FINAL

SNAPPER GROUPER AMENDMENT 14

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

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ABBREVIATIONS AND ACRONYMS

ABC	Acceptable Biological Catch
ALS	Accumulative Landings System
ACCSP	Atlantic Coastal Cooperative Statistics Program
B	A measure of fish biomass either in weight or other appropriate unit
B_{MSY}	The biomass of fish expected to exist under equilibrium conditions when fishing at F_{MSY}
B_{OY}	The biomass of fish expected to exist under equilibrium conditions when fishing at F_{OY}
B_{CURR}	The current biomass of fish
C	Catch expressed as average landings over some appropriate period
CEA	Cumulative Effects Analysis
CPUE	Catch per unit effort
DEIS	Draft Environmental Impact Statement
EFH	Essential Fish Habitat
EFH-HAPC	Essential Fish Habitat - Habitat Area of Particular Concern
EIS	Environmental Impact Statement
ESA	Endangered Species Act of 1973
F	A measure of the instantaneous rate of fishing mortality
F_{CURR}	The current instantaneous rate of fishing mortality
F_{MSY}	The rate of fishing mortality expected to achieve MSY under equilibrium conditions and a corresponding biomass of B_{MSY}
F_{OY}	The rate of fishing mortality expected to achieve OY under equilibrium conditions and a corresponding biomass of B_{OY}
FEIS	Final Environmental Impact Statement
FMU	Fishery Management Unit
MARMAP	Marine Resources Monitoring Assessment and Prediction Program
MFMT	Maximum Fishing Mortality Threshold
MMPA	Marine Mammal Protection Act of 1972
MPA	Marine Protected Area
MRFSS	Marine Recreation Fisheries Statistics Survey
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
NEPA	National Environmental Policy Act of 1969
OY	Optimum Yield
RIR	Regulatory Impact Review
SEDAR	Southeast Data, Assessment, and Review
SFA	Sustainable Fisheries Act
SIA	Social Impact Assessment
SPR	Spawning Potential Ratio
SSR	Spawning (biomass) per Recruit
T_{MIN}	The length of time in which a stock could be rebuilt in the absence of fishing mortality on that stock
TAC	Total Allowable Catch

AMENDMENT 14 TO THE FISHERY MANAGEMENT PLAN FOR THE SNAPPER GROUPER FISHERY OF THE SOUTH ATLANTIC REGION

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

Proposed actions: The primary purpose of this action is to employ a collaborative approach to identify Type 2 MPA sites with the potential to protect a portion of the population and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure to achieve a more natural sex ratio, age, and size structure within the proposed Type 2 MPAs, while minimizing adverse social and economic effects.

Lead agency: FMP – South Atlantic Fishery Management Council
EIS - National Marine Fisheries Service (NMFS)

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Final Round of Public Hearings:

September 5, 2006	Charleston, South Carolina
September 6, 2006	Myrtle Beach, South Carolina
September 7, 2006	Wrightsville Beach, South Carolina
September 11, 2006	Midway, Georgia
September 12, 2006	St. Augustine, Florida
September 13, 2006	Stuart, Florida
September 14, 2006	Islamorada, Florida
September 19, 2006	Hilton Head, South Carolina

Responses to Comments

The following section satisfies NEPA's requirement for responding to comments on the draft environmental impact statement (DEIS). NEPA requires that a federal agency shall respond to comments on the DEIS by one or more of the following means: 1) modify an existing alternative; 2) develop and analyze a new alternative; 3) supplement, improve, or modify the analyses; 4) make factual corrections; or 5) explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position. In an effort to satisfy the fifth requirement mentioned above, the following section responds to written comments generated during the comment period for Snapper Grouper Amendment 14 and DEIS, in addition to those received as verbal testimony during the eleven public hearings.

The first section summarizes and responds to Environmental Protection Agency (EPA) comments on the DEIS, which received an LO (Lack of Objections) rating from that agency. The second section summarizes and responds to public comments received during the DEIS comment period.

I. EPA Comments

EPA Comment 1 (Performance metrics): *The Final EIS should indicate which performance metrics (age, community structure, habitat, population size, etc.) will be used to measure species and habitat restoration, and what time frames will be used for monitoring.*

Response: Section 4.11 of the FEIS outlines the research required to evaluate the effectiveness of the MPAs. NOAA is responsible for the implementation of monitoring programs and it is the intention of the Council that the detailed monitoring program (including performance metrics) will be outlined through their research planning.

II. Comments from the Public

Comments on research, monitoring, and enforcement

A commenter said that once Amendment 14 is finalized, a detailed plan for research, monitoring, enforcement, and outreach/education should be developed for each of the Marine Protected Areas (MPAs), as was done for the Oculina Banks. The South Atlantic Fishery Management Council (Council) and NOAA Fisheries Service should immediately identify and secure sufficient funding to ensure full funding for these plans. These plans are necessary to achieve the MPA objectives and to avoid setting a negative precedent for future place-based management in the region.

Response: Section 4.11 of the FEIS outlines the research needed to evaluate the effectiveness of the MPAs. NOAA is responsible for the implementation of monitoring programs and it is the intention of the Council that the detailed monitoring program (including performance metrics) will be outlined through their research planning.

Sections 4.11, 4.12, and 4.13 of the FEIS outlines the Research Needs, Outreach Needs, and the Enforcement Needs, respectively. These sections were modeled from the Oculina Evaluation Plan. In developing the plan, a comprehensive process was used that included scientists, managers, and stakeholders. It was determined that to hold additional public meetings and to develop plans for each specific proposed MPA would be prohibitively expensive and labor intensive. The Council is committed to working with NOAA and its other partners to find funding and to meet the research, monitoring, assessment, outreach, and law enforcement goals associated with marine protected areas and all other management tools in place in the snapper grouper fishery.

A transit provision must not add additional enforcement challenges and should follow the recommendations of the Council's Law Enforcement Advisory Panel.

Response: Based on input received from the Council's Snapper Grouper Advisory Panel the FEIS has been modified to specify that transit with prohibited species on board will be allowed through the proposed Type 2 MPAs provided gear is stowed in accordance with regulations. The Council's Law Enforcement Advisory Panel met after the Snapper Grouper Advisory Panel had made its request and did not oppose the request to allow transit provided the gear stowage provision was included as had been done in the Gulf of Mexico. It was even suggested by a member of the Law Enforcement Advisory Panel that having similar regulations in the Gulf and South Atlantic may make enforcement easier.

Enforcement of areas located so far offshore is unrealistic. Are there funds to have officers that far out all the time?

Response: The dedication of funds are determined by the states, Coast Guard, and NOAA Fisheries and are outside of the Council's process. It is widely noted that funds dedicated towards fishery management are relatively limited, particularly as you increase the distance that the law enforcement personnel will have to travel from the coast. However, law enforcement personnel have been successful in prosecuting violations in the *Oculina* HAPC. Some unlawful fishing in the proposed MPAs could occur; however, fines for violations are likely to be substantial and will deter most fishermen from poaching. The Council also believes that self-enforcing will increase the enforcement of the MPAs. The Council has worked closely with its Law Enforcement Advisory Panel and has tried to maximize enforcement potential of the marine protect areas while minimizing the social and economic impacts.

What if natural circumstances such as a shift in the Gulf Stream cause a longline to drift inside an MPA? Would Vessel Monitoring Systems be necessary to prevent this? How much would such systems cost?

Response: Vessel Monitoring Systems (VMS) is required on longline vessels fishing for sharks and highly migratory species as follows:

(a) Applicability. To facilitate enforcement of time-area and fishery closures, an owner or operator of a commercial vessel, permitted to fish for Atlantic HMS under Sec. 635.4 and that fishes with a pelagic or bottom longline or strikenet gear, is required to install a NMFS-approved vessel monitoring system (**VMS**) unit on board the vessel and operate the **VMS** unit under the following circumstances:

(1) Whenever the vessel is away from port with pelagic longline gear on board;

(2) As of January 1, 2005, whenever a vessel issued a directed shark LAP, is away from port with bottom longline gear on board, is located between 33[deg]00[min] N. lat. and 36[deg]30[min] N. lat., and the mid-Atlantic shark closed area is closed as specified in Sec. 635.21(d)(1); or

(3) As of November 15, 2004, whenever a vessel, issued a directed shark LAP, is away from port with a gillnet on board during the right whale calving season specified in the Atlantic Large Whale Take Reduction Plan in Sec. 229.32(f) of this title.

The Council chose not to require VMS on longline vessels fishing for snapper grouper vessels at this time. Based on input received from the Law Enforcement Advisory Panel it is the responsibility of those fishing to ensure that their gear stays out of closed areas. However, all violations would be handled on a case by case basis.

Comments on the Shark bottom longline prohibition

The document lists habitat damage and bycatch of large immature fish as reasons for considering a ban on shark bottom longline gear in the MPAs. We agree with this argument and believe the ban is important to the effectiveness of the proposed MPAs.

<u>Response:</u> The Council has spent a significant amount of time discussing the measure to prohibit shark bottom longlines in the MPAs and feels that taking this step is consistent with the Council's mandate to protect essential fish habitat. Barnette (NOAA Technical Memorandum NMFS-SEFSC-449 2001) states that "due to potential entanglement impacts associated with bottom longlines, excluding their use in the vicinity of sensitive benthic habitat such as coral reefs would be an appropriate management measure". Section 4.10 of the FEIS contains a discussion concerning the potential for bycatch of snapper grouper species by shark bottom longlines to increase as the population rebuilds.

The commenter opposes the proposed prohibition of shark bottom longlines in the proposed deepwater MPAs. The true economic impacts of this action on shark fishermen have not been adequately assessed. A large portion of the observer data used to determine shark bottom longline effort in the proposed areas (1994-2001) was based on a voluntary observer program. Therefore, this data set does not capture the true importance of the proposed regions of water depth to past shark fishing efforts, which has been considerable.

<u>Response:</u> If indeed the observer data used to estimate impacts to the shark fisherman are underestimates then one can also conclude that the amount of snapper grouper species taken as bycatch by the shark bottom longline fisherman is also an underestimate and

therefore it remains necessary to close these small areas to all gear that may take severely overfished snapper grouper species and damage essential fish habitat. The economic impacts are analyzed in Section 4.10.2.

Suggestions for different sites or actions

The commenter encourages the Council to adopt [North Florida MPA] Alternative 1 (Council prefers Alternative 4) as it includes appropriate reef habitat, according to SEAMAP data. MARMAP data provide evidence of the presence of reproductive stages of snapper grouper within this site. The commenter opposes Alternatives 3, 5, and 6 because there is no scientific evidence that they contain the target species or appropriate habitat where spawning is likely to occur. In addition, the commenter does not support the eastern half of Alternative 4 for the same reasons.

Response: Alternatives 1 and 4 both include the same shelf edge habitat where juvenile snowy grouper and speckled hind in spawning condition have been collected. Furthermore, hogfish, red porgy, scamp, tomtate, and vermilion snapper in spawning condition have been found in the shelf edge habitat. However, the Council believes that Alternative 4 will protect a greater proportion of deepwater species (snowy grouper, golden tilefish, speckled hind, blueline tilefish, and yellowedge grouper) compared to Alternative 1 as the MPA includes more habitat offshore of the shelf edge.

The proposed St. Lucie Hump MPA is counterproductive, without any valid justification, and is destroying whatever respect or support the commenter's fishing community had for the Council and its regulations. Which of the 73 snapper grouper species is the Council certain live in that specific 8 square mile area?

Response: According to input from the Council's advisors and through scoping meetings, this alternative contains a rich habitat with many speckled hind, juvenile snowy grouper, Warsaw grouper, and mid-shelf species. The Council believes the small size (8 square nautical miles) mitigates much of the adverse socioeconomic effects. In addition, input received from the public in much of the area indicates there are at least two comparable reef systems nearby that are as easily accessible by the fishing community.

The proposed East Hump/Un-named Hump MPA off Florida is the only good place to catch queen snapper, both recreationally and commercially. The commenter's charter customers will go elsewhere if they can't catch queen snapper. This action is too rash and will not be reversed once implemented even if it is a mistake. More thought is needed before this MPA is established. The only positive part is the zone markers are new potential fishing spots for dolphin, tuna, and marlin.

Response: NOAA Fisheries conducted a socioeconomic study utilizing stakeholder feedback of the proposed MPA sites and alternatives. The analysis suggests adoption of Alternative 1 is preferable to the No Action alternative from a socioeconomic impact perspective since minimal ecosystem effects start to be realized after only one year and continue into the future, long-term minimal benefits are realized by fishers and their communities, forecasted costs are not significantly different from a neutral impact, and stakeholder consensus regarding the placement of the MPA is high. Data from the Accumulated Landings System shows that in 2005, 8,810 pounds (whole weight) of queen snapper were landed commercially in Monroe County at a dockside value of $20,289.

The Council should close the fishery within the proposed MPAs for the deepwater species the DEIS states need protection, but allow fishing for other snapper grouper species within the proposed MPAs.

Response: The Council determined that due to the multi-species nature of the fisheries, deepwater species such as juvenile snowy grouper and speckled hind would likely continue to be caught and suffer mortality if fishermen were allowed to target mid-shelf species such as gag and vermilion snapper within the proposed areas. Therefore, the Council felt it was best to prohibit bottom fishing for snapper grouper species but allow trolling for pelagic species such as dolphin within the closed areas.

Alternatives 1 and 4 for the proposed North Florida MPA are major sources of bottom fish for recreational anglers and charter boats. Closing this area to recreational fishing would not accomplish the Council's goals, but enforcing limits and limiting commercial fishing would. These areas are more heavily fished by commercial fishermen due to their great distance from shore. The fishing prohibition in the proposed MPA will just cause effort to increase in areas around it and will not be effective.

Response: Alternatives 1 and 4 are used by recreational fishermen and commercial fishermen. They are probably used more by commercial fishermen than recreational fishermen and will likely have a greater impact on commercial fishermen. While closing the area may cause effort to shift outside the closed area, species and habitat within the area could benefit. Furthermore, there may be long-term benefits realized by the public as species within the closed area respond to decreased fishing effort.

If an area is to be closed it should be one in need of help, not one that is thriving. The proposed North Florida MPA does not give enough "bang for your buck" and other areas should be chosen.

Response: The proposed Type 2 MPA will protect deepwater species (including snowy grouper and speckled hind), species that are undergoing overfishing and/or overfished. In addition, spawning of a number of mid-shelf species has been reported in the proposed area. The site was chosen through a collaborative process that intended to identify sites for marine protected areas with the potential to protect a portion of the population and habitat of long-lived, slow growing, deepwater snapper grouper species from directed fishing pressure to achieve a more natural sex ratio, age, and size structure within the proposed MPAs, while minimizing adverse social and economic effects

Is there a way to allow limited fishing within the boundaries for bottom species? The commenter only needs to catch a few fish for his customers, perhaps recreational fishing will still be allowed.

Response: While the location of these sites indicates that they are primarily fished by commercial fisherman, an increasing number of recreational fishermen are fishing in deeper water and targeting deepwater snapper grouper species. Therefore, due to the stock status of many of these species, the Council feels it is appropriate to protect the population and habitat of long-lived, slow growing, deepwater snapper grouper species from all directed fishing pressure to achieve a more natural sex ratio, age, and size structure.

Other comments

Commenter strongly encourages the Council to approve the final EIS and Amendment at the March 5-9, 2007, Council meeting as outlined in the DEIS.

Response: The Council plans to approve the FEIS and Amendment for submission to the Secretary of Commerce at the June 2007 Council meeting. This allowed for the Council to review all the public comments at the March meeting and make any necessary changes before final approval.

Responders strongly support the proposed network of deepwater MPAs outlined in the DEIS.

Response: No response needed.

Establishment of artificial reef habitat in the proposed Charleston Deep Artificial Reef MPA is of secondary importance to the protection of the other, natural MPAs.

Response: No response needed.

ABSTRACT

The South Atlantic Fishery Management Council (SAFMC) proposes nine management actions to amend the current Snapper Grouper Fishery Management Plan (FMP). The primary purpose of these actions is to employ a collaborative approach to identify Marine Protected Area (MPA) sites with the potential to protect a portion of the population and habitat of slow growing, long-lived deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure to achieve a more natural sex ratio, age, and size structure within the proposed MPAs, while minimizing adverse social and economic impacts.

Eight of the actions would establish Type 2 Marine Protected Areas (MPAs); one off southern North Carolina, three off South Carolina, one off Georgia, and three off Florida. The MPAs are intended to be used in concert with traditional management measures to enhance the optimum size, age, and genetic structure of slow growing, long-lived deepwater snapper grouper species.

For the purposes of Amendment 14, the Council is proposing “Type 2” MPAs where no person may fish for a South Atlantic snapper grouper in an MPA and no person may possess a South Atlantic snapper grouper in an MPA. However, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed (as defined in Appendix F).

The ninth action would prohibit use of shark bottom longlines in the Type 2 MPAs to protect deepwater species and their habitat.

TABLE OF CONTENTS

Response to Comments .... A
Abstract .... G
Table of Contents i
List of Figures vi
List of Tables x
Summary xiv
1 Introduction 1
1.1 History of the Council's Consideration of MPAs 1
1.2 Considerations for MPA Design 6
1.3 Purpose and Need 7
1.4 History of Management 12
2 Alternatives 22
2.1 Description of Alternatives 22
2.1.1 Snowy Grouper Wreck MPA 22
2.1.2 Northern South Carolina MPA (South Carolina A MPA) 23
2.1.3 Edisto MPA 24
2.1.4 Georgia MPA (Tilefish MPA) 24
2.1.5 North Florida MPA (Jacksonville/St. Augustine Ridge MPA) 25
2.1.6 St. Lucie Hump MPA 27
2.1.7 East Hump/Un-named Hump MPA 27
2.1.8 Charleston Deep Artificial Reef MPA 27
2.1.9 Shark Bottom Longlines 27
2.2 Comparison of Alternatives 28
2.2.1 Snowy Grouper Wreck MPA 28
2.2.2 Northern South Carolina MPA (South Carolina A MPA) 29
2.2.3 Edisto MPA 30
2.2.4 Georgia MPA (Tilefish MPA) 31
2.2.5 North Florida MPA (Jacksonville/St. Augustine Ridge MPA) 32
2.2.6 St. Lucie Hump MPA 34
2.2.7 East Hump/Un-named Hump MPA 34
2.2.8 Charleston Deep Artificial Reef MPA 35
2.2.9 Shark Bottom longlines 35
3 Affected Environment 36
3.1 Habitat 36
3.1.1 Inshore/Estuarine Habitat 36
3.1.2 Offshore Habitat 36
3.1.3 Essential Fish Habitat 37
3.1.4 Essential Fish Habitat – Habitat Areas of Particular Concern 38
3.2 Biological/Ecological Environment 39
3.2.1 Life History Characteristics of Target Species 39
3.2.2 Status of Target Species 43
3.2.3 Other Affected Species 67
3.3 Human Environment 75
3.3.1 Economic Description of the Fishery 76

3.3.2 Social and Cultural Environment 130
3.4 Administrative Environment 153
3.4.1 The Fishery Management Process and Applicable Laws 153
3.4.2 Enforcement 155
4 Environmental Consequences 157
4.1 Background 157
4.1.1 Biological 157
4.1.2 Economic 167
4.1.3 Social 188
4.1.4 Enforcement issues relating to the proposed MPAs 192
4.1.5 Individual Assessments of Alternatives 193
4.1.6 Data on Impacts 195
4.2 Snowy Grouper Wreck MPA 196
4.2.1 Biological Effects of Management Measure Alternatives 197
4.2.2 Economic Effects of Management Measure Alternatives 202
4.2.3 Social Effects of Management Measure Alternatives 204
4.2.4 Administrative Effects of Management Measure Alternatives 207
4.2.5 Conclusion 208
4.3 Northern South Carolina (South Carolina A MPA) MPA 209
4.3.1 Biological Effects of Management Measure Alternatives 211
4.3.2 Economic Effects of Management Measure Alternatives 217
4.3.3 Social Effects of Management Measure Alternatives 219
4.3.4 Administrative Effects of Management Measure Alternatives 220
4.3.5 Conclusion 221
4.4 Edisto MPA 222
4.4.1 Biological Effects of Management Measure Alternatives 223
4.4.2 Economic Effects of Management Measure Alternatives 232
4.4.3 Social Effects of Management Measure Alternatives 234
4.4.4 Administrative Effects of Management Measure Alternatives 236
4.4.5 Conclusion 237
4.5 Georgia MPA (Tilefish MPA) 238
4.5.1 Biological Effects of Management Measure Alternatives 239
4.5.2 Economic Effects of Management Measure Alternatives 244
4.5.3 Social Effects of Management Measure Alternatives 246
4.5.4 Administrative Effects of Management Measure Alternatives 247
4.5.5 Conclusion 247
4.6 North Florida MPA (Jacksonville/St. Augustine Ridge MPA) 248
4.6.1 Biological Effects of Management Measure Alternatives 252
4.6.2 Economic Effects of Management Measure Alternatives 259
4.6.3 Social Effects of Management Measure Alternatives 261
4.6.4 Administrative Effects of Management Measure Alternatives 263
4.6.5 Conclusion 263
4.7 St. Lucie Hump MPA 264
4.7.1 Biological Effects of Management Measure Alternatives 267
4.7.2 Economic Effects of Management Measure Alternatives 268
4.7.3 Social Effects of Management Measure Alternatives 269

4.7.4 Administrative Effects of Management Measure Alternatives 270
4.7.5 Conclusion 271
4.8 East Hump/Un-Named Hump MPA 272
4.8.1 Biological Effects of Management Measure Alternatives 273
4.8.2 Economic Effects of Management Measure Alternatives 274
4.8.3 Social Effects of Management Measure Alternatives 276
4.8.4 Administrative Effects of Management Measure Alternatives 277
4.8.5 Conclusion 277
4.9 Charleston Deep Artificial Reef MPA 278
4.9.1 Biological Effects of Management Measure Alternatives 280
4.9.2 Economic Effects of Management Measure Alternatives 285
4.9.3 Social Effects of Management Measure Alternatives 286
4.9.4 Administrative Effects of Management Measure Alternatives 286
4.9.5 Conclusion 287
4.10 Shark Bottom longlines 288
4.10.1 Biological Effects of Management Measure Alternatives 288
4.10.2 Economic Effects of Management Measure Alternatives 295
4.10.3 Social Effects of Management Measure Alternatives 299
4.10.4 Administrative Effects of Management Measure Alternative 299
4.10.5 Conclusion 300
4.11 Research Needs 301
4.12 Outreach Needs 302
4.13 Enforcement Needs 304
4.14 Cumulative Effects 306
4.14.1 Biological 307
4.14.2 Socioeconomic 316
4.15 Bycatch Practicability Analysis 321
4.15.1 Population Effects for the Bycatch Species 322
4.15.2 Ecological Effects Due to Changes in the Bycatch 332
4.15.3 Changes in the Bycatch of Other Fish Species and Resulting Population and Ecosystem Effects 333
4.15.4 Effects on Marine Mammals and Birds 333
4.15.5 Changes in Fishing, Processing, Disposal, and Marketing Costs 334
4.15.6 Changes in Fishing Practices and Behavior of Fishermen 335
4.15.7 Changes in Research, Administration, and Enforcement Costs and Management Effectiveness 335
4.15.8 Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources 336
4.15.9 Changes in the Distribution of Benefits and Costs 336
4.15.10 Social Effects 336
4.15.11 Conclusion 336
5 Social Impact Analysis 338
6 Regulatory Impact Review 339
6.1 Introduction 339
6.2 Problems and Objectives 339
6.3 Methodology and Framework for Analysis 339

6.4 Description of Fisheries ... 339
6.5 Impacts of Management Measures ... 340
6.5.1 Action 1: Establish a Type 2 MPA in the Area of the Snowy Wreck off the Coast of North Carolina ... 340
6.5.2 Action 2: Establish a Type 2 MPA in an Area off the Northern South Carolina Coast ... 341
6.5.3 Action 3: Establish a Type 2 MPA in an Area off the Central South Carolina Coast ... 342
6.5.4 Action 4: Establish a Type 2 MPA in an Area off the Georgia Coast. ... 343
6.5.5 Action 5: Establish a Type 2 MPA off the Northern Florida Coast ... 344
6.5.6 Action 6: Establish a Type 2 MPA in Area Known as St. Lucie Hump off the Florida East Coast ... 345
6.5.7 Action 7: Establish a Type 2 MPA in Area Known as East Hump and Unnamed Hump off Coast of Florida Keys ... 346
6.5.8 Action 8: Establish an Experimental Artificial Reef Type 2 MPA off the South Carolina Coast ... 347
6.5.9 Action 9: Prohibit Shark Bottom longlines in the Type 2 MPAs ... 348
6.6 Public and Private Costs of Regulations ... 349
6.7 Summary of Economic Impacts ... 350
6.8 Determination of Significant Regulatory Action ... 350
7 Regulatory Flexibility Analysis ... 351
7.1 Introduction ... 351
7.2 Statement of need for, objectives of, and legal basis for the proposed rule ... 351
7.3 Identification of all relevant Federal rules which may duplicate, overlap, or conflict with the proposed rule ... 352
7.4 Description of the projected reporting, record-keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for the preparation of the report or records ... 352
7.5 Description and estimate of the number of small entities to which the proposed rule will apply ... 352
7.6 Substantial number of small entities criterion ... 354
7.7 Significant economic impact criterion ... 355
7.8 Description of significant alternatives ... 356
8 Other Applicable Law ... 359
8.1 Administrative Procedures Act ... 359
8.2 Coastal Zone Management Act ... 359
8.3 Endangered Species Act ... 359
8.4 Executive Order 12612: Federalism ... 360
8.5 Executive Order 12866: Regulatory Planning and Review ... 360
8.6 Executive Order 12898: Environmental Justice ... 361
8.7 Executive Order 12962: Recreational Fisheries ... 361
8.8 Executive Order 13089: Coral Reef Protection ... 361
8.9 Executive Order 13158: Marine Protected Areas ... 362
8.10 Marine Mammal Protection Act ... 362
8.11 Migratory Bird Treaty Act and Executive Order 13186 ... 363

8.12 National Environmental Policy Act ... 363
8.13 National Marine Sanctuaries Act ... 364
8.14 Paperwork Reduction Act ... 364
8.15 Regulatory Flexibility Act ... 364
8.16 Small Business Act ... 365
8.17 Public Law 99-659: Vessel Safety ... 365
9 List of Preparers ... 366
10 Entities Consulted ... 367
11 References ... 369
12 Index ... 389
13 Appendices ... A-1
13.1 Appendix A. Alternatives the Council considered but eliminated from detailed study and a brief discussion of the reasons for their elimination ... A-1
13.1.1 The site selection process ... A-1
13.1.2 Allowable activities ... A-2
13.1.3 Specific Sites ... A-3
13.2 Appendix B. Law Enforcement Advisory Panel Report ... B-1
13.3 Appendix C. Essential Fish Habitat, Habitat Areas of Particular Concern, and Habitat Policy Statements ... C-1
13.4 Appendix D. Expanded take estimates of snapper grouper from the shark bottom longline fishery with the proposed Type II MPAs ... D-1
13.5 Appendix E: Delphi Panel ... 13-1
13.6 Appendix F. Snapper Grouper Amendment 14 Proposed Rule ... F-1

LIST OF FIGURES

Figure S-1. Proposed Type 2 deepwater MPAs off North Carolina, South Carolina, and Georgia. xv
Figure S-2. Proposed Type 2 deepwater MPAs off east Florida. xvi
Figure 2-1. Proposed Deepwater Type 2 MPAs off North Carolina, South Carolina, and Georgia. 23
Figure 2-2. Proposed Type 2 Deepwater MPAs off east Florida. 26
Figure 3-1. Annual landings (pounds whole weight) of snowy grouper 1986-2004. 47
Figure 3-2. Annual landings (pounds whole weight) of snowy grouper (1999-2004). 48
Figure 3-3. Mean lengths (inches, total length) of snowy grouper taken by commercial, headboat, and recreational (MRFSS) fishermen during 1984-2003. 49
Figure 3-4. Mean lengths (inches, total length) of snowy grouper taken by commercial fishermen off South Carolina and North Carolina. 50
Figure 3-5. Commercial landings of snowy grouper by state. 50
Figure 3-6. Annual landings (pounds whole weight) of golden tilefish 1986-2004. 54
Figure 3-7. Annual landings (pounds whole weight) of golden tilefish (1999-2004). 55
Figure 3-8. Mean lengths (inches, total length) of golden tilefish taken by commercial, headboat, and recreational (MRFSS) fishermen during 1984-2003. 55
Figure 3-9. Annual landings (pounds whole weight) of speckled hind 1986-2004. 57
Figure 3-10. Annual landings (pounds whole weight) of speckled hind (1999-2004). Commercial landings are from the NMFS Accumulative Landings System (ALS). 57
Figure 3-11. Mean lengths (inches, total length) of speckled hind taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2003. 58
Figure 3-12. Annual landings (pounds whole weight) of Warsaw grouper 1986-2004. 59
Figure 3-13. Annual landings (pounds whole weight) of Warsaw grouper (1999-2004). 60
Figure 3-14. Mean lengths (inches, total length) of Warsaw grouper taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2004. 60
Figure 3-15. Annual landings (pounds whole weight) of misty grouper 1986-2004. 61
Figure 3-16. Mean lengths (inches, total length) of misty grouper taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2004. 62
Figure 3-17. Annual landings (pounds whole weight) of yellowedge grouper 1986-2004. 63
Figure 3-18. Annual landings (pounds whole weight) of yellowedge grouper (1999-2004). 64
Figure 3-19. Mean lengths (inches, total length) of yellowedge grouper taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2004. 64
Figure 3-20. Annual landings (pounds whole weight) of blueline tilefish 1986-2004. 66
Figure 3-21. Annual landings (pounds whole weight) of blueline tilefish (1999-2004). Source: 66
Figure 3-22. Mean lengths (inches, total length) of blueline tilefish taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2004. 67
Figure 3-23. Proportion of ex-vessel revenue derived from the various groups in the snapper grouper complex during the period from 1999 to 2003. 85
Figure 3-24. Major events in the regulatory history of the snapper grouper fishery superimposed on total snapper grouper landings during 1983-2003. 86

Figure 3-25. Trends in dockside landings and nominal and real ex-vessel revenue for all snapper grouper species in the South Atlantic region during 1986-2003. Florida landings include all of Monroe County. 87
Figure 3-26. Trends in unit price, imports, and landings of snapper grouper species. Average unit prices are expressed in nominal value and real value (2003 dollars).......... 88
Figure 3-27. Price per pound by species group during 1986-2003................................. 91
Figure 3-28. Number of anglers participating in all saltwater fisheries by State. 103
Figure 3-29. Recreational fishing trips (private and charter) where snapper grouper species were caught (catch effort) in the South Atlantic by mode. 105
Figure 3-30. Recreational fishing trips (private and charter) where snapper grouper species were caught (catch effort) in the South Atlantic by state................................. 106
Figure 3-31. Composition of the headboat harvest by species groupings proposed in Amendment 13B averaged over the period from 1999 to 2003.................................... 118
Figure 3-32. Composition of the headboat harvest by North Carolina, South Carolina, Georgia, and North Florida (excluding harvest south of North Florida) by species groupings proposed in Amendment 13B averaged over period from 1999 to 2003....... 118
Figure 3-33. Distribution of headboat harvest by state/region averaged over the period from 1999 to 2003. 119
Figure 3-34. Composition of the charterboat harvest by species groups proposed in Amendment 13B averaged over the period from 1999 to 2003.................................... 120
Figure 3-35. Composition of the charterboat harvest in North Carolina, South Carolina, and Georgia by species groups proposed in Amendment 13B averaged over the period from 1999 to 2003. 120
Figure 3-36. Distribution of charterboat harvest by state averaged over the period from 1999 to 2003.. 121
Figure 3-37. Composition of the private recreational sector's harvest by species group proposed in Amendment 13B averaged over the period from 1999 to 2004. 121
Figure 3-38. Composition of the private recreational sector's harvest in North Carolina, South Carolina, and Georgia by species group proposed in Amendment 13B averaged over the period from 1999 to 2003. 122
Figure 3-39. Distribution of the private recreational sector's harvest by state averaged over the period from 1999 to 2003.. 122
Figure 3-40. North Carolina communities with substantial fishing activity, as identified by South Atlantic Advisory Panels.. 133
Figure 3-41. Hatteras Island and Village, Outer Banks, North Carolina...................... 135
Figure 3-42. Map of Roanoke Island, North Carolina, showing Wanchese and Manteo. 136
Figure 3-43. Area of Carteret County, North Carolina, showing Morehead City, Atlantic Beach (at the red star), and Beaufort.. 138
Figure 3-44. General area of Sneads Ferry, North Carolina.. 141
Figure 3-45. South Carolina communities with substantial fishing activity, as identified by South Atlantic Advisory Panels.. 143
Figure 3-46. Little River, South Carolina and surrounding area. 145
Figure 3-47. Florida communities with substantial fishing activity as identified by South Atlantic Advisory Panels... 148
Figure 3-48. Area map of Cape Canaveral, Florida.. 150

Figure 3-49. Marathon, Florida. 152
Figure 4-1. Flow chart describing how different economic values of MPAs are typically categorized. 169
Figure 4-2. Proposed Snowy Wreck Type 2 MPA alternatives. 197
Figure 4-3. Bottom habitat in the Snowy Grouper Wreck Type 2 MPA alternatives. 200
Figure 4-4 Snapper grouper species occurrence in Snowy Grouper Wreck Type 2 MPA alternatives. 201
Figure 4-5. Proposed Northern South Carolina Type 2 MPA (South Carolina A MPA) alternatives. 210
Figure 4-6. Bottom habitat in the Northern South Carolina Type 2 MPA alternatives. 212
Figure 4-7. Deepwater snapper grouper species occurrence in Northern South Carolina Type 2 MPA alternatives. 213
Figure 4-8. Deepwater species spawning in Northern South Carolina Type 2 MPA alternatives. 214
Figure 4-9. Proposed Edisto Type 2 MPA. 223
Figure 4-10. Bottom habitat in the Edisto Type 2 MPA alternatives. 225
Figure 4-11. Occurrence of deepwater snapper grouper species in and near the proposed Edisto Type 2 MPA. 226
Figure 4-12. Occurrence of spawning deepwater snapper grouper species in and near the proposed Edisto Type 2 MPA. 227
Figure 4-13. Occurrence of other snapper grouper species spawning in and near the proposed Edisto Type 2 MPA. 228
Figure 4-14. Occurrence of species caught in Alternatives 1 and 2 by a commercial fisherman during 2004. 230
Figure 4-15. Proposed Georgia Type 2 MPA (Tilefish Type 2 MPA) alternatives. 239
Figure 4-16. Bottom habitat in the Georgia Type 2 (Tilefish Type 2) MPA alternatives. 240
Figure 4-17. Snapper grouper species occurrence in Georgia (Tilefish) Type 2 MPA alternatives. 242
Figure 4-18. Proposed North Florida Type 2 MPA Alternatives. 250
Figure 4-19. Proposed North Florida Type 2 MPA Alternatives. 251
Figure 4-20. Bottom habitat in North Florida (Jacksonville/St. Augustine Ridge) Type 2 MPA Alternatives. 253
Figure 4-21. Deepwater snapper grouper species spawning in North Florida Type 2 MPA alternatives. 254
Figure 4-22. Other snapper grouper species spawning in North Florida Type 2 MPA alternatives. 255
Figure 4-23. Snapper grouper species occurrence in North Florida Type 2 MPA alternatives. 256
Figure 4-24. Proposed St. Lucie Hump (Sea Bass Rocks) Type 2 MPA. 265
Figure 4-25. Hard bottom data in and near the proposed St. Lucie Hump Type 2 MPA. 266
Figure 4-26. Proposed Florida East Hump Type 2 MPA. 273
Figure 4-27. Proposed Charleston Deep Artificial Reef Type 2 MPA. 279
Figure 4-28. Bottom Habitat in Charleston Deep Type 2 Artificial Reef MPA. 281

Figure 4-29. Deepwater snapper grouper species occurrence near the proposed Charleston Deep Artificial Reef Type 2 MPA. 282
Figure 4-30. Occurrence of spawning deepwater snapper grouper species near the Charleston Deep Artificial Reef Type 2 MPA. 284
Figure 4-31. Shark bottom longline observed sets from 1994-2006 for the northern zone. 289
Figure 4-32. Shark bottom longline observed sets from 1994-2006 for the southern zone. 289
Figure 4-33. Shark bottom longline observed sets from 1994-2006 for the northern zone only showing the trips that intersected a proposed Type 2 MPA alternative. 291
Figure 4-34. Shark bottom longline observed sets from 1994-2006 for the southern zone only showing the trips that intersected a proposed Type 2 MPA alternative. 291

LIST OF TABLES

Table 1-1. History of management. 12
Table 2-1. Summary of effects of management measure alternatives for the Snowy Grouper Wreck Type 2 MPA.. 28
Table 2-2. Summary of effects of management measure alternatives for the Northern South Carolina Type 2 MPA (South Carolina A Type 2 MPA). 29
Table 2-3. Summary of effects of management measure alternatives for the Edisto Type 2 MPA.. 30
Table 2-4. Summary of effects of management measure alternatives for the Georgia Type 2 MPA.. 31
Table 2-5. Summary of effects of management measure alternatives for the Type 2 North Florida MPA. 32
Table 2-6. Summary of effects of management measure alternatives for the St. Lucie Hump Type 2 MPA.. 34
Table 2-7. Summary of effects of management measure alternatives for the East Hump/Un-Named Hump Type 2 MPA. 34
Table 2-8. Summary of effects of management measure alternatives for the Charleston Deep Artificial reef Type 2 MPA. 35
Table 2-9. Summary of effects of management measure alternatives for prohibiting shark bottom longlines. 35
Table 3-1. Life history characteristics of species in Snapper Grouper Amendment 14. . 40
Table 3-2. Spawning Stock Ratio (SSR) values for snowy grouper from PDT (1990b). 46
Table 3-3. Spawning Stock Ratio (SSR) values for snowy grouper from NMFS (1991); Huntsman *et al.* (1992); and Spawning Potential Ratio from Potts and Brennan (2001). 46
Table 3-4. The percentage of snowy grouper landed by state during 1999-2003........... 46
Table 3-5. Snowy grouper regulations.. 47
Table 3-6. Spawning Stock Ratio (SSR) values for golden tilefish............................... 52
Table 3-7. Spawning Stock Ratio (SSR) values for golden tilefish.............................. 53
Table 3-8. The percentage of golden tilefish landed by state during 1999-2003. 53
Table 3-9. Golden tilefish regulations. 54
Table 3-10. Speckled hind regulations... 56
Table 3-11. History of Warsaw grouper regulations. 59
Table 3-12. Misty grouper regulations... 61
Table 3-13. Yellowedge grouper regulations... 63
Table 3-14. Blueline tilefish regulations.. 65
Table 3-15. ESA-Listed Species in the Southeast Atlantic EEZ. 70
Table 3-16. Sea turtle catch data from the Supplementary Discard Data Program (SDDP) for the southeast U.S. Atlantic. 75
Table 3-17. Anticipated 3-year incidental take in the South Atlantic Snapper Grouper fishery. 75
Table 3-18. The snapper grouper fishery in the South Atlantic: annual landings (pounds), ex-vessel revenue, and effort. 83
Table 3-19. Number of vessels operating in the snapper grouper fishery by number years, 1999 - 2003.. 84
Table 3-20. U.S. imports of snappers and groupers from 1991 to 2004......................... 89

Table 3-21. Percent revenue from important species units by month for the South Atlantic averaged over the period from 1999 to 2003. 90
Table 3-22. Average number of trips from 1999 to 2003 with landings from proposed units in Snapper Grouper Amendment 13B. 92
Table 3-23. Average number of boats from 1999 to 2003 with landings from each proposed unit in Snapper Grouper Amendment 13B. 92
Table 3-24. Summary of trip-level economic data and effort variables by primary gear for the South Atlantic snapper grouper fishery (2002-03). 94
Table 3-25. Economic characteristics of the snapper grouper fishery by state in the South Atlantic from 1999 to 2003. 96
Table 3-26. Economic characteristics of the snapper grouper fishery by state in the South Atlantic from 1999 to 2003. 97
Table 3-27. Length distribution of permitted vessels by state in 2004. 98
Table 3-28. Average ex-vessel value of the snapper grouper unit as proposed in Snapper Grouper Amendment 13B by state for the period from 1999 to 2003. 98
Table 3-29. Proportional contribution of each unit as proposed in Snapper Grouper Amendment 13B to the total ex-vessel revenue from all snapper grouper species by state, averaged over the period from 1999 to 2003. 99
Table 3-30. Percent revenue from important species units by month for North Carolina averaged over the period from 1999 to 2003. 100
Table 3-31. Percent revenue from important species units by month for South Carolina averaged over the period from 1999 to 2003. 100
Table 3-32. Percent revenue from important species units by month for Georgia averaged over the period from 1999 to 2003. 101
Table 3-33. Percent revenue from important species units by month for Florida averaged over the period from 1999 to 2003. 101
Table 3-34. The recreational fishery for snapper grouper species in the South Atlantic averaged over the period from 1999 to 2003. 102
Table 3-35. South Atlantic recreational effort for all species in the snapper grouper fishery management unit. 104
Table 3-36. Recreational fishing trips where snapper grouper species were caught (catch effort) in the South Atlantic by mode 1999 – 2003. 106
Table 3-37. Recreational fishing trips where snapper grouper species were caught in the South Atlantic by state. 107
Table 3-38. South Atlantic recreational effort for the shallow-water grouper Unit 1A. 108
Table 3-39. South Atlantic recreational effort for the shallow-water snapper unit. 109
Table 3-40. South Atlantic recreational effort for the triggerfish unit. 110
Table 3-41. South Atlantic recreational effort for the jack unit. 111
Table 3-42. South Atlantic recreational effort for the grunts and porgies (Unit 7B)..... 112
Table 3-43. South Atlantic recreational effort for the sea bass group (Unit 8). 113
Table 3-44. South Atlantic recreational effort for the deepwater grouper, tilefish, and snapper Units 2A and 2B, and grunt and porgy Unit 7A. 114
Table 3-45. South Atlantic recreational effort for the mid-shelf snapper group (Unit 4). 115
Table 3-46. Estimated headboat angler days for the South Atlantic. 116

Table 3-47. Average number of headboat trips from 1999 to 2003 by trip length and percent of total trips by duration of trip. 116
Table 3-48. Harvest of snapper grouper species by mode in the South Atlantic. 117
Table 3-49. Percent composition of the headboat harvest of species not included in the snapper grouper complex from 1999 to 2003. 123
Table 3-50. Snapper grouper for-hire permit holders by home port state. 124
Table 3-51. Charterboats and headboats operating in the South Atlantic during 1997. 124
Table 3-52. Proportion of permitted charterboat and headboat vessels in length categories. 125
Table 3-53. Summary of expenditures on saltwater trips estimated from a 1999 MRFSS add-on survey. 126
Table 3-54. Estimated trip expenditures on snapper grouper trips in the South Atlantic by state. 126
Table 3-55. Estimated trip expenditures on snapper grouper trips in the South Atlantic by mode. 126
Table 4-1. Presence of hard bottom within sampled SEAMAP* one-minute grids encompassed by the proposed MPAs. 194
Table 4-2. Average monthly catch of snowy grouper (lbs gw) during 1999-2003 for Monroe County. 205
Table 4-3. Average monthly catch of snowy grouper (lbs gw) for East Florida (including Monroe County) and the Carolinas (SC and NC) during 1999-2003. 206
Table 4-4. Occurrence of deepwater snapper grouper species in the Northern South Carolina (South Carolina A) Type 2 MPA alternatives. 215
Table 4-5. Occurrence of other snapper grouper species within the Northern South Carolina A Type 2 MPA alternatives. 215
Table 4-6. Occurrence of deepwater snapper grouper species in the Edisto Type 2 MPA alternatives. 229
Table 4-7. Occurrence of other snapper grouper species in the Edisto Type 2 MPA alternatives. 229
Table 4-8. Occurrence of target species in proposed Georgia Type 2 MPA alternatives, where * indicates individuals found in spawning condition. 243
Table 4-9. Occurrence of other snapper grouper species within the proposed Georgia Type 2 MPA alternatives (MARMAP). 243
Table 4-10. Occurrence of deepwater snapper grouper species in the North Florida Type 2 MPA alternatives. 257
Table 4-11. Occurrence of other snapper grouper species in the Florida Type 2 MPA alternatives. 258
Table 4-12. Number of observed sets that intersected with the proposed Type 2 MPA sites. 290
Table 4-13. Number of non-shark species observed in bottom longline sets that intersected with the proposed Type 2 MPA sites. 293
Table 4-14. Number of sharks observed in bottom longline sets that intersected with the proposed Type 2 MPA sites and expanded estimate of number caught in proposed Type 2 MPAs. 297
Table 4-15: Estimated value of expanded catch of shark species in the proposed Type 2 MPAs, 1994-2006. 298

Table 4-18. The cause and effect relationship of fishing and regulatory actions within the time period of the Cumulative Effects Analysis (CEA). 313
Table 4-19. Percentage of recreational and commercial landings for 2001-2004. Commercial landings are shown by gear. 323
Table 4-20. Discard logbook gross effort for the South Atlantic. 324
Table 4-21. Snapper grouper fishery effort for the South Atlantic. 324
Table 4-22. Annual number of trips reporting discard of Warsaw grouper, speckled hind, snowy grouper, golden tilefish, yellowedge grouper, misty grouper, and blueline tilefish in the South Atlantic. 325
Table 4-23. Percentage of trips that discarded Warsaw grouper, speckled hind, snowy grouper, golden tilefish, yellowedge grouper, misty grouper, and blueline tilefish in the South Atlantic. 325
Table 4-24. Average number of Warsaw grouper, speckled hind, snowy grouper, golden tilefish, yellowedge grouper, misty grouper, and blueline tilefish discarded per trip in the South Atlantic. 325
Table 4-25. Expanded number of discarded Warsaw grouper, speckled hind, snowy grouper, golden tilefish, yellowedge grouper, misty grouper, and blueline tilefish for the South Atlantic. 326
Table 4-26. The 50 most commonly discarded species during 2001-2005 in order of occurrence from highest number of trips to lowest for the South Atlantic. 326
Table 4-27. The 50 most commonly discarded species during 2001-2005 based on number of fish discarded ordered from highest to lowest for the South Atlantic. 328
Table 4-28. Estimated number of released fish from MRFSS interviews, percent released, total catch (A+B1+B2) for the South Atlantic during 2001-2005. 330
Table 6-1. Costs associated with this amendment. 349
Table 6-2. Southeast enforcement costs for implementation of Amendment 14. 349
Table 7-1. Ex-vessel and real ex-vessel revenue per vessel that landed snapper grouper species from 1999 to 2003 353
Table 7-2. Distribution of vessels that landed snapper grouper species in the South Atlantic by pounds of snapper grouper species landed from 1999 to 2003. 355

SUMMARY

Purpose and Need

Recent stock assessments indicate snowy grouper, golden tilefish, vermilion snapper, and black sea bass are experiencing overfishing (NMFS 2005b). Snowy grouper, black sea bass, and red porgy are overfished (NMFS 2005b). While we do not know the status of all snapper grouper species, it is a safe presumption based on the data we do have that the size, age, and genetic structure of many snapper grouper species has been altered by fishing pressure. Recently implemented Amendment 13C provides management measures that will end overfishing of snowy grouper, golden tilefish, vermilion snapper, and black sea bass. Amendment 15 will specify rebuilding plans for snowy grouper, black sea bass, and red porgy.

Many snapper grouper species are vulnerable to overfishing because they are long-lived (e.g., snowy grouper, golden tilefish, red snapper, gag, scamp, red grouper, red porgy), protogynous, that is, change sex usually from females to males as they grow older/larger (e.g., snowy grouper, speckled hind, Warsaw grouper, yellowedge grouper, gag, scamp, red porgy, black sea bass), form spawning aggregations (e.g., snowy grouper, gag, scamp, red snapper), and suffer high release mortality in deepwater. Deepwater species (snowy grouper, golden tilefish, speckled hind, Warsaw grouper, blueline tilefish, and misty grouper) are most vulnerable to overfishing because they live for longer than 50 years, do not survive the trauma of capture, and are protogynous (groupers) or exhibit sexual dimorphism, that is males and females grow at different rates (tilefishes). Data deficiencies make it difficult for fishery scientists and managers to develop management measures that can be trusted to sustain stocks over time, particularly for those species that are very vulnerable to overfishing while attempting to minimize, to the extent practicable, the adverse socioeconomic impacts of management measures on fishing communities.

The primary purpose of these actions is to employ a collaborative approach to identify sites for Type 2 marine protected areas (MPAs) with the potential to protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure to achieve a more natural sex ratio, age, and size structure within the proposed MPAs, while minimizing adverse social and economic effects. MPAs are the most effective fishery management tool that allows deepwater snapper grouper species to reach their natural size and age, protect spawning locations, and provide a refuge for early developmental stages of fish species.

To determine alternatives for the location, size, and orientation of the MPAs, as well as which species would be protected from harvest, the Council considered the specific goals of: (1) Utilizing a collaborative process to select MPAs; (2) Maximizing the biological benefits; (3) Minimizing the adverse social and economic effects; (4) Maximizing MPA enforceability; and (5) Maximizing monitoring capabilities. The goals are statements of a desired outcome in terms of MPA location, size, and orientation from biological, social, economic, and enforcement perspectives. Objectives include criteria the Council considered when trying to achieve these goals. The goals and objectives were developed through discussions among various interest groups, Council committees, Advisory Panels (e.g., marine protected areas, snapper grouper, law enforcement), scientific committees, and the public. The alternative comparison summaries in Section 2 of this amendment summarize the degree that each proposed site meets each goal.

Preferred Management Measures

Amendment 14 contains management alternatives that use Type 2 MPAs to aid in the recovery of overfished deepwater snapper grouper stocks and to ensure the persistence of healthy fish stocks, fisheries, and habitats by prohibiting the harvest and possession of snapper species within their borders (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Specifically the Council is using Type 2 MPAs as a management tool that will promote the optimal size, age, and genetic structure of these slow-growing, long-lived deepwater snapper grouper species. Figures S-1 and S-2 below present the alternatives being considered in this amendment. Listed immediately following are the preferred alternatives.

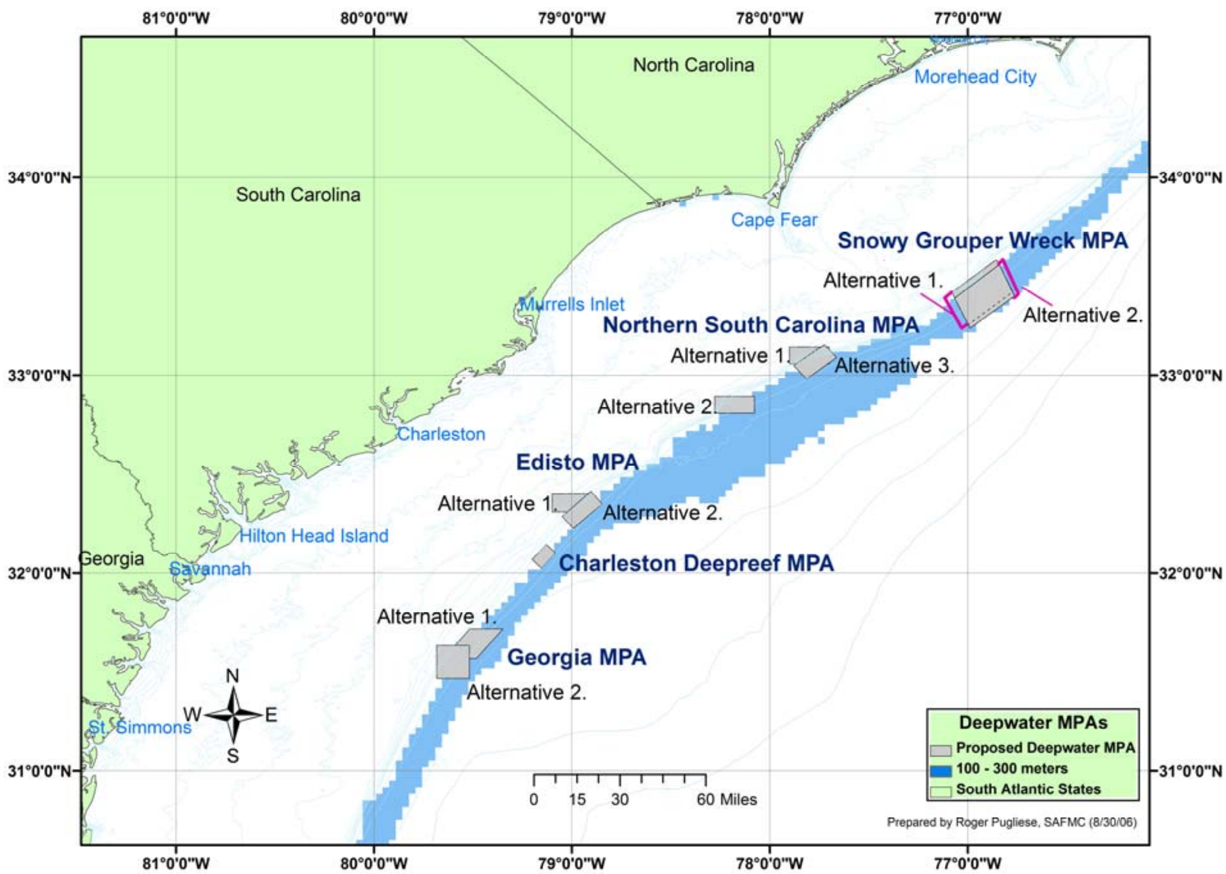

Figure S-1. Proposed Type 2 deepwater MPAs off North Carolina, South Carolina, and Georgia.

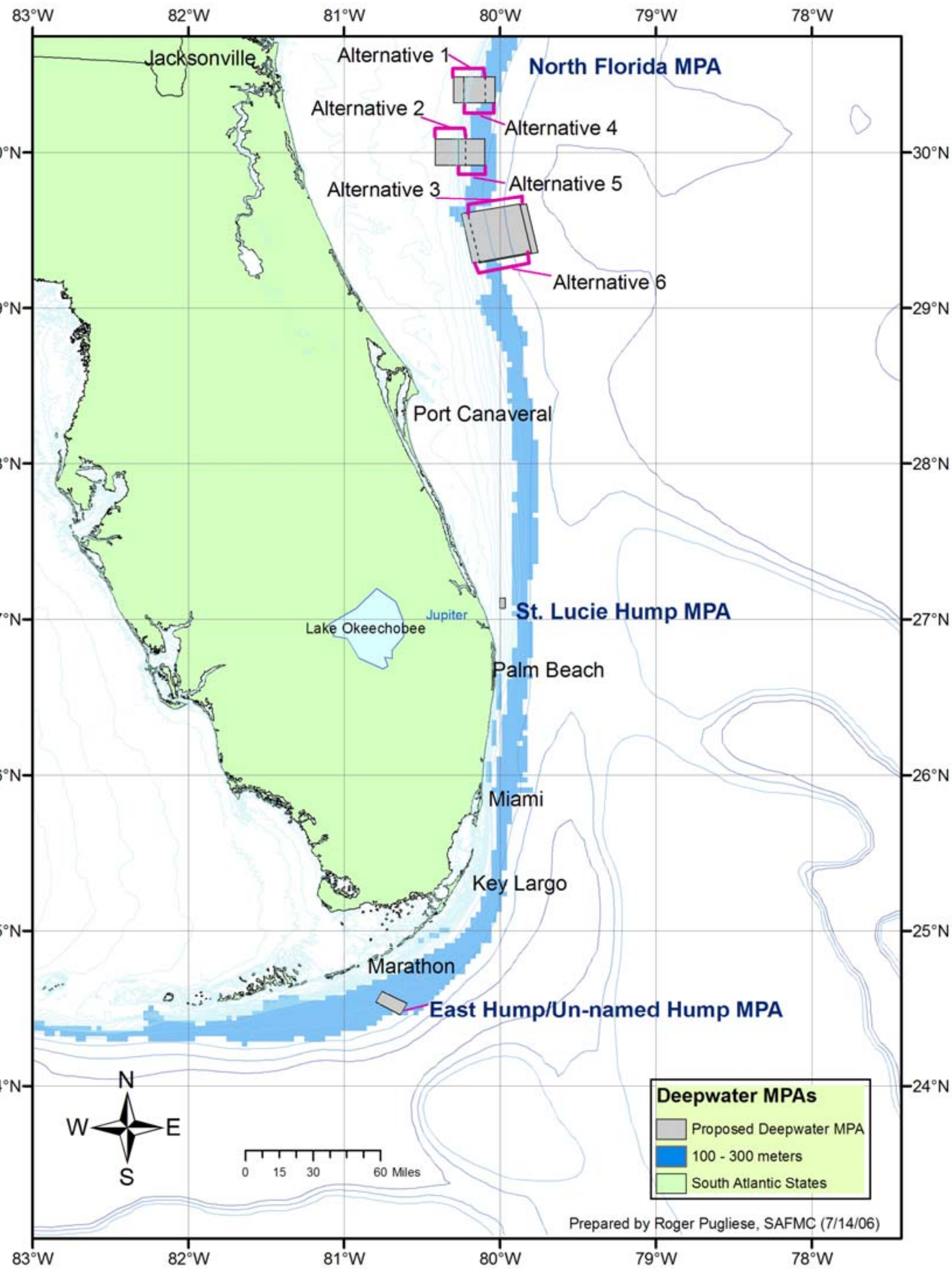

Figure S-2. Proposed Type 2 deepwater MPAs off east Florida.

Snowy Grouper Wreck MPA

Alternative 1 (Preferred). Establish a Type 2 MPA that protects the Snowy Grouper Wreck off North Carolina in the area that is bound by the following coordinates: The northwest corner at 33°25'N, 77°4.75'W; northeast corner at 33°34.75'N, 76°51.3'W; southwest corner at 33°15.75'N, 77°W; and the southeast corner at 33°25.5'N, 76°46.5'W (Figure S-1).

Northern South Carolina MPA

Alternative 2 (Preferred). Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 32°53.5' N, 78°16.75' W; the northeast corner at 32°53.5' N, 78°4.75' W; the southwest corner at 32°48.5'N, 78°16.75' W; and the southeast corner at 32°48.5' N, 78°4.75' W (Figure S-1).

Edisto MPA

Alternative 1 (Preferred). Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 32°24'N, 79°6'W; the northeast corner at 32°24'N, 78°54'W; the southwest corner at 32°18.5'N, 79°6'W; and the southeast corner at 32°18.5'N, 78°54'W (Figure S-1).

Georgia MPA (Tilefish MPA)

Alternative 1 (Preferred). Establish a Type 2 MPA off Georgia in the area bounded by the following coordinates: The northwest corner at 31°43'N, 79°31'W; the northeast corner at 31°43'N, 79°21'W; the southwest corner at 31°34'N, 79°39'W; and the southeast corner at 31°34'N, 79°29'W (Figure S-1).

North Florida MPA (Jacksonville/St. Augustine Ridge MPA)

Alternative 4 (Preferred). Establish a Type 2 MPA off north Florida in the area bounded by the following coordinates: The northwest corner at 30°29'N, 80°14'W; the northeast corner at 30°29'N, 80°2' W; the southwest corner at 30°19'N, 80°14'W; and the southeast corner at 30°19'N, 80°2'W (Figure S-2).

St. Lucie Hump MPA

Alternative 1 **(Preferred)**. Establish a Type 2 MPA protecting St. Lucie Hump, in the area bounded by the following coordinates: The northwest corner at 27°8'N, 80°W; the northeast corner at 27°8'N, 79°58'W; the southwest corner at 27°4'N, 80°W; and the southeast corner at 27°4'N, 79°58'W (Figure S-2).

East Hump/Un-named Hump MPA

Alternative 1 (Preferred). Establish a Type 2 MPA protecting the East Hump in the area bounded by the following coordinates: The northwest corner at 24°36.5'N, 80°45.5'W; the northeast corner at 24°32'N, 80°36'W; the southwest corner at 24°32.5'N, 80°48'W; and the southeast corner at 24°27.5'N, 80°38.5'W (Figure S-2).

Charleston Deep Artificial Reef MPA

Alternative 1 (Preferred). Establish an experimental artificial reef Type 2 MPA off the Coast of South Carolina in the area identified by the following boundaries: The northwest corner at 32°4' N, 79°12'W; the northeast corner at 32°8.5'N, 79°7.75'W; the southwest corner at 32°1.5'N, 79°9.3'W; and the southeast corner at 32°6'N, 79°5'W (Figure S-1).

Shark Bottom Longlines

Alternative 1 (Preferred). Prohibit the use of shark bottom longlines within MPAs.

Affected Environment

The immediate impact area would be the proposed Type 2 MPA sites and surrounding waters (the reader is to refer to Section 2.0 for maps and coordinates). Since the MPA boundaries will not prevent immigration and emigration of fish and fish larvae, the geographic scope of the Cumulative Effects Analysis (CEA) must be expanded beyond the sites. Tagging studies have not been conducted on deepwater species (i.e., snowy grouper or golden tilefish); however, it is believed that movement of these species is limited (see Section 3.0 for a discussion of species movement). Large scale movement of mid-shelf species (vermilion snapper, black sea bass, and red porgy) has not been documented (McGovern and Meister 1999). However, snowy grouper, golden tilefish, vermilion snapper, black sea bass, and red porgy have pelagic eggs and larvae that may remain in the water column for extended periods of time and travel long distances before late stage larvae or juveniles assume a demersal existence.

In light of the available information, the extent of the boundaries would depend upon the degree of fish immigration/emigration and larval transport, whichever has the greatest geographical range. The CEA cannot put geographical boundaries in terms of coordinates, but recognize that the proper geographical boundary to consider effects on the biophysical environment is larger than the MPA sites. The ranges of affected species are described in Section 3.0. The most measurable and substantial effects would be limited to the MPA sites.

Section 3.1 provides a description of the essential fish habitat. The biological/ecological environment is described in Section 3.2. Descriptions of the human and administrative environments are described in Sections 3.3 and 3.4 respectively.

Environmental Consequences

Biological, social, and economic impacts of measures proposed in this Amendment are evaluated. The amendment evaluates the practicability of taking additional action to minimize bycatch and bycatch mortality in the South Atlantic snapper grouper fishery using the ten factors provided at 50 CFR 600.350(d)(3)(i). In summary, the preferred Type 2 MPA alternatives are likely to reduce bycatch within the closed areas. However, effort could increase outside the closed areas resulting in no net reduction in bycatch.

Elimination of fishing pressure and bycatch within the Type 2 MPAs could result in long-term biological benefits, such as an increase in the mean size/age and biomass of snowy grouper, golden tilefish, Warsaw grouper, blueline tilefish, speckled hind, and mid-shelf species that occur within the preferred Type 2 MPAs alternatives. Bycatch of speckled hind and Warsaw grouper is high and establishment of Type 2 MPAs could be of particular benefit to these species. Furthermore, bycatch of snowy grouper and golden tilefish may increase as a result of management measures imposed through Amendment 13C further enhancing the benefits of these Type 2 MPAs.

Many of the proposed Type MPAs are important nursery areas to juvenile speckled hind, Warsaw grouper, and snowy grouper that are large enough to be targeted with fishing gear. Some of the Type 2 MPAs occupy a broad depth zone, which includes juvenile and adult stages of deepwater species as well as adult mid-shelf species. These Type 2 MPAs are likely to protect a greater diversity of species and life history stages than MPAs with a narrow depth range. Therefore, long-term, beneficial ecological changes are expected to occur in the community structure of reef ecosystems within the Type 2 MPAs as a result of actions that would eliminate directed fishing pressure for snapper grouper species within the closed areas.

In addition to ecological changes within the Type 2 MPAs, elimination of bycatch in the closed areas could result in long-term ecological changes in surrounding areas. For example, many of the species that are known to occur in the Type 2 MPAs such as gag and greater amberjack may move hundreds of miles each year, presumably to spawn (McGovern et al. 2005). Other species such as snowy grouper, speckled hind, and Warsaw grouper may only remain in the Type 2 MPA for a portion of their life history since these species move into deeper water with increasing size and age. With increasing size and density of fish species within Type 2 MPAs, there may be spillover into adjacent reef habitats. Furthermore, spawning of a number of deepwater (e.g., golden tilefish, speckled hind, and blueline tilefish) and shelf-edge species (e.g., vermilion snapper, red porgy, gag, scamp, etc.) has been documented in the preferred Type 2 MPAs. Thus, the proposed Type 2 MPAs may serve as a source of spawning products to surrounding areas.

For all the reasons explained above, the Council believes that the proposed Type 2 MPAs will have a long-term beneficial effect on stocks of slow growing, long-lived snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish).

Economic Impacts

Generalized impacts of MPAs

Economic benefits and costs resulting from MPA protection in general may be characterized as either consumptive or non-consumptive. Consumptive costs and benefits affect the profitability of the South Atlantic Snapper Grouper (SASG) commercial fishing fleet, the satisfaction of recreational fishermen, and the efficient use of society's resources. Non-consumptive benefits and costs include societal losses and gains as well as effects on fishery management.

Most of the consumptive costs associated with Type 2 MPAs (i.e., permanent closure where some fishing is allowed) can be generalized as displacement effects directly incurred by recreational and commercial vessels that normally fish in the newly protected areas. Direct displacement effects (costs) to fishermen unable to fish in a Type 2 MPA may include a decrease in catch levels; an increase in trip-level costs associated with searching for new fishing grounds; an increase in opportunity costs associated with learning a new type of fishing; congestion and user conflicts on new fishing grounds; and increased harvest and personal risk. Displacement effects have a negative impact on the predicted value of Type 2 MPAs; however, fishermen may be able to mitigate these costs by redirecting effort to open areas and targeting different species. Although displaced fishermen avoid some displacement costs as a result of these actions, the addition of new fishing effort to open areas could have an extra negative effect on the health of other species.

Fishermen who currently fish in proposed Type 2 MPAs bear the majority of the short-term costs associated with protection. However, due to the large number of participants in this limited entry fishery, there is no guarantee that displaced individuals would reap the benefits of stock recovery in the future. If spillover effects are realized and aggregate harvests increase, the relative profitability of targeting the protected species in open areas will increase, and effort will shift towards these species as fishermen seek to maximize their personal gains. This effort could include new entrants to the deepwater fishery, which would create crowding externalities for the originally displaced vessels. Thus, Type 2 MPA regulations without corresponding effort restrictions may lead to an inequitable distribution of long-term benefits and inefficient harvesting practices if spillover effects are realized from the protected areas.

A possible indirect consumptive cost is the short-run impact that a reduction in income has on the surrounding communities. If displaced fishermen cannot mitigate all losses incurred from the establishment of these Type 2 MPAs, their communities likewise will be negatively affected as less income flows through different sectors of the local economy. Fishing income originally spent in the community by fishermen cycles throughout the regional economy producing a multiplier effect that results in total regional expenditures that exceed the original income. The amount of fishing income lost and the magnitude of the multiplier effect determine the extent of the negative impact on the predicted value of a Type 2 MPA.

Consumptive benefits could be realized over the long-run if spillover effects are assumed to affect aggregate harvest levels in the remaining fishable areas as stocks become healthier. Major consumptive benefits include stock replenishment and spillover effects, increased stock biomass, increased harvest levels, and reduced variability of harvests and revenues.

Non-consumptive costs are incurred by federal management to implement and enforce the Type 2 MPAs. Non-consumptive benefits include option, bequest, and existence values that derive from increased species and habitat protection, as well as increases in biodiversity, improved habitat conditions and species' population structure(s), reduced risk associated with uncertain stock assessments, and the creation of experimental undisturbed areas for biological research.

Two percent of the 1,563 observed trips intercepted any of the proposed Type 2 MPAs. Consequently the level of impact on shark longline vessels is expected to be minimal. The proposed Type 2 MPAs are small and for a vessel to change the area of a set, would only involve steaming fewer than 10 miles. Affected vessels will forego some revenue from the loss of the bycatch from within the proposed MPAs. However, historic landings of snapper grouper species on those shark bottom longline trips with an observer aboard from 1994 to 2006 indicate minimal bycatch. As targeted stocks recover, the degree of bycatch of snapper grouper species in the shark bottom longline fishery is expected to increase. Therefore, it is prudent to eliminate this bycatch from the proposed Type 2 MPAs at this time. This expanded harvest was estimated to be approximately 1,106 groupers, tilefish, and black sea bass over 12 years, for a total of 92.2 fish per year. If this harvest is divided up among the 100 active vessels, the total is about 1 fish per vessel per year. If each fish was assumed to weigh 20 pounds, using the price of $2 per pound from the high price category (Figure 3-27), the potential revenue loss per vessel would be $40 per vessel per year. The estimated total value of the "lost" shark catches (value flesh and value fins) was $3,886,616 over the 12-year period. The estimated total annual loss was $323,885, and the loss for each of the 100 vessels per year was $3,239.

Impacts of proposed MPAs

Amendment 14 proposes to augment traditional methods of management with establishment of Type 2 MPAs by prohibiting the harvest and possession of snapper species within their borders (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F) in an effort to minimize the dissipation of economic rents and improve the biological health of deepwater resources throughout the jurisdiction of the South Atlantic Fishery Management Council. The economic impacts caused by these proposed Type 2 MPAs will be greatly dependent upon the economic effects of Amendment 13C, which has too recently gone in effect for its effects to be realized.

The National Marine Fisheries Service requires a Regulatory Impact Review (RIR) for all Council regulatory actions that are of public interest. In the case of Amendment 14 a major component of the RIR is an analysis of the socioeconomic impacts related to the implementation of the proposed Type 2 MPAs. Traditionally, a comparison of the benefits and costs associated with each proposed Type 2 MPA would be evaluated quantitatively. However, in this case empirical data typically used to conduct empirical analyses is at a coarser spatial scale than that of the Type 2 MPA sites proposed in Amendment 14. Thus, it is not possible to produce the robust quantitative analysis required by the RIR. As a result, a Delphi approach was adopted to provide a semiquantitative analysis of the social and economic consequences associated with implementation of Type 2 MPAs in deepwater regions of the south Atlantic snapper grouper fishery. A panel of twelve experts was selected to participate in the Delphi process. Experts were selected based on a spectrum of fishing and research backgrounds with different perspectives on the policy issue of MPAs, including stakeholders with commercial, for-hire, and recreational fishing interests, as well as others with expertise covering biology, economics, anthropology, protected resources, enforcement, and administration.

Although the diversity of the experts created instances of divergence regarding the direction (positive, negative, or neutral) of individual effects during Round One brainstorming, the panel generally displayed strong majority support on the direction and level of impacts resulting from the implementation of Type 2 MPAs. Negative impacts would be realized mainly in the form of displacement effects on fishermen and the communities that depend on them, with the possibility of management incurring some costs. However, due to the small size of the Amendment 14 MPAs and the availability of alternative fishing opportunities for displaced fishermen, these impacts were likely to be minimal and observed only in the short-term. Benefits were thought to be possible due to increases in longer-term catch levels, quality increases in the Type 2 MPA and ecosystem, option and existence values, and management benefits. These also were deemed to be minimal due to the small size of the Amendment 14 Type 2 MPAs.

In conclusion, Round One generated comments about effects that could result due to the implementation of Type 2 MPAs similar to those proposed in Amendment 14. Panelists also commented on the likely impacts that would accompany these effects. In some cases these views were diverse. For the most part the panel believed that the impacts from Amendment 14 would be minimal due to the small size of the proposed Type 2 MPAs. Additional displacement costs were associated with the alternatives that encroach into the mid-shelf regions. Lastly, an important insight came out of this round. Any impacts would have to be analyzed over different time periods: immediately (within one year); medium-term (from one to five years) and long-term (greater than five years). This result was incorporated in the structure of the next two rounds.

Social Impacts

Refer to Sections 4.1.3, 4.2.3, 4.3.3, 4.4.3, 4.5.3, 4.6.3, 4.7.3, 4.8.3, 4.9.3, and 4.10.3 for more detailed discussions of the social effects of the proposed measures.

The social and economic impacts caused by Amendment 14 are greatly dependent upon the impacts caused by Amendment 13C. The lower trip limit and reduced quota for deepwater species implemented by Amendment 13C could make it unprofitable for boats to travel to some of the proposed Type 2 MPAs, such as the Snowy Wreck and Northern South Carolina Type 2 MPAs, so the effects caused by Amendment 14 could be relatively minor. However, the reduction in the amount of fish caught as a result of the Type 2 MPAs or as a result of the Type 2 MPAs coupled with Amendment 13C is likely to have a negative impact on fish houses and dealers that rely on deepwater species as a part of their annual round. Fish houses and dealers throughout the Carolinas can be adversely impacted because of their relationship to each other and potential lack of supply from their own fishermen and from those that land and sell with other dealers. It is common for fish houses to buy from other fish houses in order to meet the demand of their clientele. A loss of supply for one area may affect the productivity of the fish houses and dealers of another.

With pressure from increased coastal development and a continued rise in property value for coastal communities, revenue reductions associated with Amendments 13C and 14 may lead some to sell or convert their docks and marinas. This would make it more difficult for commercial fishermen to exist due to a lack of available infrastructure. The loss of infrastructure means that there are numerous directly and indirectly associated businesses that can be negatively impacted, and as fish houses close, the workers are let go. If a marina is sold, it might have a serious impact on the sale of fishing supplies, such as fuel, bait, and tackle, and the number of trips. A reduction in the number of commercial fishing trips would represent a loss of annual wages to crew who are paid on a per trip basis or share program.

Any gear prohibition has social impacts as it increases the level of regulations and stress on fishermen. This is balanced by the need to protect the habitat in the Type 2 MPAs which will provide benefits to a greater number of individuals than the numbers prevented from using shark bottom longlines in the proposed Type 2 MPAs.

The economic impacts described above are not that large. Given the level of other regulations affecting fishermen, the social impacts from preventing use of bottom longlines within the Type 2 MPAs is not expected to be very large.

The Delphi study described in the previous economic impacts section assessed socioeconomic effects of the proposed Type 2 MPAs. Results are discussed in the parts of Section 4 listed above.

Conclusions

The proposed actions are consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed actions will protect a portion of the population and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. These actions should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPAs, while minimizing adverse social and economic effects.

1 Introduction

1.1 History of the Council's Consideration of MPAs

The Snapper Grouper Fishery Management Unit (FMU) is a complex of 73 species managed under the Snapper Grouper Fishery Management Plan by the South Atlantic Fishery Management Council. The FMU is very diverse and contains snappers, groupers, jacks, porgies, tilefishes, grunts, and sea basses. Seven snapper grouper species make up the "deepwater complex": snowy grouper, misty grouper, speckled hind, yellowedge grouper, Warsaw grouper, golden tilefish, and blueline tilefish. The fishery has been under management since 1983, and the original FMP has been amended 13 times. Management measures currently in place include bag limits, size limits, gear prohibitions, seasonal closures, a commercial limited entry program, and quotas.

The potential for using Marine Protected Areas (MPAs) as a management tool for the snapper grouper fishery first originated with the Council's Snapper Grouper Plan Development Team (PDT). This technical group prepared a report (PDT 1990a) entitled "The Potential of Marine Fishery Reserves for Reef Fish Management in the U.S. South Atlantic." The Plan Development Team offered this approach because they believed it was the only viable option for maintaining optimum size, age, and genetic structure of slow growing, long-lived species over the long-term. The Council received an extensive briefing on marine reserves at the February 1990 Council meeting. This provided an opportunity for the Council to discuss marine reserves as a concept and to hear about experiences with reserves in other parts of the world.

Marine reserves were initially considered as a possible option in early discussions on Amendment 4 to the Snapper Grouper Fishery Management Plan, however the Council determined the reserve concept should be addressed separately and scheduled scoping meetings in each of the states. During 1992 the Council held scoping meetings. During the 1992 scoping process support for and against the concept surfaced. The Council reviewed the scoping information at the January 1993 meeting and decided to: (1) recommend to National Marine Fisheries Service that they convene a Scientific Review Panel to review the concept of MPAs and (2) drop consideration of the marine reserve concept at that time.

A scientific review of the 1990 Snapper Grouper Plan Development Team report was completed by the Scientific Review Panel (NOAA 1995) as requested by the Council. The panel consisted of international experts with different experience in fishery science, marine reserves, ecology, fish genetics, sociology, and economics. The Scientific Review Panel concluded that properly designed marine reserves, in combination with other management measures, can be an effective management tool for reef fish resources in the U.S. South Atlantic region subject to the following conditions: (1) biological, ecological, social, and economic objectives of the marine reserves are clearly specified; (2) the relative biological, ecological, and economic impacts of marine reserves in the context of other fishery management measures have been estimated for various constituents; and (3) the development of marine reserve proposals proceed with the involvement of all constituencies and stakeholders.

Also the scientific review panel concluded that recognizing the alarming declines in stocks of key fishery species, the panel would urge that marine reserves options be considered immediately as part of a comprehensive fisheries management plan to prevent irreversible loss to species and fisheries.

In further developing Snapper Grouper Amendment 8 (and later Amendment 9), the Council realized that severe impacts would be felt by fishermen if necessary percentage reductions in catches of overfished species were imposed to achieve the mandated fishery management goals. Marine reserves once again surfaced as a potential alternative to fisheries closures.

In 1998 after deciding to reconsider the possibilities of marine reserves, the Council proceeded to take steps to initiate a fact-finding process using the Marine Reserves Committee and Advisory Panel (AP). An Action Plan was then developed that included three phases: (1) Phase I. Planning/Criteria Development, during which criteria where developed and questions were raised about the proper size, placement, and regulations within any potential marine reserves; (2) Phase II. Decision Phase in which the Council, drawing on input from 3 rounds of scoping meetings, a Marine Reserves Workshop, and the Marine Reserves AP made the decision that marine reserves were a necessary management tool for snapper grouper management; and (3) Phase III. Implementation, which includes the Council's development of this amendment.

When the informal meetings were held in 2000, the Council's intent was to begin a dialogue with stakeholders about the possibilities of using marine reserves as a management tool for snapper grouper species and not discuss specific management measures or specific sites. The meetings were not held by the Council, but Council members and staff made themselves available to meet with any group that made a request. Between January and March of 2000, Council members and staff attended 15 meetings including commercial fishing groups, recreational fishing groups, and conservation organizations. A total of 291 people attended these meetings. Through the informal meeting process, the Council was able to gauge public support for marine reserves and discuss all possible options for managing overfished snapper grouper species to determine whether marine reserves were a tool the Council should consider using.

During May and June 2000, the Council held another round of eight scoping meetings on marine reserves to give the public an opportunity to comment before the Council developed a position on whether or not to move forward with developing marine reserves as a management tool. As with the informal meetings, the Council had not yet discussed specific boundary options but was ready to make a decision on the general concept of marine reserves.

Stakeholders voiced many different opinions on the use of marine reserves. There was an equal amount of support and opposition for no-take marine reserves, but many different variations were offered from all sides. Many groups were in support of protecting known spawning areas from fishing and creating artificial habitats and prohibiting fishing in these areas.

As a result of the input received from the 2000 scoping meetings, the Marine Reserves Workshop, advice from the Marine Reserves Areas Advisory Panel, the Scientific and Statistical Committee, and the Snapper Grouper Assessment Group, the Council voted to move forward with using marine reserves.

After deciding that marine reserves were a management tool that was needed to help recover overfished snapper grouper species, the Council then needed to determine the appropriate locations to site marine reserves and the appropriate regulations within the boundaries. Continuing with the Council's philosophy of building support for marine reserves from the ground up, the Council looked to stakeholders to suggest where marine reserves should be placed (scoping process). In the Spring of 2001 the Council held a final nine scoping meetings. The public were provided charts that showed known hardbottom areas off the South Atlantic coast and were asked to use their experience and knowledge of snapper grouper species (specifically deepwater snapper grouper species) to suggest areas the Council may want to consider designating as marine reserves. As a part of this scoping process, the Marine Reserves Advisory Panel was asked to also suggest areas. As a result of this process over 40 sites were suggested and originally considered as potential marine reserves (sites not analyzed in detail and proposed as management measures in this document are listed and discussed briefly in **Appendix A**).

At their February 2001 meeting, the Council's Marine Reserves Committee discussed the difficulty managers and stakeholders were facing given that many different agencies were looking at marine reserves, marine sanctuaries, marine protected areas, etc. The different nomenclature associated with this management tool made things very confusing to the public and managers alike. The Committee determined that the term "marine reserves" was coming to imply an area that allowed no fishing. This was contrary to the Council's definition and intent. In order to be more consistent with national definitions the Council adopted the term Marine Protected Areas (MPAs).

Marine Protected Areas, as defined in Presidential Executive Order 13158, means 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.

The Council further defines MPAs within its jurisdiction as a network of specific areas of marine environments reserved and managed for the primary purpose of aiding in the recovery of overfished stocks and to ensure the persistence of healthy fish stocks, fisheries, and habitats. Such areas may be over natural or artificial bottom and may include prohibition of harvest on a permanent or lesser time period to accomplish needed conservation goals.

Another aspect of the development of appropriate MPA alternatives was deciding which activities if any would be allowed in any areas designated as an MPA. The PDT report presented to the Council in 1990 suggested that these areas be set aside for non-consumptive uses. Later when the Council began seriously looking at the use of MPAs as a management tool they purposely crafted a broad definition of the tool (marine reserves are specific areas of marine environment managed for the primary purpose of aiding in the recovery of overfished stocks and to ensure the persistence of healthy fish stocks, fisheries, and habitats). This definition allowed the Council, its advisors, and the public to discuss and analyze the costs and benefits of allowing varying activities in the future proposed MPAs. The Council considered and presented to the public the following types of actions that they considered in designating MPAs.

Type 1 - Permanent closure/no-take
Type 2 - Permanent closure/some take allowed
Type 3 - Limited duration closure/no-take
Type 4 - Limited duration closure/some take allowed

Ultimately the Council narrowed its focus for this round of MPAs and determined the greatest need for this management tool at this time was to protect deepwater snapper grouper species. After that decision was made the Council determined that both the social and economic costs of prohibiting all fishing were greater than the benefits (more effective law enforcement). The majority of the proposed MPAs (designed to protect deepwater snapper grouper species) are also very popular trolling spots for the pelagic fisheries. Therefore the Council choose to move forward with designating the proposed MPAs as Type 2 MPAs where the harvest and possession of snapper species would be prohibited within their borders (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F).

Considerations for Type 1 vs. Type 2 Marine Protected Areas

<u>Benthic-pelagic linkages</u>

The net ecological effect of allowing fishing for pelagic species (e.g., billfish, tunas, dolphin, wahoo, and others) in a Type 2 MPA designated to protect deep-water snapper grouper species (e.g., snowy grouper, tilefish, queen snapper, and others) is anticipated to be minimal for two reasons. First, there may not be a strong ecological link between pelagic species and benthic top predators in the proposed Type 2 MPAs, as those in one depth stratum rarely consume those of the other (Wahle *et al.* 2006). Deepwater snapper grouper species are generally found less than two meters from the substrate. Pelagic species are usually found in the top 30 meters of the water column and their interaction with benthic species is minimal. While there may not be a direct, strong ecological link between pelagic species and deepwater snapper grouper, food web models indicate there are trophic relationships between the two groups (Weaver and Sedberry 2005) Furthermore, some pelagic species, such as greater amberjack, occur throughout the water column, including the benthos and are taken with trolling and bottom tending gear. Greater amberjack have been collected in many of the proposed Type 2 MPAs and have been observed on the bottom from a submersible in several of the proposed Type 2 MPAs (Sedberry *et al.* 2005). While greater amberjack is not a direct predator of deepwater snapper grouper species, it probably shares food resources. There is also evidence other pelagic species such as swordfish, bluefin tuna, yellowfin tuna, and various shark species follow isolumes and occur in deepwater during daylight hours; however, these species are usually found offshore of the proposed Type 2 MPAs (Brill and Lutcavage 2001; Loefer *et al.* 2005). Although there is some trophic interaction, pelagic species and deepwater snapper grouper species generally take advantage of spatially distinct food and habitat resources and usually remain in close proximity to their set of resource needs.

Pelagic species such as marlins and tunas are not likely to be strongly affected by the proposed Type 2 MPAs because these species may swim in and out of the small protected areas frequently and would continue to be vulnerable to fishing outside of the closed area. Any impacts pelagic species such as marlins and tunas may indirectly have on the deepwater snapper grouper species is therefore unlikely to be affected by the establishment of the proposed Type 2 MPAs, even if fishing for the former were still allowed in the closed area (Wahle *et al.* 2006).

<u>Bycatch of snapper grouper species in fishery for pelagic species such as marlins and tunas</u>

Pelagic species are generally captured by trolling (i.e., towing artificial or live bait behind the wake of a vessel) at depths of 10 – 30 meters from the surface (Everhart and Youngs 1981). The proposed Type 2 MPAs are at depths ranging from 60-700 meters. However, methods used to troll for coastal migratory pelagics can access deep reef fishes. NOAA Fisheries researchers used a variety of gear types and techniques to assess the susceptibility of reef fish to trolling using downriggers at 200-400 feet in the Madison-Swanson MPA in the Gulf of Mexico (David 2003). Reef fish (gag, speckled hind, red snapper, Warsaw grouper, scamp, and greater amberjack) were captured at a rate of one fish every 100 minutes. Therefore, a Type 2 MPA where fishing for non-snapper grouper pelagic species is allowed could result in bycatch of snapper grouper species, including some deepwater species targeted for protection in this amendment.

<u>Problems with enforcement of the proposed Type 2 MPAs</u>

The main enforcement concern with the proposed MPAs is their Type 2 status. When no fishing is allowed in an area (as in a Type 1 MPA or marine reserve), and a vessel monitoring system (VMS) shows a vessel has been in the closed area, enforcement can potentially use this information along with other information to determine whether a violation has occurred. However, in a Type 2 MPA where some fishing is allowed, it is more difficult to determine whether a violation has occurred. In this situation, the only purpose served by VMS is to alert the agent that someone is in the area, not to document wrongdoing. Because the proposed MPAs are far offshore, the transit time required from when law enforcement learns someone is in an MPA to when law enforcement arrives at the site in question may be substantial, and the violator may be gone before enforcement is able to respond to a potential violation.

During 2001 and into 2002 the Council, with help from its advisors, began working to determine which of the 40 sites suggested through scoping would best meet the Council's management objective to protect deepwater snapper grouper species. In August of 2001 the Council held an unprecedented "Mega-AP" meeting of the Habitat, Coral, Snapper Grouper, MPA, Law Enforcement, and Wreckfish Advisory Panels (APs). The APs were asked to help the Council select sites that would be the most beneficial to the overfished, deepwater snapper grouper species using their various and vast knowledge, understanding that the Council's intent was to look at sites that protect more inshore snapper grouper species further down the line.

Later in 2001 the Snapper Grouper Assessment Group, the Scientific and Statistical Committee, and the Snapper Grouper AP met with the Council's Snapper Grouper Committee to provide additional input on the possible MPA sites. Based on input from the SSC, APs, and the Snapper Grouper Committee, the Council then instructed staff to develop an options paper for Snapper Grouper Amendment 14 with an initial level of analysis of sites the Council felt met the criteria of protecting overfished, deepwater snapper grouper species.

The sites that met the criteria of protecting overfished, deepwater snapper grouper species were included in the Informational Public Hearing Document and taken out to public hearings in early 2004. At those public hearings social and economic data were collected to help staff refine sites and analyze the impacts of the proposed sites. The information gathered at the Informational Public Hearings was useful in helping staff begin to assess the social and economic impacts of each individual site and is summarized under the discussion of each management measure in Section 4.

The Council produced a source document that includes much of the material prepared during development and consideration of MPA (SAFMC 2005). This material is available on the Council's website.

1.2 Considerations for MPA Design

There is a large body of recommendations for design of marine reserves and MPAs, based on scientific hypotheses and observations from current projects. Specific design considerations are summarized in the report of the Plan Development Team (1990). Questions about the proper size, placement, and regulations for potential reserves were considered by the Scientific Review Panel convened by NOAA in 1990 to review the concept of MPAs, and by the Council's Marine Reserves Committee and Advisory Panel in writing their Action Plan in 1998. The Council has focused on the presence of deepwater snapper grouper species and their habitat as the primary biological criteria for a deepwater Type 2 MPA.

While biological considerations alone may suggest certain MPA design characteristics, the social and economic impacts of MPAs on fishing communities must also be taken into consideration, for two reasons. First, National Standard 8 of the Magnuson-Stevens Act requires the Council to "take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities." Second, research shows "a fundamental lesson learned from experience throughout the world is that attempts to implement MPAs in the absence of general community support invariably fail. Inclusion of "bottom-up" or "grass-roots" approaches to planning, design, and implementation of MPAs offers the best opportunity to develop plans with the endorsement of local communities (NRC 2001)." This type of "bottom-up" approach has been the goal of the Council since the outset of their deliberations on MPAs in the South Atlantic, and its implementation has allowed them to successfully balance biological considerations with public concerns when determining the characteristics of their proposed MPAs.

Due to the complex nature of ecosystems and the limitations of traditional fisheries management methods, fisheries management may benefit from multiple management components as part of an overall plan. The proposed Type 2 MPAs are intended to augment, not replace, existing management. Lauck *et al*. (1998) suggests ". . . MPAs can serve to hedge against inevitable uncertainties, errors, and biases in fisheries management." The proposed Type 2 MPAs are expected to perform this function, among others, for the management of deepwater snapper grouper species in the South Atlantic.

1.3 Purpose and Need

Recent stock assessments indicate snowy grouper, golden tilefish, vermilion snapper, and black sea bass are experiencing overfishing (NMFS 2005b). Snowy grouper, black sea bass, and red porgy are overfished (NMFS 2005b). While we do not know the status of all snapper grouper species, it is a safe presumption based on the data we do have that the size, age, and genetic structure of many snapper grouper species has been altered by fishing pressure. Amendment 13C included management measures that end overfishing of snowy grouper, golden tilefish, vermilion snapper, and black sea bass. Amendment 15 will specify rebuilding plans for snowy grouper, black sea bass, and red porgy.

Many snapper grouper species are vulnerable to overfishing because they are long-lived (e.g., snowy grouper, golden tilefish, red snapper, gag, scamp, red grouper, and red porgy), protogynous, i.e., change sex usually from female to males as they grow older/larger (e.g., snowy grouper, speckled hind, Warsaw grouper, yellowedge grouper, gag, scamp, red porgy, and black sea bass), form spawning aggregations (e.g., snowy grouper, gag, scamp, and red snapper), and suffer high release mortality in deepwater. Deepwater species (snowy grouper, golden tilefish, speckled hind, Warsaw grouper, blueline tilefish, and misty grouper) are most vulnerable to overfishing because they live for longer than 50 years, do not survive the trauma of capture, and are protogynous (groupers) or exhibit sexual dimorphism, i.e., males and females grow at different rates (tilefishes). Data deficiencies make it difficult for fishery scientists and managers to develop management measures that can be trusted to sustain stocks over time, particularly for those species that are very vulnerable to overfishing while attempting to minimize, to the extent practicable, the adverse socioeconomic impacts of management measures on fishing communities.

The primary purpose of these actions is to employ a collaborative approach to identify MPA sites with the potential to protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure to achieve a more natural sex ratio, age, and size structure within the proposed Type 2 MPAs, while minimizing adverse social and economic effects. The proposed Type 2 MPAs are the most effective fishery management tool that allows deepwater snapper grouper species to reach their natural size and age, protect spawning locations, and provide a refuge for early developmental stages of fish species.

To determine alternatives for the location, size, and orientation of the MPAs, the Council considered the specific goals of: (1) Utilizing a collaborative process to select MPAs; (2) Maximizing the biological benefits; (3) Minimizing the adverse social and economic effects; (4) Maximizing MPA enforceability; and (5) Maximizing monitoring capabilities. The goals are statements of a desired outcome in terms of MPA location, size, and orientation from biological, social, economic, and enforcement perspectives. Objectives include criteria the Council considered when trying to achieve these goals. The goals and objectives were developed through discussions among various interest groups, Council committees, Advisory Panels (e.g., snapper grouper, law enforcement), scientific committees, and the public. The alternative comparison summaries in Section 2 of this amendment summarize the degree that each proposed site meets each goal.

Goals and Objectives

Goal 1: Utilize a collaborative process to select MPAs

Objective A. *Utilize input from scientists, fishermen, and the public to select proposed MPAs.* During the selection of the proposed Type 2 MPAs, a process was employed that involved scientists, fishermen, and the public. An Advisory Panel, consisting of scientists and fishermen, assembled known data to identify locations that would provide the greatest biological benefit to snapper grouper species. Experts on MPAs traveled throughout the southeast coast and discussed the benefits of MPAs with the public. Public input during the scoping process and the informational public hearings revealed that closure of certain sites would generate intense public disapproval. The Council realized implementation of those sites would create a degree of controversy that could impede implementation of the MPAs and compliance. Following public input, the Council employed a “bottom up” process where stakeholders proposed sites that could still achieve the biological objectives. As an example, the Council worked with fishermen in the Florida Keys following the Council’s proposed placement of an MPA on the popular location referred to as the “Islamorada Hump”. This proposal generated intense controversy due to the popularity of fishing for such fish as billfish, dolphin, wahoo, and mackerel at this site. The Council worked with the local fishing community to propose a nearby site that would achieve the biological objectives (of the MPA designation) but would not have the degree of impact and controversy as the original proposal.

Goal 2: Maximize biological benefits

Objective B. *Protect some habitat known to support deepwater snapper and grouper species. Utilize hardbottom locations to provide locations suitable to satisfy the need for these MPAs.* The Southeast Area Monitoring and Assessment Program (SEAMAP) has surveyed bottom habitat type and obtained additional data from numerous sources. This information, in part, was used to site the Type 2 MPAs to maximize the biological benefits.

Submersible work and fishery-independent surveys have documented habitat in some proposed Type 2 MPAs that hold species such as vermilion snapper, red porgy, gag, scamp, and others. Therefore, additional benefits include: protecting the size and age structure of species that suffer high release mortality at depths greater than 165 feet (50 meters) (e.g., vermilion snapper, red porgy, gag, scamp, red snapper, red grouper, gray triggerfish, black sea bass, and others) and protecting areas where commercially important reef fish species are known to spawn (e.g., red porgy, vermilion snapper, gray triggerfish, red snapper, scamp, gag, red grouper, gray triggerfish, and others).

Objective C. *Protect some areas where spawning activity of snapper grouper has been recorded.* The Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP) has noted locations where fish (e.g., snowy grouper, golden tilefish, speckled hind, red porgy, vermilion snapper, gray triggerfish, red snapper, scamp, gag, red grouper, gray triggerfish, and others) were caught in spawning condition. This information, in part, was used to site the MPAs to maximize the biological benefits.

Objective D. *Protect some areas known to be nursery areas for deepwater species.* Submersible work has documented the presence of age-0 snowy grouper in shelf edge (170 to 220 feet) habitat in many of the proposed Type 2 MPAs. Fishery-independent data, fishery-dependent data, and submersible work have documented the presence of juvenile speckled hind and Warsaw grouper in the same shelf edge habitat. The greatest abundance of speckled hind is currently in shelf edge habitat. This information, in part, was used to site the Type 2 MPAs to maximize the biological benefits to deepwater species.

Goal 3: Minimize adverse social and economic effects

Objective E. *Minimize impact on fishermen in MPAs that do not target snapper grouper species.* Many of the locations appropriate for protecting snapper grouper species are also popular fishing sites for pelagic species such as dolphin, wahoo, and mackerel. The Council felt it important to minimize the negative social and economic impacts MPAs could have on individuals fishing for non-snapper grouper species and promote stakeholder buy-in, while providing protection to the species most vulnerable to overfishing (deepwater snapper grouper species). Therefore, the alternatives proposed in this amendment are Type 2 MPAs where the harvest and possession of snapper species are prohibited within their borders (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F).

Objective F. *Orient the MPAs in a manner that provides consideration to the way that fishermen fish.* Many commercial fishermen fish along the continental shelf break, which is parallel to the shoreline. Alternatives are provided that include closed areas parallel to the shelf break to minimize disruption to fishing activity when undergoing transit to different locations.

Objective G. *Consider boater safety when designating proposed closed areas.* The Council avoided detailed consideration of sites that would significantly affect boater safety. Overly large sites and the placement of sites adjacent to major fishing ports were avoided, as both would hinder a vessel's return to port during adverse weather.

Goal 4: Maximize MPA enforceability

Objective H. *Consider the seven criteria from the Law Enforcement AP's report when determining suitable MPA sites.* The Council's Law Enforcement Advisory Panel, in 1998, submitted a report (**Appendix B**) that outlined criteria that should be considering when determining attributes of MPA. These included: (1) a marine reserve should be configured in a square or rectangle; (2) the bigger the better; (3) the boundaries should be delineated in latitude and longitude; (4) must be in an acceptable format to be included and identified on NOAA charts; (5) allowable activities in the marine reserve should be limited; (6) locate marine reserves away from highly populated areas; and (7) provide for on-site enforcement capability. To maximize the efforts of law enforcement and fishermen compliance, the Council considered these criteria when developing the Type 2 MPAs.

Goal 5: Maximize research and monitoring capabilities

Objective I. *Utilize available fishery-independent and fishery-dependent data to provide locations suitable to satisfy the need for MPAs.* Closing areas to snapper grouper fishing is expected to result in changes in the community structure, species composition, sex ratio, reproductive potential, and size/age structure of species within the closed areas. Some proposed Type 2 MPAs have been sampled annually by fishery-independent surveys. More recently, additional baseline data from within proposed Type 2 MPAs have been collected using ROVs, submersible, and from commercial fishermen through cooperative funding. Documented information on the presence of snapper grouper species was considered when siting the Type 2 MPAs to maximize the biological benefits. It is anticipated that existing, long-term fishery independent surveys will continue in the proposed Type 2 MPAs to document any changes that occur.

Objective J. *Utilize traditional knowledge, in part, to provide locations suitable to satisfy the need for MPAs.* As fishery independent data are often scarce and fishery dependent information is collected on a large spatial scale, the Council frequently relied on local knowledge of fishermen and state agency personnel to propose suitable locations. Information on spawning locations of deepwater snapper and grouper species is also limited and utilization of anecdotal knowledge is appropriate. While data has been collected in most of the proposed Type 2 MPAs, the extent of available habitat, particularly for deep-water species, is not known. It is anticipated that additional sampling will be conducted to better map available habitat and document species composition within the proposed Type 2 MPAs so that changes in community structure, sex ratio, and size/age structure can be documented. This effort would include commercial fishermen who may have knowledge of hard bottom locations. Through cooperative research, fishermen and scientists would work together to map available habitat within the proposed Type 2 MPAs and identify species composition. It is anticipated that additional funding would be provided to map the Type 2 MPAs with side scan sonar and visit potential hardbottom locations with ROV and submersible. Once additional hardbottom habitat is located, it would be monitored through fishery-independent and fishery-dependent efforts.

1.4 History of Management

The snapper grouper fishery is highly regulated; some of the species included in this amendment have been regulated since 1983. The original Fishery Management Plan (1983) included size limits for black sea bass (8") and vermilion snapper (12"). Trawl gear primarily targeting vermilion snappers were prohibited starting in January 1989. Fish traps (not including black sea bass pots) and entanglement nets were prohibited starting in January 1992. Bag limits were also implemented in January 1992 (10 vermilion snapper; 5-groupers). Quotas and trip limits for snowy grouper and golden tilefish were implemented in July 1994; tilefish were also added to the 5-grouper aggregate bag limit. A controlled access program for the commercial fishery was implemented fully beginning in 1999. In February 1999, red porgy regulations were 14" size limit and 5 fish bag limit and commercial closure during March and April; black sea bass size limit increased to 10" and a 20-fish bag limit was included; and the vermilion snapper recreational bag limit was increased to 11". All harvest of red porgy was prohibited from September 8, 1999 until August 28, 2000. Beginning on August 29, 2000 red porgy regulations included a January through April commercial closure, 1 fish bag limit, and 50 pound commercial bycatch allowance May through December. Amendment 13C, effective date October 23, 2006, increased the bag limit to 3 and specified a commercial quota of 127,000 pounds and a trip limit of 120 fish.

Specific details on these and all the other regulations implemented in the snapper grouper fishery are shown below in Table 1-1.

Table 1-1. 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" limit – red snapper, yellowtail snapper, red grouper, Nassau grouper, vermilion snapper -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 (1986)	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.

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 #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 lbs s-g on board. -Established rebuttable assumption that vessel with s-g on boar had harvested such fish in 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.
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.
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 #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
Amendment #3 (1990)	01/31/91	PR: 55 FR 39023 FR: 56 FR 2443	-Established management program for wreckfish: Added to FMU*; defined OY and overfishing; required permit to fish for, land or sell; collect data; established control date 03/28/90; fishing year beginning April 16*; process to set annual quota, with initial quota of 2 million lbs*; 10,000 lb. trip limit*; spawning season closure Jan 15-Apr 15. -Add wreckfish to the FMU; -Required permit to fish for wreckfish; -Required catch and effort reports from selected, permitted vessels; -Established a fishing year for wreckfish starting April 16; -Established 10,000 lb. trip limit; -Established a spawning season closure for wreckfish from January 15 to April 15; -Established a wreckfish quota and provisions for closure of wreckfish fishery; -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.

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 #4 (1991)	01/01/92	PR: 56 FR 29922 FR: 56 FR 56016	-Defined overfishing/overfished and specified rebuilding time periods. Required permits (commercial and for-hire) and specified data collection regulations. Established assessment group and annual adjustment (framework). -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. -Permit, gear, and vessel id requirements specified for black sea bass traps. -No retention of S-G caught in other fisheries with gear prohibited in S-G fishery if captured S-G had no bag limit or harvest was prohibited. If had a bag limit, could retain only the bag limit. -8" limit – lane snapper and black sea bass -10" limit – vermilion snapper (recreational only) -12" limit – red porgy, vermilion snapper (commercial only), gray, yellowtail, mutton, schoolmaster, queen, blackfin, cubera, dog, mahogany, and silk snappers -20" limit – red snapper, gag, and red, black, scamp, yellowfin, and yellowmouth groupers. -28" 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 is allowed by recreational or commercial fishermen -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 -commercial permit regulations established
Amendment #5 (1991)	04/06/92	PR: 56 FR 57302 FR: 57 FR 7886	-Wreckfish: established limited entry system with 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 TAC

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 #4 (1992)	07/06/93	FR: 58 FR 36155	-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 (1992)	07/31/93	PR: 58 FR 13732 FR: 58 FR 35895	-Established 8 SMZs off S. Carolina, where only hand-held, hook-and-line gear and spearfishing (excluding powerheads) was allowed.
Amendment #6 (1993)	07/27/94	PR: 59 FR 9721 FR: 59 FR 27242	-commercial quotas for snowy grouper, golden tilefish -commercial trip limits for snowy grouper, golden tilefish, -1 speckled hind and 1 Warsaw grouper per vessel per trip (recreational and commercial); no sale allowed -include golden tilefish in grouper recreational aggregate bag limits -100% logbook coverage upon renewal of permit -creation of the *Oculina* Experimental Closed Area -data collection needs specified for evaluation of possible future IFQ system
Amendment #7 (1994)	01/23/95	PR: 59 FR 47833 FR: 59 FR 66270	-12" FL – hogfish -16" limit – 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 N. Carolina -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 (1994)	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 bsb pot fishery off S. Atlantic states after 04/23/97 was not assured of future access if limited entry program developed.

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 #8 (1997)	12/14/98	PR: 63 FR 1813 FR: 63 FR 38298	-established program to limit initial eligibility for s-g fishery: Must demonstrate landings of any species in S-G FMU in 1993, 1994, 1995 or 1996; AND have held valid s-g permit between 02/11/96 and 02/11/97. -granted transferable permit with unlimited landings if vessel landed ≥ 1,000 lbs. of S-G spp. in any of the years -granted non-transferable permit with 225 lb. trip limit to all other vessels -modified problems, objectives, OY, and overfishing definitions -expanded Council's habitat responsibility -allowed retention of S-G 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.
Regulatory Amendment #7 (1998)	01/29/99	PR: 63 FR 43656 FR: 63 FR 71793	-Established 10 SMZs at artificial reefs off South Carolina.
Amendment #9 (1998)	2/24/99	PR: 63 FR 63276 FR: 64 FR 3624	-red porgy: 14" length (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" length (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 March and April; quota = 1,169,931 lbs; began fishing year May 1; prohibited coring. -Vermilion snapper: 11" length (recreational) -Gag: 24" length (recreational and commercial); no harvest or possession > bag limit, and no purchase or sale, during March and April -Black grouper: 24" length (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 S-G without a bag limit: aggregate recreational bag limit 20 fish/person/day, excluding tomtate and blue runners -Vessels with longline gear aboard may only possess snowy, Warsaw, speckled hind, yellowedge, and misty grouper; speckled hind; and golden, blueline, and sand tilefish.

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) 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
Emergency Interim Rule	09/08/99, expired 08/28/00	64 FR 48324 and 65 FR 10040	-Prohibited harvest or possession of red porgy.
Amendment #10 (1998)	07/14/00	PR: 64 FR 37082 and 64 FR 59152 FR: 65 FR 37292	-identified EFH and established HAPCs for species in the S-G FMU.

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Amendment #11 (1998)	12/02/99	PR: 64 FR 27952 FR: 64 FR 59126	-MSY proxy: goliath and Nassau grouper = 40% static 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 (MSST=3.72 mp, 1995 biomass=1.33 mp) undergoing overfishing (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 =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) -rebuilding timeframe: red snapper and groupers ≤ 15 years (year 1 = 1991) other snappers, greater amberjack, bsb, red porgy ≤ 10 years (year 1 = 1991) -overfishing level: goliath and Nassau grouper = F>F40% static SPR species: = F>F30% static SPR all other -Approved definitions for overfished and overfishing: MSST = [(1-M) or 0.5 whichever is greater]*Bmsy. MFMT = Fmsy
Amendment #12 (2000)	09/22/00	PR: 65 FR 35877 FR: 65 FR 51248	-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 during Jan-April; 1 fish bag limit; 50 lb. bycatch comm. trip limit May-December; modified management options and list of possible framework actions.

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 #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 S-G species within the *Oculina* Experimental Closed Area.
Amendment #13C (2006)	10/23/06	PR: 71 FR 33423 FR: 71 FR 55096	-Snowy Grouper Commercial – Reduce the annual commercial snowy grouper quota from 344,508 lbs gutted weight (406,519 lbs whole weight) to 151,000 lbs gutted weight (178,000 lbs whole weight) in year 1; to 118,000 lbs gutted weight (139,000 lbs whole weight) in year 2; and to 84,000 lbs gutted weight (99,000 lbs whole weight) in year 3 onwards until modified. Specify a commercial trip limit of 275 lbs gutted weight (325 lbs whole weight) during year 1; 175 lbs gutted weight (210 lbs whole weight) during year 2; and 100 lbs gutted weight (115 lbs whole weight) during year 3 onwards until modified. These trip limits apply until the quota is met. After the commercial quota is met, all purchase and sale is prohibited and harvest and/or possession is limited to the bag limit. -Snowy Grouper Recreational – Limit the possession of snowy grouper to one per person per day within the 5-grouper per person per day aggregate recreational bag limit. -Golden Tilefish Commercial – Reduce the annual commercial golden tilefish quota from 1,001,663 lbs gutted weight (1,121,863 lbs whole weight) to 295,000 lbs gutted weight (331,000 lbs whole weight). After the commercial quota is met, all purchase and sale is prohibited and harvest and/or possession is limited to the bag limit. Specify a commercial trip limit of 4,000 lbs gutted weight (4,480 lbs whole weight) until 75% of the quota is taken when the trip limit is reduced to 300 lbs gutted weight (335 lbs whole weight). Do not adjust the trip limit downwards unless 75% is captured on or before September 1. -Golden Tilefish Recreational – Limit the possession of golden tilefish to one per person per day within the 5-grouper per person per day aggregate bag limit. -Vermilion Snapper Commercial – Specify a commercial vermilion snapper quota of 1,100,000 lbs gutted weight (1,221,000 lbs whole weight). After the commercial quota is met, all purchase and sale is prohibited and harvest and/or possession is limited to the bag limit. -Vermilion Snapper Recreational – Increase the recreational vermilion snapper minimum size limit from 11” total length to 12” total length.

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.
			-Black Sea Bass Commercial – Implement the following commercial measures for black sea bass: (a) Specify a commercial quota of 477,000 lbs gutted weight (563,000 lbs whole weight) in year 1; 423,000 lbs gutted weight (499,000 lbs whole weight) in year 2; and 309,000 lbs gutted weight (364,000 lbs whole weight) in year 3 onwards until modified. This is based on a Total Allowable Catch (TAC) of 1,110,000 lbs gutted weight (1,310,000 lbs whole weight) in year 1; 983,000 lbs gutted weight (1,160,000 lbs whole weight) in year 2; and 718,000 lbs gutted weight (847,000 lbs whole weight) in year 3 onwards until modified. After the commercial quota is met, all purchase and sale is prohibited and harvest and/or possession is limited to the bag limit. (b) Require use of at least 2" mesh for the entire back panel of black sea bass pots. This measure will be effective 6 months after publication of the final rule in the Federal Register. (c) Change the fishing year from the calendar year to June 1 through May 31. (d) Require black sea bass pots be removed from the water when the quota is met. The Regional Administrator has authority to grant a 10-day grace period for removal of traps. Black Sea Bass Recreational – Implement the following recreational measures for black sea bass: (a) Specify a recreational allocation of 633,000 lbs gutted weight (746,000 lbs whole weight) in year 1; 560,000 lbs gutted weight (661,000 lbs whole weight) in year 2; and 409,000 lbs gutted weight (483,000 lbs whole weight) in year 3 onwards until modified. This is based on a Total Allowable Catch (TAC) of 1,110,000 lbs gutted weight (1,310,000 lbs whole weight) in year 1; 983,000 lbs gutted weight (1,160,000 lbs whole weight) in year 2; and 718,000 lbs gutted weight (847,000 lbs whole weight) in year 3 onwards until modified. (b) Limit recreational landings to approximate these harvest levels by increasing the recreational minimum size limit from 10" total length to 11" total length in year 1 and to 12" total length in year 2 onwards until modified, and reducing the recreational bag limit from 20 to 15 black sea bass per person per day. (c) Change the fishing year from the calendar year to June 1 through May 31.

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.
			-Red Porgy Commercial – Retain the commercial 14" total length minimum size limit and the seasonal closure (retention limited to the bag limit). Increase the commercial trip limit from 50 lbs whole weight of red porgy to 120 red porgy (210 lbs gutted weight; 220 lbs whole weight) during May through December. Specify a commercial quota of 127,000 lbs gutted weight (132,000 lbs whole weight). After the commercial quota is met, all purchase and sale is prohibited and harvest and/or possession is limited to the bag limit. -Red Porgy Recreational – Retain the recreational 14" total length minimum size limit and increase the recreational bag limit from 1 to 3 red porgy per person per day.

2 Alternatives

This environmental impact statement explores the differences among a number of management alternatives for the proposed changes to the Snapper Grouper Fishery Management Plan (FMP). Alternatives are developed to identify ways of meeting the purpose and need while addressing a range of objectives. For this Amendment, alternatives were received and developed through a long-term deliberative public process including written public comments, informal public meeting, multiple rounds of scoping meetings, public hearings, and meetings of the Council's Advisory Panels (Marine Protected Area, Snapper Grouper, Habitat, Coral, Wreckfish, and Law Enforcement) as well as interdisciplinary team meetings and Council meetings. The Council employs a process which, following a review and examination, screens alternatives to provide a reasonable range for detailed analysis. **Appendix A** contains the alternatives that were eliminated from further study and the reason for their elimination.

The environmental consequences of the alternatives are compared in both Sections 2 and 4. Section 2 provides a summary of this comparison. The reader is referred to Section 4 for the detailed wording of the alternatives and for a detailed discussion about the effects of each alternative on the biological, economic, social, and administrative environments. The affected environments are described in Section 3.

This Amendment contains management alternatives that use Type 2 marine protected areas (MPAs) to aid in the recovery of overfished, deepwater snapper grouper stocks and to ensure the persistence of healthy fish stocks, fisheries, and habitats. Specifically the Council is using Type 2 MPAs as a management tool to promote the optimal size, age, and genetic structure of these slow-growing, long-lived, deepwater snapper grouper species. Figures 2-1 and 2-2 below present the alternatives being considered in this amendment. Listed immediately below are the preferred alternatives.

2.1 Description of Alternatives

2.1.1 Snowy Grouper Wreck MPA

Alternative 1 (Preferred). Establish a Type 2 MPA that protects the Snowy Grouper Wreck off North Carolina in the area that is bound by the following coordinates: The northwest corner at 33°25'N, 77°4.75'W; northeast corner at 33°34.75'N, 76°51.3'W; southwest corner at 33°15.75'N, 77°W; and the southeast corner at 33°25.5'N, 76°46.5'W (Figure 2-1).

Alternative 2. Establish a Type 2 MPA that protects the Snowy Wreck off North Carolina in the area that is bound by the following coordinates: The northwest corner at 33°23.35'N, 77°4'W; northeast corner at 33°33.25'N, 76°50.5'W; southwest corner at 33°14.1'N, 76°59.35'W; and the southeast corner at 33°24'N, 76°45.75'W (Figure 2-1).

Alternative 3. No action. Do not establish a Type 2 MPA to protect the Snowy Grouper wreck.

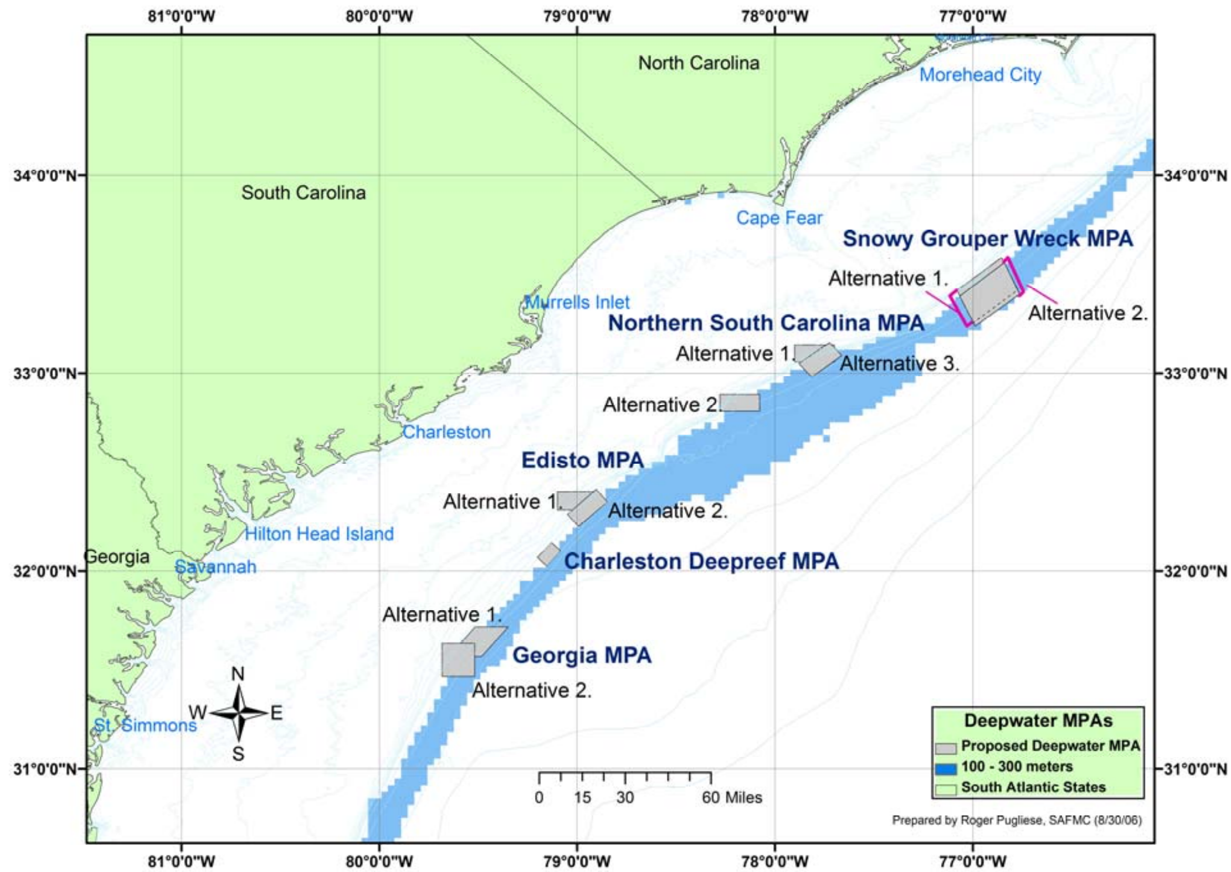


Figure 2-1. Proposed Deepwater Type 2 MPAs off North Carolina, South Carolina, and Georgia.

2.1.2 Northern South Carolina MPA (South Carolina A MPA)

Alternative 1. Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 33°8.5'N, 77°54'W; the northeast corner at 33°8.5'N, 77°42'W; the southwest corner at 33°3.5'N, 77°54'W; and the southeast corner at 33°3.5'N, 77°42'W (Figure 2-1).

Alternative 2 (Preferred). Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 32°53.5'N, 78°16.75'W; the northeast corner at 32°53.5'N, 78°4.75'W; the southwest corner at 32°48.5'N, 78°16.75'W; and the southeast corner at 32°48.5'N, 78°4.75'W (Figure 2-1).

Alternative 3. Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 33°2.75'N, 77°52.75'W; the northeast corner at 33°9.25'N, 77°43.5'W; the southwest corner at 32°58.83'N, 77°48.83'W; and the southeast corner at 33°5.3'N, 77°39.9'W (Figure 2-1).

Alternative 4. No action. Do not establish a Type 2 MPA off northern South Carolina.

2.1.3 Edisto MPA

Alternative 1 (Preferred). Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 32°24'N, 79°6'W; the northeast corner at 32°24'N, 78°54'W; the southwest corner at 32°18.5'N, 79°6'W; and the southeast corner at 32°18.5'N, 78°54'W (Figure 2-1).

Alternative 2. Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 32°17'N, 79°3'W; the northeast corner at 32°24.75'N, 78°54.2'W; the southwest corner at 32°13.5'N, 78°59.5'W; and the southeast corner at 32°21'N, 78°50.83'W (Figure 2-1).

Alternative 3. No action. Do not establish a Type 2 MPA off central South Carolina.

2.1.4 Georgia MPA (Tilefish MPA)

Alternative 1 (Preferred). Establish a Type 2 MPA off Georgia in the area bounded by the following coordinates: The northwest corner at 31°43'N, 79°31'W; the northeast corner at 31°43'N, 79°21'W; the southwest corner at 31°34'N, 79°39'W; and the southeast corner at 31°34'N, 79°29'W (Figure 2-1).

Alternative 2. Establish a Type 2 MPA off Georgia in the area bounded by the following coordinates: The northwest corner at 31°38'N, 79°41'W; the northeast corner at 31°38'N, 79°31'W; the southwest corner at 31°28'N, 79°41'W; and the southeast corner at 31°28'N, 79°31'W (Figure 2-1).

Alternative 3. No action. Do not establish a Type 2 MPA off Georgia.

2.1.5 North Florida MPA (Jacksonville/St. Augustine Ridge MPA)

Alternative 1. Establish a Type 2 MPA off north Florida in the area bounded by the following coordinates: The northwest corner at 30°29'N, 80°18'W; the northeast corner at 30°29'N, 80°8'W; the southwest corner at 30°19'N, 80°18'W; and the southeast corner at 30°19'N, 80°8'W (Figure 2-2).

Alternative 2. Establish a Type 2 MPA off north Florida in the area bounded by the following coordinates: The northwest corner at 30°5'N, 80°25'W; the northeast corner at 30°5'N, 80°15'W; the southwest corner at 29°55'N, 80°25'W; and the southeast corner at 29°55'N, 80°15'W (Figure 2-2).

Alternative 3. Establish a Type 2 MPA off North Florida in the area bounded by the following coordinates: The northwest corner at 29^{o}36.3'N, 80^{o}12.5'W; the northeast corner at 29^{o}40'N, 79^{o}50'W; the southwest corner at 29^{o}17.3'N, 80^{o}8.3'W; and the southeast corner at 29^{o}21.3'N, 79^{o}45.5'W (Figure 2-2).

Alternative 4 (Preferred). Establish a Type 2 MPA off north Florida in the area bounded by the following coordinates: The northwest corner at 30°29'N, 80°14'W; the northeast corner at 30°29'N, 80°2' W; the southwest corner at 30°19'N, 80°14'W; and the southeast corner at 30°19'N, 80°2'W (Figure 2-2).

Alternative 5. Establish a Type 2 MPA off north Florida in the area bounded by the following coordinates: The northwest corner at 30°5'N, 80°16'W; the northeast corner at 30°5'N, 80°6'W; the southwest corner at 29°55'N, 80°16'W; and the southeast corner at 29°55'N, 80°6'W (Figure 2-2).

Alternative 6. Establish a Type 2 MPA off North Florida in the area bounded by the following coordinates: The northwest corner at 29^{o}36.3'N, 80^{o}15'W; the northeast corner at 29^{o}40'N, 79^{o}52.5'W; the southwest corner at 29^{o}17.3'N, 80^{o}10.8'W; and the southeast corner at 29^{o}21.3'N, 79^{o}48'W (Figure 2-2).

Alternative 7. No action. Do not establish a Type 2 MPA off northern Florida.

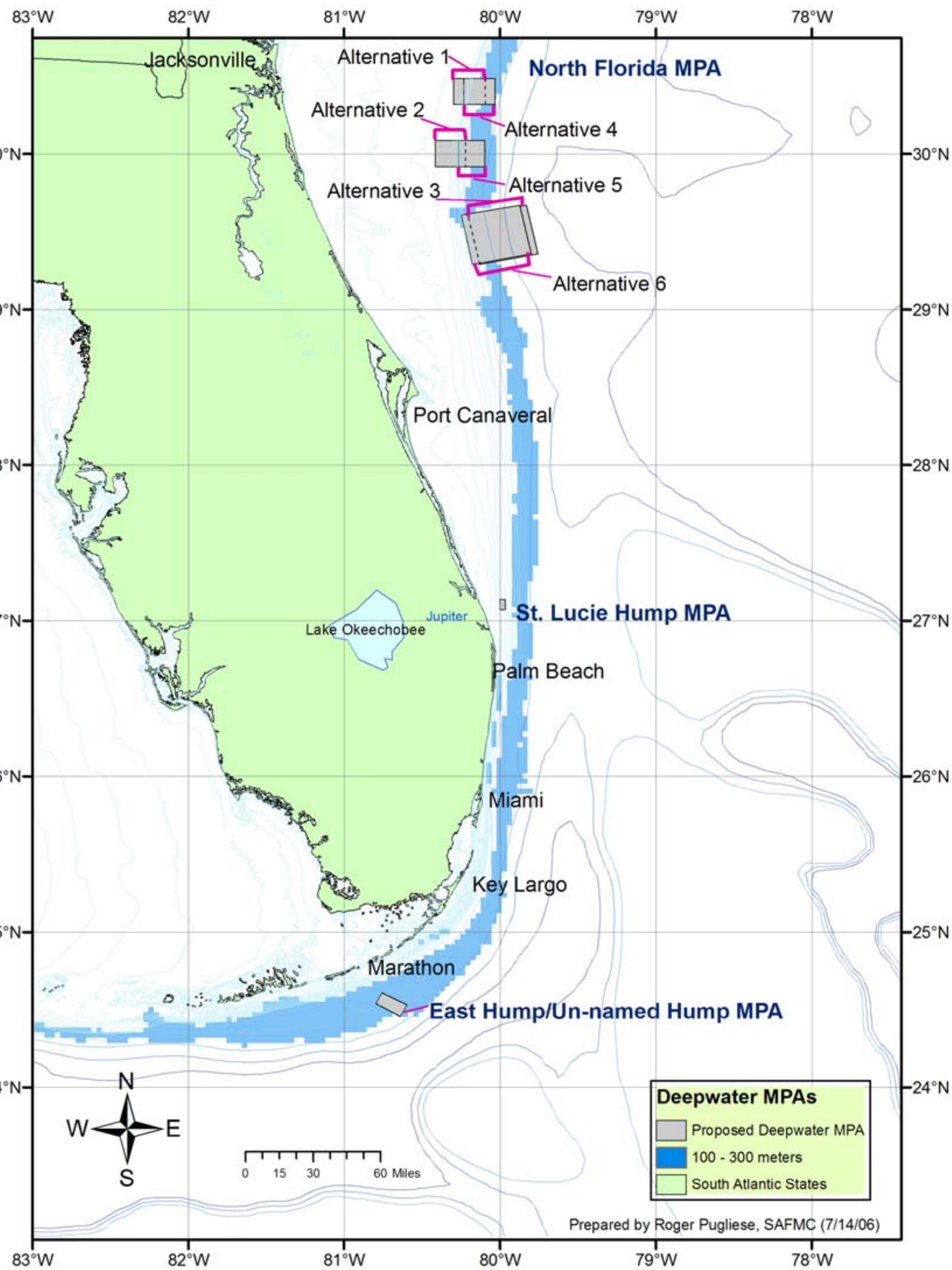


Figure 2-2. Proposed Type 2 Deepwater MPAs off east Florida.

2.1.6 St. Lucie Hump MPA

Alternative 1 **(Preferred)**. Establish a Type 2 MPA protecting St. Lucie Hump, in the area bounded by the following coordinates: The northwest corner at 27°8'N, 80°W; the northeast corner at 27°8'N, 79°58'W; the southwest corner at 27°4'N, 80°W; and the southeast corner at 27°4'N, 79°58'W (Figure 2-2).

Alternative 2. No action. Do not establish a Type 2 MPA at the St. Lucie Hump.

2.1.7 East Hump/Un-named Hump MPA

Alternative 1 (Preferred). Establish a Type 2 MPA protecting the East Hump in the area bounded by the following coordinates: The northwest corner at 24°36.5'N, 80°45.5'W; the northeast corner at 24°32'N, 80°36'W; the southwest corner at 24°32.5'N, 80°48'W; and the southeast corner at 24°27.5'N, 80°38.5'W (Figure 2-2).

Alternative 2. No action. Do not establish a Type 2 MPA at the East Hump/Un-named Hump.

2.1.8 Charleston Deep Artificial Reef MPA

Alternative 1 (Preferred). Establish an experimental artificial reef Type 2 MPA off the Coast of South Carolina in the area identified by the following boundaries: The northwest corner at 32°4' N, 79°12'W; the northeast corner at 32°8.5'N, 79°7.75'W; the southwest corner at 32°1.5'N, 79°9.3'W; and the southeast corner at 32°6'N, 79°5'W (Figure 2-1).

Alternative 2. No action. Do not establish a Type 2 MPA at the Charleston Deep Artificial Reef.

2.1.9 Shark Bottom Longlines

Alternative 1 (Preferred). Prohibit the use of shark bottom longlines within the proposed MPAs.

Alternative 2. No action.

2.2 Comparison of Alternatives

2.2.1 Snowy Grouper Wreck MPA

Table 2-1. Summary of effects of management measure alternatives for the Snowy Grouper Wreck Type 2 MPA. (M=MARMAP, S=SEAMAP)

Alternatives: (Table 2-1)	Biological Effects	Economic, Social, and Administrative Effects
Alternative 1 (Preferred): Establish a Type 2 Marine Protected Area (MPA) that protects the Snowy Wreck off North Carolina in the first alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Snowy grouper, speckled hind, red grouper, graysby, and hogfish presence reported -Potential to protect more mid-shelf species than Alt. 2 -Most known hard bottom (S)	-Fishermen from Little River, Carolina Beach, and Southport ports most likely affected If more mid-shelf species protected: -Long-term benefits to use value (e.g., commercial fishing) dependent on degree of spillover; potential effects greater than Alt. 2 -Immediate benefits to non-use values (e.g., existence value) greater than Alt. 2 -Greater short-term, adverse displacement costs than Alt. 2 -Adverse effects to enforcement -Greater negative immediate-term (within one year) and medium-term (1-5 years post implementation) effects than Alt. 2; greater positive long-term (5+ years) effects than Alt. 2 (Delphi study results)
Alternative 2: Establish a Type 2 MPA that protects the Snowy Wreck off North Carolina in the second alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Snowy grouper, speckled hind, red grouper, graysby, and hogfish presence reported -Little known hard bottom; 25% surveyed (S)	-Fishermen from Little River, Carolina Beach, and Southport ports most likely affected -Benefits to use value (e.g., revenue) dependent on degree of spillover If more mid-shelf species protected: -Benefits to non-use values less than Alt. 1. -Short-term, adverse displacement costs less than Alt. 1. -Adverse effects to enforcement -Less negative immediate-term and medium-term effects than Alt. 1; less positive long-term effects than Alt. 1 (Delphi study results)
Alternative 3: No action. Do not establish a Type 2 MPA to protect the Snowy Wreck.	No additional protection for fish or habitat	-Missed opportunity to beneficially effect non-use values and (potentially) use values -No administrative effects to enforcement

2.2.2 Northern South Carolina MPA (South Carolina A MPA)

Table 2-2. Summary of effects of management measure alternatives for the Northern South Carolina Type 2 MPA (South Carolina A Type 2 MPA).
(M=MARMAP, S=SEAMAP)

Alternatives: (Table 2-2)	Biological Effects	Economic, Social, and Administrative Effects
Alternative 1: Establish a Type 2 Marine Protected Area (MPA) off Northern South Carolina in the first alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Juvenile snowy grouper presence reported (M) -No reef fish in spawning condition reported (M) -Most known hard-bottom (S)	-Long-term benefits to use value (e.g., commercial fishing) dependent on degree of spillover -Immediate benefits to non-use values (e.g., existence value) -Short-term, adverse effects through displacement -Adverse effects to enforcement -Least negative immediate-term and medium-term effects; less positive long-term effects than Alt. 2 but more positive long-term effects than Alt. 3 (Delphi study results)
Alternative 2 (Preferred): Establish a Type 2 MPA off Northern South Carolina in the second alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Juvenile snowy grouper (greatest densities) (M) -Speckled hind and yellowedge presence recorded (M) -Speckled hind in spawning condition recorded (M) -Area closest to known snowy grouper, golden tilefish, and blueline tilefish spawning areas (M) -Second most known hard bottom (S); greatest amount of known hard bottom (M)	-Long-term benefits to use value (e.g., commercial fishing) dependent on degree of spillover -Immediate benefits to non-use values (e.g., existence value) -Short-term, adverse effects through displacement -Adverse effects to enforcement less than Alt. 1 and 3 as MPA along latitudinal/longitudinal lines -More negative immediate-term and medium-term effects than Alt. 1 but less negative immediate-term and medium-term effects than Alt. 3; most positive long-term effects (Delphi study results)
Alternative 3: Establish a Type 2 MPA off Northern South Carolina in the third alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Juvenile snowy grouper (M) -No reef fish in spawning condition reported (M) -Least known hard bottom (S)	-Long-term benefits to use value (e.g., commercial fishing) dependent on degree of spillover -Immediate-term benefits to non-use values (e.g., existence value) -Short-term, adverse effects through displacement -Adverse effects to enforcement -Highest negative immediate-term and medium-term effects; Least positive long-term effects (Delphi study results)
Alternative 4: No action. Do not establish a Type 2 MPA off Northern South Carolina.	No additional protection for fish or habitat	-Missed opportunity to beneficially effect non-use values and (potentially) use values -No administrative effects to enforcement

2.2.3 Edisto MPA

Table 2-3. Summary of effects of management measure alternatives for the Edisto Type 2 MPA. (M=MARMAP, S=SEAMAP)

Alternatives: (Table 2-3)	Biological Effects	Economic, Social, and Administrative Effects
Alternative 1 (Preferred): Establish a Type 2 Marine Protected Area (MPA) off Central South Carolina in the first alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Snowy grouper (CRP Study and M) -Juvenile snowy groupers and speckled hind (M) -Greatest amount of recorded mid-shelf species -Blueline tilefish in spawning condition reported (M) -Most-known hard bottom (S) -High-relief bio-eroded rock (Schobernd 2006) -May provide additional protection to sea turtles	-Long-term benefits to use value (e.g., commercial fishing) dependent on degree of spillover; potential effects greater than Alt. 2 -Immediate benefits to non-use values (e.g., existence value) greater than Alt. 2. -Greater short-term, adverse displacement costs than Alt. 2 -Adverse effects to enforcement -Less negative immediate-term and medium-term effects than Alt. 2; more positive long-term effects than Alt. 2 (Delphi study results)
Alternative 2: Establish a Type 2 MPA off Central South Carolina in the second alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Snowy grouper recorded (CRP study and M) -Juvenile snowy grouper and speckled hind recorded (M) -Fewer mid-shelf species recorded -Less known hard bottom (S)	-Long-term benefits to use value (e.g., revenue) dependent on degree of spillover If more mid-shelf species protected: -Immediate benefits to non-use values less than Alt. 1 -Short-term, adverse displacement costs less than Alt. 1 -Adverse effects to enforcement less than Alt. 1 as MPA along latitudinal/longitudinal lines -More negative immediate-term and medium-term effects than Alt. 1; less positive long-term effects than Alt. 1 (Delphi study results)
Alternative 3: No action. Do not establish a Type 2 MPA off Central South Carolina.	No additional protection for fish or habitat	-Missed opportunity to beneficially effect non-use values and (potentially) use values -No administrative effects to enforcement

2.2.4 Georgia MPA (Tilefish MPA)

Table 2-4. Summary of effects of management measure alternatives for the Georgia Type 2 MPA. (M=MARMAP, S=SEAMAP)

Alternatives: (Table 2-4)	Biological Effects	Economic, Social, and Administrative Effects
Alternative 1 (Preferred): Establish a Type 2 Marine Protected Area (MPA) off Georgia in the first alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Golden tilefish presence recorded (M) -Gray triggerfish presence recorded (M) -Spawning golden tilefish presence recorded (M) -Mud habitat for golden tilefish	-Long-term benefits to use value (e.g., revenue) dependent on degree of spillover If more mid-shelf species protected: -Immediate benefits to non-use values less than Alt. 2 -Short-term, adverse displacement costs less than Alt. 2 -Adverse effects to enforcement -Less negative immediate-term and medium-term effects than Alt. 2; more positive long-term effects than Alt. 2 (Delphi study results)
Alternative 2: Establish a Type 2 MPA off Georgia in the second alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Golden tilefish presence recorded (M & GADNR) -Juvenile snowy grouper presence recorded (M) -Red porgy, vermilion snapper, and whitebone porgy presence recorded (M) -Mud habitat for golden tilefish	-Long-term benefits to use value (e.g., revenue) dependent on degree of spillover If more mid-shelf species protected: -Immediate benefits to non-use values less than Alt. 2. -Short-term, adverse displacement costs less than Alt. 2. -Adverse effects to enforcement -More negative immediate-term and medium-term effects than Alt. 1; less positive long-term effects than Alt. 1 (Delphi study results)
Alternative 3: No action. Do not establish a Type 2 MPA off Georgia.	No additional protection for fish or habitat	-Missed opportunity to beneficially effect non-use values and (potentially) use values -No administrative effects to enforcement

2.2.5 North Florida MPA (Jacksonville/St. Augustine Ridge MPA)

Table 2-5. Summary of effects of management measure alternatives for the Type 2 North Florida MPA. (M=MARMAP, S=SEAMAP)

Alternatives: (Table 2-5)	Biological Effects	Economic, Social, and Administrative Effects
Alternative 1: Establish a Type 2 Marine Protected Area (MPA) off North Florida in the first alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Snowy grouper and speckled hind presence recorded (M) -Mid-shelf species reported; some in spawning condition (M) -Hard bottom present (S)	-Long-term benefits to use value (e.g., commercial fishing) dependent on degree of spillover; potential effects greater than Alt. 4, 5, and 6 -Immediate benefits to non-use values (e.g., existence value) greater than Alt. 4, 5, and 6 -Greater short-term, adverse displacement costs than Alts. 4, 5, and 6 -Adverse effects to enforcement -More negative immediate-term, medium-term, and long-term effects than any other alternative. (Delphi study results)
Alternative 2: Establish a Type 2 MPA off North Florida in the second alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Mid-shelf species reported (M) -Mid-shelf species found in spawning condition; fewer than other alternatives (M) -Hard bottom present (S) -May provide additional protection to sea turtles	-Long-term benefits to use value (e.g., commercial fishing) dependent on degree of spillover; potential effects greater than Alt. 4, 5, and 6 -Immediate benefits to non-use values (e.g., existence value) greater than Alt. 4, 5, and 6 -Greater short-term, adverse displacement costs than Alts. 4, 5, and 6 -Adverse effects to enforcement -More negative immediate-term effects than Alts. 3 or 6, less negative immediate-term effects than Alts. 1 or 4, same negative immediate-term effects as Alt. 5; more negative medium-term effects than Alts. 3 or 6, less negative medium-term effects than Alts. 1, 4, or 5; greatest long-term positive effects (Delphi study results)
Alternative 3: Establish a Type 2 MPA off North Florida in the third alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -No mid-shelf species reported -No known hard bottom recorded; only 2% surveyed (S)	-Long-term benefits to use value (e.g., revenue) dependent on degree of spillover If more mid-shelf species protected: • Immediate benefits to non-use values less than Alt. 1 and 2 • Short-term, adverse displacement costs less than Alt. 1 and 2 -Adverse effects to enforcement -Less negative immediate-term effects than Alts. 1, 2, 4, and 5, same negative immediate-term effects as Alt. 6; Least negative medium-term effects; less positive long-term effects than Alt. 2, more positive long-term effects than Alts. 1, 5, or 6 (Delphi study results)

Alternative 4 (Preferred): Establish a Type 2 MPA off North Florida in the fourth alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Mid-shelf species reported; some in spawning condition (M) -Low amount of hard bottom recorded; only 4% surveyed (S) -May include mud habitat for golden tilefish	-Long-term benefits to use value (e.g., revenue) dependent on degree of spillover If more mid-shelf species protected: • Immediate benefits to non-use values less than Alt. 1 and 2 • Short-term, adverse displacement costs less than Alt. 1 and 2 -Adverse effects to enforcement -More negative immediate-term and medium-term effects than any other alternative except Alt. 1; less positive long-term effects than Alt. 2, more positive long-term effects than Alts. 1, 3, 5, or 6 (Delphi study results)
Alternative 5: Establish a Type 2 MPA off North Florida in the fifth alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -Mid-shelf species reported; some in spawning condition (M) -Mid-shelf species found in spawning condition; fewer than other alternatives (M) -Hard bottom present (S) -May include mud habitat for golden tilefish	-Long-term benefits to use value (e.g., revenue) dependent on degree of spillover If more mid-shelf species protected: -Immediate benefits to non-use values less than Alt. 1 and 2 -Short-term, adverse displacement costs less than Alt. 1 and 2 -Adverse effects to enforcement -Same negative immediate-term effects as Alt. 2, less negative immediate-term effects than Alts. 3 or 6, more negative immediate-term effects than Alts. 1 or 4; less negative medium-term effects than Alts. 1 and 4 but more negative medium-term effects than Alts. 2, 3,and 6; neutral long-term effects, less negative than Alt. 1 and less positive than Alts. 1, 2, 4, and 6 (Delphi study results)
Alternative 6: Establish a Type 2 MPA off North Florida in the sixth alternative site.	-Beneficial effects to snappers and groupers that inhabit the area -No mid-shelf species reported -Hard bottom present (S)	-Long-term benefits to use value (e.g., revenue) dependent on degree of spillover If more mid-shelf species protected: -Immediate benefits to non-use values less than Alt. 1 and 2 -Short-term, adverse displacement costs less than Alt. 1 and 2 -Adverse effects to enforcement -Same negative immediate-term effects as Alt. 3, less negative immediate-term effects than Alts. 1, 2, 4, or 5; more negative medium-term effects than Alt. 3, less negative medium-term effects than Alts. 1, 2, 4, and 5; less positive long-term effects than Alts. 2, 3, or 4, more positive long-term effects than 1 or 5 (Delphi study results)
Alternative 7: No action. Do not establish a Type 2 MPA off North Florida.	No additional protection for fish or habitat	-Missed opportunity to beneficially effect non-use values and (potentially) use values -No administrative effects to enforcement

2.2.6 St. Lucie Hump MPA

Table 2-6. Summary of effects of management measure alternatives for the St. Lucie Hump Type 2 MPA. (M=MARMAP, S=SEAMAP)

Alternatives: (Table 2-6)	Biological Effects	Economic, Social, and Administrative Effects
Alternative 1 (Preferred): Establish a Type 2 Marine Protected Area (MPA) at the St. Lucie Hump.	-Beneficial effects to snappers and groupers that inhabit the area -Public testimony indicates presence of mid-shelf and deepwater species in the area in addition to habitat	-Long-term benefits to use value (e.g., commercial fishing) dependent on degree of spillover -Immediate benefits to non-use values (e.g., existence value) -Short-term, adverse displacement costs -Adverse effects to enforcement -More negative immediate-term effects than Alt. 2; more positive medium-term and long-term effects than Alt. 2 (Delphi study results)
Alternative 2: No action. Do not establish a Type 2 MPA at the St. Lucie Hump.	No additional protection for fish or habitat	-Missed opportunity to beneficially effect non-use values and (potentially) use values -No administrative effects to enforcement

2.2.7 East Hump/Un-named Hump MPA

Table 2-7. Summary of effects of management measure alternatives for the East Hump/Un-Named Hump Type 2 MPA. (M=MARMAP, S=SEAMAP)

Alternatives: (Table 2-7)	Biological Effects	Economic, Social, and Administrative Effects
Alternative 1 (Preferred): Establish a Type 2 Marine Protected Area (MPA) at the East Hump/Un-named Hump.	-Beneficial effects to snappers and groupers that inhabit the area -May provide additional protection to smalltooth sawfish	-Long-term benefits to use value (e.g., commercial fishing) dependent on degree of spillover -Immediate benefits to non-use values (e.g., existence value) -Short-term, adverse displacement costs -Adverse effects to enforcement -More negative immediate-term effects than Alt. 2; more positive medium-term and long-term effects than Alt. 2 (Delphi study results)
Alternative 2: No action. Do not establish a Type 2 MPA at the East Hump/Un-named Hump.	No additional protection for fish or habitat	-Missed opportunity to beneficially effect non-use values and (potentially) use values -No administrative effects to enforcement

2.2.8 Charleston Deep Artificial Reef MPA

Table 2-8. Summary of effects of management measure alternatives for the Charleston Deep Artificial reef Type 2 MPA. (M=MARMAP, S=SEAMAP)

Alternatives: (Table 2-8)	Biological Effects	Economic, Social, and Administrative Effects
Alternative 1 (Preferred): Establish an experimental artificial reef Type 2 Marine Protected Area (MPA) at the Charleston Deep Artificial Reef.	Beneficial effects to snappers and groupers that inhabit the area after placement of artificial material	-Long-term benefits to use value (e.g., commercial fishing) dependent on application of artificial material and migration of fish into the area -Immediate benefits to non-use values (e.g., existence value) -Adverse effects to enforcement -More negative immediate-term and medium-term effects than Alt. 2; more positive long-term effects than Alt. 2 (Delphi study results)
Alternative 2: No action. Do not establish an experimental artificial reef Type 2 MPA at the Charleston Deep Artificial Reef.	No additional protection for fish or habitat	-Missed opportunity to beneficially effect non-use values and (potentially) use values -No administrative effects to enforcement

2.2.9 Shark Bottom longlines

Table 2-9. Summary of effects of management measure alternatives for prohibiting shark bottom longlines.

Alternatives: (Table 2-9)	Biological Effects	Economic, Social, and Administrative Effects
Alternative 1 (Preferred): Prohibit the use of shark bottom longlines within the proposed Type 2 MPAs.	Beneficial effects to snapper and grouper species and to their habitat	Long-term benefits to use value; Short-term loss of up to $3,200 per shark bottom longline vessel. Adverse effects to enforcement
Alternative 2: No action. Do not prohibit the use of shark bottom longlines within the Type 2 MPAs.	Missed opportunity to protect snapper and grouper species and their habitat to a greater degree	Missed opportunity to protect fish populations and their habitat No administrative effects to enforcement

3 Affected Environment

3.1 Habitat

3.1.1 Inshore/Estuarine Habitat

Many deepwater snapper grouper species utilize both pelagic and benthic habitats during several stages of their life histories; larval stages of these species live in the water column and feed on plankton. Most juveniles and adults are demersal and associate with hard structures on the continental shelf that have moderate to high relief (e.g., coral reef systems, 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. Many species use various combinations of these habitats during diurnal feeding migrations or seasonal shifts in cross-shelf distributions. More detail on these habitat types is found in Sections 3.2.1 and 3.2.2 of the Council's Habitat Plan (SAFMC 1998a).

3.1.2 Offshore Habitat

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

The exact extent and distribution of productive snapper grouper habitat on the continental shelf north of Cape Canaveral is unknown. Current data suggest from 3 to 30 percent of the shelf is suitable habitat for these species. These live-bottom habitats may include low relief areas, supporting sparse to moderate growth of sessile invertebrates, moderate relief reefs from 0.5 to 2 meters (1.6 to 6.6 feet), or high relief ridges at or near the shelf break consisting of outcrops of rock that are heavily encrusted with sessile invertebrates such as sponges and sea fan species. Live-bottom habitat is scattered irregularly over most of the shelf north of Cape Canaveral, Florida, but is most abundant offshore of northeastern Florida. South of Cape Canaveral, the continental shelf narrows from 56 to 16 kilometers (35 to 10 miles) wide, becoming even more narrow off the southeast coast of Florida and the Florida Keys. 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 southeast Florida and the Florida Keys.

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 bioeroded limestone and carbonate sandstone (Newton *et al*. 1971), and exhibit vertical relief ranging from less than 0.5 meters to over 10 meters (33 feet). Ledge systems formed by rock outcrops and piles of irregularly sized boulders are also common. Parker *et al*. (1983) estimated that 24% (9,443 km^2) of the area between the 27 and 101 meter (89 and 331 feet) isobaths from Cape Hatteras to Cape Canaveral is reef habitat. Although the benthic communities found in water depths between 100 and 300 meters (328 and 984 feet) from Cape Hatteras to Key West are relatively small compared to the whole shelf, this area, based on landings data, constitutes prime reef fish habitat and probably significantly contributes to the total amount of reef habitat in this region.

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

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

The South Carolina Department of Natural Resources, NOAA/Biogeographic Characterization Branch, and the South Atlantic Fishery Management Council cooperatively generated additional information on managed species' use of offshore fish habitat. Plots of the spatial distribution of offshore species were generated from the Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP) data (Figures 35-41) in the Habitat Plan (SAFMC 1998a). The plots should be considered as point confirmation of the presence of each species within the scope of the sampling program. These plots, in combination with the hard bottom habitat distributions presented in Appendix E of the Habitat Plan (SAFMC 1998a), can be employed as proxies for offshore snapper grouper complex distributions in the south Atlantic region. Maps of the distribution of snapper grouper species by gear type based on MARMAP data can be generated through the Council's Internet Mapping System at the following web address: http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

3.1.3 Essential Fish Habitat

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

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

For specific life stages of estuarine dependent and near shore snapper grouper species, EFH includes areas inshore of the 30 meters (100-foot) contour, such as attached 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 Essential Fish Habitat – Habitat Areas of Particular Concern

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

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

3.2 Biological/Ecological Environment

3.2.1 Life History Characteristics of Target Species

3.2.1.1 Snowy Grouper

Snowy grouper occur in the Eastern Pacific and the Western Atlantic from Massachusetts to southeastern Brazil, including the northern Gulf of Mexico (Robins and Ray 1986) (Table 3-1). It is found at depths of 30-525 meters (98-1,722 feet). Adults occur offshore over rocky bottom habitat. Juveniles are often observed inshore and occasionally in estuaries (Heemstra and Randall 1993).

Snowy grouper are protogynous (changing sex from female to male with increasing size and age). The smallest, youngest male examined by Wyanski *et al.* (2000) was 72.7 centimeters (28.8") total length and age 8. The median size and age of snowy grouper was 91.9 centimeters (34.5") and age 16. The largest specimen observed was 122 centimeters (48") total length (TL) and weighed 30 kilograms (66 pounds), and was 27 years old (Heemstra and Randall 1993). The maximum age reported by Wyanski *et al.* (2000) is 29 years for fish collected off North Carolina and South Carolina. Radiocarbon techniques indicate snowy grouper may live for as long as 40 years (Pat Harris, South Carolina Department of Natural Resources, personal communication). Wyanski *et al.* (2000) report that 50% of the females are mature at 54.1 centimeters (21.3") total length and 5 years of age. The smallest mature female was 46.9 centimeters (18.5") total length, and the largest immature female was 57.5 centimeters (22.6") total length.

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

Table 3-1. Life history characteristics of species in Snapper Grouper Amendment 14.
(TL = total length; SL = standard length; cm = centimeters; in = inches; kg = kilograms; lbs = pounds; GOM = Gulf of Mexico)

	Natural Mortality Rate (M)	**Maximum Reported Size**	**Maximum Reported Age (years)**	**Change Sex (female to male)?**	**If change sex, size below which all female**	**Size at first maturity**	**Size/age at which 50% are mature**	**Size/age at which all are mature**	**Spawning season**	**Food**	**Range/Location**
Snowy Grouper	0.12	122 cm (48 in TL)/30 kg (66 lbs.)	40	Y	76.7 cm (30.2 in) TL	46.9 cm (18.5 in) TL	54.1 cm (21.3 in) TL/ 5 years	57.5 cm (22.6 in) TL	April-September	Fishes, crabs, shrimps, and cephalopods	North Carolina to Brazil, and throughout GOM
Golden Tilefish	0.08	125 cm (50 in) TL (male)/30 kg (66 lbs.)	50	N					March to July (April to May peak)	Echinoderms, fishes, crabs, and crustaceans	Nova Scotia to Florida, GOM

3.2.1.2 Golden Tilefish

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

Maximum reported size is 125 centimeters (50”) total length and 30 kilograms (66 pounds) (Dooley 1978; Robins and Ray 1986). Maximum reported age is 40 years (Harris *et al.* 2001). Radiocarbon aging indicated golden tilefish may live for at least 50 years (Pat Harris, South Carolina Department of Natural Resources, personal communication). A recent SEDAR assessment estimated natural mortality (M) at 0.08 (SEDAR 4 2004). Golden tilefish spawn off the southeast coast of the United States from March through late July, with a peak in April (Table 3-1; Harris *et al*. 2001). Grimes *et al.* (1988) indicate peak spawning occurs from May through September in waters north of Cape Canaveral. Golden tilefish primarily prey upon shrimp and crabs, but also eat fishes, squid, bivalves, and holothurians (Dooley 1978).

3.2.1.3 Speckled Hind

Speckled hind occur in the Western Atlantic Ocean, ranging from North Carolina and Bermuda to the Florida Keys, and in the northern and eastern Gulf of Mexico (Heemstra and Randall 1993, in Froese and Pauly 2003). This fish is a solitary, bathydemersal species, found in depths ranging from 25 meters (98 feet) (Heemstra and Randall 1993, in Froese and Pauly 2003) to 400 meters (1,312 feet) (Bullock and Smith 1991). Heemstra and Randall (1993), in Froese and Pauly (2003), report that it most commonly occurs at depths of 60-120 meters (197-394 feet). Bullock and Smith (1991) indicate that most commercial catches are taken from depths of 50 meters (164 feet) or more. Juveniles occur in shallower waters.

Speckled hind have a low resilience to overfishing, with a minimum population doubling time of 4.5-14 years. Maximum reported size is 110 centimeters (43.3”) TL; maximum weight, 30 kilograms (66 pounds) (Heemstra and Randall 1993, in Froese and Pauly 2003). The maximum size and age of individuals examined by Matheson and Huntsman (1984) in the South Atlantic Bight was 110 centimeters (43.3”) and 15 years, respectively. Heemstra and Randall (1993), in Froese and Pauly (2003), reported a maximum age of 25 years. Estimated size at maturity is 81.1 centimeters (32”); natural mortality rate, 0.14 (Froese and Pauly 2003).

Speckled hind are thought to form spawning aggregations (G. Gilmore, Dynamac Corporation, personal communication). Spawning reportedly occurs from July to September (Heemstra and Randall 1993, in Froese and Pauly 2003). Prey items include fishes, crustaceans, and squids (Bullock and Smith 1991; Heemstra and Randall 1993, in Froese and Pauly 2003).

3.2.1.4 Warsaw Grouper

Warsaw grouper occur in the Western Atlantic, ranging from Massachusetts to southeastern Brazil (Robins and Ray 1986) and in the Gulf of Mexico (Smith 1971). This fish is a solitary species (Heemstra and Randall 1993, in Froese and Pauly 2003), usually found on rocky ledges and seamounts (Robins and Ray 1986), at depths from 55-525 meters (180-1,722 feet) (Heemstra and Randall 1993, in Froese and Pauly 2003). Young are sometimes observed in inshore waters (Robins and Ray 1986) on jetties and shallow reefs (Heemstra and Randall 1993, in Froese and Pauly 2003).

Warsaw grouper have a low resilience to overfishing, with a minimum population doubling time of 4.5-14 years. Maximum reported size is 230 centimeters (91") TL (Heemstra and Randall 1993, in Froese and Pauly 2003) and maximum weight is 263 kilograms (580 pounds) (Robins and Ray 1986). This species spawns during August, September, and October in the Gulf of Mexico (Peter Hood, NOAA Fisheries, personal communication) and during April and May off Cuba (Naranjo 1956). Adults feed on benthic invertebrates and on fishes (Heemstra and Randall 1993, in Froese and Pauly 2003).

3.2.1.5 Misty Grouper

Misty grouper occur in the Western and Eastern Atlantic Ocean (Heemstra and Randall 1993, in Froese and Pauly 2003). In the Western Atlantic, it ranges from Bermuda and the Bahamas, southward to Brazil (Robins and Ray 1986). This fish is a solitary, bathydemersal species. Adults generally occur at depths from about 100-550 meters (327-1,803 feet) (Robins 1967). Juveniles occur in shallower waters (30 meters or 98 feet).

Virtually nothing is known about the age, growth, and reproduction of this species. Maximum reported size is 160 centimeters (63") TL and 100 centimeters (39") TL for males and females, respectively. Maximum reported weight is 107 kilograms (236 pounds) (Heemstra and Randall 1993, in Froese and Pauly 2003). The estimated size at maturity is 81.1 centimeters (31.9") and the natural mortality rate is 0.14 (Froese and Pauly 2003). This species feeds primarily on fishes, crustaceans, and squids (Heemstra and Randall 1993, in Froese and Pauly 2003).

3.2.1.6 Yellowedge Grouper

Yellowedge grouper occur in the Western Atlantic, ranging from North Carolina to southern Brazil, including the Gulf of Mexico. A solitary, demersal, deep-water species, yellowedge grouper occur in rocky areas and on sand mud bottom, at depths ranging from 64-275 meters (210-902 feet). On soft bottom habitats, this fish is often seen in or near trenches or burrow-like excavations (Heemstra and Randall 1993, in Froese and Pauly 2003).

Yellowedge grouper have a low resilience to overfishing, with a minimum population doubling time of 4.5-14 years. Maximum reported size is 114 centimeters (45.3") TL (male) and maximum weight is 18.6 kilograms (41 pounds). Maximum reported age is

32 years (Heemstra and Randall 1993, in Froese and Pauly 2003). Natural mortality rate is estimated as 0.20 (Froese and Pauly 2003).

Yellowedge grouper are protogynous (Bullock *et al.* 1996). Estimated size and age at first maturity is 50.5 centimeters (19.9”) TL and 6.2 years, respectively (Froese and Pauly 2003). A study conducted by Bullock *et al.* (1996) in the Gulf of Mexico reported that 50% of fishes are mature at 22.4”, and that 50% of females transform into males by the time they reach 81 centimeters (32.2”) TL. Spawning occurs from April through October in the South Atlantic (Keener 1984; Manooch 1984; Parker and Mays 1998). Ripe females were found in the eastern Gulf of Mexico from May through September (Bullock *et al.* 1996). A wide variety of invertebrates (mainly brachyuran crabs) and fishes comprise the diet of this species (Bullock and Smith 1991; Heemstra and Randall 1993, in Froese and Pauly 2003).

