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Public Hearing Draft of Amendment 35 to Reef Fish Fishery Management Plan

Addressing Changes to the Greater Amberjack Rebuilding Plan and Adjustments to the Stock Annual Catch Limit

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ABBREVIATIONS USED IN THIS DOCUMENT

ABC	Acceptable biological catch
ACL	Annual catch limit
ACT	Annual catch target
ALS	Annual landings summary
AMs	Accountability measures
APA	Administrative Procedures Act
ASPIC	A Stock-Production Model Incorporating Covariates
B	Biomass
B_{MSY}	Stock biomass level capable of producing an equilibrium yield of MSY
CI	Confidence Interval
Council	Gulf of Mexico Fishery Management Council
CPUE	Catch per unit effort
CS	consumer surplus
CZMA	Coastal Zone Management Act
DQA	Data Quality Act
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
F	Instantaneous rate of fishing mortality
FL	fork length
F_{MSY}	Fishing mortality rate corresponding to an equilibrium yield of MSY
F_{OY}	Fishing mortality rate corresponding to an equilibrium yield of OY
$F_{30\% \text{ SPR}}$	Fishing mortality corresponding to 30% spawning potential ratio
FMP	Fishery Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
HAPC	Habitat Area of Particular Concern
HBS	Headboat Survey
IRFA	Initial Regulatory Flexibility Analysis
LOF	List of Fisheries
M	Mortality
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MFMT	Maximum Fishing Mortality Threshold
MMPA	Marine Mammal Protection Act
mp	million pounds
MRFSS	Marine Recreational Fisheries Survey and Statistics
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
NMFS	NOAA's National Marine Fisheries Service
nm	nautical mile
NOR	net operating revenues
OMB	Office of Management and Budget
OY	Optimum Yield
PRA	Paperwork Reduction Act
PS	Producer surplus
QMS	Quota Monitoring System

RA	Regional Administrator
RFA	Regulatory Flexibility Act of 1980
RFFMP	Reef Fish Fishery Management Plan
RIR	Regulatory Impact Review
Secretary	Secretary of Commerce
SEDAR	Southeast Data, Assessment and Review
SEFSC	Southeast Fisheries Science Center
SSBR	Spawning Stock Biomass per Recruit
SSC	Scientific and Statistical Committee
SoVI	Social Vulnerability Index
SPR	Spawning Potential Ratio
TAC	Total Allowable Catch
TPWD	Texas Parks and Wildlife Department
VPA	Virtual Population Analysis
ww	Whole weight

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Name of Action

TYPE OF ACTION

( ) Administrative
(X) Draft
( ) Legislative
( ) Final

1.0 INTRODUCTION

1.1 Status of the Greater Amberjack Stock in the Gulf of Mexico

The greater amberjack update assessment was completed and reviewed by the Scientific and Statistical Committee (SSC) at their March 2011 meeting. The SSC accepted the 2011 Southeast Data Assessment and Review (SEDAR) Greater Amberjack Update as the best scientific information available. However, yield projections were considered unreliable because they showed large sensitivity to small changes in initial conditions, fishing mortality rates, and catch. Both Tier 1 and Tier 2 of the Acceptable Biological Catch (ABC) control rule which was developed by the SSC require reliable yield projections. Therefore, the SSC decided to use Tier 3b from the ABC control rule, in which the ABC is based on recent year's landings, for setting greater amberjack overfishing limit (OFL) and acceptable biological catch (ABC). In order to emphasize the need for a new benchmark stock assessment as soon as possible that could address the issues in the current Update Assessment, the SSC recommended ABC for a time period of three years beginning in 2011. However, this amendment is not likely to be implementation until 2012. Using Tier 3b from the ABC control rule the SSC set the OFL for greater amberjack equal to the weight of the mean landings for the most recent ten years (2000-2009). The OFL derived through Tier 3b by using mean landings estimated from the recent ten years is 2.38 million pounds (mp) whole weight. The SSC recommended the ABC be set at 75% of that ten-year mean which is 1.78 mp whole weight. (http://www.gulfcouncil.org/docs/SSC%20Reports/March_2011_Reef_Fish_SSC_Summary_Minutes.pdf) Greater amberjack is in its 9th year of the rebuilding plan, which ends in 2012. The management measures in this amendment are expected to reduce overfishing, but until a new stock assessment has been completed it is unknown if greater amberjack will meet its rebuilding schedule.

During the April 2011 Gulf Council meeting the status of the greater amberjack stock was discussed and during the development of this amendment several concerns were brought up. Because the SSC had declared the update assessment to be the best available scientific information, yet did not utilize the assessment when setting OFL and ABC, the Council was confused as to whether the assessment had been accepted or rejected. In an October 2011 meeting the SSC responded to the Council's request for clarification by passing two motions. The first motion was to accept the current stock status results from the 2011 Update Assessment of greater amberjack, including the F/F_{MSY} (overfishing) and B/B_{MSY} (overfished) status. This motion was a close vote, but passed dividing the SSC. The second motion, which passed unanimously with one abstention, was to reject the projections from the 2011 greater amberjack update for the purposes of developing management advice, specifically setting OFL and ABC (http://www.gulfcouncil.org/docs/SSC%20Reports/October_2011_Reef_Fish_SSC_Summary_Minutes.pdf). In other words, the SSC felt that the assessment was useful for determining the current status of the stock, but not for projecting what future catch levels would be needed to end overfishing and rebuild the stock. Consequently, the SSC did not make any specific recommendations regarding how much fishing mortality needed to be reduced to end overfishing or rebuild the overfished stock. Instead, the SSC made recommendations for OFL and ABC based on Tier 3b of the ABC control rule. However, the SSC only made recommendations for

OFL and ABC for three years in order to emphasize that a Benchmark Assessment is needed as soon as possible. Due to greater amberjack being in their 9th year of the rebuilding plan it will be unknown whether the stock has rebuilt within the ten-year target (by the end of 2012) until a new stock assessment has been completed. As of the November 9, 2011 Southeast Data Assessment and Review (SEDAR) Steering Committee meeting greater amberjack is scheduled for a Benchmark Assessment in 2013. Members of the SSC recommended important information that will be is needed prior to the next stock assessment such as additional aging studies and fishery-independent data in the Gulf of Mexico (2010 Update Assessment).

The greater amberjack stock has been under a rebuilding plan since 2003 with implementation of Secretarial Amendment 2. In 2006, a stock assessment was completed and determined the greater amberjack stock was not recovering at the rate previously projected. The stock was declared to be overfished and is undergoing overfishing (SEDAR 9 2006). The Gulf of Mexico Fisheries Management Council and NOAA Fisheries Service developed and implemented Amendment 30A to the Reef Fish FMP in response to the stock assessment results in order to end overfishing and rebuild the stock (GMFMC 2008). The minimum reduction required to rebuild the stock by 2012 was 40% of current fish mortality. The Stock ACL (equivalent to total allowable catch (TAC)) implemented in Amendment 30A was 1,871,000 pounds whole weight for 2008 through 2010 (GMFMC 2008). Amendment 30A also established quotas for the recreational and commercial sector at 1,368,000 and 503,000 pound whole weight, respectively. In addition to establishing quotas, Amendment 30A also implemented sector accountability measures. If either sector exceeds their sector allocation of the Stock ACL, the Assistant Administrator for Fisheries can close that sector for the remainder of the year. Additionally, if the sector's landings exceed their share of Stock ACL, the Assistant Administrator for Fisheries can reduce the fishing season for the time necessary to recover the overage in the following fishing year.

Secretarial Amendment 2 to the Reef Fish FMP established a rebuilding plan for greater amberjack based on a stock assessment conducted in 2000. That assessment determined that the greater amberjack stock was overfished and undergoing overfishing as of 1998 (Turner et al. 2000). Management measures to reduce the recreational bag limit from three to one fish were implemented in January 1997 and the commercial seasonal closure from March through May was implemented in January 1998; however, these closures were not incorporated into the assessment. The projected effects of these management measures were expected to eliminate overfishing; therefore, no new management measures were implemented.

Based on the parameter estimates from the SEDAR 9 2006 stock assessment, the stock was determined to be overfished ($B_{2004}/B_{MSY} < 1.0$) and undergoing overfishing ($F_{2004}/F_{MSY} > 1.0$). Biomass was less than half of B_{MSY} and fishing mortality was 52% too high in 2004. Stock biomass declined from at least 1986 through 1998 and then increased through 2003. However, these results were very dependent upon the weighting applied to the catch rate indices by fishing sector. The base-case model weighted the indices by the proportion of total catch for each sector over the last eight years. When each catch rate is weighted equally, the stock remains overfished but less so than the base case (SEDAR 9 2006).

1.2 Landings Data

Prior to Amendment 30A, there was not a specified allocation of the Stock ACL (equivalent to total allowable catch) for the recreational and commercial sectors. In Amendment 30A, the Council selected an interim allocation (73% recreational: 27% commercial) that would remain in effect until the Council, through the recommendations of an Ad Hoc Allocation Committee, could implement an amendment that fairly and equitably addresses the allocation of greater amberjack between the recreational and commercial sectors.

In 2010 both sectors exceeded their quotas for greater amberjack based on final landings (Table 1.2.1). The commercial quota was adjusted from 503,000 pounds to 373,072 pounds to account for a 2009 overage. The commercial sector was closed on October 28, 2010; however, final landings indicate that the sector exceeded its quota by 160,909 pounds whole weight (ww). Therefore, the 2011 commercial quota is 342,091 pounds ww.

The 2010 recreational quota was adjusted from 1,368,000 pounds ww to 1,243,184 pounds ww to account for a 2009 overage (Table 1.2.1). High landings in the September and October, despite the Deepwater Horizon disaster, indicate the 2010 quota was exceeded by 52,776 pounds ww. Therefore, the 2011 recreational quota is 1,315,244 pounds.

Table 1.2.1. Recreational and commercial landings of greater amberjack (pounds whole weight) from 2002 to 2009. Recreational landings were estimated (AB1) from the MRFSS, Texas Parks and Wildlife Division (TPWD), and Headboat Survey sources 2002 to 2010.

Year	For Hire	Recreational	Recreational Total	Commercial	Grand Total	Total Allowable Catch
2002	1,404,115	643,471	2,047,586	787,489	2,835,075	
2003	1,290,239	1,369,746	2,659,985	994,457	3,654,442	2,900,000
2004	1,239,120	1,142,251	2,381,371	975,870	3,357,241	2,900,000
2005	535,200	909,513	1,444,713	743,916	2,188,629	2,900,000
2006	1,021,574	390,384	1,411,958	632,583	2,044,541	5,200,000
2007	746,928	331,524	1,078,452	618,505	1,696,957	5,200,000
2008	594,398	705,833	1,300,231	504,114	1,804,345	1,871,000
2009	816,918	777,489	1,594,407	632,849	2,227,256	1,871,000
2010	688,217	764,027	1,452,244	533,981	1,986,225	1,871,000

Source: Data from SEDAR 9 Update Assessment March 2011. Calculated commercial landings were obtained from Table 3.2.4 (p. 36), recreational landings from Table 4.1.3.1 (p. 49). Commercial data included longline, vertical line and all other applicable gear types (e.g., trolling and diving with a spear). Monroe County landings were considered the South Atlantic landings.

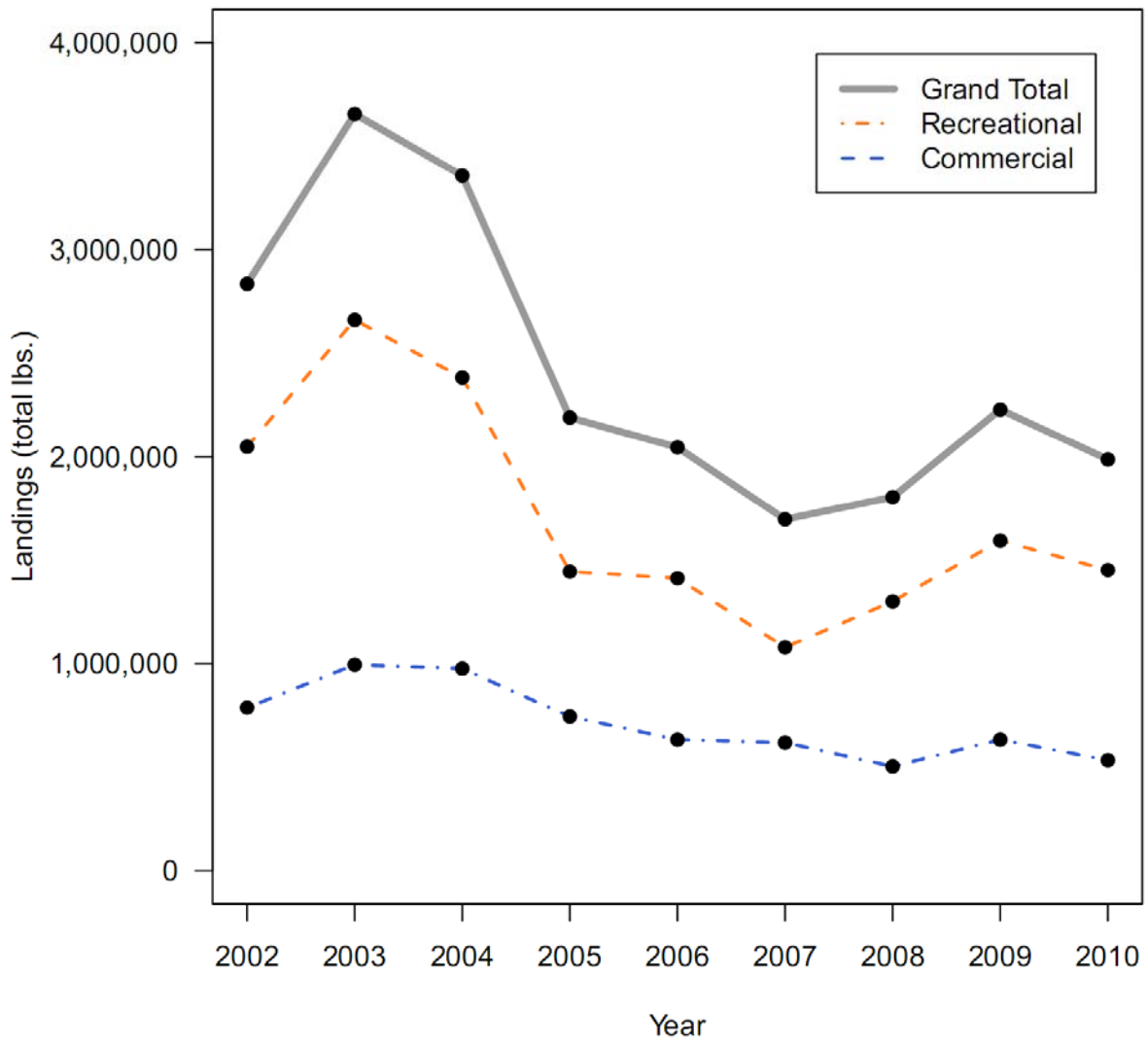

Figure 1.2.1. Recreational, commercial, and total landings in pounds whole weight of greater amberjack from 1981 through 2010. Source: SEDAR 9 Update Assessment (2011). Recreational landings were estimated (AB1) from the MRFSS, Texas Parks and Wildlife Division (TPWD), and Headboat Survey. Commercial data included longline, vertical line and all other applicable gear types (e.g., trolling and diving with a spear).

1.3 Greater Amberjack Reproductive Biology Summary

Recent studies conducted in the South Atlantic have consistently estimated that the greater amberjack peak spawning season occurs in April and May (Sedberry et al. 2006; Harris et al. 2007); whereas, studies conducted in the Gulf of Mexico have consistently estimated that peak spawning occurs a month earlier during March and April (Wells and Rooker 2002; Murie and

Parkyn 2008). A more complete description of greater amberjack reproductive biology and early life history can be found in Section 3.2.

Murie and Parkyn (2008) completed a recent study on reproductive biology of greater amberjack throughout the Gulf of Mexico using fishery-dependent as well as fishery-independent data from 1989-2008. They found females were significantly larger than males, peak spawning occurred during March and April, and by May, they documented low gonad weights indicating spawning was ending. For females, 50% of individuals were mature at 900 mm FL (35 inches FL), larger than what Harris et al. (2007) documented off south Florida.

It was suggested in the Harris et al. (2007) study that there were known spawning aggregations of greater amberjack targeted by fishers in the South Atlantic, but no evidence of this was presented. Observations by SCUBA divers in Belize documented greater amberjack in pair courtship when they were in a school of approximately 120 fish (Graham and Castellanos 2005). However, no evidence of spawning aggregations from their study was discussed by the Murie and Parkyn (2008) in the Gulf of Mexico study or other earlier studies in the Gulf.

1.4 Purpose and Need

The purpose of this amendment is to adjust the greater amberjack rebuilding plan in response to results from the 2011 Update Assessment and subsequent Scientific and Statistical Committee review and recommendations for acceptable biological catch (ABC). Following review of the 2011 Update Assessment the Scientific and Statistical Committee recommended an ABC of 1,780,000 pounds whole weight (ww). The need for this amendment is that the current Stock ACL (equivalent to the total allowable catch (TAC)) of 1,871,000 pounds ww established in Amendment 30A exceeds the ABC recommendation. Further rationale for the need of this amendment is based on a section 600.310(g)(3) of the National Standard 1 annual catch limit (ACL) and accountability measure (AM) guidelines (NS1) which states "If catch exceeds the ACL for a given stock or stock complex more than once in the last four years, the system of ACLs and AMs should be re-evaluated, and modified if necessary, to improve its performance and effectiveness." The greater amberjack Stock ACL has been exceeded twice in the last three years; therefore, this document includes a range of draft alternatives for adjusting the Stock ACL (equivalent to TAC), as well as subsequent recreational and commercial management measures to improve effectiveness of the Stock ACL and benefits to the greater amberjack stock in the Gulf of Mexico.

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires NOAA Fisheries Service and regional Fishery Management Councils to prevent overfishing, rebuild overfished stocks, and to protect, restore and promote long-term health and stability of the fishery, achieve, on a continuing basis, the optimum yield from federally managed fish stocks. These mandates are intended to ensure fishery resources are managed for the greatest overall benefit to the nation, particularly with respect to providing food production, recreational opportunities, and protecting marine ecosystems. To further this goal, the Magnuson-Stevens Act requires fishery managers to specify through rebuilding plans their strategy for rebuilding overfished stocks to a sustainable level within a specified time frame (10 years for greater amberjack), provide accountability measures to minimize the risk of

overharvest, minimize bycatch levels, and bycatch mortality to the extent practicable, and ensure that management decisions are based on the best available scientific information.

1.5 History of Management

The Reef Fish FMP [with its associated environmental impact statement (EIS)] was implemented in November 1984. The original list of species included in the management unit consisted of snappers, groupers, and sea basses. Gray triggerfish and *Seriola* species, including greater amberjack, were in a second list of species included in the fishery, but not in the management unit. The species in this list were not considered to be target species because they were generally taken incidentally to the directed fishery for species in the management unit. Their inclusion in the Reef Fish FMP was for purposes of data collection, and their take was not regulated.

Amendment 1 [with its associated environmental assessment (EA), regulatory impact review (RIR), and initial regulatory flexibility analysis (IRFA)] to the Reef Fish FMP, implemented in 1990, added greater amberjack and lesser amberjack to the list of species in the management unit. It set a greater amberjack recreational minimum size limit of 28 inches fork length (FL) and a three-fish recreational bag limit, and a commercial minimum size limit of 36 inches FL. This amendment set as a primary objective of the FMP the stabilization of long-term population levels of all reef fish species by establishing a survival rate of biomass into the stock of spawning age to achieve at least 20% spawning stock biomass per recruit (SSBR), relative to the SSBR that would occur with no fishing. A framework procedure for specification of TAC was created to allow for annual management changes. This amendment also established a commercial vessel reef fish permit as a requirement for harvest in excess of the bag limit and for the sale of reef fish.

Amendment 4 (with its associated EA and RIR), implemented in May 1992, added the remaining *Seriola* species (banded rudderfish and Almaco jack) to the management unit, and established a moratorium on the issuance of new commercial reef fish vessel permits for a maximum period of three years.

Amendment 5 (with its associated supplemental EIS, RIR, and IRFA), implemented in February 1994, required that all finfish except for oceanic migratory species be landed with head and fins attached, and closed the region of Riley's Hump (near Dry Tortugas, Florida) to all fishing during May and June to protect mutton snapper spawning aggregations.

Amendment 12 (with its associated EA and RIR), submitted in December 1995 and implemented in January 1997, reduced the greater amberjack bag limit from three fish to one fish per person, and created an aggregate bag limit of 20 reef fish for all reef fish species not having a bag limit (including lesser amberjack, banded rudderfish, Almaco jack and gray triggerfish). NOAA Fisheries Service disapproved proposed provisions to include lesser amberjack and banded rudderfish along with greater amberjack in an aggregate one-fish bag limit and to establish a 28-inch FL minimum size limit for those species.

Amendment 15 (with its associated EA, RIR, and IRFA), implemented in January 1998, closed the commercial sector for greater amberjack Gulf-wide during the months of March, April, and May. A regulatory amendment in August 1999 (with its associated EA, RIR, and IRFA) closed two areas (i.e., create two marine reserves), 115 and 104 square nautical miles respectively, year-round to all fishing under the jurisdiction of the Council with a four-year sunset closure.

Generic Sustainable Fisheries Act Amendment (with its associated EA, RIR, and IRFA), partially approved and implemented in November 1999, set the MFMT for greater amberjack at $F_{30\%\ SPR}$. Estimates of MSY, MSST, and OY were disapproved because they were based on SPR proxies rather than biomass-based estimates.

Amendment 16B (with its associated EA, RIR, and IRFA), implemented in November 1999, set a slot limit of 14 to 22 inches FL for banded rudderfish and lesser amberjack for both the commercial and recreational fisheries, and an aggregate recreational bag limit of five fish for banded rudderfish and lesser amberjack.

Secretarial Amendment 2, implemented in July, 2003 for greater amberjack, specified MSY as the yield associated with $F_{30\%\ SPR}$ (proxy for F_{MSY}) when the stock is at equilibrium, OY as the yield associated with an $F_{40\%\ SPR}$ when the stock is at equilibrium, MFMT equal to $F_{30\%SPR}$, and MSST equal to (1-M)*B_{MSY} or 75% of B_{MSY}. It also set a rebuilding plan limiting harvest to 2.9 mp for 2003-2005, 5.2 mp for 2006-2008, 7.0 mp for 2009-2011, and for 7.9 mp for 2012. This was expected to rebuild the stock in seven years. Regulations implemented in 1997 and 1998 (Amendments 12 and 15) were deemed sufficient to comply with the rebuilding plan so no new regulations were implemented.

Amendment 30A implemented August 2008, was developed to stop overfishing of gray triggerfish and greater amberjack. The amendment established annual catch limits and accountability measures for greater amberjack and gray triggerfish. For greater amberjack, it modified the rebuilding plan, increased the recreational minimum size limit to 30 inches FL, set a zero bag limit for captain and crew of for-hire vessels, and set commercial and recreational quotas.

Temporary Rule implemented in June 2010, specified the greater amberjack accountability measures for annual catch limits for the 2010 fishing season. The accountability measures developed in Amendment 30A required the commercial and recreational quotas for greater amberjack to be reduced to compensate for exceeding the allowable harvest in 2009. The commercial quota went from 503,000 pounds whole weight to 373,072 pounds while the recreational harvest was reduced from 1,368,000 pounds to 1,243,184 pounds whole weight.

Regulatory Amendment implemented in June 2011, specified the greater amberjack recreational closed season from June 1 – July 31 (76 FR 23904). The intended effect of this final rule is to mitigate the social and economic impacts associated with implementing in-season closures. This amendment also allows the recreational sector to target at least one prized fish species such as red snapper throughout the year.

2.0 MANAGEMENT ALTERNATIVES

Action 1: Modifications to the Greater Amberjack Rebuilding Plan

Alternative 1: No Action – do not modify the greater amberjack rebuilding plan or adjust the Stock ACL defined as total allowable catch in Amendment 30A. The Stock ACL would remain at 1,871,000 pounds whole weight (except if overages occur). Based on the 27% commercial and 73% recreational allocation of greater amberjack the sector ACLs are as follows:

Stock ACL	Commercial ACL (quota)	Recreational ACL (quota)
1,871,000	503,000	1,368,000

Alternative 2: Modify the rebuilding plan for greater amberjack as specified by the Scientific and Statistical Committee using Tier 3b of the ABC Control Rule and set the Stock ACL at 1,780,000 pounds whole weight. Based on the 27% commercial and 73% recreational allocation of greater amberjack the sector ACLs are as follows:

Stock ACL = ABC	Commercial ACL (quota)	Recreational ACL (quota)
1,780,000	481,000	1,299,000

Preferred Alternative 3: Modify the rebuilding plan for greater amberjack using the Gulf Council's Preferred ACL/ACT Control Rule established in the Generic ACL/Accountability Measures (AM) Amendment. Using these methods:

Option a: would set stock ACL = 1,539,000 pounds ww as reduced from ABC.

Preferred Option b: would set the ACL = ABC = 1,780,000 pounds ww and ACT = 1,539,000 pounds whole weight as reduced from ACL. Based on the 27% commercial and 73% recreational allocation of greater amberjack the sector ACLs and ACTs are as follows:

Option a. Stock ACL	
Sector	**ACLs (quotas)**
Commercial	409,000
Recreational	1,130,000
Total	1,539,000

Preferred Option b. ACL = ABC and set an ACT		
Sector	**ACL = ABC**	**ACTs (quotas)**
Commercial	481,000	409,000
Recreational	1,299,000	1,130,000
Total	1,780,000	1,539,000

Alternative 4: Modify the rebuilding plan for greater amberjack and set the Stock ACL at 0 pounds until a new stock assessment has been completed.

Discussion:

This action would modify the rebuilding plan for greater amberjack in response to results from the 2011 Update Assessment and subsequent Scientific and Statistical Committee review and recommendations for acceptable biological catch (ABC). Amendment 30A to the Fishery Management Plan for Reef Fish Resources of the Gulf of Mexico established a Stock ACL of 1,871,000 pounds whole weight (ww), which exceeds the current ABC recommendation of 1,780,000 pounds ww recommended by the SSC. An additional goal of the amendment is to re-evaluate the Stock ACL due to both the recreational and commercial sectors exceeding their quotas twice in the last three years since implementation of Amendment 30A. The National Standard 1 guidelines section 600.310 (g)(3) states "If catch exceeds the ACL for a given stock or stock complex more than once in the last four years, the system of ACLs and AMs should be re-evaluated, and modified if necessary, to improve its performance and effectiveness".

Please note, for alternatives that do not establish ACTs the quotas for each sector are equal to the sector ACLs. For alternatives where ACT is used the quotas are equal to sector ACTs.

Alternative 1 is the no action alternative and would retain the current Stock ACL. Based on the 2011 Stock Assessment for greater amberjack and the subsequent Scientific and Statistical Committee (SSC) review and acceptable biological catch (ABC) recommendations the Council would be exceeding the ABC. Therefore, this alternative is not a viable option.

Alternative 2 would modify the rebuilding plan and set the Stock ACL at the ABC recommended by the SSC at 1,780,000 pounds whole weight (ww). Based on the 73% recreational and 27% commercial allocation the respective sector quotas would be 1,299,000 pounds ww for the recreational sector and 481,000 pounds ww for the commercial sector. **Alternative 2** would be a 5% reduction from the current Stock ACL. This alternative would establish the smallest reduction in Stock ACL compared to **Alternative 1** and therefore may not provide the best biological protection to greater amberjack which have been overfished and under a rebuilding plan since 2003. Further, since both sectors have exceeded their sector ACLs in the last two years (2009 and 2010) establishing a Stock ACL=ABC may continue to trigger accountability measures if sector quotas are exceeded. The SSC recommended an ABC for a time period of three years beginning in 2011. However, this amendment is not likely to be implemented until 2012. Greater amberjack is in the 9th year of their rebuilding plan and it is unknown whether the stock will be rebuilt within the ten-year target (by the end of 2012) until a new stock assessment has been conducted. The Southeastern Data Assessment and Review (SEDAR) Steering Committee, scheduled greater amberjack for a Benchmark Assessment in 2013 based on the November 9, 2011 schedule. After review of that Benchmark Assessment the next regulatory action the Council takes could replace those developed in this amendment.

Preferred Alternative 3 would modify the rebuilding plan for greater amberjack using the Gulf Council's Preferred ACL/ACT Control Rule established in the Generic ACL/AM Amendment.

Based on the ACL/ACT Control Rule and including landings through 2010 the subsequent buffer for the commercial sector is 15% and the recreational buffer is 13%. Although both sectors exceeded their quota twice in the last four years, the primary reason the commercial buffer is greater than the recreational buffer is that the commercial sector exceeded their quota by a greater margin (i.e., 26% in 2009 and 43% in 2010); whereas, the recreational sector exceeded their quota by 16% in 2009 and 4% in 2010. This alternative allows the Council to use an optional annual catch target (ACT) if they choose (**Preferred Option b**). Recently the Council selected to use ACT in the Generic ACL/AM Amendment for several stocks that do not have an assessment or in-season accountability measures. Currently the Council selected **Preferred Option b** the stock ACL = ABC =1,780,000 pounds ww and the ACT = 1,539,000 pounds ww. If the Council selected **Option a** the stock ACL = 1,539,000 pounds ww. Under **Preferred Alternative 3** the subsequent sector quotas would be 1,130,000 pounds ww for the recreational sector and 409,000 ww for the commercial sector.

Preferred Alternative 3 would be an 18% reduction from the current Stock ACL. However, **Option a** would set the Stock ACL and subsequent sector ACLs as the quotas, which if exceeded could trigger in-season and post-season accountability measures. Whereas, **Preferred Option b** would set the stock ACL = ABC = 1,780,000 pounds ww and establish an ACT = 1,539,000 pounds ww establishing a 13% buffer between the stock ACT and stock ACL. Under the current preferred alternative, if a sector ACT (quota) was exceeded accountability measures would not be triggered until the sector ACL was exceeded. The primary rationale for establishing an ACT is to manage a stock so that the sector ACLs are not exceeded triggering post-season accountability measures, such as overage adjustments. Therefore the key is to establish sector ACTs (quotas) with enough of a buffer below the sector ACLs so that once the sector ACT is projected to be reached the appropriate sector can be closed by the Assistant Administrator for Fisheries. Under the current **Preferred Alternative 3 Option b,** if the sector ACT is projected to be exceeded or is exceeded, in-season accountability measures would be triggered closing the appropriate sector. Post-season accountability measures such as overage adjustments would only occur if the respective sector ACL was exceeded. Any ACL overage by a sector would then reduce the ACT the following year, for the respective sectors ACT (quota) by the amount of the respective sector ACL overage. **Preferred Alternative 3**, **Option b** would provide an additional layer of protection to the resource by setting the quota equal to the sector ACT which is desirable due to the overfished status, compared to **Alternative 3**, **Option a, Alternative 2, or Alternative 1** (status quo).

Alternative 4 would modify the rebuilding plan for greater amberjack and set the Stock ACL at 0 pounds until a new stock assessment has been completed. Due to the results, review, and recommendations from the SSC the current stock status for greater amberjack is overfished and undergoing overfishing. However, the SSC did not make any specific recommendations regarding how much fishing mortality needed to be reduced to end overfishing or rebuild the stock. Instead the SSC made recommendations for OFL and ABC based on Tier 3b of the ABC control rule. Additionally, their recommendations were only for three years in order to emphasize that a Benchmark Assessment is needed as soon as possible. Greater amberjack is in their 9th year of the rebuilding plan and it is unknown whether the stock will be rebuilt within the ten-year target (end of 2012) until a new stock assessment has been conducted. **Alternative 4**

would be the most dramatic change to the fishery, but would provide the most protection to the resource by reducing the Stock ACL by 100% compared to **Alternative 1** (status quo).

Alternative 4 is expected to have the greatest positive impacts to the physical and biological environments by providing the most protection to the resource, but incur the greatest negative impacts to the economic and social environments. **Preferred Alternative 3 Option b** and **Alternative 3 Option a** are expected to provide greater positive biological effects to the environment compared to **Alternative 2** or **Alternative 1** (status quo). **Alternative 3**, **Alternative 2**, and **Alternative 1** are expected to provide positive impacts to the physical environment, but are not likely to be different from one another due to the greatest reduction in Stock ACL being 18% between **Alternative 1** and **Alternative 3**.

Action 2: Recreational Management Measures

***Note: A preferred alternative may be selected under each sub-action 2.1-2.2.**

Action 2.1 Modify the Recreational Minimum Size Limit for Greater Amberjack

Preferred Alternative 1: No Action – do not modify the current minimum size limit of 30" fork length.
Alternative 2: Modify the minimum size limit for greater amberjack to 32" fork length.
Alternative 3: Modify the minimum size limit for greater amberjack to 34" fork length.
Alternative 4: Modify the minimum size limit for greater amberjack to 36" fork length.

Action 2.2 Modify the Recreational Closed Seasons for Greater Amberjack

Preferred Alternative 1: No Action – do not modify the current fixed closed season June 1-July 31.
Alternative 2: Eliminate the fixed closed season and open January 1 until quota is filled.
Alternative 3: Modify the recreational seasonal closure to March 1- May 31.
Alternative 4: Modify the recreational seasonal closure to January 1- May 31 and November 1-December 31.
Alternative 5: Modify the recreational season closure to June 1-July 23.

Discussion:

Decision tools for the greater amberjack recreational and commercial scenarios have been developed to allow the Council to examine a range of options for each sector after establishing the Stock ACL in Action 1 (SERO-LAPP Gulf Amend 35 2011). The recreational decision tool provides estimates for both projected recreational landings and total projected recreational removals under any combination of the proposed management alternatives. Total projected recreational removals include dead discards which were modeled at 20% discard mortality during the 2011 Update Assessment. A short time series of observer data was available since 2006 on discard mortality. However, data were considered too brief and had too much variability to use but will be considered at the next benchmark assessment (2010 Update Assessment). Therefore, 20% was considered the best estimate until additional information on discard mortality has been conducted.

The Scientific and Statistical Committee provided the Council with a recommended ABC based on landed catch for greater amberjack, as opposed to the more traditional targets based upon approved stock projections with a required reduction in fishing mortality. Thus, the projected reduction tables presented below represent projected landed catch and the projected total removals also listed for comparative purposes (Table 2.2.2). If the Council chooses to include dead discards (total removals) to provide further biological protection for the stock, they could manage the fishery based on total projected removals and the landings goal would also be met. The removals target specified in the decision tool are based upon the assumption that the decrease in removals needed would be proportional to the decrease in landings. Typically, projection models from Southeast Data Assessment and Review (SEDAR) assume a proportional

decrease in discards with landed catch as fishing mortality rate (F) is reduced. Thus, this approach is consistent with approaches previously applied by the Gulf Council. Managing towards a removals target is more conservative than managing towards a landings target, as most management regulations used to decrease landed catch result in increased discarded catch. If release mortality rate is greater than 0%, then the removal rate does not decrease proportionally with reductions in landings due to an increase in dead discards.

The greater amberjack recreational decision model used 2009 landings to project 2012 landings for months in which the 2009 recreational fishery for Gulf greater amberjack was open. Smoothing, extrapolation, and historical monthly percentages of annual landings were used to backfill months in 2009 when the Gulf recreational greater amberjack fishery was closed or demonstrated departures from observed historical patterns. The recreational decision tool does not account for effort shifting that may take place during seasonal closures, nor does it consider any changes in the average size of greater amberjack during rebuilding. The model also does not account for increases in numbers of trips taken to compensate for implemented effort controls such as minimum size limits or closed seasons. As such, management reductions projected by the model may be overestimates, and caution should be taken in their interpretation and use. The recreational decision tool allows the Council to select any combination of the proposed management alternatives.

Action 2.1 would adjust the recreational minimum size to some other value between 32-36 inches fork length (FL). Based on recent macroscopic analysis of gonads by Murie and Parkyn (2008) in the Gulf of Mexico, 50% of female greater amberjack attain reproductive maturity at approximately 35 inches FL between 3 and 4 years of age, respectively (Figures 2.2.1 and 2.2.2). This is greater than the current 30 inch minimum size limit. The decision tool only allows the Council to select an increase in the minimum size limit based on the information about size at reproductive maturity for females in the Gulf of Mexico (Murie and Parkyn 2008). Bycatch and bycatch mortality has been taken into account in the model based on the 20% dead discard rate used in the 2010 Update Assessment.

Preferred Alternative 1 would maintain the current minimum size limit of 30 inches FL. Based on recreational landings in 2009-2010 the most frequently landed greater amberjack was 31 inches FL (Figure 2.2.3). Yield-per-recruit analysis based on the reduction in fishery mortality (F=0.33) needed to achieve maximum sustainable yield from the 2011 Update Stock Assessment estimates a maximum yield-per-recruit of 30 inches FL (Figure 2.2.4a). However, a 30 inch FL greater amberjack is approximately 2 years old and has not likely reproduced yet (Figures 2.2.1 and 2.2.2). Less than 5% of the females in the population at the current 30 inch FL minimum size limit have achieved reproductive maturity (Figure 2.2.1). Increases in minimum size limits increase spawning potential ratio (SPR) suggesting that a minimum size limit of 36 inches FL provides the best biological benefit to the resource (**Alternative 4**). Further, a SPR of 30% is not achieved under the reduced fishing mortality rate (F=0.33) unless the minimum size limit is increased to 36 inches FL (Figure 2.2.4b).

Alternative 2 would modify the minimum size limit for greater amberjack to 32 inches FL, which is still below the size that 50% of the females in the population were estimated to achieve reproductive maturity (Murie and Parkyn 2008). **Alternative 3** would modify the minimum size

limit for greater amberjack to 34 inches FL. **Alternative 4** would modify the minimum size limit for greater amberjack to 36 inches FL. At 36 inches FL, greater than 50% of female greater amberjack were estimated to be reproductively mature and this management measure would be consistent with the commercial sector's minimum size limit. Increasing the minimum size limit for greater amberjack would increase the stocks spawning potential ratio (Figure 2.2.4b). The target 30%SPR would be reached under reduced fishing mortality (F=0.33) and the 36 inch FL minimum size limit. However, as minimum size limits increase from 30 inches FL dead discards increase. The percent reduction in harvest expected from increasing the minimum size limit and the corresponding estimated dead discards are listed in Table 2.2.1. Estimates were derived from recreational landings (2008-2010) by three modes (MRFSS, Texas Parks and Wildlife, and headboat; n=767 greater amberjack) at 1-inch minimum size limits and comparisons were make between the 30 inch FL minimum size limit and 32, 34, and 36 inch FL increases, respectively. A 20% dead mortality rate was applied to the estimated percent reduction in landings as the minimum size limit increases, consistent with the 2011 Greater Amberjack Stock Assessment Update.

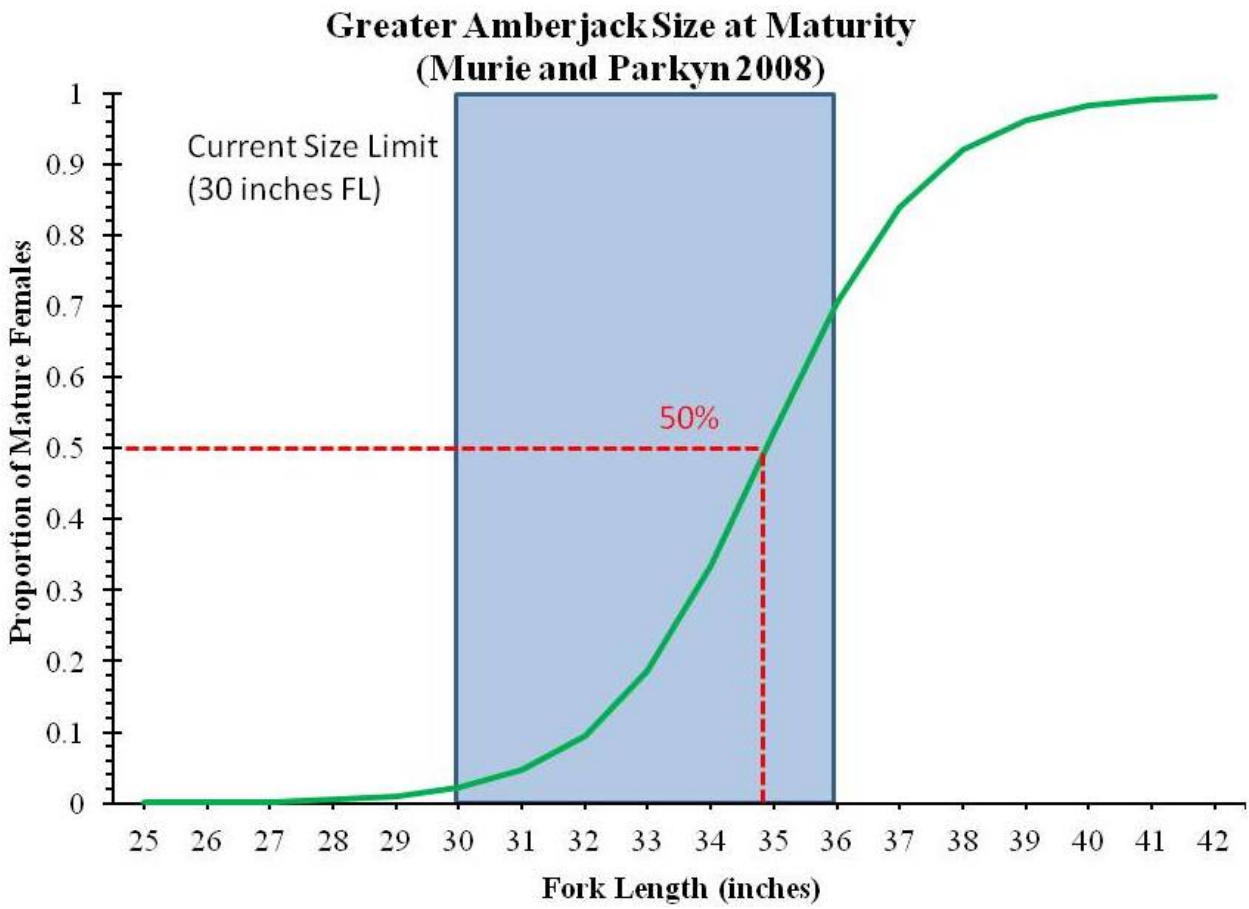

Figure 2.2.1. Proportion of mature females by length for greater amberjack in the Gulf of Mexico. Solid line represents the logistic regression model. Source: D. Murie, personal communication and SERO 2011.

Based on these estimates **Alternative 2** is expected to reduce harvest by 16% and increase dead discards by 4%. **Alternative 3** is expected to reduce harvest by 34% and increase dead discards by 9% and **Alternative 4** is expected to reduce harvest by 51% and increase dead discards by 13% (Table 2.2.1). No studies to date have examined discard mortality of greater amberjack in the recreational sector; however, headboat observer data may be a long enough time series to be used in the next stock assessment for greater amberjack. Fishers have stated during public testimony that larger greater amberjack fight harder and it takes long for them to recovery after release, if they recover at all.

Table 2.2.1. Estimated reduction in harvest and resulting dead discards based on the 20% mortality rate used in the 2011 Greater Amberjack Update Assessment.

Modify minimum size limit	Estimated harvest reduction	Estimated dead discards
30 to 32" (Alternative 2)	16.3%	4.1%
30 to 34" (Alternative 3)	34.4%	8.6%
30 to 36" (Alternative 4)	50.8%	12.7%

Source: Recreational landings from 2008-2010 including MRFSS, Texas Parks and Wildlife, and headboat mode (n=769 fish); personal communication N. Cummings, SEFSC stock assessment biologist, 2011.

Based on studies by Murie and Parkyn (2008) the predicted weights of greater amberjack using their weight-length parameters are in Table (2.2.2).

Table 2.2.2. Greater amberjack predicted weights using weight-length parameters from Murie and Parkyn (2008) study in the Gulf of Mexico.

Length		**Weight**	
Fork length (inches)	Fork length (mm)	Kilograms	Pounds
28	711	5.15	11.35
30 (status quo)	762	6.23	13.74
32	813	7.45	16.43
34	864	8.81	19.42
36	914	10.32	22.75

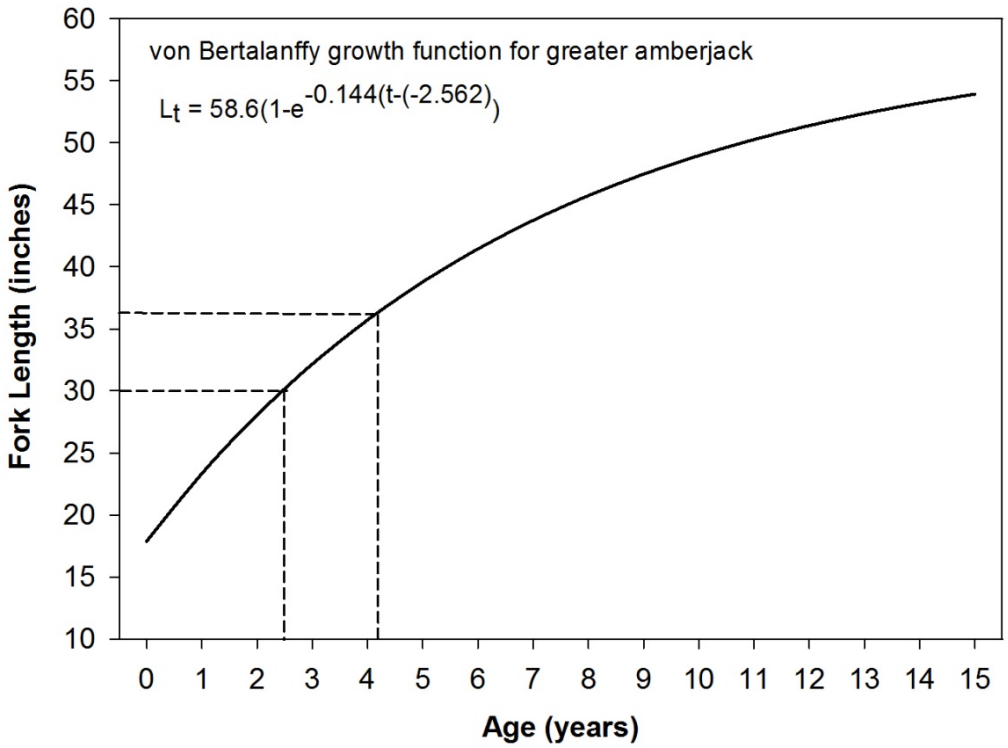

Figure 2.2.2. Von Bertalanffy growth equation and function in fork length (inches) by age (years). Source: SEDAR 9 with edits to convert centimeters into inches.

Alternative 4 is expected to provide the greatest benefits to the resource and the biological environment compared to **Alternatives 1, 2, and 3.** Impacts to the physical environment under **Alternative 4** compared to the other alternatives are not expected to be different than **Alternative 1** status quo.

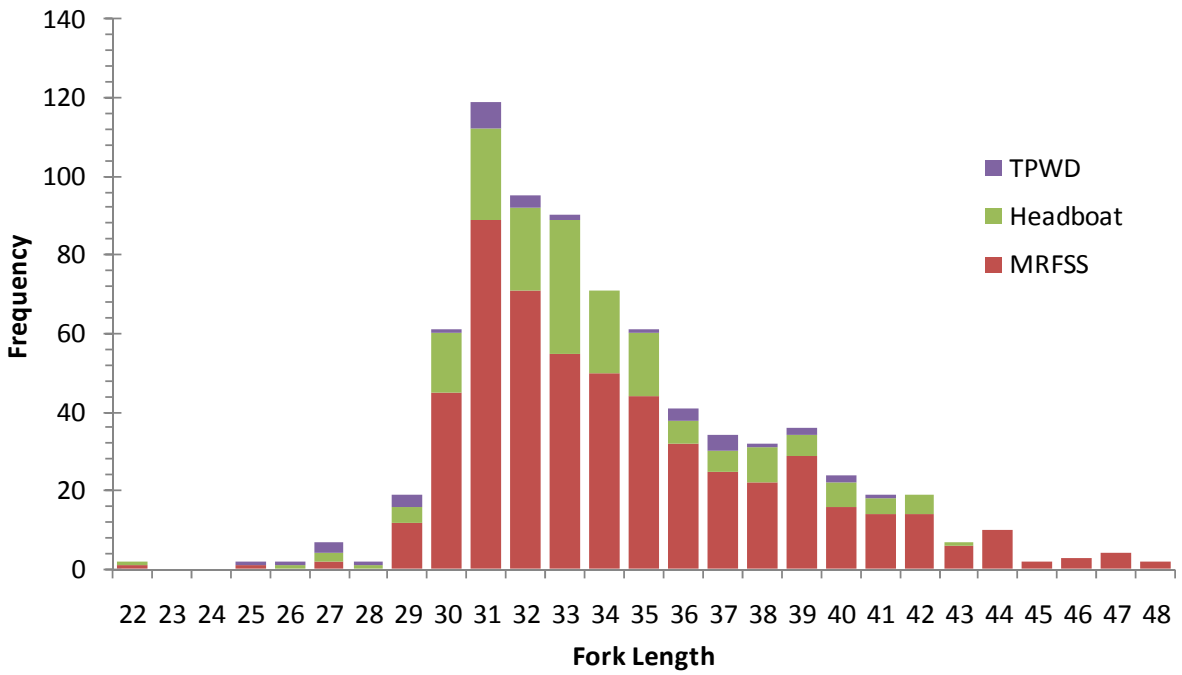

Figure 2.2.3. Size frequency distribution of recreational greater amberjack landings in 2009-2010 in the Gulf of Mexico. The current minimum size limit is 30 inches fork length. Note: Landings in red = Marine Recreational Fisheries Survey and Statistics (MRFSS), green = headboat, and purple = Texas Parks and Wildlife Division. Source: SERO 2011.

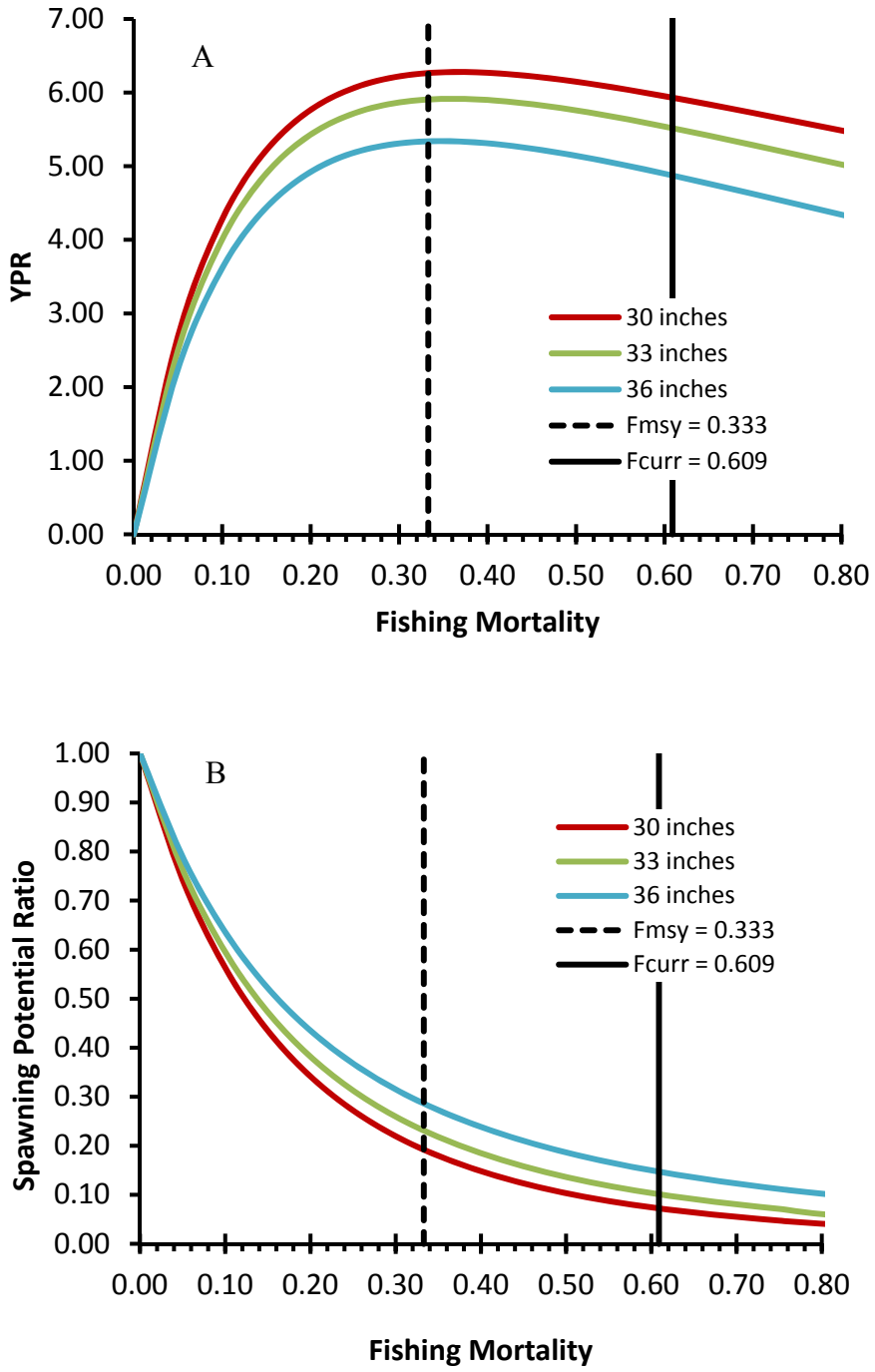

Figure 2.2.4. A). Yield-per-recruit functions for greater amberjack and B) spawning potential ratio for greater amberjack under $F_{current}$ = 0.61 and F_{msy}= 0.33 from 2011 Update Stock Assessment for three minimum size limit scenarios (30 inches FL currently for recreation sector; 33 inches FL; and 36 inches FL currently for commercial sector). Source: SERO 2011.

Action 2.2 would adjust the recreational fixed closed season for greater amberjack from the current fixed dates of June 1-July 31 (**Preferred Alternative 1**). The primary reason behind developing a fixed recreational closed season is to eliminate in-season quota closures in the fall, which can be very disruptive to the fishery. The regulatory amendment implemented this year (2011), provided a range of fixed closed seasons for the Council to choose. The rationale behind the current fixed closed season for greater amberjack was to have a highly targeted and prized fishery open when other species such as red snapper are closed. Also, several fishing rodeos occur in the fall and recreational fishers wanted to be able to fish for greater amberjack during this time. Another consideration is closing the recreational fishery during peak spawning in the Gulf of Mexico (March-April). A closure during March-May would be consistent with the current fixed closed season for the commercial sector. However, during the recent (2011) fixed closed season (when red snapper is open) some fishers voiced concerns about bycatch and bycatch mortality. Further, large greater amberjack which are targeted for their fighting ability have been anecdotally documented as dying after being brought close enough to the boat to release. Therefore, some additional alternatives are purposed such as eliminating the recently established fixed closed season as well as establishing a winter and spring closure.

Preferred Alternative 1 would maintain the current fixed closed season June 1-July 31. The primary reason behind developing a fixed recreational closed season was to eliminate in-season quota closures and allow one highly targeted species to be open when the other was closed (red snapper and greater amberjack). In addition, by establishing a fixed closed season the fishery is likely to stay open through the rest of the year. In 2009, the greater amberjack recreational sector closed in October, which can be very disruptive to the fishery and problematic for planed events such as fishing tournaments.

Alternative 2 would eliminate the fixed closed season (June 1-July 31) and the recreational fishery would open January 1 until quota is filled. This was the current recreational fishing season until the implementation of the 2011 Regulatory Amendment which established a fixed closed season June 1-July 31. This fixed closure was a management tool implemented to slow harvest and reduce the probability of an early fall closure which can be disruptive to the fishery.

Alternative 3 would modify the recreational seasonal closure to March 1-May 31. This alternative would be consistent with the commercial fixed closed season and would also protect greater amberjack during peak spawning.

