain existing gag and red grouper regulations. Minimum size limits for red and gag (20 inch TL and 22 inch TL, respectively), the February 15 to March 15 recreational closure for gag, red grouper, and black grouper, the recreational bag limit for red grouper of 1 fish per person per day within the 5-grouper aggregate bag limit would remain in effect (336 day

season). As the no action alternative, **Alternative 1** is not associated with changes in economic value.

Alternative 2 would reduce gag landings by 45 percent and increase red grouper landings by 14 percent, yielding a 274 day recreational season. **Alternative 2** would implement a gag bag limit of 1 fish per person per day within the aggregate bag limit, an aggregate grouper bag limit of 3 fish per person, and a January 15 through April 15 closed season on shallow-water grouper. Relative to the status quo, the decrease in gag harvest is expected to result in a $2.80 million decrease in economic value. Gains in economic value expected from the 14 percent increase in red grouper harvest are estimated at $ 0.35 million, approximately. For gag grouper, expected changes in recreational landings and effort for the charter, private, and, headboat sectors are presented in Table 5.9.3.1; corresponding consumer and producer surplus measures and changes in economic values are provided in Table 5.9.3.2. Tables 5.9.3.3 and 5.9.3.4, present the same information for red grouper. Aggregate net changes in surpluses and economic values expected to result from management alternatives considered in this action are provided in Table 5.9.3.5. Net changes in economic value expected from **Alternative 2** are estimated at $2.42 million, approximately.

Table 5.9.3.1: Gag Recreational Landings and Target Effort for the Charter, Private and Headboat Sectors for Management Alternatives in Action 9

GAG	Charter			Private			Headboat		
	Landings		Target	Landings		Target	Landings		Target
	Pounds	Fish	Effort	Pounds	Fish	Effort	Pounds	Fish	Effort
Alternative 1	**779,400**	**98,233**	**21,470**	**2,573,752**	**362,500**	**263,754**	**110,848**	**16,065**	**7,287**
Alternative 2	428,670	54,028	11,808	1,415,564	199,375	145,065	60,966	8,836	4,008
Alternative 3	420,876	53,046	11,594	1,389,826	195,750	142,427	59,858	8,675	3,935
Alternative 4	428,670	54,028	11,808	1,415,564	199,375	145,065	60,966	8,836	4,008
Alternative 5	428,670	54,028	11,808	1,415,564	199,375	145,065	60,966	8,836	4,008
Alternative 6	420,876	53,046	11,594	1,389,826	195,750	142,427	59,858	8,675	3,935
Alternative 7-a	600,138	75,639	16,532	1,981,789	279,125	203,091	85,353	12,370	5,611
Alternative 7-b	576,756	72,692	15,888	1,904,576	268,250	195,178	82,028	11,888	5,393
Alternative 7-c	584,550	73,675	16,102	1,930,314	271,875	197,816	83,136	12,049	5,466
Alternative 7-d	576,756	72,692	15,888	1,904,576	268,250	195,178	82,028	11,888	5,393
Alternative 7-e	576,756	72,692	15,888	1,904,576	268,250	195,178	82,028	11,888	5,393

Table 5.9.3.2: Consumer and Producer Surpluses, and Economic Value Associated with Gag Management Alternatives (Action 9)

GAG	Charter		Private	Headboat		Economic Value (EV)
	Surplus		Surplus	Surplus		
	Consumer	Producer	Consumer	Consumer	Producer	
Alternative 1	$367,391	$3,898,307	$1,355,751	$60,083	$480,968	$6,162,501
Alternative 2	$202,065	$2,144,069	$745,663	$33,046	$264,533	$3,389,376
Difference 2	-$165,326	-$1,754,238	-$610,088	-$27,037	-$216,436	-$2,773,125
Alternative 3	$198,391	$2,105,086	$732,106	$32,445	$259,723	$3,327,750
Difference 3	-$169,000	-$1,793,221	-$623,645	-$27,638	-$221,245	-$2,834,750
Alternative 4	$202,065	$2,144,069	$745,663	$33,046	$264,533	$3,389,376
Difference 4	-$165,326	-$1,754,238	-$610,088	-$27,037	-$216,436	-$2,773,125
Alternative 5	$202,065	$2,144,069	$745,663	$33,046	$264,533	$3,389,376
Difference 5	-$165,326	-$1,754,238	-$610,088	-$27,037	-$216,436	-$2,773,125
Alternative 6	$198,391	$2,105,086	$732,106	$32,445	$259,723	$3,327,750
Difference 6	-$169,000	-$1,793,221	-$623,645	-$27,638	-$221,245	-$2,834,750
Alternative 7-a	$279,217	$2,962,714	$1,030,371	$45,663	$365,536	$4,683,501
Difference 7-a	-$88,174	-$935,594	-$325,380	-$14,420	-$115,432	-$1,479,000
Alternative 7-b	$271,870	$2,884,747	$1,003,256	$44,461	$355,917	$4,560,251
Difference 7-b	-$95,522	-$1,013,560	-$352,495	-$15,622	-$125,052	-$1,602,250
Alternative 7-c	$275,543	$2,923,731	$1,016,813	$45,062	$360,726	$4,621,876
Difference 7-c	-$91,848	-$974,577	-$338,938	-$15,021	-$120,242	-$1,540,625
Alternative 7-d	$271,870	$2,884,747	$1,003,256	$44,461	$355,917	$4,560,251
Difference 7-d	-$95,522	-$1,013,560	-$352,495	-$15,622	-$125,052	-$1,602,250
Alternative 7-e	$271,870	$2,884,747	$1,003,256	$44,461	$355,917	$4,560,251
Difference 7-e	-$95,522	-$1,013,560	-$352,495	-$15,622	-$125,052	-$1,602,250

Table 5.9.3.3: Red Grouper Recreational Landings and Target Effort for the Charter, Private and Headboat Sectors for Management Alternatives in Action 9

RED	Charter			Private			Headboat		
	Landings		Target	Landings		Target	Landings		Target
	Pounds	Fish	Effort	Pounds	Fish	Effort	Pounds	Fish	Effort
Alternative 1	381,510	60,048	9,676	1,149,240	171,528	99,459	39,250	7,136	2,417
Alternative 2	434,921	68,455	11,031	1,310,134	195,542	113,383	44,745	8,135	2,755
Alternative 3	412,031	64,852	10,450	1,241,179	185,251	107,415	42,390	7,707	2,610
Alternative 4	301,393	47,438	7,644	907,900	135,507	78,572	31,008	5,638	1,909
Alternative 5	362,435	57,046	9,192	1,091,778	162,952	94,486	37,288	6,780	2,296
Alternative 6	385,325	60,649	9,773	1,160,732	173,244	100,453	39,643	7,208	2,441
Alternative 7-a	453,997	71,457	11,515	1,367,596	204,119	118,356	46,708	8,492	2,876
Alternative 7-b	358,619	56,445	9,096	1,080,286	161,237	93,491	36,895	6,708	2,272
Alternative 7-c	434,921	68,455	11,031	1,310,134	195,542	113,383	44,745	8,135	2,755
Alternative 7-d	453,997	71,457	11,515	1,367,596	204,119	118,356	46,708	8,492	2,876
Alternative 7-e	446,367	70,256	11,321	1,344,611	200,688	116,367	45,923	8,350	2,827

Table 5.9.3.4: Consumer and Producer Surpluses, and Economic Value Associated with Red Grouper Management Measures (Action 9)

Red Grouper	Charter		Private	Headboat		Economic Value (EV)
	Surplus		Surplus	Surplus		
	Consumer	Producer	Consumer	Consumer	Producer	
Alternative 1	$224,580	$1,451,430	$641,516	$26,690	$159,493	$2,503,709
Alternative 2	$256,021	$1,654,631	$731,328	$30,427	$181,822	$2,854,229
Difference 2	$31,441	$203,200	$89,812	$3,737	$22,329	$350,519
Alternative 3	$242,547	$1,567,545	$692,837	$28,825	$172,252	$2,704,006
Difference 3	$17,966	$116,114	$51,321	$2,135	$12,759	$200,297
Alternative 4	$177,418	$1,146,630	$506,798	$21,085	$125,999	$1,977,930
Difference 4	-$47,162	-$304,800	-$134,718	-$5,605	-$33,493	-$525,779
Alternative 5	$213,351	$1,378,859	$609,440	$25,356	$151,518	$2,378,524
Difference 5	-$11,229	-$72,572	-$32,076	-$1,335	-$7,975	-$125,185
Alternative 6	$226,826	$1,465,945	$647,931	$26,957	$161,088	$2,528,747
Difference 6	$2,246	$14,514	$6,415	$267	$1,595	$25,037
Alternative 7-a	$267,250	$1,727,202	$763,404	$31,761	$189,796	$2,979,414
Difference 7-a	$42,670	$275,772	$121,888	$5,071	$30,304	$475,705
Alternative 7-b	$211,105	$1,364,345	$603,025	$25,089	$149,923	$2,353,487
Difference 7-b	-$13,475	-$87,086	-$38,491	-$1,601	-$9,570	-$150,223
Alternative 7-c	$256,021	$1,654,631	$731,328	$30,427	$181,822	$2,854,229
Difference 7-c	$31,441	$203,200	$89,812	$3,737	$22,329	$350,519
Alternative 7-d	$267,250	$1,727,202	$763,404	$31,761	$189,796	$2,979,414
Difference 7-d	$42,670	$275,772	$121,888	$5,071	$30,304	$475,705
Alternative 7-e	$262,759	$1,698,174	$750,574	$31,227	$186,607	$2,929,340
Difference 7-e	$38,179	$246,743	$109,058	$4,537	$27,114	$425,631

Table 5.9.3.5: Aggregate (Red and Gag) Changes in Surpluses and Economic Value (Relative to Alternative 1) in the Recreational Sector – Action 9

Red and Gag	Charter		Private	Headboat		Economic
	Surplus		Surplus	Surplus		Value (EV)
	Consumer	Producer	Consumer	Consumer	Producer	
Alternative 1	$0	$0	$0	$0	$0	$0
Alternative 2	-$133,885	-$1,551,038	-$520,276	-$23,301	-$194,107	-$2,422,606
Alternative 3	-$151,034	-$1,677,107	-$572,324	-$25,503	-$208,486	-$2,634,454
Alternative 4	-$212,488	-$2,059,039	-$744,806	-$32,642	-$249,929	-$3,298,904
Alternative 5	-$176,555	-$1,826,810	-$642,164	-$28,372	-$224,410	-$2,898,311
Alternative 6	-$166,754	-$1,778,707	-$617,230	-$27,371	-$219,651	-$2,809,713
Alternative 7-a	-$45,504	-$659,822	-$203,492	-$9,349	-$85,128	-$1,003,295
Alternative 7-b	-$108,997	-$1,100,646	-$390,986	-$17,223	-$134,622	-$1,752,473
Alternative 7-c	-$60,407	-$771,377	-$249,126	-$11,284	-$97,913	-$1,190,106
Alternative 7-d	-$52,852	-$737,788	-$230,607	-$10,551	-$94,748	-$1,126,545
Alternative 7-e	-$57,343	-$766,817	-$243,437	-$11,085	-$97,938	-$1,176,619

Alternatives 3 to **7** consider several management scenarios combining gag grouper decreases with red grouper increase or decreases, resulting in recreational season length ranging from 214 days under **Alternative 6** to 320 days under **Alternative 7 (option a)**. Due to the large decrease in gag considered in all the alternatives, all net changes in economic values are negative. Aggregate losses in economic value corresponding to these management scenarios vary from $3.3 million under **Alternative 4** to $1.13 million under **Alternative 7 (option d)**. In selecting a preferred alternative for this action (**Alternative 7 – option e**), the Council accounted for several considerations, including, required reductions in gag harvest levels and associated socio-economic effects on the recreational sector, possible increases in red grouper harvests, and expected recreational season length. In addition, the length and timing of the closure were considered.

Preferred Alternative 7 – option e would reduce gag landings by 26 percent and increase red grouper landings by 17 percent, yielding a 306 day recreational season. **Preferred Alternative 7 – option e** would implement a gag bag limit of 2 fish per person per day within the aggregate bag limit, a red grouper bag limit of 2 fish per person per day within the aggregate bag limit; and an aggregate grouper bag limit of 4 fish per person, per day. **Preferred Alternative 7-option e** would also implement a February 1 through March 31 closed season for shallow-water grouper. Relative to the status quo, **Preferred Alternative 7 – option e** is expected to result in a $1.80 million decrease in short term economic value.

Summary

In addition to the status quo, gag and red grouper recreational management measures under this action consider several adjustments to gag and red minimum size limits, species-specific and aggregate bag limit changes, season length and format modifications. Anticipated decreases in gag landings vary from 46 to 23 percent. For red grouper, fluctuations in landings range from a 19 percent increase to a 21 percent reduction. In selecting **Alternative 7 – option e** as the preferred alternative for this action, the Council considered several factors such as required reductions in gag harvest levels and associated socio-economic effects on the recreational sector, possible increases in red grouper harvests, expected recreational season length, and, the length and timing of the recreational shallow water grouper closure. **Preferred Alternative 7 – option e** would reduce gag landings by 26 percent and increase red grouper landings by 17 percent, yielding a 306 day recreational season. Within the 4 fish per person per day aggregate grouper limit, **Preferred Alternative 7 – option e** would implement a gag bag limit of 2 fish per person per day and a red grouper bag limit of 2 fish per person per day. **Preferred Alternative 7-option e,** which is expected to result in a $1.80 million decrease in short term economic value, would also establish a February 1 through March 31 closed season for shallow-water grouper.

5.9.3.2 Direct and Indirect Effects on the Social Economic Environment

Action 1 would maintain the size limits and bag limits now in place. In the short term this alternative would not have any impacts on the recreational fishermen who target gag and red grouper because it would not change the rules they are currently under. In the long term, Alternative 1 may allow overfishing of gag grouper to continue which could require stricter regulations in the future, such as long closures, reduced TACS, etc., to correct for the overfishing which would have a negative impact on then fishermen, fishing-dependent businesses, and fishing communities involved in these fisheries.

Alternatives 2-10 offer various management options for reducing overfishing in gag grouper and for managing red grouper in the recreational fisheries. Bag limits, size limits, and closures are incorporated to achieve OY in the fisheries. When comparing each alternative, there will be some recreational fishermen who support one alternative over another, depending on how often they fish, the season they fish, and what they target. Some fishermen may prefer a larger bag limit with some restrictions on individual species, while others may prefer a smaller total bag limit with a higher bag limit on a preferred species. Due to the differences in opinions among recreational fishermen it is not possible to fully describe the social impacts of any one alternative as compared to another. During the closed season there may not be many other reef fish species to fish for. If recreational fishermen choose not to fish during the closed season there could be a negative impact on the businesses such as charter boats, bait and tackle shops, marinas, hotels, and other businesses that cater to recreational fishermen because they would not have as much business from recreational fishermen as they may if the season for gag, black, and red grouper were not closed. This would have the most impact in communities along the west coast of Florida which has the most recreational fishermen who target these species.

Summary

In the short term Alternative 1 would not have any impacts on the recreational fishermen who target gag and red grouper because it would not change the rules they are currently under. For Alternatives 2-10, there will be some recreational fishermen who support one alternative over another, depending on how often they fish, the season they fish, and what they target. During the closed season there may not be many other reef fish species to fish for. If recreational fishermen choose not to fish during the closed season there could be a negative impact on the businesses such as charter boats, bait and tackle shops, marinas, hotels, and other businesses that cater to recreational fishermen because they would not have as much business from recreational fishermen as they may if the season for gag, black, and red grouper were not closed.

5.9.4 Direct and Indirect Effects on Administrative Environment

All of the alternatives in Action 9 end gag overfishing and are therefore expected to benefit the administrative environment by complying with the mandates of the M-SFCMA. Alternatives in Action 9 that allow an increase in red grouper harvest may negatively affect the administrative environment if F is increased and not offset by other proposed management measures. Alternatives that maintain red grouper landings at or below current levels and consistent with F_{OY} would benefit the administrative environment by allowing the Council to manage red grouper to achieve F_{OY}. The following discussion summarizes the effects to the administrative environment as they pertain to law enforcement, monitoring, and implementation of management measures.

Alternative 1 (status quo/no action) would maintain status quo regulations, which include a one red grouper daily bag limit, 20-inch red grouper minimum size limit, 22-inch gag minimum size limit, five grouper daily bag limit, captain and crew grouper bag limit prohibition, and February 15 to March 15 recreational seasonal closure. The MRFSS, Texas Parks and Wildlife Department (TPWD), and the SEFSC's Headboat Survey monitor recreational landings. Monitoring recreational landings and enforcing bag limits, size limits, and closed seasons are routine fishery management actions that affect the administrative environment.

Alternatives 2-7 would not change how landings are monitored and therefore would not represent an additional administrative burden for MRFSS, TPWD or the SEFSC's headboat survey. **Alternative 2** would establish a gag bag limit of one, eliminate the red grouper bag limit, and expand the recreational closed season by two additional months. Specifying a gag bag limit would result in a new regulation to enforce, but may reduce the burden on enforcement by making it easier and faster to determine compliance with regulations (less fish to count and measure). Eliminating the red grouper bag limit would reduce the number of regulations to enforce and may increase compliance with the bag limit restriction since fewer anglers would harvest the aggregate bag limit. Expanding the recreational closure may reduce the overall burden on enforcement by making it simpler to determine whether or not anglers are complying with regulations (less fish to count and measure; either you possess shallow-water grouper during the closure or you do not possess shallow-water grouper during the closure). However, if states do not implement compatible regulations, then compliance with the closure may be greatly reduced. The increase in red grouper harvest proposed in **Alternative 2** is the second greatest of any of the alternatives considered and may therefore result in accountability measures being triggered more often (see Action 6). This alternative would also have the second highest

probability of allowing overfishing of red grouper and could therefore result in more restrictive management measures in the future to constrain red grouper harvest.

Alternative 3 would establish a one gag bag limit, two red grouper bag limit, an aggregate bag limit of three, and a three month closed season. **Alternative 4** would establish a gag bag limit of two, eliminate the red grouper bag limit, and establish a 4 ½ month closed season. Impacts to the administrative environment resulting from both of these alternatives are expected to be similar to those described for **Alternative 2**. All of these management measures are commonly used to regulate reef fish harvest in the Gulf of Mexico. Closed seasons and lower bag limits may make it easier and faster to determine compliance. Red grouper harvest would be decreased (**Alternative 4**; -21 percent) or only be increased by a small percentage (8 percent); therefore reducing the likelihood that accountability measures will be triggered (see Action 6) or overfishing will occur. The small red grouper harvest increase relative to most of the other alternatives in Action 9 would therefore benefit the administrative environment, but result in some forgone yield.

Alternative 5-6 would both decrease the aggregate bag limit to three fish and establish lengthy closed seasons (141-151 days). **Alternative 5** would not specify species specific bag limits for red or gag grouper, while **Alternative 6** would set the gag bag limit at one fish and eliminate the red grouper bag limit. Effects on the administrative environment resulting from the gag bag limit and closed seasons would be similar to those described for **Alternatives 2** and **3**. Both alternatives would end overfishing of gag and maintain red grouper landings at or near status quo levels, thereby benefiting the administrative environment by not increasing red grouper F and fulfilling the MSFCMA mandate to end overfishing.

Alternatives 7(a-e) would decrease the aggregate bag limit, increase the red grouper bag limit, implement a two gag bag limit, and establish a 45-62 day closed season. The closed seasons would be shorter than those proposed for **Alternatives 2-6**, and slightly longer than the status quo closed season of February 15 to March 15. Affects on enforcement and monitoring would be similar to those described above for other alternatives. Because **Alternatives 7(a-e)** only reduce gag harvest by 23-26 percent and rely on additional reductions in harvest to occur from fall offs in effort, these alternatives have a higher probability of not ending overfishing. **Alternatives 7(a-e)** would also result in some of the greatest increases in red grouper harvest. Greater increases in red grouper harvest will increase the probability that overfishing occurs and F_{OY} is not achieved.

Overall, **Alternatives 2-7** are not expected to significantly effect the administrative environment. **Alternatives 1** and **7** would have the greatest effects on the administrative environment, while **Alternatives 2-6** would have lesser effects. Size limits, bag limits, and closed seasons are currently used to manage the harvest of many recreational fish species and therefore changes to these regulations would not represent a significant burden on enforcement. However, more restrictive management measures could increase the rate of non-compliance, therefore resulting in an increased burden on enforcement.

Interim regulations are expected to benefit the administrative environment by addressing gag overfishing at the start of the 2009 fishing year. However, because interim regulations will differ

from more permanent regulations ultimately implemented in this amendment, angler confusion and decreased compliance with regulations could occur. Bag limits and seasonal closures are currently used to manage the harvest of groupers; therefore changes to these types of regulations should not represent a significant burden on enforcement.

5.10 Action 10. Alternatives to Reduce Discard Mortality of Grouper

The alternatives in this action address methods to reduce the number and mortality of grouper caught but not retained by fishers. **Alternative 1** would make no changes. **Alternative 2** would require pamphlets or placards describing proper handling, venting, and release methods on board fishing vessels. **Preferred Alternative 3** would reduce or eliminate commercial size limits for all species in the shallow-water grouper commercial fishery or just red grouper.

5.10.1 Direct and Indirect Effects on Physical Environment

The alternatives in this action would have no direct effect on the physical environment. **Preferred Alternative 3** may have indirect physical effects. Reduction or omission of commercial minimum size limits could result in decreased effort because fishermen might reach the shallow-water grouper or red grouper quota sooner; however, if fishermen only keep larger fish, effort would not be reduced. Reduced effort would mean fewer impacts of fishing gear on the bottom habitat. Anchors or weights on bottom longlines can impact and damage the bottom habitat. In addition, lines can drag across the surface for considerable distances during retrieval, dislodging lightweight organisms such as invertebrates. Both longlines and handlines can become entangled in coral reef and other hard bottom and cause physical damage (Barnette, 2001).

5.10.2 Direct and Indirect Effects on the Biological / Ecological Environment

Alternative 1 is the No Action alternative and does not propose any bycatch reduction measures. However when Amendment 27 to the Reef Fish FMP is implemented, circle hooks, venting tools, and dehooking devices will be required for all reef fish. Each of these instruments is expected to reduce discard mortality. The analyses in this section are based on estimated mortality rates before passage of Amendment 27. Based on published studies to-date, the effects of the new regulations may differ among species.

Circle hooks are similar to traditional J hooks, but the tip of the hook curves inward toward the shank. Ideally, after the fish swallows the hook it slides out of the stomach and esophagus without catching, then hooks in the corner of the mouth around the lower jaw. Cooke and Suski (2004) found circle hooks had a lower overall mortality for all species they studied, because circle hooks were more likely to hook in the jaw than in the gut. Likewise, Bacheler and Buckel (2004) found significantly lower gut-hooking with circle hooks (< 1 percent) than with J hooks (15 percent) and groupers were less likely to bleed when hooked in the jaw (5 percent) than when hooked in the gut (40 percent). If bleeding is a predictor of post-release mortality, then grouper would be more likely to survive when circle hooks are used because they would be more likely to be jaw-hooked and therefore less likely to bleed. Burns et al. (2002) found significantly higher survival when circle hooks were used for red grouper than when J-hooks were used, but

found no significant difference in gag survival. The difference between species is likely due to feeding behavior; red grouper tend to swallow prey whole if possible (Burns et al. 2004), which increases the chance of gut-hooking with J-hooks.

Fish with swim bladders can experience air expansion problems, particularly when raised quickly from deep water. As air expands in the swim bladder, internal organs are pushed out of place and compressed, potentially causing injury (Rummer and Bennett 2005). If the bladder bursts, the gas can be retained in the body cavity and continue to cause damage. Venting tools release gas from expanded or ruptured swim bladders in fish raised from depth. A hypodermic needle or any sharp, hollow instrument can be effective if used properly. The most obvious sign of bladder expansion and rupture is distention of the stomach out of the mouth. In a study by Bacheler and Buckel (2004), even in shallow water (< 38m) 75 percent of red grouper had distended stomachs, and in deeper water (> 41m) 95 percent had distended stomachs. No gag had distended stomachs in shallow water (< 24m), but over 60 percent had distended stomachs in deeper water (> 36m). If fish are released while still inflated, they may not be able to return to depth or even move off the surface. The resulting increased exposure to air and predators could increase mortality of discarded fish. Venting tools are designed to release gases and allow the fish to swim normally. However, venting increases handling time, and increases risk of further injury and infection if not done properly.

Dehooking devices can decrease the time and amount of handling needed to remove a hook from a fish. Hook removal time contributes significantly to release mortality (Cooke and Suski 2004). Long-handled dehookers can be used without removing the animal from the water, which can decrease stress and injury from handling and exposure. Even when a fish is removed from the water, exposure and handling time may be reduced by using a dehooker. Amendment 27 (pages 30-34 and 257-259) contains further discussion of the impacts of venting tools and dehooking devices on survival of fish.