3.2.1.7 Blueline Tilefish

Blueline tilefish occur in the Western Atlantic Ocean, ranging from North Carolina to southern Florida and Mexico, including the northern (and probably eastern) Gulf of Mexico (Dooley 1978, in Froese and Pauly 2003). Blueline tilefish are found along the outer continental shelf, shelf break, and upper slope on irregular bottom with ledges or crevices, and around boulders or rubble piles in depths of 30-236 meters (98-774 feet) and temperatures ranging from 15-23° C (59-73.4º F) (Ross 1978; Ross and Huntsman 1982; Robins and Ray 1986; Parker and Mays 1998).

Blueline tilefish have a low resilience to overfishing, with a minimum population doubling time of 4.5-14 years. Maximum reported size is 90 centimeters (35.7”) TL and maximum weight is 7 kilograms (15 pounds) (Dooley 1978, in Froese and Pauly 2003). Blueline tilefish live for at least 42 years. Spawning occurs at night, from February to October, with a peak in May at depths of 48-232 meters (157-761 feet) (Harris and Wyanski (in review)). This species feeds primarily on benthic invertebrates and fishes (Dooley 1978, in Froese and Pauly 2003).

3.2.2 Status of Target Species

3.2.2.1 Snowy Grouper

At its December 2005 meeting, the Council voted to approve Amendment 13C to the Snapper Grouper Fishery Management Plan. The Amendment was submitted to the Secretary of Commerce on February 23, 2006. Amendment 13C was approved on August 14, 2006 and was implemented on October 23, 2006.

Management measures for the commercial snowy grouper fishery – Reduce the annual commercial snowy grouper quota from 344,508 pounds gutted weight (406,519 pounds whole weight) to 151,000 pounds gutted weight (178,000 pounds whole weight) in year 1(2006); to 118,000 pounds gutted weight (139,000 pounds whole weight) in year 2; and to 84,000 pounds gutted weight (99,000 pounds whole weight) in year 3 onwards until modified. Specify a commercial trip limit of 275 pounds gutted weight (325 pounds whole weight) during year 1; 175 pounds gutted weight (210 pounds whole weight) during year 2; and 100 pounds gutted weight (115 pounds whole weight) during year 3 onwards until modified. These trip limits apply until the quota is met. After the commercial quota is met, all purchase and sale is prohibited and harvest and/or possession is limited to the bag limit.

Management measures for the recreational snowy grouper fishery – Limit the possession of snowy grouper to one per person per day within the 5-grouper per person per day aggregate recreational bag limit.

The measures in Amendment 13C that end overfishing of snowy grouper went into effect on October 23, 2006, well before Amendment 14. Snowy grouper will still be overfished but the measures taken in Amendment 13C will end over fishing on during 2009.

SEDAR 4 (2004) Assessment

The SEDAR 4 (2004) assessment determined that snowy grouper was overfished and experiencing overfishing. The data workshop convened in Charleston, SC during the week of November 3, 2003 to examine data from eight deep-water species for assessment purposes. The group determined that data and available resources were adequate to conduct assessments on snowy grouper and tilefish. Four indices were available for snowy grouper: a logbook index, headboat index, MARMAP trap index, and MARMAP short longline index. The assessment workshop chose not to use the logbook index for snowy grouper since this species forms aggregations and has been taken in large numbers over wrecks. Commercial and recreational landings as well as life history information from fishery-independent and fishery-dependent sources were used in the assessment.

Parameter estimates were made for several time periods of management interest. These include annual exploitation rate, fishing mortality rate, total landings, number of recruits, mature biomass, and total biomass. Results show a population beginning to decline as early as 1966, reaching its lowest levels in the most recent years. Increasing exploitation of snowy grouper begins at about the same time as the population decline, which coincides with an increase in the reported landings of snowy grouper. Stock status at the beginning of 2002 (the end of the assessment period) was analyzed relative to the benchmarks listed above. The maximum fishing mortality threshold (MFMT; limit fishing mortality reference point) is assumed equal to E_{MSY} or F_{MSY}, depending on the preferred measure of exploitation. Fishing status was determined relative to these. Overfishing of snowy grouper began in the mid 1970’s and has continued since. The response to fishing pressure was a steady population decline to levels below SSB_{MSY} starting in the early 1980’s. The Assessment Workshop concluded that snowy grouper was overfished and overfishing was occurring in 2002. In the absence of fishing it was determined that it would take 13 years to rebuild the stock to B_{MSY}. The maximum recommended rebuilding time is 34 years based on the formula: T_{MIN} (13 years) + one generation time (21 years). The Council is currently considering alternative rebuilding schedules and strategies for snowy grouper in Amendment 15 to the Snapper Grouper FMP.

The estimated stock status for snowy grouper in 2002 is quite low, median of 18% for $SSB(2002)/SSB_{MSY}$. This corresponds to a stock status in 2002 relative to the virgin stock size [SSB(2002)/SSBvirgin] of about 5%. The input data for the assessment model do not include a consistent abundance index that covers the whole time period of the model. The headboat CPUE and length composition data extends back to 1972, but changes in the fishery make interpretation of the observed trends in this index difficult. The headboat fishery moved inshore during the data period and consequently selectivity in the fishery changed. In the age-structured modeling, this was accommodated by dividing the headboat index into three time periods: with constant selectivity in 1972–1976, a possibly different constant selectivity in 1992–2002, and selectivity varying between them in 1977–1991. The other abundance indices do not start until 1990 or later. Therefore, the model must rely on data sources other than abundance indices for determining stock status.

Other data that provide information on stock status are the average weight and length from the fisheries landings as well as the observed age and length composition data. The 2002 average weights and lengths from the commercial fisheries suggest the population is at very low levels. The average weight and length in 2002 from the handline fishery suggests the population is near 11% and 3% of SSB_{MSY}, respectively. The average weight and length in 2002 from the longline fishery suggests the population is near 44% and 28% of SSB_{MSY}, respectively. The length composition data from the most recent years (2000-2002) also suggests a depleted population of snowy grouper. The observed length distributions are skewed toward smaller fish compared to equilibrium, virgin state length composition.

<u>Review of Previous Stock Assessments</u>

Snowy grouper has been assessed for the 1988, 1990, 1996, and 1999 fishing years (Huntsman *et al.* 1992; Potts *et al.* 1998; Potts and Brennan 2001). The 1988 and 1990 assessments used limited age and growth data and ½ L_∞ as the age of maturity to estimate static SPR. The 1996 and 1999 assessments used up-to-date age data and reproductive biology data. The resulting static SPRs were 15%, 15%, 5%, and 10% for the 1988, 1990, 1996, and 1999 fishing years, respectively.

The stock assessment for snowy grouper in 1990 (PDT 1990b) used data from 1972 through 1988/89 (Table 3-2). Spawning Stock Ratio (SSR) was calculated separately for recreational and commercial fisheries:

Table 3-2. Spawning Stock Ratio (SSR) values for snowy grouper from PDT (1990b).

SPECIES	RECREATIONAL	COMMERCIAL
Snowy Grouper	Carolinas = 10%	Carolinas = 15%
		Florida = 36 - 40%

A series of stock assessments conducted by NMFS (1991), Huntsman *et al.* (1992); and Potts and Brennan (2001) provided estimates of SSR/SPR based on catch curves (Table 3-3).

Table 3-3. Spawning Stock Ratio (SSR) values for snowy grouper from NMFS (1991); Huntsman *et al.* (1992); and Spawning Potential Ratio from Potts and Brennan (2001).

Species	Assessment Year	Catch Data From	Overall SSR
Snowy Grouper	1991	1988	15%
	1992	1990	15%
	2001	2000	10 - 19%

Landings information

During 1999-2004, 73% of the commercial catch was taken with hook and line gear and 27% was caught with longline gear. Most snowy grouper were landed off North Carolina followed by Florida (Monroe County and Eastern Florida), South Carolina, and Georgia (Table 3-4).

Table 3-4. The percentage of snowy grouper landed by state during 1999-2003. Source: NMFS Accumulative Landings System.

Area	Percent
North Carolina	39.5
South Carolina	23.0
Monroe County	19.7
Eastern Florida	16.4
Georgia	1.4

Landing peaked in 1997 at 718,000 pounds whole weight but decreased to 268,000 pounds whole weight in 2004 (Figure 3-1). Regulations, which may have affected the catch of snowy grouper, are shown in Table 3-5 and Figure 3-1.

Table 3-5. Snowy grouper regulations.

Regulation	Effective Date	Plan or Amendment
Prohibit trawls	1/12/89	Amendment 1 (SAFMC 1988)
Prohibit fish traps, entanglement nets & longlines within 50 fathoms; 5 grouper bag limit; rebuilding timeframe	1/1/92	Amendment 4 (SAFMC 1991)
Commercial quota phased-in: 540,314 lbs gutted weight in 1994 442,448 lbs gutted weight in 1995 344,508 lbs gutted weight in 1996 onwards; Commercial trip limits = 2,500 lb (gutted); Commercial bycatch limit = 300 lbs (gutted); Snowy grouper added to grouper aggregate bag limit; Established *Oculina* Experimental Closed Area	7/27/94	Amendment 6 (SAFMC 1993)
Limited entry program: transferable permits and 225-lb non-transferable permits	12/14/98	Amendment 8 (SAFMC 1997)
Vessels with longlines may only possess deepwater species	2/24/99	Amendment 9 (SAFMC 1998c)

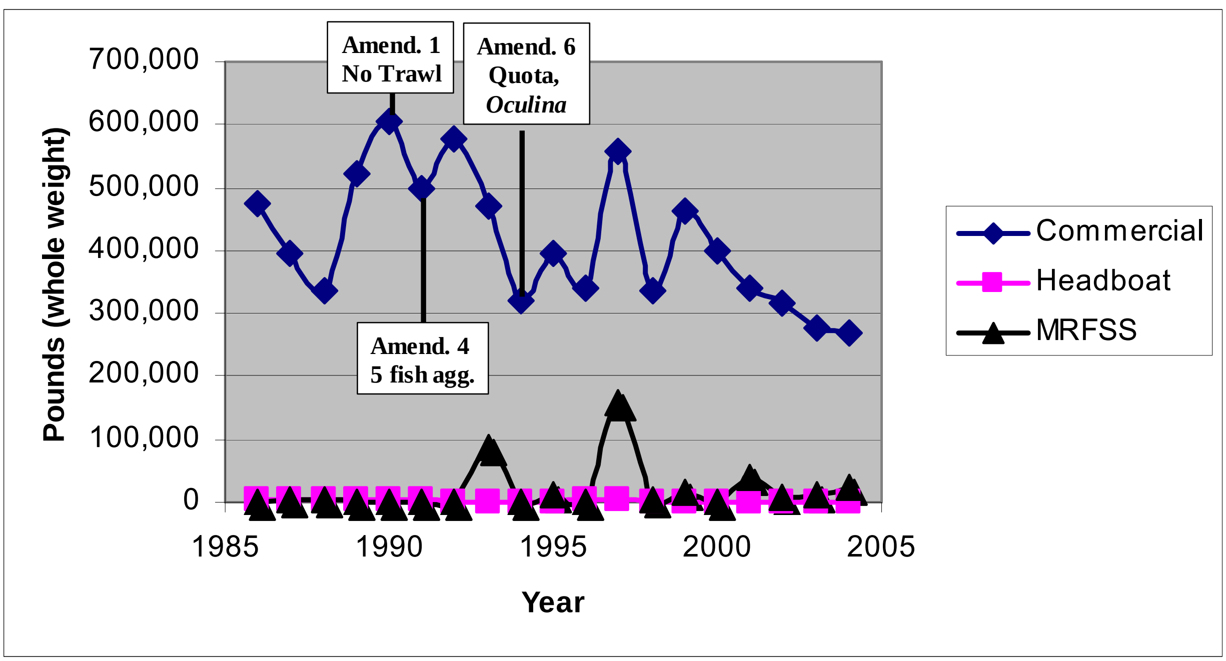


Figure 3-1. Annual landings (pounds whole weight) of snowy grouper 1986-2004. Source: Commercial landings are from the NMFS Accumulative Landings System (ALS), Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

Snowy grouper are primarily taken by commercial fishermen (Figure 3-2). Recreational catch is minor because this is a deepwater species. Based on data from ALS, MRFSS, and the Headboat Survey, recreational landings made up about 4% of the landings during 1999-2003. The mean length of snowy grouper taken with all commercial gear decreased from an average of 25.3" total length in 1984 to 21.1" total length in 2003 (Figure 3-3). The mean length of snowy grouper taken by headboat and recreational fishermen also exhibited declining trends during 1984-2004; however, there was considerable fluctuation due to the small sample sizes.

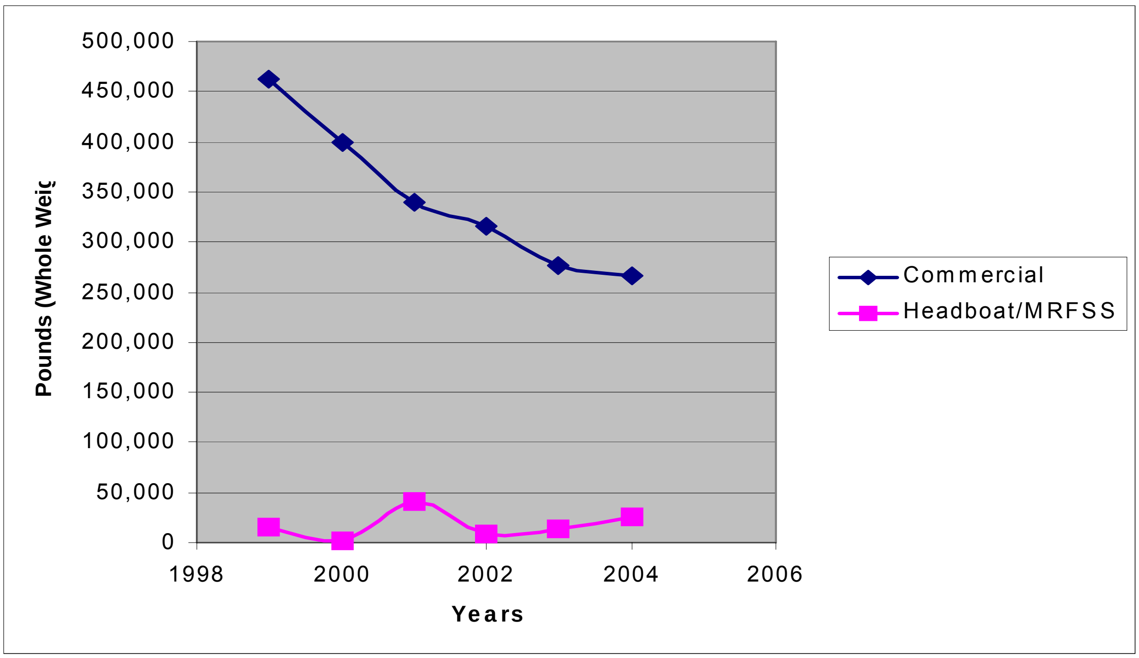


Figure 3-2. Annual landings (pounds whole weight) of snowy grouper (1999-2004). Source: Commercial landings are from the NMFS Accumulative Landings System (ALS), Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

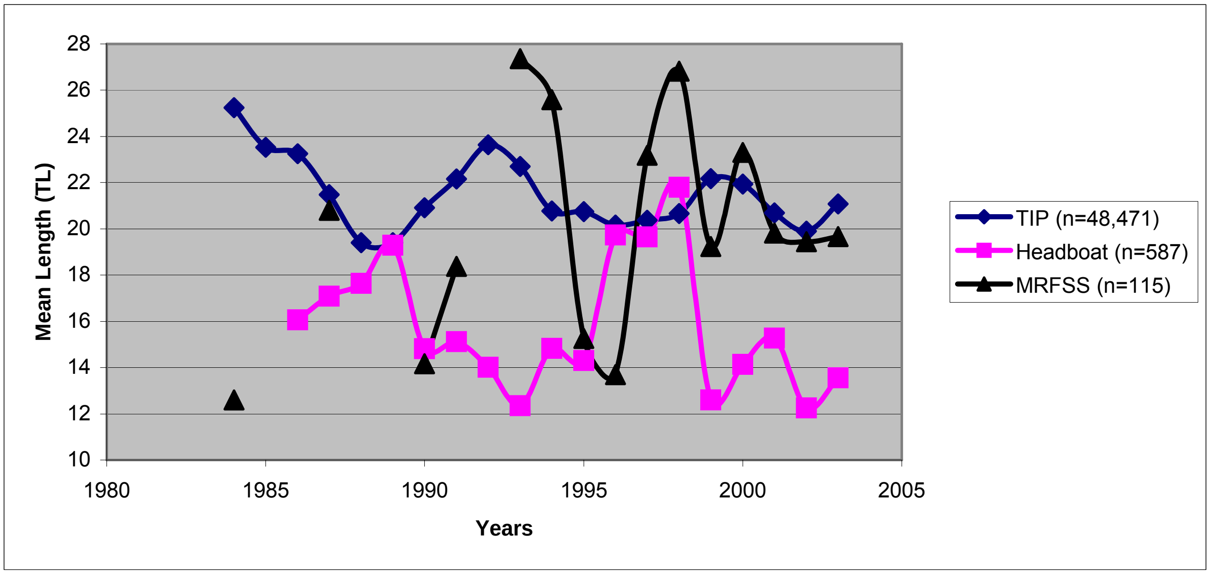


Figure 3-3. Mean lengths (inches, total length) of snowy grouper taken by commercial, headboat, and recreational (MRFSS) fishermen during 1984-2003.

There are reports from North Carolina and South Carolina fishermen of newly found "virgin" reefs with un-fished snowy grouper populations. Reports suggested that these reefs were discovered in the late 1980's and then again in the late 1990's. The reef discovered in the late 1980's was named Adrian's Mark and is reported by Epperly and Dodrill (1995). The effect of catches from this location on the average weight and length data can be seen in Figure 3-4 and Figure 3-5 in 1991-1993. The most recent virgin reef discovery is a site referred to as the "snowy wreck," which is a proposed MPA site. The brief increase in size of landed fish in 1991-1993 and 1999-2000 is apparently a direct result of fishermen finding virgin reef sites and rapidly exploiting them in 2-3 years.

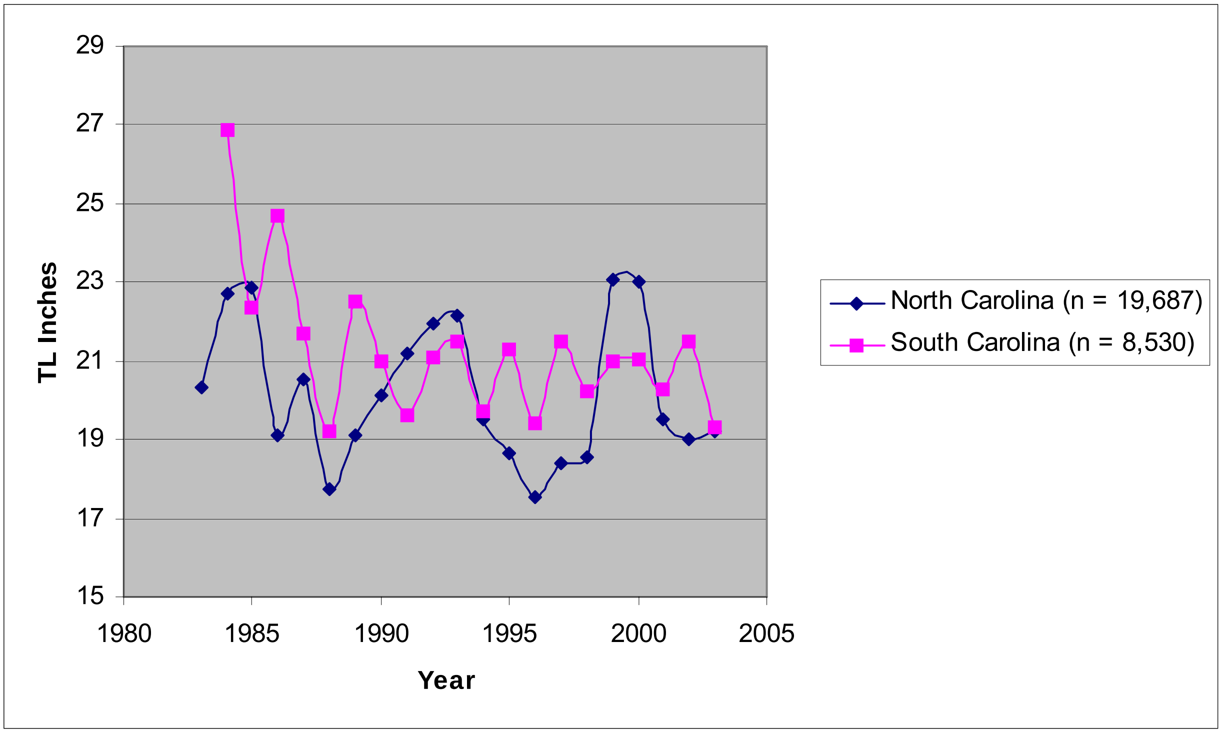


Figure 3-4. Mean lengths (inches, total length) of snowy grouper taken by commercial fishermen off South Carolina and North Carolina.

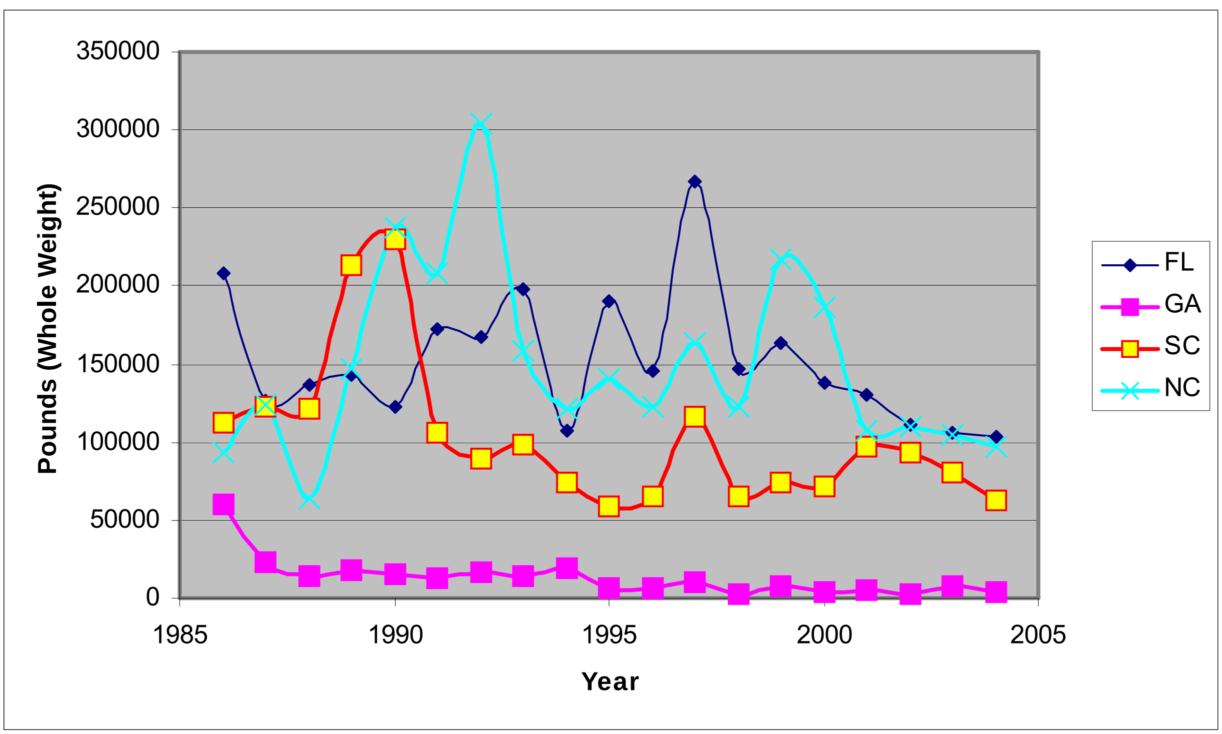


Figure 3-5. Commercial landings of snowy grouper by state.

3.2.2.2 Golden Tilefish

At its December 2005 meeting, the Council voted to approve Amendment 13C to the Snapper Grouper Fishery Management Plan. The Amendment was submitted to the Secretary of Commerce on February 23, 2004. Amendment 13C was approved on August 14, 2006 and became effective on October 23, 2006.

Management measures relating to golden tilefish were implemented for the commercial and recreational fisheries in Amendment 13C. The annual commercial golden tilefish quota was reduced from 1,001,663 pounds gutted weight (1,121,863 pounds whole weight) to 295,000 pounds gutted weight (331,000 pounds whole weight). After the commercial quota is met, all purchase and sale is prohibited and harvest and/or possession is limited to the bag limit. There is a commercial trip limit of 4,000 pounds gutted weight (4,480 pounds whole weight) until 75% of the quota is taken when the trip limit is reduced to 300 pounds gutted weight (335 pounds whole weight); the trip limit will not be adjusted downwards unless percent specified is captured on or before September 1.

For the recreational fishery, the possession of golden tilefish is limited to one per person per day within the 5-grouper per person per day aggregate recreational bag limit.

The measures in Amendment 13C that end overfishing of golden tilefish went into effect on October 23, 2006, well before Amendment 14. The measures taken in Amendment 13C ended overfishing of golden tilefish immediately.

SEDAR 4 (2004) Assessment

The SEDAR 4 (2004) stock assessment determined golden tilefish was experiencing overfishing but was not overfished. There were two indices of abundance available for the golden tilefish stock assessment. A fishery-independent index was developed from MARMAP horizontal longlines. A fishery-dependent index was developed from commercial logbook data during the data workshop. Commercial and recreational landings as well as life history information from fishery-independent and fishery-dependent sources were used in the assessment. A statistical catch-at-age model and a production model were used to assess the golden tilefish population.

Exploitation status in 2002 was analyzed relative to the maximum fishing mortality threshold (MFMT; limit reference point in *F*). The MFMT was assumed equal to E_{MSY} or F_{MSY}, depending on the measure of exploitation. Stock status in 2002 was estimated relative to SSB_{MSY} and to maximum spawning size threshold (MSST). The MSST was computed as a fraction *c* of SSB_{MSY}. Restrepo *et al.* (1998) recommend a default definition for that fraction: $c=\max(1 - M,1/2)$, where *M* is the natural mortality rate. However, this definition does not account for age-dependent *M*, as was used in this assessment. Hence to accommodate the default definition, a constant *M* was computed that would correspond to an age-dependent *M*, by providing the same proportion of survivors at the maximum observed age [$M = -\log(P)/A$, where *P* is the proportion of survivors at maximum observed age *A*]. This value of constant *M* was computed uniquely for each of the MCB runs.

Overfishing of golden tilefish (F>MFMT) began in the early 1980's and has continued in most years since then. The population responded to the fishing with a steady population decline to levels near SSB_{MSY} starting in the mid-1980s. The median value of $E(2002)/E_{MSY}$ is 1.55, with a 10^{th} to 90^{th} percentile range of [0.77 - 3.25]. The median value of $F(2002)/F_{MSY}$ is 1.53, with a range of [0.72 - 3.31]. The median value of $SSB(2002)/SSB_{MSY}$ is 0.95, with a range of [0.61 - 1.53]. The median value of SSB(2002)/MSST is 1.02, with a range of [0.65 - 1.67].

It appears likely that overfishing was occurring in 2002; however, it is less clear whether the stock was overfished in 2002. The data do not include an abundance index that covers the entire assessment period. To determine stock status, therefore, the assessment must rely in part on other data sources, such as average weight and length from landings as well as the observed age and length composition data. This was explored in the following way: Assuming an equilibrium age-structure, the predicted average weight of landed fish from commercial fisheries is portrayed as a function of stock status. The average weight in 2002 from the handline fishery suggests that the population is near 52% of SSB_{MSY}; the average weight in 2002 from the longline fishery suggests that the population is near 100.1% of SSB_{MSY}. Taken together, these results are consistent with those from the assessment model that the stock is on the border between overfished and not overfished, and that the variability around the point estimate of stock status includes both possibilities. The length composition data from the most recent years (2000 to 2002) also suggests that golden tilefish SSB is near SSB_{MSY}. Observed length distributions are skewed toward smaller fish as compared to an equilibrium virgin length composition, but correspond to the predicted length composition at SSB_{MSY}. Under F=0, the median projection depicts a tilefish stock that recovers to SSB_{MSY} within one year.

Review of Previous Stock Assessments

Spawning stock ratio information by state from PDT (1990b) is provided in Table 3-6. Golden tilefish was assessed (Table 3-7) for the 1988, 1990, and 2000 fishing years (Huntsman *et al.* 1992; Potts and Brennan 2001). The assessments of 1988 and 1990 fishing year data used limited age information from Georgia and reproductive biology data were not available. The assumption of ½ L_{∞} as the age of maturity was used for estimating the static SPR. Static SPR values were 31% and 21% for 1988 and 1990, respectively. The assessment of the 2000 fishing year used age and reproductive biology data from North Carolina and South Carolina. The resulting static SPR was 20-34%.

Table 3-6. Spawning Stock Ratio (SSR) values for golden tilefish.
Source: PDT 1990b.

SPECIES	RECREATIONAL	COMMERCIAL
Golden Tilefish		Carolinas = 35%
		North Florida = 28%
		South Florida = 42%

A series of stock assessments conducted by NMFS (1991), Huntsman *et al.* (1992); and Potts and Brennan (2001) provided estimates of SSR/SPR based on catch curves (Table 3-7).

Table 3-7. Spawning Stock Ratio (SSR) values for golden tilefish.
Source: NMFS (1991); Huntsman *et al.* (1992); and Spawning Potential Ratio from Potts and Brennan (2001).

Species	Assessment Year	Catch Data From	Overall SSR
Golden Tilefish	1991	1988	31%
	1992	1990	21%
	2001	2000	20 - 34%

Landings Information

During 1999-2004, most golden tilefish were landed off East Florida followed by South Carolina (Table 3-8). About 91% of the commercial catches were taken with longline gear.

Table 3-8. The percentage of golden tilefish landed by state during 1999-2003.
Source: Accumulative Landings System.

Area	Percent
East Florida	64.4
South Carolina	27.8
Monroe County	4.1
North Carolina	3.6
Georgia	0.1

Landings of golden tilefish were greater than 1,000,000 pounds whole weight during 1990-1993 but have generally been less than 600,000 pounds gutted weight since 1996 (Figure 3-6). The proposed quota of 285,000 pounds gutted weight would not have been met in 2003 or 2004.

Regulations, which may have affected the catch of golden tilefish, are shown in Table 3-9 and Figure 3-6.

Table 3-9. Golden tilefish regulations.

Regulation	Effective Date	Plan or Amendment
Prohibit trawls	1/12/89	Amendment 1 (SAFMC 1988)
Prohibit fish traps, entanglement nets & longlines within 50 fathoms; 5 grouper bag limit; rebuilding timeframe	1/1/92	Amendment 4 (SAFMC 1991)
Commercial quota phased-in: 1,475,795 lbs gutted weight in 1994 1,238,818 lbs gutted weight in 1995 1,001,663 lbs gutted weight in 1996 onwards; Commercial trip limit = 5,000 lbs (gutted); Commercial bycatch limit = 300 lbs (gutted); Golden tilefish added to grouper aggregate bag limit; Established *Oculina* Experimental Closed Area.	7/27/94	Amendment 6 (SAFMC 1993)
Limited entry program: transferable permits and 225-lb non-transferable permits	12/14/98	Amendment 8 (SAFMC 1997)
Vessels with longlines may only possess deepwater species	2/24/99	Amendment 9 (SAFMC 1998c)

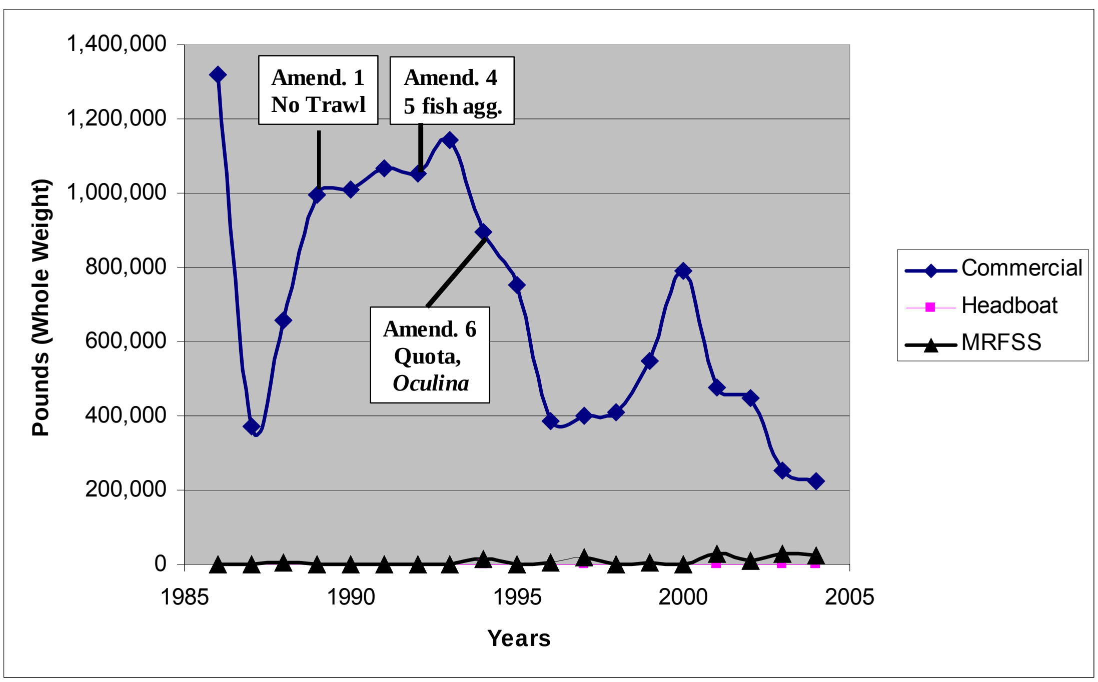


Figure 3-6. Annual landings (pounds whole weight) of golden tilefish 1986-2004. Source: Commercial landings are from the NMFS Accumulative Landings System (ALS), Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

During 1999-2004, about 98% of the golden tilefish were caught by commercial fishermen (Figure 3-7). The mean length of golden tilefish taken by commercial fishermen decreased from 27.9" total length in 1984 to 23.9" total length in 1988 (Figure 3-8). Since 1988, the mean size of commercial golden tilefish has been between 24" and 24.5" total length. Headboat and MRFSS average size has increased over time.

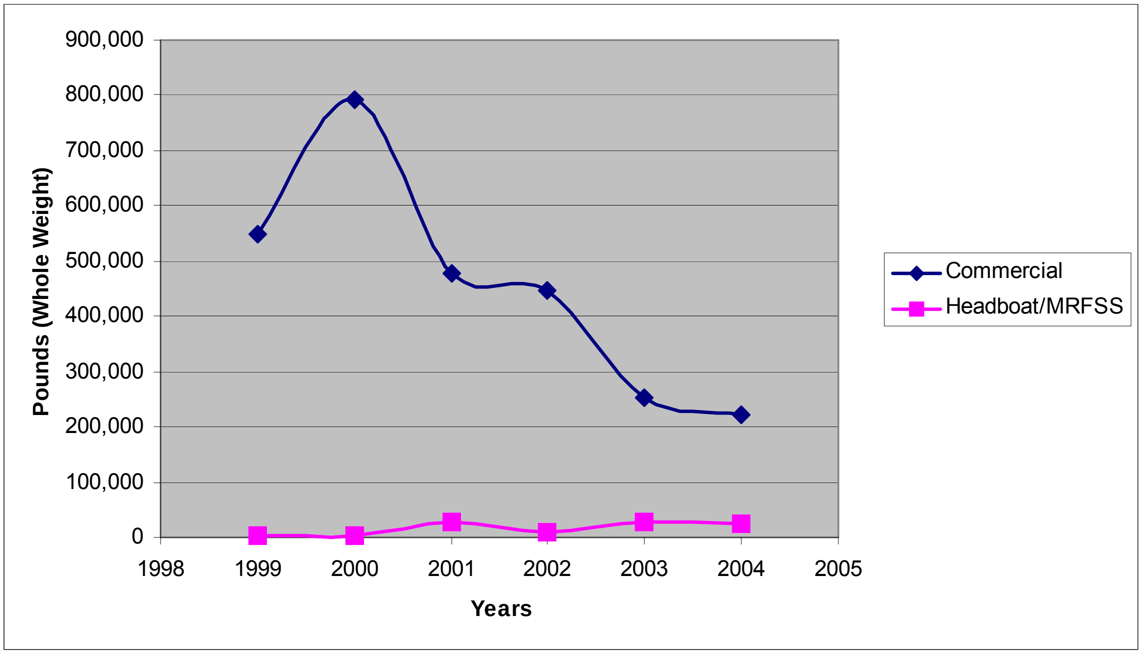


Figure 3-7. Annual landings (pounds whole weight) of golden tilefish (1999-2004). Commercial landings are from the NMFS Accumulative Landings System (ALS). Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

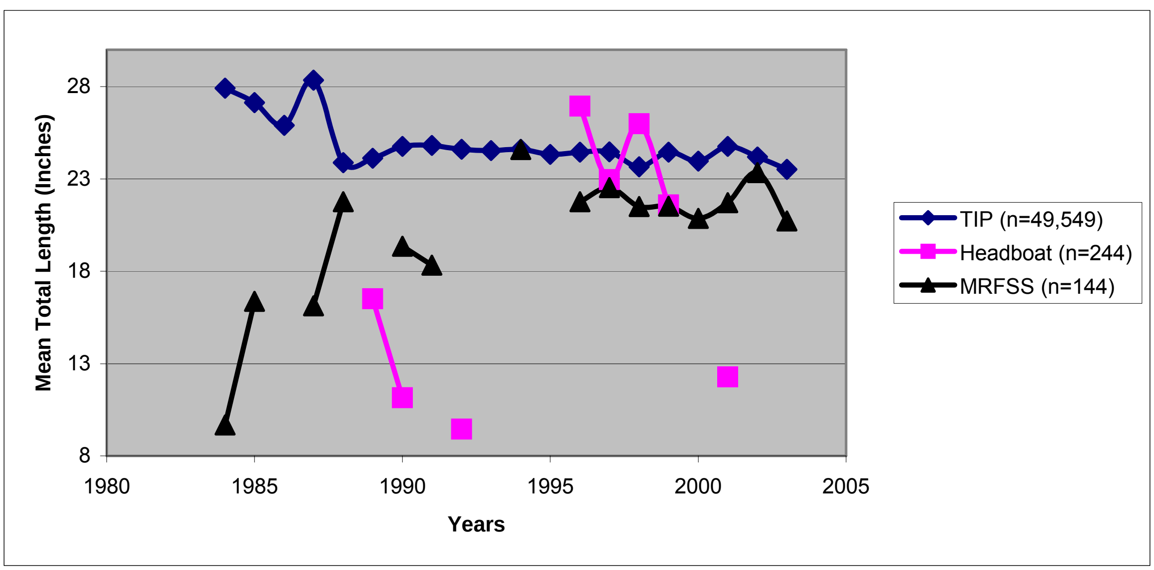


Figure 3-8. Mean lengths (inches, total length) of golden tilefish taken by commercial, headboat, and recreational (MRFSS) fishermen during 1984-2003.

3.2.2.3 Speckled Hind

The 2004 Report to Congress (NMFS 2005) indicates speckled hind are undergoing overfishing and are overfished. Speckled hind was assessed for the 1988, 1990, 1996, and 1999 fishing years (NMFS 1991; Huntsman *et al.* 1992; Potts and Brennan 2001). Length frequencies for each fishing year assessed was constructed from that year's data. Length samples came primarily from the commercial fishery. Lengths for 1996 and 1999 were limited by the management restriction of one speckled hind per trip (Table 3-10). Age and growth data were available but there were no reproductive biology data. The assumption of ½ L_∞ as the age of maturity was used for estimating the static SPR. SPR values were 25%, 12%, 8%, and 5% for 1988, 1990, 1996, and 1999 fishing years, respectively.

Table 3-10. Speckled hind regulations

Regulation	Effective Date	Plan or Amendment
Prohibit trawls	1/12/89	Amendment 1 (SAFMC 1988)
Prohibit fish traps, entanglement nets & longlines within 50 fathoms; 5 grouper bag limit; rebuilding timeframe	1/1/92	Amendment 4 (SAFMC 1991)
Possession limit of 1 per vessel per trip Prohibit sale of speckled hind Established the *Oculina* experimental closed area	7/27/94	Amendment 6 (SAFMC 1993)
Limited entry program: transferable permits and 225-lb non-transferable permits	12/14/98	Amendment 8 (SAFMC 1997)
Vessels with longlines may only possess deepwater species	2/24/99	Amendment 9 (SAFMC 1998c)

Commercial landings decreased during 1986 through 1995 and remained at low levels through 2003 (Figures 3-9 and 3-10). The magnitude of commercial and recreational catch was very similar during 1999 to 2003. However, there was a spike in commercial landings during 2004, which exceeded all values since 1993. The majority of commercial landings during 2004, were from Monroe County, Florida. The mean length of speckled hind caught by commercial fishermen has gradually increased from 17" total length in 1986 to 21" total length in 2004 (Figure 3-11). The mean length of speckled hind caught by headboat fishermen has generally been 11-17" total length with the exception of 2004 when the average size decreased to 9".

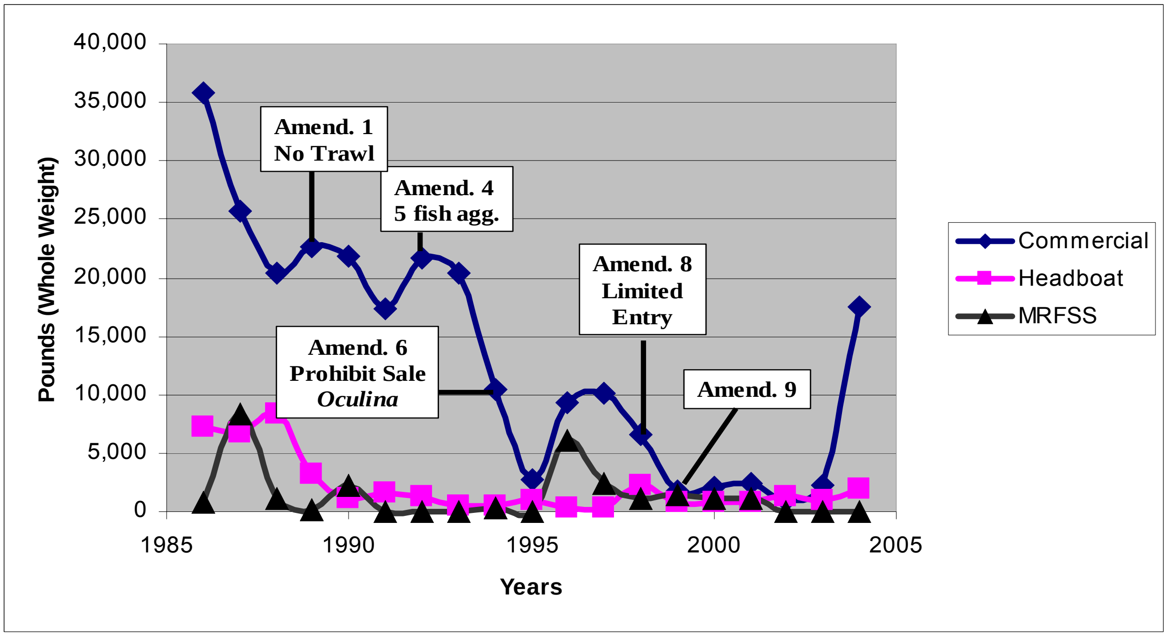


Figure 3-9. Annual landings (pounds whole weight) of speckled hind 1986-2004. Commercial landings are from the NMFS Accumulative Landings System (ALS), Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

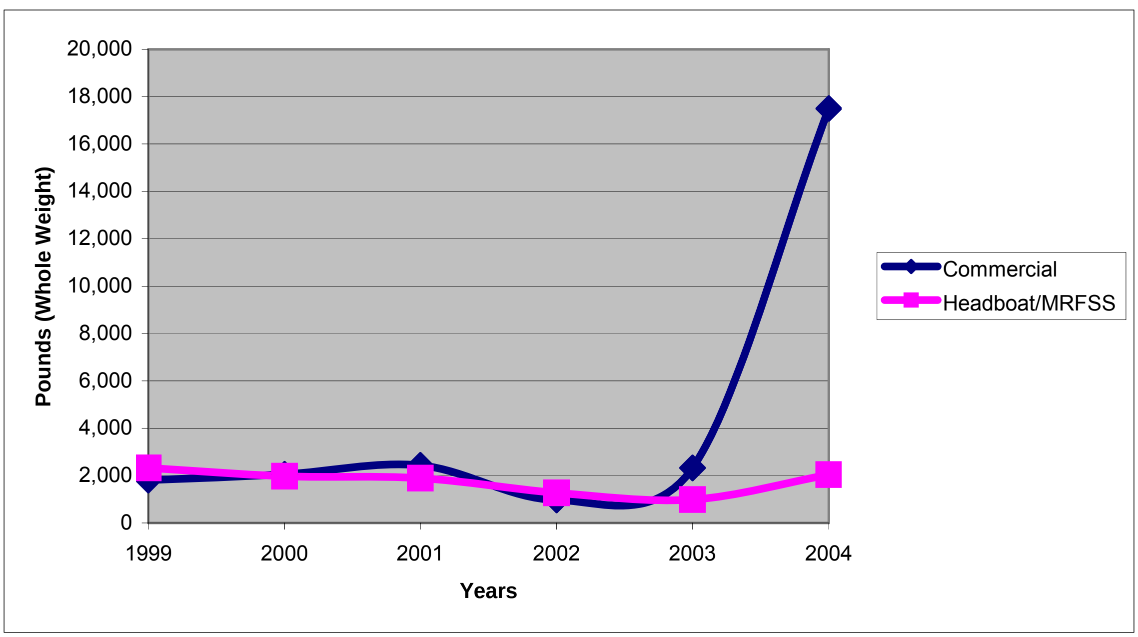


Figure 3-10. Annual landings (pounds whole weight) of speckled hind (1999-2004). Commercial landings are from the NMFS Accumulative Landings System (ALS). Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

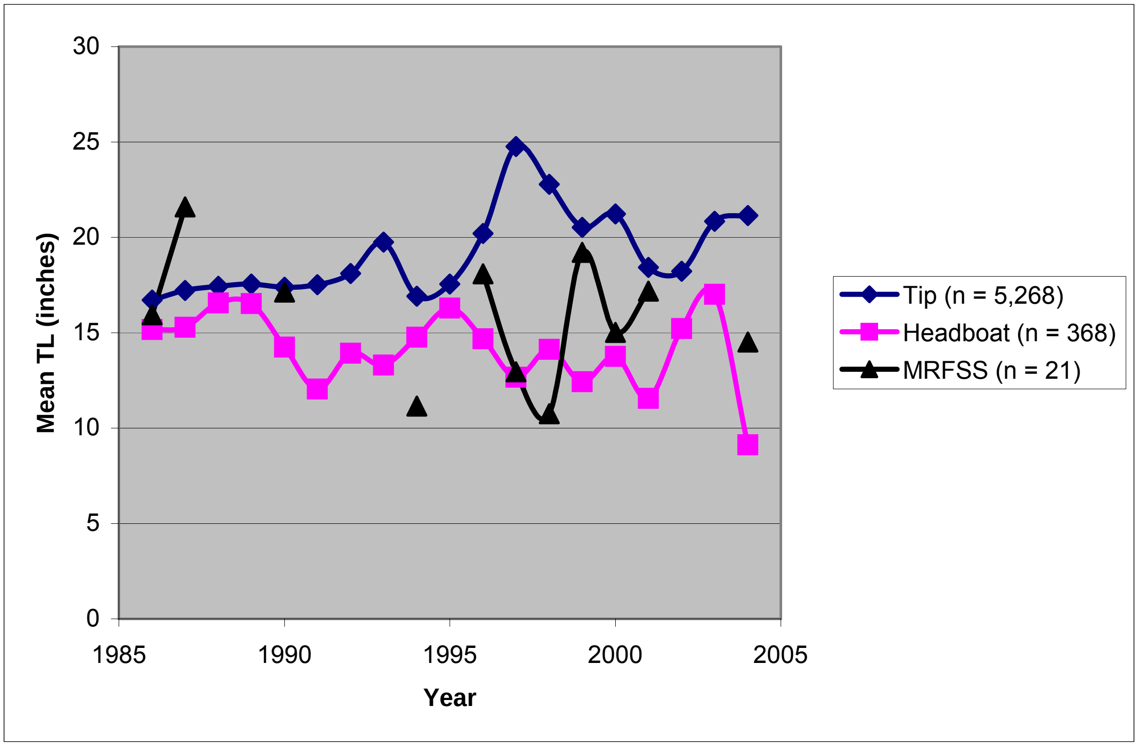


Figure 3-11. Mean lengths (inches, total length) of speckled hind taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2003.

3.2.2.4 Warsaw Grouper

The 2004 Report to Congress (NMFS 2005) indicates Warsaw grouper are undergoing overfishing and are overfished. Warsaw grouper was assessed by catch curve analysis using data from 1988 and 1990 (Huntsman *et al.* 1992). Because Warsaw grouper are infrequently caught, a single length frequency was constructed from several years (e.g., 1983-1988) for the assessment of the 1988 fishing year and 1989-1990 length samples were used for the 1990 fishing year. A limited age length key was applied to the length frequency to obtain catch-at-age data. No reproductive biology data were available; therefore, for SPR calculations the assumption for age-at-maturity was based on ½ L_∞. Static SPR values for Warsaw grouper were 0.2% and 6% for 1988 and 1990 fishing years, respectively. Regulations are shown in Table 3-11.

Table 3-11. History of Warsaw grouper regulations.

Regulation	Effective Date	Plan or Amendment
Prohibit trawls	1/12/89	Amendment 1 (SAFMC 1988)
Prohibit fish traps, entanglement nets & longlines within 50 fathoms; 5 grouper bag limit; rebuilding timeframe	1/1/92	Amendment 4 (SAFMC 1991)
Possession limit of 1 per vessel per trip Prohibit sale of Warsaw grouper Established the *Oculina* experimental closed area	7/27/94	Amendment 6 (SAFMC 1993)
Limited entry program: transferable permits and 225-lb non-transferable permits	12/14/98	Amendment 8 (SAFMC 1997)
Vessels with longlines may only possess deepwater species	2/24/99	Amendment 9 (SAFMC 1998c)

Recreational catch, with considerable fluctuation, has dominated the landings of Warsaw grouper (Figures 3-12). The last peak in harvest occurred in 2003 (Figure 3-13). The mean length of Warsaw grouper caught by commercial and recreational fishermen has increased slightly since 1986; however, sample size is small (Figure 3-14).

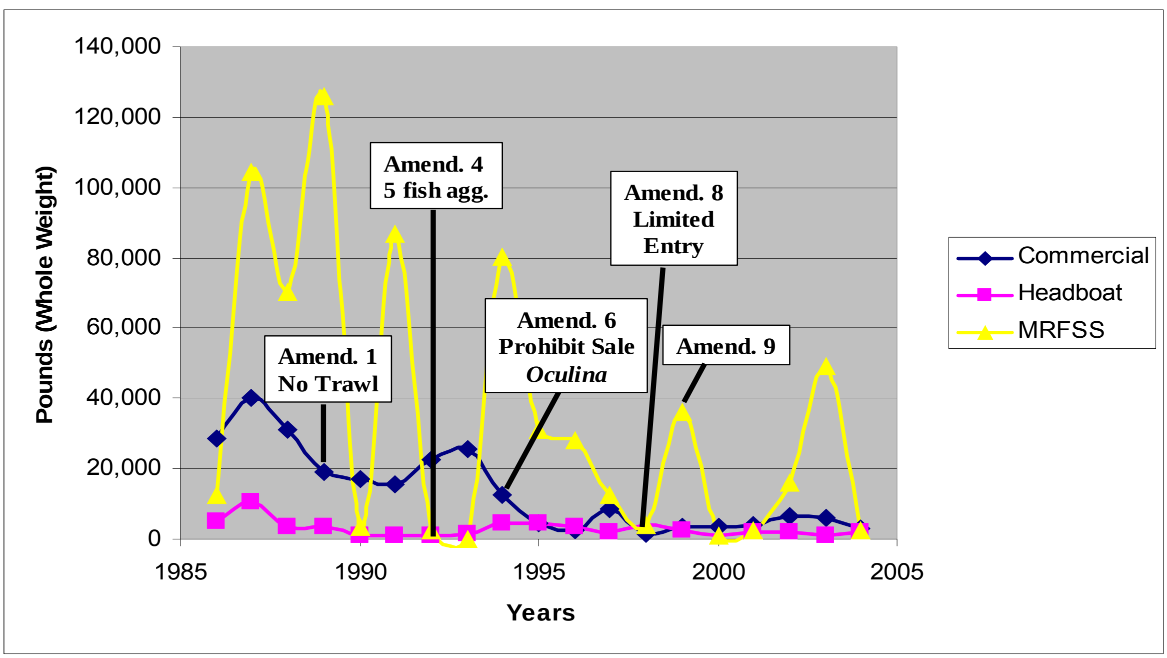


Figure 3-12. Annual landings (pounds whole weight) of Warsaw grouper 1986-2004. Source: Commercial landings are from the NMFS Accumulative Landings System (ALS), Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

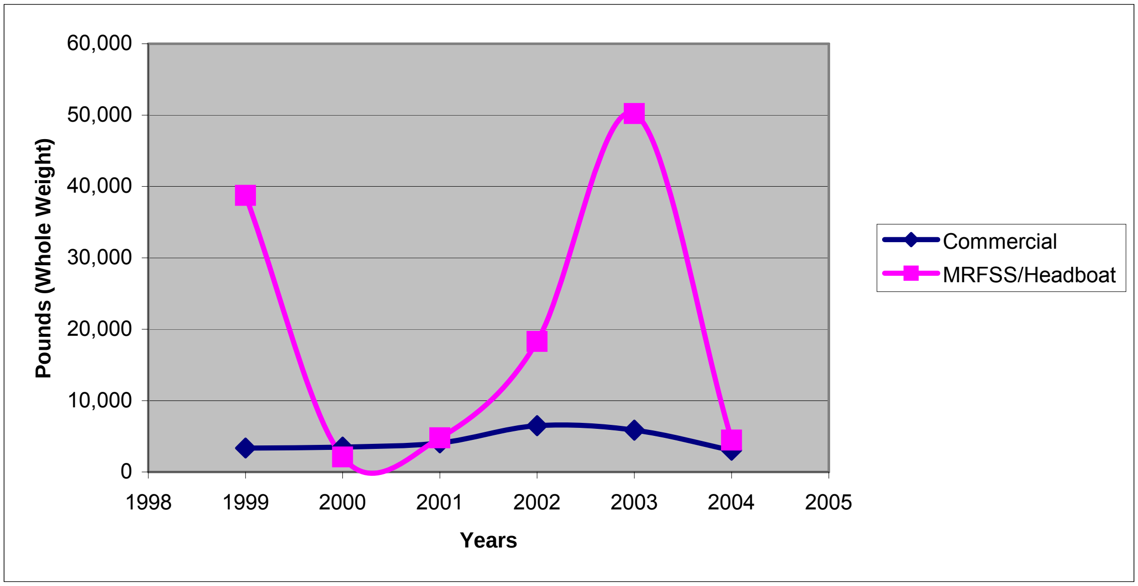


Figure 3-13. Annual landings (pounds whole weight) of Warsaw grouper (1999-2004). Source: Commercial landings are from the NMFS Accumulative Landings System (ALS). Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

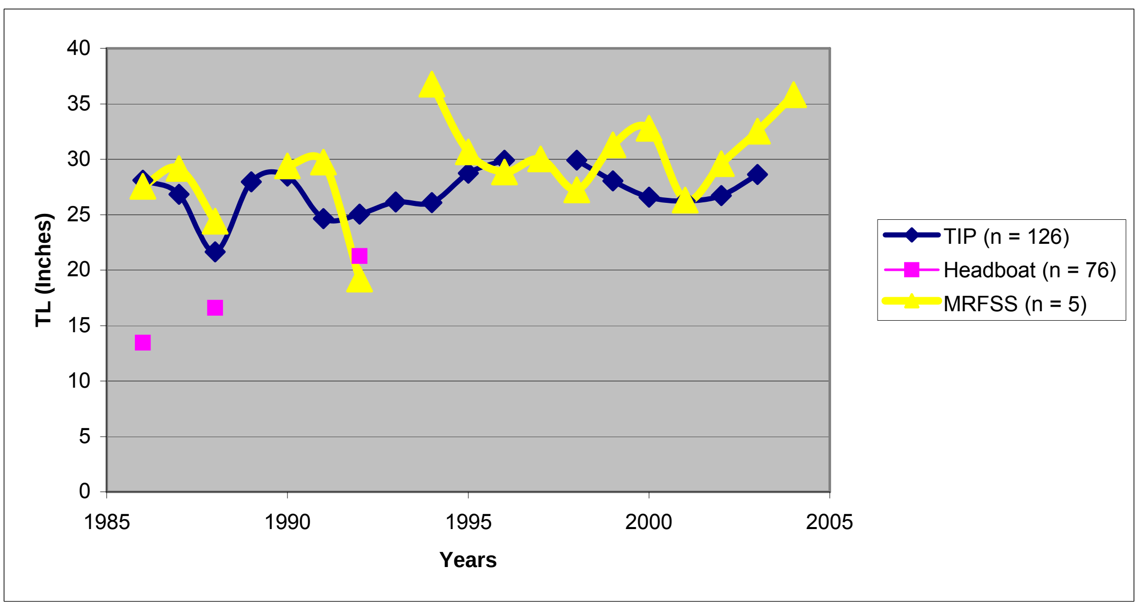


Figure 3-14. Mean lengths (inches, total length) of Warsaw grouper taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2004.

3.2.2.5 Misty Grouper

The 2004 Report to Congress (NMFS 2005) indicates the status of misty grouper is unknown. No assessment of any kind has ever been conducted on this species. Regulations are shown in Table 3-12.

Table 3-12. Misty grouper regulations

Regulation	Effective Date	Plan or Amendment
Prohibit trawls	1/12/89	Amendment 1 (SAFMC 1988)
Prohibit fish traps, entanglement nets & longlines within 50 fathoms; 5 grouper bag limit; rebuilding timeframe	1/1/92	Amendment 4 (SAFMC 1991)
Established the *Oculina* experimental closed area	7/27/94	Amendment 6 (SAFMC 1993)
Limited entry program: transferable permits and 225-lb non-transferable permits	12/14/98	Amendment 8 (SAFMC 1997)
Vessels with longlines may only possess deepwater species	2/24/99	Amendment 9 (SAFMC 1998c)

Commercial landings of misty grouper are minor and have increased from ~200 pounds whole weight in 1991 to 2,900 pounds whole weight in 2004 (Figures 3-15). With the exception of a report of over 30,000 pounds whole weight landed by recreational fishermen in 1987, there is almost no recreational catch of misty grouper. The mean length of misty grouper caught by recreational fishermen has fluctuated between 13" and 22" (Figure 3-16).

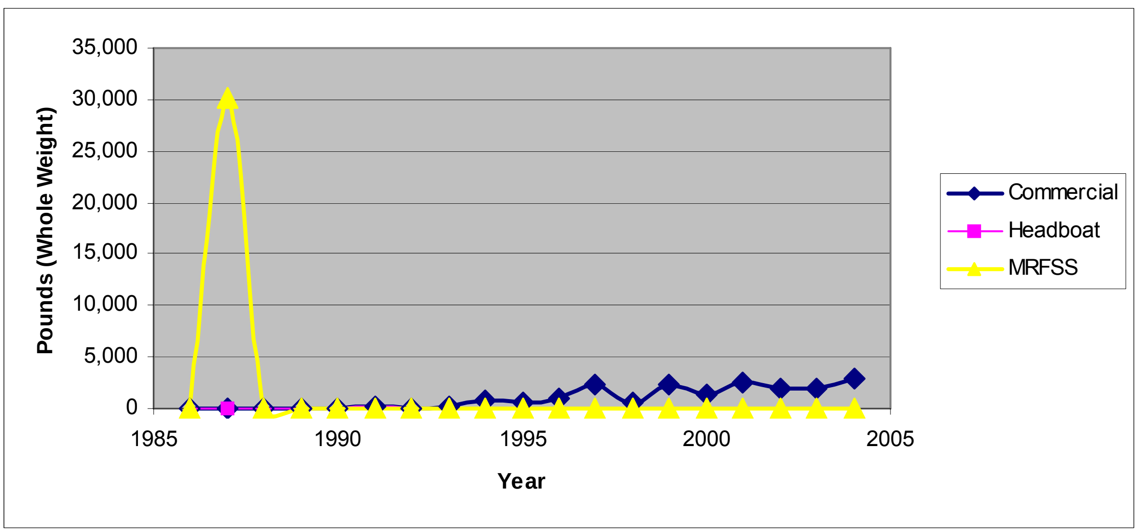


Figure 3-15. Annual landings (pounds whole weight) of misty grouper 1986-2004. Commercial landings are from the NMFS Accumulative Landings System (ALS), Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

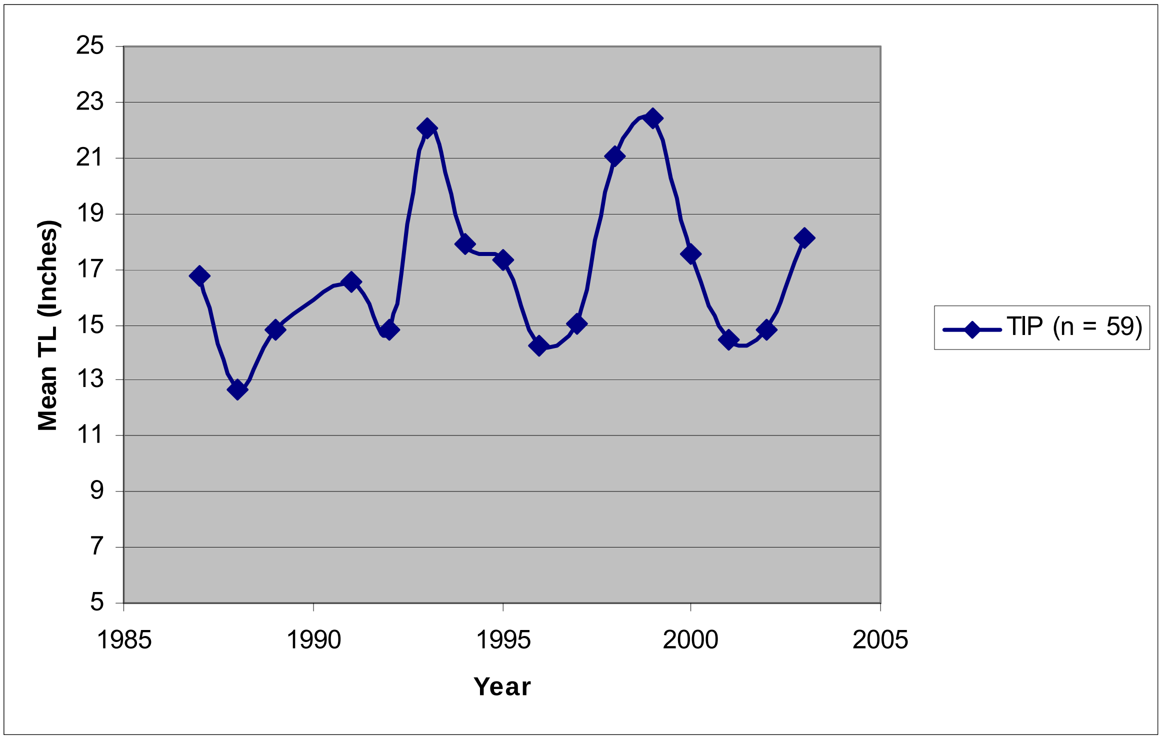


Figure 3-16. Mean lengths (inches, total length) of misty grouper taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2004.

3.2.2.6 Yellowedge Grouper

The 2004 Report to Congress (NMFS 2005) indicates the status of yellowedge grouper is unknown. The yellowedge grouper was assessed for the 1999 fishing year (Potts and Brennan 2001). Age and growth data were from unpublished data based on samples from the Gulf of Mexico. Reproductive biology data based on size were available from the U.S. South Atlantic and converted to age from the Gulf of Mexico age information. The resulting static SPR was 48%. Regulations are shown in Table 3-13.

Table 3-13. Yellowedge grouper regulations

Regulation	Effective Date	Plan or Amendment
Prohibit trawls	1/12/89	Amendment 1 (SAFMC 1988)
Prohibit fish traps, entanglement nets & longlines within 50 fathoms; 5 grouper bag limit; rebuilding timeframe	1/1/92	Amendment 4 (SAFMC 1991)
Established the *Oculina* experimental closed area	7/27/94	Amendment 6 (SAFMC 1993)
Limited entry program: transferable permits and 225-lb non-transferable permits	12/14/98	Amendment 8 (SAFMC 1997)
Vessels with longlines may only possess deepwater species	2/24/99	Amendment 9 (SAFMC 1998c)

Commercial landings of yellowedge grouper have decreased with some fluctuation since 1986 (Figures 3-17). The last peak in harvest occurred in 2000 (Figure 3-18). Recreational landings of yellowedge grouper have been minor. The mean length of yellowedge grouper caught by commercial fishermen declined from 23" total length in 1986 to 20" total length in 2004 (Figure 3-19). Headboat average length was smaller in recent years.

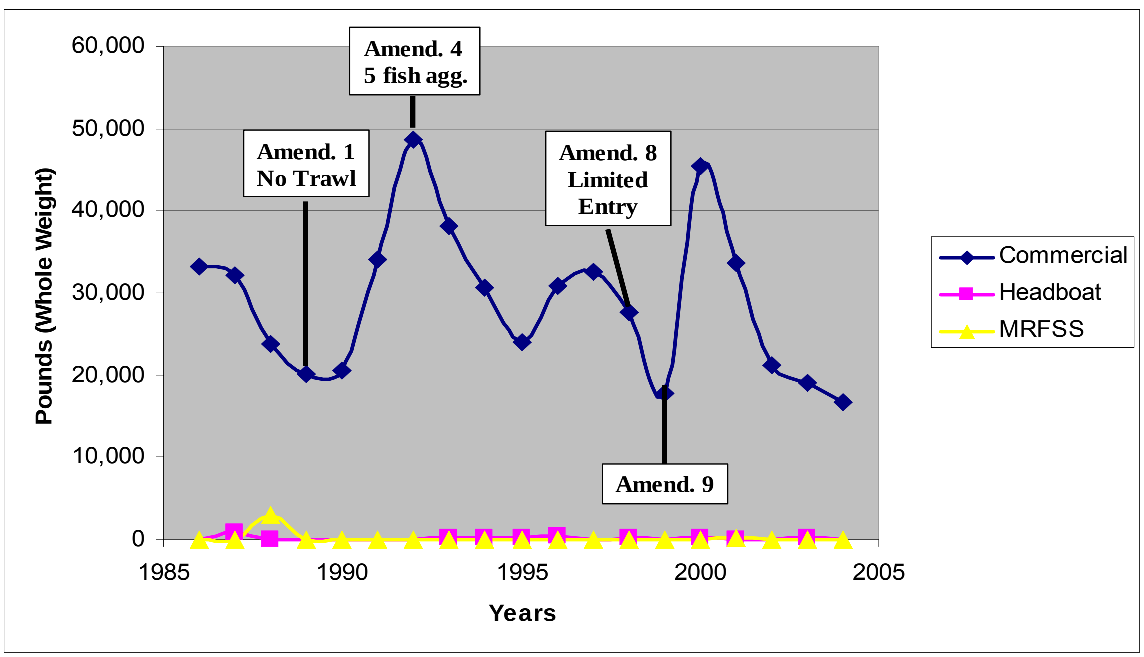


Figure 3-17. Annual landings (pounds whole weight) of yellowedge grouper 1986-2004. Commercial landings are from the NMFS Accumulative Landings System (ALS), Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

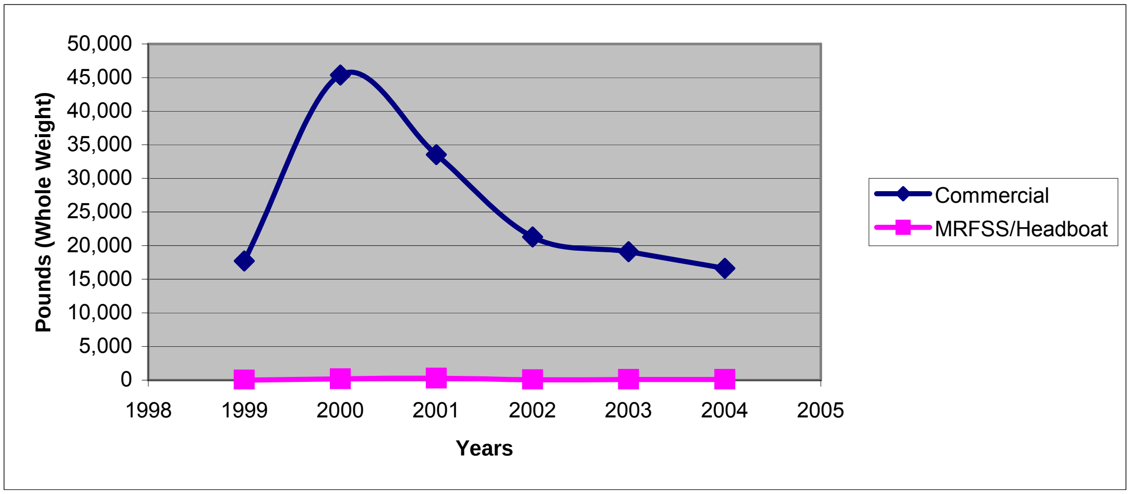


Figure 3-18.Annual landings (pounds whole weight) of yellowedge grouper (1999-2004). Source: Commercial landings are from the NMFS Accumulative Landings System (ALS). Headboat data are from NMFS-Beaufort and MRFSS data are from the MRFSS web site.

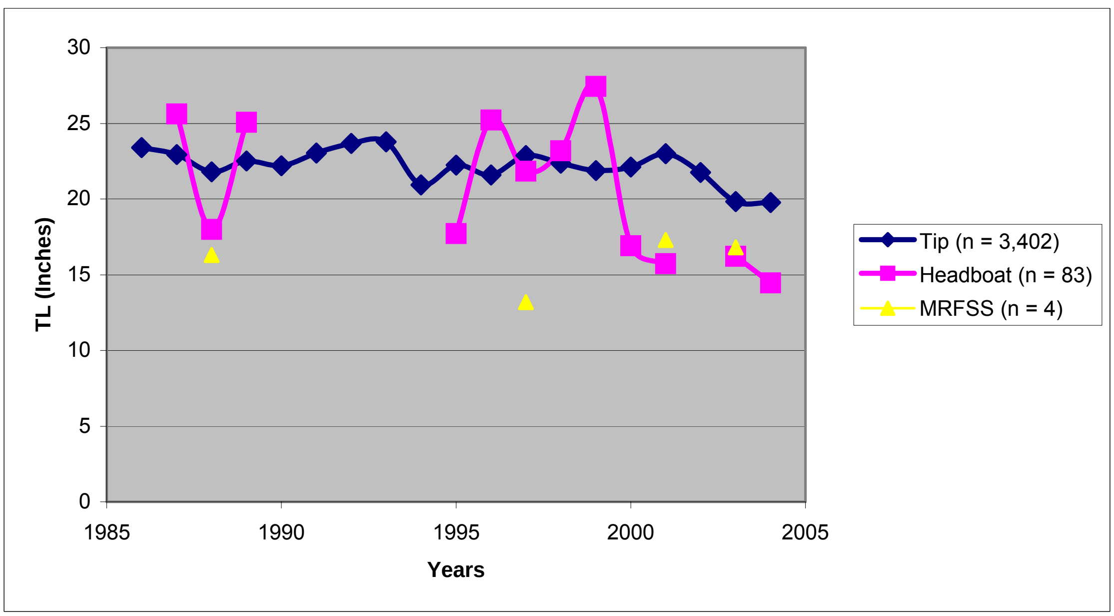


Figure 3-19. Mean lengths (inches, total length) of yellowedge grouper taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2004.

3.2.2.7 Blueline Tilefish

The 2004 Report to Congress (NMFS 2005) indicates the status of blueline tilefish is unknown. No assessment of any kind has ever been conducted on this species. Regulations are shown in Table 3-14.

Table 3-14. Blueline tilefish regulations.

Regulation	Effective Date	Plan or Amendment
Prohibit trawls	1/12/89	Amendment 1 (SAFMC 1988)
Prohibit fish traps, entanglement nets & longlines within 50 fathoms; 5 grouper bag limit; rebuilding timeframe	1/1/92	Amendment 4 (SAFMC 1991)
Blueline added to grouper aggregate bag limit Established *Oculina* Experimental Closed Area.	6/27/94	Amendment 6 (SAFMC 1993)
Limited entry program: transferable permits and 225-lb non-transferable permits	12/14/98	Amendment 8 (SAFMC 1997)
Vessels with longlines may only possess deepwater species	2/24/99	Amendment 9 (SAFMC 1998c)

Commercial catch with has dominated landings of blueline tilefish (Figures 3-20). The last peak in harvest occurred in 2002 (Figure 3-21). Commercial landings have generally decreased since 1993. Recreational catch is minor. The mean length of blueline tilefish caught by commercial and recreational fishermen shows little trend due to small sample sizes (Figure 3-22).

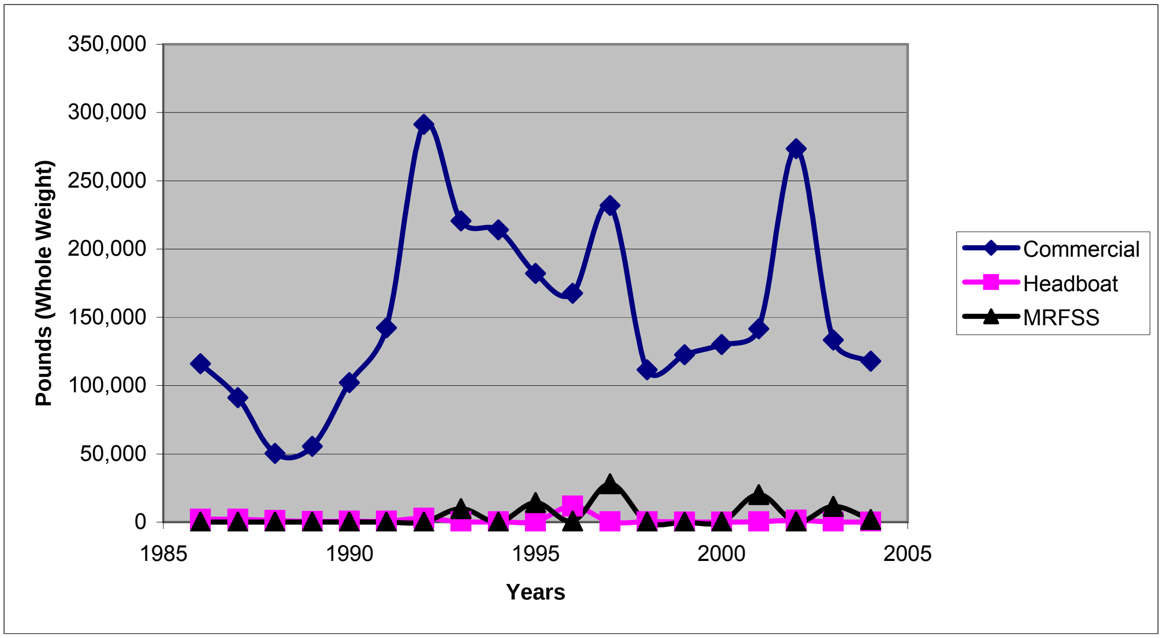


Figure 3-20. Annual landings (pounds whole weight) of blueline tilefish 1986-2004. Source: Commercial landings are from the NMFS Accumulative Landings System (ALS), Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

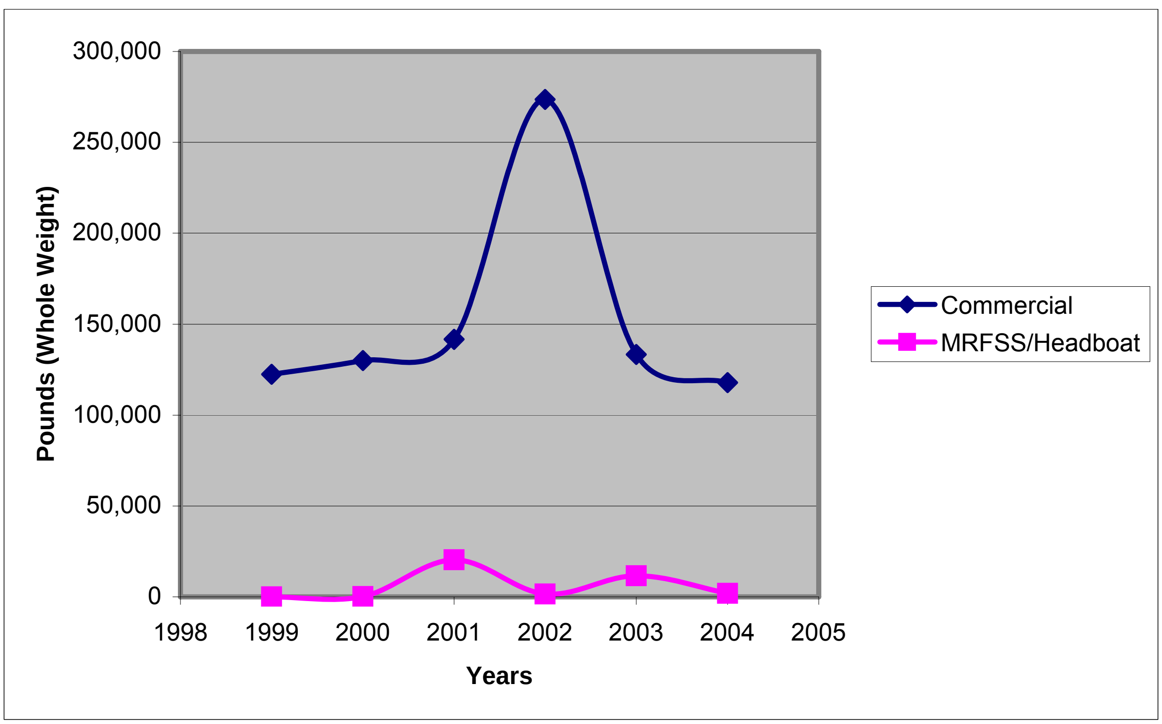


Figure 3-21. Annual landings (pounds whole weight) of blueline tilefish (1999-2004). Source: Commercial landings are from the NMFS Accumulative Landings System

(ALS). Headboat data are from NMFS-Beaufort, and MRFSS data are from the MRFSS web site.

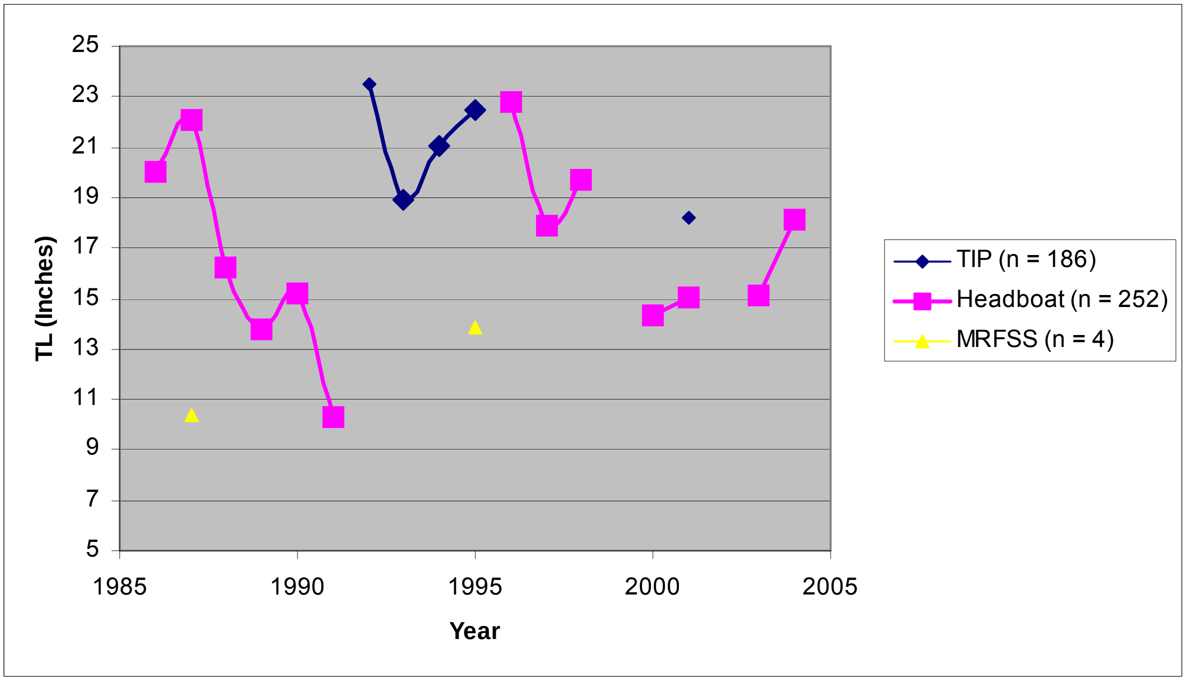


Figure 3-22. Mean lengths (inches, total length) of blueline tilefish taken by commercial, headboat, and recreational (MRFSS) fishermen during 1986-2004.

3.2.3 Other Affected Species

3.2.3.1 Highly Migratory Species

The following information is from a presentation by Chris Rilling, Highly Migratory Species Management Division (NOAA/NMFS) to the South Atlantic Council's Snapper Grouper Committee on June 13, 2006.

In regards to the shark bottom longline fishery, it operates in the Atlantic and the Gulf of Mexico, including the Caribbean, from the Mid-Atlantic Bight to South Florida, and throughout the Gulf. Currently, we have about 100 active vessels out of approximately 250 vessels with directed shark limited access permits. The majority of the vessels are fiberglass vessels approximately fifty-feet in length, although there is a fair amount of variability in the types of vessels operating, depending on the region.

They typically set from five to fifteen miles of longline with anywhere from 500 to 1,500 hooks. Sets typically occur at sunset, soak overnight, and haul back occurs in the morning. We estimate that there are approximately 4,000 to 9,000 total sets per year, depending, of course, on quotas, effort levels, and a whole variety of different factors.

The fishery, at least the bottom longline fishery, primarily targets large coastal sharks. However, other sharks, such as small coastal sharks, pelagic sharks, and dogfish may be caught incidentally. In terms of the commercial shark management measures currently in place, the fishing year operates from January 1st through December 31st.

The large coastal and small coastal shark seasons operate on a trimester basis, that is three seasons a year, the first one running from January 1st to April 30th, the second from May 1st to August 31st, and the third from September 1st to December 31st. Based on the quotas for the large coastal shark fishery, those seasons are normally abbreviated. In other words, they don't run the full four-month duration. This year (2006), for instance, in the South Atlantic the large coastal shark fishery in fact operated only from January 1st through March 15th.

The quotas for large and small coastal sharks are divided among regions, for allocation purposes and because we found that there are clearly some differences in terms of historical landings in the different regions. The regions are the North Atlantic, which runs from Maine to Virginia; the South Atlantic, which runs from North Carolina to the East Florida coast and includes the Caribbean; and the Gulf of Mexico, which runs from Texas to the West Florida coast and the Keys. In terms of the large coastal shark fishery, there are quotas and closure dates, as I mentioned, which are announced prior to the season. There is a 4,000-pound trip limit in place for directed permit holders and there's an incidental trip limit of five sharks per trip for incidental permit holders.

In terms of the small coastal sharks, pelagics, blue, and porbeagle shark fisheries, we will give fourteen days notice prior to a closure. These quotas have in recent years not been met and so the fishery has stayed open for that duration, for instance, for the first trimester season, from January 1st through April 30th, and then moved seamlessly into the second season for those three or four different species.

They are quota managed and so there are quotas for each of those different stocks. However, as I mentioned, those quotas have not been taken in recent years and there are no directed trip limits for those species. There are, however, sixteen small coastal shark and pelagic sharks per trip for incidental permit holders.

In terms of our shark bottom longline observer program, for most of the time that the observer program has been in existence, it's been run by the University of Florida Commercial Shark Fishery Observer Program, funded under a number of different grants or cooperative agreements and most recently under a contract.

That program was managed by the University of Florida from 1994 through the first season of 2005. They had a target observer coverage of 4 percent of all large coastal shark landings and, in fact, 1.6 percent of total bottom longline sets were observed during that period and that came to a total of 1,434 sets over ten years.

Beginning in mid-2005 to the present, the observer program was switched to NOAA Fisheries (NMFS), Southeast Fisheries Science Center in Panama City. Their target observed coverage rate is 4 percent and they have in fact, over the last two seasons, observed 6.2 percent of all observed sets, coming to a total of 129 sets observed.

The vessels are randomly selected each trimester, however by region, and so randomly selected within the different regions so that we get coverage from the observer program in each of the different regions, that being the North Atlantic, South Atlantic, and the Gulf of Mexico, including the Caribbean. Vessels that are selected have to have a directed shark permit. They have to have historically reported fishing for sharks with bottom longline gear during that season and they have to have had greater than 25% of landings from sharks during that season in the previous year and we more recently have started excluding vessels from selection if they've been selected in the previous three consecutive seasons, in part due to the shrinking effort and fewer number of vessels and so there's a tendency to select vessels repeatedly and we hear about that all the time.

3.2.3.2 Endangered Species Act Listed Species

The ESA-listed species and critical habitats occurring within the South Atlantic are listed in Table 3-15. The following sections represent a brief overview of these species and critical habitats. They focus on those species most likely to be impacted by the proposed amendment. Further discussion on the ESA and its requirements can be found in Section 8.3 (Other Applicable Laws, Endangered Species Act).

Table 3-15. ESA-Listed Species in the Southeast Atlantic EEZ.

NOAA Fisheries Service Jurisdiction		
Marine mammals	Scientific Name	Status
blue whale	*Balaenoptera musculus*	E
humpback whale	*Megaptera novaeangliae*	E
fin whale	*Balaenoptera physalus*	E
northern right whale	*Eubalaena glacialis*	E
sei whale	*Balaenoptera borealis*	E
sperm whale	*Physeter macrocephalus*	E
Sea Turtles	Scientific Name	Status
green sea turtle	*Chelonia mydas*	E/T*
hawksbill sea turtle	*Eretmochelys imbricata*	E
leatherback sea turtle	*Dermochelys coriacea*	E
loggerhead sea turtle	*Caretta caretta*	T
Kemp's ridley	*Lepidochelys kempii*	T
Fish	Scientific Name	Status
Smalltooth sawfish	*Pristis pectinata*	E**
Critical Habitat		
North Atlantic right whale	Critical habitat has been designated for the North Atlantic right whale in the U.S. Southeast Atlantic from the mouth of the Altamaha River, Georgia to Jacksonville, Florida, out 15 nautical miles (nm) and from Jacksonville, Florida to Sebastian Inlet, Florida, out 5 nm. A portion of this area lies within the EEZ.	
U.S. Fish and Wildlife Service Jurisdiction		
Seabirds	Scientific Name	Status
Bermuda petrel	*Pterodrama cahow*	E
roseate tern	*Sterna dougalli*	E/T***

* Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to the inability to distinguish between the populations away from the nesting beaches, green sea turtles are considered endangered wherever they occur in U.S. waters.
** The U.S. distinct population segment (DPS).
*** North American populations are listed as endangered on the Atlantic coast south to North Carolina; threatened elsewhere.
E=endangered, T=threatened

3.2.3.3 Critical Habitat and Seabirds

North Atlantic right whale critical habitat has been designated in the South Atlantic inside the area described above (Table 3-15). This area is the one of the primary known calving areas within the United States. The area's environmental features (typically referred to as the primary constituent elements) relate to water depth, water temperature, bathymetry, and food availability.

The Bermuda petrel and roseate tern are known to occur within the South Atlantic region but they are considered rare. Roseate terns breed in colonies almost exclusively on small offshore islands, often from April to May. The Bermuda petrel is most commonly found in the North Atlantic Ocean, often associated with the island of Bermuda.

3.2.3.4 Marine Mammals

Blue, sei, and sperm whales are predominantly found seaward of the continental shelf. Sightings of sperm whales are almost exclusively over the continental shelf edge and continental slope areas (Scott and Sadove 1997). Sei and blue whales also typically occur in deeper waters and neither are commonly observed in the east coast U.S. waters (CeTAP 1982; Wenzel *et al.* 1988; Waring *et al.* 1998; Waring *et al.* 2002).

Fin whales are baleen whales generally found along the 100 meter isobath with sightings also spread over deeper water including canyons along the shelf break (Waring *et al.* 1998). These whales are common in the U.S. Atlantic EEZ, though most are commonly found north of Cape Hatteras (Waring *et al.* 2004). The waters off New England are believed to be a major feeding ground for fin whales. Calving is believed to occur primarily from October to January off the mid-Atlantic region of the U.S. (Hain *et al.* 1993). Fin whales are thought to migrate to Canadian waters, open-ocean areas, and possibly sub-tropical and tropical regions (Watkins *et al.* 2000).

Northern right and humpback whales are coastal animals and are regularly sighted in the near shore area along the southeast U.S. Atlantic in November through March. North Atlantic right whales generally occur west of the Gulf Stream, from the southeast U.S. to Canada (Waring *et al.* 2002). They typically calf during the winter months in the coastal waters off Georgia and Florida (Knowlton *et al.* 1994; Kraus *et al.* 2001). The Mid-Atlantic waters are believed to serve primarily as a migratory pathway between the spring and summer feeding/nursery areas and the winter calving grounds. Sightings from aerial surveys throughout the southeast Atlantic region have reported right whales off the Carolinas from December through March including mother-calf pairs.

3.2.3.5 Sea Turtles

Green, hawksbill, leatherback, loggerhead, and Kemp's ridley sea turtles are all highly migratory and travel widely throughout the South Atlantic and could be impacted by the proposed MPAs. 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 (e.g., Lutz and Musick (eds.) 1997; Lutz *et al.* (eds.) 2002). The ESA status of these species in the

South Atlantic was recently evaluated in a Section 7 consultation (NMFS 2006) on the continued authorization of snapper grouper fishing under the South Atlantic Snapper grouper Fishery Management Plan (SGFMP) and Amendment 13C.

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 1974, Hughes 1974). At approximately 20 to 25 centimeters 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 meters (360 feet) (Frick 1976), but they most frequently make dives of less than 20 meters (65 feet) (Walker 1994). The time of these dives also varies by life stage. The maximum dive length is estimated at 66 minutes with most dives lasting from 9 to 23 minutes (Walker 1994).

The hawksbill's pelagic stage lasts from the time they leave the nesting beach as hatchlings until they are approximately 22-25 centimeters 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).

Leatherbacks are the most pelagic of all ESA-listed sea turtles and spend most of their time in the open ocean. 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 meters (Eckert *et al.* 1989) but more frequently dive to depths of 50 meters to 84 meters (Eckert *et al.* 1986). Dive times range from a maximum of 37 minutes to more routine dives of 4 to 14.5 minutes (Standora *et al.* 1984, Eckert *et al.* 1986, 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 turtles are known to eat a wide range of items including salps, jellyfish, amphipods, crabs, sygnathid fish, squid, and pelagic snails (Brongersma 1972). Stranding records indicate that when pelagic, immature loggerheads reach 40-60 centimeters 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 maximum diving depths of loggerheads range from 211 meters to 233 meters (692-764 feet) (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, 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).

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 centimeters carapace length they move to relatively shallow (less than 50 meters) 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 near shore 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 may be scavenged opportunistically from bycatch discards and from discarded bait, and are not thought to be a primary prey item (Shaver 1991). Given their predilection for shallower water, Kemp's ridleys most routinely make dives of 50 meters or less (Soma 1985, Byles 1988). Their maximum diving range is unknown. Depending on the life stage, a Kemp's ridley 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).

3.2.3.6 Marine Fish

The historical range of the smalltooth sawfish in the U.S. is 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 1999 (Schwartz 2003) and the other off Georgia in 2002 (Burgess unpublished data). 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 50 meters (Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004). Smalltooth sawfish feed primarily on fish; mullet, jacks, and ladyfish are believed to be their primary food resources (Simpfendorfer 2001). Smalltooth sawfish also prey on crustaceans (mostly shrimp and crabs) by disturbing bottom sediment with their saw (Norman and Fraser 1937, Bigelow and Schroeder 1953).

3.2.3.7 South Atlantic Snapper grouper Fishery Interactions with ESA-Listed Species

The impacts of the South Atlantic snapper grouper fishery on ESA-listed species were evaluated in a biological opinion on the continued authorization of snapper grouper fishing under the South Atlantic Snapper grouper Fishery Management Plan (SGFMP) and Amendment 13C (NMFS 2006). The fishery was not found to have any impact on Northern right whale critical habitat, seabirds, or marine mammals. That opinion stated the snapper grouper fishery would impact sea turtles and smalltooth sawfish.

The magnitude of the interactions between sea turtles, smalltooth sawfish, and the South Atlantic snapper grouper fishery was evaluated using data from the Supplementary Discard Data Program (SDDP). That program represented between approximately 5% and 14% of all South Atlantic snapper grouper fishing effort. It documented interactions between ESA-listed sea turtle species and both bottom longline gear and vertical line gear (Table 3-16). 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. These data were extrapolated in the biological opinion to better estimate the number of interactions between the entire snapper grouper fishery and ESA-listed sea turtles. That extrapolated estimate was used to project future interactions (Table 3-17).

Good estimates of sea turtle interactions with recreational fishing are not currently available. The SDDP does not provide data on recreational fishing interactions with ESA-listed sea turtle species either. Anecdotal information indicates that recreational fishermen occasionally take sea turtles with hook-and-line gear. Due to lack of data availability, the biological opinion also used the extrapolated data from the SDDP. That data was used to estimate the magnitude of recreational fishing on sea turtles (Table 3-17).

Table 3-16. Sea turtle catch data from the Supplementary Discard Data Program (SDDP) for the southeast U.S. Atlantic.
Source: SEFSC.

Period	Month	Logbook Statistical Grid	Species Caught	Number Caught	Discard Condition
Vertical Hook-and-Line Sea Turtle Catch Data					
1	4	2482	Unidentified	1	Alive
1	11	3377	Loggerhead	1	Alive
2	2	2780	Loggerhead	1	Alive
2	11	3474	Loggerhead	1	Alive
2	11	3476	Unknown	1	Alive
2	12	3476	Unknown	1	Alive
Bottom Longline Sea Turtle Catch Data					
1	8	3674	Leatherback	1	Alive
3	1	3575	Loggerhead	1	Unknown

Table 3-17. Anticipated 3-year incidental take in the South Atlantic Snapper Grouper fishery.
Source: NMFS (2006).

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

SDDP data do not include any reports of smalltooth sawfish being caught in the South Atlantic commercial snapper grouper fishery. There are no other documented interactions between smalltooth sawfish and the South Atlantic commercial snapper grouper fishery. However, smalltooth sawfish are considered vulnerable to capture by bottom longline and vertical hook-and-line gear based on their capture in other southeast fisheries using such gear (Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004). This potential for interaction led NOAA Fisheries Service to estimate 8 future interactions between smalltooth sawfish and the snapper grouper fishery in the biological opinion (Table 3-17).

3.3 Human Environment

Information in this section is provided in two categories. First, there is the economic description of the South Atlantic snapper grouper fishery, which includes descriptions of the commercial and recreational fisheries. The second section describes the social characteristics and community profiles of the snapper grouper fishery in the South Atlantic.

3.3.1 Economic Description of the Fishery

3.3.1.1 Commercial Fishery

Snapper Grouper Fishery

Description of Fishing Gear

Commercial fishermen utilize vertical lines, longlines, black sea bass pots/traps, spears, and powerheads to harvest snapper grouper species. An economic survey of commercial snapper grouper vessels along the South Atlantic coast done in the mid-1990s found that the average length of a boat was 32.7 feet, with nearly all sampled boats being less than 50 feet in length (Waters *et al.* 1997). Boats with bottom longlines tended to be the longest, had the most powerful engines, the greatest fuel capacities, and the largest holding boxes for fish and ice. On the other hand, boats with vertical lines, especially in the southern area, tended to be the shortest, had the least powerful engines, the smallest fuel capacities, and the smallest holding boxes for fish and ice (ibid).

Vertical Lines

The vertical line sector of the commercial snapper grouper fishery operates throughout the Council's area of jurisdiction from the North Carolina/Virginia border to the Atlantic side of Key West, Florida. According to NMFS Logbook data, there were 15,302 trips reported in 2001 in which vertical line (hook and line) gear was identified as the main gear for that trip. Fishermen use this gear in about 13 to 110 fathoms (78 to 660 feet) of water, both day and night.

The majority of hook and line fishermen use either electric or hydraulic reels known as "bandit" gear due to its resemblance to slot machines ("one-armed bandits") that are used in casinos. Boats generally have 2 to 4 bandit reels attached. A typical bandit reel is attached to the gunwale of the boat and consists of a fiberglass reel that holds about 1,000 feet of cable; an L-bar or spreader, which keeps the leader from tangling with the main line; a pulley to feed the cable from the reel through the L-bar; a fiberglass arm; and an electronic or hydraulic reel motor. (A photo of a bandit reel can be found in Snapper Grouper Amendment 13C).

Captains of boats with bandit gear maneuver the boat back and forth across an area of high relief that runs northeast and southwest looking for fish using a color machine and relying on fishing spots that have been previously marked on their plotter. The captain uses the color machine to differentiate bottom type and fish presence, and can tell what kind of fish may be in the area based on where they appear in the water column, the size of the air bladder that shows up on screen, and how the fish are congregated.

Fishing begins with a baited line that is thrown out over the gunwale of the boat as the fisherman releases the drag on the spool of the bandit reel and sends the line down in search of the bottom or desired depth. If dropping on a spot for the first time, the fisherman may have to adjust the depth at which s/he fishes, first finding the bottom and then reeling up the line enough to be fishing above the bottom.

Fishermen tend to either "sit and soak" or "get up and down" when using bandit gear in the mid-shelf fishery (mostly targeting vermilion snapper and some groupers). When they sit and soak, they are fishing live or dead baits with circle or "jap" hooks and letting their rigs (generally a 20- to 40-foot leader with 2 hooks) soak near the bottom for anywhere from 15 minutes to an hour. Fishermen will use the sit-and-soak method to catch grouper and some snapper, such as red snapper in about 13 to 50 fathoms (78 to 300 feet) of water. When fishermen get up and down, they are actively fishing 2 to 3 straight hooks per reel with cut bait. When fishing this way, the line is tended constantly and brought up to the surface as soon as a bite is felt. Fishermen using the get-up-and-down method catch most of the vermilion snapper, triggerfish, and porgies. Fishermen also fish for grouper using this method, but with larger hooks.

When fishing for deepwater snapper grouper species (primarily snowy grouper but also large red porgy, blueline tilefish, Warsaw grouper, and speckled hind) in 50 to 100 fathoms (300 to 600 feet) of water, fishermen bait multi-hook rigs with anywhere from 2 to 10 circle hooks with squid, Boston mackerel, or other cut bait.

In South Florida, fishermen use handlines to harvest yellowtail snapper, which is mostly a day boat fishery. Fishermen chum for yellowtail by grinding or cutting up bait fish and distributing the chum on top of the water with the intention of drawing the yellowtail snapper closer to the surface in a school to make them easier to catch. The fish are caught on handlines with "j" hooks and then chill-killed for high quality. Sometimes these fishermen use a splatter or spider pole to catch the fish when chumming, which is a 10- to 12-foot bamboo pole with a single line and a barb-less hook attached.

There is no consistent day/night pattern of fishing within the vertical line sector of the South Atlantic snapper grouper fishery. The time of day and/or night varies from captain to captain as a matter of personal preference. The majority of the bandit fleet fishes year round for snapper grouper. The only seasonal differences in catch are associated with the spawning season closures in March and April for gag grouper. Most fluctuations in fishing effort in the vertical line fishery are a result of the weather, such as hurricanes and tropical and winter storms, which limit effort. When king mackerel are running, some fishermen stop bandit fishing for snapper grouper species to target king mackerel.

Longlines

The Council allows the use of bottom longlines only in waters deeper than 50 fathoms (300 feet) and north of St. Lucie Inlet, Florida. Fishermen with longline gear onboard may only retain deepwater species. Fishermen use this gear to target snowy grouper and golden tilefish, while incidentally catching blackbelly rosefish.

Longline boats are typically bigger, have longer trips, and cost more to operate than bandit boats because they operate farther offshore. From a port such as Charleston, South Carolina, a South Carolina longline boat will travel 90 miles offshore to reach the fishing grounds, stay out for as many as 9 to 10 days, and incur expenses equivalent to $2,500.

The longline is located on a spool about midway back on the stern of the boat, and a spool generally holds about 15 miles of cable. When fishing begins, the cable is paid out through a fair lead on top of the spool and then another at the stern of the boat. A poly-ball and a high flyer are paid out first to mark the longline at one end. At the stern are usually two crewmembers that stand near baskets full of made up rigs (previously baited hooks and leaders). As the line pays out, they snap the leaders onto the mainline as fast as possible, but generally every two feet. (A photo of a spool on a longline boat can be found in Snapper Grouper Amendment 13C).

While the line is paying out, the Captain may steer the boat in a zigzag fashion or make exaggerated turns to set the gear in the desired location. Some crews use weights as the Captains make big turns to prevent the mainline from rolling over and drifting on top of itself. When the desired amount of longline is paid out, the crew breaks it loose from the drum and snaps on another poly-ball and high flyer to indicate the end of the longline.

The amount of mainline that is paid out and the length of soak time of the line varies by boat and circumstance. Sometimes boats will set out 5 miles of cable at a time making as many as 4 or more sets a day, while others will set out 15 miles at a time and make only 2 sets a day. Soak time will vary depending upon how well fishing is going; however, the longest amount of time that longline gear is in the water is about 2 hours.
The gear is hauled back from a haul back station with a boom that swings over the side of the boat that helps feed the cable through a block and pulley system. As the line is hauled back on board, catch is removed from the leaders, leaders are removed, and the main line is fed back into the level wind and back to the spool.

Longlines are fished only from daylight to dark because sea lice come out at night and eat the flesh of fish that would hook up on the line. Snapper grouper fishermen use longlines all year long with little or no seasonal fluctuation barring a busy hurricane season.

Black Sea Bass Pots

Black sea bass pots are used exclusively to target black sea bass, though bycatch of other snapper grouper species is allowed. The pots have mesh size, material, and construction restrictions to facilitate bycatch reduction and to prevent ghost fishing if pots are lost. All sea bass pots must have a valid identification tag attached and over 87 percent of tags in April 2003 were for boats with homeports in North Carolina.

Fishing practices within the black sea bass pot fishery vary by buoy practices, setting/pulling strategies, number of pots set, and length of set, with seasonal variations. Many fishermen set individual pots with one buoy line per pot. Others set doubles, which are two pots attached to one buoy line. Individual pots may also be connected to a ground line. This configuration is commonly referred to as a “trawl” and has a buoy line on each end. Indications are that only one person in North Carolina may be fishing with trawls. Both sinking and floating buoy lines are used. Many fishermen off North Carolina use floating lines because they are less likely to get hung up on the bottom, while several South Carolina fishermen reported using sinking lines. In South Carolina, fishermen report using ¼-inch poly line attached to a buoy or high flyer. Buoy lines are typically 200 feet (61 meters) in length. In the South Atlantic EEZ, the use of buoys is not required but, if used, each buoy must display the boat's assigned official number and color code.

Fishermen use different strategies for targeting black sea bass, but the most common technique is "precision setting" in which fishermen target areas located with on-board electronics, set pots on suspected aggregations of fish, and locate, pull, and move pots depending upon how well an area is producing. Pots may be clustered with only a few set in one area and many set in a different area depending upon the availability of hard bottom and how successful the catch rate. There may be anywhere from a 3 to 5 mile (4.8 to 8 kilometers) distance between pots or just 10 to 14 feet (3 to 4.5 meters). Another strategy scatters pots over a wide area or in rows, regardless of bottom habitat, and leaves the set of pots with the intention of having the fish come to the pot. This technique targets more migratory individuals, and the pots tend to stay in the water for a longer period of time.

How pots are fished varies depending on the fisherman, season, or area. Typically, fewer pots (on average 60 or less) are fished during the winter than during the summer with the majority of fishermen taking their pots in every night. In the summer when more fish are scattered, the fishermen may fish a few hundred pots and leave them out for extended periods of time, pulling them no more than twice a day. During the winter, soak times are shorter with pots being pulled 2 to 3 times a day or more. Pots set as doubles or in trawls usually have longer soak times than those individually set. In general, how long pots are soaked or whether they are removed daily depends upon the number of pots set, gear configuration, season, and the preference of the fisherman. Preferences may also vary by region.

The South Carolina black sea bass pot fishery is mainly a winter fishery. The season begins in November and, depending upon the water temperature (the colder the better for bass trapping), generally goes through April. Pots are fished individually with short soak times (in some cases about an hour), and the number of pots fished range from 6 to 30 depending upon the fisherman. Most fishermen haul their pots from the water when they return home. In the fall, most pots are set in 70 to 90 feet (21.3 to 27.4 meters) of water, and as the season progresses, fishermen tend to move their pots out to about 100 to 200 feet (30.5 to 36.6 meters). Most trips are day trips.

The North Carolina pot fishery is mainly a winter fishery as well; however, some fishermen continue to pot fish through the summer. The number of pots fished typically ranges from 25 to 60, but more pots are fished in the summer. Fishermen usually set their pots in water depths ranging from 30 to 90 feet (9 to 27.4 meters), though in areas further south, pots are generally set at depths ranging from 70 to 100 feet (21.3 to 30.5 meters). The duration of most trips is one day, however, some extend over multiple days. Roughly half of the fishermen in North Carolina pull their pots when heading home, while the other half leaves them and lets them soak for several days.

Overall, it appears that for the South Atlantic black sea bass pot fishery, the number of trips tends to be greater during the winter months than the summer. Data from the Reef Fish Logbook Program show that there were 1,054 trips in 2001 in which sea bass pots were reported as the main gear. Of these trips, 53 percent were conducted from November through March. Logbook data going back to 1998 show a range of 63 to 72 percent of reported trips occur during the November through March time period with the number of trips falling off in March.

Assessing the actual fishing effort at any given time within the black sea bass pot fishery is difficult. Many participants are active in other fisheries, including the recreational charter fishery during the summer months. The effort placed in the black sea bass pot fishery is often dependent on how well the income generated by black sea bass fishing compares to the income generated by the fisherman's other endeavors. Many snapper grouper permit holders maintain pot endorsements, but are not active in the pot fishery.

The number of fishermen permitted to fish with pots is higher than the actual number fishing. In South Carolina, logbook data suggests that as many as 50 to 60 fishermen are permitted to use pots as either their primary or secondary gear, but only a quarter of them are actively involved in pot fishing during the season.

Fishermen are required to purchase a tag for each pot they possess. As of April 23, 2003, the following number of black sea bass pot tags had been ordered for vessels with active snapper grouper permits, listed by homeport states:

- Georgia — 45 tags;
- Florida — 150 (east and west coasts combined);
- North Carolina — 1,979; and
- South Carolina — 93.

Since most fishermen tend to fish only a portion of their pots while keeping the remaining pots available to replace any losses during the season, the number of tags purchased is often not an accurate count of how many pots are actively being fished.

Powerheads and Spears

In federal waters, fishing commercially by diving and killing the fish by spear or powerheads is most commonly practiced off the coast of Florida. The use of powerheads to kill snapper grouper is illegal in the EEZ off the coast of South Carolina (50 CFR 622.31(g)) and in Special Management Zones.

Powerheads, or bangsticks, are underwater firearms that usually use 12-gauge or .357 Magnum rounds. Sharp contact from a thrust against a solid object activates a heavy, spring loaded, stainless steel firing pin, which detonates the round from a short barrel. Much of the damage inflicted on the target comes from the rapidly expanding gases forced into the body by the barrel end pressed at that moment against it.

There are 3 common methods to kill fish. First, in clear water, some fishermen shoot just a spear, because it has the capability of being more accurate at longer distances (40 to 50 feet) than a powerhead. Second, there is a traditional powerhead (also known as a bangstick), which is a powerhead attached to a metal shaft or wooden pole. The initial injury to the fish comes from a spear tip and then the powerhead is used to kill the fish. The third way is when a powerhead is on the shaft of the spear and once the trigger is pulled, the powerhead hits the fish and the round is detonated in the fish.

Bottom time is a function of depth. It is also important to separate total dive time from spearing/working time on the dive. The following two estimates of spearing/working times on the bottom are based on input from divers:

Estimate 1: about ¾ of bottom time is spearing/working time. At 100 to 120 feet a diver has about 15 minutes of spearing/working time on the bottom, and an 80 cubic foot tank lasts about 20 minutes at 100 feet. A diver can use 4 tanks per day so total spearing/working time ranges between 1 hour to 1.5 hours per diver per day.

Estimate 2: the maximum allowable bottom time is about 16 minutes per tank in the summer and 12 minutes in the summer. At 4 tanks per diver per day, the maximum bottom time would be 64 minutes in the summer and 48 minutes in the winter.

Landings, Ex-vessel Value, Price, and Effort: Regional Perspective

The snapper grouper complex is important to the commercial harvesting sector in the U.S. Southern Atlantic states (South Atlantic). In 2003, landings of all snapper grouper species managed by the South Atlantic Council amounted to 6.44 million pounds with an ex-vessel value of $11.91 million, or 7 percent of the value of all commercial landings and 21 percent of all finfish landings in the South Atlantic during this period (Table 3-18).

During the period from 1999 to 2003, the South Atlantic snapper grouper fishery was generally in decline, with the more prominent decline occurring from 2002 to 2003, possibly due to unusually cold water-temperatures in the summer and fall of 2003. Landings, ex-vessel (dockside) revenue, number of vessels in the fishery, number of permitted vessels, number of trips and days fished declined (Table 3-18). Inflation adjusted revenue for all snapper species declined by $3.55 million from 1999 to 2003 and inflation adjusted average price for all snapper grouper species declined by 8 percent (Table 3-18).

The number of vessels with any reported snapper grouper landings dropped from 1,101 in 1999 to 906 in 2003, with the decline in the number of vessels evident in all harvest categories (Table 3-18). If 2003 is discounted because it was an anomalous year, the decline in the active snapper grouper fleet is concentrated in the number of vessels that land less than 10,000 pounds of snapper grouper species annually. In terms of economic dependence on the snapper grouper fishery, only 20 vessels landed more than 50,000 pounds in 2003 and 172 vessels reported landings that exceeded 10,000 pounds the same year. It would appear that a relatively large number (734 out of 906, or about 81 percent) of vessels operated on a part-time basis in the snapper grouper fishery in 2003 (Table 3-18).

The limited access program in the South Atlantic snapper grouper fishery, in effect since 1998, has resulted in a decline of 375 permitted vessels (244 vessels with unlimited permits). Some of the vessels that exited the snapper grouper fishery were replaced through the two-for-one permitting program, while other vessels were not replaced; 1,725 different vessels in this fishery reported landings from 1999 to 2003 (Table 3-19). There appears to be a core group of vessels that frequently operate in the South Atlantic snapper grouper fishery. For example, 678 (205 + 473) vessels fished at least 4 out of the 5 years, and 473 vessels fished every year since the limited access program went into effect (Table 3-19).

Table 3-18. The snapper grouper fishery in the South Atlantic: annual landings (pounds), ex-vessel revenue, and effort.
Data Source: Southeast logbook (Southeast Fisheries Science Center, Beaufort Lab) and Southeast permits database (Southeast Regional Office, NOAA Fisheries).

Item	1999	2000	2001	2002	2003	2004
Snapper grouper landings	7.7 million	7.7 million	7.6 million	7.3 million	6.4 million	6.5 million
Ex-vessel revenue from the snapper grouper fishery	$13,996,781	$14,619,050	$13,902,225	$13,521,614	$11,914,249	
Real ex-vessel revenue in $2003*	$15,466,056	$15,618,643	$14,436,371	$13,825,781	$11,914,249	
Ex-vessel revenue from all landings in the south Atlantic **	$202,772,265	$218,251,010	$175,665,169	$168,359,567	$163,863,862	
Ex-vessel revenue from finfish landings in the south Atlantic **	$59,337,165	$69,941,863	$65,211,694	$62,615,403	$56,818,354	
Number of trips	17,200	16,241	16,922	16,820	16,176	
Days fished	29,285	28,913	29,567	29,243	27,227	
Average days per trip	1.70	1.78	1.75	1.74	1.68	
Price/lb	$1.82	$1.90	$1.84	$1.85	$1.85	
Real price/lb $2003*	$2.01	$2.03	$1.91	$1.89	$1.85	
Number of permitted vessels	1,441	1,341	1,264	1,174	1,123	1,066
Number of vessels with unlimited permits	1,085	1,001	959	907	879	841
Number of vessels landing snapper grouper species	1,101	1,045	981	955	906	
Number of vessels with more than 100 lb of landings	972	920	850	813	773	
Number of vessels with more than 1,000 lb of landings	657	606	585	583	542	
Number of vessels with more than 10,000 lb of landings	199	195	196	200	172	
Number of vessels with more than 50,000 lb of landings	27	26	26	26	20	
Number of dealer permits	239	245	252	246	271	269
Number of processors (snapper grouper species)***	6	11	9	5	10	
Number of processors (snapper grouper and unclassified finfish species)***	15	20	17	20	15	

Landings information came from the Southeast logbook. Data from the Gulf of Mexico and other (unknown) states are not included in this table. However, Monroe County data is included. In addition, wreckfish landings are not included.
* The CPI was used to adjust these values for inflation.
** Data obtained form the NMFS web site.
*** Summarized from the NMFS Annual Processor Survey.

Table 3-19. Number of vessels operating in the snapper grouper fishery by number years, 1999 - 2003.
Data Source: Southeast permits database, Permits Office, Southeast Regional Office, NOAA Fisheries.

Number of years fished	Number of vessels in the snapper grouper fishery
1	507
2	324
3	216
4	205
5	473
Total number of vessels operating in the fishery during 1999-2003	1,725

In contrast to the trend observed with other statistics on this fishery, the number of snapper grouper dealer permits issued increased during the period from 1999 to 2004 from 239 to 269 (Table 3-18). One explanation for this trend could be that fishermen are acting as their own dealers and selling directly to retailers and wholesalers in an attempt to increase profit margins or to adapt to the decline in the number of "fish houses" that operate in the South Atlantic. Fish houses provide support to the fishing industry that could include any or all of the following: dockage, fuel, ice, repair parts, gear and supplies, fish packing and processing, and a place for transactions with permitted snapper grouper dealers. In some cases, fish house owners have extended credit to vessel owners with negative cash flow problems. About 10 fish houses that provided docking facilities in the South Atlantic closed for business from 2000 to 2005. More recently, one of the main fishing docks in the snapper grouper fishery located in Murrells Inlet, South Carolina closed for business. The owner sold this waterfront property to a condominium developer. Vessels docked at that fish house relocated and there is a possibility that trip costs increased as a result of additional travel time needed to get to the fishing grounds. Also, there was a disruption of existing business relationships with snapper grouper dealers, which meant that fishermen and wholesalers had to adapt to this new situation.

Species Composition

There are numerous species that make up the snapper grouper complex, which is divided into 8 groups and 12 units as was proposed in Snapper Grouper Amendment 13B: shallow-water grouper (Units 1A, 1B, and 1C); deepwater grouper, tilefish, and snapper (Units 2A and 2B); shallow-water snapper, tilefish, and wrasse (Unit 3); mid-shelf snapper (Unit 4); triggerfish and spadefish (Unit 5); jack (Unit 6); grunt and porgy (Units 7A and 7B); and sea bass (Unit 8).[1] In terms of ex-vessel revenue, the most important groups include the shallow-water grouper, shallow-water snapper, and mid-shelf snapper groups (Figure 3-23). Of second importance in terms of revenue earned by the fleet are the deepwater grouper, tilefish, and snapper; jack; and sea bass groups. Also, no one group comprised more than 30 percent of the revenue derived from the snapper grouper complex during the period from 1999 to 2003 (Figure 3-23).

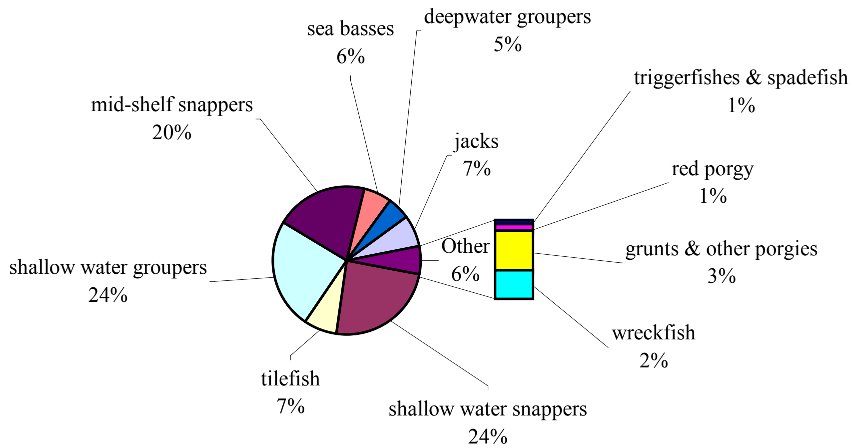


Figure 3-23. Proportion of ex-vessel revenue derived from the various groups in the snapper grouper complex during the period from 1999 to 2003.

[1]Shallow-water grouper Unit 1A consists of gag grouper, red grouper, scamp, black grouper, rock hind, red hind, graysby, yellowfin grouper, coney, yellowmouth grouper, and tiger grouper. Units 1B and 1C are composed of goliath grouper and Nassau grouper, respectively, and harvest and/or possession of these species are prohibited. Deepwater grouper, tilefish, and snapper Unit 2A is composed of snowy grouper, yellowedge grouper, Warsaw grouper, speckled hind, misty grouper, and queen snapper; Unit 2B includes golden tilefish and blueline tilefish. Shallow-water snapper, tilefish and wrasse (Unit 3) contains yellowtail snapper, gray (mangrove) snapper, mutton snapper, lane snapper, hogfish, cubera snapper, sand tilefish, dog snapper, schoolmaster, puddingwife, and mahogany snapper. Mid-shelf snapper (Unit 4) consists of vermilion snapper, red snapper, silk snapper, blackfin snapper, and black snapper. Triggerfish and spadefish (Unit 5) is composed of gray triggerfish, Atlantic spadefish, ocean triggerfish, and queen triggerfish. Jack (Unit 6) consists of greater amberjack, crevalle jack, blue runner, almaco jack, banded rudderfish, bar jack, lesser amberjack, and yellow jack. Grunt and porgy Unit 7A is composed of red porgy; Unit 7B includes 19 species: sheepshead, white grunt, black margate, knobbed porgy, tomtate, margate, jolthead porgy, scup, whitebone porgy, sailors choice, porkfish, bluestriped grunt, saucereye porgy, French grunt, cottonwick, Spanish grunt, grass porgy, longspine porgy, and smallmouth grunt. The final group, sea bass (Unit 8), consists of black sea bass, bank sea bass, and rock sea bass.

Note: Source for Figure 3-23: Accumulated landings system, Southeast Fisheries Science Center, Beaufort Lab. Average ex-vessel revenue for the period 1999 – 2003 was used to calculate the percent composition. All unclassified groupers were placed in the shallow-water grouper unit (1A) and all unclassified snappers were placed in the shallow-water snapper category.

Long-Term Trends

The South Atlantic snapper grouper fishery has been heavily regulated since the fishery management plan was implemented in 1983 (Figure 3-24). Apart from the response to fishery management regulations, fluctuations in landings can also be partly attributed to changes in stock abundance and availability, water quality, market conditions (e.g., price), and fleet dynamics. Ex-vessel prices for various species in the fishery depend upon the quantity of landings, product quality, and market conditions, such as the availability of imports, the relative prices of substitutes, and consumer income levels.

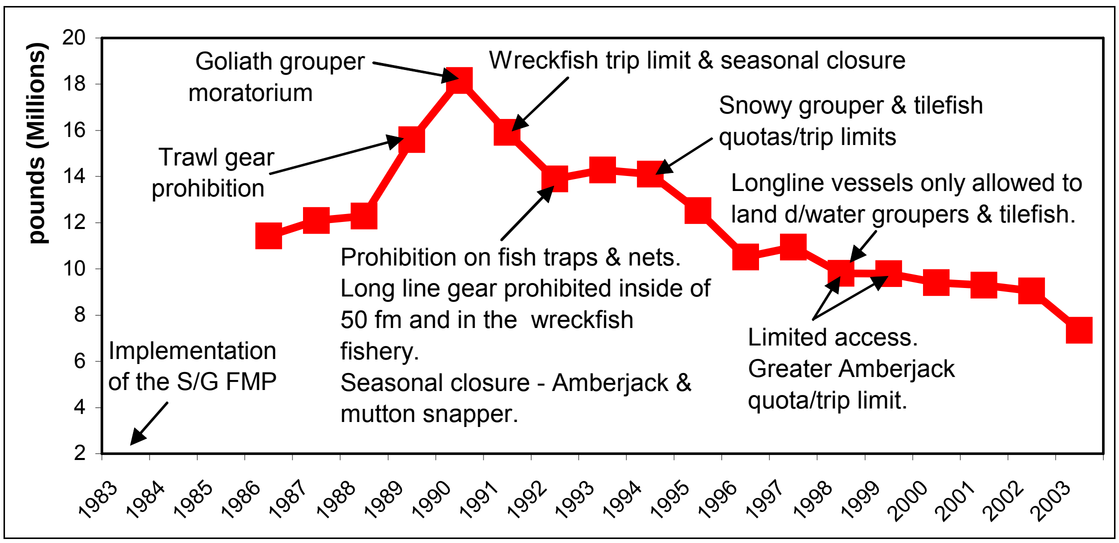


Figure 3-24. Major events in the regulatory history of the snapper grouper fishery superimposed on total snapper grouper landings during 1983-2003.
Source: Accumulated landings system, Southeast Fisheries Science Center, Beaufort Lab.

Snapper grouper ex-vessel landings and value increased from 1986 to 1990. During this period, real ex-vessel revenue increased from around \$26 million to \$35 million (Figure 3-25). Even though the overall average unit price, adjusted for inflation, was on a decreasing trend (Figure 3-25), the 59 percent increase in landings resulted in the growth in overall ex-vessel revenue from 1986 through 1990. It must be noted that data from the Accumulated Landings System (ALS) were not used to examine long-term trends in prices, landings, and revenue. These data will not correspond exactly to the statistics in Table 3-18 since this table contains statistics derived from the Southeast logbook database.

Since the peak in snapper grouper landings and revenue in 1990 there has been a steady decline in landings, ex-vessel revenue, and real ex-vessel revenue (Figures 3-25 and 3-26). The cause of this decline can be partly attributed to restrictive regulations taken to improve/maintain the health of species in the snapper grouper complex and protect essential fish habitat. The first regulations (in 1983) established a number of size limits and certain gear restrictions. In 1992, Amendment 4 prohibited fish traps, entanglement nets, longlines for wreckfish, and the use of longline gear inside of 50 fathoms for snapper grouper species in the South Atlantic EEZ. Also, additional minimum size regulations and bag limits went into effect during 1992 (Figures 3-24 and 3-25).

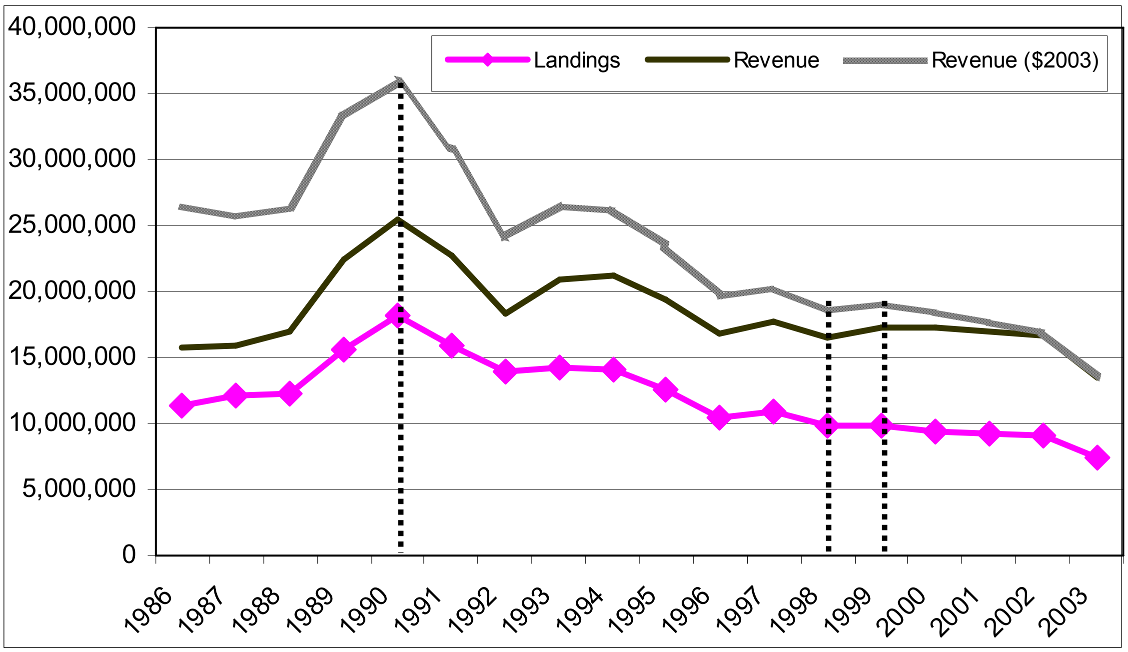


Figure 3-25. Trends in dockside landings and nominal and real ex-vessel revenue for all snapper grouper species in the South Atlantic region during 1986-2003. Florida landings include all of Monroe County.
Source: Accumulated landings system, Southeast Fisheries Science Center, Beaufort Lab.
*landings data are presented in whole weight equivalents
**Real value was calculated using the Consumer Price Index (CPI) and represents the purchasing power of earnings of a respective year in 2003 dollars.

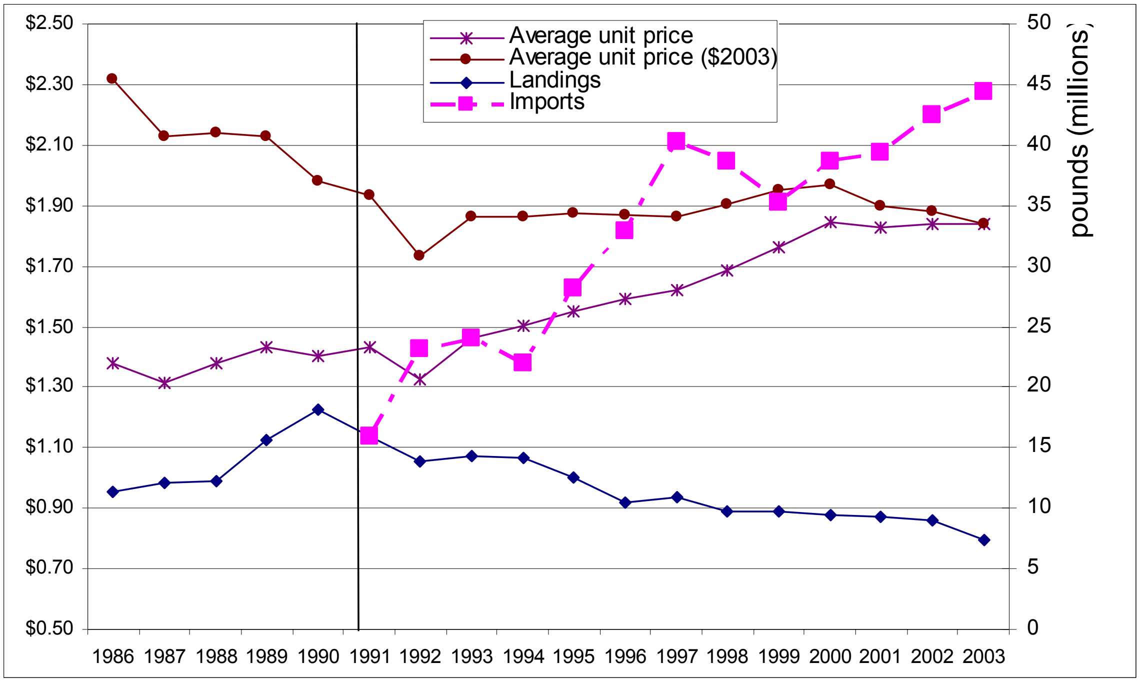


Figure 3-26. Trends in unit price, imports, and landings of snapper grouper species. Average unit prices are expressed in nominal value and real value (2003 dollars). Source: Accumulated landings system, Southeast Fisheries Science Center, Beaufort Lab.

Implementation of a limited access program in 1998/1999 partly contributed to the decline in the number of commercial vessels in the South Atlantic snapper grouper fishery (SAFMC 1997). Since 1999 the annual number of permitted vessels has declined by 375; the number of vessels with unlimited permits has declined by 244 (Table 3-18). Commercial and recreational fishermen in the snapper grouper fishery have faced additional restrictive measures that were implemented in Amendment 9 (SAFMC 1998C) and Amendment 12 (SAFMC 2000). If the current permit requirements remain in effect, it is likely that fishing effort will continue to decline into the future since each new entrant into this fishery will have to purchase two existing snapper grouper permits.

The average unit price for all snapper grouper species was fairly stable from 1986 to 1992 (Figure 3-26). Under normal conditions one could expect nominal prices to increase over time to account for inflation. However, landings increased during this period, which could partly account for the decreasing trend in inflation-adjusted prices until 1991. Real prices remained relatively stable between 1992 and 2001 and declined thereafter. Other factors that would influence snapper grouper prices include landings and market conditions in the Gulf of Mexico and the quantity of imports. It must be noted that the overall average price for snapper grouper species is calculated from data for a large number of individual species with different price trends. Also, prices for individual species will vary by size and for some species like black sea bass, there is a large difference in price per pound among the various size categories.

In 2004, the volume of snappers and groupers imported into the United States was 43 million pounds valued at $75.6 million. In comparison, domestic harvest of snappers and groupers landed at ports in the Gulf of Mexico and South Atlantic states amounted to 23.4 million pounds in 2003 (NOAA Fisheries 2004). Imports of snappers and groupers are classified into two product forms: fresh and frozen. Fresh fish comprised over 70 percent of total snapper grouper imports in 2004, which increased almost threefold from 16 million pounds in 1991 to 44.4 million pounds in 2003 (Table 3-20).

Table 3-20. U.S. imports of snappers and groupers from 1991 to 2004.
Source: NOAA Fisheries, Foreign Trade Database.

Year	Pounds of imports by product form (Millions of pounds)			Value of imports by product form (Millions of dollars)		
	Fresh	Frozen	Total	Fresh	Frozen	Total
1991	12.6	3.4	16.0	$16.3	$4.0	$20.2
1992	19.4	3.9	23.2	$28.0	$4.6	$32.6
1993	20.8	3.2	24.0	$28.9	$3.9	$32.9
1994	20.0	2.0	22.0	$28.4	$2.5	$30.9
1995	26.1	2.1	28.2	$35.9	$2.6	$38.5
1996	30.7	2.2	32.9	$44.8	$2.7	$47.5
1997	36.8	3.5	40.2	$53.8	$4.2	$58.0
1998	35.1	3.6	38.7	$53.3	$5.2	$58.5
1999	32.0	3.3	35.3	$49.4	$4.6	$53.9
2000	32.5	6.1	38.6	$53.5	$9.5	$63.0
2001	31.1	8.4	39.4	$51.7	$10.6	$62.3
2002	33.3	9.2	42.5	$57.1	$12.3	$69.5
2003	34.2	10.2	44.4	$58.9	$14.4	$73.3
2004	33.2	9.8	43.0	$61.7	$13.9	$75.6

** Weights are not converted to equivalent whole weights.

It is reasonable to expect that imports influence domestic prices. From the point of view of fishermen, imports contribute to depressing dockside prices. However, imports increase the aggregate U.S. supply of snappers and groupers, which leads to lower retail prices for consumers. Thus, consumers in this country benefit from imports, although there are also balance of trade considerations with imports, which affect the buying power of U.S. consumers in the long run. Imports also benefit some wholesalers and retailers in the fishing industry, especially at times when the domestic fishery is unable to supply current market needs.

Seasonal Variability

In terms of seasonal variability in landings and revenue, the only group that stands out is the sea bass group (Unit 8 as was proposed in Amendment 13B) where most of the harvest is taken in the winter months from November to February (See Table 3-21). The peak months for the shallow-water grouper fishery are May, June, and July in the entire South Atlantic (Table 3-21). For deepwater groupers, the peak months are May and June for the entire fishery (Table 3-21). It is interesting to note that there is a prohibition against the harvest of greater amberjack during the month of April and the peak months for the harvest of the jack unit occurs in March and May in the South Atlantic (Table 3-21).

Table 3-21. Percent revenue from important species units by month for the South Atlantic averaged over the period from 1999 to 2003.
Source: Southeast logbook data, Southeast Fisheries Science Center, Beaufort Lab.

Month	Shallow-water grouper	Deep-water grouper	Tilefish	Shallow-water snapper	Mid-shelf snapper	Triggerfish & spadefish	Jack	Red porgy	Grunts & porgies	Sea bass
Jan	8.4%	6.1%	4.3%	6.6%	5.3%	6.1%	8.1%	11.2%	6.6%	**21.0%**
Feb	8.6%	9.2%	5.1%	7.3%	5.0%	5.5%	9.1%	4.6%	7.1%	**15.6%**
Mar	3.0%	10.9%	8.7%	**10.9%**	7.5%	7.9%	**13.5%**	0.1%	7.1%	8.5%
Apr	4.0%	10.7%	**11.1%**	**11.1%**	9.3%	8.9%	2.9%	0.6%	6.4%	5.4%
May	**12.8%**	**12.0%**	**10.5%**	**10.1%**	8.8%	7.1%	**17.0%**	12.9%	7.9%	5.2%
Jun	**11.5%**	**12.3%**	9.1%	**9.8%**	9.2%	7.9%	8.1%	13.9%	8.7%	3.0%
Jul	**10.8%**	9.5%	5.8%	**10.6%**	7.5%	5.7%	7.2%	12.5%	9.8%	3.8%
Aug	9.0%	8.3%	**11.3%**	7.1%	9.9%	8.2%	6.6%	14.1%	10.2%	4.1%
Sep	6.2%	7.2%	8.7%	5.8%	9.9%	**12.1%**	7.3%	8.1%	9.1%	2.2%
Oct	9.1%	5.4%	9.6%	7.0%	11.4%	**13.2%**	7.3%	7.2%	9.6%	3.9%
Nov	8.8%	4.1%	8.1%	6.4%	9.6%	9.3%	6.4%	8.4%	8.5%	**9.3%**
Dec	7.9%	4.2%	7.6%	7.4%	6.8%	8.2%	6.7%	6.4%	9.0%	**17.8%**

Price, Number of Trips, and Revenue Differences

There appears to be substantial differences in prices among the various groups in the snapper grouper complex. It was decided that these species groupings (as was proposed in Snapper Grouper 13B) could be placed into three categories based on the observed average annual price per pound (Figure 3-27):

- Low price category – nominal price did not exceed $1.00 per pound during the entire time series. Species groups include jack (Unit 8), grunts and other porgy (Unit 7B), and triggerfish and spadefish (Unit 5).
- Medium price category – generally, prices ranged between $1.00 and $1.50 per pound. Species groups include red porgy (Unit 7A), black sea bass (Unit 8), and the tilefishes (Unit 2B). The tilefish group can be split into two categories based on average prices where blueline tilefish would fall into the low price category. Average ex-vessel prices for golden tilefish varied between $1.30 and $2.00 per pound.
- High price category – the price per pound is usually closer to or exceeds $2.00 per pound. The following groups fall into this category: deepwater grouper (Unit 2A), wreckfish (Unit 9), shallow-water grouper (Unit 1A), shallow-water snapper (Unit 3), and mid-shelf snapper (Unit 4).

It appears that the trips where shallow-water snappers, shallow-water groupers, and jacks are caught dominate the snapper grouper fishery (Table 3-22). Also, a large proportion of the snapper grouper fleet reported landings for species in these groupings (Table 3-23). As far as trips and vessels where a unit was the top revenue earner, shallow-water snappers and shallow-water groupers emerge as the most important groups in the snapper grouper fishery (Tables 3-22 and 3-23). However, there is substantial variability among the groups in terms of the proportion of trips where a unit is the top revenue earner as percent of total trips when species in that unit were caught. The shallow-water snapper unit was the top revenue earner on 69 percent of all trips where species in the unit were caught. For the mid-shelf snappers, tilefishes, sea basses, shallow-water groupers, and deepwater groupers, this figure is around 40 percent. The other units (jacks, triggerfishes and spadefish, and grunts and porgies) are not usually the top revenue earner on trips where they are caught. These are lower priced species groups and are probably not targeted as regularly as the other units in the complex that fall in the higher priced categories. Also, these species are probably caught in association with many other species and hence are not a main contributor to overall revenue (Table 3-22). In terms of primary and secondary sources of revenue, it appears that most vessels depend upon the shallow-water groupers, followed by shallow-water snappers, and then the mid-shelf snapper grouper (Table 3-23).

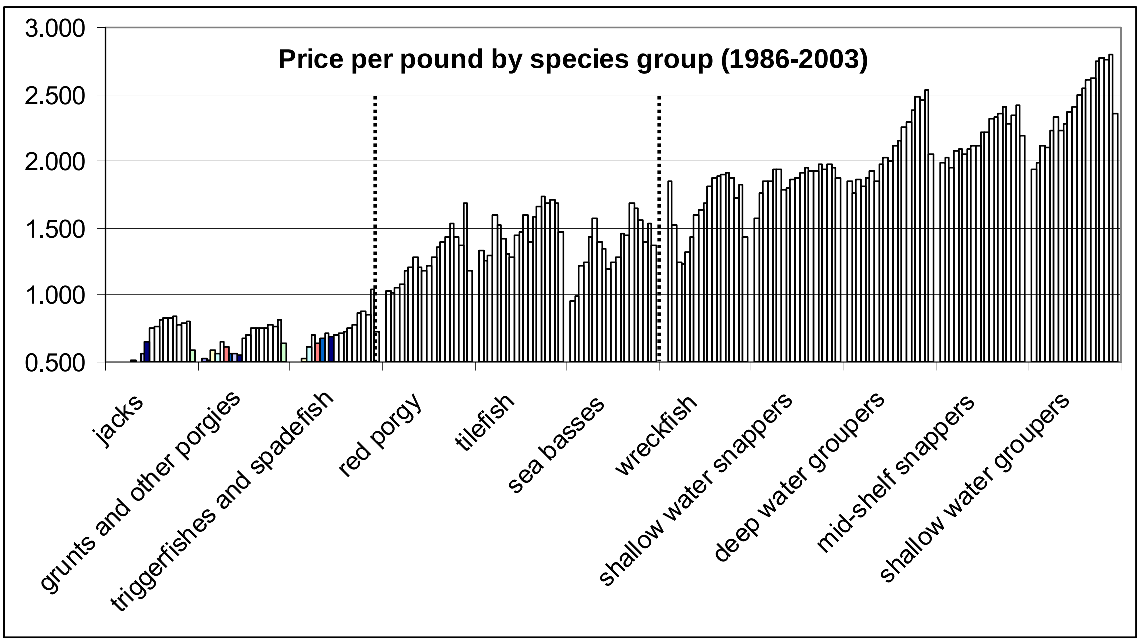


Figure 3-27. Price per pound by species group during 1986-2003.
Source: Accumulative landings system, Southeast Fisheries Science Center, Beaufort Lab.

Table 3-22. Average number of trips from 1999 to 2003 with landings from proposed units in Snapper Grouper Amendment 13B.
Source: Data table provided by the Southeast Fisheries Science Center, Beaufort Lab.

Unit	Trips with at least 1 pound in unit (Y)	Percent of all trips that landed at least 1 pound of unit	Trips with unit at top source of revenue (X)	Percent of trips with unit at top source of revenue	X as Percent of Y
Shallow-water Groupers	6,045	36%	2,745	16%	45%
Deep-water Groupers	1,816	11%	684	4%	38%
Tilefish	1,250	8%	472	3%	38%
Shallow-water Snappers	9,279	56%	6,412	38%	69%
Mid-Shelf Snappers	3,488	21%	1,487	9%	43%
Triggerfishes & Spadefish	2,478	15%	42	0%	2%
Jacks	5,742	34%	1,063	6%	19%
Red Porgy	1,446	9%	16	0%	1%
Grunts & Porgies	4,127	25%	133	1%	3%
Sea Basses	2,673	16%	1,018	6%	38%

16,672 = Average number of trips for the period from 1999 to 2003 where 1 pound of snapper grouper species in 13B was landed.
* Top revenue trips for each unit as a percent of all trips with at least 1 pound of the unit.

Table 3-23. Average number of boats from 1999 to 2003 with landings from each proposed unit in Snapper Grouper Amendment 13B.
Source: Data table provided by the Southeast Fisheries Science Center, Beaufort Lab.

Unit	Total boats with at least 1 pound of species in group	Percent of all boats that landed at least 1 pound of unit	Boats with top-revenue trips only (X)	Both top-revenue and secondary revenue trips (Y)	X + Y
Shallow-water Groupers	677	68%	95	353	448
Deep-water Groupers	269	27%	36	102	138
Tilefish	170	17%	20	56	76
Shallow-water Snappers	708	71%	200	282	482
Mid-Shelf Snappers	388	39%	47	178	225
Triggerfishes & Spadefish	307	31%	6	21	27
Jacks	625	63%	29	158	187
Red Porgy	187	19%	0	7	7
Grunts & Porgies	461	46%	6	45	51
Sea Basses	255	26%	30	73	103

998 = Average number of vessels that landed at least 1 pound of snapper grouper species during the period from 1999 to 2003.
X = Number of boats that recorded only trips for the unit as top-revenue unit.
Y = Number of boats that recorded trips for unit, with some trips as top-revenue and other trips as secondary source of revenue.

Description of Trip Cost Data

This section presents results from the first two years of an economic survey appended to the Federal Logbook Trip Report Form that is used by fishermen to report fishing activity in the South Atlantic snapper grouper, dolphin-wahoo, mackerel, and shark fisheries. The population for the economic survey consisted of all federally permitted South Atlantic snapper grouper, mackerel, and shark vessels in 2001. Approximately, one-fifth (20%) of the population was randomly selected for the survey based on state and gear stratifications. Details of the sample selection methodology and non-response rates are available in Appendix E of Snapper Grouper Amendment 13C.

Results of the survey for 2002-03 and trip-level effort variables are summarized in Table 3-24. Trips are categorized by primary gear employed to account for heterogeneity (differences) throughout the fleet. Means, standard deviations, and ranges are used to summarize effort variables and fuel prices. Considerable variability remains for revenue and cost measurements within each gear classification, so median values are used to measure central tendency (i.e., an average trip) for these variables (Larkin *et al.* 2000).

On average, sampled vessels that primarily used traps and longlines were significantly larger and employed more crew than other vessels, and longliners fished more days than all other trips. The typical hook and line or troll trip lasted from one to two days with one to two crew members, while diving trips were of similar duration and employed two crew members, on average. The vast majority (over 90 percent) of non-longline trips included the permit-holder/vessel-owner aboard suggesting that a significant subgroup of the South Atlantic snapper grouper fleet were owner-operators.

The trip-level economic performance of the fleet can be characterized across the different primary gear types. Minimum and maximum figures for revenues and expenses again illustrate the diversity of the South Atlantic snapper grouper fleet even when stratified by primary gear types. Looking across gear types, longline and trap trips clearly incurred higher expenses, but typically generated higher trip revenues and higher per day net operating revenues. Median values suggest fuel expenditures were the biggest expenditures for all types of trips; however, longline and trap trips also have significant amounts of bait, ice, and miscellaneous expenses. For hook and line, troll, and diving trips, median statistics suggest that bait, ice, and other expenses were relatively minor for at least half of these trips (in many cases these trips incurred zero expenses for these inputs); however, these cost figures are a bit misleading. The figures for bait and ice expenses can be viewed as conservative estimates due to implicit costs. For instance, some South Atlantic snapper grouper fishermen receive free ice prior to departure; however, this perceived benefit is usually counterbalanced with depressed ex-vessel prices paid by the fish house. Also, these fishermen sometimes catch their own bait, yet are not explicitly compensated for their effort (i.e., “time is money”).

Table 3-24. Summary of trip-level economic data and effort variables by primary gear for the South Atlantic snapper grouper fishery (2002-03).
Source: Southeast logbook trip cost database and catch effort database, Southeast Fisheries Science Center, Miami.

Variable	Mean	Std. Dev.	Range[3]	Mean	Std. Dev.	Range	Mean	Std. Dev.	Range
Days away	1.7	1.9	13	1.1	0.3	1	4.6	3.1	12
Crew	1.9	0.9	5	2.4	0.5	1	2.4	0.5	2
Vessel Length[4]	28	6	32	42.6	3.6	23	37.7	8.6	23
Fuel Price/gal.[5]	$1.43	$0.31	$2.28	$1.21	$0.18	$0.93	$1.09	$0.18	$0.64
	Median	Min.	Max.	Median	Min.	Max.	Median	Min.	Max.
Revenue	$218	$3	$12,414	$1,485	$100	$5,450	$1,658	$37	$15,386
Fuel exp.[6]	$28	$2	$650	$172	$63	$480	$295	$18	$950
Bait exp.	$15	$0	$700	$104	$10	$360	$293	$0	$1,845
Ice exp.	$0	$0	$256	$0	$0	$80	$85	$0	$300
Misc. exp.[7]	$0	$0	$3,373	$20	$0	$700	$200	$0	$2,052
Net Oper. Rev.[8] per day fished	$142	-$554	$2,961	$979	-$115	$5,154	$330	-$2,038	$1,755

Gear	**Trolling (n = 987)**			**Divers[2] (n = 161)**		
Variable	Mean	Std. Dev.	Range[3]	Mean	Std. Dev.	Range
Days away	1	0.2	2	1.1	0.6	4
Crew	1.3	0.6	4	2.1	0.6	4
Vessel Length[4]	28.1	5.5	38	26.5	7.3	30
Fuel Price/gal.[5]	$1.37	$0.22	$1.05	$1.55	$0.26	$1.05
	Median	Min.	Max.	Median	Min.	Max.
Revenue	$183	$2	$3,931	$252	$8	$7,137
Fuel exp.[6]	$32	$4	$422	$41	$6	$246
Bait exp.	$5	$0	$225	$0	$0	$260
Ice exp.	$0	$0	$50	$0	$0	$110
Misc. exp.[7]	$0	$0	$325	$10	$0	$210
Net Oper. Rev.[8] per day fished	$134	-$310	$2,323	$181	-$87	$1,298

1. This category includes the following gears: rods and reels, handlines, and electric and bandit reels.
2. Twenty-five percent of these trips utilized an explosive device.
3. The range is the difference between the maximum and minimum observations for each variable.
4. Mean vessel length is weighted by each vessel's number of trips.
5. Fuel prices are not adjusted for inflation.
6. This figure does not include oil expense.
7. This includes other trip-related expenditures, such as groceries, oil and other lubricants, gas for diving tanks, packing fees, and other costs that are typically incurred during a trip.
8. Net operating revenues are defined as gross trip revenues minus trip expenses (i.e., fuel, bait, ice, and miscellaneous expenses), excluding labor.

Median statistics can also give managers an idea about how regulations may affect marginal members of the fleet. For instance, at least half of all sampled vertical line, troll, and diving trips made less than \$142, \$134, and \$181 in net operating revenues per day fished, respectively. Crew shares and amortized fixed expenses (e.g., insurance, loan, and engine repair payments) must still be subtracted from net operating revenues. These modest operating profits suggest that economic shocks (e.g., rising fuel prices and increased import pressures) or regulatory effects that curtail revenue generation (e.g., size limits and quotas) or increase operating costs (e.g., closures) could drive operating margins below zero for a significant portion of these types of trips causing a short-run (and possibly permanent) exit from the industry.

Landings, Ex-vessel Value, Price, and Effort: South Atlantic States Perspective
Due to confidentiality issues, the following discussion provides summary averages from 1999 to 2003.

Florida commercial fishermen recorded the highest average ex-vessel revenue from snapper grouper landings (\$5.8 million), followed by North Carolina (\$3.7 million), South Carolina (\$3.3 million), and Georgia (\$0.8 million) (Table 3-25). A similar ranking is observed for the number of days fished, number of trips, landings, number of permitted vessels, and number of vessels in the fishery by state (Tables 3-25 and 3-26). Snapper grouper landings appear to be relatively more important to the commercial fishing industry in Florida, North Carolina, and South Carolina compared to Georgia. However, another picture emerges when considering the relative contribution of snapper grouper species to the overall ex-vessel value of finfish landings. It appears that 95 percent of the total revenue from finfish landings in Georgia is comprised of snapper grouper species (Table 3-25).

Similar to the pattern observed for the South Atlantic region, ex-vessel revenue, number of trips, and number of vessels in the snapper grouper fishery for the individual states declined during the period from 1999 to 2003. However, the relative decrease in South Carolina was not as severe as observed for the other states during this period. For example, the decrease in ex-vessel revenue was 12 percent for South Carolina compared to 31 percent for North Carolina, 32 percent for Georgia, and 22 percent for Florida (Table 3-25). A potential explanation for this difference is that even though the number of vessels declined in South Carolina (Table 3-26), the number of days fished increased (in contrast to other states) (Table 3-25). Also, the proportional decline in vessels with a high level of landings was lower in South Carolina than observed for the other states. Except for South Carolina, the number of vessels with snapper grouper permits decreased in all states where these vessels were recorded as being home ported (Table 3-25).

Table 3-25. Economic characteristics of the snapper grouper fishery by state in the South Atlantic from 1999 to 2003.
Source: Database derived from the Southeast logbook provided by the Southeast Fisheries Science Center, Beaufort Lab.

	Average per year (1999 - 2003)				Change from 1999 – 2003 (1999 to 2004 for the permit data**)			
Item	North Carolina	South Carolina	Georgia	Florida	North Carolina	South Carolina	Georgia	Florida
Snapper grouper landings	2,016,539	1,637,005	428,472	3,251,899	-24%	-3%	-20%	-17%
Ex-vessel revenue	$3,673,443	$3,273,266	$823,729	$5,806,406	-31%	-12%	-32%	-22%
Ex-vessel revenue from all landings*	$93,529,784	$27,396,198	$17,490,320	$42,408,722	-13%	-9%	-43%	-33%
Ex-vessel revenue from all finfish landings*	$34,308,323	$5,502,254	$862,760	$16,243,040	-6%	5%	-22%	-18%
Percent of total ex-vessel revenue	4%	12%	5%	14%				
Percent of total ex-vessel revenue from finfish landings	11%	59%	95%	36%				
Number of trips	3,125	1,016	182	12,346	-20%	-5%	-7%	-2%
Number of days	5,475	4,712	1,150	17,490	-18%	15%	-11%	-8%
Average trip length	1.75	4.64	6.35	1.40	2%	21%	-5%	-6%
Number of permitted vessels**	191	89	15	945	-33%	5%	-20%	-27%
Number of vessels with unlimited permits**	163	80	13	686	-28%	17%	-23%	-25%

* Data downloaded from the NOAA Fisheries web site.

** Statistics on snapper grouper permits are calculated using data from 1999 to 2004.

Another difference to note is the fact that snapper grouper trips in Georgia and South Carolina were of greater duration than the other two states. The average trip length for South Carolina and Georgia fishermen was 4.64 days and 6.35 days, respectively, compared to 1.75 days for North Carolina and 1.4 days for Florida fishermen (Table 3-25). One explanation for this difference is that the fleets that land fish in Florida and North Carolina are comprised of a larger proportion of smaller boats that make shorter trips (Table 3-27). In Florida, snapper grouper species are available closer to shore, whereas fishermen in the other three states have to travel a longer distance to the fishing grounds. The shorter average trip length in North Carolina could be explained by the fact that there is a fishery comprised of small boats that operate primarily in the inshore areas and venture farther out occasionally to catch snapper grouper species.

Average landings per vessel and average landings per trip were much higher for South Carolina and Georgia compared to the other two states (Table 3-26). For example, in South Carolina, the average total landings per trip was 1,612 pounds compared to 263 pounds in Florida. The average landings per day was at about the same level for all states except Florida where the landings per day was about 50 percent less than the average daily catch in Georgia (Table 3-26).

Table 3-26. Economic characteristics of the snapper grouper fishery by state in the South Atlantic from 1999 to 2003.
Source: Database derived from the Southeast logbook provided by the Southeast Fisheries Science Center, Beaufort Lab.

	Average per year (1999 - 2003)				Change from 1999 to 2003			
Item	North Carolina	South Carolina	Georgia	Florida	North Carolina	South Carolina	Georgia	Florida
Number of vessels (any landings)	181	75	14	738	-14%	-27%	-14%	-18%
Average landings per vessel (pounds)	11,153	21,827	29,755	4,406				
Average landings per trip (pounds)	645	1,612	2354	263				
Average landings per day (pounds)	368	347	372	186				
Number of vessels with more than 100 pounds of landings	157	73	13	631	-19%	-29%	0%	-20%
Number of vessels with more than 1,000 pounds of landings	124	64	12	402	-15%	-24%	-9%	-17%
Number of vessels with more than 10,000 pounds of landings	64	39	8	84	-27%	-12%	0%	-1%
Number of vessels with more than 50,000 pounds of landings	confidential data	10	confidential data	7				
Number of dealer permits	38	22	4	129	93%	-8%		1%

Table 3-27. Length distribution of permitted vessels by state in 2004.
Source: Southeast permits database, Permits Office, Southeast Regional Office, NOAA Fisheries.

Size Category (feet)	Florida	North Carolina	Georgia	South Carolina
Less than 20	6%	2%	0%	1%
20 - 29	51%	35%	17%	22%
30 - 39	31%	46%	42%	44%
40 - 49	10%	16%	42%	30%
50 - 59	2%	1%	0%	2%
60 - 69	1%	1%	0%	1%
70 - 79	< 1%	< 1%	< 1%	< 1%
Greater than 80	< 1%	< 1%	< 1%	< 1%
TOTAL	100%	100%	100%	100%

There is some variability among the states with respect to the species and/or species groups that dominate the overall revenue from snapper grouper landings. In terms of the overall contribution to the state's revenue from snapper grouper landings, the mid-shelf snapper, shallow-waters grouper, and sea bass units dominate North Carolina (Table 3-28). Mid-shelf snappers and shallow-water groupers also dominate the snapper grouper fishery in South Carolina (Table 3-28). In Georgia, mid-shelf snappers comprise 59 percent of the total revenue in the snapper grouper complex, followed by the shallow-water grouper unit (Table 3-29). In Florida, the most important group is the shallow-water snapper unit that makes up 43 percent of the snapper grouper revenue, which is followed by shallow-water groupers, which accounts for 17 percent of the state's snapper grouper revenue (Table 3-29).

Table 3-28. Average ex-vessel value of the snapper grouper unit as proposed in Snapper Grouper Amendment 13B by state for the period from 1999 to 2003.
Source: Southeast logbook data, Beaufort Lab.

Group	North Carolina	Georgia	South Carolina	Florida
Shallow-water groupers	$1,077,252	$217,731	$1,228,433	$962,362
Deep-water groupers	$275,553	$14,044	$228,680	$367,193
Tilefishes	$105,115	$5,476	$266,709	$689,805
Shallow-water snappers	$24,362	$10,111	$41,884	$2,483,091
Mid-shelf snappers	$1,083,541	$481,999	$1,025,725	$581,215
Triggerfishes & Spadefish	$119,604	$29,671	$72,314	$30,884
Jacks	$103,690	$51,803	$144,306	$640,809
Red Porgy	$34,969	$3,854	$24,191	$12,338
Grunts & other porgies	$77,769	$5,269	$44,746	$32,770
Sea basses	$771,669	$3,770	$196,278	$6,361
TOTAL	$3,673,524	$823,728	$3,273,266	$5,806,828

Table 3-29. Proportional contribution of each unit as proposed in Snapper Grouper Amendment 13B to the total ex-vessel revenue from all snapper grouper species by state, averaged over the period from 1999 to 2003.
Source: Southeast Fisheries Science Center logbook database, Beaufort Lab.