Alternative 4 would modify the recreational seasonal closure to January 1-May 31 and November 1-December 31 providing protection for spawning greater amberjack and allow recreational fishing effort to occur throughout the summer into early fall (September-October).

Alternative 5 would modify the recreational season closure to June 1-July 23th. Under this alternative the greater amberjack recreational season is expected to stay open throughout the year. This alternative is very similar to **Preferred Alternative 1** (June 1-July 31) with the exception of 8 additional fishing days. These additional 8 fishing days compared to status quo may seem negligible to some fishers, but may provide the for-hire industry the additional days needed to sell trips and the private recreational fishers the option for additional trips before the school year begins. **Alternative 5** may open the recreational greater amberjack season while red

snapper is still open or it may open the season shortly after red snapper season closes. However, because the season is fixed it allows private fishers and the for-hire industry additional options for planning trips.

One issue with **Preferred Alternative 1** and **Alternative 5** is bycatch and bycatch mortality of greater amberjack while red snapper season is open and greater amberjack is closed. Recreational fishing effort peaks during the summer months (May, June, and July) and fishers are not likely targeting greater amberjack, but may catch them incidentally while targeting other species such as red snapper. Bycatch mortality has been estimated at 20% from the 2011 Update Assessment, but may be higher for larger fish and possibly lower for smaller fish as documented anecdotally by fishers.

Based on spawning season for greater amberjack **Alternatives 3** and **4** may provide the greatest benefits to the resource and biological environment. Both alternatives close the recreational fishing season during peak spawning (March-May). **Preferred Alternative 1** and **Alternative 5** are very similar and are not expected to impact the biological environment differently. **Preferred Alternative 1** and **Alternative 5** would establish a fixed closed season to slow harvest providing additional positive benefits to the biological environment; whereas **Alternative 2** would not establish a fixed closed season.

The Council selected **Preferred Alternative 3, Option b** in **Action 1**. There are two recreational sub-actions **Action 2.1** would modify the minimum size limit and **Action 2.2** would modify the fixed closed seasons. The following table lists some management scenarios under each action and for each alternative that would achieve the current preferred sector ACT of 1,130,000 ww (Table 2.2.3).

Table 2.2.3. Alternatives under Action 2.1 minimum size limits and Action 2.2 closed seasons that would achieve recreational ACT (quota) = 1,130,000 ww. Note: 2012 is a leap year so there are 366 days in the year. Landings = total estimated harvest and the current management goal. Total removals = estimated harvest plus dead discards for comparative purposes. A 30 inch FL minimum size limit (**Alternative 1**) and the June 1- July 23 (**Alternative 5**) are projected to exceed the ACT (quota), but not the sector ACL.

Action 2.1, Alternative 1: Maintain the 30" fork length minimum size limit				
Action 2.2 Alternative	**Closed Season**	**Days Open**	**Landings**	**Total Removals**
1	Jun –Jul (Status quo)	305	1,071,000	1,562,000
2	None	200	1,114,000	1,596,000
3	Mar-May, Dec 25-31	267	1,128,000	1,608,000
4	Jan-May, Nov-Dec	153	953,000	1,467,000
5	Jun 1-Jul 23	313	1,136,000*	1,614,000
Action 2.1, Alternative 2: Modify minimum size limit to 32" fork length				
Action 2.2 Alternative	**Closed Season**	**Days Open**	**Landings**	**Total Removals**
1	Jun –Jul (Status quo)	305	840,000	1,377,000
2	None	239	1,113,000	1,596,000
3	Mar-May	274	883,000	1,411,000
4	Jan-May, Nov-Dec	153	738,000	1,295,000
5	Jun 1-Jul 23	313	889,000	1,416,000
Action 2.1, Alternative 3: Modify minimum size limit to 34" fork length				
Action 2.2 Alternative	**Closed Season**	**Days Open**	**Landings**	**Total Removals**
1	None	366	1,044,083	1,540,000
2	"	"	"	"
3	"	"	"	"
4	"	"	"	"
5	"	"	"	"
Action 2.1, Alternative 4: Modify minimum size limit to 36" fork length				
Action 2.2 Alternative	**Closed Season**	**Days Open**	**Landings**	**Total Removals**
1	None	366	754,000	1,308,000
2	"	"	"	"
3	"	"	"	"
4	"	"	"	"
5	"	"	"	"

Source: SERO-LAPP Gulf Amend 35 2011 decision tool. Days open, landings, and total removals in pounds whole weight were estimated from the decision tool.

Action 3: Commercial Management Measures

Alternative 1: No Action – do not adjust the commercial fixed closed season from the current March 1-May 31 closed season. Do not establish a commercial trip limit.

Table 3.1. Alternative 1 options for commercial trip limits and respective expected closure date and days the fishery is open based on two different model approaches.

Commercial harvest	Closed season	**Alternative 1**		**Alternative 2**		**Preferred Alternative 3**	
		503,000 pounds		**481,000 pounds**		**409,000 pounds**	
		Model		Model		Model	
		1	2	1	2	1	2
No Trip Limit	Mar - May	17-Sept	31-Aug	9-Sept	7-Aug	17-Aug	1-Aug
		169	152	161	145	138	122

Note: Both model approaches are shown to offer the Council a range of expected closure days and open fishing days under various Stock ACL alternatives described in Action 1. Please note the closure date is as close to the sector ACL or sector ACT as possible without exceeding it and 2012 is a leap year so there are 366 days in the year.

Preferred Alternative 2: Establish a commercial greater amberjack trip limit and maintain March 1-May 31 closed season.

Preferred Option a: Establish a 2,000 pound whole weight trip limit for greater amberjack.

Option b: Establish a 1,500 pound whole weight trip limit for greater amberjack.

Option c: Establish a 1,000 pound whole weight trip limit for greater amberjack.

Option d: Establish a 500 pound whole weight trip limit for greater amberjack

Table 3.2. Alternative 2 options for commercial trip limits and respective expected closure date and days the fishery is open based on two different model approaches.

Commercial harvest (pounds ww)	Closed season	**Alternative 1**		**Alternative 2**		**Preferred Alternative 3**	
		503,000 pounds		**481,000 pounds**		**409,000 pounds**	
		Model		Model		Model	
		1	2	1	2	1	2
Preferred Option a: 2,000	Mar - May	5-Dec	15-Nov	20-Nov	1-Nov	2-Oct	19-Sep
		248	228	232	214	184	171
Option b: 1,500	Mar - May	31-Dec	20-Dec	26-Dec	4-Dec	2-Nov	14-Oct
		274	220	268	247	214	196
Option c: 1,000	Mar - May	31-Dec	31-Dec	31-Dec	31-Dec	23-Dec	1-Dec
		274	274	274	274	266	244
Option d: 500	Mar - May	31-Dec	31-Dec	31-Dec	31-Dec	31-Dec	17-Dec
		274	274	274	274	274	250

Note: Both model approaches are shown to offer the Council a range of expected closure days and open fishing days under various Stock ACL alternatives described in Action 1. Please note the closure date is as close to the sector ACL or sector ACT as possible without exceeding it and 2012 is a leap year so there are 366 days in the year.

Alternative 3: Establish a commercial greater amberjack trip limit and eliminate March 1-May 31 closed season.

Option a: Establish a 2,000 pound whole weight trip limit for greater amberjack.
Option b: Establish a 1,500 pound whole weight trip limit for greater amberjack.
Option c: Establish a 1,000 pound whole weight trip limit for greater amberjack.
Option d: Establish a 500 pound whole weight trip limit for greater amberjack

Table 3.3. Alternative 3 options for commercial trip limits and respective expected closure date and days the fishery is open based on two different model approaches.

Commercial harvest (pounds ww)	Closed season	**Alternative 1**		**Alternative 2**		**Preferred Alternative 3**	
		503,000 pounds		**481,000 pounds**		**409,000 pounds**	
		Model		Model		Model	
		1	2	1	2	1	2
Option a: 2,000	None	18-Aug	17-Jul	9-Aug	8-Jul	13-Jul	11-Jun
		231	199	222	190	195	163
Option b: 1,500	None	14-Sept	7-Aug	31-Aug	25-Jul	29-Jul	27-Jun
		257	220	244	210	210	179
Option c: 1,000	None	12-Nov	23-Sep	23-Oct	9-Sept	31-Aug	28-Jul
		316	267	297	253	243	210
Option d: 500	None	31-Dec	2-Oct	31-Dec	9-Sep	13-Dec	4-Aug
		366	276	366	261	348	217

Note: Both model approaches are shown to offer the Council a range of expected closure days and open fishing days under various Stock ACL alternatives described in Action 1. Please note the closure date is as close to the sector ACL or sector ACT as possible without exceeding it and 2012 is a leap year so there are 366 days in the year.

Discussion:

Action 3 includes alternatives for establishing commercial trip limits for greater amberjack and either maintaining or eliminating the March 1–May 31 commercial closed season. During public testimony, commercial trip limits were suggested to keep from flooding the market and reducing bycatch of the species later in the year, particularly because the quota has been reached and exceeded in the last two years. Greater amberjack is not under the individual fishery quota (IFQ) program and landings suggest greater amberjack has become more heavily targeted by the commercial sector earlier in the year compared to previous years. Also, fishers have stated that

greater amberjack is targeted by the commercial sector at the beginning of the year until the quota is filled (Public Testimony June and August 2011 Council Meeting).

Since sector ACLs have been implemented the commercial sector exceeded their quota two out of the three years (2009 and 2010). Given landings had not previously approached the quota the overage in 2009 was unexpected. In 2010, it was anticipated that fishery closures associated with the Deepwater Horizon oil spill would slow the rate of harvest; thus, the 2010 overage was also unexpected. However, due to area closures to fishing and other oil spill mitigation measures, the 2010 overage may be partially attributed to fishers being forced to land their catch at places that had not been selected to report.

In 2011, NMFS published a rule in the Federal Register on April 29, 2011 announcing the 503,000 pound ww commercial quota would be adjusted to 313,900 pounds ww to account for the 2010 overage (76 FR 23909). However, recently updated landings data, provided by the Southeast Fisheries Science Center, indicate the commercial harvest for 2010 was 533,981 pounds ww and was 28,191 pounds ww less than was previously reported. Therefore, the new 2011 quota is 342,091 pounds ww. On June 18, 2011 the commercial sector was closed, when NMFS Fisheries Service estimated the 313,900 pounds adjusted quota would be reached. However, landings data available to date indicate the quota was not met by the closing date and that 58,254 pounds ww of the adjusted quota remains. When combined with the 28,191 pounds ww erroneously deducted for 2010, this results in 86,452 pounds ww of quota available to the commercial sector for 2011. Based on historical catch rates, NMFS projects the remaining 86,452 pounds ww of quota will be harvested in 61 days.

Two models with the following summary of their differences have been used to offer the Council a range of expected closure days and open fishing days under various sector ACL alternatives and a sector ACT alternative. Data source and preparation was identical between the two models, the primary difference is that Model 1 was based on 2009 data alone while Model 2 used data from 2002 to 2009. Model 2 also used additional analytical techniques to account for management induced changes in landing that occurred between 2002 and 2009.

Summary of data: Commercial landings data for Gulf of Mexico greater amberjack were obtained from the SEFSC's commercial ACL dataset (2011), and the SEFSC's commercial logbook program (2011). The ACL dataset provides additional quality control over Accumulated Landings System (ALS) data, which aggregates trip ticket data from dealers reporting from all the Gulf states, and incorporates landings from both federally- and state-licensed vessels. Commercial logbook records (accessed May 2011) summarize landings on a trip level, with information for each species encountered including landings (in lbs), primary gear used, and primary area and depth of capture. These data were used to evaluate reductions in commercial landings associated with closed seasons and trip limits.

Commercial trip limits are a tool for reducing the rate of commercial harvest to avoid an early closure. A small percentage of trips land more than 1,000 pounds of greater amberjack per trip (Figure 3.1). Trip limits from 3000 – 250 lb ww per trip were examined using commercial logbook data, using the same approaches used to establish the commercial baseline to scale to the ACL dataset 2009 landings and fill gaps for Mar-May and Nov-Dec to give the model predictive utility in the event a reopening were considered.

To model trip limits, if total catch per logbook-reported trip was greater than the trip limit being analyzed, the value was re-set to the new trip limit otherwise no changes to catch were made. Commercial fishermen were assumed to stop targeting amberjack once their trip limit was met, and therefore zero release mortality was assumed. Total monthly landings under status quo and each trip limit scenario were computed from the modified logbook records. Landings under trip limit scenarios were proportionalized to logbook status quo, and then all percentages were scaled up using the 2009 ACL data (accessed 9/2011) greater amberjack harvest level.

Model 1: To evaluate trip limits, commercial logbook records were used to construct a baseline of landings for open months in 2009. Monthly commercial logbook landings for open months in 2009 were converted to percentage of total annual landings. Commercial harvest of greater amberjack has been prohibited in March, April, and May since January 1998. To predict what landings trends might be if these months were re-opened, linear interpolation was used to estimate percent annual landings between February (13%) and June (16%). The re-opening of March-May is projected to increase annual landings by 44%. Additionally, quota closures for commercial greater amberjack were implemented in November-December of 2009 and 2010. November-December landings were included into the baseline based upon the average percent of annual landings (2006-2008) for November (9%) and December (8%). The commercial logbook provides incomplete landings information due to noncompliance and failure to include state-licensed commercial fishermen. To account for these additional landings, the monthly percentages of annual landings derived from logbook records were scaled to the 601,446 lb landings total reported to ALS (Source: SEFSC ACL Dataset 2011). Because the baseline predicts landings during months in 2009 that were closed (i.e. Mar-May; Nov-Dec), the projected baseline of 0.958 mp landed in the absence of any closures is substantially higher than the 0.601 mp landed in 2009.

The projected impacts of the various management measures produced output in pounds of landings (i.e. trip limit) or percent reductions (i.e. vessel limit, proportional bag limit, size limit). These results were incorporated into a Microsoft Excel-based Commercial Decision Tool (CDT1). For the CDT1, projected monthly (m) landings (L_m) were computed as:

$$L_m = T_m * O_m$$

where T_m: projected landings under user-defined trip limit and O_m: percent of month open to fishing.

Projected monthly landings were summed across the year for a variety of user-defined management scenarios and compared to the Amendment 35 ACL alternatives. In instances where the management measures were insufficient to constrain harvest below the ACL, the projected quota closure date was computed.

Model 2: Given the frequent changes in the regulatory regime, projecting future catches as a function of historical pattern becomes more complicated. For this purpose, a regression model (Generalized additive model) was developed that explicitly accounted for seasonal closure, seasonality in the fishery, as well as the affect of the catch-per-unit-effort (CPUE) on the

landings for a given year. A potential benefit of this approach is that it can consider longer time series of catch history (2002 – 2009) and evaluate change based on management tools (e.g., seasonal closures and trip limits). This methodology also permits estimation of model uncertainty, although this will underestimate the true projection interval that would likely be the most appropriate proxy of uncertainty. A full estimation of the projection uncertainty could be estimated using bootstrapping or similar approach however, this would require further testing and evaluation prior to implementation. Catch data from the commercial greater amberjack fishery were used from 2002 – 2009 to project harvest rates of greater amberjack in 2012. Data were examined as raw and adjusted (as described above) to examine the effect of trip limits. For this purpose, commercial trips with landings over the specified threshold (e.g., 2,000 pound trip limit) were re-coded to the maximum trip limit value. This process was examined for four potential trip limits (2000, 1500, 1000, and 500 pounds ww). These results were incorporated into a Microsoft Excel © based Commercial Decision Tool (CDT2). As with Model 1, projected monthly landings were summed across the year for a variety of user-defined management scenarios and compared to the Amendment 35 ACL alternatives.

Comparison of Alternatives

Currently, the commercial sector is closed to fishing from March 1-May 31 to protect greater amberjack during peak spawning. **Alternative 1** is the no action alternative and given that the last two years the commercial quota has been exceeded it would be anticipated that the quota would be exceeded again without establishing an additional management measures. Under the current **Alternative 1** no action alternative and based on the Council's **Preferred Alternative 3**, **Option b** in Action 1 the commercial ACL=481,000 ww and ACT=409,000 ww. The commercial trip limit is expected to be filled in early to mid-August (1-18 August); giving the commercial sector between 122-138 fishing days (Table 3.1). Once the sector ACT is reached it is possible that they could actually fish until September based on the sector ACL = 481,000, giving the commercial sector between 145-161 fishing days.

Preferred Alternative 2 would maintain the existing fixed closed season to protect spawning greater amberjack (March 1-May 31) but has four options for establishing a trip limit. Trips limits would prevent the market from being flooded and dissuade fishers from targeting greater amberjack until the quota is filled. If a 2,000 pound trip limit (**Preferred Option a**) was established and using the Council current preferred ACT = 409,000 ww and the commercial sector is expected to fish until mid-Sept-October (171-182 fishing days; Table 3.2). If a 1,500 pound trip limit (**Option b**) was established the commercial sector would be expected to fish until mid-October to early November (196-214 fishing days). Under a 1,000 pound trip limit the commercial sector could expect to fish until early to mid-December (244-263 fishing days). Whereas, if a 500 pound trip limit was established the commercial sector could expect to fish until mid-December to the end of December (250-274 fishing days; Table 3.2). The Council selected to use an ACT as preferred which also establishes an ACL under this scenario the sector ACL=481,000 ww. It is possible the commercial sector could fish until the days listed under **Alternative 2** by various trip limits (**Options a-d**). However, based on the quota overages by the commercial sector in the last two years and the subsequent overage adjustments the commercial sector would be managed at the sector ACT based on the Council's current preferred alternative in Action 1. If the commercial sector ACL has not been reached the Assistant

Administrator for Fisheries has the authority to re-open the fishery as well as close the fishery when the quota is projected to be reached.

Alternative 3 would eliminate the existing closed season with four options to establish a trip limit. Eliminating the fixed closed season would no longer provide protection to greater amberjack during spawning. Removing a fixed closed season and establishing a trip limit for the commercial sector may help them maintain a local market. However, this fixed closed season has been in effect since 2003. If a 2,000 pound trip limit (**Option a**) was established and using the Council current preferred ACT = 409,000 ww and the commercial sector is expected to fish until mid-Jun–mid-July (163-195 fishing days; Table 3.3). If a 1,500 pound trip limit (**Option b**) was established the commercial sector would be expected to fish until the end of June or July (179-210 fishing days). Under a 1,000 pound trip limit the commercial sector could expect to fish until the end of July-end of August (210-243 fishing days; **Option c**). Whereas, if a 500 pound trip limit was established the commercial sector could expect to fish until mid-December to the end of December (217-348 fishing days; **Option d**; Table 3.3). The Council selected to use an ACT as preferred which also establishes an ACL under this scenario (sector ACL=481,000 ww). It is possible the commercial sector could fish until the days listed under **Preferred Alternative 2** by various trip limits (**Options a-d**). However, based on the quota overages by the commercial sector in the last two years and the subsequent overage adjustments the quota the fishery is managed at the sector ACT. If the sector ACL has not be reached the Assistant Administrator for Fisheries has the authority to re-open the fishery as well as the close the fishery when the quota it projected to be reached.

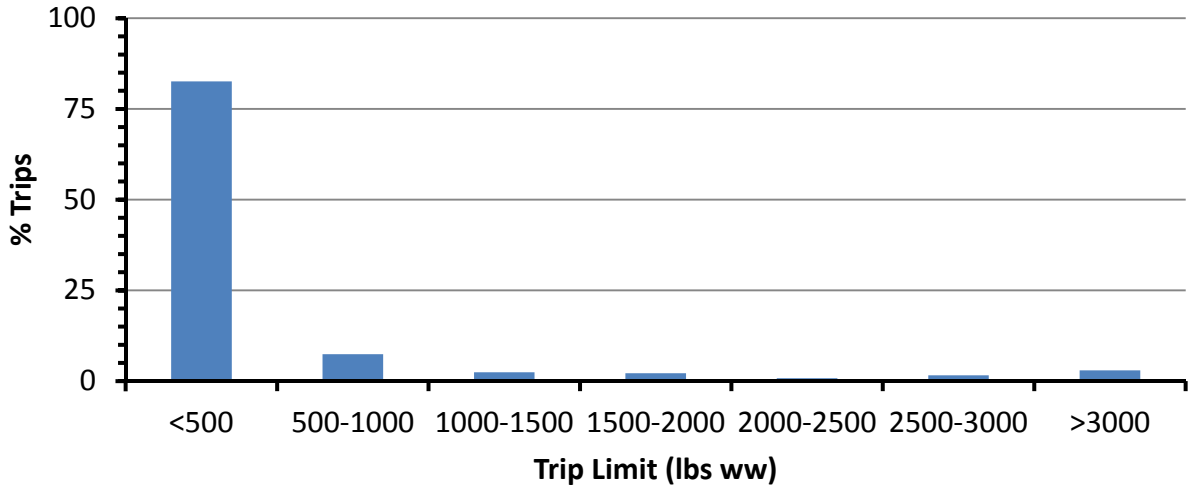

Figure 3.1. Greater amberjack commercial catch per trip based on 2009-2010 landings. Source: SERO 2011

Preferred Alternative 2 is expected to provide the greatest benefits to the resource and the biological environment compared to **Alternatives 1** and **3.** It would maintain the fixed closed season during to peak spawning and establish a trip limit. In order of benefits to the resource, the lowest trip limit (**Option d**: 500 pounds ww) would provide the greatest benefits to the resource and the biological environment compared to **Options c**, **b**, and **a**. **Option d** is expected to allow the commercial sector to fish almost year round with the exception of the fixed closed season

under (**Alternative 2, Option d**). The lowest trip limit could have the greatest positive benefits to the biological environment by reducing bycatch under higher trip limits resulting in a possible in-season closure. Based on catch per trip data from 2009-2010, the greatest percentage of trips in the commercial sector landed 500 pounds or less of greater amberjack (Figure 3.1; **Option d**). However, until the economic analysis is completed establishing a trip limit (**Preferred Option a** and Options **b**, **c**, and **d**) may have negative economic and social impacts that outweigh the positive impacts to the biological environment.

Impacts to the physical environment under **Preferred Alternative 2** compared to the other alternatives are not expected to be different than **Alternative 1** status quo. Whereas, **Alternative 3** would eliminate the fixed closed season (March 1-May 31) potentially having greater negative impacts on the physical environment compared to **Alternatives 2** and **1**. **Option d** is expected to have the greatest positive impacts to the physical environment, but are not likely to differ substantially from **Options a**, **b**, or **c** on the physical environment.

3.0 AFFECTED ENVIRONMENT

3.1 Description of the Affected Physical Environment

The physical environment for reef fish, including greater amberjack, has been described in detail in the EIS for the Generic Essential Fish Habitat Amendment and is incorporated here by reference (GMFMC 2004). The Gulf has a total area of approximately 600,000 square miles (1.5 million km^2), including state waters (Gore 1992). It is a semi-enclosed, oceanic basin connected to the Atlantic Ocean by the Straits of Florida and to the Caribbean Sea by the Yucatan Channel. Oceanic conditions are primarily affected by the Loop Current, the discharge of freshwater into the Northern Gulf, and a semi-permanent, anticyclonic gyre in the western Gulf. Gulf water surface temperatures range from 12º C to 29º C (54º F to 84º F) depending on time of year and depth of water. In the Gulf, adult greater amberjack are pelagic and epibenthic, occurring over reefs and wrecks as well as around buoys (GMFMC 2004).

The Deepwater Horizon MC252 oil spill has affected at least one-third of the Gulf area from western Louisiana east to the panhandle of Florida and south to the Campeche Bank in Mexico. The impacts of the Deepwater Horizon MC252 oil spill on the physical environment are expected to be significant and may be long-term. However, the oil remained outside most of the west Florida Shelf where red grouper and gag are particularly abundant (GMFMC 2004b). Oil was dispersed on the surface, and because of the heavy use of dispersants (both at the surface and at the wellhead), oil was also documented as being suspended within the water column, some even deeper than the location of the broken well head. Floating and suspended oil washed onto shore in several areas of the Gulf as were non-floating tar balls. Whereas suspended and floating oil degrades over time, tar balls are persistent in the environment and can be transported hundreds of miles.

Oil could intensify development of this year's hypoxic "dead" zone in the Gulf of Mexico as could higher than normal input of water from the Mississippi River drainage. For example, oil on the surface of the water could restrict the normal process of atmospheric oxygen mixing into and replenishing oxygen concentrations in the water column. In addition, microbes in the water that break down oil and dispersant also consume oxygen; this could lead to further oxygen depletion.

Environmental Sites of Special Interest Relevant to Greater Amberjack (Figure 3.1.1)

Longline/Buoy Gear Area Closure - Permanent closure to use of these gears for reef fish harvest inshore of 20 fathoms off the Florida shelf and inshore of 50 fathoms for the remainder of the Gulf (72,300 square nautical miles).

Madison/Swanson and Steamboat Lumps Marine Reserves - No-take marine reserves sited on gag spawning aggregation areas where all fishing except for surface trolling from May through October is prohibited (219 square nautical miles).

Tortugas North and South Marine Reserves - No-take marine reserves cooperatively implemented by the state of Florida, National Ocean Service (NOS), the Council, and the

National Park Service (see jurisdiction on chart) (185 square nautical miles). In addition, Generic Amendment 3 for addressing EFH requirements, Habitat Areas of Particular Concern (HAPC), and adverse effects of fishing in the following FMPs of the Gulf: Shrimp, Red Drum, Reef Fish, Stone Crab, Coral and Coral Reefs in the Gulf and Spiny Lobster and the Coastal Migratory Pelagic resources of the Gulf and South Atlantic (GMFMC 2005a) prohibited the use of anchors in these HAPCs.

Individual reef areas and bank HAPCs of the northwestern Gulf including: East and West Flower Garden Banks, Stetson Bank, Sonnier Bank, MacNeil Bank, 29 Fathom, Rankin Bright Bank, Geyer Bank, McGrail Bank, Bouma Bank, Rezak Sidner Bank, Alderice Bank, and Jakkula Bank - Pristine coral areas protected by preventing use of some fishing gear that interacts with the bottom (263.2 square nautical miles). Subsequently, some of these areas were made a marine sanctuary by NOS and this marine sanctuary is currently being revised. Bottom anchoring and the use of trawling gear, bottom longlines, buoy gear, and all traps/pots on coral reefs are prohibited in the East and West Flower Garden Banks, McGrail Bank, and on the significant coral resources on Stetson Bank.

Florida Middle Grounds HAPC - Pristine soft coral area protected from use of any fishing gear interfacing with bottom (348 square nautical miles).

Pulley Ridge HAPC - A portion of the HAPC where deep-water hermatypic coral reefs are found is closed to anchoring and the use of trawling gear, bottom longlines, buoy gear, and all traps/pots (2,300 square nautical miles).

Stressed Areas for Reef Fish - Permanent closure Gulf-wide of the near shore waters to use of fish traps, power heads, and roller trawls (i.e., “rock hopper trawls”) (48,400 square nautical miles).

Alabama Special Management Zone (SMZ) - In the Alabama SMZ, fishing by a vessel operating as a charter vessel or headboat, a vessel that does not have a commercial permit for Gulf reef fish, or a vessel with such a permit fishing for Gulf reef fish, is limited to hook-and-line gear with no more than 3 hooks. Nonconforming gear is restricted to bag limits, or for reef fish without a bag limit, to 5 percent by weight of all fish aboard.

Additionally, Generic Amendment 3 for addressing EFH requirements (GMFMC 2005a) requires a weak link in the tickler chain of bottom trawls on all habitats throughout the Gulf EEZ. A weak link is defined as a length or section of the tickler chain that has a breaking strength less than the chain itself and is easily seen as such when visually inspected. Also, the amendment establishes an education program on the protection of coral reefs when using various fishing gears in coral reef areas for recreational and commercial fishermen.

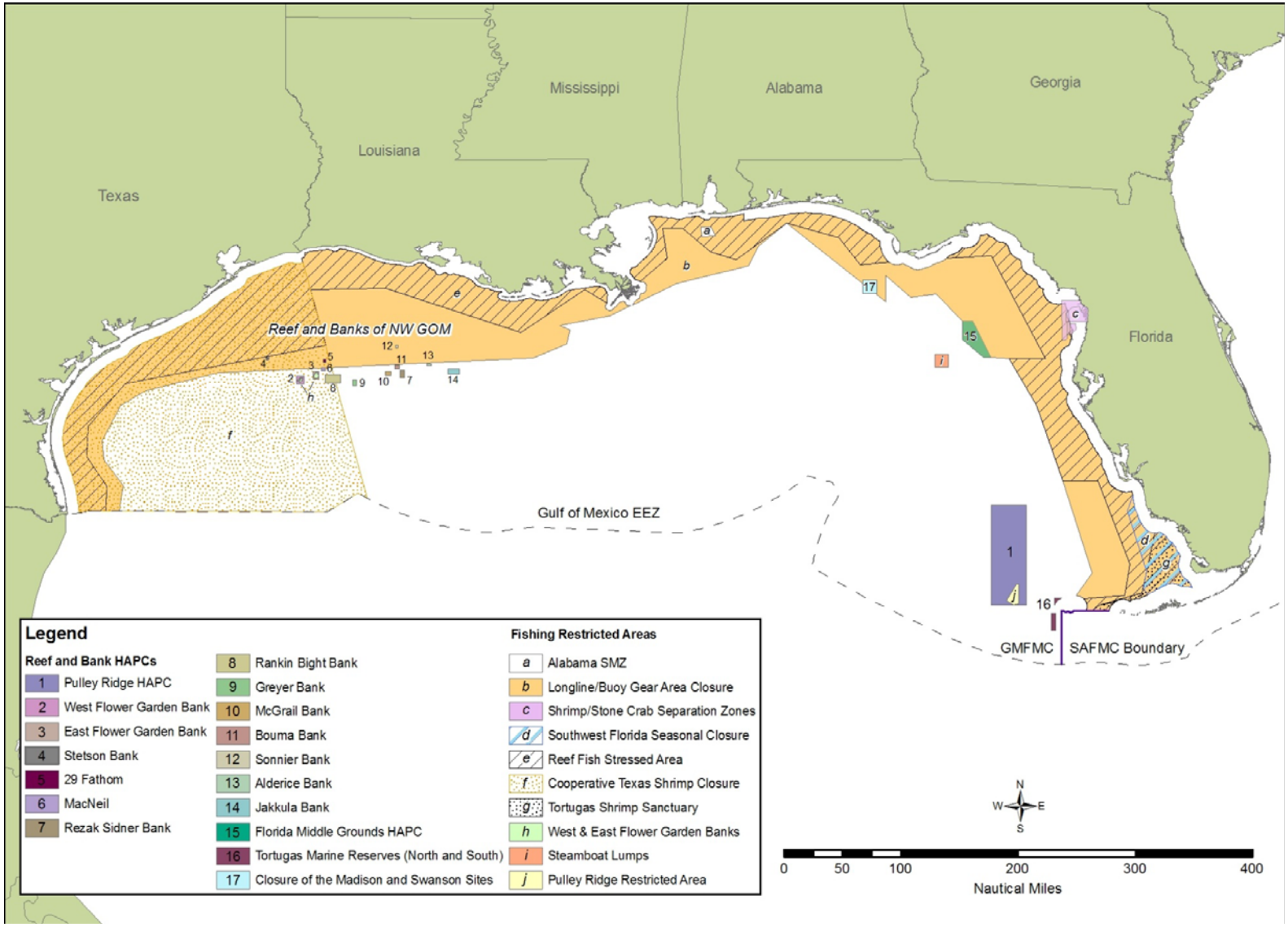

Figure 3.1.1. Map of most fishery management closed areas in the Gulf of Mexico.

3.2 Description of the Affected Biological Environment

Greater Amberjack Life History and Biology

Recent studies conducted in the South Atlantic have consistently estimated that greater amberjack peak spawning occurs in April and May (Sedberry et al. 2006; Harris et al. 2007); whereas, studies conducted in the Gulf of Mexico have consistently estimated that peak spawning occurs a month earlier during March and April (Wells and Rooker 2002; Murie and Parkyn 2008).

Early studies on greater amberjack conducted in south Florida indicated that maximum gonad development occurred in the spring months (Burch 1979). Studies in the 1990s on greater amberjack in the Gulf of Mexico estimated the spawning season off Louisiana peaked in April-June based on increased gonad weight (Beasley 1993) and in May and June by Thompson et al. (1991). Wells and Rooker (2002) conducted studies in the northwestern Gulf on larval and juvenile fish associated with floating *Sargassum* spp. Based on the size and season larvae and juvenile greater amberjack were captured by researchers they estimated that peak spawning season occurred in March and April.

Sedberry et al. (2006) documented greater amberjack spawning in the South Atlantic on both the middle and outer shelf as well as on upper-slope reefs from 15-216 m depth, but spawning females were found at deeper depths from 45-122 m. They collected spawning females from January to June, and estimated peak spawning occurred in April and May. Harris et al. (2007) completed a fishery-dependent and fishery-independent study on greater amberjack reproductive biology in the southeastern U.S. Atlantic from 2000-2004. Greater amberjack in spawning condition were captured from North Carolina to the Florida Keys; however, spawning was concentrated in areas off south Florida and the Florida Keys. Harris et al. (2007) documented evidence of spawning from January-June with peak spawning during April and May. Female greater amberjack were significantly larger than males (Harris 2004; Harris et al. 2007). For males, the size at which 50% of individuals were mature was 644 mm FL (25.4 inches FL) and for females was 826 mm FL (32.5 inches FL). They estimated a spawning season of approximately 73 days off south Florida, with a spawning period of 5 days, estimating that an individual female could spawn as frequently as 14 times during the season. Female fecundity increased with size, but was essentially constant throughout the spawning season. Greater amberjack are extremely fecund releasing 18 to 59 million eggs per female in a single spawning season (Harris et al. 2007).

Murie and Parkyn (2008) completed a recent study on reproductive biology of greater amberjack throughout the Gulf of Mexico using fishery-dependent as well as fishery-independent data from 1989-2008. They also found females were significantly larger than males but that peak spawning occurred during March and April, and by May, they documented low gonad weights. For females, 50% of individuals were mature at 900 mm FL (35 inches FL), larger than what Harris et al. (2007) documented off south Florida.

It was suggested in the Harris et al. (2007) study that there are known spawning aggregations of greater amberjack targeted by fishers in the South Atlantic, but no evidence of this was

presented. Observations by SCUBA divers in Belize documented greater amberjack in pair courtship when they were in a school of approximately 120 fish (Graham and Castellanos 2005). However, no aggregation or indication of spawning aggregations was discussed by the Murie and Parkyn (2008) Gulf of Mexico study or other earlier Gulf studies.

After spawning eggs and larvae are pelagic and smaller juveniles (<20 mm SL) are found associated with pelagic *Sargassum* spp. mats (Bortone et al. 1977; Wells and Rooker 2004a). Juveniles then shift to demersal habitats (5-6 months), where they congregate around reefs, rocky outcrops, and wrecks. Since greater amberjack are only seasonally abundant in certain parts of their range, they likely utilize a variety of habitats and/or areas each year. Greater amberjack have been documented on artificial structures as well as natural reefs (Ingram and Patterson 2001). Greater amberjack in the Gulf of Mexico have been reported to live as long as 15 years and commonly reach sizes greater than 40 inches, 1,016 mm FL (Manooch and Potts 1997).

Status of the Greater Amberjack Stock

See Section 1.1 under the Introduction.

General Information on Reef Fish Species

The National Ocean Service (NOS) of NOAA collaborated with NMFS and the Council to develop distributions of reef fish (and other species) in the GOM (SEA 1998). National Ocean Service obtained fishery-independent data sets for the GOM, including SEAMAP, and state trawl surveys. Data from the Estuarine Living Marine Resources (ELMR) Program contain information on the relative abundance of specific species (highly abundant, abundant, common, rare, not found, and no data) for a series of estuaries, by five life stages (adult, spawning, egg, larvae, and juvenile) and month for five seasonal salinity zones (0-0.5, 0.5-5, 5-15, 15-25, and >25). National Ocean Service staff analyzed these data to determine relative abundance of the mapped species by estuary, salinity zone, and month. For some species not in the ELMR database, distribution was classified as only observed or not observed for adult, juvenile, and spawning stages.

In general, reef fish are widely distributed in the GOM, occupying both pelagic and benthic habitats during their life cycle. Habitat types and life history stages are summarized in Table 3.2.1 and can be found in more detail in GMFMC (2004a). In general, both eggs and larval stages are planktonic. Larvae feed on zooplankton and phytoplankton. Exceptions to these generalizations include the gray triggerfish that lay their eggs in depressions in the sandy bottom, and gray snapper whose larvae are found around submerged aquatic vegetation (SAV). Juvenile and adult reef fish are typically demersal, and are usually associated with bottom topographies on the continental shelf (<100 m) 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. Juvenile red snapper are common on mud bottoms in the northern Gulf, particularly off Texas through Alabama. Also, some juvenile snappers (e.g. mutton, gray, red, dog, lane, and yellowtail snappers) and

groupers (e.g. goliath grouper, red, gag, and yellowfin groupers) have been documented in inshore seagrass beds, mangrove estuaries, lagoons, and larger bay systems (GMFMC 1981). More detail on hard bottom substrate and coral can be found in the FMP for Corals and Coral Reefs (GMFMC and SAFMC 1982).

Table 3.2.1. Summary of habitat utilization by life history stage for species most species in the Reef Fish FMP. This table was adapted from Table 3.2.7 in the final draft of the EIS from the Council's EFH generic amendment (GMFMC 2004a) and consolidated in this amendment. *The Council has proposed removing these species in the Generic ACL/AM Amendment which has not been approved by the Secretary of Commerce yet.

Common name	Eggs	Larvae	Early Juveniles	Late juveniles	Adults	Spawning adults
Red snapper	Pelagic	Pelagic	Hard bottoms, Sand/ shell bottoms, Soft bottoms	Hard bottoms, Sand/ shell bottoms, Soft bottoms	Hard bottoms, Reefs	Sand/ shell bottoms
Queen snapper	Pelagic	Pelagic	Unknown	Unknown	Hard bottoms	
Mutton snapper	Reefs	Reefs	Mangroves, Reefs, SAV, Emergent marshes	Mangroves, Reefs, SAV, Emergent marshes	Reefs, SAV	Shoals/ Banks, Shelf edge/slope
*Schoolmaster	Pelagic	Pelagic	Mangroves, SAV	Hard bottoms, Mangroves, Reefs, SAV, Emergent marshes	Hard bottoms, Reefs, SAV	Reefs
Blackfin snapper	Pelagic		Hard bottoms	Hard bottoms	Hard bottoms, Shelf edge/slope	Hard bottoms, Shelf edge/slope
Cubera snapper	Pelagic		Mangroves, Emergent marshes, SAV	Mangroves, Emergent marshes, SAV	Mangroves, Reefs	Reefs
Gray snapper	Pelagic, Reefs	Pelagic, Reefs	Mangroves, Emergent marshes, Seagrasses	Mangroves, Emergent marshes, SAV	Emergent marshes, Hard bottoms, Reefs, Sand/ shell bottoms, Soft bottoms	
*Dog snapper	Pelagic	Pelagic	SAV	Mangroves, SAV	Reefs, SAV	Reefs
*Mahogany snapper	Pelagic	Pelagic	Reefs, Sand/ shell bottoms	Reefs, Sand/ shell bottoms	Hard bottoms, Reefs, Sand/ shell bottoms, SAV	

Common name	Eggs	Larvae	Early Juveniles	Late juveniles	Adults	Spawning adults
Lane snapper	Pelagic		Mangroves, Reefs, Sand/ shell bottoms, SAV, Soft bottoms	Mangroves, Reefs, Sand/ shell bottoms, SAV, Soft bottoms	Reefs, Sand/ shell bottoms, Shoals/ Banks	Shelf edge/slope
Silk snapper	Unknown	Unknown	Unknown	Unknown	Shelf edge	
Yellowtail snapper	Pelagic		Mangroves, SAV, Soft bottoms	Reefs	Hard bottoms, Reefs, Shoals/ Banks	
Wenchman	Pelagic	Pelagic			Hard bottoms, Shelf edge/slope	Shelf edge/slope
Vermilion snapper	Pelagic		Hard bottoms, Reefs	Hard bottoms, Reefs	Hard bottoms, Reefs	
Gray triggerfish	Reefs	Drift algae, *Sargassum*	Drift algae, *Sargassum*	Drift algae, Reefs, *Sargassum*	Reefs, Sand/ shell bottoms	Reefs, Sand/ shell bottoms
Greater amberjack	Pelagic	Pelagic	Drift algae	Drift algae	Pelagic, Reefs	Pelagic
Lesser amberjack			Drift algae	Drift algae	Hard bottoms	Hard bottoms
Almaco jack	Pelagic		Drift algae	Drift algae	Pelagic	Pelagic
Banded rudderfish		Pelagic	Drift algae	Drift algae	Pelagic	Pelagic
Hogfish			SAV	SAV	Hard bottoms, Reefs	Reefs
Blueline tilefish	Pelagic	Pelagic			Hard bottoms, Sand/ shell bottoms, Shelf edge/slope, Soft bottoms	
Tilefish	Pelagic, Shelf edge/ slope	Pelagic	Hard bottoms, Shelf edge/slope, Soft bottoms	Hard bottoms, Shelf edge/slope, Soft bottoms	Hard bottoms, Shelf edge/slope, Soft bottoms	

Common name	Eggs	Larvae	Early Juveniles	Late juveniles	Adults	Spawning adults
*Dwarf sand perch				Hard bottoms	Hard bottoms, Soft bottoms	
*Sand perch					Reefs, SAV, Shoals/ Banks, Soft bottoms	
*Rock hind	Pelagic	Pelagic			Hard bottoms, Reefs	Hard bottoms, Reefs
Speckled hind	Pelagic	Pelagic			Hard bottoms, Reefs	Shelf edge/slope
Yellowedge grouper	Pelagic	Pelagic		Hard bottoms	Hard bottoms	
*Red hind	Pelagic	Pelagic	Reefs	Reefs	Hard bottoms, Reefs, Sand/ shell bottoms	Hard bottoms
Goliath grouper	Pelagic	Pelagic	Mangroves, Reefs, SAV	Hard bottoms, Mangroves, Reefs, SAV	Hard bottoms, Shoals/ Banks, Reefs	Reefs, Hard bottoms
Red grouper	Pelagic	Pelagic	Hard bottoms, Reefs, SAV	Hard bottoms, Reefs	Hard bottoms, Reefs	
*Misty grouper	Pelagic	Pelagic			Hard bottoms, Shelf edge/slope	Hard bottoms
Warsaw grouper	Pelagic	Pelagic		Reefs	Hard bottoms, Shelf edge/slope	
Snowy grouper	Pelagic	Pelagic	Reefs	Reefs	Hard bottoms, Reefs, Shelf edge/slope	
*Nassau grouper		Pelagic	Reefs, SAV		Hard bottoms, Reefs, Sand/ shell bottoms	Hard bottoms, Reefs, Sand/ shell bottoms

Common name	Eggs	Larvae	Early Juveniles	Late juveniles	Adults	Spawning adults
Black grouper	Pelagic	Pelagic	SAV	Hard bottoms, Reefs	Hard bottoms, Mangroves, Reefs	
Yellowmouth grouper	Pelagic	Pelagic	Mangroves	Mangroves, Reefs	Hard bottoms, Reefs	
Gag	Pelagic	Pelagic	SAV	Hard bottoms, Reefs, SAV	Hard bottoms, Reefs	
Scamp	Pelagic	Pelagic	Hard bottoms, Mangroves, Reefs	Hard bottoms, Mangroves, Reefs	Hard bottoms, Reefs	Reefs, Shelf edge/slope
Yellowfin grouper			SAV	Hard bottoms, SAV	Hard bottoms, Reefs	Hard bottoms

Status of Reef Fish Stocks

The Reef Fish FMP currently encompasses 42 species (Table 3.2.2). Eleven of these species are anticipated to be removed from the FMP by the Council in their Generic ACL/AM Amendment. Nassau grouper is anticipated to be removed from the Gulf FMP and designated to the South Atlantic Council for management throughout their range if deemed appropriate by the Secretary of Commerce. Stock assessments have been conducted on 12 species: red snapper (SEDAR 7, 2005; 2009 Update Assessment), vermilion snapper (Porch and Cass-Calay, 2001; SEDAR 9 2006c), yellowtail snapper (Muller et al., 2003; SEDAR 3, 2003), gray triggerfish (Valle et al., 2001; SEDAR 9, 2006b), greater amberjack (Turner et al., 2000; SEDAR 9 2006a; 2010 Update Assessment), hogfish (Ault et al. 2003; SEDAR 6 2003a), red grouper (NMFS, 2002a; SEDAR 12 2007), gag (Turner et al., 2001; SEDAR 10, 2006), black grouper (SEDAR 19 2009), yellowedge grouper (Cass-Calay and Bahnick 2002; SEDAR 22 2011), tilefish (golden) (SEDAR 22 2011) and goliath grouper (Porch et al., 2003; SEDAR 6, 2004b; SEDAR 23 2011). 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).

Of the 12 species for which stock assessments have been conducted in the Gulf of Mexico the second quarter report of the 2011 Status of U.S. Fisheries (http://www.nmfs.noaa.gov/sfa/statusoffisheries/2011/second/Q2_2011_FSSI_nonFSSIstockstatus.pdf) classifies four as overfished (gag, greater amberjack, gray triggerfish, and red snapper), and four as undergoing overfishing (gag, greater amberjack, gray triggerfish, and red snapper). The assessment for vermilion snapper (SEDAR 9, 2006a) indicates this species is not overfished or undergoing overfishing. Recent assessments for black grouper determined that they were not overfished or undergoing overfishing (SEDAR 19 2010). The results of the yellowedge grouper assessment (SEDAR 22 2011) determined this species was not overfished or undergoing overfishing; however, these results are not yet reflected in the 2011 Status of the U.S. Fisheries. Further the Gulf Council needs to establish and accept definitions for minimum stock size threshold (overfished) and maximum fishing mortality thresholds (overfishing) for several species including yellowedge grouper. Similarly, a 2009 Update Assessment on red snapper determined that the stock was no longer undergoing overfishing, but these results are not yet reflected in the 2011 Status of the U.S. Fisheries. A stock assessment was also completed for tilefish (golden) in SEDAR 22; however, stock status was could not be determined based on the information available about the species. Stock assessments and stock assessment reviews can be found on the Council (www.gulfcouncil.org) and SEDAR (www.sefsc.noaa.gov/sedar) websites.

Table 3.2.2. Species of the reef fish FMP grouped by family. *The Council has proposed removing these species in the Generic Annual Catch Limits and Accountability Measures which has yet to be approved by the Secretary of Commerce. **Protected groupers. Note: that Nassau grouper is a protected species and is also slated for remove and management by the South Atlantic Council.

Common Name	Scientific Name	Stock Status
Family Balistidae – Triggerfishes		
gray triggerfish	*Balistes capriscus*	Overfished, overfishing
Family Carangidae – Jacks		
greater amberjack	*Seriola dumerili*	Overfished, overfishing
lesser amberjack	*Seriola fasciata*	Unknown
almaco jack	*Seriola rivoliana*	Unknown
banded rudderfish	*Seriola zonata*	Unknown
Family Labridae - Wrasses		
hogfish	*Lachnolaimus maximus*	Unknown
Family Malacanthidae - Tilefishes		
tilefish (golden)	*Lopholatilus chamaeleonticeps*	Unknown
blueline	*Caulolatilus microps*	Unknown
goldenface	*Caulolatilus chrysops*	Unknown
*blackline tilefish	*Caulolatilus cyanops*	Unknown
*anchor tilefish	*Caulolatilus intermedius*	Unknown
Family Serranidae - Groupers		
gag	*Mycteroperca microlepis*	Overfished, overfishing
red grouper	*Epinephelus morio*	Not overfished, no overfishing
scamp	*Mycteroperca phenax*	Unknown
black grouper	*Mycteroperca bonaci*	Not overfished, no overfishing
yellowedge grouper	*Epinephelus flavolimbatus*	Not overfished, no overfishing
snowy grouper	*Epinephelus niveatus*	Unknown
speckled hind	*Epinephelus drummondhayi*	Unknown
yellowmouth grouper	*Mycteroperca interstitialis*	Unknown
yellowfin grouper	*Mycteroperca venenosa*	Unknown
warsaw grouper	*Epinephelus nigritus*	Unknown
**goliath grouper	*Epinephelus itajara*	Unknown not overfishing
*Nassau grouper **	*Epeinephelus striatus*	Unknown not overfishing
*dwarf sand perch	*Diplectrum bivittatum*	Unknown
*sand perch	*Diplectrum formosum*	Unknown
*misty grouper	*Epinephelus mystacinus*	Unknown
*rock hind	*Epinephelus adscensionis*	Unknown
*red hind	*Ephinephelus guttatus*	Unknown

Common Name	Scientific Name	Stock Status
Family Lutjanidae - Snappers		
queen snapper	*Etelis oculatus*	Unknown
mutton snapper	*Lutjanus analis*	Unknown
blackfin snapper	*Lutjanus buccanella*	Unknown
red snapper	*Lutjanus campechanus*	Overfished, no overfishing
cubera snapper	*Lutjanus cyanopterus*	Unknown
gray snapper	*Lutjanus griseus*	Unknown
lane snapper	*Lutjanus synagris*	Unknown
silk snapper	*Lutjanus vivanus*	Unknown
yellowtail snapper	*Ocyurus chrysurus*	Not overfished, no overfishing
vermilion snapper	*Rhomboplites aurorubens*	Not overfished, no overfishing
wenchman	*Pristipomoides aquilonaris*	Unknown
*schoolmaster snapper	*Lutjanus apodus*	Unknown
*dog snapper	*Lutjanus jocu*	Unknown
*mahogany snapper	*Lutjanus mahogoni*	Unknown

Protected Species

There are 28 different species of marine mammals that may occur in the Gulf. All 28 species are protected under the MMPA and six are also listed as endangered under the ESA (i.e., sperm, sei, fin, blue, humpback and North Atlantic right whales). Other species protected under the ESA occurring in the Gulf include five sea turtle species (Kemp's Ridley, loggerhead, green, leatherback, and hawksbill); two fish species (Gulf sturgeon and smalltooth sawfish), and two coral species (elkhorn coral and staghorn coral). Information on the distribution, biology, and abundance of these protected species in the Gulf is included in final EIS to the Council's Generic EFH amendment (GMFMC, 2004a) and the February 2005 and October 2009 ESA biological opinions and the on the reef fish fishery (NMFS 2005; NMFS 2009). Marine Mammal Stock Assessment Reports and additional information are also available on the NMFS Office of Protected Species website: http://www.nmfs.noaa.gov/pr/species/.

The Gulf reef fish fishery is classified in the 2008 Marine Mammal Protection Act List of Fisheries as Category III fisheries (73 FR 66048). 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% 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. Dolphins are the only species documented as interacting with these fisheries. Bottlenose dolphins prey upon on the bait, catch, and/or released discards of fish from the reef fish fishery. They are also a common predator around reef fish vessels, feeding on the discards.

All five species of sea turtles are adversely affected by the Gulf reef fish fishery. Incidental captures are relatively infrequent, but occur in all commercial and recreational hook-and-line components of the reef fishery. Captured sea turtles can be released alive or can be found dead upon retrieval of the gear as a result of forced submergence. Sea turtles released alive may later succumb to injuries sustained at the time of capture or from exacerbated trauma from fishing

hooks or lines that were ingested, entangling, or otherwise still attached when they were released. Sea turtle release gear and handling protocols are required in the commercial and for-hire reef fish fisheries to minimize post-release mortality.

Smalltooth sawfish are also affected by the Gulf reef fish fishery, but to a much lesser extent. Smalltooth sawfish primarily occur in the Gulf off peninsular Florida. Incidental captures in the commercial and recreational hook-and-line components of the reef fish fishery are rare events, with only eight smalltooth sawfish estimated to be incidentally caught annually, and none are expected to result in mortality (NMFS 2005). Fishermen in this fishery are required to follow smalltooth sawfish safe handling guidelines. The long, toothed rostrum of the smalltooth sawfish causes this species to be particularly vulnerable to entanglement in fishing gear.

3.3 Description of the Affected Economic Environment

A description of the greater amberjack stock is provided in Section 1.2. Additional details on the fishery for greater amberjack are provided in Amendment 30A to the Reef Fish FMP and Regulatory Framework Action to the Reef Fish FMP (Greater Amberjack Recreational Fishing Closure), and are incorporated herein by reference. The following information is a description of the economic environment of the greater amberjack fishery.

3.3.1 Commercial Sector

The major source of data summarized in this description is the Federal Logbook System (FLS), supplemented by average prices calculated from the Accumulated Landings System (ALS) and price indices taken from the Bureau of Labor Statistics. Inflation adjusted revenues and prices are reported in 2010 constant dollars.

3.3.1.1 Average Annual Landings, Value, and Effort

The commercial reef fish fishing fleet in the Gulf of Mexico is composed of vessels using different gear types and catching a variety of species. A license limitation program is in place in the reef fish fishery; to harvest commercial amounts of reef fish a vessel is required to have an active commercial permit on board. Commercial reef fish permits are renewable every year, although an owner is granted a grace period of one year to renew his permit. Non-renewal of a permit within this grace period results in permanent loss of that particular permit. According to the Southeast Regional Office website, the Constituency Services Branch (Permits) unofficially listed 830 current holders of Gulf of Mexico reef fish permits as of December 21, 2010.

For the 2005-2010 period, Gulf permitted commercial reef fish vessels landed an average of 14.1 million pounds (gutted weight) of reef fish valued (ex-vessel) at $39.5 million in nominal prices or $41.5 million in 2010 (real) prices (Table 3.3.1.1.1). Some of these vessels landed an average of 508,000 pounds (gutted weight) of greater amberjack valued at $571,000 in nominal prices or $600,000 in real prices. An average of 750 vessels that landed at least one pound of reef fish took 8,964 trips and spent 37,096 days at sea. An average of 325 vessels that landed at least one pound of greater amberjack took 1,229 trips and spent 6,918 days at sea. The greater amberjack

sector is a small component of the reef fish fishery in terms of landings (3.6%) and value (1.4%), but a large number of reef fish vessels landed at least one pound of greater amberjack (43.3%).

Table 3.3.1.1.1. Landings (gutted weight), nominal value, real value, boats, trips, and days away from port, 2005-2010 average.

	Greater Amberjack	Total Reef Fish	Percent[1]
Landings (1,000 pounds gw)	508	14,124	3.6
Nominal Value ($1,000)	$571	$39,519	1.4
Real Value ($1,000) in 2010 dollars	$600	$41,519	1.4
Boats	325	750	43.3
Trips	1,229	8,964	13.7
Days Away from Port	6,918	37,096	18.6

[1]Percent of greater amberjack to total reef fish.

Since more than half of greater amberjack in the Gulf of Mexico are landed in Florida, the distribution of landings by area is presented by separating Florida into four areas— Based on the NMFS' sampling stratification procedures for expense reporting and data availability, Florida was divided into four landing regions, ECFL: the Emerald Coast of FL which includes Gulf, Bay, Walton, Okaloosa, Santa Rosa and Escambia Counties; BBFL: the Big Bend of FL which includes Dixie, Taylor, Jefferson, Wakulla and Franklin Counties; WCFL: west central FL which includes Sarasota, Manatee, Hillsborough, Pinellas, Pasco, Hernando, Citrus and Levy Counties; and SWFL: southwest FL which includes Collier, Lee and Charlotte Counties and the FL Keys. A minimal amount of landings cannot be readily assigned to a specific landing area in the Gulf.

Landings of greater amberjack in Texas and Louisiana were fairly high but were substantially less than those in Florida. Alabama/Mississippi recorded very low landings. Within Florida, the bulk of landings occurred in WCFL with some good amount of landings in ECFL. BBFL and SWFL recorded relatively low landings. The distribution of revenues closely mimics that of the landings, yet there are notable differences in prices per pound across the Gulf. Excluding the "other areas", Alabama/Mississippi registered the highest real price at $1.29 per pound and Texas had the lowest at $1.08 per pound. Relatively high prices were also recorded in Florida, except in SWFL. In general, the distribution of vessels, trips, and days away from port follows the landings distribution, with at least one notable exception. There were more vessels, trips, and days away from port but lower landings in NWFL than in Texas or Louisiana.