Alternatives 2 and 3 for this action would have direct effects on the biological environment. **Alternative 2** would not require any new gear but would require instructions on board fishing vessels explaining how to properly handle, vent, and release fish. Fishers may or may not read the instructions on the placards or pamphlets, but would have the information if desired. Some vessels already have venting tools on board; pamphlets or placards would help with their proper use. Information aboard vessels should increase proper handling and release techniques, and thus increase survival of released fish.

Preferred Alternative 3 could reduce shallow-water grouper or red grouper discard mortality by decreasing or removing the commercial minimum size limit and thereby decreasing the number of fish released after catch. Coggins et al. (2007) found minimum size limits did not help fisheries for long-lived low-productivity species, such as groupers, achieve sustainability if discard mortality exceeded five percent. Rudershausen et al. (2007) also concluded minimum size limits are only moderately effective for reef fish caught in shallower portions of their depth ranges, and nearly ineffective in deep waters.

Little data on discard rate and release mortality are available for shallow-water grouper species except for red grouper and gag. In 2006, red grouper dominated the commercial shallow-water

grouper landings by weight (75.8 percent). Gag (18.0 percent), black (2.9 percent), scamp (3.4 percent), yellowfin (< 0.1 percent), and others (< 0.1 percent) composed the rest of the landings. Landings for only the longline fishery were even more skewed toward red grouper (82.3 percent), than gag (12.2 percent), black (3.2 percent), scamp (3.2 percent), yellowfin (< 0.1 percent), and others (< 0.1 percent). Therefore this discussion will mainly focus on red grouper, with some information on gag.

SEDAR 12 (2007) estimated 10 percent release mortality for all gear used in the commercial red grouper fisheries, except commercial longline release mortality was estimated at 45 percent. The commercial sector lands approximately three times more red grouper than the recreational sector. Therefore, changes to the minimum size for the commercial sector would have a larger impact than equivalent changes for the recreational sector. Long-term equilibrium analyses indicate commercial red grouper landings would increase and dead discards would decrease if the minimum size was lowered from the current 20 inches (Table 5.10.1).

Table 5.10.1. Percent change in red grouper landings and dead discards for the commercial sector if the minimum size limit is decreased from 20 inches. Modified from Walter 2007.

		Equilibrium		
Mode		18 inches	16 inches	14 inches
longline	landings	7.68%	14.45%	19.54%
	discard dead	-20.26%	-40.53%	-57.24%
handline	landings	17.12%	37.11%	55.13%
	discard dead	-15.38%	-33.75%	-50.68%
		2005, only		
longline	landings	81.88%	111.80%	120.69%
	discard dead	-66.00%	-90.12%	-97.28%
handline	landings	97.98%	130.61%	140.41%
	discard dead	-67.97%	-90.61%	-97.41%

Yield per recruit (YPR) analyses balance natural and fishing mortality to predict a harvest size that maximizes the per capita harvest. Analyses conducted by SEFSC (Walter 2007) predict YPR will increase as minimum size decreases for the entire red grouper commercial sector (**Preferred Alternative 3, Option e, Suboption i)**, with a maximum YPR realized at 10 inches (Figure 5.10.1). However, YPR increases are accompanied by SPR decreases (Figure 5.10.2). If the minimum size limit was changed to 18 inches, YPR would increase 2.6 percent and SPR would decrease 1.5 percent; if the limit was changed to 16 inches, YPR would increase 4.3 percent and SPR would decrease 2.9 percent; if the limit was changed to 14 inches, YPR would increase 5.1 percent and SPR would decrease 4.1 percent; and if the size limit was eliminated, YPR would increase 4.5 percent and SPR would decrease 6.4 percent.

Alternative 3, Suboption ii would only change the minimum size limit for the longline portion of the commercial sector. Longline landings make up 61 percent of the total commercial red grouper landings and have the highest estimated release mortality (45 percent versus 10 percent; SEDAR 12). When minimum size is kept at 20 inches for all other gear in both the recreational and commercial sectors, YPR is still maximized at a commercial longline size limit of 10 inches (Figure 5.10.1). In this case, if the minimum size limit was changed to 18 inches, YPR would increase 2.0 percent and SPR would decrease 0.7 percent; if the limit was changed to 16 inches, YPR would increase 3.4 percent and SPR would decrease 1.3 percent; if the limit was changed to

14 inches, YPR would increase 4.2 percent and SPR would decrease 1.8 percent; and if the size limit was eliminated, YPR would increase 4.6 percent and SPR would decrease 2.7 percent.

Currently, SPR is near SPR_{OY} (Figure 5.10.2). At reduced size limits for the entire commercial red grouper sector and assuming the current F, SPR would decrease below SPR_{OY} but remain above SPR_{MSY}; however, with no size limits SPR could fall below SPR_{MSY}. For the commercial longline sector, SPR would remain above SPR_{MSY} at all reduced size limits and no size limit if F remains at current levels.

Figure 5.10.1. Minimum size limit versus yield per recruit for red grouper.

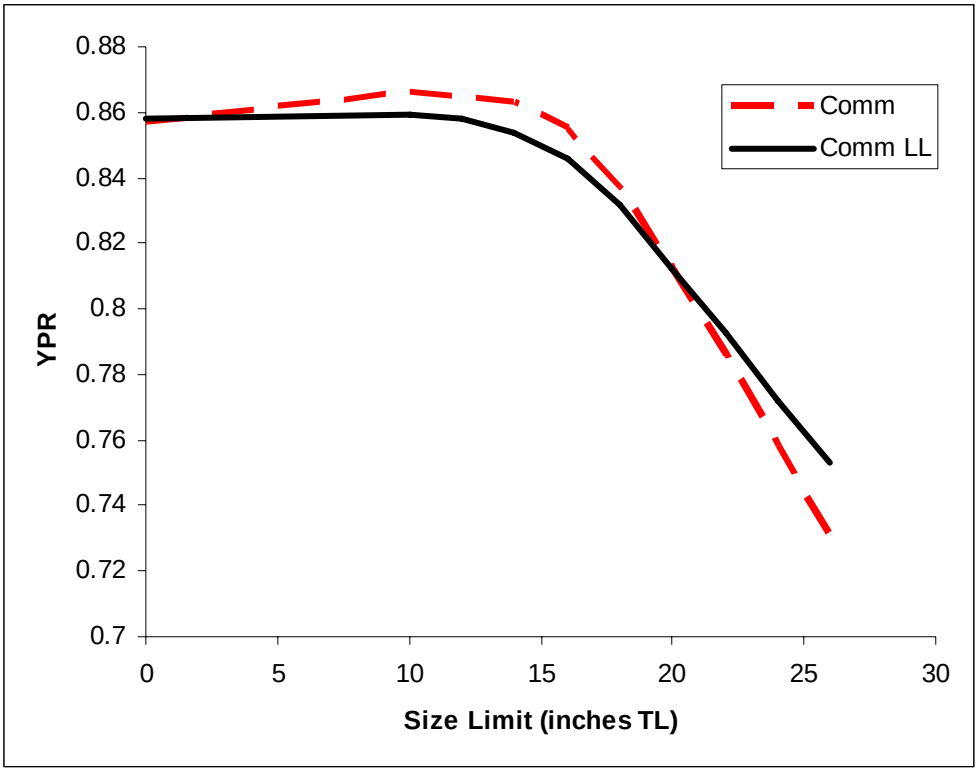
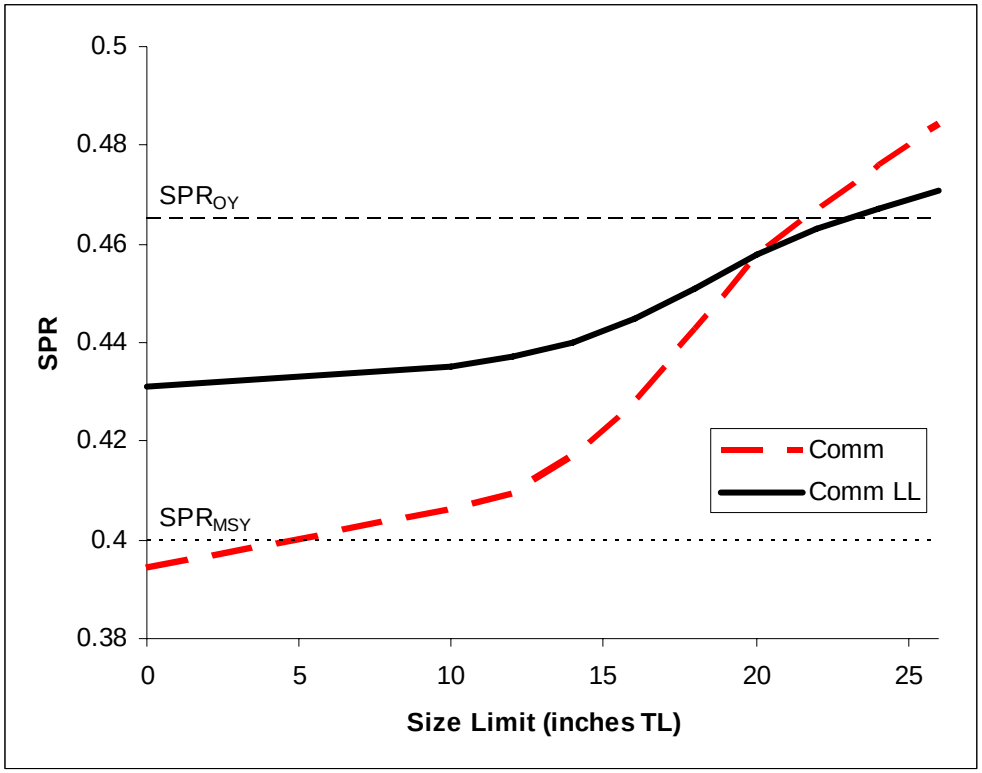


Figure 5.10.2. Minimum size limit versus spawning potential ratio for red grouper.



YPR for gag would also increase as the commercial minimum size decreases, but the increase is less than one percent for each option and suboption under **Preferred Alternative 3** (Ortiz 2007). Likewise, all decreases in SPR would be less than one percent. These small changes in YPR and SPR for the commercial gag fishery are due to the very low rate of dead discards for the gag commercial sector.

YPR analyses contain some assumptions that do not hold for the grouper fisheries in the Gulf of Mexico. All YPR analyses assume constant recruitment; however, grouper recruitment fluctuates from year to year. When a cohort from a high-recruitment year enters the fishery, higher proportions of small fish would be landed. YPR analyses also assume the fishery is regulated by a constant F policy. Because the commercial shallow-water grouper fishery is regulated through a quota, results will be somewhat different. Finally, mortality rates are assumed to be constant, when in reality they will vary with size of fish and depth of capture.

Commercial quotas are based on weight, so greater numbers of fish may be landed under a lower minimum size limit because average weight per fish would be less. If the Council chooses Alternative 2 for Action 8 (Application of Quota Closures), the red grouper fishery would close when the gag quota is reached, even if the red grouper quota has not been reached. In this case, a lower minimum size limit could allow commercial fishermen to land more red grouper before that fishery closes.

Minimum size limits should also be considered relative to the size at which the fish become

reproductively mature. **Alternative 3, Option a** would decrease the minimum size limit for three of five species that currently have size limits. Eighteen inches is lower than the size of 50 percent maturity for black grouper (~33 inches; NMFS 2005b), gag (~23 inches; SEDAR 10 2006), and yellowfin grouper (~20 inches; Cummings, 2007). **Alternative 3, Option b** would standardize size limits for all five species. Sixteen inches is below the size of maturity for three species and above the size of maturity for red grouper (~15 inches; Fitzhugh et al. 2006) and scamp (~14 inches; NMFS 2005b). **Alternative 3, Option c** would decrease the size limit for all five species, and bring the size limit for all five below the size at maturity. **Alternative 3, Option d** would allow capture of any size shallow-water grouper regardless of reproductive status. **Alternative 3, Option e** would maintain the minimum size limit above the size of maturity for red grouper.

The alternatives in this action could have an indirect effect on the ecological environment because groupers are apex predators within their food web. Increases or decreases in their population sizes may affect populations of their prey and competitors. Options in **Preferred Alternative 3** could change the size structure of the grouper population, as well as change the size of the reproductive portion of the population.

5.10.3 Direct and Indirect Effects on Economic/Social Environment

5.10.3.1 Direct and Indirect Effects on the Economic Environment

Alternative 1, no action, has no direct or indirect economic impacts. It should just be recognized that this alternative imbeds whatever measures to reduce discard mortality that were proposed in other amendments but not yet implemented.

The direct economic effects of **Alternative 2** come in the form of increasing fishing operations due to the cost of having on board fishing vessels the necessary instruction materials for venting, handling, and release of fish. Additional costs can also arise from exposing fishing vessels to possible enforcement actions for not complying with this additional requirement. The first type of cost may be partly mitigated if the agency rather than the industry shoulder the burden of developing and producing the required information materials. This is especially true for some fishing vessels which already carry some type of informational materials for properly releasing fish. These two types of costs to the industry cannot be quantified.

Alternative 3 applies only to the commercial sector of the shallow-water grouper fishery, and thus direct impacts of this alternative fall on this sector. All alternatives to the status quo provide for lower size limits, so the general expectation is that the commercial fishery would derive additional benefits from these alternatives. Markets for smaller fish the commercial fishery lost due to the higher size limit now in place could be re-exploited. Although the evidence is weak, Council public hearings of past amendments indicated the market provided some price premium for fish in the lower size category for grouper.

With commercial grouper quotas controlling overall landings, lower size limits which reduce discard mortality may be expected to reduce overall fishing mortality. Such fish mortality reductions would eventually allow higher allowable harvest levels and thus higher future benefits

not only to the commercial but also to the recreational sector. In this sense, lower size limits would have indirect economic effects on other fisheries.

The economic consequences of various options and sub-options under **Alternative 3** are presented in the two tables below. Losses in net revenues would still come from higher size limits because of the other restrictive measures in this amendment. Without the higher size limits, losses would have been higher as the positive effects of lower size limits would partially offset losses from other measures in this amendment.

There are four size limit alternatives and two applicability alternatives, resulting in eight unique combinations. The alternatives are labeled Alternatives 3ai, 3bi, 3ci, 3di, 3aii, 3bii, 3cii, and 3dii. The letters a, b, c, and d refer to size limit of 18 inches, 16 inches, 14 inches, and no size limit, respectively. The two numerals correspond to the applicability of the size limit option to (i) the entire shallow-water grouper fishery, or (ii) only to the longline sector of the shallow-water grouper fishery.

It is apparent from the results presented in Table 5.10.3.1 that losses would decrease by lowering the size limit, regardless of whether the size limit were made applicable to the entire shallow-water grouper fishery or just the longline sector of the fishery. When size limit changes were made applicable to the entire shallow-water grouper fishery and using a 3 percent discount factor, losses would fall from $17.5 million with an 18-size limit (**Alternative 3ai**) down to $11.2 million with no size limit (**Alternative 3di**). When size limit changes were made applicable only to the longline fishery, losses would drop from $18.4 million with an 18-inch size limit (**Alternative 3aii**) to $14.5 million with no size limit (**Alternative 3dii**).

Also apparent from the tabulated results is that the wider the coverage of the size limit reductions the lower would be the losses. For example, **Alternative 3bi**, with a size limit of 16 inches applicable to the entire shallow-water grouper fishery, would result in losses of $12.5 million. In contrast, **Alternative 3bii**, with the same 16-inch size limit but applicable only to the longline sector, would result in losses of $15.5 million. A similar situation would happen when contrasting **Alternative 3ai** with **Alternative 3aii**, or **Alternative 3ci** with **Alternative 3cii**, or **Alternative 3di** with **Alternative 3dii**.

The smallest losses would accrue to **Alternative 3di**, and this is a reasonable expectation since this alternative would provide for no minimum size limit for any grouper species and would apply to the entire shallow-water grouper fishery. The largest losses would come from **Alternative 3aii**, which would provide for an 18-inch size limit but would apply only to the longline segment of the shallow-water grouper fishery. This latter finding deserves additional scrutiny, because it would seem to imply that “benefits” from a size limit change would not be sufficient to offset the “losses” from its restricted applicability. Conversely, it could also imply that the applicability of the size limit change would have more dominant effects than a mere size limit change.

The following discussion focuses only on the results using a 3 percent discount factor reported in Table 5.10.3, although the resulting conclusions would also apply to results using a 7 percent discount factor. **Alternative 3ai**, which would provide for an 18-inch size limit and be

applicable to the entire shallow-water grouper fishery, would result in losses lower than **Alternative 3aii**, which would provide the same size limit but applicable only to the longline sector. However, **Alternative 3ai** would result in losses higher than any other size limit alternatives applied only to the longline sector. On the other hand, **Alternative 3bi**, which would provide for a 16-inch size limit applicable to the entire shallow-water grouper fishery, would result in losses lower than any size limit alternatives, including the no size limit option, applied only to the longline sector. The results would indicate that possibly any size limit below 18 inches made applicable to the entire shallow-water grouper fishery would dominate any other lower size limit option made applicable only to the longline fishery. This would be the case even if, as discussed in Section 3.4.1 of this document, the longline fishery historically dominated the red grouper fishery and that harvests of red grouper dominated other shallow-water grouper harvests.

From the standpoint of overall results, the various alternatives may be ranked in descending order as follows: **Alternative 3di**, **Alternative 3ci**, **Alternative 3bi**, **Alternative 3dii**, **Alternative 3cii**, **Alternative 3bii**, **Alternative 3ai**, and **Alternative 3aii**. This ranking would be unaffected by the choice of a discount factor.

The applicability of the size limit would have strong effects on the distribution of economic effects by gear type, as can be gleaned from Table 5.10.3.1. If the size limit were applied only to the longline fishery, this segment would incur substantially lower losses while the hook and line and other gear users would incur large losses. When applied to all shallow-water grouper fishery, the size limit reductions would substantially reduce the losses to gear types other than longlines. The longline sector would still benefit from lower size limits, with losses dropping from $8.8 million with an 18-inch size limit (**Alternative 3ai**) to $6.3 million with no size limit (**Alternative 3di**).

Table 5.10.3.1. Net present values of the effects of alternatives on minimum size limits. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Hook and Line	Longline	Other Gears	Total
		3% Discount Rate		
Baseline	122,586	62,855	11,707	197,148
Alternative 1	-9,737	-10,638	-2,565	-22,940
Alternative 3ai	-6,645	-8,843	-2,037	-17,525
Alternative 3bi	-4,442	-6,862	-1,196	-12,500
Alternative 3ci	-4,014	-6,345	-991	-11,350
Alternative 3di	-3,921	-6,287	-956	-11,164
Alternative 3aii	-9,778	-6,084	-2,574	-18,436
Alternative 3bii	-9,745	-3,168	-2,567	-15,480
Alternative 3cii	-9,729	-2,310	-2,563	-14,602
Alternative 3dii	-9,728	-2,208	-2,563	-14,499
		7% Discount Rate		
Baseline	107,912	55,343	10,303	173,558
Alternative 1	-8,760	-9,448	-2,274	-20,482
Alternative 3ai	-6,049	-7,869	-1,810	-15,728
Alternative 3bi	-4,107	-6,118	-1,069	-11,294
Alternative 3ci	-3,732	-5,662	-890	-10,284
Alternative 3di	-3,651	-5,611	-859	-10,121
Alternative 3aii	-8,796	-5,445	-2,282	-16,523
Alternative 3bii	-8,768	-2,879	-2,275	-13,922
Alternative 3cii	-8,754	-2,125	-2,273	-13,152
Alternative 3dii	-8,753	-2,035	-2,273	-13,061

When looking at the distribution of effects by area, it can be seen from Table 5.10.3.2 that all areas, except South Florida, would incur losses. Fishermen in South Florida would actually gain from all the size limit reduction alternatives even given other restrictive measures in this amendment. This is the case, because gag are not caught frequently in south Florida. Therefore, the benefits of a smaller size limit for red grouper are not commingled with the costs of a more restrictive TAC for gag, as is the case in other regions. These gains would not be negated by the use of a higher discount factor. Among the losers, West-Central Florida would incur the largest losses given any size limit alternative. As with other positive measures in this amendment, the alternatives reducing the size limit would tend to reduce losses forthcoming from other measures in this amendment. But the benefits from size limit reduction would not be sufficient to fully offset losses from other measures in this amendment.

Table 5.10.3.2. Net present values of the effects of alternatives on minimum size limits. Baseline numbers are in absolute values and those for each alternative are differences from the baseline. Numbers are in thousand 2005 dollars.

	Rest of Gulf	Northwest FL	West-Cent FL	South FL	Total
			3% Discount Rate		
Baseline	74,331	39,227	49,667	33,923	197,148
Alternative 1	-701	-6,756	-15,194	-290	-22,941
Alternative 3ai	-792	-5,761	-14,327	3,355	-17,525
Alternative 3bi	-775	-4,953	-12,170	5,400	-12,498
Alternative 3ci	-778	-4,806	-11,683	5,917	-11,350
Alternative 3di	-778	-4,777	-11,607	5,997	-11,165
Alternative 3aii	-689	-6,462	-12,973	1,687	-18,437
Alternative 3bii	-677	-6,225	-11,497	2,919	-15,480
Alternative 3cii	-673	-6,152	-11,060	3,282	-14,603
Alternative 3dii	-673	-6,143	-11,009	3,326	-14,499
			7% Discount Rate		
Baseline	65,380	34,560	43,761	29,858	173,559
Alternative 1	-624	-6,051	-13,515	-295	-20,485
Alternative 3ai	-705	-5,179	-12,756	2,912	-15,728
Alternative 3bi	-691	-4,465	-10,851	4,713	-11,294
Alternative 3ci	-693	-4,336	-10,424	5,168	-10,285
Alternative 3di	-693	-4,311	-10,356	5,238	-10,122
Alternative 3aii	-613	-5,792	-11,563	1,445	-16,523
Alternative 3bii	-603	-5,585	-10,264	2,529	-13,923
Alternative 3cii	-600	-5,521	-9,880	2,848	-13,153
Alternative 3dii	-599	-5,513	-9,836	2,886	-13,062

Summary

The no action alternative (**Alternative 1**) would have no direct or indirect economic impacts, but it should be recognized that this alternative imbeds whatever measures to reduce discard mortality that were proposed in other amendments but not yet implemented. The direct economic effects of Alternative 2 would come in the form of increasing the cost of fishing operations due to the cost of having on board fishing vessels the necessary instruction materials for venting, handling, and release of fish. Additional costs can also arise from exposing fishing vessels to possible enforcement actions for not complying with this additional requirement. These two types of costs to the industry cannot be quantified, but the first type of cost would be mitigated if the agency rather than the industry were to shoulder the burden of developing and producing the required information materials. The economic consequences of various options and sub-options under Alternative 3 were estimated using the same economic model. From the standpoint of overall results, the alternatives may be ranked in descending order as follows: **Alternative 3di**, **Alternative 3ci**, **Alternative 3bi**, **Alternative 3dii**, **Alternative 3cii**, **Alternative 3bii**, **Alternative 3ai**, and **Alternative 3aii**. This ranking would be unaffected by the choice of a discount factor. At a 3 percent discount factor, the losses from each size limit

option would be $17.5 million for **Alternative 3ai**, $12.5 million for **Alternative 3bi**, $11.4 million for **Alternative 3ci**, $11.2 million for **Alternative 3di**, $18.4 million for Alternative 3aii, $15.5 million for **Alternative 3bii**, $14.6 million for **Alternative 3cii**, and $14.5 million for **Alternative 3dii**.

5.10.3.2 Direct and Indirect Effects on the Social Environment

Alternative 1 would be no action. There would be no short term impact on the recreational or commercial fishermen, fishing-dependent businesses, or communities involved in this fishery because there would be no changes to the regulations currently in place.

Alternative 2 would require pamphlets or prominently displayed placards that provide instructions on venting and proper handling and release methods on board reef fish fishing vessels. This alternative would not have any impact on the recreational or commercial fishermen fishing-dependent businesses, or communities involved in this fishery because it would not directly change the way they fish.

Alternative 3 would reduce the red grouper minimum size limit from 20 inches TL:
(a) 18 inches TL for black, gag, red, and yellowfin grouper. This would allow fishermen to keep more of the fish they catch making for a more satisfying experience for the recreational fisherman and possibly reducing the time that commercial fishermen would need to fish each trip because presumably, they could keep more of the fish they caught. Fishermen have complained about throwing back fish that are too small but then don't survive when returned to the water. In the long term, keeping smaller fish may harm the stock because the fish would not grow to be as large and commercial fishermen would need to catch more fish to make up the same weight as they would have if the limit was left at 20 inches. Taking smaller fish may also reduce the number of potential breeding fish which in the long run could harm the stock. If the stocks are reduced, it may be necessary to put stricter regulations in place in the future to rebuild the stock which would have a negative impact on the recreational and commercial fishermen in that they would be able to keep less of the fish they catch.