Group	North Carolina	Georgia	South Carolina	Florida
Shallow-water groupers	29%	26%	38%	17%
Deep-water groupers	8%	2%	7%	6%
Tilefishes	3%	1%	8%	12%
Shallow-water snappers	1%	1%	1%	43%
Mid-shelf snappers	30%	59%	31%	10%
Triggerfishes & Spadefish	3%	4%	2%	1%
Jacks	3%	6%	4%	11%
Red Porgy	1%	0%	1%	0%
Grunts & other porgies	2%	1%	1%	1%
Sea basses	21%	0%	6%	0%
TOTAL	100%	100%	100%	100%

In terms of seasonal variability in landings and revenue, the only unit proposed in Snapper Grouper Amendment 13B that really stands out is the sea bass unit where most of the harvest is taken in the winter months from November/December to February in North Carolina and South Carolina (Tables 3-30 and 3-31).

There is a prohibition on the harvest of gag and black grouper during March and April, and it appears that in Georgia the fishery targeting those species shifts over to the mid-shelf complex during the closed season (Table 3-32). Also, the peak month for the shallow-water grouper fishery in Georgia appears to be May, which immediately follows the closure for gag and black grouper.

In North Carolina, most of the deep-water groupers are taken in May and June, and the shallow-water groupers are primarily harvested from May through August (Table 3-30). In South Carolina, the shallow-water grouper season appears to be from May through July and the deep-water grouper season extends from March through July (Table 3-31).

It is interesting to note that there is a prohibition against fishing for greater amberjack in April and the peak months for harvesting the jack unit occurs in March and May in Florida (Table 3-33).

Table 3-30. Percent revenue from important species units by month for North Carolina averaged over the period from 1999 to 2003.
Source: Southeast logbook data, Southeast Fisheries Science Center, Beaufort Lab.

Month	Shallow-water grouper	Deep-water grouper	Tilefish	Mid-shelf snappers	Triggerfish & spadefish	Jack	Grunt & porgies	Sea bass
Jan	5.3%	6.0%	1.2%	4.5%	5.6%	6.3%	5.6%	**19.4%**
Feb	5.0%	11.4%	5.3%	4.1%	5.2%	5.6%	5.6%	**14.7%**
Mar	2.7%	8.4%	7.1%	4.8%	6.3%	5.0%	3.9%	8.0%
Apr	4.6%	10.9%	8.3%	6.3%	6.2%	4.3%	4.1%	5.0%
May	**13.1%**	**18.4%**	**11.5%**	10.9%	7.3%	**10.0%**	8.3%	5.3%
Jun	**13.9%**	**14.5%**	**13.7%**	9.7%	10.4%	**16.2%**	**10.6%**	3.1%
Jul	**11.3%**	9.5%	**14.2%**	7.5%	7.4%	**11.4%**	**11.3%**	4.3%
Aug	**11.6%**	7.7%	**19.0%**	13.1%	10.6%	**10.2%**	**13.5%**	4.8%
Sep	6.5%	5.3%	**11.9%**	10.8%	11.8%	6.6%	9.6%	2.5%
Oct	10.3%	3.3%	4.7%	12.5%	13.7%	9.4%	10.8%	4.5%
Nov	9.1%	2.5%	2.2%	10.0%	9.1%	8.3%	8.6%	**10.8%**
Dec	6.5%	2.1%	0.9%	5.8%	6.5%	6.6%	8.2%	**17.5%**

Table 3-31. Percent revenue from important species units by month for South Carolina averaged over the period from 1999 to 2003.
Source: Southeast logbook data, Southeast Fisheries Science Center, Beaufort Lab.

Month	Shallow-water grouper	Deep-water grouper	Tilefish	Mid-shelf snappers	Triggerfish & spadefish	Grunt & porgies	Sea bass
Jan	6.6%	3.9%	5.2%	4.8%	6.3%	5.9%	**27.5%**
Feb	7.6%	7.6%	6.3%	4.3%	5.6%	6.8%	**19.3%**
Mar	2.8%	15.9%	10.5%	8.8%	10.0%	7.2%	**10.3%**
Apr	3.7%	10.3%	10.4%	12.6%	12.3%	7.3%	6.9%
May	**12.1%**	9.2%	8.5%	7.5%	5.9%	7.7%	4.7%
Jun	**11.6%**	11.0%	8.6%	8.3%	5.3%	8.0%	2.0%
Jul	**12.5%**	11.2%	5.4%	6.7%	3.6%	10.6%	1.8%
Aug	8.8%	7.9%	11.7%	8.1%	5.4%	9.3%	1.5%
Sep	7.2%	7.9%	7.1%	10.2%	13.0%	9.3%	1.0%
Oct	9.2%	7.0%	10.4%	11.5%	12.8%	8.7%	1.4%
Nov	10.0%	5.2%	10.4%	10.4%	9.2%	9.1%	3.9%
Dec	7.9%	2.9%	5.6%	6.8%	10.5%	10.0%	**19.7%**

Table 3-32. Percent revenue from important species units by month for Georgia averaged over the period from 1999 to 2003.
Source: Southeast logbook data, Southeast Fisheries Science Center, Beaufort Lab.

Month	Shallow-water grouper	Mid-shelf snappers
Jan	8.6%	5.9%
Feb	10.3%	5.9%
Mar	3.0%	10.1%
Apr	4.5%	9.3%
May	15.4%	7.4%
Jun	8.4%	9.4%
Jul	8.0%	8.0%
Aug	5.5%	8.3%
Sep	5.7%	9.5%
Oct	11.6%	10.0%
Nov	10.5%	7.6%
Dec	8.6%	8.5%

Table 3-33. Percent revenue from important species units by month for Florida averaged over the period from 1999 to 2003.
Source: Southeast logbook data, Southeast Fisheries Science Center, Beaufort Lab.

Month	Shallow-water grouper	Deep-water grouper	Tilefish	Shallow-water snapper	Mid-shelf snappers	Jack
Jan	14.1%	7.7%	4.5%	6.6%	7.0%	8.5%
Feb	13.3%	8.9%	4.7%	7.3%	7.2%	9.4%
Mar	3.5%	9.4%	8.5%	11.0%	8.1%	17.1%
Apr	3.5%	9.9%	11.9%	11.3%	8.8%	2.2%
May	12.8%	8.7%	11.2%	10.2%	8.4%	20.8%
Jun	9.4%	11.8%	8.7%	9.8%	9.6%	6.6%
Jul	8.6%	8.3%	4.6%	10.6%	8.5%	5.5%
Aug	7.1%	9.2%	9.9%	7.1%	8.1%	4.8%
Sep	4.7%	8.4%	9.0%	5.7%	8.3%	7.5%
Oct	7.0%	6.1%	10.2%	6.9%	10.0%	6.3%
Nov	6.5%	4.9%	8.2%	6.2%	9.1%	5.6%
Dec	9.4%	6.8%	8.6%	7.3%	6.8%	5.8%

3.3.1.2 Recreational Fishery

The South Atlantic recreational snapper grouper fishery is comprised of a private recreational sector and a for-hire recreational sector. The former includes anglers fishing from shore (including dock), piers, and from private/rental boats. In the subsequent description of the recreational fishery, the for-hire recreational sector is divided into the charterboat and headboat segments. Where possible catch, effort, and economic data that pertain to snapper grouper fishing are presented for each sector of this fishery. It must be noted that relevant databases for 2004 were not available for this analysis. A snapshot of the fishery is contained in Table 3-34.

Table 3-34. The recreational fishery for snapper grouper species in the South Atlantic averaged over the period from 1999 to 2003.
Source: Snapper Grouper Amendment 13C.

Item	Headboat Mode	Charter Mode	Private Mode	Total
Snapper grouper harvest (lb)	1,524,487	1,548,191	6,564,245	9,636,923
Number of fish harvested*	1,200,896	1,219,569	5,170,905	7,591,370
Value of fish caught (compensating variation)	$2,978,223	$3,024,531	$12,823,845	$18,826,599
Number of trips on which snapper grouper species were caught	235,130	112,600	2,771,074	3,118,804
Expenses by anglers on trips where snapper grouper species are caught ($2003)**	42,609,193	20,450,664	211,344,466	274,404,323

* Number of fish for other sectors estimated using average weight per fish from the headboat sector.
** For the headboat sector – multiplied expenditure estimate for the charter model by angler days to estimate the total expenditures and adjusted for inflation to 2003 dollars.

Recreational Fishing Participation

Charts depicting the number of saltwater anglers in the South Atlantic include participants engaged in all fisheries and those anglers who either fished from private/rental boats, from charter boats, or by shore/beach bank mode (Figure 3-28). Most saltwater anglers fish on the east coat of Florida and North Carolina. In Florida, it appears that there was an increasing trend in the number of saltwater anglers from 1981 to 2001 and a slight decline in 2002 and 2003. The number of participants engaged in saltwater fishing increased from 1981 through 2003 in North Carolina and by 2003 this figure was at almost the same level as observed in Florida during 2003 (Figure 3-28). The number of anglers fishing off South Carolina appears to have peaked in 1988, declined in 1989, and fluctuated with no apparent trend thereafter. In Georgia, the number of anglers decreased in the 1990s up until 1995, declined until 1999, and began increasing from 2000 (Figure 3-28).

Anglers targeted a variety of species including species in the South Atlantic snapper grouper complex (Figure 3-28). It is not possible to extract the estimated number of participants who targeted or caught snapper grouper species from this dataset. A more specific estimate of recreational activity in the South Atlantic snapper grouper fishery can be obtained from the effort data reported in the next section.

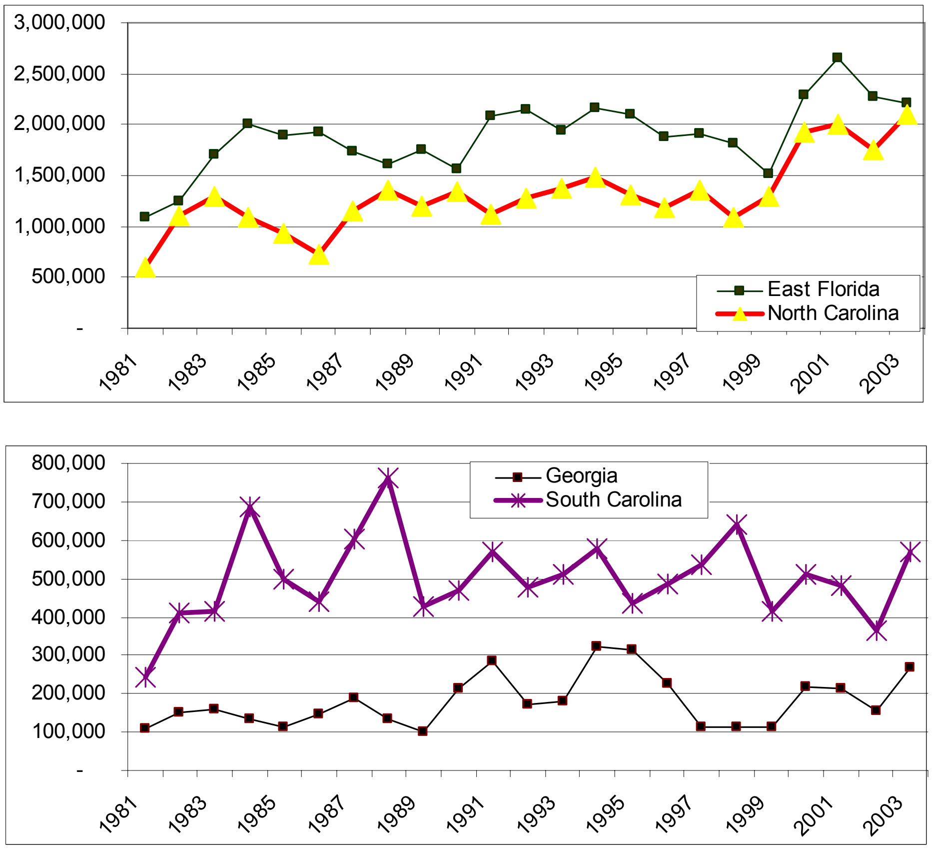


Figure 3-28. Number of anglers participating in all saltwater fisheries by State. Source: NOAA Fisheries. Note: Data for the east coast of Florida does not include Monroe County. Also, these numbers are not additive across States since an angler can fish in multiple states.

Recreational Fishing Effort

The analysis of angler effort in the snapper grouper fishery has been separated into a discussion of data from MRFSS, which covers the charter segment of the for-hire sector and the private recreational fishing sector (all modes) and the data collected from a separate survey of headboats operating in the South Atlantic.

The estimates of saltwater angling effort derived from the MRFSS can be characterized 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 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.

Harvest 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 and harvested (not released).

Total recreational trips – The total estimated number of recreational trips in the South Atlantic, regardless of target intent or catch success.

In the charter and private recreational fishing sectors, snapper grouper species were caught on 15.3 percent of all saltwater fishing trips during the period from 1999 to 2003 (Table 3-35). This proportion declines to 6.9 percent when considering only those trips where snapper grouper were actually harvested. Furthermore, snapper grouper species were harvested on about 45 percent of trips on which they were caught (1,305,882 / 2,883,874). Apart from individual preferences for particular species and catch-and-release ethics, this difference could be explained by regulatory constraints, such as bag and size limits. There was only a relatively small percentage of total trips where anglers indicated a target preference for snapper grouper species.

Table 3-35. South Atlantic recreational effort for all species in the snapper grouper fishery management unit.
Source: MRFSS, Social Sciences Branch, Southeast Regional Office, NOAA Fisheries.

	Target Effort		Catch Effort		Harvest Effort	
Year	Trips	% Total	Trips	% Total	Trips	% Total
Average 1986 - 2003	761,592	4.29%	2,456,758	13.85%	1,240,388	6.99%
Average 1999 - 2003	680,552	3.55%	2,883,874	15.29%	1,305,882	6.93%

The total number of trips where snapper grouper species were caught from 1986 to 2003 is shown in Figure 3-29. These snapper grouper catch trips fluctuated between 1.9 million and 3.2 million trips annually, and there appears to be an increasing trend from 1998 to 2003. During this period there was considerable fluctuation in the charter sector with no discernable trend. Most snapper grouper trips are taken by either private/rental or shore modes, and for the private/rental mode there appears to be an increasing trend in effort during the period from 1998 to 2003 (Figures 3-29 and 3-30).

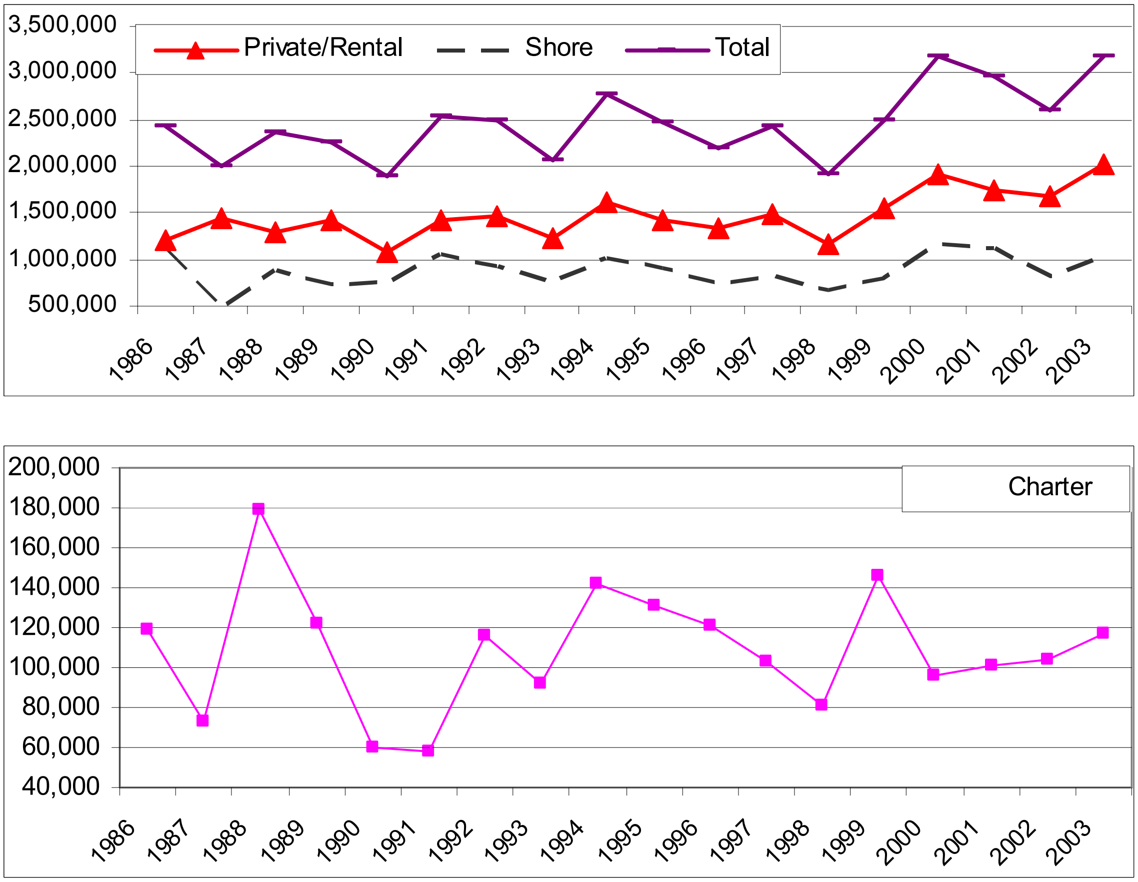
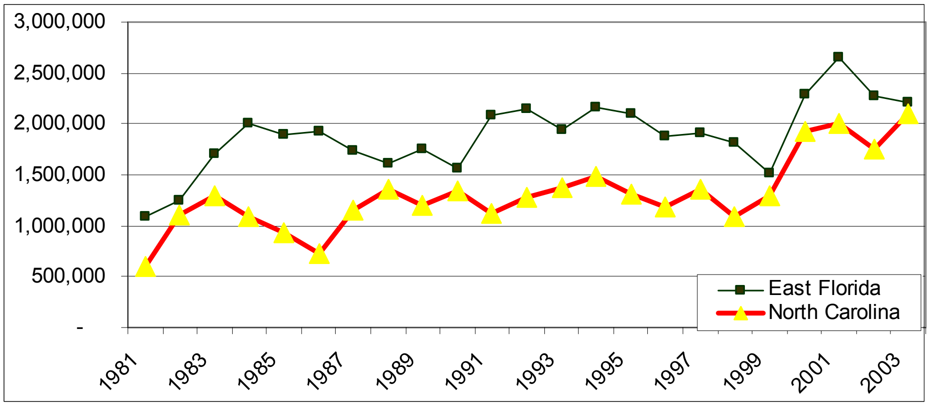


Figure 3-29. Recreational fishing trips (private and charter) where snapper grouper species were caught (catch effort) in the South Atlantic by mode.
Source: MRFSS, NMFS, SERO.

In terms of catch trips, it appears that snapper grouper species are relatively more important for charter and private/rental modes compared to the shore mode. For the charter sector and private/rental sector, snapper grouper species were caught on 28 and 20 percent of all recreational trips respectively while snapper grouper species were caught on 10 percent of all recreational shore mode trips in 2003 (Table 3-36). Among other factors, an angler's choice of mode can depend upon the species targeted, its location, and the cost of fishing.



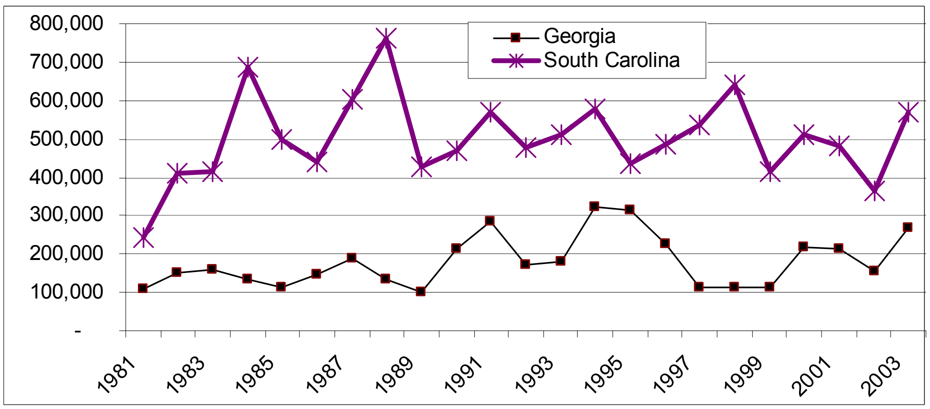


Figure 3-30. Recreational fishing trips (private and charter) where snapper grouper species were caught (catch effort) in the South Atlantic by state.
Source: MRFSS, Southeast Regional Office, NOAA Fisheries.

Table 3-36. Recreational fishing trips where snapper grouper species were caught (catch effort) in the South Atlantic by mode 1999 – 2003.
Source: MRFSS, NOAA Fisheries.

	Number of snapper grouper catch trips				Percent of all recreational trips			
Year	**Charter**	**Private/ Rental**	**Shore**	**Total**	**Charter**	**Private/ Rental**	**Shore**	**Total**
1999	145,524	1,546,316	796,956	2,488,796	21.9%	22.3%	11.7%	17.2%
2000	95,864	1,914,054	1,162,330	3,172,248	18.4%	21.0%	11.1%	15.8%
2001	100,743	1,743,299	1,127,365	2,971,408	20.3%	18.2%	9.8%	13.8%
2002	103,743	1,673,346	830,325	2,607,448	23.6%	20.2%	9.2%	14.7%
2003	117,090	2,025,667	1,035,712	3,178,470	28.4%	20.3%	9.5%	15.0%

In the South Atlantic, during the period from 2000 to 2003, an average of 85 percent of all snapper grouper catch trips (private recreational and charter sector) were either inland or inshore of three miles (SAFMC 2003). Some of the factors that determine the location of a recreational fishing trip are the species targeted, the cost of the trip, the angler's available time, and the mode of fishing.

A break down of saltwater angling effort for snapper grouper in the South Atlantic by state is shown in Table 3-37. Consistent with total participation, the majority of trips where snapper grouper species were caught occurred in Florida. For example, in 2003, snapper grouper species were caught on 2.72 million trips in Florida as compared to 0.46 million trips for the other three states combined (Table 3-37). Also, snapper grouper species appear to be relatively more important to the recreational fishery in Florida as compared to the other three states. In 2003, snapper grouper species were caught on 23.7 percent of all recreational trips in Florida as compared to less than 10 percent for the other South Atlantic states (Table 3-37).

Table 3-37. Recreational fishing trips where snapper grouper species were caught in the South Atlantic by state.
Source: MRFSS, Social Sciences Branch, Southeast Regional Office, NOAA Fisheries.

	Number of snapper grouper catch trips				Percent of all recreational trips			
Year	**East Florida**	**Georgia**	**North Carolina**	**South Carolina**	**East Florida**	**Georgia**	**North Carolina**	**South Carolina**
1999	2,153,349	20,857	233,677	80,912	26.3%	4.4%	5.1%	6.7%
2000	2,620,737	103,385	293,875	154,252	22.8%	13.0%	4.6%	11.5%
2001	2,489,972	76,705	281,553	123,178	20.0%	9.5%	4.2%	7.4%
2002	2,240,008	56,760	226,532	84,148	21.7%	9.2%	4.1%	6.7%
2003	2,716,431	92,124	228,998	140,917	23.7%	9.5%	3.4%	6.7%

Two sets of averages for target, catch, and harvest effort for each species group in the South Atlantic snapper grouper complex, calculated over the period from 1986 to 2003 and from 1999 to 2003, are shown in Table 3-38 through Table 3-45. These statistics provide another measure to gauge the relative importance of the various species groups. The relative magnitudes of the catch-effort and harvest-effort shares suggest that species in the shallow-water snapper unit (Table 3-39), grunt and porgy unit (Table 3-42), jack unit (Table 3-41), and sea bass unit (Table 3-43) are most important to saltwater anglers in the South Atlantic. Furthermore, these statistics indicate that species in the deepwater grouper and tilefish units are of little importance in the charter and private sectors of the recreational fishery.

Table 3-38. South Atlantic recreational effort for the shallow-water grouper Unit 1A. Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

	Target Effort							
	SWG		Gag Grouper		Black Grouper		Red Grouper	
Year	Trips	Percent Rec. Total	Trips	Percent Unit 1A Total	Trips	Percent Unit 1A Total	Trips	Percent Unit 1A Total
Average 1986 - 2003	72,750	0.41%	64,842	89.13%	4,797	6.59%	3,323	4.57%
Average 1999 - 2003	71,045	0.37%	62,811	87.64%	6,230	9.89%	2,357	3.35%
	Catch Effort							
	SWG		Gag Grouper		Black Grouper		Red Grouper	
Year	Trips	Percent Rec. Total	Trips	Percent Unit 1A Total	Trips	Percent Unit 1A Total	Trips	Percent Unit 1A Total
Average 1986 - 2003	132,670	0.75	60,397	45.52	12,466	9.4	42,695	32.18
Average 1999 - 2003	179,062	0.95	81,454	45.61	16,309	9.27	59,805	32.91
	Harvest Effort							
	SWG		Gag Grouper		Black Grouper		Red Grouper	
Year	Trips	Percent Rec. Total	Trips	Percent Unit 1A Total	Trips	Percent Unit 1A Total	Trips	Percent Unit 1A Total
Average 1986 - 2003	54,795	0.31%	28,617	52.23%	5,162	9.42%	12,803	23.37%
Average 1999 - 2003	60,503	0.32%	29,005	47.75%	4,581	7.59%	14,940	24.80%

Note: Shallow-water grouper Unit 1A includes gag grouper, red grouper, red hind, rock hind, yellowmouth grouper, tiger grouper, black grouper, yellowfin grouper, graysby, coney, and scamp. Harvest and/or possession of the species in shallow-water grouper units 1B and 1C are prohibited.

Table 3-39. South Atlantic recreational effort for the shallow-water snapper unit. Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

Year	Target Effort							
	SWS (Unit 3)		Yellowtail snapper		Mutton snapper		Gray snapper	
Year	Trips	Percent Rec. Total	Trips	Percent Unit 3 Total	Trips	Percent Unit 3 Total	Trips	Percent Unit 3 Total
Average 1986 - 2003	252,943	1.43%	39,122	15.47%	64,883	25.65%	145,253	57.43%
Average 1999 - 2003	169,800	0.89%	15,289	8.87%	32,252	18.32%	113,376	67.02%
	Catch Effort							
	SWS (Unit 3)		Yellowtail snapper		Mutton snapper		Gray snapper	
Year	Trips	Percent Rec. Total	Trips	Percent Unit 3 Total	Trips	Percent Unit 3 Total	Trips	Percent Unit 3 Total
Average 1986 - 2003	596,378	3.36%	100,797	16.90%	68,250	11.44%	398,190	66.77%
Average 1999 - 2003	828,512	4.42%	89,899	10.80%	83,233	10.06%	611,814	73.78%
	Harvest Effort							
	SWS (Unit 3)		Yellowtail snapper		Mutton snapper		Gray snapper	
Year	Trips	Percent Rec. Total	Trips	Percent Unit 3 Total	Trips	Percent Unit 3 Total	Trips	Percent Unit 3 Total
Average 1986 - 2003	276,220	1.56%	50,492	18.28%	45,951	16.64%	155,173	56.18%
Average 1999 - 2003	349,863	1.87%	43,013	12.16%	53,011	15.10%	220,980	63.06%

Note: The shallow-water snapper group (Unit 3) includes yellowtail snapper, mutton snapper, gray snapper, lane snapper, mahogany snapper, dog snapper, schoolmaster, cubera snapper, sand tilefish, puddingwife, and hogfish.

Table 3-40. South Atlantic recreational effort for the triggerfish unit.
Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

	Target Effort					
	T & S (unit 5)		Gray triggerfish		Atlantic spadefish	
Year	Trips	Percent Rec. Total	Trips	Percent T&S Total	Trips	Percent T&S Total
Average 1986 - 2003	17,403	0.10%	2,374	13.64%	14,924	85.76%
Average 1999 - 2003	21,551	0.11%	1,565	9.46%	20,053	91.72%
	Catch Effort					
	T & S (unit 5)		Gray triggerfish		Atlantic spadefish	
Year	Trips	Percent Rec. Total	Trips	Percent T&S Total	Trips	Percent T&S Total
Average 1986 - 2003	212,509	1.20%	86,124	40.53%	116,016	54.59%
Average 1999 - 2003	228,769	1.21%	78,535	35.43%	141,750	60.86%
	Harvest Effort					
	T & S (unit 5)		Gray triggerfish		Atlantic spadefish	
Year	Trips	Percent Rec. Total	Trips	Percent T&S Total	Trips	Percent T&S Total
Average 1986 - 2003	127,325	0.72%	39,377	30.93%	78,894	61.96%
Average 1999 - 2003	129,164	0.69%	39,771	31.95%	84,489	64.16%

Note: The triggerfish unit includes gray triggerfish, Atlantic spadefish, ocean triggerfish, and queen triggerfish.

Table 3-41. South Atlantic recreational effort for the jack unit.
Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

Year	Target Effort					
	All Jack (Unit 6)		Greater Amberjack		Blue Runner	
Year	Trips	Percent Rec. Total	Trips	Percent Jack Total	Trips	Percent Jack Total
Average 1986 - 2003	77,873	0.44%	7,329	9.41%	25,784	33.11%
Average 1999 - 2003	74,622	0.40%	4,784	6.83%	22,576	28.47%
	Catch Effort					
	All Jack (Unit 6)		Greater Amberjack		Blue Runner	
Year	Trips	Percent Rec. Total	Trips	Percent Jack Total	Trips	Percent Jack Total
Average 1986 - 2003	965,294	5.44%	57,265	5.93%	354,428	36.72%
Average 1999 - 2003	1,127,689	5.99%	54,558	4.88%	425,743	37.46%
	Harvest Effort					
	All Jack (Unit 6)		Greater Amberjack		Blue Runner	
Year	Trips	Percent Rec. Total	Trips	Percent Jack Total	Trips	Percent Jack Total
Average 1986 - 2003	351,171	1.98%	37,250	10.61%	177,294	50.49%
Average 1999 - 2003	394,677	2.10%	35,992	9.27%	222,337	55.50%

Note: The jacks unit includes greater amberjack, lesser amberjack, almaco jack, banded rudderfish, yellow jack, blue runner, bar jack, and crevalle jack.

Table 3-42. South Atlantic recreational effort for the grunts and porgies (Unit 7B). Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

	Target Effort							
	G&P Unit 7B		White Grunt		Black Margate		Sheepshead	
Year	Trips	Percent Rec. Total	Trips	Percent Unit 7B Total	Trips	Percent Unit 7B Total	Trips	Percent Unit 7B Total
Average 1986 - 2003	312,165	1.76%	1,271	0.41%	667	0.21%	294,122	94.22%
Average 1999 - 2003	308,470	1.60%	944	0.31%	932	0.31%	304,738	98.74%
	Catch Effort							
	G&P Unit 7B		White Grunt		Black Margate		Sheepshead	
Year	Trips	Percent Rec. Total	Trips	Percent Unit 7B Total	Trips	Percent Unit 7B Total	Trips	Percent Unit 7B Total
Average 1986 - 2003	617,545	3.48%	115,798	18.75%	22,776	3.69%	371,751	60.20%
Average 1999 - 2003	681,382	3.63%	96,849	14.41%	31,524	4.60%	415,289	60.79%
	Harvest Effort							
	G&P Unit 7B		White Grunt		Black Margate		Sheepshead	
Year	Trips	Percent Rec. Total	Trips	Percent Unit 7B Total	Trips	Percent Unit 7B Total	Trips	Percent Unit 7B Total
Average 1986 - 2003	430,029	2.42%	73,747	17.15%	17,759	4.13%	274,541	63.84%
Average 1999 - 2003	421,822	2.24%	67,084	16.24%	25,560	6.03%	268,044	63.15%

Note: The grunts and porgies unit includes white grunt, porkfish, margate, tomtate, bluestriped grunt, French grunt, Spanish grunt, smallmouth grunt, cottonwick, sailors choice, grass porgy, saucereye porgy, whitebone porgy, knobbed porgy, longspine porgy, sheepshead, and scup. Unit 7A is comprised of red porgy.

Table 3-43. South Atlantic recreational effort for the sea bass group (Unit 8). Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

	Target Effort			
	Sea Bass (Unit 8)		Black Sea Bass	
Year	Trips	Percent Rec. Total	Trips	Percent Rec. Total
Average 1986 - 2003	36,306	0.20%	35,379	97.45%
Average 1999 - 2003	30,618	0.16%	29,831	96.65%
	Catch Effort			
	Sea Bass (Unit 8)		Black Sea Bass	
Year	Trips	Percent Rec. Total	Trips	Percent Rec. Total
Average 1986 - 2003	416,247	2.35%	379,417	91.15%
Average 1999 - 2003	455,186	2.41%	436,915	96.04%
	Harvest Effort			
	Sea Bass (Unit 8)		Black Sea Bass	
Year	Trips	Percent Rec. Total	Trips	Percent Rec. Total
Average 1986 - 2003	170,975	0.96%	162,106	94.81%
Average 1999 - 2003	136,611	0.72%	132,510	96.93%

Note: The sea bass group includes black sea bass, rock sea bass, and bank sea bass.

Table 3-44. South Atlantic recreational effort for the deepwater grouper, tilefish, and snapper Units 2A and 2B, and grunt and porgy Unit 7A.
Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

Year	Target Effort		Target Effort		Target Effort	
	Deepwater G, T & S Unit 2A		Deepwater G, T & S Unit 2B		Grunt & Porgy Unit 7A	
Year	Trips	Percent Rec. Total	Trips	Percent Rec. Total	Trips	Percent Rec. Total
Average 1986 - 2003	688	0.00%	465	0.00%	145	0.00%
Average 1999 - 2003	444	0.00%	981	0.00%		
Average 2001-03					0	0.00%
	Catch Effort		Catch Effort		Catch Effort	
	Deepwater G, T & S Unit 2A		Deepwater G, T &S Unit 2B		Grunt & Porgy Unit 7A	
Year	Trips	Percent Rec. Total	Trips	Percent Rec. Total	Trips	Percent Rec. Total
Average 1986 - 2003	14,419	0.08%	10,266	0.06%	20,245	0.11%
Average 1999 - 2003	19,388	0.10%	18,773	0.10%		
Average 2001-03					20,490	0.10%
	Harvest Effort		Harvest Effort		Harvest Effort	
	Deepwater G, T & S Unit 2A		Deepwater G, T &S Unit 2B		Grunt & Porgy Unit 7A	
Year	Trips	Percent Rec. Total	Trips	Percent Rec. Total	Trips	Percent Rec. Total
Average 1986 - 2003	11,294	0.06%	20,245	0.10%	17,911	0.10%
Average 1999 - 2003	14,669	0.08%	20,490	0.07%		
Average 2001-03					15,143	0.07%

Note: Deepwater grouper, tilefish and snapper Unit 2A includes snowy grouper, yellowedge grouper, Warsaw grouper, speckled hind, misty grouper, and queen snapper. Unit 2B is comprised of golden tilefish and blueline tilefish. Red porgy makes up grunt and porgy Unit 7A.

Table 3-45. South Atlantic recreational effort for the mid-shelf snapper group (Unit 4). Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

	Target Effort					
	MSS (Unit 4)		Vermilion Snapper		Red Snapper	
Year	Trips	Percent Rec. Total	Trips	Percent Jack Total	Trips	Percent Jack Total
Average 1986 - 2003	59,004	0.33%	1,934	3.28%	57,006	96.61%
Average 1999 - 2003	64,239	0.33%	2,204	3.44%	61,884	96.45%
	Catch Effort					
	MSS (Unit 4)		Vermilion Snapper		Red Snapper	
Year	Trips	Percent Rec. Total	Trips	Percent Jack Total	Trips	Percent Jack Total
Average 1986 - 2003	91,219	0.51%	48,454	53.12%	50,985	55.89%
Average 1999 - 2003	129,171	0.69%	75,194	58.34%	74,696	57.92%
	Harvest Effort					
	MSS (Unit 4)		Vermilion Snapper		Red Snapper	
Year	Trips	Percent Rec. Total	Trips	Percent Jack Total	Trips	Percent Jack Total
Average 1986 - 2003	65,163	0.37%	37,001	56.78%	31,439	48.25%
Average 1999 - 2003	82,992	0.44%	55,836	67.50%	35,288	42.43%

Note: The mid-shelf snapper unit includes vermilion snapper, red snapper, black snapper, and blackfin snapper.

The total number of angler days for the headboat sector in the South Atlantic represents all headboat effort and not only those trips where snapper grouper species were caught. These estimates are calculated from a survey where it is not possible to associate catch with a specific angler on a trip. However, it is expected that a large proportion of these trips target snapper grouper species. Since 1987, it appears that there has been a declining trend in headboat angler days in the South Atlantic (Table 3-46). This represents an overall decrease of 54 percent. This decline in the number of angler days from 1987 to 2003 was observed in all South Atlantic states. Headboat effort on the east coast of Florida comprises a large proportion (70 percent) of the headboat trips in the South Atlantic, which is followed by South Carolina (18 percent), North Carolina (11 percent), and Georgia (1 percent) (Table 3-46).

Table 3-46. Estimated headboat angler days for the South Atlantic.
Source: The Headboat Survey, Southeast Fisheries Science Center, Beaufort Lab.

Year	Florida	Georgia	North Carolina	South Carolina	Total
1986	317,058		31,187	67,227	415,472
1987	329,799		34,843	78,806	443,448
1988	301,775		42,421	76,468	420,664
1989	316,864		32,933	62,708	412,505
1990	322,895		43,240	57,151	423,286
1991	280,022		40,936	67,982	388,940
1992	264,523		41,176	61,790	367,489
1993	236,973		42,786	64,457	344,216
1994	242,296	485	36,691	63,231	342,703
1995	206,852	3,214	40,295	61,739	312,100
1996	197,173	2,684	35,142	54,929	289,928
1997	170,367	2,906	37,189	60,150	270,612
1998	153,339	2,002	37,399	61,342	254,082
1999	162,195	1,857	31,596	55,499	251,147
2000	180,097	2,152	31,351	40,291	253,891
2001	161,052	2,337	31,779	49,265	244,433
2002	149,274	2,272	27,601	42,467	221,614
2003	143,585	1,426	22,998	36,556	204,565

Headboat operators usually offer their passengers options for choosing trip packages of different durations. It appears that the majority of headboat trips are of half a day duration in Florida (78 percent) and South Carolina (59 percent). In North Carolina and Georgia, the majority of trips are full day trips (Table 3-47).

Table 3-47. Average number of headboat trips from 1999 to 2003 by trip length and percent of total trips by duration of trip.
Source: The Headboat Survey, Southeast Fisheries Science Center, Beaufort Lab.

Average Number of Trips: 1999 – 2003				Percent of Total Trips		
State	Full Day	3/4 Day	1/2 Day	Full Day	3/4 Day	1/2 Day
Florida	1,972	546	9,038	17%	5%	78%
Georgia	152	1	10	93%		6%
North Carolina	561	17	374	56%	2%	38%
South Carolina	642	110	1,144	33%	6%	59%
South Atlantic	1,014	123	2,079	23%	5%	72%

Harvest in the Recreational Fishery

The harvest of recreational snapper grouper species peaked in 1988 at 12 million pounds (Table 3-48). Thereafter, landings decreased to 6.4 million pounds in 1998, and subsequently increased fluctuating between 8 million and 11 million pounds (Table 3-48). A similar trend was observed in the private recreational sector (private/rental boat mode and shore mode), which accounts for 62 percent to 78 percent of total snapper grouper landings. Snapper grouper harvest by the charter boat sector fluctuated considerable during this period with no distinct trend (Table 3-48).

Table 3-48. Harvest of snapper grouper species by mode in the South Atlantic. Source: The Headboat Survey, Southeast Fisheries Science Center, Beaufort Laboratory and MRFSS database, Southeast Regional Office, NOAA Fisheries.

Year	Charterboat[1]	Headboat[2]	Shore and Private/Rental Boat	Total
1986	821,343	2,661,961	5,437,568	8,920,872
1987	2,201,804	3,227,294	6,258,376	11,687,474
1988	2,392,740	3,417,107	6,184,386	11,994,233
1989	1,752,468	2,574,910	6,064,567	10,391,945
1990	786,090	2,557,352	4,612,202	7,955,644
1991	1,029,716	2,713,513	6,339,784	10,083,013
1992	1,540,113	2,160,642	7,338,270	11,039,025
1993	1,142,815	2,328,911	5,854,258	9,325,984
1994	2,337,545	2,119,554	6,477,448	10,934,547
1995	1,681,809	1,990,254	5,996,957	9,669,020
1996	1,433,353	1,801,595	6,161,361	9,396,309
1997	1,216,907	1,751,509	4,700,150	7,668,566
1998	975,980	1,582,317	3,857,407	6,415,704
1999	2,341,051	1,603,627	4,966,208	8,910,886
2000	1,108,396	1,553,842	7,401,989	10,064,227
2001	1,347,783	1,655,941	7,984,642	10,988,366
2002	1,363,388	1,433,118	5,184,057	7,980,563
2003	1,580,336	1,375,908	7,284,329	10,240,573
Average 1999 - 2003**	1,548,191	1,524,487	6,564,245	9,636,923

[1]Pounds of A and B1 fish estimated from the MRFSS Survey.
[2]The total annual estimate of headboat catch derived from data collected through the NMFS Headboat Survey.

There are regional differences in catch composition in the South Atlantic recreational fishery. The relative abundance of the various units in the snapper grouper harvest across the different sectors in the recreational fishery can differ considerable by state.

The mid-shelf snapper group (Unit 4) makes up the largest component of the headboat harvest in the South Atlantic (Figures 3-31 and 3-32. A number of other groups, such as the grunt and porgy group (Units 7A and 7B) and shallow-water grouper, tilefish, and snapper group (Units 2A and 2B), also comprise a substantial amount of the total headboat harvest in the South Atlantic. Even though most headboat angler trips occur off Florida, a larger proportion of the headboat harvest is taken from North and South Carolina (Figure 3-33).

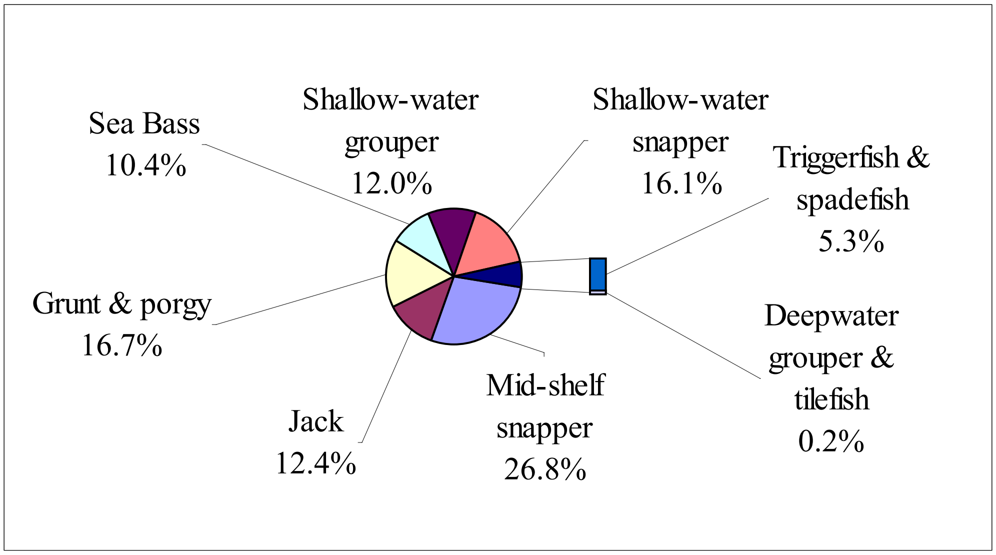


Figure 3-31. Composition of the headboat harvest by species groupings proposed in Amendment 13B averaged over the period from 1999 to 2003.
Source: The Headboat Survey, Southeast Fisheries Science Center, Beaufort Lab.

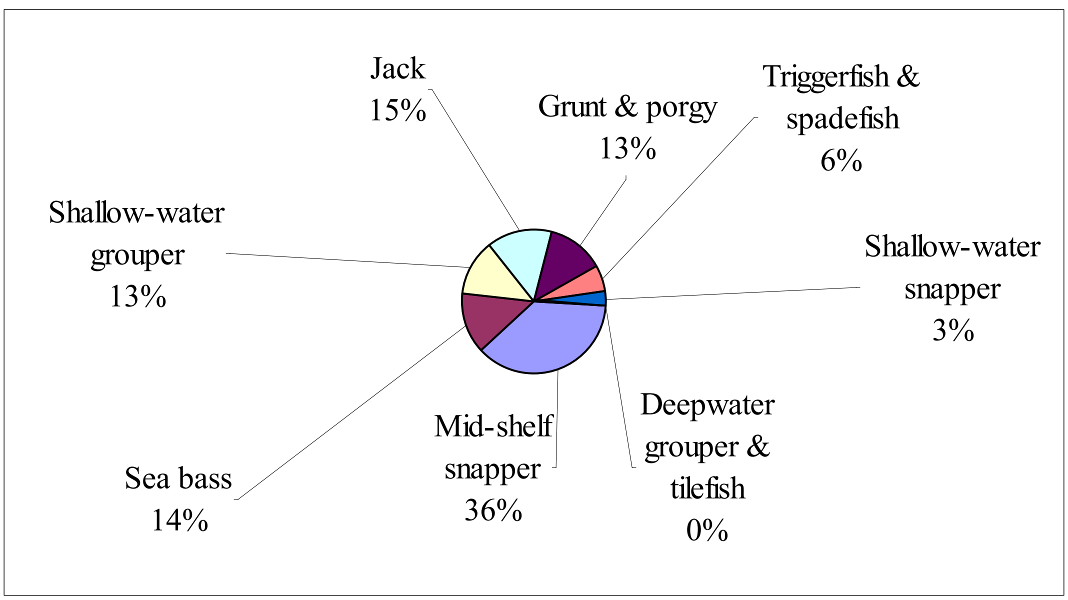


Figure 3-32. Composition of the headboat harvest by North Carolina, South Carolina, Georgia, and North Florida (excluding harvest south of North Florida) by species groupings proposed in Amendment 13B averaged over period from 1999 to 2003.
Source: The Headboat Survey, Southeast Fisheries Science Center, Beaufort Lab.

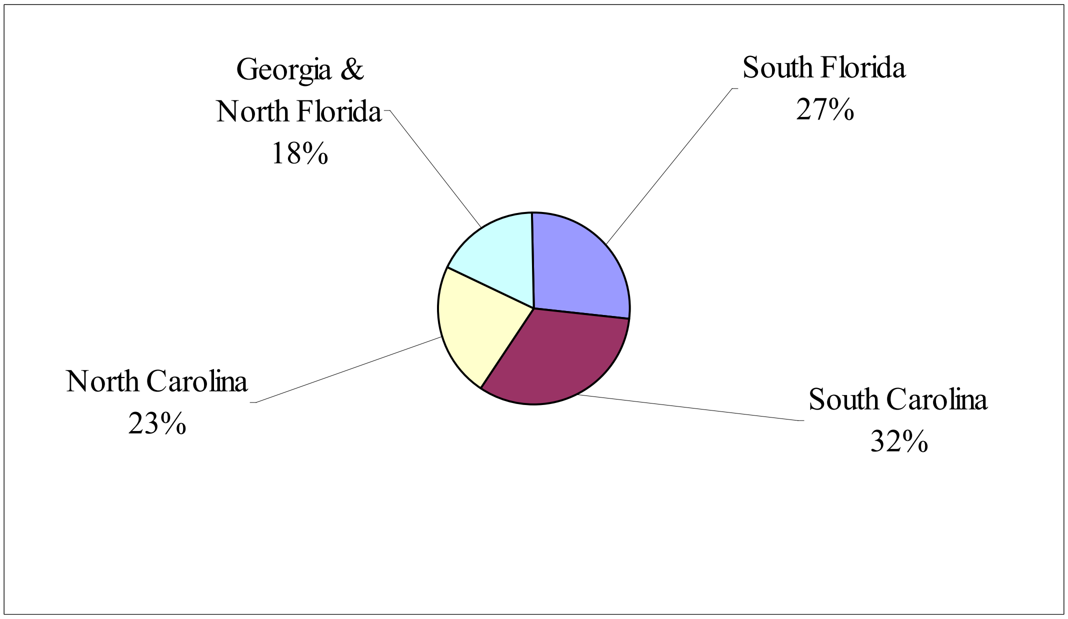


Figure 3-33. Distribution of headboat harvest by state/region averaged over the period from 1999 to 2003.
Source: The Headboat Survey, Southeast Fisheries Science Center, Beaufort Lab.

Species in the jack group (Unit 6) dominate snapper grouper harvests in the charterboat sector (Figure 3-34). The jack unit comprised an average of 48 percent of the entire snapper grouper harvest in the charter sector during the period from 1999 to 2003 (Figure 3-34). A vastly different composition emerges when the harvest from east Florida is excluded. The jack unit now comprises only 14 percent of the total charterboat harvest and the mid-shelf snapper, sea bass, and shallow-water grouper groups (Units 3, 8, and 1A and 1B) make up a substantially larger proportion of the total charterboat harvest (Figure 3-35). This is not surprising because 73 percent of the total charterboat harvest is taken on trips in east Florida where species in the jack group and the shallow-water snapper group are relatively more abundant (Figure 3-36).

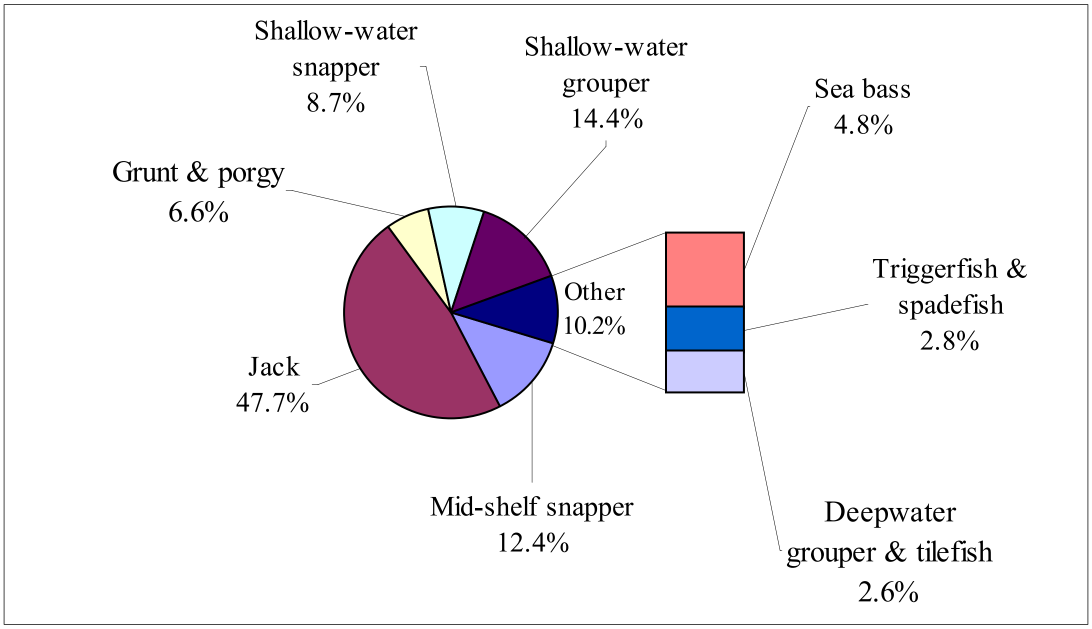


Figure 3-34. Composition of the charterboat harvest by species groups proposed in Amendment 13B averaged over the period from 1999 to 2003.
Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

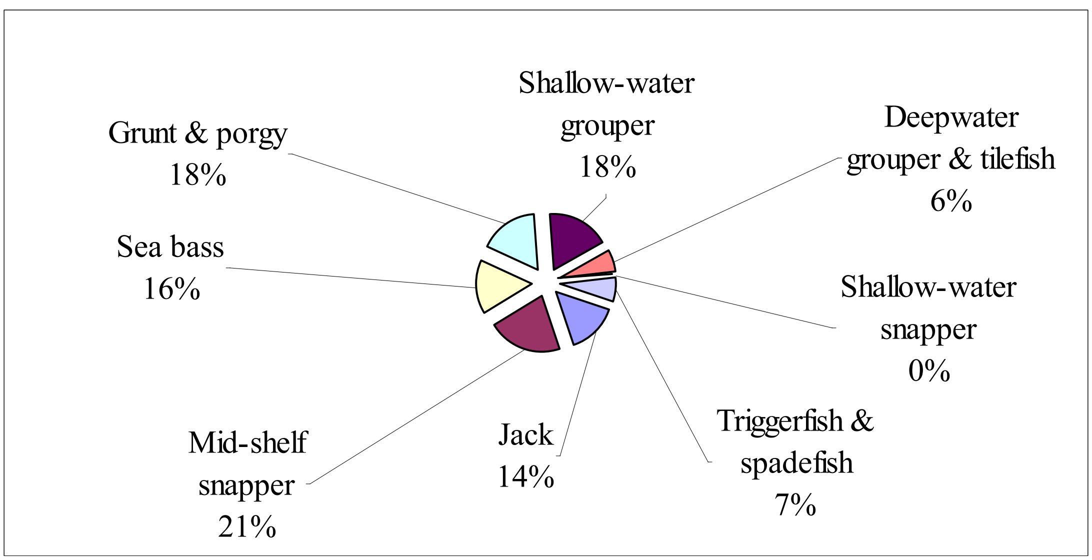


Figure 3-35. Composition of the charterboat harvest in North Carolina, South Carolina, and Georgia by species groups proposed in Amendment 13B averaged over the period from 1999 to 2003.
Note: Shallow-water grouper (Units 1A, B, and C); deepwater grouper, tilefish, and snapper (Units 2A and B); shallow-water snapper, tilefish, and wrasse (Unit 3); mid-shelf snapper (Unit 4); triggerfish and spadefish (Unit 5); jack (Unit 6); grunt and porgy (Units 7A and B); and sea bass (Unit 8). Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

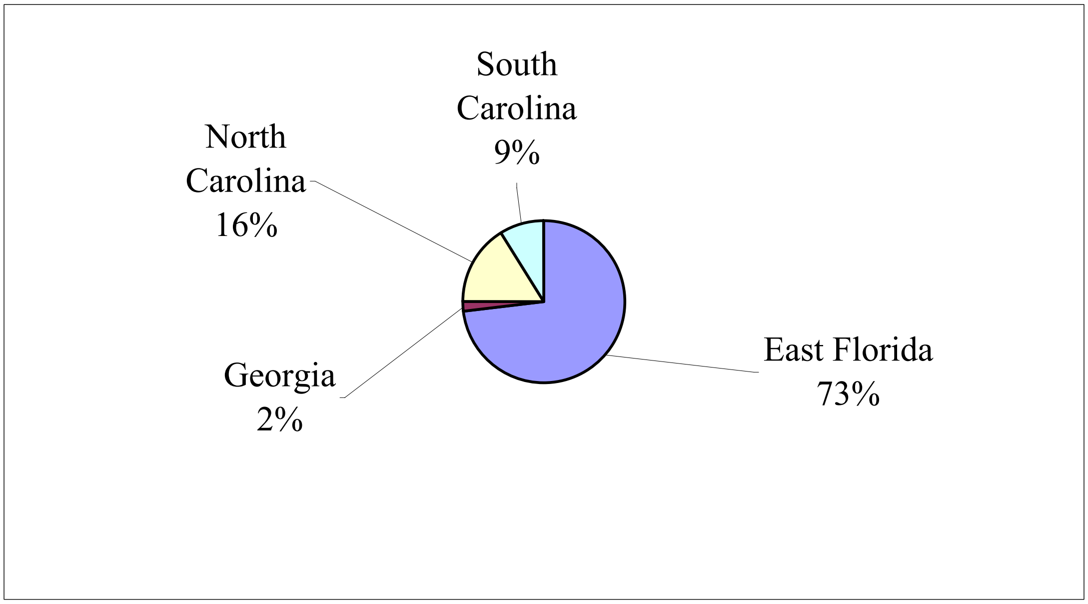


Figure 3-36. Distribution of charterboat harvest by state averaged over the period from 1999 to 2003.
Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

Harvest in the private recreational sector in the South Atlantic is dominated by species in the jack and grunt and porgy groups (Figure 3-37). These two groups comprised 60 percent of the total snapper grouper harvest during the period from 1999 to 2003 (Figure 3-37). Similar to charterboat harvest, a different catch composition emerges when Florida is excluded (Figure 3-38). Also, similar to the charterboat sector, a substantial proportion (80 percent) of the harvest is taken in Florida (Figure 3-39).

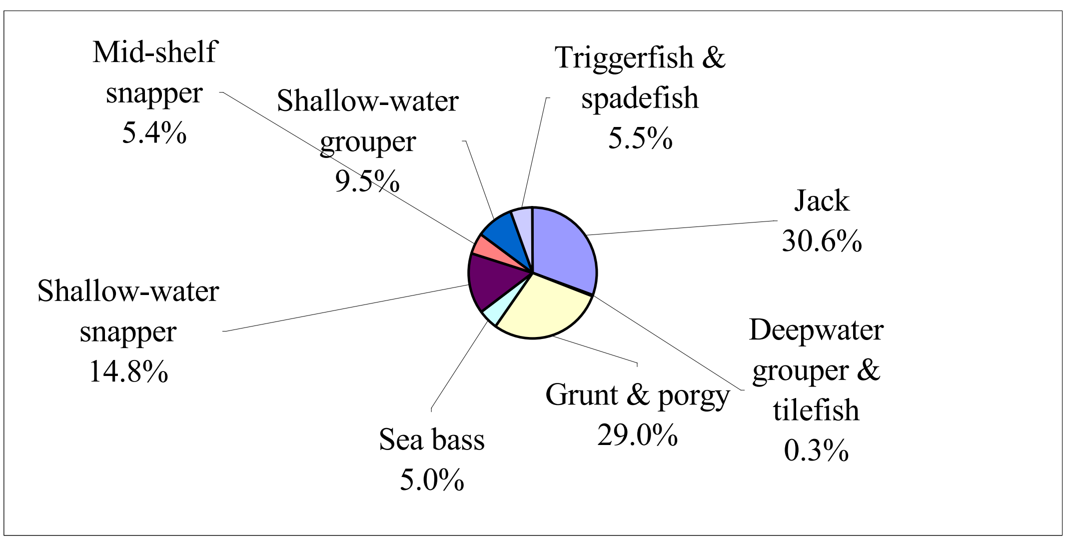


Figure 3-37. Composition of the private recreational sector's harvest by species group proposed in Amendment 13B averaged over the period from 1999 to 2004.
Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

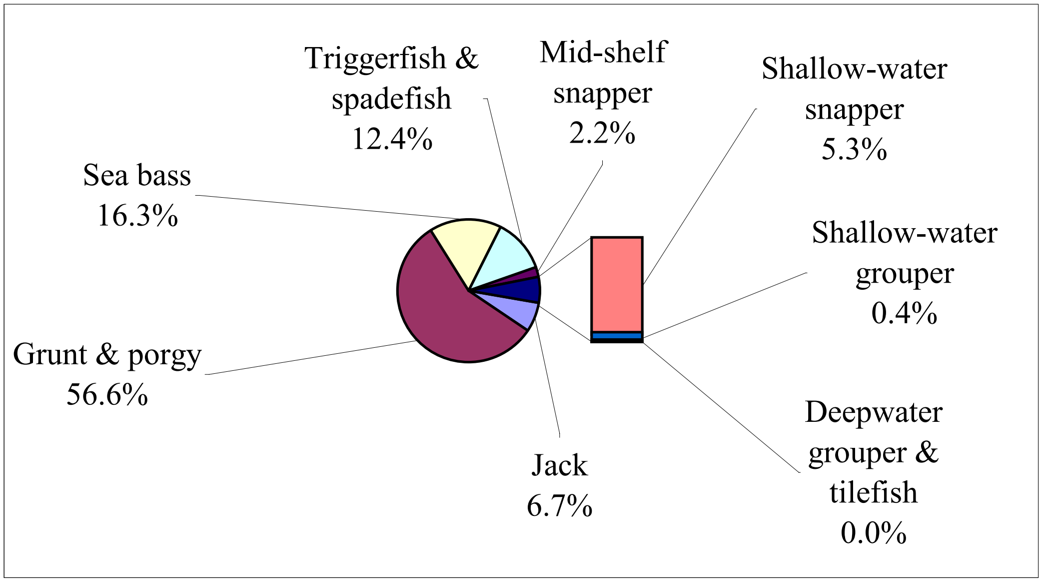


Figure 3-38. Composition of the private recreational sector's harvest in North Carolina, South Carolina, and Georgia by species group proposed in Amendment 13B averaged over the period from 1999 to 2003.
Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

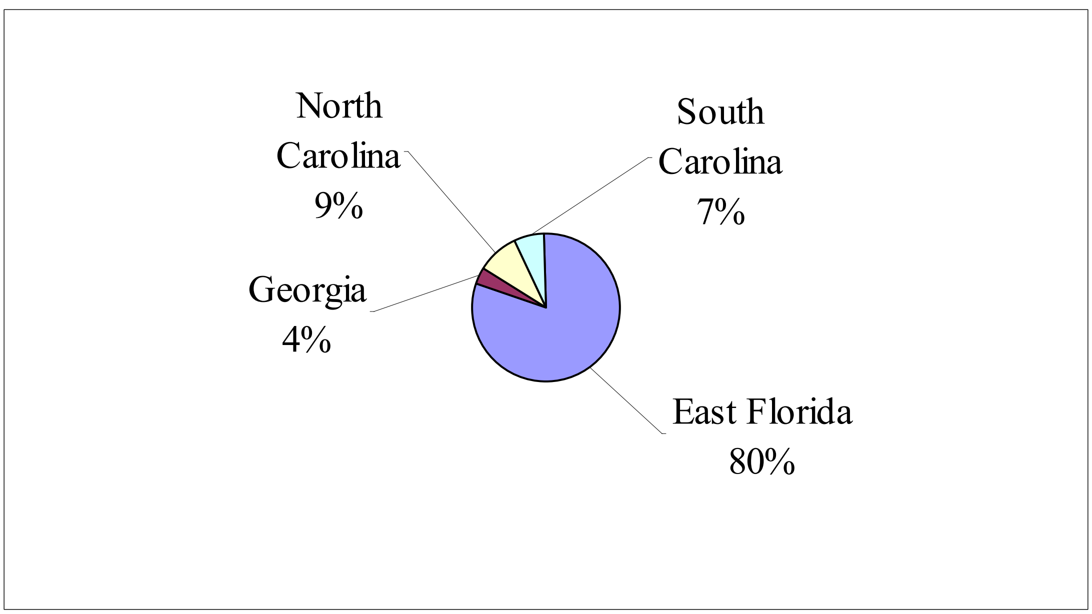


Figure 3-39. Distribution of the private recreational sector's harvest by state averaged over the period from 1999 to 2003.
Source: MRFSS database, Southeast Regional Office, NOAA Fisheries.

Headboats in the South Atlantic are dependent upon other fisheries apart from the snapper grouper complex. Over the period from 1999 to 2003, an average of 643,113 pounds of non-snapper grouper species were harvested annually by headboats in the South Atlantic. The average headboat landings of snapper grouper species during the same period amounted to 1.52 million pounds (Table 3-48). Thus, these non-snapper grouper species comprised 30 percent of the total headboat harvest in the South Atlantic, and the most frequently harvested species in this group are king mackerel and little tunny (Table 3-49). Of lesser importance are sharks, wahoo, dolphin, cobia, and bluefish.

Table 3-49. Percent composition of the headboat harvest of species not included in the snapper grouper complex from 1999 to 2003.
Source: Annual survey of headboats in the South Atlantic, Southeast Regional Office, NOAA Fisheries.

Species/Group	Percent of non-snapper grouper species
King mackerel	29.3%
Little tunny	26.1%
Sharks	8.8%
Wahoo	7.7%
Dolphin	6.1%
Cobia	5.0%
Bluefish	4.0%
Average harvest 1999 - 2003 (lbs)	643,113

Number of Permits Issued to For-Hire Operations

In the South Atlantic, charterboats and headboats are required to have a snapper grouper for-hire permit to fish for or possess snapper grouper species in the South Atlantic EEZ. The for-hire fishery operates as an open access fishery and not all of the permitted snapper grouper for-hire vessels are necessarily active in this fishery. Some vessel owners have been known to purchase open access permits as insurance for uncertainties in the fisheries in which they currently operate.

Since 1998 there has been an increasing trend in the numbers of permits issued to for-hire operations in the South Atlantic (Table 3-50). In 2004, there were 1,594 for-hire permits issued compared to 611 in 1999. The increase in South Atlantic permits might be attributed, in part, to anticipation of the charter permit moratorium in the Gulf of Mexico region that was announced in 1999, but not implemented until 2005.

Vessels with commercial snapper grouper permits also hold for-hire recreational snapper grouper permits in the South Atlantic. The number of commercial snapper grouper vessel owners purchasing these for-hire permits was greater in 2004 compared to 1999. In 2004, a total of 235 commercial snapper grouper vessel owners purchased a snapper grouper for-hire permit compared to 206 vessel owners in 1999 (Table 3-50). This increase in vessel permit issuance is somewhat odd with the declining trend in headboat effort and the fact that there has been no observed increase in catch trips in the party/charter sector for snapper grouper species.

Table 3-50. Snapper grouper for-hire permit holders by home port state.
Source: Southeast permits database, Southeast Regional Office, NOAA Fisheries.

Home port state	Number of vessels issued for-hire vessel permits						Number of vessels with both a for-hire permit and a commercial snapper grouper permit					
	1999	2000	2001	2002	2003	2004	1999	2000	2001	2002	2003	2004
Florida	361	419	675	776	957	1,084	133	133	144	145	148	151
North Carolina	134	130	180	195	206	232	37	41	39	35	45	42
South Carolina	73	76	137	129	122	108	29	32	39	34	34	33
Georgia	8	9	25	27	36	27	3	3	4	5	4	2
Virginia	3	7	10	11	5	13	2	5	6	6		4
Other states	13	23	33	38	69	48	2	5	3	2	8	3
Gulf states	19	21	35	44	82	82						
Total	**611**	**685**	**1,095**	**1,220**	**1,477**	**1,594**	**206**	**219**	**235**	**227**	**239**	**235**

There is a lot of mobility in the South Atlantic snapper grouper fishery. A vessel can be moved from area to area within a state and between states in a given year. The number of permits by state represents the vessel's location (address provided to the NOAA Fisheries Southeast Regional Permits Office) at the latest date within a particular year. The majority (776) of these permitted vessels are home ported in Florida (Table 3-50).

In addition to the permits data, Table 3-51 contains estimates of the active for-hire sector in the South Atlantic during 1997 (Holland *et al.* 1999). A total of 1,080 charter vessels and 96 headboats supplied for-hire services in all fisheries during 1997. Most of the active for-hire vessels were located in Florida during 1997 (Table 3-51).

Table 3-51. Charterboats and headboats operating in the South Atlantic during 1997.
Source: Holland *et al.* (1999).

State	Number of Headboats	Number of Charterboats
North Carolina	18	207
South Carolina	18	174
Georgia	2	56
Florida - Atlantic Coast	42	413
Florida -Keys	16	230
Total	96	1,080

Recent information on the size of for-hire vessels can be obtained from the Southeast Regional Permits Database. In 2003, the majority (86 percent) of these permitted vessels were between 21 and 49 feet in length (Table 3-52). There was a significant variation in the length composition of these permitted vessels during the period from 2000 to 2003 (Table 3-52).

Table 3-52. Proportion of permitted charterboat and headboat vessels in length categories.
Source: Southeast Regional Permits Database, Southeast Regional Office, NOAA Fisheries.

Length of Vessel (feet)	2000	2001	2002	2003
Less than 20	2%	3%	3%	2%
21 - 29	32%	31%	34%	31%
30 - 39	33%	33%	31%	32%
40 - 49	22%	21%	19%	23%
50 - 59	7%	8%	8%	9%
60 - 69	2%	2%	3%	2%
70 - 79	1%	1%	2%	1%
80 - 89	0%	0%	0%	0%
90 - 117	1%	0%	0%	0%

Economic Value and Economic Impact of the Recreational Fishery

The statistics presented in the preceding section document marine recreational fishing participation, recreational effort, and harvest of snapper grouper species. 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 compensating variation (same as non-market benefit). The magnitude of the non-market benefit derived from the recreational experience is dependent upon several quality determinants, which include fish size, catch success rate, the number of fish kept, and aesthetics. These quality variables are important not only in their determination of the value of the recreational fishing trip, but also in their influence on total demand for recreational fishing trips. For example, as the population of fish increases it is expected that angler success rate would increase and the marginal value of the fishing trip to anglers would increase, provided all other conditions remain the same.

Recent estimates of the economic value of a day of saltwater recreational fishing are available for the South Atlantic from different sources. Some of these estimates are not specific to snapper grouper fishing trips, but they shed some light on the magnitude of an angler's willingness to pay for this recreational experience. The mean value of access per marine recreational fishing trip was estimated at $109.31 for the South Atlantic (Haab *et al.* 2001). Such values can be considered good estimates of the opportunity cost of time for saltwater recreational fishing.

Other types of willingness to pay estimates represent the marginal value to the angler from a change in the bag limit or the value per fish caught per trip. Willingness to pay for an incremental increase in catch and keep rates per trip amounted to $3.01 for bottom fish species (Haab *et al.* 2001). Contingent valuation results from the same survey group yielded marginal valuation estimates of $1.06 to $2.20 to avoid a one-fish red snapper bag limit decrease (Whitehead and Haab 2001). The latter are averages across all recreational anglers and not only those anglers who targeted or caught red snapper. Results from a valuation study conducted in 1997 provided a compensating variation estimate of $2.49 per fish when calculated across recreational anglers in the boat mode category targeting snapper grouper species in the South Atlantic (Haab *et al.* 2001). This represents the value of an additional fish taken in all four states.

The valuation estimates previously discussed should not be confused with angler expenditures or economic activity generated as a result of these expenditures. Angler expenditures benefit a number of sectors that provide goods and services for saltwater sport fishing. A recent study conducted by NOAA Fisheries (Gentner *et al.* 2001) provides estimates of saltwater recreational fishing trip expenditures (Table 3-53). The average expenditure per trip varies depending upon the state, type of trip, duration, travel distance, and other factors (Tables 3-54 and 3-55).

Table 3-53. Summary of expenditures on saltwater trips estimated from a 1999 MRFSS add-on survey.
Source: Gentner *et al.* 2001.

Shore mode trip expenses	$63.61	$75.53	$54.12	$104.27	$31.78	$115.13	$36.90	$141.30
Private/rental boat trip expenses	$71.28	$92.15	$35.91	$67.07	$161.34	$77.51	$66.59	$94.15
Charter mode trip expenses	$201.66	$110.71	$139.72	$220.97	$152.45	$155.90	$96.11	$196.16
Charter fee average per day	$133.76	$70.59	$114.26	$109.97	$73.68	$80.99	$71.37	$100.79

Table 3-54. Estimated trip expenditures on snapper grouper trips in the South Atlantic by state.
Source: Public Draft of South Atlantic Snapper Grouper Amendment 13C.

Florida	2,444,099	$71.53	$174,826,401	$193,178,344
Georgia	69,966	$111.97	$7,834,093	$8,656,456
North Carolina	252,927	$76.11	$19,250,274	$21,271,021
South Carolina	116,681	$63.45	$7,403,409	$8,180,562
Total			$209,314,178	$231,286,385

Table 3-55. Estimated trip expenditures on snapper grouper trips in the South Atlantic by mode.

State	Average number of catch trips 1999 - 2003	Average weighted expenditures per trip[1]	Revenue associated with catch trips	Revenue adjusted for inflation ($2003)
Charter	112,600	$164	$18,507,851	$20,450,664
Private/Rental	1,780,536	$72	$127,342,992	$140,710,488
Shore	990,538	$65	$63,923,750	$70,633,978

Financial Operations of the Charterboat and Headboat Sectors

Holland *et al*. (1999) defined charterboats as boats for-hire carrying 6 or less passengers that charge a fee to rent the entire boat. Data from their study conducted in 1998 indicated that this trip fee ranged from $292 to $2,000. The actual cost to the passenger depended upon state, trip length, and the variety of services offered by the charter operation. In the South Atlantic, depending upon the state, the average fee for a half-day trip ranged from $296 to $360, for a full-day trip the range was $575 to $710, and for an overnight trip the average fee ranged from $1,000 to $2,000. More than 90 percent of Florida charter operators offered half-day and full-day trips and about 15 percent of the fleet offered overnight trips. In comparison, in the other South Atlantic states about 3 percent of the total charter trips were overnight trips.

Headboats tend to be larger, diesel powered and generally can carry a maximum of about 60 passengers. The average vessel length of the headboats whose owners responded to the survey was around 62 feet. In Florida, the average headboat fee was $29 for a half-day trip and $45 for a full-day trip. For North and South Carolina, the average base fee was $34 per person for a half-day trip and $61 for a full-day trip. Most of these headboat trips operated in federal waters in the South Atlantic (Holland *et al.* 1999).

Demand for charter and headboat trips will depend upon the fee charged and the quality of the fishing experience. As noted previously, variables such as catch success rates, bag (keep) limits, and aesthetics are determinants of the quality of the experience to the angler. Profits within the for-hire sector will depend upon trip demand, the fee charged, and cost of the fishing operation. The cost of fishing is expected to have an inverse relationship to the population size of the species because it is expected that costs of searching for fish decreases as the population size increases.

On the east coast of Florida, the average charter vessel length and horsepower was 39 feet and 617 hp, respectively. The average vessel length in North Carolina was comparable to Florida. Also, for the other states, it appears that charter vessels tended to be smaller than vessels in Florida and North Carolina. Electronics, such as global positioning systems (GPS) and fish finders, are common on most charter vessels in the South Atlantic. Capital investment in charter vessels averaged $109,301 in Florida, $79,868 in North Carolina, $38,150 in South Carolina, and $51,554 in Georgia (Holland *et al.* 1999). Charterboat owners incur expenses for inputs, such as fuel, ice, and tackle, in order to offer the services required by their passengers. Most expenses incurred in 1997 by charter vessel owners were on crew wages and salaries and fuel (ibid). The average annual charterboat business expenditures incurred was $68,816 for Florida vessels, $46,888 for North Carolina vessels, $23,235 for South Carolina vessels, and $41,688 for vessels in Georgia in 1997. The average capital investment for headboats in the South Atlantic was around $220,000 that same year. Total annual business expenditures averaged $135,737 for headboats in Florida and $105,045 for headboats in the other three South Atlantic states.

The average gross revenue per vessel was $51,000 for charterboats on the Atlantic coast of Florida, $60,135 in North Carolina, $26,304 in South Carolina, and $56,551 in Georgia. Revenues were generally higher for headboat vessels. Average gross revenue was estimated at $140,714 for headboat vessels in Florida and $123,000 for headboats vessels in the other South Atlantic states.

Shark Bottom Longline Fishery

In 1993, NMFS implemented the FMP for Sharks of the Atlantic Ocean, which established three management units: large coastal sharks (LCS), small coastal sharks (SCS), and pelagic sharks. At that time, NMFS identified LCS as overfished, and implemented commercial quotas for LCS and established recreational harvest limits for all sharks. In 2003, NMFS amended the measures enacted in the 1999 FMP based on the 2002 LCS and SCS stock assessments, litigation, and public comments. Implementing regulations for Amendment 1 to the 1999 FMP were published on December 24, 2003 (68 FR 74746). Management measures enacted in the amendment included: re-aggregating the large coastal shark complex, using maximum sustainable yield (MSY) as a basis for setting commercial quotas, eliminating the commercial minimum size restrictions, establishing three regional commercial quotas (Gulf of Mexico, South Atlantic, and North Atlantic) for LCS and SCS management units, implementing trimester commercial fishing seasons effective January 1, 2005, imposing gear restrictions to reduce bycatch, and a time/area closure off the coast of North Carolina effective January 1, 2005. As a result of using MSY to establish quotas, and implementing a new rebuilding plan, the overall annual landings quota for LCS in 2004 was established at 1,017 metric tons (mt) dressed weight (dw). The overall annual landings quota for SCS was established at 454 mt dw and the pelagic, blue, and porbeagle shark quotas were established at 488 mt dw, 273 mt dw, and 92 mt dw, respectively.

The regional quotas which were established in Amendment 1 to the 1999 HMS FMP for LCS and SCS were intended to improve overall management of the stocks by tailoring quotas to specific regions based on landings information. These quotas were based upon average historical landings (1999 – 2001) from the canvass and quota monitoring databases. The canvass database provides a near-census of the landings at major dealers in the southeast United States (including state landings) and the quota monitoring database collects information from dealers in the South Atlantic and Gulf of Mexico.

On November 30, 2004, NMFS issued a final rule (69 FR 69537), which established, among other things, new regional quotas based on updated landings information from 1999 – 2003. This final rule did not change the overall quotas for LCS, SCS, and pelagic sharks established in Amendment 1 to the 1999 HMS FMP, but did revise the percentages allocated to each of the regions. The updated information was based on several different databases, including the canvass and quota monitoring databases, the Northeast Commercial Fisheries Database (CFDBS), and the snapper grouper logbook. The new regional quotas and trimester seasons for the commercial Atlantic shark fishery became effective January 1, 2005.

Commercial shark fishing effort is generally concentrated in the southeastern United States and Gulf of Mexico (Cortes and Neer 2002). During 1997 – 2003, 92 – 98 percent of LCS, 38 – 49 percent of pelagic sharks, and nearly all SCS (80 – 100 percent) came from the southeast region (Cortes pers. comm.). McHugh and Murray (1997) found in a survey of shark fishery participants that the largest concentration of bottom longline fishing vessels is found along the central Gulf coast of Florida, with the John's Pass - Madeira Beach area considered the center of directed shark fishing activities. Consistent with other HMS fisheries, some shark fishery participants move from their homeports to other fishing areas as the seasons change and fish stocks move.

The Atlantic bottom longline fishery targets both LCS and SCS. Bottom longline is the primary commercial gear employed in the LCS and SCS fisheries in all regions. Gear characteristics vary by region, but in general, an approximately ten-mile long bottom longline, containing about 600 hooks, is fished overnight. Skates, sharks, or various finfishes are used as bait. The gear typically consists of a heavy monofilament mainline with lighter weight monofilament gangions. Some fishermen may occasionally use a flexible 1/16 inch wire rope as gangion material or as a short leader above the hook.

The following section provides information on shark landings as reported in the shark bottom longline observer program.

In January 2002, the observer coverage requirements in the shark bottom longline fishery changed from voluntary to mandatory participation if selected. NMFS selects approximately 40 - 50 vessels for observer coverage during each season. Vessels are randomly selected if they have a directed shark limited access permit, have reported landings from sharks during the previous year, and have not been selected for observer coverage during each of the three previous seasons.

The U.S. Atlantic commercial shark bottom longline fishery has been monitored by the University of Florida and Florida Museum of Natural History, Commercial Shark Fishery Observer Program (CSFOP) since 1994. In June 2005, responsibility for the observer program was transferred to the Southeast Fisheries Science Center's Panama City Laboratory. The observer program trains and places the observers aboard vessels in the directed shark bottom longline fishery in the Atlantic and Gulf of Mexico to collect data on the commercial shark fishery and thus improve overall management strategies for the fishery. Observers provide baseline characterization information, by region, on catch rates, species composition, catch disposition, relative abundance, and size composition within species for the large coastal and small coastal shark bottom longline fisheries.

During 2003, six observers logged 263 sea days on shark fishing trips aboard 20 vessels in the Atlantic from North Carolina to Florida and in the eastern Gulf of Mexico off Florida. The number of trips taken on each vessel ranged from one to five and the number of sea days each observer logged ranged from nine to 35. Observers documented the catches and fishing effort on approximately 150 longline sets that fished 103,351 hooks. During 2004, five observers logged 196 sea days on 56 shark fishing trips aboard

11 vessels. Observers documented the catches and fishing effort during 120 longline sets that fished 90,980 hooks.

Data from the shark observer program between 2000 and 2002 show that LCS comprised 66.2 percent of the total catch (Burgess and Morgan 2002). During 2003, LCS comprised 68.4 percent of the total catch, and in 2004 LCS comprised 66.7 percent of the total catch. Sandbar sharks dominated the observed catches with 30.6 percent of total LCS catch in 2003 and 26.6 percent in 2004. The overall catch and disposition of species for 2004 is listed in Table 3.53 (table found in the report of the shark bottom longline observer program). Regional differences in sandbar shark abundance were evident. For example, in the Carolina region, sandbar sharks comprised 67.4 percent of the total catch and 77.2 percent of the large coastal shark catch. In the Florida Gulf region, sandbar sharks comprised 62.0 percent of the total catch and 66.5 percent of the large coastal catch, whereas in the Florida East Coast region, sandbar sharks comprised only 17.2 percent of the total observed catch, and 37.1 percent of the large coastal shark catch (Burgess and Morgan 2003). Blacktip sharks comprised 13.9 percent of total observed catch and 20.3 percent of the large coastal catch (Burgess and Morgan 2002). Tiger sharks comprised 7.5 percent of the total observed catch and 11.0 percent of the large coastal shark catch. A majority of tiger sharks (71.7 percent) and nurse sharks (98.8 percent) were tagged and released.

During 2003, shark observer program data indicate that SCS comprised 28.0 percent of the total observed catch (Burgess and Morgan 2003, 2004). Atlantic sharpnose shark dominated the SCS catch (80.3 percent). The remainder of the small coastal catch consisted of blacknose sharks (5.5 percent), bonnethead (0.03 percent), and finetooth (0.02 percent). In previous seasons, the Atlantic sharpnose shark was the most frequently caught shark in the Florida East Coast region and accounted for 51.6 percent of the total observed catch, and 96.0 percent of the small coastal catch in that region (Burgess and Morgan 2002).

Bottom longlining for sharks has relatively low observed bycatch rates. Historically, finfish bycatch has averaged approximately five percent in the bottom longline fishery. Finfish bycatch for the bottom longline fishery includes, but is not limited to, skates, rays, cobia, redfish, bluefish, great barracuda, and snapper grouper species. During the second semi-annual season of 2003, observer data indicate that approximately 4,320 sharks were caught compared to 432 other fish, four invertebrates, and three sea turtles (Burgess and Johns 1999). In terms of bycatch rates, observed shark catches constitute 91 percent of the 4,759 total animals caught, with other fish comprising 10 percent, invertebrates less than .01 percent, and sea turtles less than .01 percent.

3.3.2 Social and Cultural Environment

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

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

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

Permit requirements for the commercial snapper grouper fishery were established in 1992 by Amendment 1 (SAFMC 1997). Amendment 8 (SAFMC 1997) created a limited entry system for the fishery and established two types of permits based on the historic landings associated with a particular permit. Those who could demonstrate a certain amount of landings over a certain time period received permits that did not limit the number of pounds of snapper grouper that could be landed from federal waters (hereafter referred to as "unlimited commercial permits"). These permits are fully transferable. Vessels with verified landings, but not sufficient to meet the threshold were issued permits that allowed them to land 225 pounds of snapper grouper species on each trip (hereafter referred to as "limited commercial permits"). These permits may not be sold. New entry into the fishery requires the purchase of two unlimited permits from existing permit holders to exchange for one new permit. This "two for one" system was intended to gradually decrease the number of permits in the fishery. These restrictions only applied to the commercial snapper grouper permit.

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

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

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

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

3.3.2.1 North Carolina

Figure 3-40. North Carolina communities with substantial fishing activity, as identified by South Atlantic Advisory Panels.

3.3.2.1.1 Statewide

Overview

Of the four states in the South Atlantic region, North Carolina (Figure 3-40) is often recognized as possessing the most "intact" commercial fishing industry; that is, it is more robust in terms of viable fishing communities and fishing industry activity than the other three states. The state offers a wide variety of fishing opportunities, including sound fishing, trolling for tuna, bottom fishing, and shrimping. Perhaps because of the wide variety of fishing opportunities, fishermen have been better able to weather regulations and coastal development pressures, adjusting their annual fishing patterns as times have changed.

Commercial Fishing

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

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

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

Cheuvront and Neal (2004) also provided an overview of how North Carolina commercial snapper grouper fishermen carry out their fishery. Approximately 65 percent of surveyed fishermen indicated year-round fishing. Gag is the fish most frequently targeted by these fishermen, with 61 percent of fishermen targeting gag at some point in the year, despite the prohibition of commercial sales and limitation to the recreational bag limit in March and April. Vermilion snapper (36 percent) and black sea bass (46 percent) are the next most frequently targeted species. A significant number of fishermen land king mackerel during each month, with over 20 percent of fishermen targeting king mackerel between October and May. During the gag closed season, king mackerel are targeted by about 35 percent of the fishermen. Other snapper grouper complex species landed by at least 5 percent of the fishermen in any given month were red grouper (39.5 percent), scamp (27.4 percent), snowy grouper (9.7 percent), grunts (14.5 percent), triggerfish (13.7 percent), and golden tilefish (5.6 percent). Non-snapper grouper complex species landed by at least 5 percent of the fishermen in any given month included Atlantic croaker, yellowfin tuna, bluefin tuna, dolphin, and shrimp.

Recreational Fishing

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

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

3.3.2.1.2 Hatteras Village

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

Overview

Census data indicate there was not a significant increase in population size in Hatteras Village from 1990 to 2000 (SAFMC 2006a). The demographics of the island have shifted, as is evidenced by the decreasing percentage of the population that is actively in the workforce, perhaps reflecting a larger number of retirees in the community, and the increasing proportion of residents with higher education, also reflecting a retired, professional segment of the population. Hatteras Village has also experienced a significant increase in the percent of the population in the farming, fishing, and forestry occupations, from 5.6 percent to 10.8 percent. This may reflect the increasing number of persons employed in businesses related to recreational fishing, such as charter boat captains and crew, boat repair and sales, marinas, etc. See SAFMC (2006a) for the raw data describing community demographics. Figure 3-41 includes two maps detailing the area.

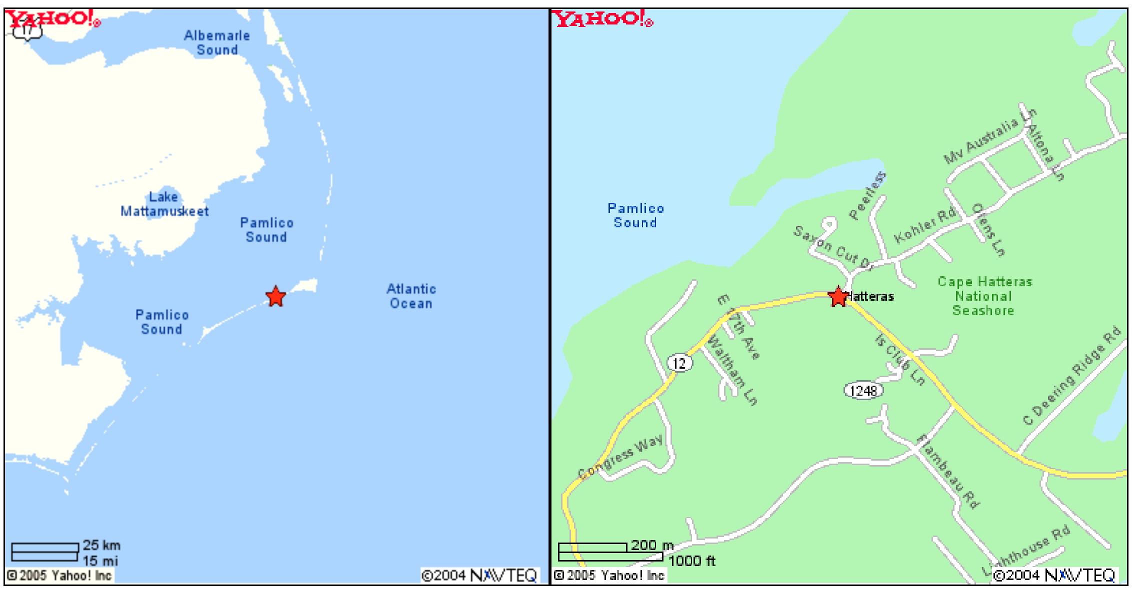


Figure 3-41. Hatteras Island and Village, Outer Banks, North Carolina.
Source: Yahoo Maps, http://www.yahoo.com.

Commercial Fishing

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

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

Recreational Fishing

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

3.3.2.1.3 Wanchese

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

Figure 3-42. Map of Roanoke Island, North Carolina, showing Wanchese and Manteo. Source: Kitner 2005.

Overview

Figure 3-42 provides a map of Roanoke Island, including Wanchese and Manteo. While Wanchese has maintained its identity as a commercial fishing community, it faces continuing pressure from developers in nearby Manteo and other Outer Banks communities. However, the town has recently approved a zoning document that would prevent unplanned growth and would help preserve working waterfronts and residential areas (Kozak 2005). A partial community profile detailing local traffic patterns, businesses, and prominent families can be found in SAFMC (2006a).

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

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

Commercial Fishing

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

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

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

There were 228 commercial vessels registered and 201 state standard commercial fishing licenses issued in the community in 2002 (SAFMC 2006a). Wanchese residents also held 12 dealer licenses. The town is an important unloading port for many vessels transiting to and from the Mid-Atlantic and South Atlantic.

Recreational Fishing

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

Figure 3-43. Area of Carteret County, North Carolina, showing Morehead City, Atlantic Beach (at the red star), and Beaufort.
Source: Yahoo Maps, http://www.yahoo.com.

3.3.2.1.4 Morehead City

In Carteret County, Morehead City, Beaufort, and Atlantic Beach form a triad of different but complementary communities in close geographic proximity (Figure 3-43). A detailed history of Morehead City, from its founding in the 1840s-1850s to its development as a center for sport and tournament fishing in recent years, can be found in SAFMC (2006a).

Overview

Morehead City's economy is currently based on tourism, fishing (commercial and recreational), light industry, government, and other service and professional industries. The town has regained its commercial viability as a modern port terminal, and benefits from its location on the "sound-side" of the Atlantic Beach resort trade. Diving has become an important tourist activity; Rodale's Scuba Diving magazine recently named

North Carolina as the best wreck diving destination in North America, and Morehead City as the best overall dive destination. Recreational fishing effort is growing quickly as new marinas, boat storage areas, boat builders, and marine supply stores open in the city.

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

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

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

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

3.3.2.1.5 Beaufort

Beaufort is located on the coast near Cape Lookout, and borders the southern portion of the Outer Banks. Its deep harbor is home to vessels of all sizes, and its marinas are a favorite stop-over for transient boaters. A detailed history of Beaufort, from its establishment to its importance as a trade center during the 18th and 19th centuries, to its later involvement in the menhaden fishing industry, can be found in SAFMC (2006a).

Overview
Tourism, service industries, retail businesses, and construction are important mainstays of the Beaufort area, with many shops and restaurants catering to people from outside the area. Census data show a slight decrease in population size from 1990 to 2000, from

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

Commercial Fishing

There has been a slight decrease in the number of unlimited commercial permits held by residents of Beaufort, from 5 permits in 1999 to 4 permits in 2004. In the last two years, the one limited commercial permit held by a Beaufort resident was no longer reported. As of 2002, the state had issued 430 commercial vessel registrations, 294 standard commercial licenses, and 32 dealer licenses to Beaufort residents.

Recreational Fishing

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

3.3.2.1.6 Atlantic Beach

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

Overview

Atlantic Beach demographic data from 1990 and 2000 show a slight population decline since 1990, as well as decreases in the percent of the population involved in farming, fishing, and forestry (SAFMC 2006a). The median age of the population has increased, perhaps a reflection of the growing number of retirees moving to this area of the coast.

Commercial Fishing

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

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

Figure 3-44. General area of Sneads Ferry, North Carolina.
Source: Yahoo Maps, http://www.yahoo.com.

3.3.2.1.7 Sneads Ferry

Sneads Ferry is a historical fishing village located on the New River near the northern tip of Topsail Island (Figure 3-44). The river joins the Intracoastal Waterway at Sneads Ferry, with easy access to the Atlantic Ocean. A very active commercial fishing community, Sneads Ferry takes in more fish than any other Onslow County port (http://www.cbcoastline.com/areainfo.htm). It also includes Camp Lejeune, a U.S. Marine base. The Sneads Ferry Shrimp Festival has been held annually since 1971. Now grown to a two-day event, the annual shrimp festival is the town's major fund-raiser. From its proceeds, the town established a 14-acre community park and built a 7,200 square foot Shrimp Festival Community Building (www.sneadsferry.com/areahistory/his_sf.htm).

Overview
Census data indicate the population of Sneads Ferry increased by about 10 percent from 1990 to 2000, from 2,031 inhabitants to 2,248. Most new residents were white, and the number of black or African American residents decreased from 159 to 115. Median

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

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

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

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

3.3.2.2 South Carolina

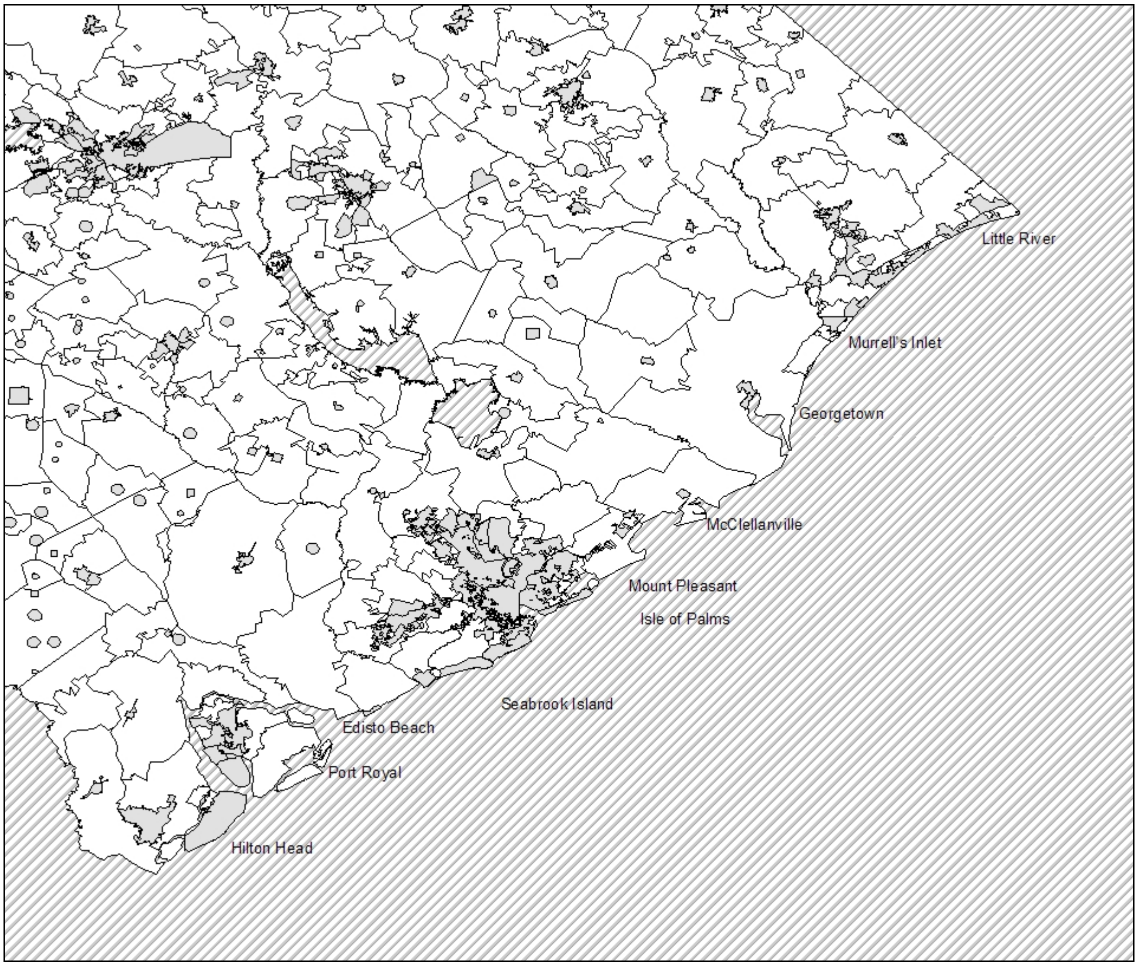


Figure 3-45. South Carolina communities with substantial fishing activity, as identified by South Atlantic Advisory Panels.

3.3.2.2.1 Statewide

Overview

South Carolina communities with substantial fishing activity (Figure 3-45) are less developed than those in North Carolina and, over the past 20 to 30 years, the state has seen much more tourist-oriented development along its coasts than Georgia or North Carolina. In Horry County, the urban area of Myrtle Beach has expanded greatly in the past few decades, and much of the coastal area has been developed as vacation homes, condominiums, and golf courses. The communities most impacted by this development are Little River, Murrells Inlet, Pawleys Island, and Georgetown, although the latter three are located in Georgetown County (Figure 3-45). The same is true of rapidly developing Charleston County, and the cities and communities of McClellanville, Mt. Pleasant, Sullivans Island, Wadmalaw Island, and Edisto Islands feel the impact of urban sprawl from the city of Charleston. Further south along the coast, the Hilton Head Island resort development has been the impetus for changing coastal landscapes in the small towns of Port Royal, Beaufort, St. Helena Island, and Bluffton.

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

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

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

3.3.2.2.2 Little River

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

Figure 3-46. Little River, South Carolina and surrounding area.
Source: Yahoo Maps, http://www.yahoo.com.

Overview

Figure 3-46 shows Little River and the surrounding area. A detailed description of changes in land-use patterns in and near Little River can be found in SAFMC (2006a). Nearby Murrells Inlet is gradually transforming into a residential community for Myrtle Beach, and SAFMC (2006a) argues this is also true for Little River.

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

Commercial Fishing

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

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

3.3.2.3 Georgia

3.3.2.3.1 Statewide

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

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

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

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

3.3.2.3.2 Townsend

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

Overview

The population of Townsend increased by over 1,000 residents from 2,413 in 1990 to 3,538 in 2000. Although there was a large relative increase in the number of Hispanic or Latino residents, from 2 to 27, most of the new inhabitants were white (1,465 in 1990 and 2,437 in 2000). Median income increased from approximately $23,000 to $35,000. Median home value nearly tripled, from $33,000 in 1990 to $98,100 in 2000, and monthly rent nearly doubled, from $213 to $431. In 1990, 26.9 percent of residents had less than a 9th grade education, but by 2000 that number declined to 11.0 percent. The percentage of those completing high school increased by nearly 15 percent, while the percent receiving a bachelor's degree or higher remained about the same, from 8.4 percent to 8.9 percent. The percent of the population with an income below the poverty line deceased by four percent, but remained high at 14.6 percent. The percentage of the population unemployed increased from 3.4 percent to 6.5 percent. There has been a sizeable decline in the percentage of the population employed in manufacturing, from 29.0 percent to 16.2 percent, and the proportion of the population employed in farming, fishing, and industry remained unchanged at approximately three percent.

Commercial Fishing

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

Recreational Fishing

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

3.3.2.4 Florida

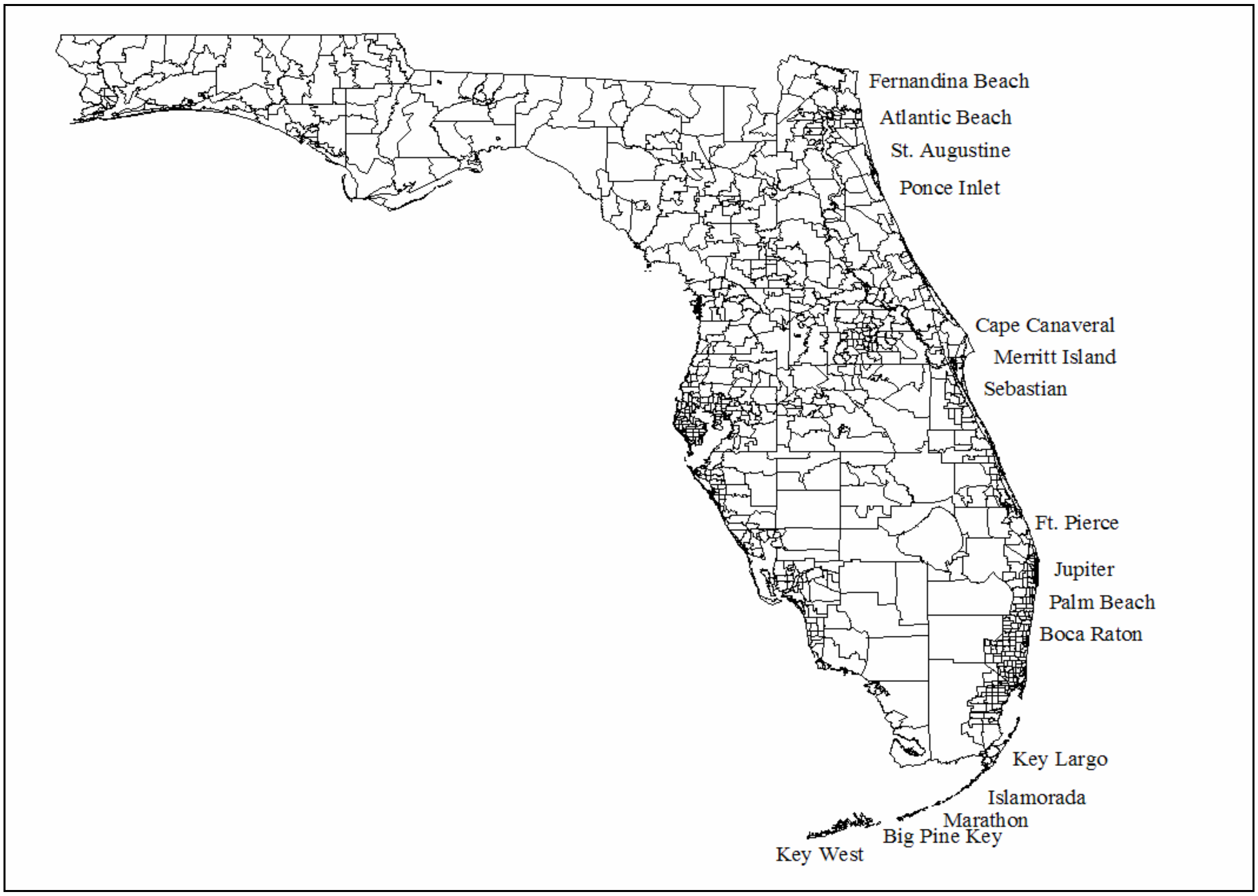


Figure 3-47. Florida communities with substantial fishing activity as identified by South Atlantic Advisory Panels.
Source: Jepson and Kitner (In Press).

3.3.2.4.1 Statewide

Overview
Florida (Figure 3-47) stands apart from other states in the South Atlantic region in fishing behaviors, history, and demographics. Florida has one of the fastest growing populations in the United States, estimated to increase each day by 750 to 1,000 new immigrants. Twenty-five percent of all vacation homes in the United States are located in Florida's coastal counties (Coastal Ocean Resource Economics 2005).

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

The natural geography of Florida also sets it apart from other South Atlantic states, particularly in the area from central Florida through the Keys. The weather is amenable to fishing almost year round, though hurricanes in 2004 were particularly devastating and took a toll on all fisheries in the state, both east and west coast. There was also a cold water event that started near West Palm Beach in 2003, which moved up the east coast causing a substantial decline in snapper grouper fishing that year. The continental shelf is much narrower in Florida than elsewhere in the region, allowing fishermen to access deepwaters quickly and return the same day. Finally, the species of snapper grouper available to fishermen in southern Florida are different than further north, with yellowtail snapper, gag and black grouper, and other alternative species such as stone crab, spiny lobster, dolphin, kingfish, and billfish allowing a greater variety of both commercial and recreational fishing opportunities. These fisheries are important to many Florida communities identified by the Snapper Grouper Advisory Panel as shown in Figure 3-47.

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

Recreational Sector
While the commercial fishing industry, though still strong, may be in decline, the recreational sector appears to be stable. Excluding the headboat sector, although the number of participants declined in 2004 to approximately 1.9 million from 2.2 million in 2003 and from a high of 2.6 million in 2001, the number of trips taken in 2003 and 2004 remained at approximately 21 million. As may be recalled from Table 3-46, the headboat sector has exhibited a steady decline. In 2004, many homeports hosted at least one vessel holding both federal charter/headboat permits and federal unlimited commercial permits. Key West and Miami stand out, with 35 and 15 such vessels, respectively.

3.3.2.4.2 Cape Canaveral

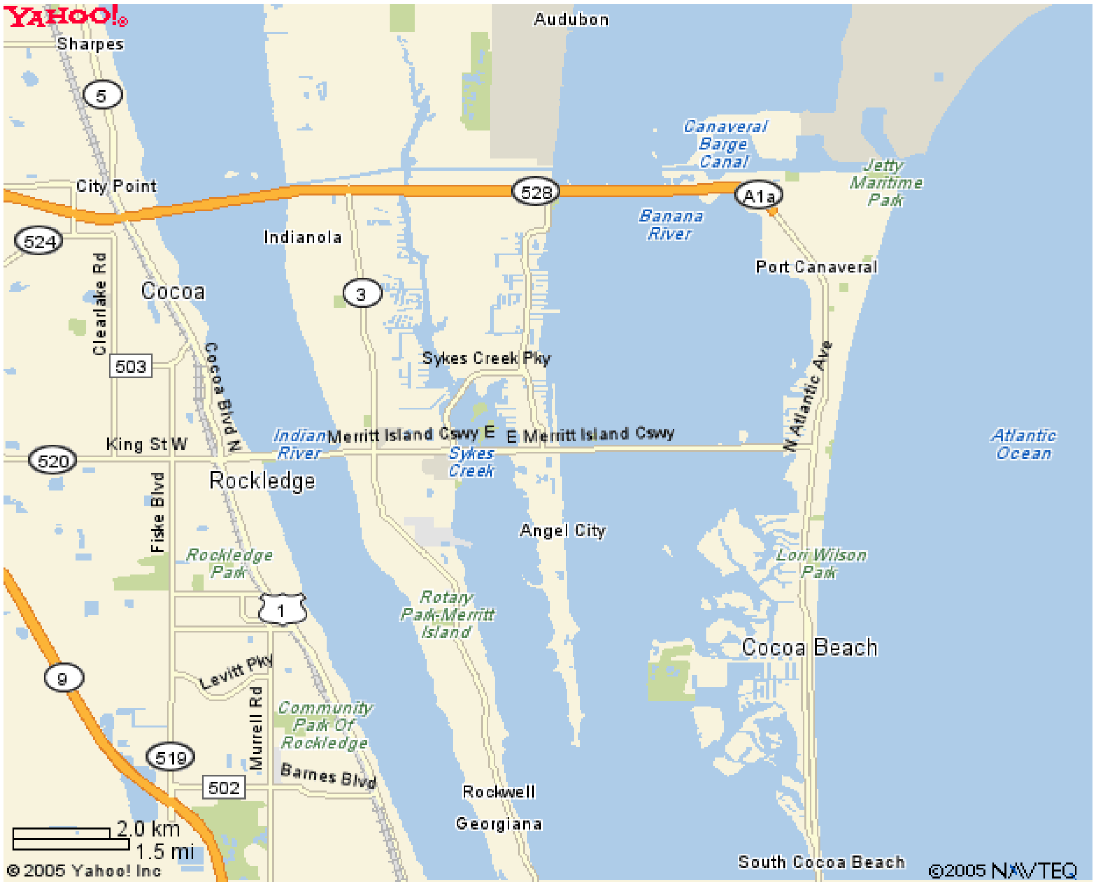


Figure 3-48. Area map of Cape Canaveral, Florida.
Source: Yahoo Maps, http://www.yahoo.com.

A detailed history of Cape Canaveral, Florida, from its first habitation 10,000 years ago, its settlement by the United States in the early 1800s, the establishment of the Banana River Naval Air Station in World War II, to NASA's arrival in 1952, can be found in SAFMC (2006a). A map of the area is shown as Figure 3-48.

Overview

Cape Canaveral has a fairly homogenous, aging population, with those 65 years and older growing from 16.1 percent of the population to 23.1 percent since 1990. Overall, educational attainment has increased. The number of persons who speak a language other than English at home has increased 2.5 percent, and fewer people have incomes below the poverty line. Unemployment has decreased, but fewer people are in the labor force today than in 1990, perhaps due to an aging population. The percentage of persons in a service occupation has grown from 14.1 percent to 20.4 percent, while there has been a sizeable decline in the percent of residents employed in forestry, mining, and fishing, from 2.7 percent in 1990 to 0.4 percent in 2000.

Fisheries in central Florida generally operate in two different environments, inshore river or inlet fishing with associated lagoons, which primarily attracts recreational fishing, and offshore areas, where commercial fishing primarily occurs. Popular inshore areas include the Indian, St. Johns, and Banana Rivers and associated lagoons. Commercial exploitation of the rivers and lagoons declined after implementation of the Florida Net Ban of 1994.

Many commercial fish houses have gone out of business or have shifted to selling imported products to supplement their local supplies. At the same time, the number of businesses possessing federal dealer permits has increased from about 180 in 1999 to a little over 200 in 2001. There is some industry speculation that the increasing number of dealer permits reflects increased decentralization in the domestic fishing markets and the need to increase profits by self-marketing.

Commercial Fishing
Cape Canaveral draws fishermen from Cocoa/Cocoa Beach, Merritt Island, Melbourne, and Titusville. These fishermen target many snapper grouper species, as well as coastal migratory pelagics such as mackerel, highly migratory species such as sharks and swordfish, and shellfish such as oysters, quahogs, and shrimp. Snowy grouper and tilefish (particularly golden or sand tilefish) landings exceed 10,000 pounds per year. Total commercial landings decreased, however, from 8.9 million pounds to 6.0 million pounds from 1998 to 2004 (SAFMC 2006a).

The number of unlimited commercial permits in this area increased from nine in 1999 to 16 in 2004. The number of limited commercial permits fluctuated over this period, but ultimately declined from four permits in 1999 to one in 2004 (SAFMC 2006a).

The number of Florida Saltwater Products Licenses issued to residents of Brevard County (where Cape Canaveral is located) decreased from 872 in 1998/99 to 492 in 2004/05 (SAFMC 2006a). This license is needed to sell marine species in the state. There have also been declines in license sales for various crustacean fisheries.

Recreational Fishing
In 2004, Brevard county supported 36 bait and tackle stores, with five in Cape Canaveral, and 70 marinas with over 3,000 wet slips, indicating the importance of recreational fishing to the area. Fourteen fishing tournaments consistently occur in the area. Additional details about these businesses and tournaments can be found in SAFMC (2006a).

As in other coastal areas of Florida, there is a fairly heavy presence in Brevard County of charter boat businesses, private marinas, and other associated businesses catering to the recreational fishing sector. The number of federally permitted charter/headboat vessels in Cape Canaveral increased from zero to seven from 1999 to 2004. According to Holland *et al.* (1999), there were approximately 32 charter boats and 2 headboats in the Canaveral/Melbourne area. Current estimates from permit files show at least 38 for-hire vessels with Snapper grouper permits homeported in Cape Canaveral or Port Canaveral, which includes approximately four headboats. That is likely a low estimate for the total number of for-hire vessels in the area since it does not include vessels in the nearby Merritt Island and in the Cocoa/Cocoa Beach areas.

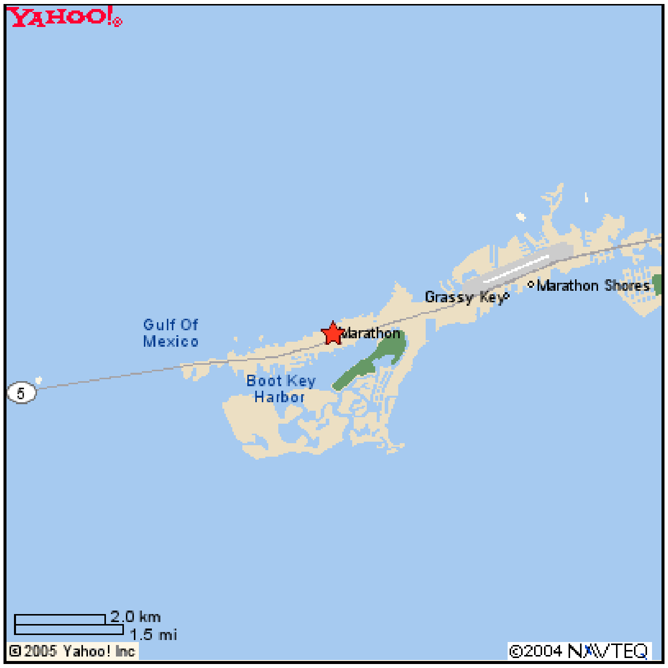


Figure 3-49. Marathon, Florida.
Source: Yahoo Maps, http://www.yahoo.com.

3.3.2.4.3 Marathon

A history of Marathon, detailing its settlement in the 1800s, the rise of industry, the effects of the Great Hurricane of 1935, the rise of tourism, and the importance of commercial fishing, can be found in SAFMC (2005a). Figure 3-49 shows a map of Marathon, which lies in Monroe County.

Overview

Census data from 1990 and 2000 show there was an increase in the overall population in Marathon from 8,857 in 1990 to 10,255 in 2000. During this period, the Hispanic population more than doubled, increasing from 1,040 to 2,095. This increase accounts for more than two thirds of the total population increase for the area. During this period of time, the median household income increased from approximately $25,000 to over $36,000.

Marathon has maintained a relatively high percentage of the total population, 4.1 percent in 2000, involved in farming, fishing, and forestry, though the percentage has declined from 8.7 percent in 1990. Since there is little commercial farming and forestry occurring in the area, the majority can be assumed to relate to fishing activities. The percentage of people that live below the poverty line decreased slightly from 15.1 percent in 1990 to 14.2 percent in 2000.

Commercial Fishing
In 1998, 184 Marathon residents were employed in fishing related industry according to the Census data, with 39 of those in the "fishing" category, 92 employed in "fish and seafood," and 47 employed by marinas (SAFMC 2006). The number of unlimited commercial permits held by community residents decreased from 65 permits to 44 permits between 1999 and 2004. Similarly, the number of limited commercial permits decreased from 43 permits to 31 permits.

Recreational Fishing
While most of the waters around Marathon are open to fishing, some areas have been set aside for eco-tourism and fish-viewing by divers and snorkelers. Sombrero Reef, said to be one of the most beautiful sections of North America's only living coral barrier reef, lies several miles offshore and is protected by the Florida Keys National Marine Sanctuary (http://www.fla-keys.com/marathon).

The importance of recreational boating and fishing to the economy of Marathon is shown by the businesses reliant upon it. As of 2004, there were at least 25 charter boat businesses, two party boat businesses, eight bait and tackle shops, and 27 marinas in the area. The number of vessels holding the federal charter/headboat permit increased from 16 in 1999 to 30 in 2004. In addition, there were seven fishing tournaments in Marathon. Most tournaments are centered on tarpon fishing. However, there are inshore and offshore fishing tournaments as well. These tournaments begin in February and run through June. Hotels and restaurants fill with participants and charters. Guides and bait shops reap the economic benefits of these people coming to the area. These tournaments are positive economic pulses in the local economy, one that thrives on the existence of tourism and recreational fishing.

3.4 Administrative Environment

3.4.1 The Fishery Management Process and Applicable Laws

3.4.1.1 Federal Fishery Management

Federal fishery management is conducted under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (16 U.S.C. 1801 et seq.), originally enacted in 1976 as the Fishery Conservation and Management Act and recent reauthorization in January 2007. The MSFCMA claims sovereign rights and exclusive fishery management authority over most fishery resources within the U.S. Exclusive Economic Zone (EEZ), an area extending 200 nautical miles from the seaward boundary of each of the coastal states, and authority over U.S. anadromous species and continental shelf resources that occur beyond the U.S. EEZ.

Responsibility for Federal fishery management decision-making is divided between the U.S. Secretary of Commerce and eight regional Fishery Management Councils that represent the expertise and interests of constituent states. Fishery Management Councils are responsible for preparing, monitoring, and revising management plans for fisheries needing management within their jurisdiction. The Secretary of Commerce (Secretary) is responsible for collecting and providing the data necessary for the Councils to prepare fishery management plans and for promulgating regulations to implement proposed plans and amendments after ensuring that management measures are consistent with the MSFCMA and with other applicable laws summarized in Section 8.0. In most cases, the Secretary has delegated this authority to NOAA Fisheries Service (NMFS).

The South Atlantic Fishery Management Council is responsible for conservation and management of fishery resources in Federal waters of the U.S. South Atlantic. These waters extend from 3 to 200 miles offshore from the seaward boundary of the States of North Carolina, South Carolina, Georgia, and east Florida to Key West. The Council has thirteen voting members: one each from the state fishery agencies of North Carolina, South Carolina, Georgia, and Florida; eight public members appointed by the Secretary; and one from NOAA Fisheries Service. 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 Council committees have full voting rights at the committee level but not at the full Council level. Council members serve three-year terms and are recommended by State Governors and appointed by the Secretary of Commerce from lists of nominees submitted by State governors. Appointed members may serve a maximum of three consecutive terms.

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

3.4.1.2 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 within the North Carolina Department of Environment and Natural Resources. The Marine Resources Division of the South Carolina Department of Natural Resources regulates South Carolina's marine fisheries. Georgia's marine fisheries are managed by the Coastal Resources Division of the Department of Natural Resources. The Division of Marine Fisheries within the Florida Fish and Wildlife Conservation Commission is responsible for managing Florida's marine fisheries. Each state fishery management agency has a designated seat on the South Atlantic Council. The purpose of state representation at the Council level is to ensure state participation in Federal fishery management decision-making and to promote the development of compatible regulations in State and Federal waters.

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

NOAA Fisheries Service'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.

3.4.2 Enforcement

There is a perception by some fishery stakeholders that a lack of enforcement is a major impediment to successful fishery management in the South Atlantic region (The Heinz Center 2000). As discussed below, multiple agencies provide enforcement assets to Federal fisheries concerns in the South Atlantic region.

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

Neither NOAA/OLE nor the USCG can provide a continuous law enforcement presence in all areas due to the limited resources of NOAA/OLE and the priority tasking of the USCG. To supplement at-sea and dockside inspections of fishing vessels, NOAA entered into Cooperative Enforcement Agreements with all but one of the States in the Southeast Region, which grants 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 State of North Carolina does not currently participate; their State constitution first needs to be modified to allow them to participate.

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

4 Environmental Consequences

4.1 Background

4.1.1 Biological

4.1.1.1 Effects of Heavy Fishing Pressure on Sex Ratio of Some Fishes

Many factors make snapper grouper species particularly vulnerable to fishing pressure and can limit the effectiveness of traditional management approaches. Some snapper grouper species have sexual strategies which potentially make them more susceptible to overfishing. Certain species, such as snowy grouper, Warsaw grouper, misty grouper, and yellowedge grouper are protogynous, changing sex from female to male at some point during their lives. When these species are overfished, and if they are unable to compensate by changing sex at smaller sizes and/or younger ages, then the ratio of males to females within the population can change, potentially diminishing reproductive success either by sperm limitation or social disruption of mating (Coleman *et al.* 1996). Skewed sex ratios can also pose problems for sexually dimorphic species whose genders do not change. For example, Harris *et al*. (2003) found a shift in the sex ratio of blueline tilefish from 1 male to 2.12 females during the 1980s to 1 male to 0.85 females in the late 1990s. They credit this shift to heavy fishing pressure, which disproportionately removed the larger individual spawning male fish from the population. The sex ratio of golden tilefish has also changed, presumably in response to intensive fishing efforts. Harris *et al.* (2001) found the removal of larger, male golden tilefish by fishing pressure skewed the sex ratio from nearly 1:1 during the early 1980s to a sex ratio principally dominated by females during 1996 to 1998.

Traditional fishery management measures (i.e., catch quotas; trip, bag, and size limits; and limited entry programs) have been used to manage the snapper grouper fishery through the implementation of 14 amendments (and a number of regulatory amendments) over the past 24 years with mixed success. These approaches have yet to achieve all the Council's objectives.

A decline in the number of males in a population may affect the reproductive fitness of a grouper species. For example, large, aggressive males tend to have favorable genetic characteristics for the species allowing them to live for long periods of time, achieve larger sizes, and successfully reproduce. Removal of individuals with the best genetic makeup may result in males having less desirable genetic characteristics to engage in successful mating encounters, which they would not otherwise achieve. This could affect the genetic fitness of the species. In addition, in an unfished population where large, dominant males are not removed, sex reversal of large females may be naturally inhibited by the presence of larger males. Such a condition may allow the population to maintain greater numbers of older females, which have the highest fecundity (Gilmore and Jones 1992). Fishing such a population may indirectly result in more females transforming into males to take advantage of the absence of the dominant males and in an overall reduction in the period of successful mating for any particular fish, therefore reducing fecundity of the population (Gilmore and Jones 1992). However, it is possible the egg production potential of a protogynous stock, which is subjected to selective removal of males, might not be affected as severely as a gonochoristic species (separate sexes) where males and females are removed at the same rate. The rationale is in protogynous species where the sex ratio is skewed toward females, egg production is high. Therefore, fishing would not necessarily reduce fecundity if it selectively removed males, because there may still be enough males present to fertilize the population of females. This is not the norm in many cases, however, because fisheries which target large fish are also harvesting large females with the greatest fecundity in addition to large males.

Some species, including gag, snowy grouper, and scamp, annually aggregate in the same locations to spawn, making it easier for fishermen to target and to remove these species in large numbers (Coleman *et al.* 2000). The largest members of an aggregation are often the most aggressive and therefore, may be the first to be removed by fishing gear (Thompson and Monroe 1974; Gilmore and Jones 1992). Epperly and Dodrill (1995) found fish behavior and the presence of more aggressive animals was as important as absolute size or age in determining vulnerability of an individual fish to capture.

4.1.1.2 Life History

Many deepwater snapper grouper species can attain very large sizes (e.g., Warsaw grouper can achieve weights of over 500 pounds), tend to grow slowly, are long lived, and mature late in life (see Table 3-1). Because these fish are late to mature, they often reach marketable size before they have reached sexual maturity and reproduce. Some fish species have evolved long life histories to survive years of poor environmental conditions, which limits the survival of young fish. These species contain a genetic makeup ensuring survival of the species, and by spawning late in life they pass this genotype to subsequent generations. Removing fish having a genetic makeup for living long lives and achieving large sizes can result in populations spawning at smaller sizes, ultimately leading to undesirable genetic traits of the species.

4.1.1.3 Management Challenges

Scientific studies have provided some general information on the biology and life history of deepwater snapper and grouper species. How life history factors influence these species' response to fishing pressure is well understood; however, little is known about the current status of most deepwater snapper grouper species relative to overfished and overfishing thresholds.

As indicated through the data included in Section 3.2.1, comprehensive assessments using both fishery dependent and independent data have been conducted for only two of the eight deepwater species in Amendment 14 (snowy grouper and golden tilefish). The status of the remaining species is unknown (NMFS 2005).

Data deficiencies make it difficult for fishery scientists and managers to develop reliable management measures to sustain stocks over time with a high degree of certainty, while attempting to minimize adverse socioeconomic impacts of fishery management measures to the extent practicable. The Magnuson-Stevens Act requires an estimate of the maximum sustainable yield (MSY) to balance between conservation and wise-use mandates. There is a certain amount of uncertainty associated with estimating biomass and fishery benchmarks in all assessments. However, estimating MSY and other benchmarks for long-lived, deepwater species is often more difficult and has greater uncertainty than for species found in shallower water.

Beginning in 1990, the Council recognized the potential of Marine Protected Areas (MPAs) as an additional and effective tool for managing deepwater snapper grouper species. The Council believes protecting snapper grouper species from fishing pressure within the MPAs proposed in Amendment 14 should act as a type of "insurance policy" and further assist in buffering regional populations from unintended or unforeseen consequences of fishery management measures.

MPAs, as defined in Presidential Executive Order 13158 in 2000, identifies "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." The South Atlantic Council further defines MPAs within its jurisdiction as a network of specific areas of marine environments reserved and managed for the primary purpose of aiding in the recovery of overfished stocks and to ensure the persistence of healthy fish stocks, fisheries, and associated habitats. Such areas may include naturally occurring or artificial bottom and water column habitats, and may include prohibition of harvest on seasonal or permanent time periods to achieve desired fishery conservation and management goals.

MPAs have been used as components of fishery management with some success in many parts of the world. Currently, many marine fisheries throughout the world's oceans are overfished owing to increases in the consumption of seafood; an increase in the number of recreational and commercial fishermen; enhanced vessel design, endurance, and configuration; and modern gear technologies, all of which have improved fishing success. These factors combined, have contributed to fisheries resource depletion and overfishing. Thus, the designation and utilization of MPAs as fishery management tools, used in concert with traditional management measures, may effectively increase fish biomass and contribute to overall fisheries production within, and adjacent to, designated MPAs.

Consequently, owing to global impacts on coastal and marine resources, some nations have, or are now establishing MPAs as tools to protect and manage marine species and their associated habitats. MPAs were first formally established in New Zealand and Australia during the 1970s (Ballentine 1991; Bohnsack 1996), to promote marine conservation. Further, the idea of designating marine habitats utilized by commercially valuable fish as protected areas is a concept which was implemented as early as the 19th century. Governments, concerned about overexploitation of commercially important fish during critical phases of their life cycles, established "no take zones" within the Finnish Salmon and Canadian Atlantic groundfish fisheries. In these examples, spawning habitats utilized by these species were closed to fishing activities (Sanchirico 2000) to protect fish stocks during respective spawning seasons.

Setting aside parts of the ocean serving important roles during reproduction, pelagic dispersal, or juvenile settlement can safeguard against many threats facing marine organisms (Bohnsack 1993). MPAs may serve to provide refuge for commercial fish target species by restricting harvesting practices within designated zones, which can be implemented in both near shore as well as deeper, offshore marine habitats. MPAs can also provide: non-fishery based benefits while allowing adjacent fisheries operations (Bohnsack 1993); improved conservation through biodiversity and ecosystem structure; increased knowledge, understanding, and appreciation of marine ecosystems; and the creation of opportunities for non-consumptive human recreational aquatic activities (Bohnsack 1998).

Benefits from MPA designation not only include the physical protection of marine communities, which are utilized by multiple fish and invertebrate species within the South Atlantic, but may also provide critical adult spawning habitat and a refuge for postlarval and juvenile stages of federally managed species and prey. MPAs may achieve this primarily through prohibiting fishing, and secondarily protecting sensitive marine habitat areas from fishing gear-related impacts.

The designation and utilization of MPAs as a fishery management tool may provide ecological benefit to the marine ecosystem. Evidence suggests "no-take" MPAs can yield biological benefits, including reductions in bycatch and fishing pressure on target species, ecosystem stresses, and impacts to sensitive benthic habitats. MPAs have been shown to increase the age and size of the fish stocks, increase stock levels, and improve habitat (Sanchirico 2000). It is also anticipated MPAs may provide direct benefit to managed fisheries through: increased distribution of fish eggs and larvae from non-fished areas (MPAs) to adjacent (fished) areas; allowing migration of juvenile and adult fish from MPAs; protecting population genetics from selective fishing; protecting against stock collapse from fishing pressure; and allowing more rapid recovery if adjacent stocks should collapse (Bohnsack 1998). However, the size, location and quality of benthic habitats within MPAs should be identified and included to provide maximum ecological benefits for the designated and adjacent areas.

For a MPA to effectively benefit a fishery, it is important to recognize and ensure the boundaries be designed to encompass ecological services/benefits of the desired fishery. There would be no benefit in the establishment of MPAs in areas where preferred habitat types may not exist or where managed species do not occur during critical/spawning life stages. Because habitat quality can vary greatly and can affect demographics, it is also critical the areas protected are a source habitat, i.e., one where birth rates exceed death rates and emigration rates exceed immigration rates, and not a sink habitat where mortality exceeds birth rates and immigration exceeds emigration (Pulliam 1988, Crowder *et al.* 2000). When evaluating prospective marine areas, careful consideration should be given to MPA boundaries to achieve intended fishery management objectives.

MPAs have been proposed to control resource uses in specified regions of the ocean for any of three general purposes (CRS 2005). These include limiting incompatible ecological or environmental uses; to create a setting where degraded habitats and reduced populations have the opportunity to restore themselves; and to preserve healthy marine habitats and ecosystems from degradation by preventing overuse. However, the benefit most often cited by proponents of MPAs is protection and restoration of commercially and recreationally valuable fish and invertebrate species populations and the habitats on which they depend (CRS 2005).

Based on evidence from existing MPAs in both temperate and tropical regions, marine reserves and protected areas will be effective tools for addressing conservation needs as part of integrated coastal and marine area management (NRC Report 2001). MPAs potentially can provide many direct fishery benefits (Bohnsack 1998) including reducing the chances of overfishing by providing refuges from population exploitation. Around the world, marine reserves have demonstrated the ability to increase fish biomass inside their borders (Meester *et al.* 2004). Compared to having all areas exploited under one set of regulations, MPAs potentially can provide greater fishery yields in the long-term by having a larger and more dependable supply of eggs and larvae dispersed to fishing grounds. MPAs can also potentially increase yield from spillover, where animal emigration exports biomass from reserves through to surrounding fishing grounds (PDT 1990a; Roberts *et al.* 2001). MPAs also can provide insurance to sustainable stocks by potentially accelerating stock recovery following natural disturbance, human accidents, management errors, or years of poor stock-recruitment (PDT 1990a). Finally, they may be the only measure that can effectively preserve stock genetic structure from detrimental effects of selective fishing practices (Conover and Munch 2002, Bohnsack *et al.* 2004).

The concept of marine reserves is simple: If protected from human interference, nature will take care of itself. A large body of scientific literature attests that harvested stocks will recover if fishing stops. Until recently, most reef fisheries were probably partly maintained by natural refuges: areas too deep, too remote, or too difficult to locate easily. With improved fishing methods and more people fishing, the effectiveness of natural refuges diminishes. MPAs are best suited to protecting species with restricted geographical movements such as most reef organisms. Reef habitats are geographically well defined, long-lasting, and restricted to relatively small areas of ocean bottom. Their importance, however, far exceeds the percentage of bottom covered because of their high biological productivity (Bohnsack 1998).

MPAs in Fisheries Management

The greatest appeal of the MPA concept to fisheries management is that MPAs have the potential of effectively restoring certain over-harvested fish populations. Additionally, the NRC report endorsed using MPAs as fishery management tools in combination with traditional management measures (CRS Report for Congress 2005). They are also attractive from a management perspective because they can simultaneously address the needs of different user groups.

MPAs can help control or reduce exploitation rates mainly in two ways. First, for species showing high site fidelity, such as deepwater snapper grouper species in the South Atlantic, MPAs can be effective in minimizing fishing pressure by directly protecting some fraction of the population. Much of the impetus for establishing MPAs has come from experience with sedentary reef species which have been severely overfished in the past and where fishing pressure has proved difficult to control by other means. MPAs may help enhance depleted fish stocks, provided reproductive success resulting from the reserves is large and replenishes the populations outside reserve boundaries. A second way in which reserves can reduce the exploitation rate is by diverting fishing effort away from areas of valuable reproductive and foraging habitats. This can be effective in fisheries that are managed by limiting the total amount of fishing effort or in fisheries that are essentially unregulated. The large closed areas now in place on Georges Bank, for example, have been found to contribute significantly to reducing fishing mortalities of cod and yellowtail flounder (NRC 2001).

One of the most important functions of MPAs to resource managers is to provide a buffer against uncertainty in assessment of the status of the managed stocks and provide insurance against stock collapse. All fishery management has some degree of uncertainty and risk; it can fail because of inadequate scientific models, errors in the data, inadequate compliance, or ineffective management actions. Chance events, such as environmental uncertainties in recruitment, could also lead to stock collapse even if fishery management were adequate for average conditions. If a stock collapses for whatever reason, MPAs can act as a reservoir for rebuilding a stock at a faster rate than would otherwise be possible (Bohnsack 1998).

MPAs in the South Atlantic and Gulf of Mexico

Existing literature shows MPAs/marine reserves could be successful in promoting more sustainable fish populations. Biological response variables such as community density, biomass, and mean organism size increase rapidly in no-take marine reserves (within 5 years) and then remain consistently higher for longer time periods (up to 40 years) when compared to fished reference areas (Halpern and Warner 2002; Halpern 2003). Results for particular species will depend on life histories. Slower-growing, late-maturing species such as snappers and groupers may take longer to exhibit significant increases in density or fish size. Conversely, heavily fished species are more likely to respond quickly once no-take reserves are put in place. For example, Beets and Friedlander (1999) note that a spawning aggregation closure that included uncommon structurally complex habitat in the U. S. Virgin Islands generally resulted in larger red hind and more numerous males within seven years. In addition, a body of experts evaluated the use of marine reserves as a management tool and concluded “A growing body of literature documents the effectiveness of marine reserves for conserving habitats, fostering the recovery of overexploited species, and maintaining marine communities” (NRC 2001). Findings for several MPAs (some fishing is allowed) or reserves (no fishing is allowed) in the southeast U. S. are summarized below.

The South Atlantic Fishery Management Council has set a precedent in the use of MPAs as a management tool in the region with establishment of the Oculina Experimental Closed Area off the east coast of Florida. In 1982, based on evidence of human-induced damage to the reefs, the Council proposed setting aside a portion of the Oculina Bank as a Coral Habitat Area of Particular Concern (HAPC) under the Magnuson-Stevens Fisheries Conservation and Management Act (16 U.S.C. §1801; SAFMC, 1982). The proposed action was finalized in 1984 when 92 square nautical miles of the Oculina Bank were designated an HAPC through the Fishery Management Plan for Coral, Coral Reefs and Live/hard bottom Habitat (SAFMC 1982).

In 1990, the Council began an investigation into a new management tool which at that time was called marine reserves to limit fishing for snapper grouper species and act as a buffer against uncertainty. The Oculina HAPC seemed to be the logical place to start, considering regulations prohibiting the use of damaging bottom tending fishing gear on sensitive coral and other associated habitats had been in place in the Oculina Bank for 10 years. In addition, historical research had documented aggregations of scamp, gag, and snowy grouper associated with certain high profile high quality coral habitats. Subsequently, the Council developed Amendment 6 to the Snapper Grouper FMP (SAFMC 1993) which established the "Oculina Experimental Closed Area" (OECA), required NMFS develop a research plan to provide the Council with information to expand the use of this tool, and provided for a possible sunset of snapper grouper regulations in 10 years. Amendment 6 specifically directed NMFS to develop a research plan and conduct scientific studies in a closed area where snapper grouper species like gag and scamp as well as deepwater species such as snowy grouper, golden tilefish, speckled hind, and Warsaw grouper could grow and reproduce without being subjected to fishing mortality. The intent was to document detailed information on habitat distribution and species use, the reestablishment of spawning aggregations, and larval transport and spillover of resources into adjacent habitats. Having this detailed information for an area in the South Atlantic region would provide the Council with strong justification to support expanding use of this tool for snapper grouper conservation elsewhere in the region. Details such as having videos developed documenting the reestablishment of grouper aggregations would provide the public with visual validation of the effectiveness of the tool in the South Atlantic.

Two years later, the Council adopted additional protections for the OECA by prohibiting the anchoring of fishing vessels within the area (SAFMC 1995). In 2000, through the Council's Comprehensive Amendment Addressing Essential Fish Habitat (SAFMC 1998b), the Oculina HAPC was expanded to include 300 square nautical miles previously restricted only to rock shrimp vessels, to prohibit the use of all trawling gear in the area. Bottom gear and anchoring restrictions were also included in the HAPC expansion, while regulations for the OECA remained in place within the original 92 square mile designated area.

Most recently, the Council voted to extend the Oculina Experimental Closed Area designation, which had been set to expire in 2004, for an indefinite period to provide continued protection of snapper/grouper populations (SAFMC 2003). The Council also reviewed the configuration and size of the OECA and determined at the March 2007 meeting that both were appropriate and should not be modified.

Based on the limited information, there appear to be some encouraging signs of positive biological impacts from the nine years the prohibition of fishing for and retention of snapper grouper species within the *Oculina* Experimental Closed Area has been in effect.

A study conducted in 2001 found that, in the few areas where habitat remained intact, there were more and larger groupers than observed in a 1995 study, and male gag and scamp were also common (Koenig 2001). The observation of male gag and scamp is particularly of interest because size, age, and proportion of males of these species have declined both in the Gulf of Mexico and South Atlantic regions (Koenig 1996; Coleman *et al*. 1996; McGovern *et al*. 1998; Koenig *et al*. 2000 in Koenig 2001). Other encouraging signs include the observation of juvenile speckled hind.

Use of MPAs, in concert with conventional management approaches, has also been embraced by resource managers in the Florida Keys. A set of 23 fully protected "no-take" marine reserves was established within the Florida Keys National Marine Sanctuary in 1997 with the objectives of building sustainable fisheries and conserving marine biodiversity (Meester *et al.* 2004). Research to date indicates that the reserves are in fact succeeding in meeting those objectives (Meester *et al.* 2004). In addition, these areas offer a unique opportunity to test reserve design theory and to evaluate efficacy in meeting resource management goals.

The Tortugas Reserve represents one of the largest fully protected marine reserves in the United States and the third largest protected coral reef area in the world (Meester *et al.* 2004). The process of reserve design and implementation in this area represents a precautionary and proactive marine resource management measure. These areas are expected to provide tangible long-term benefits for protection of marine resources in the national park and the national marine sanctuary and for recreational and commercial fishermen. It will also advance science, serving as a reference site for distinguishing between natural and human-induced changes to the Florida Keys coral reef ecosystem. (Meester *et al.* 2004).

Ault *et al*. (2006) evaluated targeted (normally fished) and non-targeted fish species in both fished and unfished areas of the park before and after establishment of the No Take Marine Reserves (NTMR). After only three years of protection, the abundance of most targeted and nontargeted species was higher, and black grouper and red grouper were larger, in the NTMRs compared to adjacent fished areas. Improvements in targeted species demographics were partly attributed to more restrictive fishery management outside the reserves. These encouraging results indicate the NTMRs seem to be effective, when used in conjunction with traditional management measures, in promoting greater abundance and possibly a more natural size distribution for targeted species.

MPAs have also been used in the management of grouper stocks in the Gulf of Mexico region. In June 2000, the National Marine Fisheries Service approved closure of two areas to fishing (except for highly migratory species) totaling 219 square nautical miles in the northeastern Gulf of Mexico (GMFMC 1999). These closures will be used for scientific evaluation of MPAs, both to protect spawning aggregations of gag and other groupers and to evaluate the effectiveness of MPAs in maintaining a more balanced sex ratio by protecting male gag from excessive fishing pressure (NRC 2001).

In the mid 1990s, Coleman *et al.* (1996) noted a disturbing decline in the proportion of males in the populations of both gag (*Mycteroperca microlepis*) and scamp (*M. phenax*), which are protogynous hermaphrodites with complex social conditions for sex change. By 1998, NMFS reported significant declines in gag stocks, suggesting that the species was approaching an overfished condition (Schirripa and Legault 1997). The problem seemed to stem, at least in part, from intense fishing on spawning aggregations on the continental shelf edge, as has occurred in other grouper stocks worldwide (Sadovy and Eklund 1999, Coleman *et al.* 2000). Aggregation sites for reef fishes tend to be consistent in time and space, making them easy and routine targets for fishers. Because it appeared that male gag remained on aggregation sites long after the spawning season, while females migrated between spawning and feeding sites (Koenig and Coleman, unpublished data), the Gulf of Mexico Fishery Management Council suggested closing aggregation sites to fishing to determine whether an MPA could protect males and perhaps reestablish the historic demographic make-up of the population (GMFMC 1999). The compromise over which areas to close, and for how long, resulted in the choice of two sites covering a total of 219 square nautical miles of relatively marginal aggregation sites already heavily fished, and an experimental closure period of 4 years (2000–2003). The work that has been conducted in the reserves over the past four years relied heavily on the input and participation of commercial fishers. Results are promising, indicating that males are remaining on site long after the spawning season, and that the CPUE of male gag and scamp within reserve boundaries is much higher than that in reference sites outside of the reserves (Koenig and Coleman, unpublished data). Based largely on these compelling preliminary data, which show that population demographics can be recovered in a fairly short period of time (even after intensive fishing), the Gulf Council recently voted to extend the closure an additional 6 years to continue tests of the efficacy of using MPAs to manage grouper stocks (GMFMC 2003).

In 1962, the U.S. government banned all access to portions of the estuaries at Merritt Island to create a security zone at Cape Canaveral. Enforcement is very strong given the need for security for the space program. Studies show the game fish in this estuarine no-take reserve are larger, older, and more abundant than those outside the reserve. In fact, the area near the reserve is now known for producing game fish of record sizes (Johnson *et al*. 1999). Through implementation of Amendment 14 to the Snapper Grouper Fishery Management Plan in the South Atlantic, similar results may be anticipated to occur for the deepwater snapper grouper species that are the focus of this amendment.

In addition to the South Atlantic and Gulf of Mexico, implementation of MPAs within the Caribbean are seen as a prominent means of addressing coastal resource management issues. Studies on the impacts of MPAs, which evaluated ecological changes regarding the abundance and size of fishes have usually shown them to be positive for biodiversity (Dixon *et al.* 1993) and fisheries management activities (Roberts and Polunin 1993; Wantiez *et al.* 1997).

Snapper Grouper Amendment 14
The South Atlantic Council has discussed the following types of MPAs:

Type 1 - Permanent closure/no-take
Type 2 - Permanent closure/some take allowed
Type 3 - Limited duration closure/no-take
Type 4 - Limited duration closure/some take allowed

For the purposes of Amendment 14, the Council is proposing "Type 2" MPAs where no person may fish for a South Atlantic snapper grouper in an MPA and no person may possess a South Atlantic snapper grouper in an MPA. However, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed (as defined in Appendix F). The purpose and need of these particular MPAs is to protect deepwater snapper grouper species from overfishing activities while allowing other types of fishing (e.g., pelagic trolling) which would not interfere with meeting this need. The Council's Law Enforcement Advisory Panel has advised the Council that enforcement activities within designated MPAs would be more effective if all fishing effort were prohibited in the area(s) (Appendix B). However, after evaluating public input through continued scoping of the proposed MPA concept, the Council has determined the social and economic impacts of prohibiting all fishing within MPAs to protect deepwater snapper grouper species would outweigh any potential law enforcement benefits. Further, public support and perception of the Council's MPA proposals has improved as a result of the Council reiterating support for allowing specific fishing effort within these MPAs. Based upon these protocols, there is evidence stakeholders have the perception of "procedural fairness," understand, and support the fishery management goals of an MPA which would result in effective compliance (NOAA, National MPA Center 2005).

4.1.2 Economic

4.1.2.1 Common Property Marine Resources

The South Atlantic snapper grouper (SASG) complex is a renewable but destructible common property marine resource. Although access to the resource is limited due to technological, regulatory, and geographical (especially in the deepwater areas associated with Amendment 14) attributes, no one stakeholder has the exclusive ability to exploit the resource. Thus, there is a tendency towards overexploitation of the resource as fishermen seek to maximize their own personal returns. As a result of competition for economic rents, more fishing capital enters the fishery.

If the market pricing mechanism does not recognize society's stake in the resource, recreational and commercial fishermen do not internalize all of the social costs of their extraction activities. Social costs consist of the private costs incurred by fishermen, such as labor, fuel, bait, and dock expenses, and external costs which are costs incurred by people who do not directly participate in the harvesting process yet place some value on the marine resources. External costs are typically linked to overuse of the resource and the inability to achieve future benefits from the fish stock in an efficient manner.

Economic theory suggests that when external costs are present in a fishery, the quantity harvested is too high and fishermen receive a lower price relative to socially efficient levels. This leads to an inefficient amount of fishing effort and a sup-optimal level of exploitation, and all stakeholders eventually suffer from overuse of the resource. From a policy perspective, it is up to management to determine how to internalize these external costs.

The lack of defined property rights has led to federal management of the SASG complex for the last 20 years in an effort to reduce competitive exploitation of SASG resources and to achieve an economically and biologically sustainable yield. However, certain life-history characteristics of some species, the multi-species nature of the SASG complex, increased (human) population growth and demand for fish, and technological improvements continue to make SASG resources (deepwater species in particular) vulnerable to depletion. Amendment 14 proposes to augment traditional methods of management with areas permanently closed to snapper grouper harvest and/or possession (However, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F) in an effort to minimize the dissipation of economic rents and improve the biological health of deepwater resources throughout the jurisdiction of the South Atlantic Fishery Management Council.

4.1.2.2 Benefit-Cost Valuation of MPAs

"Marine resources are a type of natural capital that can be invested or used to generate a return to its owner" (Carter 2003). From an economic perspective, an MPA network may be viewed as an investment instrument that is applied to a public asset (i.e., federal fishery resources). To be considered successful, total social benefits from the MPA investment must outweigh all opportunity costs that are incurred, after accounting for risk. The most efficient investment scheme (i.e., sizes and sites of discrete MPAs) is the one that either maximizes excess social benefit over cost or possibly minimizes excess social cost over benefit. In other words, the preferred regulatory option should be the one that provides the greatest benefit for the least cost. In this context, the net value of an MPA network can be evaluated using a traditional benefit-cost framework: Do the potential benefits of protection – adjusted to account for risks - outweigh the potential costs realized over both the short and long run (Sanchirico *et al.* 2002)? For the most part benefit-cost valuation of MPAs is determined by distributional effects related to the displacement of recreational and commercial fishermen, changes in economic impact on surrounding communities, and bio-economic linkages associated with the protected stock; however, societal issues may be present as well.

Economic benefits and costs resulting from MPA protection may be characterized as either consumptive (e.g., commercial and recreational fishing) or non-consumptive (e.g., diving). Consumptive costs and benefits are direct biological and economic effects that affect the profitability of the SASG commercial fishing fleet, the satisfaction of recreational fishermen, and the efficient use of society's resources. Non-consumptive benefits and costs include societal losses and gains as well as effects on fishery management. The following subsections describe specific costs and benefits relevant to implementation of MPAs for deepwater SASG species.

Costs

Consumptive Costs

Most of the consumptive costs associated with MPAs can be generalized as displacement effects directly incurred by recreational and commercial vessels that normally fish in the newly protected areas. The following descriptions of displacement costs similarly apply to both recreational and commercial vessels; thus, the term "vessels" will subsequently be used. The major difference between the two types of fishermen is that recreational fishermen are assumed to maximize happiness while commercial fishermen maximize net returns. Charter operations have characteristics of both as owners seek to maximize profits, while their customers seek to maximize their enjoyment from purchasing the fishing trip. Figure 4-1 provides a flow chart that describes how different economic values of MPAs are typically categorized.

Direct consumptive costs to fishermen unable to fish in the MPA may include a decrease in catch levels; an increase in trip-level costs associated with searching for new fishing grounds; an increase in opportunity costs associated with learning a new type of fishing; congestion and user conflicts on new fishing grounds; and increased harvest and personal risk. Displacement effects have a negative impact on the predicted value of a MPA network; however, fishermen may be able to mitigate these costs by redirecting effort to open areas and targeting different species. Although displaced fishermen avoid some displacement costs as a result of these actions, the addition of new fishing effort to open areas could have an extra negative effect on the health of other SASG stocks not targeted in Snapper Grouper Amendment 14.

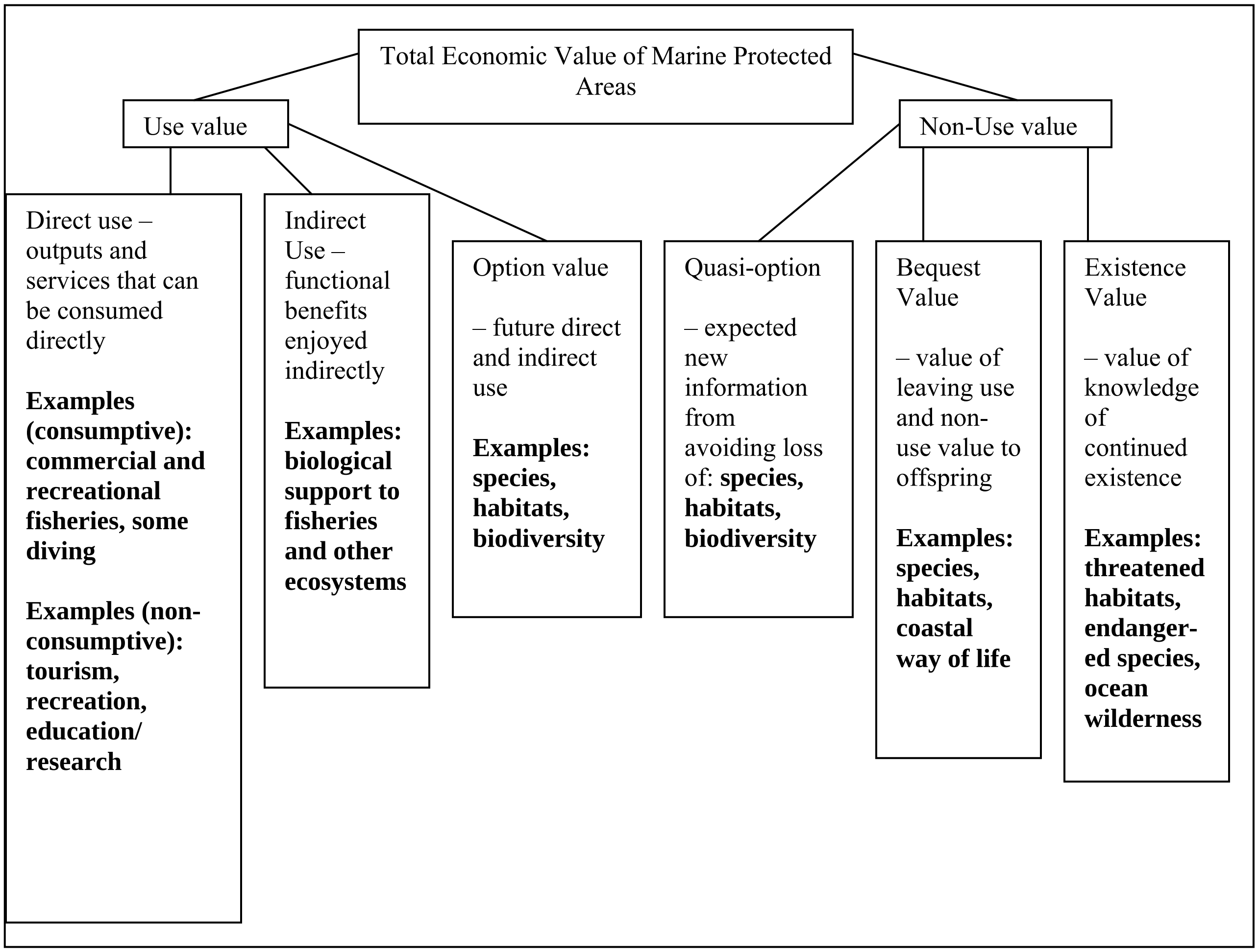


Figure 4-1. Flow chart describing how different economic values of MPAs are typically categorized.

Another important aspect of displacement costs is compensation. Fishermen who currently fish in the protected areas bear the majority of the short-term costs associated with protection. However, due to the large number of participants in the fishery, there is no guarantee that displaced individuals will reap the benefits of stock recovery in the future. If spillover effects are realized and aggregate harvests increase, the relative profitability of targeting the protected species in open areas will increase, and effort will shift towards these species as fishermen seek to maximize their personal gains in an open access scenario. This effort could include new entrants to the deepwater fishery, which would create crowding externalities for the originally displaced vessels. Thus, MPA regulations without corresponding effort restrictions may lead to an inequitable distribution of long-term benefits and inefficient harvesting practices if spillover effects are realized from the protected areas.

Major Types of Displacement Costs

Decreased Catch Levels

In the short run total catch by displaced vessels may be reduced. This result depends on technological decision-making by the affected vessels in response to the area closure. Changes in fishermen behavior are likely to have a temporal and spatial context and depend on both economic and biological conditions. Short-run technological decisions could involve changes in the variable cost structure, gear modifications, and location choices involving fishing grounds as well as homeports. Decreased harvest levels may be mitigated to the extent that fishermen can find alternative forms of fishing or spillover effects may create future harvest benefits such as increased catches or reduced harvest variability.

Increase in Trip-Level/Search/Opportunity Costs

Perhaps the most significant portion of displacement costs comes from the effect the MPA has on fishing behavior. Displaced operators must now choose new fishing locations, maybe target new species, or even learn a new type of fishing. These new trip-level decisions have a direct impact on trip-related variable costs as well as time-related opportunity costs. In particular, fuel costs are likely to change. The immediate search for profitable alternative fishing grounds likely results in additional fuel expenditures and lost opportunities to fish. In the case of the deepwater closures, vessels may actually use less fuel if the new fishing grounds are closer to shore or if significant spillover effects are realized on adjacent boundaries. However, if the vessels search for deepwater species out past the MPAs, additional fuel might be needed to go around the closed areas to avoid being caught with snapper grouper species in the protected areas unless the gear is stowed. If displaced fishermen try to learn a new type of fishing or employ new types of gear, additional costs may be incurred as the fishermen go along the learning curve. These costs may be significant since these protected areas are Type II MPAs, which allow trolling within the closed areas.

Crowding/Congestion Effects

Implementation of an MPA results in the displacement of fishermen who normally fish in the newly protected areas. If affected vessels do not exit the fishery and they continue to employ a proportion of their historical fishing effort, vessels must relocate to open areas in the SASG complex which are likely to be experiencing sub-optimal harvest rates already. The results of this effort movement potentially could be very significant biologically and economically. Additional fishing pressure might further stress already overfished inshore species. Congestion costs may be incurred directly by displaced vessels as well as indirectly by vessels that traditionally fish in the open areas as the released effort joins the traditional effort in the same size of open space. Additionally, user conflicts may develop; additional capital expenditures, such as fish finding equipment, may need to be purchased; and gear may be lost due to entanglement. In the long run, spillover effects could help to mitigate these costs.

Harvest and Personal Risks
MPA regulations could cause fishermen to incur extra risk as they seek new and unfamiliar fishing grounds or employ unfamiliar fishing techniques. This risk could incorporate both harvest and personal dimensions. Again though, the closure of deepwater areas may force vessels inshore, which could decrease the personal risk to the crew while reduced harvest variability from spillover effects could result in extra benefits.

Not all displacement costs are incurred by the fishermen though.

Regional Economic Impacts
A possible indirect consumptive cost is the short-run impact that a reduction in income has on the surrounding communities. If displaced fishermen cannot mitigate all losses incurred from the MPA, their communities likewise will be negatively affected as less income flows through different sectors of the local economy. Fishing income originally spent in the community by fishermen cycles throughout the regional economy producing a multiplier effect, which induces regional expenditures and savings totaling more than the original income. The amount of fishing income lost and the magnitude of the multiplier effect determine the extent of the negative impact on the predicted value.

Non-consumptive Costs
Decreases in the quality of inshore fishing grounds and reduced option, bequest, and existence values resulting from increased fishing pressure redirected toward inshore fish stocks result in non-consumptive costs. Effort controls coupled with area closures may mitigate some of these unintended consequences. To the extent that these costs are realized, a negative influence must be accounted for in the predicted valuation of a MPA network. See Figure 4-1 for examples of non-consumptive uses and a depiction of how non-consumptive uses relate to other economic values of MPAs.

Management Costs
Direct costs incurred by management or some institutional body include funding for planning, maintenance, and enforcement; however, enforcement costs could be mitigated relative to other types of effort restrictions resulting in a net benefit. The added regulatory cost that management must incur due to implementation of an MPA is a negative impact on the predicted value of an MPA.

Benefits

Consumptive Benefits

Consumptive benefits could be realized over the long run if spillover effects are assumed to affect aggregate harvest levels in the remaining fishable areas as stocks become healthier. Major consumptive benefits include stock replenishment and spillover effects, increased stock biomass, increased harvest levels, and reduced variability of harvests and revenues.