Table 3.3.1.1.2. Greater amberjack landings (gutted weight), real value, real price, boats, trips, and days away from port for vessels landing at least one pound of greater amberjack, by area, 2005-2010 average.

	TX	LA	AL/MS	ECFL	BBFL	WCFL	SWFL	OTHERS
Landings (1,000 lb)	95	99	14	77	25	169	28	2
Real Value ($1,000)	$103	$120	$18	$92	$30	$202	$32	$3
Real Price ($)	$1.08	$1.21	$1.29	$1.19	$1.20	$1.20	$1.14	$1.50
Boats	32	32	15	78	22	119	40	6
Trips	136	153	71	324	54	384	95	12
Days Away	760	820	336	1,625	222	2,641	480	35

3.3.1.2 Monthly Distribution of Landings, Value, and Effort

Landings of greater amberjack peaked in the months of June through August and also in January and February (Table 3.3.1.2.1). The relative absence of landings in March through May is a direct result of the seasonal closure for these months. In addition, the low landings in November and December were partly caused by quota closures in 2009 and 2010. Possibly due to the quota and seasonal closures, landings in January and February were relatively high. There were more boats and trips landing greater amberjack in January and February than in any other two-month combinations. Without considering the seasonal closure, real prices ranged from $1.14 per pound in June to $1.25 per pound in January.

Table 3.3.1.2.1. Monthly greater amberjack landings (gutted weight), nominal value, real value, boats, trips, and days away from port for vessels landing at least one pound of greater amberjack, 2005-2010 average.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Levels											
Landings (1,000 lb)	61	86	4	0	3	77	63	73	42	37	29	33
Real Value ($1,000)	$76	$99	$5	$0	$3	$88	$74	$83	$51	$44	$36	$40
Real Price ($)	$1.25	$1.15	$1.25	$0.00	$1.00	$1.14	$1.17	$1.14	$1.21	$1.19	$1.24	$1.21
Boats	129	124	14	6	14	111	100	107	90	83	61	62
Trips	183	163	16	6	17	161	142	150	124	103	79	86
Days Away	1,076	979	66	20	89	932	766	820	685	590	458	436
	Percent											
Landings	12.0	16.9	0.8	0.0	0.6	15.2	12.4	14.4	8.3	7.3	5.7	6.5
Real Value	12.7	16.5	0.8	0.0	0.5	14.7	12.4	13.9	8.5	7.3	6.0	6.7
Boats	14.3	13.8	1.6	0.7	1.6	12.3	11.1	11.9	10.0	9.2	6.8	6.9
Trips	14.9	13.3	1.3	0.5	1.4	13.1	11.5	12.2	10.1	8.4	6.4	7.0
Days Away	15.6	14.2	1.0	0.3	1.3	13.5	11.1	11.9	9.9	8.5	6.6	6.3

3.3.1.3 Distribution of Landings, Value, and Effort by Gear Type

Hook and line was the predominant gear used in fishing for greater amberjack. It accounted for 432,000 pounds (gutted weight) or 85.2 percent of greater amberjack landings (Table 3.3.1.3.1). Bottom longline and diving accounted for significantly lower amount of greater amberjack landings. Trolling and some other gear caught very minimal amount of greater amberjack. Landings by hook and line commanded the lowest price per pound, followed by bottom longline, diving, and trolling. It appears that the amount of landings by each gear type had a strong role in the determination of the price level. More boats used hook and line in fishing for greater amberjack than any other gear, although a good number of boats used bottom longline.

Table 3.3.1.3.1. Greater amberjack landings (gutted weight), real value, real price, boats, trips, and days away from port, by gear type for vessels landing at least one pound of greater amberjack, 2005-2010 average.

	Diving	Hook & Line	Bottom LL	Trolling	Others
			Levels		
Landings (1,000 lb)	20	432	54	1	0
Real Value ($1,000)	$25	$509	$65	$2	$0
Real Price ($)	$1.25	$1.18	$1.20	$2.00	$0.00
Boats	18	235	86	4	2
Trips	68	881	274	5	2
Days Away	130	4,126	2,635	13	14
			Percent		
Landings	3.9	85.2	10.7	0.2	0.0
Real Value	4.2	84.7	10.8	0.3	0.0
Boats	5.2	68.1	24.9	1.2	0.6
Trips	5.5	71.6	22.3	0.4	0.2
Days Away	1.9	59.6	38.1	0.2	0.2

3.3.1.4 Distribution of Boats by Landings Category

Vessels in the reef fish fishery caught not only several species but also varying amounts of the species. Table 3.3.1.4.1 presents landing categories of vessels that landed at least one pound of greater amberjack or any reef fish species, using landings per boat over the years 2005-2010. Since this table uses the sum of all vessels with landings within each category, vessels would be counted in one or more categories, so vessels are not directly additive across the various landing categories or across the species columns. Vessels landing greater amberjack are concentrated in the lower end of the landings distribution. During 2005-2010, 1,327 vessels landed at least one pound but no greater than 499 pounds of greater amberjack. The distribution of vessels landing any reef fish differs from that of vessels landing greater amberjack. During 2005-2010, there were more vessels in the 10,000 pounds to 49,000 pounds category than in any other categories.

Table 3.3.1.4.1. Distribution of boats landing at least one pound of greater amberjack or any reef fish species, by landings category, 2005-2010 average.

Landing Category (pounds)	Greater Amberjack	Total Reef Fish
1 – 499	1,327	814
500 – 999	251	420
1,000 – 3,999	258	1,067
4,000 – 9,999	84	754
10,000 – 49,000	29	1,254
50,000 and above	1	189

Boats using different gear types land varying amounts of fish, so the distribution of boats across various landing categories would vary by gear type. To provide some insights into this issue, a table similar to the one above but for greater amberjack only is presented in Table 3.3.1.6 with added information on gear types used. For each gear type, the distribution of vessels by landing category follows the general distribution for all gear types. That is, vessels under any gear type are concentrated at the low end of the distribution. Only vessels using hook and line belong to the high landing categories, i.e., greater than 10,000 pounds.

Table 3.3.1.4.2. Distribution of boats landing at least one pound of greater amberjack, by gear type and landings category, 2005-2010 average.

Landing Category (pounds)	Diving	Hook & Line	Bottom Longline	Trolling	Others
		Levels			
1 – 499	72	988	348	16	8
500 – 999	13	140	99	0	0
1,000 – 3,999	15	174	65	0	0
4,000 – 9,999	4	76	3	1	0
10,000 – 49,000	0	29	0	0	0
50,000 and above	0	1	0	0	0
		Percent			
1 – 499	5.0	69.0	24.3	1.1	0.6
500 – 999	5.2	55.6	39.3	0.0	0.0
1,000 – 3,999	5.9	68.5	25.6	0.0	0.0
4,000 – 9,999	4.8	90.5	3.6	1.2	0.0
10,000 – 49,000	0.0	100.0	0.0	0.0	0.0
50,000 and above	0.0	100.0	0.0	0.0	0.0

3.3.1.5 Imports

Imports of fresh snappers increased from approximately 10.8 million pounds (product weight) worth $16.0 million (current dollars) in 1991 to 21.5 million pounds worth $49.4 million in 2009. Imports peaked at 29.0 million pounds worth $60.2 million in 2007 before declining in 2008 and 2009. The recent decline in imports probably is linked to the general slow-down of economic activity in the U.S. Imports of fresh snapper primarily originated in Mexico, Central America, or South America, and entered the U.S. through the port of Miami. On average from 2006-2009, imports were above average during the months of March, April and May, and below average in November, December and January.

Imports of frozen snappers were relatively minor from 1991 through 1999, and ranged from 1.4 million pounds (product weight) worth $1.9 million (current dollars) in 1995 to 2.9 million pounds worth $4.0 million in 1998. However, imports doubled from 1999 to 2000 and increased to a peak of 12.7 million pounds worth $19.4 million in 2005. Imports remained relatively steady through 2007 and then declined to 8.1 million pounds worth $15.9 million in 2009. Imports of frozen snappers primarily originated in Brazil and entered the U.S. through the port of Miami, or originated from Indonesia and entered the U.S. through New York or Los Angeles. Imports of frozen snappers tend to be greatest during December and January and lowest in March, April and May.

Imports of fresh groupers increased from 5.6 million pounds (product weight) worth $6.1 million (current dollars) in 1991 to a peak of 12.9 million pounds worth $18.6 million in 1998. Imports have remained relatively steady since 1999, with an annual average of 8.0 million pounds worth $18.1 million. Imports generally originated in Mexico and in Panama to a much lesser extent, and entered the U.S. in Miami. Prior to 2006, imports of fresh groupers were above average in March and April and below average in October and November. However, imports in March have declined significantly since 2006.

Imports of frozen grouper were relatively minor and averaged 1.0 million pounds worth $1.6 million since 2006. Imports generally originated in Mexico or Asia, and entered the U.S. in Miami, Tampa or San Juan. On average from 2006-2009, imports of frozen groupers were above average from December through April and below average from June through August.

3.3.1.6 Economic Impacts

Fishing revenues generate business activity in multiple sectors of the economy. Business activity is characterized in the form of employment (FTE jobs) impacts, income impacts (wages, salaries, and self-employed income), and output (sales) impacts (gross business sales). Income impacts should not be added to output (sales) impacts because this would result in double counting. The various sectors are combined and summarized in the business activity model as harvester, dealer/processor, wholesaler/distributor, grocer, and restaurant sectors. It is sufficient for the current purpose to present only the overall changes in business activity to the harvesters and seafood industry.

The ex-vessel revenues used to generate the impacts on business activity are average annual revenues from greater amberjack over 2005-2010 for each state. The impacts on business activity are expressed in 2008 dollars.

Ex-vessel revenues of $356,000 in Florida generated impacts of $360,000 in output, $163,000 in income, and 6 jobs at the harvesters level in the state. Expanding beyond the harvesters level and into the entire seafood industry, these ex-vessel revenues generated $1,427,000 in output, $758,000 in income, and 28 jobs. The corresponding numbers for the other states can be interpreted in a similar fashion.

Table 3.3.1.6.1. Business activity associated with the greater amberjack dockside revenues. Output and income impacts are in 2008 dollars.

	Florida	Alabama/Mississippi	Louisiana	Texas
Dockside Revenues	$356,000	$18,000	$120,000	$103,000
Harvesters Level				
Output	$360,000	$34,000	$134,000	$137,000
Income	$163,000	$11,000	$64,000	$68,000
Employment (FTE)	6	1	3	2
Harvester and Seafood Industry				
Output	$1,427,000	$159,000	$739,000	$725,000
Income	$758,000	$81,000	$391,000	$372,000
Employment (FTE)	28	3	16	15

Source: Revenue data from logbook/ALS; economic impacts calculated by National Marine Fisheries Service Southeast Regional Office using the model developed for NMFS (2009).

3.3.2 Recreational Sector

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

3.3.2.1 Landings

The recreational sector has been the dominant sector in the Gulf greater amberjack fishery, with the sector being allocated 73% of the stock ACL. For the period 2005-2010, recreational harvests of greater amberjack accounted between 2.6 percent and 4.9 percent of total recreational harvests of reef fish, with an average of 3.7 percent (Table 3.3.2.1.1).

Table 3.3.2.1.1. Recreational landings (lbs ww) and percent distribution of greater amberjack and reef fish, 2005-2010.

	Greater Amberjack (pounds ww)	Reef Fish (pounds ww)	Percent to Reef Fish
2005	1,441,426	35,968,765	4.0
2006	1,372,660	37,928,975	3.6
2007	1,067,082	41,485,961	2.6
2008	1,279,270	38,689,565	3.3
2009	1,592,866	35,216,333	4.5
2010	1,452,244	29,790,946	4.9
Average	1,367,591	36,513,424	3.7

Source: SEFSC ACL datasets (2000-2010).

Florida has dominated all other states in the recreational landings of greater amberjack (Table 3.3.2.1.2). On average (2005-2010), Florida accounted for 65.2 percent of all recreational landings of greater amberjack, followed by Louisiana at 18.9 percent, Alabama at 13.2 percent, Texas at 2.4 percent, and lastly Mississippi at 0.8 percent. Harvests in each state fluctuated over time, but there appears to be some type of trends, upwards for Florida and downwards in other states. Mississippi recorded landings of greater amberjack only in 2008 and 2009.

Table 3.3.2.1.2. Recreational landings (lbs ww) and percent distribution of greater amberjack across all modes, by state, 2005-2010.

	Landings (pounds ww)					Percent Distribution				
	AL	FLW	LA	MS	TX	AL	FLW	LA	MS	TX
2005	409,406	809,889	175,751		46,380	28.4	56.2	12.2	0.0	3.2
2006	185,232	615,211	527,778		44,439	13.5	44.8	38.4	0.0	3.2
2007	126,664	802,361	101,313		36,745	11.9	75.2	9.5	0.0	3.4
2008	61,373	893,682	282,713	12,796	28,706	4.8	69.9	22.1	1.0	2.2
2009	83,741	1,114,755	364,419	8,920	21,030	5.3	70.0	22.9	0.6	1.3
2010	213,489	1,114,855	101,731		22,169	14.7	76.8	7.0	0.0	1.5
Avg	179,984	891,792	258,951	10,858	33,245	13.2	65.2	18.9	0.8	2.4

Source: SEFSC ACL datasets (2000-2010).

The private mode and charterboats are the two dominant modes in the harvest of greater amberjack. In 2005, private mode landings of greater amberjack were close to twice the charterboat landings (Table 3.3.2.1.3). But in the two succeeding years (2006-2007) private mode landings of the species were less than half of charterboat landings. In the next three succeeding years (2008-2010), private mode landings exceeded those of charterboats. On average, however, greater amberjack landings of the two fishing modes are not too far from each other. The headboat mode accounted for an average of 5 percent of total recreational landings of greater amberjack.

Table 3.3.2.1.3 Recreational landings (lbs ww) and percent distribution of greater amberjack across all states, by mode, 2005-2010.

	Landings (pounds ww)				Percent Distribution			
	Charterboat	Headboat	Private	Shore	Charterboat	Headboat	Private	Shore
2005	473,803	61,281	906,343	0	32.9	4.3	62.9	0.0
2006	941,682	79,892	351,086	0	68.6	5.8	25.6	0.0
2007	687,121	59,436	320,525	0	64.4	5.6	30.0	0.0
2008	537,568	54,544	687,158	0	42.0	4.3	53.7	0.0
2009	713,727	103,191	775,949	0	44.8	6.5	48.7	0.0
2010	635,015	53,203	764,027	0	43.7	3.7	52.6	0.0
Avg	664,819	68,591	634,181	0	48.6	5.0	46.4	0.0

Source: SEFSC ACL datasets (2000-2010).

Peak landings generally occurred in the months of May through August (Table 3.3.2.1.4). On average, these months accounted for approximately 61 percent of the entire year's landings. Although landings in the first and last quarters of the year were relatively low, landings in the first quarter were slightly higher than those in the last quarter, at least on average. This landings distribution is more than likely to change in the future because of the June-July seasonal closure implemented in 2011.

Table 3.3.2.1.4. Recreational landings (lbs ww) and percent distribution of greater amberjack, by month, 2005-2009.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Landings (pounds ww)											
2005	132,994	118,997	91,478	90,330	287,927	273,403	159,282	159,590	36,842	38,870	2,708	2,183
2006	22,496	22,091	94,176	88,160	280,292	274,970	141,481	140,655	80,022	84,316	49,898	49,258
2007	52,932	48,866	91,669	88,447	124,108	115,717	106,790	95,865	53,286	56,616	19,798	20,703
2008	35,506	34,394	68,736	68,257	141,487	142,116	205,327	196,863	66,954	70,204	68,294	70,472
2009	97,890	87,081	31,751	35,433	328,931	328,034	251,171	245,658	45,543	41,168	1	157
2010	37,495	37,360	138,387	137,472	237,643	230,248	59,546	58,314	139,388	150,963	36,452	35,149
Avg	63,219	58,132	86,033	84,683	233,398	227,415	153,933	149,491	70,339	73,690	29,525	29,654
	Percent Distribution											
2005	9.5	8.5	6.6	6.5	20.6	19.6	11.4	11.4	2.6	2.8	0.2	0.2
2006	1.7	1.7	7.1	6.6	21.1	20.7	10.7	10.6	6.0	6.3	3.8	3.7
2007	6.1	5.6	10.5	10.1	14.2	13.2	12.2	11.0	6.1	6.5	2.3	2.4
2008	3.0	2.9	5.9	5.8	12.1	12.2	17.6	16.8	5.7	6.0	5.8	6.0
2009	6.6	5.8	2.1	2.4	22.0	22.0	16.8	16.5	3.1	2.8	0.0	0.0
2010	2.9	2.9	10.7	10.6	18.3	17.7	4.6	4.5	10.7	11.6	2.8	2.7
Avg	5.0	4.6	6.8	6.7	18.5	18.1	12.2	11.9	5.6	5.9	2.3	2.4

Source: SEFSC ACL datasets (2000-2010); MRFSS; TPWD; HBS. Supplied by SERO-LAPP/DM.

3.3.2.2 Effort

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

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

A target trip may be considered an angler's revealed preference for a certain species, and thus may carry more relevant information when assessing the economic effects of regulations on the subject species than the other two measures of recreational effort. Given the subject nature of this amendment, the following discussion focuses on target trips for greater amberjack.

On average, greater amberjack target trips were for 3.8 percent of the target trips for reef fish, and in turn, target trips for reef fish accounted for 5.5 percent of total angler trips in the Gulf (Table 3.3.2.2.1). Target trips for greater amberjack and for all reef fish fell in 2010 possibly due to the oil spill incident, with target trips for all reef fish falling more than those for greater amberjack.

Table 3.3.2.2.1. Target trips for greater amberjack and reef fish, excluding headboats, 2005-2010.

	Greater Amberjack Target Trips		Reef Fish Target Trips	
	Trips	Percent[1]	Trips	Percent[2]
2005	64,865	5.5	1,185,932	5.4
2006	48,833	4.4	1,114,318	4.7
2007	32,274	2.1	1,501,313	6.2
2008	44,315	2.9	1,551,659	6.4
2009	50,649	3.7	1,376,775	6.2
2010	35,706	4.0	891,075	4.3
Average	46,107	3.8	1,270,179	5.5

Source: MRFSS database, NOAA Fisheries, NMFS, SERO.
[1]Percent to reef fish target trips. [2]Percent to total angler trips.

On average, most of the target trips for greater amberjack occurred in west Florida (66.1%), and the rest mostly shared by Louisiana (16.7%) and Alabama (16.5%), with Mississippi recording target trips only in 2009 (Table 3.3.2.2.2). Target trips for greater amberjack peaked in 2005 for Alabama and 2006 for Louisiana and declined quite substantially through the years. Florida's peak target trips for greater amberjack occurred in 2009 despite the fishery closure (Gulf-wide) commencing on October 24, 2009. As noted earlier, overall target trips for greater amberjack fell in 2010, but as can be gleaned from Table 3.3.2.6, target trips in Alabama increased in 2010.

Table 3.3.2.2.2. Greater amberjack target trips and percent distribution across all modes excluding headboats, by state, 2005-2010.

	Greater Amberjack **Target** Trips				Percent Distribution			
	AL	FLW	LA	MS	AL	FLW	LA	MS
2005	21,434	34,664	8,767	0	33.0	53.4	13.5	0.0
2006	9,708	24,772	14,353	0	19.9	50.7	29.4	0.0
2007	2,772	24,840	4,663	0	8.6	77.0	14.4	0.0
2008	4,265	30,743	9,306	0	9.6	69.4	21.0	0.0
2009	3,028	38,327	7,448	1,846	6.0	75.7	14.7	3.6
2010	4,530	29,553	1,623	0	12.7	82.8	4.5	0.0
Average	7,623	30,483	7,693	308	16.5	66.1	16.7	0.7

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

On average, approximately 69.3 percent of target trips for greater amberjack were recorded by anglers in private boats and the rest, in charterboats (Table 3.3.2.2.3). No greater amberjack target trips were reported by the shore mode anglers. Target trips for greater amberjack declined from their peaks in 2005 for the private mode and 2006 for the charter mode. The decline, however, was not linear as some years experienced increases in target trips relative to the previous years. Charter mode target trips for greater amberjack rose in 2006 relative to 2005, declined the next two years, increased in 2009, and fell in 2010. For the private mode, target trips for greater amberjack declined in 2006 and 2007, increased in 2008 and 2009, and declined in 2010.

Table 3.3.2.2.3. Greater amberjack target trips and percent distribution across all states, by mode excluding headboats, 2005-2010.

	Greater Amberjack **Target** Trips			Percent Distribution		
	Shore	Charter	Private	Shore	Charter	Private
2005	0	14,296	50,569	0.0	22.0	78.0
2006	0	23,579	25,253	0.0	48.3	51.7
2007	0	15,779	16,495	0.0	48.9	51.1
2008	0	8,049	36,266	0.0	18.2	81.8
2009	0	13,406	37,242	0.0	26.5	73.5
2010	0	9,684	26,022	0.0	27.1	72.9
Average	0	14,132	31,975	0.0	30.7	69.3

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

The monthly distribution of greater amberjack target trips appears to be relatively stable over the years, with March through August being the top months (Table 3.3.2.2.4). In general, the second quarter of the year has drawn the largest number of target trips for greater amberjack and the last quarter, the least. This monthly distribution of target trips generally coincided with the monthly distribution of landings.

Table 3.3.2.2.4. Greater amberjack target trips and percent distribution across all modes, excluding headboats, and states, by month, 2005-2010.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Greater Amberjack **Target** Trips											
2005	7,119	6,430	4,958	4,799	7,687	7,439	12,832	12,832	21	21	358	370
2006	919	831	1,687	1,632	11,376	11,009	4,811	4,811	1,150	1,189	4,631	4,786
2007	1,866	1,686	5,551	5,371	3,586	3,471	3,602	3,602	97	100	1,644	1,699
2008	1,971	1,843	6,711	6,495	6,496	6,286	5,261	5,261	1,114	1,152	849	877
2009	3,306	2,987	2,944	2,849	11,513	11,142	4,371	4,371	1,745	1,804	1,779	1,839
2010	0	0	4,440	4,297	6,584	6,371	2,344	2,344	3,233	3,341	1,354	1,399
Avg	2,530	2,296	4,382	4,240	7,874	7,620	5,537	5,537	1,227	1,268	1,769	1,828
	Percent Distribution											
2005	11.0	9.9	7.6	7.4	11.9	11.5	19.8	19.8	0.0	0.0	0.6	0.6
2006	1.9	1.7	3.5	3.3	23.3	22.5	9.9	9.9	2.4	2.4	9.5	9.8
2007	5.8	5.2	17.2	16.6	11.1	10.8	11.2	11.2	0.3	0.3	5.1	5.3
2008	4.4	4.2	15.1	14.7	14.7	14.2	11.9	11.9	2.5	2.6	1.9	2.0
2009	6.5	5.9	5.8	5.6	22.7	22.0	8.6	8.6	3.4	3.6	3.5	3.6
2010	0.0	0.0	12.4	12.0	18.4	17.8	6.6	6.6	9.1	9.4	3.8	3.9
Avg	5.5	5.0	9.5	9.2	17.1	16.5	12.0	12.0	2.7	2.7	3.8	4.0

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

Similar analysis of recreational effort is not possible for the headboat sector because headboat data are not collected at the angler level. Estimates of effort in the headboat sector are provided in terms of angler days, or the number of standardized 12-hour fishing days that account for the different half-, three-quarter-, and full-day fishing trips by headboats. The stationary bottom nature of headboat fishing, as opposed to trolling, suggests that most, if not all, headboat trips and, hence, angler days, are bottom or reef fish trips by intent. In a study of the for-hire fishery in the Gulf, Sutton et al. (1999) found that the mean percentage of time spent targeting greater amberjack for the entire year for all party boat operators in the Gulf of Mexico was 5.10%.

The distribution of headboat angler days by geographic area is presented in Table 3.3.2.2.5. For purposes of data collection, the headboat data collection program divides the Gulf into several areas. In Table 3.3.2.9, FLW refers to areas in Florida from the Dry Tortugas to the Florida Middle Grounds, FL-AL covers the rest of west Florida and Alabama, LA refers to the entire coastline of Louisiana, and TX includes areas in Texas from Sabine Pass-Freeport south to Port Isabel. No Mississippi vessels are included in the headboat data program. On average, the Dry Tortugas to the Florida Middle Grounds accounted for 37.4 percent of total headboat angler days in the Gulf, followed by northwest Florida to Alabama (31.7%), Texas (29.7%), and Louisiana (1.3%).

Table 3.3.2.2.5. Headboat angler days and percent distribution, by state, 2005-2010.

	Angler Days				Percent Distribution			
	FLW	FL-AL	LA	TX	FLW	FL-AL	LA	TX
2005	77,436	52,797	0	59,857	40.7	27.8	0.0	31.5
2006	57,703	66,346	5,005	70,789	28.9	33.2	2.5	35.4
2007	68,883	67,997	3,076	63,210	33.9	33.5	1.5	31.1
2008	68,058	62,118	2,945	41,188	39.0	35.6	1.7	23.6
2009	76,815	65,623	3,268	50,737	39.1	33.4	1.7	25.8
2010	70,424	40,594	217	47,154	44.5	25.6	0.1	29.8
Average	69,887	59,246	2,419	55,489	37.4	31.7	1.3	29.7

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

The seasonal distribution of headboat angler days in the Gulf closely mimics that of the private and charter target trips for greater amberjack, with March through August being the top months (Table 3.3.2.2.6). Also, the third quarter registered the largest number of headboat angler days and the last quarter, the least.

Table 3.3.2.2.6. Headboat angler days and percent distribution, by month, 2005-2010.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Headboat Angler Days											
2005	7,301	9,106	15,540	17,923	25,979	29,511	28,529	20,703	10,588	12,184	6,472	6,254
2006	6,809	8,845	15,727	17,038	24,507	29,030	33,329	21,155	16,489	14,698	7,378	4,838
2007	6,907	8,265	17,886	19,400	21,666	32,325	34,378	24,245	13,897	11,305	6,462	6,430
2008	3,066	7,391	13,678	17,199	19,547	30,997	33,537	19,088	6,303	9,942	5,587	7,974
2009	7,611	8,525	14,444	15,513	17,089	36,749	38,955	25,060	9,201	9,745	6,889	6,662
2010	4,962	5,709	13,186	18,077	13,922	26,426	22,611	14,369	8,674	16,159	9,434	4,860
Avg	6,109	7,974	15,077	17,525	20,452	30,840	31,890	20,770	10,859	12,339	7,037	6,170
	Percent Distribution											
2005	3.8	4.8	8.2	9.4	13.7	15.5	15.0	10.9	5.6	6.4	3.4	3.3
2006	3.4	4.4	7.9	8.5	12.3	14.5	16.7	10.6	8.3	7.4	3.7	2.4
2007	3.4	4.1	8.8	9.5	10.7	15.9	16.9	11.9	6.8	5.6	3.2	3.2
2008	1.8	4.2	7.8	9.9	11.2	17.8	19.2	11.0	3.6	5.7	3.2	4.6
2009	3.9	4.3	7.4	7.9	8.7	18.7	19.8	12.8	4.7	5.0	3.5	3.4
2010	3.1	3.6	8.3	11.4	8.8	16.7	14.3	9.1	5.5	10.2	6.0	3.1
Avg	3.3	4.3	8.1	9.4	10.9	16.5	17.0	11.1	5.8	6.6	3.8	3.3

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

3.3.2.3 For-hire Vessel Permits

For-hire vessels are required to have a charter/headboat permit to fish for or possess reef fish (and coastal migratory pelagic) species in the Gulf EEZ. This sector is currently under a license limitation program, where a new permit has not been issued since the program's inception in June, 2006.

In 2009, 1,422 unique for-hire vessels were permitted to operate in the Gulf reef fish fishery (Table 3.3.2.3.1). Florida, with 877 vessels, was the foremost homeport state of these vessels, followed by Texas (232), Alabama (140), Louisiana (101), and Mississippi (54). There were 18 vessels with homeports in states outside the Gulf. For each state, half or more than half of vessels were 21 to 40 feet in length. More than 80% of the vessels had 6 or less passenger

capacity (also known as "six-pack"). This total included 49 vessels that did not report information on passenger capacity. The for-hire permit does not distinguish between whether the vessel operates as a charterboat or headboat, but in all likelihood six pack vessels are charterboats. Some of the higher passenger category vessels could very well be headboats. Seventy-nine vessels were included in the headboat survey program in 2009, with the majority located in Florida (43), followed by Texas (22), Alabama (10), and Louisiana (4).

Table 3.3.2.3.1. Number of vessels with federal Gulf reef fish charter/headboat permit, vessel length, and passenger capacity, by homeport state, 2009.

	AL	FL	LA	MS	TX	OTHERS	TOTAL
	Number of Vessels						
	140	877	101	54	232	18	1,422
	Number of Vessels, by Length Category (Feet)						
20 or less	8	50	1	3	11	0	73
21-40	70	600	85	37	160	10	962
41-60	43	181	11	11	43	3	292
61-80	18	42	4	3	15	4	86
>80	1	4	0	0	3	1	9
	Number of Vessels, by Passenger Capacity (Persons)						
6 or less	99	732	93	45	204	13	1,186
7-20	10	50	2	2	4	1	69
21-40	19	39	5	6	1	0	70
41-60	8	25	1	1	10	0	45
>60	4	31	0	0	13	4	52

Source: Southeast Permits Database, NOAA Fisheries, SERO.

3.3.2.4 Economic Values and Economic Impacts

Participation, effort, and harvest are indicators of the value of saltwater recreational fishing. However, a more specific indicator of value is the satisfaction that anglers experience over and above their costs of fishing. The monetary value of this satisfaction is referred to as consumer surplus (CS). The value or benefit derived from the recreational experience is dependent on several quality determinants, which include fish size, catch success rate, and the number of fish kept. These variables help determine the value of a fishing trip and influence total demand for recreational fishing trips. Haab et al. (2009) estimated that the CS ("willingness to pay") per fish for snapper in the Southeastern U.S. is $11.46 (2010 dollars). While this estimate is not specific to greater amberjack, their study did include the amberjack genus as part of the snapper group (Carter 2010, personal communication).

While anglers receive economic value as measured by the consumer surplus associated with fishing, for-hire businesses receive value from the services they provide. Producer surplus (PS) is the measure of the economic value these operations receive. PS is the difference between the

revenue a business receives for a good or service, such as a charter or headboat trip, and the cost the business incurs to provide that good or service. Estimates of the PS associated with for-hire trips are not available. However, proxy values in the form of net operating revenues (NOR) were generated each for the charter and headboat operations. The estimated NOR values are $145.63 (2010 dollars) per charter angler trip and $49.05 (2010 dollars) per headboat angler trip. (Carter, 2010, personal communication).

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

Estimates of the economic impacts of the greater amberjack recreational fishery in the Gulf were derived using average output (sales) and job (FTE) impact coefficients for recreational angling across all fisheries (species), as derived by an economic add-on to the MRFSS, and described and utilized in NMFS (2010). Estimates of the average expenditures by recreational anglers are provided in NMFS (2010) and are incorporated herein by reference. Target trips for greater amberjack were selected as the measure of effort for estimating the resulting economic impacts. Although not provided here, estimates of the economic impacts associated with greater amberjack catch trips can be calculated based on the ratio of catch trips to target trips because the average output impact and jobs per trip cannot be differentiated by trip intent. Greater amberjack target trips in Texas were derived as Texas total angler trips multiplied by 3.5%, which is the mean percentage of time targeting amberjack for the entire twelve-month period for all charter operators in Texas. This percentage was assumed to hold for the private angler trips.

Estimates of the average greater amberjack target effort and associated economic impacts are presented in Table 3.3.2.4.1. These estimates do not include economic impacts associated with headboat target trips. The headboat sector in the Southeast is not covered in the MRFSS, so estimation of the appropriate economic impact coefficients for the head boat sector was not conducted in the development of NMFS (2009). A word of caution is in order with respect to the numbers in the "Total" column. These numbers are a simple summation of impacts in individual states. Potentially different numbers may result if the analysis were conducted on the entire Gulf as one region, because it would capture interrelations among the various states in the Gulf.

The target trips for greater amberjack in the Gulf resulted in an estimate of economic impacts of approximately $7.6 million in output (sales) and $4.3 million in value added (income). These activities supported a total of 79 FTE jobs. Charter trips contributed the greatest portion of these impacts, accounting for approximately 74% of the total output impacts, or 75% of the total value added impacts. The fact that the private mode had more than twice the number of trips than the charter mode and yet was associated with less economic impacts is due to higher expenditures per for-hire trip compared to private trips. Florida accounted for more than half the total economic impacts, followed in order by Louisiana, Alabama, Texas, and Mississippi. It should be recalled that Mississippi anglers only reported target trips in the private mode.

Table 3.3.2.4.1. Average greater amberjack target trips and associated economic impacts (2008 dollars). Output and value added impacts are not additive.

	Alabama	West Florida	Louisiana	Mississippi	Texas	Total
Shore Mode						
Target Trips	0	0	0	0	0	0
Output Impact	$0	$0	$0	$0		$0
Value Added Impact	$0	$0	$0	$0		$0
Jobs	0	0	0	0		0
Private/Rental Mode						
Target Trips	6,879	20,573	5,353	369	907	34,081
Output Impact	$400,230	$934,042	$436,530	$10,523	$152,796	$1,934,121
Value Added Impact	$219,117	$555,417	$214,700	$5,043	$81,653	$1,075,930
Jobs	4	9	4	0	1	19
Charter Mode						
Target Trips	1,371	10,096	3,555	0	121	15,143
Output Impact	$713,813	$3,170,211	$1,692,364	$0	$45,397	$5,621,785
Value Added Impact	$392,930	$1,879,609	$960,921	$0	$25,305	$3,258,765
Jobs	10	33	18	0	0	60
All Modes						
Target Trips	8,250	30,669	8,908	369	1,028	49,224
Output Impact	$1,114,043	$4,104,253	$2,128,894	$10,523	$198,193	$7,555,906
Value Added Impact	$612,047	$2,435,025	$1,175,622	$5,043	$106,957	$4,334,695
Jobs	14	42	22	0	2	79

Source: Effort data from the Marine Recreational Fisheries Statistics Survey/Marine Recreational Information Program; economic impacts calculated by National Marine Fisheries Service Southeast Regional Office using the model developed for NMFS (2009).

3.4 Description of the Affected Social Environment

This section includes a history of greater amberjack landings and regulations, and a description of the recreational and commercial portions of the greater amberjack component of the reef fish fishery. The description is based on the geographical distribution of landings and the relative importance of greater amberjack for commercial and recreational communities. A spatial approach enables consideration of fishing communities and the importance of fishery resources to those communities, as required by National Standard 8.

Greater amberjack is targeted throughout the Gulf region although landings are greatest in Florida. The majority of greater amberjack is landed by the recreational sector (approximately

70% with a range of 63.6% to 73.1% from 2002-2010) and approximately 30% is landed by the commercial sector (range of 26.9% to 36.4% from 2002-2010, Figure 1.2.1). For the purpose of setting quotas, the Council selected an interim allocation at 73% recreational: 27% commercial in Amendment 30A. Rather than directed fishing trips, greater amberjack is an important component to a multi-species fishery for both commercial and recreational fishermen. Because of this multi-species fishing practice, it is difficult to discuss greater amberjack separate from its broader context within fishing.

Fishing Effort and Management Measures

Landings data are frequently used to examine fishing behavior and effort. Figure 3.4.1 represents the interactions between humans and the greater amberjack fishery over time using landings and management regulations. Landings reflect human effort and management regulations reflect restrictions to that effort. It is important to note that a causal relationship is not implied and may not exist between implementation of an effort restriction and subsequent years' landings. Effort is influenced by many factors and a decline in landings does not imply overfishing. Numerous other factors affect landings including preference and abundance of other species (effort shifts); fuel prices and other economic considerations; season closures; and environmental events or weather conditions. Figure 3.4.1 presents fishery dependent information specific to greater amberjack including management measures and historical landings by the commercial and recreational sectors.

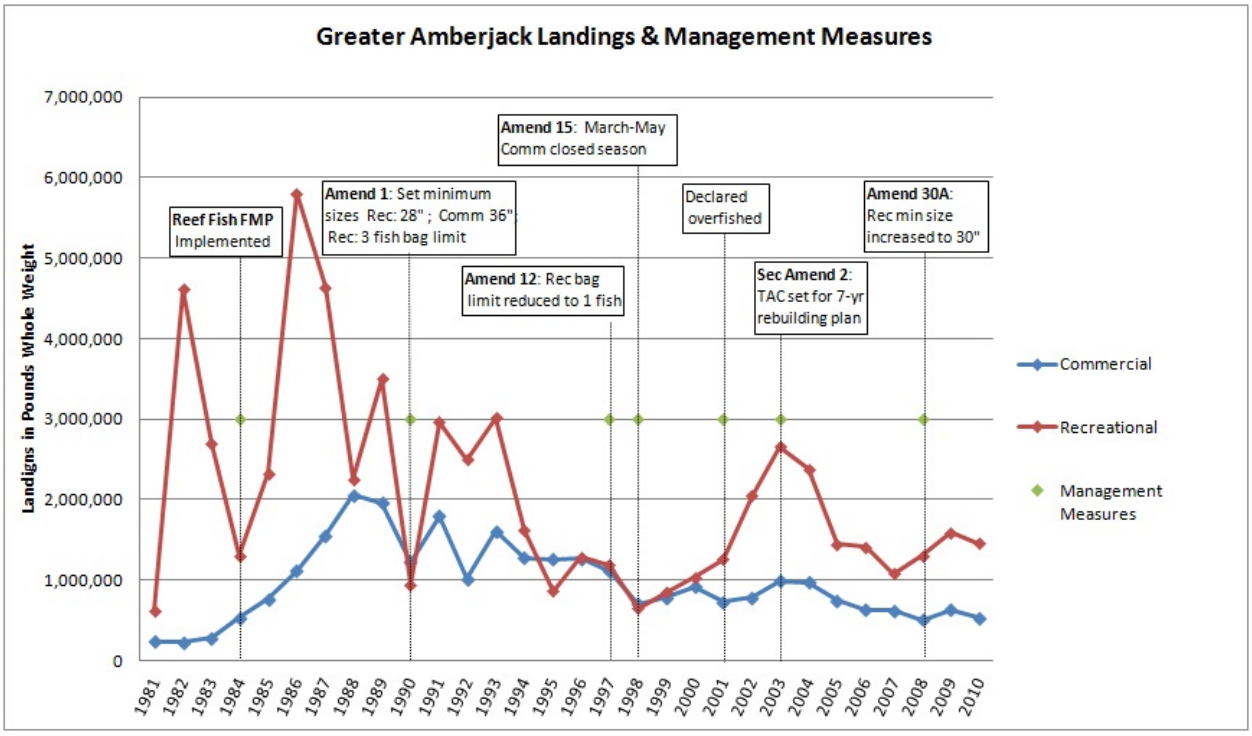

Figure 3.4.1. Commercial and recreational landings with timeline of management measures. The recreational fixed closed season (June 1 – July 31) was implemented in 2011. Source: SEDAR Greater amberjack update assessment February 2011. (Commercial landings from Table 3.2.4; Recreational landings from Table 4.1.3.1.)

Social Importance of Fishing

Socio-cultural values are qualitative in nature making it difficult to measure social valuation of marine resources and fishing activity. The following description includes multiple approaches to examining fishing importance. These spatial approaches focus on the community level (based on the address of dealers or permit holders) and identify importance by "community", defined according to geo-political boundaries (cities). A single county may thus have several communities identified as reliant on fishing and the boundaries of these communities are not discrete in terms of residence, vessel homeport, and dealer address. For example, a fisherman may reside in one community, homeport his vessel in another, and land his catch in yet another. Furthermore, while commercial fishing data are available at the species level, these data are not available for recreational fishing which must be addressed more generally. Despite these caveats, the analysis identifies where most fishing activity takes place.

To identify the communities of greatest engagement in recreational fishing, a principal component analysis (PCA) was run on a set of variables including the number of federal charter permits, number of vessels designated recreational by owner address, number of vessels designated recreational by homeport (SERO permit office 2008), and recreational fishing infrastructure (MRIP site survey 2010). The 20 communities with the highest factor scores from this analysis are identified in Table 3.4.1 as the communities of greatest recreational fishing engagement. However, this measure does not adjust for population size meaning that larger communities are given more weight over smaller communities. The ranking addresses recreational fishing generally and is not specific to greater amberjack. Ideally, additional variables quantifying the importance of recreational fishing to a community would be included (such as the amount of recreational landings in a community, number of recreational fishing related businesses, etc); however, these data are not available at the community level.

Another approach utilizes measures called the regional quotient (rq) and local quotient (lq) to identify commercial reliance on greater amberjack. The rq is a way to measure the relative importance of a given species across all communities in the region and represents the proportional distribution of commercial landings of a particular species. This proportional measure does not provide the number of pounds or the value of the catch, data which might be confidential at the community level for many places. The rq is calculated by dividing the total pounds (or value) of a species landed in a given community, by the total pounds (or value) for that species for all communities in the region.

The local quotient (lq) is a way to measure the relative importance of a particular species among all landings in the same community. The lq is calculated by dividing the total pounds (or value) of landings of a given species in a community by the total pounds (or value) of all commercial species for that same community. Thus, the lq represents the proportion of landings of a given species among other landed species, suggesting the relative importance of species to the community.

The data used for the rq and lq measures were assembled from the accumulated landings system (ALS) which includes landings of all species from both state and federal waters and is based on dealers' reports. Because of this, the address of a dealer may not be the coastal community where the dealer's facilities are located. Thus, in the analysis below, the inland community of

Houston, Texas appears as having the greatest proportional landings and value of greater amberjack. It may be assumed that the dealers in Houston are associated with fish houses in nearby coastal communities. These measures are an attempt to quantify the importance of greater amberjack to communities around the Gulf coast and suggest where impacts from management actions are more likely to be experienced.

Recreational Fishing

There is no information available concerning targeted trips among the recreational sector, made up of private vessels, charter for-hire, and headboats. However, due to the one fish bag limit and 30 inch minimum size limit, it is not likely that fishermen engage in directed trips for greater amberjack. Because of their large size, greater amberjack is often a trip's trophy catch, making it an important part to a multi-species fishing trip. Greater amberjack is also an important component in recreational tournaments.

Landings for the recreational sector are not available by species at the community level; therefore, it is difficult to identify communities as dependent on recreational fishing for greater amberjack. The 20 Gulf communities which scored highest for recreational fishing engagement based on the analysis described above are listed in Table 3.4.1. Because the analysis used discrete geo-political boundaries, Panama City and Panama City Beach had separate values for the associated variables. Calculated independently, each still ranked high enough to appear in the top 20 list suggesting a greater importance for recreational fishing.

Table 3.4.1. Top ranking communities based on recreational fishing engagement and reliance, in descending order.

Community	County	State
Destin	Okaloosa	FL
Orange Beach	Baldwin	AL
Panama City	Bay	FL
Port Aransas	Nueces	TX
Pensacola	Escambia	FL
Panama City Beach	Bay	FL
Naples	Collier	FL
St. Petersburg	Pinellas	FL
Freeport	Brazoria	TX
Biloxi	Harrison	MS
Galveston	Galveston	TX
Clearwater	Pinellas	FL
Fort Myers Beach	Lee	FL
Sarasota	Sarasota	FL
Tarpon Springs	Pinellas	FL
Dauphin Island	Mobile	AL
Apalachicola	Franklin	FL
Carrabelle	Franklin	FL
Port St. Joe	Gulf	FL
Marco Island	Collier	FL

Source: SERO permit office 2008, MRIP site survey 2010.

Commercial Fishing

Most commercially landed greater amberjack is caught using vertical line alongside other target species, as opposed to being the primary target species. This is partly due to its relatively low economic value (approximately $1/lb) and large minimum size limit (36" FL). A small percentage of commercial vessels direct trips toward greater amberjack and may land thousands of pounds in a single trip. Other commercial vessels may direct effort toward greater amberjack during part of a multi-day trip. It is this practice of directed effort that may be affected under the alternatives of Action 3 (see Section 4.3).

Figure 3.4.2 shows the spatial distribution of commercial greater amberjack landings around the Gulf, and Figure 3.4.3 identifies the communities with the most commercial landings of greater amberjack. The figures represent two ways of examining where greater amberjack landings are greatest. However, the figures are based on the dealer's address which may not correspond to the actual landing site. In Figure 3.4.2, numerous separate communities along the west central coast of Florida are identified as having sizeable landings, whereas dealer addresses are more concentrated in fewer communities around Houston and Galveston, Texas. This suggests a different social organization of commercial fishing infrastructure between Florida and Texas.

This pattern of commercial fishing infrastructure is evident in Figure 3.4.3 which identifies the 10 communities with the highest dealer reported landings in 2009. While dealers with a Houston business address reported the largest proportion of landings, three separate communities in Pinellas County, Florida appear in the list of top 10 communities. Panama City and Destin, both in the Florida panhandle, also appear on the top 10 list. Although place is one way of defining a community, a community is not defined by discrete geo-political boundaries alone. Social relationships, information exchanges, and economic interactions reflect shared interests that overlap place-based boundaries.

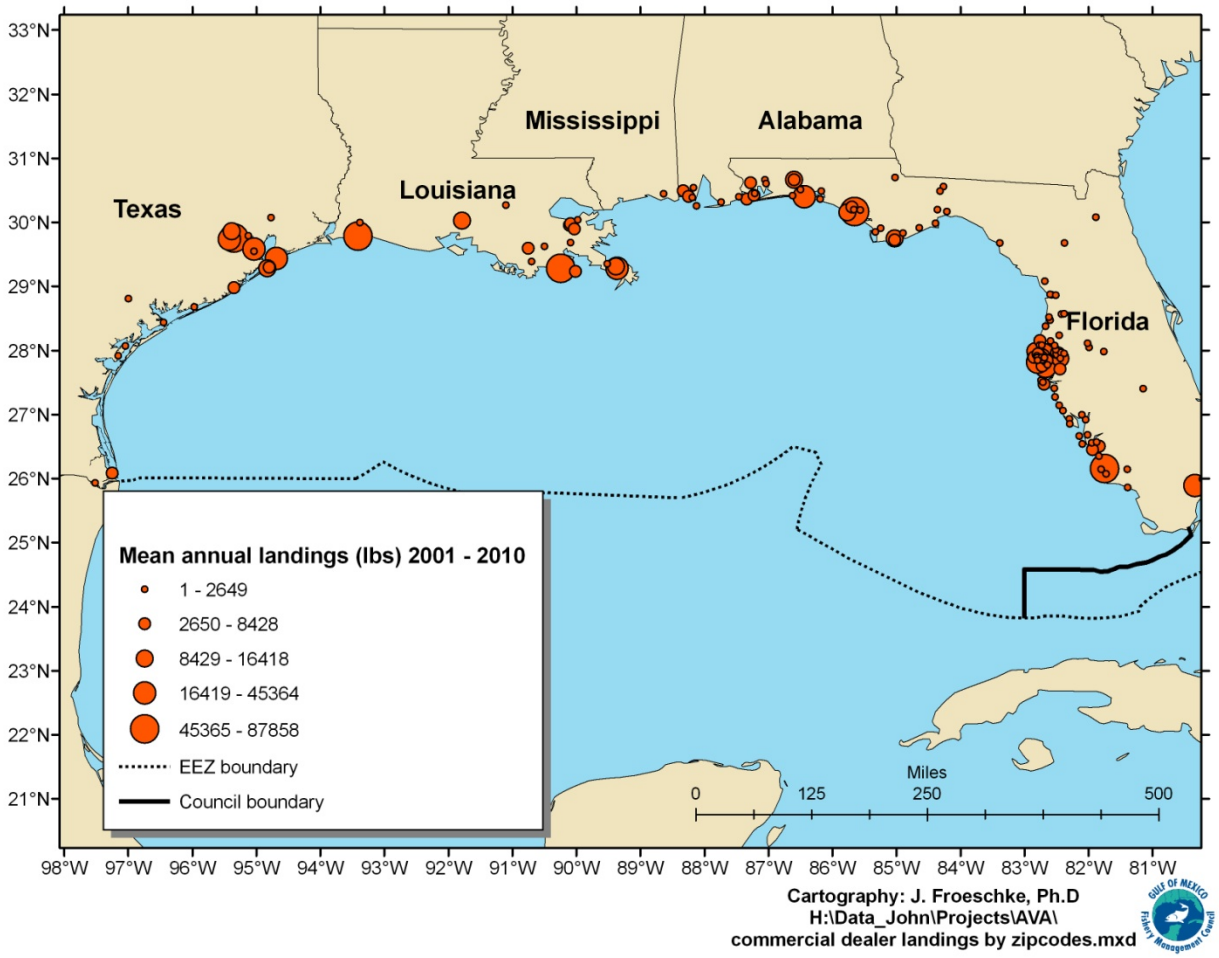

Figure 3.4.2. Distribution of commercial greater amberjack mean landings (2001-2010), based on dealer reports. Source: ALS dealer reports.

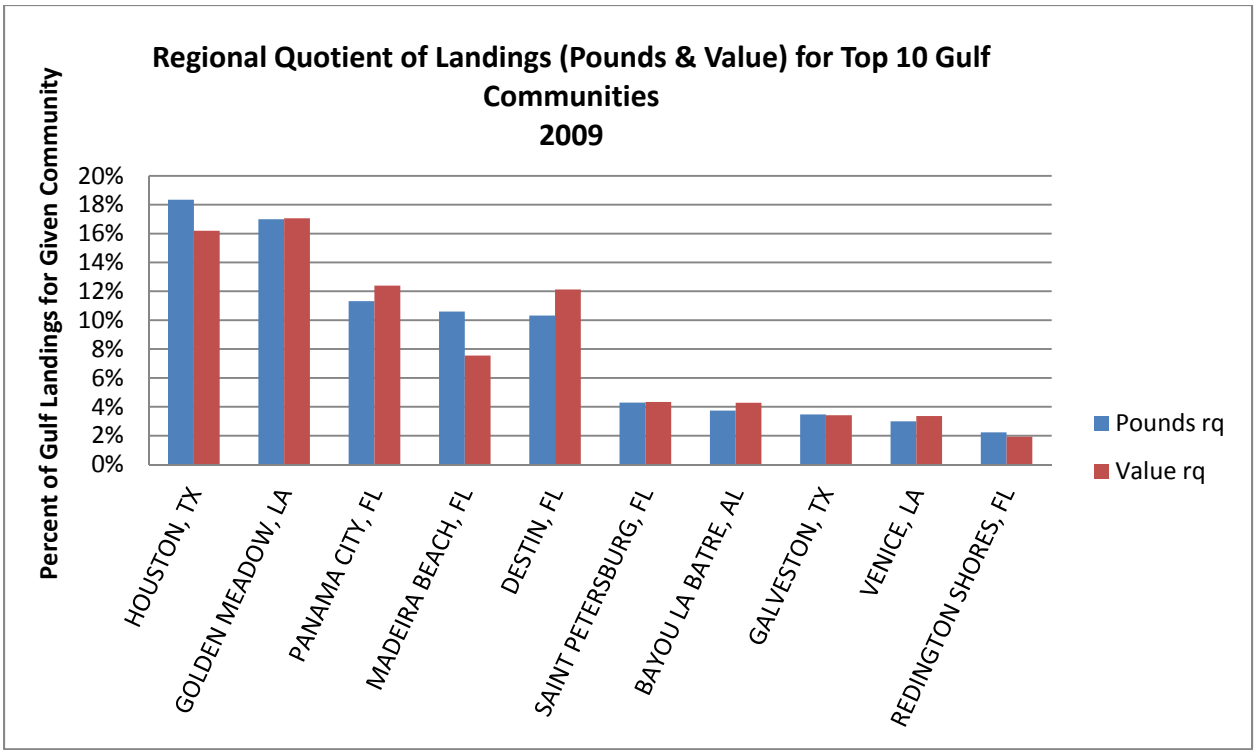

Figure 3.4.3. Proportion (rq) of greater amberjack commercial landings (pounds and value) for top 10 Gulf communities out of total landings and value of greater amberjack. For example, dealers in Golden Meadow, Louisiana reported approximately 17% of the weight and value of all greater amberjack landed in the Gulf. Source: ALS dealer reports 2009.

Importance of Greater Amberjack to Communities

The previous two figures identified where greater amberjack landings are most abundant. However, this does not necessarily reflect the importance of greater amberjack in relation to other landed species in those communities. No data are available for the proportion of recreational landings of greater amberjack by community, but these data are available for the commercial sector. Commercial landings include many species that may not be caught by the recreational sector such as shrimp and tilefish. Therefore, it cannot be assumed that the proportion of commercial greater amberjack landings among other species in a community would be similar to its proportion among recreational landings within the same community. These data should also be considered in terms of the difference between the commercial and recreational sectors' quota allocation.

Comparing the communities of recreational importance (Table 3.4.1) and those with greater commercial landings (Figure 3.4.3), four communities overlap: Destin, Panama City, and St. Petersburg, Florida, and Galveston, Texas. The following four figures employ the local quotient (lq) analysis described above to examine the relative importance of greater amberjack landings in each community. The proportions of the top 15 commercial species are shown and include state managed species.

Destin

Destin, Florida ranks first for the number of reef fish charter permits in 2010, with 118 federal permits. Destin also ranks fifth in terms of commercial greater amberjack landings in 2009 with 12% of the total value and 10% of the total pounds (Figure 3.4.3). Of the commercially landed species, greater amberjack makes up less than 5% of all commercial landings.

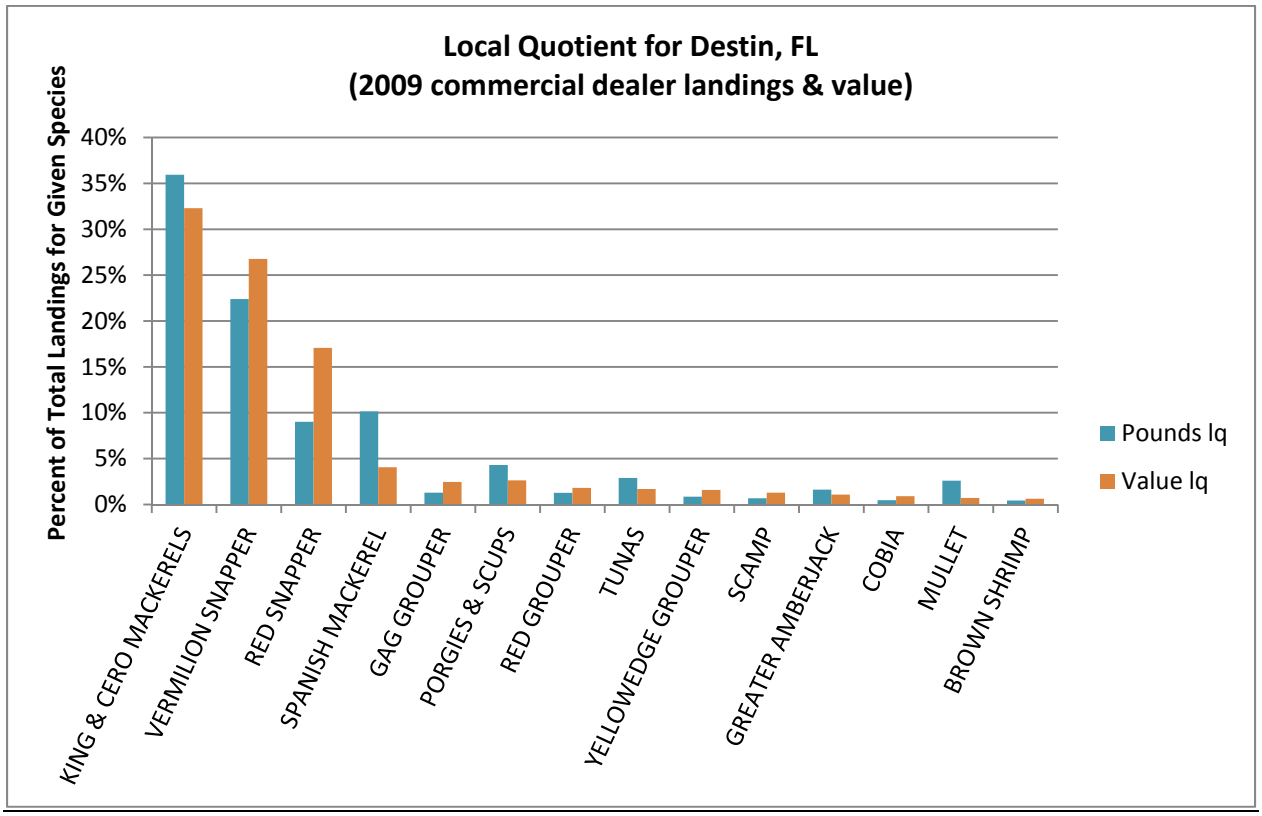

Figure 3.4.4. Proportion (lq) of commercial andings and value for top fifteen species out of total landings and value for Destin, Florida. Source: ALS dealer reports 2009.

