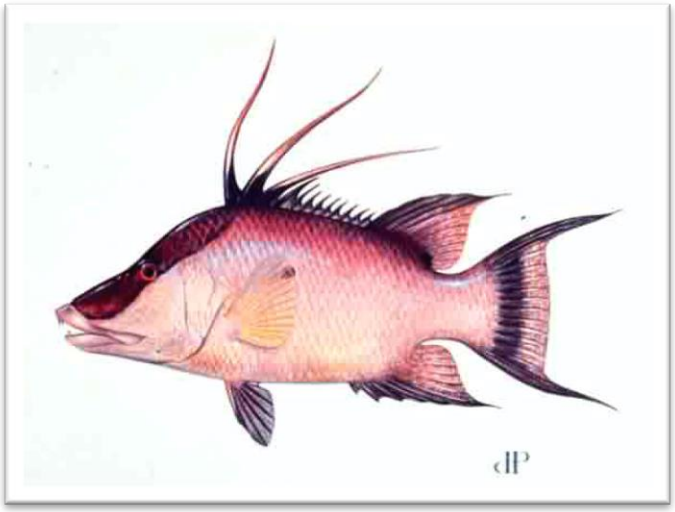
Amendment 37 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region



Modification to the hogfish fishery management unit, fishing level specifications for the two South Atlantic hogfish stocks, rebuilding plan for the Florida Keys/East Florida stock, and establishment/revision of management measures for both stocks

June 8, 2016

Draft Environmental Impact Statement Regulatory Impact Review Regulatory Flexibility Analysis
Fishery Impact Statement

A publication of the South Atlantic Fishery Management Council pursuant to National Oceanic and Atmospheric Administration
Award Number FNA15NMF4410010

Abbreviations and Acronyms Used in the FMP

ABC	acceptable biological catch
ACL	annual catch limits
AM	accountability measures
ACT	annual catch target
B	a measure of stock biomass in either weight or other appropriate unit
$\mathbf{B_{MSY}}$	the stock biomass expected to exist under equilibrium conditions when fishing at F_{MSY}
$\mathbf{B_{OY}}$	the stock biomass expected to exist under equilibrium conditions when fishing at F_{OY}
$\mathbf{B_{CURR}}$	The current stock biomass
CPUE	catch per unit effort
DEIS	draft environmental impact statement
EA	environmental assessment
EEZ	exclusive economic zone
EFH	essential fish habitat
F	a measure of the instantaneous rate of fishing mortality
$\mathbf{F_{30\%SPR}}$	fishing mortality that will produce a static SPR = 30%
$\mathbf{F_{CURR}}$	the current instantaneous rate of fishing mortality
$\mathbf{F_{MSY}}$	the rate of fishing mortality expected to achieve MSY under equilibrium conditions and a corresponding biomass of B_{MSY}
$\mathbf{F_{OY}}$	the rate of fishing mortality expected to achieve OY under equilibrium conditions and a corresponding biomass of B_{OY}
FEIS	final environmental impact statement
FMP	fishery management plan
FMU	fishery management unit
M	natural mortality rate
MARMAP	Marine Resources Monitoring Assessment and Prediction Program
MFMT	maximum fishing mortality threshold
MMPA	Marine Mammal Protection Act
MRFSS	Marine Recreational Fisheries Statistics Survey
MRIP	Marine Recreational Information Program
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	minimum stock size threshold
MSY	maximum sustainable yield
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OFL	overfishing limit
OY	optimum yield
RIR	regulatory impact review
SAFMC	South Atlantic Fishery Management Council
SEDAR	Southeast Data Assessment and Review
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
SIA	social impact assessment
SPR	spawning potential ratio
SSC	Scientific and Statistical Committee

Amendment 37 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Amendment 37)

Including a Draft Environmental Impact Statement (EIS)

Abstract: This Draft EIS is prepared pursuant to the National Environmental Policy Act to assess the environmental impacts associated with a regulatory action. In 2014, the Florida Fish and Wildlife Conservation Commission completed a stock assessment for hogfish. Based on genetic evidence, it was recommended that hogfish in the South Atlantic be managed as two stocks: Georgia through North Carolina (GA-NC) and Florida Keys/East Florida (FLK/EFL). Because of insufficient data, fishing level recommendations for the GA-NC stock were based on landings data only, and the status of that stock remains unknown. For the FLK/EFL stock, the stock assessment results showed the stock is *undergoing overfishing and is overfished* and, therefore, in need of a rebuilding plan.

The Draft EIS analyzes the impacts of a reasonable range of alternatives intended to evaluate: modifying the management unit for hogfish, establishing a rebuilding plan for the FLK/EFL stock to increase hogfish biomass to sustainable levels, specifying fishing levels for the GA-NC and FLK/EFL stocks of hogfish, and modifying or establishing management measures for both stocks of hogfish.

Responsible Agencies and Contact Persons

South Atlantic Fishery Management Council
4055 Faber Place, Suite 201
North Charleston, South Carolina 29405
IPT lead (myra.brouwer@safmc.net)

1-866-723-6210
843-769-4520 (fax)
www.safmc.net
Myra Brouwer

National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701
IPT lead (nikhil.mehta@noaa.gov)

727-824-5305
727-824-5308 (fax)
http://sero.nmfs.noaa.gov
Nikhil Mehta

Type of Action

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

Filing Dates with EPA

Notice of intent to prepare EIS published: July 31, 2015; 80 FR 45641
DEIS filed with EPA: 6/10/16
DEIS comment period ends: 8/1/16
EPA comments on DEIS: TBD

DEIS Table of Contents

Cover Sheet	II
Summary	S-1
Table of Contents	IV
Statement of Purpose and Need	S-4; 4
Proposed Actions and Comparison of Alternatives	8
Affected Environment	49
Environmental Consequences	87
Cumulative Effects	200
List of Preparers	212
List of Agencies, Organizations, and Persons to Whom a Copy of the EIS was Sent	214
Index	225
Appendix A (Considered But Rejected Alternatives)	A-1

Table of Contents

DEIS Table of Contents III
Table of Contents IV
List of Appendices XI
List of Tables XII
List of Figures XVI
Summary 1
Chapter 1. Introduction 1
1.1 What Actions Are Being Proposed in this Amendment? 1
1.2 Who is Proposing the Amendment? 1
1.3 Where is the Project Located? 2
1.4 Why are the South Atlantic Council and NMFS Considering Action? 3
1.5 What are Annual Catch Limits and Accountability Measures and Why are they Required? 5
1.6 How Does the South Atlantic Council Determine the Annual Catch Limits? . 5
1.7 How is the Council Modifying the Overfishing Definition for Hogfish and Other Assessed Snapper Grouper Species? 6
Chapter 2. Proposed Actions and Alternatives 8
2.1 Action 1. Modify the Fishery Management Unit (FMU) for hogfish 8
2.1.1 Comparison of Alternatives 9
2.2 Action 2. Specify Maximum Sustainable Yield (MSY) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 12
2.2.1 Comparison of Alternatives 12
2.3 Action 3. Specify Minimum Stock Size Threshold (MSST) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 15
2.3.1 Comparison of Alternatives 15
2.4 Action 4. Establish Annual Catch Limits (ACLs) for the Georgia through North Carolina (GA-NC) stock of hogfish 18
2.4.1 Comparison of Alternatives 18
2.5 Action 5. Establish a rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock of hogfish 21
2.5.1 Comparison of Alternatives 23
2.6 Action 6. Establish Annual Catch Limits (ACLs) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish 26
2.6.1 Comparison of Alternatives 26
2.7 Action 7. Establish a recreational Annual Catch Target (ACT) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 30
2.7.1 Comparison of Alternatives 31
2.8 Action 8. Increase the commercial and recreational minimum size limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 34
2.8.1 Comparison of Alternatives 34

2.9 Action 9. Establish a commercial trip limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish. 38
2.9.1 Comparison of Alternatives 38
2.10 Action 10. Modify and/or establish recreational bag limits for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 41
2.10.1 Comparison of Alternatives 41
2.11 Action 11. Establish a recreational fishing season for the Florida Keys/East Florida (FLK/EFL) stock of hogfish 43
2.11.1 Comparison of Alternatives 43
2.12 Action 12. Establish commercial and recreational accountability measures (AMs) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 45
2.12.1 Comparison of Alternatives 46
Chapter 3. Affected Environment 49
3.1 Habitat Environment 49
3.1.1 Inshore/Estuarine Habitat 49
3.1.2 Offshore Habitat 49
3.1.3 Essential Fish Habitat 51
3.1.4 Habitat Areas of Particular Concern 51
3.2 Biological and Ecological Environment 53
3.2.1 Fish Populations Affected by this Amendment 53
3.2.2 Other Species Affected 55
3.2.3 The Stock Assessment Process 55
3.2.4 Protected Species 56
3.2.4.1 ESA-Listed Sea Turtles 57
3.2.4.2 ESA-Listed Marine Fish 60
3.3 Economic Environment 61
3.3.1 Commercial Sector 61
3.3.2 Recreational Sector 66
3.4. Social Environment 75
3.4.1 Commercial Sector 75
3.4.2 Recreational Sector 79
3.4.3 Environmental Justice Considerations 82
3.5 Administrative Environment 84
3.5.1 The Fishery Management Process and Applicable Laws 84
3.5.1.1 Federal Fishery Management 84
3.5.1.2 State Fishery Management 85
3.5.1.3 Enforcement 86
Chapter 4. Environmental Consequences 87
Action 1. Modify the Fishery Management Unit (FMU) for hogfish 87
4.1.1 Biological Effects 87
4.1.2 Economic Effects 88
4.1.3 Social Effects 88
4.1.4 Administrative Effects 89

Action 2. Specify Maximum Sustainable Yield (MSY) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 91
4.2.1 Biological Effects 91
4.2.2 Economic Effects 92
4.2.3 Social Effects 92
4.2.4 Administrative Effects 93
Action 3. Specify Minimum Stock Size Threshold (MSST) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 94
4.3.1 Biological Effects 94
4.3.2 Economic Effects 96
4.3.3 Social Effects 97
4.3.4 Administrative Effects 97
Action 4. Establish Annual Catch Limits (ACLs) for the Georgia through North Carolina (GA-NC) stock of hogfish 99
4.4.1 Biological Effects 99
4.4.2 Economic Effects 105
4.4.3 Social Effects 106
4.4.4 Administrative Effects 108
Action 5. Establish a rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock of hogfish 109
4.5.1 Biological Effects 109
4.5.2 Economic Effects 111
4.5.3 Social Effects 111
4.5.4 Administrative Effects 112
Action 6. Establish Annual Catch Limits (ACLs) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish 114
4.6.1 Biological Effects 114
4.6.2 Economic Effects 122
4.6.3 Social Effects 122
4.6.4 Administrative Effects 124
Action 7. Establish a recreational Annual Catch Target (ACT) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 126
4.7.1 Biological Effects 126
4.7.2 Economic Effects 128
4.7.3 Social Effects 129
4.7.4 Administrative Effects 130
Action 8. Increase the commercial and recreational minimum size limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 131
4.8.1 Biological Effects 131
4.8.2 Economic Effects 143
4.8.3 Social Effects 146
4.8.4 Administrative Effects 148

Action 9. Establish a commercial trip limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 149
4.9.1 Biological Effects..... 149
4.9.2 Economic Effects 156
4.9.3 Social Effects 157
4.9.4 Administrative Effects 158
Action 10. Modify and/or establish recreational bag limits for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 159
4.10.1 Biological Effects..... 159
4.10.2 Economic Effects 165
4.10.4 Administrative Effects 166
Action 11. Establish a recreational fishing season for the Florida Keys/East Florida (FLK/EFL) stock of hogfish 168
4.11.1 Biological Effects..... 168
4.11.2 Economic Effects 171
4.11.3 Social Effects 172
4.11.4 Administrative Effects 173
Action 12. Establish commercial and recreational accountability measures (AMs) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish stocks of hogfish 174
4.12.1 Biological Effects..... 174
4.12.2 Economic Effects 176
4.12.3 Social Effects 177
4.12.4 Administrative Effects 178
Chapter 5. South Atlantic Council's Choice for the Preferred Alternatives..... 180
5.1 Modify the Fishery Management Unit (FMU) for hogfish 180
5.1.1 Snapper Grouper Advisory Panel (AP) Comments and Recommendations.... 180
5.1.2 Law Enforcement Advisory Panel (LE AP) Comments and Recommendations..... 180
5.1.3 Scientific and Statistical Committee (SSC) Comments and Recommendations..... 180
5.1.4 Public Comments and Recommendations 181
5.1.5 South Atlantic Council Choice for Preferred Alternative..... 181
5.2 Specify Maximum Sustainable Yield (MSY) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 182
5.2.1 Snapper Grouper AP Comments and Recommendations 182
5.2.2 Law Enforcement AP Comments and Recommendations..... 182
5.2.3 Scientific and Statistical Committee Comments and Recommendations .. 182
5.2.4 Public Comments and Recommendations 182
5.2.5 South Atlantic Council Choice for Preferred Alternative..... 183
5.3 Action 3. Specify Minimum Stock Size Threshold (MSST) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 184

5.3.1 Snapper Grouper AP Comments and Recommendations 184
5.3.2 Law Enforcement AP Comments and Recommendations..... 184
5.3.3 Scientific and Statistical Committee Comments and Recommendations .. 184
5.3.4 Public Comments and Recommendations 184
5.3.5 South Atlantic Council Choice for Preferred Alternative..... 185
5.4 Establish Annual Catch Limits (ACLs) for the Georgia through North Carolina (GA-NC) stock of hogfish..... 186
5.4.1 Snapper Grouper AP Comments and Recommendations 186
5.4.2 Law Enforcement AP Comments and Recommendations..... 186
5.4.3 Scientific and Statistical Committee Comments and Recommendations .. 186
5.4.4 Public Comments and Recommendations 186
5.4.5 South Atlantic Council Choice for Preferred Alternative..... 187
5.5 Establish a rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock of hogfish..... 188
5.5.1 Snapper Grouper AP Comments and Recommendations 188
5.5.2 Law Enforcement AP Comments and Recommendations..... 188
5.5.3 Scientific and Statistical Committee Comments and Recommendations .. 188
5.5.4 Public Comments and Recommendations 189
5.5.5 South Atlantic Council Choice for Preferred Alternative..... 189
5.6 Establish Annual Catch Limits (ACLs) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish 190
5.6.1 Snapper Grouper AP Comments and Recommendations 190
5.6.2 Law Enforcement AP Comments and Recommendations..... 190
5.6.3 Scientific and Statistical Committee Comments and Recommendations .. 190
5.6.4 Public Comments and Recommendations 190
5.6.5 South Atlantic Council Choice for Preferred Alternative..... 190
5.7 Establish a recreational Annual Catch Target (ACT) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 191
5.7.1 Snapper Grouper AP Comments and Recommendations 191
5.7.2 Law Enforcement AP Comments and Recommendations..... 191
5.7.3 Scientific and Statistical Committee Comments and Recommendations .. 191
5.7.4 Public Comments and Recommendations 191
5.7.5 South Atlantic Council Choice for Preferred Alternative..... 191
5.8 Increase the commercial and recreational minimum size limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 192
5.8.1 Snapper Grouper AP Comments and Recommendations 192
5.8.2 Law Enforcement AP Comments and Recommendations..... 192
5.8.3 Scientific and Statistical Committee Comments and Recommendations .. 192
5.8.4 Public Comments and Recommendations 193
5.8.5 South Atlantic Council Choice for Preferred Alternative..... 193
5.9 Establish a commercial trip limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 194
5.9.1 Snapper Grouper AP Comments and Recommendations 194
5.9.2 Law Enforcement AP Comments and Recommendations..... 194

5.9.3 Scientific and Statistical Committee Comments and Recommendations .. 194
5.9.4 Public Comments and Recommendations 195
5.9.5 South Atlantic Council Choice for Preferred Alternative 195
5.10 Modify and/or establish recreational bag limits for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish 196
5.10.1 Snapper Grouper AP Comments and Recommendations 196
5.10.2 Law Enforcement AP Comments and Recommendations 196
5.10.3 Scientific and Statistical Committee Comments and Recommendations 196
5.10.4 Public Comments and Recommendations 197
5.10.5 South Atlantic Council Choice for Preferred Alternative 197
5.11 Establish a recreational fishing season for the Florida Keys/East Florida (FLK/EFL) stock of hogfish 198
5.11.1 Snapper Grouper AP Comments and Recommendations 198
5.11.2 Law Enforcement AP Comments and Recommendations 198
5.11.3 Scientific and Statistical Committee Comments and Recommendations 198
5.11.4 Public Comments and Recommendations 199
5.11.5 South Atlantic Council Choice for Preferred Alternative 199
5.12 Establish commercial and recreational accountability measures (AMs) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish stocks of hogfish 200
5.12.1 Snapper Grouper AP Comments and Recommendations 200
5.12.2 Law Enforcement AP Comments and Recommendations 200
5.12.3 Scientific and Statistical Committee Comments and Recommendations 200
5.12.4 Public Comments and Recommendations 200
5.12.5 South Atlantic Council Choice for Preferred Alternative 200
Chapter 6. Cumulative Effects 201
6.1 Biological/Ecological/Socio-economic Effects 201
Chapter 7. List of Preparers 212
Chapter 8. List of Agencies, Organizations and Persons to whom a Copy of the EIS was Sent 214
Chapter 9. References 215
Chapter 10. Index 225
Appendix A. Considered But Rejected Alternatives A-1
Appendix B. Glossary B-1
Appendix C. History of Management C-1
Appendix D. Bycatch Practicability Analysis D-1
Appendix E. Regulatory Impact Review E-1
Appendix F. Regulatory Flexibility Analysis F-1
Appendix G. Other Applicable Laws G-1
Appendix H. Essential Fish Habitat and Ecosystem-based Management H-1
Appendix I. Fishery Impact Statement I-1

Appendix J. Other Effects (Unavoidable Adverse Effects, Relationship Between Short-Term Uses and Long-Term Productivity, Mitigation, Monitoring, and Enforcement Measures, and Irreversible and Irretrievable Commitments of Resources)..... J-1
Appendix K. Revised Projections K-1
Appendix L. Modeling the Combined Effects of Snapper-Grouper Amendment 37 Proposed Management Measures for Recreationally-Caught Hogfish.....L-1
Appendix M. Modeling the Combined Effects of Snapper-Grouper Amendment 37 Proposed Management Measures for Commercially Caught Hogfish M-1
Appendix N. Method for Specifying the FLK/EFL Hogfish OFL, ABC, and ACL in Numbers of Fish..... N-1

List of Appendices

Appendix A. Considered But Rejected Alternatives

Appendix B. Glossary

Appendix C. History of Management

Appendix D. Bycatch Practicability Analysis

Appendix E. Regulatory Impact Review

Appendix F. Regulatory Flexibility Analysis

Appendix G. Other Applicable Law

Appendix H. Essential Fish Habitat and Ecosystem-based Management

Appendix I. Fishery Impact Statement

Appendix J. Other Effects

Appendix K. Revised Projections

Appendix L. Description of Recreational Decision Tool

Appendix M. Description of Commercial Decision Tool

Appendix N. Methodology for Specifying the FLK/EFL Hogfish OFL, ABC, and ACL in Numbers of Fish

List of Tables

Table 2.2.1. Hogfish recommendations for the Florida Keys/East Florida stock of hogfish. Note: values are in metric tons. 13
Table 2.4.1. The South Atlantic Council's SSC ABC recommendation for the GA-NC stock of hogfish. 18
Table 2.4.2. Commercial and recreational ACLs for the GA-NC stock per the SSC's recommendation using the ORCS approach in the ABC Control Rule under **Sub-alternatives 2a-2c**. 20
Table 2.5.1. A summary of the various rebuilding scenarios (Alternatives 1-5) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish. 24
Table 2.6.2. Sector ACLs for the FLK/EFL stock for **Sub-alternatives 2a-2c** in **Action 6** and based on ABC projections from **Preferred Alternative 3** in **Action 5** where ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success. 28
Table 2.7.1. Recreational ACTs (in numbers) for the GA-NC stock of hogfish for each of the recreational ACL sub-alternatives in Action 4. 32
Table 2.7.2. Recreational ACTs (numbers of fish) under consideration for the FLK/EFL stock of hogfish based on **Preferred Sub-alternative 2b** under **Action 6**. 33
Table 3.2.1. Three-year South Atlantic anticipated takes sea turtles in the snapper grouper fishery. 59
Table 3.3.1. Number of valid or renewable South Atlantic commercial snapper grouper permits (2010 through 2014). 61
Table 3.3.2. Number of vessels, number of trips and landings (lbs gw) by year. 62
Table 3.3.3. Number of vessels and ex-vessel revenues by year (2014 dollars)*. 63
Table 3.3.4. Number of trips that landed hogfish in Georgia through North Carolina in excess of each proposed trip limit and number of vessels that took such trips (2010 through 2014 average). 63
Table 3.3.5. Number of trips that landed hogfish in the Florida Keys/East Florida in excess of each proposed trip limit and number of vessels that took such trips (2010 through 2014 average). 64
Table 3.3.6. Average annual business activity (2010 through 2014) associated with the commercial harvest of hogfish and the harvest of all species by vessels that landed hogfish. All monetary estimates are in 2014 dollars. 66
Table 3.3.6. Recreational landings (lbs gw) of hogfish, by area, 2010-2014. 66
Table 3.3.7. Number of South Atlantic for-hire snapper grouper permits, by homeport state, 2010-2014. 67
Table 3.3.8. Hogfish recreational target trips, by mode and state, 2010-2014*. 69
Table 3.3.9. Hogfish recreational catch trips, by mode and state, 2010-2014*. 70
Table 3.3.10. Headboat angler days and percent distribution by state (2010-2014). 71
Table 3.3.11. Headboat angler days and percent distribution by month (2010-2014). 71
Table 3.3.12. Summary of hogfish target trips (2010 through 2014 average) and associated business activity (2014 dollars)*. Output and value added impacts are not additive. 74
Table 3.4.1. Average 2012 Vessel Local Quotient by Community 77

Table 3.4.2. South Atlantic Communities Average Rank by For-hire Permits and For-hire Permits per Population. 79
Table 4.4.1. The South Atlantic's SSC ABC recommendation for the GA-NC stock of hogfish. 100
Table 4.4.2. Commercial and recreational landings (lbs ww) for the GA-NC stock of hogfish, 1986-2008. 101
Table 4.4.4. Commercial (lbs ww) and recreational landings (numbers of fish) for the GA-NC stock of hogfish, 2000-2014. 104
Table 4.4.5. Recreational and commercial sector ACLs with recreational consumer surplus (CS) and commercial ex-vessel expected values (in 2014 $) for the Georgia through North Carolina stock of hogfish. 106
Table 4.5.1. ABC under rebuilding plan Alternatives 2-5. Preferred alternative indicated in bold. 110
Table 4.6.1. Commercial and recreational landings (lbs ww) used to re-calculate hogfish sector allocations for FLK/EFL hogfish stock, 1986-2008. 115
Table 4.6.2. Sector ACLs for the FLK/EFL stock for **Sub-alternatives 2a-2c** in **Action 6** and based on ABC projections from **Preferred Alternative 3** in **Action 5** where ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success. 118
Table 4.6.3. Commercial (lbs ww) and recreational landings (numbers) for the FLK/EFL stock of hogfish, 2000-2014. 120
Table 4.6.4. Recreational landings (private and charter; numbers of fish) of hogfish in federal and state waters off Florida, 2010-2014. 120
Table 4.6.5. Commercial landings (lbs ww) of hogfish in federal and state waters off Florida, 2010-2014. 121
Table 4.6.6. Recreational and commercial sector ACLs with recreational consumer surplus (CS) and commercial ex-vessel expected values (in 2014 $) for the FLK/EFL stock of hogfish. 122
Table 4.7.1. Recreational ACTs (in pounds and numbers) for the GA-NC stock of hogfish for each of the Recreational ACL sub-alternatives in Action 4. 127
Table 4.7.2. Recreational ACTs (numbers of fish) under consideration for the FLK/EFL stock of hogfish based on **Preferred Sub-alternative 2b** under **Action 6**. 128
Table 4.7.3. The numbers of fish and consumer surplus values for the recreational ACTs proposed by the sub-alternatives of **Preferred Alternatives 2** and **3** based on preferred alternatives from Actions 4 and 6. Preferred sub-alternatives indicated in bold. 129
Table 4.8.1. Projected 2017 baseline monthly recreational landings in numbers of fish for A) GA-NC and B) FLK/EFL hogfish under status quo management measures with no seasonal or quota closures. Assumes MRIP landings uniformly distributed within waves. Projection based on mean 2012-2015 observed landings. 135
Table 4.8.2. Projected hogfish recreational landings, length of season and percent of ACL expected to be landed for the GA-NC stock under various minimum size limit alternatives for the ACLs proposed under Action 4. 136
Table 4.8.3. Projected recreational harvest (in numbers of fish) and season length for the FLK/EFL stock under various proposed minimum size limit and ACL alternatives. Preferred alternatives shown in bold. 137

Table 4.8.4. Projected reductions in recreational hogfish landings (in numbers of fish) for the GA-NC stock, by month, for headboat (HB), charter, and private modes, under proposed minimum size limits. Preferred alternative indicated in bold. 138
Table 4.8.5. Projected reductions in recreational hogfish landings (in numbers of fish) for the FLK/EFL stock, by month, for headboat (HB), charter, and private modes, under proposed minimum size limits. Preferred alternative indicated in bold. 139
Table 4.8.6. Percent reductions in commercial landings (in pounds whole weight) for GA-NC, by month, at under proposed minimum size limits. Preferred alternative indicated in bold..... 141
Table 4.8.7. Percent reductions in commercial landings (in pounds whole weight) for FLK/EFL, by month, under proposed minimum size limits. Preferred alternative indicated in bold..... 141
Table 4.8.9. Preferred Alternative 3 expected recreational CS and commercial ex-vessel revenue (2014 $) for hogfish landed from Florida Keys/Florida East Coast stock in the first year of implementation using the ACL from **Action 6**, **Preferred Sub-alternative 2b**..... 146
Table 4.9.1. Percent decrease in landings by gear and for all gear, for various commercial hogfish trip limits for GA-NC..... 152
Source: South Atlantic commercial logbook data, 2012-2014. 152
Table 4.9.2. Percent decrease in landings by gear and for all gear, for various commercial hogfish trip limits for FLK/EFL..... 152
Source: South Atlantic commercial logbook data, 2012-2014. 152
Table 4.9.3. Estimated landings (lbs ww) in first year of implementation (2017) for GA-NC under the various minimum size limit (Action 8) and trip limit (Action 9) combinations*..... 154
Table 4.9.4. Estimated commercial season length (days open) for the FLK/EFL stock of hogfish under ACL **Preferred Alt 2b (3,510 lbs ww)** in Action 6 and different minimum size limit (Action 8) and trip limit (Action 9) alternatives in first year of implementation (2017). Preferred alternatives indicated in bold..... 155
Table 4.9.5. Estimated commercial landings (lbs ww) for the FLK/EFL stock of hogfish under ACL **Preferred Alt 2b (3,510 lbs ww)** in Action 6 and different minimum size limit (Action 8) and trip limit (Action 9) alternatives in first year of implementation (2017). Preferred alternatives indicated in bold..... 155
Table 4.9.6. Expected percent of the ACL landed (**Action 2, Preferred Alternative 2b**) and commercial ex-vessel value (in 2014 $) of the trip limits proposed for the GA-NC stock..... 157
Table 4.10.1. Recreational landings (lbs ww) of hogfish by state in the South Atlantic during 2012-2014..... 159
Table 4.10.2. Estimated percentage decrease in recreational landings from decreasing the bag limit in the South Atlantic. Percentage decrease in landings is presented by mode for the GA-NC and FLK/EFL stocks were from 2012 through 2014..... 162
Table 4.10.3. Projected recreational landings for the GA-NC hogfish stock for various ACL (Action 4), preferred minimum size limit (17 inches FL) and estimated percent of ACL landed under proposed bag limit alternatives. Preferred alternatives indicated in bold..... 163

Table 4.10.4. Estimated landings and projected closure dates for recreational under proposed bag limit alternatives for the FLK/EFL hogfish stock at the preferred minimum size limit of 16 inches under Action 8 for all ACL alternative (Action 6). Preferred alternatives indicated in bold. 164
Table 4.10.5. Expected differences in recreational consumer surplus (in 2014 $) for **Alternative 2** proposed bag limits for the GA-NC stock. 165
Table 4.10.6. Expected differences in recreational consumer surplus (in 2014 $) for **Alternative 3** proposed bag limits for the FLK/EFL stock. 165
Table 4.11.1. Projected landings and percent of recreational ACL that would be landed under preferred ACL, minimum size limit (16 inches FL), and bag limit (1 fish/angler/day) alternatives for the recreational season alternatives in Action 11. Preferred alternatives indicated in bold. 170
Table 4.11.2. Expected differences in recreational consumer surplus (in 2014 $) for season lengths proposed by Action 11, **Preferred Alternative 2** and its sub-alternatives. 172

List of Figures

Figure 1.6.1. The relationship of the reference points to each other. 6
Figure 2.1.1. Proposed boundary Sub-alternatives 2a (gray), 2b (dotted) and **2c (Preferred)** (black) to separate the Florida Keys/East Florida stock of hogfish from the Gulf of Mexico stock 9
Figure 3.2.1. Two components of the biological environment described in this document. 53
Figure 3.3.1. Annual commercial landings of hogfish (lbs gw) by stock area. ... 62
Figure 3.4.1. Snapper grouper Unlimited and 225-pound trip limit permits 1999-2014. 75
Figure 3.4.2. Hogfish Pounds and Value Regional Quotient (RQ) for Top 15 Florida Communities. 76
Figure 3.4.3. Hogfish Pounds and Value Regional Quotient (RQ) for Top 15 GA-NC Communities. 76
Figure 3.4.4. Commercial Fishing Engagement and Reliance for Top 15 Florida Communities. 78
Figure 3.4.5. Commercial Fishing Engagement and Reliance for Top 15 Georgia-North Carolina Communities. 79
Figure 3.4.6. Recreational Fishing Engagement and Reliance for Top 15 Engaged Florida Communities. 81
Figure 3.4.7. Recreational Fishing Engagement and Reliance for Top 15 Engaged South Carolina and North Carolina Communities. 81
Figure 3.4.8. Social Vulnerability Indices for Selected Commercial and Recreationally Fishing Engaged Florida Communities. 83
Figure 3.4.9. Social Vulnerability Indices for Selected Commercial and Recreationally Fishing Engaged Communities in Georgia, South Carolina and North Carolina. 83
Figure 4.4.1. Annual recreational landings of hogfish (lbs ww) for Georgia, South Carolina, and North Carolina compared to the potential recreational ACLs under **Preferred Alternative 2**. 107
Figure 4.4.2. Annual commercial landings of hogfish (lbs ww) for Georgia, South Carolina, and North Carolina compared to the potential commercial ACLs under **Preferred Alternative 2**. 108
Figure 4.6.1. Annual recreational landings of FLK/EFL hogfish (lbs ww) for compared to the potential recreational ACLs under each sub-alternative under **Preferred Alternative 2**. 124
Figure 4.6.2. Annual commercial landings of FLK/EFL hogfish (lbs ww) for compared to the potential commercial ACLs under each sub-alternative under **Preferred Alternative 2**. 125
Figure 4.8.1. Size at transition (female to male) for hogfish in North Carolina (preliminary data). 132

Figure 4.8.2. Maturation of hogfish (*Lachnolaimus maximus*) from the eastern Gulf of Mexico and south Florida for (A) females by age, (B) females by size, (C) males by age, and (D) males by size. 133
Figure 4.8.3. Size distribution (fork lengths in inches) of landed hogfish reported by the Southeast Headboat Survey (2011-2013; red) and MRIP (2012-2014; blue) for (A) GA-NC and (B) FLK/EFL stocks of hogfish. 134
Figure 4.8.4. Size distribution in inches FL of hogfish landed commercially in: (A) GA-NC and (B) Florida Keys/East Florida, 2012-2014..... 140
Figure 4.9.1. Distribution of commercially harvested hogfish per trip (lbs ww) by year, from 2012 through 2014, in the South Atlantic..... 150
Figure 4.9.2. Distribution of commercially harvested hogfish per trip (lbs ww) by gear, from 2012 through 2014, in the South Atlantic..... 150
Source: Commercial logbook dataset accessed April 2, 2015. 150
Figure 4.9.3. Distribution of commercially harvested hogfish per trip (lbs ww) by area (GA-NC and FLK/EFL) from 2012 through 2014. 151
Figure 4.9.4. Annual commercial hogfish landings (lbs ww) by year and region. 153
Figure 4.10.1. Distribution of hogfish harvested per person from two recreational datasets (MRIP and Headboat) during 2012-2014, in the South Atlantic... 160
Figure 4.10.2. Distribution of hogfish harvested per vessel from two recreational datasets (MRIP and Headboat) during 2012-2014, in the South Atlantic... 161
Figure 4.11.1. Recreational landings (lbs ww) by two-month waves during 2012-2014 for the South Atlantic Region, including Monroe County, Florida..... 169

Summary

What Actions Are Being Proposed in this Amendment?

Amendment 37 includes 12 actions to address:

- Separating the hogfish fishery management unit into two stocks: Georgia through North Carolina (GA-NC stock) and Florida Keys/East Florida (FLK/EFL stock)
- Specification of Acceptable Biological Catch, Annual Catch Limits, and Optimum Yield for both stocks
- Rebuilding plan for the FLK/EFL stock
- Commercial and recreational management measures for both stocks
- Accountability Measures for both stocks

South Atlantic Fishery Management Council

- Responsible for conservation and management of fish stocks in the South Atlantic Region
- Consists of 13 voting members who are appointed by the Secretary of Commerce, 1 representative from each of the 4 South Atlantic states, the Southeast Regional Director of NMFS, and 4 non-voting members
- Responsible for developing fishery management plans and amendments under the Magnuson-Stevens Act; recommends actions to NMFS for implementation
- Management area is from 3 to 200 nautical miles off the coasts of North Carolina, South Carolina, Georgia, and east Florida through Key West.

Why are the South Atlantic Council and NMFS Considering Action?

The Florida Fish and Wildlife Conservation Commission completed a stock assessment for hogfish in 2014 (SEDAR 37 2014). Based on genetic evidence it was recommended that hogfish in the South Atlantic be managed as two stocks: Georgia through North Carolina (GA-NC) and Florida Keys/East Florida (FLK/EFL). SEDAR 37 was then evaluated with regard to fishing level recommendations. The South Atlantic Fishery Management Council's (South Atlantic Council) Scientific and Statistical Committee (SSC) developed catch level recommendations for the GA-NC stock using the Only Reliable Catch Stocks approach, as outlined in Level 4 of the South Atlantic Council's ABC control rule because the SSC did not consider assessment results (SEDAR 37 2014) for the GA-NC stock as sufficient to determine stock status and inform management decisions. Hence, the status of that stock is unknown. For the FLK/EFL stock, the SSC considered the benchmark assessment (SEDAR 37 2014) to represent the best available science and recommended it for use in management. The stock assessment results showed the stock is *undergoing overfishing and is overfished* and, therefore, is in need of a rebuilding plan.

Amendment 37 would specify the boundary between the FLK/EFL hogfish stock, managed by the South Atlantic Council, and the Gulf of Mexico hogfish stock, managed by the Gulf of Mexico Fishery Management Council. This demarcation would aid in enforcing regulations and properly tracking landings for each stock. Amendment 37 also includes actions to specify ABC, annual catch limits (ACLs), and optimum yield for the GA-NC and FLK/EFL stocks, establish a rebuilding plan for the FLK/EFL stock, and implement or modify management measures for both stocks to attain the desired level of harvest.

What Management Measures are Being Considered for Hogfish in Georgia and the Carolinas?

Because of insufficient data, the status of the GA-NC stock of hogfish is unknown. An ABC (level of total removals that is biologically feasible) has been estimated based on an approach that uses only landings data. The recommended ABC for this stock is 35,716 pounds whole weight (lbs ww). Estimates of maximum sustainable yield (MSY) and minimum stock size threshold (MSST) are obtained from a stock assessment and are therefore unknown for the GA-NC stock. Below are some of the management changes the South Atlantic Council is considering for this stock:

- The current preferred alternative defines the management unit from the Georgia/Florida state boundary northward to the North Carolina/Virginia state boundary – **Action 1**
- The current preferred alternative re-calculates sector allocations based on the current preferred redefined geographic boundary to maintain current apportionment - the re-calculated allocations would be 69.13% commercial and 30.87% recreational – **Action 4**
- The current preferred alternative specifies the commercial ACL beginning in 2017 (based on recalculated allocation and 95% ABC) = 23,456 lbs ww (the average of commercial landings from 2010 to 2014 is 20,454 lbs ww) – **Action 4**
- The current preferred alternative specifies the recreational ACL beginning in 2017 (based on re-calculated allocation and 95% ABC) = 988 fish (the average of recreational landings from 2010 to 2014 is 545 fish) – **Action 4**
- The current preferred alternative increases the minimum size limit (for both sectors) to 17 inches fork length (the current limit is 12 inches fork length) – **Action 8**
- The current preferred alternative would establish a commercial trip limit of 500 pounds gutted weight (lbs gw; currently there is no trip limit in federal waters) – **Action 9**
- The current preferred alternative establishes a recreational bag limit of 2 fish per person per day (currently there is no bag limit in federal waters off Georgia and the Carolinas) – **Action 10**

What Management Measures are Being Considered for Hogfish in Florida and the Florida Keys?

The stock assessment results showed that the hogfish stock in Florida and the Florida Keys is overfished and undergoing overfishing. When a stock is overfished the South Atlantic Council must put in place a rebuilding plan to bring the population back up to a sustainable level. The stock assessment produced estimates of MSY and MSST for this stock and the South Atlantic Council would adopt them through this amendment. In addition, the South Atlantic Council must decide how they plan to rebuild the stock (i.e., over what time period and at what level of fishing). Below are some of the management changes the South Atlantic Council is considering for this stock:

- The current preferred alternative defines the management unit from the Georgia/Florida state boundary to a line just south of Cape Sable, Florida, running due west (25^0 09'.000 North Latitude) – **Action 1**
- The current preferred alternative specifies a rebuilding plan that sets the ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success (this was the recommendation from the South Atlantic Council's Scientific and Statistical Committee) – **Action 5**
- The current preferred alternative re-calculates sector allocations based on the current preferred redefined geographic boundary to maintain current apportionment - the re-calculated allocations would be 9.63% commercial and 90.37% recreational – **Action 6**
- The current preferred alternative establishes a commercial ACL beginning in 2017 (based on recalculated allocation and 95% ABC) = 3,510 lbs ww (the average of commercial landings from 2010 to 2014 is 13,976 lbs ww) – **Action 6**
- The current preferred alternative establishes a recreational ACL beginning in 2017 (based on re-calculated allocation and 95% ABC) = 15,689 fish (the average of recreational landings from 2010 to 2014 is 121,329 fish) – **Action 6**
- The current preferred alternative increases the minimum size limit (for both sector) to 16 inches fork length (currently the limit is 12 inches fork length) – **Action 8**
- The current preferred alternative specifies a commercial trip limit of 25 lbs ww (currently there is no trip limit in federal waters) – **Action 9**
- The current preferred alternative decreases the recreational bag limit to 1 fish per person per day from the current 5 fish limit – **Action 10**
- The current preferred alternative establishes an annual recreational fishing season from July through October – **Action 11**

Purpose for Actions

The *purpose* of this amendment is to modify the management unit for hogfish, specify fishing levels based on Scientific and Statistical Committee recommendations for the Georgia-North Carolina and Florida Keys/East Florida stocks of hogfish, and modify or establish management measures. For the Florida Keys/East Florida stock of hogfish, establish a rebuilding plan to increase hogfish biomass to sustainable levels within a specified time period based on results of the recent stock assessment.

Need for Actions

The *need* for this amendment is to align the management boundaries for hogfish with the best available science (i.e., genetic information), and end overfishing and rebuild the Florida Keys/East Florida stock of hogfish while minimizing, to the extent practicable, adverse social and economic effects.

Chapter 1. Introduction

1.1 What Actions Are Being Proposed in this Amendment?

Amendment 37 includes 12 actions to address:

- Modification of the hogfish fishery management unit;
- Specification of acceptable biological catch (ABC), annual catch limit (ACL), and optimum yield (OY) for the Georgia-North Carolina (GA-NC) stock;
- Management and accountability measures (AMs) for the GA-NC stock;
- Specification of fishing levels and rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock; and
- Management measures and AMs for the FLK/EFL stock.

1.2 Who is Proposing the Amendment?

The South Atlantic Fishery Management Council (South Atlantic Council) develops the amendment and submits it to the National Marine Fisheries Service (NMFS) who, on behalf of the Secretary of Commerce, ultimately approves, disapproves, or partially approves the amendment, and implements the actions in the amendment through the development of regulations. NMFS is a line office of the National Oceanic and Atmospheric Administration. The South Atlantic Council and NMFS are also responsible for making this document available for public comment. The draft environmental impact statement (EIS) will be made available to the public during the scoping process, at public hearings, and in South Atlantic Council meeting briefing books. The final EIS/amendment will be published for public comment during the notice of availability and proposed rule stages of the rulemaking process. The public hearing draft and final EIS/amendment may be found online at: (insert link when available)

1.3 Where is the Project Located?

Management of the federal snapper grouper fishery located off the southeastern United States (South Atlantic) in the 3-200 nautical miles U.S. Exclusive Economic Zone is conducted under the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Snapper Grouper FMP, SAFMC 1983) (**Figure 1.3.1**). Hogfish is one of 59 species managed by the South Atlantic Council under the Snapper Grouper FMP.

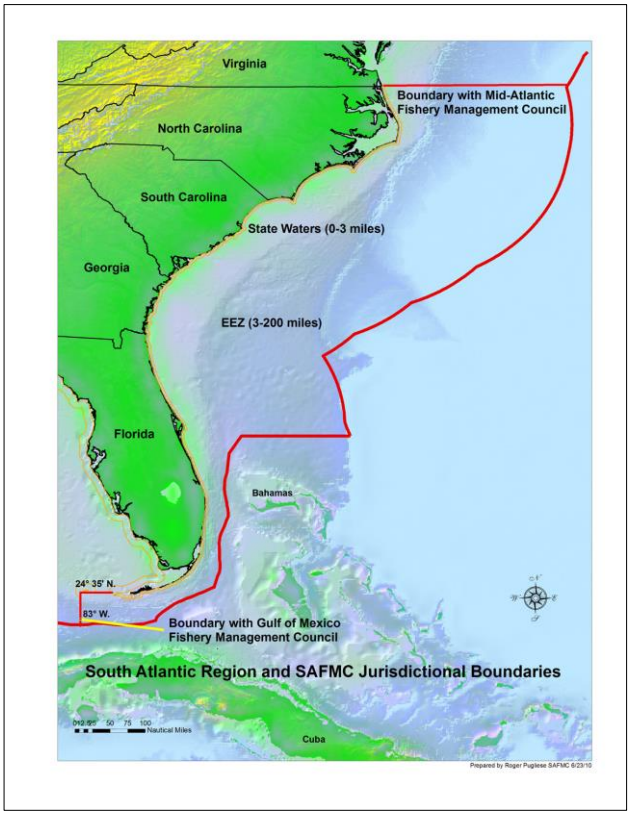


Figure 1.3.1. Jurisdictional boundaries of the South Atlantic Fishery Management Council.

1.4 Why are the South Atlantic Council and NMFS Considering Action?

The Florida Fish and Wildlife Conservation Commission completed a benchmark stock assessment for hogfish in 2014 (SEDAR 37 2014). The South Atlantic Council's Scientific and Statistical Committee (SSC) reviewed the assessment and provided fishing level recommendations in October 2014. The South Atlantic Council received the SSC's recommendations at their December 2014 meeting. Based on genetic evidence, the SSC supported treating hogfish in the South Atlantic as two stocks: Georgia through North Carolina (GA-NC) and Florida Keys/East Florida (FLK/EFL). SEDAR 37 (2014) was then evaluated with regard to fishing level recommendations. The SSC developed catch level recommendations for the GA-NC stock using the Only Reliable Catch Stocks approach, as outlined in Level 4 of the South Atlantic Council's ABC control rule because the SSC did not consider assessment results (SEDAR 37 2014) for the GA-NC stock as sufficient to determine stock status and inform management decisions. The Southeast Fisheries Science Center(SEFSC) concurred with this determination For the FLK/EFL stock, the SSC considered the benchmark assessment (SEDAR 37 2014) to represent the best available science and recommended it for use in management. The SEFSC concurred with this determination. The assessment results indicate the FLK/EFL stock is undergoing overfishing and is overfished. Therefore, the FLK/EFL stock is in need of a rebuilding plan.

Amendment 37 would address specifying the boundary between the FLK/EFL stock, managed by the South Atlantic Council, and the Gulf of Mexico stock, managed by the Gulf of Mexico Fishery Management Council. The amendment would also establish a boundary between the FLK/EFL stock and the GA-NC stock. These demarcations need to take place to aid in enforcing regulations. Amendment 37 also includes actions that would specify ABC, ACLs, and OY for the GA-NC and FLK/EFL stocks, establish a rebuilding plan for the FLK/EFL stock, and implement or modify management measures for GA-NC and FLK/EFL stocks to attain the appropriate level of harvest.

Purpose for Actions

The *purpose* of this amendment is to modify the management unit for hogfish, specify fishing levels based on the South Atlantic Fishery Management Council's Scientific and Statistical Committee recommendations for the Georgia-North Carolina and Florida Keys/East Florida stocks of hogfish, and modify or establish management measures. For the Florida Keys/East Florida stock of hogfish, this amendment would establish a rebuilding plan to increase hogfish biomass to sustainable levels within a specified time period based on results of the recent stock assessment.

Need for Actions

The *need* for this amendment is to align the management boundaries for hogfish with the best available science (i.e., genetic information), and end overfishing and rebuild the Florida Keys/East Florida stock of hogfish while minimizing, to the extent practicable, adverse social and economic effects.

1.5 What are Annual Catch Limits and Accountability Measures and Why are they Required?

A reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) in 2007 required implementation of new tools to end and prevent overfishing to achieve the optimum yield (OY) from a fishery. The tools are annual catch limits (ACLs) and accountability measures (AMs). An ACL is the level of annual catch of a stock that, if met or exceeded, triggers some corrective action. The AMs are the corrective action, and they are management controls to prevent ACLs from being exceeded and to correct overages of ACLs if they occur. Two examples of AMs include an in-season closure if catch is projected to reach the ACL and reducing the ACL by an overage of the catch that occurred the previous fishing year. Amendment 37 includes alternatives that would revise the current ACLs and AMs for hogfish.

Definitions

Annual Catch Limits (ACLs)
The level of annual catch (pounds or numbers) that triggers accountability measures to ensure that overfishing is not occurring.

Annual Catch Targets (ACTs)
The level of annual catch (pounds or numbers) that is the management target of the fishery, and accounts for management uncertainty in controlling the actual catch at or below the ACL.

Accountability Measures (AMs)
Management controls to prevent ACLs, including sector ACLs, from being exceeded, and to correct or mitigate overages of the ACL if they occur.

Allocations
A division of the overall ACL among sectors (e.g., recreational and commercial) to create sector ACLs.

Maximum Sustainable Yield (MSY)
Largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions.

Optimum Yield (OY)
The amount of catch that will provide the greatest overall benefit to the nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems.

Minimum Stock Size Threshold (MSST)
A status determination criterion. If current stock size is below MSST, the stock is overfished.

1.6 How Does the South Atlantic Council Determine the Annual Catch Limits?

ACLs are derived from the overfishing limit (OFL) and the ABC **(Figure 1.6.1)**. The South Atlantic Council's SSC determines the OFL from the stock assessment and the ABC (based on the South Atlantic Council/SSC's ABC control rule), and recommends those to the South Atlantic Council. The OFL is an estimate of the catch level above which overfishing is occurring. The ABC is defined as the level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL and any other scientific uncertainty.

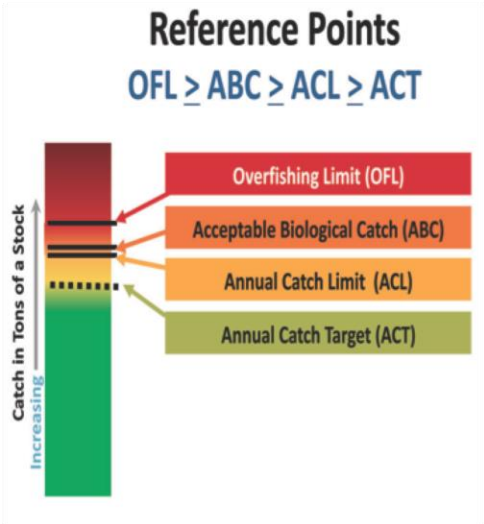


Figure 1.6.1. The relationship of the reference points to each other.

1.7 How is the Council Modifying the Overfishing Definition for Hogfish and Other Assessed Snapper Grouper Species?

The Magnuson-Stevens Act National Standard 1 (NS 1) Guidelines provide a definition of overfishing that allows overfishing to be determined in two ways, by a fishing mortality rate or by a level of catch:

50 C.F.R § 600.310 (e)(2)(i)(B)

> *Overfishing (to overfish) occurs whenever a stock or stock complex is subjected to a level of fishing mortality or annual total catch that jeopardizes the capacity of a stock or stock complex to produce maximum sustainable yield (MSY) on a continuing basis.*

The NS 1 Guidelines provide more detail about these two methods, and require that fishery management plans (FMP) describe which method will be used to determine an overfishing status:

50 C.F.R. § 600.310 (e)(2)(ii)(A)

> *Status Determination Criteria to determine overfishing status. Each FMP must describe which of the following two methods will be used for each stock or stock complex to determine an overfishing status.*
> *(1) Fishing mortality rate exceeds maximum fishing mortality threshold (MFMT). Exceeding the MFMT for a period of 1 year or more constitutes overfishing. The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate or F value), or as a function of spawning biomass or other measure of reproductive potential.*
> *(2) Catch exceeds the overfishing limit (OFL). Should the annual catch exceed the annual OFL for 1 year or more, the stock or stock complex is considered subject to overfishing.*

The OFL is defined as an annual level of catch that corresponds directly to the MFMT, and is the best estimate of the catch level above which overfishing is occurring.

MFMT Method - Overfishing occurring if fishing mortality exceeds the MFMT

This method is a more direct way than the OFL method (see below) of comparing the fishing rate to the maximum allowed rate of fishing, and it is less sensitive to recent fluctuations in recruitment. The estimates of fishing mortality are based on the maximum annual fishing mortality at any age. However, fishing mortality rates cannot be directly measured. They must be calculated as part of a stock assessment or assessment update, thus fishing mortality rates are only available for years when assessments are conducted.

The "current" fishing mortality rate for an assessed stock corresponds to the last year of data used in the assessment. Therefore, use of the "current fishing mortality" rate may not reflect the true status of the stock in years following a stock assessment, particularly if actions are taken to constrain effort and harvest.

OFL Method - Overfishing occurring if annual landings exceed the OFL

The OFL method is based on catch levels that are more easily understood by constituents than fishing mortality. Unlike fishing mortality rates, a determination can be made on an annual basis as soon as catch totals are available. However, the use of the OFL method might not be appropriate for stocks with highly variable recruitment that cannot be predicted and therefore incorporated into the forecast of stock condition on which the OFL is based.

Overfishing Definition for the FLK/EFL stock of hogfish and other assessed snapper grouper stocks in the South Atlantic region

Each of the two methods for determining overfishing has benefits and drawbacks with MFMT being a better estimate of overfishing status in a year in which a stock is assessed and OFL a better estimate of overfishing status in years when a current estimate of fishing mortality is not available. Therefore, the South Atlantic Council has approved using both the MFMT and OFL as metrics to determine the overfishing status of the following assessed snapper grouper species: red grouper (Amendment 24; SAFMC 2011b), yellowtail snapper (Regulatory Amendment 15; SAFMC 2013b), black sea bass (Regulatory Amendment 19; SAFMC 2013c), blueline tilefish (Amendment 32; SAFMC 2014c), gag and wreckfish (Regulatory Amendment 22; SAFMC 2015b), and snowy grouper (Regulatory Amendment 20; SAFMC 2015c). Through Amendment 37, the South Atlantic Council is adopting this overfishing determination methodology for the following assessed snapper grouper species: FLK/EFL stock of hogfish, vermilion snapper, mutton snapper, golden tilefish, red porgy, greater amberjack, black grouper, and gray triggerfish. For these species overfishing will be determined on an annual basis by the MFMT and OFL methods. The estimate of F_{MSY} (MFMT) for an assessed stock is a single value, while the corresponding OFL values will change with changes in the magnitude of the stock. If either the MFMT (during an assessment year) or the OFL method (during a non-assessment year) is exceeded, the stock will be considered to be undergoing overfishing.

Chapter 2. Proposed Actions and Alternatives

2.1 Action 1. Modify the Fishery Management Unit (FMU) for hogfish

Alternative 1 (No Action). There is a Gulf of Mexico stock and South Atlantic stock of hogfish separated at the jurisdictional boundary between the South Atlantic Fishery Management Council and the Gulf of Mexico Fishery Management Council:
The boundary coincides with the line of demarcation between the Atlantic Ocean and the Gulf of Mexico, which begins at the intersection of the outer boundary of the EEZ, as specified in the Magnuson-Stevens Act, and 83°00' W. long., proceeds northward along that meridian to 24°35' N. lat., (near the Dry Tortugas Islands), thence eastward along that parallel, through Rebecca Shoal and the Quicksand Shoal, to the Marquesas Keys, and then through the Florida Keys to the mainland at the eastern end of Florida Bay, the line so running that the narrow waters within the Dry Tortugas Islands, the Marquesas Keys and the Florida Keys, and between the Florida Keys and the mainland, are within the Gulf of Mexico.

Preferred Alternative 2. Modify the snapper grouper fishery management unit (FMU) to specify two separate stocks of hogfish: (1) a Georgia through North Carolina (GA-NC) stock from the Georgia/Florida state boundary to the North Carolina/Virginia state boundary, and (2) a Florida Keys/East Florida (FLK/EFL) stock from the Florida/Georgia state boundary south to:

Sub-alternative 2a. The South Atlantic/Gulf of Mexico Council boundary.
Sub-alternative 2b. The Monroe/Collier County line.
Preferred Sub-alternative 2c. A line just south of Cape Sable running due west (25^0 09'.000 North Latitude).

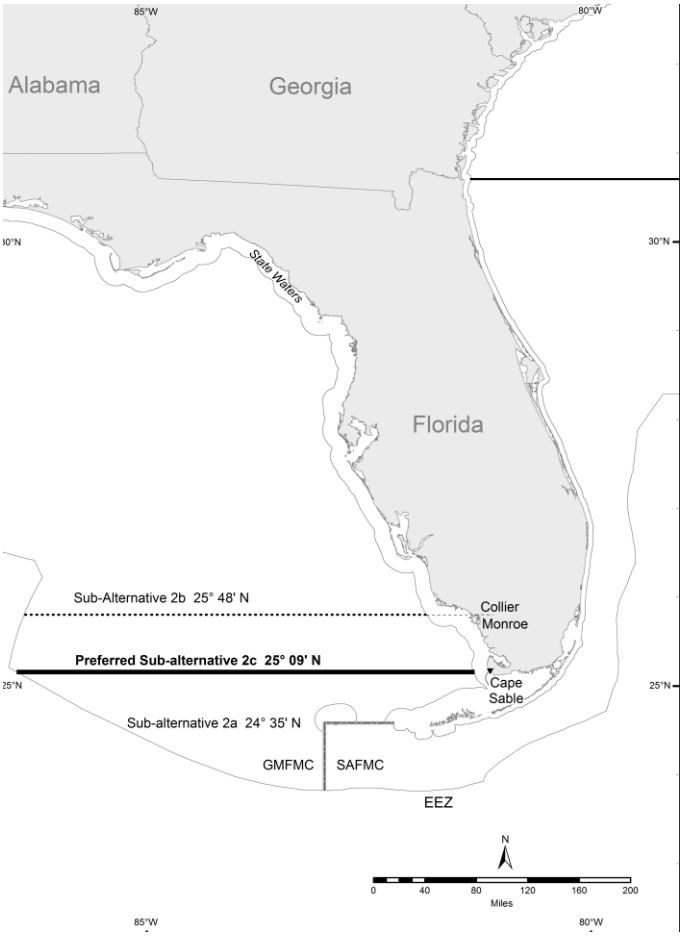


Figure 2.1.1. Proposed boundary Sub-alternatives 2a (gray), 2b (dotted) and **2c (Preferred)** (black) to separate the Florida Keys/East Florida stock of hogfish from the Gulf of Mexico stock .
Source: Amanda Frick, NMFS SERO

2.1.1 Comparison of Alternatives

Alternative 1 (No Action) would make no changes to specify separate stocks of hogfish within the snapper grouper FMU and would, therefore, fail to recognize the latest scientific information on those stocks. **Preferred Alternative 2** would specify the boundaries for the Georgia through North Carolina (GA-NC) stock of hogfish and the sub-alternatives would define the boundary between the Florida Keys/East Florida (FLK/EFL) stock of hogfish managed by the South Atlantic Fishery Management Council (South Atlantic Council), and the Gulf of Mexico stock managed by the Gulf of Mexico Fishery Management Council (Gulf Council). **Sub-alternative 2a** would use the jurisdictional boundary between the South Atlantic and Gulf Councils but would not fit the biological demarcation of the two stocks so that a portion of the FLK/EFL stock would remain within the Gulf Council's jurisdiction. **Sub-alternative 2b** uses the Monroe/Collier County line to differentiate the two stocks. This boundary would result in a better fit to the areas in which the two stocks are contained, but there could be negative law enforcement issues associated with different regulations for hogfish in the two areas nearest to

that boundary. The Monroe/Collier County line was used in the SEDAR 37 (2014) assessment to differentiate between the FLK/EFL stock of hogfish and that in the West Florida shelf. **Preferred Sub-alternative 2c** considers a point just south of Cape Sable as a starting point for the boundary line to differentiate the two stocks. According to local law enforcement officials, this would be a good demarcation point because it coincides with an existing boundary for Florida's Pompano Endorsement Zone and would, therefore, aid in simplifying regulations. Under **Preferred Sub-alternative 2c**, the Florida Keys would be managed exclusively by the South Atlantic Council. In addition, it is far enough north of the Florida Keys and far enough south of Naples and Marco Island, which would likely result in less fishing effort across this boundary, and in turn help reduce bycatch. In terms of biological effects, **Preferred Alternative 2** would be beneficial over **Alternative 1 (No Action)** since management would be aligned with the most recent scientific information on the hogfish resource. Seyoum et al. (2015) state that the two stocks split from each other along the "coastal area west of the Florida Everglades". Thus, from a biological standpoint, **Sub-alternatives 2a-2c (Preferred)** would result in similar biological effects..

Commercial landings for annual catch limit (ACL) monitoring by the Southeast Fisheries Science Center (SEFSC) and the National Marine Fisheries Service (NMFS) Southeast Regional Office are assigned to a region based on captain-reported catch area. Headboat landings for ACL monitoring are assigned to an area fished; for vessels in Monroe County, landings are assigned to a region based on port. Marine Recreational Information Program (MRIP) hogfish landings for recreational ACL monitoring are based on reported catch area, with Monroe County landings re-assigned (also known as "post-stratified") from the Gulf to the South Atlantic, consistent with decisions made in SEDAR 37 (2014). Minor changes to regional boundaries such as those being considered in **Action 1** may facilitate the enforcement of management regulations but would not impact approaches to ACL monitoring. Thus, ACL monitoring for hogfish would remain consistent with past approaches in regards to the assignment of landings to a region in Monroe County; these approaches are consistent with those used in SEDAR 37 (2014).

As described above, modifying the management unit for hogfish is not expected not alter the current harvest or use of the resource. Therefore, **Alternative 1 (No Action)** and **Preferred Alternative 2** (along with its sub-alternatives) are not expected to have any additional economic effects as modifications to the harvest of hogfish may be affected by other actions in this amendment.

Although additional effects would not usually be expected from retaining the current hogfish FMU under **Alternative 1 (No Action)**, this would be inconsistent with the stock assessment. **Preferred Alternative 2** would align hogfish management with updated scientific information. However, if changes in the quota or other management measures restricted access for fishermen harvesting hogfish in specific areas, there may be some negative social effects due to restricted access to the resource.

Any indirect effects from **Sub-alternatives 2a-2c (Preferred)** would be similar for all fishermen targeting hogfish, except for fishermen in the Florida Keys. Under **Sub-alternatives**

2a and **2b**, management of hogfish in the Florida Keys would be split between the Gulf and South Atlantic Councils' jurisdiction. This would pose problems for the Florida Keys fishermen, since some vessels fish in both jurisdictions and may be subject to separate sets of (present and future) fishing regulations. As stated previously, under **Preferred Sub-alternative 2c**, the Florida Keys would be managed exclusively by the South Atlantic Council. Thus, some additional benefits would be expected from **Preferred Sub-alternative 2c**, compared to **Sub-alternatives 2a** and **2b**.

Although the South Atlantic Council would manage the FLK/EFL stock of hogfish in the exclusive economic zone (EEZ) off the Florida Keys under either of the boundaries proposed in **Sub-alternatives 2b** and **2c (Preferred)**, the existing Gulf of Mexico rules and requirements for for-hire and commercial permits would remain in place in the Gulf of Mexico until changed through a future amendment. Under current regulations, vessels operating as for-hire or commercial vessels in the Gulf region[1] and catching reef fish species, including hogfish, are required to have the applicable federal Gulf Reef Fish Charter/Headboat Permit or a Gulf Reef Fish Commercial Permit. In the South Atlantic region, vessels operating as for-hire or commercial vessels and harvesting snapper grouper species, including hogfish, are required to have the applicable federal South Atlantic Snapper Grouper Charter/Headboat Permit, South Atlantic Snapper Grouper 225-pound Commercial Permit, or a South Atlantic Snapper Grouper Unlimited Commercial Permit. The operators of the federally permitted vessels would also follow the sale and reporting requirements associated with each permit with regards to hogfish. This means that federally permitted South Atlantic vessels do not need a Gulf federal permit to harvest FLK/EFL hogfish when fishing in the South Atlantic region, but would need a Gulf federal permit if they are fishing the FLK/EFL stock of hogfish in the Gulf Region.

[1] For the purpose of this paragraph, Gulf region refers to federal waters in the Gulf of Mexico seaward of Florida-Texas as defined in 16 USC § 302(a)(1)(E) and South Atlantic region refers to federal waters in the Atlantic ocean seaward of the states of Florida-North Carolina as defined in 16 USC §302(a)(1)(C). The boundary between the regions is defined in 50 CFR § 600.105(c).

2.2 Action 2. Specify Maximum Sustainable Yield (MSY) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). Currently, the maximum sustainable yield (MSY) equals the yield produced by F_{MSY}. $F_{30\%SPR}$ is used as the F_{MSY} proxy for hogfish in the South Atlantic.

Preferred Alternative 2. MSY equals the yield produced by F_{MSY} or the F_{MSY} proxy ($F_{30\%SPR}$). MSY and F_{MSY} are recommended by the most recent SEDAR/SSC.

Preferred Sub-alternative 2a. GA-NC stock of hogfish.

Preferred Sub-alternative 2b. FLK/EFL stock of hogfish.

Alternatives	Equation	F_{MSY}	MSY Values (lbs whole weight)
Alternative 1 (No Action)	MSY is not defined for the GA-NC stock or the FLK/EFL stock	unknown	unknown
Alternative 2 (Preferred)	**MSY equals the yield produced by F_{MSY} or the F_{MSY} proxy. MSY and F_{MSY} are recommended by the most recent SEDAR/SSC.**	**Sub-alt 2a: GA-NC = unknown Sub-alt 2b: FLK/EFL = 0.138**	**GA-NC = unknown FLK/EFL = 346,095**

2.2.1 Comparison of Alternatives

Maximum sustainable yield (MSY) is the largest long-term average catch that can be taken from a stock or stock complex under prevailing ecological and environmental conditions. MSY for snapper grouper species was initially specified in Amendment 11 (SAFMC 1998) to the Snapper Grouper FMP. For hogfish, Amendment 11 defined MSY as the yield produced when fishing at a rate that will produce MSY where $F_{30\%SPR}$ is used as the F_{MSY} proxy. At that time, MSY was unknown for hogfish due to lack of data. When a stock assessment is conducted, however, the model usually produces estimates of MSY. In the case of hogfish, the stock assessment (SEDAR 37 2014) only applies to the Florida Keys/East Florida (FLK/EFL) stock; hence, an estimate of MSY is available for the FLK/EFL stock but not the Georgia through North Carolina (GA-NC) stock. The South Atlantic Council needs to take action to adopt the new definition and value for MSY. It is the South Atlantic Council's intent that selecting a definition for MSY would allow for any subsequent revisions to that value when the stock

assessment is updated or a new assessment is performed without the South Atlantic Council having to take action. The South Atlantic Council's Scientific and Statistical Committee (SSC) endorsed the guidance provided by SEDAR 37 (2014) regarding MSY and, therefore, the two alternatives considered in this action provide the range of reasonable alternatives to setting the MSY for hogfish. **Preferred Alternative 2** and its **Sub-alternatives 2a** and **2b** would provide the South Atlantic Council with that option. SEDAR 37 (2014) produced estimates for F_{MSY} and the yield at F_{MSY} for the FLK/EFL stock. Those values are 0.138 and 346,095 pounds whole weight (lbs ww), respectively, and correspond to **Preferred Sub-alternative 2b (Table 2.2.1)**.

Table 2.2.1. Hogfish recommendations for the Florida Keys/East Florida stock of hogfish. Note: values are in metric tons.

Criteria	Deterministic	Probabilistic
Overfished evaluation	Yes, F/Fmsy= 1.593	1.440
Overfishing evaluation	Yes, SSB/MSST= 0.466	0.494
MFMT (Fmsy)	0.138	0.140
SSBmsy (male & female mature biomass, units not reported)	1,043.44	1,033.725
MSST (male & female mature biomass, units not reported)	856.664	848.688
MSY (1000 lb)	156.986	156.973
Y at 75% Fmsy (1000 lb)	Not reported	Not reported
ABC Control Rule Adjustment	22.5%	
P-Star (Prebuild)	27.5% (72.5%)	
OFL (1000 lb)		
ABC RECOMMENDATIONS: Projection results at the recommended P* were not available when this report was finalized. The projection report will be included as an appendix to this report.		

Source: SSC report, October 2014.

For the GA-NC stock of hogfish, the MSY value is unknown (**Preferred Sub-alternative 2a**) because an assessment could not be performed on the stock. However, should data become available to conduct an assessment on that stock, **Preferred Sub-alternatives 2a** and **2b** would allow the South Atlantic Council to adopt the new MSY value without having to prepare an additional amendment. **Preferred Sub-alternatives 2a** and **2b** would be biologically beneficial over **Alternative 1 (No Action)** as they would incorporate the latest biologically relevant information on the hogfish resource into management actions that would be better tailored to address the status of the resource.

As a benchmark, MSY sets off the parameters that condition subsequent management actions, and as such, defining MSY takes special significance. Of the alternatives considered in this action, **Preferred Sub-alternatives 2a** and **2b**, which address recommendations in the most recent SEDAR and by the SSC, have a better scientific basis. Hence, they provide a more solid ground for management actions that have economic implications.

Social effects of management specifications such as MSY for a stock would be associated with both the biological and economic effects of the MSY value in the rebuilding plan. An MSY level that reflects the best available information (**Preferred Sub-alternatives 2a** and **2b**) could

result in lower fishing mortality values in the rebuilding plan, and consequentially lower ACLs, which would likely affect fishermen targeting hogfish. However, an informed and relevant MSY (**Preferred Sub-alternatives 2a** and **2b**) is expected to contribute to the success of the rebuilding strategy, resulting in greater expected long-term benefits to the commercial fleet and recreational fishermen who target hogfish than **Alternative 1 (No Action)**.

2.3 Action 3. Specify Minimum Stock Size Threshold (MSST) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). Minimum stock size threshold (MSST) for hogfish in the South Atlantic is equal to SSB_{MSY} ((1-M) or 0.5, whichever is greater).

Alternative 2. MSST = SSB_{MSY} ((1-M) or 0.5, whichever is greater).
Sub-alternative 2a. For the GA-NC stock of hogfish.
Sub-alternative 2b. For the FLK/EFL stock of hogfish.

Alternative 3. MSST = 50% of SSB_{MSY}
Sub-alternative 3a. For the GA-NC stock of hogfish.
Sub-alternative 3b. For the FLK/EFL stock of hogfish.

Preferred Alternative 4. MSST = 75% of SSB_{MSY}
Preferred Sub-alternative 4a. For the GA-NC stock of hogfish.
Preferred Sub-alternative 4b. For the FLK/EFL stock of hogfish.

Alternatives	MSST Equation	M	MSST Values (lbs whole weight)
1 (No Action)	MSST = SSB_{MSY} ((1-M) or 0.5, whichever is greater).	0.25	unknown
2	MSST = SSB_{MSY} ((1-M) or 0.5, whichever is greater).	0.179	GA-NC = unknown FLK/EFL = 1,888,621
3	MSST = 50% of SSB_{MSY}	0.179	GA-NC = unknown FLK/EFL = 1,150,195
4 (Preferred)	**MSST = 75% of SSB_{MSY}**	**0.179**	**GA-NC = unknown** **FLK/EFL = 1,725,293**

2.3.1 Comparison of Alternatives

The minimum stock size threshold (MSST) is the biomass level below which a stock is considered overfished. MSST for hogfish in the South Atlantic is currently specified as MSST = SSB_{MSY}*((1-M) or 0.5, whichever is greater) where SSB_{MSY} is the spawning stock biomass at the MSY level and M is the natural mortality rate. MSST has not been specified for the Georgia through North Carolina (GA-NC) and Florida Keys/East Florida (FLK/EFL) stocks (**Alternative**

1 (No Action)). Regulatory Amendment 21 to the Snapper Grouper FMP (SAFMC 2014d), effective November 6, 2014, changed the definition for MSST for select snapper grouper species (red snapper, blueline tilefish, gag, black grouper, yellowtail snapper, vermilion snapper, red porgy, and greater amberjack) with low M from MSST = SSB_{MSY}*((1-M) or 0.5, whichever is greater) to MSST = 75% SSB_{MSY}. Other Snapper Grouper FMP amendments changed MSST to 75% SSB_{MSY} for snowy grouper, golden tilefish, and red grouper because natural mortality rate for those species is also very low (Amendments 15A, 15B, and 24, respectively). When the natural mortality rate is low (i.e., less than 0.25), even small fluctuations in biomass due to natural variations not related to fishing mortality may cause a stock to vary between an overfished or rebuilt condition. When a species is identified as overfished, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires that a plan be implemented to rebuild the stock. Redefining MSST for these species was done to help prevent unnecessary overfished designations when small drops in biomass are due to natural variation in recruitment or other environmental variables, and ensure that rebuilding plans are applied to stocks when truly appropriate. Natural mortality for the FLK/EFL stock of hogfish is estimated at 0.179, which is within the range of natural mortality values for species addressed in Regulatory Amendment 21, Amendment 15A, Amendment 15B, and Amendment 24 (0.08 – 0.23). **Alternative 1 (No Action)** is not a viable alternative unless hogfish continue to be managed as a single stock, which would be contrary to the latest scientific evidence. Under all the alternatives considered, the MSST for the GA-NC hogfish stock would remain unknown, thus biological effects would be the same. **Alternative 2** would retain the current MSST formula (SSB_{MSY} *(1-M) or 0.5, whichever is greater) but apply it to each of the two hogfish stocks. This alternative results in the highest MSST value for the FLK/EFL stock but incorporates natural mortality in the equation, thus risking an overfished determination when one is not needed, as explained above. **Alternative 3** would set MSST at 50% of the SSB_{MSY}, which would result in a lower threshold than that proposed under **Preferred Alternative 4** (75% SSB_{MSY}). The biological benefits of **Preferred Alternative 4** and its sub-alternatives, which would trigger a rebuilding plan when biomass is at 75% of SSB_{MSY}, would be expected to be greater than **Alternative 3**, which would have a lower biomass threshold for an overfished determination (50%SSB_{MSY}), because biomass would not be allowed to decrease as much as it would under **Alternative 3** before triggering implementation of a rebuilding plan. At their October 2013 meeting, the South Atlantic Council's SSC acknowledged that the 75%SSB_{MSY} approach is an acceptable choice for MSST, and they voiced no concern regarding the adoption of this management reference point for South Atlantic Council managed species.

With rebuilding taking place over a number of years, management actions and their economic consequences could change over time depending on a variety of factors, including the status of the stock and fishing conditions. **Alternative 3** would appear to be best from an economic standpoint, because it is unlikely to trigger restrictive rebuilding actions in the short term. One possible downside of this alternative is that once the stock is considered overfished, the required rebuilding actions could be very restrictive and potentially remain for quite some time. **Alternatives 1 (No Action)** and **2** lie on one end of the continuum for potential negative economic effects because they have the highest probability of triggering restrictive rebuilding actions. A possible mitigating factor with **Alternatives 1 (No Action)** and **2** is the possibility

that the required management actions would have adverse economic effects which would not last long. But a frequently varying regulatory regime would tend to de-stabilize business planning and fishing decisions, which could have potentially worse economic consequences. The economic implications of **Preferred Alternative 4** and its sub-alternatives may be characterized as falling between **Alternatives 1 (No Action)/2** and **Alternative 3**.

Social effects of revised biological parameters such as MSST for a stock would be associated with both the biological and economic effects of the modified MSST value. Under all alternatives, fishermen could be affected by future restricted access to a specific species due to an overfished designation, which could have negative effects on associated fishing businesses and communities. Although **Preferred Alternative 4** and its sub-alternatives present a more restrictive approach to set the MSST than **Alternative 3**, they would also be more likely to trigger a rebuilding plan than **Alternative 3**, which may avoid negative biological impacts to the stock.

2.4 Action 4. Establish Annual Catch Limits (ACLs) for the Georgia through North Carolina (GA-NC) stock of hogfish

Alternative 1 (No Action). The current acceptable biological catch (ABC) for the entire stock of hogfish is 134,824 lbs ww and ACL = optimum yield (OY) = ABC. The commercial ACL = 49,469 lbs ww (36.69%) and the recreational ACL = 85,355 lbs ww (63.31%).

Preferred Alternative 2. Establish an ACL for the GA-NC stock. Specify commercial and recreational ACLs using re-calculated sector allocations based on proposed modifications to the management unit (69.13% commercial and 30.87% recreational). The ABC for the GA-NC stock = 35,716 pounds whole weight (lbs ww).

Sub-alternative 2a. ACL = OY = ABC

Preferred Sub-alternative 2b. ACL = OY = 95% ABC

Sub-alternative 2c. ACL = OY = 90% ABC

2.4.1 Comparison of Alternatives

Because the SEDAR 37 (2014) stock assessment was not deemed applicable to the GA-NC stock of hogfish, the South Atlantic Council's Scientific and Statistical Committee (SSC) applied Level 4 of the ABC Control Rule to arrive at an acceptable biological catch (ABC) recommendation for the Georgia through North Carolina (GA-NC) stock of hogfish. Based on methodology in *Calculating Acceptable Biological Catch for Stocks That Have Reliable Catch Data Only* (Only Reliable Catch Stocks – ORCS) (Berkson et al. 2011), the South Atlantic Council's SSC recommended an approach to compute the ABC for unassessed stocks with only reliable catch data. The approach involves selection of a "catch statistic", a scalar to denote the risk of overexploitation for the stock, and a scalar to denote the management risk level. The SSC provides the first two criteria for each stock, and the South Atlantic Council specifies their risk tolerance level for each stock. **Table 2.4.1** presents the values and scalars used in the calculation.

Table 2.4.1. The South Atlantic Council's SSC ABC recommendation for the GA-NC stock of hogfish.

Statistic	Value
Risk of Overexploitation	Moderately High
Associated Scalar	1.25
Range of Years	1999-2007
Year of Max Landings	2006
Catch Statistic	40,818 lbs ww
Council Risk Scalar (Preferred from Am 29)	0.7
Proposed ABC	**35,716 lbs ww**

Table 2.4.2 shows the proposed total ACL and sector ACLs for the GA-NC hogfish stock. Sector allocations differ from those under **Alternative 1 (No Action)** because splitting the stock renders it necessary to re-calculate sector allocations using the appropriate landings for the relevant geographic area. That is, only landings from Georgia and the Carolinas were used to derive sector allocations based on the existing allocation formula whereas sector allocations under **Alternative 1 (No Action)** were computed using commercial and recreational landings for the four South Atlantic states. The recreational ACL is presented in numbers of fish for each proposed alternative. The South Atlantic Council prefers specifying the recreational ACL in numbers of fish and the commercial ACL in pounds. Their rationale is that recreational landings are already tracked in numbers of fish while commercial landings are tracked in pounds. Because this amendment also considers changing the minimum size limit for the GA-NC stock of hogfish, specifying the recreational ACL in pounds could potentially increase the risk of exceeding the ABC in pounds because larger fish are heavier. However, if the ACL were to be specified in numbers, there would be a lower risk of exceeding the recreational ACL due to an increase in the minimum size limit. The South Atlantic Council also discussed the high percent standard error (PSE) associated with the recreational data and the fact that there were very few intercepts for recreational effort using spear. For the GA-NC stock of hogfish, the recreational ACL was converted from pounds to numbers of fish using an average recreational weight of 10.60 lbs ww per fish.

Hogfish are currently managed as a unit stock within the South Atlantic Council's area of jurisdiction. Hence, **Alternative 1 (No Action)** specifies the ABC, ACLs and sector allocations (based on the South Atlantic Council's approved allocation formula) for the entire stock. Since **Action 1** proposes to split the hogfish stock into two based on recent genetic evidence, **Alternative 1 (No Action)** is not a viable alternative as it would ignore the latest scientific information on hogfish stock structure. The SEDAR 37 (2014) stock assessment was not deemed applicable for the GA-NC portion of the stock, therefore **Preferred Alternative 2** and its sub-alternatives propose ABCs based on the South Atlantic Council's ABC control rule for stocks with only reliable catch (ORCS approach). **Sub-alternatives 2b (Preferred)** and **2c** would have a greater positive biological effect than **Sub-alternative 2a** because they would create a buffer between the ACL/OY and ABC, with **Sub-alternative 2c** setting the most conservative ACL at 90% of the ABC (**Table 2.4.2**). Creating a buffer between the ACL/OY and ABC would provide greater assurance that overfishing is prevented, and the long-term average biomass is near or above SSB_{MSY}. However, the South Atlantic Council's ABC control rule takes into account scientific uncertainty. The Magnuson-Stevens Act National Standard 1 (NS1) guidelines indicate an ACL may typically be set very close to the ABC. Setting a buffer between the ACL and ABC would be appropriate in situations where there is uncertainty in whether or not management measures are constraining fishing mortality to target levels. An annual catch target (ACT), which is not required, can also be set below the ACL to account for management uncertainty and provide greater assurance overfishing does not occur.

Table 2.4.2. Commercial and recreational ACLs for the GA-NC stock per the SSC's recommendation using the ORCS approach in the ABC Control Rule under **Sub-alternatives 2a-2c**.

Sub-alternative	Total ACL (lbs)	Rec ACL (lbs)	Rec ACL (numbers)	Comm ACL (lbs)
2a	35,716	11,026	1,040	24,690
2b (Preferred)	**33,930**	**10,474**	**988**	**23,456**
2c	32,144	9,923	936	22,221

Note: Council prefers to specify recreational ACL in numbers and commercial ACL in lbs. Recreational ACL converted from pounds to numbers using an average weight of 10.60 lbs ww per fish

Compared to average recreational landings from 2010-2014 (658 fish; **Table 4.4.4**) the recreational ACL for hogfish in Georgia and the Carolinas under **Preferred Sub-alternative 2b** (988 fish) is not expected to be met. For the commercial sector, the preferred commercial ACL of 23,456 lbs ww would translate to a 16% reduction in commercial harvest based on average commercial landings over the past 5 years (27,892 lbs ww; **Table 4.4.4**).

Because **Alternative 1 (No Action)** would continue to specify an ACL for the entire stock of hogfish and thus fail to respond to the latest scientific evidence on the species' stock structure, it is not a viable alternative. In general, assuming a sector is able to catch its entire ACL, the higher the ACL, the greater the positive direct economic effects for all sectors, as long as the ACL is not exceeded. Based on past landings history, however, neither sector ACL is expected to be met under any of the alternatives of **Action 4**; therefore, it is expected that there would be no differences in economic effects among any of the alternatives.

Because recreational landings are likely to vary year by year, there would likely be some years in which recreational landings would reach the recreational ACL and recreational accountability measures (AMs) would be triggered. If an in-season closure and payback measure are implemented as recreational AMs in **Action 12**, there would likely be some negative effects on recreational fishermen and for-hire businesses that target hogfish. In general, a higher ACL would lower the chance of triggering a recreational AM (if implemented) and would result in the lowest level of negative effects on the recreational sector. Among the action alternatives, **Sub-alternative 2a** would be the most beneficial for recreational fishermen, followed by **Preferred Sub-alternative 2b**, and **Sub-alternative 2c.** The potential commercial AMs in **Action 12** would mirror current commercial AMs for each stock, and there would be a possibility of an in-season closure for a year with high landings, or a payback if triggered. In general, a higher ACL would lower the chance of triggering a closure, resulting in the lowest level of negative effects on the commercial sector. **Sub-alternative 2a** would be the most beneficial for commercial fishing businesses who may harvest hogfish, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c.**

2.5 Action 5. Establish a rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

Alternative 1 (No Action). The current ABC for the entire stock of hogfish is 134,824 lbs ww. There is no rebuilding plan in place for hogfish in the South Atlantic.

Alternative 2. Define a rebuilding plan where the rebuilding strategy for the Florida Keys/East Florida (FLK/EFL) stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 50% probability of rebuilding success. The overfishing limit (OFL) is the yield at F_{MSY}. The spawning stock biomass (SSB_{MSY}) is 2,300,391 lbs ww. Year 1 = 2017

Year	F	SSB (lbs)	Probability of SSB > SSB_{MSY}	OFL (numbers)	ABC (numbers)	Discards (numbers)
2017	0.087	466,101	0	35,986	22,457	283
2018	0.087	615,078	0	41,810	26,929	349
2019	0.087	780,517	0	47,335	31,367	412
2020	0.087	958,225	0.001	53,574	36,477	483
2021	0.087	1,145,995	0.01	60,324	42,153	561
2022	0.087	1,341,203	0.049	67,119	48,052	642
2023	0.087	1,540,211	0.125	73,662	53,910	722
2024	0.087	1,739,110	0.224	79,808	59,601	771
2025	0.087	1,934,221	0.327	85,486	65,008	814
2026	0.087	2,122,134	0.421	90,657	70,070	852
2027	0.087	2,300,212	0.5	95,311	74,752	885

Source: Fish and Wildlife Research Institute. Revised projections for SEDAR 37 (**Appendix K**).

Preferred Alternative 3. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success. The OFL is the yield at F_{MSY}. The SSB_{MSY} is 2,300,391 lbs ww. Year 1 = 2017

Year	F	SSB (lbs)	Probability of SSB > SSB_{MSY}	OFL (numbers)	ABC (numbers)	Discards (numbers)
2017	0.07	466,101	0	35,986	17,930	283
2018	0.069	623,334	0	41,810	21,421	351
2019	0.068	801,673	0	47,335	24,996	418
2020	0.068	997,357	0.001	53,574	29,200	494
2021	0.068	1,208,116	0.014	60,324	33,965	577
2022	0.067	1,430,997	0.067	67,119	39,027	664
2023	0.067	1,661,827	0.167	73,662	44,162	751
2024	0.067	1,896,011	0.293	79,808	49,254	806
2025	0.067	2,129,079	0.417	85,486	54,183	855
2026	0.068	2,356,761	0.525	90,657	58,878	898
2027	0.068	2,575,569	0.613	95,311	63,295	936

Source: Fish and Wildlife Research Institute. Revised projections for SEDAR 37 (**Appendix K**).
Note: Projections for various F scenarios were completed using Stock Synthesis (SS3). Under a constant F scenario, the F values vary over the span of the projection due to changes in the stock's vulnerable biomass and age composition.

Alternative 4. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 7 years with a 50% probability of rebuilding success. The OFL is the yield at F_{MSY}. The SSB_{MSY} is 2,300,391 lbs ww. Year 1 = 2017

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	OFL (numbers)	ABC (numbers)	Discards (numbers)
2017	0.027	466,101	0	35,986	6,695	283
2018	0.027	643,910	0	41,810	8,320	357
2019	0.027	853,516	0	47,335	10,015	433
2020	0.027	1,092,682	0.002	53,574	12,023	520
2021	0.027	1,359,505	0.03	60,324	14,329	616
2022	0.027	1,650,910	0.133	67,119	16,823	718
2023	0.027	1,962,295	0.306	73,662	19,402	820
2024	0.027	2,288,307	0.494	79,808	22,028	889

Source: Fish and Wildlife Research Institute. Revised projections for SEDAR 37 (**Appendix K**).

Alternative 5. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate that rebuilds the stock in 7 years with a 72.5% probability of rebuilding success. The OFL is the yield at F_{MSY}. The SSB_{MSY} is 2,300,391 lbs ww. Year 1 = 2017

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	OFL (numbers)	ABC (numbers)	Discards (numbers)
2017	0.022	466,101	0	35,986	5,530	283
2018	0.022	646,051	0	41,810	6,780	358
2019	0.022	859,315	0	47,335	8,136	434
2020	0.022	1,103,904	0.002	53,574	9,787	523
2021	0.022	1,378,000	0.031	60,324	11,725	621
2022	0.022	1,678,512	0.145	67,119	13,861	724
2023	0.022	2,000,728	0.329	73,662	16,110	829
2024	0.022	2,339,124	0.523	79,808	18,441	899

Source: Fish and Wildlife Research Institute. Revised projections for SEDAR 37 (**Appendix K**).

2.5.1 Comparison of Alternatives

In the tables above, the terminal spawning stock biomass (SSB) in the rebuilding projections may not equal or exceed the base run estimate of the spawning stock biomass at the maximum sustainable yield (SSB_{MSY}) because the SSB estimates in the projections were generated from multiple bootstrap iterations to incorporate uncertainty into the projections. Therefore, the actual SSB_{MSY} that the projections are rebuilding to is not the estimate from the base run but the median (or other type of estimate in the case of the 72.5% probability of success runs) from the bootstrap distribution. **Table 2.5.1** below provides a summary of the alternatives for **Action 5**.

The South Atlantic Council prefers specifying the recreational ACL in numbers of fish and the commercial ACL in pounds. Their rationale is that recreational landings are already tracked in numbers of fish while commercial landings are tracked in pounds. Issues develop, however, when different size limits are considered for management and the commercial and recreational ACLs are in different units: if the minimum size limit is increased, as the Council proposes to do, the average size and thus weight of fish harvested will also increase. If the method for converting between an ACL in pounds and an ACL in numbers does not address the change in average weight, the expected increase in the average weight of landed fish could lead to the poundage associated with the ACL specified in numbers exceeding the ACL expressed in pounds. This could also result in a perceived shift in allocations when they are compared in the original units across sectors, and if the change in weight landed is great enough, the ABC and OFL in pounds could be exceeded. However, if the recreational ABC and ACL were specified in numbers, there would be a lower risk of exceeding the recreational ACL due to an increase in the minimum size limit. The South Atlantic Council also discussed the high percent standard error (PSE) associated with the recreational data and the fact that there were very few intercepts for recreational effort using spear. **Appendix N** includes a detailed account of the methodology used to specify the recreational ACL for the FLK/EFL stock of hogfish in numbers of fish.

Table 2.5.1. A summary of the various rebuilding scenarios (Alternatives 1-5) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish.

Alternatives	F rate strategy	F rate	Year 1 ABC (numbers)	Rebuilt stock (years)	Probability of rebuilt stock
1 (No action)	Do not specify a rebuilding plan. The current ABC for the entire stock of hogfish is 137,824 lbs ww				
2	Constant	0.087	22,457	10	50%
3 (Preferred)	**Constant**	**0.070 (year 1)**	17,930	**10**	**72.5%**
4	Constant	0.027	6,695	7	50%
5	Constant	0.022 (year 1)	5,530	7	72.5%

The terminal, or last, year of data in the hogfish assessment report (SEDAR 37 2014) was 2012. Projections for various fishing mortality (F) scenarios were completed using Stock Synthesis (SS3) base model configurations for the FLK/EFL hogfish stock (SEDAR 37 2014). Originally, projections were based on year 1 = 2016 and extending through 2026, or to the point of stock rebuilding if a scenario did not result in rebuilding within 10 years. However, in 2015, recreational harvest of hogfish was closed on August 24 due to an increase in landings during Wave 2 of the Marine Recreational Information Program (MRIP) survey. As a result, landings for 2015 were above the landings level assumed in the stock projections raising concerns that the projections might no longer represent the best scientific information available. Therefore, the South Atlantic Council requested updated projections for the FLK/EFL hogfish stock using the most recent landings estimates. The new revised projections (**Appendix K**) included the most recent landings and charged year 1 to 2017 to reflect the likely implementation date of management actions. The projected overfishing limits (OFLs) and acceptable biological catches (ABCs) assume the current hogfish minimum size limit (12 inches fork length).

Since the stock assessment for the FLK/EFL stock falls under Tier 1 of the ABC control rule, the SSC recommended a P* = 0.275 with a probability of rebuilding success of 72.5%, which corresponds to the values shown under **Preferred Alternative 3**. Since the SEDAR 37 (2014) stock assessment determined that the FLK/EFL hogfish stock is overfished, **Alternative 1 (No Action)** is not a viable alternative. Moreover, the South Atlantic Council received notification (via letter dated February 17, 2015), of the overfished determination for the FLK/EFL stock of hogfish. Therefore, under the Magnuson-Stevens Act the South Atlantic Council has two years to develop and implement a rebuilding plan for that stock. **Alternative 2** would rebuild the stock in the required 10 years but at a lower probability of success than that recommended by the SSC, whereas **Alternatives 4** and **5** would rebuild the stock in 7 years with 50% and 72.5% probabilities of rebuilding success, respectively. Since the stock would rebuild in a shorter time period, **Alternatives 4** and **5** would implement lower ABCs (and consequently lower ACLs) than alternatives that rebuild the stock in the required 10 years. In general, lower levels of harvest and less time to rebuild translate into higher biological benefits for the stock; hence, the biological benefits of **Alternatives 4** and **5** would be higher than those under **Preferred Alternative 3**. However, the SSC has indicated that harvest levels proposed under **Preferred**

Alternative 3 are sustainable and would achieve the goal of rebuilding the FLK/EFL stock of hogfish within a reasonable timeframe. Therefore, there is no biological need to constrain harvest below this level. Compared to **Alternative 1 (No Action)**, the biological effects of **Alternatives 2-5** would be beneficial since management would be responding to the best scientific information available and results of the SEDAR 37 (2014) stock assessment have indicated that the FLK/EFL stock of hogfish is overfished and undergoing overfishing.

Rebuilding plans in general impose negative direct economic effects in the short term in favor of more direct positive economic effects in the long term as the stock recovers. The difficulty is in balancing those long term and short-term economic effects. Being overly restrictive in the short term could rebuild the stock faster, but perhaps at the expense of pushing some fishermen out of the hogfish portion of the snapper grouper fishery because they are unable to survive financially under the restrictions. Being too lenient in the short term could jeopardize the probability of rebuilding the stock as needed. **Alternative 1 (No Action)** is not a viable alternative to consider, as there are statutory requirements to rebuild all fishery stocks that are overfished or undergoing overfishing. The rebuilding plan has indirect economic effects in that it frames the ACL decision (**Action 6**). The level of the ABC in and of itself does not have direct economic effects.

Because higher ABC levels (and associated ACLs) would be expected to result in less short-term negative effects on fishermen by allowing more access to hogfish, **Alternative 2** would likely have the least effects associated with catch limits, followed by **Preferred Alternative 3**, **Alternative 4**, and then **Alternative 5**. However, a longer rebuilding plan (**Alternative 2** and **Preferred Alternative 3**) would extend any negative effects on fishermen due to harvest restrictions more than under the shorter (7-year) rebuilding plans in **Alternatives 4** and **5**. Additionally, lower probability of rebuilding could result in long-term negative effects on the stock, which would affect future fishing opportunities. Overall, **Preferred Alternative 3** would be a longer period (10 years) for rebuilding, but may result in a lower level of negative short-term effects than under **Alternatives 4** and **5** due to higher ABCs/ACLs.

2.6 Action 6. Establish Annual Catch Limits (ACLs) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

Alternative 1 (No action). The current acceptable biological catch (ABC) for the entire stock of hogfish is 134,824 lbs ww and ACL = optimum yield (OY) = ABC. The commercial ACL = 49,469 lbs ww (36.69%) and the recreational ACL = 85,355 lbs ww (63.31%).

Preferred Alternative 2. Establish ACLs for the FLK/EFL stock of hogfish. Specify commercial and recreational ACLs for 2017-2027. ACLs will not increase automatically in a subsequent year if present year projected catch has exceeded the total ACL. Specify commercial and recreational ACLs using re-calculated sector allocations based on proposed modifications to the management unit (9.63% commercial and 90.37% recreational).

Sub-alternative 2a. ACL = OY = ABC
Preferred Sub-alternative 2b. ACL = OY = 95% ABC
Sub-alternative 2c. ACL = OY = 90% ABC

2.6.1 Comparison of Alternatives

Table 2.6.2 shows the proposed total annual catch limit (ACL) and sector ACLs for the Florida Keys/East Florida (FLK/EFL) hogfish stock. Sector allocations differ from those under **Alternative 1 (No Action)** because splitting the current hogfish single stock into two stocks renders it necessary to re-calculate sector allocations using the appropriate landings figures for the relevant geographic area. Under **Alternative 2**, only landings from Florida were used to derive sector allocations based on the existing allocation formula, whereas sector allocations under **Alternative 1 (No Action)** were computed using commercial and recreational landings for the four South Atlantic states. The recreational ACL is presented in numbers of fish for each proposed alternative based on the South Atlantic Council's preferred rebuilding plan alternative under **Action 5**. The South Atlantic Council prefers specifying the recreational ACL in numbers of fish and the commercial ACL in pounds. The South Atlantic Council's rationale is that recreational landings are already tracked in numbers of fish while commercial landings are tracked in pounds. Issues develop, however, when different size limits are considered for management and the commercial and recreational ACLs are in different units: if the minimum size limit is increased, as the Council proposes to do, the average size, and thus weight, of fish harvested will also increase. If the method for converting between an ACL in pounds and an ACL in numbers does not address the change in average weight, the expected increase in the average weight of landed fish could lead to the poundage associated with the ACL specified in numbers exceeding the ACL expressed in pounds. This could also result in a perceived shift in allocations when they are compared in the original units across sectors, and if the change in weight landed is great enough, the ABC and OFL in pounds could be exceeded. To avoid these issues, the method described in **Appendix N** was used to specify the recreational ABC and ACL for the FLK/EFL stock of hogfish in numbers of fish. This method is designed to keep the numbers of fish harvested constant while allowing the yield to vary based on the possible change in selectivity due to changes in the minimum size limit. Specifying the recreational ABC and

ACL in numbers results in a lower risk of exceeding the recreational ACL due to an increase in the minimum size limit. The South Atlantic Council also discussed the high percent standard error (PSE) associated with the recreational data, and the fact that there were very few data intercepts for recreational effort using spear.

Hogfish are currently managed as a single unit stock within the South Atlantic Council's area of jurisdiction. Hence, **Alternative 1 (No Action)** specifies the ABC, ACLs and sector allocations (based on the South Atlantic Council's approved allocation formula) for the entire stock. Since **Action 1** proposes to split the hogfish stock into two based on recent genetic evidence, **Alternative 1 (No Action)** is not a viable alternative as it would ignore the latest scientific information on hogfish stock structure. **Preferred Alternative 2** and its sub-alternatives proposes a total ACL for the Florida Keys/East Florida (FLK/EFL) stock using different buffers to account for management uncertainty. **Preferred Alternative 2** and its sub-alternatives would also act as an AM in that, if the combined commercial and recreational ACL (total ACL), as estimated by the National Marine Fisheries Service (NMFS), is exceeded in a fishing year, then during the following fishing year, the increase in the ACL will not be applied automatically to the commercial and recreational ACLs. In that situation, NMFS will evaluate the landings data, using the best scientific information available, to determine whether or not an increase in the commercial and recreational ACLs will be applied.

Compared to average recreational landings from 2010-2014 (95,719 fish; **Table 4.6.3**) the recreational ACL under **Preferred Sub-alternative 2b** for 2017 (15,689 fish) would result in an 84% reduction in recreational harvest in east Florida and the Florida Keys. For the commercial sector, the preferred commercial ACL of 3,510 lbs ww for 2017 would translate to a 72% reduction in commercial harvest based on average commercial landings over the past 5 years (12,573 lbs ww; **Table 4.6.3**).

Sub-alternatives 2b (Preferred) and **2c** would have a greater positive biological effect than **Sub-alternative 2a** because they would create a buffer between the ACL/OY and ABC, with **Sub-alternative 2c** setting the most conservative ACL at 90% of the ABC (**Table 2.6.2**). Creating a buffer between the ACL/OY and ABC would provide greater assurance that overfishing is prevented, and the long-term average biomass is near or above the spawning stock biomass at the maximum sustainable yield (SSB_{MSY}). However, the South Atlantic Council's ABC control rule takes into account scientific uncertainty. The Magnuson-Stevens Act National Standard 1 (NS 1) guidelines indicate that an ACL may typically be set very close to the ABC. Setting a buffer between the ACL and ABC would be appropriate in situations where there is uncertainty in whether or not management measures are constraining fishing mortality to target levels. An annual catch target (ACT), which is not required, can also be set below the ACL to account for management uncertainty and provide greater assurance overfishing does not occur.

Alternative 1 (No Action) is not a viable alternative for this action because establishing an ACL for a stock is a statutory requirement. The sub-alternatives under **Preferred Alternative 2** represent a large reduction from the estimated baseline landings under **Alternative 1 (No Action)** (**Table 4.6.3**). For the recreational sector, **Sub-alternatives 2a-2c** represent 14-15% of

the baseline landings consumer surplus value. In the commercial sector, **Sub-alternatives 2a-2c** represent approximately 12% of the baseline ex-vessel landings value. Among the **Preferred Alternative 2** sub-alternatives, **Sub-alternative 2a** would result in the highest positive direct economic effects, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c**.

Table 2.6.2. Sector ACLs for the FLK/EFL stock for **Sub-alternatives 2a-2c** in **Action 6** and based on ABC projections from **Preferred Alternative 3** in **Action 5** where ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success.

Year	ABC (numbers)	Total ACL (numbers)	Rec ACL (numbers)	Commercial ACL (lbs)	Commercial ACL (numbers)
Sub-alternative 2a (ACL = OY = ABC)					
2017	17,930	17,930	16,514	3,695	1,416
2018	21,421	21,421	19,597	4,762	1,824
2019	24,996	24,996	22,709	5,969	2,287
2020	29,200	29,200	26,407	7,291	2,793
2021	33,965	33,965	30,627	8,712	3,338
2022	39,027	39,027	35,114	10,213	3,913
2023	44,162	44,162	39,653	11,768	4,509
2024	49,254	49,254	44,141	13,344	5,113
2025	54,183	54,183	48,470	14,912	5,713
2026	58,878	58,878	52,578	16,443	6,300
2027	63,295	63,295	56,432	17,914	6,863
Preferred Sub-alternative 2b (ACL = OY = 95%ABC)					
2017	**17,930**	**17,034**	**15,689**	**3,510**	**1,345**
2018	**21,421**	**20,350**	**18,617**	**4,524**	**1,733**
2019	**24,996**	**23,746**	**21,574**	**5,670**	**2,173**
2020	**29,200**	**27,740**	**25,086**	**6,926**	**2,654**
2021	**33,965**	**32,267**	**29,096**	**8,277**	**3,171**
2022	**39,027**	**37,076**	**33,358**	**9,703**	**3,718**
2023	**44,162**	**41,954**	**37,671**	**11,179**	**4,283**
2024	**49,254**	**46,791**	**41,934**	**12,677**	**4,857**
2025	**54,183**	**51,474**	**46,046**	**14,167**	**5,428**
2026	**58,878**	**55,934**	**49,949**	**15,621**	**5,985**
2027	**63,295**	**60,130**	**53,610**	**17,018**	**6,520**
Sub-alternative 2c (ACL = OY = 90%ABC)					
2017	17,930	16,137	14,863	3,325	1,274
2018	21,421	19,279	17,637	4,286	1,642
2019	24,996	22,496	20,438	5,372	2,058
2020	29,200	26,280	23,766	6,562	2,514
2021	33,965	30,569	27,564	7,841	3,004
2022	39,027	35,124	31,602	9,192	3,522
2023	44,162	39,746	35,688	10,591	4,058
2024	49,254	44,329	39,727	12,010	4,601

2025	54,183	48,765	43,623	13,421	5,142
2026	58,878	52,990	47,320	14,799	5,670
2027	63,295	56,966	50,788	16,122	6,177

Note: The Council prefers to specify the recreational ACL in numbers of fish and the commercial ACL in pounds. See **Appendix N** for methodology used to derive the recreational ACL in numbers.

Recreational landings of hogfish in the FLK/EFL sub-region have been much higher than the proposed recreational ACLs under **Preferred Alternative 2**. If an in-season closure and payback measure is implemented under **Action 12**, there would likely be some negative effects on recreational fishermen and for-hire businesses that target hogfish, as access will be greatly restricted. In general, a higher ACL would lower the chance of triggering a recreational AM (if implemented) and result in the lowest level of negative effects on the recreational sector. After **Alternative 1 (No Action)**, **Sub-alternative 2a** would be the most beneficial for recreational fishermen, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c**. However, because the proposed recreational ACLs in **Preferred Alternative 2** would all be much lower than recreational landings in recent years, all sub-alternatives would likely result in negative effects on recreational anglers, for-hire businesses and for-hire clients who harvest or would harvest hogfish. The potential commercial AMs in **Action 12** would mirror current commercial AMs for each stock, and there would be a possibility of an in-season closure for a year with high landings, or a payback if triggered. In general, a higher ACL would lower the chance of triggering a closure, resulting in in the lowest level of negative effects on the commercial sector. After **Alternative 1 (No Action)**, **Sub-alternative 2a** would be the most beneficial for commercial fishing businesses who may harvest hogfish, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c.**

2.7 Action 7. Establish a recreational Annual Catch Target (ACT) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). The current annual catch target (ACT) is 59,390 lbs ww and applies to hogfish throughout the South Atlantic Council's jurisdiction. The ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater, and where Percent Standard Error (PSE) = average PSE 2005-2009.