Replenishment/Stock Effects

These effects refer to a net increase in biomass and aggregate harvest in the remaining open areas due to implementation of the MPA. Deepwater groupers and tilefish have a low resilience to overfishing due to life-history characteristics such as slow growth, high minimum population doubling times, and a mostly sedentary lifestyle. However, these same characteristics also make these species good candidates for repopulation through MPAs. The amount of economic benefit that will eventually be derived due to spillover effects from the MPA depends on a myriad of biological and economic factors specific to the species in question and the vessels that target them. These factors are discussed in some detail below. The long-term realization of spillover effects will have a positive impact on the predicted economic value of a MPA network.

Increased Catch Levels

Over the long run, aggregate catch by displaced and unaffected vessels alike may increase due to spillover effects. This result depends on biological characteristics of the stock as well as fleet wide technological decision-making in response to the area closure. If spillover occurs in open fishing grounds, which historically have contributed a relatively small share towards aggregate catch (perhaps due to overexploitation), then the probability of increased harvests is relatively higher; however, if the protected species are overly sessile, the probability of increased harvests is relatively lower (Sanchirico 2002). The phenomenon known as a “double-dividend” where aggregate biomass increases as well as harvest rates is more likely to be achieved in a previously overfished area. The relative level of dispersion of a protected stock throughout the adjacent open fishing grounds also may determine the success of future harvest levels.

Changes in fishermen behavior have a temporal and spatial context and depend on both economic and biological conditions. Short-run technological decisions could be augmented with long-run capital stuffing expenditures by both displaced and unaffected fishing operations. In the long run, all vessels would make entry/exit decisions as they assess the relative profitability of targeting the newly enhanced deepwater stocks. The extent that catch levels increase over time will add worth to the predicted value of an MPA; however, these benefits need to be adjusted to account for risk and may not be realized in the future by the fishermen presently displaced by the MPA.

Reduced Harvest Variation
Increased protection of the spawning stock biomass, older and larger individuals, and genetic diversity may lead to more natural population structures, increased harvestable biomass, increased dispersal, and new recruits in the remaining open areas in the fishery. These attributes likely would lead to a reduction in variation of deepwater stock abundance as well as resulting revenues and improved harvest portfolios. Thus, reduced harvest variation constitutes a positive addition to the predicted value of a MPA network. Economically, the importance of this benefit is directly related to the level of risk aversion exhibited by an individual fisherman. Biologically, if spillover occurs in open fishing grounds, which contribute a relatively small share towards aggregate catch (perhaps due to over-exploitation), then the probability of a reduction in harvest variation is relatively higher; however, if the protected species are immobile, the probability of a reduction in harvest variation is relatively lower (Sanchirico 2002).

Non-consumptive Benefits

Quality Increases in MPAs
If regulation works from a biological perspective, then fish in the MPA over time become more numerous and heavier, on average, due to an increase of older fish in the population. Protection could also increase biodiversity, community structure, and general habitat conditions in the short- and long-term (Leeworthy and Wiley 2002). These benefits could contribute to an overall healthier ecosystem which eventually supports sustained recreational and commercial fishing activities. Thus, environmental quality increases constitute a positive addition to the predicted value of an MPA.

Option Values
Benefits may arise from maintaining the option to use the ecological resources within the protected areas in the future. In essence, society is paying a risk premium (i.e., closing the area) to keep the option of future use available and hedge the uncertainty associated with overfishing the deepwater species. Thus, the capture of option value through closures constitutes a positive addition to the predicted value of an MPA. See Figure 4-1 for a depiction of how option values relate to other economic values of MPAs.

Bequest and Existence Values
Benefits may arise from MPAs as future generations are able to utilize the deepwater resources. The amount that society is willing to pay for this benefit is known as a bequest value. Additionally, knowing that deepwater species will continue to exist in the future is known as an existence value. Thus, the realization of bequest and existence values through closures constitutes a positive addition to the predicted value of an MPA. See Figure 4-1 for a depiction of how bequest and existence values relate to other economic values of MPAs.

Management Benefits

Other non-consumptive benefits can be realized by management. Primarily, management can use MPAs to reduce the risk associated with uncertain stock assessments and create experimental undisturbed areas for biological research. This benefit is particularly important as management has been urged to use the "Precautionary Principle" when dealing with threatened fish stocks. Also, the deepwater Type 2 MPAs specified by Amendment 14 may allow managers to extend added protection to rare deepwater species, such as speckled hind and Warsaw groupers, that are either discarded or caught as bycatch with snowy groupers. These species experience overexploitation and high discard mortality due to the depths at which they are caught but are not necessarily capable of being protected if fishing were to continue normally for other species. Thus, benefits captured by management such as risk reduction or protection for additional species constitute a positive addition to the predicted value of an MPA.

4.1.2.3 Delphi Study – Socioeconomic comparison of alternative sites

The following explanation of the study was paraphrased from SEDEP (2007):

A cardinal ranking of the alternative Type 2 MPA sites, based on quantified expected net socioeconomic benefits, is not possible because of the lack of empirical data at a spatial scale necessary to do such a comparison. As a result, the Delphi method was adopted to develop a semi-quantitative ranking system in order to compare the socioeconomic impacts of each Type 2 MPA alternative.

The Delphi method is a communications technique with the objective of producing a collective expert opinion. This collective expert opinion can be used by decision makers when other information is lacking.

Using the Delphi method, a decision-making entity is able to create a structured communications forum of experts who systematically address a problem where relevant empirical data are missing, but collective expert opinion may be useful. With current technology, initial inquiries into a problem may be sent by email to a pre-selected panel of experts or a website could be constructed that allows the group of experts to respond in a real-time communications system. Regardless of the technology used, the inquiries are designed to initiate exploration and discussion of the problem resulting in individual responses to the inquiries posed. The individual responses are then summarized and presented back to the panel members enabling each one of them to review all responses and clarify or change his/her own position based on his/her interpretations of the other members' responses. In turn, these summarized responses are used to generate a second round of queries and the process is repeated until no additional information or knowledge is presented and/or no one changes his/her position. At the end, either some level of group consensus is reached or majority/minority opinions or equally split opinions are established.

Use of the Delphi method or consensus-based approaches is not new to natural resource management or the consideration of MPAs. The Delphi method was advocated as a useful tool for fishery managers over 25 years ago by Zuboy (1981), and it has been used in the field of natural resource management (e.g., Crance 1987; Clark *et al.* 2006). Application of group-consensus approaches in fisheries management have been made regarding the planning of MPAs (Bohnsack 1997; Scholtz *et al.* 2004); however, no Delphi or consensus-oriented approach has been used to forecast socioeconomic impacts that may result from implementation of an MPA.

Potential participants for the forum of experts were identified from the Carolinas to the Florida Keys based on a spectrum of fishing and research backgrounds with different perspectives on the policy issue of MPAs. Twelve experts participated in the structured communications forum with the objective of developing a semi-quantitative ranking system of the socioeconomic impacts of the Type 2 MPA alternatives. Most of the twelve participants had significant knowledge about the biology associated with the proposed Type 2 MPA sites and the socioeconomics associated with the fishermen and communities dependent on these sites, as well as general knowledge of MPAs. The majority of the experts also had direct experience with at least one of the sites whether it was through fishing, biological research, or interaction with dependent stakeholders.

The particular Delphi method used consisted of three rounds: a Policy Delphi (Round One), a more traditional Delphi (Round Two), and an impact analysis (Round Three). The name given to this modified Delphi approach was the Southeast Delphi Expert Panel (SEDEP). SEDEP was conducted by email from July 17, 2006, to September 30, 2006.

Round One was a brainstorming session for the panelists to introduce their views regarding the effects of implementing a Type 2 MPA and the associated positive and/or negative socioeconomic impacts of those effects, such as the social and economic impacts caused by a loss of a fishing area. A summary of effects and their associated socioeconomic impacts (i.e., benefits/advantages and costs/disadvantages) was produced from the panelists' responses and are presented in Section 2. Although the diversity of experts created instances of divergence regarding the direction (positive, negative, or neutral) of socioeconomic impacts, the panel generally displayed strong majority support on the direction and level of impacts resulting from implementation of generic Type 2 MPAs. For example, there was a general consensus that negative impacts would be realized mainly in the form of short-term displacement effects on fishermen and the communities that depend on them, along with possible management costs. Also, there was general agreement that benefits were possible due to increases in long-term catch levels, quality increases in the MPA and ecosystem, preserving the area for future uses, knowledge that snapper grouper species and associated habitat will exist in the future, and management benefits. However, it was believed that when a Type II MPA is small, like the size of the Amendment 14 MPAs, both the costs and benefits would be minimal.

The goal of Round Two was to group and rank the most important of the effects identified by the panel in the first round and, through an iterative process, develop a generally accepted set of groupings. To begin to do so, panelists were presented four initial groupings of the identified effects based on common characteristics: 1) Administrative Effects; 2) Commercial, For-Hire, and Recreational Fishing Effects; 3) Community and Social Effects; and 4) Ancillary (Ecosystem) Effects (See Table 2 in

Appendix E of this document). For the most part, panel members accepted these groupings and ranked them; however, three panelists offered alternative groupings and ranked these alternative groupings. Unfortunately, due to time constraints, these three panelists were asked to resubmit their responses and rank the original four groupings.

A time dimension was introduced during the second round to distinguish the level of socioeconomic impacts over time. Specifically, panelists were asked to examine the socioeconomic impact of an effect immediately (less than one year), in the medium-term (one to five years), and long-term (over five years). At the end of Round Two, the four groups of effects were ranked by each participating expert on the basis of expected overall socioeconomic impacts throughout the three time periods (immediate-term, medium-term, long-term). Points were assigned based on ranking. The top ranked group of effects was assigned five points, the second ranked grouping four points, the third ranked grouping three points, and fourth ranked grouping two points. The relative importance of each group is reflected by its weighted score, which was computed by dividing the total points for that group by the highest point total attributed to any one grouping in each time period. The four groupings and their relative weights appear in Table 3 in Appendix E of this document and were used in Round Three.

As shown in Table 3 of Appendix E, administrative effects were viewed as relatively important in all three time periods, varying from being most important in the medium-term to second most important in the immediate and long-terms. Most of the panelists identified law enforcement to be the key component of any realized socioeconomic benefits of MPAs that are realized over time. The exclusionary nature of the Amendment 14 Type 2 MPAs for reef fishermen suggested immediate benefits to management's goal of reducing fishing and bycatch mortality. Other administrative effects identified as important included increased managerial flexibility relative to the use of traditional regulations, improved stock assessments, and the burden of educating stakeholders.

Table 3 of Appendix E shows that as time goes on the magnitude of effects on commercial, for-hire, and recreational fishermen becomes less of a factor in determining the difference in socioeconomic impacts among alternative sites for a Type 2 MPA. Initially, some fishermen would have to avoid traditional fishing areas and incur displacement costs; however, as they adjust to the closed areas and any new associated regulations, the negative impacts would dissipate over time. This is not to suggest that the panel believed the effects on fishermen were equal across Amendment 14 MPA alternatives. A concern was raised by the panel that the immediate-term impacts would be significantly higher for alternatives that encompassed mid-shelf waters relative to deep water-only sites.

As shown in Table 3 of Appendix E, ancillary (ecosystem) effects caused by implementation of Type 2 MPAs were considered to have greater socioeconomic importance over time. Panelists identified positive economic impacts from long-term biological stock benefits, future spillover effects, increased ecosystem quality, and option and existence values. In the case of the Amendment 14 Type 2 MPAs there was still concern that these benefits would not be measurable due to the small sizes of the MPAs and lack of baseline estimates and monitoring before and after the closures. Short-term benefits would be realized from the immediate protection of stocks, the ecosystem, and habitats in addition to a reduction in bycatch mortality of juveniles and non-targeted species. There was strong support among the panel that net ancillary effects would be positive in the medium- and long-terms and either neutral or positive in the immediate-term.

Community and social effects were ranked last in terms of the magnitude of associated social and economic impacts as shown in Table 3 of Appendix E. The panel was mixed on whether these results would be positive or negative in terms of Type 2 MPAs that are the size and in locations like those under consideration in Amendment 14. In the immediate term, most panelists believed that negative but minimal effects would impact fish houses or core labor patterns, and negative attitudes toward the Type 2 MPAs by the local fishing communities would surface due to initial dissatisfaction with the program. These negative impacts would dissipate over time, however, as fishermen and fish houses would adjust to the closed areas and communities would eventually become indifferent to or supportive of the Type 2 MPAs. Some panelists contended that non-fishing communities would incur immediate- and medium-term non-consumptive benefits related to the Type 2 MPAs, while others suggested longer-term community benefits if spillover effects from the Type 2 MPAs occurred. If poaching were to occur in the closed areas, local support for the conservation measures would erode before or as long-term benefits began to materialize. Both medium- and long-term benefits of the Type 2 MPAs to fishermen and their communities were considered to arise from the possibility of avoiding stricter fishing regulations in the future.

The goal of Round Three was to differentiate the socioeconomic impacts among alternatives for each proposed site in Amendment 14. In the terminology of the Delphi method, this is considered an impact analysis. Each panelist was asked to forecast the magnitude of the net socioeconomic impact of each group of effects in each time period based on a scale from negative 3, representing a high negative net impact, to plus 3, being a high positive net impact. A score of zero represented a non-influential grouping when trying to analyze the social and economic consequences associated with the Amendment 14 alternatives. Another reason for a zero score might have been that the positive and negative impacts associated with different effects within a group canceled each other out. This was very possible since the groupings were necessarily broadly defined. The responses by the panelists for each group of effects in each time period were analyzed to assess patterns of conformity and divergence. It is important to note that none of the panelists were asked to predict and estimate socioeconomic impacts of maintaining the status quo. The final rankings of the various Type 2 MPA alternatives for each time period are incorporated into section 4.2 of this document.

Possible Socioeconomic Consequences Associated with Implementation of Type 2 MPAs – Delphi Round One Results

The main purpose of the Delphi research was to provide a semi-quantitative analysis of the economic and social consequences among alternatives for each proposed Type 2 MPA in Amendment 14. In order to achieve this goal, we first had to identify the possible effects that may result from implementation of Type 2 MPAs in general. So, in Round One we initiated a Policy Delphi which was a panel brainstorming session about the general outcomes that may result from implementation of Type 2 MPAs and the net directional impact (i.e., positive, negative, or neutral) that these effects would have on a baseline estimate of overall socioeconomic consequences. A Policy Delphi differs from a traditional Delphi in that its final goal is not to obtain a consensus rather to elicit differing viewpoints regarding some political issue (Turoff 1970). Thus, the role of Round One pertained more to policy analysis than decision-making.

As the round progressed it became apparent that most panelists were focusing on the Amendment 14 sites. This proved beneficial as expert testimony regarding individual Type 2 MPA sites was naturally disseminated to the panel at an early stage of the Delphi experiment. Panelists that were unfamiliar with those particular Type 2 MPAs began to think about Type 2 MPAs within the framework of Amendment 14 early in the Delphi process.

The rest of this section contains a description of effects (i.e., benefits/advantages and costs/disadvantages) that may impact stakeholders after implementation of Type 2 MPAs similar to the alternatives proposed in Amendment 14. For each effect, majority and minority support from the Delphi panel about that effect's direction (i.e., negative, positive, or neutral) and level (i.e., minimal, moderate, or high) of influence on socioeconomic impacts resulting from implementation of Amendment 14 Type 2 MPAs, in particular, are summarized and discussed. Benefits/Advantages add positive value to a baseline estimate of the net impact of socioeconomic effects from implementation of Type 2 MPAs, while costs/disadvantages affect the baseline estimate negatively. It should be noted that these concepts are very hard to quantify and should be viewed as positive or negative effects with varying and unknown degrees of influence on an overall prediction of net socioeconomic benefits or losses associated with a particular Type 2 MPA alternative. With this in mind, the panel was asked to decide if each Round One effect would have a positive, negative, or neutral influence on a baseline estimate. As evidenced by the diversity of the panel, at times opinions varied widely regarding net directional impacts even when responses centered on the relatively small Amendment 14 Type 2 MPAs.

Benefit-Cost Valuation of Type 2 MPAs

From a socioeconomic as well as a biological perspective, Type 2 MPAs can be evaluated with a traditional benefit-cost framework in which the potential benefits of protection are compared to the potential costs when evaluated over the immediate-, medium-, and long-run. The preferred regulatory options from a socioeconomic perspective would be integrated sites that provide the greatest benefit for the least cost, or minimize the cost of achieving a given benefit. The following sections describe specific types of benefits and costs (advantages and disadvantages) relevant to the implementation of Type 2 MPAs for deep water species in the SASG fishery. Socioeconomic effects may arise due to the displacement of recreational, for-hire, and commercial fishermen, resulting in impacts on surrounding communities and biological changes over time. Long-term yields could increase due to a buildup in harvestable biomass resulting in positive socioeconomic impacts directly related to biological productivity. For example, spawning levels in the Type 2 MPAs and subsequent recruitment of young fish to open areas could increase; adult fish could spillover the boundaries of the Type 2 MPA into nearby open fishing grounds; and average weight and value of fish landed could increase. Social issues associated with the distribution of potential benefits and costs among fishermen, dependent communities, and other stakeholders may be present as well. Lastly, administrative benefits and costs may be realized.

Displacement effects are incurred by recreational, for-hire, and commercial vessels that normally fish in the newly protected areas.[2] Direct displacement costs to fishermen who are unable to fish in the Type 2 MPA include a decrease in catch levels, an increase in trip-level costs associated with searching for new fishing grounds, an increase in costs associated with learning new types of fishing, congestion, increased effort levels and user conflicts on new fishing grounds, and decreased personal safety. Displacement effects lower the predicted value of the net socioeconomic impact from implementation of a Type 2 MPA network. However, fishermen may be able to mitigate these costs by redirecting their fishing effort to open areas and possibly targeting different species. Over time, if spawning stock biomass increases and fish become heavier and more abundant in open areas, then fishing effort by new and existing boats will increase in the open areas as fishermen seek to maximize profits or recreational enjoyment. Although displaced fishermen may avoid or minimize displacement costs as a result of these opportunities, the addition of new fishing effort to open areas could cause congestion effects and have a negative influence on the status of newly targeted species resulting in future negative socioeconomic effects.

Fishermen who currently fish in the proposed protected areas typically bear short-term costs associated with implementation. Further, there is no guarantee that displaced

[2] The following descriptions of socioeconomic effects similarly apply to recreational, for-hire, and commercial vessels; thus, the terms "vessels" or "fishermen" will subsequently be used. The major difference (from a socioeconomic perspective) between recreational and commercial fishermen is that recreational fishermen are assumed to maximize their recreational enjoyment while commercial vessels maximize their profits. For-hire operations have characteristics of both as owners seek to maximize profits while their customers seek to maximize their enjoyment from purchasing the product (i.e., trip).

individuals will eventually be compensated by realizing future benefits from stock recovery or enhanced recruitment rates. In other words, short-term displacement costs would be incurred by dislocated vessels, but the long-term benefits of increased biological productivity as a result of the Type 2 MPA would be shared by all existing vessels and new entrants to the fishery. The major types of displacement costs are described below.

Short-Term Catch Levels. In the short-run, total catch by displaced vessels may be reduced due to implementation of Type 2 MPAs. The magnitude of this displacement depends on the existing condition of the fishery and the effort response by the affected vessels. Subsequent catch levels and their concomitant socioeconomic impact depend on a tradeoff between protection within the MPA and fishing density outside. Assuming prior to Type 2 MPA creation that fishing effort is distributed uniformly across space, the greatest detrimental short-term impacts on fishers moving from closed to open areas in terms of declining catch-per-unit-effort (CPUE) and total landings occur when a fishery is fully-exploited or overfishing exists while fishing density increases in the open areas (Bohnsack 2000).[3] Possible short-run responses to the Type 2 MPA regulation include changes in the variable cost structure of commercial operations, gear modifications, and location choices involving alternative fishing grounds as well as home ports. Decreased short-run yields may be mitigated to the extent that fishermen find alternative forms of fishing or alternative fishing locations. In the long-run, harvestable biomass growth due to enhanced recruitment and spillover from the closed areas could increase future catches or reduce the annual variability of harvests mitigating some of the short-run negative consequences.

Many of the panelists felt that decreases in short-run catch levels due to implementation of the Type 2 MPAs in Amendment 14 would generally be minimal due to the small size of the Type 2 MPAs and minimal fishing effort currently seen on some sites. Also, many felt that mitigation would be fairly easy since similar fishing areas existed close by, allowing displaced vessels to maintain catch levels. Decreased catch levels of deep water species could be offset by redirecting fishing effort towards alternative species in nearby fishing grounds. In general, alternatives that encroached into shallower waters of the mid-continental shelf regions were viewed to have a higher negative impact on fishermen. Decreasing catch levels of additional snapper grouper species such as shallow water groupers and vermilion snapper in mid-shelf areas would affect a larger number of operations in contrast to alternatives that encompass deep waters only. Lastly, decreases in deep water catches due to Amendment 14 may only be marginal if deep water snapper grouper trips are eliminated due to reductions in the commercial quota as well as trip and bag limits for snowy grouper and golden tilefish enacted by Amendment 13C to the Snapper Grouper FMP.

Trip-Level/Search/Other Costs. In theory, perhaps the most significant portion of displacement costs comes from the effect the closure has on fishing behavior. Displaced operators must choose new fishing locations, maybe target new species, possibly learn

[3] See Smith (2004) for an interesting discussion about the implications of spatially heterogeneous fishing effort, long-term fishery yields, and MPAs.

new types of fishing, or ultimately decide not to fish. These new trip-level decisions have a direct impact on the realization of profits and enjoyment as well as time-related opportunity costs. In particular, fuel usage and expenditures are likely to change. The immediate search for alternative fishing grounds likely results in additional fuel expenditures and lost opportunities to fish. If vessels must travel to more distant fishing grounds, then additional fuel is needed to go around the closed areas to avoid being caught with regulated species. Conversely, if the new fishing grounds are closer to shore or significant replenishment effects are realized on nearby fishing grounds, vessels will probably use the same amount of fuel or less. If displaced fishermen try to learn new types of fishing, additional costs are incurred as they purchase new gear or modify existing gear. Further, they will lack experience with the new gear, and it will take time for them to become proficient and improve profits or recreational satisfaction.[4]

In practice, many of the panelists felt that increases in trip-level and search costs due to implementation of the Type 2 MPAs in Amendment 14 would generally be minimal due to the small size of the Type 2 MPAs and existing knowledge of nearby fishing grounds. South Atlantic fishermen typically have knowledge of a very broad area to fish although significant recreational effort may bunch up on known sites. Changes in fishing patterns would probably be similar in scale to historical switching caused by the natural variability in catch rates. It was noted since exploration is a defining characteristic of deep water trips in the south Atlantic, negative displacement effects are more likely to be realized when fishermen target new species or change fishing practices rather than from alternative location choices. Many felt that mitigation of these types of displacement costs would be fairly easy as most Type 2 MPA sites were small, and well-known productive fishing areas existed close by, thus minimizing search costs and expenditures on new technology. Furthermore, south Atlantic fishermen routinely target different species throughout the year as catch rates and market prices fluctuate. One panelist noted that an initial course change of less than six degrees would be necessary to reach a spot five miles outside the Type 2 MPA adding approximately one-quarter mile of transit to trips that typically total 50 miles or more. Alternatives that covered only the deep water grounds were generally viewed to have the lowest negative impact on fishermen since fishing distance would be closer or no different.

Crowding/Congestion Effects. implementation of a Type 2 MPA results in the spatial displacement of fishermen who normally fish in the newly protected areas. If affected vessels do not exit the fishery, they must relocate to open areas which could be experiencing suboptimal harvest rates already. The result of this change in the location of fishing effort potentially could be large biologically and economically. Additional fishing pressure might further stress already overfished species. Increased fishing density in open areas may result in congestion effects as the displaced effort joins the traditional effort in the same size of open space. One consequence would be lower CPUE rates for displaced and existing boats as they compete for the limited biomass in the open fishing areas. This could create incentives for additional capital expenditures, such as fish

[4] This impact could be large since the Amendment 14 sites are Type 2 MPAs, which allow trolling for pelagic species within the areas.

finding equipment. Additionally, user conflicts may develop, and gear may be lost due to entanglement. In the long-run increased fishing yields would help to mitigate these costs.

In general, the panel viewed negative impacts from congestion effects to be a large possibility. First, there were a number of comments suggesting a linkage to recent increases in recreational effort. The panel suggested that the closer to shore that displaced commercial vessels had to move, the more conflict would result with recreational vessels. Also, there was concern of crowding effects in the pelagic fisheries. Another viewpoint suggested that displaced vessels would create additional depletion of mid-shelf or inshore stocks not covered by Amendment 14 if overfishing in these areas is already a problem. Some panel members felt there would be negative impacts from congestion but that they would be temporary and minimal, especially as "survival of the fittest" takes effect.

Personal Safety. Type 2 MPA regulations could cause fishermen to incur extra risk as they seek new and unfamiliar fishing grounds or employ unfamiliar fishing techniques. Increases to total transit times could result in increased safety risk to captain and crew especially during times of inclement weather. On the other hand, closure of deep water areas may force vessels inshore which could decrease personal risk.

The panel overwhelmingly thought that no impact would result from changes in safety to the captain and crew. Most felt that the Type 2 MPAs in Amendment 14 are too small and/or fishermen already had very good knowledge of alternative fishing sites. Safety risks associated with alternative fishing areas on the outer continental shelf are pretty similar. Others felt that fishermen already incur a considerable amount of risk, and that would not change significantly if Amendment 14 were implemented.

Regional Economic Impacts. Not all displacement costs are incurred by fishermen. An indirect cost due to implementation of Type 2 MPAs is the impact on the surrounding communities due to a reduction in income for displaced fishing operations and related businesses, such as fish houses, tackle and bait shops. If displaced stakeholders cannot mitigate all losses incurred due to the Type 2 MPA, their communities likewise will be negatively affected as less income flows through different sectors of the local and regional economies. Socioeconomic impacts are absorbed at the community level and extended to the regional level. Fishing-related income originally spent in the community cycles throughout the economy producing a multiplier effect resulting in total expenditures that exceed the original income. The amount of fishing income lost and the magnitude of the multiplier effect determine the extent of the negative influence on the predicted value of socioeconomic impacts from implementation of Type 2 MPAs. Of course, alternative activities that mitigate this income loss reduce the negative socioeconomic consequences imparted on local and regional economies.

Most panelists felt that the short-term impact on local and regional economies from income loss would be negative but minimal due to the small size of the proposed Amendment 14 Type 2 MPAs and the existence of viable fishing alternatives. Panelists felt that local and regional impacts would be much more pronounced due to increases in the cost of fuel, increased regulations (especially consequences from enactment of Amendment 13C in 2006), and development in coastal communities rather than due to the Type 2 MPAs proposed in Amendment 14. Locally, very few south Atlantic communities are substantially dependent on fishing income; thus, lost fishing income would have a less pronounced effect than in the past. Regionally, negative socioeconomic impacts due to loss of fishing income are becoming marginal relative to industries such as tourism, service, and construction.

Socioeconomic benefits are realized if biological productivity throughout the fishery increases due to implementation of Type 2 MPAs. Positive influences on the predicted value of socioeconomic impacts from implementation of Type 2 MPAs are linked to stock replenishment, increased yields, and reduced variability of catches and revenues.

Replenishment/Stock Effects. Benefits are realized over the long-run if Type 2 MPAs increase the biomass of deep water species and stocks become healthier. Type 2 MPAs directly influence biological productivity by reducing directed fishing mortality and bycatch, protecting habitat from gear damages, and increasing spillover and total reproductive output. Replenishment effects in open areas are direct results of increased spawning output from fish in the Type 2 MPA and spillover of adult fish. The amount of socioeconomic benefit that will eventually be derived due to replenishment or stock effects from the Type 2 MPAs depends on a myriad of biological and economic factors specific to the species in question and the vessels that target them, as well as the size of the Type 2 MPA sites. Deep water groupers and tilefish have a low resilience to overfishing due to life-history characteristics such as slow growth, late maturity, high minimum population doubling times, and a mostly sedentary lifestyle. However, these same characteristics make these species good candidates for repopulation through Type 2 MPAs since the relatively site-specific adult snowy grouper and tilefish would be protected from bottom fishing effort.

In general the panel felt that this benefit would be insignificant in the short-term but probably positive as recruitment and spillover from the MPAs occur in the longer-term. Biomass increases due to spillover or gains in reproductive output would likely occur several years after the closure due to the life history characteristics of the deep water species. However, there were a large number of responses that suggested that these benefits would be immeasurable due to the small amount of protected habitat in each proposed Type 2 MPA and a lack of existing baseline data needed to fully assess this effect.

Catch Levels in the Future. Long-term yields could increase after implementation of Type 2 MPAs due to a buildup in harvestable biomass resulting in socioeconomic benefits directly related to biological factors such as stock abundance, healthier fish stocks, and spillover and dispersion effects (Sanchirico 2000). Over the long-run, aggregate catch by displaced and unaffected vessels alike may increase due to biological productivity. This result depends on ecological structure, oceanographic patterns, biological characteristics of the stock, and the scale and location of the Type 2 MPAs as well as changes in fishing operations in response to the area closure (Sanchirico 2000).

Spillover into open areas is dependent on fish migrations and habitat suitability. The level of dispersion of a protected stock throughout the adjacent open fishing grounds is a determinant of the level of future harvests. Socioeconomic benefits from increased long-term yields are more likely to be realized from species that migrate to open areas of suitable habitat, although biological spillover effects may be realized through larval transport.

Changes in fishing behavior have a temporal and spatial context and depend on both economic and biological conditions. In the short-run, redirection of fishing effort or overcapitalization may imperil fish stocks in surrounding areas. In the long-run, vessels could leave the fishery if stock benefits do not equal short-run displacement and opportunity costs. Alternatively, new vessels could enter if long-term increases in aggregate yields are large. The extent that catch levels increase over time adds worth to the predicted value of socioeconomic impacts from implementation of Type 2 MPAs; however, these potential future benefits may not be realized exclusively by the fishermen immediately displaced by the Type 2 MPAs.

The panel generally felt that any positive impact of increased future catch levels due to the implementation of Type 2 MPAs would be minimal due to the small size of the proposed MPAs and the sessile nature of deep water species. There was some consensus that in the short-run negative consequences could be realized since displaced fishermen may redirect effort towards unprotected species in new areas. Also, some noted that if commercial and recreational effort was not capped, any benefit would be lost. Linking future catch levels to the implementation of the Amendment 14 Type 2 MPAs would be difficult due to a lack of accurate baseline data describing aggregate biomass levels within and outside the sites.

Landings (or Yield) Variation. Increased protection of the spawning stock biomass through implementation of Type 2 MPAs may lead to more natural population structures with older and larger individuals and greater genetic diversity. As a result, there could be increased harvestable biomass, increased dispersal, and greater recruitment to the remaining open areas in the fishery. These attributes likely would lead to a reduction in the annual variation in the biomass of deep water stocks and interconnected harvests and revenues. If spillover occurs, then the abundance and harvest levels in surrounding areas will become less variable. Fishermen who are financially risk averse will prefer more stable harvests, whereas fishermen who are financial risk takers will not.

The general consensus of the panel was that a reduction in landings variability would be a positive effect; however, the impact is unlikely to be realized from implementation of the Amendment 14 Type 2 MPAs due to their small size. Also, the MPAs do not uniformly protect all life stages. Panelists suggested that many factors lead to variation in landings (e.g., market and oceanographic conditions, weather), and the marginal effect due to relatively small MPAs would be insignificant in light of these other sources of variation.

Option and Existence Values. Benefits arise from maintaining the option to use the ecological resources within the protected areas in the future. In essence, society is paying a risk premium, by closing the area to bottom fishing, to keep the option of future use available and hedge the uncertainty associated with overfishing the targeted species. Additionally, the knowledge that species will continue to exist in the future, even if never used, can generate value, known as existence value. Option and existence values constitute positive additions to the predicted value of socioeconomic impacts from implementation of Type 2 MPAs.

The panel's viewpoints were fairly divergent regarding the impact of these effects. A significant number felt that a positive impact would be realized by protecting deep water species. Some thought Type 2 MPAs can secure nonuse benefits by serving as a hedge against future stock collapses. Others felt that the status of deep water species was strong enough such that only marginal benefits in option or existence values would be realized. Alternatively, redirected effort toward mid-shelf and inshore fishing areas reduces option and existence values associated with newly targeted shallow water grouper and mid-shelf species.

Quality Increases in Type 2 MPAs. If regulation works from a biological perspective, then fish in the Type 2 MPAs over time become more numerous and heavier, on average, due to an increase in the number of older fish in the population. Also, protection could increase biodiversity, genetic diversity, community structure, and general habitat conditions in the short- and long-term. These benefits could contribute to an overall healthier ecosystem which eventually supports sustained recreational and commercial fishing activities outside the Type 2 MPA sites. Thus, improvements in environmental quality constitute a positive addition to the predicted value of socioeconomic impacts from implementation of Type 2 MPAs.

On the other hand, decreases in the quality of alternative fishing grounds and reduced option and existence values resulting from increased fishing pressure redirected toward alternative fish stocks result in costs. Effort controls coupled with area closures may mitigate some of these unintended consequences. To the extent that these costs are realized a negative influence must be accounted for in the predicted valuation of socioeconomic impacts from implementation of Type 2 MPAs.

The panel generally felt that a positive but minimal impact in the quality of the habitat protected by the Type 2 MPAs would result. They responded that with adequate enforcement some significant increases in individual and population size would result but would be difficult to measure. In some cases, it is unclear to what extent the Amendment 14 alternatives encompass hard bottom habitats and the quality of the habitat that is included in the Type 2 MPAs.

Management Benefits and Costs. Fishery managers use Type 2 MPAs to reduce risk associated with uncertain stock assessments and create undisturbed areas for experimental biological research. This benefit is particularly important as managers have been urged to use the Precautionary Principle when dealing with fish stocks that are overfished or for which overfishing is occurring. Management costs include the expense of maintaining and enforcing Type 2 MPAs once implemented as well as public outreach and education. The overall objective of management is to achieve conservation and fishery management goals.

In general the panel felt management benefits would be minimal. Also, enforcement of the Type 2 MPA boundaries was considered crucial if protection is to produce any benefits. Another viewpoint suggested that management benefits would only be realized if Type 2 MPAs were used in conjunction with traditional management methods. The deep water Type 2 MPAs specified by Amendment 14 allow managers to invoke the Precautionary Principle by extending added protection to relatively rare, deep water species, such as speckled hind and Warsaw groupers, that are caught as secondary species with snowy groupers and sometimes discarded to comply with existing regulations that limit their harvest to 1 per vessel (recreational and commercial) per trip with no sale. These species experience high discard mortality due to the depths at which they are caught, and it is difficult to protect them when fishing continues normally for other more abundant species. Additionally, some alternatives offer protection to mid-shelf species resulting in extra administrative benefits. However, some panelists countered that protection accorded to species other than those listed in the deep water fishery management units was beyond the scope of Amendment 14. There was diversity among the panel regarding costs to management. Panelists argued that costs associated with education, compliance, enforcement, scientific monitoring, and administration would increase. However, others argued that management costs should go down if no bottom fishing was allowed or vessel monitoring systems were implemented.

Individual panelists also identified other effects and influences including: community and social impacts, ecosystem protection, non-consumptive opportunities, improved knowledge of marine systems, and bycatch mortality.

Community and Social Impacts. There was a great amount of diversity among panelists regarding the impact on communities resulting from implementation of Type 2 MPAs. Some panelists felt that a negative influence on the community would be realized, even if minimal due to the size of the Type 2 MPAs in Amendment 14 and alternative fishing opportunities. Negative effects that could be realized include job loss, psychological impacts including depression and alcoholism, and detrimental effects on packing houses and their employees. On the other hand, some panelists felt that positive community effects would be realized as long-term increased reliability in fishing stocks were realized. Non-fishing communities could experience positive social benefits through the realization of option and existence values.

Ecosystem Protection. In general, the panel felt that there would be benefits resulting from ecosystem protection because even minimal reductions in fishing pressure would help to restore more natural conditions to local ecosystems. This may be due to decreases in habitat damage due to gear impacts, as well as a more natural balance of size classes, species diversity, predators, and prey.

Non-Consumptive Opportunities. One panelist mentioned that divers may benefit from the creation of Type 2 MPAs as they would like to watch or take pictures of fish. Due to the location, size, and depths of the Type 2 MPAs in Amendment 14, it is unlikely that large benefits would arise due to non-consumptive activities of this type.

Improved Knowledge of Marine Systems. Two panelists suggested the possibility of experimental benefits from the Type 2 MPAs in Amendment 14 as they could provide an opportunity for long-term monitoring and education. Also, the point was raised that heavily fished areas may take a long time to rebound enough to allow the study of an "unfished population".

Bycatch Mortality. Benefits are realized as bycatch mortality is reduced within the Type 2 MPAs.

Summary. Although the diversity of the experts created instances of divergence regarding the direction (positive, negative, or neutral) of individual effects during Round One brainstorming, the panel generally displayed strong majority support on the direction and level of impacts resulting from the implementation of Type 2 MPAs. Negative impacts would be realized mainly in the form of displacement effects on fishermen and the communities that depend on them, with the possibility of management incurring some costs. However, due to the small size of the Amendment 14 MPAs and the availability of alternative fishing opportunities for displaced fishermen, these impacts were likely to be minimal and observed only in the short-term. Benefits were thought to be possible due to increases in longer-term catch levels, quality increases in the Type 2 MPA and ecosystem, option and existence values, and management benefits. These also were deemed to be minimal due to the small size of the Amendment 14 Type 2 MPAs.

In conclusion, Round One generated comments about effects that could result due to the implementation of Type 2 MPAs similar to those proposed in Amendment 14. Panelists also commented on the likely impacts that would accompany these effects. In some cases these views were diverse. For the most part the panel believed that the impacts from Amendment 14 would be minimal due to the small size of the proposed Type 2 MPAs. Additional displacement costs were associated with the alternatives that encroach into the mid-shelf regions. Lastly, an important insight came out of this round. Any impacts would have to be analyzed over different time periods: immediately (within one year); medium-term (from one to five years) and long-term (greater than five years). This result was incorporated in the structure of the next two rounds.

4.1.3 Social

4.1.3.1 General Effects of MPAs Proposed in Amendment 14

The following sections describe the proposed Type 2 MPAs throughout the South Atlantic Councils area of authority. In order to assess the socio-economic impacts of these alternatives we must first address some general concerns about the proposed Type 2 MPAs and their effectiveness as a management strategy. The majority of these data are derived from a study examining fishermen's perspectives regarding the effectiveness of MPAs, highlighting certain proposed MPA areas (Freibaum 2005). The second data set is derived from public informational hearings held throughout the region by the South Atlantic Council (see the MPA Source Document included on the Amendment 14 CD for more details).

Freibaum (2005) examined the impact of MPAs on local communities and fisheries, focusing on fishermen's perspectives regarding the current status of the fisheries and the potential effectiveness of MPAs in the U.S. South Atlantic region. In 2004 and 2005, she conducted 80 interviews between Morehead City, North Carolina and Stuart, Florida. These interviews were carried out with 39 charter/headboat captains, 29 charter captains who held commercial permits, and 12 commercial fishermen with no recreational affiliation. Of these 80 fishermen, 58 described themselves as full-time fishermen, while 22 called themselves part-timers. The interviews were conducted by telephone, and included standard and open-ended questions to allow respondents the opportunity to express their perspectives. The sample was drawn opportunistically and had a response rate of 82%. An opportunistic sample means utilizing whatever strategy necessary to identify participants in the local fisheries and then making contact over the phone to discuss the research objectives.

4.1.3.2 General Concern about the Implementation of MPAs

The Science

Most fishermen are not against MPAs as a concept, but in the opinions of many fishermen, when put into practice, MPAs as a management tool must prove to be effective in reaching the objectives associated with the closed areas. Dr. Bohnsack, a NOAA fishery scientist, has looked at a number of MPAs and argued that one must assess biological, economic, cultural, and geographic factors before determining the best type of MPA to be implemented. He also suggests that one needs to be careful about implementing MPAs with multiple use strategies, and that there is a correlation between the harvest of pelagic species on other species in the closed area. This means that a Type 2 MPA may actually cause problems for the bottom species the MPA is trying to protect. The problems that may arise stem from disruptions in the vertical water column by the removal of certain kinds of species.

There is concern among fishermen about the scientific evidence to support the notion that the Type 2 MPAs proposed in Amendment 14 will be successful. Although the theoretical case for MPAs has been vetted in the scientific community, experimental data with which to predict the effectiveness of MPAs for deepwater species in the snapper grouper fishery is more recently becoming available (See Section 4.1.1). When fishermen believe the "science" lacks validity or credibility, their frustration grows because it adds to the belief that the government is trying to impose unpopular and ineffective regulations on them. Moreover, there can be serious economic and social ramifications because regulation negatively impacts their livelihoods and they must find ways to compensate for the loss of revenue and income. This can generate animosity and make future collaborative research and management difficult because of the strained relationship. Warranted or not, this is how many "feel". For the most part, they do not mind giving something up if they can agree that there is something that is needed to be done to help the stock. However, if an MPA is implemented and fishermen perceive it to be unwarranted or unnecessary, there are some that are more likely to continue to fish in the area because they deem the law to be unjust. It may take only a small amount of poaching to undermine the effectiveness proposed MPAs. Those fishers who stayed out of the MPAs would suffer because the possible biological benefits of the MPAs to fished species would not occur. In such a case, only the poachers would benefit.

Enforcement

Effective enforcement of MPAs is critical to their success in achieving biological objectives and the maintenance of a positive public attitude toward them. As mentioned in an earlier section, if an MPA is not adequately enforced, then access to the fishing grounds in the MPA will be lost for those who voluntarily observe the boundaries of the MPA, while catch rates will increase for fishermen who cross the boundary and fish illegally in the protected area.

The reality is that local compliance and self monitoring are needed for MPAs to be effective. There are some positives and negative impacts that occur based on whether there is adequate formal or informal enforcement of the areas. Some of these are as follows:

Positive Effects Associated with Enforcement

- Increased biomass of protected species
- More likely to achieve biological objectives
- Spillover at the boundaries
- Increased opportunity for tourism/dive related activities
- Record size fish
- If self imposed enforcement is successful it creates greater solidarity for the group, thus enhancing future influence on fishery policy

Negative Effects of Inadequate Enforcement

- Reduce the likelihood for compliance
- Increase in poaching
- Less chance for achieving biological objectives
- Illegal fishing is rewarded
- Fishermen perceive themselves as having been displaced for no reason
- Becomes a "paper" MPA, which equates to a loss of money, time, and confidence in the management process

Effects of Unemployment and Job Loss

Throughout his research on the impact of unemployment and job loss in the workplace, Caplan (2003) suggests that job loss is a given even in the best of circumstances. Such frictional unemployment occurs as part of the normal adjustment among employer strategies, workforce talents, and consumer needs and preferences. For many individuals, however, job loss has costly effects that go well beyond loss of income, exacting a heavy psychological and social price on the unemployed person and his or her family.

From the Great Depression to the present, a consistent body of research shows that job loss leads to increased symptoms of depression and anxiety. These emotional changes are sometimes accompanied by alcohol abuse and increased propensity for violent behavior (Caplan 2003).

Such tendencies are caused by more than just money issues. Employees develop identities that are wrapped up with being productive — with being the family breadwinner. While surveys of job seekers indicate that nearly all job loss is due to economic reasons, unemployed persons may report feelings of shame, loss of confidence, and low self-esteem (Caplan 2003).

Caplan (2003) highlights many of the potential social and psychological impacts associated with unemployment and job loss in fisheries, especially considering that fishermen are often fiercely independent individuals whose identities are directly tied to their occupation. In a study of longline fishermen in Hawaii, Dr. Stewart Allen notes that fishermen report increased anxiety, depression, sense of hopelessness, frustration, anger, and identity loss associated with unemployment and job loss. There is evidence that these conditions can manifest themselves in increased violence or violent outbursts, alcoholism, drug addiction, suicide, and a variety of other problems that places stress on all aspects of family and social life. Caplan (2003) notes that unemployment and job loss can actually make it much more difficult to get re-employed. This is something that counters the notion that if fishermen are simply eliminated from fishing they can easily make the transition into some other form of employment.

Implications of Amendment 13C for the effects of proposed Type 2 MPAs

Amendment 13C for the snapper grouper fishery included substantial reductions in total allowable catches and trip limits for the commercial deepwater fisheries for groupers and tilefish, and may eliminate a substantial amount of fishing activity for the deepwater groupers in areas that have been proposed for Type 2 MPAs. If this is the case, then implementation of the proposed Type 2 MPAs would have little additional effect. However, some proposed Type 2 MPAs, especially in Florida, that are located closer to shore and include species other than the deepwater groupers or tilefish, may create additional economic and social impacts for commercial and recreational fishermen.

4.1.3.3 Integrating Social Science into MPA Management

According to Buck (1995) there are at least three ways in which social issues directly influence fishery management plans. First, in determining the optimum yield for a fishery, there may be more liberal interpretations of the definition if Regional Council members are reluctant to disrupt people's lives by imposing reductions in their allowable harvests. Second, social issues can influence the appointment of Regional Council members and the composition of Advisory Panels. Third, fishery management plans are directly affected by social values when the allocation of harvest rights is at issue. For example, there may be conflicting interests between commercial and recreational fishers, inshore or offshore fleets, different gear groups, or groups of different heritage. Opinions will be divided among all of these sectors as to what the qualifying criteria for allocation should be. These difficulties make the allocation issues in fishery management extremely sensitive.

The success of an MPA is dependent upon its acceptance within the community in which it is established as well as by those communities and individuals which harvest from the proposed closed area. A 2004 study examined saltwater anglers' attitudes towards varying degrees of restrictiveness with MPAs. It found that as restrictiveness increased, support for MPAs decreased (Salz and Loomis 2004). There are approximately 34 million anglers in the U.S., of which 12 million fish in saltwater (Salz and Loomis 2004). Many fishers have a conservation ethic, as evidenced by participation in catch and release programs, memberships in environmental organizations, and participation in fish tagging. Keeping the fishing community engaged in the regulatory process is also important since fishers have local knowledge in locating source sites. Without their support and helpful information, chances of achieving success at sustainable fishery goals are reduced (Helvey 2004). To understand the human dimension of implementing an MPA, fishery managers need to understand social science variables that are involved. These include demographics, perceptions and beliefs of the stakeholders, use patterns, cultural ties or traditional use, and market and non-market values or dependency on the resources (Lyons 2002).

Supporters of the newly proposed Freedom to Fish Act oppose no-take MPAs claiming they violate the "open access principle". The Freedom to Fish Act was proposed in 2000 and would make MPAs more difficult to implement within federal waters that prohibit recreational fishing. This bill is supported by many sportfishing interest groups. Even though it is still awaiting Congressional action, the Rhode Island legislature recently passed a similar law, with other coastal states following their lead. The Rhode Island Freedom to Fish and Marine Conservation Act establishes standards that must be achieved before the designation of a "no-take" MPA. However, not all recreational fishers oppose MPAs. For example, during the implementation of marine reserves in Hawaii, many local anglers supported the management option, despite opposition from national sportfishing organizations (Salz and Loomis 2004). Moreover, throughout the South Atlantic there appears to be support for Type 2 MPAs and a sense of partnership between the South Atlantic Council and local users as they have come together to negotiate siting and discuss impacts. Continued efforts such as these will increase the likelihood that MPAs as a collaborative management tool can be effective.

Some earlier MPAs were created with this very notion of collaboration built into the process of development and implementation. The Tortugas Ecological Reserve is approximately 70 miles off Key West in the Florida Keys National Marine Sanctuary. Its implementation was a success because the socioeconomic aspect of establishing an MPA was integrated with ecological factors. The social impacts were investigated and included profiles of commercial and recreational fishers. The process involved a Sanctuary Advisory Council, which consisted of a range of stakeholders, including a technical and socio-economic team, who created the supplemental EIS and determined boundary alternatives for the reserve. After two years of negotiations, the stakeholders agreed upon the siting of the Tortugas Ecological Reserve (Sanchirico *et al.* 2002). As a part of the Tortugas 2000 reserve planning process, GIS maps of popular fishing sites were overlaid with maps of marine habitat so critical areas could be set aside while attempting to minimize the social impact on the fishers (MPA News 2002). The ability of marine resource managers and other stakeholders, such as the fishers, to interact and work together helped the process. Anecdotal stakeholder knowledge was used directly and treated equal to that of traditional scientists. Fishers reported that they felt more involved and respected during the process (Bernstein *et al.* 2004).

Implementation of MPAs remains controversial, despite documented successes (see Polacheck 1990, Bohnsack 1993, Dugan and Davis 1993, Helvey 2004). There are concerns that they may threaten the fishing rights of recreational anglers or be counter productive to conservation for social reasons. MPAs have documented biological benefits, however there is still uncertainty (see Sobel 1993, McClanahan and Kaunda-Arara 1996, Johnson *et al*. 1999, Murray *et al*. 1999, Roberts *et al*. 2001). There is even more uncertainty and questions when attempting to assess the costs and benefits to social and economic aspects, since studies on them have only begun to increase in recent years (see Dixon 1993, Cocklin *et al.* 1998, Pomeroy 1999, Milon 2000, Dobrzynski and Nicholson 2001). Implementation of MPAs creates winners and losers throughout the process, generally identifiable by those who have access and those who do not. The winners and losers come from all user groups when MPAs are developed in a collaborative manner, meaning a greater likelihood for buy-in to the concept as well as compliance because the MPAs were not created to specifically deny access by particular user groups.

4.1.3.4 The Delphi Study: A socioeconomic comparison of proposed sites

A description of the rationale for the study can be found in Section 4.1.2.3.

4.1.4 Enforcement issues relating to the proposed MPAs

One barrier to MPA support and implementation has been concern over the ability to adequately enforce these areas. The Council's Law Enforcement Advisory Panel (LEAP) has been involved in the development of the proposed MPAs from the beginning and provided the Council with a list of criteria for the Council to consider before taking action (Appendix B). The criteria that the LEAP recommended included that an MPA should be a square or a rectangle; the bigger the better; the boundaries should be delineated in latitude and longitude; must be in acceptable format to be included and identified on NOAA charts; allowable activities in the MPAs should be limited; and locate MPAs away from highly populated areas.

There was unanimous agreement among the LEAP that public support was among the most critical aspects of developing MPAs. They also recommended to the Council there should be a "threat assessment" conducted by the appropriate state, NMFS and Coast Guard enforcement personnel (potentially the AP) for each MPA being developed. The LEAP completed a report on the Enforceability of the Proposed MPAs (ratings are included in Section 4.13) in February of 2006 which the Council considered along with social and economic information when choosing preferred alternatives.

The proposed Type 2 MPAs in this document meet some but not all of the criteria set out by the LEAP. In choosing the proposed Type 2 MPAs the Council weighed the law enforcement concerns as well as the biological, social, and economic concerns.

4.1.5 Individual Assessments of Alternatives

The following assessments contain qualitative valuations of the net effects of possible economic impacts, identified by the Policy Delphi in Section 1.1.2.1.1, on a baseline net economic valuation of each Type 2 MPA alternative described in Amendment 14. Due to a lack of spatially relevant data, a quantitative analysis cannot be performed with a reasonable sense of confidence at this time. However, semi-quantitative estimates of the socioeconomic impacts (i.e., benefits and costs) resulting from the implementation of Type 2 MPA alternatives cited in Amendment 14 were produced by the Delphi experiment. These results are included in the assessments. Table 4-1 indicates presence of hard bottom within sampled SEAMAP* 1-minute grids encompassed by the proposed deepwater MPAs.

Table 4-1. Presence of hard bottom within sampled SEAMAP* one-minute grids encompassed by the proposed MPAs.

Presence of Hard Bottom within Sampled SEAMAP* 1 Minute Grids encompassed by Proposed Marine Protected Areas

MPA Name**		Grid Area Showing Presence of Hard Bottom (square miles)	Approximate Total Grid Area (square miles)	Total Grid Area with Any Data (square miles)	% of Grids with Data Showing Hard Bottom	% of Total MPA Area With Grid Samples	% of Total MPA Area with Grids Showing Presence of Hard Bottom
Snowy Wreck MPA	Alternative 1	4.54	190.00	54.00	8.41%	28.42%	2.39%
Snowy Wreck MPA	Alternative 2	0.09	190.00	29.00	0.31%	15.26%	0.05%
Northern South Carolina MPA	Alternative 1	16.61	68.00	20.61	80.59%	30.31%	24.43%
Northern South Carolina MPA	Alternative 2	13.06	68.00	27.08	48.22%	39.82%	19.20%
Northern South Carolina MPA	Alternative 3	8.56	68.00	23.56	36.34%	34.65%	12.59%
Edisto MPA	Alternative 1	3.71	77.00	8.71	42.59%	11.31%	4.82%
Edisto MPA	Alternative 2	0.61	77.00	3.61	16.90%	4.69%	0.79%
Georgia MPA	Alternative 1	0.54	102.00	7.54	7.13%	7.39%	0.53%
Georgia MPA	Alternative 2	2.34	113.00	10.34	22.62%	9.15%	2.07%
North Florida MPA	Alternative 1	30.72	115.00	42.72	71.91%	37.15%	26.71%
North Florida MPA	Alternative 2	10.31	115.00	21.31	48.38%	18.53%	8.97%
North Florida MPA	Alternative 3	0.00	512.00	19.00	0.00%	3.71%	0.00%
North Florida MPA	Alternative 4	14.84	115.00	23.84	62.25%	20.73%	12.90%
North Florida MPA	Alternative 5	2.29	115.00	6.29	36.41%	5.47%	1.99%
North Florida MPA	Alternative 6	0.18	512.00	9.18	1.96%	1.79%	0.04%
St. Lucie Hump		1.18	9.44	2.36	50.00%	25.00%	12.50%
Chas. Deepwater Artificial Reef MPA		0.00	23.60	2.36	0.00%	10.00%	0.00%

*(Hard Bottom includes Hard Bottom and Possible Hard Bottom)
Calculations developed from estimates provided by FWRI based on SEAMAP and MPA Layers in SAFMC Habitat and Ecosystem IMS
Note: SEAMAP grid data were used to calculate these values; area encompassed by proposed East Florida Hump MPA not covered
**Prefered Alternative in Bold

4.1.6 Data on Impacts

At their June 2006 meeting the Council's Scientific and Statistical Committee (SSC) reviewed the draft amendment and recommended that a quantitative estimate of impacts be added to the document.

The Southeast Logbook Program provides catch by statistical grid (1 degree squares). Initially impacts were going to be estimated by looking at the total snapper grouper catch in a grid containing a Type 2 MPA (or any portion of a MPA) and assuming that the catch from the Type 2 MPA was between zero and the total catch in the grid. This would certainly have placed an upper and lower bound on the level of catch impacted. Another method would have used the percentage of the grid covered by a proposed Type 2 MPA and assumed that the catch would be reduced by the same percentage. Both of these methods would have resulted in quantitative estimates of the level of potential impact.

Preliminary estimates of these levels of catch were presented during the Informational Public Hearings to try and get those attending to further refine our estimates. This effort was not successful.

The Interdisciplinary Team decided to not include these quantitative estimates in favor of including a qualitative discussion of the level of impacts.

The NMFS Southeast Regional Office and Southeast Fisheries Science Center conducted a Delphi study to develop a quantitative estimate of impacts. Results were reviewed by the SSC and the Council at the December 3-8, 2006 meeting and are included in the final EIS and Amendment.

Acting on direction from the Council, the SSC was also presented with the estimations from the logbook data and the results from the Delphi study and was asked to determine the best source for estimating impacts of the alternatives. The SSC concluded that both estimates of impacts should be included and thus they have been added under the Economic Impacts section of each management measure.

4.2 Snowy Grouper Wreck MPA

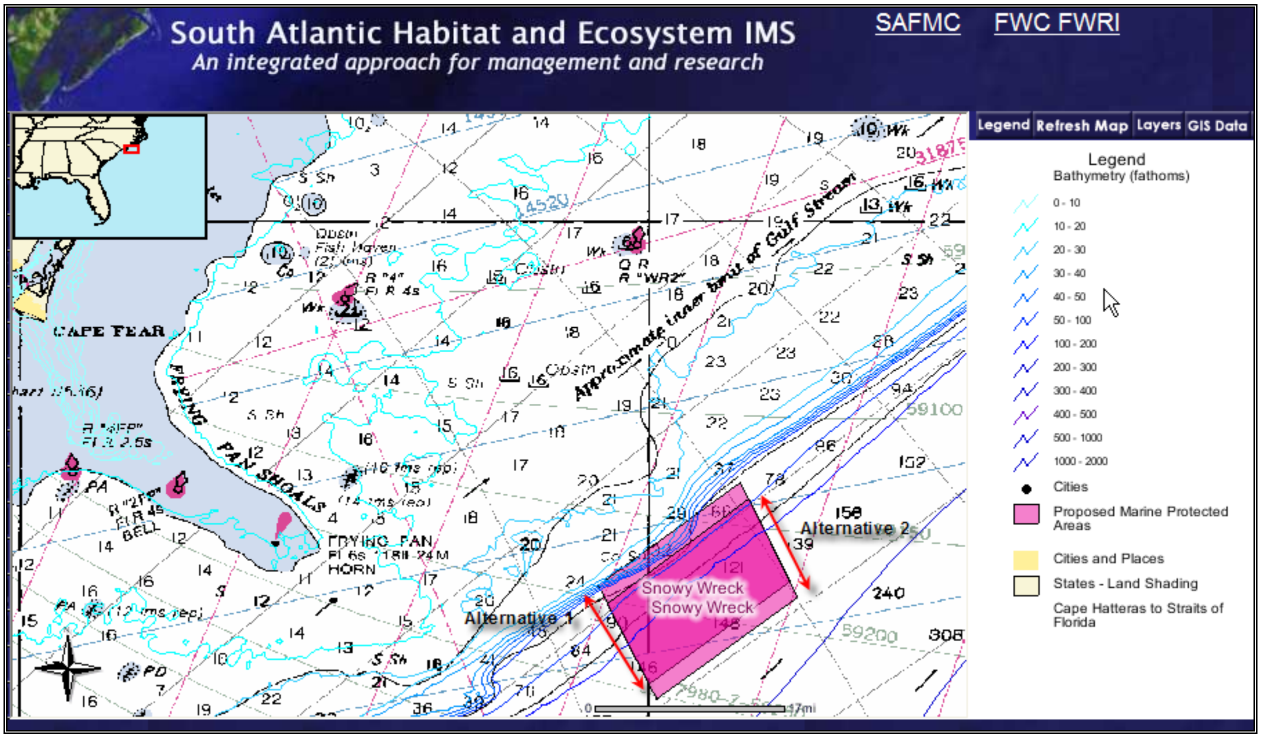
Alternative 1. Preferred Alternative - Establish a Type 2 MPA that protects the Snowy Wreck off North Carolina in the area that is bound by the following coordinates: The northwest corner at 33°25'N, 77°4.75'W; northeast corner at 33°34.75'N, 76°51.3'W; southwest corner at 33°15.75'N, 77°W; and the southeast corner at 33°25.5'N, 76°46.5'W (Figure 4-2).

Alternative 2. Establish a Type 2 MPA that protects the Snowy Wreck off North Carolina in the area that is bound by the following coordinates: The northwest corner at 33°23.35'N, 77°4'W; northeast corner at 33°33.25'N, 76°50.5'W; southwest corner at 33°14.1'N, 76°59.35'W; and the southeast corner at 33°24'N, 76°45.75'W (Figure 4-2).

Alternative 3. No action. Do not establish a Type 2 MPA to protect the Snowy Grouper Wreck.

Alternative 1 of this proposed Type 2 MPA is located approximately 55 nautical miles southeast of Southport, North Carolina and **Alternative 2** is located approximately 57 nautical miles southeast of Southport. The size of both alternatives is approximately 15 by 10 nautical miles.

Both alternative Snowy Wreck MPA sites include an area ranging from 150 meters (492 feet) to 300 meters (984 feet) deep. **Alternative 1** also includes a shallow area ranging from 60 meters (197 feet) to 100 meters (328 feet), and **Alternative 2** includes a deeper area exceeding 300 meters (984 feet) in depth (Figure 4-2).



Approximate Corner Points:

Alternative 1. (Approx. 55nm SE of Southport)

NW 33 Degrees 25 Minutes N. 77 Degrees 4.75 Minutes W.	NE 33 Degrees 34.75 Minutes N. 76 Degrees 51.3 Minutes W.
SW 33 Degrees 15.75 Minutes N. 77 Degrees 0 Minutes W.	SE 33 Degrees 25.5 Minutes N. 76 Degrees 46.5 Minutes W.

Alternative 2. (Approx. 57nm SE of Southport)

NW 33 Degrees 23.35 Minutes N. 77 Degrees 4 Minutes W.	NE 33 Degrees 33.25 Minutes N. 76 Degrees 50.5 Minutes W.
SW 33 Degrees 14.1 Minutes N. 76 Degrees 59.35 Minutes W.	SE 33 Degrees 24 Minutes N. 76 Degrees 45.75 Minutes W.

Prepared by Roger Pugliese, SAFMC (1/05/05)

Figure 4-2. Proposed Snowy Wreck Type 2 MPA alternatives.

4.2.1 Biological Effects of Management Measure Alternatives

Alternatives 1 and 2 were chosen as potential Type 2 MPAs because they contain a wreck that was once the site of a known aggregation of snowy grouper, which was believed to be targeted heavily by a few individuals in the late 1990s and fished down. Figures 3-4 and 3-5 reveal that catches of snowy grouper at the snowy wreck probably resulted in a spike in landings and an increase in the mean size of snowy grouper landed in North Carolina. This is apparently a direct result of fishermen finding a virgin reef site and rapidly exploiting them in 2-3 years. Within the proposed Type 2 MPA, there is anecdotal information that there are a few smaller wrecks that also hold snowy grouper.

According to the commercial fishing industry, **Alternatives 1 and 2** hold many snowy grouper, speckled hind, gag, and red porgy. It is reported that red grouper, graysby, and hogfish have also been caught at the snowy wreck. Information from public hearings indicates that the snowy wreck is mostly fished by commercial snapper grouper fishermen out of Little River, South Carolina and the ports of Carolina Beach and Southport, North Carolina. This area is also heavily fished by fishermen who troll for tuna, marlin, dolphin, and wahoo during certain times of the year.

Because the targeted species live a long time and grow slowly, it is likely that the desired changes in sex ratio, size, and age structure resulting from establishment of the Type 2 MPAs will not be apparent in the short-term. For example, Roberts *et al*. (2001) found the lag time between establishment of a marine reserve and occurrence of record-size specimens of spotted sea trout, red drum, and black drum corresponded closely to the species longevity, with record-size specimens of longer-lived species taking longer to occur. It follows that, since the mean age at sexual maturity of golden tilefish is 24 years (SEDAR 4 2004), the generations of golden tilefish which are protected from fishing by the Type 2 MPAs will not reproduce until many years after the MPAs are implemented. Desired demographic changes may not be detectable at the population level for many years, and would therefore be considered long-term effects of the Type 2 MPAs. However, it is possible that some short-term effects such as more and larger fish would be seen on a timeframe closer to 10 years as Koenig (2001) found with groupers in the Oculina Experimental Closed Area.

To the extent that wrecks within the proposed Type 2 MPA are protected from fishing there will be positive biological benefits. Work conducted by Quattrini and Ross (2006) indicates that snowy grouper are still present on the "snowy wreck". Both **Alternative 1** and **Alternative 2** encompass the wrecks of concern and both should have the same effect on protecting snowy grouper in the area. **Alternative 1** is situated a little further inshore and may contain more hard bottom habitat, and may protect more mid-shelf species than **Alternative 2**.

Alternative 3 would maintain the status quo and would not protect the fish that are still present on the snowy wreck and other wrecks and natural bottom sites within the proposed Type 2 MPA from directed fishing pressure. By allowing fishing to continue on all individuals in the population it is less likely that the natural size and age structure of the deepwater stocks will be restored.

The depth of the Type 2 MPA proposed in **Alternative 1** and **2** will likely have little impact on Kemp's ridleys, green, and hawksbill turtles because these species are generally found landward of the proposed sites. Loggerhead and leatherback turtles may occur within these proposed areas; therefore, these alternatives may provide localized protection to these species from incidental hook-and-line capture. The overall benefit of any area closure on sea turtles will be influenced by its impacts on fishing effort and fishing effort distribution. Evaluating these potential changes in fishing effort and effort distribution is difficult. Without such an evaluation the overall impacts of these area closures on ESA-listed species cannot be known with certainty.

Alternative 3 would maintain the status quo and perpetuate the existing level of risk for ESA-listed species interactions as summarized in the Affected Environment of Snapper Grouper Amendment 13C (SAFMC 2006a).

Table 4-1 indicates that 28.42% of the area in **Alternative 1** has grid areas with data and 8.41% show presence of hard bottom habitat. Approximately 15.26% of **Alternative 2** has grid areas with data of which 0.31% show presence of hard bottom habitat (Figure 4-3).

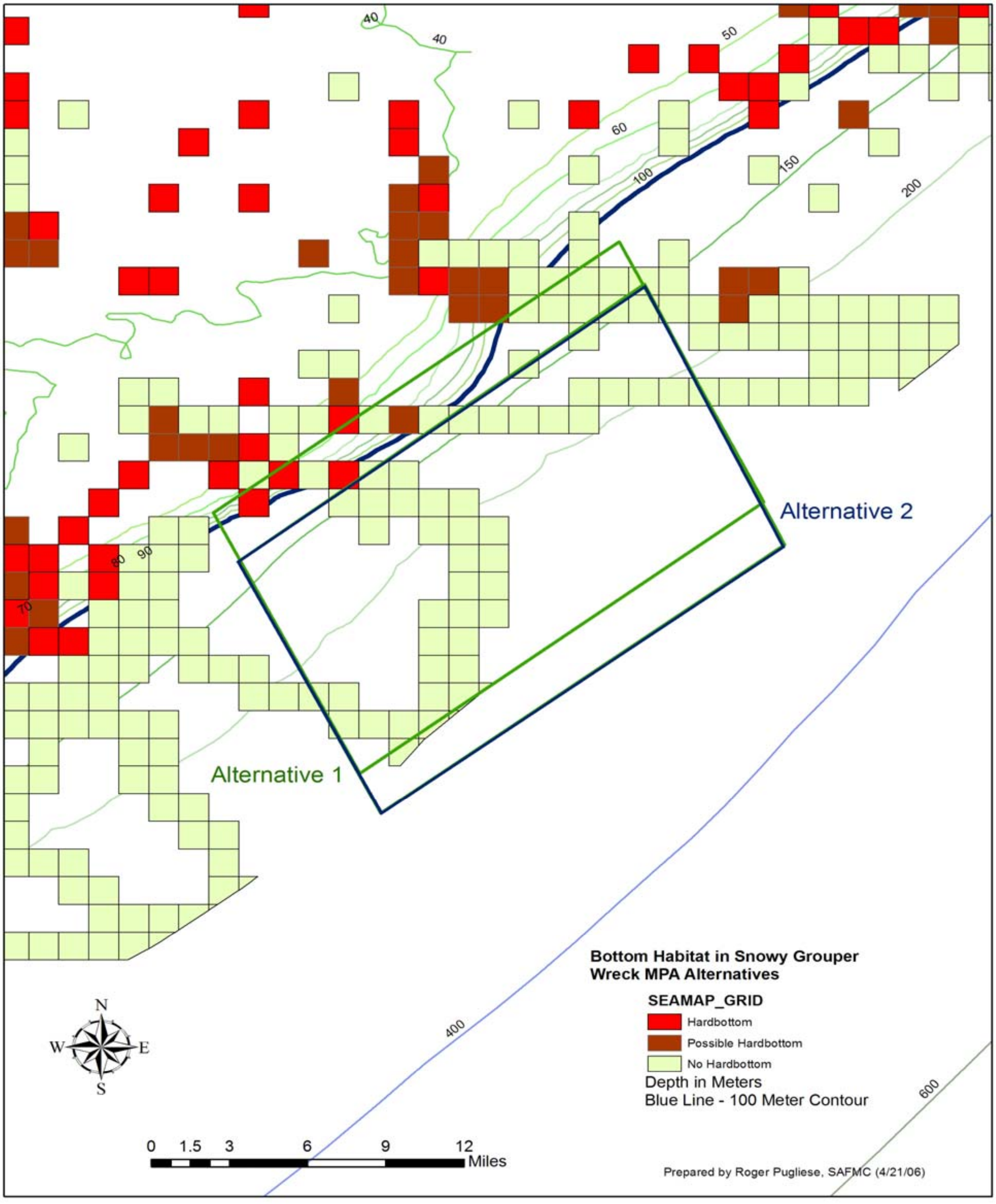


Figure 4-3. Bottom habitat in the Snowy Grouper Wreck Type 2 MPA alternatives. Source: SEAMAP.

Quattrini and Ross (2006) surveyed the snowy wreck and adjacent locations with submersible, remotely operated vehicle, otter trawl, and hook and line gear during 2001 to 2004. The snowy wreck was confirmed to be a 37 meter long steel hulled ship surrounded by sand. The ship was determined to be intact and covered with encrusting invertebrates. The depth of the bottom of the ship was 248 to 253 meters and depth at the top of the wreck was 238 meters. During an ROV dive in August 2004, only seven fish species were observed including 83 snowy grouper. Quattrini and Ross (2006) stated that with the exception of the snowy wreck, hard bottom was "scarce or absent" within the proposed MPA sites at depths greater than 125 meters (Figure 4-3). Figure 4-4 shows presence of snapper grouper species (tomtate-black and red porgy-orange) in Snowy Grouper Wreck Type 2 MPA Alternatives based on MARMAP surveys.

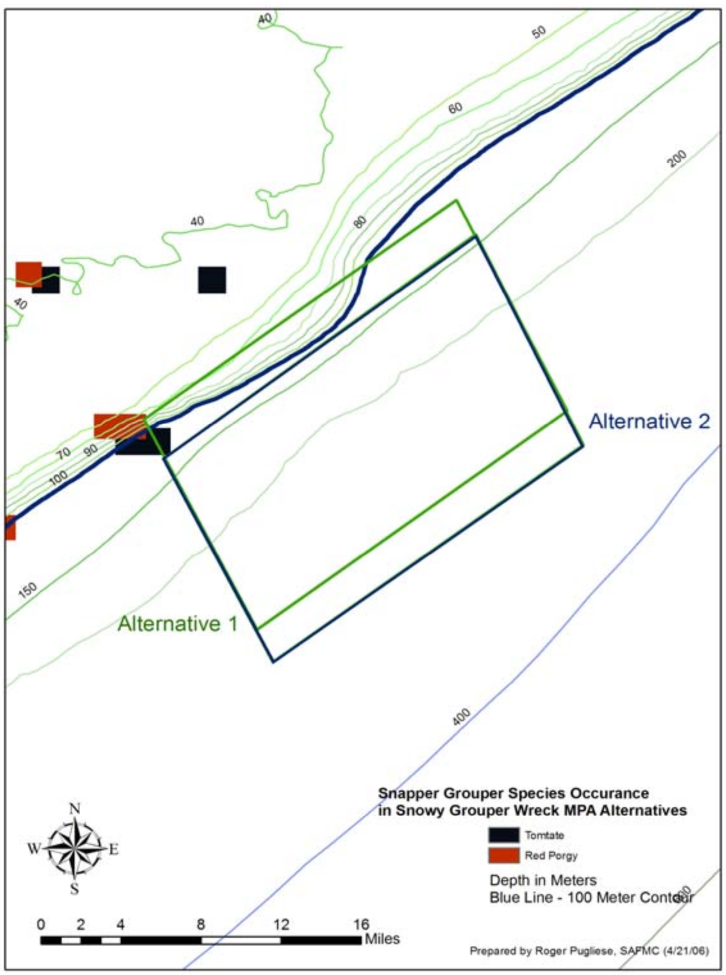


Figure 4-4 Snapper grouper species occurrence in Snowy Grouper Wreck Type 2 MPA alternatives.

In summary, there is reason to believe snowy grouper are found within some or all of the proposed Snowy Wreck Type 2 MPA sites, based on the work of Quattrini and Ross (2006) and public knowledge of the historic importance of this site to the species. Establishment of the Type 2 MPA would be expected to protect these species from fishing pressure within its borders and, over the long-term, may lead to a more natural sex ratio, age, and size structure.

4.2.2 Economic Effects of Management Measure Alternatives

The Snowy Wreck was chosen as a potential Type 2 MPA because it was once the site of a known aggregation of snowy groupers that was believed to be targeted heavily by a few individuals in the late 1990s and fished down. Within the proposed Type 2 MPA, there are a few smaller wrecks that also hold snowy grouper. According to industry, this area holds a lot of snowy grouper, speckled hind, gag, and red porgy. Red grouper, speckled hind, and hog snapper have also been caught at this location. Information from public hearings tells us that this area is mostly fished by commercial snapper grouper fishermen out of Little River, South Carolina and the ports of Carolina Beach and Southport, North Carolina. This area is also heavily fished by fishermen who troll for tuna, marlin, dolphin, and wahoo during certain times of the year.

Alternative 1 or 2 would prohibit fishing for or possession of all species in the snapper grouper complex in the Type 2 MPA, however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed. Both **Alternative 1** and **Alternative 2** encompass the wrecks of concern and should have similar results in protecting snowy grouper in the area. **Alternative 1** is situated a little further inshore than **Alternative 2** and contains hard bottom areas; consequently, **Alternative 1** may protect more mid-shelf and rare deepwater species.

Short-term benefits derived from **Alternative 1** relative to **Alternative 2**, due mainly to the possibility that more species would be protected under **Alternative 1**, may include additional option and existence value. This could potentially result from preservation; a hedge against uncertain stock assessments for more species; and enhanced size, age, and genetic structure of mid-shelf and rare deepwater species residing in the western inshore portion of **Alternative 1**. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors, such as potential spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations. Costs associated with **Alternative 1** relative to **Alternative 2** would be the converse of the benefits listed above regarding any species that would have been protected in the far eastern portion of **Alternative 2** but not in **Alternative 1**. The relative impact of these benefits and costs would depend on the amount of additional mid-shelf and deepwater biomass that is contained in the western portion of **Alternative 1**. However, this impact could be mitigated to the extent that snowy grouper or rare, deepwater species reside exclusively in the eastern portion of **Alternative 2**.

Costs associated with either **Alternative 1 or 2** may include reduction in incomes of displaced fishermen due to harvest reductions attributable to the MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits;

increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species by displaced fishermen.

Short-term net displacement costs incurred by fishermen would likely be higher for **Alternative 1** relative to **Alternative 2** since fishermen who harvest mid-shelf species in the western portion of **Alternative 1** would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the mid-shelf region. This conclusion assumes that there are fewer operations that would be affected in the eastern deepwater portion of **Alternative 2**, especially since vessels would have to travel around the MPA if any snapper grouper species were caught in this area. Displaced vessels, as well as other parts of the fleet, may experience congestion costs as effort relocates to other non-protected areas.

Alternative 3 is the no-action option. Benefits associated with **Alternative 3** relative to **Alternatives 1 and 2** may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species by displaced fishermen. Costs associated with **Alternative 3** relative to **Alternatives 1 and 2** may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind.

The South Atlantic Snapper Grouper Commercial Logbook data was used to estimate landings of snapper grouper species that came from within the MPA alternatives. The Southeast Logbook Program provides catch by statistical grid (1 degree squares) which is at a coarser spatial scale than that of the Type 2 MPA sites proposed in this amendment. To assign a proportion of the catch from a logbook grid it was assumed that all snapper grouper catch came from the 50-300m depth range. We then calculated what percentage of the logbook grid contained that bottom (50-300m) and then how much of that was contained within a Type 2 MPA alternative. While this method can help the Council assess the quantitative impacts of the various alternatives, it is not as comprehensive at the Delphi approach (discussed below) which looks at the socioeconomic impacts from a variety of perspectives (including the recreational and scientific sectors).

In terms of catch of deepwater snapper grouper species, estimated using the proportional method, **Alternative 1** would have a slightly greater impact to the commercial sector in regards to loss of catch than **Alternative 2**. Data from 2000 show that an estimated 8,732 pounds of deepwater snapper grouper species could have come from **Alternative 1** versus 8,587 pounds from **Alternative 2.** The data also show that 232,995 pounds of all snapper grouper species came from **Alternative 1** versus 222,346 pounds from **Alternative 2.**

The Delphi panel concluded the immediate and medium-term socioeconomic impacts of the proposed Snowy Wreck MPA would be minimally negative, but the long-term effects would be minimally greater than neutral for both alternative sites (SEDEP 2007; Appendix E; immediate **Preferred Alternative 1**=-1.18 and **Alternative 2**=-1.04; medium-term Preferred **Alternative 1**=-0.58 and **Alternative 2**=-0.54; long-term Preferred Alternative 1=0.31 and Alternative 2=0.28). The Delphi panel concluded "additional displacement costs would be incurred by the fishing sector in the immediate-term if [Preferred] **Alternative 1** is adopted rather than **Alternative 2**. . . [and] there is no confidence that additional socioeconomic benefits would be realized by adopting [Preferred] **Alternative 1** over **Alternative 2**. . . when compared to the No Action alternative, long-term minimal-to-moderate ecosystem benefits were associated with **Alternative 2**. Furthermore, the immediate-term displacement effects associated with **Alternative 2** were found to be significantly different from a neutral effect and forecasted to be in the moderate range (SEDEP 2007; Appendix D)."

4.2.3 Social Effects of Management Measure Alternatives

Both **Alternative 1 and 2** encompass the wrecks of concern and should provide approximately equivalent protection for snowy grouper. **Alternative 1** is located slightly shoreward of **Alternative 2** and may include more mid-shelf species. Therefore, the short-term social and economic effects of **Alternative 1** would be greater than for **Alternative 2** because it would take away fishing grounds for important mid-shelf species in addition to the deepwater species. Therefore, a greater number of boats and trips likely would be affected by choosing **Alternative 1** than **Alternative 2**, with greater losses in landings and revenues and greater aggregate changes in steaming time and harvesting costs to get to legal fishing grounds. With a greater number of displaced fishing trips, **Alternative 1** also would affect a greater number of trips that are taken to legal fishing grounds by increasing the competition for the existing biomass.

The commercial industry is most likely to feel impacts as a result of the regulations from Amendment 13C. The lower trip limit and reduced quota for snowy grouper could make it unprofitable for boats to travel to the sites of the proposed Type 2 MPA, so the additional impacts due to Amendment 14 could be relatively minor. However, Amendment 13C was implemented in October 2006 and the actual effects have not yet been observed.

After implementation of Amendment 13C in October 2006, a consideration for snowy grouper fishermen in North Carolina, South Carolina, Georgia, and Florida was when the fishing season would open and close. The fishery closed upon implementation of Amendment 13C, because the specified quota had been exceeded. However, during 2007 onwards, a trip limit will be in place, which should keep the fishery open for most of the year. Fishermen from different areas target snowy grouper at different times during the year. The Florida Keys fishery is year round but has peak months in January and

February (Table 4-2), due in large part to the strength of ocean currents. In North Carolina and South Carolina the peak portion of the season is February through April (Table 4-3). With the fishing year beginning on January 1st, and if the Council had not reduced the trip limit, it is possible that those fishing down south before it really starts up north could fill a majority of the quota. For example, from January 1 – March 31 in the years 1999-2003, fishermen in Monroe County caught 32% of their annual catch; whereas, fishermen from the Carolinas caught 26% of their annual quota. To assure all fishers' participation in this fishery, Amendment 13C implemented a trip limit, which would likely keep the fishery open all year. The greater impacts of a reduced trip limit and quota for snowy grouper are due to Amendment 13C and the additional effects due to Amendment 14 could be relatively minor.

Table 4-2. Average monthly catch of snowy grouper (lbs gw) during 1999-2003 for Monroe County.
Source: Logbooks.

Month	Monroe	%	Cum %
January	6,407	10.03%	10.03%
February	8,166	12.79%	22.82%
March	5,679	8.89%	31.71%
April	5,959	9.33%	41.04%
May	4,611	7.22%	48.26%
June	4,622	7.24%	55.50%
July	6,051	9.47%	64.97%
August	4,076	6.38%	71.36%
September	4,097	6.42%	77.77%
October	5,072	7.94%	85.71%
November	4,248	6.65%	92.37%
December	4,875	7.63%	100.00%
Total	63,864		

Table 4-3. Average monthly catch of snowy grouper (lbs gw) for East Florida (including Monroe County) and the Carolinas (SC and NC) during 1999-2003.

Month	FL	FL %	FL Cumulative %	Carolinas	Carolina %	Carolinas Cumulative %
January	8,578	7.00%	7.00%	9,199	4.79%	4.79%
February	11,647	9.51%	16.51%	18,239	9.50%	14.29%
March	10,970	8.96%	25.47%	21,629	11.26%	25.55%
April	12,990	10.61%	36.08%	20,276	10.56%	36.11%
May	11,351	9.27%	45.35%	27,424	14.28%	50.39%
June	13,242	10.81%	56.16%	26,126	13.60%	63.99%
July	11,078	9.05%	65.21%	20,222	10.53%	74.52%
August	10,919	8.92%	74.12%	14,393	7.49%	82.01%
September	8,656	7.07%	81.19%	12,569	6.54%	88.56%
October	9,060	7.40%	88.59%	9,477	4.93%	93.49%
November	6,404	5.23%	93.82%	7,727	4.02%	97.52%
December	7,570	6.18%	100.00%	4,772	2.48%	100.00%
Total	122,465			192,053		

There are few private recreational anglers that travel as far as the Snowy Wreck to target these species, hence there is likely to be little impact on the majority of the private recreational fishermen regardless of the option. There are charter boats and headboats that fish the area and it is likely that area closures associated with implementation of proposed Type 2 MPAs may produce a change in the number of trips made to target these species. **Alternative 2** may have a greater impact because of the mid-shelf species lost since its western boundary is closer to shore. The charter and headboat industry may also be impacted because they would have to target these bottom species in other areas, potentially increasing fishing pressure on other sites. It may also have a negative effect because these longer trips are usually built into the annual round of these boats, designated for specialized fishermen. These fishermen often travel great distances on land in order to fish on these boats. They spend money in the local community and often pay a higher fare for the boat trip, based on its specialization. A potential long-term benefit is that there may be spillover from the existence of a healthy Type 2 MPA, making border fishing much more lucrative and productive and potentially making it more likely that the longer and more expensive trips can be filled by the charter and headboats.

The reduction in the amount of fish being caught as a result of the Type 2 MPAs, or as a result of the Type 2 MPAs coupled with Amendment 13C, is likely to have a negative impact on fish houses and dealers that rely on these species as a part of their annual round. Even fish houses in Morehead City were worried about the lack of supply that would be available from other fish houses throughout the region. It is common for fish houses to buy from other fish houses in order to meet the demand of their clientele. For this reason a Morehead City, North Carolina fish dealer might be negatively impacted by a loss experienced in supply from fish dealers in southern North Carolina or northern South Carolina.

With pressure for increased coastal development and a continued rise in property value for coastal communities, revenue reductions associated with Amendments 13C and 14 may lead some to sell or convert their docks and marinas. This would make it more difficult for the commercial fishermen to exist, due to a lack of available infrastructure. The loss of infrastructure means that there are numerous directly and indirectly associated businesses that can be negatively impacted. This means that as fish houses close, the workers would be let go. If a marina is sold, it might have a serious impact on the sale of fishing supplies such as fuel, bait, and tackle. Also consider what the loss of this area would do in terms of a reduction in the number of trips. The reason is that a reduction in number of trips means that crew would not be paid as much regardless if they are paid on a trip by trip basis or a share program. This could mean a loss of adequate crew or a reduction in total wages for the crew.

Alternative 3 (no action) would not have these impacts.

The Delphi panel predicted the "Community and Social Effects" of the proposed Type 2 MPAs, in addition to other types of effects. The panelists concluded the immediate and medium-term impacts of the community and social effects of both proposed Snowy Wreck MPA sites would be in the more than minimally to less than minimally negative range, but the long-term community impacts of both alternatives would be close to neutral (SEDEP 2007, Appendix D); immediate weighted impact of **Alternative 1**=-1.51 and **Alternative 2**=-1.40; medium-term weighted impact of **Alternative 1**=-0.76 and **Alternative 2**=-0.81; long-term weighted impact of **Alternative 1**=0.01 and **Alternative 2**=-0.04).

4.2.4 Administrative Effects of Management Measure Alternatives

Alternatives 1 and 2 would have impacts on enforcement as establishment of a Type 2 MPA would require more law enforcement resources than are currently being dedicated to the snapper grouper fishery. SAFMC's Law Enforcement Advisory Panel (LEAP) presented the Council with a report titled the Enforceability of Proposed MPAs. For the report the member States evaluated their assets and categorized their ability to effectively patrol each MPA as either **HIGH**, **MODERATE**, or **LOW**. This rating is based solely on the individual states assets and does not include the assets that their Federal partners may or may not have. This report categorized the Snowy Wreck MPA (including both Alternatives 1 and 2) as "**LOW**". A "**LOW**" rating means that patrols of the area would only occur during an organized enforcement detail with Federal partners such as NMFS or USCG. The State does not have the assets or personnel with the proper training to patrol the area. Additional funding will be ***essential*** to increase the ability rating. In addition, some burden would be experienced by requiring NMFS to provide notice to the public about changes in regulations.

Alternative 3 would not carry these enforcement and administrative costs.

4.2.5 Conclusion

The Council chose **Alternative 1** as their preferred alternative because it contains more of the hardbottom habitat that is suitable for the deepwater snapper grouper species. While Alternative 1 is more likely to have greater short-term economic impacts on fishermen, the Council expects greater long-term biological benefits by choosing this alternative.

The proposed action is consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed action will protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. This action should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPA, while minimizing adverse social and economic effects.

4.3 Northern South Carolina (South Carolina A MPA) MPA

Alternative 1. Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 33°8.5'N, 77°54'W; the northeast corner at 33°8.5'N, 77°42'W; the southwest corner at 33°3.5'N, 77°54'W; and the southeast corner at 33°3.5'N, 77°42'W (Figure 4-5).

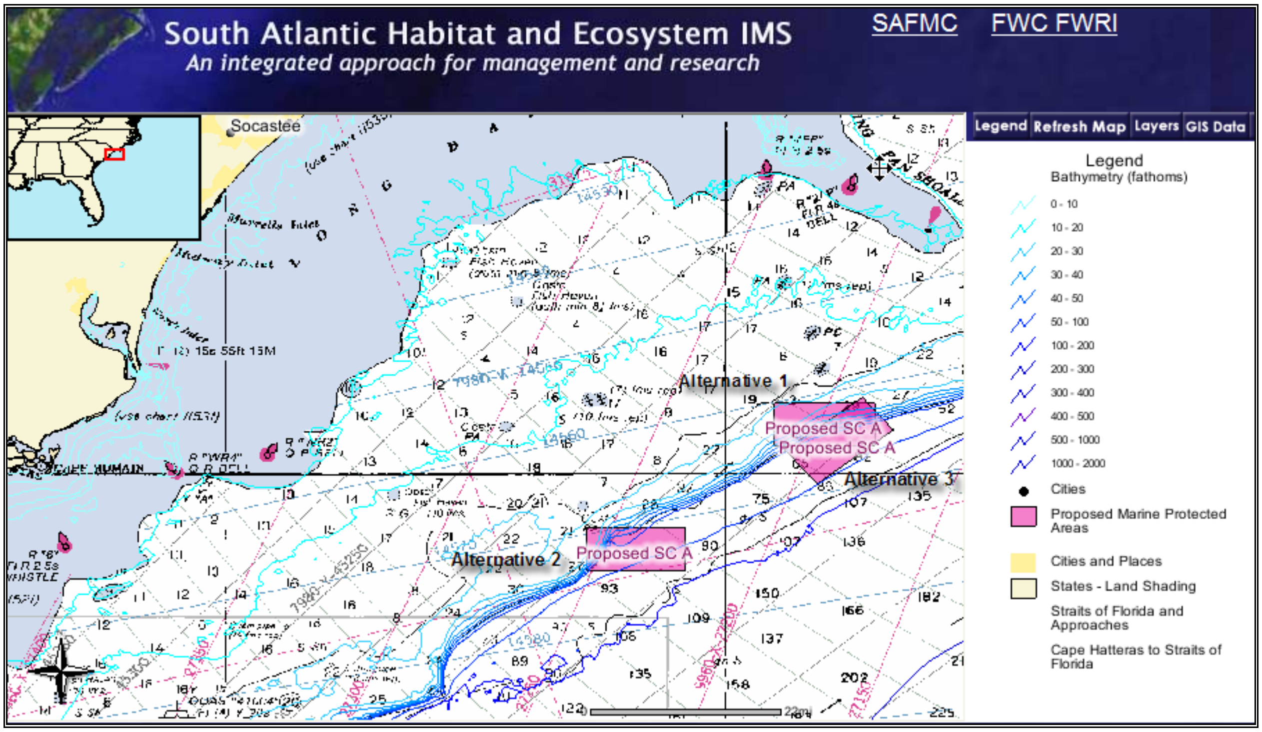
Alternative 2. **Preferred Alternative** - Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 32°53.5'N, 78°16.75'W; the northeast corner at 32°53.5'N, 78°4.75'W; the southwest corner at 32°48.5'N, 78°16.75'W; and the southeast corner at 32°48.5'N, 78°4.75'W (Figure 4-5).

Alternative 3. Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 33°2.75'N, 77°52.75'W; the northeast corner at 33°9.25'N, 77°43.5'W; the southwest corner at 32°58.83'N, 77°48.83'W; and the southeast corner at 33°5.3'N, 77°39.9'W (Figure 4-5).

Alternative 4. No action. Do not establish a Type 2 MPA off northern South Carolina.

Alternative 1 for the proposed Northern South Carolina Type 2 MPA is located approximately 61 nautical miles from Murrells Inlet, South Carolina, **Alternative 2** is located approximately 54 nautical miles from Murrells Inlet, and **Alternative 3** is located approximately 65 nautical miles from Murrells Inlet. All three alternatives are 10 by 5 nautical miles in size. These are areas of low relief that were previously heavily trawled by roller rigs before they were prohibited in 1989 through Snapper Grouper Amendment 1 (SAFMC 1988). Fishermen refer to the area as “smurfville” because it holds many small vermilion snapper. Information received during the public input process indicates that this area is fished mostly in the winter and that it holds deepwater species like snowy grouper and speckled hind as well as other snapper grouper species such as red porgy, triggerfish, and gag.

South Carolina Type 2 MPA **Alternative 1 and 2** run east to west, while **Alternative 3** runs parallel to shore. **Alternative 1 and 3** share an area ranging in depth from 70 to 140 meters (230 to 460 feet). **Alternative 1** also includes more shallow water ranging from 40 to 80 meters (131 to 262 feet) deep , while **Alternative 3** includes a greater area of deepwater (100-150 meters (328-492 feet)). Waters in **Alternative 2** are from 50 to 180 meters (164 to 591 feet) deep. The depth profiles of **Alternatives 1 and 2** are similar, but Alternative 2 is located farther offshore and includes deeper water than **Alternative 1** (Figure 4-5).



Approximate Corner Points:

Alternative 1. (Approx. 61nm from Murrells Inlet)

NW 33 Degrees 8.5 Minutes N. 77 Degrees 54 Minutes W.	NE 33 Degrees 8.5 Minutes N. 77 Degrees 42 Minutes W.
SW 33 Degrees 3.5 Minutes N. 77 Degrees 54 Minutes W.	SE 33 Degrees 3.5 Minutes N. 77 Degrees 42 Minutes W.

Alternative 2. (Approx. 54nm from Murrells Inlet)

NW 32 Degrees 53.5 Minutes N. 78 Degrees 16.75 Minutes W.	NE 32 Degrees 53.5 Minutes N. 78 Degrees 4.75 Minutes W.
SW 32 Degrees 48.5 Minutes N. 78 Degrees 16.75 Minutes W.	SE 32 Degrees 48.5 Minutes N. 78 Degrees 4.75 Minutes W.

Alternative 3. (Approx. 65nm from Murrells Inlet)

NW 33 Degrees 2.75 Minutes N. 77 Degrees 52.75Minutes W.	NE 33 Degrees 9.25 Minutes N. 77 Degrees 43.5 Minutes W.
SW 32 Degrees 58.83 Minutes N. 77 Degrees 48.83 Minutes W.	SE 33 Degrees 5.3 Minutes N. 77 Degrees 39.9 Minutes W.

Prepared by Roger Pugliese, SAFMC
(10/30/06)

Figure 4-5. Proposed Northern South Carolina Type 2 MPA (South Carolina A MPA) alternatives.

4.3.1 Biological Effects of Management Measure Alternatives

SEAMAP data (SEAMAP 2001) indicate the presence of hard bottom within all three Type 2 MPA options (Figure 4-6). Proposed **Alternatives 1 and 2** have the highest occurrence of known hard bottom (Figure 4-6). Most of the known hard bottom habitat is shelf edge in depths of approximately 50 meters. Approximately 30.31% of **Alternative 1** has grid areas with data of which 80.59% show presence of hard bottom habitat (Table 4-1). About 34.65% of **Alternative 3** has grids with data, of which 36.33% show presence of hard bottom habitat (Table 4-1). **Alternative 2** has a greater percentage of grid areas with data (40%) and 48% show the presence of hard bottom habitat (Table 4-1).

Submersible work conducted in **Alternative 2** indicates that the shelf edge habitat consist of low-relief bioeroded rock (Schobernd 2006).

The MARMAP fishery independent sampling program has collected data in and near the proposed Northern South Carolina Type 2 MPA alternatives (Figure 4-7, Table 4-4). These data show that snowy grouper occur in all alternatives while speckled hind and yellowedge grouper have only been caught in **Alternative 2**. In all alternative sites, snowy grouper are probably dominated by juveniles since adult snowy grouper are most often taken in depths of 200 meters and greater. The greatest densities of snowy grouper have been taken in **Alternative 2**. Speckled hind in spawning condition have been taken in **Alternative 2** (Sedberry *et al.* In Press). MARMAP has not collected any other deepwater species in spawning condition within the three alternatives. **Alternatives 1 and 3** are north and inshore of the known areas where golden tilefish occur. Furthermore, MARMAP has little knowledge of good habitat in **Alternatives 1 or 3**. More hard bottom has been identified by MARMAP within **Alternative 2** than **Alternatives 1 or 3**. Most of this habitat is located in the western part of **Alternative 2**. However the southeast portion of **Alternative 2** is close to known locations where snowy grouper, golden tilefish, and blueline tilefish have been caught, including individuals in spawning condition (Figure 4-8).

MARMAP data (Figure 4-6, Table 4-5) indicate that many mid-shelf snapper grouper species are also found within all three alternatives for this Type 2 MPA. However, more reef fish species have been caught in **Alternative 2** than **Alternatives 1 or 3**. Furthermore, reef fish species in spawning condition (Figure 4-8) have been collected in **Alternative 2** (Sedberry *et al.* In Press). Reproductive behavior of gray triggerfish has been observed during submersible dives in **Alternative 2** (Schobernd 2006). Reef fish in spawning condition have not been collected in **Alternative 1 or 3**.

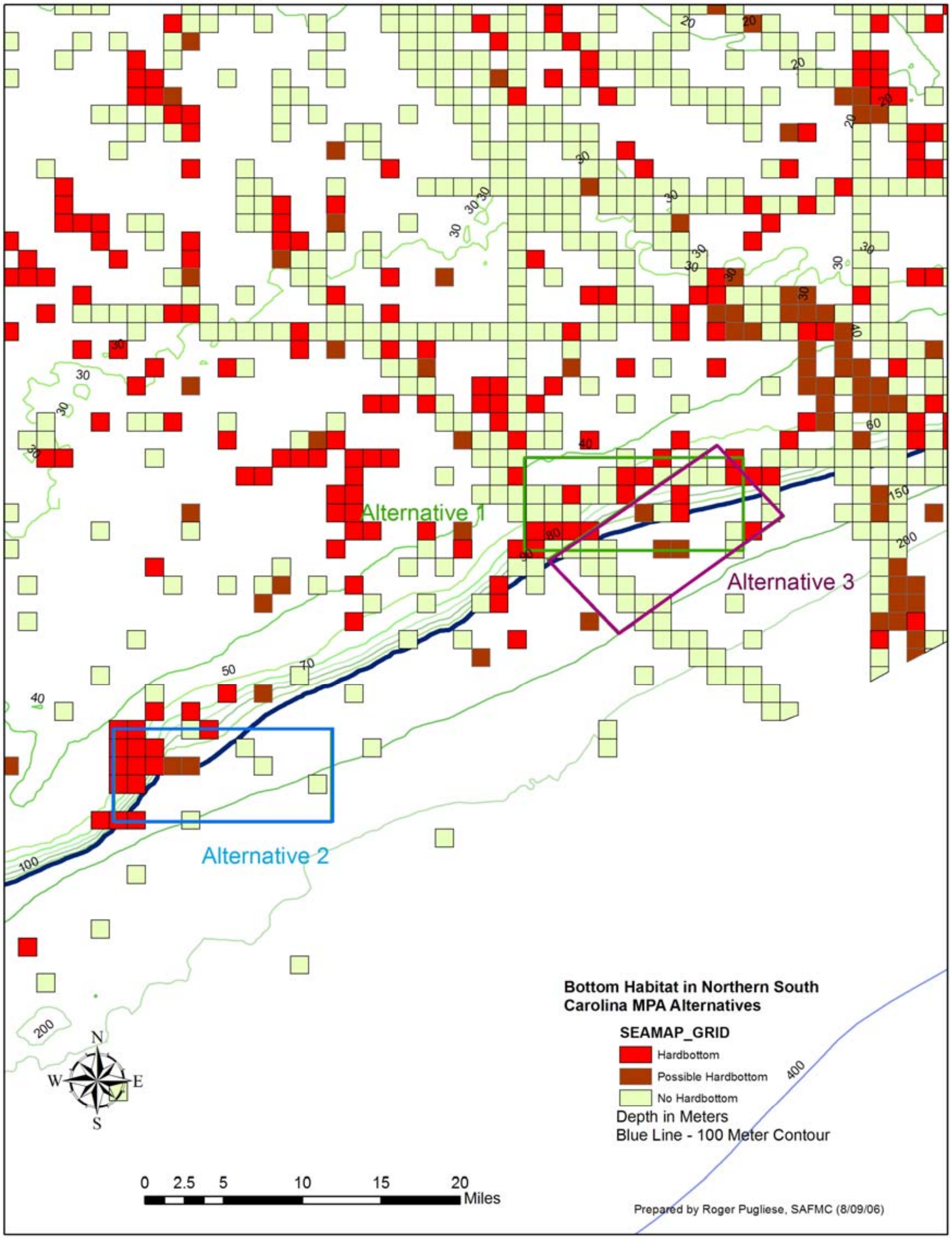


Figure 4-6. Bottom habitat in the Northern South Carolina Type 2 MPA alternatives. Source: SEAMAP.

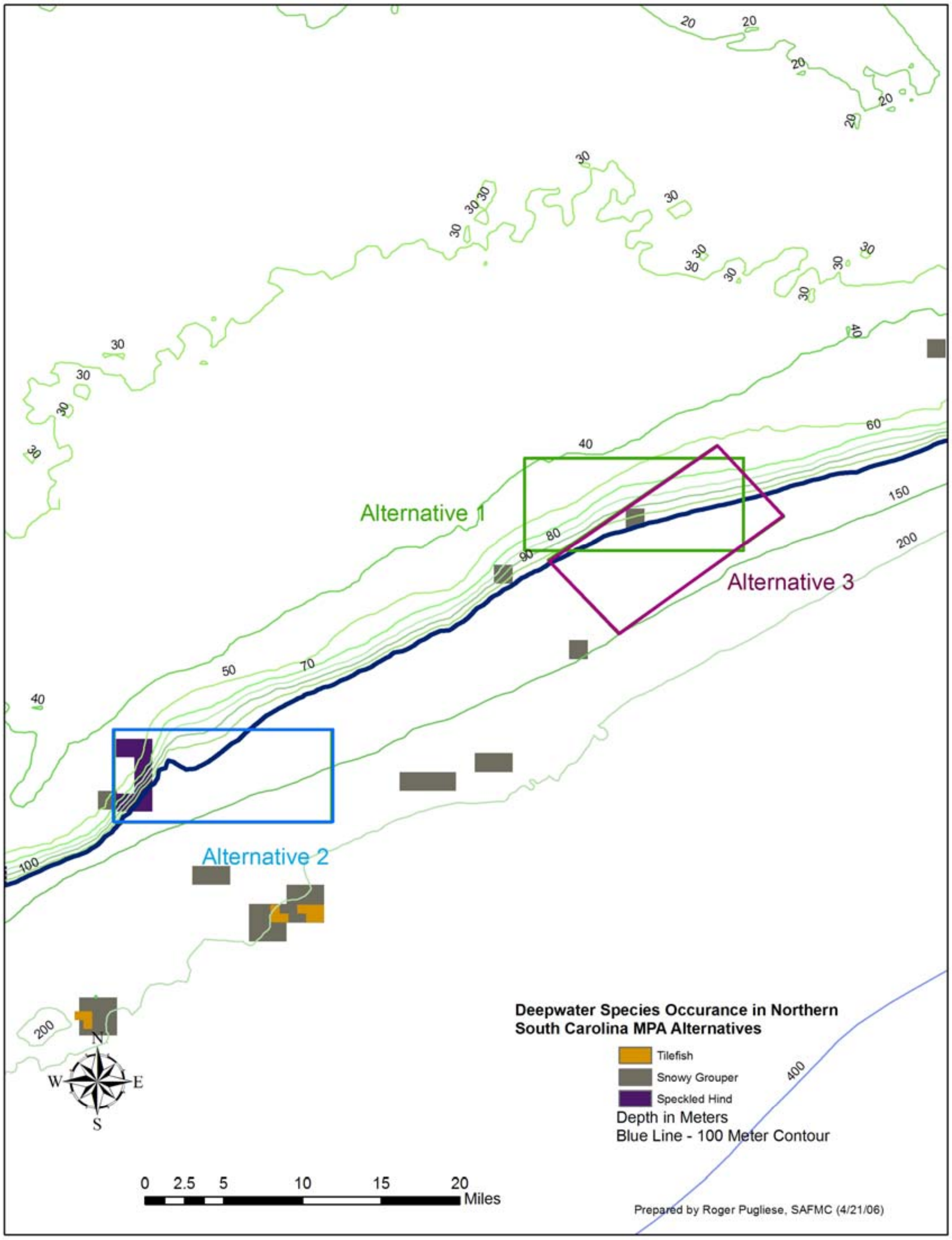


Figure 4-7. Deepwater snapper grouper species occurrence in Northern South Carolina Type 2 MPA alternatives.
Source: MARMAP in http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

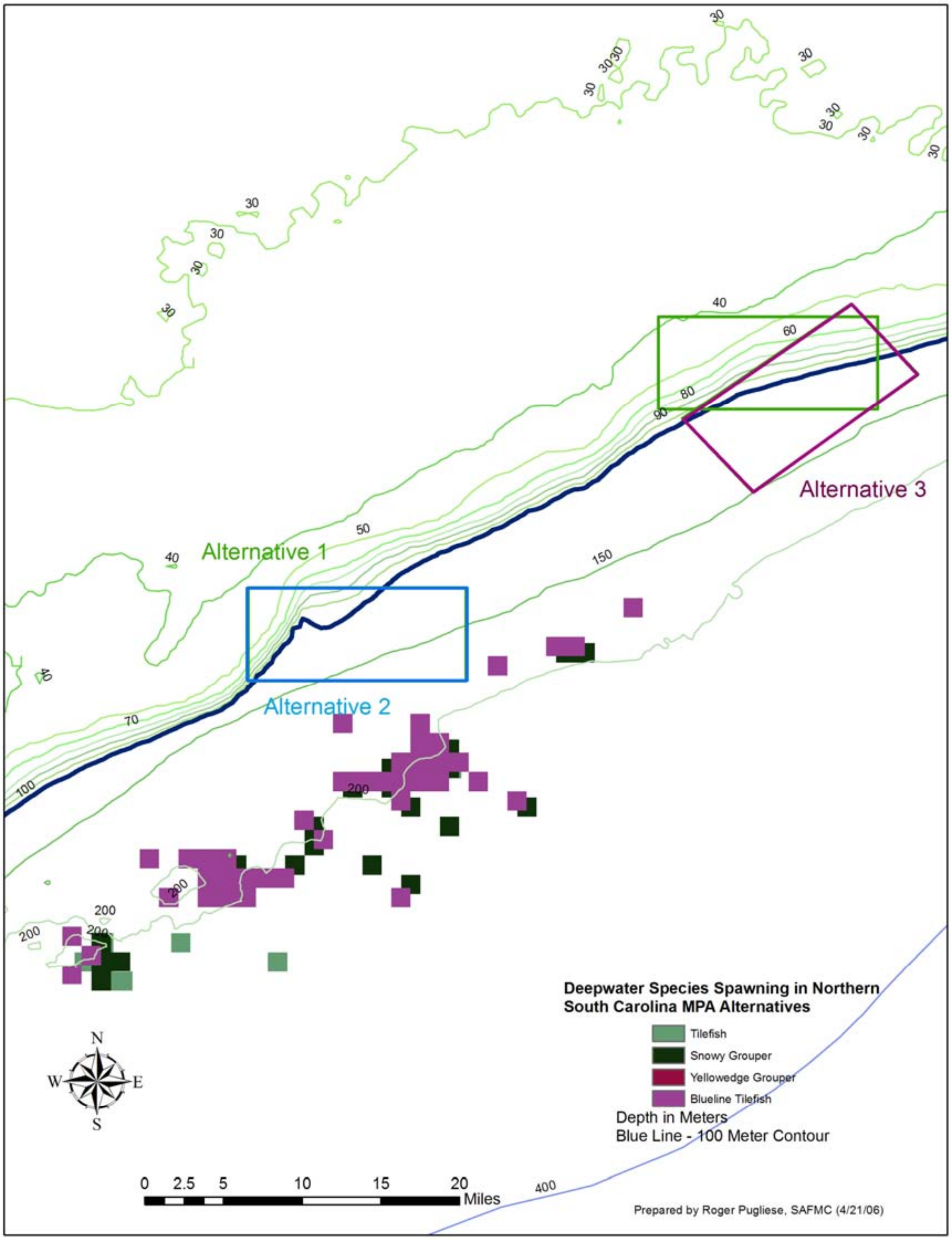


Figure 4-8. Deepwater species spawning in Northern South Carolina Type 2 MPA alternatives. Source: MARMAP as presented in http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

Table 4-4. Occurrence of deepwater snapper grouper species in the Northern South Carolina (South Carolina A) Type 2 MPA alternatives.

Species	Alternative 1	Alternative 2	Alternative 3
Snowy grouper	X	X	X
Golden tilefish			
Speckled hind		X*	
Yellowedge grouper		X	
Blueline tilefish			

* Asterisks indicate species were also found in spawning condition (MARMAP).

Table 4-5. Occurrence of other snapper grouper species within the Northern South Carolina A Type 2 MPA alternatives.

Species	Alternative 1	Alternative 2	Alternative 3
Black Sea Bass			
Gag		X*	
Gray triggerfish	X	X*	X
Greater amberjack			
Knobbed porgy	X	X*	X
Lesser amberjack			
Red porgy	X	X	X
Red grouper		X	
Red Snapper		X	
Rock Hind		X	
Scamp		X*	
Tomtate			
Vermilion snapper	X	X*	X
Whitebone porgy			
White grunt	X	X*	X

* Asterisks indicate species were also found in spawning condition (MARMAP).

Because the targeted species live a long time and grow slowly, it is likely that the desired changes in sex ratio, size, and age structure resulting from establishment of the Type 2 MPAs will not be apparent in the short-term. For example, Roberts *et al*. (2001) found the lag time between establishment of a marine reserve and occurrence of record-size specimens of spotted sea trout, red drum, and black drum corresponded closely to the species longevity, with record-size specimens of longer-lived species taking longer to occur. It follows that, since the mean age at sexual maturity of golden tilefish is 24 years (SEDAR 4 2004), the generations of golden tilefish which are protected from fishing by the Type 2 MPAs will not reproduce until many years after the Type 2 MPAs are implemented. Desired demographic changes may not be detectable at the population level for many years, and would therefore be considered long-term effects of the Type 2 MPAs. However, it is possible that some short-term effects such as more and larger fish would be seen on a timeframe closer to 10 years as Koenig (2001) found with groupers in the Oculina Experimental Closed Area.

Juvenile snowy grouper have been caught in **Alternatives 1-3** and speckled hind have been found in **Alternative 2**. **Alternative 3** is orientated parallel to the coast and shelf break which could be beneficial to the fishing industry as it encompasses more deepwater habitat than **Alternatives 2 and 3**. Furthermore, some members of the commercial fishing industry stated that they fish in a pattern parallel to the coast and the shelf break. A Type 2 MPA with this orientation would allow fishermen to more easily maneuver around the closed area. However, **Alternative 3** may have less hard bottom habitat than **Alternatives 1 and 2** for deepwater and other reef fish species and therefore provide less benefit to deepwater species and fishermen who harvest these species. Protecting a portion of the shelf edge habitat could provide long-term benefits to deepwater species and fishermen since shelf edge habitat serves as a nursery for species such as snowy grouper, speckled hind, and Warsaw grouper.

Alternatives 1 and 2 are oriented perpendicular to the coast and encompass deepwater and mid-shelf habitat. As such, they both also have been found to hold many mid-shelf species such as red porgy, vermilion snapper, and gray triggerfish. However, many spawning mid-shelf species have been found in **Alternative 2. Alternative 2** is also closer to known spawning areas for snowy grouper, golden tilefish, and blueline tilefish than **Alternatives 1 and 3**. While these Type 2 MPAs are designed by the Council to protect deepwater snapper grouper species, they co-occur with mid-shelf species. Since some mid-shelf species are overfished (e.g., red porgy) or experiencing overfishing (e.g., vermilion snapper) protection of mid-shelf species can be considered an indirect benefit of this Type 2 MPA.

Alternative 4 (no action) would limit the extent to which management can improve the status of these deepwater fish populations. Traditional fishery management measures will not be as effective as Type 2 MPAs in enhancing the age and size structure of deepwater species.

Deepwater species such as snowy grouper will move through the Type 2 MPA with development. There would mostly be juvenile snowy grouper in the proposed Type 2 MPAs. We would not see a size and age structure that resembles a virgin stock in the proposed Type 2 MPAs even after they were established and fishing for them was prohibited.

Alternatives 1, **2**, and **3** will likely have little impact on Kemp's ridleys, green, and hawksbill turtles because these species are generally found landward of the proposed sites. Loggerhead and leatherback turtles may occur within these proposed areas. Therefore, these alternatives may provide localized protection to these species from incidental hook-and-line capture. The overall benefit of any area closure on sea turtles will be influenced by its impacts on fishing effort and fishing effort distribution. Evaluating these potential changes in fishing effort and effort distribution is difficult. Without such an evaluation the overall impacts of these area closures on ESA-listed species cannot be known with certainty.

Alternative 4 would maintain the status quo and perpetuate the existing level of risk for ESA-listed species interactions as summarized in the Affected Environment of Snapper Grouper Amendment 13C (SAFMC 2006a).

In summary, there is reason to believe snowy grouper, speckled hind, and yellowedge grouper are found within some or all of the proposed Northern South Carolina Type 2 MPA alternative sites, based on findings of the MARMAP survey, and the SEAMAP survey documented favorable habitat conditions. Establishment of this Type 2 MPA would be expected to protect these species from fishing pressure within its borders and, over the long-term, promote a more natural sex ratio, age, and size structure.

4.3.2 Economic Effects of Management Measure Alternatives

Alternatives 1 and 3 for the proposed Northern South Carolina MPA are both located a little over 60 nautical miles from Murrells Inlet, South Carolina, and **Alternative 2** is located approximately 54 nautical miles from Murrells Inlet. All three alternatives are 10 by 5 nautical miles in size. SEAMAP data indicate the presence of hard bottom within all three MPA options with proposed **Alternatives 1 and 2** having the highest occurrence of known hard bottom. These data show that snowy grouper can be found in all the alternatives while speckled hind have only been found in **Alternative 2**. MARMAP data indicates many mid-shelf snapper grouper species such as gray triggerfish, red porgy, knobbed porgy, and vermilion snapper are also found within all three alternatives for this Type 2 MPA. Many mid-shelf species including vermilion snapper have been found in spawning condition in these areas.

Alternative 1, 2, or 3 would prohibit fishing for or possession of snapper grouper species in the MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Snowy grouper are found within the boundaries of all three alternatives; thus, consumptive benefits, such as stock effects, increased harvest levels, and reduced harvest variation, would have a positive impact on the predicted value of any of the alternative Type 2 MPAs. Additionally, non-consumptive benefits would positively affect this value if increases in environmental quality, option values, or existence values are realized. The extent to which these positive effects would be realized depends on the composition of the stock within the different Type 2 MPA alternatives. As noted above, a number of other snapper grouper species are found in these areas; thus, long-run stock benefits may be increased as other species are protected. Benefits associated with the protection of spawning vermilion snapper may be especially valuable in the long run; however, it is not clear which alternative contains a relative plurality of these young fish.

Costs associated with **Alternatives 1, 2, or 3** may include reduction in incomes of displaced fishermen due to harvest reductions attributable to the MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species by displaced fishermen.

Since these sites are mostly fished in the winter, a seasonal dimension is introduced to the displacement effects. The extent that displaced fishermen can replace lost income or mitigate extra search and congestion costs will depend on alternative fishing opportunities during the winter season or increasing effort during other times of the year.

Alternative 4 is the no-action option. Benefits associated with **Alternative 4** relative to the other alternatives may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species by displaced fishermen. Costs associated with **Alternative 4** relative to the other alternatives may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind.

The South Atlantic Snapper Grouper Commercial Logbook data was used to estimate landings of snapper grouper species that came from within the MPA alternatives. The Southeast Logbook Program provides catch by statistical grid (1 degree squares) which is at a coarser spatial scale than that of the Type 2 MPA sites proposed in this amendment. To assign a proportion of the catch from a logbook grid it was assumed that all snapper grouper catch came from the 50-300m depth range. We then calculated what percentage of the logbook grid contained that bottom (50-300m) and then how much of that was contained within a Type 2 MPA alternative. While this method can help the Council assess the quantitative impacts of the various alternatives, it is not as comprehensive at the Delphi approach which looks at the socioeconomic impacts from a variety of perspectives (including the recreational and scientific sectors).

In terms of catch of deepwater snapper grouper species , estimated using the proportional method, **Preferred Alternative 2** would have the greatest impact to the commercial sector in regards to loss of deepwater catch than **Alternative 1** or **Alternative 3**. Data from 2000 show that an estimated 20,288 pounds of deepwater snapper grouper species came from **Alternative 2** versus 2,825 from **Alternative 1** and 3,190 pounds for **Alternative 3**. In terms of all snapper grouper species caught, 90,287 pounds were estimated to have come from **Alternative 3**, 79,956 pounds from **Alternative 1,** and 69,578 pounds from **Preferred Alternative 2**.

The Delphi panel concluded the immediate and medium-term impacts of the socioeconomic effects of the proposed Northern South Carolina Type 2 MPA sites would be negative, but the long-term impacts of all three alternative sites would be positive (SEDEP 2007 (Appendix E); immediate weighted impact of **Alternative 1**=-0.94, Preferred **Alternative 2**=-0.95, and **Alternative 3**=-1.07; medium-term weighted impact of **Alternative 1**=-0.24, **Preferred Alternative 2**=-0.27, and **Alternative 3**=-0.40; long-term weighted impact of **Alternative 1**=0.70, **Preferred Alternative 2**=0.74, and **Alternative 3**=0.21). Overall, **Alternative 3** would produce significantly less socioeconomic benefits than the other alternatives, but there would be no significant difference between the socioeconomic impacts of **Alternatives 1 and 2**. In summary, the panel concluded "…both alternatives [1 and 2] are forecasted to produce moderate ecosystem benefits in the long-run while inflicting minimal to moderate immediate-term displacement effects on fishermen and their communities (SEDEP 2007)."

4.3.3 Social Effects of Management Measure Alternatives

All three options will negatively impact commercial fishermen due to the loss of productive fishing grounds. **Alternative 2** is closer to fishermen from the Charleston, Murrels Inlet, Myrtle Beach, and Georgetown area which means increased steam time and displacement onto other fishing grounds and greater costs and increased likelihood of crowding and overfishing other areas targeted by fishermen. Depending on the effects associated with Amendment 13C, impacts are likely to vary greatly, especially if the quotas are at a level that does not make it cost efficient to fish that far away.

When Amendment 13C was implemented, a consideration for snowy grouper fishermen in South Carolina is when the season starts. The Florida Keys fishery is a year round fishery but has peak months in between December and February. This is due in large part to the currents. In North Carolina and South Carolina the peak portion of the season is February through April. Given that the fishing year begins in January it is possible that a majority of the quota could be fished down south before it really starts up north. This would lead to a great deal of displacement and force fishermen to focus their attention on other activities/fisheries. This means that there may be an increased cost to switch over gear, locate new places, and target species already being heavily fished, but these impacts would be due to Amendment 13C and the additional effects of Amendment 14 would be relatively minor.

There are private recreational anglers that travel to these areas to target these species, hence there is likely to be some impact on this segment of the fishery regardless of the option. However, these Type 2 MPAs will not be as detrimental to the private fishermen as they will be for the for-hire sector. There are charter boats and headboats that fish in the proposed areas, and it is likely that the proposed Type 2 MPA may produce a change in the number of trips made to target these species, thus equating to a loss of revenue for the owner, captain, and crew. **Alternative 2** may have a greater impact than **Alternatives 1 or 3** because of the mid-shelf species lost because of the closure. The charter and headboat industry may also be impacted because they now must target these bottom species in other areas, potentially creating overfishing on other sites. Deepwater bottom fishing is often sold as a specialized trip. The loss would equate to an important loss in revenue for boat, captain, and crew. A potential benefit is that there may be spillover from the existence of a healthy fish population within the MPA, making border fishing much more lucrative and productive.

The reduction in the amount of fish being caught as a result of the Type 2 MPAs, or as a result of the Type 2 MPAs coupled with Amendment 13C, is likely to have a negative impact on those fish houses and dealers that rely on these species as a part of their annual round. Even fish houses and dealers throughout the Carolinas can be impacted because of their relationship to each other and potential lack of supply from their own fishermen and from those that land and sell with other dealers. It is common for fish houses to buy from other fish houses in order to meet the demand of their clientele. A loss of supply for one area may affect the productivity of the fish houses and dealers in another area.

With increased pressure for coastal development and an increase in property value for coastal communities, revenue reductions due to Amendment 13C and 14 may lead some to sell or convert their docks and marinas. This would make it more difficult for the commercial fishermen to exist because of a loss of places to dock, offload, and sell their fish. The loss of infrastructure means that there are numerous other directly and indirectly associated businesses that would be negatively impacted. This means that as fish houses close, the workers would be let go. If a marina is sold, it might have a serious impact on the sale of fishing supplies, such as fuel, bait, and tackle. This Type 2 MPA may reduce the number of trips which would mean that crew would not be paid as much regardless of whether they are paid on a trip by trip basis or a share basis. This could mean a loss of adequate crew or a reduction in total wages for the crew.

Alternative 4 (no action) would not have these impacts.

The Delphi panel predicted the "Community and Social Effects" of the proposed MPAs, in addition to other types of effects. The panelists concluded the immediate and medium-term impacts of the community and social effects of the proposed Northern South Carolina Type 2 MPA sites would be negative (immediate/medium-term: **Alternative 1**=-1.23/-0.66, **Alternative 2**=-1.25,/-0.69 and **Alternative 3**=-1.46/-0.82). In the long-term, the social and community impacts of **Alternative 3** would be negative (-0.43), but those of **Alternatives 1 and 2** would be more positive than if the Type 2 MPA were not created (0.15 and 0.22, respectively).

4.3.4 Administrative Effects of Management Measure Alternatives

Alternatives 1, 2, and 3 would have impacts on enforcement as establishment of a Type 2 MPA would require more law enforcement resources than are currently being dedicated to the snapper grouper fishery. SAFMC's Law Enforcement Advisory Panel (LEAP) presented the Council with a report titled the Enforceability of Proposed MPAs. For the report the member States evaluated their assets and categorized their ability to effectively patrol each MPA as either **HIGH**, **MODERATE**, or **LOW**. This rating is based solely on the individual states assets and does not include the assets that their Federal partners may or may not have. This report categorized the Northern South Carolina MPA as "**LOW**". A "**LOW**" rating means that patrols of the area would only occur during an organized enforcement detail with Federal partners such as NMFS or USCG. The State does not have the assets or personnel with the proper training to patrol the area. Additional funding will be ***essential*** to increase the ability rating. The report did specify that **Alternative 3** would be the preferable location alternative but did not elaborate on reasons.

In addition, some burden would be experienced by requiring NMFS to provide notice to the public about changes in regulations.

Alternative 4 would not carry these enforcement and administrative costs.

4.3.5 Conclusion

The Council chose **Alternative 2** as their preferred alternative because it is the alternative with the most hardbottom suitable for deepwater snapper grouper species. More of the species of concern such as snowy grouper, speckled hind, and yellowedge grouper have been found in this alternative than other alternatives. The social impacts of choosing **Alternative 2** are expected to be greater than if the other alternatives were chosen because it is the area closest to shore. However, the Council hopes to mitigate some of those impacts by allowing transit of vessels with snapper grouper species on board provided gear is stowed. According to the Delphi Panel this **Alternative 2** is "forecasted to produce moderate ecosystem benefits in the long-run while inflicting minimal to moderate immediate-term displacement effects on fishermen and their communities".

The proposed action is consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed action will protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. This action should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPA, while minimizing adverse social and economic effects.

4.4 Edisto MPA

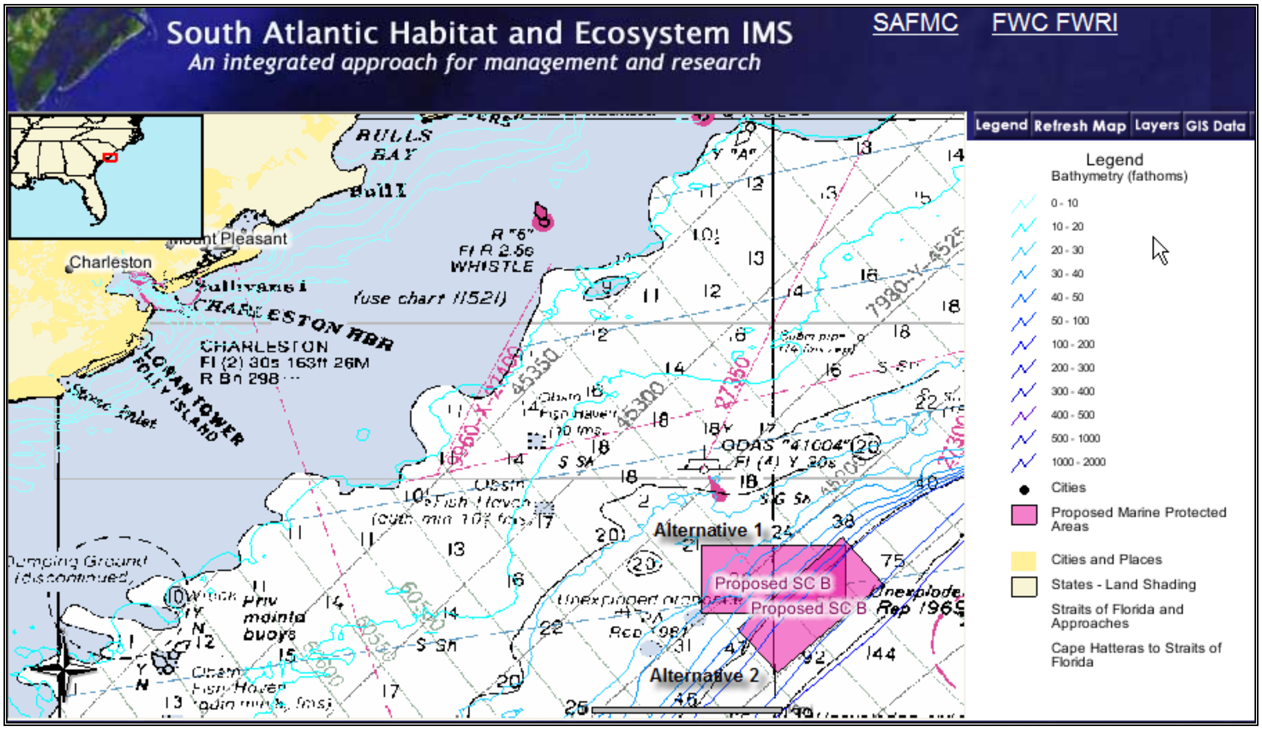
Alternative 1. Preferred Alternative - Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 32°24'N, 79°6'W; the northeast corner at 32°24'N, 78°54'W; the southwest corner at 32°18.5'N, 79°6'W; and the southeast corner at 32°18.5'N, 78°54'W (Figure 4-9).

Alternative 2. Establish a Type 2 MPA in the area bounded by the following coordinates: The northwest corner at 32°17'N, 79°3'W; the northeast corner at 32°24.75'N, 78°54.2'W; the southwest corner at 32°13.5'N, 78°59.5'W; and the southeast corner at 32°21'N, 78°50.83'W (Figure 4-9).

Alternative 3. No action. Do not establish a Type 2 MPA off central South Carolina.

Alternative 1 for the proposed Edisto Type 2 MPA is oriented perpendicular to the coast and is located approximately 45 nautical miles southeast of the Charleston, South Carolina harbor. **Alternative 2** is oriented along the shelf break and is located approximately 50 nautical miles southeast of Charleston, South Carolina harbor. Both alternatives are 10 by 5 nautical miles in size.

Both proposed Edisto Type 2 MPA sites include an area ranging in depth from 80 meters (262 feet) to 140 meters (459 feet). **Alternative 1**, which is perpendicular to the shoreline, includes more shallow water ranging from 45 to 80 meters (148 to 262 feet) deep. **Alternative 2**, which runs parallel to the shoreline, includes additional water 60-150 meters (197-492 feet) deep (Figure 4-9).



Approximate Corner Points:

Alternative 1. (Approx. 45nm SE of Charleston Harbor)

NW 32 Degrees 24 Minutes N. 79 Degrees 6 Minutes W.	NE 32 Degrees 24 Minutes N. 78 Degrees 54 Minutes W.
SW 32 Degrees 18.5 Minutes N. 79 Degrees 6 Minutes W.	SE 32 Degrees 18.5 Minutes N. 78 Degrees 54 Minutes W.

Alternative 2. (Approx. 50nm SE of Charleston Harbor)

NW 32 Degrees 17 Minutes N. 79 Degrees 3 Minutes W.	NE 32 Degrees 24.75 Minutes N. 78 Degrees 54.2 Minutes W.
SW 32 Degrees 13.5 Minutes N. 78 Degrees 59.5 Minutes W.	SE 32 Degrees 21 Minutes N. 78 Degrees 50.83 Minutes W.

Prepared by Roger Pugliese, SAFMC (1/03/05)

Figure 4-9. Proposed Edisto Type 2 MPA.

4.4.1 Biological Effects of Management Measure Alternatives

Alternative 1 is heavily fished by commercial, headboat, and private recreational fishermen according to public testimony. The western half encompasses an area that holds many more mid-shelf species than deepwater snapper grouper species. The eastern half of **Alternative 1** includes habitat for red porgy and juvenile snowy grouper. Submersible work conducted in **Alternative 1** indicates that the shelf edge habitat consists of moderate to high-relief, bioeroded rock (Schobernd 2006).

SEAMAP data (SEAMAP 2001) indicates the presence of hard bottom within both alternatives of the proposed Edisto MPA (Figure 4-10). **Alternative 1** shows 11.31% of the grid areas have data of which 42.64% show the presence of hard bottom habitat (Table 4-1). About 4.69% of **Alternative 2** has grid areas with data and 16.90% of those areas show presence of hard bottom habitat. (Table 4-1).

The MARMAP fishery independent sampling program has collected data in and near the proposed Edisto MPA alternatives (Figures 4-11, 4-12, and 4-13; Table 4-6). These data show that snowy grouper and speckled hind have been collected within the boundaries of both **Alternatives 1 and 2**. MARMAP has collected blueline tilefish in spawning condition within **Alternative 1** (Figure 4-12). Furthermore, **Alternatives 1 and 2** hold juvenile snowy grouper, which would move into deeper water with ontogeny.

Figure 4-13 and Table 4-6 show the occurrence of other snapper grouper species in and near the proposed Edisto MPA. Many mid-shelf species, such as vermilion snapper, red porgy, gag, scamp, and black sea bass have been collected in **Alternative 1** (Table 4-7). Sedberry *et al.* (2005) documented that at least 13 reef fish species spawn within **Alternative 1**. Fewer mid-shelf species have been collected in **Alternative 2**.

A recent Cooperative Research Project documented the presence of snowy grouper within **Alternatives 1 and 2**. Most of the snowy grouper were taken in the area of overlap between the two alternatives (Figure 4-14).

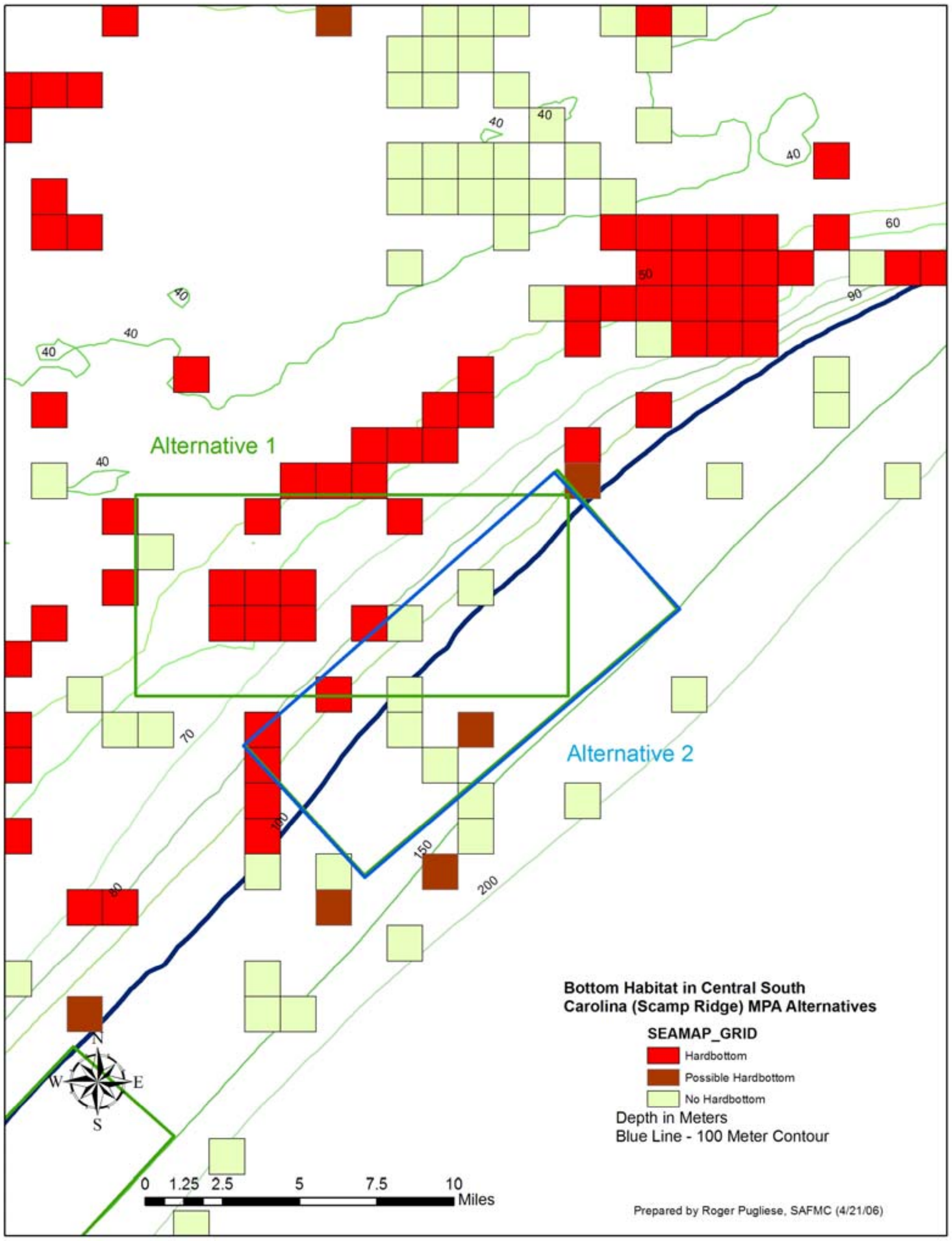


Figure 4-10. Bottom habitat in the Edisto Type 2 MPA alternatives.
Source: SEAMAP.

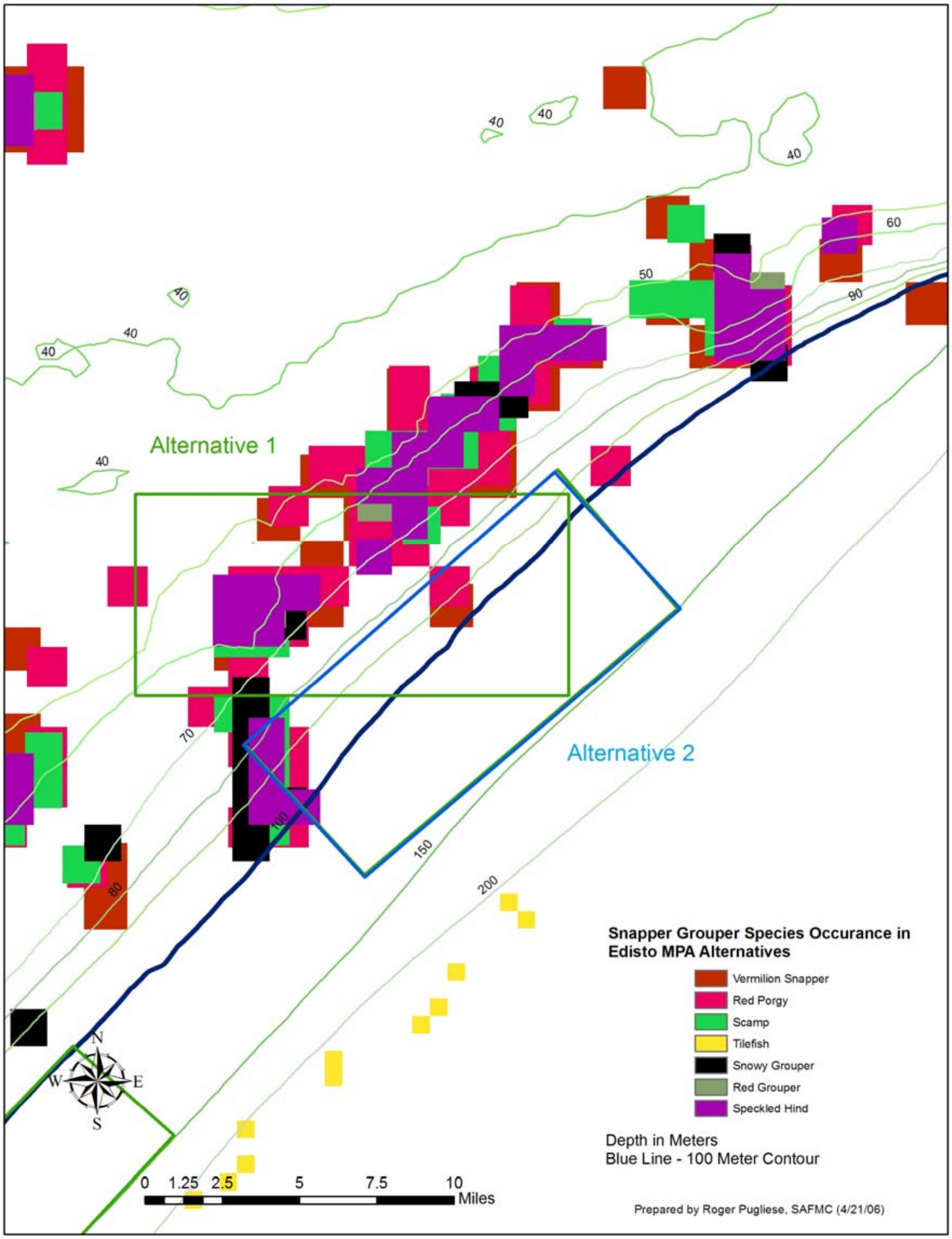


Figure 4-11. Occurrence of deepwater snapper grouper species in and near the proposed Edisto Type 2 MPA.
Source: MARMAP via http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

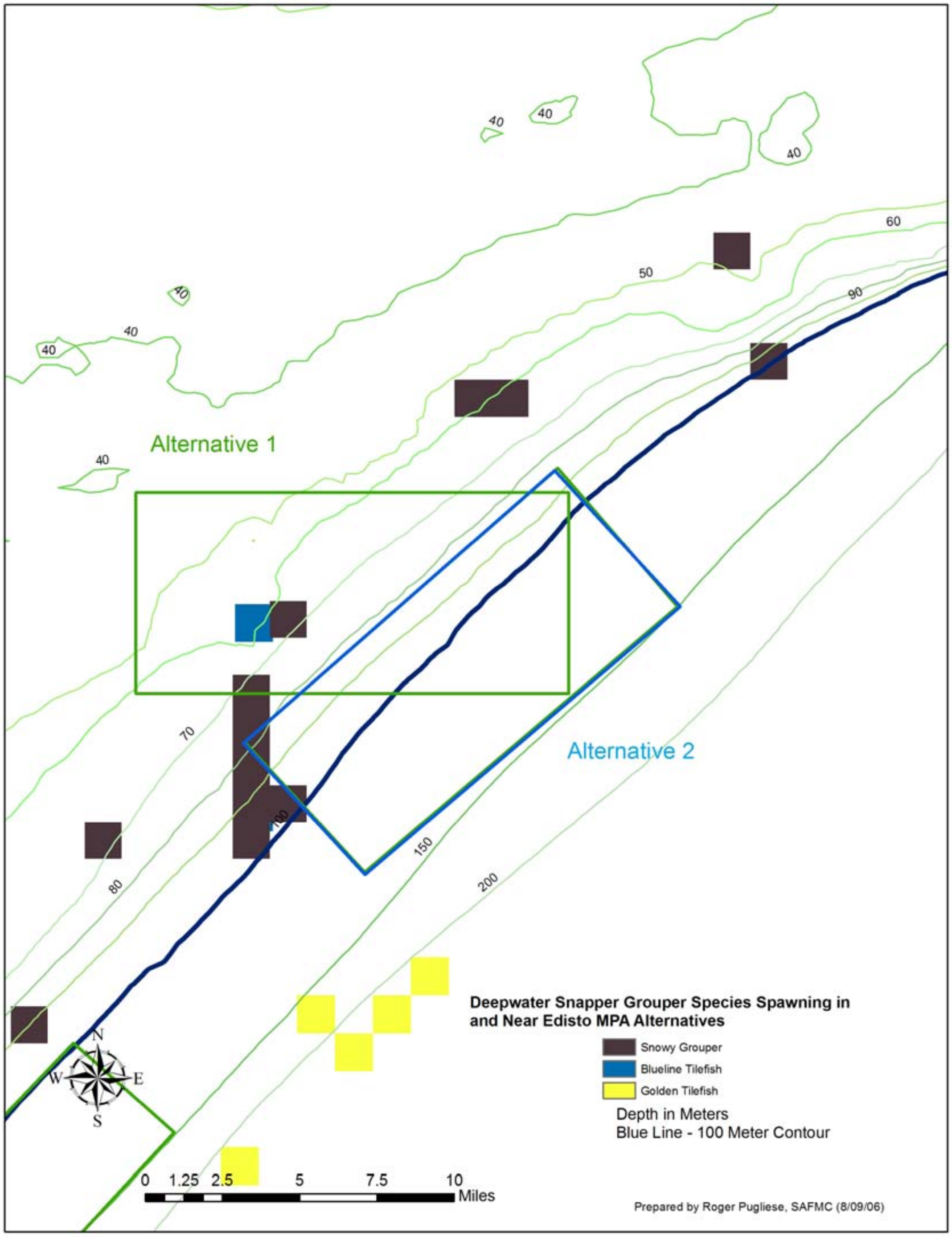


Figure 4-12. Occurrence of spawning deepwater snapper grouper species in and near the proposed Edisto Type 2 MPA.
Source: MARMAP via http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

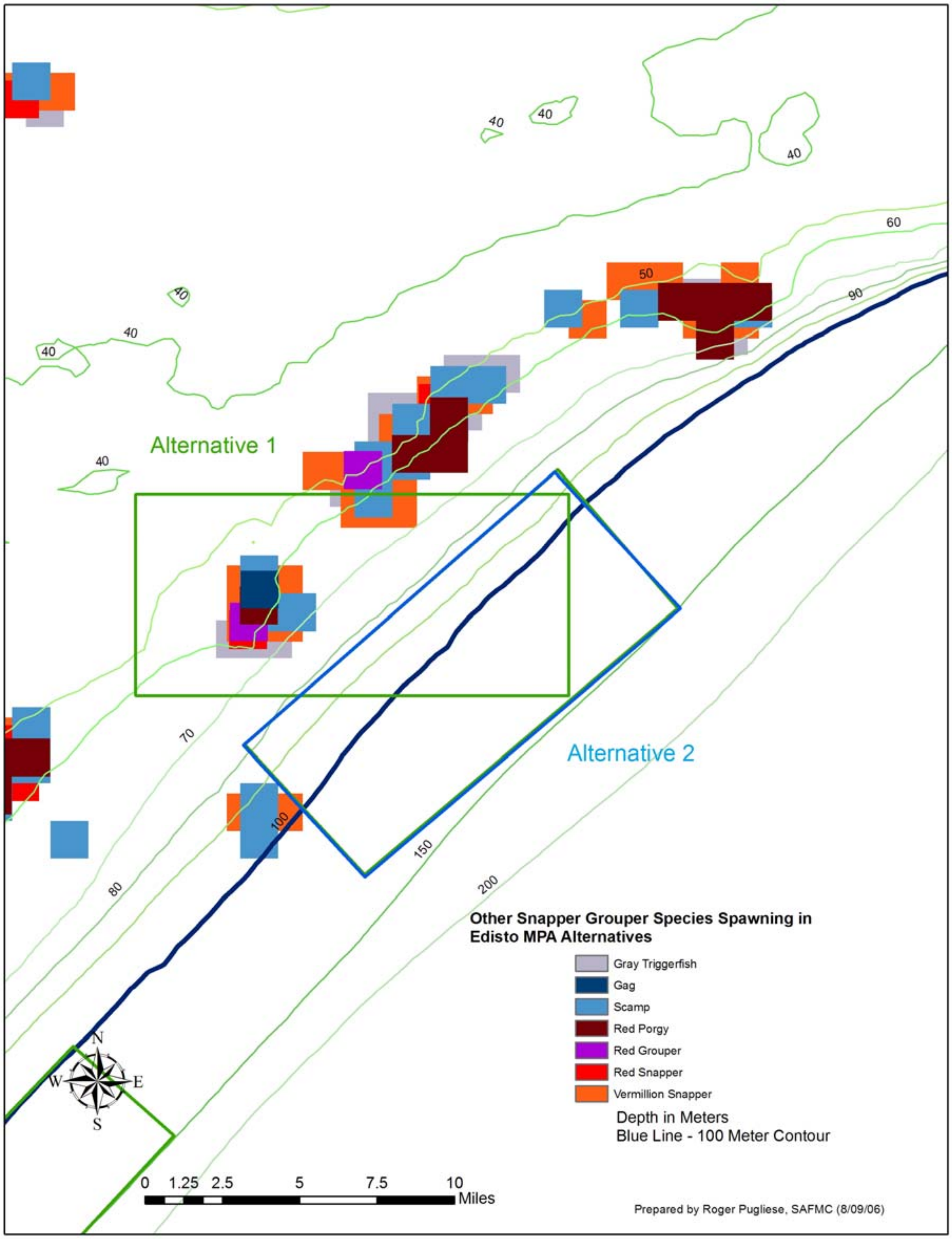


Figure 4-13. Occurrence of other snapper grouper species spawning in and near the proposed Edisto Type 2 MPA.
Source: MARMAP via http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

Table 4-6. Occurrence of deepwater snapper grouper species in the Edisto Type 2 MPA alternatives.

Species	Alternative 1	Alternative 2
Snowy grouper	X	X
Golden tilefish		
Speckled hind	X	X
Yellowedge grouper		
Blueline tilefish	X*	

* Asterisks indicate species were also found in spawning condition (MARMAP).

Table 4-7. Occurrence of other snapper grouper species in the Edisto Type 2 MPA alternatives.

Species	Alternative 1	Alternative 2
Black sea bass	X	
Gag	X*	
Gray triggerfish	X*	X
Greater amberjack	X*	
Knobbed porgy	X*	X
Lesser amberjack		
Red porgy	X*	X
Red grouper	X*	
Red snapper	X*	
Rock hind	X*	
Scamp	X*	X
Tomtate	X	
Vermilion snapper	X*	X
Whitebone porgy	X	X
White grunt	X	

* Asterisks indicate species were also found in spawning condition (MARMAP).

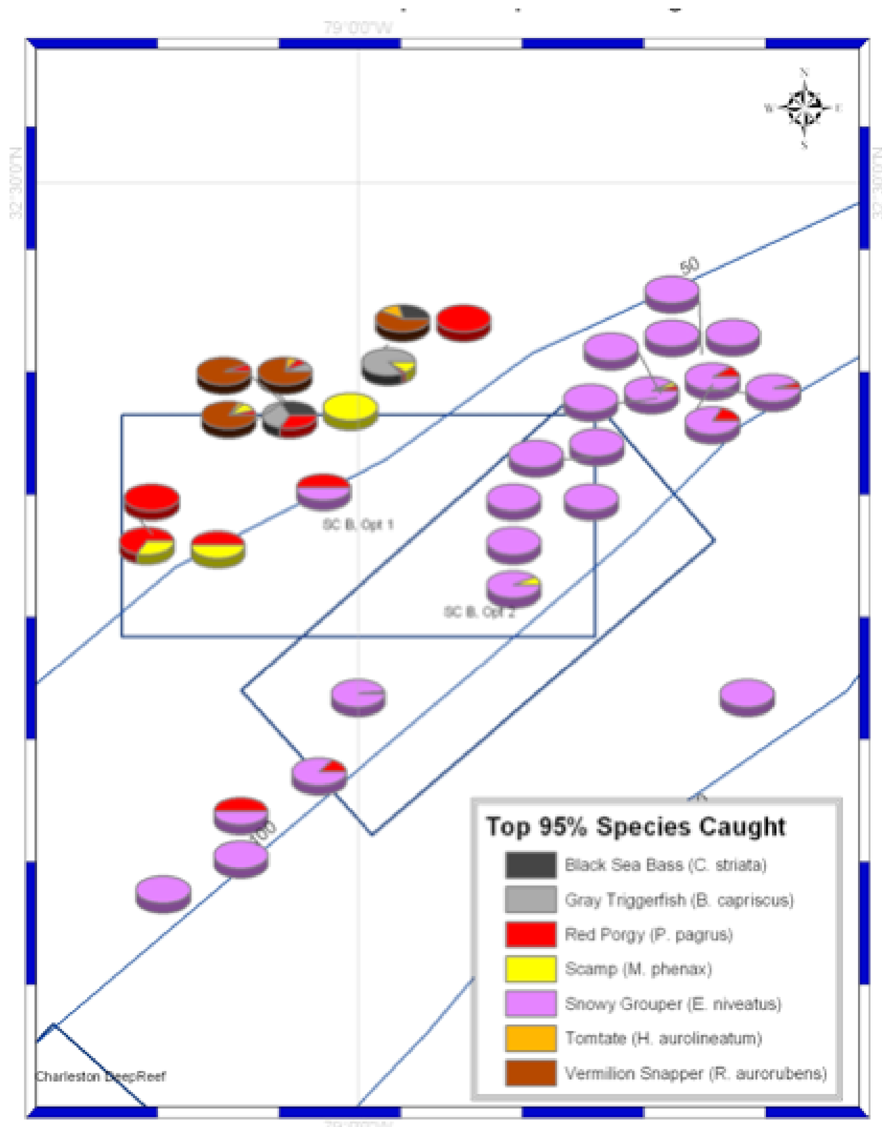


Figure 4-14. Occurrence of species caught in Alternatives 1 and 2 by a commercial fisherman during 2004.
Source: Harris and Stephen (2005).

Because the targeted species live a long time and grow slowly, it is likely that the desired changes in sex ratio, size, and age structure resulting from establishment of the Type 2 MPAs will not be apparent in the short-term. For example, Roberts *et al*. (2001) found the lag time between establishment of a marine reserve and occurrence of record-size specimens of spotted sea trout, red drum, and black drum corresponded closely to the species longevity, with record-size specimens of longer-lived species taking longer to occur. It follows that, since the mean age at sexual maturity of golden tilefish is 24 years (SEDAR 4 2004), the generations of golden tilefish which are protected from fishing by the Type 2 MPAs will not reproduce until many years after the MPAs are implemented. Desired demographic changes may not be detectable at the population level for many years, and would therefore be considered long-term effects of the Type 2 MPAs. However, it is possible that some short-term effects such as more and larger fish would be seen on a timeframe closer to 10 years as Koenig (2001) found with groupers in the Oculina Experimental Closed Area.

Both alternative sites are known to hold snowy grouper and speckled hind. Blueline tilefish in spawning condition have been found in **Alternative 1**. **Alternative 2** is oriented parallel to the coast and shelf break and could be beneficial to the fishing industry as it encompasses more deepwater habitat than **Alternative 1**. However, there also could be long-term benefits to protecting a portion of the shelf edge habitat since it serves as a nursery for deepwater species such as snowy grouper, speckled hind, and Warsaw grouper. Some members of the commercial fishing industry stated that they fish in a pattern parallel to the coast and the break. A Type 2 MPA with this orientation may allow fishermen to more easily maneuver around the closed area; however, **Alternative 2** may have less hard bottom habitat than **Alternative 1** and could be less beneficial to deepwater species.

Alternative 1 is oriented perpendicular to the coast and encompasses deepwater and mid-shelf habitat. It holds many mid-shelf species such as red porgy, vermilion snapper, and gray triggerfish. Many spawning, mid-shelf species have been found in **Alternative 1.** While these Type 2 MPAs are designed by the Council to protect deepwater snapper grouper species, mid-shelf and deepwater species co-occur during various phases of their life history. Since many mid-shelf species are overfished or experiencing overfishing, protection of these species can be considered an indirect benefit of this Type 2 MPA. Furthermore, since **Alternative 1** encompasses a broader depth range than **Alternative 2**, it could provide a greater benefit to various developmental stages of deepwater species.

The large number of species found in **Alternative 1** may be related to circulation patterns in the South Atlantic. **Alternatives 1 and 2** reside in an area of upwelling that results from deflection of the Gulf Stream at the Charleston Bump and establishment of the Charleston Gyre (Sedberry *et al.* 2005). Upwelling results in nutrient rich water and high primary productivity that is beneficial to early life stages of fishes. Furthermore, the Charleston Gyre may serve to retain spawning products within the vicinity of these Type 2 MPAs as well as transport some species such as gag and snowy grouper towards nursery areas. Therefore, **Alternative 1** and, to some degree, **Alternative 2** may serve as "source" of spawning products for surrounding regions as well as a "sink" and nursery area where early life stages are retained in the MPAs.

Deepwater species such as snowy grouper will move through the Type 2 MPA with development. There would mostly be juvenile snowy grouper in the proposed Type 2 MPAs. We would not see a size and age structure that resembles a virgin stock in the proposed Type 2 MPAs even after they were established and fishing for them was prohibited.

Alternative 3 (no action) will limit the extent to which management can improve the status of these deepwater fish populations. Traditional fishery management measures will not be as effective as Type 2 MPAs in enhancing the age and size structure of deepwater species.

Alternative 2 is in deeper waters than Kemp's ridley, green, and hawksbill turtles are believed to forage (20 to 50 meters) and would likely have little impact on these species. Loggerhead and leatherback turtles may occur within this proposed area. Therefore, this alternative may provide localized protection to these species from incidental hook-and-line capture. **Alternative 1** may provide more benefit to all ESA-listed sea turtles because it encompasses shallower depths, which are within the diving and foraging range of all listed sea turtles. The overall benefit of any area closure on sea turtles will be influenced by its impacts on fishing effort and fishing effort distribution. Evaluating these potential changes in fishing effort and effort distribution is difficult. Without such an evaluation the overall impacts of these area closures on ESA-listed species cannot be known with certainty.

Alternative 3 would maintain the status quo and perpetuate the existing level of risk for ESA-listed species interactions as summarized in the Affected Environment of Snapper Grouper Amendment 13C (SAFMC 2006a).

In summary, there is reason to believe snowy grouper, speckled hind, and blueline tilefish are found within some or all of the proposed Edisto Type 2 MPA sites, based on findings of the MARMAP survey, and the SEAMAP survey documented favorable habitat conditions. Establishment of this MPA would be expected to protect these species from fishing pressure within its borders and, over the long-term, promote a more natural sex ratio, age, and size structure.

4.4.2 Economic Effects of Management Measure Alternatives

Both **Alternative 1** and **Alternative 2** are areas 10 by 5 nautical miles in size. **Alternative 1** is oriented perpendicular to the coastline, 45 nautical miles southeast of Charleston, South Carolina. **Alternative 2** is orientated parallel to the coast and break, which is beneficial to industry because it encompasses preferable deepwater habitat without taking in as much mid-shelf habitat. Industry representatives also stated that they fish in a pattern that is parallel to the coast and the break and the orientation of **Alternative 2** would allow them to more easily maneuver around the closed area.

Both **Alternative 1** and **Alternative 2** are known to hold snowy grouper and speckled hind with more being observed in **Alternative 1**; additional mid-shelf species such as vermilion snapper, red porgy, and black sea bass are also found in greater quantities in **Alternative 1** relative to **Alternative 2**. Both alternatives contain hard bottom habitat, which is the preferred habitat type for the deepwater species targeted by this amendment; however, the majority of hard bottom has been found within **Alternative 1**. Additionally, blueline tilefish in spawning condition have been found in **Alternative 1**. **Alternative 2** is orientated parallel with the coast and break which is beneficial to industry as it encompasses preferable deepwater habitat without taking in as much mid-shelf habitat.

Short-term benefits derived from **Alternative 1** relative to **Alternative 2**, due mainly to the possibility that a greater amount of hard bottom habitat is covered and more species would be protected under **Alternative 1**, may include additional option and existence value through preservation, a hedge against uncertain stock assessments for more species, protection of blueline tilefish spawning areas, and enhanced diversity of deepwater and mid-shelf species. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors, such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations. Costs associated with **Alternative 1** relative to **Alternative 2** would be the converse of the benefits listed above regarding any species that would have been protected in **Alternative 2**, but not in **Alternative 1**.

Either **Alternative 1 or 2** would prohibit fishing for or possession of snapper grouper species in the Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Costs associated with either **Alternative 1** or **Alternative 2** may include a reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species displaced fishermen.

Short-term net displacement costs incurred by fishermen would likely be higher for **Alternative 1** relative to **Alternative 2** since fishermen who harvest mid-shelf species in **Alternative 1** would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the mid-shelf species, which is unknown. This conclusion assumes that there are fewer operations that would be affected in **Alternative 2** if any snapper grouper species were caught in this area. Costs to fishermen would be lower in **Alternative 2** relative to **Alternative 1** since they could more easily maneuver around the closed area. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Alternative 3 is the no-action option. Benefits associated with **Alternative 3** relative to **Alternatives 1 and 2** may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen. Costs associated with **Alternative 3** relative to **Alternatives 1 and 2** may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper, speckled hind, blueline tilefish (**Alternative 1** only), and other mid-shelf species.

The South Atlantic Snapper Grouper Commercial Logbook data was used to estimate landings of snapper grouper species that came from within the MPA alternatives. The Southeast Logbook Program provides catch by statistical grid (1 degree squares) which is at a coarser spatial scale than that of the Type 2 MPA sites proposed in this amendment. To assign a proportion of the catch from a logbook grid it was assumed that all snapper grouper catch came from the 50-300m depth range. We then calculated what percentage of the logbook grid contained that bottom (50-300m) and then how much of that was contained within a Type 2 MPA alternative. While this method can help the Council assess the quantitative impacts of the various alternatives, it is not as comprehensive at the Delphi approach which looks at the socioeconomic impacts from a variety of perspectives (including the recreational and scientific sectors).