Suboption (b) would reduce the minimum size to 16 inches for black, gag, red, and yellowfin grouper, and scamp. This would allow fishermen to keep more of the fish they catch making for a more satisfying experience for the recreational fisherman and possibly reducing the time that commercial fishermen would need to fish each trip because presumably, they could keep more of the fish they caught. Fishermen have complained about throwing back fish that are too small but don't survive when returned to the water. In the long term, keeping smaller fish may harm the stock because the fish would not grow to be as large and commercial fishermen would need to catch more fish to make up the same weight as they would have if the limit was left at 20 inches. Taking smaller fish may also reduce the number of potential breeding fish which in the long run could harm the stock. If the stocks are reduced, it may be necessary to put stricter regulations in place in the future to rebuild the stock which would have a negative impact on the recreational and commercial fishermen.

Suboption (c) would reduce the minimum size to 14 inches for black, gag, red, and yellowfin grouper, and scamp. This would allow fishermen to keep more of the fish they catch making for

a more satisfying experience for the recreational fisherman and possibly reducing the time that commercial fishermen would need to fish each trip because presumably, they could keep more of the fish they caught. Fishermen have complained about throwing back fish that are too small but don't survive when returned to the water. In the long term, keeping smaller fish may harm the stock because the fish would not grow to be as large and commercial fishermen would need to catch more fish to make up the same weight as they would have if the limit was left at 20 inches. Taking smaller fish may also reduce the number of potential breeding fish which in the long run could harm the stock. If the stocks are reduced, it may be necessary to put stricter regulations in place in the future to rebuild the stock which would have a negative impact on the recreational and commercial fishermen.

Suboption (d) would eliminate the size limit on any grouper species. This would allow fishermen to keep more of the fish they catch making for a more satisfying experience for the recreational fisherman and possibly reducing the time that commercial fishermen would need to fish each trip because presumably, they could keep more of the fish they caught. Fishermen have complained about throwing out fish that are too small but don't survive when returned to the water. In the long term, keeping smaller fish may harm the stock because the fish would not grow to be as large and commercial fishermen would need to catch more fish to make up the same weight as they would have if the limit was left at 20 inches. Taking smaller fish may also reduce the number of potential breeding fish which in the long run could harm the stock. If the stocks are reduced, it may be necessary to put stricter regulations in place in the future to rebuild the stock which would have a negative impact on the recreational and commercial fishermen in that they would be able to keep less of the fish they catch.

Summary

Alternative 1 would not have any impact on the social environment because there would be no changes made to the size limits. **Alternative 2** would not have any impact on the social environment because it is an administrative action. **Alternative 3** provides various options for reducing size limits which may help to prevent discards and would allow fishermen to catch more keeper fish. Fishermen have complained about throwing back fish that are too small but don't survive when returned to the water. In the long term, keeping smaller fish may harm the stock because the fish would not grow to be as large and commercial fishermen would need to catch more fish to make up the same weight as they would have if the limit was left at 20 inches. Taking smaller fish may also reduce the number of potential breeding fish which in the long run could harm the stock. If the stocks are reduced, it may be necessary to put stricter regulations in place in the future to rebuild the stock which would have a negative impact on the recreational and commercial fishermen in that they would be able to keep less of the fish they catch.

5.10.4 Direct and Indirect Effects on Administrative Environment

Alternative 1 would not have any effect on the administrative environment as it maintains existing gear and size limits with no modifications.

The pamphlets or placards required by **Alternative 2** would need to be designed, produced, and distributed by NMFS. Enforcement would also be required to ensure the informational materials

are on board vessels.

Alternative 3, Options a and **e** would have little effect on the administrative environment because a commercial minimum size limit is already in place for each of the five species. **Alternative 3, Options b and c** would result in an improvement in the administrative environment because commercial size limits would be the same for all five species, making law enforcement easier. **Alternative 3, Option d** would eliminate the need for law enforcement concerning commercial size limits. Eliminating size limits for the entire shallow water grouper commercial sector **(Preferred Suboption i)** would require less law enforcement than for just the longline portion (**Suboption ii**).

5.11 Action 11. Creation of Additional Marine Reserves and Time/Area Closures

5.11.1 Direct and Indirect Effects on Physical Environment

The main impact of area closures on the physical environment is protection from gear impacts on the bottom habitat. A detailed description of the major types of gear used and their potential impacts is provided in Section 5.3.1. To summarize briefly:

Longlines are the dominant gear used in the commercial red grouper fishery. Direct underwater observations have shown that longline gear can be swept across the bottom by currents or by hooked fish (High 1998). However, the use of anchors and weights can reduce the impact of such movements (Grimes et al. 1982). Based on the direct observations, it is logical to assume that bottom longline gear would have a minor impact on sandy or muddy habitat areas. However, due to the vertical relief that hardbottom and coral reef habitats provide, it would be expected that bottom longline gear may become entangled, resulting in potential negative impacts to habitat (Barnette 2001).

Bandit gear is the dominant gear used in the commercial gag fishery. In their use, a weighted line is lowered to the bottom, and then the lead is raised slightly off the bottom (Siebenaler and Brady 1952). Thus, the gear is in direct contact with the bottom for only a short period of time. Barnette (2001) suggests that physical impacts may include entanglement and minor degradation of benthic species from line abrasion and the use of weights (sinkers).

Spearguns and slings are used in both commercial and recreational grouper fishing but are a relatively minor component of both. Barnette (2001) cited a study by Gomez (1987) that concluded that spearfishing on reef habitat may result in some coral breakage, but damage is probably negligible. In addition, there could be some impacts from divers touching coral with hands or from resuspension of sediment by fins (Barnette 2001). Such impacts should be negligible to non-existent for well-trained and experienced spearfishermen who stay in the water column and avoid contact with the bottom.

Rod and reel is the dominant gear used in the recreational grouper fishery. Fishing line from fishing can become entangled on coral and hard bottom outcroppings. The subsequent algal growth can foul and eventually kill the underlying coral (Barnette 2001). Researchers conducting studies in the marine reserve at Madison-Swanson reported seeing lost fishing line on

the bottom, much of which appeared to be fairly old and covered with growth(personal communication, Andrew David), a clear indication that bottom fishing has had an impact on the physical environment prior to fishing being prohibited in the reserves (GMFMC 2003).

Alternative 1 (no action) would continue to allow gear impacts on the bottom habitat in areas that might otherwise be considered for designation as marine reserves. While the immediate impacts from any one piece of gear may be small, over time the cumulative impacts from multiple gear interactions could potentially result in habitat degradation.

Preferred Alternative 2 would reduce gear impacts on the bottom habitat by designating an additional area where the use of gear would be restricted. **Option a** (Snyder Ridge) defines a rectangular shaped area that straddles the 40-fathom contour and encloses about 127 nautical square miles, slightly larger than either of the existing reserve sites (Madison-Swanson – 115 sq. nm, Steamboat Lumps – 104 sq. nm). **Preferred Option b** (Edges 40 Fathom Contour) contains nearly all of Snyder Ridge and is a parallelogram shaped area running from the northern edge of the Steamboat Lumps reserve northwest along the 40-fathom contour for approximately 37 nm. It encompasses an area of about 390 square nautical miles (sq. nm). The habitat for these areas is similar, consisting of low relief areas scattered with high relief rocky outcrops. Gag and scamp spawning aggregations have been directly observed by scientists in submersibles (personal communication, Chris Koenig), and this has been described as an active region of commercial grouper fishing (personal communication, Chris Koenig). **Option b** covers an area that is three times as large as **Option a**, and would therefore provide three times the protection to the physical environment. **Options i, ii, iii and iv** define the type of fishing restrictions that would apply within the new reserve. **Option i** would implement the same restrictions that currently exist for the Madison-Swanson and Steamboat Lumps reserves; all fishing prohibited November through April, with surface trolling allowed May through October. **Option ii** would also prohibit all fishing for six months, November through April, but would allow all fishing May through October, thus creating a seasonal area closure. **Preferred Option iii** is similar to **Option ii**, except that it would create the seasonal closure for four month, January through April. **Option iv** would create the shortest time/area closure, two months (March-April), and would encompass only half of the February-March peak gag spawning season. Since **Option i** would prohibit bottom fishing year-round while **Options ii, iii and iv** would allow bottom fishing for six to ten months of the year, **Option i** is more conservative and provides greater protection to the physical environment than **Options ii, iii and iv**. Likewise, **Option ii** is more conservative than **Options iii and iv** since it provides an additional two or four months of protection. **Options i, ii and ii** all provide closed area protection during the peak gag spawning months of February to March, when there is most likely to be additional fishing effort within the area. **Option iv** allows fishing in the area during February, and could concentrate fishing on spawning aggregations during that period. Without repeal of the existing February 15 to March 15 commercial closed season on gag, black grouper and red grouper, all of the options provide more protection than the status quo, by providing additional protections to a portion of the gag spawning aggregations and possibly other spawning aggregations. With the intended repeal of the closed season, spawning aggregations that are outside of the time/area closure will be opened up to fishing. The largest area covered by the time/area closure only covers a portion of the dominant gag spawning grounds identified by Koenig et al. (1996), likely not more than 50 percent of the area. In addition, **Preferred Option iii** allows reef fish fishing in the area during a portion of the total

gag spawning season, and **Option iv** allows reef fish fishing in the area during a portion of the total and peak gag spawning season. Thus **Option iv** is likely to provide less overall protection for spawning gag than the existing closed season. **Options i, ii and iii** could provide protections to spawning gag (in decreasing order of effectiveness) that could be either greater or less than the existing closed season depending upon how successfully they are enforced and complied with relative to the closed season. With all of the options, repeal of the closed season will reduce protection of the offshore male gag population by allowing year-round fishing on them.

Alternative 3 expands the existing Madison-Swanson reserve by adding an additional 70 sq. nm to the north and west. The total area of the Madison Swanson reserve would increase from 115 sq. nm to 185 sq. nm, a 61% increase. The habitat is similar to that for the Madison-Swanson reserve, which is described as an area having rocky ledges with relief up to 5 fathoms, and is characterized by outcrops of limestone and pinnacles (personal communication, Chris Koenig). Arial surveys conducted by University of Miami researchers (Smith and Zurcher 2007) show that this is an area used by both commercial and recreational fishing vessels. In size, the area impacted is less than either option under **Alternative 2**. However, due to its habitat and relatively close proximity to shore compared to the **Alternative 2**, this is likely the most heavily fished area, and therefore would show the greatest reduction in physical impacts from gear interactions.

Alternative 4 creates two cross-sectional reserves by extending the existing Madison-Swanson and Steamboat Lumps reserves shoreward to the state-federal boundary. This includes approximately two thirds of the Madison-Swanson extension in Alternative 3, but most of the area that would be included in the Madison-Swanson northward extension is mapped as predominately sand or silt bottom in the Environmental Impact Statement for the Council's Generic Essential Fish Habitat Amendment (GMFMC 2004a) (Figure 6). The Steamboat Lumps eastward extension is mapped as predominately sand bottom until about the 20 fathom boundary (approximately half of the extension), and hard bottom from there shoreward. As discussed previously, gear impacts on sandy or muddy habitat areas would be minor. However, on hardbottom habitats there is potential for gear to become entangled. Another consideration is that the areas outside of the Madison-Swanson and Steamboat Lumps reserves are not mapped in great detail. Although wide areas are shown as sand or hard bottom in the EFH map (Figure 6), which is only the predominant habitat. In actuality there are likely to be areas of hard bottom scattered within the sand area, and areas of sand or silt scattered within the hardbottom areas. Because of the sheer size of these reserves (an additional 1,560 square nm for the two extensions combined) and the large amount of hard bottom east of 20 fathoms in the Steamboat Lumps extension combined with partial protection to hard bottom that would be included in **Alternative 3**, **Alternative 4** will provide protection to more hard bottom habitat than any of the other alternatives, but in doing so, it will also place large expanses of soft bottom off limits to bottom fishing gear, where impacts will be minor.

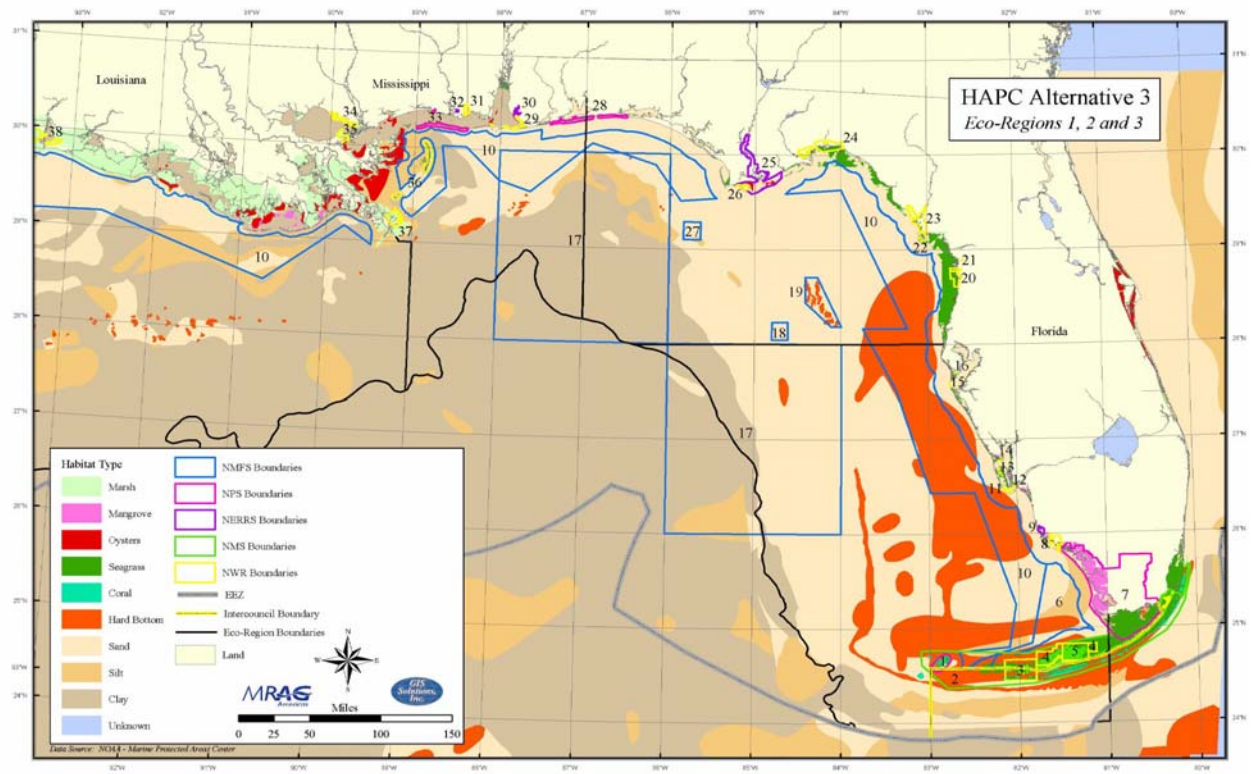


Figure 6. Gulf of Mexico habitat map figure 2.3.15 in volume 1 of the Environmental Impact Statement for the Council's Generic Essential Fish Habitat Amendment (GMFMC 2004a). The boxes labeled 27 and 18 are the Madison-Swanson and Steamboat Lumps reserves. Alternative 4 would extend Madison-Swanson northward and Steamboat Lumps eastward to the federal-state boundary. See Figure 2 for an illustration of the extensions.

5.11.2 Direct and Indirect Effects on the Biological / Ecological Environment

The existing Madison-Swanson and Steamboat Lumps marine reserves provide habitat for several reef fish species. In the Madison-Swanson reserve, gag, red grouper, scamp and red snapper are found on reefs in these reserves, and the Madison-Swanson reserve is a known spawning aggregation area for gag and scamp. The Steamboat Lumps reserve was established as a low relief habitat to contrast with the high relief habitat of Madison-Swanson. Steamboat Lumps has been reported as not containing significant grouper/snapper habitat[6]. However, direct underwater observations by researchers from Florida State University have shown that red grouper in Steamboat Lumps utilize flat areas with veneer of sand over solution holes, which they excavate to form depressions exposing the underlying carbonate rock[7]. Their excavations harbor suites of fish and invertebrate species whose abundances increase as a result, including vermilion snapper *Rhomboplites aurorubens*, black grouper *Mycteroperca bonaci* and spiny

[6] PowerPoint presentation titled "Northeast Gulf of Mexico Marine Reserve Program", given by Chris Gledhill at the October 29 – November 1, 2007 Gulf Council meeting in Biloxi, Mississippi.

[7] PowerPoint presentation titled, "Red Grouper on the West Florida Shelf", given by Felicia Coleman at the October 29 – November 1, 2007 Gulf Council meeting in Biloxi, Mississippi.

lobster *Panulirus argus* (Coleman and Williams 2002). In this way, red grouper act as ecosystem engineers that alter the habitat and create interdependencies with other important species.

Gag, like many of the groupers, are protogynous hermaphrodites, i.e., they begin their adult life as females and later transition to males. Since males constitute the older age classes in a population, male gag may be particularly susceptible to declines due to juvenescence in a heavily exploited population. In addition, gag are haremic spawners, and it has been suggested that in a spawning aggregation, males are more aggressive than females and hook and line fishing tends to select males before females (Gilmore and Jones 1992, Koenig at al. 1996). A decline in the ratio of male to female gag in the Gulf of Mexico has been an ongoing source of concern. This issue is reviewed in detail in the introductory discussion in Section 2.10 (Action 11 – Creation of marine reserves). Because the male gag tend to remain offshore year-round, selective protection of areas around the 40-fathom depth contour may provide protection for the males.

Alternative 1, no action, does not create any new closed areas. In a presentation at the October 2007 Gulf Council meeting, NMFS noted that the Steamboat Lumps reserve does not contain significant grouper/snapper habitat. The ridge and fish pits area total 1.8 km^2 (0.7 m^2). While the Madison-Swanson reserve contains about 50 times as much habitat, the total gag habitat within the two reserves combined is only 5.1% of shelf-edge habitat sampled by SEAMAP survey. During 2001-2005, the Madison-Swanson reserve saw increases in key reef fish species (gag, red grouper, scamp, red snapper), but so did open-access areas observed at Twin Ridges and the eastern Gulf of Mexico. During 2006-2007, the Madison-Swanson reserve saw decreases in abundance of all for species while the open-access areas saw abundance level or declining. There did not appear to be any change in the average size of gag in the reserve during the 2001-2007 monitoring period.[8] Researchers have previously said that it may take a minimum of ten years to detect any changes due to reserves, and have noted ongoing poaching in both the Madison-Swanson and Steamboat Lumps reserves that may be reducing their effectiveness. Thus the answer to the question of whether reserves have an impact on the gag stock or on the male proportion of gag is inconclusive at this time. While the Ecosystem SSC has stated that the Madison-Swanson experiment is a key test of effect of sex ratio changes and poaching in MPAs[9], both the Ecosystem SSC and the Council's former Reef Fish Stock Assessment Panel have, as far back as 1999, stated that the existing reserves are too small to have any stock-wide impacts (GMFMC 1999b, 2007a,b).

Preferred Alternative 2 would create an area closure along the 40-fathom contour of either 127 square nm (**Option a**) or 390 square nm (**Preferred Option b**). These new areas fall within the area identified by Koenig et al. (1996) as the dominant gag spawning area. If there is an impact on the gag stock or male proportion, these areas are in the best area to affect an impact.

[8] Summarized from a PowerPoint presentation titled Northeast Gulf of Mexico Marine Reserve Program, by Christopher T. Gledhill and Andrew W. David, presented at the October 29 – November 1, 2007 Gulf Council meeting in Biloxi, Mississippi.

[9] PowerPoint presentation titled, Can existing ecosystem models provide useful advice to the Council about key ecosystem management questions? Presented by Carl Walters at the October 29 – November 1, 2007 Gulf Council meeting in Biloxi, Mississippi.

However, **Option a** encompasses an area only slightly larger than the existing Madison-Swanson and Steamboat Lumps areas. The Ecosystem SSC, based on its ecosystem modeling results, has suggested that such small MPAs on at least the northern part of the Florida Shelf will not be an effective tool for regulation of fishing impacts (GMFMC 2007a,b). **Option b** creates an area closure about three times larger than **Option a**, and is more likely to have long-term impacts on the gag stock of the male population. **Options i, ii iii and iv** determine what kind and how much fishing activity is allowed within the reserve. **Option i** is the most conservative of the three. It creates a year round reserve and applies the same rules that currently exist for the Madison-Swanson and Steamboat Lumps reserves, i.e. all fishing is prohibited November through April, and surface trolling is allowed May through October. **Option ii** differs in that it allows all fishing during the six months, May through October, rather than just surface trolling, thus creating a six month seasonal area closure that encompasses the entire spawning period for gag while allowing unrestricted fishing outside of the spawning season. **Preferred Option iii** is similar to **Option ii** in that it creates a seasonal area closure but for only four months, January through April. **Preferred Option iii** does not close the area for the entire gag spawning season, but it does encompass the months of January through March, when peak spawning is most likely to occur. **Option iv** creates a seasonal area closure for only two months, March and April, and only closes the area for half of the peak February to March gag spawning season. By leaving known areas with gag aggregations open during part of the peak spawning season, this option may encourage effort shifting to concentrate fishing on the aggregations, and could be counterproductive to protecting spawners,

Options i, ii and iii could provide protections to spawning gag (in decreasing order of effectiveness) that could be either greater or less than the existing closed season depending upon how successfully they are enforced and complied with relative to the closed season. **Option iv** leaves the area open to reef fish fishing during half of the peak gag spawning season, and is therefore less likely to provide protection for many spawning aggregations. **Option i** will also provide protection for male gag in the reserve year round, and for spawning of other species such as scamp that may utilize the area during the May through October period. With all of the options, repeal of the closed season will reduce protection of the offshore male gag population by allowing year-round fishing on them.

Alternative 3 expands the Madison-Swanson reserve to an area north and west of the existing reserve known to have habitat for gag spawning. This is also an area heavily used by both commercial and recreational fishing vessels (Smith and Zurcher 2007), which would be diverted away from this area. Because this area is smaller than either of the options in **Alternative 2**, its impact, if any, on spawning aggregations and male gag would likely be less than that alternative. Because of its relatively close proximity to shore, poaching may be a greater problem with this alternative than with the other alternatives.

Alternative 4 is based on the recommendation from the Ecosystem SSC's modeling workshops that existing MPAs on at least the northern part of the Florida Shelf will not be an effective tool for regulation of fishing impacts; much larger, cross-shelf MPAs would be needed to protect a range of species from fishing suffered during life-cycle offshore movement (GMFMD 2007a,b). However, in their modeling exercises, the Ecosystem SSC was unable to demonstrate an impact from the specific cross-shelf MPAs proposed in this alternative. One possible reason could be a

lack of detailed habitat data within the extensions (personal communication, C. Walters). This alternative does not provide additional protection for either spawning aggregations or the offshore male population. However, the Ecosystem SSC noted that protection of fish during spawning does not protect them from harvest during seasonal migrations at other times of the year (GMFMC 2007b). Female gag migrating to and from the spawning areas may be susceptible to fishing mortality, particularly if fishermen locate pre-spawning aggregations. The reserves created in **Alternative 4** will protect a portion of the female gag during their spawning migrations. In addition, as cross-sectional reserves encompassing a variety of habitats, they will function as ecological reserves to help maintain biodiversity, similar to the Tortugas ecological reserves.

5.11.3 Direct and Indirect Effects on Economic/Social Environment

5.11.3.1 Direct and Indirect Effects on the Economic Environment

The two MPAs, Madison-Swanson and Steamboat Lumps, have been in effect since 2000. Steamboat Lumps is located in statistical area 6, and its size of 104 square nm is about 1.3% of the statistical area's total size of 8,100 sq. nm. Madison-Swanson is located in statistical area 8 and comprises about 115 sq. nm, which is about 1.2% of the statistical area's total size of 9,570 sq. nm. Fishing within these two areas is prohibited November through April, with surface trolling allowed May through October. The no action alternative refers to these two areas and their attendant fishing rules. **Alternative 2** would create an additional MPA, either the Snyder Ridge (127 sq. nm; **Option a**) or the Edges 40 Fathom Contour (390 sq. nm; **Preferred Option b**). Under this alternative, fishing regulation options consist of fishing rules identical to those of the two existing MPAs where all fishing is prohibited in an area from November to April and surface trolling can occur from May through October (**Option i**), or all fishing is prohibited in an area from November to April and all fishing is allowed from May through October (**Option ii**), or all fishing is prohibited in an area from January to April and all fishing is allowed from May through December (**Preferred Option iii**), or all fishing is prohibited in an area from March to April and all fishing is allowed from May through January (**Option iv**). **Alternative 3** would expand the size of the Madison-Swanson reserve by about 70 sq. nm, with the same fishing rules. **Alternative 4** would expand the Madison-Swanson reserve by an additional 523 sq. nm and the Steamboat Lumps by an additional 1,037 sq. nm. Existing fishing rules apply to the expanded areas. Other than **Alternative 1** then, all alternatives in this section would have direct economic effects in terms of highly likely increases in short-run cost and potential future benefits. The potential costs and benefits of any of the measures that would expand existing MPAs may be contended to magnify, but not necessarily in a linear fashion, the corresponding effects of existing MPAs.