Year	Hogfish PSE
2005	28.7
2006	34.3
2007	23.9
2008	30.9
2009	29.5
Average	29.5

Source: NMFS Office of Science and Technology MRIP Domain Catch Totals (2015)

Preferred Alternative 2. Establish an ACT for the GA-NC stock of hogfish for the recreational sector.

Sub-alternative 2a. ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater.

Preferred Sub-alternative 2b. ACT =85% recreational ACL.

Sub-alternative 2c. ACT = 75% recreational ACL.

Year	Hogfish PSE (GA-NC)
2010	61.9
2011	67.3
2012	63.1
2013	56.1
2014	n/a
Average	62.1%

Source: NMFS Office of Science and Technology MRIP Domain Catch Totals (2015)

Preferred Alternative 3. Establish an ACT for the FLK/EFL stock of hogfish for the recreational sector.

Sub-alternative 3a. ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater.

Preferred Sub-alternative 3b. ACT =85% recreational ACL.

Sub-alternative 3c. ACT = 75% recreational ACL.

Year	Hogfish PSE East FL-FL Keys
2010	30.5
2011	22.0
2012	24.7
2013	14.7
2014	10.7
Average	20.5

Source: NMFS Office of Science and Technology MRIP Domain Catch Totals (2015)

2.7.1 Comparison of Alternatives

The National Standard 1 (NS 1) guidelines recommend the use of annual catch targets (ACTs) to prevent annual catch limits (ACLs) from being exceeded. For species without in-season management control, managers may utilize ACTs that are set below ACLs so that catches do not exceed the ACLs. If an ACT is specified as part of the system of accountability measures (AMs) for hogfish, an ACT control rule that accounts for management uncertainty may be utilized for setting the ACT. The objective for establishing an ACT and related AMs is to prevent the ACL from being exceeded. In managing the snapper grouper fishery, however, the South Atlantic Council has chosen not to use ACTs to trigger AMs because it is anticipated that improvements in reporting will reduce management uncertainty. Should the South Atlantic Council, in the future, utilize ACTs to manage recreational harvest, these values will already have been specified and become part of the regulations.

Since the ACT is typically set lower, and would be reached sooner, than the ACL for any given species, using an ACT rather than the ACL as a trigger for AMs in the recreational sector may prevent an ACL overage. This more conservative approach would likely help to ensure that recreational data uncertainties do not cause or contribute to excessive ACL overages for vulnerable species. Using recreational ACTs rather than the ACLs to trigger recreational AMs may not eliminate ACL overages completely; however, using such a strategy for the recreational sector may reduce the need to compensate for very large overages.

The updated framework procedure included in Amendment 17B to the Snapper Grouper FMP (SAFMC 2010b) allows for the timely establishment and adjustment of ACTs (and ACLs) if the South Atlantic Council and NMFS determine they are necessary.

The NS1 guidelines recommend a performance standard by which the efficacy of any system of ACLs and AMs can be measured and evaluated. According to the guidelines:

> *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 (50 C.F.R. § 600.310(g)(3)).*

If an evaluation concludes that the ACL is being chronically exceeded for any one species or species group, and post-season AMs are repeatedly needed to correct for ACL overages, adjustments to management measures would be made. As stated previously, the updated framework procedure implemented through Amendment 17B (SAFMC 2010b) could be utilized to modify management measures such as bag limits, trip limits, seasonal closures, and gear prohibitions in a timely manner. Using the regulatory amendment process to implement such changes, if needed, is the most timely method of addressing issues associated with repeated ACL overages through permanent regulations.

Table 2.7.1 shows recreational ACTs (in numbers of fish) for the GA-NC stock of hogfish based on the proposed recreational ACL alternatives in **Action 4**.

Table 2.7.1. Recreational ACTs (in numbers) for the GA-NC stock of hogfish for each of the recreational ACL sub-alternatives in Action 4.

	Sub-alt 2a ACL=ABC	**Pref Sub-alt 2b ACL=95%ABC**	**Sub-alt 2c ACL=90%ABC**
ACT=rec ACL (1-PSE) or rec ACL*0.5, whichever is greater	520	494	468
ACT=85%rec ACL (Preferred)	**884**	**840**	**796**
ACT=75%recACT	780	741	702

Table 2.7.2 shows recreational ACTs for the FLK/EFK stock for the **Alternative 3** sub-alternatives, including **Preferred Sub-alternative 3b**. Recreational ACTs are specified in numbers of fish based on **Preferred Sub-alternative 2b** under **Action 6**.

Alternative 1 (No Action) is not a viable alternative for management as the current stock of hogfish is proposed to be separated into two stocks (Action 1) and the current ACT set for the recreational sector would no longer be valid. Because the South Atlantic Council has not employed ACTs in its management strategy for the snapper grouper fishery, the biological effects of **Preferred Alternatives 2** and **3** (and their respective sub-alternatives) would be neutral. Compared to **Alternative 1 (No Action)**, **Preferred Alternatives 2** and **3** (and their respective sub-alternatives) would be biologically beneficial in that management would be adjusted to apply to two separate stocks of hogfish and, therefore, be responding to the best scientific information available about the target species.

Preferred Sub-alternative 2b and **Preferred Sub-alternative 3b** would allow for the highest catches (and highest positive direct economic effects). **Sub-alternatives 2c** and **3a,** which result in the second highest ACL, would be expected to result in the next highest amount of positive direct economic effects, followed by **Sub-alternatives 2a** and **3c**. But since the ACT is not being used to trigger AMs, there are no expected direct economic effects from any of the proposed sub-alternatives under **Preferred Alternatives 2** and **3**.

Establishment of a recreational ACT for each stock of hogfish would likely have little effect on recreational fishermen targeting hogfish, unless the South Atlantic Council decides to set the ACT as a trigger for AMs at a later time. A higher ACT could be more beneficial for fishermen, depending on the levels specified in **Preferred Alternatives 2** and **3**. Because the ACT is used for monitoring only, it is expected that the social effects of **Alternative 1 (No Action)**, **Preferred Alternative 2**, and **Preferred Alternative 3** would be the similar.

Table 2.7.2. Recreational ACTs (numbers of fish) under consideration for the FLK/EFL stock of hogfish based on **Preferred Sub-alternative 2b** under **Action 6**.

Year	Rec ACL (numbers)	Sub-alt 2a (numbers)	Pref Sub-alt 2b (numbers)	Sub-alt 2c (numbers)
2017	15,689	12,472	13,335	11,767
2018	18,617	14,800	15,824	13,963
2019	21,574	17,151	18,338	16,180
2020	25,086	19,944	21,323	18,815
2021	29,096	23,131	24,731	21,822
2022	33,358	26,520	28,354	25,019
2023	37,671	29,948	32,020	28,253
2024	41,934	33,338	35,644	31,451
2025	46,046	36,607	39,139	34,535
2026	49,949	39,709	42,457	37,462
2027	53,610	42,620	45,568	40,207

2.8 Action 8. Increase the commercial and recreational minimum size limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). The current minimum size limit for hogfish is 12 inches fork length (FL) for both the commercial and recreational sectors in federal waters of the South Atlantic Region, and state waters of South Carolina, North Carolina, and Florida. There is no minimum size limit for hogfish in state waters of Georgia.

Preferred Alternative 2. Increase the commercial and recreational minimum size limit for the GA-NC stock of hogfish in the South Atlantic Region.

Sub-alternative 2a. 16 inches FL
Preferred Sub-alternative 2b. 17 inches FL
Sub-alternative 2c. 18 inches FL
Sub-alternative 2d. 19 inches FL
Sub-alternative 2e. 20 inches FL
Sub-alternative 2f. Increase the minimum size limit from 12 inches FL to 15 inches FL in year 1, to 18 inches FL in year 2, and to 20 inches FL in year 3.

Preferred Alternative 3. Increase the commercial and recreational minimum size limit for the FLK/EFL stock of hogfish in the South Atlantic Region.

Sub-alternative 3a. 14 inches FL
Sub-alternative 3b. 15 inches FL
Preferred Sub-alternative 3c. 16 inches FL
Sub-alternative 3d. 17 inches FL
Sub-alternative 3e. Increase the minimum size limit from 12 inches FL to 14 inches FL in year 1 and to 16 inches FL in year 3.

2.8.1 Comparison of Alternatives

The current minimum size limit for commercial and recreational harvest of hogfish in the South Atlantic is 12 inches fork length (FL). **Preferred Alternatives 2** and **3** include sub-alternatives for minimum size limits for the Georgia through North Carolina (GA-NC) stock and the Florida Keys/East Florida (FLK/EFL) stock, respectively. Sub-alternatives under **Preferred Alternative 2** contain a wider range of size limit options because the hogfish belonging to the GA-NC stock attain larger sizes than fish belonging to the FLK/EFL stock. In addition to **Sub-alternatives 2a** through **2e** and **3a** through **3d**, which would each implement a size limit that would remain in place until modified through an amendment to the regulations, the South Atlantic Council is also considering a step-up approach to implementation of a minimum size limit for both stocks. **Sub-alternatives 2f** and **3e** are designed to increase the minimum size limit over time for each of the two hogfish stocks, respectively. The intent of these alternatives is to allow resource users more time to adjust to the change in minimum size limit.

Hogfish begin life as females and eventually become male if they live long enough. It is estimated that for the GA-NC stock, 24 inches FL is the size at which half the hogfish population is male and nearly all hogfish are males at 30 inches FL (Scott Van Sant, SEFSC, unpublished data). In Florida and the Florida Keys, 16 inches FL (~age 7) is the size at which half of the hogfish population is male and nearly all hogfish are males at 25 inches FL (~age 14) (McBride et al. 2008). **Alternative 1 (No Action)** would maintain the current minimum size limit of 12 inches FL for hogfish throughout the South Atlantic and would therefore not respond to the latest scientific information on hogfish stock structure that establishes two genetically different stocks in the South Atlantic region. **Preferred Sub-alternative 2b** would establish a minimum size limit for GA-NC hogfish stock of 17 inches FL. As such, this alternative could result in removal of individuals before sex change can occur and thus impart negative biological impacts to the stock. The same would be true for the remainder of the sub-alternatives under **Preferred Alternative 2**, as none propose a minimum size limit above the size at transition. Hence, all of the sub-alternatives under **Preferred Alternative 2** are expected to result in the same level of biological impact.

For the GA-NC stock, minimum size limits of 16 inches FL and above would result in projected reductions in recreational harvest (across all modes) of less than 5% (**Table 4.8.1**). However, the projected reductions in harvest are based on limited available data and are, therefore, highly uncertain. For the commercial sector, the preferred minimum size limit of 17 inches FL (**Preferred Sub-alternative 2b**) is expected to result in an average reduction in commercial landings of only 2% (**Table 4.8.3**). Although the status of the GA-NC stock is unknown, preferred commercial and recreational ACLs (**Action 4**) are above recent average commercial and recreational landings, respectively; therefore, management measures to constrain harvest are not needed. However, as mentioned above, biological benefits could result from a precautionary approach to address population stability considering this species' life history characteristics.

Studies on reproductive biology of hogfish in Florida suggest that minimum size limits above 16 inches FL would allow more females to transition to males thus promoting spawning harems and benefiting the hogfish population (McBride and Johnson 2007; McBride et al. 2008; Munoz et al. 2010; Collins and McBride 2011). Therefore, **Sub-alternatives 3c (Preferred)**, **3d** and **3e** would increase the minimum size limit for the FLK/EFL stock of hogfish to a level that would impart the most biological benefits to the stock. Of these, **Preferred Sub-alternative 3c** would be the most biologically beneficial, followed by **Sub-alternatives 3d** and **3e**. Assuming the socially-mediated size at transition (Collins and McBride 2011) has remained around 16 inches FL in the FLK/EFL sub-region since the study by McBride et al. (2008), **Sub-alternative 3b** would impart less biological benefits to the FLK/EFL hogfish stock than **Sub-alternatives 3c (Preferred)-3e**, because it would continue to allow removal of the most reproductively productive individuals and possibly disrupt formation of harems since individuals would be harvested before transition from female to male could take place. Because size at transition is socially-mediated and the FLK/EFL stock is overfished, there is a strong possibility the size at transition is currently lower than 16 inches FL; however, it should also be noted that in a non-overfished stock, the size at transition might be above 16 inches FL. The greatest biological

benefits to the FLK/EFL stock would result from the appropriate combination of management measures (minimum size limit (**Action 8**), commercial trip limit (**Action 9**), recreational bag limit (**Action 10**), and recreational season (**Action 11**).

In general, increasing the size limit for a species has little long-term economic effect unless the larger size limit results in greater numbers of fish reaching spawning size and/or fish have higher fecundity prior to being harvested. Size limits that result in more spawning and/or higher fecundity would result on more direct, long-term, positive economic effects presumably through the availability of increased numbers of fish in the future. The greater the increase in the size limit from **Alternative 1 (No Action)**, the greater the probability for short-term negative economic effects. However, a significant increase in the minimum size limit could also result in greater long-term positive economic effects as long as increased size limits translates into a larger spawning biomass and overall biomass increasing above the minimum limit.

For the GA-NC stock of hogfish, overall, in the short-term, there are negligible differences among the **Preferred Alternative 2** sub-alternatives. From least to most long-term, direct, positive economic effects for the recreational sector for **Preferred Alternative 2** would be **Preferred Sub-alternative 2b-Sub-alternative 2e**, and then **2a**. It is not clear where **Sub-alternative 2f** would fit in the rankings, however; in the long-term, it would be expected to fall between **Sub-alternative 2e** and **Alternative 1 (No Action)**. In terms of least to most long-term, direct, positive economic effects for the commercial sector, the sub-alternatives for **Preferred Alternative 2** would be **2e**, **2d**, **2c**, **Preferred 2b**, and then **Sub-alternative 2a**. It is not clear where **Sub-alternative 2f** would fit in the rankings, however; in the long-term, it would be expected to fall between **Sub-alternative 2a** and **Sub-alternative 2e**.

Preferred Alternative 3 and its sub-alternatives would increase the minimum size limit of the FLK/EFL stock for both the recreational and commercial sectors. **Preferred Alternative 3** sub-alternatives would result in relatively small changes in expected consumer surplus (CS) compared to **Alternative 1 (No Action**; 12" FL); however, some sub-alternatives are expected to result in positive economic effects while others are expected to result in negative economic effects. From least to most short-term, direct, negative economic effects for the recreational sector **Preferred Alternative 3, Sub-alternative 3b** (15" FL), **Alternative 1 (No Action**; 12" FL), **Sub-alternative 3a** (14" FL), the first year of implementation for **Sub-alternative 3e** (14"/16" FL), **Preferred Sub-alternative 3c** (16" FL), and **Sub-alternative 3d** (17" FL).

Commercial sector landings for the FLK/EFL stock are relatively low with an **Alternative 1 (No Action)** expected ex-vessel value of just $12,656 (in 2014 $; **Table 4.8.9**). The expected economic effects differences between **Alternative 1 (No Action)** and the **Preferred Alternative 3** sub-alternatives for the commercial sector are small, with a range of $58.

Some social effects of minimum size limits would be associated with the positive and negative biological effects of minimum size limits on the hogfish stocks. Positive effects of allowing only fish of a certain size that are caught in the South Atlantic exclusive economic zone (EEZ) to be landed could help maintain sustainability of harvest and the health of each hogfish stock, which would be beneficial to recreational and commercial fishermen in the long term.

Negative effects of potential increase in discard mortality due to higher minimum size limit could affect the stock and in turn, commercial and recreational fishing opportunities. In general, as the minimum size limit increases, the higher of the expected reduction in recreational landings that could occur.

For the GA-NC stock of hogfish, the most negative effects would be expected under **Sub-alternative 2e** and year 3 under **Sub-alternative 2f**, followed in order by **Sub-alternative 2d**, **Sub-alternative 2c** and year 2 under **Sub-alternative 2f**, **Preferred Sub-alternative 2b**, **Sub-alternative 2a**, year 1 under **Sub-alternative 2f**, and then **Alternative 1 (No Action)**. There would be minimal or no expected effects on the commercial sector by any minimum size limit in **Sub-alternatives 2a-2f** (**Figure 4.8.4**), including **Preferred Sub-alternative 2b**, because in general the commercial fleet is currently harvesting larger hogfish.

For the FLK/EFL stock of hogfish, The most short-term negative effects on the recreational sector would be expected under **Sub-alternative 3d**, followed in order by **Preferred Sub-alternative 3c** and year 3 under **Sub-alternative 3e**; **Sub-alternative 3b**; and **Sub-alternative 3a** and year 1 under **Sub-alternative 3f**; and then **Alternative 1 (No Action)**. Similar to the recreational sector, an increase in the minimum size limit will likely result in negative short-term effects on commercial vessels harvesting FLK/EFL hogfish by limiting access to the available hogfish. Because most commercially harvested FLK/EFL hogfish are at the current minimum size limit (**Figure 4.8.3**), it can be expected that commercial vessels will target other species instead of trying to catch hogfish of a larger size, as proposed in **Sub-alternatives 3a-3e** including **Preferred Sub-alternative 3c**. Because hogfish are a popular menu item in local restaurants in the Florida Keys, there may be some negative effects on restaurants that focus on regional fare.

It should be noted that although expected short-term negative social effects would be the least under **Alternative 1 (No Action)**, there would likely be long-term negative biological effects that would limit recreational and commercial fishing opportunities for FLK/EFL hogfish in the future and for a longer period of time. To meet the rebuilding goals in **Action 5**, reducing harvest through a higher minimum size limit is expected to be more beneficial to recreational fishermen, commercial fishermen, and for-hire businesses in the long term.

2.9 Action 9. Establish a commercial trip limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). There is no commercial trip limit for hogfish in the South Atlantic region.

Preferred Alternative 2. Establish a commercial trip limit for the GA-NC stock of hogfish in the South Atlantic region.

Sub-alternative 2a. 100 lbs ww per trip.
Sub-alternative 2b. 250 lbs ww per trip.
Preferred Sub-alternative 2c. 500 lbs ww per trip.
Sub-alternative 2d. 750 lbs ww per trip.
Sub-alternative 2e. No trip limit

Preferred Alternative 3. Establish a commercial trip limit for the FLK/EFL stock of hogfish in the South Atlantic region.

Preferred Sub-alternative 3a. 25 lbs ww per trip.
Sub-alternative 3b. 50 lbs ww per trip.
Sub-alternative 3c. 100 lbs ww per trip.
Sub-alternative 3d. 150 lbs ww per trip.
Sub-alternative 3e. 200 lbs ww per trip.
Sub-alternative 3f. No trip limit

2.9.1 Comparison of Alternatives

Action 9 proposes a range of trip limit options for each of the hogfish stocks. **Alternative 1 (No Action)** would not impose a commercial trip limit for hogfish in the South Atlantic. However, the South Atlantic Council is considering trip limits to help manage hogfish in their respective geographic areas. **Preferred Alternative 2** and its sub-alternatives includes options for a commercial trip limit for the Georgia through North Carolina (GA-NC) stock ranging from 100 lbs ww to no trip limit. The range of alternatives was selected based on the distribution of commercial trips in that geographic area. The South Atlantic Council selected a commercial trip limit of 500 lbs ww (**Preferred Sub-alternative 2c**) as their preferred alternative for the GA-NC stock. The preferred commercial annual catch limit (ACL) for the GA-NC stock is 23,456 lbs ww (**Action 4**) and, based on commercial landings between 2012 and 2014, only 1% of commercial trips in that region land 500 lbs ww or more per trip. In addition, projected landings under size limit (**Action 8**) and trip limit alternatives (**Action 9**) are expected to be less than the ACL of 23,456 lbs ww (**Table 4.9.3**). Therefore, it is expected that the proposed commercial ACL would not be met and an in-season closure for the commercial sector of the GA-NC stock would not occur. Under **Preferred Alternative 2**, there would be little difference in estimated landings among **Sub-alternatives 2a** through **2e**. Since the status of the GA-NC stock is unknown but average commercial landings are below the proposed commercial ACL for 2017

(23,456 lbs ww; **Action 4**), indicating that there is currently no need to constrain commercial harvest, there would be no difference in potential biological effects among the alternatives.

Preferred Alternative 3 includes sub-alternatives for commercial trip limits ranging from 25 to 200 lbs ww per trip (**Preferred Sub-alternative 3a**) to no trip limit (**Sub-alternative 3f**) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish. In Florida and the Florida Keys commercial harvest is very minimal compared to that of the recreational sector with 72% of the commercial trips landing 25 lbs ww or less per trip (**Figure 4.9.3**). The alternatives with smaller trip limits obviously extend the commercial fishing season longer than the ones with larger trip limits, with no difference between **Alternative 1 (No Action)** and **Sub-alternative 3f** (**Table 4.9.4**). It is estimated that a commercial ACL of 3,510 lbs ww (**Preferred Sub-alternative 2b** in **Action 6**), size limit of 16 inches FL (**Preferred Sub-alternative 3c** in **Action 8**), and a trip limit of 25 lbs ww (**Preferred Sub-alternative 3a** in **Action 9)** would result in 181 commercial fishing days for the FLK/EFL stock. Biological effects under all the alternatives considered in **Action 9** would not differ significantly because there are ACLs and in-season AMs in place. The only difference between the alternatives in **Action 9** is the number of commercial fishing days.

Generally, trip limits are not considered to be economically efficient because they require an increase in the number of trips and associated trip costs to land the same amount of fish. Alternatives resulting in fewer trips that must stop targeting hogfish once the trip limit has been met, would have the lowest direct negative economic effect. Trip costs cannot be estimated because data are not available. The entire commercial sector ACL for the GA-NC stock is not expected to be landed under any of the **Preferred Alternative 2** sub-alternatives. The ranking of **Sub-alternatives 2a** through **2e** in terms of least to most direct positive economic effect are **2a**, **2b**, **Preferred 2c**, **2d**, and **2e/**(which is the same as **Alternative 1(No Action)**). The entire commercial sector ACL for the Florida Keys/Florida East Coast stock is expected to be caught under all of the sub-alternatives of **Preferred Alternative 3**. **Table 4.9.2** shows the expected decreases in pounds landed by gear type. As the same value per pound is applied, the corresponding decreases in expected economic value by gear remains the same. The only difference is the number of trips it is expected to take to land the commercial ACL; therefore, there are no estimated differences in aggregate expected ex-vessel revenue among the sub-alternatives of **Preferred Alternative 3**. The lower the trip limit, the more likely some commercial vessels will be negatively affected. Lower trip limits may reduce profits through a reduction in efficiency and the severity of such impacts would be based on the overall dependence a vessel has on hogfish and the vessel's ability to substitute revenue from landing other species.

Commercial fishermen in the communities identified in **Section 3.4** would likely be those affected by a change in the hogfish commercial trip limit. However, it is likely that fishermen who have targeted hogfish in recent years also target other species, and would be able to adjust their businesses to adapt to regulatory changes. In general, a commercial trip limit may help slow the rate of harvest, lengthen a season, and prevent the ACL from being exceeded, but trip

limits that are too low may make fishing trips inefficient and too costly if fishing grounds are too far away. Additionally, if the trip limit is too low, the commercial ACL may not be met.

2.10 Action 10. Modify and/or establish recreational bag limits for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). The recreational bag limit is 5 fish per person per day in federal and state waters off the east coast of Florida. There is no recreational bag limit in federal waters off Georgia and South Carolina, or North Carolina.

Preferred Alternative 2. Establish a recreational bag limit for the GA-NC stock of hogfish.
- **Preferred Sub-alternative 2a.** 2 fish per person per day.
- **Sub-alternative 2b.** 1 fish per person per day.
- **Sub-alternative 2c.** 1 fish per vessel per day.

Preferred Alternative 3. Modify the recreational bag limit for the FLK/EFL stock of hogfish.
- **Sub-alternative 3a.** 3 fish per person per day.
- **Sub-alternative 3b.** 2 fish per person per day.
- **Preferred Sub-alternative 3c.** 1 fish per person per day.
- **Sub-alternative 3d.** 1 fish per vessel per day.

2.10.1 Comparison of Alternatives

Under **Alternative 1 (No Action)**, the recreational bag limit would remain 5 fish per person per day in federal waters off the east coast of Florida, and there would be no bag limit specified in federal waters off the remaining South Atlantic states. **Preferred Alternative 2** and its sub-alternatives would establish a recreational bag limit for the Georgia through North Carolina (GA-NC) stock of 2 fish per person per day under **Preferred Sub-alternative 2a**, 1 fish per person and 1 fish per vessel under **Sub-alternatives 2b** and **2c**, respectively. For the GA-NC stock, there would be no percentage decrease in recreational landings under **Preferred Sub-alternative 2a** (2 fish per person) for private, charter, and headboat (**Table 4.10.2**), because most of the recreational harvest of hogfish is from the FLK/EFL stock (**Table 4.10.1**). At the preferred minimum size limit of 17 inches FL (**Preferred Sub-alternative 2b** under **Action 8**), a 2 fish per person per day recreational bag limit would result in about 42% the proposed recreational ACL being landed (**Table 4.10.3**). Projected landings vary only slightly among the proposed bag limit sub-alternatives. In terms of biological effects, there would be no difference among the sub-alternatives under **Preferred Alternative 2** since ACLs and AMs are in place to prevent overfishing.

Preferred Alternative 3 addresses bag limit options for the Florida Keys/East Florida (FLK/EFL) stock. **Sub-alternatives 3a**, **3b**, and **3c (Preferred)** propose 3, 2, and 1 fish per person per day recreational bag limits, respectively, whereas **Sub-alternative 3d** proposes a 1 fish per vessel per day recreational bag limit. **Preferred Alternative 3** includes a greater range of sub-alternatives for the FLK/EFL stock compared to **Preferred Alternative 2** because the FLK/EFL stock is overfished and undergoing overfishing (SEDAR 37 2014) and a reduction in

harvest is necessary to rebuild that stock. For the FLK/EFL stock, there would be no decrease in harvest for headboats under **Preferred Sub-alternative 3c** (1 fish per person) but a 22% decrease in landings for the charter mode and a 45% decrease in private recreational landings (**Table 4.10.2**). For charter and private modes, **Sub-alternative 3d** would have the largest percent decrease, followed by **Sub-alternative 3c (Preferred)**, **3b**, and **3a** (**Table 4.10.2**). The projected percent reductions in landings are higher for the private mode than the charter mode because private recreational anglers harvest more hogfish per vessel compared to headboats (**Figure 4.10.2**). In terms of biological effects, there would be no difference among the sub-alternatives under **Preferred Alternative 3** since ACLs and AMs are in place to prevent overfishing.

Individual recreational anglers who catch hogfish from the GA-NC stock rarely catch more than one fish. In terms of least to highest expected positive direct economic effects for the GA-NC stock, the ranking would be **Sub-alternative 2c** (1 fish/vessel/day), **2b** (1 fish/person/day), and **Preferred Sub-alternative 2a** (2 fish/person/day)**/Alternative 1 (No Action)** (No bag limit). Recreational hogfish trips in FLK/EFL stock would be affected by the sub-alternatives under **Preferred Alternative 3** based on historical recreational landings. In terms of least to highest expected positive direct economic effects for the FLK/EFL stock would be **Sub-alternative 3d** (1 fish/vessel/day), **3b** (2 fish/person/day), **3a** (3 fish/person/day), **Preferred 3c** (1 fish/person/day), and **Alternative 1 (No Action)** (5 fish/person/day)

In general, the social effects of modifying the recreational bag or vessel limit would be a trade-off between longer seasons under lower bag limits, and the negative effects on recreational fishing opportunities because the bag limit is too low. While **Preferred Alternatives 2** and **3** would limit recreational fishing opportunities for hogfish by changing the recreational fishing experience by restricting the number of hogfish that can be kept, the season will also likely be longer because the rate of harvest would be slower. **Alternative 1 (No Action)** would be the most beneficial to recreational fishermen in the short-term but could detract from measures to rebuild the FLK/EFL stock. For the GA-NC stock, **Sub-alternative 2c** would be the most restrictive by designating a vessel limit of one fish, and would in particular be expected to negatively affect private recreational anglers (**Table 4.10.2**). **Preferred Sub-alternative 2a** and **Sub-alternative 2b** would be expected to have little or no effects on recreational fishing opportunities, similar to **Alternative 1 (No Action)**. For the FLK/EFL stock, the most restrictive recreational limit (**Sub-alternative 3d**) may eliminate recreational fishing opportunities for charter and private recreational anglers (**Table 4.10.2**). Less restrictive recreational limits in **Sub-alternative 3a, 3b** and **3c (Preferred)** and **Alternative 1 (No Action**) would improve benefits to the recreational sector and associated businesses, but may also shorten the fishing season under the recreational ACL specified in **Action 6**.

2.11 Action 11. Establish a recreational fishing season for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

Alternative 1 (No Action). There is no recreational fishing season for hogfish in the South Atlantic. The recreational fishing year for hogfish is January 1 through December 31.

Preferred Alternative 2. Establish a recreational fishing season for the FLK/EFL stock of hogfish in the South Atlantic region.

Sub-alternative 2a. May-June
Sub-alternative 2b. July-August
Sub-alternative 2c. July-September
Preferred Sub-alternative 2d. July-October

2.11.1 Comparison of Alternatives

Alternative 1 (No Action) would not establish a recreational fishing season for the Florida Keys/Eat Florida (FLK/EFL) stock of hogfish. **Preferred Alternative 2** considers establishing a recreational fishing season of May-June (**Sub-alternative 2a**), July-August (**Sub-alternative 2b**), July-September (**Sub-alternative 2c**) and July-October (**Preferred Sub-alternative 2d**). **Table 4.11.1** shows when the recreational sector would close, how many days would be open, the landings and percent of the recreational ACL that would be expected to be landed at the preferred minimum size and bag limit options: 16 inches FL (**Preferred Sub-alternative 3c** in **Action 8**) and a 1 per person per day recreational bag limit (**Preferred Sub-alternative 3c** in **Action 10**). The biological effects of the proposed sub-alternatives would be neutral because fishing would occur outside of the spawning season, and ACLs and accountability measures (AMs) would ensure overfishing does not occur. Compared to **Alternative 1 (No Action)**, all of the proposed sub-alternatives would impart biological benefit because **Alternative 1 (No Action)** would allow fishing to occur during the spawning season.

The economic effects of establishing a set recreational season for hogfish would depend on several factors. Depending on how quickly the recreational sector ACL is expected to be caught, it is impossible to know whether setting an exact season is more beneficial to the recreational sector because of the delay related to processing MRIP landings estimates. Too long of a delay in closing the recreational sector could result in very large overages and shortened future seasons. The expected differences in consumer surplus (CS) between the alternatives/sub-alternatives of **Action 11** are negligible at only 1-2% difference among them. From least to greatest positive direct economic effects are **Sub-alternative 2a**, **Sub-alternative 2b/Preferred Sub-alternative 2c**, and **Alternative 1 (No Action)**.

The social effects of **Sub-alternatives 2a, 2b,** and **2c (Preferred)** under **Preferred Alternative 2** compared to **Alternative 1 (No Action)** would depend on when recreational effort is highest for FLK/EFL hogfish, and the effect of the proposed recreational bag limits in **Action 10** on constraining catch to the proposed ACL in **Action 6**. Because hogfish is an important

recreational species for south Florida, and particularly the Florida Keys, it is likely that any seasonal restriction on recreational harvest under **Preferred Alternative 2** could have negative effects on recreational fishing opportunities. As shown in **Table 4.11.1**, the combination of a bag limit and a recreational season would result in the longest expected season under **Sub-alternative 2c** when compared to season length in **Alternative 1 (No Action)** and **Sub-alternatives 2a** and **2b**. It should be noted that specifying only two months during which recreational harvest would be allowed (**Sub-alternatives 2a** and **2b**) could result in recreational landings not reaching the proposed recreational ACL in **Action 6**.

Because the expected closure date under **Sub-alternative 2c** is before the end of September (**Table 4.11.1**), when incorporating the potential ACLs and bag limits, it can be assumed that the expected closure date under **Preferred Sub-alternative 2d** would be the same. Therefore, there would be no major differences in the effects on recreational fishing opportunities between **Sub-alternative 2c** and **Preferred Sub-alternative 2d** under the current expected restrictions and fishery conditions. However, under **Preferred Sub-alternative 2d**, an additional month would be beneficial for recreational fishing opportunities if there is a future increase in the recreational ACL that allowed a longer fishing season.

2.12 Action 12. Establish commercial and recreational accountability measures (AMs) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 1 (No Action). Current commercial and recreational AMs apply to hogfish throughout the South Atlantic Council's area of jurisdiction. (See **Section 2.12.1** for the current AMs.)

Preferred Alternative 2. If commercial landings reach or are projected to reach the commercial annual catch limit (ACL), NMFS would close the commercial sector for the remainder of the fishing year. On and after the effective date of such a notification, all sale or purchase is prohibited and harvest or possession of hogfish in or from the EEZ would be limited to the recreational bag and possession limit. This bag and possession limit applies in the South Atlantic on board a vessel for which a valid Federal commercial or charter vessel/headboat permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. Additionally, if the commercial ACL is exceeded, NMFS would reduce the commercial ACL in the following fishing year by the amount of the commercial overage, <u>only if hogfish is overfished **and** the total ACL (commercial ACL and recreational ACL) of the respective stock is exceeded</u>.

Preferred Sub-alternative 2a. For the GA-NC stock of hogfish.
Preferred Sub-alternative 2b. For the FLK/EFL stock of hogfish.

Preferred Alternative 3. If recreational landings reach or are projected to reach the recreational ACL, NMFS would close the recreational sector for the remainder of the fishing year, unless, using the best scientific information available, NMFS determines that a closure is unnecessary.

Sub-alternative 3a. For the GA-NC stock of hogfish <u>if the stock is overfished.</u>
Preferred Sub-alternative 3b. For the GA-NC stock of hogfish <u>regardless of stock status.</u>
Sub-alternative 3c. For the FLK/EFL stock of hogfish <u>if the stock is overfished.</u>
Preferred Sub-alternative 3d. For the FLK/EFL stock of hogfish <u>regardless of stock status.</u>

Preferred Alternative 4. If recreational landings exceed the recreational ACL, then during the following fishing year, recreational landings will be monitored for a persistence in increased landings. If necessary, NMFS would reduce the length of fishing season and the recreational ACL in the following fishing year by the amount of the recreational overage, <u>only if the species is overfished **and** the total ACL (commercial ACL and recreational ACL) of the respective stock is exceeded</u>. The length of the recreational season and recreational ACL will not be reduced if NMFS determines, using the best scientific information available, that a reduction is unnecessary.

Preferred Sub-alternative 4a. For the GA-NC stock of hogfish.
Preferred Sub-alternative 4b. For the FLK/EFL stock of hogfish.

2.12.1 Comparison of Alternatives

The proposed action would contribute to creating a consistent regulatory environment in the South Atlantic. The Generic Accountability Measures (AMs) and Dolphin Allocations Amendment (Amendment 34 to the Snapper Grouper FMP; SAFMC 2015d)), which became effective on February 22, 2016, made AMs for hogfish consistent with those for other snapper grouper species. However, since Amendment 37 proposes two hogfish stocks, AMs need to be specified for each stock. Current AMs (**Alternative 1 (No Action)**) for hogfish throughout the South Atlantic region are below:

Commercial: If commercial landings, as estimated by the Science and Research Director, reach or are projected to reach the commercial ACL, the Assistant Administrator will file a notification with the Office of the Federal Register to close the commercial sector for the remainder of the fishing year. On and after the effective date of such a notification, all sale or purchase is prohibited and harvest or possession of this species in or from the South Atlantic EEZ is limited to the bag and possession limit. This bag and possession limit applies in the South Atlantic on board a vessel for which a valid Federal commercial or charter vessel/headboat permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. If commercial landings exceed the ACL, and the species is overfished, based on the most recent Status of U.S. Fisheries Report to Congress, the Assistant Administrator will file a notification with the Office of the Federal Register, at or near the beginning of the following fishing year to reduce the ACL for that following year by the amount of the overage in the prior fishing year.

Recreational: If recreational landings, as estimated by the Science and Research Director, exceed the recreational ACL, then during the following fishing year, recreational landings will be monitored for a persistence in increased landings and, if necessary, the Assistant Administrator will file a notification with the Office of the Federal Register, to reduce the length of the following recreational fishing season by the amount necessary to ensure recreational landings do not exceed the recreational ACL in the following fishing year. However, the length of the recreational season will also not be reduced during the following fishing year if the Regional Administrator determines, using the best scientific information available, that a reduction in the length of the following fishing season is unnecessary.

For the commercial sector, the payback provision under **Preferred Alternative 2** would be triggered infrequently, because the payback would only be required if two criteria are met: (1) hogfish is overfished *and* the total ACL has been exceeded. At this time, both of these scenarios cannot take place at the same time for the GA-NC stock of hogfish, since the status of the stock is unknown. As such, **Preferred Sub-alternative 2a** is the least biologically beneficial alternative for the GA-NC stock of hogfish because a commercial payback would never be triggered, even when it was biologically needed. For the FLK/EFL stock of hogfish, while the likelihood of both of these scenarios taking place at the same time is small, one of the two

criteria to trigger a commercial payback has already been met as the stock is overfished. Hence, **Preferred Sub-alternative 2b** may impart biological benefits to the FLK/EFL stock. However, since **Preferred Alternative 2** would prohibit harvest in-season if the commercial ACLs for the respective hogfish stock was met or was projected to be met, overages of the total ACL (commercial and recreational combined) would be unlikely.

Preferred Alternatives 3 and **4** would apply to the recreational sector. **Preferred Sub-alternatives 3b** and **3d** would trigger an in-season closure for the GA-NC stock and the FLK/EFL stock, respectively, regardless of stock status. These sub-alternatives have the potential to result in biological benefits to both stocks compared to **Sub-alternatives 3a** and **3c** since an overfished determination would not be needed to trigger a closure and thus ACL overages would be avoided. Under **Preferred Alternative 4**, if the recreational ACL is exceeded, recreational landings during the following year would be monitored for persistence in increased landings. If necessary, the recreational season *and* the recreational ACL would be reduced the following fishing year but only if the respective hogfish stock is overfished and the total ACL (commercial + recreational) is exceeded. In this respect, **Preferred Alternative 4** is almost identical to **Preferred Alternative 2** for the commercial sector; however, the Regional Administrator would determine, based upon the best scientific information available, whether a payback is actually needed. Thus, **Preferred Alternative 4** would maintain the ability of the Regional Administrator to interpret landings data to determine whether a payback is needed. However, these sub-alternatives would all allow the payback to take the form of a recreational ACL reduction *and* a season length reduction, compared to **Alternative 1 (No Action)**, which only allows for a season length reduction as a form of payback. However, **Preferred Alternative 3** would allow the Regional Administrator to close the recreational sector when the recreational ACL for the respective hogfish stock is met or projected to be met. Therefore, if in-season closures are implemented when needed to prevent recreational ACLs from being exceeded, the need to initiate an ACL payback the following year would be greatly reduced.

Since **Preferred Alternatives 2** and **3** would prohibit commercial and recreational harvest in-season if the sector ACLs were met or were projected to be met and since overages of the total ACL (commercial and recreational combined) would be unlikely to occur, significant biological impacts, beneficial or adverse, on the GA-NC and FLK/EFL stocks of hogfish are not expected.

The selection of any of the sub-alternatives under **Preferred Alternative 2** through **Preferred Alternative 4** does not change the basic premise of **Alternative 1 (No Action)** that commercial fishing would be stopped when the commercial ACL has been met or projected to be met or the following recreational fishing season shortened when recreational ACL is exceeded. Thus, only when overages occur would the various alternatives have possibly differing economic effects. The relative magnitude of short-term economic effects of the various alternatives would depend on the likelihood of triggering the hogfish AMs. The alternatives' long-term economic effects would depend on their effects on the sustainability of the stock to support continued fishing opportunities for the commercial and recreational fishing participants. Overall, the potential economic impacts of **Preferred Alternatives 2** through **Preferred Alternative 4** are not expected to be significant. There is no expected economic effects difference between

Alternative 1 (No Action), **Preferred Alternative 2 (Preferred Sub-Alternatives 2a** and **2b)**, and **Preferred Alternative 4 (Preferred Sub-Alternatives 4a** and **4b)**.

AMs can have significant direct and indirect social effects because, when triggered, can restrict harvest in the current season or subsequent seasons. However, AMs are critical in keeping landings from exceeding the recommended catch levels, which is crucial under a rebuilding plan. **Alternative 1 (No Action)** would maintain the current AMs but maintain their applicability to a single stock of hogfish. Therefore, because the stock is being split into two under Action 1, **Alternative 1 (No Action)** is no longer viable because the current AMs would no longer apply to each of the two stocks. **Preferred Alternative 2** and **Preferred Sub-alternatives 2a** and **2b** would have similar effects on commercial fishermen and businesses as **Alternative 1 (No Action)**, except that there may be more flexibility in the payback provision because the total ACL must be exceeded and the stock be overfished. For the GA-NC stock of hogfish, the payback provision under **Preferred Sub-alternative 2a** is not expected to be triggered frequently because, on average, commercial landings of hogfish in that geographic area have been similar to the proposed commercial ACL (see **Table 4.4.4**) and recreational landings have been well below the proposed recreational ACL. A payback would only be triggered if the total ACL were exceeded and the stock was deemed overfished. Since the status of the GA-NC stock of hogfish remains unknown, a payback would not be required and, therefore, there would be no negative social effects. For the FLK/EFL stock, **Preferred Sub-alternative 2b** may result in negative social effects since a payback is likely to be triggered. For this stock, the proposed commercial and recreational ACLs are substantially lower than average landings in recent years and SEDAR 37 (2014) indicated the stock is overfished. Hence, the likelihood of the total ACL being exceeded is higher than for the GA-NC stock.

Because there is no in-season closure for the recreational sector in place (**Alternative 1 (No Action)**), there is no additional means to reduce the risk of an overage, particularly for the FLK/EFL stock. **Preferred Alternative 3/Preferred Sub-alternatives 3b** and **3d** would require an in-season closure regardless of stock status, which would be expected to be more beneficial than **Sub-alternatives 3a** and **3c** for fishermen by contributing to success in the rebuilding plan for the FLK/EFL stock, and sustaining harvest for the GA-NC stock.

Similar to **Alternative 1 (No Action)**, **Preferred Alternative 4/ Preferred Sub-alternatives 4a** and **4b** would maintain the same post-season recreational AM but make the AMs applicable to each of the two stocks of hogfish.

Chapter 3. Affected Environment

This section describes the affected environment in the proposed project area. The affected environment is divided into four major components:

- **Habitat environment** (Section 3.1)
- **Biological and Ecological environment** (Section 3.2)
- **Economic and Social environment** (Sections 3.3)
- **Administrative environment** (Section 3.4)

3.1 Habitat Environment

3.1.1 Inshore/Estuarine Habitat

Many snapper grouper species utilize both pelagic and benthic (bottom) habitats during several stages of their life histories; larval stages of these species live in the water column and feed on plankton. Most juveniles and adults are demersal (bottom dwellers) and associate with hard structures on the continental shelf that have moderate to high relief (e.g., coral reef systems and artificial reef structures, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings). Juvenile stages of some snapper grouper species also utilize inshore seagrass beds, mangrove estuaries, lagoons, oyster reefs, and embayment systems. In many species, various combinations of these habitats may be utilized during daytime feeding migrations or seasonal shifts in cross-shelf distributions. Additional information on the habitat utilized by species in the Snapper Grouper Complex is included in Volume II of the Fishery Ecosystem Plan (FEP; SAFMC 2009b) and incorporated here by reference. The FEP can be found at: http://www.safmc.net/ecosystem-management/fishery-ecosystem-plan-1.

3.1.2 Offshore Habitat

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

The exact extent and distribution of productive snapper grouper habitat in South Atlantic continental shelf habitats is unknown. Current data suggest from 3 to 30% of the shelf is suitable

habitat for these species. These live-bottom habitats may include low relief areas, supporting sparse to moderate growth of sessile (permanently attached) invertebrates, moderate relief reefs from 0.5 to 2 meters (1.6 to 6.6 ft), or high relief ridges at or near the shelf break consisting of outcrops of rock that are heavily encrusted with sessile invertebrates such as sponges and sea fan species. Live-bottom habitat is scattered irregularly over most of the shelf north of Cape Canaveral but is most abundant offshore from northeastern Florida. South of Cape Canaveral the continental shelf narrows from 56 to 16 kilometers (35 to 10 mi) wide off the southeast coast of Florida and the Florida Keys. The lack of a large shelf area, presence of extensive, rugged living fossil coral reefs, and dominance of a tropical Caribbean fauna are distinctive benthic characteristics of this area.

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

Artificial reef structures are also utilized to attract fish and increase fish harvests; however, research on artificial reefs is limited and opinions differ as to whether or not these structures promote an increase of ecological biomass or merely concentrate fishes by attracting them from nearby, natural un-vegetated areas of little or no relief. There are several notable shipwrecks along the southeast coast in state and federal waters including Lofthus (eastern Florida), SS Copenhagen (southeast Florida), Half Moon (southeast Florida), Hebe (Myrtle Beach, South Carolina), Georgiana (Charleston, South Carolina), U.S.S. Monitor (Cape Hatteras, North Carolina), Huron (Nags Head, North Carolina), and Metropolis (Corolla, North Carolina).

The distribution of coral and live hard bottom habitat as presented in the Southeast Marine Assessment and Prediction Program (SEAMAP) bottom mapping project is a proxy for the distribution of the species within the snapper grouper complex. The method used to determine hard bottom habitat relied on the identification of reef obligate species including members of the snapper grouper complex. The Florida Fish and Wildlife Research Institute (FWRI), using the best available information on the distribution of hard bottom habitat in the South Atlantic region, prepared maps which consolidate known distribution of coral, hard/live bottom, and artificial reefs as hard bottom, are available on the South Atlantic Council's online map services: http://ocean.floridamarine.org/safmc_atlas/. An introduction to the system is found at: http://www.safmc.net/ecosystem-management/mapping-and-gis-data.

Plots of the spatial distribution of offshore species were generated from the Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP) data. The plots serve

as point confirmation of the presence of each species within the scope of the sampling program. These plots, in combination with the hard bottom habitat distributions previously mentioned, can be employed as proxies for offshore snapper grouper complex distributions in the south Atlantic region. Maps of the distribution of snapper grouper species by gear type based on MARMAP data can also be generated through the South Atlantic Council's Internet Mapping System at the above address.

Additional information on the habitat utilized by snapper grouper species is included in Volume II of the Fishery Ecosystem Plan (SAFMC 2009b). The FEP can be found at: http://www.safmc.net/ecosystem-management/fishery-ecosystem-plan-1.

3.1.3 Essential Fish Habitat

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

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

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

3.1.4 Habitat Areas of Particular Concern

Areas which meet the criteria for Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPCs) for species in the snapper grouper management unit include medium to high profile offshore hard bottoms where spawning normally occurs; localities of known or likely

periodic spawning aggregations; near shore hard bottom areas; The Point, The Ten Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump (South Carolina); mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets; all state-designated nursery habitats of particular importance to snapper grouper (e.g., Primary and Secondary Nursery Areas designated in North Carolina); pelagic and benthic *Sargassum*; Hoyt Hills for wreckfish; the Oculina Bank Habitat Area of Particular Concern; all hermatypic coral habitats and reefs; manganese outcroppings on the Blake Plateau; South Atlantic Council-designated Artificial Reef Special Management Zones (SMZs); and deepwater MPAs. Areas that meet the criteria for EFH-HAPCs include habitats required during each life stage (including egg, larval, postlarval, juvenile, and adult stages).

In addition to protecting habitat from fishing related degradation though fishery management plan regulations, the South Atlantic Council, in cooperation with NMFS, actively comments on non-fishing projects or policies that may impact essential fish habitat. With guidance from the Habitat Advisory Panel, the South Atlantic Council has developed and approved policies on: energy exploration, development, transportation and hydropower re-licensing; beach dredging and filling and large-scale coastal engineering; protection and enhancement of submerged aquatic vegetation; alterations to riverine, estuarine and near shore flows; offshore aquaculture; and marine invasive species and estuarine invasive species.

The potential impacts the actions in this amendment may have on EFH, and EFH-HAPCs are discussed in **Chapter 4** of this document. **Appendix H** has detailed information on EFH and EFH-HAPCs for all Council managed species.

3.2 Biological and Ecological Environment

3.2.1 Fish Populations Affected by this Amendment

The reef environment in the South Atlantic management area affected by actions in this environmental impact statement is defined by two components (**Figure 3.2.1**). Each component will be described in detail in the following sections.

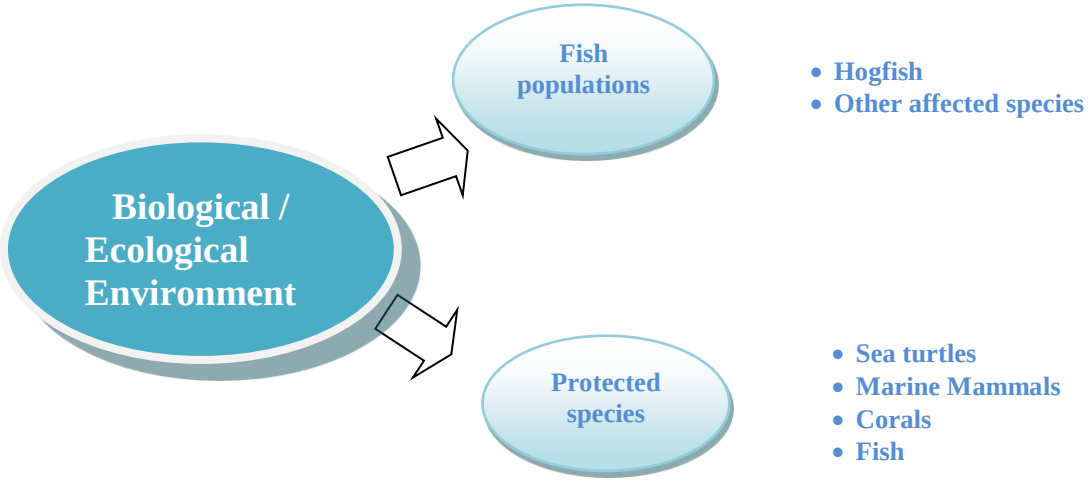


Figure 3.2.1. Two components of the biological environment described in this document.

The waters off the South Atlantic coast are home to a diverse population of fish. The snapper grouper fishery management unit contains 59 species of fish, many of them neither "snappers" nor "groupers". These species live in depths from a few feet (typically as juveniles) to hundreds of feet. As far as north/south distribution, the more temperate species tend to live in the upper reaches of the South Atlantic management area (e.g., black sea bass, red porgy) while the tropical variety's core residence is in the waters off south Florida, Caribbean Islands, and northern South America (e.g., black grouper, mutton snapper). These are reef-dwelling species that live amongst each other. These species rely on the reef environment for protection and food. There are several reef tracts that follow the southeastern coast. The fact that these fish populations congregate dictates the nature of the fishery (multi-species) and further forms the type of management regulations proposed in this document.

Hogfish (*Lachnolaimus maximus*) Life History

Hogfish occur in tropical, subtropical and warm temperate waters of the Atlantic Ocean (Brazil to Bermuda), and throughout the Gulf of Mexico and Caribbean Sea. After a planktonic larval phase (30-40 days), juvenile hogfish settle nearshore in estuaries, seagrass beds or shallow reef habitats (Davis 1976, Colin 1982, Ault et al. 2003), and gradually move offshore with growth (Collins and McBride 2011). Adults are typically associated with hard bottom, reef habitats, and individuals have been observed as deep as 65 m (Collins and McBride 2011). Hogfish are visual predators that feed primarily during daylight hours on benthic invertebrates

(Randall and Warmke 1967), so their depth range is likely limited by light availability and food sources.

Hogfish are protogynous hermaphrodites that form harems. All fish mature as females first, and eventually become male if they live long enough. A single male maintains harems of 5 to 15 females (Colin 1982, Munoz et al. 2010) during extended spawning seasons that last for months. Hogfish are pair spawners (Davis 1976, Colin 1982), and spawning occurs daily during the spawning season (McBride and Johnson 2007, Collins and McBride 2008, Munoz et al. 2010). The size (197-727 mm FL) and age (1-11 yr) range at which sexual transition occurs indicates that transition is socially mediated (Collins and McBride 2011). Sex change can take several months (McBride and Johnson 2007), so removal of the dominant male has the potential to significantly affect harem stability and decrease reproductive potential (Munoz et al. 2010).

Hogfish Life History
An Overview

- Extend from Brazil to Bermuda, throughout the Gulf of Mexico and Caribbean Sea.
- Adults are typically associated with hard bottom and reef habitats, as deep as 65 m, with juveniles in nearshore estuaries, seagrass beds or shallow reef habitats.
- Protogynous hermaphrodites, form harems.
- The spawning season extends from December through April.
- Oldest fish reported is 23 years old.

Peak spawning activity for this species has been repeatedly demonstrated to occur during the winter and spring months (Davis 1976, Colin 1982, Claro et al. 1989, McBride and Johnson 2007, Collins and McBride 2008, Munoz et al 2010). These studies have demonstrated that spawning activity occurs predominantly during the months of December through April, and begins (and ends) slightly earlier in the Florida Keys than on the West Florida shelf (Davis 1976, McBride et al. 2008).

Hogfish have been managed as a single stock within the United States since initial regulations were implemented in 1994 by the State of Florida. Landings within the U.S. occur predominantly within state and federal waters adjacent to the state of Florida. Management regulations are consistent between state and federal waters throughout their U.S. range. Genetic data were not available for this species prior to 2013, so previous stock assessments have treated hogfish as a single stock (Ault et al. 2003). However, recent genetic analyses by Seyoum et al. (2015) have demonstrated distinct stocks between the eastern Gulf of Mexico (WFL), the Florida Keys and southeast Florida (FLK/EFL), and the Carolinas (GA-NC).

Additional life history, biological characteristics, and stock status information for hogfish may be found the Southeast Data, Assessment, and Review (SEDAR) report, SEDAR 37 (2014), which is available on the SEDAR web site http://www.sefsc.noaa.gov/sedar/ and is hereby incorporated by reference (see **Section 3.2.3** of this document for more information on the SEDAR process).

Stock status of Hogfish

The stock status of hogfish off Florida was assessed in 2004 (SEDAR 6 2004). However, the review panel rejected the assessment due to data and technical flaws. A benchmark assessment was completed in 2014 with data through 2012 (SEDAR 37 2014) which the review panel accepted and recommended for use in management for the hogfish stock in east Florida and the Florida Keys (FLK/EFL).

3.2.2 Other Species Affected

Thompson and Switzer (2015) reported on habitat selection and overlap in terms of location, abiotic, and habitat variables of six co-occurring species including gag, lane snapper, gray snapper, black sea bass, white grunt, and hogfish. Results showed that hogfish were the least sympatric with the co-occurring species, with gag and the snappers co-occurring much more commonly (Thompson and Switzer 2015). Bycatch of other species is incidental in the hook-and-line fishery for hogfish, with no bycatch of other co-occurring species expected in the spear fishery for hogfish. For details on the life histories and ecology of co-occurring species, the reader is referred to Volume II of the Fishery Ecosystem Plan (SAFMC 2009b) available at: http://www.safmc.net/ecosystem-management/fishery-ecosystem-plan-1.

An expanded discussion of life history traits, population characteristics, and stock status of snapper grouper species affected by this amendment can be found in **Sections 3.2.1** and **3.3** of the Comprehensive Annual Catch Limit Amendment (SAFMC 2011a), which are hereby incorporated by reference and may be found at https://www.dropbox.com/s/mp3xwedsrarfpjn/Comp%20ACL%20Am%20101411%20FINAL.pdf.

3.2.3 The Stock Assessment Process

The Southeast Data, Assessment, and Review (SEDAR) process is a cooperative fishery management council process initiated to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and U.S. Caribbean. The Caribbean, Gulf of Mexico, and South Atlantic Fishery Management Councils manage SEDAR in coordination with the National Marine Fisheries Service (NMFS) and the Atlantic and Gulf States Marine Fisheries Commissions. SEDAR seeks improvements in the scientific quality of stock assessments, constituent and stakeholder participation in assessment development, transparency in the assessment process, and a rigorous and independent scientific review of completed stock assessments.

SEDAR is organized around three workshops. First is the Data Workshop, during which fisheries monitoring and life history data are reviewed and compiled. Second is the Assessment Workshop, which may be conducted via a workshop and several webinars, during which assessment models are developed and population parameters are estimated using the information provided from the Data Workshop. Third and final is the Review Workshop, during which

independent experts review the input data, assessment methods, and assessment products. The completed assessment, including the reports of all three workshops and all supporting documentation, are then forwarded to the South Atlantic Council's Scientific and Statistical Committee (SSC). The SSC considers whether the assessment represents the best available science and develops fishing level recommendations for South Atlantic Council's consideration.

SEDAR workshops are public meetings organized by SEDAR. Workshop participants appointed by the lead Council are drawn from state and federal agencies, non-government organizations, Council members, Council advisors, and the fishing industry with a goal of including a broad range of disciplines and perspectives. All participants are expected to contribute to this scientific process by preparing working papers, contributing data, providing assessment analyses, evaluating and discussing information presented, and completing the workshop report.

3.2.4 Protected Species

There are 49 species, or distinct population segments (DPSs) of species, protected by federal law that may occur in the exclusive economic zone (EEZ) of the South Atlantic Region. Thirty-one of these species are marine mammals protected under the Marine Mammal Protection Act (MMPA) (Wynne and Schwartz 1999, Waring et al. 2013). The MMPA requires that each commercial fishery be classified by the number of marine mammals they seriously injure or kill. NMFS's List of Fisheries (LOF) classifies U.S. commercial fisheries into three categories based on the number of incidental mortality or serious injury they cause to marine mammals. More information about the LOF and the classification process can be found at: http://www.nmfs.noaa.gov/pr/interactions/lof/

Six of the marine mammal species (sperm, sei, fin, blue, humpback, and North Atlantic right whales) protected by the MMPA, are also listed as endangered under the Endangered Species Act (ESA). In addition to those six marine mammals, five species of sea turtles (green, hawksbill, Kemp's ridley, leatherback, and loggerhead); the smalltooth sawfish; five DPSs of Atlantic sturgeon; and six species of coral [elkhorn coral (*Acropora palmata*), staghorn coral (*A. cervicornis*) ("*Acropora*" collectively); lobed star coral (*Orbicella annularis*), mountainous star coral (*O. faveolata*), and knobby star coral (*O. franksi*) ("*Orbicella*" collectively); and rough cactus coral (*Mycetophylia ferox*)] are also protected under the ESA. Portions of designated critical habitat for North Atlantic right whales, the Northwest Atlantic (NWA) DPS of loggerhead sea turtles, and *Acropora* corals occur within the South Atlantic Council's jurisdiction. NMFS has conducted specific analyses ("Section 7 consultations") to evaluate the potential adverse effects from the South Atlantic snapper grouper fishery on species and critical habitat protected under the ESA. Information on these, as well as sea turtles and smalltooth sawfish and how they are adversely affected by the snapper grouper fishery are discussed below.

Subsequent to the June 7, 2006, biological opinion, elkhorn and staghorn coral (*Acropora cervicornis* and *Acropora palmata*) were listed as threatened. In a consultation memorandum dated July 9, 2007, NMFS concluded the continued authorization of the South Atlantic snapper grouper fishery is not likely to adversely affect these *Acropora* species. On November 26, 2008, an *Acropora* critical habitat was designated. In a consultation memorandum dated December 2,

2008, NMFS concluded the continued authorization of the snapper grouper fishery is not likely to adversely affect *Acropora* critical habitat. On September 10, 2014, NMFS listed 20 new coral species under the ESA, five of those species occur in the Caribbean (including Florida) and all of these are listed as threatened. The 2 previously listed *Acropora* coral species remain protected as threatened. In an "ESA section 7 consultation on the continued authorization of the snapper grouper and dolphin and wahoo fisheries following the listing of new coral species", dated September 11, 2014, NMFS indicated that the previous determination remains valid and the South Atlantic snapper grouper fishery is still not likely to adversely affect *Acropora* corals.

The September 10, 2014, final listing rule provided some new information on the threats facing *Acropora*; however, none of the information suggested that previous determinations were no longer valid. For this reason, a memo dated September 11, 2014, indicates that previous determination remains valid and the South Atlantic snapper grouper fishery is still not likely to adversely affect *Acropora* corals. For the remaining 5 species of coral (*Mycetophyllia ferox, Dendrogyra cylindrus, Orbicella annularis, O. faveolata, and O. franksi*), the threats to corals from fishing identified in the status review for these species (SSR) include (1) trophic effects, (2) human-induced physical damage, and (3) destructive fishing practices. The September 11, 2014, memo indicates South Atlantic snapper grouper fishery will not cause trophic effects because it does not capture herbivorous fish.

3.2.4.1 ESA-Listed Sea Turtles

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

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

The **hawksbill's** pelagic stage lasts from the time they leave the nesting beach as hatchlings until they are approximately 22-25 cm in straight carapace length (Meylan 1988, Meylan and Donnelly 1999). The pelagic stage is followed by residency in developmental habitats (foraging areas where juveniles reside and grow) in coastal waters. Little is known about the diet of pelagic stage hawksbills. Adult foraging typically occurs over coral reefs, although other hard-

bottom communities and mangrove-fringed areas are occupied occasionally. Hawksbills show fidelity to their foraging areas over several years (Van Dam and Diéz 1998). The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Gravid females have been noted ingesting coralline substrate (Meylan 1984) and calcareous algae (Anderes Alvarez and Uchida 1994), which are believed to be possible sources of calcium to aid in eggshell production. The maximum diving depths of these animals are not known, but the maximum length of dives is estimated at 73.5 minutes. More routinely, dives last about 56 minutes (Hughes 1974).

Kemp's ridley hatchlings are also pelagic during the early stages of life and feed in surface waters (Carr 1987, Ogren 1989). Once the juveniles reach approximately 20 cm carapace length they move to relatively shallow (less than 50 m) benthic foraging habitat over unconsolidated substrates (Márquez-M. 1994). They have also been observed transiting long distances between foraging habitats (Ogren 1989). Kemp's ridleys feeding in these nearshore areas primarily prey on crabs, though they are also known to ingest mollusks, fish, marine vegetation, and shrimp (Shaver 1991). The fish and shrimp Kemp's ridleys ingest are not thought to be a primary prey item but instead may be scavenged opportunistically from bycatch discards or from discarded bait (Shaver 1991). Given their predilection for shallower water, Kemp's ridleys most routinely make dives of 50 m or less (Soma 1985, Byles 1988). Their maximum diving range is unknown. Depending on the life stage, Kemp's ridleys may be able to stay submerged anywhere from 167 minutes to 300 minutes, though dives of 12.7 minutes to 16.7 minutes are much more common (Soma 1985, Mendonca and Pritchard 1986, Byles 1988). Kemp's ridleys may also spend as much as 96% of their time underwater (Soma 1985, Byles 1988).

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

Loggerhead hatchlings forage in the open ocean and are often associated with *Sargassum* rafts (Hughes 1974, Carr 1987, Walker 1994, Bolten and Balazs 1995). The pelagic stage of these sea turtles eat a wide range of organisms including salps, jellyfish, amphipods, crabs, syngnathid fish, squid, and pelagic snails (Brongersma 1972). Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic (Witzell 2002). Here they forage over hard- and soft-bottom habitats (Carr 1986). Benthic foraging loggerheads eat a variety of invertebrates with crabs and mollusks being an important prey source (Burke et al. 1993). Estimates of the maximum diving depths of loggerheads range

from 211 m to 233 m (692-764ft.) (Thayer et al. 1984, Limpus and Nichols 1988). The lengths of loggerhead dives are frequently between 17 and 30 minutes (Thayer et al. 1984, Limpus and Nichols 1988, Limpus and Nichols 1994, Lanyan et al. 1989) and they may spend anywhere from 80 to 94% of their time submerged (Limpus and Nichols 1994, Lanyan et al. 1989).

Sea turtles are vulnerable to capture by bottom longline and vertical hook-and-line gear. The magnitude of the interactions between sea turtles and the South Atlantic snapper grouper fishery was evaluated in NMFS (2006) using data from the Supplementary Discard Data Program (SDDP). Three loggerheads and three unidentified sea turtles were caught on vertical lines; one leatherback and one loggerhead were caught on bottom longlines, all were released alive. The effort reported in the program represented between approximately 5% and 14% of all South Atlantic snapper grouper fishing effort. These data were extrapolated in NMFS (2006) to better estimate the number of interactions between the entire snapper-grouper fishery and ESA-listed sea turtles. The extrapolated estimate was used to project future interactions (**Table 3.2.1**).

Table 3.2.1. Three-year South Atlantic anticipated takes sea turtles in the snapper grouper fishery.

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

Source: NMFS 2006. NMFS (National Marine Fisheries Service). 2006. Endangered Species Act Section 7 consultation on the continued authorization of snapper grouper fishing under the Snapper Grouper FMP and Proposed Amendment 13C. Biological Opinion. June 7.

The SDDP does not provide data on recreational fishing interactions with ESA-listed sea turtle species. However, anecdotal information indicates that recreational fishermen occasionally take sea turtles with hook-and-line gear. The biological opinion also used the extrapolated data from the SDDP to estimate the magnitude of recreational fishing on sea turtles (**Table 3.2.1**).

Regulations implemented through Amendment 15B to the Snapper Grouper FMP (74 FR 31225; June 30, 2009; SAFMC 2008b) required all commercial or charter/headboat vessels with a South Atlantic snapper grouper permit, carrying hook-and-line gear on board, to possess required literature and release gear to aid in the safe release of incidentally caught sea turtles and smalltooth sawfish. Comprehensive Ecosystem-Based Amendment 2 modified these requirements (76 FR 82183; December 30, 2011; SAFMC 2011c) by requiring different gear for vessels with different freeboard heights, mirroring the requirements in the Gulf of Mexico. These regulations are thought to decrease the mortality associated with accidental interactions with sea turtles and smalltooth sawfish.

On September 22, 2011, NMFS and the U.S. Fish and Wildlife Service determined the loggerhead sea turtle population consists of nine distinct population segments (DPSs) (76 FR 58868). Previously, loggerhead sea turtles were listed as threatened species throughout their global range. The snapper grouper fishery interacts with loggerhead sea turtles from what is now considered the Northwest Atlantic (NWA) DPS, which remains listed as threatened. Five DPSs of Atlantic sturgeon were also listed since the completion of the 2006 biological opinion. In a consultation memorandum dated February 15, 2012, NMFS concluded the continued authorization of the South Atlantic snapper grouper fishery is not likely to adversely affect the Atlantic sturgeon. The February 15, 2012, memorandum also stated that because the 2006 biological opinion had evaluated the impacts of the fishery on the loggerhead subpopulations now wholly contained within the NWA DPS, the opinion's conclusion that the fishery is not likely to jeopardize the continued existence of loggerhead sea turtles remains valid.

On July 10, 2014, NMFS published a final rule designating critical habitat for the Northwest Atlantic Ocean (NWA) Loggerhead Sea Turtle DPS in the *Federal Register* (79 FR 39856). The final rule, effective August 11, 2014, designates 38 marine areas within the Atlantic Ocean and Gulf of Mexico, which contain the physical or biological features essential for the conservation of the loggerhead sea turtle. A memorandum dated September 16, 2014, evaluated the effects of continued authorization of federal fisheries, including snapper grouper, on the newly-designated critical habitat. The memo concluded that activities associated with the snapper grouper fishery would not adversely affect any of the NWA loggerhead DPS critical habitat units.

3.2.4.2 ESA-Listed Marine Fish

Historically the **smalltooth sawfish** in the U.S. ranged from New York to the Mexico border. Their current range is poorly understood but believed to have contracted from these historical areas. In the South Atlantic region, they are most commonly found in Florida, primarily off the Florida Keys (Simpfendorfer and Wiley 2004). Only two smalltooth sawfish have been recorded north of Florida since 1963 [the first was captured off North Carolina in 1963 and the other off Georgia in 2002 (National Smalltooth Sawfish Database, Florida Museum of Natural History)]. Historical accounts and recent encounter data suggest that immature individuals are most common in shallow coastal waters less than 25 meters (Bigelow and Schroeder 1953, Adams and Wilson 1995), while mature animals occur in waters in excess of 100 meters (Simpfendorfer pers. comm. 2006). Smalltooth sawfish feed primarily on fish. Mullet, jacks, and ladyfish are believed to be their primary food sources (Simpfendorfer 2001). Smalltooth sawfish also prey on crustaceans (mostly shrimp and crabs) by disturbing bottom sediment with their saw (Norman and Fraser 1938, Bigelow and Schroeder 1953).

3.3 Economic Environment

A description of the hogfish stock is provided in **Section 3.2**. Additional details on the South Atlantic Snapper Grouper Fishery can be found in the Comprehensive ACL Amendment for the South Atlantic Region (SAFMC 2011a) and Amendment 24 (SAFMC 2011b) and are incorporated herein by reference.

3.3.1 Commercial Sector

The major sources of data summarized in this description are the NMFS SERO Permits Information Management System (PIMS) and 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 (BLS). Inflation adjusted revenues and prices are reported in 2014 dollars. Landings are expressed in pounds (lbs) gutted weight (gw) to match the method for collecting ex-vessel price information. The gutted to whole weight (ww) conversion rate is ww = gw x 1.11.

Permits

Any fishing vessel that harvests and sells any of the snapper grouper species from the South Atlantic EEZ must have a valid South Atlantic commercial snapper grouper permit, which is a limited access permit. As of June 30, 2015, there were 557 valid or renewable South Atlantic Snapper Grouper Unlimited Permits and 118 valid or renewable 225-lb Trip-limited Permits. After a permit expires, it can be renewed or transferred up to one year after the date of expiration. The number of valid or renewable snapper grouper permits declined steadily from 2010 through 2014 (**Table 3.3.1**).

Table 3.3.1. Number of valid or renewable South Atlantic commercial snapper grouper permits (2010 through 2014).

	Unlimited	225-lb Trip-limited
2010	624	139
2011	615	138
2012	604	132
2013	592	129
2014	584	125
Average	604	133

Source: NMFS SERO Permits Dataset, 2015.

Landings, Value, and Effort

Landings of hogfish for each proposed stock area from 2010 through 2014 are presented in **Figure 3.3.1**. Landings in Georgia through North Carolina decreased by approximately 50% from 2010 through 2014, whereas landings from the Florida Keys and East Florida increased by approximately 31%.

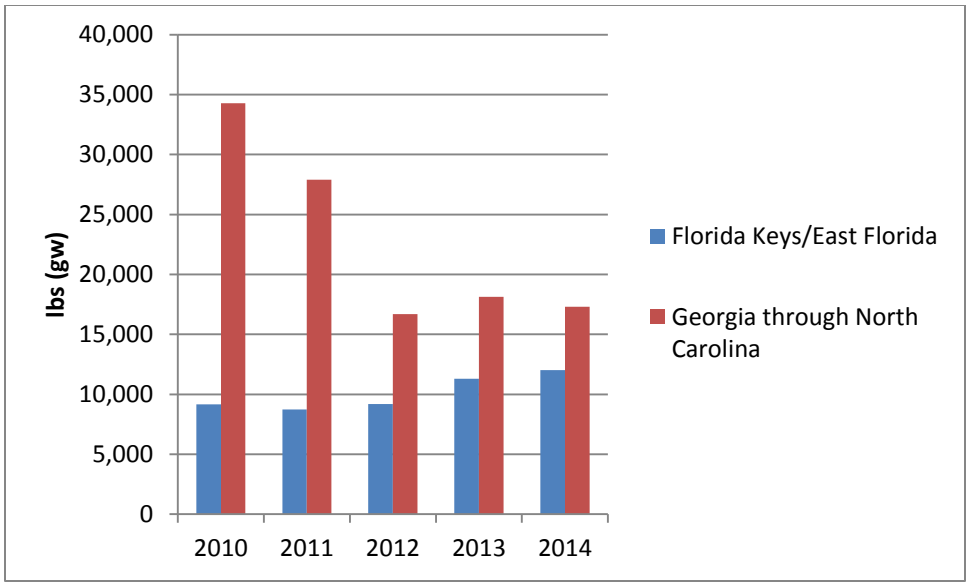


Figure 3.3.1. Annual commercial landings of hogfish (lbs gw) by stock area.
Source: NMFS SEFSC Coastal Fisheries Logbook.

On average (2010 through 2014), for the vessels that landed hogfish each year, hogfish accounted for only 1.2% of all species landings and 1.5% of all species revenue (**Table 3.3.2** and **Table 3.3.3**). Vessels with reported landings of hogfish took almost 5 times as many non-hogfish trips as hogfish trips. The average annual price per pound of hogfish during 2010 through 2014 was $3.64 (2014 dollars) and average prices were mostly stable across years.

Table 3.3.2. Number of vessels, number of trips and landings (lbs gw) by year.

Year	Number of vessels that caught hogfish (> 0 lbs gw)	Number of trips that caught hogfish	hogfish landings (lbs gw)	Other species' landings jointly caught with hogfish (lbs gw)	Number of SATL trips that only caught other species	Other species' landings on SATL trips without hogfish (lbs gw)
2010	131	573	43,421	609,628	2,942	2,035,375
2011	147	617	36,619	600,670	3,326	2,450,628
2012	131	607	25,895	497,928	2,901	1,848,574
2013	129	700	29,440	479,596	3,127	2,142,733
2014	136	711	29,317	473,602	3,262	2,081,666
Average	135	642	32,938	532,285	3,112	2,111,795

Source: NMFS SEFSC Coastal Fisheries Logbook.

Table 3.3.3. Number of vessels and ex-vessel revenues by year (2014 dollars)*.

	Number of vessels that caught hogfish	Dockside revenue from hogfish	Dockside revenue from 'other species' jointly caught with hogfish	Dockside revenue from 'other species' caught on SATL trips without hogfish	Total dockside revenue	Average total dockside revenue per vessel
2010	131	$146,109	$1,926,324	$5,694,058	$7,766,491	$59,286
2011	147	$131,513	$1,915,203	$6,872,024	$8,918,740	$60,672
2012	131	$92,580	$1,781,292	$5,452,284	$7,326,156	$55,925
2013	129	$108,809	$1,835,368	$6,249,005	$8,193,182	$63,513
2014	136	$116,120	$1,766,921	$5,988,655	$7,871,696	$57,880
Average	135	$119,026	$1,845,022	$6,051,205	$8,015,253	$59,455

Source: NMFS SEFSC Coastal Fisheries Logbook for landings and NMFS Accumulated Landings System for prices.
*Revenues converted to 2014 dollars using the 2014 annual Consumer Price Index (CPI) for all US urban consumers provided by the Bureau of Labor and Statistics (BLS) (http://www.bls.gov/data/).

On average (2010 through 2014), the majority of hogfish trips that occurred in Georgia through North Carolina landed less than 100 lbs gw of hogfish per trip (**Table 3.3.4**). Only approximately 19% of vessels that landed hogfish in Georgia through North Carolina from 2010 through 2014 reported landings in excess of 100 lbs gw on a single trip. In the Florida Keys and East Florida, on average (2010 through 2014), the majority of hogfish effort occurred on trips with reported hogfish landings of less than 25 lbs gw per trip (**Table 3.3.5**). Approximately half of the vessels that landed hogfish in the Florida Keys and East Florida, however, reported taking a trip with hogfish landings in excess of 25 lbs gw.

Table 3.3.4. Number of trips that landed hogfish in Georgia through North Carolina in excess of each proposed trip limit and number of vessels that took such trips (2010 through 2014 average).

	Trip Limit			
	100	250	500	750
Number of trips with hogfish landings in excess of each trip limit option	47	23	9	5
(percent of all hogfish trips)	(17.1%)	(8.3%)	(3.4%)	(1.9%)
Number of vessels that took a trip with hogfish landings in excess of each trip limit option	12	5	***	***
(percent of all hogfish vessels)	(19.1%)	(8.7%)	***	***

Source: NMFS SEFSC Coastal Fisheries Logbook.
*** 3 or fewer vessels.

Table 3.3.5. Number of trips that landed hogfish in the Florida Keys/East Florida in excess of each proposed trip limit and number of vessels that took such trips (2010 through 2014 average).

	Trip Limit (lbs, gw)				
	25	**50**	**100**	**150**	**200**
Number of trips with hogfish landings in excess of each trip limit option	103	50	15	7	4
(percent of all hogfish trips)	(28.1%)	(13.6%)	(4.0%)	(1.8%)	(1.1%)
Number of vessels that took a trip with hogfish landings in excess of each trip limit option	37	23	10	5	4
(percent of all hogfish vessels)	(48.2%)	(29.9%)	(13.0%)	(7.0%)	(4.9%)

Source: NMFS SEFSC Coastal Fisheries Logbook.

Imports

Imports of seafood products compete in the domestic seafood market and have in fact dominated many segments of the seafood market. Imports aid in determining the price for domestic seafood products and tend to set the price in the market segments in which they dominate. Seafood imports have downstream effects on the local fish market. At the harvest level for snapper and grouper species, including hogfish, imports affect the returns to fishermen through the ex-vessel prices they receive for their landings. As substitutes to domestic production of snappers and groupers, imports tend to cushion the adverse economic effects on consumers resulting from a reduction in domestic landings. The following describes the imports of fish products which directly compete with domestic harvest of snappers and groupers, including hogfish.

Imports[2] of fresh snapper were 22.8 million lbs product weight (pw) in 2010. They decreased to 21.7 million lbs pw in 2011, then increased steadily to 23.6 million lbs pw in 2014. Total revenue from fresh snapper imports increased from $64.5 million (2014 dollars[3]) in 2010 to a five-year high of $72.1 million in 2014. Imports of fresh snappers primarily originated in Mexico, Central America, or South America, and entered the U.S. through the port of Miami. Imports of fresh snapper were highest on average (2010 through 2014) during the months March through July.

Imports of frozen snapper were substantially less than imports of fresh snapper from 2010 through 2014. The annual value of frozen snapper imports ranged from $20.9 million (2014 dollars) to $30 million during the time period, with a peak in 2012. Imports of frozen snapper

[2] NOAA Fisheries Service purchases fisheries trade data from the Foreign Trade Division of the U.S. Census Bureau. Data are available for download at http://www.st.nmfs.noaa.gov/st1/trade/index.html.
[3] Converted to 2014 dollars using the 2014 annual Consumer Price Index (CPI) for all US urban consumers provided by the Bureau of Labor and Statistics (BLS) (http://www.bls.gov/data/).

primarily originated in South America (especially Brazil), Indonesia, and Mexico. The majority of frozen snapper imports entered the U.S. through the ports of Miami and New York. Imports of frozen snappers tended to be lowest during March through June when fresh snapper imports were the highest.

Imports of fresh grouper ranged from 8.2 million lbs pw to 10 million lbs pw from 2010 through 2014. Total revenue from fresh grouper ranged from $27.6 million (2014 dollars) to $36.8 million during this time period, with a peak in 2013. The bulk of fresh grouper imports originated in Mexico and entered the U.S. through Miami. From 2010 through 2014 fresh grouper imports were lowest on average during the month of March and higher the rest of the year, with a peak in July.

Imports of frozen grouper were minimal and stable from 2010 through 2014, ranging from 1.3 million lbs pw worth $2.5 million (2014 dollars) to 2 million lbs pw worth $3.6 million. Frozen grouper imports generally originated in Mexico and to a lesser extent, Asia and entered the U.S. through Miami and Tampa. There was an inverse relationship in monthly landings between frozen and fresh groupers, with average imports being the highest in March for frozen grouper and lower during other months.

Business Activity

The commercial harvest and subsequent sales and consumption of fish generates business activity as fishermen expend funds to harvest the fish and consumers spend money on goods and services, such as hogfish purchased at a local fish market and served during restaurant visits. These expenditures spur additional business activity in the region(s) where the harvest and purchases are made, such as jobs in local fish markets, grocers, restaurants, and fishing supply establishments. In the absence of the availability of a given species for purchase, consumers would spend their money on substitute goods and services. As a result, the analysis presented below represents a distributional analysis only; that is, it only shows how economic effects may be distributed through regional markets and should not be interpreted to represent the impacts if these species are not available for harvest or purchase.

Estimates of the average annual business activity associated with the commercial harvest of hogfish, and all species harvested by the vessels that harvested hogfish, were derived using the model developed for and applied in NMFS (2011b) and are provided in **Table 3.3.6**. This business activity is characterized as full-time equivalent jobs, 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. It should be noted that the results provided should be interpreted with caution and demonstrate the limitations of these types of assessments. These results are based on average relationships developed through the analysis of many fishing operations that harvest many different species. Separate models to address individual species are not available. For example, the results provided here apply to a general reef fish category rather than just hogfish and a harvester job is "generated" for approximately every $45,000 in ex-vessel revenue. These results contrast with the information provided in **Table 3.3.2**, which shows an average of 135 harvesters (vessels) with recorded landings of hogfish from 2010 through 2014.

Table 3.3.6. Average annual business activity (2010 through 2014) associated with the commercial harvest of hogfish and the harvest of all species by vessels that landed hogfish. All monetary estimates are in 2014 dollars.

Species	Average Ex-vessel Value ($ thousands)	Total Jobs	Harvester Jobs	Output (Sales) Impacts ($ thousands)	Income Impacts ($ thousands)
Hogfish	$119	20	3	$1,567	$668
All species on all trips made by vessels that landed greater than one pound of hogfish in a year.	$8,015	1,374	179	$105,533	$44,977

Source: Calculated by NMFS SERO using the model developed for NMFS (2011b).

3.3.2 Recreational Sector

The recreational sector of the snapper grouper fishery is comprised of a private and for-hire component. The private component includes anglers fishing from shore (all land-based structures) and private/rental boats. The for-hire component is composed of charter boats and headboats (also called party boats). Charter boats generally carry fewer passengers and charge a fee on an entire vessel basis, whereas headboats carry more passengers and payment is per person.

Landings

The vast majority of estimated recreational landings from 2010 through 2014 occurred in the Florida Keys/East Florida area, which includes Monroe County (**Table 3.3.6**). Landings fluctuated during this time period in all areas.

Table 3.3.6. Recreational landings (lbs gw) of hogfish, by area, 2010-2014.

Year	North Carolina	South Carolina	Georgia / East FL*	East Florida	Monroe County	Total
2010	1,771	1,992	108	54,078	128,002	185,952
2011	461	79	744	48,525	40,797	90,606
2012	4,178	3	178	84,042	281,172	369,573
2013	825	5	255	63,998	92,768	157,852
2014	8	16	368	111,410	154,087	265,889
Average	1,448	419	331	72,411	139,365	213,974

Source: SEFSC Marine Recreational Information Program (MRIP) ACL datasets (July 2015).
*Landings estimates from the Southeast Region Headboat Survey (SRHS) are pooled between Northeast Florida (north of Sebastian, FL) and Georgia.

Permits

For-hire vessels are required to have a for-hire snapper grouper permit to fish for or possess snapper grouper species in the South Atlantic EEZ. As of June 30, 2015, there were 1,381 valid for-hire snapper grouper permits. This sector operates as an open access fishery and not all permitted vessels are necessarily active in the fishery. Some vessel owners may have obtained

open access permits as insurance for uncertainties in the fisheries in which they currently operate. The number of for-hire vessel permits issued for the South Atlantic snapper grouper fishery decreased from 1,812 permits in 2010 to a five-year low of 1,727 permits in 2014 (**Table 3.3.7**). The majority of snapper grouper for-hire permitted vessels were home-ported in Florida; a relatively high proportion of these permitted vessels were also home-ported in North Carolina and South Carolina. Many vessels with South Atlantic for-hire snapper grouper permits were home-ported in states outside of the SAFMC's area of jurisdiction. On average (2010 through 2014), these vessels accounted for approximately 11% of the total number of for-hire snapper grouper permits issued.

Table 3.3.7. Number of South Atlantic for-hire snapper grouper permits, by homeport state, 2010-2014.

Home Port	2010	2011	2012	2013	2014	Average
North Carolina	331	330	312	307	294	315
South Carolina	145	132	138	150	160	145
Georgia	27	26	26	30	34	29
Florida	1,109	1,099	1,122	1,121	1,062	1,103
Gulf (AL-TX)	86	91	93	91	81	88
Others	114	103	106	100	96	104
Total	1,812	1,781	1,797	1,799	1,727	1,783

Source: NMFS SERO Permits Dataset, 2015.

Although the for-hire permit application collects information on the primary method of operation, the permit itself does not identify the permitted vessel as either a headboat or a charter vessel and vessels may operate in both capacities. However, only federally permitted headboats are required to submit harvest and effort information to the NMFS Southeast Region Headboat Survey (SRHS). Participation in the SRHS is based on determination by the Southeast Fishery Science Center (SEFSC) that the vessel primarily operates as a headboat. As of April 24, 2015, 77 South Atlantic headboats were registered in the SRHS (K. Fitzpatrick, NMFS SEFSC, pers. comm.). The majority of these headboats were located in Florida/Georgia (49), followed by North Carolina (18) and South Carolina (10).

There are no specific permitting requirements for recreational anglers to harvest snapper grouper species. Instead, anglers are required to possess either a state recreational fishing permit that authorizes saltwater fishing in general, or be registered in the federal National Saltwater Angler Registry system, subject to appropriate exemptions. As a result, it is not possible to identify with available data how many individual anglers would be expected to be affected by this proposed amendment.

Angler Effort

Recreational effort derived from the Marine Recreational Information Program (MRIP) database can be characterized in terms of the number of trips as follows:

- 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.
- 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.
- Total recreational trips - The total estimated number of recreational trips, regardless of target intent or catch success.

Other measures of effort are possible, such as directed trips (the number of individual angler trips that either targeted or caught a particular species), among other measures. **Table 3.3.8** and **Table 3.3.9** present target and catch effort estimates associated with hogfish. Most of the estimated target and catch effort for hogfish occurred in Florida, with the private mode being the most prevalent mode of fishing. Although not shown, on average (2010 through 2014), hogfish target trips, across all modes and states, accounted for approximately 8.9% of all snapper grouper target trips and hogfish catch trips accounted for approximately 1.6% of all snapper grouper catch trips.

Table 3.3.8. Hogfish recreational target trips, by mode and state, 2010-2014*.

Year	Florida	North Carolina**	Total
Charter Mode			
2010	1,478	0	1,478
2011	262	0	262
2012	0	0	0
2013	152	0	152
2014	207	0	207
Average	420	0	420
Private/Rental Mode			
2010	24,982	0	24,982
2011	10,445	0	10,445
2012	17,926	734	18,660
2013	23,297	0	23,297
2014	16,361	0	16,361
Average	18,602	147	18,749
All Modes			
2010	26,460	0	26,460
2011	10,707	0	10,707
2012	17,926	734	18,660
2013	23,449	0	23,449
2014	16,568	0	16,568
Average	19,022	147	19,169

Source: MRIP database, NOAA Fisheries, NMFS, SERO.
*There were no hogfish target trips estimated for Georgia or South Carolina and none for the shore mode.
**2012 estimates were expanded from only three intercepted trips. There were no intercepted hogfish target trips in North Carolina for other years.
Note: Effort estimates have been post-stratified to include Monroe County, FL.

Table 3.3.9. Hogfish recreational catch trips, by mode and state, 2010-2014*.

Year	Florida	North Carolina	South Carolina**	Total
Shore Mode				
2010	327	263	0	590
2011	0	900	0	900
2012	1,458	0	0	1,458
2013	294	0	0	294
2014	1,329	3,080	0	4,409
Average	682	849	0	1,530
Charter Mode				
2010	814	35	15	864
2011	1,491	0	0	1,491
2012	1,402	89	0	1,491
2013	2,998	243	0	3,241
2014	4,030	0	0	4,030
Average	2,147	73	3	2,223
	Private/Rental Mode			
2010	16,926	872	758	18,555
2011	13,519	499	0	14,017
2012	27,686	686	0	28,372
2013	28,080	387	0	28,467
2014	28,561	0	0	28,558
Average	22,954	489	152	23,594
All Modes				
2010	18,067	1,170	773	20,009
2011	15,009	1,398	0	16,408
2012	30,545	775	0	31,321
2013	31,372	630	0	32,002
2014	33,918	3,080	0	36,998
Average	25,782	1,411	155	27,348

Source: MRIP database, NOAA Fisheries, NMFS, SERO.
*There were no hogfish catch trips estimated for Georgia.
**2010 estimates were expanded from only two intercepted trips. There were no intercepted hogfish catch trips in South Carolina for other years.
Note: Effort estimates have been post-stratified to include Monroe County, FL.

Similar analysis of recreational effort is not possible for the headboat mode because headboat data are not collected at the angler level. Estimates of effort by the headboat mode are provided in terms of angler days, or the total number of standardized full-day angler trips[4]. Headboat effort, in terms of angler days, increased substantially in Florida/Georgia from 2010 through 2014, while effort remained relatively constant in North Carolina and South Carolina (**Table 3.3.10**). Headboat effort was the highest, on average, during the summer months of June through August (**Table 3.3.11**).

Table 3.3.10. Headboat angler days and percent distribution by state (2010-2014).

	Angler Days			Percent Distribution		
	Florida/Georgia	North Carolina	South Carolina	Florida/Georgia	North Carolina	South Carolina
2010	123,662	21,071	44,951	65.2%	11.1%	23.7%
2011	124,041	18,457	44,645	66.3%	9.9%	23.9%
2012	139,623	20,766	41,003	69.3%	10.3%	20.4%
2013	165,679	20,547	40,963	72.9%	9.0%	18.0%
2014	195,890	22,691	42,025	75.2%	8.7%	16.1%
Average	149,779	20,706	42,717	70.3%	9.7%	20.0%

Source: NMFS SRHS.

Table 3.3.11. Headboat angler days and percent distribution by month (2010-2014).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Headboat Angler Days											
2010	5,937	6,437	12,786	18,329	19,898	29,301	31,801	25,123	10,755	13,313	8,458	7,546
2011	8,011	10,688	13,718	17,472	17,786	29,793	33,259	21,634	11,107	8,352	6,491	8,832
2012	9,230	9,663	17,307	19,587	18,232	27,819	35,115	25,052	15,894	8,677	6,564	8,252
2013	10,182	10,892	14,541	16,129	20,969	33,079	39,463	33,830	16,335	14,534	6,698	10,537
2014	8,748	13,512	19,808	22,570	25,764	39,115	44,066	32,886	15,203	15,235	9,088	14,611
Avg	8,422	10,238	15,632	18,817	20,530	31,821	36,741	27,705	13,859	12,022	7,460	9,956
	Percent Distribution											
2010	3.1%	3.4%	6.7%	9.7%	10.5%	15.4%	16.8%	13.2%	5.7%	7.0%	4.5%	4.0%
2011	4.3%	5.7%	7.3%	9.3%	9.5%	15.9%	17.8%	11.6%	5.9%	4.5%	3.5%	4.7%
2012	4.6%	4.8%	8.6%	9.7%	9.1%	13.8%	17.4%	12.4%	7.9%	4.3%	3.3%	4.1%
2013	4.5%	4.8%	6.4%	7.1%	9.2%	14.6%	17.4%	14.9%	7.2%	6.4%	2.9%	4.6%
2014	3.4%	5.2%	7.6%	8.7%	9.9%	15.0%	16.9%	12.6%	5.8%	5.8%	3.5%	5.6%
Avg	4.0%	4.8%	7.3%	8.9%	9.6%	14.9%	17.3%	13.0%	6.5%	5.6%	3.5%	4.6%

Source: NMFS SRHS.

[4] Headboat trip categories include half-, three-quarter-, full-, and 2-day trips. A full-day trip equals one angler day, a half-day trip equals .5 angler days, etc. Angler days are not standardized to an hourly measure of effort and actual trip durations may vary within each category.

Economic Value

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.

Direct estimates of the CS for hogfish are not currently available. There are, however, estimates for snapper and grouper species in general. Haab et al. (2012) estimated the CS (willingness to pay (WTP) for one additional fish caught and kept) for snappers and groupers in the southeastern U.S. using four separate econometric modeling techniques. The finite mixture model, which takes into account variation in the preferences of fishermen, had the best prediction rates of the four models and, as such, was selected for presentation here. The WTP for an additional snapper (excluding red snapper) estimated by this model was $12.37 (2014 dollars)[5]. This value may seem low and may be strongly influenced by the pooling effect inherent to the model in which it was estimated. The WTP for an additional red snapper, in comparison, was estimated to be $140.23 (2014 dollars). The WTP for an additional grouper was estimated to be $134.73 (2014 dollars). Another study estimated the value of the consumer surplus for catching and keeping a second grouper on an angler trip at approximately $103 (2014 dollars) and lower thereafter (approximately $69 for a third grouper, $51 for a fourth grouper, and $40 for a fifth grouper) (Carter and Liese 2012). Additionally, this study estimated the value of harvesting a second red snapper at approximately $81 (2014 dollars) and lower thereafter. No estimates were provided for other snapper species.

The foregoing estimates of economic value should not be confused with economic impacts associated with recreational fishing expenditures. Although 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.

With regards to for-hire businesses, economic value can be measured by producer surplus (PS) per passenger trip (the amount of money that a vessel owner earns in excess of the cost of providing the trip). Estimates of the PS per for-hire passenger trip are not available. Instead, net operating revenue (NOR), which is the return used to pay all labor wages, returns to capital, and owner profits, is used as a proxy for PS. For the South Atlantic region, estimated NOR values are $163 (2014 dollars) per charter angler trip and $44 per headboat angler trip (C. Liese, NMFS SEFSC, pers. comm.)[6].

[5] Estimates converted to 2014 dollars using the 2014 annual Consumer Price Index (CPI) for all US urban consumers provided by the Bureau of Labor and Statistics (BLS) (http://www.bls.gov/data/).
[6] Estimates were converted to 2014 dollars using the 2014 annual CPI for all US urban consumers provided by the BLS (http://www.bls.gov/data/).

Business Activity

The desire for recreational fishing generates economic activity as consumers spend their income on various goods and services needed for recreational fishing. This spurs economic activity in the region where recreational fishing occurs. It should be clearly noted that, in the absence of the opportunity to fish, the income would presumably be spent on other goods and services and these expenditures would similarly generate economic activity in the region where the expenditure occurs. As such, the analysis below represents a distributional analysis only.

Estimates of the business activity (economic impacts) associated with recreational angling for hogfish were derived using average impact coefficients for recreational angling for all species, as derived from an add-on survey to the Marine Recreational Fisheries Statistics Survey (MRFSS) to collect economic expenditure information, as described and utilized in NMFS (2011b). Estimates of the average expenditures by recreational anglers are also provided in NMFS (2011b) and are incorporated herein by reference.

Recreational fishing generates business activity (economic impacts). Business activity for the recreational sector is characterized in the form of full-time equivalent jobs, output (sales) impacts (gross business sales), and value-added impacts (difference between the value of goods and the cost of materials or supplies). Estimates of the average target effort (2010-2014) for hogfish and associated business activity (2014 dollars) are provided in **Table 3.3.12**. The average impact coefficients, or multipliers, used in the model are invariant to the "type" of effort and can therefore be directly used to measure the impact of other effort measures such as catch trips if desired. To calculate the multipliers from **Table 3.3.12**, simply divide the desired impact measure (output impact, value-added impact, or jobs) associated with a given state and mode by the number of target trips for that state and mode. It is noted that multipliers are not provided for combinations of states and modes that had zero estimated hogfish target trips from 2010 through 2014.

The estimates provided in **Table 3.3.12** only apply at the state-level. These numbers should not be added across the region. Addition of the state-level estimates to produce a regional (or national) total could either under- or over-estimate the actual amount of total business activity because of the complex relationship between different jurisdictions and the expenditure/impact multipliers. Neither regional nor national estimates are available at this time.

Estimates of the business activity associated with headboat effort are not available. Headboat vessels are not covered in the MRFSS/MRIP, so, in addition to the absence of estimates of target effort, estimation of the appropriate business activity coefficients for headboat effort has not been conducted.

Table 3.3.12. Summary of hogfish target trips (2010 through 2014 average) and associated business activity (2014 dollars)*. Output and value added impacts are not additive.

	East Florida	North Carolina
	Private/Rental Mode	
Target Trips	18,602	147
Output Impact	$967,360	$12,392
Value Added Impact	$544,606	$7,025
Jobs	8	0
	Charter Mode	
Target Trips	420	0
Output Impact	$334,777	$0
Value Added Impact	$220,338	$0
Jobs	3	0
	All Modes	
Target Trips	19,022	147
Output Impact	$1,302,136	$12,392
Value Added Impact	$764,944	$7,025
Jobs	11	0

*There were no hogfish target trips estimated for Georgia or South Carolina and none for the shore mode.
Source: effort data from MRIP; economic impact results calculated by NMFS SERO using the model developed for NMFS (2011b).

3.4. Social Environment

Descriptions of the social and cultural environment of snapper grouper fishing communities are contained in Jepson et al. (2005), Amendment 17A (SAFMC 2010a), and the Comprehensive Annual Catch Limit Amendment (SAFMC 2011a).

3.4.1 Commercial Sector

Since 2001, South Atlantic Snapper Grouper Unlimited Permits and Snapper Grouper 225-lb Trip Limit Permits have shown a downward trend (**Figure 3.4.1**) as would be expected with a limited entry program in place since 1998 and a "2 for 1" requirement for new permits. That trend will likely continue as long as the criteria are a continued part of management for the snapper grouper commercial fishery. The decline in the number of permits has slowed in recent years as there seems to be a leveling off with the number of unlimited permits in 2013 going from 593 to 584 in 2014 and limited permits dropping from 130 in 2013 to 125 in 2014.

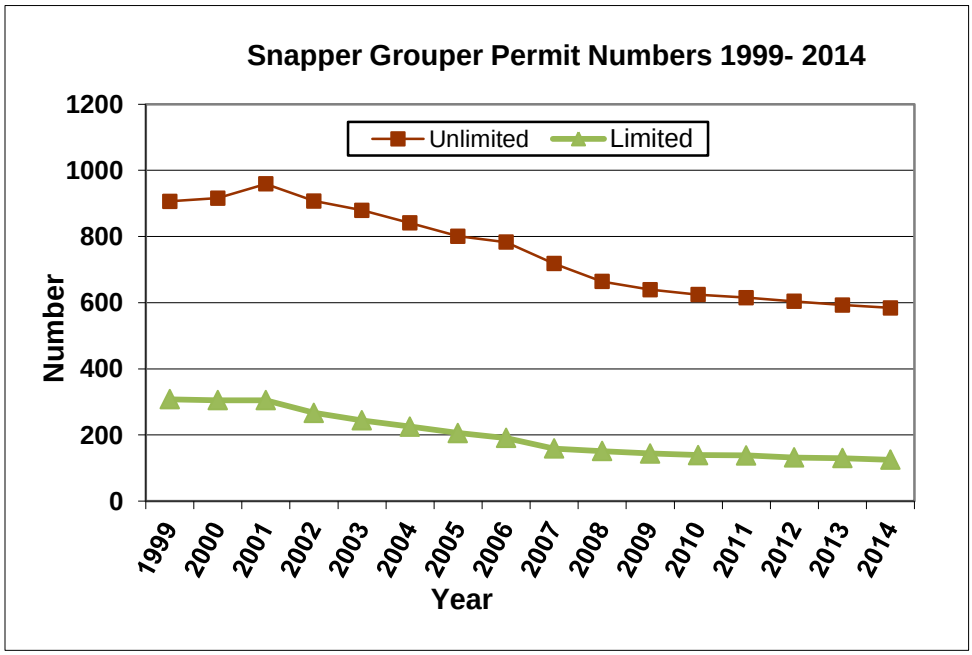


Figure 3.4.1. Snapper grouper Unlimited and 225-pound trip limit permits 1999-2014.
Source: NMFS SERO Permits (2015).

In terms of where permit holders are landing hogfish, **Figure 3.4.2** provides a ranking of the top fifteen communities in Florida with hogfish landings and their regional quotient (RQ). Regional quotient is the amount of hogfish landed by a community out of all hogfish landed within the South Atlantic region[7]. Most hogfish are landed in Southeast Florida, with Key West dominating other ports, although Mayport is in the top five in terms of RQ. St. Augustine and Jacksonville Beach are other Northeastern Florida communities within the top fifteen.

[7] The values on the y axis are not provided to protect confidentiality.