In terms of catch of deepwater snapper grouper species it can be estimated using the proportional method that **Alternative 2** has the potential to have a greater impact to the commercial sector in regards to loss of catch than **Preferred Alternative 1**. Data from 2000 show that an estimated 15,764 pounds of deepwater snapper grouper species came from **Alternative 2** versus 8,063 pounds from **Preferred Alternative 1**. **Alternative 2** also has the potential to have a greater impact in terms of catch of all snapper grouper species with an estimated 57,791 pounds coming from that area versus 46,393 pounds from **Preferred Alternative 1**.

The Delphi panel concluded the impacts of the socioeconomic effects of the proposed Edisto MPA would be minimally negative in the immediate-term while slightly larger than neutral in the medium-term, but the long-term impacts of **Alternative 1 and Alternative 2** would be minimally positive and minimally larger than neutral, respectively (SEDEP 2007, Appendix E); immediate **Alternative 1**=-0.93 and **Alternative 2**=-0.94; medium-term **Alternative 1**=-0.08 and **Alternative 2**=-0.26; long-term **Alternative 1**=1.02 and **Alternative 2**=0.39). The study concluded “Additional long-term benefits would be accrued if [**Preferred Alternative 1**] is adopted rather than **Alternative 2** (SEDEP 2007).” There were no predicted additional displacement costs to the fishing industry from choice of **Preferred Alternative 1** over **Alternative 2**. The panel predicted the choice of any alternative other than No Action would result in immediate, minimal displacement costs to fishermen and their communities but long-term, minimal ecosystem benefits would eventually accrue.

4.4.3 Social Effects of Management Measure Alternatives

MARMAP fishery independent sampling has collected data in and near **Alternatives 1 and 2**. These data show that snowy grouper and speckled hind have been collected within the boundaries of both **Alternatives 1 and 2**, but more have been collected in **Alternative 1**. MARMAP collected blueline tilefish in spawning condition within **Alternative 1**. **Alternative 2** is oriented parallel with the coast and continental shelf break which is beneficial to industry as it encompasses preferable deepwater habitat without taking in as much mid-shelf habitat. Industry also stated that they fish in a pattern that is parallel to the coast and the break and this orientation will allow them to more easily maneuver around the closed area. On the other hand, sampling data suggest that many mid-shelf species, such as vermilion snapper, red porgy, and black sea bass occur in and near the proposed site for **Alternative 1** and that fewer mid-shelf species have been collected in **Alternative 2**. In this regard, the short-term social and economic effects of **Alternative 1** would be greater than for **Alternative 2** because it would take away fishing grounds for important mid-shelf species in addition to the deepwater species.

Depending on where you fish **Alternatives 1 or 2** may be more intrusive from a transportation standpoint, based on the way they are positioned. This means that boats have to go around the MPA if they have any deepwater snapper grouper species on their boat, regardless of where they caught the fish. This could result in longer steam time and higher costs.

Fishermen are frustrated with the attempt to protect the deepwater species in areas perceived to be too shallow. **Alternative 1** has a fair amount of area that is in the 24 to 26 fathom range. In their opinion this alternative would only prevent them from targeting mid-shelf snappers and groupers, as opposed to the deepwater species.

According to the minutes from the Little River public hearing in 2004, there is a fair amount of tilefish targeted in these closures. This is the first real discussion of tilefish and appears to be of major concern to some fishermen from the area. There are others that argue the Type 2 MPAs are not deep enough to effectively protect deepwater species and that the likelihood is that the mid-shelf fishery is going to be severely impacted. These areas are apparently fished by fishermen from Charleston as well as those as far north as Little River and Murrell's Inlet. There is concern about displacement of fishermen onto nearby open areas, creating potential conflict and additional fishing pressure in open areas.

There seems to be a fair amount of recreational, including for-hire, activity in these areas, mostly because these areas are productive, mid-shelf areas. The argument is that the closure will not protect what it is intended to protect. Recreational fishermen argue that there will be a loss of money due to increased time to steam to certain areas and that it may displace fishermen onto other grounds already under pressure for mid-shelf species.

The reduction in the amount of fish being caught as a result of the Type 2 MPAs or as a result of the Type 2 MPAs coupled with Amendment 13C is likely to have a negative impact on those fish houses and dealers that rely on these species as a part of their annual round. Even fish houses and dealers throughout the Carolinas can be impacted because of their relationship to each other and potential lack of supply from their own fishermen and from those that land and sell with other dealers. It is common for fish houses to buy from other fish houses in order to meet the demand of their clientele. A loss of supply for one area may affect the productivity of the fish houses and dealers in another area.

With increased pressure from coastal development and an increase in property value in coastal communities, revenue reductions due to Amendments 13C and 14 may lead some to sell or convert their docks and marinas. This would make it more difficult for the commercial fishermen to exist because of a loss of places to dock, offload, and sell their fish. The loss of infrastructure means that there are numerous other directly and indirectly associated businesses that would be negatively impacted. This means that as fish houses close, the workers would be let go. If a marina is sold, it might have a serious impact on the sale of fishing supplies, such as fuel, bait, and tackle. This Type 2 MPA may reduction in the number of trips. The reason is that a reduce the number of trips means that crew would not be paid as much regardless of whether they are paid on a trip by trip basis or a share basis. This could mean a loss of adequate crew or a reduction in total wages for the crew.

Alternative 3 (no action) would not have these impacts.

The Delphi panel predicted the "Community and Social Effects" of the proposed Type 2 MPAs, in addition to other types of effects. The predicted immediate impacts of the community and social effects of the proposed Edisto Type 2 MPA sites would be minimally negative (**Alternative 1**=-1.11 and **Alternative 2**=-1.19), as the medium-term impacts would be slightly less than neutral (**Alternative 1**=-0.25 and **Alternative 2**=-0.35); however, the long-term impacts would be indeterminable from neutral (**Alternative 1**=0.54 and **Alternative 2**=0.07) (SEDEP 2007, Appendix E).

4.4.4 Administrative Effects of Management Measure Alternatives

Alternatives 1 and 2 would have impacts on enforcement as establishment of a Type 2 MPA would require more law enforcement resources than are currently being dedicated to the snapper grouper fishery. SAFMC's Law Enforcement Advisory Panel (LEAP) presented the Council with a report titled the Enforceability of Proposed MPAs. For the report the member States evaluated their assets and categorized their ability to effectively patrol each MPA as either **HIGH**, **MODERATE**, or **LOW**. This rating is based solely on the individual states assets and does not include the assets that their Federal partners may or may not have. This report categorized the Edisto MPA as "**LOW**". A "**LOW"** rating means that patrols of the area would only occur during an organized enforcement detail with Federal partners such as NMFS or USCG. The State does not have the assets or personnel with the proper training to patrol the area. Additional funding will be ***essential*** to increase the ability rating. The report did specify that **Alternative 2** would be the preferable location alternative but did not elaborate on reasons.

In addition, some burden would be experienced by requiring NMFS to provide notice to the public about changes in regulations.

Alternative 3 would not carry these enforcement and administrative costs.

4.4.5 Conclusion

The Council chose **Alternative 1** as its preferred alternative for the proposed Edisto Type 2 MPA because it holds more of the hardbottom habitat suitable for deepwater snapper grouper species. Spawning blueline tilefish, juvenile snowy grouper, and speckled hind have all been found within the boundaries of **Alternative 1** which has a broader depth range and is more suitable for nursery habitat than the other alternative. The Delphi Panel found that **Alternative 1** would have the most long-term ecological, social, and economic benefits.

The proposed action is consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed action will protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. This action should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPA, while minimizing adverse social and economic effects.

4.5 Georgia MPA (Tilefish MPA)

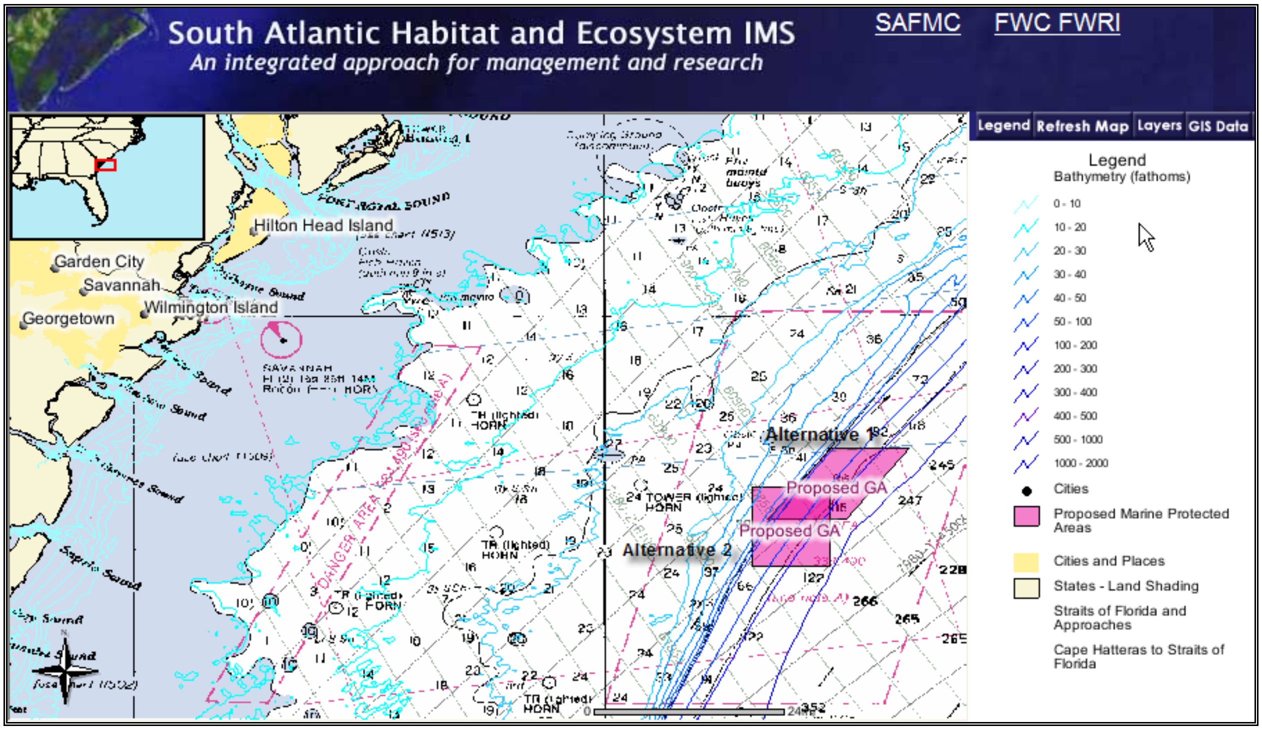
Alternative 1. Preferred Alternative - Establish a Type 2 MPA off Georgia in the area bounded by the following coordinates: The northwest corner at 31°43'N, 79°31'W; the northeast corner at 31°43'N, 79°21'W; the southwest corner at 31°34'N, 79°39'W; and the southeast corner at 31°34'N, 79°29'W (Figure 4-15).

Alternative 2. Establish a Type 2 MPA off Georgia in the area bounded by the following coordinates: The northwest corner at 31°38'N, 79°41'W; the northeast corner at 31°38'N, 79°31'W; the southwest corner at 31°28'N, 79°41'W; and the southeast corner at 31°28'N, 79°31'W (Figure 4-15).

Alternative 3. No action. Do not establish a Type 2 MPA off Georgia.

Alternative 1 is located approximately 69 nautical miles southeast of the mouth of Wassaw Sound, Georgia. **Alternative 2** is located approximately 65 nautical miles southeast of the mouth of Wassaw Sound. Both alternatives are 10 by 10 nautical miles in size. Input received from the public process indicates that golden tilefish are often caught within both alternatives. The vast majority of fishing that occurs in this area is trolling for pelagic species such as tuna and dolphin. This area is occasionally fished commercially for snapper grouper species but lies east of an area called Triple Ledge that is an important area for the commercial industry.

Georgia Type 2 MPA **Alternatives 1 and 2** are in waters 90 to 210 meters (295 to 689 feet) deep. **Alternative 1** runs parallel to the shore and includes additional waters ranging from 90 to 300 meters (295 to 984 feet) in depth. **Alternative 2** includes an area with a wider depth range than Alternative 1, 65 to 380 meters (213 to 1,247 feet) (Figure 4-15).



Approximate Corner Points:

Alternative 1. (Approx. 69nm SE of the Mouth of Wassaw Sound)

NW 31 Degrees 43 Minutes N. 79 Degrees 31 Minutes W.	NE 31 Degrees 43 Minutes N. 79 Degrees 21 Minutes W.
SW 31 Degrees 34 Minutes N. 79 Degrees 39 Minutes W.	SE 31 Degrees 34 Minutes N. 79 Degrees 29 Minutes W.

Alternative 2. (Approx. 65nm SE of the Mouth of Wassaw Sound)

NW 31 Degrees 38 Minutes N. 79 Degrees 41 Minutes W.	NE 31 Degrees 38 Minutes N. 79 Degrees 31 Minutes W.
SW 31 Degrees 28 Minutes N. 79 Degrees 41 Minutes W.	SE 31 Degrees 28 Minutes N. 79 Degrees 31 Minutes W.

Figure 4-15. Proposed Georgia Type 2 MPA (Tilefish Type 2 MPA) alternatives.

4.5.1 Biological Effects of Management Measure Alternatives

SEAMAP data indicate the presence of limited hard bottom within both alternatives of the proposed Georgia MPA. Only 7.39% of grid areas have data and 7.16% show the presence of hard bottom for **Alternative 2** (Table 4-1 and Figure 4-16). About 7% of the grid areas with data are contained in **Alternative 1** and 23% of those in **Alternative 2** show presence of hard bottom habitat (Table 4-1 and Figure 4-16). A large portion of the area of both alternatives (140 to 220 meters) is mud habitat suitable for golden tilefish.

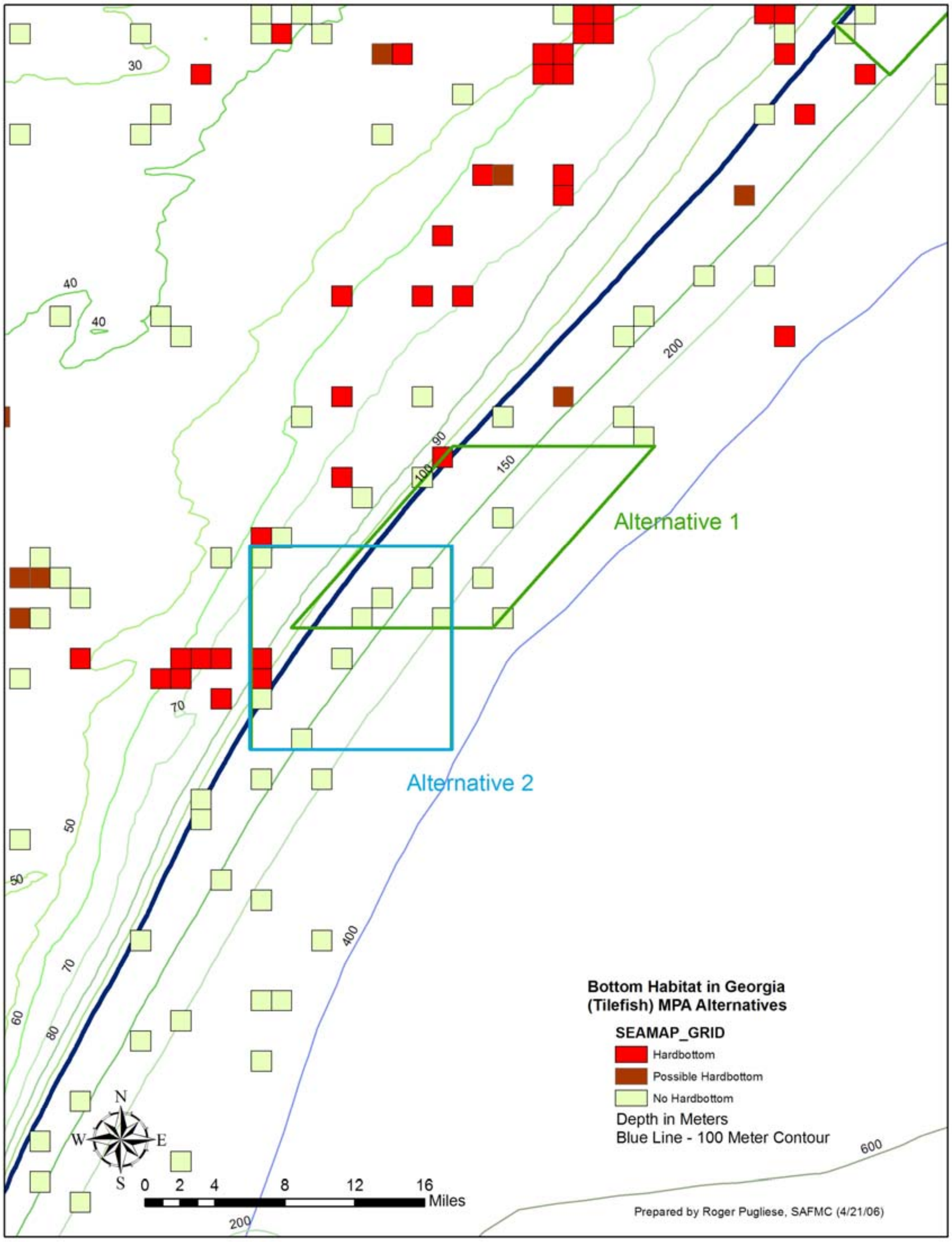


Figure 4-16. Bottom habitat in the Georgia Type 2 (Tilefish Type 2) MPA alternatives.

The MARMAP fishery independent sampling program has collected data in and near the proposed Georgia MPA alternatives (Figure 4-17, Table 4-8). These data show that juvenile snowy grouper occur in shelf edge areas of **Alternative 2**, while golden tilefish have been found in the mud habitat of **Alternatives 1 and 2**. Furthermore, golden tilefish have been collected in **Alternative 2** during Georgia Bulldog research cruises. MARMAP has collected golden tilefish in spawning condition in **Alternative 1** and to the north of the site.

Figure 4-17 and Table 4-9 shows the occurrence of snapper grouper species in and near the proposed Georgia MPA. MARMAP data indicate that few mid-shelf species, such as vermilion snapper, red porgy, and whitebone porgy have been collected from the area within **Alternative 2** and only gray triggerfish has been collected within **Alternative 1**. No mid-shelf species in spawning condition have been found in either alternative. Warsaw grouper and snowy grouper were observed in **Alternative 2** during a recent submersible survey (Harter and David 2006).

Because the targeted species live a long time and grow slowly, it is likely that the desired changes in sex ratio, size, and age structure resulting from establishment of the Type 2 MPAs will not be apparent in the short-term. For example, Roberts *et al*. (2001) found the lag time between establishment of a marine reserve and occurrence of record-size specimens of spotted sea trout, red drum, and black drum corresponded closely to the species longevity, with record-size specimens of longer-lived species taking longer to occur. It follows that, since the mean age at sexual maturity of golden tilefish is 24 years (SEDAR 4 2004), the generations of golden tilefish which are protected from fishing by the Type 2 MPAs will not reproduce until many years after the MPAs are implemented. Desired demographic changes may not be detectable at the population level for many years, and would therefore be considered long-term effects of the Type 2 MPAs. However, it is possible that some short-term effects such as more and larger fish would be seen on a timeframe closer to 10 years as Koenig (2001) found with groupers in the Oculina Experimental Closed Area.

Golden tilefish in spawning condition have been found in **Alternative 1** while juvenile snowy grouper occur in **Alternative 2**. **Alternative 1** is oriented parallel to the coast and shelf break and could be beneficial to the fishing industry as it encompasses more deepwater habitat than **Alternative 2**. However, there also could be long-term benefits to protecting a portion of the shelf edge habitat since it serves as a nursery for deepwater species such as snowy grouper, speckled hind, and Warsaw grouper. Some members of the commercial fishing industry stated that they fish in a pattern parallel to the coast and the break. An Type 2 MPA with this orientation may allow fishermen to more easily maneuver around the closed area. **Alternative 1** mostly encompasses the mud-bottom habitat that tilefish prefer.

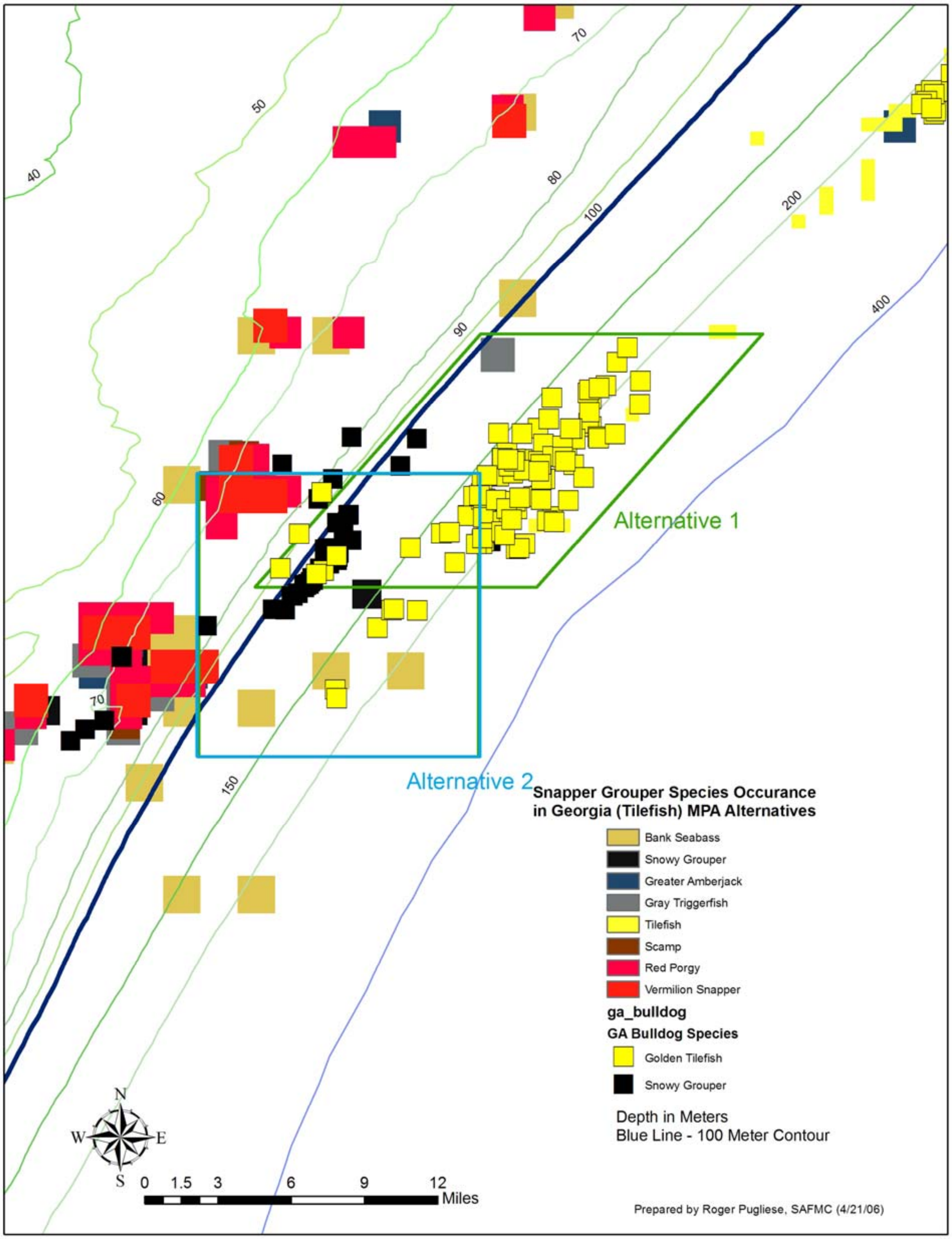


Figure 4-17. Snapper grouper species occurrence in Georgia (Tilefish) Type 2 MPA alternatives.
Source: MARMAP in (http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

Table 4-8. Occurrence of target species in proposed Georgia Type 2 MPA alternatives, where * indicates individuals found in spawning condition.

Species	Alternative 1	Alternative 2
Snowy grouper		X
Golden tilefish	X*	X
Speckled hind		
Yellowedge grouper		
Blueline tilefish		

Table 4-9. Occurrence of other snapper grouper species within the proposed Georgia Type 2 MPA alternatives (MARMAP).

Species	Alternative 1	Alternative 2
Black sea bass		
Gag		
Gray triggerfish	X	
Greater amberjack		
Knobbed porgy		
Lesser amberjack		
Red porgy		X
Red grouper		
Red snapper		
Rock hind		
Scamp		
Tomtate		
Vermilion snapper		X
Whitebone porgy		X
White grunt		

Alternative 2 is oriented perpendicular to the coast and encompasses deepwater and mid-shelf habitat. As such they both also have been found to hold some mid-shelf species such as red porgy and vermilion snapper. Furthermore, **Alternative 2** includes a broader depth range that could serve as a nursery area for various developmental stages of deepwater species.

Alternative 3 (no action) would limit the extent to which management can improve the status of these deepwater fish populations. Traditional fishery management measures alone may not be as effective as Type 2 MPAs in enhancing the age and size of deepwater species.

The depth of the Type 2 MPAs proposed under **Alternatives 1 and 2** will likely have little impact on Kemp's ridleys, green, and hawksbill turtles because these species are generally found landward of the proposed sites. Loggerhead and leatherback turtles may occur within these proposed areas. Therefore, these alternatives may provide localized protection to these species from incidental hook-and-line capture. Closure of these areas may also provide benefit for smalltooth sawfish as one was encountered within the vicinity of **Alternative 2**. The overall benefit of these area closures to ESA-listed species will be influenced by its impacts on fishing effort and fishing effort distribution.

Evaluating these potential changes in fishing effort and effort distribution is difficult. Without such an evaluation the overall impacts of these area closures on ESA-listed species cannot be known with certainty.

Alternative 3 would maintain the status quo and perpetuate the existing level of risk for ESA-listed species interactions as summarized in the Affected Environment of Snapper Grouper Amendment 13C (SAFMC 2006a).

In summary, there is reason to believe snowy grouper and golden tilefish are found within some or all of the alternative proposed Tilefish Type 2 MPA sites, based on findings of the MARMAP survey, and the SEAMAP survey documented favorable habitat conditions. Establishment of this Type 2 MPA would be expected to protect these species from fishing pressure within its borders and, over the long-term, promote a more natural sex ratio, age, and size structure.

4.5.2 Economic Effects of Management Measure Alternatives

Alternatives 1 and 2 are located 69 and 65 nautical miles from Wassaw Sound, Georgia, respectively and are 10 by 10 nautical miles in size. However, **Alternative 1** is orientated parallel with the coast and break, while **Alternative 2** is situated perpendicular to the coast.

Both **Alternative 1** and **Alternative 2** contain limited amounts of hard bottom habitat, and both areas are known to hold golden tilefish with snowy grouper found in **Alternative 2** and spawning golden tilefish in **Alternative 1**. Few mid-shelf species, such as vermilion snapper, red porgy, and whitebone porgy have been collected from the area within **Alternative 2** and only gray triggerfish has been collected within **Alternative 1**. No mid-shelf species in spawning condition have been found in either site. **Alternative 1** is orientated parallel with the coast and break which is beneficial to industry as it encompasses preferable tilefish habitat without taking in as much mid-shelf habitat. Industry also stated that they fish in a pattern that is parallel to the coast and the break and this orientation would allow them to more easily maneuver around the closed area. This alternative mostly encompasses the mud-bottom habitat that tilefish prefer. **Alternative 2** is orientated perpendicular to the coast encompasses deepwater and mid-shelf habitat.

Short-term benefits derived from **Alternative 2** relative to **Alternative 1**, due mainly to the possibility that a greater amount of snowy grouper and mid-shelf species would be protected by **Alternative 2**, may include additional option and existence value through preservation, a hedge against uncertain stock assessments for more species, and enhanced diversity of deepwater and mid-shelf species. However, **Alternative 1** may offer more benefits than **Alternative 2** in regards to tilefish as this area would protect spawning tilefish and contains more preferable tilefish habitat than **Alternative 2**. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors, such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations.

Both **Alternatives 1 and 2** would prohibit fishing for or possession of snapper grouper species in the Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Costs associated with either **Alternative 1** or **Alternative 2** may include reduction in incomes of displaced fishermen due to harvest reductions attributable to the MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species displaced fishermen.

Short-term, net, displacement costs incurred by fishermen would likely be higher for **Alternative 2** relative to **Alternative 1** since fishermen who harvest mid-shelf species and snowy grouper in **Alternative 2** would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the snowy grouper and mid-shelf species, which is unknown. This conclusion assumes that there are fewer operations that would be affected in **Alternative 1** if any snapper grouper species were caught in this area. Costs to fishermen would be lower in **Alternative 1** since they could more easily maneuver around the closed area, although the extent to which more tilefish are found in these areas would determine the relative magnitude of displacement costs among the alternatives. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Alternative 3 is the no-action option. Benefits associated with **Alternative 3** relative to **Alternatives 1 and 2** may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species by displaced fishermen. Costs associated with **Alternative 3** relative to **Alternatives 1 and 2** may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind.

The South Atlantic Snapper Grouper Commercial Logbook data was used to estimate landings of snapper grouper species that came from within the MPA alternatives. The Southeast Logbook Program provides catch by statistical grid (1 degree squares) which is at a coarser spatial scale than that of the Type 2 MPA sites proposed in this amendment. To assign a proportion of the catch from a logbook grid it was assumed that all snapper grouper catch came from the 50-300m depth range. We then calculated what percentage of the logbook grid contained that bottom (50-300m) and then how much of that was contained within a Type 2 MPA alternative. While this method can help the Council assess the quantitative impacts of the various alternatives, it is not as comprehensive at the Delphi approach which looks at the socioeconomic impacts from a variety of perspectives (including the recreational and scientific sectors).

In terms of catch of deepwater snapper grouper species, estimated using the proportional method, **Alternative 2** would have a slightly greater impact to the commercial sector in regards to loss of catch than **Preferred Alternative 1**.Data from 2000 show that an estimated 3,193 pounds of deepwater snapper grouper species came from **Alternative 2** versus 2,882 from **Preferred Alternative 1**. **Alternative 2** would also have the potential to have a greater impact in terms of all snapper grouper species than **Preferred Alternative 1** with an estimated 17,381 pounds coming from **Alternative 2** versus 15,685 pounds coming from **Preferred Alternative 1**.

The Delphi panel concluded the immediate and medium-term impacts of the socioeconomic effects of the proposed Georgia MPA sites would be minimally negative, but the long-term impacts of both alternative sites would range from neutral to minimally positive (SEDEP 2007, Appendix E); immediate Preferred Alternative 1=-0.73 and Alternative 2=-0.92; medium-term Preferred Alternative 1=-0.04 and Alternative 2=-0.39; long-term Preferred Alternative 1=0.89 and Alternative 2=0.11). Long-term benefits of Preferred Alternative 1 would be higher than Alternative 2. The displacement costs to fishing communities of the two alternatives would not be significantly different. The choice of Preferred Alternative 1 rather than No Action would result in immediate, minimal displacement costs to fishermen and their communities but long-term, minimal ecosystem benefits were predicted to accrue.

4.5.3 Social Effects of Management Measure Alternatives

Alternative 1 is oriented parallel with the coast and continental shelf break which is beneficial to industry as it encompasses preferable tilefish habitat without taking in as much mid-shelf habitat. Industry also stated that they fish in a pattern that is parallel to the coast and the break, and this orientation will allow them to more easily maneuver around the closed area. This alternative mostly encompasses the mud-bottom habitat that tilefish prefer. **Alternative 2** is oriented perpendicular to the coast and encompasses deepwater and mid-shelf habitat.

There are expected to be few impacts to the recreational fishing sector as most of the recreational fishing in this area is trolling for pelagic species which will still be allowed. It is difficult to assess any shore impacts in this area at this time. Possible job loss from fish houses and crew could result from fewer trips made off the coast of Georgia.

Alternative 3 (no action) would not have these impacts.

The Delphi panel predicted the “Community and Social Effects” of the proposed Georgia Type 2 MPA, in addition to other types of effects. The predicted immediate impacts of the social and community effects of the proposed Georgia MPA sites would be minimally negative (SEDEP 2007, Appendix E; **Alternative 1**=-1.10 and **Alternative 2**=-1.23), while the medium-term impacts were predicted to be less than minimally negative (**Alternative 1**=-0.33 and **Alternative 2**=-0.59). The long-term impacts of both alternative sites would be minimally larger than neutral and neutral, respectively (**Alternative 1**=0.51 and **Alternative 2**=0.02). **Preferred Alternative 1** scored more favorable immediate, medium-term, and long-term impacts than **Alternative 2** (SEDEP 2007, Appendix E).

4.5.4 Administrative Effects of Management Measure Alternatives

Alternatives 1 and 2 would have impacts on enforcement as establishment of an Type MPA would require more law enforcement resources that are currently being dedicated to the snapper grouper fishery. SAFMC's Law Enforcement Advisory Panel (LEAP) presented the Council with a report titled the Enforceability of Proposed MPAs. For the report the member States evaluated their assets and categorized their ability to effectively patrol each MPA as either **HIGH**, **MODERATE**, or **LOW**. This rating is based solely on the individual states assets and does not include the assets that their Federal partners may or may not have. This report categorized the Georgia (Tilefish) Type 2 MPA as "**LOW**". A "**LOW"** rating means that patrols of the area would only occur during an organized enforcement detail with Federal partners such as NMFS or USCG. The State of Georgia does not have the assets or personnel with the proper training to patrol the area. Additional funding will be ***essential*** to increase the ability rating. In addition, some burden would be experienced by requiring NMFS to provide notice to the public about changes in regulations.

Alternative 3 would not carry these enforcement and administrative costs.

4.5.5 Conclusion

The Council chose **Alternative 1** as its preferred alternative for the proposed Georgia Type 2 MPA because a large portion of the area has mud-bottom habitat suitable for golden tilefish. Snowy grouper and golden tilefish in spawning condition have been found within the boundaries of **Alternative 1**. According to the Delphi Panel, **Alternative 1** has the greatest long-term ecological, social, and economic benefits.

The proposed action is consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed action will protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. This action should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPA, while minimizing adverse social and economic effects.

4.6 North Florida MPA (Jacksonville/St. Augustine Ridge MPA)

Alternative 1. Establish a Type 2 MPA off north Florida in the area bounded by the following coordinates: The northwest corner at 30°29'N, 80°18'W; the northeast corner at 30°29'N, 80°8'W; the southwest corner at 30°19'N, 80°18'W; the southeast corner at 30°19'N, 80°8'W (Figure 4-18).

Alternative 2. Establish a Type 2 MPA off north Florida in the area bounded by the following coordinates: The northwest corner at 30°5'N, 80°25'W; the northeast corner at 30°5'N, 80°15'W; the southwest corner at 29°55'N, 80°25'W; and the southeast corner at 29°55'N, 80°15'W (Figure 4-18).

Alternative 3. Establish a Type 2 MPA off North Florida in the area bounded by the following coordinates: The northwest corner at 29°36.3'N, 80°12.5'W; the northeast corner at 29°40'N, 79°50'W; the southwest corner at 29°17.3'N, 80°8.3'W; and the southeast corner at 29°21.3'N, 79°45.5'W (Figure 4-18).

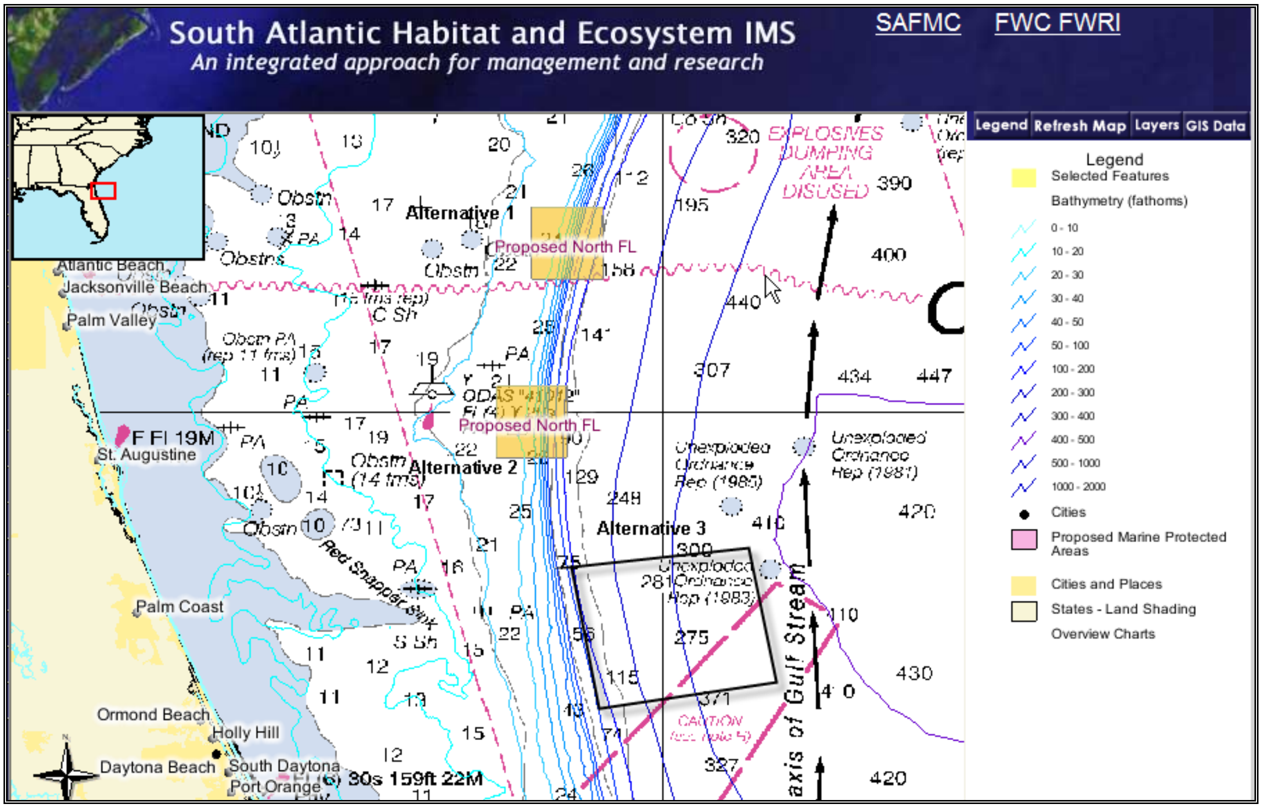
Alternative 4. Preferred Alternative - Establish a Type 2 MPA off north Florida in the area bounded by the following coordinates: The northwest corner at 30°29'N, 80°14'W; the northeast corner at 30°29'N, 80°2'W; the southwest corner at 30°19'N, 80°14'W; and the southeast corner at 30°19'N, 80°2'W (Figure 4-19).

Alternative 5. Establish a Type 2 MPA off north Florida in the area bounded by the following coordinates: The northwest corner at 30°5'N, 80°16'W; the northeast corner at 30°5'N, 80°6'W; the southwest corner at 29°55'N, 80°16'W; and the southeast corner at 29°55'N, 80°6'W (Figure 4-19).

Alternative 6. Establish a Type 2 MPA off North Florida in the area bounded by the following coordinates: The northwest corner at 29°36.3'N, 80°15'W; the northeast corner at 29°40'N, 79°52.5'W; the southwest corner at 29°17.3'N, 80°10.8'W; and the southeast corner at 29°21.3'N, 79°48'W (Figure 4-19).

Alternative 7. No action. Do not establish a Type 2 MPA off northern Florida.

Alternative 1 for the proposed North Florida MPA is approximately 57 nautical miles off the mouth of the St. John's River near Jacksonville, Florida. **Alternative 4** is similar to **Alternative 1** but is approximately 60 nautical miles off the mouth of the St. John's River near Jacksonville, Florida. **Alternative 2** is approximately 47 nautical miles east of St. Augustine, Florida. **Alternative 5** is similar to **Alternative 2** but is approximately 55 nautical miles east of St. Augustine, Florida. **Alternative 3** is approximately 43 nautical miles off New Smyrna Beach, Florida. **Alternative 6** is similar to **Alternative 3** but is approximately 45 nautical miles off New Smyrna Beach, Florida. **Alternatives 1, 2, 4, and 5** are 10 by 10 nautical miles in size. **Alternatives 3 and 6** are 22 by 23 nautical miles in size. There are six alternative sites for the North Florida MPA. **Alternatives 1** and **4** share an area which ranges from 60 to 200 meters (197 to 656 feet) deep. **Alternative 1** also includes an area of shallower water 55-80 meters deep (180 to 262 feet), while **Alternative 4** also includes a deeper area of 200-380 meters (656 to 1,247 feet). **Alternatives 2** and **5** overlap in an area with depths ranging from 90 to 150 meters (295 to 492 feet). **Alternative 2** also includes a shallower area of 55 to 80 meters (180 to 262 feet), while **Alternative 5** includes a deeper area of 150 to 390 meters (492 to 1,280 feet). Most of **Alternative sites 3** and **6** overlap in an area ranging from 200 to 690 meters (656 to 2,264 feet) deep. **Alternative 6** also includes a shallower area of 80 to 150 meters (262 to 492 feet), while **Alternative 3** includes a deeper area exceeding 700 meters (2,297 feet) (Figures 4-18 and 4-19).



Approximate Corner Points:

Alternative 1. (Approx. 57nm E of St. Johns River)

NW 30 Degrees 29 Minutes N. 80 Degrees 18 Minutes W.	NE 30 Degrees 29 Minutes N. 80 Degrees 8 Minutes W.
SW 30 Degrees 19 Minutes N. 80 Degrees 18 Minutes W.	SE 30 Degrees 19 Minutes N. 80 Degrees 8 Minutes W.

Alternative 2. (Approx. 47 nm E of St. Augustine)

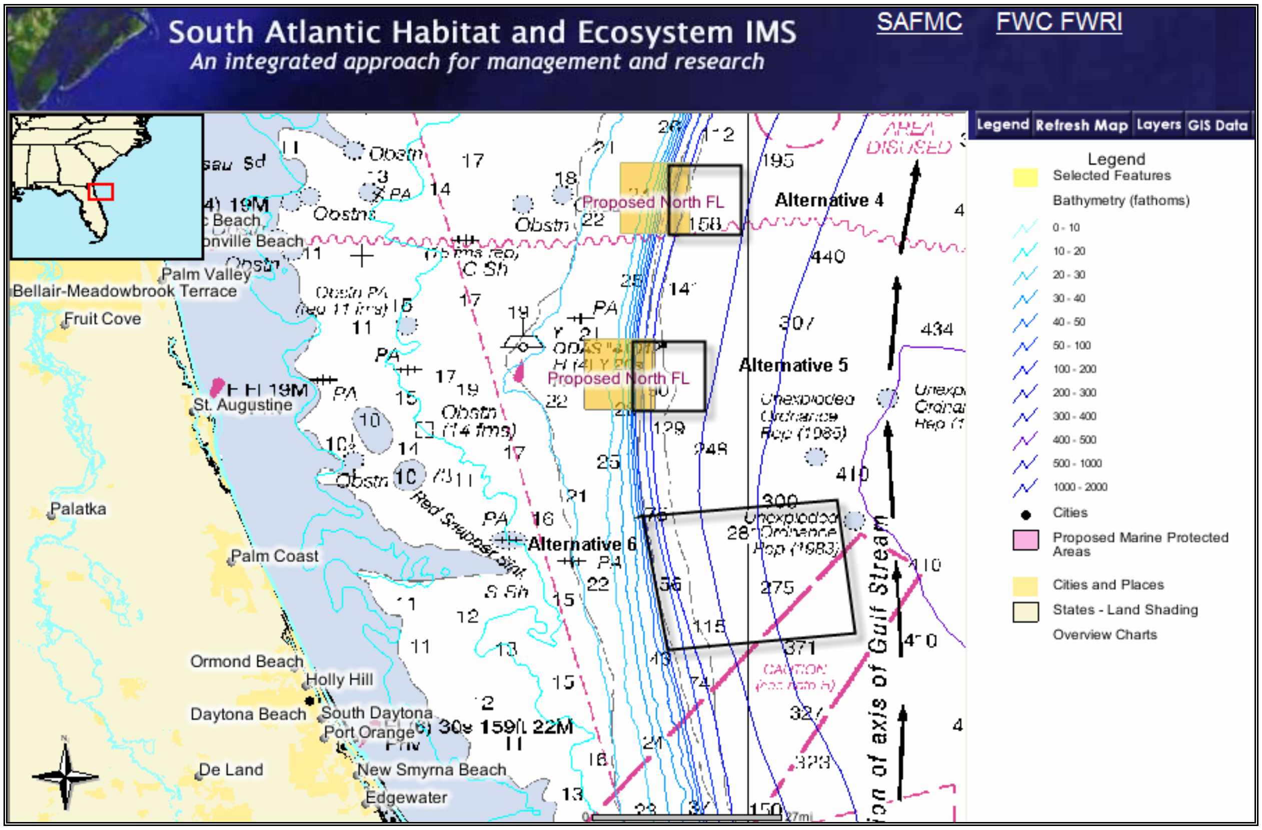
NW 30 Degrees 5 Minutes N. 80 Degrees 25 Minutes W.	NE 30 Degrees 5 Minutes N. 80 Degrees 15 Minutes W.
SW 29 Degrees 55 Minutes N. 80 Degrees 25 Minutes W.	SE 29 Degrees 55 Minutes N. 80 Degrees 15 Minutes W.

Alternative 3. (Approx. 45 nm from New Smyrna Beach)

NW 29 Degrees 36.3 Minutes N. 80 Degrees 12.5 Minutes W.	NE 29 Degrees 40 Minutes N. 79 Degrees 50 Minutes W.
SW 29 Degrees 17.3 Minutes N. 80 Degrees 8.3 Minutes W.	SE 29 Degrees 21.3 Minutes N. 79 Degrees 45.5 Minutes W.

Prepared by Roger Pugliese, SAFMC (10/30/06)

Figure 4-18. Proposed North Florida Type 2 MPA Alternatives.



Approximate Corner Points:

Alternative 4. (Approx. 60 nm E of St. Johns River)

NW 30 Degrees 29 Minutes N. 80 Degrees 14 Minutes W.	NE 30 Degrees 29 Minutes N. 80 Degrees 2 Minutes W.
SW 30 Degrees 19 Minutes N. 80 Degrees 14 Minutes W.	SE 30 Degrees 19 Minutes N. 80 Degrees 2 Minutes W.

Alternative 5. (Approx. 55 nm E of St. Augustine)

NW 30 Degrees 5 Minutes N. 80 Degrees 16 Minutes W.	NE 30 Degrees 5 Minutes N. 80 Degrees 6 Minutes W.
SW 29 Degrees 55 Minutes N. 80 Degrees 16 Minutes W.	SE 29 Degrees 55 Minutes N. 80 Degrees 6 Minutes W.

Alternative 6. (Approx. 43 nm from New Smyrna Beach)

NW 29 Degrees 36.3 Minutes N. 80 Degrees 15 Minutes W.	NE 29 Degrees 40 Minutes N. 79 Degrees 52.5 Minutes W.
SW 29 Degrees 17.3 Minutes N. 80 Degrees 10.8 Minutes W.	SE 29 Degrees 21.3 Minutes N. 79 Degrees 48 Minutes W.

Prepared by Roger Pugliese, SAFMC (10/30/06)

Figure 4-19. Proposed North Florida Type 2 MPA Alternatives.

4.6.1 Biological Effects of Management Measure Alternatives

Alternatives 1 and 2 were proposed to the Council by the Council's Habitat Advisory Panel. Input received during the public scoping and meeting process indicated that **Alternatives 1 and 2** are heavily fished both commercially and recreationally for mid-shelf snapper grouper species and that there are few deepwater species found in either area. In addition to bottom fishing for snapper grouper, these areas are used for trolling for pelagic species. **Alternatives 4 and 5** were modifications suggested by the Council to capture a greater amount of deepwater habitat. **Alternative 3** is a site proposed at a public hearing held in the affected area. According to public input, this site is more appropriate as a Type 2 MPA at this time because it holds more of the deepwater snapper grouper species the Council intends to protect. **Alternative 6** is similar to **Alternative 3** but located inshore of **Alternative 3**. This alternative was suggested by the Council to capture a greater amount of habitat for tilefish and snowy grouper that exists between 100 and 200 meters.

SEAMAP data indicate the presence of hard bottom within both Type 2 MPA options (Figure 4-20). Table 4-1 indicates that the percentage of grid areas with data is greatest for **Alternative 1** (42.72%) of which 71.91% shows presence of hard bottom habitat. Approximately 20.73% of **Alternative 4** (offshore of **Alternative 1**) has grid areas with data of which 62.65% show presence of hard bottom habitat. Off St. Augustine, Florida, 19% of **Alternative 2** has grid areas with data of which 48.38% show presence of hard bottom habitat. Offshore of **Alternative 2**, 5.47% of **Alternative 5** has grid areas with data of which 36.41% show presence of hard bottom habitat (Table 4-1). Bottom habitat from SEAMAP data is shown for all alternatives in Figure 4-20.

Submersible dives in **Alternatives 1, 2, 4, and 5** determined that shelf-edge reefs were composed of slab pavement, blocked boulders, and buried blocked boulders (Schobernd 2006). Slab pavement is a thin, flat layer of rock that makes up the surface of the reef. Slabs were often separated by fissures and cracks filled with sediment. Blocked boulders made up the offshore, steep-sloping face of the ridge. These squared-off rocks were about one meter in height, and almost perfectly cubed in shape. Buried blocked boulders were the same shape and size as blocked boulders; however, those rocks were less exposed than blocked boulders due to accumulated layers of sediment surrounding them.

Only 2% of **Alternative 3** has been surveyed and there is no known hard bottom habitat; about 4% of **Alternative 6** has been surveyed of which 1% is considered to be hard bottom (Table 4-1).

The MARMAP fishery independent sampling program has collected data in and near the proposed North Florida Type 2 MPA alternatives (Figures 4-21, 4-22, and 4-23; Table 4-10). These data show that snowy grouper and speckled hind can be found in **Alternatives 1, 2, 4, and 5**. Golden tilefish have also been taken in **Alternative 5**, offshore of **Alternative 2**. The mud habitat at depths of 180 – 220 meters in **Alternative 4** may also hold golden tilefish.

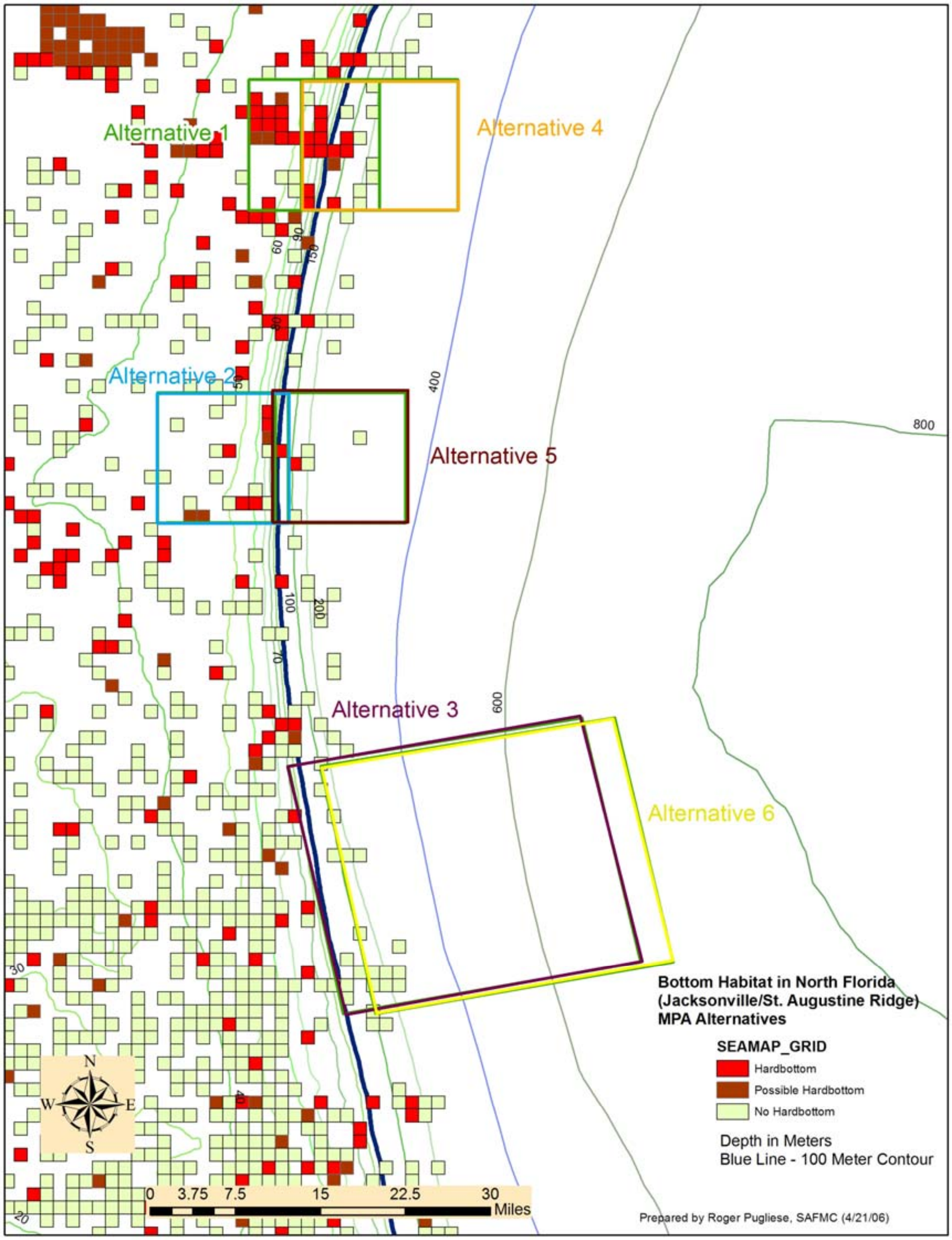


Figure 4-20. Bottom habitat in North Florida (Jacksonville/St. Augustine Ridge) Type 2 MPA Alternatives.

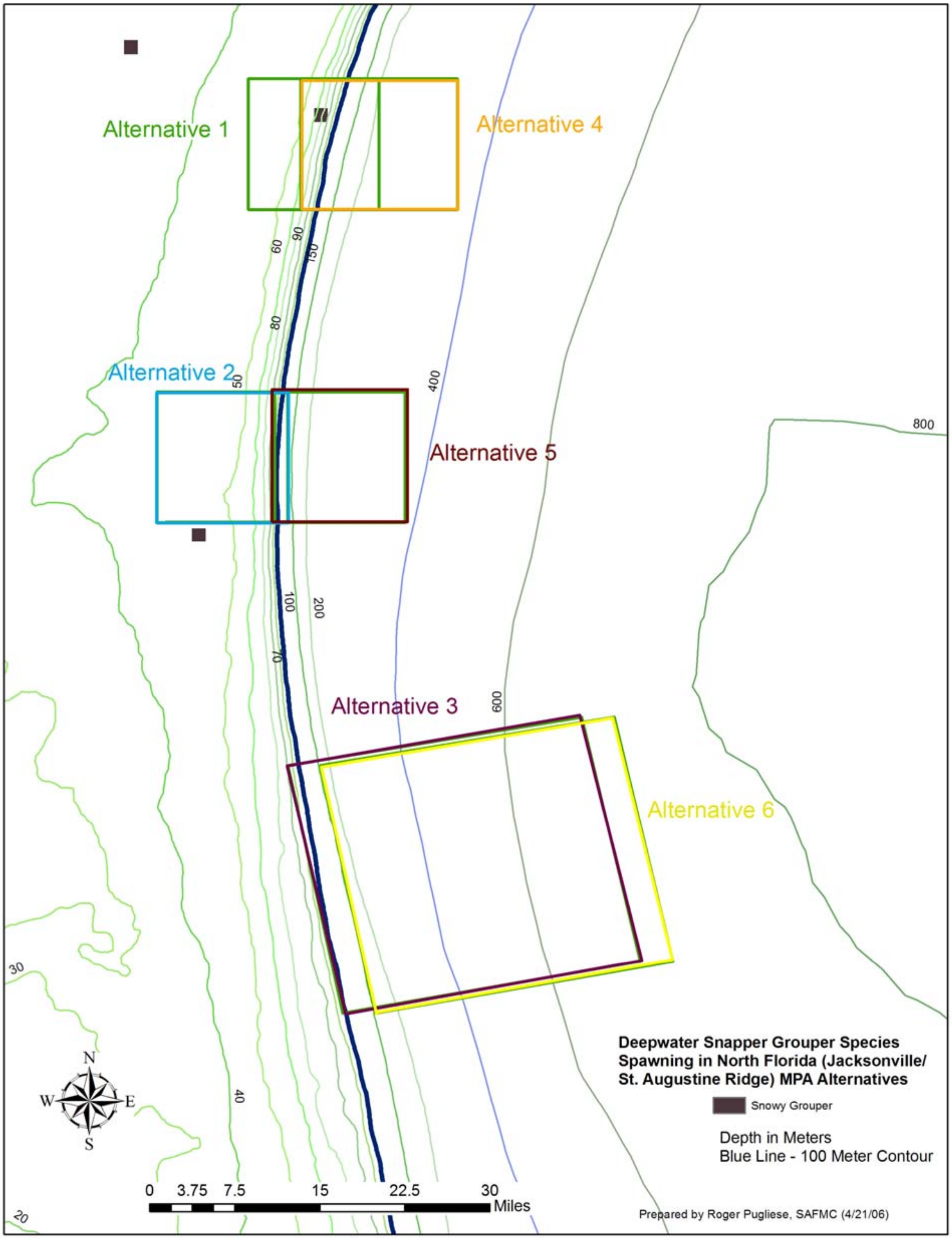


Figure 4-21. Deepwater snapper grouper species spawning in North Florida Type 2MPA alternatives.
Source: MARMAP in (http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

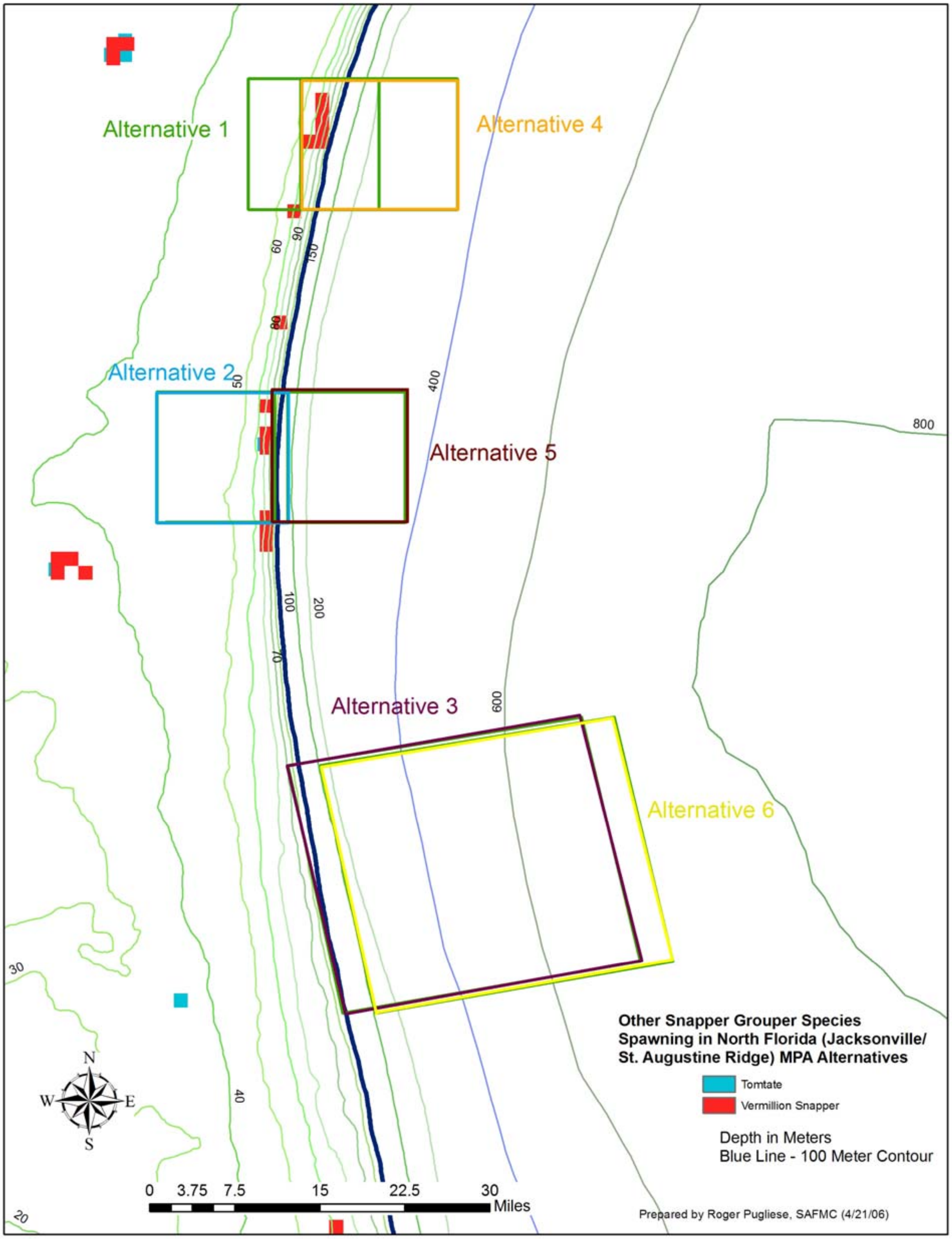


Figure 4-22. Other snapper grouper species spawning in North Florida Type 2 MPA alternatives.
Source: MARMAP in (http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

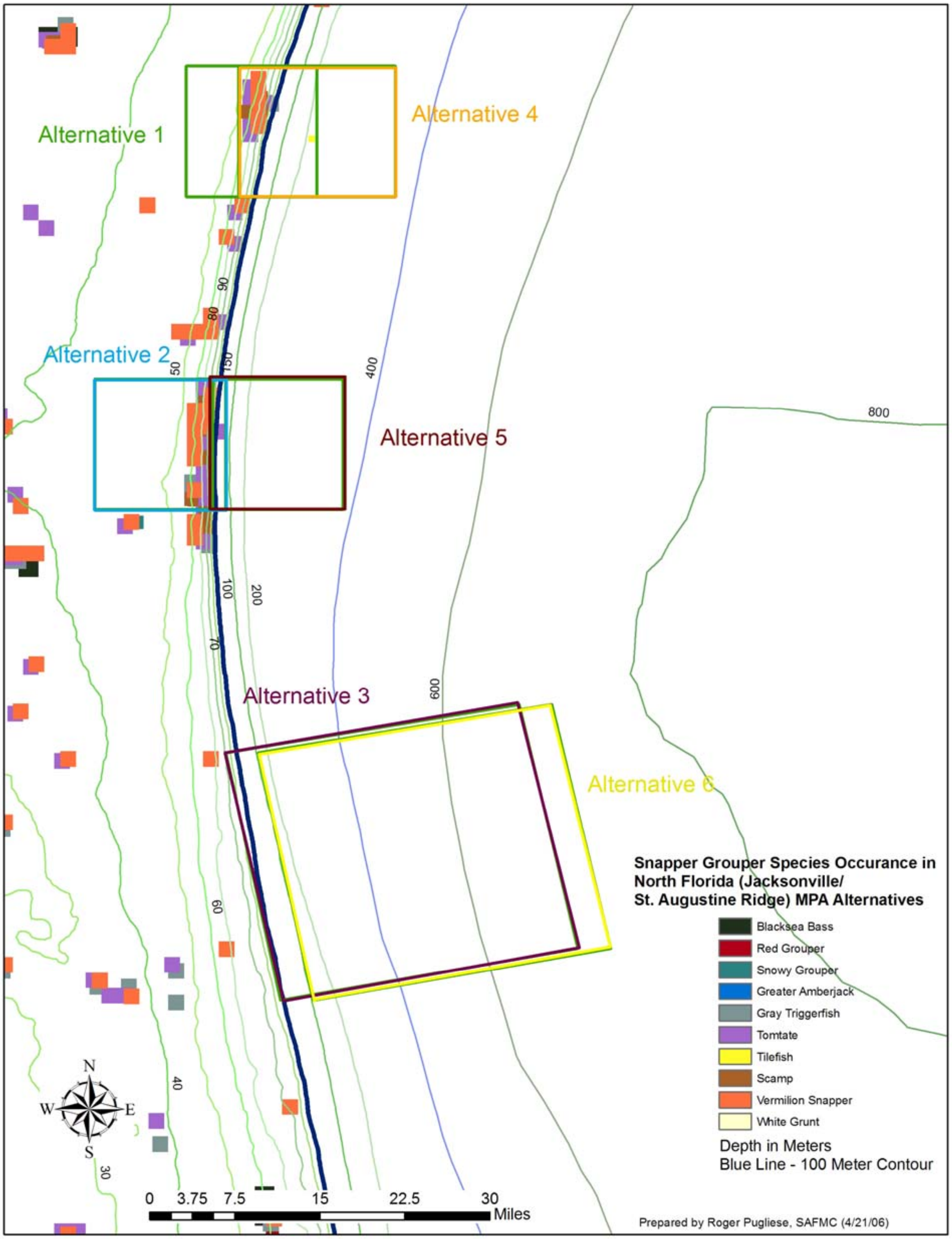


Figure 4-23. Snapper grouper species occurrence in North Florida Type 2 MPA alternatives.
Source: MARMAP in (http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.)

Table 4-10. Occurrence of deepwater snapper grouper species in the North Florida Type 2 MPA alternatives.

Species	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Snowy grouper	X	X		X	X	
Golden tilefish					X	
Speckled hind	X*	X		X*	X	
Yellowedge grouper						
Blueline tilefish						

* Asterisks indicate species were also found in spawning condition (MARMAP).

MARMAP has not collected a deepwater species in spawning condition within any alternatives. However, during submersible dives in shelf edge habitat common to **Alternatives 1 and 4,** one speckled hind was observed with a distended abdomen, apparently full of ripe eggs (Schobernd 2006).

Figure 4-23 and Table 4-11 show the occurrence of collections of other snapper grouper species in and near the proposed North Florida Type 2 MPAs. Many mid-shelf species, such as vermilion snapper, red porgy, and scamp have been collected within **Alternatives 1, 2**, **4, and 5** and many of those species have been found in spawning condition. Hogfish were observed displaying courtship behavior on submersible dives in shelf edge habitat of **Alternatives 1 and 4** (Schobernd 2006). Scamp were also observed displaying courtship behavior in shelf edge habitat of **Alternatives 1, 2, 4, and 5**. Fewer mid-shelf species in spawning condition have been collected in **Alternatives 2 and 5** than **Alternative 3**
and 6. There is no record of collection of any snapper grouper species in **Alternatives 3 and 6**.

Because the targeted species live a long time and grow slowly, it is likely that the desired changes in sex ratio, size, and age structure resulting from establishment of the Type 2 MPAs will not be apparent in the short-term. For example, Roberts *et al*. (2001) found the lag time between establishment of a marine reserve and occurrence of record-size specimens of spotted sea trout, red drum, and black drum corresponded closely to the species longevity, with record-size specimens of longer-lived species taking longer to occur. It follows that, since the mean age at sexual maturity of golden tilefish is 24 years (SEDAR 4 2004), the generations of golden tilefish which are protected from fishing by the Type 2 MPAs will not reproduce until many years after the Type 2 MPAs are implemented. Desired demographic changes may not be detectable at the population level for many years, and would therefore be considered long-term effects of the Type 2 MPAs. However, it is possible that some short-term effects such as more and larger fish would be seen on a timeframe closer to 10 years as Koenig (2001) found with groupers in the Oculina Experimental Closed Area.

Table 4-11. Occurrence of other snapper grouper species in the Florida Type 2 MPA alternatives.

Species	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Bank Sea Bass	X	X		X	X	
Black Sea Bass						
Gag		X			X	
Gray triggerfish	X	X*		X	X*	
Greater amberjack						
Hogfish	X*			X*		
Knobbed porgy	X	X		X	X	
Lesser amberjack						
Red porgy	X*	X		X*	X	
Red grouper	X	X		X	X	
Red snapper		X			X	
Scamp	X*	X*		X*	X*	
Tomtate	X*	X		X*	X	
Vermilion snapper	X*	X*		X*	X*	
Whitebone porgy	X			X		
White grunt						

* Asterisks indicate species were also found in spawning condition (MARMAP).

Both snowy grouper and speckled hind have been found in **Alternatives 1, 2, 4, and 5**. Speckled hind in spawning condition has been observed in shelf edge habitat that is coincidental with **Alternative 1 and 4**. **Alternatives 4 and 5**, which are offshore of **Alternatives 1 and 3**, may include mud habitat for golden tilefish as well as some hard bottom habitat for juvenile snowy grouper. However, these areas have not been very well surveyed. Golden tilefish are commonly taken off Cape Canaveral, Florida and a few specimens have been taken off northern Florida through limited sampling efforts by MARMAP.

The proposed Type 2 MPA may provide an additional indirect positive biological benefit since many mid-shelf species also occur in **Alternatives 1, 2, 4, and 5**. Vermilion snapper, hogfish, scamp, red porgy, and tomtate are known to spawn in **Alternatives 1 and 4**. Vermilion snapper, scamp, and gray triggerfish in spawning condition have been collected in **Alternatives 2 and 5**.

Alternative 7 (no action) would limit the extent to which management can improve the status of these deepwater fish populations. Traditional fishery management measures may not be as effective as Type 2 MPAs in enhancing the age and size structure of deepwater species.

The depth of the Type 2 MPAs proposed under **Alternatives 1, 3, 4,** and **5** will likely have little impact on Kemp's ridleys, green, and hawksbill turtles because these species are generally found landward of the proposed sites. Loggerhead and leatherback turtles may occur within these proposed areas. Therefore, these alternatives may provide localized protection to these species from incidental hook-and-line capture. **Alternative 2** may provide more benefit to sea turtles as it encompasses shallower depths, which are within the diving and foraging range of all listed sea turtle species. The overall benefit of any area closure on sea turtles will be influenced by its impacts on fishing effort and fishing effort distribution. Evaluating these potential changes is difficult, and without such an evaluation the overall impacts of these area closures on ESA-listed species cannot be known with certainty.

Alternative 7 would maintain the status quo and thus keep the existing level of risk for ESA-listed species interactions as summarized in the Affected Environment of Snapper Grouper Amendment 13C (SAFMC 2006a).

In summary, there is reason to believe snowy grouper, speckled hind, golden tilefish, and blueline tilefish are found within some or all of the alternative proposed North Florida MPA sites, based on findings of the MARMAP survey, and the SEAMAP survey documented favorable habitat conditions. Establishment of this Type 2 MPA would be expected to protect these species from fishing pressure within its borders and, over the long-term, promote a more natural sex ratio, age, and size structure.

4.6.2 Economic Effects of Management Measure Alternatives

Alternative 1 for the proposed North Florida Type 2 MPA is approximately 57 nautical miles off the mouth of the St. John's River near Jacksonville, Florida. **Alternative 4** is similar to **Alternative 1** but is approximately 60 nautical miles off the mouth of the St. John's River near Jacksonville, Florida. **Alternative 2** is approximately 47 nautical miles east of St. Augustine, Florida. **Alternative 5** is similar to **Alternative 2** but is approximately 55 nautical miles east of St. Augustine, Florida. **Alternative 3** is approximately 43 nautical miles off New Smyrna Beach, Florida. **Alternative 6** is similar to **Alternative 3** but is approximately 45 nautical miles off New Smyrna Beach, Florida. **Alternatives 1, 2, 4, and 5** are 10 by 10 nautical miles in size. **Alternatives 3 and 6** are 22 by 23 nautical miles in size.

Alternative 1 and **Alternative 2** are heavily fished both commercially and recreationally for mid-shelf snapper groupers species such as vermilion snapper, red porgy, and scamp grouper, and there are a few deepwater species (snowy grouper and speckled hind) found in both areas although none in spawning condition. Both alternatives contain similar occurrences of hard bottom habitat. Both alternatives are orientated parallel with the coast and break which is beneficial to industry, but they both contain significant mid-shelf habitat.

Short-term benefits derived from both alternatives may include additional option and existence value through preservation, a hedge against uncertain stock assessments for more species, limited protection of deepwater species, and enhanced diversity of deepwater and mid-shelf species. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations. The benefits are likely to be realized mainly for mid-shelf species rather than the deepwater species. Thus, **Alternatives 4, 5, and 6** have been proposed; however, there is no information regarding these sites at this time other than they appear to be situated to the east of **Alternatives 1 and 2**. To the extent that these new areas would encompass more deepwater stocks and less mid-shelf species, differences in net benefits among the alternatives would be observed.

Alternatives 1 - 6 would prohibit fishing for or possession of snapper grouper species in the Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Costs associated with **Alternatives 1 - 6** may include reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen.

Short-term, net, displacement costs incurred by fishermen would likely be higher for **Alternatives 1 and 2** relative to **Alternatives 4, 5, and 6** since fishermen who harvest mid-shelf species in **Alternatives 1 and 2** would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the mid-shelf species, which is unknown. This conclusion assumes there are fewer operations that would be affected in **Alternatives 4, 5, and 6** if any snapper grouper species were caught in this area. Additionally, displaced vessels, as well as other parts of the fleet, may experience congestion costs as effort relocates to other non-protected areas.

Alternative 7 is the no-action option. Benefits associated with **Alternative 7** relative to the other alternatives may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen. Costs associated with **Alternative 4** relative to the other three alternatives may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind.

The South Atlantic Snapper Grouper Commercial Logbook data were used to estimate landings of snapper grouper species that came from within the Type 2 MPA alternatives. The Southeast Logbook Program provides catch by statistical grid (1 degree squares) which is at a coarser spatial scale than that of the Type 2 MPA sites proposed in this amendment. To assign a proportion of the catch from a logbook grid it was assumed that all snapper grouper catch came from the 50-300m depth range. We then calculated what percentage of the logbook grid contained that bottom (50-300m) and then how much of that was contained within a Type 2 MPA alternative. While this method can help the Council assess the quantitative impacts of the various alternatives, it is not as comprehensive at the Delphi approach which looks at the socioeconomic impacts from a variety of perspectives (including the recreational and scientific sectors).

In terms of catch of deepwater snapper grouper species it can be estimated using the proportional method that **Alternative 3** (25,342 pounds) would have the greatest impact to the commercial sector in regards to loss of catch followed by **Alternative 6** (17,099 pounds), **Alternative 5** (9,507 pounds), and then **Alternative 3** (5,251 pounds). **Alternatives 4 and 1** would have minimal impacts with 243 and 181 pounds of deepwater species landed respectively. Data from 2000 show that an estimated 113,826 pounds of all snapper grouper species were taken from **Alternative 4,** with 86, 957 pounds coming from **Alternative 5**, 84,525 pounds from **Alternative 1**, 80,390 pounds from **Alternative 3**, 54,243 from **Alternative 6**, and 48,023 from **Alternative 2**.

The Delphi panel concluded that the immediate and medium-term impacts of the socioeconomic effects of the proposed North Florida MPA sites would be minimally negative to slightly less than neutral, but the long-term impacts would be either neutral or slightly positive for all sites except **Alternative 1** (SEDEP 2007, Appendix E); immediate weighted impact of **Alternative 1**=-1.48, **Alternative 2**=-1.21, **Alternative 3**=-0.90, **Alternative 4**=-1.29, **Alternative 5**=-1.21, and **Alternative 6**=-0.90; medium-term weighted impact of **Alternative 1**=-0.88, **Alternative 2**=-0.38, **Alternative 3**=-0.29, **Alternative 4**=-0.56, **Alternative 5**=-0.54, and **Alternative 6**=-0.33; long-term weighted impact of **Alternative 1**=-0.27, **Alternative 2**=0.32, **Alternative 3**=0.08, **Alternative 4**=0.19, **Alternative 5**=0.00, and A**lternative 6**=0.03). The Delphi panel concluded that **Alternatives 1** and **4** were inferior to **Alternatives 2, 3, 5,** and **6**. The results of the Delphi panel of the North Florida MPA alternatives are as follows: “Except in one case (**Alternative 4**, long-term, community and social impacts), the panel forecasted negative or neutral socioeconomic impacts to fishermen and communities for all North Florida MPA alternatives over all time frames…both **Alternatives 2** and **3** [deemed the best alternatives] would result in minimally negative immediate impacts that would be significantly different from a neutral effect (SEDEP 2007, Appendix E).”

4.6.3 Social Effects of Management Measure Alternatives

Input received during the public scoping and meeting process indicated that **Alternatives 1 and 2** are heavily fished both commercially and recreationally for mid-shelf snapper groupers species and that there are few deepwater species found in either area. In addition to bottom fishing for snapper grouper, these areas are used to troll for pelagic species. **Alternative 3** was proposed during the Informational Public Hearing held in Jacksonville, Florida by the meeting attendees. **Alternatives 4 and 5** were later added by the Council as a possible compromise between what they believed fisherman requested at public hearing and what was originally proposed.

According to fishermen who attended the public hearing, there is little doubt that **Alternatives 1** and **2** are going to affect mid-shelf species more than deepwater species thus negatively impacting the mid-shelf fishery for both the commercial and private/recreational fishery.

The only thing that can be suggested is that if the recently determined sites created by the Council (**Alternatives 4, 5, and 6**) meet the concerns of the fishermen from the public hearing, in relation to depth, there should be less impact on the fishermen who also rely on the mid-shelf species.

The reduction in the amount of fish being caught as a result of the Type 2 MPAs or as a result of the Type 2 MPAs coupled with Amendment 13C is likely to have a negative impact on those fish houses and dealers that rely on these species as a part of their annual round. Even fish houses and dealers throughout the Carolinas can be impacted because of their relationship to each other and potential lack of supply from their own fishermen and from those that land and sell with other dealers. It is common for fish houses to buy from other fish houses in order to meet the demand of their clientele. A loss of supply for one area may affect the productivity of the fish houses and dealers of another.

Alternatives 1 and 2 would likely have the greatest impact on shore-based activities. With increased pressure for coastal development and an increase in property value for coastal communities, revenue reductions due to Amendment 13C and 14 may lead some to sell or convert their docks and marinas. This would make it more difficult for the commercial fishermen to exist because of a loss of places to dock, offload, and sell their fish. The loss of infrastructure means that there are numerous other directly and indirectly associated businesses that would be negatively impacted. This means that as fish houses close, the workers would be let go. If a marina is sold, it might have a serious impact on the sale of fishing supplies, such as fuel, bait, and tackle. Also to be considered is what the loss of this area would do in terms of a reduction in the number of trips. The reason is that a reduction in number of trips means that crew would not be paid as much regardless if they are paid on a trip by trip basis or a share basis. This could mean a loss of adequate crew or a reduction in total wages for the crew.

Alternative 7 (no action) would not have these impacts.

The Delphi panel predicted the "Community and Social Effects" of the proposed North Florida MPA, in addition to other types of effects. The predicted immediate impacts of the community and social effects of the proposed North Florida MPA ranged from larger than minimally negative to slightly less than minimally negative for every alternative (**Alternatives 1 through 6**: -1.67, -1.53, -0.80, -1.58, -1.51, and -0.86, respectively – SEDEP 2007, Appendix E). Predicted community and social impacts would also be in the minimally negative range after the first year (**Alternatives 1 through 6**: -1.23, -0.76, -0.47, -0.92, -1.03, and -0.44, respectively). Except in one case (**Preferred Alternative 4**), the panel forecasted the proposed North Florida MPA would instigate community and social impacts after five years that would register less than neutral (**Alternatives 1 through 8**: -0.54, -0.05, -0.14, 0.10, -0.11, and -0.23, respectively).

4.6.4 Administrative Effects of Management Measure Alternatives

Alternatives 1 through 6 would have impacts on enforcement as establishment of an Type 2 MPA would require more law enforcement resources than are currently being dedicated to the snapper grouper fishery. SAFMC's Law Enforcement Advisory Panel (LEAP) presented the Council with a report titled the Enforceability of Proposed MPAs. For the report the member States evaluated their assets and categorized their ability to effectively patrol each MPA as either **HIGH**, **MODERATE**, or **LOW**. This rating is based solely on the individual states assets and does not include the assets that their Federal partners may or may not have. This report categorized the North Florida Type 2 MPA as "**LOW**". A "**LOW"** rating means that patrols of the area would only occur during an organized enforcement detail with Federal partners such as NMFS or USCG. The State of Florida does not have the assets or personnel with the proper training to patrol the area. Additional funding will be ***essential*** to increase the ability rating.

In addition, some burden would be experienced by requiring NMFS to provide notice to the public about changes in regulations.

Alternative 7 would not carry these enforcement and administrative costs.

4.6.5 Conclusion

The Council chose **Alternative 4** as their preferred alternative for the proposed Type 2 North Florida MPA because it is an area that has the greatest potential to hold deepwater habitat suitable for deepwater species including snowy grouper and speckled hind. The area also has mud-bottom habitat suitable for golden tilefish. The alternative was developed by the Council during the collaborative process as a compromise between fishermen and the Habitat Advisory Panel. While the Delphi Panel found **Alternative 4** inferior to the other alternatives, the Council determined that it was the best compromise to balance the biological benefits with the social and economic impacts of a Type 2 MPA.

The proposed action is consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed action will protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. This action should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPA, while minimizing adverse social and economic effects.

4.7 St. Lucie Hump MPA

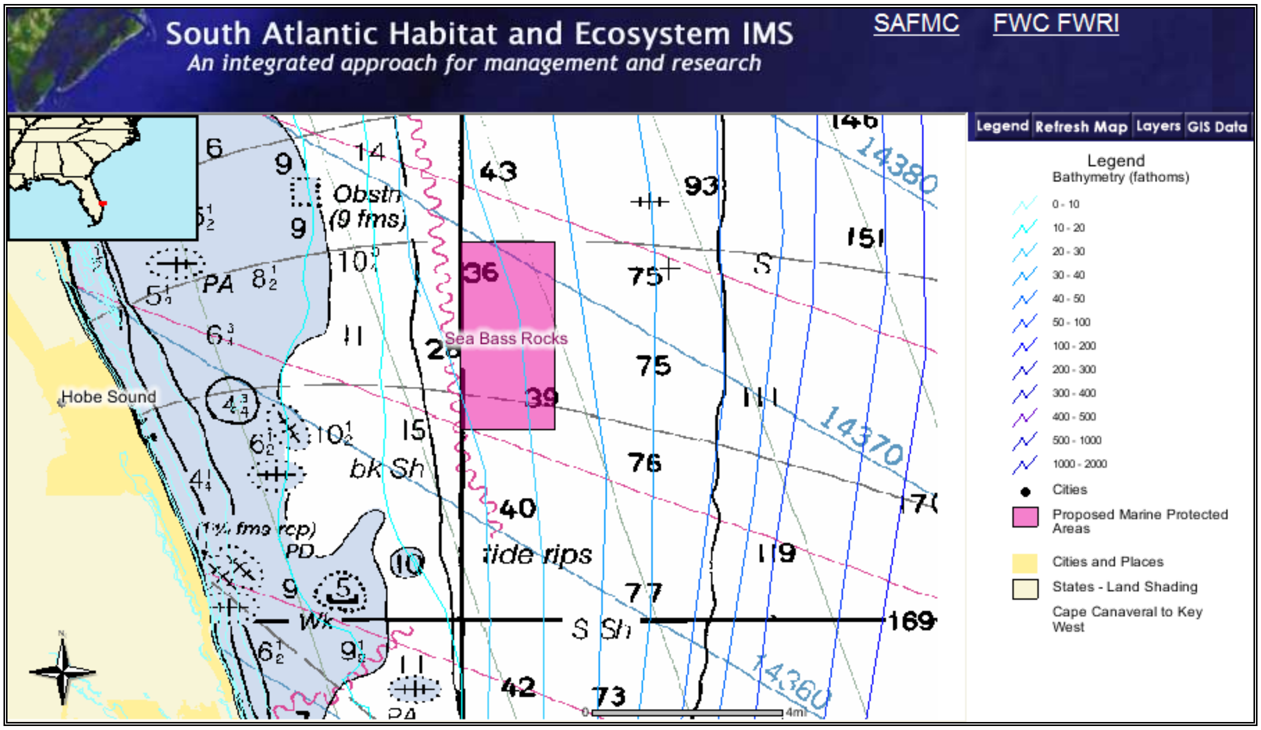
Alternative 1. Preferred Alternative - Establish a Type 2 MPA protecting the St. Lucie Hump, in the area bounded by the following coordinates: The northwest corner at 27°8'N, 80°W; the northeast corner at 27°8'N, 79°58'W; the southwest corner at 27°4'N, 80°W; and the southeast corner at 27°4'N, 79°58'W (Figure 4-24).

Alternative 2. No action. Do not establish a Type 2 MPA at the St. Lucie Hump.

The MPA proposed in **Alternative 1** is located approximately 9 nautical miles southeast of St. Lucie Inlet, Florida. The size of this proposed area is 4 by 2 nautical miles.

Table 4-1 indicates that, of the total grid areas with data (25%), half of those show presence of hard bottom habitat (Figure 4-25). According to input received from the Council's advisors and through the public scoping and hearing process, this area is very habitat rich with many speckled hind, juvenile snowy grouper, Warsaw grouper, and mid-shelf species such as sea bass, red porgy, and red snapper present. This proposed Type 2 MPA is located between two inlets making the area less popular to fish than other hard bottom areas such as "Pushbutton Hill". This area is heavily targeted by fishermen trolling for pelagic species. The St. Lucie Hump Type 2 MPA site occurs in water 66 to 69 meters (216 to 234 feet) deep (Figure 4-24).

The Council only has two alternatives for this action given the special characteristics of the area (very habitat rich, located between fishing areas to the north and south that are more popular or just as popular which reduces the socio-economic impacts, high level of traffic with vessels in transit, etc.). The Council considered other possible sites but only this site came out of the public process used to identify potential sites. Appendix A contains other alternatives considered.



Approximate Corner Points:

(Approx. 9 nm SE of St. Lucie Inlet)

NW 27 Degrees 8 Minutes N. 80 Degrees 0 Minutes W.	NE 27 Degrees 8 Minutes N. 79 Degrees 58 Minutes W.
SW 27 Degrees 4 Minutes N. 80 Degrees 0 Minutes W.	SE 27 Degrees 4 Minutes N. 79 Degrees 58 Minutes W.

Prepared by Roger Pugliese, SAFMC (10/30/06)

Figure 4-24. Proposed St. Lucie Hump (Sea Bass Rocks) Type 2 MPA.

Figure 4-25. Hard bottom data in and near the proposed St. Lucie Hump Type 2 MPA. Source: SEAMAP via http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

4.7.1 Biological Effects of Management Measure Alternatives

There are no MARMAP data available on the occurrence of snapper grouper species in the proposed St. Lucie Hump MPA because the program does not sample the area south of Cape Canaveral, Florida.

Because the targeted species live a long time and grow slowly, it is likely that the desired changes in sex ratio, size, and age structure resulting from establishment of the Type 2 MPAs will not be apparent in the short-term. For example, Roberts *et al*. (2001) found the lag time between establishment of a marine reserve and occurrence of record-size specimens of spotted sea trout, red drum, and black drum corresponded closely to the species longevity, with record-size specimens of longer-lived species taking longer to occur. It follows that, since the mean age at sexual maturity of golden tilefish is 24 years (SEDAR 4 2004), the generations of golden tilefish which are protected from fishing by the Type 2 MPAs will not reproduce until many years after the Type 2 MPAs are implemented. Desired demographic changes may not be detectable at the population level for many years, and would therefore be considered long-term effects of the Type 2 MPAs. However, it is possible that some short-term effects such as more and larger fish would be seen on a timeframe closer to 10 years as Koenig (2001) found with groupers in the Oculina Experimental Closed Area.

There are few fishery independent data for this area as it located near the extreme southern edge of where MARMAP samples. Local knowledge from the Council's scientific advisors and advisors panels indicates that this area holds the desired deepwater species, specifically snowy grouper and golden tilefish.

Alternative 2 (no action) would limit the extent to which management could improve the status of these deepwater fish populations. Traditional fishery management measures may not be as effective as Type 2 MPAs in enhancing the age and size structure of deepwater species.

Alternative 1 is in deeper waters than Kemp's ridley, green, and hawksbill turtles are believed to forage (20 to 50 meters) and likely have little impact on these species. Loggerhead and leatherback turtles may occur within this proposed area. Subsequently, this alternative may provide localized protection to these species from incidental hook-and-line capture. The overall benefit of this area closure for sea turtles will be influenced by its impacts on fishing effort and fishing effort distribution. Evaluating these potential changes in fishing effort and effort distribution is difficult. Without such an evaluation the overall impacts of these area closures on ESA-listed species cannot be known with certainty.

Alternative 2 would maintain the status quo and perpetuate the existing level of risk for ESA-listed species interactions as summarized in the Affected Environment of Snapper Grouper Amendment 13C (SAFMC 2006a).

In summary, the Council believes the proposed St. Lucie Hump Type 2 MPA has the potential to hold the targeted species, based on documentation of the presence of suitable habitat by SEAMAP and public testimony that speckled hind, snowy grouper, and Warsaw grouper are present in the area. Establishment of this Type 2 MPA would be expected to protect these species from fishing pressure within its borders and, over the long-term, promote a more natural sex ratio, age, and size structure.

4.7.2 Economic Effects of Management Measure Alternatives

Alternative 1 is located approximately 9 nautical miles southeast of St. Lucie Inlet, Florida and is 4 by 2 nautical miles in size. **Alternative 1** is very habitat rich with a lot of speckled hind, smaller snowy grouper, Warsaw grouper, and mid-shelf species such as sea bass, red porgy, and red snapper. Although fishery independent data for this alternative is minimal, there is evidence that this area does hold the desired deepwater species, specifically snowy grouper and golden tilefish.

Short-term benefits derived from **Alternative 1** depend on the extent that deepwater species reside and spawn in the proposed protected area. Benefits may include additional option and existence value through preservation, a hedge against uncertain stock assessments for deepwater species, and enhanced size, age, and genetic structure of deepwater species residing in **Alternative 1**. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations. The protected area seems to be located in relatively shallow water; thus, benefits may be accrued for mid-shelf species as well as deepwater species.

Alternative 1 would prohibit fishing for or possession of snapper grouper species in the Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Costs associated with **Alternative 1** may include reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen.

Short-term net displacement costs incurred by fishermen would be correlated to the amount of current fishing effort in this area. It is likely that both recreational and commercial fishermen would be displaced due to the proximity of the site to the east coast of Florida. The configuration of the Type 2 MPA (parallel to the Florida coast) may mitigate avoidance costs to fishermen if they fish in a pattern that is parallel to the coast. The protected area seems to be located in relatively shallow water; thus, fishermen targeting mid-shelf species may experience displacement in addition to those targeting deepwater species. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Alternative 2 is the no-action option. Benefits associated with **Alternative 2** relative to **Alternative 1** may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen. Costs associated with **Alternative 2** relative to **Alternative 1** may include reduced opportunity to protect rare, deepwater, and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind.

The South Atlantic Snapper Grouper Commercial Logbook data were used to estimate landings of snapper grouper species that came from within the Type 2 MPA alternatives. The Southeast Logbook Program provides catch by statistical grid (1 degree squares) which is at a coarser spatial scale than that of the Type 2 MPA sites proposed in this amendment. To assign a proportion of the catch from a logbook grid it was assumed that all snapper grouper catch came from the 50-300m depth range. We then calculated what percentage of the logbook grid contained that bottom (50-300m) and then how much of that was contained within a Type 2 MPA alternative. While this method can help the Council assess the quantitative impacts of the various alternatives, it is not as comprehensive at the Delphi approach which looks at the socioeconomic impacts from a variety of perspectives (including the recreational and scientific sectors).

In terms of catch of deepwater snapper grouper species it can be estimated using the proportional method that 500 pounds of deepwater species were caught in **Alternative 1** and that 642 pounds of all snapper grouper species came from that area.

The Delphi panel concluded the immediate impacts of the socioeconomic effects of the proposed St. Lucie Hump MPA (**Alternative 1**) would be less than minimally negative (-0.67), but the medium- and long-term effects would be slightly larger than neutral and less than minimally positive, respectively (0.10 and 0.63, respectively; SEDEP 2007, Appendix E). In summary, the panel found "..minimal displacement costs would be incurred by the fishing sector as well as dependent communities in the immediate-term if **Alternative 1** was adopted rather than the No Action alternative. On the other hand, minimal ecosystem effects are forecasted starting after one year of implementation of **Alternative 1** (SEDEP 2007, Appendix E)."

4.7.3 Social Effects of Management Measure Alternatives

There are small, deepwater fish taken in **Alternative 1**, and fishermen have suggested that because of the depth you can pop the bladder and still release them (unlike fishing in much deeper water where the fish come up dead or dying). This is an area that is fished by both commercial and recreational fishermen and a closure would not only affect those fisheries but those shore-based activities associated with commercial and recreational fishing. As one fisherman mentioned, there appears to be a fair amount of fishing ground around there so perhaps a Type 2 MPA that allows for trolling would be sufficient.

One fishermen commented that you wouldn't want to ban trolling in this area because a number of dolphin and sailfish are caught here, which makes it a prime location for fishing tournaments.

Alternative 2 (no action) would not have these impacts.

The Delphi panel predicted the "Community and Social Effects" of the proposed St. Lucie Hump Type 2 MPA, in addition to other types of effects. The predicted immediate impacts of the community and social effects of the proposed St. Lucie Hump Type 2 MPA would be minimally negative (**Alternative 1**==0.96), but the medium- and long-term impacts would be neutral (0.02) after the first year and less than minimally positive (0.65) after five years (SEDEP 2007, Appendix E.)

4.7.4 Administrative Effects of Management Measure Alternatives

Alternative 1 would have impacts on enforcement as establishment of a Type 2 MPA would require more law enforcement resources than are currently being dedicated to the snapper grouper fishery. SAFMC's Law Enforcement Advisory Panel (LEAP) presented the Council with a report titled the Enforceability of Proposed MPAs. For the report the member States evaluated their assets and categorized their ability to effectively patrol each MPA as either **HIGH**, **MODERATE**, or **LOW**. This rating is based solely on the individual states assets and does not include the assets that their Federal partners may or may not have. This report categorized the St. Lucie Hump Type 2 MPA as "**MODERATE**". A "**MODERATE"** rating indicates that with some additional assets, or the relocation of existing assets, patrols could be conducted from time to time and during targeted details. Additional funding ***will likely*** be required to increase the ability rating to "HIGH".

In addition, some burden would be experienced by requiring NMFS to provide notice to the public about changes in regulations.

Alternative 2 would not carry these enforcement and administrative costs.

4.7.5 Conclusion

The Council chose **Alternative 1** as their preferred alternative for the proposed St. Lucie Hump Type 2 MPA because, according to information provided by local stakeholders and scientific advisors, this area contains suitable habitat for deepwater snapper grouper species and contains snowy grouper, speckled hind, and Warsaw grouper. The Delphi Panel concluded that minimal displacement costs would be incurred by fishermen or the local community if **Alternative 1** were chosen.

The proposed action is consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed action will protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. This action should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPA, while minimizing adverse social and economic effects.

4.8 East Hump/Un-Named Hump MPA

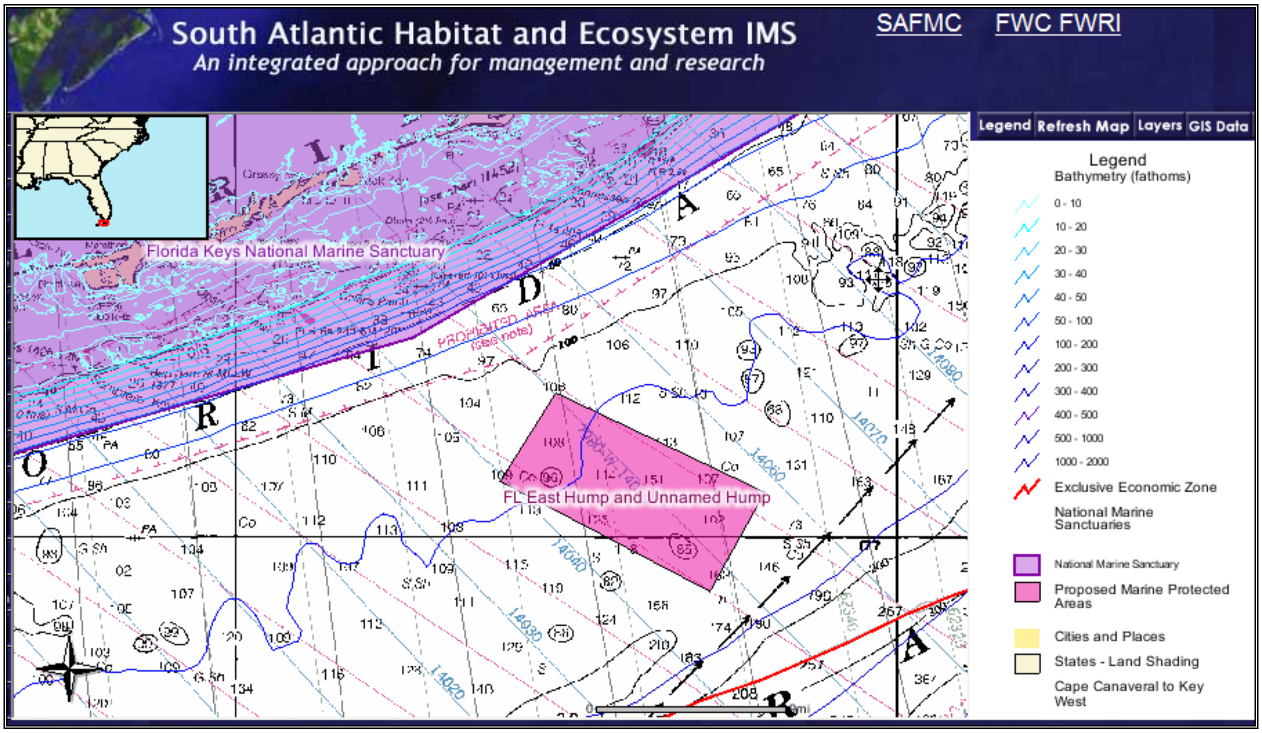
Alternative 1. Preferred Alternative- Establish a Type 2 MPA protecting the East Hump in the area bounded by the following coordinates: The northwest corner at 24°36.5'N, 80°45.5'W; the northeast corner at 24°32'N, 80°36'W; the southwest corner at 24°32.5'N, 80°48'W; and the southeast corner at 24°27.5'N, 80°38.5'W (Figure 4-26).

Alternative 2. No action. Do not establish a Type 2 MPA at the East Hump/Un-Named Hump.

The Type 2 MPA proposed in **Alternative 1** is located approximately 13 nautical miles southeast of Long Key, Florida. The size of this proposed area is 5 by 10 nautical miles.

The Council only has two alternatives for this action given the special characteristics of the area (very habitat rich, located near the Islamorada Hump that is much more popular which reduces the socio-economic impacts, high level of traffic with vessels in transit, etc.). Waters in the proposed Type 2 MPA which includes the East Hump/Unnamed Hump are 194 to 296 meters (636 to 971 feet) deep, while the tops of the humps are 155 to 165 meters (509 to 541 feet) deep (Figure 4-26).

The Council considered other possible sites (e.g., the Islamorada Hump) but only this site came out of the public process used to identify potential sites. Appendix A contains other alternatives considered.



Approximate Corner Points:

(Approx. 13nm SE of Long Key)

NW 24 Degrees 36.5 Minutes N. 80 Degrees 45.5 Minutes W.	NE 24 Degrees 32 Minutes N. 80 Degrees 36 Minutes W.
SW 24 Degrees 32.5 Minutes N. 80 Degrees 48.0 Minutes W.	SE 24 Degrees 27.5 Minutes N. 80 Degrees 38.5 Minutes W.

Prepared by Roger Pugliese, SAFMC (1/03/06)

Figure 4-26. Proposed Florida East Hump Type 2 MPA.

4.8.1 Biological Effects of Management Measure Alternatives

Because the targeted species live a long time and grow slowly, it is likely that the desired changes in sex ratio, size, and age structure resulting from establishment of the Type 2 MPAs will not be apparent in the short-term. For example, Roberts *et al*. (2001) found the lag time between establishment of a marine reserve and occurrence of record-size specimens of spotted sea trout, red drum, and black drum corresponded closely to the species longevity, with record-size specimens of longer-lived species taking longer to occur. It follows that, since the mean age at sexual maturity of golden tilefish is 24 years (SEDAR 4 2004), the generations of golden tilefish which are protected from fishing by the Type 2 MPAs will not reproduce until many years after the Type 2 MPAs are implemented. Desired demographic changes may not be detectable at the population level for many years, and would therefore be considered long-term effects of the Type 2 MPAs. However, it is possible that some short-term effects such as more and larger fish would be seen on a timeframe closer to 10 years as Koenig (2001) found with groupers in the Oculina Experimental Closed Area.

The site of the proposed Type 2 MPA has never been sampled by SEAMAP, so there is no documentation of available habitat. It is located beyond where MARMAP currently samples, so there is no species occurrence data available. However, the Snapper Grouper Committee received a proposal from the Islamorada Charterboat Association explaining the characteristics of the East Hump and Unnamed Hump (both humps are included in the proposed MPA) and discussed it at their October 2001 meeting. The document stated snowy grouper, golden tilefish, and Warsaw grouper were found at the site, as were many other fish species.

Alternative 2 (no action) would limit the extent to which management could improve the status of these deepwater fish populations. Traditional fishery management measures may not be as effective as Type 2 MPAs in enhancing the age and size structure of deepwater species.

Alternative 1 will likely have little impact on Kemp's ridleys, green, and hawksbill turtles because these species are generally found landward of the proposed site. Loggerhead and leatherback turtles may occur within this proposed area. Therefore, this alternative may provide localized protection to these species from incidental hook-and-line capture. **Alternative 1** may also provide benefit to smalltooth sawfish as they occur mainly off peninsula Florida and one was encountered within the vicinity of this site. The overall benefit of this area closure for ESA-listed species will be influenced by its impacts on fishing effort and fishing effort distribution. Evaluating these potential changes in fishing effort and effort distribution is difficult. Without such an evaluation the overall impacts of these area closures on ESA-listed species cannot be known with certainty.

Alternative 2 would maintain the status quo and perpetuate the existing level of risk for ESA-listed species interactions as summarized in the Affected Environment of Snapper Grouper Amendment 13C (SAFMC 2006a).

In summary, the Council believes the proposed East Hump/Un-Named Hump Type 2 MPA has the potential to hold the targeted species, based on a document prepared by the Islamorada Charterboat Association. Establishment of this Type 2 MPA would be expected to protect these species from fishing pressure within its borders and, over the long-term, promote a more natural sex ratio, age, and size structure.

4.8.2 Economic Effects of Management Measure Alternatives

Alternative 1 is located in the vicinity of the area commonly known as the East Hump off the coast of the Florida Keys. It is located approximately 13 nautical miles southeast of Long Key, Florida. The area measures 5 by 10 nautical miles. There are no fishery independent data regarding species occurrence for this proposed site.

It is expected that at some point in the future populations of deepwater snapper grouper species would return to an age and size structure that more closely resembles a virgin stock.

Short-term benefits derived from **Alternative 1** depend on the extent that deepwater species reside and spawn in the proposed protected area. Benefits may include additional option and existence value through preservation, a hedge against uncertain stock assessments for deepwater species, and enhanced size, age, and genetic structure of deepwater species residing in **Alternative 1**. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations.

Alternative 1 would prohibit fishing for or possession of snapper grouper species in the Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Costs associated with **Alternative 1** may include reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen.

Short-term, net, displacement costs incurred by fishermen would be correlated to the amount of current fishing effort in this area. It is likely that both recreational and commercial fishermen would be displaced due to the proximity of the site to the Florida Keys. The configuration of the Type 2 MPA (perpendicular to the Florida Keys Marine Sanctuary) may mitigate avoidance costs to fishermen rather than if the area had been parallel. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Alternative 2 is the no-action option. Costs associated with **Alternative 2** relative to **Alternative 1** may include reduced opportunity to protect deepwater species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish deepwater stocks in these areas; inefficient use of societal resources if deepwater species landings were at a level that did not maximize net social benefit; and reduction in option and existence values for deepwater species. Benefits associated with **Alternative 2** relative to **Alternative 1** may include no reduction in incomes or utility of displaced commercial and recreational fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the snapper grouper fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species (e.g., yellowtail snapper) by displaced fishermen.

The South Atlantic Snapper Grouper Commercial Logbook data were used to estimate landings of snapper grouper species that came from within the Type 2 MPA alternatives. The Southeast Logbook Program provides catch by statistical grid (1 degree squares) which is at a coarser spatial scale than that of the Type 2 MPA sites proposed in this amendment. To assign a proportion of the catch from a logbook grid it was assumed that all snapper grouper catch came from the 50-300m depth range. We then calculated what percentage of the logbook grid contained that bottom (50-300m) and then how much of that was contained within a Type 2 MPA alternative. While this method can help the Council assess the quantitative impacts of the various alternatives, it is not as comprehensive at the Delphi approach which looks at the socioeconomic impacts from a variety of perspectives (including the recreational and scientific sectors).

In terms of catch of deepwater snapper grouper species it can be estimated using the proportional method that 2,415 pounds of deepwater snapper grouper species were taken from **Preferred Alternative 1** (data from 2000) and that 18,503 pounds of all snapper grouper species also came from this area.

The Delphi panel concluded the immediate socioeconomic impacts of the proposed East Hump MPA site (**Alternative 1**) would be less than minimally negative (-0.35), but the medium- and long-term effects would be slightly and minimally positive, respectively (0.35 and 0.96, respectively; SEDEP 2007, Appendix E). The panel concluded, "adoption of **Alternative 1** seems preferable to the No Action alternative from a socioeconomic impact perspective since minimal ecosystem effects start to be realized after only one year and continue into the future, long-term minimal benefits are realized by fishers and their communities, forecasted costs are not significantly different from a neutral impact, and stakeholder consensus regarding the placement of the MPA is high (SEDEP 2007, Appendix E)."

4.8.3 Social Effects of Management Measure Alternatives

The Council had originally proposed a Type 2 MPA in the area of the well known Islamorada Hump. This is an area that is socially and economically important to this section of the Florida Keys. The East Hump alternative (**Alternative 1**) was proposed to the Council by local fishing organizations and is believed to have similar biological benefits as the Islamorada Hump site with less social and economic impact due to its location being distant from Marathon and Islamorada fishing ports. According to the minutes from January 22, 2004 in Islamorada, Florida, the recreational industry appears to be pleased with what the Council has decided in regards to the type of MPA selected (Type 2) and the repositioning from the Islamorada Hump to the East Hump alternative. There appears to be a great deal of bottom fishing that goes on around these areas, and according to both the private/recreational and commercial fishermen attending the meeting, these areas are able to hold the effort of anyone who has been displaced from the site.

Alternative 2 (no action) would not have these impacts.

The Delphi panel predicted the "Community and Social Effects" of the proposed East Hump MPA, in addition to other types of effects. The immediate impacts of the community and social effects of the proposed East Hump Type 2 MPA site (**Alternative 1**) would be less than minimally negative (-0.50), but they would range from less than minimally positive to minimally positive after the first year (0.28) and after five years (0.94), respectively (SEDEP 2007, Appendix E).

4.8.4 Administrative Effects of Management Measure Alternatives

Alternative 1 would have impacts on enforcement as establishment of an MPA would **Alternative 1** would have impacts on enforcement as establishment of a Type 2 MPA would require more law enforcement resources than are currently being dedicated to the snapper grouper fishery. SAFMC's Law Enforcement Advisory Panel (LEAP) presented the Council with a report titled the Enforceability of Proposed MPAs. For the report the member States evaluated their assets and categorized their ability to effectively patrol each MPA as either **HIGH**, **MODERATE**, or **LOW**. This rating is based solely on the individual states assets and does not include the assets that their Federal partners may or may not have. This report categorized the East Hump Type 2 MPA as "**MODERATE**". A "**MODERATE"** rating indicates that with some additional assets, or the relocation of existing assets, patrols could be conducted from time to time and during targeted details. Additional funding ***will likely*** be required to increase the ability rating to "HIGH".

In addition, some burden would be experienced by requiring NMFS to provide notice to the public about changes in regulations.

Alternative 2 would not carry these enforcement and administrative costs.

4.8.5 Conclusion

The Council chose **Alternative 1** as their preferred alternative for the proposed East Hump/Un-Named Hump Type 2 MPA because it has the potential to hold the targeted species, based on a document prepared by the Islamorada Charterboat Association. Establishment of this Type 2 MPA would be expected to protect these species from fishing pressure within its borders and, over the long-term, promote a more natural sex ratio, age, and size structure. In addition the Delphi Panel concluded adoption of **Alternative 1** seems preferable to the No Action alternative from a socioeconomic impact perspective since minimal ecosystem effects start to be realized after only one year and continue into the future, long-term minimal benefits are realized by fishers and their communities, forecasted costs are not significantly different from a neutral impact, and stakeholder consensus regarding the placement of the MPA is high (SEDEP 2007; Appendix E)."

The proposed action is consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed action will protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. This action should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPA, while minimizing adverse social and economic effects.

4.9 Charleston Deep Artificial Reef MPA

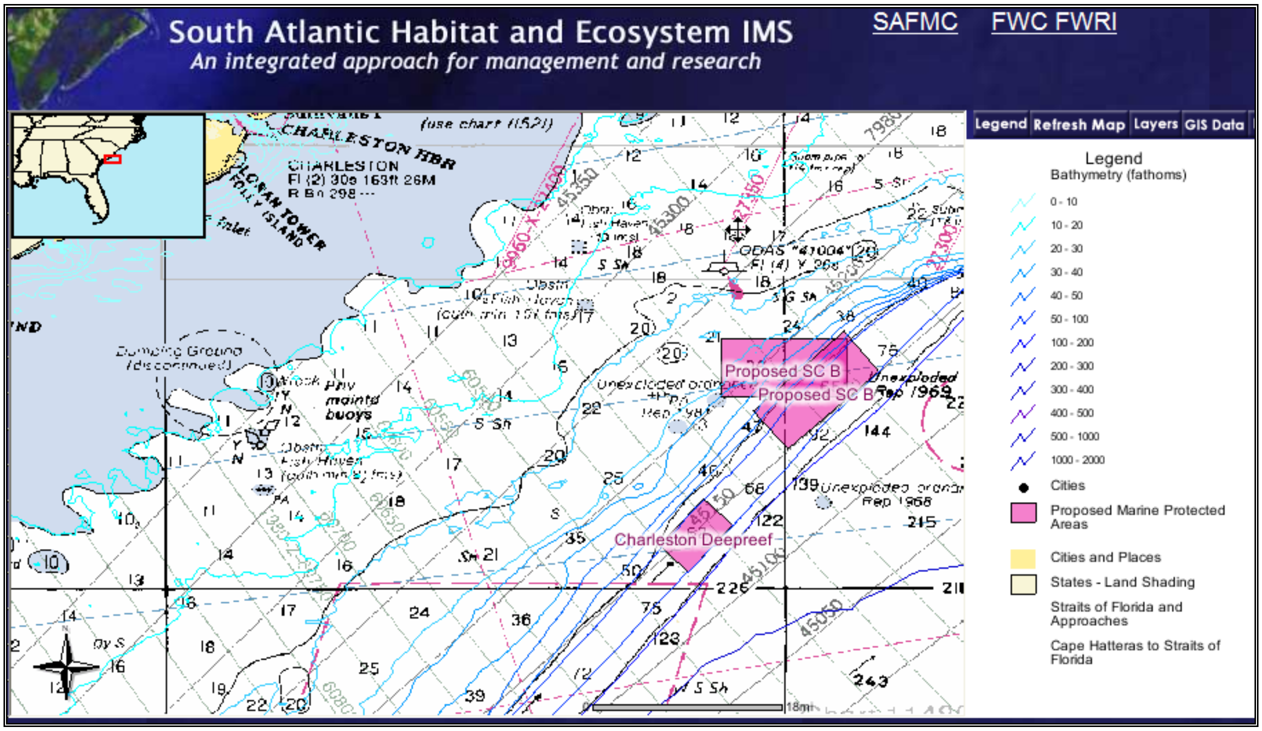
Alternative 1 (Preferred Alternative). Establish an experimental artificial reef Type 2 MPA off the Coast of South Carolina in the area bounded by the following coordinates: The northwest corner at 32°4'N, 79°12'W; the northeast corner at 32°8.5'N, 79°7.75'W; the southwest corner at 32°1.5'N, 79°9.3'W; and the southeast corner at 32°6'N, 79°5'W (Figure 4-27).

Alternative 2. No action. Do not establish an experimental artificial reef Type 2 MPA off the coast of South Carolina.

Throughout the many rounds of public meetings the Council has held regarding MPAs, one of the most common sentiments from members of the public was that the Council use artificial reefs instead of natural bottom as MPAs and/or build more artificial reefs to mitigate for the loss to users of natural bottom that has been designated a MPA. Advisors to the Council have also suggested that artificial reefs can be used as a tool to study the enforcement of closed areas, monitoring of closed areas, and many other scientific questions. The Council is considering establishing an experimental artificial reef Type 2 MPA to help study some of the questions surrounding MPAs and artificial reefs.

The Council has only two alternatives for this action given the unique nature of this type of MPA (artificial reef, built on sand bottom). The alternative was developed by Council staff and biologists from the State of South Carolina. In developing this alternative they looked to avoid known hardbottom habitat (from SEAMAP data) but to place a site just offshore of where other artificial reefs were being studied.

Alternative 1 is located approximately 50 nautical miles southeast of Charleston Harbor, South Carolina. The area measures 3.5 by 6 nautical miles. The proposed site for the Charleston Deep Artificial Reef MPA is 100 to 150 meters (328 to 492 feet) deep (Figure 4-27).



Approximate Corner Points:
(Approx. 50 nm SE of Charleston Harbor)

NW 32 Degrees 4 Minutes N. 79 Degrees 12 Minutes W.	NE 32 Degrees 8.5 Minutes N. 79 Degrees 7.75 Minutes W.
SW 32 Degrees 1.5 Minutes N. 79 Degrees 9.3 Minutes W.	SE 32 Degrees 6 Minutes N. 79 Degrees 5 Minutes W.

Prepared by Roger Pugliese, SAFMC (10/30/06)

Figure 4-27. Proposed Charleston Deep Artificial Reef Type 2 MPA.

4.9.1 Biological Effects of Management Measure Alternatives

SEAMAP data (SEAMAP 2001) indicate the lack of hard bottom within this artificial reef MPA alternative (Figure 4-28). Approximately 6% of the area has been sampled, of which 0% is known hard bottom (Table 4-1). Figure 4-29 shows that no deepwater species have been collected by MARMAP within the proposed Charleston Deep Artificial Reef MPA. However, many deepwater species (snowy grouper, golden tilefish, and speckled hind) have been collected in the waters surrounding this area. The Charleston Deep Artificial Reef Type 2 MPA would be located shallower than the preferred habitat depth for golden tilefish and is deeper than the shelf edge habitat where midshelf species are found. The proposed Type 2 MPA is in a depth range preferred by juvenile snowy grouper, speckled hind, and Warsaw grouper. Management benefits may be realized as artificial reefs can be used as a tool to study the enforcement of closed areas, monitoring of closed areas, and many other scientific questions. Any biological benefits to deepwater species would accrue after artificial reef material (such as sunken ships, tanks, or highway materials) was added to the site to improve the available habitat and attract fish from elsewhere.

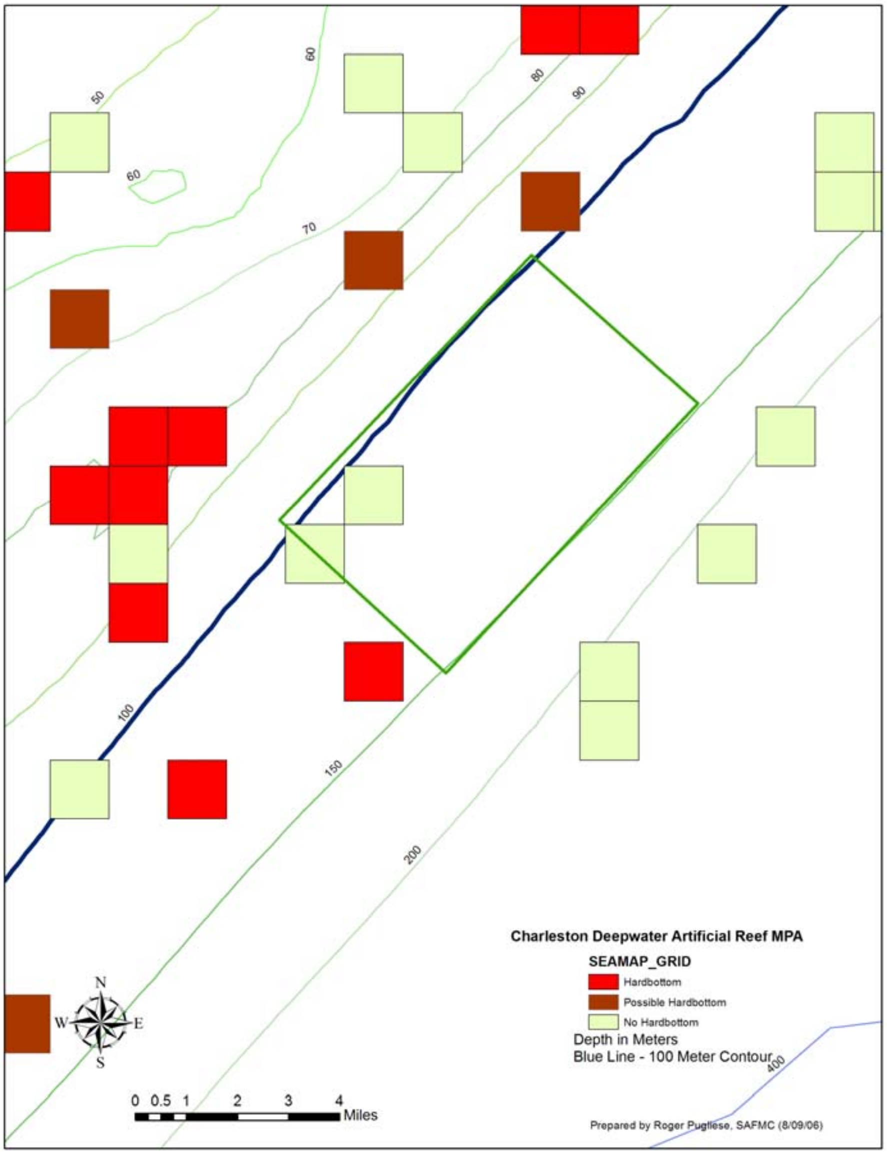


Figure 4-28. Bottom Habitat in Charleston Deep Type 2 Artificial Reef MPA.

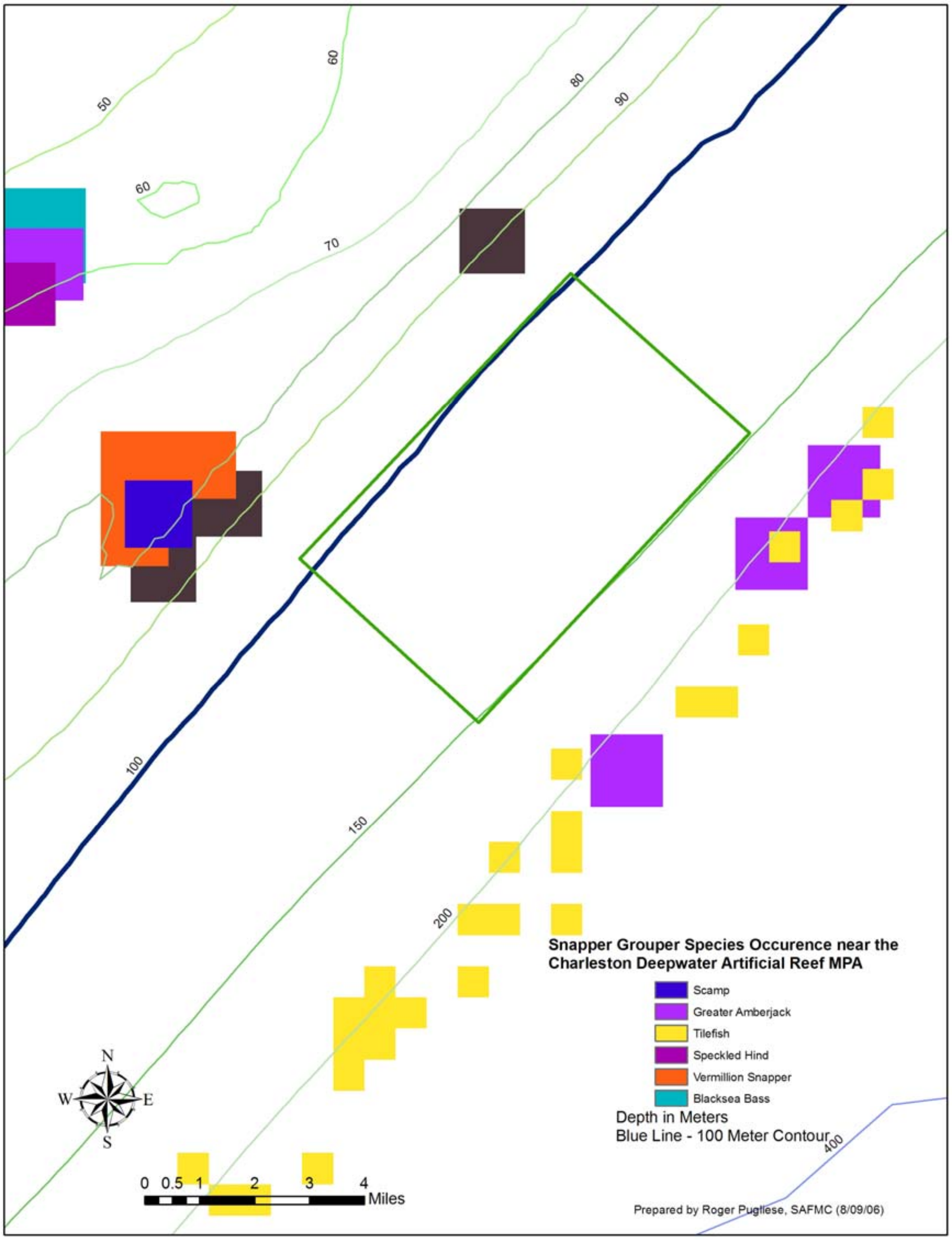


Figure 4-29. Deepwater snapper grouper species occurrence near the proposed Charleston Deep Artificial Reef Type 2 MPA.
Source: MARMAP via http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

Figure 4-30 shows a few collections of spawning golden tilefish and blueline tilefish in the waters surrounding the proposed Charleston Deep Artificial Reef Type 2 MPA. It is believed that currently there are no snapper grouper species found in this area as it does not appear to contain desirable habitat. The biological effects of making this area a Type 2 MPA come after material is placed on the sand bottom and an artificial reef is created. It may take some time before this site becomes populated with the deepwater species the Council intends to protect. However sites previously created by programs such as South Carolina Department of Natural Resources have proven to be effective at attracting snapper grouper species around artificial material.

MARMAP data show multiple collections of snowy grouper, speckled hind, and golden tilefish both to the inshore and offshore side of this location. There have also been collections of spawning blueline and golden tilefish surrounding this proposed Type 2 MPA. It is unlikely that golden tilefish will be attracted to artificial structure as they prefer a mud habitat. Furthermore, the site is too shallow for golden tilefish. However, artificial material placed in the proposed site would be expected to attract juvenile snowy grouper, speckled hind, Warsaw grouper, and possibly blueline tilefish.

The depth of the protected area proposed under **Alternative 1** will likely have little impact on Kemp's ridleys, green, and hawksbill turtles because these species are generally found landward of the proposed site. Loggerhead and leatherback turtles may occur within this proposed area. Therefore, this alternative may provide localized protection to these species from incidental hook-and-line capture. The overall benefit of this area closure for sea turtles will be influenced by its impacts on fishing effort and fishing effort distribution. Evaluating these potential changes in fishing effort and effort distribution is difficult. Without such an evaluation the overall impacts of these area closures on ESA-listed species cannot be known with certainty.

Alternative 2 would maintain the status quo and perpetuate the existing level of risk for ESA-listed species interactions as summarized in the Affected Environment of Snapper Grouper Amendment 13C (SAFMC 2006a).

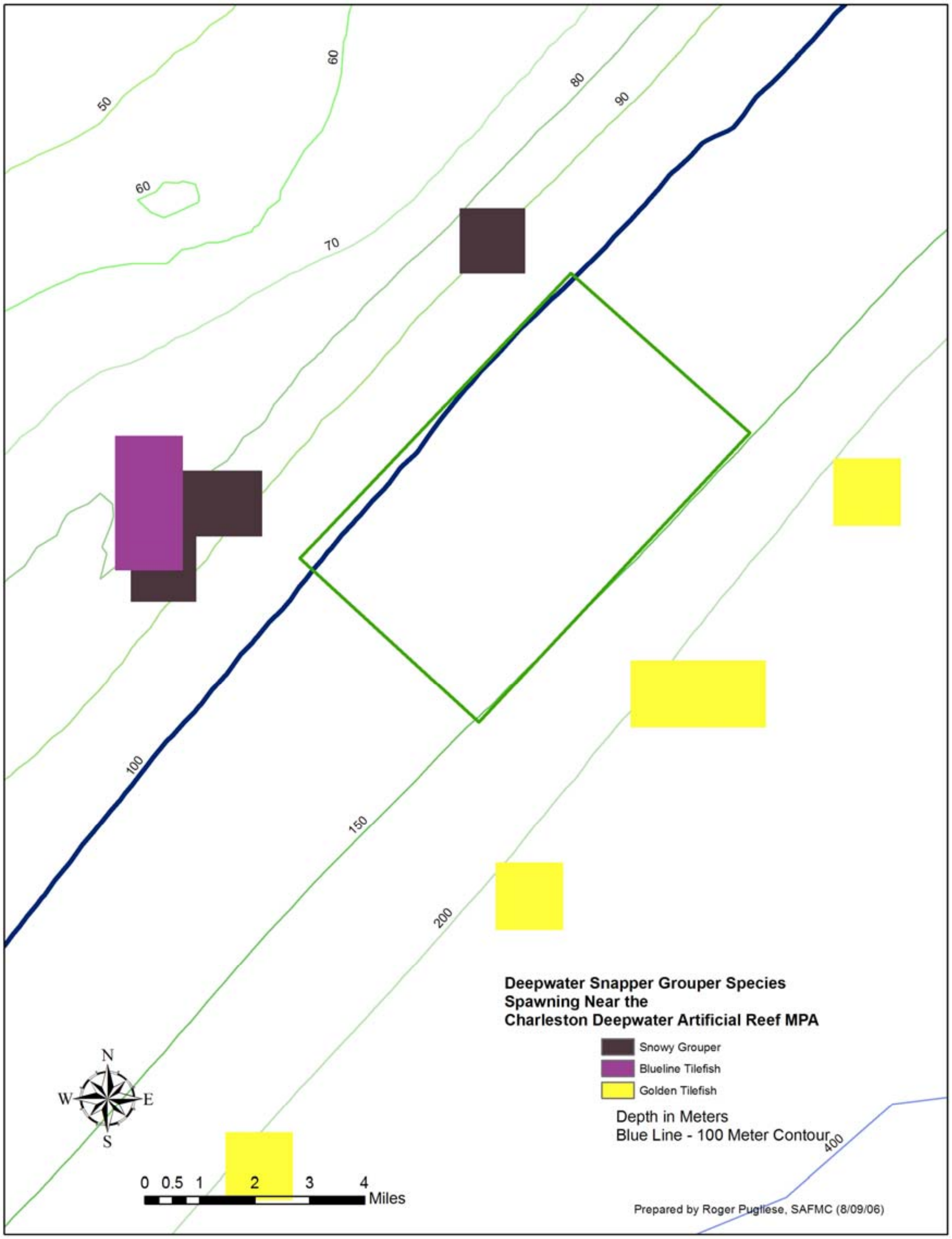


Figure 4-30. Occurrence of spawning deepwater snapper grouper species near the Charleston Deep Artificial Reef Type 2 MPA.
Source: MARMAP via http://ocean.floridamarine.org/efh_coral/ims/viewer.htm.

4.9.2 Economic Effects of Management Measure Alternatives

Alternative 1 is located approximately 50 nautical miles from Charleston Harbor (South Carolina). The area measures 3.5 by 6 nautical miles. It is believed that currently no snapper grouper species are found in this area because it does not contain the desirable habitat.

Since this area does not contain any hardbottom, and it is believed there are no snapper grouper species found in this area, short-term stock benefits probably will not be realized for **Alternative 1**. Longer-term benefits such as enhanced size, age, and genetic structure of deepwater species residing in **Alternative 1** and increased aggregate biomass and reduced harvest variability may be realized after the artificial reef is constructed. These benefits will depend on the amount of the stock that migrates into the area from the inshore and offshore sides of the Type 2 MPA. Additional benefits may arise if spawning stocks of golden and blueline tilefish migrate to this area. Management benefits may be realized
as artificial reefs can be used as a tool to study the enforcement of closed areas, monitoring of closed areas, and many other scientific questions.

Alternative 1 would prohibit fishing for or possession of snapper grouper species within the Type 2 MPA (However, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). The prohibition is expected to have no immediate effect on current fishery practices, because it is believed that no snapper grouper species are found in the area. If artificial reef material was introduced and fish were attracted to the MPA from outside the area, the loss of those fish from the potentially harvestable stock would have some degree of economic effect. However, given the relatively small size of the proposed MPA, the impact of such relocation of fish is likely to be minor. Costs of **Alternative 1** would include those associated with the creation, enforcement, and studying of the Type 2 MPA.

Alternative 2 is the no-action option. Costs associated with **Alternative 2** relative to **Alternative 1** may include reduced opportunity to protect deepwater species that may migrate and spawn in these areas and the foregone species variety that could result; loss of the opportunity to create deepwater stocks in these areas; and reduction in option and existence values for deepwater species that would reside in the artificial reef area. Benefits for no action would mainly include the mitigation of any costs associated with the creation, enforcement, and studying of the proposed Type 2 MPA.

The Delphi panel concluded the immediate, medium-term, and long-term socioeconomic impacts of the proposed Charleston Deep Artificial Reef site (**Alternative 1**) would be slightly positive (0.23, 0.27, and 0.36, respectively). The panel predicted "Alternative 1 is preferable to No Action for the Charleston Deep Artificial Reef MPA as minimal long-term ecosystem benefits are forecasted without incurring any other net impacts that are significantly different from a neutral effect (SEDEP 2007, Appendix E)."

4.9.3 Social Effects of Management Measure Alternatives

Throughout the many rounds of public meetings the Council has held regarding MPAs, one of the most common sentiments from members of the public was that the Council use artificial reefs instead of natural bottom as MPAs and/or build more artificial reefs to mitigate for the loss to users of natural bottom that has been designated a MPA. Advisors to the Council have also suggested that artificial reefs can be used as a tool to study the enforcement of closed areas, monitoring of closed areas, and many other scientific questions. The Council is proposing to establish an experimental artificial reef Type 2 MPA to help study some of the questions surrounding MPAs (**Alternative 1**).

Data suggests that no deepwater species have been collected by MARMAP within the proposed Charleston Deep Artificial Reef Type 2 MPA. However, many deepwater species (snowy grouper, golden tilefish, and speckled hind) have been collected in the waters surrounding this area. Therefore, there should be no immediate negative social impacts from designating this area as an Type 2 MPA. However, if artificial reef material was introduced and fish were attracted to the Type 2 MPA from outside the area, the loss of those fish from the potentially harvestable stock may cause frustration among fishermen who may perceive a net negative effect to their livelihood from this Type 2 MPA. However, given the relatively small size of the proposed Type 2 MPA, the impact of such relocation of fish is likely to be minor.

Alternative 2 (no action) would not have these impacts.

The Delphi study predicted the community and social impacts of the proposed (and only) Charleston Artificial Reef Type 2 MPA site (**Preferred Alternative 1**), in addition to other types of impacts. The predicted immediate, medium-term, and long-term effects were less than minimally positive (0.29, 0.43, and 0.71, respectively). The panel predicted ". . . societal gains in the form of existence and option values would be realized. Fishermen and dependent communities would . . . benefit as spillover effects would create new economic activities" (SEDEP 2007, Appendix E).

4.9.4 Administrative Effects of Management Measure Alternatives

Alternative 1 would have impacts on enforcement as establishment of a Type 2 MPA would require more law enforcement resources than are currently being dedicated to the snapper grouper fishery. SAFMC's Law Enforcement Advisory Panel (LEAP) presented the Council with a report titled the Enforceability of Proposed MPAs. For the report the member States evaluated their assets and categorized their ability to effectively patrol each MPA as either **HIGH**, **MODERATE**, or **LOW**. This rating is based solely on the individual states assets and does not include the assets that their Federal partners may or may not have. This report categorized the Charleston Deep reef Type 2 MPA as "**LOW**". A "**LOW"** rating means that patrols of the area would only occur during an organized enforcement detail with Federal partners such as NMFS or USCG. The State of South Carolina does not have the assets or personnel with the proper training to patrol the area. Additional funding will be ***essential*** to increase the ability rating.

When artificial reef material is added to the site, it will be provided by non-federal entities (Council minutes, June 2006 meeting), resulting in no additional federal administrative costs for material identification, transport, and placement. If a state elected to take on such costs, they would cause an administrative burden at the state government level.

In addition, some burden would be experienced by requiring NMFS to provide notice to the public about changes in regulations.

Alternative 2 would not carry these enforcement and administrative costs.

4.9.5 Conclusion

The Council chose to create the Charleston Deep Artificial Reef Type 2 MPA (**Alternative 1**) in order to better study the enforcement of Type 2 MPAs, monitoring of Type 2 MPAs, and many other scientific questions. The Delphi Panel predicted that societal gains in the form of existence and option values would be realized; fishermen and dependent communities would benefit as spillover effects would create new economic activities.

This action responds to the many suggestions received during the many rounds of public meetings that the Council use artificial reefs instead of natural bottom as MPAs and/or build more artificial reefs to mitigate for the loss to users of natural bottom that has been designated a MPA. While the Council concluded that only using artificial reefs instead of natural bottom would not be sufficient, creation of the Charleston Deep Artificial Reef Type 2 MPA will allow research to be conducted and hopefully document the benefits of such artificial reefs.

The proposed action is consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed action will protect a portion of the population (including spawning aggregations) and create new habitat for long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. This action should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPA, while minimizing adverse social and economic effects.

4.10 Shark Bottom longlines

Alternative 1. Preferred Alternative - Prohibit the use of shark bottom longlines in the proposed Type 2 MPAs.

Alternative 2. No action. Do not prohibit use of shark bottom longlines in the proposed Type 2 MPAs.

The Council is proposing to prohibit use of shark bottom longlines within the proposed Type 2 MPAs to avoid three negative outcomes. First, there is bycatch of deepwater snapper grouper species in the shark bottom longline fishery in the proposed Type 2 MPAs. Although this bycatch is currently small, it could increase as the snapper grouper stocks recover. Second, use of shark bottom longlines would damage essential fish habitat in the proposed Type 2 MPAs. Third, use of shark bottom longlines in the proposed Type 2 MPAs would create an enforcement loophole which would make it more difficult to keep people from using bottom longlines to catch snapper grouper species in the proposed Type 2 MPAs.

4.10.1 Biological Effects of Management Measure Alternatives

The extent of snapper grouper bycatch in the shark bottom longline fishery was evaluated using three approaches: A direct count of bycatch, an expanded estimate based on observed shark bottom longline sets, and an expanded estimate based on observed bottom longline sets and an estimate of overall fishing effort.

First, the observed shark bottom longline sets over the previous twelve years, from 1994 through 2006, were analyzed. The proposed South Atlantic Type 2 MPAs were plotted with the sets as shown in Figures 4-31 and 4-32. The points indicate the beginning and end points of the sets themselves and then they're connected by the line between the two points. Out of 1,563 observed sets over the approximately twelve-year period, 34 of those sets intersected at some point with one or more of the proposed Type 2 MPAs. The northernmost areas are shown in Figure 4-31 and the southern areas are shown in Figure 4-32. These two figures demonstrate the level of shark bottom longline effort in the areas around the proposed Type 2 MPAs.

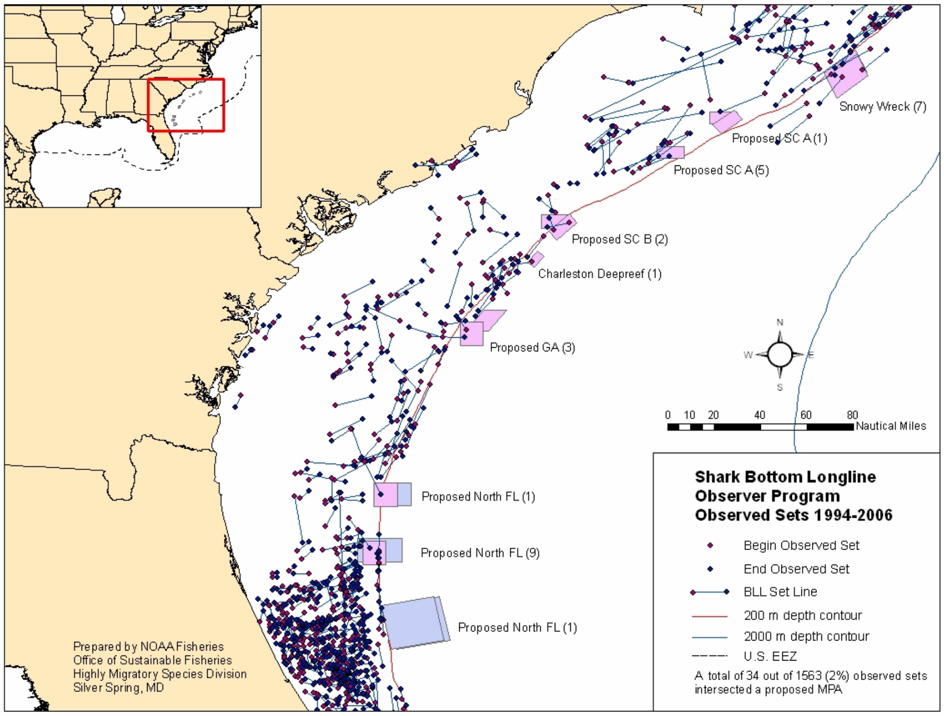


Figure 4-31. Shark bottom longline observed sets from 1994-2006 for the northern zone. Source: Chris Rilling, HMS Management Division, NMFS/NOAA, June 13, 2006.

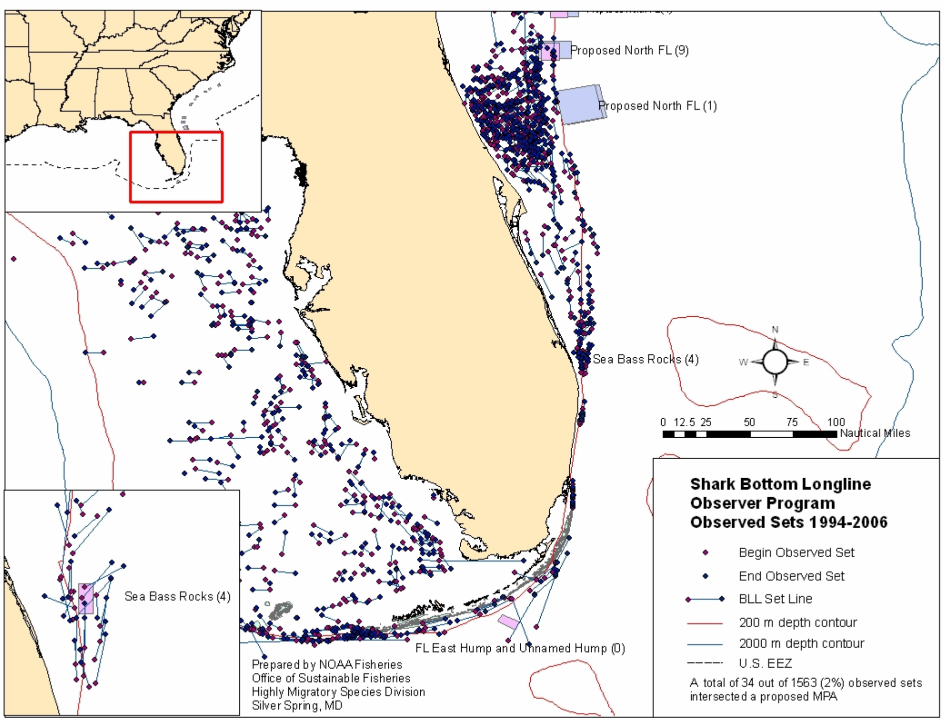


Figure 4-32. Shark bottom longline observed sets from 1994-2006 for the southern zone. Source: Chris Rilling, HMS Management Division, NMFS/NOAA, June 13, 2006.

Figures 4-33 and 4-34 include only the sets that intersected with the Proposed Type 2 MPAs. The Snowy Wreck was clearly one of the top, with seven sets (Figure 4-33). The middle sites for North Florida had nine sets. Most of them had one, two, or fewer than three.

Although most sets began and ended outside the proposed Type 2 MPAs, it was not possible to determine at what point on a set a particular species was caught. Therefore, a set was included if it intersected with any portion of a proposed Type 2 MPA. This resulted in a likely overestimate of snapper grouper bycatch in the proposed Type 2 MPAs because all of the catches on these sets did not necessarily occur in the proposed Type 2 MPAs.

A total of 34 out of 1,563 sets (2%) over the 12-year period at some point intersected with one of the proposed Type 2 MPA alternatives (Table 4-12). The Type 2 MPA alternative with the highest number of sets was the proposed North Florida 2 with 9 sets. The second highest was the Snowy Wreck Type 2 MPA with 7 sets.

Table 4-12. Number of observed sets that intersected with the proposed Type 2 MPA sites. Source: Chris Rilling, HMS Management Division, NMFS/NOAA, June 13, 2006.

Type 2 MPA	**Number of Observed Sets in Type 2 MPAs**
Snowy Wreck	7
Proposed SC A1 (Alt. 1=1; Alt. 2=0)	1
Proposed SC A2 (Alt. 3)	5
Proposed SC B (Edisto Alt. 1&2; the 2 sets hit both sites)	2
Charleston Deep (Artificial Reef)	1
GA (Alt. 1=0; Alt. 2=3)	3
Proposed North FL 1 (Alts 1&4; 1 set hit both sites)	1
Proposed North FL 2 (Alts. 2&5 hard to separate the sets)	9
Proposed North FL 3 (Alts. 3&6 hard to separate the sets)	1
Sea Bass Rocks (St. Lucie Hump)	4
FL East Hump	0
TOTAL	34

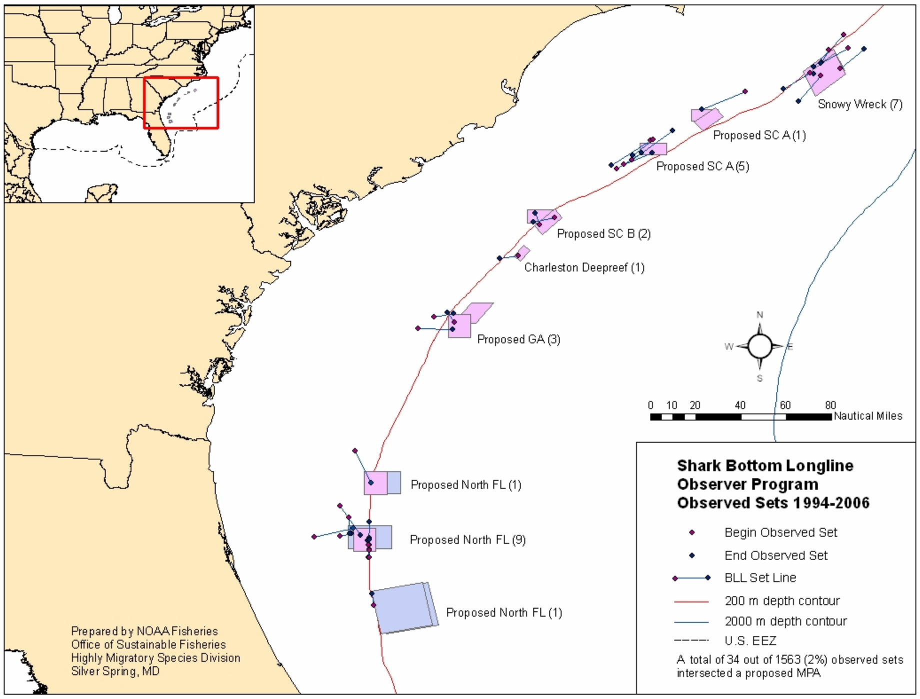


Figure 4-33. Shark bottom longline observed sets from 1994-2006 for the northern zone only showing the trips that intersected a proposed Type 2 MPA alternative.
Source: Chris Rilling, HMS Management Division, NMFS/NOAA, June 13, 2006.

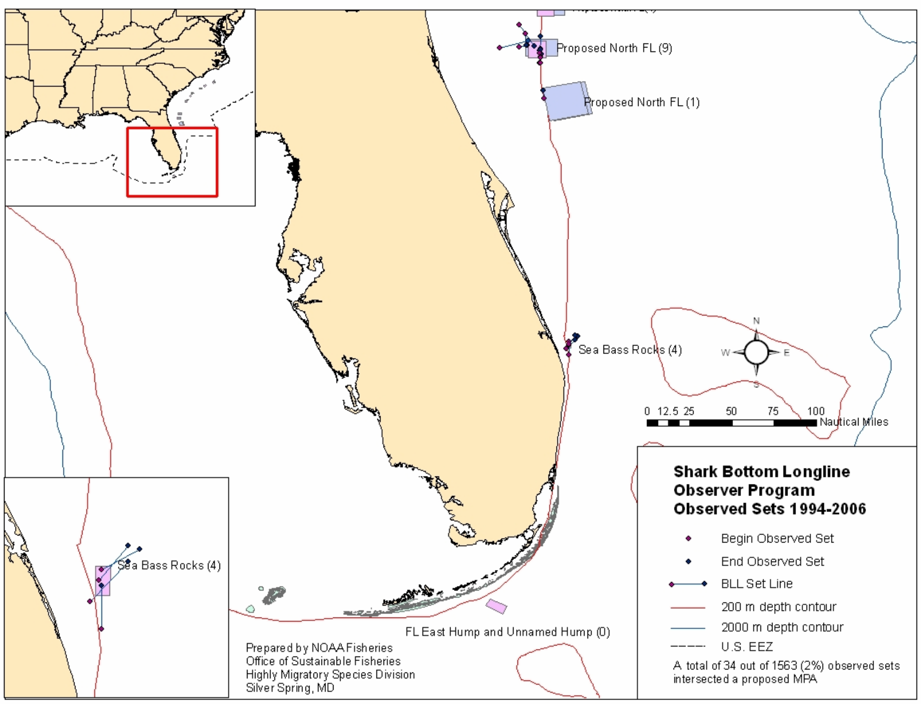


Figure 4-34. Shark bottom longline observed sets from 1994-2006 for the southern zone only showing the trips that intersected a proposed Type 2 MPA alternative.
Source: Chris Rilling, HMS Management Division, NMFS/NOAA, June 13, 2006.

Table 4-13 shows bycatch of non-shark species on observed sets in the Atlantic. Overall, 2.8% of all sets were observed. Based on the 34 observed sets which intersected the MPAs, the impacts of this fishery on the snapper grouper complex appear to be minimal, with 29 grouper observed caught since 1994.

The second analysis expanded the actual number of snapper grouper caught on observed sets in the proposed Type 2 MPAs to estimate those caught on all sets in the proposed Type 2 MPAs. First, the percentage of shark bottom longline trips that were observed was estimated:

Period 1. University of Florida observers 1994-mid-2005
Observed trips = 1,434
% trips observed = 1.6%
Therefore total trips = 89,625 based on a simple ratio analysis (1434*100/1.6)

Period 2. NMFS SEFSC observers mid-2005->
Observed trips = 129
% trips observed = 6.21%
Therefore total trips = 2,077 based on a simple ratio analysis (129*100/6.21)

Therefore total trips = 91,702 (over full time series, 1994-2006)

Total observed bottom longline sets 1994 – 2006 was 1,563
Therefore total % observed trips = 1.7%

Given that 65% of the trips occurred in the Atlantic (Chris Rilling, personal communication), the numbers of snapper grouper species in Tables 4-13 and 4-14 were expanded using a simple ratio analysis. For example, 7 almaco jack were caught in the Atlantic on 1,563 observed trips. The total caught on all trips in the Atlantic was 267 [=(7*(91,702*.65)/1,563)]. The observed catch was expanded for the entire Atlantic and for harvest from the proposed Type 2 MPAs as shown in Tables 4-13 and 4-14. These numbers are for the full 12-year period. There is a high level of uncertainty in the expanded catch estimates described here, due to extrapolation of data from a small sample of longline catches to the entire shark bottom longline fishery. Based on this analysis, 1,106 groupers were caught in the proposed Type 2 MPAs over the 12 year period (Table 4-13).

Table 4-13. Number of non-shark species observed in bottom longline sets that intersected with the proposed Type 2 MPA sites.
Source: Chris Rilling, HMS Management Division, NMFS/NOAA, June 13, 2006; shark observer data. Gregg Waugh, South Atlantic Council staff expanded the catch; methods described above.

CATCHES IN SHARK BOTTOM LONGLINE FISHERY (1994-2006)				EXPANDED CATCH (65% ATLANTIC)	
	Number Caught	Number Caught	Percent Atl.	Number Caught	Number Caught
Species	in MPAs	in Atlantic only	in MPAs	in Atlantic	in MPAs
Almaco jack	1	7	14.3%	267	38
Basket star	1	1	100.0%	38	38
Black sea bass	0	11	0.0%	419	0
Box crab	2	6	33.3%	229	76
Brittle star	4	13	30.8%	496	153
Clearnose skate	2	76	2.6%	2,898	76
Cobia	2	121	1.7%	4,614	76
Conger eel	1	8	12.5%	305	38
Gag grouper	18	74	24.3%	2,822	686
Grouper	1	121	0.8%	4,614	38
Human waste	1	0	#DIV/0!	0	38
Leopard toadfish	2	2	100.0%	76	76
Mahi	3	8	37.5%	305	114
Red grouper	6	186	3.2%	7,093	229
Reticulate moray	1	1	100.0%	38	38
Sharksucker	3	66	4.5%	2,517	114
Skate	1	55	1.8%	2,097	38
Smalltooth sawfish	1	10	10.0%	381	38
Snowy grouper	2	40	5.0%	1,525	76
Starfish	1	52	1.9%	1,983	38
Stingray	5	168	3.0%	6,407	191
Tilefish	0	605	0.0%	23,072	0
Wahoo	3	6	50.0%	229	114
Warsaw grouper	1	8	12.5%	305	38
Yellowfin grouper	1	3	33.3%	114	38
Total Bycatch	63	1,648		62,848	2,403
Total Grouper	29	432		16,475	1,106
Total Grouper + Tilefish	29	1,037		39,547	1,106
Tot. Grouper+Tile+BSB	29	1,048		39,966	1,106

The third estimate of snapper grouper bycatch in the proposed Type 2 MPAs was made by Siegfried *et al.* (2006a). This report (included as Appendix D) examined the same observer data described above, but considered only catches in the preferred alternative sites for Type 2 MPAs. Fourteen sets intersected the preferred Type 2 MPA sites, and of these sets five caught snapper grouper species as bycatch. Four of those five sets occurred in the Snowy Wreck Type 2 MPA. There was not enough data to estimate snapper grouper bycatch in any other proposed preferred or non-preferred Type 2 MPAs: A later inquiry showed data from the non-preferred sites was not sufficient to carry out additional analysis. Although there were nine sets in the proposed North Florida 2 Type 2 MPA (Table 4-12), no snapper grouper species were caught on these sets.

Effort was estimated as follows: "Total effort in the South Atlantic was obtained from the NMFS coastal fishery logbook database, a mandatory reporting program wherein vessel operators provide information on catch, effort, and gear characteristics for each fishing trip. The effort used to select vessels may be biased high because sets with the target species were not identified in the coastal fisheries logbook. . . (Siegfried *et al.* 2006a)." Therefore, trips where sharks and/or snapper grouper species were caught incidentally were included in the analysis. "The U.S. Atlantic Ocean is divided up into statistical areas referred to herein as grids. The proposed MPA total areas were calculated as proportions of each grid. The coastal fishery logbook database was queried to find the total fishing effort . . . by grid (Siegfried *et al.* 2006a)." The Snowy Wreck MPA made up 3.92% of Grid 3376 and 0.84% of Grid 3377. It was estimated that 0.0061 snapper-grouper were caught per thousand hooks in grid 3376 and 0.0586 per thousand hooks for grid 3377. Siegfried *et al.* (2006a) noted that, because logbook data do not give specific details on fishing locations, they assumed ". . .effort was equally distributed across the entire statistical grid when it is much more likely effort was concentrated to specific fishing grounds (Siegfried *et al.* 2006a)." The authors concluded ". . . it is likely the shark bottom longline fishery has minimal impacts on the proposed marine protected areas (Siegfried *et al.* 2006a)."

In summary, all three analyses showed bycatch of snapper grouper species on shark bottom longline sets in the proposed Type 2 MPAs in the last twelve years has been minimal. However, as the stocks of deepwater snapper grouper species recover due to management measures such as the proposed Type 2 MPAs, quotas, and other future management measures, the shark bottom longline fishery may have more impact on deepwater snapper grouper populations. Therefore, it is prudent to eliminate this source of bycatch within the MPAs at this time.

Effects of shark bottom longlines on essential fish habitat in the proposed Type 2 MPAs

There is concern over the impacts to essential fish habitat for snapper grouper species by shark bottom longline gear. The following excerpt from NOAA Technical Memorandum NMFS-SEFSC-449 (Barnette 2001) discusses the impacts of the gear on habitat (cited references can be found in Barnette 2001):

When a vessel is retrieving a bottom longline it may be dragged across the bottom for some distance. The substrate penetration, if there is any, would not be expected to exceed the breadth of the fish hook, which is rarely more than 50mm (Drew and Larsen, 1994). More importantly is the potential effect of the bottom longline itself, especially when the gear is employed in the vicinity of the complex vertical habitat such as sponges, gorgonians, and corals. Observations of halibut longline gear off Alaska included in a North Pacific Fishery Management Council Environmental Impact Statement (NPFMC, 1992) provide some insight into the potential interactions longline gear may have with the benthos. During the retrieval process of longline gear, the line was noted to sweep the bottom for considerable distances before lifting off the bottom. It snagged whatever objects where in its path, including rocks and corals. Smaller rocks were upended and hard coral were broken, though soft corals appeared to be unaffected by the passing line. Fish were observed to move the groundline numerous feet along the bottom and up into the water column during escape runs, disturbing objects in their path. This line motion has been noted for distances of 15.2m (50 ft.) or more on either side of a hooked fish. Based on these observations, it is logical to assume that the longline gear would have minor impact to sandy or muddy habitat areas. However, due to the vertical relief that hardbottom and coral reefs provide, it would be expected that longline gear may become entangled resulting in potential impacts to habitat. Due to a lack of interaction with the benthos pelagic longlines would have a negligible impact.

To the extent that high relief benthic habitat occurs or will occur in the proposed Type 2 MPAs, due to the potential entanglement impacts associated with bottom longlines, excluding their use in the vicinity of benthic habitat such as coral reefs would be an appropriate management measure. Siegfried *et al.* (2006a) found "In the data provided by at-sea observers, there was a noticeable trend of avoiding the MPA when making bottom longline sets targeting sharks, likely due to the avoidance of bottom structure." This provides further evidence that there may be some bottom habitat in the proposed Type 2 MPAs which could be affected by shark bottom longlines.