The major economic benefit from the two MPAs would arise from protection of the fish within the reserves. If successful, areas around the reserve would also benefit from having increased fish abundance. With these two effects, the overall allowable harvest for protected species may be increased as to also increase the economic benefits from the fishery. Research conducted from 2001 to 2007 have shown significantly larger and older red snapper, red grouper, and scamp within the two MPAs relative to outside areas. However, the evidence for gag in terms of enhanced stock level and higher male proportion is inconclusive. It appears then that the

alternatives expanding the marine reserves would potentially yield some biological benefits to red snapper, red grouper, and scamp. The effects on gag are uncertain. Even if catches do not increase outside of the MPAs, it is possible for economic benefits to be derived from the creation of an MPA if the resulting enhanced stock condition inside the MPA allows for less restrictive management of fishing activity outside of the MPA.

On the cost side, it is instructive to outline the general costs associated with the establishment of the two marine reserves, with the understanding that these costs may be expected to increase if current reserves are expanded or new ones are created.

The primary effect of the two marine reserves on the commercial sector would be the displacement of fishermen that historically utilized the fishery resource in those areas. It is assumed that fishermen who historically harvested fish in the two areas must have considered the areas as more productive than other areas. Otherwise, they would have fished in these other areas. The reserves, therefore, removed more productive areas from these fishermen's production horizon. As a result, two things are likely to happen to these participants. First, their harvest and revenues would decrease. The reduction in harvest would come from fishing in less productive areas. Second, if fishermen attempted to offset their harvest and revenue loss by fishing in other areas, they would incur higher cost per pound of fish caught or fewer fish per dollar of cost relative to their previous fishing activities in the reserves. In addition to profit reductions of these vessels directly affected by the marine reserves, other vessels fishing elsewhere would also be affected to the extent that they would now face additional competition from the vessels displaced from the reserves. An additional consideration is the possible mitigation effect on prices that reduced harvest quantities may cause. However, since the two marine reserves accounted for only a small portion of total grouper and reef fish caught in Florida and elsewhere in the Gulf, a reduction in harvest would not likely be accompanied by a significant, if any, increase in price.

Recreational vessels, particularly the for-hire vessels, that fished in the reserves for reef fish would also be displaced by the establishment of the reserves. They would either have to shift their fishing effort on the reserves to highly migratory species, which are still allowed to be harvested within the reserves, or shift their fishing effort to other areas. It is likely that such effect on fishing effort would increase the cost of recreational fishing. In addition, competition would increase in those areas receiving displaced effort. Thus, not only would the cost of recreational fishing increase, there is also the likelihood that the overall quality of the fishing experience would decline.

Closed areas could also increase enforcement costs. Studies on the two marine reserves mentioned some enforcement problems regarding fishing within the reserves, and this may signify that more enforcement activities and thereby more expenditures may be required in order for the reserves to be effective. This is perhaps true especially if the same regulatory structure currently governing existing marine reserves are imposed on new marine reserves. Currently, fishing of certain species using certain gear types is allowed within the two existing marine reserves. In addition, vessel transit through the reserves is allowed. The VMS requirement on commercial vessels and for-hire vessels with commercial permits would definitely enhance the enforcement of fishing rules within the reserves. Maybe via VMS enforcement officers can

distinguish between fishing and transit activities in the closed area, but they might not be able to accurately tell if a fishing activity occurring within the reserves is one that is allowed by the rules. Moreover, violations by private recreational vessels, which are exempted from the VMS requirement, would still continue to pose problems.

There are two additional points worth mentioning about the benefits and costs of the two marine reserves and thus also of any alternative expanding the marine reserve areas. First, the benefits (if achieved) would accrue in the future while the costs would be incurred from the moment the reserves were established. Second, the realization of benefits is less certain than the imposition of costs. The economic issue with respect to the expansion of the reserves, therefore, has to take into account not only the trade-off between short-run costs and long-term benefits but also the probability of realizing the expected benefits and incurring the costs.

In Amendment 21, which extended the two marine reserves, it was estimated that the two reserves would reduce revenues of commercial vessels by about $352,000 annually. If the new marine reserves possessed the same characteristics as the two existing reserves, it would appear that annual revenue reductions would be more under **Alternatives 2(b), 4(a), and (4b)** since each of these alternatives would add larger areas than those of the two marine reserves combined. **Alternatives 2(a) and 3** would reduce revenues by lesser amounts but nonetheless there would be additional revenue reductions. The specific magnitudes of effects of **Alternatives 2(a) and 2(b)** would also depend on the extent of fishery closures in these areas under **Sub-options (i) through (iv)**. Of the four sub-options, the potentially most restrictive is **Sub-option (i)**, which would ban all fishing for six months and open for surface trolling the other six months. This particular sub-option would likely result in the largest revenue reductions. The next largest revenue reductions would come from **Sub-option (ii)**, which is structured similarly as the first sub-option but with the added proviso of allowing all fishing, not only surface trolling, in the open months. Next in line would be **Preferred Sub-option (iii)**, which would ban all fishing for four months and allow all fishing the other months. The least revenue reductions would come from **Sub-option (iv)**, which would ban all fishing for only two months and allow all fishing the other months. Revenue losses to the for-hire vessels as well as additional fishing costs to both commercial and recreational vessels could not estimated.

Although it would appear straightforward to estimate the magnitude of effects of the new alternatives using the same approach used in Amendment 21, there is not enough information to do the estimation. In addition, that approach may not be entirely appropriate. To appreciate the difficulty involved in quantifying the effects of the alternatives to expand existing marine reserves, it is instructive to describe the approach previously used.

In the original regulatory amendment that established the two reserves in 2000, it was estimated that closure of the two areas would reduce overall landings of gag by 2.28%, red grouper by 0.61%, black grouper by 1.5%, and other shallow-water grouper by 0.05%. Two major assumptions used in the estimation were: (1) the closed areas would cover all areas in Statistical Areas 6 and 8 with water depths between 30 and 50 fathoms and, (2) all commercial landings of shallow-water grouper in Statistical Areas 6 and 8 would follow the distribution of landings by water depth reported in the Florida Trip Ticket System (FTTS). Although arguably a practical necessity, the first assumption would result in an overestimate of impacts of the proposed action

since it would encompass a larger geographic range than the proposed action. Further, the second assumption was questioned by industry participants on the basis that reported depths of catch in the FTTS did not reflect actual catches by water depths. Industry participants contended that most grouper catches were caught in water depths below 50 fathoms while the FTTS information used showed that most catches of grouper were from areas deeper than 50 fathoms. If industry comments were true, then the second assumption would lead to an underestimation of impacts of the closed areas on commercial landings.

One way of modifying the first assumption was to further assume that catches of shallow-water grouper between 30 and 50 fathoms were uniformly distributed within these water depths. In this way, grouper catches in the reserves could be calculated as the product of grouper caught between 30 and 50 fathoms and the proportion of area within the reserves to total area between 30 and 50 fathoms. The Steamboat Lumps site, which is located in Statistical Area 6, covers an area of 104 sq. nm and is 13.2% of the area between 30 and 50 fathoms. The Madison-Swanson site, which is located in Statistical Area 8, covers an area of 115 sq. nm and is 25.7% of the area between 30 and 50 fathoms. These percentages were assumed to represent the proportion of grouper caught between 30 and 50 fathoms that could be assigned to the two reserves. It should be noted that this approach did not differentiate between the different species of shallow-water grouper.

Modifying the second assumption involved using different information regarding the distribution of grouper catches within Statistical Areas 6 and 8. One possible source of additional information was the distribution of red grouper catches by water depth reported in the Trip Interview Program (TIP). Although some concerns were raised regarding the representativeness of sampled trips for this program, it did provide information on catches by water depths that appeared to address the criticism leveled at the FTTS data regarding the distribution of grouper catches by water depths. Per TIP information for 1998-1999, about 55.4% of red grouper were caught between 30 and 50 fathoms. Information for other species was not available. It was, therefore, assumed that this distribution of catches by water depths for red grouper also applied to the other species in the shallow water grouper complex.

The described approach hinges critically on the assumptions that all areas within the 30 to 50 fathom contour lines of the statistical areas 6 and 8 are equally productive and that fishing effort is also equally apportioned over all subject areas. In addition, the approach also depends on the appropriateness of using extending TIP information on catches by water depths of a species or two to all shallow-water groupers and even other fish species previously caught in the marine reserves. How valid are these assumptions (especially when applied to the new marine reserve areas considered in this amendment) cannot be ascertained. For the new marine reserve areas, it is important to use information on the distribution of catches and fishing effort within these areas.

Using a more theoretically sound approach, Smith, Zhang, and Coleman (2006) estimated the effects of the two marine reserves in the Gulf, with particular focus on gag. Results of their model were inconclusive when evaluating the Madison-Swanson reserve. When applied to the Steamboat Lumps, their model found that after four years, the reserve did not produce statistically significant losses in sustainable yield or statistically significant gains in biological

production. One major implication of these results for the two marine reserves is that while costs continue to be incurred by fishing participants, benefits derivable from the reserves are still uncertain. Expanding the reserves would likely add costs to the fishing participants. Whether actual benefits would accrue from new/expanded reserves cannot be given a definite answer.

A couple of points, however, are worth noting here. First, Smith, Zhang, and Coleman hinted that the results they obtained for gag may be conditioned by the short time frame (4.5 years) they used, and suggested maintaining the reserves over a longer period. Under current regulations, the two reserves would sunset in 2010 unless extended by another amendment. Second, as noted in the biological effects part of this section, the Ecosystem SSC and the Council's former Reef Fish Stock Assessment Panel indicated that the two reserves are too small to have any stock-wide impacts. Whether any of the alternatives to expand current marine reserves would be sufficient to address the noted concern about marine reserve size can only be answered after it is implemented preferably over a longer time frame.

Summary

Other than **Alternative 1**, all alternatives in this section would have direct economic effects in terms of increasing short-run cost and potential future benefits. The potential costs and benefits of any of the measures that would expand existing MPAs may be contended to magnify, but not necessarily in a linear fashion, the corresponding effects of existing MPAs. On the basis of researches done on the two existing marine reserves, economic benefits from the alternatives in this section could come from potentially higher yields for red snapper, red grouper, and scamp. The effects on gag productivity appear to be uncertain.

The primary effect of the various alternatives to expand marine reserves on the fishing sectors would be the displacement of fishers that historically utilized the fishery resource in those areas. This would tend to reduce commercial and recreational harvests and thus also commercial and for-hire revenues and benefits to anglers. If vessels were to attempt to offset their losses by fishing in other areas, they could partly offset revenues and benefits but at the expense of higher costs. The net effects are relatively uncertain.

5.11.3.2 Direct and Indirect Effects on the Social Environment

Alternative 1. No action. This alternative would not have any impacts on the social environment in the short term because it would not create any additional marine reserves that prohibit fishing for grouper and other reef fish.

Alternative 2 would establish a new marine reserve within the gag spawning area: **option (a)** is Snyder Ridge which is approximately 127 square miles. Establishing new marine reserves could have a negative impact on commercial and recreational fishermen who would no longer be able to fish in these areas. If this is an area where fishermen now fish, they will have to find other areas to fish in. Charter boat fishermen may have to find new areas to take their clients if this area is where they normally fish. Commercial and recreational fishermen may have to use more fuel to get to other locations that are further away from where they now fish if they were fishing in the area that will be part of a new reserve. Fishermen will be prohibited from fishing for other

species that may be located in the area that would be designated as a preserve which could lower overall landings.

If creating a new marine reserve keeps commercial and recreational fishermen from fishing in an area they are accustomed to, there may be loss of profits while they find new areas to fish. It may also make it more difficult to find fish to harvest which could indirectly change their fishing patterns. Recreational fishermen may decide to fish from other ports where they can more easily access areas that are not part of a reserve. This could indirectly impact businesses such as hotels, bait and tackle shops, marinas, etc., that now cater to fishermen who fish in these areas. If closing off this area to fishermen results in a reduction in catch for the commercial fishermen, then there may also be a loss of profits and possible loss of jobs that are dependent on the fishing industry in businesses located nearest the newly created reserve.

Although this action in itself may not have a major impact on the commercial and recreational fisheries, cumulatively there are added impacts when considered with other closures and regulations that restrict fishing.

In the long term, if the creation of a new reserve helps to protect the spawning grounds for gag grouper, then this will aid in the rebuilding of the stocks which will benefit commercial and recreational fishermen, fishing dependent businesses, and fishing communities involved in the fishery in the future because presumably there would be more fish to harvest.

Alternative 2, option (b) would create a reserve at the edges of the 40 fathom contour reserve which is approximately 390 square miles. Like **option (a)** establishing new marine reserves could have a negative impact on commercial and recreational fishermen who would no longer be able to fish in these areas. If this is an area where fishermen now fish, they will have to find other areas to fish in. Charter boat fishermen may have to find new areas to take their clients to if this area is where they normally fish causing uncertainty in their catches while they adjust. Commercial and recreational fishermen may have to use more fuel to get to other locations that are further away from where they now fish if they were fishing in the area that will be part of a new reserve. Fishermen will be prohibited from fishing for other species that may be located in the area that would be designated as a preserve.

If creating a new marine reserve keeps commercial and recreational fishermen from fishing in an area they are accustomed to, there may be loss of profits while they find new areas to fish. It may also make it more difficult to find fish to harvest which could indirectly change their fishing patterns. Recreational fishermen may decide to fish from other ports where they can more easily access areas that are not part of a reserve. This could indirectly impact businesses such as hotels, bait and tackle shops, marinas, etc., that now cater to fishermen who fish in these areas. If closing off this area to fishermen results in a reduction in catch for the commercial fishermen, then there may also be a loss of profits and possible loss of jobs that are dependent on the fishing industry in businesses located nearest the newly created reserve.

In the short term, **Alternative 2, option (b)** would have more of a negative impact on commercial and recreational fishermen because it would close off a larger area than **option (a)**. Although this action in itself may not have a major impact on the commercial and recreational

fisheries, cumulatively there is an added impact when considered with other closures and regulations that restrict fishing.

In the long term, if the creation of a new reserve helps to protect the spawning grounds for gag grouper, then this will aid in the rebuilding of the stocks which will benefit commercial and recreational fishermen, fishing dependent businesses, and fishing communities involved in the fishery in the future because presumably there would be more fish to harvest.

For either Option (a) or Option (b) under Alternative 2, there are four sub-options specifying restrictions on fishing activities. These sub-options range from the most restrictive (**Sub-option (i)**) which would prohibit all fishing for six months and allow surface trolling in the other six months to the least restrictive (**Sub-option (iv)**) which would ban all fishing only for two months and allow all fishing in the other months. The short-term adverse impacts on commercial and recreational fishermen would in general positively correlate with the restrictiveness of the various sub-options. From the largest to the smallest adverse impacts, the various sub-options may be ordered as follows: **Sub-option (i)**, **Sub-option (ii)**, **Sub-option (iii)**, **and Sub-option (iv)**. On the other hand, the long-term protection afforded to the fish stock, particularly gag, would be higher under the more restrictive sub-options.

Alternative 3 would expand the Madison-Swanson Marine Reserve to the north and west to adding approximately 70 more square miles to the reserve. This would extend the reserve area closer to shore and could require that fishermen who fish in this area travel further from shore to avoid the newly defined reserve.

Establishing new marine reserves or expanding existing ones could have a negative impact on commercial and recreational fishermen who would no longer be able to fish in these areas. If this is an area where fishermen now fish, they will have to find other areas to fish in. Charter boat fishermen may have to find new areas to take their clients to if this area is where they normally fish causing uncertainty in their catches while they adjust. Commercial and recreational fishermen may have to use more fuel to get to other locations that are further away from where they now fish if they were fishing in the area that will be part of a new reserve. Fishermen will be prohibited from fishing for other species that may be located in the area that would be designated as a preserve.

If creating a new marine reserve keeps commercial and recreational fishermen from fishing in an area they are accustomed to, there may be loss of profits while they find new areas to fish. It may also make it more difficult to find fish to harvest which could indirectly change their fishing patterns. Recreational fishermen may decide to fish from other ports where they can more easily access areas that are not part of a reserve. This could indirectly impact businesses such as hotels, bait and tackle shops, marinas, etc., that now cater to fishermen who fish in these areas. If closing off this area to fishermen results in a reduction in catch for the commercial fishermen, then there may also be a loss of profits and possible loss of jobs that are dependent on the fishing industry in businesses located nearest the newly created reserve.

Although this action in itself may not have a major impact on the commercial and recreational fisheries, cumulatively there is an added impact when considered with other closures and regulations that restrict fishing.

In the long term, if the creation of a new reserve helps to protect the spawning grounds for gag grouper, then this will aid in the rebuilding of the stocks which will benefit commercial and recreational fishermen, fishing dependent businesses, and fishing communities involved in the fishery in the future because presumably there would be more fish to harvest.

Alternative 4 would expand the Madison-Swanson and Steamboat Lumps marine reserves into a network of cross-shelf closed areas to protect gag grouper and other species during life-cycle offshore movement. **Option (a)** would close off an additional 523 square nautical miles and **option (b)** would close off an additional 1,037 square nautical miles.

Establishing new marine reserves could have a negative impact on commercial and recreational fishermen who would no longer be able to fish in these areas. If this is an area where fishermen now fish, they will have to find other areas to fish in. Charter boat fishermen may have to find new areas to take their clients to if this area is where they normally fish causing uncertainty in their catches while they adjust. Commercial and recreational fishermen may have to use more fuel to get to other locations that are further away from where they now fish if they were fishing in the area that will be part of a new reserve. Fishermen will be prohibited from fishing for other species that may be located in the area that would be designated as a preserve.

If creating a new marine reserve keeps commercial and recreational fishermen from fishing in an area they are accustomed to, there may be loss of profits while they find new areas to fish. It may also make it more difficult to find fish to harvest which could indirectly change their fishing patterns. Recreational fishermen may decide to fish from other ports where they can more easily access areas that are not part of a reserve. This could indirectly impact businesses such as hotels, bait and tackle shops, marinas, etc., that now cater to fishermen who fish in these areas. If closing off this area to fishermen results in a reduction in catch for the commercial fishermen, then there may also be a loss of profits and possible loss of jobs that are dependent on the fishing industry in businesses located nearest the newly created reserve.

Although this action in itself may not have a major impact on the commercial and recreational fisheries, cumulatively there is an added impact when considered with other closures and regulations that restrict fishing.

In the short term, **option (a)** may have less impact on commercial and recreational fishermen than **option (b)** because the area that would be expanded is smaller.
In the long term, if the creation of a new reserve helps to protect the spawning grounds for gag grouper, then this will aid in the rebuilding of the stocks which will benefit commercial and recreational fishermen, fishing dependent businesses, and fishing communities involved in the fishery in the future because presumably there would be more fish to harvest.

Summary

Alternative 1 would have the least negative impacts on the social environment in the short term because it would not create any additional marine reserves that restrict fishing within it. **Alternatives 2, 3,** and **4** would each create additional reserves or add to existing reserves. Commercial and recreational fishermen may prefer one alternative over another, depending on which port they fish from and where the fish. The impact to any particular fishermen will depend on if they can find other places to fish, or if the creation of reserve areas causes a reduction in harvest and a loss of income for commercial fishermen.

Recreational fishermen may decide to fish from other ports where they can more easily access areas that are not part of a reserve. This could indirectly impact businesses such as hotels, bait and tackle shops, marinas, etc., that now cater to fishermen who fish in these areas. If closing off this area to fishermen results in a reduction in catch for the commercial fishermen, then there may also be a loss of profits and possible loss of jobs that are dependent on the fishing industry in businesses located nearest the newly created reserve.

Although any of these actions may not have a major impact on the commercial and recreational fisheries, cumulatively there is an added impact when considered with other closures and regulations that restrict fishing.

In the long term, if the creation of a new reserve helps to protect the spawning grounds for gag grouper, then this will aid in the rebuilding of the stocks which will benefit commercial and recreational fishermen, fishing dependent businesses, and fishing communities involved in the fishery in the future because presumably there would be more fish to harvest.

5.11.4 Direct and Indirect Effects on Administrative Environment

Alternative 1 does not create any new area closures and therefore does not change any exiting administrative impacts. Fishermen will still need to be notified of the existing reserves and fishing restrictions though regulation pamphlets, and enforcement of the offshore areas will still need to be conducted at sea by the U.S. Coast Guard and/or Florida FWC enforcement. There are no permit or gear requirements for fishermen other than a requirement that fishing gear (other than surface trolling gear during May through October) must be appropriately stowed while a vessel is in the restricted area, and a vessel must be in transit if it has a species onboard that is prohibited from harvest in the reserve.

Under any alternative except Alternative 1, the creation of any new reserves or seasonal area closures would require notification to fishermen through revised regulation pamphlets and news releases.

A key concern with offshore reserves is poaching, which can reduce the effectiveness of reserves. All of the alternatives except **Alternative 1** increase the amount of area restricted to fishing, and may require additional at-sea enforcement efforts by the U.S. Coast Guard and Florida FWC enforcement. In order of the amount of increased area, **Alternative 3** creates the smallest increase, followed by **Alternative 2a, Alternative 2b, and Alternative 4**. Under

Alternative 2, the allowance for surface trolling during part of the year in **Option i** can complicate enforcement by requiring that vessels be identified not only as to whether the are fishing, but also what kind of fishing activities they are participating in. This same concern applies to **Alternatives 3 and 4**, which extend the existing reserves and regulations.

The effectiveness of marine reserves as a fishery management tool remains in question. The existing Madison-Swanson and Steamboat Lumps reserves were established as an experiment to evaluate their effectiveness. Any new or expanded reserves created in **Alternatives 2, 3 or 4** would also need to be monitored for effectiveness, requiring additional research funding.

5.12 Action 12. Duration of Marine Reserves and Area Closures

The previous discussion of Action 11 (creation of marine reserves or area closures) reviewed the environmental impacts of creating new area closures on the west Florida shelf or of extending existing reserves. The alternatives in this section determine how long those impacts will be in effect. **Preferred Alternative 1** and **Alternatives 2 and 3** address the duration of any new reserves or seasonal closures created in Action 11, while **Preferred Alternative 4** addresses reauthorization of the existing Madison-Swanson and Steamboat Lumps marine reserves, which are currently set to expire on June 16, 2010.

5.12.1 Direct and Indirect Effects on Physical Environment

Preferred Alternative 1 (no action) states that there will be no expiration date specified for any new area closures created under Action 11. This means that the impacts to the physical environment described in Section 5.11.1 will continue indefinitely, or until modified in a subsequent plan amendment. Since these impacts are beneficial in terms of protecting bottom habitat, this is most likely the longest and therefore the most conservative alternative

Alternative 2 would set the expiration date on any new area closures at June 16, 2010, to coincide with the existing expiration date for Madison-Swanson and Steamboat Lumps reserves. Since this amendment will likely not be implemented before mid-2009 at the earliest, this would provide only about one year of protection to the bottom habitat, unless the area closures are continued in a subsequent amendment that would need to begin to be developed immediately. This time frame is likely too short to establish any significant impacts.

Alternative 3 would establish new area closures for a period of 10 years. This would provide protection for the bottom habitat over an extended period, although not as long as **Preferred Alternative 1**. Thus, this alternative, while less conservative than **Alternative 1**, is more conservative than **Alternative 2**, is. After ten years, the area closures and the protection they afford would expire unless extended in a subsequent amendment

Preferred Alternative 4 addresses reauthorization of the existing Madison-Swanson and Steamboat Lumps marine reserves. Option a, the no action option for this alternative, allows the reserves to expire on June 10, 2010, at which time year round unrestricted fishing will again be allowed in those areas. Actions such as longlining or fishing lines becoming entangled in the bottom are potential likely sources of damage to the bottom habitat. **Preferred Option b** would

reauthorize the reserves indefinitely. The Madison-Swanson and Steamboat Lumps reserves would thus remain in place unless removed by a subsequent amendment. This provides the greatest long-term benefits to the bottom habitat of all the options. **Option c** would reauthorize the reserves for an additional 10 years, while this would provide short-term benefits to the habitat, a subsequent plan amendment within ten years would be needed to continue the long-term benefits inherent in **Option b**.