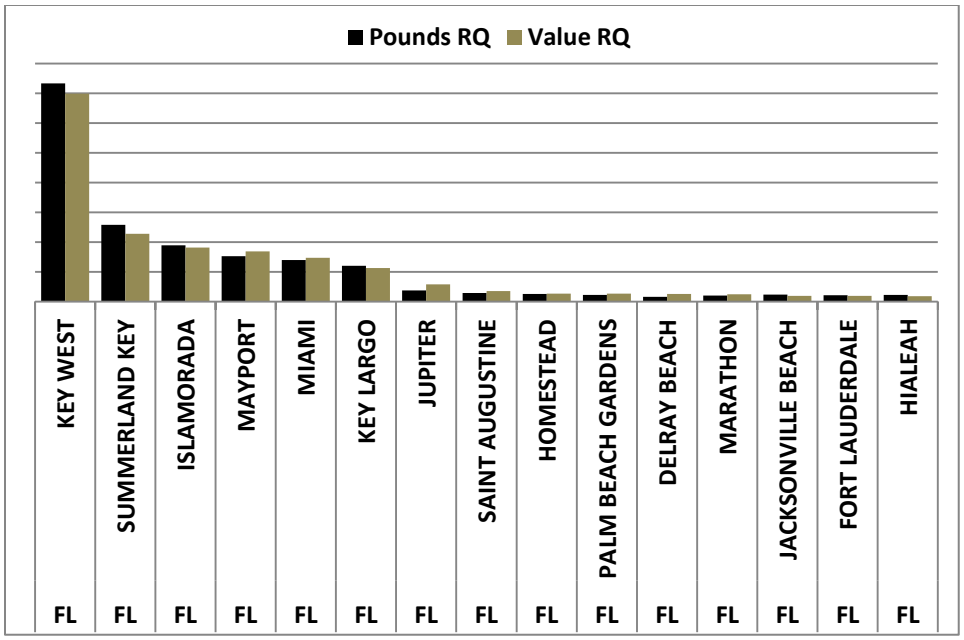


Figure 3.4.2. Hogfish Pounds and Value Regional Quotient (RQ) for Top 15 Florida Communities. Source: NMFS: ALS 2013

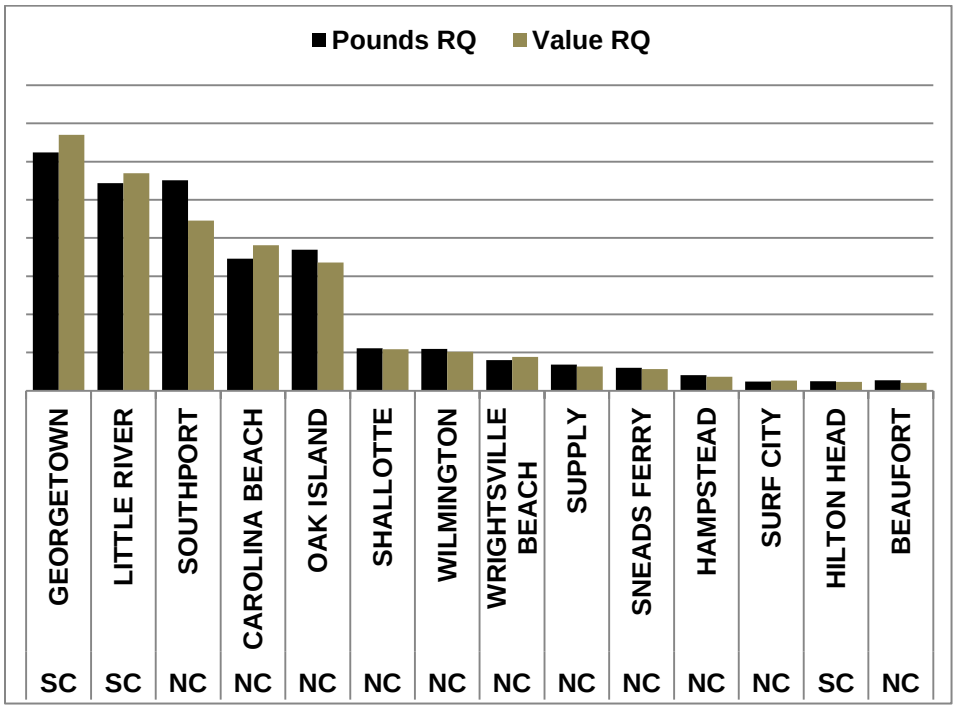


Figure 3.4.3. Hogfish Pounds and Value Regional Quotient (RQ) for Top 15 GA-NC Communities. Source: NMFS: ALS 2013

The areas outside of Florida where hogfish are landed, from Georgia to North Carolina, are dominated by Murrells Inlet, SC with the highest RQ. There are no communities in Georgia within the top 15 communities.

Hogfish are commercially harvested primarily with spear and hook and line. They tend to be an easy target for spear fishermen and are prized for their taste and texture. They are likely bycatch for commercial hook and line fishermen. As their numbers are limited they make up a small part of the catch. This is evident in **Table 3.4.1** where the average vessel local quotient by community is described. A vessel local quotient is the amount of hogfish harvested by a vessel out of all species harvested within a year and averaged here by community. Although some communities did have a higher average vessel local quotient, they were not included because there were fewer than 3 within a community. The highest average local quotient in **Table 3.4.1** was approximately 12 percent of hogfish out of total annual harvest of all species.

Table 3.4.1. Average 2012 Vessel Local Quotient by Community

Community	Average Vessel LQ	Number of Vessels
Big Pine Key, FL	0.1196	7
Little Torch Key, FL	0.1031	3
Key West, FL	0.0611	27
Little River, SC	0.0519	9
Conch Key, FL	0.0416	3
Jacksonville, FL	0.0341	7
Murrells Inlet, SC	0.0115	6
Miami, FL	0.0102	7
Southport, NC	0.0049	11
Tavernier, FL	0.0046	5

Commercial Fishing Engagement and Reliance

To better understand how South Atlantic fishing communities are engaged and reliant on fishing overall, several indices composed of existing permit and landings data were created to provide a more empirical measure of fishing dependence (Colburn and Jepson 2012, Jepson and Colburn 2013). Commercial fishing engagement uses the absolute numbers of permits, landings and value, while commercial fishing reliance includes many of the same variables as engagement, but divides by population to give an indication of the per capita impact of this activity.

Using a principal component and single solution factor analysis each community receives a factor score for each index to compare to other communities. Factor scores are represented by colored bars and are standardized, therefore the mean is zero. Two thresholds of 1 and ½ standard deviation above the mean are plotted onto the graphs to help determine thresholds for significance. Because the factor scores are standardized, a score above 1 is also above one standard deviation.

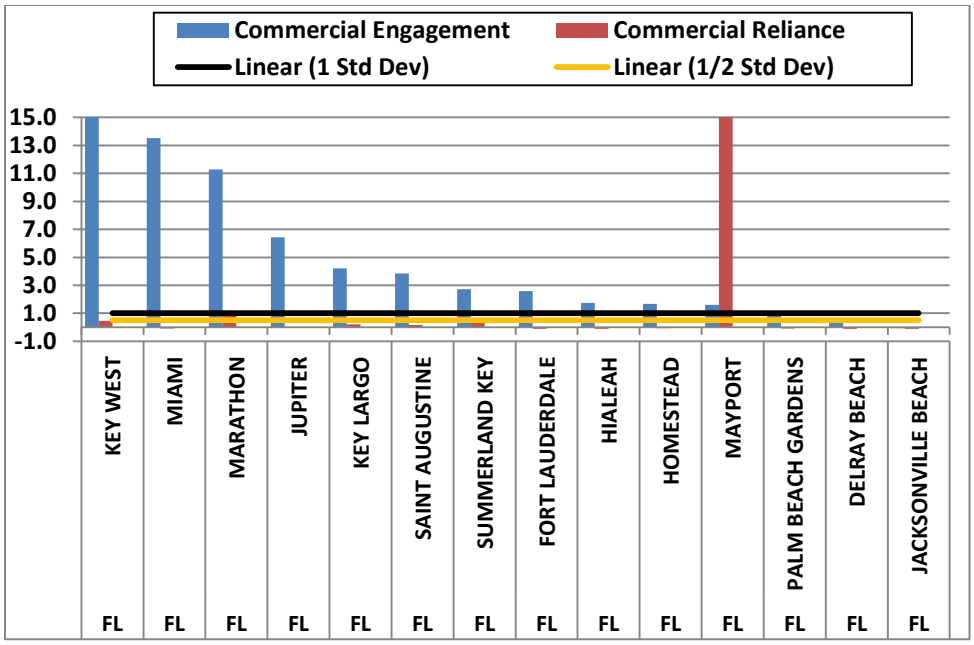


Figure 3.4.4. Commercial Fishing Engagement and Reliance for Top 15 Florida Communities. Source: NMFS Social Indicators 2015

Most of the Florida communities that have a high regional quotient for hogfish are also highly engaged in commercial fishing according to **Figure 3.4.4**. Key West is one of the highest commercially engaged fishing communities while Delray Beach and Jacksonville Beach are neither highly engaged nor reliant. Mayport has the highest reliance of any Florida community, largely due to its small population. The only other community that exceeds the lowest threshold for reliance is Marathon.

The majority of those communities outside of Florida with high regional quotients for hogfish are also highly engaged in commercial fishing, but few show commercial fishing reliance. For North Carolina, **Figure 3.4.5** shows Wilmington having the highest engagement, while Surf City and Hampstead have little engagement or reliance. Sneads Ferry is both highly engaged and reliant with Beaufort and Southport showing high engagement with some reliance on commercial fishing.

It is expected for those communities that are both highly engaged and reliant on commercial fishing, may experience vulnerabilities from any negative impacts from regulatory change. While their engagement and reliance are not the only factors that should be considered and other vulnerabilities may exist as outlined below in **Section 3.4.3** (Environmental Justice). While these vulnerabilities may exist, this does not mean that a community will experience negative impacts, only that these factors can contribute to the possibility of negative impacts.

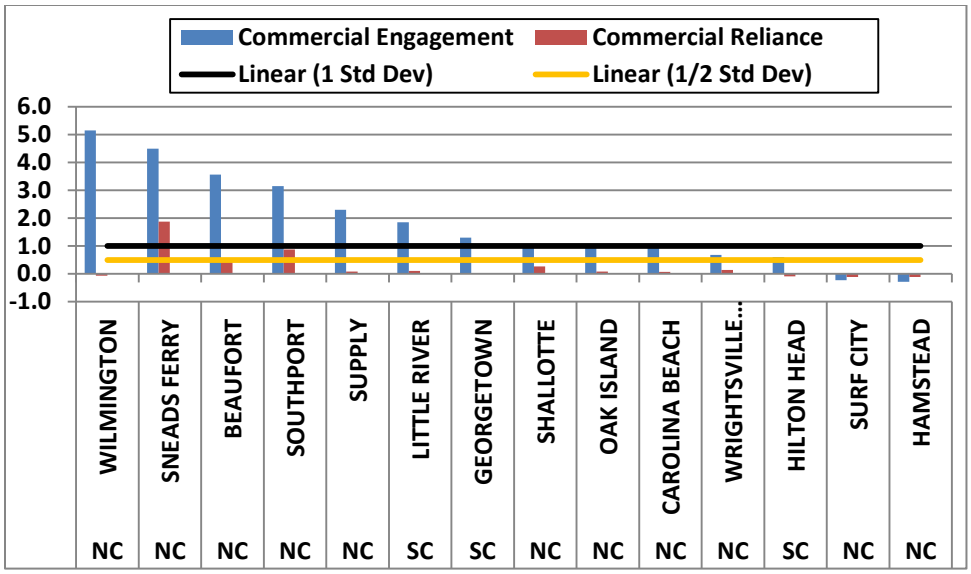


Figure 3.4.5. Commercial Fishing Engagement and Reliance for Top 15 Georgia-North Carolina Communities.
Source: NMFS: Social Indicators 2015

3.4.2 Recreational Sector

Hogfish is a popular species for recreational divers and also hook and line fishermen. Because it is difficult to co-locate recreational fishermen and the species for which they fish, **Table 3.4.2** identifies those communities in the South Atlantic that have a high number of for-hire vessels and that same number divided by the community's population. Both ranks are averaged to understand the importance of for-hire fishing to that community. Rankings are based upon the vessel's description of its primary category of fishing: charter, headboat, or commercial. Florida and North Carolina have the most number of communities by their average rank for charter and headboat designated vessels. Key West, FL ranks first in terms of number of for-hire vessels and Hatteras, NC is ranked first when dividing that number by the community population. These measures are similar to the recreational engagement and reliance measures that are used below to also gauge the importance of recreational fishing to a community.

Table 3.4.2. South Atlantic Communities Average Rank by For-hire Permits and For-hire Permits per Population.

State	Community	Number of For-hire Permits	Number of Permits Rank	Permits per Population Rank	Average Rank
NC	Manteo	24	6	2	4
FL	Islamorada	36	3	8	5.5
NC	Hatteras	14	11	1	6
FL	Marathon	44	2	11	6.5
FL	Key West	118	1	16	8.5
NC	Atlantic Beach	13	13	6	9.5
FL	Key Colony Beach	9	16	3	9.5

State	Community	Number of For-hire Permits	Number of Permits Rank	Permits per Population Rank	Average Rank
FL	Ponce Inlet	14	11	17	14
NC	Calabash	9	16	13	14.5
SC	Murrells Inlet	16	9	24	16.5
FL	Duck Key	6	28	5	16.5
NC	Wanchese	8	20	15	17.5
SC	Little River	15	10	27	18.5
NC	Nags Head	8	20	20	20
FL	Cudjoe Key	7	25	18	21.5
FL	Tavernier	7	25	19	22
NC	Morehead City	9	16	31	23.5
FL	Cape Canaveral	9	16	33	24.5
NC	Wrightsville Beach	6	28	22	25
NC	Southport	6	28	25	26.5
NC	Holden Beach	3	41	12	26.5
SC	Hilton Head Island	19	8	46	27
NC	Carolina Beach	7	25	30	27.5
FL	Key Largo	8	20	36	28
NC	Topsail Beach	2	47	9	28

The communities in Florida that are highly engaged in recreational fishing in **Figure 3.4.6** are many of the same communities that have important charter fishing activity in **Table 3.4.2**. Only five highly engaged Florida communities have high reliance: Islamorada, Key West, Ponce Inlet, Marathon, and Big Pine Key. St. Augustine is highly engaged and does show moderate reliance, as does Key Largo. Although these communities are highly engaged and reliant on recreational fishing, we do not know to what extent that fishermen fish for hogfish. We can only assume that for many of the Keys communities that there are fishermen who recreationally fish for hogfish and in other Florida communities may also. It may be that for many of those communities where hogfish are landed commercially, there may also be a higher instance of recreational hogfish landings.

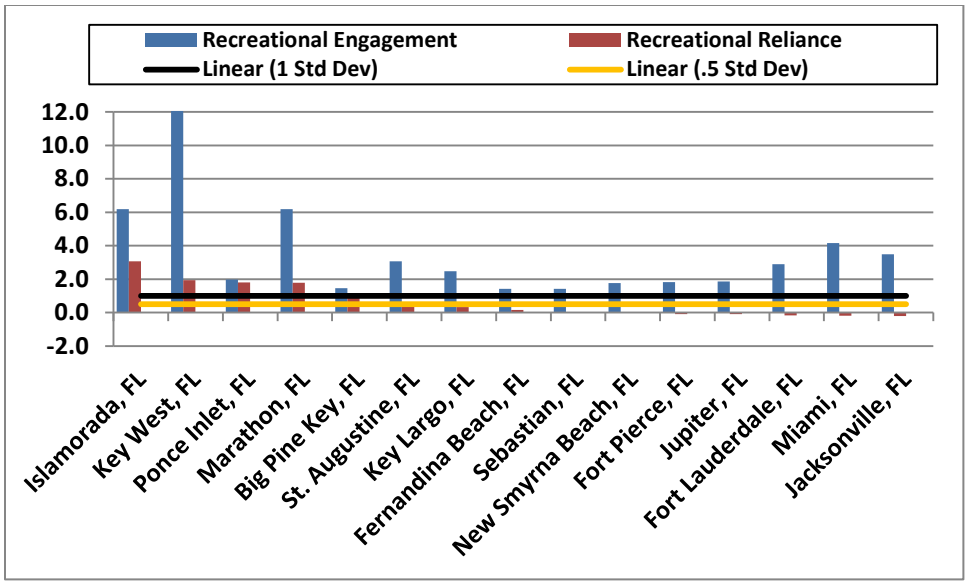


Figure 3.4.6. Recreational Fishing Engagement and Reliance for Top 15 Engaged Florida Communities.
Source: NMFS: Social Indicators 2015

Those communities outside of Florida that are highly engaged are shown in **Figure 3.4.7**. Several show high reliance on recreational fishing in turn. The communities of Murrells Inlet, South Carolina; Atlantic Beach, Wanchese, Wrightsville Beach, and Nags Head, North Carolina; all have high engagement and reliance on recreational fishing. Several others show high engagement and moderate reliance, including Morehead City, North Carolina; Little River, South Carolina; and Carolina Beach, North Carolina.

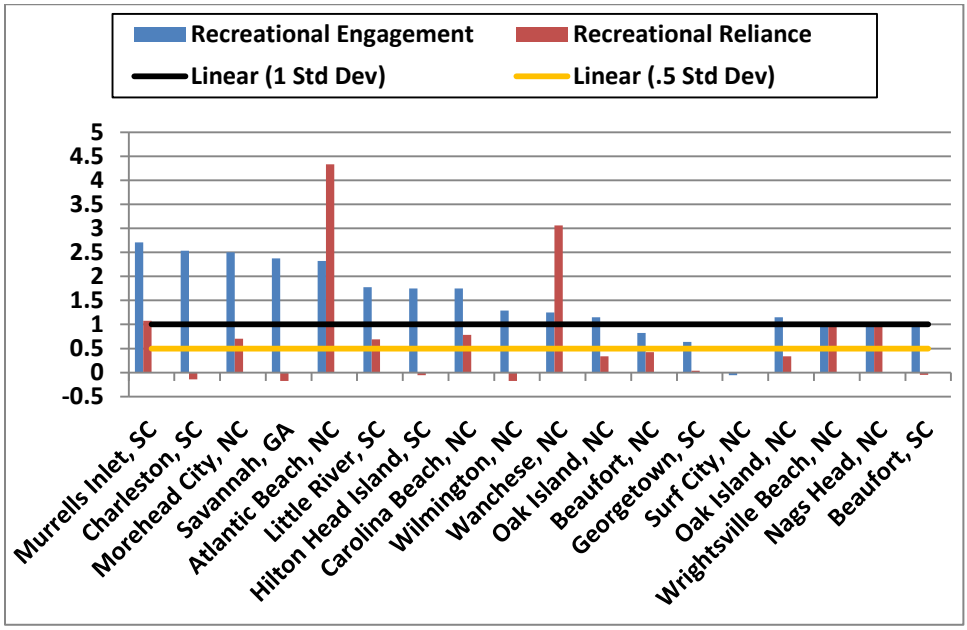


Figure 3.4.7. Recreational Fishing Engagement and Reliance for Top 15 Engaged South Carolina and North Carolina Communities.
Source: NMFS: Social Indicators 2015

The above communities, like those in Florida, demonstrate that recreational fishing likely plays a prominent role in the local economy. Again, it is not possible to place hogfish fishing activity within a particular community and it is assumed that some fishermen in certain locales do participate in harvesting that species.

Those communities that are both highly engaged and reliant on both commercial and recreational fishing and have high regional quotients might be expected to be most likely to exhibit vulnerabilities to negative impacts from the proposed regulatory changes in this amendment. At this time it is only possible to identify those communities that are highly engaged in fishing activities and have fishermen who may harvest hogfish within that community.

3.4.3 Environmental Justice Considerations

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

Commercial fishermen and coastal communities in the South Atlantic may experience some impacts by the proposed actions depending upon the alternatives selected and whether they have negative or positive social effects. However, information on the race and income status for many of the individuals involved in fishing is not available. To evaluate where EJ concerns might exist, a suite of social vulnerability indices have been developed. The three indices are poverty, population composition, and personal disruptions. The variables included in each of these indices have been identified through the literature as being important components that contribute to a community's vulnerability. Indicators such as increased poverty rates for different groups, more single female-headed households and households with children under the age of 5, disruptions such as higher separation rates, higher crime rates and unemployment all are signs of populations experiencing vulnerabilities. These vulnerabilities signify that it may be difficult for someone living in these communities to recover from significant social disruption that might stem from a change in their ability to work or maintain a certain income level.

Because many of the communities included in both the commercial and recreational engagement and reliance figures are the same, a select group most common from each region and sector were included in the following figures. In **Figure 3.4.8** there are very few selected communities in Florida that exceed the thresholds for social vulnerability. Fort Pierce and Miami are the only two that demonstrate that substantial social vulnerabilities exist.

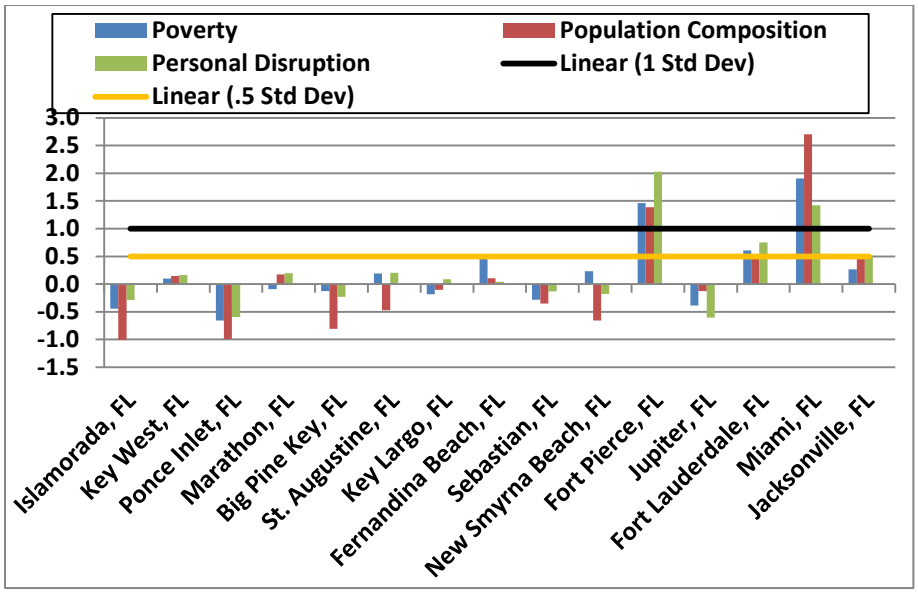


Figure 3.4.8. Social Vulnerability Indices for Selected Commercial and Recreationally Fishing Engaged Florida Communities.
Source: NMFS: Social Indicators 2015

The same is true for communities outside of Florida, as only Georgetown, SC and Savannah, GA exhibit substantial social vulnerabilities as they either exceed both thresholds for all three vulnerabilities or have exceeded the lowest threshold for all three. The other communities in the region show some vulnerability but exceed only the lower threshold for one or two vulnerabilities.

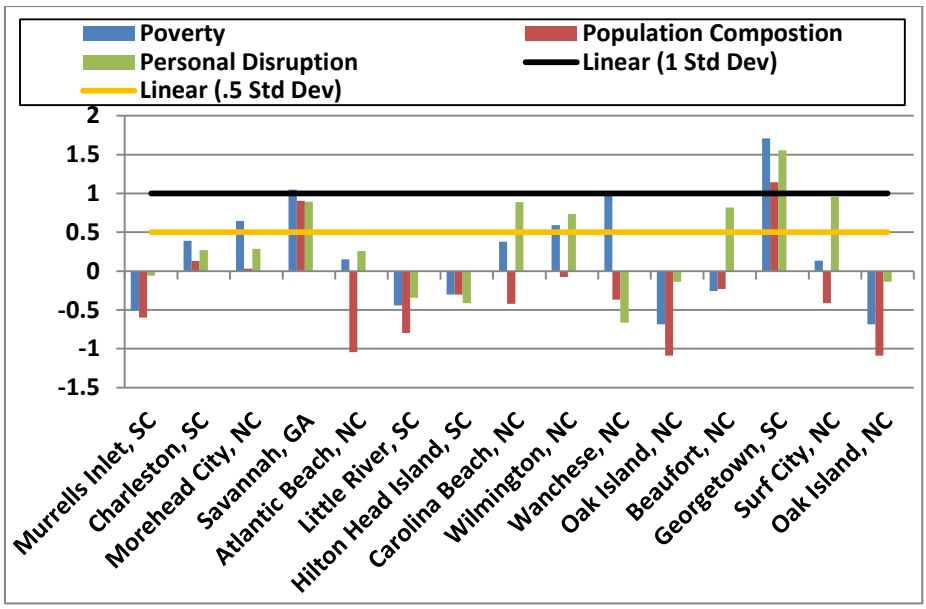


Figure 3.4.9. Social Vulnerability Indices for Selected Commercial and Recreationally Fishing Engaged Communities in Georgia, South Carolina and North Carolina.
Source: NMFS: Social Indicators 2015

Those communities that exhibit high social vulnerabilities may experience negative social effects if the alternatives within this amendment have adverse impacts. This is not to say that these communities will be negatively affected, but the indicators suggest that they may experience difficulties. These are the communities that would be most at risk depending upon their fishing engagement and reliance. Overall, because hogfish represent a small portion of many fishing portfolios, the impacts will likely not be community wide, but will more likely affect businesses and households individually. At this time, there are no metrics that allow for the analysis of those types of impacts on individuals or households.

3.5 Administrative Environment

3.5.1 The Fishery Management Process and Applicable Laws

3.5.1.1 Federal Fishery Management

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

Responsibility for federal fishery management decision-making is divided between the U.S. Secretary of Commerce (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 collecting and providing the data necessary for the councils to prepare fishery management plans and for promulgating regulations to implement proposed plans and amendments after ensuring that management measures are consistent with the Magnuson-Stevens Act and with other applicable laws. In most cases, the Secretary has delegated this authority to NMFS.

The South Atlantic Council is responsible for conservation and management of fishery resources in federal waters of the U.S. South Atlantic. These waters extend from 3 to 200 mi offshore from the seaward boundary of North Carolina, South Carolina, Georgia, and east Florida to Key West. The South Atlantic Council has thirteen voting members: one from NMFS; one each from the state fishery agencies of North Carolina, South Carolina, Georgia, and Florida; and eight public members appointed by the Secretary. On the South Atlantic Council, there are two public members from each of the four South Atlantic States. Non-voting members include representatives of the U.S. Fish and Wildlife Service, U.S. Coast Guard, State Department, and Atlantic States Marine Fisheries Commission (ASMFC). The South Atlantic Council has adopted procedures whereby the non-voting members serving on the South Atlantic Council Committees have full voting rights at the Committee level but not at the full South Atlantic Council level. The South Atlantic Council also established two voting seats for the Mid-Atlantic Council on the South Atlantic Mackerel Committee and one voting seat on the

Snapper Grouper Committee. South Atlantic Council members serve three-year terms and are recommended by state governors and appointed by the Secretary from lists of nominees submitted by state governors. Appointed members may serve a maximum of three consecutive terms.

Public interests also are involved in the fishery management process through participation on Advisory Panels and through council meetings, which, with few exceptions for discussing personnel and legal matters, are open to the public. The South Atlantic Council uses its Scientific and Statistical Committee (SSC) to review the data and science being used in assessments and fishery management plans/amendments. In addition, the regulatory process is in accordance with the Administrative Procedure Act, in the form of "notice and comment" rulemaking.

3.5.1.2 State Fishery Management

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

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

NMFS's State-Federal Fisheries Division is responsible for building cooperative partnerships to strengthen marine fisheries management and conservation at the state, inter-regional, and national levels. This division implements and oversees the distribution of grants for two national (Inter-jurisdictional Fisheries Act and Anadromous Fish Conservation Act) and two regional (Atlantic Coastal Fisheries Cooperative Management Act and Atlantic Striped Bass Conservation Act) programs. Additionally, it works with the ASMFC to develop and implement cooperative State-Federal fisheries regulations.

3.5.1.3 Enforcement

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

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

The NOAA Office of General Counsel Penalty Policy and Penalty Schedule is available online at http://www.gc.noaa.gov/enforce-office3.html.

Chapter 4. Environmental Consequences

Action 1. Modify the Fishery Management Unit (FMU) for hogfish

4.1.1 Biological Effects

Hogfish are currently managed as a single stock within the South Atlantic Fishery Management Council's (South Atlantic Council) area of jurisdiction. Recently, however, research on the genetic structure of hogfish (Seyoum et al. 2015) indicated that three genetically distinct population segments are present in the southeastern U.S.: (1) the eastern Gulf of Mexico, (2) the Florida Keys and the southeast coast of Florida, and (3) the Carolinas. Two of the population segments are within the South Atlantic Council's area of jurisdiction. An amendment to the Snapper Grouper FMP (SAFMC 1983) is therefore needed to delineate the two stocks of hogfish.

Alternatives*
(preferred alternatives in bold)

1. No Action**.** There is a Gulf of Mexico stock and South Atlantic stock of hogfish separated at the jurisdictional boundary between the South Atlantic Fishery Management Council and the Gulf of Mexico Fishery Management Council.

2. Modify the Snapper Grouper Fishery Management Unit (FMU) to specify two separate stocks of hogfish: (1) a Georgia through North Carolina (GA-NC) stock from the Georgia/Florida state boundary to the North Carolina/Virginia state boundary, and (2) a Florida Keys/East Florida (FLK/EFL) stock from the Florida/Georgia state boundary south to:

2a. The South Atlantic/Gulf of Mexico Council boundary.
2b. The Monroe/Collier County line.
2c. A line just south of Cape Sable running due west.

*Refer to Chapter 2 for detailed language of alternatives

Under **Alternative 1 (No Action)**, hogfish would continue to be managed as a single stock, thus ignoring the latest scientific evidence. As such, management measures might not be as effective because biological parameters such as growth rates, natural mortality, etc. might not accurately be ascribed to at least some portion of the population. **Preferred Alternative 2** would specify a Georgia through North Carolina (GA-NC) stock of hogfish north of the Georgia-Florida border and a Florida Keys/East Florida (FLK/EFL) stock south of the Georgia-Florida border according to recommendations in Seyoum et al. (2015). Hence, **Preferred Alternative 2** would result in positive biological benefits since management would be based on the latest scientific research and regulations could be better tailored to address specific management issues pertinent to each stock. **Sub-alternatives 2a-2c (Preferred)** propose alternatives for the dividing line between the Gulf of Mexico stock (under the jurisdiction of the Gulf of Mexico Fishery Management Council [Gulf Council]) and the FLK/EFL stock. **Preferred Sub-alternative 2c** would define that boundary by a line just south of Cape Sable running due west (25^0 09'.000 North Latitude). According to local law enforcement officials, this would be a good demarcation point because it coincides with an existing boundary for

Florida's Pompano Endorsement Zone and would, therefore, aid in simplifying regulations. Under **Preferred Sub-alternative 2c**, the Florida Keys would be managed exclusively by the South Atlantic Council. In addition, the proposed boundary under **Preferred Sub-alternative 2c** is far enough north of the Florida Keys and far enough south of Naples and Marco Island, which would likely result in less fishing effort across this boundary, and in turn help reduce bycatch (see **Appendix D**, Bycatch Practicability Analysis (BPA) for more details). In addition, Seyoum et al. (2015) state that the two stocks split from each other along the "coastal area west of the Florida Everglades". Thus, from a biological standpoint, **Sub-alternatives 2a-2c (Preferred)** would result in similar biological effects. No changes to how landings are monitored for tracking annual catch limits (ACLs) would result from any of the sub-alternatives considered under this action.

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on Endangered Species Act (ESA)-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on essential fish habitat (EFH) or EFH-Habitat Areas of Particular Concern (HAPC) are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic region).

4.1.2 Economic Effects

The economic effects analysis for each action and alternative in this amendment is analyzed separately. The Regulatory Impact Review (**Appendix E**) contains the combined economic effects analysis for the preferred alternatives of all of the actions.

As described in **Section 4.1.1**, modifying the management unit for hogfish is not expected to alter the current harvest or use of the resource. Therefore, **Alternative 1 (No Action)** and **Preferred Alternative 2** (along with its sub-alternatives) are not expected to have any direct economic effects. Indirect economic effects may come about from this action due to its effects on other actions in this amendment that would make modifications to the harvest of hogfish.

4.1.3 Social Effects

Changes to management of hogfish and access to the resource could affect fishermen who target hogfish, and associated communities and fishing businesses. **Section 3.4** provides detailed information about communities that could be affected by management changes and ACLs, particularly for fishermen and communities in the Florida Keys.

Modifying the snapper grouper FMU to specify separate stocks of hogfish would not be expected to result in direct social effects. However, there may be some indirect effects on fishermen and associated communities associated with aligning management with the most recent stock assessment, and also with any associated management changes due to designation of the two hogfish stocks.

Although additional effects would not usually be expected from retaining the FMU under **Alternative 1 (No Action)**, this would be inconsistent with the stock assessment. **Preferred Alternative 2** would align hogfish management with updated scientific information. However, if changes in the quota or other management measures restrict access for fishermen harvesting hogfish in specific areas, there may be some negative social effects.

Any indirect effects from **Sub-alternatives 2a-2c (Preferred)** would be similar for all fishermen targeting hogfish, except for fishermen in the Florida Keys. Under **Sub-alternatives 2a** and **2b**, management of hogfish in the Florida Keys would be split between the Gulf and South Atlantic Councils' jurisdiction. This would pose problems for the Florida Keys fishermen, as some vessels fish in both jurisdictions and may be subject to separate sets of fishing regulations. Under **Preferred Sub-alternative 2c**, the Florida Keys would be managed exclusively by the South Atlantic Council. Thus, some additional benefits would be expected from **Preferred Sub-alternative 2c**, compared to **Sub-alternatives 2a** and **2b**.

4.1.4 Administrative Effects

Alternative 2 (Preferred) would split the current stock of hogfish in the South Atlantic into two stocks, GA-NC and FLK/EFL, separated by a line due west from just south of Cape Sable (**Sub-alternative 2c, Preferred**). **Sub-alternative 2c (Preferred)** would have greater administrative effects compared with **Sub-alternatives 2b** and **2a**, since the South Atlantic/Gulf of Mexico Council boundary and the Monroe/Collier County line are already established boundaries. Under **Sub-alternative 2c (Preferred)**, the Gulf Council would need to remove the portion of hogfish in Monroe County, Florida, from the Reef Fish FMU and give management jurisdiction to the South Atlantic Council. Compared to **Alternative 1 (No Action)**, the preferred alternatives would increase the administrative burden for both Councils (South Atlantic and Gulf of Mexico) and for the National Marine Fisheries Service (NMFS). Administrative impacts resulting from the new regulations would include tracking ACLs for two stocks within the South Atlantic Council's jurisdiction instead of one and educating the public and law enforcement personnel on the new boundaries. However, according to input received from Florida law enforcement personnel, **Sub-alternative 2c (Preferred)** would offer benefits over **Sub-alternatives 2a** and **2b** since the proposed boundary coincides with an existing boundary for Florida's Pompano Endorsement Zone and would, therefore, aid in simplifying regulations.

Although the South Atlantic Council would management the FLK/EFL stock of hogfish in the exclusive economic zone (EEZ) off the Florida Keys under either of the boundaries proposed in **Sub-alternatives 2b** and **2c (Preferred)**, the existing Gulf of Mexico rules and requirements for for-hire and commercial permits would remain in place until changed through a future amendment. Under current regulations, vessels operating as for-hire or commercial vessels in

the Gulf region[8] and catching reef fish species, including hogfish, are required to have the applicable federal Gulf Reef Fish Charter/Headboat permit or a Gulf Reef Fish Commercial permit. In the South Atlantic region, vessels operating as for-hire or commercial vessels and harvesting snapper grouper species, including hogfish, are required to have the applicable federal South Atlantic Snapper Grouper Charter/Headboat permit, South Atlantic Snapper Grouper 225-lb Commercial permit, or a South Atlantic Snapper Grouper Unlimited Commercial permit. The operators of the federally permitted vessels would also follow the sale and reporting requirements associated with each permit with regards to hogfish. This means that federally permitted South Atlantic vessels do not need a Gulf federal permit to harvest hogfish in the east Florida/Florida Keys hogfish management unit when fishing in the South Atlantic region, but would need a Gulf federal permit if they are fishing for hogfish in the Gulf Region.

[8] For the purpose of this paragraph, Gulf region refers to federal waters in the Gulf of Mexico seaward of Florida-Texas as defined in 16 USC 302(a)(1)(E) and South Atlantic region refers to federal waters in the Atlantic ocean seaward of the states of Florida-North Carolina as defined in 16 USC 302(a)(1)(C). The boundary between the regions is defined in 50 CFR 600.105(c).

Action 2. Specify Maximum Sustainable Yield (MSY) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternatives
(preferred alternatives in bold)

1. (No Action). Do not define MSY for the GA-NC or the FLK/EFL stocks of hogfish. Currently, MSY equals the yield produced by F_{MSY}. $F_{30\%SPR}$ is used as the F_{MSY} proxy for hogfish in the South Atlantic.

2. MSY equals the yield produced by F_{MSY} or the F_{MSY} proxy. MSY and F_{MSY} are recommended by the most recent SEDAR/SSC.

2a. GA-NC stock of hogfish. F_{MSY} = $F_{30\%SPR}$. MSY unknown.

2b. FLK/EFL stock of hogfish. F_{MSY} = 0.138. MSY = 346,095 lbs ww

4.2.1 Biological Effects

The maximum sustainable yield (MSY) is a reference point used by managers to assess fishery performance over the long term. Defining MSY for each of the stocks of hogfish under **Preferred Alternative 2** would not alter the current harvest or use of the resource. Specification of MSY merely establishes a benchmark for resource evaluation on which additional management actions would be based, if necessary. MSY in **Alternative 1 (No Action)** is defined as the yield produced by F_{MSY} where $F_{30\%SPR}$ is used as a proxy for F_{MSY} and represents the overfishing level defined in Amendment 11 to the Snapper Grouper FMP (SAFMC 1998) for a combined hogfish stock. MSY is not currently defined for the Georgia through North Carolina (GA-NC) or the Florida Keys/East Florida (FLK/EFL) stocks of hogfish.

Under **Alternative 1 (No Action)**, a poundage for MSY is not specified since one was not specified in Amendment 11. **Alternative 2 (Preferred)** would allow for periodic adjustments of F_{MSY} and MSY values based on estimates from new assessments without the need for a plan amendment. Because the SEDAR 37 (2014) stock assessment was not considered applicable to the GA-NC stock of hogfish, **Sub-alternative 2a (Preferred)** would essentially maintain the status quo for that stock. However, it differs from **Alternative 1 (No Action)** in that it would allow future adjustments without the need for a plan amendment if a stock assessment were to produce an estimate of MSY for that stock. **Sub-alternative 2b (Preferred)** would redefine MSY for the FLK/EFL stock based on the recommendation of SEDAR 37 (2014) and the South Atlantic Council's Scientific and Statistical Committee (SSC) to equal the value associated with the yield at F_{MSY} (346,095 pounds whole weight [lbs ww]). The specification of a MSY equation would have beneficial effects on the FLK/EFL stock of hogfish as it provides a reference point to monitor the long-term performance of the stock.

As none of the alternatives considered under this action would have direct effects on resource harvest or use, biological effects would be neutral. However, **Alternative 2 (Preferred)**, which is recommended in the most recent SEDAR and by the SSC, has a better scientific basis and thus provides a more solid ground for management actions that have economic and social

implications. Bycatch and discards would not increase or decrease as a result of this action. For more information, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic region).

4.2.2 Economic Effects

Defining the MSY for hogfish does not alter the current harvest or use of the resource. Specification of this measure merely establishes a benchmark for fishery and resource evaluation from which additional management actions for the species would be based, should comparison of the fishery and resource with the benchmark indicate that management adjustments are necessary. The impacts of these management adjustments would be evaluated at the time they are proposed. As a benchmark, MSY would not limit how, when, where, or with what frequency participants in the fishery engage in harvesting the resource. This includes participants who directly utilize the resource (principally commercial vessels, for-hire operations, and recreational anglers), as well as participants associated with peripheral and support industries.

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

As a benchmark, MSY sets off the parameters that condition subsequent management actions, and as such, defining MSY takes special significance. Of the alternatives considered in this action, **Alternative 2 (Preferred)** and its sub-alternatives, which is recommended in the most recent SEDAR and by the SSC, has a better scientific basis. Hence, it provides a more solid ground for management actions that have economic implications.

4.2.3 Social Effects

Social effects of management specifications such as MSY for a stock would be associated with both the biological and economic effects of the MSY value in the rebuilding plan. An MSY level that reflects the best available information (**Preferred Alternative 2**, **Preferred Sub-alternative 2a** and **Preferred Sub-alternative 2b**) could result in lower fishing mortality values in the rebuilding plan, and consequentially lower ACLs, which would likely affect fishermen targeting hogfish. However, in the case of the FLK/EFL stock of hogfish, an informed and relevant MSY (**Preferred Alternative 2**) is expected to contribute to the success of the

rebuilding strategy, resulting in greater expected long-term benefits to the commercial fleet and recreational fishermen who target hogfish than under **Alternative 1 (No Action)**.

4.2.4 Administrative Effects

The potential administrative effects of these alternatives differ in terms of the implied restrictions required to constrain hogfish stocks to the respective benchmarks. Defining an MSY proxy establishes a harvest goal for the hogfish portion of the snapper grouper fishery, for which management measures would be implemented. Those management measures would directly impact the administrative environment according to the level of conservativeness associated with the chosen MSY and subsequent restrictions placed on the fishery to constrain harvest levels. For the GA-NC stock of hogfish, **Sub-alternative 2a (Preferred)** differs from **Alternative 1 (No Action)** in that it would allow for periodic adjustments of F_{MSY} and MSY values based on estimates from new assessments without the need for a plan amendment. As such, **Sub-alternative 2a (Preferred)** would reduce the administrative burden from current levels. For the FLK/EFL stock of hogfish, **Sub-alternative 2b (Preferred)** would allow for adoption of the MSY value recommended by the latest stock assessment as well as subsequent adjustments as new assessments or updates are conducted without the need for a plan amendment. Therefore, none of the alternatives considered under this action would result in significant changes in administrative effects compared to **Alternative 1 (No Action).**

Action 3. Specify Minimum Stock Size Threshold (MSST) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternatives
(preferred alternatives in bold)

1 (No Action). Do not define MSST for the GA-NC and FLK/EFL stocks of hogfish. MSST for hogfish in the South Atlantic is equal to SSB_{MSY} ((1-M) or 0.5, whichever is greater).

2. MSST = SSB_{MSY} ((1-M) or 0.5, whichever is greater).
   - 2a. For the GA-NC stock of hogfish.
   - 2b. For the FLK/EFL stock of hogfish.

3. MSST = 50% of SSB_{MSY}.
   - 3a. For the GA-NC stock of hogfish.
   - 3b. For the FLK/EFL stock of hogfish.

4. MSST = 75% of SSB_{MSY}.
   - **4a. For the GA-NC stock of hogfish.**
   - **4b. For the FLK/EFL stock of hogfish.**

4.3.1 Biological Effects

The minimum stock size threshold (MSST) corresponds to the level of biomass below which a stock is considered overfished. If it is determined that a stock's biomass is below the MSST, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires a rebuilding plan, which could result in harvest reductions.

Alternative 1 (No Action) would retain the MSST definition established in Amendment 11 to the Snapper Grouper FMP (SAFMC 1998) for the entire stock of hogfish in the South Atlantic. But because Action 1 proposed to define two separate stocks of hogfish, Alternative 1 (No Action) is not a viable alternative. **Alternative 2** would impart the same definition of MSST to each of the two stocks of hogfish being defined in this amendment. Hence, in terms of biological effects, **Alternatives 1 (No Action)** and **2** are identical. The current definition of MSST under **Alternatives 1 (No Action)** and **2** requires that MSST be at least one half of SSB_{MSY}, but allows for it to be greater than this value if natural mortality (M) is suitably low. If (1-M) is equal to 0.5, then the value obtained from this alternative would be the same as that obtained from **Alternative 3,** which sets the MSST at 50% of the Spawning Stock Biomass at MSY (SSB_{MSY}). **Preferred Alternative 4** would establish MSST at 75% of SSB_{MSY} for the Georgia through North Carolina (GA-NC; **Preferred Sub-alternative 4a**) and Florida Keys/East Florida (FLK/EFL; **Preferred Sub-alternative 4b**) stocks of hogfish.

SEDAR 37 (2014) estimated natural mortality for hogfish at 0.179. However, because the stock assessment was not deemed applicable to the GA-NC stock, this estimate is valid for the FLK/EFL stock only. For species with such low natural mortality, such as hogfish, the biomass threshold for determining if the stock is overfished (MSST) under the current definition (**Alternatives 1 (No Action)** and **2**) is very close to the biomass level when the stock is not considered overfished (SSB_{MSY}). Since this definition nearly eliminates the buffer between MSST and SSB_{MSY} for stocks with low natural mortality rates, a stock would never be permitted

to fall below SSB_{MSY} without triggering an "overfished" determination and mandatory development of a rebuilding plan. The most biologically conservative alternative, therefore, is **Alternative 2** because it would ensure that a rebuilding plan is developed for each of the hogfish stocks when biomass fell below 82% of SSB_{MSY}; however, under this alternative a rebuilding plan may also be required when it is not biologically necessary. The biological benefits of **Alternative 2** would take the form of increased harvest restrictions that would be implemented with the intent to rebuild the stock according to the current MSST threshold criterion. **Alternative 3** and its sub-alternatives would be the least biologically beneficial since it would allow biomass to decrease by 50% before triggering the rebuilding plan requirement. **Preferred Alternative 4** and its sub-alternatives would still require the development of a rebuilding plan if hogfish was deemed overfished, but would reduce the risk of requiring a rebuilding plan when decreased biomass was due to natural variations in recruitment.

Additionally, if the same management measures are used to rebuild a stock under all the alternatives considered, the stock would be expected to rebuild fastest under **Alternative 2** because the overfished threshold (MSST) would be closest to the rebuilt threshold SSB_{MSY}. Therefore, **Alternative 2** could be considered to have the greatest biological benefit among alternatives considered in this action. The tradeoff associated with the assurance provided by this conservative definition of MSST is that natural variation in recruitment could cause stock biomass to frequently alternate between an overfished and rebuilt condition (biomass at SSB_{MSY}), even if the fishing mortality rate applied to the stock was within the limits specified by the maximum fishing mortality threshold (MFMT). If realized, this situation could result in administrative and socio-economic burdens related to developing and implementing multiple rebuilding plans that may not be biologically necessary. However, simulations on a wide variety of species by Restrepo et al. (1998) indicated that stocks at biomass levels approximating $75\%SSB_{MSY}$ can rebuild to SSB_{MSY} fairly quickly with little constraint on fishing mortality. Therefore, it is not biologically necessary to have extremely small buffers between overfished and rebuilt thresholds.

Preferred Alternative 4 and its sub-alternatives, which would set MSST equal to $75\%SSB_{MSY}$, is consistent with how the South Atlantic Council has approached defining MSST for other snapper grouper stocks with low natural mortality estimates. The South Atlantic Council changed the MSST definition to $75\%SSB_{MSY}$ for snowy grouper (SAFMC 2008a), golden tilefish (SAFMC 2008b), red grouper (SAFMC 2011b) and, more recently, other snapper grouper species (red snapper, blueline tilefish, gag, black grouper, yellowtail snapper, vermilion snapper, red porgy, and greater amberjack) (SAFMC 2014d). These species have low estimates of natural mortality, and the overfished threshold from the status quo MSST definition is very close to the biomass threshold when stocks are not considered overfished. The biological benefits of **Preferred Alternative 4** and its sub-alternatives, which would trigger a rebuilding plan when biomass is at 75% of SSB_{MSY}, would be expected to be greater than **Alternative 3**, which would have a lower biomass threshold for an overfished determination ($50\%SSB_{MSY}$) because biomass would not be allowed to decrease as much as it would under **Alternative 3** before triggering implementation of a rebuilding plan. At their October 2013 meeting, the South Atlantic Council's SSC acknowledged that the $75\%SSB_{MSY}$ approach is an acceptable choice for

MSST, and they voiced no concern regarding the adoption of this management reference point for South Atlantic Council managed species. Bycatch and discards would not increase or decrease as a result of this action. For more information, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.3.2 Economic Effects

Like MSY, MSST does not alter the current harvest or use of the resource, and thus would have no direct economic effects on fishery participants and associated industries or communities. Unlike MSY, however, MSST is directly related to actions for rebuilding the stock, actions that would have economic implications.

In general, a high MSST level is susceptible to triggering rebuilding actions that could limit harvest or fishing opportunities, thereby affecting the economic status of fishery participants. A low MSST level would be associated with lower probability of enacting rebuilding actions that would alter the economic environment. To the extent that rebuilding actions necessitated by a chosen MSST would tend to have economic effects, it is possible to provide some general implications of the MSST alternatives.

Alternatives 2-4 (Preferred) each have **sub-alternatives a** and **b** pertaining to the GA-NC and FLK/EFL stocks, respectively. **Alternative 2** is functionally equivalent to **Alternative 1 (No Action)** except that **Alternative 2** allows MSST to be set to SSB_{MSY} ((1-M) or 0.5, whichever is greater) for each of the stocks separately. Assuming that **Action 1** would result in the decision to create separate management stocks for the GA-NC hogfish stock and for the FLK/EFL stock, the expected economic effects for the **Sub-alternatives a** and **b** for each alternative are similar.

With rebuilding taking place over a number of years, management actions and their economic consequences could change over time depending on a variety of factors, including the status of the stock and fishing conditions. **Alternative 3** would appear to be best from an economic standpoint, because it is unlikely to trigger restrictive rebuilding actions in the short term. One possible downside of this alternative is that once the stock is considered overfished, the required rebuilding actions could be very restrictive and potentially remain for quite some time. **Alternatives 1 (No Action)** and **2** lie on one end of the continuum for potential negative economic effects because they have the highest probability of triggering restrictive rebuilding actions. A possible mitigating factor with **Alternatives 1 (No Action)** and **2** is the possibility that the required management actions would have adverse economic effects which would not last long. But a frequently varying regulatory regime would tend to de-stabilize business planning

and fishing decisions which could have potentially worse economic consequences. The economic implications of **Preferred Alternative 4** and its sub-alternatives may be characterized as falling between **Alternatives 1 (No Action)/2** and **Alternative 3**.

4.3.3 Social Effects

Social effects of revised biological parameters such as MSST for a stock would be associated with both the biological and economic effects of the modified MSST value. The estimated spawning stock biomass (SSB) as compared to MSST serves as a proxy for designating a stock as overfished or not. If the proxy is not accurately representing the stock status, the outcomes of the 'overfished' designation when a stock is not overfished can have negative long- and short-term social effects associated with restricted or no access to the fish. Conversely, if an inaccurate proxy results in a stock designated as not overfished when it *is* overfished, the fishing fleets, associated businesses and communities could be negatively impacted in the long term due to decline in the stock and negative broader biological impacts of overfishing. Lastly, an inaccurate proxy that causes a stock to fluctuate between overfished and not overfished would likely have negative effects on fishermen by requiring changes in regulations on harvest too often. This could negatively affect stability and planning for fishing businesses, in addition to fishing opportunities for recreational anglers, due to inconsistent access to the resource. Although for some fishermen, any access to a stock would be beneficial, the positive effects of consistency in regulations (even if access is restricted) and stability of the fishery would also be expected from a more fixed designation as overfished or not overfished.

Under all alternatives, fishermen could be affected by future restricted access to a specific species due to an overfished designation, which could have negative effects on associated fishing businesses and communities. Although **Preferred Alternative 4** (and its sub-alternatives) propose a more restrictive approach to set the MSST than **Alternative 3**, it would also be the most likely to trigger a rebuilding plan sooner, which may avoid more severe biological impacts to the stock (as noted in **Section 4.3.1**).

If the FMU were modified in **Action 1** to align with the approach used in the stock assessment for the stock boundary, **Alternative 1 (No Action)** would not be consistent with the most recent scientific information as in **Sub-alternatives 2a/b, 3a/b**, and **4a/b (Preferred)**.

4.3.4 Administrative Effects

The MSST is the level of biomass below which a species would be considered overfished and is thus tied to implementation of management measures. Those management measures would directly impact the administrative environment according to the level of conservativeness associated with the chosen MSST and subsequent restrictions placed on the species to constrain harvest levels. The current MSST definition under **Alternative 1 (No Action)** could cause hogfish to fluctuate between an overfished and rebuilt condition (constantly triggering rebuilding plans), if hogfish were to continue to be managed as a single stock. **Alternative 2** and its sub-alternatives are identical to **Alternative 1 (No Action)** but would apply to each individual stock

of hogfish. Hence, both alternatives would be the most administratively burdensome of the MSST alternatives under consideration. The larger the buffer between MSST and SSB_{MSY}, the lower the probability that hogfish would be considered overfished and require a rebuilding plan. Therefore, **Alternative 3** and its sub-alternatives are the least administratively burdensome of the alternatives considered since under **Alternative 3** and its sub-alternatives, hogfish would be least likely to be considered overfished and least likely to require a rebuilding plan. Potential administrative impacts increase as the distance between the MSST value and SSB_{MSY} decreases, therefore, **Alternatives 3** and **4 (Preferred)**, and their respective sub-alternatives, would result in increasingly greater administrative impacts, respectively. However, **Sub-alternatives 3a** and **4a (Preferred)**, would not result in any changes to the administrative burden relative to **Alternative 1 (No Action)** as the MSST value for the GA-NC stock of hogfish would remain unknown.

Action 4. Establish Annual Catch Limits (ACLs) for the Georgia through North Carolina (GA-NC) stock of hogfish

Alternatives
(preferred alternatives in bold)

1 (No Action). The current ABC for the entire stock of hogfish is 134,824 lbs ww and ACL = OY = ABC. The commercial ACL = 49,469 lbs ww (36.69%) and the recreational ACL = 85,355 lbs ww (63.31%).

2. Establish an ACL for the GA-NC stock. Specify commercial and recreational ACLs using re-calculated sector allocations based on proposed modifications to the management unit (69.13% commercial and 30.87% recreational). The ABC for the GA-NC stock = 35,716 pounds whole weight (lbs ww).

2a. ACL = OY = ABC.
2b. ACL = OY = 95% ABC.
2c. ACL = OY = 90% ABC.

4.4.1 Biological Effects

Genetic evidence indicates that hogfish within the South Atlantic Council's area of jurisdiction belong to two distinct stocks (Seyoum et al. 2015). The SEDAR 37 (2014) assessment, however, was not deemed applicable to the Georgia through North Carolina (GA-NC) stock due to lack of data; hence, the status of the GA-NC stock is currently unknown. Based on methodology in *Calculating Acceptable Biological Catch for Stocks That Have Reliable Catch Data Only* (Only Reliable Catch Stocks – ORCS) (Berkson et al. 2011), the South Atlantic Council's Scientific and Statistical Committee (SSC) recommended an approach to compute the acceptable biological catch (ABC) for unassessed stocks with only reliable catch data, as per the South Atlantic Council's ABC Control Rule. The approach involves selection of a "catch statistic", a scalar to denote the risk of overexploitation for the stock, and a scalar to denote the management risk level. The SSC provides the first two criteria for each stock, and the South Atlantic Council specifies their risk tolerance level for each stock.

Catch Statistic: The median was considered inadequate to represent the high fluctuation in landings—i.e., to appropriately capture the range of occasional high landings—therefore, the maximum catch over the period 1999-2007 was chosen instead. This time period was chosen to (1) be consistent with the period of landings used in the South Atlantic Council's Comprehensive ACL Amendment (SAFMC 2011a), and (2) to minimize the impact of recent regulations and the economic downturn on the landings time series. For the GA-NC stock of hogfish, 2006 was the year of highest landings over the 1999-2007 time period and was selected as the "catch statistic."

Risk of Overexploitation: Based on SSC consensus and expert judgment, each stock was assigned to a final risk of exploitation category based on a suite of attributes used to assess the level of risk. For hogfish, the SSC assigned a risk of overexploitation of 1.25, indicating the species is at moderately high risk of overexploitation.

Risk Tolerance: The next step in the process involves multiplying the "catch statistic x scalar" metric by a range of scalar values that reflects the South Atlantic Council's risk tolerance level.

For instance, the South Atlantic Council may choose to be more risk-averse in computing the ABC for a stock that exhibits a moderately high risk of overexploitation. As such, the South Atlantic Council may use a scalar of 0.50 for such stocks to specify a more conservative ABC. On the other hand, stocks with low risk of overexploitation, and thus able to tolerate a higher level of management risk, may be assigned a less conservative scalar, such as 0.90. For hogfish, the South Atlantic Council selected a risk tolerance scalar of 0.7.

Table 4.4.1 below summarizes the ORCS approach to arrive at the ABC for the GA-NC stock of hogfish.

Table 4.4.1. The South Atlantic's SSC ABC recommendation for the GA-NC stock of hogfish.

Statistic	Value
Risk of Overexploitation	Moderately High
Associated Scalar	1.25
Range of Years	1999-2007
Year of Max Landings	2006
Catch Statistic	40,818 lbs ww
Council Risk Scalar (Preferred from Am 29)	0.7
Proposed ABC	**35,716 lbs ww**

The allocation formula from the Comprehensive ACL Amendment (SAFMC 2011) was used to specify commercial and recreational allocations for the GA-NC hogfish stock: (0.5 * catch history) + (0.5 * current trend) where catch history = average landings 1986-2008, current trend = average landings 2006-2008. The formula was applied to the Southeast Fishery Science Center (SEFSC) commercial ACL data, accessed in July 2014, and post-stratified SEFSC recreational data accessed in February 2015. Recreational data were post-stratified to include Marine Recreational Information Program (MRIP) landings from Monroe County in the FLK/EFL sub-region, consistent with the SEDAR 37 stock assessment. Commercial and recreational landings used to recalculate sector allocations are shown in **Table 4.4.2**.

Table 4.4.2. Commercial and recreational landings (lbs ww) for the GA-NC stock of hogfish, 1986-2008.

Year	Rec	Comm	Total
1986	20,625	8,040	28,665
1987	8,733	9,295	18,028
1988	942	10,186	11,128
1989	3,193	15,177	18,370
1990	1,848	27,862	29,710
1991	814	23,886	24,700
1992	3,309	32,274	35,583
1993	6,272	31,739	38,011
1994	688	23,063	23,751
1995	83,580	36,903	120,483
1996	262	17,471	17,733
1997	977	25,394	26,371
1998	1,338	21,959	23,297
1999	1,215	29,186	30,401
2000	2,417	24,104	26,521
2001	1,471	14,193	15,664
2002	11,796	20,557	32,353
2003	2,343	9,307	11,650
2004	3,888	19,295	23,183
2005	15,082	19,255	34,337
2006	17,385	23,433	40,818
2007	8,782	20,754	29,536
2008	9,044	30,437	39,481

Source: NMFS SERO

Alternative 1 (No Action) would not establish an ACL for the GA-NC stock of hogfish, which would not adhere to the best scientific information available (SEDAR 37) and therefore, is not a viable alternative. To set the ACL and optimum yield (OY) for the GA-NC stock of hogfish, the South Atlantic Council may exercise varying degrees of precaution to account for management uncertainty: **Sub-alternative 2a** would set the ACL and OY at the same level as ABC, whereas **Preferred Sub-alternative 2b** and **Sub-alternative 2c** would each provide a management uncertainty buffer of 5% and 10%, respectively.

Sub-alternatives 2a-2c would set OY equal to the ACL. National Standard 1 (NS1) establishes the relationship between conservation and management measures, preventing overfishing, and achieving OY from each stock, stock complex, or fishery. The NS1 guidelines discuss the relationship of OFL to the MSY and ACL to OY. The OFL is an annual amount of catch that corresponds to the estimate of maximum fishing mortality threshold applied to a stock; MSY is the long-term average of such catches. The ACL is the limit that triggers AMs and is the management target for the species. Management measures for a fishery should, on an annual basis, prevent the ACL from being exceeded. The long-term objective is to achieve OY through

annual achievement of an ACL. The NS1 guidelines state that if OY is set close to MSY, the conservation and management measures in the fishery must have very good control of the amount of catch in order to achieve the OY without overfishing.

The South Atlantic Council and their SSC have established an ABC Control Rule that takes into consideration scientific and management uncertainty to ensure catches are maintained below OFL. Setting the ACL equal to the ABC (**Sub-alternative 2a**) leaves no buffer between the two harvest parameters, which may increase risk that harvest could exceed the ABC. The South Atlantic Council considered alternatives in the Comprehensive ACL Amendment (SAFMC 2011a) and Amendment 24 to the Snapper Grouper FMP (SAFMC 2011b) that would set the ACL below the ABC but selected ACL=OY=ABC as their preferred alternative. More recently, the South Atlantic Council has frequently set ACLs for snapper grouper species at the same level as the ABC. However, AMs and ACLs are in place to ensure overfishing of hogfish does not occur. The NS 1 Guidelines recommend a performance standard by which the system of ACLs and AMs can be measured and evaluated. If the ACL is exceeded more than once over the course of four years, the South Atlantic Council would reassess the system of ACLs and AMs for the species. The South Atlantic Council has taken action in Amendment 34 (SAFMC 2015d) to enhance the effectiveness of the AMs for hogfish. Amendment 37 would clarify the AMs for the two South Atlantic stocks of hogfish in **Action 12**.

Sub-alternatives 2b (Preferred) and **2c** would have a greater positive biological effect than **Sub-alternative 2a** because they would create a buffer between the ACL/OY and ABC, with **Sub-alternative 2c** setting the most conservative ACL at 90% of the ABC (**Table 4.4.3**), while **Alternative 1 (No Action)** would not represent the best scientific information available. Creating a buffer between the ACL/OY and ABC would provide greater assurance that overfishing is prevented, and the long-term average biomass is near or above SSB_{MSY}. However, the South Atlantic Council's ABC Control Rule takes into account scientific uncertainty. The Magnuson-Stevens Act NS 1 guidelines indicate an ACL may typically be set very close to the ABC. Setting a buffer between the ACL and ABC would be appropriate in situations where there is uncertainty in whether or not management measures are constraining fishing mortality to target levels. An annual catch target (ACT), which is not required, can also be set below the ACL to account for management uncertainty and provide greater assurance overfishing does not occur.

The South Atlantic Council prefers specifying the recreational ACL in numbers of fish and the commercial ACL in pounds. Their rationale is that recreational landings are already tracked in numbers of fish while commercial landings are tracked in pounds. Because this amendment also considers changing the minimum size limit for the GA-NC stock of hogfish, specifying the recreational ACL in pounds could potentially increase the risk of exceeding the ABC in pounds because larger fish are heavier. However, if the recreational ABC and ACL were specified in numbers, there would be a lower risk of exceeding the recreational ACL due to an increase in the minimum size limit. The South Atlantic Council also discussed the high percent standard error (PSE) associated with the recreational data and the fact that there were very few intercepts for recreational effort using spear.

Table 4.4.3. Commercial and recreational ACLs for the GA-NC stock per the SSC's recommendation using the ORCS approach in the ABC Control Rule under **Sub-alternatives 2a-2c**.

Sub-alternative	Total ACL (lbs)	Rec ACL (lbs)	Rec ACL (numbers)	Comm ACL (lbs)
2a	35,716	11,026	1,040	24,690
2b (Preferred)	**33,930**	**10,474**	**988**	**23,456**
2c	32,144	9,923	936	22,221

Note: The South Atlantic Council prefers to specify recreational ACL in numbers and commercial ACL in pounds. Recreational ACL converted from pounds to numbers using an average weight of 10.60 lbs ww per fish.

With vastly improved commercial monitoring mechanisms recently implemented, it is unlikely that repeated commercial ACL overages would occur. The Commercial Landings Monitoring System (CLM) came online in June 2012 and is now being used to track commercial landings of federally managed fish species. This system is able to track individual dealer reports, track compliance with reporting requirements, project harvest closures using five different methods, and analyze why ACLs are exceeded. The CLM performs these tasks by taking into account: (1) spatial boundaries for each stock based on fishing area; (2) variable quota periods such as overlapping years or multiple quota periods in one year; and (3) overlapping species groups for single species as well as aggregated species. Data sources for the CLM system include the Standard Atlantic Fisheries Information System for Georgia and South Carolina, and the Bluefin Data file upload system for Florida and North Carolina. The CLM system is also able to track dealer reporting compliance with a direct link to the permits database in NMFS Southeast Regional Office (SERO).

Additionally, the SEFSC worked with SERO, the Gulf Council, and South Atlantic Council to develop a Joint Dealer Reporting Amendment (GMFMC & SAFMC 2013b), which became effective on August 7, 2014. The Joint Dealer Reporting Amendment requires electronic reporting, increases required reporting frequency for dealers to once per week, and requires a single dealer permit for all finfish dealers in the Southeast Region. The CLM and the new dealer reporting requirements constitute major improvements to how commercial fisheries are monitored, and go beyond monitoring efforts that were in place when the NS1 guidelines were developed. The new CLM quota monitoring system and actions in the Joint Generic Dealer Reporting amendment are expected to provide more timely and accurate data reporting and would thus reduce the incidence of quota overages.

Harvest monitoring efforts in the recreational sector have also been improved. On January 27, 2014, regulations became effective requiring headboats to report their landings electronically once per week (Generic Headboat Amendment, GMFMC & SAFMC 2013a). The SEFSC is also developing an electronic reporting system for charter boats operating in the Southeast Region and the Gulf of Mexico and South Atlantic Councils are developing amendments that would require electronic reporting for charterboats with a set reporting frequency. These recreational harvest monitoring efforts could substantially increase the accuracy and timeliness of in-season reporting and reduce the risk of recreational ACL overages, which would be biologically

beneficial for hogfish. Therefore, there is a low risk of exceeding the commercial and recreational ACLs and **Preferred Alternative 2** and its sub-alternatives can be used as part of a successful harvest management system for hogfish with little risk of overfishing. This in turn, would help reduce discards and bycatch. Bycatch of other species is incidental in the hook-and-line portion of the snapper grouper fishery for hogfish, with no bycatch of other co-occurring species expected in the spear fishery for hogfish (see **Appendix D**, BPA, for more information).

Table 4.4.4 shows annual commercial and recreational hogfish landings from 2000 through 2014 for the GA-NC sub-region. Compared to average recreational landings from 2010-2014 (658 fish) the recreational ACL under **Preferred Sub-alternative 2b** (988 fish) is not expected to be met. For the commercial sector, the preferred commercial ACL of 23,456 lbs ww for 2017 would translate to a 16% reduction in commercial harvest based on average commercial landings over the past 5 years (27,892 lbs ww).

Table 4.4.4. Commercial (lbs ww) and recreational landings (numbers of fish) for the GA-NC stock of hogfish, 2000-2014.

Year	Rec landings (lbs ww)	Rec landings (nums)	Comm landings (lbs ww)	TOTAL landings (lbs ww)
2000	2,417	228	24,104	26,521
2001	1,471	139	14,193	15,664
2002	11,796	1113	20,557	32,353
2003	2,343	221	9,307	11,650
2004	3,888	367	19,295	23,183
2005	15,082	1423	19,255	34,337
2006	17,385	1640	23,433	40,818
2007	8,782	828	20,754	29,536
2008	9,044	853	30,437	39,481
2009	2,083	197	34,242	36,325
2010	15,539	1466	41,898	57,437
2011	1,977	187	35,959	37,936
2012	14,093	1330	20,630	34,723
2013	3,146	297	19,731	22,877
2014	95	9	21,242	21,337

Note: Recreational ACL converted from pounds to numbers using an average weight of 10.60 lbs ww per fish
Source: SERO and SEFSC

To simulate the impacts of various combinations of proposed management measures, recreational decision tools (RDTs; **Appendix L**) and commercial decision tools (**Appendix M**) were developed. Analyses for subsequent actions in this amendment employ these tools to project landings levels and season length, where appropriate. Details of the methodology, assumptions, caveats, and data inputs are included in **Appendices L** and **M**. To address uncertainty mean projected closure dates and projected landings were determined across 1000

bootstrapped runs of each combination of proposed management measures. Bootstrapping runs accounted for uncertainty in projections data by averaging across 2012-2015 landings generated from random draws from a normal distribution fit to mean and standard deviation from landings survey data from the modified hogfish landings dataset used in the models. Bootstrapping also accounted for uncertainty in size limit and bag limit reductions using random draws for these reductions drawn from normal distributions fit to the mean and standard deviation of the most recent three years of simulated size and bag limit reductions. Bootstrapping runs accounting for uncertainty in monthly catch rate estimates and reductions associated with various proposed management measures indicate that quota closure estimates could deviate by over a month, and that uncertainty is highest when the season is long, because uncertainty in daily catch rates accumulates through time. Although the RDTs attempt to address uncertainties in catch rates and the impacts of various management measures, the bounds of this uncertainty are not fully captured by the models; as such, they should be used with caution for management decision-making. As a foundation for comparisons, it is assumed that the 2012-2015 mean catch rate is representative of future trends in catch rates. However, substantial uncertainty exists in this projected baseline, especially for the GA-NC sub-region, where hogfish catches may be viewed as a somewhat rare event. Baseline discards are also highly uncertain, especially for the GA-NC sub-region. Economic conditions, weather events, changes in catch-per-unit effort, fisher response to management regulations, variation in survey estimates due to rarity of intercepts, and a variety of other factors may cause departures from this assumption.

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.4.2 Economic Effects

Alternative 1 (No Action) is not a viable alternative for this action because establishing an ACL for a stock is a statutory requirement. Based on history, the landings for this stock are not expected to exceed the ACL under any of the proposed alternatives. The recreational sector is expected to land 431 fish with a consumer surplus (CS) of between $5,331 and $58,073 (in 2014 dollars) depending on which CS proxy is used ($12.37 for a snapper or $134.74 for a grouper; **Table 4.8.2** and **Section 3.3.2**). The commercial sector is expected to land 20,534 lbs ww with an ex-vessel value of $76,797 (**Table 4.8.8** and **Appendix M**). **Table 4.4.5** shows the maximum expected economic effects for the sub-alternatives of **Preferred Alternative 2**. However, based on past behavior, neither commercial fishers, nor recreational anglers are expected to meet their sector ACL for this stock. Therefore, the values shown in **Table 4.4.5** represent potential maximum values, assuming each sector would land its respective ACL. If the stock was not split, there would not be any expected recreational sector landings from Georgia to North Carolina, and because of the historically low recreational landings from Georgia to North Carolina in the early part of the year, the FLK/EFL portion of the hogfish fishery would catch the

entire ACL. Therefore, the status quo for the recreational sector under **Alternative 1 (No Action)** would be no expected recreational landings for Georgia to North Carolina during the year.

Table 4.4.5. Recreational and commercial sector ACLs with recreational consumer surplus (CS) and commercial ex-vessel expected values (in 2014 $) for the Georgia through North Carolina stock of hogfish.

	Recreational ACL (numbers)	Recreational CS	Commercial ACL (lbs)	Commercial ex-vessel
Sub-alternative 2a	1,040	$12,865	24,690	$89,224
Sub-alternative 2b (Preferred)	**988**	**$12,222**	**23,456**	**$84,761**
Sub-alternative 2c	936	$11,578	22,221	$80,302

Based on actual landings history, there are no expected differences in terms of economic effects among **Alternative 1 (No Action), Sub-alternative 2a**, **Preferred Sub-alternative 2b**, and **Sub-alternative 2c**.

In general, assuming a sector is able to catch its entire ACL, the higher the ACL, the greater the positive direct economic effects for all sectors, as long as the ACL is not exceeded. Therefore, **Sub-alternative 2a** represents the highest potential positive direct economic effects, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c**. Based on past landings history, neither sector ACL is expected to be met under any of the alternatives of **Action 4**; therefore, it is expected that there would be no differences in economic effects among any of the alternatives.

4.4.3 Social Effects

Compared to other snapper grouper species--such as black sea bass, vermilion snapper, and gray triggerfish--hogfish is not as economically and socially important in Georgia, South Carolina, and North Carolina. However, there are some communities that may have fishermen, fishing businesses, and recreational anglers who would be affected by management changes for the GA-NC stock of hogfish. Commercial landings are relatively high in the South Carolina communities of Little River and Georgetown, and North Carolina communities around the Cape Fear River including Southport, Carolina Beach, and Oak Island (**Figure 3.4.3**). These are also communities that have high levels of engagement and reliance on commercial and recreational fishing (**Figures 3.4.5** and **3.4.7**).

The ACL for any stock does not directly affect resource users unless the ACL is met or exceeded, in which case AMs that restrict or close harvest could negatively impact the commercial fleet, for-hire fleet, and private anglers. AMs can have significant direct and indirect social effects because, when triggered, can restrict harvest in the current season or subsequent seasons. While the negative effects are usually short-term, they may at times induce other indirect effects through changes in fishing behavior or business operations that could have long-

term social effects, such as increased pressure on another species, or fishermen having to stop fishing all together due to regulatory closures. However, restrictions on harvest contribute to sustainable management goals, and are expected to be beneficial to fishermen and communities in the long term.

Under **Preferred Alternative 2**, the ACL for the GA-NC would be based on the most recent stock assessment, but could also set ACLs lower than recent recreational and commercial landings. This could result in early closures, paybacks, or other management measures.

Because recreational landings are estimated to vary year by year (**Figure 4.4.1**), there would likely be some years in which recreational landings would reach the recreational ACL and recreational AMs would be triggered. If an in-season closure and payback measure are implemented as recreational AMs in **Action 12**, there would likely be some negative effects on recreational fishermen and for-hire businesses that target hogfish. In general, a higher ACL would lower the chance of triggering a recreational AM (if implemented) and result in the lowest level of negative effects on the recreational sector. Among the action alternatives, **Sub-alternative 2a** would be the most beneficial for recreational fishermen, followed by **Preferred Sub-alternative 2b**, and **Sub-alternative 2c.**

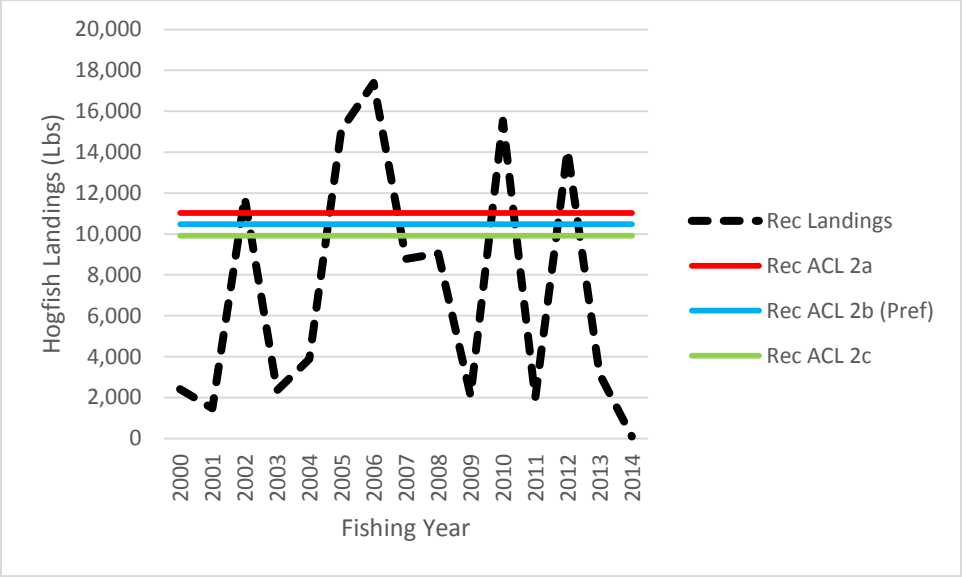


Figure 4.4.1. Annual recreational landings of hogfish (lbs ww) for Georgia, South Carolina, and North Carolina compared to the potential recreational ACLs under **Preferred Alternative 2**.

Similarly, there have been years during which commercial landings in GA-NC would have been under the proposed commercial ACLs, and years in which landings would have reached or exceeded the potential commercial ACLs (**Figure 4.4.2**). The potential commercial AMs in **Action 12** would mirror current commercial AMs for each stock, and there would be a possibility of an in-season closure for a year with high landings. In general, a higher ACL would lower the chance of triggering a closure, resulting in in the lowest level of negative effects on the

commercial sector. **Sub-alternative 2a** would be the most beneficial for commercial fishing businesses who may harvest hogfish, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c**.

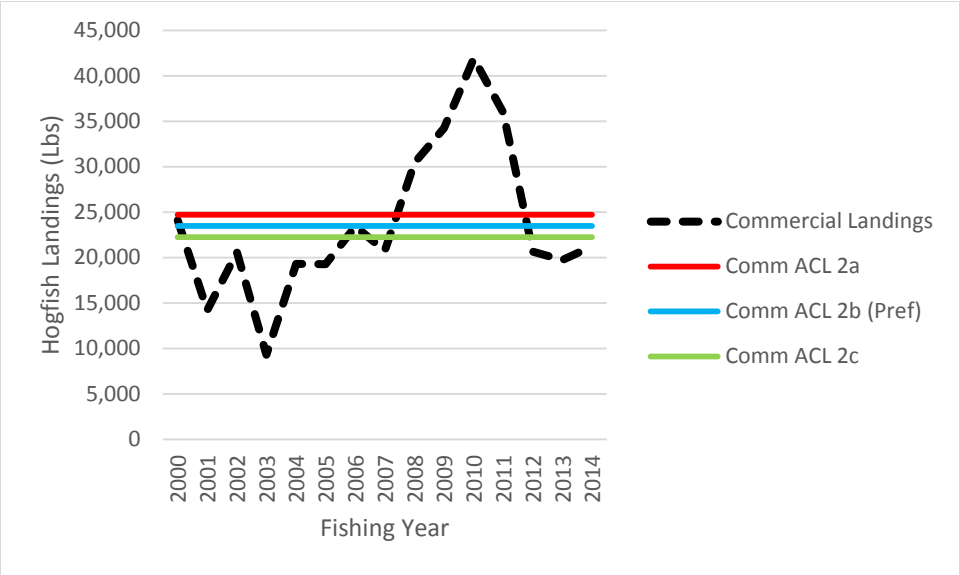


Figure 4.4.2. Annual commercial landings of hogfish (lbs ww) for Georgia, South Carolina, and North Carolina compared to the potential commercial ACLs under **Preferred Alternative 2**.

4.4.4 Administrative Effects

Negative administrative impacts of this action are likely to be minimal. **Alternative 1 (No Action)**, **Sub-Alternatives 2a, 2b (Preferred)** and **2c** would not result in significant administrative cost or time burdens other than notifying fishery participants of the change in the sector ACLs and continued monitoring of the sector ACLs. The burden on law enforcement would not change under either alternative since commercial quota closures and bag limits implemented are currently enforced.

Action 5. Establish a rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

4.5.1 Biological Effects

The hogfish population in the South Atlantic had not been assessed until SEDAR 37 (2014). The assessment showed the Florida Keys/East Florida (FLK/EFL) stock of hogfish is overfished and undergoing overfishing. Hence, the South Atlantic Council must establish a rebuilding plan for that stock within two years of receiving notification of its status. **Action 5** presents options for the rebuilding strategy and schedule that would govern the rebuilding plan for the FLK/EFL stock of hogfish and the resulting acceptable biological catch (ABC).

Alternatives 2-5 would establish a rebuilding strategy based on the results of the most recent stock assessment (SEDAR 37 2014). Because recreational landings were projected to reach the ACL, the recreational sector for hogfish was closed in August 2015 due to an increase in landings during Wave 2 of the MRIP survey. As a result, preliminary landings for 2015 were above the landings level assumed in the original set of stock projections from the SEDAR 37 (2014) assessment, raising concerns that the projections might no longer represent the best scientific information available. Hence, the South Atlantic Council requested updated projections for the FLK/EFL hogfish stock using the most recent landings estimates. The request was for the same suite of scenarios provided in the original projections, modified with the most recent landings estimates and changing year 1 to 2017 to reflect the likely implementation date of the management actions.

Alternatives*
(preferred alternatives in bold)

1 (No Action). The current ABC for the entire stock of hogfish is 134,824 lbs ww. There is no rebuilding plan in place for hogfish in the South Atlantic.

2. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 50% probability of rebuilding success. The Overfishing Limit (OFL) is the yield at F_{MSY}. The spawning stock biomass at MSY (SSB_{MSY}) is 2,300,391 pounds whole weight (lbs ww). Year 1 = 2017.

3. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success. The OFL is the yield at F_{MSY}. The SSB_{MSY} is 2,300,391 pounds whole weight (lbs ww). Year 1 = 2017.

4. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 7 years with a 50% probability of rebuilding success. The OFL is the yield at FMSY. The SSB_{MSY} is 2,300,391 pounds whole weight (lbs ww). Year 1 = 2017.

5. Define a rebuilding plan where the rebuilding strategy for the FLK/EFL stock of hogfish sets ABC equal to the yield at a constant fishing mortality rate that rebuilds the stock in 7 years with a 72.5% probability of rebuilding success. The OFL is the yield at F_{MSY}. The SSB_{MSY} is 2,300,391 pounds whole weight (lbs ww). Year 1 = 2017.

*Refer to Chapter 2 for detailed language of alternatives.

The South Atlantic Council's SSC recommended a rebuilding scenario that would set the ABC at the yield under a constant fishing mortality rate that rebuilds the stock in 10 years with a 72.5% probability of rebuilding success. This rebuilding scenario corresponds to **Preferred Alternative 3** (**Table 4.5.1**). Under **Alternatives 2-5** the total ABC would increase over time until the spawning stock biomass (SSB) reaches the level at which the stock is considered to be

rebuilt (~ 2.3 million pounds). Under **Preferred Alternative 3**, this level would be reached in 2027.

Table 4.5.1. ABC under rebuilding plan Alternatives 2-5. Preferred alternative indicated in bold.

		Alt 2	Preferred Alt 3	Alt 4	Alt 5
Year	**OFL (Numbers)**	**ABC (Numbers)**	**ABC (Numbers)**	**ABC (Numbers)**	**ABC (Numbers)**
2017	35,986	22,457	**17,930**	6,695	5,530
2018	41,810	26,929	**21,421**	8,320	6,780
2019	47,335	31,367	**24,996**	10,015	8,136
2020	53,574	36,477	**29,200**	12,023	9,787
2021	60,324	42,153	**33,965**	14,329	11,725
2022	67,119	48,052	**39,027**	16,823	13,861
2023	73,662	53,910	**44,162**	19,402	16,110
2024	79,808	59,601	**49,254**	22,028	18,441
2025	85,486	65,008	**54,183**	---	---
2026	90,657	70,070	**58,878**	---	---
2027	95,311	74,752	**63,295**	---	---

The South Atlantic Council prefers specifying the recreational ACL in numbers of fish and the commercial ACL in pounds. Their rationale is that recreational landings are already tracked in numbers of fish while commercial landings are tracked in pounds. Issues develop, however, when different size limits are considered for management and the commercial and recreational ACLs are in different units: if the minimum size limit is increased, as the Council proposes to do, the average size and thus weight of fish harvested will also increase. If the method for converting between an ACL in pounds and an ACL in numbers does not address the change in average weight, the expected increase in the average weight of landed fish could lead to the poundage associated with the ACL specified in numbers exceeding the ACL expressed in pounds. This could also result in a perceived shift in allocations when they are compared in the original units across sectors, and if the change in weight landed is great enough, the ABC and OFL in pounds could be exceeded. However, if the recreational ABC and ACL were specified in numbers, there would be a lower risk of exceeding the recreational ACL due to an increase in the minimum size limit. The South Atlantic Council also discussed the high percent standard error (PSE) associated with the recreational data and the fact that there were very few data intercepts for recreational effort using spear. **Appendix N** includes a detailed account of the methodology used to specify the recreational ACL for the FLK/EFL stock of hogfish in numbers of fish.

Alternative 1 (No Action) is not a viable alternative to consider, as there are statutory requirements to rebuild all fishery stocks that are overfished. **Alternative 2** yields higher ABCs than **Preferred Alternative 3** at a probability of rebuilding of 50%. This level of harvest is higher than that recommended by the South Atlantic Council's SSC. **Alternatives 4** and **5** both result in lower ABCs than those under **Preferred Alternative 3** and rebuild the FLK/EFL stock of hogfish in 7 years instead of 10. In general, lower levels of harvest and less time to rebuild

translate into higher biological benefits for the stock, hence the biological benefits of **Alternatives 4** and **5** would be higher than those under **Preferred Alternative 3**. However, the SSC has indicated that harvest levels proposed under **Preferred Alternative 3** are sustainable and would achieve the goal of rebuilding the FLK/EFL stock of hogfish within a reasonable timeframe. Therefore, there is no biological need to constrain harvest below this level. Compared to **Alternative 1 (No Action)**, the biological effects of **Alternatives 2-5** would be beneficial since management would be responding to the best scientific information available and results of the SEDAR 37 (2014) stock assessment have indicated that the FLK/EFL stock of hogfish is overfished and undergoing overfishing.

Preferred Alternative 3 in **Action 5** is more conservative than **Alternative 2**, and could result in more discards in the short term. However, with a higher probability of success of rebuilding the stock in 10 years, there would be less discards in the long term after the stock has been rebuilt. Furthermore, bycatch and discards are not expected to increase because the majority of the fishing gear used to harvest hogfish is spear, which is very selective. For more information, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.5.2 Economic Effects

Rebuilding plans in general impose negative direct economic effects in the short term in favor of more direct positive economic effects in the long term as the stock recovers. The difficulty is in balancing those long term and short-term economic effects. Being overly restrictive in the short term could rebuild the stock faster, but perhaps at the expense of pushing some fishermen out of the hogfish portion of the snapper grouper fishery because they are unable to survive financially under the restrictions. Being too lenient in the short term could jeopardize the probability of rebuilding the stock as needed.

As mentioned previously, **Alternative 1 (No Action)** is not a viable alternative to consider, as there are statutory requirements to rebuild all fishery stocks that are overfished or undergoing overfishing. The rebuilding plan has indirect economic effects in that it frames the ACL decision (**Action 6**). The level of the ABC in and of itself does not have direct economic effects.

4.5.3 Social Effects

Although establishment of a rebuilding strategy for the FLK/EFL stock of hogfish is primarily an administrative action, the selected level of fishing mortality and associated ABCs determine the level of restrictiveness in management that is needed to rebuild the resource within

the specified timeframe. The level to which access to the resource is limited or non-existent would determine the magnitude of the associated social and economic effects expected to accrue during the recovery period. The rebuilding strategies and associated ABCs in this action are trade-offs of long-term and short-term biological benefits, which are directly tied to long-term and short-term social benefits. A more conservative rebuilding strategy would likely result in short-term negative social impacts such as loss of income and decreased fishing opportunities due to lower target fishing mortality. However, the resulting larger sustainable biomass once the FLK/EFL hogfish stock is rebuilt is expected to produce long-term social benefits, including stable and sustainable livelihoods for commercial fishermen and the for-hire sector, consistent product for fish houses and restaurants, and private recreational fishing opportunities.

Section 3.4 describes Florida communities that could be affected by changes to the FLK/EFL hogfish rebuilding plan, particularly in the Florida Keys. Additionally, hogfish is an important part of the tourism and culinary scene in the Florida Keys, as a signature dish of the area. Changes to access to hogfish could also affect fish houses and restaurants that depend on a steady supply of hogfish.

Because the recent assessment determined that FLK/EFL hogfish is overfished and experiencing overfishing, **Alternative 1 (No Action)** would be expected to result in negative long-term effects on fishermen associated with negative biological effects on the stock, even if this alternative may provide some short-term benefits by not restricting harvest. The level of negative short-term effects on fishermen and communities due to restrictions would depend on the length of the rebuilding plan and the severity of restrictions. Overall, the most benefits to fishermen and communities would come from a balance between minimal harvest restrictions for a minimal time period, but still achieve rebuilding goals to ensure long-term sustainability of the hogfish stock.

Because higher ABC levels (and associated ACLs) would be expected to result in less short-term negative effects on fishermen by allowing more access to hogfish, **Alternative 2** would likely have the least effects associated with catch limits, followed by **Preferred Alternative 3**, **Alternative 4**, and then **Alternative 5**. However, a longer rebuilding plan (**Alternative 2** and **Preferred Alternative 3**) would extend any negative effects on fishermen due to harvest restrictions more than under the shorter (7-year) rebuilding plans in **Alternatives 4** and **5**. Additionally, lower probability of rebuilding could result in long-term negative effects on the stock, which would affect future fishing opportunities. Overall, **Preferred Alternative 3** would be a longer period (10 years) for rebuilding, but may result in a lower level of negative short-term effects than under **Alternatives 4** and **5** due to higher ABCs/ACLs.

4.5.4 Administrative Effects

In general, the shorter the rebuilding schedule the more restrictive the harvest limitations needed to rebuild the stock within the specified timeframe. Greater restrictions can result in increased impacts on the administrative environment due to an increased need to closely track landings; enforce bag, trip, and size limits; or implement in-season and post-season AMs.

Alternative 1 (No Action) would not establish a rebuilding schedule for the FLK/EFL stock of hogfish and would, therefore, not comply with Magnuson-Stevens Act requirements for developing rebuilding plans. **Alternative 2** would rebuild the FLK/EFL stock of hogfish in 10 years, but with only a 50% probability of success. **Alternative 3 (Preferred)** would rebuild the FLK/EFL stock of hogfish in 10 years with a 72.5% probability of rebuilding success. **Alternatives 4** and **5** have the shortest rebuilding schedule considered and would require implementation of additional harvest restrictions to meet the goal of rebuilding the stock within 7 years. Therefore, of all the rebuilding schedule alternatives that specify a timeframe, **Alternatives 4** and **5** would be most likely to impact the administrative environment in the form of developing, implementing, and monitoring more restrictive harvest regulations for hogfish. Of all the alternatives considered, **Alternative 3 (Preferred)** would be the most efficient rebuilding strategy and least likely to impact the administrative environment.

Action 6. Establish Annual Catch Limits (ACLs) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

Alternatives
(preferred alternatives in bold)

1 (No Action). The current ABC for the entire stock of hogfish is 134,824 lbs ww and ACL = OY = ABC. The commercial ACL = 49,469 lbs ww (36.69%) and the recreational ACL = 85,355 lbs ww (63.31%).

2. Establish ACLs for the FLK/EFL stock of hogfish. Specify commercial and recreational ACLs for 2017-2025. ACLs will not increase automatically in a subsequent year if present year projected catch has exceeded the total ACL. Specify commercial and recreational ACLs using re-calculated sector allocations based on proposed modifications to the management unit (9.63% commercial and 90.37% recreational).

2a. ACL = OY = ABC.
2b. ACL = OY = 95% ABC.
2c. ACL = OY = 90% ABC.

4.6.1 Biological Effects

The allocation formula from the Comprehensive ACL Amendment (SAFMC 2011a) was used to specify commercial and recreational allocations for the Florida Keys/East Florida (FLK/EFL) hogfish stock: (0.5 * catch history) + (0.5 * current trend) where catch history = average landings 1986-2008, current trend = average landings 2006-2008. The formula was applied to Southeast Fisheries Science Center (SEFSC) commercial ACL data, accessed in July 2014, and post-stratified SEFSC recreational data accessed in February 2015). Recreational data were post-stratified to include Marine Recreational Information Program (MRIP) landings from Monroe County in the FLK/EFL sub-region, consistent with the SEDAR 37 stock assessment. Commercial and recreational landings data used to re-calculate sector allocations are shown in **Table 4.6.1**.

Alternative 1 (No Action) would not establish an ACL for the FLK/EFL stock of hogfish, which would not adhere to the best scientific information available (SEDAR 37) and therefore, is not a viable alternative. To set the annual catch limit (ACL) and optimum yield (OY) for the FLK/EFL stock of hogfish, the South Atlantic Council may exercise varying degrees of precaution to account for management uncertainty. **Sub-alternative 2a** would set the ACL and OY at the same level as ABC, whereas **Sub-alternatives 2b** (**Preferred**) and **2c** would each provide a management uncertainty buffer of 5% and 10%, respectively.

Table 4.6.1. Commercial and recreational landings (lbs ww) used to re-calculate hogfish sector allocations for FLK/EFL hogfish stock, 1986-2008.

Year	Recreational	Commercial	Total
1986	173,489	28,878	202,367
1987	340,881	44,300	385,181
1988	247,203	48,362	295,565
1989	151,578	54,155	205,733
1990	307,831	53,914	361,745
1991	196,098	53,590	249,688
1992	309,536	54,495	364,031
1993	266,249	42,646	308,895
1994	224,732	34,716	259,448
1995	285,983	39,433	325,416
1996	159,365	40,136	199,501
1997	168,822	42,573	211,395
1998	57,160	31,211	88,371
1999	115,575	24,155	139,730
2000	40,295	28,015	68,310
2001	79,266	18,455	97,721
2002	99,499	19,525	119,024
2003	123,767	20,623	144,390
2004	190,292	23,299	213,591
2005	189,126	12,380	201,506
2006	120,381	11,337	131,718
2007	271,031	14,402	285,433
2008	361,301	17,882	379,183

Source: NMFS SERO

Sub-alternative 2a, **Preferred Sub-alternative 2b**, and **Sub-alternative 2c** would set OY equal to the ACL. NS1 establishes the relationship between conservation and management measures, preventing overfishing, and achieving OY from each stock, stock complex, or fishery. The NS1 guidelines discuss the relationship of the overfishing limit (OFL) to the maximum sustainable yield (MSY) and ACL to OY. The OFL is an annual amount of catch that corresponds to the estimate of maximum fishing mortality threshold applied to a stock; MSY is the long-term average of such catches. The ACL is the limit that triggers accountability measures (AMs) and is the management target for the species. Management measures for a fishery should, on an annual basis, prevent the ACL from being exceeded. The long-term objective is to achieve OY through annual achievement of an ACL. The NS1 guidelines state that if OY is set close to MSY, the conservation and management measures in the fishery must have very good control of the amount of catch to achieve the OY without overfishing.

The South Atlantic Council and their Scientific and Statistical Committee (SSC) have established an ABC Control Rule that takes into consideration scientific and management uncertainty to ensure catches are maintained below OFL. Setting the ACL equal to the ABC

(**Sub-alternative 2a**) leaves no buffer between the two harvest parameters, which may increase risk that harvest could exceed the ABC. The South Atlantic Council considered alternatives in the Comprehensive ACL Amendment (SAFMC 2011a) and Amendment 24 to the Snapper Grouper FMP (SAFMC 2011b) that would set the ACL below the ABC but selected ACL=OY=ABC as their preferred alternative. More recently, the South Atlantic Council has frequently set ACLs for snapper grouper species at the same level as the ABC. However, accountability measures (AMs) and ACLs are in place to ensure overfishing of hogfish does not occur. The NS1 guidelines recommend a performance standard by which the system of ACLs and AMs can be measured and evaluated. If the ACL is exceeded more than once over the course of four years, the South Atlantic Council would reassess the system of ACLs and AMs for the species. The South Atlantic Council took action in Amendment 34 to the Snapper Grouper FMP (SAFMC 2015d) to enhance the effectiveness of the AMs for hogfish. **Action 12** in Amendment 37 includes alternatives that would clarify the AMs for the two South Atlantic stocks of hogfish.

Sub-alternatives 2b (Preferred) and **2c** would have a greater positive biological effect than **Sub-alternative 2a** because they would create a buffer between the ACL/OY and ABC, with **Sub-alternative 2c** setting the most conservative ACL at 90% of the ABC (**Table 4.6.2**). **Alternative 1 (No Action)** would not establish an ACL for the FLK/EFL stock of hogfish, which would not adhere to the best scientific information available (SEDAR 37) and therefore, is not a viable alternative. Creating a buffer between the ACL/OY and ABC would provide greater assurance that overfishing is prevented, and the long-term average biomass is near or above SSB_{MSY}. However, the South Atlantic Council's ABC Control Rule takes into account scientific uncertainty. The Magnuson-Stevens Act NS 1 guidelines indicate an ACL may typically be set very close to the ABC. Setting a buffer between the ACL and ABC would be appropriate in situations where there is uncertainty in whether or not management measures are constraining fishing mortality to target levels. An ACT, which is not required, can also be set below the ACL to account for management uncertainty and provide greater assurance overfishing does not occur.

The South Atlantic Council prefers specifying the recreational ACL in numbers of fish and the commercial ACL in pounds. Their rationale is that recreational landings are already tracked in numbers of fish while commercial landings are tracked in pounds. Issues develop, however, when different size limits are considered for management and the commercial and recreational ACLs are in different units: if the minimum size limit is increased, as the Council proposes to do, the average size and thus weight of fish harvested will also increase. If the method for converting between an ACL in pounds and an ACL in numbers does not address the change in average weight, the expected increase in the average weight of landed fish could lead to the poundage associated with the ACL specified in numbers exceeding the ACL expressed in pounds. This could also result in a perceived shift in allocations when they are compared in the original units across sectors, and if the change in weight landed is great enough, the ABC and OFL in pounds could be exceeded. To avoid these issues, the method described in **Appendix N** was used to specify the recreational ABC and ACL for the FLK/EFL stock of hogfish in numbers of fish. This method is designed to keep the numbers of fish harvested constant while allowing the yield to vary based on the possible change in selectivity due to changes in the minimum size

limit. Specifying the recreational ABC and ACL in numbers results in a lower risk of exceeding the recreational ACL due to an increase in the minimum size limit. The South Atlantic Council also discussed the high percent standard error (PSE) associated with the recreational data and the fact that there were very few intercepts for recreational effort using spear. **Appendix N** includes a detailed account of the methodology used to specify the recreational ACL for the FLK/EFL stock of hogfish in numbers of fish.

Table 4.6.2. Sector ACLs for the FLK/EFL stock for **Sub-alternatives 2a-2c** in **Action 6** and based on ABC projections from **Preferred Alternative 3** in **Action 5** where ABC equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success.

Year	ABC (numbers)	Total ACL (numbers)	Rec ACL (numbers)	Commercial ACL (lbs)	Commercial ACL (numbers)
Sub-alternative 2a (ACL = OY = ABC)					
2017	17,930	17,930	16,514	3,695	1,416
2018	21,421	21,421	19,597	4,762	1,824
2019	24,996	24,996	22,709	5,969	2,287
2020	29,200	29,200	26,407	7,291	2,793
2021	33,965	33,965	30,627	8,712	3,338
2022	39,027	39,027	35,114	10,213	3,913
2023	44,162	44,162	39,653	11,768	4,509
2024	49,254	49,254	44,141	13,344	5,113
2025	54,183	54,183	48,470	14,912	5,713
2026	58,878	58,878	52,578	16,443	6,300
2027	63,295	63,295	56,432	17,914	6,863
Preferred Sub-alternative 2b (ACL = OY = 95%ABC)					
2017	**17,930**	**17,034**	**15,689**	**3,510**	**1,345**
2018	**21,421**	**20,350**	**18,617**	**4,524**	**1,733**
2019	**24,996**	**23,746**	**21,574**	**5,670**	**2,173**
2020	**29,200**	**27,740**	**25,086**	**6,926**	**2,654**
2021	**33,965**	**32,267**	**29,096**	**8,277**	**3,171**
2022	**39,027**	**37,076**	**33,358**	**9,703**	**3,718**
2023	**44,162**	**41,954**	**37,671**	**11,179**	**4,283**
2024	**49,254**	**46,791**	**41,934**	**12,677**	**4,857**
2025	**54,183**	**51,474**	**46,046**	**14,167**	**5,428**
2026	**58,878**	**55,934**	**49,949**	**15,621**	**5,985**
2027	**63,295**	**60,130**	**53,610**	**17,018**	**6,520**
Sub-alternative 2c (ACL = OY = 90%ABC)					
2017	17,930	16,137	14,863	3,325	1,274
2018	21,421	19,279	17,637	4,286	1,642
2019	24,996	22,496	20,438	5,372	2,058
2020	29,200	26,280	23,766	6,562	2,514
2021	33,965	30,569	27,564	7,841	3,004
2022	39,027	35,124	31,602	9,192	3,522
2023	44,162	39,746	35,688	10,591	4,058
2024	49,254	44,329	39,727	12,010	4,601
2025	54,183	48,765	43,623	13,421	5,142
2026	58,878	52,990	47,320	14,799	5,670
2027	63,295	56,966	50,788	16,122	6,177

Note: The Council prefers to specify the recreational ACL in numbers of fish and the commercial ACL in pounds. See **Appendix N** for methodology used to derive the recreational ACL in numbers.

With vastly improved commercial monitoring mechanisms recently implemented, it is unlikely that repeated commercial ACL overages would occur. The Commercial Landings Monitoring System (CLM) came online in June 2012 and is now being used to track commercial landings of federally managed fish species (see **Section 4.4.1**). The CLM system is can track dealer reporting compliance with a direct link to the permits database at SERO. Additionally, the Joint Dealer Reporting Amendment (GMFMC & SAFMC 2013b), which became effective on August 7, 2014 requires electronic reporting, increases required reporting frequency for dealers to once per week, and requires a single dealer permit for all finfish dealers in the Southeast Region. The new CLM quota monitoring system and actions in the Joint Generic Dealer Reporting amendment are expected to provide more timely and accurate data reporting and would thus reduce the incidence of quota overages.

Harvest monitoring efforts in the recreational sector have also been improved. On January 27, 2014, regulations became effective requiring headboats to report their landings electronically once per week (Generic Headboat Amendment, GMFMC & SAFMC 2013a). The SEFSC is also developing an electronic reporting system for charter boats operating the Southeast Region, and the Gulf of Mexico and South Atlantic Councils are developing amendments that would require electronic reporting for charterboats with a set reporting frequency. **Preferred Alternative 2** and its sub-alternatives would also act as an AM in that, if the combined commercial and recreational ACL (total ACL), as estimated by the National Marine Fisheries Service (NMFS), is exceeded in a fishing year, then during the following fishing year, an automatic increase will not be applied to the commercial and recreational ACLs. The NMFS will evaluate the landings data, using the best scientific information available, to determine whether or not an increase in the commercial and recreational ACLs will be applied. Therefore, there is a low risk of exceeding the commercial and recreational ACLs and **Preferred Alternative 2** and its sub-alternatives can be used as part of a successful harvest management system for hogfish with little risk of overfishing. This in turn, would help decrease discards and bycatch. Furthermore, as mentioned in **Appendix D** (BPA), discards are inherently low for the gear used to harvest hogfish (primarily spear), and other actions are considered in this amendment that could help prevent this ACL from exceeding (**Actions 7** through **12**).

Table 4.6.3 shows annual commercial and recreational hogfish landings from 2000 through 2014 for the FLK/EFL sub-region. Compared to average recreational landings from 2010-2014 (95,719 fish) the recreational ACL under **Preferred Sub-alternative 2b** for 2017 (15,689 fish) would result in an 84% reduction in recreational harvest in east Florida and the Florida Keys. For the commercial sector, the preferred commercial ACL of 3,510 lbs ww for 2017 would translate to a 72% reduction in commercial harvest based on average commercial landings over the past 5 years (12,573 lbs ww).

Table 4.6.3. Commercial (lbs ww) and recreational landings (numbers) for the FLK/EFL stock of hogfish, 2000-2014.

Year	Rec landings (num)	Commercial landings (lbs ww)
2000	18,689	28,015
2001	36,764	18,455
2002	46,148	19,525
2003	83,171	20,623
2004	90,064	23,299
2005	87,718	12,380
2006	55,833	11,337
2007	122,276	14,402
2008	167,573	17,882
2009	111,001	12,014
2010	77,301	10,554
2011	37,309	10,384
2012	147,626	12,145
2013	69,077	13,950
2014	147,284	15,833

Source: SERO and SEFSC

Landings data were explored in terms of location, i.e. the percentage of hogfish landings in Florida that occur in federal vs. state waters. **Tables 4.6.4** and **4.6.5** show recreational and commercial landings from 2010 through 2014 by area fished.

Table 4.6.4. Recreational landings (private and charter; numbers of fish) of hogfish in federal and state waters off Florida, 2010-2014.

Year	Landings in federal waters	Landings in state waters	Total	Percent federal	Percent state
2010	18,049	58,494	77,231	23.4%	75.7%
2011	11,686	25,528	37,214	31.4%	68.6%
2012	49,359	97,052	147,522	33.5%	65.8%
2013	25,148	43,803	68,951	36.5%	63.5%
2014	40,973	105,626	147,103	27.9%	71.8%

Source: NMFS SERO

Table 4.6.5. Commercial landings (lbs ww) of hogfish in federal and state waters off Florida, 2010-2014.