In Snapper Grouper Amendment 4 (1991), the Council took a number of actions to prohibit gear that interacted with habitat. Use of snapper grouper longlines (i.e., bottom longlines) within 50 fathoms and South of St. Lucie Inlet, Florida was prohibited due to habitat damage; the Council also prohibited longlines in the wreckfish fishery to protect habitat. To improve enforcement of these prohibitions, the Council limited vessels with longline gear aboard to only possessing deepwater species (SAFMC 1998c). The Council's Comprehensive Amendment to the Fishery Ecosystem Plan, which is currently being developed, proposed eliminating any other gear that has the potential to interact with habitat within the proposed Type 2 MPAs. This action has since been moved to the second Comprehensive Amendment anticipated to be addressed in 2008.

4.10.2 Economic Effects of Management Measure Alternatives

Two percent of the 1,563 observed trips intercepted any of the proposed Type 2MPAs. Consequently, it is estimated that the level of impact on shark longline vessels is expected to be minimal. The proposed Type 2 MPAs are small and for a vessel to change the area of a set, would only involve steaming fewer than 10 miles. However, NOAA Fisheries Service encourages further public comment (i.e., in addition to commenting during the DEIS and public hearing stage), especially from Atlantic shark bottom longline fishermen, that may improve that estimate.

Loss of snapper grouper bycatch revenue

Affected vessels will forego some revenue from the loss of snapper grouper bycatch from within the proposed Type 2 MPAs. The expanded harvest obtained using the second method was estimated to be approximately 1,106 groupers, tilefish, and black sea bass over 12 years, for a total of 92.2 fish per year. If this harvest is divided up among the 100 active vessels, the total is approximately 1 fish per vessel per year. If each fish was assumed to weigh 20 pounds, using the price of $2 per pound from the high price category (Figure 3-27), the potential revenue loss per vessel would be $40 per vessel per year. Siegfried *et al.* (2006a) estimated snapper grouper bycatch as the catch per unit of effort (snapper grouper per 1000 hooks) in each grid. The estimated number of snapper grouper caught in each statistical grid per year would be obtained by multiplying this number by the total effort (number of hooks) in that grid, obtained from the coastal logbooks; based on this method, less than one snapper grouper would be caught each year in each of the grids containing the Snowy Wreck MPA (K. Siegfried, NOAA Southeast Fisheries Science Center, personal communication). Therefore, the potential revenue loss per vessel would be extremely low.

Loss of shark revenue

The second method of estimating expanded bycatch of snapper grouper species was applied to shark catches on the same observed sets to obtain the expanded catches of sharks shown in Table 4-14.

The estimated revenue loss per vessel per year from the loss of shark catches (Table 4-15) was calculated as follows. Some species were excluded because, although they were found in the Atlantic, they were not caught in the MPAs. The dusky shark is a protected species and so could not be sold. A few were excluded because average weight could not be estimated. The expanded catch per species was obtained from Table 4-15. The average value per pound for specific shark species in 2005 was obtained from the Accumulated Landings System, along with the average value of shark fins ($19.48 per lb). Where the value for a particular species was not available, the maximum value observed for any shark species was used (shortfin mako, $0.81/lb) (Table 4-15). The average length of most shark species was obtained from the NOAA Fisheries Observer Program, and the average weight of those shark species was estimated based on published length-weight relationships when available (John Carlson, NOAA Fisheries Southeast Fisheries Science Center, Personal Communication). The average total lengths of the

Table 4-14. Number of sharks observed in bottom longline sets that intersected with the proposed Type 2 MPA sites and expanded estimate of number caught in proposed Type 2 MPAs.
Source: Observer data: Chris Rilling, HMS Management Division, NOAA Fisheries Service, June 13, 2006. Expanded catch: Julie Weeder, NOAA Fisheries Service, using methods described in Biological Impacts section.

Catches in Shark Bottom Longline Fishery (1994-2006)				Expanded Catch (65% Atlantic)	
	Actual Number Caught		% Atlantic In MPAs	Estimated Number Caught	
Species	In MPAs	In Atlantic		In Atlantic	In MPAs
Atlantic sharpnose	75	14,386	0.5	548,622	2,860
Bigeye thresher	12	21	57.1	801	458
Blacknose	47	1,116	4.2	42,560	1,792
Blacktip	0	2,716	0	103,577	0
Bonnethead	0	58	0	2,212	0
Bull	5	194	2.6	7,398	191
Carcharhinus spp.	1	13	7.7	496	38
Dusky	32	1,736	1.8	66,204	1,220
Finetooth	0	8	0	305	0
Great Hammerhead	6	251	2.4	9,572	229
Lemon	2	98	2.0	3,737	76
Night	2	145	1.4	5,530	76
Nurse	4	945	0.4	36,038	153
Sand Tiger	1	410	0.2	15,636	38
Sandbar	1,012	19,849	5.1	756,958	38,593
Scalloped Hammerhead	29	895	3.2	34,132	1,106
Shortfin Mako	5	105	4.8	4,004	191
Silky	30	544	5.5	20,746	1,144
Sixgill	1	6	16.7	229	38
Smooth dogfish	1	538	0..2	20517	38
Smooth hammerhead	0	7	0	267	0
Spinner	2	220	0.9	8,390	76
Tiger	549	6,929	7.9	264,243	20,937
Unidentified	1	11	9.1	419	38
Total	1,817	51,201		1,952,593	69,293

remaining species were obtained from Schulze-Haugen *et al.* (2003), and sharks of similar average total length with known average weights were substituted (Silky shark weight was substituted for that of bigeye thresher and sand tiger, dusky shark weight for shortfin mako, and sandbar weight for lemon.) The total dressed weight of each species was calculated as the total weight divided by 1.39 (Table 4-15) (Chris Rilling, NOAA Fisheries HMS, personal communication). The weight of the fins was calculated as 5% of the dressed weight (Rilling, NOAA Fisheries HMS, personal communication). The weight of the flesh was the dressed weight minus the weight of the fins (Table 4-15). The estimated total value of the "lost" shark catches (value flesh and value fins) was $3,886,617 over the 12-year period. The estimated total annual loss was $323,885, and the loss for each of the 100 vessels per year was $3,239.

Table 4-15: Estimated value of expanded catch of shark species in the proposed Type 2 MPAs, 1994-2006.

	Avg. Weight (lbs)	Estimated Total Dressed Weight	Estimated Total Weight Fins	Avg. Value Flesh (per lb)	Estimated Total Value Flesh	Estimated Total Value Fins
Atlantic sharpnose	5.1	10,411	521	0.36	$3,561	$10,141
Bigeye thresher	54.8	18,050	902	0.81	$13,889	$17,581
Blacknose	16.7	21,556	1,078	0.53	$10,853	$20,995
Bull	181.7	24,970	1,249	0.32	$7,591	$24,321
Great Hammerhead	306.2	50,452	2,523	0.21	$10,065	$49,141
Lemon	86.7	4,739	237	0.32	$1,441	$4,616
Night	65.8	3,597	180	0.81	$2,768	$3,503
Nurse	86.7	9,541	477	0.81	$7,342	$9,293
Sand Tiger	54.8	1,498	75	0.81	$1,152	$1,459
Sandbar	86.7	2,406,648	120,332	0.27	$617,305	$2,344,076
Scalloped Hammerhead	62.8	77,372	3,869	0.21	$15,436	$75,361
Shortfin Mako	45.1	6,197	310	0.81	$4,769	$6,036
Silky	54.8	45,085	2,254	0.36	$15,419	$43,913
Spinner	34.8	1,901	95	0.26	$469	$1,851
Tiger	26.6	400,966	20,048	0.32	$121,894	$390,541
Total Value over 12-year period					$3,041,381	$845,236

The third method of estimating snapper grouper abundance, used in Siegfried *et al.* (2006a) was also used to estimate catches of shark species in the proposed MPAs (Siegfried *et al.* 2006b), and the value of that estimate was derived as follows. Siegfried *et al.* (2006a) estimated 2,984 sharks are caught per year in the proposed MPAs (preferred alternative sites only). Because Siegfried *et al.* (2006b) estimated the overall number of sharks caught in the proposed MPAs, not the number of each species of shark, the average weight of the sandbar shark (86.7 lbs.) (the species most commonly caught in the MPAs) and the maximum value observed for any shark species (mako shark-$0.81/lb) (Table 4-14 and 4-15) was used. The same value and conversion factor for fins as was used above was used (Table 4-15). Therefore, the total value of all sharks caught in the proposed Type 2 MPAs each year was estimated as $324,508:

2,984*{[(86.7/1.39)*0.05*$19.48] + [(86.7/1.39)*0.95*$0.81]}

Given that there were 100 vessels, the total estimated annual value of all sharks caught in the proposed Type 2 MPAs per vessel was $3,245.

4.10.3 Social Effects of Management Measure Alternatives

Any gear prohibition has social impacts as it increases the level of regulations and stress on fishermen. This is balanced by the need to protect the habitat in the Type 2 MPAs which will provide benefits to a greater number of individuals than the numbers prevented from using shark bottom longlines in the Type 2 MPAs.

The economic impacts described above are not that large. Given the level of other regulations affecting fishermen, the social impacts from preventing use of bottom longlines within the Type 2 MPAs is not expected to be very large.

4.10.4 Administrative Effects of Management Measure Alternative

The proposed action is needed to ensure law enforcement can effectively prohibit fishing for snapper grouper with bottom longlines in the proposed MPAs. Current regulations do not specify the difference between bottom longlines used to catch snapper grouper species and those used to catch sharks. Fishing regulations for the South Atlantic use the following definition: "*Longline* means a line that is deployed horizontally to which gangions and hooks are attached. A longline may be a bottom longline, *i.e.*, designed for use on the bottom…" (50 CFR 622.2). Fishing regulations for highly migratory species use the following definition: "*Bottom longline* means a longline that is deployed with enough weights and/or anchors to maintain contact with the ocean bottom." (50 CFR 635.2). NOAA Office of Law Enforcement personnel told the Council that it is difficult for boarding officers to determine what species a gear such as bottom longline is targeting, and that officers often rely on the word of the captain of the vessel being boarded as to what species they are targeting. While the gear may be rigged differently to operate in each fishery it can still catch other species, albeit not always as efficiently. Therefore, there is the potential for an enforcement loophole which this action would eliminate.

4.10.5 Conclusion

The Council chose **Alternative 1** because there is potential for bycatch of deepwater snapper grouper species in the shark bottom longline fishery in the proposed Type 2 MPAs. Second, there is potential for the shark bottom longlines to damage essential fish habitat in the proposed Type 2 MPAs. Third, use of shark bottom longlines in the proposed Type 2 MPAs would create an enforcement loophole which would make it more difficult to keep people from using bottom longlines to catch snapper grouper species in the proposed Type 2 MPAs.

The proposed action is consistent with the goals and objectives of the Snapper Grouper FMP as amended. It is anticipated the proposed action will protect a portion of the population (including spawning aggregations) and habitat of long-lived, slow growing, deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish) from directed fishing pressure. This action should begin to move the populations towards a more natural sex ratio, age, and size structure within the proposed Type 2 MPA, while minimizing adverse social and economic effects.

4.11 Research Needs

Mapping needs

- Map the proposed Type 2 MPAs.

Research and monitoring needs

- Model coupled biological and physical properties as well as relevant chemical/nutrient and physiological characteristics.

- Determine and monitor the effect of the Type 2 MPAs on deepwater snapper grouper species' distribution and status.
  - Assess spawning aggregations of deepwater snapper grouper species.
  - Track fish movement.
  - Identify fish population demographics (e.g., size and age structure, sex ratio, etc.) within the Type 2 MPAs.
  - Determine pre-closure distribution of dominant harvested species in and outside the Type 2 MPAs, in order to provide historical context for subsequent assessments.
  - Determine age distribution, nursery grounds, migratory patterns, and mortality rates for dominant harvested fish stocks.

- Identify stressors affecting the Deepwater Type 2 MPAs.
  - Identify natural and anthropogenic stressors (i.e., disease, gear impacts, poaching, enforcement, etc.)

- Identify key trophodynamic functional groups.
  - Identify food web structure and dynamics.
  - Determine impact of lionfish invasion on recovery potential of deepwater snapper grouper species within the Type 2 MPAs.

Assessment needs

- Determine the effect of management measures in the Type 2 MPAs on the status of deepwater snapper grouper fishery stocks:
  - Characterize deepwater snapper grouper species within the Type 2 MPAs compared to reference sites (including distribution and abundance patterns, size and age distribution, spawning aggregation presence, sex ratios, etc.).
  - Characterize fish communities, inside and out, including habitat utilization patterns, trophic interactions, ontogenetic changes, predator-prey relationships, etc.
  - Connectivity to the broader seascape (larval sources and sinks, spill-over effects).

- Determine how oceanographic conditions and episodic events affect fish stock condition, reproduction, and growth:

- Quantify the extent, intensity, and frequency of episodic events (upwelling, storms, etc).
- Assess the impact of episodic events (upwelling, storms, etc).

4.12 Outreach Needs

The list of outreach needs included in this section is modified from the outreach component of the Council's 2005 Oculina Experimental Closed Area (OECA) Evaluation Plan. For additional information about the OECA Evaluation Plan and efforts used to develop the outreach component of the plan, visit: http://www.safmc.net/HabitatManagement/DeepwaterCorals/Oculina/tabid/246/Default.aspx.

The Council will solicit input from its Information and Education Advisory Panel and the Information and Education Committee in reviewing these needs and possibly developing further recommendations. As with the outreach component of the Oculina Experimental Closed Area Evaluation Plan, the Council acknowledges the need to work closely through partnerships to achieve these outreach needs. Possible partners in outreach efforts include, but are not limited to: Sea Grant, NOAA Fisheries, NOAA National Undersea Research Center at the University of North Carolina – Wilmington (NURC/UNCW), NOAA Office for Law Enforcement, individual state marine resources and law enforcement agencies, NOAA National Marine Sanctuary Program, Harbor Branch Oceanographic Institution, Centers for Ocean Sciences Education Excellence (COSEE) in South Carolina and Florida, Project Oceanica, and others.

GOAL: Increase awareness and understanding of the Deepwater Type 2 MPAs among fishermen, citizens, and visitors in the South Atlantic region and the U.S. public.

Project 1: Provide SAFMC regulation brochures to area fishermen.

- *Tasks:* reprint updated federal regulation brochure to include the Type 2 MPAs and distribute to federal, state, and local law enforcement offices for distribution.
- *Justification:* the regulations brochure will provide a summary of regulations and information for the Type 2 MPAs as well as an identification chart for snapper/grouper species found in the area.

Project 2: Work with fishing chart manufacturers (both printed and electronic) and/or vendors to improve available information for the Deepwater Type 2 MPAs

- *Tasks:* identify manufacturers of more commonly used fishing charts in South Atlantic, contact manufacturers and coordinate methods to update products.
- *Justification:* fishermen have expressed concerns that charts commonly used do not currently portray the coordinates and restrictions for new Type 2 MPAs.

Project 3: Develop and distribute news releases (coordinating with local contacts) to focus on law enforcement activities, research and monitoring projects, and the ecological importance of the Type 2 MPAs.

- *Tasks:* work closely with law enforcement agencies (state and federal) to highlight law enforcement activities and cases; create science-based news releases relevant to ongoing research and monitoring activities with focus on habitat, snapper grouper species, and links to ecosystem-based management. Coordinate releases with ongoing activities and strive to provide high resolution photos and graphics to media.
- *Justification:* increase awareness of all activities in the Type 2 MPAs.

Project 4: Develop Powerpoint presentations about Deepwater Type 2 MPAs; distribute on CD, post at Web site, and present to fishing clubs, environmental groups, local governments, etc.

- *Tasks:* design and create a PowerPoint presentation using existing photos, video, maps, and other information to highlight Type 2 MPAs, history of management, research and monitoring activities, law enforcement, etc.
- *Justification:* provides a quick method to distribute information for use by various audiences, can be readily updated.

Project 5: Develop and distribute posters and rack cards/informational brochures at area bait and tackle shops, marinas, fish houses, boating stores, fishing tournaments, boat shows, etc.

- *Tasks:* contract design layout and printing for poster and complimentary rack cards and/or brochure, distribute to targeted businesses and fishing tournament directors.
- *Justification:* effectively designed poster and brochures and/or rack cards would draw attention to the Type 2 MPAs and provide quick access to general information about habitat, fish species, maps, regulations, and law enforcement contacts.

Project 6: Expand the Council's web site to provide comprehensive education and outreach products (e.g., regulations, publications, research and monitoring information, law enforcement activities, news releases, high resolution video and photographs, maps, etc.). Publicize availability of information by having links posted on other fishing/Non-Governmental Organizations/tourism related web sites.

- *Tasks:* enhance the Council website and integrate materials, including links to other relevant sites. Publicize the availability of web-based information.
- *Justification:* The Web site is the best media for maintaining comprehensive, dynamic content and imagery. The availability of this information can be publicized from other existing high-profile Web sites.

Project 7: Develop education products for teachers (K-12) and informal educators, post on SAFMC Web site, and develop packet for distribution to science teachers.

- *Tasks:* Identify, develop, and produce education products
- *Justification:* This was identified as a need at area constituent meetings held to address outreach needs for the OECA Evaluation Plan and determined a priority item by the Information and Education Advisory Panel. Initial ground work will be needed to identify local education needs.

Project 8: Develop TV documentaries working with environmental TV outlets (e.g., Discovery Channel, Public TV, and independent media contractors).

- *Tasks:* produce documentaries for television that feature the Type 2 MPAs; possibly tie in with interest in the proposed Deepwater Coral Habitat Areas of Particular Concern and the Council's approach to ecosystem-based management through the Fishery Ecosystem Plan and Comprehensive Amendment.
- *Justification:* TV is number one way to reach the public.

4.13 Enforcement Needs

There are two very large obstacles facing enforcement of these proposed Type 2 MPAs. The first is the great distance that the majority of these Type 2 MPAs are located from shore. The second is the fact that these are Type 2 areas which allow certain fishing activities to exist. Consequently, occasional flyovers by enforcement aircraft would not be an effective tool; therefore, an on-site enforcement presence will be necessary in order to determine whether the fishing activity is lawful or not.

Law Enforcement Advisory Panel Members representing the member States have evaluated their assets and categorized their ability to effectively patrol each MPA as either HIGH, MODERATE, or LOW. **This rating is based solely on the individual states assets and does not include the assets that their Federal partners may or may not have.**

A **"HIGH"** rating means that the area is easily accessible with the assets and personnel already in place. Such an area may already be patrolled and would not require additional assets. Additional funding ***may*** be required to maintain adequate enforcement patrols.

A **"MODERATE"** rating indicates that with some additional assets, or the relocation of existing assets, patrols could be conducted from time to time and during targeted details. Additional funding ***will likely*** be required to increase the ability rating to "HIGH".

A **"LOW"** rating means that patrols of the area would only occur during an organized enforcement detail with Federal partners such as NMFS or USCG. The States do not have the assets or personnel with the proper training to patrol the area. Additional funding will be ***essential*** to increase the ability rating.

Each proposed Type 2 MPA is listed below by State. Comments on location options are listed as well as the ability of patrol rating.

Florida

1) **North Florida:**	No option preference.	Enforceability: **LOW**
2) **Sea Bass Rocks:**	No location option.	Enforceability: **MODERATE**
3) **East Hump:**	No location option.	Enforceability: **MODERATE**

Georgia

4) **Georgia MPA:**	No option preference.	Enforceability: **LOW**

South Carolina

5) **South Carolina A:**	Location option #3.	Enforceability: **LOW**
6) **South Carolina B:**	Location option #2.	Enforceability: **LOW**
7) **Deep Reef:**	No location option.	Enforceability: **LOW**

North Carolina

8) **Snowy Wreck:**	No location option	Enforceability: **LOW**

Meeting even the LOW rating will only be accomplished at the expense of some other enforcement priority. To accomplish any increase in the enforcement rating/presence would require a substantial funding increase to include:

- Hire, train, and equip additional law enforcement personnel
- Administrative support
    - Personnel
    - Equipment
- Acquire several fully equipped large offshore patrol vessels
- Recurring operational costs
    - Fuel
    - Maintenance
    - Dockage
    - Etc.
- Aircraft surveillance support costs

4.14 Cumulative Effects

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

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

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

This CEA for the biophysical environment will follow these 11 steps. Cumulative effects for the socio-economic environment will be analyzed separately.

4.14.1 Biological

SCOPING FOR CUMULATIVE EFFECTS

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

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

I. The direct and indirect effects of the proposed actions (**Section 4.0**);

II. Which resources, ecosystems, and human communities are affected (**Section 3.0**)? The species primarily affected by the actions in this amendment include snowy grouper, misty grouper, speckled hind, yellowedge grouper, Warsaw grouper, golden tilefish, and blueline tilefish. Other "mid-shelf" species will be affected, including vermilion snapper, scamp, and red porgy; and

III. Which effects are important from a cumulative effects perspective (**information revealed in this CEA**)?

2. Establish the geographic scope of the analysis.

The immediate impact area would be the proposed Type 2 MPA sites and surrounding waters (the reader is to refer to Section 2.0 for maps and coordinates). Since the Type 2 MPA boundaries would be solely political in nature and do not prevent immigration and emigration of fish and fish larvae, the geographic scope of the CEA must be expanded beyond the sites. Tagging studies have not been conducted on deepwater species (i.e., snowy grouper or golden tilefish); however, it is believed that movement of these species is limited (see Section 3.0 for a discussion of species movement). Large scale movement of mid-shelf species (vermilion snapper, black sea bass, and red porgy) has not been documented (McGovern and Meister 1999). However, snowy grouper, golden tilefish, vermilion snapper, black sea bass, and red porgy have pelagic eggs and larvae that may remain in the water column for extended periods of time and travel long distances before late stage larvae or juveniles assume a demersal existence (that is move from the water column to the bottom).

In light of the available information, the extent of the boundaries would depend upon the degree of fish immigration/emigration and larval transport, whichever has the greatest geographical range. The CEA cannot put geographical boundaries in terms of coordinates, but recognizes that the proper geographical boundary to consider effects on the biophysical environment is larger than the Type 2 MPA sites. The ranges of affected species are described in Section 3.0. The most measurable and substantial effects would be limited to the Type 2 MPA sites.

3. Establish the timeframe for the analysis.

Establishing a timeframe for the CEA is important when the past, present, and reasonably foreseeable future actions are discussed. It would be advantageous to go back to a time when there was a natural, or some modified (but ecologically sustainable) condition. However, data collection, for many fisheries began when species were already fully exploited. Therefore, the timeframe for analyses should be initiated when data collection began for the various fisheries. The timeframe for the analysis was determined by the minimum amount of time needed for the targeted species to respond to the proposed actions. Mean generation time (the average age at sexual maturity) is one measure sometimes used to determine how long it will take for a stock to respond to management measures. The generation time was available for two of the seven deepwater species in this amendment. The generation times for snowy grouper and golden tilefish are estimated at 21 and 24 years, respectively (SEDAR 4 2006). Therefore, the timeframe for the analysis is 24 years. It is not possible to bracket the timeframe with a future date as these alternatives would prevent fishing for snapper grouper species for an indefinite time period. Monitoring should continue indefinitely for all sites to ensure that the objectives are being achieved.

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

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

I. Fishery-related actions affecting snowy grouper, golden tilefish, vermilion snapper, black sea bass, and red porgy.

A. Past

The reader is referred to **<u>Section 1.2 History of Management</u>** for past regulatory activity for the fish species. These include bag and size limits, spawning season closures (red porgy), trip limits, commercial quotas, gear prohibitions and limitations, area closures, and a commercial limited access system.

B. Present

The proposed actions would prohibit fishing for or possessing species in the Snapper Grouper Fishery Management Unit at certain locations in the South Atlantic EEZ (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Also, shark bottom longlines would be prohibited within the Type 2 MPAs. The primary purpose is to promote the optimum size, age, and genetic structure of slow growing, long-lived deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish).

C. Reasonably Foreseeable Future

Snapper Grouper Amendment 13C was approved on August 14, 2006 and final regulations became effective on October 23, 2006. Amendment 13C implemented quotas, trip limits, and bag limits to end overfishing of snowy grouper, golden tilefish, black sea bass, and vermilion snapper. Red porgy harvest was increased consistent with the rebuilding program.

Snapper Grouper Amendment 15 is being developed. Amendment 15 would: update select management reference points for the snowy grouper, golden tilefish, vermilion snapper, red porgy, and black sea bass stocks; modify rebuilding schedules for the snowy grouper and black sea bass stocks; define rebuilding strategies for the snowy grouper, red porgy, and black sea bass stocks; established a deepwater multi-species unit with snowy grouper as the indicator species; establish a strategy to ensure stock rebuilding stays on schedule should the total allowable catch levels specified in rebuilding plans be accidentally exceeded; adjust the golden tilefish fishing year to begin September 1 and eliminate the current stepped trip limit reduction strategy; eliminate the 12" total length minimum size limit regulation for the queen snapper and silk snapper; require a federal commercial snapper grouper permit to sell snapper grouper species harvested in federal waters of the South Atlantic and limit sales to only those fish captured on commercial trips; extend the allowable timeframe for renewing a commercial snapper grouper permits to one year after the date the permit expires; and modify the current snapper grouper limited access program to allow permit holders to incorporate their businesses on a 1-for-1 transfer basis.

Based on the 2005 and 2006 stock assessments, NMFS is preparing Amendment 2 to the Consolidated HMS Fishery Management Plan to rebuild sandbar, dusky, and porbeagle sharks while providing an opportunity for the sustainable harvest of blacktip sharks in the Gulf of Mexico. NMFS has requested comments on commercial management options including, but not limited to, quota levels, regional and seasonal quotas, trip limits, minimum sizes, quota monitoring, applying dead discards and state landings after a Federal closure to the quota, counting quota over- and underages, authorized gears, permit structure, prohibited species, and the Mid-Atlantic shark closure. In addition, NMFS requested comments on recreational management options including retention limits, minimum sizes, authorized gears, and landings requirements. NMFS also requested comments on display quotas and collection of sharks through exempted fishing permits, display permits, and scientific research permits. NMFS anticipates completing this amendment and any related documents by January 1, 2008.

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

A. Past
B. Present
C. Reasonably foreseeable future

In terms of natural disturbances, it is difficult to determine the effect of non-Council and non-fishery related actions on stocks of the species primarily affected by the Type 2 MPAs. Annual variability in natural conditions such as water temperature, currents, food availability, predator abundance, etc. can affect the abundance of young fish, which survive the egg and larval stages each year to become juveniles (i.e., recruitment). This natural variability in year class strength is difficult to predict as it is a function of many interactive and synergistic factors that cannot all be measured (Rothschild 1986). Furthermore, natural factors such as storms, red tide, cold water upwelling, etc. can affect the survival of juvenile and adult fishes; however, it is very difficult to quantify the magnitude of mortality it may have on a stock. Juvenile black sea bass and occasionally snowy grouper occur in estuarine areas along the southeastern United States (Robins and Ray 1986; Heemstra and Randall 1993). Alteration of estuarine habitats could affect survival of juveniles. However, estimates of the abundance of fish, which utilize this habitat, as well as determining the impact habitat alteration may have on juveniles is problematic.

AFFECTED ENVIRONMENT

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

The trends in the condition of snowy grouper, golden tilefish, vermilion snapper, black sea bass, and red porgy are described by recent stock assessments (SEDAR 1 2002, SEDAR 2 2003a, SEDAR 2 2003b, SEDAR 4 2004, SEDAR Update #1 2005). The SEDAR stock assessment indicates biomass of snowy grouper declined from about 2.5 times the biomass at MSY (B_{MSY}) in 1970 to 50% of B_{MSY} in 1985 (SEDAR 4 2004). In 2002, biomass was only about 18% of B_{MSY}. Fishing mortality (F) was close to the fishing mortality that would produce MSY (F_{MSY}) in 1975. In the early 1980s, F was more that 4 times greater than F_{MSY}. Since the early 1980s, F has fluctuated around 3 times F_{MSY}.

The biomass of golden tilefish declined from about 2.5 times B_{MSY} in 1980 to slightly above B_{MSY} in the early 1980s. Since the early years biomass has fluctuated around B_{MSY}. Fishing mortality (F) has shown a great deal of fluctuation over the years. In 1981, F rose very rapidly to almost 5 times F_{MSY} and then decreased well below F_{MSY} in the late 1980s. Fishing mortality rose to almost 4 times F_{MSY} in 1993 and then declined to F_{MSY} in 1996. In 2002, F was 1.5 times greater than F_{MSY}.

The SSC and the SEDAR review panel determined that estimates of vermilion snapper biomass from the stock assessment were not reliable. Estimates of F increased from around F_{MAX}, a proxy for F_{MSY}, in 1981 to almost 6 times F_{MAX} in 1986. F remained high until 1997 when it decreased to 1.3 times F_{MAX}. In 2001, F was 1.6 times F_{MAX} (SEDAR 2 2003a).

A fishery has existed for black sea bass off the southeastern United States since the middle 1800s. Landings rose very rapidly in the 1960s and the stock was considered to be severely depressed as far back as 1967 (SEDAR Assessment Update #1 2005). Biomass decreased from about 60% of B_{MSY} in 1984 to about 20% of B_{MSY} in 1994. A slight increase in biomass occurred in recent years to 27% of B_{MSY} in 2004. Fishing mortality rate for black sea bass fully recruited to fishing gear increased from F_{MSY} in 1978 to over 6 times F_{MSY} in 2004. However, the exploitation rate (E) of age 1+ fish decreased from 3 times the exploitation rate that will achieve MSY (E_{MSY}) in 1994 to about 1.5 times E_{MSY} in 2004.

Biomass of red porgy decreased steadily from about 2.8 times B_{MSY} in 1972 to around 40% of B_{MSY} during the middle 1990s. Biomass increased to 44% of B_{MSY} in 2001. Fishing mortality (F) increased from about 30% of F_{MSY} in 1972 to greater than 4 times F_{MSY} in 1990. Fishing mortality decreased, with some fluctuation, to 45% of F_{MSY} in 2001.

Snowy grouper and golden tilefish are extremely long-lived (>50 years), slow growing, late maturing, making them very susceptible to stresses such as fishing pressure (Wyanski *et al.* 2000, Harris *et al.* 2001). The capacity to recover from heavy fishing depends on factors such as age at maturity, generation time, environmental conditions, available habitat, harvesting pressure, age at removal, ability to reach a mature age, and predation. Due to the life history characteristics of snowy grouper and golden tilefish, the amount of time needed to recover from periods of heavy fishing pressure would be greater than for vermilion snapper, black sea bass, and red porgy. For example, in the absence of fishing pressure, it is estimated that snowy grouper would rebuild to B_{MSY} in 13 years (SEDAR 4 2004). In contrast, other affected species such as vermilion snapper, black sea bass, and red porgy are not as long-lived, are faster growing, and mature at smaller sizes than snowy grouper or golden tilefish. Thus, recovery of vermilion snapper, black sea bass, and red porgy would require a shorter period of time than snowy grouper and golden tilefish. For example, black sea bass, which lives for a maximum of 10-20 years, matures at 7” total length, and is considered to be seriously overfished, will rebuild to B_{MSY} in only five years in the absence of fishing. Effects on the human environment are described in Section 4.14.2.

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

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

Fish populations

Quantitative definitions of overfishing and overfished for the species primarily affected are identified in Amendments 11 and 12 to the Snapper Grouper FMP (SAFMC 1998d, 2000). Numeric values of thresholds for overfishing and overfished are being modified in Amendment 15 for all snapper grouper species. These values includes maximum sustainable yield (MSY), the fishing mortality rate that produces MSY (F_{MSY}), the biomass or biomass proxy that supports MSY (B_{MSY}), the minimum stock size threshold below which a stock is considered to be overfished (MSST), the maximum fishing mortality threshold above which a stock is considered to be undergoing overfishing (MFMT), and optimum yield (OY).

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

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

DETERMINING THE ENVIRONMENTAL CONSEQUENCES OF CUMULATIVE EFFECTS

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

The relationship between human activities and biophysical ecosystems within the context of this CEA is solely related to extractive activities and the installment of regulations as outlined in Table 4-18.

Table 4-18. The cause and effect relationship of fishing and regulatory actions within the time period of the Cumulative Effects Analysis (CEA).

Time period/dates	Cause	Observed and/or Expected Effects
1960s-1983	Growth overfishing of many reef fish species.	Declines in mean size and weight of many species including black sea bass.
August 1983	8" total length black sea bass; 4" trawl mesh (SAFMC 1983).	Protected youngest spawning age classes.
Pre-January 12, 1989	Habitat destruction, growth overfishing of vermilion snapper.	Damage to snapper grouper habitat, decreased yield per recruit of vermilion snapper.
January 1989	Trawl prohibition to harvest fish (SAFMC 1988b).	Increase yield per recruit of vermilion snapper; eliminate trawl damage to live bottom habitat.
Pre-January 1, 1992	Overfishing of many reef species including red porgy, vermilion snapper, and snowy grouper.	Spawning stock ratio of these species is estimated to be less than 30% indicating that they are overfished.
January 1992	Prohibited gear: fish traps south of Cape Canaveral, FL; entanglement nets; longline gear inside of 50 fathoms; powerheads and bangsticks in designated SMZs off SC; 10" total length vermilion snapper (recreational only); 12" total length vermilion snapper and red grouper (commercial only); 10 vermilion snapper/person/day, aggregate grouper bag limit of 5/person/day (SAFMC 1991).	Protected smaller spawning age classes of vermilion snapper and red grouper. Protect habitat. Protected grouper with bag limit reduction.
Pre-June 27, 1994	Overfishing of snowy grouper and golden tilefish; high fishing intensity and damage to *Oculina* habitat.	SSR for snowy grouper and golden tilefish below 30% indicates that they are overfished. Noticeable decrease in numbers and species diversity in are of *Oculina* off FL
June 1994	Commercial quotas and trip limits for snowy grouper and golden tilefish. Prohibition of fishing for and retention of snapper grouper species (HAPC renamed OECA) (SAFMC 1994)	Put limit on fishing mortality of snowy grouper and golden tilefish. Initiated the recovery of snapper grouper species in OECA.
1992-1999	Declining trends in biomass and overfishing continue for a number of snapper grouper species including vermilion snapper, black sea bass and red porgy.	Spawning potential ratio for vermilion snapper, black sea bass, and red porgy is less than 30% indicating that they are overfished.
June 24, 1999	Red porgy: 14" total length (recreational and commercial); 5 fish bag limit; March-April closure. Black sea bass: 10" total length	Ends overfishing of red porgy, rebuilding of biomass begins. F decreases in 2000 for black sea bass but increases again in 2001. No further declines in black sea bass biomass. F for vermilion snapper remains at lower levels than

Time period/dates	Cause	Observed and/or Expected Effects
	(recreational and commercial); 20 fish bag limit. Vermilion snapper: 11” total length (recreational). Aggregate bag limit of no more than 10 fish/person/day (SAFMC 1998c).	during 1983-1996 but is still above Fmsy. Egg production increases.
1999-2000	Red porgy is not overfishing but remains overfished.	Needs to be rebuilt to B_{MSY}.
September 22, 2000	Establish 18 year rebuilding timeframe, January-April closure, 1 fish bag limit, 50-lb incidental catch (SAFMC 2000).	Biomass continues to rebuild.
October 23, 2006	Snapper Grouper FMP Amendment 13C (SAFMC 2006a).	Reduce fishing mortality on snowy grouper, golden tilefish, black sea bass, and vermilion snapper. Allow increase harvest of red porgy.
In development (final Council approval scheduled for June 2007).	Snapper Grouper FMP Amendment 14.	Use MPAs as a management tool to promote the optimum size, age, and genetic structure of slow growing, long-lived deepwater snapper grouper species (speckled hind, snowy grouper, Warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, and blueline tilefish).
In development	Snapper Grouper FMP Amendment 15 (SAFMC 2006b).	Update select management reference points for the snowy grouper, golden tilefish, vermilion snapper, red porgy, and black sea bass stocks; modify rebuilding schedules for the snowy grouper and black sea bass stocks; define rebuilding strategies for the snowy grouper, red porgy, and black sea bass stocks; establish a strategy to ensure stock rebuilding stays on schedule should the total allowable catch levels specified in rebuilding plans be accidentally exceeded; adjust the golden tilefish fishing year to begin September 1 and eliminate the current stepped trip limit reduction strategy; eliminate the 12” total length minimum size limit regulation for the queen snapper and silk snapper; require a federal commercial snapper grouper permit to sell snapper grouper species harvested in federal waters of the South Atlantic and limit sales to only those fish captured on commercial trips; extend the allowable timeframe for renewing a commercial snapper grouper permits to one year after the date the permit expires; and modify the current snapper grouper limited access program to allow permit holders to incorporate their businesses on a 1-for-1 transfer basis.
In development	Snapper Grouper Amendment 16	Evaluate creation of Limited Access Privilege Program

9. Determine the magnitude and significance of cumulative effects.

Current management actions, as summarized in Section 2.0, should reduce fishing mortality at certain locations and are expected to have a beneficial, cumulative effect on the biophysical environment. These management actions are expected to increase stock biomass in the vicinity of the Type 2 MPAs, which may affect other stocks. Evidence from MARMAP CPUE and reports from fishermen indicate the red porgy stock is rebuilding as a result of management measures implemented in Snapper Grouper FMP Amendment 12 (SAFMC 2000). Many of the affected species (e.g., snowy grouper and golden tilefish) are upper level predators preying primarily on fish, benthic invertebrates, and in some cases, squid (Nelson 1988; Bullock and Smith 1991). The degree of competition for food resources between these species and other co-occurring species may increase as stock abundance increases. In addition, other affected species (mainly red porgy, vermilion snapper, black sea, bass and other co-occurring species) may begin to compete for habitat as they increase in abundance.

Restrictions in the catch of species primarily affected from actions in this Amendment and Amendment 13C could result in fishermen shifting effort to other species and other locations. The snapper grouper ecosystem includes many species that occupy the same habitat at the same time. For example, black sea bass co-occur with tomtate, scup, red porgy, white grunt, vermilion snapper, red grouper, scamp, gag, and others. Therefore, restricted species are likely to still be caught since they will be incidentally caught when fishermen target other co-occurring species. Continued overexploitation of any snapper grouper species could disrupt the natural community structure of the reef ecosystems that support these species. However, some fishermen may choose to use different gear types and target species in different fisheries such as mackerel and dolphin.

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

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

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

11. Monitor the cumulative effects of the selected alternative and modify management as necessary.
The effects of the proposed action are, and will continue to be, monitored through collection of data by NMFS, States, stock assessments and stock assessment updates, life history studies, and other scientific observations.

4.14.2 Socioeconomic

As described in Section 3.3, the snapper grouper fishery can be separated into two main components: the recreational fishery and the commercial fishery. There is some overlap between the for-hire recreational sector and the commercial harvesting sector in the south Atlantic snapper grouper fishery as some vessels or vessel owners are engaged in both for-hire recreational activities and the commercial harvest and sale of snapper grouper species.

The commercial snapper grouper fishery in the U.S. southern Atlantic states (South Atlantic) is comprised of vessels that utilize a number of different gear types and target a variety of species. Vessels employing hook and line gear dominate the commercial fishery and landings. However, even among this gear category there is a fair degree of heterogeneity in terms of species harvested, area fished, trip length, vessel size and horsepower, operating costs, and output of snapper grouper landings and value.

The South Atlantic recreational fishery is comprised of a private recreational sector and a for-hire recreational sector. The former includes anglers fishing from shore (including docks), piers, and from private/rental boats while the latter is divided into the charterboat and headboat segments. Holland *et al.* (1999) defined charterboats as boats for-hire carrying 6 or less passengers that charge a fee to rent the entire boat. Headboats tend to be larger, diesel powered and generally can carry a maximum of around 60 passengers.

<u>The effect of imports, fuel prices, coastal development, and snapper grouper regulations</u>
Since the peak in snapper grouper landings and revenue in 1990, there has been a steady decline in landings, ex-vessel revenue, and real ex-vessel revenue (Figure 3-24 and 3-25). The cause of this decline can be partly attributed to restrictive regulations taken to improve/maintain the health of species in the snapper grouper complex and to protect essential fish habitat.

The snapper grouper fishery has been heavily regulated since the fishery management plan was implemented in 1983, which initiated a number of size limit measures and certain gear restrictions. In 1992, Amendment 4 prohibited fish traps, entanglements nets, longlines for wreckfish, and the use of longline gear inside of 50 fathoms for snapper grouper species in the south Atlantic Exclusive Economic Zone (EEZ). Also, additional minimum size regulations and bag limits went into effect during 1992. Implementation of a limited access program in 1998/1999 contributed partly to the decline in the number of commercial vessels in the snapper grouper fishery. Since 1999, the annual number of permitted vessels has declined by 375; the number of vessels with unlimited permits has declined by 244. Some of the vessels that exited the snapper grouper fishery were replaced through the two for one permitting program while other vessels were not replaced. It is reasonable to hypothesize that the decrease in landings, ex-vessel (dockside) revenue, number of vessels in the fishery, number of trips, and days fished observed from 1999 to 2003 can be partly attributed to the 2 for 1 permitting requirement. If the current permit requirements remain in effect, it is likely that fishing effort will continue its decline into the future since each new entrant into this fishery will have to purchase two existing snapper grouper permits. Also, the number of non-transferable permits will decline over time as their owners stop fishing or die.

Commercial and recreational fishermen in the snapper grouper fishery have faced additional restrictive measures that were implemented in Amendment 9 (SAFMC 1998c) and Amendment 12 (SAFMC 2000). A detailed account of these regulations is contained in the history of management section of this document (Section 1.4).

Apart from the response to fishery management regulations, fluctuations in landings can also be partly attributed to changes in stock abundance and availability, water quality, market conditions (e.g., price), and fleet dynamics. Ex-vessel prices for the various species in the fishery depend on the quantity of landings, product quality, market conditions such as the availability of imports and the relative prices of substitutes, and consumer income levels.

It is reasonable to assume that non-regulatory factors such as imports and increased fuel prices had a direct impact on the profitability of this industry and will continue to do so in the future. It appears that imports may be one contributing factor in keeping the average unit price for all snapper grouper species at about the same level from 1992. Imports of snappers and groupers are classified into two product forms: fresh and frozen. Fresh fish comprised over 70 percent of total snapper grouper imports in 2004, which increased almost threefold from 16 million pounds in 1991 to 44.4 million pounds in 2003. Other factors that influence snapper grouper prices include landings of reef fishes and market conditions in the Gulf of Mexico.

More recently, the increasing trend in coastal development and the associated increase in property taxes, increased cost of dockage, and decreased public access to the waterfront have impacted the commercial fishing industry and possibly a segment of the private and for-hire recreational sectors. Certainly, the closure of fish houses in the South Atlantic may have had substantial effects on the snapper grouper commercial fishery. Fish houses provide support to the fishing industry that could include any or all of the following: dockage, fuel, ice, repair parts, gear and supplies, fish packing and processing, and a place for transactions with permitted snapper grouper dealers. In some cases, fish house owners have extended credit to vessel owners with negative cash flow problems. About 10 fish houses that provided docking facilities in the South Atlantic closed for business during the past five years. More recently, one of the main fishing docks in the snapper grouper fishery located in Murrells Inlet, South Carolina closed for business. The owner sold this waterfront property to a condominium developer. Vessels docked at that fish house relocated and there is a possibility that trip costs increased as a result of additional travel time needed to get to the fishing grounds. Also, these closures caused a disruption of existing business relationships with snapper grouper dealers, which meant that fishermen and wholesalers had to adapt to this new situation. It appears that an increasing number of fishermen are acting as their own dealers and selling directly to retailers and wholesalers in an attempt to increase profit margins or to adapt to the decline in the number of "fish houses" operating in the South Atlantic. It is expected that these non-regulatory factors will influence the future composition and profitability of the commercial fishing industry.

The increased loss of public access to the waterfront displaced by marinas, private docks, and other development could have a negative effect on the segments of the private recreational fishery that trailer their vessels and depend on public boat ramps, or anglers who fish from shore especially in Florida. The harvest of recreational snapper grouper species peaked in 1988 at 12.4 million pounds. Thereafter, landings decreased to 6.5 million pounds in 1998, and subsequently fluctuated between 8.0 million pounds and 11.06 million pounds. A similar trend was observed in the private recreational sector (private/rental boat mode and shore mode), which accounts for 62 percent to 78 percent of total snapper grouper recreational landings. Most snapper grouper trips are taken by either private/rental or shore modes, and for the private/rental mode there appears to be an increasing trend in effort during the period 1998 to 2003.

Since 1987, it appears that there has been a declining trend in headboat angler days in the South Atlantic. In contrast to the private recreational sector, harvest by the headboat sector has been on a steady decline since 1988. The decline in headboat effort could be a contributing factor in the reduction in headboat harvest of this species. Also, restrictive regulations that were implemented in 1999 and 2000 accounted for the very low harvest levels observed in the recreational fishery during 1999 and 2000. It is reasonable to speculate that the decrease in headboat harvest of vermilion snapper after 1991 could be partly attributed to the declining trend in headboat effort and the 10 fish bag limit and 10 inch minimum size limit measures implemented in 1992.

One explanation for the decline in demand for headboat trips could be the result of the continued increase in the ownership of private recreational vessels by resident anglers in the South Atlantic states. This shift could partly account for the 54 percent decrease in headboat effort observed from 1988 to 2003.

Amendment 13C for the snapper grouper fishery (approved on August 14, 2006 and implemented on October 23, 2006) included substantial reductions in total allowable catch and trip limits for the commercial deepwater fisheries for groupers and tilefish, and may eliminate a substantial amount of fishing activity for the deepwater groupers in areas that have been proposed for Type 2 MPAs. If this were the case, then implementation of the proposed Type 2 MPAs would have little additional effect. Nonetheless, some proposed Type 2 MPAs, especially in Florida, that are located closer to shore and include species other than deepwater groupers or tilefish, may create additional economic and social impacts for commercial and recreational fishermen because Amendment 13C may not substantially reduce their fishing activity in the proposed areas.

Economic effects of proposed measures in Snapper Grouper Amendment 14

A Delphi study was conducted with the objective of assessing the economic impacts of the Type 2 MPAs proposed in Amendment 14. Consequently, the following discussion about the economic effects of the proposed Type 2 MPAs is limited to the economic impacts of MPAs in general. Refer to Section 4.1.2 for more detailed discussions of qualitative economic effects of Type 2 MPAs.

Amendment 14 proposes to augment traditional methods of management with establishment of Type 2 MPAs in an effort to minimize the dissipation of economic rents and improve the biological health of deepwater resources throughout the jurisdiction of the South Atlantic Fishery Management Council. The economic impacts caused by these proposed Type 2 MPAs will be greatly dependent upon the economic effects of Amendment 13C.

Economic benefits and costs resulting from Type 2 MPA protection in general may be characterized as either consumptive or non-consumptive. Consumptive costs and benefits affect the profitability of the South Atlantic Snapper Grouper (SASG) commercial fishing fleet, the satisfaction of recreational fishermen, and the efficient use of society's resources. Non-consumptive benefits and costs include societal losses and gains as well as effects on fishery management.

Most of the consumptive costs associated with a Type 2 MPA network can be generalized as displacement effects directly incurred by recreational and commercial vessels that normally fish in the newly protected areas. Direct displacement effects (costs) to fishermen unable to fish in a Type 2 MPA may include a decrease in catch levels; an increase in trip-level costs associated with searching for new fishing grounds; an increase in opportunity costs associated with learning a new type of fishing; congestion and user conflicts on new fishing grounds; and increased harvest and personal risk. Displacement effects have a negative impact on the predicted value of a Type 2 MPA; however, fishermen may be able to mitigate these costs by redirecting effort to open areas and targeting different species. Although displaced fishermen avoid some displacement costs as a result of these actions, the addition of new fishing effort to open areas could have an extra negative effect on the health of other species.

Fishermen who currently fish in proposed Type 2 MPAs bear the majority of the short-term costs associated with protection. However, due to the large number of vessels in the fishery, there is no guarantee that displaced individuals will reap the benefits of stock recovery in the future. If spillover effects are realized and aggregate harvests increase, the relative profitability of targeting the protected species in open areas will increase, and effort will shift towards these species as fishermen seek to maximize their personal gains in an open access scenario. This effort could include new entrants to the deepwater fishery, which would create crowding externalities for the originally displaced vessels. Thus, Type 2 MPA regulations without corresponding effort restrictions may lead to an inequitable distribution of long-term benefits and inefficient harvesting practices if spillover effects are realized from the protected areas.

A possible indirect consumptive cost is the short-run impact that a reduction in income has on the surrounding communities. If displaced fishermen cannot mitigate all losses incurred from the establishment of Type 2 MPAs, their communities likewise will be negatively affected as less income flows through different sectors of the local economy. Fishing income originally spent in the community by fishermen cycles throughout the regional economy producing a multiplier effect that results in total regional expenditures that exceed the original income. The amount of fishing income lost and the magnitude of the multiplier effect determine the extent of the negative impact on the predicted value of a Type 2 MPA.

Consumptive benefits could be realized over the long-run if spillover effects are assumed to affect aggregate harvest levels in the remaining fishable areas as stocks become healthier. Major consumptive benefits include stock replenishment and spillover effects, increased stock biomass, increased harvest levels, and reduced variability of harvests and revenues.

Non-consumptive costs are incurred by federal management to implement and enforce Type 2 MPAs. Non-consumptive benefits include option, bequest, and existence values that derive from increased species and habitat protection, as well as increases in biodiversity, improved habitat conditions and species' population structure(s), reduced risk associated with uncertain stock assessments, and the creation of experimental undisturbed areas for biological research.

Social effects of proposed measures in Snapper Grouper Amendment 14

Refer to Sections 4.1.3, 4.2.3, 4.3.3, 4.4.3, 4.5.3, 4.6.3, 4.7.3, 4.8.3, 4.9.3, and 4.10.3 for more detailed discussions of the social effects of the proposed measures.

The social and economic impacts caused by Amendment 14 are greatly dependent upon the impacts caused by Amendment 13C. The lower trip limit and reduced quota for deepwater species implemented by Amendment 13C could make it unprofitable for boats to travel to some of the proposed Type 2 MPAs, such as the Snowy Wreck and Northern South Carolina Type 2 MPA, so the effects caused by Amendment 14 could be relatively minor. However, the reduction in the amount of fish caught as a result of the Type 2 MPAs or as a result of the Type 2 MPAs coupled with Amendment 13C is likely to have a negative impact on fish houses and dealers that rely on deepwater species as a part of their annual round. Fish houses and dealers throughout the Carolinas can be adversely impacted because of their relationship to each other and potential lack of supply from their own fishermen and from those that land and sell with other dealers. It is common for fish houses to buy from other fish houses in order to meet the demand of their clientele. A loss of supply for one area may affect the productivity of the fish houses and dealers of another.

With pressure from increased coastal development and a continued rise in property value for coastal communities, revenue reductions associated with Amendments 13C and 14 may lead some to sell or convert their docks and marinas. This would make it more difficult for commercial fishermen to exist due to a lack of available infrastructure. The loss of infrastructure means that there are numerous directly and indirectly associated businesses that can be negatively impacted, and as fish houses close, the workers are let go. If a marina is sold, it might have a serious impact on the sale of fishing supplies, such as fuel, bait, and tackle, and the number of trips. A reduction in the number of commercial fishing trips would represent a loss of annual wages to crew who are paid on a per trip basis or share basis.

The effects of other fishing regulations

A large proportion of snapper grouper vessels operate in other fisheries in the South Atlantic and other regions, as well as reef fish fisheries in the Gulf of Mexico. For example, in 2004, a total of 167 vessels in the South Atlantic snapper grouper fishery held Gulf of Mexico reef fish permits. Most of these vessels were home ported in Florida (extracted from the Southeast Permits Database). Many of the longline vessels in the South Atlantic snapper grouper fishery also operate in the shark fishery and at least six of these vessels are permitted to fish in the Gulf of Mexico reef fish fisheries. Measures enacted in the Gulf of Mexico fishery and in the highly regulated shark fishery will therefore have an effect on the economic performance of these vessels. NMFS is currently preparing Amendment 2 to the Consolidated HMS Fishery Management Plan to address the 2005 and 2006 stock assessments. NMFS anticipates completing the amendment and associated documents by January 1, 2008.

Also, management of fisheries in the Mid-Atlantic States may affect the economic performance of snapper grouper vessels, especially those in the black sea bass fishery, since many of these vessels operate in fisheries managed by the Mid-Atlantic Fishery Management Council. Similarly, state regulations will also affect the profitability of the snapper grouper commercial sector.

Potential effort shifts to other fisheries

In response to implementation of MPAs, there could be additional effort directed at dolphin, wahoo, king mackerel, Spanish mackerel, sharks, and other HMS species; however, the impacts on those fisheries may be negligible once the impacts caused by regulations for Amendment 13C are realized. In addition, other species in the mid-shelf complex and other abundant snapper grouper species could receive additional directed effort, and individual vessels could also increase their effort in fisheries within state waters.

4.15 Bycatch Practicability Analysis

The South Atlantic Council is required by MSFCMA §303(a)(11) to establish a standardized bycatch reporting methodology to assess the amount and type of bycatch occurring in the fishery include management measures that, to the extent practicable and in the following priority (A) minimize bycatch and (B) minimize the mortality of bycatch which cannot be avoided. The MSFCMA defines bycatch as “fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. Such term does not include fish released alive under a recreational catch-and-release fishery management program" (MSFCMA §3(2)). The term economic discard means fish which are the target of a fishery, but which are not retained because they are of an undesirable size, sex, or quality or for other economic reasons (MSFCMA §3(9)). This category of discards generally includes certain species, sizes, and/or sexes with low or no market value. The term regulatory discard means fish harvested in a fishery which fishermen are required by regulation to discard whenever caught, or are required by regulation to retain but not sell (MSFCMA §3(38).

NMFS outlines at 50 CFR §600.350(d)(3)(i) ten factors that should be considered in determining whether a management measure minimizes bycatch or bycatch mortality to the extent practicable. These are:

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

Agency guidance provided at 50 CFR §600.350(d)(3)(ii) suggests the Councils adhere to the precautionary approach found in the Food and Agriculture Organization of the United Nations (FAO) Code of Conduct for Responsible Fisheries (Article 6.5) when faced with uncertainty concerning these ten practicability factors. According to Article 6.5 of the FAO Code of Conduct for Responsible Fisheries, using the absence of adequate scientific information as a reason for postponing or failing to take measures to conserve target species, associated or dependent species, and non-target species and their environment, would not be consistent with a precautionary approach.

4.15.1 Population Effects for the Bycatch Species

4.15.1.1 Background

Amendment 14 is intended to protect a portion of the population and habitat of long-lived, slow growing, deepwater snapper grouper species (snowy grouper, golden tilefish, speckled hind, Warsaw grouper, yellowedge grouper, misty grouper, and blueline tilefish) from directed fishing pressure to achieve a more natural sex ratio and age and size structure within the proposed Type 2 MPAs, while minimizing adverse social and economic effects.

Logbook data from 2001-2004 indicates the directed commercial fishery for the deepwater snapper grouper species addressed by Amendment 14 are primarily taken by the commercial fishery. Longline gear dominates landings for most species except snowy grouper, blueline tilefish, and misty grouper (Table 4-19).

Table 4-19. Percentage of recreational and commercial landings for 2001-2004. Commercial landings are shown by gear.
Source: Recreational landings include headboat and MRFSS data; commercial data from NMFS Logbook.

Species	% Recreational	% Commercial	% Hook and line	% Longline
Snowy Grouper	6.7	93.3	70.3	29.7
Golden tilefish	5.4	94.6	7.7	92.3
Speckled hind	17.7	82.3	33.0	67.0
Warsaw grouper	87.8	12.2	24.3	75.7
Yellowedge grouper	0.5	99.5	25.9	74.1
Misty grouper	0	100	91.6	8.4
Blueline tilefish	5.7	94.3	50.4	49.6

Restrictions, which are currently being used to manage these species include quotas (snowy grouper, golden tilefish), trip limits (snowy grouper and golden tilefish), and recreational/commercial possession limit of one per trip with no sale allowed (speckled hind and Warsaw grouper), and bag limits (snowy grouper, golden tilefish, speckled hind, Warsaw grouper, yellowedge grouper, misty grouper, and blueline tilefish).

Management measures proposed in Amendment 14 would establish eight Type 2 MPAs from North Carolina to southern Florida. Fishing for or possessing snapper grouper species and use of shark bottom longlines would be prohibited within the proposed MPAs (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Bycatch of the species listed above within the closed areas would be eliminated. Furthermore, other species including black sea bass, gag, gray triggerfish, greater amberjack, knobbed porgy, lesser amberjack, red porgy, red grouper, red snapper, rock hind, scamp, tomtate, vermilion snapper, whitebone porgy, and white grunt are reported to occur in some of the proposed Type 2 MPAs. Therefore, there would be no bycatch of these species within the Type 2 MPAs areas upon implementation of Amendment 14 unless poaching occurred.

NMFS recently conducted a formal biological opinion on the effects of the South Atlantic Snapper Grouper fishery on ESA-listed species (NMFS 2006). That opinion stated that operation of the South Atlantic snapper grouper fishery may adversely affect green, Kemp’s ridley, leatherback, and loggerhead sea turtles, but was not likely to jeopardize their continued existence. The management measures proposed in Amendment 14 are not expected to create any adverse effects on these species that were not previously considered in NMFS (2006). Establishment of Type 2 MPAs would reduce the potential for bycatch of green, Kemp’s ridley, leatherback, and loggerhead sea turtles within these MPAs.

4.15.1.2 Commercial Fishery

During 2001 to 2005, approximately 20% of snapper grouper permitted vessels from the Gulf of Mexico and South Atlantic were randomly selected to fill out supplementary logbooks. Data from 2001 are not presented because some values are questionable. During 2002-2005, an average of 61% of the trips in the South Atlantic reported discards (Table 4-20). The average number of trips per year during 2002 to 2005 was 16,808 (Table 4-21).

Table 4-20. Discard logbook gross effort for the South Atlantic.
Source: NMFS SEFSC Logbook Program.

YEAR	Trips reporting Discard	Trips reporting no Discard	Sample Trips	% Trips with Discard
2002	2,947	1,449	4,396	67.0%
2003	3,028	2,040	5,068	59.7%
2004	2,091	1,837	3,928	53.2%
2005	1,904	1,162	3,066	62.1%
Grand Total	9,970	6,488	16,458	60.6%
Mean	2,493	1,622	4,115	

Table 4-21. Snapper grouper fishery effort for the South Atlantic.
Source: NMFS SEFSC Logbook Program.

YEAR	Trips
2002	17,856
2003	18,125
2004	16,711
2005	14,538
Mean	16,808

For deepwater species in Amendment 14, the number of trips that reported discards was greatest for speckled hind followed by Warsaw grouper; both species are limited to 1 per trip and may not be sold (Table 4-22). Other deepwater species are rarely discarded; however, it is possible the discard rate of snowy grouper and possibly golden tilefish will increase in 2006 and 2007 due to management regulations that have been imposed through Amendment 13C. Table 4-23 shows the estimated percentage of snapper grouper trips that discarded deepwater species.

Table 4-22. Annual number of trips reporting discard of Warsaw grouper, speckled hind, snowy grouper, golden tilefish, yellowedge grouper, misty grouper, and blueline tilefish in the South Atlantic.
Source: NMFS SEFSC Logbook Program.

YEAR	Warsaw Grouper	Speckled Hind	Snowy Grouper	Golden Tilefish	Yellowedge Grouper	Misty Grouper	Blueline Tilefish
2002	10	63	2	0	0	1	0
2003	18	55	2	0	0	0	1
2004	1	13	0	0	0	0	2
2005	1	27	3	0	2	0	2

Table 4-23. Percentage of trips that discarded Warsaw grouper, speckled hind, snowy grouper, golden tilefish, yellowedge grouper, misty grouper, and blueline tilefish in the South Atlantic.
Source: NMFS SEFSC Logbook Program.

YEAR	Warsaw Grouper	Speckled Hind	Snowy Grouper	Golden Tilefish	Yellowedge Grouper	Misty Grouper	Blueline Tilefish
2002	0.23	1.43	0.05	0.00	0.00	0.02	0.00
2003	0.36	1.09	0.04	0.00	0.00	0.00	0.02
2004	0.03	0.33	0.00	0.00	0.00	0.00	0.05
2005	0.03	0.88	0.10	0.00	0.07	0.00	0.07

During 2002-2005, the average number of individual fish discarded per trip was greatest for speckled hind followed by Warsaw grouper (Table 4-24). Other deepwater species are rarely discarded. The discard rate of snowy grouper and possibly golden tilefish will increase in 2006 and 2007 due to regulations imposed through Amendment 13C.

Table 4-24. Average number of Warsaw grouper, speckled hind, snowy grouper, golden tilefish, yellowedge grouper, misty grouper, and blueline tilefish discarded per trip in the South Atlantic.
Source: NMFS SEFSC Logbook Program.

YEAR	Warsaw Grouper	Speckled Hind	Snowy Grouper	Golden Tilefish	Yellowedge Grouper	Misty Grouper	Blueline Tilefish
2002	2.2	16.3	2.5	0.0	0.0	1.0	0.0
2003	2.3	15.4	1.5	0.0	0.0	0.0	1.0
2004	1	3.9	0.0	0.0	0.0	0.0	1.0
2005	1	4.9	1.3	0.0	2.5	0.0	1.0

Since the discard logbook database represents a sample, data were expanded to estimate the number of discarded fish in the whole fishery. The method for expansion was to (1) estimate the probability of discarding a species; (2) estimate the number of fish discarded per trip; and (3) estimate the number discarded in the whole fishery (total discarded = total trips * discard probability * discard number). During 2002-2005, an average of 2,010 speckled hind were discarded per year (Table 4-25). Snowy grouper, golden tilefish, yellowedge grouper, misty grouper, and blueline tilefish were rarely discarded.

Table 4-25. Expanded number of discarded Warsaw grouper, speckled hind, snowy grouper, golden tilefish, yellowedge grouper, misty grouper, and blueline tilefish for the South Atlantic.
Source: NMFS SEFSC Logbook Program.

YEAR	Warsaw Grouper	Speckled Hind	Snowy Grouper	Golden Tilefish	Yellowedge Grouper	Misty Grouper	Blueline Tilefish
2002	89	4,179	20	0	0	4	0
2003	148	3,019	11	0	0	0	4
2004	4	217	0	0	0	0	9
2005	5	625	19	0	24	0	9
Mean	62	2,010	12	0	6	1	5

Six of the top 10 species most often discarded on snapper grouper trips have also been reported to occur in one or more of the preferred Type 2 MPA alternatives. These species include red porgy, vermilion snapper, scamp, gag, red grouper, and black sea bass (Tables 4-26).

Table 4-26. The 50 most commonly discarded species during 2001-2005 in order of occurrence from highest number of trips to lowest for the South Atlantic.
Note: Highlighted species have been reported to occur in one or more of the preferred Type 2 MPA alternatives. Count is number of trips that reported discarding the species. Sum is the reported number discarded. **These values are not expanded.** Source: NMFS SEFSC Logbook Program.

Species	Count	Sum
SNAPPER,YELLOWTAIL	1131	10,528
PORGY,RED,UNC	717	44,706
SNAPPER,VERMILION	593	45,388
SCAMP	588	7,433
KING MACKEREL and CERO	583	4,200
GROUPER,GAG	553	3,902
GROUPER,RED	468	2,313
SEA BASS,ATLANTIC,BLACK,UNC	429	94,564
GROUPER,BLACK	355	2,629
SHARK,UNC	331	2,307
AMBERJACK,GREATER	293	1,942
SNAPPER,RED	288	9,091
BONITO,ATLANTIC	233	1,066

Species	Count	Sum
TUNA,LITTLE (TUNNY)	221	1,311
SNAPPER,MANGROVE (Duplicate of 3760)	190	1,588
HIND,SPECKLED	173	2,252
BARRACUDA	170	837
MENHADEN	164	24,452
AMBERJACK	152	568
SNAPPER,MUTTON	142	430
SHARK,ATLANTIC SHARPNOSE	136	3,588
DOLPHINFISH	135	795
BLUE RUNNER	117	868
GRUNTS	116	2,993
SEA BASS,ROCK	111	9,385
SHARK,BLACKTIP	110	753
TRIGGERFISH,GRAY	107	1,570
FINFISHES,UNC FOR FOOD	105	997
TRIGGERFISHES	105	1,066
REMORA	99	233
KING MACKEREL	93	811
COBIA	91	155
SCUPS OR PORGIES,UNC	90	1,003
SHARK,DOGFISH,SPINY	86	8,867
SHARK,SANDBAR	78	1,424
GRUNT,WHITE	65	4,478
GROUPERS	62	3,839
SHARK,NURSE	61	176
SPANISH MACKEREL	60	657
CERO	55	160
PARROTFISH	55	99
SHARK,DOGFISH,UNC	47	2,623
SNAPPER,MANGROVE	47	248
RUDDERFISH (SEA CHUBS)	46	351
BLUEFISH	44	1,632
CREVALLE	43	133
FINFISHES,UNC,BAIT,ANIMAL FOOD	42	4,251
GROUPER,NASSAU	38	55
GROUPER,WARSAW	38	228

Seven of the top 10 species most often discarded on snapper grouper in terms of number have also been reported to occur in one or more of the Type 2 preferred MPA alternatives. These species include black sea bass, vermilion snapper, red porgy, red snapper, scamp, and white grunt (Tables 4-27).

Table 4-27. The 50 most commonly discarded species during 2001-2005 based on number of fish discarded ordered from highest to lowest for the South Atlantic. Note: Highlighted species have been reported to occur in one or more of the preferred Type 2 MPA alternatives. Count is number of trips that reported discarding the species. Sum is the reported number discarded. **These values are not expanded.** Source: NMFS SEFSC Logbook Program.

Species	Count	Sum
SEA BASS,ATLANTIC,BLACK,UNC	429	94,564
SNAPPER,VERMILION	593	45,388
PORGY,RED,UNC	717	44,706
MENHADEN	164	24,452
SNAPPER,YELLOWTAIL	1131	10,528
SEA BASS,ROCK	111	9,385
SNAPPER,RED	288	9,091
SHARK,DOGFISH,SPINY	86	8,867
SCAMP	588	7,433
GRUNT,WHITE	65	4,478
FINFISHES,UNC,BAIT,ANIMAL FOOD	42	4,251
KING MACKEREL and CERO	583	4,200
GROUPER,GAG	553	3,902
GROUPERS	62	3,839
SHARK,ATLANTIC SHARPNOSE	136	3,588
GRUNTS	116	2,993
GROUPER,BLACK	355	2,629
GRUNT,TOMTATE	22	2,628
SHARK,DOGFISH,UNC	47	2,623
GROUPER,RED	468	2,313
SHARK,UNC	331	2,307
HIND,SPECKLED	173	2,252
AMBERJACK,GREATER	293	1,942
BLUEFISH	44	1,632
SNAPPER,MANGROVE (Duplicate of 3760)	190	1,588
TRIGGERFISH,GRAY	107	1,570
BALLYHOO	31	1,500
SHARK,SANDBAR	78	1,424
TUNA,LITTLE (TUNNY)	221	1,311
SHARK,DOGFISH,SMOOTH	32	1,245
BONITO,ATLANTIC	233	1,066
TRIGGERFISHES	105	1,066
SKATES	38	1,011
SCUPS OR PORGIES,UNC	90	1,003
FINFISHES,UNC FOR FOOD	105	997
BLUE RUNNER	117	868
BARRACUDA	170	837
SHARK,TIGER	28	824
KING MACKEREL	93	811
DOLPHINFISH	135	795

Species	Count	Sum
SHARK,BLACKTIP	110	753
SNAPPERS,UNC	27	697
SPANISH MACKEREL	60	657
AMBERJACK	152	568
PINFISH,SPOTTAIL	36	557
CHUBS	27	493
AMBERJACK,LESSER	8	484
SNAPPER,MUTTON	142	430
BIGEYE SCAD	7	395

4.15.1.3 Recreational Fishery

For the recreational fishery, estimates of the number of recreational discards are available from MRFSS. There are no estimates from the headboat survey. The MRFSS system classifies recreational catch into three categories:

- Type A - Fishes that were caught, landed whole, and available for identification and enumeration by the interviewers.

- Type B - Fishes that were caught but were either not kept or not available for identification.

    - Type B1 - Fishes that were caught and filleted, released dead, given away, or disposed of in some way other than Types A or B2.

    - Type B2 - Fishes that were caught and released alive.

For the deepwater species in Amendment 14, the percentage of fish released was highest for speckled hind (94.1%) and Warsaw grouper (22.5%). The percentage of released fish was lower for other deepwater species. However, estimates of fish released for many of the deepwater species may not be reliable due to small sample size. The percentage of released mid-shelf species that are known to occur in at least one of the preferred Type 2 MPA alternatives was generally very high (Table 4-28).

Table 4-28. Estimated number of released fish from MRFSS interviews, percent released, total catch (A+B1+B2) for the South Atlantic during 2001-2005. Source: MRFSS Web Site.

Species	Est Total	Est Released	% Released
Snowy Grouper	42,407	5,502	13.0
Golden Tilefish	84,391	0	0.0
Speckled Hind	11,682	10,996	94.1
Warsaw Grouper	7,389	1,660	22.5
Yellowedge Grouper	3,530	0	0.0
Misty Grouper	54	0	0.0
Blueline Tilefish	21,067	3,893	18.5
Red Grouper	614,581	503,378	81.9
Tomtate	2,554,067	2,043,525	80.0
Red Snapper	1,031,420	820,147	79.5
Gag	759,183	571,845	75.3
Black Sea Bass	12,756,387	7,740,981	60.7
Red Porgy	290,668	174,093	59.9
Gray Triggerfish	1,076,630	640,378	59.5
Lesser Amberjack	5,469	2,839	51.9
Greater Amberjack	321,470	160,863	50.0
White Grunt	1,716,608	749,102	43.6
Scamp	95,012	39,799	41.9
Vermilion Snapper	1,575,686	641,216	40.7
Rock Hind	18,183	7,096	39.0
Whitebone Porgy	49,238	2,084	4.2
Knobbed Porgy	28,901	0	0.0

4.15.1.4 Finfish Bycatch Mortality

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 these species is extremely high. The Council's Scientific and Statistical Committee (SSC) indicates release mortality rates are probably near 100%. Release mortality rates for blueline tilefish, yellowedge grouper, and misty grouper are also probably near 100% since these species are taken in deepwater (Froese and Pauly 2003). Release mortality rates for Warsaw grouper and speckled hind may be a little bit less than the other deepwater species since juveniles are commonly taken at the shelf edge (49 meters).

Release mortality rates have been estimated for some of the mid-shelf species that occur in the preferred MPA alternatives. SEDAR 2 (2003a) estimates release mortality rates of 25% and 40% for vermilion snapper taken by recreational and commercial fishermen, respectively. However, Burns *et al.* (2002) and Harris and Stephens (2006) suggest release mortality rates might be higher than those endorsed by SEDAR 2 (2003a). SEDAR 2 (2003b) recommends a release mortality rate of 15% for black sea bass based on cage studies conducted by Collins (1996) and Collins *et al*. (1999). SEDAR 1 (2002) recommended release mortality rates of 35% for red porgy caught by commercial fishermen and 8% for red porgy taken by the recreational sector. SEDAR 10 (2006) used release mortality rates of 25% for gag taken by recreational fishermen and 40% for gag taken in the commercial fishery. Release mortality rates for other mid-shelf species have not been estimated but likely fall within the range of 15 to 40% for other mid-shelf species assessed through the SEDAR process.

4.15.1.5 Practicability of Management Measures in Directed Fisheries Relative to their Impact on Bycatch and Bycatch Mortality

Snowy Grouper and Golden Tilefish
Commercial bycatch of snowy grouper and golden tilefish is currently low (Table 4-25). Since there is no size limit and the previous quota was rarely met, there is little incentive to release these species. Snowy grouper and golden tilefish are in the five grouper per person per day aggregate; however, the aggregate limit is rarely met. Therefore, there are very few recreational discards (Table 4-28). Bycatch of snowy grouper and golden tilefish could increase in late 2006 when Amendment 13C is implemented. The magnitude of increase in bycatch will depend on efforts of fishermen avoiding locations where snowy grouper and golden tilefish occur when a quota or trip limit is met. In addition, commercial fishermen may choose to not use longline gear if the golden tilefish quota is met, which will substantially decrease the magnitude of golden tilefish and snowy grouper bycatch.

The preferred Type 2 MPA alternatives will eliminate bycatch of snowy grouper and golden tilefish within the preferred Type 2 MPAs where these species occur. It is not clear if overall bycatch of snowy grouper and snowy grouper will decrease since fishermen may increase effort outside the closed areas. Given the reduced quotas and trip limits imposed through Amendment 13C, snowy grouper is likely to become an incidental catch fishery. Therefore, it is possible that fishermen will no longer target areas where snowy grouper occur. As a result, the preferred Type 2 MPA alternatives could reduce bycatch of snowy grouper. Alternatively, effort could increase outside of the closed areas and snowy grouper might continue to be caught and released when fishermen target co-occurring species.

Warsaw Grouper and Speckled Hind
Due to the commercial and recreational restriction of 1 fish per trip and prohibition on sale, discards of Warsaw grouper and speckled hind is high (Tables 4-25 and 4-28). The preferred Type 2 MPA alternatives will reduce bycatch of these species within the closed areas. However, effort for co-occurring species could increase outside the closed area. Therefore, the overall rate of bycatch might not change.

Yellowedge grouper, Misty Grouper, and Blueline Tilefish
Commercial bycatch of yellowedge grouper, misty grouper, and blueline tilefish is low (Table 4-25) and likely to remain so because there is no commercial and recreational size limit or commercial quota. As a result, there is little incentive to release these species.

Yellowedge grouper, misty grouper, and blueline tilefish species are in the five grouper per person per day aggregate; however, the aggregate limit is rarely met. Therefore, there are few recreational discards (Table 4-28). Therefore, the preferred Type 2 MPA alternatives will have little effect on reducing bycatch of these species.

<u>Mid-Shelf Species</u>
Other species including black sea bass, gag, gray triggerfish, greater amberjack, knobbed porgy, lesser amberjack, red porgy, red grouper, red snapper, rock hind, scamp, tomtate, vermilion snapper, whitebone porgy, and white grunt are known to occur in some of the proposed Type 2 MPAs. Therefore, there would be no bycatch of these species within the closed areas upon implementation of Amendment 14. Black sea bass, vermilion snapper, red porgy, red snapper, scamp, gag, white grunt, and red grouper are among discarded species in the commercial and recreational fishery in recent years (Tables 4-25 and 4-28). The preferred MPA alternatives are likely to reduce bycatch of these species within the proposed Type 2 MPAs. Overall bycatch of these species might not decrease since fishermen may increase effort outside the areas.

4.15.2 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. The preferred Type 2 MPA alternatives are likely to eliminate discards within the areas. Elimination of fishing pressure and bycatch within the Type 2 MPAs could result in an increase in the mean size/age and biomass of snowy grouper, golden tilefish, Warsaw grouper, blueline tilefish, and speckled hind that occur within the closed areas. Yellowedge grouper and misty grouper are less frequently taken in commercial landings and have limited documentation in the proposed Type 2 MPAs. Many of the proposed Type 2 MPAs are important nursery areas to juvenile speckled hind, Warsaw grouper, and snowy grouper that are large enough to be targeted with fishing gear. Therefore, implementation of the Type 2 MPAs would reduce or eliminate bycatch of juvenile stages and protect nursery areas for these commercially important species. Some of the preferred Type 2 MPA alternatives occupy a broad depth zone which includes juvenile and adult stages of deepwater species as well as adult mid-shelf species. These Type 2 MPAs are likely to protect a greater diversity of species and life history stages than Type 2 MPAs with a narrow depth range. Therefore, a prohibition of fishing for or possessing snapper grouper species with the exception of vessels in transit, prohibition on shark bottom longlines, and elimination of bycatch within the Type 2 MPAs will likely result in positive ecological changes in the community structure of reef ecosystems within the closed areas.

4.15.3 Changes in the Bycatch of Other Fish Species and Resulting Population and Ecosystem Effects

Many of the preferred Type 2 MPA alternatives are likely to reduce the number of discards of a number of mid-shelf species including black sea bass, gag, gray triggerfish, greater amberjack, knobbed porgy, lesser amberjack, red porgy, red grouper, red snapper, rock hind, scamp, tomtate, vermilion snapper, whitebone porgy, and white grunt that have been documented to occur within the preferred Type 2 MPAs. Elimination of fishing pressure and bycatch within the Type 2 MPAs could result in an increase in the mean size/age and biomass of mid-shelf species that reside there. Many of the proposed MPAs are important nursery areas to juvenile speckled hind, Warsaw grouper, and snowy grouper that are large enough to be targeted with fishing gear.

In addition to ecological changes within the Type 2 MPAs, establishment of Type 2 MPAs could result in ecological changes to surrounding areas. For example, many of the species that are known to occur in the Type 2 MPAs such as gag and greater amberjack may move hundreds of miles each year, presumably to spawn (McGovern et al. 2005). Other species such as snowy grouper, speckled hind, and Warsaw grouper may only remain in the Type 2 MPA for a portion of their life history since these species move into deeper water with increasing size and age. Without fishing pressure and bycatch, an increase in size and density of fish species within Type 2 MPAs is expected. As a result, there may be spillover into adjacent reef habitats. Furthermore, spawning of a number of deepwater (e.g., golden tilefish, speckled hind, and blueline tilefish) and shelf-edge species (e.g., vermilion snapper, red porgy, gag, scamp, etc.) has been documented in the preferred MPA alternatives. Thus, the Type 2 MPAs may serve as a source of spawning products to surrounding areas.

4.15.4 Effects on Marine Mammals and Birds

Establishment of Type 2 MPAs and associated termination of bottom fishing effort in the area has the potential to further reduce the potential number of interactions with 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 large whales. The southeast U.S. Atlantic black sea bass pot fishery is included in the grouping of the Atlantic mixed species trap/pot fisheries, which the 2004 List of Fisheries classifies as a Category II. Gear types used in these fisheries are determined to have occasional incidental mortality and serious injury of marine mammals (69 FR 153; August 10, 2004). However, there are no reports of marine mammal interactions in the commercial snapper grouper fishery.

There are no known interactions between the black sea bass pot fishery and large whales. Although the gear type used within the black sea bass pot fishery can pose an entanglement risk to large whales, the distribution and occurrence of sperm, fin, sei, and blue whales are unlikely to overlap with the black sea bass pot fishery operated within the snapper grouper fishery. Right and humpback whales may overlap both spatially and temporally with the black sea bass pot fishery. Measures to reduce entanglement risk in pot/trap fisheries for these two species are being addressed under the revised Atlantic Large Whale Take Reduction Plan (70 FR 118; June 21, 2005). Based on this information, NMFS (2006) stated the continued operation of the snapper grouper fishery in the southeast U.S. Atlantic EEZ is not likely to adversely affect sperm, fin, sei, and blue whales.

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 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 USFWS data). Neither species has been described as associating with vessels or having had interactions with the snapper grouper fishery. Therefore, interaction with fisheries has not been reported as a concern for either of these species.

4.15.5 Changes in Fishing, Processing, Disposal, and Marketing Costs

Preferred Type 2 MPA management alternatives in Amendment 14 are likely to reduce bycatch within the areas and could affect the cost of fishing operations. Establishment of Type 2 MPAs and elimination of bycatch within the areas could result in an increase in consumptive benefits, such as stock effects and increased harvest levels, which would have a positive impact on the predicted value of any of the proposed Type 2 MPAs.

Additionally, non-consumptive benefits would positively affect this value if increases in environmental quality, option values, or existence values are realized. The extent to which these positive effects would be realized depends on the composition of the stock within the different Type 2 MPA alternatives. A number of other snapper grouper species are found in the different Type 2 MPAs; thus, long-run stock benefits may be increased as other species are protected. Long-term benefits associated with the protection of spawning deepwater and mid-shelf species may be especially valuable.

Costs associated with Type 2 MPAs may include reduction in incomes of displaced fishermen due to harvest reductions attributable to Type 2 MPA regulations; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species by displaced fishermen. The extent that displaced fishermen can replace lost income or mitigate extra search and congestion costs will depend on alternative fishing opportunities during the winter season or increasing effort during other times of the year.

4.15.6 Changes in Fishing Practices and Behavior of Fishermen

Establishment of Type 2 MPAs through Amendment 14 could result in a modification of fishing practices by commercial and recreational fishermen, thereby affecting the magnitude of discards outside of the proposed Type 2 MPAs. While it is likely bycatch will be reduced in the preferred Type 2 MPA alternatives, there is a potential for increased discards outside the Type 2 MPAs if fishermen increase effort in areas that are not closed to fishing.

Fishermen can be educated about methods to reduce bycatch and enhance survival of regulatory discards. While this may be advantageous for mid-shelf species, deepwater species experience nearly 100% mortality from depth related trauma. Furthermore, it is not clear that changes in behavior could substantially affect the amount of bycatch incurred. Gear changes such as hook type or hook size could have some affect on reducing bycatch mortality. Furthermore, closed seasons, new or reduced quotas, reduced trip limits, and increased size limits could cause some commercial and recreational fishermen to reduce effort. Measures in Amendment 15, such as closing a deepwater species group when the quota is met for an indicator species may help to reduce bycatch. A Limited Access Privilege program (LAPP) would likely influence fishing practices and behavior, thereby contributing to a reduction in bycatch. However, it is difficult to quantify any of the measures in terms of reducing discards until the magnitude of bycatch has been monitored over several years. Amendment 15 will establish a program for monitoring bycatch in the snapper grouper fishery.

4.15.7 Changes in Research, Administration, and Enforcement Costs and Management Effectiveness

Research and monitoring is needed to understand the effectiveness of proposed Type 2 MPA management measure in reducing bycatch. The research and monitoring outlined in Section 4.11 will address some of these issues. Additional work is needed to determine the effectiveness of measures being developed in Amendment 15 and by the Council (LAPPs and Ecosystem Fishery Management Plan) to reduce bycatch. Some observer information has recently been provided by MARFIN and Cooperative Research Programs but more is needed. 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. Furthermore, the use of electronic logbooks could be enhanced to enable fishery managers to obtain information on species composition, size distribution, geographic range, disposition, and depth where fish are released. Additional administrative and enforcement efforts will be needed to implement and enforce these regulations.

4.15.8 Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

Preferred Type 2 MPA alternatives, which are likely to decrease discards in the closed areas could result in social and/or economic impacts as discussed in Section 4.

4.15.9 Changes in the Distribution of Benefits and Costs

The extent to which the preferred Type 2 MPA alternatives will decrease the magnitude of discards is unknown. It is likely that bycatch will decrease within the areas but effort could increase outside the areas resulting in no net reduction in bycatch. Research and monitoring is needed to understand the effectiveness of proposed Type 2 MPA management measure in reducing bycatch inside and outside the closed areas. The Research and Monitoring outlined in Section 4.11 will help address these issues.

4.15.10 Social Effects

The social effects of the preferred Type 2 MPA alternatives, which are likely to decrease discards in the areas, are discussed in Section 4.

4.15.11 Conclusion

This section evaluates the practicability of taking additional action to minimize bycatch and bycatch mortality in the South Atlantic snapper grouper fishery using the ten factors provided at 50 CFR 600.350(d)(3)(i). In summary, the preferred Type 2 MPA alternatives are likely to reduce bycatch within the areas. However, effort could increase outside the areas resulting in no net reduction in bycatch.

Elimination of fishing pressure and bycatch within the Type 2 MPAs could result in an increase in the mean size/age and biomass of snowy grouper, golden tilefish, Warsaw grouper, blueline tilefish, speckled hind, and mid-shelf species that occur within the preferred Type 2 MPAs. Bycatch of speckled hind and Warsaw grouper is very high and establishment of Type 2 MPAs could be of particular benefit to these species. Furthermore, bycatch of snowy grouper and golden tilefish may increase as a result of management measures imposed through Amendment 13C further enhancing the benefits of the Type 2 MPAs.

Many of the proposed Type 2 MPAs are important nursery areas to juvenile speckled hind, Warsaw grouper, and snowy grouper that are large enough to be targeted with fishing gear. Some of the Type 2 MPAs occupy a broad depth zone, which includes juvenile and adult stages of deepwater species as well as adult mid-shelf species. These Type 2 MPAs are likely to protect a greater diversity of species and life history stages than Type 2 MPAs with a narrow depth range. Therefore, ecological changes are expected to occur in the community structure of reef ecosystems within the Type 2 MPAs as a result of actions that would eliminate fishing pressure within the closed areas.

In addition to ecological changes within the Type 2 MPAs, establishment of Type 2 MPAs and elimination of bycatch in the areas could result in ecological changes in surrounding areas. For example, many of the species that are known to occur in the Type 2 MPAs such as gag and greater amberjack may move hundreds of miles each year, presumably to spawn (McGovern et al. 2005). Other species such as snowy grouper, speckled hind, and Warsaw grouper may only remain in the Type 2 MPA for a portion of their life history since these species move into deeper water with increasing size and age. With increasing size and density of fish species within Type 2 MPAs, there may be spillover into adjacent reef habitats. Furthermore, spawning of a number of deepwater (e.g., golden tilefish, speckled hind, and blueline tilefish) and shelf-edge species (e.g., vermilion snapper, red porgy, gag, scamp, etc.) has been documented in the preferred Type 2 MPA alternatives. Thus, the Type 2 MPAs may serve as a source of spawning products to surrounding areas.

Additional measures to reduce bycatch in the snapper grouper fishery are being developed. Amendment 15 to the Snapper Grouper FMP will propose additional measures to reduce bycatch in the snapper grouper fishery. For example, a deepwater species grouping based on biological, geographic, economic, taxonomic, technical, social, and ecological factors has been proposed in Amendment 15. The group would be represented by an indicator species, which has been recently assessed. One alternative in Amendment 15 would close fishing for all species in a species grouping once the quota was met for an indicator species or the deepwater unit that does not include the indicator species. Since species in a group are likely to be caught together, such an alternative could reduce bycatch.

A Limited Access Privilege Program for the snapper grouper fishery is being discussed in Amendment 16. Under a LAP program, commercial fishermen could be allocated percentages of a TAC which is set by fishery managers based on estimates of what level of catch the fishery can sustain. This program has the potential to substantially reduce bycatch by providing fishermen more flexibility to decide where and when to fish. LAP programs could give fishermen the flexibility to target more favorable harvesting conditions and avoid areas where bycatch of certain species is more likely.

5 Social Impact Analysis

The fishing community is described in Section 3.3.2 Social and Cultural Environment and the direct and indirect social impacts are described in Sections 4.2.3, 4.3.3, 4.4.3, 4.5.3, 4.6.3, 4.7.3, 4.8.3, 4.9.3, and 4.10.3. Section 4.14 describes the Cumulative Impacts and Section 4.14.2 covers the Socioeconomic Impacts.

Given that these discussions are an integral part of this amendment, a stand-alone Social Impact Assessment is not required.

6 Regulatory Impact Review

6.1 Introduction

Executive Order (E.O.) 12866 requires a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. The RIR does three things: (1) it provides a comprehensive review of the level and incidence of impacts associated with a regulatory action; (2) it provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives which could be used to solve the problem; and (3) it ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective way.

The RIR also serves as the basis for determining whether any proposed regulations are a "significant regulatory action" under certain criteria provided in Executive Order 12866 (E.O. 12866) and whether the approved regulations will have a "significant economic impact on a substantial number of small business entities" in compliance with the Regulatory Flexibility Act of 1980 (RFA).

6.2 Problems and Objectives

The purpose and need, issues, problems, and objectives of the proposed amendment are presented in Section 1.1 and are incorporated herein by reference. In summary, the primary purpose of this amendment is to employ a collaborative approach to identify MPA sites with the potential to protect a portion of the population and habitat of long-lived, slow growing, deepwater snapper grouper species from directed fishing pressure to achieve a more natural sex ratio, age and size structure within the proposed Type 2 MPAs while minimizing adverse social and economic effects.

6.3 Methodology and Framework for Analysis

This RIR assesses management measures from the standpoint of determining the resulting changes in costs and benefits to society. To the extent practicable, the net effects of the proposed measures should be stated in terms of producer and consumer surplus, changes in profits, employment in the direct and support industries, and participation by for-hire fishermen and private anglers. However, this information does not exist for the fisheries or areas of fisheries covered by the proposed action. Therefore, the impacts of the proposed action are described in terms of qualitative changes in costs and benefits. A detailed explanation of the methodology can be found in Section 4.1.2.

6.4 Description of Fisheries

The South Atlantic snapper grouper (SASG) fishery is described in Section 3.3, and is incorporated herein by reference.

6.5 Impacts of Management Measures

This proposed amendment contains eight actions which consider establishing Type 2 MPAs, and the ninth action addresses shark bottom longlines. Four costs are associated with the Type 2 MPAs: 1) losses of landings and associated revenues due to the prohibition against fishing for species in a Type 2 MPA, 2) potential increases in operating costs because vessels may have to operate in a different manner, 3) potential congestion of vessels outside a Type 2 MPA, and 4) administrative and enforcement costs. Additional details on the economic impacts of the proposed management alternatives are included in Section 4 and are included herein by reference.

6.5.1 Action 1: Establish a Type 2 MPA in the Area of the Snowy Wreck off the Coast of North Carolina

Either Alternative 1 or Alternative 2 will result in the prohibition of fishing for or possession of any snapper grouper species in the designated Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Both Alternative 1 and Alternative 2 encompass the wrecks of concern and should have similar results in protecting snowy grouper in the area. Alternative 1 is situated a little further inshore than Alternative 2 and contains hardbottom areas; consequently, Alternative 1 may protect more mid-shelf and rare deepwater species.

Short-term benefits derived from Alternative 1 relative to Alternative 2, due mainly to the possibility that more species would be protected under Alternative 1, may include additional option and existence value through preservation; a hedge against uncertain stock assessments for more species; and enhanced size, age, and genetic structure of mid-shelf and rare deepwater species residing in the western inshore portion of Alternative 1. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors, such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations.

Costs associated with Alternatives 1 and 2 may include reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen. Costs associated with Alternative 1 relative to Alternative 2 would be the converse of the benefits listed above regarding any species that would have been protected in the far eastern portion of Alternative 2 but not in Alternative 1.

Short-term net displacement costs incurred by fishermen would likely be higher for Alternative 1 relative to Alternative 2 since fishermen who harvest mid-shelf species in the western portion of Alternative 1 would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the mid-shelf region. This conclusion assumes that there are fewer operations that would be affected in the eastern deepwater portion of Alternative 2, especially since vessels would have to travel around the Type 2 MPA if any snapper grouper species were caught in this area unless the gear was stowed.

Displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

The relative impact of these benefits and costs would depend on the amount of additional mid-shelf and deepwater biomass that is contained in the western portion of Alternative 1. However, this impact could be mitigated to the extent that snowy grouper or rare deepwater species reside exclusively in the eastern portion of Alternative 2.

Alternative 3 (status quo alternative) is not expected to have any direct impacts since all current and customary fishing behaviors would be unaffected. Costs associated with Alternative 3 relative to Alternatives 1 and 2, however, may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind. Benefits associated with Alternative 3 relative to Alternatives 1 and 2 may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen.

6.5.2 Action 2: Establish a Type 2 MPA in an Area off the Northern South Carolina Coast

Alternative 1, 2, or 3 would prohibit fishing for or possession of snapper grouper species in the Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Snowy grouper are found within the boundaries of all three alternatives; thus, consumptive benefits, such as stock effects, increased harvest levels, and reduced harvest variation, would have a positive impact on the predicted value of any of the alternative Type 2 MPAs. Additionally, nonconsumptive benefits would positively affect this value if increases in environmental quality, option values, and/or existence values are realized. The extent to which these positive effects would be realized depends on the composition of the stock within the different Type 2 MPA alternatives. As noted above, a number of other snapper grouper species are found in these areas; thus, long-run stock benefits may be increased as other species are protected. Benefits associated with the protection of spawning vermilion snapper may be especially valuable in the long-run; however, it is not clear which alternative contains a relative plurality of these young fish.

Costs associated with Alternatives 1, 2, or 3 may include a reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species by displaced fishermen.

Since these sites are mostly fished in the winter, a seasonal dimension is introduced to the displacement effects. The extent that displaced fishermen can replace lost income or mitigate extra search and congestion costs will depend on alternative fishing opportunities during the winter season or increasing effort during other times of the year. Short-term net displacement costs incurred by fishermen would likely be higher for Alternatives 1 and 2 relative to Alternative 3 since the sites are perpendicular to the coast, and fishermen who harvest mid-shelf species would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the mid-shelf region and the relative increase in distance traveled to avoid the Type 2 MPA. Displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Alternative 4 is the no-action option. Costs associated with Alternative 4 relative to Alternatives 1, 2, and 3 may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind. Benefits associated with Alternative 4 relative to the other alternatives may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species by displaced fishermen.

6.5.3 Action 3: Establish a Type 2 MPA in an Area off the Central South Carolina Coast

Either Alternative 1 or 2 would prohibit fishing for or possession of any snapper grouper species in the MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Costs associated with either Alternative 1 or Alternative 2 may include a reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species displaced fishermen.

Harvest reductions and increased variable or fixed costs associated with switching fishing habits are expected to be less for Alternative 2 than Alternative 1 because of Alternative 2's orientation to the coast and break.

Alternative 3 is the no-action option. Costs associated with Alternative 3 relative to Alternatives 1 and 2 may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind. Benefits associated with Alternative 3 relative to Alternatives 1 and 2 may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species by displaced fishermen.

6.5.4 Action 4: Establish a Type 2 MPA in an Area off the Georgia Coast.

Either Alternative 1 or 2 would prohibit fishing for or possession of snapper grouper species in the MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Short-term benefits derived from Alternative 2 relative to Alternative 1, due mainly to the possibility that a greater amount of snowy grouper and mid-shelf species would be protected through Alternative 2, may include additional option and existence value through preservation, a hedge against uncertain stock assessments for more species, and enhanced diversity of deepwater and mid-shelf species. However, Alternative 1 may offer more benefits than Alternative 2 in regards to tilefish as this area would protect spawning tilefish and contains more preferable tilefish habitat than Alternative 2. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors, such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations.

Costs associated with either Alternative 1 or Alternative 2 may include a reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species displaced fishermen.

Short-term net displacement costs incurred by fishermen would likely be higher for Alternative 2 relative to Alternative 1 since fishermen who harvest mid-shelf species and snowy grouper in Alternative 2 would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the snowy grouper and mid-shelf species, which is unknown. This conclusion assumes that there are fewer operations that would be affected in Alternative 1 if any snapper grouper species were caught in this area. Costs to fishermen would be lower in Alternative 1 since they could more easily maneuver around the area (or stow their gear), although the extent to which more tilefish are found in these areas would determine the relative magnitude of displacement costs among the alternatives. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Alternative 3 is the no-action option. Benefits associated with Alternative 3 relative to Alternatives 1 and 2 may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species by displaced fishermen. Costs associated with Alternative 3 relative to Alternatives 1 and 2 may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind.

6.5.5 Action 5: Establish a Type 2 MPA off the Northern Florida Coast.

Alternatives 1 through 6 would prohibit fishing for or possession of any snapper grouper species in the Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Short-term benefits derived from Alternatives 1 and 2 may include additional option and existence value through preservation, a hedge against uncertain stock assessments for more species, limited protection of deepwater species, and enhanced diversity of deepwater and mid-shelf species. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors, such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations. The benefits are likely to be realized mainly for mid-shelf species rather than the deepwater species. Thus, Alternatives 4, 5, and 6 have been proposed; however, there is no information regarding these sites at this time other than they appear to be situated to the east of Alternatives 1 and 2. To the extent that these new areas would encompass more deepwater stocks and less mid-shelf species, differences in net benefits among the alternatives would be observed.

Costs associated with Alternatives 1 through 6 may include a reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen.

Short-term net displacement costs incurred by fishermen would likely be higher for Alternatives 1 and 2 relative to Alternatives 4, 5, and 6 since fishermen who harvest mid-shelf species in Alternatives 1 and 2 would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the mid-shelf species, which is unknown. This conclusion assumes there are fewer operations that would be affected in Alternative 4, 5, and 6 if any snapper grouper species were caught in this area. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Alternative 7 is the no action option. Costs associated with Alternative 7 relative to all other alternatives may include reduced opportunity to protect deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper and mid-shelf landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper, speckled hind, and other mid-shelf species. Benefits associated with Alternative 3 relative to all other alternatives may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen.

6.5.6 Action 6: Establish a Type 2 MPA in Area Known as St. Lucie Hump off the Florida East Coast

Alternative 1 would prohibit fishing for or possession of snapper grouper species in the MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Short-term benefits derived from Alternative 1 depend on the extent that deepwater species reside and spawn in the proposed protected area. Benefits may include additional option and existence value through preservation; a hedge against uncertain stock assessments for deepwater species; and enhanced size, age, and genetic structure of deepwater species residing in Alternative 1. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors, such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations. The protected area seems to be located in relatively shallow water; thus, benefits may be accrued for mid-shelf species as well as deepwater species.

Costs associated with Alternative 1 may include a reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen.

Short-term net displacement costs incurred by fishermen would be correlated to the amount of current fishing effort in this area. It is likely that both recreational and commercial fishermen would be displaced due to the proximity of the site to the east coast of Florida. The configuration of the Type 2 MPA (parallel to the Florida coast) may mitigate avoidance costs to fishermen if they fish in a pattern that is parallel to the coast. The protected area seems to be located in relatively shallow water; thus, fishermen targeting mid-shelf species may experience displacement in addition to those targeting deepwater species. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.
Alternative 2 is the no-action option. Benefits associated with Alternative 2 relative to Alternative 1 may include no reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen. Costs associated with Alternative 2 relative to Alternative 1 may include reduced opportunity to protect rare deepwater and mid-shelf species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish the snowy grouper stock in these areas; inefficient use of societal resources if snowy grouper landings were at a level that did not maximize net social benefit; and reduction in option and existence values for snowy grouper and speckled hind.

6.5.7 Action 7: Establish a Type 2 MPA in Area Known as East Hump and Unnamed Hump off Coast of Florida Keys

Alternative 1 would prohibit fishing for or possession of any snapper grouper species within the Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Short-term benefits derived from Alternative 1 depend on the extent that deepwater species reside and spawn in the proposed protected area. Benefits may include additional option and existence value through preservation; a hedge against uncertain stock assessments for deepwater species; and enhanced size, age, and genetic structure of deepwater species residing in Alternative 1. Longer-term benefits such as increased aggregate biomass and reduced harvest variability would depend on various factors, such as spillover and dispersal rates, environmental shocks, fleet dynamics, and future regulations.

Costs associated with Alternative 1 may include reduction in incomes of displaced fishermen due to harvest reductions attributable to the Type 2 MPA regulation; an increase in variable or fixed costs associated with search or switching fishing habits; increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); adverse economic impacts on surrounding communities; enforcement and/or additional management costs; and increased fishing pressure on other species (e.g., vermilion snapper) by displaced fishermen.

Short-term net displacement costs incurred by fishermen would be correlated to the amount of current fishing effort in this area. It is likely that both recreational and commercial fishermen would be displaced due to the proximity of the site to the Florida Keys. The configuration of the Type 2 MPA (perpendicular to the Florida Keys Marine Sanctuary) may mitigate avoidance costs to fishermen rather than if the area had been parallel. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Alternative 2 is the no-action option. Benefits associated with Alternative 2 relative to Alternative 1 may include no reduction in incomes or utility of displaced commercial and recreational fishermen due to harvest reductions attributable to the Type 2 MPA regulation; no increase in variable or fixed costs associated with search or switching fishing habits; no increased congestion from displaced vessels in other sectors of the SASG fishery (e.g., mid-shelf snappers); no adverse economic impacts on surrounding communities; no enforcement or additional management costs; and no increased fishing pressure on other species (e.g., yellowtail snapper) by displaced fishermen. Costs associated with Alternative 2 relative to Alternative 1 may include reduced opportunity to protect deepwater species in these areas and the reduction in species variety that could result; loss of the opportunity to replenish deepwater stocks in these areas; inefficient use of societal resources if deepwater species landings were at a level that did not maximize net social benefit; and reduction in option and existence values for deepwater species.

6.5.8 Action 8: Establish an Experimental Artificial Reef Type 2 MPA off the South Carolina Coast

Alternative 1 would prohibit fishing for or possession of snapper grouper species within the Type 2 MPA (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F). Since this area does not contain any hardbottom, and it is believed there are no snapper grouper species found in this area, short-term stock benefits probably will not be realized for Alternative 1. Longer-term benefits such as enhanced size, age, and genetic structure of deepwater species residing in Alternative 1 and increased aggregate biomass and reduced harvest variability may be realized after the artificial reef is constructed. These benefits will depend on the amount of the stock that migrates into the area from the inshore and offshore sides of the Type 2 MPA. Additional benefits may arise if spawning stocks of golden and blueline tilefish migrate to this area. Management benefits may be realized as artificial reefs can be used as a tool to study the enforcement of closed areas, monitoring of closed areas, and many other scientific questions.

It is believed that no snapper grouper species are found in the area. Consequently, the prohibition is expected to have no effect on current fishing practices. Costs of Alternative 1 would include those associated with the creation, enforcement, and studying of the Type 2 MPA.

Alternative 2 is the no-action option. Costs associated with Alternative 2 relative to Alternative 1 may include reduced opportunity to protect deepwater species that may migrate and spawn in these areas and the foregone species variety that could result; loss of the opportunity to create deepwater stocks in these areas; and reduction in option and existence values for deepwater species that would reside in the artificial reef area. Benefits of no action would mainly include the mitigation of any costs associated with the creation, enforcement, and studying of the proposed Type 2 MPA.

6.5.9 Action 9: Prohibit Shark Bottom longlines in the Type 2 MPAs

Alternative 1 would prohibit use of shark bottom longlines within the Type 2 MPAs. Given that 2% of the 1,563 observed shark bottom longline trips intercepted any of the proposed Type 2 MPAs, the level of impact on shark longline vessels is expected to be minimal. The proposed Type 2 MPAs are small and for a vessel to change the area of a set, would only involve steaming fewer than 10 miles. Affected vessels will forego some revenue from the loss of the bycatch from within the proposed Type 2 MPAs. The expanded harvest obtained (see Section 4.10) was estimated to be approximately 1,106 groupers, tilefish, and black sea bass over 12 years, for a total of 92.2 fish per year. If this harvest is divided up among the 100 active vessels, the total is approximately 1 fish per vessel per year. If each fish was assumed to weigh 20 pounds, using the price of $2 per pound from the high price category (Figure 3-27), the potential revenue loss per vessel would be $40 per vessel per year. The estimated revenue loss from the loss of shark catches was estimated to be between $3,239 and $3,245 per vessel per year (see Section 4.10.2).

Alternative 2 is the no-action option. Costs associated with Alternative 2 relative to Alternative 1 may include reduced opportunity to protect deepwater species that may migrate and spawn in these areas and the foregone species variety that could result; loss of the opportunity to create deepwater stocks in these areas; loss of the opportunity to protect habitat in these areas; loss of the opportunity to increase the effectiveness of law enforcement; and reduction in option and existence values for deepwater species that would reside in the artificial reef area. Benefits of no action would mainly include the mitigation of any costs associated with the creation, enforcement, and studying of the proposed Type 2 MPA.

6.6 Public and Private Costs of Regulations

The preparation, implementation, enforcement, and monitoring of this or any Federal action involves the expenditure of public and private resources which can be expressed as costs associated with the regulations. Costs associated with this amendment are shown in Table 6-1.

Table 6-1. Costs associated with this amendment.

ITEM	COST
Council costs of document preparation, meetings, public hearings, and information dissemination	$100,000
NOAA Fisheries administrative costs of document preparation, meetings and review	$100,000
Annual law enforcement costs	$4,577,924
TOTAL	$4,777,924

A summary of estimated enforcement costs is shown in Table 6-2.

Table 6-2. Southeast enforcement costs for implementation of Amendment 14.

Position/Grade*	Number of Personnel	% of Time	Estimated Costs
ASAC/14	1	10	$13,378
SA/12	2	75	$147,128
Personnel Costs			**$160,506**
Training Travel			$2,000
Investigative Travel			$20,000
JEA Personnel/Fuel	*	*	$395,418
Patrol Vessels	**	**	$4,000,000
Other Costs			$4,417,418
Total			**$4,577,924**

6.7 Summary of Economic Impacts

For the most part benefit-cost valuation of Type 2 MPAs is determined by distributional effects related to the displacement of recreational and commercial fishermen, changes in economic impact on surrounding communities, and bioeconomic linkages associated with the protected stock; however, societal issues may be present as well.

Economic benefits and costs resulting from Type 2 MPA protection may be characterized as either consumptive (e.g., commercial and recreational fishing) or nonconsumptive (e.g., recreational diving). Consumptive costs and benefits are direct biological and economic effects that affect the profitability of the SASG commercial fishing fleet, the satisfaction of recreational fishermen, and the efficient use of society's resources. (Recreational effects may be realized in Georgia and Florida, but are likely to be minimal for South Carolina and North Carolina due to longer distances traveled from homeport to the protected areas). Non-consumptive benefits and costs include societal losses and gains as well as effects on fishery management. Management and enforcement costs are expected to total approximately $4.8 million.

6.8 Determination of Significant Regulatory Action

Pursuant to Executive Order (E.O.) 12866, a regulation is considered a "significant regulatory action" if it: (1) has an annual effect on the economy of $100 million or more or adversely affects in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) creates a serious inconsistency or otherwise interferes with an action taken or planned by another agency; (3) materially alters the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raises novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866.

The proposed action will not meet the $100 million threshold, nor are there expected to be any significant adverse effects on prices, employment, or competition. Measures in this action do not adversely affect the environment, public health or safety, or state, local, or tribal governments or communities, nor do they interfere or create inconsistency with any action of another agency, including state fishing agencies. No effects on the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof have been identified. The actions in the proposed action represent normal management options or practices and, therefore, do not raise novel legal or policy issues.

Since the proposed regulatory action will not meet any of the conditions listed above, it is determined that the proposed rule, if implemented, would not constitute a "significant regulatory action" under E.O. 12866.

7 Regulatory Flexibility Analysis

This Regulatory Flexibility Analysis does not consider the impact of the proposed action to prohibit use of shark bottom longlines in the MPAs because there is insufficient information to make a determination of the size of the impacts and the number of small businesses affected. Therefore, NOAA Fisheries Service encourages small businesses to comment on the potential impacts of this action.

7.1 Introduction

The purpose of the Regulatory Flexibility Act (RFA) is to establish a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and applicable statutes, to fit regulatory and informational requirements to the scale of businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration. The RFA does not contain any decision criteria; instead, the purpose of the RFA is to inform the agency, as well as the public, of the expected economic impacts of the alternatives contained in the FMP or amendment (including framework management measures and other regulatory actions) and to ensure that the agency considers alternatives that minimize the expected impacts while meeting the goals and objectives of the FMP and applicable statutes.

With certain exceptions, the RFA requires agencies to conduct a regulatory flexibility analysis for each proposed rule. The regulatory flexibility analysis is designed to assess the impacts various regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those impacts. In addition to analyses conducted for the RIR, the regulatory flexibility analysis provides: (1) a description of the reasons why action by the agency is being considered; (2) a succinct statement of the objectives of, and legal basis for the proposed rule; (3) an identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap, or conflict with the proposed rule; (4) a description and, where feasible, an estimate of the number of small entities to which the proposed rule will apply; (5) a description of the projected reporting, record-keeping, and other compliance requirements of the final rule, including an estimate of the classes of small entities which will be subject to the requirements of the report or record; and (6) a description of significant alternatives to the proposed rule which accomplish the stated objectives of applicable statues and which minimize any significant economic impact of the proposed rule on small entities.

7.2 Statement of need for, objectives of, and legal basis for the proposed rule

The purpose and need, issues, problems and objectives of Snapper Grouper Amendment 14 are described in detail in Section 1.3 and are incorporated herein by reference. In summary, the primary purpose of this amendment is to employ a collaborative approach to identify Type 2 MPA sites with the potential to protect a portion of the population and habitat of long-lived, slow growing, deepwater snapper grouper species from directed fishing pressure to achieve a more natural sex ratio, age, and size structure within the proposed Type 2 MPAs while minimizing adverse social and economic effects. The Magnuson-Stevens Fishery Management and Conservation Act, as amended and reauthorized, provides the statutory basis for the proposed rule.

7.3 Identification of all relevant Federal rules which may duplicate, overlap, or conflict with the proposed rule

No duplicative, overlapping, or conflicting Federal rules have been identified.

7.4 Description of the projected reporting, record-keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for the preparation of the report or records

These actions will prohibit fishing for or possession of any snapper grouper species (however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as defined in Appendix F) and prohibit use of shark bottom longlines within any of the Type 2 MPAs.

7.5 Description and estimate of the number of small entities to which the proposed rule will apply

Two general classes of small business entities would be directly affected by the proposed rule, commercial fishing vessels and for-hire fishing vessels. The Small Business Administration defines a small entity in the commercial fishing sector as a firm that is independently owned and operated, is not dominant in its field of operation, and has average annual gross receipts not in excess of $4 million (2002 NAICS 11411). For a for-hire business, the appropriate revenue benchmark is $6.5 million (2002 NAICS 487210).

A comprehensive study of vessels that participated in the South Atlantic snapper grouper fishery in 1994 provided estimates of total vessel revenue from all fishing activities (Waters *et al.* 1997). Average net incomes estimated from the boats that were sampled in this study, in declining order, were $83,224 for boats that primarily used bottom longlines in the northern area, $23,075 for boats that primarily used black sea bass pots in the northern area, $15,563 for boats that primarily used bottom longlines in the southern area, $11,649 for boats that primarily used vertical lines in the southern area, and $8,307 for boats that primarily used vertical lines in the northern area. Overall, boats in the northern area averaged $14,143 in net income based on average revenues of $48,702, while boats in the southern area averaged $12,388 net income based on average revenues of $39,745.

Average annual ex-vessel revenue from landings of snapper grouper species per vessel from 1999 to 2003 ranges from $12,713 to $14,171 and in 2003 dollars from $13,150 to $14,946 (Table 7-1).

Table 7-1. Ex-vessel and real ex-vessel revenue per vessel that landed snapper grouper species from 1999 to 2003.
Source: Southeast Regional Office, NOAA Fisheries.

Item	1999	2000	2001	2002	2003
Ex-vessel revenue	$13,996,781	$14,619,050	$13,902,225	$13,521,614	$11,914,249
Real ex-vessel revenue in $2003	$15,466,056	$15,618,643	$14,436,371	$13,825,781	$11,914,249
Number of vessels that landed snapper grouper species	1,101	1,045	981	955	906
Average ex-vessel revenue per vessel	$12,713	$13,990	$14,171	$14,159	$13,150
Average real ex-vessel revenue per vessel	$14,047	$14,946	$14,716	$14,477	$13,150

Although some fleet activity may exist in this fishery, the extent of such has not been determined. Thus, all vessels are assumed to be unique business entities. Given the gross revenue profile captured by the Southeast logbook program and the findings of Waters *et al.* (2000), it is assumed that it is unlikely the SBA revenue benchmark will be exceeded and it is assumed that all vessels are small entities.

Holland *et al.* (1999) defined charterboats as boats for hire carrying 6 or fewer passengers that charge a fee to rent the entire boat. Headboats tend to be larger, generally can carry a maximum of around 60 passengers, and the fee is paid on an individual angler basis. Holland *et al.* (1999) employed two methods to determine the average gross revenue per vessel for the for-hire sector. The first method summarized the survey response of total gross revenue provided by the vessel owner. The second method calculated gross revenues based on the survey response to the average price per trip/passenger and the average number of trips/passengers taken/carried per year. The second method consistently generated higher estimates of average gross revenues, suggesting either over-reporting by survey respondents of individual components utilized in the calculated method, or under-reporting of gross revenues. This analysis assumes the alternative results provide an acceptable range of the true average gross revenues for this sector. These results are as follows: $51,000 to $69,268 for charterboats on the Atlantic coast of Florida; $60,135 to $73,365 for charterboats in North Carolina; $26,304 to $32,091 for charterboats in South Carolina; $56,551 to $68,992 for charterboats in Georgia; $140,714 to $299,551 for headboats in Florida; and $123,000 to $261,990 for headboats in the other South Atlantic states. Similar to the situation with the commercial harvest sector, some fleet activity may exist within the for-hire sector. The magnitude and identity of such is unknown, however, and all vessels are assumed to represent unique business entities. Given the gross revenue profiles provided, it is clear that vessels in the for-hire recreational sector will also not exceed the SBA revenue benchmark and all for-hire entities are determined to be small business entities.

There were 1,066 commercial snapper grouper permitted vessels in the South Atlantic during 2004 (Table 3-18). A number of these permitted vessels were not active in the snapper grouper fishery. It is not possible to estimate the total number of true latent permits (i.e., those permits which are not expected to be fished in any given year and may exist only for speculative purposes) since permits with no associated landings could become active in a subsequent year. The number of permitted vessels, however, is an upper bound on the universe of vessels in this fishery. The assumed lower bound of the universe of vessels is the number of active vessels in the latest year for which data are available. This lower bound estimate is 906 vessels, or the number of vessels/permits with recorded landings of snapper grouper species in the South Atlantic in 2003 (Table 3-18). Thus, the range of vessels assumed to potentially operate in the commercial snapper grouper fishery is 906 to 1,066. A complete description of these entities is contained in Section 3.3.1. Currently, there is insufficient information to determine the number of commercial fishing vessels that fish for any snapper grouper species in the proposed Type 2 MPAs.

For the for-hire sector, 1,594 snapper grouper for-hire permits were issued to vessels in the southern Atlantic states in 2004 (Table 3-50). The for-hire fishery operates as an open access fishery and not all of the permitted snapper grouper for-hire vessels are necessarily active in this fishery. Some vessel owners have been known to purchase open access permits as insurance for uncertainties in the fisheries in which they currently operate. Holland *et al*. (1999) estimated that a total of 1,080 charter vessels and 96 headboats supplied for-hire services in all fisheries in Florida (east and west coast) and the rest of the South Atlantic in 1997 (Table 3-51). Currently, there is insufficient information to assess the number of for-hire vessels that fish for any snapper grouper species in the proposed Type 2 MPAs.

According to data provided by HMS Management Division, approximately 100 of the 250 vessels with directed shark permits are active.

7.6 Substantial number of small entities criterion

Currently, there is insufficient information to assess the numbers or percentages of commercial and for-hire vessels that fish for snapper grouper species in the proposed Type 2 MPAs and thus would be directly affected by the proposed rule. Consequently, it may or may not affect a substantial number of small entities.

7.7 Significant economic impact criterion

The outcome of "significant economic impact" can be ascertained by examining two issues: disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All vessel operations affected by the proposed Amendment are considered small entities so the issue of disproportionality does not arise in the present case. However, among the small entities in the commercial harvesting sector, there is a high degree of diversity in terms of landings of snapper grouper species and primary gear employed as represented in Tables 7-2 and 3-24.

Table 7-2. Distribution of vessels that landed snapper grouper species in the South Atlantic by pounds of snapper grouper species landed from 1999 to 2003.
Source: Southeast Regional Office, NOAA Fisheries.

Number of Vessels	1999	2000	2001	2002	2003
1 to 100 lbs of snapper grouper landed	11.72%	11.96%	13.35%	14.87%	14.68%
101 to 1,000 lbs of snapper grouper landed	28.61%	30.05%	27.01%	24.08%	25.50%
1,001 to 10,000 lbs of snapper grouper landed	41.60%	39.33%	39.65%	40.10%	40.84%
10,001 to 50,000 lbs of snapper grouper landed	15.62%	16.17%	17.33%	18.22%	16.78%
Over 50,000 lbs of snapper grouper landed	2.45%	2.49%	2.65%	2.72%	2.21%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

At present, there is insufficient information to determine how many vessels of the various landings classifications operate in any of the proposed MPAs.

Profitability: Do the regulations significantly reduce profit for a substantial number of small entities?

The proposed Type 2 MPAs would prohibit fishing for or possession of any snapper grouper species (with the exception of vessels in transit and with gear properly stowed) and prohibit use of shark bottom longlines within the MPAs. Consequently, a direct cost of the rule would be the losses of revenues and profits derived from fishing for or possessing snapper grouper species and using shark bottom longlines in those areas. It is expected that vessels will mitigate some of these losses by relocating to other areas. However, there is insufficient information to quantify the losses of revenues and profits from the creation of the Type 2 MPAs.

7.8 Description of significant alternatives

Discussion of the expected impacts of the alternatives considered in this action is contained in Sections 4.2 and 7.0 and is incorporated herein by reference. A summary of these alternatives follows.

Three alternatives, including the status quo, were considered for the proposed action to establish a Type 2 MPA in the area of Snowy Wreck. The status quo (Alternative 3) would reduce the opportunity to protect mid-shelf and rare deepwater snapper grouper species in these areas and the reduction in species variety that could result. The first alternative would protect more mid-shelf and rare deepwater species, while short-term net displacement costs incurred by fishermen would likely be higher for Alternative 1 relative to Alternative 2 since fishermen who harvest mid-shelf species in the western portion of Alternative 1 would also be affected.

Four alternatives, including the status quo, were considered for the proposed action to establish a Type 2 MPA off the northern South Carolina coast. The status quo alternative (Alternative 4) would reduce the opportunity to protect mid-shelf and rare deepwater species and the reduction in species variety that could result. Short-term, net, displacement costs incurred by fishermen would likely be higher for Alternatives 1 and 2 relative to Alternative 3 since the sites are perpendicular to the coast, and fishermen who harvest mid-shelf species would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the mid-shelf region and the relative increase in distance traveled to avoid the Type 2 MPA. Displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Three alternatives, including the status quo, were considered for the proposed action to establish a Type 2 MPA off the southern coast of South Carolina (Edisto MPA). The status quo alternative (Alternative 3) would reduce the opportunity to protect mid-shelf and rare deepwater species and the reduction in species variety that could result. Short-term, net, displacement costs incurred by fishermen would likely be higher for Alternative 1 relative to Alternative 2 since the site is perpendicular to the coast, and fishermen who harvest mid-shelf species would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the mid-shelf region and the relative increase in distance traveled to avoid the Type 2 MPA unless gear is stowed. Displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Three alternatives, including the status quo, were considered for the proposed action to establish a Type 2 MPA off the coast of Georgia. The status quo alternative (Alternative 3) would reduce the opportunity to protect tilefish, snowy grouper, and mid-shelf snapper grouper species in these areas and the reduction in species variety that could result. Alternative 2 may protect a greater amount of snowy grouper and mid-shelf species than the first alternative, while Alternative 1 may give greater protection to spawning tilefish relative to Alternative 2. Short-term net displacement costs incurred by fishermen would likely be higher for Alternative 2 relative to Alternative 1 since fishermen who harvest mid-shelf species and snowy grouper in Alternative 2 would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the snowy grouper and mid-shelf species, which is unknown. This conclusion assumes that there are fewer operations that would be affected in Alternative 1 if any snapper grouper species were caught in this area. Costs to fishermen would be lower in Alternative 1 since they could more easily maneuver around the closed area, although the extent to which more tilefish are found in these areas would determine the relative magnitude of displacement costs among the alternatives.

Seven alternatives, including the status quo, were considered for the proposed action to establish a Type 2 MPA off the north Florida coast. The status quo alternative (Alternative 7) would reduce the opportunity to protect deepwater and mid-shelf snapper grouper species in these areas and the reduction in species variety that could result. Short-term, net, displacement costs incurred by fishermen would likely be higher for Alternatives 1, 2, and 3 relative to Alternatives 4, 5, and 6 since fishermen who harvest mid-shelf species in Alternatives 1, 2, and 3 would also be affected. The relative impact of these costs would be directly related to the number of additional displaced vessels that fish the mid-shelf species, which is unknown. This conclusion assumes there are fewer operations that would be affected in Alternative 4, 5, and 6 if any snapper grouper species were caught in this area. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Two alternatives, including the status quo, were considered for the proposed action to establish a Type 2 MPA in the area known as St. Lucie Hump off the coast of Florida. The status quo alternative (Alternative 2) would reduce the opportunity to protect deepwater and mid-shelf snapper grouper species in these areas and the reduction in species variety that could result. Alternative 1's short-term, net, displacement costs would be correlated to the amount of current fishing effort in this area. It is likely that both recreational and commercial fishermen would be displaced due to the proximity of the site to the east coast of Florida. The configuration of the Type 2 MPA (parallel to the Florida coast) may mitigate avoidance costs to fishermen if they fish in a pattern that is parallel to the coast.

Two alternatives, including the status quo, were considered for the proposed action to establish a Type 2 MPA in the vicinity of the area known as East Hump and Unnamed Hump off the coast of the Florida Keys. The status quo alternative (Alternative 2) would reduce the opportunity to protect deepwater and mid-shelf snapper grouper species in these areas and the reduction in species variety that could result. Short-term net displacement costs incurred by fishermen due to Alternative 1 would be correlated to the amount of current fishing effort in this area. It is likely that both recreational and commercial fishermen would be displaced due to the proximity of the site to the Florida

Keys. The configuration of the Type 2 MPA (perpendicular to the Florida Keys Marine Sanctuary) may mitigate avoidance costs to fishermen rather than if the area had been parallel. Additionally, displaced vessels as well as other parts of the fleet may experience congestion costs as effort relocates to other non-protected areas.

Two alternatives, including the status quo, were considered for the proposed action to establish an artificial reef Type 2 MPA off the coast of South Carolina. The status quo alternative (Alternative 2) would reduce the opportunity to protect deepwater and mid-shelf snapper grouper species in these areas and the reduction in species variety that could result. It is believed that no snapper grouper species are found in this area. Consequently, Alternative 1 would not affect current practices of snapper grouper fishermen.

Two alternatives, including the status quo, were considered for the proposed action to prohibit use of shark bottom longlines in the Type 2 MPAs. The status quo alternative (Alternative 2) would make it more difficult to enforce the Type 2 MPAs, which would reduce the opportunity to protect deepwater and mid-shelf snapper grouper species in these areas and the reduction in species variety that could result. Alternative 1 would prohibit use of shark bottom longlines within the Type 2 MPAs.

8 Other Applicable Law

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (16 U.S.C. 1801 et seq.), as amended and reauthorized, governs the conservation and management of ocean fishing in the United States. The purpose of the MSFCMA is to create sustainable fisheries in United States waters through elimination of overfishing and rebuilding of overfished stocks important to commercial, recreational, and subsistence fisheries. In addition to the MSFCMA, the Council and NOAA Fisheries must comply with many applicable laws during the preparation of Fishery Management Plans (FMPs) and FMP amendments. Major laws affecting Federal fishery management decision making in the South Atlantic are summarized below.

8.1 Administrative Procedures Act

All federal rulemaking is governed under the provisions of the Administrative Procedure Act (APA) (5 U.S.C. Subchapter II), which establishes a "notice and comment" procedure to enable public participation in the rulemaking process. Under the APA, NOAA Fisheries 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.

8.2 Coastal Zone Management Act

Section 307(c)(1) of the federal Coastal Zone Management Act (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. Based on the analysis of the environmental consequences of the proposed action in Section 4.0, the Council has concluded this amendment would improve Federal management of snapper grouper species.

This amendment is consistent with the Coastal Zone Management Plans of Florida, South Carolina, Georgia, and North Carolina to the maximum extent practicable. This determination was submitted to the responsible state agencies under Section 307 of the CZMA administering approved Coastal Zone Management Programs in the States of Florida, South Carolina, Georgia, and North Carolina.

8.3 Endangered Species Act

The Endangered Species Act (ESA) of 1973 (16 U.S.C. Section 1531 et seq.) requires that federal agencies use their authorities to conserve threatened and endangered species. They must ensure actions they authorize, fund, or carry out are not likely to harm the continued existence of those species or the habitat designated as critical to their survival and recovery. The ESA requires NOAA Fisheries Service to consult with the appropriate administrative agency (itself for most marine species, the U.S. Fish and Wildlife Service for all remaining species) when proposing an action that "may affect" critical habitat or threatened or endangered species. 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, including a biological opinion, are required when proposed actions may affect and are "likely to adversely affect" threatened or endangered species adversely modify designated critical habitat. If jeopardy or adverse modification is found, the consulting agency is required to suggest reasonable and prudent alternatives.

NOAA Fisheries Service has recently completed a biological opinion on the ESA-listed species (see Section 3.2.3) potentially impacted by the continued operation of the South Atlantic snapper grouper fishery. That opinion found that the management measures proposed under Amendment 13C to the South Atlantic Snapper Grouper Fishery Management Plan are not likely to jeopardize the continued existence of any ESA-listed species or adversely modify critical habitat. An incidental take statement was issued allotting take for green, hawksbill, loggerhead, leatherback, and Kemp's ridley 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.

8.4 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 amendment and associated regulations. The affected states have been closely involved in developing the proposed management measures and the principal state officials responsible for fisheries management in their respective states have not expressed federalism related opposition to the proposed action.

8.5 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, NOAA Fisheries prepares a Regulatory Impact Review (RIR) for all fishery regulatory actions that implement a new 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 RFA. 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.

8.6 Executive Order 12898: Environmental Justice

E.O. 12898 requires that Federal agencies conduct their programs, policies, and activities in a manner to ensure that 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.

8.7 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 including, but not limited to, developing joint partnerships; promoting the restoration of recreational fishing areas that are limited by water quality and habitat degradation; fostering sound aquatic conservation and restoration endeavors; and evaluating the effects of Federally-funded, permitted, or authorized actions on aquatic systems and evaluating the effects of Federally-funded, permitted, or authorized actions on aquatic systems and recreational fisheries, and documenting those effects. 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 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 NOAA Fisheries and the U.S. Fish and Wildlife Service to develop a joint agency policy for administering the ESA.

8.8 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.

Amendment 14 to the Snapper Grouper FMP, which would establish eight Type 2 MPAs, fulfills the intentions of E.O. 13089. The proposed action would prohibit fishing for or possessing snapper grouper species (unless a vessel is in transit and gear is stowed) or use of shark bottom longlines within the proposed Type 2 MPAs.

8.9 Executive Order 13158: Marine Protected Areas

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 (MPAs). 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".

Amendment 14 proposes to establish 8 MPAs in the South Atlantic Council's area of authority which fulfils the intention of E.O. 13158.

8.10 Marine Mammal Protection Act

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 NOAA Fisheries) is responsible for the conservation and management of cetaceans and pinnipeds (other than walruses). The Secretary of the Interior is responsible for walruses, sea and marine otters, polar bears, manatees, and dugongs.

Part of the responsibility that NOAA Fisheries Service 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.

The commercial hook-and-line components of the South Atlantic snapper grouper fishery (i.e., bottom longline, bandit gear, and handline) are listed as Category III as there have been no documented interactions between this fishery and marine mammals (68 FR 41725). The black sea bass pot component of the South Atlantic snapper grouper fishery is considered part of the Atlantic mixed species trap/pot fishery, a Category II fishery, under the MMPA. An interaction with a marine mammal has never been documented in the South Atlantic black sea bass pot fishery. The fisheries' classification changed as a precaution because of known interactions with marine mammals by gears very similar to those utilized in the black sea bass fishery.

8.11 Migratory Bird Treaty Act and Executive Order 13186

The Migratory Bird Treaty Act (MBTA) implemented several bilateral treaties for bird conservation between the United States and Great Britain, the United States and Mexico, the United States and Japan, and the United States and the former Union of Soviet Socialists Republics. Under the MBTA, it is unlawful to pursue, hunt, take, capture, kill, possess, trade, or transport any migratory bird, or any part, nest, or egg of a migratory bird, included in treaties between the, except as permitted by regulations issued by the Department of the Interior (16 U.S.C. 703-712). Violations of the MBTA carry criminal penalties. Any equipment and means of transportation used in activities in violation of the MBTA may be seized by the United States government and, upon conviction, must be forfeited to it.

Executive Order 13186 directs each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a memorandum of understanding (MOU) with the U.S. Fish and Wildlife Service (USFWS) to conserve those bird populations. In the instance of unintentional take of migratory birds, NOAA Fisheries Service would develop and use principles, standards, and practices that will lessen the amount of unintentional take in cooperation with the USFWS. Additionally, the MOU would ensure that NEPA analyses evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.

An MOU is currently being developed, which will address the incidental take of migratory birds in commercial fisheries under the jurisdiction of NOAA Fisheries. NOAA Fisheries Service must monitor, report, and take steps to reduce the incidental take of seabirds that occurs in fishing operations. The United States has already developed the U.S. National Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries. Under that plan many potential MOU components are already being implemented.

8.12 National Environmental Policy Act

Concerned with the degree of damages incurred by human activity on the sensitive ecological environment in the United States, Congress passed, and Richard Nixon signed into law, the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. §§ 4321 *et seq.* NEPA sets the national environmental policy by providing a mandate and framework for federal agencies to consider all reasonably foreseeable environmental effects of their actions. In addition, it requires disclosure of information regarding the environmental impacts of any federal or federally funded action to public officials and citizens before decisions are made and actions taken. The analysis and results are presented to the public and other agencies through the development of NEPA documentation.

The Final Environmental Impact Statement (FEIS) integrated into Amendment 14 to the FMP serves as the documentation to satisfy the requirements of NEPA.

8.13 National Marine Sanctuaries Act

Under the National Marine Sanctuaries Act (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 the NOAA. The Act 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. Gray's Reef and Florida Keys are the two marine sanctuaries in the South Atlantic EEZ.

8.14 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to control paperwork requirements imposed on the public by the federal government. The authority to manage information collection and record keeping requirements is vested with the Director of the Office of Management and Budget. This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

The Council is not proposing, in this amendment, measures that would involve increased paperwork and consideration under this Act.

8.15 Regulatory Flexibility Act

The Regulatory Flexibility Act (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, NOAA Fisheries 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 Act 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 Act's provisions.

8.16 Small Business Act

Enacted in 1953, the Small Business Act requires that agencies assist and protect small-business interests to the extent possible to preserve free competitive enterprise.

8.17 Public Law 99-659: Vessel Safety

Public Law 99-659 amended the MSFCMA 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 the snapper grouper fishery 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 people participating in the fishery nor 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. Therefore, this amendment proposes neither procedures for making management adjustments due to vessel safety problems nor procedures to monitor, evaluate, or report on the effects of management measures on vessel or crew safety under adverse weather or ocean conditions.

9 List of Preparers

Name	Title	Agency	Division	Location
Heather Blough	NEPA Specialist	NMFS	SF	SERO
Myra Brouwer	Fishery Scientist	SAFMC	N/A	SAFMC
David Dale	EFH Specialist	NMFS	HC	SERO
Rick DeVictor	Environmental Impact Scientist	SAFMC	N/A	SAFMC
Doug DeVries	Fishery Biologist	NMFS		SEFSC
Tracy Dunn	Enforcement Specialist	NMFS	LE	SERO
Andy Herndon	Protected Resources	NMFS	PR	SERO
Denise Johnson	Economist	NMFS	SF	SERO
David Keys	NEPA Coordinator	NMFS	SF	SERO
Kathi Kitner	Anthropologist	SAFMC	N/A	SAFMC
Beverly Lambert	Fisheries & Law Enforcement	NMFS	SF	SERO
Vishwanie Maharaj	Economist	SAFMC	N/A	SAFMC
Jack McGovern	Fishery Biologist	NMFS	SF	SERO
Margaret Murphy	Protected Resources Scientist	SAFMC	N/A	SAFMC
Kerry O'Malley	Fishery Scientist	SAFMC	N/A	SAFMC
Roger Pugliese	Senior Fishery Biologist	SAFMC	N/A	SAFMC
Monica Smit-Brunello	Attorney Advisor	NOAA	GC	SERO
Mark Sramek	Fisheries & Habitat	NMFS	SF	SERO
Brent Stoffle	Anthropologist	NMFS	Economics	SEFSC
Jim Waters	Economist	NMFS	Economics	SEFSC
Julie Weeder	Fishery Management Specialist	NMFS	SF	SERO
Gregg Waugh	Deputy Director	SAFMC	N/A	SAFMC
Erik Williams	Stock Assessment Biologist	NMFS	SF	SEFSC

10 Entities Consulted

Responsible Agency

Amendment 14:
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Environmental Impact Statement:
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List of Agencies, Organizations, and Persons Consulted

SAFMC Law Enforcement Advisory Panel
SAFMC Snapper Grouper Advisory Panel
SAFMC Marine Protected Areas Advisory Panel
SAFMC Coral Advisory Panel
SAFMC Habitat and Environmental Protection Panel
SAFMC Scientific and Statistical Committee
North Carolina Coastal Zone Management Program
South Carolina Coastal Zone Management Program
Georgia Coastal Zone Management Program
Florida Coastal Zone Management Program
Florida Fish and Wildlife Conservation Commission
Georgia Department of Natural Resources
South Carolina Department of Natural Resources
North Carolina Division of Marine Fisheries
North Carolina Sea Grant
South Carolina Sea Grant
Georgia Sea Grant
Florida Sea Grant
Atlantic States Marine Fisheries Commission
Gulf and South Atlantic Fisheries Development Foundation
Gulf of Mexico Fishery Management Council
National Marine Fisheries Service
- Washington Office
- Office of Ecology and Conservation
- Southeast Regional Office
- Southeast Fisheries Science Center

National Oceanic and Atmospheric Administration
- General Counsel
United States Coast Guard
United States Environmental Protection Agency, Region IV
Monroe County Commercial Fishermen, Inc.
North Carolina Fisheries Association, Inc.
National Fisheries Institute
Ocean Conservancy
Atlantic Coast Conservation Association
Environmental Defense
Project Reefkeeper
Marine Conservation Network
South Atlantic Sustainable Fisheries Association
HMS Advisory Panel

11 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.

Alsop, III, F. J. 2001. Smithsonian Handbooks: Birds of North America eastern region. DK Publishing, Inc. New York, NY

Anderes Alavrez, 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, J.A. Bohnsack, J. Luo, D.E. Harper, and D.B. McClellan. 2006. Building sustainable fisheries in Florida's coral reef ecosystem: Positive signs in the Dry Tortugas. Bulletin of Marine Science 78(3): 633-654.

Ballantine, B. 1991. Marine Reserves for New Zealand. University of Auckland, Leigh Laboratory Bulletin 25:1-196.

Barnette, M.C. 2001. A review of the fishing gear utilized within the Southeast Region and their potential impacts on essential fish habitat. NOAA Technical Memorandum NMFS-SEFSC-449.

Beets, J. and A. Friedlander. 1999. Evaluation of a conservation strategy: a spawning aggregation closure for red hind, *Epinephelus guttatus*, in the US Virgin Islands. Environmental Biology of Fishes 55:91–98.

Bernstein, B.S., S. Iudicello, and C. Stringer. 2004. Lessons Learned from Recent Marine Protected Area Designations in the United States. Report for The National Marine Protected Area Center (NOAA).

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.

Bohnsack, J.A. 1993. Marine reserves: They enhance fisheries, reduce conflicts, and protect resources. Oceanus, Fall 1993: 63-71.

Bohnsack, J. A. 1996. Maintenance and Recovery of Fishery Productivity in Tropical Reef Fisheries, Fish and Fisheries Series 20: 283-313.

Bohnsack, J. A. 1998. Application of marine reserves to reef fish management. Australian Journal of Ecology 23: 298-304.

Bohnsack, J. A. 2000. A comparison of the short-term impacts of no-take marine reserves and minimum size limits. Bulletin of Marine Science 66 (3): 635-650.

Bohnsack, J. A, J. S. Ault, and B. Causey. 2004. Why Have No-Take Marine Protected Areas? American Fisheries Symposium 42: 185-193.

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.

Brill, R.W. and M.E. Lutcavage. 2001. Understanding environmental influences of movements and depth distributions of tunas and billfishes can significantly improve population assessments. American Fisheries Society Symposium 25:179-198.

Brongersma, L.D. 1972. European Atlantic Turtles. Zool. Verhand. Leiden 121:318.

Buck, E.H. 1995. Social Aspects of Federal Fishery Management. CRS Report for Congress, April 21. 95-553.

Bullock, L.H. and G.B. Smith. 1991. Seabasses (Pisces: Serranidae). Memoirs of the Hourglass Cruises. St. Petersburg [Mem Hourglass Cruises.], vol. 8, no. 2, Florida Marine Research Institute, Department of Natural Resources, St. Petersburg, Florida (USA). 243 pp.

Bullock, L. H., M. F. Godcharles, and R. E. Crabtree. 1996. Reproduction of yellowedge grouper, *Epinephelus flavolimbatus*, for the eastern Gulf of Mexico. Bull. Mar. Sci. 59:216-224.

Burgess, G.H. and K.M. Johns. 1999. Commercial shark fishery observer program: Analysis of the large coastal shark fishery - July and August 1998 season in the southeastern United States, with a review of the 1998 commercial fishery in the region. Final report to the Highly Migratory Species Division, NMFS, Award No. 40GANF800117. 38 pp.

Burgess, G.H. and A. Morgan. 2002. Commercial shark fishery observer program; support for an observer program monitoring the directed commercial shark fishery in the eastern Gulf of Mexico and Atlantic Ocean. Final report to Highly Migratory Species Division, National Marine Fisheries Service. Award No. NA06FM0194.

Burgess, G.H. and A. Morgan. 2003. Commercial shark fishery observer program; renewal of an observer program to monitor the directed commercial shark fishery in the Gulf of Mexico and South Atlantic 2002(2) and 2003(1) fishing seasons. Final report to Highly Migratory Species Division, National Marine Fisheries Service. Award No. NA16FM1598.

Burgess, G.H. and A. Morgan. 2004. Commercial shark fishery observer program; an observer program report on the monitoring of the directed commercial shark fishery in the eastern Gulf of Mexico and South Atlantic 2003(2) fishing season. Final report to Highly Migratory Species Division, National Marine Fisheries Service. Award No. NA03NMF4540075.

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: 1176.

Burrell, V. G. 2000. The recreational fishery in South Carolina: The Little River Story. Educational Report 19, South Carolina Department of Natural Resources, Marine Resources Research Institute, Charleston, SC.

Byles, R.A. 1988. Behavior and Ecology of Sea Turtles from Chesapeake Bay, Virginia. Ph.D. dissertation, College of William and Mary, Williamsburg, VA.

Caplan, Robert. 2003. Making Unemployment Work for the Jobless. http://www.Forward.com (Accessed 10/30/2003). Accessed 11/6/2006 at: http://cache.zoominfo.com/cachedpage/?archive_id=0&page_id=520049450&page_url=%2f%2fwww.forward.com%2fissues%2f2003%2f03.10.31%2foped2. html&page_last_updated=10%2f30%2f2003+2%3a07%3a14+AM&firstName=Robert&lastName=Caplan

Carr, A. 1986. Rips, FADS, and little loggerheads. BioScience 36:92.

Carr, A. 1987. New perspectives on the pelagic stage of sea turtle development. Conservation Biology 1:103.

Carter, D.W. 2003. Protected areas in marine resource management: another look at the economics and research issues. Ocean and Coastal Management 46(5):439-456.

CETAP. 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf. Cetacean and Turtle Assessment Program, University of Rhode Island. Final Report #AA551-CT8-48 to the Bureau of Land Management, Washington, DC, 538 pp.

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.

Cheuvront, B. and M. Neal. 2004. A social and Economic Analysis of Snapper Grouper Complex Fisheries in North Carolina South of Cape Hatteras. A report for the NC Technical Assistance to the SAFMC, Task 5: NEPA Related Activities, Contract No. SA-03-03-NC. Morehead City, NC. 50 pages.

Clark, K. E., J.E. Applegate, L.J. Niles, and D.S. Dobkin. 2006. An objective means of species status assessment: adapting the Delphi technique. Wildlife Society Bulletin 34 (2): 419-425.

Claro, R. 1994. Características generales de la ictiofauna. p. 55-70. In R. Claro (ed.) Ecología de los peces marinos de Cuba. Instituto de Oceanología Academia de Ciencias de Cuba and Centro de Investigaciones de Quintana Roo.

Coastal Ocean Resource Economics 2005

Cocklin, C., M. Craw, and I. McAuley. 1998. Marine Reserves in New Zealand: Use Rights, Public Attitudes and Social Impacts. Coastal Management 26(3): 213-231.

Coleman, F. C., C. C. Koenig, and L. A. Collins. 1996. Reproductive styles of shallow-water grouper (Pisces: Serranidae) in the eastern Gulf of Mexico and the consequences of fishing spawning aggregations. Environmental Biology Fishes 47:129-141.

Coleman, F. C., C. C. Koenig, G. R. Huntsman, J. A. Musick, A. M. Eklund, J. C. McGovern, R. W. Chapman, G. R. Sedberry, and C. B. Grimes. 2000. Longlived reef fishes: the grouper-snapper complex. Fisheries 25(3):14-21.

Coleman, F.C., P. B. Baker, C.C. Koenig. 2004. A Review of Gulf of Mexico Marine Protected Areas: Successes, Failures, and Lessons Learned, www.fisheries.org, Vol. 29(2):10-21.

Collins, M. R. 1996. Survival estimates for demersal reef fishes released by anglers. Proc. Gulf Caribb. Fish. Inst. 44:259-269.

Collins, M. R., J. C. McGovern, G. R. Sedberry, H. S. Meister, and R. Pardieck. 1999. Swim bladder deflation in black sea bass and vermilion snapper: potential for increasing postrelease survival. North American Journal of Fisheries Management. 19:828-832.

Conover, D. and Munch, S. 2002. Sustaining Fisheries Yields Over Evolutionary Time Scales. Science, July 2002. pp. 94-96.

Cortes, E. and J. Neer. 2002. Updated Catches of Sharks. 2002 SEW Document SB-02-15.

Crance, J. H. 1987. Habitat suitability index curve for paddlefish, developed by the Delphi technique. North American Journal of Fisheries Management 7 (1): 123-130.

Crowder, L. B., S. J. Lyman, W. F. Figueria, and J. Priddy. 2000. Source-sink population dynamics and the problem of siting marine reserves. Bulletin of Marine Science, 66:799-820.

CRS Report for Congress, Marine Protected Areas: An Overview, February 2005, Jeffrey Zinn, Eugene H. Buck.

David, A. 2003. Susceptibility of reef fish to fishing in N.E. Gulf of Mexico Marine Protected Areas. Panama City, NMFS Southeast Fishery Science Center**:** 21.

Dixon, J.A. 1993. Economic Benefits of Marine Protected Areas. Oceanus 36(3): 35-38.

Dixon, J.A., L. F. Scura, and T. van't Hof. 1993. Meeting ecological and economic goals: marine parks in the Caribbean. Ambio 22:117-125.

Dobrzynski, T. and E. Nicholson. 2001. An Evaluation of the Short-term Social and Economic Impacts of Marine Reserves on User Groups in Key West. A Report prepared for Environmental Defense.

Dooley, J.K., 1978. Malacanthidae. In W. Fischer (ed.) FAO species identification sheets for fishery purposes. Western Central Atlantic (Fishing Area 31). Volume 3. FAO, Rome.

Dugan, J.E. and G.E. Davis. 1993. Applications of Marine Refugia to Coastal Fisheries Management. Canadian Journal of Fisheries and Aquatic Sciences 50:2029-2042.

Eckert, S.A., D.W. Nellis, K.L. Eckert, and G.L. Kooyman. 1986. Diving patterns of two leatherback sea turtles (*Dermochelys coriacea*) during internesting 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.

Epperly, S.P. and J.W. Dodrill. 1995. Catch rates of snowy grouper, *Epinephelus niveatus*, on the deep reefs of Onslow Bay, Southeastern U.S.A. Bull. Mar. Sci. 56(2):450-461.

Everhart, W.H. and W.D. Youngs. 1981. Principles of Fishery Science. Cornell University Press, London. 349 pp.

Freibaum, J. 2005. Fishers' Perceptions of Fisheries Management and Marine Protected Areas Along the South Atlantic Coast of the U.S. Paper presented at 2005 FAME Conference, Seattle, April 23 – 24.

Frick, J. 1974. Orientation and behavior of hatchling green turtles (*Chelonia mydas*) in the sea. Animal Behavior 24:849.

Froese, R. and D. Pauly, Editors. 2003. FishBase. World Wide Web electronic publication. www.fishbase.org, version 24 September 2003.

Gentner, B., M. Price, and S. Steinback. 2001. Marine Angler Expenditures in the Southeast Region, 1999. NOAA Technical Memorandum NMFS-F/SPO-48.

Gilmore, R.G. and R.S. Jones. 1992. Color variation and associated behavior in the epinepheline groupers, *Mycteroperca microlepis* (Goode and Bean) and *M. phenax* (Jordan and Swain). Bulletin of Marine Science 51: 83-103.

GMFMC 2003. A Review of Gulf of Mexico Marine Protected Areas: Successes, Failures, and Lessons Learned, Felicia C. Coleman, Pamela B. Baker, Christopher C. Koenig, Fisheries, Volume 29, No. 2.

GMFMC. 2003. Amendment 21 to the Reef Fish Management Plan. Gulf of Mexico Fishery Management Council. The Commons at Rivergate. 3018 North U.S. Highway 301, Suite 1000. Tampa, Florida 33619-227.

Grimes, C.B., C.F. Idelberger, K.W. Able, and S.C. Turner. 1988. The reproductive biology of tilefish *Lopholatilus chamaeleonticeps* and vulnerability to exploitation. Fishery Bulletin 86:745-762.

Haab, T. C., J. C. Whitehead, and T. McConnell. 2001. The Economic Value of Marine Recreational Fishing in the Southeast United States. NOAA Technical Memorandum NMFS-SEFSC-466.

Hain, J. H. W., M. J. Ratnaswamy, R. D. Kenney, and H. E. Winn. 1993. The fin whale, *Balaenoptera physalus*, in waters of the northeastern United States continental shelf. *Report to the International Whaling Commission* 42:653-669.

Halpern, B.S. and R.R. Warner. 2002. Marine reserves have rapid and lasting effects. Ecology Letters 5: 361-366.

Halpern, B.S. 2003. The impact of marine reserves: Do reserves work and does reserve size matter? Ecological Applications 13(1 Supplement): S117-S137.

Harris, P.J. and J. Stephen. 2005. Final Report Characterization of commercial reef fish catch and bycatch off the southeast coast of the United States. CRP Grant No. NA03NMF4540416.

Harris, P.J. and D.M. Wyanski. (in review). Age, growth and reproductive biology of the blueline tilefish, *Caulolatilus microps*, along the southeastern coast of the United States, 1982-99.

Harris, P.J., S.M. Padgett, and P.T. Powers. 2001. Exploitation-related changes in the growth and reproduction of tilefish and implications for the management of deepwater fisheries. America Fisheries Society Symposium 23:199-210.

Harter, S. and A. David. 2006. South Atlantic marine protected areas: Year two of a pre-closure evaluation of habitat and fish assemblages in five proposed reserves. Panama City, NMFS**:** 19.

Heemstra, P.C. and J.E. Randall. 1993. FAO species catalogue. Vol. 16. Groupers of the world. (Family Serranidae, Subfamily Epinephelinae). An annotated and illustrated catalogue of the grouper, rockcod, hind, coral grouper and lyretail species known to date. FAO Fish. Synops. 16(125).

Helvey, M. 2004. "Seeking Consensus on Designing Marine Protected Areas: Keeping the Fishing Community Engaged". Coastal Management 32: 173-190.

Holland, S. M., A. J. Fedler, and J. W. Milon. 1999. The Operation and Economics of the Charter and Headboat Fleets of the Eastern Gulf of Mexico and South Atlantic Coasts. University of Florida Office of research, Technology, and Graduate Education. Report prepared for the National Marine Fisheries Service. Grant Number NA77FF0553.

Hughes, G.R. 1974. The sea-turtles of south-east 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.

Huntsman, G.R., J. Potts, R. Mays, R.L. Dixon, P.W. Willis, M. Burton, and B.W. Harvey. 1992. A stock assessment of the snapper grouper complex in the U.S. South Atlantic based on fish caught in 1990. Report to the South Atlantic Fishery Management Council. June 1992. NMFS Beaufort Lab, 101 Pivers Island Road, Beaufort, NC, 28516-9722.

Johnson, D.R., N.A. Funacelli, and J.A. Bohnsack. 1999. Effectiveness of an Existing Estuarine No-Take Fish Sanctuary Within the Kennedy Space Center, Florida. North American Journal of Fisheries Management 19(4): 436-453.

Keener, P. 1984. Age, growth, and reproductive biology of the yellowedge grouper, *Epinephelus flavolimbatus*, off the coast of South Carolina. M.S. Thesis, College of Charleston. 65pp.

Keinath, J.A. and J.A. Musick. 1993. Movements and diving behavior of a leatherback sea turtle, *Dermochelys coriacea*. Copeia 1993:1010.

Kitner, K. R. 2006. Beeliners, Pinkies and Kitties: Mobility and Marginalization in the South Atlantic Snapper Grouper Fishery. Human Organization 65(3): 294-306.

Knowlton, A. R., S. D. Kraus, and R. D. Kenney. 1994. Reproduction in North Atlantic right whales (*Eubalaena glacialis*). Canadian Journal of Zoology 72:1297-1305.

Koenig, C.C. 2001. *Oculina* Banks: Habitat, fish populations, restoration and enforcement: Report to the South Atlantic Fishery Management Council.

Koenig, C.C., F.C. Coleman, L.A. Collins, Y. Sadovy, and P.L. Colin, 1996. Reproduction in the gag (*Mycteroperca microlepis*) (Pisces: Serranidae) in the eastern Gulf of Mexico and the consequences of fishing spawning aggregations. p. 307-323. In F. Arreguín-Sánchez, J.L. Munro, M.C. Balgos and D. Pauly (eds.) Biology, fisheries and culture of tropical groupers and snappers. ICLARM Conference Proceedings 48.

Koenig, C.C., F.C. Coleman, C.B. Grimes, G.R. Fitzhugh, K.M. Scanlon, C.T. Gledhill, and M. Grace. 2000. Protection of fish spawning habitat for the conservation of warm-temperate reef-fish fisheries of shelf-edge reefs of Florida. Bulletin of Marine Science 66:593-616.

Kozak, C. 2005. Wanchese braces for growth with land-use plan. The Virginian-Pilot.

Kraus, S. D., P. K. Hamilton, R. D. Kenney, A. Knowlton, and C. K. Slay. 2001. Reproductive parameters of the North Atlantic right whale. Journal of Cetacean Resource Management (Special Issue), 2: 231-236.

Lanyon, 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.

Larkin, S.L., C.M. Adams, and D.J. Lee. 2000. Reported Trip Costs, Gross Revenues, and Net Returns for U.S. Atlantic Pelagic Longline Vessels. Marine Fisheries Review. 62(2):49-60.

Lauck, T., C.W. Clark, M. Mangel, and G. Munro. 1998. Implementing the precautionary principle in fisheries management through marine reserves. Ecological Applications 8(1 Supplement): S72-S78.

Last, P. R. and J. D. Stevens. 1994. Sharks and Rays of Australia. CSIRO Australia. 513 pp.

Leeworthy, V.S. and P.C. Wiley. 2002. Socioeconomic impact analysis of marine reserve alternatives for the Channel Islands National Marine Sanctuary. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Special Projects, Silver Spring, MD.

Leon, Y.M. and C.E. Diez. 2000. Ecology and population biology of hawksbill turtles at a Caribbean feeding ground. Pp.32-33 *In*: Proceedings of the 18th International Sea Turtle Symposium, Abreau-Grobois, F.A., Briseno-Duenas, R., and Sarti, L. Compilers. NOAA Technical Memorandum NMFS-SEFSC-436.

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.

Loefer, J.K, G.R. Sedberry, and J.C. McGovern. 2005. Vertical movements of shortfin mako in the Western North Atlantic as determined by pop-up satellite tagging. Southeastern Naturalist 4:237-246.

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.

Lyons, S. 2002. Marine Protected Areas Social Science Strategy. Presentation at National MPA Center Science Institute, NOAA, September 2002.

MacDonald, L.H. 2000. Evaluating and managing cumulative effects: process and constraints. Environmental Management 26(3): 299-315.

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.

Manooch, C.S. 1984. Fisherman's Guide: Fishes of the Southeastern United States. Raleigh, NC: Museum of Natural History. 362 pp.

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.

Matheson, R.H., III and G.R. Huntsman. 1984. Growth, mortality, and yield-per-recruit models for speckled hind and snowy grouper from the United States, South Atlantic Bight. Trans. Am. Fish. Soc. 113(5):607-616.

Mayor, P., B. Phillips, and Z. Hillis-Starr. 1998. Results of stomach content analysis on the juvenile hawksbill turtles of Buck Island Reef National Monument, U.S.V.I. pp.230-232 *in* Proceedings of the 17th Annual Sea Turtle Symposium, S. Epperly and J. Braun, Compilers. NOAA Tech. Memo. NMFS-SEFSC-415

McClanahan, T.R. and B. Kaunda-Arara. 1996. Fishery recovery in a coral-reef marine park and its effect on the adjacent fishery. Conservation Biol. 10(4): 1187-1199

McGovern, J.C. and H.M. Meister. 1999. Data Report on MARMAP Tagging Activities From the Southeast Coast of the United States. MARMAP Data Report.

McGovern, J.C., D.M. Wyanski, O. Pashuk, C.S. Manooch, III, and G.S. Sedberry. 1998. Changes in the sex ratio and size at maturity of gag, *Mycteroperca microlepis*, from the Atlantic coast of the southeastern United States during 1976-1995. Fish. Bull. 96:797-807.

McGovern, J.C., G. R. Sedberry, H. S. Meister, T. M. Westendorff, D. M. Wyanski, and P. J. Harris. 2005. A Tag and Recapture Study of Gag, *Mycteroperca microlepis*, from the Southeastern United States. Bulletin of Marine Science 76:47-59.

McHugh, R.J. and T.J. Murray. 1997. An Analysis of the Demand for and Supply of Shark. MARFIN Grant No. NA57FF0052, University of South Florida and Georgia State University, December 1997.

Meester, G.A., A. Mehrotra, J.S. Ault, and E.K. Baker. 2004. Designing Marine Reserves for Fishery Management. Management Science 50(8): 1031-1043.

Mendonca, M.T. and P.C.H. Pritchard. 1986. Offshore movements of post-nesting Kemp's ridley sea turtles (*Lepidochelys kempi*). Herpetologica 42:373.

Meyland, 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.

Milon, J. 2000. Pastures, fences, tragedies and marine reserves. Bulletin of Marine Science 66(3):901-916.

Moore, C.M. and R.F. Labinsky. 1984. Population parameters of a relatively unexploited stock of snowy grouper in the lower Florida Keys. Transactions of the American Fisheries Society 113:322-329.

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.

MPA News. 1999. Tortugas Working Group Gets Consensus on Reserve, is Challenged by Anglers. 1(1): September 1999.

MRFSS. 2003. Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division.

Murray, S., R.F. Ambrose, J.A. Bohnsack, L.W. Botsford, M.H. Carr, G.E. Davis, P.K. Dayton, D. Gotshall, D.R. Gunderson, M.A. Hixon, J. Lubchenco, M. Mangel, A. MacCall, D.A. McArdle, J.C. Ogden, J. Roughgarden, R.M. Starr, M.J. Tegner, and M.M. Yoklavich. 1999. Notake reserve networks: Sustaining fishery populations and marine ecosystems. Fisheries 24(11): 11-25.

Naranjo, A. 1956. Cordel y anzuelo. Editorial Cenit, La Habana, Cuba. 251 pp.

National Research Council. 2001. Marine Protected Areas: Tools for Sustaining Ocean Ecosystems. National Research Council, Washington, D.C. 288 pp.

Nelson, R.S. 1988. A study of the life history, ecology, and population dynamics of four sympatric reef predators (*R. aurorubens, L. campechanus, H. melanurum,* and *P. pagrus*) on the East and West Flower Garden Banks, NW Gulf of Mexico. Ph.D. thesis, North Carolina State Univ., Raleigh, N.C., 197 p.

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, Raleigh. 57p.

NMFS (National Marine Fisheries Service). 1991. South Atlantic snapper grouper assessment. 1991. DOC/NOAA/NMFS/SEFSC. Staff report by NMFS Beaufort Lab, 101 Pivers Island Road, Beaufort, NC 28516. Unpublished manuscript. 6pp.

NMFS (National Marine Fisheries Service). 2004. Endangered Species Act Section 7 consultation on the Construction of a Fishing Pier in the City of Jacksonville, Florida. Biological Opinion, November 3.

NMFS (National Marine Fisheries Service). 2005. Report to Congress.

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.

NOAA Fisheries. 2004. Fisheries of the United States 2003. Current fisheries statistics No. 20003.