5.12.2 Direct and Indirect Effects on the Biological / Ecological Environment

Preferred Alternative 1 would leave new closed areas in place indefinitely. This would provide the greatest protection from fishing interactions for organisms and ecosystems within the reserves. Monitoring studies to date in the Madison-Swanson and Steamboat Lumps reserves have been inconclusive as to whether there are biological or ecosystem benefits, particularly with respect to abundance of key reef fish species and proportion of male gag[10], but researchers have suggested that a minimum of ten years is needed to detect any changes. This alternative would provide adequate time to assess the effectiveness of the reserves.

Alternative 2 would result in new area closures expiring on June 16, 2010, unless extended in a subsequent amendment. This is less than two years from an expected implementation date of mid- 2009. Based on the monitoring reports for the Madison-Swanson and Steamboat Lumps marine reserves, this is too short a time to detect any impacts to biological/ecological environment.

Alternative 3 would result in new area closures expiring ten years after implementation. Since the average age for a female gag to transition to a male is about 11 years (SEDAR 10), this ten-year time period will not provide sufficient time to fully evaluate the effects on the male gag population. However, it will allow time for male gag numbers and the gag stocks to respond to the protection from the closed areas, and will allow long-term scientific studies on the effects of the reserves. Because this alternative's duration is between that of **Alternatives 1 and 2**, it is less conservative than Alternative 2 but more restrictive than **Preferred Alternative 1**.

Preferred Alternative 4 extends the duration of the existing Madison-Swanson and Steamboat Lumps reserves. Option a allows the existing sunset date of June 16, 2010 to remain in place, thus removing any protections for the biological/ecological environment. While the evidence of effectiveness of these reserves is inconclusive, this may be due to too short a time period or to illegal poaching. **Preferred Option b** continues the reserves indefinitely, providing the maximum long-term protection for the biological/ecological environment within the reserve. Benefits may over time also accrue to the habitat adjacent to the reserve through spillover migration of adult fish and through egg dispersal from spawners within the reserve not only from gag, but also from scamp and other species that utilize the reserves as a spawning area. **Option c** extends the reserves for an additional 10 years, providing short term benefits similar to **Option b**, but requiring a subsequent amendment to continue those benefits further.

[10] Presentations from Chris Gledhill, Andrew David and Chris Koenig given at the October 29 – November 1, 2007 Gulf Council meeting in Biloxi, Mississippi

5.12.3 Direct and Indirect Effects on Economic/Social Environment

5.12.3.1 Direct and Indirect Effects on the Economic Environment

The Madison-Swanson and Steamboat Lumps reserves are set to expire in 2010 unless extended by another amendment. Alternatives 1 through 3 would address the duration of area fishing closures created under Action 11. The no action alternative (**Preferred Alternative 1**) is a little different from the usual no action alternative. It would, in effect, provide for an indefinite duration of any marine reserves or area closures created under Action 11. The Council, however, can intervene any time and terminate the marine reserves or area closures. **Alternative 2** would provide for the new reserves or closed areas to sunset at the same time as the two existing reserves in 2010. **Alternative 3** would provide for a 10-year duration for new reserves or area closures. **Preferred Alternative 4** would address the duration of the two existing marine reserves, with three sub-options under it. **Sub-option (a)** is a no action alternative and thus would allow the two marine reserves to sunset in 2010. **Preferred Sub-option (b)** would extend indefinitely the duration of the two existing marine reserves. **Sub-option (c)** would extend for ten years the duration of the two existing marine reserves.

In general, the duration of the new marine reserves or area closures would be longest under **Preferred Alternative 1** and shortest under **Alternative 2**. For the two existing marine reserves, the duration would be longest under **Preferred Sub-option (b)** and shortest under **Sub-option (a)**.

One major economic consideration here is that costs to fishery participants would directly vary with the duration of the reserves. For marine reserves or area closures created under Action 11, Preferred Alternative 1 may be considered to result in the largest costs while the lowest costs would accrue to **Alternative 2.** For the two existing marine reserves, the largest cost would accrue to **Preferred Sub-option (b)**, and the lowest to **Sub-option (a)**.

For determination of benefits, however, there appears the need to allow marine reserves or closed areas to exist for an extended period of time. For newly created marine reserves or area closures under Action 11, **Alternative 2** would provide for the shortest time, so evaluation of new marine reserves or area closures is, at best, bound to come up with inconclusive results. Thus, for proper evaluation of new marine reserves, **Alternative 2** may be ranked lowest. An indefinite duration (**Preferred Alternative 1**) would offer the best scenario for properly evaluating marine reserves. But an indefinite duration would not appear to be a good balance between costs and proper evaluation of the benefits from marine reserves. It appears that such balance would likely be achieved by a 10-year horizon (**Alternative 3**). A similar comment may be made about the duration of the two existing marine reserves. **Sub-option (a)** would not allow enough time to evaluate the effects of the two marine reserves. On the other end, **Preferred Sub-option (b)** would impose a relatively large cost. Again, it appears the balancing and costs and effectiveness of marine reserves evaluation would be offered by **Sub-option (c)**.

<u>Summary</u>

One major economic consideration here is that a proper evaluation of marine reserves is a function of its duration, but costs to fishery participants directly vary with the duration of the reserves. Balancing costs and evaluative period of marine reserves appears likely to be achieved by a 10-year horizon, both for the newly created marine reserves or area closures (**Alternative 3**) and the two existing marine reserves (**Sub-option (c)**).

5.12.3.2 Direct and Indirect Effects on the Social Environment

Preferred Alternative 1 would be no action and reserves created under Action 11 will be monitored for effectiveness and will remain in effect unless terminated in a subsequent amendment. From a social stand point, commercial and recreational fishermen may be less in favor of the creation of reserves if they are restricted from fishing in these areas indefinitely. They may be more willing to favor the creation of reserve areas if they think that the closure will result in increased stock which will benefit them in the long term as the stock rebuilds and the area can be once again open for fishing. If fishermen were expecting these areas to reopen in 2010, then keeping them closed until 2018 may cause fishermen to doubt council actions that originally allowed for the reopening of these closed areas in 2010.

Alternative 2 would allow for the monitoring of new reserves created in Action 11 and the reserves would expire after June 16, 2010 unless reauthorized in a subsequent amendment. This alternative would allow for the newly created reserves to be reopened in 2010 unless a new amendment is put in place before then. Reopening areas that were declared a reserve will benefit recreational and commercial fishermen in the short term because they would only be prohibited from fishing these areas for two years. Because the effectiveness of the reserves will be monitored, it is assumed that they will only be closed as long as necessary to rebuild stocks. Fishermen may be more willing to comply with a closure if it is for a short period of time and would aid in the rebuilding of stocks. In the long term, monitoring may show that the stocks are not rebuilt enough to open the reserves created in Action 11 to fishing again and new regulations will need to be written to keep these areas closed past 2010.

Alternative 3 would allow for the monitoring of new reserves created in Action 11 and the reserves would expire 10 years after implementation unless reauthorized in a subsequent amendment. This alternative could have negative impacts on commercial and recreational fishermen who now fish in these areas because it will keep these areas closed for a minimum of ten years.

Preferred Alternative 4 addresses the continued duration of the existing Madison-Swanson and Steamboat Lumps reserves. **Option (a)** would result in the Madison-Swanson and Steamboat Lumps reserves remaining only until the expiration date of June 16, 2010. Commercial and recreational fishermen may support the creation of reserves if they think the reserves will once again be open to them for fishing once the stock is rebuilt. A sunset of June 16, 2010 would benefit fishermen who would once again be able to fish these areas after that date. **Preferred Option (b)** would keep the Madison-Swanson and Steamboat Lumps reserves under the current regulations unless terminated in a subsequent amendment. From a social stand point, commercial and recreational fishermen may be less in favor of the creation of reserves if they are restricted from fishing in these areas indefinitely. They may be more willing to favor the

creation of reserve areas if they think that the closure will result in increased stock which will benefit them in the long term as the stock rebuilds and the area can be once again open for fishing. **Option (c)** would change the sunset date for Madison-Swanson and Steamboat Lumps reserves so they expire in ten years rather than in 2010. If fishermen were expecting these areas to reopen in 2010, then keeping them closed until 2018 may cause fishermen to doubt council actions that originally allowed for the reopening of these closed areas in 2010.

Establishing new marine reserves could have a negative impact on commercial and recreational fishermen who would no longer be able to fish in these areas. If this is an area where fishermen now fish, they will have to find other areas to fish in. Commercial and recreational fishermen may feel that ten years is too long to be restricted from an area. Closing off these areas will require that fishermen find new locations to fish in. Charter boat fishermen may have to find new areas to take their clients to if this area is where they normally fish causing uncertainty in their catches while they adjust. Commercial and recreational fishermen may have to use more fuel to get to other locations that are further away from where they now fish if they were fishing in the area that will be part of a new reserve. Fishermen will be prohibited from fishing for other species that may be located in the area that would be designated as a preserve.

If creating a new marine reserve keeps commercial and recreational fishermen from fishing in an area they are accustomed to, there may be loss of profits while they find new areas to fish. It may also make it more difficult to find fish to harvest which could indirectly change their fishing patterns. Recreational fishermen may decide to fish from other ports where they can more easily access areas that are not part of a reserve. This could indirectly impact businesses such as hotels, bait and tackle shops, marinas, etc., that now cater to fishermen who fish in these areas. If closing off this area to fishermen results in a reduction in catch for the commercial fishermen, then there may also be a loss of profits and possible loss of jobs that are dependent on the fishing industry in businesses located nearest the newly created reserve.

Although this action in itself may not have a major impact on the commercial and recreational fisheries, cumulatively there is an added impact when considered with other closures and regulations that restrict fishing.

In the long term, if the creation of a new reserve helps to protect the spawning grounds for gag grouper, then this will aid in the rebuilding of the stocks which will benefit commercial and recreational fishermen, fishing dependent businesses, and fishing communities involved in the fishery in the future because presumably there would be more fish to harvest.

5.12.4 Direct and Indirect Effects on Administrative Environment

All of the alternatives would require that reserves and area closures be monitored for effectiveness, adding to the administrative requirements from the SEFSC.

Preferred Alternative 1 would provide the least impact on the administrative environment. Since new area closures would be in existence indefinitely, there would be no need to periodically create an amendment to extend their duration. However, if monitoring and

evaluation of the area closures determines that they are not effective, an amendment would be required to modify or terminate them.

Alternative 2 would require that a new plan amendment be prepared and implemented by June 16, 2010 if the new area closures are to be continued beyond that date. This would add to the administrative load for the Council and the SERO by requiring that preparation of that amendment begin even before implementation of this amendment.

Alternative 3 would require a new amendment to consider extending the new reserves prior to 2018, depending upon when this amendment is implemented. This would also create the administrative impact on the Council and SERO described for **Alternative 2**, but deferred for ten years.

Preferred Alternative 4 affects the administrative environment related to the existing Madison-Swanson and Steamboat Lumps reserves. **Option a** would allow the reserves to expire on their present sunset date of June 16, 2010. This would relieve the SEFSC of the requirement to monitor the reserves effectiveness, but would also eliminate areas valuable to research scientists studying human impacts on the marine environment. **Preferred Option b** would continue the existing reserves indefinitely, requiring ongoing monitoring but eliminating the need for a subsequent reauthorization amendment. **Option c** would continue the existing reserves for an additional ten years. This would require ongoing monitoring over a finite time period, with a potential extension by a subsequent plan amendment. Requiring a subsequent amendment would impact the administrative environment for the Gulf Council and SERO ten years after implementation of this amendment.

5.13 Action 13. Federal Regulatory Compliance

5.13.1 Direct and Indirect Effects on Physical Environment

Fishery management actions that affect the physical environment mostly relate to the interactions of fishing with bottom habitat, either through gear impacts to bottom habitat or through the incidental harvest of bottom habitat. The degree a habitat is affected by fishing gear depends largely on the vulnerability of the affected habitat to disturbance, and on the rate that the habitat can recover from disturbance (Barnette 2001). Because habitat-gear interactions are closely linked to fishing effort, management measures that reduce fishing effort benefit habitat by reducing these interactions.

The degree and magnitude of impacts to the physical environment are often gear-specific. For instance, retrieval of commercial longline gear can abrade, snag and dislodge smaller rocks, corals, and sessile invertebrates (Bohnsack in Hamilton, 2000; Barnette 2001). The damage that this gear inflicts to the bottom depends on currents and the amount of line sweep caused by hooked fish (Barnette 2001). Vertical line gear has the potential to snag and entangle bottom structures and cause tear-offs or abrasions (Barnette 2001). If this gear is lost or improperly disposed of it can entangle marine life or become fouled with algae and eventually kill essential fish habitat, such as corals (Hamilton 2000; Barnette, 2001). Anchors may cause direct damage

to habitat, especially at well known, frequently visited fishing sites. The cumulative effects of repeated anchoring could damage the hard bottom areas where fishing for reef fish occurs.

The effects on the physical environment resulting from **Alternative 1** are expected to be similar to current fishing conditions. **Alternative 1** would not require commercial or for-hire reef fish permit holders to comply with the more restrictive of state or federal reef fish regulations when fishing in state waters. As a result, no change in fishing effort is expected to occur because no new fishing regulations would be implemented; therefore, habitat-gear interactions are estimated to remain unchanged.

Preferred Alternative 2 would provide slight benefits to important reef fish habitat in state waters if fishermen have to abide by more restrictive reef fish regulations than allowed by the state. More restrictive regulations are expected to reduce effort and the amount of time spent fishing, which would indirectly benefit the physical environment by reducing habitat-gear interactions. However, any benefits from **Preferred Alternative 2** to the physical environment are expected to be small given that most reef fish are harvested in federal waters and only a small number of reef fish species currently have inconsistent state and federal regulations (e.g., recreational red snapper, gag, red grouper and black grouper).

5.13.2 Direct and Indirect Effects on the Biological / Ecological Environment

The Magnuson-Stevens Act mandates that Council's prevent overfishing and rebuild overfished stocks. Additionally, the recent reauthorization of the Magnuson-Stevens Act requires Councils to establish annual catch limits and accountability measures for managed stocks by 2010 (species currently subject to overfishing) or 2011 (all other species). Currently in the Gulf of Mexico, four species are undergoing overfishing (red snapper, greater amberjack, gag, and gray triggerfish) and three species are overfished (red snapper, greater amberjack, and gray triggerfish). In February 2008, NOAA Fisheries Service implemented new regulations for red snapper. New regulations are also proposed for gray triggerfish and greater amberjack; these regulations will likely become effective in fall 2008. This amendment also proposes regulations to end overfishing of gag. In order to end overfishing, rebuild overfished stocks, and maintain stocks at sustainable levels, recreational and commercial fishermen must closely adhere to quotas and annual catch levels. This is especially true given that proposed federal regulations assume states will adopt consistent regulations. If states do not adopt consistent regulations, then more liberal regulations in state waters may allow harvest to exceed allowable catch levels. If this occurs, the likelihood of overfishing is increased and for overfished stocks, stock recovery is slowed. With regard to future annual catch limits, this could also lead to accountability measures being triggered more often to ensure landings are maintained within allowable limits.

Alternative 1 would not require commercial and for-hire reef fish permit holders to comply with the more restrictive of state or federal reef fish regulations. Currently, state and federal regulations for reef fish are largely consistent. Notable exceptions include recreational regulations for red snapper (recreational bag limit and seasonal closure) and grouper (seasonal closure). **Alternative 1** would negatively affect the biological environment for those species that lack consistent state and federal regulations. The likelihood of reef fish experiencing landings overages would be increased. Additionally, the likelihood of overfishing occurring would be

increased and stock recovery for overfished reef fish species would be slowed. Lack of state consistency may also result in more restrictive accountability measures to ensure quotas/catch levels are not exceeded, such as the recently shortened 2008 red snapper recreational fishing season. As mentioned above, red snapper and grouper are the two primary reef fish species that do not have consistent state-federal regulations. In 2007, a significant overage was estimated to occur in the recreational red snapper fishery. The recreational red snapper allocation in 2007 was 3.185 million pounds, but MRFSS landings alone were estimated at 3.77 million pounds. When Texas and Headboat landings are included, it is estimated the 2007 quota was exceeded by approximately 1 mp or more. During this same year, a seasonal closure for recreational grouper was also implemented in federal waters, but consistent regulations were not implemented by the states of Florida and Alabama, which is where a majority of grouper landings occur. If proposed harvest reductions for these species are not achieved, then overfishing may continue. This will negatively affect stock abundance and the size and age-structure of these reef fish populations.

Preferred Alternative 2 would require commercial and for-hire reef fish permit holders to comply with the more restrictive of state or federal reef fish regulations when fishing in state waters. This alternative is expected to positively benefit the biological environment by increasing the likelihood that overfishing is ended or does not occur. **Preferred Alternative 2** will also increase the likelihood that overfished stocks will recover in the timeframe necessary to rebuild. However, because this alternative would not affect non-permitted private anglers it would not eliminate the possibility of landings overages or overfishing from occurring. NOAA Fisheries Service does not currently require a recreational fishing permit and therefore does not have jurisdiction to establish permit conditions at this time for private anglers. NOAA Fisheries Service does have the authority to establish permit requirements and conditions for federal for-hire and commercial permit holders who choose to have a federal fishing permit and engage in the privilege of fishing (see Table 2.13.1).

During the June 2008 Council meeting, the Council requested NOAA Fisheries Service prepare an interim rule for 2009 based on the preferred gag management measures specified in Amendment 30B. Section 305(c) of the MSFCMA provides NOAA Fisheries Service authority to implement interim regulations to address overfishing. Gag was declared undergoing overfishing in October 2006. Other stocks within the reef fish complex undergoing overfishing include: red snapper, greater amberjack, and gray triggerfish. All of these species are also overfished and under rebuilding plans. The interim rule would pertain to all four species undergoing overfishing. Federally permitted reef fish commercial and for-hire vessels would have to abide by the more restrictive of state or federal reef fish regulations when fishing in state waters. Benefits to the biological environment would be similar to those described above. The likelihood of overfishing ending for these species would be increased and the likelihood that annual catch limits would be exceeded would be reduced. Recreational anglers would not be directly affected by this interim regulation because there is currently no requirement for a federal permit when fishing in the Gulf EEZ.

5.13.3 Direct and Indirect Effects on Economic/Social Environment

5.13.3.1 Direct and Indirect Effects on the Economic Environment

The no action alternative (**Alternative 1**) would not be expected to have any direct economic impacts on fishery participants because it would not place any additional restrictions. All customary fishing and business practices could continue. However, if incompatibilities between state and federal regulations exist, federal fishing rules may not be capable of achieving the management goals, leading to indirect impacts. Incompatibilities can go in either direction; state regulations can be either more restrictive or less restrictive that the federal regulations. If state regulations are more restrictive and the associated harvest reductions not factored into the determination of the federal regulations, the management measures applicable Gulf-wide will be more severe than necessary, resulting in potential forgone economic benefits. For a rebuilding fishery, the additional harvest savings from more restrictive state regulations would be expected to support faster rebuilding. However, the benefits of quicker recovery may or may not be sufficient to offset the costs (forgone benefits) of unnecessarily restrictive federal measures. For a stable fishery (i.e., a fishery not undergoing rebuilding), the overly restrictive federal regulations would simply represent lost benefits with no future offset. If state regulations are less restrictive than the federal regulations and the federal regulations do not account for such, then the goals of the federal regulations will not be met, necessitating corrective future action to impose more restrictive measures with likely adverse economic consequences. Regardless of the point at which federal management accounts for the incompatible regulations, the incompatibility creates a situation of inequity that may induce additional adverse economic outcomes, such as sector conflict, reduced cooperation by other states or constituents, etc. Between the two potential situations, i.e., state regulations could be more or less restrictive than federal regulations, the latter is perceived to be the more common and troublesome situation (see Section 2.13). Further, vessels would be subject to more restrictive state regulations and all circumstances, so focus on the situation where state regulations are less restrictive is more relevant.

Under **Alternative 2**, where state and federal reef fish regulations are not the same, all federally permitted reef fish vessels would be required to comply with the more restrictive reef fish regulations when fishing in state waters. While the actual state regulations would not be affected, this alternative would be expected to reduce the amount of harvest overage associated with incompatible regulations, thereby reducing either the amount of subsequent corrective Gulf-wide action required to account for non-compliance induced overages to meet management objectives, or the severity of restrictions placed on the entire fishery as a result of systematic incorporation of assumed non-compliance. While forced compliance would be expected to result in economic losses to affected entities, similar to projections for vessels elsewhere in the Gulf, these losses would be expected to be offset by the economic benefits to the other participants in the fishery that are able to avoid the more restrictive measures that would be required to limit the fishery to its harvest targets. Such compliance would effectively simply put all participants on an equal footing with respect to the federal regulations. Failure to comply with federal regulations would subject the vessel to fines and potential permit sanction. While the restrictive management may on occasion be so severe as to result in business failure for some fishery participants, such is usually the exception rather than the rule such that the costs of failure to

comply with the federal regulations, particularly under a permit sanction, would exceed the economic costs of compliance.

While requiring compliance with the more restrictive regulations would be expected to reduce the severity of federal requirements and generate increased economic benefits relative to the status quo, since not all fishery participants are permitted, all potential overages will not be eliminated. Specifically, recreational anglers and for-hire vessels that only fish in state waters would not have to follow the more restrictive federal regulations. The significance of the remaining regulatory imbalance would depend on which group traditionally harvests more fish, which would likely vary by species and state. A potential outcome of this, however, is that the less restrictive measures for these entities may result in demand shifts, altering each sector's costs and benefits and the general ability to compete with other vessels or sectors. Within the for-hire sector, federally permitted vessels could lose business to vessels that operate exclusively in state waters. Further, the for-hire sector in general could lose business in favor of anglers choosing to fish more as a private or rental angler.

Summary

Alternative 1, being the no action alternative, would not impose any additional measures affecting fishing operations and so would have no direct impacts on fishery participants. In the event, however, of incompatibilities between state and federal regulations where federal regulations are more restrictive, the objectives of federal fishery management may not be met. And this could trigger future more restrictive actions affecting all federal fishing participants. **Alternative 2** would be expected to reduce the amount of harvest overage associated with incompatible regulations, thereby reducing the amount or severity of subsequent corrective Gulf-wide action. But this would totally eliminate any potential overages because some vessels operating in state waters do not have federal permits.

5.13.3.2 Direct and Indirect Effects on the Social Environment

Alternative 1 would be no action and in the short term would not have any direct impacts of the commercial or charter boat fishermen, businesses, or communities that depend on the reef fish fishery. **Alternative 2** would require that all vessels with federal commercial or charter reef fish permits must comply with the more restrictive state or federal reef fish regulations when fishing in state waters. This alternative would have direct impacts on commercial and charter boat fishermen who have reef permits because it would force fishermen to be under whichever rules were the most restrictive. Some fishermen who have reef permits fish in state waters when federal waters are closed.

This amendment would make it easier for the federal government to enforce rules for people with reef permits fishing in state waters and would bring both state and federal areas under the same restrictions such as closures, bag limits, etc. Under the regulations now, fishermen can continue to fish in state waters when the federal waters are closed, if the state waters are still open. This is a benefit to commercial and charter reef fish fishermen, but makes it more difficult to monitor fishing if the states and federal regulations are different. By requiring that fishermen

comply with which ever regulations are the more restrictive, fishermen will be more limited by regulations than they are now.

5.13.4 Direct and Indirect Effects on Administrative Environment

Alternative 1 (status quo) would require commercial and for-hire reef fish permit holders to abide by existing permit conditions. If state regulations are more liberal than federal regulations, then permit holders could potentially increase the amount of fish they harvest. As discussed in Section 5.13.2, this could result in harvest overages and increase the likelihood of overfishing. This could also trigger accountability measures associated with annual catch limits more often, thereby increasing the burden on the administrative environment to implement adjustments associated with accountability measures. Implementing accountability measures could take up considerable staff time to monitor and quantitatively determine the magnitude of an overage(s) and the subsequent accountability measures that are required to prevent the overage from occurring. If the level of excess harvest resulting from inconsistent state-federal regulations significantly affects management objectives, such as preventing overfishing and rebuilding overfished stocks, then subsequent amendments to fishery management plans may be necessary to adjust management measures to prevent or end overfishing and establish or revise rebuilding plans. Development of new amendments would negatively affect the administrative environment by increasing costs and the burden on staff to draft such documents.

Preferred Alternative 2 is a proactive accountability mechanism that reduces the probability of a landings overage occurring. **Preferred Alternative 2** would require commercial and for-hire reef fish permit holders to comply with the more restrictive of state or federal reef fish regulations when fishing in state waters. This alternative would positively affect the administrative environment by reducing the likelihood of landings overages, by reducing the likelihood of overfishing occurring, and by increasing the likelihood that accountability measures are not triggered in the future. Benefits to the administrative environment would also include reduced costs and less time to develop future amendments and regulatory actions. The alternative would not directly affect private anglers, because NOAA Fisheries Service does not currently require a recreational fishing permit and therefore does not have jurisdiction to establish permit conditions. As a result, management's ability to constrain landings to necessary catch levels would be diminished and the risk of overfishing or landings overages occurring would still remain, although to a lesser extent than **Alternative 1**.