Panama City

Panama City, Florida was ranked third for the number of reef fish charter permits in 2010 with 67 federal permits. Both Panama City and Panama City Beach ranked within the top 10 recreational fishing communities based on the fishing involvement analysis discussed above suggesting a higher level of involvement across geo-political boundaries. Panama City also ranked third in terms of commercial greater amberjack landings in 2009 with 12% of the total value and 11% of the total pounds (Figure 3.4.3). Of the commercially landed species, greater amberjack makes up less than 5% of all commercial landings.

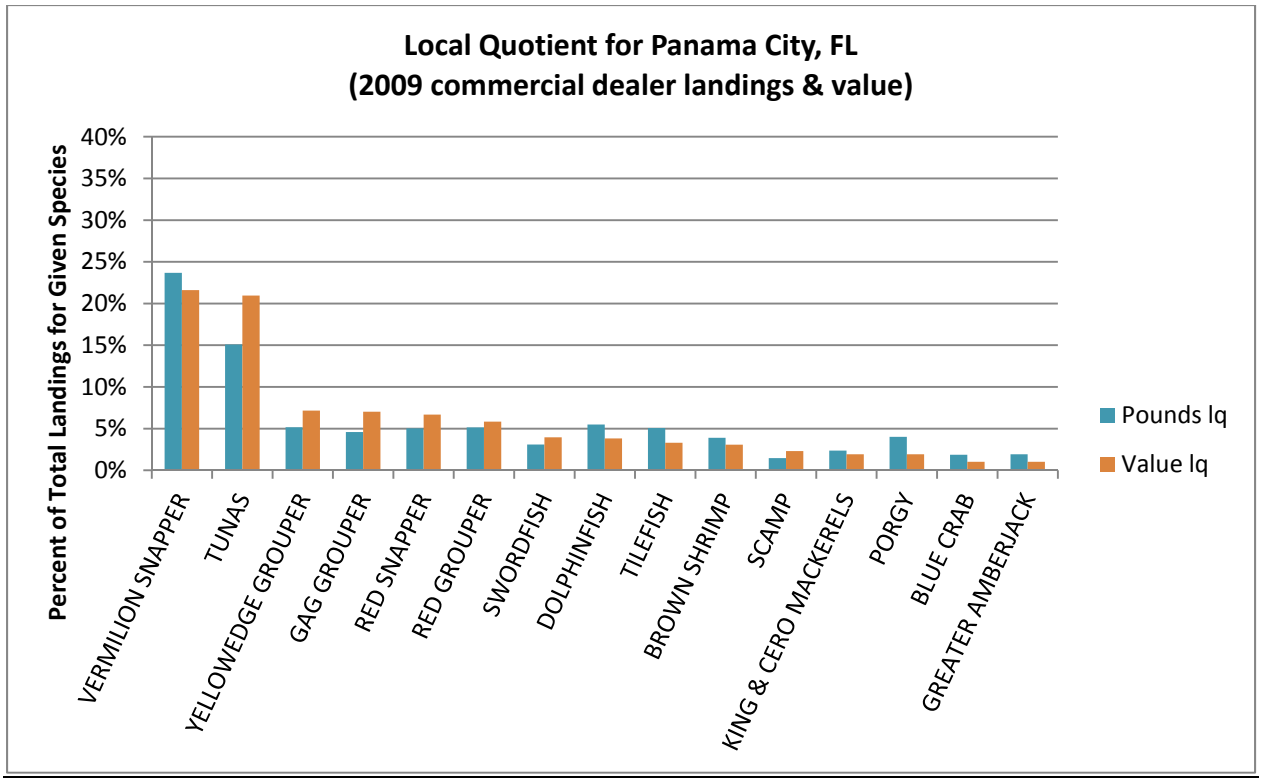

Figure 3.4.5. Proportion (lq) of commercial landings and value for top fifteen species out of total commercial landings and value for Panama City, Florida. Source: ALS dealer reports 2009.

Saint Petersburg

With 23 federal permits in 2010, Saint Petersburg, Florida did not rank among the top communities in terms of the number of permits. However, it ranked high in terms of recreational involvement based on the results presented in Table 3.4.1. Saint Petersburg ranked sixth in terms of commercial greater amberjack landindgs in 2009 with 4.3% of the total value and 4.3% of the total pounds (Figure 3.4.2) for all Gulf landings. Of the commercially landed species, greater amberjack makes up less than 5% of all commercial landings.

Three communities identified as having high recreational fishing importance (Table 3.4.1) and greater commercial landings (Figure 3.4.3) are located in Pinellas County, Florida; Saint Petersburg appears on both lists. That several communities independently rank high enough to appear among the top ranked communities suggests a high reliance on fishing in the area. It also supoorts the fact that the location of fishing communities may be less important in defning a community than the interests shared by respective members. Coastal development along the Pinellas County coast has blurred city boundaries and led to changes in the value and use of coastal areas. In turn, these changes have led the process of gentrification which makes it more expensive to live in coastal areas as property values push people of lower incomes, inland.

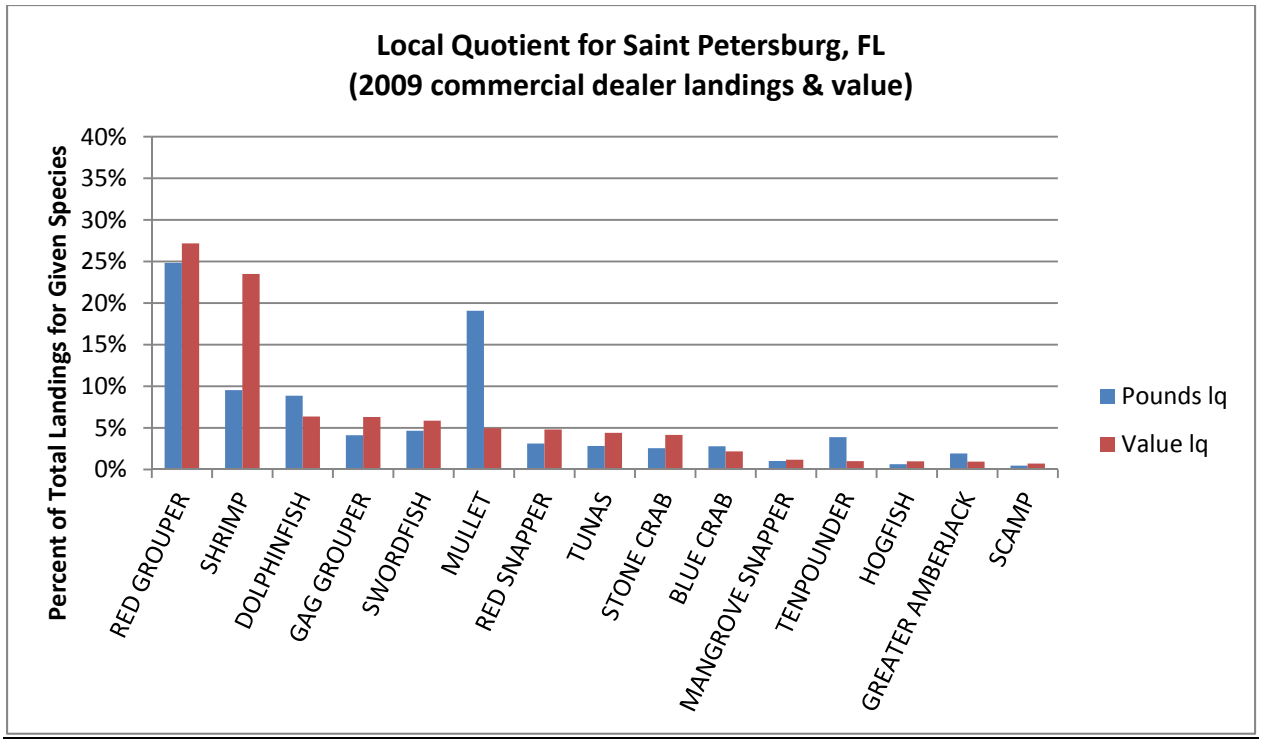

Figure 3.4.6. Proportion (lq) of commercial landings and value for top fifteen species out of total commercial landings and value for St. Petersburg, Florida. Source: ALS dealer reports 2009.

Galveston

Galveston, Texas was ranked fifth in terms of number of reef fish charter permits for the year 2010 with 45 federal permits. Galveston was also ranked eighth in terms of commercial greater amberjack landings for 2009 with 3.4% of the total value and 3.5% of the total pounds (Figure 3.4.2). Compared with shrimp landings, however, greater amberjack is not nearly as important. However, Houston, Texas ranked first in terms of commercial greater amberjack landings in 2009 based on dealer reports. It is likely that a significant proportion of these landings occurred at a physical site in or near Galveston, the nearest coastal port to the inland city of Houston.

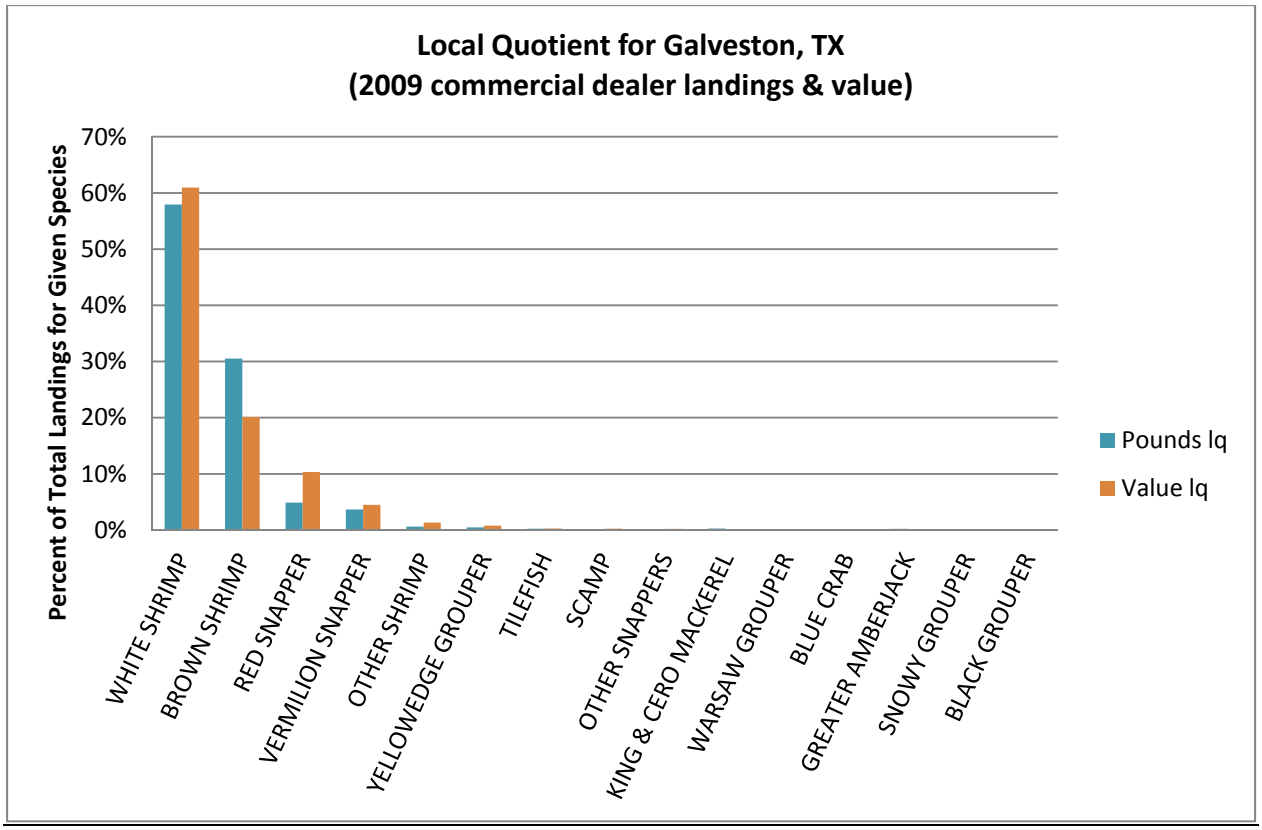

Figure 3.4.7. Proportion (lq) of commercial landings and value for top fifteen species out of total commercial landings and value for Galveston, Texas. Source: ALS dealer reports. 2009.

The low commercial value and one fish recreational bag limit likely limit greater amberjack from being a directed fishery. For both sectors it is difficult to speak of community reliance on greater amberjack; rather, greater amberjack is an important component to the reef fish complex. Although the communities above ranked among the top 10 communities for greater amberjack landings throughout the Gulf, greater amberjack represents less than 5% of the total commercial landings within each community. While landings are proportionally low, greater amberjack consistently ranks within the top 15 species in commercial communities. This supports its status as an important component in the reef fish complex, rather than a primary target species. Landings at the commuity level are not available for the recreational sector, thus a comparable analysis is not possible. Rather than engaging in directed trips, greater amberjack is generally targeted during trips along with other species. It is an important trophy and meat fish, prized for both its size and fighting behavior, making for a thrilling fishing experience.

Environmental Justice Considerations

Executive Order 12898 requires federal agencies conduct their programs, policies, and activities in a manner to ensure individuals or populations are not excluded from participation in, or denied the benefits of, or subjected to discrimination because of their race, color, or national origin. In addition, and specifically with respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns

of populations who principally rely on fish and/or wildlife for subsistence. The main focus of Executive Order 12898 is to consider "the disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories…" This executive order is generally referred to as environmental justice (EJ).

Persons employed in the greater amberjack fishery and associated businesses and communities along the Gulf of Mexico coast would be expected to be affected by this proposed action. However, information on the race and income status for groups at the different participation levels (vessel owners, crew, dealers, processors, employees, employees of associated support industries, etc.) is not available. Because this proposed action could be expected to affect fishermen and associated industries in numerous communities along the Gulf coast, census data (available at the county level, only) have been assessed to examine whether any coastal counties have poverty or minority rates that exceed the environmental justice thresholds.

The threshold for comparison that was used was 1.2 times the state average such that, if the value for the county was greater than or equal to 1.2 times the state average, then the county was considered an area of potential environmental justice concern. Census data for the year 2010 was used. For Florida, the estimate of the minority (interpreted as non-white, including Hispanic) population was 39.5%, while 13.2% of the total population was estimated to be below the poverty line. These values translate in environmental justice thresholds of approximately 47.4% and 15.8%, respectively (Table 3.4.2). Based on the demographic information provided, no potential environmental justice concern is evident with regard to the percent of minorities for the counties of the west coast of Florida. With regard for poverty, Dixie (3.8%), Franklin (8%), Gulf (1.7%), Jefferson (4.6%), Levy (3.3%), and Taylor (7.1%) counties exceed the threshold by the percentage noted. No potential environmental justice concern is evident for the remaining counties which fall below the poverty and minority thresholds. The same method was applied to the remaining Gulf States.

Table 3.4.2. Each state's average proportion of minorities and population living in poverty, and the corresponding threshold used to consider an area of potential environmental justice concern (Census Bureau 2010).

	Minorities		Poverty	
State	% Population	EJ Threshold	% Population	EJ Threshold
FL	39.5	47.4	13.2	15.8
AL	31.5	37.8	16.8	20.2
MS	41.2	49.4	21.4	25.7
LA	38.2	45.8	18.4	22.1
TX	52.3	62.7	16.8	20.1

In Alabama, Mobile was the only county to exceed the minority threshold (by 1.7%). Neither of Alabama's coastal counties exceeded the poverty threshold for potential environmental justice concern. No coastal county in Mississippi exceeded either threshold. In Louisiana, Orleans Parish exceeded the minority threshold by 25% and the poverty threshold by 1.3%. Texas has

several counties that exceeded the thresholds. In descending order of magnitude for exceeding the minority threshold were Willacy (26.3%), Cameron (24.7%), Kleberg (12.3%), Kenedy (9%), Nueces (2.8%), and Harris (.8%). Exceeding the poverty threshold were Kenedy (32.3%), Willacy (26.8%), Cameron (15.6%), Kleberg (6%), and Matagorda (1.8%). Willacy, Kenedy, Cameron, and Kleberg counties exceed both the minority and poverty thresholds and are the communities identified as most likely to be vulnerable to environmental justice concerns.

Table 3.4.1 provided a summary of 20 communities considered substantially dependent on recreational fishing and Figure 3.4.3 depicts the 10 communities with the greatest landings of greater amberjack, proportionally. In comparing these communities with the preceding analysis identifying counties with potential Environmental Justice concerns, six of the communities listed as important to recreational or commercial fishing are located in five counties identified as having potential for environmental justice concerns. In Florida, both Apalachicola and Carrabelle are located in Franklin County, which exceeded the poverty threshold by 8%; Port St. Joe in Gulf County exceeded the poverty threshold by 1.7%. Bayou La Batre in Mobile County, Alabama exceeded the minority threshold for environmental justice concerns by 1.7%, but did not exceed the poverty threshold. In Texas, Houston in Harris County exceeded the minority threshold by .8% and Port Aransas in Nueces County exceeded the minority threshold by 2.8%.

People in these communities may be affected by fishing regulations in two ways: participation and employment. Although these communities may have the greatest potential for environmental justice concerns, no data are available on the race and income status for those involved in the local fishing industry (employment), or for their dependence on greater amberjack specifically (participation). The fishery is primarily recreational and requires boat access; there is not a subsistence fishery for greater amberjack. Thus, it is not likely that the participation of environmental justice populations will be affected. Based on the analysis above, the greatest risk would likely arise in Franklin County (exceeds the poverty threshold by 8%), should loss of employment occur. However, it would be difficult to identify a causal relationship between actions in this amendment and any loss of jobs in the county, as numerous other factors would likely be involved. Nevertheless, because the greater amberjack fishery does not represent a substantial proportion of landings in the respective communities, no environmental justice concerns are expected to arise in these communities as a result of the actions in this amendment. Although no environmental justice issues have been identified, the absence of potential environmental justice concerns cannot be assumed.

3.5 Description of the Affected Administrative Environment

Federal Fishery Management

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

Responsibility for federal fishery management decision-making is divided between the Secretary of Commerce (Secretary) and eight regional fishery management councils that represent the expertise and interests of constituent states. Regional councils are responsible for preparing, monitoring, and revising management plans for fisheries needing management within their jurisdiction. The Secretary is responsible for promulgating regulations to implement proposed plans and amendments after ensuring management measures are consistent with the Magnuson-Stevens Act and with other applicable laws summarized in Section 10. In most cases, the Secretary has delegated this authority to NOAA Fisheries Service.

The Council is responsible for fishery resources in federal waters of the Gulf. These waters extend to 200 nautical miles offshore from the nine-mile seaward boundary of the states of Florida and Texas, and the three-mile seaward boundary of the states of Alabama, Mississippi, and Louisiana. The length of the Gulf coastline is approximately 1,631 miles. Florida has the longest coastline of 770 miles along its Gulf coast, followed by Louisiana (397 miles), Texas (361 miles), Alabama (53 miles), and Mississippi (44 miles).

The Council consists of seventeen voting members: 11 public members appointed by the Secretary; one each from the fishery agencies of Texas, Louisiana, Mississippi, Alabama, and Florida; and one from NMFS. The public is also involved in the fishery management process through participation on advisory panels and through publically open Council meetings, with some exceptions for discussing internal administrative matters. The regulatory process is also in accordance with the Administrative Procedures Act, in the form of "notice and comment" rulemaking, which provides extensive opportunity for public scrutiny and comment, and requires consideration of and response to those comments.

Regulations contained within FMPs are enforced through actions of the NOAA's Office of Law Enforcement, the USCG, and various state authorities. To better coordinate enforcement activities, federal and state enforcement agencies have developed cooperative agreements to enforce the Magnuson-Stevens Act. These activities are being coordinated by the Council's Law Enforcement Advisory Panel and the Gulf States Marine Fisheries Commission's Law Enforcement Committee have developed a five year "Gulf Cooperative Law Enforcement Strategic Plan - 2006-2011."

State Fishery Management

The purpose of state representation at the Council level is to ensure state participation in federal fishery management decision-making and to promote the development of compatible regulations in state and federal waters. The state governments of Texas, Louisiana, Mississippi, Alabama, and Florida have the authority to manage their respective state fisheries. Each of the five Gulf States exercises legislative and regulatory authority over their states' natural resources through discrete administrative units. Although each agency is the primary administrative body with respect to the states natural resources, all states cooperate with numerous state and federal regulatory agencies when managing marine resources. A more detailed description of each state's primary regulatory agency for marine resources is provided in Amendment 22 (GMFMC 2004).

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Modifications to the Greater Amberjack Rebuilding Plan

4.1.1 Direct and Indirect Effects on the Physical Environment

Impacts of these alternatives on the physical environment would depend on the resulting reduction in the level of fishing effort by the commercial and recreational sectors. The commercial sector is currently allocated 27% of the Stock ACL and the recreational sector is currently allocated 73% of the Stock ACL. Using greater amberjack landings history from 2001-2010, commercial longlines landed 10% of the greater amberjack and vertical lines (i.e., electric reel, bandit rig, hook and line, and trolling) landed 70% of the greater amberjack, while 20% of the landings were from unclassified gear types (SEFSC Commercial ACL Data 2011). Landings by trolling and diving with a spear were low and infrequent compared to hand and electric vertical lines in the commercial sector. The recreational sector (headboat, charter, and private modes) primarily uses hand lines sometimes electric reels to fish for reef fish including greater amberjack. When recreational fishers are targeting greater amberjack they often use live baits and the attached weights and hooks may or may not touch the bottom depending on the structure type and fisher experience level. Recreational fishers also harvest greater amberjack with spear and powerhead gear.

Longlines

Longline gear is deployed over hard bottom habitats using weights to keep the gear in direct contact with the bottom. The potential for this gear to adversely impact the bottom depends on the type of habitat it is set on, the presence or absence of currents and the behavior of fish after being hooked. In addition, this gear upon retrieval can abrade, snag, and dislodge smaller rocks, corals, and sessile invertebrates (Hamilton 2000; Barnette 2001). Direct underwater observations of longline gear in the Pacific halibut fishery by High (1998) noted that the gear could sweep across the bottom. A study that directly observed deployed longline gear (Atlantic tilefish fishery) found no evidence that the gear shifted significantly, even when set in currents. Lack of gear shifting even in strong currents was attributed to setting anchors at either end of the

longline 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).

Vertical lines

Concentrations of many managed reef fish species are higher on hard bottom areas than on sand or mud bottoms, thus vertical line gear fishing generally occurs over hard bottom areas (GMFMC 2004a). Vertical lines include multi-hook lines known as bandit gear, handlines, and rod-and-reels. 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 attached organism such as soft corals and sponges to tear off or be abraded (Barnette 2001). In using bandit gear, 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).

Anchor damage is also associated with vertical-line fishing vessels, particularly by the recreational sector where fishermen may repeatedly visit well marked or known fishing locations. 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 greater amberjack and other reef fish occurs. The for-hire sector and commercial sector that uses vertical line gear are typically known to anchor more frequently over the reef sites.

Spear and Powerhead

Spearguns are used by both the recreational and commercial sector to harvest greater amberjack but represent a relatively minor component of both. Barnette (2001) summarizes a previous study that concluded spearfishing on reef habitat may result in some coral breakage. In addition, there could be some impacts from divers touching coral with hands or from re-suspension of sediment by fins (Barnette 2001).

Alternative 4 would allow zero harvest of greater amberjack until another stock assessment has been completed and would provide the greatest benefit to the physical environment. However it is unknown how much closing the greater amberjack fishery would reduce the number of recreational fishing trips and resulting effort. Target trips are expected to be reduced, but it can only be speculated as by how much. Further the commercial sector would still fish for other reef fish even if greater amberjack is closed. It is expected that under **Alternative 4** the commercial sector would impact that physical environment less than or similarly to status quo.

Preferred Alternative 3 Option b and **Option a** are expected to provide greater positive benefits to the physical environment compared to **Alternative 2** and **Alternative 1** (status quo), because it is an 18% reduction from the current Stock ACL. **Alternative 2** is expected to

provide greater positive benefits to the physical environment compared to **Alternative 1** due to the 5% reduction in Stock ACL.

4.1.2 Direct and Indirect Effects on the Biological/Ecological Environment

Management actions that directly impact the biological and ecological environment include fishing mortality and the resulting population size, life history characteristics, and the role of the species within its habitat. Removal of fish from the population through fishing reduces the overall population size and reproductive potential. **Action 1** would modify the rebuilding plan and reduce the Stock ACL from status quo thereby reducing fishing mortality and the rate of removals.

Alternative 4 would provide the greatest biological benefit to the greater amberjack stock; however, the negative economic and social effects from this alternative may outweigh the biological gains. **Alternative 4** would provide the greatest benefit to the stock until a new assessment is completed and would be the most conservative approach. Since greater amberjack is in their 9th year of the rebuilding plan and it is unknown whether the stock has rebuilt with the ten-year target (end of 2012) until a new stock assessment has been completed. If the Council wanted to take a conservative approach **Alternative 4** is expected to provide the greatest positive benefits to the stock. **Preferred Alternative 3 Option b** and **Option a** are expected to provide greater positive benefits to the biological and ecological environment than **Alternative 2** or **Alternative 1** (status quo). **Option a** would establish the Stock ACL that is 13% lower than **Alternative 1**; whereas, **Preferred Option b** would establish an ACT that is 13% lower than **Alternative 1**. **Preferred Option b** would establish an ACT (quota) below the Stock ACL providing an additional buffer by establishing an ACT (quota) below the Stock ACL. This buffer has been established to reduce the probably of exceeding the Stock ACL which would result in post-season overage adjustments. Both the recreational and commercial sectors have exceed their quotas twice in the last three years therefore this added buffer would provide an additional benefit to the stock by reducing the probably of exceeding the Stock ACL. Both **Preferred Option b** and **Option a** would provide greater biological and ecological benefits to the resource than **Alternative 2** or **Alternative 1** (status quo). **Alternative 2** would reduce the Stock ACL by 5% compared to **Alternative 1** (status quo) providing the least biological benefits to the resource compared to **Alternative 3** and **Alternative 4**.

4.1.3 Direct and Indirect Effects on the Economic Environment

In general, a higher ACL/ACT may be associated with better economic conditions because it would allow fishing participants to continue their operations with lower probability of being subject to more restrictive regulations. In this case, the best alternative would be the no action alternative (**Alternative 1**). Given, however, that this alternative is not a viable alternative because it would mean exceeding the recommended ABC for greater amberjack, the best alternative from an economics standpoint would be a stock ACL equal to 1,780,000 pounds. Among the alternatives, the worst from an economics standpoint is **Alternative 4**, which would eliminate most economic activities associated with the greater amberjack segment of the reef fish fishery. The recreational sector may still gain some benefits from catch and release activities but

these benefits would be at very limited levels. The commercial sector would forgo all profits derivable from this segment of the reef fish fishery.

The general economic implications of the various ACL/ACT alternatives would differ between the commercial and recreational sectors. Assuming current regulations, the economic effects of the various ACL/ACT alternatives would be the same, at least in the short term, mainly because quota closures would be unlikely under any of the ACL/ACT alternative. If quota closures start to occur, a higher ACL would provide better economic conditions. If quota closures do not occur but regulations are changed, the economic effects on the recreational sector would vary across the various segments (for-hire, private) of the sector. The effects, for example, of modifying the size limit or seasonal closure are analyzed in Section 4.2.1.3.

Given current regulations, the various ACL/ACT alternatives would result in different fishing season lengths, and these would have different economic implications on the sector. In terms of revenue effects, a stock ACL of 1,780,000 pounds, which implies a commercial ACL of 481,000 pounds (**Alternative 2**), would result in revenue reductions of $22,000. A stock ACL of 1,539,000 pounds, which implies a commercial ACL of 409,000 pounds (**Alternative 3, Option a**), or a stock ACL of 481,000 pounds, which implies a commercial ACT of 409,000 pounds (**Alternative 3, Option b**), would result in revenue reductions of $99,000. A change in regulations would have economic implications on the commercial that would depend on the type of regulations implemented. Section 4.3.3 considers the revenue implications of modifying the seasonal closure coupled with trip limits.

Based on current conditions, **Alternative 4** would result in more than $500,000 a year in revenues lost. An equivalent amount, or likely more, would possibly be lost to the recreational sector under **Alternative 4**.

4.1.4 Direct and Indirect Effects on the Social Environment

This action will impact the human environment relevant to how much the quota is lowered from the current quota (**Alternative 1**, no action). The remaining alternatives propose reductions to the quota from the status quo by 5% (**Alternative 2**), 18% (**Preferred Alternative 3**), and 100% (**Alternative 4**). Generally, social impacts can be expected in proportion to the decrease in quota as fishing behavior and resource usage is restricted from current levels of fishing activity.

National Standard 8 specifies that consideration be given to the impacts of regulatory action on fishing communities. However, the specific wording of the Magnuson-Stevens Act and the National Standards mandates priority to end overfishing, relegating potential impacts on human communities as secondary. This amendment is driven by the mandates of National Standard 1 and the Magnuson-Stevens Act to rebuild the greater amberjack stock and prevent overfishing. The selection of the status quo **Alternative 1,** conflicts with the mandates of the Magnuson-Stevens Act. Although **Alternative 1**, no action, would result in the least negative social impacts by not modifying the rebuilding plan for greater amberjack, meaning no further reductions to the quota would be implemented, this alternative is not allowable under the current requirements of the Magnuson-Stevens Act.

Alternatives 2 and **Preferred Alternative 3** provide modifications to the rebuilding plan using different approaches to configuring the quota. The method used to determine the quota does not incur social impacts; rather, negative social impacts would arise from (and be in proportion to) the reduction in how much people are allowed to catch. **Alternative 2** represents a 5% reduction in the quota from the status quo **Alternative 1** and would likely incur the least social impacts after **Alternative 1**, as it reduces the quota by the narrowest margin. **Preferred Alternative 3** would incur greater social impacts, as it decreases the quota by a greater margin.

The quota is the amount of catch allowed before a fishery is closed. The greater amberjack quota has been exceeded twice in the last four years. Current regulations require post-season accountability measures when the annual catch limit is exceeded, which decreases the following season's quota. The difference between **Preferred Alternative 3, option a** and **preferred option b** is the latter sets the quota at a buffer (called the annual catch target), that is below the annual catch limit. The season will be closed when the buffer is reached. By setting the quota at a buffer, it is less likely that the annual catch limit will be exceeded, thus avoiding a reduction in the following year's quota. The annual catch limit of **preferred option b** is equal to **Alternative 2**, a 5% reduction from the current quota. Thus, should it be determined that the recreational sector exceeds the quota following the season closure when the buffer is reached, accountability measures would not be triggered unless the annual catch limit (equivalent to Alternative 2) is exceeded. Compared with **Preferred Alternative 3**, **option a**, where a post-season quota reduction is triggered if the quota is exceeded, positive effects may be expected from **preferred option b**, as it could prevent a future quota reduction by closing the season before the annual catch limit is met.

The buffer of **Alternative 3, option a** is calculated using the ACL/ACT Control Rule resulting in a 15% buffer for the commercial sector and a 13% buffer for the recreational sector. However, the actual quota under **Alternative 3 option a** represents a 19% reduction for the commercial sector and 17% reduction for the recreational sector, compared to the status quo (**Alternative 1**) quota. This is a greater reduction to the quota of each sector, suggesting greater impacts are possible.

The complete closure of the harvest of greater amberjack until a new stock assessment has been completed (**Alternative 4**), would incur the greatest negative social impacts. Although these impacts might be ameliorated in the long-term if the stock were to rebuild faster, for the majority of fishermen of both sectors, greater amberjack is caught alongside other species, rather than targeted on directed trips. This means that a complete closure is not likely to affect effort greatly as the majority of trips would still occur. Even under a complete closure, a substantial amount would still be caught and discarded on non-targeted trips. Furthermore, given the unknown current stock status of the fishery a complete closure of greater amberjack would be perceived as an extreme action given the inability to measure any potential biological benefits.

4.1.5 Direct and Indirect Effects on the Administrative Environment

Alternative 4 would impact the administrative environment the greatest by burdening law enforcement officials with maintaining zero harvest. **Preferred Alternative 3 Option b** establishes both an ACT (quota) and Stock ACL, creating more of a burden on the administrative

environment compared to **Alternative 3 Option a** or **Alternative 2**. Sector quotas either the **Preferred Alternative 3**, **Option b** as the ACT or the other alternatives which establish Stock ACLs would need to be monitored throughout the year. If one sector is projected to exceed their quota the fishery would need to be closed in-season and if the sector ACL was exceeded an overage adjustment would need to be accounted for next year as part of the post-season accountability measures. Under **Preferred Alternative 3**, **Option b** any overage of the sector ACL would be reduced from the following year's sector ACT (quota). Whereas, **Alternative 3 Option a** and **Alternative 2** would establish a Stock ACL that would need to be monitored without the additional buffer of an ACT. **Alternative 3 Option a** and **Alternative 2** would create similar administrative burden because both would establish new Stock ACLs compared to **Alternative 1**. **Alternative 1** would create the least administrative burden, but would not address the biological aspects of rebuilding the greater amberjack stock.

4.2 Recreational Management Measures

4.2.1. Action 2.1 Modify the Recreational Minimum Size Limit for Greater Amberjack

4.2.1.1 Direct and Indirect Effects on the Physical Environment

Action 2.1 is intended to impact the biological environment and is not expected to have differing direct or indirect effects on the physical environment. It is possible increasing the minimum size limit for greater amberjack could result in recreational fishers staying on a particular reef site longer, extend their fishing trip, or go further from shore in search of catching and landing a legal greater amberjack. However, recreational fisher behavior is largely unknown based on management changes to greater amberjack minimum size limits. Therefore, no difference in impacts to the physical environment is expected from **Preferred Alternative 1** compared to **Alternatives 2**, **3**, and **4**.

4.2.1.2 Direct and Indirect Effects on the Biological/Ecological Environment

Action 2.1 is expected to have the greatest positive impacts to the biological and ecological environment. Overall, any increase in the minimum size limit of greater amberjack is expected to provide positive benefits to the biological environment by increasing the spawning potential of female greater amberjack. Under status quo the minimum size limit, 30 inches fork length (FL), less than 5% of the female greater amberjack in the population have reached reproductive maturity. Increasing the minimum size limit to 36 inches FL (**Alternative 4**) is expected to provide the greatest biological benefits to the resource. **Alternative 3** would increase the minimum size limit to 34 inches FL and **Alternative 2** would increase the minimum size limit to 32 inches FL and is expected to provide greater biological benefits to the resource than **Alternative 1** in that respective order. The Council and Reef Fish AP have stated concerns about bycatch mortality of greater amberjack, if the minimum size limit was increased. There were also concerns about slowing harvest if only the minimum size limit was increased, based on bycatch. To address these concerns a data set including landings from Marine Recreational Fisheries Survey and Statistics, Texas Parks and Wildlife, and the Headboat mode from 2008-2010 was used. Landings were separated by 1 inch increments in a size frequency distribution to compare the estimated reduction in harvest as the minimum size limit is increased and the

resulting estimate of dead discards that would result. Based on this data set if the minimum size limit was increased from 30 to 32 inches FL (**Alternative 2**) the resulting recreational harvest is estimated to be reduced by 16.3% and dead discard are expected to increase by 4.1% (Table 2.2.1). **Alternative 3** would increase the minimum size limit to 34 inches FL estimated to slow harvest by 34.4% and increase dead discards by 8.6% and **Alternative 4** is estimated to reduce the estimated harvest rate by 51% and increase dead discards by 13% (See Table 2.2.1).

4.2.1.3 Direct and Indirect Effects on the Economic Environment

The procedure for calculating the economic effects of the management alternatives for the recreational sector involves estimating the expected changes in consumer surplus (CS) to anglers and net operating revenues (NOR) to for-hire vessels. Consumer surplus is the amount of money that an angler would be willing-to-pay for a fishing trip over and above the cost of the trip. Net operating revenue is total revenue less operating costs, such as fuel, ice, bait, and other supplies. This procedure follows the method employed in the regulatory amendment implementing a recreational seasonal closure for greater amberjack (GMFMC 2011). It also draws upon the general method used in the regulatory amendment to change the TAC for red snapper (GMFMC 2010) as well as the economic analysis for the red snapper fishery closure in the Gulf of Mexico (NMFS 2008).

Analysis of the expected changes in CS and NOR was conducted relative to the no action alternative (Preferred Alternative 1). For analytical purposes, the no action alternative consists of a June 1-July 31 seasonal closure, minimum size limit of 30 inches FL, and bag limit of 1 fish per angler. To quantify the economic effects, the Greater Amberjack Decision Tool was modified to include economic values (SERO/LAPP; SEFSC). The CS value introduced into the Decision Tool is $11.46 per fish and the NOR used is $145.63 per charter angler trip, with both values expressed in 2010 dollars. Changes in harvests would prompt the changes in CS whereas changes in target trips would prompt the changes in NOR. The absence of target information for anglers in headboats precluded the estimation of NOR changes in headboats.

An increase in the recreational size limit for greater amberjack would be expected to reduce recreational harvest as well as the quality of fishing experience. It is possible that reductions in harvests and fishing quality would lead to trip cancellations, but the current modeling approach cannot determine how many trips would be cancelled. In view of this, quantification of the effects of the alternative size limits is limited to changes in CS.

In principle, the no action alternative (**Preferred Alternative 1**) would not introduce any changes to the economic environment. From a modeling perspective, this alternative is used as the baseline scenario against which all size limit alternatives would be compared. It may be noted that current modeling projects that the current seasonal closure would constraint recreational harvests to at or below any of the recreational ACL/ACT alternatives considered in this amendment.

The effects of increasing the recreational size limit from 30 inches FL to 32 inches FL (**Alternative 2**), to 34 inches FL **(Alternative 3**), and to 36 inches FL (**Alternative 4**) are presented, respectively, in Table 4.2.1.3.1., Table 4.2.1.3.2, and Table 4.2.1.3.3. The effects of

the various size limit alternatives are similar in nature and vary only in magnitude. All alternatives would result in CS reductions, with higher size limits resulting in larger CS reductions. Total CS reductions would amount to $128,000 under **Alternative 2**, $228,000 under **Alternative 3**, and $329,000 under **Alternative 4**.

Anglers in all fishing modes would experience CS reductions, with the magnitude of reductions determined by the size of harvest reductions. Charterboat anglers would experience the largest CS reductions, followed closely by private mode anglers and to a lesser degree by headboat anglers. As may be recalled from the description of the economic environment, charterboats accounted for the highest average harvests, followed closely by the private mode. Headboats accounted for a small share of the total recreational harvest of greater amberjack.

As already noted and also shown in the three tables, the size limit alternatives would not result in NOR reductions because of the implicit assumption that these alternatives would not result in any trip cancellation. Two other features worth noting in the tabulated results are the absence of effects for the months of June and July and the relatively larger effects in May and August. The first is due to the seasonal closure which is assumed to remain under any of the size limit alternatives. The second reflects the relatively large harvests in the month before and month after the seasonal closure, a condition that generally accompanies any fishery closures. While this condition may be expected to remain in the near future, the possibility is always open for the recreational sector in general to adapt to fishery regulations. Along this line, it is possible that anglers and for-hire vessel operators may eventually adapt to any size limit increase as to change the distribution of harvests over time and thus also the distribution of CS benefits/reductions.

One other issue worth recognizing in the estimation of the effects of size limit alternatives pertains to the model's projection on recreational harvest. Under the no action alternative, the model projects that the recreational harvests would not exceed any of the recreational ACL/ACT alternatives. This projection would also hold true under any of the size limit alternatives. In the event that the recreational sector is able to effectively shift effort to the open months, harvests will increase to the point possibly of exceeding the recreational ACL/ACT resulting in quota closures. In that eventuality, increasing the size limit may constrain harvest increases as to shorten the length of the quota closures. Whether any CS or NOR savings from a shorter closure under a higher size limit would outweigh CS reductions from the size limit increase is an issue that would have to be evaluated.

Table 4.2.1.3.1. Changes in consumer surplus (CS) and net operating revenue (NOR) relative to the no action alternative from an increase in size limit to 32 inches fork length (Alternative 2).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Consumer Surplus (thousand dollars)													
HB	-1	0	-1	-1	-2	0	0	-2	-1	-1	0	0	-9
CH	-2	-2	-4	-2	-24	0	0	-20	-3	-4	-3	-3	-67
PRI	-3	-3	-6	-5	-16	0	0	-9	-1	-1	-4	-4	-52
Total	-5	-5	-11	-9	-42	0	0	-31	-6	-6	-7	-8	-128
Net Operating Revenue (thousand dollars)													
CH	0	0	0	0	0	0	0	0	0	0	0	0	0

HB – headboat; CH – charterboat; PRI – private mode.

Table 4.2.1.3.2. Changes in consumer surplus (CS) and net operating revenue (NOR) relative to the no action alternative from an increase in size limit to 34 inches fork length (Alternative 3).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Consumer Surplus (thousand dollars)													
HB	-2	-1	-1	-3	-4	0	0	-3	-3	-2	0	-1	-21
CH	-3	-3	-7	-6	-39	0	0	-37	-6	-5	-4	-5	-114
PRI	-5	-5	-10	-9	-30	0	0	-15	-2	-3	-7	-7	-93
Total	-9	-9	-19	-18	-73	0	0	-55	-11	-10	-11	-12	-228
Net Operating Revenue (thousand dollars)													
CH	0	0	0	0	0	0	0	0	0	0	0	0	0

HB – headboat; CH – charterboat; PRI – private mode

Table 4.2.1.3.3. Changes in consumer surplus (CS) and net operating revenue (NOR) relative to the no action alternative from an increase in size limit to 36 inches fork length (Alternative 4).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Consumer Surplus (thousand dollars)													
HB	-2	-1	-2	-4	-5	0	0	-6	-5	-2	-1	-1	-29
CH	-4	-4	-10	-7	-47	0	0	-52	-9	-8	-7	-8	-156
PRI	-6	-6	-16	-14	-52	0	0	-23	-4	-4	-9	-10	-144
Total	-12	-12	-27	-26	-105	0	0	-82	-17	-15	-16	-18	-329
Net Operating Revenue (thousand dollars)													
CH	0	0	0	0	0	0	0	0	0	0	0	0	0

HB – headboat; CH – charterboat; PRI – private mode

4.2.1.4 Direct and Indirect Effects on the Social Environment

Impacts can be expected from modifying the recreational minimum size limit if fishermen find it difficult to land a legal size fish, making the fishing experience less satisfying. No social impacts are expected from maintaining the 30 inch FL minimum size **(Preferred Alterative 1**, no action). Among landings in 2009-2010, the most frequently landed greater amberjack was 31 inches FL. The larger the minimum size, the fewer fish that are caught of that size (Figure 2.2.3). Impacts can thus be expected from an increase in the minimum size limit due to a reduction in harvest and the impacts corresponding in severity with the estimated harvest reduction. Increasing the minimum size to 32" FL (**Alternative 2**) is estimated to reduce harvest by 16.3%. An increase to 34" FL (**Alternative 3**) could reduce harvest by 34.4%, and an increase to 36" FL (**Alternative 4**) could reduce harvest by 50.8%. Thus, fishermen would be most impacted by an increase in the minimum size limit to 36" FL (**Alternative 4**). Furthermore, increases in harvest reductions would coincide with increases in dead discards. Throwing back dead fish is perceived as wasteful and is frustrating for fishermen.

On the other hand, social benefits are expected to accrue in the long term if a larger minimum size helps in rebuilding the stock. Less than 5% of 30 inch females have achieved reproductive maturity. Thus, an increase in the minimum size limit would mean fewer removals of fish that have yet to reach reproductive maturity. This would enable an increase in the spawning potential ratio and be beneficial to the stock. If the larger minimum size limit aids in rebuilding the stock and the quota is increased then it would be expected to benefit the fishermen, businesses, and fishing communities that target greater amberjack. It should be noted that an increase to 36" FL would make the minimum size limit consistent with that of the commercial sector.

4.2.1.5 Direct and Indirect Effects on the Administrative Environment

The alternatives in **Action 2.1** are expected to have positive impacts to the biological environment with minimal impacts to the administrative environment compared to status quo. **Preferred Alternative 1** would have the least impact on the administrative environment, because the current minimum size limit is 30 inches FL for the recreational sector. **Alternatives 2**, **3**, and **4** are expected to have similar impacts on the administrative environment because they would be modified from status quo. Any change to the regulations would create the additional burden on the administrative environment in the beginning; however, after the regulations are in effect **Alternatives 2**, **3**, and **4** are not expected to have additional impacts on the administrative environment.

4.2.2 Action 2.2 Modify the Recreational Closed Season for Greater Amberjack

4.2.2.1 Direct and Indirect Effects on the Physical Environment

It is unknown how many recreational anglers leave the dock intending to target greater amberjack, or how fishing behavior would change based on the various alternatives for closed seasons. The following comparison of alternatives is based on the number of available fishing days under each alternative. This comparison does not take into account fishing during the

closed season or effort shifting outside of the closed season. Physical impacts to the environment could occur when gear such as weights, hooks, and anchors hit and damage the substrate and surrounding habitat. Recreational fishers typically use hand-lines or spears to harvest greater amberjack, see Section 4.1.1.1 for a comparison of gear types and impacts to the physical environment. **Alternative 4** would likely have the greatest positive impacts on the physical environment because the season is the shortest under this alternative with only 153 open fishing days. The following alternatives are listed in order from greatest positive benefits to least expected positive benefits to the physical environment; **Alternative 2, 3**, **Preferred Alternative 1** and **5** with the following number of open fishing days: 200, 267, 305, and 313, respectively (Table 2.2.2).

4.2.2.2 Direct and Indirect Effects on the Biological/Ecological Environment

Action 2.2 would modify the recreational closed season for greater amberjack. **Alternatives 3** and **4** are expected to provide the greatest positive benefits to the biological and ecological environments by protected the resource during spawning. Peak spawning in the Gulf of Mexico has been found for greater amberjack during the months of March and April tailing off by May (Murie and Parkyn 2008). No studies to date have identified whether greater amberjack form spawning aggregations. A study by Harris et al. (2007) suggested spawning aggregations of greater amberjack were targeted by fishers in the South Atlantic, but no evidence of this was presented. Whereas, diver observations in Belize documented greater amberjack in pair courtship while in schools of 120 fish (Graham and Castellanos 2005). It is unknown if fishers target these schools or aggregations of greater amberjack more heavy during spawning than at other times of the year; therefore, **Alternatives 3** and **4** are expected to provide positive benefits to the resource by protecting them during spawning if they are in fact being targeted. Closing recreational fishing during the months of March-May would be consistent with the current commercial fixed closed season. **Preferred Alternative 1** and **Alternative 5** are very similar and are not expected to impact the biological environment differently. Both of these alternatives would close the recreational sector the same months with 8 additional fishing days allowed under **Alternative 5**. **Preferred Alternative 1** and **Alternative 5** establish fixed closed seasons, during months of peak effort to slow the rate of harvest and thereby providing some additional biological benefits to the resource compared to no closure (**Alternative 2**).

4.2.2.3 Direct and Indirect Effects on the Economic Environment

The procedure for calculating the economic effects of the management alternatives for the recreational sector involves estimating the expected changes in consumer surplus (CS) to anglers and net operating revenues (NOR) to for-hire vessels. Consumer surplus is the amount of money that an angler would be willing-to-pay for a fishing trip over and above the cost of the trip. Net operating revenue is total revenue less operating costs, such as fuel, ice, bait, and other supplies. This procedure follows the method employed in the regulatory amendment implementing a recreational seasonal closure for greater amberjack (GMFMC 2011). It also draws upon the general method used in the regulatory amendment to change the TAC for red snapper (GMFMC 2010) as well as the economic analysis for the red snapper fishery closure in the Gulf of Mexico (NMFS 2008).

Analysis of the expected changes in CS and NOR was conducted relative to the no action alternative (Preferred Alternative 1). For analytical purposes, the no action alternative consists of a June 1-July 31 seasonal closure, minimum size limit of 30 inches FL, and bag limit of 1 fish per angler. To quantify the economic effects, the Greater Amberjack Decision Tool was modified to include economic values (SERO/LAPP; SEFSC). The CS value introduced into the Decision Tool is $11.46 per fish and the NOR used is $145.63 per charter angler trip, with both values expressed in 2010 dollars. Changes in harvests would prompt the changes in CS whereas changes in target trips would prompt the changes in NOR. The absence of target information by headboat anglers precluded the estimation of headboat NOR changes.

Modifying the seasonal closure would alter the distribution of harvests (and possibly total harvests) and associated economic values. A seasonal closure would lead to harvest reductions as well as trip cancellations assuming that anglers would not shift their effort to the open months. Given such assumption, it is possible to quantify not only the CS changes but also the NOR changes, although given the modeling limitations only NOR changes to charterboats will be estimated.

In principle, the no action alternative (**Preferred Alternative 1**) would not introduce any changes to the economic environment. From a modeling perspective, this alternative is used as the baseline scenario against which all seasonal closure alternatives, including the alternative that removes the seasonal closure, would be compared. It may be noted that current modeling projects that the current seasonal closure would constraint recreational harvests to at or below any of the recreational ACL/ACT alternatives considered in this amendment.

The economic effects of modifying the seasonal closure are not unidirectional as in the case of modifying the recreational size limit. **Alternative 2** would eliminate the fixed closed season and allow the fishery to be open until the quota is reached. Without the fixed closed season, the recreational harvests are projected to be met at various times of the year under the different ACL/ACT alternatives considered in this amendment: August 19 under a recreational ACL of 1,368,000 pounds; August 10 under a recreational ACL of 1,299,000 pounds; and, July 7 under a recreational ACT of 1,130,000 pounds. Under any of the ACL/ACT alternatives, removing the fixed closed season would result in CS and NOR increases. The magnitude of CS and NOR increases would vary directly with the level of ACL/ACT, with the higher ACL being associated with larger CS and NOR increases. It may be noted, though, that NOR increases would be the same under an ACL of 1,368,000 and an ACL of 1,299,000. Apparently, a 9-day difference in closure for the month of August would not matter in terms of the number of trips cancelled.

By eliminating the fixed June 1-July 31 closed season, CS and NOR losses in this period would be recouped as shown in the positive amounts for this period. On the hand, the quota closures would result in CS and NOR reductions for the closed period as shown in the negative amounts for the closed period. It turns out in the present case that large CS and NOR increases from opening the months of June and July to fishing would more than compensate for the losses due to the quota closures.

Eliminating the fixed closed season would benefit the private mode anglers more than anglers in charterboats and headboats. The main reason for this, as can be gleaned from the tables, is that

private mode anglers would experience larger CS increases from opening June and July to fishing and smaller CS reductions during the quota closed months. This results is particularly notable because, as found in an earlier analysis, charterboat anglers would experience more CS reductions than private mode anglers under any of the alternatives for increasing the size limit.

It is worth recognizing at this stage that these analytical results crucially hinge on the model assumption that the recreational effort would not shift to the open months. Were effort shift, quota closures would become longer over time, potentially resulting in CS and NOR losses to outweigh CS and NOR increases from opening the June-July period to recreational fishing.

Table 4.2.2.3.1. Changes in consumer surplus (CS) and net operating revenue (NOR) relative to the no action alternative from eliminating the closed season, assuming a recreational ACL of 1,368,000 pounds (Alternative 2 with Alternative 1 for ACL).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Consumer Surplus (thousand dollars)													
HB	0	0	0	0	0	13	14	-4	-8	-5	-1	-1	8
CH	0	0	0	0	0	69	82	-34	-15	-15	-13	-14	60
PRI	0	0	0	0	0	115	45	-19	-7	-7	-17	-18	92
Total	0	0	0	0	0	196	140	-57	-29	-27	-31	-32	160
Net Operating Revenue (thousand dollars)													
CH	0	0	0	0	0	567	83	0	0	0	-11	-12	627

HB – headboat; CH – charterboat; PRI – private mode

Table 4.2.2.3.2. Changes in consumer surplus (CS) and net operating revenue (NOR) relative to the no action alternative from eliminating the closed season, assuming a recreational ACL of 1,299,000 pounds (Alternative 2 with Alternative 2 for ACL).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Consumer Surplus (thousand dollars)													
HB	0	0	0	0	0	13	14	-7	-8	-5	-1	-1	5
CH	0	0	0	0	0	69	82	-55	-15	-15	-13	-14	39
PRI	0	0	0	0	0	115	45	-30	-7	-7	-17	-18	81
Total	0	0	0	0	0	196	140	-93	-29	-27	-31	-32	124
Net Operating Revenue (thousand dollars)													
CH	0	0	0	0	0	567	83	0	0	0	-11	-12	627

HB – headboat; CH – charterboat; PRI – private mode

Table 4.2.2.3.3. Changes in consumer surplus (CS) and net operating revenue (NOR) relative to the no action alternative from eliminating the closed season, assuming a recreational ACT of 1,130,000 pounds (Alternative 2 with Alternative 3 for ALC/ACT).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Consumer Surplus (thousand dollars)													
HB	0	0	0	0	0	13	9	-7	-8	-5	-1	-1	0
CH	0	0	0	0	0	69	53	-55	-15	-15	-13	-14	10
PRI	0	0	0	0	0	115	29	-30	-7	-7	-17	-18	65
Total	0	0	0	0	0	196	90	-93	-29	-27	-31	-32	75
Net Operating Revenue (thousand dollars)													
CH	0	0	0	0	0	567	83	0	0	0	-11	-12	627

HB – headboat; CH – charterboat; PRI – private mode

The effects of **Alternative 3**, which would modify the closure to March 1-May 31, are presented in Table 4.2.2.3.4. This alternative would result in CS increases for headboat and charterboat anglers but CS reductions for private mode anglers. CS savings from June and July would more than compensate for the CS losses from the new closed period for headboat and charterboat anglers. In contrast, CS savings from June and July by private mode anglers would be less than CS reductions during the new closed period. Summing across all modes, this alternative would generate a CS increase of $41,000. In terms of NOR effects, this alternative would result in relatively large reductions in charterboat CS of $327,000. Given this relatively large NOR losses, the overall result of **Alternative 3** would be negative, amounting to an overall benefit reduction of $286,000. One other important consideration here is that model projections under **Alternative 3** resulted in harvests not exceeding any of the ACL/ACT alternatives. This is the reason for zero effects in August through December.

Table 4.2.2.3.4. Changes in consumer surplus (CS) and net operating revenue (NOR) relative to the no action alternative from seasonal closure of March 1-May 31 (Alternative 3).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Consumer Surplus (thousand dollars)													
HB	0	0	-2	-5	-7	13	14	0	0	0	0	0	13
CH	0	0	-16	-16	-71	69	82	0	0	0	0	0	47
PRI	0	0	-30	-29	-118	115	45	0	0	0	0	0	-19
Total	0	0	-49	-50	-196	196	140	0	0	0	0	0	41
Net Operating Revenue (thousand dollars)													
CH	0	0	-199	-192	-586	567	83	0	0	0	0	0	-327

HB – headboat; CH – charterboat; PRI – private mode

Alternative 4 would modify the recreational seasonal closure to January 1-May 31 and November 1-December 31. The effects of this alternative are presented in Table 4.2.2.3.5. A long closure as proposed under this alternative is expected to result in negative effects. This is borne out by the tabulated results. However, headboat and charterboat anglers would experience small CS increases, but the relatively large CS reduction for private mode anglers would dominate. The resulting overall CS loss would amount to $62,000. A relatively large NOR

reduction for charterboats of $421,000 would increase the overall losses to $483,000. One other point to add here is that model projections **Alternative 4** resulted in the recreational harvest under not exceeding any of the ACL/ACT alternatives, so no CS or NOR reductions would be attributable to quota closures.