Year	Landings in federal waters	Landings in state waters	Landings unknown	Total	Percent federal	Percent state	Percent unknown
2010	47,047	1,663	3,742	52,452	90%	3%	7%
2011	41,235	2,548	2,560	46,343	89%	5%	6%
2012	27,035	3,380	2,360	32,775	82%	10%	7%
2013	27,400	3,031	3,250	33,681	81%	9%	10%
2014	25,502	3,984	8,138	37,624	68%	11%	22%

Source: NMFS SERO

To simulate the impacts of various combinations of proposed management measures, recreational decision tools (RDTs; **Appendix L**) and commercial decision tools (**Appendix M**) were developed. Analyses for subsequent actions in this amendment employ these tools to project landings levels and season length, where appropriate. Details of the methodology, assumptions, caveats, and data inputs are included in **Appendices L** and **M**. To address uncertainty mean projected closure dates and projected landings were determined across 1000 bootstrapped runs of each combination of proposed management measures. Bootstrapping runs accounted for uncertainty in projections data by averaging across 2012-2015 landings generated from random draws from a normal distribution fit to mean and standard deviation from landings survey data from the modified hogfish landings dataset used in the models. Bootstrapping also accounted for uncertainty in size limit and bag limit reductions using random draws for these reductions drawn from normal distributions fit to the mean and standard deviation of the most recent three years of simulated size and bag limit reductions. Bootstrapping runs accounting for uncertainty in monthly catch rate estimates and reductions associated with various proposed management measures indicate that quota closure estimates could deviate by over a month, and that uncertainty is highest when the season is long, because uncertainty in daily catch rates accumulates through time. Although the RDTs attempt to address uncertainties in catch rates and the impacts of various management measures, the bounds of this uncertainty are not fully captured by the models; as such, they should be used with caution for management decision-making. As a foundation for comparisons, it is assumed that the 2012-2015 mean catch rate is representative of future trends in catch rates. However, substantial uncertainty exists in this projected baseline, especially for the GA-NC sub-region, where hogfish catches may be viewed as a somewhat rare event. Baseline discards are also highly uncertain, especially for the GA-NC sub-region. Economic conditions, weather events, changes in catch-per-unit effort, fisher response to management regulations, variation in survey estimates due to rarity of intercepts, and a variety of other factors may cause departures from this assumption.

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.6.2 Economic Effects

Alternative 1 (No Action) is not a viable alternative for this action because establishing an ACL for a stock is a statutory requirement. Based on ACL values specified in **Table 4.6.2**, **Table 4.6.6** shows short-term (2017) sector ACLs and expected economic returns (in 2014 dollars) for the alternatives/sub-alternatives for **Action 6**. **Section 3.3.2** gives two proxy estimates for CS for recreationally caught hogfish. One is $12.37 based on the value of catching a snapper (but not a red snapper) and $134.74 based on the value of catching a grouper. Because of the wide differences in proxy values, both are shown in **Table 4.6.6**.

Table 4.6.6. Recreational and commercial sector ACLs with recreational consumer surplus (CS) and commercial ex-vessel expected values (in 2014 $) for the FLK/EFL stock of hogfish.

	Rec ACL (numbers)	Recreational CS - Snapper	Recreational CS - Grouper	Commercial ACL (lbs ww)	Commercial ex-vessel
Sub-alternative 2a	19,699	$243,677	$2,654,243	3,697	$13,827
Sub-alternative 2b	**18,714**	**$231,492**	$2,521,524	**3,512**	**$13,135**
Sub-alternative 2c	17,729	$219,308	$2,388,805	3,327	$12,443

Source: NMFS SERO Recreational Decision Tool, **Appendix L**

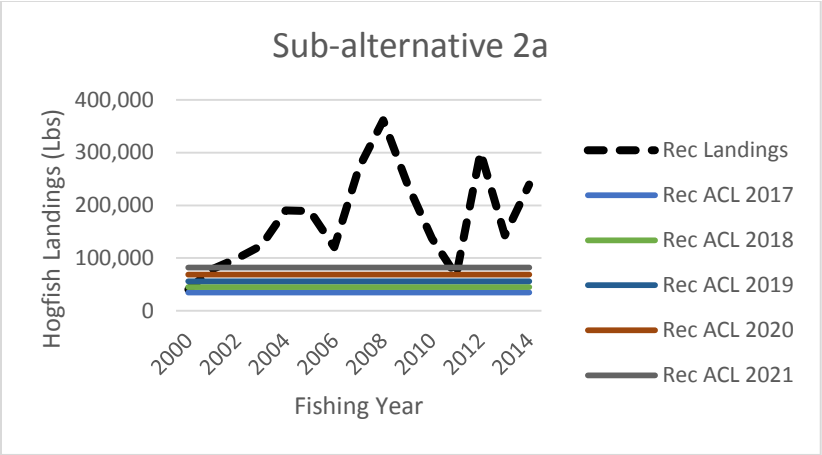
The sub-alternatives under **Preferred Alternative 2** represent a large reduction from the estimated baseline landings under **Alternative 1 (No Action)** (**Table 4.6.3**). For the recreational sector, **Sub-alternatives 2a-2c** represent 14-15% of the baseline landings CS value. In the commercial sector, **Sub-alternatives 2a-2c** represent approximately 12% of the baseline ex-vessel landings value. Among the **Preferred Alternative 2** sub-alternatives, **Sub-alternative 2a** would result in the highest positive direct economic effects, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c**.

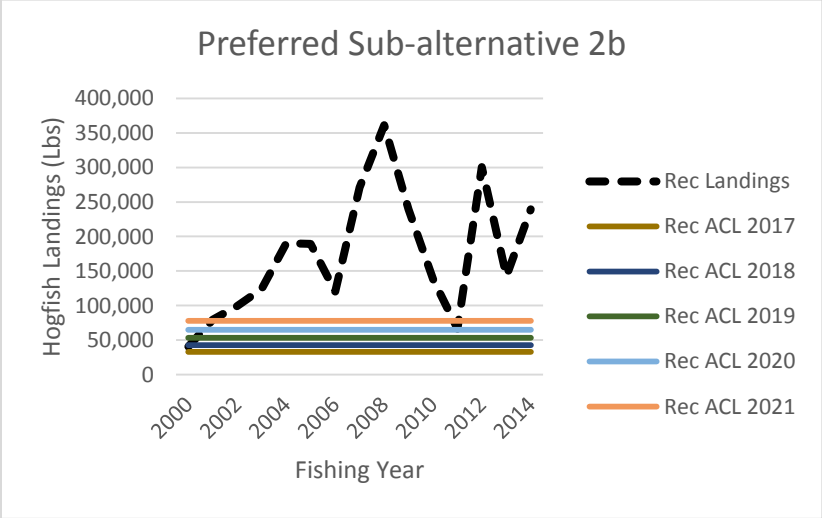
4.6.3 Social Effects

As noted in **Section 4.4.3**, social effects of ACLs are associated with changes to access through associated AMs triggered by reaching the ACL. In general, the higher the ACL, the greater the short-term social and economic benefits that would be expected to accrue, assuming long-term recovery and rebuilding goals are met. Adhering to stock recovery and rebuilding goals is assumed to result in net long-term positive social and economic benefits. Additionally, adjustments in an ACL based on updated information from a stock assessment would be the most beneficial in the long term to fishermen and coastal communities because ACLs would be based on the current conditions, even if the updated information indicates that a lower ACL is appropriate to sustain the stock.

Under **Preferred Alternative 2**, the ACL for the FLK/EFL stock would be based on the most recent stock assessment, but could also set ACLs lower than recent recreational and commercial landings in the area. This could result in early closures, paybacks, or other management measures.

Recreational landings of hogfish in the FLK/EFL stock (**Table 4.6.3**) are much higher than the proposed recreational ACLs under **Preferred Alternative 2** (**Table 4.6.2** and **Figure 4.6.1**). If an in-season closure and payback measure are implemented as recreational AMs in **Action 12**, there would likely be some negative effects on recreational fishermen and for-hire businesses that target hogfish, as access would be greatly restricted. In general, a higher ACL would lower the chance of triggering a recreational AM (if implemented) and result in the lowest level of negative effects on the recreational sector. After **Alternative 1 (No Action)**, **Sub-alternative 2a** would be the most beneficial for recreational fishermen, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c**. However, because the proposed ACLs in **Preferred Alternative 2** would all be much lower than recreational landings in recent years, all sub-alternatives would likely result in negative effects on recreational anglers, for-hire businesses and for-hire clients who harvest or would harvest hogfish.





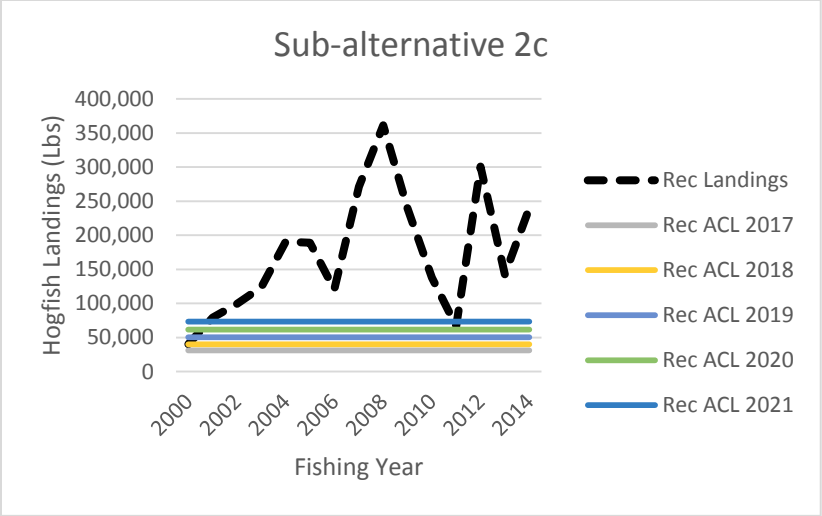


Figure 4.6.1. Annual recreational landings of FLK/EFL hogfish (lbs ww) for compared to the potential recreational ACLs under each sub-alternative under **Preferred Alternative 2**.

Although commercial landings of FLK/EFL hogfish are much lower compared to recreational landings, the proposed commercial ACLs under **Preferred Alternative 2** are much lower than commercial landings in recent years (**Figure 4.6.2**). The potential commercial AMs in **Action 12** would mirror current commercial AMs for each stock, and there would be a possibility of an in-season closure for a year with high landings, or a payback if triggered. In general, a higher ACL would lower the chance of triggering a closure, resulting in in the lowest level of negative effects on the commercial sector. After **Alternative 1 (No Action)**, **Sub-alternative 2a** would be the most beneficial for commercial fishing businesses who may harvest hogfish, followed by **Preferred Sub-alternative 2b** and **Sub-alternative 2c.**

4.6.4 Administrative Effects

Negative administrative impacts of this action are likely to be minimal. **Alternative 1 (No Action)**, **Sub-alternatives 2a, 2b (Preferred),** and **2c** would not result in significant administrative cost or time burdens other than notifying fishery participants of the change in the sector ACLs and continued monitoring of the sector ACLs. The burden on law enforcement would not change under either alternative since commercial quota closures and bag limits implemented are currently enforced.

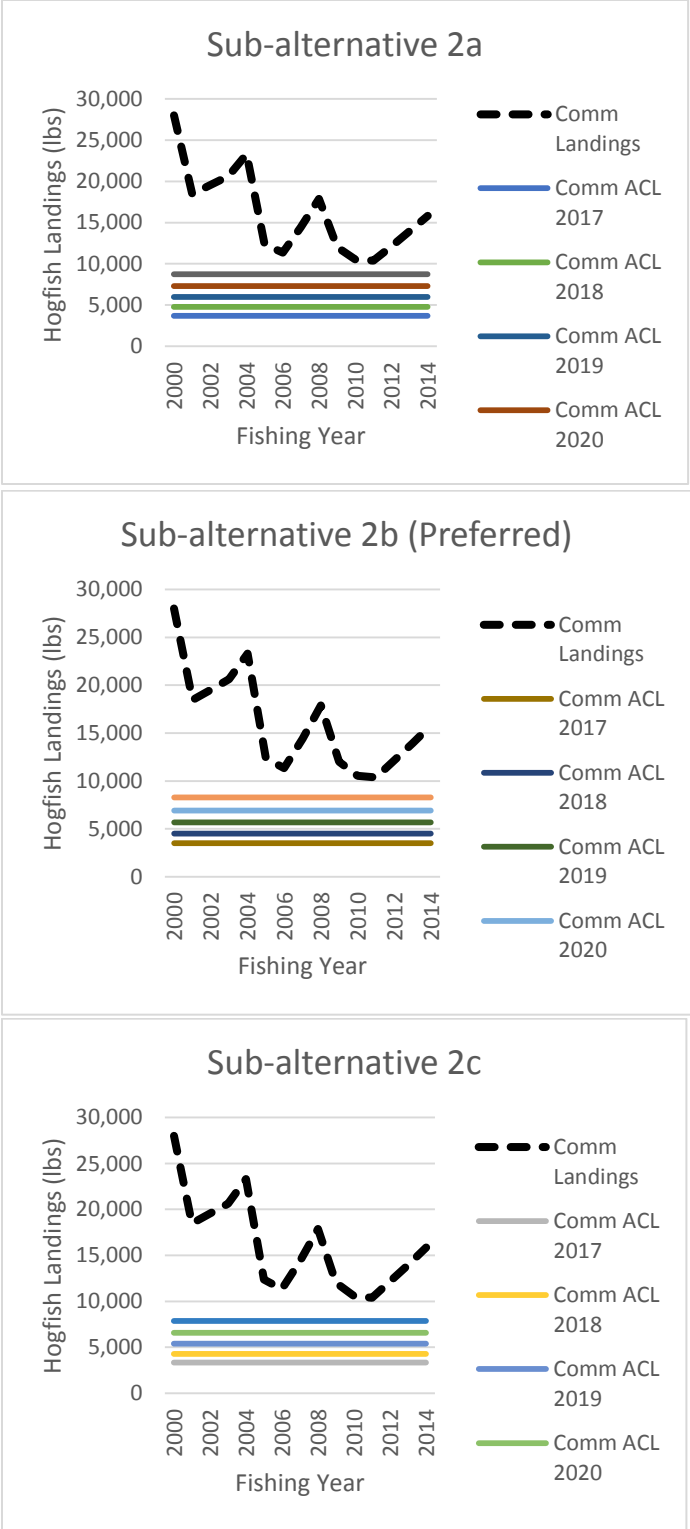


Figure 4.6.2. Annual commercial landings of FLK/EFL hogfish (lbs ww) for compared to the potential commercial ACLs under each sub-alternative under **Preferred Alternative 2**.

Action 7. Establish a recreational Annual Catch Target (ACT) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternatives
(preferred alternatives in bold)

1 (No Action). The current ACT is 59,390 lbs ww and applies to hogfish throughout the South Atlantic Council's jurisdiction. The ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater, and where Percent Standard Error (PSE) = average PSE 2005-2009.

2. Establish an ACT for the GA-NC stock of hogfish for the recreational sector.

2a. ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater.
2b. ACT =85% recreational ACL.
2c. ACT = 75% recreational ACL.

3. Establish an ACT for the FLK/EFL stock of hogfish for the recreational sector.

3a. ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater.
3b. ACT =85% recreational ACL.
3c. ACT = 75% recreational ACL.

4.7.1 Biological Effects

As explained in **Section 2.7.1**, ACTs can be used to prevent ACLs from being exceeded. For species without in-season management control to prevent the ACL from being exceeded, managers may utilize ACTs that are set below annual catch limits (ACLs) so that catches do not exceed the ACLs. In managing the snapper grouper fishery, however, the South Atlantic Council has chosen not to use ACTs to trigger accountability measures (AMs) because it is anticipated that improvements in reporting would significantly reduce management uncertainty. Should the South Atlantic Council, in the future, utilize ACTs to manage recreational harvest, these values will already have been specified and become part of the regulations.

Since the ACT is typically set lower and would be reached sooner than the ACL, using an ACT rather than the ACL as a trigger for AMs in the recreational sector may prevent an ACL overage. This more conservative approach, would likely help to ensure that recreational data uncertainties do not cause or contribute to excessive ACL overages for vulnerable species. Using recreational ACTs rather than the ACLs to trigger recreational AMs may not eliminate ACL overages completely; however, using such a strategy for the recreational sector may reduce the need to compensate for very large overages. Because the South Atlantic Council has not employed ACTs in its management strategy for the snapper grouper fishery, the biological effects of **Preferred Alternatives 2** and **3** (and their respective sub-alternatives) would be neutral. Compared to **Alternative 1 (No Action)**, **Preferred Alternatives 2** and **3** (and their respective sub-alternatives) would be biologically beneficial in that management would be adjusted to apply to two separate stocks of hogfish and; therefore, be responding to the best scientific information available about the target species.

The Percent Standard Error (PSE) for the GA-NC stock of hogfish is 62.1% and the PSE for the FLK/EFL stock is 20.5%. The South Atlantic Council has consistently chosen to specify recreational ACTs using a formula that incorporates the PSE in order to account for uncertainty in recreational landings estimates. However, recreational landings estimates for the GA-NC stock of hogfish are imprecise (and therefore have high PSEs) due to low MRIP intercepts that may result from low intercept rates of recreational divers. Hogfish are primarily harvested with spearfishing gear. Using the South Atlantic Council's existing ACT formula (Rec ACT = rec ACL*(1-PSE) or 0.5, whichever is greater), would have resulted in setting the GA-NC recreational ACT at 50% of the recreational ACL. Given that the proposed recreational ACLs for the GA-NC stock of hogfish are low compared to status quo, the South Atlantic Council chose instead to establish the recreational ACT at 85% of the recreational ACL (**Preferred Sub-alternative 2b**). For the FLK/EFL stock of hogfish, the South Atlantic Council selected **Preferred Sub-alternative 3b** to maintain consistency.

Table 4.7.1 shows recreational ACTs for the GA-NC stock of hogfish based on the proposed recreational ACL alternatives in **Action 4**.

Table 4.7.1. Recreational ACTs (in pounds and numbers) for the GA-NC stock of hogfish for each of the Recreational ACL sub-alternatives in Action 4.

	ACL=ABC		**ACL=95%ABC**		**ACL=90%ABC**	
	Lbs	**num**	**lbs**	**num**	**lbs**	**num**
ACT=rec ACL (1-PSE) or rec ACL*0.5, whichever is greater	5,513	520	5,237	494	4,961	468
ACT=85%rec ACL (Preferred)	**9,372**	**884**	**8,903**	**840**	**8,435**	**796**
ACT=75%recACT	8,269	780	7,856	741	7,442	702

Table 4.7.2 shows recreational ACTs for the FLK/EFK stock for the **Alternative 3** sub-alternatives, including **Preferred Sub-alternative 3b**. Recreational ACTs are specified in numbers of fish based on **Preferred Sub-alternative 2a** under **Action 6**.

This action would not be expected to affect discards and/or bycatch, since the only consequence of reaching the ACT would be to monitor the landings, which MRIP does anyway. For more information on bycatch and discards, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

Table 4.7.2. Recreational ACTs (numbers of fish) under consideration for the FLK/EFL stock of hogfish based on **Preferred Sub-alternative 2b** under **Action 6**.

Year	Rec ACL	Sub-alt 2a	Pref Sub-alt 2b	Sub-alt 2c
2017	15,689	12,472	**13,335**	11,767
2018	18,617	14,800	**15,824**	13,963
2019	21,574	17,151	**18,338**	16,180
2020	25,086	19,944	**21,323**	18,815
2021	29,096	23,131	**24,731**	21,822
2022	33,358	26,520	**28,354**	25,019
2023	37,671	29,948	**32,020**	28,253
2024	41,934	33,338	**35,644**	31,451
2025	46,046	36,607	**39,139**	34,535
2026	49,949	39,709	**42,457**	37,462
2027	53,610	42,620	**45,568**	40,207

4.7.2 Economic Effects

The purpose of establishing ACTs is to help prevent a sector from exceeding its ACLs due to management uncertainty. However, the South Atlantic Council has chosen not to use ACTs to trigger AMs because it is anticipated that improvements in reporting will reduce management uncertainty. Should the South Atlantic Council, in the future, utilize ACTs to manage recreational harvest, these values will already have been specified and become part of the regulations. Exceeding an ACL would have direct negative economic effects on all sectors potentially due to a reduced stock size and to a sector that would have its future ACL reduced by the size of the overage.

The economic effects analysis of this action assumes that the ACT would be used limit recreational harvest and that fishing would stop when the ACT is reached. Without being able to predict exactly how much precaution is needed in setting the ACT, it is difficult to compare alternatives. However, if harvest was closed too early for a sector based on the ACT, there would be direct negative economic effects as well because the sector was prohibited from harvesting fish. The ACTs being established by this action only apply to the recreational sector. There are no commercial ACTs being proposed as commercial landings reporting requirements allow for the commercial sector to be closed comparatively more quickly when the commercial sector ACL is met or projected to be met.

Table 4.7.3 shows the expected ACT and consumer surplus (CS) (in 2014 dollars) for the sub-alternatives of **Preferred Alternatives 2** and **3**. The ACTs and CS for **Preferred Alternative 2** sub-alternatives do not change over time. The ACTs and CS for **Preferred Alternative 3** sub-alternatives increase over time (**Table 4.7.2**). For **Preferred Alternative 3**, the ACTs and CS values shown in **Table 4.7.3** are only for 2017. As the ACTs for the FK/EFL stock increase, the expected CS would increase accordingly.

Table 4.7.3. The numbers of fish and consumer surplus values for the recreational ACTs proposed by the sub-alternatives of **Preferred Alternatives 2** and **3** based on preferred alternatives from Actions 4 and 6. Preferred sub-alternatives indicated in bold.

Alternative 2: Georgia - North Carolina Stock			
	Recreational ACT (numbers)	**Recreational CS - Snapper**	**Recreational CS - Grouper**
Sub-alternative 2a	494	$6,111	$66,562
Sub-alternative 2b	**840**	**$10,391**	**$113,182**
Sub-alternative 2c	741	$9,166	$99,842
Alternative 3: Florida Keys/East Coast Florida			
	Recreational ACT (numbers)	**Recreational CS -Snapper**	**Recreational CS - Grouper**
Sub-alternative 3a	14,155	$175,097	$1,907,245
Sub-alternative 3b	**15,134**	**$187,208**	**$2,039,155**
Sub-alternative 3c	13,354	$165,189	$1,799,318

Source: Hogfish Recreational Decision Tool, **Appendix L**

Alternative 1 (No Action) is not a viable alternative for management as the previous single stock of hogfish has been separated into two separate stocks and the current ACT set for the recreational sector is no longer valid. As stated in **Section 4.4.2**, based on past behavior, recreational anglers are not expected to meet their sector ACT for the GA-NC stock. The recreational sector is expected to land 431 fish with an expected CS of $5,331 to $58,073 (in 2014 dollars). Assuming hypothetically that the recreational sector for GA-NC stock (**Preferred Alternative 2**) could reach its ACT, **Preferred Alternative 2, Preferred Sub-alternative 2b** and **Preferred Alternative 3, Preferred Sub-alternative 3b** would allow for the highest catches (and highest positive direct economic effects) before the ACT could be used to trigger a closure for the recreational sector. **Preferred Alternative 2, Sub-alternative 2c** and **Preferred Alternative 3, Sub-alternative 3a**, which results in the second highest ACT, would be expected to result in the next highest amount of positive direct economic effects, followed by **Preferred Alternative 2, Sub-alternative 2a** and **Preferred Alternative 3, Sub-alternative 3c**.

4.7.3 Social Effects

Establishment of a recreational ACT for each stock of hogfish would likely have little effects on recreational fishermen targeting hogfish, unless the South Atlantic Council decides to set the ACT as a trigger for AMs at a later time. A higher ACT could be more beneficial for fishermen, depending on the levels specified in **Preferred Alternative 2** and **Preferred Alternative 3**. Because the ACT is used for monitoring only, it is expected that the social effects of **Alternative 1 (No Action)**, **Preferred Alternative 2**, and **Preferred Alternative 3** would be the similar.

As noted in **Section 4.7.1**, the PSE for the GA-NC hogfish stock is 62.1% and that could result in the ACT under **Sub-alternatives 2a** being set lower than under **Preferred Sub-**

alternatives 2b or **2c**. **Preferred Sub-alternatives 2b** would ensure that the ACT was not associated with the PSE and could be more beneficial to fishermen if the South Atlantic Council chooses to use ACT for management and monitoring purposes.

4.7.4 Administrative Effects

Under this action, it is important to note that recreational data collection can be more administratively burdensome due to time delays and lengthy reviews. Specifying an ACT alone would not increase the administrative burden over the status quo, other than adding an additional layer of precautionary monitoring to the system of AMs. In-season monitoring needed for tracking how much of the ACT has been harvested throughout a particular fishing season can potentially result in a need for additional cost and personnel resources if a monitoring mechanism is not already in place. However, because the ACT alternatives as they are presented here do not trigger any corrective or preventative action, no additional in-season monitoring is required regardless of where the ACT level is set. Therefore, there is no difference in the potential administrative impacts associated with **Alternatives 2a, 2b (Preferred), 2c, 3a, 3b (Preferred)**, and **3c** when compared with **Alternative 1 (No Action)**.

Action 8. Increase the commercial and recreational minimum size limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternatives
(preferred alternatives in bold)

1 (No Action). The current minimum size limit for hogfish is 12 inches fork length (FL) for both the commercial and recreational sectors in federal waters of the South Atlantic Region, and state waters of South Carolina, North Carolina, and Florida. There is no minimum size limit for hogfish in state waters of Georgia.

2. Increase the commercial and recreational minimum size limit for the GA-NC stock of hogfish in the South Atlantic Region.

2a. 16 inches FL
2b. 17 inches FL
2c. 18 inches FL
2d. 19 inches FL
2e. 20 inches FL
2f. Increase the minimum size limit from 12" to 15" in year 1, to 18" in year 2, and to 20" in year 3.

3. Increase the commercial and recreational minimum size limit for the FLK/EFL stock of hogfish in the South Atlantic Region.

3a. 14 inches FL
3b. 15 inches FL
3c. 16 inches FL
3d. 17 inches FL
3e. Increase the minimum size limit from 12" to 14" in year 1 and to 16" in year 3.

4.8.1 Biological Effects

Hogfish are protogynous: fish mature as females first, and are expected to eventually become male if they live long enough. Research conducted on hogfish that would belong to the FLK/EFL stock, indicate that a single male maintains harems of 5 to 15 females (Colin 1982, Munoz et al. 2010) during extended spawning seasons that last for months. Hogfish are pair spawners (Davis 1976, Colin 1982), and spawning occurs daily during spawning season (McBride and Johnson 2007, Collins and McBride 2008, Munoz et al. 2010). The size (7.8-28.6 inches fork length [FL]) and age (1-11 years) range at which sexual transition occurs indicates that transition is socially mediated (Collins and McBride 2011).

It is estimated that for the GA-NC stock, 24 inches FL is the size at which half the hogfish population is male and nearly all hogfish are males at 30 inches FL (**Figure 4.8.1**). The size at transition was calculated based on macroscopic investigation of gonad samples collected in 2013 through 2015 from vessels fishing off North Carolina (Scott Van Sant, SEFSC, unpublished data) using binary logistic regression implemented in SAS 9.1. The smallest male observed was 15 inches FL. No female hogfish were observed greater than 30 inches FL. These data are preliminary and will likely change when a complete historical analysis is completed; however, they provide a general estimate of the transition size for hogfish off North Carolina that can be considered in the management of the GA-NC stock.

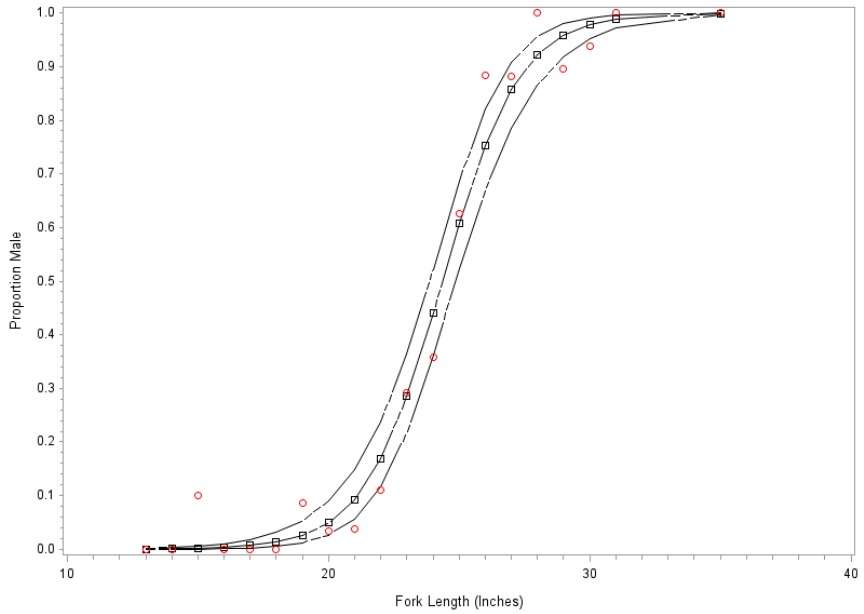


Figure 4.8.1. Size at transition (female to male) for hogfish in North Carolina (preliminary data). Source: Scott Van Sant, SEFSC.

Studies on Florida hogfish have estimated that 50% of females between 16 and 17.6 inches FL and between 0.9 and 1.6 years are sexually mature (McBride et al. 2008, Collins and McBride 2011). Males may occur as small as 7.8 inches FL, but 50% of males in the Florida Keys that are 16.4 inches FL and 7 years old are sexually mature (McBride et al. 2008; **Figure 4.8.2**). Sex change in hogfish can take several months (McBride and Johnson 2007), so removal of the dominant male has the potential to significantly affect harem stability and decrease reproductive potential (Munoz et al. 2010). Size limits above 16 inches FL (**Sub-alternatives 3c, 3d** and **3e**) may provide hogfish the opportunity to form harems and transition to males. McBride et al. (2008) state: "…the size of 50% male maturation, approximately 415 to 425 mm (16.3-16.7 inches) FL, is well above the current minimum size limit. Evidently, to reduce disruption to spawning harems and avoid recruitment overfishing, the minimum size limit should be increased."

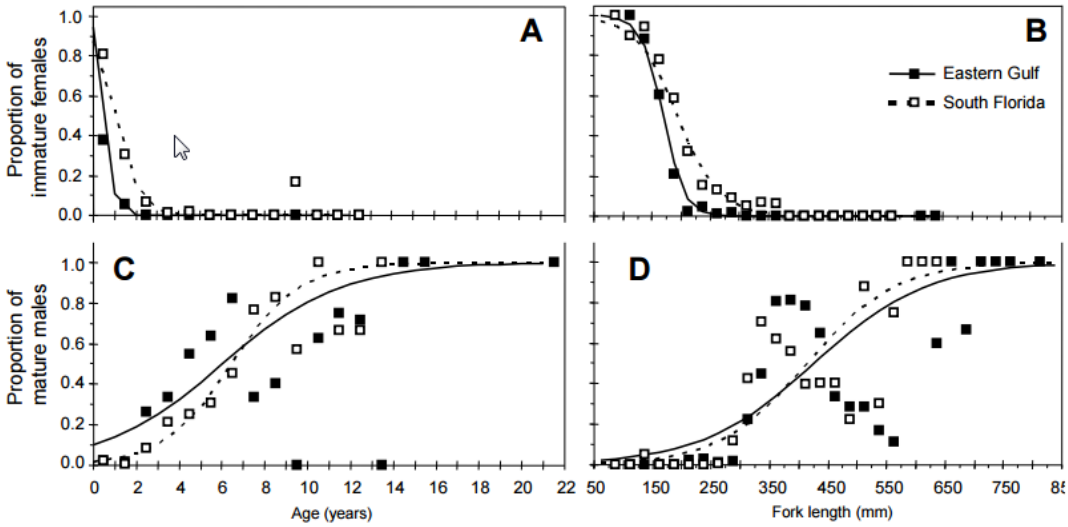


Figure 4.8.2. Maturation of hogfish (*Lachnolaimus maximus*) from the eastern Gulf of Mexico and south Florida for (A) females by age, (B) females by size, (C) males by age, and (D) males by size. Source: Figure 4 in McBride et al. 2008.

Size distributions (in inches fork length) of recreationally harvested hogfish for the GA-NC and FLK/EFL stocks are shown in **Figure 4.8.3**. Hogfish harvested recreationally in the GA-NC sub-region are well above the current minimum size limit of 12 inches FL, whereas the size distribution of hogfish harvested recreationally in Florida peaks at the current minimum size limit and ranges from 10 inches FL to over 20 inches FL.

Assuming no change in recreational management measures (**Alternative 1 (No Action)**) recreational harvest of hogfish in the GA-NC sub-region in 2017 would not be expected to reach the proposed recreational ACL of 988 fish (**Preferred Sub-alternative 2b, Action 4)** based on mean 2011-2014 observed landings (**Table 4.8.1A**). The various minimum size limit alternatives have no effect on predicted landings (**Table 4.8.2**).

For the FLK/EFL stock, under existing management measures (**Alternative 1 (No Action)**), recreational landings in 2017 are projected to exceed the proposed recreational ACL of 15,689 fish around the beginning of February based on mean 2012-2015 observed landings (**Table 4.8.1B**). In such a scenario, the NMFS would have to project the duration of the fishing season before the start of the year because the recreational ACL would be landed well before the Wave 1 landings were available. Moreover, the likelihood of the recreational ACL not going up the following year would increase, as **Preferred Alternative 2** under **Action 6** indicates that ACLs would not increase automatically in a subsequent year if present year projected catch exceeds the total ACL.

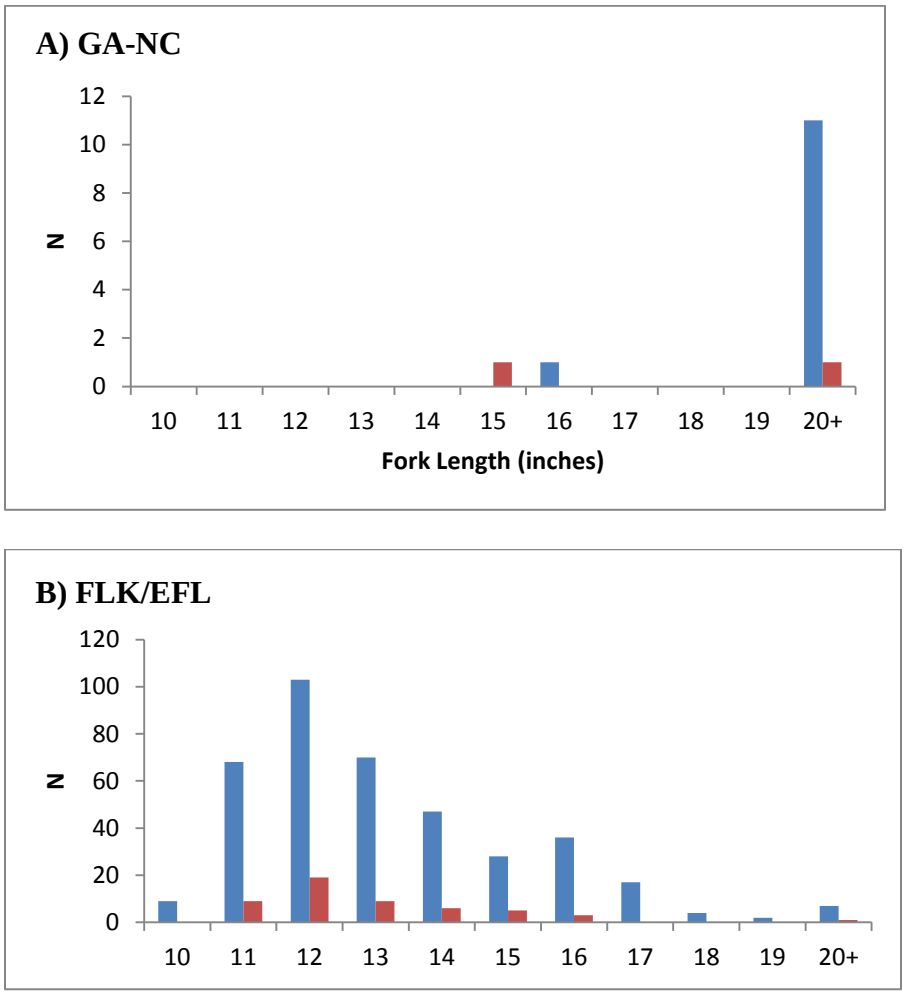


Figure 4.8.3. Size distribution (fork lengths in inches) of landed hogfish reported by the Southeast Headboat Survey (2011-2013; red) and MRIP (2012-2014; blue) for (A) GA-NC and (B) FLK/EFL stocks of hogfish.
Sources: NMFS SERO. MRIP (NMFS OST, accessed May 2015) and Southeast Headboat Survey (HBS bp72_13 file).

Table 4.8.1. Projected 2017 baseline monthly recreational landings in numbers of fish for A) GA-NC and B) FLK/EFL hogfish under status quo management measures with no seasonal or quota closures. Assumes MRIP landings uniformly distributed within waves. Projection based on mean 2012-2015 observed landings.

A) GA-NC

LANDINGS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SRHS	0	0	0	0	1	2	24	1	2	2	0	0
MRIP CHARTER	0	0	0	0	7	7	7	7	4	4	0	0
MRIP PRIVATE	0	0	0	0	152	147	32	32	0	0	0	0
Total	**0**	**0**	**0**	**0**	**160**	**156**	**64**	**40**	**6**	**6**	**0**	**0**

B) FLK/EFL

LANDINGS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SRHS	29	23	25	16	13	16	10	7	5	6	9	19
MRIP CHARTER	283	256	108	104	354	343	16	16	174	180	324	335
MRIP PRIVATE	12,604	11,384	27,813	26,916	9,228	8,930	17,961	17,961	4,994	5,161	2,743	2,835
Total	**12,915**	**11,663**	**27,946**	**27,036**	**9,595**	**9,289**	**17,988**	**17,984**	**5,173**	**5,346**	**3,077**	**3,188**

Source: NMFS SERO

Table 4.8.2. Projected hogfish recreational landings, length of season and percent of ACL expected to be landed for the GA-NC stock under various minimum size limit alternatives for the ACLs proposed under Action 4.

ACL Alternative	Size Limit	Open Days	Landings (N)	Percent of ACL landed
Alt 2a	12	365	431	41
Pref Alt 2b		365	431	44
Alt 2c		365	431	46
Alt 2a	15	365	431	41
Pref Alt 2b		365	431	44
Alt 2c		365	431	46
Alt 2a	16	365	417	40
Pref Alt 2b		365	417	42
Alt 2c		365	417	45
Alt 2a	**17**	365	411	40
Pref Alt 2b		**365**	**411**	**42**
Alt 2c		365	411	44
Alt 2a	18	365	411	40
Pref Alt 2b		365	411	42
Alt 2c		365	411	44
Alt 2a	19	365	411	40
Pref Alt 2b		365	411	42
Alt 2c		365	411	44
Alt 2a	20	365	411	40
Pref Alt 2b		365	411	42
Alt 2c		365	411	44

Source: NMFS SERO Recreational Decision Tool. See **Appendix L**.

Under the preferred minimum size limit of 16 inches FL (**Preferred Sub-alternative 3b**) and assuming no other changes to recreational management measures for the FLK/EFL stock, the proposed recreational ACL for 2017 of 15,689 hogfish (**Preferred Sub-alternative 2b, Action 6**), would be landed in 95 days (**Table 4.8.3**). Under the current calendar fishing year, unless a recreational season were implemented through **Action 11**, the recreational ACL would be met in early April.

Projected reductions in harvest under different minimum size limits for the recreational sector are shown in **Tables 4.8.4** and **4.8.5** for the GA-NC and FLK/EFL stocks of hogfish, respectively. For the GA-NC region, minimum size limits of 16 inches FL and above would result in some reduction in harvest for the for-hire mode (headboat and charter; **Table 4.8.3**). However, the projected reductions in harvest are based on limited available data and are, therefore, highly uncertain. In the FLK/EFL region, minimum size limits, especially at 15 inches FL (**Sub-alternative 3b**) and above, would constrain harvest across all modes, with projected reductions in recreational harvest across all modes ranging from 59% to 84% (**Table 4.8.5**).

Table 4.8.3. Projected recreational harvest (in numbers of fish) and season length for the FLK/EFL stock under various proposed minimum size limit and ACL alternatives. Preferred alternatives shown in bold.

ACL Alternative	Size Limit	Bag Limit	Closure Date	Open Days	Landings (N)	Removals (N)
2a	14	5 Fish	12-Mar	71	16,425	22,377
Pref 2b			**10-Mar**	**69**	**15,524**	**21,501**
2c			8-Mar	67	14,623	20,625
2a	15	5 Fish	22-Mar	81	16,433	22,385
Pref 2b			**19-Mar**	**78**	**15,386**	**21,367**
2c			17-Mar	76	14,688	20,688
2a	**16**	5 Fish	8-Apr	98	16,477	22,428
Pref 2b			**5-Apr**	**95**	**15,669**	**21,641**
2c			2-Apr	92	14,860	20,855
2a	17	5 Fish	8-Jun	159	16,474	22,425
Pref 2b			**23-May**	**143**	**15,677**	**21,649**
2c			6-May	126	14,830	20,825

Source: NMFS SERO Recreational Decision Tool. See **Appendix L**.

Table 4.8.4. Projected reductions in recreational hogfish landings (in numbers of fish) for the GA-NC stock, by month, for headboat (HB), charter, and private modes, under proposed minimum size limits. Preferred alternative indicated in bold.
Note: data have been pooled to achieve a minimum sample size of 30 fish per estimate.

	HB (NUMBERS; 2011-2013)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
16	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
17	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**	**45%**
18	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
19	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
20	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
	CHARTER (NUMBERS; 2012-2014)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
16	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**
18	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
19	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
20	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
	PRIVATE (NUMBERS; 2012-2014)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
16	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
18	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
19	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%

Sources: Headboat CRNF file (mean 2011-2013), MRIP Catch-Effort Files (mean 2012-2014).
Note: There were insufficient samples to model monthly impacts of proposed size limits for headboat; headboat catch effort file for 2014 not available. See **Appendix L**.

Table 4.8.5. Projected reductions in recreational hogfish landings (in numbers of fish) for the FLK/EFL stock, by month, for headboat (HB), charter, and private modes, under proposed minimum size limits. Preferred alternative indicated in bold.
Note: data have been pooled to achieve a minimum sample size of 30 fish per estimate.

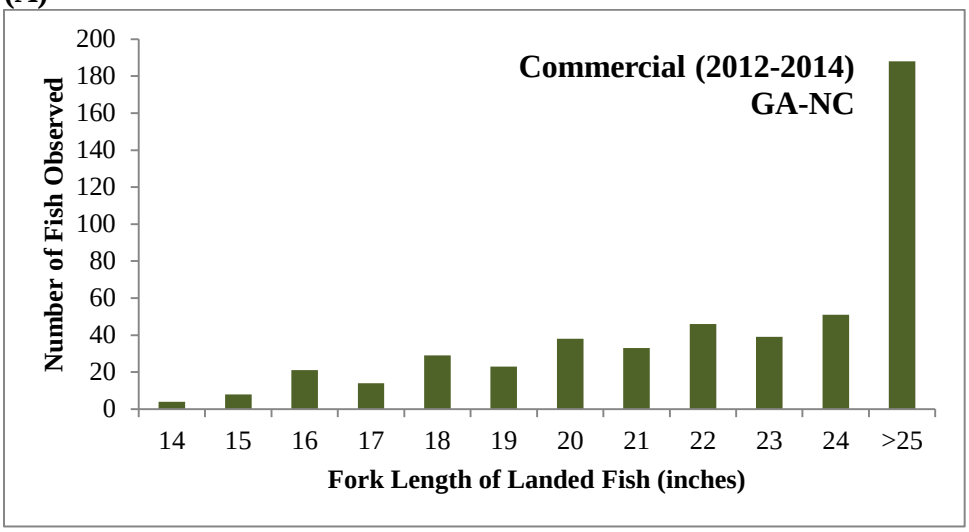
	HB (NUMBERS; 2011-2013)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%
15	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%
16	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**
17	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%
	CHARTER (NUMBERS; 2012-2014)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	33%	33%
15	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	70%	70%
16	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**84%**	**76%**	**76%**
17	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%

	PRIVATE (NUMBERS; 2012-2014)											
Size limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	54%	54%	50%	50%	30%	30%	53%	53%	54%	54%	56%	56%
15	63%	63%	61%	61%	71%	71%	54%	54%	60%	60%	63%	63%
16	**75%**	**75%**	**70%**	**70%**	**73%**	**73%**	**59%**	**59%**	**63%**	**63%**	**71%**	**71%**
17	82%	82%	81%	81%	84%	84%	69%	69%	77%	77%	80%	80%

Sources: Headboat CRNF file (mean 2011-2013), MRIP Catch-Effort Files (mean 2012-2014).
Note: There were insufficient samples to model monthly impacts of proposed size limits for headboat; headboat catch effort file for 2014 not available. See **Appendix L**.

The size distributions (inches FL) of commercially harvested hogfish for the GA-NC and FLK/EFL stocks are shown in **Figure 4.8.4**. The majority of commercially harvested hogfish in the GA-NC portion of the stock are 25 inches FL and greater whereas in Florida, the majority of commercially harvested hogfish are at the 12-inch FL minimum size limit. **Tables 4.8.6** and **4.8.7** present the projected reduction in commercial harvest, by month, under the various proposed minimum size limits for the GA-NC and FLK/EFL stocks, respectively.

(A)



(B)

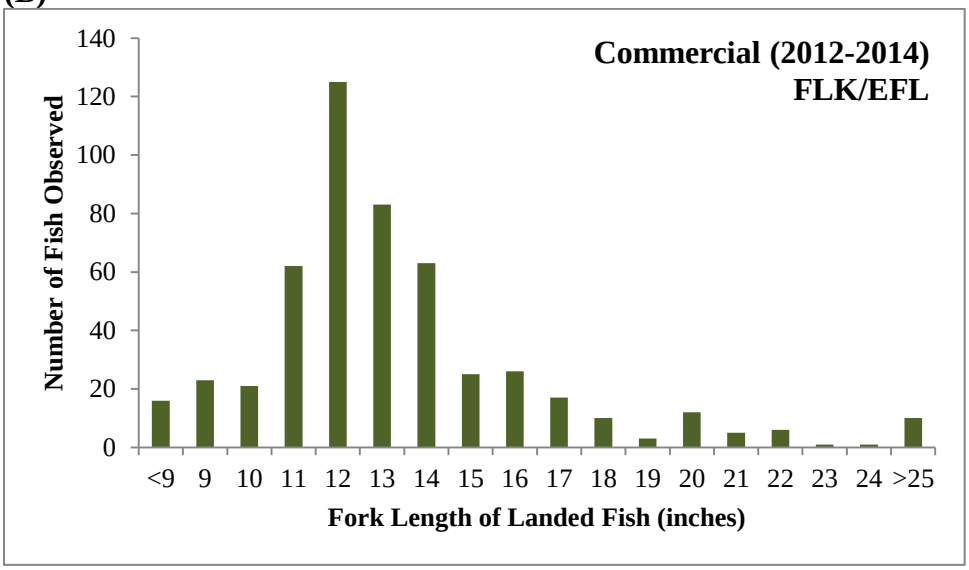


Figure 4.8.4. Size distribution in inches FL of hogfish landed commercially in: (A) GA-NC and (B) Florida Keys/East Florida, 2012-2014.
Source: NMFS SERO. Commercial TIP data (L. Beerkircher, SEFSC, pers. comm.)

For the GA-NC region, the preferred minimum size limit of 17 inches FL (**Preferred Sub-alternative 2b**) would result in an average reduction in commercial landings of only 2%. At a minimum size limit of 20 inches FL, average commercial harvest would be reduced by only 8% (**Table 4.8.6**).

Table 4.8.6. Percent reductions in commercial landings (in pounds whole weight) for GA-NC, by month, at under proposed minimum size limits. Preferred alternative indicated in bold.

	Month												
Size Limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Mean 2012-2014**
12	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1	1	1	1	0	1	0	0	0	0	0	0	1
17	**1**	**3**	**3**	**4**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**2**
18	3	4	4	5	3	4	3	2	2	1	2	2	3
19	7	7	9	7	4	6	5	5	2	2	5	6	6
20	9	12	11	8	5	8	8	7	3	4	7	9	8

Sources: SEFSC TIP data (accessed May 2015).
Note: Some months were pooled with surrounding months to achieve a sample size >30.

Table 4.8.7. Percent reductions in commercial landings (in pounds whole weight) for FLK/EFL, by month, under proposed minimum size limits. Preferred alternative indicated in bold.

	Month												
Size Limit (inches FL)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Mean 2012-2014**
12	0	0	0	0	0	0	0	0	0	0	0	0	0
14	58	64	66	12	3	9	12	24	45	68	48	61	29
15	71	71	73	18	9	15	17	59	61	68	58	76	41
16	**76**	**77**	**77**	**19**	**9**	**66**	**22**	**61**	**64**	**68**	**66**	**80**	**47**
17	81	77	77	21	13	70	36	62	72	90	76	85	54

Sources: SEFSC TIP data (accessed May 2015).
Note: Some months were pooled with surrounding months to achieve a sample size >30.

Alternative 1 (No Action) would continue a minimum size limit of 12 inches FL for both the commercial and recreational sectors off North Carolina, South Carolina, and Florida, with no minimum size limit off Georgia. **Sub-alternatives 2a-2e** propose minimum size limits ranging from 16 inches FL to 20 inches FL, for the GA-NC stock of hogfish. **Sub-alternative 2f** would increase the minimum size limit from 12 inches FL to 15 inches FL in the first year, 18 inches FL in the second year, and 20 inches FL in the third year. Off North Carolina, 50% of hogfish transition to males at 24.5 inches FL (**Figure 4.8.1**); hence, the preferred minimum size limit of 17 inches FL (**Preferred Sub-alternative 2b**) would continue to allow removal of the most reproductively successful individuals with potentially negative biological effects on the population.

On average, **Sub-alternative 2e** would result in a 45% reduction in harvest from mean landings from 2012 through 2014 for the headboat sector and 15% and 0% for the charter and private sectors, respectively (**Table 4.8.4**). Of all the sub-alternatives under **Preferred Alternative 2**, **Sub-alternative 2f** would be the least conservative and expected to have the least biological benefits. **Sub-alternative 2e** would be the most biologically conservative of the alternatives considered and, presumably result in the greatest biological benefit. Although annual catch limits (ACLs) and accountability measures (AMs) are in place to constrain harvest and ensure overfishing does not occur, larger minimum size limits would provide more spawning opportunities and a greater percentage of males in the stock.

For the FLK/EFL stock of hogfish, **Preferred Alternative 3** and its sub-alternatives would increase the minimum size limits from 14 inches FL (**Sub-alternative 3a**) to 17 inches FL (**Sub-alternative 3d**). **Sub-alternative 3e** would increase the minimum size limit from 12 inches FL to 14 inches FL in the first year, and 16 inches FL in the third year. As mentioned previously, studies on reproductive biology of hogfish in Florida suggest that minimum size limits above 16 inches FL would allow more females to transition to males thus promoting spawning harems and benefiting the hogfish population. Hence, **Sub-alternatives 3c (Preferred)**, **3d**, and **3e** would increase the minimum size limit for the FLK/EFL stock of hogfish to a level that would impart the most biological benefits to the stock. Of these, **Preferred Sub-alternative 3c** would be the most biologically beneficial, followed by **Sub-alternatives 3d** and **3e**. Assuming the socially-mediated size at transition (Collins and McBride 2011) has remained around 16 inches FL in the FLK/EFL sub-region since the study by McBride et al. (2008), **Sub-alternative 3b** would impart less biological benefits to the FLK/EFL hogfish stock than **Sub-alternatives 3c (Preferred)-3e**, because it would continue to allow removal of the most reproductively productive individuals and possibly disrupt formation of harems since individuals would be harvested before transition from female to male could take place. Because size at transition is socially-mediated and the FLK/EFL stock is overfished, there is a strong possibility the size at transition is currently lower than 16 inches FL; however, it should also be noted that in a non-overfished stock, the size at transition might be above 16 inches FL. SEDAR 37 (2014) indicates that hogfish have been overfished since 1986, well before the McBride et al. (2008) study. Per SEDAR 37 (2014): "…the base model predicted the [FLK/EFL] population as being overfished and experiencing overfishing for nearly the entire time frame of the model runs [1986-2012]."

In general, biological effects would increase with larger size limits. **Sub-alternative 3a** would result in negative biological effects compared to the other alternatives considered. Compared to **Alternative 1 (No Action)**, **Sub-alternatives 3a-3e** would be expected to benefit the FLK/EFL stock of hogfish to varying degrees. On average, **Sub-alternative 3b** would reduce harvest from mean 2012-2014 landings by 72% for the headboat sector, and by 77% and 62% for the charter and private sectors, respectively (**Table 4.8.5**). While **Sub-alternatives 3c (Preferred)-3e** would result in greater potential reductions in recreational harvest, they would be more biologically beneficial (**Table 4.8.5**). **Preferred Sub-alternative 3c** would result in average annual reductions in recreational harvest of 80% for the headboat sector, 82.6% for the charter sector, and 68.5% for the private sector. Similar effects are expected for the commercial

sector, with **Preferred Sub-alternative 3c** reducing commercial harvest by a mean of 47%, compared to a mean of 29% for **Sub-alternative 3a**, 41% under **Sub-alternative 3b** and 54% under **Sub-alternative 3d** (**Table 4.8.7**). **Sub-alternative 3e** would be expected to result in percent reductions of commercial harvest similar to **Sub-alternative 3a** in year 1 and similar to **Sub-alternative 3c (Preferred)** in year 3 (**Table 4.8.7**). However, ACLs and AMs are in place to constrain harvest.

Changes in size limits can lead to regulatory discards; however, extensive scientific evidence from life history studies, spawning, and social structure (Davis 1976; Colin 1982; McBride and Johnson 2007; McBride et al. 2008, Munoz et al. 2010; and Collins and McBride 2011) listed in SEDAR 37 (2014) recommend an increase in the minimum size limit, which would be beneficial to the hogfish stocks and aid in rebuilding. Bycatch and discards would not be expected to increase as a result of an increase in the minimum size limit, since the dominant mode of harvest is by spearfishing, which is highly selective, and fishers using this gear would be expected to target larger fish. For more information, see **Appendix D** (BPA).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.8.2 Economic Effects

In general, increasing the size limit for a species has little long-term economic effect unless the larger size limit results in greater numbers of fish reaching spawning size and/or fish have higher fecundity prior to being harvested. Size limits that result in more spawning and/or higher fecundity would result on more direct, long-term, positive economic effects presumably through the availability of increased numbers of fish in the future. However, there could be some direct, short-term, negative economic effects as fewer fish would be available to harvest until the current population grows into the new minimum size and/or the biomass of harvestable fish increases. The greater the increase in the size limit from **Alternative 1 (No Action)**, the greater the probability for short-term negative economic effects. However, a significant increase in the minimum size limit could also result in greater long-term positive economic effects as long as increased size limits translates into a larger spawning biomass and overall biomass increasing above the minimum limit.

There were very few data points available to estimate the economic effects for the consumer surplus (CS) estimates for the recreational sector for the GA-NC stock. Also, there is no specific CS value available for recreationally caught hogfish for either the FLK/EFL or GA-NC stocks. Two values are used as proxies, a CS value for catching a species of snapper (but not red snapper) at $12.37 (in 2014 dollars) and one for catching a grouper at $134.74 (see **Section 3.3.2**).

Table 4.8.8 shows the expected number of fish landed for the recreational sector for each **Preferred Alternative 2** sub-alternative and indicates CS for **Alternative 1 (No Action)** and the differences from the status quo using both CS estimates for all of the **Preferred Alternative 2** sub-alternatives. It also shows the expected commercial landings and ex-vessel values in terms of expected differences from **Alternative 1 (No Action)**.

Alternative 1 (No Action) affords the highest positive, direct, short-term economic effects compared to the **Preferred Alternative 2** sub-alternatives. There were no distinguishable differences between **Preferred Alternative 2**, **Sub-alternative 2f** for the first year and **Alternative 1 (No Action)**. However, the long-term direct economic effects for **Alternative 1 (No Action)** would result in a more compressed stock size and presumably lower fecundity leading to fewer fish available to harvest when compared to other **Preferred Alternative 2** sub-alternatives. It should be noted that the differences in estimated consumer surplus for all the **Preferred Alternative 2** sub-alternatives is rather small. The economic benefit of establishing a larger minimum size limit would be an increased stock size with a larger range in sizes of fish. Overall, in the short-term, there are negligible differences among the **Preferred Alternative 2** sub-alternatives. From least to most long-term, direct, positive economic effects for the recreational sector for **Preferred Alternative 2** would be **Preferred Sub-alternative 2b-Sub-alternative 2e**, and then **2a**. It is not clear where **Sub-alternative 2f** would fit in the rankings, however; in the long-term, it would be expected to fall between **Sub-alternative 2e** and **Alternative 1 (No Action).**

In terms of least to most long-term, direct, positive economic effects for the commercial sector, the sub-alternatives for **Preferred Alternative 2** would be **2e**, **2d**, **2c**, **Preferred 2b**, and then **Sub-alternative 2a**. It is not clear where **Sub-alternative 2f** would fit in the rankings, however; in the long-term, it would be expected to fall between **Sub-alternative 2a** and **Sub-alternative 2e**.

Table 4.8.8. **Preferred Alternative 2** expected recreational CS and commercial ex-vessel revenue (2014 $) changes from status quo (**Alternative 1 – No Action**) for hogfish landed from the GA-NC stock in the first year of implementation.

Sub-alternative	Size Limit	Recreational Numbers*	Recreational CS - Snapper	Recreational CS - Grouper	Commercial Pounds	Commercial Ex-vessel
Alternative 1	12" FL	431	$5,331	$58,073	20,534	$74,744
Sub-alt. 2a	16" FL	417	-$173	-$1,886	20,406	-$466
Preferred 2b	**17" FL**	**411**	-$247	-$2,695	**20,128**	**-$1,478**
Sub-alt. 2c	18" FL	411	-$247	-$2,695	19,918	-$2,242
Sub-alt. 2d	19" FL	411	-$247	-$2,695	19,398	-$4,135
Sub-alt. 2e	20" FL	411	-$247	-$2,695	18,921	-$5,871
Sub-alt. 2f	15"/18"/20" FL	431	$0	$0	20,498	-$131

***** Numbers of recreational fish catch estimates are based on the point estimate, not the confidence interval.
Note: Sub-alternative 2f uses a stepped approach to increasing the size limit with an increase to 15" in year 1, 18" in year 2, and 20" in year 3. Given the uncertainty associated with predicting further into the future, the effects are based only on the 15" size limit increase.
Source: Hogfish Recreational Decision Tool, **Appendix L**

Table 4.8.9 shows the expected number of fish landed for the recreational sector for each **Preferred Alternative 3** sub-alternative and indicates CS values for **Alternative 1 (No Action)** and the differences from the status quo using both CS estimates for all of the **Preferred Alternative 3** sub-alternatives. It also shows the expected commercial landings and ex-vessel values in terms of expected differences from **Alternative 1 (No Action)**.

Preferred Alternative 3 and its sub-alternatives would increase the minimum size limit of the FLK/EFL stock for both the recreational and commercial sectors. As shown in **Table 4.8.9**, all of the **Preferred Alternative 3** sub-alternatives would result in relatively small changes in expected CS compared to **Alternative 1 (No Action**; 12"); however, some sub-alternatives are expected to result in positive economic effects while others are expected to result in negative economic effects. From least to most short-term, direct, negative economic effects for the recreational sector **Preferred Alternative 3, Sub-alternative 3b** (15"), **Alternative 1 (No Action**; 12"), **Sub-alternative 3a** (14"), the first year of implementation for **Sub-alternative 3e** (14"/16"), **Preferred Sub-alternative 3c** (16"), and **Sub-alternative 3d** (17").

Commercial sector landings for the FLK/EFL stock are relatively low with an **Alternative 1 (No Action)** expected ex-vessel value of just $12,656 (in 2014 $; **Table 4.8.9**). The expected economic effects differences between **Alternative 1 (No Action)** and the **Preferred Alternative 3** sub-alternatives for the commercial sector are small, with a range of $58.

Table 4.8.9. Preferred Alternative 3 expected recreational CS and commercial ex-vessel revenue (2014 $) for hogfish landed from Florida Keys/Florida East Coast stock in the first year of implementation using the ACL from **Action 6**, **Preferred Sub-alternative 2b**.

Sub-alternative	Size Limit	Recreational Numbers*	Recreational CS - Snapper	Recreational CS - Grouper	Commercial Pounds	Commercial Ex-vessel
Alternative 1	12" FL	15,415	$190,684	$2,077,017	3,477	$12,656
Sub-alt. 3a	14" FL	15,524	$1,348	$14,687	3,477	$0
Sub-alt. 3b	15" FL	15,386	-$359	-$3,907	3,484	$25
Preferred 3c	**16" FL**	**15,669**	**$3,142**	**$34,224**	**3,477**	**$0**
Sub-alt. 3d	17" FL	15,677	$3,241	$35,302	3,468	-$33
Sub-alt. 3e	14"/16" FL	15,524	$1,348	$14,687	3,477	$0

***** Numbers of recreational fish catch estimates are based on the point estimate, not the confidence interval.
Note: Sub-alternative 3e uses a stepped approach to increasing the size limit with an increase to 14" in year 1, 16" in year 3. Given the uncertainty associated with predicting further into the future, the effects are based only on the 14" size limit increase.
Source: Hogfish Recreational Decision Tool, **Appendix L**

4.8.3 Social Effects

As discussed in **Section 4.5.3**, hogfish is an important commercial and recreational species in the Florida Keys. Additionally, as discussed in **Section 4.4.3**, there are communities in South Carolina and North Carolina that may be affected by management changes for GA-NC hogfish.

Some social effects of minimum size limits would be associated with the positive and negative biological effects of minimum size limits on the hogfish stocks (**Section 4.8.1**). Positive effects of allowing only fish of a certain size that are caught in the South Atlantic EEZ to be landed could help maintain sustainability of harvest and the health of each hogfish stock, which would be beneficial to recreational and commercial fishermen in the long term. Negative effects of potential increases in discard mortality due to higher minimum size limit could affect the stock and in turn, commercial and recreational fishing opportunities.

Because recreational harvest would be reduced as the minimum size limit increases (see **Table 4.8.2**), there would be expected negative short-term effects on recreational fishermen targeting hogfish in North Carolina, South Carolina, and Georgia under an increased minimum size limit for the GA-NC stock (**Preferred Alternative 2**). However, there would be more expected negative effects on private recreational anglers than on recreational fishermen on for-hire vessels. Fishing opportunities for hogfish on headboat trips would be expected to be negatively affected under higher minimum size limits, although any minimum size limit of 16 inches or higher would likely result in the same effects on headboat businesses and clients (**Table 4.8.2**). It is likely that headboat businesses and clients would be the most affected by the largest minimum size limit and at the same level under all sub-alternatives in **Preferred Alternative 2**, including **Preferred Sub-alternative 2b**. For the charter businesses, a 16-inch FL minimum size limit (**Sub-alternative 2a**) would likely have fewer negative effects on fishing opportunities than other sub-alternatives under **Preferred Alternative 2**, including **Preferred**

Sub-alternative 2b. There would be few or short-term effects on headboats and charter boats expected under **Alternative 1 (No Action**).

Private recreational anglers may target smaller sizes of hogfish, and an increase under **Preferred Alternative 2** would likely have some negative effects on fishing opportunities (**Table 4.8.2**). In general, as the minimum size limit increases, the higher the expected reduction in recreational landings that could occur. The most negative effects would be expected under **Sub-alternative 2e** and year 3 under **Sub-alternative 2f**, followed in order by **Sub-alternative 2d**, **Sub-alternative 2c** and year 2 under **Sub-alternative 2f**, **Preferred Sub-alternative 2b**, **Sub-alternative 2a**, year 1 under **Sub-alternative 2f**, and then **Alternative 1 (No Action)**.

There would be minimal or no expected effects on the commercial sector by any minimum size limit in **Sub-alternatives 2a-2f** (**Figure 4.8.4**), including **Preferred Sub-alternative 2b**, because in general the commercial fleet is harvesting larger hogfish.

Similar to the minimum size limit change for GA-NC hogfish, there would be expected negative short-term effects on recreational fishermen targeting hogfish in Florida under an increased minimum size limit for the FLK/EFL stock (**Preferred Alternative 3**). Fishing opportunities for hogfish on headboat trips and for private recreational anglers would be expected to be negatively affected under higher minimum size limits other than **Alternative 1 (No Action)** (**Table 4.8.5**). Even the smallest proposed increase (**Sub-alternative 3a**) would likely decrease recreational landings for headboats, charter boats, and private anglers by about 50% or more. The reduction in landings increases as the minimum size limit increases, and it is likely that any proposed increase in minimum size limit under **Preferred Alternative 3** would have substantial negative short-term effects on recreational fishing opportunities for FLK/EFL hogfish, and fishermen and for-hire businesses would switch target species. Although catch-and-release for hook and line fishermen may continue to allow some opportunities, hogfish is usually targeted as a fish to take home and eat.

In general, larger minimum size limits would have more negative effects on recreational fishing opportunities in the immediate future. The most short-term negative effects on the recreational sector would be expected under **Sub-alternative 3d**, followed in order by **Preferred Sub-alternative 3c** and year 3 under **Sub-alternative 3e**; **Sub-alternative 3b**; and **Sub-alternative 3a** and year 1 under **Sub-alternative 3f**; and then **Alternative 1 (No Action)**.

Similar to the recreational sector, an increase in the minimum size limit would likely result in negative short-term effects on commercial vessels harvesting FLK/EFL hogfish by limiting access to the available hogfish. Because most commercially harvested FLK/EFL hogfish are at the current minimum size limit (**Figure 4.8.3**), it can be expected that commercial vessels would target other species instead of trying to catch hogfish of a larger size, as proposed in **Sub-alternatives 3a-3e** including **Preferred Sub-alternative 3c**. Because hogfish are a popular menu item in local restaurants in the Florida Keys, there could be some negative effects on restaurants that focus on regional fare.

It should be noted that although expected short-term negative social effects would be the least under **Alternative 1 (No Action)**, there would likely be long-term negative biological effects that would limit recreational and commercial fishing opportunities for FLK/EFL hogfish in the future and for a longer period of time. To meet the rebuilding goals in **Action 5**, reducing harvest through a higher minimum size limit is expected to be more beneficial to recreational fishermen, commercial fishermen, and for-hire businesses in the long term.

4.8.4 Administrative Effects

Beneficial administrative effects would be expected from **Sub-alternatives 2a, 2b (Preferred), 2c, 2d, 2e, 2f, 3a, 3b, 3c (Preferred), 3d, and 3e** compared to **Alternative 1 (No Action)**, which would continue to have a minimum size limit for three out of the four states in the South Atlantic region. Alternatives that specify a consistent minimum size limit throughout the South Atlantic Council's jurisdiction would help the public avoid confusion with regulations and aid law enforcement. Administrative impacts on the agency associated with the action alternatives would be incurred by rulemaking, outreach, education and enforcement.

Action 9. Establish a commercial trip limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternatives
(preferred alternatives in bold)

1 (No Action). There is no commercial trip limit for hogfish in the South Atlantic Region.

2. Establish a commercial trip limit for the GA-NC stock of hogfish in the South Atlantic Region.

2a. 100 lbs ww per trip.
2b. 250 lbs ww per trip.
2c. 500 lbs ww per trip.
2d. 750 lbs ww per trip.
2e. No trip limit

3. Establish a commercial trip limit for the FLK/EFL stock of hogfish in the South Atlantic Region.

3a. 25 lbs ww per trip.
3b. 50 lbs ww per trip.
3c. 100 lbs ww per trip.
3d. 150 lbs ww per trip
3e. 200 lbs ww per trip
3f. No trip limit

4.9.1 Biological Effects

Preferred Alternatives 2 and **3** (including their respective sub-alternatives) would propose commercial trip limit options for the Georgia through North Carolina (GA-NC) and Florida Keys/East Florida (FLK/EFL) stocks of hogfish, respectively. **Sub-alternatives 2e**, and **3f** would not establish a commercial trip limit for either stock.

Commercial logbook data were explored to determine harvest of hogfish per trip and to analyze trip limit options. During 2012-2014 (the most recent years of complete data), 2,008 commercial trips landed hogfish in the South Atlantic (**Figure 4.9.1**). During 2012-2014, 64% of the commercial trips landed 25 lbs ww or less, 14% landed 50 lbs ww, 9% landed 75 lbs ww, 5% landed 200 lbs ww, 2% landed 300 lbs ww, 1% landed 400 lbs ww, and <1% landed 500 lbs ww or more (**Figure 4.9.1**).

Hogfish are commercially harvested primarily by spear and hook-and-line gear. **Figure 4.9.2** shows the distribution of hogfish landings per trip by gear type. The majority of the trips that landed hogfish during 2012-2014 used spear (47%, 950 trips) and hook and line gear (42%, 842 trips). **Figure 4.9.3** shows hogfish harvested commercially per trip (lbs ww) in two areas of the South Atlantic, GA-NC and FLK/EFL, during 2012-2014.

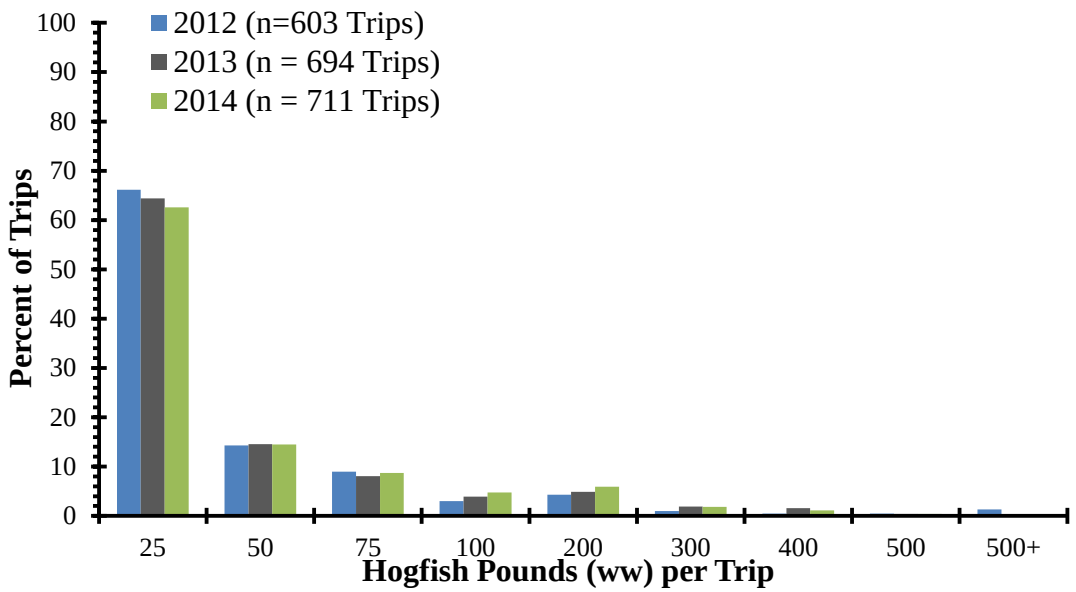


Figure 4.9.1. Distribution of commercially harvested hogfish per trip (lbs ww) by year, from 2012 through 2014, in the South Atlantic.
Source: Commercial logbook dataset accessed April 2, 2015.

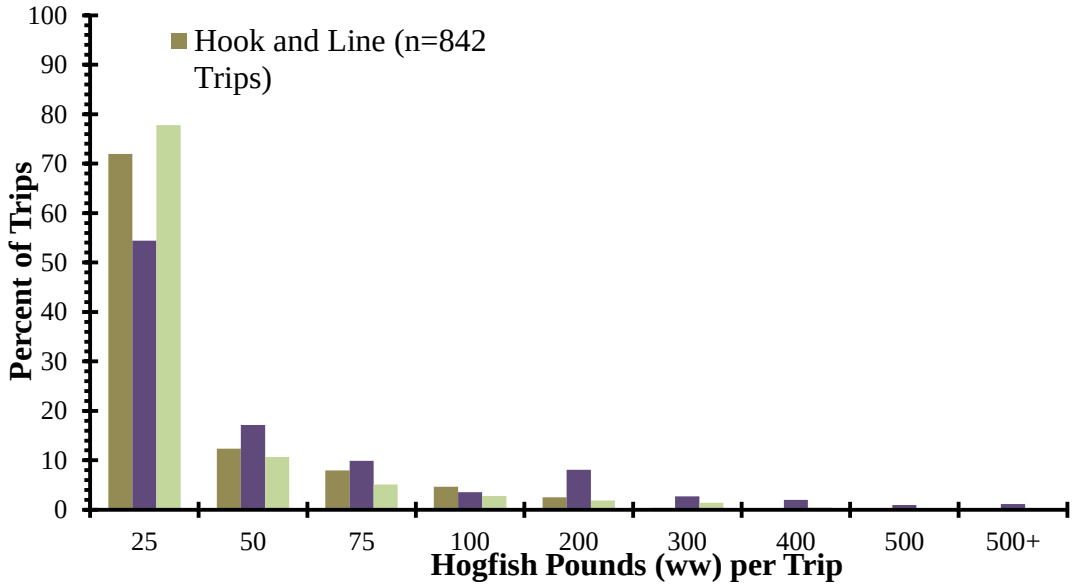


Figure 4.9.2. Distribution of commercially harvested hogfish per trip (lbs ww) by gear, from 2012 through 2014, in the South Atlantic.
Note: The "Other" gear type consists of hogfish landings from gill nets, traps, and if the gear type was not provided in the commercial logbook dataset.
Source: Commercial logbook dataset accessed April 2, 2015.

More commercial trips (1,238) were observed for the FLK/EFL stock than in GA-NC (770) during 2012-2014, but GA-NC had higher pounds per trip (**Figure 4.9.3**). For GA-NC, 53% of the commercial trips landed 25 lbs ww or less per trip, 13% landed 50 lbs ww, 11% landed 75 lbs ww, 6% landed 100 lbs ww, 9% landed 200 lbs ww, 3% each landed 300 and 400 lbs ww, and 1% landed 500 lbs ww or more (**Figure 4.9.3**). In the FLK/EFL area, 72% of the commercial trips landed 25 lbs ww or less per trip, 15% landed 50 lbs ww, 7% landed 75 lbs ww, 3% (each) landed 100 and 200 lbs ww, and less than 1% landed 300 lbs ww or more (**Figure 4.9.3**).

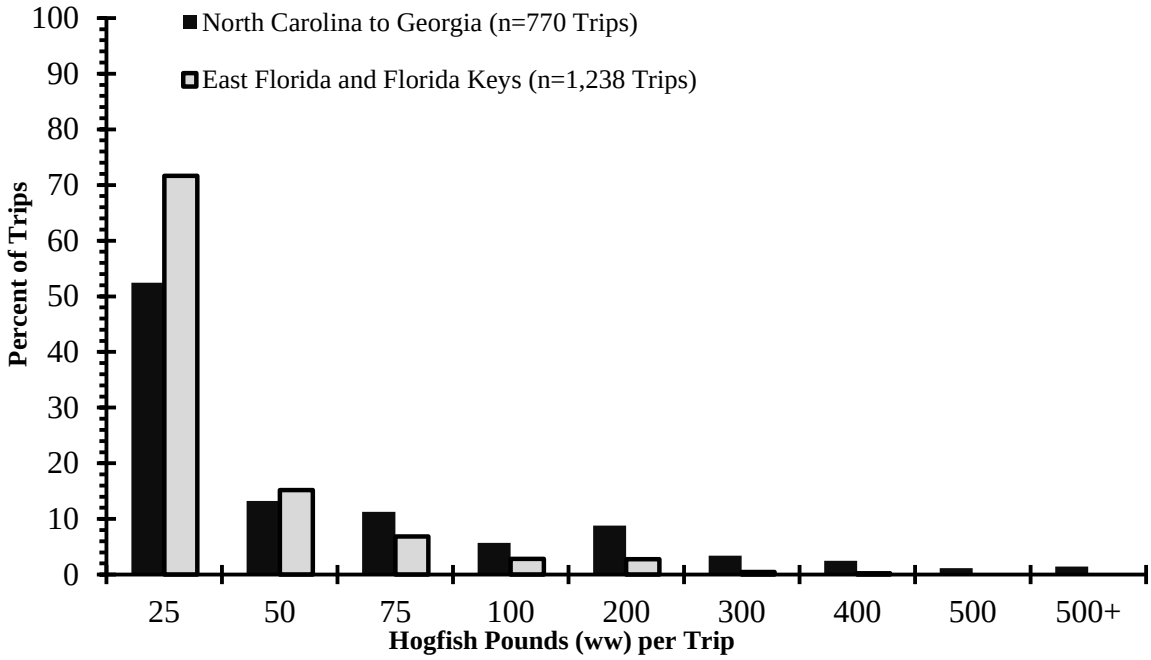


Figure 4.9.3. Distribution of commercially harvested hogfish per trip (lbs ww) by area (GA-NC and FLK/EFL) from 2012 through 2014.
Source: Commercial logbook dataset accessed April 2, 2015.

The percentage decrease in landings by gear and for all gear types were calculated for the different trip limits considered under **Preferred Alternatives 2** and **3**. The results for GA-NC are shown in **Table 4.9.1** and the results for FLK/EFL are shown in **Table 4.9.2**. Note that these table refer only to reductions in baseline landings and do not account for new ACLs or differences across size limits.

Table 4.9.1. Percent decrease in landings by gear and for all gear, for various commercial hogfish trip limits for GA-NC.

Alternative 2; Trip Limit (lbs ww)	Hook and Line	Spear	All Gear (incl. hook-and-line, spear, gill nets, traps, etc.)
Sub-alternative 2a - 100	2.2%	40.1%	42.8%
Sub-alternative 2b - 250	0.2%	19.2%	19.6%
Sub-alternative 2c - 500	**0.0%**	**6.0%**	**6.0%**
Sub-alternative 2d - 750	0.0%	2.8%	2.8%
Sub-alternative 2e – No trip limit	0.0%	0.0%	0.0%

Source: South Atlantic commercial logbook data, 2012-2014.

Table 4.9.2. Percent decrease in landings by gear and for all gear, for various commercial hogfish trip limits for FLK/EFL.

Alternative 3; Trip Limit (lbs ww)	Hook-and-Line	Spear	All Gear (incl. hook-and-line, spear, gill nets, traps, etc.)
Sub-alternative 3a - 25	**10.1%**	**29.4%**	**45.8%**
Sub-alternative 3b - 50	6.7%	15.2%	25.9%
Sub-alternative 3c - 100	4.1%	5.1%	11.3%
Sub-alternative 3d - 150	3.1%	2.3%	6.7%
Sub-alternative 3e - 200	2.5%	1.6%	4.6%
Sub-alternative 3f – No trip limit	0.0%	0.0%	0.0%

Source: South Atlantic commercial logbook data, 2012-2014.

Sub-alternative 2a (100 lbs ww trip limit) would have the largest percentage decrease in commercial landings for the GA-NC stock of hogfish, followed by **Sub-alternatives 2b** (250 lbs ww trip limit), and **Preferred Sub-alternative 2c** (500 lbs ww trip limit) (**Table 4.9.1**). This is expected, given that only 6% of the commercial trips during 2012-2014 landed 100 lbs ww, 9% landed 200 lbs ww, and only 1% landed 500 lbs ww or more (**Figure 4.9.3**).

Preferred Sub-alternative 3a (25 lbs ww trip limit) would result in the largest percentage decrease in commercial landings for the FLK-EFL stock of hogfish, followed by **Sub-alternatives 3b** (50 lbs ww trip limit), **3c** (100 lbs ww trip limit), **3d** (150 lbs ww trip limit), and **3e** (200 lbs ww trip limit) (**Table 4.9.2**). This reflects **Figure 4.9.3**, which shows that most (72%) of the commercial trips landed 25 lbs ww or less per trip. **Sub-alternatives 2e** and **3f** propose no commercial trip limit for the GA-NC stock and the FLK/EFL stock, respectively. Since these two alternatives would not constrain and reduce harvest the percentage decrease in commercial landings is zero.

A SARIMA (seasonal auto-regressive integrated moving average) model[9] was fit to the average daily hogfish landings by month (1997 through 2014) to capture seasonal and non-seasonal trends in the data, especially the recent increasing trend from 2011 through 2014 (**Figure 4.9.4**). This approach was deemed more appropriate than using an average of recent landings (see **Appendix M** for more details).

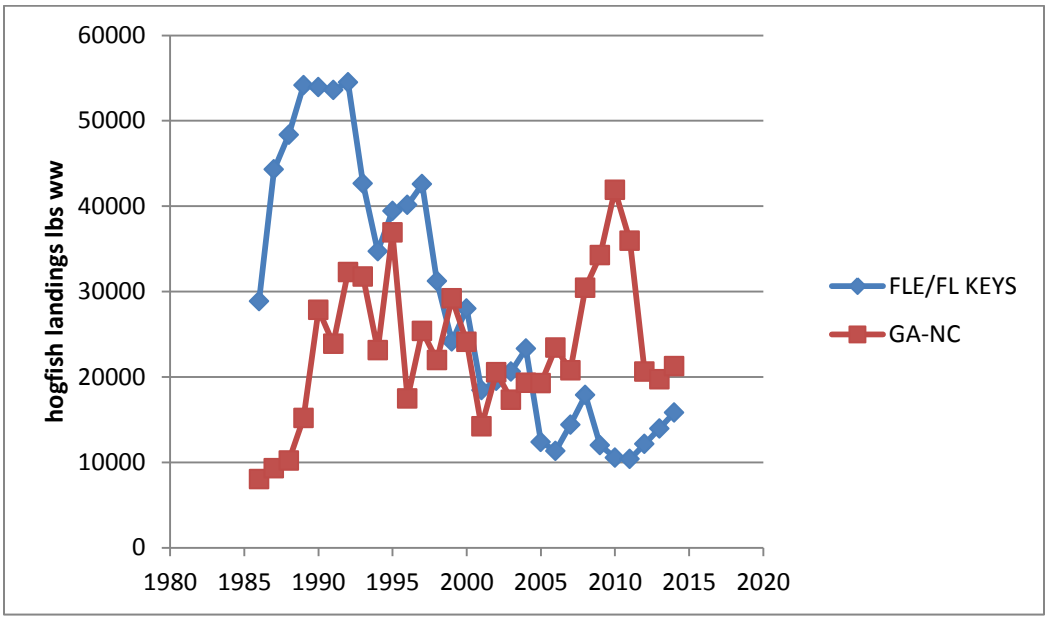


Figure 4.9.4. Annual commercial hogfish landings (lbs ww) by year and region.

The baseline landings used for the Georgia through North Carolina region were the average annual landings from 2012 through 2014. **Table 4.9.3** shows estimated commercial landings for the GA-NC stock in 2017 under all ACL alternatives (**Action 4**) using a combination of the minimum size limits (**Action 8**) and trip limits (**Action 9**).

The proposed (**Preferred Sub-alternative 2b** under **Action 4**) commercial ACL in 2017 for the GA-NC stock is 23,456 lbs ww (**Table 4.4.1** in **Action 4**). The landings under all size limit alternatives (**Action 8**) as well as trip limit alternatives in **Action 9** are estimated to be under this ACL (**Table 4.9.3**). Therefore, it is expected that none of the ACL alternatives would result in an in-season closure for the commercial sector of the GA-NC stock. The commercial season length under all combinations of alternatives is expected to be 365 (plus one if leap year) days. For **Preferred Alternative 2** and its sub-alternatives in **Action 9**, there would be little difference in estimated landings among **Sub-alternatives 2a** through **2e**.

[9] These models are fitted to time series data either to better understand the data or to predict future points in the series (forecasting).

Table 4.9.3. Estimated landings (lbs ww) in first year of implementation (2017) for GA-NC under the various minimum size limit (Action 8) and trip limit (Action 9) combinations*.

	Trip Limit (lbs ww)				
Size Limit (FL inches)	**No limit (Alt 1 - Status Quo)**	**100 (Alt 2a)**	**250 (Alt 2b)**	**500 (Pref Alt 2c)**	**750 (Alt 2d)**
12 (Alt 1 - Status Quo)	20,534	11,745	16,554	19,339	19,951
16 (Alt2a)	20,406	11,703	16,482	19,232	19,831
17 (Pref Alt 2b)	20,128	11,612	16,327	**18,999**	19,572
18 (Alt 2c)	19,918	11,543	16,209	18,822	19,376
19 (Alt 2d)	19,398	11,370	15,912	18,382	18,891
20 (Alt 2e)	18,921	11,210	15,636	17,979	18,447
15/18/20 (Alt 2f**)	20,498	11,733	16,534	19,309	19,917

* This assumes that effort and catch rates will not change in response to management measures, only landings will change.
Note 1: Season length here will be 365 days +1 if leap year. Because season length will not be affected, and because there was minimal variability in monthly average prices, changes in landings and econ effects were modeled at the annual level only.
Note 2: Because the estimated landings are not expected to exceed even the most conservative ACL alternative, each trip limit/size limit combination is expected to have the same effect for all ACL alternatives.
Note 3: Trip limit and size limit alternatives will not be considered separately from action to form two management areas, NC to GA and East FL/FL Keys.
**Alt 2f in Action 8 uses a stepped approach to increasing the size limit with an increase to 15 inches in year 1, 18 inches in year 2, and 20 inches in year 3. Given the uncertainty associated with predicting further into the future, the effects are based only on the 15 inches size limit increase that would occur in year 1.
Source: Commercial Decision Tool, see **Appendix M**.

The estimated commercial fishing season length (days open) for the FLK/EFL stock of hogfish under the preferred ACL alternative in **Action 6**, combined with the size limits in **Action 8** and trip limits in **Action 9**, is shown in **Table 4.9.4**. Estimated landings are shown in similar fashion in **Table 4.9.5**. The alternatives with smaller trip limits obviously extend the commercial fishing season longer than the ones with larger trip limits, with no difference between **Alternative 1 (No Action)** and **Sub-alternative 3f** (**Table 4.9.4**). A commercial ACL of 3,510 lbs ww (**Preferred Sub-alternative 2b** in **Action 6**), size limit of 16 inches FL (**Preferred Sub-alternative 3c** in **Action 8**), and a trip limit of 25 lbs ww (**Preferred Sub-alternative 3a** in **Action 9)** would result in 181 commercial fishing days for the FLK-EFL stock. Biological effects under all the alternatives considered in **Action 9** would not differ significantly because there are ACLs and in-season AMs in place. The only difference among the alternatives in **Action 9** is the number of commercial fishing days.

Table 4.9.4. Estimated commercial season length (days open) for the FLK/EFL stock of hogfish under ACL **Preferred Alt 2b (3,510 lbs ww)** in Action 6 and different minimum size limit (Action 8) and trip limit (Action 9) alternatives in first year of implementation (2017). Preferred alternatives indicated in bold.

	Trip Limit (lbs ww)					
Size Limit (FL inches)	No limit (Alt 1 - Status Quo)	**25 (Pref Alt 3a)**	50 (Alt 3b)	100 (Alt 3c)	150 (Alt 3d)	200 (Alt 3e)
12 (Alt 1 - Status Quo)	115	148	128	121	117	115
14 (Alt 3a)	143	172	151	144	143	143
15 (Alt 3b)	148	180	159	150	148	148
16 (Pref Alt 3c)	150	**196**	172	152	150	150
17 (Alt 3d)	153	202	181	159	154	153
14/16 (Alt 3e*)	143	172	151	144	143	143

* Alt 3e in Action 8 is a step increase, with an increase to 14 inches in year 1 and an increase to16 inches in year 3. Model uncertainty is such that year 3 predictions would be highly uncertain. As such, estimates are for year 1 only and match those associated with Alt 3a in Action 8.
Source: Commercial Decision Tool, see **Appendix M**.

Table 4.9.5. Estimated commercial landings (lbs ww) for the FLK/EFL stock of hogfish under ACL **Preferred Alt 2b (3,510 lbs ww)** in Action 6 and different minimum size limit (Action 8) and trip limit (Action 9) alternatives in first year of implementation (2017). Preferred alternatives indicated in bold.

	Trip Limit (lbs ww)					
Size Limit (FL inches)	No limit (Alt 1 - Status Quo)	**25 (Pref Alt 3a)**	50 (Alt 3b)	100 (Alt 3c)	150 (Alt 3d)	200 (Alt 3e)
12 (Alt 1 - Status Quo)	3,506	3,470	3,481	3,471	3,507	3,486
14 (Alt 3a)	3,489	3,490	3,473	3,446	3,475	3,489
15 (Alt 3b)	3,462	3,498	3,509	3,494	3,453	3,462
16 (Alt 3c)	3,454	**3,487**	3,493	3,478	3,444	3,454
17 (Alt 3d)	3,497	3,501	3,499	3,505	3,493	3,497
14/16 (Alt 3e*)	3,489	3,490	3,473	3,446	3,475	3,489

* Alt 3e in Action 8 is a step increase, with an increase to14 inches in year 1 and an increase to16 inches in year 3. Model uncertainty is such that year 3 predictions would be highly uncertain. As such, estimates are for year 1 only and match those associated with Alt 3a in Action 8.
Source: Commercial Decision Tool, see **Appendix M**.

None of the preferred sub-alternatives in this action would result in a year-long commercial fishing season. Therefore, with an early closure, discards could be expected. However, as mentioned in **Appendix D** (BPA), the snapper grouper fishery includes many species occupying similar habitats at the same time. Thompson and Switzer (2015) reported on habitat selection and overlap in terms of location, abiotic, and habitat variables of six co-occurring species: gag, lane snapper, gray snapper, black sea bass, white grunt, and hogfish. Results showed that hogfish were the least sympatric (overlapping in distribution), with gag and the snappers co-occurring much more commonly (Thompson and Switzer 2015). Bycatch of other snapper grouper species is incidental to hook-and-line fishing for hogfish, with no bycatch of other co-occurring species expected when spear is used to target hogfish. Therefore, detrimental effects of discards and bycatch are not expected from this action.

None of the alternatives under consideration for this action are expected to adversely impact species or critical habitat listed under the ESA. Establishing commercial trip limits for hogfish as addressed in this action would not alter the way in which the snapper grouper fishery is prosecuted in terms of gear types used or areas fished; nor would any of the alternatives substantially increase or decrease fishing effort. Therefore, no impacts on ESA-listed species or designated critical habitat thereof are anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area).

The proposed alternatives under this action would not alter the way the commercial portion of the snapper grouper fishery for hogfish is prosecuted. Furthermore, the gear predominantly used by hogfish commercial fishermen (spear and hook-and-line gear) are known to have minimal to no bycatch issues, and do little damage to physical or biogenic habitats (Blue Ocean 2010; Seafood Watch 2010). Therefore, no adverse effects on EFH, EFH-HAPCs, or Coral HAPCs are anticipated (see **Section 3.1** and **Appendix H** for a detailed description of EFH in the South Atlantic region).

4.9.2 Economic Effects

Generally, trip limits are not considered to be economically efficient because they require an increase in the number of trips and associated trip costs to land the same amount of fish. The fewer the number of trips that do not take place because the trip limit has been reached would result in the least amount of direct negative economic effect. There are no specific trip costs available for average trip costs associated with either stock, therefore specific values associated with trip costs cannot be estimated.

The entire commercial sector ACL for the GA-NC stock is not expected to be landed under any of the sub-alternatives of **Preferred Alternative 2**. **Table 4.9.6** shows what percent of the ACL is expected to be landed and the expected ex-vessel revenue for each commercial trip limit. The ranking of **Sub-alternatives 2a** through **2e** in terms of least to most direct positive economic effect is **2a**, **2b**, **Preferred 2c**, **2d**, and **2e/Alternative 1 (No Action)**.

Table 4.9.6. Expected percent of the ACL landed (**Action 2, Preferred Alternative 2b**) and commercial ex-vessel value (in 2014 $) of the trip limits proposed for the GA-NC stock.

	Trip Limit (ww)	Expected % of ACL Landed	Commercial Ex-vessel
Sub-alt. 2a	100 lbs	50%	$43,926
Sub-alt. 2b	250 lbs	71%	$61,912
Preferred 2c	**500 lbs**	**82%**	**$72,328**
Sub-alt. 2d	750 lbs	85%	$74,617
Sub-alt. 2e	No limit	88%	$76,797

Source: Commercial Decision Tool, **Appendix M**.

The entire commercial sector ACL for the Florida Keys/Florida East Coast stock is expected to be caught under all of the sub-alternatives of **Preferred Alternative 3**. **Table 4.9.2** shows the expected decreases in pounds landed by gear type. As the same value per pound is applied, the corresponding decreases in expected economic value by gear remains the same. The only difference is the number of trips it is expected to take to land the commercial ACL; therefore, there are no estimated differences in aggregate expected ex-vessel revenue among the sub-alternatives of **Preferred Alternative 3**. The lower the trip limit, the more likely some commercial vessels will be negatively affected. Lower trip limits may reduce profits through a reduction in efficiency and the severity of such impacts would be based on the overall dependence a vessel has on hogfish and the vessel's ability to substitute revenue from landing other species.

4.9.3 Social Effects

Commercial fishermen in the communities identified in **Section 3.4** would likely be those affected by a change in the hogfish commercial trip limit. However, it is likely that fishermen who have targeted hogfish in recent years also target other species, and would be able to adjust their businesses to adapt to regulatory changes. In general, a commercial trip limit may help slow the rate of harvest, lengthen a season, and prevent the ACL from being exceeded, but trip limits that are too low may make fishing trips inefficient and too costly if fishing grounds are too far away. Additionally, if the trip limit is too low, the commercial ACL may not be met.

The magnitude of hogfish commercial landings in the South Atlantic is small (**Figures 4.9.1-4.9.3**), with a large majority of trips landing 25 lbs ww or less. While a trip limit may help to slow the rate of harvest by restricting landings for larger vessels, it is likely that establishing a trip limit under **Preferred Alternatives 2** and **3** would have minimal effects on commercial fishermen and associated communities. The social benefits of potentially extending the fishing season by slowing the rate of harvest and contributing to rebuilding goals for FLK/EFL hogfish would be greater under the lower trip limits (**Sub-alternative 2a** and **Preferred Sub-alternative 3a**), and would be reduced as the trip limit increased. For the GA-NC stock, a higher trip limit as under **Sub-alternative 2b**, **Preferred Sub-alternative 2c**, followed by **Sub-alternative 2d** would allow flexibility for larger vessels or on trips with higher catches of hogfish. For the

FLK/EFL stock, the higher trip limits in **Sub-alternatives 3b-3e** may provide the same flexibility to larger vessels but would likely have little effect on the commercial fleet because of the low catches of commercial hogfish per trip. The absence of a trip limit (**Alternative 1 (No Action)**, **Sub-alternatives 2e** and **3f**) would likely have little effect on commercial fishermen in the short-term, but could result in negative effects in the future if some commercial vessels began targeting hogfish at higher levels.

4.9.4 Administrative Effects

Currently, there is no trip limit for the hogfish commercial sector (**Alternative 1, No Action**). **Sub-alternatives 2a, 2b, 2c (Preferred), 2d, 2e, 3a (Preferred), 3b, 3c, 3d, 3e,** and **3f** could add to the administrative burden in the form of cost, time, or law enforcement efforts because new commercial trip limits for the GA-NC and the FLK/EFL stocks would need to be monitored and enforced. However, even if the commercial ACLs are met under each of the proposed commercial trip limits, the administrative resources required to implement in-season closures would not be much different from what is currently in place under **Alternative 1 (No Action)**. Higher trip limits could have slightly greater administrative effects because they increase the likelihood that the commercial ACL would be met and a commercial closure would occur. All of the proposed sub-alternatives under **Preferred Alternatives 2** and **3** would require notifying the commercial snapper grouper fishery and law enforcement personnel of an impending trip limit change for hogfish. Therefore, **Alternative 1 (No Action)** would be the least burdensome alternative compared to **Sub-alternatives 2a, 2b, 2c (Preferred), 2d, 2e, 3a (Preferred), 3b, 3c, 3d, 3e, and 3f**.

Action 10. Modify and/or establish recreational bag limits for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternatives
(preferred alternatives in bold)

1 (No Action). The recreational bag limit is 5 fish per person per day off Florida and there is no recreational bag limit off Georgia, South Carolina, and North Carolina.

2. Modify the recreational bag limit for the GA-NC stock of hogfish in the South Atlantic Region.

- **2a. 2 fish per person per day.**
- 2b. 1 fish per person per day.
- 2c. 1 fish per vessel per day.

3. Modify the recreational bag limit for the Florida Keys/East Florida FLK/EFL stock of hogfish in the South Atlantic Region.

- 3a. 3 fish per person per day.
- 3b. 2 fish per person per day.
- **3c. 1 fish per person per day.**
- 3d. 1 fish per vessel per day.

4.10.1 Biological Effects

During 2012-2014, recreational landings (lbs ww) of hogfish were predominantly from Monroe County, Florida and East Florida, followed by North Carolina, Georgia/East Florida, and South Carolina (**Table 4.10.1**).

Alternative 1 (No Action) would maintain the 5 fish per person per day recreational bag limit for hogfish off Florida, with no recreational bag limit off Georgia, South Carolina, and North Carolina. Under **Preferred Alternative 2**, for the GA-NC stock of hogfish, **Sub-alternatives 2a (Preferred)** and **2b** would consider a 2 fish per person per day and 1 fish per person per day recreational bag limit, respectively, whereas **Sub-alternative 2c** would consider a 1 fish per vessel per day recreational bag limit.

Under **Preferred Alternative 3**, for the FLK/EFL stock of hogfish, **Sub-alternatives 3a**, **3b**, and **3c (Preferred)** would consider 3, 2, and 1 fish per person per day recreational bag limits, respectively, whereas **Sub-alternative 3d** would consider a 1 fish per vessel per day recreational bag limit.

Table 4.10.1. Recreational landings (lbs ww) of hogfish by state in the South Atlantic during 2012-2014.

Year	North Carolina	South Carolina	Georgia/East FL	East Florida	Monroe County	Total
2012	4,178	3	178	84,042	281,172	369,573
2013	825	5	255	63,998	92,768	157,852
2014	8	16	368	111,410	154,087	265,889
Average 2012-2014	**1,670**	**8**	**267**	**86,483**	**176,009**	**264,438**

Source: MRIP ACL dataset generated from the SEFSC on July 20, 2015.

MRIP catch and effort files from 2012 to 2014 were explored to determine recreational trips that harvested hogfish in the South Atlantic. Five hundred fifty-five recreational trips (194 MRIP and 361 Headboat trips) from North Carolina through Monroe County, Florida harvested hogfish. None of the headboat trips harvested more than 1 hogfish per person. The MRIP private and charter trips had 78% of the trips harvesting 2 hogfish per person or less, 14% of the trips harvesting 3-4 hogfish per person, and 8% of the trips harvesting 5 hogfish or more per person (**Figure 4.10.1**).

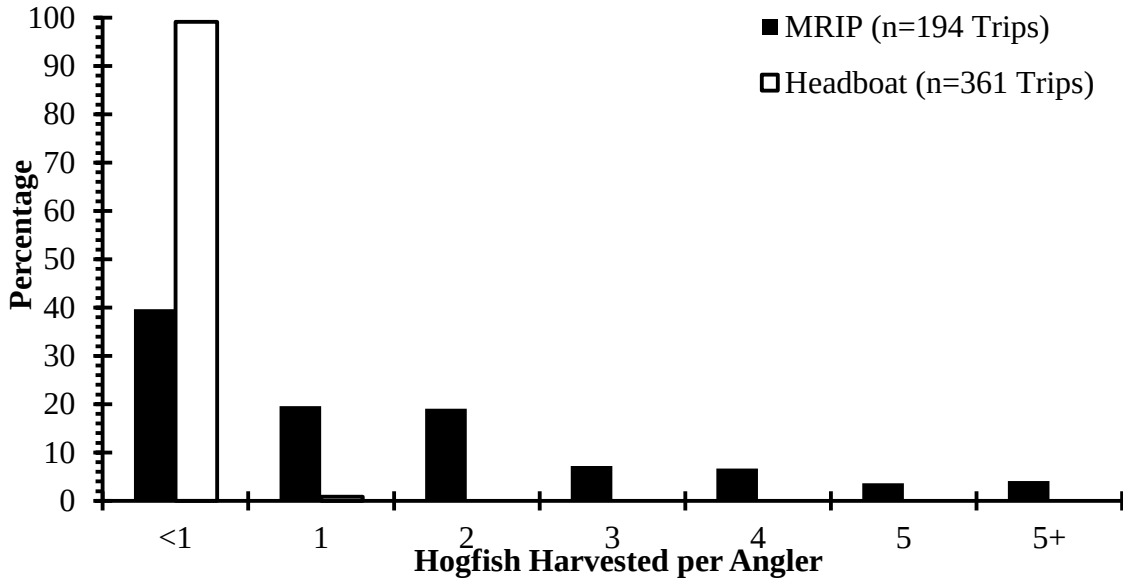


Figure 4.10.1. Distribution of hogfish harvested per person from two recreational datasets (MRIP and Headboat) during 2012-2014, in the South Atlantic.

Figure 4.10.2 shows the distribution of hogfish harvested per vessel during 2012-2014. Among headboats trips, 87% harvested 1 hogfish per vessel, 10% harvested 2 hogfish, 1% harvested 3 hogfish, and 2% harvested more than 5 hogfish per vessel. For the MRIP private and charter recreational trips, 19% harvested 1 hogfish per vessel, 34% harvested 2 hogfish per vessel, 19% harvested 4 hogfish per vessel, and 28% harvested more than 5 hogfish per vessel (**Figure 4.10.2**).