5.14 Cumulative Effects Analyses (CEA)

As directed by NEPA, federal agencies are mandated to assess not only the indirect and direct impacts, but cumulative impacts of actions as well. The 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.

This section uses an approach for assessing cumulative effects that was initially used in Amendment 26 to the Reef Fish FMP and is based upon guidance offered in CEQ (1997). 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.

Cumulative effects on the biophysical environment, socio-economic environment, and administrative environments are analyzed below.

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

The CEQ cumulative effects guidance states this step is accomplished through three activities as follows:

I. The direct and indirect effects of the proposed actions (Section 5.1-5.3);
II. Which resources, ecosystems, and human communities are affected (Sections 3 and 4); and
III. Which effects are important from a cumulative effects perspective (information revealed in this CEA)

2. Establish the geographic scope of the analysis.

The immediate areas affected by this action and analyzed in this CEA are the federal waters of the Gulf of Mexico. These are the waters extending from the seaward side of the state waters of Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida state waters to 200 miles. Eight species are in the SWG fishery, but gag and red grouper comprise the bulk of the grouper fishery. A brief description of their distribution and habitat requirements is provided below.

Red grouper are found from Massachusetts to Brazil including the Gulf of Mexico (Briggs, 1958). They are most abundant on the Florida and Yucatan Shelves and are found in coastal waters and estuaries out to 300 feet (Bullock and Smith, 1991). Juveniles use estuarine seagrass

beds and inshore reefs (patch and transitional reefs) as nursery areas (Sluka et al., 1994; Ross and Moser, 1995). Adults are generally found over low relief hard bottom. Smith et al. (1975) frequently observed red grouper in diver surveys of the Florida Middle Ground. Sullivan and Sluka (1996) and Sluka and Sullivan (1996) reported that in the Florida Keys, red grouper inhabited reef-ridge, high relief spur and groove, and channel patch reefs. In the South Atlantic Bight, Huntsman and Dixon (1976) found that most red grouper in headboat catches were caught at depths between 120 to 210 feet. Richardson and Gold (1997) examined genetic diversity in Gulf of Mexico red grouper populations. They determined that stocks from the west Florida shelf and Campeche Banks could not be distinguished from each other and that red grouper in the Gulf should be considered a unit stock.

Gag are found from New York to Rio de Janeiro excluding the West Indies and they are abundant in the eastern Gulf of Mexico (Briggs, 1958). They are usually found in the Gulf of Mexico from coastal waters to 250 feet deep (Bullock and Smith, 1991). Adults are generally found over reef and shelf-break habitats with males occurring further offshore (Koenig et al., 1996). Smith et al. (1975) found gag to be common in diver transects of the Florida Middle Ground. Juveniles recruit to estuarine seagrass beds in the spring at an age of about 40 to 43 days (Keener et al., 1988; Ross and Moser, 1995; Coleman et al. 1998) and remain in the beds through the fall when they migrate to nearshore reefs. Bortone et al. (1994) reported juvenile and subadult gag on artificial reefs in nearshore waters of the Florida panhandle.

Reef fish vessels and dealers are primarily found in Gulf States. Based on either mailing addresses or home ports, 98 percent of historical charter captain reef fish, 96 percent of for-hire reef fish, and 98 percent of commercial reef fish permitted vessels are found in Gulf States. For permitted reef fish dealers, 95 percent are found in Gulf States. Therefore, the primary affects of the actions in this amendment and on the reef fish fishery in general would likely affect participants in the Gulf of Mexico region.

3. Establish the timeframe for the analysis

Grouper stocks in the Gulf of Mexico have been periodically assessed since 1991. Most assessments have focused on gag and red grouper, but yellowedge grouper (Cass-Calay and Bahnick, 2002), and goliath grouper (Porch et al., 2003; SEDAR 6, 2004b) have also been assessed. The 2006 SEDAR 10 gag stock assessment included data for analysis of stock status from 1963-2004 for commercial landings, and 1981-2004 for recreational landings. The catch data for both commercial and recreational fisheries included a conversion of a portion of black grouper landings to gag to reflect mis-identification of gag as black grouper, particularly during the 1980s and in the northern Gulf. In addition, most commercial grouper landings were not identified to species prior to 1986. Unclassified grouper landings are available from 1963-1985.

The following is a list of reasonably foreseeable future management actions. These are described in more detail in Step 4.

- Next assessments for gag and red grouper through SEDAR are scheduled to occur in mid-2011. SEDAR assessments for yellowedge grouper and tilefish are scheduled for 2010.
- Amendment 28 to the Reef Fish FMP is scheduled to begin development in 2008. This

amendment would examine fair and equitable ways to allocate all FMP resources between recreational and commercial fisheries.

- Amendment 29 to the Reef Fish FMP is scheduled to be completed in 2008. This amendment would establish a grouper IFQ program for the commercial reef fish fishery.
- Reef Fish Amendment 30A was been submitted to the Secretary for approval in early 2008, and subsequent regulations will likely be in effect in by August 2008. This amendment revises the greater amberjack rebuilding plan, establishes a gray triggerfish rebuilding plan, provides measures to constrain commercial and recreational harvest for both species to prevent overfishing, and sets accountability measures for the fisheries on both species.
- Reef Fish Amendment 30B is scheduled to be completed in mid 2008. This amendment addresses gag thresholds and benchmarks; establishing gag and red grouper TAC, interim allocations and AMs; ending overfishing of gag; managing gag and red grouper commercial and recreational harvests consistent with TAC; reducing grouper discard mortality; establishing marine reserves; and requiring compliance with Federal fishery management regulations by federally permitted reef fish vessels when fishing in state waters.
- An interim rule to implement gag regulations by January 1, 2009, has been requested by the Council. These regulations, if implemented, would end gag overfishing while the Council continues work on Amendment 30B.
- The Council will be developing either a Reef Fish amendment or a generic amendment to address ACLs and corresponding AMs. The reauthorized Magnuson-Stevens Act was enacted on January 12, 2007, and requires ACLs to be developed in 2010 for stocks subject to overfishing and 2011 for all other stocks.
- The Council is scheduled to complete an Aquaculture FMP in 2009. This FMP would provide a programmatic approach to evaluating the impacts of aquaculture proposals in the Gulf of Mexico and a comprehensive framework for regulating such activities.

4. Identify the other actions affecting the resources, ecosystems, and human communities of concern.

a. Past actions affecting grouper fisheries are summarized in Section 1.4. The following list identifies more recent actions.

- Commercial grouper regulatory amendment established a 6,000 pound gutted weight aggregate deep-water and shallow-water grouper trip limit for the commercial grouper fishery.
- Recreational grouper regulatory amendment established a recreational red grouper bag limit of 1 fish per person per day as part of the 5 grouper per person aggregate bag limit, prohibited for-hire vessel captains and crews from retaining bag limits of any grouper while under charter and established a recreational closed season for red grouper, gag, and black grouper from February 15 to March 15 each year.
- Reef Fish Amendment 18A examined enforcement and monitoring issues including a VMS requirement, changes to the framework for setting TAC for reef fish, and gear requirements for permitted reef fish vessels to carry turtle release gear.
- Reef Fish Amendment 24 replaced the commercial reef fish permit moratorium with a

permanent limited access system.

- Joint Reef Fish/Coastal Migratory Pelagics (CMP) Amendment 25/17 replaced the for-hire reef fish and CMP permit moratorium with a permanent limited access system.
- Reef Fish Amendment 26 established an IFQ program for the red snapper fishery in the Gulf of Mexico.
- The final rule for the Council's Amendment 27/14 published in January 2008. This rule revises the red snapper rebuilding plan, provides measures to constrain the recreational harvest to its quota, and provides measures to minimize bycatch in the reef fish and shrimp fisheries. Bycatch reduction measures include permitted reef fish vessels having specific bycatch reduction gear onboard.

b. The following are recent reef fish actions not summarized in Section 1.4 but are important to the reef fish fishery in general.

An Individual Fishing Quota program (Amendment 26) for the commercial red snapper fishery was implemented in January, 2007. Each fisherman received a percentage share of the available commercial quota (See Amendment 27/14 above) based on previous historical landings. Fisherman can now fish for red snapper as necessary to keep markets supplied year-around and expend some of their previous fishing effort toward other reef fish such as vermilion snapper or grouper. Alternate targeted species or bycatch may include gag, red grouper, or other grouper species.

The Council approved a regulatory amendment to rescind all management of the vermilion snapper management measures implemented by GMFMC (2004c). A new stock assessment indicated that those measures were not necessary and, in fact, the stock was being fished at a yield equivalent to that at F_{OY}. A rule to address actions in this amendment published on January 3, 2008.

The Council is currently working on a draft public hearing document for Amendment 29 whose goal is to rationalize effort and reduce overcapacity in the commercial grouper and tilefish fisheries in order to achieve and maintain OY. This amendment evaluates several management programs that could be capable either independently or in combination of accomplishing the above goal. Programs evaluated include allowing permit stacking, eliminating latent permits, creating grouper and tilefish endorsements, and developing a grouper IFQ program.

The Council took final action to approve Amendment 30A at their January 2008 meeting. This amendment addresses overfishing greater amberjack and gray triggerfish. Besides revising the greater amberjack rebuilding plan and establishing a rebuilding plan for gray triggerfish, this amendment would set measures to constrain recreational and commercial harvests of these species consistent with the rebuilding plan and would establish accountability measures should harvest exceed that stated in the respective rebuilding plans. The amendment is currently under review by the Secretary of Commerce. A final rule implementing regulations from this amendment will likely publish during the summer 2008.

At their November 2007 meeting, the Council recognized the difficulties involved in decisions allocating reef fish TACs between recreational and commercial fisheries. They established an

Allocation Ad Hoc Committee to examine fair and equitable ways to allocate all FMP resources between recreational and commercial fisheries. Once completed, the principles for setting allocations should be more transparent and understandable to the various sectors in the fishery. Amendment 28 will likely be the amendment addressing allocation.

The Magnuson-Stevens Reauthorization Act (MSRA) was enacted on January 12, 2007. It added provisions strengthening the requirements to end and prevent overfishing and rebuild U.S. stocks. It requires annual catch limits (ACLs) and corresponding AMs to ensure that overfishing does not occur. It also requires conservation and management measures be prepared and implemented within 2 years of notification that a stock is "overfished" or "subject to overfishing" in order to end overfishing immediately and begin rebuilding stocks. NMFS understands an ACL to mean a specified amount of a fish stock (e.g., measure of weight or numbers of fish) for a fishing year that is a target amount of annual total catch that takes into account projected estimates for landings and discard mortality from all user groups and sectors. The MSRA restricts ACLs to not exceed the recommendations of Council SSCs and plan amendments specify mechanisms for establishing ACLs. Measures are required by the MSRA to ensure accountability and ACLs will need to be developed in 2010 for stocks subject to overfishing and 2011 for all other stocks. Either a reef fish amendment or a generic amendment would be necessary to establish ACLs and AMs for reef fish stocks. Amendment 30B (this amendment) addresses catch limits and AMs for gag which is undergoing and for red grouper (Action 6). However, these measures may be revised in a future amendment as ACLs and AMs are developed for other reef fish stocks.

c. The following are non-FMP actions which can influence the reef fish fishery.

The demand for liquefied natural gas (LNG) is increasing. To meet this demand, 15 new LNG terminals are proposed for the Gulf of Mexico and one LNG currently exists in Lake Charles, Louisiana. Nine of the proposed facilities are closed loop systems that will not impact fishery resources, but six proposed facilities would each circulate approximately 100 - 200 million gallons of water per day to heat the liquefied natural gas back to its gaseous phase. Each facility would impact billions of fish eggs, larvae, and plankton each year. All fish eggs and larvae are assumed to be killed after passing through these systems. NMFS and the Council are concerned about the potential impact of these facilities on fish populations in the Gulf of Mexico. One facility at Sabine Pass, Texas would filter 30 percent of the water in Sabine Lake each year. Because most reef fish have pelagic larvae (see Section 3.2.2), some species may be affected by these facilities. The EPA has required the power generating industry to use closed loop systems to mitigate impacts on aquatic biota.

The hurricane season is from June 1 to November 30, a time period accounting for 97 percent of all tropical activity affecting the Atlantic Basin (NOAA, 2007). These storms, although unpredictable in their annual occurrence, can devastate areas of the Gulf of Mexico when they occur. For example, the 2005 hurricane season was the busiest and costliest on record. There were 28 named storms, including 15 hurricanes, four of which reached category 5 strength. Along the Gulf coast from the Florida Panhandle to Texas, five named storms (Tropical Storm Arlene and Hurricanes Cindy, Dennis, Katrina, and Rita) made landfall. Hurricanes Katrina (landfall August 29, 2005) and Rita (landfall September 24, 2005) were the most devastating of

these storms, impacting an area stretching from eastern Texas to western Alabama and resulting in significant physical and economic damage to coastal communities. These storms came on the heal of hurricanes in 2004, especially Hurricane Ivan which caused extensive damage in the Orange Beach, Alabama – Pensacola, Florida area. Direct losses to the fishing industry and businesses supporting fishing activities included: loss of vessels, loss of revenue due to cancelled fishing trips, and destruction of marinas and other fishery infrastructure (Walker et al. 2006). However, while these effects may be temporary, those fishing related businesses whose profitability is marginal may be put out of business should a hurricane strike.

Due to the continuing rise in the cost of fishing, including increases in the cost of fuel and insurance, along with other increases in operating costs, it is becoming more difficult for many fishermen to make a living fishing. For example, fuel prices have increased nearly 2.5 times since 2002 (GMFMC 2007c). This could have negative impacts on communities that are dependent on jobs that support reef fish fisheries. Reductions in TAC could result in shorter seasons for various fisheries. This may also impact the businesses that are dependent on the commercial and recreational reef fish fisheries in that there will be fewer days to sell charter services, ice, fuel, tackle, hotel rooms, and other services to people participating in the fishery.

Eighty percent of seafood consumed in the United States is imported and the amount being imported has been steadily increasing (NMFS 2007). For reef fish, imports between 1993 and 2006 have increased from a low of 22 mp in 1994 to a high of 49.7 mp in 2005 (See Section 3.3.1 – Imports). This compares to average domestic Gulf grouper annual landings of 18.4 mp over this same time period. Domestic annual Gulf grouper landings have been declining since reaching a peak of 20.5 mp in 2002. The value of imports has increased from a low of $42.3 million in 1994 to $101.7 million in 2006 and is greater than domestic imports which peaked in value in 2001 at $50.1 million. It should be noted numbers presented above are not directly comparable because of differences in product such as fresh versus frozen, but the difference in magnitudes between the domestic fish and imports shows the large market share of imports in the reef fish market. The effects of imports on domestic fisheries can cause fishermen to loose markets through fishery closures as dealers and processors use imports to meet demand, and limit the price fishermen can receive for their products through competitive pricing of imports.

It is unclear how global climate changes will affect Gulf of Mexico fisheries. Suggested impacts include temperature changes in coastal and marine ecosystems could influence organism metabolism and alter ecological processes such as productivity and species interactions; change precipitation patterns and cause a rise in sea level which could change the water balance of coastal ecosystems; alter patterns of wind and water circulation in the ocean environment; and influence the productivity of critical coastal ecosystems such as wetlands, estuaries, and coral reefs (Kennedy et al. 2002). Modeling of climate change in relation to the northern Gulf of Mexico hypoxic zone may exacerbate attempts to reduce the area affected by these events (Justic et al. 2003).

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

This step should identify the trends, existing conditions, and the ability to withstand stresses of

the environmental components. According to the CEQ guidance describing stress factors, there are two types of information needed. The first are the socioeconomic driving variables identifying the types, distribution, and intensity of key social and economic activities within the region. The second are the indicators of stress on specific resources, ecosystems, and communities.

Reef Fish Fisheries

Data used to monitor commercial reef fish effort includes the number of vessels with landings, the number of trips taken, and trip duration. Declines in effort may be a signal of stress within the fishery. These trends are described in Sections 3.1, 3.4, 6.0, 7.0, and briefly summarized here. While landings in the reef fish fishery have shown patterns of increases and decreases, the number of boats actively participating in the reef fish fishery (except for gag) show a pattern of decline over time. For shallow-water grouper, the average number of 2005-06 boats with landings for the years 1993-98 fell from 1,059 to 791 and red grouper, from 797 to 666. This same trend is reflected by the reef fish fishery as a whole. The number of permitted vessels, which has remained relatively constant, is greater than the number of vessels having landings. This suggests there are permits not actively employed in the fishery, but could be used in the event noticeable improvements in the fishery arise. This reduction in the numbers of vessels participating in the fishery also reflects a decline in the number trips taken and days away from port by the fishery as a whole.

There are several potential reasons for the decline in effort for reef fish and shallow-water grouper. These may include an increase in fishing costs, increases in harvesting efficiency, more restrictive regulations (particularly for the grouper fishery), and even improvements in the stock status of certain species (effort shifting). However, data currently is inadequate to determine which factors contribute the most to declines in fishing effort for reef fish and grouper, and what might be the causes for the apparent increase in fishing effort for gag.

Social and economic characteristics of recreational anglers are collected periodically as an add-on survey to the MRFSS. Data used to monitor recreational reef fish effort in the fishery primarily comes from MRFSS and includes the number of trips and number of catch trips. Declines in effort may be a signal of stress within the fishery. These trends are described in Section 3.4.2. The level and pattern of change in recreational effort has remained about flat from 1993 through 1996, fluctuated between 1997 and 1999, and then increased relatively fast since 2000. Private and charter fishing modes accounted for most of target trips, with the charter mode the most common mode for red grouper and private the most common for gag. For both species, Florida accounts for most landings; however, landings in Alabama have been increasing in recent years.

Summary characteristics of the for-hire fleet were analyzed as part of the analyses for the development of the current limited access system (GMFMC 2005c). These analyses indicated for-hire operations were generally profitable. Costs associated with these businesses include bookkeeping services, advertising and promotion, fuel and oil, bait expenses, docking fees, food/drink for customers and crew, ice expenses, insurance expenses, maintenance expenses, permits and licenses, and wage/salary expense. Most vessels carry per trip about half of the maximum passenger capacity. Therefore, substantial excess capacity exists in the sector. As

with the commercial fishery, increases in fishing costs, increases in harvesting efficiency, more restrictive regulations (particularly for the grouper fishery), and changes in the stock status of certain species may affect effort in this sector.

Gag and Red Grouper

Major stresses to grouper stocks have primarily come from overfishing which has either occurred for red and goliath grouper, or is currently occurring for gag. Trends in landings and the status grouper stocks are summarized in Section 3.3 and are based on NMFS stock assessments and SEDARs 6 (goliath grouper), 10 (gag), and 12 (red grouper). The following summarizes these stocks.

Goliath grouper in the Gulf of Mexico was assessed in 2004 populations in Florida was conducted in 2004 as part of SEDAR 06. The assessment agreed with anecdotal information indicating a rapid stock decline in the 1980s. In 1990, a moratorium on Goliath grouper harvest was implemented for both the commercial and recreational fisheries (See Section 1.3 History of Management). Since this harvest moratorium, the Goliath grouper stock has shown indications of recovery; however the extent of the recovery is uncertain. Porch et al. (2006) extended the SEDAR assessment by estimating the level of F under the moratorium based on recommendations from the SEDAR 6 review panel (SEDAR 6, 2004a). The base model suggested that the post-moratorium level of F was similar to the estimate for the MFMT level specified in the Generic SFA Amendment at about $F_{50\%SPR}$. Based on Porch et al. (2006), the model suggests that there is less than a 40 percent chance the stock will recover to the levels stipulated by the generic SFA within the next 10 years. Therefore, any additional harvest would make a recovery even less likely. However, there is controversy on what the overfishing and overfished thresholds should be for this species. The FWC is currently developing a research program to obtain further information on the stock to better determine its condition.

Briefly, estimated catches of gag (landings and dead discards) from 1998 to 2004 have exceeded catches in earlier years. The 2004 catch was about 85 percent higher than the highest estimated catches from before 1998 and about 75 percent higher than the more recent catches (1999) used in the last assessment. Commercial landings since the late 1990's have increased about 60 percent compared to the 1980's and estimated recreational landings have almost doubled from the 1980's. As would be expected, estimated annual Fs have also generally from about 0.2 in the mid-1970s to about 0.5 in 2004.

The estimated gag spawning stock biomass declined during the late 1960's and the 1970's, remained at about 20 mp during the 1980's and early 1990's. The spawning stock biomass then increased from 1997 to 2001, perhaps as a result of the higher recruitment. In recent years, estimated total biomass peaked at about 56 mp in 2002 and then declined to an estimated 51 mp in 2004.

With regard to the status of the stock, gag are considered to be undergoing overfishing. The most recent 4-year average F (0.40) from the most recent stock assessment was above the MFMT value of 0.27. Amendment 30B would define the overfished threshold (MSST) for gag. Whichever definition is chosen, the stock would not be considered in an overfished condition. Regardless of stock status, fishing mortality does need to be reduced to end overfishing and

ensure the stock status does not worsen in the future.

For red grouper, total landings are variable with an overall declining trend from 1986 to 1998 (9 to 4.6 mp). Total landings then increased to nearly 8 mp in 1999 where they have stabilized through 2005 averaging 7.5 mp. Within sectors, commercial longline landings gradually increase during between 1986 and 2005. Commercial handline landings declined considerably over the same time period from 3.74 mp in 1990 to less than 1 mp in 1998, but have increased to 1.5 mp in recent years. Recreational landings have been less than total commercial landings. With the exception of the 1995-1997 period when landings were much lower than average, recreational landings have fluctuated between 1 and 3 mp. From 1986, F increased steadily, peaking in 1993. After 1993, F declined through 1998. Fishing mortality increased slightly in 1999, but has been on another downward trend through 2005.

Red grouper stock abundance has averaged approximately 27.6 million fish and varies with little trend between 1986 and 1999. However, abundance jumped sharply in 2000 to 40.5 million fish when a strong 1999 year class entered the fishery. Spawning stock is measured as total female gonad weight. The estimated spawning stock has gradually improved since 1986 from just below 500 metric tons (mt) of eggs in late 1980's to over 700 mt in the last few years including the observed high of 752 mt of eggs in 2005.

A stock assessment conducted in 1999 indicated red grouper stock status was one of overfished and overfishing in the 1997, the last year of data used in the assessment. A subsequent 2007 assessment using data through 2004, indicated the stock was no longer overfished or undergoing overfishing. This was in part due to a strong recruitment year in 2000.

The status of the yellowedge grouper stock remains essentially undetermined. An age-structured stock assessment model for yellowedge grouper in the U.S. Gulf of Mexico was conducted in 2002 (RFSAP 2002). The model was very sensitive to input parameters, and small changes in highly uncertain parameters resulted large changes in the estimated status of the stock. Therefore, the RFSAP concluded that the analysis of the stock was insufficient to determine the status of the stock relative to the definitions of overfished and overfishing (RFSAP, 2002). However, because of the longevity of yellowedge grouper, they may be particularly susceptible to even relatively low fishing mortality rates. The RFSAP recommended that the commercial yield should not greatly exceed the historical average of 0.84 million lbs.

Ecosystem

With respect to stresses to the ecosystem from actions in this amendment, changes in the gag and red grouper fisheries are not likely to create additional stress. Vertical gear and longlines, the primary gear used by the fishery, can damage habitat through snagging or entanglement, however, as described in Section 5.1.1, these impacts are minimal. Changes in the population size structure as a result of shifting grouper fishing selectivities and increases in stock abundance could lead to changes in the abundance of other reef fish species that compete with grouper for shelter and food. Predators of grouper species could increase if grouper abundance is increased, while species competing for similar resources as groupers could potentially decrease in abundance if food and/or shelter are less available. Efforts to model these interactions are still in their development stages, and so predicting possible stresses on the ecosystem in a meaningful

way is not possible at this time.

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

This section examines whether resources, ecosystems, and human communities 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.

Reef Fish Fisheries

As indicated above, both commercial and for-hire fisheries are subject to stress as a result of increases in fishing costs, increases in harvesting efficiency, more restrictive regulations (particularly for the grouper fishery), and changes in the stock status of certain species (effort shifting). Reductions in dollars generated by these entities would likely be felt in the fishery infrastructure. For the reef fish fishery, an indicator of stress would be a decline in the number of permitted vessels. For the commercial fishery, the number of vessels landing either shallow-water grouper or red grouper has been decreasing (see Section 3.1). However, the number of permitted vessels has remained the same at about 1,000 vessels over the past few years. This indicates some fishermen are not participating in the fishery. Whether they are holding their permits as speculation for selling their permit, or waiting until reef fish prices improve to a point where returning to the fishery becomes more profitable is unknown.