Table 4.2.2.3.5. Changes in consumer surplus (CS) and net operating revenue (NOR) relative to the no action alternative from seasonal closure of January 1-May 31 and November 1-December 13 (Alternative 4).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Consumer Surplus (thousand dollars)													
HB	-3	-2	-2	-5	-7	13	14	0	0	0	-1	-1	7
CH	-7	-6	-16	-16	-71	69	82	0	0	0	-13	-14	8
PRI	-12	-11	-30	-29	-118	115	45	0	0	0	-17	-18	-77
Total	-22	-19	-49	-50	-196	196	140	0	0	0	-31	-32	-62
Net Operating Revenue (thousand dollars)													
CH	-38	-34	-199	-192	-586	567	83	0	0	0	-11	-12	-421

HB – headboat; CH – charterboat; PRI – private mode

Alternative 5 would shorten the closure by a few days to June 1-July 23. To the extent that this alternative would not result in quota closures practically under any of the ACL/ACT alternatives, this few open days would result in total benefit increase of $119,000 (CS = $36,000; NOR = $83,000). Anglers from all fishing modes would experience CS increases, with charterboat anglers benefiting more than others.

Table 4.2.2.3.6. Changes in consumer surplus (CS) and net operating revenue (NOR) relative to the no action alternative from seasonal closure of June 1-July 23 (Alternative 5).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Consumer Surplus (thousand dollars)													
HB	0	0	0	0	0	0	4	0	0	0	0	0	4
CH	0	0	0	0	0	0	21	0	0	0	0	0	21
PRI	0	0	0	0	0	0	11	0	0	0	0	0	11
Total	0	0	0	0	0	0	36	0	0	0	0	0	36
Net Operating Revenue (thousand dollars)													
CH	0	0	0	0	0	0	83	0	0	0	0	0	83

HB – headboat; CH – charterboat; PRI – private mode

4.2.2.4 Direct and Indirect Effects on the Social Environment

The implementation of the fixed closed season for greater amberjack during the months of June and July was intended (1) to avoid in-season closures and (2) to allow for fishing of this large trophy fish when red snapper season is closed. Modifications to the recreational closed season for greater amberjack (**Action 2.2**) could affect the social environment in these two ways. The June through July closed season (**Preferred Alternative 1**, no action) was implemented to reduce fishing effort for greater amberjack and avoid in-season closures. A fixed closed season allows private recreational fishermen and for-hire operators the ability to schedule fishing trips with more certainty. An in-season closure is disruptive to planning fishing trips because the date

of the closure is not known in advance. Impacts would arise from in-season closures if planned fishing trips must be cancelled. Also, the fixed closed season allows greater amberjack to remain open when red snapper is closed. Conversely, when red snapper is open, greater amberjack is closed. This is a benefit for recreational fishermen who prefer to have one of the two trophy fish open throughout the year. Impacts may arise from modifying the season if fishing trips are not taken as a result of an overlap in the red snapper and greater amberjack closures. **Preferred Alternative 1** would maintain the social benefits from the June through July closed season and is not expected to incur any impacts.

Eliminating the fixed closed season (**Alternative 2)** would open the recreational fishery from January 1 until the quota is filled. This alternative could negatively affect for-hire operators and private recreational fishermen as the closure date for the fishery would be announced with little notice. Without a fixed closed season, the quota is expected to be filled in approximately 200 days. This makes it likely that the greater amberjack and red snapper seasons will close at approximately the same time and neither greater amberjack nor red snapper would be open throughout the fall. On the other hand, the season would be open for both species during June and most of July, allowing fishermen to target both during summer fishing trips. **Alternative 2** could provide benefits to anglers who prefer to have red snapper and greater amberjack open at the same time. Some anglers may prefer to take fewer fishing trips due to the costs (e.g., fuel) of multiple trips to target species at different times of the year. However, since recreational fishermen often target multiple species at one time, this may not include as much of a benefit unless private anglers are interested in targeting greater amberjack and red snapper specifically.

Alternative 3 would modify the recreational season closure for greater amberjack to March 1-May 31 which coincides with the peak spawning season and the commercial sector's closed season. Closing the season at this time could provide benefits to the stock thereby benefiting fishermen in the long term. However, red snapper is also closed at this time meaning that negative impacts may accrue to fishermen by prohibiting access to a trophy species on a year round basis. On the other hand, as with the benefits described for **Preferred Alternative 1**, a fixed closed season reduces the likelihood of an in-season closure and enables the scheduling of fishing trips. **Alternative 3** is not expected to reduce effort sufficiently to avoid an in-season closure; it is likely that the season will need to be closed during the last week of December.

Alternative 4 would modify the recreational seasonal closure so that the season is open from June 1–October 31, five months in duration. As with **Preferred Alternative 1** and **Alternative 3,** benefits could accrue to fishermen by establishing a fixed closure that enables the scheduling of fishing trips and avoids the likelihood of an in-season closure. The season would also be open throughout the summer and into early fall when fishing participation (effort) is greatest. As with **Alternatives 2** and **3,** the red snapper season would coincide with this alternative and both trophy species would be open at the same time, benefiting those fishermen who prefer to target both species on summer trips. This is not as desirable for for-hire operators who have expressed support for having one of the two trophy species open when the other is closed. Conversely, this alternative could provide long term benefits because part of the closure would occur during the peak spawning time of March through April. Protecting spawning greater amberjack during this time could help in rebuilding the stock, allowing for an increase in the quota as a result.

Alternative 5 is most similar to **Preferred Alternative 1** and would shorten the status quo fixed closed season by eight days. Thus, the greater amberjack season would reopen closest to the date when red snapper is anticipated to close; the greater amberjack season would be open concurrent with the closure of the red snapper season. This alternative would be expected to include nearly the same benefits to for-hire operators and private recreational fishermen as **Preferred Alternative 1**. With **Alternative 5** there is a chance that the recreational greater amberjack season might open while the red snapper season is still open which could provide fishermen with the chance to target both species at the same time which would be favorable to fishermen, especially those that cannot afford the fuel cost to target various species separately.

4.2.2.5 Direct and Indirect Effects on the Administrative Environment

The alternatives in **Action 2.2** are expected to have positive biological and physical impacts on their respective environments and create nominal differences in the direct and indirect impacts on the administrative environment. **Preferred Alternative 1** would have the least impact on the administrative environment, because the current fixed closed season June 1- July 31 is already established for the recreational sector. **Alternatives 3**, **4**, and **5** are expected to have similar impacts on the administrative environment because they would be modified from status quo. Whereas, **Alternative 2** would create the greatest burden on the administrative environment, because all fixed closed seasons would be removed. Landings for the recreational sector would need to be closely monitored and enforced when the quota was projected to be reached so that it is not exceeded. Managing the recreational sector without a fixed closed season has resulted in overages in the past two years. An additional, level of public information and broadcasts by radio and press releases may be necessary to inform stakeholders when the fishery is closed, because it could be a different month and day each year based on natural changes in the resource and shifts in effort.

4.3 Commercial Management Measures

4.3.1 Direct and Indirect Effects on the Physical Environment

Direct effects to the physical environment resulting from commercial fishing include physical damage to habitat associated with anchoring, longline snags on the bottom, and hook-and-line abrading the bottom and potentially tearing off attached organisms as discussed in Section 4.1.1. Seventy percent of the greater amberjack commercial landings from 2001-2010 were caught using vertical line gear including bandit gear, electric reels, and trolling (SEFSC Commercial ACL Data 2011).

This gear is unlikely to contact bottom habitat or cause any damage because greater amberjack are pelagic and are primarily caught in the water column above structure. Anchoring over wrecks or other structure to fish for greater amberjack may have a negative effect on those structures and surrounding benthic habitat. Commercial longline vessels captured 10% of the total commercial greater amberjack landed from 2001-2010. However, bottom longlines are not used to target greater amberjack and typically catch the fish while setting and retrieving the gear so effort with this gear type should not be affected by a reduction in the sector ACL. Additionally, to use longline gear an endorsement is required as implemented in Amendment 31 (GMFMC 2010). Spearfishing and other unclassified gear, including unclassified diving gear

accounted for an estimated 20% of the commercial harvest from 2001-2010. There are several existing habitat areas of particular concern, marine sanctuaries, and marine reserves in the Gulf of Mexico providing additional protection to greater amberjack habitat and help reduce impacts to the physical environment (see Section 3.1).

Alternative 1, the no action alternative, would maintain the current fixed fishing season with no trip limit, Under this alternative the commercial sector is expected to have 122-138 fishing days and close between the 1 – 17th of August. The in-season management measures developed to adhere to the sector ACL would be to close the sector when the ACT or quota has been reached. This closure is not expected to vary the fishing effort and would not have any additional direct or in-direct effects on the physical environment. The commercial sector uses similar gear to catch the different reef fish species including greater amberjack. Thus, fishing effort would continue even if greater amberjack is closed.

Preferred Alternative 2, Preferred Option a, would maintain the current closed fishing season and establish a commercial trip limit of 2,000 pounds per trip. Establishing trip limits is expected to provide a longer greater amberjack fishing season and is not anticipated to shift any fishing effort or methods because less than 5% percent of trips exclusively target greater amberjack (SEFSC Commercial Logbook 2011). Therefore, this alternative would have minimal effects on the physical environment relative to **Alternative 1**. As described in Table 3.2, model 1 it is estimated that the 2,000 pound trip limit would provide a 184 day fishing season in comparison to the 1,500 pound trip limit providing 214 days; the 1,000 pound trip limit providing 266 days, and the 500 pound trip limit providing a 274 day fishing season. The difference between the four options on direct and indirect effects to the environment is expected to be minimal.

Alternative 3 would eliminate the existing current closed season (March 1 – May 31) and has four options (**a-d**) to establish a commercial trip limit (2000, 1500, 1000, 500 pounds whole weight, respectively). By eliminating the fixed closed season the commercial quota is expected to be filled faster even if a trip limit is implemented. If the fixed closed season was removed and the Council selected a 2,000 pound trip limit the quota is expected to be met in 163 – 195 fishing days. The closed season was established in 1998 to protect greater amberjack spawning populations. The elimination of the closed season and increased fishing effort during greater amberjack spawning would be expected to have direct effects on the physical environment. Establishing trip limits is expected to provide a longer harvest season, but is not anticipated to shift any fishing efforts or methods, and is anticipated to have positive effects on the physical environment. The difference between the four options on direct and indirect effects to the environment is minimal. Under **Alternative 3**, the estimated number of fishing days and projected date of closure under 2000, 1500, 1000, and 500 pound options are analyzed in Table 3.3.

4.3.2 Direct and Indirect Effects on the Biological/Ecological Environment

Management actions that directly impact the biological and ecological environment include fishing mortality and the resulting population size, life history characteristics, and the role of the species within its habitat. Removal of fish from the population through fishing reduces the

overall population size and reproductive potential. Benefits associated with ending overfishing and rebuilding the stock include: expanding the size- and age-structure, increasing stock abundance and biomass, and reducing mortality.

Alternative 1, the no action alternative, protects the stock by closing the sector during the spawning, but is expected to have the shortest fishing season, resulting in the highest number of discards after the season is closed. **Preferred Alternative 2** maintains the fixed closed season during spawning, and has four options for trip limits (2000, 1500, 1000 and 500 pounds ww, respectively) **Alternative 3** would remove the fixed closed season to protect greater amberjack during the spawning season and has the same the four options to set trip limits as **Preferred Alternative 2**. **Alternative 3** will reduce the number of discards as compared to **Alternative 1**, by not implementing the closed season, assuming the commercial sector is still harvesting other reef fish and may incidentally catch greater amberjack. The trip limits are expected to provide positive benefits to the biological and ecological environment by reducing the number of discards by slowing harvest and extending the fishing season. **Option d** would establish the smallest trip limit, but is expected to extend the fishing season throughout the year under **Preferred Alternative 2** and until the middle of December reducing discards that may occur during quota closures. **Alternative 3** would re-open the seasonal closure during spawning and is projected to increase annual landings by 44%, assuming there is no quota closure. The removal of the spawning season closure in **Alternative 3** is expected to have a greater negative biological and ecological impact on the environment compared to **Alternative 1** and **Preferred Alternative 2**. The anticipated negative effects from the re-opening of the closed season would be from the removal of reproductive age fish prior to or during spawning, resulting in less spawning stock biomass. **Option d** under **Preferred Alternative 2,** would keep the fixed closed season during spawning and establish a 500 pound ww trip limit. Establishing a small trip limit such as (**Option d**) would provide the greatest biological benefits to the resource by slowing harvest that should allow the stock to rebuild faster. It is possible a small trip limit could increase regulatory discards. However, the Council has selected **Preferred Option a,** that would establish a 2,000 pound trip limit and is expected to provide benefits to the biological and ecological environments by slowing harvest and closing the season earlier than **Options b, c**, and **d**. However, the number of discards are estimated to be higher in under **Option a** compared to **Options b, c,** and **d.** Thus, the implementation of the 2,000 trip limit could result in negative effects to the biological environment in comparison to the other three options, but is still expected to provide greater benefits to the biological and ecological environment that **Alternative 1**.

4.3.3 Direct and Indirect Effects on the Economic Environment

The procedure for calculating the economic effects of the management alternatives for the commercial sector involves estimating the expected changes in ex-vessel revenues. Although net operating income would have been a better metrics, the assignment of costs to harvesting greater amberjack cannot be undertaken with the current model used.

Analysis of the expected changes in ex-vessel revenues was conducted relative to the no action alternative (**Alternative 1**). For analytical purposes, the no action alternative consists of a March 1-May 31 seasonal closure and commercial ACL of 503,000 pounds. To quantify the economic

effects, the Greater Amberjack Decision Tool was modified to include ex-vessel prices expressed in 2010 dollars (SERO/LAPP; SEFSC).

Implementing a commercial trip limit may be expected to reduce the amount of harvest per trip. This would directly translate into reductions in ex-vessel revenues per trip and possibly profits assuming a relatively stable cost per trip. To the extent that the a trip limit could postpone quota closures to some later date, some of the revenue losses from a trip limit could be recouped by undertaking more trips later in the year. These additional trips would also incur additional fishing costs so that profit per vessel as well as for the entire harvesting industry may remain the same, decrease, or increase. One favorable factor of a trip limit is the possibility it could lengthen the season so that landings would not occur over a short period which would only tend to depress prices. In addition, a longer fishing season would afford those who target or catch greater amberjack on a seasonal basis an opportunity to fish for the species. Given the limitations of current modeling approach which focuses on revenue effects, these considerations pertinent to the implementation of a trip limit cannot be readily incorporated into the analysis.

In principle, the no action alternative (**Alternative 1**) would not introduce any changes to the economic environment. From a modeling perspective, this alternative is used as the baseline scenario against which all trip limit alternatives would be compared. As noted earlier, the current analysis uses a more restrictive definition of the no action alternative as consisting of a seasonal closure and a commercial ACL of 503,000 pounds. For the current analysis then, **Alternative 1** is not in its entirety the no action alternative as it includes other ACL values. These other ACL values would also need to be evaluated and compared with the no action alternative.

Table 4.3.3.1 presents the revenue changes relative to the no action alternative under the different ACL/ACT. Zero entries mean revenues under the different ACL/ACT are the same as those of the no action alternative. As with the no action alternative, these other ACL/ACT would result in quota closures, and these quota closures would be relatively longer than that of the no action alternative. An ACL of 481,000 pounds would result in revenue reductions of $22,000 and the ACT of 409,000 pounds, revenue reductions of $99,000.

Table 4.3.3.1. Changes in ex-vessel revenues (thousand dollars) relative to the no action alternative due to different ACL/ACT (Alternative 1).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
ACL=481,000 POUNDS													
	0	0	0	0	0	0	0	0	-22	0	0	0	-22
ACT=409,000 POUNDS													
	0	0	0	0	0	0	0	-54	-45	0	0	0	-99

The revenue effects of the various trip limit alternatives under **Alternative 2** are presented in Table 4.3.3.2. The same set of trip limit alternatives is analyzed under different ACL/ACT, since quota closures would occur not only at different times for different trip limits given the same ACL/ACT but also at different times for the same trip limits given different ACL/ACT.

Under any ACL/ACT alternative, all trip limit alternatives would result in overall revenue reductions. The only exception to this is the 2,000-pound trip limit under the current ACL of 503,000 pounds which would result in a $4,000 increase in revenues. For this particular alternative, revenue gains from an extended season would outweigh revenue losses from the trip limit. Also under any ACL/ACT alternative, revenue losses would increase with lower trip limits. The only exception to this is the 1,500-pound trip limit under the ACT of 409,000 pounds which would result in slightly smaller loss than the 2,000-pound trip limit.

Any trip limit alternative under any of the ACL/ACT alternative would result in relatively large revenue losses in June, July, and August. This reflects the relatively large landings on these months under the no action alternative. Most of these revenue losses would not recouped by revenue gains from an extended season.

Table 4.3.3.2. Changes in ex-vessel revenues (thousand dollars) relative to the no action alternative due to trip limits, assuming a March 1–May 31 seasonal closure (Alternative 2).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
ACL=503,000 POUNDS													
O-A	-4	-16	0	0	0	-42	-21	-38	20	52	46	6	4
O-B	-5	-22	0	0	0	-49	-32	-49	13	47	43	41	-12
O-C	-9	-31	0	0	0	-56	-47	-63	2	41	39	37	-87
O-D	-16	-44	0	0	0	-67	-67	-81	-11	30	30	28	-198
ACL=481,000 POUNDS													
O-A	-4	-16	0	0	0	-42	-21	-38	20	52	31	0	-17
O-B	-5	-22	0	0	0	-49	-32	-49	13	47	43	36	-18
O-C	-9	-31	0	0	0	-56	-47	-63	2	41	39	37	-87
O-D	-16	-44	0	0	0	-67	-67	-81	-11	30	30	28	-198
ACT=409,000 POUNDS													
O-A	-4	-16	0	0	0	-42	-21	-38	20	3	0	0	-96
O-B	-5	-22	0	0	0	-49	-32	-49	13	47	1	0	-95
O-C	-9	-31	0	0	0	-56	-47	-63	2	41	39	27	-97
O-D	-16	-44	0	0	0	-67	-67	-81	-11	30	30	28	-198

O-A: 2,000 lb trip limit; O-B: 1,500 lb trip limit; O-C: 1,000 lb trip limit; O-D: 500 lb trip limit.

Table 4.3.3.3 presents the revenue effects of **Alternative 3**, which would eliminate the seasonal closure and impose trip limits. All trip limit alternatives under any ACL/ACT alternative would result in overall revenue losses, with larger losses being associated with lower ACL/ACT alternatives. Revenue gains from opening to fishing the months of March through May would not outweigh the losses from the trip limits and shorter season.

Under a given ACL/ACT, overall revenue reductions would not necessarily be larger with lower trip limits. For example, a 500-pound trip limit would result in smaller revenue reductions than a 1,000-pound trip limit except under the ACL of 481,000 pounds. Moreover, a 1,500-pound trip limit would result in smaller revenue reductions than a 2,000-pound trip limit under any of the ACL/ACT alternative.

By comparing the results in Table 4.3.3.3 to those in Table 4.3.3.2, it can be seen that with the exception of the lowest trip limit, trip limits without the season closure would result in larger revenue reductions than their counterparts when the seasonal closure is maintained. Unless the greater amberjack market or fishing significantly improves in the months of March through May when these months are opened to fishing, eliminating the seasonal closure and implementing trip limits would generally result in lower economic conditions than maintaining the seasonal closure with trip limits, at least from the standpoint of revenue effects.

Table 4.3.3.3. Changes in ex-vessel revenues (thousand dollars) relative to the no action alternative due to trip limits, assuming a March 1–May 31 seasonal closure (Alternative 2).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
ACL=503,000 POUNDS													
O-A	-4	-16	0	0	0	-42	-21	-38	20	52	46	6	4
O-B	-5	-22	0	0	0	-49	-32	-49	13	47	43	41	-12
O-C	-9	-31	0	0	0	-56	-47	-63	2	41	39	37	-87
O-D	-16	-44	0	0	0	-67	-67	-81	-11	30	30	28	-198
ACL=481,000 POUNDS													
O-A	-4	-16	0	0	0	-42	-21	-38	20	52	31	0	-17
O-B	-5	-22	0	0	0	-49	-32	-49	13	47	43	36	-18
O-C	-9	-31	0	0	0	-56	-47	-63	2	41	39	37	-87
O-D	-16	-44	0	0	0	-67	-67	-81	-11	30	30	28	-198
ACT=409,000 POUNDS													
O-A	-4	-16	0	0	0	-42	-21	-38	20	3	0	0	-96
O-B	-5	-22	0	0	0	-49	-32	-49	13	47	1	0	-95
O-C	-9	-31	0	0	0	-56	-47	-63	2	41	39	27	-97
O-D	-16	-44	0	0	0	-67	-67	-81	-11	30	30	28	-198

O-A: 2,000 lb trip limit; O-B: 1,500 lb trip limit; O-C: 1,000 lb trip limit; O-D: 500 lb trip limit.

4.3.4 Direct and Indirect Effects on the Social Environment

Action 3 includes alternatives with sub-options outlining commercial trip limits (**Preferred Alternative 2** and **Alternative 3**) and an alternative to eliminate the fixed closed season (**Alternative 3**). The fixed closed season applies to the commercial sector only, extending from March through May. This time period coincides with the peak spawning season of greater amberjack in the Gulf of Mexico (March to April and ending in May). Among the effort restricting tools available to managers, fishermen generally support closures during spawning times as they agree with the biological need to protect fish on which they depend when the fish are reproducing. No additional social impacts would arise from maintaining the closed season (**Alternative 1** and **Preferred Alternative 2**). Given that a spawning season closure is an effort restriction with general approval by fishermen, its elimination (**Alternative 3**) considering other possible effort restrictions (such as adjusting size or trip limits) appears counter-intuitive to a rebuilding plan. Although fishermen would be able to fish during the spawning season if it was eliminated, they currently exceed the quota with a nine month season. Thus, extending the

season by removing the fixed closed season would not provide any more fish to the fishermen or provide social benefits.

Preferred Alternative 2 and **Alternative 3** include the same set of four sub-options to establish a 2,000 pound (**Preferred Option a**), 1,500 pound (**Option b**), 1,000 pound (**Option c**), or 500 pound (**Option d**) trip limit for greater amberjack. (The following analysis refers to the options by letter, as the impacts would be the same for either **Preferred Alternative 2** or **Alternative 3**; the difference in impacts between the alternatives was analyzed above.) Table 4.3.4.1 contains data on the number of vessels per year that landed quantities of greater amberjack that exceed each of the trip limit options. These data reflect the highest landings of each vessel per year and each vessel likely made numerous trips. The number of vessels with landings greater than each proposed trip limit is a subset of the previous column's maximum landing weight. For example, in 2009, 318 unique vessels landed greater amberjack at least once during the year. Of those 318 vessels, 79 vessels landed more than 500 pounds on a single trip. The proportion of vessels that made at least a single landing greater than each of the proposed options is shown in Table 4.3.4.2. The table includes three time frames for comparison: the average number of vessels landing greater than each trip limit for 10 years, 5 years, and a single year (2009). Although the number of vessels landing greater amberjack varies each year, the proportion of vessels with landings greater than each trip limit has remained consistent. These data facilitate consideration of the number of vessels that may be impacted by the adoption of each proposed trip limit.

Table 4.3.4.1. Number of vessels by year with greater amberjack landings greater than the proposed sub-options of Preferred Alternative 2 and Alternative 3. The columns contain the number of unique vessels landing greater amberjack. The first column (> 0 lbs) is the total number of vessels landing greater amberjack on at least one trip for the given year. Subsequent columns contain the number of vessels out of the total (> 0 lbs) that landed more greater amberjack than each proposed trip limit on a single trip.

Number of vessels which may be affected under:		Option d	Option c	Option b	Option a
Landings by Year	**> 0 lbs**	**> 500 lbs**	**> 1,000 lbs**	**> 1,500 lbs**	**> 2,000 lbs**
1991	5	1	1	1	1
1992	173	40	19	11	8
1993	530	110	66	48	36
1994	566	135	71	48	37
1995	509	120	68	48	36
1996	509	137	76	49	35
1997	491	115	71	49	39
1998	446	99	52	30	24
1999	467	100	56	41	29
2000	464	104	60	46	30
2001	455	113	56	40	32
2002	465	104	59	39	31
2003	492	127	72	53	40
2004	468	112	68	48	37
2005	447	104	59	41	33
2006	360	87	49	35	29
2007	287	76	42	33	27
2008	314	80	42	26	19
2009	318	79	44	34	25
2010	218	63	37	27	23

Source: Nick Farmer, SERO.

Table 4.3.4.2. Proportion of vessels with landings of greater amberjack that exceed each proposed trip limit option. Although the number of vessels landing greater amberjack varies by year (see Table 4.3.4.1), the proportion of vessels with landings that exceed each trip limit option is fairly consistent.

		Option d	**Option c**	**Option b**	**Option a**
Vessels with landings exceeding proposed trip limit	>0 lbs	>500 lbs	>1000 lbs	>1500 lbs	>2000 lbs
2000-2009 (Average)	407	98.6	55.1	39.5	30.3
	100%	**24%**	**14%**	**10%**	**7%**
2005-2009 (Average)	345.2	85.2	47.2	33.8	26.6
	100%	**25%**	**14%**	**10%**	**8%**
2009	318	79	44	34	25
	100%	**25%**	**14%**	**11%**	**8%**

Source: Nick Farmer, SERO.

Generally, greater amberjack is caught by vertical line (70%) alongside other reef fish species and makes up only a part of most vessels' landings per trip. Roughly 75% of vessels that landed greater amberjack did not land more than 500 pounds on a single trip. However, approximately 8% of vessels that landed greater amberjack landed more than 2,000 pounds in a single trip. Some vessels may target greater amberjack in a directed trip and land several thousands of pounds. Others may direct effort on a single day of a multi-day trip and exceed 2,000 pounds on this day alone (David Walker, pers. comm.). Nevertheless, greater amberjack directed trips are part of a flexible, multi-fishery strategy of a subset of vessels rather than a full-time dedicated fishery.

It is not likely that any vessel targets greater amberjack full-time. For the majority of vessels, a trip limit should have no impact as most vessels never land more than 500 pounds (**Option d**). However, some conduct directed trips seasonally and others direct effort during part of a multi-day fishing trip. These are examples of diversified fishing strategies which enable fishermen to adapt to changing regulations and fishing conditions. Implementing a trip limit will narrow the available fishing options, negatively impacting fishing behavior and practice for some fishermen. Thus, the trip limit is likely to affect a segment of participants, rather than affecting all participants evenly. The adopted option (**Preferred Option a**, or **Options b, c, d**) will affect only those vessels which make landings greater than the maximum corresponding pounds. Vessels will likely continue to fish but will switch effort in unknown ways. Relative to the no action **Alternative 1** where no trip limit would be implemented, **Preferred Option a** would affect the fewest vessels and is expected to incur the least social impacts among the proposed options. **Option d**'s trip limit of 500 pounds would affect the most (25% of those who land greater amberjack) with **Options b** and **c** falling between.

It is commonly accepted that there will be winners and losers from fishery management decisions. However, determining the winners and losers is often rooted in political decisions based on constructed valuation of the resource's best usage (Copes 1997). The adoption of a trip limit would selectively impact only those vessels that direct effort toward greater amberjack and whose landings exceed the chosen trip limit. On the other hand, implementing a trip limit

(**Preferred Option a, Options b, c, d**) would essentially prohibit directed trips allowing the majority of vessels to continue catching greater amberjack alongside other reef fish species during a longer season. If no trip limit were adopted (**Alternative 1**), the season is expected to remain open for 122-138 days. Smaller trip limits will impact more vessels, but allow the season to remain open longer under model 1: 2,000 lb trip limit, 184 day season (**Preferred Option a)**; 1,500 lb trip limit, 214 day season (**Option b**); and 1,000 lb trip limit, 266 day season (**Option c**). The most restrictive trip limit (**Option d**) would allow the longest fishing season (274 days), providing the greatest benefits to those who catch greater amberjack incidentally, but impacting the fishing behavior of 25% of those catching greater amberjack. The **Preferred Option a** affects the smallest number of vessels (8%), but would extend the season for the majority of vessels by nearly two months.

4.3.5 Direct and Indirect Effects on the Administrative Environment

Alternative 1 is not expected to impact the administrative environment because it would not change the current management measures. **Preferred Alternative 2** and **Alternative 3** would have the greatest burden on the administrative environment due to the establishment of commercial trip limits (**Preferred Option a** or **Options b-d**). These trip limits would increase the burden for law enforcement agencies which would have to monitor compliance with any trip limits established under **Preferred Alternative 2 or Alternative 3**. **Alternative 3** is expected to have less of an impact on the administrative environment compared to **Preferred Alternative 2**, because there would only be one closed commercial season to monitor once the quota has been closed. Therefore, **Alternative 1** would have the least adverse effect on the administrative environment while **Preferred Alternative 2** would have the most.

5.0 BYCATCH PRACTICABILITY ANALYSIS

Background/Overview

The Gulf Council is required by MSA §303(a) (11) to establish a standardized bycatch reporting methodology for federal fisheries and to identify and implement conservation and management measures that, to the extent practicable and in the following order, (A) minimize bycatch and (B) minimize the mortality of bycatch that cannot be avoided. The MSA defines bycatch as "fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. Such term does not include fish released alive under a recreational catch-and-release fishery management program" (MSA §3(2)). Economic discards are fish that are discarded because they are undesirable to the harvester. This category of discards generally includes certain species, sizes, and/or sexes with low or no market value.
Regulatory discards are fish that are required by regulation to be discarded, but also include fish that may be retained but not sold. NMFS outlines at 50 CFR §600.350(d) (3) (i) ten factors that should be considered in determining whether a management measure minimizes bycatch or bycatch mortality to the extent practicable.

Guidance provided at 50 CFR 600.350(d)(3) identifies ten factors to consider in determining whether a management measure minimizes bycatch or bycatch mortality to the extent practicable. These are:

1. Population effects for the bycatch species.
2. Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem).
3. Changes in the bycatch of other species of fish and the resulting population and ecosystem effects.
4. Effects on marine mammals and birds.
5. Changes in fishing, processing, disposal, and marketing costs.
6. Changes in fishing practices and behavior of fishermen.
7. Changes in research, administration, and enforcement costs and management effectiveness.
8. Changes in the economic, social, or cultural value of fishing activities and non-consumptive uses of fishery resources.
9. Changes in the distribution of benefits and costs.
10. Social effects.

The Councils are encouraged to adhere to the precautionary approach outlined in Article 6.5 of the Food and Agriculture Organization (FAO) of the United Nations Code of Conduct for Responsible Fisheries when uncertain about these factors.

The greater amberjack fishery is currently regulated with size limits, bag limits, quotas, and seasonal closures. These measures are generally effective in limiting fishing mortality, the size of fish landed, the number of targeted fishing trips, and/or the time fishermen spend pursuing a species. However, these management tools may have the unavoidable adverse effect of creating regulatory discards, which reduces landings. Consequently, the Council is considering in this amendment the practicability of taking additional action to further minimize greater amberjack bycatch, by sector.

Greater Amberjack Release Mortality Rates

Commercial Discard Rates

Greater amberjack discard rates were calculated for the Gulf vertical line fishery using both self-reported data (discard coastal logbook) and observer data (SEDAR 9 2006a). Total Gulf vertical line (handline and electric reel/bandit rig) effort was used along with the calculated discard rates to provide two estimates of total greater amberjack discards from the Gulf vertical line fishery. Those calculated discards were also compared with discard estimates calculated for the 2006 greater amberjack assessment (SEDAR 9 2006a). Vertical line discards, calculated using the self-reported data, are presented in Table 5.1. Calculation of discards followed the methods used in the 2006 assessment (SEDAR 9- DW17). In that analysis, results from generalized linear models (GLM's) indicated significant differences in discard rates across time period (Jan-Jul, Aug-Dec) and number of hooks per line fished (1-2, 3-9, >9 hooks). Mean discard rates were calculated for each year, by month, and hooks per line. Total effort was available from the coastal logbook data (a census of landings and effort data from vessels with federal fishing permits). Effort, defined as number of trips, was summed within each year/period/hooks per line. Total discards were calculated for each stratum as: stratum mean discard rate per trip x the number of stratum total trips. Discards of all strata within a year were summed to provide total yearly discards. Confidence intervals (5% and 95%) were calculated for each stratum specific discard rate. The discard rates at the confidence intervals were also multiplied by total vertical line effort to provide a measure of uncertainty around the discard calculations. Discards were calculated as numbers of discarded fish and were converted to pounds by multiplying by 12.83 pounds, the mean weight of a discarded greater amberjack reported in observer data from years 2002-2009. Total weight of discards was also calculated for 20% and 40% discard mortality, following the methods of the 2006 assessment (SEDAR 9).

Amendment 1 to the GMFMC, Reef Fish FMP implemented a 36 inch commercial minimum size regulation in 1990 thus discarding can be expected for years 1990 and later. To calculate discards for the years 1990-2001, the mean discard rate across the years 2002-2009 was calculated for each hook per line stratum. Those discard rates were multiplied by total vertical line effort within each year/hooks per line stratum.

While updating the total discard calculations for the 2011 SEDAR 9 update (using the self-reported logbook data set, the continuity case of SEDAR 9), a programming error in the 2005 SAS code was identified (K. McCarthy, personal communication). Correction of the coding error resulted in much lower discard totals than were calculated in 2005 using the same data set. The corrected SAS code was used to calculate total vertical line discards using the self-reported data for the 2011 SEDAR update.

An additional source of commercial handline discards was evaluated for the SEDAR 9 2011 update. Gulf reef fish observer data were also used to calculate greater amberjack discard rates of commercial vertical line vessels. The observer program was initiated in late 2006; therefore, the data were only available for only brief time series. The 2011 SEDAR Update used data from 2007 through 2009. Only the 2007 and later data were used in the SEDAR 2011 update

assessment for greater amberjack. The observer data set, 2007-2009, also reflects a small fraction of total commercial vertical line effort in the Gulf (<1% of total hook hours fished).

Due to the small number of observed greater amberjack discards (387 discarded fish in 195 observed trips) the data were stratified by year only. Discard rate was calculated as: number of fish discarded per hook hour fished. Total effort in hook hours was available from the coastal logbook data. Total discards per year during 2007-2009 were calculated as: yearly mean discard rate per hook hour fished x total hook hours fished. Yearly discards for the years 1990-2006 were calculated using the mean discard rate across all years, 2007-09, multiplied by the yearly total effort in hook hours. Uncertainty around the yearly calculated discards was determined following the methods described above for self-reported discard analyses. Vertical line discards calculated using the observer data are presented in 2006 SEDAR 9 Table 3.3.1.1B. Yearly calculated discards are also provided in number of fish, weight in pounds, and weight assuming 20% and 40% discard mortality.

The 2006 SEDAR 9 stock assessment provides a comparison of yearly total discards of greater amberjack from commercial vertical line vessels calculated using both self-reported discard data and observer data in Table 5.1 and 5.2. Total discards calculated using the same data set for the update assessment, but with the corrected code were less than 500,000 pounds per year. It is also noted that the self-reported discards may be unrealistically low due to a proportion of fishers, up to 40% of all trips in a year, reporting "no discards" for a trip. Total discards calculated using the observer data, in contrast, were more similar to the SEDAR 9 2006 discards than to the 2010 self-reported discards. Commercial vertical line discards calculated using observer reported discard rates were much higher in 2008 than in other years. The 2009 calculated discards, however, were the fewest of any year of the time series. That large variability between years may have resulted from the small number of hook hours observed which, by chance, had either much higher (2008) or lower (2009) discard rates than both the 2007 rate and the mean rate (SEDAR 9 Table 3.3.1.2). During each year of available observer data, the sampling fraction (percent of total effort observed) was less than 1% of the total effort reported to the coastal logbook program. Variability in discards among years prior to 2007 was due to yearly differences in total effort because the mean discard rate was applied to yearly effort during that period.

Numbers of discards were calculated using the mean discard rate. Pounds of discards were calculated by applying the mean weight of a discarded fish to the number of discards. Number of discards assuming a 20% and 40% discard mortality were also calculated. Confidence intervals (CI) were the number of discards calculated by applying the discard rates at the 5% and 95% confidence intervals of the mean rate to total effort.

Table 5.1 Self-reported NMFS, SEFSC Coastal Logbook Program Discard Data

A.

Year	Number of discards (fish)	Discard 95% CI	Discard 5% CI	Pounds of discards	20% discard mortality (lbs)	40% discard mortality (lbs)
1990	13,660	17,765	9,554	175,256	35,051	70,102
1991	24,003	30,588	17,417	307,954	61,591	123,182
1992	19,979	26,113	13,846	256,335	51,267	102,534
1993	22,969	29,385	16,553	294,688	58,938	117,875
1994	23,450	29,596	17,303	300,861	60,172	120,345
1995	23,616	29,785	17,447	302,993	60,599	121,197
1996	26,230	33,135	19,324	336,525	67,305	134,610
1997	26,875	33,539	20,210	344,803	68,961	137,921
1998	27,488	34,441	20,535	352,669	70,534	141,067
1999	27,996	35,260	20,732	359,191	71,838	143,676
2000	27,392	34,895	19,889	351,442	70,288	140,577
2001	25,445	31,929	18,961	326,456	65,291	130,582
2002	36,241	56,602	16,317	464,970	92,994	185,988
2003	36,299	57,649	15,030	465,717	93,143	186,287
2004	26,180	37,272	15,182	335,885	67,177	134,354
2005	14,313	25,043	3,620	183,638	36,728	73,455
2006	8,406	14,327	2,572	107,846	21,569	43,139
2007	11,222	17,764	4,711	143,977	28,795	57,591
2008	11,509	17,557	5,853	147,665	29,533	59,066
2009	13,901	27,592	5,187	178,343	35,669	71,337

Table 5.2 NMFS, SEFSC Galveston, Texas Laboratory Reef Fish Observer Program

Year	Number of discards (fish)	Discard 95% CI	Discard 5% CI	Pounds of discards	20% discard mortality (lbs)	40% discard mortality (lbs)
1990	86,678	112,766	60,590	1,112,079	222,416	444,832
1991	196,453	255,580	137,325	2,520,486	504,097	1,008,194
1992	116,427	151,468	81,385	1,493,754	298,751	597,502
1993	120,103	156,251	83,955	1,540,927	308,185	616,371
1994	142,946	185,969	99,923	1,833,993	366,799	733,597
1995	142,819	185,803	99,834	1,832,363	366,473	732,945
1996	154,095	200,473	107,716	1,977,037	395,407	790,815
1997	172,267	224,115	120,419	2,210,188	442,038	884,075
1998	160,801	209,198	112,404	2,063,074	412,615	825,230
1999	177,072	230,366	123,778	2,271,831	454,366	908,732
2000	169,229	220,163	118,296	2,171,212	434,242	868,485
2001	170,533	221,859	119,207	2,187,937	437,587	875,175
2002	175,117	227,823	122,411	2,246,752	449,350	898,701
2003	185,449	241,264	129,634	2,379,309	475,862	951,723
2004	168,820	219,631	118,010	2,165,966	433,193	866,386
2005	151,539	197,148	105,930	1,944,244	388,849	777,698
2006	154,076	200,448	107,703	1,976,789	395,358	790,716
2007	115,351	174,884	55,819	1,479,959	295,992	591,984
2008	265,288	379,021	151,555	3,403,647	680,729	1,361,459
2009	70,557	115,787	25,327	905,247	181,049	362,099

In the 2006 SEDAR 9 evaluation of greater amberjack discard rates (SEDAR 9-DW17); estimates of discards were not made for the longline fishery. For the 2011 update assessment, this convention was carried forward. As summarized earlier in Section 3.2 (Commercial landings summary by gear), this species is not targeted by the longline fishery. Future benchmark evaluations should continue to examine both the self-reported and observer data to better quantify the levels of greater amberjack discards from the commercial longline fishery.

Release mortality rate for greater amberjack in the Gulf of Mexico is unreported (SEDAR 9 2006a). Headboat and commercial handline observer studies off North Carolina estimated release mortality rate ranges from 8-9% for greater amberjack (Robert Dixon, pers. comm. in SEDAR 9 2006a); however, sample sizes were small for these studies. Release mortality rates were based on observations of greater amberjack at the surface after release (floating, swimming down etc). The SEDAR 9 data workshop panel suggested a minimum release mortality rate for greater amberjack of 10% for vertical line, with actual release mortality potentially higher owing to fish dying after release that did not float at the surface. The SEDAR 9 data workshop panel

recommended using a range of release mortality rates to evaluate the sensitivity of the SEDAR 9 stock assessment to this parameter. Discard mortality rates of 0, 20, and 40% were used for the assessment, with 20% selected based on the information available.

Greater amberjack are also caught as bycatch in shrimp trawls. The latest stock assessment (SEDAR 2011 Update) Data Workshop (DW) Panel noted that greater amberjack at that time this species was not on the workup for the observer evaluation program. The Panel further noted that because their abundance in trawls is so low as supported by the average percent occurrence values with (99%) and without (8%) Bycatch Reduction Device (BRDs) that reliable annual estimate would have been difficult with these statistical estimators (due to the high frequency of zero observations) (see SEDAR9 DW Report, Section 3.4.2 and Table 3.5). In general, estimation results from all the methods where estimations were produced (modified Bayesian and Model 7) indicated large to enormous uncertainty and the SEDAR 9 DW Panel noted the results seemed unrealistic. Estimates from the Bayesian model were not successful. In addition, assigning size (or age) to estimates of shrimp trawl bycatch was not possible at the time of the 2006 SEDAR 9 stock assessment as only a very few observations from the observer study had been measured.

Recreational Discard Rates

Unlike Marine Recreational Fisheries Survey and Statistics (MRFSS), the Headboat survey does not provide estimates of released fish. Because a proportion of the released fish are expected to die, the estimated number of releases is necessary in order to develop a complete time series of removals for use in subsequent population modeling analysis. Table 5.3 provides the time series of discard estimates (numbers of fish) from the MRFSS survey.

The protocols adopted by the SEDAR 9 DW Panel to quantify discards for the headboat mode were continued for the SEDAR 9 2011 update. There were two main recommendations made: 1) estimate the ratio of headboat releases (B2) to the total catch (A+B1+B2) from MRFSS charter boat mode only (Table 5.3 and Table 5.4) and 2) use this source (and sector) to estimate headboat releases. The SEDAR 9 DW Panel felt that charter boat and headboat fishing are most similar and the rate of released fish would be most alike. Private boat fishing likely would not be the same as the “for-hire” sector. New information on recreational discards available from self reported logbooks and also from observer trips was also reviewed for the 2010 update

As in the previous two greater amberjack stock evaluations (SEDAR9; Turner et al. 2000) discards were not estimated for TPWD source.

Table 5.3 Estimated greater amberjack discards (B2) for the charter boat, charter/headboat combined and private angler fisheries from the MRFSS survey. Units for B2 = numbers of fish.

	Charter	Cbt/Hbt	Private
YEAR	B2	B2	B2
1981		0	15,241
1982		0	45,085
1983		21,562	65,994
1984		3,595	5,242
1985		0	0
1986	53,124		90,249
1987	33,125		60,659
1988	1,043		18,381
1989	19,267		99,683
1990	23,748		46,475
1991	223,982		31,737
1992	91,758		87,662
1993	126,098		70,870
1994	64,783		40,143
1995	10,986		55,409
1996	42,758		20,355
1997	18,478		20,741
1998	39,120		42,782
1999	42,037		36,835
2000	31,872		80,717
2001	55,808		393,931
2002	82,883		185,028
2003	56,535		171,196
2004	30,730		123,898
2005	27,093		111,463
2006	30,418		81,417
2007	34,609		132,165
2008	65,630		130,548
2009	58,995		83,474
Grand Total	1,264,881	25,156	2,347,379

Table 5.4 Estimated discard ratios (B2/AB1B2) for Gulf of Mexico greater amberjack from the charter, charter/headboat, and private angler fisheries from the MRFSS survey. Units for B2 and AB1B2 are number of fish.

YEAR		Cbt	Cbt/Hbt	Priv	Grand Total
	1981	0.00	0.00	0.13	0.12
	1982	0.00	0.00	0.23	0.07
	1983	0.00	0.10	0.58	0.26
	1984	0.00	0.04	0.54	0.08
	1985	0.00	0.00	0.00	0.00
	1986	0.17	0.00	0.46	0.28
	1987	0.10	0.00	0.23	0.16
	1988	0.01	0.00	0.18	0.08
	1989	0.11	0.00	0.34	0.25
	1990	0.50	0.00	0.54	0.53
	1991	0.50	0.00	0.73	0.52
	1992	0.42	0.00	0.72	0.53
	1993	0.53	0.00	0.68	0.57
	1994	0.43	0.00	0.68	0.50
	1995	0.39	0.00	0.70	0.62
	1996	0.47	0.00	0.39	0.44
	1997	0.34	0.00	0.62	0.45
	1998	0.67	0.00	0.79	0.73
	1999	0.60	0.00	0.67	0.63
	2000	0.46	0.00	0.83	0.68
	2001	0.66	0.00	0.91	0.87
	2002	0.53	0.00	0.82	0.70
	2003	0.47	0.00	0.68	0.61
	2004	0.36	0.00	0.72	0.60
	2005	0.49	0.00	0.66	0.62
	2006	0.41	0.00	0.71	0.59
	2007	0.51	0.00	0.87	0.76
	2008	0.69	0.00	0.76	0.73
	2009	0.63	0.00	0.70	0.67
Grand Total		0.39	0.03	0.59	0.44
Ave-2009		0.44	0.03	0.58	0.47
Ave-2003		0.41	0.03	0.54	0.42
Ave 2004-2009		0.52		0.74	0.66

Sea Turtles

The 2009 BiOp (NMFS 2009a,b) stated that combining an immediate mortality of 43.5% with a 30% post-release morality on the remaining sea turtles yields a 60.5% overall estimated mortality for loggerhead sea turtles captured on reef fish bottom longlines (i.e.,(100% - 43.5%)*0.30+43.5%). Therefore, of the estimated 519 loggerheads caught annually, 314 (519 takes x 0.605) resulted in mortality. Based on a summary of the types of interactions that result from bottom longline interactions, the BiOp conservatively estimated the 1 green, 1 hawksbill, 1 Kemp's ridley, and 1 leatherback sea turtle captures were all lethal. Loggerhead sea turtle takes observed in the bottom longline component of the reef fish fishery included both later-stage sexually immature sea turtles and mature sea turtles. These life history stages are very important for population recovery because their reproductive value is high. Satellite telemetry studies of adult female loggerhead sea turtles indicate the importance of the west Florida shelf as benthic foraging habitat (Schroeder et al. manuscript in prep). For the past 20 years, FWRI has coordinated a detailed sea turtle nesting-trend monitoring program.

Table 5.5 Anticipated Triennial Takes in the October 13, 2009 Biological Opinion

Species	Commercial Bottom Longline Takes (Mortalities)	Commercial Vertical Line Takes (Mortalities)	Recreational Vertical Line Takes (Mortalities)	Vessel Strike Takes- All Lethal	Entire Fishery Takes (Mortalities)
Loggerhead	732 (443)[A] 623 (378)[B]	76 (23)	254 (75)	90(90)	1152 (631)[A] 1043 (566)[B]
Kemp's ridley	3 (3)	23 (7)	74 (22)	9 (9)	88 (39)
Green	3 (3)	14 (4)	45 (14)	54 (54)	170 (75)
Leatherback	3 (3)	1 (1)	1 (1)	6 (6)	11 (11)
Hawksbill	3 (3)	1 (1)	1 (1)	3 (3)	8 (8)
Smalltooth sawfish	2 (0)	2 (0)	4 (0)	0 (0)	8 (0)

[A]=anticipated in 2009-2011; [B]=anticipated for all subsequent 3-year periods

Loggerhead sea turtle nests counted annually at core index nesting beaches in Florida from 1989 through 2008 indicate a declining trend in loggerhead sea turtle nesting (FWRI 2008; Witherington et al. 2009). Witherington et al. (2009) have argued the observed decline in the annual counts of loggerhead sea turtle nests on Index and Statewide beaches in peninsular Florida can best be explained by a decline in the number of adult female loggerhead sea turtles in the population.

NMFS completed an Analysis of the Need to reinitiate endangered species action Section 7 consultation on the Fishery Management Plan for Reef Fish resources of the Gulf of Mexico on September 15, 2010. This need for analysis concluded that the 2009 opinion authorized the take

of sea turtles and smalltooth sawfish (see Table 5.5). There is no information to indicate that the amount or extent of anticipated take specified in the incidental take statement has been exceeded. As of September 15, 2010, the NMFS had observed the take of only one listed species (a loggerhead sea turtle) on bottom longline gear, despite increased observer coverage in this component of the fishery. There have been no commercial vertical line takes observed, and there is no new information to suggest that recreational vertical line or vessel strike takes have been exceeded.

Other Bycatch

Other species incidentally encountered by the reef fish fishery include mammals and sea birds. The Gulf commercial reef fish fishery is listed as a Category III fishery in NMFS' List of Fisheries (76 FR 79312, November 29, 2011). 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% 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 2009 BiOp also estimated eight smalltooth sawfish to be captured by reef fish fishery during 2009-2011 (NMFS 2009a,b).

The three primary orders of seabirds in the Gulf are Procellariiformes (petrels, albatrosses, and shearwaters), Pelecaniformes (pelicans, gannets and boobies, cormorants, tropic birds, and frigate birds), and Charadriiformes (phalaropes, gulls, terns, noddies, and skimmers) (Clapp et al. 1982; Harrison 1983). Several other species of seabirds also occur in the Gulf, and are listed as threatened or endangered by the U.S. Fish and Wildlife Service, including: piping plover, least tern, roseate tern, bald eagle, and brown pelican (the brown pelican is endangered in Mississippi and Louisiana and delisted in Florida and Alabama). Human disturbance of nesting colonies and mortalities from birds being caught on fishhooks and subsequently entangled in monofilament line are primary factors affecting sea birds. Oil or chemical spills, erosion, plant succession, hurricanes, storms, heavy tick infestations, and unpredictable food availability are other threats. No evidence exists that the directed reef fish fishery adversely affects seabirds.

The Council and NMFS took action in Amendment 18A to the Reef Fish FMP (effective September 8, 2006) to comply with the RPM that any sea turtle or smalltooth sawfish taken in the reef fish fishery is handled in such a way as to minimize stress to the animal and increase its survival rate. Regulations were implemented requiring sea turtle release gear be onboard reef fish-permitted vessels when fishing to facilitate the safe release of any incidentally caught sea turtles or smalltooth sawfish. In addition, vessels with commercial and for-hire reef fish vessel permits are required to possess specific documents providing instructions on the safe release of incidentally caught sea turtles or smalltooth sawfish. RPMs also required better data collection from the fishery on incidental takes of sea turtles.

One way effort has been made to reduce the chance of sea turtle interactions through Amendment 31 is the prohibition of longline gear in certain areas, depths, or months, or some combination of the three. The more abundant sea turtles are in a given area and the higher the fishing effort in that area, the greater the probability a sea turtle will be incidentally caught by the gear. For example, most observed sea turtle takes occurred on fishing trips west of the Tampa

Bay area, all but one turtle take was on a set at 50 fathoms or less, and 76% of sea turtles takes occurred from June through August (NMFS-SEFSC 2009). Most of the longline fishing effort is conducted in these places and at these times. The ESA rule prohibited bottom longline fishing in with a restriction of 1,000 hooks per vessel with no more than 750 hooks rigged at any given time.

Practicability of current management measures in the directed greater amberjack fishery relative to their impact on bycatch and bycatch mortality.

The commercial greater amberjack fishery is managed with a 36-inch minimum size limit, March through May seasonal closure, and gear restrictions. A 30-inch minimum size limit and one-fish bag limit are used to manage the recreational greater amberjack fishery. The following discusses current and proposed management measures with respect to their relative impacts on bycatch.

Size limits

Minimum size limits is estimated to be the greatest source of regulatory discards for most reef fish species. In 1990, a 36-inch FL commercial minimum size limit and a 28-inch FL recreational minimum size limit were implemented for greater amberjack. The recreational size limit was increased to a 30-inch minimum size limit in August 2008.

Size limits are typically established to reduce fishing mortality, increase yield-per-recruit, and prevent growth overfishing. A negative consequence of increasing the minimum size limit is potential increases in discards. A 1996-1999 tagging study of commercially caught greater amberjack in the South Atlantic indicated 41% of all greater amberjack caught were discarded (McGovern, pers. comm.). Reducing the commercial minimum size limit would reduce discards significantly (SERO 2007), but would increase harvest rates and therefore fishing mortality, unless further restrictions are imposed. Increasing the recreational minimum size limit is estimated to increase the proportion of dead discards to landings, but the overall magnitude of dead discards is estimated to be less for higher size limits relative to the status quo because of the reductions in harvest being considered in this amendment. Historical trends indicate dead discards increased after implementation of higher size limits, but quickly declined as the size distribution of greater amberjack adjusted to the new minimum size limit.

A yield-per-recruit analysis has recently been conducted to determine if the legal minimum size limit for greater amberjack is adequately protecting against growth overfishing (SEDAR 9 2006a; Appendix 12.2.3). Greater amberjack in spawning condition were captured from North Carolina to the Florida Keys; however, spawning was concentrated in areas off south Florida and the Florida Keys. Harris et al. (2007) documented evidence of spawning from January-June with peak spawning during April and May. Female greater amberjack were significantly larger than males (Harris 2004; Harris et al. 2007). For males, the size at which 50% of individuals were mature was 644 mm FL (25.4 inches FL) and for females was 826 mm FL (32.5 inches FL). They estimated a spawning season of approximately 73 days off south Florida, with a spawning period of 5 days, estimating that an individual female could spawn as frequently as 14 times during the season. Female fecundity increased with size, but was essentially constant throughout the spawning season. Greater amberjack are extremely fecund releasing 18 to 59 million eggs per female in a single spawning season (Harris et al. 2007). Murie and Parkyn (2008) completed

a recent study on reproductive biology of greater amberjack throughout the Gulf of Mexico using fishery-dependent as well as fishery-independent data from 1989-2008. They also found females were significantly larger than males but that peak spawning occurred during March and April, and by May, they documented low gonad weights suggesting spawning was ending. For females, 50% of individuals were mature at 900 mm FL (35 inches FL), larger than what Harris et al. (2007) documented off south Florida. Increasing the recreational minimum size limit could potentially benefit spawning potential if the increase does not result in a significant amount of forgone yield due to losses associated with natural and release mortality. Yield-per-recruit analysis did increase for larger minimum size limits, but only when fishing mortality was greater than Fmsy (F=0.33 from 2011 SEDAR 9 Update), but fishing at this rate would result in overfishing (Appendix 12.2.3).

This amendment includes alternatives to modify the current recreational minimum size limit of 30 inches FL to 32, 34, or 36 inches FL, respectively. Based upon the decision model (SERO-LAPP Gulf Amend 35 2011), under the assumption of 20% release mortality, as the minimum size limit increases from 30 inches FL the estimated dead discards increase. However, if the minimum size limit is increased, harvest is estimated to slow, because fewer fish are landed so total removals do not increase proportionately. The Council is considering increasing the minimum size limit but opted against it, due to concerns about the quota being caught more quickly if the minimum size was modified (i.e., harvest would not be slowed) as well as potentially increasing bycatch mortality.