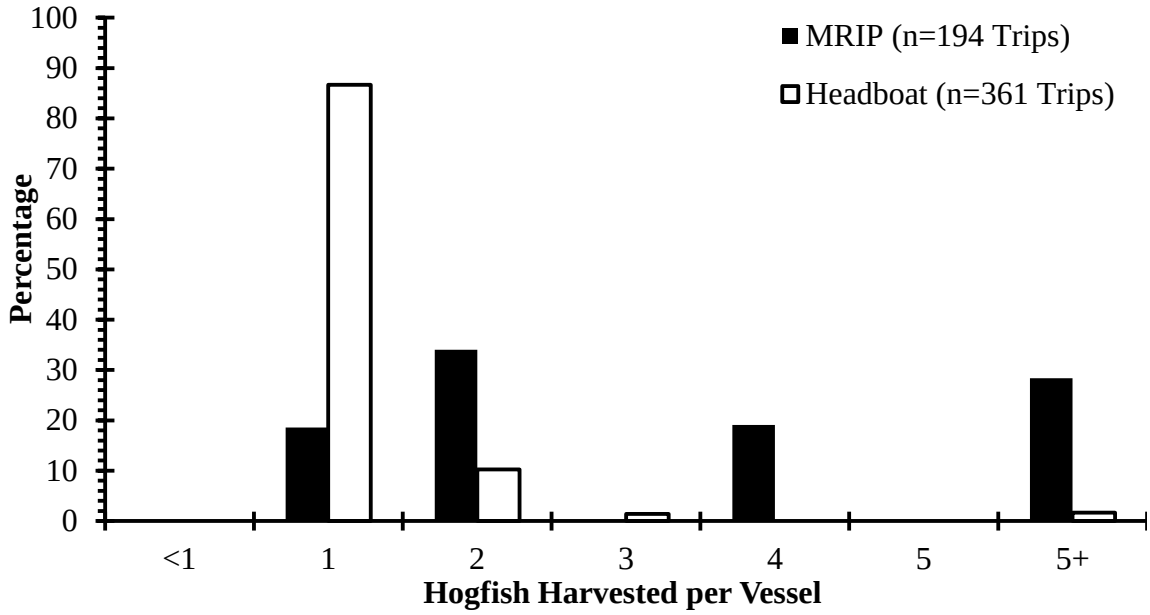


Figure 4.10.2. Distribution of hogfish harvested per vessel from two recreational datasets (MRIP and Headboat) during 2012-2014, in the South Atlantic.

Reductions in landings from the proposed bag limits in **Preferred Alternatives 2** and **3** (and their sub-alternatives) were calculated. A discard mortality of 10% (SEDAR 37 2014) was applied to the bag limit analysis. The majority of the MRIP trips that harvested hogfish from 2012-2014 were with spearfishing gear (56%, n=109 trips). Discard mortality for spearfishing trips was assumed to be zero because spearfishing is very selective and any reduction in bag limit would result in the spearing of fewer fish. For example, if the bag limit is reduced from five to three fish, then spear fishermen would focus their efforts to only spear three fish; that is, it is assumed that fishermen would not spear five fish and release two.

The calculated percentage decreases in landings for the bag limits under consideration are shown by mode in **Table 4.10.2**. There were no calculated reductions in landings for headboat bag limits per person because there were no trips in 2012 to 2014 that harvested more than one hogfish per person. The percentage decrease in landings from the bag limits (per person) from North Carolina to Georgia was very small, because only 5% (n=9 trips) of the MRIP trips occurred from North Carolina to Georgia from 2012 to 2014. In both regions, the bag limits per vessel had higher reductions because this would restrict the catch to only one hogfish per trip for the entire vessel.

Table 4.10.2. Estimated percentage decrease in recreational landings from decreasing the bag limit in the South Atlantic. Percentage decrease in landings is presented by mode for the GA-NC and FLK/EFL stocks were from 2012 through 2014.

Bag Limit	MRIP		Headboat
	Charter	Private	
North Carolina to Georgia Preferred Alternative 2			
2 per Person (Sub-alternative 2a)	**0%**	**0%**	**0%**
1 per Person (Sub-alternative 2b)	0%	0%	0%
1 per Vessel (Sub-alternative 2c)	33%	75%	41%
Florida Keys/East Florida Preferred Alternative 3			
3 per Person (Sub-alternative 3a)	3%	12%	0%
2 per Person (Sub-alternative 3b)	10%	24%	0%
1 per Person (Sub-alternative 3c)	**22%**	**45%**	**0%**
1 per Vessel (Sub-alternative 3d)	93%	98%	32%

Source: NMFS SERO

For the GA-NC stock, there would be no percentage decrease in recreational landings under **Preferred Sub-alternative 2a** (2 fish per person) for private, charter, and headboat (**Table 4.10.2**), because most of the recreational harvest of hogfish is from the FLK/EFL stock (**Table 4.10.1**). At the preferred minimum size limit of 17 inches FL (**Preferred Sub-alternative 2b** under **Action 8**), a 2 fish per person per day recreational bag limit would result in about 42% the proposed recreational ACL being landed. (**Table 4.10.3**). Projected landings vary only slightly for the proposed bag limit sub-alternatives. In terms of biological effects, there would be no difference among the sub-alternatives under **Preferred Alternative 2** since ACLs and AMs are in place to prevent overfishing.

Table 4.10.3. Projected recreational landings for the GA-NC hogfish stock for various ACL (Action 4), preferred minimum size limit (17 inches FL) and estimated percent of ACL landed under proposed bag limit alternatives. Preferred alternatives indicated in bold.

ACL Alternative	Size Limit	Bag Limit	Closure Date	Open Days	Landings (N)	Percent of ACL landed
Alt 2a	**17**	**2 Fish/Angler**	N/A	365	411	40
Pref Alt 2b			**N/A**	**365**	**411**	**42**
Alt 2c			N/A	365	411	44
Alt 2a	17	1 Fish/Angler	N/A	365	410	39
Pref Alt 2b			N/A	365	410	41
Alt 2c			N/A	365	410	44
Alt 2a	17	1 Fish/Vessel	N/A	365	122	12
Pref Alt 2b			N/A	365	122	12
Alt 2c			N/A	365	122	13

For the FLK/EFL stock, there would be no decrease in harvest for headboats under **Preferred Sub-alternative 3c** (1 fish per person) but a 22% decrease in landings for the charter mode and a 45% decrease in private recreational landings (**Table 4.10.2**). For charter and private modes, **Sub-alternative 3d** would have the largest percentage decrease, followed by **Sub-alternative 3c (Preferred)**, **3b**, and **3a** (**Table 4.10.2**). The percent reductions in landings are higher for the private mode than the charter mode calculations because private recreational anglers harvest more hogfish per vessel compared to headboats (**Figure 4.10.2**). These data are presented by month in Table 4 of **Appendix L**.

The proposed recreational annual catch limit (ACL) for the FLK/EFL stock would be expected to be met under every sub-alternative of **Preferred Alternative 3** except **Sub-alternative 3d** under the preferred minimum size limit of 16 inches FL **(Table 4.10.4)**. There would be little biological difference among the sub-alternatives because ACLs and accountability measures (AMs) are in place to ensure overfishing does not occur. The various sub-alternatives would affect the length of time that the recreational sector was open during the fishing year. For the preferred recreational ACL for the FLK/EFL stock of hogfish and at the preferred minimum size limit of 16 inches FL, the recreational season would be expected to close on July 1 under the current calendar fishing year. This combination of size and bag limit alternatives results in the second longest opening for the recreational sector; recreational harvest is projected to remain open 6 day longer under the slightly higher ACL under **Sub-alternative 2a** of **Action 6**. Being the most restrictive at 1 fish per vessel per day, **Sub-alternative 3d** is expected to result in no in-season closure for the recreational sector (**Table 4.10.4**).

Table 4.10.4. Estimated landings and projected closure dates for recreational under proposed bag limit alternatives for the FLK/EFL hogfish stock at the preferred minimum size limit of 16 inches under Action 8 for all ACL alternative (Action 6). Preferred alternatives indicated in bold.

ACL Alternative	Size Limit	Bag Limit	Closure Date	Open Days	Landings (numbers)	Removals (numbers)
Alt 2a	16	5 Fish	8-Apr	98	16,477	22,428
Pref Alt 2b			5-Apr	95	15,669	21,641
Alt 2c			2-Apr	92	14,860	20,855
Alt 2a	16	3 Fish	15-Apr	105	16,293	22,248
Pref Alt 2b			12-Apr	102	15,581	21,556
Alt 2c			8-Apr	98	14,632	20,633
Alt 2a	16	2 Fish	26-Apr	116	16,346	22,300
Pref Alt 2b			22-Apr	112	15,527	21,503
Alt 2c			18-Apr	108	14,707	20,706
Alt 2a	**16**	**1 Fish**	7-Jul	188	16,401	22,353
Pref Alt 2b			**1-Jul**	**182**	**15,625**	**21,599**
Alt 2c			15-Jun	166	14,848	20,843
Alt 2a	16	1 per Vessel	N/A	365	482	6,871
Pref Alt 2b			N/A	365	482	6,871
Alt 2c			N/A	365	482	6,871

Source: Recreational Decision Tool, **Appendix L**.

Reducing the recreational bag limits would not be expected to increase discards, however, as shown in the analysis presented earlier in this section. Most recreational anglers rarely harvest more than 1-2 hogfish per person; therefore, decreasing the recreational bag limit is not expected to result in an increase in discards and bycatch of hogfish. For more information, see **Appendix D** (BPA).

None of the alternatives under consideration for this action are expected to adversely impact species or critical habitat listed under the ESA. Establishing recreational bag limits for hogfish as addressed in this action would not alter the way in which the snapper grouper fishery is prosecuted in terms of gear types used or areas fished; nor would any of the alternatives substantially increase or decrease fishing effort. Therefore, no impacts on ESA-listed species or designated critical habitat thereof are anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area).

The proposed alternatives under this action would not alter the way the recreational portion of the snapper grouper fishery for hogfish is prosecuted. Furthermore, the gear predominantly used by hogfish recreational fishermen (spear) is known to have minimal to no bycatch issues, and do little damage to physical or biogenic habitats (Blue Ocean 2010; Seafood Watch 2010). Therefore, no adverse effects on EFH, EFH-HAPCs, or Coral HAPCs are anticipated (see **Section 3.1** and **Appendix H** for a detailed description of EFH in the South Atlantic Region).

4.10.2 Economic Effects

There were very few data points available to estimate the economic effects for the consumer surplus (CS) estimates for the recreational sector for the GA-NC stock. Also, there is no specific consumer surplus available for recreationally caught hogfish for either the FLK/EFL or GA-NC stocks. Two values are used as proxies, consumer surplus for catching a snapper species (but not red snapper) at $12.37 (in 2014 dollars) and consumer surplus for catching a grouper at $134.74 (see **Section 3.3.2**).

Recreational anglers who catch hogfish from the GA-NC stock rarely catch more than one fish. This is evident when comparing the expected total consumer surplus **Alternative 1 (No Action)** and **Sub-alternatives 2a (Preferred)** and **2b** as shown in **Table 4.10.5**. However, it appears that if one angler on a vessel catches at least one hogfish, others on the vessel will do the same as there is a large drop in the expected recreational consumer surplus between 1 fish per person per day (**Sub-alternative 2b**) and 1 fish per vessel per day (**Sub-alternative 2c**). In terms of least to highest expected positive direct economic effects for the GA-NC stock are **Sub-alternative 2c** (1 fish/ vessel/day), **2b** (1 fish/person/day), and **Preferred Sub-alternative 2a** (2 fish/person/day)/**Alternative 1 (No Action)** (No bag limit).

Table 4.10.5. Expected differences in recreational consumer surplus (in 2014 $) for **Alternative 2** proposed bag limits for the GA-NC stock.

	Bag Limit	Landings (Numbers)	Recreational CS - Snapper	Recreational CS - Grouper
Alternative 1	No bag limit	431	$5,331	$58,073
Preferred 2a	**2 fish/person/day**	**431**	**$0**	**$0**
Sub-alt. 2b	1 fish/person/day	429	-$25	-$269
Sub-alt. 2c	1 fish/vessel/day	134	-$3,674	-$40,018

Source: Hogfish Recreational Decision Tool, **Appendix L**

The sub-alternatives of **Alternative 3** (FLK/EFL stock) would establish a recreational trip limit that would be more restrictive than the current five fish per person limit (**Alternative 1 (No Action)**). Under (**Alternative 1 (No Action)**) and each **Alternative 3** sub-alternative except (**Sub-alternative 3d**), the entire recreational sector portion of the ACL is expected to be caught rather quickly. Historically, most recreational hogfish trips in FLK/EFL stock would be affected by the sub-alternatives of **Alternative 3** as shown in **Table 4.10.6**. In terms of least to highest expected positive direct economic effects for the FLK/EFL stock would be **Sub-alternative 3d** (1 fish/vessel/day), **3b** (2 fish/person/day), **3a** (3 fish/person/day), **Preferred 3c** (1 fish/person/day), and **Alternative 1 (No Action)** (5 fish/person/day).

Table 4.10.6. Expected differences in recreational consumer surplus (in 2014 $) for **Alternative 3** proposed bag limits for the FLK/EFL stock.

	Bag Limit	Landings (Numbers)	Recreational CS - Snapper	Recreational CS - Grouper
Alternative 1	5 fish/person/day	15,669	$193,826	$2,111,241

Sub-alt. 3a	3 fish/person/day	15,581	-$1,089	-$11,857
Sub-alt. 3b	2 fish/person/day	15,527	-$1,757	-$19,133
Preferred 3c	**1 fish/person/day**	**15,625**	**-$544**	**-$5,929**
Sub-alt. 3d	1 fish/vessel/day	482	-$187,863	-$2,046,296

Source: Hogfish Recreational Decision Tool, **Appendix L**

4.10.3 Social Effects

In general, the social effects of modifying the recreational bag or vessel limit would be a trade-off between longer seasons under lower bag limits, and the negative effects on recreational fishing opportunities because the bag limit is too low. While **Preferred Alternatives 2** and **3** would limit recreational fishing opportunities for hogfish by changing the recreational fishing experience by restricting the number of hogfish that can be kept, the season would also likely be longer because the rate of harvest would be slower.

Different levels of recreational fishing opportunities under each alternative could affect recreational anglers and for-hire businesses targeting hogfish. The social effects of bag limits can be associated with how many and at what times of year the recreational catch may be retained. Additionally, any long-term negative biological effects on the stock due to recreational landings from higher bag limits, or dead discards due to lower bag limits, would also likely result in negative effects of recreational fishing opportunities in future years.

In general, social benefits from improved recreational fishing opportunities would result from a bag limit that has the largest portion of the year open to recreational harvest, with the highest number of fish per person, as long as the recreational ACL is not exceeded and there is no in-season closure or post-season payback. **Alternative 1 (No Action)** would be the most beneficial to recreational fishermen in the short-term but could detract from measures to rebuild the FLK/EFL stock and sustain the GA-NC stock. For the GA-NC stock, **Sub-alternative 2c** would be the most restrictive by designating a vessel limit of one fish, and would in particular be expected to negatively affect private recreational anglers (**Table 4.10.2**). **Preferred Sub-alternative 2a** and **Sub-alternative 2b** would be expected to have little or no effects on recreational fishing opportunities, similar to **Alternative 1 (No Action)**.

For the FLK/EFL stock, the most restrictive recreational limit (**Sub-alternative 3d**) may eliminate recreational fishing opportunities for charter and private recreational anglers (**Table 4.10.2**). Less restrictive recreational limits in **Sub-alternative 3a, 3b** and **3c (Preferred)** and **Alternative 1 (No Action**) would improve benefits to the recreational sector and associated businesses, but may also shorten the fishing season under the recreational ACL specified in **Action 6**.

4.10.4 Administrative Effects

Under **Alternative 1 (No Action)**, there would be no recreational bag limit in three out of four states in the South Atlantic region for hogfish. **Sub-alternatives 2a (Preferred), 2b, 2c, 3a, 3b, 3c (Preferred), and 3d** would add to the administrative burden in the form of cost, time, law enforcement efforts, and informing the public, when compared with **Alternative 1 (No Action)**.

However, consistent regulations help avoid confusion with the public and aid law enforcement, which reduces the administrative burden in the long term.

Action 11. Establish a recreational fishing season for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

Alternatives
(preferred alternatives in bold)

1 (No Action). There is no recreational season for hogfish in the South Atlantic.

2. Establish a season for the Florida Keys/East Florida (FLK/EFL) stock of hogfish in the South Atlantic region.
- 2a. May-June
- 2b. July-August
- 2c. July-September
- **2d. July-October**

4.11.1 Biological Effects

Davis (1976), Colin (1982), Claro et al. (1989), McBride and Johnson (2007), Collins and McBride (2008) and, Munoz et al. (2010) indicated that spawning activity of hogfish occurs predominantly during December through April, and begins (and ends) slightly earlier in the Florida Keys than on the West Florida shelf.

Hogfish are protogynous: all fish mature first as females first, and eventually become male, if they live long enough. A single male maintains harems of 5 to 15 females (Colin 1982, Munoz et al. 2010) during extended spawning seasons that last for months. Hogfish are pair spawners (Davis 1976, Colin 1982), and spawning occurs daily during the spawning season (McBride and Johnson 2007, Collins and McBride 2008, Munoz et al. 2010). Sex change can take several months (McBride and Johnson 2007), so removal of the dominant male has the potential to significantly affect harem stability and decrease reproductive potential (Munoz et al. 2010).

Average recreational landings, as reported by the Marine Recreational Information Program (MRIP) of hogfish throughout the South Atlantic during 2012-2014 peak in July and August and decrease markedly thereafter (**Figure 4.11.1**).

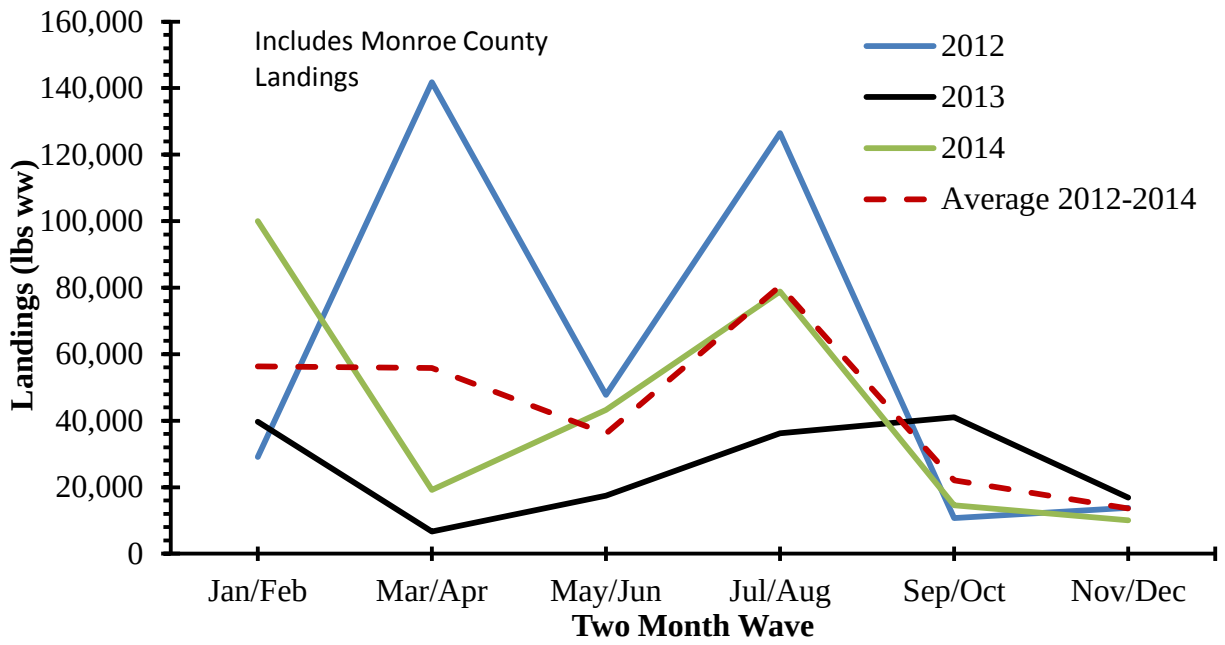


Figure 4.11.1. Recreational landings (lbs ww) by two-month waves during 2012-2014 for the South Atlantic Region, including Monroe County, Florida.

Alternative 1 (No Action) would not establish a recreational fishing season. **Preferred Alternative 2** considers establishing a recreational fishing season of May-June (**Sub-alternative 2a**), July-August (**Sub-alternative 2b**), July-September (**Sub-alternative 2c**) and July-October (**Preferred Sub-alternative 2d**). **Table 4.11.1** shows when the recreational sector would close, how many days would be open, the landings and percent of the recreational ACL that would be expected to be landed at the preferred minimum size and bag limit options: 16 inches FL (**Preferred Sub-alternative 3c** in **Action 8**) and a 1 per person per day recreational bag limit (**Preferred Sub-alternative 3c** in **Action 10**).

Table 4.11.1. Projected landings and percent of recreational ACL that would be landed under preferred ACL, minimum size limit (16 inches FL), and bag limit (1 fish/angler/day) alternatives for the recreational season alternatives in Action 11. Preferred alternatives indicated in bold.

ACL Alternative	Size Limit	Bag Limit	Closure Date	Season	Landings (numbers)	Percent of ACL landed
Alt 2a	16	1 Fish/Angler	No closure	May-Jun	2,634	16
Pref Alt 2b			No closure	May-Jun	2,634	17
Alt 2c			No closure	May-Jun	2,634	18
Alt 2a	16	1 Fish/Angler	No closure	Jul-Aug	8,016	49
Pref Alt 2b			No closure	Jul-Aug	8,016	51
Alt 2c			No closure	Jul-Aug	8,016	54
Alt 2a	16	1 Fish/Angler	No closure	Jul-Sep	8,985	54
Pref Alt 2b			No closure	Jul-Sep	8,985	57
Alt 2c			No closure	Jul-Sep	8,985	60
Alt 2a	**16**	**1 Fish/Angler**	No closure	Jul-Oct	9,987	60
Pref Alt 2b			**No closure**	**Jul-Oct**	**9,987**	**64**
Alt 2c			No closure	Jul-Oct	9,987	67

Source: NMFS SERO. Recreational Decision Tool, **Appendix L**.

The biological effects of the proposed sub-alternatives would be neutral because fishing would occur outside of the spawning season, and ACLs and accountability measures (AMs) would ensure overfishing does not occur. Compared to **Alternative 1 (No Action)**, all of the proposed sub-alternatives would impart biological benefit because **Alternative 1 (No Action)** would allow fishing to occur during the spawning season.

Preferred Sub-alternative 2d would reduce the recreational fishing season to four months and could lead to an increase in discards; however, hogfish are primarily targeted with spearfishing gear, which is very selective and results in very low discards. Additionally, hogfish are not caught with co-occurring species, as is the case with other species in the snapper grouper complex. Therefore, an increased level of discards is not expected from this action (see **Appendix D**, BPA, for more details).

This action would not significantly modify the way in which the snapper grouper fishery is prosecuted in terms of gear types used. Therefore, there are no impacts on ESA-listed species or designated critical habitats anticipated as a result of this action (see **Section 3.2.4** for a detailed description of ESA-listed species and critical habitat in the action area). Furthermore, no impacts on EFH or EFH-HAPC are expected to result from any of the alternatives considered for this action (see **Section 3.1** for a detailed description of EFH in the South Atlantic Region).

4.11.2 Economic Effects

There is no specific consumer surplus available for recreationally caught hogfish. Two values are used as proxies, consumer surplus for catching a snapper species (but not red snapper) at $12.37 (in 2014 dollars) and consumer surplus for catching a grouper at $134.74 (see **Section 3.3.2**).

The economic effects of establishing a set recreational season for hogfish would depend on several factors. The factors would include whether or not the season was restrictive enough to keep the recreational ACL from being exceeded or if the season was too restrictive and unnecessarily restricting access to the resource, thus preventing achievement of optimum yield.

Under each of the alternatives/sub-alternatives of **Action 11** the recreational season for hogfish would last less than one two-month MRIP wave based on **Action 6**, **Preferred Alternative 2**, **Preferred Sub-alternative 2b**. **Table 4.11.2** shows what the expected consumer surplus (CS) would be for each of the proposed recreational fishing seasons. The differences in CS as calculated by the Recreational Decision Tool (**Appendix L**) largely depend on heterogeneous wave-level daily catch rates. Additionally, the differences in CS among the **Alternative 2 (Preferred)** sub-alternatives depend on when the in-season closure is triggered. **Sub-alternative 2b** and **Preferred Sub-alternative 2c** both have the same start date and projected date of reaching the recreational sector ACL at the end of July, hence the same expected CS values.

Table 4.11.2. Expected differences in recreational consumer surplus (in 2014 $) for season lengths proposed by Action 11, **Preferred Alternative 2** and its sub-alternatives.

	Season	Landings (Numbers)	Recreational CS - Snapper	Recreational CS - Grouper
Alt 1 (No Action)	No Closure	15,677	$193,924	$2,112,319
Sub-alt. 2a	May-June	15,478	-$2,461.63	-$26,813
Sub-alt. 2b	July-August	15,667	-$123.70	-$1,347
Preferred 2c	**July-September**	**15,667**	**-$123.70**	**-$1,347**

Source: Hogfish Recreational Decision Tool, **Appendix L**

In each case, the sub-alternatives of **Preferred Alternative 2** are more restrictive than **Alternative 1 (No Action)**. However, depending on how quickly the recreational sector ACL is expected to be caught, it is impossible to know whether setting an exact season is more beneficial to the recreational sector because of the delay related to processing MRIP landings estimates. Too long of a delay in closing the recreational sector could result in very large overages and shortened future seasons. Until there is analysis of the sub-alternatives of **Preferred Alternative 2**, it will not be known whether setting a fixed season, or which fixed season is most appropriate for the FLK/EFL hogfish stock.

The expected differences in CS among the alternatives/sub-alternatives of **Action 11** are negligible at only 1-2%. From least to greatest positive direct economic effects are **Sub-alternative 2a**, **Sub-alternative 2b/Preferred Sub-alternative 2c**, and **Alternative 1 (No Action)**.

4.11.3 Social Effects

Hogfish is an important recreational species in some areas of the South Atlantic, particularly in South Florida and the Florida Keys (see **Section 3.4**). Imposing a recreational season on the FLK/EFL stock could change the level of access to hogfish during periods when hogfish are available and when participation in the fishery is highest. However, long-term biological benefits of maintaining a healthy stock would contribute to future fishing opportunities for both the commercial and recreational sectors.

The social effects of **Sub-alternatives 2a-2d (Preferred)** under **Preferred Alternative 2** compared to **Alternative 1 (No Action)** would depend on when recreational effort is the highest for FLK/EFL hogfish, and how the proposed recreational limits in **Action 10** would work under the proposed ACLs in **Actions 4** and **6**. Because hogfish is an important recreational species for south Florida and particularly the Florida Keys, it is likely that any restriction on time for recreational harvest under **Preferred Alternative 2** may have negative effects on recreational fishing opportunities.

As shown in **Table 4.11.1**, the combination of a bag limit and recreational season would result in the longest expected season under **Sub-alternative 2c** when compared to season length in **Alternative 1 (No Action)** and **Sub-alternatives 2a** and **2b**. It should be noted that

specifying only two months during which recreational harvest would be allowed (**Sub-alternatives 2a** and **2b**) could result in recreational landings not reaching the recreational ACL as designated in **Action 6**.

Because the expected closure date under **Sub-alternative 2c** is before the end of September (**Table 4.11.1**) when incorporating the potential ACLs and bag limits, it can be assumed that the expected closure date under **Preferred Sub-alternative 2d** would be the same. Therefore there would be no major differences in the effects on recreational fishing opportunities between **Sub-alternative 2c** and **Preferred Sub-alternative 2d** under the current expected restrictions and fishery conditions. However, under **Preferred Sub-alternative 2d**, an additional month would be beneficial for recreational fishing opportunities if there is a future increase in the recreational ACL that allowed a longer fishing season.

4.11.4 Administrative Effects

Sub-alternatives 2a, **2b**, **2c**, and **2d** (**Preferred)** could increase administrative costs compared to **Alternative 1 (No Action)** as these alternatives would establish a recreational fishing season with a closure of the recreational sector for the months of January through June, and October through December. However, an in-season closure would also be expected under the **Alternative 1 (No Action)**. Therefore, the administrative effects could be similar between **Alternatives 1 (No Action)** and **Sub-alternatives 2a, 2b, 2c, and 2d (Preferred)**. The administrative effects of **Sub-alternatives 2a, 2b, 2c, and 2d (Preferred)** would be greater than **Alternative 1 (No Action)** since the fishing season is only specified for a specific time of the year versus a year-round fishing season. Changing the fishing season under **Sub-alternatives 2a**, **2b**, **2c**, and **2d (Preferred)** would add to the administrative burden in the form of cost, time, and law enforcement efforts.

Action 12. Establish commercial and recreational accountability measures (AMs) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish stocks of hogfish

Alternatives*
(preferred alternatives in bold)

1 (No Action). Current commercial and recreational AMs apply to hogfish throughout the South Atlantic Fishery Management Council's area of jurisdiction. (see **Section 2.12.1** for current AMs)

2. If commercial landings reach or are projected to reach the commercial ACL, the commercial sector will close for the remainder of the fishing year; all sale or purchase will be prohibited and harvest or possession of hogfish in or from the EEZ would be limited to the recreational bag and possession limit. This bag and possession limit applies in the South Atlantic on board a vessel for which a valid Federal commercial or charter vessel/headboat permit for South Atlantic snapper grouper has been issued, without regard to where such species were harvested, i.e., in state or Federal waters. If the commercial ACL is exceeded, the commercial ACL in the following fishing year will be reduced by the amount of the commercial overage, only if hogfish is overfished and the total ACL is exceeded.

2a, For the GA-NC stock of hogfish.
2b, For the FLK/EFL stock of hogfish

3. If recreational landings reach or are projected to reach the recreational ACL, the recreational sector will close for the remainder of the fishing year, unless NMFS determines that a closure is unnecessary.

3a. For the GA-NC stock of hogfish if the stock is overfished.
3b. For the GA-NC stock of hogfish regardless of stock status.
3c. For the FLK/EFL stock of hogfish if the stock is overfished.
3d. For the FLK/EFL stock of hogfish regardless of stock status.

4. If recreational landings exceed the recreational ACL, then during the following fishing year, landings will be monitored for a persistence in increased landings. If necessary, the length of fishing season and the recreational ACL will be reduced in the following fishing year by the amount of the recreational overage, only if the species is overfished and the total ACL is exceeded. The length of the recreational season and recreational ACL will not be reduced if NMFS determines a reduction is unnecessary.

4a. For the GA-NC stock of hogfish
4b. For the FLK/EFL stock of hogfish

* See Chapter 2 for complete language of alternatives.

4.12.1 Biological Effects

Accountability measures (AMs) for hogfish were revised through Amendment 34 to the Snapper Grouper FMP (SAFMC 2015d; effective February 22, 2016). A revision to the AMs for hogfish and many other snapper grouper species was necessary to create a consistent regulatory environment while preventing unnecessary negative socio-economic impacts, and prevent overfishing. Subsequent to the reauthorization of the Magnuson-Stevens Act in 2007, the South Atlantic Council established AMs for managed species over the next several years through various amendments to the Snapper Grouper FMP. Consequently, inconsistencies in the regulatory language arose creating some confusion. Through implementation of Amendment 34 (SAFMC 2015d), however, the South Atlantic Council has brought consistency in the management response to meeting or exceeding established annual catch limits (ACLs) for snapper grouper species.

As Amendment 34 was being developed, however, work was underway to determine the stock structure of hogfish (Seyoum et al. 2015). Since a splitting of the hogfish stock within the South Atlantic Council's area of jurisdiction is being proposed in this

amendment (**Action 1**), action must be also taken to specify AMs for each of the two hogfish stocks.

Under **Alternative 1 (No Action)**, the current AMs for both the commercial and recreational sectors of hogfish would continue to apply to the South Atlantic Council's entire area of jurisdiction, which does not adhere to the best scientific information available as recommended in SEDAR 37 (2014), and is therefore, not a viable alternative. For the commercial sector, the payback provision under **Preferred Alternative 2** would be triggered infrequently, because the payback would only be required if two criteria are met: (1) hogfish is overfished *and* the total ACL has been exceeded. At this time, the likelihood of both of these scenarios taking place at the same time for the GA-NC stock of hogfish is zero, since the status of the stock is unknown. As such, **Preferred Sub-alternative 2a** is the least biologically advantageous alternative for the GA-NC stock of hogfish because a commercial payback would never be triggered, even when it was biologically needed. For the FLK/EFL stock of hogfish, while the likelihood of both of these scenarios taking place at the same time is small, one of the two criteria to trigger a commercial payback has already been met as the stock is overfished. Hence, **Preferred Sub-alternative 2b** may impart biological benefits to the FLK/EFL stock. However, since **Preferred Alternative 2** would prohibit harvest in-season if the commercial ACLs for the respective hogfish stock was met or was projected to be met, overages of the total ACL (commercial and recreational combined) would be unlikely.

Preferred Alternatives 3 and **4** (and their respective sub-alternatives) would apply to the recreational sector. **Preferred Sub-alternatives 3b** and **3d** would trigger an in-season closure for the GA-NC stock and the FLK/EFL stock, respectively, regardless of stock status. These sub-alternatives have the potential to impart biological benefits to both stocks compared to **Sub-alternatives 3a** and **3c** since an overfished determination would not be needed to trigger a closure and thus ACL overages would be avoided. Under **Preferred Sub-alternatives 4a** and **4b**, if the recreational ACL is exceeded, recreational landings during the following year would be monitored for persistence in increased landings. If necessary, the recreational season *and* the recreational ACL would be reduced the following fishing year but only if the respective hogfish stock is overfished and the total ACL (commercial + recreational) is exceeded. In this respect, **Preferred Sub-alternatives 4a** and **4b** are almost identical to **Preferred Sub-alternatives 2a** and **2b** for the commercial sector; however, the Regional Administrator would determine, based upon the best scientific information available, whether a payback is actually needed. The Regional Administrator may determine that a payback is not needed in a case where the combined total ACL has been met and the species is overfished, but an ongoing stock assessment indicates the species, or a species in a species group, is no longer overfished; or if ACL overages are shown to be caused by increased rates of harvest due to increasing stock abundance rather than increased fishing effort. Thus, **Preferred Sub-alternatives 4a** and **4b** would maintain the ability of the Regional Administrator to interpret landings data to determine whether a payback is needed. However, these sub-alternatives would all allow the payback to take the form of a recreational ACL reduction *and* a season length reduction, compared to **Alternative 1 (No Action)**, which only allows for a season length reduction as a form of payback for the entire area under the South Atlantic Council's jurisdiction. However, **Preferred Alternative 3** and all its

sub-alternatives would allow the Regional Administrator to close the recreational sector when the recreational ACL for the respective hogfish stock is met or projected to be met. Therefore, if in-season closures are implemented when needed to prevent recreational ACLs from being exceeded, the need to initiate an ACL payback the following year would be greatly reduced.

Since **Preferred Alternatives 2** and **3** would prohibit commercial and recreational harvest in-season if the sector ACLs were met or were projected to be met and since overages of the total ACL (commercial and recreational combined) would be unlikely to occur, significant biological impacts, beneficial or adverse, on the GA-NC and FLK/EFL stocks of hogfish are not expected.

The in-season closures if the commercial and recreational ACLs are exceeded as well as payback measures proposed in these preferred sub-alternatives would be expected to prevent ACLs from exceeding, hence helping reduce discards (see **Appendix D**, BPA, for more details on bycatch and discards).

None of the alternatives considered under this action would significantly alter the way in which the hogfish portion of the snapper grouper fishery is prosecuted in the South Atlantic EEZ. No adverse impacts on endangered or threatened species are anticipated because of this action; nor are any adverse impacts on EFH or EFH HAPC including corals, sea grasses, or other habitat types expected because of this action.

4.12.2 Economic Effects

In general, AMs help ensure that ACLs are not exceeded, particularly on a consistent basis. Exceeding an ACL on a consistent basis presents a high likelihood of overfishing which could possibly derail a rebuilding strategy adopted for an overfished stock or even drive an otherwise healthy stock to being overfished. Once overfishing occurs, or a stock become overfished, and more restrictive regulations are adopted, affected fishers could redirect their effort to other species that could also experience overfishing or be overfished over time. This could eventually trigger untoward repercussions on the ecological environment for a stock and other associated species. Incorporating paybacks in AMs may not eliminate the occurrence of overages but it does decrease the likelihood that overages (and overfishing) would occur over time.

Action 12 considers alternatives that would modify AMs for hogfish which had recently been modified in Snapper Grouper Amendment 34 (SAFMC 2015d). Under **Alternative 1 (No Action)**, the current AMs in place for these species would not be modified. **Preferred Alternative 2** specifies the same conditions that would require paybacks of overages in the commercial sector, which are the same as **Alternative 1 (No Action)**. The AMs **Preferred Sub-alternatives 2a** and **2b** specify that the commercial harvest for the GA-NC and FLK/EFL stocks would close when the commercial ACL is met or projected to be met.

Preferred Alternative 3, Sub-alternatives 3a and **3c** would close the recreational sector for the rest of the fishing year only if the GA-NC or FLK/EFL stocks are overfished. **Preferred**

Sub-alternatives 3b and **3d** would close the recreational sector for the rest of the fishing year regardless of the stock status.

Preferred Alternative 4 considers an in-season closure for the recreational sector. **Preferred Sub-alternatives 4a** and **4b** are analogous to **Preferred Alternative 2**, but for the recreational sector. **Preferred Sub-alternatives 4a** and **4b** would require NMFS to monitor the recreational sector for a persistence in increased landings and if necessary reduce the recreational ACL the following fishing year for the amount of the recreational overage.

The selection of any of the sub-alternatives of **Preferred Alternative 2** through **Preferred Alternative 4** does not change the basic premise of **Alternative 1 (No Action)** that commercial fishing would be stopped when the commercial ACL has been met or projected to be met or the following recreational fishing season shortened when recreational ACL is exceeded. Thus, only when overages occur would the various alternatives have possibly differing economic effects. The relative magnitude of short-term economic effects of the various alternatives would depend on the likelihood of triggering the hogfish AMs. The alternatives' long-term economic effects would depend on their effects on the sustainability of the stock to support continued fishing opportunities for the commercial and recreational fishing participants, overall the potential economic impacts of **Preferred Alternatives 2** through **Preferred Alternative 4** are not expected to be significant.

There is no expected economic effects difference between **Alternative 1 (No Action)**, **Preferred Alternative 2 (Preferred Sub-Alternatives 2a** and **2b)**, and **Preferred Alternative 4 (Preferred Sub-Alternatives 4a** and **4b)**.

4.12.3 Social Effects

AMs can have significant direct and indirect social effects because, when triggered, can restrict harvest in the current season or subsequent seasons. However, AMs are critical in keeping landings from exceeding the recommended catch levels, which is crucial under a rebuilding plan. **Alternative 1 (No Action)** would maintain the current AMs but maintain their applicability to a single stock of hogfish. Therefore, because the stock is being split into two under Action 1, **Alternative 1 (No Action)** is no longer viable because the current AMs would no longer apply to each of the two stocks. **Preferred Alternative 2** and **Preferred Sub-alternatives 2a** and **2b** would have similar effects on commercial fishermen and businesses as **Alternative 1 (No Action)**, except that there may be more flexibility in the payback provision because the total ACL must be exceeded and the stock be overfished. For the GA-NC stock of hogfish, the payback provision under **Preferred Sub-alternative 2a** is not expected to be triggered frequently because, on average, commercial landings of hogfish in that geographic area have been similar to the proposed commercial ACL (see **Table 4.4.4**) and recreational landings have been well below the proposed recreational ACL. A payback would only be triggered if the total ACL were exceeded and the stock was deemed overfished. Since the status of the GA-NC stock of hogfish remains unknown, a payback would not be required and, therefore, there would be no negative social effects. For the FLK/EFL stock, **Preferred Sub-alternative 2b** may result

in negative social effects since a payback is likely to be triggered. For this stock, the proposed commercial and recreational ACLs are substantially lower than average landings in recent years and SEDAR 37 (2014) indicated the stock is overfished. Hence, the likelihood of the total ACL being exceeded is higher than for the GA-NC stock.

Because there is no in-season closure for the recreational sector in place (**Alternative 1 (No Action)**), there is no additional means to reduce the risk of an overage, particularly for the FLK/EFL stock. **Preferred Alternative 3/Preferred Sub-alternatives 3b** and **3d** would require an in-season closure regardless of stock status, which would be expected to be more beneficial than **Sub-alternatives 3a** and **3c** for fishermen by contributing to success in the rebuilding plan for the FLK/EFL stock, and sustaining harvest for the GA-NC stock.

Similar to **Alternative 1 (No Action)**, **Preferred Alternative 4/ Preferred Sub-alternatives 4a** and **4b** would maintain the same post-season recreational AM but make the AMs applicable to each of the two stocks of hogfish.

4.12.4 Administrative Effects

Under **Alternative 1 (No Action)**, AMs would not be separate for the GA-NC and FLK/EFL stocks. Therefore, any increase or decrease in administrative burden associated with **Alternatives 2-4** (including their sub-alternatives) would be caused by more or less frequently implemented AMs. **Preferred sub-alternatives 2a** and **2b** would continue the in-season commercial sector closure AM with slight changes to the administrative environment based on the frequency with which each of the AM options would be triggered. **Sub-alternative 2b** (**Preferred**) is likely to be triggered the most often and, therefore, would be associated with the highest level of administrative impacts in the form of document preparation and notifications sent to the commercial sector participants informing them that the ACL the following year would be reduced. **Sub-alternative 2a** (**Preferred**) is likely to follow **Sub-alternative 2b** (**Preferred**) in frequency of implementation. However, if AMs are not implemented when they are biologically necessary, the risk of overfishing increases and the administrative burden associated with having to curtail overfishing are much greater than those associated with implementing an effective AM. **Sub-alternatives 3a, 3b (Preferred), 3c,** and **3d** (**Preferred**) would consider an in-season recreational sector closure AM with slight changes to the administrative environment based on the frequency with which each of the AM options would be triggered. **Preferred sub-alternatives 3b** and **3d** are likely to be triggered more often than **Sub-alternatives 3a** and **3c** and, therefore, would be associated with a higher level of administrative impacts in the form of document preparation and notifications sent to the recreational sector participants informing them of the closure of the recreational sector for the remainder of the year. The administrative impacts associated with **Preferred Sub-alternatives 4a** and **4b** are largely the same as all the sub-alternatives under **Alternative 3** for the recreational sector, with the addition of continued monitoring for persistence of increased landings when the recreational ACL has been exceeded. Because landings are already closely monitored and recreational AMs are in place, the addition of the payback provision of the recreational AM would not constitute an additional administrative burden. Payback provisions for the recreational sector under **Preferred Sub-**

alternative 4a and **4b** alternatives are the least likely to have administrative burdens compared with **Preferred Sub-alternatives 2a** and **2b, Sub-alternatives 3a, 3b (Preferred), 3c,** and **3d (Preferred)**, because two conditions would have to be met, the species would have to be overfished *and* the total ACL (for both the commercial and recreational sectors) would have to be met.

Chapter 5. South Atlantic Council's Choice for the Preferred Alternatives

To be completed after June 2016 Council meeting

5.1 Modify the Fishery Management Unit (FMU) for hogfish

5.1.1 Snapper Grouper Advisory Panel (AP) Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had no recommendations on Action 1 at that time.

5.1.2 Law Enforcement Advisory Panel (LE AP) Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.1.3 Scientific and Statistical Committee (SSC) Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had the following recommendations pertaining to stock structure:

The SSC reviewed the hogfish benchmark assessment conducted by FWC-FWRI. The SSC first considered the evidence of stock separation and justification for conducting separate assessments of the GA-NA and Southeast FL/FL keys stocks. Points of discussion included the following items:

- *The dividing point between the GA-NC and SE Florida stocks is not well defined. One reason for this is a lack of genetic sample coverage from*
- *Northern Florida through South Carolina. However, the genetic evidence does suggest a distinction between the stocks in NC and South Florida.*
- *Whether there is a true biological difference in growth between the different stocks or whether the observed differences reflect age truncation due to heavy fishing.*
    - *Sensitivity analyses show stock status is sensitive to this assumption.*
    - *The SSC recommends investigating this issue by comparing size distributions from the fishery to closed areas within the EFL/FL Keys. Some evidence suggests that the apparent difference in length comps/growth is due to fishing pressure.*
- *Catch uncertainty is high, due to the dominance of harvest by the recreational fishery.*

After much discussion the SSC supported treating hogfish in the South Atlantic as two stocks. Each assessment was then evaluated with regard to fishing level recommendations.

5.1.4 Public Comments and Recommendations

Commercial fishermen in the Florida Keys who have both South Atlantic Snapper Grouper and Gulf Reef Fish permits would prefer the boundary between the Florida Keys/East Florida (FLK/EFL) and Gulf of Mexico (West Florida) stocks of hogfish to be at the jurisdictional boundary between the two Councils. Other commenters supported the South Atlantic Fishery management Council's (South Atlantic Council) preferred alternative (line due west just south of Cape Sable, Florida).

5.1.5 South Atlantic Council Choice for Preferred Alternative

5.2 Specify Maximum Sustainable Yield (MSY) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

5.2.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had no recommendations on Action 2 at that time.

5.2.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.2.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC stated the following pertaining to the GA-NC and FLK/EFL (referred to as "SE/SFL" in the SSC report) stocks of hogfish:

GA-NC stock: *the SSC agreed with recommendations from the CIE reviewers to not consider assessment results for the GA-NC stock as sufficient to determine stock status and inform management decisions. Although there isn't another analysis available for this stock a statistical catch at age model is not the appropriate modeling framework to analyze the available data and therefore this assessment is not considered the best available science. The Committee recommends that catch level recommendations for the GA-NC hogfish stock be developed using the ORCS approach, as outlined in the Council's ABC control rule.*

SE/SFL stock: *the SSC felt that despite the concerns described above this assessment represents a significant improvement from the methodological approach previously used to set ABC for hogfish. Further the Committee recognized that data-poor methods would not have been sufficient to capture all the complex biological nuances inherent to hogfish life history and population dynamics. Therefore, the SSC considered the benchmark assessment of SE/SFL hogfish to represent the best available science and recommended it be used for fisheries management. Specifically, the Committee accepted the estimate of steepness (h) and associated MSY reference points provide by the base run.*

5.2.4 Public Comments and Recommendations

Since there is no stock assessment that can be used for the Georgia through North Carolina (GA-NC) stock of hogfish, the South Atlantic Council should not consider changes in management for that stock.

5.2.5 South Atlantic Council Choice for Preferred Alternative

5.3 Action 3. Specify Minimum Stock Size Threshold (MSST) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

5.3.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had no recommendations on Action 3 at that time.

5.3.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.3.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC stated the following pertaining to the GA-NC and FLK/EFL (referred to as "SE/SFL" in the SSC report) stocks of hogfish:

<u>GA-NC stock:</u> *the SSC agreed with recommendations from the CIE reviewers to not consider assessment results for the GA-NC stock as sufficient to determine stock status and inform management decisions. Although there isn't another analysis available for this stock a statistical catch at age model is not the appropriate modeling framework to analyze the available data and therefore this assessment is not considered the best available science. The Committee recommends that catch level recommendations for the GA-NC hogfish stock be developed using the ORCS approach, as outlined in the Council's ABC control rule.*

<u>SE/SFL stock:</u> *the SSC felt that … this assessment represents a significant improvement from the methodological approach previously used to set ABC for hogfish. Further the Committee recognized that data-poor methods would not have been sufficient to capture all the complex biological nuances inherent to hogfish life history and population dynamics. Therefore, the SSC considered the benchmark assessment of SE/SFL hogfish to represent the best available science and recommended it be used for fisheries management. Specifically, the Committee accepted the estimate of steepness (h) and associated MSY reference points provide by the base run.*

5.3.4 Public Comments and Recommendations

Since there is no stock assessment that can be used for the GA-NC stock of hogfish, the South Atlantic Council should not consider changes in management for that stock.

5.3.5 South Atlantic Council Choice for Preferred Alternative

5.4 Establish Annual Catch Limits (ACLs) for the Georgia through North Carolina (GA-NC) stock of hogfish

5.4.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had the following recommendations on Action 4:

MOTION: RECOMMEND SUB-ALTERNATIVE 2A UNDER ACTION 4 AS PREFERRED ALTERNATIVE
Sub-alternative 2a. ACL = OY = ABC
APPROVED BY AP

RECOMMENDATION: FOR THE NC-GA STOCK, THE COUNCIL SHOULD CONSIDER REGULATING COMMERCIAL AND RECREATIONAL HOGFISH BASED ON TWO SEPARATE GEARS (HOOK-AND-LINE AND SPEAR). MAINTAINING SEPARATE ACLs FOR COMMERCIAL AND RECREATIONAL BUT NOT BASED ON GEAR. INTENT IS TO BETTER MANAGE USING DIFFERENT SIZE LIMITS, ETC.

5.4.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.4.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had the following recommendation for setting the ABC for the GA-NC stock. The SSC had no recommendation for specifying the ACL.

The SSC agreed with recommendations from the CIE reviewers to not consider assessment results for the GA-NC stock as sufficient to determine stock status and inform management decisions. Although there isn't another analysis available for this stock a statistical catch at age model is not the appropriate modeling framework to analyze the available data and therefore this assessment is not considered the best available science. The Committee recommends that catch level recommendations for the GA-NC hogfish stock be developed using the ORCS approach, as outlined in the Council's ABC control rule.

5.4.4 Public Comments and Recommendations

- Since there is no stock assessment that can be used for the GA-NC stock of hogfish, the South Atlantic Council should not consider changes in management for that stock.
- At the proposed commercial ACL, the season will only last 9 months.

- Fishermen expressed concern that the Marine Recreational Information Program (MRIP) survey is not sampling dive boats adequately and, therefore, recreational estimates for the GA-NC stock do not reflect abundance of hogfish in that region.

5.4.5 South Atlantic Council Choice for Preferred Alternative

5.5 Establish a rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

5.5.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had no recommendations on Action 5 at that time.

5.5.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.5.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had the following recommendations for the FLK/EFL stock (referred to as "SE/SFL" in the SSC report) of hogfish:

<u>SE/SFL stock:</u> *the SSC felt that … this assessment represents a significant improvement from the methodological approach previously used to set ABC for hogfish. Further the Committee recognized that data-poor methods would not have been sufficient to capture all the complex biological nuances inherent to hogfish life history and population dynamics. Therefore, the SSC considered the benchmark assessment of SE/SFL hogfish to represent the best available science and recommended it be used for fisheries management. Specifically, the Committee accepted the estimate of steepness (h) and associated MSY reference points provide by the base run.*
In addition to the uncertainties noted for hogfish in general, the Committee notes the following items pertaining to the SE/SFL stock:

- *Productivity for the SE Florida stock is not well estimated. Estimates suggest the stock began at low biomass at the start of the time series and drops slightly over time, resulting in a lack of contrast.*
- *As noted in the general comments, observed growth rates of the SE FL stock are below that of the GA-NC stock. Whether this is due to the high exploitation indicated by the model or geographic habitat differences is unknown. From an assessment modeling perspective, there is large variability in the input growth data, yet small CV's assigned to the growth model used internally by the model.*
- *A likelihood profile on R0 was unavailable. The SSC felt this diagnostic analysis would be very informative given the narrow range of stock abundance seen in this assessment (from 9% of virgin to between 6% and 8% of virgin). This range may not provide enough contrast to infer stock productivity and determine stock status given the amount of uncertainty in the input data and model assumptions.*

- *The SSC expressed serious concern regarding the fact that data weighting procedures were not used in this assessment. Although effective sample sizes were calculated they were not used to reweight the different data sources used in the assessment.*
- *The SSC also felt that although the estimated dome-shaped selectivities seemed justified, the degree of doming (e.g., terminal selectivity fixed at zero for some fisheries) represents an additional concern. Further, although uncertainty in selectivity was reflected in the bootstraps the fact that the functional form of some selectivities was still imposed indicates that uncertainty in fishery selectivity was not fully captured and characterized.*

Since this assessment falls under Tier 1 of our ABC control rule, ABC was obtained according to a P value. A summary of results from applying the ABC control rule is presented below:*
1. Assessment Information: Tier 1 (0%)
2. Uncertainty Characterization: Tier 3 – Medium (-5%)
3. Stock Status: Tier 4 – Overfished and Overfishing is occurring (-7.5%).
4. Productivity-Susceptibility Analysis: Tier 3 – High Risk (-10%): based on the MRAG report.

In total, these results provide for an adjustment score of -22.5%, a P of 27.5%, and a PREBUILD of 72.5%. An yield stream for rebuilding will be provided after the Council either approves the probability of rebuilding recommend above or provides further input on the probability of rebuilding to be used.*

Regarding the next assessment of hogfish, the SSC recommends that it be conducted in 5 years and that it should address all the concerns put forth by the SSC and CIE reviewers. Further, the Committee recommended that the next assessment explore the use of several classes of models (of different complexity) instead of just a statistical catch at age model.

5.5.4 Public Comments and Recommendations

No specific comments regarding proposed rebuilding plan.

5.5.5 South Atlantic Council Choice for Preferred Alternative

5.6 Establish Annual Catch Limits (ACLs) for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

5.6.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had no recommendations on Action 6 at that time.

5.6.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.6.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had no recommendation for setting an ACL for the FLK/EFL stock.

5.6.4 Public Comments and Recommendations

No specific comments regarding proposed ACLs.

5.6.5 South Atlantic Council Choice for Preferred Alternative

5.7 Establish a recreational Annual Catch Target (ACT) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

5.7.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had the following recommendations on Action 7:

MOTION: SUPPORT THE COUNCIL'S PREFERRED FOR ACTION 7.
Preferred Alternative 2. Establish an annual catch target (ACT) for the GA-NC stock of hogfish for the recreational sector.
Sub-alternative 2a. ACT = recreational ACL*(1-PSE) or ACL*0.5, whichever is greater.
Preferred Sub-alternative 2b. ACT =85% recreational ACL.
APPROVED BY AP

5.7.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.7.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had no recommendations pertaining to specifying recreational ACTs for either stock.

5.7.4 Public Comments and Recommendations

No specific comments regarding proposed recreational ACTs.

5.7.5 South Atlantic Council Choice for Preferred Alternative

5.8 Increase the commercial and recreational minimum size limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

5.8.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had the following recommendations on Action 8:

MOTION: RECOMMEND SUB-ALTERNATIVE 2B AS PREFERRED FOR ACTION 8.
Preferred Alternative 2. Increase the commercial and recreational minimum size limit for the GA-NC stock of hogfish in the South Atlantic Region.

Sub-alternative 2b. 17 inches FL

APPROVED BY AP (6 TO 5)

MOTION: RECOMMEND SUB-ALTERNATIVE 3E AS PREFERRED FOR ACTION 8.
Preferred Alternative 3. Increase the commercial and recreational minimum size limit for the Florida Keys/East Florida (FLK/EFL) stock of hogfish in the South Atlantic Region.

Sub-alternative 3e. Increase the minimum size limit from 12" to 14" in year 1 and to 16" in year 3.

APPROVED BY AP

RECOMMENDATION: FOR THE NC-GA STOCK, THE COUNCIL SHOULD CONSIDER REGULATING COMMERCIAL AND RECREATIONAL HOGFISH BASED ON TWO SEPARATE GEARS (HOOK-AND-LINE AND SPEAR). MAINTAINING SEPARATE ACLs FOR COMMERCIAL AND RECREATIONAL BUT NOT BASED ON GEAR. INTENT IS TO BETTER MANAGE USING DIFFERENT SIZE LIMITS, ETC.

RECOMMENDATION: LOOK AT SLOT LIMIT (12 TO 16 INCHES) FOR FLORIDA HOGFISH.

5.8.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.8.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had no recommendations pertaining to modifications to the minimum size limit for either stock.

At their May 3-5, 2016 meeting, the SSC conducted a technical review of the Recreational Decision Tool (see **Appendix L**) developed by the NMFS Southeast Regional Office (SERO) to analyze the effects of proposed recreational management measures. The SSC had the following recommendations:

- The hogfish decision tool was considered Best Scientific Information Available.
- The Socio-economic Panel (SEP) of the SSC had specific recommendations in its report (see Appendix 1 to the SSC's final report) regarding the consumer surplus estimates used to calculate the economic effects for the recreational sector and the order of the analysis for minimum size limits and trip limits. SERO staff agreed to incorporate these recommendations to the extent practicable. The SEP also had questions regarding an apparent pattern for landings cycling, peaking every 3 or 4 years followed by several years of big declines, and questioned whether this might be biological in origin. The SSC was also uncertain as to whether this pattern has a biological basis, but SERO staff's revised analysis after the SEP meeting using a 4-year lag to account for the apparent longer-term cycle did not produce a meaningful result.
- A retroactive validation was recommended.

5.8.4 Public Comments and Recommendations

GA-NC: Support for increase in minimum size. Suggest increase to 16 inches FL.

FLK/EFL:

- Most support for an increase in the minimum size limit to 16 inches FL.
- Some commenters supported a 17-inch minimum size limit for Florida hogfish.
- Support for the preferred 15-inch FL but even better would be increasing to 14" up to 16" over 3 years (based on the growth rates of healthier stocks like those in Dry Tortugas or the Gulf, hogfish will reach 16 inches in 2-3 years).
- Consider step-up increase in minimum size limit for Florida hogfish up to 18" or 20".
- A large number of undersized hogfish are harvested during mini-season. An increase in minimum size limit without prohibiting harvest during mini-season could lead to massive discards.
- Also consider a possible slot limit or a soft slot limit where only one fish over 21-22 inches, for instance, can be taken per vessel so as to limit the number of large males that can be taken while still maintaining trophy fishing.
- An increase in the minimum size limit may affect dockside value and price to consumers because restaurants want a certain size fillet.

5.8.5 South Atlantic Council Choice for Preferred Alternative

5.9 Establish a commercial trip limit for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

5.9.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had the following recommendations on Action 9:

MOTION: RECOMMEND THAT THE COUNCIL CONSIDER ADDITIONAL SUB-ALTERNATIVES FOR 150 AND 200 POUND COMMERCIAL TRIP LIMIT FOR GA-NC (ACTION 9).
APPROVED BY AP (1 OPPOSED)

5.9.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.9.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had no recommendations pertaining to specification of commercial trip limits for either stock.

At their May 3-5, 2016 meeting, the Socio-Economic Panel (SEP) of the SSC conducted a technical review of the Commercial Decision Tool (see **Appendix M**) developed by the NMFS Southeast Regional Office to analyze the effects of proposed commercial management measures. The SEP had the following recommendations:

- The SEP concurred with the use of average price per pound as a proxy measure of marginal value for the commercial fishery.
- For the FLE-Keys area, there appears to be a pattern for landings to cycle, peaking every 3 or 4 years followed by several years of big declines. This could be related to the hogfish 3-5 year generation time, cycles in ocean conditions, or other factors. The SEP recommended a revised analysis that considers a 4-year lag to account for the apparent longer-term cycle.

  Perform the analysis for minimum size limits first, and then perform the analysis for trip limits conditioned on the result for each proposed minimum size limit (MSL). This could be accomplished by running the analysis on trip catches after applying the percentage reduction from each proposed MSL. The issue is that it may be harder for fishermen to reach the trip limit if a minimum size limit is already limiting the number of fish they can keep.

5.9.4 Public Comments and Recommendations

GA-NC:

- Concern that the 25-pound proposed commercial trip limit in Florida will cause effort shift to Carolinas.
- Council should consider a two-month spawning season (May-June) closure for hogfish in the Carolinas (for both sectors) and 500-pound commercial trip limit. OR no spawning closure and decrease the trip limit to 350 pounds.
- No commercial trip limit or the largest possible. Consider implementing commercial trip limit similar to what is currently in place in NC. Otherwise, consider commercial trip limit of 700 pounds.
- Consider a head count trip limit for commercial sector in the Carolinas because there is a lot of variation in weight among hogfish in that region.

FLK/EFL:

- Commercial fishermen who target hogfish in the Keys stated that the proposed trip limit would impact them significantly because they engage in multi-day trips. At 25 pounds per trip, they would not be able to stay in business.
- If trip limit needs to go in place, consider daily trip limit for Florida hogfish.
- Consider no commercial trip limit in Florida, as the commercial sector has not hit its ACL.

5.9.5 South Atlantic Council Choice for Preferred Alternative

5.10 Modify and/or establish recreational bag limits for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

5.10.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had the following recommendations on Action 10:

MOTION: RECOMMEND THE COUNCIL CONSIDER A RECREATIONAL BAG LIMIT FOR THE GA-NC STOCK OF 2 FISH PER PERSON PER DAY (SUB-ALTERNATIVE 2A).
Alternative 2. Establish a recreational bag limit for the GA-NC stock of hogfish in the South Atlantic Region.
Sub-alternative 2a. 2 fish per person per day.
APPROVED BY AP

MOTION: RECOMMEND THE COUNCIL CONSIDER SUB-ALTERNATIVE 3B (2 FISH PER PERSON PER DAY) FOR THE FLK/EFL STOCK OF HOGFISH
Alternative 3. Modify the recreational bag limit for the Florida Keys/East Florida (FLK/EFL) stock of hogfish in the South Atlantic Region.
Sub-alternative 3b. 2 fish per person per day.
APPROVED BY AP

5.10.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.10.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had no recommendations pertaining to modification to the recreational bag limits for either stock.

At their May 3-5, 2018 meeting, the SSC conducted a technical review of the Recreational Decision Tool (see **Appendix L**) developed by the NMFS Southeast Regional Office to analyze the effects of proposed recreational management measures. The SSC had no specific recommendations on management actions.

5.10.4 Public Comments and Recommendations

GA-NC: No opposition to preferred bag limit (2/person/day). Suggestion to establish 5 fish limit currently in place in Florida.

FLK/EFL:

- Consider a 3-fish bag limit or add to snapper aggregate.
- Support for bag limit of 2 per person per day or 2 per vessel per day, whichever is more restrictive.
- Some support for 1 hogfish per person per day.

5.10.5 South Atlantic Council Choice for Preferred Alternative

5.11 Establish a recreational fishing season for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

5.11.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had the following recommendations on Action 11:

MOTION: RECOMMEND THAT THE COUNCIL CONSIDER A SPAWNING SEASON CLOSURE FOR GA-NC (MAY-JUNE) AND KEEP THE CALENDAR YEAR AS THE FISHING YEAR FOR THE RECREATIONAL SECTOR.
APPROVED BY AP

NOTE: *Under "Other Business", the AP approved the following motion regarding the fishing year for hogfish. After the meeting, the AP Chair corroborated the AP's preference for a July 1 start date for both sector.*
MOTION: RECOMMEND THE COUNCIL START THE HOGFISH COMMERCIAL AND RECREATIONAL FISHING YEAR ON JULY 1.
APPROVED BY AP

MOTION: RECOMMEND AN ADDITIONAL SUB-ALTERNATIVE 3C UNDER ACTION 11 FOR A RECREATIONAL SEASON FOR FL HOGFISH MAY 1 THROUGH SEPTEMBER 30.

5.11.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.11.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had no recommendations pertaining to establishment of a recreational season for the FLK/EFL stock of hogfish.

At their May 3-5, 2018 meeting, the SSC conducted a technical review of the Recreational Decision Tool (see **Appendix L**) developed by the NMFS Southeast Regional Office to analyze the effects of proposed recreational management measures. The SSC had no specific recommendations on management actions.

5.11.4 Public Comments and Recommendations

GA-NC:

- The South Atlantic Council should consider a two-month spawning season (May-June) closure for hogfish in the Carolinas (for both sectors) and 500-pound commercial trip limit or no spawning closure and decrease the trip limit to 350 pounds.

FLK/EFL:

- Suggest prohibiting recreational harvest of hogfish during August (lobster mini-season) to reduce discards.
- Suggestion to close recreational harvest of hogfish during June through August.

5.11.5 South Atlantic Council Choice for Preferred Alternative

5.12 Establish commercial and recreational accountability measures (AMs) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish stocks of hogfish

5.12.1 Snapper Grouper AP Comments and Recommendations

The Snapper Grouper AP discussed Amendment 37 at their November 3-4, 2015 meeting in Charleston, South Carolina. The AP had no recommendations on Action 12 at that time.

5.12.2 Law Enforcement AP Comments and Recommendations

The LE AP received an overview of Amendment 37 at their March 7-8, 2016 meeting in Jekyll Island, Georgia. The LE AP had no comments or recommendations.

5.12.3 Scientific and Statistical Committee Comments and Recommendations

The SSC reviewed the results of the SEDAR 37 (2014) stock assessment at their October 28-30, 2014 meeting. The SSC had no recommendations pertaining to modification of accountability measures for either stock.

5.12.4 Public Comments and Recommendations

The public had no comments on accountability measures.

5.12.5 South Atlantic Council Choice for Preferred Alternative

Chapter 6. Cumulative Effects

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

Various approaches for assessing cumulative effects have been identified, including checklists, matrices, indices, and detailed models. The Council on Environmental Quality (CEQ) offers guidance on conducting a Cumulative Effects Analysis (CEA) in a report titled "Considering Cumulative Effects under the National Environmental Policy Act" (CEQ 1997). The report outlines 11 items for consideration in drafting a CEA for a proposed action.

6.1 Biological/Ecological/Socio-economic Effects

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

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

I. The direct and indirect effects of the proposed actions **(Chapter 4)**;

II. Which resources, ecosystems, and human communities are affected **(Chapter 3)**; and

III. Which effects are important from a cumulative effects perspective **(information revealed in this CEA)**.

B. Establish the geographic scope of the analysis.

The immediate impact area would be the federal 200-mile limit of the Atlantic off the coasts of North Carolina, South Carolina, Georgia, and east Florida to Key West, which is also the South Atlantic Fishery Management Council's (South Atlantic Council) area of jurisdiction. Additionally, the area in the Gulf of Mexico, from a line just south of Cape Sable running due west (25^0 09'.000 North Latitude) will be included in the South Atlantic Council's jurisdiction for management of hogfish in the Florida Keys. This will be accomplished by Amendment 43 to the Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico. In light of the available information, the extent of the geographical boundaries for this analysis would depend upon the degree of fish immigration/emigration and larval transport, whichever has the greatest

geographical range. Therefore, the proper geographical boundary to consider effects on the biophysical environment is larger than the entire South Atlantic exclusive economic zone (EEZ). The ranges of affected species are described in **Section 3.2**. The most measurable and substantial effects would be limited to the South Atlantic region.

C. Establish the timeframe for the analysis.

The timeframe for the analysis of cumulative effects is 1983 through the present, and reasonably foreseeable future. Fishery managers implemented the first significant regulations pertaining to hogfish in 1983 through the Snapper Grouper FMP (SAFMC 1983), by including it in the list of species that would be regulated under this FMP. The rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock of hogfish would be complete in 2027.

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

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

Fishery-related actions affecting the snapper grouper species addressed in this amendment

A. Past

The reader is referred to **Appendix C** for past regulatory activity pertaining to all species in the Snapper Grouper FMP. Past regulatory activity for the relevant snapper grouper species in this amendment is listed below.

B. Present

Currently, there are several actions under development affecting the snapper grouper fishery.

The Generic AM and Dolphin Allocation Amendment, which included Amendment 34 to the Snapper Grouper FMP (SAFMC 2015d), modified the accountability measures (AMs) for snapper grouper species and golden crab to make them consistent with AMs already implemented for other species and other fishery management plans (FMP). This amendment became effective on February 22, 2016.

Regulatory Amendment 16 to the Snapper Grouper FMP, which was approved by the South Atlantic Council at their December 2015 meeting, would address the prohibition on the use of black sea bass pots from November through April that was implemented through Regulatory Amendment 19 to the Snapper Grouper FMP (SAFMC 2013c).

Regulatory Amendment 25 to the Snapper Grouper FMP, which was approved by the South Atlantic Council at their December 2015 meeting, considers actions that would adjust the annual

catch limits (ACLs), optimum yield, and commercial and recreational management measures for the blueline tilefish stock, change the fishing year for yellowtail snapper, and increase the recreational bag limit for black sea bass.

Amendment 36 to the Snapper Grouper FMP would establish new special management zones to protect spawning areas for snapper grouper species including speckled hind and warsaw grouper.

Amendment 41 to the Snapper Grouper FMP would revise the biological parameters, catch levels, and management measures for mutton snapper.

C. Reasonably Foreseeable Future

Regulatory Amendment 23 to the Snapper Grouper FMP would modify the start date of the fishing year for the commercial golden tilefish hook-an-line sector, and establish a commercial trip limit for the Jacks complex.

Regulatory Amendment 24 to the Snapper Grouper FMP would revise the composition of the Jacks complex, modify commercial management measures for almaco jack, consider removing size limits for deepwater species (silk snapper, queen snapper, and blackfin snapper), adjust the spawning season closure for shallow water grouper, adjust the minimum size limit for red grouper, and consider a commercial split season for red porgy.

The Comprehensive Ecosystem-Based Amendment 3 contains an action to improve bycatch reporting for the snapper grouper fishery.

A Joint Commercial Logbook Reporting Amendment would require electronic reporting of logbook information by federally-permitted vessels.

The Joint Charter Boat Reporting Amendment would require charter vessels to regularly report their landings information electronically. Including charter boats in the recreational harvest reporting system would further improve the agency's ability to monitor recreational catch rates in-season.

II. Non-Council and other non-fishery related actions, including natural events affecting snapper grouper species in this amendment.

A. Past
B. Present
C. Reasonably foreseeable future

In terms of natural disturbances, it is difficult to determine the effect of non-Council and non-fishery related actions on stocks of snapper grouper species. Annual variability in natural conditions such as water temperature, currents, food availability, predator abundance, etc. can affect the abundance of young fish, which survive the egg and larval stages each year to become juveniles (i.e., recruitment). This natural variability in year class strength is difficult to predict, as it is a function of many interactive and synergistic factors that cannot all be measured (Rothschild 1986). Furthermore, natural factors such as storms, red tide, cold-water upwelling, etc. can affect the survival of juvenile and adult fishes; however, it is very difficult to quantify the magnitude of mortality these factors may have on a stock. Alteration of preferred habitats for snapper grouper species could affect survival of fish at any stage in their life cycles. However, estimates of the abundance of fish, which utilize any number of preferred habitats, as well as determining the impact habitat alteration may have on snapper grouper species, is problematic.

Climate change can impact marine ecosystems through ocean warming by increased thermal stratification, reduced upwelling, sea level rise, increases in wave height and frequency, loss of sea ice, and increased risk of diseases in marine biota. Decreases in surface ocean pH due to absorption of anthropogenic CO_2 emissions may impact a wide range of organisms and ecosystems, particularly organism that absorb calcium from surface waters, such as corals and crustaceans (IPCC 2007, and references therein).

The BP/Deepwater Horizon oil spill event, which occurred in the Gulf of Mexico on April 20, 2010 did not impact fisheries operating the South Atlantic. Oil from the spill site has not been detected in the South Atlantic region, and is not likely to pose a threat to the species addressed in this amendment.

Coastal development projects, including beach fill, channel dredging, and port expansions, can impact hard bottom and coral reef habitats utilized by hogfish. These projects may contribute to a combined cumulative effect on hogfish habitat in this region but the effect they have on the rebuilding plan for the FLK/EFL stock of hogfish proposed in Amendment 37 is uncertain. However, regulatory programs and associated environmental consultations are in place to mitigate impacts of coastal development through avoidance, minimization and compensation measures. Moreover, because the vast majority of coastal development projects occur in state waters the impacts would not be expected to affect the entire habitat for hogfish in South Florida. Furthermore, hogfish in the Gulf of Mexico are not undergoing overfishing and are not overfished, and it is conceivable that larvae from these fish and those in the marine sanctuaries in the Florida Keys area could help the hogfish stock in South Florida.

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

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

withstand stresses of the environmental components. Information on species most affected by this amendment is provided in **Section 3.2** of this document.

Because of regulatory and economic changes that have affected the snapper grouper fishery, any action that restricts economic opportunity may have detrimental social and/or economic effects. The commercial sector of the snapper grouper fishery has seen significant changes in regulatory actions with limited entry, ACLs and associated AMs, and other restrictive measures.

Furthermore, almost all fishermen or businesses with snapper grouper commercial permits also hold at least one (and usually multiple) additional commercial or for-hire permit to maintain the opportunity to participate in other fisheries. Even within the snapper grouper fishery, effort can shift from one species to another due to environmental, economic, or regulatory changes. Overall, changes in management of one species in the snapper grouper fishery can impact effort and harvest of another species (in the snapper grouper fishery or in another fishery) because of multi-fishery participation that is characteristic in the South Atlantic region.

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

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

Protected species and the relation to regulatory thresholds, within the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA), can be found in **Section 3.2**, **Chapter 4**, and **Appendix G** of this document.

Fish populations

This document updates thresholds already specified for hogfish to ensure future overfishing does not occur, and to ensure these stocks can be maintained at sustainable levels. With current AMs in place for hogfish and co-occurring species it is unlikely that these thresholds would be exceeded. If the harvest limits are exceeded, management measures are in place to either restrict further fishing or correct for the overage in the following fishing season. Furthermore, specification of ACLs, AMs, commercial trip limits, recreational bag limits, and fishing seasons considered in this amendment are all intended to prevent overfishing.

Climate change

The Environmental Protection Agency's climate change webpage (http://www.epa.gov/climatechange/) provides basic background information on measured or anticipated effects from global climate change. A compilation of scientific information on climate change can be found in the United Nations Intergovernmental Panel on Climate Change's Fifth Assessment Report (November 2, 2014). Those findings are incorporated here by reference and are summarized. Global climate change can affect marine ecosystems through ocean warming by increased thermal stratification, reduced upwelling, sea level rise, and through increases in wave height and frequency, loss of sea ice, and increased risk of diseases in marine biota. Decreases in surface ocean pH due to absorption of anthropogenic carbon dioxide emissions may affect a wide range of organisms and ecosystems. These influences could negatively affect biological factors such as migration, range, larval and juvenile survival, prey availability, and susceptibility to predators.

In the southeast, general impacts of climate change have been predicted through modeling, with few studies on specific effects to species. Warming sea temperature trends in the southeast have been documented, and animals must migrate to cooler waters, if possible, if water temperatures exceed survivable ranges (Needham et al. 2012). Higher water temperatures may also allow invasive species to establish communities in areas they may not have been able to survive previously. Other potential impacts of climate change to the southeast include increases in hurricanes, decreases in salinity, altered circulation patterns, and sea level rise. The combination of warmer water and expansion of salt marshes inland with sea-level rise may increase productivity of estuarine-dependent species in the short term. However, in the long term, this increased productivity may be temporary because of loss of fishery habitats due to wetland loss (Kennedy et al. 2002). Actions from this amendment are not expected to contribute to climate change through the increase of carbon emissions associated with fishing activities.

Protected resources

The effects of the actions in this amendment and their relation to regulatory thresholds, within the ESA and MMPA, can be found in **Sections 3.2**, **Chapter 4**, and **Appendix G** of this document.

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

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

reference points for the species. The baseline condition for the resources, ecosystems, and human communities can be found in **Chapter 3.**

The cumulative social and economic effects of past, present, and future amendments may be described as limiting fishing opportunities in the short-term, with some exceptions of actions that alleviate some negative social and economic impacts. The intent of these amendments is to improve prospects for sustained participation in the respective fisheries over time and the proposed actions in this amendment are expected to result in some important long-term benefits to the commercial and for-hire fishing fleets, fishing communities and associated businesses, and private recreational anglers. The proposed changes in this amendment that could affect access to several important species in the South Atlantic region may contribute to changes in the snapper grouper fishery within the context of the current economic and regulatory environment at the local and regional level.

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

The cause and effect relationship of fishing and regulatory actions for hogfish is shown in **Table 6.1**.

Table 6.1. The cause and effect relationship of fishing and regulatory actions within the time period of the Cumulative Effects Analysis (CEA).

Time period/dates	Cause	Observed and/or Expected Effects
August 31, 1983	4" trawl mesh; established minimum size limits for several species; limitations on harvest and gear; (Snapper Grouper FMP; SAFMC 1983)	Prevent growth overfishing in 13 snapper grouper species.
January 12, 1989	Prohibited trawls (Snapper Grouper Amendment 1; SAFMC 1989).	Prevent damage to habitat and harvest of undersized snapper grouper species.
January 1, 1992	Prohibited gear: fish traps south of Cape Canaveral, FL; entanglement nets; longline gear inside of 50 fathoms; powerheads and bangsticks in designated SMZs off SC. Size/Bag limits: 10" TL vermilion snapper (recreational only); 12" TL vermilion snapper (commercial only); 10 vermilion snapper/person/day; aggregate grouper bag limit of 5/person/day; and 20" TL gag, red, black, scamp, yellowfin, and yellowmouth grouper size limit (Snapper Grouper Amendment 4; SAFMC 1991).	Reduce mortality of snapper grouper species.
June 27, 1994	*Oculina* Experimental closed area; commercial quotas for snowy grouper, golden tilefish, commercial trip limits for snowy grouper, golden tilefish, speckled hind, and warsaw grouper,	Conserve overfished stocks of stocks of snapper grouper species and rebuild snapper grouper resources.

Time period/dates	Cause	Observed and/or Expected Effects
	prohibit sale of warsaw grouper and speckled hind (Snapper Grouper Amendment 6; SAFMC 1993).	
January 23, 1995	**Established a minimum size limit of 12" FL for Hogfish**, 16" TL for mutton snapper; 12" TL for blackfin, cubera, dog, gray, mahogany, queen schoolmaster, silk, and yellowtail snappers, and red porgy; powerheads prohibited in the EEZ off South Carolina; required dealer, charter, and headboat federal permits (Snapper Grouper Amendment 7; SAFMC, 1995a).	Management measures implemented to prevent overfishing and rebuild snapper grouper resources. Hogfish was thought to be overfished, but data were insufficient to determine status.
May 1995	**Recreational bag limit of 5 hogfish per person off Florida**, 2 cubera per person for fish 30" TL or larger off Florida, and minimum size limit of 12" for gray triggerfish off Florida (Snapper Grouper Regulatory Amendment 6; SAFMC 1995b).	Prevent overfishing of hogfish, gray triggerfish, and cubera snapper.
December 14, 1998	Limited entry program for snapper grouper species; transferable permits and 225-lb permits (Snapper Grouper Amendment 8; SAFMC 1997).	Prevent overfishing, reduce over-capacity, minimize gear and area conflicts, promote efficient utilization of the resource, minimize habitat damage, and provide a flexible management system for the snapper grouper resource.
December 2, 1999	**MSY proxy for hogfish at 30% SPR; OY proxy for hogfish at 40% static SPR**; identify and define fishing communities; and address bycatch management measures (Snapper Grouper Amendment 11; SAFMC 1999).	Prevent overfishing and rebuild overfished snapper grouper species by making definitions of MSY, OY, overfishing, and overfished status consistent with National Standard Guidelines.
November 15, 2000	Established 12 special management zones (SMZs) at artificial reefs off Georgia; revised boundaries of 7 existing SMZs off Georgia to meet CG permit specs; restricted fishing in new and revised SMZs (Snapper Grouper Regulatory Amendment 8; SAFMC 2000).	Effective use of snapper grouper resource on and around SMZs and artificial reefs.
April 26, 2004	Extended for an indefinite period the regulation prohibiting fishing for and possessing snapper grouper species within the *Oculina* Experimental Closed Area (Snapper Grouper FMP Amendment 13A; SAFMC 2004)	Enhance stock stability and increase recruitment of snapper grouper species.
February 12, 2009	Established eight deepwater Type II marine protected areas (MPAs) where fishing for or possession of snapper	Protect a portion of the population and habitat of long-lived, slow growing, deepwater snapper grouper species

Time period/dates	Cause	Observed and/or Expected Effects
	grouper species are prohibited (Snapper Grouper FMP Amendment 14; SAFMC 2009a).	from fishing pressure to achieve a more natural sex ratio, age, and size structure within the MPAs.
July 29, 2009	Required dehooking devices for releasing snapper grouper species; increase the length of the spawning season closure, and reduce overall harvest of gag and vermilion snapper (Snapper Grouper FMP Amendment 16; SAFMC 2009b).	Protect spawning aggregations of snapper grouper species in spawning condition; and end overfishing of gag and vermilion snapper.
July 22, 2010	Provided presentation of spatial information for EFH and EFH-HAPC designations under the Snapper Grouper FMP; designated deepwater coral HAPCs (Comprehensive Ecosystem Based Amendment 1, Snapper Grouper Amendment 19; SAFMC 2009c).	Protect habitat for snapper grouper species.
March 3, 2011	Required use of non-stainless steel circle hooks when fishing for snapper grouper species with hook-and-line gear north of 28 deg. N latitude in the South Atlantic EEZ (Snapper Grouper Amendment 17A; SAFMC 2010	Reduce discard and bycatch mortality in snapper grouper species.
April 16, 2012	**MSA mandate to establish ACLs and AMs for species managed by the council that are not undergoing overfishing, including hogfish**. **Commercial ACL for hogfish in commercial sector: 48,772 lb ww; recreational ACL for hogfish in recreational sector: 98,866 lb ww.** (Comprehensive ACL Amendment, Snapper Grouper Amendment 25; SAFMC 2011a)	Prevent overfishing while maintaining catch levels consistent with achieving OY for the snapper grouper resource.
July 17, 2013	**Revised the acceptable biological catch estimates, ACL, and recreational annual catch targets for unassessed snapper grouper species including hogfish; commercial ACL for hogfish: 49,469 lb ww; recreational ACL for hogfish in recreational sector: 85,355 lb ww.** The recreational data collection system has changed from MRFSS to MRIP. (Snapper Grouper Regulatory Amendment 13; SAFMC 2013c).	Ensure that the ACLs are based on the best scientific information available, and to prevent unnecessary negative socio-economic impacts to participants in the snapper grouper fishery and fishing community.
January 27, 2014	Required headboat vessels fishing in the South Atlantic for snapper grouper, dolphin and wahoo, and coastal migratory pelagics to submit weekly electronic fishing records (Generic	Ensure timelier fishing information from headboats to better monitor recreational ACLs, improve stock assessments, and to help obtain 100% compliance with

Time period/dates	Cause	Observed and/or Expected Effects
	Headboat Reporting Amendment, Snapper Grouper Amendment 31; SAFMC 2013).	reporting in South Atlantic fisheries.
August 7, 2014	Created a single dealer permit that would allow the holder to first receive any of the species managed under the eight FMPs; submit forms online on a weekly basis (Generic Dealer Amendment, Gulf of Mexico Fishery Management Council 2013)	Ensure timelier purchase information from dealers to better monitor ACLs and achieve OY in eight FMPs in the South Atlantic (including Snapper Grouper) and the Gulf of Mexico.
November 6, 2014	Modified the definition of the overfished threshold for red snapper, blueline tilefish, gag, black grouper, yellowtail snapper, vermilion snapper, red porgy, and greater amberjack (Snapper Grouper Regulatory Amendment 21; SAFMC 2014)	Prevent snapper grouper species from being designated as overfished when small drops in biomass are due to natural variation in recruitment or other environmental variables such as storms, and extreme water temperatures, and to ensure that rebuilding plans are applied to stocks only when truly appropriate.
July 1, 2015	Updated the South Atlantic Council's ABC control rule to incorporate methodology for determining the ABC of unassessed species, adjusted ABCs for fourteen unassessed snapper-grouper species, adjust ACLs and ACTs for three species complexes and four snapper-grouper species based on revised ABCs, modified management measures for gray triggerfish (Snapper Grouper Amendment 29; SAFMC 2015a)	Ensure ACLs and management measures for select snapper grouper species are using the best scientific information available.
December 28, 2015	Revised regulations for snapper grouper species, dolphin, and wahoo harvested lawfully in the Bahamas and brought into U.S. federal waters (Dolphin Wahoo Amendment 7 and Snapper Grouper Amendment 33; SAFMC 2015b)	Ensure consistency in regulations for snapper grouper species, dolphin, and wahoo, and assist law enforcement.
February 22, 2016	Modified AMs for snapper grouper species and golden crab, and adjusted sector allocations for dolphin (Generic Accountability Measures and Dolphin Allocation Amendment, Snapper Grouper Amendment 34; SAFMC 2016)	Ensure consistent AMs for snapper grouper species and golden crab, and revise allocations for dolphin to prevent overfishing.

9. Determine the magnitude and significance of cumulative effects.

Amendment 37 alone would not result in significant cumulative impacts on the snapper grouper fishery since there are 48 other species that fishers can harvest besides hogfish. The overall cumulative social and economic effects would be associated with decreased fishing

opportunities for hogfish, especially in the FLK/EFL region, which would be expected to result in adverse effects in the short-term, but result in beneficial effects in the long-term, as the stock rebuilds. Actions in Amendment 37 that address the hogfish segment of the snapper grouper fishery, together or separately, are not expected to result in significant cumulative adverse biological effects, since a rebuilding plan will be implemented for the FLK/EFL stock of hogfish. Furthermore, management measures such as increasing the minimum size limit, commercial trip limit, recreational bag limit, and a fishing season are all designed to minimize significant adverse effects to the human environment. All of the proposed, or recently implemented management actions affecting hogfish within the snapper grouper fishery, are intended to improve management of the snapper grouper resource, while minimizing, to the maximum extent practicable adverse social and economic impacts. The actions in Amendment 37 are expected to establish a rebuilding plan in place for the FLK/EFL stock of hogfish to increase its biomass back to sustainable levels by 2027.

The actions in Amendment 37 are not likely to result in direct, indirect, or cumulative adverse effects to unique areas, such as significant scientific cultural, or historical resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas as the proposed action is not expected to substantially increase fishing effort or the spatial and/or temporal distribution of current fishing effort within the South Atlantic region. The USS Monitor, Gray's Reef, and Florida Keys National Marine Sanctuaries are within the boundaries of the South Atlantic EEZ. The proposed actions are not likely to cause loss or destruction of the resources found within the national marine sanctuaries.

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

The cumulative adverse effects on the biophysical environment are expected to be negligible. Hogfish are harvested using hook-and-line gear and by spear, both of these gear types are associated with minimal damage to the biophysical environment. Mitigation is not necessary for the successful implementation of the proposed actions in this amendment.

11. Monitor the cumulative effects of the selected alternatives and adopt management.

The effects of the proposed actions are, and will continue to be, monitored through collection of data by the NMFS, states, stock assessments and stock assessment updates, life history studies, and other scientific observations. A framework procedure is already in place (Amendment 27 to the Snapper Grouper FMP) that will allow future adjustments to ACLs, AMs, and management measures for hogfish in a timely manner, based on new scientific information such as another stock assessment. A comparison of the alternatives for each action in Amendment 37 can be found in **Chapter 2** and details of the environmental consequences of each action can be found in **Chapter 4**.

Chapter 7. List of Preparers

Name	Agency/Division	Title
Myra Brouwer	SAFMC	Interdisciplinary plan team (IPT) Lead/Fishery Biologist
Nikhil Mehta	SERO/SF	IPT Lead/Fishery Biologist
Rick DeVictor	SERO/SF	IPT Co-lead/South Atlantic Branch Chief
Jennifer Lee	SERO/PR	Fishery Biologist
Brian Cheuvront	SAFMC	Deputy Director for Management
Mike Errigo	SAFMC	Data analyst
Chip Collier	SAFMC	Biologist
David Dale	SERO/HC	EFH Specialist
Adam Bailey	SERO	Technical Writer and Editor
Nick Farmer	SERO	Biologist
Mike Larkin	SERO	Biologist
David Records	SERO/SF	Economist
Mike Jepson	SERO/SF	Social Scientist
Noah Silverman	NMFS/SER	Regional NEPA Coordinator
Monica Smit-Brunello	NOAA GC	General Counsel
Mark Fields	NOAA OLE	Criminal Investigator
Jack McGovern	SERO/SF	Assistant Regional Administrator
Kari McLauchlin	SAFMC	Social Scientist
Gregg Waugh	SAFMC	Executive Director

List of Interdisciplinary Plan Team (IPT) Members

Name	Agency/Division	Title
Myra Brouwer	SAFMC	Interdisciplinary plan team (IPT) Lead/Fishery Biologist
Nikhil Mehta	SERO/SF	IPT Lead/Fishery Biologist
Rick DeVictor	SERO/SF	IPT Co-lead/South Atlantic Branch Chief
Jennifer Lee	SERO/PR	Fishery Biologist
Brian Cheuvront	SAFMC	Deputy Director for Management
Mike Errigo	SAFMC	Data analyst
Chip Collier	SAFMC	Biologist
Kate Siegfried	SEFSC	Research Fish Biologist
David Dale/Pace Wilber	SERO/HC	EFH Specialist
Adam Bailey	SERO	Technical Writer and Editor
Nick Farmer	SERO	Biologist
Mike Larkin	SERO	Biologist
David Records	SERO/SF	Economist
Mike Jepson	SERO/SF	Social Scientist
Noah Silverman	NMFS/SER	Regional NEPA Coordinator
Mark Fields	NOAA OLE	Criminal Investigator
Monica Smit-Brunello	NOAA GC	General Counsel
Larry Perruso	SEFSC	Economist
Jack McGovern	SERO/SF	Assistant Regional Administrator
Kari McLauchlin	SAFMC	Social Scientist
Gregg Waugh	SAFMC	Executive Director

NMFS = National Marine Fisheries Service, SAFMC = South Atlantic Fishery Management Council, SF = Sustainable Fisheries Division, PR = Protected Resources Division, SERO = Southeast Regional Office, HC = Habitat Conservation Division, GC = General Counsel

Chapter 8. List of Agencies, Organizations and Persons to whom a Copy of the EIS was Sent

National Marine Fisheries Service
- Southeast Fisheries Science Center
- Southeast Regional Office
- Office for Law Enforcement

NOAA General Counsel
Environmental Protection Agency
United States Coast Guard
United States Fish and Wildlife Services
United States Department of Interior
United States Department of State
Marine Mammal Commission
United States Coast Guard
Florida Fish and Wildlife Conservation Commission
Georgia Department of Natural Resources
South Carolina Department of Natural Resources
North Carolina Division of Marine Fisheries

Chapter 9. References

Adams, W.F., and C. Wilson. 1995. The status of the smalltooth sawfish, *Pristis pectinata* Latham 1794 (Pristiformes: Pristidae) in the United States. Chondros 6(4):1-5.

Anderes Alvarez, B.A., and I. Uchida. 1994. Study of the Hawksbill turtle (*Eretmochelys imbricata)* stomach content in Cuban waters. *In*: Study of the Hawksbill turtle in Cuba (I), Ministry of Fishing Industry, Cuba.

Ault, J.S., S.G. Smith, G.A. Diaz, and E. Franklin. 2003. Florida Hogfish Fishery Stock Assessment. Florida Marine Research Institute Final Report No. FFWCC S 7701 617573.

Berkson, J., L. Barbieri, S. Cadrin, S. L. Cass-Calay, P. Crone, M. Dorn, C. Friess, D. Kobayashi, T. J. Miller, W. S. Patrick, S. Pautzke, S. Ralston, and M. Trianni. 2011. Calculating Acceptable Biological Catch for Stocks That Have Reliable Catch Data Only (Only Reliable Catch Stocks – ORCS). NOAA Technical Memorandum NMFS-SEFSC-616, 56 p.

Bigelow, H.B., and W.C. Schroeder. 1953. Sawfishes, guitarfishes, skates and rays, pp. 1-514. *In:* Tee-Van, J., C.M Breder, A.E. Parr, W.C. Schroeder and L.P. Schultz (eds). Fishes of the Western North Atlantic, Part Two. Mem. Sears Found. Mar. Res. I.

Bjorndal, K.A. 1980. Nutrition and grazing behavior of the green sea turtle, *Chelonia mydas*. Marine Biology 56:147.

Bjorndal, K.A. 1997. Foraging ecology and nutrition of sea turtles. *In*: Lutz, P.L. and J.A. Musick (eds.), The Biology of Sea Turtles. CRC Press, Boca Raton, Florida.

Blue Ocean Institute. 2010. The blue ocean institute guide to ocean friendly seafood. http://www.blueocean.org/files/Seafood_Guide.pdf

Bolten, A.B., and G.H., Balazs. 1995. Biology of the early pelagic stage – the "lost year." *In*: Bjorndal, K.A. (ed.), Biology and Conservation of Sea Turtles, Revised edition. Smithsonian Institute Press, Washington, D.C., 579.

Brongersma, L.D. 1972. European Atlantic Turtles. Zool. Verhand. Leiden, 121:318

Burke, V.J., E.A. Standora, and S.J. Morreale. 1993. Diet of juvenile Kemp's ridley and loggerhead sea turtles from Long Island, New York. Copeia, 1993, 1176.

Byles, R.A. 1988. Behavior and Ecology of Sea Turtles from Chesapeake Bay, Virginia. Ph.D. dissertation, College of William and Mary, Williamsburg, VA.

Carr, A. 1986. Rips, FADS, and little loggerheads. BioScience 36:92.

Carr, A. 1987. New perspectives of the pelagic stage of sea turtle development. Conservation Biology 1(2):103.

Carter, D.W. and C. Liese. 2012. The Economic Value of Catching and Keeping or Releasing Saltwater Sport Fish in the Southeast USA. North American Journal of Fisheries Management, 32:4, 613-625. http://dx.doi.org/10.1080/02755947.2012.675943

CEQ (Council on Environmental Quality). 1997. Considering Cumulative Effects Under the National Environmental Policy Act. U.S. Council on Environmental Quality, Washington, DC. 64 pp.

Claro, R., A. Garcia-Cagide and R. Fernández de Alaiz. 1989. Caracteristicas biológicas del pez perro, *Lachnolaimus maximus* (Walbaum), en el golfo de Batabanó, Cuba. Revista Investigaciones Marinas 10: 239-252.

Colburn, L.L. and M. Jepson. 2012. Social Indicators of Gentrification Pressure in Fishing Communities: A Context for Social Impact Assessment. Coastal Management 40(3): 289-300.

Colin, P.L. 1982. Spawning and larval development of the hogfish, *Lachnolaimus maximus* (Pisces: Labridae). Fishery Bulletin, U. S. 80 (4): 853-862.

Collins A. and R. McBride. 2008. Final report for integrating life history, mating system, fishing effects, and habitat of hogfish, *Lachnolaimus maximus*, a harem spawning fish in the southeast U.S. FWRI File Code F2541-05-07-F.

Collins, A.B. and R.S. McBride. 2011. Demographics by depth: Spatially explicit life-history dynamics of a protogynous reef fish. Fishery Bulletin, U. S., 109, 232–242.

Davis, J.C. 1976. Biology of the hogfish, *Lachnolaimus maximus* (Walbaum), in the Florida Keys. M. S. Thesis. University of Miami. Coral Gables, FL. 86 pp.

Eckert, S.A., D.W. Nellis, K.L. Eckert, and G.L. Kooyman. 1986. Diving patterns of two leatherback sea turtles (*Dermochelys coriacea*) during interesting intervals at Sandy Point, St. Croix, U.S. Virgin Islands. Herpetologica 42:381.

Eckert, S.A., K.L. Eckert, P. Ponganis, and G.L. Kooyman. 1989. Diving patterns of two leatherback sea turtles (*Dermochelys coriacea*). Canadian Journal of Zoology 67:2834.

Florida Marine Species Rule. FWCC Rule No. 68-42.001, accessed at: https://www.flrules.org/gateway/chapterhome.asp?chapter=68B-42

Frick, J. 1976. Orientation and behavior of hatchling green turtles (*Chelonia mydas*) in the sea. Animal Behavior 24:849.

Garrity-Blake, B. & B. Nash. 2012. An Inventory of North Carolina Fish Houses: Five-Year Update. A North Carolina Sea Grant Report. UNC-SG-12-06. 42 pp.

GMFMC (Gulf of Mexico Fishery Management Council) & SAFMC (South Atlantic Fishery Management Council). 2013a. Joint South Atlantic/Gulf of Mexico Generic Charter/Headboat Reporting in the South Atlantic. Amendment 31 to the Snapper Grouper FMP with Final Environmental Assessment, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

GMFMC (Gulf of Mexico Fishery Management Council) & SAFMC (South Atlantic Fishery Management Council). 2013b. Generic Amendment to the fishery management plans for the Gulf of Mexico and South Atlantic Regions for Modifications to Federally Permitted Seafood Dealer Reporting Requirements. South Atlantic Fishery Management Council 4055 Faber Place Drive, Suite 201; North Charleston, South Carolina 29405.

Haab, T., Hicks, R. L., Schnier, K., Whitehead, J. C. 2012. Angler heterogeneity and the species-specific demand for marine recreational fishing. Working Paper No. 10-02. Appalachian State University, Department of Economics. Available: http://econ.appstate.edu/marfin/. (September 2014).

Hughes, G.R. 1974. The sea turtles of southeast Africa. II. The biology of the Tongaland loggerhead turtle *Caretta caretta* L. with comments on the leatherback turtle *Dermochelys coriacea* L. and green turtle *Chelonia mydas* L. in the study region. Oceanographic Research Institute (Durban) Investigative Report. No. 36.

IPCC (Intergovernmental Panel on Climate Change). 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

IPCC (Intergovernmental Panel on Climate Change). 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

Jepson, M., K. Kitner, A. Pitchon, W.W. Perry, and B. Stoffle. 2005. Potential fishing communities in the Carolinas, Georgia, and Florida: An effort in baseline profiling and mapping. NOAA Technical Report (available at http://sero.nmfs.noaa.gov/sf/socialsci/pdfs/SA%20Fishing%20Community%20Report.pdf)

Jepson, M. and L.L. Colburn. 2013. Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. Southeast and Northeast Regions. U.S. Dept. of Commerce., NOAA Technical Memorandum NMFS-F/SPO-129, 64 p.

Keinath, J.A., and J.A., Musick. 1993. Movements and diving behavior of a leatherback sea turtle, *Dermochelys coriacea*. Copeia 1993:1010.

Kennedy, V. S., R. R. Twilley, J. A. Kleypas, J. H. Cowan, Jr., S. R. Hare. 2002. Coastal and Marine Ecosystems & Global Climate Change: Potential Effects on U.S. Resources. Pew Center on Global Climate Change. 52 p.

Lanyan, J.M., C.J. Limpus, and H., Marsh. 1989. Dugongs and turtles: grazers in the seagrass system. *In:* Larkum, A.W.D, A.J., McComb and S.A., Shepard (eds.) Biology of Seagrasses. Elsevier, Amsterdam, 610.

Limpus, C.J., and N., Nichols. 1988. The southern oscillation regulates the annual numbers of green turtles (*Chelonia mydas*) breeding around northern Australia. Australian Journal of Wildlife Research 15:157.

Limpus, C.J., and N., Nichols. 1994. Progress report on the study of the interaction of El Niño Southern Oscillation on annual *Chelonia mydas* numbers at the southern Great Barrier Reef rookeries. *In:* Proceedings of the Australian Marine Turtle Conservation Workshop, Queensland Australia.

Lutz, P.L., and J.A., Musick (eds.). 1997. The Biology of Sea Turtles. CRC Press, Boca Raton, Florida.

Lutz, P.L., J.A., Musick, and J. Wyneken. 2002. The Biology of Sea Turtles, Volume II. CRC Press, Boca Raton, Florida.

MacIntyre, I.G. and J.D. Milliman. 1970. Physiographic features on the outer shelf and upper slope, Atlantic Continental Margin, southeastern United States. Geological Society of America Bulletin 81:2577-2598.

Márquez -M, R.1994. Synopsis of biological data on the Kemp's ridley turtles, *Lepidochelys kempii* (Garman, 1880). NOAA Technical Memo, NMFS-SEFSC-343. Miami, FL.

McBride, R.S. and Johnson, M.R. 2007. Sexual development and reproductive seasonality of hogfish (Labridae: *Lachnolaimus maximus*), an hermaphroditic reef fish. Journal of Fish Biology 71:1270-1292.

McBride, R.S., P.E. Thurman, and L.H. Bullock. 2008. Regional variations of hogfish (*Lachnolaimus maximus*) life history: Consequences for spawning biomass and egg production models. J. Northw. Atl. Fish. Sci. 41:1–12.

Mendonca, M.T., and P.C.H., Pritchard. 1986. Offshore movements of post-nesting Kemp's ridley sea turtles (*Lepidochelys kempi*). Herpetologica 42:373.

Meylan, A. 1984. Feeding Ecology of the Hawksbill turtle (*Eretmochelys imbricata)*: Spongivory as a Feeding Niche in the Coral Reef Community. Dissertation, University of Florida, Gainesville, FL.

Meylan, A. 1988. Spongivory in hawksbill turtles: a diet of glass. *Science* 239:393-395.

Meylan, A.B., and M. Donnelly. 1999. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata)* as critically endangered on the 1996 IUCN Red List of Threatened Animals. Chelonian Conservation and Biology 3(2): 200-204.

Miller, G.C. and W.J. Richards. 1979. Reef fish habitat, faunal assemblages and factors determining distributions in the South Atlantic Bight. Proceedings of the Gulf and Caribbean Fisheries Institute 32:114-130.

Mortimer, J.A. 1981. The feeding ecology of the West Caribbean green turtle (*Chelonia mydas*) in Nicaragua. Biotropica 13:49.

Mortimer, J.A. 1982. Feeding ecology of sea turtles. *In*: Bjorndal, K.A. (ed.), Biology and Conservation of Sea Turtles. Smithsonian Institute Press, Washington, D.C.

Muñoz, R.C., M.L. Burton, K.J. Brennan, and R.O. Parker. 2010. Reproduction, habitat utilization, and movements of hogfish (*Lachnolaimus maximus*) in the Florida Keys, U.S.A.: comparisons from fished versus unfished habitats. Bull. Mar. Sci. 86:93–116.

Needham, H., D. Brown, and L. Carter. 2012. Impacts and adaptation options in the Gulf coast. Report prepared for the Center for Climate and Energy Solutions. 38 pp. http://www.c2es.org/docUploads/gulf-coast-impacts-adaptation.pdf

Newton J.G., O.H. Pilkey, and J.O. Blanton. 1971. An Oceanographic Atlas of the Carolina and continental margin. North Carolina Dept. of Conservation and Development. 57 p.

NMFS (National Marine Fisheries Service). 2006. Endangered Species Act section 7 consultation on the Continued Authorization of Snapper-Grouper Fishing under the South Atlantic Snapper-Grouper Fishery Management Plan (RFFMP) and Proposed Amendment 13C. Biological Opinion. June 7.

NMFS (National Marine Fisheries Service). 2011b. Fisheries Economics of the United States, 2009. U.S. Department of Commerce, NOAA Technical Memorandum. National Marine Fisheries Service-F/SPO-118. http://www.st.nmfs.noaa.gov/st5/publication/fisheries_economics_2009.html

Norman, J. R., and F. C.. Fraser. 1938. Giant Fishes, Whales and Dolphins. W. W. Norton and Company, Inc, New York, NY. 361 pp.