For the for-hire fishery, analyses conducted on the effects of a limited access program for for-hire vessels indicated operations were generally profitable (GMFMC 2005c). However, testimony from for-hire operators in light of recent red snapper regulations have suggested some for-hire operators may go out of business, particularly in the northeastern Gulf (GMFMC 2007c). Best available survey and modeling results indicate that relatively few trip cancellations were expected to occur as a result of this action. Most survey respondents indicated that when faced with a reduced or zero red snapper bag limit, they would either continue fishing for red snapper or fish for another species. Fishing for other species may generate distributional effects (i.e., the trips may occur from different ports, modes, or seasons, resulting in one port/entity/season losing business while another gains). These distributional effects, however, cannot be predicted with current data. Further, for at least red snapper trips, preliminary data through August 2007 do not support claims of widespread reductions in charter business as a result of more restrictive red snapper measures. Thus, based on inference from the red snapper for-hire fishery, while it is possible some for-hire fishermen may go out of business as a result of actions in Amendment 30B or other reef fish amendments, the fishery as a whole is not undergoing widespread harm.

Grouper

No thresholds or benchmarks have been set specifically for most grouper. Amendment 1 to the Reef Fish FMP, implemented in 1990 before the Sustainable Fisheries Act (SFA) was passed,

established the minimum spawning stock biomass at 20 percent SPR for all reef fish species. The Generic SFA Amendment proposed SFA definitions for OY, MSST and MFMT for three reef fish species and generic definitions for all other reef fish. The definition of MFMT for other reef fish which includes grouper species, $F_{30\%SPR}$, was approved and implemented. Definitions for OY and MSST were disapproved because they were not biomass-based.

A recent assessment was conducted for gag in 2006 under the SEDAR stock assessment process. SEDAR 10 methods and results are summarized in Sections 1.2.1 and 3.3. Based on the parameter estimates for 2004, the stock was found to be undergoing overfishing. A brief description of the stock and its status can be found in step 5 of this CEA. Measures proposed in this amendment are designed to immediately relieve stress on the gag stock and over the next six years relieve stress on the ecosystem. Landings will initially be reduced by approximately 29 to 45 percent depending on the value selected for MFMT.

For red grouper, Sustainable Fisheries Act compliant thresholds and targets were defined in Secretarial Amendment 1. MFMT is defined as the fishing mortality rate at MSY. MSST is defined as $(1\text{-}M)*B_{MSY}$ with natural mortality (M) equal to 0.14. MSY is the yield associated with F_{MSY} when the stock is at equilibrium and OY is the yield associated with fishing at 75 percent of F_{MSY} when the stock is at equilibrium.

A new stock assessment for red grouper was completed in 2007 using an age-structured production model (SEDAR 12 2007). The assessment and its results are summarized in Section 1.2.2 and 3.2. Based on landings data from 1986 to 2005, this assessment indicated the stock had recovered from an overfished state in 1999 and so is no longer considered overfished. The assessment also indicted the stock was no longer undergoing overfishing. Therefore, harvest constraints currently placed on the stock as it recovered could be relaxed so the stock can be harvested at OY. Measures addressing the revised status of this stock are being proposed in this amendment.

Stock assessments have been conducted for yellowedge grouper (Cass-Calay and Bahnick, 2002) and goliath grouper (Porch et al., 2003; SEDAR 6, 2004b). However, the stock status of these species is uncertain. The assessment for yellowedge grouper concluded the stock condition was unknown and the assessment for Goliath grouper indicated the stock was still overfished. A review of the Nassau grouper's stock status was conducted by Eklund (1994), and updated estimates of generation times were developed by Legault and Eklund (1998).

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 first stock assessment of gag was conducted in 1994 and then again in 1997, 2001, and 2006. An overview of the assessments is provided in Section 1.2. The most recent assessment was completed in 2006 through the SEDAR process. The assessment shows trends in biomass, fishing mortality, fish weight, and fish length dating to the earliest periods of data collection.

For this assessment, reliable commercial landings data were estimated back to 1963; however, grouper were not identified by species until 1986. Recreational data were available since 1981. Within this timeframe, gag have not been considered overfished, but some previous assessments indicated gag may have been undergoing overfishing.

The first stock assessment of red grouper was conducted in 1991 and then again in 1993, 1999, 2002, and 2007. An overview of the assessments is provided in Section 1.2. The most recent assessment was completed in 2007 through the SEDAR process. The assessment shows trends in biomass, fishing mortality, fish weight, and fish length dating to the earliest periods of data collection. For this assessment, reliable commercial and recreational landings data were estimated back to 1981. Within this timeframe, red grouper the 1999 assessment, a 2000 re-evaluation of the 1999 assessment, and the 2002 assessment have indicated this stock has been undergoing overfishing and was overfished, but has now recovered to B_{MSY}.

Information is lacking on the social environment of these fisheries, although some economic data are available. Fishery-wide ex-vessel revenues are available dating to the early 1960s, and individual vessel ex-vessel revenues are available from 1993 when the logbook program was implemented for all commercial vessels.

8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities. Cause-and–effect relationships are presented in Tables 5.14.1 and 5.14.2.

Table 5.14.1. The cause and effect relationship of fishing and regulatory actions for gag within the time period of the CEA.

Time periods	Cause	Observed and/or expected effects
1986 -1989	Growth and recruitment overfishing	Declines in mean size and weight
1990	Minimum size limit of 20-inch; 5 aggregate grouper bag limit; 9.2 mp shallow-water grouper quota	Slight increase in commercial landings; decline in recreational landings
1999	22-inch recreational minimum size limit; 24-inch commercial minimum size limit; and 1 month commercial seasonal closure	Slight increase in both commercial and recreational landings
2005	Commercial trip limit and decrease in recreational aggregate bag limit	Slight decrease in commercial landings as quota filled and shallow-water grouper fishery closed; significant declines in recreational landings; overfishing occurring

Table 5.14.2. The cause and effect relationship of fishing and regulatory actions for red grouper within the time period of the CEA

Time periods	Cause	Observed and/or expected effects
1986 -1989	Growth and recruitment overfishing	Declines in mean size and weight
1990	Minimum size limit of 20-inch; 5	Slight increase in both commercial and

	aggregate grouper bag limit; 9.2 mp shallow-water grouper quota	recreational landings
1999	1 month commercial seasonal closure	Increase in commercial and recreational landings
2005	Commercial trip limit; 1-fish red grouper bag limit; recreational seasonal closure	Decrease in commercial landings as quota filled and shallow-water grouper fishery closed; significant declines in recreational landings; overfishing ended

9. Determine the magnitude and significance of cumulative effects.

The objectives of this amendment and associated EIS are fourfold. The first objective is to define MSST and OY, and to possibly redefine MFMT, and to set a TAC and management measures that will end overfishing of gag. Because the red grouper stock has recovered from an overfished state, the second objective is to increase red grouper TAC consistent with a level that would achieve OY. Two other objectives of this amendment are to co-manage gag and red grouper by implementing concurrent management measures, and to consider the expansion of the existing marine reserves or to create new reserves to better protect gag stocks. Actions 1, 3, 5, and 10-13 address the first objective and Actions 3, 5, and 13 address the second objective. Actions 7 and 8 address the co-management of gag, red grouper, and other shallow-water species. Actions 10 and 11 address the expansion of current or the creation of new marine reserves. The short- and long-term direct and indirect effects of each these actions are provided in Sections 5.1 through 5.13.

To examine the magnitude and significance of the cumulative effects, important valued environmental components (VECs) were identified for the overall action to be taken with this amendment. VECs are "any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern" (EIP 1998). For purposes of this analysis, an initial 25 VECs were identified, and the consequences of each alternative proposed in this amendment on each VEC were evaluated. Some of these VECs were combined into a revised VEC because many of the past, current, and reasonably foreseeable future actions (RFFA) were similar. Based on this analysis, seven VECs were determined to be the most important for further consideration. These are shown in Table 5.14.3.

VECs not included for further analysis included sharks, consumers, and protected resources. Sharks were not considered as an important VEC because, as shark stocks have declined, the shark fishery has become more and more regulated, limiting the effects of this fishery and the stock on reef fish stocks. There may be some effort shifting from the shark fishery to the reef fish fishery due to increased restrictions, however, this effect will likely be minor because only a minority of vessels have dual permits. Consumers were eliminated from further analysis because of the high level of imported reef fish. Possible effects from reductions in domestic production would likely be offset by increased imports. Protected resources were also eliminated from further analyses in this section. Biological opinions have concluded the primary reef fish gear (longline and hook-and-line) were not likely to jeopardize sea turtles or small tooth sawfish.

Because actions considered in this amendment are not expected to change how reef fish fishing gear is used in the prosecution of the reef fish fishery, any take associated with reef fish fishing should not exceed that considered in biological opinions. All other Endangered Species Act (ESA)-listed species heave been found not likely to be adversely affected or not affected by the reef fish fishery. For marine mammals, gear used in the reef fish fishery were classified in the 2008 List of Fisheries (72 FR 66048, November 2007, 2007) as Category III fisheries. This means this fishery has minimal impacts on marine mammals (see Section 5.19 for more information).

Table 5.14.3. VECs considered, consolidated, or not included for further evaluation.

VECs considered for further evaluation	VECs consolidated for further evaluation	VECs not included for further evaluation
Habitat - hard bottom - EFH		
Managed resources - gag - red grouper - other reef fish species	Gag Red grouper Other shallow water grouper Deepwater grouper Other reef fish Prey species Competitors Predators	Sharks Protected species
Vessel owner, captain and crew - Commercial - For-hire	Crew Fishing Communities	
Dealers		Consumers
Anglers		
Infrastructure	Fishing Communities	
Administration	Federal Rulemaking Federal Permitting Federal Education State Rulemaking/Framework State Education	

The following discussion refers to the effects of past, present, and RFFAs on the various VECs. These effects are summarized in Table 5.14.4.

Habitat

EFH, as defined in the GMFMC (2004a), for the Reef Fish FMP consists of all Gulf of Mexico estuaries; Gulf of Mexico waters and substrates extending from the US/Mexico border to the boundary between the areas covered by the Gulf of Mexico and the South Atlantic fishery management councils from estuarine waters out to depths of 100 fathoms. In general, reef fish are widely distributed in the Gulf of Mexico, occupying both pelagic and benthic habitats during their life cycle. A planktonic larval stage lives in the water column and feeds on zooplankton and phytoplankton (GMFMC 2004a). Juvenile and adult reef fish are typically demersal and usually associated with bottom topographies on the continental shelf (<100m) which have high relief, i.e., coral reefs, artificial reefs, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings. However, several species are found over sand and soft-bottom substrates. For example, juvenile red snapper are common on mud bottoms in the northern Gulf, particularly off Texas through Alabama. Also, some juvenile snapper (e.g. mutton, gray, red, dog, lane, and yellowtail snappers) and grouper (e.g. Goliath grouper, red, gag, and yellowfin groupers) have been documented in inshore seagrass beds, mangrove estuaries, lagoons, and larger bay systems.

Section 3.2.2 and GMFMC (2004a) describe the physical environment inhabited by groupers, particularly for red grouper and gag. Groupers are carnivorous bottom dwellers, generally associated (as adults) with hard-bottom substrates, and rocky reefs. Eggs and larvae for all species are pelagic. Depending on the species, juveniles either share the same habitat as adults, or are found in different habitats and undergo an ontogenetic shift as they mature. For red grouper, juveniles are found in nearshore waters until they reach approximately 16 inches and move offshore (GMFMC 2004a). Adults are associated with rocky outcrops, wrecks, reefs, ledges, crevices, caverns, as well as "live bottom" areas, in depths of 3 to 190 m. Juvenile gag are estuarine dependent and are found in seagrass beds (GMFMC 2004a). Adult gag are associated with hard bottom substrates, including offshore reefs and wrecks, coral and live bottoms, and depressions and ledges. Spawning adults form aggregations in depths of 50 to 120 m, with the densest aggregations occurring around the Big Bend area of Florida. Females undergo a migration from shallower waters to the deeper waters where spawning occurs, while males generally stay at the same depths where spawning occurs (Koenig 1999).

From fishing, the most sensitive gear/habitat combinations include EFH for reef fish species. These include fish otter trawls, shrimp otter trawls, roller frame trawls, and pair trawls over coral reefs; crab scrapes over coral reefs; oyster dredges over submerged aquatic vegetation (SAV), oyster reefs, or coral reefs; rakes over coral reefs; and patent tongs over SAV, oyster reefs, or coral reefs (GMFMC 2004a). Some of these gear/habitat interactions are unlikely to occur in actual practice (e.g., shrimp trawls towed through hard bottom areas can destroy shrimp nets and so are avoided). In general, gears that are actively fished by towing have the highest potential to alter habitats. However, some habitats, such as coral reefs and hard bottoms are sensitive to interactions with passive gears (e.g. traps) as well. Most directed reef fish fishing activities, as described in Section 5.1.1, use longlines, vertical lines, fish traps, and spearfishing gear. These have low levels of impacts compared to other gears.

In the past, some fishing practices have had detrimental effects on the physical environment. Gears such as roller trawls and fish traps damaged habitats while harvesting fish species. As a result of these effects, the Council developed stressed areas to reduce these impacts. Further protections have been developed, primarily by either prohibiting fishing or limiting fishing activities that can occur within certain areas. These are summarized in Section 3.1 and displayed in Figure 3.2. More recently, generic EFH Amendment 3 was implemented in 2006. The rule associated with this amendment prohibited bottom anchoring and the use of trawling gear, bottom longlines, buoy gear, and all traps/pots to protect coral reefs in several HAPCs, and required a weak link in the tickler chain of bottom trawls on all habitats throughout the Gulf of Mexico EEZ to minimize damage done to habitats should the chain get hung up on natural bottom structures.

Current management measures of the reef fish fishery have likely been beneficial to hard bottom areas. Vertical gear and longlines used in the reef fish fishery can damage habitat through snagging or entanglement. Longlines can also damage hard bottom structures during retrieval as the line sweeps across the seafloor. Additionally, anchoring over hard-bottom areas can also affect benthic habitat by breaking or destroying hard bottom structures. However, these gears are not believed to have much negative impact on bottom structures and are considerably less

destructive than other commercial gears, such as traps and trawls. Fish traps have been used to harvest reef fish and this gear can cause significant damage to corals and other epibenthic organisms. However, this gear was retired from use in the fishery in February 2007.

Damage caused from reef fish fishing, while minor is associated with the level of fishing effort (see Section 5.1.1). Therefore, actions reducing levels of effort would result in greater benefits to the physical environment because fishing related interactions with habitat would be reduced. Thus, actions described in steps 3 and 4 of this CEA such as Amendments 22, 27/14 (red snapper), 23 (vermilion snapper), Secretarial Amendment 1 (red grouper), and Secretarial Amendment 2 (greater amberjack), which have reduced fishing effort for some species, and possibly the fishery on the whole, have had a positive effect on hard bottom habitats. RFFAs, such as Amendment 30A and the development of ACLs and AMs should also benefit these habitats as they would also reduce or limit fishing effort.

Reef fish EFH, particularly coral reefs and SAVs, are particularly susceptible to non-fishing activities (GMFMC 2004a). The greatest threat comes from dredge-and-fill activities (ship channels, waterways, canals, and coastal development). Oil and gas activities as well as changes in freshwater inflows can also adversely affect these habitats. EFH and HAPC designations described in Section 3.2 are intended to promote careful review of proposed activities that may affect these important habitats to assure that the minimum practicable adverse impacts occur on EFH. However, NMFS has no direct control over final decisions on such projects. The cumulative effects of these alternatives depend on decisions made by agencies other than NMFS, as NMFS and the Gulf Council have only a consultative role in non-fishing activities. Decisions made by other agencies that permit destruction of EFH in a manner that does not allow recovery, such as bulkheads on former mangrove or marine vegetated habitats, would constitute irreversible commitments. However, irreversible commitments should occur less frequently as a result of EFH and HAPC designations. Accidental or inadvertent activities such as ship groundings on coral reefs or propeller scars on seagrass could also cause irreversible loss.

Managed Resources

There are 42 species of reef fish managed in the Gulf of Mexico EEZ, and of the species where the stock status is known, four of seven are undergoing overfishing (red snapper, gag, gray triggerfish and greater amberjack) and two of four species are considered overfished (greater amberjack and red snapper; see Section 3.3). Recent assessments for gray triggerfish and gag (SEDAR 9, 2006b and SEDAR 10, 2006, respectively) suggest these two species are experiencing overfishing, and stock recovery for greater amberjack is occurring slower than anticipated.

In the past, the lack of management of reef fish has allowed many stocks to undergo both growth and recruitment overfishing. This has allowed some stocks to decline as indicated in numerous stock assessments (Section 3.3). For grouper, management measures including a minimum size limit, commercial quota, and aggregate bag limit were put in place in 1990 (Section 1.4). None of these measures halted increases in landings. An increase in the size limit and one month commercial closure put in place in 1999 also did not end the increase in grouper landings. During this time period, red grouper became overfished and gag came close to being overfished.

Present management measures put in place primarily for red grouper through Secretarial Amendment 1, 2005 emergency and interim rules, and 2005 regulatory amendments have allowed red grouper to rebuild to a point where the stock is no longer considered overfished, which they were designed to do. However, these measures did not limit the gag harvest enough to prevent overfishing from occurring. In fact, these measures, along with actions from Amendments 22, 27/14 (red snapper), 23 (vermilion snapper)[11], Secretarial Amendment 1 (red grouper) and Secretarial Amendment 2 (greater amberjack), may have redirected effort towards other reef fish species such as gag. Gag currently have no harvest limit other than being a part of the shallow-water grouper quota.

Fishery management RFFAs are expected to benefit managed species. The purposes of this amendment are to end overfishing of gag, manage red grouper consistent with this species' OY level, co-manage gag and red grouper, and consider the expansion of the existing marine reserves or to create new reserves to better protect gag stocks. In addition, this amendment contains measure to better manage grouper stocks on the whole and assist in the management of other species should state and federal regulations differ. Other actions are expected to be taken by the Council that would likely be beneficial to the stock and are described in steps 3 and 4 of this CEA. As a result of the MSRA, ACLs and AMs are to be applied to managed stocks. These are intended to develop triggers for action to be taken immediately should a stock appear to be approaching an overfishing condition. These triggers for action are being considered for shallow-water grouper species in Action 6 of this amendment. Amendment 30A is designed to reduce F in the greater amberjack and gray triggerfish fisheries. Amendment 29 would develop a grouper IFQ program for the commercial fishery. IFQ programs have been shown to reduce bycatch and discard mortality in fisheries because fishermen have options in terms of when and where to fish. Additionally, commercial quotas are better regulated under these programs.

Non-fishing activities are likely to adversely affect reef fish stocks. LNG facilities are being proposed in the western and northern Gulf. As described in Step 4c, these facilities can have a negative effect on species with pelagic larvae, like most reef fish species. To mitigate the affects of these facilities, closed- rather than open-loop systems are being called for. At this time, the effect of LNG facilities is unknown and is likely to be less for reef fish species than other more coastal species such as red drum. Global warming is another factor which could have a detrimental effect on reef fish species. However, what these effects might be cannot be quantified at this time.

Vessel Owner, Captain, and Crew (Commercial and For Hire)

Adverse or beneficial effects of actions to vessel owners, captains, and crew are tied to the ability for a vessel to make money. In commercial fisheries, these benefits are usually derived in terms of shares awarded after fishing expenses are accounted for. The greater the difference between expenses and payment for caught fish, the more revenue is generated by the fishing vessel. In

[11] Note a 2007 regulatory amendment rescinded management measures in Amendment 23, reducing the effect of this amendment on other reef fish stocks.

the for-hire sector, revenues are generated by the number of trips sold for charter businesses, and by the number of paying passengers for headboat businesses.

Relative to this amendment, the commercial fishery has benefited from past actions in the reef fish fishery. By being able to harvest these species unhindered by regulations prior to 1990, many vessels have been able to enter the fishery. For red grouper, the primary grouper species landed by the fishery, landings averaged at 6.2 mp from 1986-1989, 4.8 mp from 1990-1998, and 5.7 mp from 1999-2005. Gag, the second most commercially harvested species, landings have averaged at about 1.5 mp from 1963 to 1997, and have increased in recent years (1998-2004) to an annual average of 2.7 mp. To constrain harvest so as not to overexploit reef fish in general and grouper specifically, the Council had implemented size limits, quotas, seasonal closures, and a permit moratorium to constrain the commercial harvest prior to 2000. These measures have met with limited success.

Current management measures have had a negative, short-term impact on the commercial fishery. Landing restrictions were needed to keep the commercial red grouper harvest within its quota. This forced closures in the commercial shallow-water grouper fishery in 2004 and 2005 to prevent the fishery from exceeding the red grouper quota. This kept many commercial vessels from taking more fishing trips during these years. As a result, a trip limit was instituted in 2005 in an attempt to lengthen the commercial season. For 2006 and 2007, the fishery did not exceed its quota. Further compounding the negative effects on the fishery are imports. Imports on domestic fisheries can cause fishermen to lose markets through fishery closures as dealers and processors use imports to meet demand, and limit the price fishermen can receive for their products through competitive pricing of imports. Other factors which have had an adverse effect on the commercial fishery include increases in fishing costs such as fuel and hurricanes which may have pushed marginal fishing operations out of business (see step 4c).

Many RFFAs are likely to have a short-term negative impact on the commercial fishery. Red snapper (Amendment 27/14), gray triggerfish, and greater amberjack (Amendment 30A) have been experiencing overfishing. Measures required to end this condition and rebuild stocks have constrained the harvest for these species and are likely to increase competition within the fishery to harvest other stocks. Some short-term beneficial actions include an increase in TAC and relaxation of management measures for red grouper (this amendment) and vermilion snapper (regulatory amendment) because these stocks have been rebuilt.

Because many management RFFAs are designed to manage stocks at OY (e.g., Amendment 27/14, 30A, 30B), these actions should have long-term benefits for the commercial fishery. Stocks would be harvested at a sustainable level, and at higher levels for those stocks being rebuilt. The Council is developing a grouper IFQ amendment. IFQs allow individual fishermen to fish their shares when and where they want. As a result, prices for landed fish are expected to increase as observed in other IFQ programs (GMFMC 2006). Some RFFAs may have negative consequences. An amendment to develop ACLs and AMs for reef fish stocks would likely require the Council adopt more conservative harvest levels than currently in place, reducing the amount of biomass available for the fishery to harvest. Other measures being developed, but whose effects are unclear at this time, include addressing allocation between the commercial and recreational reef fish fisheries, and an amendment allowing offshore aquaculture in the Gulf of

Mexico. Dependent on allocations selected, the share of some stocks to the commercial fishery may increase or decrease. Non-management related RFFAs which could affect the commercial fishery include hurricanes and increases in fishing costs (e.g., fuel). Hurricanes are unpredictable and localized in their effects. Increases in fishing costs, unless accompanied by a similar increase in price per pound of fish, are likely to decrease the profitability of fishing operations.

Relative to this amendment, the for-hire fishery has benefited from past actions in the reef fish fishery. By being able to harvest these species unhindered by regulations prior to 1990, many vessels have been able to enter the fishery. This increase has been fueled by increased interest by the public to go fishing (i.e., more trips sold) as evidenced by an almost three-fold increase in recreational fishing effort since 1986 (SEDAR 12 2007). For gag, the most important recreationally harvested species, annual discards were less than 0.5 million fish from 1981 to 1990. However, from 1990 onward, the number of discarded fish has increased from about 0.5 million to over 3.5 million fish in 2004. This is likely due to size and bag limits first introduced in 1990. Red grouper are the second most common grouper species landed by the fishery. Landings averaged approximately 2.0 mp from 1986-1995, 1.0 mp from 1996-1998, and 1.7 mp from 1999-2005. To constrain harvest so as not to overexploit reef fish in general and grouper specifically, the Council had implemented size and bag limits prior to 2000. The Council additionally implemented a permit moratorium to constrain the recreational effort from the for-hire industry in 2003. These measures have met with limited success toward ending overfishing.

Current management measures may have had a negative, short-term impact on the for-hire fishery. Landing restrictions were needed to keep the recreational red grouper harvest within its allocation of TAC. These included a reduced bag limit and seasonal closure. If these measures reduced interest by the public to take for-hire fishing trips, then the number of trips would likely go down. Other factors which have had an adverse effect on the for-hire fishery include increases in fishing costs such as fuel and hurricanes which may have pushed marginal fishing operations out of business (see step 4c). However, these factors may be less important than may seem apparent. For the red snapper for-hire fishery, reductions in charter fishing from more restrictive regulations, increased costs, and effects from hurricanes were claimed by the fishery (GMFMC 2007c). Preliminary red snapper data for 2007 found only lingering effects of the 2005 hurricanes; annual average effort for 2004 through 2005 were only slightly greater than in 2007. While the available data cannot address claims of severe economic losses by individual entities, data did not support contentions of widespread industry harm. Consistent with the projections, widespread loss of effort from these factors was not apparent. However, for red snapper, effort may have shifted to other species or other charter businesses.