NOAA Fisheries. 1995. Review of the use of marine fishery reserves in the U.S. southeastern Atlantic. NOAA Technical Memorandum NMFS-SEFSC-376. 31 pp.

Norman, J. R. and F. C. Fraser. 1938. Giant Fishes, Whales and Dolphins. W. W. Norton and Company, Inc, New York, NY. 361 pp.

NRC (National Research Council). 2001. Marine protected areas: tools for sustaining ocean ecosystems. National Research Council, National Academy Press, Washington DC.

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, Masters thesis, Universidad Nacional Federico Villareal, Lima, Peru.

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.

Parker, R.O., Jr., 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.

PDT (Plan development Team). 1990a. The potential of marine fishery reserves for reef fish management in the U. S. southern Atlantic. Snapper grouper plan development team report for the South Atlantic Fishery Management Council. NOAA Technical Memorandum NMFS-SEFC-261.

PDT (Plan Development Team). 1990b. 1990 NMFS/PDT snapper grouper assessment. Report available from the South Atlantic Fishery Management Council, 1 Southpark Circle, Suite 306, Charleston, SC 29407.

Polacheck, T. 1990. Year Round Closed Areas as a Management Tool. Natural History 4: 327-354.

Pomeroy, C. 1999. Social Considerations for Marine Reserves: Socio-economic Considerations. *In*: Effectiveness of Marine Reserves in California's National Marine Sanctuaries, R. Starr, ed. Report to the Monterey Bay National Marine Sanctuary. Pp. 73-88.

Potts, J.C. and K. Brennan. 2001. Trends in catch data and static SPR values for 15 species of reef fish landed along the southeastern United States. Report for South Atlantic Fishery Management Council, Charleston, SC.

Potts, J.C., M.L. Burton, and C.S. Manooch, III. 1998. Trends in catch data and static SPR values for 15 species of reef fish landed along the southeastern United States. Report for South Atlantic Fishery Management Council, Charleston, SC.

Poulakis, G. R. and J. C. Seitz. 2004. Recent occurrence of the smalltooth sawfish, *Pristis pectinata* (Elasmobranchiomorphi: Pristidae), in Florida Bay and the Florida Keys, with comments on sawfish ecology. Florida Scientist 67(27): 27-35.

Pulliam H. R. 1988. Sources, Sinks, and Population Regulation. American Naturalist 132: 652-661.

Quattrini, A.M. and S.W. Ross. 2006. Fishes associated with North Carolina shelf-edge hardbottoms and initial assessment of a proposed marine protected area. Bull. Mar. Sci. 79(1):137-163.

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. Technical guidance on the use of precautionary approaches to implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-31. Washington, D.C. 54 pp.

Roberts C. M. and N.V.C. Polunin. 1993. Marine Reserves: Simple Solutions to Managing Complex Fisheries? Ambio 22: 363-368.

Roberts, C, W.J. Ballantine, C.D. Buxton, P. Dayton, L.B. Crowder, W. Milon, M.K. Orbach, D. Pauly, J. Trexler, and C.J. Walters. 1995. Review of the use of Marine Fishery Reserves in the U.S. southeastern Atlantic. NOAA Technical Memorandum NMFS-SEFSC-376. 31pp.

Roberts, C., J.A. Bohnsack, F. Gell, J.P. Hawkins, and R. Goodridge. 2001. Effects of Marine Reserves on Adjacent Fisheries. Science 294(5548): 1920-1923.

Robins, C.R. 1967. The juvenile of the serranid fish *Epinephelus mystacinus* and its status in Florida waters. Copeia 1967(4):838-839.

Robins, C.R. and G.C. Ray. 1986. A field guide to Atlantic coast fishes of North America. Houghton Mifflin Company, Boston, U.S.A. 354 p.

Ross, S.W. 1978. Life history aspects of the gray tilefish *Caulolatilus microps* (Goode and Bean, 1878). M.S. Thesis, College of William and Mary, Williamsburg, VA. 125 p.

Ross, S.W. and G.R. Huntsman. 1982. Age, growth, and mortality of blueline tilefish from North Carolina and South Carolina. Trans. Am. Fish. Soc. 111:585-592.

Rothschild, B.J. 1986. Dynamics of Marine Fish Populations. Harvard University Press. Cambridge, Massachusetts. 277pp.

Sadovy, Y. and A. M. Eklund. 1999. Synopsis of biological information on the Nassau grouper, *Epinephelus striatus* (Bloch 1792) and the jewfish, *E. itajara* (Lichtenstein 1822). NOAA Technical Report FAO Fisheries NMFS 146.

SAFMC (South Atlantic Fishery Management Council) and GMFMC (Gulf of Mexico Fishery Management Council). 1982. Fishery Management Plan for Corals and Coral Reefs and Environmental Impact Statement and Regulatory Impact Review. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 1983. Fishery Management Plan for Snapper Grouper Fishery, Environmental Impact Statement and Regulatory Impact Review. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 89pp.

SAFMC (South Atlantic Fishery Management Council). 1988. Amendment Number 1 and Environmental Assessment and Regulatory Impact Review to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 63 pp.

SAFMC (South Atlantic Fishery Management Council). 1991. Amendment Number 4, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 200 pp.

SAFMC (South Atlantic Fishery Management Council). 1993. Amendment Number 6, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 155 pp.

SAFMC (South Atlantic Fishery Management Council). 1994. Amendment Number 7, Regulatory Impact Review, Regulatory Impact Review and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 110 pp.

SAFMC (South Atlantic Fishery Management Council). 1997. Amendment Number 8, Regulatory Impact Review, Social Impact Assessment, Initial Regulatory Flexibility Analysis and Supplemental Environmental Impact Statement for 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). 1998a. Amendment Number 9, Final Supplemental 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, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 1998b. Final Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region. Including a Final Environmental Impact Statement /Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699. 136pp.

SAFMC (South Atlantic Fishery Management Council). 1998c. Amendment Number 9, Final Supplemental 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, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 1998d. Comprehensive Amendment Addressing Sustainable Fishery Act Definitions and Other Required Provisions in Fishery Management Plans of the South Atlantic Region (Amendment 11 to the Snapper Grouper Fishery Management Plan). South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 2000. Final Amendment 12 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. March.

South Atlantic Fishery Management Council. 2005. MPA Source Document. South Atlantic Fishery Management Council, 1 Southpark Circle, Charleston, S.C. 29407-4699. Available from the Council's website: www.safmc.net.

SAFMC (South Atlantic Fishery Management Council). 2006a. Amendment Number 13C, Final Supplemental Environmental Impact Statement, Biological Assessment, 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, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 2006b. Draft of Amendment Number 15, Draft Supplemental Environmental Impact Statement, Biological Assessment, 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, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699.

Salz, R.J. and D.K. Loomis. 2004. Saltwater Anglers' Attitudes toward Marine Protected Areas. Fish 29(6): 10-17.

Sanchirico, J. 2000. Marine Protected Areas: Can They Revitalize Our Nation's Fisheries? Resources 140: 6-9.

Sanchirico, J.N. 2000. Marine protected areas as fishery policy: a discussion of potential costs and benefits. Resources for the Future, Discussion Paper 00-23, Washington, D.C.

Sanchirico, J.N., K.A. Cochran, and P.M. Emerson. 2002. Marine protected areas: economic and social implications. Resources for the Future, Discussion Paper 02-26, Washington, D.C.

Schirripa, M. J., and C. M. Legault. 1997. Status of the gag stocks of the Gulf of Mexico. Assessment 2.0 stock assessment, Southeast Fisheries Science Center, Sustainable Fisheries Division, Miami, FL. NOAA/NMFS.

Schobernd, C.M. 2006. Submersible observation of Southeastern U.S. Deep Reef Fish Assemblages: Habitat Characteristics, Spatial and Temporal Variation, and Reproductive Behavior. M.S. Thesis, College of Charleston. 85pp.

Scholz, A., K. Bonzon, R. Fujita, N. Benjamin, N. Woodling, P. Black, and C. Steinbeck. 2004. Participatory socioeconomic analysis: drawing on fishermen's knowledge for marine protected area planning in California. Marine Policy 28: 335-349.

Scott, T. M. and S. S. Sadove. 1997. Sperm whale, *Physeter macrocephalus*, sightings in the shallow shelf waters off Long Island, New York. *Marine Mammal Science.* 13:317-321.

Schwartz, F. J. 2003. Bilateral asymmetry in the rostrum of the smalltooth sawfish, *Pristis pectinata* (pristiformes: family pristidae). Journal of North Carolina Academy of Science 119:41-47.

SEAMAP (Southeast Area Monitoring and Assessment Program-South Atlantic). 2001. Distribution of bottom habitats on the continental shelf from North Carolina through the Florida Keys. SEAMAP-SA Bottom Mapping Workgroup, Atlantic States Marine Fisheries Commission, Washington, D.C. 166 p.

SEDAR 1 (Southeast Data, Assessment and Review). 2002. Report of Red Porgy Stock Assessment Workshop. April 8 - May 6, 2002, Beaufort, NC. Prepared for the South Atlantic Fishery Management Council, Charleston, SC. Issued May 6, 2002. Corrected October 28, 2002.

SEDAR 2 (Southeast Data, Assessment and Review). 2003a. Report of the Vermilion Snapper Stock Assessment. January 6-10, 2003. Beaufort, N.C. 39p.

SEDAR 2 (Southeast Data, Assessment and Review). 2003b. Report of the Black Sea Bass Stock Assessment. January 6-10, 2003, Beaufort, N.C. 77pp.

SEDAR 4 (Southeast Data, Assessment and Review). 2004. Stock assessment of the deepwater snapper grouper complex in the South Atlantic. SEDAR 4 Stock Assessment Report 1. SEDAR4-SAR1. 2004.

SEDAR (Southeast Data, Assessment and Review). 2005. Report of Stock Assessment: Black Sea Bass. SEDAR Assessment Update #1. Assessment Workshop of March 15–17, 2005. Beaufort, North Carolina.

Southeast Delphi Expert Panel (SEDEP). 2007. SEDEP: Type II Marine Protected Areas for the South Atlantic Snapper Grouper Complex. National Marine Fisheries Service, Southeast Fisheries Science Center, Social Science Research Group. Miami, FL. Final Report. 102 p.

Sedberry, G.R., J.C. McGovern, and O. Pashuk. 2001. The Charleston Bump: an island of essential fish habitat in the Gulf Stream. *In:* G.R. Sedberry, editor. American Fisheries Society, Symposium 25, Bethesda, Maryland. Pages 3-24.

Sedberry, G.R., C.L. Cooksey, S.E. Crowe, J. Hyland, P.C. Jutte, C.M. Ralph, and L.R. Sautter. 2005. Characterization of deep reef habitat off the Southeastern U.S., with particular emphasis on discovery, exploration, and description of reef fish spawning sites. South Carolina Department of Natural Resources. Project Number NA16RP2697.

Sedberry, G.R., O. Pashuk, D.M. Wyanski, J.A. Stephen, and P. Weinbach. In Press. Spawning locations for Atlantic fishes off the Southeastern U.S. Proc. Gulf Caribb. Fish. Inst.

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.

Siegfried, K., M. Ribera, L. Hale, and J. Carlson. 2006a. Expanded take estimates of snapper grouper from the shark bottom longline fishery within proposed Type II Marine Protected Areas in the South Atlantic Fishery Management Council's Amendment 14 to the Snapper grouper Fishery Management Plan. National Marine Fisheries Service Panama City Laboratory Contribution 06-16. Panama City, Florida. 11 pages.

Siegfried, K., M. Ribera, L. Hale, and J. Carlson. 2006b. Expanded take estimates of coastal shark from the shark bottom longline fishery within proposed Type II Marine Protected Areas in the South Atlantic Fishery Management Council's Amendment 14 to the Snapper grouper Fishery Management Plan. National Marine Fisheries Service Panama City Laboratory Contribution 06-20. Panama City, Florida. 9 pages.

Simpfendorfer, CA. 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. 2002. Smalltooth sawfish: The USA's first endangered elasmobranch? Endangered Species Update 19: 53-57.

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.

Smith, C.L. 1971. A revision of the American groupers: *Epinephelus* and allied genera. Bull. Am. Mus. Nat. Hist. 146:1-241.

Smith, M. D. 2004. Fishing yield, curvature and spatial behavior: implications for modeling marine reserves. Natural Resource Modeling 17(3):273-298.

Sobel, J. 1993. Conserving Biological Diversity Through Marine Protected Areas: A Global Challenge. Oceanus 36: 19 – 26.

Soma, M. 1985. Radio biotelemetry system applied to migratory study of turtle. Journal of the Faculty of Marine Science and Technology 21:47. Tokai University, Japan.

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.

The H. John Heinz III Center for Science, Economics, and the Environment (The Heinz Center). 2000. Improving Federal Fisheries Management in the Caribbean Region: A Summary of Views Presented During the Caribbean Regional Roundtable. August.

Thompson, R. and J.L. Munro. 1974. The biology, ecology and bionomics of Caribbean reef fishes: Lutjanidae (snappers). Zoology Dep., Univ. West Indies, Kingston, Jamaica Res. Rep. 3.

Turoff, M. 1970. The Design of a Policy Delphi. Technological Forecasting and Social Change 2:149-171.

Van Dam, R. and C. Diéz. 1997. Predation by hawksbill turtles on sponges at Mona Island, Puerto Rico. Proc. 8th International Coral Reef Symposium 2: 1421-1426.

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.

Wahle, C., R. Grober-Dunsmore, and L. Woonick. 2006. Managing recreational fishing in MPAs through vertical zoning: The importance of understanding benthic-pelagic linkages. MPA News 7(8): 5.

Walker, T.A. 1994. Post-hatchling dispersal of sea turtles. *In*: Proceedings of the Australian Marine Turtle Conservation Workshop, Queensland Australia. P.79.

Wantiez, L., P. Thollot, and Kulbicki. 1997. Effects of marine reserves on coral reef fish communities from five islands in New Caledonia. Coral Reefs 16: 215-224.

Waring, G.T., D.L. Palka, P.J. Clapham, S. Swartz, M. Rossman, T. Cole, K.D. Bisack, and L.J. Hansen. 1998. U.S. Atlantic Marine Mammal Stock Assessments. NOAA Tech. Memo NMFS-NEFSC. Northeast Fisheries Science Center, Woods Hole, Massachusetts 02543-1026. December.

Waring, G.T., J. M. Quintal, and C.P. Fairfield (eds). 2002. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2002. NOAA Technical Memorandum NMFS-NE-169. Northeast Fisheries Science Center, Woods Hole, Massachusetts 02543-1026. September.

Waring, G.T, R.M. Pace, J. M. Quintal, C. P. Fairfield, and K. Maze-Foley, (eds). 2004. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2003. NOAA Technical Memorandum NMFS-NE-182. Northeast Fisheries Science Center, Woods Hole, Massachusetts 02543-1026. May.

Waters, J.R., R.J. Rhodes, W. Waltz, and R. Wiggers. 1997. Executive Summary: An economic survey of commercial reeffish boats along the U.S. South Atlantic Coast. USDC/NOAA/NMFS and SCDNR. November 1997. Unpublished.

Watkins, W.A., M.A. Daher, G.M. Reppucci, J.E. George, D.L. Martin, N.A. DiMarzio, and D.P. Gannon. 2000. Seasonality and distribution of whale calls in the North Pacific. Oceanography 13: 62-67.

Weaver, D.C. and G.R. Sedberry. 2001. Trophic subsidies at the Charleston Bump: food web structure of reef fishes on the continental slope of the Southeastern United States. American Fisheries Society Symposium 25:137-152.

Wenzel, F., D. K. Mattila, and P. J. Clapham. 1988. *Balaenoptera musculus* in the Gulf of Maine. Marine Mammal Science 4(2):172-175.

Westera, M.B., P. Lavery, and G. Hyndes. 2003. Recreationally targeted fish assemblages differ between protected and fished areas in a fringing coral reef marine park. Journal of Experimental Marine Biology and Ecology 294 (2): 145-168.

Whitehead, J.C. and T.C. Haab. 2001. Analysis of Contingent Evaluation data from the 1997-98 Southeast Economic Add-On Survey Data. NOAA Technical Memorandum NMFS-SEFSC-465.

Witzell, W.N. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): suggested changes to the life history model. Herpetological Review 33(4):266-269.

Wyanski, D.M., D.B. White, and C.A. Barans. 2000. Growth, population age structure, and aspects of the reproductive biology of snowy grouper, *Ephinephelus niveatus*, off North Carolina and South Carolina. Fishery Bulletin 98(1):199-218.

Zuboy, J. R. 1981. A new tool for fishery managers: the Delphi technique. North American Journal of Fisheries Management 1: 55-59.

12 Index

Affected environment
   Administrative, 153–56
   Biological/Ecological, 39–75
   Habitat, 36–39
   Human, 75–153
Alternatives
   Comparison, 28–35
   Description, 22–27
Comments
   EPA, A
   Public, A
   Responses, A–F
Cumulative effects, 306–21
Effects
   Biological, 157–66
   Economic, 167–74
   Social, 188–92
Entities consulted, 367–68
History of management, 12–19
List of preparers, 366
Marine mammals, 333
National Environmental Policy Act, ii, 363, 364, 372
Other applicable law, 359–65
Purpose and need, 7–8
Regulatory impact review, 339–48
Research needs, 301
Scoping, 22
Sea turtles, 70
Seabirds, 70
Social impact analysis, 338
Southeast, Data, Assessment, and Review, ii, 41, 44, 51, 198, 215, 230, 241, 257, 267, 273, 308, 310, 311, 312, 330, 331, 385
Summary, xiv

13 Appendices

13.1 Appendix A. Alternatives the Council considered but eliminated from detailed study and a brief discussion of the reasons for their elimination

13.1.1 The site selection process

An Action Plan was then developed that included three phases: Phase I. Planning/Criteria Development, during which criteria where developed and questions were raised about the proper size, placement and regulations within any potential marine reserves; Phase II. Decision Phase in which the Council, drawing on input from 3 rounds of scoping meetings, a Marine Reserves Workshop and the Marine Reserves AP made the decision that marine reserves were a necessary management tool for snapper grouper management; and Phase III. Implementation, this phase includes the Council's development of this amendment.

As outlined in Section 1 of this document the Council went through a long and deliberative public process to come to the determination that MPAs were a management tool necessary to help re-build overfished snapper grouper stocks. Once the decision was reached to move forward with the concept of MPAs an Action Plan (in SAFMC, 2005) was then developed that included three phases: Phase I. Planning/Criteria Development, during which criteria where developed and questions were raised about the proper size, placement and regulations within any potential marine reserves; Phase II. Decision Phase in which the Council, drawing on input from 3 rounds of scoping meetings, a Marine Reserves Workshop and the Marine Reserves AP made the decision that marine reserves were a necessary management tool for snapper grouper management; and Phase III. Implementation, which includes the Council's development of this amendment. The Council then explored ways to choose MPA sites that would both provide maximum biological benefits to the most vulnerable snapper grouper species and minimize social and economic impacts to stakeholders. The Council was steadfast in its belief that development of MPA must be a "bottom-up" process and that buy-in from user groups would ultimately determine the success of MPAs. Thus the public was asked to suggest MPA sites for the Council to consider.

An original list of criteria for the siting of MPAs was developed by the MPA Advisory Panel and was included in the Public Information Document (SAFMC, 2000). The Council asked the public and the AP to rank the list of criteria with the intent that the Council would use that public input to make their decision on the rank of the criteria. Those criteria along with a list of criteria borrowed from the National Marine Sanctuary's development of the Tortugas reserve were then used to determine which sites in the South Atlantic may appropriate for MPAs.

In the Spring of 2001 the Council held nine scoping meetings. The Scoping Document (SAFMC, 2001) included the list of criteria as an appendix. These were included so that the Council could gather public comment on which criteria should be used in developing

MPAs. The public was also provided charts that showed known hardbottom areas off the South Atlantic coast and was asked to use their experience and knowledge of snapper grouper species to suggest areas the Council may want to consider designating as marine reserves. As a part of this scoping process, the Marine Reserves Advisory Panel was asked to also suggest areas. As a result of this process over 40 sites were suggested and originally considered as potential marine reserves.

Many of the listed criteria were used both by the general public, the Council's advisors, and the Council to select the eight proposed sites proposed in this amendment, i.e. spawning areas, size of area, allowable activities, location, scientific basis, geography, social acceptance, regional considerations, urgency and degree of threat, timing for implementation, and fisheries sustainability. Through the process of developing the MPA Evaluation Plan (Section 4) other items from the list of criteria will come into play, such as measurable goals, biodiversity and habitat, monitoring, education, timeframes to evaluate results, research needs and opportunities, periodic review and enforcement/compliance.

At its meeting in June 2001 the MPA Committee and the Council looked at the list of suggested MPAs brought forth through the scoping process and decided to develop MPAs using sites from the list developed by the public. The Council further determined that more specifically the most important criteria during this round of developing MPAs would be the protection of deepwater snapper grouper species. Therefore, the Council is only considering sites that provide protection for deepwater species. The biological, economic and social impacts of these sites will be evaluated. However, as we understand the Council's position there is no mandate that we use all items listed as criteria in Attachments 1 and 2 as we develop Amendment 14.

13.1.2 Allowable activities

Another aspect of the development of appropriate MPA alternatives was deciding which activities if any would be allowed in any areas designated as MPAs. The PDT report presented to the Council in 1990 suggested that these areas be set aside for non-consumptive uses. Later when the Council began seriously looking at the use of MPAs as a management tool they purposely crafted a broad definition of the tool (marine reserves are specific areas of marine environment managed for the primary purpose of aiding in the recovery of overfished stocks and to insure the persistence of healthy fish stocks, fisheries, and habitats). This definition allowed the Council, its advisors, and the public to discuss and analyze the costs and benefits of allowing varying activities in the future proposed MPAs. As discussed in Section 1.0 of this document the Council considered and presented to the public the following types of actions that they considered in designating MPAs.

Type 1 - Permanent closure/no-take
Type 2 - Permanent closure/some take allowed
Type 3 - Limited duration closure/no-take
Type 4- Limited duration closure/some take allowed

Ultimately the Council narrowed its focus for this round of MPAs and determined the greatest need for this management tool at this time was to protect deepwater snapper grouper species. After that decision was made the Council determined that the both the social and economic costs of prohibiting all fishing were greater than the benefits (more effective law enforcement). The majority of the proposed MPAs (designed to protect deepwater snapper grouper species) are also very popular trolling spots for the pelagic fisheries. Therefore the Council choose to move forward with designating the proposed MPAs, Type 2 MPAs (fishing for snapper grouper species would be prohibited but other types of legal fishing would be allowed).

13.1.3 Specific Sites

13.1.3.1 Inshore Sites

The below sites are not being analyzed in Amendment 14 because they do not meet the Council's criteria of protecting deepwater snapper grouper species. However, as the Council considers using MPAs to protect mid-shelf snapper grouper species in subsequent amendments these sites will be analyzed in greater detail.

Other Possible Alternative 1A (North Carolina): This box represents an area within the New River bombing range. Water depth in this area is approximately 7-13 fathoms. This area was originally chosen because of its importance for juvenile gag recruitment, sub-adult gags and black sea bass. It was removed from consideration during this round of developing MPAs because it is inshore, in shallow water, and does not meet the Council's criteria of protecting overfished deepwater snapper grouper species.

NW 34°27' N 77°20' W	NE 34°27' N 77°10' W
SW 34°17' N 77°20' W	SE 34°17' N 77°10' W

Other Possible Alternative 2A (North Carolina): This box represents an area west of the "WR2 Tower". Water depth is 14-19 fathoms and it holds many of the mid-shelf snapper grouper complex species. This site holds a lot of structure and red porgy and vermilion snapper. It was removed from consideration during this round of developing MPAs because it is in shallow water, inshore and does not meet the Council's criteria of protecting overfished deepwater snapper grouper species. This area also produces roughly 80% of the fish landed from Topsail, Carolina and Wrightsville Beaches and would have great impacts on those areas.

NW 34°02' N 77°20' W	NE 34°02' N 77°10' W
SW 33°52' N 77°20' W	SE 33°52' N 77°10' W

Other Possible Alternative 3A (North Carolina): This box represents an area that surrounds “Frying Pan Tower”. It is recommended that this site be 5miles by 5 miles surrounding the tower. Water depth is 9-12 fathoms. This area is a popular diving site, but is also within close proximity to University of North Carolina at Wilmington which may make it ideal for research and monitoring. This area was removed for consideration at this time because it is inshore, in shallow water and does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

NW 33°35' N 77°30' W	NE 33°35' N 77°20' W
SW 33°25' N 77°30' W	SE 33°25' N 77°20' W

Other Possible Alternative 4A (North Carolina): This box represents an area east of Cape Lookout. The water depth for this area is approximately in 50 –100 fathoms. This area was removed for consideration, because although it meets the depth criteria it is located next to an area known as “Big Rock” and is highly utilized. It is also located near the “Atlas Tanker” and many people move through this box to get to the wreck.

NW 34°30' N 76°00' W	NE 34°30' N 75°00' W
SW 34°20' N 76°00' W	SE 34°20' N 75°00' W

Other Possible Alternative 5A (South Carolina): The center point of this five by ten nautical mile box is located at 31^{o} 53.0’ N; 080^{o} 08.0’ W and the box would be orientated horizontally. This site is in 9-10 fathoms. Due to its inshore location and shallow water It was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species

Other Possible Alternative 6A (South Carolina): The center point of this five by ten nautical mile box is located at 33^{o} 00.0’ N; 078^{o} 07.0’ W and the box would be orientated vertically. This site is in 17-22 fathoms. Due to its inshore location and shallow water It was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

Other Possible Alternative 7A (South Carolina): The center point of this five by ten nautical mile box is located at 32^{o}38.0’ N; 079^{o} 28.5’ W and the box would be orientated horizontally. This site is in 7-13 fathoms. Due to its inshore location and shallow water It was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

Other Possible Alternative 8A (South Carolina): The center point of this five by ten nautical mile box is located at 32^{o} 18.5’ N; 079^{o} 33.5’ W and the box would be orientated horizontally. This site is in 14-17 fathoms. Due to its inshore location and shallow water It was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species

Other Possible Alternative 9A (South Carolina): The center point of this five by ten nautical mile box is located at 31^{o} 53.0’ N; 080^{o} 08.0’ W and the box would be orientated horizontally. This site is in 12-15 fathoms. Due to its inshore location and shallow water It was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species

Other Possible Alternative 10A (South Carolina): The center point of this five by ten nautical mile box is located at 31^{o} 45.0’ N; 070^{o} 53.0’ W and the box would be orientated horizontally. This site is in 19-25 fathoms. Due to its inshore location and shallow water It was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species

Other Possible Alternative 11A (Georgia): Located in 20-27 fathoms, the SW corner of this potential MPA lies at approximately 31º45.0’ N Latitude, 79º53.0 W Longitude The recommended area is located north of U.S. Navy TACTS tower “R8” (31º38.0’ N Latitude) and west of the outer boundary of Georgia Artificial Reef WW (79º57.7’ W Longitude). The area does not incorporate the tower since it is targeted heavily by fishermen but is located near the tower since it may be possible to use this structure for MPA monitoring and enforcement/compliance. This site does not include artificial reef WW, which is located just inshore of the proposed inner boundary. The site was proposed to be 5nm x 10nm long. Scattered live bottom is reported to occur throughout. This site was intensely targeted by roller trawls in the past, yielding large numbers of very small vermilion snapper and holds possible habitat for vermilion, red porgy, and other snapper grouper species. Due to its inshore location and shallow water it was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

Other Possible Alternative 12A (Georgia): Located in 14-20 fathoms, the SW corner of this potential MPA lies at approximately 30º57.0 N Latitude, 80º45.0’W Longitude. Located north of U.S. Navy TACTS tower “R5” (30º56.5’ N Latitude 80º45.0 W Longitude , the site does not incorporate the tower since it is targeted heavily by fishermen; however it may be possible for this structure for MPA monitoring and enforcement/compliance. The MPA was proposed to be 5nm x 5nm. Scattered live bottom is reported to occur throughout with possible habitat for red porgy and other snapper grouper species. Due to its inshore location and shallow water it was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

Other Possible Alternative 13A (Georgia): Located in 60-70’ depths, the SW corner of this potential MPA lies at approximately 31º27.2 N Latitude, 80º45.34’ W longitude. Located north east of Gray’s Reef, this predominant sand-shell site has been proposed by CCA for construction of an artificial reef. This site was proposed to be 2 nm x 2 nm in size. Due to its inshore location and shallow water it was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

Other Possible Alternative 14A (Georgia): Located in 55’-70’ depths, this site would encompass the southeast quadrant of the Gray’s Reef National Marine Sanctuary. Establishment of a restricted study site within Gray’s Reef has been discussed in conjunction with the revision of the Sanctuary’s management plan; however, this process remains ongoing at this time and no proposals/recommendations have been finalized. This site was removed from further consideration because it did not meet the Council’s criteria of protecting deepwater snapper grouper species and also because it lies within the boundaries of Gray’s Reef National Marine Sanctuary and the Council felt it was best to refer this site to their management process.

Other Possible Alternative 15A (Florida): Outside of the Indian river Lagoon area (known as the “Chris Benson Reef (?)) from the A-can north approximately 25 miles. A lot of hardbottom habitat. Due to its inshore location and shallow water it was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

Other Possible Alternative 16A (Florida): Red Snapper Sink or the Spring outside of St. Augustine, Florida in 18-22 fathoms of water. Due to its inshore location and shallow water it was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

Other Possible Alternative 17A (Florida): Blackmars reef and Tanzars Reef. Due to its inshore location and shallow water it was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

Other Possible Alternative 18A (Florida): Pines area 8 miles off Sebastian in 55’-65’of water, for the purpose of habitat protection. Due to its inshore location and shallow water it was removed from consideration during this round of developing MPAs because it does not meet the Council’s criteria of protecting overfished deepwater snapper grouper species.

13.1.3.2 Offshore Sites

The following sites are not being analyzed in detail in Amendment 14 because they do not meet the Council's criteria for MPAs.

Other Possible Alternative 1B (Georgia): "Charleston Bump", east of Sapelo Island, with center coordinates at approximately 31º30.0'N Latitude, 78º30.0'W Longitude. Initially thought to lie east of South Carolina, George Sedberry indicated that the "Bump" actually lies due east of Georgia. This was proposed for consideration as an MPA due to documented importance to fisheries, ongoing studies, and other regulations already affecting this area. Size of the MPA was suggested at 10nm x 10nm or larger Complete closure was recommended for consideration. This site was removed from consideration because the only South Atlantic fishery operating in this area (Wreckfish) is well managed and considered a clean fishery.

Other Possible Alternative 2B (Florida): Islamorada Hump was chosen as a potential MPA because of spawning activity such as amberjack, snowy grouper and blackfin tuna. It has also been noted that Warsaw grouper are often caught there. It was suggested that this area be a no-take MPA. This site was removed from consideration because due to its popularity as a fishing spot and the economic impact MPA regulations for this site would have on the local community. The East Hump an alternate, yet comparable, site was added to the list to replace the Islamorada Hump.

13.1.3.3 Sites in State Waters

The Council determined that it would not be appropriate at this time to analyze sites in State waters because they lie in waters too shallow to help deepwater species. However, Council members recognize that some snapper grouper species rely on habitats in State waters for part of their lifecycle, and as the Council considers using MPAs for those snapper grouper species they will work closely with the States to ensure adequate protection.

Other Possible Alternative 1C (Florida): Carysfort Reef - Current Sanctuary Preservation Area should be extended out into deeper water to encompass area outside this SPA that holds black grouper. This area was removed from further consideration due to the fact that it lies in shallow waters. Also this site is known as "sailfish ally" and is very important to the charter industry in that area.

Other Possible Alternative 2C (Florida): South of Fowery Rocks which is part of Biscayne National Park's Emerald Reef . This possible MPA would start at 30'water depth and extend to 300' depth. This area is historically a cubera snapper spawning site, a good general site for habitat and for ease of enforcement. This area was removed from further consideration because it lies within the boundaries of the Key Biscayne National Park and is in water too shallow for deepwater species.

Other Possible Alternative 3C (Florida): In Broward County the Greater Ft. Lauderdale Marine Preserves Committee is recommending a state MPA off of Ft. Lauderdale by the Sea and it is recommend that there be a federal extension of that area from the shoreline out to the third reef line. This area was removed from consideration because it lies in water that is too shallow for deepwater species.

Other Possible Alternative 4C (Florida): Sloans Curve to the breakers which is 60-80ft of water. Currently there is a dive community which is imposing restrictions on itself and it is recommended that this area be made a full no-take zone. This area was removed from consideration because it lies in water that is too shallow for deepwater species.

Other Possible Alternative 5C (Florida): Lake Worth Inlet, South Jetty: This is a very small area where pre-spawning Grouper aggregations occur when cold fronts pass through this area and produce strong ground seas and NW winds. The aggregation occurs in December and January months. This area was removed from consideration because it lies in water that is too shallow for deepwater species.

Other Possible Alternative 6C (Florida): This area is called the Palm Beach Reefs. This is a high profile hard bottom with coral, sponges, sea fan and periodic, early winter, pre-spawning Grouper aggregations may be found. The local dive boat operators have discouraged spearfishing in this area and have seen a return of many Snapper Grouper species. This area was removed from consideration because it lies in water that is too shallow for deepwater species.

13.1.3.4 Other Sites

Other Possible Alternative 2D (Florida): *Oculina* habitat from current restricted Oculina Bank area north to off the coast of North Carolina where the *Oculina* coral ends. Recommendation is to allow fishing but not allow bottom fishing or anchoring.

Other Possible Alternative 3D (Florida): Continue the current restrictions in the Oculina Experimental Research Reserve and improve upon enforcement. This was addressed in Snapper Grouper Amendment 13A and the restrictions were continued.

Other Possible Alternative 4D (Florida): Peanut *Oculina*. This is a sensitive *Oculina* reef structure in 180’ that has gag grouper and amberjack aggregations. *Oculina* coral structure. This site was removed from consideration due to the small size of the area which will make enforcement extremely difficult.

Other Possible Alternative 5D (Florida): Deepwater spawning spot north of the 44200 line on the *Oculina* shelf. The Council did not receive enough information about this site (e.g., habitat, species occurrence, catch, etc.) to consider it at this time.

13.1.3.5 VMS

Other Possible Alternative 1. Require VMS on all commercial snapper grouper vessels. The Council will be evaluating use of VMS on all vessels in the Fishery Ecosystem Plan Comprehensive Amendment. The Council favors a more comprehensive evaluation of VMS through that process. In addition, the Council did not want to require fishermen to pay for VMS if they may choose to leave the fishery in a few years due to an upcoming dedicated access privilege program

Other Possible Alternative 2. Require VMS on all commercial snapper grouper vessels with longline gear aboard. The Council will be evaluating use of VMS on all vessels in the Fishery Ecosystem Plan Comprehensive Amendment. The Council favors a more comprehensive evaluation of VMS through that process. In addition, the Council did not want to require fishermen to pay for VMS if they may choose to leave the fishery in a few years due to an upcoming dedicated access privilege program

Other Possible Alternative 3: Require VMS on all commercial and for-hire snapper grouper vessels. The for-hire sector has very minimal impact in the MPA areas given their distance from shore. Also, the Council will be evaluating use of VMS on all commercial and possibly all for-hire vessels in the Fishery Ecosystem Plan Comprehensive Amendment. The Council favors a more comprehensive evaluation of VMS in the for-hire sector through that process. In addition, the Council did not want to require fishermen to pay for VMS if they may choose to leave the fishery in a few years due to an upcoming dedicated access privilege program

13.2 Appendix B. Law Enforcement Advisory Panel Report

RECOMMENDATIONS OF THE JOINT LAW ENFORCEMENT COMMITTEE AND ADVISORY PANEL ON ENFORCEMENT CRITERIA FOR ESTABLISHING MARINE RESERVES

The Council's Law Enforcement Committee and Advisory Panel discussed the marine reserve concept and enforcement criteria for establishing marine reserves at their February 19-20, 1998 meeting. There was unanimous agreement that one of the most critical aspects of establishing marine reserves, both from the scientific and enforcement standpoint, will be public support. Consensus was the Council, through its I & E Committee, should develop a plan for educating the public on the need for marine reserves and for selling the concept to the fishing community.

A motion was approved recommending that as the Council proceeds on establishing marine reserves, there should be a "threat assessment" conducted by the appropriate state, NMFS and Coast Guard enforcement personnel (potentially the AP) for each marine reserve being developed. This assessment should be presented to the Council before they take action.

The committee and advisory panel developed the following criteria for the Marine Reserve Committee's consideration:

1. A marine reserve should be configured in a square or rectangle.
>> irregular shapes are very difficult to enforce

2. The bigger the better.
>> wider areas are easier to enforce
>> **do not** include buffer zones

3. The boundaries should be delineated in latitude and longitude.
>> where possible the boundaries should actually be latitude and longitude lines
>> **do not** use water depths
>> **do not** use County lines

4. Must be in an acceptable format to be included and identified on NOAA charts.
>> will require coordination with appropriate NOAA personnel

5. Allowable activities in the marine reserve should be limited.

>> No transit - best

>> Prohibit all fishing - next best

>> If any fishing activity or gear is allowed, enforcement becomes very difficult.

6. Locate marine reserves away from highly populated areas.

>> the location should provide for the best possible buy-in by fishermen

>> voluntary compliance is the most important element for insuring enforceability

7. Provide for on-site enforcement capability.

>> there will be costs associated with this capability

Committee members:	**AP members:**
Hartig, Chairman	Pendarvis, Chair
Flanigan	Proulx
Gay	Bryson
Hass	Garbade
Love	Buckson
Pino	Rivenbark
Stone	RADM Saunders
	Raine
	Lt. Davis

13.3 Appendix C. Essential Fish Habitat, Habitat Areas of Particular Concern, and Habitat Policy Statements

Essential Fish Habitat and Movement towards Ecosystem-Based Management

With the Habitat Plan as a cornerstone, the Council is developing an ecosystem-based approach to resource management. Evolution of the Habitat Plan into a Fishery Ecosystem Plan, and transition from single species management to ecosystem-based management, will require a greater understanding of the South Atlantic Bight ecosystem and the complex relationships among humans, marine life and essential fish habitat. This effort will provide a more comprehensive understanding of the biological, social and economic impacts of management

Over 18 workshops have been held to date to integrate and update habitat information and begin development of the South Atlantic Fishery Ecosystem Plan (FEP). These workshops brought together Habitat and Coral Advisory Panel members and a core group of resource and habitat experts from cooperating federal, state and academic institutions as well as conservation organizations that participated directly in development of the Habitat Plan. Updated life history and stock status information on managed species and the characteristics of the food web they exist within will be incorporated as well as social and economic research needed to fully address ecosystem-based management.

Topics of workshops conducted to date include:

- wetlands,
- oyster/shell habitat,
- seagrass,
- pelagic habitat (including *Sargassum* and the water column),
- coral and live/hard bottom,
- artificial reefs,
- GIS to support EFH and ecosystem-based management,
- water issues affecting fishery habitat and production,
- marine zoning,
- fishing impacts on habitat,
- food web modeling (Ecopath with Ecosim) and
- social and economic data needs

In addition, a regional workshop was held in November 2005 to identify research and monitoring needs to support ecosystem-based management in the South Atlantic. Nationally and internationally recognized experts participated and provided guidance to determine the most significant needs to be addressed in development of ecosystem-based management.

Writing Teams (composed of AP members, experts from state and federal agencies, universities and Council staff) will review, update and expand chapters of the Habitat Plan and develop new chapters for the FEP (e.g., Ecosystem Modeling and Research Needs to support Ecosystem-Based Management). Information compiled during, and as follow-up to the workshops, is helping the Council meet the EFH mandate to update EFH and EFH-HAPC information and designations. This will also help the Council meet the National Environmental Policy Act (NEPA) mandate to update Environmental Impact Statements (EIS) for all fishery management plans under Council jurisdiction. The FEP will be used to develop a Comprehensive Amendment/EIS for all Fishery Management Plans (FMPs).

An outline for the FEP was developed and approved by the Council in June 2005.

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 and transportation;
2. Beach dredging and filling and large-scale coastal engineering;
3. Protection and enhancement of submerged aquatic vegetation; and
4. Alterations to riverine, estuarine, and nearshore flows.

In 2005, the Council's policy on energy exploration, development and transportation was revised an updated. The new policy addresses impacts related to Liquefied Natural Gas (LNG), hydropower re-licensing and other renewable energy technologies such as wind farms. As part of the FEP development process, the Council will update existing policies and develop new ones (i.e. aquaculture).

The 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.

<u>South Atlantic Bight Ecopath Model</u>

The Council is developing a food web model (Ecopath with Ecosim) to characterize the ecological relationships of South Atlantic species, including those managed by the Council. This effort will help the Council and cooperators in identifying available information and data gaps while providing insight into ecosystem function. More importantly, the model will aid in identifying research necessary to better define populations, fisheries and their interrelationships. The model will include the area between the North Carolina/Virginia border through the Florida Keys and extend from the upper wetlands to the 300-meter isobath. Catch data from 1995 to 2004 will be included. The Council is investigating the possibility of expanding and refining the South Atlantic Ecopath Model with development of embedded sub-models for the *Oculina* Bank HAPC, The Florida Keys, Deepwater Snapper Grouper Habitat and Albemarle-Pamlico Sound.

Cooperative Research to Support Ecosystem-Based Management

High Resolution Maps of Habitat on the South Atlantic Continental Shelf

The Council has partnered with the National Undersea Research Center at the University of North Carolina at Wilmington (NURC/UNCW) by providing seed money to begin multi-beam sonar mapping of the outer continental shelf and upper continental slope. This region of the Exclusive Economic Zone (EEZ) from just north of Cape Hatteras (North Carolina) to Cape Canaveral (Florida), covering a depth range of 100-500 m, includes important habitat for current and future economically valuable species (e.g., groupers, wreckfish, crabs, tilefish, etc.). Habitats used by these species include soft bottoms of various types and a wide range of hard bottom lithotypes. This area includes important and unique features such as "The Point" canyon system (just north of Cape Hatteras, North Carolina) and the "Charleston Bump" (off of Cape Romain, South Carolina). The features of these two EFH-HAPCs result in significant oceanographic effects in the region (e.g. upwellings) and also represent productive fishery areas. Throughout the region, and toward the deeper end (350-450 m), are scattered but extensive deep reef systems composed of delicate, slow growing ahermatypic corals (e.g., *Lophelia*). All of these habitats are poorly mapped. In addition, the Council is considering deepwater MPAs that fall in the same depth range. High-resolution (1-2 m) bathymetry maps are required for these areas.

A newly purchased NURP Autonomous Underwater Vehicle (AUV) will be operated by NURC/UNCW. The unit will be maintained and operated by NURC/UNCW and be used in the initial testing by mapping deepwater coral and associated habitats in the South Atlantic.

Regional Internet Map Server for Coral and Live/Hard Bottom Habitat and South Atlantic Habitat/Ecosystem Web Site

The South Atlantic Council and the Florida Fish and Wildlife Research Institute (FWRI) have developed a Habitat and Ecosystem web site and an Internet Map Server (IMS). FWRI currently hosts the IMS application. The IMS currently includes over 100 layers of bottom type data, EFH and EFH-HAPCs, species' distributions, etc. Data layers and associated metadata can be downloaded or queried within the IMS. The applications has proven to be an effective tool for displaying, sharing and querying spatial information including that related to hardbottom and EFH throughout the South Atlantic region. The video and still imagery archives served from this site provide researchers a unique opportunity to observe important habitats and coral resources in the region.

A customized map wizard is also being developed for this project. FWRI is programming an ASP application that will provide users an alternative method to produce maps. This application will have a user-friendly interface to select layers of interest, identify features from multiple layers, customize map sizes and modify legend elements.

The Council's Internet Mapping System is at:
http://ocean.floridamarine.org/efh_coral/ims/viewer.htm

Essential Fish Habitat (EFH), Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPCs) and Applicable Protection Measures

Following is a summary of the current South Atlantic Council's EFH and EFH-HAPCs. Information supporting their designation will be reviewed, revised and updated (pursuant to the EFH Final Rule) as part of the Fishery Ecosystem Plan and Comprehensive Ecosystem Amendment development process currently underway. EFH and EFH-HAPCs summarized in this appendix are available in GIS format through the Council's Internet Mapping System http://ocean.floridamarine.org/efh_coral/ims/viewer.htm

Snapper Grouper FMP

Essential fish habitat for snapper grouper species is included in section 3.1.3

Areas which meet the criteria for EFH-HAPCs for species in the snapper grouper management unit are described in section 3.1.4.

Protection Measures:

* Prohibition on 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, FL; fish traps, bottom tending (roller-rig) trawls on live bottom habitat, and entanglement gear
* Prohibition on the harvest or possession of all snapper grouper species in the *Oculina* Experimental Closed Area
* Prohibition on the use of explosive charges, including powerheads, in the EEZ off South Carolina
* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development, transportation and hydropower re-licensing; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation
* Prohibition or restriction of highly efficient and potentially damaging fishing gear that are not compatible with the intent of the SMZ permittee for the artificial reef or fish attraction device.

* Prohibition on take, damage and possession in the EEZ of prohibited corals (except under a federal permit for scientific, educational, or restoration purposes), wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans.

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.

Protection Measures:

* Prohibition on trawling for rock shrimp the *Oculina* Bank
* Mandatory use of bycatch reduction devices in the penaeid shrimp fishery
* Mandatory use of Vessel Monitoring System in the rock shrimp fishery
* Concurrent closure of the EEZ to penaeid shrimping if environmental conditions in state waters are such that the over wintering spawning stock is severely depleted
* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development, transportation and hydropower re-licensing; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.

Red Drum FMP

For red drum, essential fish habitat includes all the following habitats to a depth of 50 meters offshore: tidal freshwater; estuarine emergent vegetated wetlands (flooded saltmarshes, brackish marsh, and tidal creeks); estuarine scrub/shrub (mangrove fringe); submerged rooted vascular plants (sea grasses); oyster reefs and shell banks; unconsolidated bottom (soft sediments); ocean high salinity surf zones; and artificial reefs. The area covered includes Virginia through the Florida Keys.

Areas which meet the criteria for EFH-HAPCs for red drum include all coastal inlets, all state-designated nursery habitats of particular importance to red drum (for example, in North Carolina this would include all Primary Nursery Areas and all Secondary Nursery Areas); documented sites of spawning aggregations in North Carolina, South Carolina, Georgia, and Florida described in the Habitat Plan; other spawning areas identified in the future; and habitats identified for submerged aquatic vegetation.

Protection Measures:

* Closed to possession or harvest in or from the EEZ
* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development, transportation and hydropower re-licensing; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.

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, 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).

Protection Measures:

* Prohibition on the use of gill nets in the coastal migratory pelagics fishery
* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development, transportation and hydropower re-licensing; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation
* Prohibition on 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, FL; fish traps, bottom tending (roller-rig) trawls on live bottom habitat, and entanglement gear.
* Prohibition on take, damage and possession in the EEZ of prohibited corals (except under a federal permit for scientific, educational, or restoration purposes), wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans.

<u>Golden Crab FMP</u>

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

Protection measures:

* Depth limitation on deployment of traps as follows: 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.

* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development, transportation and hydropower re-licensing; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.

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.

Protection Measures:

* Prohibition on tending traps at night.
* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development, transportation and hydropower re-licensing; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.
* Prohibition on take, damage and possession in the EEZ of prohibited corals (except under a federal permit for scientific, educational, or restoration purposes), wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans.
* Prohibition on 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, FL; fish traps, bottom tending (roller-rig) trawls on live bottom habitat, and entanglement gear.

Coral, Coral Reefs, and Live/Hard Bottom Habitats FMP

Essential fish habitat for corals (stony corals, octocorals, and black corals) must 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 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.

Protection Measures:

* Establishment of an optimum yield of zero.
* Prohibition on take, damage and possession in the EEZ of prohibited corals (except under a federal permit for scientific, educational, or restoration purposes), wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans.
* Designation of the *Oculina* Bank Habitat Area of Particular Concern
* Expansion of 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. Established a framework procedure to modify or establish Coral HAPCs.
* In the *Oculina* Bank HAPC: prohibition on bottom longline, bottom trawl, dredge, pot or trap; prohibition on anchoring, use of an anchor and chain or grapple and chain by any fishing vessel; prohibition on fishing or possession of rock shrimp from the area; prohibition on the possession of *Oculina* coral; prohibition on fishing for or retention of snapper grouper species in the Experimental Closed Area (located within the HAPC).
* Prohibition on the use or possession of toxic chemicals in a coral area in the EEZ
* Prohibition on the use of a power assisted tool to take prohibited coral, allowable octocorals or live rock
* Establishment of a framework procedure to modify or establish Coral HAPCs
* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development, transportation and hydropower re-licensing; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.

Dolphin 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).

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).

Protection Measures:

* Protection of dynamic benthic habitats associated with pelagic habitat. Prohibition on 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, FL; fish traps, bottom tending (roller-rig) trawls on live bottom habitat, and entanglement gear.
* Prohibition on take, damage and possession of prohibited corals, wild live rock, aquacultured live rock without the required federal permit, octocorals north of Cape Canaveral (FL) or sea fans.
* Prohibition on all harvest of *Sargassum* in the EEZ south of the SC-NC border
* Prohibition on all harvest of *Sargassum* in the EEZ within 100 miles of shore off North Carolina
* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development, transportation and hydropower re-licensing; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.

***Sargassum* FMP**

Areas which meet the criteria for EFH-HAPCs for Sargassum include all areas within the EEZ that contain *Sargassum* population. (This definition was rejected by NMFS – Council will readdress. This pelagic habitat is protected through the Fishery Management Plans for Pelagic *Sargassum* Habitat, Coastal Migratory Pelagics and Dolphin Wahoo).

Protection Measures:

* Prohibition on 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).

* Prohibition 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.
* Limitation of harvest of *Sargassum* from the South Atlantic EEZ to the months of November through June.
* Establishment of an annual Total Allowable Catch (TAC) of 5,000 pounds landed wet weight.
* Requirement that an official observer be present on each *Sargassum* harvesting trip.
* Requirement 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.
* SAFMC policies on beach dredging and filling and large-scale coastal engineering; energy exploration, development, transportation and hydropower re-licensing; protection and enhancement of Submerged Aquatic Vegetation (SAV) habitat; alterations to riverine, estuarine and nearshore flows; ocean dredged material disposal sites and underwater berm creation.

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 managed 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 Habitat Protection Policies

Policy Statement Concerning Beach Dredging and Filling and Large-Scale Coastal Engineering

Policy Context

This document establishes the policies of the South Atlantic Fishery Management Council (SAFMC) regarding protection of the essential fish habitats (EFH) and habitat areas of particular concern (EFH-HAPCs) impacted by beach dredge and fill activities, and related large-scale coastal engineering projects. The policies are designed to be consistent with the overall habitat protection policies of the SAFMC as formulated and adopted in the Habitat Plan (SAFMC, 1998a) and the Comprehensive EFH Amendment (SAFMC, 1998b).

The findings presented below assess the threats to EFH potentially posed by activities related to the large-scale dredging and disposal of sediments in the coastal ocean and adjacent habitats, and the processes whereby those resources are placed at risk. The policies established in this document are designed to avoid, minimize and offset damage caused by these activities, in accordance with the general habitat policies of the SAFMC as mandated by law.

EFH At Risk from Beach Dredge and Fill Activities

The SAFMC finds:

1) In general, the array of large-scale and long-term beach dredging projects and related disposal activities currently being considered for the United States southeast together constitute a real and significant threat to EFH under the jurisdiction of the SAFMC.

2) The cumulative effects of these projects have not been adequately assessed, including impacts on public trust marine and estuarine resources, use of public trust beaches, public access, state and federally protected species, state critical habitat, SAFMC-designated EFH and EFH-HAPCs.

3) Individual beach dredge and fill projects and related large-scale coastal engineering activities rarely provide adequate impact assessment*s* or consideration of potential damage to fishery resources under state and federal management. Historically, emphasis has been placed on the logistics of dredging and economics, with environmental considerations dominated by compliance with the Endangered Species Act for sea turtles, piping plovers and other listed organisms. There has been little or no consideration of hundreds of other species affected many with direct fishery value.

4) Opportunities to avoid or minimize impacts of beach dredge and fill activities on fishery resources, and offsets for unavoidable impacts have rarely been proposed or implemented. Monitoring is rarely adequate to develop statistically appropriate impact evaluations.

5) Large-scale beach dredge and fill activities have the potential to impact a variety of habitats across the shelf, including:

   a) waters and benthic habitats near the dredging sites;
   b) waters between dredging and filling sites;
   c) waters and benthic habitats in or near the fill sites, and
   d) waters and benthic habitats potentially affected as sediments move subsequent to deposition in fill areas.

6) Certain nearshore habitats are particularly important to the long-term viability of commercial and recreational fisheries under SAFMC management, and potentially threatened by large-scale, long-term or frequent disturbance by dredging and filling:

   a) the swash and surf zones and beach-associated bars;
   b) underwater soft-sediment topographic features;
   c) onshore and offshore coral reefs, hardbottom and worm reefs; and
   d) inlets.

7) Large sections of South Atlantic waters potentially affected by these projects, both individually and collectively, have been identified as EFH or EFH-HAPC by the SAFMC**,** as well as the Mid-Atlantic Fishery Management Council (MAFMC) in the

case of North Carolina. Potentially Affected species and their EFH under federal management include (SAFMC, 1998b):

a) summer flounder (various nearshore waters, including the surf zone and inlets; certain offshore waters);
b) bluefish (various nearshore waters, including the surf zone and inlets);
c) red drum (ocean high-salinity surf zones and unconsolidated bottoms nearshore waters);
d) many snapper and grouper species (live hardbottom from shore to 600 feet, and – for estuarine-dependent species [e.g., gag grouper and gray snapper] – unconsolidated bottoms and live hardbottoms to the 100 foot contour);
e) black sea bass (various nearshore waters, including unconsolidated bottom and live hardbottom to 100 feet, and hardbottoms to 600 feet);
f) penaeid shrimp (offshore habitats used for spawning and growth to maturity, and waters connecting to inshore nursery areas, including the surf zone and inlets);
g) coastal migratory pelagics [e.g., king mackerel, Spanish mackerel] (sandy shoals of capes and bars, barrier island ocean-side waters from the surf zone to the shelf break inshore of the Gulf Stream; all coastal inlets);
h) corals of various types (hard substrates and muddy, silt bottoms from the subtidal to the shelf break); and
i) areas identified as EFH for Highly Migratory Species (HMS) managed by the Secretary of Commerce (e.g., sharks: inlets and nearshore waters, including pupping and nursery grounds).

In addition, hundreds of species of crustaceans, mollusks, and annelids that are not directly managed, but form the critical prey base for most managed species, are killed or directly affected by large dredge and fill projects.

8) Beach dredge and fill projects also potentially threaten important habitats for anadromous species under federal, interstate and state management (in particular, inlets and offshore overwintering grounds), as well as essential overwintering grounds and other critical habitats for weakfish and other species managed by the Atlantic States Marine Fisheries Commission (ASMFC) and the states. The SAFMC also identified essential habitats of anadromous and catadromous species in the region (inlets and nearshore waters).

9) Many of the habitats potentially affected by these projects have been identified as EFH-HAPCs by the SAFMC. The specific fishery management plan is provided in parentheses:

a) all nearshore hardbottom areas (SAFMC, snapper grouper).
b) all coastal inlets (SAFMC, penaeid shrimps, red drum, and snapper grouper).
c) near-shore spawning sites (SAFMC, penaeid shrimps, and red drum).
d) benthic *Sargassum* (SAFMC, snapper grouper).
e) from shore to the ends of the sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras, North Carolina; Hurl Rocks, South Carolina; *Phragmatopora* (worm

reefs) reefs off the central coast of Florida and nearshore hardbottom south of Cape Canaveral (SAFMC, coastal migratory pelagics).

f) Atlantic coast estuaries with high numbers of Spanish mackerel and cobia from ELMR, to include Bogue Sound, New River, North Carolina; Broad River, South Carolina (SAFMC, coastal migratory pelagics).

g) Florida Bay, Biscayne Bay, Card Sound, and coral hardbottom habitat from Jupiter Inlet through the Dry Tortugas, Florida (SAFMC, Spiny Lobster)

h) Hurl Rocks (South Carolina), The *Phragmatopoma* (worm reefs) off central east coast of Florida, nearshore (0-4 meters; 0-12 feet) hardbottom off the east coast of Florida from Cape Canaveral to Broward County; offshore (5-30 meters; 15-90 feet) hardbottom 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 (SAFMC, Coral, Coral Reefs and Live Hardbottom Habitat).

i) EFH-HAPCs designated for HMS species (e.g., sharks) in the South Atlantic region (NMFS, Highly Migratory Species).

10) Habitats likely to be affected by beach dredge and fill projects include many recognized in state-level fishery management plans. Examples of these habitats include Critical Habitat Areas established by the North Carolina Marine Fisheries Commission, either in FMPs or in Coastal Habitat Protection Plans (CHAs).

11) Recent work by scientists in east Florida has documented important habitat values for nearshore, hardbottom habitats often buried by beach dredging projects, is used by over 500 species of fishes and invertebrates, including juveniles of many reef fishes. Equivalent scientific work is just beginning in other South Atlantic states, but life histories suggest that similar habitat use patterns will be found.

Threats to Marine and Estuarine Resources from Beach Dredge and Fill Activities and Related Large Coastal Engineering Projects

The SAFMC finds that beach dredge and fill activities and related large-scale coastal engineering projects (including inl*et al*teration projects) and disposal of material for navigational maintenance, threaten or potentially threaten EFH through the following mechanisms:

1) Direct mortality and displacement of organisms at and near sediment dredging sites
2) Direct mortality and displacement of organisms at initial sediment fill sites
3) Elevated turbidity and deposition of fine sediments down-current from dredging sites
4) Alteration of seafloor topography and associated current and waves patterns and magnitudes at dredging areas
5) Alteration of seafloor sediment size-frequency distributions at dredging sites, with secondary effects on benthos at those sites
6) Elevated turbidity in and near initial fill sites, especially in the surf zone, and deposition of fine sediment down-current from initial fill sites (ASMFC, 2002)

7) Alteration of nearshore topography and current and wave patterns and magnitudes associated with fill
8) Movement of deposited sediment away from initial fill sites, especially onto hardbottoms
9) Alteration of large-scale sediment budgets, sediment movement patterns and feeding and other ecological relationships, including the potential for cascading disturbance effects
10) Alteration of large-scale movement patterns of water, with secondary effects on water quality and biota
11) Alteration of movement patterns and successful inlet passage for larvae, post-larvae, juveniles and adults of marine and estuarine organisms
12) Alteration of long-term shoreline migration patterns (inducing further ecological cascades with consequences that are difficult to predict)
13) Exacerbation of transport and/or biological uptake of toxicants and other pollutants released at either dredge or fill sites

In addition, the interactions between cumulative and direct (sub-lethal) effects among the above factors certainly trigger non-linear impacts that are completely unstudied.

Policies for Beach Dredge and Fill Projects and Related Large Coastal Engineering Projects

The SAFMC establishes the following general policies related to large-scale beach dredge and fill and related projects, to clarify and augment the general policies already adopted in the Habitat Plan and Comprehensive Habitat Amendment (SAFMC 1998a; SAFMC 1998b):

1) Projects should avoid, minimize and where possible offset damage to EFH and EFH-HAPCs.

2) Projects requiring expanded EFH consultation should provide detailed analyses of possible impacts to each type of EFH, with careful and detailed analyses of possible impacts to EFH-HAPCs and state CHAs, including short and long-term, and population and ecosystem scale effects. Agencies with oversight authority should require expanded EFH consultation.

3) Projects requiring expanded EFH consultation should provide a full range of alternatives, along with assessments of the relative impacts of each on each type of EFH, HAPC and CHAs.

4) Projects should avoid impacts on EFH, HAPCs and CHAs that are shown to be avoidable through the alternatives analysis, and minimize impacts that are not.

5) Projects should include assessments of potential unavoidable damage to EFH and other marine resources, using conservative assumptions.

6) Projects should be conditioned on the avoidance of avoidable impacts, and should include compensatory mitigation for all reasonably predictable impacts to EFH, taking into account uncertainty about these effects. Mitigation should be local, up-front and in-kind, and should be adequately monitored, wherever possible.

7) Projects should include baseline and project-related monitoring adequate to document pre-project conditions and impacts of the projects on EFH.

8) All assessments should be based upon the best available science, and be appropriately conservative so follow and precautionary principles as developed for various federal and state policies.

9) All assessments should take into account the cumulative impacts associated with other beach dredge and fill projects in the region, and other large-scale coastal engineering projects that are geographically and ecologically related.

References

ASMFC 2002. Beach Nourishment: A Review of the Biological and Physical Impacts ASMFC Habitat Management Series # 7 November 2002, Atlantic States Marine Fisheries Commission, 1444 Eye Street NW, Sixth Floor, Washington DC 20005. 179 pp.

Butler IV, M. J., J. H. Hunt, W. F. Herrnkind, M. J. Childress, R. Bertelsen, W. Sharp, T. Matthews, J. M. Field, and H. G. Marshall. 1995. Cascading disturbances in Florida Bay, U.S.A.: cyanobacteria blooms, sponge mortality, and implications for juvenile spiny lobsters Panulirus argus. Mar. Ecol. Prog. Ser. 129:119-125.

Dodge, R. E., R. C. Aller and J. Thomson. 1974. Coral growth related to resuspension of bottom sediments. Nature 247: 574-576.

Gilmore, R. G., Jr. 1977. Fishes of the Indian River Lagoon and adjacent waters, Florida. Bull. Fl. St. Mus. Bio. Sci. 22(3), 147 p.

Gilmore, R. G., Jr. 1992. Striped croaker, Bairdiella sanctaeluciae. pp. 218-222. In C. R. Gilbert, ed. Rare and endangered biota of Florida. II. Fishes. Univ. Press of Florida, Gainesville, FL, 242 p.

Greene, Karen. 2002. Beach nourishment: a review of the biological and physical impacts. Atlantic States Marine Fisheries Commission. Habitat Management Series #7, November 2002. 174 pp.

Hackney, C.T., M. Posey, S. Ross and A. Norris. 1996. A review and synthesis of data on surf zone fishes and invertebrates in the South Atlantic Bight and the potential impacts from beach renourishment. Report to the U.S. Army Corps of Engineers, Wilmington District.

Kirtley, D. W. and W. F. Tanner. 1968. Sabellariid worms: builders of a major reef type. J. Sed. Petrol. 38(1):73-78.

Lindeman, K. C. 1997. Comparative management of beach systems of Florida and the Antilles: applications using ecological assessment and decision support procedures. Pp.134-164. In: G. Cambers, ed. Managing beach resources in the smaller Caribbean islands. UNESCO Coastal Region & Small Island Papers # 1, 269 p.

Lindeman, K.C. and D.B. Snyder. 1999. Nearshore hardbottom fishes of southeast Florida and effects of habitat burial caused by dredging. Fish. Bull. 97(3):508-525.

Nelson, W. G. 1989. Beach nourishment and hardbottom habitats: the case for caution. pp. 109-116. In: S. Tait, ed. Proc. 1989 National Conf. Beach Preserv. Technol. Fl. Shore and Beach Preserv. Assoc., Tallahassee, FL, 236 p.

Nelson, W. G. and L. Demetriades. 1992. Peracariids associated with sabellariid worm rock (Phragmatopoma lapidosa Kinberg) at Sebastian Inlet, Florida, U.S.A. J. Crust. Bio. 12(4):647-654.

Odum, W. E. 1982. Environmental degradation and the tyranny of small decisions. BioScience 32(9):728-29.

Pandolfi, J., D. R. Robertson, and D. R. Kirtley. 1998. Sabellariid worms: builders of a major reef type. Coral Reefs 17:120.

Peterson, C.H., D.H.M. Hickerson, and G.G. Johnson. 2000. Short-term consequences of nourishment and bulldozing on the dominant large invertebrates of a sandy beach. J. Coastal Res. 16(2): 368-378.

Sedberry, G. R. and R. F. Van Dolah. 1984. Demersal fish assemblages associated with hard-bottom habitat in the South Atlantic Bight of the U. S. A. Environ. Biol. Fishes 11(4):241-258.

SAFMC. 1998a. Final habitat plan for the South Atlantic region: Essential Fish Habitat requirements for fishery management plans of the South Atlantic Fishery Management Council. 457 pp plus appendices.

SAFMC. 1998b. Final Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region. Including a Final Environmental Impact Statement /Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699. 136pp.

Telesnicki, G.J. and W.M. Goldberg. 1995. Effects of turbidity on the photosynthesis and respiration of two South Florida reef coral species. Bull. Mar. Sci. 57(2):527-539.

Wilber, P. and M. Stern. 1992. A re-examination of infaunal studies that accompany beach nourishment projects. Proc. 1992 Natl. Conf. Beach Preserv. Tech. pp: 242-256.

Policies for the Protection and Restoration of Essential Fish Habitats from Energy Exploration, Development, Transportation and Hydro-power Re-licensing

Policy Context

This document establishes the policies of the South Atlantic Fishery Management Council (SAFMC) regarding protection of Essential Fish Habitat (EFH) and Essential Fish Habitat - Habitat Areas of Particular Concern (EFH-HAPCs) from threats associated with energy exploration, development, transportation and hydropower re-licensing. The policies are designed to be consistent with the overall habitat protection policies of the SAFMC as formulated and adopted in the Habitat Plan (SAFMC 1998a), the Comprehensive EFH Amendment (SAFMC 1998b) and the various Fishery Management Plans (FMPs) of the Council.

The findings presented below assess the threats to EFH potentially posed by activities related to energy development and hydropower re-licensing in offshore and coastal waters, riverine systems, and adjacent wetland habitats, and the processes whereby those resources are placed at risk. The policies established in this document are designed to avoid, minimize, and offset damage caused by these activities, in accordance with the general habitat policies of the SAFMC as mandated by law. To address any future energy projects in the South Atlantic region, the SAFMC reserves the right to revise this policy when more information becomes available.

EFH At Risk from Energy Exploration, Development Transportation and Hydropower Re-licensing Activities

The SAFMC finds:

1. That oil or gas drilling for exploration or development on or closely associated with EFH including – but not limited to – coral, coral reefs, and live/hardbottom habitat at all depths in the Exclusive Economic Zone (EEZ), EFH-HAPCs, or other special biological resources essential to commercial and recreational fisheries under SAFMC jurisdiction, be prohibited.

2. That all facilities associated with oil and gas exploration, development, and transportation be designed to avoid impacts on coastal ecosystems and sand sharing systems.

3. That adequate spill containment and cleanup equipment be maintained for all development and transportation facilities and, that the equipment be available on-site or located so as to be on-site within the landing time trajectory. An environmental bond should be required to assure that adequate resources will be available for unanticipated environmental impacts, spill response, clean-up and environmental impact assessment.

4. That exploration and development activities should be scheduled to avoid migratory patterns, breeding and nesting seasons of endangered and threatened species,

including – but not limited to – northern right whales in coastal waters off the southeastern United States.

5. That the Environmental Impact Statement (EIS) for any Lease Sale address impacts from activities specifically related to natural gas production, safety precautions required in the event of the discovery of "sour gas" or hydrogen sulfide reserves and the potential for transport of hydrocarbons to nearshore and inshore estuarine habitats resulting from the cross-shelf transport by Gulf Stream spin-off eddies. The EIS should also address the development of contingency plans to be implemented if problems arise due to oceanographic conditions or bottom topography, the need for and availability of onshore support facilities in coastal areas, and an analysis of existing facilities and community services in light of existing major coastal developments.

6. That EISs prepared for liquefied natural gas (LNG) pipeline projects or other energy-related projects must fully describe direct and cumulative impacts to EFH, including deepwater coral communities. Impact evaluations should include quantitative assessments for each habitat based on recent scientific studies pertinent to that habitat, and the best available information.

7. That construction and operation of open-loop (flow-through) LNG processing facilities be prohibited in areas that support EFH.

8. That hydropower project prescriptions include measures that ensure that the amount and timing of flows mimic natural conditions. In addition, the best available technologies that allow for fish passage should be integrated into the project design.

9. That projects requiring expanded EFH consultation provide a full range of alternatives, along with assessments of the relative impacts of each on each type of EFH, EFH-HAPC and state-designated Critical Habitat Areas (CHAs).

10. That energy development activities have the potential to cause impacts to a variety of habitats across the shelf and to nearshore, estuarine, and riverine systems and wetlands, including:

    a) waters and benthic habitats in or near drilling and disposal sites, including those potentially affected by sediment movement and by physical disturbance associated with drilling activities and site development;
    b) waters and benthic habitats in or near LNG processing facilities or other energy development or transportation sites,
    c) exposed hardbottom (e.g. reefs and live bottom) in shallow and deepwaters,
    d) coastal wetlands and
    e) riverine systems and associated wetlands.

11. That certain offshore, nearshore and riverine habitats are particularly important to the long-term viability of commercial and recreational fisheries under SAFMC

management, and potentially threatened by oil and gas and other energy exploration, development, transportation, and hydropower re-licensing activities:

a) coral, coral reef and live/hardbottom habitat, including deepwater coral communities,
b) marine and estuarine waters,
c) estuarine wetlands, including mangroves and marshes,
d) submersed aquatic vegetation,
e) waters that support diadromous fishes, and
f) waters hydrologically connected to waters that support EFH.

12. That siting and design of onshore receiving, holding, and transport facilities could have impacts on wetlands and endangered species' habitats if they are not properly located.

13. Sections of South Atlantic waters potentially affected by these projects, both individually and collectively, have been identified as EFH or EFH-HAPC by the SAFMC. Potentially affected species and their EFH under federal management include (SAFMC, 1998b):

a) summer flounder (various nearshore waters, including the surf zone and inlets; certain offshore waters),
b) bluefish (various nearshore waters, including the surf zone and inlets),
c) red drum (ocean high-salinity surf zones and unconsolidated bottoms in the nearshore),
d) many snapper and grouper species (live hardbottom from shore to 600 feet, and – for estuarine-dependent species (e.g., gag grouper and gray snapper) – unconsolidated bottoms and live hardbottoms to the 100 foot contour),
e) black sea bass (various nearshore waters, including unconsolidated bottom and live hardbottom to 100 feet, and hardbottoms to 600 feet),
f) penaeid shrimp (offshore habitats used for spawning and growth to maturity, and waters connecting to inshore nursery areas, including the surf zone and inlets),
g) coastal migratory pelagics (e.g., king mackerel, Spanish mackerel) (sandy shoals of capes and bars, barrier island ocean-side waters from the surf zone to the shelf break inshore of the Gulf Stream; all coastal inlets),
h) corals of various types and associated organisms (on hard substrates in shallow, mid-shelf, and deepwater),
i) muddy, silt bottoms from the subtidal to the shelf break, deepwater corals and associated communities),
j) areas identified as EFH for Highly Migratory Species managed by the Secretary of Commerce (e.g., sharks: inlets and nearshore waters, including pupping and nursery grounds), and
k) riverine areas that support diadromous fishes, including important prey species such as shad and herring, in addition to shortnose and Atlantic sturgeon.

14. Many of the habitats potentially affected by these activities have been identified as EFH-HAPCs by the SAFMC. Each habitat, type of activity posing a potential threat and FMP is provided as follows:

    a) all nearshore hardbottom areas – exploration, transportation and development (SAFMC snapper grouper);
    b) all coastal inlets – transportation and development (SAFMC penaeid shrimp, red drum, and snapper grouper);
    c) nearshore spawning sites – transportation and development (SAFMC penaeid shrimps and red drum);
    d) benthic Sargassum – exploration, transportation and development (SAFMC snapper grouper);
    e) from shore to the ends of the sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras, North Carolina; Hurl Rocks, South Carolina; and *Phragmatopoma* (worm reefs) reefs off the central coast of Florida and near shore hardbottom south of Cape Canaveral – transportation and development (SAFMC coastal migratory pelagics);
    f) Atlantic coast estuaries with high numbers of Spanish mackerel and cobia from ELMR, to include Bogue Sound, New River, North Carolina; Broad River, South Carolina – transportation and development (SAFMC coastal migratory pelagics);
    g) Florida Bay, Biscayne Bay, Card Sound, and coral hardbottom habitat from Jupiter Inlet through the Dry Tortugas, Florida – exploration, transportation and development (SAFMC spiny lobster);
    h) Hurl Rocks (South Carolina); The *Phragmatopoma* (worm reefs) off central east coast of Florida; nearshore (0-4 meters; 0-12 feet) hardbottom off the east coast of Florida from Cape Canaveral to Broward County; offshore (5-30 meters; 15-90 feet) hardbottom 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 – transportation and development (SAFMC Coral, Coral Reefs and Live Hardbottom Habitat); and
    i) EFH-HAPCs designated for HMS species (e.g., sharks) in the South Atlantic region – exploration, transportation and development (NMFS Highly Migratory Species).

15. Habitats likely to be affected by oil and gas exploration, development and transportation, and hydropower re-licensing activities include many recognised in state level fishery management plans. Examples of these habitats include Critical Habitat Areas (CHAs) established by the North Carolina Marine Fisheries Commission, either in FMPs or in Coastal Habitat Protection Plans.

16. Scientists in east Florida have documented exceptionally important habitat values for nearshore hardbottom used by over 500 species of fishes and invertebrates, including juveniles of many reef fishes. Equivalent scientific work is just beginning in other South Atlantic states, but life histories suggest that similar habitat use patterns will be found.

Threats to Marine and Estuarine Resources from Energy Exploration, Development, Transportation and Hydropower Re-licensing Activities

The SAFMC finds that energy exploration, development, transportation and hydropower re-licensing activities threaten or potentially threaten EFH through the following mechanisms:

14) Direct mortality and displacement of organisms at and near drilling, dredging, and/or trenching sites,

15) Deposition of fine sediments (sedimentation) and drilling muds down-current from drilling, dredging, trenching, and/or backfilling sites,

16) Chronic elevated turbidity in and near drilling, dredging, trenching, and/or backfilling sites,

17) Direct mortality of larvae, post-larvae, juveniles and adults of marine and estuarine organisms occurring from spills from pipelines or from vessels in transit near or close to inlet areas,

18) Alteration of long-term shoreline migration patterns (with complex, often indeterminable, ecological consequences),

19) Burial of sensitive coral resources and associated habitat resulting from "frac-outs" associated with horizontal directional drilling,

20) Permanent conversion of soft bottom habitat to artificial hardbottom habitat through installing a hard linear structure (i.e., a pipe covered in articulated concrete mats),

21) Impacts to benthic resources from placement and shifting of pipelines and cables, and from other types of direct mechanical damage,

22) Alterations in amount and timing of stream flow and significant reductions in fish passage resulting from damming or diverting rivers, and

23) Alteration of community diversity, composition, food webs and energy flow due to addition of structure.

In addition, the interactions between cumulative and direct (lethal and sub-lethal) effects among the above-listed can affect the magnitude of the overall impacts. Such interactions may result in a scale of effect that is multiplicative rather than additive. Those effects are at present nearly completely unstudied.

SAFMC Policies for Energy Exploration, Development, Transportation and Hydropower Re-licensing Activities

The SAFMC establishes the following general policies related to energy exploration, development, transportation, and hydropower re-licensing activities and related projects, to clarify and augment the general policies already adopted in the Habitat Plan and Comprehensive Habitat Amendment (SAFMC, 1998a; SAFMC, 1998b):

1. Projects should avoid, minimize, and – where possible – offset damage to EFH and EFH-HAPCs. This should be accomplished, in part, by integrating the best available and least imp active technologies into the construction design.

2. Agencies with oversight authority should require expanded EFH consultation for projects with the potential to significantly damage EFH. Projects requiring expanded EFH consultation should include detailed analyses for a full range of alternatives of possible impacts to each type of EFH, each EFH-HAPC and each CHA, including short and long-term effects and cumulative impacts at local, population and ecosystem scales. These analyses should utilize resource-protective assumptions and the best available science.

3. Projects should utilize the alternative that minimizes total impact EFH, EFH-HAPCs, and CHAs.

4. Projects should include detailed assessments of potentially unavoidable damage to EFH and other marine resources associated with the preferred or selected alternative and cumulative impacts, using conservative assumptions and the best available science.

5. Compensatory mitigation should not be considered until avoidance and minimization measures have been duly demonstrated. Compensatory mitigation should be required to offset losses to EFH, including losses associated with temporary impacts, and should take into account uncertainty and the risk of the chosen mitigation measures inadequately offsetting the impacts. Mitigation should be local, “up-front,” and “in-kind,” and include long-term monitoring to assess and ensure the efficacy of the mitigation program selected.

6. Projects should include pre-project, project-related, and post-project monitoring adequate to document pre-project conditions and the initial, long-term and cumulative impacts of the project on EFH.

7. All EFH assessments should be based upon the best available science, be conservative, and follow precautionary principles as developed for various Federal and State policies.

8. All EFH assessments should document the cumulative impacts associated with all natural and anthropogenic stressors on EFH, including other energy exploration, development, transportation, and re-licensing projects that are geographically and ecologically related.

9. Projects should comply with existing standards and requirements regulating domestic and international transportation of energy products including regulated waste disposal and emissions which are intended to minimize negative impacts on and preserve the quality of the marine environment.

10. Open-loop LNG processing facilities should be avoided in favor of closed-loop systems.

11. The re-licensing of hydropower projects should provide for adequate amount and timing of water flow, in addition to fish passage.

12. Third party environmental inspectors should be required on all projects to provide for independent monitoring and permit compliance.

13. Resource sensitivity training modules should be developed specific to each project, construction procedures and habitat types found within the project impact area. This training should be provided to all contractors and sub-contractors that are anticipated to work in or adjacent to areas that support sensitive habitats.

The SAFMC recommends the following specific concerns and issues be addressed by the Federal Energy Regulatory Commission, Minerals Management Service, and/or the U.S. Army Corps of Engineers prior to approval of any license, application, or permit.

A. The following requirements should apply to any permit to drill any exploratory well or wells in any Lease Sale with the potential to affect EFH in the Sam's jurisdiction. These concerns and issues should also be included in a new EIS for any future Outer Continental Shelf (OCS) Leasing Plan:

1. Identification of the on-site fisheries resources, including both pelagic and benthic communities, that inhabit, spawn, or migrate through the lease sites with special focus on those specific lease blocks where industry has expressed specific interest in the pre-lease phases of the leasing process. Particular attention should be given to critical life history stages (i.e. eggs and larvae) that are most sensitive to oil spills and seismic exploration.

2. Identification of on-site or potentially affected state or federally-listed species (e.g. endangered, threatened, special concern, etc.), marine mammals, pelagic birds, diadromous fishes, and all species regulated under federal fishery management plans.

3. Determination of impacts of all exploratory and development activities on the fisheries resources prior to MMS approval of any applications for permits to drill in the Exploratory Unit area, including effects of seismic survey signals on fish behavior, eggs and larvae.

4. Identification of commercial and recreational fishing activities in the vicinity of the lease or Exploratory Unit area, their season of occurrence and intensity, and any impacts whether temporary or permanent on the potential to continue those activities associated with the project or activity.

5. Determination of the physical and chemical oceanographic and meteorological characteristics of the area through field studies by MMS or the applicant, including on-site direction and velocity of currents and tides, sea states, temperature, salinity, water quality, wind storms frequencies, and intensities and icing conditions. Such studies must be required prior to approval of any exploration plan submitted in order to have adequate information upon which to base decisions related to site-specific proposed activities. Studies should include detailed characterization of seasonal surface currents and likely spill trajectories.

6. Description of required monitoring activities to be used to evaluate environmental conditions, and assess the impacts of exploration activities in the lease area or the Exploratory Unit.

7. Identification of the quantity, composition, and method of disposal of solid and liquid wastes and pollutants likely to be generated by offshore, onshore, and transportation operations associated with oil and gas exploration development and transportation.

8. Development of an oil spill contingency plan which includes oil spill trajectory analyses specific to the area of operations, dispersant-use plan including a summary of toxicity data for each dispersant, identification of response equipment and strategies, establishment of procedures for early detection and timely notification of an oil spill, and "chain-of-command" and notification procedures inclusive of all local, state and federal agencies and agency personnel to be notified when an oil spill is discovered, as well as defined and specific actions to be taken after discovery of an oil spill.

9. Mapping of environmentally sensitive areas (e.g., spawning aggregations of snappers and groupers); coral resources and other significant benthic habitats (e.g., tilefish mudflats) along the edge of the continental shelf (including the upper slope); calico scallop, royal red shrimp, and other productive benthic fishing grounds; other special biological resources; and northern right whale calving grounds and migratory routes, and subsequent deletion from inclusion in the respective lease block(s).

10. Planning for oil and gas product transport should be done to determine methods of transport, pipeline corridors, and onshore facilities.

11. The applicant, or MMS, must provide an analysis of biological community dynamics, and pathways and flows of energy, to ascertain accumulation of toxins and impacts on biological communities.

12. Due to the critical nature of canyons and steep relief to important fisheries (e.g. billfishes, swordfish and tunas) an evaluation of shelf-edge and down-slope dynamics, and a resource assessment to determine transport and fate of contaminants should be required.

13. Discussion of the potential adverse impacts upon fisheries resources of the discharges of all drill cuttings and all drilling muds that may be approved for use in the lease area or the Exploration Unit, as well as discharges associated with production activities (i.e. produced waters). This should include: physical and chemical effects upon pelagic and benthic species and communities, including spawning behavior, effects on eggs and larval stages; effects upon sight-feeding species of fish; and analysis of methods and assumptions underlying the model used to predict the dispersion of discharged muds and cuttings from exploration activities.

14. Discussion of secondary impacts affecting fishery resources associated with onshore oil and gas related development such as storage and processing facilities, dredging and dredged material disposal, roads and rail lines, fuel and electrical transmission line routes, waste disposal, and others.

B. The following requirements should apply to any permit or license to construct LNG gas pipelines and related facilities with the potential to affect EFH in the Sam's jurisdiction:

1. The least damaging construction method for traversing reef tracts and deepwater corals should be integrated into the project design.

2. Hydro test chemicals that may be harmful to fish and wildlife resources shall not be discharged into waters of the United States.

3. Geotechnical studies shall be completed to ensure that the geology of the area is appropriate for the construction method and that geological risks are appropriately mitigated.

4. All work vessels associated with construction that traverses any reef system should be equipped with standard navigation aids, safety lighting and communication equipment. A vessel monitoring system with global positioning system will be employed to continuously monitor all vessel movements and locations in real time.

5. Any anchor placement should completely avoid corals and be diver verified. In addition, measures to avoid anchor sweep should be developed and implemented.
6. Appropriate exclusion zones should be designated around sensitive marine habitats.

7. Pre- and post-project monitoring should be completed in addition to monitoring during construction. The pre-project monitoring should establish pre-project conditions; project monitoring should examine if unanticipated impacts are occurring and if corrective actions are needed; and post-project (immediate and long-term) monitoring should document impacts to resources resulting from the project, and any recovery from those impacts.

8. All feasible avoidance and minimization measures must be used to protect deepwater coral communities. Those measures must be fully described in detail prior to authorization of any permit or license.

9. A contingency plan should be required to address catastrophic blowouts or more chronic material losses from LNG facilities, including trajectory and other impact analyses and remediation measures and responsibilities.

10. Periodic long-term monitoring of pipelines and nearby deepwater resources should be conducted to evaluate the environmental effects of these installations on deepwater marine communities.

11. Appropriate mitigation should be developed in concert with the NMFS Habitat Conservation Division to offset unavoidable impacts.

C. The requirement listed below should apply to any relevant permit or license to construct wind farms or hydro turbine energy producing facilities with the potential to affect EFH in the SAFMC jurisdiction. To date, such projects are conceptual, yet reasonably foreseeable as future proposed actions. Given the existing information, it is reasonable to conclude that such projects may have an impact on EFH. However, at this time sufficient information is not available to make general project-type recommendations.

1. Submarine cables should be placed in a manner that avoids impacts to EFH. The best available technologies should be used to install such cables to avoid and minimize temporary and long-term impacts to EFH. If placed on the seabed, cables should be anchored and/or stabilized, and stability analyses should be conducted to ensure that the cable can withstand a 100-year storm event in appropriate water depths.

2. Many of the areas designated as EFH are important to protected resources (e.g., endangered and threatened species and marine mammals) in the region. Direct and indirect impacts may result from noise, electromagnetic fields, vessel traffic, pollutants/water quality issues, alteration of the benthos and habitat degradation or habitat exclusion. The degree of impact can depend on the species, the type of turbine, the method of installation, site characteristics and the layout and size of the facility. Therefore, any EIS prepared for the construction, operation or decommissioning of a wind energy generating facility should include maps of

species' ranges, migratory pathways, and use of habitat as part of an evaluation of direct and cumulative impacts to protected resources.

D. The following requirements should apply to the re-licensing of hydropower plants on rivers draining to waters under SAFMC jurisdiction:

1. The construction of fish ladders or other measures to should be implemented into the project design to provide for the safe and effective passage of fish to and from vital upstream habitats.
2. In stream flows prescriptions should ensure adequate quality, timing, and amount of water flow.

Policy and Position on Previous Oil and Gas Exploration Proposals

The SAFMC urged the Secretary of Commerce to uphold the 1988 coastal zone inconsistency determination of the State of Florida for the respective plans of exploration filed with MMS by Mobil Exploration and Producing North America, Inc. for Lease OCS-G6520 (Pulley Ridge Block 799) and by Union Oil Company of California for Lease OCS-G6491/6492 (Pulley Ridge Blocks 629 & 630). Both plans of exploration involved lease blocks lying within the lease area comprising the offshore area encompassed by Part 2 of Lease Sale 116, and south of 26° North latitude. The Council's objection to the proposed exploration activities was based on the potential degradation or loss of extensive live bottom and other habitat essential to fisheries under Council jurisdiction.

The SAFMC also supported North Carolina's determination that the plans of exploration filed with MMS by Mobil Exploration and Producing North America, Inc. for Lease OCS Manteo Unit are not consistent with North Carolina's Coastal Zone Management program.

The Council has expressed concern to the Outer Continental Shelf Leasing and Development Task Force about the proposed area and recommended that no further exploration or production activity be allowed in the areas subject to Presidential Task Force Review (the section of Sale 116 south of 26° N latitude).

The following section addresses the recommendations, concerns and issues expressed by the South Atlantic Council (Source: Memorandum to Regional Director, U.S. Fish and Wildlife Service, Atlanta, Georgia from Regional Director, Gulf of Mexico OCS Region dated October 27, 1995):

"The MMS, North Carolina, and Mobil entered into an innovative Memorandum of Understanding on July 12, 1990, in which the MMS agreed to prepare an Environmental Report (ER) on proposed drilling offshore North Carolina. The scope of the ER prepared by the MMS was more comprehensive than an EIS would be. The normal scoping process used in preparation of a NEPA-type document would not only 'identify significant environmental issues deserving of study' but also 'de-emphasize insignificant issues, narrowing the scope' (40 CFR 1500.4) by scoping out issues not ripe for decisions.

Of particular interest to North Carolina are not the transient effects of exploration, but rather the downstream and potentially broader, long-term effects of production and development. The potential effects associated with production and development would normally be "scoped out" of the (EIS-type) document and would be the subject of extensive NEPA analysis only after the exploration phase proves successful, and the submittal of a full-scale production and development program has been received for review and analysis. The ER addressed three alternatives: the proposed Mobil plan to drill a single exploratory well, the no-action alternative and the alternative that the MMS approve the Mobil plan with specific restrictions (monitoring programs and restrictions on discharges). The ER also analyzes possible future activities, such as development and production, and the long-term environmental and socioeconomic effects associated with such activities. The MMS assured North Carolina that all of the State's comments and concerns would be addressed in the Final ER (USDOI 1990).

The MMS also funded a Literature Synthesis study (USDOI MMS 1993a) and a Physical Oceanography study (USDOI MMS 1994), both recommended by the Physical Oceanography Panel and the Environmental Sciences Review Panel (ESRP). Mobil also submitted a draft report to the MMS titled *Characterization of Currents at Manteo Block 467 off Cape Hatteras, North Carolina*. The MMS also had a Cooperative Agreement with the Virginia Institute of Marine Science to fund a study titled *Seafloor Survey in the Vicinity of the Manteo Prospect Offshore North Carolina* (USDOI MMS 1993b). The MMS had a Cooperative Agreement with East Carolina University to conduct a study titled *Coastal North Carolina Socioeconomic Study* (USDOI MMS 1993c). The above-mentioned studies were responsive to the Earp's recommendations as well as those of the SAFMC and the State of North Carolina."

Copies of these studies can be acquired from the address below:
Minerals Management Service, Technical Communication Services
MS 4530 381 Eden Street
Herndon, VA 22070-4897 (703) 787-1080

In addition, by letter dated November 21, 2003, the SAFMC provided the following recommendations on the AES Ocean Express LNG pipeline project:

- The deepwater touch down route should be pre-inspected by ROV and the pipeline right of way shall be clear of all deepwater resources;
- Adjust deepwater touchdown position to maintain an appropriate buffer from any such deepwater resources;
- Require deepwater resources, other EFH and the deepwater touchdown position be mapped by ROV to confirm the resource position in relation to the installed pipeline;
- Conduct pre-installation video surveys to select the route that maximizes avoidance of these deepwater coral and live bottom habitats; and

- Monitor pipelines and nearby deepwater resources after installation to evaluate the environmental effects of these installations on deepwater marine communities.

References

SAFMC. 1998a. Final Habitat Plan for the South Atlantic region: Essential Fish Habitat requirements for fishery management plans of the South Atlantic Fishery Management Council. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, SC 29407-4699. 457 pp. plus appendices.

SAFMC. 1998b. Final Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region. Including a Final Environmental Impact Statement /Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, SC 29407-4699. 136pp.

USDOI, MMS. 1990. Atlantic Outer Continental Shelf, Final Environmental Report on Proposed Exploratory Drilling Offshore North Carolina, Vols. I-III.

USDOI, MMS. 1993a. North Carolina Physical Oceanography Literature Study. Contract No. 14-35- 0001-30594.

USDOI, MMS. 1993b. Benthic Study of the Continental Slope Off Cape Hatteras, North Carolina. Vols. I-III. MMS 93-0014, -0015, -0016.

USDOI, MMS. 1993c. Coastal North Carolina Socioeconomic Study. Vols. I-V. MMS 93-0052, -0053, -0054, -0055, and -0056.

USDOI, MMS. 1994. North Carolina Physical Oceanographic Field Study. MMS 94-0047.

Policy Statement Concerning Alterations to Riverine, Estuarine and Nearshore Flows

Policy Context

This document establishes the policies of the South Atlantic Fishery Management Council (SAFMC) regarding protection of the essential fish habitats (EFH) and habitat areas of particular concern (EFH-HAPCs) associated with alterations of riverine, estuarine and nearshore flows. Such hydrologic alterations occur through activities such as flood control reservoir and hydropower operations, water supply and irrigation withdrawals, deepening of navigation al channels and inlets, and other modifications to the normative hydrograph. The policies are designed to be consistent with the overall habitat protection policies of the SAFMC as formulated and adopted in the Habitat Plan (October 1998) and the Comprehensive EFH Amendment (October 1998).

The findings presented below assess the threats to EFH potentially posed by activities related to the alteration of flows in southeast rivers, estuaries and nearshore ocean habitats, and the processes whereby those resources are placed at risk. The policies established in this document are designed to avoid, minimize and offset damage caused by these activities, in accordance with the general habitat policies of the SAFMC as mandated by law.

EFH At Risk from Flow-Altering Activities

The SAFMC finds:

6) In general, the array of existing and proposed flow-altering projects being considered for the Southeastern United States for states with river systems that drain into the South Atlantic Fishery Management Council area of jurisdiction together constitutes a real and significant threat to EFH under the jurisdiction of the SAFMC.

7) The cumulative effects of these projects have not been adequately assessed, including impacts on public trust marine and estuarine resources (especially diadromous species), use of public trust waters, public access, state and federally protected species, state critical habitat, SAFMC-designated EFH and EFH-HAPCs.

8) Individual proposals resulting in hydrologic alterations rarely provide adequate assessments or consideration of potential damage to fishery resources under state and federal management. Historically, emphasis has been placed on the need for human water supply, hydropower generation, agricultural irrigation, flood control and other human uses. Environmental considerations have been dominated by compliance with limitations imparted by the Endangered Species Act for shortnose sturgeon, and/or through provisions of Section 18 of the Federal Power Act, as administered by the Federal Energy Regulatory Commission, which applies to the provision of passage for anadromous species, as well as the provisions of the Fish and Wildlife Act.

9) Opportunities to avoid and minimize impacts of hydrologic alterations on fishery resources, and offsets for unavoidable impacts have rarely been proposed or implemented.

10) Hydrologic alterations have caused impacts to a variety of habitats including:

e) waters, wetlands and benthic habitats near the discharge and withdrawal points, especially where such waters are used for spawning by anadromous species;
f) waters, wetlands and benthic habitats in the area downstream of discharge or withdrawal points;
g) waters wetlands and benthic habitats in receiving estuaries of southeast rivers; and
h) waters and benthic habitats of nearshore ocean habitats receiving estuarine discharge.

6) Certain riverine, estuarine and nearshore habitats are particularly important to the long-term viability of commercial and recreational fisheries under SAFMC management, and threatened by large-scale, long-term or frequent hydrologic alterations:

e) freshwater riverine reaches and/or wetlands used for anadromous spawning;
f) downstream freshwater, brackish and mid-salinity portions of rivers and estuaries serving as nursery areas for anadromous and estuarine-dependant species; and
g) nearshore oceanic habitats off estuary mouths.

7) Large sections of South Atlantic waters potentially affected by these projects, both individually and collectively, have been identified as EFH or EFH-HAPC by the SAFMC**,** as well as the Mid-Atlantic Fishery Management Council (MAFMC) in the case of North Carolina. Potentially affected species and their EFH under federal management include (SAFMC, 1998) include:

a) summer flounder (various nearshore waters, including the surf zone and inlets; certain offshore waters).
b) bluefish (various nearshore waters, including the surf zone and inlets)
c) red drum (ocean high-salinity surf zones and unconsolidated bottoms in the nearshore).
d) many snapper and grouper species (live hard bottom from shore to 600 feet, and – for estuarine-dependent species [e.g., gag grouper and gray snapper] – unconsolidated bottoms and live hard bottoms to the 100 foot contour).
e) black sea bass (various nearshore waters, including unconsolidated bottom and live hard bottom to 100 feet, and hard bottoms to 600 feet).
f) penaeid shrimp (offshore habitats used for spawning and growth to maturity, and waters connecting to inshore nursery areas, including the surf zone and inlets).
g) coastal migratory pelagics (e.g., king mackerel, Spanish mackerel) (sandy shoals of capes and bars, barrier island ocean-side waters from the surf zone to the shelf break inshore of the Gulf Stream; all coastal inlets).
h) corals of various types (hard substrates and muddy, silt bottoms from the subtidal to the shelf break).
i) areas identified as EFH for Highly Migratory managed by the Secretary of Commerce (e.g., sharks / inlets and nearshore waters, including pupping and nursery grounds).

8) Projects which entail hydrologic alterations also threaten important fish habitats for anadromous species under federal, interstate and state management (in particular, riverine spawning habitats, riverine and estuarine habitats, including state designated areas - e.g. Primary and Secondary Nursery Areas of North Carolina), as well as essential overwintering grounds in nearshore and offshore waters. All diadromous species are under management by the Atlantic States Marine Fisheries Commission and the states. The SAFMC also identified essential habitats of anadromous and catadromous species in the region (inlets and nearshore waters).

9) Numerous habitats that have been by these projects causing hydrologic alterations have been identified as EFH-HAPCs by the SAFMC. The specific fishery management plan is provided in parentheses:

a) all nearshore hard bottom areas (SAFMC, snapper grouper).
b) all coastal inlets (SAFMC, penaeid shrimps, red drum, and snapper grouper).
c) near-shore spawning sites (SAFMC, penaeid shrimps, and red drum).
d) benthic *Sargassum* (SAFMC, snapper grouper).
e) from shore to the ends of the sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras, North Carolina; Hurl Rocks, South Carolina; *Phragmatopora* (worm reefs) reefs off the central coast of Florida and near-shore hard-bottom south of Cape Canaveral (SAFMC, coastal migratory pelagics).
f) Atlantic coast estuaries with high numbers of Spanish mackerel and Cobia from ELMR, to include Bogue Sound, New River, North Carolina; Broad River, South Carolina (SAFMC, coastal migratory pelagics).
g) Florida Bay, Biscayne Bay, Card Sound, and coral hard bottom habitat from Jupiter Inlet through the Dry Tortugas, Florida (SAFMC, Spiny Lobster)
h) Hurl Rocks (South Carolina), The Phragmatopoma (worm reefs) off central east coast of Florida, nearshore (0-4 meters; 0-12 feet) hard bottom off the east coast of Florida from Cape Canaveral top Broward County); offshore (5-30 meters; 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 (SAFMC, Coral, Coral Reefs and Live hard Bottom Habitat).
i) EFH-HAPCs designated for HMS species (e.g., sharks) in the South Atlantic region (NMFS, Highly Migratory Species).

10) Habitats likely to be affected by projects which alter hydrologic regimes include many recognized in state level fishery management plans. Examples of these habitats include Critical Habitat Areas established by the North Carolina Marine Fisheries Commission, either in FMPs or in Coastal Habitat Protection Plans.

Threats to Marine and Estuarine Resources from Hydrologically-Altering Activities

The SAFMC finds that activities which alter normative hydrologic regimes of rivers, estuaries, inlets and nearshore oceanic habitats threaten or potentially threaten EFH through the following mechanisms:

24) Direct mortality of organisms at withdrawal points through hydrologic regimes

In addition, the interactions between cumulative and direct (sub-lethal) effects among the above factors certainly trigger non-linear impacts that are completely unstudied.

Policies for Flow-altering Projects

The SAFMC establishes the following general policies related projects resulting in hydrologic alterations, to clarify and augment the general policies already adopted in the Habitat Plan and Comprehensive Habitat Amendment (SAFMC 1998a; SAFMC 1998b):

1) Projects should avoid, minimize and where possible offset damage to EFH and EFH-HAPCs.

2) Projects requiring expanded EFH consultation should provide detailed analyses of possible impacts to each type of EFH, with careful and detailed analyses of possible impacts to EFH-HAPCs and state Critical Habitat Areas (CHAs), including short and long-term, and population and ecosystem scale effects. Agencies with oversight authority should require expanded EFH consultation.

3) Projects requiring expanded EFH consultation should provide a full range of alternatives, along with assessments of the relative impacts of each on each type of EFH, HAPC and CHAs.

4) Projects should avoid impacts on EFH, HAPCs and CHAs that are shown to be avoidable through the alternatives analysis, and minimize impacts that are not.

5) Projects should include assessments of potential unavoidable damage to EFH and other marine resources, using conservative assumptions.

6) Projects should be conditioned on the avoidance of avoidable impacts, and should include compensatory mitigation for all reasonably predictable impacts to EFH, taking into account uncertainty about these effects. Mitigation should be local, up-front and in-kind, and should be adequately monitored, wherever possible.

7) Projects should include baseline and project-related monitoring adequate to document pre-project conditions and impacts of the projects on EFH.

8) All assessments should be based upon the best available science, and be appropriately conservative so follow and precautionary principles as developed for various federal and state policies.

9) All assessments should take into account the cumulative impacts associated with other projects in the same southeast watershed.

References

SAFMC. 1998a. Final habitat plan for the South Atlantic region: Essential Fish Habitat requirements for fishery management plans of the South Atlantic Fishery Management Council. 457 pp plus appendices.

SAFMC. 1998b. Final Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region. Including a Final Environmental Impact Statement /Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699. 136pp.

Policy for Protection and Enhancement of Marine Submerged Aquatic Vegetation (SAV) Habitat

The South Atlantic Fishery Management Council (SAFMC) and the Habitat and Environmental Protection Advisory Panel has considered the issue of the decline of Marine Submerged Aquatic Vegetation SAV (or seagrass) habitat in Florida and North Carolina as it relates to Council habitat policy. Subsequently, the Council's Habitat Committee requested that the Habitat Advisory Panel develop the following policy statement to support Council efforts to protect and enhance habitat for managed species.

Description and Function

In the South Atlantic region, SAV is found primarily in the states of Florida and North Carolina where environmental conditions are ideal for the propagation of seagrasses. The distribution of SAV habitat is indicative of its importance to economically important fisheries: in North Carolina, total SAV coverage is estimated to be 200,000 acres; in Florida, the total SAV coverage is estimated to be 2.9 million acres. SAV serves several valuable ecological functions in the marine systems where it occurs. Food and shelter afforded by SAV result in a complex and dynamic system that provides a primary nursery habitat for various organisms that is important both to the overall system ecology as well as to commercial and recreationally important fisheries. SAV habitat is valuable both ecologically as well as economically; as feeding, breeding, and nursery ground for numerous estuarine species, SAV provides for rich ecosystem diversity. Further, a number of fish and shellfish species, around which is built several vigorous commercial and recreational fisheries, rely on SAV habitat for a least a portion of their life cycles. For more detailed discussion, please see Appendix 1.

Status

SAV habitat is currently threatened by the cumulative effects of overpopulation and consequent commercial development and recreation in the coastal zone. The major anthropogenic threats to SAV habitat include:

(1) mechanical damage due to:
- (a) propeller damage from boats,
- (b) bottom-disturbing fish harvesting techniques,
- (c) dredging and filling;

(2) biological degradation due to:
- (a) water quality deterioration by modification of temperature, salinity, and light attenuation regimes;
- (b) addition of organic and inorganic chemicals.

SAV habitat in both Florida and North Carolina has experienced declines from both natural and anthropogenic causes. However, conservation measures taken by state and federal agencies have produced positive results. The national Marine Fisheries Service has produced maps of SAV habitat in the Albemarle-Pamlico Sound region of North Carolina to help stem the loss of this critical habitat. The threats to this habitat and the potential for successful conservation measures highlight the need to address the decline of SAV. Therefore, the South Atlantic Council recommends immediate and direct action be taken to stem the loss of this essential habitat. For more detailed discussion, please see Appendix 2.

Management

Conservation of existing SAV habitat is critical to the maintenance of the living resources that depend on these systems. A number of federal and state laws and regulations apply to modifications, either direct or indirect, to SAV habitat. However, to date the state and federal regulatory process has accomplished little to slow the decline of SAV habitat. Furthermore, mitigation measures to restore or enhance impacted SAV have met with little success. These habitats cannot be readily restored; the South Atlantic Council is not aware of any seagrass restoration project that has ever prevented a net loss of SAV habitat. It has been difficult to implement effective resource management initiatives to preserve existing seagrass habitat resources due to the lack of adequate documentation and specific cause/effect relationships (for more detailed discussion, please see Appendix 3).

Because restoration/enhancement efforts have not met with success, the South Atlantic Council considers it imperative to take a directed and purposeful action to protect remaining SAV habitat. The South Atlantic Council strongly recommends that a comprehensive strategy to address the disturbing decline in SAV habitat in the South Atlantic region. Furthermore, as a stepping stone to such a long-term protection strategy, the South Atlantic Council recommends that a reliable status and trend survey be adopted to verify the scale of local declines of SAV.

The South Atlantic Council will address the decline of SAV, and consider establishing specific plans for revitalizing the SAV resources of the South Atlantic region. This may be achieved by the following integrated triad of efforts:

Planning:

- The Council promotes regional planning which treats SAV as an integral part of an ecological system.

- The Council supports comprehensive planning initiatives as well as interagency coordination and planning on SAV matters.

- The Council recommends that the Habitat Advisory Panel members actively seek to involve the Council in the review of projects which will impact, either directly or indirectly, SAV habitat resources.

Monitoring and Research:

- Periodic surveys of SAV in the region are required to determine the progress toward the goal of a net resource gain.

- The Council supports efforts to
  (1) standardize mapping protocols,

(2) develop a Geographic Information System databases for essential habitat including seagrass, and

(3) research and document causes and effects of SAV decline including the cumulative impacts of shoreline development.

Education and Enforcement:

- The Council supports education programs designed to heighten the public's awareness of the importance of SAV. An informed public will provide a firm foundation of support for protection and restoration efforts.

- Existing regulations and enforcement need to be reviewed for their effectiveness.

- Coordination with state resource and regulatory agencies should be supported to assure that existing regulations are being enforced.

SAFMC SAV Policy Statement- Appendix 1

Description and Function

Worldwide, Submerged Aquatic Vegetation (SAV) constitutes one of the most conspicuous and common shallow-water habitat types. These angiosperms have successfully colonized standing and flowing fresh, brackish, and marine waters in all climatic zones, and most are rooted in the sediment. Marine SAV beds occur in the low intertidal and subtidal zones and may exhibit a wide range of habitat forms, from extensive collections of isolated patches to unbroken continuous beds. The bed is defined by the presence of either aboveground vegetation, its associated root and rhizome system (with living merited), or the presence of a seed bank in the sediments, as well as the sediment upon which the plant grows or in which the seed back resides. In the case of patch beds, the unvegetated sediment among the patches is considered seagrass habitat as well.

There are seven species of seagrass in Florida's shallow coastal areas: turtle grass (*Thalassic restudied*); manatee grass (*Syringodium filiforme*); shoal grass (*Halodule wrightii*); star grass (*Halophila engelmanni*); paddle grass (*Halophila decipiens*); and Johnson's seagrass (*Halophila johnsonii*) (See Appendix 4). Recently, *H. johnsonii* has been proposed for listing by the National Marine Fisheries Service as an endangered plant species. Areas of seagrass concentration along Florida's east coast are Mosquito Lagoon, Banana River, Indian River Lagoon, Lake Worth and Biscayne Bay. Florida Bay, located between the Florida Keys and the mainland, also has an abundance of seagrasses, but is currently experiencing an unprecedented decline in SAV distribution.

The three dominant species found in North Carolina are shoalgrass (*Halodule wrightii*), eelgrass (*Zostera marina*), and widgeongrass (*Ruppia maritima*). Shoalgrass, a subtropical species has its northernmost distribution at Oregon Inlet, North Carolina. Eelgrass, a temperate species, has its southernmost distribution in North Carolina. Areas of seagrass concentration in North Carolina are southern and eastern Pamlico Sound, Core Sound, Back Sound, Bogue Sound and the numerous small southern sounds located behind the beaches in Onslow, Pender, Brunswick, and New Hanover Counties (See distribution maps in Appendix 4).

Seagrasses serve several valuable ecological functions in the marine estuarine systems where they occur. Food and shelter afforded by the SAV result in a complex and dynamic system that provides a primary nursery habitat for various organisms that are important both ecologically and to commercial and recreational fisheries. Organic matter produced by these seagrasses is transferred to secondary consumers through three pathways: herbivores that consume living plant matter; detritivores that exploit dead matter; and microorganisms that use seagrass-derived particulate and dissolved organic compounds. The living leaves of these submerged plants also provide a substrate for the attachment of detritus and epiphytic organisms, including bacteria, fungi, meiofauna, micro- and marcroalgae, macroinvertebrates. Within the seagrass system, phytoplankton also are present in the water column, and macroalgae and microalgae are associated with the sediment. No less important is the protection afforded by the variety of living spaces in the tangled leaf canopy of the grass bed itself. In addition to biological benefits, the SAVs also cycle nutrients and heavy metals in the water and sediments, and dissipate wave energy (which reduces shoreline erosion and sediment resuspension).

There are several types of association fish may have with the SAVs. Resident species typically breed and carry out much of their life history within the meadow (e.g., gobiids and syngnathids). Seasonal residents typically breed elsewhere, but predictably utilize the SAV during a portion of their life cycle, most often as a juvenile nursery ground (e.g., sparids and lutjanids). Transient species can be categorized as those that feed or otherwise utilize the SAV only for a portion of their daily activity, but in a systematic or predictable manner (e.g., haemulids).

In Florida many economically important species utilize SAV beds as nursery and/or spawning habitat. Among these are spotted seatrout (*Cynoscion nebulosus*), grunts (Haemulids), snook (*Centropomus sp.*), bonefish (*Albula vulpes*), tarpon (*Megalops atlanticus*) and several species of snapper (Lutjanids) and grouper (Serranids). Densities of invertebrate organisms are many times greater in seagrass beds than in bare sand habitat. Penaeid shrimp, spiny lobster (*Panulirus argus*), and bay scallops (*Argopecten irradians*) are also dependent on seagrass beds.

In North Carolina 40 species of fish and invertebrates have been captured on seagrass beds. Larval and juvenile fish and shellfish including gray trout (*Cynoscion regalis*), red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), mullet (*Mugil cephalus*), spot (*Leiostomus xanthurus*), pigfish (*Orthopristis chrysoptera*), gag (*Mycteroperca microlepis*), white grunt (*Haemulon plumieri*), silver perch (*Bairdiella chrysoura*), summer flounder (*Paralichthys dentatus*), southern flounder (*P. lethostigma*), blue crabs (*Callinectes sapidus*), hard shell clams (*Mercenaria mercenaria*), and bay scallops (*Argopecten irradians*) utilize the SAV beds as nursery areas. They are the sole nursery grounds for bay scallops in North Carolina. SAV meadows are also frequented by adult spot, spotted seatrout, bluefish (*Pomatomus saltatrix*), menhaden (*Brevortia tyrannus*), summer and southern flounder, pink and brown shrimp, hard shell clams, and blue crabs. Offshore reef fishes including black sea bass (*Centropristis striata*), gag (*Mycteroperca microlepis*), gray snapper (*Lutjanus griseus*), lane snapper (*Lutjanus synagris*), mutton snapper (*Lutjanus annalis*), and spottail pinfish (*Diplodus holbrooki*). Ospreys, egrets, herons, gulls and terns feed on fauna in SAV beds, while swans, geese, and ducks feed directly on the grass itself. Green sea turtles (*Chelonia mydas*) also utilize seagrass beds, and juveniles may feed directly on the seagrasses.

SAFMC SAV Policy Statement- Appendix 2

Status

The SAV habitat represents a valuable natural resource which is now threatened by overpopulation in coastal areas. The major anthropogenic activities that impact seagrass habitats are: 1) dredging and filling, 2) certain fish harvesting techniques and recreational vehicles, 3) degradation of water quality by modification of normal temperature, salinity, and light regimes, and 4) addition of organic and inorganic chemicals. Although not caused by man, disease ("wasting disease" of eelgrass) has historically been a factor. Direct causes such as dredging and filling, impacts of bottom disturbing fishing gear, and impacts of propellers and boat wakes are easily observed, and can be controlled by wise management of our seagrass resources (See Appendix 3). Indirect losses are more subtle and difficult to assess. These losses center on changes in light availability to the plants by changes in turbidity and water color. Other indirect causes of seagrass loss may be ascribed to changing hydrology which may in turn affect salinity levels and circulation. Reduction in flushing can cause an increase in salinity and the ambient temperature of a water body, stressing the plants. Increase in flushing can mean decreased salinity and increased turbidity and near-bottom mechanical stresses which damage or uproot plants.

Increased turbidity and decreasing water transparency are most often recognized as the cause of decreased seagrass growth and altered distribution of the habitats. Turbidity may result from upland runoff, either as suspended sediment or dissolved nutrients. Reduced transparency due to color is affected by freshwater discharge. The introduction of additional nutrients from terrigenous sources often leads to plankton blooms and increased epiphytization of the plants, further reducing light to the plants. Groundwater enriched by septic systems also may infiltrate the sediments, water column, and near-shore seagrass beds with the same effect. Lowered dissolved oxygen is detrimental to invertebrate and vertebrate grazers. Loss of these grazers results in overgrowth by epiphytes.

Large areas of Florida where seagrasses were abundant have now lost these beds from both natural and man-induced causes (this is not well documented on a large scale except in the case of Tampa Bay). One of these depleted areas is Lake Worth in Palm Beach County. Here, dredge and fill activities, sewage disposal and stormwater runoff have almost eliminated this resource. North Biscayne Bay lost most of its seagrasses from urbanization. The Indian River Lagoon has lost many seagrass beds from stormwater runoff has caused a decrease in water transparency and reduced light penetration. Many seagrass beds in Florida have been scarred from boat propellers disrupting the physical integrity of the beds. Vessel registrations, both commercial and recreational, have tripled from 1970-71 (235, 293) to 1992-93 (715,516). More people engaged in marine activities having an effect on the limited resources of fisheries and benthic communities, Florida's assessment of dredging/propeller scar damage indicates that Dade, Lee, Monroe, and Pinellas Counties have the most heavily damaged seagrass beds. Now Florida Bay, which is rather remote from human population concentrations, is experiencing a die-off of seagrasses, the cause of which has not yet been isolated. Cascading effects of die-offs cause a release of nutrients resulting in algal blooms which, in turn, adversely affect other seagrass areas, and appear to be preventing recolonization and natural succession in the bay. It appears that Monroe County's commercial fish and shellfish resources, with a dockside landing value of $50 million per year, is in serious jeopardy.

In North Carolina total SAV coverage is estimated at 200,000 acres. Compared to the state's brackish water SAV community, the marine SAVs appear relatively stable. The drought and increased water clarity during the summer of 1986 apparently caused an increase in SAV abundance in southeastern Pamlico Sound and a concomitant increase in bay scallop densities. Evidence is emerging, however, that characteristics of "wasting disease" are showing up in some of the eelgrass populations in southern Core Sound, Back Sound, and Bogue Sound. The number of permits requested for development activities that potentially impact SAV populations is increasing. The combined impacts of a number of small, seemingly isolated activities are cumulative and can lead to the collapse of large seagrass biosystems. Also increasing is evidence of the secondary removal of seagrasses. Clam-kicking (the harvest of hard clams utilizing powerful propeller wash to dislodge the clams from the sediment) is contentious issue within the state of North Carolina. The scientific community is convinced that mechanical harvesting of clams damages SAV communities. The scallop fishery also could be harmed by harvest-related damage to eelgrass meadows.

SAFMC SAV Policy Statement- Appendix 3

Management

Conservation of existing SAV habitat is critical to the maintenance of the living resources that depend on these systems. A number of federal and state laws require permits for modification and/or development in SAV. These include Section 10 of the Rivers and Harbors Act (1899), Section 404 of the Clean Water Act (1977), and the states' coastal area management programs. Section 404 prohibits deposition of dredged or fill material in waters of the United States without a permit from the U.S. Army Corps of Engineers. The Fish and Wildlife Coordination Act gives federal and state resource agencies the authority to review and comment on permits, while the National Environmental Policy Act requires the development and review of Environmental Impact Statements. The Magnuson Fisheries Conservation and Management Act has been amended to require that each fishery management plan include a habitat section. The Council's habitat subcommittee may comment on permit requests submitted to the Corps of Engineers when the proposed activity relates to habitat essential to managed species. State and federal regulatory processes have accomplished little to slow the decline of SAV habitat. Many of the impacts cannot be easily controlled by the regulations as enforced. For example, water quality standards are written so as to allow a specified deviation from background concentration, allowing for a certain amount of degradation. An example of this is Florida's class III water transparency standard, which defines the compensation depth to be where 1% of the incident light remains. The compensation depth for seagrass is in excess of 10% and for some species is between 15 and 20%. The standard allows a deviation of 10% in the compensation depth which translates into 0.9% incident light or an order of magnitude less than what the plants require. Mitigation measures to restore or enhance impacted areas have met with little success. SAV habitats cannot be readily restored; in fact, the South Atlantic Council is not aware of any seagrass restoration project that has ever avoided a net loss of seagrass habitat. It has been difficult to implement effective resource management initiatives to preserve seagrass habitat due to the lack of documentation on specific cause/effect relationships. Even though studies have identified certain cause/effect relationships in the destruction of these areas, lack of long-term, ecosystem-scale studies precludes an accurate scientific evaluation of the long-term deterioration of seagrasses. Some of the approaches to controlling propeller scar damage to seagrass beds include: education, improved channel marking restricted access zones, (complete closure to combustion engines, pole or troll areas), and improved enforcement. The South Atlantic Council sees the need for monitoring of seagrass restoration and mitigation not only to determine success from plant standpoint but also for recovery of faunal populations and functional attributes of the essential habitat type. The South Atlantic Council also encourages long-term trend analysis monitoring of distribution and abundance using appropriate protocols and Geographic Information System approaches.

SAFMC SAV Policy Statement- Appendix 4

(SAV Distribution Maps in SAFMC 1995 and Revised in Appendix C of the Habitat Plan)

Policy Statement Concerning Dredging and Dredge Material Disposal Activities

Ocean Dredged Material Disposal Sites (ODMDS) and SAFMC Policies.
The shortage of adequate upland disposal sites for dredged materials has forced dredging operations to look offshore for sites where dredged materials may be disposed. These Ocean Dredged Material Disposal Sites (ODMDSs) have been designated by the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) as suitable sites for disposal of dredged materials associated with berthing and navigation channel maintenance activities. The South Atlantic Fishery Management Council (SAFMC; the Council) is moving to establish its presence in regulating disposal activities at these ODMDSs. Pursuant to the Magnuson Fishery Conservation and Management Act of 1976 (the Magnuson Act), the regional fishery management Councils are charged with management of living marine resources and their habitat within the 200 mile Exclusive Economic Zone (EEZ) of the United States. Insofar as dredging and disposal activities at the various ODMDSs can impact fishery resources or essential habitat under Council jurisdiction, the following policies address the Council's role in the designation, operation, maintenance, and enforcement of activities in the ODMDSs:

The Council acknowledges that living marine resources under its jurisdiction and their essential habitat may be impacted by the designation, operation, and maintenance of ODMDSs in the South Atlantic. The Council may review the activities of EPA, COE, the state Ports Authorities, private dredging contractors, and any other entity engaged in activities which impact, directly or indirectly, living marine resources within the EEZ.

The Council may review plans and offer comments on the designation, maintenance, and enforcement of disposal activities at the ODMDSs.

ODMDSs should be designated or redesignated so as to avoid the loss of live or hard bottom habitat and minimize impacts to all living marine resources.

Notwithstanding the fluid nature of the marine environment, all impacts from the disposal activities should be contained within the designated perimeter of the ODMDSs.

The final designation of ODMDSs should be contingent upon the development of suitable management plans and a demonstrated ability to implement and enforce that plan. The Council encourages EPA to press for the implementation of such management plans for all designated ODMDSs.

All activities within the ODMDSs are required to be consistent with the approved management plan for the site.

The Council's Habitat and Environmental Protection Advisory Panel when requested by the Council will review such management plans and forward comment to the Council. The Council may review the plans and recommendations received from the advisory sub-panel and comment to the appropriate agency. All federal agencies and entities receiving a comment or recommendation from the Council will provide a detailed written response to the Council regarding the matter pursuant to 16 U.S.C. 1852 (i). All other agencies and entities receiving a comment or recommendation from the Council should provide a detailed written response to the Council regarding the matter, such as is required for federal agencies pursuant to 16 U.S.C. 1852 (i).

ODMDSs management plans should indicate appropriate users of the site. These plans should specify those entities/ agencies which may use the ODMDSs, such as port authorities, the U.S. Navy, the Corps of Engineers, etc. Other potential users of the ODMDSs should be acknowledged and the feasibility of their using the ODMDSs site should be assessed in the management plan.

Feasibility studies of dredge disposal options should acknowledge and incorporate ODMDSs in the larger analysis of dredge disposal sites within an entire basin or project. For example, Corps of Engineers analyses of existing and potential dredge disposal sites for harbor maintenance projects should incorporate the ODMDSs as part of the overall analysis of dredge disposal sites.

The Council recognizes that EPA and other relevant agencies are involved in managing and/or regulating the disposal of all dredged material. The Council recognizes that disposal activities regulated under the Ocean Dumping Act and dredging/filling carried out under the Clean Water Act have similar impacts to living marine resources and their habitats. Therefore, the Council urges these agencies apply the same strict policies to disposal activities at the ODMDSs. These policies apply to activities including, but not limited to, the disposal of contaminated sediments and the disposal of large volumes of fine-grained sediments. The Council will encourage strict enforcement of these policies for disposal activities in the EEZ. Insofar as these activities are relevant to disposal activities in the EEZ, the Council will offer comments on the further development of policies regarding the disposal/ deposition of dredged materials.

The Ocean Dumping Act requires that contaminated materials not be placed in an approved ODMDS. Therefore, the Council encourages relevant agencies to address the problem of disposal of contaminated materials. Although the Ocean Dumping Act does not specifically address inshore disposal activities, the Council encourages EPA and other relevant agencies to evaluate sites for the suitability of disposal and containment of contaminated dredged material. The Council further encourages those agencies to draft management plans for the disposal of contaminated dredge materials. A consideration for total removal from the basin should also be considered should the material be contaminated to a level that it would have to be relocated away from the coastal zone.

Offshore and Nearshore Underwater Berm Creation

The use of underwater berms in the South Atlantic region has recently been proposed as a disposal technique that may aid in managing sand budgets on inlet and beachfront areas. Two types of berms have been proposed to date, one involving the creation of a long offshore berm, the second involving the placement of underwater berms along beachfronts bordering an inlet. These berms would theoretically reduce wave energy reaching the beaches and/or resupply sand to the system.

The Council recognizes offshore berm construction as a disposal activity. As such, all policies regarding disposal of dredged materials shall apply to offshore berm construction. Research should be conducted to quantify larval fish and crustacean transport and use of the inlets prior to any consideration of placement of underwater berms. Until the impacts of berm creation in inlet areas on larval fish and crustacean transport are determined, the Council recommends that disposal activities should be confined to approved ODMDSs. Further, new offshore and near shore underwater berm creation activities should be reviewed under the most rigorous criteria, on a case-by-case basis.

Open Water Disposal

The SAFMC is opposed to the open water disposal of dredged material into aquatic systems which may adversely impact habitat that fisheries under Council jurisdiction are dependent upon. The Council urges state and federal agencies, when reviewing permits considering open water disposal, to identify the direct and indirect impacts such projects could have on fisheries habitat.

The SAFMC concludes that the conversion of one naturally functioning aquatic system at the expense of creating another (marsh creation through open water disposal) must be justified given best available information.

13.4 Appendix D. Expanded take estimates of snapper grouper from the shark bottom longline fishery with the proposed Type II MPAs

Expanded take estimates of snapper grouper from the shark bottom longline fishery within proposed Type II Marine Protected Areas in the South Atlantic Fishery Management Council's Amendment 14 to the Snapper grouper Fishery Management Plan

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Introduction:

The South Atlantic Fishery Management Council (SAFMC) is evaluating 15+ alternatives for the establishment of nine Type II Marine Protected Areas (MPAs) for the protection of seven species within the deepwater snapper grouper complex in the South Atlantic Exclusive Economic Zone (EEZ)); speckled hind (*Epinephelus drummondhayi*), snowy grouper (*E. niveatus*), warsaw grouper (*E. nigritus*), misty grouper (*E. mystacinus*), yellowedge grouper (*E. flavolimbatus*), tilefish (*Lopholatilus chamaeleonticeps*), and blueline tilefish (*Caulolatilus microps*) (SAFMC, Summary Council Motions - 6/15/06). Four of these species are considered to be overfished (speckled hind, snowy grouper, warsaw grouper, and tilefish), one is not considered to be overfished (yellowedge grouper), and the status of two is unknown (misty grouper and blueline tilefish). The snapper grouper fishery operating in the South Atlantic EEZ is managed under the South Atlantic Snapper grouper Fishery Management Plan (FMP), under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The Council decided to consider the implementation of deepwater MPAs in Amendment 14 to the Snapper grouper FMP.

Marine Protected Areas are a management tool, which are hoped to allow deepwater grouper and tilefish species to increase the size and number of adults, protect spawning aggregation sites (and thus increase reproductive output and subsequent recruitment) and provide a refuge for early life history stages. Although these proposed MPAs target deep-water species, positive impacts may also benefit species in the shallow grouper/snapper complex found within these sites; e.g., gag (*Mycteroperca microlepis*), scamp (*M. phenax*), red grouper (*E. morio*), red snapper (*Lutjanus campechanus*) and vermilion snapper (*Rhomboplites aurorubens*).

The SAFMC is focusing on Type II MPAs, which will close the areas to bottom fishing but allow continued trolling for coastal pelagic (CP) and highly migratory species (HMS). The SAFMC also intends to request the National Marine Fisheries Service (NMFS) to implement regulations to prohibit the use of shark bottom longline gear within the MPAs proposed in this amendment. To evaluate the impacts of the shark longline fishery on snapper grouper species within the proposed deepwater MPAs in Amendment 14, we expand observed takes of snapper-grouper complex from the shark bottom longline observer program to obtain overall estimates of snapper grouper catch within the proposed MPAs.

Methodology:

Definition of the Fishery

The shark bottom longline fishery is active from the mid-Atlantic Bight to south Florida and throughout the Gulf of Mexico. Vessels in the fishery are typically fiberglass and average up to 50 feet in length. Longline characteristics vary regionally with gear normally consisting of about 5-15 miles of longline and 500-1500 hooks. Gear is set at sunset and allowed to soak overnight before hauling back in the morning. There are currently about 100 active vessels in this fishery out of about 250 vessels that possess directed shark fishing permits. These vessels make between 4000-9000 sets per year. The bottom longline gear targets large coastal sharks, but small coastal, pelagic and dogfish species are also caught. Bycatch consists of groupers, snappers, tilefishes and skates and rays.

Observer Data

From 1994 through 2001, observer coverage was conducted on a voluntary basis. Beginning with the 2002 fishing season, observer coverage of the Atlantic shark directed bottom longline fishery became mandatory under authority of 50 CFR 635.7. The Commercial Shark Fishery Observer Program (CSFOP), Florida Museum of Natural History, University of Florida, Gainesville, FL (Burgess and Morgan, 2003), coordinated observer coverage from 1994 through the 1st trimester season of 2005. Starting with the 2nd trimester season of 2005, responsibility for the fishery observer program was transferred to National Marine Fisheries Service (NMFS), Southeast Fisheries Science Center (SEFSC), Panama City Laboratory.

Vessels for observer coverage are randomly selected from a pool of vessels each trimester season based on the following criteria: the vessel/owner must possess a current directed shark permit, and the permit holder (i.e. vessel/owner) must have reported fishing with bottom longline gear in the second season of the previous year and the permit holder must not have been selected for observer coverage for the prior three consecutive shark seasons. Vessels are selected from three fishing regions: North Atlantic, South Atlantic, and Gulf of Mexico. The North Atlantic is defined as from Virginia to Maine, the South Atlantic is defined as the east coast of Florida to North Carolina and the Caribbean, and the Gulf of Mexico is defined as Texas to west coast of Florida including the Florida Keys (NMFS, 2005). From 2002-2005, the objective of vessel selection was to achieve a representative 5% level of coverage of the total fishing effort in each fishing area and during each fishing season of that year (Chris Rilling, NMFS Office of Sustainable Fisheries, pers. comm.). Beginning in 2006, target coverage level is 3.9% of the total fishing effort. This level is estimated to attain a sample size needed to provide estimates of sea turtle, smalltooth sawfish, or marine mammal interactions with an expected coefficient of variation of 0.3 (Carlson, unpublished).

Fishery Effort

Total fishing effort information was obtained from the NMFS coastal fishery logbook database. This is a mandatory reporting program where vessel operators provide information on catch, effort, and gear characteristics for each fishing trip. Shark bottom longline sets typically occur at dusk, are allowed to soak for overnight and are hauled back in the next morning. Vessels generally make one set per fishing day (Smith *et al*. 2006). When extracting data from the coastal fisheries logbook, each record within the logbook data was assumed to represent an individual set. The criterion for classifying effort as operating in the shark bottom longline fishery in the logbooks was that longline was the gear used and any amount of sharks and/or grouper were landed, and fishing effort occurred in the same statistical sampling areas as the proposed MPAs. The effort selected as a result may be biased high because sets the target species was not identified in the coastal fisheries logbook.

Total Snapper grouper Catch Estimation

The Data

The Mid-Atlantic bight and the South Atlantic are divided up into statistical areas we will refer to here as grids. The proposed MPAs areas were calculated as proportions of each grid (Table #). The coastal fishery logbook database (cite or source?) was queried to find the total fishing effort—number of hooks—by year (1994-2006) and by grid. Observer data from the University of Florida observer program database and the NMFS-based shark bottom longline observer program were merged to a total of 819 sets. Of those, 14 sets intersected the proposed MPAs (Figure: map, Table #). Of those 14 intersecting sets, 5 contained grouper or snapper bycatch. One warsaw grouper was caught in the proposed Central South Carolina 1 MPA, but that was not enough data to predict future catches of grouper in that grid. The other four sets that contained bycatch were in the proposed MPA Snowy Wreck 1, therefore the findings of this report are specific to the Snowy Wreck 1 proposed MPA area only. There is not enough data to estimate the impact of the shark bottom longline fishery on the other MPA in a statistically robust fashion.

Analysis

Our statistical methods follow those outlined in Ortiz *et al*. (2000). We calculated the proportion of sets with bycatch using a GLM. This method calculates the probability of bycatch in a set using a binomial likelihood

$$f\left(pos\right)=\binom{n}{pos}p^{pos}\left(1-p\right)^{n-pos} \tag{1.1}$$

where *pos* is the proportion of positive tows, *n* is the total observed tows, and *p* is the mean of $\frac{pos}{n}$. We assume a logit link function for our GLM. To calculate the mean bycatch rate, we used the delta method (Pennington 1983; Stefansson 1996; Ortiz *et al.* 2000). The delta method has also been used by Garrison at the SEFSC-Miami laboratory to estimate bycatch of protected species in longline gear. After we estimate the mean bycatch rate, we applied that to the proportion of the grid area that contains an MPA and the proportion of the set that was in the MPA according to Table (#). Finally we scaled the estimate up to the observed and unobserved vessels in each MPA by multiplying the estimate by total logbook effort.

Results and Discussion:

For Snowy Wreck 1, which is 3.92% of Grid 3376 and .84% of Grid 3377, our estimated are as follows:

Grid	3376	3377
Catch Rate/1000 hooks	6.13E-03	5.86E-02

We had insufficient data to estimate a bycatch rate for any of the other proposed MPAs.

Literature Cited:

Ortiz, M., Legault, C. M. & Ehrhardt, N. M. (2000) An alternative method for estimating bycatch from the U.S. shrimp trawl fishery in the Gulf of Mexico, 1972-1995. *Fish B-Noaa* 98: 583-599.

Pennington, M. (1983) Efficient Estimators of Abundance, for Fish and Plankton Surveys. *Biometrics* 39: 281-286.

Stefansson, G. (1996) Analysis of groundfish survey abundance data: Combining the GLM and delta approaches. *ICES Journal of Marine Science* 53(3): 577-588.

13.5 Appendix E: Delphi Panel

SEDEP:

Type II Marine Protected Areas for the South Atlantic Snapper Grouper Complex

SOUTHEAST DELPHI EXPERT PANEL

NATIONAL MARINE FISHERIES SERVICE

SOUTHEAST FISHERIES SCIENCE CENTER

SOCIAL SCIENCE RESEARCH GROUP

MIAMI, FL

JULY 17 – SEPTEMBER 15, 2006

Final Report

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

EXECUTIVE SUMMARY 4
INTRODUCTION 7
MODIFIED DELPHI METHODOLOGY 15
POLICY DELPHI: ROUND ONE RESULTS 19
Benefit-Cost Valuation of Type II MPAs 20

ITERATIVE DELPHI: ROUND TWO RESULTS 32
IMPACT ANALYSIS: ROUND THREE RESULTS 39
Snowy Wreck MPA 44
Northern South Carolina MPA 49
Edisto MPA 55
Georgia MPA 61
North Florida MPA 66
St. Lucie Hump MPA 76
East Hump MPA 80
Charleston Deep Artificial Reef MPA 84

DISCUSSION 87
REFERENCES 91
APPENDIX 1 – ROUND ONE INSTRUCTIONS AND TABLES 93
APPENDIX 2 – ROUND TWO INSTRUCTIONS AND TABLES 96
APPENDIX 3 – ROUND THREE INSTRUCTIONS AND TABLES 102

EXECUTIVE SUMMARY

Amendment 14 to the Snapper Grouper Fishery Management Plan proposes to augment traditional methods of management with permanently closed Type II marine protected areas (MPAs) in an effort to improve the biological health of south Atlantic deepwater resources and mitigate negative socioeconomic consequences resulting from spatial closures. The South Atlantic Fishery Management Council (Council) has proposed seven MPAs from North Carolina to the Florida Keys as well as an experimental site. As part of the regulatory process, socioeconomic impacts to fishery stakeholders must be identified and measured for each proposed alternative site. Due to poor spatial resolution, empirical data are not available to perform a traditional impact analysis. This report outlines a tractable methodology that produces semi-quantitative forecasts of socioeconomic consequences associated with implementing Type II MPAs in the deepwater south Atlantic snapper grouper (SASG) fishery.

The methodology is based on a modified Delphi approach. An expert panel responded to three rounds of inquiry consisting of a Policy Delphi, a traditional iterative Delphi, and an impact analysis. Results included a thorough discussion of possible socioeconomic effects due to the implementation of Type II MPAs, broad groupings of these effects along with relative weights of importance, and rankings of alternatives. The final rankings produced best options for each proposed MPA from a net socioeconomic impact perspective.

We compare the results from the modified Delphi approach to the Council's preferred alternatives for each MPA. The Council's preferred alternative for the Snowy Wreck MPA is Alternative 1 while the Delphi analysis deemed Alternative 2 as the highest ranked alternative from a socioeconomic impact perspective. The Delphi approach forecasts higher displacement effects to the commercial and possibly for-hire fishing sectors in the immediate-term for Alternative 1 relative to Alternative 2. Furthermore, no additional socioeconomic benefits are forecasted if Alternative 1 is implemented rather than Alternative 2.

The Council's preferred alternative for the Northern South Carolina MPA is Alternative 2 while the Delphi analysis could not find any significant differences between

Alternatives 1 and 2 from a socioeconomic impact perspective. Potential tradeoffs between administrative/ecosystem and fishing sector impacts due to the adoption of one alternative over the other are forecasted to be negligible. Both alternatives are forecasted to produce moderate ecosystem benefits in the long-run while inflicting minimal to moderate immediate-term displacement effects on fishermen and their communities. These costs and benefits are significantly different from a neutral effect.

The Council's preferred alternative for the Edisto MPA is Alternative 1. The Delphi analysis suggests that additional long-term benefits would accrue if Alternative 1 is adopted rather than Alternative 2. The analysis does not forecast additional displacement costs to the fishing sector by adopting Alternative 1 over Alternative 2. When compared to the No Action alternative, long-term minimal ecosystem benefits associated with Alternative 1 were found to be statistically different from a neutral effect. However, these benefits come with a price: immediate minimal displacement costs to fishermen and their communities.

The Council's preferred alternative for the Georgia MPA is Alternative 1. The Delphi analysis suggests that additional long-term benefits would accrue if Alternative 1 is adopted rather than Alternative 2. The analysis does not forecast additional displacement costs to the fishing sector by adopting Alternative 1 over Alternative 2. When compared to the No Action alternative, long-term minimal ecosystem benefits associated with Alternative 1 were found to be statistically different from a neutral effect. However, these benefits come with a price: immediate minimal displacement costs to fishermen and their communities.

The Council's preferred alternative for the North Florida MPA is Alternative 4. Through nonparametric testing and a comparison of weighted impact scores Alternative 4 was shown to be inferior to Alternative 2. Alternative 3 statistically produces the same net administrative and ecosystem impacts as Alternative 2 but with lower immediate cost to fishing sectors and dependent communities. Except in one case (Alternative 4, long-term, community and social impacts) the panel forecasted negative or neutral socioeconomic impacts to fishermen and communities for all North Florida MPA alternatives over all time frames. Nonparametric tests and final weighted scores suggest that both Alternatives 2 and 3 result in minimally negative impacts in the immediate-term that are statistically different from a neutral effect. No other socioeconomic impacts resulting from these two alternatives were found to be statistically different from the assumed neutral effects from No Action. The analysis suggests that costs could be minimized by not adopting either Alternative 2 or 3, which were deemed as the two best alternatives of the six proposed.

The Council's preferred alternative for the St. Lucie Hump MPA is Alternative 1. The Delphi analysis suggests that minimal displacement costs would be incurred by the fishing sector as well as dependent communities in the immediate-term if Alternative 1 was adopted rather than the No Action alternative. On the other hand, minimal ecosystem effects are forecasted starting after one year of implementation of Alternative 1. The analysis did not find any other forecasted time-dependent socioeconomic impacts significantly different from neutral.

The Council's preferred alternative for the East Hump/Un-named Hump MPA is Alternative 1. The Delphi analysis suggests adoption of Alternative 1 is preferable to the No Action alternative from a socioeconomic impact perspective since minimal ecosystem effects start to be realized after only one year and continue into the future, long-term minimal benefits are realized by fishers and their communities, forecasted costs are not significantly different from a neutral impact, and stakeholder consensus regarding the placement of the MPA is high.

The Council does not have a preferred alternative for the Charleston deep artificial reef MPA. The Delphi analysis suggests that no displacement costs would be incurred by the fishing sector or dependent communities if Alternative 1 is adopted rather than the No Action alternative. Alternative 1 is preferable to No Action as minimal long-term ecosystem benefits are forecasted without incurring any net impacts that are significantly different from a neutral effect.

The results from the Delphi study must be interpreted with caution. First, our sample sizes for each MPA analysis were relatively small (either seven or eight respondents) and may not represent a true cross-section of knowledge regarding the Amendment 14 MPAs. Second, although we were able to calculate measures of statistical significance regarding nonparametric tests of differences in socioeconomic impacts between alternatives, we perform many of them for this study. With so many tests, significant differences could be concluded even in the presence of a random draw, which could lead to an inflated probability of making an erroneous conclusion when we are rejecting the null hypothesis of no differences in socioeconomic impacts between alternatives. Also, it is important to realize that the panel reported impact scores over time, and in most cases it was not discernable whether they incorporated aspects of risk or other dynamically influenced attributes into their scoring system. Consequently, each score for each alternative in a particular time period should be viewed independently of their scores for the other time periods. **We cannot justify or advocate a process of comparing alternatives by adding impact scores over time periods.**

Southeast Delphi Expert Panel: Forecasting Socioeconomic Impacts Associated with Implementation of Type II Marine Protected Areas for Deepwater South Atlantic Snapper Grouper Species

INTRODUCTION

As defined by Marine Protected Areas Executive Order 13158, a marine protected area (MPA) is "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" (Federal Register 2000). MPAs are spatially oriented fishery management strategies designed to allow exploited species and/or impaired ecosystems to recover over time by excluding (partially or fully) fishing effort from fishing grounds and essential fish habitats, including reefs and spawning sites. Socioeconomic impacts to fishery stakeholders must be identified and measured using the best available scientific data and techniques as part of the regulatory process of implementing MPAs in federal fisheries. This research outlines a tractable methodology that produces semi-quantitative forecasts of these impacts and is especially useful when empirical data are lacking or poor in quality. We apply the methodology to a contemporary regulatory problem and forecast the type and incidence of socioeconomic consequences associated with implementing Type II MPAs in the deepwater south Atlantic snapper grouper (SASG) fishery.[5]

> In 1990 the South Atlantic Fishery Management Council (Council) first investigated the potential of MPAs to protect slow-growing, long-lived snapper grouper species through the Council's Snapper Grouper Plan Development Team (PDT) (Plan Development Team 1990). Over the next decade the Council initiated public scoping meetings and a scientific review of the 1990 PDT report while also implementing the Experimental *Oculina* Research Reserve off Ft. Pierce, FL and accepting MPAs associated with the Florida Keys Marine Sanctuary which extended into the Council's jurisdiction. In 2000 the Council began discussion regarding implementation of MPAs from North Carolina to the Florida Keys to protect deepwater species susceptible to overfishing (i.e., snowy grouper, golden and blueline tilefish, speckled hind, and Warsaw, misty, and yellowedge groupers). This process culminated in the development of Amendment 14 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (Snapper Grouper FMP).
>
> The stated objective of Amendment 14 is "to employ a collaborative approach to identify MPA sites with the potential to protect a portion of the population and habitat of long-lived deepwater snapper grouper species to achieve a more natural sex ratio, age, and size structure within the proposed MPAs, while minimizing adverse social and economic impacts" (SAFMC 2006). Amendment 14 proposes to augment traditional methods of management with permanently closed Type II MPAs in an effort to improve the biological health of south Atlantic deepwater resources and mitigate negative socioeconomic consequences resulting from spatial closures. Within the Type II MPAs all harvesting and possession of species in the Snapper Grouper FMP would be prohibited, but other types of fishing (e.g., pelagic trolling, shrimp trawling) would be allowed.

The SASG fishery is a renewable but destructible common pool marine resource. Although access to the fishery is limited due to technological, regulatory, and geographical attributes, no stakeholder has an exclusive ability to utilize the resource such as private landowners do. Thus, there is a tendency towards overexploitation through excess effort and capital spending as fishermen seek to maximize their own personal returns. As a result of competition for economic rents, too much fishing capital enters the fishery as recreational, for-hire, and commercial fishermen do not internalize (i.e., have to pay for) all of the *social costs* of their extraction activities. Social costs consist of *private costs*, such as labor, fuel, bait, and dock expenses, incurred by an individual fisherman and *external costs* which are costs imposed on other fishermen or people who do not directly participate in the harvesting process yet place some value on

[5] A "Type II" MPA allows some level of fishing effort within the protected areas.

the marine resources. External costs are typically linked to overuse of the resource and the inability to achieve future benefits from the fish stock in an efficient manner.

The existence of external costs and the incentive for overuse of fishery resources has led to federal management of the SASG fishery during the last 20 years in an effort to protect snapper grouper resources and to achieve a biological and economically sustainable yield. However, certain life-history characteristics of some species, the multispecies nature of the fishery, increased (human) population growth and demand for fish, and technological improvements continue to make snapper grouper resources vulnerable to depletion. This is particularly true for deepwater species, such as snowy grouper and golden tilefish, because they are site-specific, relatively long-lived, and slow-growing. In an effort to improve the biological health of deepwater resources throughout the jurisdiction of the Council, Amendment 14 augments traditional fishery regulations with a permanently closed Type II MPA network.

The alternative MPAs proposed by Amendment 14 are depicted in the following two figures, and their descriptions are derived from the Council's Public Hearing Draft for Amendment 14 (SAFMC 2006), published research, and expert testimony. Figure 1 shows alternative sites for the following proposed MPAs: Snowy Grouper Wreck, Northern South Carolina, Edisto, Charleston Deep Artificial Reef, and Georgia.

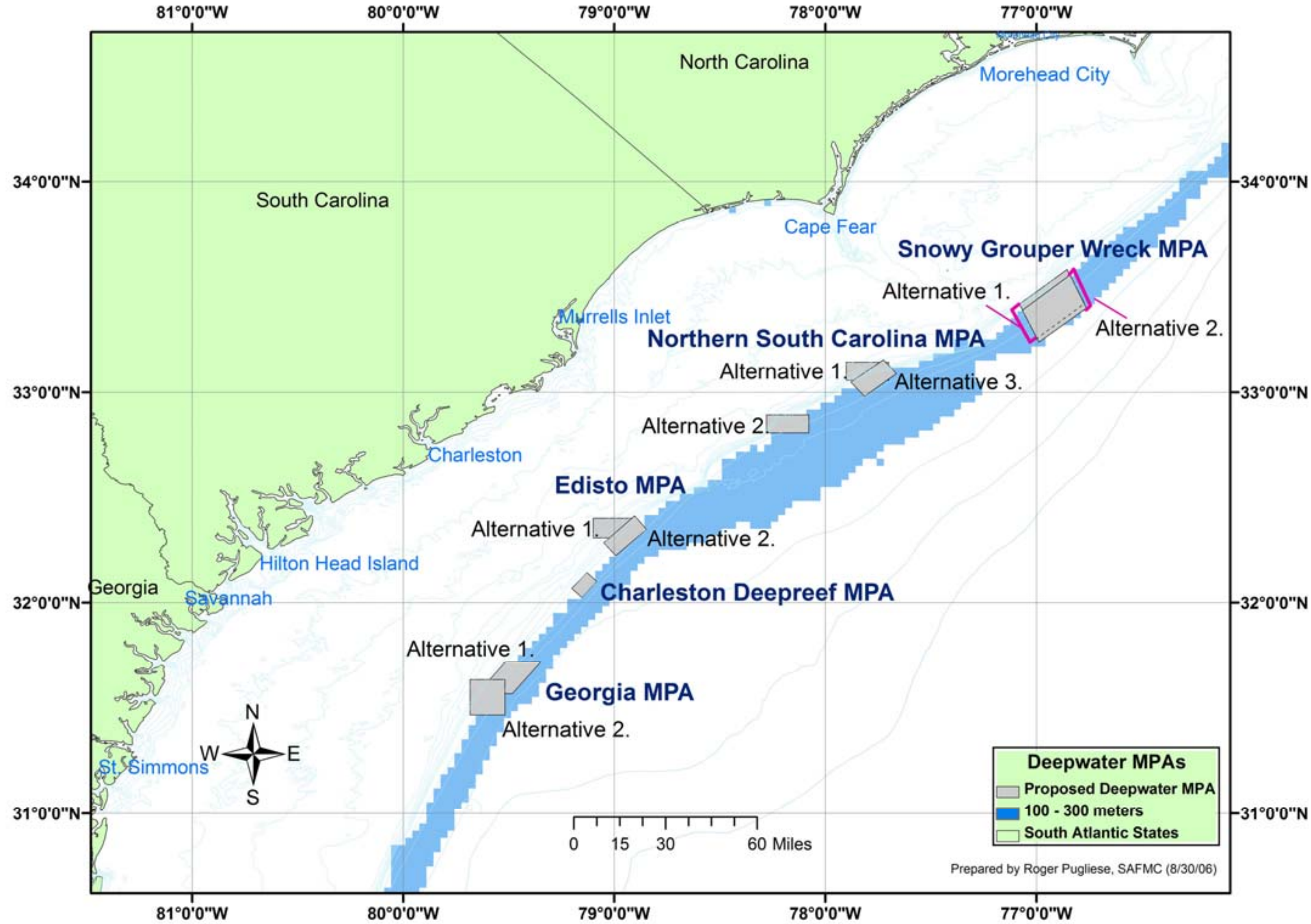
Snowy Grouper Wreck MPA

This MPA contains two alternatives, approximately 10 X 15 nautical miles, which are located about 55 nautical miles southeast of Southport, NC. According to Quattrini and Ross (2006), both alternatives contain numerous hardbottoms, although they are scarce or absent in depths greater than about 125 m. The area holds a wreck that once was the site of a known snowy grouper aggregation and is believed to have been regularly fished by a few vessels over the last two decades. There is a probability that spawning of snowy grouper occurs in this area, and Alternative 1 could include habitat for juvenile snowy grouper. Commercial activity in Alternative 2 is relatively light (about six boats) while over 12 vessels regularly fish for snappers and shallow water groupers in the mid-shelf region of Alternative 1. The area is heavily fished by fishermen who troll for tuna, marlin, dolphin, and wahoo during certain times of the year.

Northern South Carolina MPA

This MPA contains three alternatives, approximately 5 X 10 nautical miles, which are located nearly 55 nautical miles southeast of Murrells Inlet, SC. The alternative sites are areas of low relief containing significant hard bottom. The area is fished mostly in the winter and contains deepwater species particularly snowy grouper and speckled hind as well as small vermillion snapper in the mid-shelf regions. The shelf edge habitat in Alternative 2 is an important nursery area for speckled hind and Warsaw grouper and contains known spawning areas for speckled hind and many mid-shelf species; however, spawning areas for golden tilefish and snowy grouper exist in deeper waters outside of its boundaries. The shelf edge area is a popular fishing spot for deepwater and mid-shelf snapper grouper species.

Figure 1. Proposed Amendment 14 MPAs in the Carolinas and Georgia (SAFMC 2006; http://www.safmc.net/portals/6/images/DWMPAsNorthAug06(2).jpg)



Edisto MPA

This MPA contains two alternatives, approximately 5 X 10 nautical miles, which are located roughly 45 nautical miles southeast of Charleston, SC. Both sites reside in an area of upwelling and are known to hold snowy grouper and speckled hind.[6] Alternative 1 contains significant hard bottom, and the shelf edge portion is fished heavily by commercial, headboat, and private recreational fishermen for many mid-shelf snapper grouper species as well as snowy grouper (including juveniles), speckled hind, and blueline tilefish; however, the alternative is too shallow to include habitat for spawning snowy grouper.

[6] Upwelling results in nutrient rich water beneficial to early life stages of fishes.

Charleston Deep Artificial Reef MPA

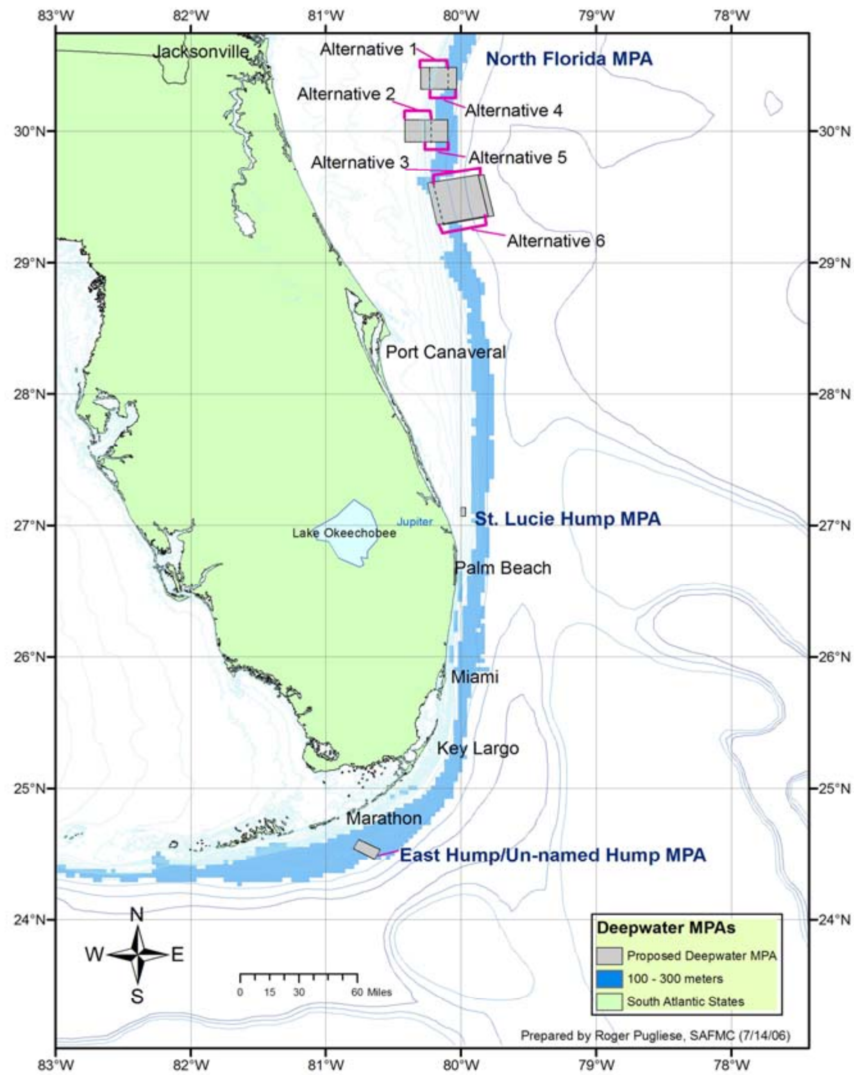
This MPA contains one alternative, approximately 3.5 X 6 nautical miles, which is located about 50 nautical miles east of Charleston Harbor, SC. The proposed site is an experimental artificial MPA that the Council is considering to be used as a scientific study area regarding the dynamics of MPA implementation. The proposed MPA is in a depth range preferred by juvenile snowy grouper, speckled hind, and Warsaw grouper.

Georgia MPA

This MPA contains two alternatives, approximately 10 X 10 nautical miles, which are located roughly 65 nautical miles east of Wassaw Sound, GA. Both sites contain known golden tilefish habitat, but tilefish are not typically landed within 30 fathoms. Occasional commercial landings of rosefish and snowy grouper have been reported; however, the majority of fishing activity that occurs in these sites is trolling for pelagic species such as tuna and dolphin.

Figure 2 shows alternative sites for the following proposed MPAs: North Florida, St. Lucie Hump, and East Hump/Un-Named Hump.

Figure 2. Proposed Amendment 14 Florida MPAs (SAFMC 2006; http://www.safmc.net/portals/6/images/DWMPAsSouthAug06(2).jpg)



North Florida MPA

This MPA contains six alternatives, ranging in size from 10 X 10 nautical miles to 22 X 23 nautical miles. The six alternative sites are situated in locations from 57 nautical miles off the mouth of the St. John's River near Jacksonville (Alternative 1) to off Ormond Beach (Alternative 6). The relatively large number of alternatives is the result of Council and public input in a compromise effort to capture a greater amount of deepwater habitat than was originally proposed. Alternatives 1 and 2 are heavily fished both commercially and recreationally for mid-shelf snapper grouper species. Alternative

4 contains significant hard bottom shelf edge habitat that is a popular fishing spot for mid-shelf species. Alternatives 3 and 6 are compromise alternatives proposed by the Council to include areas with a greater amount of deepwater habitat. The North Florida MPA alternatives are also areas known for rock and royal red shrimp trawling.

St. Lucie Hump MPA

This MPA contains one alternative, approximately 2 X 4 nautical miles, which is located about 9 nautical miles southeast of St. Lucie Inlet, FL. Anecdotal information indicates that this area is habitat rich with speckled hind, snowy grouper (including juveniles), golden tilefish, and various mid-shelf snapper grouper species. The area is also heavily trolled for pelagic species.

East Hump/Un-Named Hump

This MPA contains one alternative, approximately 5 X 10 nautical miles, which is located about 13 nautical miles from Long Key, FL. The site was proposed to the Council by local fishing organizations as an alternative to a site on the Islamorada Hump. The area is habitat rich and heavily trolled for pelagic species. This site may also provide protection to greater amberjack which is of historical concern to the Council.

Empirical data, such as logbook reports, are typically used to conduct quantitative analyses of the socioeconomic impacts of fishery management actions in the SASG fishery. However, these data are reported at a coarser spatial scale than that of the MPA sites proposed in Amendment 14. Thus, it is not possible to produce a robust quantitative analysis to assess the socioeconomic impacts that would be caused by implementation of the proposed MPAs. As a result, a modified Delphi approach was adopted to develop a semi-quantitative ranking system for *ex ante* forecasting of the type and extent of socioeconomic consequences associated with the implementation of Type II MPAs in deepwater regions of the SASG fishery.

A panel of experts was selected to participate in the Delphi process through anonymous email correspondence. For this panel we recruited stakeholders with commercial, for-hire, and recreational fishing interests, as well as others with expertise covering biology, economics, anthropology, protected resources, enforcement, and administration. The panelists were geographically dispersed from the Carolinas to the Florida Keys. Experts were selected based on a spectrum of fishing and research backgrounds with different perspectives on the policy issue of MPAs and not necessarily on the basis of detailed knowledge about the deepwater sites proposed in Amendment 14. This was a priority in order to represent contrasting viewpoints of different stakeholders. However, some panel members had direct knowledge of individual sites being proposed in Amendment 14. Their viewpoints were treated as expert testimony and systematically disseminated to the rest of the panel so that each panelist had some fundamental information about the proposed sites.

In the next section we outline the modified Delphi approach used in this study to produce a semi-quantitative socioeconomic impact analysis for Amendment 14 to the Snapper Grouper FMP. Results from each stage of the modified Delphi follow. A final section discusses the implications of our findings for the Amendment 14 regulatory process and possible future applications of the group consensus approach to fisheries management.

MODIFIED DELPHI METHODOLOGY

The Delphi method is a statistical feedback technique that generates repetitive response, discussion, and judgment among a panel of diverse experts resulting in a sound collective opinion. The methodology allows experts to participate in a structured forum of communication so that they may systematically address a complex social problem where relevant empirical data are lacking, eventually making forecasts and/or supporting policy decisions.[7] Since the first applications sponsored by the U.S. Air Force and carried out at the RAND Corporation in the post-World War II era, Delphi methodology has evolved over time; however, core traits of the technique have remained intact. With current technology inquiries may be sent by e-mail to a pre-selected expert panel, or a website could be constructed that allows the group of experts to respond to a real-time

[7] The seminal reference for a discussion of the Delphi Technique with diverse applications is Linstone and Turoff (1975).

communications system. Regardless of the medium, these inquiries are designed to initiate exploration and discussion of a complex subject resulting in individual responses to the problems posed. Individual responses are summarized and presented back to the panel enabling the experts to review all responses and clarify or change their own position based on their perception of the collective views of the panel. This process is repeated until some level of group consensus is reached regarding the designated problem. Other possible results include "demonstrating points of agreement or divergence, finding alternatives with majority or strong minority support, and providing a neutral forum for communication between experts" (Linstone and Turoff 1975). Essential characteristics of Delphi experiments include anonymity, repetition, controlled feedback, and statistical summaries of group opinion.