Closed Seasons

The March through May commercial greater amberjack season closure was implemented in January 1998. The commercial season closure corresponds to the peak period of spawning (Burch 1979; Thompson et al. 1991; Beasley 1993; Harris et al. 2004). Discards are thought to be low during the closed season because commercial fishermen can avoid targeting schools of greater amberjack. A June through July recreational fishing closure was implemented to prevent the quota from being exceeded this year (2011). This amendment includes alternatives that would modify the existing June through July recreational closed season to the following: no fixed season closure (i.e., January 1 until the quota is reached), March through May, a split season closure of January through May and November through December, and lastly, a closure from June 1 through July 23. Implementing a closed season would be expected to increase the number of discards, although the impacts on the stock would be substantially reduced if targeted trips for greater amberjack are eliminated during the closed season as recreational anglers choose to pursue retainable stocks (Appendix 12.2.1).

Bag Limits

A one-fish greater amberjack recreational bag limit has been in effect since 1997. A low bag limit can encourage discards from high-grading once the bag limit is met. However, the minimum size limit likely plays a more significant role in determining the overall number of recreational discards. During 2003-2005, approximately 31% of MRFSS trips landing greater amberjack reported landing one or more greater amberjack per angler (Strelcheck, pers. comm.). This high percentage of trips indicates the potential for discards after the bag limit is met.

However, no changes to the bag limit are currently proposed in this amendment for the recreational greater amberjack fishery.

Allowable Gear

Vertical hook-and-line gear (bandit rigs, manual handlines) is the primary gear used in the greater amberjack commercial fishery. During 2002-2004, vertical-line gear accounted for 90% of both the greater amberjack landings, longlines accounted for 10% of the greater amberjack landings (SEDAR 9 2006b).

On average, longlines harvest larger greater amberjack than vertical-line gear. TIP data from 2003-05 indicates the average size of greater amberjack caught on longlines was four inches greater than the average size caught on vertical-line gear (43.6 vs. 39.6 inches FL). The difference in size at harvest is evident in size limit analyses for greater amberjack, which indicate greater reductions in harvest occur for vertical-line gear than longlines when comparing similar minimum size limits (SERO 2007a). Because the size of landed fish is greater, the number of discards is less on longlines than vertical-line gear, because the gear selects for larger fish. McCarthy (2005) estimated vertical-line gear discards of greater amberjack by the commercial fishery during 1993 to 2004, but could not estimate longline discards because of the small number of trips reporting discards. Additionally, little is known on the release mortality rates associated with each of these gears. The 2006 assessment assumed a constant 20% release mortality rate for all gears and fisheries. More scientific information is needed to determine the magnitude and release mortality rates for various gears used in the greater amberjack commercial fishery. For instance, in the commercial red grouper fishery, longlines are assumed to have a 45% release mortality rate while vertical-line gear has a 10% release mortality rate. This difference in release mortality rate between gears can be important if one gear discards substantially more fish than the other, but kills a smaller percentage of the fish released.

Rod-and-reel is the primary gear used in the recreational fishery. Circle hooks are used by some anglers when targeting greater amberjack. Some greater amberjack are also caught using spears, which do not affect discards or release mortality since all fish caught are killed. Only undersized fish mistakenly killed while spearfishing would contribute to discard mortality.

Recreational discards are primarily due to the recreational size limits in each of these fisheries and the one fish greater amberjack bag limit; however, allowable gears can affect release mortality rates. Amendment 27/14 to the Reef Fish and Shrimp FMPs summarizes various research studies examining the effects of circle hooks, hook sizes, venting tools, and dehooking devices on survival of reef fishes after release.

Alternatives being considered to minimize bycatch

Reductions in dead discards can be accomplished either by reducing the number of greater amberjack discarded or reducing the release mortality rate of discards. To reduce the number of discards, management measures must limit fishing effort or change the selectivity of fishing gears in such a way that reduces the harvest of sub-legal fish. To reduce the discard mortality rate of greater amberjack, sources of release mortality must first be identified (e.g., depth, length,

hooking location, surface interval, temperature) and management measures must be imposed to reduce discard mortality rates.

This amendment considers several management measures to reduce greater amberjack discards and discard mortality. Alternatives directly or indirectly affecting bycatch include reducing the recreational greater amberjack minimum size limit and modifying the recreational season closure (Action 2.1).

Practicability Analysis

Criterion 1: Population effects for the bycatch species

Directed-fishery bycatch of greater amberjack results in forgone yield. However, increases to the minimum size limit may offset losses in yield due to bycatch, thereby increasing overall yield-per-recruit. Any reductions in directed fishery bycatch must be accounted for when setting ACL; the less bycatch is reduced, the more directed ACL must be reduced.

Criterion 2: Ecological effects due to changes in the bycatch of greater amberjack (on other species in the ecosystem)

The relationships among species in marine ecosystems are complex and poorly understood, making the nature and magnitude of ecological effects difficult to predict with any accuracy. The Scientific Steering Committee (SSC) rejected the projections from the SEDAR 9 2011 Update Assessment for the purposes of developing management advice. Under any rebuilding scenario considered, the stock will be significantly larger than they are currently. Greater amberjack are opportunistic predators that feed on benthic and pelagic fishes, squid and crustaceans. Greater amberjack eggs and larvae are pelagic and smaller juveniles (<20 mm SL) are found associated with pelagic *Sargassum* spp. mats (Bortone et al. 1977; Wells and Rooker 2004a). Juveniles then shift to demersal habitats (5-6 months), where they congregate around reefs, rocky outcrops, and wrecks (see Section 3.2). Reductions in bycatch and fishing mortality will allow the greater amberjack stock to increase in abundance, resulting in increased competition for prey with other predators. Consequently, it is possible that forage species and competitor species could decrease in abundance in response to an increase in greater amberjack abundance.

Criterion 3: Changes in the bycatch of other species of fish and invertebrates and the resulting population and ecosystem effects

Population and ecosystem effects resulting from changes in the bycatch of other species of fish and invertebrates are difficult to predict. Fishermen can specifically target greater amberjack while they are schooling. Snappers, groupers, and other reef fishes are commonly caught in association with greater amberjack. Those most commonly caught include: red snapper, vermilion snapper, gag, and red grouper. Red snapper are undergoing overfishing and overfished (SEDAR 7 2005; GMFMC 2007), red grouper are not overfished and are not undergoing overfishing (SEDAR 12 2007), gag are undergoing overfishing, and are overfished (SEDAR 10 2011), and vermilion snapper are not undergoing overfishing and not overfished. Regulatory

discards significantly contribute to fishing mortality in all of these reef fish fisheries, especially red snapper and groupers.

Increasing the greater amberjack recreational minimum size limit will increase the proportion of dead discards to landings, but may result in an overall decrease in the magnitude of discards because of the reduction in landings considered in this amendment. Assuming anglers continue to target greater amberjack if the minimum size limits are increased, less effort will be directed at other species thereby providing a small net benefit to those species because of lower fishing mortality and less bycatch.

Criterion 4: Effects on marine mammals and birds

The effects of current management measures on marine mammals and birds are described above. Bycatch minimization measures evaluated in this amendment are not expected to significantly affect marine mammals and birds. There is no information to indicate marine mammals and birds rely on greater amberjack for food.

Criterion 5: Changes in fishing, processing, disposal, and marketing costs

Reducing the stock ACL and establishing a commercial trip limit will affect costs associated with fishing operations. Modifying recreational or commercial seasonal closures for greater amberjack will have direct impacts to both recreational anglers and commercial fishermen. Commercial fishermen will incur losses in revenue due to limiting the amount of harvest per trip. However, a commercial trip limit is expected to increase the duration of the fishing season and thus increase revenues when the fishery has previously been closed. A trip limit is also expected to bring a higher market price due to the fact that market demand remains constant while there is less fish harvested per trip. Recreational anglers would incur greater losses in consumer surplus resulting from a seasonal closure when compared to a higher minimum size limit. Circle hooks (which are required through implementation of Amendment 27/14) are comparable in price to J-hooks, but would represent an initial increase in costs for those anglers and commercial fishermen currently not using circle hooks. Similarly, venting tools and dehooking devices would increase angler costs. However, all of these gear requirements represent small increases relative to total trip costs. To the extent that reducing the ACL for greater amberjack, reductions in commercial revenue and recreational consumer surplus would occur.

Criterion 6: Changes in fishing practices and behavior of fishermen

All bycatch minimization measures proposed are expected to change angler behavior and fishing practices. Reductions to the minimum size limit will increase catch rates, reduce bycatch, and affect decisions about where to fish. Increases to the minimum size limit will decrease catch rates and increase the proportion and/or magnitude of bycatch. The technique for setting a circle hook is different than the technique used to set standard J-hooks. Circle hooks will require anglers to steadily and slowly reel in the slack in the line until the hook sets itself, rather than jerking on the line to set the hook. Because circle hooks result in more fish hooked in the jaw, removing hooks and releasing greater amberjack should be easier. Dehooking devices will allow fishermen to remove hooks easier and more quickly from undersized fish and non-targeted

species without having to handle the fish as much. Venting tools will allow anglers to carefully deflate the fish's gas bladder before returning the fish to the water. Seasonal closures and trip limits will alter angler effort, at least initially, and may affect decisions about when and where to fish.

Criterion 7: Changes in research, administration, and enforcement costs and management effectiveness

Proposed bycatch minimization measures are not expected to significantly impact administrative costs. Size limits, bag limits, and closed seasons are currently used to regulate the commercial and recreational fishery. Establishing a commercial trip limit is expected to increase enforcement costs and management effectiveness. All of these bycatch minimization measures will require additional research to determine the magnitude and extent of reductions in bycatch and bycatch mortality.

Criterion 8: Changes in the economic, social, or cultural value of fishing activities and non-consumptive uses of fishery resources

If the minimum size limit in the recreational greater amberjack fishery is increased it is expected to positively impact the stock by fostering a faster recovery rate, but may have negative social implications.

The establishment of a commercial trip limit is expected to result in positive benefits to the commercial fishery. The economic benefits of the commercial trip limit is expected to include an extended fishing season, maintaining higher market prices by not flooding the market with large harvest, and being able to maintain the local market after the traditional tourist season.

Criterion 9: Changes in the distribution of benefits and costs

Bycatch minimization measures that provide an overall net benefit to the stock and increase the rate of recovery will benefit both sectors. Additionally, proposed commercial trip limits would reduce the commercial fishermen ability to harvest larger amounts of greater amberjack per trip. Bycatch minimization measures are intended to provide an overall net benefit to the stock, by reducing mortality associated with bycatch and increasing the rate of stock recovery.

Criterion 10: Social effects

Bycatch is considered wasteful and it reduces overall yield obtained from the fishery. Minimizing bycatch to the extent practicable will increase efficiency, reduce waste, and benefit stock recovery, thereby resulting in net social benefits. In Action 2, of the Recreational Management Measures the proposed increase in recreational size limits from 30 inches to 32, 34, or 36 inches would narrow the difference between the 36 inch commercial size limit. This may be a social benefit as the size limits would be perceived as more fair and equitable to all user groups. However, the Council chooses not to implement any size limit change to the recreational fishery.

CONCLUSIONS

Analysis of the ten bycatch practicability factors indicates there would be positive biological impacts associated with further reducing bycatch and bycatch mortality in the directed greater amberjack fishery. The main benefits of reducing the greater amberjack bycatch, reducing the ACL, and establishing a commercial trip limit are: 1) less waste and 2) increased yield in the directed fishery. Approximately one-sixth of all directed yield is forgone due to recreational and commercial discards. Reducing discards and discard mortality rates would allow greater ACLs to be achieved in the directed fishery. In some cases, however, greater amberjack management measures (e.g., season closures, higher size limits) may need to be imposed to end overfishing but result in small increases in bycatch. When determining reductions associated with various management measures, release mortality was factored into the analysis, in order to adjust the estimated reductions for losses due to dead discards. The increases in discards associated with each of these management measures varies, with the greatest increase in discards associated with changes to the minimum size limit. The benefits of reducing harvest, ending overfishing, and rebuilding the stock is estimated to outweigh the benefits of further reducing discard mortality.

6.0 REGULATORY IMPACT REVIEW

To Be Completed

6.1 Introduction

6.2 Problems and Objectives

6.3 Description of Fishery

6.4 Effects of Management Alternatives

6.5 Public and Private Costs

6.6 Determination of Significant Regulatory Action

7.0 REGULATORY FLEXIBILITY ACT ANALYSIS

To Be Completed

7.1 Introduction

7.2 Statement of Need

7.3 Description of Estimate of the Number of Small Entities

7.4 Description of Project Reporting

7.5 Identification of Relevant Federal Rules

7.6 Significance of Economic Impacts on Small Entities

7.7 Description of Significant Alternatives

8.0 OTHER APPLICABLE LAW

The MSFCMA (16 U.S.C. 1801 et seq.) provides the authority for fishery management in federal waters of the exclusive economic zone. However, fishery management decision-making is also affected by a number of other federal statutes designed to protect the biological and human components of U.S. fisheries, as well as the ecosystems that support those fisheries. Major laws affecting federal fishery management decision-making are summarized below.

Administrative Procedures Act

All federal rulemaking is governed under the provisions of the Administrative Procedure Act (APA) (5 U.S.C. Subchapter II), which establishes a "notice and comment" procedure to enable public participation in the rulemaking process. Under the APA, NMFS is required to publish notification of proposed rules in the Federal Register and to solicit, consider, and respond to public comment on those rules before they are finalized. The APA also establishes a 30-day waiting period from the time a final rule is published until it takes effect.

Coastal Zone Management Act

Section 307(c)(1) of the federal Coastal Zone Management Act of 1972 (CZMA), as amended, requires federal activities that affect any land or water use or natural resource of a state's coastal zone be conducted in a manner consistent, to the maximum extent practicable, with approved state coastal management programs. The requirements for such a consistency determination are set forth in NOAA regulations at 15 C.F.R. part 930, subpart C. According to these regulations and CZMA Section 307(c)(1), when taking an action that affects any land or water use or natural resource of a state's coastal zone, NMFS is required to provide a consistency determination to the relevant state agency at least 90 days before taking final action.

Upon submission to the Secretary, NMFS will determine if this plan amendment is consistent with the Coastal Zone Management programs of the states of Alabama, Florida, Louisiana, Mississippi, and Texas to the maximum extent possible. Their determination will then be submitted to the responsible state agencies under Section 307 of the CZMA administering approved Coastal Zone Management programs for these states.

Data Quality Act

The Data Quality Act (DQA) (Public Law 106-443) effective October 1, 2002, requires the government to set standards for the quality of scientific information and statistics used and disseminated by federal agencies. Information includes any communication or representation of knowledge such as facts or data, in any medium or form, including textual, numerical, cartographic, narrative, or audiovisual forms (includes web dissemination, but not hyperlinks to information that others disseminate; does not include clearly stated opinions).

Specifically, the Act directs the Office of Management and Budget to issue government wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by federal agencies." Such guidelines have been issued, directing all federal agencies to create and disseminate agency-specific standards to: (1) ensure information quality and develop a pre-dissemination review process; (2) establish administrative mechanisms allowing affected persons to seek and obtain correction of information; and (3) report periodically to Office of Management and Budget on the number and nature of complaints received.

Scientific information and data are key components of FMPs and amendments and the use of best available information is the second national standard under the MSFCMA. To be consistent with the Act, FMPs and amendments must be based on the best information available. They should also properly reference all supporting materials and data, and be reviewed by technically competent individuals. With respect to original data generated for FMPs and amendments, it is important to ensure that the data are collected according to documented procedures or in a manner that reflects standard practices accepted by the relevant scientific and technical communities. Data will also undergo quality control prior to being used by the agency and a pre-dissemination review.

Endangered Species Act

The Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. Section 1531 et seq.) requires federal agencies use their authorities to conserve endangered and threatened species. The ESA requires NMFS, when proposing a fishery action that "may affect" critical habitat or endangered or threatened species, to consult with the appropriate administrative agency (itself for most marine species, the U.S. Fish and Wildlife Service for all remaining species) to determine the potential impacts of the proposed action. Consultations are concluded informally when proposed actions may affect but are "not likely to adversely affect" endangered or threatened species or designated critical habitat. Formal consultations, including a biological opinion, are required when proposed actions may affect and are "likely to adversely affect" endangered or threatened species or adversely modify designated critical habitat. If jeopardy or adverse modification is found, the consulting agency is required to suggest reasonable and prudent alternatives. A summary of the most recent biological opinion for the reef fish fishery can be found in Section 3.2. NOAA Fisheries Service, as part of the Secretarial review process, will make a determination regarding the potential impacts of the proposed actions.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas, and on the importing of marine mammals and marine mammal products into the United States. Under the MMPA, the Secretary of Commerce (authority delegated to NMFS) is responsible for the conservation and management of cetaceans and pinnipeds (other than walruses). The Secretary of the Interior is responsible for walruses, sea and marine otters, polar bears, manatees, and dugongs.

Part of the responsibility that NMFS has under the MMPA involves monitoring populations of marine mammals to make sure that they stay at optimum levels. If a population falls below its optimum level, it is designated as "depleted," and a conservation plan is developed to guide research and management actions to restore the population to healthy levels.

In 1994, Congress amended the MMPA, to govern the taking of marine mammals incidental to commercial fishing operations. This amendment required the preparation of stock assessments for all marine mammal stocks in waters under U.S. jurisdiction, development and implementation of take-reduction plans for stocks that may be reduced or are being maintained below their optimum sustainable population levels due to interactions with commercial fisheries, and studies of pinniped-fishery interactions.

Under section 118 of the MMPA, NMFS must publish, at least annually, a List of Fisheries (LOF) that places all U.S. commercial fisheries into one of three categories based on the level of incidental serious injury and mortality of marine mammals that occurs in each fishery. The categorization of a fishery in the LOF determines whether participants in that fishery may be required to comply with certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The conclusions of the most recent List of Fisheries for gear used by the reef fish fishery can be found in Section 3.2.

Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (PRA) (44 U.S.C. 3501 et seq.) regulates the collection of public information by federal agencies to ensure the public is not overburdened with information requests, the federal government's information collection procedures are efficient, and federal agencies adhere to appropriate rules governing the confidentiality of such information. The PRA requires NMFS to obtain approval from the Office of Management and Budget before requesting most types of fishery information from the public. Actions 2 and 3 may have PRA consequences.

Executive Orders

E.O. 12630: Takings

The Executive Order on Government Actions and Interference with Constitutionally Protected Property Rights that became effective March 18, 1988, requires each federal agency prepare a

Takings Implication Assessment for any of its administrative, regulatory, and legislative policies and actions that affect, or may affect, the use of any real or personal property. Clearance of a regulatory action must include a takings statement and, if appropriate, a Takings Implication Assessment. The NOAA Office of General Counsel will determine whether a Taking Implication Assessment is necessary for this amendment.

E.O. 12866: Regulatory Planning and Review

Executive Order 12866: Regulatory Planning and Review, signed in 1993, requires federal agencies to assess the costs and benefits of their proposed regulations, including distributional impacts, and to select alternatives that maximize net benefits to society. To comply with E.O. 12866, NMFS prepares a Regulatory Impact Review (RIR for all fishery regulatory actions that either implement a new fishery management plan or significantly amend an existing plan. RIRs provide a comprehensive analysis of the costs and benefits to society of proposed regulatory actions, the problems and policy objectives prompting the regulatory proposals, and the major alternatives that could be used to solve the problems. The reviews also serve as the basis for the agency's determinations as to whether proposed regulations are a "significant regulatory action" under the criteria provided in E.O. 12866 and whether proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Analysis. A regulation is significant if it a) has an annual effect on the economy of $100 million or more or adversely affects in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments and communities; b) creates a serious inconsistency or otherwise interferes with an action taken or planned by another agency; c) materially alters the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or d) raises novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

E.O. 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations

This Executive Order mandates that each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. The Executive Order is described in more detail relative to fisheries actions in Section 3.4.

E.O. 12962: Recreational Fisheries

This Executive Order requires federal agencies, in cooperation with states and tribes, to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities through a variety of methods including, but not limited to, developing joint partnerships; promoting the restoration of recreational fishing areas that are limited by water quality and habitat degradation; fostering sound aquatic conservation and restoration endeavors; and evaluating the effects of federally-funded, permitted, or

authorized actions on aquatic systems and recreational fisheries, and documenting those effects. Additionally, it establishes a seven-member National Recreational Fisheries Coordination Council responsible for, among other things, ensuring that social and economic values of healthy aquatic systems that support recreational fisheries are considered by federal agencies in the course of their actions, sharing the latest resource information and management technologies, and reducing duplicative and cost-inefficient programs among federal agencies involved in conserving or managing recreational fisheries. The Council also is responsible for developing, in cooperation with federal agencies, States and Tribes, a Recreational Fishery Resource Conservation Plan - to include a five-year agenda. Finally, the Order requires NMFS and the U.S. Fish and Wildlife Service to develop a joint agency policy for administering the ESA.

E.O. 13089: Coral Reef Protection

The Executive Order on Coral Reef Protection requires federal agencies whose actions may affect U.S. coral reef ecosystems to identify those actions, utilize their programs and authorities to protect and enhance the conditions of such ecosystems, and, to the extent permitted by law, ensure actions that they authorize, fund, or carry out do not degrade the condition of that ecosystem. By definition, a U.S. coral reef ecosystem means those species, habitats, and other national resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction or control of the United States (e.g., federal, state, territorial, or commonwealth waters).

Regulations are already in place to limit or reduce habitat impacts within the Flower Garden Banks National Marine Sanctuary. Additionally, NMFS approved and implemented Generic Amendment 3 for EFH, which established additional HAPCs and gear restrictions to protect corals throughout the Gulf. There are no implications to coral reefs by the actions proposed in this amendment. The alternatives in Action 8 (Time and Area Closures) will reduce impacts in the areas of proposed time/area closures, but although those areas contain hard bottom habitat, they are not areas of living coral reefs.

E.O. 13132: Federalism

The Executive Order on Federalism requires agencies in formulating and implementing policies, to be guided by the fundamental Federalism principles. The Order serves to guarantee the division of governmental responsibilities between the national government and the states that was intended by the framers of the Constitution. Federalism is rooted in the belief that issues not national in scope or significance are most appropriately addressed by the level of government closest to the people. This Order is relevant to FMPs and amendments given the overlapping authorities of NMFS, the states, and local authorities in managing coastal resources, including fisheries, and the need for a clear definition of responsibilities. It is important to recognize those components of the ecosystem over which fishery managers have no direct control and to develop strategies to address them in conjunction with appropriate state, tribes and local entities (international too).

No Federalism issues have been identified relative to the action proposed in this amendment. Therefore, consultation with state officials under Executive Order 12612 is not necessary.

E.O. 13158: Marine Protected Areas

This Executive Order requires federal agencies to consider whether their proposed action(s) will affect any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural or cultural resource within the protected area. There are several MPAs, HAPCs, and gear-restricted areas in the eastern and northwestern Gulf.

Essential Fish Habitat

The amended MSFCMA included a new habitat conservation provision known as EFH that requires each existing and any new FMPs to describe and identify EFH for each federally managed species, minimize to the extent practicable impacts from fishing activities on EFH that are more than minimal and not temporary in nature, and identify other actions to encourage the conservation and enhancement of that EFH. To address these requirements the Council has, under separate action, approved an EIS (GMFMC 2004b) to address the new EFH requirements contained within the MSFCMA. Section 305(b)(2) requires federal agencies to obtain a consultation for any action that may adversely affect EFH. An EFH consultation will be conducted for this action.

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NMFS = National Marine Fisheries Service, SF = Sustainable Fisheries Division

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GC = General Counsel, SERO=Southeast Regional Office, NEPA=National Environmental Policy Act, HC = Habitat Conservation, SEFSC=Southeast Fisheries Science Center Commission and PR = Protected Resources Division.

10.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSON TO WHOM COPIES OF THE STATEMENT ARE SENT

Federal Agencies

Gulf of Mexico Fishery Management Council's
- Scientific and Statistical Committee
- Socioeconomic Assessment Panel
- Reef Fish Advisory Panel

National Marine Fisheries Service
- Southeast Fisheries Science Center
- Southeast Regional Office

U.S. Coast Guard
Environmental Protection Agency

State Agencies

- Texas Department of Wildlife and Fisheries
- Louisiana Department of Wildlife and Fisheries
- Mississippi Department of Marine Resources
- Alabama Department of Conservation and Natural Resources
- Florida Fish and Wildlife Conservation Commission

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12.0 APPENDICES

12.1 Alternatives Considered but Rejected

At the August 2011 Council meeting

Action 1: Modifications to the Greater Amberjack Rebuilding Plan

Alternative 4: Modify the rebuilding plan for greater amberjack based on information in the 2011 Update Assessment. In 2009 the fishing mortality rate was estimated at 0.609 and needs to be reduced to 0.333 (approximately 55%). Using these methods:

Option a: would set the stock ACL = 1,220,000 pounds ww as reduced from ABC for a period of three years beginning in 2012.

Option b: would set the ACL = ABC= 1,780,000 pounds ww and ACT = 1,200,000 pounds ww as reduced from ACL for a period of three years beginning in 2012. Based on the 27% commercial and 73% recreational allocation of greater amberjack the sector quotas are as follows:

Option a. Stock ACL	
Sector	Stock ACL
Commercial	329,000
Recreational	891,000
Total	1,220,000

Option b. ACL = ABC and set an ACT		
Sector	ACL=ABC	ACT
Commercial	481,000	329,000
Recreational	1,299,000	891,000
Total	1,780,000	1,220,000

The Council moved Alternative 4 Option a and Option b to the considered, but rejected section at their August 2011 Council meeting. This alternative was moved during the earlier stages of developing the document. Some Council members felt this alternative was too conservative and did not need any additional analysis. Other members may have felt the methods used to develop this alternative were not approved by the Scientific and Statistical Committee who made a motion to the effect that the assessment was useful for determining the current status of the stock, but not for projecting what future catch levels would be needed to end overfishing and rebuild. Based on the information the Council moved this alternative to considered, but rejected.

Action 3: Commercial Management Measures

Alternative 2: Establish commercial greater amberjack trip limit and maintain March 1-May 31 closed season.

Option d: Establish a 1,500 pound whole weight trip limit to August 31, and 1,000 pound trip limit from September 1-December 31.

Option e: Establish a 1,500 pound whole weight trip limit to September 31, and 1,000 pound trip limit from October 1- December 31.

The Council moved these alternatives to considered but rejected because some members felt the step down commercial trip limits would place an additional burden on the administrative environments. Whereas, other felt these could be confusing when tracking landings and management changes for the stock assessment processes. There was little to no public testimony in favor of this step down trip limit alternatives.

At the October 2011 meeting

Action 2.1 Establish a Proportional Bag Limit or Vessel Limit for Greater Amberjack

Alternative 1: No Action – do not modify the current one fish per angler bag limit (excluding captain and crew), status quo or establish any type of vessel limit.

Alternative 2: Establish a proportional bag limit (number of fish per anglers on the vessel)
Option a: 1 fish per 2 anglers
Option b: 1 fish per 3 anglers

Alternative 3: Establish a recreation vessel limit for greater amberjack
Option a: Set a 4 fish per vessel limit.
Option b: Set a 3 fish per vessel limit.
Option c: Set a 2 fish per vessel limit.
Option d: Set a 1 fish per vessel limit.

At the October 2011 Council meeting they moved the proportional bag limit and vessel limit alternatives to considered, but rejected. During development of these alternatives many Council members reiterated that there was little public interest in establishing proportional bag limit also known as fractional bag limits. In fact, some members of the public had voiced strong disinterest in the development of fractional bag limits. Vessel limits were more welcomed by the public; however, based on the reduction in Stock ACL necessary some Council members felt this alternative was not necessary to meet the management goals and other management measures that have better public support would suffice.

Action 2.1 would establish a proportional bag limit or vessel limit for greater amberjack. The current bag limit for the recreational sector is one greater amberjack per angler excluding captain and crew. A suggestion during public testimony for other species that are overfished (e.g., gag) was to establish a one fish per vessel limit or some type of proportional recreational bag limit based on a number of fish per number of anglers on the vessel. The decision tool has options up to 1 fish per 3 anglers on the vessel.

Alternative 1 is status quo and would not modify the current bag limit from 1 fish per angler or establish any type of vessel limit. Alternative 2 Option a would modify the proportional bag limit to 1 fish per 2 anglers and Alternative 2 Option b would modify the proportional bag limit to 1 fish per 3 anglers. If a 1 fish per 2 anglers bag limit (Alternative 2 Option a) was selected as preferred, by mode a 45% reduction in landings would be estimated for both the charter and private recreational landings; whereas, a 39% reduction in headboat landings would be expected

(Table 2.1.1). However, of the total recreational landings of greater amberjack headboat landings tend to be the lowest compared to other modes. In 2009, headboat represented 7% of the recreational landings whereas, the charter industry landed 43% and the private recreational anglers landed 50%. Alternative 2 Option b would establish a 1 fish per 3 anglers bag limit for greater amberjack and is estimated to reduce recreational landings by 72% for private, 64% for charter, and 51% for headboat (Table 2.1.1).

Table 2.1.1. Estimated average annual bag limit percent reductions by mode and projected landings based on 2009 data.

Bag Limit	Charter	Private	Headboat	Charter	Private	Headboat
1 Fish/1 Angler	0%	0%	0%	728,602	843,367	107,602
1 Fish/2 Anglers	45%	45%	39%	400,731	463,852	65,637
1 Fish/3 Anglers	64%	72%	51%	255,011	236,143	52,725

Source: SERO-LAPP Gulf Amend 35 2011, Recreational (a).

Alternative 3 would establish a recreational vessel limit for greater amberjack. The recreational decision tool also allows the Council to explore the potential of establishing a recreational vessel limit up to 50 fish per vessel (SERO-LAPP Gulf Amend 35 2011 (a)). However, reductions in landings are not expected until the vessel limit is reduced to 35 fish per vessel and only for the headboat mode (Table 2.1.2). Further, 30-35 fish per vessel limit is only expected to achieve a 1% reduction in estimated landings of greater amberjack, due to the number of passengers carried on headboats (20-50). A reduction in estimated landings for the charter mode doesn't occur until limits are more restrictive than 10 fish per vessel, due to the number of passengers carried on charter trips (Table 2.1.2). Whereas, a reduction in landings for the private recreational mode does not occur until the vessel limit is reduced to 4 fish per vessel or less. Alternative 3 Option a would set a 4 fish per vessel limit and reductions in recreational landings from the private mode are estimated to be 2%, 26% in the charter, and 54% in the headboat. However, landings in the recreational sector tend to be the lowest by the headboat mode estimated at 7% in 2009 versus 43% by charter, and 50% by private mode. In order of least to greatest estimated reductions in landings Option b would establish a 3 fish per vessel limit, Option c would establish a 2 fish per vessel limit, and Option d would establish a 1 fish per vessel limit.

Table 2.1.2. Estimated vessel limit percent reductions and projected landings in pounds based on 2009 data.

Fish per vessel	Charter	Private	Headboat	Charter	Private	Headboat
50	0%	0%	0%	728,602	843,367	107,602
45	0%	0%	0%	728,602	843,367	107,602
40	0%	0%	0%	728,602	843,367	107,602
35	0%	0%	1%	728,602	843,367	107,602
30	0%	0%	1%	728,602	843,367	106,526
25	0%	0%	3%	728,602	843,367	106,526
20	0%	0%	6%	728,602	843,367	101,146
15	0%	0%	11%	728,602	843,367	95,766
10	1%	0%	26%	721,316	843,367	79,625
9	3%	0%	30%	706,744	843,367	75,321
8	5%	0%	34%	692,172	843,367	71,017
7	7%	0%	38%	677,600	843,367	66,713
6	11%	0%	42%	648,456	843,367	62,409
5	18%	0%	47%	597,454	843,367	57,029
4	26%	2%	54%	539,165	826,500	49,497
3	38%	10%	61%	451,733	759,030	41,965
2	53%	24%	70%	342,433	640,959	32,281
1	71%	46%	82%	211,295	455,418	19,368

Source: SERO-LAPP Gulf Amend 35 2011, Recreational (a).

Action 2.2 Modify the Recreational Closed Seasons for Greater Amberjack

Alternative 5: Modify the recreational season to close June 1 and re-open the day after red snapper season closes.

The Council moved this alternative to considered, but rejected at their October meeting. Some Council members felt this alternative would not provide enough notice for fishers and individuals involved in the for-hire industry selling trips. Many for-hire operators base their trips on the opening and closing of highly targeted and prized species such as greater amberjack or red snapper and this alternative would place undue stress and inconvenience on those stakeholders.

Alternative 5 would modify the recreational season for greater amberjack to close June 1 when the recreational red snapper season opens and open the day after red snapper season closes. Due to this alternative being tied to the recreational red snapper season this alternative adds an additional level of uncertainty. Two targeted species seasons (i.e., red snapper and greater amberjack) would essentially be unknown when one would open and the other would be closed for the next three years (2013-2015). The for-hire sector may lose customers because it would be challenging to forewarn them when and if either one targeted species or the other could be retained. Further, the length of the recreational red snapper season is projected to be is typically released to the public in April before the June 1 start of the recreational red snapper season. The

following analysis represents a range of scenarios based on the rebuilding red snapper stock and previous recreational red snapper seasons (35-65 days). Although the red snapper stock is rebuilding, anticipated increases in total allowable catch may be partially offset by increasing participation in the fishery, increasing catch-per-unit effort (CPUE; 2009 SEDAR Update Assessment p.141), and increasing average weights of individual fish. Increasing participation, CPUE, and average weight would all result in the quota being caught more quickly (SERO-LAPP-2011-03). Therefore, a range of closed fishing days for greater amberjack are presented in Table 2.3.1.

Table 2.3.1. Range of scenarios for discussion of Alternative 5: Modify the recreational season to close June 1 and re-open the day after red snapper season closes based on the current Preferred Alternative 3 Recreational quota = 1,130,000 ww.

Potential Red Snapper Seasons	Open Season	Days Closed	Minimum Size Limit	Proportional bag limit	Estimated Landings	Projected Closures
Jun 1-Jul 5	Jan-May, Jul 6- Oct 5	35	30”	1fish/ 1angler	1,126,000	Oct 6-Dec 31
Jun 1-Jul 15	Jan-May, Jul 16-Nov 15	45	30”	1fish/ 1angler	1,115,000	Nov 16-Dec 31
Jun 1-Jul 25	Jan-May, Jul 26-Dec 31	55	30”	1fish/ 1angler	1,120,000	None
Jun 1-Aug 4	Jan-May, Aug 5-Dec 31	65	30”	1fish/ 1angler	1,039,000	None

If the recreational red snapper season was 35 days and the recreational quota was 1,130,000 ww (Preferred Alternative 3 Option b) and the greater amberjack recreational management measures were maintained at status quo not only would the recreational greater amberjack closed season be Jun 1-Jul 5 but would also be projected to close in the fall around October 6th (Table 2.3.1). Similarly if the red snapper season was 45 days with status quo management measures for greater amberjack the closed season would be Jun 1-Jul 15 but would also be projected to close in the fall around November 16th (Table 2.3.1). If the red snapper season was 55 days or greater June 1-July 25th the greater amberjack recreational season is not expected to close in the fall under the current preferred Stock ACL selected in Action 1 so no additional scenarios were provided after a 65 day recreational red snapper season.

12.2 Methods for Decision Tools

12.2.1 Modeling the Combined Effects of Gulf Reef Fish Amendment 35 Proposed Management Measures for Greater Amberjack

LAPP/DM Branch
NOAA Fisheries Service
Southeast Regional Office

Introduction

The first formal assessment of greater amberjack (*Seriola dumerili*) stocks in the Gulf of Mexico indicated that the stock was overfished and undergoing overfishing as of 1998 (Turner et al. 2000). Management measures to reduce the recreational bag limit from three to one fish were implemented in January 1997 and a commercial seasonal closure from March through May was implemented in January 1998; however, these closures were not incorporated into the Turner et al. (2000) assessment. The projected effects of these management measures were expected to eliminate overfishing; therefore, no new management measures were implemented under the rebuilding plan approved by Secretarial Amendment 2 in 2003 (NMFS 2003).

In 2006, a new stock assessment was completed and determined the greater amberjack stock was overfished, undergoing overfishing, and not recovering at the rate previously projected (SEDAR 9 2006). In response to these assessment results, the Gulf of Mexico Fishery Management Council (Gulf Council) and the National Marine Fisheries Service (NMFS) developed Amendment 30A to the Reef Fish FMP to end overfishing and rebuild the stock (GMFMC 2008). Upon implementation in August 2008, Amendment 30A required a reduction of fishing mortality and implemented a total allowable catch of 1.871 million pounds whole weight (mp ww) (GMFMC 2008). Amendment 30A also established annual catch limits (ACLs) for the recreational and commercial sectors at 1.368 mp and 0.503 mp ww, respectively. In addition to establishing quotas, Amendment 30A also increased the recreational size limit to 30-inches FL, eliminated the bag limit for captain and crew of for-hire vessels, and implemented sector accountability measures (AMs). Under the AMs, if a sector's ACL is met or projected to be met during the fishing year, harvest and retention of greater amberjack by that sector is prohibited for the remainder of the year. Additionally, if a sector exceeds its ACL, the overage is deducted from the sector's ACL for the subsequent fishing year.

In 2009, the recreational fishing season for Gulf of Mexico greater amberjack was closed on October 24, 2009, because the recreational ACL was projected to be exceeded in-season. The total 2009 recreational landings exceeded the ACL by 0.125 mp despite the in-season closure. The AMs required the length of the recreational fishing season in 2010 to be reduced by the amount necessary to recover the overage that occurred during the 2009 fishing year. The 2010 recreational ACL was set at 1.243 mp. Recreational harvest in 2010 was slowed by fishery closures associated with the Deepwater Horizon oil spill, and the 2010 recreational fishing season remained open through the end of the fishing year. The 2010 recreational ACL was

exceeded by 0.053 mp. The 2011 recreational ACL was set at 1.315 mp to adjust for the 2010 overage. The Gulf Council also approved a regulatory amendment that prohibits recreational greater amberjack harvest and retention from June 1-July 31. This closure is intended to slow the rate of harvest and reduce the likelihood of an early end of year closure, and it was first implemented during the 2011 fishing year.

In 2009, the commercial greater amberjack sector was closed on November 7, 2009 because the commercial ACL was projected to be exceeded in-season. The total 2009 commercial landings exceeded the ACL by 0.130 mp despite this in-season closure. The 2010 commercial ACL was subsequently reduced to 0.373 mp. This ACL was exceeded by 0.189 mp despite an in-season closure on October 28, 2010. The 2011 commercial ACL was set at 0.3139 mp and was projected to be met on June 17, 2011. The season was closed for the remainder of the year and will reopen on January 1, 2012.

In March 2011, the Gulf Council's Scientific and Statistical Committee (SSC) reviewed the 2011 greater amberjack update assessment and recommended an acceptable biological catch (ABC) of 1.78 mp ww; a 4.8% reduction from the ABC established by Amendment 30A. In response to the SSC's recommendation, the Gulf Council began drafting Amendment 35. Amendment 35 will adjust the greater amberjack rebuilding plan and implement management measures to constrain recreational and commercial harvest to the reduced ACL levels. This amendment considers recreational ACLs ranging from 1.368 mp to 0 lb, and commercial ACLs ranging from 0.503 mp to 0 lb. In August 2011, the Gulf Council selected a preferred recreational ACL alternative of 1.13 mp and a preferred commercial ACL alternative of 0.409 mp. This report presents the development of a recreational decision tool (RDT) and a commercial decision tool (CDT) to simulate the impacts of various combinations of proposed management measures to support Amendment 35.

Current Management Regulations

The following regulations currently apply to the Gulf of Mexico greater amberjack fishery:

1) One greater amberjack recreational bag limit (implemented January 1997).
2) 30-inch FL recreational minimum size limit (implemented August 2008).
3) 36-inch FL commercial minimum size limit (implemented February 1990).
4) June 1 through July 31 recreational closed season (implemented June 2011).
5) March 1 through May 31 commercial closed season (implemented January 1998).

Methods

The RDT and CDT were implemented in Microsoft Excel using drop-down menus to obtain user inputs regarding desired management measures (Figure 1). Excel was chosen because it is widely available for constituent use. Impacts of management measures were simulated using programs written in SAS (SAS Institute, Cary, NC). The following management options were evaluated in this report:

Recreational Sector

1) Seasonal closures
2) Size limits
3) Vessel limits
4) Fractional bag limits

Commercial Sector

1) Seasonal closures
2) Trip limits

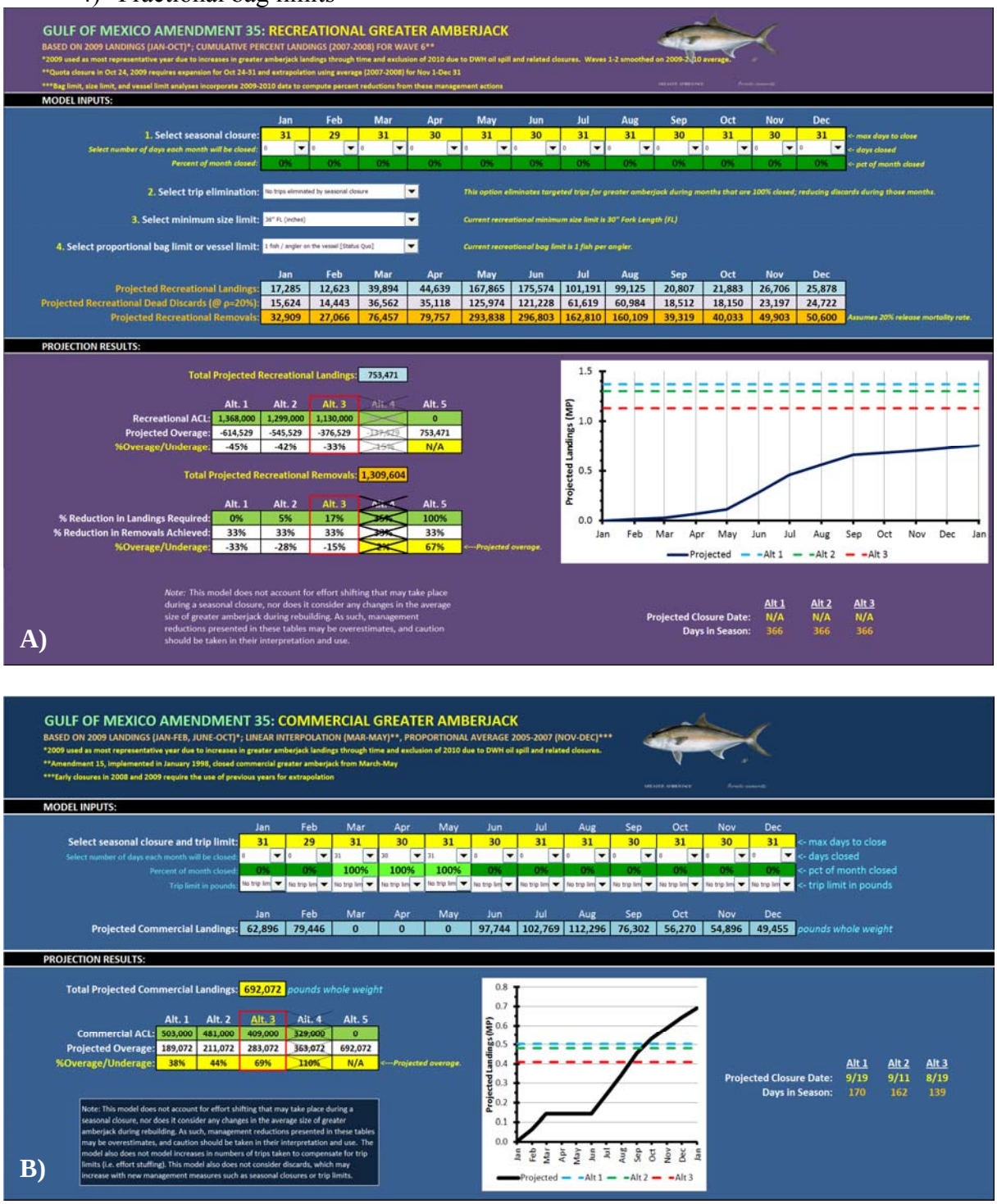

Figure 1. Screenshots for A) recreational and B) commercial decision tools, showing dropdown menus for user-specified management measures.

Data Sources

Recreational landings data for Gulf of Mexico greater amberjack were obtained from the Southeast Fisheries Science Center's (SEFSC) ACL Dataset (accessed September 2011), which provided aggregated landings data from the Marine Recreational Fisheries Statistics Survey (MRFSS), the SEFSC's Headboat Survey (HBS), and the Texas Parks and Wildlife Department (TPWD) Creel Survey. The ACL dataset provides improved quality assurance and quality control (QA/QC) on the raw data generated by the MRFSS and SEFSC headboat survey. The ACL dataset uses MRFSS weight estimates when available. In some cases, MRFSS provides an estimate of numbers landed but no weight estimate, due to missing weights in the intercept data. In these cases, the SEFSC uses weight substitutions to provide a weight estimate in the ACL data. MRFSS intercepts collect data on port agent observed landings ('A' catch) and angler reported landings ('B1' catch) and discards ('B2' catch) in numbers by species, two-month 'wave' (e.g., Wave 1 = Jan/Feb, …, Wave 6 = Nov/Dec), area fished (inland, state, and federal waters), mode of fishing (charter, private/rental, shore), and state (west Florida, Alabama, Mississippi, and Louisiana). HBS landings are generated after the end of each calendar year, at which time they are included in the ACL dataset. HBS landings in weight are calculated using a combination of logbook reports and dockside sampling, and adjustments to landings are made based on underreporting and misreporting determined through dockside validation by port agents. HBS records contain trip-level information on number of anglers, trip duration, date, area fished, landings (number of fish) and releases (number fish) by species. TPWD generates estimates of landings for private/rental boats and charter vessels fishing off Texas. TPWD landings are reported in numbers by 'high-use' (May 15-November 20) and 'low-use' time periods (November 21-May 14), area fished (state and federal waters), and mode (charter, private/rental). TPWD high and low use landings estimates can be re-estimated to correspond to MRFSS two-month waves. Landings, biological data (size of catch), and catch-effort information from each of these surveys were used to evaluate reductions in landings and discards (when available) associated with various greater amberjack closed seasons, vessel limits, fractional bag limits, and size limits. Following approaches used in the most recent stock assessment, MRFSS data from Monroe County were post-stratified and removed west Florida landing and discard estimates.

Typically, projected impacts of management measures are modeled as compared to a two- or three-year baseline; however, as evidenced by quota closures and overages in 2009 and 2010, fishing pressure on the greater amberjack stock in the Gulf appears to be increasing within both the recreational and commercial sectors. Thus, for projection purposes, 2009 was selected as the year most closely approximating future harvest patterns. Harvest data for 2010 was mostly excluded from this baseline because landings after April 2010 were deemed inappropriate for projections due to the confounding effects of fishery closures associated with the Deepwater Horizon oil spill.

To establish a recreational landings baseline, the three recreational datasets (i.e. MRFSS, HBS, and TPWD) were broken into monthly landings assuming a uniform distribution of landings within waves. The baseline was formed primarily from 2009 landings but gap filling was done in some months to smooth irregularities and backfill for quota closures. Landings from January to April came directly from the Headboat and TPWD 2009 datasets. MRFSS landings of greater

amberjack typically follow a dome-shaped seasonal pattern, but showed an uncharacteristic pattern in 2009, with landings higher in January and February (~11% of annual projected) than in March and April (~4% of annual projected). Wave 1 landings historically (2000-2008) have accounted for 8 ± 1% (mean ± SE) of annual landings, as compared to 16 ± 2% % from Wave 2. To avoid overestimating reductions in future harvest in January or February, this 2009 irregularity was smoothed by redistributing MRFSS 2009 Wave 1-2 landings using the average percent landings within Waves 1-2 from MRFSS 2009-2010 data. This redistribution placed 9% of the 2009 MRFSS annual landings into Wave 1 and 13% into Wave 2.

Recreational baseline data from all three datasets for May to September were derived directly from 2009 landings without modification. October 2009 landings following the October 24 quota closure were extrapolated by expanding the reported October landings by 29.2% to account for the percentage of closed days. As November and December were closed in 2009 and 2010, baseline landings for these months were derived by expanding 2009 landings by average percent cumulative landings for November and December 2007-2008 (+7% MRFSS-Charter, +8% MRFSS-Private, +3% HBS). No greater amberjack landings were reported by TPWD for Wave 6 2007-2009. Baseline recreational landings by month and mode are presented in Table 1A. Because the baseline predicts landings during periods in 2009 that were closed to prevent quota overages (i.e. Oct 24-Dec 31), the projected baseline of 1.68 mp in the absence of any closures is higher than the 1.493 mp ww landed in 2009. Baseline discards (in numbers) by month and mode were also developed in similar fashion, and converted to weights using 2009 discard average weight data from the update assessment (SEDAR-9 Update 2011).

Commercial landings data for Gulf of Mexico greater amberjack were obtained from the SEFSC's commercial ACL dataset (accessed June 2011), and the SEFSC's commercial logbook program (accessed May 2011). The SEFSC commercial ACL dataset provides additional QA/QC for data collected by the SEFSC via the Accumulated Landings System and state trip ticket programs. Landings data are provided in pounds ww, and logbook records summarize landings on a trip level, with information for each species encountered including landings (in lbs), primary gear used, and primary area and depth of capture. Monthly commercial logbook landings for open months in 2009 were converted to a percentage of the total annual landings. Commercial harvest of greater amberjack has been prohibited in March, April, and May since January 1998. To predict what landings trends might be if these months were re-opened, linear interpolation was used to estimate percent annual landings between February and June. Re-opening March-May is projected to increase annual landings by 44%, assuming no quota closure. Quota closures for commercial greater amberjack were implemented in November-December of 2009 and 2010; these months were back-filled using average percent of annual landings (2006-2008) for November (9%) and December (8%). The commercial logbook provides incomplete landings information due to noncompliance and failure to include state-licensed commercial fishermen. Monthly percentages of annual landings derived from logbook records were scaled to the 601,446 lb annual total (Source: SEFSC ACL Dataset 2011). The baseline commercial landings by month are presented in Table 1B. Because the baseline predicts landings during months in 2009 that were closed (i.e. Mar-May; Nov-Dec), the projected baseline of 0.958 mp landed in the absence of any closures is substantially higher than the 0.601 mp landed in 2009.

Table 1. Projected baseline 2012 monthly A) recreational landings, B) recreational discards, and C) commercial landings in pounds whole weight (lb ww) of Gulf greater amberjack under status quo management measures with no seasonal or quota closures.

A: REC. LANDINGS	Jan*	Feb*	Mar*	Apr*	May	Jun	Jul	Aug	Sep	Oct**	Nov***	Dec***
HBS	4,180	2,438	3,240	7,843	10,158	19,545	21,722	16,208	11,602	7,474	1,498	1,692
TPWD CHARTER	0	0	0	0	0	0	497	497	0	0	0	0
TPWD PRIVATE	305	275	0	0	63	61	456	456	23	24	0	0
MRFSS CHARTER	11,796	10,654	29,259	28,316	128,320	124,181	146,486	146,486	26,659	27,548	23,559	24,344
MRFSS PRIVATE	22,697	20,500	56,300	54,484	220,380	213,271	82,406	82,406	12,154	12,560	31,745	32,803
	38,977	**33,868**	**88,799**	**90,642**	**358,921**	**357,058**	**251,567**	**246,053**	**50,439**	**47,606**	**56,801**	**58,839**

B: REC DISCARDS	Jan*	Feb*	Mar*	Apr*	May	Jun	Jul	Aug	Sep	Oct**	Nov***	Dec***
HBS	4,784	4,321	5,804	5,616	16,723	16,183	16,551	16,822	14,824	15,319	1,899	3,862
TPWD CHARTER	0	0	0	0	0	0	0	0	0	0	0	0
TPWD PRIVATE	0	0	0	0	0	0	0	0	0	0	0	0
MRFSS CHARTER	31,209	28,188	77,413	74,916	152,932	147,999	26,272	26,272	26,499	27,383	29,683	30,672
MRFSS PRIVATE	20,436	18,458	50,691	49,056	269,158	260,475	114,896	114,896	21,606	22,326	54,307	56,117
	56,428	**50,967**	**133,908**	**129,588**	**438,812**	**424,657**	**157,719**	**157,990**	**62,929**	**65,027**	**85,889**	**90,651**

Source: 2009 ACL Data (accessed 9/2011) uniformly distributed within waves. Monroe County MRFSS landings removed.
**MRFSS Waves 1-2 smoothed from 2009-2010 average percent landings by wave.*
***Oct 24-31 extrapolated by expanding Oct landings by 23%.*
****Nov-Dec landings expanded from average (2007-2008) percentage of annual cumulative landings accounted for in Wave 6.*

C: COMM LANDINGS	Jan	Feb	Mar†	Apr†	May†	Jun	Jul	Aug	Sep	Oct	Nov††	Dec††
COMMERCIAL	62,896	79,446	84,020	88,595	93,169	97,744	102,769	112,296	76,302	56,270	54,896	49,455

Source: 2009 commercial logbook data (accessed 9/2011) scaled to 2009 ACL data (accessed 9/2011).
†*Based upon linear interpolation between February and June landings.*
††*Expanded using average (2006-2008) monthly percent annual landings.*

Seasonal Closure Analyses

Landings of greater amberjack are highly seasonal in the Gulf of Mexico; thus, reductions associated with seasonal closures differ greatly depending upon the time period selected for closure (Figure 2). To model the effects of a seasonal closure, users of the RDT and CDT models can specify the number of days closed for each month. These choices were converted to a percentage of days closed for a given month. The projected landings during that month under the other user-specified management measures were then reduced by the percentage of the month that was closed. Landings were assumed uniformly distributed within months; no effort shifting or effort compression was modeled. In the RDT, landings that were eliminated by a seasonal closure were converted to dead discards at a release mortality rate of 20%.

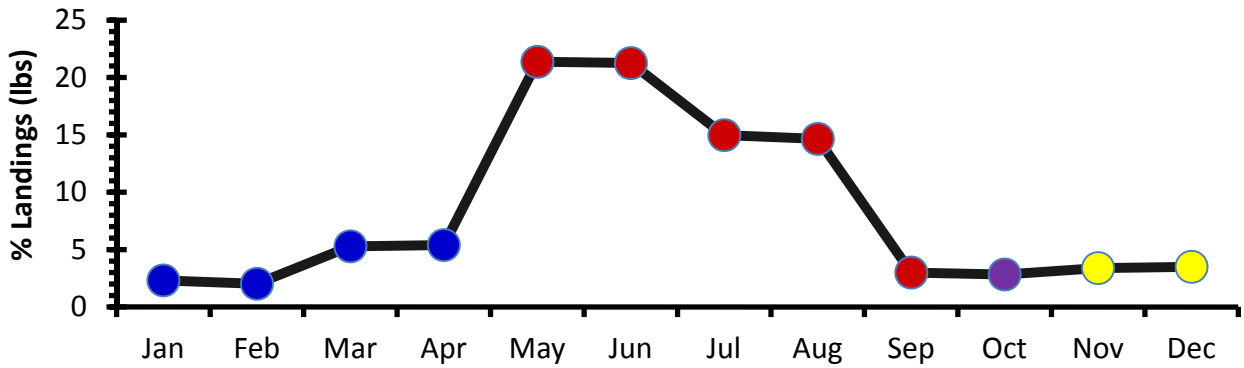

Figure 2A. Distribution by month of simulated 'baseline' Gulf recreational greater amberjack landings from MRFSS, Headboat observer, and Texas Parks and Wildlife datasets. Landings assumed uniformly distributed within waves. MRSS landings from Monroe County were removed following SEDAR-9 (2011). MRFSS landings from Jan-Apr 2009 (blue) were redistributed using 2009-2010 proportional averages by wave. Landings from May-Sept (red) came from 2009 ACL dataset (accessed 9/2011). Landings from Oct (purple) was proportionally expanded to account for quota closure in the last week of the month. Baseline landings for Nov-Dec were derived from average percent cumulative landings for Nov-Dec 2007-2008.