Many RFFAs are likely to have a short-term negative impact on the for-hire fishery. Red snapper (Amendment 27/14), gray triggerfish, greater amberjack (Amendment 30A), and gag (this amendment) have been experiencing overfishing. Measures required to end this condition and rebuild stocks have constrained the harvest for these species. If these measures result in less interest by the fishing public to take fishing trips on for-hire vessels, then this will have an adverse affect on this sector. However, as mentioned above, this effect was not apparent for red snapper because the for-hire fishery has the ability to shift to other species. Some short-term beneficial actions include an increase in TAC and relaxation of management measures for red

grouper (this amendment) and vermilion snapper (regulatory amendment) because these stocks have been rebuilt.

Because many management RFFAs are designed to manage stocks at OY (e.g., Amendment 27/14, 30A, 30B), these actions should be beneficial to the for-hire fishery. As mentioned for the commercial fishery, stocks would be harvested at a sustainable level, and at higher levels for those stocks being rebuilt. Some RFFAs may have negative consequences. An amendment to develop ACLs and AMs for reef fish stocks is likely to require the Council adopt more conservative harvest levels than currently in place, reducing the amount of biomass available for the fishery to harvest. If these actions reduce the participation of the public in the recreational fishery, the for-hire sector will be adversely affected. Other measures being developed, but whose effects are unclear at this time, include addressing allocation between the commercial and recreational reef fish fisheries, and an amendment allowing offshore aquaculture in the Gulf of Mexico. Dependent on allocations selected, the share of some stocks to the recreational (including for-hire) fishery may increase or decrease. Non-management related RFFAs which could affect the commercial fishery include hurricanes and increases in fishing costs. Hurricanes are unpredictable and localized in their effects. Increases in fishing costs, unless accompanied by a similar increase in the price charged per trip, are likely to decrease the profitability of fishing operations.

Dealers

Reef fish vessels and dealers are primarily found in Gulf states (step 2). Approximately 182 dealers possess permits to buy and sell reef fish species (Sramek pers. comm.). More than half of all reef fish dealers are involved in buying and selling grouper. These dealers may hold multiple types of permits. Average employment information per reef fish dealer is not known. Although dealers and processors are not synonymous entities, Keithly and Martin (1997) reported total employment for reef fish processors in the Southeast at approximately 700 individuals, both part and full time. It is assumed that all processors must be dealers, yet a dealer need not be a processor. Further, processing is a much more labor-intensive exercise than dealing. The profit profile for dealers or processors is not known.

Relative to past actions, dealers have benefitted from actions that have allowed the commercial fishery to expand as described above. However, the affect of measures constraining commercial landings both in the past, present, and RFFA may not have negative affects on dealers. As described in step 4c, the amount of reef fish imports have doubled between 1994 and 2005. In terms of pounds, 2005 imports (49.7 mp) were more than twice domestic annual Gulf grouper landings (average 18.4 mp). This means dealers have the ability to substitute domestic product with imports. In addition, dealers also have the ability to substitute other domestic seafood products for grouper in order to satisfy public demand for seafood. Therefore, the negative effects from management actions for the fishery may not necessarily translate into negative effects for dealers. As domestic fish stocks are rebuilt and management programs such as IFQs are instituted, a more stable supply of domestic reef fish will be available to dealers. This should improve their ability to market these products and improve profits they receive from handling these fish.

Anglers

It is estimated that 2.7 million private anglers fish in the Gulf. These anglers target red drum about 35 percent of the time and spotted sea trout 33 percent of the time. Red snapper is the most common reef fish targeted by 4.5 percent of private anglers that were intercepted (GMFMC 2004a, c). As summarized in Holiman (2000), the typical angler in the Gulf is 44 years old, male (80%), white (90%), and employed full-time (92%). They have a mean income of $42,700, and have fished in the state for an average of 16 years. The average number of trips taken in the 12 months preceding the interview was about 38 and these were mostly (75%) one-day trips with average expenditure of less than $50. Seventy-five percent reported that they held salt-water licenses, and 59 percent of them owned boats used for recreational saltwater fishing.

The effects of various past, present, and RFFA management measures on anglers are measured through levels of participation in the fishery. Measures that reduce participation are negative and measures that increase participation are positive. However, it is difficult to assess what affects past and present management measures have had on anglers because the amount of effort by the private sector has continually increased where data was available. This increase has been from just over 6 million trips in 1981 to over 14 million trips in 2004 (SEDAR 12 2007). Therefore, it is difficult to link changes in participation to specific management action. Likely the effects of how various management measures have affected participation by anglers is similar to the effects on the for-hire industry discussed above. This includes outside factors such as hurricanes and increasing fuel and other costs.

Infrastructure

Infrastructure refers to fishing-related businesses and includes marinas, rentals, snorkel and dive shops, boat dockage and repair facilities, tackle and bait shops, fish houses, and lodgings related to recreational fisheries industry. This infrastructure is tied to the commercial and recreational fisheries and can be affected by adverse and beneficial economic conditions in those fisheries. Therefore, the effects of past, present, and RFFAs should reflect responses by the fisheries to these actions. Past actions allowing the recreational and commercial fisheries to expand have had a beneficial effect providing business opportunities to service the need of these industries. Present actions which have constrained the commercial fisheries likely have had a negative effect since lower revenues generated from the fishery would be available to support the infrastructure. However, as conditions improve for the fishery as described above through RFFAs, similar benefits should be accrued by the businesses comprising the infrastructure. For the recreational fishery, as stated above, it is difficult to assess the impact of present and RFFAs since angler participation has been increasing. Actions enhancing this participation should also be beneficial to the infrastructure. However, it should be noted the Council has been receiving public testimony that participation may be declining as fuel prices increase.

Administration

Administration of fisheries is conducted through federal (including the Council) and state agencies which develop and enforce regulations, collect data on various fishing entities, and assess the health of various stocks. As more regulations are required to constrain stock

exploitation to sustainable levels, greater administration of the resource is needed. The NMFS law enforcement, in cooperation with state agencies, would continue to monitor regulatory compliance with existing regulations and NMFS would continue to monitor both recreational and commercial landings to determine if landings are meeting or exceeding specified quota levels. Further, stock status needs to be periodically assessed to ensure stocks are being maintained at proper levels. Some present actions have assisted the administration of fisheries in the Gulf. In 2007, an IFQ program was implemented for the commercial red snapper fishery, requiring NMFS to monitor the sale of red snapper IFQ shares. Recordkeeping requirements for IFQ shares would also improve commercial quota monitoring and prevent or limit overages from occurring. This should improve red snapper quota monitoring. VMS has also been implemented for all commercial reef fish vessels in 2007 and is helping enforcement identify vessels violating various fishing closures. RFFAs are designed to improve stock status. This will require increases in the administrative burden to ensure harvest is constrained at a level maintaining stock sustainability.

VECs	Past Actions	Present Actions	Reasonably Foreseeable Future Actions	Combined Effects of Past, Present, and Future Actions
Habitat - hard bottom - EFH	**Negative** - combined effects of disturbance by fishing gear and non-fishing actions reduce habitat quality	**Somewhat less negative** - combined effects of disturbance by fishing gear reduced, but still occurring so habitat quality still reduced	**Positive, but minor** - some reduction in effort should lead to reduced disturbance from fishing actions.	**Positive** - Stabilizing effort should lead to reduced disturbance from fishing actions
Managed resources - gag - red grouper - other reef fish species	**Negative** - for some stocks, allowed to become overfished; bycatch mortality from directed fishing for other species	**Positive** - overfished stocks under rebuilding plans, F reduced on stocks undergoing overfishing (e.g., red grouper). **Negative** - overfishing is occurring on some stocks (e.g., gag). **Negative** - bycatch mortality from directed fishing for other species	**Positive, long term** - As grouper stocks improve, less effort shifting toward other managed reef fish species. **Negative, short term** - if effort reduction for grouper, possible shifting toward other reef fish species.	**Negative, short term** - Potential increased harvesting due to effort shifting, possible bycatch mortality. **Positive long term** - as stocks increase, effort redirected back towards those stocks, less bycatch.
Vessel owner, captain and crew - Commercial - For-hire	**Positive** - Fishery has supported profitable vessels; increase recreational participation	**Negative** - lower catch per unit effort/effort results in increased fishing cost and reduces profits; decrease recreational participation	**Negative, short term** - reducing harvests reduces profits; reduce recreational participation. **Positive, long term** - as harvests allowed to approach OY, profits increase; increased recreational participation.	**Negative, short term** - reducing harvests reduces profits; reduce recreational participation. **Positive, long term** - as harvests allowed to approach OY, profits increase; increased recreational participation.
Dealers	**Positive** - Fishery has supported profitable landings	**Uncertain or zero effect** – replace domestic harvest with imports or substitutes.	**Zero, short term** - replace domestic harvest with imports or substitutes. **Positive, long term** - as harvests managed at OY, stable market.	**Zero, short term** - replace domestic harvest with imports or substitutes. **Positive, long term** - as harvests managed at OY, stable market.
Anglers	**Positive** - fewer restrictions allowing greater catches, increase recreational participation	**Negative** - lower catch per unit effort/effort results in reduced recreational participation	**Negative, short term** - lower catch per unit effort/effort results in reduced recreational participation. **Positive, long term** - as harvests allowed to approach OY, increase recreational participation.	**Negative, short term** - lower catch per unit effort/effort results in reduced recreational participation. **Positive, long term** - as harvests allowed to approach OY, increase recreational participation.

VECs	Past Actions	Present Actions	Reasonably Foreseeable Future Actions	Combined Effects of Past, Present, and Future Actions
Infrastructure	**Positive** - Fishery has supported profitable fishing operations which have supported an increase in infrastructure. Recreational fishery participation expands.	**Negative** – Contraction of fishing operations resulting in fewer dollars available to support infrastructure. **Positive** - Recreational fishery participation increases.	**Negative, short term** - Contraction of fishing operations resulting in fewer dollars available to support infrastructure. Recreational fishery participation declines. **Positive, long term** - as harvests allowed to approach OY, fishery expands allowing more money to support infrastructure. Recreational fishery participation expands.	**Negative, short term** - Contraction of fishing operations resulting in fewer dollars available to support infrastructure. Recreational fishery participation declines. **Positive, long term** - as harvests allowed to approach OY, fishery expands allowing more money to support infrastructure. Recreational fishery participation expands.
Administration	**Positive** - Fewer regulations minimized administrative and enforcement requirements	**Negative** - overfishing of stocks requires increased regulations and enforcement costs	**No effect** - Measures used to ensure compliance with regulations already in effect	**Negative, short term** - overfishing of stocks requires increased regulations and enforcement costs. **Positive, long term** – New programs enhance monitoring and enforcement

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

The cumulative effects of the rebuilding plan for gag and restricting red grouper harvests from expanding on the biophysical and socioeconomic environments are positive since they will ultimately restore/maintain the stocks at a level that will allow the maximum benefits in yield and recreational fishing opportunities to be achieved. However, short-term negative impacts on the fisheries' socioeconomic environment may occur due to the need to limit directed harvest and reduce bycatch mortality. These negative impacts can be minimized for the recreational fishery by using combinations of bag limits, size limits and closed seasons and for the commercial fishery by using combinations of trip limits, size limits or season closures that will provide the least disruption while maintaining TAC.

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

The effects of the proposed actions are, and will continue to be, monitored through collection of landings data by NMFS, stock assessments and stock assessment updates, life history studies, economic and social analyses, and other scientific observations. Landings data for the recreational sector in the Gulf of Mexico is collected through MRFSS, NMFS' Headboat Survey, and the Texas Marine Recreational Fishing Survey. MRFSS is currently being replaced by Marine Recreational Information Program (MRIP), a program designed to improve the monitoring of recreational fishing. Commercial data is collected through trip ticket programs, port samplers, and logbook programs. Currently, SEDAR assessments of Gulf of Mexico gag and red grouper are scheduled for 2011.

5.15 Unavoidable Adverse Effects

Catch quotas, minimum size limits, bag limits, and seasonal closures, are generally effective in limiting total fishing mortality, the type of fish targeted, the number of targeted fishing trips, and/or the time spent pursuing a species. However, these management tools have the unavoidable adverse effect of creating regulatory discards. Discard mortality must be accounted for in a stock assessment as part of the allowable biological catch, and thus restricts TACs. Gag discard mortality rates were estimated in SEDAR 10 (2006) at 67 percent for the commercial fishery, and, dependent on the geographic region and depth zone fished, 11-42 percent (average 20 percent) for the recreational fishery. While the release mortality rate is higher in the commercial fishery than in the recreational fishery, the number of discards is significantly lower in the commercial fishery than the recreational fishery. A review of the discard mortality data conducted in SEDAR 12 (2007) indicated appropriate discard mortality levels for red grouper were 10 percent for the recreational, handline, and trap fisheries and 45 percent for the longline fishery. Information of gag and red grouper discard mortality rates are described in more detail in Section 4.

This amendment considers several management measures to reduce grouper discards and discard mortality. Alternatives that could either directly or indirectly reduce red grouper, gag, and shallow-water bycatch, include lower grouper minimum size limits (Actions 9 and 10), a higher

recreational red grouper bag limit (Action 9), and pamphlets and prominently displayed placards describing proper handling and release methods (Action 10). Other alternatives considered in this amendment that may increase grouper bycatch include a lower gag bag limit, longer recreational closed seasons, and commercial quota closures. In addition, the rule implementing Amendment 27/14 requires venting tools, dehookers, and non-stainless steel circle hooks be onboard reef fish fishing vessels in an effort to reduce discard mortality.

Many of the current participants in the reef fish fishery may never recuperate losses incurred from the more restrictive management actions imposed in the short-term to end overfishing of gag. Because gag is but one of the reef fish species managed in the Reef Fish FMP, short-term losses are not expected to be significant, and other species may be substituted to make up for losses to the fishery. With the anticipated recovery of the stock, future participants in the reef fish fishery will benefit. Overall, short-term impacts of actions such as reductions in total allowable harvest for the directed fishery would be offset with much higher allowable catch levels as the stock recovers and is rebuilt.

Actions considered in this amendment should not have adverse effects on public health or safety since these measures should not alter actual fishing practices, just how or when activities can occur. Unique characteristics of the geographic area are highlighted in Section 3. Adverse effects of fishing activities on the physical environment are described in detail in Sections 5.1-5.13. These sections conclude little impact on the physical environment should occur from actions proposed in this document. Uncertainty and risk associated with the measures are described in detail in the same sections as well as assumptions underlying the analyses.

5.16 Relationship Between Short-term Uses and Long-term Productivity

The objectives of this amendment and associated EIS are fourfold. The first objective is to define MSST and OY, and to possibly redefine MFMT, and to set a TAC and management measures that will end overfishing of gag. Because the red grouper stock has recovered from an overfished state, the second objective is to increase red grouper TAC consistent with a level that would achieve OY. Two other objectives of this amendment are to co-manage gag and red grouper by implementing concurrent management measures, and to consider the expansion of the existing marine reserves or to create new reserves to better protect gag stocks.

Objectives related to gag management would require reducing fishing and bycatch mortality from both directed and incidental harvest sectors. The relationship between short-term economic uses and long-term economic productivity are discussed in the preceding section. However, because gag is but one species in the reef fish complex, these effects may be mitigated through effort shifting to other species and may not be significant.

5.17 Mitigation, Monitoring and Enforcement Measures

The process of ending overfishing on gag stocks, co-managing red grouper and gag, and expanding prior or creating new marine reserves are expected to have a negative short-term effect on the social and economic environment, and will create a burden on the administrative environment. No alternatives are being considered that would avoid these negative effects

because they are a necessary cost associated with rebuilding and protecting these stocks in the reef fish fishery. The range of alternatives has varying degrees of economic costs and administrative burdens. Some alternatives have relatively small short-term economic costs and administrative burdens, but would also provide smaller and more delayed long-term benefits. Other alternatives have greater short-term costs, but provide larger and more immediate long-term benefits. Therefore, it is difficult to mitigate these measures and managers must balance the costs and benefits when choosing management alternatives for the reef fish fishery.

To ensure overfishing of gag ends and ensure the harvest of red grouper does not exceed OY, periodic reviews of stock status are needed. These reviews are designed to incorporate new information and to address unanticipated developments in the respective fisheries and would be used to make appropriate adjustments in the reef fish regulations should harvest not achieve OY objectives. These assessments would be requested as needed by the SEDAR Steering Committee. It should be noted that these periodic stock assessments are not meant to replace the scheduled review by the Secretary of Commerce of rebuilding plans/regulations of overfished fisheries required under §304(e)(7) of the MSFCMA that is to occur at least every two years to ensure adequate progress toward stock rebuilding and ending overfishing. Additionally, NOAA Fisheries annually reports on the status of stocks in its Report to Congress.

Reviews will be based on periodic stock assessments. The next assessment for gag and red grouper is scheduled to occur in 2011. These assessments should benefit from updated landings information through state and federal fishery monitoring programs. Additionally, NMFS and other government agencies support research on these species by federal, state, academic, and private research entities.

Based on annual updates on the harvest or on projected stock status from the periodic stock assessments, NMFS may file a notification a fishery needs to be closed should harvest exceed gag and red grouper TACs (See Action 6 on Accountability Measures). Depending on the outcome of the assessments, the Council may determine further management action should be taken. Actions that the Council could employ to further restrict harvest include, but would not be limited to changes in size limits, bag limits, seasonal closures, or area closures. The Council has four options for implementing these measures. The first is to amend the Reef Fish FMP to include new information and management actions. Recent plan amendments put forth by the Council have taken between two and three years from conception to implementation. The second method is a regulatory amendment based on the framework established in Amendments 1 and 4 of the Reef Fish FMP to set TAC. Appropriate regulatory changes that may be implemented through framework include: 1) setting the TAC's for each stock or stock complex to achieve a specific level of ABC; and 2) bag limits, size limits, vessel trip limits, closed seasons or areas, gear restrictions, and quotas designed to achieve the TAC level (GMFMC 1989; 1991). However, TAC and catch limits may be adjusted only after a new stock assessment has been completed. Recent regulatory amendments have taken between 9 months and two years from conception to implementation.

The NMFS may take other management actions through emergency or an interim measures. Emergency actions and interim measures only remain in effect for 180 days after the date of publication of the rule and may be extended by publication in the *Federal Register* for one

additional period of not more than 186 days provided the public has had an opportunity to comment on the emergency actions and interim measures. The MSFCMA further states that when a Council requests that an emergency action and interim measure be taken, the Council should also be actively preparing plan amendments or regulations that address the emergency on a permanent basis.

What type of rule making vehicle the NMFS or the Council determine is needed is difficult to predict. Actions would be dictated by the severity of overages in harvest and by the time frame needed to implement a regulatory change. If the overage in harvest is small, but would still allow the stock to recover within the maximum time frame required by NMFS guidance, NMFS could apply the accountability measures. Should the overage be severe, the Council could ask for an emergency action or interim rule that would severely restrict or halt the harvest of gag or red grouper while the Council explores management measures that would bring the harvest to levels consistent with those defined by the rebuilding plan.

Current reef fish regulations are labor intensive for law enforcement officials. NMFS law enforcement officials work cooperatively with other federal and state agencies to keep illegal activity to a minimum. Violators are penalized, and for reef fish commercial and reef fish for-hire operators, permits required to operate in their respective fisheries can be sanctioned.

Reef fish management measures include a number of area-specific regulations where reef fish fishing is restricted or prohibited in order to protect habitat or spawning aggregations of fish, or to reduce fishing pressure in areas that are heavily fished. Additionally, this amendment includes alternative to expand existing or create new marine reserves. To improve enforceability of these areas, the Council has established a VMS program for the commercial reef fish fishery to improve enforcement. VMS allows NMFS enforcement personnel to monitor compliance with these area-specific regulations, and track and prosecute violations.

5.18 Irreversible and Irretrievable Commitments of Resources

There are no irreversible or irretrievable commitments of agency resources proposed herein. The actions to change quotas/allocations, size limits, bag limits, fishing seasons, and area quotas are readily changeable by the Council in the future. There may be some loss of immediate income (irretrievable in the context of an individual not being able to benefit from compounded value over time) to some sectors from the restricted fishing seasons caused by quota closures.

5.19 Any Other Disclosures

CEQ guidance on environmental consequences (40 CFR §1502.16) indicates the following elements should be considered for the scientific and analytic basis for comparisons of alternatives. These are:

a) Direct effects and their significance.
b) Indirect effects and their significance.

c) Possible conflicts between the proposed action and the objectives of federal, regional, state, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned.
d) The environmental effects of alternatives including the proposed action.
e) Energy requirements and conservation potential of various alternatives and mitigation measures.
f) Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.
g) Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.
h) Means to mitigate adverse environmental impacts.

Items a, b, d, e, f, and h are addressed in Sections 2, 3, 4, and 5.1-5.13. Items a, b, and d are directly discussed in Sections 2 and 5. Item e is discussed in economic analyses. Alternatives that encourage fewer fishing trips would result in energy conservation. Item f is discussed throughout the document as fish stocks are a natural and depletable resource. A goal of this amendment is to make these stocks sustainable resources for the nation. Mitigations measures are discussed in Section 5.16. Item h is discussed in sections 3 and 5, with particular mention in Section 5.17.

The other elements are not applicable to the actions taken in this document. Because this amendment concerns the management of two marine fish stocks, it is not in conflict with the objectives of federal, regional, state, or local land use plans, policies, and controls (Item c). However, it should be noted the goals of this amendment are to end overfishing on gag, maintain both gag and red grouper stocks at a biomass level sufficient to allow the fisheries to harvest at OY, and to consider the expansion of the existing marine reserves or to create new reserves to better protect gag stocks. These are goals the federal government shares with regional and state management agencies (see Section 3.5 – Administrative environment). Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures (Item g) is not a factor in this amendment. The actions taken in this amendment will affect a marine stock and its fishery, and should not affect land-based, urban environments.

With respect to the ESA, fishing activities pursuant the reef fish fishery should not affect endangered and threatened species or critical habitat in any manner not considered in prior consultations on this fishery. The most recent Biological Opinion (BiOp) on the Gulf of Mexico reef fish fishery was completed on February 15, 2005. The BiOp concluded authorization of this fishery is not likely to jeopardize the continued existence of endangered green, leatherback, hawksbill, and Kemp's ridley sea turtles, threatened loggerhead sea turtles, and endangered smalltooth sawfish. All other ESA-listed species at that time were all found not likely to be adversely affected or not affected. On July 17, 2006, an informal section 7 consultation determined threatened elkhorn coral and staghorn coral, listed subsequent to the February 15, 2005, opinion, are also not likely to be adversely affected by this fishery. With respect to the Marine Mammal Protection Act, fishing activities conducted under the Reef Fish FMP should have no adverse impact on marine mammals. The reef fish fishery is prosecuted primarily with

longline and hook-and-line gear, and is classified in the 2008 List of Fisheries (72 FR 14466, November27, 2007) as Category III fishery. This classification indicates the annual mortality and serious injury of a marine mammal stock resulting from any fishery is less than or equal to 1 percent of the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock, while allowing that stock to reach or maintain its optimum sustainable population. The proposed actions are not expected to alter existing fishing practices in such a way as to alter the interactions with marine mammals.

Because the proposed actions are directed towards the management of naturally occurring species in the Gulf of Mexico, the introduction or spread of nonindigenous species should not occur.

6. REGULATORY IMPACT REVIEW

6.1 Introduction

The National Marine Fisheries Service (NMFS) requires a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. The RIR does three things: (1) it provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action; (2) it provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problem; and, (3) it ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost-effective way. The RIR also serves as the basis for determining whether the proposed regulations are a "significant regulatory action" under the criteria provided in Executive Order (E.O.) 12866 and provides some information that may be used in conducting an analysis of impacts on small business entities pursuant to the Regulatory Flexibility Act (RFA). This RIR analyzes the probable impacts that management alternatives in this amendment to the Reef Fish FMP would have on the commercial and recreational reef fish sectors.

6.2 Problems and Issues in the Fisheries

Problems addressed by the proposed amendment to the Reef Fish FMP are discussed in Section 1.2 of this document and are included herein by reference.

6.3 Objectives

Management measures under consideration in this amendment aim to address gag (SEDAR 10) and red grouper (SEDAR 12) assessment recommendations. This amendment proposes to reduce the harvest of gag grouper in order to end overfishing and implement concordant red grouper harvest levels. The amendment also proposes to set management thresholds and targets for gag grouper that comply with the SFA. Measures considered in this amendment also include the establishment of accountability measures and annual catch limits, the concordance between federal and state regulations, the establishment of requirement of federal regulatory compliance, the creation of additional marine reserves, and extension of existing ones.