The lack of refined spatial data relevant to the proposed Amendment 14 MPAs offered a unique opportunity in fisheries management to apply a new application of a Delphi experiment. The Delphi methodology was advocated as a useful tool for fishery managers over 25 years ago by Zuboy (1981). Since Zuboy's article, Delphi methods have been readily applied in the field of natural resource management (e.g., Crance 1987; Clark *et al*. 2006). Applications of group consensus in fisheries management have been conducted regarding the planning of MPAs (Bohnsack 1997; Scholz *et al*. 2004); however, no Delphi or consensus-oriented studies have been carried out that specifically forecast the level of socioeconomic impacts that may result from implementation of MPAs. In this paper we have proposed a modified Delphi approach to generate information necessary to differentiate the economic and social consequences among alternatives for each proposed site in Amendment 14. The modified Delphi methodology consisted of three rounds: a Policy Delphi (Round One), a traditional iterative Delphi (Round Two), and an impact analysis (Round Three).

The name given to our modified Delphi experiment was the Southeast Delphi Expert Panel (SEDEP). SEDEP was conducted by email from July 17, 2006 to September 30, 2006. Larry Perruso and Denise Johnson, who are industry economists at the National Marine Fisheries Service, served as panel moderators throughout the process and conducted the initial telephone inquiries with potential experts. Originally, 17 experts agreed to participate in the study.[8] As mentioned before, their proficiencies were diverse; however, five of the original panelists did not participate in any of the rounds. These panelists included two enforcement officials, two NMFS administrators, and one commercial fisherman. The remaining 12 panelists participated in at least one round, and most had significant cross-knowledge about the biology associated with the proposed sites in Amendment 14 and the socioeconomics associated with the fishermen and communities dependent on these sites, as well as general knowledge of MPAs. The majority of the participating experts also had direct experience with at least one of the sites whether it was through actual fishing, biological research, or interaction with dependent stakeholders.

For the most part all communication between the panelists and the moderation team was done through a third party administrator, Paul Baertlein, via email. All emails sent to panelists used blind carbon copy during all three rounds, which is a technology that hides the recipients' email addresses. Experts were assigned a random respondent number insuring anonymity among panel members as well as between the panel and the moderation team. This was done so no bias originated among the moderators as they evaluated the responses from the first two rounds. Due to the complexity of Round Three, the moderation team did conduct telephone calls with individual panelists to aid responses during this round. Care was taken not to influence any responses, and since the impact analysis was purely quantitative, there was not any opportunity to amend a respondent's impact scores due to mediator bias. Updates and final results from each round were distributed in the same manner to the panel using Word, PDF, and Excel formats.

The Delphi experiment was conducted in three stages, or Rounds. Round One was a Policy Delphi in which the panelists identified a comprehensive list of effects that potentially could be associated with the kinds of Type II MPAs that would be implemented by Amendment 14. Thus, Round One was a brainstorming session designed to produce strongly opposing views among the panelists regarding the general

[8] In some cases a group of respondents participated as one expert. For example, researchers from the same institution had studied the biology of some of the sites, so in these cases multiple informed opinions contributed to a single Delphi expert submission. Also, in some cases fishermen with direct information of certain sites or fishing patterns in those areas influenced a panelist's final submission with their own expert knowledge.

types of effects that would create positive or negative socioeconomic consequences due to the implementation of Type II MPAs. A future application of Round One may be useful for the Council's Advisory Panels when they discuss other amendments. A Policy Delphi of this sort can be used as a precursor to committee activity, not so much to gain a consensus on an issue as to expose all the differing positions without the meeting digressing into an ineffectual argumentative situation.

Round Two was more analogous to a traditional Delphi approach. The primary objective of Round Two was to group and rank the most important of the effects produced by the Round One brainstorming session. To do so, panelists were asked to group the individual effects identified in Round One on the basis of common characteristics. A time dimension was introduced to distinguish the immediate (less than one year) effects of implementing a Type II MPA from effects that would arise in the medium-term (one to five years) and long-term (over five years). Thus, groups of effects were ranked based on their expected overall impacts throughout various time periods after implementation of Type II MPAs in general.

The primary objective of Round Three and the overall research was to differentiate the socioeconomic consequences among alternatives for each proposed site in Amendment 14. We used a weighted scoring system based on the results from Rounds One and Two to achieve this objective. In Delphi terminology, this is considered an impact analysis. Each panelist was asked to estimate the impact of each group of effects in each time period on a scale of (-3, 3), with a score of zero representing a neutral impact (Table 1). Overall impact scores for each grouping of effects in each time period were calculated with a probabilistic consensus model that enabled us to test for agreement in responses among panelists (Romney *et al*. 1986). Relative weights based on the rankings of effects from Round Two were used to calculate the overall weighted impact scores in each time period that were employed to compare the alternatives associated with the Amendment 14 MPA sites. The Wilcoxon Signed-Rank Test produces a nonparametric statistic that was used to formally test for differences in scores among the alternatives. The No Action alternative was not explicitly evaluated by the panelists and was defined to have a score of zero.

Table 1.—Scoring of the Impact of Group Effects after MPA Implementation

-3	HIGH NEGATIVE IMPACT.	+3	HIGH POSITIVE IMPACT.
-2	MODERATE NEGATIVE IMPACT.	+2	MODERATE POSITIVE IMPACT.
-1	MINIMAL NEGATIVE IMPACT.	+1	MINIMAL POSITIVE IMPACT.
0	NEUTRAL IMPACT.		

POLICY DELPHI: ROUND ONE RESULTS

The main purpose of this research is to provide a semi-quantitative analysis of the economic and social consequences among alternatives for each proposed MPA in Amendment 14. In order to achieve this goal, we first had to identify the possible effects that may result from implementation of Type II MPAs in general. So, in Round One we initiated a Policy Delphi which was a panel brainstorming session about the general outcomes that may result from implementation of Type II MPAs and the net directional impact (i.e., positive, negative, or neutral) that these effects would have on a baseline estimate of overall socioeconomic consequences. A Policy Delphi differs from a traditional Delphi in that its final goal is not to obtain a consensus rather to elicit differing viewpoints regarding some political issue (Turoff 1970). Thus, the role of Round One pertained more to policy analysis than decision-making.

As the round progressed it became apparent that most panelists were focusing on the Amendment 14 sites. This proved beneficial as expert testimony regarding individual MPA sites was naturally disseminated to the panel at an early stage of the Delphi experiment. Panelists that were unfamiliar with those particular MPAs began to think about MPAs within the framework of Amendment 14 early in the Delphi process.

The rest of this section contains a description of effects (i.e., benefits/advantages and costs/disadvantages) that may impact stakeholders after implementation of Type II MPAs similar to the alternatives proposed in Amendment 14. For each effect, majority and minority support from the Delphi panel about that effect's direction (i.e., negative, positive, or neutral) and level (i.e., minimal, moderate, or high) of influence on socioeconomic impacts resulting from implementation of Amendment 14 MPAs, in particular, are summarized and discussed. Benefits/Advantages add positive value to a baseline estimate of the net impact of socioeconomic effects from Type II MPA implementation, while costs/disadvantages affect the baseline estimate negatively. It should be noted that these concepts are very hard to quantify and should be viewed as positive or negative effects with varying and unknown degrees of influence on an overall prediction of net socioeconomic benefits or losses associated with a particular MPA alternative. With this in mind, the panel was asked to decide if each Round One effect would have a positive, negative, or neutral influence on a baseline estimate. As evidenced by the diversity of the panel, at times opinions varied widely regarding net directional impacts even when responses centered on the relatively small Amendment 14 Type II MPAs.

Benefit-Cost Valuation of Type II MPAs

From a socioeconomic as well as a biological perspective, a network of Type II MPAs can be evaluated with a traditional benefit-cost framework in which the potential benefits of protection are compared to the potential costs when evaluated over the immediate-, medium-, and long-run. The preferred regulatory options from a socioeconomic perspective would be integrated sites that provide the greatest benefit for the least cost, or minimize the cost of achieving a given benefit. The following sections describe specific types of benefits and costs (advantages and disadvantages) relevant to the implementation of Type II MPAs for deepwater species in the SASG fishery. Socioeconomic effects may arise due to the displacement of recreational, for-hire, and commercial fishermen, impacts on surrounding communities, and biological changes over time. Long-term yields could increase due to a buildup in harvestable biomass resulting in positive socioeconomic impacts directly related to biological productivity. For example, spawning levels in the MPAs and subsequent recruitment of young fish to open areas could increase; adult fish could spillover the boundaries of the MPA into nearby open fishing grounds; and average weight and value of fish landed could increase. Social issues associated with the distribution of potential benefits and costs among fishermen, dependent communities, and other stakeholders may be present as well. Lastly, administrative benefits and costs may be realized.

Displacement effects are incurred by recreational, for-hire, and commercial vessels that normally fish in the newly protected areas.[9] Direct displacement costs to fishermen who are unable to fish in the MPA include a decrease in catch levels, an increase in trip-level costs associated with searching for new fishing grounds, an increase in costs associated with learning new types of fishing, congestion, increased effort levels and user conflicts on new fishing grounds, and decreased personal safety. Displacement effects lower the predicted value of the net socioeconomic impact from implementation of a Type II MPA network. However, fishermen may be able to mitigate these costs by redirecting their fishing effort to open areas and possibly targeting different species. Over time, if spawning stock biomass increases and fish become heavier and more abundant in open areas, then fishing effort by new and existing boats will increase in the open areas as fishermen seek to maximize profits or recreational enjoyment. Although displaced fishermen may avoid or minimize displacement costs as a result of these opportunities, the addition of new fishing effort to open areas could cause significant congestion effects and have a negative influence on the status of newly targeted species resulting in future negative socioeconomic effects.

Fishermen who currently fish in the proposed protected areas typically bear significant short-term costs associated with implementation. Further, there is no guarantee that displaced individuals will eventually be compensated by realizing future benefits from stock recovery or enhanced recruitment rates. In other words, short-term displacement costs would be incurred by dislocated vessels, but the long-term benefits of increased biological productivity as a result of the MPA would be shared by all existing vessels and new entrants to the fishery. The major types of displacement costs are described below.

Short-Term Catch Levels.--In the short-run, total catch by displaced vessels may be reduced due to implementation of Type II MPAs. The magnitude of this displacement depends on the existing condition of the fishery and the effort response by the affected

[9] The following descriptions of socioeconomic effects similarly apply to recreational, for-hire, and commercial vessels; thus, the terms "vessels" or "fishermen" will subsequently be used. The major difference (from a socioeconomic perspective) between recreational and commercial fishermen is that recreational fishermen are assumed to maximize their recreational enjoyment while commercial vessels maximize their profits. For-hire operations have characteristics of both as owners seek to maximize profits while their customers seek to maximize their enjoyment from purchasing the product (i.e., trip).

vessels. Subsequent catch levels and their concomitant socioeconomic impact depend on a tradeoff between protection within the MPA and fishing density outside. Assuming prior to reserve creation that fishing effort is distributed uniformly across space, the greatest detrimental short-term impacts on fishers moving from closed to open areas in terms of declining catch-per-unit-effort (CPUE) and total landings occur when a fishery is fully-exploited or overfishing exists while fishing density increases in the open areas (Bohnsack 2000).[10] Possible short-run responses to the MPA regulation include changes in the variable cost structure of commercial operations, gear modifications, and location choices involving alternative fishing grounds as well as home ports. Decreased short-run yields may be mitigated to the extent that fishermen find alternative forms of fishing or alternative fishing locations. In the long-run, harvestable biomass growth due to enhanced recruitment and spillover from the closed areas could increase future catches or reduce the annual variability of harvests mitigating some of the short-run negative consequences.

Many of the panelists felt that decreases in short-run catch levels due to implementation of the Type II MPAs in Amendment 14 would generally be minimal due to the small size of the MPAs and minimal fishing effort currently seen on some sites. Also, many felt that mitigation would be fairly easy since similar fishing areas existed close by, allowing displaced vessels to maintain catch levels. Decreased catch levels of deepwater species could be offset by redirecting fishing effort towards alternative species in nearby fishing grounds. In general, alternatives that encroached into shallower waters of the mid-continental shelf regions were viewed to have a higher negative impact on fishermen. Decreasing catch levels of additional snapper grouper species such as shallow water groupers and vermilion snapper in mid-shelf areas would affect a larger number of operations in contrast to alternatives that encompass deepwaters only. Lastly, decreases in deepwater catches due to Amendment 14 may only be marginal if deepwater snapper grouper trips are eliminated due to reductions in the commercial quota as well as trip and bag limits for snowy grouper and golden tilefish enacted by Amendment 13C to the Snapper Grouper FMP.

[10] See Smith (2004) for an interesting discussion about the implications of spatially heterogeneous fishing effort, long-term fishery yields, and MPAs.

Trip-Level/Search/Other Costs.—In theory, perhaps the most significant portion of displacement costs comes from the effect the closure has on fishing behavior. Displaced operators must choose new fishing locations, maybe target new species, possibly learn new types of fishing, or ultimately decide not to fish. These new trip-level decisions have a direct impact on the realization of profits and enjoyment as well as time-related opportunity costs. In particular, fuel usage and expenditures are likely to change. The immediate search for alternative fishing grounds likely results in additional fuel expenditures and lost opportunities to fish. If vessels must travel to more distant fishing grounds, then additional fuel is needed to go around the closed areas to avoid being caught with regulated species. Conversely, if the new fishing grounds are closer to shore or significant replenishment effects are realized on nearby fishing grounds, vessels will probably use the same amount of fuel or less. If displaced fishermen try to learn new types of fishing, additional costs are incurred as they purchase new gear or modify existing gear. Further, they will lack experience with the new gear, and it will take time for them to become proficient and improve profits or recreational satisfaction.[11]

In practice, many of the panelists felt that increases in trip-level and search costs due to implementation of the MPAs in Amendment 14 would generally be minimal due to the small size of the MPAs and existing knowledge of nearby fishing grounds. South Atlantic fishermen typically have knowledge of a very broad area to fish although significant recreational effort may bunch up on known sites. Changes in fishing patterns would probably be similar in scale to historical switching caused by the natural variability in catch rates. It was noted since exploration is a defining characteristic of deepwater trips in the south Atlantic, negative displacement effects are more likely to be realized when fishermen target new species or change fishing practices rather than from alternative location choices. Many felt that mitigation of these types of displacement costs would be fairly easy as most MPA sites were small, and well-known productive fishing areas existed close by, thus minimizing search costs and expenditures on new technology. Furthermore, south Atlantic fishermen routinely target different species

[11] This could be significant since the Amendment 14 sites are Type II MPAs, which allow trolling for pelagic species within the closed areas.

throughout the year as catch rates and market prices fluctuate. One panelist noted that an initial course change of less than six degrees would be necessary to reach a spot five miles outside the MPA adding approximately one-quarter mile of transit to trips that typically total 50 miles or more. Alternatives that covered only the deepwater grounds were generally viewed to have the lowest negative impact on fishermen since fishing distance would be closer or no different.

Crowding/Congestion Effects.--Implementation of a Type II MPA results in the spatial displacement of fishermen who normally fish in the newly protected areas. If affected vessels do not exit the fishery, they must relocate to open areas which could be experiencing suboptimal harvest rates already. The result of this change in the location of fishing effort potentially could be very significant biologically and economically. Additional fishing pressure might further stress already overfished species. Increased fishing density in open areas may result in congestion effects as the displaced effort joins the traditional effort in the same size of open space. One consequence would be lower CPUE rates for displaced and existing boats as they compete for the limited biomass in the open fishing areas. This could create incentives for additional capital expenditures, such as fish finding equipment. Additionally, user conflicts may develop, and gear may be lost due to entanglement. In the long-run increased fishing yields would help to mitigate these costs.

In general the panel viewed negative impacts from congestion effects to be a significant possibility. First, there were a number of comments suggesting a linkage to recent increases in recreational effort. The panel suggested that the closer to shore that displaced commercial vessels had to move, the more conflict would result with recreational vessels. Also, there was concern of crowding effects in the pelagic fisheries. Another viewpoint suggested that displaced vessels would create additional depletion of mid-shelf or inshore stocks not covered by Amendment 14 if overfishing in these areas is already a problem. Some panel members felt there would be negative impacts from congestion but that they would be temporary and minimal, especially as “survival of the fittest” takes effect.

Personal Safety.--MPA regulations could cause fishermen to incur extra risk as they seek new and unfamiliar fishing grounds or employ unfamiliar fishing techniques. Increases to total transit times could result in increased safety risk to captain and crew especially during times of inclement weather. On the other hand, closure of deepwater areas may force vessels inshore which could decrease personal risk.

The panel overwhelmingly thought that no impact would result from changes in safety to the captain and crew. Most felt that the MPAs in Amendment 14 are too small and/or fishermen already had very good knowledge of alternative fishing sites. Safety risks associated with alternative fishing areas on the outer continental shelf are pretty similar. Others felt that fishermen already incur a considerable amount of risk, and that would not change significantly if Amendment 14 were implemented.

Regional Economic Impacts.-- Not all displacement costs are incurred by fishermen. An indirect cost due to implementation of Type II MPAs is the impact on the surrounding communities due to a reduction in income for displaced fishing operations and related businesses, such as fish houses, tackle and bait shops. If displaced stakeholders cannot mitigate all losses incurred due to the MPA, their communities likewise will be negatively affected as less income flows through different sectors of the local and regional economies. Socioeconomic impacts are absorbed at the community level and extended to the regional level. Fishing-related income originally spent in the community cycles throughout the economy producing a multiplier effect resulting in total expenditures that exceed the original income. The amount of fishing income lost and the magnitude of the multiplier effect determine the extent of the negative influence on the predicted value of socioeconomic impacts from implementation of a Type II MPA network. Of course, alternative activities that mitigate this income loss reduce the negative socioeconomic consequences imparted on local and regional economies.

Most panelists felt that the short-term impact on local and regional economies from income loss would be negative but minimal due to the small size of the proposed Amendment 14 MPAs and the existence of viable fishing alternatives. Panelists felt that local and regional impacts would be much more pronounced due to increases in the cost of fuel, increased regulations (especially forthcoming consequences from enactment of

Amendment 13C in 2006), and development in coastal communities rather than due to the MPAs proposed in Amendment 14. Locally, very few south Atlantic communities are substantially dependent on fishing income; thus, lost fishing income would have a less pronounced effect than in the past. Regionally, negative socioeconomic impacts due to loss of fishing income are becoming marginal relative to industries such as tourism, service, and construction.

Socioeconomic benefits are realized if biological productivity throughout the fishery increases due to implementation of Type II MPAs. Positive influences on the predicted value of socioeconomic impacts from implementation of a Type II MPA network are linked to stock replenishment, increased yields, and reduced variability of catches and revenues.

Replenishment/Stock Effects.-- Benefits are realized over the long-run if Type II MPAs increase the biomass of deepwater species, and stocks become healthier. The MPA directly influences biological productivity by reducing directed fishing mortality and bycatch, protecting habitat from gear damages, and increasing spillover and total reproductive output. Replenishment effects in open areas are direct results of increased spawning output from fish in the MPA and spillover of adult fish. The amount of socioeconomic benefit that will eventually be derived due to replenishment or stock effects from the MPA network depends on a myriad of biological and economic factors specific to the species in question and the vessels that target them, as well as the size of the MPA sites. Deepwater groupers and tilefish have a low resilience to overfishing due to life-history characteristics such as slow growth, late maturity, high minimum population doubling times, and a mostly sedentary lifestyle. However, these same characteristics make these species good candidates for repopulation through Type II MPAs since the relatively site-specific adult snowy grouper and tilefish would be protected from bottom fishing effort.

In general the panel felt that this benefit would be insignificant in the short-term but probably positive as recruitment and spillover from the MPAs occur in the longer-term. Biomass increases due to spillover or gains in reproductive output would likely occur several years after the closure due to the life history characteristics of the deepwater species. However, there were a significant number of responses that suggested that these benefits would be immeasurable due to the small amount of protected habitat in each proposed MPA and a lack of existing baseline data needed to fully assess this effect.

Catch Levels in the Future.-- Long-term yields could increase after implementation of Type II MPAs due to a buildup in harvestable biomass resulting in socioeconomic benefits directly related to biological factors such as stock abundance, healthier fish stocks, and spillover and dispersion effects (Sanchirico 2000). Over the long-run, aggregate catch by displaced and unaffected vessels alike may increase due to biological productivity. This result depends on ecological structure, oceanographic patterns, biological characteristics of the stock, and the scale and location of the Type II MPA network as well as changes in fishing operations in response to the area closure (Sanchirico 2000). Spillover into open areas is dependent on fish migrations and habitat suitability. The level of dispersion of a protected stock throughout the adjacent open fishing grounds is a determinant of the level of future harvests. Socioeconomic benefits from increased long-term yields are more likely to be realized from species that migrate to open areas of suitable habitat, although biological spillover effects may be realized through larval transport.

Changes in fishing behavior have a temporal and spatial context and depend on both economic and biological conditions. In the short-run, redirection of fishing effort or overcapitalization may imperil fish stocks in surrounding areas. In the long-run, vessels could leave the fishery if stock benefits do not equal short-run displacement and opportunity costs. Alternatively, new vessels could enter if long-term increases in aggregate yields are significant. The extent that catch levels increase over time adds worth to the predicted value of socioeconomic impacts from implementation of a Type II MPA network; however, these potential future benefits may not be realized exclusively by the fishermen immediately displaced by the MPA.

The panel generally felt that any positive impact of increased future catch levels due to the implementation of Type II MPAs would be minimal due to the small size of the proposed MPAs and the sessile nature of deepwater species. There was some consensus that in the short-run negative consequences could be realized since displaced fishermen may redirect effort towards unprotected species in new areas. Also, some noted that if commercial and recreational effort was not capped, any benefit would be lost. Linking future catch levels to the implementation of the Amendment 14 MPAs would be difficult due to a lack of accurate baseline data describing aggregate biomass levels within and outside the sites.

Landings (or Yield) Variation.--Increased protection of the spawning stock biomass through implementation of Type II MPAs may lead to more natural population structures with older and larger individuals and greater genetic diversity. As a result, there could be increased harvestable biomass, increased dispersal, and greater recruitment to the remaining open areas in the fishery. These attributes likely would lead to a reduction in the annual variation in the biomass of deepwater stocks and interconnected harvests and revenues. If spillover occurs, then the abundance and harvest levels in surrounding areas will become less variable. Fishermen who are financially risk averse will prefer more stable harvests, whereas fishermen who are financial risk takers will not.

The general consensus of the panel was that a reduction in landings variability would be a positive effect; however, the impact is unlikely to be realized from implementation of the Amendment 14 sites due to their small size. Also, the MPAs do not uniformly protect all life stages throughout the network. Panelists suggested that many factors lead to variation in landings (e.g., market and oceanographic conditions, weather), and the marginal effect due to relatively small MPAs would be insignificant in light of these other sources of variation.

Option and Existence Values.--Benefits arise from maintaining the option to use the ecological resources within the protected areas in the future. In essence, society is paying a risk premium, by closing the area, to keep the option of future use available and hedge the uncertainty associated with overfishing the targeted species. Additionally, the knowledge that threatened species will continue to exist in the future, even if never used, can generate value, known as existence value. Option and existence values constitute positive additions to the predicted value of socioeconomic impacts from implementation of a Type II MPA network.

The panel's viewpoints were fairly divergent regarding the impact of these effects. A significant number felt that a positive impact would be realized by protecting deepwater species. Some thought Type II MPAs can secure nonuse benefits by serving as a hedge against future stock collapses. Others felt that the status of deepwater species was strong enough such that only marginal benefits in option or existence values would be realized. Alternatively, redirected effort toward mid-shelf and inshore fishing areas reduces option and existence values associated with newly targeted shallow water grouper and mid-shelf species.

Quality Increases in MPAs.--If regulation works from a biological perspective, then fish in the MPA over time become more numerous and heavier, on average, due to an increase in the number of older fish in the population. Also, protection could increase biodiversity, genetic diversity, community structure, and general habitat conditions in the short- and long-term. These benefits could contribute to an overall healthier ecosystem which eventually supports sustained recreational and commercial fishing activities outside the MPA sites. Thus, improvements in environmental quality constitute a positive addition to the predicted value of socioeconomic impacts from implementation of a Type II MPA network.

On the other hand, decreases in the quality of alternative fishing grounds and reduced option and existence values resulting from increased fishing pressure redirected toward alternative fish stocks result in costs. Effort controls coupled with area closures may mitigate some of these unintended consequences. To the extent that these costs are realized a negative influence must be accounted for in the predicted valuation of socioeconomic impacts from implementation of a Type II MPA network.

The panel generally felt that a positive but minimal impact in the quality of the habitat protected by the MPAs would result. They responded that with adequate enforcement some significant increases in individual and population size would result but would be difficult to measure. In some cases, it is unclear to what extent the Amendment 14 alternatives encompass hard bottom habitats and the quality of the habitat that is included in the MPAs.

Management Benefits and Costs.--Fishery managers use MPAs to reduce risk associated with uncertain stock assessments and create undisturbed areas for experimental biological research. This benefit is particularly important as managers have been urged to use the Precautionary Principle when dealing with fish stocks that are overfished or for which overfishing is occurring. Management costs include the expense of maintaining and enforcing MPAs once implemented as well as public outreach and education. The overall objective of management is to achieve conservation and fishery management goals.

In general the panel felt management benefits would be minimal. Also, enforcement of the MPA boundaries was considered crucial if protection is to produce any benefits. Another viewpoint suggested that management benefits would only be realized if MPAs were used in conjunction with traditional management methods. The deepwater Type II MPAs specified by Amendment 14 allow managers to invoke the Precautionary Principle by extending added protection to relatively rare deepwater species, such as speckled hind and Warsaw groupers, that are caught as secondary species with snowy groupers and sometimes discarded to comply with existing regulations that limit their harvest. These species experience high discard mortality due to the depths at which they are caught, and it is difficult to protect them when fishing continues normally for other more abundant species. Additionally, some alternatives offer protection to mid-shelf species resulting in extra administrative benefits. However, some panelists countered that protection accorded to species other than those listed in the deepwater fishery management units was beyond the scope of Amendment 14. There was diversity among the panel regarding costs to management. Panelists argued that costs associated with education, compliance, enforcement, scientific monitoring, and administration would increase. However, others argued that management costs should go down if no bottom fishing was allowed, or vessel monitoring systems were implemented.

Individual panelists also identified other effects and influences including: community and social impacts, ecosystem protection, non-consumptive opportunities, improved knowledge of marine systems, and bycatch mortality.

Community and Social Impacts.—There was a great amount of diversity among panelists regarding the impact on communities resulting from implementation of Type II MPAs.

Some panelists felt that a negative influence on the community would be realized, even if minimal due to the size of the MPAs in Amendment 14 and alternative fishing opportunities. Negative effects that could be realized include job loss, psychological impacts including depression and alcoholism, and detrimental effects on packing houses and their employees. On the other hand, some panelists felt that positive community effects would be realized as long-term increased reliability in fishing stocks were realized. Non-fishing communities could experience positive social benefits through the realization of option and existence values.

Ecosystem Protection.—In general, the panel felt that there would be benefits resulting from ecosystem protection because even minimal reductions in fishing pressure would help to restore more natural conditions to local ecosystems. This may be due to decreases in habitat damage due to gear impacts, as well as a more natural balance of size classes, species diversity, predators, and prey.

Non-Consumptive Opportunities.—One panelist mentioned that divers may benefit from the creation of Type II MPAs as they would like to watch or take pictures of fish. Due to the location, size, and depths of the MPAs in Amendment 14, it is unlikely that significant benefits would arise due to non-consumptive activities of this type.

Improved Knowledge of Marine Systems.—Two panelists suggested the possibility of experimental benefits from the MPAs in Amendment 14 as they could provide an opportunity for long-term monitoring and education. Also, the point was raised that heavily fished areas may take a long time to rebound enough to allow the study of an "unfished population."

Bycatch Mortality.—Benefits are realized as bycatch mortality is reduced within the Type II MPA.

Summary—Although the diversity of the experts created instances of divergence regarding the direction (positive, negative, or neutral) of individual effects during Round One brainstorming, the panel generally displayed strong majority support on the direction and level of impacts resulting from the implementation of Type II MPAs. Negative impacts would be realized mainly in the form of displacement effects on fishermen and the communities that depend on them, with the possibility of management incurring some costs. However, due to the small size of the Amendment 14 MPAs and the availability of alternative fishing opportunities for displaced fishermen, these impacts were likely to be minimal and observed only in the short-term. Benefits were thought to be possible due to increases in longer-term catch levels, quality increases in the MPA and ecosystem, option and existence values, and management benefits. These also were deemed to be minimal due to the small size of the Amendment 14 MPAs.

In conclusion, Round One generated comments about effects that could result due to the implementation of Type II MPAs similar to those proposed in Amendment 14. Panelists also commented on the likely impacts that would accompany these effects. In some cases these views were diverse. For the most part the panel believed that the impacts from Amendment 14 would be minimal due to the small size of the proposed MPAs. Additional displacement costs were associated with the alternatives that encroach into the mid-shelf regions. Lastly, an important insight came out of this round. Any impacts would have to be analyzed over different time periods: immediately (within one year); medium-term (from one to five years); and, long-term (greater than five years). This result was incorporated in the structure of the next two rounds.

ITERATIVE DELPHI: ROUND TWO RESULTS

Round Two was more analogous to a traditional Delphi approach. The primary objective of Round Two was to group and rank the most important of the effects produced by the Round One brainstorming session. To do so, panelists were asked to group the individual effects identified in Round One on the basis of common characteristics. The four most important of these groups were to be used in Round Three to accomplish the overall objective of quantifying the economic and social consequences among alternatives for each proposed site in Amendment 14. A time dimension was introduced to distinguish the immediate (less than one year) effects of implementing a

Type II MPA from effects that would arise in the medium-term (one to five years) and long-term (over five years).[12] Thus, groups of effects were ranked based on their expected overall impacts throughout various time periods after implementation of Type II MPAs in general.[13]

Three iterations of this round were completed to give panelists an opportunity to view others' rankings and comments before submitting (or resubmitting) their own rankings. Points were assigned based on ranking. The top ranked group of effects was assigned five points. The second ranked group of effects was assigned four points. The third ranked grouping was assigned three points. The fourth ranked grouping was assigned two points, and the fifth ranked grouping was assigned one point. Due to time constraints, only the points assigned to the rankings of the four original groupings submitted by the moderators were totaled over all respondents for each time period. The relative importance of each group was reflected by its weighted score, which was computed by dividing total points for that group by the highest point total attributed to any one grouping in each time period. The groupings and their relative weights then transferred to Round Three and were used to calculate weighted impact scores. These weighted scores were employed to compare the alternatives associated with the Amendment 14 MPA sites on the basis of overall socioeconomic impacts within each time period.

Table 2 shows the classification of the Round One effects, and the common characteristics that each grouping shares. Administrative effects deal with the management and administration of Type II MPAs. Effects on fishermen in the commercial, for-hire, and recreational sectors include impacts on catch levels, changes in trip-level costs, and congestion issues. Community and social effects can impact at the local or regional level while bioeconomic and non-consumptive influences are the major components of the ancillary (ecosystem) effects grouping.

[12] The length of the time frames was defined by the moderators and was not a product of panel consensus.
[13] The moderation team offered four initial groupings to the panel at the beginning of Round Two: Administrative; Commercial, For-Hire, and Recreational; Community and Social Effects; and, Ancillary (Ecosystem) Effects. For the most part the panel ranked only these groupings; however, three panelists offered alternative groupings. Due to time constraints these panelists were asked to resubmit their rankings based only on the initial four groupings. Their contributions are noted later in this section.

Three panelists offered alternative group headings to those proposed by the moderators at the beginning of Round Two. Panelists suggested other groupings that incorporated a spatial dimension; separated management, economic, social, and biological effects; identified stock assessment benefits; and, separated the commercial sector from the for-hire and recreational interests. These suggestions were well-founded and presented to the entire panel for discussion. However, given our limited time, we were not able to generate a legitimate discussion among enough panel members to warrant changes to the original four groupings offered by the moderation team. A traditional Delphi experiment given sufficient time would try to form a consensus among the panel regarding the scope of these groupings through iterative communications and summarized results.

The final rankings and weights of the four groupings by nine panelists are presented in Table 3. As mentioned in the methods section above, groupings were ranked in importance on a one to five scale and were assigned points that correspond to the ordered nature of the ranking system. Relative weights were calculated by dividing each group's total points in a time period by the highest number of total points for any grouping in that same time period. Therefore, the group with the highest number of total points received a weight of 1.00, and all other groups received weights less than 1.00. The weights were interpreted as the relative importance that the panel attributed to each grouping of effects when determining the socioeconomic impacts of the implementation of Type II MPAs. The final rankings and weights were derived through repetitive feedback of statistical summaries of updated rankings to the panel in three iterations during Round Two.

Table 2.-- Groupings of Effects Associated with the Implementation of Type II MPAs

Groupings of Effects	Administrative	Commercial, For-Hire, and Recreational	Community and Social Effects	Ancillary (Ecosystem) Effects
Common Charac-teristics of the Group	**Management and Administration of MPAS**	**Influence of MPAs on Fishermen Fishing Inside or Outside MPA**	**Community or Regional Influences**	**Influences Associated with Future Use or Status of the Resource**
	Conservation and Fishery Management Goals	Catch Levels and Landings Variation	Local Economic and Social Effects	Ecosystem and Habitat Effects
	Enforcement and Monitoring	Trip-Level Search and Other Costs	Regional Economic and Social Effects	Option and Existence Values
	Education and Awareness	Crowding and Congestion	Associated Employment (e.g. fish houses, dealers, bait and tackle shops)	Bycatch Mortality
	Improved Stock Assessments	Personal Safety		Non-consumptive (non-use) Opportunities
	Insurance Against Stock Collapse	Commercial and For-Hire Profitability and Recreational Enjoyment		Replenishment, Abundance, and Other Stock Effects
	Improved Knowledge of Marine Systems and Effectiveness of MPAs	Replenishment, Abundance, and Other Stock Effects		Catch Levels and Landings Variation
	Ecosystem and Habitat Effects	Industry Employment		

Table 3.--Ranks and Relative Weights of Four Groupings of Effects Associated with the Implementation of Type II MPAs (N = 9)

Group Heading	Immediate		Medium-Run		Long-Run	
	Rank	Weight	Rank	Weight	Rank	Weight
Administrative	2	0.95	1	1.00	2	0.84
Commercial, For-Hire, and Recreational	1	1.00	2	0.89	3	0.81
Ancillary (Ecosystem) Effects	3	0.71	2	0.89	1	1.00
Community and Social Effects	4	0.60	4	0.64	4	0.59

Relative weights were important for the final semi-quantitative estimates of the socioeconomic consequences resulting from the implementation of the alternative sites for the MPAs proposed in Amendment 14. Weighting implies that some groups of effects should be more influential than others on the final determination of socioeconomic impacts. For instance, Table 3 suggests that within one year of implementing a Type II MPA community and social effects would be 60% as important as effects on the commercial, recreational, and for-hire sectors in determining the overall impact of the different proposed sites for each MPA. The effects ranked as most important in each time period had weights of 1.00.

Some interesting trends were depicted by Table 3. First, community and social effects were considered less important than all other groupings in all time periods when analyzing social and economic effects resulting from the implementation of Type II MPAs. The panel was mixed on whether these effects would be positive or negative in the case of the Amendment 14 alternatives. In the immediate-term, most panelists felt that some negative yet minimal effects would impact fish houses or core labor patterns, and negative attitudes toward the MPAs by the local fishing communities would surface due to initial dissatisfaction with the program. These negative impacts would dissipate over time as fishermen and fish houses adjust to the minimally sized closed areas, and communities become indifferent to the MPAs after the initial displacement effects are absorbed. Others thought that non-fishing communities would see immediate- and medium-term non-consumptive benefits related to the MPAs, while others suggested longer-term community benefits if spillover from the MPAs was realized. Enforcement was viewed as a key component as to whether future community benefits would be realized as poaching could erode local support for the conservation measures just as long-term benefits start to materialize. Finally, by avoiding stricter regulations in the future fishermen and their dependent communities would accrue medium- and long-term benefits.

Second, Table 3 shows that as time goes on the importance of effects on commercial, for-hire, and recreational fishermen becomes less of a factor in determining the difference in socioeconomic consequences among alternative sites for each MPA. Initially, some fishermen will have to avoid traditional fishing areas and incur displacement costs. As fishermen make adjustments to the new regulations and fish around the closed areas, the negative impacts dissipate over the medium- and long-terms. As discussed before, the negative impact of immediate displacement effects are likely to be minimal due to the small sizes of the proposed Amendment 14 MPAs and the existence of viable alternative grounds close by. However, concern was raised by the panel that the immediate-term impacts would be significantly higher for the alternatives that encompassed mid-shelf waters relative to the deepwater-only sites. Spillover and recruitment effects would create socioeconomic benefits for the fishing sectors related to stock enhancement (e.g., abundance, replenishment, condition) in the long-term by improving yield per unit of effort; however, these benefits were forecasted to be minimal. Again, enforcement was viewed as a key component as to whether long-term bioeconomic-related benefits would ever materialize.

Third, over time ancillary (ecosystem) effects become more important in assessing social and economic impacts resulting from the implementation of Type II MPAs. These effects were viewed as happening very slowly at first locally, and then accelerating in the medium- and long-terms regionally. The Amendment 14 MPAs are expected over time to produce biological benefits that are correlated with positive socioeconomic impacts. Panelists identified potential positive bioeconomic-related impacts from long-term biological stock benefits (e.g., resource and ecosystem replenishment, stock condition and abundance), future spillover effects, increased ecosystem quality, and option and existence values. Still, there was concern as to whether these benefits would be measurable due to the small sizes of the MPAs and lack of baseline estimates and monitoring before and after the closures. Short-term benefits would be realized from immediate protection provided to stocks, the ecosystem, and habitats as well as a reduction in bycatch mortality of juveniles and non-targeted, relatively rare deepwater species (e.g., speckled hind, Warsaw grouper). There was strong majority support on the panel viewing ancillary effects to be a net positive in the medium- and long-terms, and either neutral or positive in the immediate-term.

Lastly, administrative effects were viewed as relatively important throughout all time periods. The exclusionary nature of the Amendment 14 MPAs for reef fishermen suggested quick benefits to management as the goal of reducing fishing and bycatch mortality would be immediately achieved. Over time enforcement was viewed as a very important determinant of socioeconomic consequences especially if the quality and quantity of the resources in the MPA changed for the better. In fact, much of the panel identified enforcement as the crucial factor in determining the success of any of the alternative MPAs. Another important aspect may be the implementation of Vessel Monitoring System (VMS) devices which would be a significant financial burden to fishermen, but a reduction in the cost of enforcement to management. Other important administrative impacts included increased managerial flexibility relative to the use of traditional regulations, improved stock assessments, and the burden of educating stakeholders.

In conclusion, Round Two grouped the many effects identified in Round One into four aggregate groupings based on common characteristics associated with the implementation of Type II MPAs. Panelists were asked to rank these four groupings in their ability to distinguish the economic and social consequences associated with the different alternative MPAs proposed in Amendment 14 in the immediate-, medium-, and long-terms. Relative weights were then calculated for each grouping for each of these time periods. The four groupings and their relative weights were carried over to Round Three. Strong majority opinions on the panel included the importance of administrative impacts, especially enforcement, in all time periods, gradual importance of ancillary impacts over time with positive net benefits in later time periods, gradual decline of impacts to fishing sectors over time with negative displacement impacts in the immediate-term, and a relatively smaller influence from community effects when assessing the degree of net socioeconomic impacts. One criticism of the grouping process was that the group headings were too broad and contained too many variables to allow efficient rankings of the different alternatives. This point is well taken. However, due to the complexity of Round Three, the moderation team limited the amount of groupings to the original four. This limited the burden on respondents to a reasonable amount.

IMPACT ANALYSIS: ROUND THREE RESULTS

The primary objective of Round Three and the overall research was to differentiate the socioeconomic consequences among alternatives for each proposed site in Amendment 14. We proposed a weighted scoring system using the results from previous rounds to achieve this objective. In Delphi terminology, this is considered an impact analysis. Each grouping of effects identified in Round Two was evaluated for likely impacts in the form of benefits/advantages and costs/disadvantages relevant to each alternative site in the immediate-term (less than one year), medium-term (one to five years), and long-term (over five years) for each MPA in Amendment 14. Each grouping's weight, which represents the relative importance of that grouping in assessing the incidence of socioeconomic impacts after implementation of Type II MPAs, was derived in Round Two based on ordered rankings by the panel. The groupings were defined in Table 2.

In Round Three the panel was asked to forecast the magnitude of the net socioeconomic impact of each grouping produced in Round Two based on a scale of (-3, 3) for each alternative site in Amendment 14 (Table 1). Panelists submitted impact scores for each grouping of effects for each alternative site in the three different time periods. A score of zero represented a non-influential grouping when trying to analyze the social and economic consequences associated with the Amendment 14 alternatives. Another reason for a zero score might have been that the positive and negative impacts associated with different effects within a group canceled each other out. This was very possible since the groupings were necessarily broadly defined.

The responses by the panelists for each group of effects in each time period were combined by using a probabilistic consensus model (Romney *et al*. 1986). Although the consensus model was not originally intended for use in the Delphi approach, it lends itself well for assessing and modeling consensus, agreement, and patterned variation in expert judgments. In the Delphi application we utilize the model to reconstruct an "answer key" based on patterns of agreement among our expert panelists. The "answer key" represents forecasted socioeconomic impacts for groupings of effects in different time periods and is produced by the consensus model based on correlations among the original impact scores submitted by the panel and Bayesian statistical theory. The cultural consensus model is based on the premise that variation in knowledge among individuals can be attributed to cultural differentials, and allows us to test for differences in responses for subcultures of knowledge within the Delphi panel based on professional affiliation: biologists and non-biologists.

For each MPA impact analysis two tables are presented that summarize the results of the consensus model. The first table (denoted by "a") presents socioeconomic impact scores produced by the consensus model for each grouping of effects in each time period for each alternative. The second table (denoted by "b") summarizes the final weighted impact scores for each alternative in each time period.

We employ a basic methodology to compare the alternatives for each MPA. However, the methodology expands when more than two alternatives (other than No Action) are considered, such as in the Northern South Carolina and North Florida MPAs. First, we institute a specification test for the consensus model. The idea of culture as consensus is based on the assumption that agreement among informants is positively correlated with the likelihood that an individual's response is correct (Romney *et al*. 1986). Thus, the level of variation in impact scores should be examined to determine if systematic differences exist among subpopulations of the Delphi panel. If the panel responses agree with the consensus structure, the ratio of the first to second eigenvalues in a minimum residual factor analysis should be relatively large (Johnson and Griffith 1996). A large ratio (distributed as chi-squared) suggests that there was good agreement among panelists regarding the level of socioeconomic impacts resulting from the implementation of a particular Amendment 14 MPA alternative. This implies that no subcultures exist within the panel's overall knowledge pool regarding the socioeconomic consequences of implementation of Type II MPAs in the south Atlantic. In this case, cultural consensus theory suggests that the final weighted impact scores are likely to be more consistent estimators of net socioeconomic impacts than if agreement did not exist due to differential knowledge among subgroups of the panel.

After the specification test, we compared the final weighted impact scores in the "b" tables. Weighted socioeconomic impact scores (based on the consensus model) allowed direct comparison of competing alternatives for each MPA in each time period along with the No Action alternative. Weighted scores from each group of effects were added and standardized to produce an overall weighted impact score for each alternative during different time frames. The status quo (i.e., do not implement an MPA on this site) was assumed to have a score of zero.

Then, we reviewed the "a" tables to identify temporal trends in the socioeconomic impacts forecasted by the consensus model by groupings of effects. This analysis developed testable hypotheses about differences in impact levels among competing alternatives which were analyzed later by nonparametric testing.

After hypothesis development, we utilize a number of Wilcoxon Signed-Rank Tests to identify differences in socioeconomic impact levels among the different alternatives for each MPA. Signed-Rank Tests are nonparametric tests that analyze paired responses from continuous data. The Wilcoxon Signed-Rank Test produces a nonparametric statistic that can be used to test the hypothesis of whether paired samples are likely drawn from the same population distribution. The tests produce a corresponding exact p-value. Signed-Rank Tests were performed to detect any differences in the forecasted impacts produced by the consensus model among alternatives. This allowed direct comparison of competing alternatives for each MPA in each time period along with the No Action alternative. A small p-value suggests that the consensus impact scores for one alternative are significantly different from the other (i.e., net socioeconomic impacts are more beneficial or less costly for one alternative compared to the other).

The original (i.e., pre-consensus model forecasts) weighted impact scores from each panelist offered an opportunity to assess statistical differences in socioeconomic consequences for different alternatives in the same time period. Individual weighted impact scores for any two alternatives in a given time period for a proposed MPA may be viewed as paired observations for each panelist. In our research we compare the weighted impact scores submitted by each panelist among the two alternatives by instituting a Signed-Rank Test and computing an exact p-value for the test statistic. A small p-value suggests that the weighted panel scores for one alternative are significantly different from the other (i.e., net socioeconomic impacts are more beneficial or less costly for one alternative compared to the other in that time period).

The original impact scores (non-weighted, non-consensus) submitted by the panel represented another opportunity to test for differences in socioeconomic impacts across alternatives using Signed-Rank Tests. Individual impact scores were compared to analyze differences in socioeconomic impacts resulting from particular groupings of effects in certain time periods. These tests were usually performed based on the hypotheses that were developed by analyzing trends in the consensus-forecasted socioeconomic impacts from the "a" tables. Also, when more than two alternatives (other than No Action) were analyzed for a particular MPA, Wilcoxon Signed-Rank Tests were used to show the inferiority of one alternative to the others.

When the eigenvalue test statistic described above was relatively small and/or the difference in weighted scores among alternatives was insignificant based on a large p-value associated with the Signed-Rank Test, we tested for differential knowledge among subgroups of the panel. Specifically, we assumed that independent samples of weighted impact scores were randomly drawn from two subpopulations of the Delphi panel. This hypothesis of the existence of subcultures of knowledge was tested based on professional affiliation: biologists or non-biologists. We employed a Wilcoxon-Mann-Whitney nonparametric estimator to test differences between two independent samples from among Delphi subgroups and calculated the corresponding exact p-value. A small p-value implies that knowledge differentials do systematically exist within the Delphi panel regarding a particular alternative in a particular time period. Further examination of individual responses regarding the impacts associated with different groupings of effects in some cases revealed points of divergence among panelists based on professional affiliation.

The results from Round Three must be interpreted with caution. First, our sample sizes for each impact analysis were relatively small (either seven or eight respondents) and may not represent a true cross-section of knowledge regarding the Amendment 14 MPAs. Second, although we were able to calculate measures of statistical significance regarding the nonparametric tests, we perform many of them for this study. With so many tests, significant differences could be concluded even in the presence of a random draw, which could lead to an inflated probability of making an erroneous conclusion when we are rejecting the null hypothesis of no differences in socioeconomic impacts between alternatives. Also, it is important to realize that the panel reported impact scores over time, and in most cases it was not discernable whether they incorporated aspects of risk or other dynamically influenced attributes into their scoring system. Consequently, each score for each alternative in a particular time period should be viewed independently of their scores for the other time periods. **We cannot justify or advocate a process of comparing alternatives by adding impact scores over time periods.**

Finally, an important assumption should be discussed regarding comparison to the No Action alternative. In all paired comparisons we assume a neutral effect associated with the No Action alternative. Panelists were not asked to forecast benefits or costs for the status quo. Instead, they were asked to use the scoring system in Table 3 to forecast the *changes* that would occur if an MPA were created on a particular site. The caveat is that we do not know how sophisticated the panelists' forecasts were with regard to a changing status quo over time due to the impending implementation of Amendment 13C. This issue was too complex to incorporate into Round Three due to time constraints and respondent fatigue.

Snowy Wreck MPA

The predicted impact scores produced by the consensus model for the Snowy Wreck MPA are presented in Table 4a. These scores represent forecasts of the magnitude of socioeconomic impacts associated with the Snowy Wreck MPA using the original responses from eight panelists as inputs. Table 4b summarizes the corresponding weighted impact scores, including the No Action alternative.

Table 4a. Impact Scores (Consensus Model) for Snowy Wreck MPA Alternatives

SNOWY WRECK MPA (N=8)

	ADMINISTRATIVE			COMMERCIAL, FOR-HIRE, AND RECREATIONAL			ANCILLARY (ECOSYSTEM) EFFECTS			COMMUNITY AND SOCIAL EFFECTS		
	IMMEDIATE	MEDIUM-TERM	LONG-TERM	IMMEDIATE	MEDIUM-TERM	LONG-TERM	IMMEDIATE	MEDIUM-TERM	LONG-TERM	IMMEDIATE	MEDIUM-TERM	LONG-TERM
ALTERNATIVE 1	-1.08	-0.91	-0.78	-1.94	-1.03	-0.14	0.04	0.37	1.78	-1.51	-0.76	0.01
ALTERNATIVE 2	-1.11	-0.92	-0.81	-1.57	-0.87	-0.14	0.10	0.40	1.74	-1.40	-0.81	-0.04

Table 4b. Weighted Impact Scores (Consensus Model) for Snowy Wreck MPA Alternatives

SNOWY WRECK MPA (N=8)

	IMMEDIATE	MEDIUM-TERM	LONG-TERM
ALTERNATIVE 1	-1.18	-0.58	0.31
ALTERNATIVE 2	-1.04	-0.54	0.28
NO ACTION	0.00	0.00	0.00

First, we examine the results from the consensus model. The ratio of the two largest eigenvalues derived from a minimum residual factor analysis is 5.04 and 4.00 for Alternatives 1 and 2, respectively. This suggests that the original data from the panel are a good fit for the consensus model, which indicates agreement among panelists and lends confidence to the forecasted impact scores for both alternatives.

We cannot determine the highest ranking alternative from viewing the weighted impact scores in Table 4b, and a comparison of final weighted impact scores among alternatives is inconclusive. The No Action alternative scores highest in the immediate- and medium-terms while Alternative 1 scores highest in the long-term. Alternative 2 scores higher than Alternative 1 in both the immediate- and medium-terms. As fishing sectors and communities adjust to the closures over the long-run and administrative costs stabilize, moderate ecosystem effects begin to be realized causing both alternatives to be ranked higher than the No Action alternative more than five years after implementation. This conclusion concurs with the final time-dependent rankings and weights derived for the groupings of effects in Round Two (Table 3).

Comparison of Alternatives 1 and 2

Impact scores produced from the consensus model (Table 4a) may be analyzed to identify the various impacts associated with adoption of Alternatives 1 and 2. Adoption of either alternative results in minimal net administrative costs in all time periods. Less than moderate (Alternative 2) to moderate (Alternative 1) negative impacts are incurred by fishing sectors in the immediate-run while net benefits to fishermen and their communities approach the neutral level in the long-run. Communities also experience higher than minimal negative effects in the near-term under both alternatives. Moderate ecosystem benefits are forecasted after five years for both alternatives. When considering Alternative 1 relative to Alternative 2, the impact scores from the consensus model appear to be very similar in magnitude. The main question is whether adoption of Alternative 1 inflicts an additional burden to the fishing sector in the short-term while gaining nothing in net benefits relative to Alternative 2 over time.

We implement nonparametric tests on paired samples to determine whether statistical differences exist in the socioeconomic impacts between the two alternatives. First, a Wilcoxon Signed-Rank Test is performed to determine if the forecasted impact scores produced by the consensus model (Table 4a) are significantly different between alternatives. A paired observation exists for each grouping of effects in each time period ($n = 12$ time-dependent groupings of effects). A two-sided exact p-value of .51 is calculated suggesting that we cannot reject the hypothesis that the two samples come from the same population distribution. In other words, the test fails to provide evidence that the socioeconomic impacts forecasted by the consensus model are significantly different for either alternative.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 8 panelists). Two-sided exact p-values of .12, .50, and 1.00 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that the final weighted impact scores for the two alternatives are the same in the medium- and long-terms. The p-values of .50 and 1.00 suggest that in the medium- and long-terms the alternatives are virtually indistinguishable in the eyes of our relatively small expert panel. In fact, only one panelist recorded different weighted impact scores for the two alternatives in the long-run. However, the relatively small value of .12 is suggestive of a difference in the expected level of impacts immediately after implementation of the MPA.

Since the last Signed-Rank Test suggested potential differences in impact scores for the immediate-term, we reexamine our hypothesis regarding the relative socioeconomic impact on the fishing sector in the short-run. This time we apply a Signed-Rank Test to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if statistical differences exist between the impact scores reported for each alternative regarding impacts to the fishing sector in the immediate-term (n = 8 panelists). Expert testimony from Round One revealed that Alternative 1 encroaches into the mid-shelf region and would affect more fishing operations than Alternative 2. Thus, we performed a one-sided Signed-Rank Test producing an exact p-value of .12. We can reject the hypothesis of no differences in socioeconomic impacts on the fishing sector in the immediate-term and be 88% confident that significant additional negative consequences arise due to these effects when Alternative 1 is adopted over Alternative 2.[14] Additional Signed-Rank Tests did not find

[14] A Wilcoxon-Mann-Whitney Test produces two-tailed exact p-values of .08 and .12 when we test for group (biologists and non-biologists) differences within the panel regarding the impacts on the fishing sector in the immediate-term for Alternatives 1 and 2, respectively. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences realized by the fishing sector in the short-run may

significant differences for any other groups of effects in any time periods; thus, Alternative 2 is ranked higher than Alternative 1.

Comparison of Alternative 2 with No Action

Now, we implement nonparametric tests on paired samples to determine whether the socioeconomic impacts resulting from Alternative 2 are statistically different from the assumed neutral effects that would take place if the No Action alternative is adopted. First, a Wilcoxon Signed-Rank Test is performed to determine if the forecasted impact scores produced by the consensus model for Alternative 2 (Table 4a) are significantly different from the assumed neutral effect resulting from taking No Action. A paired observation exists for each grouping of effects in each time period (n = 12 time-dependent groupings of effects). A two-sided exact p-value of .10 is calculated when comparing Alternative 2 to the No Action alternative. The test is suggestive of a difference in the expected level of socioeconomic impacts forecasted by the consensus model for Alternative 2 from a neutral effect, but not conclusive.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 8 panelists). In this case, a weighted score of zero is assumed for each panelist for the No Action alternative. When comparing Alternative 2 and the No Action alternative two-sided exact p-values of .03, .30, and .17 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we can reject the hypothesis that the final weighted impact scores associated with Alternative 2 are the same as No Action in the immediate-term but not in the medium- or long-terms. In other words, the final weighted impact scores in Table 4b suggest that net costs in the near-term are minimal but statistically different from No Action after adoption of Alternative 2 while net benefits in the medium- and long-terms are indistinguishable from a neutral effect.

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exist, but the tests are not conclusive. Non-biologists generally forecasted greater negative impacts than did biologists for both alternatives in the near-term. The differences in impact scores between the alternatives arose from one biologist and two non-biologists forecasting larger negative impacts realized by the fishing sector for Alternative 1 relative to Alternative 2.

Finally, we investigate the impacts of individual groupings of effects in the short-run by looking at the original Round 3 responses submitted by the panel. We first apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if the impact scores reported for Alternative 2 regarding possible negative impacts in the short-run (n = 8 panelists) are significantly different from a neutral effect. When Alternative 2 is compared to the No Action alternative in the immediate-term, two-sided exact p-values of .22, .02, .88, and .03 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. These tests suggest short-term displacement costs related to adopting Alternative 2 would be incurred by fishermen and their communities. When Alternative 2 is compared to the No Action alternative in the long-term to identify sources of potential benefits, two-sided exact p-values of .41, .81, .03, and 1.0 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. These tests suggest long-term benefits related to adopting Alternative 2 would result from ecosystem impacts. There is no evidence that impacts due to other groupings of effects in any other time periods are statistically different from a neutral effect if Alternative 2 is implemented.

Summary

Our analysis suggests that additional displacement costs would be incurred by the fishing sector in the immediate-term if Alternative 1 is adopted rather than Alternative 2. The analysis did not find any other significant differences in expected socioeconomic impacts between these alternatives in any time periods; thus, there is no confidence that additional socioeconomic benefits would be realized by adopting Alternative 1 over Alternative 2. This result corroborated expert testimony from Round One that suggested Alternative 1 encroaches into the mid-shelf region and would affect more fishing operations than Alternative 2. Commercial activity in the outer continental shelf of Alternative 2 is relatively light (about six boats) while more than 12 additional commercial vessels and an unknown number of for-hire operators regularly fish for snappers and shallow water groupers in the mid-shelf region of Alternative 1. Expert testimony revealed that no significant recreational effort exists within the Snowy Wreck MPA alternatives.

When compared to the No Action alternative, long-term minimal-to-moderate ecosystem benefits were associated with Alternative 2. Furthermore, the immediate-term displacement effects associated with Alternative 2 were found to be significantly different from a neutral effect and forecasted to be in the moderate range.

Northern South Carolina MPA

The predicted impact scores produced by the consensus model for the Northern South Carolina MPA are presented in Table 5a. These scores represent forecasts of the magnitude of socioeconomic impacts associated with the Northern South Carolina MPA using the original responses from seven panelists as inputs. Table 5b summarizes the corresponding weighted impact scores, including the No Action alternative.

Table 5a. Impact Scores (Consensus Model) for Northern South Carolina MPA Alternatives

NORTHERN SOUTH CAROLINA MPA (N=7)

	Administrative			Commercial, For-Hire, and Recreational			Ancillary (Ecosystem) Effects			Community and Social Effects		
	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term
Alternative 1	-0.88	-0.44	-0.05	-1.57	-0.57	0.31	0.13	0.61	1.98	-1.23	-0.66	0.15
Alternative 2	-0.70	-0.27	0.20	-1.94	-0.94	0.10	0.36	0.70	2.02	-1.25	-0.69	0.22
Alternative 3	-0.99	-0.74	-0.57	-1.62	-0.69	-0.46	-0.07	0.57	1.77	-1.46	-0.82	-0.43

Table 5b. Weighted Impact Scores (Consensus Model) for Northern South Carolina MPA Alternatives

Northern South Carolina MPA (N=7)	Immediate	Medium-Term	Long-Term
Alternative 1	-0.94	-0.24	0.70
Alternative 2	-0.95	-0.27	0.74
Alternative 3	-1.07	-0.40	0.21
No Action	0.00	0.00	0.00

First, we examine the results from the consensus model. The ratio of the two largest eigenvalues derived from a minimum residual factor analysis is 6.75, 4.59, and 1.54 for Alternatives 1, 2, and 3, respectively. This suggests that the original data for Alternatives 1 and 2 from the panel are a good fit for the consensus model, which indicates agreement among panelists and lends confidence to the forecasted impact scores for both alternatives. The low value for Alternative 3 suggests a lack of fit to the consensus model, which indicates systematic differences in forecasting among the panelists.

We cannot determine the highest ranking alternative from viewing the weighted impact scores in Table 5b, and a comparison of final weighted impact scores among alternatives is inconclusive. The No Action alternative scores highest in the immediate- and medium-terms, while all three Alternatives score higher than the No Action alternative in the long-term. As fishing sectors and communities adjust to the closures over the long-run and administrative costs stabilize, moderate ecosystem effects begin to be realized causing all alternatives to be ranked higher than the No Action alternative more than five years after implementation. This conclusion concurs with the final time-dependent rankings and weights derived for the groupings of effects in Round Two (Table 3). Additionally, Alternative 1 scores higher than Alternative 2 in both the immediate- and medium-terms. Alternative 3 scores lower than both Alternatives 1 and 2 in all time periods.

Comparison of Alternative 3 with other alternatives

At this point we show that Alternative 3 is inferior to Alternatives 1 and 2. We employ the nonparametric Wilcoxon Signed-Rank Test to determine if the forecasted impact scores produced by the consensus model (Table 5a) are significantly different among alternatives. Comparing the alternatives two at a time results in a paired observation for each grouping of effects in each time period (n = 12 time-dependent groupings of effects). Signed-Rank Tests comparing Alternative 3 to Alternatives 1 and 2 produced two-sided exact p-values of .00 and .03, respectively. Comparison against the assumed neutral effects associated with adoption of the No Action alternative resulted in a two-sided exact p-value of .08. Thus, we can conclude that the net socioeconomic impacts resulting from implementation of Alternative 3 are significantly different than those that would be realized by the implementation of either Alternative 1 or 2. A comparison of the forecasted and weighted impact scores in Tables 5a and 5b implies that this difference results in less realized net socioeconomic benefits associated with Alternative 3. Additionally, the low eigenvalue ratio associated with the consensus model for Alternative 3 implies that forecasts concerning the socioeconomic impacts are not likely to be consistent estimates of the true impacts due to differences in cultural knowledge on the panel.[15] Since we provide evidence that Alternative 3 is inferior to the other alternatives from a socioeconomic impact perspective, the rest of the impact analysis for the Northern South Carolina MPA compares Alternatives 1 and 2 only.

Comparison of Alternatives 1 and 2

Next, we examine the forecasted socioeconomic impacts from the consensus model (Table 5a) for Alternatives 1 and 2. Net socioeconomic impacts related to administrative and ecosystem effects are forecasted to be higher in each time period for

[15] We implement Wilcoxon-Mann-Whitney Tests to nonparametrically test for group differences (biologists vs. non-biologists) in the weighted scores of the panelists for Alternative 3 in all time periods. The WMW Tests produces two-sided exact p-values of .06 and .11 for the immediate- and medium-term analyses. The magnitudes of the p-values suggest that subcultures in knowledge regarding the socioeconomic consequences associated with Alternative 3 in the short- and medium-run may exist but the tests are not conclusive. Another WMW Test produces a two-sided exact p-value of .63 when group differences are tested for the weighted panel responses in the long-run. Consequently, we conclude that the panel shares the same cultural knowledge base regarding the long-term socioeconomic impacts associated with Alternative 3.

Alternative 2 while net impacts associated with commercial, for-hire, and recreational fishing sectors are forecasted to be higher for Alternative 1 in all time periods. Net socioeconomic impacts related to community effects are higher in the short- and medium-terms for Alternative 1 but higher for Alternative 2 in the long-run. For both alternatives the consensus model forecasts immediate displacement costs in the moderate range to the fishing sector and realization of moderate ecosystem benefits in the long-run. The primary tradeoff appears to involve accepting relatively higher negative impacts over time for the fishing sector while realizing larger net administrative and ecosystem benefits if Alternative 2 is adopted rather than Alternative 1.

We implement nonparametric tests on paired samples to determine whether statistical differences exist in the socioeconomic impacts from the consensus model in Table 5a between the two alternatives. When Alternatives 1 and 2 are compared, a two-sided exact p-value of .72 is calculated suggesting that we cannot reject the hypothesis that the two samples come from the same population distribution. In other words, the test fails to provide evidence that the socioeconomic impacts forecasted by the consensus model are significantly different between Alternatives 1 and 2.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist ($n = 7$ panelists) in each time period. Two-sided exact p-values of .62, 1.00, and .75 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that the final weighted impact scores for Alternatives 1 and 2 are the same in any of the three time periods. The large p-values suggest that the alternatives are virtually indistinguishable in all time periods in the eyes of our relatively small expert panel.

Since we still do not have statistical evidence to rank Alternatives 1 and 2, we reexamine our hypothesis regarding the realization of net administrative and ecosystem benefits at the expense of increased negative consequences to the fishing sector if Alternative 2 is implemented instead of Alternative 1. We apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round

Three in an effort to determine if statistical differences exist between the impact scores reported for each alternative regarding impacts to the fishing sector in each time period (n = 7 panelists). Two-sided exact p-values of .25, .25, and 1.00 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that the socioeconomic impacts to the fishing sector are the same for the two alternatives in any three of the time periods.

We perform the same tests on the administrative and ecosystem impact scores. For administrative effects, two-sided exact p-values of 1.00, 1.00, and .50 are calculated for the immediate-, medium-, and long-terms, respectively. The high p-values suggest that in all time periods differences in socioeconomic impacts derived from administrative effects are virtually indistinguishable for Alternatives 1 and 2 in the eyes of our relatively small expert panel. For ecosystem effects, two-sided exact p-values of 1.00 are calculated for all three time periods. The high p-values suggest that in all time periods differences in socioeconomic impacts derived from ecosystem effects do not exist between Alternatives 1 and 2.[16]

Comparison of Alternatives 1 and 2 with No Action

Now, we implement nonparametric tests on paired samples to determine whether the socioeconomic impacts resulting from Alternatives 1 and 2 are statistically different from the assumed neutral effects that would take place if the No Action alternative is adopted. First, a Wilcoxon Signed-Rank Test is performed to determine if the forecasted impact scores produced by the consensus model for Alternatives 1 and 2 are significantly different from the assumed neutral effect resulting from taking No Action (Table 5a). A paired observation exists for each grouping of effects in each time period (n = 12 time-dependent groupings of effects). Two-sided exact p-values of .42 and .53 are calculated when comparing Alternatives 1 and 2 to the No Action alternative, respectively. The test

[16] We implement Wilcoxon-Mann-Whitney Tests to nonparametrically test for group differences (biologists vs. non-biologists) in the weighted scores of the panelists for Alternatives 1 and 2 in all time periods. The WMW Tests produce two-sided exact p-values of .13 for all time periods for Alternative 1, and two-sided exact p-values of .27, .13, and .13 for the immediate-, medium-, and long-term analyses, respectively for Alternative 2. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences associated with Alternatives 1 and 2 do not exist for any time periods.

fails to provide evidence that the socioeconomic impacts forecasted by the consensus model for Alternatives 1 and 2 are significantly different from a neutral effect.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 7 panelists). In this case, a weighted score of zero is assumed for each panelist for the No Action alternative. When comparing Alternative 1 and the No Action alternative two-sided exact p-values of .03, .70, and .08 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that the final weighted impact scores associated with Alternative 1 are the same as No Action in the medium-term, but the evidence suggests differences in impacts in the short-term and is suggestive of a difference in the long-term. Similarly, when comparing Alternative 2 with the No Action alternative, two-sided exact p-values of .03, .69, and .11 are produced for the immediate-, medium-, and long-terms, respectively. In other words, the final weighted impact scores in Table 5b suggest that net costs in the immediate-term are minimal but statistically different from No Action for both Alternatives 1 and 2. The forecasted impacts are not statistically different from the No Action alternative in the medium-term. Differences are suggestive but not conclusive for the long-term.

Finally, we investigate the impacts of individual groupings of effects over time by looking at the original Round 3 responses submitted by the panel. We first apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if the impact scores reported for Alternatives 1 and 2 regarding possible negative impacts in the short-run (n = 7 panelists) are significantly different from a neutral effect. When Alternative 1 is compared to the No Action alternative in the immediate-term, two-sided exact p-values of .11, .02, .56, and .03 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. When Alternative 2 is compared to the No Action alternative in the immediate-term, two-sided exact p-values of .28, .02, .75, and .03 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. These tests suggest immediate-term costs related to adopting Alternatives 1 or 2 results from fishing and community impacts. Comparison to No Action regarding long-term ecosystem impacts yields two-sided exact p-values of .03 and .03 for Alternatives 1 and 2, respectively. Hence, ecosystem impacts are statistically different from a neutral effect in the long-run for both alternatives.

Summary

Our analysis suggests that Alternative 3 is inferior to both Alternatives 1 and 2. A key informant for the Northern South Carolina MPA testified that no significant hardbottom has been observed within Alternative 3. Statistically we cannot find any significant difference in net socioeconomic impacts between Alternatives 1 and 2. Tradeoffs between administrative/ecosystem and fishing sector impacts due to the adoption of one alternative over the other are forecasted to be negligible. Both alternatives are forecasted to produce moderate ecosystem benefits in the long-run while inflicting minimal to moderate immediate-term displacement effects on fishermen and their communities. These costs and benefits are significantly different from a neutral effect.

Edisto MPA

The predicted impact scores produced by the consensus model for the Edisto MPA are presented in Table 6a. These scores represent forecasts of the magnitude of socioeconomic impacts associated with the Edisto MPA using the original responses from seven panelists as inputs. Table 6b summarizes the corresponding weighted impact scores, including the No Action alternative.

Table 6a. Impact Scores (Consensus Model) for Edisto MPA Alternatives

	Edisto MPA (N=7)											
	Administrative			Commercial, For-Hire, and Recreational			Ancillary (Ecosystem) Effects			Community and Social Effects		
	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term
Alternative 1	-1.02	-0.31	0.18	-1.70	-0.86	0.85	0.41	1.09	2.14	-1.11	-0.25	0.54
Alternative 2	-1.31	-0.84	-0.67	-1.38	-0.77	0.15	0.39	0.96	1.67	-1.19	-0.35	0.07

Table 6b. Weighted Impact Scores (Consensus Model) for Edisto MPA Alternatives

	Edisto MPA (N=7)		
	Immediate	Medium-Term	Long-Term
Alternative 1	-0.93	-0.08	1.02
Alternative 2	-0.94	-0.26	0.39
No Action	0.00	0.00	0.00

First, we examine the results from the consensus model. The ratio of the two largest eigenvalues derived from a minimum residual factor analysis is 6.94 and 6.77 for Alternatives 1 and 2, respectively. This suggests that the original data from the panel are a good fit for the consensus model, which indicates agreement among panelists and lends confidence to the forecasted impact scores for both alternatives.

We cannot determine the highest ranking alternative from viewing the weighted impact scores in Table 6b, and a comparison of final weighted impact scores among alternatives is inconclusive. The No Action alternative scores highest in the immediate- and medium-terms while Alternative 1 scores highest in the long-term. Alternative 2 scores lower than Alternative 1 in all time periods. As fishing sectors and communities adjust to the closures and greater net administrative benefits are realized over the long-run, moderate ecosystem effects begin to materialize causing both alternatives to be ranked higher than the No Action alternative more than five years after implementation. This conclusion concurs with the final time-dependent rankings and weights derived for the groupings of effects in Round Two (Table 3).

Comparison of Alternatives 1 and 2

Impact scores produced from the consensus model (Table 6a) may be analyzed to identify the various impacts associated with adoption of Alternatives 1 and 2. In the immediate-term negative impacts to fishing sectors are forecasted to be less than moderate for both alternatives. Local and regional communities should expect slightly smaller net socioeconomic impacts than the fishing sectors. Forecasts for Alternative 1 in the long-term suggest that some net benefits might occur for fishermen and their communities. Forecasts associated with Alternative 2 suggest that even in the long-run administrative impacts are minimally negative. Except in two cases (immediate- and medium-terms, Commercial, For-Hire, and Recreational Effects) Alternative 1 is forecasted to deliver either smaller losses or greater benefits compared to Alternative 2 for impacts related to all groupings of effects in all time periods (Table 6a). Socioeconomic impacts related to ecosystem effects are forecasted to be in the less than moderate (Alternative 2) to moderate (Alternative 1) range in the long-run. The main tradeoff is smaller immediate- and medium-term displacement costs for fishermen with Alternative 2 compared to smaller losses or greater benefits for all other effects in all time periods for Alternative 1. The additional net benefits from adoption of Alternative 1 seem to materialize mainly in the long-run.

We implement nonparametric tests on paired samples to determine whether statistical differences exist in the socioeconomic impacts between the two alternatives. First, a Wilcoxon Signed-Rank Test is performed to determine if the forecasted impact scores produced by the consensus model (Table 6a) are significantly different between alternatives. A paired observation exists for each grouping of effects in each time period ($n = 12$ time-dependent groupings of effects). A two-sided exact p-value of .02 is calculated suggesting that we can reject the hypothesis that the two samples come from the same population distribution. In other words, the test provides evidence that the socioeconomic impacts forecasted by the consensus model are significantly different for each alternative; however, at this point we have not statistically shown which alternative produces the higher net benefits (i.e., is ranked higher).

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 7 panelists). Two-sided exact p-values of .88, .88, and .12 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis in any time period that the final weighted impact scores for the two alternatives are the same. The relatively small value of .12 suggests that some difference in the expected level of impacts may exist five years after implementation of the MPA; however, the tests are not conclusive. Also, the p-values of .88 suggest that in the immediate- and medium-terms the alternatives are virtually indistinguishable in the eyes of our relatively small expert panel.

Since the last Signed-Rank Test suggested potential differences in impact scores for the long-term, we reexamine our hypothesis regarding the relative socioeconomic impact on the fishing sector in the short- and medium-terms and the realization of long-term net benefits. First, we apply Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if statistical differences exist between the impact scores reported for each alternative regarding impacts to the fishing sector in the immediate- and medium-terms (n = 7 panelists). Two Signed-Rank Tests produce two-sided exact p-values of .50 and 1.0 for the immediate- and medium-terms, respectively. The results suggest that no differences in socioeconomic impacts on the fishing sector exist between Alternatives 1 and 2 in the immediate- or medium-terms. We perform additional Signed-Rank Tests to determine if differences in socioeconomic impacts exist in the long-run between alternatives. Two-sided exact p-values of .12, .25, .12, and .25 are produced for administrative, fishing, ecosystem, and community long-term effects, respectively. We can reject the hypothesis of no differences in socioeconomic impacts due to administrative and ecosystem effects in the long-term and be 88% confident that significant additional positive consequences arise due to these effects when Alternative 1 is adopted over Alternative 2. Likewise, we can reject with some degree of confidence the hypothesis of no differences in socioeconomic impacts on fishermen and communities in the long-term and be 75%

confident that significant additional positive consequences arise due to these effects when Alternative 1 is adopted over Alternative 2.[17] In light of this information and since Alternative 1 produces a higher weighted impact score in every time period (Table 6b), we conclude Alternative 1 ranks higher than Alternative 2 from a socioeconomic impact perspective.

Comparison of Alternative 1 and No Action

Now, we implement nonparametric tests on paired samples to determine whether the socioeconomic impacts resulting from Alternative 1 are statistically different from the assumed neutral effects that would take place if the No Action alternative is adopted. First, a Wilcoxon Signed-Rank Test is performed to determine if the forecasted impact scores produced by the consensus model (Table 6a) for Alternative 1 are significantly different from the assumed neutral effect resulting from taking No Action. A paired observation exists for each grouping of effects in each time period (n = 12 time-dependent groupings of effects). A two-sided exact p-value of .91 is calculated when comparing Alternative 1 to the No Action alternative. The test fails to provide evidence that the socioeconomic impacts forecasted by the consensus model for Alternative 1 are significantly different from a neutral effect.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 7 panelists). In this case, a weighted score of zero is assumed for each panelist for the No Action alternative. When comparing Alternative 1 and the No Action alternative two-sided exact p-values of .06, .94, and .06 are calculated for the immediate-,

[17] A Wilcoxon-Mann-Whitney Test produces two-tailed exact p-values of .66 and .11 when we test for group (biologists and non-biologists) differences within the panel regarding the impacts on the fishing sector in the immediate-term for Alternatives 1 and 2, respectively. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences realized by the fishing sector in the short-run do not exist. Additional WMW Tests to test for cultural differences regarding long-term impacts produce two-sided exact p-values of .28, .06, .74, and .03 for administrative, fishing, ecosystem, and community long-term effects, respectively, for Alternative 1; and, .97, .08, .46, and .28 for administrative, fishing, ecosystem, and community long-term effects, respectively, for Alternative 2. The results suggest subcultures regarding knowledge about the long-term socioeconomic impacts might exist for impacts on the fishing sectors under both alternatives as well as community impacts associated with Alternative 1.

medium-, and long-terms, respectively. These tests suggest that we can reject with limited confidence the hypothesis that the final weighted impact scores associated with Alternative 1 are the same as No Action in the immediate- and long-terms but not in the medium-term. In other words, the final weighted impact scores in Table 6b suggest that net costs in the near-term are minimal but statistically different from No Action after adoption of Alternative 1 while net benefits in the long-term are minimal and statistically different from a neutral impact.

Next, we investigate the impacts of individual groupings of effects in the long-run by looking at the original Round 3 responses submitted by the panel. We first apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if the impact scores reported for Alternative 1 regarding possible positive impacts in the long-run ($n = 7$ panelists) are significantly different from a neutral effect. When Alternative 1 is compared to the No Action alternative in the long-term, two-sided exact p-values of 1.0, .31, .06, and .50 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. These tests suggest long-term benefits related to adopting Alternative 1 may result from ecosystem impacts. There is no evidence that long-term benefits due to other groupings of effects are statistically different from a neutral effect if Alternative 1 is implemented. When Alternative 1 is compared to the No Action alternative in the short-term to identify sources of immediate costs, two-sided exact p-values of .16, .03, .12, and .06 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. These tests suggest short-term displacement costs related to adopting Alternative 1 may result from impacts to fishermen and their communities. There is no evidence that short-term costs due to other groupings of effects are statistically different from a neutral effect if Alternative 1 is implemented.

Summary

Our analysis suggests that additional long-term benefits would be accrued if Alternative 1 is adopted rather than Alternative 2. The analysis did not find any other significant differences in expected socioeconomic impacts between the alternatives in any time periods. Thus, there is no confidence in additional displacement costs to the fishing sector by adopting Alternative 1 over Alternative 2. When compared to the No Action alternative, long-term minimal ecosystem benefits associated with Alternative 1 were found to be statistically different from a neutral effect. However, these benefits come with a price: immediate minimal displacement costs to fishermen and their communities.

Georgia MPA

The predicted impact scores produced by the consensus model for the Georgia MPA are presented in Table 7a. These scores represent forecasts of the magnitude of socioeconomic impacts associated with the Georgia MPA using the original responses from eight panelists as inputs. Table 7b summarizes the corresponding weighted impact scores, including the No Action alternative.

Table 7a. Impact Scores (Consensus Model) for Georgia MPA Alternatives

	Georgia MPA (N=8)											
	Administrative			Commercial, For-Hire, and Recreational			Ancillary (Ecosystem) Effects			Community and Social Effects		
	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term
Alternative 1	-0.65	-0.25	0.33	-1.40	-0.54	0.62	0.44	0.91	1.81	-1.10	-0.33	0.51
Alternative 2	-1.28	-1.13	-0.97	-1.47	-0.85	-0.43	0.58	1.03	1.52	-1.23	-0.59	0.02

Table 7b. Weighted Impact Scores (Consensus Model) for Georgia MPA Alternatives

	Georgia MPA (N=8)		
	Immediate	Medium-Term	Long-Term
Alternative 1	-0.73	-0.04	0.89
Alternative 2	-0.92	-0.39	0.11
No Action	0.00	0.00	0.00

First, we examine the results from the consensus model. The ratio of the two largest eigenvalues derived from a minimum residual factor analysis is 4.86 and 3.10 for Alternatives 1 and 2, respectively. This suggests that the original data from the panel are a good fit for the consensus model, which indicates agreement among panelists and lends confidence to the forecasted impact scores for both alternatives.

We cannot determine the highest ranking alternative from viewing the weighted impact scores in Table 7b, and a comparison of final weighted impact scores among alternatives is inconclusive. The No Action alternative scores highest in the immediate- and medium-terms, while both alternatives score higher than the No Action alternative in the long-term. Alternative 1 scores higher than Alternative 2 in all time periods. As fishing sectors and communities adjust to the closures over the long-run, greater than minimal-to-moderate ecosystem effects are realized causing both alternatives to be ranked higher than the No Action alternative more than five years after implementation. This conclusion concurs with the final time-dependent rankings and weights derived for the groupings of effects in Round Two (Table 3).

Comparison of Alternatives 1 and 2

Impact scores produced from the consensus model (Table 7a) may be analyzed to identify the various impacts associated with adoption of Alternatives 1 and 2. In the immediate-term negative impacts to fishing sectors are forecasted to be more than minimal for both alternatives. Local and regional communities should expect slightly smaller net socioeconomic impacts than the fishing sectors. Forecasts for Alternative 1 in the long-term suggest that some net benefits might occur for fishermen and their communities. Forecasts associated with Alternative 2 suggest that even in the long-run administrative impacts are minimally negative, impacts to fishing sectors are negative, and impacts on fishing communities are neutral. Except in two cases (immediate- and medium-terms, Ancillary Effects) Alternative 1 is forecasted to deliver either smaller losses or greater benefits than Alternative 2 for all groupings of effects in all time periods (Table 7a). Socioeconomic impacts related to ecosystem effects are forecasted to be in the minimal-to-moderate range in the long-run for both alternatives. When considering adoption of Alternative 2 to Alternative 1, the main tradeoff is greater ecosystem effects with Alternative 2 in the immediate- and medium-terms compared to smaller losses or greater gains for all other effects in all time periods for Alternative 1.

We implement nonparametric tests on paired samples to determine whether statistical differences exist in the socioeconomic impacts between the two alternatives. First, a Wilcoxon Signed-Rank Test is performed to determine if the forecasted impact scores produced by the consensus model (Table 7a) are significantly different between alternatives. A paired observation exists for each grouping of effects in each time period (n = 12 time-dependent groupings of effects). A two-sided exact p-value of .01 is calculated suggesting that we can reject the hypothesis that the two samples come from the same population distribution. In other words, the test provides evidence that the socioeconomic impacts forecasted by the consensus model are significantly different for each alternative. However, at this point we have not statistically shown which alternative produces the higher net benefits (i.e., is ranked higher).

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 8 panelists). Two-sided exact p-values of .92, .31, and .09 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that the final weighted impact scores for the two alternatives are the same in each time period. The relatively small value of .09 for the long-term analysis suggests that some difference in the expected level of impacts may exist five years after implementation of the MPA; however, the tests are not conclusive. Also, the p-value of .92 suggests that in the immediate-term the alternatives are virtually indistinguishable in the eyes of our relatively small expert panel.

Since the last Signed-Rank Test suggested potential differences in impact scores for the long-term, we reexamine our hypothesis regarding the realization of long-term net benefits in general and ecosystem benefits in the immediate- and medium-terms. First, we apply Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if statistical differences exist between the ecosystem impact scores reported for each alternative in the immediate- and medium-terms (n = 8 panelists). Two Signed-Rank Tests produce two-sided exact p-values of 1.0 for the immediate- and medium-terms. The results suggest that no differences in socioeconomic impacts on the fishing sector exist in the immediate- or medium-terms between alternatives. We perform additional Signed-Rank Tests to determine if differences in socioeconomic impacts exist in the long-run between alternatives. Two-sided exact p-values of .12, .12, .31, and .25 are produced for administrative, fishing, ecosystem, and community long-term effects, respectively. We can reject the hypothesis of no differences in socioeconomic impacts due to administrative and fishing sector effects in the long-term and be 88% confident that significant additional positive consequences arise due to these effects when Alternative 1 is adopted over Alternative 2. Likewise, we can reject with some degree of confidence the hypothesis of no differences in socioeconomic impacts on communities in the long-term and be 75% confident that significant additional positive consequences arise due to these effects when Alternative 1 is adopted over Alternative 2. In light of this information and since Alternative 1 produces a higher weighted impact score in every time period (Table 7b), we conclude from a socioeconomic perspective that Alternative 1 ranks higher than Alternative 2.[18]

Comparison of Alternative 1 and No Action

Now, we implement nonparametric tests on paired samples to determine whether the socioeconomic impacts resulting from Alternative 1 are statistically different from the assumed neutral effects that would take place if the No Action alternative is adopted. First, a Wilcoxon Signed-Rank Test is performed to determine if the forecasted impact scores produced by the consensus model (Table 7a) for Alternative 1 are significantly different from the assumed neutral effect resulting from taking No Action. A paired observation exists for each grouping of effects in each time period (n = 12 time-

[18] We implement Wilcoxon-Mann-Whitney Tests to nonparametrically test for group differences (biologists vs. non-biologists) in the weighted scores of the panelists for Alternatives 1 and 2 in all time periods. The WMW Tests produce two-sided exact p-values of .88, .20, and .06 for the immediate-, medium-, and long-term analyses, respectively for Alternative 1, and two-sided exact p-values of .03, .03, and .06 for the immediate-, medium-, and long-term analyses, respectively for Alternative 2. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences associated with Alternative 2 may exist for all time periods while subcultures may exist in the long-run only for Alternative 1. Non-biologists generally forecasted greater negative impacts than did biologists for both alternatives.

dependent groupings of effects). A two-sided exact p-value of .98 is calculated when comparing Alternative 1 to the No Action alternative. The test fails to provide evidence that the socioeconomic impacts forecasted by the consensus model for Alternative 1 are significantly different from a neutral effect.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 8 panelists). In this case, a weighted score of zero is assumed for each panelist for the No Action alternative. When comparing Alternative 1 and the No Action alternative two-sided exact p-values of .04, .46, and .05 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we can reject the hypothesis that the final weighted impact scores associated with Alternative 1 are the same as No Action in the immediate- and long-terms but not in the medium-term. In other words, the final weighted impact scores in Table 7b suggest that net costs in the near-term are minimal but statistically different from No Action after adoption of Alternative 1, while net benefits in the long-term are minimal and statistically different from a neutral impact.

Next, we investigate the impacts of individual groupings of effects in the long-run by looking at the Round 3 responses submitted by the panel. We first apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if the impact scores reported for Alternative 1 regarding possible positive impacts in the long-run (n = 8 panelists) are significantly different from a neutral effect. When Alternative 1 is compared to the No Action alternative in the long-term, two-sided exact p-values of .72, .26, .02, and .36 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. These tests suggest long-term benefits related to adopting Alternative 1 may result from ecosystem impacts. There is no evidence that long-term benefits due to other groupings of effects are statistically different from a neutral effect if Alternative 1 is implemented. When Alternative 1 is compared to the No Action alternative in the short-term to identify sources of immediate costs, two-sided exact p-values of .11, .02, .31, and .02 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. These tests suggest short-term displacement costs related to adopting Alternative 1 may result from impacts to fishermen and their communities. There is no evidence that short-term costs due to other groupings of effects are statistically different from a neutral effect if Alternative 1 is implemented.

Summary

Our analysis suggests that additional long-term benefits would be accrued if Alternative 1 is adopted rather than Alternative 2. The analysis did not find any other significant differences in expected socioeconomic impacts between the alternatives in any time periods. Thus, there is no confidence in additional displacement costs to the fishing sector by adopting Alternative 1 over Alternative 2. When compared to the No Action alternative, long-term minimal ecosystem benefits associated with Alternative 1 were found to be statistically different from a neutral effect. However, these benefits come with a price: immediate minimal displacement costs to fishermen and their communities.

North Florida MPA

The predicted impact scores produced by the consensus model for the North Florida MPA are presented in Table 8a. These scores represent forecasts of the magnitude of socioeconomic impacts associated with the North Florida MPA using the original responses from eight panelists as inputs. Table 8b summarizes the corresponding weighted impact scores, including the No Action alternative.

Table 8a. Impact Scores (Consensus Model) for North Florida MPA Alternatives

NORTH FLORIDA MPA (N=8)	Administrative			Commercial, For-Hire, and Recreational			Ancillary (Ecosystem) Effects			Community and Social Effects		
	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term
Alternative 1	-1.43	-1.17	-0.96	-2.48	-1.77	-1.05	0.04	0.60	1.11	-1.67	-1.23	-0.54
Alternative 2	-1.07	-0.57	-0.22	-2.17	-1.17	-0.39	0.23	0.88	1.57	-1.53	-0.76	-0.05
Alternative 3	-1.39	-0.90	-0.77	-1.28	-0.54	-0.03	0.21	0.77	1.02	-0.80	-0.47	-0.14
Alternative 4	-1.35	-0.76	-0.44	-2.11	-1.36	-0.59	0.19	0.72	1.40	-1.58	-0.92	0.10
Alternative 5	-1.25	-0.90	-0.83	-2.03	-1.19	-0.72	0.27	0.87	1.36	-1.51	-1.03	-0.11
Alternative 6	-1.31	-1.02	-0.96	-1.29	-0.49	0.00	0.15	0.67	1.04	-0.86	-0.44	-0.23

Table 8b. Weighted Impact Scores (Consensus Model) for North Florida MPA Alternatives

NORTH FLORIDA MPA (N=8)	Immediate	Medium-Term	Long-Term
Alternative 1	-1.48	-0.88	-0.27
Alternative 2	-1.21	-0.38	0.32
Alternative 3	-0.90	-0.29	0.08
Alternative 4	-1.29	-0.56	0.19
Alternative 5	-1.21	-0.54	0.00
Alternative 6	-0.90	-0.33	0.03
No Action	0.00	0.00	0.00

First, we examine the results from the consensus model. The ratio of the two largest eigenvalues derived from a minimum residual factor analysis is 2.09, 2.40, 3.92, 2.57, 6.61, and 2.58 for Alternatives 1, 2, 3, 4, 5, and 6, respectively. This suggests that the original data for Alternatives 3 and 5 from the panel are a good fit for the consensus model, which indicates agreement among panelists and lends confidence to the forecasted impact scores for both alternatives. The low values for Alternatives 1, 2, 4, and 6 suggest a lack of fit to the consensus model, which indicates systematic differences in forecasting among the panelists.

We cannot determine the highest ranking alternative from viewing the weighted impact scores in Table 8b, and a comparison of final weighted impact scores among alternatives is inconclusive. The No Action alternative scores highest in the immediate- and medium-terms, while all alternatives except Alternatives 1 and 5 score higher than the No Action alternative in the long-term. As fishing sectors and communities adjust to the closures over the long-run and administrative costs decrease, minimal to moderate ecosystem effects begin to be realized producing weighted impact scores around the neutral range for all alternatives five years after implementation. This conclusion concurs with the final time-dependent rankings and weights derived for the groupings of effects in Round Two (Table 3). Additionally, Alternative 1 scores lowest in all time frames. Alternative 4 scores second lowest in the near- and medium- terms but second highest in the long-term. Alternative 2 scores highest in the long-term but is less than Alternatives 3 and 6 in the immediate- and medium-terms.

Analysis of Alternative 1

At this point we show that Alternative 1 is inferior to all other alternatives. We employ the nonparametric Wilcoxon Signed-Rank Test to determine if the forecasted impact scores produced by the consensus model are significantly different among alternatives (Table 8a). Comparing the alternatives two at a time results in a paired observation for each grouping of effects in each time period (n = 12 time-dependent groupings of effects). Signed-Rank Tests comparing Alternative 1 to Alternatives 2-6 produced two-sided exact p-values of .00 in all tests. Comparison against the assumed neutral effects associated with adoption of the No Action alternative resulted in a two-sided exact p-value of .02. Thus, we can conclude that the net socioeconomic impacts resulting from implementation of Alternative 1 are significantly different than those that would be realized by the implementation of Alternatives 2-6 or taking no action. A comparison of the forecasted and weighted impact scores in Tables 8a and 8b implies that

Alternative 1 results in greater losses or smaller benefits than any of the other alternatives or no action. Additionally, the low eigenvalue ratio associated with the consensus model for Alternative 1 implies that forecasts concerning the socioeconomic impacts are not likely to be consistent estimates of the true impacts due to differences in cultural knowledge on the panel.[19] Since we provide evidence that Alternative 1 is inferior to the other alternatives from a socioeconomic impact perspective, we turn our focus towards the remaining options.

Analysis of Alternative 4

We can eliminate Alternative 4 from consideration by showing that it is inferior to Alternative 2. A Signed-Rank Test comparing these two alternatives produces a two-sided exact p-value of .01. Thus, we can conclude that the net socioeconomic impacts resulting from implementation of Alternative 2 are significantly different than those that would be realized by the implementation of Alternative 4. A comparison of the forecasted and weighted impact scores in Tables 8a and 8b provides evidence that this difference results in less realized net socioeconomic benefits associated with Alternative 4.[20]

Analysis of Alternatives 2, 3, 5 and 6

Paired comparison tests between Alternatives 2, 3, 5, 6, and the No Action alternative when evaluated in light of the consensus model results in Tables 8a and 8b

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[19] We implement Wilcoxon-Mann-Whitney Tests to nonparametrically test for group differences (biologists vs. non-biologists) in the weighted scores of the panelists for Alternative 1 in all time periods. The WMW Tests produce two-sided exact p-values of .03, .06, and .03 for the immediate-, medium-, and long-term analyses. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences associated with Alternative 1 may exist for all time periods. Non-biologists generally forecasted greater negative impacts than did biologists for Alternative 1. In fact, in the long-term all weighted impact scores for members of the biological subculture were positive. However, only one non-biologist had a positive weighted impact score for Alternative 1, due mainly to his/her forecast of high ecosystem benefits in the long-term.

[20] We implement Wilcoxon-Mann-Whitney Tests to nonparametrically test for group differences (biologists vs. non-biologists) in the weighted scores of the panelists for Alternative 4 in all time periods. The WMW Tests produce two-sided exact p-values of .03, .03, and .06 for the immediate-, medium-, and long-term analyses. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences associated with Alternative 4 may exist for all time periods. Non-biologists generally forecasted greater negative impacts than did biologists for Alternative 4. In fact, in the long-term all weighted impact scores for members of the biological subculture were positive. Only one non-biologist had a positive weighted impact score for Alternative 4, due mainly to his/her forecast of high ecosystem benefits in the long-term.

could not determine clear rankings. The early elimination of Alternatives 1 and 4 suggest that geography may be influencing the panel's impact scores since these alternatives share much of the same area (Figure 2). If no significant differences in socioeconomic impacts exist between alternatives that are close to each other we may be able to simplify the ranking of the remaining options. Rather than compare the four remaining alternatives to each other, we could compare the two general locations that contain the remaining four sites.

We initially examine the forecasted socioeconomic impacts from the consensus model for Alternatives 2 and 5 (Table 8a). Net socioeconomic impacts are forecasted to be greater after adoption of Alternative 2 in the medium- and long-terms for all groupings of effects relative to Alternative 5. In the short-run net impacts are forecasted to be higher for Alternative 5 regarding effects on fishermen, communities, and the ecosystem. For both alternatives the consensus model forecasts immediate displacement costs in the moderate range to the fishing sector and dependent communities with the realization of less than moderate ecosystem benefits in the long-run.

We implement nonparametric tests on paired samples to determine whether statistical differences exist in the socioeconomic impacts between the two alternatives. When the consensus impact scores of Alternatives 2 and 5 are compared, a two-sided exact p-value of .04 is calculated, suggesting that we can reject the hypothesis that the two samples come from the same population distribution with a reasonable amount of certainty. In Table 8a, Alternative 2 either has lower costs or higher benefits in most categories, which probably explains the finding of a significant difference in the incidence of socioeconomic impacts.

We then apply another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist (n = 8 panelists) in each time period. Two-sided exact p-values of .25, 1.00, and .81 are calculated for the immediate-, medium-, and long-terms, respectively. From these tests we cannot reject the hypothesis that the final weighted impact scores for Alternatives 2 and 5 are the same in any of the three time periods.

Since we still do not have statistical evidence to rank Alternatives 2 and 5 on a temporal basis, we check if any advantages exist for a particular grouping of effects by adopting one alternative over another. Specifically, in the long-run will adoption of Alternative 2 produce greater net administrative and ecosystem benefits? We apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if statistical differences exist between the impact scores reported for each alternative regarding impacts to the administrative and ecosystem groupings in the long-run (n = 8 panelists). Two-sided exact p-values of .50 are calculated for both the long-run administrative and ecosystem effects. These tests suggest that we cannot reject the hypothesis that net socioeconomic impacts arising from administrative and ecosystem effects are the same for the two alternatives in the long-run. No other significant differences were detected for the groupings in any time periods.

Our original paired comparisons test suggested significant differences exist between Alternatives 2 and 5; however, we could not pinpoint with confidence where the difference in net benefits accrues. We must still pick one alternative, so we can compare the general location with that which contains Alternatives 3 and 6. Consequently, we view Table 8b which shows consensus weighted scores for Alternative 2 are either the same (short-term) or higher than those for Alternative 5 and select Alternative 2 as superior to Alternative 5.

Next, we focus on the forecasted socioeconomic impacts from the consensus model for Alternatives 3 and 6 (Table 8a). We conduct nonparametric tests on paired samples to compare consensus impact scores. The resulting two-sided exact p-value of .20 suggests that we cannot reject the hypothesis that the two samples come from the same population distribution, and the comparison of the forecasted impacts across groupings in different time periods is inconclusive.

We then apply another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist (n = 8 panelists) in each time period. Two-sided exact p-values of 1.00, 1.00, and .25 were calculated for the immediate-, medium-, and long-terms, respectively. The large p-values suggest that the alternatives are virtually indistinguishable in the short- and medium-terms in the eyes of our relatively small expert panel. Hence, no discernable temporal trends exist to justify ranking one alternative higher than the other.

An investigation into the original panel responses suggests that the socioeconomic impacts resulting from adoption of either alternative are virtually the same. We select Alternative 3 for the comparison of localities with Alternative 2 since the eigenvalue ratio from the consensus model was higher than that for Alternative 6.

Comparison of Alternatives 2 and 3

Next, we examine the forecasted socioeconomic impacts from the consensus model (Table 8a) for Alternatives 2 and 3. Negative socioeconomic impacts related to administrative effects are forecasted to be higher in each time period for Alternative 3, while Alternative 2 results in higher net ecosystem benefits in all time periods. Costs associated with commercial, for-hire, and recreational fishing sectors are forecasted to be higher for Alternative 2 in all time periods. Negative socioeconomic impacts related to community effects are higher in the short- and medium-terms for Alternative 2 but higher for Alternative 3 in the long-run. The consensus model forecasts immediate displacement costs in the moderate range for Alternative 2 to the fishing sector, but less so for alternative 3. The model forecasts minimal ecosystem benefits in the long-run associated with Alternative 3, but more so for Alternative 2. When considering adopting Alternative 2 over Alternative 3, the primary tradeoff to examine is whether to accept higher negative impacts over time for the fishing sector and communities while realizing larger ecosystem benefits and smaller administrative costs.

We implement a Wilcoxon Signed-Rank Test to determine whether statistical differences exist in the socioeconomic impacts between the two alternatives. When Alternatives 2 and 3 are compared, a two-sided exact p-value of .72 is calculated suggesting that we cannot reject the hypothesis that the two samples come from the same population distribution. In other words, the test with consensus forecasts from Table 8a fails to provide evidence that the socioeconomic impacts are significantly different between Alternatives 2 and 3.

We then apply another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. Two-sided exact p-values of .22, .84, and .47 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that the final weighted impact scores for Alternatives 2 and 3 are the same in any of the three time periods.

Since we still do not have statistical evidence to rank Alternatives 2 or 3, we reexamine our hypothesis regarding the realization of net administrative and ecosystem benefits at the expense of increased negative consequences to the fishing sector and dependent communities if Alternative 2 is implemented instead of Alternative 3. We apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if statistical differences exist between the impact scores reported for each alternative regarding impacts to each group of effects in each time period (n = 8 panelists). We find that differences in socioeconomic impacts may exist in the near-term for the fishing sectors and dependent communities; two-sided exact p-values of .06 are calculated for both groupings. No other differences in impacts are statistically significant.[21]

Comparison of Alternatives 2 and 3 with No Action

Now, we conduct a Wilcoxon Signed-Rank Test on paired samples to determine whether the socioeconomic impacts resulting from Alternatives 2 and 3 (Table 8a) are statistically different from the assumed neutral effects that would take place if the No Action alternative is adopted. A paired observation exists for each grouping of effects in each time period (n = 12 time-dependent groupings of effects). Two-sided exact p-values of .18 and .13 are calculated when comparing Alternatives 2 and 3 to the No Action alternative, respectively. The test fails to provide evidence that the socioeconomic

[21] We implement Wilcoxon-Mann-Whitney Tests to nonparametrically test for group differences (biologists vs. non-biologists) in the weighted scores of the panelists for Alternatives 2 and 3 in all time periods. The WMW Tests produce two-sided exact p-values of .03, .06, and .03 for the immediate-, medium-, and long-term analyses, respectively for Alternative 2, and two-sided exact p-values of .03, .06, and .11 for the immediate-, medium-, and long-term analyses, respectively for Alternative 3. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences associated with Alternative 2 may exist for all time periods while subcultures may exist in the short- and medium-terms for Alternative 3. Non-biologists generally forecasted greater negative impacts than did biologists for both alternatives.

impacts forecasted by the consensus model for Alternatives 2 and 3 are significantly different from a neutral effect.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 8 panelists). In this case, a weighted score of zero is assumed for each panelist for the No Action alternative. When comparing Alternative 2 and the No Action alternative two-sided exact p-values of .02, .31, and .55 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that the final weighted impact scores associated with Alternative 2 are the same as No Action in the medium- and long-terms; however, we can in the short-term. Similarly, when comparing Alternative 3 with the No Action alternative, two-sided exact p-values of .02, .38, and 1.0 are produced for the immediate-, medium-, and long-terms, respectively. In other words, the final weighted impact scores in Table 8b suggest that net costs in the near-term are minimal but statistically different from No Action for both Alternatives 2 and 3. No other differences in impacts are statistically different from a neutral effect for either alternative.

Next, we investigate the impacts of individual groupings of effects over time by looking at the original Round 3 responses submitted by the panel. We first apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if the impact scores reported for Alternatives 2 and 3 in the short-run (n = 8 panelists) are significantly different from a neutral effect. When Alternative 2 is compared to the No Action alternative in the immediate-term, two-sided exact p-values of .05, .01, .88, and .02 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. When Alternative 3 is compared to the No Action alternative in the immediate-term, two-sided exact p-values of .03, .03, .50, and .06 are calculated for the administrative, fishing sector, ecosystem, and community groupings of effects, respectively. These tests suggest near-term costs related to adopting Alternatives 2 or 3 may result from administrative, fishing, and community impacts. Similar comparisons to

No Action regarding long-term ecosystem impacts yields two-sided exact p-values of .08 and .25 for Alternatives 2 and 3, respectively. While the paired tests indicated that the immediate-term losses associated with Alternatives 2 and 3 are significantly different from No Action, there is less evidence that long-term ecosystem impacts are statistically different from a neutral effect if either Alternative 2 or 3 is implemented.

Summary

Our analysis suggests that Alternatives 1 and 4 are inferior to Alternatives 2, 3, 5, and 6. The remaining four options were divided into common locales for comparison. Alternative 2 was deemed superior to Alternative 5 strictly based on the impact scores from the consensus model (Table 8a); there were no statistical differences in the level of net socioeconomic impacts forecasted by the panel. Likewise, there were no statistical differences in the impact levels when we compared Alternatives 3 and 6. Alternative 3 was chosen for final comparison to Alternative 2 based strictly on a significant eigenvalue ratio associated with the first two factor residuals of the consensus model. We hypothesized from Table 8a that adoption of Alternative 2 over Alternative 3 may result in larger ecosystem benefits and lower administrative costs at the cost of higher immediate displacement costs to fishermen and their communities. Tests showed that differences in socioeconomic impacts may result in the short-term for fishermen and their communities if Alternative 2 is adopted rather than Alternative 3, but confidence in this conclusion is not very strong. No other significant differences were detected. Alternative 3 statistically produces the same net administrative and ecosystem impacts as Alternative 2 but with lower immediate cost to fishing sectors and dependent communities.

Except in one case (Alternative 4, long-term, community and social impacts) the panel forecasted negative or neutral socioeconomic impacts to fishermen and communities for all North Florida MPA alternatives over all time frames. Also, final weighted scores from the consensus model (Table 8b) are less than or only slightly larger than zero for all alternatives in all time periods. In light of this evidence, comparison to the No Action alternative seems nontrivial in the case of the North Florida MPA. Nonparametric tests and final weighted scores suggest that both Alternatives 2 and 3 result in minimally negative impacts in the immediate-term that are statistically different from a neutral effect. No other socioeconomic impacts resulting from these two alternatives were found to be statistically different from the assumed neutral effects from No Action. The analysis suggests that costs could be minimized by not adopting either Alternative 2 or 3, which were deemed as the two best alternatives of the six proposed.

One interesting comment that came out of the impact analysis for the North Florida MPA was the possible negative effect on a fishery unrelated to the snapper grouper complex. Evidently, both sites are situated on trawling grounds for royal red and pink shrimp. Expert opinion suggested that this would disrupt the shrimp fishing patterns since trawls were set for miles at a time. Avoidance of the MPA areas could be extremely disruptive to traditional trawling practices. The language regarding the Type II MPAs in Amendment 14 clearly state that other fishing effort would be allowed in the MPAs. However, the intent seemed to address trolling effort not necessarily shrimp trawling effort. An unintended consequence of the North Florida sites may be the displacement of south Atlantic shrimpers who utilize these areas.

St. Lucie Hump MPA

The predicted impact scores produced by the consensus model for the St. Lucie Hump MPA are presented in Table 9a. These scores represent forecasts of the magnitude of socioeconomic impacts associated with the St. Lucie Hump MPA using the original responses from eight panelists as inputs. Table 9b summarizes the corresponding weighted impact scores, including the No Action alternative.

Table 9a. Impact Scores (Consensus Model) for St. Lucie Hump MPA Alternatives

	St. Lucie Hump MPA (N=8)											
	Administrative			Commercial, For-Hire, and Recreational			Ancillary (Ecosystem) Effects			Community and Social Effects		
	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term
Alternative 1	-0.84	-0.57	-0.43	-1.14	-0.01	0.58	0.45	1.03	1.54	-0.96	0.02	0.65

Table 9b. Weighted Impact Scores (Consensus Model) for St. Lucie Hump MPA Alternatives

ST. LUCIE HUMP MPA (N=8)			
	IMMEDIATE	MEDIUM-TERM	LONG-TERM
ALTERNATIVE			
1	-0.67	0.10	0.63
NO ACTION	0.00	0.00	0.00

First, we examine the results from the consensus model. The ratio of the two largest eigenvalues derived from a minimum residual factor analysis is 4.35 for Alternative 1. This suggests that the original data for Alternative 1 from the panel are a good fit for the consensus model, which indicates agreement among panelists and lends confidence to the forecasted impact scores.

Comparison of Alternative 1 with No Action

Since there is only one proposed site for the St. Lucie Hump MPA, comparisons are made between it and the No Action alternative. A comparison of final weighted impact scores among alternatives is inconclusive (Table 9b). The No Action alternative scores higher in the immediate-term while Alternative 1 scores higher in the medium- and long-terms. As fishing sectors and communities adjust to the closures and eventually accrue minimal net benefits over the long-run, and administrative costs are reduced, minimal-to-moderate ecosystem effects begin to be realized causing Alternative 1 to be ranked higher than the No Action alternative one year after implementation. This conclusion concurs with the final time-dependent rankings and weights derived for the groupings of effects in Round Two (Table 3).

Impact scores produced from the consensus model may be analyzed to identify the various impacts associated with adoption of Alternative 1 (Table 9a). Adoption of Alternative 1 results in smaller than minimal net administrative costs in all time periods. Minimal negative impacts are incurred by fishing sectors and related communities in the immediate-run with neutral to less than minimal benefits realized over time. Minimal ecosystem benefits are forecasted within five years with minimal-to-moderate ancillary benefits occurring in the long-run. When considering Alternative 1, the main tradeoff to examine is whether more benefits will be accrued over time in the form of ecosystem, fishery, and community impacts than the initial costs to communities and the fishing sectors as well as minimal net administrative costs in all time periods. We assume that acceptance of the No Action alternative produces a neutral impact from all groupings of effects in all time periods.

We implement a Wilcoxon Signed-Rank Test on paired samples to determine whether the socioeconomic impacts resulting from Alternative 1 are statistically different from the assumed neutral effects that would take place if the No Action alternative is adopted (Table 9a). A paired observation exists for each grouping of effects in each time period (n = 12 time-dependent groupings of effects). A two-sided exact p-value of .91 is calculated suggesting that we cannot reject the hypothesis that the two samples come from the same population distribution. In other words, the test fails to provide evidence that the socioeconomic impacts forecasted by the consensus model for Alternative 1 are significantly different from a neutral effect.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 8 panelists). In this case, a weighted score of zero is assumed for each panelist for the No Action alternative. Two-sided exact p-values of .03, .58, and .03 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we can reject the hypothesis that the final weighted impact scores associated with Alternative 1 are the same as No Action in the immediate- and long-terms but not in the medium-term. In other words, the final weighted impact scores in Table 9b suggest that net costs in the immediate-term are minimal but statistically different from No Action, while net benefits accrued in the long-term are minimal and also significantly different from No Action.

Next, we investigate the impacts of individual groupings of effects over time by looking at the original Round 3 responses submitted by the panel. We first apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if the impact scores reported for Alternative 1 regarding possible negative impacts in each time period (n = 8 panelists) are significantly different from a neutral effect. Two-sided exact p-values of .19, .56, and .75 are calculated for administrative effects in the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that net administrative impacts are neutral in any of the time periods On the other hand, two-sided exact p-values of .02 and .03 are calculated for immediate-term fishing and community impacts, respectively. Hence, short-term net impacts to the fishing sectors and dependent communities are forecasted to be minimally negative and statistically different from a neutral effect.

We perform the same tests to determine if the forecasted benefits arising from adoption of Alternative 1 are significantly different from a neutral effect. For ecosystem effects, two-sided exact p-values of .25, .03, and .03 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that net ecosystem impacts are neutral in the short-run. However after one year, ecosystem benefits are statistically different from the neutral effect and forecasted to be in the minimally positive range. Two-sided exact p-values of .31 and .34 are calculated for long-term fishing and community impacts, respectively, which suggest that we cannot reject the hypothesis that long-term benefits to the fishing sectors or communities under Alternative 1 will be the same as No Action.[22]

Summary

Our analysis suggests that minimal displacement costs would be incurred by the fishing sector as well as dependent communities in the immediate-term if Alternative 1 was adopted rather than the No Action alternative. On the other hand, minimal ecosystem effects are forecasted starting after one year of implementation of Alternative 1. The analysis did not find any other forecasted time-dependent socioeconomic impacts significantly different from neutral.

[22] We implement Wilcoxon-Mann-Whitney Tests to nonparametrically test for group differences (biologists vs. non-biologists) in the weighted scores of the panelists for Alternative 1 in all time periods. The WMW Tests produce two-sided exact p-values of .06, .06, and .20 for the immediate-, medium-, and long-term analyses. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences associated with Alternative 1 may exist in the short- and medium-terms. Non-biologists generally forecasted greater negative impacts than did biologists for Alternative 1. However, the non-biologists' responses tended to be closer to the final weighted impact scores derived by the consensus model.

East Hump MPA

The predicted impact scores produced by the consensus model for the East Hump MPA are presented in Table 10a. These scores represent forecasts of the magnitude of socioeconomic impacts associated with the East Hump MPA using the original responses from eight panelists as inputs. Table 10b summarizes the corresponding weighted impact scores, including the No Action alternative.

Table 10a. Impact Scores (Consensus Model) for East Hump MPA Alternatives

	East Hump MPA (N=8)											
	Administrative			Commercial, For-Hire, and Recreational			Ancillary (Ecosystem) Effects			Community and Social Effects		
	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term
Alternative 1	-0.51	-0.44	-0.44	-0.66	0.36	1.20	0.45	1.26	1.95	-0.50	0.28	0.94

Table 10b. Weighted Impact Scores (Consensus Model) for East Hump MPA Alternatives

	East Hump MPA (N=8)		
	Immediate	Medium-Term	Long-Term
Alternative 1	-0.35	0.35	0.96
No Action	0.00	0.00	0.00

First, we examine the results from the consensus model. The ratio of the two largest eigenvalues derived from a minimum residual factor analysis is 4.04 for Alternative 1. This suggests that the original data for Alternative 1 from the panel are a good fit for the consensus model, which indicates agreement among panelists and lends confidence to the forecasted impact scores.

Comparison of Alternative 1 with No Action

Since there is only one proposed site for the East Hump MPA, comparisons are made between it and the No Action alternative. A comparison of final weighted impact scores among alternatives is inconclusive (Table 10b). The No Action alternative scores higher in the immediate-term while Alternative 1 scores higher in the medium- and long-terms. As fishing sectors and communities adjust to the closures and eventually accrue minimal net benefits over the long-run amid relatively stable administrative costs, minimal-to-moderate ecosystem effects begin to be realized causing Alternative 1 to be ranked higher than the No Action alternative one year after implementation. This conclusion concurs with the final time-dependent rankings and weights derived for the groupings of effects in Round Two (Table 3).

Impact scores produced from the consensus model may be analyzed to identify the various impacts associated with adoption of Alternative 1 (Table 10a). Adoption of Alternative 1 results in smaller than minimal net administrative costs in all time periods. Less than minimal negative impacts are incurred by fishing sectors and related communities in the immediate-run, with these sectors realizing minimal benefits over the long-run. Minimal ecosystem benefits are forecasted after one year with moderate ancillary benefits occurring in the long-run. When considering Alternative 1, the main tradeoff to examine is whether more benefits will be accrued over time in the form of ecosystem, fishery, and community impacts than the initial costs to communities and the fishing sectors as well as less than minimal net administrative costs in all time periods. We assume that acceptance of the No Action alternative produces a neutral impact from all groupings of effects in all time periods.

We implement a Wilcoxon Signed-Rank Test on paired samples to determine whether the socioeconomic impacts resulting from Alternative 1 are statistically different from the assumed neutral effects that would take place if the No Action alternative is adopted (Table 10a). A paired observation exists for each grouping of effects in each time period ($n = 12$ time-dependent groupings of effects). A two-sided exact p-value of .41 is calculated suggesting that we cannot reject the hypothesis that the two samples come from the same population distribution. In other words, the test fails to provide evidence that the socioeconomic impacts forecasted by the consensus model for Alternative 1 are significantly different from a neutral effect.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 8 panelists). In this case, a weighted score of zero is assumed for each panelist for the No Action alternative. Two-sided exact p-values of .44, .12, and .02 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we can reject the hypothesis that the final weighted impact scores associated with Alternative 1 are the same as No Action in the long-term but not in the immediate-term. In other words, the final weighted impact scores in Table 10b suggest that net benefits in the long-term are minimal but statistically different from No Action, while net impacts accrued in the first five years after adoption are not significantly different from No Action.

Next, we investigate the impacts of individual groupings of effects over time by looking at the original Round 3 responses submitted by the panel. We first apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if the impact scores reported for Alternative 1 regarding possible negative impacts in each time period (n = 8 panelists) are significantly different from a neutral effect. Two-sided exact p-values of 1.0 are calculated for administrative effects in all time periods. These large p-values suggest that net administrative impacts are not significantly different from neutral after adoption of Alternative 1 in any time periods. Two-sided exact p-values of .53 and .62 are calculated for immediate-term fishing and community impacts, respectively. Hence, short-term net impacts to the fishing sectors and dependent communities as well as administrative impacts in all time periods are not forecasted to be significantly different from a neutral effect.

We perform the same tests to determine if the forecasted benefits arising from adoption of Alternative 1 are significantly different from a neutral effect. For ecosystem effects, two-sided exact p-values of .12, .02, and .02 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that net ecosystem impacts are neutral in the short-run; however, the test is not conclusive. However after one year, ecosystem benefits are statistically different from the neutral effect and forecasted to be in the minimally to moderately positive range.

Two-sided exact p-values of .03 and .06 are calculated for long-term fishing and community impacts, respectively, suggesting that long-term benefits to the fishing sectors or communities may be accrued. These long-term impacts are forecasted to be minimally positive.[23]

Summary

Our analysis suggests that displacement costs incurred by the fishing sector as well as dependent communities in the immediate-term if Alternative 1 was adopted rather than the No Action alternative are not significantly different from a neutral effect. Neither are administrative impacts in all time periods. On the other hand, minimal to moderate ecosystem effects are forecasted starting after one year of implementation of Alternative 1 as well as minimally positive impacts to fishers and their communities after five years. The analysis did not find any other forecasted time-dependent socioeconomic impacts significantly different from neutral.

The following insights from the panel reflect the possible dynamics associated with the East Hump MPA. There are ample fishing opportunities in the Florida Keys. Initially, increased search and learning costs might be incurred by displaced commercial, charter, and recreational fishermen. Over time the abundance of fishing opportunities in the Keys would allow them to regain their level of past fishing success, likely targeting the same species. However, some congestion effects might take place in nearby areas. Bottom fishermen should benefit from stock rejuvenation in the long-term. The panel suggested that enforcement costs for this site should be minimal due to the consensus regarding the site between management and fishing interests. This site was agreed upon by different sectors of the fishing community as an alternative to an initial site which was located on the more heavily fished Islamorada Hump. According to expert testimony, an MPA directly off the coast of the so-called "Fishing Capital of the World" would have led to extensive displacement costs to the fishing industry and local and regional

[23] We implement Wilcoxon-Mann-Whitney Tests to nonparametrically test for group differences (biologists vs. non-biologists) in the weighted scores of the panelists for Alternative 1 in all time periods. The WMW Tests produce two-sided exact p-values of .42, .74, and .88 for the immediate-, medium-, and long-term analyses. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences associated with Alternative 1 do not exist for any time periods regarding the East Hump MPA.

communities. It is likely that the consensus among different user groups helped to mitigate displacement costs on any particular group of fishermen.

Adoption of Alternative 1 seems preferable to the No Action alternative from a socioeconomic impact perspective since minimal ecosystem effects start to be realized after only one year and continue into the future, long-term minimal benefits are realized by fishers and their communities, forecasted costs are not significantly different from a neutral impact, and stakeholder consensus regarding the placement of the MPA is high.

Charleston Deep Artificial Reef MPA

The predicted impact scores produced by the consensus model for the Charleston Deep Artificial Reef MPA are presented in Table 11a. These scores represent forecasts of the magnitude of socioeconomic impacts associated with the Charleston Deep Artificial Reef MPA using the original responses from seven panelists as inputs. Table 11b summarizes the corresponding weighted impact scores, including the No Action alternative.

Table 11a. Impact Scores (Consensus Model) for Charleston Deep Artificial Reef Alternatives

CHARLESTON DEEP ARTIFICIAL REEF MPA (N=7)

	ADMINISTRATIVE			COMMERCIAL, FOR-HIRE, AND RECREATIONAL			ANCILLARY (ECOSYSTEM) EFFECTS			COMMUNITY AND SOCIAL EFFECTS		
	IMMEDIATE	MEDIUM-TERM	LONG-TERM	IMMEDIATE	MEDIUM-TERM	LONG-TERM	IMMEDIATE	MEDIUM-TERM	LONG-TERM	IMMEDIATE	MEDIUM-TERM	LONG-TERM
ALTERNATIVE 1	-0.94	-0.90	-1.15	0.00	0.04	0.27	0.04	0.54	1.16	0.23	0.27	0.36

Table 11b. Weighted Impact Scores (Consensus Model) for Charleston Deep Artificial Reef MPA Alternatives

CHARLESTON DEEP ARTIFICIAL REEF MPA (N=7)

	IMMEDIATE	MEDIUM-TERM	LONG-TERM
ALTERNATIVE 1	-0.22	-0.06	0.19
NO ACTION	0.00	0.00	0.00

First, we examine the results from the consensus model. The ratio of the two largest eigenvalues derived from a minimum residual factor analysis is 3.28 for Alternative 1. This suggests that the original data for Alternative 1 from the panel are a good fit for the consensus model, which indicates agreement among panelists and lends confidence to the forecasted impact scores.

Comparison of Alternative 1 with No Action

Since there is only one proposed site for the Charleston Deep Artificial Reef MPA, comparisons are made between it and the No Action alternative. A comparison of final weighted impact scores among alternatives is inconclusive (Table 11b). The No Action alternative scores higher in the immediate- and medium-terms while Alternative 1 scores higher in the long-term. The consensus model results in Table 11a suggest fishing sectors and communities are not likely to be affected by the experimental site. Minimal administrative costs are required to sustain and study the site resulting in minimal ecosystem benefits over the long-run. When considering Alternative 1, the main tradeoff to examine is whether sufficient ecosystem benefits will be accrued over time in light of minimal administrative costs. We assume that acceptance of the No Action alternative produces a neutral impact from all groupings of effects in all time periods.

We implement a Wilcoxon Signed-Rank Test on paired samples to determine whether the socioeconomic impacts resulting from Alternative 1 are statistically different from the assumed neutral effects that would take place if the No Action alternative was adopted (Table 11a). A paired observation exists for each grouping of effects in each time period ($n = 12$ time-dependent groupings of effects). A two-sided exact p-value of .62 is calculated suggesting that we cannot reject the hypothesis that the two samples come from the same population distribution. In other words, the test fails to provide evidence that the socioeconomic impacts forecasted by the consensus model for Alternative 1 are significantly different from a neutral effect.

We further attempt to identify differences in socioeconomic impacts by applying another Wilcoxon Signed-Rank Test to the weighted impact scores for each time period derived from the original responses from the panel and without adjustments from the consensus model. A paired observation in this instance occurs for each panelist in each time period (n = 7 panelists). In this case, a weighted score of zero is assumed for each panelist for the No Action alternative. Two-sided exact p-values of .62, .44, and .20 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that the final weighted impact scores associated with Alternative 1 are the same as No Action in all time periods.

Next, we investigate the impacts of individual groupings of effects over time by looking at the original Round 3 responses submitted by the panel. We first apply separate Signed-Rank Tests to the original non-weighted impact scores submitted by the panel during Round Three in an effort to determine if the impact scores reported for Alternative 1 regarding possible negative administrative impacts in each time period (n = 7 panelists) are significantly different from a neutral effect. Two-sided exact p-values of .25, .50, and .52 are calculated for administrative effects in the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that net administrative impacts are neutral in any of the time periods

We perform the same tests to determine if the forecasted benefits arising from adoption of Alternative 1 are significantly different from a neutral effect. For ecosystem effects, two-sided exact p-values of 1.0, .12, and .03 are calculated for the immediate-, medium-, and long-terms, respectively. These tests suggest that we cannot reject the hypothesis that net ecosystem impacts are neutral in the immediate-term. However after five years, ecosystem benefits are statistically different from the neutral effect and forecasted to be in the minimally positive range.[24]

Summary

Our analysis suggests that no displacement costs would be incurred by the fishing sector or dependent communities if Alternative 1 is adopted rather than the No Action alternative. This conclusion is corroborated by expert testimony from Round One. Minimally positive ancillary effects are forecasted starting after five years of

[24] We implement Wilcoxon-Mann-Whitney Tests to nonparametrically test for group differences (biologists vs. non-biologists) in the weighted scores of the panelists for Alternative 1 in all time periods. The WMW Tests produce two-sided exact p-values of .94, .86, and .77 for the immediate-, medium-, and long-term analyses. The tests suggest that subcultures in knowledge regarding the socioeconomic consequences associated with Alternative 1 do not exist for any time periods regarding the Charleston Deep Artificial Reef MPA.

implementation of Alternative 1 as a successful artificial reef should start to generate ecosystem benefits over time as the habitat develops and replenishment, abundance, and stock effects are realized. The analysis did not find that administrative costs would be significantly different from neutral in any time period. It should be noted that in the case of this MPA the conclusion of neutral administrative impacts is likely to be a result of a cancellation effect between significant administrative costs, such as education, the cost of creating the artificial reef and enforcement, and significant administrative benefits such as research knowledge. According to expert testimony, an important benefit that would arise in the long-term would be the knowledge gained by researchers and management regarding MPAs as they study the evolution of the artificial reef into a sustainable deepwater habitat. In light of the Precautionary Principle and a lack of existing baseline data regarding the performance of south Atlantic marine protected areas over time, administrative benefits may eventually grow larger than administrative costs resulting in a net positive effect although this was not forecasted by the panel. Alternative 1 is preferable to No Action for the Charleston Deep Artificial Reef MPA as minimal long-term ecosystem benefits are forecasted without incurring any other net impacts that are significantly different from a neutral effect.

DISCUSSION

Amendment 14 to the Snapper Grouper FMP proposes to augment traditional methods of management with permanently closed Type II MPAs in an effort to improve the biological health of south Atlantic deepwater resources and mitigate negative socioeconomic consequences resulting from spatial closures. The Council has proposed seven MPAs from North Carolina to the Florida Keys as well as an experimental site. As part of the regulatory process, socioeconomic impacts to fishery stakeholders must be identified and measured for each proposed alternative site. Due to poor spatial resolution, empirical data are not available to perform a traditional impact analysis. This report outlines a tractable methodology that produces semi-quantitative forecasts of socioeconomic consequences associated with implementing Type II MPAs in the deepwater SASG fishery.

The methodology is based on a modified Delphi approach. An expert panel responded to three rounds of inquiry consisting of a Policy Delphi, a traditional iterative Delphi, and an impact analysis. Results included a thorough discussion of possible socioeconomic effects due to the implementation of Type II MPAs, broad groupings of these effects along with relative weights of importance, and rankings of alternatives. The final rankings produced best options for each proposed MPA from a net socioeconomic impact perspective.

We compare the results from the modified Delphi approach to the Council's preferred alternatives for each MPA. The Council's preferred alternative for the Snowy Wreck MPA is Alternative 1 while the Delphi analysis deemed Alternative 2 as the highest ranked alternative from a socioeconomic impact perspective. The Delphi approach forecasts higher displacement effects to the commercial and possibly for-hire fishing sectors in the immediate-term for Alternative 1 relative to Alternative 2. Furthermore, no additional socioeconomic benefits are forecasted if Alternative 1 is implemented rather than Alternative 2.

The Council's preferred alternative for the Northern South Carolina MPA is Alternative 2 while the Delphi analysis could not find any significant differences between Alternatives 1 and 2 from a socioeconomic impact perspective. Potential tradeoffs between administrative/ecosystem and fishing sector impacts due to the adoption of one alternative over the other are forecasted to be negligible. Both alternatives are forecasted to produce moderate ecosystem benefits in the long-run while inflicting minimal to moderate immediate-term displacement effects on fishermen and their communities. These costs and benefits are significantly different from a neutral effect.

The Council's preferred alternative for the Edisto MPA is Alternative 1. The Delphi analysis suggests that additional long-term benefits would accrue if Alternative 1 is adopted rather than Alternative 2. The analysis does not forecast additional displacement costs to the fishing sector by adopting Alternative 1 over Alternative 2. When compared to the No Action alternative, long-term minimal ecosystem benefits associated with Alternative 1 were found to be statistically different from a neutral effect. However, these benefits come with a price: immediate minimal displacement costs to fishermen and their communities.

The Council's preferred alternative for the Georgia MPA is Alternative 1. The Delphi analysis suggests that additional long-term benefits would accrue if Alternative 1 is adopted rather than Alternative 2. The analysis does not forecast additional displacement costs to the fishing sector by adopting Alternative 1 over Alternative 2. When compared to the No Action alternative, long-term minimal ecosystem benefits associated with Alternative 1 were found to be statistically different from a neutral effect. However, these benefits come with a price: immediate minimal displacement costs to fishermen and their communities.

The Council's preferred alternative for the North Florida MPA is Alternative 4. Through nonparametric testing and a comparison of weighted impact scores Alternative 4 was shown to be inferior to Alternative 2. Alternative 3 statistically produces the same net administrative and ecosystem impacts as Alternative 2 but with lower immediate cost to fishing sectors and dependent communities. Except in one case (Alternative 4, long-term, community and social impacts) the panel forecasted negative or neutral socioeconomic impacts to fishermen and communities for all North Florida MPA alternatives over all time frames. Nonparametric tests and final weighted scores suggest that both Alternatives 2 and 3 result in minimally negative impacts in the immediate-term that are statistically different from a neutral effect. No other socioeconomic impacts resulting from these two alternatives were found to be statistically different from the assumed neutral effects from No Action. The analysis suggests that costs could be minimized by not adopting either Alternative 2 or 3, which were deemed as the two best alternatives of the six proposed.

The Council's preferred alternative for the St. Lucie Hump MPA is Alternative 1. The Delphi analysis suggests that minimal displacement costs would be incurred by the fishing sector as well as dependent communities in the immediate-term if Alternative 1 was adopted rather than the No Action alternative. On the other hand, minimal ecosystem effects are forecasted starting after one year of implementation of Alternative 1. The analysis did not find any other forecasted time-dependent socioeconomic impacts significantly different from neutral.

The Council's preferred alternative for the East Hump/Un-named Hump MPA is Alternative 1. The Delphi analysis suggests adoption of Alternative 1 is preferable to the

No Action alternative from a socioeconomic impact perspective since minimal ecosystem effects start to be realized after only one year and continue into the future, long-term minimal benefits are realized by fishers and their communities, forecasted costs are not significantly different from a neutral impact, and stakeholder consensus regarding the placement of the MPA is high.

The Council does not have a preferred alternative for the Charleston deep artificial reef MPA. The Delphi analysis suggests that no displacement costs would be incurred by the fishing sector or dependent communities if Alternative 1 is adopted rather than the No Action alternative. Alternative 1 is preferable to No Action as minimal long-term ecosystem benefits are forecasted without incurring any net impacts that are significantly different from a neutral effect.

The results from the Delphi study must be interpreted with caution. First, our sample sizes for each MPA analysis were relatively small (either seven or eight respondents) and may not represent a true cross-section of knowledge regarding the Amendment 14 MPAs. Second, although we were able to calculate measures of statistical significance regarding the nonparametric tests, we perform many of them for this study. With so many tests, significant differences could be concluded even in the presence of a random draw, which could lead to an inflated probability of making an erroneous conclusion when we are rejecting the null hypothesis of no differences in socioeconomic impacts between alternatives. Also, it is important to realize that the panel reported impact scores over time, and in most cases it was not discernable whether they incorporated aspects of risk or other dynamically influenced attributes into their scoring system. Consequently, each score for each alternative in a particular time period should be viewed independently of their scores for the other time periods. **We cannot justify or advocate a process of comparing alternatives by adding impact scores over time periods.**

REFERENCES

Bohnsack, James A. 1997. Consensus development and the use of marine reserves in the Florida Keys, U.S.A. Proceedings of the 8th International Coral Reef Symposium 2:1927-1930.

Bohnsack, James A. 2000. A comparison of the short-term impacts of no-take marine reserves and minimum size limits. Bulletin of Marine Science 66(3):635-650.

Clark, Kathleen E., James E. Applegate, Lawrence J. Niles, and David S. Dobkin. 2006. An objective means of species status assessment: adapting the Delphi technique. Wildlife Society Bulletin 34(2):419-425.

Crance, Johnie H. 1987. Habitat suitability index curves for paddlefish, developed by the Delphi technique. North American Journal of Fisheries Management 7(1):123-130.

Federal Register. May 2000. Presidential Documents 65(105). Washington, D.C.

Harter, Stacy and Andrew David. August 2005. South Atlantic marine protected areas: pre-closure evaluation of habitat and fish assemblages in five proposed reserves. Report to the South Atlantic Fishery Management Council.

Johnson, Jeffrey C. and David C. Griffith. 1996. Pollution, food safety, and the distribution of knowledge. Human Ecology 24(1):87-107.

Linstone, Harold A. and Murray Turoff (editors). 1975. The Delphi method: techniques and applications. Addison-Wesley Publishing Company, Reading, Massachusetts.

Plan Development Team. 1990. The potential of marine fishery reserves for reef fish management in the U.S. southern Atlantic. NOAA Technical Memorandum, NMFS-SEFC-261.

Quattrini, Andrea M. and Steve W. Ross. 2006. Fishes associated with North Carolina shelf-edge hardbottoms and initial assessment of a proposed marine protected area. Bulletin of Marine Science 79(1):137-163.

Romney, A. Kimball, Susan C. Weller, and William H. Batchelder. 1986. Culture as consensus: a theory of culture and informant accuracy. American Anthropologist 88(2):313-338.

SAFMC (South Atlantic Fishery Management Council). August 2006. Public hearing draft: snapper grouper Amendment 14. South Atlantic Fishery Management Council, Charleston, S.C.

Sanchirico, James N. 2000. Marine protected areas: a discussion of potential costs and benefits. Discussion Paper 00-23. Resources for the Future, Washington, D.C.

Scholz, Astrid, Kate Bonzon, Rod Fujita, Natasha Benjamin, Nicole Woodling, Peter Black, and Charles Steinback. 2004. Participatory socioeconomic analysis: drawing on fishermen's knowledge for marine protected area planning in California. Marine Policy 28:335-349.

Sedberry, G.R., O. Pashuk, D.M. Wyanski, J.A. Stephen, and P. Weinbach. In Press. Spawning locations for Atlantic fishes off the southeastern U.S. Proc. Gulf Caribb. Fish. Inst.

Smith, Martin D. 2004. Fishing yield, curvature and spatial behavior: implications for modeling marine reserves. Natural Resource Modeling 17(3):273-298.

Turoff, Maury. 1970. The design of a Policy Delphi. Technological Forecasting and Social Change 2(2):149-171.

Zuboy, James R. 1981. A new tool for fishery managers: the Delphi technique. North American Journal of Fisheries Management 1:55-59.

APPENDIX 1 – ROUND ONE INSTRUCTIONS AND TABLES

The primary objective of Round One is to prepare an exhaustive list of possible economic and social effects (i.e. benefits/costs, advantages/disadvantages) of implementing Type II marine protected areas (MPAs), and to define the impact of each effect as being positive or negative from an economic and social perspective. The Type II MPAs in Amendment 14 will prohibit all harvests and possession of species in the Snapper Grouper FMP, but other types of fishing (e.g., pelagic trolling) would be allowed. In Round Two the panel will be asked to rank these effects, and in Round Three the top "vote-getters" will be used to rank the alternative sites that have been proposed for each MPA in Amendment 14.

Due to the diversity of expertise on the panel, the types of effects that will be identified are likely to vary across the full spectrum of stakeholder interest. Differing viewpoints about the likely outcomes are anticipated, and one purpose of the Delphi process is to encourage a discussion about them. However, please remember that the overall goal of this Delphi experiment is to generate information necessary to differentiate the ***economic and social consequences*** among alternatives for each proposed site in Amendment 14. When necessary the mediation team will edit or return comments for clarification so that the experiment does not digress into a forum on the concept of MPAs or Amendment 14 in general.

The accompanying Round One Attachment contains the first draft of the qualitative analysis which will be used in the economic and social impact assessments for Amendment 14. Its main purpose is to stimulate discussion by the panel. Comments regarding the content of the attached document are encouraged and should be submitted in the "General Comments" section after the table that appears below. Results from Round One will provide the basis for a more complete qualitative assessment of the economic and social effects of the MPAs proposed in Amendment 14.

Round One Instructions:

In the table below, the first column lists some effects of implementing MPAs that are discussed in the Round One Attachment. The second column shows their expected overall impacts, with a positive sign denoting a beneficial or advantageous effect and a negative sign denoting a costly or disadvantageous one. A tabled entry of '0' could be used to denote a neutral or no effect.

(1) Please use column three to add any comments about these potential effects. Do you think our initial assessments are incorrect? Please provide additional comments that will improve the initial assessments.

(2) Also, the Round One Attachment may have omitted important economic and social effects. Please use the shaded rows at the bottom of the table to list up to five additional effects that may have been missed, as well as their expected impacts and any relevant explanatory comments.

For this round, comments will be summarized and redistributed to the panel on Wednesday (July 19) and Monday (July 24). Results will be posted on Wednesday (July 26) along with materials for Round Two. When responding, please use this Word document for comments and discussion. Save a copy for your records and send the entire document as an attachment in an email to Paul.Baertlein@noaa.gov. Feel free to send updated comments anytime during this period; however, please use this initial form when doing so. This will allow us to easily identify your newest comments without having to compare them to your previous responses.

Individual Effect (i.e. benefit, cost, advantage, disadvantage)	Net Impact of Effect (i.e. negative, neutral, or positive)	Panel Member Comments/Discussion
Decreased Catch Levels	-	
Increase in Trip-Level Search and Other Costs	-	
Crowding and Congestion Effects	-	
Harvest and Personal Risks	-	
Regional Economic Impacts	-	
Replenishment and Stock Effects	+	
Increased Catch Levels in the Future	+	
Reduced Harvest Variation	+	

Quality Increases in MPAs	+	
Option and Existence Values	+	
Management Benefits	+	
Management Costs	-	
Community/Social Impacts	-	
Ecosystem Changes	+	

APPENDIX 2 – ROUND TWO INSTRUCTIONS AND TABLES

The primary objective of Round One was for the panel to brainstorm and create an exhaustive list of the potential economic and social effects that could result from implementation of Type II MPAs in general. The Type II MPAs in Amendment 14 will prohibit all harvests and possession of species in the Snapper Grouper FMP, but other types of fishing (e.g., pelagic trolling) would be allowed.

Round One resulted in the following list of potential effects and possible net impacts as denoted by panel members. In the table below, positive or beneficial net effects are denoted with a plus sign, negative or disadvantageous net effects are denoted with a negative sign, and '0' denotes a neutral or no effect. Note that differing opinions surfaced about net impacts of the same type of effect. We have included an attachment to this email that contains a summary of all commentary from Round One if you would like to review comments by individual panel members associated with a particular effect or its proposed net impact. Eleven out of seventeen panelists participated in Round One.

The primary objective of Round Two is to group and rank the most important of these effects. To do so, the individual effects identified in Round One should be arranged into groups based on common characteristics. These groups will be used in Round Three to accomplish the overall objective of quantifying the ***economic and social consequences*** among alternatives for each proposed site in Amendment 14.

Summary of Results from Round One

Individual Effect (i.e. benefit, cost, advantage, disadvantage)	Net Impact of Effect (i.e. negative, positive, or neutral)	Individual Effect (i.e. benefit, cost, advantage, disadvantage)	Net Impact of Effect (i.e. negative, positive, or neutral)
Catch Levels	-/+/0	**Landings (or yield) Variation**	+/0
Trip-Level Search and Other Costs	-/+/0	**Management Impacts**	-/+/0
Crowding and Congestion	-/+/0	**Option and Existence Values**	+/0
Personal Safety	-/+/0	**Ecosystem Impacts**	+/0

Regional Economic Impacts	-/+/0	**Non-consumptive Opportunities**	+
Replenishment and Stock Effects	+/0	**Community/Social Impacts**	-/+/0
Improve Knowledge of Marine Systems	+	**Bycatch Mortality**	+

Round Two Instructions:

In Table 1 below, each column contains individual effects that the Mediation Team has grouped together based on some common characteristics. For example, "Management Impacts" and "Enforcement and Compliance" make up the group "Administrative" based on the common characteristics "Management and Administration of MPAs." Note that individual effects may be included under more than one group heading. For example, "Replenishment, Abundance, and Stock Effects" is assigned to "Commercial, For-Hire, and Recreational" and "Ancillary Effects." These biological effects are assigned to both groupings because they can directly affect the future status of the resource and indirectly affect the future economic outcomes for commercial, for-hire and recreational boats that are based on stock abundance.

(Step 1) In Table 1, please use the shaded rows under each column to comment about a proposed grouping or the common characteristics used for classification of individual effects. In your comments please consider the following questions: Is the group name representative of the effects listed under it? Is an effect misclassified under a particular group heading? Did we leave out an effect from a particular grouping?

Table 1 represents one way of grouping expected outcomes from Type II MPA implementation, but you as panel members with different backgrounds in the fishery may wish to group the effects differently based on a different set of common characteristics.

(Step 2) In Table 2, if you believe that the Mediation Team missed a grouping or erred in the classification of individual effects within the proposed groupings, provide up to three additional groupings (one group per column) in the same manner as presented in Table 1. Type the new group heading in the first row of the column, the common characteristics that define the new grouping in row two, and the relevant Round One effects in the rows underneath.

(Step 3) Once the groups are identified in Tables 1 and 2, use Table 3 to consider the timing of each group's impact as occurring immediately, in the medium-term after a short lag (within five years), or in the long-term after a longer time delay (after five years) **for the MPAs that are proposed in Amendment 14.** For example, commercial and recreational catches may decline immediately when fishing areas are closed, but catches in nearby fishing grounds might increase in the long-term if biological productivity within the MPA increases the abundance of fish in nearby open areas. Each group's **overall** impact should be identified as positive, negative or neutral during each of the different time periods if Amendment 14 were implemented. Then, rank the groups in order of importance, with separate rankings for each time period.

In the column labeled "Group Heading," list the five most important groupings of individual effects (from Tables 1 and 2) that you consider to be significant for assessing the economic and social impacts associated with the implementation of Type II MPAs in Amendment 14. The next three primary columns, "Immediate," "Medium-Term," and "Long-Term," represent different time periods after the implementation of any of the Amendment 14 MPAs. For each time period, use the "Rank" subcolumn to rank each group of effects by importance (1 = Most Important, 5 = Least Important) for assessing the economic and social impacts of alternative sites of the Amendment 14 MPAs during that particular time frame. Then use the "Effect" subcolumn to describe the overall impact of that group as positive (+), negative (-), or neutral (0) during this time frame. Note that individual effects within the same group could create positive or negative consequences, so your answers in column two should be the net impact of all effects under the group heading. Lastly, comments regarding each group's ranking or overall impact for each time period may be entered in the third subcolumn, labeled "Comments."

During this round updates will be provided daily. Even though only four groupings are listed initially in Table 1, it is likely that the panel will propose additional groups of effects. Thus, we anticipate that you will have five or more groups to evaluate for importance by the end of the round. As you view updates, you are encouraged to reconsider your rankings as different groupings are identified by other panelists. Comments accompanying these rankings and evaluations of overall impacts should help the panel to develop a consensus regarding the best ways to group and assess the various effects of implementing the MPAs from Amendment 14. General Comments are also encouraged, especially regarding the appropriateness of our definition of medium- and long-term time periods, and may be entered in the space following your entries in Table 3.

Due to time constraints regarding the Amendment 14 process, this round will be limited to one week with daily updates. Final results will be posted on Thursday (August 10) along with materials for Round Three. When responding, please use this Word document for table entries, comments, and discussion. Save a copy for your records and send the entire document as an attachment in an email to Paul.Baertlein@noaa.gov. Feel free to send updated comments anytime during this period. Remember you may wish to submit new rankings as other panel members suggest new groupings.

Table 1

Groupings of Effects	**Administrative**	**Commercial, For-Hire, and Recreational**	**Community and Social Impacts**	**Ancillary Effects**
Common Charac-teristics of the Group	**Management and Administration of MPAS**	**Influence of MPAs on Fishermen Fishing Inside or Outside MPA**	**Community or Regional Influences**	**Influences Associated with Future Use or Status of the Resource**
	Management Impacts	Catch Levels	Associated Employment (e.g. fish houses, dealers)	Ecosystem and Habitat Impacts
	Enforcement and Compliance	Trip-Level Search and Other Costs	Regional Economic Impacts	Option and Existence Values
		Crowding and Congestion		Bycatch Mortality
		Personal Safety		Non-consumptive (non-use) Opportunities
		Commercial and For-Hire Profitability and Recreational Enjoyment		Improved Knowledge of Marine Systems
		Replenishment, Abundance, and Stock Effects		Landings Variation
		Industry Employment		Replenishment, Abundance, and Stock Effects
Comments				

Table 2

Groupings of Effects			
Common Characteristics of the Group			
Comments			

Note: If you wish to add more than 3 groups, copy/paste Table 2.

Table 3

"Rank": [1, 2, 3, 4, 5] with 1 = Most Important, 5 = Least Important

"Effect": "+" = positive, "-" = negative, "0" = neutral

NOTE: If you are filling out this table with a particular MPA in mind, please list it here:

Group Heading	Immediate			Medium-Run		
	Rank	Effect	Comments	Rank	Effect	Comments

Group Heading	Long-Run		
	Rank	Effect	Comments

APPENDIX 3 – ROUND THREE INSTRUCTIONS AND TABLES

Below are the instructions for completing Round Three of the Delphi experiment. Please fill out the Excel spreadsheet attached to the email and return it to us.

The objective of Round Three and the overall Delphi project is to differentiate the ***economic and social consequences*** among alternative sites for each proposed MPA in Amendment 14. We have devised a weighted scoring system using the results from previous rounds to achieve this objective. In Delphi terminology, this is considered an impact analysis.

Round Two identified groups of effects that you will evaluate for likely impacts in the form of benefits and costs (advantages and disadvantages) for each site for three different time frames, defined as immediate, medium-term, and long-term. Each grouping's "weight" represents the consensus relative importance of that grouping in assessing the socioeconomic impacts, and was derived in Round Two based on ordered rankings by the panel. This was the "weight" column in Table 1 of the Round Two final results.

In Round Three, the panel will be asked to estimate each grouping's impact on a scale of (-3, -2, -1, 0, +1, +2, +3) for the proposed alternative sites for each MPA. Table 1 defines the scoring system from a high negative impact (with a score of -3) to high positive impact (with a score of +3). A score of zero implies that there are no social and economic consequences *in that grouping* associated with the site choice. Another reason for a zero score would be that the positive and negative impacts associated with different effects within a group canceled each other out. This is very possible since the groupings are very broadly defined.

Table 1.—Scoring of the Impact of Group Effects after MPA Implementation

-3	High negative impact.	+3	High positive impact.
-2	Moderate negative impact.	+2	Moderate positive impact.
-1	Minimal negative impact.	+1	Minimal positive impact.
0	No or neutral impact.		

In the attached Excel file, there is one sheet for each MPA. On each sheet you will find an impact table with as many rows as alternative sites are proposed for each MPA. Each impact table has comment boxes associated with the entries in each row and column. If you place your cursor (the white cross) over the cell in question, comments will appear that define group effects, time frames, weighted scores, and alternative sites. Comments specific to each MPA automatically appear to the right of the impact table. These comments include testimony from panelists who are familiar with the biology of these sites as well as current fishing effort. A map is displayed below the impact table to show the relative position of each alternative site. Lastly, final weighted scores particular to each alternative are automatically computed based on your entries in the corresponding impact table and posted to the table located to the right of each map.

We would like you to use the scoring definitions in Table 1 to score the likely economic and social consequences of each proposed alternative during different time frames. Scores for each proposed site should be entered in the appropriate white cells in the Excel impact tables.

Due to the large number of alternatives, you may want to assign similar impact rankings to all alternatives based on general knowledge of the impacts likely to be observed. This is fine; however, please remember that the different boundaries associated with the different alternatives for the same MPA could lead to different kinds of effects. **These differences are the focus of this round of the experiment.** In other words, the difference in characteristics associated with each of these sites could lead to different magnitudes of the impacts of the effects from MPA implementation or different kinds of effects altogether. For instance, differences in bottom terrain, species composition, depth, and distance from shore could cause different levels of impact from the effects caused by accepting that particular site.

If you have high confidence that an impact should be different for a particular alternative site compared to Type II MPAs in general, please let the panel know by submitting comments in a separate Word document explaining why these impacts would be distinctive for that particular alternative. We will redistribute these comments with subsequent Round Three updates.

As always, please call us at 305-361-4211 if you have questions.

Thanks again for your help.

Charleston Artificial Reef MPA

	Administrative			Commercial, For-Hire, and Recreational			Ancillary Effects			Community and Social Impacts		
	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term	Immediate	Medium-Term	Long-Term
Alternative 1												

Alternative 1 is located approximately 50 nautical miles from Charleston Harbor (South Carolina) and close to the Charleston Deep Reef. It is believed that currently no snapper grouper species are found in this area because it does not contain the desirable habitat. The biological effects of making this area an MPA come after material is placed on the sand bottom and an artificial reef is created.

MARMAP data show multiple collections of snowy grouper, speckled hind, and golden tilefish both to the inshore and offshore side of this location. There have been collections of spawning blueline and golden tilefish surrounding the proposed MPA; however, this site is too shallow for golden tilefish.

13.6 Appendix F. Snapper Grouper Amendment 14 Proposed Rule

•••••••• Billing Code: 3510-22-**

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Parts 622 and 635

[Docket No. ; I.D.]

RIN 0648-****

Fisheries of the Caribbean, Gulf of Mexico, and South Atlantic; Snapper grouper Fishery off the Southern Atlantic States; Amendment 14; Atlantic Highly Migratory Species; Atlantic Commercial Shark Management Measures

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule; request for comments.

SUMMARY: NMFS issues this proposed rule to implement Amendment 14 to the Fishery Management Plan for the Snapper grouper Fishery of the South Atlantic Region (FMP), as prepared and submitted by the South Atlantic Fishery Management Council (Council). Amendment 14 proposes to establish eight marine protected areas (MPAs) in which fishing for or possession of South Atlantic snapper grouper and the use of shark bottom longlines would be prohibited; however, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear

appropriately stowed. The intended effects of this proposed rule are to protect a portion of the population and habitat of long-lived, slow growing, deepwater snapper grouper species from fishing pressure to achieve a more natural sex ratio, age, and size structure within the proposed MPAs, while minimizing adverse social and economic effects.

DATES: Written comments on this proposed rule must be received no later than 5:00 p.m., eastern time, on [insert date 45 days after date of publication in the FEDERAL REGISTER].

ADDRESSES: You may submit comments on the proposed rule by any of the following methods:

- E-mail: 0648-**.Proposed@noaa.gov. Include in the subject line of the e-mail comment the following document identifier 0648-**.
- Federal e-Rulemaking Portal: http://www.regulations.gov. Follow the instructions for submitting comments.
- Mail: Julie Weeder, Southeast Regional Office, NMFS, 263 13th Avenue South, St. Petersburg, FL 33701.

Copies of Amendment 14 may be obtained from the South Atlantic Fishery Management Council, 4055 Faber Place, Suite 201, North Charleston, SC 29405; phone: 843-571-4366 or 866-SAFMC-10 (toll free); fax: 843-769-4520; e-mail: safmc@safmc.net. Amendment 14 includes a Final Environmental Impact Statement (FEIS), a Biological Assessment, an Initial Regulatory Flexibility Analysis, a Regulatory Impact Review, and a Social Impact Assessment/Fishery Impact Statement.

FOR FURTHER INFORMATION CONTACT: Julie Weeder, telephone: 727-824-5305, fax: 727-824-5305, e-mail: Julie.Weeder@noaa.gov.

SUPPLEMENTARY INFORMATION: The snapper grouper fishery off the southern Atlantic states is managed under the FMP. The FMP was prepared by the Council and is implemented under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) by regulations at 50 CFR part 622. NMFS issues this proposed rule to implement Amendment 14 to the FMP. The Atlantic shark fishery is managed under the Consolidated Highly Migratory Species Fishery Management Plan (HMS FMP). The HMS FMP is implemented under the authority of the Magnuson-Stevens Act by regulations at 50 CFR part 635.

Background

Stock assessments indicate that black sea bass, red porgy, and snowy grouper are overfished, i.e., spawning stock biomass is not sufficient to reproduce and support continued productivity. In addition, black sea bass, golden tilefish, snowy grouper, and vermilion snapper are experiencing overfishing, i.e., the current rate of fishing mortality jeopardizes the capacity of the fishery to produce its maximum sustainable yield on a continuing basis. Reductions in catch and protection of habitat are needed.

Availability of Amendment 14

Additional background and rationale for the measures discussed above are contained in Amendment 14. The availability of Amendment 14 was announced in the Federal Register on [insert date], (72 FR ******). Written comments on Amendment 14 must be received by [insert date]. All comments received on Amendment 14 or on this proposed rule during their respective comment periods will be addressed in the preamble to the final rule.

Classification

At this time, NMFS has not determined that Amendment 14 is consistent with the national standards of the Magnuson-Stevens Act and other applicable laws. NMFS, in making that determination, will take into account the data, views, and comments received during the comment periods on Amendment 14 and this proposed rule.

This proposed rule has been determined to be not significant for purposes of Executive Order 12866.

The Council prepared an FEIS for Amendment 14; a notice of availability was published on [insert date], (70 FR *****).

List of Subjects

50 CFR Part 622

Fisheries, Fishing, Puerto Rico, Reporting and recordkeeping requirements, Virgin Islands.

50 CFR Part 635

Fisheries, Fishing, Fishing vessels, Foreign relations, Imports, Penalties, Reporting and recordkeeping requirements, Treaties.

Dated:

For the reasons set out in the preamble, 50 CFR parts 622 and 635 are proposed to be amended as follows:

PART 622--FISHERIES OF THE CARIBBEAN, GULF, AND SOUTH ATLANTIC

1. The authority citation for part 622 continues to read as follows:

Authority: 16 U.S.C. 1801 et seq.

2. In § 622.2, the definition of MPA is added in alphabetical order to read as follows:

§ 622.2 Definitions and acronyms.

* * * * *

MPA means marine protected area.

* * * * *

3. In § 622.35, paragraph (i) is added to read as follows:

§ 622.35 Atlantic EEZ seasonal and/or area closures.

* * * * *

(i) MPAs.

(1) No person may fish for a South Atlantic snapper grouper in an MPA and no person may possess a South Atlantic snapper grouper in an MPA. However, the prohibition on possession does not apply to a person aboard a vessel that is in transit with fishing gear appropriately stowed as specified in paragraph (i)(2) of this section. MPAs consist of deep-water areas as follows:

(i) Snowy Grouper Wreck MPA is bounded by rhumb lines connecting, in order, the following points:

Point	North lat.	West long.
A	33°25'	77°04.75'
B	33°34.75'	76°51.3'
C	33°25.5'	76°46.5'
D	33°15.75'	77°00.0'
A	33°25'	77°04.75'

(ii) Northern South Carolina MPA is bounded on the north by 32°53.5' N. lat.; on the south by 32°48.5'; on the east by 78°04.75' W. long.; and on the west by 78°16.75' W. long.

(iii) Edisto MPA is bounded on the north by 32°24' N. lat.; on the south by 32°18.5'; on the east by 78°54.0' W. long.; and on the west by 79°06.0' W. long.

(iv) Georgia MPA is bounded by rhumb lines connecting, in order, the following points:

Point	North lat.	West long.
A	31°43'	79°31'
B	31°43'	79°21'
C	31°34'	79°29'

D	32°34'	79°39'
A	31°43'	79°31'

(v) North Florida MPA is bounded on the north by 30°29' N. lat.; on the south by 30°19'; on the east by 80°02' W. long.; and on the west by 80°14' W. long.

(vi) St. Lucie Hump MPA is bounded on the north by 27°08' N. lat.; on the south by 27°04' N. lat.; on the east by 79°58' W. long.; and on the west by 80°00' W. long.

(vii) East Hump/Un-Named Hump MPA is bounded by rhumb lines connecting, in order, the following points:

Point	North lat.	West long.
A	24°36.5'	80°45.5'
B	24°32'	80°36'
C	24°27.5'	80°38.5'
D	24°32.5'	80°48'
A	24°36.5'	80°45.5'

(viii) Charleston Deep Artificial Reef is bounded on the north by 32°4' N. lat.; on the south by 32°6' N. lat; on the east by 79°5' W. long.; and on the west by 79°12' W. long.

(2) For the purpose of paragraph (i)(1) of this section, transit means direct, non-stop progression through the MPA at a speed in excess of four knots with a visible wake. Fishing gear appropriately stowed means—-

(i) A longline may be left on the drum if all gangions and hooks are disconnected and stowed below deck. Hooks cannot be baited. All buoys must be disconnected from the gear; however, buoys may remain on deck.

(ii) A trawl or try net may remain on deck, but trawl doors must be disconnected from such net and must be secured.

(iii) A gillnet, stab net, or trammel net must be left on the drum. Any additional such nets not attached to the drum must be stowed below deck.

(iv) Terminal gear (i.e., hook, leader, sinker, flasher, or bait) used with an automatic reel, bandit gear, buoy gear, handline, or rod and reel must be disconnected and stowed separately from such fishing gear. A rod and reel must be removed from the rod holder and stowed securely on or below deck.

(v) A crustacean trap, fish trap, golden crab trap, or sea bass pot cannot be baited. All buoys must be disconnected from the gear; however, buoys may remain on deck.

* * * * *

PART 635--ATLANTIC HIGHLY MIGRATORY SPECIES

1. The authority citation for part 635 continues to read as follows:

Authority: 16 U.S.C. 971 et seq.; 16 U.S.C. 1801 et seq.

2. In § 635.21, the last sentence of paragraph (d) introductory text is revised and paragraph (d)(5) is added to read as follows:

§ 635.21 Gear operation and deployment restrictions.

* * * * *

(d) Bottom longlines. * * * If a vessel issued a permit under this part is in a closed area designated under paragraphs (d)(1) or (d) 5) of this section with bottom longline gear on board, it is a rebuttable presumption that any fish on board such a vessel were taken with bottom longline in the closed area.

* * * * *

(5) If bottom longline gear is on board a vessel that has been issued a permit under this part 635, no person aboard that vessel may fish or deploy a bottom longline in a marine protected area (MPA) or possess a South Atlantic snapper grouper in such MPA, as specified in § 622.35(i) of this chapter. South Atlantic snapper grouper are defined in § 622.2 of this chapter.

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