Ogren, L.H. 1989. Distribution of juvenile and subadult Kemp's ridley turtles: Preliminary results from the 1984-1987 surveys. *In*: C.W. Caillouet Jr. and A.M. Landry Jr. (eds.) Proceedings from the 1st Symposium on Kemp's ridley Sea Turtle Biology, Conservation, and Management. Sea Grant College Program, Galveston, TX. 116.

Paredes, R.P. 1969. Introduccion al Estudio Biologico de *Chelonia mydas agassizi* en el Perfil de Pisco, Master's thesis, Universidad Nacional Federico Villareal, Lima, Peru.

Parker, R.O., D.R. Colby, and T.D. Willis. 1983. Estimated amount of reef habitat on a portion of the U.S. South Atlantic and Gulf of Mexico Continental Shelf. Bulletin of Marine Science 33:935-940.

Randall, J.A. and G.L. Warmke. 1967. The food habits of the hogfish (*Lachnolaimus maximus*), a labrid fish from the western Atlantic. Caribbean Journal of Science. 7: 141-144.

Restrepo, V.R., G.G. Thompson, P.M. Mace, W.L. Gabriel, L.L. Low, A.D. MacCall, R.D. Methot, J.E. Powers, B.L. Taylor, P R. Wade, and J.F. Witzig. 1998. Approaches to Implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-## Available at: http://www.nmfs.noaa.gov/sfa/NSGtkgd.pdf

Rothschild, B.J. 1986. Dynamics of Marine Fish Populations. Harvard University Press. Cambridge, Massachusetts. 277pp.

SAFMC (South Atlantic Fishery Management Council). 1983. Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 1998. Amendment 11 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 2008a. Amendment 15A, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2008b. Amendment 15B, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2009a. Amendment 16, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2009b. Fishery Ecosystem Plan for the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2010a. Amendment 17A, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2010b. Amendment 17B, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2010c. Comprehensive Ecosystem Based Amendment 1 (Amendment 19 to the Snapper Grouper FMP). South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2011a. Comprehensive Annual Catch Limit Amendment for the South Atlantic Region with Final Environmental Impact Statement, Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2011b. Amendment 24 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2011c. Comprehensive Ecosystem Based Amendment 2, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. (Amendment 23 to the Snapper Grouper FMP). South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2013a. Amendment 18B to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Assessment, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2013b. Regulatory Amendment 15 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Assessment, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2013c. Regulatory Amendment 19 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Assessment, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2014a. Amendment 27 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Assessment, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2014b. Regulatory Amendment 14, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2014c. Amendment 32, with Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2015a. Amendment 29, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2015b. Regulatory Amendment 22, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2015c. Regulatory Amendment 20, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2015d. Amendment 34, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the

Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

Seafood Watch Program. 2010. Monterey Bay Aquarium. http://www.seafoodwatch.org.

SEDAR (Southeast Data, Assessment and Review) 6. 2004. Florida Hogfish. Ault, J.S., Steven G. Smith, G.A. Diaz and E. Franklin. Florida Marine Research Institute, Florida Fish & Wildlife Conservation Commission, 100 Eighth Avenue S.E., St. Petersburg, Florida 33701. Available at: sedarweb.org

SEDAR (Southeast Data, Assessment and Review) 37. 2014. South Atlantic and Gulf of Mexico Hogfish. SEDAR, 4055 Faber Place Drive, Suite 201; North Charleston, SC 29405. Available at: sedarweb.org

Seyoum S., A.B. Collins, C. Puchulutegue, R.S. McBride, and M.D. Tringali. 2015. Genetic population structure of hogfish (Labridae: *Lachnolaimus maximus*) in the southeastern United States. Fishery Bulletin 113:442–455.

Shaver. D.J. 1991. Feeding ecology of wild and head-started Kemp's ridley sea turtles in south Texas waters. Journal of Herpetology 25:327.

Simpfendorfer, C.A. 2001. Essential habitat of the smalltooth sawfish, *Pristis pectinata*. Report to the National Fisheries Service's Protected Resources Division. Mote Marine Laboratory, Technical Report (786) 21pp.

Simpfendorfer, C.A. and T.R. Wiley. 2004. Determination of the distribution of Florida's remnant sawfish population, and identification of areas critical to their conservation. Mote Marine Laboratory, Technical Report July 2, 2004, 37 pp.

Soma, M. 1985. Radio biotelemetry system applied to migratory study of turtle. Journal of the Faculty of Marine Science and Technology, Tokai University, Japan, 21:47.

Standora, E.A., J.R., Spotila, J.A., Keinath, and C.R. Shoop. 1984. Body temperatures, diving cycles, and movements of a subadult leatherback turtle, *Dermochelys coriacea*. Herpetologica 40:169.

Thayer, G.W., K.A., Bjorndal, J.C., Ogden, S.L., Williams, and J.C., Zieman. 1984. Role of large herbivores in seagrass communities. Estuaries 7:351.

Thompson, K. and T. Switzer. 2015. Habitiat use and niche overlap of nearshore reef fish associated with seagrass habitats in the eastern Gulf of Mexico. 145th Annual Meeting of the American Fisheries Society. Portland, Oregon.

Van Dam, R., and C. Diéz. 1998. Home range of immature hawksbill turtles (*Eretmochelys imbricata*) at two Caribbean islands. Journal of Experimental Marine Biology and Ecology 220(1):15-24.

Walker, T.A. 1994. Post-hatchling dispersal of sea turtles. p. 79. *In*: Proceedings of the Australian Marine Turtle Conservation Workshop, Queensland Australia.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, (eds). 2013. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2012. U.S. Department of Commerce, Woods Hole, MA.

Witzell, W.N. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): suggested changes to the life history model. Herpetological Review 33(4):266-269.

Wynne, K. and M. Schwartz. 1999. Guide to marine mammals and turtles of the U.S. Atlantic and Gulf of Mexico. Rhode Island Sea Grant, Narragansett. 115pp.

Chapter 10. Index

Acceptable Biological Catch (ABC), 2, 3, 18, 19, 26, 27, 99, 100, 110
Accountability Measures, 1, 5, 210, 15
Administrative impacts, 111
Annual Catch Limits (ACLs), 2, 3, 5, 18, 19, 26, 27, 89, 99, 114, 174, 186, 190
annual catch target (ACT), 30, 3
Atlantic States Marine Fisheries Commission (ASMFC), 84, 85
Biological effects, 219
Bycatch, XI, 55, 88, 92, 96, 104, 143, 156, 1, 2, 1, 3, 4, 6, 7
climate change, 206, 3, 6, 9
Council, 31, 2
Cumulative Effects Analysis (CEA), 207
discards, 58, 92, 96, 104, 111, 119, 127, 143, 156, 164, 166, 171, 176, 1, 2, 3, 2, 4, 5, 6, 7, 8, 9, 10
Endangered Species Act (ESA), 56, 156, 164, 205, 2
environmental justice (EJ), 82
Essential fish habitat (EFH), 51
Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPCs), 51
exclusive economic zone, I, 56, 202, 1, 8, 2
final environmental impact statement, I
Fisheries, 31, 219, 223
Florida Fish and Wildlife Conservation Commission, II, 1, 3, 85, 214, 1
hogfish, 1, II, 1, 2, 3, 1, 3, 5, 7, 8, 9, 10, 12, 13, 14, 15, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 36, 37, 38, 39, 41, 42, 43, 45, 46, 47, 54, 55, 61, 62, 63, 64, 65, 66, 68, 69, 70, 72, 73, 74, 75, 76, 77, 78, 80, 82, 84, 87, 88, 89, 91, 92, 93, 94, 97, 99, 100, 101, 102, 104, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 120, 122, 123, 124, 125, 126, 127, 128, 129, 131, 132, 133, 134, 136, 138, 139, 140, 141, 142, 143, 146, 147, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 164, 166, 168, 171, 174, 175, 176, 201, 202, 205, 207, 208, 209, 210, 211, 216, 218, 219, 220, 1, 2, 3, 4, 16, 1, 2, 1, 7, 12, 13, 1, 3, 4
Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), 16, 51, 84, 94, 1
Marine Mammal Protection Act, I, 56, 205, 7, 6
Marine Recreational Information Program, I, 10, 66, 68, 1
maximum fishing mortality threshold (MFMT), 6, 95, 7
maximum sustainable yield (MSY), 2, 3, 6, 2
minimum stock size threshold (MSST), 2, 3, 4, 7, 2
National Environmental Policy Act, I, II, 7, 4
National Marine Fisheries Service, I, II, 1, 10, 55, 59, 89, 213, 219, 4, 13, 14, 1, 2, 1
National Oceanic and Atmospheric Administration, 1, I, 1, 4
National Standard 1 Guidelines, 6
NMFS Office for Law Enforcement, 86
Only Reliable Catch Stocks (ORCS), 1, 3
Optimum Yield (OY), 2, 3, 101, 114, 4
overfished, II, 1, 3, 15, 16, 17, 25, 35, 41, 45, 46, 47, 48, 94, 95, 96, 97, 109, 111, 112, 142, 175, 177, 179, 206, 207, 208, 210, 3, 1, 4, 5, 2, 7, 13, 1, 5, 9, 11, 7, 1
overfishing, I, II, 1, 3, 5, 6, 7, 19, 25, 27, 41, 91, 97, 101, 102, 104, 109, 111, 112, 115, 116, 119, 132, 142, 174, 178, 205, 207, 208, 209, 210, 4, 5, 1, 2, 4, 7, 8, 11, 14, 1, 5, 9, 11, 12, 1
Overfishing Limit (OFL), 21, 22, 23, 1
rebuilding plan, 1, II, 1, 2, 3, 1, 3, 13, 16, 17, 21, 22, 23, 24, 25, 26, 48, 92, 94, 95, 97, 98, 109, 110, 112, 177, 178, 188, 211, 1, 10, 12, 16, 1, 2, 5, 12, 1, 3
release mortality, 2, 1
Resources, 223
Scientific and Statistical Committee, I, 3, 16, 56, 85, 95, 110, 180, 182, 184, 186, 188, 190, 191, 192, 194, 196, 198, 200, 5, 1, 4
SEDAR 37 2014, 1, 3, 24, 41, 109, 161, 1, 2, 3, 12
Social impacts, 112
South Atlantic Fishery Management Council, 1, I, II, 2, 8, 9, 201, 213, 220, 221, 222, 4, 1, 13, 14, 15, 16, 1, 16, 17, 1
Southeast Data Assessment and Review, I, 4
Southeast Data, Assessment, and Review (SEDAR), 54
Southeast Fisheries Science Center (SEFSC), 3, 10, 103, 2, 6, 8
Spawning Stock Biomass (SSB_{MSY}), 21, 22, 23
stock assessment, II, 1, 2, 3, 5, 7, 10, 12, 13, 18, 19, 24, 25, 88, 89, 91, 93, 94, 97, 100, 107, 109, 111, 114, 122, 175, 211, 1, 1, 3, 12, 1, 3, 4

Appendix A. Considered But Rejected Alternatives

Will be finalized after June 2016 Council meeting

Action 5. Establish a rebuilding plan for the Florida Keys/East Florida (FLK/EFL) stock of hogfish

Alternative 2. Define a rebuilding plan where the rebuilding strategy for the Florida Keys/East Florida (FLK/EFL) stock of hogfish sets ABC equal to the yield at 75% F_{MSY} and rebuilds the stock in 11 years. The Overfishing Limit (OFL) is the yield at F_{MSY}. The Spawning Stock Biomass (SSB_{MSY})is 2,300,391 lbs ww. Year 1 = 2016.

Year	F	ABC (lbs ww)	ABC (numbers)	OFL* (lbs ww)	OFL* (numbers)	Spawning Stock Biomass (lbs ww)
2016	0.104	95,380	39,710	127,490	53,140	806,960
2017	0.104	113,180	45,900	146,850	59,930	965,140
2018	0.104	131,870	51,660	166,560	66,060	1,133,820
2019	0.104	150,840	57,520	185,930	72,140	1,306,580
2020	0.104	169,700	63,430	204,610	78,130	1,479,650
2021	0.104	188,110	69,190	222,310	83,830	1,649,810
2022	0.104	205,760	74,660	238,830	89,130	1,813,950
2023	0.104	222,410	79,750	253,990	93,950	1,969,510
2024	0.104	237,870	84,430	267,700	98,280	2,114,570
2025	0.104	252,030	88,670	279,930	102,120	2,247,960
2026	0.104	264,800	92,470	290,720	105,500	**2,368,780**

Source: FWRI 2015. Projection resulting from SEDAR 37 (2014) stock assessment.

Discussion: While the probably of rebuilding for this projection was not provided in the original analysis, it is probably very close to 50% since the estimated spawning stock biomass is very close to SSB_{MSY}. Also, the projection has 2016 as year 1, which no longer matches the timeline of development for Amendment 37 and, therefore, is nota reasonable alternative.

Action 8. Increase the commercial and recreational minimum size limit for the GA-NC and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 2. Increase the commercial and recreational minimum size limit for the GA-NC stock of hogfish in the South Atlantic Region.

Sub-alternative 2a. 13 inches FL
Sub-alternative 2b. 14 inches FL
Sub-alternative 2c. 15 inches FL

Discussion: Hogfish in the Georgia through North Carolina sub-region attain larger sizes than those off east Florida and the Florida Keys. The average sizes of hogfish harvested recreationally and commercially in this region are 25.8 inches fork length (FL) and 23.6 inches FL, respectively. In addition, hogfish in the Georgia through North Carolina (GA-NC) sub-region transition from female to male at approximately 24 inches FL. **Sub-alternatives 2a-2c**

were removed from consideration because they proposed minimum sizes that are too small and therefore did not fit within the range of reasonable alternatives.

Alternative 3. Increase the commercial and recreational minimum size limit for the Florida Keys/East Florida (FLK/EFL) stock of hogfish in the South Atlantic Region.

Sub-alternative 3a. 13 inches FL
Sub-alternative 3f. 18 inches FL
Sub-alternative 3g. 19 inches FL
Sub-alternative 3h. 20 inches FL

Discussion: Hogfish in Florida and the Florida Keys sub-region attain smaller sizes, in general, than hogfish in the Georgia through North Carolina sub-region. The average sizes of hogfish harvested recreationally and commercially in this region are 13.8 inches fork length (FL) and 15.1 inches FL, respectively. In addition, hogfish in Florida and the Florida Keys sub-region transition from female to male at approximately 16 inches FL. **Sub-alternative 3a** proposes too small a size limit to be effective whereas **Sub-alternatives 3f-3h** were removed from consideration because they proposed minimum sizes that are too large and therefore did not fit within the range of reasonable alternatives.

Action 9. Establish a commercial trip limit for the GA-NC and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 2. Establish a commercial trip limit for the GA-NC stock of hogfish in the South Atlantic Region.

Sub-alternative 2d. 1,000 lbs ww per trip.

Discussion: A distribution of the pounds landed per commercial trip in the GA-NC sub-region (see **Chapter 4**, **Action 8**) showed that only 1% of trips landed 500 lbs ww or more. Hence, **Sub-alternative 2d** was not within the range of reasonable alternatives to be considered.

Action 10. Modify and/or establish recreational bag limits for the GA-NC and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 2. Establish a recreational bag limit for the GA-NC stock of hogfish in the South Atlantic Region.

Sub-alternative 2a. 5 fish per person per day.
Sub-alternative 2b. 4 fish per person per day.
Sub-alternative 2c. 3 fish per person per day.

Discussion: A distribution of the number of hogfish harvested per angler in the South Atlantic region showed that most anglers are catching 1 or 2 hogfish (see **Chapter 4**, **Action 10**). Hence bag limits above 2 fish per person per day were removed from consideration as they did not constitute reasonable alternatives.

Alternative 3. Modify the recreational bag limit for the Florida Keys/East Florida (FLK/EFL) stock of hogfish in the South Atlantic Region.

Sub-alternative 3a. 5 fish per person per day.
Sub-alternative 3b. 4 fish per person per day.

Discussion: A distribution of the number of hogfish harvested per angler in the South Atlantic region showed that most anglers are catching 1 or 2 hogfish (see **Chapter 4**, **Action 10**). Hence bag limits above 2 fish per person per day were removed from consideration as they did not constitute reasonable alternatives.

Action 11. Establish a recreational fishing season for the GA-NC and Florida Keys/East Florida (FLK/EFL) stocks of hogfish

Alternative 2. Establish a recreational fishing season for the GA-NC stock of hogfish in the South Atlantic region.

Sub-alternative 2a. May-August
Sub-alternative 2b. July-August
Sub-alternative 2c. May-June

Discussion: The status of the GA-NC stock of hogfish remains unknown as the stock assessment was not deemed applicable to that stock due to insufficient data. However, hogfish in that sub-region attain larger sizes and, based on fishermen's comments, appear to be abundant partly due to their distribution far from shore. The stock does not seem to be experiencing heavy fishing pressure and average recreational landings in recent years have been well below the proposed recreational ACL. Hence the South Atlantic Fishery management Council (South Atlantic Council) did not consider it appropriate to impose a recreational season on that stock.

Establish commercial and recreational accountability measures (AMs) for the Georgia through North Carolina (GA-NC) and the Florida Keys/East Florida (FLK/EFL) stocks of hogfish stocks of hogfish

Alternative 5. If recreational landings exceed the recreational annual catch limit (ACL) for two consecutive fishing years, then during the following (*i.e.*, third) fishing year, recreational landings will be monitored for a persistence in increased landings. If necessary, NMFS would reduce the length of fishing season and the recreational ACL after two consecutive years of exceeding the recreational ACL in the following fishing year by the amount of the average annual recreational overage, only if the species is overfished **and** the total ACL (commercial ACL and recreational ACL) of the respective stock is exceeded. The length of the recreational season and recreational ACL will not be reduced if NMFS determines, using the best scientific information available, that a reduction is unnecessary.

Sub-alternative 5a. For the GA-NC stock of hogfish.
Sub-alternative 5b. For the FLK/EFL stock of hogfish.

Discussion: The South Atlantic Council removed this alternative from consideration because it has the potential to allow overages of the recreational ACL for two consecutive years before

triggering an accountability measures. This scenario was deemed too risky for a stock that is overfished and undergoing overfishing.

Appendix B. Glossary

Allowable Biological Catch (ABC): Maximum amount of fish stock than can be harvested without adversely affecting recruitment of other components of the stock. The ABC level is typically higher than the total allowable catch, leaving a buffer between the two.

ALS: Accumulative Landings System. NMFS database which contains commercial landings reported by dealers.

Biomass: Amount or mass of some organism, such as fish.

B_{MSY}: Biomass of population achieved in long-term by fishing at F_{MSY}.

Bycatch: Fish harvested in a fishery, but not sold or kept for personal use. Bycatch includes economic discards and regulatory discards, but not fish released alive under a recreational catch and release fishery management program.

Caribbean Fishery Management Council (CFMC): One of eight regional councils mandated in the Magnuson-Stevens Fishery Conservation and Management Act to develop management plans for fisheries in federal waters. The CFMC develops fishery management plans for fisheries off the coast of the U.S. Virgin Islands and the Commonwealth of Puerto Rico.

Catch Per Unit Effort (CPUE): The amount of fish captured with an amount of effort. CPUE can be expressed as weight of fish captured per fishing trip, per hour spent at sea, or through other standardized measures.

Charter Boat: A fishing boat available for hire by recreational anglers, normally by a group of anglers for a short time period.

Cohort: Fish born in a given year. (See year class.)

Control Date: Date established for defining the pool of potential participants in a given management program. Control dates can establish a range of years during which a potential participant must have been active in a fishery to qualify for a quota share.

Constant Catch Rebuilding Strategy: A rebuilding strategy where the allowable biological catch of an overfished species is held constant until stock biomass reaches B_{MSY} at the end of the rebuilding period.

Constant F Rebuilding Strategy: A rebuilding strategy where the fishing mortality of an overfished species is held constant until stock biomass reached BMSY at the end of the rebuilding period.

Directed Fishery: Fishing directed at a certain species or species group.

Discards: Fish captured, but released at sea.

Discard Mortality Rate: The % of total fish discarded that do not survive being captured and released at sea.

Derby: Fishery in which the TAC is fixed and participants in the fishery do not have individual quotas. The fishery is closed once the TAC is reached, and participants attempt to maximize their harvests as quickly as possible. Derby fisheries can result in capital stuffing and a race for fish.

Effort: The amount of time and fishing power (i.e., gear size, boat size, horsepower) used to harvest fish.

Exclusive Economic Zone (EEZ): Zone extending from the shoreline out to 200 nautical miles in which the country owning the shoreline has the exclusive right to conduct certain activities such as fishing. In the United States, the EEZ is split into state waters (typically from the shoreline out to 3 nautical miles) and federal waters (typically from 3 to 200 nautical miles).

Exploitation Rate: Amount of fish harvested from a stock relative to the size of the stock, often expressed as a percentage.

F: Fishing mortality.

Fecundity: A measurement of the egg-producing ability of fish at certain sizes and ages.

Fishery Dependent Data: Fishery data collected and reported by fishermen and dealers.

Fishery Independent Data: Fishery data collected and reported by scientists who catch the fish themselves.

Fishery Management Plan: Management plan for fisheries operating in the federal produced by regional fishery management councils and submitted to the Secretary of Commerce for approval.

Fishing Effort: Usually refers to the amount of fishing. May refer to the number of fishing vessels, amount of fishing gear (nets, traps, hooks), or total amount of time vessels and gear are actively engaged in fishing.

Fishing Mortality: A measurement of the rate at which fish are removed from a population by fishing. Fishing mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous is that percentage of fish dying at any one time.

Fishing Power: Measure of the relative ability of a fishing vessel, its gear, and its crew to catch fishes, in reference to some standard vessel, given both vessels are under identical conditions.

$F_{30\%SPR}$: Fishing mortality that will produce a static SPR = 30%.

$F_{45\%SPR}$: Fishing mortality that will produce a static SPR = 45%.

F_{OY}: Fishing mortality that will produce OY under equilibrium conditions and a corresponding biomass of B_{OY}. Usually expressed as the yield at 85% of F_{MSY}, yield at 75% of F_{MSY}, or yield at 65% of F_{MSY}.

F_{MSY}: Fishing mortality that if applied constantly, would achieve MSY under equilibrium conditions and a corresponding biomass of B_{MSY}.

Fork Length (FL): The length of a fish as measured from the tip of its snout to the fork in its tail.

Framework: An established procedure within a fishery management plan that has been approved and implemented by NMFS, which allows specific management measures to be modified via regulatory amendment.

Gear restrictions: Limits placed on the type, amount, number, or techniques allowed for a given type of fishing gear.

Growth Overfishing: When fishing pressure on small fish prevents the fishery from producing the maximum poundage. Condition in which the total weight of the harvest from a fishery is improved when fishing effort is reduced, due to an increase in the average weight of fishes.

Gulf of Mexico Fishery Management Council (GFMC): One of eight regional councils mandated in the Magnuson-Stevens Fishery Conservation and Management Act to develop management plans for fisheries in federal waters. The GFMC develops fishery management plans for fisheries off the coast of Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida.

Head Boat: A fishing boat that charges individual fees per recreational angler onboard.

Highgrading: Form of selective sorting of fishes in which higher value, more marketable fishes are retained, and less marketable fishes, which could legally be retained are discarded.

Individual Fishing Quota (IFQ): Fishery management tool that allocates a certain portion of the TAC to individual vessels, fishermen, or other eligible recipients.

Longline: Fishing method using a horizontal mainline to which weights and baited hooks are attached at regular intervals. Gear is either fished on the bottom or in the water column.

Magnuson-Stevens Fishery Conservation and Management Act: Federal legislation responsible for establishing the fishery management councils and the mandatory and discretionary guidelines for federal fishery management plans.

Marine Recreational Fisheries Statistics Survey (MRFSS): Survey operated by NMFS in cooperation with states that collects marine recreational data.

Maximum Fishing Mortality Threshold (MFMT): The rate of fishing mortality above which a stock's capacity to produce MSY would be jeopardized.

Maximum Sustainable Yield (MSY): The largest long-term average catch that can be taken continuously (sustained) from a stock or stock complex under average environmental conditions.

Minimum Stock Size Threshold (MSST): The biomass level below which a stock would be considered overfished.

Modified F Rebuilding Strategy: A rebuilding strategy where fishing mortality is changed as stock biomass increases during the rebuilding period.

Multispecies fishery: Fishery in which more than one species is caught at the same time and location with a particular gear type.

National Marine Fisheries Service (NMFS): Federal agency within NOAA responsible for overseeing fisheries science and regulation.

National Oceanic and Atmospheric Administration: Agency within the Department of Commerce responsible for ocean and coastal management.

Natural Mortality (M): A measurement of the rate at which fish are removed from a population by natural causes. Natural mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous is that percentage of fish dying at any one time.

Optimum Yield (OY): The amount of catch that will provide the greatest overall benefit to the nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems.

Overfished: A stock or stock complex is considered overfished when stock biomass falls below the minimum stock size threshold (MSST) (e.g., current biomass < MSST = overfished).

Overfishing: Overfishing occurs when a stock or stock complex is subjected to a rate of fishing mortality that exceeds the maximum fishing mortality threshold (e.g., current fishing mortality rate > MFMT = overfishing).

Quota: % or annual amount of fish that can be harvested.

Percent Standard Error (PSE): A measure of precision presented with all data estimates.

Recruitment (R): Number or percentage of fish that survives from hatching to a specific size or age.

Recruitment Overfishing: The rate of fishing above which the recruitment to the exploitable stock becomes significantly reduced. This is characterized by a greatly reduced spawning stock, a decreasing proportion of older fish in the catch, and generally very low recruitment year after year.

Scalar: A number of magnitude that ascends or descends proportionally.

Scientific and Statistical Committee (SSC): Fishery management advisory body composed of federal, state, and academic scientists, which provides scientific advice to a fishery management council.

Selectivity: The ability of a type of gear to catch a certain size or species of fish.

South Atlantic Fisheries Management Council (SAFMC): One of eight regional councils mandated in the Magnuson-Stevens Fishery Conservation and Management Act to develop management plans for fisheries in federal waters. The SAFMC develops fishery management plans for fisheries off North Carolina, South Carolina, Georgia, and the east coast of Florida.

Spawning Potential Ratio (Transitional SPR): Formerly used in overfished definition. The number of eggs that could be produced by an average recruit in a fished stock divided by the number of eggs that could be produced by an average recruit in an unfished stock. SPR can also be expressed as the spawning stock biomass per recruit (SSBR) of a fished stock divided by the SSBR of the stock before it was fished.

% Spawning Per Recruit (Static SPR): Formerly used in overfishing determination. The maximum spawning per recruit produced in a fished stock divided by the maximum spawning per recruit, which occurs under the conditions of no fishing. Commonly abbreviated as %SPR.

Spawning Stock Biomass (SSB): The total weight of those fish in a stock which are old enough to spawn.

Spawning Stock Biomass Per Recruit (SSBR): The spawning stock biomass divided by the number of recruits to the stock or how much spawning biomass an average recruit would be expected to produce.

Total Allowable Catch (TAC): The total amount of fish to be taken annually from a stock or stock complex. This may be a portion of the Allowable Biological Catch (ABC) that takes into consideration factors such as bycatch.

Total Length (TL): The length of a fish as measured from the tip of the snout to the tip of the tail.

Appendix C. History of Management

The snapper grouper fishery is highly regulated; some of the species included in this amendment have been regulated since 1983. The following table summarizes actions in each of the amendments to the original Snapper Grouper Fishery Management Plan (FMP), as well as some events not covered in amendment actions.

*Shaded rows indicate FMP Amendments

Table C-1. Snapper Grouper History of Management

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
FMP (1983)	08/31/83	PR: 48 FR 26843 FR: 48 FR 39463	-12" total length (TL) limit – red snapper, yellowtail snapper, red grouper, Nassau grouper; -8" limit – black sea bass; -4" trawl mesh size; -Gear limitations – poisons, explosives, fish traps, trawls; -Designated modified habitats or artificial reefs as Special Management Zones (SMZs).
Regulatory Amendment #1 (1987)	03/27/87	PR: 51 FR 43937 FR: 52 FR 9864	-Prohibited fishing in SMZs except with hand-held hook-and-line and spearfishing gear; -Prohibited harvest of goliath grouper in SMZs.
Amendment #1 (1988)	01/12/89	PR: 53 FR 42985 FR: 54 FR 1720	-Prohibited trawl gear to harvest fish south of Cape Hatteras, NC and north of Cape Canaveral, FL; -Directed fishery defined as vessel with trawl gear and ≥200 lb s-g on board; -Established rebuttable assumption that vessel with s-g on board had harvested such fish in the exclusive economic zone (EEZ).
Regulatory Amendment #2 (1988)	03/30/89	PR: 53 FR 32412 FR: 54 FR 8342	-Established 2 artificial reefs off Ft. Pierce, FL as SMZs.
Emergency Rule	8/3/90	55 FR 32257	-Added wreckfish to the fishery management unit (FMU); -Fishing year beginning 4/16/90; -Commercial quota of 2 million pounds; -Commercial trip limit of 10,000 pounds per trip.
Fishery Closure Notice	8/8/90	55 FR 32635	- Fishery closed because the commercial quota of 2 million pounds was reached.
Notice of Control Date	09/24/90	55 FR 39039	-Anyone entering federal wreckfish fishery in the EEZ off S. Atlantic states after 09/24/90 was not assured of future access if limited entry program developed.
Amendment #2 (1990)	10/30/90	PR: 55 FR 31406 FR: 55 FR 46213	-Prohibited harvest/possession of goliath grouper in or from the EEZ; -Defined overfishing for goliath grouper and other species.
Emergency Rule	11/1/90	55 FR 40181	-Extended the measures implemented via emergency

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
Extension			rule on 8/3/90.
Regulatory Amendment #3 (1989)	11/02/90	PR: 55 FR 28066 FR: 55 FR 40394	-Established artificial reef at Key Biscayne, FL as SMZ; -Fish trapping, bottom longlining, spear fishing, and harvesting of Goliath grouper prohibited in SMZ.
Amendment #3 (1990)	01/31/91	PR: 55 FR 39023 FR: 56 FR 2443	-Added wreckfish to the FMU; -Defined optimum yield and overfishing; -Required permit to fish for, land or sell wreckfish; -Required catch and effort reports from selected, permitted vessel; -Established control date of 03/28/90; -Established a fishing year for wreckfish starting April 16; -Established a process to set annual quota, with initial quota of 2 million pounds; provisions for closure; -Established 10,000 pound trip limit; -Established a spawning season closure for wreckfish from January 15 to April 15; -Provided for annual adjustments of wreckfish management measures.
Notice of Control Date	07/30/91	56 FR 36052	-Anyone entering federal snapper grouper fishery (other than for wreckfish) in the EEZ off S. Atlantic states after 07/30/91 was not assured of future access if limited entry program developed.
Amendment #4 (1991)	01/01/92	PR: 56 FR 29922 FR: 56 FR 56016	-Prohibited gear: fish traps except black sea bass traps north of Cape Canaveral, FL; entanglement nets; longline gear inside 50 fathoms; bottom longlines to harvest wreckfish; powerheads and bangsticks in designated SMZs off S. Carolina. -Defined overfishing/overfished and established rebuilding timeframe: red snapper and groupers ≤ 15 years (year 1 = 1991); other snappers, greater amberjack, black sea bass, red porgy ≤ 10 years (year 1 = 1991); -Required permits (commercial & for-hire) and specified data collection regulations; -Established an assessment group and annual adjustment procedure (framework); -Permit, gear, and vessel id requirements specified for black sea bass traps; -No retention of snapper grouper spp. caught in other fisheries with gear prohibited in snapper grouper fishery if captured snapper grouper had no bag limit or harvest was prohibited. If had a bag limit, could retain only the bag limit; -8” TL limit – lane snapper; -10” TL limit – vermilion snapper (recreational only); -12” TL limit – red porgy, vermilion snapper (commercial only), gray, yellowtail, mutton, schoolmaster, queen, blackfin, cubera, dog,

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
			mahogany, and silk snappers; -20" TL limit – red snapper, gag, and red, black, scamp, yellowfin, and yellowmouth groupers; -28" fork length (FL) limit – greater amberjack (recreational only); -36" FL or 28" core length – greater amberjack (commercial only); -Bag limits – 10 vermilion snapper, 3 greater amberjack -Aggregate snapper bag limit – 10/person/day, excluding vermilion snapper and allowing no more than 2 red snappers; -Aggregate grouper bag limit – 5/person/day, excluding Nassau and goliath grouper, for which no retention (recreational & commercial) is allowed; -Spawning season closure – commercial harvest greater amberjack > 3 fish bag prohibited in April south of Cape Canaveral, FL; -Spawning season closure – commercial harvest mutton snapper >snapper aggregate prohibited during May and June; -Charter/headboats and excursion boat possession limits extended.
Amendment #5 (1992)	04/06/92	PR: 56 FR 57302 FR: 57 FR 7886	For wreckfish: -Established limited entry system with individual transferable quotas (ITQs); -Required dealer to have permit; -Rescinded 10,000 lb. trip limit; -Required off-loading between 8 am and 5 pm; -Reduced occasions when 24-hour advance notice of offloading required for off-loading; -Established procedure for initial distribution of percentage shares of total allowable catch (TAC).
Emergency Rule	8/31/92	57 FR 39365	For Black Sea Bass (bsb): -Modified definition of bsb pot; -Allowed multi-gear trips for bsb; -Allowed retention of incidentally-caught fish on bsb trips.
Emergency Rule Extension	11/30/92	57 FR 56522	For Black Sea Bass: -Modified definition of bsb pot; -Allowed multi-gear trips for bsb; -Allowed retention of incidentally-caught fish on bsb trips.
Regulatory Amendment #4 (1992)	07/06/93	FR: 58 FR 36155	-For Black Sea Bass: -Modified definition of bsb pot; -Allowed multi-gear trips for bsb; -Allowed retention of incidentally-caught fish on bsb trips.
Regulatory Amendment #5	07/31/93	PR: 58 FR 13732 FR: 58 FR 35895	-Established 8 SMZs off South Carolina, where only hand-held, hook-and-line gear and spearfishing

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
(1992)			(excluding powerheads) was allowed.
Amendment #6 (1993)	07/27/94	PR: 59 FR 9721 FR: 59 FR 27242	-Set up separate commercial TAC levels for golden tilefish and snowy grouper; -Established commercial trip limits for snowy grouper, golden tilefish, speckled hind, and warsaw grouper; -Included golden tilefish in grouper recreational aggregate bag limits; -Prohibited sale of warsaw grouper and speckled hind; -100% logbook coverage upon renewal of permit; -Creation of the *Oculina* Experimental Closed Area; -Data collection needs specified for evaluation of possible future individual fishing quota system.
Amendment #7 (1994)	01/23/95	PR: 59 FR 47833 FR: 59 FR 66270	-12" FL – hogfish; -16" TL – mutton snapper; -Required dealer, charter and headboat federal permits; -Allowed sale under specified conditions; -Specified allowable gear and made allowance for experimental gear; -Allowed multi-gear trips in NC; -Added localized overfishing to list of problems and objectives; -Adjusted bag limit and crew specs. for charter and head boats; -Modified management unit for scup to apply south of Cape Hatteras, NC; -Modified framework procedure.
Regulatory Amendment #6 (1994b)	05/22/95	PR: 60 FR 8620 FR: 60 FR 19683	-Established actions which applied only to EEZ off Atlantic coast of FL: Bag limits – 5 hogfish/person/day (recreational only), 2 cubera snapper/person/day > 30" TL; 12" TL – gray triggerfish.
Notice of Control Date	04/23/97	62 FR 22995	-Anyone entering federal black sea bass pot fishery off South Atlantic states after 04/23/97 was not assured of future access if limited entry program developed.
Interim Rule Request	1/16/98		-The South Atlantic Fishery Management Council (Council) requested all Amendment 9 measures except black sea bass pot construction changes be implemented as an interim request under the Magnuson-Stevens Act.
Action Suspended	5/14/98		-NMFS informed the Council that action on the interim rule request was suspended.
Emergency Rule Request	9/24/98		-Council requested Amendment 9 be implemented via emergency rule.
Amendment #8 (1997)	12/14/98	PR: 63 FR 1813 FR: 63 FR 38298	-Established program to limit initial eligibility for snapper grouper fishery: -Must have demonstrated landings of any species in

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
			the snapper grouper FMU in 1993, 1994, 1995 or 1996; and have held valid snapper grouper permit between 02/11/96 and 02/11/97; -Granted transferable permit with unlimited landings if vessel landed ≥ 1,000 pounds (lb) of snapper grouper species in any of the years; -Granted non-transferable permit with 225 lb trip limit to all other vessels; -Modified problems, objectives, optimum yield (OY), and overfishing definitions; -Expanded the Council's habitat responsibility; -Allowed retention of snapper grouper species in excess of bag limit on permitted vessel with a single bait net or cast nets on board; -Allowed permitted vessels to possess filleted fish harvested in the Bahamas under certain conditions.
Request not Implemented	1/22/99		-NMFS informed the Council that the final rule for Amendment 9 would be effective 2/24/99; therefore they did not implement the emergency rule.
Regulatory Amendment #7 (1998a)	01/29/99	PR: 63 FR 43656 FR: 63 FR 71793	-Established 10 SMZs at artificial reefs off South Carolina.

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
Amendment #9 (1998)	2/24/99	PR: 63 FR 63276 FR: 64 FR 3624	-Red porgy: 14" TL (recreational and commercial); 5 fish rec. bag limit; no harvest or possession > bag limit, and no purchase or sale, in March and April; -Black sea bass: 10" TL (recreational and commercial); 20 fish rec. bag limit; required escape vents and escape panels with degradable fasteners in bsb pots; -Greater amberjack: 1 fish rec. bag limit; no harvest or possession > bag limit, and no purchase or sale, during April; quota = 1,169,931 lb; began fishing year May 1; prohibited coring; -Specified size limits for several snapper grouper species (indicated in parentheses in inches TL): including yellowtail snapper (12), mutton snapper (16), red snapper (20); red grouper, yellowfin grouper, yellowmouth grouper, and scamp (20) ; -Vermilion snapper: 11" TL (recreational), 12" TL commercial; -Gag: 24" TL (recreational); no commercial harvest or possession > bag limit, and no purchase or sale, during March and April; -Black grouper: 24" TL (recreational and commercial); no harvest or possession > bag limit, and no purchase or sale, during March and April; -Gag and Black grouper: within 5 fish aggregate grouper bag limit, no more than 2 fish may be gag or black grouper (individually or in combination); -All snapper grouper without a bag limit: aggregate recreational bag limit 20 fish/person/day, excluding tomtate and blue runner; -Vessels with longline gear aboard may only possess snowy, warsaw, yellowedge, and misty grouper, and golden, blueline and sand tilefish.
Emergency Action	9/3/99	64 FR 48326	-Reopened the Amendment 8 permit application process.
Emergency Interim Rule	09/08/99, expired 08/28/00	64 FR 48324 and 65 FR 10040	-Prohibited harvest or possession of red porgy.

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
Amendment #11 Comprehensive Sustainable Fisheries Act Amendment (1998)	12/02/99	PR: 64 FR 27952 FR: 64 FR 59126	-Maximum sustainable yield (MSY) proxy: goliath and Nassau grouper = 40% static spawning potential ratio (SPR); all other species = 30% static SPR; -OY: hermaphroditic groupers = 45% static SPR; goliath and Nassau grouper = 50% static SPR; all other species = 40% static SPR -Overfished/overfishing evaluations: BSB: overfished (minimum stock size threshold (MSST)=3.72 mp, 1995 biomass=1.33 mp); undergoing overfishing (maximum fishing mortality threshold (MFMT)=0.72, F1991-1995=0.95) Vermilion snapper: overfished (static SPR = 21-27%) Red porgy: overfished (static SPR = 14-19%). Red snapper: overfished (static SPR = 24-32%) Gag: overfished (static SPR = 27%) Scamp: no longer overfished (static SPR = 35%) Speckled hind: overfished (static SPR = 8-13%) Warsaw grouper: overfished (static SPR = 6-14%) Snowy grouper: overfished (static SPR = 5-15%) White grunt: no longer overfished (static SPR = 29-39%) Golden tilefish: overfished (couldn't estimate static SPR) Nassau grouper: overfished (couldn't estimate static SPR) Goliath grouper: overfished (couldn't estimate static SPR) -overfishing level: goliath and Nassau grouper = F>F40% static SPR; all other species: = F>F30% static SPR Approved definitions for overfished and overfishing. MSST = [(1-M) or 0.5 whichever is greater]*B_{MSY}. MFMT = $F_{MSY.}$
Amendment #10 Comprehensive Essential Fish Habitat Amendment (1998)	07/14/00	PR: 64 FR 37082 and 64 FR 59152 FR: 65 FR 37292	-Identified essential fish habitat (EFH) and established habitat areas of particular concern (HAPC) for species in the snapper grouper FMU.

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
Amendment #12 (2000)	09/22/00	PR: 65 FR 35877 FR: 65 FR 51248	For Red porgy: -MSY=4.38 mp; OY=45% static SPR; MFMT=0.43; MSST=7.34 mp; rebuilding timeframe=18 years (1999=year 1); -no sale of red porgy during Jan-April; -1 fish bag limit; -50 lb. bycatch commercial trip limit May-December; -Modified management options and list of possible framework actions.
Amendment #9 (1998) resubmitted	10/13/00	PR: 63 FR 63276 FR: 65 FR 55203	-Commercial trip limit for greater amberjack.
Regulatory Amendment #8 (2000)	11/15/00	PR: 65 FR 41041 FR: 65 FR 61114	-Established 12 SMZs at artificial reefs off Georgia; revised boundaries of 7 existing SMZs off Georgia to meet CG permit specs; restricted fishing in new and revised SMZs.
Amendment #13A (2003)	04/26/04	PR: 68 FR 66069 FR: 69 FR 15731	-Extended for an indefinite period the regulation prohibiting fishing for and possessing snapper grouper species within the *Oculina* Experimental Closed Area.
Notice of Control Date	10/14/05	70 FR 60058	-Considered management measures to further limit participation or effort in the commercial fishery for snapper grouper species (excluding wreckfish).
Amendment #13C (2006)	10/23/06	PR: 71 FR 28841 FR: 71 FR 55096	-End overfishing of snowy grouper, vermilion snapper, black sea bass, and golden tilefish. Increase allowable catch of red porgy. Year 1 = 2006; 1. <u>Snowy Grouper</u> Commercial: -Quota = 151,000 lb gutted weight (gw) in year 1, 118,000 lb gw in year 2, and 84,000 lb gw in year 3 onwards. -Trip limit = 275 lb gw in year 1, 175 lb gw in year 2, and 100 lb gw in year 3 onwards; Recreational: -Limit possession to one snowy grouper in 5 grouper per person/day aggregate bag limit; 2. <u>Golden Tilefish</u> Commercial: Quota of 295,000 lb gw, 4,000 lb gw trip limit until 75% of the quota is taken when the trip limit is reduced to 300 lb gw. Do not adjust the trip limit downwards unless 75% is captured on or before September 1; Recreational: Limited possession to 1 golden tilefish in 5 grouper per person/day aggregate bag limit; 3. <u>Vermilion Snapper</u> Commercial: Quota of 1,100,000 lb gw;

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
			Recreational: 12" TL size limit. 4. Black Sea Bass Commercial: Quota of 477,000 lb gw in year 1, 423,000 lb gw in year 2, and 309,000 lb gw in year 3 onwards; -Required use of at least 2" mesh for the entire back panel of black sea bass pots effective 6 months after publication of the final rule; -Required black sea bass pots be removed from the water when the quota is met; -Changed fishing year from calendar year to June 1 – May 31; Recreational: Recreational allocation of 633,000 lb gw in year 1, 560,000 lb gw in year 2, and 409,000 lb gw in year 3 onwards. Increase minimum size limit from 10" to 11" in year 1 and to 12" in year 2; -Reduced recreational bag limit from 20 to 15 per person per day; -Changed fishing year from the calendar year to June 1 through May 31. 5. Red Porgy Commercial and recreational: -Retained 14" TL size limit and seasonal closure (retention limited to the bag limit); -Specified a commercial quota of 127,000 lb gw and prohibit sale/purchase and prohibit harvest and/or possession beyond the bag limit when quota is taken and/or during January through April; -Increased commercial trip limit from 50 lb ww to 120 red porgy (210 lb gw) during May through December;--Increased recreational bag limit from one to three red porgy per person per day.
Notice of Control Date	3/8/07	72 FR 60794	-Considered measures to limit participation in the snapper grouper for-hire sector.
Amendment #15A (2008)	3/14/08	73 FR 14942	- Established rebuilding plans and status determination criteria for snowy grouper, black sea bass, and red porgy.
Notice of Control Date	12/4/08	74 FR 7849	-Established a control date for the golden tilefish portion of the snapper grouper fishery in the South Atlantic.
Notice of Control Date	12/4/08	74 FR 7849	-Established control date for black sea bass pot sector in the South Atlantic.
Amendment #14 (2007)	2/12/09	PR: 73 FR 32281 FR: 74 FR 1621	-Established eight deepwater Type II marine protected areas (MPAs) to protect a portion of the population and habitat of long-lived deepwater snapper grouper species.
Amendment #16 (2009)	7/29/09	PR: 74 FR 6297 FR: 74 FR 30964	-Specified status determination criteria for gag and vermilion snapper;

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
			For gag: -Specified interim allocations 51% commercial & 49% recreational; -Recreational and commercial shallow water grouper spawning closure January through April; -Directed commercial quota= 352,940 lb gw; -Reduced 5-fish aggregate grouper bag limit, including tilefish species, to a 3-fish aggregate; -Captain and crew on for-hire trips cannot retain the bag limit of vermilion snapper and species within the 3-fish grouper aggregate; For vermilion snapper: -Specified interim allocations 68% commercial & 32% recreational; -Directed commercial quota split Jan-June=315,523 lb gw and 302,523 lb gw July-Dec; -Reduced bag limit from 10 to 5 and a recreational closed season November through March; -Required dehooking tools.
Amendment #15B (2008)	2/15/10	PR: 74 FR 30569 FR: 74 FR 58902	-Prohibited the sale of bag-limit caught snapper grouper species; -Reduced the effects of incidental hooking on sea turtles and smalltooth sawfish; -Adjusted commercial renewal periods and transferability requirements; -Implemented plan to monitor and assess bycatch; -Established reference points for golden tilefish; -Established allocations for snowy grouper (95% commercial & 5% recreational) and red porgy (50% commercial & 50% recreational).
Amendment #19 Comprehensive Ecosystem-Based Amendment 1 (CE-BA1) (2009)	7/22/10	PR: 75 FR 14548 FR: 75 FR 35330	-Provided presentation of spatial information for EFH and EFH-HAPC designations under the Snapper Grouper FMP; -Designation of deepwater coral HAPCs.
Amendment #17A (2010)	12/3/10 red snapper closure; circle hooks 3/3/2011	PR: 75 FR 49447 FR: 75 FR 76874	-Required use of non-stainless steel circle hooks when fishing for snapper grouper species with hook-and-line gear north of 28 deg. N latitude in the South Atlantic EEZ; -Specified an annual catch limit (ACL) and an accountability measure (AM) for red snapper with management measures to reduce the probability that catches will exceed the stocks' ACL; -Specified a rebuilding plan for red snapper; -Specified status determination criteria for red snapper;

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
			-Specified a monitoring program for red snapper.
Emergency Rule	12/3/10	75 FR 76890	-Delayed the effective date of the area closure for snapper grouper species implemented through Amendment 17A.
Amendment #17B (2010)	1/30/11	PR: 75 FR 62488 FR: 75 FR 82280	-Specified ACLs, annual catch targets (ACT), and AMs, where necessary, for 9 species undergoing overfishing -Modified management measures as needed to limit harvest to the ACL or ACT; -Updated the framework procedure for specification of total allowable catch; -Prohibited harvest of 6 deepwater species seaward of 240 feet to curb bycatch of speckled hind and warsaw grouper.
Regulatory Amendment #10 (2010)	5/31/11	PR: 76 FR 9530 FR: 76 FR 23728	-Eliminated closed area for snapper grouper species approved in Amendment 17A.
Regulatory Amendment #9 (2011)	Bag limit: 6/22/11 Trip limits: 7/15/11	PR: 76 FR 23930 FR: 76 FR 34892	-Established trip limits for vermilion snapper and gag; -Increased trip limit for greater amberjack; -Reduced bag limit for black sea bass.
Amendment #23 Comprehensive Ecosystem-based Amendment 2 (CE-BA2) (2011)	1/30/12	PR: 76 FR 69230 FR: 76 FR 82183	-Designated the Deepwater MPAs as EFH-HAPCs; -Limit harvest of snapper grouper species in SC SMZs to the bag limit; -Modify sea turtle release gear.
Amendment # 25 Comprehensive Annual Catch Limit Amendment; (2011)	4/16/12	PR: 76 FR 74757 Amended PR: 76 FR 82264 FR: 77 FR 15916	-Established acceptable biological catch (ABC) control rules, establish ABCs, ACLs, and AMs for species not undergoing overfishing; -Removed some species from South Atlantic FMU and designate others as ecosystem component species; -Specified allocations between the commercial and, recreational sectors for species not undergoing overfishing; -Limited the total mortality for federally managed species in the South Atlantic to the ACLs.
Regulatory Amendment #11 (2011)	5/10/12	PR: 76 FR 78879 FR: 77 FR 27374	-Eliminated 240 ft harvest prohibition for six deepwater species.
Amendment #18A (2012)	7/1/12	PR: 77 FR 16991 FR: 77FR3 2408	-Limited participation and effort in the black sea bass sector; -Modifications to management of the black sea bass pot sector;

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
			-Improved the accuracy, timing, and quantity of fisheries statistics.
Amendment #24 (2011)	7/11/12	PR: 77 FR 19169 FR: 77 FR 34254	-Specified MSY, rebuilding plan (including ACLs, AMs, and OY, and allocations for red grouper.
Regulatory Amendment #12 (2012)	10/9/12	FR: 77 FR 61295	-Adjusted the ACL and OY for golden tilefish; -Considered specifying a commercial ACT; -Revised recreational AMs for golden tilefish;
Amendment #20A (2012)	10/26/12	PR: 77 FR 19165 FR: 77 FR 59129	-Redistributed latent shares for the wreckfish individual transfer quota (ITQ) program.
Amendment #18B (2013)	5/23/13	PR: 77 FR 75093 FR: 77 FR 23858	-Limited participation and effort in the golden tilefish commercial sector through establishment of a longline endorsement; -Modified trip limits; -Specified allocations for gear groups (longline and hook and line);
Regulatory Amendment #13 (2013)	7/17/13	PR: 78 FR 17336 FR: 78 FR 36113	-Revised the ABCs, ACLs (including sector ACLs), and ACTs implemented by the Comprehensive ACL Amendment. The revisions may prevent a disjunction between the established ACLs and the landings used to determine if AMs are triggered.
Amendment #28 (2013)	8/23/13	PR: 78 FR 25047 FR: 78 FR 44461	-Established regulations to allow harvest of red snapper in the South Atlantic.
Regulatory Amendment #18 (2013)	9/5/13	PR: 78 FR 26740 FR: 78 FR 47574	-Adjusted ACLs for vermilion snapper and red porgy, and remove the 4-month recreational closure for vermilion snapper.
Regulatory Amendment #15 (2013)	9/12/13	PR: 78 FR 31511 FR: 78 FR 49183	-Modified the existing specification of OY and ACL for yellowtail snapper in the South Atlantic; -Modified the existing gag commercial ACL and AM for gag that requires a closure of all other shallow water groupers (black grouper, red grouper, scamp, red hind, rock hind, graysby, coney, yellowmouth grouper, and yellowfin grouper) in the South Atlantic when the gag commercial ACL is met or projected to be met.

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
Regulatory Amendment #19 (2013)	ACL: 9/23/13 Pot closure: 10/23/13	PR: 78 FR 39700 FR: 78 FR 58249	-Adjusted the ACL for black sea bass and implement an annual closure on the use of black sea bass pots from November 1 to April 30.
Amendment #27 (2014)	1/27/2014	PR:78 FR 78770 FR: 78 FR 57337	-Established the South Atlantic Council as the responsible entity for managing Nassau grouper throughout its range including federal waters of the Gulf of Mexico; -Modified the crew member limit on dual-permitted snapper grouper vessels; -Modified the restriction on retention of bag limit quantities of some snapper grouper species by captain and crew of for-hire vessels; -Minimized regulatory delay when adjustments to snapper grouper species' ABC, ACLs, and ACTs are needed as a result of new stock assessments; -Addressed harvest of blue runner by commercial fishermen who do not possess a South Atlantic Snapper Grouper Permit.
Amendment #31 Joint South Atlantic and Gulf of Mexico Generic Headboat Reporting Amendment (2013)	1/27/2014	PR:78 FR 59641 FR: 78 FR 78779	-Included under the Generic charter/headboat reporting amendment, that modified required logbook reporting for headboat vessels to require electronic reporting, regarding snapper grouper landings.
Blueline Tilefish Emergency Rule	4/17/2014 through 10/10/2014 or 4/18/2015	PR: 79 FR 21636 FR:79 FR 61262	-Removed the blueline tilefish portion from the deep-water complex ACL; -Established separate commercial and recreational ACLs and AMs for blueline tilefish.
Regulatory Amendment # 21	11/6/2014	PR: 79 FR 44735 FR: 79 FR 60379	-Modified the definition of the overfished threshold for red snapper, blueline tilefish, gag, black grouper, yellowtail snapper, vermilion snapper, red porgy, and greater amberjack
Regulatory Amendment #14	12/8/2014	PR: 79 FR 22936 FR: 79 FR 66316	-Modified the fishing year for greater amberjack; -Modified the fishing year for black sea bass; -Modified the AMs for vermilion snapper and black sea bass; -Modify the trip limit for gag.

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
Amendment #32	3/30/2015	PR: 80 FR 3207 FR: 80 FR 16583	-End overfishing of blueline tilefish; -Separated blueline tilefish from the deepwater complex; -Specified ACLs for blueline tilefish and the deepwater complex; -Specified AMs for blueline tilefish; -Revised AMs for the deepwater complex; -Specify recreational ACTs for blueline tilefish.
Amendment #29	7/1/2015	NOA:79 FR 69819 PR: 79 FR 72567 FR: 80 FR 30947	-Updated the Council's ABC control rule to incorporate methodology for determining the ABC of unassessed species, adjust ABCs for fourteen unassessed snapper-grouper species, adjust ACLs and ACTs for three species complexes and four snapper-grouper species based on revised ABCs; -Modified and implement gray triggerfish minimum size limits; -Established a commercial split season and commercial trip limits for gray triggerfish.
Regulatory Amendment #22	Effective September 11, 2015, except for the amendments to §§ 622.190(b) and 622.193(r)(1) which were effective August 12, 2015	PR:80 FR 31880 FR:80 FR 48277	-Adjusted ACLs and OY for gag and wreckfish; -Modified the gag bag limit within the aggregate grouper bag limit.
Regulatory Amendment #20	8/20/2015	PR: 80 FR 18797 FR: 80 FR 43033	-Increased the recreational and commercial ACLs for snowy grouper; -Adjusted the rebuilding strategy; -Increased the commercial trip limit; -Modified the recreational fishing season.
Amendment # 33 Dolphin Wahoo Amendment 7 and Snapper Grouper Amendment 33	1/27/16	NOA:80 FR 55819 PR:80 FR 60601 FR:80 FR 80686	-Allowed dolphin and wahoo fillets to enter the U.S. EEZ after lawful harvest in The Bahamas; -Specified the condition of any dolphin, wahoo, and snapper-grouper fillets; -Described how the recreational bag limit is determined for any fillets; -explicitly prohibited the sale or purchase of any dolphin, wahoo, or snapper-grouper recreationally harvested in The Bahamas; -Specified the required documentation to be onboard any vessels that have these fillets; -Specified transit and stowage provisions for any vessels with fillets.

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
Amendment #34 Generic Accountability Measures and Dolphin Allocation Amendment (Snapper Grouper 34)	2/22/16	NOA:80 FR 41472 PR:80 FR 58448 FR: 81 FR 3731	-Modify AMs for snapper-grouper species -Modify the AM for commercial golden crab fishery -Adjust sector allocations for dolphin.
Regulatory Amendment #16	TBD	TBD	-Revise the prohibition of fishing with black sea bass pots from Nov.1-April 30.
Regulatory Amendment #17	TBD	TBD	
Regulatory Amendment #23	TBD	TBD	
Regulatory Amendment #24	TBD	TBD	
Regulatory Amendment #25	TBD	TBD	- Adjust the annual catch limits, optimum yield, and commercial and recreational management measures for the blueline tilefish stock, change fishing year for yellowtail snapper, and increase bag limit for black sea bass.
Amendment # 20B	TBD	TBD	-Update wreckfish ITQ according to reauthorized Magnuson-Stevens Act.
Amendment # 22	Not Developed	Not Developed	-Establish a recreational tagging program for snapper grouper species with small ACLs

Document	All Actions Effective By:	Proposed Rule Final Rule	Major Actions. Note that not all details are provided here. Please refer to Proposed and Final Rules for all impacts of listed documents.
Amendment # 26 Comprehensive Ecosystem-Based Amendment 3 (CE-BA3)	TBD	TBD	-Modifies bycatch and discard reporting for commercial and for-hire vessels.
Amendment #35	TBD	TBD	-Removed black snapper, dog snapper, mahogany snapper, and schoolmaster from the Snapper-Grouper FMP; -Clarified regulations governing the use of Golden Tilefish Longline Endorsements to align them with the Council's original intent when the endorsement program was implemented.
Amendment #36	TBD	TBD	-Establish special management zones to enhance protection for snapper-grouper species in spawning condition including speckled hind and warsaw grouper.
Amendment #37	TBD	TBD	-Modify the hogfish fishery management unit; -Specify fishing levels for the two South Atlantic hogfish stocks; -Establish a rebuilding plan for the Florida Keys/East Florida stock; -Establish/revised management measures for both hogfish stocks in the South Atlantic Region, such as size limits, recreational bag limits, and commercial trip limits.
Amendment #38	TBD	TBD	-Expand the management boundaries for species in the snapper grouper fishery management unit.
Amendment #41	TBD	TBD	-Update the acceptable biological catch, annual catch limit, maximum sustainable yield, minimum stock size threshold, optimum yield (OY), and revise management measures for mutton snapper

Appendix D. Bycatch Practicability Analysis

1.0 Population Effects for the Bycatch Species

Background
In 2014, a stock assessment for hogfish was conducted under the Southeast Data, Assessment, and Review process with data through 2012 (SEDAR 37). Based on genetic evidence, SEDAR 37 determined that hogfish in the South Atlantic should be treated as two separate stocks, one for Georgia-North Carolina (GA-NC), and the other for Florida Keys/East Florida (FLK/EFL). SEDAR 37 also determined the status of the GA-NC stock of hogfish to be unknown, and the FLK/EFL stock of hogfish to be overfished and undergoing overfishing. In Amendment 37 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Amendment 37), the South Atlantic Fishery Management Council (Council) is proposing to modify the management unit for hogfish, specify fishing levels based on the Council's Scientific and Statistical Committee's recommendations for the GA-NC and FLK/EFL stocks of hogfish, and modify or establish management measures. For the FLK/EFL stock of hogfish, the Council is proposing to establish a rebuilding plan to increase hogfish biomass to sustainable levels within a specified time period.

Commercial Sector
Regulations (50 C.F.R. § 622.176) require participants in the South Atlantic snapper grouper fishery who are selected by the Science and Research Director (SRD) to maintain and submit a fishing record on forms provided by the SRD. Fishermen in the snapper-grouper fishery are also required to submit logbooks with trip and effort information. Hogfish have been caught commercially with a variety of gear types including spear/diving, vertical line/hook-and-line, and traps (SEDAR 37 2014). Effort from the commercial logbooks showed a declining trend in effort for hook and line fisheries in both the GA-NC stock and the FLK/EFL stock. Effort from 1993-2012 for the spear sector in the FLK/EFL stock generally declined since a high in 2002, but experienced a substantial increase from a low in 2010 through 2012 (SEDAR 37 2014). According to SEDAR 37 (2014), reports of hogfish discards were infrequent and because of those low sample sizes discard rates were the mean rate over the years 2002-2013 within each gear and region stratum. Divers reported 45% of discarded hogfish as all the fish were dead or the majority of the fish were dead. An additional 49% of hogfish were reported as kept by divers, while 4.4% of discarded hogfish were reported as "majority alive" by divers. Vertical line fishers (both hand and electric) reported 79% of discarded hogfish were alive with another 19.8% reported as kept (SEDAR 37 2014).

Recreational Sector
For the recreational sector, estimates of the number of recreational landings and discards are available from Marine Recreational Fishery Statistics Survey (MRFSS, 1981-2012), Marine Recreational Information Program (MRIP, 2004-2012), and the NMFS Southeast Headboat Survey. Early MRFSS data were calibrated to the MRIP data following the procedures of Salt et al. (2012) in SEDAR 37 (2014). SEDAR 37 (2014) reports that recreational fishing for hogfish is associated primarily with spearfishing, with the majority of the landings coming from

South/Southeastern and Western Florida. Despite Hogfish being caught infrequently on hook and line (Kingsley 2004), landings from hook and line make up a substantial fraction of the recorded landings, given that the majority of recreational trips are hook-and-line. For the Florida stocks, recent landings (2004-2012 from MRIP) estimated approximately 20% of the total recreational harvest from hook-and-line, while for the GA-NC stocks, approximately 90% was estimated as hook-and-line. Recreational harvest of hogfish was primarily from private boats, with only a small proportion from either charter boats, shore-based fishing, or headboats (SEDAR 37 2014).

Finfish Bycatch Mortality

Data in SEDAR 37 (2014) reveal that hogfish are primarily landed by spearfishing, so there are minimal data regarding catch and release mortality. Release mortality for the hook-and-line gear is suspected to be minimal due to the fact that most hogfish in deeper water (where barotrauma is more likely to occur) are of legal size (> 12”fork length (FL); Collins and McBride 2011), and are, therefore, unlikely to be released under the current management regime (12” FL minimum size limit and no closed seasons). The extent of mortality due to divers shooting sublegal fish is unknown. SEDAR 37 (2014) assumed a discard mortality rate of 10% for hook and line gear and 100% for spear gear.

During 2009-2013, the commercial sector had fewer discards of Snapper Grouper species including hogfish compared to the recreational sector (Table D-1). Recreational discards of several Snapper Grouper species in the Private mode were higher than the landings for Headboat and Charterboat modes (Table D-1). However, discards for hogfish were highest in the Headboat mode (Table D-1).

Table D-1. South Atlantic snapper grouper headboat, charter, private, and commercial mean estimates of landings and discards (2009-2013).

Species	HEADBOAT			CHARTER			PRIVATE			COMMERCIAL	
	Landings (N)	Discards (N)	Ratio (D:L)	Landings (N)	Discards (N)	Ratio (D:L)	Landings (N)	Discards (N)	Ratio (D:L)	Landings (lbs)	Discards (N)
Almaco jack	3,276	246	8%	2,581	1,211	47%	3,900	6,108	157%	197,432	800
Atlantic spadefish	133	35	27%	262	48	18%	101,741	114,598	113%	27,045	0
Banded rudderfish	15,614	2,665	17%	2,658	2,428	91%	7,603	6,474	85%	68,163	115
Bank sea bass	5,607	0	0%	792	2,084	263%	2,708	10,135	374%	540	0
Bar jack	341	59	17%	0	141		2,818	8,995	319%	4,457	0
Black grouper	337	1,339	397%	900	8,002	889%	6,589	24,499	372%	51,616	1,351
Black sea bass	165,443	553,232	334%	62,295	182,704	293%	257,417	2,682,646	1042%	510,102	60,568
Black snapper	0	0	0%	0	0		0	0		9	0
Blackfin snapper	79	59	75%	68	0	0%	1,843	0	0%	1,546	0
Blue runner	19,715	9,236	47%	10,749	15,023	140%	627,727	658,209	105%	227,134	1,762
Blueline tilefish	4,148	78	2%	9,576	459	5%	19,680	650	3%	341,160	234
Coney	50	51	101%	11	19	181%	723	174	24%	54	3
Cottonwick	13	0	0%	0	0		148	0	0%	0	0
Cubera snapper	367	19	5%	4	0	0%	1,960	111	6%	4,395	0
Dog snapper	48	12	25%	57	0	0%	822	0	0%	308	0
Gag	2,479	4,678	189%	2,688	16,025	596%	14,258	80,697	566%	471,689	7,004
Golden crab	0	0		0	0		0	0		634,192	0
Golden tilefish	8,868	0	0%	120,672	30,875	26%	904,657	520,822	58%	472,484	12
Goliath grouper	0	30	14966%	0	0		0	8,054		0	215
Gray snapper	43,916	6,465	15%	16,081	1,236	8%	279,017	1,292,452	463%	122,538	26,114
Gray triggerfish	57,539	12,135	21%	35,115	7,709	22%	92,990	111,012	119%	401,615	2,138
Graysby	1,604	1,306	81%	1,136	418	37%	5,467	10,518	192%	618	23
Greater amberjack	3,448	1,811	53%	16,390	6,814	42%	20,143	23,684	118%	897,173	1,635
Hogfish	140	231	165%	41	3	7%	29,102	3,190	11%	42,219	41

Species	HEADBOAT			CHARTER			PRIVATE			COMMERCIAL	
	Landings (N)	Discards (N)	Ratio (D:L)	Landings (N)	Discards (N)	Ratio (D:L)	Landings (N)	Discards (N)	Ratio (D:L)	Landings (lbs)	Discards (N)
Jolthead porgy	6,690	114	2%	3,014	0	0%	10,681	1,240	12%	5,055	0
Knobbed porgy	5,562	182	3%	727	0	0%	7,769	326	4%	22,913	0
Lane snapper	18,673	2,290	12%	11,644	3,506	30%	45,257	130,718	289%	3,057	210
Lesser amberjack	207	31	15%	12	0	0%	51	0	0%	17,374	23
Longspine porgy	6	0	0%	0	0		290	170	59%	0	0
Mahogany snapper	45	4	8%	0	0		35	0	0%	45	0
Margate	765	206	27%	188	59	32%	3,436	3,952	115%	3,876	23
Misty grouper	0	0		0	0		0	0		655	1
Mutton snapper	13,001	3,436	26%	19,547	8,826	45%	75,902	113,500	150%	73,908	597
Ocean triggerfish	729	0	0%	304	77	25%	4,107	3,769	92%	0	0
Queen snapper	5	0	0%	1	0	0%	0	0		3,087	84
Red grouper	1,373	10,547	768%	945	5,631	596%	18,781	52,502	280%	258,312	1,614
Red hind	212	64	30%	85	0	0%	460	564	123%	7,781	47
Red porgy	20,697	14,510	70%	9,527	3,034	32%	16,657	5,350	32%	170,004	9,800
Red snapper	5,398	44,889	832%	4,246	16,805	396%	20,521	94,894	462%	82,133	13,272
Rock hind	1,319	574	44%	83	18	22%	517	2,324	450%	13,147	11
Rock sea bass	8	0	0%	177	238	134%	2,524	6,330	251%	389	16
Sailors choice	286	0	0%	37	1,367	3740%	16,170	12,371	77%	0	0
Sand tilefish	796	952	120%	396	3,439	868%	4,863	22,423	461%	995	159
Saucereye porgy	148	1	0%	0	0		1,462	0	0%	0	0
Scamp	2,547	2,016	79%	2,275	1,361	60%	4,080	2,406	59%	194,931	740
Schoolmaster	244	0	0%	2	0	0%	4,873	2,435	50%	30	0
Scup	9,968	1,866	19%	294	28	9%	647	1,508	233%	0	414
Silk Snapper	1,322	108	8%	276	34	12%	153	855	558%	10,166	7

Species	HEADBOAT			CHARTER			PRIVATE			COMMERCIAL	
	Landings (N)	Discards (N)	Ratio (D:L)	Landings (N)	Discards (N)	Ratio (D:L)	Landings (N)	Discards (N)	Ratio (D:L)	Landings (lbs)	Discards (N)
Snowy grouper	151	51	34%	984	341	35%	861	331	38%	86,858	264
Tomtate	51,944	59,693	115%	1,159	6,544	565%	65,439	227,285	347%	176	620
Vermilion snapper	145,661	87,183	60%	37,198	18,308	49%	52,666	50,317	96%	966,504	9,033
White grunt	143,151	36,412	25%	19,706	9,601	49%	195,099	184,863	95%	108,712	389
Whitebone porgy	4,910	159	3%	2,893	9	0%	9,109	1,088	12%	13	0
Yellowedge grouper	20	2	9%	35	0	0%	44	0	0%	15,619	6
Yellowfin grouper	13	5	42%	0	0		97	0	0%	3,275	6
Yellowmouth grouper	12	5	43%	15	0	0%	0	0		204	0
Yellowtail snapper	99,863	33,144	33%	179,508	76,571	43%	287,217	715,637	249%	1,216,264	71,453

Sources: MRIP data from SEFSC Recreational ACL Dataset (Jan 2015), Headboat data from SEFSC Headboat Logbook CRNF files (expanded; July 2014), Commercial landings data from SEFSC Commercial ACL Dataset (July 2014) with discard estimates from expanded SEFSC Commercial Logbook (Nov 2014) and Commercial Discard Logbook (Nov 2014).
Note: Commercial gray triggerfish includes "triggerfishes, unclassified" category; commercial white grunt includes "grunts, unclassified" category.

Release Mortality Rates

Release mortality rates are unknown for many managed species. Recent SEDAR assessments include estimates of release mortality rates based on published studies. Stock assessment reports can be found at http://www.sefsc.noaa.gov/sedar/.

For hogfish, SEDAR 37 (2014) assumed a discard mortality rate of 10% for hook and line gear and 100% for spear gear. SEDAR 17 (2008) recommended a release mortality rate for vermilion snapper of 41% for the commercial sector and 38% for the recreational sector. The recent stock assessment for yellowtail snapper chose a rate of 10% release mortality as an approximation for the lower bound on release mortality for yellowtail snapper (SEDAR 27A 2012). SEDAR 10 (2006) estimated release mortality rates of 40% and 25% for gag taken by commercial and recreational fishermen, respectively. SEDAR 24 (2010) used release mortality rates of 48% commercial; 41% for-hire, and 39% private recreational for red snapper. Commercial and recreational release mortality rates were estimated as 20% for black grouper and red grouper in SEDAR 19 (2010). SEDAR 15 (2008) estimated a 20% release mortality rate for greater amberjack. SEDAR 32, which is under development, assumes a 12.5% release mortality rate for gray triggerfish. Snowy grouper are primarily caught in water deeper than 300 feet and golden tilefish are taken at depths greater than 540 feet; therefore, release mortality of the species are probably near 100% (SEDAR 4 2004, SEDAR 25 2011). Release mortality of black sea bass is considered to be low (7% for the recreational sector and 1% for the commercial sector) (SEDAR 25 2011) indicating minimum size limits are probably an effective management tool for black sea bass. Commercial sector discard mortality for red porgy is 35%, and 8% for the recreational sector (SEDAR Update 2012). SEDAR 32 (2013), estimates discard mortality for blueline tilefish is 100%, consistent with other deep-water species (i.e., snowy grouper, and golden tilefish); however, if new management is implemented to reduce the discard mortality rate, it might be appropriate for population projections to consider something lower than 100% (SEDAR 32 2013).

1.1 Practicability of Management Measures in Directed Fisheries Relative to their Impact on Bycatch and Bycatch Mortality

Expected Impacts on Bycatch for the Proposed Action

The snapper grouper fishery represents many species occupying the same location at the same time. Thompson and Switzer (2015) reported on habitat selection and overlap in terms of location, abiotic, and habitat variables of six co-occurring species including gag, lane snapper, gray snapper, black sea bass, white grunt, and hogfish. Results showed that hogfish were the least sympatric with the co-occurring species, with gag and the snappers co-occurring much more commonly (Thompson and Switzer 2015). Bycatch of other species is incidental in the hook-and-line fishery for hogfish, with no bycatch of other co-occurring species expected in the spear fishery for hogfish.

Preferred Sub-alternative 2c in **Action 1** would modify the snapper grouper fishery management unit to specify two separate stocks of hogfish, one from GA-NC, and the other from

the Georgia-Florida state boundary south to a line just south of Cape Sable running due west (25^0 09'.000 North Latitude). According to local law enforcement officials, this would be a good demarcation point because it is far enough north of the Keys and far enough south of Naples and Marco Island, which might translate to less fishing effort across this boundary, and in turn help reduce bycatch.

Preferred Sub-alternatives 2a and **2b** in **Action 2** would define maximum sustainable yield (MSY) for both the hogfish stocks equal to the yield produced by F_{MSY} or the F_{MSY} proxy ($F_{30\%SPR}$). MSY and F_{MSY} are recommended by the most recent SEDAR/SSC. **Preferred Sub-alternatives 4a** and **4b** in **Action 3** would define minimum stock size threshold (MSST) equal to 75% of SSB_{MSY} for both the stocks of hogfish and is consistent with how the Council has approached defining MSST for other snapper grouper stocks with low natural mortality estimates. Natural mortality for the FLK/EFL stock of hogfish is estimated at 0.179.

Preferred Sub-alternative 2b in **Action 4** would establish ACL equal to optimum yield (OY) equal to 95% acceptable biological catch (ABC) for the GA-NC stock of hogfish. The status of this stock is unknown as per SEDAR 37 (2014) and providing a buffer between the ACL and ABC could help reduce discards without compromising best scientific information available. Additionally, the Southeast Fisheries Science Center (SEFSC) worked with NMFS, the Gulf of Mexico Fishery Management Council (Gulf of Mexico Council), and South Atlantic Council to develop a Joint Dealer Reporting Amendment, which will be implemented on August 7, 2014 (SAFMC 2013c). The Joint Dealer Reporting Amendment increased required reporting frequency for dealers to once per week, and required a single dealer permit for all finfish dealers in the Southeast Region. On January 27, 2014, the Generic For-Hire Reporting Amendment was implemented (78 FR 78779, SAFMC 2013c), which required all federally-permitted headboats in the South Atlantic to report landings information electronically and on a weekly basis. The commercial landings monitoring system (CLM), the for-hire reporting, and the new dealer reporting requirements constitute major improvements to how commercial and for-hire fisheries are monitored, and go far beyond monitoring efforts that were in place when the National Standard 1 guidelines were developed. The new CLM quota monitoring system and actions in the Joint Generic Dealer and Generic For-Hire Reporting amendments are expected to provide more timely and accurate data reporting and would thus reduce the incidence of quota overages. Thus, **Preferred Sub-alternative 2b** in **Action 4** is not expected to affect the magnitude of bycatch of hogfish in the recreational or commercial sectors.

Preferred Alternative 3 in **Action 5** would establish a rebuilding plan for the FLK/EFL stock of hogfish using a rebuilding strategy setting ABC equal to a constant fishing mortality rate, under which the stock would be expected to rebuild in 10 years with a 72.5% probability of rebuilding success. This alternative is more conservative than ones considered under this action, and could result in more discards in the short term. However, with a higher probability of success of rebuilding the stock in 10 years, there would be less discards in the long term after the stock has been rebuilt.

Preferred Sub-alternative 2b in **Action 6** would establish ACL=OY=95% ABC for the FLK/EFL stock of hogfish. Similar to Action 4, this approach would provide a buffer between

the ACL and ABC and is based on the findings of the latest stock assessment (SEDAR 37 2014). A lower ACL could result in more discards, but, as mentioned earlier in this BPA, discards are inherently low for the gear used to harvest hogfish (primarily spear), and other actions are considered in this amendment that could help prevent this ACL from exceeding (Actions 7 through 12).

In **Action 7**, **Preferred Sub-alternatives 2b** and **3b** would establish an annual catch target (ACT) of 85% of the recreational ACL, for the recreational sector for the GA-NC and FLK/EFL stocks, respectively. This action would have not be expected to affect discards and/or bycatch, since the only consequence of reaching the ACT would be to monitor the landings, which MRIP does anyway.

Preferred Sub-alternative 2b in **Action 8** would increase the commercial and recreational minimum size limit for the GA-NC stock from 12" fork length (FL) to 17" FL; and **Preferred Sub-alternative 3b** in **Action 8** would increase the commercial and recreational minimum size limit for the FLK/EFL stock from 12" fork length (FL) to 15" FL. Changes in size limits can lead to regulatory discards; however, extensive scientific evidence related to life history studies, spawning, and social structure (Davis 1976; Colin 1982; McBride and Johnson 2007; McBride et al. 2008, Munoz et al. 2010; and Collins and McBride 2011) listed in SEDAR 37 (2014) recommend an increase in the size limit, which would be beneficial to the hogfish stocks and aid in rebuilding. Bycatch and discards would not be expected to increase by the increase in size limit, since the dominant mode of harvest is by spearfishing, which is highly selective in nature, and fishers using spear would be targeting the larger sized fish instead of the current ones at 12" FL.

In **Action 8**, **Preferred Sub-alternative 2c** would establish a commercial trip limit of 500 lbs per trip for the GA-NC stock of hogfish; and **Preferred Sub-alternative 3a** would establish a commercial trip limit of 25 lbs per trip for the FLK/EFL stock. Analysis in Amendment 37 (**Section 4.9.1**) shows that most of the commercial trips harvested low amounts of hogfish per trip and spear was the dominant gear type used. As mentioned before in this BPA, this gear type has not been associated with high rates of discards and therefore, the preferred sub-alternatives in Action 8 are not expected to result in an increase in bycatch and discards of hogfish.

In **Action 9**, **Preferred Sub-alternative 2a** would establish a recreational bag limit of 2 fish per person per day for the GA-NC stock of hogfish; and **Preferred Sub-alternative 3c** would establish a recreational bag limit of 1 fish per person per day for the FLK/EFL stock. The current recreational bag limit is 5 fish per person per day off Florida, with no recreational bag limit off Georgia, South Carolina, and North Carolina.

Reducing the recreational bag limits under **Action 10** would be expected in increase discards, however, analysis in Amendment 37 (**Figure 4.10.1**) revealed that during 2012-2014, 100% of the headboats harvested no more than 1 hogfish per angler; among private recreational anglers 78% harvested 1-2 hogfish per angler, 14% harvested 3-4 hogfish, and 8% harvested 5 hogfish or more per angler. Therefore, decreasing the recreational bag limit is not expected to result in an increase in discards and bycatch of hogfish.

Preferred Sub-alternative 2c in **Action 11** would establish a recreational fishing season for the FLK/EFL stocks of hogfish, from July through September. Peak spawning activity for hogfish in Florida and the Caribbean occurs during the winter and spring months (Davis 1976, Colin 1982, Claro et al. 1989, McBride and Johnson 2007, Collins and McBride 2008, Munoz et al 2010). These studies have demonstrated that spawning activity occurs predominantly during the months of December through April, and begins (and ends) slightly earlier in the Florida Keys than on the West Florida shelf (Davis 1976, McBride et al. 2008). **Preferred Sub-alternative 2c** in **Action 11** would reduce the recreational fishing season to three months and could lead to an increase in discards, however, as mentioned earlier in this BPA, hogfish are not caught with co-occurring species, as is the case with other species in the Snapper Grouper Complex. Therefore, an increased level of discards is not expected from this action.

Preferred Sub-alternatives 2a, **2b**, **3a**, **3b**, **4a**, and **4b** in **Action 12** would establish accountability measures for the commercial and recreational sectors for both the GA-NC and FLK/EFL stocks of hogfish. The in-season closures if the commercial and recreational ACLs are exceeded as well as payback measures proposed in these preferred sub-alternatives would be expected to prevent ACLs from exceeding, hence helping reduce discards.

Past, Current, and Future Actions to Prevent Bycatch and Improve Monitoring of Harvest, Discards, and Discard Mortality.

The Comprehensive Ecosystem-Based Amendment 2 (CE-BA 2; SAFMC 2011g) included actions that removed harvest of octocorals off Florida from the Coral, Coral Reefs, and Live/Hard Bottom Habitat Fishery Management Plan (Coral FMP); set the octocoral ACL for Georgia, South Carolina, and North Carolina equal to 0; modified management of special management zones (SMZs) off South Carolina; revised sea turtle release gear requirements for the snapper grouper fishery that were established in Amendment 15B to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Snapper Grouper FMP; SAFMC 2008); and designated new essential fish habitat (EFH) and EFH-Habitat Areas of Particular Concern in the South Atlantic. There is no bycatch associated with octocoral harvest within the management area of the Coral FMP since harvest is prohibited. CE-BA 2 also included an action that limited harvest and possession of snapper grouper and coastal migratory pelagics (CMP) species to the bag limit in SMZs off South Carolina. This action could reduce bycatch of regulatory discards around SMZs by restricting commercial harvest in the area, but it would probably have very little effect on the magnitude of overall bycatch of snapper grouper species in the South Atlantic.

Other actions have been taken in recently implemented amendments that could reduce bycatch of and bycatch mortality of federally-managed species in the South Atlantic. Amendment 13C to Snapper Grouper FMP (SAFMC 2006) required the use of 2 inch mesh in the back panel of black sea bass pots, which has likely reduced the magnitude of regulatory discards. Amendment 16 to the Snapper Grouper FMP (SAFMC 2009) required the use of dehooking devices, which could help reduce bycatch mortality of vermilion snapper, black sea bass, gag, red grouper, black grouper, and red snapper. Dehooking devices can allow fishermen to remove hooks with greater

ease and more quickly from snapper grouper species without removing the fish from the water. If a fish does need to be removed from the water, dehookers could still reduce handling time in removing hooks, thus increasing survival (Cooke et al. 2001). Furthermore, Amendment 17A to the Snapper Grouper FMP (SAFMC 2010a) required circle hooks for snapper grouper species north of 28 degrees latitude, which is expected to reduce bycatch mortality of snapper grouper species. Amendment 17B to the Snapper Grouper FMP (SAFMC 2010b) established ACLs and AMs and address overfishing for eight species in the snapper grouper management complex: golden tilefish, snowy grouper, speckled hind, warsaw grouper, black sea bass, gag, red grouper, black grouper, and vermilion snapper. Overfishing is no longer occurring for golden tilefish, black sea bass, snowy grouper, red grouper, black grouper, and vermilion snapper.

The Comprehensive ACL Amendment (SAFMC 2011b) implemented ACLs and AMs for species not undergoing overfishing in the Fishery Management Plans for snapper grouper, dolphin and wahoo, golden crab and *Sargassum*, in addition to other actions such as allocations and establishing annual catch targets for the recreational sector. The Comprehensive ACL Amendment (SAFMC 2011b) also established additional measures to reduce bycatch in the snapper grouper fishery with the establishment of species complexes based on biological, geographic, economic, taxonomic, technical, social, and ecological factors. ACLs were assigned to these species complexes, and when the ACL for the complex is met or projected to be met, fishing for species included in the entire species complex is prohibited for the fishing year. ACLs and AMs will likely reduce bycatch of target species and species complexes as well as incidentally caught species.

Amendment 18A to the Snapper Grouper FMP (SAFMC 2011f), included actions that could reduce bycatch of black sea bass and the potential for interactions with protected species. Actions in Amendment 18A limited the number of participants in the black sea bass pot sector, required fishermen bring pots back to port at the completion of a trip, and limited the number of pots a fishermen can deploy. Amendment 24 to the Snapper Grouper FMP (SAFMC 2011h) established a rebuilding plan for red grouper, which was overfished and undergoing overfishing. Red grouper is no longer undergoing overfishing or overfished. Amendment 24 (SAFMC 2011h) also established ACLs and AMs for red grouper, which could help to reduce bycatch of red grouper and co-occurring species.

Amendment 18B to the Snapper-Grouper FMP (SAFMC 2013c), established an endorsement program for the commercial golden tilefish longline sector, which could have positive effects for habitat and protected species. Regulatory Amendment 14 to the Snapper Grouper FMP (SAFMC 2014b) modified the fishing year for greater amberjack and black sea bass; modified the AMs for vermilion snapper and black sea bass; and modified the trip limit for gag. these actions could be expected to extend the fishing season for these species and therefore could reduce the magnitude of discards. Regulatory Amendment 15 to the Snapper Grouper FMP (SAFMC 2013c) included actions for yellowtail snapper and gag that are expected to reduce bycatch of snapper-grouper species. Regulatory Amendment 20 (SAFMC 2015) increased the recreational and commercial ACLs for snowy grouper; adjusted the rebuilding strategy; increased the commercial trip limit; and modified the recreational fishing season for snowy grouper to be consistent with that of blueline tilefish. These actions would be expected to extend the fishing seasons without

exceeding the ACLs and consistent fishing seasons for co-occurring species such as snowy grouper and blueline tilefish would help reduce bycatch and discard mortality (which is 100% for these deepwater species). Amendment 36 to the Snapper Grouper FMP, which is under development, includes actions that affect marine protected areas, and could reduce bycatch of many snapper grouper species, especially speckled hind and warsaw grouper.

The Joint Dealer Reporting Amendment (Amendment 31 to the Snapper Grouper FMP, SAFMC 2013c), which went into effect on January 27, 2014, has changed the reporting frequency for landings by headboats from monthly to weekly, and requires that reports be submitted electronically. The action is expected to provide more timely information on landings and discards. Improved information on landings would help ensure ACLs are not exceeded. Furthermore, more timely and accurate information would be expected to provide a better understanding of the composition and magnitude of catch and bycatch, enhance the quality of data provided for stock assessments, increase the quality of assessment output, and lead to better decisions regarding additional measures to reduce bycatch. Management measures that affect gear and effort for a target species can influence fishing mortality in other species. Therefore, enhanced catch and bycatch monitoring would provide better data that could be used in multi-species assessments.

The South Atlantic Council is developing an amendment to require that all federally-permitted charter vessels reporting landings information to the Southeast Fisheries Science Center (SEFSC) electronically. Additionally, an amendment will be developed to require that all federally-permitted commercial fishing vessels in the southeast also report their logbook landings information electronically. These future actions are expected to help to improve estimates on the composition and magnitude of catch and bycatch of snapper grouper species, as well as all other federally-managed species in the southeast region.

Additional information on fishery related actions from the past, present, and future considerations can be found in **Chapter 6** (Cumulative effects) of the environmental assessment.

1.2 Ecological Effects Due to Changes in the Bycatch

The ecological effects of bycatch mortality are the same as fishing mortality from directed fishing efforts. If not properly managed and accounted for, either form of mortality could potentially reduce stock biomass to an unsustainable level. As mentioned in the above section, actions have been taken, and are underway to reduce bycatch and enhance data reporting for snapper grouper species. Better bycatch and discard data would provide a better understanding of the composition and magnitude of catch and bycatch, enhance the quality of data provided for stock assessments, increase the quality of assessment output, and lead to better decisions regarding additional measures to reduce bycatch. Management measures that affect gear and effort for a target species can influence fishing mortality in other species. Therefore, enhanced catch and bycatch monitoring would provide better data that could be used in multi-species assessments.

As summarized in **Section 1.1** of this BPA, most actions in Amendment 37 are not expected to result in significant changes in bycatch of hogfish. Additionally, as stated in **Chapter 3,** and analyzed in detail in **Chapter 4**, the biological (and consequently ecological) effects due to changes in the bycatch would likely be negligible.

1.3 Changes in the Bycatch of Other Fish Species and Resulting Population and Ecosystem Effects

Amendment 37 is not expected to affect major changes in bycatch of other fish species. As mentioned in **Section 1.1** of this BPA, hogfish were the least sympatric with the co-occurring species such as gag, lane snapper, gray snapper, black sea bass, and white grunt, with gag and the snappers co-occurring much more commonly (Thompson and Switzer 2015). Bycatch of other species is incidental in the hook-and-line fishery for hogfish, with no bycatch of other co-occurring species expected in the spear fishery for hogfish. Furthermore, improved data monitoring and reporting measures have been implemented, and will continue to improve in the near future, that could be expected to reduce bycatch and discards.

1.4 Effects on Marine Mammals and Birds

Under Section 118 of the Marine Mammal Protection Act (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. Of the gear utilized within the snapper grouper fishery, only the black sea bass pot is considered to pose an entanglement risk to marine mammals. The southeast U.S. Atlantic black sea bass pot sector is included in the grouping of the Atlantic mixed species trap/pot fisheries, which the 2016 LOF classifies as a Category II (81 FR 20550, April 9, 2016). Gear types used in these fisheries are determined to have occasional incidental mortality and serious injury of marine mammals. However, hogfish are not harvested using this gear in either the commercial or the recreational sector. For the South Atlantic snapper grouper fishery, the best available data on protected species interactions are from the SEFSC Supplementary Discard Data Program (SDDP) initiated in July of 2000. The SDDP sub-samples 20% of the vessels with an active permit. Since August 2001, only three interactions with marine mammals have been documented; each was taken by handline gear and each released alive (McCarthy SEFSC database). The longline and hook-and-line gear components of the snapper grouper in the South Atlantic are classified in the 2016 LOF as Category III fisheries.

The Bermuda petrel and roseate tern occur within the action area. Bermuda petrels are occasionally seen in the waters of the Gulf Stream off the coasts of North Carolina and South Carolina during the summer. Sightings are considered rare and only occurring in low numbers (Alsop 2001). Roseate terns occur widely along the Atlantic coast during the summer but in the southeast region, they are found mainly off the Florida Keys (unpublished US Fish and Wildlife Service data). Interaction with fisheries has not been reported as a concern for either of these species.

Fishing effort reductions have the potential to reduce the amount of interactions between the fishery and marine mammals and birds. Although, the Bermuda petrel and roseate tern occur within the action area, these species are not commonly found and neither has been described as associating with vessels or having had interactions with the snapper grouper fishery. Thus, it is believed that the snapper grouper fishery is not likely to negatively affect the Bermuda petrel and the roseate tern.

1.5 Changes in Fishing, Processing, Disposal, and Marketing Costs

Research and monitoring is ongoing to understand the effectiveness of proposed management measures and their effect on bycatch. In 1990, the Southeast Fisheries Science Center (SEFSC) initiated a logbook program for vessels with federal permits in the snapper grouper fishery from the Gulf of Mexico and South Atlantic. Approximately 20% of commercial fishermen are asked to fill out discard information in logbooks; however, a greater percentage of fishermen could be selected with emphasis on individuals that dominate landings. The SEFSC is developing electronic logbooks, which could be used to enable fishery managers to obtain information on species composition, size distribution, geographic range, disposition, and depth of fishes that are released. Further, the Joint Commercial Logbook Reporting Amendment is being developed by the South Atlantic Council and the Gulf of Mexico Council, which would require electronic reporting of landings information by federally-permitted commercial vessels to increase the timeliness and accuracy of landings and discard data.

Recreational discards are obtained from MRIP and logbooks from the NMFS headboat program. Additional data collection activities for the recreational sector are being considered by the South Atlantic Council that could allow for a better monitoring of snapper grouper bycatch in the future. Some observer information has been provided by Marine Fisheries Initiative and Cooperative Research Programs (CRP), but more is desired for the snapper grouper fishery. In December 2012, the Southeast Region Headboat Survey underwent a transition from paper logbooks to electronic logbooks, which is expected to improve the quality of data in that sector. As of January 1, 2013, the paper logbook form has been replaced by a new electronic logbook. The form is available through a password protected Web site on the internet, which can be accessed by personal computer, computer tablet, or “smart phone”. The South Atlantic Council approved the For-Hire Amendment at their March 2013 meeting, which was approved and implemented in January 2014. This amendment requires weekly electronic reporting by the headboat sector.

Cooperative research projects between science and industry are being used to a limited extent to collect bycatch information on the snapper grouper fishery in the South Atlantic. For example, Harris and Stephen (2005) characterized the entire (retained and discarded) catch of reef fishes from a selected commercial fisherman in the South Atlantic including total catch composition and disposition of fishes that were released. The Gulf and South Atlantic Fisheries Foundation, Inc. conducted a fishery observer program within the snapper grouper vertical hook-and-line (bandit rig) fishery of the South Atlantic United States. Through contractors they randomly placed observers on cooperating vessels to collect a variety of data quantifying the participation, gear, effort, catch, and discards within the fishery.

In the spring 2010, Archipelago Marine Research Ltd. worked with North Carolina Sea Grant and several South Atlantic Unlimited Snapper Grouper Permit holders to test the effectiveness of electronic video monitoring to measure catch and bycatch. A total of 93 trips were monitored with video monitoring, 34 by self-reported fishing logbooks, and 5 by observers. Comparisons between electronic video monitoring data and observer data showed that video monitoring was a reliable source of catch and bycatch data.

Research funds for observer programs, as well as gear testing and testing of electronic devices are also available each year in the form of grants from the Marine Fisheries Initiative, Saltonstall-Kennedy program, and the CRP. Efforts are made to emphasize the need for observer and logbook data in requests for proposals issued by granting agencies. A condition of funding for these projects is that data are made available to the Councils and NMFS upon completion of a study.

Additional administrative and enforcement efforts would help to implement and enforce fishery regulations. NMFS established the South East Fishery-Independent Survey in 2010 to strengthen fishery-independent sampling efforts in southeast U.S. waters, addressing both immediate and long-term fishery-independent data needs, with an overarching goal of improving fishery-independent data utility for stock assessments. Meeting these data needs is critical to improving scientific advice to the management process, ensuring overfishing does not occur, and successfully rebuilding overfished stocks on schedule.

Economic effects of the actions proposed in Amendment 37 are addressed in **Chapter 4**, as well as **Appendices E** (Regulatory Impact Review) and **F** (Regulatory Flexibility Act Analysis).

1.6 Changes in Fishing Practices and Behavior of Fishermen

Actions proposed in Amendment 37 could result in a modification of fishing practices by commercial and recreational fishermen. However, as discussed in **Sections 1.0** and **1.1** of this BPA, the magnitude of discards is not expected to be significantly affected by the proposed actions. It is difficult to quantify any of the measures in terms of reducing discards until bycatch has been monitored over several years. Commercial and recreational bycatch information is collected by NMFS, and that information will continue to be analyzed to determine what changes, if any, have taken place in terms of fishing practices and fishing behavior as a result of the actions implemented through this amendment.

Social effects of actions proposed in Amendment 37 are addressed in **Chapter 4** of this document. **Section 3.3.3** includes information on environmental justice.

1.7 Changes in Research, Administration, and Enforcement Costs and Management Effectiveness

Research and monitoring is ongoing to understand the effectiveness of proposed management measure and their effect on bycatch. In 1990, the SEFSC initiated a logbook program for vessels

with federal permits in the snapper grouper fishery from the Gulf of Mexico and South Atlantic. In 1999, logbook reporting was initiated for vessels catching king and Spanish mackerel (Gulf of Mexico and South Atlantic Fishery Management Councils). Approximately 20% of commercial fishermen from snapper grouper, dolphin wahoo, and CMP fisheries are asked to fill out discard information in logbooks; however, a greater percentage of fishermen could be selected with emphasis on individuals that dominate landings. Recreational discards are obtained from the MRIP and logbooks from the NMFS headboat program.

Additional data collection activities for the recreational sector of the snapper grouper, dolphin wahoo, and CMP fisheries are being considered by the Council that could allow for a better monitoring of bycatch in the future. The Council is also developing an amendment to improve commercial logbook reporting for these fisheries. Some observer information for the snapper grouper fishery has been provided by the SEFSC, Marine Fisheries Initiative, and Cooperative Research Programs (CRP), but more is desired for the snapper grouper, dolphin wahoo, and CMP fisheries. Currently, for the snapper grouper fishery, headboats are required to carry observers, if selected.

Cooperative research projects between science and industry are being used to a limited extent to collect bycatch information on the snapper grouper fishery in the South Atlantic. For example, Harris and Stephen (2005) characterized the entire (retained and discarded) catch of reef fishes from a selected commercial fisherman in the South Atlantic including total catch composition and disposition of fishes that were released. The Gulf and South Atlantic Fisheries Foundation, Inc. (Foundation) conducted a fishery observer program within the snapper grouper vertical hook-and-line (bandit rig) fishery of the South Atlantic United States. Through contractors they randomly placed observers on cooperating vessels to collect a variety of data quantifying the participation, gear, effort, catch, and discards within the fishery.

In the spring 2010, Archipelago Marine Research Ltd. worked with North Carolina Sea Grant and several South Atlantic Unlimited Snapper Grouper Permit holders to test the effectiveness of electronic video monitoring to measure catch and bycatch. A total of 93 trips were monitored with video monitoring, 34 by self-reported fishing logbooks, and 5 by observers. Comparisons between electronic video monitoring data and observer data showed that video monitoring was a reliable source of catch and bycatch data.

Research funds for observer programs, as well as gear testing and testing of electronic devices are also available each year in the form of grants from the Foundation, Marine Fisheries Initiative, Saltonstall-Kennedy program, and the CRP. Efforts are made to emphasize the need for observer and logbook data in requests for proposals issued by granting agencies. A condition of funding for these projects is that data are made available to the Councils and NMFS upon completion of a study.

Stranding networks have been established in the Southeast Region. The NMFS SEFSC is the base for the Southeast United States Marine Mammal Stranding Program (http://sero.nmfs.noaa.gov/pr/strandings.htm). NMFS authorizes organizations and volunteers under the MMPA to respond to marine mammal strandings throughout the United States. These

organizations form the stranding network whose participants are trained to respond to, and collect samples from live and dead marine mammals that strand along southeastern United State beaches. The SEFSC is responsible for: coordinating stranding events; monitoring stranding rates; monitoring human caused mortalities; maintaining a stranding database for the southeast region; and conducting investigations to determine the cause of unusual stranding events including mass strandings and mass mortalities (http://www.sefsc.noaa.gov/species/mammals/strandings.htm).

The Southeast Regional Office and the SEFSC participate in a wide range of training and outreach activities to communicate bycatch related issues. The NMFS Southeast Regional Office issues public announcements, Southeast Fishery Bulletins, or News Releases on different topics, including use of turtle exclusion devices, bycatch reduction devices, use of methods and devices to minimize harm to turtles and sawfish, information intended to reduce harm and interactions with marine mammals, and other methods to reduce bycatch for the convenience of constituents in the southern United States. These are mailed out to various organizations, government entities, commercial interests and recreational groups. This information is also included in newsletters and publications that are produced by NMFS and the various regional fishery management councils. Announcements and news released are also available on the internet and broadcasted over NOAA weather radio.

NMFS established the South East Fishery-Independent Survey in 2010 to strengthen fishery-independent sampling efforts in southeast U.S. waters, addressing both immediate and long-term fishery-independent data needs, with an overarching goal of improving fishery-independent data utility for stock assessments. Meeting these data needs is critical to improving scientific advice to the management process, ensuring overfishing does not occur, and successfully rebuilding overfished stocks on schedule.

1.8 Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

The preferred management measures and any changes in economic, social, or cultural values are discussed in **Chapter 4** of Amendment 37. Further analysis can be found in **Appendices E** (Regulatory Impact Review) and **F** (Regulatory Flexibility Act Analysis).

1.9 Changes in the Distribution of Benefits and Costs

The distribution of benefits and costs expected from proposed actions in the environmental assessment are discussed in **Chapter 3**. Economic and social effects of the proposed actions are addressed in **Chapter 4** of this document.

1.10 Social Effects

The social effects of all the measures are described in **Chapter 4** of Amendment 37.

1.11 Conclusion

This section evaluates the practicability of taking additional action to minimize bycatch and bycatch mortality using the ten factors provided at 50 CFR 600.350(d)(3)(i). In summary, measures proposed in Amendment 37 are intended to modify the management unit for hogfish, specify fishing levels based on the Council SSC's recommendations for the GA-NC and FLK/EFL stocks of hogfish, and modify or establish management measures. For the FLK/EFL stock of hogfish, this amendment would establish a rebuilding plan to increase hogfish biomass to sustainable levels within a specified time period based on results of the recent stock assessment (SEDAR 37 2014). These actions are necessary to align the management boundaries for hogfish with the best available science (i.e., genetic information), and end overfishing and rebuild the FLK/EFL stock of hogfish while minimizing, to the extent practicable, adverse social and economic effects. As summarized in **Section 1.1** of this BPA, the actions in Amendment 37 are not expected to result in significant changes in bycatch of hogfish.

References

Colin, P. L. 1982. Spawning and larval development of the hogfish, *Lachnolaimus maximus* (Pisces: Labridae). Fishery Bulletin, U. S. 80 (4): 853-862.

Collins A. and R McBride. 2008. Final report for integrating life history, mating system, fishing effects, and habitat of hogfish, *Lachnolaimus maximus*, a harem spawning fish in the southeast U.S. FWRI File Code F2541-05-07-F.

Collins, A.B. and R.S. McBride. 2011. Demographics by depth: Spatially explicit life-history dynamics of a protogynous reef fish. Fishery Bulletin, U. S., 109, 232–242.

Cooke, S.J., D.P. Philipp, K.M. Dunmall, and J.F.Schreer. 2001. The influence of terminal tackle on injury, handling time, and cardiac disturbance of rock bass. North American Journal of Fisheries Management. Vol. 21, no. 2, pp. 333-342.

Davis, J. C. 1976. Biology of the hogfish, *Lachnolaimus maximus* (Walbaum), in the Florida Keys. M. S. Thesis. University of Miami. Coral Gables, FL. pp: 86.

Harris, P. J., and J. Stephen. 2005. Characterization of commercial reef fish catch and bycatch off the southeast coast of the United States. Final Report. Cooperative Research Program Grant No. NA03NMF4540416. SEDAR 15-RD07. July 2005..

Kingsley, MCS, ed. 2004. The Hogfish in Florida: assessment review and advisory report. Report prepared for the South Atlantic Fishery Management Council, the Gulf of Mexico Fisheries Management Council, and the National Marine Fisheries Service. Southeast Data and Assessment Review. vi+15pp.

McBride, R.S. and Johnson, M. R. 2007. Sexual development and reproductive seasonality of hogfish (Labridae: *Lachnolaimus maximus*), an hermaphroditic reef fish. Journal of Fish Biology 71:1270-1292.

McBride, R. S., P. E. Thurman, and L. H. Bullock. 2008. Regional variations of hogfish (*Lachnolaimus maximus*) life history: Consequences for spawning biomass and egg production models. J. Northw. Atl. Fish. Sci. 41:1–12.

Muñoz, R. C., M. L. Burton, K. J. Brennan, and R. O. Parker. 2010. Reproduction, habitat utilization, and movements of hogfish (*Lachnolaimus maximus*) in the Florida Keys, U.S.A.: comparisons from fished versus unfished habitats. Bull. Mar. Sci. 86:93–116.

NMFS-SERO (National Marine Fisheries Service-Southeast Regional Office. 2011. Regulatory Amendment 11: Warsaw Grouper and Speckled Hind Catches in the U.S. South Atlantic NOAA Fisheries Service Southeast Regional Office, June 1, 2011 (revised August 23, 2011), SERO-LAPP-2011-06.