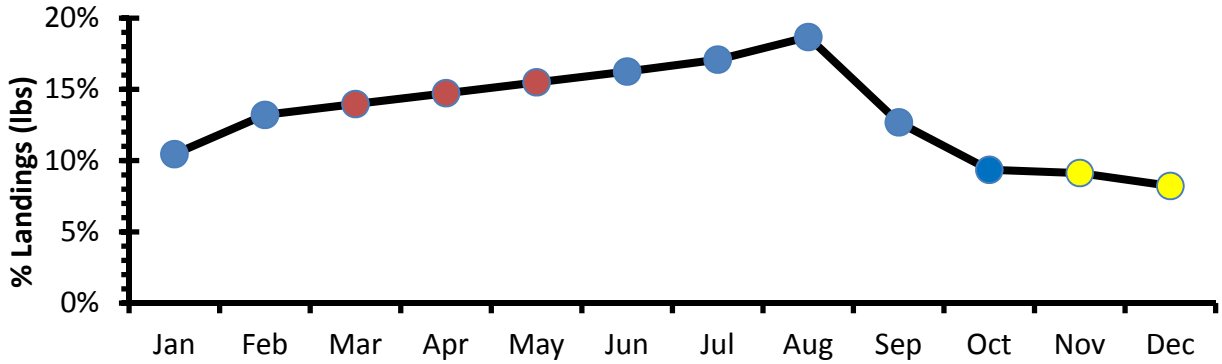

Figure 2B. Distribution by month of simulated 'baseline' Gulf commercial greater amberjack landings from logbook data (accessed 9/2011). Landings from Mar-May (red) predicted via linear extrapolation between February-June. Landings from Nov-Dec (yellow) predicted from the average percent of annual landings (2006-2008) during most recent years without quota closure.

Recreational Target Trip Elimination

A total greater amberjack harvest prohibition during a given month may reduce angler incentive to deliberately target greater amberjack, which may, in turn, reduce encounter rates with the stock during that month. MRFSS intercept records where anglers reported targeting greater amberjack were identified as 'target' trips. In the event of a 100% closure, target trips were assumed to no longer occur. Landings and discards were then re estimated using a catch estimate program, developed by NMFS Office of Science and Technology, applied to modified intercept records with target trips removed. Reductions predicted for Waves 1 and 2 were pooled because the program predicted an elimination of all greater amberjack encounters during Wave 2, which was deemed unrealistic. Due to the quota closure in Wave 6, Wave 5 reductions were used as a proxy for Wave 6. Percent reductions in landings and discards were then computed relative to the baseline (Table 2). MRFSS Private mode reductions were used as a proxy for encounters that would be eliminated for TPWD Private mode. MRFSS Charter mode reductions were used as a proxy for encounters that would be eliminated for HBS and TPWD Charter. This simulation had no impact upon the predicted landed catch, as it required a 100% closure during a given month (i.e. landed catch = 0 with or without trip elimination). It did have an impact upon total removals, by reducing the formerly landed catch that was converted to dead discards at a release mortality rate of 20% and also by reducing the discarded catch relative to baseline levels. Trip elimination is predicted to have the most substantial impacts during the first four months of the year, and the impacts are more pronounced for the private mode.

Table 2A. Projected reductions in monthly recreational landings of greater amberjack under 'trip elimination' relative to simulation baseline for for-hire (charter, headboat) and private modes.

LANDINGS	Jan *	Feb *	Mar *	Apr *	May	Jun	Jul	Aug	Sep	Oct	Nov**	Dec**
FOR-HIRE	39%	39%	39%	39%	18%	18%	6%	6%	*0%*	*0%*	*0%*	*0%*
PRIVATE	79%	79%	79%	79%	28%	28%	15%	15%	22%	22%	22%	22%

*Reductions predicted for Waves 1 and 2 were pooled.
**Due to the quota closure in Wave 6, Wave 5 reductions were used as a proxy for Wave 6.

Table 2B. Projected reductions in monthly recreational discards of greater amberjack under 'trip elimination' relative to simulation baseline for for-hire (charter, headboat) and private modes.

DISCARDS	Jan *	Feb *	Mar *	Apr *	May	Jun	Jul	Aug	Sep	Oct	Nov**	Dec**
FOR-HIRE	61%	61%	61%	61%	3%	3%	0%	0%	0%	0%	0%	0%
PRIVATE	76%	76%	76%	76%	24%	24%	3%	3%	*0%*	*0%*	0%	0%

Recreational Vessel Limits

The MRFSS system classifies recreational catch into three categories:

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

Type A and B1 catches were used for vessel limit analyses. Type A catch represents the total catch of all anglers on a fishing trip. However, some or all of the anglers contributing to the A catch are also interviewed to report type B1 catch, and those may be recorded on an individual basis. If the number of people contributing to the A catch was greater than the number of people interviewed to report B1 catch, the following formula was used to account for possible under reporting of the B1 catch:

$$B1 = B1_{interviewed} \times (\#\ people\ in\ fishing\ party / \#\ people\ interviewed\ to\ report\ B1\ catch).$$

The total catch per vessel was then determined by summing the total Type A and Type B1 catches (AB1) for each trip. Percent reductions in harvest were estimated for vessel limits ranging from 1 through 10, 15, 20, 25, 30, 40, 45, and 50 fish per vessel. If AB1 catch per vessel was greater than the vessel limit being analyzed, the value was re-set to the new vessel limit ($AB1_{vessel\ limit}$), otherwise no changes to the vessel's catch were made. Discard mortality was not incorporated into the analysis.

The following formulas were used to estimate reductions in harvest resulting from vessel limits:

$$If\ AB1\ catch <= vessel\ limit,\ then\ harvest = A + B1$$

$$If\ AB1\ catch > vessel\ limit,\ then\ harvest = AB1_{vessel\ limit}$$

Reductions for headboat and TPWD vessel limits were calculated in a similar manner as described above, except no B1 catch data were available. If the catch per vessel trip was greater than the vessel limit being analyzed ($A_{vessel\ limit}$), the value was re-set to the vessel limit, as described above. If the catch per vessel was less than the vessel limit being analyzed, then no change to the catch was made. Percent reductions associated with vessel limits were estimated relative to the status quo of no vessel limit, by mode of fishing (Table 3). Due to concerns about low sample sizes, output was pooled for 2009-2010 data. MRFSS and TPWD output were pooled by mode and outputs for all sources were pooled across nearest months until a sample size of 50 for status quo was achieved. For example, if only 40 greater amberjack were intercepted in January, January samples would be pooled with December and February samples; if this failed to attain the 50 sample target, November and March samples would be included, and so on. The same pattern used to achieve the target sample size in numbers was then applied to

compute reductions in pounds. Vessel limits vary in their impact by mode; headboat is most heavily impacted, followed by charter, with private only impacted by low (<3 fish/vessel) vessel limits.

Table 3A. Projected reduction of headboat greater amberjack landings by month for various vessel limits. Warmer colors denote higher reductions.

Bag Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
45	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
40	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
35	0%	1%	0%	2%	0%	0%	0%	0%	0%	3%	0%	0%
30	2%	2%	0%	3%	0%	0%	0%	3%	0%	3%	6%	0%
25	3%	8%	0%	5%	0%	0%	1%	6%	2%	5%	12%	0%
20	9%	24%	2%	8%	3%	2%	1%	9%	3%	8%	18%	0%
15	17%	30%	4%	17%	11%	6%	5%	13%	10%	11%	24%	9%
10	29%	46%	18%	29%	27%	25%	21%	23%	25%	24%	34%	18%
9	32%	48%	20%	35%	30%	29%	27%	26%	29%	27%	39%	20%
8	36%	51%	22%	39%	35%	33%	32%	29%	32%	31%	43%	21%
7	40%	54%	26%	43%	40%	37%	37%	33%	36%	34%	46%	23%
6	45%	57%	30%	47%	44%	42%	43%	37%	40%	39%	50%	27%
5	52%	61%	36%	52%	49%	47%	49%	42%	45%	43%	54%	32%
4	60%	65%	41%	58%	56%	54%	55%	48%	51%	50%	58%	39%
3	68%	71%	49%	65%	63%	61%	62%	55%	58%	57%	64%	48%
2	77%	78%	58%	74%	71%	70%	71%	64%	66%	67%	72%	61%
1	88%	88%	74%	84%	83%	81%	82%	77%	80%	81%	81%	79%

Table 3B. Projected reduction of MRFSS and TPWD charter greater amberjack landings by month for various vessel limits. Warmer colors denote higher reductions.

Bag Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
45	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
40	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
35	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
30	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
25	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
15	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
10	2%	0%	0%	0%	1%	1%	0%	3%	2%	2%	3%	2%
9	4%	0%	0%	0%	4%	2%	5%	5%	3%	5%	6%	4%
8	5%	0%	0%	0%	5%	2%	8%	7%	5%	8%	9%	7%
7	8%	0%	0%	1%	7%	4%	11%	8%	7%	12%	13%	10%
6	13%	3%	4%	5%	14%	6%	16%	13%	11%	17%	19%	14%
5	19%	8%	9%	13%	21%	12%	20%	19%	17%	24%	27%	21%
4	25%	13%	15%	22%	30%	20%	31%	28%	25%	32%	34%	28%
3	35%	23%	26%	32%	42%	32%	42%	45%	40%	42%	45%	38%
2	51%	43%	44%	48%	56%	47%	56%	58%	54%	56%	58%	53%
1	69%	62%	67%	71%	74%	69%	70%	75%	72%	74%	75%	69%

Table 3C. Projected reduction of MRFSS and TPWD private greater amberjack landings by month for various vessel limits. Warmer colors denote higher reductions.

Bag Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
45	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
40	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
35	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
30	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
25	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
15	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
10	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
9	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
8	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4	1%	2%	2%	1%	1%	3%	2%	2%	1%	1%	2%	2%
3	7%	9%	10%	12%	13%	15%	14%	11%	10%	9%	5%	9%
2	22%	25%	25%	28%	29%	30%	25%	22%	22%	22%	15%	21%
1	48%	54%	55%	53%	54%	49%	41%	38%	38%	38%	38%	45%

Recreational Fractional Bag Limit Analysis

Three fractional bag limits were evaluated: 1) One fish per one angler; 2) One fish per two anglers; and, 2) one fish per three anglers. For trips where the number of anglers was not in multiples of two or three people, anglers were not allowed to keep one additional fish.

Fractional bag limits were calculated in a similar manner as vessel limits, except reductions were determined on a per angler basis rather than a per vessel basis. MRFSS type A + B1 (AB1) catch was divided by the number of people contributing to the catch to estimate the average catch per person. If AB1 catch per person was greater than the fractional bag limit being analyzed, the value was re-set to the fractional bag limit ($AB1_{bag\ limit}$), otherwise no changes to catch were made.

Headboat and TPWD bag limit reductions were calculated in a similar manner except only landed (i.e. Type 'A') fish were available for analysis. Catch per person was calculated by dividing the total number of fish landed by the number of anglers. If the catch per angler was greater than the bag limit analyzed ($A_{bag\ limit}$), the value was re-set to the bag limit, as described above. If the catch per angler was less than the bag limit analyzed, then no changes to the catch were made. Percent reductions associated with fractional bag limits were estimated by mode of fishing relative to the status quo of one fish per one angler (Table 4). Due to concerns about low sample sizes, output was pooled for 2009-2010 data. MRFSS and TPWD output were pooled by mode and outputs for all sources were pooled across nearest months until a sample size of 50 for status quo was achieved. The same pattern used to achieve the target sample size in numbers was then applied to compute reductions in pounds. Proportional bag limits are predicted to have the largest impacts upon the private mode, followed by charter, with the least impact upon headboat.

Table 4. Projected reduction of greater amberjack landings by month for various proportional bag limits for A) headboat, B) MRFSS and TPWD charter, and C) MRFSS and TPWD private. Warmer colors denote higher reductions.

A) Headboat

Fract. Bag Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Fish/1 Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/2 Anglers	29%	27%	13%	24%	21%	17%	23%	18%	18%	20%	25%	5%
1 Fish/3 Anglers	43%	39%	23%	38%	32%	28%	35%	30%	27%	31%	37%	21%

B) MRFSS & TPWD Charter

Fract. Bag Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Fish/1 Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/2 Anglers	35%	33%	35%	40%	40%	34%	36%	39%	36%	35%	36%	34%
1 Fish/3 Anglers	56%	55%	56%	62%	56%	55%	56%	60%	56%	54%	54%	53%

C) MRFSS & TWPD Private

Fract. Bag Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Fish/1 Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/2 Anglers	37 %	41 %	41 %	37 %	36%	36 %	28 %	27 %	28 %	29 %	30 %	35 %
1 Fish/3 Anglers	70 %	71 %	71 %	61 %	61%	56 %	46 %	51 %	53 %	53 %	62 %	66 %

Recreational Minimum Size Limit Analyses

Length measurements collected during biological sampling associated with HBS, MRFSS, and TPWD were converted to inches FL using standard conversion factors and equations summarized in Table 5 (Figure 3; SEDAR 9 2011). MRFSS weight measurements were recorded in kilograms whole weight (ww) and headboat weight measurements were recorded in grams ww. No weight information was available for TPWD intercepts. All fish weights for TPWD intercepts and some fish weights for MRFSS intercepts were not recorded for greater amberjack so whole weight was estimated from length using the equations summarized in Table 5. All weight measurements were recorded for each intercept in the headboat database.

Table 5. Meristic conversions for Gulf of Mexico greater amberjack. Source: SEDAR-9 (2011).

Conversion	Source	Model	r^2
TL (mm) vs. FL (mm)	**FIN**	**TL = 1.0253(FL) + 70.165**	**0.91**
Whole weight (lbs) vs. FL (in)	**TIP**	**$WW = 0.001(FL)^{2.8078}$**	**0.99**
Gutted weight (lbs) vs. FL (in)	**TIP**	**$GW = 0.0007(FL)^{2.8948}$**	**0.98**

Reductions in harvest (both numbers and weight of fish) were calculated for each mode of fishing (charter, headboat, and private/rental) for minimum size limits (MSL) at 1 inch intervals between 30-36 inches as follows:

Percent reduction = *((C – G) - B)/C*, where:
C = catch in either number of fish or pounds WW
G = number or weight of fish that are greater than or equal to the MSL
B = number or weight of fish smaller than the 30-inch FL MSL (non-compliance or measurement error)

MSL from 30 to 36 inches FL in one-inch increments were evaluated. Percent reductions associated with MSL were estimated by mode of fishing normalized to a 0% reduction at the recreational status quo of 30 inches (Table 6). Due to concerns about low sample sizes, output was pooled for 2009-2010 data. MRFSS and TPWD output were pooled by mode and outputs

for all sources were pooled across nearest months until a sample size of 50 fish (in numbers) for status quo was achieved. The same pattern used to achieve the target sample size in numbers was then applied to compute reductions in pounds. Projected MSL impacts vary by month and mode.

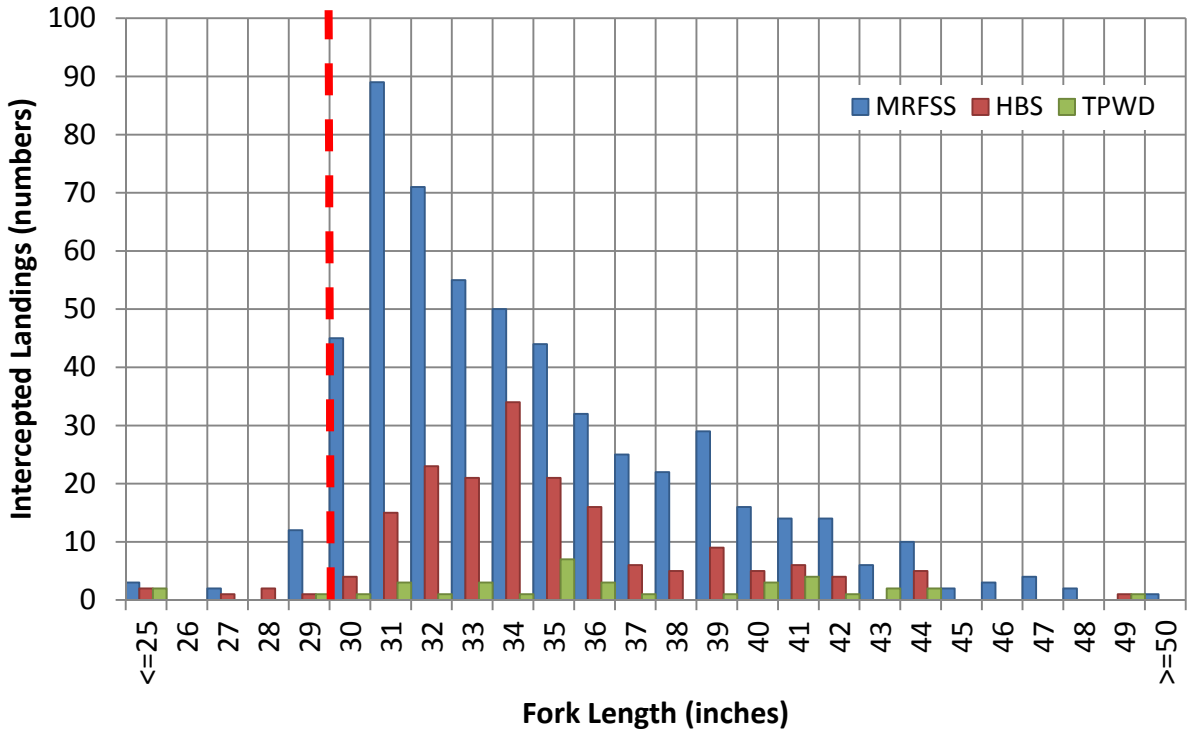

Figure 3. Fork length (FL) distribution for biologically sampled intercepts of recreationally landed greater amberjack in the Gulf of Mexico from MRFSS (blue), headboat survey (HBS; red), and TPWD (green). Red line denotes current recreational minimum size limit of 30 inches FL.

Table 6A. Projected reduction of headboat greater amberjack landings by month for various minimum size limits. Warmer colors denote higher reductions.

Size Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	9%	11%	10%	11%	10%	8%	4%	5%	5%	6%	7%	9%
32	23%	23%	24%	27%	24%	19%	14%	16%	17%	19%	20%	23%
33	42%	47%	50%	47%	43%	32%	18%	20%	20%	21%	27%	33%
34	59%	66%	67%	68%	68%	52%	31%	33%	35%	38%	45%	48%
35	65%	72%	74%	77%	78%	67%	53%	48%	48%	43%	50%	53%
36	70%	77%	79%	82%	82%	77%	71%	62%	61%	49%	57%	59%

Table 6B. Projected reduction of MRFSS and TPWD charter greater amberjack landings by month for various minimum size limits. Warmer colors denote higher reductions.

Size Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	18%	18%	14%	8%	21%	15%	15%	13%	13%	13%	17%	16%
32	24%	27%	22%	15%	34%	39%	31%	25%	23%	24%	24%	23%
33	32%	37%	32%	26%	46%	47%	40%	33%	29%	25%	24%	28%
34	44%	52%	45%	36%	54%	53%	50%	45%	41%	35%	31%	34%
35	57%	65%	54%	43%	62%	57%	56%	54%	48%	45%	40%	49%
36	65%	72%	59%	45%	67%	63%	64%	64%	59%	54%	50%	57%

Table 6C. Projected reduction of MRFSS and TPWD private greater amberjack landings by month for various minimum size limits. Warmer colors denote higher reductions.

Size Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	14%	13%	13%	11%	8%	8%	10%	10%	8%	11%	10%	13%
32	21%	23%	21%	17%	14%	11%	16%	19%	20%	22%	22%	24%
33	35%	38%	30%	26%	22%	19%	28%	33%	38%	40%	38%	35%
34	38%	41%	34%	30%	25%	21%	30%	34%	38%	42%	40%	39%
35	47%	52%	46%	43%	39%	36%	44%	48%	50%	53%	50%	52%
36	48%	57%	52%	49%	44%	42%	49%	52%	56%	58%	55%	55%

Commercial Trip Limits

Commercial trip limits are a tool for reducing the rate of commercial harvest to avoid an early closure. For greater amberjack, a relatively small percentage of trips comprise the bulk of the commercial harvest (Figure 4). Trip limits from 250-3,000 lb ww per trip were examined using commercial logbook data. To model trip limits, if total catch per logbook-reported trip was greater than the trip limit being analyzed, the value was re-set to the new trip limit, otherwise no changes to catch were made. Commercial fishermen were assumed to stop targeting amberjack once their trip limit was met. If the CDT user selected a trip limit for a given month, the percent reduction predicted by the trip limit model was applied to baseline monthly landings (Table 7).

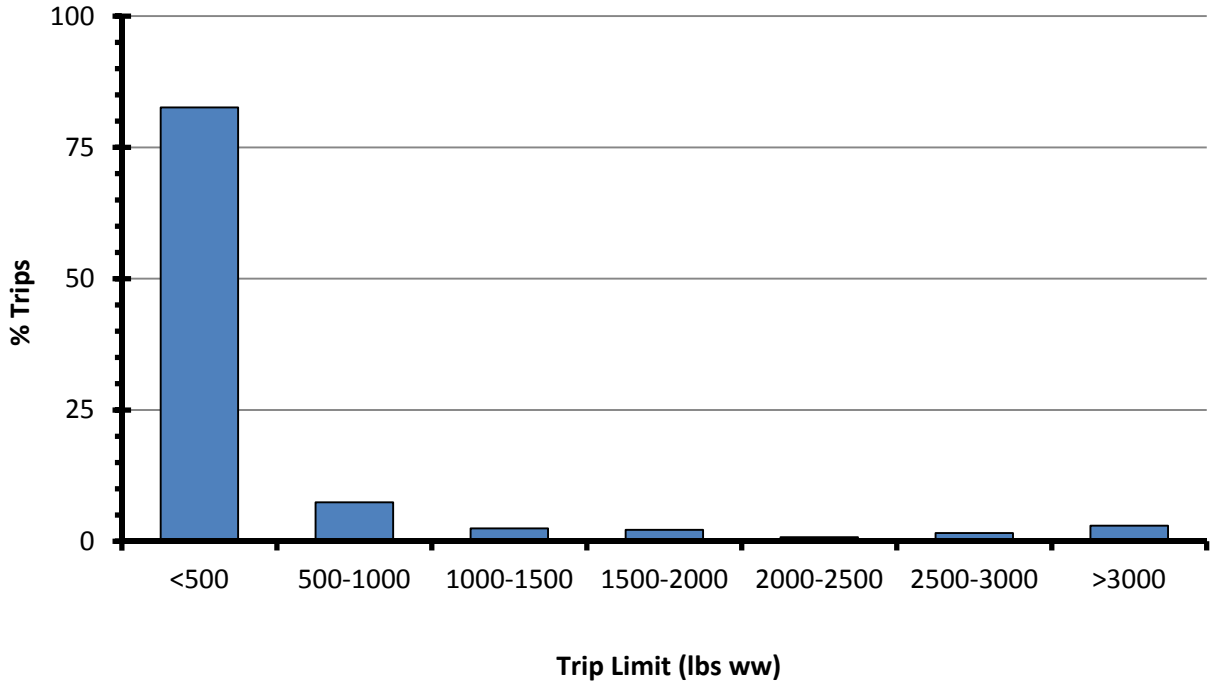

Figure 4. Commercial greater amberjack catch-per-trip as reported to SEFSC logbooks in 2009.

Table 7. Projected monthly commercial greater amberjack landings for various trip limits.

MONTH	NO LIMIT	3000 LB	2500 LB	2000 LB	1500 LB	1000 LB	750 LB	500 LB	250 LB
Jan	62,896	62,151	60,933	59,715	58,497	55,173	52,994	48,187	35,516
Feb	79,446	69,199	66,763	63,615	57,719	48,665	43,097	35,947	24,937
Mar	84,020	69,230	66,442	62,836	56,822	48,357	43,210	36,459	25,729
Apr	88,595	69,262	66,121	62,057	55,924	48,049	43,323	36,972	26,522
May	93,169	69,293	65,800	61,277	55,027	47,740	43,436	37,484	27,314
Jun	97,744	69,324	65,479	60,498	54,129	47,432	43,550	37,996	28,106
Jul	102,769	96,584	91,695	83,857	73,625	59,988	52,244	41,911	27,389
Aug	112,296	91,896	85,119	76,698	66,293	53,249	45,362	36,593	24,193
Sep	76,302	67,993	64,256	59,385	52,683	42,787	37,109	30,256	20,933
Oct	56,270	52,332	49,892	46,519	42,454	36,757	32,711	26,940	18,882
Nov	54,896	47,618	45,663	43,527	40,588	36,433	33,235	28,345	20,235
Dec	49,455	45,736	44,597	42,910	40,406	36,139	32,617	27,751	20,290

Note: Purple shading denotes gaps filled with linear interpolation; orange shading denotes extrapolation from 2006-2008 average percent annual landings.

Combined Effects of User-Defined Management Measures

The projected impacts of the various management measures produced output in pounds of landings (i.e. trip limit) or percent reductions (i.e. vessel limit, proportional bag limit, size limit). These results were incorporated into Microsoft Excel RDT and CDT models. For both models, if month (*m*) was 100% closed, landings were set to zero pounds for all sectors. For the RDT, if a month was partially or fully open, the projected landings (L) were computed as follows:

$$L_{sector,m} = BL_{sector,m} * O_m * \varsigma_{sector,m} * (\beta_{sector,m} \text{ OR } \upsilon_{sector,m})$$

where BL: baseline landings, O: percent of month open to fishing, ς: percent landed catch remaining following size limit implementation, β: percent landed catch remaining following fractional bag limit implementation, and υ: percent landed catch remaining following vessel limit implementation. The RDT does not allow a proportional bag limit and a vessel limit to be modeled simultaneously.

If month (m) was 100% closed and the user-defined trip elimination (τ) to be false, projected discards (D) were computed as baseline discards (BD) plus baseline landings (BL). Similarly, if month (m) was 100% closed and the user-defined trip elimination (τ) to be true, discards (D) were computed as:

$$\mathrm{D}_{sector,m} = \mathrm{BD}_{sector,m} * \tau^{\mathrm{D}}_{sector,m} + \mathrm{BL}_{sector,m} * \tau^{\mathrm{L}}_{sector,m}$$

where τ: the percent reduction in landings (L) and discards (D) due to trip elimination. For the RDT, if a month was partially or fully open, the projected discards were computed as follows:

$$\mathrm{D}_{sector,m} = \underbrace{\mathrm{BD}_{sector,m}}_{\text{baseline discards}} + \underbrace{(\mathrm{BL}_{sector,m} - \mathrm{L}_{sector,m})}_{\text{new management discards}}.$$

Projected discards were multiplied by a 20% release mortality rate to convert to dead discards. Projected dead discards were added to projected landings to determine total removals.

For the CDT, projected monthly landings were computed as:

$\mathrm{L}_m = \mathrm{T}_m * \mathrm{O}_m$

where T_m: projected landings under user-defined trip limit (see Table 7).

For both decision tools, the projected monthly landings were summed across the year for a variety of user-defined management scenarios and compared to the Amendment 35 ACL alternatives. In instances where the management measures were insufficient to constrain harvest below the ACL, the projected quota closure date was computed.

Results

Recreational

Table 8 presents projected recreational landings and quota closure dates under a variety of management alternatives. The RDT predicted that without the recently approved June-July closure or additional management measures, the recreational greater amberjack harvest in 2012 would be 1.68 mp (Figure 5A). Under this scenario, a quota closure would likely be necessary on July 20, limiting the season to just 201 days. Increasing the recreational size limit to 34 inches is projected to constrain harvest below the ACL (Figure 5B), as would the recently approved June-July closure (Figure 5C) or a 1 fish per 2 angler proportional bag limit (Figure 5D).

Table 8. Projected recreational harvest in million pounds whole weight (mp ww) of Gulf greater amberjack under a variety of proposed management measures. Text in bold denote changes from status quo; red text denotes potential quota closure date. Alt 1 ACL = 1.368 mp ww, Alt 2 ACL = 1.299 mp ww, and Alt 3 ACL = 1.130 mp ww.

Closed Season	Size Limit	Bag limit	Vessel limit	Days Open (Alt 1)	Days Open (Alt 2)	Days Open (Alt 3)	Projected Landings w/o Quota Closure (mp ww)
Jun -Jul	30”	1fish/1angler	N/A	305	305	305	1.071
Jun 1-Jul 15	30”	1fish/1angler	N/A	321	321	283 *(Nov. 24)*	1.201
None	**34”**	1fish/1angler	N/A	366	366	366	1.044
None	30”	N/A	**3fish/vessel**	366	366	299 *(Oct. 26)*	1.226
Mar-May	30”	1fish/1angler	N/A	274	274	267 *(Dec. 25)*	1.142
Jun	30”	**1fish/2anglers**	N/A	336	336	336	0.864
Nov-May	30”	1fish/1angler	N/A	153	153	153	0.953
None	30”	N/A	**2fish/vessel**	366	366	366	0.990
May	30”	**1fish/2anglers**	N/A	335	335	335	0.873
Nov	30”	**1fish/3anglers**	N/A	336	336	336	0.716
May 16-Jul	30”	1fish/1angler	N/A	289	289	289	0.886
Jun 1-Jul 15	30”	**1fish/3anglers**	N/A	321	321	321	0.517
None	30”	N/A	**1fish/vessel**	366	366	366	0.664
Nov-Jun 15	30”	1fish/1angler	N/A	138	138	138	0.774
Jun-Jul	30”	**1fish/2anglers**	N/A	305	305	305	0.694
None	**36”**	1fish/1angler	N/A	366	366	366	0.754

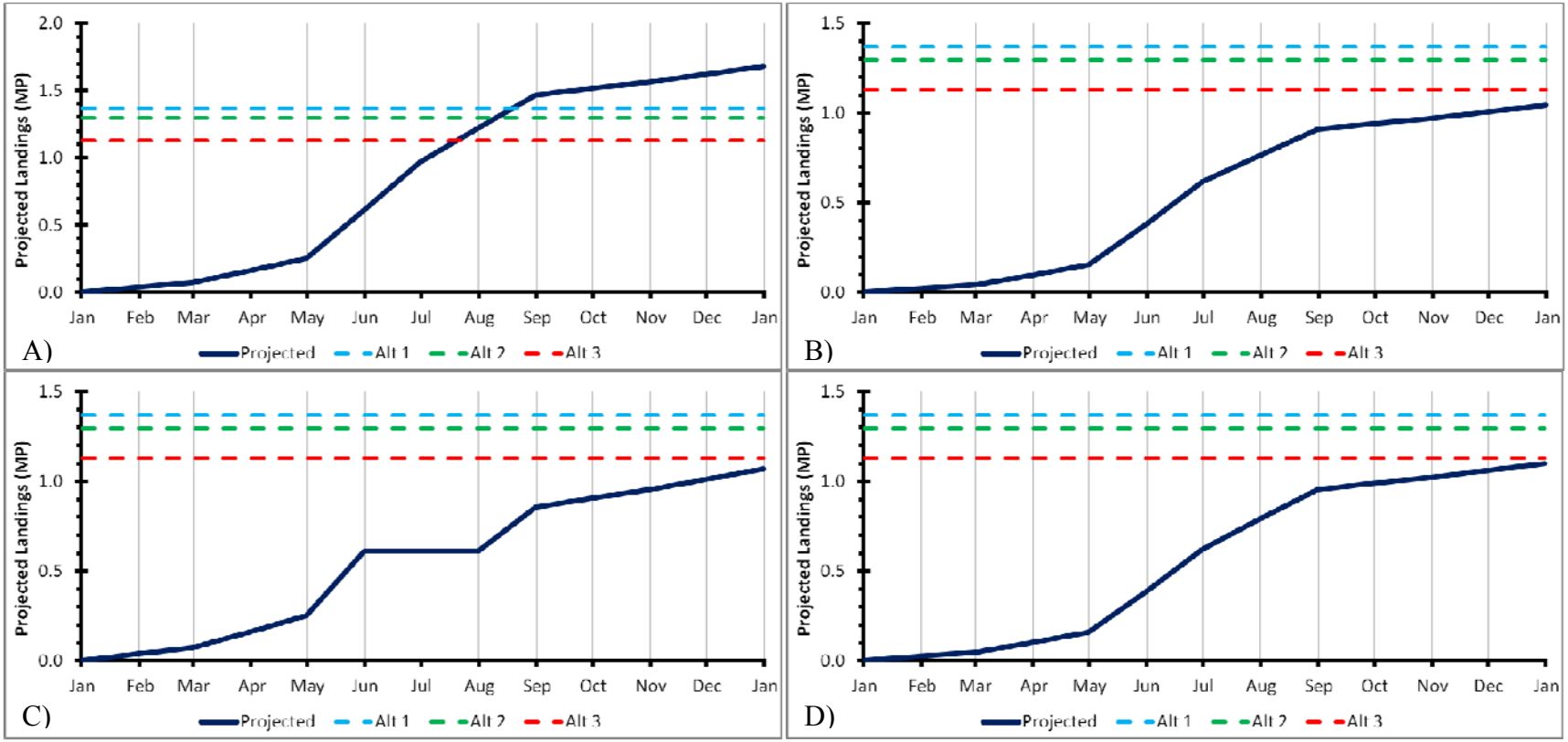

Figure 5. Projected recreational harvest in million pounds whole weight (MP) under A) no seasonal closure or additional management measures, B) a 34 inch size limit, C) a June-July seasonal closure, and D) a 1 fish per 2 angler proportional bag limit for annual catch limit (ACL) alternatives 1 (blue; 1.368 MP), 2 (green; 1.299 MP), and 3 (red; 1.130 MP) in Amendment 35.

Commercial

Table 9 presents projected commercial landings and quota closure dates under a variety of management alternatives. The CDT predicted that without additional management measures, including closing the commercial sector when the quota is met, the commercial greater amberjack harvest in 2012 would be 0.692 mp (Figure 6A). Under this scenario, a quota closure would likely be necessary on August 19, limiting the season to just 139 days. Reducing the trip limit to 1,000 lb ww is projected to nearly constrain harvest below the ACL (Figure 6B); a quota closure might be required on December 25. Harvest would likely be constrained below the ACL by a Jan-Jun 15 closure coupled with a 1,500 lb trip limit (Figure 6C) or a 750 lb trip limit (Figure 6D).

Table 9. Projected commercial harvest in million pounds whole weight (mp ww) of Gulf greater amberjack under a variety of proposed management measures. Text in bold denote changes from status quo; red text denotes potential quota closure date.

Closed Season	Trip Limit	Days Open (Alt 1)	Days Open (Alt 2)	Days Open (Alt 3)	Projected Landings w/o Quota Closure (mp ww)
Mar-May	None	170 *(Sept. 19)*	162 *(Sept. 11)*	139 *(Aug. 19)*	0.692
Mar-May	**2000 lb**	249 *(Dec. 7)*	234 *(Nov. 22)*	185 *(Oct. 4)*	0.537
Mar-May	**1500 lb**	274	269 *(Dec. 27)*	215 *(Nov. 3)*	0.486
Mar-May	**1500 lb (Jan-Feb, June-Aug); 1000 lb (Sept-Dec)**	274	274	228 *(Nov. 16)*	0.462
Mar-May	**1500 lb (Jan-Feb, June-Sept); 1000 lb (Oct-Dec)**	274	274	220 *(Nov. 8)*	0.472
Mar-May	**1000 lb**	274	274	267 *(Dec. 25)*	0.417
Mar-May	**750 lb**	274	274	274	0.381
Mar-May	**1000 lb (Jan-Feb, June-Oct); 500 lb (Nov-Dec)**	274	274	274	0.400
Mar-May	**1500 lb (Jan-Feb, June-July); 500 lb (Aug-Dec)**	274	274	274	0.394
Mar-June	None	190 *(Nov. 8)*	178 *(Oct. 27)*	142 *(Sept. 21)*	0.594
Jan-June 15	**1500 lb**	199	199	199	0.365
Mar-July	None	213	206 *(Dec. 25)*	163 *(Nov. 12)*	0.492

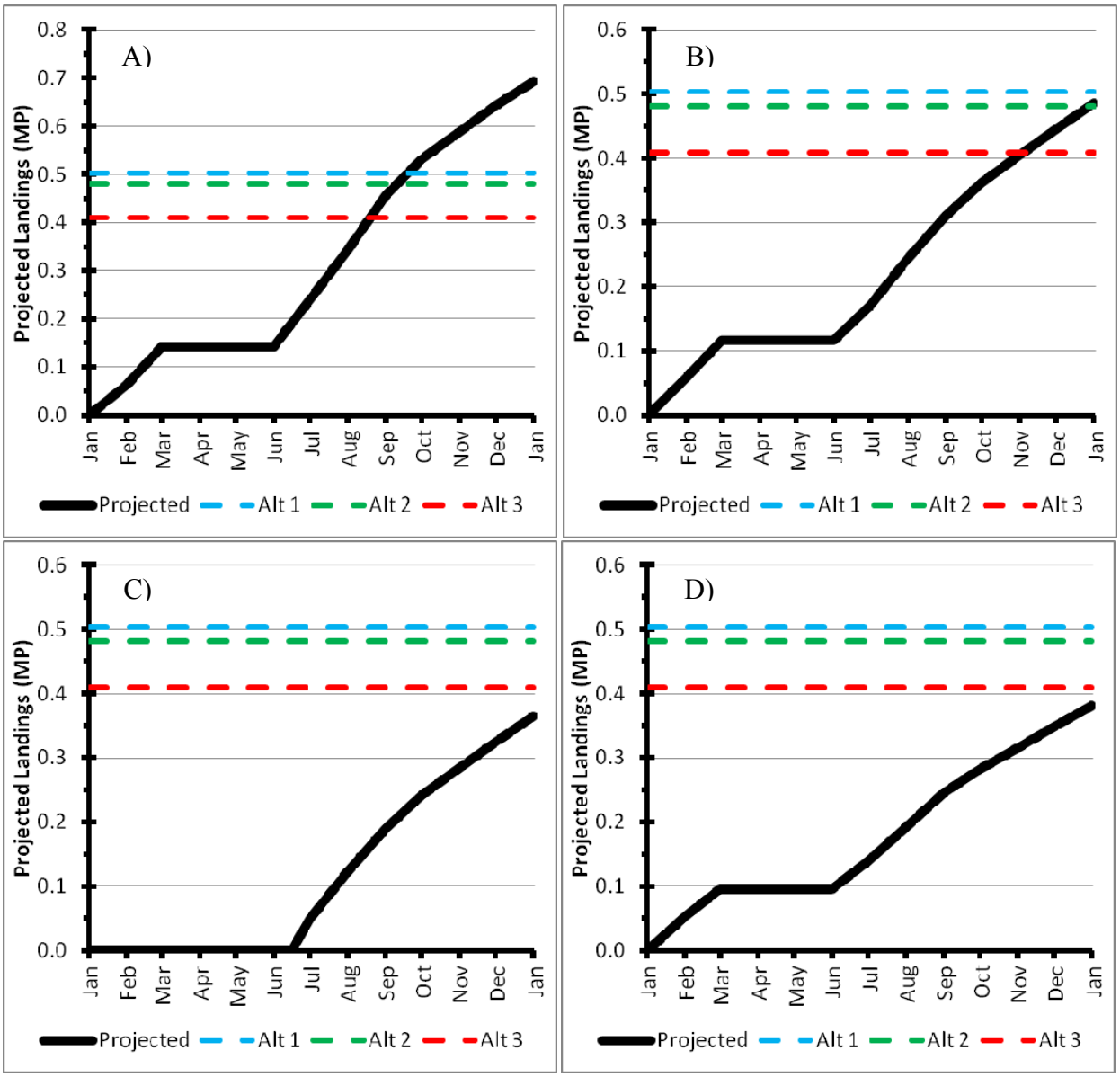

Figure 6. Projected commercial harvest in million pounds whole weight (MP) under A) Mar-May seasonal closure with no additional management measures, B) Mar-May seasonal closure with a 1,000 lb trip limit, C) a Jan-June 15 seasonal closure and a 1,500 lb trip limit, and D) Mar-May seasonal closure with a 750 lb trip limit for annual catch limit (ACL) alternatives 1 (blue; 0.503 MP), 2 (green; 0.481 MP), and 3 (red; 0.409 MP) in Amendment 35.

Discussion

As with most projection models, the reliability of the RDT and CDT results are dependent upon the accuracy of their underlying data and input assumptions. We have attempted to create a realistic baseline as a foundation for comparisons, under the assumption that 2009 is the most representative year for future trends. Uncertainty exists in this baseline, as economic conditions, weather events, changes in catch-per-unit effort (CPUE), fisher response to management regulations, and a variety of other factors may cause departures from this assumption. The bounds of this uncertainty are not captured by the model as currently configured; as such, it should be used with caution as a 'best guess' for future dynamics. In addition to the aforementioned sources of uncertainty, the modeled reductions associated with management measures assume that past performance in the fishery is a good predictor of future dynamics. We have attempted to constrain the range of data considered to recent years to reduce the unreliability of this assumption; however, due to the long-standing commercial spawning closure and quota closures in previous years, we have been forced to fill gaps in recent data when establishing a baseline. Greater uncertainty exists in our predictions during these extrapolated time periods relative to months where greater amberjack was open in 2009.

Neither model accounts for effort shifting that may take place during a seasonal closure. Effort shifting may lead to increased removal rates before and after a closure that partially offset the reductions expected from the closure. The models also do not consider non-compliance with various proposed regulations, which would similarly offset the projected reductions. Neither model considers any changes in the average size of greater amberjack during rebuilding. An increased average size would lead to fishermen capturing their quota more rapidly relative to previous years under similar effort levels. All of these factors would result in more pessimistic projections. As such, management reductions presented in this report may be overestimates, and caution should be taken in their interpretation and use. By contrast, continued adverse economic conditions and rising fuel prices may reduce effort, which would counter these other trends.

In general, the models suggest additional management regulations are necessary to rebuild greater amberjack within the allowable time frame and constrain harvest below the ACL. For the recreational sector, the recently approved June-July seasonal closure would accomplish this objective. However, increasing the recreational size limit to 34 inches fork length (FL) would accomplish this objective without a seasonal closure and may be more biologically advantageous. Murie and Parkyn (2008) determined the size of 50% maturity to be about 35 inches fork length and spawning potential ratio (SPR) would be greatly enhanced by increasing the size limit (SERO 2011). Although greater amberjack release mortality rate is poorly quantified, it is estimated to be around 20% (SEDAR-9 Update 2011); thus, a high percentage of fish released due to an increased size limit may survive to spawn and promote recovery of the stock.

For the commercial sector, retaining or extending the current March-May spawning closure and coupling it with a trip limit appears to be necessary to constrain harvest and extend the length of the commercial fishing season. The most straightforward management alternative explored that reduced projected landings below the Alt 3 (Preferred) ACL was a 750 lb trip limit during all open months. This projection is limited by the assumption that fishermen will not make

additional trips to partially offset their losses due to a severely restrictive trip limit. This dynamic would result in the CDT overestimating the reductions associated with the trip limit. Higher trip limits would extend the length of the commercial fishing season, but will not likely be sufficient to prevent quota closures.

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12.2.2 Projection of Greater Amberjack Landings Using Generalized Additive Models

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Introduction

Greater amberjack is a prized species in for both commercial and recreational anglers in the Gulf of Mexico. This species is intensively managed and annual landings may be affected by factors other than stock size or fishing effort. In the past, total harvest has been constrained by seasonal closures and in-season quota monitoring; however, existing measures may be insufficient to constrain landings to Annual Catch Limits/Targets specified by the Gulf Council. Additionally, there is a seasonal component in which the manner this fishery is prosecuted, both as a consequence of regulation and other factors. Given the frequent changes in the regulatory regime, projecting future catches as a function of historical pattern becomes more complicated. However, incorporating longer time series may provide information about inter-annual variability and provide a mechanism to characterize uncertainty in historical and projected landings estimates. For this purpose, a regression model was developed that explicitly accounted for seasonal closure and landings, as well as the affect of catch-per-unit-effort (CPUE [a proxy for relative stock size]) on the landings for a given year.

A potential benefit of this approach is that it can incorporate longer time series of catch and effort (here: 2002 – 2009) and evaluate change based on management measures (e.g., seasonal closures, trip limits). This methodology also permits estimation of model uncertainty, although this will underestimate the true projection interval that would likely be the most appropriate proxy of within model uncertainty. A full estimation of the projection uncertainty could be estimated using bootstrapping or similar approach however, this would require further testing and evaluation prior to implementation. The current objective is to develop a user-friendly harvest projection tool that incorporates longer time-series, incorporates uncertainty into fits and model projections, and provides a mechanism to evaluate assumptions on which the model is based.

Current Management Regulations

The following regulations currently apply to the Gulf of Mexico greater amberjack fishery:

1) Recreational bag limit: One fish/person/day amberjack (implemented January 1997).
2) 30-inch FL recreational minimum size limit (implemented August 2008).
3) 36-inch FL commercial minimum size limit (implemented February 1990).
4) June 1 through July 31 recreational closed season (implemented June 2011).
5) March 1 through May 31 commercial closed season (implemented January 1998).

Methods

Commercial landings data were obtained from the SEFSC commercial ACL dataset (accessed June 2011), and the SEFSC commercial logbook program (accessed May 2011). These data were aggregated into a monthly time series and provided by NMFS-SERO (Gulf A35 Greater Amberjack Commercial Decision Tool 1Sept2011 Locked.xlsx [source SERO]). Monthly catch data from commercial greater amberjack fishery were used from 2002 – 2009 (Figure 1) to project harvest rates of greater amberjack in 2012. Data were examined as raw and adjusted to examine the effect of trip limits. For this purpose, commercial trips with landings over the specified threshold (e.g., 2000 lb trip limit) were recoded to the maximum trip limit value. This process was examined for four potential trip limits (500, 1000, 1500, and 2000 lbs).

The historical time series (by month from January 2002 through December 2009) was modeled using generalized additive models (GAM). Generalized additive models (Hastie and Tibshirani 1990) are extensions of generalized linear models with a linear predictor involving a sum of smooth functions of covariates. For greater amberjack projections,

Landings (lbs) = s(month) + factor(closure) + CPUE index,

where month was fitted using a cubic-spline smoother (*s*), closure was a factor variable of two levels (*open or closed*) and the CPUE index was a weighted mean of two commercial indices of abundance (Source: SEDAR 9). A Quasi-Poisson error distribution was used with a log link to best approximate the dispersion assumption. Model selection was based on statistical significance of covariates ($\alpha = 0.1$). Model validation was done via visual inspection of residual plots against covariates (Zuur et al. 2009). Analyses were conducted in R 2.11.1x64 (R Development Core Team 2008) with functions from the "mgcv" package (Wood 2008).

Results

Historical landings have both short- (seasonality,) and long-term (non-stationarity) dynamics due to variety of factors including (fishing effort, management, stock biomass, season migration of fishery) (Figure 1) . A GAM was developed for each times series (n=5, without trip limits and for 500, 1000, 1500, and 2000 lb trip limits). Projections for year 2012 (including 95% confidence intervals) were made from fitted GAM models using the “predict” function from the mgcv package in R.

To evaluate management scenarios under consideration by the Gulf Council, daily harvest rate, by month and trip limits were determined by summing the monthly projected catch (assuming no closed season) and dividing by the number of days in each month. The resulting daily harvest rate ± 95% confidence limits were calculated for each month and trip limit being considered. These values were incorporated into a Microsoft Excel© based decision support tool (Figure 2). This tool can be used to

evaluate various combinations of trip-limits and closed seasons to meet management targets.

Based on the fitted model, projections and uncertainty were estimated in 2012 Projected monthly harvest was also estimated from the fitted GAM demonstrating the seasonal pattern of harvest (Figure 3). Uncertainty of projected harvest is greatest from March to May as this period has historically been closed from harvest by management regulations. To evaluate annual landings with respect to potential management goals, the cumulative projected 2012 landings (2012 Projected landings assuming no trip limits or closed season: 1,092,349 lbs ww). Based on this projection a suite of management measures may be necessary to meet management harvest goals. To fully evaluate potential management alternatives, projections were exported to the decision support tool. For each potential scenario (developed using built-in drop down menus), projected harvest and season length (days) are reported in graphical and tabular form. Using this tool, it also possible to consider some within-year changes to trip limits (e.g., lowering trip limit as quota is approached). Many potential configurations can be evaluated using the decision tool including partial or whole month closed-seasons as well as monthly changes in trip-limits.

Example

To provide clarity to the methodology, this section is provided a worked example of the model fit and projected results. Current management regulations for greater amberjack commercial fishery specify a 3-month closed season (March – May) but do not require trip-limits. This example will fit a GAM model to historical data and project 2012 landings under the current management regime. The generalized additive model (GAM) was used to model historic catch data (2002 – 2009; Figure 1) as a function of month, harvest (open or closed season), and a weighted commercial CPUE index (proxy for stock abundance; source SEDAR 2009). A summary of the fitted GAM model (Table 1) suggests the model provides a good fit to the historical data (pseudo-R^2 = 81.5%). Model validation was accomplished by examining plots of residuals versus predictor variables (Figure 3A-D). Plots of residuals against the variables should be without trend and without large deviations in spread across levels of the variable of interest. Model residuals largely satisfied these requirements. The fitted model was used to project 2012 landings including 95% confidence intervals) assuming no-trip limits and a 3-month closed season (Table 2, Figure 4A-B). Total projected landings for this scenario are 751,213 which exceed current, preferred management targets (ACL = 481,000, ACT 409,000 lbs.) suggesting other or additional management measures are necessary to achieve target harvest levels (Figure 5). To further evaluate additional scenarios, projected harvest rates were imported into the Excel© decision support tool (Figure 6).

Conclusion

Development of user-friendly decision support tools can aide scientists and resource managers in evaluating potential options to achieve management goals. These tools have been incorporated previously in Gulf of Mexico fisheries and could be useful in bridging the data to information gap exists in natural resource management.

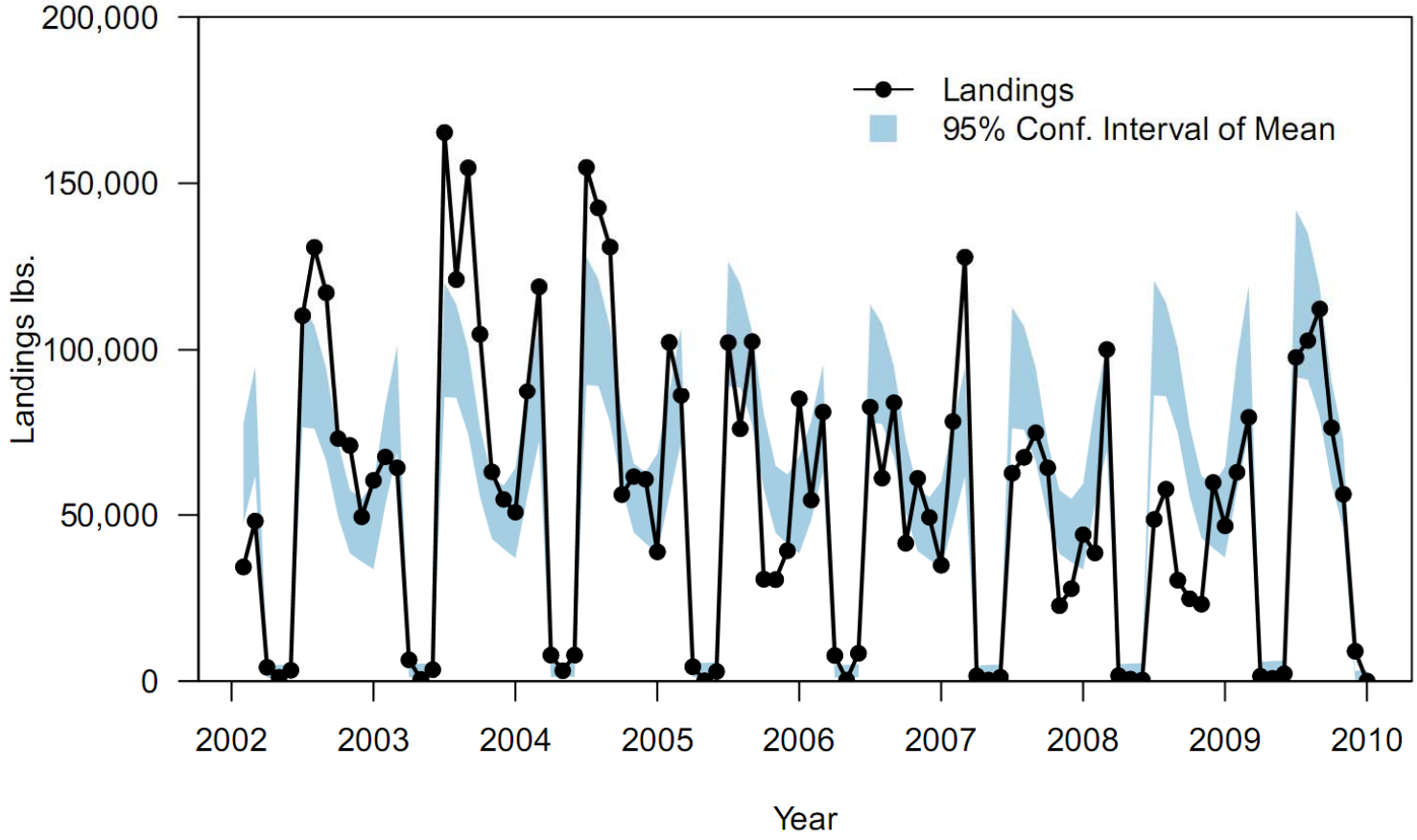

Figure 1. Historical commercial landings of greater amberjack from 2002 to 2009. Points represent landings by month. Low landings from March to May each year result from a seasonal prohibition of harvest. Blue shaded region represents 95% confidence interval of a generalized additive model fit to the historical data.

Cells in yellow can be changed via drop down menu (click on yellow cells)

Projected season length: 213

Gulf of Mexico Amendment 35: Commercial Greater Amberjack projected catch based on alternative harvest strategies 2012

Variables that can be changed via drop down menu on cells:
Days closed
Trip limit

Greater amberjack projections using generalized additive model that explicitly accounted for seasonal closure, seasonality in the fishery, as well as the affect of the catch-per-unit-effort (CPUE) on the landings for a given year.
Developed by John T. Froeschke Ph.D. (Gulf Council Staff)

Model Inputs

Model Inputs	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Days in Month Open	31	29	31	30	31	30	31	31	30	31	30	31
Days closed	0	0	31	30	31	30	31	0	0	0	0	0
Day open	31	29	0	0	0	0	0	31	30	31	30	31
Trip limit	None	None	1000	1000	1000	1500	1500	None	None	None	None	None
Projected monthly catch	**77,232**	**96,721**	**0**	**0**	**0**	**0**	**0**	**99,260**	**75,055**	**59,299**	**56,107**	**57,555**

Acceptable values
Days in Month
0: to max days in month
Trip limit
None, 2000, 1500, 1000, 500

Projection Results

Projected catch (lbs)	**521,231**
Upper Conf. Limit of mean (9	**583,727**
Lower Conf. Limit of mean (	**458,735**

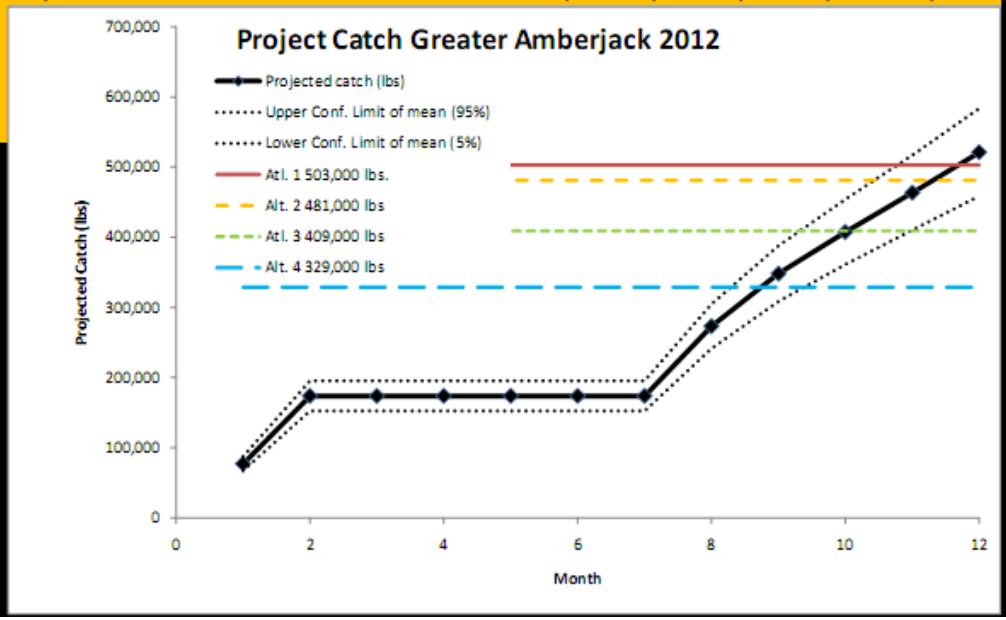

Figure 2. Screenshot for the commercial decision tool including cells in yellow that can be specified by the user to consider alternative management measures.