NC DMF (North Carolina Division of Marine Fisheries). 2011. Blueline Tilefish Exempted Fishing Permit (EFP) Final Report. 6 pp.

Parker, Jr., R.O. and R.W. Mays. 1998. Southeastern U.S. deepwater reef fish assemblages, habitat characteristics, catches, and life history summaries. NOAA Tech. Report, National Marine Fisheries Service 138.

SAFMC (South Atlantic Fishery Management Council). 2006. Amendment 13C to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Assessment, Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2007. Final Amendment 14, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2008. Amendment 15B to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Impact Statement, Biological Assessment, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. 324 pp. plus appendices.

SAFMC (South Atlantic Fishery Management Council). 2009. Amendment 16 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. 608 pp. plus appendices.

SAFMC (South Atlantic Fishery Management Council). 2010a. Amendment 17A, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2010b. Amendment 17B, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2011a. Comprehensive Ecosystem Based Amendment 2, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. (Amendment 23 to the Snapper Grouper FMP). South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2011b. Comprehensive Annual Catch Limit Amendment for the South Atlantic Region with Final Environmental Impact Statement, Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. 755 pp. plus appendices.

SAFMC (South Atlantic Fishery Management Council). 2011d. Amendment 24 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2012a. Amendment 18A to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2012b. Amendment 18B to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2008a. Amendment 15A to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Impact Statement, Biological Assessment, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. 325 pp. with appendices.

SAFMC (South Atlantic Fishery Management Council). 2013a. Generic Amendment to the fishery management plans for the Gulf of Mexico and South Atlantic Regions for Modifications to Federally Permitted Seafood Dealer Reporting Requirements, Including Environmental Assessment, Social Impact Statement/Fishery Impact Statement, Regulatory Impact Review, and Regulatory Flexibility Act Analysis. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2013b. Joint South Atlantic/Gulf of Mexico Generic Charter/Headboat Reporting in the South Atlantic Amendment Amends the following South Atlantic Fishery Management Plans: Snapper Grouper, Dolphin and Wahoo, and Coastal Migratory Pelagic Resources with Environmental Assessment, Initial Regulatory Flexibility Act Analysis, Regulatory Impact Review, and Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2013c. Regulatory Amendment 15 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2014. Regulatory Amendment 14 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Assessment, Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SEDAR 4. 2004. Stock Assessment Report 1. Stock assessment of the deep-water snapper-grouper complex in the South Atlantic. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR 10. 2006. Stock assessment of gag in the South Atlantic. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR 15. 2008. Stock assessment of greater amberjack in the South Atlantic. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR 17 Update Assessment. 2012. Stock Assessment of Vermilion Snapper off the southeastern U.S. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR 19. 2010. Stock Assessment Report 1 (South Atlantic and Gulf of Mexico Black Grouper); and Stock Assessment Report 2 (South Atlantic Red Grouper). Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR 24. 2010. Stock Assessment Report. South Atlantic Red Snapper. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR 25. 2011. Stock Assessment Report. South Atlantic Black Sea Bass. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR Update. 2012. Stock Assessment Update Report. South Atlantic Red Porgy. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR 27A. 2012. Stock Assessment Report. Yellowtail snapper in the South Atlantic and Gulf of Mexico. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR 32. 2013. Stock Assessment Report. South Atlantic Blueline Tilefish. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

SEDAR 37. 2014. Stock Assessment Report. Hogfish in the South Atlantic and Gulf of Mexico. Available from the SEDAR website: www.sefsc.noaa.gov/sedar/

Thompson, K. and T. Switzer. 2015. Habitiat use and niche overlap of nearshore reef fish associated with seagrass habitats in the eastern Gulf of Mexico. 145th Annual Meeting of the American Fisheries Society. Portland, Oregon.

Appendix E. Regulatory Impact Review

To be completed after Council takes final action.

Appendix F. Regulatory Flexibility Analysis

To be completed after Council takes final action.

Appendix G. Other Applicable Laws

1.1 Administrative Procedure Act (APA)

All federal rulemaking is governed under the provisions of the APA (5 U.S.C. Subchapter II), which establishes a "notice and comment" procedure to enable public participation in the rulemaking process. Among other things under the APA, the National Marine Fisheries Service (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 wait period from the time a final rule is published until it takes effect, with some exceptions. Amendment 37 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Amendment 37) complies with the provisions of the APA through the South Atlantic Fishery Management Council's (South Atlantic Council) extensive use of public meetings, requests for comments and consideration of comments. The proposed rule associated with this amendment will have a request for public comments, which complies with the APA, and upon publication of the final rule, unless the rule falls within an APA exception, there will be a 30-day wait period before the regulations are effective.

1.2 Information Quality Act (IQA)

The IQA (Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-443)) which took effect October 1, 2002, directed the Office of Management and Budget (OMB) to issue government-wide guidelines that "provide policy and procedural guidelines to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by federal agencies." OMB directed each federal agency to issue its own guidelines, establish administrative mechanisms allowing affected persons to seek and obtain correction of information that does not comply with OMB guidelines, and report periodically to OMB on the number and nature of complaints. The NOAA Section 515 Information Quality Guidelines require a series of actions for each new information product subject to the IQA. Amendment 37 has used the best available information and made a broad presentation thereof. The information contained in this document was developed using best available scientific information. Therefore, this document is in compliance with the IQA.

1.3 Coastal Zone Management Act (CZMA)

Section 307(c)(1) of the federal CZMA of 1972 requires that all federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. While it is the goal of the South Atlantic Council to have management measures that complement those of the states, federal and state administrative procedures vary and regulatory changes are unlikely to be fully instituted at the same time. The South Atlantic Council believes the actions in this amendment are consistent to the maximum extent practicable with the Coastal Zone Management Plans of Florida, Georgia, South Carolina, and North Carolina. Pursuant to Section 307 of the CZMA, this determination will be submitted to the responsible state agencies who administer the approved Coastal Zone Management Programs in the States of Florida, South Carolina, Georgia, and North Carolina.

1.4 Endangered Species Act (ESA)

The ESA of 1973 (16 U.S.C. Section 1531 et seq.) requires that federal agencies must ensure actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered species or the habitat designated as critical to their survival and recovery. The ESA requires NMFS to consult with the appropriate administrative agency (itself for most marine species, and the U.S. Fish and Wildlife Service for all remaining species) when proposing an action that may affect threatened or endangered species or adversely modify critical habitat. Consultations are necessary to determine the potential impacts of the proposed action. They are concluded informally when proposed actions may affect but are "not likely to adversely affect" threatened or endangered species or designated critical habitat. Formal consultations, resulting in a biological opinion, are required when proposed actions may affect and are "likely to adversely affect" threatened or endangered species or adversely modify designated critical habitat. NMFS completed a biological opinion in 2006 (NMFS 2006) evaluating the impacts of the continued authorization of the South Atlantic snapper grouper fishery under the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Snapper Grouper FMP) and Amendment 13C to the Snapper Grouper FMP on ESA-listed species (see **Chapter 3**). The opinion stated the fishery was not likely to adversely affect North Atlantic right whale critical habitat, seabirds, or marine mammals (see NMFS 2006 for discussion on these species). However, the opinion did state that the snapper grouper fishery would adversely affect sea turtles and smalltooth sawfish, but would not jeopardize their continued existence. An incidental take statement was issued for green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, as well as smalltooth sawfish. Reasonable and prudent measures to minimize the impact of these incidental takes were specified, along with terms and conditions to implement them. See NMFS (2006) for a full discussion of impacts to smalltooth sawfish.

Table G-1. Three-year South Atlantic anticipated takes sea turtles in the snapper grouper fishery.

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

Source: NMFS 2006. NMFS (National Marine Fisheries Service). 2006. Endangered Species Act Section 7 consultation on the continued authorization of snapper grouper fishing under the Snapper Grouper FMP and Proposed Amendment 13C. Biological Opinion. June 7.

Sea turtles are vulnerable to capture by bottom longline and vertical hook-and-line gear. The magnitude of the interactions between sea turtles and the South Atlantic snapper grouper fishery was evaluated in NMFS (2006) using data from the Supplementary Discard Data Program

(SDDP). Three loggerheads and three unidentified sea turtles were caught on vertical lines; one leatherback and one loggerhead were caught on bottom longlines, all were released alive. The effort reported in the program represented between approximately 5% and 14% of all South Atlantic snapper-grouper fishing effort. These data were extrapolated in NMFS (2006) to better estimate the number of interactions between the entire snapper-grouper fishery and ESA-listed sea turtles. The extrapolated estimate was used to project future interactions (**Table G-1**).

The SDDP does not provide data on recreational fishing interactions with ESA-listed sea turtle species. However, anecdotal information indicates that recreational fishermen occasionally take sea turtles with hook-and-line gear. The biological opinion also used the extrapolated data from the SDDP to estimate the magnitude of recreational fishing on sea turtles (**Table G-1**).

Regulations implemented through Amendment 15B to the Snapper Grouper FMP (74 FR 31225; June 30, 2009) required all commercial or charter/headboat vessels with a South Atlantic snapper grouper permit, carrying hook-and-line gear on board, to possess required literature and release gear to aid in the safe release of incidentally caught sea turtles and smalltooth sawfish. These regulations are thought to decrease the mortality associated with accidental interactions with sea turtles and smalltooth sawfish.

Subsequent to the June 7, 2006, opinion, NMFS made several modifications to the list of protected species for which they are responsible. These changes included (1) the listing of two species of *Acropora* coral (71 FR 26852, May 9, 2006), (2) the designation of *Acropora* critical habitat (73 FR 72210, November 26, 2008), (3) the determination that the loggerhead sea turtle population consists of nine DPSs (76 FR 58868, September 22, 201 1), (4) the listing of five DPSs of Atlantic sturgeon (77 FR 5914, February 6, 2012, and 77 FR 5880, February 6, 2012), and (5) the listing of five additional coral species (79 FR 53851, September 10, 2014).

NMFS addressed these ESA changes in a series of consultation memoranda. In separate memoranda, NMFS concluded the continued authorization of the South Atlantic snapper-grouper fishery is not likely to adversely affect elkhorn or staghorn coral (*Acropora* spp.; July 9, 2007), *Acropora* critical habitat (December 2, 2008), and Atlantic sturgeon (February 15, 2012). The February 15, 2012, memorandum also stated that because the 2006 biological opinion had evaluated the impacts of the snapper-grouper fishery on the loggerhead sea turtle subpopulations now wholly contained within the Northwest Atlantic DPS, the biological opinion's conclusion that the fishery is not likely to jeopardize the continued existence of loggerhead sea turtles remains valid. In a memorandum dated January 23, 2013, NMFS concluded new information provided in the proposed reclassification (uplisting) of *Acropora* did not change the previous effects determination that the fishery was not likely to adversely affect *Acropora*. No new information was included in the final listing rule (79 FR 53851, September 10, 2014) that indicates NMFS's previous effects determinations regarding the potential impacts of the snapper-grouper fishery on *Acropora* were incorrect.

The final listing rule published on September 10, 2014, listed 20 new coral species under the ESA. Five of those new species occur in the Caribbean (including Florida) and all of these are listed as threatened. In a memorandum dated September 11, 2014, NMFS evaluated the effects of continued authorization of the snapper-grouper fishery on those newly listed coral species.

NMFS concluded that any adverse effects on these species from the snapper-grouper fishery are extremely unlikely to occur and are therefore discountable.

Additionally, on July 10, 2014, NMFS designated 5 habitat types across 38 marine areas in the Gulf of Mexico and South Atlantic that encompassed the 15 primary constituent elements (PCEs) of critical habitat for the northwest Atlantic Ocean (NWA) loggerhead sea turtle DPS. In a memorandum dated September 16, 2014, NMFS evaluated the potential impacts all federally managed fisheries in the Gulf of Mexico and South Atlantic regions may have on the NWA loggerhead sea turtle DPS critical habitat. The evaluation concluded the snapper-grouper fishery uses fishing methods and gear types that will either have no effect or are highly unlikely to adversely affect any of the PCEs; thus, any adverse effects from this fishery are discountable.

1.5 Executive Order 12612: Federalism

E.O. 12612 requires agencies to be guided by the fundamental federalism principles when formulating and implementing policies that have federalism implications. The purpose of the Order is to guarantee the division of governmental responsibilities between the federal government and the states, as intended by the framers of the Constitution. No federalism issues have been identified relative to the actions proposed in this document and associated regulations. Therefore, preparation of a Federalism assessment under E.O. 12612 is not necessary.

1.6 Executive Order 12866: Regulatory Planning and Review

E.O. 12866, 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 implement a new fishery management plan (FMP) or that significantly amend an existing plan. RIRs provide a comprehensive analysis of the costs and benefits to society associated with 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 Act. A regulation is significant if it is likely to result in an annual effect on the economy of at least $100,000,000 or if it has other major economic effects.

In accordance with E.O. 12866, the following is set forth by the South Atlantic Council: (1) this rule is not likely to have an annual effect on the economy of more than $100 million or to adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) this rule is not likely to create any serious inconsistencies or otherwise interfere with any action taken or planned by another agency; (3) this rule is not likely to materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights or obligations of recipients thereof; (4) this rule is not likely to raise novel or policy issues arising out of legal mandates, or the principles set forth in the Executive Order; and (5) this rule is not controversial.

This amendment includes the RIR as **Appendix E**.

1.7 Executive Order 12898: Environmental Justice

E.O. 12898 requires that "to the greatest extent practicable and permitted by law…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 alternatives being considered in this document are not expected to result in any disproportionate adverse human health or environmental effects to minority populations or low-income populations of Florida, North Carolina, South Carolina, or Georgia, rather the impacts would be spread across all participants in the snapper grouper fishery regardless of race or income. A detailed description of the communities impacted by the actions contained in this document and potential socioeconomic impacts of those actions are contained in **Chapters 3** and **4** of this document

1.8 Executive Order 12962: Recreational Fisheries

E.O. 12962 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. Additionally, the Order 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 National Recreational Fisheries Coordination 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.

The alternatives considered in this document are consistent with the directives of E.O. 12962.

1.9 Executive Order 13089: Coral Reef Protection

E.O. 13089, signed by President William Clinton on June 11, 1998, recognizes the ecological, social, and economic values provided by the Nation's coral reefs and ensures that federal agencies are protecting these ecosystems. More specifically, the Order requires federal agencies to identify actions that may harm U.S. coral reef ecosystems, to utilize their program and authorities to protect and enhance the conditions of such ecosystems, and to ensure that their actions do not degrade the condition of the coral reef ecosystem.

The alternatives considered in this document are consistent with the directives of E.O. 13089.

1.10 Executive Order 13158: Marine Protected Areas (MPAs)

E.O. 13158 was signed on May 26, 2000, to strengthen the protection of U.S. ocean and coastal resources through the use of Marine Protected Areas. The E.O. defined MPAs as "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 and cultural resources therein". It directs federal agencies to work closely with state, local and non- governmental partners to create a comprehensive network of MPAs "representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources".

The alternatives considered in this document are consistent with the directives of E.O. 13158.

1.11 Marine Mammal Protection Act (MMPA)

The 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. It also prohibits 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 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". A conservation plan is then 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. The MMPA requires a commercial fishery to be placed in one of three categories, based on the relative frequency of incidental serious injuries and mortalities of marine mammals. Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing; Category II designates fisheries with occasional serious injuries and mortalities; and Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities.

Under the MMPA, to legally fish in a Category I and/or II fishery, a fisherman must take certain steps. For example, owners of vessels or gear engaging in a Category I or II fishery, are required to obtain a marine mammal authorization by registering with the Marine Mammal Authorization Program (50 CFR 229.4). They are also required to accommodate an observer if requested (50 CFR 229.7(c)) and they must comply with any applicable take reduction plans. The commercial hook-and-line components of the South Atlantic snapper grouper fishery (i.e., bottom longline, bandit gear, and handline), which targets snapper grouper species are listed as part of a Category

III fishery (79 FR 77919, December 29, 2014) because there have been no documented interactions between these gear and marine mammals. The black sea bass pot component of the South Atlantic snapper grouper fishery is part of the Atlantic mixed species trap/pot fishery, a Category II fishery, in the final 2015 LOF (79 FR 77919, December 29, 2014). The Atlantic mixed species trap/pot fishery designation was created in 2003 (68 FR 41725, July 15, 2003), by combining several separately listed trap/pot fisheries into a single group. This group was designated Category II as a precaution because of known interactions between marine mammals and gear similar to those included in this group. Prior to this consolidation, the black sea bass pot fishery in the South Atlantic was a part of the "U.S. Mid-Atlantic and Southeast U.S. Atlantic Black Sea Bass Trap/Pot" fishery (Category III). There has never been a documented interaction between marine mammals and black sea bass trap/pot gear in the South Atlantic. The actions in this EA are not expected to negatively impact the provisions of the MMPA

1.12 National Environmental Policy Act (NEPA)

This document has been written and organized in a manner that meets NEPA requirements, and thus is a consolidated NEPA document, including an EA, as described in NOAA Administrative Order (NAO) 216- 6, Section 6.03.a.2.

Purpose and Need for Action

The purpose and need for this action are described in **Chapter 1**.

Alternatives

The alternatives for this action are described in **Chapter 2**.

Affected Environment

The affected environment is described in **Chapter 3**.

Impacts of the Alternatives

The impacts of the alternatives on the environment are described in **Chapter 4**.

1.13 National Marine Sanctuaries Act (NMSA)

Under the NMSA (also known as Title III of the Marine Protection, Research and Sanctuaries Act of 1972), as amended, the U.S. Secretary of Commerce is authorized to designate National Marine Sanctuaries to protect distinctive natural and cultural resources whose protection and beneficial use requires comprehensive planning and management. The National Marine Sanctuary Program is administered by the Sanctuaries and Reserves Division of NOAA. The NMSA provides authority for comprehensive and coordinated conservation and management of these marine areas. The National Marine Sanctuary Program currently comprises 13 sanctuaries around the country, including sites in American Samoa and Hawaii. These sites include significant coral reef and kelp forest habitats, and breeding and feeding grounds of whales, sea

lions, sharks, and sea turtles. The three sanctuaries in the South Atlantic exclusive economic zone are the USS Monitor, Gray's Reef, and Florida Keys National Marine Sanctuaries.

The alternatives considered in this document are not expected to have any adverse impacts on the resources managed by the National Marine Sanctuaries.

1.14 Paperwork Reduction Act (PRA)

The purpose of the PRA is to minimize the burden on the public. The PRA is intended to ensure that the information collected under the proposed action is needed and is collected in an efficient manner (44 U.S.C. 3501 (1)). The authority to manage information collection and record keeping requirements is vested with the Director of the Office of Management and Budget (OMB). This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications. The PRA requires NMFS to obtain approval from the OMB before requesting most types of fishery information from the public. Actions in this document are not expected to affect PRA.

1.15 Regulatory Flexibility Act (RFA)

The RFA of 1980 (5 U.S.C. 601 et seq.) requires federal agencies to assess the impacts of regulatory actions implemented through notice and comment rulemaking procedures on small businesses, small organizations, and small governmental entities, with the goal of minimizing adverse impacts of burdensome regulations and record-keeping requirements on those entities. Under the RFA, NMFS must determine whether a proposed fishery regulation would have a significant economic impact on a substantial number of small entities. If not, a certification to this effect must be prepared and submitted to the Chief Counsel for Advocacy of the Small Business Administration. Alternatively, if a regulation is determined to significantly impact a substantial number of small entities, the RFA requires the agency to prepare an initial and final Regulatory Flexibility Analysis to accompany the proposed and final rule, respectively. These analyses, which describe the type and number of small businesses, affected, the nature and size of the impacts, and alternatives that minimize these impacts while accomplishing stated objectives, must be published in the *Federal Register* in full or in summary for public comment and submitted to the chief counsel for advocacy of the Small Business Administration. Changes to the RFA in June 1996 enable small entities to seek court review of an agency's compliance with the RFA's provisions.

As NMFS has determined whether a proposed fishery regulation would have a significant economic impact on a substantial number of small entities, a certification to this effect will be prepared and submitted to the Chief Counsel for Advocacy of the Small Business Administration.

This amendment includes the RFA as **Appendix F**.

1.16 Small Business Act (SBA)

Enacted in 1953, the SBA requires that agencies assist and protect small-business interests to the extent possible to preserve free competitive enterprise. The objectives of the SBA are to foster business ownership by individuals who are both socially and economically disadvantaged; and to promote the competitive viability of such firms by providing business development assistance including, but not limited to, management and technical assistance, access to capital and other forms of financial assistance, business training, and counseling, and access to sole source and limited competition federal contract opportunities, to help firms achieve competitive viability. Because most businesses associated with fishing are considered small businesses, NMFS, in implementing regulations, must make an assessment of how those regulations will affect small businesses.

1.17 Public Law 99-659: Vessel Safety

Public Law 99-659 amended the Magnuson-Stevens Fishery Conservation and Management Act to require that a FMP or FMP amendment must consider, and may provide for, temporary adjustments (after consultation with the U.S. Coast Guard and persons utilizing the fishery) regarding access to a fishery for vessels that would be otherwise prevented from participating in the fishery because of safety concerns related to weather or to other ocean conditions. No vessel would be forced to participate in South Atlantic fisheries under adverse weather or ocean conditions as a result of the imposition of management regulations proposed in this amendment. No concerns have been raised by South Atlantic fishermen or by the U.S. Coast Guard that the proposed management measures directly or indirectly pose a hazard to crew or vessel safety under adverse weather or ocean conditions.

Appendix H. Essential Fish Habitat and Ecosystem-based Management

South Atlantic Fishery Management Council Habitat Conservation, Ecosystem Coordination and Collaboration

The Council, using the Essential Fish Habitat Plan as the cornerstone, adopted a strategy to facilitate the move to an ecosystem-based approach to fisheries management in the region. This approach required a greater understanding of the South Atlantic ecosystem and the complex relationships among humans, marine life, and the environment including essential fish habitat. To accomplish this, a process was undertaken to facilitate the evolution of the Habitat Plan into a Fishery Ecosystem Plan (FEP), thereby providing a more comprehensive understanding of the biological, social, and economic impacts of management necessary to initiate the transition from single species management to ecosystem-based management in the region.

Moving to Ecosystem-Based Management

The Council adopted broad goals for Ecosystem-Based Management to include maintaining or improving ecosystem structure and function; maintaining or improving economic, social, and cultural benefits from resources; and maintaining or improving biological, economic, and cultural diversity. Development of a regional FEP (SAFMC 2009b) provided an opportunity to expand the scope of the original Council Habitat Plan and compile and review available habitat, biological, social, and economic fishery and resource information for fisheries in the South Atlantic ecosystem. The South Atlantic Council views habitat conservation as the core of the move to EBM in the region. Therefore, development of the FEP was a natural next step in the evolution and expands and significantly updates the SAFMC Habitat Plan (SAFMC 1998a) incorporating comprehensive details of all managed species (SAFMC, South Atlantic States, ASMFC, and NOAA Fisheries Highly Migratory Species and Protected Species) including their biology, food web dynamics, and economic and social characteristics of the fisheries and habitats essential to their survival. The FEP therefore serves as a source document and presents more complete and detailed information describing the South Atlantic ecosystem and the impact of fisheries on the environment. This FEP updated information on designated Essential Fish Habitat (EFH) and EFH-Habitat Areas of Particular Concern; expanded descriptions of biology and status of managed species; presented information that will support ecosystem considerations for managed species; and described the social and economic characteristics of the fisheries in the region. In addition, it expanded the discussion and description of existing research programs and needs to identify biological, social, and economic research needed to fully address ecosystem-based management in the region. It is anticipated that the FEP will provide a greater degree of guidance by fishery, habitat, or major ecosystem consideration of bycatch reduction, prey-predator interactions, maintaining biodiversity, and spatial management needs. This FEP serves as a living source document of biological, economic, and social information for all Fishery Management Plans (FMP). Future Environmental Assessments and Environmental Impact Statements associated with subsequent amendments to Council FMPs will draw from or cite by reference the FEP.

The Fishery Ecosystem Plan for the South Atlantic Region encompasses the following volume structure:
FEP Volume I - Introduction and Overview of FEP for the South Atlantic Region
FEP Volume II - South Atlantic Habitats and Species
FEP Volume III - South Atlantic Human and Institutional Environment
FEP Volume IV - Threats to South Atlantic Ecosystem and Recommendations
FEP Volume V - South Atlantic Research Programs and Data Needs
FEP Volume VI - References and Appendices

Comprehensive Ecosystem-Based Amendment (CE-BA) 1 (SAFMC 2009b) is supported by this FEP and updated EFH and EFH-HAPC information and addressed the Final EFH Rule (e.g., GIS presented for all EFH and EFH-HAPCs). Management actions implemented in CE-BA 1 established deepwater Coral HAPCs to protect what is thought to be the largest continuous distribution (>23,000 square miles) of pristine, deepwater coral ecosystems in the world.

The Fishery Ecosystem Plan, slated to be revised every 5 years, will again be the vehicle to update and refine information supporting designation and future review of EFH and EFH-HAPCs for managed species. Planning for the update is being conducted in cooperation with the Habitat Advisory Panel during the fall and winter of 2013 with initiation during 2014.

Ecosystem Approach to Deepwater Ecosystem Management
The South Atlantic Council manages coral, coral reefs and live/hard bottom habitat, including deepwater corals, through the Fishery Management Plan for Coral, Coral Reefs and Live/Hard Bottom Habitat of the South Atlantic Region (Coral FMP). Mechanisms exist in the FMP, as amended, to further protect deepwater coral and live/hard bottom habitats. The SAFMC's Habitat and Environmental Protection Advisory Panel and Coral Advisory Panel have supported proactive efforts to identify and protect deepwater coral ecosystems in the South Atlantic region. Management actions in Comprehensive Ecosystem-Based Amendment (CE-BA 1) (SAFMC 2009b) established deepwater coral HAPCs (C- HAPCs) to protect what is thought to be the largest continuous distribution (>23,000 square miles) of pristine deepwater coral ecosystems in the world. In addition, CE-BA 1 established areas within the CHAPC, which provide for traditional fishing in limited areas, which do not impact deepwater coral habitat. CE-BA 1, supported by the FEP, also addressed non-regulatory updates for existing EFH and EFH- HAPC information and addressed the spatial requirements of the Final EFH Rule (i.e., GIS presented for all EFH and EFH-HAPCs). Actions in this amendment included modifications in the management of the following: octocorals; special management zones (SMZs) off the coast of South Carolina; and sea turtle release gear requirements for snapper grouper fishermen. The amendment also designated essential fish habitat (EFH) and EFH-Habitat Areas of Particular Concern (EFH-HAPCs).

CE-BA 2 established annual catch limits (ACL) for octocorals in the South Atlantic as well as modifying the Fishery Management Unit (FMU) for octocorals to remove octocorals off the coast of Florida from the FMU (SAFMC 2011). The amendment also limited the possession of managed species in the SMZs off South Carolina to the recreational bag limit for snapper grouper and coastal migratory pelagic species; modified sea turtle release gear requirements for the snapper grouper fishery based upon freeboard height of vessels; amends Council fishery

management plans (FMPs) to designate or modify EFH and EFH-HAPCs, including the FMP for Pelagic Sargassum Habitat; amended the Coral FMP to designate EFH for deepwater Coral HAPCs designated under CE-BA 1; and amended the Snapper Grouper FMP to designate EFH-HAPCs for golden and blueline tilefish and the deepwater Marine Protected Areas. The final rule was published in the federal register on December 30, 2011, and regulations became effective on January 30, 2012.

Building from a Habitat to an Ecosystem Network to Support the Evolution

Starting with our Habitat and Environmental Protection Advisory Panel, the Council expanded and fostered a comprehensive Habitat network in our region to develop the Habitat Plan of the South Atlantic Region completed in 1998 to support the EFH rule. Building on the core regional collaborations, the Council facilitated an expansion to a Habitat and Ecosystem network to support development of the FEP and CE-BA as well as coordinate with partners on other regional efforts.

Integrated Ocean Observing System (IOOS) and Southeast Coastal and Ocean Observing Regional Association (SECOORA)

The Integrated Ocean Observing System (IOOS®) is a partnership among federal, regional, academic, and private sector parties that works to provide new tools and forecasts to improve safety, enhance the economy, and protect our environment. IOOS supplies critical information about our Nation's oceans, coasts, and Great Lakes. Scientists working to understand climate change, governments adapting to changes in the Arctic, municipalities monitoring local water quality, and industries affected by coastal and marine spatial planning all have the same need: reliable, timely, and sustained access to data and information that inform decision making. Improving access to key marine data and information supports several purposes. IOOS data sustain national defense, marine commerce, and navigation safety. Scientists use these data to issue weather, climate, and marine forecasts. IOOS data are also used to make decisions for energy siting and production, economic development, and ecosystem-based resource management. Emergency managers and health officials need IOOS information to make decisions about public safety. Teachers and government officials rely on IOOS data for public outreach, training, and education.

SECOORA is one of 11 Regional Associations established nationwide through the US IOOS whose primary source of funding is through a 5-year cooperative agreement titled "Coordinated Monitoring, Prediction, and Assessment to Support Decision-Makers Needs for Coastal and Ocean Data and Tools". However, SECOORA was recently awarded funding via a NOAA Regional Ocean Partnership grant through the Governors' South Atlantic Alliance. SECOORA is the regional solution to integrating coastal and ocean observing data in the Southeast United States to inform decision makers and the general public. The SECOORA region encompasses 4 states, over 42 million people, and spans the coastal ocean from North Carolina to the west Coast of Florida and is creating customized products to address these thematic areas: Marine Operations; Coastal Hazards; Ecosystems, Water Quality, Living Marine Resources; and Climate Change. The Council is a voting member and Council staff was recently re-elected to serve on the Board of Directors for the Southeast Coastal Regional Ocean Observing Association (SECOORA) to guide and direct priority needs for observation and modeling to support fisheries

oceanography and integration into stock assessments through SEDAR. Cooperation through SECOORA is envisioned to facilitate the following:

- Refining current or water column designations of EFH and EFH-HAPCs (e.g., Gulf Stream and Florida Current).
- Providing oceanographic models linking benthic, pelagic habitats, and food webs.
- Providing oceanographic input parameters for ecosystem models.
- Integration of OOS information into Fish Stock Assessment process in the SA region.
- Facilitating OOS system collection of fish and fishery data and other research necessary to support the Council's use of area-based management tools in the SA Region including but not limited to EFH, EFH-HAPCs, Marine Protected Areas, Deepwater Coral Habitat Areas of Particular Concern, Special Management Zones, and Allowable Gear Areas.
- Integration of OOS program capabilities and research Needs into the South Atlantic Fishery Ecosystem Plan.
- Collaboration with SECOORA to integrate OOS products with information included in the Council's Habitat and Ecosystem Web Services and Atlas to facilitate model and tool development.
- Expanding Map Services and the Regional Habitat and Ecosystem Atlas in cooperation with SECOORAs Web Services that will provide researchers access to data or products including those collected/developed by SA OOS partners.

SECOORA researchers are developing a comprehensive data portal to provide discovery of, access to, and metadata about coastal ocean observations in the southeast US. Below are various ways to access the currently available data.

One project recently funded by SECOORA initiated development of species specific habitat models that integrate remotely sensed and in situ data to enhance stock assessments for species managed by the Council. The project during 2013/2014 was initiated to address red porgy, gray triggerfish, black seabass, and vermilion snapper. Gray triggerfish and red porgy are slated for assessment through SEDAR in 2014/15 and 2015/16 respectively.

National Fish Habitat Plan and Southeast Aquatic Resource Partnership (SARP)

In addition, the Council serves on the National Habitat Board and, as a member of the Southeast Aquatic Resource Partnership (SARP), has highlighted this collaboration by including the Southeast Aquatic Habitat Plan (SAHP) and associated watershed conservation restoration targets into the FEP. Many of the habitat, water quality, and water quantity conservation needs identified in the threats and recommendations Volume of the FEP are directly addressed by on-the-ground projects supported by SARP. This cooperation results in funding fish habitat restoration and conservation intended to increase the viability of fish populations and fishing opportunity, which also meets the needs to conserve and manage
Essential Fish Habitat for Council managed species or habitat important to their prey. To date, SARP has funded 53 projects in the region through this program. This work supports conservation objectives identified in the SAHP to improve, establish, or maintain riparian zones, water quality, watershed connectivity, sediment flows, bottoms and shorelines, and fish passage, and addresses other key factors associated with the loss and degradation of fish habitats. SARP also developed the Southern Instream Flow Network (SIFN) to address the impacts of flow alterations in the Southeastern US aquatic ecosystems which leverages policy, technical

experience, and scientific resources among partners based in 15 states. Maintaining appropriate flow into South Atlantic estuarine systems to support healthy inshore habitats essential to Council managed species is a major regional concern and efforts of SARP through SIFN are envisioned to enhance state and local partners ability to maintain appropriate flow rates.

Governor's South Atlantic Alliance (GSAA)

Initially discussed as a South Atlantic Eco-regional Compact, the Council has also cooperated with South Atlantic States in the formation of a Governor's South Atlantic Alliance (GSAA). This will also provide regional guidance and resources that will address State and Council broader habitat and ecosystem conservation goals. The GSAA was initiated in 2006. An Executive Planning Team (EPT), by the end of 2007, had created a framework for the Governors South Atlantic Alliance. The formal agreement between the four states (NC, SC, GA, and FL) was executed in May 2009. The Agreement specifies that the Alliance will prepare a "Governors South Atlantic Alliance Action Plan" which will be reviewed annually for progress and updated every five years for relevance of content. The Alliance's mission and purpose is to promote collaboration among the four states, and with the support and interaction of federal agencies, academe, regional organizations, non-governmental organizations, and the private sector, to sustain and enhance the region's coastal and marine resources. The Alliance proposes to regionally implement science-based actions and policies that balance coastal and marine ecosystems capacities to support both human and natural systems. The GSAA Action Plan was released in December 2010 and describes the four Priority Issue Areas that were identified by the Governors to be of mutual importance to the sustainability of the region's resources: Healthy Ecosystems; Working Waterfronts; Clean Coastal and Ocean Waters; and Disaster-Resilient Communities. The goals, objectives, actions, and implementation steps for each of these priorities were further described in the GSAA Implementation Plan released in July 2011. The final Action Plan was released on December 1, 2010 and marked the beginning of intensive work by the Alliance Issue Area Technical Teams (IATTs) to develop implementation steps for the actions and objectives. The GSAA Implementation Plan was published July 6, 2011, and the Alliance has been working to implement the Plan through the IATTs and two NOAA-funded Projects. The Alliance also partners with other federal agencies, academia, non-profits, private industry, regional organizations, and others. The Alliance supports both national and state-level ocean and coastal policy by coordinating federal, state, and local entities to ensure the sustainability of the region's economic, cultural, and natural resources. The Alliance has organized itself around the founding principles outlined in the GSAA Terms of Reference and detailed in the GSAA Business Plan. A team of natural resource managers, scientists, and information management system experts have partnered to develop a Regional Information Management System (RIMS) and recommend decision support tools that will support regional collaboration and decision-making. In addition to regional-level stakeholders, state and local coastal managers and decision makers will also be served by this project, which will enable ready access to new and existing data and information. The collection and synthesis of spatial data into a suite of visualization tools is a critical step for long-term collaborative planning in the South Atlantic region for a wide range of coastal uses. The Council's Atlas presents the spatial representations of Essential Fish Habitat, managed areas, regional fish and fish habitat distribution, and fishery operation information and it can be linked to or drawn on as a critical part of the collaboration with the RIMS.

South Atlantic Landscape Conservation Cooperative
One of the more recent collaborations is the Council's participation as Steering Committee member for the newly establish South Atlantic Landscape Conservation Cooperative (SALCC). Landscape Conservation Cooperatives (LCCs) are applied conservation science partnerships focused on a defined geographic area that informs on-the-ground strategic conservation efforts at landscape scales. LCC partners include DOI agencies, other federal agencies, states, tribes, non-governmental organizations, universities, and others. The newly formed Department of Interior Southeast Climate Services Center (CSC) has the LCCs in the region as their primary clients. One of the initial charges of the CSCs is to downscale climate models for use at finer scales.

The SALCC developed a Strategic Plan through an iterative process that began in December 2011. The plan provides a simple strategy for moving forward over the next few years. An operations plan was developed under direction from the SALCC Steering Committee to redouble efforts to develop version 1.0 of a shared conservation blueprint by spring-summer of 2014. The SALCC is developing the regional blueprint to address the rapid changes in the South Atlantic including but not limited to climate change, urban growth, and increasing human demands on resources which are reshaping the landscape. While these forces cut across political and jurisdictional boundaries, the conservation community does not have a consistent cross-boundary, cross-organization plan for how to respond. The South Atlantic Conservation Blueprint will be that plan. The blueprint is envisioned to be a spatially-explicit map depicting the places and actions need to sustain South Atlantic LCC objectives in the face of future change. The steps to creating the blueprint include development of: indicators and targets (shared metrics of success); the State of the South Atlantic (past, present, and future condition of indicators); and a Conservation Blueprint. Potential ways the blueprint could be used include: finding the best places for people and organizations to work together; raising new money to implement conservation actions; guiding infrastructure development (highways, wind, urban growth, etc.); creating incentives as an alternative to regulation; bringing a landscape perspective to local adaptation efforts; and locating places and actions to build resilience after major disasters (hurricanes, oil spills, etc.). Integration of connectivity, function, and threats to river, estuarine and marine systems supporting Council managed species is supported by the SALCC and enhanced by the Council being a voting member of its Steering Committee. In addition, the Council's Regional Atlas presents spatial representations of Essential Fish Habitat, managed areas, regional fish and fish habitat distribution, and fishery operation information and it be linked to or drawn on as a critical part of the collaboration with the recently developed SALCC Conservation Planning Atlas.

Building Tools to support EBM in the South Atlantic Region
The Council has developed a Habitat and Ecosystem Section of the website http://www.safmc.net/ecosystem/Home/EcosystemHome/tabid/435/Default.aspx and, in cooperation with the Florida Wildlife Research Institute (FWRI), developed a Habitat and Ecosystem Internet Map Server (IMS). The IMS was developed to support Council and regional partners' efforts in the transition to EBM. Other regional partners include NMFS Habitat Conservation, South Atlantic States, local management authorities, other Federal partners, universities, conservation organizations, and recreational and commercial fishermen. As technology and spatial information needs evolved, the distribution and use of GIS demands greater capabilities. The Council has continued its collaboration with FWRI in the now

evolution to Web Services provided through the regional SAFMC Habitat and Ecosystem Atlas (http://ocean.floridamarine.org/safmc_atlas/) and the SAFMC Digital Dashboard (http://ocean.floridamarine.org/safmc_dashboard/). The Atlas integrates services for the following:

Species distribution and spatial presentation of regional fishery independent data from the SEAMAP-SA, MARMAP, and NOAA SEFIS systems; SAFMC Fisheries: (http://ocean.floridamarine.org/SA_Fisheries/)

Essential Fish Habitat and Essential Fish Habitat Areas of Particular Concern; SAFMC EFH: (http://ocean.floridamarine.org/sa_efh/)

Spatial presentation of managed areas in the region; SAFMC Managed Areas: (http://ocean.floridamarine.org/safmc_managedareas/)

An online life history and habitat information system supporting Council managed, State managed, and other regional species was developed in cooperation with FWRI. The Ecospecies system is considered dynamic and presents, as developed, detailed individual species life history reports and provides an interactive online query capability for all species included in the system: http://atoll.floridamarine.org/EcoSpecies

Web Services System Updates:
Essential Fish Habitat (EFH) – displays EFH and EFH-HAPCS for SAFMC managed species and NOAA Fisheries Highly Migratory Species.
Fisheries - displays Marine Resources Monitoring, Assessment, and Prediction (MARMAP) and Southeast Area Monitoring and Assessment Program South Atlantic (SEAMAP-SA) data.
Managed Areas - displays a variety of regulatory boundaries (SAFMC and Federal) or management boundaries within the SAFMC's jurisdiction.
Habitat – displays habitat data collected by SEADESC, Harbor Branch Oceanographic Institute (HBOI), and Ocean Exploration dives, as well as the SEAMAP shallow and ESDIM deepwater bottom mapping projects, multibeam imagery, and scientific cruise data.
Multibeam Bathymetry - displays a variety of multibeam data sources and scanned bathymetry charts.
Nautical Charts – displays coastal, general, and overview nautical charts for the SAFMC's jurisdictional area.

Ecosystem Based Action, Future Challenges and Needs
The Council has implemented ecosystem-based principles through several existing fishery management actions including establishment of deepwater Marine Protected Areas for the Snapper Grouper fishery, proactive harvest control rules on species (e.g., dolphin and wahoo) which are not overfished, implementing extensive gear area closures which in most cases eliminate the impact of fishing gear on Essential Fish Habitat, and use of other spatial management tools including Special Management Zones. Pursuant to development of the Comprehensive Ecosystem-Based Amendment, the Council has taken an ecosystem approach to protect deepwater ecosystems while providing for traditional fisheries for the Golden Crab and

Royal Red shrimp in areas where they do not impact deepwater coral habitat. The stakeholder based process taps in on an extensive regional Habitat and Ecosystem network. Support tools facilitate Council deliberations and with the help of regional partners, are being refined to address long-term ecosystem management needs.

One of the greatest challenges to the long-term move to EBM in the region is funding high priority research, including but not limited to, comprehensive benthic mapping and ecosystem model and management tool development. In addition, collecting detailed information on fishing fleet dynamics including defining fishing operation areas by species, species complex, and season, as well as catch relative to habitat is critical for assessment of fishery, community, and habitat impacts and for Council use in place based management measures. Additional resources need to be dedicated to expand regional coordination of modeling, mapping, characterization of species use of habitats, and full funding of regional fishery independent surveys (e.g., MARMAP, SEAMAP, and SEFIS) which are linking directly to addressing high priority management needs. Development of ecosystem information systems to support Council management should build on existing tools (e.g., Regional Habitat and Ecosystem GIS and Arc Services) and provide resources to regional cooperating partners for expansion to address long-term Council needs.

The FEP and CE-BA 1 complement, but do not replace, existing FMPs. In addition, the FEP serves as a source document to the CE-BAs. NOAA should support and build on the regional coordination efforts of the Council as it transitions to a broader management approach. Resources need to be provided to collect information necessary to update and refine our FEP and support future fishery actions including but not limited to completing one of the highest priority needs to support EBM, the completion of mapping of near-shore, mid-shelf, shelf edge, and deepwater habitats in the South Atlantic region. In developing future FEPs, the Council will draw on SAFEs (Stock Assessment and Fishery Evaluation reports) which NMFS is required to provide the Council for all FMPs implemented under the Magnuson-Stevens Act. The FEP, which has served as the source document for CE-BAs, could also meet some of the NMFS SAFE requirements if information is provided to the Council to update necessary sections.

EFH and EFH-HAPC Designations Translated to Cooperative Habitat Policy Development and Protection

The Council actively comments on non-fishing projects or policies that may impact fish habitat. Appendix A of the Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region (SAFMC 1998b) outlines the Council's comment and policy development process and the establishment of a four-state Habitat Advisory Panel. Members of the Habitat Advisory Panel serve as the Council's habitat contacts and professionals in the field. AP members bring projects to the Council's attention, draft comment letters, and attend public meetings. With guidance from the Advisory Panel, the Council has developed and approved policies on:

1. Energy exploration, development, transportation, and hydropower re-licensing;
2. Beach dredging and filling and large-scale coastal engineering;
3. Protection and enhancement of submerged aquatic vegetation;
4. Alterations to riverine, estuarine, and nearshore flows;
5. Marine aquaculture;

6. Marine Ecosystems and Non-Native and Invasive Species: and
7. Estuarine Ecosystems and Non-Native and Invasive Species.

NOAA Fisheries, State and other Federal agencies apply EFH and EFH-HAPC designations and protection policies in the day-to-day permit review process. The revision and updating of existing habitat policies and the development of new policies is being coordinated with core agency representatives on the Habitat and Coral Advisory Panels. Existing policies are included at the end of this Appendix.

The Habitat and Environmental Protection Advisory Panel, as part of their role in providing continued policy guidance to the Council, is during 2013/14, reviewing and proposing revisions and updates to the existing policy statements and developing new ones for Council consideration. The effort is intended to enhance the value of the statements and support cooperation and collaboration with NOAA Fisheries Habitat Conservation Division and State and Federal partners in better addressing the Congressional mandates to the Council associated with designation and conservation of EFH in the region.

South Atlantic Bight Ecopath Model

The Council worked cooperatively with the University of British Columbia and the Sea Around Us project to develop a straw-man and preliminary food web models (Ecopath with Ecosim) to characterize the ecological relationships of South Atlantic species, including those managed by the Council. This effort was envisioned to help the Council and cooperators in identifying available information and data gaps while providing insight into ecosystem function. More importantly, the model development process provides a vehicle to identify research necessary to better define populations, fisheries, and their interrelationships. While individual efforts are still underway in the South Atlantic, only with significant investment of new resources through other programs will a comprehensive regional model be further developed.

The latest collaboration builds on the previous Ecopath model developed through the Sea Around Us project for the South Atlantic Bight with a focus on beginning a dialogue on the implications of potential changes in forage fish populations in the region that could be associated with environmental or climate change or changes in direct exploitation of those populations.

Essential Fish Habitat and Essential Fish Habitat Areas of Particular Concern

Following is a summary of the current South Atlantic Council's EFH and EFH-HAPCs. Information supporting their designation was updated (pursuant to the EFH Final Rule) in the Council's Fishery Ecosystem Plan and Comprehensive Ecosystem Amendment:

Snapper Grouper FMP

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

Gulf Stream is an essential fish habitat because it provides a mechanism to disperse snapper grouper larvae.

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

Areas which meet the criteria for EFH-HAPCs for species in the snapper-grouper management unit include medium to high profile offshore hard bottoms where spawning normally occurs; localities of known or likely periodic spawning aggregations; nearshore hard bottom areas; The Point, The Ten Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump (South Carolina); mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets; all state-designated nursery habitats of particular importance to snapper grouper (e.g., Primary and Secondary Nursery Areas designated in North Carolina); pelagic and benthic *Sargassum*; Hoyt Hills for wreckfish; the *Oculina* Bank Habitat Area of Particular Concern; all hermatypic coral habitats and reefs; manganese outcroppings on the Blake Plateau; and Council-designated Artificial Reef Special Management Zones (SMZs). In addition, the Council through CEBA 2 (SAFMC 2011) designated the deepwater snapper grouper MPAs and golden tilefish and blueline tilefish habitat as EFH-HAPCs under the Snapper Grouper FMP as follows:

EFH-HAPCs for golden tilefish to include irregular bottom comprised of troughs and terraces inter-mingled with sand, mud, or shell hash bottom. Mud-clay bottoms in depths of 150-300 meters are HAPC. Golden tilefish are generally found in 80-540 meters, but most commonly found in 200-meter depths.

EFH-HAPC for blueline tilefish to include irregular bottom habitats along the shelf edge in 45-65 meters depth; shelf break or upper slope along the 100-fathom contour (150-225 meters); hardbottom habitats characterized as rock overhangs, rock outcrops, manganese-phosphorite rock slab formations, or rocky reefs in the South Atlantic Bight; and the Georgetown Hole (Charleston Lumps) off Georgetown, SC.

EFH-HAPCs for the snapper grouper complex to include the following deepwater Marine Protected Areas (MPAs) as designated in Snapper Grouper Amendment 14: Snowy Grouper Wreck MPA, Northern South Carolina MPA, Edisto MPA, Charleston Deep Artificial Reef MPA, Georgia MPA, North Florida MPA, St. Lucie Hump MPA, and East Hump MPA.

Deepwater Coral HAPCs designated in Comprehensive Ecosystem-Based Amendment 1 are designated as Snapper Grouper EFH-HAPCs: Cape Lookout Coral HAPC, Cape Fear Coral HAPC, Blake Ridge Diapir Coral HAPC, Stetson-Miami Terrace Coral HAPC, and Pourtalés Terrace Coral HAPC.

Shrimp FMP

For penaeid shrimp, Essential Fish Habitat includes inshore estuarine nursery areas, offshore marine habitats used for spawning and growth to maturity, and all interconnecting water bodies as described in the Habitat Plan. Inshore nursery areas include tidal freshwater (palustrine), estuarine, and marine emergent wetlands (e.g., intertidal marshes); tidal palustrine forested areas; mangroves; tidal freshwater, estuarine, and marine submerged aquatic vegetation (e.g., seagrass); and subtidal and intertidal non- vegetated flats. This applies from North Carolina through the Florida Keys.

For rock shrimp, essential fish habitat consists of offshore terrigenous and biogenic sand bottom habitats from 18 to 182 meters in depth with highest concentrations occurring between 34 and 55 meters. This applies for all areas from North Carolina through the Florida Keys. Essential fish habitat includes the shelf current systems near Cape Canaveral, Florida, which provide major transport mechanisms affecting planktonic larval rock shrimp. These currents keep larvae on the Florida Shelf and may transport them inshore in spring. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse rock shrimp larvae.

Essential fish habitat for royal red shrimp include the upper regions of the continental slope from 180 meters (590 feet) to about 730 meters (2,395 feet), with concentrations found at depths of between 250 meters (820 feet) and 475 meters (1,558 feet) over blue/black mud, sand, muddy sand, or white calcareous mud. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse royal red shrimp larvae.

Areas which meet the criteria for EFH-HAPCs for penaeid shrimp include all coastal inlets, all state-designated nursery habitats of particular importance to shrimp (for example, in North Carolina this would include all Primary Nursery Areas and all Secondary Nursery Areas), and state-identified overwintering areas.

Coastal Migratory Pelagics FMP

Essential fish habitat for coastal migratory pelagic species includes sandy shoals of capes and offshore bars, high profile rocky bottom, and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward, including *Sargassum*. In addition, all coastal inlets and all state-designated nursery habitats of particular importance to coastal migratory pelagics (for example, in North Carolina this would include all Primary Nursery Areas and all Secondary Nursery Areas).

For Cobia essential fish habitat also includes high salinity bays, estuaries, and seagrass habitat. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse coastal migratory pelagic larvae.

For king and Spanish mackerel and cobia essential fish habitat occurs in the South Atlantic and Mid-Atlantic Bights.

Areas which meet the criteria for EFH-HAPCs include sandy shoals of Capes Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf stream; The Point, The Ten-Fathom Ledge, and Big Rock (North Carolina); The Charleston

Bump and Hurl Rocks (South Carolina); The Point off Jupiter Inlet (Florida); *Phragmatopoma* (worm reefs) reefs off the central east coast of Florida; nearshore hard bottom south of Cape Canaveral; The Hump off Islamorada, Florida; The Marathon Hump off Marathon, Florida; The "Wall" off of the Florida Keys; Pelagic *Sargassum*; and Atlantic coast estuaries with high numbers of Spanish mackerel and cobia based on abundance data from the ELMR Program. Estuaries meeting this criteria for Spanish mackerel include Bogue Sound and New River, North Carolina; Bogue Sound, North Carolina (Adults May-September salinity >30 ppt); and New River, North Carolina (Adults May-October salinity >30 ppt). For Cobia they include Broad River, South Carolina; and Broad River, South Carolina (Adults & juveniles May-July salinity >25ppt).

Golden Crab FMP

Essential fish habitat for golden crab includes the U.S. Continental Shelf from Chesapeake Bay south through the Florida Straits (and into the Gulf of Mexico). In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse golden crab larvae. The detailed description of seven essential fish habitat types (a flat foraminferan ooze habitat; distinct mounds, primarily of dead coral; ripple habitat; dunes; black pebble habitat; low outcrop; and soft-bioturbated habitat) for golden crab is provided in Wenner et al. (1987). There is insufficient knowledge of the biology of golden crabs to identify spawning and nursery areas and to identify HAPCs at this time. As information becomes available, the Council will evaluate such data and identify HAPCs as appropriate through the framework.

Spiny Lobster FMP

Essential fish habitat for spiny lobster includes nearshore shelf/oceanic waters; shallow subtidal bottom; seagrass habitat; unconsolidated bottom (soft sediments); coral and live/hard bottom habitat; sponges; algal communities (*Laurencia*); and mangrove habitat (prop roots). In addition the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse spiny lobster larvae.

Areas which meet the criteria for EFH-HAPCs for spiny lobster include Florida Bay, Biscayne Bay, Card Sound, and coral/hard bottom habitat from Jupiter Inlet, Florida through the Dry Tortugas, Florida.

Coral, Coral Reefs, and Live/Hard Bottom Habitats FMP

Essential fish habitat for corals (stony corals, octocorals, and black corals) incorporate habitat for over 200 species. EFH for corals include the following:

A. Essential fish habitat for hermatypic stony corals includes rough, hard, exposed, stable substrate from Palm Beach County south through the Florida reef tract in subtidal waters to 30 m depth; subtropical (15°-35° C), oligotrophic waters with high (30-35$^{o}/_{oo}$) salinity and turbidity levels sufficiently low enough to provide algal symbionts adequate sunlight penetration for photosynthesis. Ahermatypic stony corals are not light restricted and their essential fish habitat includes defined hard substrate in subtidal to outer shelf depths throughout the management area.

B. Essential fish habitat for *Antipatharia* (black corals) includes rough, hard, exposed, stable substrate, offshore in high (30-35$^{o}/_{oo}$) salinity waters in depths exceeding 18 meters (54 feet), not restricted by light penetration on the outer shelf throughout the management area.

C. Essential fish habitat for octocorals excepting the order Pennatulacea (sea pens and sea pansies) includes rough, hard, exposed, stable substrate in subtidal to outer shelf depths within a wide range of salinity and light penetration throughout the management area.

D. Essential fish habitat for Pennatulacea (sea pens and sea pansies) includes muddy, silty bottoms in subtidal to outer shelf depths within a wide range of salinity and light penetration.

Areas which meet the criteria for EFH-HAPCs for coral, coral reefs, and live/hard bottom include: The 10-Fathom Ledge, Big Rock, and The Point (North Carolina); Hurl Rocks and The Charleston Bump (South Carolina); Gray's Reef National Marine Sanctuary (Georgia); The *Phragmatopoma* (worm reefs) reefs off the central east coast of Florida; Oculina Banks off the east coast of Florida from Ft. Pierce to Cape Canaveral; nearshore (0-4 meters; 0-12 feet) hard bottom off the east coast of Florida from Cape Canaveral to Broward County); offshore (5-30 meter; 15-90 feet) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks; Biscayne Bay, Florida; Biscayne National Park, Florida; and the Florida Keys National Marine Sanctuary. In addition, the Council through CEBA 2 (SAFMC 2011) designated the Deepwater Coral HAPCs as EFH-HAPCs under the Coral FMP as follows:

Deepwater Coral HAPCs designated in Comprehensive Ecosystem-Based Amendment 1 as Snapper Grouper EFH-HAPCs: Cape Lookout Coral HAPC, Cape Fear Coral HAPC, Blake Ridge Diapir Coral HAPC, Stetson-Miami Terrace Coral HAPC, and Pourtalés Terrace Coral HAPC.

Dolphin and Wahoo FMP

EFH for dolphin and wahoo is the Gulf Stream, Charleston Gyre, Florida Current, and pelagic *Sargassum*. This EFH definition for dolphin was approved by the Secretary of Commerce on June 3, 1999 as a part of the South Atlantic Council's Comprehensive Habitat Amendment (SAFMC 1998b) (dolphin was included within the Coastal Migratory Pelagics FMP at that time).

Areas which meet the criteria for EFH-HAPCs for dolphin and wahoo in the Atlantic include The Point, The Ten-Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump and The Georgetown Hole (South Carolina); The Point off Jupiter Inlet (Florida); The Hump off Islamorada, Florida; The Marathon Hump off Marathon, Florida; The "Wall" off of the Florida Keys; and Pelagic *Sargassum*. This EFH-HAPC definition for dolphin was approved by the Secretary of Commerce on June 3, 1999 as a part of the South Atlantic Council's Comprehensive Habitat Amendment (dolphin was included within the Coastal Migratory Pelagics FMP at that time).

Pelagic *Sargassum* Habitat FMP

The Council through CEBA 2 (SAFMC 2011) designated the top 10 meters of the water column in the South Atlantic EEZ bounded by the Gulfstream, as EFH for pelagic Sargassum.

Actions Implemented That Protect EFH and EFH-HAPCs

Snapper Grouper FMP

- Prohibited the use of the following gears to protect habitat: bottom longlines in the EEZ inside of 50 fathoms or anywhere south of St. Lucie Inlet, Florida; bottom longlines in the wreckfish fishery; fish traps; bottom tending (roller- rig) trawls on live bottom habitat; and entanglement gear.
- Established the *Oculina* Experimental Closed Area where the harvest or possession of all species in the snapper grouper complex is prohibited.

Established deepwater Marine Protected Areas (MPAs) as designated in Snapper Grouper Amendment 14: Snowy Grouper Wreck MPA, Northern South Carolina MPA, Edisto MPA, Charleston Deep Artificial Reef MPA, Georgia MPA, North Florida MPA, St. Lucie Hump MPA, and East Hump MPA.

Shrimp FMP

- Prohibition of rock shrimp trawling in a designated area around the *Oculina* Bank,
- Mandatory use of bycatch reduction devices in the penaeid shrimp fishery,
- Mandatory Vessel Monitoring System (VMS) in the Rock Shrimp Fishery.
- A mechanism that provides for the concurrent closure of the EEZ to penaeid shrimping if environmental conditions in state waters are such that the overwintering spawning stock is severely depleted.

***Pelagic Sargassum* Habitat FMP**

- Prohibited all harvest and possession of *Sargassum* from the South Atlantic EEZ south of the latitude line representing the North Carolina/South Carolina border (34° North Latitude).
- Prohibited all harvest of *Sargassum* from the South Atlantic EEZ within 100 miles of shore between the 34° North Latitude line and the Latitude line representing the North Carolina/Virginia border.
- Harvest of *Sargassum* from the South Atlantic EEZ is limited to the months of November through June.
- Established an annual Total Allowable Catch (TAC) of 5,000 pounds landed wet weight.
- Required that an official observer be present on each *Sargassum* harvesting trip. Require that nets used to harvest *Sargassum* be constructed of four inch stretch mesh or larger fitted to a frame no larger than 4 feet by 6 feet.

Coastal Migratory Pelagics FMP

- Prohibited of the use of drift gillnets in the coastal migratory pelagic fishery.

Golden Crab FMP

- In the northern zone, golden crab traps can only be deployed in waters deeper than 900 feet; in the middle and southern zones traps can only be deployed in waters deeper than 700 feet.

Northern zone - north of the 28°N. latitude to the North Carolina/Virginia border;
Middle zone - 28°N. latitude to 25° N. latitude; and
Southern zone - south of 25°N. latitude to the border between the South Atlantic and Gulf of Mexico Fishery Management Councils.

Coral, Coral Reefs and Live/Hard Bottom FMP

- Established an optimum yield of zero and prohibiting all harvest or possession of these resources which serve as essential fish habitat to many managed species.
- Designated the *Oculina* Bank Habitat Area of Particular Concern.
- Expanded the *Oculina* Bank Habitat Area of Particular Concern (HAPC) to an area bounded to the west by 80°W. longitude, to the north by 28°30' N. latitude, to the south by 27°30' N. latitude, and to the east by the 100 fathom (600 feet) depth contour.
- Established the following two Satellite *Oculina* HAPCs: (1) Satellite *Oculina* HAPC #1 is bounded on the north by 28°30'N. latitude, on the south by 28°29'N. latitude, on the east by 80°W. longitude, and on the west by 80°3'W. longitude; and (2) Satellite *Oculina* HAPC #2 is bounded on the north by 28°17'N. latitude, on the south by 28°16'N. latitude, on the east by 80°W. longitude, and on the west by 80°3'W. longitude.
- Prohibited the use of all bottom tending fishing gear and fishing vessels from anchoring or using grapples in the *Oculina* Bank HAPC.
- Established a framework procedure to modify or establish Coral HAPCs.
- Established the following five deepwater CHAPCs:

Cape Lookout Lophelia Banks CHAPC;
Cape Fear Lophelia Banks CHAPC;
Stetson Reefs, Savannah and East Florida Lithoherms, and Miami Terrace (Stetson- Miami Terrace) CHAPC;
Pourtales Terrace CHAPC; and
Blake Ridge Diapir Methane Seep CHAPC.

- Within the deepwater CHAPCs, the possession of coral species and the use of all bottom damaging gear are prohibited including bottom longline, trawl (bottom and mid-water), dredge, pot or trap, or the use of an anchor, anchor and chain, or grapple and chain by all fishing vessels.

South Atlantic Council Policies for Protection and Restoration of Essential Fish Habitat
SAFMC Habitat and Environmental Protection Policy
In recognizing that species are dependent on the quantity and quality of their essential habitats, it is the policy of the SAFMC to protect, restore, and develop habitats upon which fisheries species depend; to increase the extent of their distribution and abundance; and to improve their productive capacity for the benefit of present and future generations. For purposes of this policy, "habitat" is defined as the physical, chemical, and biological parameters that are necessary for continued productivity of the species that is being managed. The objectives of the SAFMC policy will be accomplished through the recommendation of no net loss or significant environmental degradation of existing habitat. A long-term objective is to support and promote a net-gain of fisheries habitat through the restoration and rehabilitation of the productive capacity of habitats that have been degraded, and the creation and development of productive habitats where increased fishery production is probable. The SAFMC will pursue these goals at state, Federal, and local levels. The Council shall assume an aggressive role in the protection and enhancement of habitats important to fishery species, and shall actively enter Federal, decision making processes where proposed actions may otherwise compromise the productivity of fishery resources of concern to the Council.

SAFMC EFH Policy Statements
In addition to implementing regulations to protect habitat from fishing related degradation, the Council in cooperation with NOAA Fisheries, actively comments on non-fishing projects or policies that may impact fish habitat. The Council adopted a habitat policy and procedure document that established a four-state Habitat Advisory Panel and adopted a comment and policy development process. Members of the Habitat Advisory Panel serve as the Council's habitat contacts and professionals in the field. With guidance from the Advisory Panel, the Council has developed and approved a number of habitat policy statements which are available on the Habitat and Ecosystem section of the Council website (http://www.safmc.net/ecosystem/Home/EcosystemHome/tabid/435/Default.aspx).

References:

SAFMC (South Atlantic Fishery Management Council). 1998a. Habitat Plan for the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 1998b. Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 2009a. Fishery Ecosystem Plan for the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2009b. Comprehensive Ecosystem-

Based Amendment 1 for the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Suite 201; North Charleston, SC 29405.

SAFMC (South Atlantic Fishery Management Council). 2011. Comprehensive Ecosystem-Based Amendment 2 for the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Suite 201; North Charleston, SC 29405.

Wenner, E. L., G. F. Ulrich, and J. B. Wise. 1987. Exploration for golden crab, Geryon fenneri, in the south Atlantic Bight: distribution, population structure, and gear assessment. Fishery Bulletin 85:547-560.

Appendix I. Fishery Impact Statement

The Magnuson-Stevens Fishery Conservation and Management Act requires a FIS be prepared for all amendments to Fishery Management Plans (FMPs). The FIS contains an assessment of the likely biological and socioeconomic effects of the conservation and management measures on: 1) fishery participants and their communities; 2) participants in the fisheries conducted in adjacent areas under the authority of another Council; and 3) the safety of human life at sea.

Actions Contained in Amendment 37 to the Snapper Grouper FMP (Amendment 37)

In 2014, the Florida Fish and Wildlife Conservation Commission completed a stock assessment for hogfish. Based on genetic evidence, it was recommended that hogfish in the South Atlantic be managed as two stocks: Georgia through North Carolina (GA-NC) and Florida Keys/East Florida (FLK/EFL). Because of insufficient data, fishing level recommendations for the GA-NC stock were based on landings data only, and the status of that stock remains unknown. For the FLK/EFL stock, the stock assessment results showed the stock is *undergoing overfishing and is overfished* and, therefore, in need of a rebuilding plan.

Amendment 37 includes actions that evaluate: modifying the management unit for hogfish; establishing a rebuilding plan for the FLK/EFL stock to increase hogfish biomass to sustainable levels; specifying fishing levels for the GA-NC and FLK/EFL stocks of hogfish, and modifying or establishing management measures for both stocks of hogfish.

Assessment of Biological Effects

The action to specify a GA-NC stock of hogfish north of the Georgia-Florida border and a FLK/EFL stock south of the Georgia-Florida border according to the recommendation of the latest stock assessment (SEDAR 37 2014) would result in positive biological benefits since management would be based on the latest scientific research and regulations could be better tailored to address specific management issues pertinent to each stock.

The actions modifying maximum sustainable yield (MSY) and minimum stock size threshold (MSST) for both the GA-NC and FLK/EFL stocks of hogfish are expected to have positive biological impacts to the environment. These definitions are based on the most recent stock assessment (SEDAR 37 2014) and the best available scientific information reviewed by the South Atlantic Fishery Management Councils' (Council) Scientific and Statistical Committee (SSC), thereby recommending the best protection for the resource.

The Council chose a conservative rebuilding plan for the FLK/EFL stock of hogfish with a high probability of success, and the SSC indicated that the harvest levels proposed under this rebuilding plan would be sustainable and help achieve the goal of rebuilding the FLK/EFL stock of hogfish within a reasonable timeframe.

The actions to specify sector annual catch limits (ACLs) and recreational annual catch targets (ACTs) would have positive effects to the GA-NC and FLK/EFL stocks of hogfish and associated ecosystem. The specification of targets and limits, in the form of ACLs and ACTs, are crucial components of any management program involving natural resources. Without the designation of these components, regulations may not be sufficient to prevent overfishing. The Council would manage towards a biological benchmark based on scientific advice from the SSC, in the form of an acceptable biological catch (ABC) level. The specification of an ABC would protect fishery resources to allow sustainable exploitation because it follows the Council's ABC control rule and accounts for scientific uncertainty. Sustainable exploitation would allow the existence of an appropriate number of older, larger fishes in the population; a robust population provides additional protections against recruitment failure due to several years of poor environmental conditions for eggs and larvae. Conversely, delaying rebuilding could make stocks more susceptible to adverse environmental conditions that might affect recruitment success, or to unanticipated errors in parameter estimates, which could result in excessive fishing. Furthermore, the ACLs and recreational ACTs chosen by the Council include management uncertainty buffers that would provide additional protection to the hogfish stocks.

The actions to specify accountability measures (AMs) for both stocks of hogfish would have positive effects as the action would prohibit harvest in-season for both sectors if the ACLs are projected to be met. The AMs also specify corrective action if the sector ACLs are exceeded. Furthermore, several management measures are considered that would help prevent the sector ACLs from exceeding.

The actions to specify management measures would be expected to have neutral biological effects because ACLs and AMs would be in place to cap harvest, and take action if ACLs are exceeded. Furthermore, the Council's choice for minimum size limits, recreational bag limits, commercial trip limits, and establishing a recreational fishing season for the FLK/EFL stock of hogfish are meant to extend the fishing season for both stocks of hogfish without adversely affecting the biological effects.

Assessment of Economic Effects

Will be updated after the June 2016 Council meeting.

Assessment of Social Effects

Will be updated after the June 2016 Council meeting.

Assessment of Effects on Safety at Sea

The actions considered in Amendment 37 would not be expected to affect the current level of safety at sea.

Appendix J. Other Effects (Unavoidable Adverse Effects, Relationship Between Short-Term Uses and Long-Term Productivity, Mitigation, Monitoring, and Enforcement Measures, and Irreversible and Irretrievable Commitments of Resources)

1.1 Unavoidable Adverse Impacts

There are no unavoidable adverse effects on the human environment that may result from the implementation of Amendment 37 to the Snapper Grouper Fishery Management Plan in the South Atlantic Region (Amendment 37).

Actions considered in this amendment should not have adverse effects on public health or safety because these measures should not alter actual fishing practices, just how, when, and where activities can occur. Unique characteristics of the geographic area are highlighted in **Chapters 3 and 6**. These sections conclude little impact on the physical environment should occur from actions proposed in this document.

1.2 Effects of the Fishery on Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) require the National Marine Fisheries Service (NMFS) and the Councils to describe and identify Essential Fish Habitat (EFH) for each life stage of each managed species. The Magnuson-Stevens Act also directs NMFS and the Councils to identify actions to encourage the conservation and enhancement of EFH and identify measures to minimize to the extent practicable the adverse effects of fishing on EFH.

The biological and administrative impacts of the proposed actions are described in **Section 4.0**, including impacts on habitat. No actions proposed in this document are anticipated to have any adverse impact on EFH or EFH-Habitat Areas of Particular Concern (HAPC) for managed species including species in the snapper grouper complex. No additional impacts of fishing on EFH were identified during the public hearing process. Therefore the South Atlantic Fishery Management Council (Council) has determined no new measures to address impacts on EFH are necessary at this time.

Although the proposed actions are not considered to have an adverse impact on EFH requiring consultation, having particular habitat types designated as EFH for multiple life stages of multiple species provides a relative indicator of the overall value of a particular habitat which serve to strengthen the basis of NMFS EFH Conservation Recommendations. However, because the proposed action will not result in any individual habitat type or geographic area previously identified as EFH to lose that designation, the Councils' intent to protect and conserve EFH and NMFS's authority to implement that conservation mandate through the EFH consultation process is not considered to be eliminated.

The Council's adopted habitat policies, which may directly affect the area of concern, are available for download through the Habitat/Ecosystem section of the South Atlantic Council's website:
http://www.safmc.net/EcosystemManagement/HabitatProtection/HabitatPolicies/tabid/245/Default.aspx.

NOTE: The Final EFH Rule, published on January 17, 2002, (67 FR 2343) replaced the interim Final Rule of December 19, 1997 on which the original EFH and EFH-HAPC designations were made. The Final Rule directs the Councils to periodically update EFH and EFH-HAPC information and designations within fishery management plans. As was done with the original Habitat Plan, a series of technical workshops were conducted by Council habitat staff and a draft plan that includes new information has been completed pursuant to the Final EFH Rule.

1.3 Damage to Ocean and Coastal Habitats

The alternatives and proposed actions are not expected to have any adverse effect on the ocean and coastal habitat.

Management measures implemented in the original Snapper Grouper Fishery Management Plan through Amendment 7 (SAFMC 1994a) combined have significantly reduced the impact of the snapper grouper fishery on essential fish habitat (EFH). The Council has reduced the impact of the fishery and protected EFH by prohibiting the use of poisons and explosives; prohibiting use of fish traps and entanglement nets in the exclusive economic zone; banning use of bottom trawls on live/hard bottom habitat north of Cape Canaveral, Florida; restricting use of bottom longline to depths greater than 50 fathoms north of St. Lucie Inlet; and prohibiting use of black sea bass pots south of Cape Canaveral, Florida. These gear restrictions have significantly reduced the impact of the fishery on coral and live/hard bottom habitat in the South Atlantic Region.

Additional management measures in Amendment 8 (SAFMC 1997a), including specifying allowable bait nets and capping effort, have protected habitat by making existing regulations more enforceable. Establishing a controlled effort program limited overall fishing effort and to the extent there is damage to the habitat from the fishery (e.g. black sea bass pots, anchors from fishing vessels, impacts of weights used on fishing lines and bottom longlines), limited such impacts.

In addition, measures in Amendment 9 (SAFMC 1998b), that include further restricting longlines to retention of only deepwater species and requiring that black sea bass pot have escape panels with degradable fasteners, reduce the catch of undersized fish and bycatch and ensure that the pot, if lost, will not continue to “ghost” fish. Amendment 13C (SAFMC 2006) increased mesh size in the back panel of pots, which has reduced bycatch and retention of undersized fish. Amendment 15B (SAFMC 2008b) implemented sea turtle bycatch release equipment requirements, and sea turtle and smalltooth sawfish handling protocols and/or guidelines in the permitted commercial and for-hire snapper grouper fishery.

Amendment 16 (SAFMC 2009a), implemented an action to reduce bycatch by requiring fishermen to use dehooking devices. Limiting the overall fishing mortality reduces the

likelihood of over-harvesting of species with the resulting loss in genetic diversity, ecosystem diversity, and sustainability.

Measures adopted in the Coral and Shrimp FMPs have further restricted access by fishermen that had potential adverse impacts on essential snapper grouper habitat. These measures include the designation of the *Oculina* Bank HAPC and the rock shrimp closed area (see the Shrimp and Coral FMP/Amendment documents for additional information).

The Council's Comprehensive Habitat Amendment (SAFMC 1998d) contains measures that expanded the *Oculina* Bank Habitat of Particular Concern (HAPC) and added two additional satellite HAPCs. Amendment 14 (SAFMC 2007), established marine protected areas where fishing for or retention of snapper grouper species would be prohibited. Furthermore, the Comprehensive Ecosystem Based Amendment 1 (CE-BA 1) (SAFMC 2010c) established deepwater coral habitat of particular concern to protect what is believed to be the largest distribution (>23,000 square miles) of pristine deepwater coral ecosystems in the world. CE-BA 1 also created allowable gear areas for the golden crab fishery and shrimp fishery access areas for the deepwater shrimp fishery. The establishment of these areas allows for the continuation of these fisheries in their historical fishing grounds with little or no negative impacts to protected deepwater coral habitat.

Coral Amendment 8, if implemented, would expand the Stetson-Miami Terrace Deepwater Coral HAPC, the Cape Lookout Deepwater Coral HAPC, the *Oculina* Bank HAPC, while implementing a transit provision through the Oculina Bank HAPC.

Management measures implemented in the Golden Crab FMP (SAFMC 1995) has reduced the impact of the golden crab fishery on EFH. The Golden Crab FMP set up a management program for the golden crab fishery in the South Atlantic EEZ, established a limited entry system, and divided the fishery into three zones.

The Dolphin Wahoo FMP (SAFMC 2003a) has reduced the impact of the dolphin and wahoo fishery on EFH. The Dolphin Wahoo FMP closed the longline fisheries for dolphin and wahoo in areas closed to the use of such gear for highly migratory pelagic species, and specified EFH and EFH habitat areas of particular concern.

1.4 Relationship of Short-Term Uses and Long-Term Productivity

The relationship between short-term uses and long-term productivity will not be affected by Amendment 37. The effects of the actions and alternatives in this amendment on fishermen and associated communities vary with the temporal and spatial characteristics of the allowable catch through annual catch limits (ACLs). While the ACLs for the Florida Keys/East Florida (FLK/EFL) stock of hogfish will be decreased from current catch levels, the rebuilding plan will ensure that the FLK/EFL stock rebuilds in 10 years, subsequent to which, the ACLs could be increased based on the results of a stock assessment. Furthermore, management actions such as commercial trip limits, recreational bag limits, size limits, and accountability measures are also considered in Amendment 37 to extend the fishing season for both stocks of hogfish despite the ACLs being lowered from current levels.

1.5 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments are defined as commitments that cannot be reversed, except perhaps in the extreme long-term, whereas irretrievable commitments are lost for a period of time. There are no irreversible and irretrievable commitments in Amendment 37.

1.6 Unavailable or Incomplete Information

The Council on Environmental Quality, in its implementing regulations for the National Environmental Policy Act (NEPA), addressed incomplete or unavailable information at 40 CFR 1502.22 (a) and (b). There are two tests to be applied: 1) Does the incomplete or unavailable information involve "reasonable foreseeable adverse effects…;" and 2) is the information about these effects "essential to a reasoned choice among alternatives…".

A stock assessment has been conducted for hogfish. Status determinations for hogfish were derived from the Southeast Data Assessment and Review (SEDAR) process, which involves a series of three workshops designed to ensure each stock assessment reflects the best available scientific information. The findings and conclusions of each SEDAR workshop are documented in a series of reports, which are ultimately reviewed and discussed by the South Atlantic Council and their Scientific and Statistical Committee (SSC). SEDAR participants, the Council advisory committees, the Council, and NMFS staff reviewed and considered any concerns about the adequacy of the data. The Council's SSC determined that the hogfish assessment is based on the best available data.

While stock assessment findings can be associated with different degrees of uncertainty, there is no reason to assume such uncertainty leads to unrealistically optimistic conclusions about stock status. Rather, the stock could be in worse shape than indicated by the stock assessment. Uncertainty due to unavailable or incomplete information should not be used as a reason to avoid taking action. Therefore, there are reasonable foreseeable significant adverse effects of not taking action in Amendment 37. Failure to take action would not meet the purpose and need as stated in the environmental impact statement.

Appendix K. Revised Projections

Projections of the South Florida/Florida Keys Hogfish Stock under Various Rebuilding Scenarios

A report to the SAFMC SSC

October 2015

Dustin Addis and Mike Murphy
Florida Fish and Wildlife Research Institute
100 8th Ave. S.E., Saint Petersburg, FL 33701
(727) 502-4935
Dustin.Addis@myfwc.com

Introduction

Projections of Hogfish biomass were approved by the SAFMC at its March 2015 meeting to develop alternatives for rebuilding the Florida Keys including the Dry Tortugas and Eastern Florida (FLK/EFL) hogfish stock. Preliminary projections within the assessment indicated the stock can be rebuilt within 10 years under an F=0 scenario, so the maximum rebuilding time for projections is 10 years (SEDAR 37, 2014). Initial projections were requested by the SAFMC to be presented at the April 2015 SSC meeting, where Hogfish landings for 2015 were assumed to be the average landings for 2013-2014. The recreational fishery for Hogfish was closed recently due to an increase in landings observed during 2015 Wave 2 of the MRIP survey. As a result, preliminary landings for 2015 are above the landings level assumed for initial projections presented at the April SSC meeting. Due to concerns that the initial projections may no longer represent the best scientific information available, the council requested updated Hogfish projections for the East Florida/Florida Keys Hogfish stock using the most recent landings estimates for use in Snapper Grouper FMP Amendment 37.

Methods

Interim Landings

The last year of data in the Hogfish assessment report (SEDAR 37, 2014) was 2012 and changes in regulations will likely impact 2017 landings for the FLK/EFL stock. Therefore, recent catch data were generated for commercial and recreational fleets (2013-2016) by SAFMC staff. In order to generate these landings within the assessment model, the level of fishing mortality rate (F) needed to project the annual total dead biomass (landings and dead discards) for 2013- 2016 was estimated and used for all considered projection scenarios.

Projections

Projections for various F scenarios were completed using Stock Synthesis (SS3) base model configurations for the FLK/EFL hogfish stock (SEDAR 37 2014):

- F=0: no directed fishing scenario (constant discard mortality)
- $F=F_{Current}$: total fishing rate was held constant during 2017-2027 at the geometric mean rate for 2013-2015
- Constant F at F=75% F_{MSY}: a constant fishing mortality rate at 75% of F_{MSY}
- Constant F at $F=F_{MSY}$: a constant fishing mortality rate at MSY
- Constant F that rebuilds to the spawning stock biomass at MSY level in 10 years and F's associated with 72.5% probability of rebuilding in 10 years
- Constant F that rebuilds to the spawning stock biomass at MSY level in 7 years and F's associated with 72.5% probability of rebuilding in 7 years

Projection results are based on year 1 = 2017 and extending through 2027. The probability that SSB exceeds SSB_{MSY} was calculated as one minus the "Norm.Dist" function in MS Excel, which returns the normal distribution using the value for the distribution (SSB_{MSY} = 2300.39, in thousands of pounds) and the specified mean and standard deviation of projected SSB estimates by year.

Within SS3 forecasting, projections were run assuming that biology, recruitment, selectivity, and relative apical F's among fleets are the same as the last three years of the assessment (2010-2012). The predicted fleet (commercial: spear, hook-and-line, trap; recreational spear and hook-and-line) catch allocations reflected the average distribution of apical F's among fleets during 2013-2015. These allocations were also applied to 2013-2016 interim catch totals. Forecast catches within the projections were total dead fish (biomass or numbers) because hogfish discards were included in the landings in the assessment model. The predicted discarded portions of the forecasted total dead catches were estimated using observed landings and discards during 2010-2012. The base model estimates of 2010-2012 fleet-specific exploitation rates were partitioned into landed and discarded components by dividing observed discards by the total biomass or numbers to estimate fleet-specific discard exploitation rates.

These discard rates were subtracted from the corresponding fleet-specific total exploitation rates estimated within all projections and applied to the stock biomass or abundance to calculate discards. Retained catch was then calculated by subtracting these predicted discards from the total dead biomass or numbers.

All projection analyses involved iterative searches used to solve for annual scalars applied to fleet-specific exploitations to match the target exploitation rate for each projection scenario. Similar iterative searches were run for rebuild projections but the F was found by matching to the target spawning biomass at MSY. These scalars changed through time to keep the overall force of fishing constant despite the changing age structure of the stock encountered by fisheries with different selectivity patterns.

Results

The total interim landings and discards (2013-2016) are presented in pounds (in 1000s) and numbers (in 1000s) in Table 1. Projection results under scenarios: F_0, $F_{Current}$, 75% F_{MSY}, and F_{MSY} for 2017-2027 are presented in Tables 2,3,4, and 5, respectively in terms of fishing mortality rate applied, spawning stock biomass, annual stock biomass, and yield expressed in pounds (in 1000s) and numbers (in 1000s) for landings and discards. Projection results under rebuilding scenarios for constant F projections that rebuild in 10 years are presented for Prebuild=50% (Table 6) and Prebuild=72.5% (Table 7). Projection results under Prebuild scenarios for constant F projections that rebuild in 7 years are presented for Prebuild=50% (Table 8) and Prebuild=72.5% (Table 9).

References

SEDAR 37. 2014. The 2013 Stock Assessment Report for Hogfish in the South Atlantic and Gulf of Mexico. SEDAR, North Charleston, SC. 295 p.

Tables

Table 1. SAFMC staff recommended FLK/EFL Hogfish combined landings and dead discards for commercial and recreational fisheries by gear for 2013-2016.

Pounds in 1000s

Year	Landings	Discards	Total
2013	143.097	6.049	149.146
2014	287.042	12.686	299.728
2015	414.080	5.124	419.204
2016	281.764	7.759	289.523

Numbers in 1000s

Year	Landings	Discards	Total
2013	56.764	2.359	59.123
2014	153.903	5.637	159.540
2015	217.675	2.263	219.938
2016	142.458	3.435	145.893

Table 2. Projection results from the FLK/EFL stock for the F_0 rebuilding scenario. Pounds and numbers are in thousands. The calculated SSB_{MSY} = 2300.39. Probability of SSB exceeding SSB_{MSY} was calculated using the Norm.Dist function in MS Excel.

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	Annual Stock Biomass (pounds)	Yield (pounds)	Yield (numbers)	Discards (pounds)	Discards (numbers)
2017	0.001	466.101	0.000	559.762	0	0	0.595	0.283
2018	0.001	656.236	0.000	767.982	0	0	0.816	0.361
2019	0.001	885.847	0.000	1016.392	0	0	1.080	0.442
2020	0.001	1154.361	0.003	1304.632	0	0	1.386	0.536
2021	0.001	1460.854	0.049	1630.762	0	0	1.732	0.641
2022	0.001	1802.857	0.201	1991.380	0	0	2.115	0.753
2023	0.001	2176.072	0.427	2381.761	0	0	2.530	0.866
2024	0.001	2575.173	0.642	2796.428	0	0	2.970	0.979
2025	0.001	2994.447	0.798	3229.460	0	0	3.431	1.089
2026	0.001	3427.809	0.894	3674.594	0	0	3.903	1.194
2027	0.001	3869.461	0.946	4126.057	0	0	4.383	1.294

Table 3. Projection results from the FLK/EFL stock for the $F_{Current}$ rebuilding scenario, where $F_{Current}$ is the geometric mean of the terminal three years of observed landings (2013-2015). Pounds and numbers are in thousands. The calculated SSB_{MSY} = 2300.39. Probability of SSB exceeding SSB_{MSY} was calculated using the Norm.Dist function in MS Excel.

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	Annual Stock Biomass (pounds)	Yield (pounds)	Yield (numbers)	Discards (pounds)	Discards (numbers)
2017	0.344	466.101	0.000	559.762	192.138	90.620	0.595	0.283
2018	0.344	493.416	0.000	588.133	201.877	91.912	0.625	0.313
2019	0.344	513.277	0.000	608.812	208.976	92.687	0.647	0.329
2020	0.344	526.966	0.000	623.793	214.118	94.100	0.663	0.347
2021	0.344	537.927	0.000	636.165	218.364	95.721	0.676	0.367
2022	0.344	547.661	0.000	647.193	222.149	97.223	0.687	0.387
2023	0.344	556.404	0.001	657.080	225.543	98.545	0.698	0.407
2024	0.344	564.209	0.003	665.897	228.569	99.713	0.707	0.426
2025	0.344	571.131	0.007	673.708	231.251	100.750	0.716	0.444
2026	0.344	577.192	0.014	680.542	233.597	101.660	0.723	0.460
2027	0.344	582.494	0.026	686.514	235.646	102.460	0.729	0.475

Table 4. Projection results from the FLK/EFL stock for the 75% F_{MSY} rebuilding scenario. Pounds and numbers are in thousands. The calculated SSB_{MSY} = 2300.39. Probability of SSB exceeding SSB_{MSY} was calculated using the Norm.Dist function in MS Excel.

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	Annual Stock Biomass (pounds)	Yield (pounds)	Yield (numbers)	Discards (pounds)	Discards (numbers)
2017	0.104	466.101	0.000	559.762	57.475	26.890	0.595	0.283
2018	0.104	607.011	0.000	713.666	73.278	31.916	0.758	0.346
2019	0.104	760.757	0.000	880.137	90.370	36.831	0.935	0.406
2020	0.104	922.999	0.000	1055.546	108.382	42.452	1.121	0.473
2021	0.104	1091.807	0.007	1237.319	127.046	48.640	1.314	0.546
2022	0.104	1264.951	0.036	1422.584	146.069	55.003	1.511	0.622
2023	0.104	1439.271	0.094	1607.887	165.095	61.256	1.708	0.696
2024	0.104	1611.407	0.174	1789.770	183.771	67.242	1.901	0.767
2025	0.104	1778.262	0.260	1965.064	201.770	72.872	2.087	0.835
2026	0.104	1937.054	0.341	2130.953	218.803	78.088	2.264	0.897
2027	0.104	2085.738	0.411	2285.463	234.670	82.865	2.428	0.953

Table 5. Projection results from the FLK/EFL stock for the F_{MSY} rebuilding scenario. Pounds and numbers are in thousands. The calculated SSB_{MSY} = 2300.39. Probability of SSB exceeding SSB_{MSY} was calculated using the Norm.Dist function in MS Excel.

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	Annual Stock Biomass (pounds)	Yield (pounds)	Yield (numbers)	Discards (pounds)	Discards (numbers)
2017	0.138	466.101	0.000	559.762	76.834	35.986	0.595	0.283
2018	0.138	590.523	0.000	695.461	95.460	41.810	0.739	0.342
2019	0.138	721.263	0.000	837.017	114.891	47.335	0.889	0.394
2020	0.138	854.127	0.000	981.056	134.663	53.574	1.042	0.453
2021	0.138	988.036	0.003	1125.950	154.552	60.324	1.196	0.517
2022	0.138	1121.737	0.019	1269.877	174.308	67.119	1.349	0.582
2023	0.138	1253.088	0.053	1410.452	193.604	73.662	1.498	0.646
2024	0.138	1379.819	0.103	1545.339	212.120	79.808	1.642	0.707
2025	0.138	1499.935	0.160	1672.500	229.575	85.486	1.777	0.764
2026	0.138	1611.740	0.217	1790.237	245.737	90.657	1.902	0.817
2027	0.138	1714.178	0.269	1897.567	260.470	95.311	2.016	0.865

Table 6. Projection results from the FLK/EFL stock for the Rebuild 10 scenario, referring to a constant fishing rate that will rebuild the stock in 10 years associated with a probability of rebuilding (Prebuild) of 50%. Pounds and numbers are in thousands. The calculated SSB_{MSY} = 2300.39. Probability of SSB exceeding SSB_{MSY} was calculated using the Norm.Dist function in MS Excel.

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	Annual Stock Biomass (pounds)	Yield (pounds)	Yield (numbers)	Discards (pounds)	Discards (numbers)
2017	0.087	466.101	0.000	559.762	48.026	22.457	0.595	0.283
2018	0.087	615.078	0.000	722.569	61.994	26.929	0.768	0.349
2019	0.087	780.517	0.000	901.690	77.363	31.367	0.958	0.412
2020	0.087	958.225	0.001	1093.573	93.826	36.477	1.162	0.483
2021	0.087	1145.995	0.010	1295.324	111.135	42.153	1.376	0.561
2022	0.087	1341.203	0.049	1503.628	129.008	48.052	1.597	0.642
2023	0.087	1540.211	0.125	1714.531	147.103	53.910	1.821	0.722
2024	0.087	1739.110	0.224	1924.009	165.076	59.601	2.044	0.771
2025	0.087	1934.221	0.327	2128.292	182.603	65.008	2.261	0.814
2026	0.087	2122.134	0.421	2323.934	199.389	70.070	2.469	0.852
2027	0.087	2300.212	0.500	2508.350	215.211	74.752	2.664	0.885

Table 7. Projection results from the FLK/EFL stock for the Rebuild 10 scenario, referring to a constant fishing rate that will rebuild the stock in 10 years associated with a probability of rebuilding (Prebuild) of 72.5%. Pounds and numbers are in thousands. The calculated SSB_{MSY} = 2300.39. Probability of SSB exceeding SSB_{MSY} was calculated using the Norm.Dist function in MS Excel.

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	Annual Stock Biomass (pounds)	Yield (pounds)	Yield (numbers)	Discards (pounds)	Discards (numbers)
2017	0.070	466.101	0.000	559.762	38.367	17.930	0.595	0.283
2018	0.069	623.334	0.000	731.680	49.449	21.421	0.777	0.351
2019	0.068	801.673	0.000	924.754	61.982	24.996	0.982	0.418
2020	0.068	997.357	0.001	1135.772	75.710	29.200	1.206	0.494
2021	0.068	1208.116	0.014	1361.710	90.469	33.965	1.446	0.577
2022	0.067	1430.997	0.067	1598.863	106.059	39.027	1.698	0.664
2023	0.067	1661.827	0.167	1842.710	122.197	44.162	1.957	0.751
2024	0.067	1896.011	0.293	2088.511	138.566	49.254	2.219	0.806
2025	0.067	2129.079	0.417	2331.672	154.851	54.183	2.477	0.855
2026	0.068	2356.761	0.525	2567.875	170.750	58.878	2.728	0.898
2027	0.068	2575.569	0.613	2793.672	186.018	63.295	2.968	0.936

Table 8. Projection results from the FLK/EFL stock for the Rebuild 7 scenario, referring to a constant fishing rate that will rebuild the stock in 7 years associated with a probability of rebuilding (Prebuild) of 50%. Pounds and numbers are in thousands. The calculated SSB_{MSY} = 2300.39. Probability of SSB exceeding SSB_{MSY} was calculated using the Norm.Dist function in MS Excel.

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	Annual Stock Biomass (pounds)	Yield (pounds)	Yield (numbers)	Discards (pounds)	Discards (numbers)
2017	0.027	466.101	0.000	559.762	14.352	6.695	0.595	0.283
2018	0.027	643.910	0.000	754.386	19.342	8.320	0.801	0.357
2019	0.027	853.516	0.000	981.219	25.157	10.015	1.042	0.433
2020	0.027	1092.682	0.002	1238.377	31.751	12.023	1.315	0.520
2021	0.027	1359.505	0.030	1523.051	39.049	14.329	1.618	0.616
2022	0.027	1650.910	0.133	1831.318	46.953	16.823	1.945	0.718
2023	0.027	1962.295	0.306	2158.166	55.333	19.402	2.293	0.820
2024	0.027	2288.307	0.494	2498.077	64.049	22.028	2.654	0.889

Table 9. Projection results from the FLK/EFL stock for the Rebuild 7 scenario, referring to a constant fishing rate that will rebuild the stock in 7 years associated with a probability of rebuilding (Prebuild) of 72.5%. Pounds and numbers are in thousands. The calculated SSB_{MSY} = 2300.39. Probability of SSB exceeding SSB_{MSY} was calculated using the Norm.Dist function in MS Excel.

Year	F	SSB (pounds)	Probability of SSB > SSB_{MSY}	Annual Stock Biomass (pounds)	Yield (pounds)	Yield (numbers)	Discards (pounds)	Discards (numbers)
2017	0.022	466.101	0.000	559.762	11.858	5.530	0.595	0.283
2018	0.022	646.051	0.000	756.747	15.774	6.780	0.804	0.358
2019	0.022	859.315	0.000	987.529	20.469	8.136	1.049	0.434
2020	0.022	1103.904	0.002	1250.438	25.906	9.787	1.328	0.523
2021	0.022	1378.000	0.031	1542.725	32.042	11.725	1.639	0.621
2022	0.022	1678.512	0.145	1860.424	38.810	13.861	1.976	0.724
2023	0.022	2000.728	0.329	2198.414	46.106	16.110	2.335	0.829
2024	0.022	2339.124	0.523	2551.010	53.809	18.441	2.710	0.899

Appendix L. Modeling the Combined Effects of Snapper-Grouper Amendment 37 Proposed Management Measures for Recreationally-Caught Hogfish

LAPP/DM and Social Science Branches
National Marine Fisheries Service, Southeast Regional Office

Introduction

The Florida Fish and Wildlife Conservation Commission (FWC) completed a benchmark stock assessment for hogfish in 2014 (SEDAR 37 2014). The South Atlantic Fishery Management Council (Council)'s Scientific and Statistical Committee (SSC) reviewed the assessment and provided fishing level recommendations in October 2014. The Council received the SSC's recommendations at their December 2014 meeting. Based on genetic evidence, the SSC supported treating hogfish in the South Atlantic as two stocks: Georgia-North Carolina (GA-NC) and Florida Keys/East Florida (FLK/EFL). Each stock was then evaluated with regard to fishing level recommendations. The SSC developed catch level recommendations for the GA-NC stock using the Only Reliable Catch Stocks (ORCS) approach, as outlined in Level 4 of the Council's acceptable biological catch (ABC) control rule. For the FLK/EFL stock, the SSC considered the benchmark assessment to represent the best available science and recommended it for use in management. The Southeast Fisheries Science Center (SEFSC) concurred with this determination. The assessment results indicated the FLK/EFL stock is undergoing overfishing, is overfished and, therefore, is in need of a rebuilding plan.

In response to the outcome of the SEDAR 37 (2014) assessment, the Council began development of Amendment 37 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (SG-37). SG-37 proposes different ABCs, annual catch limits (ACLs), annual catch targets, seasonal closures, minimum size limits (MSL), and bag limits for the FLK/EFL and GA-NC hogfish stocks. This report presents the development of recreational decision tools (RDTs) to simulate the impacts of various combinations of proposed management measures to support SG-37 (Figure 1).

Current Management Regulations

The following regulations currently apply to South Atlantic hogfish recreational fishing:

1) 12-inch fork length minimum size limit (MSL) (South Atlantic Federal waters, State waters off Florida, South Carolina, and North Carolina)
2) 5-fish per harvester daily bag limit (South Atlantic Federal waters, State waters off Florida and North Carolina)

SNAPPER-GROUPER AMENDMENT 37: RECREATIONAL HOGFISH

RECREATIONAL DECISION TOOL for EAST FLORIDA / FLORIDA KEYS STOCK

Baseline landings based on average of 2012-2015

MODEL INPUTS:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1. Select seasonal closure:	31	29	31	30	31	30	31	31	30	31	30	31	<- max days to close
Select number of days each month will be closed:	31	29	31	30	31	30	0	0	0	31	30	31	<- days closed
Percent of month closed:	100%	100%	100%	100%	100%	100%	0%	0%	0%	100%	100%	100%	<- pct of month closed

2. Select effort shift scalar: 0% effort shift — *How much will catch rates increase in months surrounding seasonal closure, reflecting possible effort shifting?*

3. Select minimum size limit: 16" FL (inches) — *Current recreational minimum size limit is 12" Fork Length (FL)*

4. Select bag limit or vessel limit: 1 fish / angler on the vessel — *Current recreational bag limit is 5 fish per angler on the vessel.*

ACL ALTERNATIVE 2a:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Projected Recreational Landings (N):	0	0	0	0	0	0	4,008	4,007	970	0	0	0	
Projected Recreational Dead Discards (N @ ρ=10%):	762	712	968	966	563	545	408	408	140	172	251	260	
Projected Recreational Removals (N):	762	712	968	966	563	545	4,416	4,415	1,110	172	251	260	*Assumes 10% release mortality rate for hook and line, perfect compliance for spear trips (73% of all landings).*

ACL ALTERNATIVE 2b:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Projected Recreational Landings (N):	0	0	0	0	0	0	4,008	4,007	970	0	0	0	
Projected Recreational Dead Discards (N @ ρ=10%):	762	712	968	966	563	545	408	408	140	172	251	260	
Projected Recreational Removals (N):	762	712	968	966	563	545	4,416	4,415	1,110	172	251	260	*Assumes 10% release mortality rate for hook and line, perfect compliance for spear trips (73% of all landings).*

ACL ALTERNATIVE 2c:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Projected Recreational Landings (N):	0	0	0	0	0	0	4,008	4,007	970	0	0	0	
Projected Recreational Dead Discards (N @ ρ=10%):	762	712	968	966	563	545	408	408	140	172	251	260	
Projected Recreational Removals (N):	762	712	968	966	563	545	4,416	4,415	1,110	172	251	260	*Assumes 10% release mortality rate for hook and line, perfect compliance for spear trips (73% of all landings).*

PROJECTION RESULTS:

LANDINGS

	Alt 2a	Alt 2b	Alt 2c
Recreational ACL (LBS):	34,672	32,939	31,205
Recreational ACL (N):	16,514	15,688	14,863
Total Projected Recreational Landings (N):	8,985	8,985	8,985
%ACL Landed:	54%	57%	60%
	0%	0%	

FIXED ACL, DOES NOT ADJUST TO DIFFERENT SIZE LIMITS, BASED ON SAFMC STAFF PROPOSED OFL, ABC, AND ACL IN NUMBERS APPROACH FROM SAFMC STAFF PRESENTATION 3/4/2016 TO SAFMC SSC

<--Select ACT buffer [feature disabled]

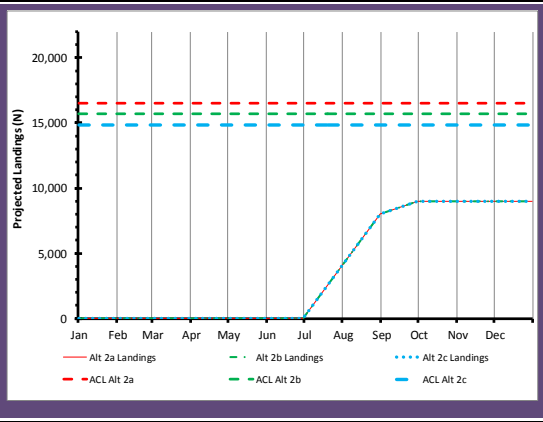
REMOVALS

	Alt 2a	Alt 2b	Alt 2c
Total Projected Recreational Removals (N):	15,141	15,141	15,141

QUOTA CLOSURE

	Alt 2a	Alt 2b	Alt 2c
Projected Closure Date:	N/A	N/A	N/A
Open Days in Season:	92	92	92

Note: This model does not account for effort shifting that may take place during a seasonal closure, nor does it consider any changes in the average size of hogfish during rebuilding. Thus, management reductions presented in these tables may be overestimates, and caution should be taken in their interpretation and use.



ECONOMIC EFFECTS PROJECTIONS:

ACL Alt 2a

CHANGE FROM STATUS QUO CONSUMER SURPLUS (2014 $) - Full Recreational Fishery

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
-$159,771	-$149,430	-$357,406	-$309,745	-$67,404	-$65,239	-$132,421	-$132,433	-$20,015	-$33,077	-$18,691	-$19,310	-$1,464,942

ACL Alt 2b

CHANGE FROM STATUS QUO CONSUMER SURPLUS (2014 $) - Full Recreational Fishery

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
-$159,771	-$149,430	-$357,406	-$309,745	-$67,404	-$65,239	-$132,421	-$132,433	-$20,015	-$33,077	-$18,691	-$19,310	-$1,464,942

ACL Alt 2c

CHANGE FROM STATUS QUO CONSUMER SURPLUS (2014 $) - Full Recreational Fishery

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
-$159,771	-$149,430	-$357,406	-$309,745	-$67,404	-$65,239	-$132,421	-$132,433	-$20,015	-$33,077	-$18,691	-$19,310	-$1,464,942

Note 1: This model implicitly assumes that hogfish will be landed in addition to other species on a trip and that the proposed action will have no effect on the number of recreational trips that would be expected to occur under the status quo.
Note 2: Estimated landings are rounded to the nearest whole fish and all landed fish are assigned the same value regardless of size.
Note 3: For a breakdown by mode, see Economics tab (link below).

ADDITIONAL DETAILS AVAILABLE ON THE ECONOMICS TAB

Figure 1A. Screenshot of FLK/EFL hogfish recreational decision tool, showing dropdown menus for user-specified management measures.

SNAPPER-GROUPER AMENDMENT 37: RECREATIONAL HOGFISH

RECREATIONAL DECISION TOOL for GEORGIA to NORTH CAROLINA STOCK

Baseline landings based on average of 2012-2015

MODEL INPUTS:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1. Select seasonal closure:	31	29	31	30	31	30	31	31	30	31	30	31	<- max days to close
Select number of days each month will be closed:	0	0	0	0	0	0	0	0	0	0	0	0	<- days closed
Percent of month closed:	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	<- pct of month closed

2. Select effort shift scalar: 0% effort shift — *How much will catch rates increase in months surrounding seasonal closure, reflecting possible effort shifting?*

3. Select minimum size limit: 12" FL (inches) [Status Quo] — *Current recreational minimum size limit is 12" Fork Length (FL)*

4. Select bag limit or vessel limit: Status Quo (no bag limit) — *Current recreational bag limit is 5 fish per angler on the vessel.*

ACL ALTERNATIVE 2a:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Projected Recreational Landings (N):	0	0	0	0	160	156	64	40	6	6	0	0	
Projected Recreational Dead Discards (N @ ρ=10%):	0	0	0	0	41	39	0	0	0	0	0	0	
Projected Recreational Removals (N):	0	0	0	0	201	195	64	40	6	6	0	0	Assumes 10% release mortality rate.

ACL ALTERNATIVE 2b:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Projected Recreational Landings (N):	0	0	0	0	160	156	64	40	6	6	0	0	
Projected Recreational Dead Discards (N @ ρ=10%):	0	0	0	0	41	39	0	0	0	0	0	0	
Projected Recreational Removals (N):	0	0	0	0	201	195	64	40	6	6	0	0	Assumes 10% release mortality rate.

ACL ALTERNATIVE 2c:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Projected Recreational Landings (N):	0	0	0	0	160	156	64	40	6	6	0	0	
Projected Recreational Dead Discards (N @ ρ=10%):	0	0	0	0	41	39	0	0	0	0	0	0	
Projected Recreational Removals (N):	0	0	0	0	201	195	64	40	6	6	0	0	Assumes 10% release mortality rate.

PROJECTION RESULTS:

LANDINGS

	Alt 2a	Alt 2b	Alt 2c
Recreational ACL (LBS):	11,025	10,474	9,923
Recreational ACL (N):	1,040	988	936
Total Projected Recreational Landings (N):	431	431	431
%ACL Landed:	41%	44%	46%
	0%	0%	

Minimum mean weight at 12 inch MSL = 1.38 lb ww. Estimated mean weight is 10.6 lb ww, which is larger than mean hogfish weights at the largest minimum size limit proposed (20 inches)

<--Select ACT buffer [feature disabled]

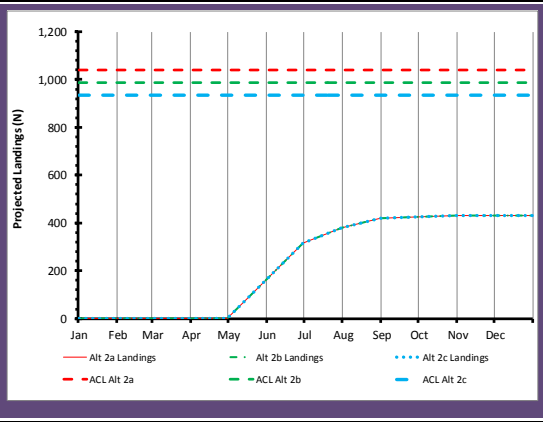
REMOVALS

	Alt 2a	Alt 2b	Alt 2c
Total Projected Recreational Removals (N):	511	511	511

QUOTA CLOSURE

	Alt 2a	Alt 2b	Alt 2c
Projected Closure Date:	N/A	N/A	N/A
Open Days in Season:	365	365	365

Note: This model does not account for effort shifting that may take place during a seasonal closure, nor does it consider any changes in the average size of hogfish during rebuilding. Thus, management reductions presented in these tables may be overestimates, and caution should be taken in their interpretation and use.



ECONOMIC EFFECTS PROJECTIONS:

ACL Alt 2a

CHANGE FROM STATUS QUO CONSUMER SURPLUS (2014 $) - Full Recreational Fishery

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
$0	$0	$0	$0	$1,979	$1,930	$779	$495	$74	$74	$0	$0	$5,331

ACL Alt 2b

CHANGE FROM STATUS QUO CONSUMER SURPLUS (2014 $) - Full Recreational Fishery

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
$0	$0	$0	$0	$1,979	$1,930	$779	$495	$74	$74	$0	$0	$5,331

ACL Alt 2c

CHANGE FROM STATUS QUO CONSUMER SURPLUS (2014 $) - Full Recreational Fishery

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
$0	$0	$0	$0	$1,979	$1,930	$779	$495	$74	$74	$0	$0	$5,331

Note 1: This model implicitly assumes that hogfish will be landed in addition to other species on a trip and that the proposed action will have no effect on the number of recreational trips that would be expected to occur under the status quo.
Note 2: Estimated landings are rounded to the nearest whole fish and all landed fish are assigned the same value regardless of size.
Note 3: For a breakdown by mode, see Economics tab (link below).

ADDITIONAL DETAILS AVAILABLE ON THE ECONOMICS TAB

Figure 1B. Screenshot of GA-NC recreational hogfish decision tool, showing dropdown menus for user-specified management measures.

Methods

The RDTs for FLK/EFL (**Figure 1A**) and GA-NC (**Figure 1B**) hogfish were implemented in Microsoft Excel using drop-down menus to obtain user inputs regarding desired management measures. 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 RDTs evaluated seasonal closures, size limits, and bag limits.

Data Sources

Recreational landings data for hogfish are typically obtained from the SEFSC's ACL Dataset, which provides aggregated landings data from the Marine Recreational Information Program (MRIP) and the SEFSC's Southeast Region Headboat Survey (SRHS). The ACL dataset provides improved quality assurance and quality control on the raw data generated by the MRIP and SRHS. The ACL dataset uses MRIP weight estimates when available. In some cases, MRIP 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 based on a minimum of 30 samples to provide a weight estimate in the ACL data. MRIP 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 (Florida, North Carolina, South Carolina, and Georgia). SRHS landings are generated after the end of each calendar year, at which time they are included in the ACL dataset. SRHS 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. SRHS records contain trip-level information on number of anglers, trip duration, date, area fished, landings (number of fish) and releases (number fish) by species.

Because SEDAR 37 (2014) identified three hogfish stocks (FLK/EFL, GA-NC, and Gulf of Mexico), and SG-37 includes separate actions for managing the FLK/EFL GA-NC stock in the Council's jurisdiction, the underlying data required a modified ACL dataset. Working with SEFSC, an approach was developed that was mostly consistent with how the SEFSC assigns weights for ACL monitoring but with minor modifications for hogfish due to the stock definitions emerging from SEDAR 37 (2014). The SEFSC typically assigns average weights to headboat and MRIP data based on a minimum sample size of 30 using the following hierarchy:

sub-region, year, state, mode of fishing, wave, area of fishing (i.e., inshore vs. offshore)

The SEFSC code was used for weight estimation coupled with the raw MRIP data; however, GA-NC was considered to be a separate sub-region. The Monroe County area was assigned to the FLK/EFL sub-region prior to running weight estimation so that regional average weight draws for Florida would not pull from the Gulf of Mexico sub-region for the Monroe County sub-region. Numbers of fish were expanded appropriately using MRIP-developed site weights.

Because low sample sizes often led to aggregation at the species-region level, eliminating all temporal variability, another level of hierarchy (*decade*) was added:

sub-region, decade, year, state, mode of fishing, wave, area of fishing (i.e., inshore vs. offshore)

The program was recoded to specify minimum sample size thresholds of n=10 for GA-NC and n=30 for FLK/EFL. Due to low sub-region sample sizes, the minimum sample size for GA-NC was set at the highest value that would still capture decadal trends in average weight. An output file of hogfish landings and discards in numbers and pounds was generated, by mode and wave, and included headboat data from the SEFSC Recreational ACL Database (accessed Nov 2015). This file included information from Wave 1, 1986 to Wave 3, 2015.

Due to a lack of clear inter-annual trends and high inter-annual variability, mean landings from the most recent four fishing years (2012-2015) were used to project 2017 landings; however, there is high uncertainty in projected landings, especially for Waves 1-2 off FLK/EFL and Wave 3 off GA-NC (note error bars in Figure 2). Dead discards were assumed to be 10 percent of the total discards under the release mortality rate for hook-and-line used in SEDAR 37 (2014). Data from 2015 were included, when available, because high landings in early 2015 resulted in an early recreational closure and led the Council to request revised projections from FWC.

The SEFSC reviewed the code and associated output, and agreed with the approach to assigning average weights to hogfish for SG-37. The possible misidentification of some hogfish as 'pigfish' in North Carolina was discussed. The SEFSC recommended not making any changes to the MRIP size file to handle this potential issue; they indicated National Marine Fisheries Service (NMFS) Office of Science and Technology (OS&T) would need to recommend these modifications. NMFS OS&T subsequently evaluated these issues and sent a letter to the Council indicating they did not feel any changes were conclusively supported. Additionally, the SEDAR 37 (2014) assessment did not make any modifications for this potential misidentification.

Landings, biological data (size of catch), and catch-effort information from the MRIP and SRHS surveys were used to evaluate reductions in landings and discards (when available) associated with various proposed hogfish closed seasons, bag limits, and size limits. Following approaches used in the most recent stock assessment, MRIP data from Monroe County were post-stratified and removed from west Florida landing and discard estimates. Due to a lack of more temporally-resolved landings data, landings were assumed uniformly distributed across days within waves for MRIP and days within months for headboat.

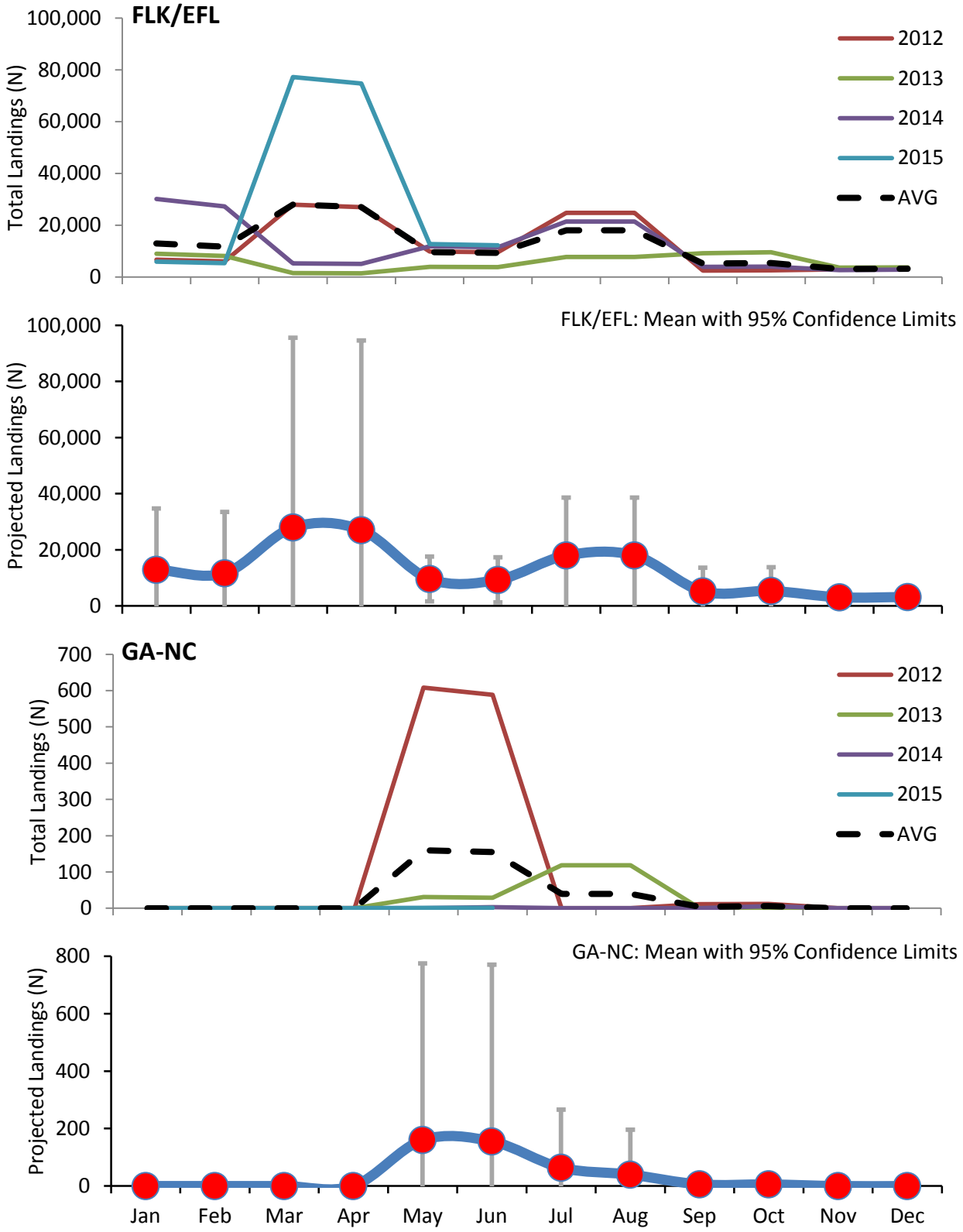


Figure 2. South Atlantic recreational hogfish landings 2012-2015 with mean and 95% confidence intervals for FLK/EFL (top two) and GA-NC (bottom two).

Table 1. Projected 2017 baseline monthly recreational landings and discards in numbers of fish for A) FLK/EFL and B) GA-NC hogfish under status quo management measures with no seasonal or quota closures. Assumes MRIP landings uniformly distributed within waves. Projection based on mean 2012-2015 observed landings.

A) FLK/EFL

LANDINGS	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
SRHS	29	23	25	16	13	16	10	7	5	6	9	19
MRIP CHARTER	283	256	108	104	354	343	16	16	174	180	324	335
MRIP PRIVATE	12,604	11,384	27,813	26,916	9,228	8,930	17,961	17,961	4,994	5,161	2,743	2,835
	12,915	**11,663**	**27,946**	**27,036**	**9,595**	**9,289**	**17,988**	**17,984**	**5,173**	**5,346**	**3,077**	**3,188**

DISCARDS	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
SRHS	21	17	54	34	5	6	0	0	2	3	6	12
MRIP CHARTER	211	191	234	227	134	130	0	0	84	87	206	213
MRIP PRIVATE	3,846	3,473	2,056	1,989	2,861	2,769	249	249	164	169	1,458	1,506
	4,078	**3,682**	**2,344**	**2,250**	**3,001**	**2,905**	**249**	**249**	**250**	**259**	**1,670**	**1,731**

B) GA-NC

LANDINGS	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
SRHS	0	0	0	0	1	2	24	1	2	2	0	0
MRIP CHARTER	0	0	0	0	7	7	7	7	4	4	0	0
MRIP PRIVATE	0	0	0	0	152	147	32	32	0	0	0	0
	0	**0**	**0**	**0**	**160**	**156**	**64**	**40**	**6**	**6**	**0**	**0**

DISCARDS	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
SRHS	21	17	54	34	5	6	0	0	2	3	6	12
MRIP CHARTER	0	0	0	0	0	0	0	0	0	0	0	0
MRIP PRIVATE	0	0	0	0	406	393	0	0	0	0	0	0
	0	**0**	**0**	**0**	**406**	**393**	**0**	**0**	**0**	**0**	**0**	**0**

Seasonal Closures

Landings of hogfish are highly seasonal; 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 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. Because seasonal closures might result in effort shifting, the effects of increased catch rates in open months were evaluated with a user-defined effort shift scalar ranging from 0 percent to 100 percent. Because catch rates were expressed as daily catch rates rather than catch per unit effort, the effort shift scalars were designed to redistribute days as a proxy for increased effort before and after closures. This approach allowed the model to compensate for lost fishing days due to seasonal closures while preserving differences in daily catch rates between months. When effort shifting was selected by the user, projected catch rates and discards during open months under the user-selected management measures were scaled to compensate for lost fishing days:

$$L_{mode,m} = \left(BL_{mode,m} * O_m\right) * \left(1 + \sigma_m * \begin{cases} if < 100\%\ closed: \left[\left(\frac{\sum_{d=Jan\ 1}^{Dec\ 31}[d=closed]}{\sum_{d=Jan\ 1}^{Dec\ 31}[d]}\right) * \left(1 + \frac{\sum_{m=Jan}^{Dec}[O_m=0\%]}{\sum_{m=Jan}^{Dec}[O_m>0\%]}\right)\right] \\ if\ 100\%\ closed: 0 \end{cases}\right) \quad (1)$$

where $L_{mode,m}$: projected landings after accounting for change in open season, $BL_{mode,m:}$ projected landings by mode and month, d: day of the month, O_m: percent of month open to fishing, and σ_m: effort shift scalar for open month m.

Size Limits

Length measurements collected during biological sampling associated with SRHS and MRIP were converted to inches fork length using standard conversion factors and equations summarized in SEDAR 37 (2014). Data from the three most recent available years were used from SRHS catch-effort files (2011-2013) and SEFSC-prepared MRIP catch-effort files (2012-2014). The mean and standard deviation for reductions in harvest under simulated size limits across the three most recent years were computed by simulating the removal of undersized fish at different size limits, recomputing landings, and comparing those recomputed landings to the baseline.

The impacts of proposed MSL were simulated by multiplying projected landings by the simulated scalar reduction in harvest under different proposed MSL. Because the ACL for hogfish will be specified in numbers of fish, scalar multipliers were calculated in numbers of fish for each mode of fishing (charter, headboat, and private/rental) for MSL at 1-inch intervals between 12-20 inches as follows:

$$\varsigma_{mode,m} = (G + B)/C, \quad (2)$$

where $\varsigma_{mode,m}$: MSL impact scalar, *C*: catch in number of fish at the current MSL, *G*: number of fish that are greater than or equal to the proposed MSL, and *B*: number of fish smaller than the current MSL (non-compliance or measurement error).

$$L_{mode,m} = BL_{mode,m} * \varsigma_{mode,m}, \quad (3)$$

where $L_{mode,m}$: projected landings after accounting for change in size limit, $BL_{mode,m:}$ projected landings by mode and month, and $\varsigma_{mode,m}$: size limit scalar impact.

Under equation (3) above, the scalar for the recreational status quo of 12 inches would be 100 percent. Data were pooled across waves when necessary to avoid sample sizes lower than 30 fish. Figure 3 presents available information, by sub-region, regarding fork lengths of sampled fish. Figure 3 helps clarify why the size limit impacts in Table 3 are greater for the FLK/EFL sub-region. The size limit approach assumes a level of illegal harvest consistent with historical observations.

Bag Limits

The impacts of proposed bag limits were simulated by multiplying projected landings by the simulated scalar reduction in harvest under different proposed bag limits. Data from the three most recent available years were used from SRHS catch-effort files (2011-2013) and SEFSC-prepared MRIP catch-effort files (2012-2014). The mean and standard deviation for reductions in harvest under simulated bag limits across the three most recent years were computed by simulating the removal of undersized fish at different bag limits, recomputing landings, and comparing those recomputed landings to the baseline.

Because the recreational ACL for hogfish will be specified in numbers of fish, scalar multipliers were calculated in numbers of fish for each mode of fishing (charter, headboat, and private/rental) for bag limits ranging from 1 fish per vessel to 5 fish per angler (status quo). Bag limit impacts were modeled by modifying trip records when catch-per-angler on the trip exceeded a given bag limit. For example, if catch per angler on a trip was 3 fish/angler and the bag limit being simulated was 1 fish/angler, the catch per trip was adjusted to reflect a 1 fish/angler catch rate. The total landings in numbers of fish were summarized by bag limit alternative, year, and mode of fishing:

$$\beta_{mode,m} = (C - E - I)/C, \quad (4)$$

where $\beta_{mode,m}$: bag limit impact by mode and month, *C*: catch in number of fish at the current bag limit, *E*: number of fish on trip that exceed the proposed bag limit, *I*: number of fish above the current bag limit (non-compliance or measurement error)

$$L_{mode,m} = BL_{mode,m} * \beta_{mode,m}, \quad (5)$$

where $L_{mode,m}$: projected landings after accounting for change in bag limit, $BL_{mode,m}$: projected landings by mode and month, $\beta_{mode,m}$: bag limit scalar impact.

The average ratio of bag limit modified landings to reported landings across the most recent three years was used as the bag limit scalar ($\beta_{mode,m}$), by mode. Data were pooled across waves when necessary to avoid sample sizes lower than 30 fish. Table 4 shows projected bag limit reductions for hogfish, by region and mode of fishing. The size limit approach assumes a level of illegal harvest consistent with historical observations.

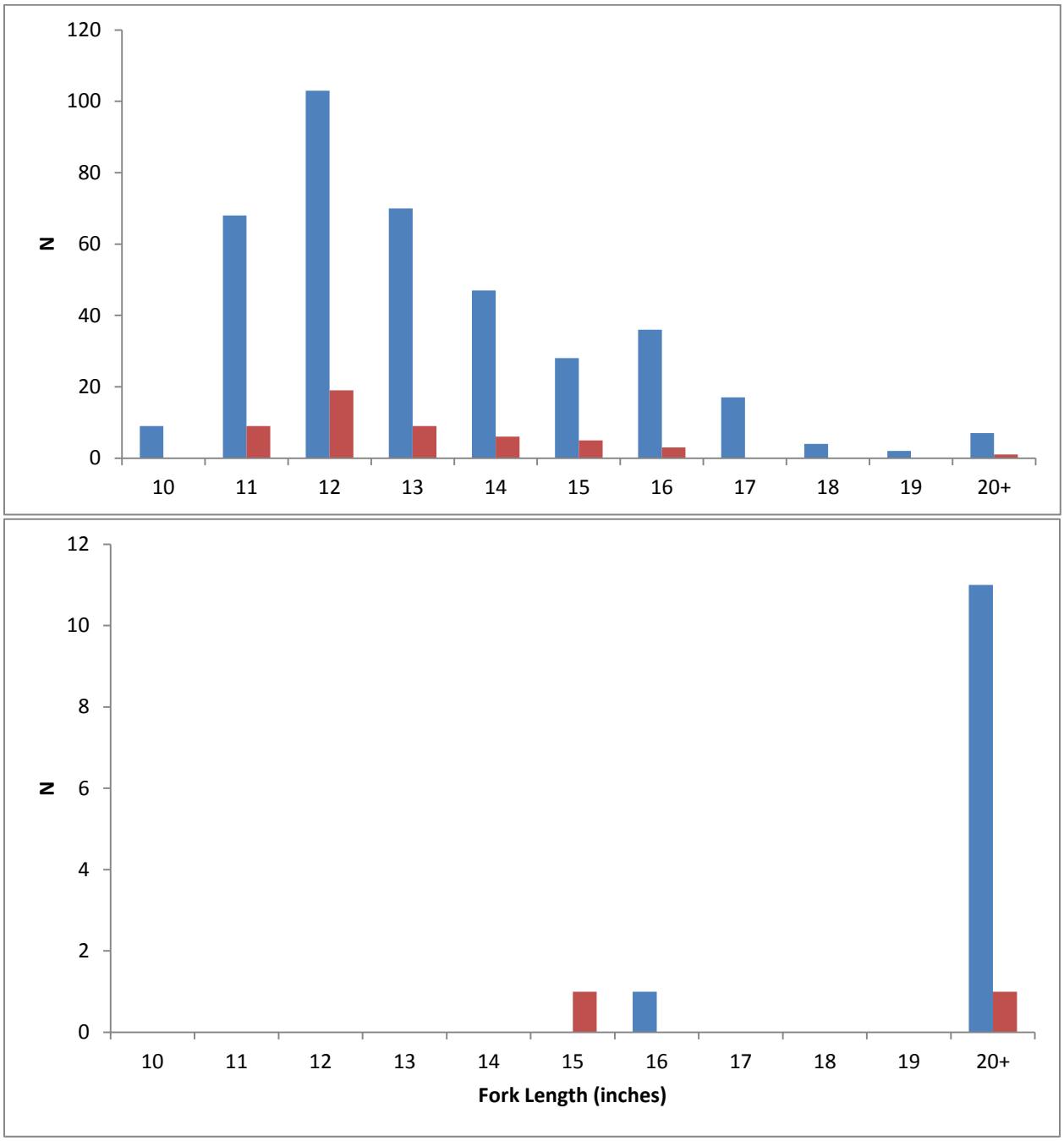


Figure 3. Fork lengths of landed hogfish reported by SRHS (2011-2013; red) and MRIP (2012-2014; blue) for FLK/EFL (top) and GA-NC (bottom) stocks of hogfish.

Combined Effects of User-Defined Management Measures

For both RDT models, if month (m) was 100 percent closed, landings were set to zero fish for all modes. If a month was partially or fully open, the projected landings (L) were computed as follows:

$$L_{mode,m} = \left(BL_{mode,m} * O_m * \varsigma_{mode,m} * \beta_{mode,m}\right) * \left(1 + \sigma_m * \begin{cases} if < 100\%\ closed: \left[\left(\frac{\sum_{d=Jan\ 1}^{Dec\ 31}[d = closed]}{\sum_{d=Jan\ 1}^{Dec\ 31}[d]}\right) * \left(1 + \frac{\sum_{m=Jan}^{Dec}[O_m = 0\%]}{\sum_{m=Jan}^{Dec}[O_m > 0\%]}\right)\right] \\ if\ 100\%\ closed: 0 \end{cases}\right)$$

Projected discards were computed as baseline discards plus the difference between projected landings (L) and baseline landings (BL). Projected increased landings and discards due to effort shifting also accounted for changes in management measures. The new management discards resulting from new management measures were assumed to be distributed across spear and hook-and-line gear types based on observations from SEDAR 37 (2014). In the FLK/EFL sub-region, recreational landings were 73 percent spear from 2010-2012 (SEDAR 37 2014, Tables 7.2.2.1, 7.2.3.5, and 7.2.3.6). Spear trips were assumed to only select legal fish; thus, only 27 percent of new management discards (i.e., those originating from hook-and-line trips) were added to baseline discards to compute total discards. Per SEDAR 37 (2014), approximately 4 percent of total discards are attributable to spear gear, despite this gear comprising a much larger proportion of the overall landings. Although anecdotal information suggests a high proportion of the GA-NC sub-region landings come from spear trips, they are infrequently sampled by MRIP (SEDAR 37 2014, Table 7.2.3.1). From 2010-2012, no spear trips from the GA-NC sub-region were intercepted; thus, 100 percent of new management discards from the GA-NC sub-region were added to baseline discards to compute projected discards. For both sub-regions, projected discards from hook-and-line were multiplied by a 10 percent release mortality rate to convert to dead discards, consistent with the SEDAR 37 (2014) release mortality rate for hook-and-line gear. Projected dead discards were added to projected landings to determine total removals.

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 SG-37 ACL alternatives. In instances where the management measures were insufficient to constrain harvest below the ACL, the projected quota closure date was computed along with the total landings at the time of closure. Uncertainty in mean projected closure dates and projected landings were determined across 1000 bootstrapped runs of each user-selected model configuration. Bootstrapping runs accounted for uncertainty in projections data by averaging across 2012-2015 landings generated from random draws from a normal distribution fit to mean and standard deviation from landings survey data from the modified hogfish landings dataset discussed previously. Bootstrapping also accounted for uncertainty in size limit and bag limit reductions using random draws for these reductions drawn from normal distributions fit to the mean and standard deviation of the most recent three years of simulated size and bag limit reductions.

For the FLK/EFL sub-region, ABC recommendations in numbers of fish and pounds were provided by the SEDAR 37 (2014) stock assessment under status quo management measures at $P_{rebuild}$=72.5 percent over 10 years. Under different size limits, bag limits, and season openings, selectivity and retention functions in the stock assessment might change, leading to different ABC recommendations. The most appropriate method to address the feedback between selected management measures and ABC recommendations would be to run updated stock assessment projections using the new management measures; however, this would require modifications to the SEDAR 37 (2014) stock assessment program that will not be completed in time. In response to a concern by SERO staff that an ABC in pounds might be exceeded under increasing MSLs without corresponding reductions in the ACL in numbers, Council staff proposed a method to set the ABC and total ACL in numbers of fish. Council staff also developed a modified yield per recruit (YPR) model to investigate the effects of changes in the MSL on fishing mortality rate (*F*). The modified YPR analysis indicated that the fishery could continue to harvest the same number of fish up to the 20-inch proposed MSL alternative with little to no effect on the overall value of *F*. After substantial discussion and a review of yield-per-recruit analyses performed by SAFMC staff, the SAFMC's Scientific and Statistical Committee recommended use of the Council staff's proposed ACL time series that would not change under different MSLs (SAFMC 2016). In this time series, the ACL at 100 percent of the ABC for 2017 is 16,514 fish. The RDT manages towards SG-37 ACL Alternatives 2a-2c (i.e., 100 percent, 95 percent (Preferred), and 90 percent of the ABC).

For the GA-NC sub-region, the ABC recommendation in pounds is based on the SSC's ORCS approach, with a catch statistic of 40,818 pounds whole weight from 2006 (maximum catch 1999-2007), a risk of overexploitation of 1.25, and a risk tolerance of 0.7. The resultant ABC recommendation of 35,716 pounds whole weight is allocated 30.9 percent to the recreational sector. The recreational ABC allocation of 11,025 pounds whole weight is converted to 1,040 fish, based on the 2012-2015 mean weight of 10.60 pounds whole weight. Because the observed mean weight of landed fish off GA-NC is much larger than the mean weight of a fish at a 20-inch size (5.61 lb), no adjustments to the GA-NC recreational ACL were explored; the ACL for the sub-region was fixed (Preferred ACL = 95% ABC = 988 fish).

Economic Effects

Dynamic short-term economic effects projections are built into the RDT. Estimates are displayed in 2014 dollars. Baseline economic values for recreational hogfish in each sub-region, FLK/EFL and GA-NC, were simulated using projected daily catch rates for each sub-region, absent any changes to existing hogfish management measures. Prior to the implementation of SG-37, hogfish was managed as a single stock from east Florida to North Carolina, excluding MRIP landings from Monroe County, with an ACL of 85,355 pounds whole weight in MRIP-based units. To determine what the baseline landings would be if no actions were taken in SG-37, landings were projected in pounds whole weight from east Florida to North Carolina based on mean 2012-2015 landings from the SEFSC Recreational ACL Database (accessed September 2015). The projected ACL overage date in the Council's jurisdiction in the absence of SG-37 management measures was determined as April 26. The baseline for economic comparisons in the FLK/EFL model included projected landings (in numbers) from east Florida from January 1 – April 26. Landings from Monroe County for the entire year were also included in the

economic comparison baseline; in the absence of SG-37, fishers in Monroe County would not be anticipated to hit a quota closure if Monroe County hogfish remained as part of the western Gulf of Mexico quota. For the GA-NC RDT, the baseline for economic comparisons included landings from GA-NC (in numbers) from January 1 – April 26.

For the recreational sector, short-term economic effects are estimated as changes in consumer surplus (CS); an estimate of the value received by recreational anglers from catching and keeping hogfish. To calculate CS, the projected landings (number of fish) for each month were multiplied by the willingness to pay for an additional 'snapper' ($12.37) from Haab et al. (2012), the best proxy for willingness to pay for hogfish[10]. The RDT displays the total change in CS relative to the status quo under any combination of ACL, MSL, bag limit, and season closure alternatives. The RDT does not assign any value to hogfish that are caught and released, so although changes in discard rates may have long-term positive or negative economic effects in terms of future yields, these are not captured in the CS estimates provided by the RDT. Such long-term economic effects should, however, be considered in the regulatory analysis for SG-37.

Results

Seasonal Closures

Closures during time periods of highest landings will provide the most efficient reductions in harvest. Table 1 shows hogfish landings by month. For the FLK/EFL region, the highest landings occur in Mar-Apr followed by July-Aug. For the GA-NC region, the highest landings occur in May-June with very few landings outside those months. There is high inter-annual variability in hogfish seasonal landings trends (Figure 2). If landings for the FLK/EFL region are close to 2012 or 2014, the model will be relatively accurate, but it under predicts 2015 Wave 2 and over predicts nearly all of 2013. If landings for the GA-NC region are close to 2015, the model will be relatively accurate, but it under predicts 2012 Wave 3 and over predicts 2013-2014.

Minimum Size Limits

MSLs, especially at 15 inches fork length and above, appear to be an effective means of constraining harvest off FLK/EFL (Table 2a). MSLs in the FLK/EFL region appear to be effective across all modes. MSLs off GA-NC appear to be ineffective, especially for private mode; however, their impacts are somewhat uncertain due to limited data (Table 2b). Figure 2 indicates most fish off the GA-NC sub-region are greater than 20 inches fork length. An MSL of 17 inches fork length or greater off the GA-NC sub-region would provide some reductions in for-hire harvest.

[10] All kept hogfish are assigned the same value, regardless of their size. In reality, anglers may receive higher value from larger fish, though this cannot be estimated with available data.

Bag Limits

In both sub-regions, a 1-fish per-vessel per-day bag limit is anticipated to result in extreme cuts to harvest across all modes (Table 3). Due to their high passenger capacity, bag limits that constrain catch per angler are relatively ineffective for headboats (Table 3). Off FLK/EFL, bag limits of 2 fish and 1 fish per angler appear relatively effective for constraining harvest (Table 3a). Off GA-NC, bag limits had no impact on harvest with the exception of 1-fish per-vessel limits (Table 3b).

Combined Effects

Table 4a presents estimates of closure date, season length, landings, removals, and change in consumer surplus for a variety of proposed combinations of management measures for the FLK/EFL stock. Not surprisingly, uncertainty in closure date and landings was higher under scenarios with long recreational fishing seasons, allowing more days with uncertain catch rates to accumulate. Substantial economic losses are anticipated relative to the baseline under all scenarios because the proposed ACL alternatives in this sub-region are much lower than projected baseline landings in this sub-region, and charter and private anglers in the Monroe County area would no longer be aggregated into the Gulf of Mexico, which has a stock ACL and no history of quota closures. Assuming no effort shifting, under the Council's preferred ACL, Alternative 2b, and preferred MSL alternative of 16 inches fork length, with a 1-fish per-person per-day bag limit, and a July 1 – Oct 31 fishing season, the season could be up to 123 days, with no quota closure predicted. With a May 1 opening, a 16-inch MSL and a 1-fish-per-person bag limit, a quota closure is anticipated after 245 open days, on December 5, with a standard deviation of around 20 days (i.e., 95 percent confidence limit range: October 27 – No Closure). Effort shifting would result in increased landings and discards within the open season and associated economic gains. Figure 4 shows the impacts of effort shifting on landings, discards, and change in consumer surplus for the Council's current preferred alternatives. Effort shifting can lead to substantial increases in catch during the open season and may result in early quota closures and lost potential revenue. Increasing the size limit or reducing the bag limit are anticipated to greatly reduce total removals in the FLK/EFL region due to the ability of spearfishers to select legal fish and avoid discards.

Table 4b presents estimates of closure date, season length, landings, removals, and change in consumer surplus for a variety of proposed combinations of management measures for the GA-NC stock. No closures to prevent an ACL overage are anticipated for any combination of management alternatives for the GA-NC component of the stock. Due to the lack of closures, uncertainty in projected landings and reductions from various management measures did not impact estimates of season length or landings.

Table 2. Projected reductions of headboat and MRIP hogfish landings off (A) FLK/EFL and (B) GA-NC, in numbers, by month, for various minimum size limits. Note: data have been pooled to achieve a minimum sample size of 30 fish per estimate.

A) FLK/EFL

	HB (NUMBERS; 2011-2013)											
FORK LENGTH	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	43%	43%	43%	43%	43%	43%	43%	43%	43%	43%	43%	43%
14	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%
15	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%
16	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
17	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%
18	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%
19	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%
20	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%

	CHARTER (NUMBERS; 2012-2014)											
FORK LENGTH	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	18%	18%	18%	18%	18%	18%	18%	18%	18%	18%	9%	9%
14	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	33%	33%
15	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	70%	70%
16	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	76%	76%
17	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
18	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
19	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
20	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%

	PRIVATE (NUMBERS; 2012-2014)											
FORK LENGTH	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	34%	34%	35%	35%	15%	15%	31%	31%	43%	43%	35%	35%
14	54%	54%	50%	50%	30%	30%	53%	53%	54%	54%	56%	56%
15	63%	63%	61%	61%	71%	71%	54%	54%	60%	60%	63%	63%
16	75%	75%	70%	70%	73%	73%	59%	59%	63%	63%	71%	71%
17	82%	82%	81%	81%	84%	84%	69%	69%	77%	77%	80%	80%
18	86%	86%	84%	84%	90%	90%	87%	87%	79%	79%	84%	84%
19	89%	89%	86%	86%	90%	90%	90%	90%	81%	81%	85%	85%
20	89%	89%	88%	88%	90%	90%	90%	90%	83%	83%	85%	85%

B) GA-NC

	HB (NUMBERS; 2011-2013)											
FORK LENGTH	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	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%
16	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
17	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
18	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
19	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%
20	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%	45%

	CHARTER (NUMBERS; 2012-2014)											
FORK LENGTH	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	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%
16	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
18	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
19	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
20	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%

	PRIVATE (NUMBERS; 2012-2014)											
FORK LENGTH	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	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%
16	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
18	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
19	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%

Table 3. Projected reductions of headboat and MRIP hogfish landings off (A) FLK/EFL and (B) GA-NC, in numbers, by month, for various bag limits. Note data have been pooled to achieve a minimum sample size of 30 fish per estimate.

A) FLK/EFL

	Headboat (2012-2014), Numbers											
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/Vessel	32%	21%	18%	17%	22%	35%	64%	68%	27%	27%	26%	29%

	MRIP Charter (2012-2014) Numbers											
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 Fish/Angler	5%	5%	5%	5%	4%	4%	5%	5%	0%	0%	0%	0%
2 Fish/Angler	16%	16%	15%	15%	11%	11%	10%	10%	4%	4%	5%	5%
1 Fish/Angler	24%	24%	32%	32%	23%	23%	23%	23%	17%	17%	11%	11%
1 Fish/Vessel	91%	91%	95%	95%	94%	94%	92%	92%	93%	93%	91%	91%

	MRIP Private (2012-2014) Numbers											
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4 Fish/Angler	5%	5%	3%	3%	6%	6%	3%	3%	6%	6%	5%	5%
3 Fish/Angler	10%	10%	12%	12%	14%	14%	11%	11%	14%	14%	11%	11%
2 Fish/Angler	22%	22%	24%	24%	26%	26%	21%	21%	29%	29%	23%	23%
1 Fish/Angler	42%	42%	43%	43%	49%	49%	45%	45%	49%	49%	43%	43%
1 Fish/Vessel	99%	99%	99%	99%	99%	99%	100%	100%	99%	99%	93%	93%

B) GA-NC

	Headboat (2012-2014), Numbers											
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/Vessel	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%	41%

	MRIP Charter (2012-2014) Numbers											
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/Vessel	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%

	MRIP Private (2012-2014) Numbers											
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/Angler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1 Fish/Vessel	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%

Table 4. Mean and standard deviation from 1000 bootstrapped estimates of closure date, season length (days), landings (number of fish), removals (number of fish), and change in CS from status quo (SQ) in 2014 USD for a variety of proposed combinations of SG-37 management measures. Council preferred in bold. All runs assume no effort shifting.

A) FLK/EFL

ACL Alternative	Season	Size Limit	Bag Limit	Closure Date	Open Days	Landings (N)	Removals (N)	Change from SQ CS ($)
Alt 2a	Jan 1-Dec 31	12	5 Fish/ Angler	02/09	39 ± 0.76	16,311 ± 119	22,204	-1,375,086.31
Alt 2b				02/07	37 ± 0.75	15,486 ± 121	21,394	-1,385,402.89
Alt 2c				02/05	35 ± 0.74	14,659 ± 122	20,584	-1,395,707.10
Alt 2a	Jan 1-Dec 31	15	1 Fish/ Angler	04/25	39 ± 0.76	16,380 ± 105	22,204	-1,375,086.31
Alt 2b				04/20	37 ± 0.73	15,558 ± 98	21,394	-1,385,402.89
Alt 2c				04/16	107 ± 4.31	14,728 ± 100	20,584	-1,395,707.10
Alt 2a	July 1-Dec 31	15	2 Fish/ Angler	11/01	137 ± 26.36	16,454 ± 146	22,448	-1,371,993.81
Alt 2b				10/16	114 ± 24.59	15,641 ± 79	21,633	-1,382,372.24
Alt 2c				09/30	97 ± 21.09	14,804 ± 72	20,835	-1,392,528.01
Alt 2a	July 1-Dec 31	16	2 Fish/ Angler	11/21	184 ± 26.21	16,065 ± 678	21,610	-1,382,681.49
Alt 2b				11/09	184 ± 27.49	15,508 ± 408	21,610	-1,382,681.49
Alt 2c				10/25	150 ± 26.95	14,782 ± 211	20,854	-1,392,292.98
Alt 2a	July 1-Dec 31	16	1 Fish/ Angler	11/21	184 ± 25.79	16,052 ± 669	21,610	-1,382,681.49
Alt 2b				11/08	184 ± 26.92	15,504 ± 384	21,610	-1,382,681.49
Alt 2c				10/26	150 ± 27.50	14,788 ± 176	20,854	-1,392,292.98
Alt 2a	May 1-Dec 31	17	2 Fish/ Angler	11/20	245 ± 26.37	15,493 ± 927	19,759	-1,406,209.23
Alt 2b				11/12	245 ± 28.32	15,192 ± 670	19,759	-1,406,209.23
Alt 2c				10/31	245 ± 28.36	14,669 ± 389	19,759	-1,406,209.23
Alt 2a	May 1-Dec 31	16	1 Fish/ Angler	12/13	245 ± 17.80	14,424 ± 887	19,711	-1,406,802.99
Alt 2b				12/05	245 ± 19.57	14,391 ± 826	19,711	-1,406,802.99
Alt 2c				11/29	245 ± 23.39	14,239 ± 648	19,711	-1,406,802.99
Alt 2a	**July 1-Oct 31**	**16**	**1 Fish/ Angler**	No Closure	123 ± 0	10,705 ± 893	16,116	-1,452,547.25
Alt 2b				**No Closure**	**123 ± 0**	**10,705 ± 893**	**16,116**	**-1,452,547.25**
Alt 2c				No Closure	123 ± 0	10,705 ± 893	16,116	-1,452,547.25

B) GA-NC

ACL Alternative	Season	Size Limit	Bag Limit	Closure Date	Open Days	Landings (N)	Removals (N)	Change from SQ CS ($)
Alt 2a	Jan 1-Dec 31	12	None	No Closure	365 ± 0	470 ± 33	493	5,059.33
Alt 2b				No Closure	365 ± 0	470 ± 33	493	5,059.33
Alt 2c				No Closure	365 ± 0	470 ± 33	493	5,059.33
Alt 2a	**Jan 1-Dec 31**	**17**	**2 Fish/Angler**	No Closure	365 ± 0	412 ± 30	493	5,059.33
Alt 2b				**No Closure**	**365 ± 0**	**412 ± 30**	**493**	**5,059.33**
Alt 2c				No Closure	365 ± 0	412 ± 30	493	5,059.33
Alt 2a	Jan 1-Dec 31	16	2 Fish/Angler	No Closure	365 ± 0	445 ± 32	493	5,059.33
Alt 2b				No Closure	365 ± 0	445 ± 32	493	5,059.33
Alt 2c				No Closure	365 ± 0	445 ± 32	493	5,059.33
Alt 2a	Jan 1-Dec 31	20	4 Fish/Angler	No Closure	365 ± 0	445 ± 32	498	5,133.55
Alt 2b				No Closure	365 ± 0	445 ± 32	498	5,133.55
Alt 2c				No Closure	365 ± 0	445 ± 32	498	5,133.55

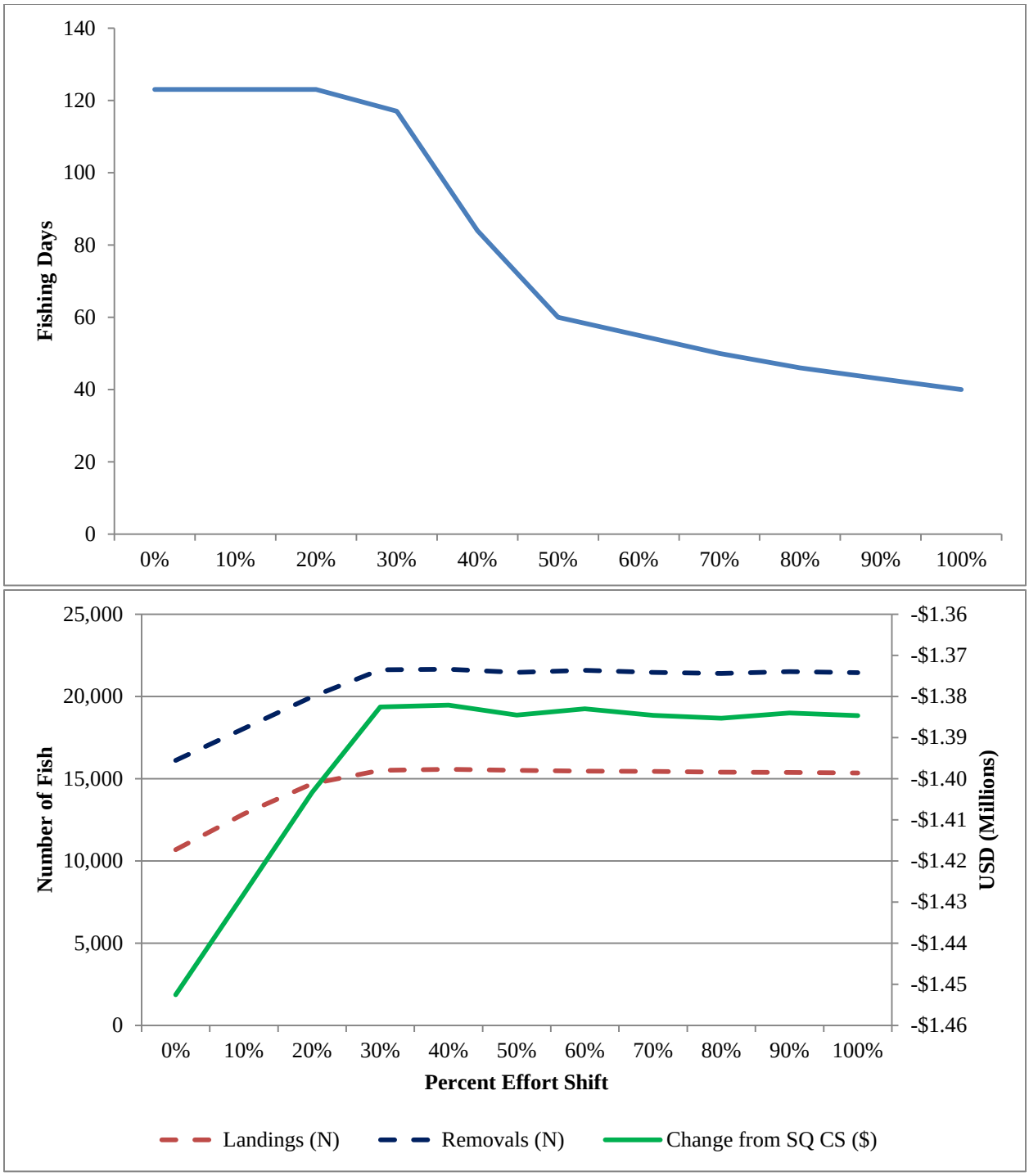


Figure 4. Impacts of effort shifting on estimates of fishing days (top; blue), landings (bottom; red), removals (bottom; dark blue), and change in CS from status quo (SQ) in 2014 USD (bottom; green - right axis) for Council's preferred SG-37 management measures for FLE/FLK (assumes ACL=95 percent ABC, July 1-Oct 31 season, 16-inch MSL, 1-fish/angler bag limit).

Discussion

As with most projection models, the reliability of the RDTs is dependent upon the accuracy of the underlying data and input assumptions. Although the RDTs attempt to address uncertainties in catch rates and the impacts of various management measures, the bounds of this uncertainty are not fully captured by the models as currently configured; as such, they should be used with caution for management decision-making. As a foundation for comparisons, it is assumed that the 2012-2015 mean catch rate is representative of future trends in catch rates. As evidenced by the error bars in Figure 2, substantial uncertainty exists in this projected baseline, especially for the GA-NC sub-region, where hogfish catches may be viewed as a somewhat rare event. Baseline discards (see Table 1) are also highly uncertain, especially for the GA-NC sub-region. Economic conditions, weather events, changes in catch-per-unit effort, fisher response to management regulations, variation in survey estimates due to rarity of intercepts, and a variety of other factors may cause departures from this assumption.

A total hogfish harvest prohibition during a given month may reduce angler incentive to deliberately target hogfish, which may, in turn, reduce encounter rates with the stock during that month. The MRIP intercept records where anglers reported targeting hogfish were identified as 'target' trips. Trip elimination was not considered in the RDT because preliminary analyses indicated trip elimination was an unrealistic assumption for hogfish. This model implicitly assumes that hogfish would be landed in addition to other species on a trip and that the proposed action would have no effect on the number of recreational trips that would be expected to occur under the status quo. This is supported by analysis of the MRIP intercept files (2010 through 2014), which shows hogfish are typically landed in conjunction with other species. If the hogfish season were shortened, it is assumed that anglers would still fish for these other species, and if it were lengthened, it is assumed that anglers would harvest hogfish that would have otherwise been discarded or avoided (in the case of spearfishing). Because there is no expected change in angler trips, for-hire businesses (charter and headboat vessels) are not expected to be negatively affected in terms of producer surplus. The expectation is that for-hire anglers would still book the same number/type of trips at the same price point.

In addition to the aforementioned sources of uncertainty, the modeled reductions associated with management measures assume that past performance is a good predictor of future dynamics. The range of data considered has been constrained to recent years to reduce the unreliability of this assumption; however, due to recent quota closures, substantial variability in recent catches, and the substantial changes in management being proposed (i.e., shifting stock boundary, large cuts to ACL, changes in MSLs, bag limits, and closed seasons), these estimates should be viewed as reliable for relative comparisons but less useful for predicting exact closure dates or precise economic impacts. Bootstrapping runs accounting for uncertainty in monthly catch rate estimates and reductions associated with various proposed management measures indicate that quota closure estimates could deviate by over a month, and that uncertainty is highest when the season is long, because uncertainty in daily catch rates accumulates through time. Uncertainty was also higher for when moderately effective management measures were selected rather than draconian measures.

The relative impacts of various proposed management options explored in the RDT are anticipated to be robust to uncertainty in future catch rates; however, the exact season lengths projected are subject to high uncertainty. The RDT models account for size and bag limit impacts separately. Harvest eliminated by a size limit might be also computed as eliminated by a bag limit or vice versa. Effort shifting may lead to increased removal rates before and after a closure that partially offset the reductions expected from the closure. Little information exists to inform management decision-making regarding the extent of effort shifting possible. A recreational closure was implemented from June 1-July 31 for Gulf of Mexico greater amberjack in June 2011. In 2009 and 2010, Wave 3 (May-June) landings for greater amberjack averaged 44 percent of the annual harvest; from 2011-2015, Wave 3 landings only averaged 19 percent of the annual harvest, indicating a cut in harvest nearly proportional with the reduction in open days (i.e., 0 percent effort shifting). However, Wave 4 (July-Aug) landings have been far more variable with no clear indication of a reduction in harvest associated with the seasonal closure, suggesting up to a 100 percent post-closure effort shift may have occurred. Due to substantial uncertainty in the amount of effort shifting that might occur, it was configured as a user-defined feature in the RDT. Increased effort shifting leads to increased landings; under some scenarios this might also lead to an earlier quota closure (Figure 4).

The RDTs do not consider non-compliance with various proposed regulations, which would similarly offset the projected reductions. Violations of any of these assumptions would cause the models to overestimate the impacts of proposed management measures. The models do not consider differences in the impacts of management measures by gear. In the FLK/EFL RDT, based on observations from SEDAR 37 (2014), only 27 percent of fish that would have been landed under status quo management measures are converted to discards because knife-edged selectivity is assumed for spearfishing gear, so only hook-and-line gear creates discards. Data were not available on the catch effort files to evaluate management measures by gear. If management measures are less effective for hook-and-line gear, the RDT model for FLK/EFL would underestimate total removals by underestimating landed catch and overestimating dead discards. Because management reductions presented in this report may be overestimates, caution should be taken in their interpretation and use. By contrast, changes in economic conditions and/or fuel prices may influence fishing effort. Reduced effort due to external forces such as high fuel prices could lead to harvest less than that predicted by the RDT models.

The FLK/EFL RDT indicates that additional management regulations are necessary to rebuild FLK/EFL hogfish and constrain harvest to the ACL. Increasing the MSL is one effective means of constraining harvest and may also provide additional benefits due to the unique life history of hogfish. Hogfish are monandric, protogynous hermaphrodites, where fish mature as females first, and are expected to eventually become male if they live long enough. Research conducted on hogfish that would belong to the FLK/EFL stock indicate that a single male maintains harems of 5 to 15 females (Colin 1982, Muñoz et al. 2010) during extended spawning seasons that last for months. Hogfish are pair spawners (Davis 1976, Colin 1982), and spawning occurs daily during spawning season (McBride and Johnson 2007, Collins and McBride 2008, Muñoz et al. 2010). The size (7.8-28.6 inches fork length) and age (1-11 years) range at which sexual transition occurs indicates that transition is socially mediated (Collins and McBride 2011). Life history studies on hogfish that would belong to the FLK/EFL stock have estimated female size and age at 50 percent maturity to occur between 6.0 and 7.6 inches FL and 0.9 to 1.6

years (McBride et al. 2008, Collins and McBride 2011). Males may occur as small as 7.8 inches FL, but size at 50 percent male maturity has been estimated as 16.4 inches fork length and 7 years in the Florida Keys (McBride et al. 2008). Sex change in hogfish can take several months (McBride and Johnson 2007), so removal of the dominant male has the potential to significantly affect harem stability and decrease reproductive potential (Munoz et al. 2010). MSLs above 16 inches fork length (Sub-alternatives a-e) may provide hogfish the opportunity to form harems and transition to males. McBride et al. (2008) state: "…the size of 50 percent male maturation, approximately 415 to 425 mm (16.3-16.7 inches) FL, is well above the current MSL. Evidently, to reduce disruption to spawning harems and avoid recruitment overfishing, the MSL should be increased."

For hogfish in the GA-NC stock, the size at transition was calculated based on macroscopic investigation of gonad samples collected in 2013 through 2015 from vessels fishing off North Carolina (Scott Van Sant, SEFSC, unpublished data). The size at which 50 percent of females transition to males was estimated to be 24 inches fork length using binary logistic regression implemented in SAS 9.1. The smallest male observed was 15 inches FL. No female hogfish were observed greater than 30 inches FL. These data are preliminary and will likely change when a complete historical analysis is completed; however, they provide a general estimate of the transition size for hogfish off North Carolina that can be considered in the management of the GA-NC stock.

Hogfish release mortality rate is estimated to be around 10 percent for hook-and-line and 100 percent for spearfishing (SEDAR 37 2014). Spearfishing is assumed to generate few discards as fishers can visually assess the size of the fish prior to shooting. Hook-and-line is assumed to be the predominant gear producing discards. Spearfishing should produce little to no bycatch during a closure, as hogfish are easily distinguished from other species. Considering these factors, a high percentage of hogfish released due to an increased size limit, bag limit, or closed season may survive to spawn and promote recovery of the stock. This is explicitly modeled in the FLK/EFL RDT because available data suggested 73 percent of landings originate from spearfishing trips; however, it is not modeled for GA-NC because no spearfishing trips were intercepted 2010-2012. Substantial anecdotal information suggests spearfishing trips are common in the GA-NC sub-region; thus, the available data may only be applicable as an estimate for the impacts of proposed management regulations on hook-and-line trips in the GA-NC sub-region. It is likely that increasing the MSL or reducing the bag limit in the GA-NC sub-region would have similar positive biological effects for hogfish as seen in the FLK/EFL RDT, by reducing total removals.

References

Colin, P. L. 1982. Spawning and larval development of the hogfish, *Lachnolaimus maximus* (Pisces: Labridae). Fishery Bulletin, U. S. 80 (4): 853-862.

Collins A, R McBride. 2008. Final report for integrating life history, mating system, fishing effects, and habitat of hogfish, *Lachnolaimus maximus*, a harem spawning fish in the southeast U.S. FWRI File Code F2541-05-07-F.

Collins, A.B. & McBride, R.S. 2011. Demographics by depth: Spatially explicit life-history dynamics of a protogynous reef fish. Fishery Bulletin, U. S., 109, 232–242.

Davis, J. C. 1976. Biology of the hogfish, *Lachnolaimus maximus* (Walbaum), in the Florida Keys. M. S. Thesis. University of Miami. Coral Gables, FL. pp: 86.

Haab, T., Hicks, R. L., Schnier, K., Whitehead, J. C. 2012. Angler heterogeneity and the species-specific demand for marine recreational fishing. Working Paper No. 10-02. Appalachian State University, Department of Economics. Available: http://econ.appstate.edu/marfin/. (September 2014).

McBride, R. S., P. E. Thurman, and L. H. Bullock. 2008. Regional variations of hogfish (*Lachnolaimus maximus*) life history: Consequences for spawning biomass and egg production models. J. Northw. Atl. Fish. Sci. 41:1–12.

McBride, R.S. and Johnson, M. R. 2007. Sexual development and reproductive seasonality of hogfish (Labridae: *Lachnolaimus maximus*), an hermaphroditic reef fish. Journal of Fish Biology 71:1270-1292.

Muñoz, R. C., M. L. Burton, K. J. Brennan, and R. O. Parker. 2010. Reproduction, habitat utilization, and movements of hogfish (*Lachnolaimus maximus*) in the Florida Keys, U.S.A.: comparisons from fished versus unfished habitats. Bull. Mar. Sci. 86:93–116.

South Atlantic Fishery Management Council (SAFMC). 2016. Scientific and Statistical Committee (SSC) Meeting Report. Charleston, SC, March 9, 2016. 13 pp.

Southeast Data Assessment and Review (SEDAR)-37. 2014. The 2013 stock assessment report for hogfish in the South Atlantic and Gulf of Mexico. Florida Fish and Wildlife Conservation Commission, St. Petersburg, Florida. 573 pp. Available at: http://sedarweb.org/docs/sar/SEDAR37_Hogfish_SAR.pdf

Appendix M. Modeling the Combined Effects of Snapper-Grouper Amendment 37 Proposed Management Measures for Commercially Caught Hogfish

LAPP/DM and Social Science Branches
NOAA Fisheries Service, Southeast Regional Office

Introduction

Amendment 37 proposes alternatives that would divide the South Atlantic hogfish stock into a Georgia through North Carolina stock and an East Florida/Florida Keys stock, each with its own quota and management measures. To model the economic effects to the commercial sector resulting from the various combinations of management alternatives proposed in Amendment 37, it was necessary to both construct baseline landings estimates for each of the new regions and estimate changes in landings under each combination of annual catch limit (ACL), size limit, and trip limit alternatives for each region. In recent years (2012 through 2014), the commercial sector in the South Atlantic has harvested less than 75 percent of the ACL (set at 49,469 pounds whole weight [lbs ww]) each year. Commercial hogfish landings data, by state, provided by the Southeast Fisheries Science Center, were used for baseline landings construction by each proposed sub-region. Analysis of historical landings in the most recent four years of available data (2011 through 2014), reveals an increasing trend for East Florida and the Florida Keys and a more random pattern for Georgia through North Carolina (Figure 1). A time-series model was fit to landings data for the East Florida/Florida Keys sub-region to capture this trend and was used to forecast landings there in future years. For the Georgia through North Carolina sub-region, the average of 3-year landings from 2012 through 2014 was used to predict future landings.

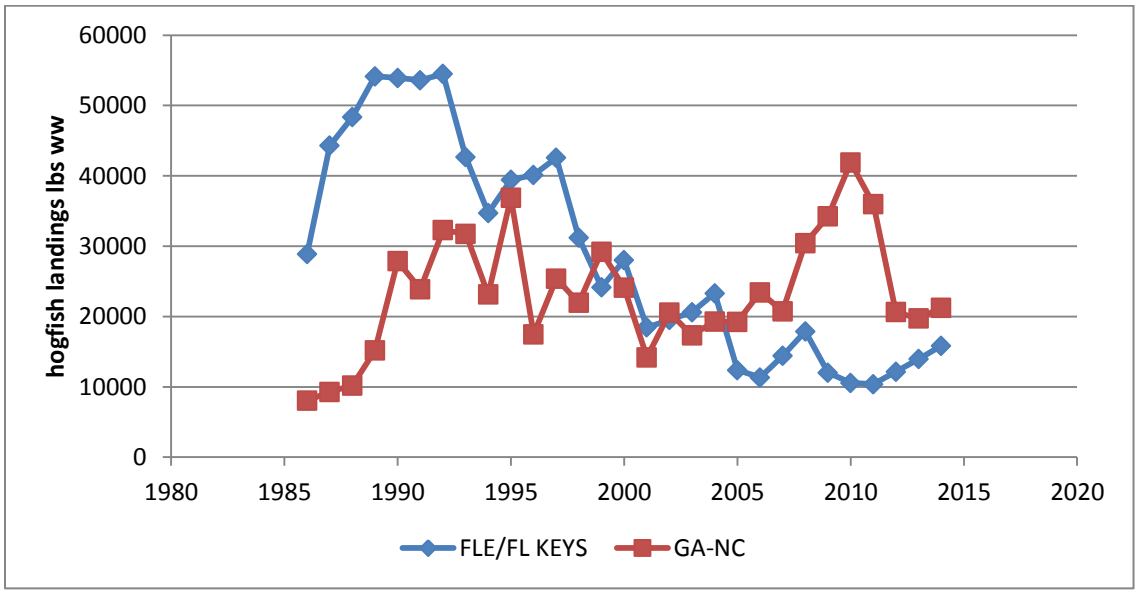


Figure 1. Annual commercial hogfish landings (lbs ww) by year and region.

East Florida/Florida Keys Model

A SARIMA (seasonal auto-regressive integrated moving average) model was fit to the average daily hogfish landings by month (1997 through 2014) to capture seasonal and non-seasonal trends in the data, especially the recent increasing trend from 2011 through 2014. This approach seemed more appropriate than using an average of recent landings. The SARIMA model was fit to daily average landings by month because of the expectation that season length would become an important comparative factor for analyzing alternatives and daily harvest estimates would be required for this analysis. The rationale for this decision was that the extremely restrictive ACL alternatives proposed in the action were expected to be exceeded regardless of the other proposed alternatives, meaning the only economic effect the minimum size limit and trip limit alternatives would have is on the length of the season, not revenue[11].

Prior to fitting the model, average daily landings by month were log-transformed to reduce the impacts of heteroscedastic errors. During the model identification phase, a Dicky Fuller test and Phillips-Perron unit-root test were performed. Without a constant, the null hypothesis of a random walk could not be rejected. Additionally a simple first order autoregressive model was fit to the data and the magnitude of the estimated coefficient was approximately one, suggesting first differencing was required. Running the tests on the differenced log landings data did show the unit-root had been removed. Autocorrelation plots and partial autocorrelation plots were used to identify candidate autoregressive and moving average terms. Model selection included many iterations of testing with various autoregressive, moving average, and differencing terms. Estimated coefficient p-values, Akaike's Information Criterion values and root mean squared errors (RMSE) (in-sample and out of sample[12]) were used for model selection. The best fit and predictions were achieved from a log-transformed (to handle non-constant variance) SARIMA model, differenced by 1 and 12 (to handle non-stationarity and seasonality), a first-order moving average term, and a seasonal moving average term. As seen in Figure 2, because this time series has an underlying random walk pattern, the dynamic forecast intervals expand rapidly as we project further into the future. Nevertheless, the short-term estimates are expected to be a better prediction of future landings than the average of 2012 through 2014 landings (as used for the Georgia through North Carolina area), given the clear increasing trend in daily landings in recent years. Model estimation was performed in both Stata and SAS, yielding almost identical results.

[11] This assumes that effort, catch rates, and prices will not change in response to management measures, only landings will change. As management measures become more prohibitive, these assumptions become weaker.
[12] For the out-of-sample tests, the SARIMA model variations were re-fit without 2014 observed values and forecasts of 2014 were compared to this hold-out sample via RMSE.

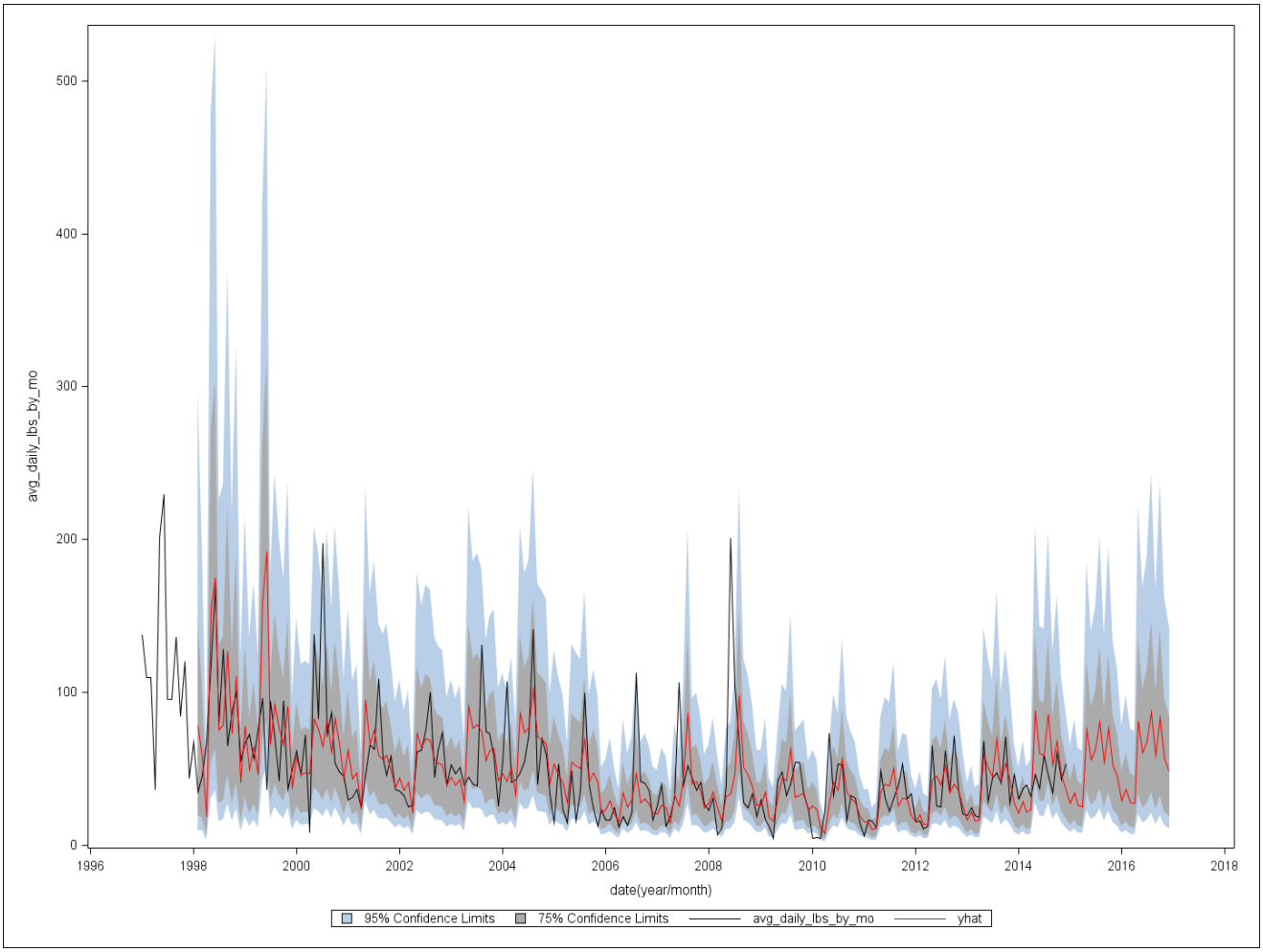


Figure 2. Average daily hogfish landings by year and month with SARIMA model predictions and corresponding forecast intervals.

Because the proposed ACL sub-alternatives for the East Florida/Florida Keys region are substantially lower than projected baseline landings, it is expected that the quota would be harvested in full during the year and an in-season quota closure would occur, even under the most restrictive combination of minimum size limit and trip limit alternatives. This means that the selection of the ACL alternative is the driving factor in terms of changes in revenue from the baseline and the other proposed management measures will only have an effect on the season length. To estimate changes in revenue resulting from each of the ACL sub-alternatives, first the baseline landings and revenue were constructed from the projected annual landings estimated by the SARIMA model. The projected baseline landings for 2016 were 20,380 lbs ww[13]. Although the action is not expected to be implemented until 2017, confidence in model forecasts becomes increasingly low beyond 2016 and so 2016 values are used as the best estimate of daily landings

[13] This assumes that even with the increasing trend captured by the SARIMA model, the overall South Atlantic hogfish stock ACL of 49,469 lbs ww would not be exceeded under the status quo in 2017 and no quota closures would occur.

in 2017 as well[14]. These baseline landings were then multiplied by an average annual price (2012 through 2014) of hogfish per pound ww of $3.74 (2014 dollars; Source: ACL commercial data set, July 20, 2015)[15]. Because it is estimated that the proposed ACL alternatives would be exceeded under any combination of other alternatives, to calculate expected effects to commercial revenue, each ACL alternative value was multiplied by the aforementioned price and a difference was taken between this value and the baseline revenue value (Table 1).

To model season length it was necessary to project landings at the daily level. This was done using the average daily landings by month for 2016, as predicted by the dynamic SARIMA forecast. Again, given the increasing forecast interval for the SARIMA model, it did not seem prudent to project beyond 2016, and therefore, 2016 will serve as a best estimate for 2017 daily landings. Daily landings estimates were multiplied by the estimated percent of status quo landings remaining after each size limit increase, times the estimated percent of landings remaining after each trip limit decrease[16]. For a description of the percent remaining estimation processes, see Appendix A. These daily estimates were then summed up until the day before the cumulative landings were projected to exceed the proposed ACL for 2017, at which time a quota closure would be expected to occur and hogfish landings would cease. Season length was calculated as the number of days up until the day at which the quota was projected to be exceeded (Tables 2-4). Under the status quo ACL, the season length would be expected to be 365 (plus one if leap year) days.

Table 1. Estimated revenue under ACL alternatives and change in revenue relative to status quo in first year of implementation (2017).

	ACL (lbs ww)	ESTIMATED REVENUE (2014 dollars)	CHANGE FROM STATUS QUO (2014 dollars)
Alt 2a	3,695	$ 13,818	$ (62,395)
Alt 2b	3,510	$ 13,126	$ (63,087)
Alt 2c	3,325	$ 12,434	$ (63,779)

Note 1: Because the daily-level model works with daily catch rates that are different based on the combination of alternatives, this can result in total expected landings being closer to or further from the actual ACL at the time of the closure. For simplicity sake, the above figures assume that the cumulative landings will be exactly equal to the ACL at the time of the in-season quota closure, ignoring the minor differences in the model estimates.
Note 2: The estimates provided by this analysis are only for the expected year of implementation, 2017. Negative effects would be expected to continue to occur relative to the status quo in subsequent years, assuming constant prices, effort and catch rates; however, these negative effects would be decreasing in magnitude relative to the ACL increases included in the rebuilding schedule.

[14] It is important to note that even the 2016 estimates are highly uncertain because they are greater than 12 periods past the last observed daily average landings value, meaning they are based entirely on the landings values forecasted for 2015.
[15] Because there are many substitute species for hogfish, it is assumed to have a high price elasticity of demand and, therefore, ex-vessel price would not be very sensitive to the estimated changes in landings. Additionally, there has been low fluctuation in price over time and the overall quantity of commercial hogfish landings relative to other snapper grouper species is low.
[16] Fish that are discarded as a result of a higher minimum size limit (MSL) would no longer count towards the trip limit, implying that the reduction in landings necessary to comply with the new trip limit after those discards are accounted for would be lower than it would be under the status quo MSL. As such, separate trip limit percent remaining scalars were calculated for each size limit to prevent overestimation of reductions.

Table 2. Estimated season length under ACL Alt 2a (3,695 lbs ww) and different minimum size limit and trip limit alternatives in first year of implementation (2017).

	Trip Limit (lbs ww)					
Size Limit (FL inches)	**No limit (Alt 1 - Status Quo)**	**25 (Alt 3a)**	**50 (Alt 3b)**	**100 (Alt 3c)**	**150 (Alt 3d)**	**200 (Alt 3e)**
12 (Alt 1 - Status Quo)	121	153	131	123	121	121
14 (Alt 3a)	145	177	155	147	145	145
15 (Alt 3b)	151	185	163	153	151	151
16 (Alt 3c)	154	202	181	160	155	154
17 (Alt 3d)	163	208	186	169	164	163
14/16 (Alt 3e*)	145	177	155	147	145	145

*3e is a step increase, with an increase to14 in year 1 and an increase to16 in year 3. Model uncertainty is such that year 3 predictions would be highly uncertain. As such, estimates are for year 1 only and match those associated with Alt 3a.

Table 3. Estimated season length under ACL Alt 2b (3,510 lbs ww) and different minimum size limit and trip limit alternatives in first year of implementation (2017).

	Trip Limit (lbs ww)					
Size Limit (FL inches)	**No limit (Alt 1 - Status Quo)**	**25 (Alt 3a)**	**50 (Alt 3b)**	**100 (Alt 3c)**	**150 (Alt 3d)**	**200 (Alt 3e)**
12 (Alt 1 - Status Quo)	115	148	128	121	117	115
14 (Alt 3a)	143	172	151	144	143	143
15 (Alt 3b)	148	180	159	150	148	148
16 (Alt 3c)	150	196	172	152	150	150
17 (Alt 3d)	153	202	181	159	154	153
14/16 (Alt 3e*)	143	172	151	144	143	143

*3e is a step increase, with an increase to14 in year 1 and an increase to16 in year 3. Model uncertainty is such that year 3 predictions would be highly uncertain. As such, estimates are for year 1 only and match those associated with Alt 3a.

Table 4. Estimated season length under ACL Alt 2c (3,325 lbs ww) and different minimum size limit and trip limit alternatives in first year of implementation (2017).

	Trip Limit (lbs ww)					
Size Limit (FL inches)	**No limit (Alt 1 - Status Quo)**	**25 (Alt 3a)**	**50 (Alt 3b)**	**100 (Alt 3c)**	**150 (Alt 3d)**	**200 (Alt 3e)**
12 (Alt 1 - Status Quo)	108	144	125	115	110	109
14 (Alt 3a)	140	167	148	142	141	140
15 (Alt 3b)	146	174	154	147	146	146
16 (Alt 3c)	148	191	164	149	148	148
17 (Alt 3d)	150	196	171	151	150	150
14/16 (Alt 3e*)	140	167	148	142	141	140

*3e is a step increase, with an increase to14 in year 1 and an increase to16 in year 3. Model uncertainty is such that year 3 predictions would be highly uncertain. As such, estimates are for year 1 only and match those associated with Alt 3a.

Georgia through North Carolina Model

Based on historical average annual landings (2012 through 2014), it is expected that none of the ACL alternatives would result in an in-season closure. Therefore, the season length under all combinations of alternatives is expected to be 365 (plus one if leap year) days. The estimated change in landings under the different combinations of minimum size limit and trip limit alternatives for the commercial sector, would also be the same for each of the ACL alternatives. The baseline landings used for the Georgia through North Carolina region were the average annual landings from 2012 through 2014. An average annual price (2012 through 2014) of hogfish per lb ww of $3.74 (2014 dollars; Source: ACL commercial data set, July 20, 2015) was used to generate baseline revenue estimates[17]. To estimate landings under the various minimum size limit and trip limit alternatives, average annual landings (2012 through 2014) were multiplied by the estimated percent of status quo landings remaining after each size limit increase, times the estimated annual percent of landings remaining after each trip limit decrease (Table 5) [18]. For a description of the percent remaining estimation processes, see Appendix A. These landings estimates were then multiplied by the average price and the difference between estimated revenue and baseline revenue was taken to produce estimated economic effects estimates for the first year of implementation, 2017 (Table 6). Comparable economic effects are expected to continue to occur in subsequent years, assuming no changes in effort, catch rates, or prices. However, for Sub-alternative 2f of Action 8, the reductions in revenue relative to the status quo would be expected to increase with each minimum size limit increase.

[17] Because there are many substitute species for hogfish, it is assumed to have a high price elasticity of demand and, therefore, ex-vessel price would not be very sensitive to the estimated changes in landings. Additionally, there has been low fluctuation in price over time and the overall quantity of commercial hogfish landings relative to other snapper grouper species is low.

[18] Fish that are discarded as a result of a higher minimum size limit (MSL) would no longer count towards the trip limit, implying that the reduction in landings necessary to comply with the new trip limit after those discards are accounted for would be lower than it would be under the status quo MSL. As such, separate trip limit percent remaining scalars were calculated for each size limit to prevent overestimation of reductions.

Table 5. Estimated landings in first year of implementation (2017) for all ACL alternatives and various minimum size limit and trip limit combinations*.

	Trip Limit (lbs ww)				
Size Limit (FL inches)	**No limit (Alt 1 - Status Quo)**	**100 (Alt 2a)**	**250 (Alt 2b)**	**500 (Alt 2c)**	**750 (Alt 2d)**
12 (Alt 1 - Status Quo)	20,534	11,745	16,554	19,339	19,951
16 (Alt2a)	20,406	11,703	16,482	19,232	19,831
17 (Alt 2b)	20,128	11,612	16,327	18,999	19,572
18 (Alt 2c)	19,918	11,543	16,209	18,822	19,376
19 (Alt 2d)	19,398	11,370	15,912	18,382	18,891
20 (Alt 2e)	18,921	11,210	15,636	17,979	18,447
15/18/20 (Alt 2f)**	20,498	11,733	16,534	19,309	19,917

* This assumes that effort and catch rates will not change in response to management measures, only landings will change.
Note 1: Season length here will be 365 days +1 if leap year. Because season length will not be affected, and because there was minimal variability in monthly average prices, changes in landings and econ effects were modeled at the annual level only.
Note 2: Because the estimated landings are not expected to exceed even the most conservative ACL alternative, each trip limit/size limit combination is expected to have the same effect for all ACL alternatives.
Note 3: Trip limit and size limit alternatives will not be considered separately from action to form two management areas, NC to GA and East FL/FL Keys.
**Alt 2f uses a stepped approach to increasing the size limit with an increase to 15 in in year 1, 18 in in year 2, and 20 in in year 3. Given the uncertainty associated with predicting further into the future, the effects are based only on the 15 in size limit increase that would occur in year 1.

Table 6. Estimated change in revenue (2014 dollars) from status quo in first year of implementation (2017) for all ACL alternatives and various minimum size limit and trip limit combinations*.

	Trip Limit (lbs ww)				
Size Limit (FL inches)	**No limit (Alt 1 - Status Quo)**	**100 (Alt 2a)**	**250 (Alt 2b)**	**500 (Alt 2c)**	**750 (Alt 2d)**
12 (Alt 1 - Status Quo)	$ -	$ (32,869)	$ (14,886)	$ (4,470)	$ (2,183)
16 (Alt2a)	$ (479)	$ (33,025)	$ (15,154)	$ (4,870)	$ (2,630)
17 (Alt 2b)	$ (1,520)	$ (33,365)	$ (15,736)	$ (5,741)	$ (3,599)
18 (Alt 2c)	$ (2,306)	$ (33,625)	$ (16,176)	$ (6,405)	$ (4,332)
19 (Alt 2d)	$ (4,251)	$ (34,273)	$ (17,287)	$ (8,048)	$ (6,144)
20 (Alt 2e)	$ (6,033)	$ (34,872)	$ (18,317)	$ (9,555)	$ (7,805)
15/18/20 (Alt 2f)**	$ (136)	$ (32,913)	$ (14,962)	$ (4,583)	$ (2,310)

* This assumes that effort, catch rates and prices will not change in response to management measures, only landings will change.
** Alt 2f uses a stepped approach to increasing the size limit with an increase to 15 in in year 1, 18 in in year 2, and 20 in in year 3. Given the uncertainty associated with predicting further into the future, the effects are based only on the 15 in size limit increase that would occur in year 1.

Appendix A: Methods for estimating percent of landings remaining after implementation of minimum size limit increases and trip limit decreases.

Minimum Size Limits

Scalar values representing the percent of harvest remaining after the implementation of each minimum size limit (MSL) were calculated at 1-inch intervals between 12-20 inches fork length (FL) as follows:

$$Percent_Remaining_t = (G_t + B_t)/C_t, \text{ where:} \quad (1)$$

C = catch in pounds WW,
G = weight of fish that are greater than or equal to the MSL,
B = weight of fish smaller than the current 12-inch FL MSL (non-compliance or measurement error), and
t = time period (month for FLE/FL Keys; year for GA-NC).

The above equation (1) was applied to average monthly landings by fish size (2012 through 2014) from the Trip Interview Program (TIP)[19]. In some instances, observations were pooled across nearest months until a sample size of 30 fish (in numbers) for the status quo was achieved. These monthly percent remaining values were used in the East Florida/Florida Keys model. For the Georgia to North Carolina model, the above formula was applied to average annual landings by fish size (2012 through 2014) from TIP. Assuming the distribution of trip-level landings by fish size remains the same on average in the future, these percent remaining scalars can be applied to estimated future landings to predict changes in landings from implementation of such size limits relative to the status quo.

Trip Limits

Scalar values representing the percent of harvest remaining after the implementation of each trip limit were calculated as follows:

$$Percent_Remaining_t = \sum_{trips_t} TL_pounds / \sum_{trips_t} pounds, \text{ where:} \quad (2)$$

TL_pounds = trip-level hogfish landings (lbs ww) truncated at proposed trip limit
pounds= trip-level hogfish landings (lbs ww)
t = time period (month for FLE/FL Keys; year for GA-NC)

The above equation (2) was applied to commercial logbook data from 2012 through 2014. Separate trip limit percent remaining scalars were produced for each MSL in each time period, by first applying MSL percent remaining scalars to the logbook data and then calculating the trip limit scalars. This methodology helps prevent overestimation of reductions in landings when trip limits and MSLs are implemented together. Assuming the distribution of trip-level landings

[19] http://www.sefsc.noaa.gov/interview/userguide.htm

remains the same on average in the future, these percent remaining scalars can be applied to estimated future landings to predict changes in landings from implementation of such trip limits relative to the status quo. This approach also assumes that a reduction in the commercial trip limit will only affect trip-level landings, not the number of trips.

Appendix N. Method for Specifying the FLK/EFL Hogfish OFL, ABC, and ACL in Numbers of Fish

Dr. Mike Errigo and Chip Collier
South Atlantic Fishery Management Council
Updated March 2, 2016

At the Council's request, Amendment 37 specifies the proposed recreational ACL for hogfish in numbers of fish (converted from pounds using average weight) and the commercial ACL in pounds. Issues develop, however, when different size limits are considered for management and the commercial and recreational ACLs are in different units: if the minimum size limit is increased, as the Council proposes to do, the average size and thus weight of fish harvested will also increase. If the method for converting between an ACL in pounds and an ACL in numbers does not address the change in average weight, the expected increase in the average weight of landed fish could lead to the poundage associated with the ACL specified in numbers exceeding the ACL expressed in pounds. This could also result in a perceived shift in allocations when they are compared in the original units across sectors, and if the change in weight landed is great enough, the ABC and OFL in pounds could be exceeded.

The assumption made above is that the conditions input to the model used in projections (certain level of recruitment, selectivity, natural mortality, productivity, etc.) will remain consistent in the fishery after the implementation of Amendment 37, including the change in the minimum size limit. If this assumption is correct, then exceeding the yield of the ABC and OFL in pounds would result in overfishing. However, once the minimum size limit change is implemented by Amendment 37, the selectivity and resulting yield per recruit (YPR) may change from the assumed levels that were input to the model. Therefore, the yield in pounds from fishing at F_{target} will be higher with a higher average fish size. Since the recreational fishery is currently harvesting hogfish at an average size below the Council's preferred minimum size limit of 15 inches (13.9 inches on average 2012-2014) and approximately 70% of the harvested fish are currently below this preferred minimum size, there is a good chance that implementing the preferred minimum size limit will change the selectivity of the recreational fishery.

The most appropriate method to address changes in management measures, such as size limits, that affect fishery selectivity is to update the management parameters, such as MSY and F_{MSY} along with projections of yield and stock size, to reflect the expected selectivity patterns. This is very important because estimates of stock productivity are linked to selectivity and will change when a management action affects future selectivity. Council staff had initial discussions with FWC about the potential to rerun the projections and update productivity measures with selectivity consistent with the proposed size limit increase. However, this will require some modifications to the assessment program. Since SEDAR 37 was conducted using the SS3 assessment model, which is highly complex and there is no one in the region qualified to perform the type of code modification required on the fly, the timing, including review by the SSC for acceptance prior to use, will not fit the statutory timeline for Amendment 37. We will pursue having this modification made for future assessments or updates.

Council staff developed a modified YPR model to investigate the effects of changes in the minimum size on fishing mortality (F) (**Appendix**). The intent was to investigate whether a higher yield could be taken by the fishery, while harvesting the same number of fish, and still not result in overfishing. The results of the modified YPR indicate that the fishery could continue to harvest the same number of fish up to the 20" proposed minimum size alternative with little to no effect on the value of F (**Appendix Table 1**). This is because F is based on numbers killed, so alternatives with the same number of fish killed will have similar F values when you consider F over the same range of ages in all the alternatives. Therefore, the recreational fishery can harvest a higher poundage of hogfish without causing the stock to undergo overfishing.

One method of addressing the change in selectivity due to the change in the minimum size limit would be to specify the OFL, ABC, and ACLs in numbers of fish; however, current sector allocations are based on landings in pounds, so allocations could be impacted if ratios derived from pounds are simply applied to fishing levels expressed in numbers. For the method proposed here, the OFL and ABC are specified in numbers and each value has an associated yield in pounds based on average weight from the stock assessment projections (**Tables 1-2**). The associated yield in pounds is used to calculate the allocation but is not used for calculating or tracking harvest in the recreational sector. The commercial sector's allocation is calculated in both pounds and numbers; therefore, either can be used to track the harvest for that sector. However, the ABC would still be specified in numbers of fish. A stepwise process to derive the sector ACLs could be:

1. Calculate the total ACL
    - If ABC=ACL, then the total ACL in numbers is provided directly as output from the projections from the stock assessment (**Table 1**).
    - If there is an uncertainty buffer between ACL and ABC, then reduce the ABC (numbers) by the uncertainty buffer to get total ACL (numbers, **Table 2**).
2. Allocate the total ACL- This step allocates the ACL between sectors using the status quo method used for all other stocks managed in the South Atlantic. Using the associated yield (pounds) for the ABC or yield with uncertainty buffer included, calculate the allocation for each sector based on the formula derived in the Comprehensive ACL Amendment. Commercial allocation is 9.63% based on weight and recreational allocation is 90.37% based on weight for the FLK/EFL stock.
3. Convert the commercial allocation from pounds to numbers - Divide the commercial sector allocation in pounds by the average weight of commercially-caught hogfish. The average weight of commercially-caught hogfish for the FLK/EFL stock is 3.21 lbs. (Source: Average of gear-specific average weights from the most recent assessment weighted by the commercial landings in number by gear, Mike Errigo).
    - At this step the commercial allocation has now been calculated in both pounds and numbers and either can be used as the final commercial ACL, depending on the preference of the Council. If pounds are chosen, the ABC will still need to be tracked in numbers, requiring the commercial landings to be converted into numbers at some point.

4. Calculate the Recreational ACL (numbers) - Subtract the commercial allocation in numbers from the total ACL in numbers.

Some benefits of calculating the ACL using this method and specifying the OFL and ABC in numbers include:

- The ABC is not exceeded due to changes in the minimum size and average weights.
- Continues to use the standard method to calculate sector allocations.
- The recreational fishery is tracked in its native units.
- The recreational ACL remains constant in Amendment 37 regardless of what minimum size limit is proposed.
- The harvest reductions needed to rebuild the stock will reduce the number of potential weight observations through the MRIP program, making estimation of landings in weight even more unreliable than they already are for a rarely encountered species. Therefore, uncertainty is reduced by setting the OFL, ABC, and ACL in numbers and tracking the landings in numbers.
    - On average from 2012-2014, 246 hogfish a year are observed (Type A catch) through the MRIP survey in this stock, but only 80 of those are weighed (32.5%).
- The numbers of fish measured in the commercial fishery greatly exceeds the number measured in the recreational fishery (Rec: 0.035% of catch, Comm: 0.58% of catch, Comm samples 16.6 times more of the catch than Rec); therefore, we are using the dataset with less uncertainty to convert from weight to numbers.
- The average size of commercially caught hogfish already exceeds the average size of fish under the preferred size limit and might not shift as much as the recreational fishery likely will.
- Evidence suggests that even if the average weight of landed fish does increase due to an increase in the minimum size that overfishing will not occur (see **Appendix**).

Issues to consider:

- The associated yield in pounds of the ACL in numbers can exceed the SSC approved ABC in pounds if the average weight of landed fish increases due to an increase in the minimum size limit. However, the modified YPR analysis developed by Council staff shows that the yield in pounds from fishing at F_{target} will be higher with a higher average fish size.
- Realized allocation may shift in weight. Allocation in weight will be dependent on average weight estimated for the fisheries. Amendment 37 uses an average weight value of 1.85 lbs. for recreationally caught hogfish, which is slightly above the average weight of a 12-inch hogfish. It is not known what the recreational average weight of hogfish will be under different size limits and how it will change over time. However, this is an issue whenever the ACL for a sector is set in numbers and the allocation is calculated in pounds regardless of the units of the ABC.

This method, developed by Council staff, is designed to keep the numbers of fish harvested constant while allowing the yield to vary based on the possible change in selectivity due to changes in the minimum size limit. Yields above the SSC-approved projections in pounds are possible, but the results of the YPR model developed by Council staff show that as long as the number of fish does not exceed the projected landings then overfishing will not be occurring (see **Appendix**). This proposed method also is consistent with the allocation formula currently in use, which relies on landings in pounds to calculate the sector allocations. The method proposed by SERO staff for calculating the recreational ACL of hogfish in the FLK/EFL stock reduces the number of fish harvested in the recreational sector based on average weight of fish at different size limits and does not consider changes in selectivity due to changes in the minimum size limit. Until a new assessment or new projections can be run to account to changes in selectivity due to changes in the minimum size, Council staff propose this method of specifying the OFL and ABC in numbers and allowing the yield to vary based on changes in selectivity as an interim method for setting the recreational ACL for the FLK/EFL stock of hogfish.

Table 1. Proposed ABC and ACLs for the FLK/EFL hogfish stock. This example is for **Sub-alternative 2a** in **Action 6** (ACL=ABC). The average weight is estimated by the stock assessment model. The average weight of commercially caught hogfish is 2.61 lbs. based on commercial samples.

New Proposed Method To Calculate Hogfish ACL Using Only Comm Avg Wt						
Year	**ABC**	**Model Proj Avg Wt**	**Yield of ABC**	**Yield of Comm ACL**	**Comm ACL**	**Rec ACL**
	(number)	**(lbs/fish)**	**(pounds)**	**(pounds)**	**(number)**	**(number)**
2017	17,930	2.14	38,367	3,695	1,416	16,514
2018	21,421	2.31	49,449	4,762	1,824	19,597
2019	24,996	2.48	61,982	5,969	2,287	22,709
2020	29,200	2.59	75,710	7,291	2,793	26,407
2021	33,965	2.66	90,469	8,712	3,338	30,627
2022	39,027	2.72	106,059	10,213	3,913	35,114
2023	44,162	2.77	122,197	11,768	4,509	39,653
2024	49,254	2.81	138,566	13,344	5,113	44,141
2025	54,183	2.86	154,851	14,912	5,713	48,470
2026	58,878	2.90	170,750	16,443	6,300	52,578
2027	63,295	2.94	186,018	17,914	6,863	56,432

Table 2. Proposed ABC and ACLs for the FLK/EFL hogfish stock. This example is for **Preferred Sub-alternative 2b** in **Action 6** (ACL=95% ABC). The average weight is estimated by the stock assessment model. The average weight of commercially caught hogfish is 2.61 lbs. based on commercial samples.

New Proposed Method To Calculate Hogfish ACL Using Only Comm Avg Wt							
Year	ABC	Total ACL	Model Proj Avg Wt	Yield of Total ACL	Yield of Comm ACL	Comm ACL	Rec ACL
	(number)	(number)	(lbs/fish)	(pounds)	(pounds)	(number)	(number)
2017	17,930	17,032	2.14	36,449	3,510	1,345	15,687
2018	21,421	20,336	2.31	46,977	4,524	1,733	18,603
2019	24,996	23,743	2.48	58,883	5,670	2,173	21,571
2020	29,200	27,770	2.59	71,925	6,926	2,654	25,116
2021	33,965	32,310	2.66	85,946	8,277	3,171	29,139
2022	39,027	37,043	2.72	100,756	9,703	3,718	33,325
2023	44,162	41,909	2.77	116,087	11,179	4,283	37,626
2024	49,254	46,846	2.81	131,638	12,677	4,857	41,989
2025	54,183	51,437	2.86	147,108	14,167	5,428	46,009
2026	58,878	55,935	2.90	162,213	15,621	5,985	49,950
2027	63,295	60,108	2.94	176,717	17,018	6,520	53,588

Table 3. Sector ACLs in pounds and numbers (recreational) for **Sub-alternatives 2a-2c** in **Action 6** and based on ABC projections from **Preferred Alternative 3** in **Action 5** where ABC is equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success. Recreational ACL in numbers of fish is based on an average weight of 1.85 lbs. ww. (Source Amendment 37)

Sub-alternative 2a: ACL=OY=ABC					
Year	Total ABC (pounds)	Total ACL (pounds)	Rec ACL (pounds)	Rec ACL (number)	Commercial ACL (pounds)
2017	38,367	38,367	34,672	18,742	3,695
2018	49,449	49,449	44,687	24,155	4,762
2019	61,982	61,982	56,013	30,277	5,969
2020	75,710	75,710	68,419	36,983	7,291
2021	90,469	90,469	81,757	44,193	8,712
2022	106,059	106,059	95,846	51,808	10,213
2023	122,197	122,197	110,429	59,692	11,768
2024	138,566	138,566	125,222	67,688	13,344
2025	154,851	154,851	139,939	75,643	14,912
2026	170,750	170,750	154,307	83,409	16,443
2027	186,018	186,018	168,104	90,867	17,914

Table 3. Continued.

Preferred Sub-alternative 2b: ACL=OY=95% ABC					
Year	**Total ABC (pounds)**	**Total ACL (pounds)**	**Rec ACL (pounds)**	**Rec ACL (number)**	**Commercial ACL (pounds)**
2017	38,367	36,449	32,939	17,805	3,510
2018	49,449	46,977	42,453	22,947	4,524
2019	61,982	58,883	53,212	28,764	5,670
2020	75,710	71,925	64,998	35,134	6,926
2021	90,469	85,946	77,669	41,983	8,277
2022	106,059	100,756	91,053	49,218	9,703
2023	122,197	116,087	104,908	56,707	11,179
2024	138,566	131,638	118,961	64,303	12,677
2025	154,851	147,108	132,942	71,860	14,167
2026	170,750	162,213	146,591	79,239	15,621
2027	186,018	176,717	159,699	86,324	17,018

Sub-alternative 2c: ACL=OY=90% ABC					
Year	**Total ABC (pounds)**	**Total ACL (pounds)**	**Rec ACL (pounds)**	**Rec ACL (number)**	**Commercial ACL (pounds)**
2017	38,367	34,530	31,205	16,868	3,325
2018	49,449	44,504	40,218	21,740	4,286
2019	61,982	55,784	50,412	27,250	5,372
2020	75,710	68,139	61,577	33,285	6,562
2021	90,469	81,422	73,581	39,774	7,841
2022	106,059	95,453	86,261	46,628	9,192
2023	122,197	109,977	99,386	53,722	10,591
2024	138,566	124,709	112,700	60,919	12,010
2025	154,851	139,366	125,945	68,078	13,421
2026	170,750	153,675	138,876	75,068	14,799
2027	186,018	167,416	151,294	81,781	16,122

APPENDIX
YPR Spreadsheet Description

During development of Amendment 37, concern arose when the weight expected to be harvested from the fishery at different size limits was greater than the projected ABC in pounds at the current12-inch size limit. The best option for developing ABC/ACL recommendations for different size limits would be using projections from a stock assessment. However, statutory time constraints do not allow for the time needed to develop code for such projections. While the stock assessment projections are being developed, a Yield per Recruit (YPR) model is provided to determine if overfishing would occur with an increase in the minimum size limit and the ACL specified in numbers of fish. This YPR model is intended to provide insight into potential changes in fishing mortality (F) and yield in pounds when size limits are changed and ACL in numbers is held constant.

The parameters used in this example are based on model parameters used in the SEDAR 37 stock assessment for the FLK/EFL stock of hogfish (Cells C2-C13, C19-C20) (Cooper et al. 2015). The YPR model is based on the Baranov catch equation (Column S), selectivity (Catch: Column K and Retention: Column L), growth (Length: Column G and Weight: Column H), and mortality (Natural: Column R and Fishing: Column U). Typical YPR models are designed to look at the yield for each recruit at different harvest rates assuming selectivity was constant. Because the F that would be solved for in a typical YPR model only includes the exploited population, the model had to be modified to allow for a comparison across different ages of exploited population. In this model we are assuming that the ACL is specified in numbers and we want to calculate the resulting yield in pounds and F rates (Table 1). This is an example of a hypothetical population for harvest rates, numbers of fish, and discards and should not be considered estimates of sustainable harvest; however, the model does simulate some aspects of the FLK/EFL stock of hogfish in that it uses parameters for growth, natural mortality, and selectivity (catch) from that assessment.

First, fishing mortality on the exploited portion of the population was calculated (the portion of the population above the minimum size, exploited F). Exploited F was calculated by minimizing the squared difference between the yield in numbers (Cell S30) and the ACL in numbers (Cell C26). Yield in numbers was calculated using the Baranov catch equation for each age class in the hypothetical population (Column S) under the assumption that exploitable F is constant for all age classes greater than the selected size limit (Column R). For this F rate estimation, the exploitable age classes can change with a change in the minimum size limit (Cell C17). Retention due to the size limit is determined by the retained selectivity (Column L), which assumes knife-edge selectivity. The total yield in pounds to the fishery (Cell C27) was calculated based on the length and weight-at-age in pounds (Column T). The ages from 3+ were included in the model because that was the size of recruitment to the fishery at the current 12 inch size limit based on SEDAR 37 (Cooper et al. 2015).

Next, the fishing mortality on the entire population above the initial 12 inch minimum size also needed to be calculated for each of the new minimum size limits (population F). This population F is the F rate experienced by the portion of the population that could be selected by the fishery if the size limit was not changed. In the estimation of population F, an average

natural mortality is needed. The natural mortality is weighted based on numbers-at-age for an unexploited population (Column N) * selectivity at age (Column K) * scaled Lorenzen mortality estimate (Column U). This resulted in a weighted population natural mortality of 0.180 (Cell V29) for the exploitable age classes based on a 12-inch size limit. The resulting abundance of all exploitable age classes at the current 12-inch size limit (Cell O28) and the weighted average M (Cell V29) were used in a second Baranov equation (Cell P30) where population F (Cell C23) was estimated for the population by minimizing the difference between the catch and the ACL.

$$Number\ harvested = PopSize \times \left(\frac{PopF}{PopF + WeigtedM}\right) \times \left(1 - e^{-(PopF+WeightedM)}\right)$$

Where the number harvested (Cell P30) is the value used to calculate the sum of squared difference for minimization, PopSize is the number of fish in the population age 3 and greater (Cell O28), PopF is the population F (Cell C23), and WeightedM is the average natural mortality for the population age 3 and greater weighted by the number of fish at each age (Cell V29). The population F is changed to minimize the squared difference between the number harvested and the ACL. In this calculation, the original Fs were not changed and only the population F was changed to match the harvest. Although the age classes exposed to fishing mortality changed with different size limits in this estimation, the abundance of all the exploitable age classes at the 12-inch minimum size was used to estimate the population F (ages 3+). The same methods were used to estimate the total fishing mortality (total F) for the population (fishing mortality plus discard mortality, Cell C24) except the difference between the summed total killed (Cell Y29) and the estimated killed (Y30) were minimized. The estimated number killed was derived from the Baranov Catch equation. Total F is the equivalent of what is used in assessments to determine if overfishing is occurring in a population (fishing mortality plus discard mortality). The total killed (Column Y) is the number of fish landed plus the dead discards. The population that was available for discarding (Column Q) was estimated in the same way the exploitable population size at age (Column P) was estimated with the exception of the use of discard selectivity rather than fishery selectivity (Column M). The discard selectivity was simply estimated as 1 – retained selectivity (if it can be selected for by the fishery, but not retained, then it can be discarded). Number of discards (Column W) was estimated using the Baranov catch equation, which included the exploitable F (Cell C22) multiplied by both the fishery selectivity (Column K) and the discard selectivity (Column M) at age. Finally, number of discards is multiplied by the proportion of the fishery that is hook and line (Cell C 20) since the assumption was there would be negligible discards from the dive sector (<2% since 2010). The hook and line discard mortality rate (Cell C19) was then applied to the number of discards to get dead discards (Column X).

The results indicated that the exploited F increases rapidly for the exploited age classes as size limit increases (**Appendix Table 1**). This is due to the lower population abundance available to the fishery when harvest begins. The exploited F rates must go up since the same numbers of fish are assumed to be taken from a smaller portion of the population. In this hypothetical population, the exploited F more than doubled when the minimum size went from 12 inches to 20 inches.

However the population F (F for all ages selected for by the fishery above the current 12-inch minimum size) remains constant and the total F (including discard mortality) barely changes as the minimum size increases (**Appendix Table 1**). The population F remains constant because the same numbers of fish are being landed, regardless of what size they are. For hogfish, the dead discards are relatively low since the bulk of the fishery is prosecuted via diving where the fisherman can avoid interacting with an undersized fish. Although including the dead discards increases the total kills (additional 310 dead fish at a 20 inch size limit), it only increases by a relatively small amount, which does not significantly increase the total F. Including discards had minimal impact for this simulated population, but it is likely that discards from other fisheries that are dominated by hook and line harvest will have a greater effect on the total F.

When a size limit is changed, the expected yield in pounds will differ even though the ACL in numbers was not changed. In the simulated example, the expected yield for an ACL of 10,000 fish increased from 70,298 lbs. for a 12-inch size limit to 107,863 lbs. for a 20-inch size limit. As the size limit increases, the harvest shifts to larger, heavier fish and the yield from these fish naturally increases. This shift in harvest can have an overall impact on the population differently than modelled by a simple YPR approach. Larger fish often spawn more and have greater fecundity than smaller individuals. When these larger fish are removed from the population, the reproductive capacity of the population could be reduced. These complex interactions need to be modelled through a projection analysis using the stock assessment results.

Appendix Table 1. Results of the YPR simulation showing pounds harvested and F rates at different minimum sizes. Size Lim (in) is the proposed size limit in inches, Num Harvested is the number of fish harvested, Lbs. Harvested is the pounds harvested associated with the numbers of fish harvested at a given size limit, Exploited F is the F rate on the portion of the population that can be harvested under the given size limit, Population F is the overall F rate felt by the population greater than the current 12 inch minimum size under each proposed size limit, and Total F is the F rate that includes the dead discards.

Size Lim (in)	Num Harvested	Lbs Harvested	Exploited F	Population F	Total F
12	10,000	70,298	0.08	0.08	0.08
14	10,000	80,457	0.10	0.08	0.08
16	10,000	90,133	0.13	0.08	0.08
18	10,000	99,293	0.16	0.08	0.08
20	10,000	107,863	0.21	0.08	0.09