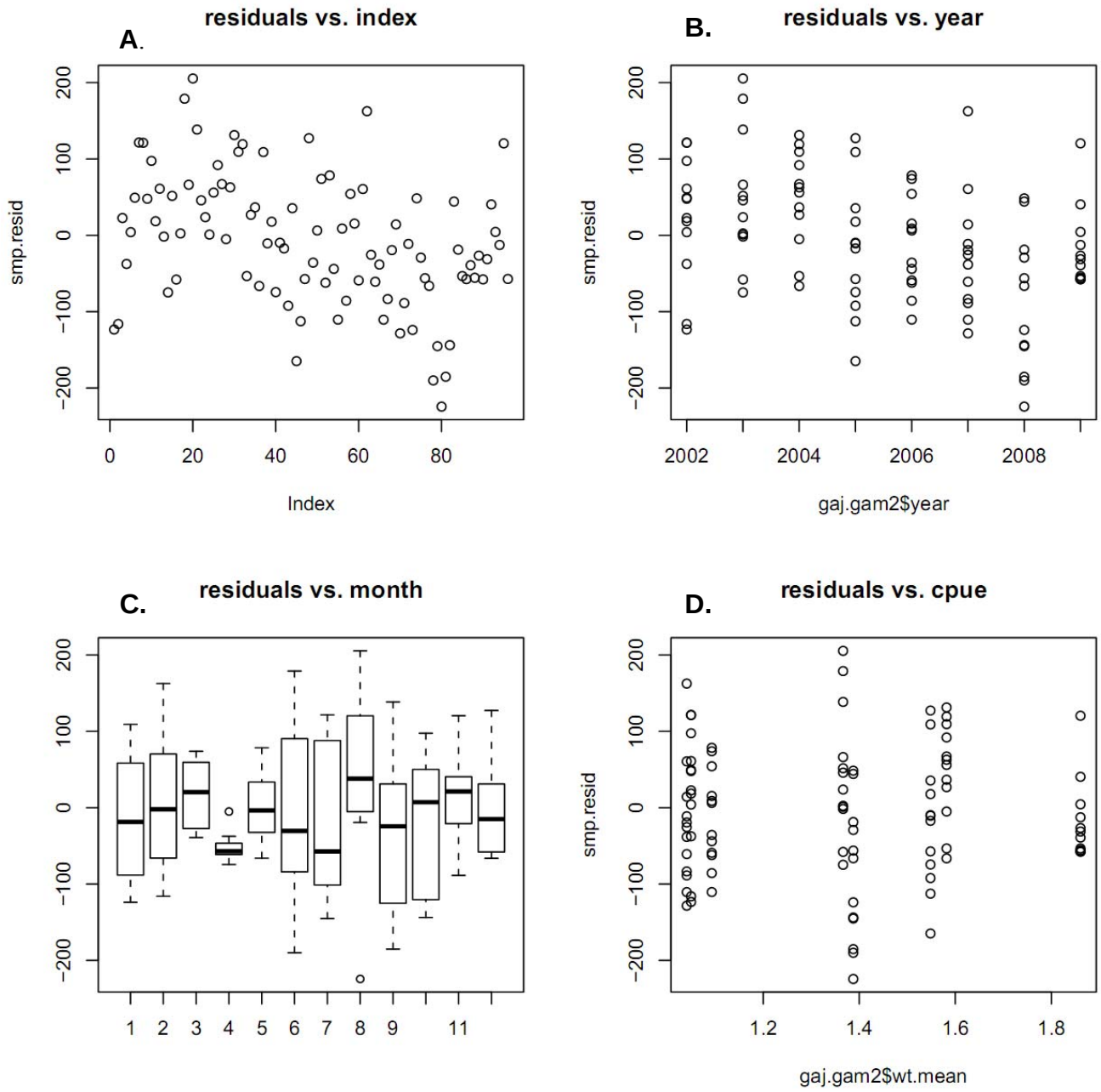

Figure 3. Plot of residuals of generalized additive model (GAM) fit to greater amberjack commercial landings (2002 -2009) (A) and against year (B), month (C), CPUE index (D).

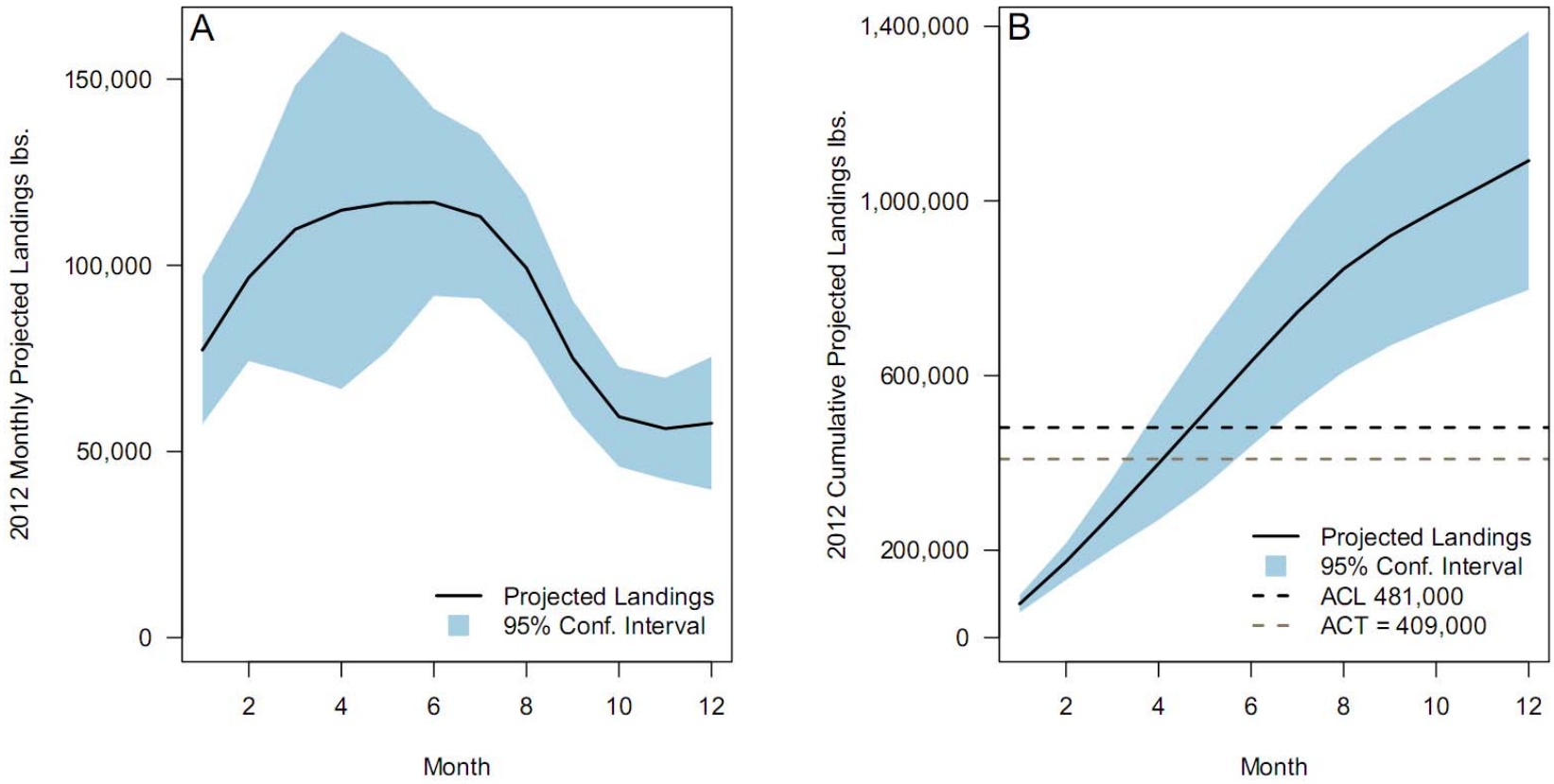

Figure 4. Projected monthly harvest for greater amberjack in the Gulf of Mexico (A). Black line indicates projected 2012 landings by month assuming no closed-season or trip limits. Blue-shaded region marks 95% confidence interval of within model uncertainty. B) Projected cumulative landings for 2012 in comparison to annual catch limit (ACL = 481,000) and annual catch target (ACT = 409,000 lbs).

Table 1. Example model summary used to project greater amberjack catch in 2012. Generalized additive model was fit where total weight of catch (lbs) = s(month) + factor(season) + index where month was fitted using a smoother, season was a factor variable of two levels (open or closed) and the index was a weighted mean of commercial indices of abundance (Source: SEDAR 9). A Quasi-Poison error distribution was used with a log link to best approximate the dispersion assumption. Model selection was based on statistical significance of covariates (α = 0.1).

```
Family: quasipoisson
Link function: log
Formula:
(weight) ~ s(month, bs = "cs") + factor(season) + wt.mean
Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)      7.4670     0.3886  19.215  < 2e-16 ***
factor(season)1   3.4314     0.3497   9.813 8.34e-16 ***
wt.mean          0.2597     0.1434   1.811   0.0735 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Approximate significance of smooth terms:
         edf Ref.df     F  p-value
s(month) 4.628  5.513 7.213 5.24e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
R-sq.(adj) =  0.703   Deviance explained = 81.5%
GCV score = 8625.2  Scale est. = 7939.9    n = 96
```

Table 2. Projected 2012 commercial landings under three management scenarios from the commercial greater amberjack decision tool assuming no trip limits and 3-month closed season.
Data source: 2009 commercial logbook data (accessed 9/2011) scaled to ACL data (accessed (9/2011).

Projected commercial landings	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total Projected Landings
Mar - May closure	77,232	96,721	0	0	0	116,892	113,090	99,260	75,055	59,299	56,107	57,555	751,213

Table 3. Projected commercial landings under three management scenarios from the commercial greater amberjack decision tool.

Data source: 2009 commercial logbook data (accessed 9/2011) scaled to ACL data (accessed (9/2011).

Projected commercial landings	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total Projected Landings
No closure or trip limit	77,232	96,721	109,626	114,787	116,723	116,892	113,090	99,260	75,055	59,299	56,107	57,555	1,092,349
Mar - May closure	77,232	96,721	0	0	0	116,892	113,090	99,260	75,055	59,299	56,107	57,555	751,213
Mar - May closure and 2000 lb. trip limit	66,181	71,342	0	0	0	83,435	79,767	70,377	58,259	49,687	46,080	44,661	569,788

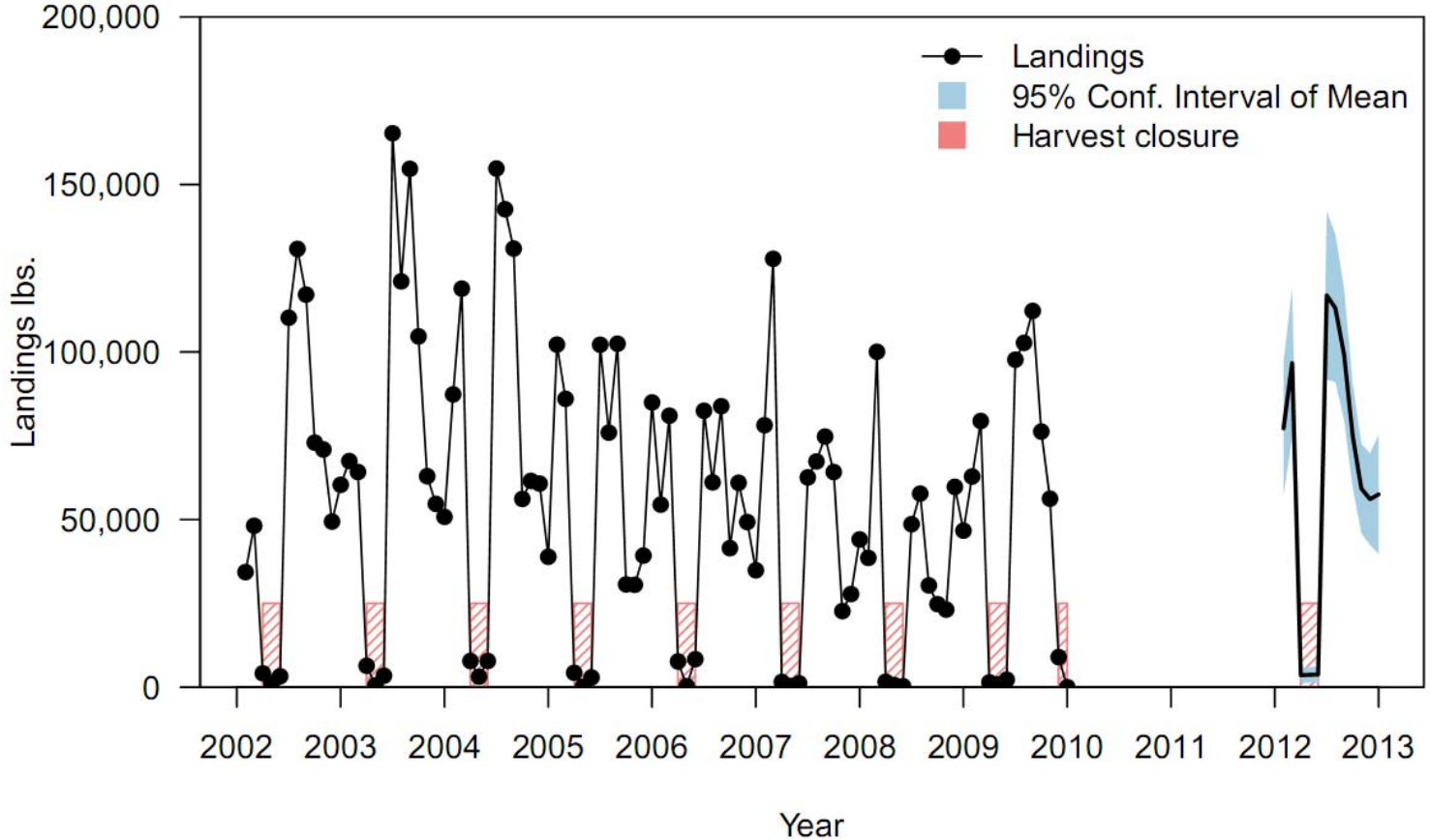

Figure 5. Historical (2002 – 2009) and projected (2012) commercial landings of greater amberjack in the Gulf of Mexico. Points represent landings by month. Low landings from March to May each year result from a seasonal prohibition of harvest. Blue shaded region represents 95% confidence interval of projected landings from a generalized additive model fit to the historical data.

Cells in yellow can be changed via drop down menu (click on yellow cells)

Projected season length: 274

Gulf of Mexico Amendment 35: Commercial Greater Amberjack projected catch based on alternative harvest strategies 2012

Variables that can be changed via drop down menu on cells:
Days closed
Trip limit

Greater amberjack projections using generalized additive model that explicitly accounted for seasonal closure, seasonality in the fishery, as well as the affect of the catch-per-unit-effort (CPUE) on the landings for a given year.
Developed by John T. Froeschke Ph.D. (Gulf Council Staff)

Model Inputs

Model Inputs	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Days in Month Open	31	29	31	30	31	30	31	31	30	31	30	31
Days closed	0	0	31	30	31	0	0	0	0	0	0	0
Day open	31	29	0	0	0	30	31	31	30	31	30	31
Trip limit	None	None	None	None	None	None	None	None	None	None	None	None
Projected monthly catch	**77,232**	**96,721**	**0**	**0**	**0**	**116,892**	**113,090**	**99,260**	**75,055**	**59,299**	**56,107**	**57,555**

Acceptable values
Days in Month
0: to max days in month
Trip limit
None, 2000, 1500, 1000, 500

Projection Results

Projected catch (lbs)	**751,213**
Upper Conf. Limit of mean (9	**837,781**
Lower Conf. Limit of mean (5	**664,645**

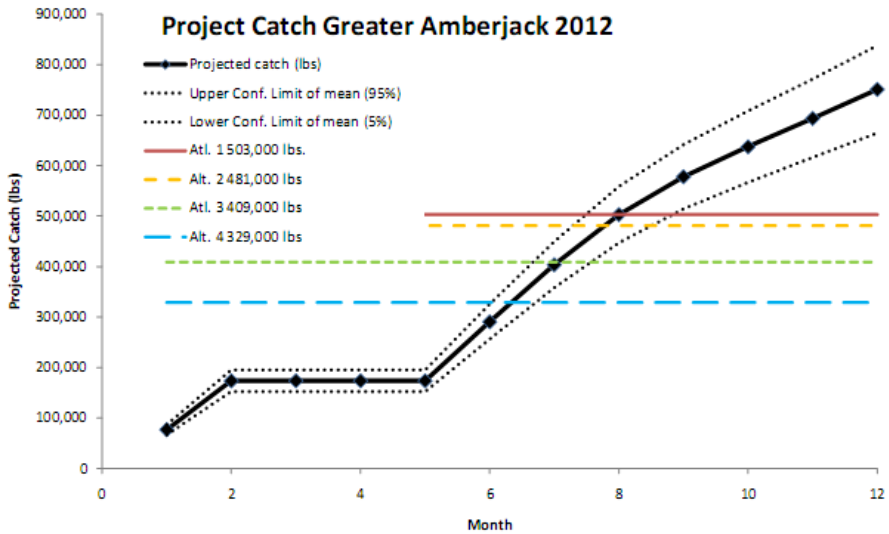

Figure 6. Screenshot for the commercial decision tool as configured to project a 3-month closed season in 2012.

12.2.3 Greater Amberjack Yield-per-recruit and Spawning Potential Ratio Analysis for the Gulf of Mexico

NOAA Fisheries Service
Southeast Regional Office
September 30, 2011

Introduction

A stock assessment of Gulf of Mexico greater amberjack determined the stock remained overfished and is undergoing overfishing (SEDAR 9 Update 2011). The Gulf of Mexico Fishery Management Council is considering management measures to reduce stock annual catch limit (equivalent to total allowable catch in Amendment 30A) of greater amberjack in order to rebuild the stock, including increasing the minimum size limit. The commercial minimum size limit is 36 inches fork length (FL) and has been in effect since implementation of Amendment 1 to the Reef Fish FMP in 1990. The current recreational minimum size limit of 30 inches FL was implemented in 2008 through Amendment 30A to the Reef Fish Fishery Management Plan. Greater amberjack begin maturing at 28 inches FL, reach 50% maturity at 34.7 inches FL, and reach full maturity at 40 inches FL (Murie and Parkyn 2008). Thus, the current recreational minimum size limit is below the size at 50% maturity. The following analyses evaluate the yield-per-recruit (YPR) and spawning potential ratios achieved at various recreational minimum size limits under a variety of fishing mortality rates. Two methods were considered: one that assumes knife-edge selectivity of greater amberjack at the minimum size limit, and another method that includes discard selectivity for sub-legal fish and harvest selectivity for legal-sized fish.

Method

YPR and SPR with knife-edge selectivity

Following Ault et al. (1998, 2008), a length-based computer algorithm (REEFS - Reef Ecosystem Exploited Fishery Simulator) that employed an age-independent continuous population model was used to determine population numbers and biomass at given lengths over time. The algorithm begins with determining the average number of fish at a given length ($\overline{N}(L)$):

$$\overline{N}(L) = \int_{L_r}^{L_\lambda} R(\tau - a)S(a)P(L|a)da. \qquad (1)$$

The equation is integrated from size at recruitment (L_r) to the largest size (L_λ). *R(τ-a)* is cohort recruitment lagged back to birth date, *S(a)* is survivorship to age *a*, and $P(L|a)$ is the conditional probability of being length *L* given the fish is age *a*.

Population biomass, $B(L|a,t)$, is the product of numbers-at-age, $N(L|a,t)$, times weight-at-age, $W(L|a,t)$, where $(L|a,t)$ represents the length (L) for a given age *a* at time *t*. Yield in weight (Y_w) was calculated as the fishing mortality rate multiplied by the exploited population biomass:

$$Y_W = F(t)\int_{L_c}^{L_\lambda} B(L|a,t)dL = F(t)\int_{L_c}^{L_\lambda} N(L|a,t)W(L|a,t)dL \qquad (2)$$

where *F(t)* is the fishing mortality rate applied to the exploited phase (L_c to L_λ) in year *t*. YPR was calculated by dividing the yield (Y_w) by the initial number of recruits. Spawning stock biomass (SSB), a measure of stock reproductive potential, was integrated between the minimum size of sexual maturity (L_m) and the maximum size (L_λ):

$$SSB(t) = \int_{L_m}^{L_\lambda} B(L|a,t)dL. \qquad (3)$$

SPR is a management benchmark that measures the stock's reproductive potential to produce optimum yields on a sustainable basis. SPR is calculated as

$$SPR = \frac{SSB_{exploited}}{SSB_{unexploited}} \qquad (4)$$

where $SSB_{exploited}$ is the spawning stock biomass associated with a fishing mortality rate and $SSB_{unexploited}$ is the spawning stock biomass with no fishing mortality.

REEFS model inputs came from the literature and are summarized in **Table 1**. Additional detail on the maturity of females by length is provided in **Figure 1** (Murie and Parkyn 2008).

Table 1- REEFS model input values for amberjack life history parameter estimates and the source of the information.

Parameter	Estimate	Unit	Definition	Source
t_0	-2.526	years	Age at zero length	Murie and Parkyn (2008)
K	0.144	per year	Brody growth coefficient	Murie and Parkyn (2008)
L_∞	1489	mm fl	Ultimate length	Murie and Parkyn (2008)
W_∞	39.73	kilograms	Ultimate weight	Murie and Parkyn (2008)
t_{max}	15	years	Maximum age	Murie and Parkyn (2008)
α	6.7E-08	dimensionless	Weight-length parameter	Murie and Parkyn (2008)
β	2.765	dimensionless	Weight-length parameter	Murie and Parkyn (2008)
L_m	34.7	inches	Length at 50% maturity	Murie and Parkyn (2008)
M	0.25	per year	Natural mortality rate	SEDAR 9 (2010)
$F_{current}$	0.609	per year	Current fishing mortality rate	SEDAR 9 (2010)
F_{msy}	0.333	per year	Fishing mortality rate maximizing sustainable yield	SEDAR 9 (2010)

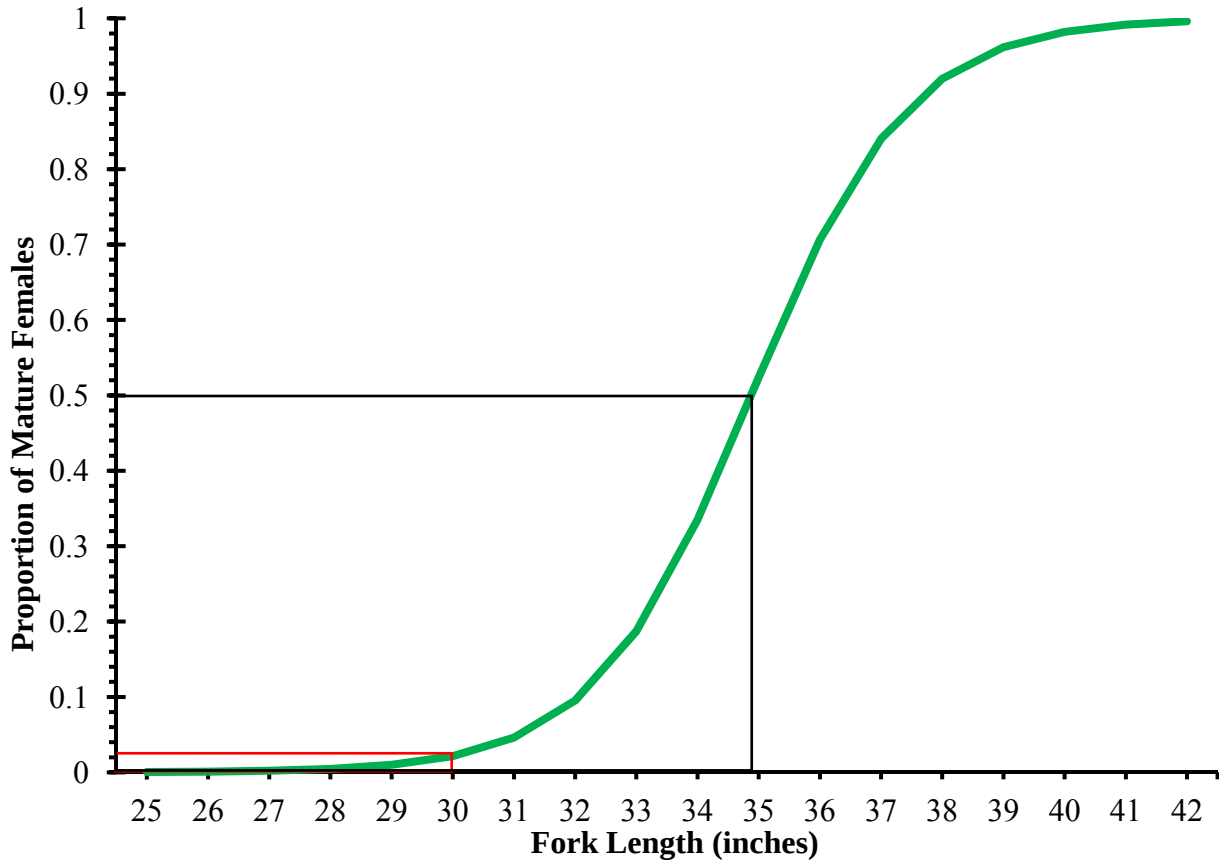

Figure 1.- Proportion of mature females by length for greater amberjack in the Gulf of Mexico. Data comes from Murie and Parkyn (2008). Black lines denote size at 50% maturity; red lines denote percent maturity at current recreational size limit.

YPR and SPR values were calculated using the current recreational minimum size limit (30 inches FL) with the current fishing mortality rate ($F_{current}$ = 0.609 y^{-1}) and the maximum sustainable yield fishing mortality rate (F_{msy} = 0.333 y^{-1}) provided from the most recent stock assessment (SEDAR 9 2010). YPR and SPR were also computed across a range of reasonable combinations of fishing mortality rates and minimum sizes.

YPR and SPR with discard and harvest selectivity

YPR and SPR were calculated using a modified version of a model originally developed by the Florida Fish and Wildlife Institute (FWRI-YPR). The original model was age-based and was converted to a length-based model using the age-length relationship described by Murie and Parkyn (2008; see **Table 1**). The lengths considered corresponded to ages ranging from 0 to 15 years. Natural mortality was set equal to 0.25, consistent with the 2010 greater amberjack update assessment (SEDAR 9 2010). Selectivity was assumed to be flat-topped and was based on headboat and for-hire observer data obtained from the Gulf States Marine Fisheries Commission and Florida Fish and Wildlife Conservation Commission. The observer data indicated that the frequency of greater amberjack caught increased from 10 to 20 inches, then remained stable or declined thereafter (**Figures 2A, B**). Discard selectivity was assumed to increase from 0 to 1

between 10 and 20 inches FL, then reduced from 1 to 0 within two inches of the specified minimum size limit (**Figure 3**). Harvest selectivity increased from 0 to 1 within 2 inches of the minimum size limit (**Figure 3**). All fish were assumed to be fully selected once reaching the minimum size limit.

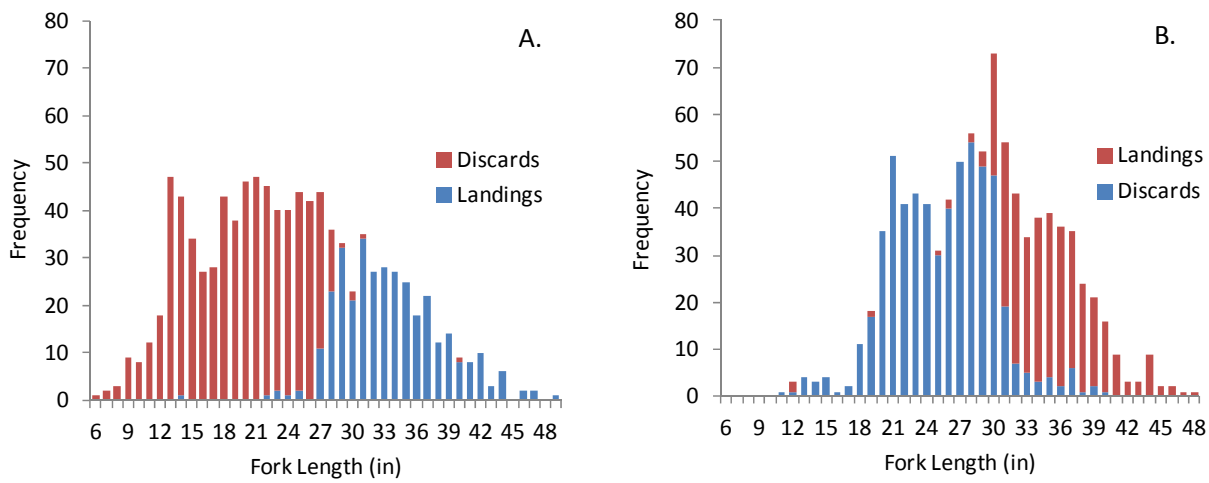

Figure 2.- Length frequency distribution for Gulf of Mexico greater amberjack landings and discards observed on **A)** headboats (2004-2007) and **B)** charter boats and headboats (2009-2011).

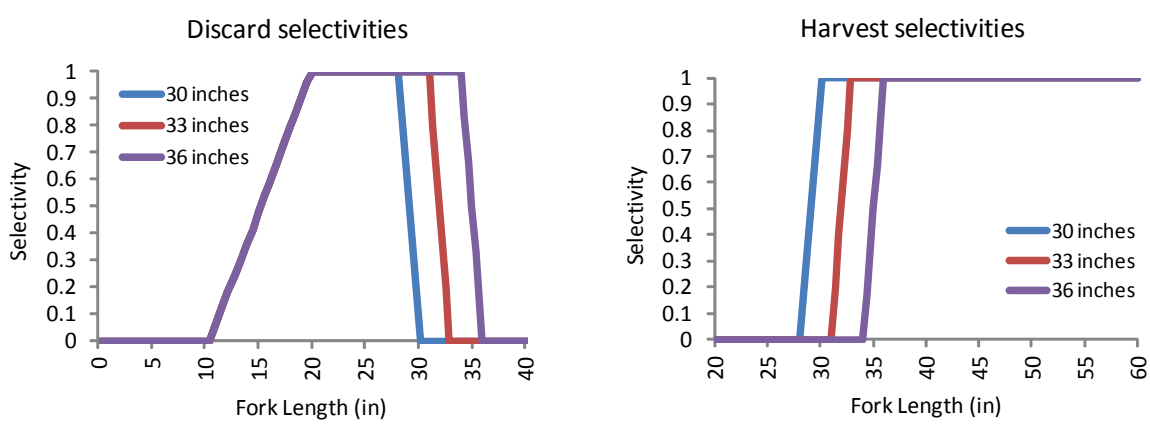

Figure 3.- Assumed harvest and discard selectivity used in the FWRI-YPR model to calculate YPR and SPR for various minimum recreational size limits.

Fishing mortality rates ranging from 0.0 to 1.0 were modeled in increments of 0.05. The following equations were used to model the fishing mortality associated with harvest ($F_{harvest}$) and discards ($F_{discards}$):

$$F_{harvest} = hs*F \quad (5)$$

$$F_{discards} = ds*F*r \quad (6)$$

where, *hs* is the selectivity at length for harvested fish for a particular size limit, *ds* is the selectivity at length for discarded fish for a particular size limit, *F* is the fishing mortality rate, and *r* is the discard mortality rate. Following SEDAR 9 (2010) the discard mortality rate was 20%. To estimate total fishing mortality (F_{total}) and total mortality (Z) for each length the following equations were used:

$$F_{total} = F_{harvest} + F_{discards} \quad (7)$$

$$Z = F_{total} + M \quad (8)$$

The number of survivors for each length (N_L) was estimated using the following equations:

$$N_L = R*\exp(-Z) \quad (9)$$

$$N\_bar = N_L*(1 - \exp(-Z))/Z \quad (10)$$

where, R is the proportion of initial recruitment to length *L*, N_L is the number of survivors for each length, and *N_bar* is the estimated number of survivors between length *L* and length *L + 1*.

Predicted weight (WW) was calculated with

$$WW = \alpha(Length)^{\beta}$$

where a and b are weight-length parameters given in **Table 1**.

YPR and SSB for each length were calculated using equations 11 and 12:

$$YPR = WW*F_{harvest}*N\_bar \quad (11)$$

$$SSB = WW*N\_bar*\%mature \quad (12)$$

Total YPR for each size limit across all lengths were calculated as the sum of YPR. Total SPR for each size limit across all lengths was calculated using equation 13:

$$SPR = SSB_{Fexploited}/SSB_{unexploited\ (F=0)} \quad (13)$$

Results

The REEFS model estimated YPR equal to 7.01 pounds whole weight for the 30 inch minimum size limit at $F_{current}$ (0.609 y^{-1}). YPR contours (**Figure 4**) revealed YPR at F_{msy} was maximized at 6.6 pounds. At F_{msy}, YPR decreased if the minimum size limit was greater than or less than 30 inches FL. YPR did increase for larger minimum size limits, but only when F was greater than $F_{msy,}$ which would result in overfishing. SPR at $F_{current}$ for the 30 inch FL minimum size limit was 10%, while SPR at F_{msy} for the 30 inch FL minimum size limit was 23% (**Figure 5**). Increasing the minimum size limit at F_{msy} would result in higher SPR.

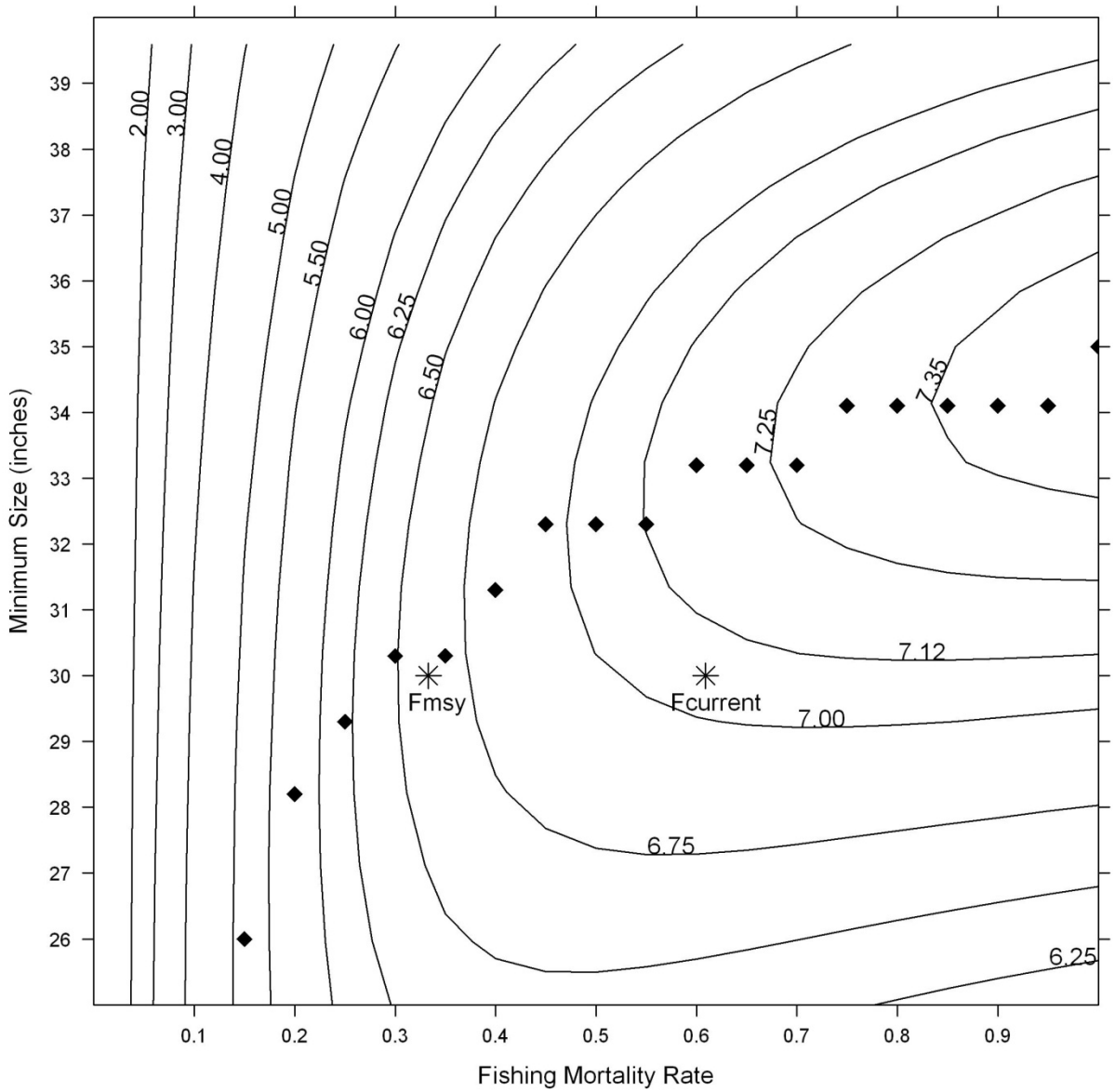

Figure 4.- REEFS model generated contours for yield-per-recruit in pounds for greater amberjack in the Gulf of Mexico obtained from combinations of fishing mortality rates and minimum sizes. The diamond points represent the maximum yield-per-recruit for each fishing mortality rate. The asterisks represent $F_{current}$ and F_{msy} (2011 Update Assessment of SEDAR 9) for the current 30 inch FL minimum recreational size limit.

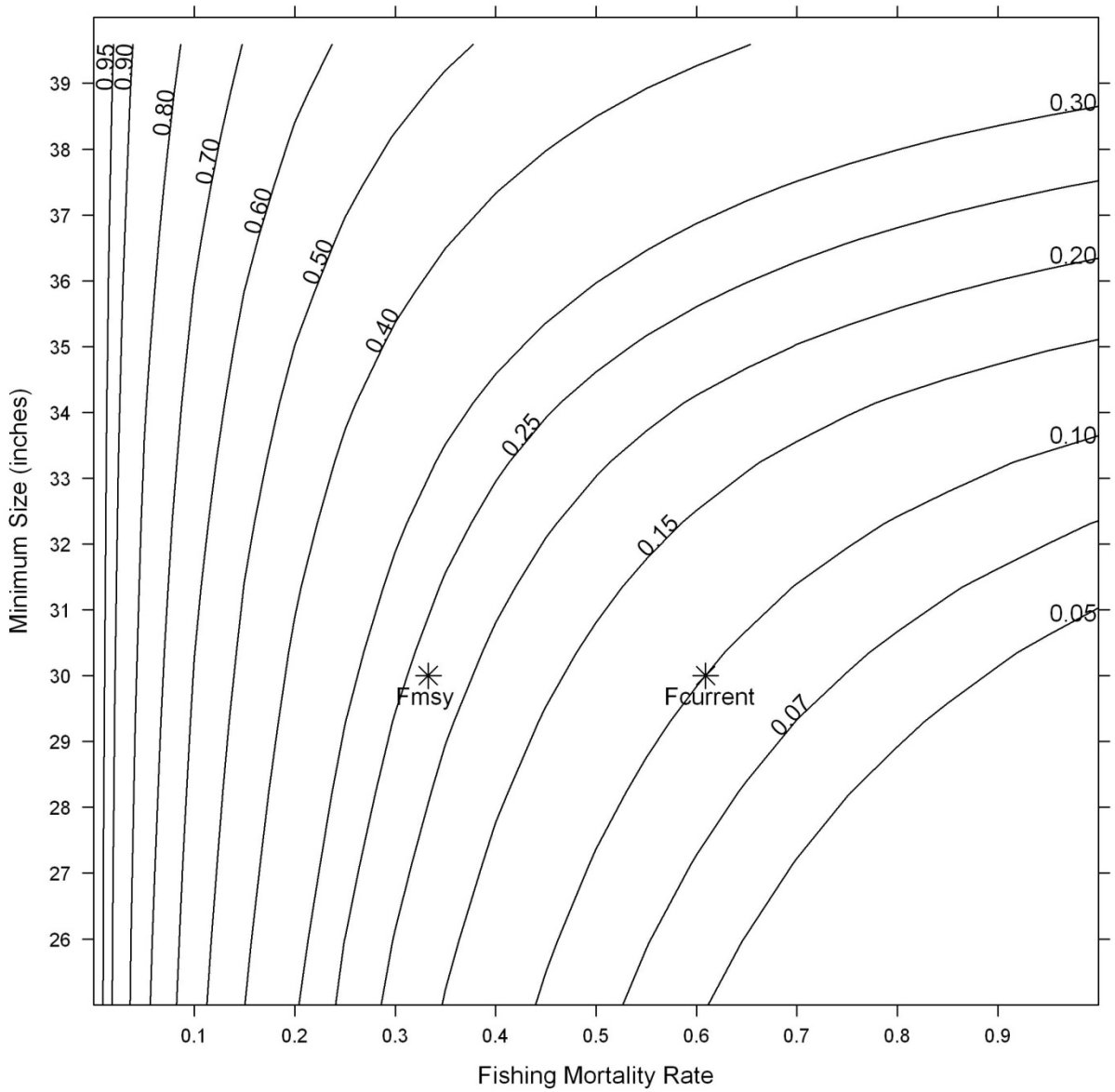

Figure 5- Spawning stock biomass ratio contours as functions of fishing mortality rate and minimum size. The asterisks represent $F_{current}$ and F_{msy} (SEDAR 9 2010) for the current 30 inch FL minimum recreational size limit.

The FWRI-YPR model generated similar results to the REEFS model. A size limit of 30 inches FL generated the highest YPR (6.1 pounds whole weight) (**Figure 6**). Conversely, the highest SPR was generated with a size limit of 36 inches FL (**Figure 7**). Unlike the REEFS model, YPR was projected to decline at fishing mortality rates above F_{msy}.

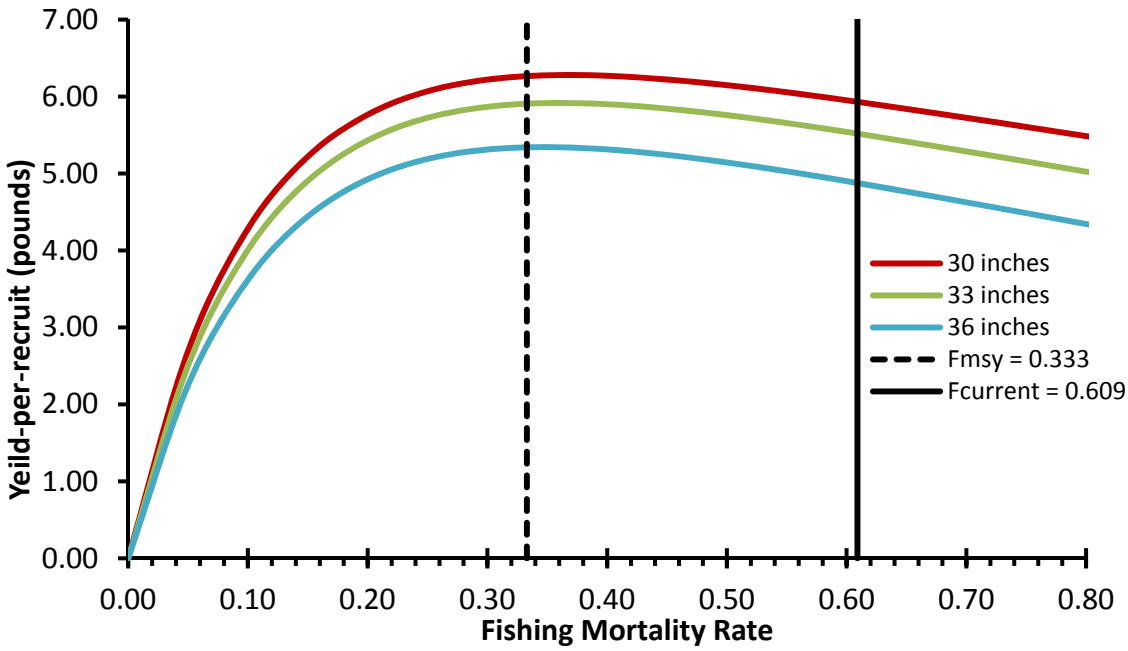

Figure 6.- FWRI-YPR model generated yield-per-recruit plotted against fishing mortality rates for three different minimum size limits. The black bar represents $F_{current}$ (0.609 y^{-1}) and the dashed line bar represents F_{msy} (0.333 y^{-1}) as estimated in SEDAR 9 (2010).

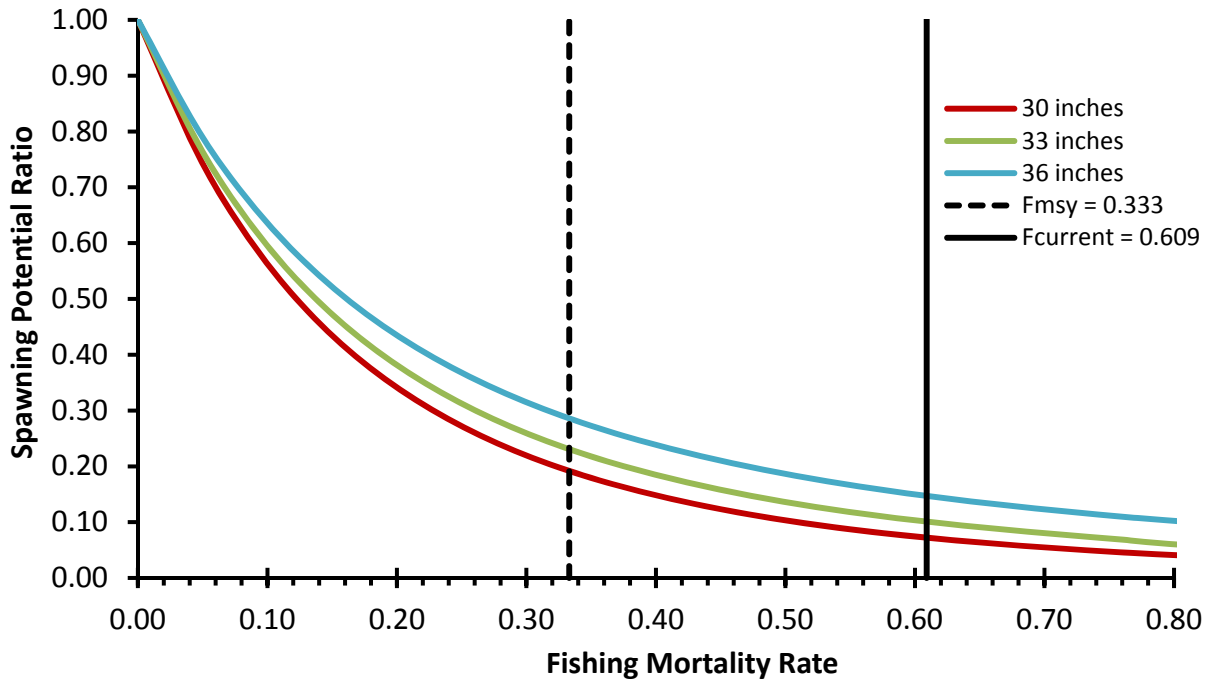

Figure 7.- FWRI-YPR model generated spawning potential ratios plotted against fishing mortality rates for three different minimum size limits. The black bar represents $F_{current}$ (0.609 y^{-1}) and the dashed line bar represents F_{msy} (0.333 y^{-1}) as stated in SEDAR 9 (2010).

A comparison of the YPR analysis results for the two different models is shown in **Figure 8** for a 30 inch FL minimum size limit. YPR generated by both models was comparable for fishing mortality rates less than 0.2 y^{-1}. At fishing mortality rates greater than 0.2 y^{-1}, YPR continued to increase under the REEFS model, but declined for the FWRI-YPR model. This difference was due to inclusion of discard selectivity in the FWRI-YPR model, which resulted in losses in potential yield and spawning biomass due to discarding of undersized fish.

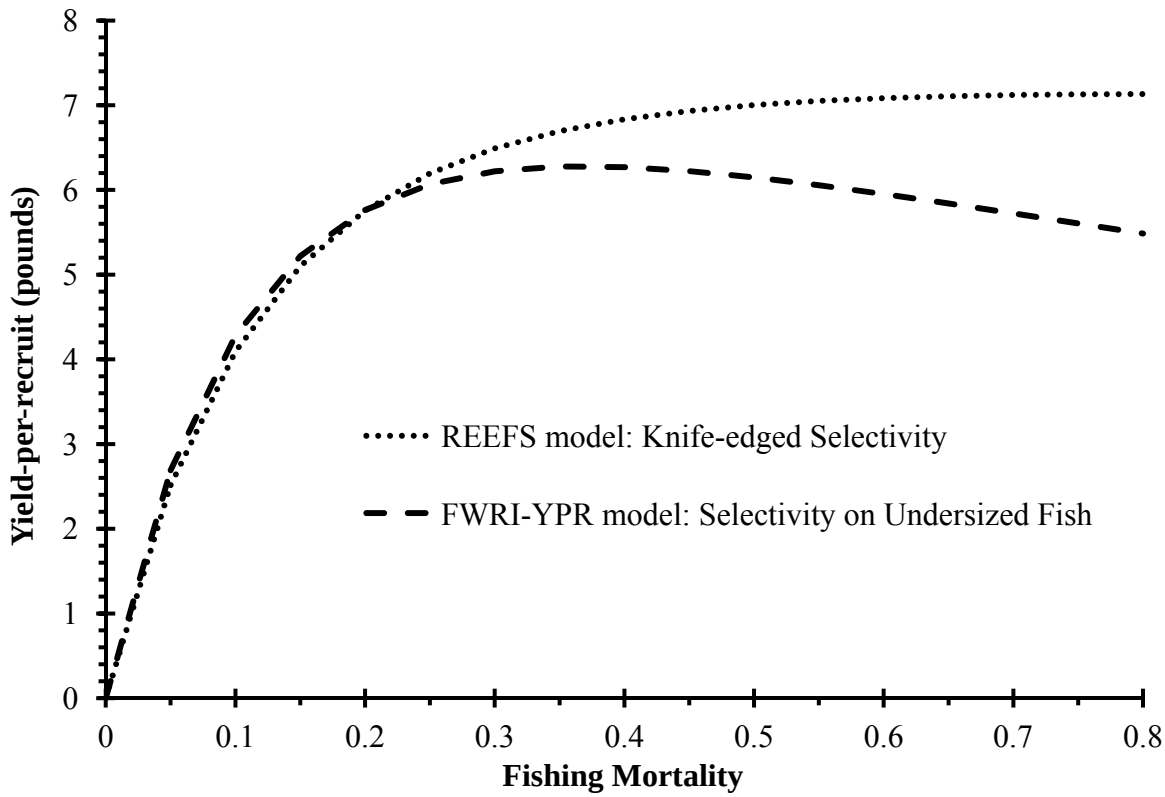

Figure 8.- Yield-per-recruit plotted against fishing mortality rates for a minimum size of 30 inches FL using the REEFS and FWRI-YPR models. The FWRI-YPR model applied selectivity to both discarded and harvested greater amberjack while the REEFS model applied knife-edged selectivity only to fish at or above the minimum size limit.

Discussion

Overall, both models used in this report yielded similar results despite different assumptions about selectivity. Both models indicated that there was a trade-off between YPR and SPR. If the management goal is to achieve a higher SPR, then increasing the minimum size limit would be beneficial; however, this would result in less YPR. If the management goal is to maximize YPR, then the current minimum size limit appears appropriate.

Applying selectivity and discard mortality to undersized fish (FWRI-YPR model) lowered the YPR achieved at fishing mortality rates exceeding 0.2 y^{-1} (**Figure 6**). The mortality of undersized fish due to release mortality reduced the potential harvest and yield from the

fishery. Given the length frequency distributions of greater amberjack discards and landings (**Figure 2**), application of selectivity and discard mortality to undersized fish is considered a more realistic assumption than knife-edged selection.

As with any analysis, results are limited by data inputs and assumptions. Both models assumed constant natural mortality across lengths. Natural mortality is likely highest at the smallest, youngest ages and declines with age and size. The analysis also assumed the population reached equilibrium with respect to fishing mortality; therefore, recruitment is constant. Lastly, for the FWRI-YPR model, it was assumed that selectivity followed a logistic relationship. This assumption is consistent with SEDAR 15 (2008), which assumed logistic selectivity for recreationally caught greater amberjack in the South Atlantic. Different assumptions about greater amberjack susceptibility to harvest and discard selectivity would affect YPR and SPR results. Additional sensitivity runs not presented herein were performed to evaluate what would happen to YPR and SPR if full discard selectivity was delayed from 20 to 28 inches FL. These sensitivity runs yielded similar results to the results presented herein; i.e., YPR was highest at 30 inches FL and increasing the minimum size limit resulted in higher SPR.

References

Ault, J.S., J.A. Bohnsack, and G.A. Meester. 1998. A retrospective (1979-1996) multispecies assessment of coral reef fish stocks in the Florida Keys. Fishery Bulletin 96(3): 395-414.

Ault, J.S., S.G. Smith, J. Luo, M.E. Monaco, and R.S. Appledoorn. 2008. Length-based assessment of sustainability benchmarks for coral reef fishes in Puerto Rico. Environmental Conservation. 35(3):221-231.

Murie, D.J. and D.C. Parkyn. 2008. Age, growth, and sex maturity of greater amberjack (Seriola dumerili) in the Gulf of Mexico. MARFIN Final Report: NA05NMF4331071. 52 pp.

Southeast Data, Assessment, and Review (SEDAR) 9 Stock Assessment Update Report. 2010. Gulf of Mexico Greater Amberjack. North Charleston, South Carolina. 178 pp.

Southeast Data, Assessment, and Review (SEDAR) 15 Stock Assessment Report 2, South Atlantic Greater Amberjack. 2008. 379 pp.

12.3 Public Hearing Locations and Summaries

Public hearings will be held at the following locations:

Monday, January 9, 2012
Hilton Tampa Airport Westshore
2225 North Lois Avenue, Tampa, FL 33607
(813) 877-6688

Wednesday, January 11, 2012
Crowne Plaza New Orleans Airport
2829 Williams Boulevard, Kenner, LA 70062
(504) 467-5611

Wednesday, January 11, 2012
Hilton Garden Inn Orange Beach Beachfront
23092 Perdido Beach Boulevard, Orange Beach, AL 36561
(251) 974-1600

Thursday, January 12, 2012
Four Points by Sheraton
940 Beach Boulevard, Biloxi, MS 39530
(228) 546-3100

Wednesday, January 11, 2012
Hilton Garden Inn Panama City
1101 U.S. Highway 231, Panama City, FL 32405
(850) 392-1093

Tuesday, January 17, 2012
Hilton San Luis, 5400 Seawall Boulevard, Galveston Island, TX 77551
(409) 744-5000

Wednesday, January 18, 2012
Plantation Suites & Conference Center
1909 Highway 361, Port Aransas, TX 78379
(361) 749-3866

Final Public Testimony Will be Heard on February 1, 2012
Renaissance Mobile Riverview Plaza Hotel
64 S. Water Street
Mobile, AL 36602
(251) 415-3074